GE Medical Systems

# Technical Publication

## Direction 5101600GDO
## Revision 0

## Discovery LS 2.0 Conformance Statement

for DICOM (ID/Net v3.0)

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- Failure to heed this Warning may result in injury to the service provider, operator or patient from electric shock, mechanical or other hazards.

- Ce Manuel de maintenance n'est disponible qu'en anglais.
- Si le technicien du client a besoin de ce manuel dans une autre langue que l'anglais, c'est au client qu'il incombe de le faire traduire.
- Ne pas tenter d'intervention sur les équipements tant que le manuel Service n'a pas été consulté et compris.
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- Si proceda alla manutenzione dell'apparecchiatura solo dopo aver consultato il presente manuale ed averne compreso il contenuto.
- Non tenere conto della presente avvertenza potrebbe far compiere operazioni da cui derivino lesioni all'addetto alla manutenzione, all'utilizzatore ed al paziente per folgorazione elettrica, per urti meccanici od altri rischi.

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## REVISON HISTORY

| REV. | DATE | REASON FOR CHANGE |
|---|---|---|
| A | July 2003 | First Draft |
| B | August 2003 | Updated to incorporate review comments |
| 0 | August 2003 | Updated to incorporate review comments from GCC. For Zero-Revision |

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# 1 INTRODUCTION

This DICOM Conformance Statement specifies the compliance to DICOM conformance requirements for the relevant features (Networking, Media, Print SCU etc) on this GEMS product. Note that the format of this section strictly follows the format defined in DICOM Standard PS 3.2 (Conformance). Please refer to that part of the standard while reading this section.
The Discovery LS product provides sophisticated networking, image processing and storage functions on CT/PET data. In view of the requirements to conform to a global standard that permits interoperability across equipment produced by different vendors, Discovery LS will provide support for DICOM 3.0.

Discovery LS provides a flexible design to fully utilize all features of individual components of these of Hybrid PET/CT scanner. This is achieved through an integration of three different Application Entities (AEs). The three Application Entities work independently and provide functionalities specific to CT standalone system, PET standalone system and Xeleris advanced review & processing station.

This document has three sections, each of which will discuss the Services provided by each AE in detail. The IODs for each AE is provided at the Appendix.

## 1.1 Overview

**Section 1,** *General Introduction and Content Organization,* provides general information about the content and scope of this document.

**Section 2,** *DICOM Conformance for Network Conformance for the DST CT Application Entity,* is the DICOM Conformance Statement related to the CT acquisition host, the PET acquisition host, and the Xeleris (formerly eNTEGRA) Display and Review Workstation on the Discovery LS product.

**Section 3,** *Media Storage Conformance*, covers the DICOM Conformance Statement related to Media Storage Application Profile.

**Section 4,** *Print SCU Conformance,* is the DICOM Conformance Statement related to DICOM Print SCU Application. This product uses DICOM Print SCU to print the images to DICOM Compliant Printers

**Section 5,** *Storage Commitment Conformance,* is the DICOM Conformance Statement related to DICOM Storage Commitment implementation on the CT host of the Discovery LS product.

**Section 6,** *Modality Worklist Conformance,* is the DICOM Conformance Statement related to DICOM Modality Worklist implementation on this product.

**Section 7,** *Performed Procedure Step Conformance,* is the DICOM Conformance Statement related to DICOM Modality Performed Procedure Step implementation on the CT host of the Discovery LS product.

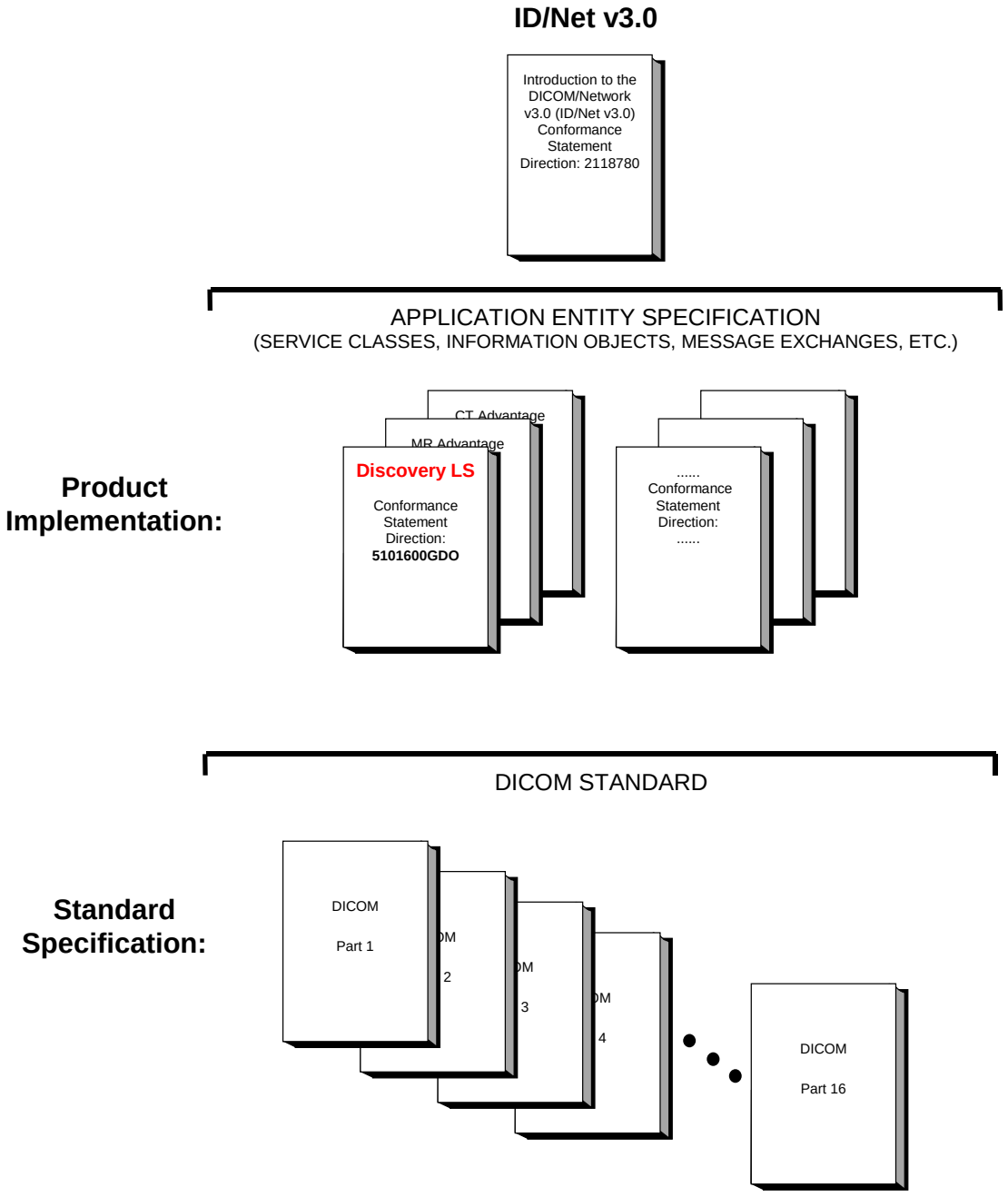
**Appendix A,** IOD Definitions for CT, MR Information Objects

**Appendix B,** IOD Definitions for PET Image Information Object
**Appendix C,** DICOMDIR Directory Information for Media Storage Service
**Appendix D,** IOD Definitions for Standalone PET Curve IOD
**Appendix E,** Patient Root Query Retrieve Information Model Definition
**Appendix F,** Study Root Query Retrieve Information Model Definition
**Appendix G,** IOD Definitions for Standalone Curve IOD Implementation

## 1.2 Overall Conformance Statement Documentation Structure

The documentation structure of the ID/Net v3.0 Conformance Statements and their relationship with the DICOM Conformance Statements is shown in Illustration 1-1.

**ILLUSTRATION 1-1**




This document specifies the DICOM implementation supported by the Discovery LS. It is entitled:

> Discovery LS *Conformance Statement for DICOM (ID/Net v3.0), Direction* **5101600GDO**

This Conformance Statement documents the DICOM Conformance Statement and Technical Specification required to interoperate with the GE ID/Net v3.0

network interface. Introductory information, which is applicable to all GE ID/Net v3.0 Conformance Statements, is described in the document:

> Introduction *to the DICOM/Network v3.0 (ID/Net v3.0) Conformance Statements, Direction 2118780*

This introduction familiarizes the reader with DICOM terminology and general concepts. It should be read prior to reading individual products' ID/Net v3.0 Conformance Statements.

The ID/Net v3.0 Conformance Statement, contained in this document, also specifies the Lower Layer communications which it supports (e.g. TCP/IP). However, the Technical Specifications are defined in the DICOM Part 8 standard.

For more information including Network Architecture and basic DICOM concepts, please refer to the *Introduction*.

For more information regarding DICOM, copies of the Standard may be obtained on the Internet at http://medical.nema.org. Comments on the Standard may be addressed to:

DICOM Secretariat
NEMA
1300 N. 17th Street, Suite 1847
Rosslyn, VA 22209
USA
Phone: +1.703.841.3200

## 1.3 Intended Audience

The reader of this document is concerned with software design and/or system integration issues. It is assumed that the reader of this document is familiar with the DICOM standards and with the terminology and concepts which are used in those standards.

If readers are unfamiliar with DICOM terminology they should first refer to the document listed below, then read the DICOM Standard itself, prior to reading this Conformance Statement document.

*Introduction to the DICOM/Network (ID/Net v3.0)*
*Conformance Statements*
*Direction 2118780*

## 1.4 Scope and Field of Application

It is the intent of this document, in conjunction with the *Introduction to the Integrated DICOM/Network (ID/Net v3.0) Conformance Statements Direction 2118780,* to provide an unambiguous specification for GE ID/Net v3.0 implementations. This specification, called a Conformance Statement, includes a DICOM Conformance Statement and is necessary to insure proper processing and interpretation of GE medical image data exchanged using DICOM. The GE ID/Net v3.0 Conformance Statements are available to the public.

The reader of this conformance statement should be aware that different GE devices are capable of using different Information Object Definitions. For example, a GE CT scanner may send images using the CT Information Object, MR Information Object, Secondary Capture Object, etc.

Included in this Conformance Statement are Module Definitions which define all data elements used by the GE ID/Net v3.0 implementation. If the user encounters unspecified private data elements while parsing a GE Data Set, the user is well advised to ignore those data elements (per the DICOM standard). Unspecified private data element information is subject to change without notice. If, however, the device is acting as a "full fidelity storage device", it should retain and retransmit all of the private data elements which are sent by GE devices.

## 1.5 Important Remarks

The use of these Conformance Statements, in conjunction with the DICOM Standards, is intended to facilitate communication with GE imaging equipment. However, **by itself, it is not sufficient to insure that inter-operation will be successful.** The **user (or user's agent)** needs to proceed with caution and address at least four issues:

- **Integration -** The integration of any device into an overall system of interconnected devices goes beyond the scope of standards (DICOM), and of this introduction and associated Conformance Statements when interoperability with non-GE equipment is desired. The responsibility to analyze the applications requirements and to design a solution that integrates GE imaging equipment with non-GE systems is the **user's** responsibility and should not be underestimated. The **user** is strongly advised to ensure that such integration analysis is correctly performed.

- **Validation -** Testing the complete range of possible interactions between any GE device and non-GE devices, before the connection is declared operational, should not be overlooked. Therefore, the **user** should ensure that any non-GE provider accepts full responsibility for all validation required for their connection with GE devices. This includes the accuracy of the image data once it has crossed the interface between the GE imaging equipment and the non-GE device and the stability of the image data for the intended applications.
  Such a validation is required before any clinical use (diagnosis and/or treatment) is performed. It applies when images acquired on GE imaging equipment are processed/displayed on a non-GE device, as well as when images acquired on non-GE equipment is processed/displayed on a GE console or workstation.

- **Future Evolution -** GE understands that the DICOM Standard will evolve to meet the user's growing requirements. GE is actively involved in the development of the DICOM Standard. DICOM will incorporate new features and technologies and GE may follow the evolution of the Standard. ID/Net v3.0 is based on DICOM as specified in each ID/Net DICOM Conformance Statement. Evolution of the Standard may require changes to devices which have implemented DICOM. In addition, GE reserves the right to discontinue or make changes to the support of communications features (on its products) reflected on by these ID/Net DICOM Conformance Statements. The **user** should ensure that any non-GE provider, which connects with GE devices, also plans future evolution of the DICOM standard. Failure to do so will likely result in the loss of function and/or connectivity as the DICOM Standard

changes and GE products are enhanced to support these changes.

- **Interaction -** It is the sole responsibility of the **non-GE provider** to ensure that communications with the interfaced equipment does not cause degradation of GE imaging equipment performance and/or function.

## 1.6 References

A list of references which is applicable to all ID/Net v3.0 Conformance Statements is included in the *Introduction to the Integrated DICOM/Network v3.0 (ID/Net v3.0) Conformance Statements Direction 2118780.*

## 1.7 Definitions

A set of definitions applicable to all ID/Net v3.0 Conformance Statements is included in the *Introduction to the Integrated DICOM/Network v3.0 (ID/Net v3.0) Conformance Statements Direction 2118780.*

## 1.8 Symbols and Abbreviations

A list of symbols and abbreviations which is applicable to all ID/Net v3.0 Conformance Statements is included in the *Introduction to the Integrated DICOM/Network v3.0 (ID/Net v3.0) Conformance Statements Direction 2118780.*

# 2 NETWORK CONFORMANCE STATEMENT

## 2.1 INTRODUCTION

This section of the DICOM Conformance Statement specifies the Discovery LS 2.0 compliance to DICOM conformance requirements for the relevant **Networking** features on this GEMS product. Note that the format of this section strictly follows the format defined in DICOM Standard PS 3.2 (Conformance). Please refer to that part of the standard while reading this section. It details the DICOM Service Classes and roles that are supported by this product.

The Discovery LS product uses DICOM services to import images for possible further analysis and/or processing. It also uses DICOM services to export images to other DICOM-compliant systems.

User has the capability to create and display CT images (from the CT acquisition host), PET images (from the PET host). These images can be transferred to any DICOM workstation that supports the PET and CT IODs. The Xeleris display workstation has the ability to Receive DICOM CT and PET (among other IODs) images, and co-register and fuse the anatomical detail of the CT images with the Functional PET images – through offline registration. The PET and CT images produced by Discovery LS are perfectly aligned and fusion registration will be seemless.

On the Xeleris workstation, the user can generate Secondary (Screen) Captures to store, in DICOM format, the presentation state of images, most notably “fused” CT/PET images. This provides the user with a digital alternative to hardcopy filming: important portions of the study can be captured and stored on a PACS or analysis workstation rather than captured on film. This allows access to viewing the CT/PET images in a fused state on their PACS or other workstation that might not have a CT/PET registration/fusion software application.

The Discovery LS DICOM implementation allows the user to send CT/MR/PET Images, PET Curve, Secondary Capture image data through the acquisition systems or received from any other DICOM Compliant system to another DICOM station. Discovery LS also allows query and retrieve of data stored in its local database from a remote station and can query and retrieve images stored in a remote DICOM station. In this situation Discovery LS is providing the DICOM C-FIND and C-MOVE services as a service class provider (SCP) and that of a DICOM C-FIND and C-MOVE service class user (SCU). Connect Pro option provides additional capabilities Modality Worklist (MWL) and Performed Procedure Step (MPPS), which provide integration of this GEMS imaging equipment with Hospital Informatiion System.

## 2.2 IMPLEMENTATION MODEL

All DICOM functionality on the Discovery LS product is handled by three Application Entities namely CT DICOM AE, PET DICOM AE, Xeleris DICOM AE. The DICOM AEs are commanded to perform DICOM services through the buttons and menu selections on the main user interface panel. The AEs are also listening to pre-defined ports for incoming connections.
The following table illustrates the services provided by each AE.

| Application Entitiy | Service/Role | IODs supported |
|---|---|---|
| CT DICOM Server AE | C-STORE SCU | CT, MR, SC |

| Application Entitiy | Service/Role | IODs supported |
|---|---|---|
| | C-STORE SCP | CT, MR, SC |
| | Query Retrieve SCU | CT, MR, SC |
| | Query Retrieve SCP | CT, MR, SC |
| | Media Storage (MOD) FSC/FSR | CT, MR, SC |
| | DICOM Print SCU | CT, MR, SC |
| | Storage Commitment SCU | CT, MR, SC |
| | Modality Worklist SCU | |
| | Performed Procedure Step SCU | |
| PET DICOM Server AE | C-STORE SCU | PET[1], SC |
| | C-STORE SCP | PET[1], CT, MR, SC |
| | Query Retrieve SCU | PET[1], CT, MR, SC |
| | Query Retrieve SCP | PET[1], SC |
| Xeleris DICOM Server AE | C-STORE SCU | PET[1], CT, MR, SC |
| | C-STORE SCP | PET[1], CT, MR, SC |
| | Query Retrieve SCU | PET[1], CT, MR, SC |
| | Query Retrieve SCP | PET[1], CT, MR, SC |
| | Media Storage (MOD) FSC/FSR | PET[1], CT, MR, SC |
| | DICOM Print SCU | PET[1], CT, MR, SC |
| | Storage Commitment SCU | PET[1], CT, MR, SC |

### 2.2.1 Application Data Flow Diagram

The Basic and Specific Application models for CT/MR Dicom Receive functionality are shown in the following Illustration:

The Basic and Specific Application models for the DICOM Query functionality, and the ability to Send/Receive/Query-Retrieve PET DICOM Images and Curves, Send/Receive/Query-Retrieve Secondary Capture DICOM Images, and Receive/Query-Retrieve CT and MR images, are shown in the following Illustration :

#### 2.2.1.1 CT Application Entity

There are five Real-World Activities that will cause the DICOM Server Application Entity (DICOM Server AE) to initiate a DICOM association to a remote DICOM Application Entity.

The *Choose "Push" Option* Real-World activity consists of an operator selecting one or more study, series or image in the local database manager and choosing either "Push Examination", "Push Series" or "Push Image from the "Network" pulldown menu on the local database manager to send the image(s) to a selected destination.

Real-World Activity, *Query Remote*, causes the DICOM Server AE to initiate an association to the Remote DICOM AE and request the list of all studies. Once the
DICOM Server AE receives the list of studies, it will select the first study (as determined through the local database manager list sort criterion) and request the list of series for that study. After receiving the

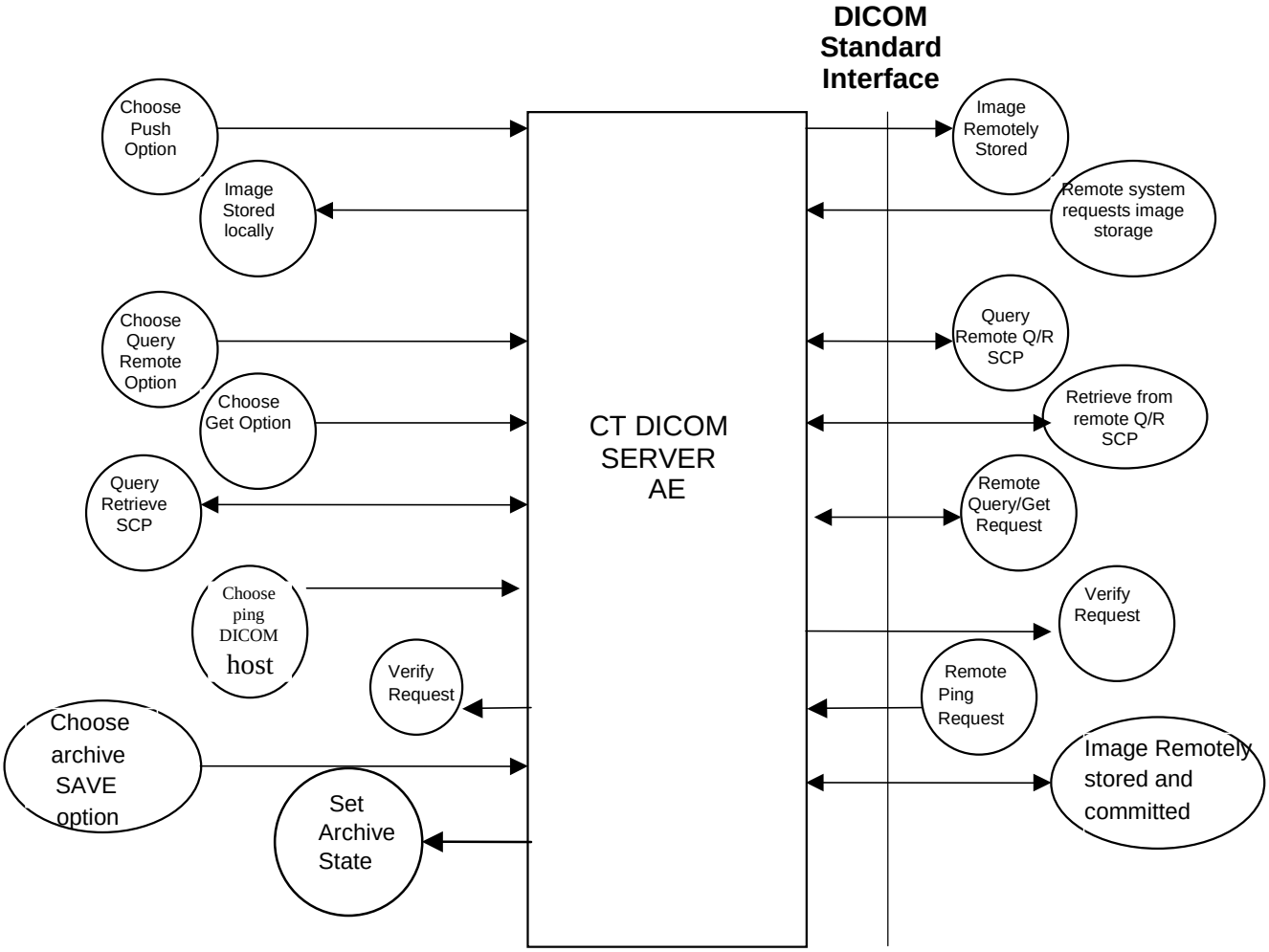
[1] PET in this table implies PET Image IOD and PET Curve IOD

list of series the DICOM Server AE will ask for the list of images for the first series in the list. The operator can then select any study in the study list to retrieve the list of series and images.

Real-World Activity, *Choose "Get"" Option*, will be available once the *Query Remote* activity is performed. The operator can now select one or more study (series or image) and ask the DICOM Server AE to retrieve the selected image(s) from the Remote DICOM AE by choosing either "Get Examination", "Get Series", or "Get Images".

Real-World Activity, *Choose "Ping DICOM host" Option*, consists of an operator selecting "Ping DICOM host" from the "Network" pull down menu. This will cause the DICOM Server AE to initiate a "*DICOM Verification Request*" to the remote AE, to verify the remote system activeness.

The *Choose "storage commitment" Option* Real-World activity consists of an operator configuring the remote node as an "*archive node*" . Select "choose media" option under "Archive" pull down menu. Select "Remote Node" in that menu. Select one or more study, series or image in the local database manager and choose either *"Save Exam"* or "*Save Series*"" from the "Archive" pull down menu. This will cause the DICOM server AE to send the image(s) to the selected destination and wait for the storage commitment from the remote node. The remote node should be a storage commitment provider.

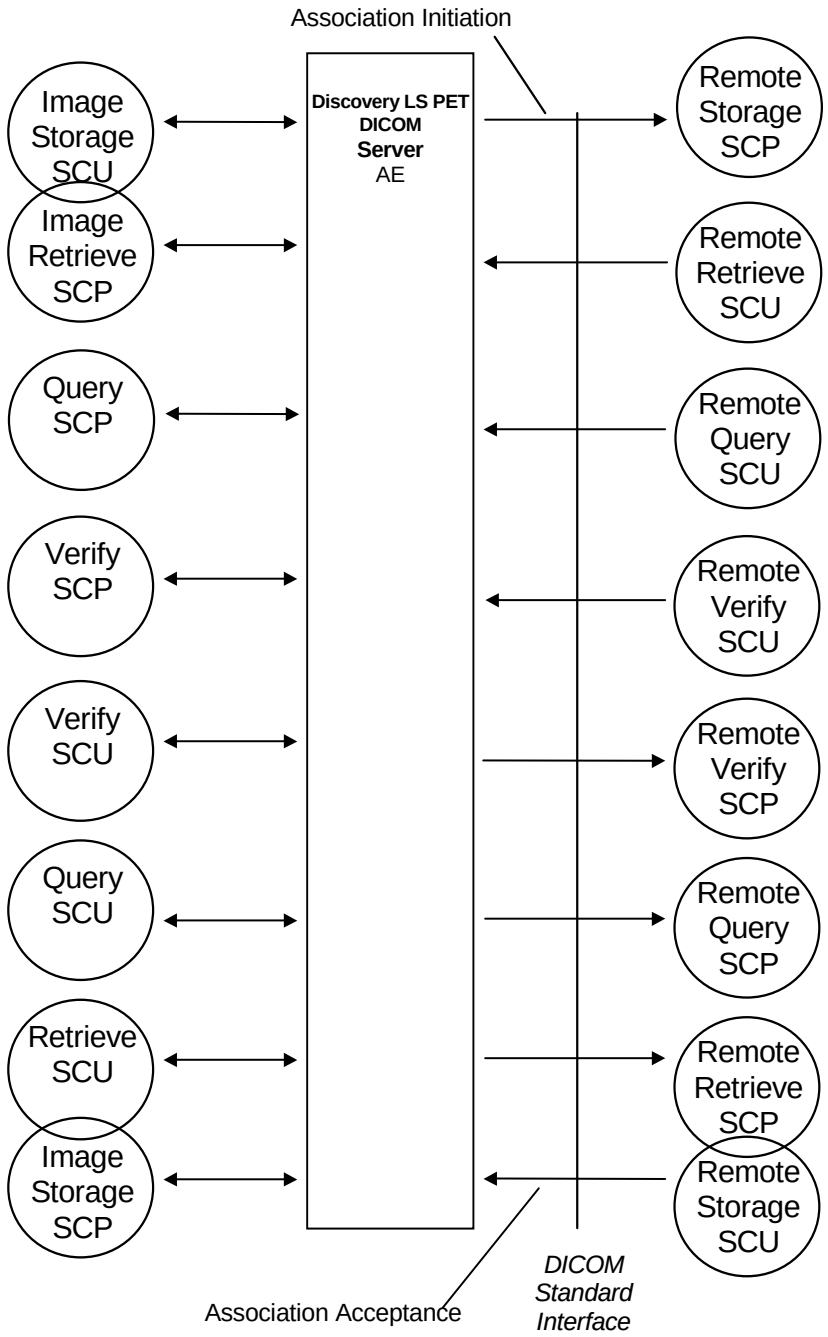



There is no Real-World activity required for the DICOM Server AE to respond to an incoming DICOM store, query or retrieve. The DICOM Server AE is always prepared to respond to a DICOM Store, Query, or Retrieve by any remote DICOM AE.

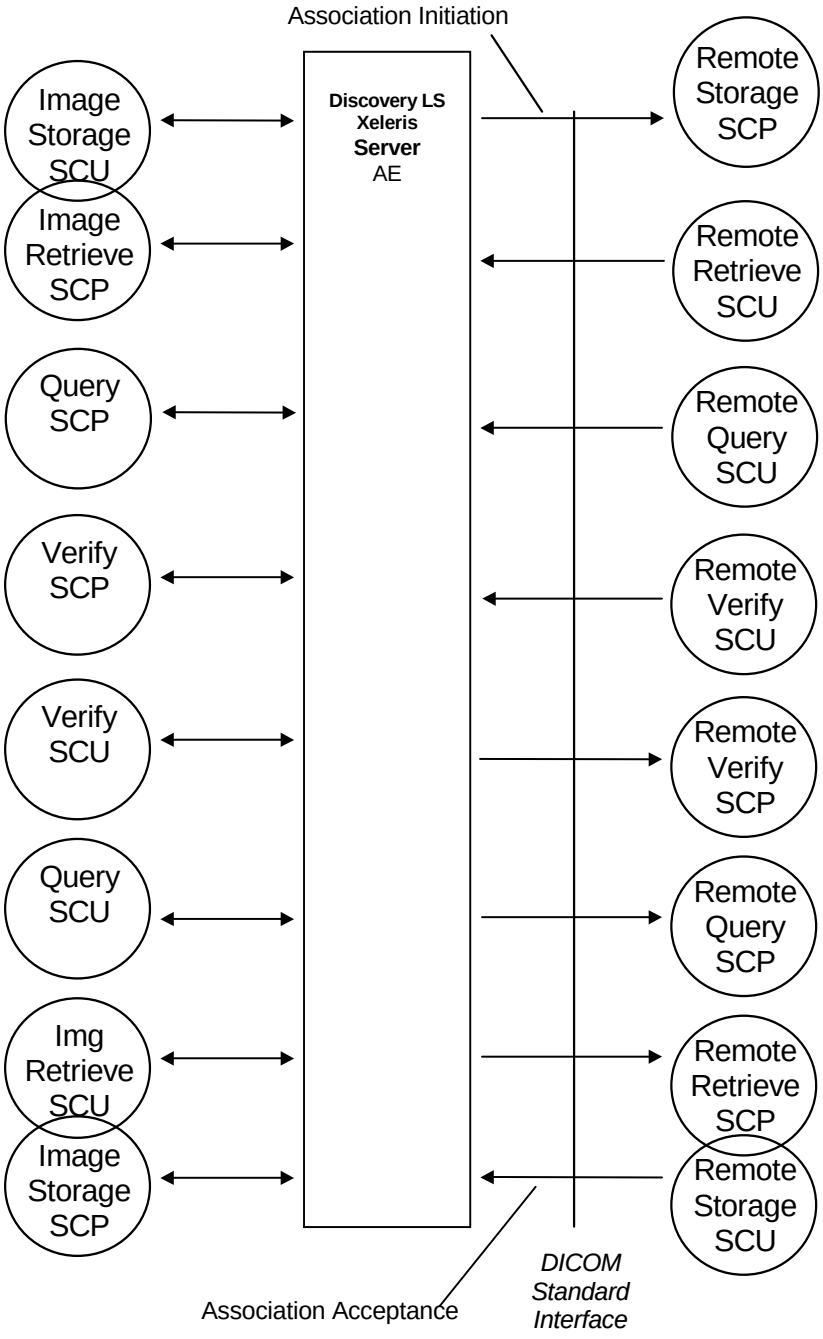
The DICOM Server AE will perform the Real-World activity *Image Installation* after the remote AE sends an image to the this AE.

Once a *Query* request is received, the CT DICOM Server AE will search the local database for all entries that match the keys requested by the Remote DICOM AE and send back the list of matches. The CT DICOM Server AE will also respond to an incoming retrieval request from a Remote AE by sending the image(s) to the Destination AE

### 2.2.1.2 PET Application Entity



#### 2.2.1.3 Xeleris Application Entity




### 2.2.2 Functional Definition of AE's

The **CT DICOM Server Application Entity initiates** the following operations:

- *Ping DICOM Host(Verification)*: The CT DICOM Server initiates an association and sends a C-ECHO-RQ message to the remote DICOM AE, the remote DICOM Server will send back a C-ECHO-RSP message with a status of “success”.

- *Push:* Initiate an association to a Remote AE to send image(s). If the Remote AE accepts the presentation context applicable to the image(s) being sent, the CT DICOM Server AE will send the image(s) by invoking C-STORE-RQ operation for each image on the same association.
- *Query:* Initiate an association with a Remote AE to query for images on the remote host. A Study-Root Study-Level C-FIND-RQ request will be sent to the Remote AE once an association has been established. After all responses are received, CT DICOM Server AE will issue a Series-Level C-FIND-RQ request to get the series for a study in the list. An Image-Level C-FIND-RQ will be issued for the first series in the series list.
- *Get:* Send a C-MOVE-RQ request to a Remote AE after successful association establishment. The CT DICOM Server AE's Storage SCP will receive the images over a separate association.

The **CT DICOM Server AE waits for association requests** from Remote AEs that wish to perform the following operations:

- *Verification*: If a C-ECHO-RQ message is received, the CT DICOM Server AE will send back a C-ECHO-RSP message with a status of "success".
- *Image Storage*: If a C-STORE-RQ message is received, the CT DICOM Server AE will receive the image and try to update the local database. If the image is stored successfully on storage media and the database updated a status of "success" will be returned in a C-STORE-RSP message.
- *Query*: If a C-FIND-RQ message is received the CT DICOM Server AE will search the database for the requested attributes and send back a C-FIND-RSP message containing a match and a status of "pending". After all matching records have been sent, a status of "success' will be returned in a C-FIND-RSP message. The Remote AE can terminate the query by sending a C-CANCEL-FIND-RQ message.
- *Retrieve*: If a C-MOVE-RQ message is received the CT DICOM Server AE will lookup its list of configured Remote AEs for the Destination AE. If the Destination AE is configured, the CT DICOM Server AE will open a new association to the Destination AE and use C-STORE-RQ to send the image(s). The CT DICOM Server AE will send a C-MOVE-RSP message with a status of "pending" after every five images are sent. When all images are sent or if CT DICOM Server AE receives a C-CANCEL-MOVE-RQ a final C-STORE-RSP will be sent back with an appropriate status.

The **PET DICOM Server AE initiates** the following functions:

- *Store*: Initiates a DICOM association in order to send PET images and curves, and Secondary Capture images to a remote AE. If the remote AE accepts a presentation context applicable to the image(s), curve(s) being sent, the PET DICOM Server will send the images/curves data via the C-STORE service.
- *Verify*: Initiates a DICOM association in order to send a verification message to a remote AE via a C-ECHO-RQ message.
- *Query*: Initiates a DICOM association in order to query images on a remote AE. If the remote AE accepts a presentation context applicable to the query request(s) being sent, the PET DICOM Server will receive appropriate query responses via the C-FIND service.
- *Retrieve* Initiates a DICOM association in order to fetch PET images/curves and Secondary Capture image data from a remote AE. If the remote AE accepts a presentation context applicable to the retrieve request(s), the remote AE initiates a C-STORE-RQ to the PET DICOM Server AE. If this is acceptable to the PET DICOM Server AE, then, the image(s)/curve(s) data is(are) sent to the PET DICOM Server AE.
- Responds to DICOM associations transmitting CT or MR images to be stored.

The **PET DICOM Server AE responds** to the following functions:

- *Store*: Responds to incoming C-STORE -RQ messages by storing the incoming PET images and curves, and Secondary Capture images, onto the disk.
- *Query*: Responds to incoming C-FIND-RQ messages by searching its local database for the requested attributes and returning a C-FIND-RSP message containing a match and a status of "pending." All other matches are also returned in C-FIND-RSP messages with status of "pending" until the last message which is returned with a status of "success." The remote AE can terminate the query by sending a C-CANCEL-FIND-RQ message.
- *Retrieve*: Responds to incoming C-MOVE-RQ messages by searching its local database for the requested PET image(s)/curve(s) and Secondary Capture image data and returning each via a C-STORE-RQ message. The PET DICOM Server will return a C-MOVE -RSP message after each image is sent. The status returned is "pending" until the last image is sent, in which case the appropriate status is returned. The remote AE can terminate the retrieve by sending a C-CANCEL-MOVE-RQ message.
- *Verify*: Responds to incoming C-ECHO-RQ messages by returning a C-ECHO-RSP message with a status of "success."

The **Xeleris DICOM Server Application Entity (AE) initiates** the following functions:

- *Stor*e: Initiates a DICOM association in order to send images to a remote AE. If the remote AE accepts a presentation context applicable to the image(s) being sent, the XELERIS DICOM Server will send the images via the C-STORE service.
- *Ver i f y* : Initiates a DICOM association in order to send a verification message to a remote AE via a C-ECHO-RQ message.
- *Quer*y: Initiates a DICOM association in order to query images on a remote AE. If the remote AE accepts a presentation context applicable to the query request(s) being sent, the XELERIS DICOM Server will receive appropriate query responses via the C-FIND service.
- *Retrieve* Initiates a DICOM association in order to fetch images from a remote AE. If the remote AE accepts a presentation context applicable to the retrieve request(s), the remote AE initiates a DICOM association for C-STORE-RQ to the XELERIS DICOM Server AE. If this is acceptable to the XELERIS DICOM Server AE, then, the image(s) is(are) sent to the XELERIS DICOM Server AE.

The **Xeleris DICOM Server AE responds** to the following functions:

- *Stor*e: Responds to incoming C-STORE -RQ messages by storing the incoming data stream onto the disk.
- *Quer*y: Responds to incoming C-FIND-RQ messages by searching its local database for the requested attributes and returning a C-FIND-RSP message containing a match and a status of "pending." All other matches are also returned in C-FIND-RSP messages with status of "pending" until the last message which is returned with a status of "success." The remote AE can terminate the query by sending a C-CANCEL-FIND-RQ message.
- *Retrieve*: Responds to incoming C-MOVE-RQ messages by searching its local database for the requested image(s) and returning each via a C-STORE-RQ message. The XELERIS DICOM Server will return a C-MOVE -RSP message after each image is sent. The status returned is "pending" until the last image is sent, in which case the appropriate status is returned. The remote AE can terminate the retrieve by sending a C-CANCEL-MOVE-RQ message.
- *Ver i f y* : Responds to incoming C-ECHO-RQ messages by returning a C-ECHO-RSP message with a status of "success."

### 2.2.3 Sequencing of Real-World Activities

Real-World Activity *Query Remote* must be performed before *Choose Get Option* can be performed.

### 2.2.4 CT Application Entity

#### 2.2.4.1 AE SPECIFICATIONS

##### 2.2.4.1.1 DICOM Server AE Specification

This Application Entity provides Standard Conformance to the following DICOM SOP Classes as an SCU:

| SOP Class Name (SCU) | SOP Class UID |
|---|---|
| Verification (Echo) | 1.2.840.10008.1.1 |
| CT Image Information Storage | 1.2.840.10008.5.1.4.1.1.2 |
| MR Image Information Storage | 1.2.840.10008.5.1.4.1.1.4 |
| Secondary Capture Image Storage | 1.2.840.10008.5.1.4.1.1.7 |
| Study Root Query/Retrieve – FIND | 1.2.840.10008.5.1.4.1.2.2.1 |
| Study Root Query/Retrieve – MOVE | 1.2.840.10008.5.1.4.1.2.2.2 |
| Storage Commitment Push Model | 1.2.840.10008.1.20.1 |

This Application Entity provides Standard Conformance to the following DICOM SOP classes as an SCP:

| SOP Class Name (SCP) | SOP Class UID |
|---|---|
| Verification (Echo) | 1.2.840.10008.1.1 |
| CT Information Storage | 1.2.840.10008.5.1.4.1.1.2 |
| MR Information Storage | 1.2.840.10008.5.1.4.1.1.4 |
| Secondary Capture Image Storage | 1.2.840.10008.5.1.4.1.1.7 |
| Study Root Query/Retrieve – FIND | 1.2.840.10008.5.1.4.1.2.2.1 |
| Study Root Query/Retrieve – MOVE | 1.2.840.10008.5.1.4.1.2.2.2 |

##### 2.2.4.1.1.1 Association Establishment Policy

**General**

The DICOM Application Context Name (ACN), which is always proposed, is:

| Application Context Name | 1.2.840.10008.3.1.1.1 |
|---|---|

The Maximum Length PDU negotiation is included in all association establishment requests. The maximum length PDU for association initiated by the DICOM Server AE is:

| Maximum Length PDU | 51 Kbytes |
|---|---|

SOP class Extended Negotiation is not supported.

Maximum PDU Length of Zero ( 0 ) is not supported. The association request will be rejected when a request with “Maximum PDU length of zero” is received.

The maximum number of Presentation Context Items that is supported is 60. Note that the same Abstract Syntax may be offered multiple times with different Transfer Syntax.

The user information items sent by this product are:
- Maximum PDU Length and,
- Implementation UID

**Number of Associations**

The DICOM Server AE (SCU) will initiate only one DICOM association at a time to perform an image store to a remote host or retrieve image(s) from a Remote AE.

The DICOM Server AE (SCP) can have a maximum of four DICOM associations open simultaneously to receive and store image store or respond to an echo.

**Asynchronous Nature**

Asynchronous mode is not supported. All operations will be performed synchronously.

**Implementation Identifying Information**

The Implementation UID allows unique identification of a set of products that share the same implementation.

The Implementation UID for this ID/Net v3.0 Implementation is:

| | |
|---|---|
| Discovery LS CT AE Implementation UID | 1.2.840.113619.6.55 |

**2.2.4.1.1.2 Association Initiation by Real-World Activity**

This AE attempts to initiate a new association due to a “ Ping DICOM Host” or “Push” operation initiated by the user. A new association is also initiated when the user performs a “Query Remote” operation or issues a retrieve operation by performing a “Get” operation at Study/Series/Image level.

**Push Image(s) to Remote AE**

*Associated Real-World Activity*

The operator must first select a destination by choosing “Select Remote Host” from the “Network” pull-down menu on the local database manager and then choose a hostname.

The “Push” operation will cause the DICOM server AE to initiate an Association when the operator selects one or more study, series, or images in the local database manager and then chooses either

"Push Examination", "Push Series", or "Push Image" from the "Network" pull-down menu on the local database manager.

**Note:** If multiple study, series, or images are chosen to be pushed, one association will be established for each of the studies, series, or images.

*Proposed Presentation Contexts*

The following table shows the proposed presentation contexts for the DICOM Server AE after Real-World Activity "Push" Operation has been performed.

**Table 2.2.1.2.1.2-1 Proposed Presentation Contexts for DICOM Server AE and Real-World activities Push, Query, Pull(Get Images) and Verification(Dicom Ping) SCUs**

| Presentation Context Table – Proposal | | | | | |
|---|---|---|---|---|---|
| Abstract Syntax | | Transfer Syntax | | Role | Extended Negotiation |
| Name | UID | Name List | UID List | | |
| CT Image Storage | 1.2.840.10008.5.1.4.1.1.2 | Implicit VR Little Endian<br>Implicit VR Big Endian (GE Private)<br>Explicit VR Little Endian<br>Explicit VR Big Endian | 1.2.840.10008.1.2<br>1.2.840.113619.5.2<br>1.2.840.10008.1.2.1<br>1.2.840.10008.1.2.2 | SCU | None |
| MR Image Storage | 1.2.840.10008.5.1.4.1.1.4 | Implicit VR Little Endian<br>Implicit VR Big Endian (GE Private)<br>Explicit VR Little Endian<br>Explicit VR Big Endian | 1.2.840.10008.1.2<br>1.2.840.113619.5.2<br>1.2.840.10008.1.2.1<br>1.2.840.10008.1.2.2 | SCU | None |
| Secondary Capture Image Storage | 1.2.840.10008.5.1.4.1.1.7 | Implicit VR Little Endian<br>Implicit VR Big Endian (GE Private)<br>Explicit VR Little Endian<br>Explicit VR Big Endian | 1.2.840.10008.1.2<br>1.2.840.113619.5.2<br>1.2.840.10008.1.2.1<br>1.2.840.10008.1.2.2 | SCU | None |
| Study Root Query/Retrieve FIND | 1.2.840.10008.5.1.4.1.2.2.1 | Implicit VR Little Endian | 1.2.840.10008.1.2 | SCU | None |
| Study Root Query/Retrieve MOVE | 1.2.840.10008.5.1.4.1.2.2.2 | Implicit VR Little Endian | 1.2.840.10008.1.2 | SCU | None |
| Verification | 1.2.840.10008.1.1 | Implicit VR Little Endian | 1.2.840.10008.1.2 | SCU | None |

**Note:** Other Abstract Syntax and Transfer Syntax names may be offered when establishing an association. These are private syntax which may be ignored. See section 2.4.

***SOP Specific Conformance Statement C_STORE SCU***

This implementation can perform multiple C-STORE operations over a single association.

Upon receiving a C-STORE confirmation containing a successful status, this implementation will perform the next C-STORE operation. The association will be maintained if possible.

Upon receiving a C-STORE confirmation containing a Refused status, this implementation will terminate the association.

Upon receiving a C-STORE confirmation containing any status that is not Success or Refused, this implementation will consider the current request to be a failure but will continue to attempt to send the remaining images in the request on the same association.

Each C-STORE operation supports an “Association Timer”. This timer starts when the association request is sent or received and stops when the association is established. The time-out is 900 seconds.

Each C-STORE operation also supports an “Operation Inactivity Timer”. This time-out starts once the first C-STORE request has been issued (on association) or received and is reset each time a C-STORE response has been received or when subsequent C-STORES are sent. This time-out is 900 seconds.

Each C-STORE operation also supports a “Session Timer”. This timer starts when the association is established and stops when the association is ended. This time-out is 60 minutes.

If any of the three timers mentioned above expires, the connection is closed and the operation in progress is considered failed.

**Note:** The time-outs are configurable.

When DICOM Server AE initiates an association to issue a C-STORE, one of the following two operations will be performed.

1. If the image is stored locally on the Discovery LS in DICOM format (“Dicm” appears in the “Fmt” column at the exam level of the local database manager), the image will be transmitted by the DICOM Server AE with the same elements as was originally received or created locally (for the standard elements only).

2. If the image is stored locally on the Discovery LS in a non-DICOM Advantage format (“Adv appears in the “Fmt” field at the exam level of the local database manager), the image will be translated and then transmitted by the DICOM Server AE to the identical profiles specified by the CT Advantage Conformance Statement for DICOM (Direction 2118781) and the MR Signa Advantage Conformance Statement for DICOM (Direction 2118782).

### Query Remote AE

*Associated Real-World Activity*

The operator must first select a destination by choosing *“Select Remote Host”* from “*Network”* pull-down menu on the local database manager and then choose a hostname. To do custom queries select “***Yes***” for “***Custom search***” option.

*Note:*
Custom queries can be done on the following fields *“Last Name contains”, “Exam Number”, “Patient Id”, “Accession Number”.*

To initate a Query select “***Receive***” from “***Network***” pull-down menu.

*Note:*

If *"Custom Search"* option is set then a small GUI will show up. Operator will be able to enter custom query fields. Entering values in *"Last Name contains"* field will initiate wild card query for patient name.

The *"Query"* operation will cause the DICOM Server AE to initiate an association to the selected Remote AE when the *"Query Remote Host"* entry is selected from the *"Network"* pull-down menu. Once a list of Study/Series/Image is retrieved, the operator can invoke the *"Get"* operation by choosing *"Get Exam"* or *"Get Series"* or *"Get Image"* from the *"Network"* pull-down menu.

*Proposed Presentation Contexts*

When the Real-World activity *"Query"* or *"Get"* is initiated all presentation contexts shown in table 2.2.1.2.1.2-1 are proposed during association establishment, but only the Query/Retrieve-FIND related contexts are applicable to this activity.

***SOP Specific Conformance Statement for C-FIND SCU***

After the *Query* operation is initiated, the DICOM Server AE will perform a study-root C-FIND-RQ request at each of the three levels (Study, Series, and Image) in succession. The Initial Study-Level request will ask for all studies in the Remote database.

The C-FIND SCU will not perform any extended negotiation and so will only perform hierarchical query. Relational Queries are not supported.

Each C-FIND SCU operation supports an "Association Timer", "Operation Inactivity Timer" and "Session Timer" with time out values of 900 seconds, 900 seconds and 60 minutes respectively.

If a "Cancel" or "Refused" status is returned from the Remote AE the association is closed and the operation terminated.

The DICOM Server AE will parse each matching C-FIND-RSP reply and ignore the entries it fails to parse. Tables 2.3.1.2.2.2.1-1 - 2.3.1.2.2.2.1-3 shows the various fields that are requested at the Study, Series, and Image levels of the C-FIND request.

Query results are filtered based on the Modality field. Only CT/MR images are supported.

**Note:** In the following tables the Type field has the following meaning:
**R** - Required **U** - Unique **O** - Optional **P** - Private

**Table 2.3.1.2.2.2.1-1: Requested Study Level Keys**

| Description | Type | Tag | Value |
|---|---|---|---|
| Study date | R | 0008,0020 | Zero length |
| Study time | R | 0008,0030 | Zero length |
| Accession number | R | 0008,0050 | Zero length, or value specified in custom query |
| Patient's name | R | 0010,0010 | Zero length, or value specified in custom query |
| Patient id | R | 0010,0020 | Zero length, or value specified in custom query |
| Study id | R | 0020,0010 | Zero length, or value specified in custom query |
| Study Instance UID | U | 0020,000D | Zero length |

| Description | Type | Tag | Value |
|---|---|---|---|
| Study description | O | 0008,1030 | Zero length |
| Private Creator Identification | P | 0009,00xx | GEMS_IDEN_01 |
| Suite Id | P | 0009,xx02 | Zero Length |

**Table 2.3.1.2.2.2.1-2: Requested Series Level Keys**

| Description | Type | Tag | Value |
|---|---|---|---|
| Study Instance UID | U | 0020,000D | Study Instance UID from Study level query response |
| Modality | R | 0008,0060 | Zero length |
| Series number | R | 0020,0011 | Zero length |
| Series Instance UID | U | 0020,000E | Zero length |
| Series description | O | 0008,103E | Zero length |
| Manufacturer | O | 0008,0070 | Zero length |
| Images in series | O | 0020,1002 | Zero length |

**Table 2.3.1.2.2.2.1-3: Requested Image Level Keys -**

| Description | Type | Tag | Value |
|---|---|---|---|
| Study Instance UID | U | 0020,000D | Study Instance UID from Study level query response |
| Series Instance UID | U | 0020,000E | Series Instance UID from Series level query response |
| Instance number | R | 0020,0013 | Zero length |
| SOP Instance UID | U | 0008,0018 | Zero length |
| Image type | O | 0008,0008 | Zero length |
| Rows | O | 0028,0010 | Zero length |
| Columns | O | 0028,0011 | Zero length |
| Image position | O | 0020,0032 | Zero length |
| Image orientation | O | 0020,0037 | Zero length |
| Slice thickness | O | 0018,0050 | Zero length |
| Slice spacing | O | 0018,0088 | Zero length |
| Gantry tilt | O | 0018,1120 | Zero length |
| Convolution kernel | O | 0018,1210 | Zero length |
| Reconstruction diameter | O | 0018,1100 | Zero length |
| Data collection diameter | O | 0018,0090 | Zero length |
| Flip angle | O | 0018,1314 | Zero length |
| Echo number | O | 0018,0086 | Zero length |
| Echo time | O | 0018,0081 | Zero length |
| Inversion time | O | 0018,0082 | Zero length |
| Repetition time | O | 0018,0080 | Zero length |
| Trigger time | O | 0018,1060 | Zero length |
| Private Creator Identification | P | 0019,00xx | GEMS_ACQU_01 |
| Dfov Rect | P | 0019,xx1E | Zero Length |
| Midscan Time | P | 0019,xx24 | Zero Length |
| Azimuth | P | 0019,xx26 | Zero Length |
| Number of Echo | P | 0019,xx7E | Zero Length |
| Private Creator Identification | P | 0021,00xx | GEMS_RELA_01 |
| Scout Anref | P | 0021,xx4A | Zero Length |

| Description | Type | Tag | Value |
|---|---|---|---|
| Private Creator Identification | P | 0027,00xx | GEMS_IMAG_01 |
| Location RAS | P | 0027,xx40 | Zero Length |
| Location | P | 0027,xx41 | Zero Length |
| Center R Coordinate | P | 0027,xx42 | Zero Length |
| Center A Coordinate | P | 0027,xx43 | Zero Length |
| Table Start Location | P | 0027,xx50 | Zero Length |
| Table End Location | P | 0027,xx51 | Zero Length |
| RAS Letter for Side of Image | P | 0027,xx52 | Zero Length |
| RAS Letter for Anterior/Posterior | P | 0027,xx53 | Zero Length |
| RAS Letter for Scout Start Location | P | 0027,xx54 | Zero Length |
| RAS Letter for Scout End Location | P | 0027,xx55 | Zero Length |
| Image Dimension X | P | 0027,xx60 | Zero Length |
| Image Dimension Y | P | 0027,xx61 | Zero Length |

### Get Image(s) from Remote AE

*Associated Real-World Activity*

The operator must first select a destination by choosing *"Select Remote Host"* from "*Network"* pull-down menu on the local database manager and then choose a hostname. The operator then has to perform the Real-World activity *"Query"* to get a list of Study/Series/Image. Once the list of Study/Series/Image is retrieved, the operator can invoke the *"Get"* operation by choosing *"Get Exam"* or *"Get Series"* or *"Get Image"* from the *"Network"* pull-down menu.

*Proposed Presentation Contexts*

When the Real-World activity *"Get"* is initiated all presentation contexts shown in table 2.2.1.2.1.2-1 are proposed during association establishment, but only the Query/Retrieve-MOVE related contexts are applicable to this activity.

*SOP Specific Conformance Statement for C-MOVE SCU*

When the operator starts a *Get* operation at any level (Study, Series, Image) the DICOM Server AE will initiate a C-MOVE-RQ request to the Remote AE with the DICOM Server AE as the Destination AE. The Storage SCP will handle the incoming images as described in section 2.2.1.3.1.

Each C-MOVE SCU operation supports an "Association Timer", "Operation Inactivity Timer" and "Session Timer" with time out values of 900 seconds, 300 seconds and 60 minutes respectively.

The DICOM Server AE will send a C-CANCEL-MOVE-RQ to the Remote AE if the operator *"Pauses"* or *"Clears"* the job from the local database manager Network queue.

### Real-World Activity: Verify (DICOM Ping)

*Associated Real-World Activity*

The operator must first select a destination by choosing *"Select Remote Host"* from "*Network"* pull-down menu on the local database manager and then choose a hostname.

The operator must then select the "*Ping DICOM host*" form "*Network*" pull-down menu.

The DICOM server will initiate an association with the remote DICOM AE in order to verify communication at the application level. The success or failure of the verification process is displayed to the user.

*Proposed Presentation Context Table*

Refer to the Table 2.2.1.2.1.2-1 for the Proposed Presentation Contexts for DICOM Server AE and Real-World activity Verification

*SOP Specific DICOM Conformance C_ECHO SCU*

The Discovery LS DICOM Server AE provides standard conformance to the DICOM Verification Service Class.

Each ECHO operation supports an "Association Timer", "Operation Inactivity Timer" and "Session Timer" with a time out values of 900 seconds, 30 seconds and 60 minutes respectively

**Real-World Activity: Storage Commitment -**

*Associated Real-World Activity*

The operator must first select a destination by choosing *"Select Remote Host"* from "*Network"* pull-down menu on the local database manager and then choose a hostname. Select the "*Update*" option, if the hostname is already present. Set the "*Archive Node*" option to "*Yes*". If the remote host is not present add the remote host in the local database with "*Archive Node*" option set to "*Yes*".

*Note :*

The remote node should be a Storage Commitment SCP.

The operator must then select " Archive " pull-down menu on the local database manager. Select "*Select Media*" option menu. Select "*Remote Node*" in the menu.

*Note :*

The remote node option on the archive menu will be present only if a remote node is configured as an archive node.

The operator then selects one or more study, series, or images in the local database manager and then chooses either "Save Examination", "Save Series", or "Save Image" from the "Archive" pull-down menu on the local database manager.

*Note:*

Also refer to section 5.3.1.3

*Proposed Presentation Context Table*

Refer to section 5.3.1.4

*SOP Specific Conformance Statement Storage Commitment SCU*

Refer to section 5.3.1.4

#### 2.2.4.1.1.3 Association Acceptance Policy

The DICOM Server AE places limitations on who may connect to it .

If the Remote AE needs to “Push Images” or “Query/Retrieve Images”, to the local system then it has to be configured in the Local system to do the same.

To configure a remote AE choose “Select Remote Host” in the “network” pull down menu. Select the Remote Host and choose “Update” option, if the Remote AE is already present. If the Remote AE is not present choose “Add” option to add the Remote AE.

Set “Push Images” option to “Yes” , if the Remote AE needs to push images to the Local system

Set “Query/Retrieve” option to “Yes”, if the Remote AE needs to “Query/Retrieve” the local system.

When the DICOM Server AE accepts an association for image storage, it will receive any images transmitted on that association and store the images on disk.

It will also respond to queries from Remote AEs by sending matching entries. Any Remote AE can request and receive a list of images on the local database. The Remote AE must be configured in the local database manager’s list of Remote AE for it to be able to retrieve images from DICOM Server AE.

Any remote AE can open an association to the DICOM Server AE for the purpose of verification.

**Receive Image(s)**

This AE is indefinitely listening for associations. No operator action is required to receive an image.

*Associated Real-World Activity*

The Real-World Activity associated with the Receive Image(s) operation is the storage of the image on the disk drive of the Discovery LS.

*Presentation Context Table*

**Table 2.2.1.3.1.2-1: Accepted Presentation Contexts for DICOM Server AE and Real-World Activity Receive Image(s)**

| Presentation Context Table - Accepted | | | |
|---|---|---|---|
| Abstract Syntax | Transfer Syntax | Role | Extended |

| | | | | | Negotiation |
|---|---|---|---|---|---|
| Name | UID | Name List | UID List | | |
| Verification | 1.2.840.10008.1.1 | Implicit VR Little Endian | 1.2.840.10008.1.2 | SCP | None |
| CT Image Storage | 1.2.840.10008.5.1.4.1.1.2 | Implicit VR Little Endian<br>Implicit VR Big Endian (GE Private)<br>Explicit VR Little Endian<br>Explicit VR Big Endian | 1.2.840.10008.1.2<br>1.2.840.113619.5.2<br>1.2.840.10008.1.2.1<br>1.2.840.10008.1.2.2 | SCP | None |
| MR Image Storage | 1.2.840.10008.5.1.4.1.1.4 | Implicit VR Little Endian<br>Implicit VR Big Endian (GE Private)<br>Explicit VR Little Endian<br>Explicit VR Big Endian | 1.2.840.10008.1.2<br>1.2.840.113619.5.2<br>1.2.840.10008.1.2.1<br>1.2.840.10008.1.2.2 | SCP | None |
| Secondary Capture Image Storage | 1.2.840.10008.5.1.4.1.1.7 | Implicit VR Little Endian<br>Implicit VR Big Endian (GE Private)<br>Explicit VR Little Endian<br>Explicit VR Big Endian | 1.2.840.10008.1.2<br>1.2.840.113619.5.2<br>1.2.840.10008.1.2.1<br>1.2.840.10008.1.2.2 | SCP | None |

**Note:** The SCP does not have a default acceptance policy if more than one acceptable transfer syntax is proposed by the SCU. It is the responsibility of the SCU to make a selection from more than one transfer sentences accepted.

*SOP Specific Conformance to C_STORE SCP*

The DICOM Server AE conforms to the SOP's of the Storage Service Class at level 1 (base). Private elements will be discarded from the image when receiving images containing non-GE private data elements. All of the **standard** type elements ( 1,1c,2,2c,3) will be retained.

Each C-STORE SCP operation supports an "Association Timer", "Operation Inactivity Timer" and "Session Timer" with time out values of 900 seconds, 900 seconds and 60 minutes respectively.

**Image Reception**

If the DICOM Server AE returns one of the following status codes, then the C-STORE operation was unsuccessful and no image will be installed:

- 0110 (Processing Failure) Indicates that an internal system call has failed while processing an image.

- A711 (Out of Resources) Indicates that probably there was not enough disk space to store the image. The user should attempt recovery by removing some images from the Discovery LS system.

- A712 (Out of Resources) Indicates that there was not enough resource (such as memory) to store the image.

- A800 (SOP Class not supported)

In the event of a successful C-STORE operation, the image has successfully been written to disk. The image will then be accessed in the same manner as any other image by the applications on the Discovery LS system.

Images may be deleted when instructed to do so by the user. Thus the duration of the storage of the image is determined by the users of the Discovery LS system.

**Image Installation**

If the image installation is unsuccessful, a message will appear in the Message Log informing the user of the failure and the image will be removed.

If the image installation process finds that an element is not encoded according to the DICOM standard, it will fail to install the image and the file will be removed.

**Image Installation of GE Created MR or CT Images**

Images that were originally created on recent GE MR and CT scanners will be converted from their native Advantage Proprietary Format to DICOM format for transmission. If the images are stored as full fidelity representations and are subsequently returned to recent GE scanners, then the images will be transformed back to Advantage Proprietary Format.

There is an assumption made by such GE scanners:

The private element (0009,xx01) is used as the full fidelity flag. If this flag contains the string: “GE_GENESIS_FF” when received by a scanner, then it is assumed that the image object was originally a GE created image object and contains all private elements that it was sent with.

If full fidelity flag is present and not all the elements are sent back as sent (i.e., not full fidelity) there are 2 possible actions:

1. the translator will do its best to convert the image and will use default values where DICOM fields are missing
2. If certain critical information is not provided then the image will be stored as a Secondary Capture

It is strongly suggested that if GE private element (0009,xx01) is present then all GE private elements originally associated with the image be preserved.

*Note :*

The images created on Discovery LS system will be stored as DICOM images with GE Big endian ( Private transfer syntax ) on the system.

The private element (0009,xx01) will have the value “CT_LIGHTSPEED”.

**Image Installation of non-GE Created MR or CT Images**
Images received from non GE products are installed as appropriate image object without any of their private data elements. Also if some critical fields (mandatory) are missing, then the image will not be installed.

### Verification Request from Remote AE

This AE is indefinitely listening for associations. No operator action is required to respond to a *verification* message.

*Associated Real-World Activity*

The Real-World Activity associated with the verification request is to send a C-ECHO response message with a status of “success” to the requesting AE.

*Presentation Context Table*

**Table 2.2.1.3.2.2-1: Acceptable Presentation Contexts for DICOM Server AE and Real-World Activity Verification Request**

| Presentation Context Table | | | | | |
|---|---|---|---|---|---|
| Abstract Syntax | | Transfer Syntax | | Role | Extended Negotiation |
| Name | UID | Name List | UID List | | |
| Verification | 1.2.840.10008.1.1 | Implicit VR Little Endian | 1.2.840.10008.1.2 | SCP | None |

*SOP Specific Conformance to C_ECHO SCP*

The DICOM Server AE provides standard conformance to the DICOM Verification Service Class.

Each ECHO operation supports an “Association Timer”, “Operation Inactivity Timer” and “Session Timer” with a time out values of 900 seconds, 30 seconds and 60 minutes respectively.

### Query Request from Remote AE

This AE is indefinitely listening for associations. No operator action is required to respond to a *query* request.

*Associated Real-World Activity*

The Real-World Activity associated with the query request is to search the local database for entries that match the request and send a C-FIND response message with a status of “pending” for each matching entry.

*Presentation Context Table*

**Table 2.2.1.3.1.2-1: Acceptable Presentation Contexts for DICOM Server AE and Real-World Activity Query Request**

| Presentation Context Table | | | | | |
|---|---|---|---|---|---|
| Abstract Syntax | | Transfer Syntax | | Role | Extended Negotiation |
| Name | UID | Name List | UID List | | |
| Study Root Query/Retrieve FIND | 1.2.840.10008.5.1.4.1.2.2.1 | Implicit VR Little Endian | 1.2.840.10008.1.2 | SCP | None |

*SOP Specific Conformance to C-FIND SCP*

Each C-FIND SCP operation supports an “Association Timer”, “Operation Inactivity Timer” and “Session Timer” with a time out values of 900 seconds, 900 seconds and 60 minutes respectively.

All Required( R) and Unique(U) study, series, and image level keys for the Study-Root Query/Retrieve information model are supported. Some optional (O) keys are also supported as described in the following tables.

**Note:** In the following tables the type field has the following meaning:
**R** - Required **U** - Unique **O** - Optional **P** - Private

**Table 2.3.1.3.3.2.1-1 Supported study level keys**

| Description | Type | Tag | Usage |
|---|---|---|---|
| Study date | R | 0008,0020 | Matched |
| Study time | R | 0008,0030 | Matched |
| Accession number | R | 0008,0050 | Matched |
| Patient’s name | R | 0010,0010 | Matched |
| Patient id | R | 0010,0020 | Matched |
| Study id | R | 0020,0010 | Matched |
| Study Instance UID | U | 0020,000D | Matched |
| Study description | O | 0008,1030 | Returned |
| Suite Id | P | 0009,0002 | Returned |

**Table 2.3.1.3.3.2.1-2 Supported series level keys**

| Description | Type | Tag | Usage |
|---|---|---|---|
| Modality | R | 0008,0060 | Matched |
| Series number | R | 0020,0011 | Matched |
| Series Instance UID | U | 0020,000E | Matched |
| Series description | O | 0008,103E | Returned |

| Description | Type | Tag | Usage |
|---|---|---|---|
| Manufacturer | O | 0008,0070 | Returned |
| Images in series | O | 0020,1002 | Returned |

**Table 2.3.1.3.3.2.1-3 Supported image level keys**

| Description | Type | Tag | Usage |
|---|---|---|---|
| Instance number | R | 0020,0013 | Matched |
| SOP Instance UID | U | 0008,0018 | Matched |
| Image type | O | 0008,0008 | Returned |
| Rows | O | 0028,0010 | Returned |
| Columns | O | 0028,0011 | Returned |
| Image position | O | 0020,0032 | Returned |
| Image orientation | O | 0020,0037 | Returned |
| Slice thickness | O | 0018,0050 | Returned |
| Slice spacing | O | 0018,0088 | Returned |
| Gantry tilt | O | 0018,1120 | Returned |
| Convolution kernel | O | 0018,1210 | Returned |
| Reconstruction diameter | O | 0018,1100 | Returned |
| Data collection diameter | O | 0018,0090 | Returned |
| Flip angle | O | 0018,1314 | Returned |
| Echo number | O | 0018,0086 | Returned |
| Echo time | O | 0018,0081 | Returned |
| Inversion time | O | 0018,0082 | Returned |
| Repetition time | O | 0018,0080 | Returned |
| Trigger time | O | 0018,1060 | Returned |
| Dfov Rect | P | 0019,001E | Returned |
| Midscan Time | P | 0019,0024 | Returned |
| Azimuth | P | 0019,0026 | Returned |
| Number of Echo | P | 0019,007E | Returned |
| Scout Anref | P | 0021,004A | Returned |
| Location RAS | P | 0027,0040 | Returned |
| Location | P | 0027,0041 | Returned |
| Center R Coordinate | P | 0027,0042 | Returned |
| Center A Coordinate | P | 0027,0043 | Returned |
| Table Start Location | P | 0027,0050 | Returned |
| Table End Location | P | 0027,0051 | Returned |
| RAS Letter for Side of Image | P | 0027,0052 | Returned |
| RAS Letter for Anterior/Posterior | P | 0027,0053 | Returned |
| RAS Letter for Scout Start Location | P | 0027,0054 | Returned |
| RAS Letter for Scout End Location | P | 0027,0055 | Returned |
| Image Dimension X | P | 0027,0060 | Returned |
| Image Dimension Y | P | 0027,0061 | Returned |

**Note:** In the above tables the type field has the following meaning:
**R** - Required **U** - Unique **O** - Optional **P** - Private

Only keys with Usage type *Matched* will be matched against values in the database.

Values in keys of type *Returned* will be ignored and will be filled in with data from the database.

If an optional key is requested that does not appear in any of the tables above, that key will be ignored and no corresponding element will be returned.

If the database does not have a value corresponding to any requested optional key a zero-length element will be returned.

Sequence matching is not supported.

Range matching is supported for attributes of type date and time.

Only hierarchical query is supported.

**Retrieve Request From Remote AE**

This AE is indefinitely listening for associations. No operator action is required to respond to a *retrieve* request.

*Associated Real-World Activity*

The Real-World Activity associated with the Retrieve Request is to send all images corresponding to the C-MOVE request to the destination AE through a separate association.

*Presentation Context Table*

**Table 2.2.1.3.4.2-1: Acceptable Presentation Contexts for DICOM Server AE and Real-World Activity Retrieve Request.**

| Presentation Context Table | | | | | |
|---|---|---|---|---|---|
| Abstract Syntax | | Transfer Syntax | | Role | Extended Negotiation |
| Name | UID | Name List | UID List | | |
| Study Root Query/Retrieve MOVE | 1.2.840.10008.5.1.4.1.2.2.2 | Implicit VR Little Endian | 1.2.840.10008.1.2 | SCP | None |

*SOP Specific Conformance to C-MOVE SCP*

The DICOM Server AE provides standard conformance to the baseline Study-root C-MOVE Service Class SCP.

Each C-MOVE SCP operation supports an “Association Timer”, “Operation Inactivity Timer” and “Session Timer” with a time out values of 900 seconds, 300 seconds and 60 minutes respectively. These time-outs are configurable in dcs.cfg as *bi_assoc_tio*, *bi_store_tio* and *bi_session_tio* respectively.

All images requested in a C-MOVE-RQ will be sent over a single association. A C-MOVE-RSP with a "pending" status will be returned to the requester every five images.

The C-MOVE SCP will invoke C-STORE requests for the following SOP classes:

| SOP Class Name | SOP Class UID |
|---|---|
| CT Image Information Storage | 1.2.840.10008.5.1.4.1.1.2 |
| MR Image Information Storage | 1.2.840.10008.5.1.4.1.1.4 |
| Secondary Capture image storage | 1.2.840.10008.5.1.4.1.1.7 |

In addition to the C-MOVE response status values defined in DICOM part 4 the following status values will be returned:

- C000 - Indicates that an error occurred while retrieving records from the local database.
- C001 - Indicates all other processing error.
- C011 - If the Destination AE returns a *"Storage Full"* condition this status will be returned. This status will only be sent if the Destination AE returns a status of A711 and is only applicable if the Destination AE is another GE Medical Systems product.

*Presentation Context Acceptance Criteria*

No criterion.

*Transfer Syntax Selection Policy*

All protocols detailed above in the tables are supported, no priority selection is given.

### 2.2.4.2 COMMUNICATION PROFILES

#### 2.2.4.2.1 Supported Communication Stacks (parts 8,9)

DICOM Upper Layer (Part 8) is supported using TCP/IP.

#### 2.2.4.2.2 TCP/IP Stack

The TCP/IP stack is inherited from a UNIX Operating System.

##### 2.2.4.2.2.1 Physical Media Support

Ethernet v2.0, IEEE 802.3. Auto senses 10/100 Base T Ethernet connection.

#### 2.2.4.2.3 Point-to-Point Stack

A 50-pin ACR-NEMA connection is not applicable to this product.

### 2.2.4.3 EXTENSIONS / SPECIALIZATIONS / PRIVATIZATIONS – CT Application Entity

#### 2.2.4.3.1 Specialized Information Object Definition

Following is a list of additional private attributes defined for a standard **CT IOD**.

(0008,0008) Value 3: CT Image IOD specific specializations
AXIAL
LOCALIZER
SEGMENTED
REFORMATTED
PROCESSED
COMBINED

Value 4 : CT Image implementation specific
MIN IP
MIP
AVERAGE
VOLREN
INTEGRAL
HD MIP
RAYSUM
SURFACE
MINMAX

(0018,0022) Scan Options : Defined Terms
AXIAL MODE
DYNAMIC MODE
SCOUT MODE
AXIAL MODE
STATIC XRON MODE
STATIC XROFF MODE
TUBE HEAT MODE
DAS MODE
TUBE CAL MODE
BIOPSY MODE
CINE
HELICAL
ROTGENCAL MODE

#### 2.2.4.3.2 Private SOP's

ID/Net v2.0 Private IOD's are based upon the April 1993 draft version of the DICOM. ID/Net v2.0 IOD's are supported for backward compatibility.

**Note:** See the "ID/Net v2.0 Implementation Profiles" (Direction 46-269546G2) for definitions of Information Objects.

| Presentation Context Table - Accepted / Proposed | | | | | |
|---|---|---|---|---|---|
| Abstract Syntax | | Transfer Syntax | | Role | Extended Negotiation |
| Name | UID | Name List | UID List | | |
| GE Private DICOM MR Image Information Object (ID/Net v2.0 compatible) | 1.2.840.113619.4.2 | Implicit VR Little Endian | 1.2.840.10008.1.2 | Both | None |
| GE Private DICOM MR Image Information Object (ID/Net v2.0 compatible) | 1.2.840.113619.4.2 | Implicit VR Big Endian (GE Private) | 1.2.840.113619.5.2 | Both | None |
| GE Private DICOM CT Image Information Object (ID/Net v2.0 compatible) | 1.2.840.113619.4.3 | Implicit VR Little Endian | 1.2.840.10008.1.2 | Both | None |
| GE Private DICOM CT Image Information Object (ID/Net v2.0 compatible) | 1.2.840.113619.4.3 | Implicit VR Big Endian (GE Private) | 1.2.840.113619.5.2 | Both | None |
| GE Private DICOM Display Information Object (ID/Net v2.0 compatible) | 1.2.840.113619.4.4 | Implicit VR Little Endian | 1.2.840.10008.1.2 | Both | None |
| GE Private DICOM Display Information Object (ID/Net v2.0 compatible) | 1.2.840.113619.4.4 | Implicit VR Big Endian (GE Private) | 1.2.840.113619.5.2 | Both | None |

#### 2.2.4.3.3 Private Data Elements

Refer to ***Appendix B*** for a complete listing of private data elements used with this implementation.

### 2.2.4.4 CONFIGURATION

#### 2.2.4.4.1 AE Title/Presentation Address Mapping

The Discovery LS system allows the user to "add", "Remove", or "Update the mapping of remote AE Titles to IP Addresses and Ports. These options can be selected from the "Remote Host Selection" menu displayed by choosing "Select

Remote Host" from the "Network" pull-down menu from the local database manager.

#### 2.2.4.4.2 Configurable Parameters

The following fields are configurable for the DICOM Server AE:

- Local AE Title (the machine hostname)
- Local IP Address
- Local IP Netmask
- Max PDU length
- Time-outs, which are set for all hosts, are configurable in dcs.cfg:
  *Association time-out - *bi_assoc_tio*
  *Session timeout - *bi_session_tio*
  *Create timeout - *bi_ncreate_tio*

**Note:** All configurations should be performed by a GE Field Service Engineer.

**Note:** The local port on which the Discovery LS CT system receives DICOM incoming TCP connections is port **4006**.

#### 2.2.4.5 SUPPORT OF EXTENDED CHARACTER SETS

In addition to the DICOM default character set, *Discovery LS* supports the ISO IR 100 Latin alphabet #1 supplementary set for the purpose of interchange.

### 2.2.5 PET Application Entity

#### 2.2.5.1 AE SPECIFICATIONS - PET Application Entity

This Application Entity provides Standard Conformance to the following DICOM SOP Classes as an **SCU**:

| SOP Class Name | SOP Class UID |
|---|---|
| PET Image Storage | 1.2.840.10008.5.1.4.1.1.128 |
| PET Curve Storage | 1.2.840.10008.5.1.4.1.1.129 |
| Standalone Curve Storage | 1.2.840.10008.5.1.4.1.1.9 |
| Secondary Capture Storage | 1.2.840.10008.5.1.4.1.1.7 |
| Study Root Query/Retrieve Information Model - FIND | 1.2.840.10008.5.1.4.1.2.2.1 |
| Study Root Query/Retrieve Information Model - MOVE | 1.2.840.10008.5.1.4.1.2.2.2 |
| Verification SOP Class – ECHO | 1.2.840.10008.1.1 |

This Application Entity provides Standard Conformance to the following DICOM SOP Classes as an **SCP**:

| SOP Class Name | SOP Class UID |
|---|---|
| PET Image Storage | 1.2.840.10008.5.1.4.1.1.128 |
| PET Curve Storage | 1.2.840.10008.5.1.4.1.1.129 |
| Standalone Curve Storage | 1.2.840.10008.5.1.4.1.1.9 |
| Secondary Capture Storage | 1.2.840.10008.5.1.4.1.1.7 |
| CT Image Image Storage | 1.2.840.10008.5.1.4.1.1.2 |
| MR Image Image Storage | 1.2.840.10008.5.1.4.1.1.4 |
| Patient Root Query/Retrieve Information Model - FIND | 1.2.840.10008.5.1.4.1.2.1.1 |
| Patient Root Query/Retrieve Information Model - MOVE | 1.2.840.10008.5.1.4.1.2.1.2 |
| Study Root Query/Retrieve Information Model - FIND | 1.2.840.10008.5.1.4.1.2.2.1 |
| Study Root Query/Retrieve Information Model - MOVE | 1.2.840.10008.5.1.4.1.2.2.2 |
| Verification SOP Class | 1.2.840.10008.1.1 |

#### 2.2.5.1.1.1 Association Establishment Policies - PET Application Entity

**General**

The DICOM Application Context Name (ACN) for PET DICOM Server AE , which is always proposed, is:

| Application Context Name | 1.2.840.10008.3.1.1.1 |
|---|---|

The Maximum Length PDU negotiation is included in all association establishment requests.
The maximum length PDU for an association initiated by the PET DICOM Server AE in SCU role is:

| Maximum Length PDU for SCU role | 64 Kbytes |
|---|---|

The maximum length PDU for an association initiated by the PET DICOM Server AE in SCP role is:

| Maximum Length PDU for SCP role | 128 Kbytes |
|---|---|

Note- The PET DICOM Server AE does not support a PDU length of zero.
The SOP Class Extended Negotiation is not supported.
The maximum number of Presentation Context Items that will be proposed is 8. Note that the same Abstract Syntax may be offered multiple times with different Transfer Syntaxes.
The user information Items sent by this product are :

- Maximum PDU Length
- Implementation UID
- Implementation Version Name

**Number of Associations**

The PET DICOM Server AE (SCU) will initiate only one DICOM association at a time to perform an image store to a single remote AE. Only one association can be open at any point of time in order to perform Send, Query and Retrieve operations. However, if AutoTransfer option is enabled on the PET UI, an additional association will be established and this could co-exist with any association initiated by the user manually from PET network UI.

The PET DICOM Server AE (SCP) can have a maximum of eight DICOM associations open simultaneously to service queries, retrieves or verifications.

**Asynchronous Nature**

Asynchronous mode is not supported. All operations will be performed synchronously.

**Implementation Identifying Information - PET Application Entity**

The Implementation UID for this DICOM Implementation is:

| ***Discovery LS PET AE*** **Implementation UID** | **1.2.840.113619.6.99** |
|---|---|

The Implementation Version Name for this DICOM Implementation is:

| ***Discovery LS PET AE*** **Implementation Version Name** | **"GE Advance"** |
|---|---|

**2.2.5.1.1.2 Association Initiation Policy - PET Application Entity**

The PET DICOM Server AE initiates a new association:

- Due to an image send operation being initiated from the Discovery LS Network Operations User interface
- Due to a Verify operation initiated to determine whether the remote DICOM station is operational.
- Due to image data being Queried from a Remote AE, where the query operation is initiated from the Discovery LS Network Operations User interface.
- Due to image data being Retrieved from a Remote AE, where the retrieve operation is initiated from the Discovery LS Network Operations User interface.

**Real-World Activity : Send/Image Store - PET Application Entity**

*Associated Real-World Activity*

The operator must select the image type of data to be included for the transfer data to be transferred from the Patient Listing, and select a destination from the Network Operations User Interface. Once these selections have been made, the operator pushes the "Transfer" button to initiate a Send operation. The PET DICOM Server AE will then initiate an association with the remote AE in order to send the selected data.

Note that for each send operation, typically one association is established. The exception to this is that, if a send fails, the current association may be closed and another is opened for sending the remaining data (image(s)/curve(s) data).

The "Transfer In Progress Window" (TIPW) and the Transfer Status textual string on the bottom left hand corner of the Network Operations User Interface in association with the Transfer Log indicates the status of the data being transferred. The associated error messages due to a failed operation can be one of the following. The Discovery LS Error Log utility provides more detailed information regarding the cause of the error. -

- "%s - Transfer completed"
- "%s - Error during transfer"
- "%s - Transfer completed with errors"
- "DICOM Transfer operation has been canceled"
- Error while initializing DCM…
- Error connecting to a remote station via DICOM …
- Error while deinitializing DCM
- Error while reading from database
- Error while connecting to database
- Error while disconnecting from database
- Error during translation
- Invalid DICOM Dictionary
- Cannot transfer Polar Map Imagesets via DICOM for this release
- Cannot transfer SINOGRAM imagesets via DICOM for this release
- Data Already exists in the database. Database Write did not take place
- "Remote station %s is down"
- "Sinogram Imagesets are not currently supported via DICOM transfer"
- “Dicom Transfer/Export failed: Image does not contain the coordinates of the image plane – Dicom tag (0020,0032)” and one warning
- Warning! Dataset does not match SOP Class or Coercion of Data Elements.

***Note*** - The symbol “%s” denotes the station name of the remote DICOM AE. In some cases this symbol could also be replaced by a combination of the patient name, date and station name.

*Proposed Presentation Context Table*

The following table shows the proposed presentation contexts for the PET DICOM AE, after the real-world activity “Send”

| Presentation Context Table – Proposed | | | | | |
|---|---|---|---|---|---|
| **Abstract Syntax** | | **Transfer Syntax** | | **Role** | **Extended Negotiation** |
| **Name** | **UID** | **Name List** | **UID List** | | |
| PET Image Storage | 1.2.840.10008.5.1.4.1.1.128 | Implicit VR Little Endian<br>Explicit VR Little Endian<br>Explicit VR Big Endian | 1.2.840.10008.1.2<br>1.2.840.10008.1.2.1<br>1.2.840.10008.1.2.2 | SCU | None |
| PET Curve Storage | 1.2.840.10008.5.1.4.1.1.129 | Implicit VR Little Endian<br>Explicit VR Little Endian<br>Explicit VR Big Endian | 1.2.840.10008.1.2<br>1.2.840.10008.1.2.1<br>1.2.840.10008.1.2.2 | SCU | None |
| Standalone Curve Storage | 1.2.840.10008.5.1.4.1.1.9 | Implicit VR Little Endian<br>Explicit VR Little Endian<br>Explicit VR Big Endian | 1.2.840.10008.1.2<br>1.2.840.10008.1.2.1<br>1.2.840.10008.1.2.2 | SCU | None |
| Secondary Capture Image Storage | 1.2.840.10008.5.1.4.1.1.7 | Implicit VR Little Endian<br>Explicit VR Little Endian | 1.2.840.10008.1.2<br>1.2.840.10008.1.2.1<br>1.2.840.10008.1.2. | SCU | None |

| | | | | | |
|---|---|---|---|---|---|
| | | Explicit VR Big Endian | 2 | | |

***SOP Specific DICOM Conformance Statement for all Storage SOP Classes***

This implementation can perform multiple C-STORE operations over a single association.
Upon receiving a C-STORE confirmation containing a Successful status, this implementation will perform the next C-STORE operation. The association will be maintained if possible.

Upon receiving a C-STORE confirmation containing a Refused status, this implementation will terminate the association.
Upon receiving a C-STORE confirmation containing a status other than Successful or Refused, this implementation will consider the current request to be a failure but will continue to attempt to send any remaining images in the request on a different association.

Each C-STORE operation supports a configurable "Association Timer." This timer starts when the association request is sent or received and stops when the association is established. The default time-out value is 100 seconds.
Each C-STORE operation supports a configurable "Session Timer." This timer starts when an association is established and stops when the association is ended. The default time-out value is 11400 seconds.

***Note*** - A Session Timer of this duration is required to provide a mechanism for the transfer of a complete database between 2 Discovery LS stations. The session timer starts with the transfer of the first image and terminates after the time-out value is reached.

If any of the above timers expires, the association is closed and the operation in progress is considered to be failed.

Following are the status codes that are more specifically processed when receiving messages from a **Storage** SCP equipment :

| Service Status | Status Codes | Further Meaning | Application Behavior When receiving Status Codes | Related Fields Processed if received |
|---|---|---|---|---|
| Refused | A700 | Out of resources | The message "NetDicom: Possible Memory Allocation Failure in Remote. Status <a700>" is posted onto the Error Log Utility on the *GE Discovery LS*. | (0000,0902) |
| | A710 | Image not written into remote SCP's database. | The message "NetDicom: Remote system unable to write data into temporary file. Status <a710>" is posted onto the Error Log Utility on the *GE Discovery LS*. | (0000,0902) |
| | A711 | Internal Error in the remote SCP | The message "NetDicom: Remote system unable to post buffer to receive events. Status <a711>" is posted onto the Error Log Utility on the *GE Discovery LS*. | (0000,0902) |
| | A712 | Remote SCP could not determine size of total data buffer received from the SCU. | The message "NetDicom: Remote system unable to acceess-determine filesize of incoming data. Status <a712>" is posted onto the Error Log Utility on the *GE Discovery LS*. | (0000,0902) |
| | A713 | Remote SCP could not determine header data offset for | The message "NetDicom: Remote system | (0000,0902) |

| Service Status | Status Codes | Further Meaning | Application Behavior When receiving Status Codes | Related Fields Processed if received |
|---|---|---|---|---|
| | | Data IOD transmission | unable to determine data offset in temporary file. Status <a713>" is posted onto the Error Log Utility on the *GE Discovery LS*. | |
| | A714 | Remote SCP received invalid DICOM P-DATA packet from the SCU. | The message "NetDicom: Remote System received invalid data packet. Status <a714>" is posted onto the Error Log Utility on the *GE Discovery LS*. | (0000,0902) |
| | A715 | Remote SCP could not open temporary file in which it stored data received from the SCU. | The message "NetDicom: Remote System could not re-open temporary file for processing. Status <a715>" is posted onto the Error Log Utility on the *GE Discovery LS*. | (0000,0902) |
| | A716 | Remote SCP could not read data received from the SCU. | The message "NetDicom: Remote System could not read IOD. Status <a715>" is posted onto the Error Log Utility on the *GE Discovery LS*. | (0000,0902) |
| Error | C000 | Cannot Understand | The message "NetDicom: Remote system Error - Cannot Understand Error. Status <c000>" is posted onto the Error Log Utility on the *GE Discovery LS*. | (0000,0901) (0000,0902) |
| | C001 | Remote System failed to Parse DICOM Stream. | The message "NetDicom: Remote system could not parse DICOM stream. Translation Failed. Status <c001>" is posted onto the Error Log Utility on the *GE Discovery LS*. | (0000,0901) (0000,0902) |
| | C002 | Database Write Failed. | The message "NetDicom: Remote system error - Database write failed. Status <c002>" is posted onto the Error Log Utility on the *GE Discovery LS*. | (0000,0901) (0000,0902) |
| | C003 | Image already exists on the remote SCP. | The message "NetDicom: Remote system error - Duplicate Transmission! Image already exists. Status <c003>" is posted onto the Error Log Utility on the *GE Discovery LS*. | (0000,0901) (0000,0902) |
| | A9xx | Data Set does not match SOP Class | The message "NetDicom: Remote system error - Data did not match SOP Class" is posted onto the Error Log Utility on the *GE Discovery LS*. | (0000,0901) (0000,0902) |
| Warning | B000 | Coercion of Data Elements | The message "NetDicom: Remote system warning -Coercion of Data Elements. Status <b000>" is posted onto the Error Log Utility on the *GE Discovery LS*. | (0000,0901) (0000,0902) |
| | B007 | Data Set does not match SOP Class | The message "NetDicom: Remote system warning - IOD does not match SOP Class. Status <b007>" is posted onto the Error Log Utility on the *GE Discovery LS*. | (0000,0901) (0000,0902) |
| | B006 | Elements Discarded | The message "NetDicom: Remote system | (0000,0901) |

| Service Status | Status Codes | Further Meaning | Application Behavior When receiving Status Codes | Related Fields Processed if received |
|---|---|---|---|---|
| | | | warning. Data elements discarded. Status <b006>" is posted onto the Error Log Utility on the *GE Discovery LS*. | (0000,0902) |
| Success | 0000 | | The message "Transfer DB completed successfully" is posted onto the Transfer Log Window.; | None |

***Note*** *-The error codes A700-A716 and C001-C003 are Discovery LS PET AE Private Status Codes.* Discovery LS PET AE *will return one of the above mentioned status codes (Refused and Error) in case of Image Send Failure . DICOM PS3.4 provides the flexibility of returning private status codes. GE Discovery LS uses them to provide more information to the user in case of an Image Send failure.*

### Real-World Activity: Verify - PET Application Entity

*Associated Real-World Activity*

Service personnel invoke the utility "DICOMping" from the UNIX command line. The PET DICOM Server AE will initiate an association with the remote DICOM AE in order to verify communication at the application level. The success or failure of the verification process is displayed to the user.

*Proposed Presentation Context Table*

| Presentation Context Table - Proposed | | | | | |
|---|---|---|---|---|---|
| Abstract Syntax | | Transfer Syntax | | Role | Extended Negotiation |
| Name | UID | Name List | UID List | | |
| Verification SOP Class | 1.2.840.10008.1.1 | Implicit VR Little Endian | 1.2.840.10008.1.2 | SCP | None |

***SOP Specific DICOM Conformance Statement for Verification SOP Class***

The PET DICOM Server AE provides standard conformance to the DICOM Verification Service Class.

### Real-World Activity: Query - PET Application Entity

*Associated Real-World Activity*

The Discovery LS implements the query operation in two levels. The first level of query provides query results pertaining to the Patient & Study Tables only. The second level of query provides results regarding the Series table for a given Patient.
The operator must select a DICOM AE as the Source Station on the Discovery LS Network Operations UI in order to initiate the DICOM Query operation. The PET DICOM Server AE will the initiate an association with the remote AE in order to query the remote AE. The Discovery LS initiates Queries at the Study Level, and allows the user to specify either a Universal Match (wild card query) or a Selective Query based on Patient Name, Patient ID, and/or Study Date (including ranges) for the initial Query. The results of the query operation are indicated on the Level A box of the Network Operations UI. The status of the operation in case of a failure/warning is available through the Discovery LS Error Log Utility.
The Second Level Query operation is initiated by the selection of one of the query results on the Level A box. With, the selection of one of these results a query operation is automatically initiated with no other user intervention. The PET DICOM Server AE will then initiate an association with the remote AE

in order to query the remote AE for the given query result. The status of the operation in case of a failure/warning is available through the Discovery LS Error Log Utility.
The Discovery LS makes use of the Study Root Query Model to initiate a Search/Query operation. Details of this model are provided in Section 5 of this document.
Note that for each query operation, typically one association is established. The exception to this is that, if a query fails, the current association is closed and a new query operation is re-initiated automatically. If this fails as well, the operation terminates with a failure status and the appropriate errors are logged and are accessible through the Discovery LS Error Log Utility.
The UI indicates the status of the on-going Query operation through a textual status on the bottom left hand corner of the Network Operations UI.

*Proposed Presentation Context Table*

The following table shows the proposed presentation contexts for the PET DICOM Server AE, after the real-world activity "Query"

| Presentation Context Table – Proposed | | | | | |
|---|---|---|---|---|---|
| **Abstract Syntax** | | **Transfer Syntax** | | **Role** | **Extended Negotiation** |
| **Name** | **UID** | **Name List** | **UID List** | | |
| Study Root Query/Retrieve Information Model - FIND | 1.2.840.10008.5.1.4.1.2.2.1 | Implicit VR Little Endian<br>Explicit VR Little Endian<br>Explicit VR Big Endian | 1.2.840.10008.1.2<br>1.2.840.10008.1.2.1<br>1.2.840.10008.1.2.2 | SCU | None |

***SOP Specific DICOM Conformance Statement for the Study Root Query/Retrieve Information Model - FIND SOP Class***

This implementation can perform multiple C-FIND operations over a single association.
Upon receiving a C-FIND confirmation containing a Success status, this implementation will perform the next C-FIND operation. The association will be maintained if possible.
Upon receiving a C-FIND confirmation containing a Pending status, this implementation will wait for further C-FIND responses from the remote DICOM AE.
Upon receiving a C-FIND confirmation containing a Refused status, this implementation will terminate the association.

Upon receiving a C-FIND confirmation containing a status other than Successful, Pending or Refused, this implementation will consider the current request to be a failure but will continue to attempt to send any remaining images in the request on a different association.
Each C-FIND operation supports a configurable "Association Timer." This timer starts when the association request is sent or received and stops when the association is established. The default time-out value is 100 seconds.
Each C-FIND operation supports a configurable "Session Timer." This timer starts when an association is established and stops when the association is ended. The default time-out value is 11400 seconds.

***Note*** - A Session Timer of this duration is required to provide a mechanism for the transfer of a complete database between 2 Discovery LS stations. The timer starts with the transfer of the first image and terminates after the time-out value is reached.
If any of the above timers expires, the association is closed and the operation in progress is considered failed.

Following are the status codes that are more specifically processed when receiving messages from a **Query** SCP equipment :

| Service Status | Status Codes | Further Meaning | Application Behavior When receiving Status Codes | Related Fields Processed if received |
|---|---|---|---|---|
| Refused | A700 | Out of resources | The message "NetDicom: Possible Memory Allocation Failure in Remote. Status <a700>" is posted onto the Error Log Utility on the *GE Discovery LS*. | (0000,0902) |
| Failed | A900 | Identifier does not match SOP Class | The message "NetDicom: Remote system error - Data did not match SOP Class" is posted onto the Error Log Utility on the *GE Discovery LS*. | (0000,0901) (0000,0902) |
| | Cxxx | Unable to process | The message "NetDicom: Remote system Error - Cannot Understand Error. Status <cxxx>" is posted onto the Error Log Utility on the *GE Discovery LS*. | (0000,0901) (0000,0902) |
| Cancel | FE00 | Matching terminated due to cancel | The message "Canceling DICOM Query" is posted on the bottom left hand corner of the Network Operations UI. This message persists as long as the Query is not canceled. Once the query operation is canceled, this message disappears. | None |
| Success | 0000 | Matching is complete - No final identifier is supplied | The message "Querying Remote station via DICOM" is posted on the bottom left hand corner of the Network Operations UI when the query operation is in progress. This message disappears once the query operation is complete. | None |
| Pending | FF00 | Matches are continuing - Current Match is supplied and any Optional Keys were supported in the same manner as Required Keys. | The message "Querying Remote station via DICOM" is posted on the bottom left hand corner of the Network Operations UI. This message persists as long as the query operation is in progress. | Identifier |
| | FF01 | Matches are continuing - Warning that one or more Optional Keys were not supported for existence and/or matching for this Identifier | - No user visible output - | Identifier |

**Real-World Activity: Retrieve - PET Application Entity**

*Associated Real-World Activity*

The ***Discovery LS*** operator can fetch data from a remote DICOM AE in the following manner.
The operator initiates a DICOM Query as described in 2.3.2.2.3.1. The second step involves invocation of the Fetch/Transfer operation by the selection of one or more search results (Study/Series/Image results) on the Level A or Level B boxes on the Network Operations UI, and then pushing the "Transfer" button to initiate the operation. The PET DICOM Server AE will then initiate an association with the remote AE in order to fetch DICOM imagesets from the remote AE for the given Study/Series/Image selection. The status of the operation is logged onto the Transfer Log.

The Discovery LS makes use of the Study Root Query Model to initiate a Retrieve operation. Details of this model are provided in Section 5 of this document.
Note that for each retrieve operation, typically one association is established. The exception to this is that, if a retrieve fails, the current association is closed and another is opened for retrieving the remaining data (image(s), curves data).

The UI indicates the status of the on-going Retrieve/Fetch/Transfer operation through the Transfer in Progress Window and a textual status on the bottom left hand corner of the Network Operations UI, which indicates the status of the Retrieve operation. Typical error messages that may appear on the Transfer Log after the completion of a Retrieve operation can be one of the following -

- "%s - Transfer completed"
- "%s - Error during transfer"
- "%s - Transfer completed with errors"
- "DICOM Transfer operation has been canceled"
- Error while initializing DCM…
- Error connecting to a remote station via DICOM …
- Error while deinitializing DCM
- Error during translation
- Invalid DICOM Dictionary
- "%s - Error while fetching from remote station"
- "%s - Fetched from remote station"
- "DICOM Fetch completed on remote station"
- "DICOM Fetch completed with errors. %d items not fetched"
- "DICOM Fetch completed because of user cancel. %d items not fetched"
- "Selected exams have no imagesets to transfer"
- "Remote station %s is down"
- "Sinogram Imagesets are not currently supported via DICOM transfer"
- "PolarMap/BullsEye Imagesets are not currently supported via DICOM transfer"
- "Already exists in the local database. Not fetching from remote"
- "Dicom Transfer/Export failed: Image does not contain the coordinates of the image plane – Dicom tag (0020,0032)"

***Note*** - The symbol "%s" denotes the station name of the remote DICOM AE. In some cases this symbol could also be replaced by a combination of the patient name, date and station name. The symbol "%d" denotes an integer value.

*Proposed Presentation Context Table*

The following table shows the proposed presentation contexts for the PET DICOM Server AE, after the real-world activity "Retrieve"

| Presentation Context Table - Proposed | | | | | |
|---|---|---|---|---|---|
| **Abstract Syntax** | | **Transfer Syntax** | | **Role** | **Extended Negotiation** |
| **Name** | **UID** | **Name List** | **UID List** | | |
| Study Root Query/Retrieve Information Model - MOVE | 1.2.840.10008.5.1.4.1.2.2.2 | Implicit VR Little Endian<br>Explicit VR Little Endian<br>Explicit VR Big Endian | 1.2.840.10008.1.2<br>1.2.840.10008.1.2.1<br>1.2.840.10008.1.2.2 | SCU | None |

***SOP Specific DICOM Conformance Statement for the Study Root Query/Retrieve Information Model - MOVE SOP Class***

This implementation can perform multiple C-MOVE operations over a single association.
Upon receiving a C-MOVE confirmation containing a Successful status, this implementation will perform the next C-MOVE operation. The association will be maintained if possible.

Upon receiving a C-MOVE confirmation containing a Pending status, this implementation will wait for further C-MOVE responses from the remote DICOM AE.
Upon receiving a C-MOVE confirmation containing a Refused status, this implementation will terminate the association.

Upon receiving a C-MOVE confirmation containing a status other than Successful, Pending or Refused, this implementation will consider the current request to be a failure but will continue to attempt to send any remaining images in the request on a different association.

Each C-MOVE operation supports a configurable "Association Timer." This timer starts when the association request is sent or received and stops when the association is established. The default time-out value is 100 seconds.
Each C-MOVE operation supports a configurable "Session Timer." This timer starts when an association is established and stops when the association is ended. The default time-out value is 11400 seconds.
***Note*** - A Session Timer of this duration is required to provide a mechanism for the transfer of a complete database between 2 Discovery LS stations. The session timer starts with the transfer of the first image and terminates after the time-out value is reached.
If any of the above timers expires, the association is closed and the operation in progress is considered failed.

Following are the status codes that are more specifically processed when receiving messages from a **Retrieve** SCP equipment:

| Service Status | Status Codes | Further Meaning | Application Behavior When receiving Status Codes | Related Fields Processed if received |
|---|---|---|---|---|
| Refused | A701 | Out of resources - Unable to calculate number of matches | The message "Error! Remote station could not send data" is posted on the Transfer Log on the Network Operations UI. | (0000,0902) |
| | A702 | Out of resources - Unable to perform sub-operations | The message "Error! Remote station could not send data" is posted on the Transfer Log on the Network Operations UI. | (0000,1021)<br>(0000,1022)<br>(0000,1023) |
| | A801 | Move Destination Unknown | The message "Error! Remote station is not configured to send data to local station" is posted on the Transfer Log on the Network Operations UI. | (0000,0902) |
| Failed | A900 | Identifier does not match SOP Class | The message "Error! Remote station could not match identifier with SOP Class" is posted on the Transfer Log on the Network Operations UI. | (0000,0901)<br>(0000,0902) |
| | Cxxx | Unable to process | The message "Error! Remote station failed in processing data" is posted on the Transfer Log on the Network Operations | (0000,0901)<br>(0000,0902) |

| Service Status | Status Codes | Further Meaning | Application Behavior When receiving Status Codes | Related Fields Processed if received |
|---|---|---|---|---|
| | | | UI. | |
| Cancel | FE00 | Sub-operations terminated due to a Cancel indication | The message “DICOM Fetch completed because of user cancel. N items not fetched.” is posted on the Transfer Log on the Network Operations UI. | (0000,1020)<br>(0000,1021)<br>(0000,1022)<br>(0000,1023) |
| Warning | B000 | Sub-operations Complete - One or more Failures. | The message “Warning status received from remote DICOM station during fetch” is posted on the Transfer Log on the Network Operations UI. | (0000,1021)<br>(0000,1022)<br>(0000,1023) |
| Success | 0000 | Sub-operations Complete - No Failure. | The message “DICOM Fetch completed on remote station” is posted on the Transfer Log on the Network Operations UI. | (0000,1021)<br>(0000,1022)<br>(0000,1023) |
| Pending | FF00 | Sub-operations are continuing - | The message “Transfer DB started” is posted on the Transfer Log on the Network Operations UI. | (0000,1020)<br>(0000,1021)<br>(0000,1022)<br>(0000,1023) |

#### 2.2.5.1.1.3 Association Acceptance Policy - PET Application Entity

The PET DICOM Server AE places limitation on who may connect to it depending on its configuration. The operator must configure the AE Title, Port Number, and IP Address of the remote workstation for Query, Verify , and PET/Curve transfers.

The PET DICOM Server AE responds to image store operations from remote AE’s. Any Remote AE can request and receive a list of images located in the local Discovery LS database. Any Remote AE can send images (PET Image/Stand alone Curve/PET Curve/GE Discovery LS PET Data) to the Discovery LS to be stored in the local database.

Any remote AE can open an association to the PET DICOM Server AE for the purpose of application level communication verification.

The PET DICOM Server AE responds to query requests from remote AE’s and responds with matching responses if remote AE is configured in Discovery LS. Remote AE can also request the PET DICOM Server AE to retrieve image data from theDiscovery LS, and to store this data in the database of the remote AE.

**Real-World Activity - Image Store SCP - PET Application Entity**

*Associated Real-World Activity*

The PET DICOM Server AE is always listening for associations. No operator action is required to respond to a Store request.

The real-world activity associated with the Store request is to store the image data in the local database and send a C-STORE -RSP message with the status of “success” for each image that can be stored in the local database. A C-STORE-RSP message with the status “failed” is sent for each image that cannot be stored in the local database.

The following are the Presentation Context supported by PET DICOM Server AE Server:

| Presentation Context Table – Accepted | | | | | |
|---|---|---|---|---|---|
| **Abstract Syntax** | | **Transfer Syntax** | | **Role** | **Extended Negotiation** |
| **Name** | **UID** | **Name List** | **UID List** | | |
| PET Image Storage | 1.2.840.10008.5.1.4.1.1.128 | Implicit VR Little Endian<br>Explicit VR Little Endian<br>Explicit VR Big Endian | 1.2.840.10008.1.2<br>1.2.840.10008.1.2.1<br>1.2.840.10008.1.2.2 | SCP | None |
| PET Curve Storage | 1.2.840.10008.5.1.4.1.1.129 | Implicit VR Little Endian<br>Explicit VR Little Endian<br>Explicit VR Big Endian | 1.2.840.10008.1.2<br>1.2.840.10008.1.2.1<br>1.2.840.10008.1.2.2 | SCP | None |
| Standalone Curve Storage | 1.2.840.10008.5.1.4.1.1.9 | Implicit VR Little Endian<br>Explicit VR Little Endian<br>Explicit VR Big Endian | 1.2.840.10008.1.2<br>1.2.840.10008.1.2.1<br>1.2.840.10008.1.2.2 | SCP | None |
| Secondary Capture Image Storage | 1.2.840.10008.5.1.4.1.1.7 | Implicit VR Little Endian<br>Explicit VR Little Endian<br>Explicit VR Big Endian | 1.2.840.10008.1.2<br>1.2.840.10008.1.2.1<br>1.2.840.10008.1.2.2 | SCP | None |
| CT Image Storage | 1.2.840.10008.5.1.4.1.1.2 | Implicit VR Little Endian | 1.2.840.10008.1.2 | SCP | None |
| MR Image Storage | 1.2.840.10008.5.1.4.1.1.4 | Implicit VR Little Endian | 1.2.840.10008.1.2 | SCP | None |

***SOP Specific DICOM Conformance Statement for all Storage SOP Classes***

The Discovery LS provides Level 1 Storage support as defined in the DICOM Standards. (Refer DICOM PS3.4 for further details on level of conformance). This implies that it may discard any Type 3 attributes, including Private Data Elements. The Discovery LS PET AE preserves Type 3 attributes that have a logical, analogous field in the PET database. Following are the status codes the application may send back to the SCU Equipment after performing the requested **Storage**:

| Service Status | Status Codes | Further Meaning | Status Code sending explanation | Related Fields sent back to the SCU |
|---|---|---|---|---|
| Refused | A700 | Out of resources | Insufficient memory to carry out further operations. | (0000,0902) |
| | A710 | Image not written into SCP's database. | Unable to write incoming image data into temporary file. Mainly due to non-availability of system resources. | (0000,0902) |
| | A711 | Internal Error in the SCP | Unable to post a buffer to receive events from the SCU. | (0000,0902) |
| | A712 | SCP could not determine size of total data buffer received from | Unable to access-determine filesize of incoming data. | (0000,0902) |

| Service Status | Status Codes | Further Meaning | Status Code sending explanation | Related Fields sent back to the SCU |
|---|---|---|---|---|
| | | the SCU. | | |
| | A713 | SCP could not determine header data offset for Data IOD transmission | Unable to determine data offset in temporary file. | (0000,0902) |
| | A714 | SCP received invalid DICOM P-DATA packet from the SCU. | Received invalid data packet from SCU. | (0000,0902) |
| | A715 | SCP could not open temporary file in which it stored data received from the SCU. | Could not re-open temporary file for processing.. | (0000,0902) |
| | A716 | SCP could not read data received from the SCU. | Cold not read IOD received from the SCU. | (0000,0902) |
| Error | C000 | Cannot Understand | Cannot Understand Error. | (0000,0901) (0000,0902) |
| | C001 | System failed to Parse DICOM Stream. | Could not parse DICOM stream. Translation Failed. | (0000,0901) (0000,0902) |
| | C002 | Database Write Failed. | Database write failed. | (0000,0901) (0000,0902) |
| | C003 | Image already exists on the SCP. | Duplicate Transmission! Image already exists in the local database. | (0000,0901) (0000,0902) |
| | A900 | Data Set does not match SOP Class | Data did not match SOP Class | (0000,0901) (0000,0902) |
| Warning | B000 | Coercion of Data Elements | Coercion of Data Elements. | (0000,0901) (0000,0902) |
| | B007 | Data Set does not match SOP Class | IOD does not match SOP Class. | (0000,0901) (0000,0902) |
| | B006 | Elements Discarded | Data elements discarded. | (0000,0901) (0000,0902) |
| Success | 0000 | | | None |

***Note*** *-The error codes A700-A716 and C001-C003 are Discovery LS PET AE Private Status Codes.* Discovery LS*stations will return one of the above mentioned status codes (Refused and Error) in case of Image Send Failure. DICOM PS3.4 provides the flexibility of returning private status codes.* Discovery LS *uses them to provide more information to the user in case of an Image Send failure.*

*Presentation Context Acceptance Criterion*

The Presentation Context accepted by the PET DICOM Server has to be one supported by the PET DICOM Server and to which the remote Image Store SCU has accorded the highest priority.

*Transfer Syntax Selection Policies*

No specific Transfer Syntax selection policy is applied for a given presentation context. The first transfer syntax to be proposed amongst a set of transfer syntax for a given SOP class, by the SCU, will be considered for negotiation by the PET DICOM Server. However, if the PET DICOM Server fails to support this transfer syntax, it shall then negotiate with the next transfer syntax proposed by the remote SCU, for the specific SOP class in question and so on. If the PET DICOM Server does not support any of the transfer syntax proposed by the SCU, the association negotiation shall fail.

**Real-World Activity: Query SCP - PET Application Entity**

*Associated Real-World Activity*

The PET DICOM Server AE is always listening for associations. No operator action is required to respond to Query request.

The real-world activity associated with the Query request is to search the local database for all entries that match the request and send a C-FIND-RSP message with the status of "pending" for each matching entry. The exception to this is the last message which is sent with a status of "success."

*Accepted Presentation Context Table*

| Presentation Context Table - Accepted | | | | | |
|---|---|---|---|---|---|
| **Abstract Syntax** | | **Transfer Syntax** | | **Role** | **Extended Negotiation** |
| **Name** | **UID** | **Name List** | **UID List** | | |
| Patient Root Query/Retrieve Information Model - FIND | 1.2.840.10008.5.1.4.1.2.1.1 | Implicit VR Little Endian<br>Explicit VR Little Endian<br>Explicit VR Big Endian | 1.2.840.10008.1.2<br>1.2.840.10008.1.2.1<br>1.2.840.10008.1.2.2 | SCP | None |
| Study Root Query/Retrieve Information Model - FIND | 1.2.840.10008.5.1.4.1.2.2.1 | Implicit VR Little Endian<br>Explicit VR Little Endian<br>Explicit VR Big Endian | 1.2.840.10008.1.2<br>1.2.840.10008.1.2.1<br>1.2.840.10008.1.2.2 | SCP | None |

Note that this implementation does not support extended negotiation for the C-FIND Service, including that for relational-queries.

***SOP Specific DICOM Conformance Statement for the Patient Root Query/Retrieve Information Model – FIND and Study Root Query/Retrieve Information Model - FIND***

Following are the status codes the Application may send back to the SCU Equipment after performing the requested **Query**:

| Service Status | Status Codes | Further Meaning | Status Code sending explanation | Related Fields Processed if received |
|---|---|---|---|---|
| Refused | A700 | Out of resources | Returned if the DICOM Server runs out of resources (e.g. memory); error logged. | (0000,0902) |
| Failed | A900 | Identifier does not match SOP Class | Returned if the incoming data did not match SOP Class | (0000,0901)<br>(0000,0902) |
| | C000 | Unable to process | Returned by the DICOM Server if for any other reason, not specified elsewhere in this table, the Find operation failed; error logged. | (0000,0901)<br>(0000,0902) |
| Cancel | FE00 | Matching terminated due to cancel | Returned if the DICOM Server receives a C-CANCEL-FIND-RQ message; error logged. | None |
| Success | 0000 | Matching is complete - No final identifier is supplied | Returned when the DICOM Server completes the find operation. | None |
| Pending | FF00 | Matches are continuing - Current Match is supplied and any Optional Keys were supported in the same manner as Required Keys. | Returned by the DICOM Server for every match found. | Identifier |

| Service Status | Status Codes | Further Meaning | Status Code sending explanation | Related Fields Processed if received |
|---|---|---|---|---|
| | FF01 | Matches are continuing - Warning that one or more Optional Keys were not supported for existence and/or matching for this Identifier | Returned by the DICOM Server if one or more Optional Keys were not supported for existence and/or matching. | Identifier |

*Presentation Context Acceptance Criterion*

The Presentation Context accepted by the PET DICOM Server has to be one supported by the PET DICOM Server and to which the remote Query SCU has accorded the highest priority.

*Transfer Syntax Selection Policies*

No specific Transfer Syntax selection policy is applied for a given presentation context. The first transfer syntax to be proposed amongst a set of transfer syntax for a given SOP class, by the SCU, will be considered for negotiation by the PET DICOM Server. However, if the PET DICOM Server fails to support this transfer syntax, it shall then negotiate with the next transfer syntax proposed by the remote SCU, for the specific SOP class in question and so on. If the PET DICOM Server does not support any of the transfer syntax proposed by the SCU, the association negotiation shall fail.

**Real-World Activity: Image Retrieve SCP - PET Application Entity**

*Associated Real-World Activity*

The PET DICOM Server AE is always listening for associations. No operator action is required to respond to an Image Retrieve request.
The real-world activity associated with the Image Retrieve request is to send all images, curves data corresponding to the C-MOVE request to the specified destination AE through a separate association.

*Accepted Presentation Context Table*

| Presentation Context Table - Accepted | | | | | |
|---|---|---|---|---|---|
| Abstract Syntax | | Transfer Syntax | | Role | Extended Negotiation |
| Name | UID | Name List | UID List | | |
| Patient Root Query/Retrieve Information Model - MOVE | 1.2.840.10008.5.1.4.1.2.1.2 | Implicit VR Little Endian<br>Explicit VR Little Endian<br>Explicit VR Big Endian | 1.2.840.10008.1.2<br>1.2.840.10008.1.2.1<br>1.2.840.10008.1.2.2 | SCP | None |
| Study Root Query/Retrieve Information Model - MOVE | 1.2.840.10008.5.1.4.1.2.2.2 | Implicit VR Little Endian<br>Explicit VR Little Endian<br>Explicit VR Big Endian | 1.2.840.10008.1.2<br>1.2.840.10008.1.2.1<br>1.2.840.10008.1.2.2 | SCP | None |

Note that this implementation does not support extended negotiation for the C-MOVE Service, including that for relational-retrieve.

***SOP Specific DICOM Conformance Statement for the Patient Root Query/Retrieve Information Model – MOVE and Study Root Query/Retrieve Information Model - MOVE SOP Classes***

Following are the status codes the Application may send back to the SCU Equipment after performing the requested **Retrieve**:

| Service Status | Status Codes | Further Meaning | Status Code sending explanation | Related Fields Processed if received |
|---|---|---|---|---|
| Refused | A701 | Out of resources - Unable to calculate number of matches | Returned if the DICOM Server can't find requested SOP instance(s); error logged. | (0000,0902) |
| | A702 | Out of resources - Unable to perform sub-operations | Returned if the DICOM Server runs out of resources (e.g. memory); error logged. | (0000,1021)<br>(0000,1022)<br>(0000,1023) |
| | A801 | Move Destination Unknown | Returned if the DICOM Server has no information on destination AE; error logged. | (0000,0902) |
| Failed | A900 | Identifier does not match SOP Class | Returned if the DICOM Server receives other than the Patient Root Query/Retrieve Information Model or Study Root Query/Retrieve Information Model SOP class. | (0000,0901)<br>(0000,0902) |
| | C000 | Unable to process | Returned if the DICOM Server cannot successfully interpret the C-MOVE-RQ message. | (0000,0901)<br>(0000,0902) |
| Cancel | FE00 | Sub-operations terminated due to a Cancel indication | Returned if the DICOM Server receives a C-CANCEL-MOVE-RQ message. | (0000,1020)<br>(0000,1021)<br>(0000,1022)<br>(0000,1023) |
| Warning | B000 | Sub-operations Complete - One or more Failures. | Returned upon completion if one or more of the specified images failed to transfer to the destination AE. | (0000,1021)<br>(0000,1022)<br>(0000,1023) |
| Success | 0000 | Sub-operations Complete - No Failure. | Returned after the transfer of the last image. | (0000,1021)<br>(0000,1022)<br>(0000,1023) |
| Pending | FF00 | Sub-operations are continuing - | Returned after the transfer of each imageset (series) except for the last. | (0000,1020)<br>(0000,1021)<br>(0000,1022)<br>(0000,1023) |

*Presentation Context Acceptance Criterion*

The Presentation Context accepted by the PET DICOM Server has to be one supported by the PET DICOM Server and to which the remote Retrieve SCU has accorded the highest priority.

*Transfer Syntax Selection Policies*

No specific Transfer Syntax selection policy is applied for a given presentation context. The first transfer syntax to be proposed amongst a set of transfer syntax for a given SOP class, by the SCU, will be considered for negotiation by the PET DICOM Server. However, if the PET DICOM Server fails to support this transfer syntax, it shall then negotiate with the next transfer syntax proposed by the remote SCU, for the specific SOP class in question and so on. If the PET DICOM Server does not support any of the transfer syntax proposed by the SCU, the association negotiation shall fail.

**Real-World Activity: Verify SCP - PET Application Entity**

*Associated Real-World Activity*

The PET DICOM Server AE is always listening for associations. No operator action is required to respond to a Verification request.

The real-world activity associated with the Verification request is to send a C-ECHO-RSP message with a status of "success" to the requesting AE.

*Accepted Presentation Context Table*

| Presentation Context Table - Accepted | | | | | |
|---|---|---|---|---|---|
| Abstract Syntax | | Transfer Syntax | | Role | Extended Negotiation |
| Name | UID | Name List | UID List | | |
| Verification SOP Class | 1.2.840.10008.1.1 | Implicit VR Little Endian | 1.2.840.10008.1.2 | SCP | None |

***SOP Specific DICOM Conformance Statement for Verification SOP Class***

The PET DICOM Server AE provides standard conformance to the DICOM Verification service class.

*Presentation Context Acceptance Criterion*

The Presentation Context accepted by the PET DICOM Server has to be one supported by the PET DICOM Server and to which the remote Verification SCU has accorded the highest priority.

*Transfer Syntax Selection Policies*

No specific Transfer Syntax selection policy is applied for a given presentation context. The first transfer syntax to be proposed amongst a set of transfer syntax for a given SOP class, by the SCU, will be considered for negotiation by the PET DICOM Server. However, if the PET DICOM Server fails to support this transfer syntax, it shall then negotiate with the next transfer syntax proposed by the remote SCU, for the specific SOP class in question and so on. If the PET DICOM Server does not support any of the transfer syntax proposed by the SCU, the association negotiation shall fail.

### 2.2.5.2 COMMUNICATION PROFILES - PET Application Entity

#### 2.2.5.2.1 Supported Communication Stacks (PS 3.8, PS 3.9)

DICOM Upper Layer (PS 3.8) is supported using TCP/IP.

#### 2.2.5.2.2 OSI Stack

OSI stack not supported

#### 2.2.5.2.3 TCP/IP Stack

The TCP/IP stack is inherited from a UNIX Operating System.

##### 2.2.5.2.3.1 API

Not applicable to this product.

##### 2.2.5.2.3.2 Physical Media Support

DICOM is indifferent to the Physical medium over which TCP/IP executes (e.g. Ethernet V2.0,IEEE 802.3, ATM, FDDI)

**Note:** For more information about the Physical Media available on the GE Discovery LS PET AE please refer to the Product Data Sheet.

#### 2.2.5.2.4 Point-to-Point Stack

A 50-pin ACR-NEMA connection is not applicable to this product.

### 2.2.5.3 EXTENSIONS / SPECIALIZATIONS / PRIVATIZATIONS - PET Application Entity

#### 2.2.5.3.1 Standard Extended /Specialized/Private SOPs

#### 2.2.5.3.2 Private Transfer Syntaxes

The Discovery LS does not implement any private transfer syntaxes.

### 2.2.5.4 CONFIGURATION - PET Application Entity

The Discovery LS system is configured by GEMS Field Service Engineers. The DICOM configuration items below are configurable or re-configurable by a Field Service Engineer but are not accessible through the Discovery LS user interface.

#### 2.2.5.4.1 AE Title/Presentation Address Mapping

The Discovery LS allows for the configuration of the mapping of remote AE titles to IP addresses and ports. The IP address of a remote AE may be in a different sub net (using routing). This configuration is performed by GEMS Field Service Engineers.

#### 2.2.5.4.2 Configurable Parameters

The following fields are configurable for the PET DICOM Server AE (local):

- Local AE Title (Configurable, but by default, set to hostname of the GE Discovery LS PET computer in all capitals (CAPS) )
- Local IP Address
- Local IP Netmask

Note that the port on which the Discovery LS receives DICOM incoming TCP/IP connections is **4030** (for Query, Verify, and Send/Receive/Query-Retrieve PET Image/Curve/Secondary Capture data, and Receive/Query-Retrieve CT/MR data).
The following fields are configurable for every remote DICOM AE:

- Remote AE Title
- Remote IP Address
- Listening TCP/IP Port Number

The following fields are configurable (in /usr/PET/systemConfig/local/scu.cfg and /usr/PET/systemConfig/local/scp.cfg):

- Association Establishment Timer
- Store, Find, Move, Timers
- Inactivity Timers
- Maximum Length PDU
- Number of simultaneous associations

**Note:** All configurations must be performed by a GE Field Engineer.

### 2.2.5.5 SUPPORT OF EXTENDED CHARACTER SETS - PET Application Entity

Starting in DLS 2.0, PET AE server in will support only the ISO_IR 100 (ISO 8859-1:1987 Latin alphabet N 1. supplementary set) as extended character sets.

### 2.2.6 Xeleris Application Entity

#### 2.2.6.1 DICOM AE Specifications

This Application Entity provides Standard Conformance to the following DICOM SOP Classes as an **SCU:**

| SOP Class Name | SOP Class UID |
|---|---|
| Nuclear Medicine Image Storage | 1.2.840.10008.5.1.4.1.1.20 |
| Secondary Capture Image Storage | 1.2.840.10008.5.1.4.1.1.7 |
| Xeleris Private SOP Class Storage | 1.2.840.113619.4.27 |
| Stand-alone Curve Storage | 1.2.840.10008.5.1.4.1.1.9 |
| Study Root Query/Retrieve Information Model – FIND | 1.2.840.10008.5.1.4.1.2.2.1 |
| Study Root Query/Retrieve Information Model – MOVE | 1.2.840.10008.5.1.4.1.2.2.2 |
| Verification – ECHO | 1.2.840.10008.1.1 |
| CT Image Storage | 1.2.840.10008.5.1.4.1.1.2 |
| PET Image Storage | 1.2.840.10008.5.1.4.1.1.128 |
| MR Image Storage | 1.2.840.10008.5.1.4.1.1.4 |

This Application Entity provides Standard Conformance to the following DICOM SOP Classes as an **SC**P:

| SOP Class Name | SOP Class UID |
|---|---|
| Nuclear Medicine Image Storage | 1.2.840.10008.5.1.4.1.1.20 |
| MR Image Storage | 1.2.840.10008.5.1.4.1.1.4 |
| Secondary Capture Image Storage | 1.2.840.10008.5.1.4.1.1.7 |
| Xeleris Private SOP Class Storage | 1.2.840.113619.4.27 |
| Stand-alone Curve Storage | 1.2.840.10008.5.1.4.1.1.9 |
| CT Image Storage | 1.2.840.10008.5.1.4.1.1.2 |
| Patient Root Query/Retrieve Information Model – FIND | 1.2.840.10008.5.1.4.1.2.1.1 |

| | |
|---|---|
| Patient Root Query/Retrieve Information Model – MOVE | 1.2.840.10008.5.1.4.1.2.1.2 |
| Study Root Query/Retrieve Information Model – FIND | 1.2.840.10008.5.1.4.1.2.2.1 |
| Study Root Query/Retrieve Information Model – MOVE | 1.2.840.10008.5.1.4.1.2.2.2 |
| Verification – ECHO | 1.2.840.10008.1.1 |
| PET Image Storage | 1.2.840.10008.5.1.4.1.1.128 |

#### 2.2.6.1.1 Association Establishment Policies - Xeleris Application Entity

##### 2.2.6.1.1.1 General

The DICOM Application Context Name (ACN), which is always proposed, is:

| | |
|---|---|
| **Application Context Name** | **1.2.840.10008.3.1.1.1** |

The Maximum Length PDU negotiation is included in all association establishment requests. The maximum length PDU for an association initiated by the XELERIS DICOM Server is:

| | |
|---|---|
| **Maximum Length PDU** | **128K Bytes** |

The SOP Class Extended Negotiation is not supported.
The maximum number of Presentation Context Items that will be proposed is 8. Note that the same Abstract Syntax may be offered multiple times with different Transfer Syntaxes.

The user information Items sent by this product are:
• Maximum PDU Length
• Implementation UID

##### 2.2.6.1.1.2 Number of Associations

The XELERIS DICOM Server AE (SCU) will initiate only one DICOM association at a time to perform an image store to a single remote AE. A maximum of three associations can be open at any point of time in order to perform Send, Query and Retrieve operations. Multiple Send and Retrieve operations can be performed. Simultaneous Query operations cannot be initiated. The total number of associations are restricted to a maximum of three, and can be any permutation/combination of the above.

The XELERIS DICOM Server AE (SCP) can have a maximum of four DICOM associations open simultaneously to service queries, retrieves or verifications.

##### 2.2.6.1.1.3 Asynchronous Nature

Asynchronous mode is not supported. All operations are performed synchronously.

#### 2.2.6.1.1.4 Implementation Identifying Information

The Implementation UID for this DICOM Implementation is:

| | |
|---|---|
| **Xeleris/eNTEGRA Processing & Review Implementation UID** | **1.2.840.113619.6.112** |

### 2.2.6.1.2 Association Inititation Policies - Xeleris Application Entity

The XELERIS DICOM Server AE initiates a new association

- Due to an image send operation being initiated from the Xeleris/eNTEGRA user interface
  - Due to a Verify operation initiated to determine whether the remote DICOM station is operational.
  - Due to image data being Queried from a Remote AE, the query operation being initiated from Xeleris/eNTEGRA Search/Fetch user interface.
  - Due to image data being Retrieved from a Remote AE. the retrieve operation being initiated from Xeleris/eNTEGRA's Search/Fetch user interface.

#### 2.2.6.1.2.1 Real-World Activity: Image Send - Xeleris Application Entity

**Associated Real-World Activity**

The operator must both select image(s) to be transferred from the Patient Selector and select a destination from the Network Card. Once these selections have been made, the operator pushes the "Send" button to initiate an image send operation. The XELERIS DICOM Server will then initiate an association with the remote AE in order to send the selected image(s).
Note that for each send operation, typically one association is established. The exception to this is that, if an image send fails, the current association is closed and another is opened for sending the remaining image(s).
The UI will indicate the status of the dataset being transferred. The status can be one of CONNECTING, ACTIVE, COMPLETED or FAILED. The associated error messages due to a failed status can be one of the following -•
Fatal System Error! Cannot Send
- Out of system memory: Cannot Send!
- Exceeded the Maximum Job Limit
- Error in Database Access
- DICOM Station Configuration Error
- DICOM Configuration Error
- Failed to connect to DICOM Station
- DICOM Protocol Error
- Failed to disconnect from DICOM station
- Remote Database Write Error
- Remote DICOM station failed to respond or Remote station is down
- Unknown Error returned from Remote Station and one warning
- Warning! Dataset does not match SOP Class or Coercion of Data Elements.

**Proposed Presentation Context Table**

The following table shows the proposed presentation contexts for the XELERIS DICOM Server AE after real-world activity “Image Send” has been initiated.

**Presentation Context Table - Proposed**

| Abstract Syntax | | Transfer Syntax | | Role | Extended Negotiation |
|---|---|---|---|---|---|
| Name | UID | Name List | UID List | | |
| Nuclear Medicine Image Storage | 1.2.840.10008.5.1.4.1.1.20 | Implicit VR Little Endian<br>Explicit VR Little Endian | 1.2.840.10008.1.2<br>1.2.840.10008.1.2.1 | SCU | None |
| Stand-Alone Curve Storage | 1.2.840.10008.5.1.4.1.1.9 | Implicit VR Little Endian<br>Explicit VR Little Endian | 1.2.840.10008.1.2<br>1.2.840.10008.1.2.1 | SCU | None |
| Xeleris Private SOP Class Storage | 1.2.840.113619.4.27 | Implicit VR Little Endian<br>Explicit VR Little Endian | 1.2.840.10008.1.2<br>1.2.840.10008.1.2.1 | SCU | None |
| Secondary Image Capture Storage | 1.2.840.10008.5.1.4.1.1.7 | Implicit VR Little Endian<br>Explicit VR Little Endian | 1.2.840.10008.1.2<br>1.2.840.10008.1.2.1 | SCU | None |
| CT Image Storage | 1.2.840.10008.5.1.4.1.1.2 | Implicit VR Little Endian<br>Explicit VR Little Endian | 1.2.840.10008.1.2<br>1.2.840.10008.1.2.1 | SCU | None |
| PET Image Storage | 1.2.840.10008.5.1.4.1.1.128 | Implicit VR Little Endian<br>Explicit VR Little Endian | 1.2.840.10008.1.2<br>1.2.840.10008.1.2.1 | SCU | None |

*SOP Specific DICOM Conformance Statement for all Storage SOP Classes*

This implementation can perform multiple C-STORE operations over a single association.
Upon receiving a C-STORE confirmation containing a Successful status, this implementation will perform the next C-STORE operation. The association will be maintained if possible.

Upon receiving a C-STORE confirmation containing a Refused status, this implementation will terminate the association.
Upon receiving a C-STORE confirmation containing a status other than Successful or Warning, this implementation
will consider the current request to be a failure but will continue to attempt to send any remaining images in the request on a different association.

Following are the status codes that are more specifically processed when receiving messages from **Storage** SCP equipment:

| Service Status | Status Codes | Further Meaning | Application Behaviour while receiving Status Codes |
|---|---|---|---|
| Refused | A700 | Out of resources. | The message “DICOM Protocol Error” posted on the Log Card |
| | A710 | Out of resources. | The message “Remote Database could not write dataset” posted to the network Log card. |
| | A720 | Out of resources. | The message “Internal Error on the Remote Station” posted to the network Log card. |
| | A730 | Out of resources. | The message “Error! Translation Failed. Cannot send Dataset” posted to the network Log card. |
| | A740 | Out of resources. | The message “Error! Remote Station could not find Pixel Data” posted to the network Log card. |
| Error | Cxxx | Cannot Understand | The message “Unknown Error returned from Remote Station” posted to the network Log card. |
| | A9xx | Data Set does not match SOP Class | The message “Warning!! Dataset does not match SOP Class or Coercion of data elements” posted to the network Log card. The report about store failure is also posted to the network Log card |
| Warning | B000 | Coercion of Data Elements | The message “Warning!! Dataset does not match SOP Class or Coercion of data elements” posted to the network Log card. |
| | B007 | Data Set does not match SOP Class | The message “Warning!! Dataset does not match SOP Class or Coercion of data elements” posted to the network Log card. |

| | | | |
|---|---|---|---|
| | B006 | Elements Discarded | The message “Warning!! Dataset does not match SOP Class or Coercion of data elements” posted to the network Log card. |
| Success | 0000 | | The message “Dataset Transfer Completed” posted to the network Log card. |

NOTE: The error codes A700-A740 are Xeleris/eNTEGRA Private Status Codes. Xeleris/eNTEGRA stations will return one of the above mentioned status codes (Refused and Error) in case of Image Send Failure. DICOM PS3.4 provides the flexibility of returning private status codes. Xeleris/eNTEGRA uses them to provide more information to the Xeleris/eNTEGRA user in case of an Image Send failure.
If Non-Xeleris/eNTEGRA stations SCP return the same status code, Xeleris/eNTEGRA SCU will interpret them as per the table above. The non-Xeleris/eNTEGRA station’s interpretation of the status code will not be considered.

#### 2.2.6.1.2.2 Real-World Activity: Verify - Xeleris Application Entity

**Associated Real-World Activity**

Service personnel invoke the utility “sendecho” from the UNIX command line. The AE Title of the remote is supplied on the command line along with the IP address and the port number of the remote DICOM station. The XELERIS DICOM server will initiate an association with the remote DICOM AE in order to verify communication at the application level. The success or failure of the verification process is displayed to the user.

**Proposed Presentation Context Table**

| Presentation Context Table - Proposed | | | | | |
|---|---|---|---|---|---|
| **Abstract Context** | | **Transfer Syntax** | | **Role** | **Extended Negotiation** |
| **Name** | **UID** | **Name List** | **UID List** | | |
| Verification SOP Class | 1.2.840.10008.1.1 | Implicit VR Little Endian | 1.2.840.10008.1.2 | **SCU** | **None** |

*SOP Specific DICOM Conformance Statement for all Verify SOP Classes*

The XELERIS DICOM Server AE provides standard conformance to the DICOM Verification Service Class.

#### 2.2.6.1.2.3 Real-World Activity: Query - Xeleris Application Entity

**Associated Real-World Activity**

Xeleris/eNTEGRA implements the query operation in two levels. The first level of query provides query results pertaining to the Patient & Study Tables only. The second level of query provides results regarding the Series and Image tables for a given Patient. The operator must push the “Search/Fetch Template” button on Xeleris/eNTEGRA Search/Fetch UI. This pops-up a Search/Fetch Template with Patient Name, Patient Id, Study From Date, Study To Date and Study Id (Search Parameters).

The operator must indicate the search criteria by entering the search parameters and then push the "Search" button to initiate the Query operation. The XELERIS DICOM Server will then initiate an association with the remote AE in order to query the remote AE for the given Search Parameters. The results of the Search operation are indicated on the Search/Fetch UI of Xeleris/eNTEGRA. The status of the operation is logged onto the Search/Fetch Log Card.

The Second Level Query operation is initiated by the selection of one or more search results on the Search/Fetch UI and then pushing the "Search Again" button to initiate the operation. The XELERIS DICOM Server will then initiate an association with the remote AE in order to query the remote AE for the given Search Parameters. The results of the Search operation are indicated on the Search/Fetch UI of Xeleris/eNTEGRA. The status of the operation is logged onto the Search/Fetch Log Card.

Xeleris/eNTEGRA makes use of the Study Root Query Model to initiate a Search/Query operation. Details of this model are provided in Section 5 of this document.
Note that for each level of a query operation, a single association is established.

**Proposed Presentation Context Table**

The following table shows the proposed presentation contexts for the XELERIS DICOM Server AE after real-world activity "Image Query" has been initiated:

| Presentation Context Table - Proposed | | | | | |
|---|---|---|---|---|---|
| **Abstract Context** | | **Transfer Syntax** | | **Role** | **Extended Negotiation** |
| **Name** | **UID** | **Name List** | **UID List** | | |
| Study Root Query/ Retrieve Information Model - FIND | 1.2.840.10008.5.1.4.1.2.2.1 | Implicit VR Little Endian<br><br>Explicit VR Little Endian | 1.2.840.10008.1.2<br><br>1.2.840.10008.1.2.1 | **SCU** | **None** |

*SOP Specific DICOM Conformance Statement for all Query SOP Classes*

This implementation can perform multiple C-FIND operations over a single association.
Upon receiving a C-FIND confirmation containing a Successful status, this implementation will perform the next C-FIND operation. The association will be maintained if possible.
Upon receiving a C-FIND confirmation containing a Pending status, this implementation will wait for further C-FIND responses from the remote DICOM AE.
Upon receiving a C-FIND confirmation containing a Refused status, this implementation will terminate the association.

Upon receiving a C-FIND confirmation containing a status other than Successful, Pending or Refused, this implementation will consider the current request to be a failure but will continue to attempt to send any remaining images in the request on a different association.
Following are the status codes that are more specifically processed when receiving, messages from **Query** SCP equipment:

| Service | Status | Further Meaning | Application Behaviour while |
|---|---|---|---|

**Status Codes receiving Status Codes**

| | | | |
|---|---|---|---|
| Refused | A700 | Out of resources. | The message “DICOM Protocol Error” posted on the Log Card |
| Cancel | FE00 | Matching terminated due to Cancel. | The message “Cancelling in progress. Cannot initiate another search until cancel is complete.” is posted to the Search/Fetch Log Card.<br><br>The message “Search Cancelled. Cancel Acknowledgment Received.” is posted to the Search/Fetch Log Card. |
| Success | 0000 | | The message “Dataset Transfer Completed” posted to the network Log card. |
| Failed | A900 | Identifier does not match SOP Class | The message “Failed to Query Remote DICOM Station” is posted to the Search/Fetch Log Card. |
| | C000 | Unable to process | The message “Remote DICOM station failed to Process Query Request” is posted to the Search/Fetch Log Card. |
| Pending | FF00 | Matches are continuing - Current Match is supplied and any Optional Keys were supported in the same manner as Required Keys. | - No Visible User Output |
| | FF01 | Matches are continuing - Warning that one or more Optional Keys were not supported for existence and/or matching for this Identifier. | A warning message is logged in a log file but is not visible to the operator. |

#### 2.2.6.1.2.4 Real-World Activity: Retrieve - Xeleris Application Entity

**Associated Real-World Activity**

The Xeleris/eNTEGRA operator can fetch data from a remote DICOM AE in two ways. The first mechanism requires

the operator to push the “Search/Fetch Template” button on Xeleris/eNTEGRA Search/Fetch UI. This pops-up a Search/Fetch Template with Patient Name, Patient Id, Study From Date, Study To Date and Study Id (Search Parameters).
The operator must indicate the Image Retrieve/Fetch criteria by entering the fetch parameters and then push the “Fetch” button to initiate the Retrieve operation. The XELERIS DICOM Server will then initiate an association with the remote AE in order to fetch DICOM imagesets from the remote AE for the given Fetch Parameters. The status of the operation is logged onto the Search/Fetch Log Card.
The second mechanism involves invocation of the Fetch operation by the selection of one or more search results (Patient/Study/Series/Image results) on the Search/Fetch UI and then pushing the “Fetch” button to initiate the operation. This mechanism assumes that the operator has preceded the Fetch with a Query operation. The XELERIS DICOM Server will then initiate an association with the remote AE in order to fetch DICOM imagesets from the remote AE for the given Patient/Study/Series/Image selection. The status of the operation is logged onto the Search/Fetch Log Card.
Xeleris/eNTEGRA makes use of the Study Root Query Model to initiate a Fetch/Retrieve operation. Details of this model are provided in Section 5 of this document.
Note that for each level of a retrieve operation, a single association is established.

The UI will indicate the status of the on-going Retrieve operation through a dialogue box which indicates the status of the Retrieve operation. Typical error messages that may appear on the Search/Fetch Log Card after the completion of a Retrieve operation can be one of the following:

- Fatal System Error! Cannot Send
- Exceeded the Maximum Job Limit
- DICOM Station Configuration Error
- DICOM Configuration Error
- Failed to connect to DICOM Station
- DICOM Protocol Error
- Failed to disconnect from DICOM station
- Unknown Error returned from Remote Station
- DICOM Formatting Error
- DICOM Retrieve Failed
- DICOM Retrieve Initialization Failed
- Remote DICOM Station unable to send datasets
- Remote DICOM station is not aware of destination station to send datasets
- Remote DICOM station - Database Retrieve Request Failed
- Remote DICOM station - Unable to Process Retrieve Requests
- Remote DICOM station failed to respond or Remote station is down

### Proposed Presentation Context Table

The following table shows the proposed presentation contexts for the XELERIS DICOM Server AE after real-world activity “Image Retrieve” has been initiated:

| Presentation Context Table - Proposed | | | | | |
|---|---|---|---|---|---|
| **Abstract Context** | | **Transfer Syntax** | | **Role** | **Extended Negotiation** |
| **Name** | **UID** | **Name List** | **UID List** | | |
| Study Root Query/ Retrieve | 1.2.840.10008.5.1.4.1.2.2.2 | Implicit VR Little | 1.2.840.10008.1.2 | **SCU** | **None** |

| | | | | | |
|---|---|---|---|---|---|
| Information Model - MOVE | | Endian<br><br>Explicit VR Little Endian | 1.2.840.10008.1.2.1 | | |

*SOP Specific DICOM Conformance Statement for all Query SOP Classes*

This implementation can perform multiple C-MOVE operations over a single association.
Upon receiving a C-MOVE confirmation containing a Successful status, this implementation will perform the next C-MOVE operation. The association will be maintained if possible.
Upon receiving a C-MOVE confirmation containing a Pending status, this implementation will wait for further C-MOVE responses from the remote DICOM AE.
Upon receiving a C-MOVE confirmation containing a Refused status, this implementation will terminate the
association.
Upon receiving a C-MOVE confirmation containing a status other than Successful, Pending or Warning, this
implementation will consider the current request to be a failure but will continue to attempt to send any remaining images in the request on a different association.
Following are the status codes that are more specifically processed when receiving messages from **Retrieve** SCP equipment:

| Service Status | Status Codes | Further Meaning | Application Behaviour while receiving Status Codes |
|---|---|---|---|
| Refused | A700 | Out of resources – Unable to calculate number of matches. | The message “Remote DICOM Station unable to send datasets” posted on the Log Card. |
| | A702 | Out of resources – Unable to calculate number of matches. | The message “Remote DICOM Station unable to send datasets” posted on the Log Card. |
| | A801 | Out of resources – Unable to calculate number of matches. | The message “Remote DICOM Station unable to send datasets” posted on the Log Card. |
| Cancel | FE00 | Matching terminated due to Cancel. | The message “Cancelling in progress. Cannot initiate another search until cancel is complete.” is posted to the Search/Fetch Log Card.<br><br>The message “Search Cancelled. Cancel Acknowledgment Received.” is posted to the Search/Fetch Log Card. |

| | | | |
|---|---|---|---|
| Success | 0000 | | The message “Dataset Transfer Completed” posted to the network Log card. |
| Failed | A900 | Identifier does not match SOP Class | The message “Failed to Query Remote DICOM Station” is posted to the Search/Fetch Log Card. |
| | C000 | Unable to process | The message “Remote DICOM station failed to Process Query Request” is posted to the Search/Fetch Log Card. |
| Pending | FF00 | Matches are continuing - Current Match is supplied and any Optional Keys were supported in the same manner as Required Keys. | - No Visible User Output |
| | FF01 | Matches are continuing - Warning that one or more Optional Keys were not supported for existence and/or matching for this Identifier. | A warning message is logged in a log file but is not visible to the operator. |

#### 2.2.6.1.3 Association Acceptance Policy

The XELERIS DICOM Server AE places no limitation on whom may connect to it.
The XELERIS DICOM Server AE responds to image store operations from remote AE’s. Any Remote AE can request and receive a list of images located in the local Xeleris/eNTEGRA database. Any Remote AE can send images (CT/MR/NM/SC/Stand alone Curve/Xeleris/eNTEGRA Private Data) to Xeleris/eNTEGRA to be stored in the local Xeleris/eNTEGRA database.

Any remote AE can open an association to the DICOM Server AE for the purpose of application level communication verification.

The XELERIS DICOM Server AE responds to query requests from remote AE’s and responds with matching responses.

Any remote AE can also request the XELERIS DICOM Server AE to retrieve image data from Xeleris/eNTEGRA, and to store this data in the database of the remote AE.

##### 2.2.6.1.3.1 Real-World Activity: Image Storage SCP - Xeleris Application Entity

**Associated Real-World Activity**

The DICOM Server AE is always listening for associations. No operator action is required to respond to a Store request.

The real-world activity associated with the Store request is to store the image data in the local database and send a C-STORE -RSP message with the status of “success” for each image that can be stored in the local database. A C-STORE-RSP message with the status “failed” is sent for each image that cannot be stored in the local database.

CT, MR, PET, NM images are stored with Full fidelity in Xeleris database.

**Accepted Presentation Context Table**

| Presentation Context Table - Proposed | | | | | |
|---|---|---|---|---|---|
| Abstract Syntax | | Transfer Syntax | | Role | Extended Negotiation |
| Name | UID | Name List | UID List | | |
| Nuclear Medicine Image Storage | 1.2.840.10008.5.1.4.1.1.20 | Implicit VR Little Endian | 1.2.840.10008.1.2 | SCP | None |
| | | Explicit VR Little Endian | 1.2.840.10008.1.2.1 | | |
| Stand-Alone Curve Storage | 1.2.840.10008.5.1.4.1.1.9 | Implicit VR Little Endian | 1.2.840.10008.1.2 | SCP | None |
| | | Explicit VR Little Endian | 1.2.840.10008.1.2.1 | | |
| Xeleris Private SOP Class Storage | 1.2.840.113619.4.27 | Implicit VR Little Endian | 1.2.840.10008.1.2 | SCP | None |
| | | Explicit VR Little Endian | 1.2.840.10008.1.2.1 | | |
| Secondary Image Capture Storage | 1.2.840.10008.5.1.4.1.1.7 | Implicit VR Little Endian | 1.2.840.10008.1.2 | SCP | None |
| | | Explicit VR Little Endian | 1.2.840.10008.1.2.1 | | |
| CT Image Storage | 1.2.840.10008.5.1.4.1.1.2 | Implicit VR Little Endian | 1.2.840.10008.1.2 | SCP | None |
| | | Explicit VR Little Endian | 1.2.840.10008.1.2.1 | | |
| MR Image Storage | 1.2.840.10008.5.1.4.1.1.128 | Implicit VR Little Endian | 1.2.840.10008.1.2 | SCP | None |
| | | Explicit VR Little Endian | 1.2.840.10008.1.2.1 | | |

**NOTE :** **Xeleris supports level 2 SCP storage.**

*SOP Specific DICOM Conformance Statement for the STORE SOP Class*

Following are the status codes the Application may send back to the SCU Equipment after performing the requested **Store**:

| Service | Status | Further Meaning | Application Behaviour while |
|---|---|---|---|

## Status Codes receiving Status Codes

| | | | |
|---|---|---|---|
| Refused | A700 | Out of resources | Returned if the DICOM Server runs out of resources (e.g. memory); error logged. |
| | A710 | Out of resources | Dataset not written into the remote database |
| | A720 | Out of resources | Internal error in the DICOM AE |
| | A730 | Out of resources | DICOM AE failed to understand DICOM stream |
| | A740 | Out of resources | DICOM AE failed to access pixel data in the DICOM stream. |
| Warning | B000 | Coercion of Data Elements | Warning! Dataset does not match SOP Class or Coercion of Data Elements |
| | B007 | Data Set does not match SOP Class | Warning! Dataset does not match SOP Class or Coercion of Data Elements |
| | B006 | Elements Discarded | Warning! Dataset does not match SOP Class or Coercion of Data Elements |
| Success | 0000 | Image store onto Xeleris is complete. | Returned when the DICOM Server completes the store operation. |
| Error | A9xx | Dataset does not match SOP Class | Returned by the DICOM Server if for any other reason, not specified elsewhere in this table, the Store operation failed; error logged. |
| | Cxxx | Cannot Understand | Returned by the DICOM Server if for any other reason, not specified elsewhere in this table, the Store operation failed; error logged. |

**NOTE**

The error codes A700-A740 are Xeleris/eNTEGRA Private Status Codes. Xeleris/eNTEGRA stations will return one of the above mentioned status codes (Refused and Error) in case of Image Receive Failure. DICOM PS3.4 provides the flexibility of returning private status codes. Xeleris/ eNTEGRA uses them to provide more information to the Xeleris/eNTEGRA user in case of an Image Receive failure.

**Presentation Context Acceptance Criterion**

The Presentation Context that will be accepted by the DICOM Server will be the one to which the remote Storage SCU has accorded the highest priority and that is supported by the DICOM Server.

**Transfer Syntax Selection Policies**

A Transfer Syntax that will be selected will be the one to which the remote Storage SCU has accorded the highest priority and that is supported by the DICOM Server.

### 2.2.6.1.3.2 Real-World Activity: Query SCP - Xeleris Application Entity

**Associated Real-World Activity**

The DICOM Server AE is always listening for associations. No operator action is required to respond to Query request.

The real-world activity associated with the Query request is to search the local database for all entries that match the request and send a C-FIND-RSP message with the status of “pending” for each matching entry. The exception to this is the last message which is sent with a status of “success.”

**Accepted Presentation Context Table**

| Presentation Context Table - Proposed | | | | | |
|---|---|---|---|---|---|
| **Abstract Context** | | **Transfer Syntax** | | **Role** | **Extended Negotiation** |
| **Name** | **UID** | **Name List** | **UID List** | | |
| Patient Root Query/ Retrieve Information Model - FIND | 1.2.840.10008.5.1.4.1.2.1.1 | Implicit VR Little Endian<br><br>Explicit VR Little Endian | 1.2.840.10008.1.2<br><br>1.2.840.10008.1.2.1 | SCP | **None** |
| Study Root Query/ Retrieve Information Model - FIND | 1.2.840.10008.5.1.4.1.2.2.1 | Implicit VR Little Endian<br><br>Explicit VR Little Endian | 1.2.840.10008.1.2<br><br>1.2.840.10008.1.2.1 | SCP | **None** |

**NOTE**

This implementation does not support extended negotiation for the C-FIND Service, including that for relational-queries.

*SOP Specific DICOM Conformance Statement for the Patient Root Query/Retrieve Information Model - Find and Study Root Query/Retrieve Information Model - FIND SOP Classes*

Following are the status codes the Application may send back to the SCU Equipment after performing the requested **Query**:

| Service Status | Status Codes | Further Meaning | Application Behaviour while receiving Status Codes |
|---|---|---|---|
| Refused | A700 | Out of resources | Returned if the DICOM Server runs out of resources (e.g. memory); error logged. |
| Failed | C000 | Unable to process | Returned by the DICOM Server if for any other reason, not specified elsewhere in this table, the Find operation failed; error logged. |
| Cancel | FE00 | Matching terminated due to cancel | Returned if the DICOM Server receives a C-CANCEL-FIND-RQ message; error logged. |
| Success | 0000 | Matching is complete - No final identifier is supplied. | Returned when the DICOM Server completes the operation. |
| Pending | FF00 | Matches are continuing - Current Match is supplied and any Optional Keys were supported in the same manner as Required Keys. | |
| | FF01 | Matches are continuing - Warning that one or more Optional Keys were not supported for existence and/or matching for this Identifier | |

**Presentation Context Acceptance Criterion**

The Presentation Context that will be accepted by the DICOM Server will be the one to which the remote Storage SCU has accorded the highest priority and that is supported by the DICOM Server.

**Transfer Syntax Selection Policies**

A Transfer Syntax that will be selected will be the one to which the remote Storage SCU has accorded the highest priority and that is supported by the DICOM Server.

### 2.2.6.1.3.3 Real-World Activity: Image Retrieve SCP - Xeleris Application Entity

**Associated Real-World Activity**

The DICOM Server AE is always listening for associations. No operator action is required to respond to an Image Retrieve request.
The real-world activity associated with the Image Retrieve request is to send all images corresponding to the C-MOVE request to the specified destination AE through a separate association.

**Accepted Presentation Context Table**

| Presentation Context Table - Proposed | | | | | |
|---|---|---|---|---|---|
| **Abstract Context** | | **Transfer Syntax** | | **Role** | **Extended Negotiation** |
| **Name** | **UID** | **Name List** | **UID List** | | |
| Patient Root Query/ Retrieve Information Model - MOVE | 1.2.840.10008.5.1.4.1.2.1.2 | Implicit VR Little Endian<br><br>Explicit VR Little Endian | 1.2.840.10008.1.2<br><br>1.2.840.10008.1.2.1 | SCP | **None** |
| Study Root Query/ Retrieve Information Model - MOVE | 1.2.840.10008.5.1.4.1.2.2.2 | Implicit VR Little Endian<br><br>Explicit VR Little Endian | 1.2.840.10008.1.2<br><br>1.2.840.10008.1.2.1 | SCP | **None** |

**NOTE**

This implementation does not support extended negotiation for the C-MOVE Service, including that for relational-retrieve.

*SOP Specific DICOM Conformance Statement for the Patient Root Query/Retrieve Information Model - MOVE and Study Root Query/Retrieve Information Model - MOVE SOP Classes*

Following are the status codes the Application may send back to the SCU Equipment after performing the requested **Retrieve**:

| Service Status | Status Codes | Further Meaning | Application Behaviour while receiving Status Codes |
|---|---|---|---|
| Refused | A701 | Out of resources – Unable to calculate number of matches. | Returned if the DICOM Server can't find requested SOP instance(s); error logged. |
| | A702 | Out of resources – Unable to calculate number of matches. | Returned if the DICOM Server can't find requested SOP instance(s); error logged. |
| | A801 | Out of resources – Unable to calculate number of matches. | Returned if the DICOM Server can't find requested SOP instance(s); error logged. |
| Failed | A900 | Identifier does not match SOP Class | Returned if the DICOM Server receives other than the Patient Root Query/Retrieve Information Model or Study Root Query/Retrieve Information Model SOP class. |
| | C000 | Unable to process | Returned if the DICOM Server cannot successfully interpret the C-MOVE-RQ message. |
| Cancel | FE00 | Sub-operations terminated due to a Cancel indication | Returned if the DICOM Server receives a C-CANCEL-MOVE-RQ message. |
| Warning | B000 | Sub-operations Complete - One or more failures. | Returned upon completion if one or more of the specified images failed to transfer to the destination AE. |
| Success | 0000 | Sub-operations Complete - No Failure | Returned after the transfer of the last image. |
| Pending | FF00 | Sub-operations are continuing | Returned after the transfer of each image except for the last. |

**2.2.6.1.3.4 Real-World Activity: Verify SCP - Xeleris Application Entity**

### Associated Real-World Activity

The XELERIS DICOM Server AE is always listening for associations. No operator action is required to respond to a Verification request.

The real-world activity associated with the Verification request is to send a C-ECHO-RSP message with a status of “success” to the requesting AE.

### Accepted Presentation Context Table

| Presentation Context Table - Proposed | | | | | |
|---|---|---|---|---|---|
| **Abstract Context** | | **Transfer Syntax** | | **Role** | **Extended Negotiation** |
| **Name** | **UID** | **Name List** | **UID List** | | |
| Verification SOP Class | 1.2.840.10008.1.1 | Implicit VR Little Endian | 1.2.840.10008.1.2 | SCP | **None** |

*SOP Specific DICOM Conformance Statement for Verification SOP Class*

The XELERIS DICOM Server AE provides standard conformance to the DICOM verification service class.

### Presentation Context Acceptance Criterion

The Presentation Context that will be accepted by the XELERIS DICOM Server will be the one to which the remote Storage SCP has accorded the highest priority and that is supported by the XELERIS DICOM Server.

### Transfer Syntax Selection Policies

A Transfer Syntax that will be selected will be the one to which the remote Storage SCU has accorded the highest priority and that is supported by the DICOM Server.

## 2.2.6.2 Communication Profiles - Xeleris Application Entity

### 2.2.6.2.1 Support Communication Stacks (PS 3.8, PS 3.9)

DICOM Upper Layer (PS 3.8) is supported using TCP/IP.

### 2.2.6.2.2 OSI Stack

The OSI Communication Stack is not supported by this implementation.

### 2.2.6.2.3 TCP/IP Stack

The TCP/IP Communication Stack is inherited from the UNIX operating system.

### 2.2.6.2.4 API

Not applicable to this product.

#### 2.2.6.2.5 Physical Media Support

Ethernet 802.3 provides the physical network layer for this product.

#### 2.2.6.2.6 Point-to-Point Stack

The Point-to-Point Communication Stack is not supported by this implementation.

### 2.2.6.3 Extentions/Privatizations/Specialization - Xeleris Application Entity

#### 2.2.6.3.1 Standard Extended/Specialized/Private SOPs

Xeleris/eNTEGRA NM Images are Standard Extended NM Image Storage SOP Class (see Section 3.6 for a complete description). Xeleris/eNTEGRA implements a transfer SOP class for full fidelity transfer of protocol data between
Xeleris/eNTEGRA systems. The protocol data object conveys information about image processing steps, results data, and display formatting. Protocol data objects are not visible on the Xeleris/eNTEGRA patient selector, but are generally sent automatically with image data if the entire series is selected for transfer. For details of the Xeleris/eNTEGRA Private Protocol Data Object refer to Section 9.

#### 2.2.6.3.2 Private Transfer Syntaxes

Xeleris/eNTEGRA does not implement any private transfer syntaxes.

### 2.2.6.4 Configurations - Xeleris Application Entity

The Xeleris/eNTEGRA system is configured by GEMS Field Service Engineers. The DICOM configuration items below are configurable or re-configurable by a Field Service Engineer but are not accessible through the Xeleris/eNTEGRA user interface.

#### 2.2.6.4.1 AE Title/Presentation Address Mapping

Xeleris/eNTEGRA allows for the configuration of the mapping of remote AE titles to IP addresses and ports. The IP address of a remote AE may be in a different subnet (using routing). A router is configurable to ensure communication from one sub-net to another. This configuration is performed by GEMS Field Service Engineers.

#### 2.2.6.4.2 Configuration Parameters

The following parameters are configurable for the DICOM Server AE:
• Local AE Title (set to hostname of Xeleris/eNTEGRA computer)
• Local IP address
• Local DICOM Port Number - to change the port number set the enviroment variable DCM_PORT
If the variable is not defined, the default port number (104) is used
Note that the default port on which Xeleris/eNTEGRA receives DICOM incoming TCP/IP connections is **104.** Theconfiguration of IP routers and subnet mask is available on a OS level.

### 2.2.6.5 Support of Extended Character Sets

Xeleris/eNTEGRA will support only the ISO_IR 100 (ISO 8859-1:1987 Latin alphabet N 1. supplementary set) as extended character sets.

## 2.3 CODES AND CONTROLLED TERMINOLOGY

Discovery LS product uses no coded terminology.

## 2.4 SECURITY PROFILES

Discovery LS product does not conform to any defined DICOM Security Profiles.
It is assumed that the product is used within a secured environment. It is assumed that a secured environment includes at a minimum:

1. Firewall or router protections to ensure that only approved external hosts have network access to the product.
2. Firewall or router protections to ensure that the product only has network access to approved external hosts and services.

Any communications with external hosts and services outside the locally secured environment use appropriate secure network channels (such as a Virtual Private Network (VPN))

# 3 MEDIA STORAGE CONFORMANCE STATEMENT

### 3.1.1 Introduction

This section specifies the Discovery LS conformance to DICOM Media Interchange. It details the DICOM Media Storage Application Profiles and roles, which are supported by this product.

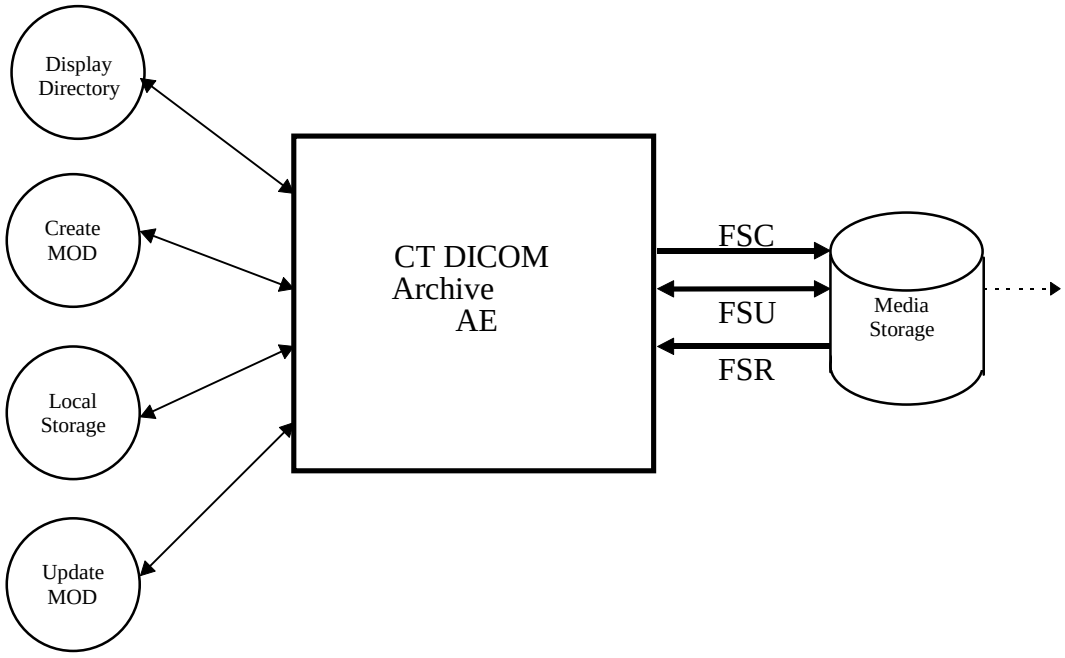
### 3.1.2 Implementation Model: MOD Archive Server

The Discovery LS product supports DICOM Media functionality on the CT Application Entity (MOD Archive Server). The CT MOD Archive Server AE is commanded to perform DICOM services through the buttons and menu selections on the main user interface panel.

#### 3.1.2.1 Application Data Flow Diagram

The CT MOD Archive Server creates and/or updates the 5.25 inch (130mm) MOD media with various DICOM SOP instances. It can process CT, MR, and Secondary Capture IODs.

**ILLUSTRATION 3-1:**
**SPECIFIC AE APPLICATION MODEL**




The product has a local storage that may contain various SOP instances. These may have been obtained by original creation, network transfer (DICOM or

proprietary), or by reading removable media from other devices. The origin of SOP instances is outside the scope of this claim.

The MOD Archive Server AE can initialize Media by acting as an FSC to create a new DICOM File-set on a 2.3GB MOD media or a 1.2GB MOD media. It initializes the DICOM File-set and writes the specified SOP instances onto the MOD. The SOP instances written will be limited to instances that match the criteria of one of the Application Profiles that is supported. When updating media, a pre-existing File-set will be updated with the selected SOP instances that match one of the supported Application Profiles.

#### 3.1.2.2 Functional Definitions of AE's

This product has only one media interchange Application Entity: the CT MOD Archive Server AE.

The MOD Archive Server can perform these functions:

- It can initialize (create DOS filesystem) a piece of media, writing a new label and DICOM File-set onto the media. (“LABEL”)
- It can update a piece of media by adding new SOP instances to an already existing DICOM File-set from local storage. (“SAVE”)
- It can display a directory listing of the File-set on a piece of media. (“QUERY”)
- It can copy SOP instance from the MOD onto local storage. (“RESTORE”)

#### 3.1.2.3 Sequencing of Real World Activities

The updating function can only be performed on a piece of media that has already had a DICOM File-set created.

The display function can only be performed on a piece of media that has already has a DICOM File-set created. With no SOP instances having been added, the directory will be displayed empty.

The copy function can only be performed with a piece of media that has DICOM SOP instances in the File-set.

There are no other sequencing requirements.

#### 3.1.2.4 File Meta Information for Implementation Class and Version

The File Meta-Information for this implementation is:

| | |
|---|---|
| File Meta-Information Version | 1 |
| Implementation UID | 1.2.840.113619.6.55 |
| Implementation Version Name | 1.0 |

### 3.1.3 AE Specifications

#### 3.1.3.1 MOD Archive Specification

The MOD Archive provides standard conformance to DICOM Interchange Option of the Media Storage Service Class. The Application Profiles and roles are listed in Table 3.1-1.

**Table 3.1-1: Application Profile, Activities and Roles for MOD Update**

| Application Profiles Supported | Real World Activity | Role | SC Option |
|---|---|---|---|
| STD-CTMR-MOD23<br>AUG-CTMR-MOD23 | Create MOD | FSC | Interchange |
| | Update MOD | FSU | Interchange |
| | Display Directory | FSR | Interchange |
| | Copy To Local Storage | FSR | Interchange |
| STD-CTMR-MOD12<br>AUG-CTMR-MOD12 | Create MOD | FSC | Interchange |
| | Update MOD | FSU | Interchange |
| | Display Directory | FSR | Interchange |
| | Copy To Local Storage | FSR | Interchange |
| PRI-CTMR-MOD12 | Display Directory | FSR | Interchange |
| | Copy To Local Storage | FSR | Interchange |

The MOD Archive Application will query the user before initializing media when a File-set is found on the media and an initialize operation has been requested.

As an FSU role, the system will produce directory sequences for each SOP instance that is added to the File-set consistent with the AUG-CTMR-MOD{12,23} profile and it will make the File-set directory so that an early installed base system that only understands the PRI-CTMR-MOD12 profile will not be able to use the media.

#### 3.1.3.1.1 File Meta Information for the Application Entity

Following are the values set in the File Meta Information for this AE:

| | |
|---|---|
| **Source Application Entity Title** | **Not used by the MOD Archive Application** |
| **Private Information Creator UID** | **Not used by the MOD Archive Application** |
| **Private Information** | **Not used by the MOD Archive Application** |

#### 3.1.3.1.2 Real World Activities

##### 3.1.3.1.2.1 Real World Activity: Create MOD Request

The MOD Archive Application acts as an FSC using the Interchange option when requested to initialize (“LABEL”) the media.

The MOD Archive Application will label the media and take the user provided list of SOP instances, eliminating any SOP instances on that list that does not correspond to one of the Application Profiles in Table 3.1-1. These SOP

instances are written to the media and a corresponding DICOMDIR sequence record is created.

**Application Profiles for the RWA: Create MOD**

The Create MOD RWA applies to the STD-CTMR and AUG-CTMR Application Profiles listed in Table 3.1-1. For extensions and specializations see section 3.4.

**Options:**

Following are the SOP Class, Photometric Interpretation, and Transfer Syntax combinations created by this AE as an FSC/FSU.

**Table 3.3.1.2.1.2-1 : IODs and Transfer Syntaxes supported for RWA: Create MOD**

| SOP Class | SOP Class UID | Photometric Interpretation Value | Transfer Syntax | Transfer Syntax UID |
|---|---|---|---|---|
| Basic Directory | 1.2.840.10008.1.3.10 | - | Explicit VR Little Endian Uncompressed | 1.2.840.10008.1.2.1 |
| CT Image | 1.2.840.10008.5.1.4.1.1.2 | MONOCHROME2 | JPEG Lossless Process 14 (selection value 1) | 1.2.840.10008.1.2.4.70 |
| CT Image | 1.2.840.10008.5.1.4.1.1.2 | MONOCHROME2 | Explicit VR Big Endian | 1.2.840.10008.1.2.2 |
| MR Image | 1.2.840.10008.5.1.4.1.1.4 | MONOCHROME2 | JPEG Lossless Process 14 (selection value 1) | 1.2.840.10008.1.2.4.70 |
| MR Image | 1.2.840.10008.5.1.4.1.1.4 | MONOCHROME2 | Explicit VR Big Endian | 1.2.840.10008.1.2.2 |
| Secondary Capture Image | 1.2.840.10008.5.1.4.1.1.7 | MONOCHROME2 | JPEG Lossless Process 14 (selection value 1) | 1.2.840.10008.1.2.4.70 |
| Secondary Capture Image | 1.2.840.10008.5.1.4.1.1.7 | MONOCHROME2 | Explicit VR Big Endian | 1.2.840.10008.1.2.2 |

*Notes:*

The CT Media Archive Server AE does not support writing images using the Explicit VR Little Endian Transfer Syntax as an FSC/FSU of the STD-CTMR profiles.

The Media Archive Server AE does not support writing Secondary Capture Palette Color images as an FSC/FSU of the STD-CTMR profiles.

The default Transfer Syntax for writing images is JPEG Lossless. Use of Explicit VR Big Endian Transfer Syntax may be configured by a field service engineer.

### 3.1.3.1.2.2 Real World Activity: Display Directory

The CT MOD Archive Application acts as an FSR using the Interchange option when requested to provide a directory listing.

When an MOD update Application is requested to provide a directory listing it will read the File-set and display the DICOMDIR directory entries for those Series in the File-set that have Modality value of “CT” or “MR”.

**Application Profiles for the RWA: MOD Display Directory**

The MOD Display Directory RWA applies to all Application Profiles listed in Table 3.1-1. For extensions and specializations see section 3.4.

**Options:**

None applicable.

#### 3.1.3.1.2.3 Real World Activity: Copy to Local Storage

The MOD Archive Application acts as an FSR when copying from the MOD to local storage.

The MOD Archive Application will copy any SOP Instance selected from an MOD Directory list from the MOD to the local storage upon request.

*Note:*

The MOD Display Directory Real-World Activity will filter out Series that do not match the Modality value of “CT” or “MR”; hence any SOP Instances in non-CT/MR series will not be able to be copied to local storage.

**Application Profiles for the RWA: Copy to Local Storage**

The MOD Copy to Local Storage RWA applies to all Application Profiles listed in Table 3.1-1. For extensions and specializations see section 3.4.

**Options:**

Following are the SOP Class, Photometric Interpretation, and Transfer Syntax combinations read by this AE as an FSR for copy to local storage.

**Table 3.3.1.2.3.2-1 : IODs and Transfer Syntaxes supported for RWA: Copy to Local Storage**

| SOP Class | SOP Class UID | Photometric Interpretation Value | Transfer Syntax | Transfer Syntax UID |
|---|---|---|---|---|
| CT Image | 1.2.840.10008.5.1.4.1.1.2 | MONOCHROME2 | Explicit VR Little Endian | 1.2.840.10008.1.2.1 |
| CT Image | 1.2.840.10008.5.1.4.1.1.2 | MONOCHROME2 | JPEG Lossless Process 14 (selection value 1) | 1.2.840.10008.1.2.4.70 |
| CT Image | 1.2.840.10008.5.1.4.1.1.2 | MONOCHROME2 | Explicit VR Big Endian | 1.2.840.10008.1.2.2 |
| MR Image | 1.2.840.10008.5.1.4.1.1.4 | MONOCHROME2 | Explicit VR Little Endian | 1.2.840.10008.1.2.1 |

| | | | | |
|---|---|---|---|---|
| MR Image | 1.2.840.10008.5.1.4.1.1.4 | MONOCHROME2 | JPEG Lossless Process 14 (selection value 1) | 1.2.840.10008.1.2.4.70 |
| MR Image | 1.2.840.10008.5.1.4.1.1.4 | MONOCHROME2 | Explicit VR Big Endian | 1.2.840.10008.1.2.2 |
| Secondary Capture Image | 1.2.840.10008.5.1.4.1.1.7 | MONOCHROME2 | Explicit VR Little Endian | 1.2.840.10008.1.2.1 |
| Secondary Capture Image | 1.2.840.10008.5.1.4.1.1.7 | MONOCHROME2 | JPEG Lossless Process 14 (selection value 1) | 1.2.840.10008.1.2.4.70 |
| Secondary Capture Image | 1.2.840.10008.5.1.4.1.1.7 | MONOCHROME2 | Explicit VR Big Endian | 1.2.840.10008.1.2.2 |

#### 3.1.3.1.2.4 Real World Activity: Update MOD

The MOD Archive Application acts as an FSU using the Interchange option when requested to update an MOD.

The MOD Archive Application will take the selected list of SOP instances and eliminate any SOP instance that does not correspond to permissible SOP instances listed in the Application Profiles Table 3.1-1. The remaining SOP instances are written to the media that is found in the MOD Archive Application disk drive. The determination of the potentially applicable Application Profile is dependent on the type of media and associated software on which the AE has been invoked.

**Application Profiles for the RWA: Update MOD Request**

The Update MOD Request RWA applies to the STD-CTMR and AUG-CTMR Application Profiles listed in Table 3.1-1. For extensions and specializations see section 3.4.

**Options:**

See Section 3.3.1.2.1.2.

### 3.1.4 Augmented and Private Application Profiles

#### 3.1.4.1 Augmented Application Profiles

#### 3.1.4.1.1 AUG-CTMR-MOD12 and AUG-CTMR-MOD23 Application Profiles

The AUG-CTMR-MOD12 and AUG-CTMR-MOD23 Application Profiles (hereinafter denoted AUG-CTMR) are augmentations of the corresponding STD-CTMR Application Profiles.

#### 3.1.4.1.1.1 SOP Classes and Transfer Syntaxes

The AUG-CTMR Application Profiles add the following SOP Classes and Transfer Syntaxes to the STD-CTMR Profile:

**Table 3.4.1.1.1-1 : Additional IODs and Transfer Syntaxes for AUG-CTMR Application Profiles**

| Information Object Definition | SOP Class UID | Transfer Syntax and UID | FSC Req. | FSR Req. | FSU Req. |
|---|---|---|---|---|---|
| CT Image Storage | 1.2.840.10008.5.1.4.1.1.2 | Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2 | O | O | O |
| MR Image Storage | 1.2.840.10008.5.1.4.1.1.4 | Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2 | O | O | O |
| SC Image Storage | 1.2.840.10008.5.1.4.1.1.7 | Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2 | O | O | O |

#### 3.1.4.1.1.2 Directory Information in DICOMDIR

The modality attribute (0008,0060) value in the DICOMDIR Series records shall be CT or MR.

#### 3.1.4.1.1.3 Other Parameters

**Image Attribute Values**

The attributes listed in Table 3.3.3.1.5.1-1 used within the Image files shall take the values specified.

**Table 3.3.3.1.5.1-1: AUG-CTMR Profiles Required Image Attribute Values**

| Attribute | Tag | Value |
|---|---|---|
| Modality | (0008,0060) | CT/MR |
| Photometric Interpretation | (0028,0004) | MONOCHROME2 |
| Bits Allocated | (0028,0100) | 16 |
| Bits Stored | (0028,0101) | 16 |

Overlay data if present shall be encoded in Overlay Data (60XX,3000).

### 3.1.4.2 Private Application Profiles

The MOD Archive Server supports a private Application Profile: PRI-CTMR-MOD12 as an FSR.

#### 3.1.4.2.1 PRI-CTMR-MOD12 Private Application Profile

The PRI-CTMR-MOD12 Application Profile specifies the media interchange of CT and MR objects using an improper JPEG compression process. This process, formerly used in some GE products but now retired, resulted in interoperability problems when SOP Instances were decoded using readily available industry decompression routines. In most respects, this profile is identical to the STD-CTMR-MOD12 Application Profile.

#### 3.1.4.2.1.1 Roles and Service Class Options

Since the process that created media with this profile is now retired, the only Role allowed is File-Set Reader.

#### 3.1.4.2.1.2 SOP Classes and Transfer Syntax

The PRI-CTMR-MOD12 Application Profile is defined for the SOP Classes and corresponding Transfer Syntax of the following table:

**Table 3.4.2.1.2-1 : IODs and Transfer Syntaxes for PRI-CTMR-MOD12 Application Profile**

| Information Object Definition | SOP Class UID | Transfer Syntax and UID | FSC Req. | FSR Req. | FSU Req. |
|---|---|---|---|---|---|
| CT Image Storage | 1.2.840.10008.5.1.4.1.1.2 | JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70 | - | O | - |
| MR Image Storage | 1.2.840.10008.5.1.4.1.1.4 | JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70 | - | O | - |
| SC Image Storage | 1.2.840.10008.5.1.4.1.1.7 | JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70 | - | O | - |

*Note:*

The Transfer Syntax specified in Table 3.4.2.1.2-1 is the one declared in the File Meta-Information Header, but in fact an improper encoding of that Transfer Syntax is used in the image objects. See 3.4.2.1.5.1.

#### 3.1.4.2.1.3 Physical Media and Media Formats

The PRI-CTMR-MOD12 Application Profile requires the 130mm 1.2GB 512 Byte per Sector Magneto-Optical Rewriteable physical media with the PC File System, as defined in PS3.12.

#### 3.1.4.2.1.4 Directory Information in DICOMDIR

The PRI-CTMR-MOD12 Application Profile uses the same Directory Information as the STD-CTMR-MOD12 Profile, except that the Frame of Reference UID (0020,0052) key Attribute of the IMAGE Directory Records is not present.

*Notes:*

The absence of the Frame of Reference UID Attribute in the IMAGE Directory Record is used by the product as an indication that the referenced SOP Instance has been encoded by the improper JPEG encoder.

#### 3.1.4.2.1.5 Other Parameters

**Image Attribute Values**

The Pixel Data (7FE0,0010) of SOP Instances stored with Transfer Syntax JPEG Lossless Process 14 (selection value 1), UID 1.2.840.10008.1.2.4.70, are improperly encoded as follows:

- In the JPEG 'SOS' (0xFFDA) header, the entropy coding table selector codes are 0x11. (They should be 0x00.) This is the key indication that the pixel data has been encoded by the improper JPEG encoder.
- The predictor value used at the beginning of each line uses the last value of the previous line in the image. (The JPEG standard says the predictor for the first line element of each line should be the first element of the line immediately above the current line.)
- The computation of the pixel value difference to be entropy encoded is computed as (Predictor - value). (It should be calculated as (value - Predictor).)

### 3.1.5 Extensions, Specializations and Privatization of SOP Classes and Transfer Syntax

#### 3.1.5.1 Extensions, Specialization's and Privatization's of SOP Classes

The CT/MR SOP Class Images have definitions extended for Defined Terms and include GE specific Private Data elements. The following sections describe the details for these SOP classes.

##### 3.1.5.1.1 SOP Specific Conformance Statement for CT SOP Class

Refer to ***section 2.4*** for standard extensions and ***Appendix B*** for private data elements.

##### 3.1.5.1.2 SOP Specific Conformance Statement for MR SOP Class

Refer to ***section 2.4*** for standard extensions and ***Appendix B*** for private data elements.

### 3.1.6 Configuration

The MOD Archive Application may have either a 1.2GB or a 2.3GB drive installed.

**Table 3.5-1 : Supported Profiles for various Drive Configurations**

| Disk Drive Installed | Profiles Supported |
|---|---|
| 1.2GB Optical Disk Drive | PRI-CTMR-MOD12 |
| | STD-CTMR-MOD12 |
| 2.3GB-Optical Disk Drive | PRI-CTMR-MOD12 |
| | STD-CTMR-MOD12 |
| | STD-CTMR-MOD23 |

### 3.1.7 Support of Extended Character Sets

The MOD Archive Application will support copy of SOP instances containing the ISO IR 100 (Latin alphabet No. 1, supplementary set) and DICOM default character sets as defined in PS3.5.

# 4 PRINT SCU CONFORMANCE

### 4.1.1 Introduction

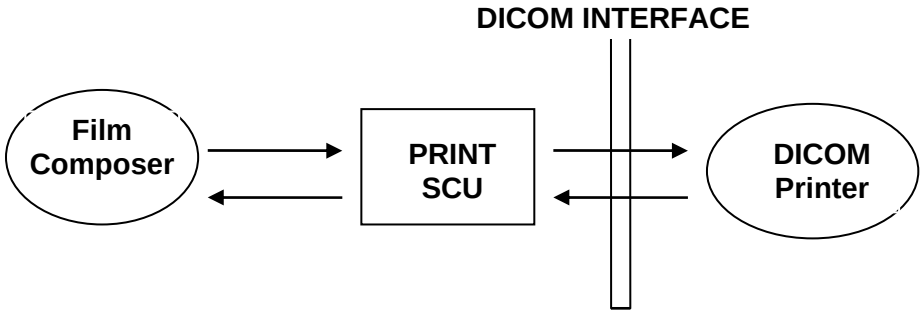
This conformance statement specifies the Discovery LS conformance to the DICOM Print SCU Application Profile. The Discovery LS product uses DICOM Print SCU to print images on DICOM Compliant Printers. CT & MR images can be printed from Discovery LS CT AE. Discovery LS also supports review and print of CT/MR/PET and Fused images from Xeleris Workstation. Refer to "Cedara Hardcopy Server as DICOM Print Management SCU" for more details.

### 4.1.2 IMPLEMENTATION MODEL : PRINT SCU

The DICOM Print SCU is a DICOM print filter which provides the capability to print images to DICOM printers. The DICOM Print filter acts as an SCU of the DICOM print management SOP class.

#### 4.1.2.1 Application Data Flow Diagram

**DICOM print SCU Implementation model**




The Film Composer is the User interface and this is used to initiate the local real world activity. The user issues the print request using Film Composer. Film composer allows printer selection and it composes the pre-formatted film file. This film file is interpreted by Print SCU and it sends the appropriate messages to DICOM print SCP running on a DICOM printer.

#### 4.1.2.2 Functional Definition of AE's

DICOM Print SCU Establishes the Association to the requested printer for printing the composed film.

#### 4.1.2.3 Sequencing of Real-World Activities

- The DICOM printer is installed through a camera installation process. The DICOM printer is selected from the Film Composer Interface for Manual Filming. Autofilming is enabled using the camera setup via the camera installation process.
- Images may be acquired for printing in the following manner:
  - Images to be printed may be manually dropped from Viewing applications into the manual film composer slots.
  - Images to be printed may be automatically dropped from Viewing applications into the manual film composer slots.
  - Images to be printed may be manually dropped from Viewing applications into the auto film composer slots.
  - Image series to be printed may be automatically dropped from the PrintSeries application into the manual film composer slots.
  - Images to be printed may be automatically dropped from the Scanning Application into the auto film composer slots.
- Based upon the filming mode (and the attributes) used to acquire images into the film composer, films will be automatically printed when the film session is full, or the user must press the Print Button to print the images.
- The Print SCU retrieves the Print SCP status by using the N-GET service of Printer SOP Class. If the printer returns a FAILURE status the print session will be terminated. The printer status is not read.
- The film session is created using the N-CREATE service. The print session will be terminated if the printer fails to create the film session.
- The film box is created using the N-CREATE service. The print session will be terminated if the printer fails to create the film box.
- The images are placed on the film box by using the N-SET. If the printer fails to place the image on the film box, the print session will be terminated.
- The film will be printed using the N-ACTION. Only film box printing is supported. If the printer fails to print the film, the print session will be terminated.
- After the successful N-ACTION, the film box will be deleted using the N-DELETE. Any N-EVENT-REPORTS given to the PRINT SCU will be received but the data is ignored. After the film box is deleted, the association will be closed.
- Upon the successful completion of the above sequencing and the association is closed, the user will be notified of the successful print session.

### 4.1.3 AE SPECIFICATIONS

#### 4.1.3.1 DICOM Print SCU AE Specification

Print SCU provides Standard Conformance to the following DICOM 3.0 SOP classes as an SCU:

| SOP CLASS name | SOP CLASS UID |
|---|---|
| Basic grayscale print management meta SOP class | **1.2.840.10008.5.1.1.9** |
| Print Job SOP class | **1.2.840.10008.5.1.1.14** |

##### 4.1.3.1.1 Association Establishment Policy

#### 4.1.3.1.1.1 General

The Film Composer provides options to indicate the printer AE title and Printer host name. These parameters are used by the Print SCU to establish the association with the desired printer.

The DICOM Application Context Name (ACN), which is always proposed, is:

| Application Context Name | 1.2.840.10008.3.1.1.1 |
|---|---|

The Maximum Length PDU negotiation is included in all association establishment requests. The maximum length PDU for association initiated by the DICOM Print SCU AE is:

| Maximum Length PDU | 16 Kbytes |
|---|---|

#### 4.1.3.1.1.2 Number of Associations

The Print SCU will initiate only one association with printer. Multiple associations are not supported.

#### 4.1.3.1.1.3 Asynchronous Nature

The print SCU does not support asynchronous operations. All operations will be performed synchronously.

#### 4.1.3.1.1.4 Implementation identifying information

The Implementation UID allows unique identification of a set of products that share the same implementation.

The Implementation UID for this ID/Net v3.0 Implementation is:

| Discovery LS Implementation UID | 1.2.840.113619.6.55 |
|---|---|

### 4.1.3.1.2 Association Establishment Policy

Print SCU initiates the association with the Printer.

#### 4.1.3.1.2.1 Real World Activity

**Associated Real-World Activity - "Print"**

The Film Composer allows the user to select printers and it also allows the user to drag and drop the images (from the viewer application) into the film. It also allows the user to manipulate some print parameters like film format and number of copies to print. When the user presses the "Print" Button, the Film composer communicates this request to Print SCU which then tries to establish the association with the requested printer and transmits the images for printing.

**Proposed Presentation Contexts**

The Proposed Presentation Context Table for the Print SCU is as shown in following Table.

| Presentation Context Table – Proposed | | | | | |
|---|---|---|---|---|---|
| Abstract Syntax | | Transfer Syntax | | Role | Extended Negotiation |
| Name | UID | Name | UID | | |
| Basic Grayscale Print Management Meta SOP Class | 1.2.840.10008.5.1.1.9 | DICOM Implict VR Little Endian Transfer Syntax | 1.2.840.10008.1.2 | SCU | None |
| Verification SOP Class | 1.2.840.10008.1.1 | DICOM Implict VR Little Endian Transfer Syntax | 1.2.840.10008.1.2 | SCU | None |
| Printer SOP Class | 1.2.840.10008.5.1.1.16 | DICOM Implict VR Little Endian Transfer Syntax | 1.2.840.10008.1.2 | SCU | None |
| Print Job SOP Class | 1.2.840.10008.5.1.1.14 | DICOM Implicit VR Little Endian Transfer Syntax | 1.2.840.10008.1.2 | SCU | None |

**Note:** Certain Presentation Contexts may be negotiated that are not used during the association. See the following sections for the DICOM Print services performed by the Discovery LS.

### 4.1.3.1.2.2 SOP Specific Conformance Statement

The Print SCU supports the following mandatory SOP classes which are defined under the Basic Grayscale Print Management Meta SOP Class.

The Print SOP Classes supported by Print SCU :

| NAME | UID |
|---|---|
| Basic Film Session SOP Class | 1.2.840.10008.5.1.1.1 |
| Basic Film Box SOP Class | 1.2.840.10008.5.1.1.2 |
| Basic Grayscale Image Box SOP | 1.2.840.10008.5.1.1.4 |
| Printer SOP Class | 1.2.840.10008.5.11.16 |

The Print SCU does not support any optional SOP Classes.

**Note:** The asterisk (*) preceding some of the SOP attributes in the following sections indicates optional SCP attributes. The SCU is aware of these optional attributes and will not fail on the receipt of a response without the optional attributes; the limitation being that this information

is not available for the User. Some SCP's will terminate the association with a failure upon the receipt of an optional attribute it does not support.

**Basic Film Session SOP Class**

The Print SCU supports the following DIMSE Service Elements for the Basic Film Session SOP Class.

N-CREATE - Requests the Print SCP to create an instance of Basic Film Session.

The following Attribute values are supported by the N-CREATE:

| Attribute | DICOM Tag | Valid Range | Default Value |
|---|---|---|---|
| * Number of Copies | ( 2000, 0010 ) | 1-99 | Set by user |
| * Print Priority | ( 2000, 0020 ) | HIGH / MED / LOW | Set in Configuration file ( Default value is HIGH ) |
| * Medium Type | ( 2000, 0030 ) | CLEAR FILM<br>BLUE FILM<br>PAPER | Set in Configuration File |
| * Film Destination | ( 2000, 0040 ) | MAGAZINE<br>PROCESSOR | Set in Configuration File |

**Note: *** denotes that the attribute is optional for the SCU. However, we do provide values for all of these optional attributes and if the SCP does not support the requested value it may choose to either return a failure status or ignore the value provided and use its default value.

If Failure status is returned during N-CREATE operation of Film session the following action will be taken by Print SCU:
0x213 "Resource Limitation" message will be sent.
All other status "Failure" message will be sent.
In all the cases the print session will be terminated.

**Basic Film box SOP Class**

The Print SCU supports the following DIMSE Service Elements for the Basic Film Box SOP Class.

N-CREATE - Requests the Print SCP to create an instance of Film Box.
N-ACTION - Requests the Print SCP to print the Film Box onto Printer.
N-DELETE - Requests the Print SCP to delete the Film Box Instance.

The Following Attribute values are supported:

| Attribute | DICOM Tag | Valid Range | Default Value |
|---|---|---|---|
| Image Display Format | ( 2010, 0010 ) | STANDARD/C,R<br>Printer Dependent | Set in User Interface |
| Reference Film Session Sequence | ( 2010, 0500 ) | | |
| *Film Orientation | ( 2010, 0040 ) | PORTRAIT | Set in Configuration File |
| Film Size ID | ( 2010, 0050 ) | Sent zero length | Sent zero length |

| | | | |
|---|---|---|---|
| *Magnification type | ( 2010, 0060 ) | BILINEAR<br>CUBIC<br>REPLICATE<br>NONE | Set in Configuration File |
| *Max Density | ( 2010, 0130 ) | 0-4095 | Set in Configuration File |
| Configuration Information | ( 2010, 0150 ) | Printer Dependent | Set in Configuration File |
| *Smoothing type | ( 2010, 0080 ) | Printer Dependent | Set in Configuration File |
| *Border density | ( 2010, 0100 ) | BLACK<br>WHITE | Set in Configuration File |
| *Empty image density | ( 2010, 0110 ) | BLACK<br>WHITE | Set in Configuration File |
| *Min density | ( 2010, 0120 ) | 0-4094 | Set in Configuration File |
| *Trim | ( 2010, 0140 ) | NO | NO |

**Note:** Attributes “sent zero length” use the camera default values.
**Note: *** denotes that the attribute is optional for the SCU. However, we do provide values for all of these optional attributes and if the SCP does not support the requested value it may choose to either return a failure status or ignore the value provided and use its default value.

If Failure status is returned during N-CREATE operation of Film box following action will be taken by Print SCU.
0x213 “Resource Limitation” message will be sent.
0x106 “Unsupported Film Format” message will be sent.
All other status “Failure” message will be sent
In all the cases the print session will be terminated.

If Failure status is returned during N-ACTION operation of Film box following action will be taken by Print SCU.
0xC602 “Unable to Create Print Job” message will be sent.
All other status “Failure” message will be sent.
In all the cases the print session will be terminated.

If Failure status is returned during N-DELETE operation of Film box following action will be taken by Print SCU.
All the return status “Failure” message will be sent and the print session will be terminated.

### Basic Grayscale Image Box SOP Class

The Print SCU supports the following DIMSE Service Elements for Grayscale Image Box SOP Class.

N-SET - Requests the Printer to set the image box attributes.

The Following Attribute values are supported:

| Attribute | DICOM Tag | Valid Range | Default Value |
|---|---|---|---|
| Image Position | ( 2020, 0010 ) | Based on Image Display Format | No Default Value |
| Pre-formatted Grayscale Image Sequence | ( 2020, 0110 ) | | |
| >Samples per pixel | ( 0028, 0002 ) | 1 | 1 |
| >Photometric Interpretation | ( 0028, 0004 ) | MONOCHROME2 | MONOCHROME2 |
| >Rows | ( 0028, 0010 ) | Image Dependent | Image Dependent |
| >Columns | ( 0028, 0011 ) | Image Dependent | Image Dependent |
| >Pixel Aspect Ratio | ( 0028, 0034 ) | 1/1 | 1/1 |
| >Bits Allocated | ( 0028, 0100 ) | 8 | 8 |
| >Bits Stored | ( 0028, 0101 ) | 8 | 8 |
| >High Bit | ( 0028, 0102 ) | 7 | 7 |
| >Pixel Representation | ( 0028, 0103 ) | 0 (unsigned integer) | 0 (unsigned integer) |
| *Polarity | ( 2020, 0020 ) | NORMAL | NORMAL |

**Note: *** denotes that the attribute is optional for the SCU. However, we do provide values for all of these optional attributes and if the SCP does not support the requested value it may choose to either return a failure status or ignore the value provided and use its default value.

If Failure status is returned during N-SET operation of Image Box following action will be taken by Print SCU.
0xC605 “Resources temporarily not available” message will be sent.
All other status “Failure” message will be sent.
In all the cases the print session will be terminated.

### Printer SOP Class

N-GET DIMSE service is supported for the Printer SOP Class. If an N-EVENT-REPORT DIMSE service is received when the association is active, Print SCU handles the relevant states but the data received is ignored.

Print SCU issues the request to retrieve the following attributes:

| Optional Attribute | DICOM Tag | Default Value |
|---|---|---|
| Printer Status | ( 2110, 0010 ) | Printer shall return Value |
| Printer Status Info | ( 2110, 0020 ) | Printer shall return Value |
| Printer Name | ( 2110, 0030 ) | Printer shall return Value |
| Manufacturer | ( 0008, 0070 ) | Printer shall return Value |
| Manufacturer Model Name | ( 0008, 1090 ) | Printer shall return Value |
| Device Serial No. | ( 1800, 1000 ) | Printer shall return Value |
| Software Versions | ( 1800, 1020 ) | Printer shall return Value |
| Date Last Calibrated | ( 1800, 1200 ) | Printer shall return Value |
| Time Last Calibrated | ( 1800, 1201 ) | Printer shall return Value |

The Print SCU issues the N-GET service to retrieve the printer status. The status is processed as follows:

- If Printer status (2110, 0010) is NORMAL, the film is printed.
- If Printer status (2110, 0010) is FAILURE, the print job is terminated. The Printer Status Info (2110, 0020) attribute is not processed.
- If Printer status (2110, 0010) is WARNING, one of three things will happen:

a) If the Printer Status Info (2110, 0020) is “SUPPLY LOW” the status is displayed to the user and the print job continues.
b) If the Printer Status Info (2110, 0020) is “RECEIVER FULL” or “SUPPLY EMPTY” or “FILM JAM” the status is displayed to the user and the print job is aborted.
For all other Printer Status Info (2110, 0020) values, the status is ignored and the print job continues.

**Print Job SOP Class**

Print SCU looks for following attributes in N-EVENT REPORT data received from Print SCP. If Print SCU does not receive N-EVENT_REPORT it requests the Print SCP to retrieve the following set of attributes using N-GET .

| Attribute Name | DICOM Tag | Default Value |
|---|---|---|
| Execution Status | ( 2100, 0020 ) | Value returned by Print SCP |
| Execution Status info | ( 2100, 0030 ) | Value returned by Print SCP |
| Print Priority | ( 2000, 0020 ) | Value returned by Print SCP |
| Creation Date | ( 2100, 0040 ) | Value returned by Print SCP |
| Creation Time | ( 2100, 0050 ) | Value returned by Print SCP |
| Printer Name | ( 2110, 0030 ) | Value returned by Print SCP |
| Originator | ( 2100, 0070 ) | Value returned by Print SCP |

#### 4.1.3.1.3 Association Acceptance Policy

The Print SCU does not accept associations.

### 4.1.4 COMMUNICATION PROFILES

#### 4.1.4.1 Supported Communication Stacks (parts 8,9)

DICOM Upper Layer (Part 8) is supported using TCP/IP.

##### 4.1.4.1.1 TCP/IP Stack

The TCP/IP stack is inherited from the UNIX Operating System.

###### 4.1.4.1.1.1 API

Not Applicable

###### 4.1.4.1.1.2 Physical Media Support

Ethernet v2.0, IEEE 802.3**.**

### 4.1.5 Standard Extended/Specialized/Private SOPs

None.

### 4.1.6 Configuration

#### 4.1.6.1 AE Title/Presentation Address Mapping

The Local AE title is "hostname_DCP", where “hostname” is the unique hostname within the network.

The Discovery LS system allows the user to “add”, “Remove”, or “Update” the mapping of remote DICOM Printer AE Titles to IP Addresses and Ports. These options can be selected from the Service Desktop camera installation utility.

#### 4.1.6.2 Configurable Parameters

The following fields are configurable for the DICOM Print SCU AE:

**Note:** All configurations should be performed by a GE Field Service Engineer.

- Local IP Address
- Local IP Netmask
- Max PDU length

- The following DICOM print parameters are configurable. The valid ranges are shown in earlier sections of this conformance statement.
  - Medium Type (2000, 0030)
  - Film Destination (2000, 0040)
  - Magnification Type (2010, 0060)
  - Min Density (2010, 0120)
  - Max Density (2010, 0130)
  - Empty Image Density (2010, 0110)
  - Border Density (2010, 0100)
  - Configuration Information (2010, 0150)
  - Smoothing Type (2010, 0080)
- The following network timers are supported and are configurable. When these timers expire the association is terminated. The default values are:
  - Association Time out = 600 seconds
  - Session Time out = 3000 seconds (total time for open association)
  - N-SET Time out = 300 seconds
  - N-ACTION Time out = 300 seconds
  - N-CREATE Time out = 300 seconds
  - N-DELETE Time out = 300 seconds
  - N-GET Time out = 100 seconds

- Time-outs, which are set for all hosts, are configurable in dprint.cfg:
  *Association time-out - *bi_assoc_tio*
  *Session timeout - *bi_session_tio*
  *Create timeout - *bi_ncreate_tio*

**Note:** All configurations are performed by a GE Field Service Engineer.

### 4.1.7 Support of Extended Character Set

The Print SCU does not support any Extended Character Set.

# 5 Storage Commitment Conformance

## 5.1.1 Introduction

This section of the DICOM conformance statement specifies Discovery LS compliance to the Storage Commitment Push Model SOP Class. The CT DICOM Application Entity handles all the Storage Commitment DICOM functionalities. DST CT AE supports Storage Commitment of CT, MR and Secondary Capture for images born on CT. The DST PET and Xeleris do not support Storage Commitment.

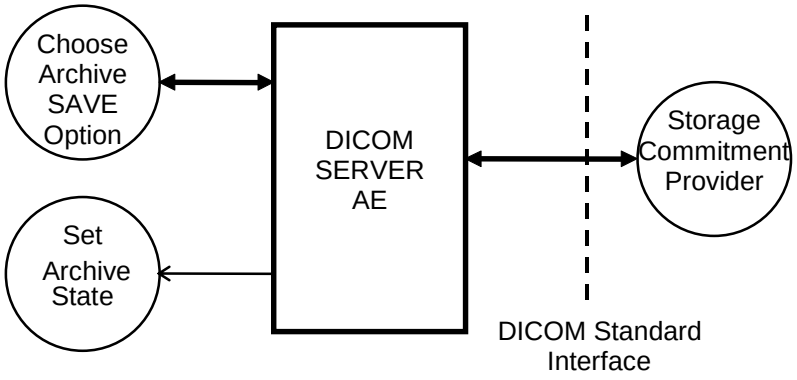
### 5.1.2 Implementation Model

#### 5.1.2.1 Application data flow diagram

Illustration 5-0 is a subset of Illustration 2-0 showing the data flow diagram for Storage Commitment.

**ILLUSTRATION 5-0**

**APPLICATION DATA FLOW DIAGRAM**




There is only one Real-World activity that will cause the CT DICOM Server Application Entity (CT DICOM Server AE) to initiate an association to a remote DICOM entity that is a Service Class Provider (SCP) of the Storage Commitment SOP class.

The *Choose Archive save Option* Real-World activity consists of an operator choosing a remote DICOM AE that supports Storage Commitment as provider as the archive device and selecting one or more exam or series from the local database and choosing either *Save Exam* or *Save Series* from the archive menu. The images to be committed are sent to the remote provider entity first. The Commitment request for the transferred image instances is sent after the complete image transfer. The Commitment response can come on same association or on a different association.

The Real-World activity *Set Archive State* is performed by the CT DICOM Server AE to respond to an incoming Storage Commitment response from the remote Storage Commitment Provider.

#### 5.1.2.2 Functional definitions

The CT DICOM Server AE initiates the following operations:

- Negotiates and establishes association with remote Storage Commitment Provider
- Sends the selected images to the remote DICOM AE.
- Closes the association.
- If all the images are transferred without failures the following steps will be executed. If there are any failures the job will marked as failed and the Storage Commitment request will not be sent.
- Establishes a new association for sending the commitment request. Here note that a storage Commitment request does not imply that the acquisition of images is complete.
- Receives the response on same association or on a different association.
- Updates the archive flag information for successful instances. The archive flag is shared with the local archive and the two can not be distinguished.

#### 5.1.2.3 Sequencing of real-world activities

The user has to select the remote commitment provider and the exams/series to be pushed before clicking Save Exam/Series button on the Archive menu.

### 5.1.3 AE Specifications

#### 5.1.3.1 DICOM Server AE specifications

In addition to the SOP Classes defined in Section 3.3.1, the DICOM Server AE provides Standard Conformance to the following SOP class as an SCU:

| SOP class name | SOP class UID |
|---|---|
| Storage Commitment Push model SOP class | 1.2.840.10008.1.20.1 |

##### 5.1.3.1.1 Association establishment policies

The association establishment policies for the CT DICOM Server AE are described in Section 2.2.4.1.1.1.

##### 5.1.3.1.2 Association initiation policy

An association is initiated by the Storage SCU to the Service Provider, to send the images to be committed. A separate association is established to send the commitment request.

##### 5.1.3.1.3 Real World Activity

###### 5.1.3.1.3.1 Associated Real World Activity - ”Save exam/series”

See 2.2.4.1.1.2. The user selects the exam/series to be archived. All the images currently in the selected exam/series will be sent to the selected remote archive node (which is also the Storage commitment SCP) using DICOM C-STORE operations. Once all the images are transferred the commitment request will be sent on a separate association.

#### 5.1.3.1.3.2 Associated Real World Activity - "Auto Archive exam/series"

The Auto archive API's are used to archive the exams/series onto local archive media or the remote archive node (which shall be a Storage Commitment SCP) without manual interface. If the default device selected for Auto Archive is a remote Storage Commitment SCP then all the images currently in the specified exam/series will be sent to the selected Storage commitment SCP using C-STORE operations. On successful transfer of all the images the Storage Commitment request will be sent.

### 5.1.3.1.4 Proposed Presentation Contexts

The Proposed Presentation Context table for the DICOM Storage Commitment SCU is as shown in following Table.

| Presentation Context Table | | | | | |
|---|---|---|---|---|---|
| Abstract Syntax | | Transfer Syntax | | Role | Extended Negotiation |
| Name | UID | Name | UID | | |
| Storage Commitment Push Model | 1.2.840.10008.1.20.1 | DICOM Implict VR Little Endian | 1.2.840.10008.1.2 | SCU | None |

The Storage Commitment SCU can send the commitment request for following DICOM 3.0 SOP classes.

| NAME | UID |
|---|---|
| CT Image Storage SOP Class | 1.2.840.10008.5.1.4.1.1.2 |
| MR Image storage SOP Class | 1.2.840.10008.5.1.4.1.1.4 |
| Secondary Capture Storage SOP Class | 1.2.840.10008.5.1.4.1.1.7 |

### 5.1.3.1.5 Request Processing

The images in the selected exam/series are sent to the remote commitment provider entity using DICOM C-STORE operations. If there are any failures in the image transfers the Storage commitment request will not be sent. The corresponding job will be marked as failed and user will be notified of the status of job.

If all the images are successfully transferred then the commitment request will be sent on a different association with the list of sop instances.

If the N-Action request fails, the job will be marked as failed otherwise following sequence of actions will take place.

The SCU waits for **N-Action-Rsp** from provider on the same association for a configurable amount of time. If it does not receive **N-Action-Rsp** during this time it will close the association. It changes the Job state to ”Wait” indicating the job is waiting for the response from commitment provider. The job will be marked as failed if the response is not received by ***stop job time***. Stop job time is the maximum duration the job can wait for responses.

A New transaction uid will be created for each retry by user. The old transaction uid is not applicable for these requests.

The Following DIMSE service Elements are supported for the Storage Commitment request and response processing.

N-ACTION - Requests the remote Storage Commitment SCP to commit to storing the image instances.

N-EVENT-REPORT - The response sent by the remote Storage Commitment SCP.

The following attributes are sent as part of the **DATA Set** for the **N-Action request**.

| Attribute | Tag | Value |
|---|---|---|
| Transaction UID | (0008,1195) | Transaction UID |
| Referenced SOP Sequence | (0008,1199) | |
| >SOP Class UID | (0008,1150) | |
| >SOP Instance UID | (0008,1155) | |

- Referenced Study Component sequence attribute is not sent.
- Storage Media File-Set ID and Storage Media File-Set UID attributes are not supported.

#### 5.1.3.1.6 Response Processing

Once the N-EVENT REPORT response is received, the following actions will be taken depending on the status of response.

##### 5.1.3.1.6.1 Commit response with SUCCESS status

The Archive flag information in the browser for all the successful instances will be updated. The status will be changed to “Y” .

The job queue entry will be removed

**Note :**

- The following attributes are expected as part of **DATA Set** for **N-Event-Request** from SCP

| Attribute | Tag | Value |
|---|---|---|

| | | |
|---|---|---|
| Transaction UID | (0008,1195) | Value received from SCP |
| Referenced SOP Sequence | (0008,1199) | Value received from SCP |
| >SOP Class UID | (0008,1150) | Value received from SCP |
| >SOP Instance UID | (0008,1155) | Value received from SCP |

N-Event-Response will be sent on the same association itself. No DATA Set will be sent along with the response.

#### 5.1.3.1.6.2 Commit response with FAILURE status

The following attributes are expected as part of **DATA Set** for **N-Event-Request** from SCP

| Attribute | Tag | Value |
|---|---|---|
| Transaction UID | (0008,1195) | Value received from SCP |
| Failed SOP Sequence | (0008,1199) | Value received from SCP |
| >SOP Class UID | (0008,1150) | Value received from SCP |
| >SOP Instance UID | (0008,1155) | Value received from SCP |
| >Failure Reason | (0008,1197) | Value received from SCP |

In case of complete/partial failure the user will be notified about the status and the job entry will be paused. There is no attempt made to retry automatically the failed sop instances. However the user can manually retry the failed jobs. Such requests will be treated as new requests. This will go through the whole sequence of operations once again.

The failure reason is ignored.

Failed SOP instances will have their archive flag information unaltered.

***Note :***

***The archive status flag in the browser is a shared flag with local archive. When the status is "Y", it means that the images are archived but doesn't specify whether on local archive device or remote archive device. It is left to the user's discretion whether the local sop instances (with their archive flag set to "Y" ) are to be deleted.***

N-Event-Response will be sent on the same association itself. No DATA Set will be sent along with the response.

#### 5.1.3.1.7 Association Acceptance Policy

A single association will be accepted at any time to receive Storage Commitment responses.

# 6 Modality Work List Conformance

### 6.1.1 INTRODUCTION

This section of the DICOM Conformance Statement specifies the Discovery LS compliance to DICOM conformance requirements for the Modality Worklist features on this GEMS product.

The Modality Worklist Service, provided by Connect Pro option for Discovery LS, allows a user to query for and display DICOM modality worklist information from a remote hospital or radiology department information system computer. For example, a user may wish to query for all procedures scheduled to be performed on the scanner. In this situation, Modality Worklist is providing the DICOM C-FIND service as a service class user (SCU).

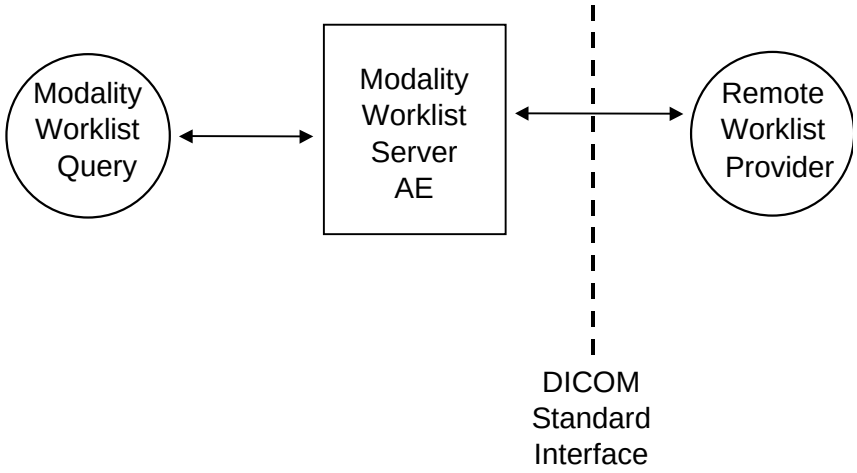
### 6.1.2 IMPLEMENTATION MODEL

All the Modality Worklist DICOM functionality provided by the Discovery LS product is logically provided by the CT DICOM Server AE (Worklist Server). The CT Worklist Server DICOM AE is commanded to perform DICOM modality worklist query services through the use of the Discovery LS user interface.

#### 6.1.2.1 Application Data Flow Diagram

**ILLUSTRATION** 6-0

**MODALITY WORKLIST DATA FLOW DIAGRAM**




#### 6.1.2.2 Functional definitions

The CT DICOM ModalityWorklist Server AE is implemented as an application process on the scanner host computer. It runs as a daemon serving requests from the user interface to obtain modality worklists, query remote AE's and return the results to the user interface.

The ModalityWorklist Worklist Server AE initiates the following functions:

- *Query*: Initiates a DICOM association in order to query a remote AE. If the remote AE accepts a presentation context applicable to modality worklist, the Worklist Server AE will issue a modality worklist query request via the C-FIND service.

#### 6.1.2.3 Sequencing of Real-World Activities

1. The user or the system initiates a modality worklist query (as a modality worklist SCU) to the Modality Worklist SCP with a given set of query parameters.
2. The Modality Worklist SCP returns responses, which match the query parameters.
3. Items from the returned worklist responses are presented to the user.
4. A subset of the returned worklist responses is included in acquired DICOM images related to the responses.

### 6.1.3 AE SPECIFICATIONS

#### 6.1.3.1 Worklist Server AE Specification

This Application Entity provides Standard Conformance to the following DICOM SOP Classes as an **SCU**:

| SOP Class Name | SOP Class UID |
|---|---|
| Modality Worklist Information Model - FIND | 1.2.840.10008.5.1.4.31 |

##### 6.1.3.1.1 Association Establishment Policies

###### 6.1.3.1.1.1 General

The DICOM Application Context Name (ACN), which is always proposed, is:

| Application Context Name | 1.2.840.10008.3.1.1.1 |
|---|---|

The Maximum Length PDU negotiation is included in all association establishment requests. The maximum length PDU for an association initiated by the DICOM Worklist Server is:

| Maximum Length PDU | 50 Kbytes |
|---|---|

The SOP Class Extended Negotiation is not supported.

The maximum number of Presentation Context Items that will be proposed is 1.

###### 6.1.3.1.1.2 Number of Associations

The CT DICOM Worklist Server AE (SCU) will initiate only one DICOM association at a time to perform a modality worklist query of a single remote AE.

###### 6.1.3.1.1.3 Asynchronous Nature

Asynchronous mode is not supported. All operations are performed synchronously.

#### 6.1.3.1.1.4 Implementation Identifying Information

The Implementation UID for this DICOM Implementation is:

| | |
|---|---|
| **ModalityWorklist for Discovery LS Implementation UID** | **1.2.840.113619.6.50** |

#### 6.1.3.1.2 Association Initiation Policy

The Worklist Server AE initiates a new association due to an update operation being initiated from the Discovery LS user interface.

#### 6.1.3.1.2.1 Real-World Activity: Worklist Query

**Associated Real-World Activity**

The operator of the system initiates a query for a Modality Worklist by either opening the Schedule screen or by opening the Schedule screen and pressing the Update button. The choice of which of these two behaviors occurs is user configurable. The Worklist Server will then initiate an association with the remote AE in order to query for the worklist.

A user can configure a number of parameters which directly control the worklist query request. The user can request worklist items that are intended for the scanner the user is working at, all items that apply to the modality of the scanner the user is working at or all worklist items available. These selections and their affects on worklist query parameters are given below:

This Scanner:

- Modality, (0008,0060) - set to CT
- Scheduled Station AE Title, (0040,0001) - set to local AE title

This Modality:

- Modality, (0008,0060) - set to CT
- Scheduled Station AE Title, (0040,0001) - zero-length (universal matching)

All Scanners:

- Modality, (0008,0060) - zero-length (universal matching)
- Scheduled Station AE Title, (0040,0001) - zero-length (universal matching)

The scheduled dates of procedures of interest can be specified for query by selecting a specific date range. The date ranges available are Today, Days Before Today, Days After Today and All Days. These selections and their affects on worklist query parameters are given below:

Today:

Scheduled Procedure Step Start Date (0040,0002) - set to YYYYMMDD, where this date is the current date.

Days Before Today and Days After Today:

Scheduled Procedure Step Start Date (0040,0002) - set to YYYYMMDD-YYYYMMDD, where this date range represents the specified number of days before today and/or after today. Note that number of days both before and after can be specified in the same query and that each always includes today.

All Days:

Scheduled Procedure Step Start Date (0040,0002) - zero-length (universal matching)

**Proposed Presentation Context Table**

The following table shows the proposed presentation contexts for the Worklist Server AE after real-world activity “Worklist Query” has been initiated:

| Presentation Context Table - Proposed | | | | | |
|---|---|---|---|---|---|
| **Abstract Syntax** | | **Transfer Syntax** | | **Role** | **Extended Negotiation** |
| **Name** | **UID** | **Name List** | **UID List** | | |
| Modality Worklist Information Model – FIND | 1.2.840.10008.5.1.4.31 | Implicit VR Little Endian | 1.2.840.10008.1.2 | SCU | None |

***SOP Specific DICOM Conformance Statement for the Worklist SOP Class***

If the remote AE does not support the proposed Presentation Context, an appropriate error is logged and the operator is notified.

This implementation can receive multiple C-FIND results over a single association. Only one association is opened at a time.

Each C-FIND response received from the remote AE is parsed to verify the length/type of the items in the response (see section 2.3.1.2.1.2.2 for more information). Upon detecting any error in the response data, the Worklist Server AE will issue a C-FIND-CANCEL and, upon receipt of a C-FIND-RSP (or if an applicable timer expires), will abort the association. All previously received worklist items are retained.

On receipt of any error from the remote AE, the Worklist Server will issue a C-FIND-CANCEL and, upon receipt of a C-FIND-RSP (or if an applicable timer expires), will abort the association. All previously received worklist items are retained. Warnings received from the remote AE are ignored.

Each C-FIND operation supports a configurable “Association Timer.” This timer starts when the association request is sent or received and stops when the association is established. The default time-out value is 30 seconds.

Each C-FIND operation supports a configurable “Session Timer.” This timer starts when an association is established and stops when the association is ended. The default time-out value is 3600 seconds.

If any of the above timers expires, the association is aborted (A-ABORT) and the operation in progress is considered to be failed. Any previously received worklist items are discarded.

***Record Acceptance Policy***

The Discovery LS implementation adheres to strict value checking of incoming query responses from the remote AE. Each response received is examined to verify that all Type 1 attributes are present with non-zero length, that all Type 2 attributes are present (possibly with zero length) and that the data for all attributes is consistent with respect to the attributes' value representation (VR).

Any inconsistencies in the response data, with respect to the categories described above, are considered errors. Upon detecting any such errors in the response data, the Worklist Server AE will issue a C-FIND-CANCEL and, upon receipt of a C-FIND-RSP (or if an applicable timer expires), will abort the association. All previously received worklist items are retained. Note that the absence of requested Type 3 attributes is not considered an error.

Fields considered Type 1 by the Worklist Server include:

- (0010,0010), Patient Name
- (0010,0020), Patient ID
- (0020,000D), Study Instance UID
- (0040,0001), Scheduled Station AE Title
- (0040,0002), Scheduled Procedure Step Start Date [1]
- (0040,0003), Scheduled Procedure Step Start Time [1]
- (0040,0009), Scheduled Procedure Step ID
- (0040,1001), Requested Procedure ID

[1] Start Date must be of the form YYYYMMDD, exactly eight numeric characters, and Start Time must be of the form HHMMSS, exactly six numeric characters.

Fields considered Type 2 by Worklist Server include:

- (0008,0050), Accession Number
- (0008,0060), Modality
- (0008,0090), Referring Physician Name
- (0010,0030), Patient Date of Birth
- (0010,0040), Patient Sex
- (0010,1030), Patient Weight in kg
- (0010,2000), Medical Alerts
- (0010,2110), Contrast Allergies
- (0010,21C0), Pregnancy Status
- (0032,1032), Requesting Physician
- (0032,1070), Requested Contrast Agent
- (0038,0010), Admission ID
- (0038,0050), Special Needs
- (0038,0300), Current Patient Location
- (0038,0500), Patient State

- (0040,0006), Performing Physician
- (0040,0010), Scheduled Station Name
- (0040,0011), Scheduled Procedure Step Location
- (0040,0012), Pre-order Medication
- (0040,1003), Requested Procedure Priority
- (0040,1004), Patient Transport Arrangements
- (0040,3001), Confidentiality Constraint

#### 6.1.3.1.3 Association Acceptance Policy

The Worklist Server AE does not respond to attempts by a remote AE to open an association.

### 6.1.4 COMMUNICATION PROFILES

#### 6.1.4.1 Supported Communication Stacks (PS 3.8, PS 3.9)

DICOM Upper Layer (PS 3.8) is supported using TCP/IP.

#### 6.1.4.2 OSI Stack

The OSI Communication Stack is not supported by this implementation.

#### 6.1.4.3 TCP/IP Stack

The TCP/IP Communication Stack is inherited from the IRIX operating system.

#### 6.1.4.3.1 API

Not applicable to this product.

#### 6.1.4.3.2 Physical Media Support

Ethernet 802.3 provides the physical network layer for this product.

#### 6.1.4.4 Point-to-Point Stack

The Point-to-Point Communication Stack is not supported by this implementation.

### 6.1.5 EXTENSIONS / SPECIALIZATIONS / PRIVATIZATIONS

#### 6.1.5.1 Standard Extended /Specialized/Private SOPs

ModalityWorklist for Discovery LS does not implement any private transfer SOP classes.

#### 6.1.5.2 Private Transfer Syntaxes

ModalityWorklist for Discovery LS does not implement any private transfer syntaxes.

### 6.1.6 CONFIGURATION

The ModalityWorklist feature is configured by GEMS Field Service engineers. The DICOM configuration items below are configurable or re-configurable by a Field Service Engineer and are not accessible by users through the Discovery LS user interface.

#### 6.1.6.1 AE Title/Presentation Address Mapping

ModalityWorklist allows for the configuration of the following parameters which pertain to the remote AE.

- Remote AE (HIS/RIS) IP address - IP address used to contact the remote AE
- Remote AE (HIS/RIS) IP port - IP port used to contact the remote AE

These parameters define where worklist queries will be directed. Configuration of these parameters is performed by GEMS Field Service engineers using the ModalityWorklist installation facilities.

#### 6.1.6.2 Configurable Parameters

The following parameters are configurable for the DICOM Worklist Server AE:

- Local (Worklist Server) AE Title (automatically set to host name of scanner)
- Local IP address
- Local IP netmask
- Local IP gateway

The following parameters are configurable by changing their values in the configuration file **/usr/g/config/WLdcm.cfg**. Note that these parameters typically need not be changed. Furthermore, no support is provided for retaining changed settings: the values will require changing again after a system software upgrade.

- Implementation UID
- PDU size
- Association time-out period
- Session time-out period
- C-FIND time-out period

### 6.1.7 SUPPORT OF EXTENDED CHARACTER SETS

ModalityWorklist will support only the ISO_IR 100 (ISO 8859-1:1987 Latin alphabet N 1. supplementary set) as extended character sets.

### 6.1.8 Modality Worklist INFORMATION MODEL Definition

#### 6.1.8.1 ModalityWorklist Mapping of DICOM Entities

**TABLE 3.3-1**
**MAPPING OF DICOM ENTITIES TO MODALITY WORKLIST ENTITIES**

| DICOM | Modality Worklist Entity |
|---|---|

| | |
|---|---|
| Scheduled Procedure Step | Exam |
| Requested Procedure | Exam |
| Imaging Service Request | Exam |
| Visit | Exam |
| Patient | Patient |

### 6.1.8.2 Information Model MODULE TABLE

Table 3.4-1 identifies the defined modules within the entities which comprise the DICOM Modality Worklist Information Model. Modules are identified by Module Name.

See DICOM PS 3.3 and PS 3.4 for a complete definition of the entities, modules, and attributes.

**TABLE 3.4-1**
**MODALITY WORKLIST INFORMATION MODEL MODULES**

| Entity Name | Module Name | Reference |
|---|---|---|
| Scheduled Procedure Step | SOP Common | 3.5.2.1 |
| | Scheduled Procedure Step | 3.5.2.2 |
| Requested Procedure | Requested Procedure | 3.5.3.1 |
| Imaging Service Request | Imaging Service Request | 3.5.4.1 |
| Visit | Visit Identification | 3.5.5.1 |
| | Visit Status | 3.5.5.2 |
| | Visit Relationship | 3.5.5.3 |
| | Visit Admission | 3.5.5.4 |
| Patient | Patient Relationship | 3.5.6.1 |
| | Patient Identification | 3.5.6.2 |
| | Patient Demographic | 3.5.6.3 |
| | Patient Medical | 3.5.6.4 |

### 6.1.8.3 INFORMATION Model Keys

Please refer to DICOM Standard PS 3.3. (Information Object Definitions) and PS 3.4 (Service Class Specifications) for a description of each of the Entities contained within the Modality Worklist Information Model.

The following Module descriptions contain the attributes which are present in a C-FIND request message sent by the Worklist Server AE to a remote AE. It should be noted that they are the same as those defined in the DICOM Standard, PS 3.4 (Service Class Specifications) and include:

- Name
- Tag group and element numbers
- Expected Matching Key Type: R-required, O-optional
- Expected Return Key Type:

- 1 - non-zero value required
- 1C - conditionally of type 1
- 2 - required to be present, possibly with zero-length value
- 3 - optional

- Mapped into The Image - whether this data is mapped into subsequently acquired images
- Notes - clarification of this implementation's use/treatment of this attribute

All data elements in the following Module descriptions are requested by the Worklist Server AE. Values of data elements that are not mapped into images, and are not otherwise dealt with (displayed on the user interface, etc.), are not used and are, thus, discarded upon receipt. See Table B-1 for further information.

Data elements for which values can be sent for matching purposes are described as such. Data elements for which values are not sent are sent with zero length and universal matching will apply. This is the default case if no other description to the contrary is provided.

#### 6.1.8.4 Supported Matching

The following are the types of matching that can be request by the implementation:

- Single Value matching
- Universal Matching
- Range of date/time

#### 6.1.8.5 Scheduled Procedure Step Entity

##### 6.1.8.5.1 SOP Common Module

**TABLE 3.5-1**
**SOP COMMON MODULE ATTRIBUTES**

| Attribute Name | Tag | Expected Matching Key Type | Expected Returned Key Type | Mapped into the Image | Note |
|---|---|---|---|---|---|
| Specific Character Set | (0008,0005) | O | 1C | No | Matching for this item is supported only for the character set ISO_IR 100. This value is always sent and therefore, must be returned. |

##### 6.1.8.5.2 Scheduled Procedure Step Module

**TABLE 3.5-2**
**SCHEDULED PROCEDURE STEP MODULE ATTRIBUTES**

| Attribute Name | Tag | Expected Matching Key Type | Expected Returned Key Type | Mapped into the Image | Note |
|---|---|---|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| Scheduled Procedure Step Sequence | (0040,0100) | R | 1 | No | |
| >Scheduled Station AE Title | (0040,0001) | R | 1 | No | Matching is supported as follows: either no AE title is supplied (universal matching), or the scanner's Worklist Server AE title is supplied for matching; this is user selectable. |
| >Scheduled Procedure Step Start Date | (0040,0002) | R | 1 | No | Matching is supported as one of the following; this is user selectable:<br>• all days,<br>• today only,<br>• today and a number of days before today,<br>• today and a number of days after today,<br>• today and a number of days before today and a number of days after today.<br>Number of days before/after is specified by the user.<br>Returned values must be exactly 8 numeric characters in YYYYMMDD format. |
| >Scheduled Procedure Step Start Time | (0040,0003) | R | 1 | No | This attribute is sent with zero-length. Returned values must be exactly 6 numeric characters in HHMMSS format. |
| >Modality | (0008,0060) | R | 1 | Yes | Matching is supported as follows: either no Modality is supplied (universal matching), or the scanner's Modality is supplied for matching; this is user selectable. |
| >Scheduled Performing Physician's Name | (0040,0006) | R | 2 | No | This attribute is sent with zero-length. |
| >Scheduled Procedure Step Description | (0040,0007) | O | 1C | Yes | |
| >Scheduled Station Name | (0040,0010) | O | 2 | No | |
| >Scheduled Procedure Step Location | (0040,0011) | O | 2 | No | |
| >Scheduled Action Item Code Sequence | (0040,0008) | O | 1C | No | |
| >>Code Value | (0008,0100) | O | 1C | No | |
| >>Coding Scheme Designator | (0008,0102) | O | 1C | No | |
| >>Code Meaning | (0008,0104) | O | 3 | No | |
| >Pre-Medication | (0040,0012) | O | 2C | No | |
| >Scheduled Procedure Step ID | (0040,0009) | O | 1 | Yes | |
| >Requested Contrast Agent | (0032,1070) | O | 2C | No | Displayed on "More Info..." screen. |

### 6.1.8.6 Requested Procedure Entity

#### 6.1.8.6.1 Requested Procedure Module

**TABLE 3.5-3**
**REQUESTED PROCEDURE MODULE ATTRIBUTES**

| Attribute Name | Tag | Expected Matching Key Type | Expected Returned Key Type | Mapped into the Image | Note |
|---|---|---|---|---|---|
| Requested Procedure ID | (0040,1001) | O | 1 | Yes | User can enter the value for Requested Procedure Id prior to query. If user has entered the value then that value will be sent as part of the query. The value returned in the response shall be mapped to the image. |
| Requested Procedure Description | (0032,1060) | O | 1C | Yes | Truncated to 22 characters. |
| Requested Procedure Code Sequence | (0032,1064) | O | 1C | No | |
| >Code Value | (0008,0100) | O | 1C | No | |
| >Coding Scheme Designator | (0008,0102) | O | 1C | No | |
| >Code Meaning | (0008,0104) | O | 3 | No | |
| Study Instance UID | (0020,000D) | O | 1 | Yes (Based on User option) | User ( Modality ) will be able to configure the following. If the user has set the option to “Use MWL Study UID”, then study Instance UID will be copied into the final DICOM image header. If this option is not set then a new Study instance UID is generated locally on the scanner. |
| Referenced Study Sequence | (0008,1110) | O | 2 | No | |
| >Referenced SOP Class UID | (0008,1150) | O | 1C | No | |
| >Referenced SOP Instance UID | (0008,1155) | O | 1C | No | |
| Requested Procedure Priority | (0040,1003) | O | 2 | No | |
| Patient Transport Arrangements | (0040,1004) | O | 2 | No | |
| Requested Procedure Location | (0040,1005) | O | 3 | No | |
| Confidentiality Code | (0040,1008) | O | 3 | No | |

### 6.1.8.7 Imaging Service Request Entity

#### 6.1.8.7.1 Imaging Service Request Module

**TABLE 3.5-4**

**IMAGING SERVICE REQUEST MODULE ATTRIBUTES**

| Attribute Name | Tag | Expected Matching Key Type | Expected Returned Key Type | Mapped into the Image | Note |
|---|---|---|---|---|---|
| Accession Number | (0008,0050) | O | 2 | Yes | User will be able to enter value for Accession Number prior to query to be sent as part of C-FIND request. Supports maximum of 16 characters. |
| Requesting Physician | (0032,1032) | O | 2 | No | |
| Referring Physician's Name | (0008,0090) | O | 2 | Yes | Truncated to 32 characters |
| Requesting Service | (0032,1033) | O | 3 | No | |

### 6.1.8.8 Visit Entity

#### 6.1.8.8.1 Visit Identification

**TABLE 3.5-5**
**VISIT IDENTIFICATION MODULE ATTRIBUTES**

| Attribute Name | Tag | Expected Matching Key Type | Expected Returned Key Type | Mapped into the Image | Note |
|---|---|---|---|---|---|
| Admission ID | (0038,0010) | O | 2 | No | |
| Institution Name | (0008.0080) | O | 3 | No | |

#### 6.1.8.8.2 Visit Status

**TABLE 3.5-6**
**VISIT STATUS MODULE ATTRIBUTES**

| Attribute Name | Tag | Expected Matching Key Type | Expected Returned Key Type | Mapped into the Image | Note |
|---|---|---|---|---|---|
| Current Patient Location | (0038,0300) | O | 2 | No | Displayed on “More Info...” screen. |

#### 6.1.8.8.3 Visit Relationship

**TABLE 3.5-7**
**VISIT RELATIONSHIP MODULE ATTRIBUTES**

| Attribute Name | Tag | Expected Matching Key Type | Expected Returned Key Type | Mapped into the Image | Note |
|---|---|---|---|---|---|
| Referenced Patient Sequence | (0008,1120) | O | 2 | No | |
| >Referenced SOP Class UID | (0008,1150) | O | 2 | No | |
| >Referenced SOP Instance UID | (0008,1155) | O | 2 | No | |

#### 6.1.8.8.4 Visit Admission

No data elements are requested from the Visit Admission Module.

### 6.1.8.9 Patient Entity

#### 6.1.8.9.1 Patient Relationship

No data elements are requested from the Patient Relationship Module.

#### 6.1.8.9.2 Patient Identification

**TABLE 3.5-8**
**PATIENT IDENTIFICATION MODULE ATTRIBUTES**

| Attribute Name | Tag | Expected Matching Key Type | Expected Returned Key Type | Mapped into the Image | Note |
|---|---|---|---|---|---|
| Patient's Name | (0010,0010) | R | 1 | Yes | This attribute is sent with zero-length. Supports upto 32 characters. See also **Note1**. User can also specify the patient name to search for on the Disocvery LS UI. |
| Patient ID | (0010,0020) | R | 1 | Yes | This attribute is sent with zero-length. Supports upto 16 characters. User can also specify the patient ID to search for on the Disocvery LS UI. |

***Note 1 :***

- *Modality Worklist server supports 32 characters for patient Name*
- *Supports DICOM format for patient Name ( with "^" as delimiters )*
- *If patient name in worklist has more than 32 characters then*
  - *Worklist will be accepted by the server*
  - *Worlist Browser will display only the first 32 characters*
  - *"More Info" screen will display the full patient name*
  - ***Only the FIRST 32** characters is copied into the final DICOM image header*

- Patient Demographic

**TABLE 3.5-9**
**PATIENT DEMOGRAPHIC MODULE ATTRIBUTES**

| Attribute Name | Tag | Expected Matching Key Type | Expected Returned Key Type | Mapped into the Image | Note |
|---|---|---|---|---|---|
| Patient's Birth Date | (0010,0030) | O | 2 | Yes | This value is also used to calculate the Patient's Age. |
| Patient's Sex | (0010,0040) | O | 2 | Yes | |
| Patient's Weight | (0010,1030) | O | 2 | Yes | Limited to maximum value of 999 kg. |
| Confidentiality constraint on patient data | (0040,3001) | O | 2 | No | |
| Patient's Size | (0010,1020) | O | 3 | No | |
| Patient's Address | (0010,1040) | O | 3 | No | |
| Patient's Telephone Numbers | (0010,2154) | O | 3 | No | |

#### 6.1.8.9.3 Patient Medical

**TABLE 3.5-10**
**PATIENT MEDICAL MODULE ATTRIBUTES**

| Attribute Name | Tag | Expected Matching Key Type | Expected Returned Key Type | Mapped into the Image | Note |
|---|---|---|---|---|---|
| Patient State | (0038,0500) | O | 2 | No | |
| Pregnancy Status | (0010,21C0) | O | 2 | No | Displayed on "More Info..." screen. |
| Medical Alerts | (0010,2000) | O | 2 | No | Displayed on "More Info..." screen. |
| Contrast Allergies | (0010,2110) | O | 2 | No | Displayed on "More Info..." screen. |
| Special Needs | (0038,0050) | O | 2 | No | Displayed on "More Info..." screen. |
| Additional Patient History | (0010,21B0) | O | 3 | Yes | Displayed on "More Info..." screen. |

### 6.1.9 Private data dictionary

The ModalityWorklist implementation does not define any Private Attributes within the Modality Worklist Information Model.

### 6.1.10 C-FIND Request Message

This section provides a detailed description of the C-FIND request message data that is provided to the remote AE during a worklist query operation. The dump in Table D-1 below lists, in exact message order, the fields transferred as part of the C-FIND request message for a typical query.

In this particular dump, no values are specified for the Scheduled Procedure Step Start and End Dates (the attributes are sent with zero length). In DICOM this is interpreted as meaning all dates (i.e. universal matching). The Modality is also not specified in this particular dump, meaning all modalities. Note that the user,

through the use of the Discovery LS user interface, can submit a worklist query that will cause non-zero values to be sent for these attributes.

Worklist query is supported only for CT & MR modalities. PET modality worklists can be queried by using “All Systems” options on UI – but the resulting PET Worklist item will show the modality as ‘MX’.

**TABLE D-1**
**C-FIND REQUEST MESSAGE DUMP**

```
(0008,0000) UL    108                   #     4,  1  IdentifyingGroupLength
(0008,0005) CS    [ISO_IR 100]          #    12,  1  SpecificCharacterSet
(0008,0050) SH    (no value available)  #     0,  0  AccessionNumber
(0008,0080) LO    (no value available)  #     0,  0  InstitutionName
(0008,0090) PN    (no value available)  #     0,  0  ReferringPhysicianName
(0008,1110) SQ    (Sequence with explicit Length #=1) #    24,  1  ReferencedStudySequence
 (fffe,e000) na    (Item with explicit Length  #=2)  #    16,  1  Item
  (0008,1150) UI    (no value available)  #     0,  0  ReferencedSOPClassUID
  (0008,1155) UI    (no value available)  #     0,  0  ReferencedSOPInstanceUID
 (fffe,e00d) na    (ItemDelimitationItem for re-encoding) #     0,  1  ItemDelimitationItem
(fffe,e0dd) na    (SequenceDelimitationItem for re-enc.) #     0,  1  SequenceDelimitationItem
(0008,1120) SQ    (Sequence with explicit Length #=1)  #    24,  1  ReferencedPatientSequence
 (fffe,e000) na    (Item with explicit Length  #=2)  #    16,  1  Item
  (0008,1150) UI    (no value available)  #     0,  0  ReferencedSOPClassUID
  (0008,1155) UI    (no value available)  #     0,  0  ReferencedSOPInstanceUID
 (fffe,e00d) na    (ItemDelimitationItem for re-encoding) #     0,  1  ItemDelimitationItem
(fffe,e0dd) na    (SequenceDelimitationItem for re-enc.) #     0,  1  SequenceDelimitationItem
(0010,0000) UL    96                    #     4,  1  PatientGroupLength
(0010,0010) PN    (no value available)  #     0,  0  PatientName
(0010,0020) LO    (no value available)  #     0,  0  PatientID
(0010,0030) DA    (no value available)  #     0,  0  PatientBirthDate
(0010,0040) CS    (no value available)  #     0,  0  PatientSex
(0010,1000) LO    (no value available)  #     0,  0  Other Patient IDs
(0010,1020) DS    (no value available)  #     0,  0  PatientSize
(0010,1030) DS    (no value available)  #     0,  0  PatientWeight
(0010,1040) LO    (no value available)  #     0,  0  PatientAddress
(0010,2000) LO    (no value available)  #     0,  0  MedicalAlerts
(0010,2110) LO    (no value available)  #     0,  0  ContrastAllergies
(0010,2154) SH    (no value available)  #     0,  0  PatientTelephoneNumber
(0010,2160) SH    (no value available)  #     0,  0  Ethinc Group
(0010,21b0) LT    (no value available)  #     0,  1  AdditionalPatientHistory
(0010,21c0) US    (no value available)  #     0,  0  PregnancyStatus
(0010,4000) LT    (no value available)  #     0,  0  Patient Comments
(0020,0000) UL    8                     #     4,  1  ImageGroupLength
(0020,000d) UI    (no value available)  #     0,  0  StudyInstanceUID
(0032,0000) UL    64                    #     4,  1  StudyGroupLength
(0032,1032) PN    (no value available)  #     0,  0  RequestingPhysician
(0032,1033) LO    (no value available)  #     0,  0  RequestingService
(0032,1060) LO    (no value available)  #     0,  0  RequestedProcedureDescription
(0032,1064) SQ    (Sequence with explicit Length #=1) #    32,  1  RequestedProcedureCodeSequence
 (fffe,e000) na    (Item with explicit Length  #=3)  #    24,  1  Item
  (0008,0100) SH    (no value available)  #     0,  0  CodeValue
  (0008,0102) SH    (no value available)  #     0,  0  CodingSchemeDesignator
  (0008,0104) LO    (no value available)  #     0,  0  CodeMeaning
 (fffe,e00d) na    (ItemDelimitationItem for re-encoding)  #     0,  1  ItemDelimitationItem
(fffe,e0dd) na    (SequenceDelimitationItem for re-enc.)  #     0,  1  SequenceDelimitationItem
(0038,0000) UL    32                    #     4,  1  VisitGroupLength
(0038,0010) LO    (no value available)  #     0,  0  AdmissionID
(0038,0050) LO    (no value available)  #     0,  0  SpecialNeeds
(0038,0300) LO    (no value available)  #     0,  0  CurrentPatientLocation
(0038,0500) LO    (no value available)  #     0,  0  PatientState
(0040,0000) UL    192                   #     4,  1  ModalityWorklistGroupLength
(0040,0100) SQ    (Sequence with explicit Length #=1) #   136,  1  ScheduledProcedureStepSequence
 (fffe,e000) na    (Item with explicit Length  #=12)  #   128,  1  Item
  (0008,0060) CS    (no value available)  #     0,  0  Modality
  (0032,1070) LO    (no value available)  #     0,  0  RequestedContrastAgent
  (0040,0001) AE    (no value available)  #     0,  0  ScheduledStationAETitle
  (0040,0002) DA    (no value available)  #     0,  0  ScheduledProcedureStepStartDate
  (0040,0003) TM    (no value available)  #     0,  0  ScheduledProcedureStepStartTime
  (0040,0006) PN    (no value available)  #     0,  0  ScheduledPerformingPhysiciansName
  (0040,0007) LO    (no value available)  #     0,  0  ScheduledProcedureStepDescription
```

```
  (0040,0008) SQ    (Seq with explicit Length #=1) #    32,  1  ScheduledActionItemCodeSequence
   (fffe,e000) na    (Item with explicit Length  #=3) #    24,  1  Item
    (0008,0100) SH    (no value available)  #     0,  0  CodeValue
    (0008,0102) SH    (no value available)  #     0,  0  CodingSchemeDesignator
    (0008,0104) LO    (no value available)  #     0,  0  CodeMeaning
   (fffe,e00d) na    (ItemDelimitationItem for re-encoding) #     0,  1  ItemDelimitationItem
  (fffe,e0dd) na    (SequenceDelimitationItem for re-enc.) #     0,  1  SequenceDelimitationItem
  (0040,0009) SH    (no value available)  #     0,  0  ScheduledProcedureStepID
  (0040,0010) SH    (no value available)  #     0,  0  ScheduledStationName
  (0040,0011) SH    (no value available)  #     0,  0  ScheduledProcedureStepLocation
  (0040,0012) LO    (no value available)  #     0,  0  PreMedication
 (fffe,e00d) na    (ItemDelimitationItem for re-encoding) #     0,  1  ItemDelimitationItem
(fffe,e0dd) na    (SequenceDelimitationItem for re-enc.) #     0,  1  SequenceDelimitationItem
(0040,1001) SH    (no value available)  #     0,  0  RequestedProcedureID
(0040,1003) SH    (no value available)  #     0,  0  RequestedProcedurePriority
(0040,1004) LO    (no value available)  #     0,  0  PatientTransportArrangements
(0040,1005) LO    (no value available)  #     0,  0  RequestedProcedureLocation
(0040,1008) LO    (no value available)  #     0,  0  ConfidentialityCode
(0040,1010) PN    (no value available)  #     0,  0  Names of Intended Recipients
(0040,1400) LT    (no value available)  #     0,  0  Requested Procedure Comments
(0040,2400) LT    (no value available)  #     0,  0  Imaging Service Request Comm.
(0040,3001) LO    (no value available)  #     0,  0  ConfidentialityConstraintOnPatientData
```

If the query is for a particular date range, the ScheduledProcedureStepStartDate will be filled with a valid date range. If either the start or end date are left blank by the user, they will simply be blank in the query.

Below is an example of a date range for August 30, 1997 through October 12, 1997.

```
(0040,0002) DA    [19970830-19971012]   #    18,  1  ScheduledProcedureStepStartDate
```

Below is an example of a date range for August 30, 1997 through the end of time.

```
(0040,0002) DA    [19970830-]   #    18,  1  ScheduledProcedureStepStartDate
```

Below is an example of a date range from the beginning of time through August 30, 1997.

```
(0040,0002) DA    [-19970830]   #    18,  1  ScheduledProcedureStepStartDate
```

If the query is for records for this modality, the Modality will be filled in as follows:

```
(0008,0060) CS    [CT]                  #     2,  1  Modality
```

If the query is for records for this Scanner, the Modality will be filled in with CT as above and the Scheduled Station AE Title will be filled in with the value configured for this system. For example, this station was configured as CTRoom1.

```
(0040,0001) AE    [CTRoom1]             #     8,  1  ScheduledStationAETitle
```

User will be able to enter the values for “Accession Number” prior to the query. If value is entered then that value will be sent as part of the query. For example, if “1234” is entered then

```
    (0008,0050) SH    [1234]  #     4,  1  AccessionNumber
```

User will be able to enter the values for “Requested Procedure Id” prior to the query. If value is entered then that value will be sent as part of the query. For example, if “3456” is entered then

```
(0040,1001) SH    [3456]  #    4, 1  RequestedProcedureID
```

### 6.1.11 Use of Specific DICOM Data

This section details the use of the DICOM data returned by remote AEs during worklist queries. The Discovery LS user interface fields which display the data, along with the data’s mapping into resulting acquired and transferred DICOM images, is presented in following table D-2.

**TABLE D-2**
**SPECIFIC DATA USAGE**

| DICOM Worklist Data Element | Patient Schedule Screen Field | Discovery LS DICOM Image Data Element |
|---|---|---|
| Accession Number (0008,0050) | Req Number | Accession Number<br>Supports maximum of 16 characters. |
| Patient ID (0010,0020) | Patient ID | Patient ID<br>Supports maximum of 16 characters. |
| Patient Name (0010,0010) | Patient Name | Patient Name<br>Supports maximum of 32 characters. |
| Patient’s Birth Date (0010,0030) | Patient Age (Patient Birth Date user to calculate age) | Patient Birth Date |
| Patient's Sex (0010,0040) | Sex | Patient’s Sex |
| Patient's Weight (0010,1030) | Weight in Kg | Patient's Weight |
| Referring Physician’s Name (0008,0090) | Referring Physician | Referring Physician’s Name |
| Requested Procedure Description (0032,1060) | Exam Description | Study Description. |
| Scheduled Procedure Step Start Date (0040,0002) | Date | Not available. |
| Scheduled Procedure Step Start Time (0040,0003) | Time | Not available. |
| Study Instance UID (0020,000d) | Study instance UID (only displayed on the “More Info...” screen) | Study Instance UID **, if User has set the preference to “Use MWL Study UID”.** |
| Requested Procedure Id (0040,1001) | Requested Proc ID | Requested Procedure Id. |
| Pregnancy Status (0010,21C0) | Pregnancy Status (only displayed on the “More Info...” screen) | Not available. |
| Medical Alerts (0010,2000) | Medical Alerts (only displayed on the “More Info...” screen) | Not available. |
| Contrast Allergies (0010,2110) | Contrast Allergies (only displayed on the “More Info...” screen) | Not available. |

| | | |
|---|---|---|
| Special Needs (0038,0050) | Special Needs (only displayed on the “More Info...” screen) | Not available. |
| Requested Contrast Agent (0032,1070) | Requested Contrast Agent (only displayed on the “More Info...” screen) | Not available. |
| Current Patient Location (0038,0300) | Current Patient Location (only displayed on the “More Info...” screen) | Not available. |
| Additional Patient History (0010,21B0) | Additional Patient History (only displayed on the “More Info...” screen) | Patient History. |

Note that the display of a specific data item on the “More Info...” screen is contingent on the item being enabled for display. Depending on the preferences of each specific site, data can either be displayed or not. A GE field service engineer can assist in setting these site preferences.

### 6.1.12 Setting User Preferences

#### 6.1.12.1 Setting “Use MWL Study UID” Option

Setting this option to “**Yes**” will copy the **Study Instance UID** from work-list into the final **DICOM Image header**. If this option is set to “**No**” then a new study instance uid will be generated locally.

- Click on “Patient Schedule”
- Click on “Preferences” button
- Set the option “Use Study Instance UID”, to either “**Yes**” or “**No**”

#### 6.1.12.2 Setting Custom Query Option

This option will allow the user to enter values for “Accession Number” and / or “ Requested Procedure Id” , which are used for Custom Query.

- Click on “Patient Schedule”
- Click on “Preferences” button
- Set the option “**Show Update Parameters** ”, to “**Yes”**
- To do a query click on “Update” button
- A User Interface will show, which has provision to enter values for
    - Accession Number
    - Requested Procedure Id

# 7 PERFORMED PROCEDURE STEP CONFORMANCE STATEMENT

## 7.1.1 INTRODUCTION

This section of the DICOM Conformance Statement specifies the Discovery LS compliance to DICOM conformance requirements for the Performed Procedure Step feature on this GEMS product.

The Connect Pro option for Discovery LS allows a Modality Performed Procedure Step to be communicated to the Hospital/Radiology information system from the CT host. The PPS feature provides the DICOM Modality Performed Procedure Step service as a service class user (SCU).

This feature works in conjunction with DICOM Modality Worklist feature, if installed. However the conformance of this feature is independent of Modality worklist feature. For information on conformance of the Modality WorkList feature, please refer to the section 6.

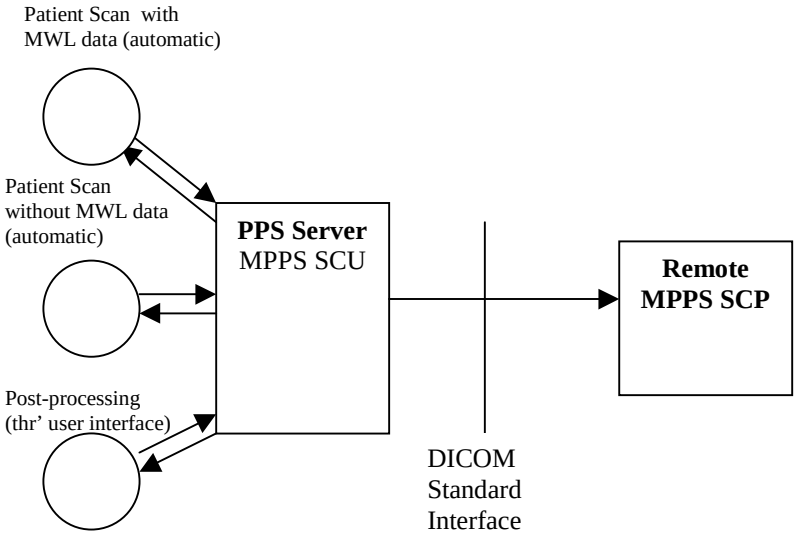
## 7.1.2 IMPLEMENTATION MODEL

The DICOM 'Performed Procedure Step' service is provided by the CT DICOM Server AE (PPS Server). The PPS Server DICOM AE is commanded to perform Performed Procedure Step services either automatically or through the user interface. However, it is to be noted that the CT and PET scans cannot be separated into different Procedure Steps. One PET/CT exam on Discovery LS results in a single Performed Procedure Step.

### 7.1.2.1 APPLICATION DATA FLOW DIAGRAM

**ILLUSTRATION** 7-0

**MODALITY PERFORMED PROCEDURE STEP DATA FLOW DIAGRAM**



### 7.1.2.2 Functional Definition of AEs

The CT PPS Server AE is implemented as an application process on the scanner host computer. It runs as a daemon serving requests from other applications to send the PPS information to the remote AE and return the results to the requesting application.

The CT PPS Server AE initiates the following functions.

- *Start PPS*: Initiates a DICOM association in order to create a DICOM Modality Performed Procedure Step SOP instance in the remote AE. If the remote AE accepts a presentation context applicable to Modality performed Procedure Step, the PPS Server AE will issue a request to create the SOP instance in the remote AE via the N-CREATE service.
- *Complete PPS*: Initiates a DICOM association in order to update a DICOM Modality Performed Step instance that is already created with the remote AE. If the remote AE accepts a presentation context applicable to Modality performed Procedure Step, the PPS Server AE will issue a request to update the SOP instance in the remote AE via the N-SET service. The PPS Status is set to 'COMPLETED'.
- *Discontinue PPS*: Initiates a DICOM association in order to update a DICOM Modality Performed Step instance that is already created with the remote AE. If the remote AE accepts a presentation context applicable to Modality performed Procedure Step, the PPS Server AE will issue a request to update the SOP instance in the remote AE via the N-SET service. The PPS Status is set to 'DISCONTINUED'.

### 7.1.2.3 Sequencing of Real-World Activities

#### 7.1.2.3.1 PPS from acquisition system with MWL data

The system has a CT Modality Worklist Server AE installed. Worklist information is obtained from HIS/RIS system through the use of Basic Worklist Management Service. Use of the information retrieved in the creation of Image SOP instance is described in the Modality Worklist Conformance section. Use of the information retrieved in MPPS SOP instances is described later in this document.

- The system initiates a 'Start PPS' before starting a scan, i.e. when the image acquisition is started. The system retrieves necessary information related to the Scheduled Procedure Step from Modality Worklist Server. PPS Server AE initiates a MPPS (Modality Performed Procedure Step) N-CREATE request to the remote AE (MPPS SCP), in-order to create a MPPS SOP instance at the remote AE.
- The MPPS SCP returns response indicating the success/failure of the request execution. The PPS state information is updated in the system based on the response data, and is presented to the user. ***The DICOM association is closed.***
- System includes the necessary information related to Scheduled Procedure Steps and the Performed procedure Step in the image instances created.
- At the end of image acquisition, system initiates a 'Complete PPS' or 'Discontinue PPS' based on the choice selected by the user using the user interface provided. The user is also given a choice 'Defer PPS' which is described below. PPS Server AE initiates a MPPS N-SET request to the remote AE, in-order to update the MPPS SOP instance,

that is already created**. The N-SET is sent over a new DICOM association**

- The remote AE returns response indicating the success/failure of the request execution. The PPS state information is updated in the system based on the response data, and is presented to the user.
- At the end of image acquisition, if the user has chosen 'Defer PPS', the user is provided with an interface to 'Complete PPS' or 'Discontinue PPS' at any later time. The user might wish to alter the image set generated through acquisition, before invoking these operations. Note that the user explicitly uses the user interface provided to invoke this operation, as in the case of PPS generated for post-processing, which is described in the following section. **PPS messages N-CREATE ( if applicable) and N-SET will be sent over the same DICOM association**
- The remote AE returns response indicating the success/failure of the request execution. The PPS state information is updated in the system based on the response data, and is presented to the user.

#### 7.1.2.3.2 PPS from acquisition system without MWL data

The system either does not have a CT Modality Worklist Server AE installed or a Modality Worklist Server AE installed but no Worklist information is obtained from HIS/RIS system for the current procedure that is being performed. The information required for performing the procedure is supplied through the user interface of the system. The use of this information in MPPS SOP instances is described later in this document.

- The system initiates a 'Start PPS' before starting a scan, i.e. when the image acquisition is started. PPS Server AE initiates a MPPS (Modality Performed Procedure Step) N-CREATE request to the remote AE (MPPS SCP), in-order to create a MPPS SOP instance at the remote AE.
- The MPPS SCP returns response indicating the success/failure of the request execution. The PPS state information is updated in the system based on the response data, and is presented to the user.
- System includes the necessary information related to Scheduled Procedure Steps and the Performed procedure Step in the image instances created.
- At the end of image acquisition, system initiates a 'Complete PPS' or 'Discontinue PPS' based on the choice selected by the user using the user interface provided. The user is also given a choice 'Defer PPS' which is described below. PPS Server AE initiates a MPPS N-SET request to the remote AE, in-order to update the MPPS SOP instance, that is already created.
- The remote AE returns response indicating the success/failure of the request execution. The PPS state information is updated in the system based on the response data, and is presented to the user.
- At the end of image acquisition, if the user has chosen 'Defer PPS', the user is provided with an interface to 'Complete PPS' or 'Discontinue PPS' at any later time. The user might wish to alter the image set generated through acquisition, before invoking these operations. Note that the user explicitly uses the user interface provided to invoke this operation, as in the case of PPS generated for post-processing, which is described in the following section.

- The remote AE returns response indicating the success/failure of the request execution. The PPS state information is updated in the system based on the response data, and is presented to the user.

#### 7.1.2.3.3 PPS from post-processing system

- The user initiates post-processing on the images generated through acquisition. Note that only certain applications supports this option.
- The system creates a Modality performed Procedure Step instance locally in the system. If the source image instances has the Scheduled Procedure Step information, it is copied into the image instances created. Also the system includes the necessary information related to the Modality Performed Procedure Step into the image instance.
- At the end of (one or more) post-processing, the user initiates 'Complete PPS' or 'Discontinue PPS' through the user interface provided. PPS Server AE initiates a MPPS (Modality Performed Procedure Step) N-CREATE request to the remote AE (MPPS SCP), in-order to create a MPPS SOP instance at the remote AE (which is actually a replica of the locally created MPPS SOP instance).
- The remote AE returns response indicating the success/failure of the request execution. If the response indicates success, PPS Server AE initiates a MPPS N-SET request to the remote AE, in-order to update the MPPS SOP instance, that is already created, with the additional information.
- The remote AE returns response indicating the success/failure of the request execution. The PPS state information is updated in the system based on the response data, and is presented to the user.

### 7.1.3 AE SPECIFICATION

#### 7.1.3.1 PPS Server AE Specification

This Application Entity provides Standard Conformance to the following DICOM SOP Classes as an SCU:

| SOP Class Name | SOP Class UID |
|---|---|
| Modality Performed Procedure Step | 1.2.840.10008.3.1.2.3.3 |

#### 7.1.3.1.1 Association Establishment Policies

##### 7.1.3.1.1.1 General

The DICOM Application Context Name (ACN), which is always proposed, is:

| **Application Context Name** | **1.2.840.10008.3.1.1.1** |
|---|---|

The Maximum Length PDU negotiation is included in all association establishment requests. The maximum length PDU from an association initiated by the PPS Server AE is:

| **Maximum Length PDU** | **128 Kbytes** |
|---|---|

The SOP Class Extended negotiation is not supported.

The maximum number of presentation negotiation items that will be proposed is 1.

#### 7.1.3.1.1.2 Number of Associations

The PPS Server will initiate only one DICOM association at any time to perform a PPS operation to the remote AE.

#### 7.1.3.1.1.3 Asynchronous Nature

Asynchronous mode is not supported. All operations are performed synchronously.

#### 7.1.3.1.1.4 Implementation Identifying information

The implementation UID for this DICOMv3.0 Implementation is:

| | |
|---|---|
| **PPS Feature for Discovery LS Implementation UID** | 1.2.840.113619.6.55 |

### 7.1.3.1.2 Association Initiation Policy

The PPS Server AE initiates a new association for every PPS operation initiated.

#### 7.1.3.1.2.1 Real-World Activity: Performed Procedure Step creation and update

**Associated Real-World Activity**

The real-world activities are mentioned in section 7*.2.3 Sequencing of Real-World Activities*. Each of the real world activity results in either creating a new Performed procedure Step SOP instance at the remote SCP or updating an already created Performed Procedure Step SOP instance as per the DICOM standard.

**Proposed Presentation Context Table**

The following table shows the proposed presentation contexts for the PPS Server AE after any of the real-world activity listed in section 7*.2.3 Sequencing of Real-World Activities*, is initiated.

| Presentation Context Table - Proposed | | | | | |
|---|---|---|---|---|---|
| Abstract Syntax | | Transfer Syntax | | Role | Extended Negotiation |
| Name | UID | Name List | UID List | | |
| Modality Performed Procedure Step | 1.2.840.10008.3.1.2.3.3 | Implicit VR Little Endian | 1.2.840.10008.1.2 | SCU | None |

*SOP Specific DICOM Conformance Statement for MPPS SOP class*

If the remote AE does not support the proposed Presentation context, an appropriate error message logged. Only one association is opened at a time.

All the operations used by this SOP class support an association timer, which is configurable. The timer is started when a request (association request, N-CREATE request or N-SET request) is send and stopped when the respective response is received. The default time-out value is 300 seconds.

All the operations used by this SOP class support a “Session Timer”. This timer is started when the association is established and stopped when association is ended. The default time-out value is 3000 seconds.

If any of the above timers expires the association is aborted and the operation in-progress is considered FAILED.

In any case an operation (N-CREATE or N-SET) fails, system updates the state to enable operator to manually invoke the operation at any later time.

#### 7.1.3.1.3 Association Acceptance Policy

The PPS Server AE does not respond to attempts by remote AE to open an association.

### 7.1.4 COMMUNICATION PROFILES

#### 7.1.4.1 Supported Communication Stacks (PS 3.8)

DICOM Upper Layer (PS 3.8) is supported using TCP/IP.

#### 7.1.4.2 OSI Stack

The OSI Communication stack is not supported by this implementation.

#### 7.1.4.3 TCP/IP Stack

The TCP/IP stack is inherited from the IRIX operating system.

#### 7.1.4.3.1 API

Not Applicable to this product.

#### 7.1.4.3.2 Physical Media Support

Ethernet 802.3 provides the physical network layer for this product.

#### 7.1.4.4 Point-to-Point Stack

The Point-to-Point Stack is not supported by this implementation.

### 7.1.5 EXTENSIONS/SPECIALIZATION/PRIVATIZATION

#### 7.1.5.1 Standard Extended/Specialized/Private SOPs

PPS for Discovery LS does not implement any private SOP classes.

#### 7.1.5.2 Private Transfer Syntaxes

PPS for Discovery LS does not implement any private Transfer Syntaxes.

### 7.1.6 CONFIGURATION

The PPS feature is configured by GEMS Field Service Engineers. The DICOM configuration items below are configurable or re-configurable by the Field Service Engineer and are not accessible by users through the Discovery LS's user interface.

#### 7.1.6.1 AE Title/Presentation address Mapping

PPS allows for the configuration of the following parameters which pertain to the remote AE.

- Remote MPPS AE IP Address - IP Address used to contact the remote MPPS AE
- Remote AE (HIS/RIS) IP Port - IP Port used to contact the remote MPPS AE
- Remote MPPS AE Title - Application Entity Title used to contact the remote MPPS AE

These parameters define where the MPPS requests will be directed. Configuration of these parameters is performed by GEMS Field Service engineers, using the installation facilities.

#### 7.1.6.2 Configurable Parameters

The following are configurable for the PPS Server AE:

- Local (PPS Server AE) AE Title (The default is host name of the scanner appended with string "_PPS")
- Local IP Address
- Local IP net-mask
- Local IP gateway

The following parameters are configurable, but need change only in case of a system software upgrade:

- Implementation UID
- PDU size
- Association time-out period
- Session time-out period

### 7.1.7 SUPPORT OF EXTENDED CHARACTER SETS

PPS feature for Discovery LS does not support any extended character set.

### 7.1.8 N-CREATE & NSET REQUEST MESSAGE

PPS Feature for Discovery LS supports all named attributes listed in Table F.7.2.1 in PS3.4 of DICOM standard. That is, attributes that are not explicitly referenced by name in the table are not supported. (Example is last row in the table reads "All other attributes from Radiation Dose Module and Billing and Material Code Module". The attributes referenced here are not supported).

For the MPPS associated with an acquisition, the following attributes are copied from the Modality Worklist SCU into the MPPS request Message, if procedure performed corresponds to the SPS information retrieved through the Modality Worklist.

Discovery LS supports the selection of **single** or **multiple** SPS for a scan. The following are applicable.

- Single SPS selection results in single PPS message
- Multiple SPS selection results in single PPS message
- Multiple SPS selection is allowed **only if they all correspond to same patient id**
- A maximum of 10 SPS's can be selected
- Referenced Study Sequence - a maximum of five Item's is supported. *This attribute will be present only if SPS information is available from Modality Worklist SCU.*
- At the end of acquisition the user might choose to 'Defer PPS' and later choose to 'Complete PPS' or 'Discontinue PPS' from the user interface provided in the system. In this case, the date and time when user chooses to 'Complete PPS' or 'Discontinue PPS' is taken as the Performed Procedure Step End Date and Performed Procedure Step End Time respectively (Not the actual end date and end time of acquisition)
- Mapping of SPS data to **MPPS SOP instance** is explained in section 7.10
- Mapping of specific SPS data to **CT DICOM IMAGE HEADER** , for PPS is explained in section 7.11

For the MPPS associated with a post-processing the following restrictions apply on the attributes listed below.

- Referenced Study Sequence – The sequence is not sent in the MPPS message
- Scheduled Step Attribute Sequence – a maximum of ONE item is supported. The attribute will be send only if SPS information is available in the image instance.
- Referenced Patient Sequence – This sequence is not added
- Scheduled action Item Code Sequence – The sequence is not send in the MPPS message
- Performed Procedure Step Start date & Performed Procedure Step start time – The exam date and exam time that is the Start date and Start Time of the associated Study Component (Exam) is used, not the actual time when post-processing started.
- Performed Procedure Step end date & Performed Procedure Step end time - The date and time when user chooses to 'Complete PPS' or 'Discontinue PPS' is taken as the Performed Procedure Step End Date and Performed Procedure Step End Time respectively (Not the actual end date and end time of post-processing).
- Procedure Code Sequence – This sequence is sent with ZERO items in the MPPS message
- Performed Action Item Code Sequence – This sequence is sent with ZERO items in the MPPS message.
- Referenced Standalone SOP Instance Sequence – The sequence is sent with ZERO items in the MPPS message.

### 7.1.9 ERROR HANDLING AND RECOVERY

PPS Server AE does not define any extended error codes. The standard error codes are handled. On a response with status 'success' for the N-CREATE or N-SET request, the system updates the state and indicates the same on the user interface. On a response with status other than 'success' the operation is deemed 'Failed' and the system updates the state and indicates the same on the user interface. If the request has failed or response is not received before the association timeout, the operation is deemed 'Failed' and the system updates the state and indicates the same on the user interface.

If the operation is 'Failed', detailed message is logged into system log-file and system provides an alternative mechanism to retry the failed operation through the user interface to ensure that transient failures do not affect the feature performance.

### 7.1.10 USE OF SPECIFIC DICOM DATA

The following table gives specific usage of some of attributes in the MPPS SOP instance created, with reference to each of the real-world scenarios mentioned in 7*.2.3* of this document.

| Attribute Name | Tag | Usage in MPPS Instance | | |
|---|---|---|---|---|
| | | **Acquisition with MWL data** | **Acquisition without MWL data** | **Post-Processing** |
| Specific Character Set | (0008,0005) | Not used, but copied into image header | Not used | Not used, but copied into image header |
| Scheduled Step Attribute Sequence | (0040,0270) | Only one item | | Only one item |
| >Study Instance UID | (0020,000D) | Copied from SPS, if option to copy is selected or else created at the scanner | Created at the scanner | Copied from source image |
| >Referenced Study Sequence | (0008,1110) | Copied from SPS, if selected | Not sent as part of image header | Not sent as part of image header |
| >Accession Number | (0008,0050) | Copied from SPS, if selected | User input on the scanner | Copied from source image |
| >Placer Order Number/Imaging Service Request | (0040,2016) | Not sent as part of image header | Not sent as part of image header | Not sent as part of image header |
| >Filler Order Number/Imaging Service Request | (0040,2017) | Not sent as part of image header | Not sent as part of image header | Not sent as part of image header |

| Attribute Name | Tag | Usage in MPPS Instance | | |
|---|---|---|---|---|
| | | Acquisition with MWL data | Acquisition without MWL data | Post-Processing |
| >Requested Procedure ID | (0040,1001) | Copied from SPS, if selected | User input on the scanner | Copied from source image |
| >Requested Procedure Description | (0032,1060) | Copied from SPS, if selected | Not used | Not sent as part of image header |
| >Placer Order Number/Procedure | (0040,1006) | Not sent as part of image header | Not used | Not sent as part of image header |
| >Filler Order Number/Procedure | (0040,1007) | Not sent as part of image header | Not used | Not sent as part of image header |
| >Scheduled Procedure ID | (0040,0009) | Copied from SPS, if selected | Not used | Copied from source image |
| >Scheduled Procedure Step Description | (0040,0007) | Copied from SPS, if selected | Not used | Copied from source image |
| >Scheduled Action Item Code Sequence | (0040,0008) | Copied from SPS, if selected | Not used | Not sent as part of image header |
| Patient's Name | (0010,0010) | Copied from SPS, if selected | User input on the scanner | Copied from source image |
| Patient ID | (0010,0020) | Copied from SPS, if selected | User input on the scanner | Copied from source image |
| Patient's Birth Date | (0010,0032) | Copied from SPS, if selected | User input on the scanner | Copied from source image |
| Patient's Sex | (0010,0040) | Copied from SPS, if selected | User input on the scanner | Copied from source image |
| Referenced Patient Sequence | (0008,1120) | Copied from SPS, if selected | Not used | No item |
| Performed Procedure Step ID | (0040,0253) | Created at the scanner. Will have the following ***"PPS_ID_<exam number"*** | Created at the scanner. Will have the following ***"PPS_ID_<exam number"*** | New generated, may not be unique |
| Performed Station AE Title | (0040,0241) | Local system host-name | Local system host-name | Local system host-name |
| Performed Station Name | (0040,0242) | Local system suite id | Local system suite id | Local system host-name |
| Performed Location | (0040,0243) | Local system suite id | Local system suite id | Not used |

| Attribute Name | Tag | Usage in MPPS Instance | | |
|---|---|---|---|---|
| | | Acquisition with MWL data | Acquisition without MWL data | Post-Processing |
| Performed Procedure Step Start Date | (0040,0244) | Same as exam start date | Same as exam date | Same as exam date |
| Performed Procedure Step Start Time | (0040,0245) | Same as exam start time | Same as exam time | Same as exam time |
| Performed Procedure Step Description | (0040,0254) | Copied from SPS, if selected | Not sent as part of image header | Not sent as part of image header |
| Performed Procedure Step status | (0040,0252) | See Note 1. | See Note 1. | See Note 1. |
| Performed Procedure Type Description | (0040,0255) | Not sent as part of image header | Not sent as part of image header | Not sent as part of image header |
| Procedure Code Sequence | (0008,1032) | Not sent as part of image header | Not sent as part of image header | Not sent as part of image header |
| Performed Procedure Step End Date | (0040,0250) | Date when all images got installed | Date when all images got installed | The date “Complete PPS” or “Discontinue PPS” is invoked, not the actual end of post-processing |
| Performed Procedure Step End Time | (0040,0251) | Time when all images got installed | Time when all images got installed | The time “Complete PPS” or “Discontinue PPS” is invoked, not the actual end of post-processing |
| Modality | (0008,0060) | Value “CT” is stored in image header | Value “CT” is stored in image header | Value “CT” is stored in image header |
| Study ID | (0020,0010) | Same as exam number | Same as exam number | Copied from source image |
| Performed Action Item Code Sequence | (0040,0260) | Copied from SPS, if selected | Not used | Not used |
| Performed Series Sequence | (0040,0340) | One item for each series created | One item for each series created | One item for each series created with post-processing |
| >Performing Physician's Name | (0008,1050) | Copied from SPS, if selected | User input on the scanner | Not sent as part of image header |
| >Protocol Name | (0018,1030) | The name of the protocol selected on the scanner | The name of the protocol selected on the scanner | Copied from source image |
| >Operator's Name | (0008,1070) | Copied from SPS, if selected | User input on the scanner | Not sent as part of image header |

| Attribute Name | Tag | Usage in MPPS Instance | | |
|---|---|---|---|---|
| | | Acquisition with MWL data | Acquisition without MWL data | Post-Processing |
| >Retrieve AE Title | (0008,0054) | Local system host-name | Local system host-name | host-name of the system |
| >Referenced Image Sequence | (0008,1140) | One item for each image created within the series | One item for each image created within the series | One item for each image generated by post-processing |
| >Referenced Standalone SOP Instance Sequence | (0040,0220) | Not sent as part of image header | Not sent as part of image header | Not sent as part of image header |
| >All other attributes from Performed Series Sequence (which Table F.7.2.1 of DICOM standard PS3.4 does not explicitly list) | | Not sent as part of image header | Not sent as part of image header | Not sent as part of image header |
| All other attributes from Radiation Dose Module and Billing and Material Code Module (which Table F.7.2.1 of DICOM standard PS3.4 does not explicitly list) | | Not sent as part of image header | Not sent as part of image header | Not sent as part of image header |

Note 1:

- When PPS start ( N-CREATE) message is sent, this element will have the value “INPROGRESS”
- When PPS end ( N-SET) message is sent, this element will have either “COMPLETE” or “DISCONTINUE” based on user selection

### 7.1.11 USE OF SPECIFIC DICOM DATA

| Attribute Name | Tag | Usage in CT DICOM Image Header |
|---|---|---|
| **Patient Level** | | |
| Patient Name | (0010,0010) | Copied from SPS, if selected |
| Patient ID | (0010,0020) | Copied from SPS, if selected |
| Patient Birthdate | (0010,0020) | Copied from SPS, if selected |
| Patient Sex | (0010,0040) | Copied from SPS, if selected |
| Referenced Patient Sequence | (0008,1150) | Copied from SPS, if selected |
| >Ref. SOP class uid | (0008,1150) | |
| >Ref. SOP Instance uid | (0008,1155) | |
| **Study Level** | | |
| Study Instance UID | (0020,000D) | Copied from SPS, if selected |
| Study ID | (0020,0010) | Copied from SPS, if selected |
| Referring Physicians | (0008,0090) | Copied from SPS, if selected |

| | | |
|---|---|---|
| name | | |
| Accession Number | (0008m0050) | If multiple SPS's are selected, then accession number from the first selection ( determined by the user) is used |
| Referenced Study Sequence | (0008,1110) | Copied from SPS, if selected |
| >Ref. SOP class uid | (0008,1150) | |
| >Ref. SOP Instance uid | (0008,1155) | |
| **Series Level** | | |
| Modality | (0008,1060) | Value "CT" is copied |
| Protocol Name | (0018,1030) | Name of the selected protocol is copied |
| Operator Name | (0008,0090) | Copied from SPS, if selected |
| Referenced Study Component Sequence | (0008,1111) | Will be present only if SPS , obtained form HIS/RIS is selected for scanning |
| >Ref. SOP class uid | (0008,1150) | Value of MPPS SOP class UID |
| >Ref. SOP Instance uid | (0008,1155) | Scanner generated unique UID |
| Requested Attribute Sequence | (0040,0275) | Will be present only if SPS , obtained form HIS/RIS is selected for scanning. If multiple SPS's are selected then this will contain multiple items one for each SPS. For all other cases this element will not be present |
| >Requested Procedure Id | (0040,1001) | Copied from SPS, if selected |
| >Scheduled Procedure Step Id | (0040,0009) | Copied from SPS, if selected |
| > Scheduled Procedure Step description | (0040,0007) | Copied from SPS, if selected |
| >Scheduled Action Item Code Sequence | (0040,0008) | Copied from SPS, if selected |
| Performed Procedure Step Id | (0040,0253) | Created at the scanner. The string "***PPS_ID_<examnumber>"*** is used. |
| Performed Procedure Step start date | (0040,0244) | Same as exam start date |
| Performed Procedure Step start time | (0040,0245) | Same as exam start time |
| Performed Procedure Step description | (0040,0254) | Exam description is used |

# A CT/MR IOD Definitions

## A.1 CT Specific IOD Definition

### A.1.1 CT Image IOD Modules

| Entity Name | Module Name | Reference | Usage |
|---|---|---|---|
| Patient | Patient | A.4.1 | M |
| Study | General Study | A.4.2 | M |
| | Patient Study | A.4.3 | U |
| Series | General Series | A.4.4 | M |
| Frame of Reference | Frame of Reference | A.4.12 | M |
| Equipment | General Equipment | A.4.5 | M |
| Image | General Image | A.4.6 | M |
| | Image Plane | A.4.7 | M |
| | Image Pixel | Only the type 1 elements are sent. | M |
| | Contrast/Bolus | A.4.8 | C |
| | CT Image | A.1.2 | M |
| | VOI LUT | A.4.11 | U |
| | SOP Common | A.4.9 | M |

### A.1.2 CT Image Module

| Attribute Name | Tag | Type | Notes |
|---|---|---|---|
| KV | (0018,0060) | 2 | Value always sent. |
| Acquisition Number | (0020,0012) | 2 | Value always sent. |
| Scan Options | (0018,0022) | 3 | Value always sent. |
| Data Collection Diameter | (0018,0090) | 3 | Value always sent. |
| Reconstruction Diameter | (0018,1100) | 3 | Value sent for all images except scouts. |
| Distance Source to Detector | (0018,1110) | 3 | Value always sent. |
| Distance Source to Patient | (0018,1111) | 3 | Value always sent. |
| Gantry / Detector Tilt | (0018,1120) | 3 | Value always sent. |
| Table Height | (0018,1130) | 3 | Value always sent. |
| Rotation Direction | (0018,1140) | 3 | Not sent for scout or axial. |
| Exposure Time | (0018,1150) | 3 | Value always sent. |
| X-Ray Tube Current | (0018,1151) | 3 | Value always sent. |
| Exposure | (0018,1152) | 3 | Value always sent. |
| Filter Type | (0018,1160) | 3 | Sent.<br>Defined terms:<br>BODY FILTER<br>BOWTIE FLAT FILT<br>FLAT FILTER<br>LARGE BOWTIE FIL |

| | | | |
|---|---|---|---|
| Focal Spot | (0018,1190) | 3 | Sent. Fixed value of 0.7 or 1.2. |
| Convolution Kernel | (0018,1210) | 3 | Not sent for scouts.<br>Defined terms:<br>SMOOTH<br>SOFT<br>STANDARD<br>DETAIL<br>BONE<br>EDGE<br>SHARP<br>LUNG |

**CAUTION**

**It is possible for the operator of CT LightSpeed QX/i system to change the table height while scanning a series of images. Therefore, implementations must use the Frame of Reference UID (0020,0052) in conjunction with the Table Height (0018,1130) to determine if two images are spatially related.**

### A.1.2.1 Implementation Specific details

For all CT Images created by Discovery LS patient birth date element (0010,0030) is sent, if the operator has entered the details. If the operator has not entered the details it will be sent as a “Zero length element”
The length of Accession number element (0008,0050) is a maximum of 16 characters
Window Center (0028,1050) and Window Width (0028,1051) are sent for all CT Images created by Discovery LS
Based on whether contrast was used or not the following applies for CT Images created by Discovery LS

| **Mode** | **(0018,0010)** | **(0018,1040)** |
|---|---|---|
| No Contrast | Not sent | Not sent |
| Oral Contrast | Oral Contrast Agent name | The string “Oral” |
| IV Contrast | IV Contrast agent name | The String “IV” |
| Oral and IV contrast | Oral contrast agent<br>“ & “<br>IV Contrast agent | The string “Oral & IV” |

Supported field length for DICOM fields

| **DICOM Tag** | **Field Name** | **Field Length** |
|---|---|---|
| ( 0008, 0050 ) | Accession Number | 16 characters |
| ( 0010, 0010 ) | Patient Name | 32 characters |

| | | |
|---|---|---|
| ( 0010, 0020 ) | Patient Id | 16 characters |

## A.2 MR Specific IOD Definition

### A.2.1 MR Image IOD Modules

| Entity Name | Module Name | Reference | Usage |
|---|---|---|---|
| Patient | Patient | A.4.1 | M |
| Study | General Study | A.4.2 | M |
| | Patient Study | A.4.3 | U |
| Series | General Series | A.4.4 | M |
| Frame of Reference | Frame of Reference | A.4.12 | M |
| Equipment | General Equipment | A.4.5 | M |
| Image | General Image | A.4.6 | M |
| | Image Plane | A.4.7 | M |
| | Image Pixel | Only the type 1 elements are sent. | M |
| | Contrast/Bolus | A.4.8 | C |
| | MR Image | A.2.2 | M |
| | SOP Common | A.4.9 | M |

### A.2.2 MR Image Module

| Attribute Name | Tag | Type | Notes |
|---|---|---|---|
| Scan Options | (0018,0021) | 2 | Always sent. |
| MR Acquisition Type | (0018,0023) | 2 | 2D or 3D depending on acquisition type. |
| Repetition Time | (0018,0080) | 2C | Sent if Scanning Sequence is **EP** and Sequence Variant is not **SK**. |
| Echo Time | (0018,0081 | 2 | Sent. |
| Inversion Time | (0018,0082) | 2C | Sent. |
| Echo Train Length | (0018,0091) | 2 | Sent. |
| Trigger Time | (0018,1060) | 2C | Sent. |
| Angio Flag | (0018,0025) | 3 | |
| Number Of Averages | (0018,0083) | 3 | |
| Imaging Frequency | (0018,0084) | 3 | |
| Imaged Nucleus | (0018,0085) | 3 | Zero-length element is sent. |
| Echo Number | (0018,0086) | 3 | |
| Magnetic Field Strength | (0018,0087) | 3 | Image strength, if 0, NOT sent. |
| Spacing Between Slices | (0018,0088) | 3 | |
| Percent Sampling | (0018,0093) | 3 | |
| Percent Phase Field of View | (0018,0094) | 3 | |
| Pixel Bandwidth | (0018,0095) | 3 | |

| | | | |
|---|---|---|---|
| Nominal Interval | (0018,1062) | 3 | |
| Heart Rate | (0018,1088) | 3 | If 0, NOT sent. |
| Cardiac Number of Images | (0018,1090) | 3 | If 0, NOT sent. |
| Trigger Window | (0018,1094) | 3 | If 0, NOT sent. |
| Reconstruction Diameter | (0018,1100) | 3 | |
| Receiving Coil | (0018,1250) | 3 | |
| Transmitting Coil | (0018,1251) | 3 | |
| Acquisition Matrix | (0018,1310) | 3 | |
| Phase Encoding Direction | (0018,1312) | 3 | |
| Flip Angle | (0018,1314) | 3 | |
| Variable Flip Angle Flag | (0018,1315) | 3 | |
| SAR | (0018,1316) | 3 | |
| Temporal Resolution | (0020,0110) | 3 | |

## A.3 SC Specific IOD Definition

### A.3.1 SC Image IOD Modules

| Entity Name | Module Name | Reference | Usage |
|---|---|---|---|
| Patient | Patient | A.4.1 | M |
| Study | General Study | A.4.2 | M |
| | Patient Study | A.4.3 | U |
| Series | General Series | A.4.4 | M |
| Equipment | General Equipment | A.4.5 | U |
| | SC Equipment | A.4.13 | M |
| Image | General Image | A.4.6 | M |
| | Image Pixel | Only the type 1 elements are sent. | M |
| | SC Image | Not sent (consists entirely of type 3 element). | M |
| | Modality LUT | Only the type 1C elements are sent. | U |
| | VOI LUT | A.4.11 | U |
| | SOP Common | A.4.9 | M |

## A.4 CT/MR/SC IOD Common Module Definitions

### A.4.1 Patient Module

| Attribute Name | Tag | Type | Notes |
|---|---|---|---|
| Patient's Name | (0010,0010) | 2 | As entered at user interface or from worklist. *Supports 5 different components delimited by "^".* |

| | | | |
|---|---|---|---|
| | | | *Supports a maximum length of 32 characters including the delimiter* . |
| Patient ID | (0010,0020) | 2 | As entered at user interface or from worklist. |
| Patient's Birth Date | (0010,0030) | 2 | Always sent zero length. |
| Patient's Sex | (0010,0040) | 2 | Always sent. |

### A.4.2 General Study Module

| Attribute Name | Tag | Type | Notes |
|---|---|---|---|
| Study Instance UID | (0020,000D) | 1 | Generated uniquely for each exam. Value from worklist, if present, is not filled in here. |
| Study Date | (0008,0020) | 2 | Generated for each exam and always sent. |
| Study Time | (0008,0030) | 2 | Generated for each exam and always sent. |
| Accession Number | (0008,0050) | 2 | Value from user interface or worklist sent. |
| Referring Physician's Name | (0008,0090) | 2 | Value from user interface sent. |
| Study ID | (0020,0010) | 2 | Value from user interface or worklist sent. |
| Study Description | (0008,1030) | 3 | Value from user interface sent. |
| Name of Physician(s) Reading Study | (0008,1060) | 3 | Sent if entered at the user interface. |

### A.4.3 Patient Study Module

| Attribute Name | Tag | Type | Notes |
|---|---|---|---|
| Patient's Age | (0010,1010) | 3 | Calculated from Date of Birth entered at user interface. |
| Patient's Weight | (0010,1030) | 3 | Value from user interface. |
| Additional Patient's History | (0010,21b0) | 3 | Value from user interface. |

### A.4.4 General Series Module

| Attribute Name | Tag | Type | Notes |
|---|---|---|---|
| Series Number | (0020,0011) | 2 | Generated sequentially, always sent. |
| Laterality | (0020,0060) | 2C | Always sent zero-length. |
| Series Date | (0008,0021) | 3 | Generated for each series and always sent. |
| Series Time | (0008,0031) | 3 | Generated for each series and always sent. |
| Performing Physician's Name | (0008,1050) | 3 | |
| Protocol Name | (0008,1030) | 3 | Sent if entered at user interface. |
| Series Description | (0008,103E) | 3 | Value from user interface is sent. |
| Operators Name | (0008,1070) | 3 | Value from user interface is sent. |

| | | | |
|---|---|---|---|
| Patient Position | (0018,5100) | 2C | Sent. As selected by operator when patient is positioned. Defined terms are:<br>HFP = Head-First Prone<br>HFS = Head-First Supine<br>HFDR = Head-First Decubitus Right<br>HFDL = Head-First Decubitus Left<br>FFDR = Feet-First Decubitus Right<br>FFDL = Feet-First Decubitus Left<br>FFP = Feet-First Prone<br>FFS = Feet-First Supine |

### A.4.5 General Equipment Module

| Attribute Name | Tag | Type | Notes |
|---|---|---|---|
| Manufacturer | (0008,0070) | 2 | Always sent as “GE MEDICAL SYSTEMS” |
| Institution Name | (0008,0080) | 3 | Sent. Value is configurable. |
| Station Name | (0008,1010) | 3 | Sent. Value is configurable. |
| Manufacturers Model Name | (0008,1090) | 3 | |
| Device Serial Number | (0018,1000) | 3 | Sent if present in image. |
| Software Versions | (0018,1020) | 3 | Always sent as “05” for this version - does not distinguish individual software releases. |
| Spatial Resolution | (0018,1050) | 3 | Sent only for MR images. |
| Pixel Padding Value | (0028,0120) | 3 | Sent. |

### A.4.6 General Image Module

| Attribute Name | Tag | Type | Notes |
|---|---|---|---|
| Image Number | (0020,0013) | 2 | Generated based on<br>Scan.scan_mode<br>image_location<br>image_time<br>image_bin_time, always sent. |
| Patient Orientation | (0020,0020) | 2C | Always sent zero length. |
| Image Date | (0008,0023) | 2C | Generated for each image, always sent. |
| Image Time | (0008,0033) | 2C | Generated for each image, always sent. |
| Image Type | (0008,0008) | 3 | Always sent. |
| Acquisition Number | (0020,0012) | 3 | Generated for each acquisition, always sent. |
| Acquisition Date | (0008,0022) | 3 | Generated for each acquisition, always sent. |
| Acquisition Time | (0008,0032) | 3 | Generated for each acquisition, always sent. |

### A.4.7 Image Plane Module

| Attribute Name | Tag | Type | Notes |
|---|---|---|---|
| Slice Thickness | (0018,0050) | 2 | Value always sent. |
| Image Slice Location | (0020,1041) | 3 | Value always sent. |

### A.4.8 Contrast Bolus Module

| Attribute Name | Tag | Type | Notes |
|---|---|---|---|
| Contrast/Bolus Agent | (0018,0010) | 2 | Sent if contrast exam, as entered in user interface. |
| Contrast/Bolus Route | (0018,1040) | 3 | Sent if contrast exam, as entered in user interface. |

### A.4.9 SOP Common Module

| Attribute Name | Tag | Type | Notes |
|---|---|---|---|
| Specific Character Set | (0008,0005) | 1C | ISO_IR 100 |

### A.4.10 Overlay Plane Module

| Attribute Name | Tag | Type | Notes |
|---|---|---|---|
| Overlay Data | (60xx,3000) | 1C | Only for SC & Standalone Overlay IOD Definitions |

### A.4.11 VOI LUT Module

| Attribute Name | Tag | Type | Notes |
|---|---|---|---|
| Window Center | (0028,1050) | 3 | Window Center for display. Always sent. |
| Window Width | (0028,1051) | 1C | Window Width for display. Always sent. |

### A.4.12 Frame of Reference Module

| Attribute Name | Tag | Type | Notes |
|---|---|---|---|
| Frame of Reference UID | (0020,0052) | 1 | |
| Position Reference Indicator | (0020,1040) | 2 | Value as entered at the user interface. |

**CAUTION**

**It is possible for the operator of CT LightSpeed QX/i system to change the table height while scanning a series of images. Therefore, implementations must use the Frame of Reference UID (0020,0052) in conjunction with the Table Height (0018,1130) to determine if two images are spatially related.**

### A.4.13 SC Equipment Module

| Attribute Name | Tag | Type | Notes |
|---|---|---|---|
| Modality | (0008,0060) | 3 | Modality of original image (MR or CT). |

## A.5 CT Image IOD Private Data Elements Definition

Enclosed is a listing of private data elements used in this implementation for CT Image IOD definition.

### A.5.1 Private Creator Identification (GEMS_IDEN_01)

| Attribute Name | Tag | VR | VM |
|---|---|---|---|
| Full fidelity | (0009,1001) | LO | 1 |
| Suite id | (0009,1002) | SH | 1 |
| Product id | (0009,1004) | SH | 1 |
| Image actual date | (0009,1027) | SL | 1 |
| Equipment UID | (0009,10E3) | UI | 1 |

*Note :*

*For all CT images created by Discovery LS system, (0009,xx01) element will have the value "CT_LIGHTSPEED".*

### A.5.2 Private Creator Identification (GEMS_ACQU_01)

| Attribute Name | Tag | VR | VM |
|---|---|---|---|
| Number of cells I in Detector | (0019,1002) | SL | 1 |
| Cell number at Theta | (0019,1003) | DS | 1 |
| Cell spacing | (0019,1004) | DS | 1 |
| Horiz. Frame of ref. | (0019,100F) | DS | 1 |
| Series contrast | (0019,1011) | SS | 1 |
| First scan ras | (0019,1018) | LO | 1 |
| Last scan ras | (0019,101A) | LO | 1 |
| Table speed | (0019,1023) | DS | 1 |
| Mid scan time | (0019,1024) | DS | 1 |
| Mid scan flag | (0019,1025) | SS | 1 |
| Degrees of azimuth | (0019,1026) | SL | 1 |
| Gantry period | (0019,1027) | DS | 1 |

| Attribute Name | Tag | VR | VM |
|---|---|---|---|
| Number of triggers | (0019,102C) | SL | 1 |
| Angle of first view | (0019,102E) | DS | 1 |
| Trigger frequency | (0019,102F) | DS | 1 |
| Scan FOV type | (0019,1039) | SS | 1 |
| Segment number | (0019,1042) | SS | 1 |
| Total segments requested | (0019,1043) | SS | 1 |
| View compression factor | (0019,1047) | SS | 1 |

| | | | |
|---|---|---|---|
| Recon post proc. Flag | (0019,1052) | SS | 1 |
| Dependent on #views processed | (0019,106A) | SS | 1 |

### A.5.3 Private Creator Identification (GEMS_RELA_01)

| Attribute Name | Tag | VR | VM |
|---|---|---|---|
| Series from which Prescribed | (0021,1003) | SS | 1 |
| Series Presribed From | (0021,1035) | SS | 1 |
| Image Prescribed From | (0021,1036) | SS | 1 |
| Biopsy position | (0021,1091) | SS | 1 |
| Biopsy T location | (0021,1092) | FL | 1 |
| Biopsy ref location | (0021,1093) | FL | 1 |

### A.5.4 Private Creator Identification (GEMS_STDY_01)

| Attribute Name | Tag | VR | VM |
|---|---|---|---|
| Start time(secs) in first axial | (0023,1070) | FD | 1 |

### A.5.5 Private Creator Identification (GEMS_IMAG_01)

| Attribute Name | Tag | VR | VM |
|---|---|---|---|
| Scout Type | (0027,1010) | SS | 1 |
| Vma mamp | (0027,101C) | SL | 1 |
| Vma mod | (0027,101E) | SL | 1 |
| Vma clip | (0027,101F) | SL | 1 |
| Smart scan ON/OFF flag | (0027,1020) | SS | 1 |
| Plane Type | (0027,1035) | SS | 1 |
| Center R coord of plane image | (0027,1042) | FL | 1 |
| Center A coord of plane image | (0027,1043) | FL | 1 |
| Center S coord of plane image | (0027,1044) | FL | 1 |
| Normal R coord | (0027,1045) | FL | 1 |
| Normal A coord | (0027,1046) | FL | 1 |
| Normal S coord | (0027,1047) | FL | 1 |
| Table start location | (0027,1050) | FL | 1 |
| Table end location | (0027,1051) | FL | 1 |

### A.5.6 Private Creator Identification (GEMS_PARM_01)

| Attribute Name | Tag | VR | VM |
|---|---|---|---|
| Window value | (0043,1010) | US | 1 |
| X-ray chain | (0043,1012) | SS | 3 |
| Number of overranges | (0043,1016) | SS | 5 |
| Delta start time | (0043,101E) | DS | 1 |
| Max overranges in a view | (0043,101F) | SL | 1 |
| Corrected after glow terms | (0043,1021) | SS | 1 |
| Reference channels | (0043,1025) | SS | 6 |
| No views ref chans blocked | (0043,1026) | US | 6 |

| | | | |
|---|---|---|---|
| Scan pitch ratio | (0043,1027) | SH | 1 |
| Unique image iden | (0043,1028) | OB | 1 |
| Private Scan Options | (0043,102B) | SS | 4 |
| RA cord of target recon center | (0043,1031) | DS | 2 |
| Trigger on position | (0043,1040) | FL | 4 |
| Degree of rotation | (0043,1041) | FL | 4 |
| DAS trigger source | (0043,1042) | SL | 4 |
| DAS fpa gain | (0043,1043) | SL | 4 |
| DAS output source | (0043,1044) | SL | 4 |
| DAS ad input | (0043,1045) | SL | 4 |
| DAS cal mode | (0043,1046) | SL | 4 |
| Start scan to X-ray on delay | (0043,104D) | FL | 4 |
| Duration of X-ray on | (0043,104E) | FL | 4 |

### A.5.7 Private Creator Identification(GEMS_HELIOS_01)

| Attribute Name | Tag | VR | VM |
|---|---|---|---|
| Number of Macro Rows in Detector | (0045, 1001) | SS | 1 |
| Macro width at ISO Center | (0045, 1002) | FL | 1 |
| DAS type | (0045, 1003) | SS | 1 |
| DAS gain | (0045, 1004) | SS | 1 |
| DAS Temprature | (0045, 1005) | SS | 1 |
| Table Direction | (0045, 1006) | CS | 1 |
| Z smoothing Factor | (0045, 1007) | FL | 1 |
| View Weighting Mode | (0045, 1008) | SS | 1 |
| Sigma Row number | (0045, 1009) | SS | 1 |
| Minimum DAS value | (0045, 100A) | FL | 1 |
| Maximum Offset Value | (0045, 100B) | FL | 1 |
| Number of Views shifted | (0045, 100C) | SS | 1 |
| Z tracking Flag | (0045, 100D) | SS | 1 |
| Mean Z error | (0045, 100E) | FL | 1 |
| Z tracking Error | (0045, 100F) | FL | 1 |
| Start View 2A | (0045, 1010) | SS | 1 |
| Number of Views 2A | (0045, 1011) | SS | 1 |
| Start View 1A | (0045, 1012) | SS | 1 |
| Sigma Mode | (0045, 1013) | SS | 1 |
| Number of Views 1A | (0045, 1014) | SS | 1 |
| Start View 2B | (0045, 1015) | SS | 1 |
| Number Views 2B | (0045, 1016) | SS | 1 |
| Start View 1B | (0045, 1017) | SS | 1 |
| Number of Views 1B | (0045, 1018) | SS | 1 |
| Iterbone Flag | (0045, 1021) | SS | 1 |
| Perisstaltic Flag | (0045, 1022) | SS | 1 |
| CardiacReconAlgorithm | (0045, 1030) | CS | 1 |
| AvgHeartRateForImage | (0045, 1031) | CS | 1 |
| TemporalResolution | (0045, 1032) | FL | 1 |
| PctRpeakDelay | (0045, 1033) | CS | 1 |

### A.5.8 Private Creator Identification (GEMS_CT_CARDIAC_001)

| Attribute Name | Tag | VR | VM |
|---|---|---|---|
| CT Cardiac Sequence | (0049, 1001) | SQ | 1 |
| HeartRateAtConfirm | (0049, 1002) | CS | 1 |
| AvgHeartRatePriorToConfirm | (0049, 1003) | FL | 1 |
| MinHeartRatePriorToConfirm | (0049, 1004) | CS | 1 |
| MaxHeartRatePriorToConfirm | (0049, 1005) | CS | 1 |
| StdDevHeartRatePriorToConfirm | (0049, 1006) | FL | 1 |
| NumHeartRateSamplesPriorToConfirm | (0049, 1007) | US | 1 |
| AutoHeartRateDetectPredict | (0049, 1008) | CS | 1 |
| SystemOptimizedHeartRate | (0049, 1009) | CS | 1 |
| EkgMonitorType | (0049, 100A) | ST | 1 |
| NumReconSectors | (0049, 100B) | CS | 1 |
| RpeakTimeStamps | (0049, 100C) | FL | 256 |

### A.5.9 Private Creator Identification (GEMS_CT_VES_01)

| Attribute Name | Tag | VR | VM |
|---|---|---|---|
| CTVESSequence | (0051,1001) | SQ | 1 |
| VESaccessionNumber | (0008,0050) | SH | 1 |
| VESprocedureCodeSequence | (0008,1032) | SQ | 1 |
| VESactionItemCodeValue | (0008,0100) | SH | 1 |
| VESactionItemCodeScheme | (0008,0102) | SH | 1 |
| VESactionItemCodeMeaning | (0008,0104) | LO | 1 |
| VESreferenceStudySequence | (0008,1110) | SQ | 1 |
| VESRefStudySequenceSopClassUid | (0008,1150) | UI | 1 |
| VESRefStudySequenceSopInstanceUid | (0008,1155) | UI | 1 |
| VESstudyInstanceUID | (0020,000D) | UI | 1 |
| VESrequestedProcedureDescription | (0032,1060) | LO | 1 |
| VESrequestedProcedureID | (0040,1001) | SH | 1 |

## A.6 MR Image IOD Private Data Elements Definition

### A.6.1 Private Creator Identification (GEMS_IDEN_01)

| Attribute Name | Tag | VR | VM |
|---|---|---|---|
| Full fidelity | (0009,1001) | LO | 1 |
| Suite id | (0009,1002) | SH | 1 |
| Product id | (0009,1004) | SH | 1 |
| Image actual date | (0009,1027) | SL | 1 |
| Service id | (0009,1030) | SH | 1 |
| Mobile location number | (0009,1031) | SH | 1 |
| Equipment UID | (0009,10E3) | UI | 1 |
| Genesis Version - now | (0009,10E6) | SH | 1 |
| Exam Record checksum | (0009,10E7) | UL | 1 |
| Actual series data time stamp | (0009,10E9) | SL | 1 |

### A.6.2 Private Creator Identification (GEMS_PATI_01)

| Attribute Name | Tag | VR | VM |
|---|---|---|---|
| Patient Status | (0011,1010) | SS | 1 |

### A.6.3 Private Creator Identification (GEMS_ACQU_01)

| Attribute Name | Tag | VR | VM |
|---|---|---|---|
| Horiz. Frame of ref. | (0019,100F) | DS | 1 |
| Series contrast | (0019,1011) | SS | 1 |
| Last pseq | (0019,1012) | SS | 1 |
| Series plane | (0019,1017) | SS | 1 |
| First scan ras | (0019,1018) | LO | 1 |
| First scan location | (0019,1019) | DS | 1 |
| Last scan ras | (0019,101A) | LO | 1 |
| Last scan loc | (0019,101B) | DS | 1 |
| Display field of view | (0019,101E) | DS | 1 |
| Acquisition Duration | (0019,105A) | FL | 1 |
| Second echo | (0019,107D) | DS | 1 |
| Number of echoes | (0019,107E) | SS | 1 |
| Table delta | (0019,107F) | DS | 1 |
| Contiguous | (0019,1081) | SS | 1 |
| Peak SAR | (0019,1084) | DS | 1 |
| Monitor SAR | (0019,1085) | SS | 1 |
| Cardiac repetition time | (0019,1087) | DS | 1 |
| Images per cardiac cycle | (0019,1088) | SS | 1 |
| Actual receive gain analog | (0019,108A) | SS | 1 |
| Actual receive gain digital | (0019,108B) | SS | 1 |
| Delay after trigger | (0019,108D) | DS | 1 |
| Swappf | (0019,108F) | SS | 1 |
| Pause Interval | (0019,1090) | SS | 1 |
| Pulse Time | (0019,1091) | DS | 1 |
| Slice offset on freq axis | (0019,1092) | SL | 1 |
| Center Frequency | (0019,1093) | DS | 1 |
| Transmit Gain | (0019,1094) | SS | 1 |
| Analog receiver gain | (0019,1095) | SS | 1 |
| Digital receiver gain | (0019,1096) | SS | 1 |
| Bitmap defining CVs | (0019,1097) | SL | 1 |
| Center freq. Method | (0019,1098) | SS | 1 |
| Pulse seq. Mode | (0019,109B) | SS | 1 |
| Pulse seq. Name | (0019,109C) | LO | 1 |
| Pulse seq. Date | (0019,109D) | DT | 1 |
| Internal pulse seq. Name | (0019,109E) | LO | 1 |
| Transmitting coil | (0019,109F) | SS | 1 |
| Surface Coil Type | (0019,10A0) | SS | 1 |
| Extremity Coil flag | (0019,10A1) | SS | 1 |
| Raw data run number | (0019,10A2) | SL | 1 |

| | | | |
|---|---|---|---|
| Calibrated Field strength | (0019,10A3) | UL | 1 |
| SAT fat/water/bone | (0019,10A4) | SS | 1 |
| Receive bandwidth | (0019,10A5) | DS | 1 |
| User data | (0019,10A7) | DS | 1 |
| User data | (0019,10A8) | DS | 1 |
| User data | (0019,10A9) | DS | 1 |
| User data | (0019,10AA) | DS | 1 |
| User data | (0019,10AB) | DS | 1 |
| User data | (0019,10AC) | DS | 1 |
| User data | (0019,10AD) | DS | 1 |
| User data | (0019,10AE) | DS | 1 |
| User data | (0019,10AF) | DS | 1 |
| User data | (0019,10B0) | DS | 1 |
| User data | (0019,10B1) | DS | 1 |
| User data | (0019,10B2) | DS | 1 |
| User data | (0019,10B3) | DS | 1 |
| User data | (0019,10B4) | DS | 1 |
| User data | (0019,10B5) | DS | 1 |
| User data | (0019,10B6) | DS | 1 |
| User data | (0019,10B7) | DS | 1 |
| User data | (0019,10B8) | DS | 1 |
| User data | (0019,10B9) | DS | 1 |
| User data | (0019,10BA) | DS | 1 |
| User data | (0019,10BB) | DS | 1 |
| User data | (0019,10BC) | DS | 1 |
| User data | (0019,10BD) | DS | 1 |
| Projection angle | (0019,10BE) | DS | 1 |
| Saturation planes | (0019,10C0) | SS | 1 |
| Surface coil intensity | (0019,10C1) | SS | 1 |
| SAT location R | (0019,10C2) | SS | 1 |
| SAT location L | (0019,10C3) | SS | 1 |
| SAT location A | (0019,10C4) | SS | 1 |
| SAT location P | (0019,10C5) | SS | 1 |
| SAT location H | (0019,10C6) | SS | 1 |
| SAT location F | (0019,10C7) | SS | 1 |
| SAT thickness R/L | (0019,10C8) | SS | 1 |
| SAT thickness A/P | (0019,10C9) | SS | 1 |
| SAT thickness H/F | (0019,10CA) | SS | 1 |
| Prescribed flow axis | (0019,10CB) | SS | 1 |
| Velocity encoding | (0019,10CC) | SS | 1 |
| Thickness disclaimer | (0019,10CD) | SS | 1 |
| Prescan type | (0019,10CE) | SS | 1 |
| Prescan status | (0019,10CF) | SS | 1 |
| Raw data type | (0019,10D0) | SH | 1 |
| Projection Algorithm | (0019,10D2) | SS | 1 |
| Projection algorithm | (0019,10D3) | SH | 1 |
| Fractional echo | (0019,10D5) | SS | 1 |
| Prep pulse | (0019,10D6) | SS | 1 |

| | | | |
|---|---|---|---|
| Cardiac phases | (0019,10D7) | SS | 1 |
| Variable echoflag | (0019,10D8) | SS | 1 |
| Concatenated SAT | (0019,10D9) | DS | 1 |
| User data | (0019,10DF) | DS | 1 |
| User data | (0019,10E0) | DS | 1 |
| Velocity Encode Scale | (0019,10E2) | DS | 1 |
| Fast phases | (0019,10F2) | SS | 1 |
| Transmission gain | (0019,10F9) | DS | 1 |

### A.6.4 Private Creator Identification (GEMS_RELA_01)

| Attribute Name | Tag | VR | VM |
|---|---|---|---|
| Series from which Prescribed | (0021,1003) | SS | 1 |
| Genesis Version - now | (0021,1005) | SH | 1 |
| Series Record checksum | (0021,1007) | UL | 1 |
| Genesis version – Now | (0021,1018) | SH | 1 |
| Acq recon record checksum | (0021,1019) | UL | 1 |
| Table start location | (0021,1020) | DS | 1 |
| Series from which prescribed | (0021,1035) | SS | 1 |
| Image from which prescribed | (0021,1036) | SS | 1 |
| Screen Format | (0021,1037) | SS | 1 |
| Locations in acquisition | (0021,104F) | SS | 1 |
| Graphically prescribed | (0021,1050) | SS | 1 |
| Rotation from source x rot | (0021,1051) | DS | 1 |
| Rotation from source y rot | (0021,1052) | DS | 1 |
| Rotation from source z rot | (0021,1053) | DS | 1 |
| Image position | (0021,1054) | SH | 3 |
| Image orientation | (0021,1055) | SH | 6 |
| Integer slop | (0021,1056) | SL | 1 |
| Integer slop | (0021,1057) | SL | 1 |
| Integer slop | (0021,1058) | SL | 1 |
| Integer slop | (0021,1059) | SL | 1 |
| Integer slop | (0021,105A) | SL | 1 |
| Float slop | (0021,105B) | DS | 1 |
| Float slop | (0021,105C) | DS | 1 |
| Float slop | (0021,105D) | DS | 1 |
| Float slop | (0021,105E) | DS | 1 |
| Float slop | (0021,105F) | DS | 1 |
| Auto window/level alpha | (0021,1081) | DS | 1 |
| Auto window/level beta | (0021,1082) | DS | 1 |
| Auto window/level window | (0021,1083) | DS | 1 |
| To window/level level | (0021,1084) | DS | 1 |

### A.6.5 Private Creator Identification (GEMS_STDY_01)

| Attribute Name | Tag | VR | VM |
|---|---|---|---|
| Number of series in Study | (0023,1001) | SL | 1 |

| | | | |
|---|---|---|---|
| Number of unarchived Series | (0023,1002) | SL | 1 |
| Reference image field | (0023,1010) | SS | 1 |
| Summary image | (0023,1050) | SS | 1 |
| Start time(secs) in first axial | (0023,1070) | FD | 1 |
| No. of updates to header | (0023,1074) | SL | 1 |
| Indicates if study has complete info (DICOM/genesis) | (0023,107D) | SS | 1 |

### A.6.6 Private Creator Identification (GEMS_SERS_01)

| Attribute Name | Tag | VR | VM |
|---|---|---|---|
| Last pulse sequence used | (0025,1006) | SS | 1 |
| Images in Series | (0025,1007) | SL | 1 |
| Landmark Counter | (0025,1010) | SL | 1 |
| Number of Acquisitions | (0025,1011) | SS | 1 |
| Indicates no. of updates to header | (0025,1014) | SL | 1 |
| Series Complete Flag | (0025,1017) | SL | 1 |
| Number of images archived | (0025,1018) | SL | 1 |
| Last image number used | (0025,1019) | SL | 1 |
| Primary Receiver Suite and Host | (0025,101A) | SH | 1 |

### A.6.7 Private Creator Identification (GEMS_IMAG_01)

| Attribute Name | Tag | VR | VM |
|---|---|---|---|
| Image archive flag | (0027,1006) | SL | 1 |
| Scout Type | (0027,1010) | SS | 1 |
| Foreign Image Revision | (0027,1030) | SH | 1 |
| Imaging Mode | (0027,1031) | SS | 1 |
| Pulse Sequence | (0027,1032) | SS | 1 |
| Imaging Options | (0027,1033) | SL | 1 |
| Plane Type | (0027,1035) | SS | 1 |
| Oblique Plane | (0027,1036) | SL | 1 |
| RAS letter of image location | (0027,1040) | SH | 1 |
| Image location | (0027,1041) | FL | 1 |
| Center R coord of plane image | (0027,1042) | FL | 1 |
| Center A coord of plane image | (0027,1043) | FL | 1 |
| Center S coord of plane image | (0027,1044) | FL | 1 |
| Normal R coord | (0027,1045) | FL | 1 |
| Normal A coord | (0027,1046) | FL | 1 |
| Normal S coord | (0027,1047) | FL | 1 |
| R Coord of Top Right Corner | (0027,1048) | FL | 1 |
| A Coord of Top Right Corner | (0027,1049) | FL | 1 |
| S Coord of Top Right Corner | (0027,104A) | FL | 1 |
| R Coord of Bottom Right Corner | (0027,104B) | FL | 1 |
| A Coord of Bottom Right Corner | (0027,104C) | FL | 1 |
| S Coord of Bottom Right Corner | (0027,104D) | FL | 1 |
| Image dimension - X | (0027,1060) | FL | 1 |

| | | | |
|---|---|---|---|
| Image dimension - Y | (0027,1061) | FL | 1 |
| Number of Excitations | (0027,1062) | FL | 1 |

### A.6.8 Private Creator Identification (GEMS_IMPS_01)

| Attribute Name | Tag | VR | VM |
|---|---|---|---|
| Lower range of Pixels1 | (0029,1015) | SL | 1 |
| Lower range of Pixels1 | (0029,1016) | SL | 1 |
| Lower range of Pixels2 | (0029,1017) | SL | 1 |
| Upper range of Pixels2 | (0029,1018) | SL | 1 |
| Len of tot hdr in bytes | (0029,101A) | SL | 1 |
| Version of the hdr struct | (0029,1026) | SS | 1 |
| Advantage comp. Overflow | (0029,1034) | SL | 1 |
| Advantage comp. Underflow | (0029,1035) | SL | 1 |

### A.6.9 Private Creator Identification (GEMS_PARM_01)

| Attribute Name | Tag | VR | VM |
|---|---|---|---|
| Bitmap of prescan options | (0043,1001) | SS | 1 |
| Gradient offset in X | (0043,1002) | SS | 1 |
| Gradient offset in Y | (0043,1003) | SS | 1 |
| Gradient offset in Z | (0043,1004) | SS | 1 |
| Img is original or unoriginal | (0043,1005) | SS | 1 |
| Number of EPI shots | (0043,1006) | SS | 1 |
| Views per segment | (0043,1007) | SS | 1 |
| Respiratory rate, bpm | (0043,1008) | SS | 1 |
| Respiratory trigger point | (0043,1009) | SS | 1 |
| Type of receiver used | (0043,100A) | SS | 1 |
| Peak rate of change of gradient field | (0043,100B) | DS | 1 |
| Limits in units of percent | (0043,100C) | DS | 1 |
| PSD estimated limit | (0043,100D) | DS | 1 |
| PSD estimated limit in tesla per second | (0043,100E) | DS | 1 |
| Saravghead | (0043,100F) | DS | 1 |
| Window value | (0043,1010) | US | 1 |
| GE image integrity | (0043,101C) | SS | 1 |
| Level value | (0043,101D) | SS | 1 |
| Unique image iden | (0043,1028) | OB | 1 |
| Histogram tables | (0043,1029) | OB | 1 |
| User defined data | (0043,102A) | OB | 1 |
| Private Scan Options | (0043,102B) | SS | 4 |
| Effective echo spacing | (0043,102C) | SS | 1 |
| String slop field 1 | (0043,102D) | SH | 1 |
| String slop field 2 | (0043,102E) | SH | 1 |
| Raw data type | (0043,102F) | SS | 1 |
| Raw data type | (0043,1030) | SS | 1 |
| RA cord of target recon center | (0043,1031) | DS | 2 |
| Raw data type | (0043,1032) | SS | 1 |

| | | | |
|---|---|---|---|
| Neg_scanspacing | (0043,1033) | FL | 1 |
| Offset Frequency | (0043,1034) | IS | 1 |
| User_usage_tag | (0043,1035) | UL | 1 |
| User_fill_map_MSW | (0043,1036) | UL | 1 |
| User_fill_map_LSW | (0043,1037) | UL | 1 |
| User25...User48 | (0043,1038) | FL | 24 |
| Slop_int_6... slop_int_9 | (0043,1039) | IS | 4 |

# B PET IOD Definitions

## B.1 PET Specific IOD Definitions

This section specifies the use of the DICOM PET Image IOD to represent the information included in PET images produced by this implementation. Corresponding attributes are conveyed using the module construct. The contents of this section are:
PET Image IOD Description

PET Image IOD Entity-Relationship Model

PET Image IOD Module Table

PET Image Information Module Definitions

### B.1.1 PET IMAGE IOD Implementation

The Discovery LS PET AE implementation of DICOM uses the PET image format when creating image objects. In order to preserve full fidelity when transferring data to a Discovery LS workstation, some specialized database information is encoded as private DICOM attributes. All of the Standard and private attributes used are defined in the module tables. Discovery LS PET AE private data dictionary is included in Section B.2.

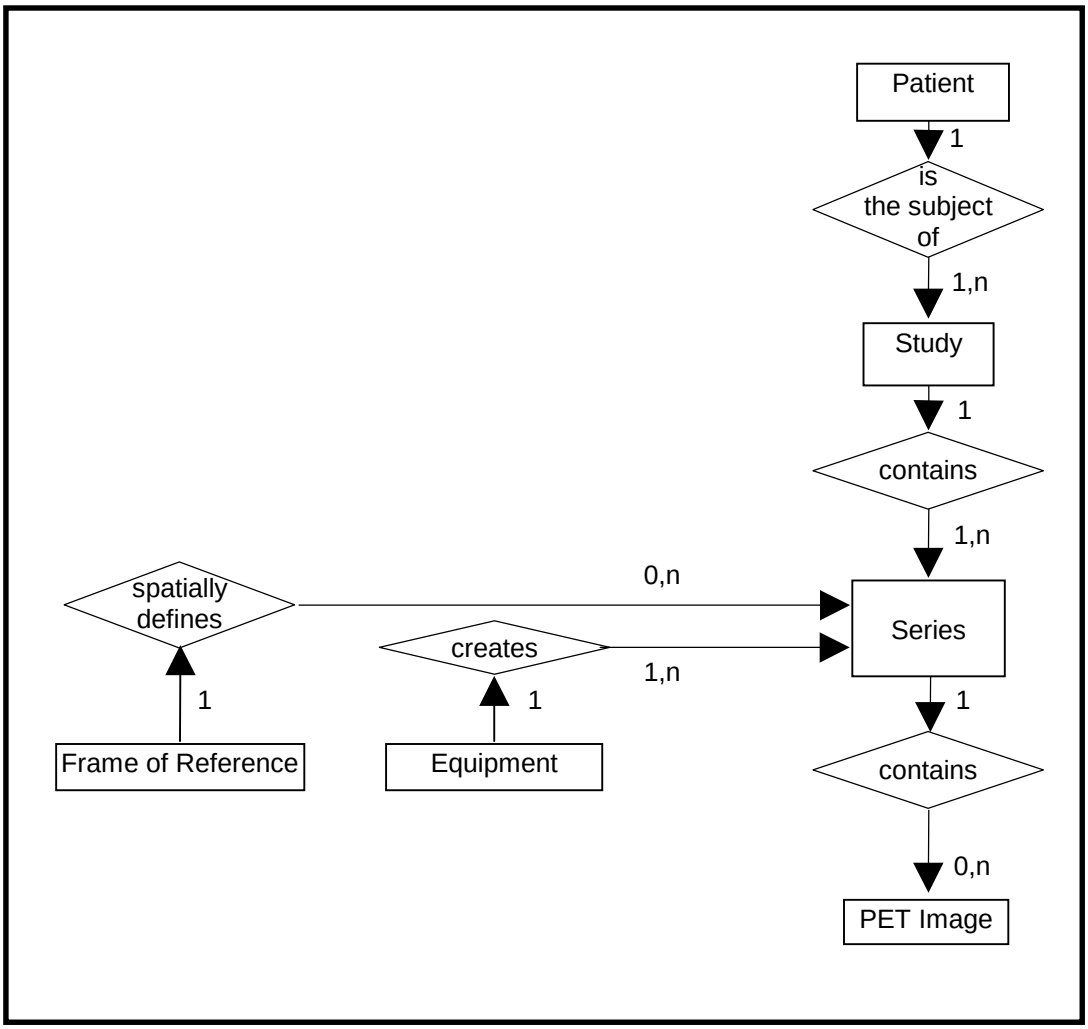
### B.1.2 PET IMAGE Entity-Relationship Model

The Entity-Relationship diagram for the PET Image interoperability schema is shown in Illustration B.1.2-1 **.** In this figure, the following diagrammatic convention is established to represent the information organization:

- each entity is represented by a rectangular box
- each relationship is represented by a diamond shaped box.
- the fact that a relationship exists between two entities is depicted by lines connecting the corresponding entity boxes to the relationship boxes.

The relationships are fully defined with the maximum number of possible entities in the relationship shown. In other words, the relationship between Series and Image can have up to n Images per Series, but the Patient to Study relationship has 1 Study for each Patient (a Patient can have more than one Study on the system, however each Study will contain all of the information pertaining to that Patient).

**ILLUSTRATION B.1.2-1**
**PET IMAGE ENTITY RELATIONSHIP DIAGRAM**




### B.1.2.1 ENTITY DESCRIPTIONS

Please refer to DICOM Standard Part 3 (Information Object Definitions) for a description of each of the entities contained within the PET Information Object.

#### B.1.2.1.1 Patient Entity Description

The Patient Entity defines the characteristics of a patient who is the subject of one or more medical studies which produce medical images.

#### B.1.2.1.2 Study Entity Description

The Study Entity defines the characteristics of a medical study performed on a patient. A study is a collection of one or more series of medical images which are logically related for the purpose of diagnosing a patient. Each study is associated with exactly one patient.

#### B.1.2.1.3 Series Entity Description

The Series Entity defines the attributes which are used to group images into distinct logical sets. Each series is associated with exactly one study.

#### B.1.2.1.4 Equipment Entity Description

The Equipment Entity describes the particular imaging device which produced the series of images. An imaging device may produce one or more series within a study. The Equipment Entity does not describe the data acquisition or image creation Attributes used to generate images within a series.

#### B.1.2.1.5 Frame of Reference Entity Description

The Frame of Reference Entity identifies the coordinate system which conveys spatial and/or temporal information of images in a series.

#### B.1.2.1.6 PET Image Entity Description

The PET Image Entity defines the attributes which describe the pixel data of a PET image. The pixel data is generated as a direct result of patient scanning (an ORIGINAL image) or it is derived from an original image through image processing steps (a DERIVED image). An image is defined by its image plane, pixel data characteristics, gray scale and/or color mapping characteristics and modality specific characteristics (acquisition parameters and image creation information).

### B.1.2.2 Mapping of DICOM entities

**TABLE 7.1.6.2-1**
**MAPPING OF DICOM ENTITIES TO DISCOVERY LS PET AE SPECIFIC ENTITIES**

| DICOM | *Discovery LS PET AE specific* Entity |
|---|---|
| Patient | Patient |
| Study | Exam |
| Series | Imageset |
| Image | Image |

## B.1.3 PET IMAGE IOD MODULE TABLE

Within an entity of the DICOM PET IOD, attributes are grouped into related set of attributes. A set of related attributes is termed a module. A module facilitates the understanding of the semantics concerning the attributes and how the attributes are related with each other. A module grouping does not infer any encoding of information into datasets.
Table 7.1.11-1 identifies the defined modules within the entities which comprise the DICOM PET IOD. Modules are identified by Module Name.
See DICOM Part 3 for a complete definition of the entities, modules, and attributes.

**TABLE 7.1.11-1**
**PET IMAGE IOD MODULES**

| Entity Name | Module Name | Reference |
|---|---|---|
| Patient | Patient | B.1.4.1.1 |
| | GE Discovery LS PET Patient | B.1.4.1.2 |
| Study | General Study | B.1.4.2.1 |
| | Patient Study | B.1.4.2.2 |
| | GE Discovery LS PET Exam | B.1.4.2.3 |
| Series | General Series | B.1.4.3.1 |
| | PET Series | B.1.4.3.2 |
| | PET Isotope | B.1.4.3.3 |
| | PET Multi-gated Acquisition | B.1.4.3.4 |
| | NM/PET Patient Orientation | B.1.4.3.5 |
| | GE Discovery LS PET Imageset | B.1.4.3.6 |
| | GE Discovery LS PET Scan | B.1.4.3.8 |
| Frame of Reference | Frame of Reference | B.1.4.4.1 |
| Equipment | General Equipment | B.1.4.5.1 |
| Image | General Image | B.1.4.6.1 |
| | Image Plane | B.1.4.6.2 |
| | Image Pixel | B.1.4.6.3 |
| | PET Image | B.1.4.6.4 |
| | Overlay Plane | 3.5.6.5 |
| | VOI LUT | B.1.4.6.6 |
| | GE Discovery LS PET Image | B.1.4.6.6 |
| | GE Discovery LS PET Frame | B.1.4.6.8 |
| | GE Discovery LS PET ROI | B.1.4.6.9 |
| | GE Discovery LS PET Annotation | B.1.4.6.10 |
| General Modules | SOP Common | B.1.4.7.1 |

## B.1.4 PET IMAGE INFORMATION MODULE DEFINITIONS

Please refer to DICOM Standard Part 3 (Information Object Definitions) for a description of each of the entities and modules contained within the PET Information Object.
The following modules are included to convey Enumerated Values, Defined Terms, and Optional Attributes supported. Type 1 & Type 2 Attributes are also included for completeness and to define what values they may take and all the attributes are taken from respective tables in GE Discovery LS PET AE Database. It should be noted that they are the same ones as defined in the DICOM Standard Part 3 (Information Object Definitions).

### B.1.4.1 Common Patient Entity Modules

#### B.1.4.1.1 Patient Module

This section specifies the Attributes of the Patient that describe and identify the Patient who is the subject of a diagnostic Study. This Module contains Attributes of the patient that are needed for diagnostic interpretation of the Image and are common for all studies performed on the patient.

**TABLE 2.4-1**
**PATIENT MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Attribute (Discovery LS PET Patient table unless otherwise specified) | Notes |
|---|---|---|---|---|---|---|
| **Patient's Name** | **(0010,0010)** | **2** | **PN (64)** | **1** | **patient_name** | |
| **Patient ID** | **(0010,0020)** | **2** | **LO (64)** | **1** | **patient_identifier** | |
| **Patient's Birth Date** | **(0010,0030)** | **2** | **DA (26)** | **1** | **birthdate** | |
| **Patient's Sex** | **(0010,0040)** | **2** | **CS (16)** | **1** | **sex** | |
| **Referenced Patient Sequence** | **(0008,1120)** | **3** | **SQ** | **1** | **Not Used** | |
| **>Referenced SOP Class UID** | **(0008,1150)** | **1C** | **UI** | **1** | **Not Used** | |
| **>Referenced SOP Instance UID** | **(0008,1155)** | **1C** | **UI** | **1** | **Not Used** | |
| **Patient's Birth Time** | **(0010,0032)** | **3** | **TM** | **1** | **Not Used** | |
| **Other Patient IDs** | **(0010,1000)** | **3** | **LO** | **1-n** | **Not Used** | |
| **Other Patient Names** | **(0010,1001)** | **3** | **PN** | **1-n** | **Not Used** | |
| **Ethnic Group** | **(0010,2160)** | **3** | **SH** | **1** | **Not Used** | |
| **Patient Comments** | **(0010,4000)** | **3** | **LT** | **1** | **Not Used** | |

### B.1.4.1.2 GE Discovery LS PET Patient

Refer to Section B.2.2 for details.

### B.1.4.2 Common Study Entity Modules

The following Study IE Modules are common to all Composite Image IODs which reference the Study IE. These Module contain Attributes of the patient and study that are needed for diagnostic interpretation of the image.

#### B.1.4.2.1 General Study Module

This section specifies the Attributes which describe and identify the Study performed upon the Patient.

**TABLE 2.4-2**
**GENERAL STUDY MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Attribute (GE Discovery LS PET Exam table unless otherwise specified) | Notes |
|---|---|---|---|---|---|---|
| **Study Instance UID** | **(0020,000 D)** | **1** | **UI** | **1** | **study_uid** | |
| **Study Date** | **(0008,0020 )** | **2** | **DA** | **1** | **extract date from exam_datetime** | |
| **Study Time** | **(0008,0030 )** | **2** | **TM** | **1** | **extract time exam_datetime** | |
| **Referring Physician's Name** | **(0008,0090 )** | **2** | **PN** | **1** | **ref_physician** | |
| **Study ID** | **(0020,0010 )** | **2** | **SH** | **1** | **study_identifier** | |
| **Accession Number** | **(0008,0050 )** | **2** | **SH** | **1** | **requisition** | |
| **Study Description** | **(0008,1030 )** | **3** | **LO** | **1** | **exam_desc** | |
| **Physician(s) of Record** | **(0008,1048 )** | **3** | **PN** | **1-n** | Not Used | |
| **Name of Physician(s) Reading Study** | **(0008,1060 )** | **3** | **PN** | **1-n** | **diagnostician** | |
| **Referenced Study Sequence** | **(0008,1110 )** | **3** | **SQ** | **1** | Not Used | |
| **> Referenced SOP Class UID** | **(0008,1150 )** | **1C** | **UI** | **1** | Not Used | |
| **> Referenced SOP Instance UID** | **(0008,1155 )** | **1C** | **UI** | **1** | Not Used | |

#### B.1.4.2.2 Patient Study Module

This section defines Attributes that provide information about the Patient at the time the Study was performed.

**TABLE 2.4-3**

**PATIENT STUDY MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Attribute (GE Discovery LS PET Exam table unless otherwise specified) | Notes |
|---|---|---|---|---|---|---|
| **Admitting Diagnosis Description** | **(0008,1080)** | **3** | **LO** | **1-n** | **Not Used** | |
| **Patient's Age** | **(0010,1010)** | **3** | **AS** | **1** | **truncate years from (Exam.exam_datetime - Patient.patient_birthdate)** | |
| **Patient's Size** | **(0010,1020)** | **3** | **DS** | **1** | **patient_ht / 100.0 (convert cm to m)** | |
| **Patient's Weight** | **(0010,1030)** | **3** | **DS** | **1** | **patient_wt** | |
| **Occupation** | **(0010,2180)** | **3** | **SH** | **1** | **Not Used** | |
| **Additional Patient's History** | **(0010,21B0)** | **3** | **LT** | **1** | **patient_history** | |

### B.1.4.2.3 GE Discovery LS PET Exam Module

Refer to Section B.2.3 for details.

### B.1.4.3 Common Series Entity Modules

The following Series IE Modules are common to all Composite Image IODs which reference the Series IE.

### B.1.4.3.1 General Series Module

This section specifies the Attributes which identify and describe general information about the Series within a Study.

**TABLE 2.4-4**
**GENERAL SERIES MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Attribute (GE Discovery LS PET ImageSet table unless otherwise specified) | Notes |
|---|---|---|---|---|---|---|
| **Modality** | **0008,0060)** | **1** | **CS** | **1** | **Imageset.modality** | |
| **Series Instance UID** | **(0020,000E)** | **1** | **UI** | **1** | **IF (SOP Class UID == "1.2.840.113619.4.30") THEN = Scan.scan_id ELSE = image_set_id** | |
| **Series Number** | **0020,0011)** | **2** | **IS** | **1** | **series_number** | |
| **Laterality** | **0020,0060)** | **2C** | **CS** | **1** | **Not Used** | |

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Attribute (GE Discovery LS PET ImageSet table unless otherwise specified) | Notes |
|---|---|---|---|---|---|---|
| **Series Date** | **0008,0021)** | **3** | **DA** | **1** | **superceded by PET Series.Series Date (0008,0021)** | |
| **Series Time** | **0008,0031)** | **3** | **TM** | **1** | **superceded by PET Series.Series Time (0008,0031)** | |
| **Performing Physician's Name** | **0008,1050)** | **3** | **PN** | **1-n** | **Not Used** | |
| **Protocol Name** | **0018,1030)** | **3** | **LO** | **1** | **Not Used** | |
| **Series Description** | **0008,103E)** | **3** | **LO** | **1** | **IF (SOP Class UID == "1.2.840.113619.4.30") THEN = Scan.scan_description ELSE = is_description** | |
| **Operators' Name** | **(0008,1070)** | **3** | **PN** | **1-n** | **Exam.operator** | |
| **Referenced Study Component Sequence** | **(0008,1111)** | **3** | **SQ** | **1** | **Not Used** | |
| **> Referenced SOP Class UID** | **(0008,1150)** | **1C** | **UI** | **1** | **Not Used** | |
| **> Referenced SOP Instance UID** | **(0008,1155)** | **1C** | **UI** | **1** | **Not Used** | |
| **Body Part Examined** | **0018,0015)** | **3** | **CS** | **1** | **Not Used** | |
| **Patient Position** | **(0018,5100)** | **2C** | **CS** | **1** | **Scan.patient_position, Frame.patient_entry** | |
| **Smallest Pixel Value in Series** | **(0028,0108)** | **3** | **US/SS** | **1** | **Not Used** | |
| **Largest Pixel Value in Series** | **(0028,0109)** | **3** | **US/SS** | **1** | **Not Used** | |

### B.1.4.3.2 PET Series Module

**TABLE 2.4-5**
**PET SERIES MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Attribute (GE Discovery LS PET ImageSet table unless otherwise specified) | Notes |
|---|---|---|---|---|---|---|
| **Series Date** | **0008,0021)** | **1** | **DA** | **1** | **extract date from Scan.scan_datetime** | |
| **Series Time** | **(0008,0031)** | **1** | **TM** | **1** | **extract time from Scan.scan_datetime** | |
| **Counts Source** | **(0054,1002** | **1** | **CS** | **1** | **Scan.scan_type** | |

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Attribute (GE Discovery LS PET ImageSet table unless otherwise specified) | Notes |
|---|---|---|---|---|---|---|
| | ) | | | | | |
| **Units** | **(0054,1001 )** | **1** | **CS** | **1** | **units** | |
| **Series Type** | **(0054,1000 )** | **1** | **CS** | **2** | **is_contents Scan.scan_mode** | |
| **Reprojection Method** | **(0054,1004 )** | **2C** | **CS** | **1** | **is_contents** | |
| **Number of R-R Intervals** | **(0054,0061 )** | **1C** | **US** | **1** | **IF (Scan.scan_mode == [ gated ] ) THEN Count the unique image.image_bin_time for images with Image.image_set_id = thisSOPInstance.ImageSetID ELSE = NULL** | |
| **Number of Time Slots** | **(0054,0071 )** | **1C** | **US** | **1** | **IF (Scan.scan_mode == [ gated ] ) THEN = 1 ELSE = NULL** | |
| **Number of Time Slices** | **(0054,0101 )** | **1C** | **US** | **1** | **Count the unique image.image_time for images with Image.image_set_id = thisSOPInstance.ImageSetID** | |
| **Number of Slices** | **(0054,0081 )** | **1** | **US** | **1** | **Count the unique image.image_location for images with Image.image_set_id = thisSOPInstance.ImageSetID** | |
| **Corrected Image** | **0028,0051)** | **2** | **CS** | **1-n** | **many** | |
| **Randoms Correction Method** | **(0054,1100 )** | **3** | **CS** | **1** | **IF (Scan.scan_type = [ emission ] THEN TR 14: emiss_randoms trans_randoms = NULL ELSE TR 14: trans_randoms emiss_randoms = NULL** | |
| **Attenuation Correction Method** | **(0054,1101 )** | **3** | **LO** | **1** | **attenuation atten_coefficient atten_smooth** | |
| **Scatter Correction Method** | **(0054,1105 )** | **3** | **LO** | **1** | **scatter** | |
| **Decay Correction** | **(0054,1102 )** | **1** | **CS** | **1** | **decay** | |
| **Reconstruction Diameter** | **(0018,1100 )** | **3** | **DS** | **1** | **bp_dfov * 10.0 (cm to mm)** | |

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Attribute (GE Discovery LS PET ImageSet table unless otherwise specified) | Notes |
|---|---|---|---|---|---|---|
| **Convolution Kernel** | **(0018,1210)** | **3** | **SH** | **1-n** | **many** | |
| **Reconstruction Method** | **(0054,1103)** | **3** | **LO** | **1** | **recon_method** | |
| **Detector Lines of Response Used** | **(0054,1104)** | **3** | **LO** | **1** | **axial_angles_used** | |
| **Acquisition Start Condition** | **(0018,0073)** | **3** | **CS** | **1** | **Scan.start_condition** | |
| **Acquisition Start Condition Data** | **(0018,0074)** | **3** | **IS** | **1** | **Scan.start_cond_data** | |
| **Acquisition Termination Condition** | **(0018,0071)** | **3** | **CS** | **1** | **Scan.sel_stop_cond** | |
| **Acquisition Termination Condition Data** | **(0018,0075)** | **3** | **IS** | **1** | **Scan.sel_stop_cond_data** | |
| **Field of View Shape** | **(0018,1147)** | **3** | **CS** | **1** | **IF is_type == [ native PET images] THEN = ”CYLINDRICAL RING”** | |
| **Field of View Dimensions** | **(0018,1149)** | **3** | **IS** | **1-2** | **10.0*Scan.scan_fov \ Scan.axial_fov** | |
| **Gantry /Detector Tilt** | **(0018,1120)** | **3** | **DS** | **1** | **Scan.gantry_tilt_angle** | |
| **Gantry/Detector Slew** | **(0018,1121)** | **3** | **DS** | **1** | | |
| **Type of Detector Motion** | **(0054,0202)** | **3** | **CS** | **1** | **IF is_type == [ native PET images] THEN = ”NONE”** | |
| **Collimator Type** | **(0018,1181)** | **2** | **CS** | **1** | **Scan.collimation** | |
| **Collimator/Grid Name** | **(0018,1180)** | **3** | **SH** | **1** | **Not Used** | |
| **Axial Acceptance** | **(0054,1200)** | **3** | **DS** | **1** | **Scan.axial_acceptance acceptance_flag axial_angle_3d** | |
| **Axial Mash** | **(0054,1201)** | **3** | **IS** | **2** | **Scan.axial_acceptance acceptance_flag** | |
| **Transverse Mash** | **(0054,1202)** | **3** | **IS** | **1** | **Scan.theta_compression** | |
| **Detector Element Size** | **(0054,1203)** | **3** | **DS** | **2** | **Not Used** | |
| **Coincidence Window Width** | **(0054,1210)** | **3** | **DS** | **1** | **Scan.upper_coinc_limit - Scan.lower_coinc_limit** | |
| **Energy Window Range** | **(0054,0013** | **3** | **SQ** | **1** | | |

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Attribute (GE Discovery LS PET ImageSet table unless otherwise specified) | Notes |
|---|---|---|---|---|---|---|
| **Sequence** | **)** | | | | | |
| **> Energy Window Lower Limit** | **(0054,0014 )** | **3** | **DS** | **1** | **Scan.lower_energy_limit** | |
| **> Energy Window Upper Limit** | **(0054,0015 )** | **3** | **DS** | **1** | **Scan.upper_energy_limit** | |
| **Secondary Counts Type** | **(0054,1220 )** | **3** | **CS** | **1-n** | **IF (Scan.delayed_events == [ separate ] ) THEN = ”DLYD”** | |

### B.1.4.3.3 PET Isotope Module

**TABLE 2.4-6**
**PET ISOTOPE MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Attribute (GE Discovery LS PET Scan table unless otherwise specified) | Notes |
|---|---|---|---|---|---|---|
| **Radiopharmaceutical Information Sequence** | **(0054,0016 )** | **2** | **SQ** | **1** | **Single item sequence** | |
| **> Radionuclide Code Sequence** | **(0054,0300 )** | **2** | **SQ** | **1** | **Single item sequence** | |
| **>> Code Value** | **(0008,0100 )** | **1C** | **SH** | **1** | **Code value is based on radionuclide_name** | |
| **>> Coding Scheme Designator** | **(0008,0102 )** | **1C** | **SH** | **1** | **99SDM** | |
| **>> Code Meaning** | **(0008,0104 )** | **3** | **LO** | **1** | **radionuclide_name** | |
| **> Radiopharmaceutical Route** | **(0018,1070 )** | **3** | **LO** | **1** | **Not Used** | |
| **> Administration Route Code Sequence** | **(0054,0302 )** | **3** | **SQ** | **1** | **Not Used** | |
| **>> Code Value** | **(0008,0100 )** | **1C** | **SH** | **1** | **Not Used** | |
| **>> Coding Scheme Designator** | **(0008,0102 )** | **1C** | **SH** | **1** | **Not Used** | |
| **>> Code Meaning** | **(0008,0104 )** | **3** | **LO** | **1** | **Not Used** | |
| **> Radiopharmaceutical Volume** | **(0018,1071 )** | **3** | **DS** | **1** | **pre_inj_volume** | |
| **> Radiopharmaceutical Start Time** | **(0018,1072 )** | **3** | **TM** | **1** | **admin_datetime** | |
| **> Radiopharmaceutical Stop Time** | **(0018,1073 )** | **3** | **TM** | **1** | **Not Used** | |

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Attribute (GE Discovery LS PET Scan table unless otherwise specified) | Notes |
|---|---|---|---|---|---|---|
| **> Radionuclide Total Dose** | **(0018,1074)** | **3** | **DS** | **1** | **tracer_activity, post_inj_activity, half_life, meas_datetime, admin_datetime, post_inj_datetime** | |
| **> Radionuclide Half Life** | **(0018,1075)** | **3** | **DS** | **1** | **half_life** | |
| **> Radionuclide Positron Fraction** | **(0018,1076)** | **3** | **DS** | **1** | **positron_fraction** | |
| **> Radiopharmaceutical Specific Activity** | **(0018,1077)** | **3** | **DS** | **1** | **Not Used** | |
| **> Radiopharmaceutical** | **(0018,0031)** | **3** | **LO** | **1** | **tracer_name** | |
| **> Radiopharmaceutical Code Sequence** | **(0054,0304)** | **3** | **SQ** | **1** | **Single item sequence** | |
| **>> Code Value** | **(0008,0100)** | **1C** | **SH** | **1** | **Value is based on tracer_name** | |
| **>> Coding Scheme Designator** | **(0008,0102)** | **1C** | **SH** | **1** | **99SDM** | |
| **>> Code Meaning** | **(0008,0104)** | **3** | **LO** | **1** | **tracer_name** | |
| **Intervention Drug Information Sequence** | **(0018,0026)** | **3** | **SQ** | **1** | **Not Used** | |
| **> Intervention Drug Name** | **(0018,0034)** | **3** | **LO** | **1** | **Not Used** | |
| **> Intervention Drug Code Sequence** | **(0018,0029)** | **3** | **SQ** | **1** | **Not Used** | |
| **>> Code Value** | **(0008,0100)** | **1C** | **SH** | **1** | **Not Used** | |
| **>> Coding Scheme Designator** | **(0008,0102)** | **1C** | **SH** | **1** | **Not Used** | |
| **>> Code Meaning** | **(0008,0104)** | **3** | **LO** | **1** | **Not Used** | |
| **> Intervention Drug Start Time** | **(0018,0035)** | **3** | **TM** | **1** | **Not Used** | |
| **> Intervention Drug Stop Time** | **(0018,0027)** | **3** | **TM** | **1** | **Not Used** | |
| **> Intervention Drug Dose** | **(0018,0028)** | **3** | **DS** | **1** | **Not Used** | |

### B.1.4.3.4 PET Multi-gated Acquisition Module

**TABLE 2.4-7**

**PET MULTI-GATED ACQUISITION MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Attribute (GE Discovery LS PET Scan table unless otherwise specified) | Notes |
|---|---|---|---|---|---|---|
| **Beat Rejection Flag** | **(0018,1080)** | **2** | **CS** | **1** | **IF ( trig_rej_method == [ none ] ) THEN = "N" ELSE = "Y"** | |
| **Trigger Source or Type** | **(0018,1061)** | **3** | **LO** | **1** | **Not Used** | |
| **PVC Rejection** | **(0018,1085)** | **3** | **LO** | **1** | **trig_rej_method** | |
| **Skip Beats** | **(0018,1086)** | **3** | **IS** | **1** | **number_for_reject** | |
| **Heart Rate** | **(0018,1088)** | **3** | **IS** | **1** | **Not Used** | |
| **Framing Type** | **(0018,1064)** | **3** | **LO** | **1** | **binning_mode** | |

### B.1.4.3.5 NM/PET Patient Orientation Module

**TABLE 2.4-8**
**NM/PET PATIENT ORIENTATION MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | VR | VM | GE Discovery LS PET Attribute | Notes |
|---|---|---|---|---|---|---|
| **Patient Orientation Code Sequence** | **(0054,0410)** | **2** | **SQ** | **1** | **Zero length sequence** | |
| **> Code Value** | **(0008,0100)** | **1C** | **SH** | **1** | | |
| **> Coding Scheme Designator** | **(0008,0102)** | **1C** | **SH** | **1** | | |
| **> Code Meaning** | **(0008,0104)** | **3** | **LO** | **1** | | |
| **> Patient Orientation Modifier Code Sequence** | **(0054,0412)** | **2C** | **SQ** | **1** | | |
| **>> Code Value** | **(0008,0100)** | **1C** | **SH** | **1** | | |
| **>> Coding Scheme Designator** | **(0008,0102)** | **1C** | **SH** | **1** | | |
| **>> Code Meaning** | **(0008,0104)** | **3** | **LO** | **1** | | |
| **Patient Gantry Relationship Code Sequence** | **(0054,0414)** | **2** | **SQ** | **1** | **Zero length sequence** | |
| **> Code Value** | **(0008,0100)** | **1C** | **SH** | **1** | | |
| **> Coding Scheme** | **(0008,0102** | **1C** | **SH** | **1** | | |

| Attribute Name | Tag | Type | VR | VM | GE Discovery LS PET Attribute | Notes |
|---|---|---|---|---|---|---|
| **Designator** | **)** | | | | | |
| **> Code Meaning** | **(0008,0104 )** | **3** | **LO** | **1** | | |

#### B.1.4.3.6 GE Discovery LS PET ImageSet Module

#### B.1.4.3.7 Refer to Section B.2.6 for details.

#### B.1.4.3.8 GE Discovery LS PET Scan Module

Refer to Section B.2.4 for details.

### B.1.4.4 Common Frame Of Reference Entity Modules

The following Frame of Reference IE Module is common to all Composite Image IODs which reference the Frame of Reference IE.

#### B.1.4.4.1 Frame Of Reference Module

This section specifies the Attributes necessary to uniquely identify a frame of reference which insures the spatial relationship of Images within a Series. It also allows Images across multiple Series to share the same Frame Of Reference. This Frame Of Reference (or coordinate system) shall be constant for all Images related to a specific Frame Of Reference.

**TABLE 2.4-9**
**FRAME OF REFERENCE MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | VR | VM | GE Discovery LS PET Attribute | Notes |
|---|---|---|---|---|---|---|
| **Frame of Reference UID** | **(0020,0052 )** | **1** | **UI** | **1** | **IF (ImageSet.for_identifier != NULL) THEN = ImageSet.for_identifier ELSE = idbMakeId()** | |
| **Position Reference Indicator** | **(0020,1040 )** | **2** | **LO** | **1** | **Scan.landmark_name** | |

### B.1.4.5 Common Equipment Entity Modules

The following Equipment IE Module is common to all Composite Image IODs which reference the Equipment IE.

#### B.1.4.5.1 General Equipment Module

This section specifies the Attributes which identify and describe the piece of equipment which produced a Series of Images.

**TABLE 2.4-10**
**GENERAL EQUIPMENT MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Attribute (GE Discovery LS PET Exam table | Notes |
|---|---|---|---|---|---|---|

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | unless otherwise specified) | |
| **Manufacturer** | **(0008,0070)** | **2** | **LO** | **1** | **manufacturer** | |
| **Institution Name** | **(0008,0080)** | **3** | **LO** | **1** | **hospital_name** | |
| **Institution Address** | **(0008,0081)** | **3** | **ST** | **1** | **Not Used** | |
| **Station Name** | **(0008,1010)** | **3** | **SH** | **1** | **Not Used** | |
| **Institutional Department Name** | **(0008,1040)** | **3** | **LO** | **1** | **Not Used** | |
| **Manufacturer's Model Name** | **(0008,1090)** | **3** | **LO** | **1** | **scanner_desc** | |
| **Device Serial Number** | **(0018,1000)** | **3** | **LO** | **1** | | |
| **Software Versions** | **(0018,1020)** | **3** | **LO** | **1** | **Image.software_version Curve.software_version Frame.software_version** | |
| **Spatial Resolution** | **(0018,1050)** | **3** | **DS** | **1** | **Not Used** | |
| **Date of Last Calibration** | **(0018,1200)** | **3** | **DA** | **1-n** | **Not Used** | |
| **Time of Last Calibration** | **(0018,1201)** | **3** | **TM** | **1-n** | **Not Used** | |
| **Pixel Padding Value** | **(0028,0120)** | **3** | **US or SS** | **1** | **Not Used** | |

### B.1.4.6 Common Image Entity Modules

The following Image IE Modules are common to all Composite Image IODs which reference the Image IE.

#### B.1.4.6.1 General Image Module

This section specifies the Attributes which identify and describe an image within a particular series.

**TABLE 2.4-11**
**GENERAL IMAGE MODULE ATTRIBUTES**

| **Attribute Name** | Tag | Type | VR | VM | Discovery LS PET Attribute (GE Discovery LS PET Image table unless otherwise specified) | Notes |
|---|---|---|---|---|---|---|
| **Image Number** | **(0020,0013)** | **2** | **IS** | **1** | **Scan.scan_mode image_location image_time image_bin_time** | **Refer Note Below** |

| | | | | | | |
|---|---|---|---|---|---|---|
| Patient Orientation | (0020,0020) | 2C | CS | 2 | Not Used | |
| Image Date | 0008,0023) | 2C | DA | 1 | extract date from image_datetime | |
| Image Time | 0008,0033) | 2C | TM | 1 | extract time from image_datetime | |
| Image Type | (0008,0008) | 3 | CS | 1-n | superceded by PET Image.Image Type (08,08) | |
| Acquisition Number | 0020,0012) | 3 | IS | 1 | Not Used | |
| Acquisition Date | 0008,0022) | 3 | DA | 1 | superceded by PET Image.Acquisition Date (08,22) | |
| Acquisition Time | 0008,0032) | 3 | TM | 1 | superceded by PET Image.Acquisition Time (08,32) | |
| Referenced Image Sequence | (0008,1140) | 3 | SQ | 1 | Not Used | |
| > Referenced SOP Class UID | (0008,1150) | 1C | UI | 1 | Not Used | |
| > Referenced SOP Instance UID | (0008,1155) | 1C | UI | 1 | Not Used | |
| Derivation Description | (0008,2111) | 3 | ST | 1 | truncate ImageSet.derivation to 1024A | |
| Source Image Sequence | (0008,2112) | 3 | SQ | 1 | Not Used | |
| > Referenced SOP Class UID | (0008,1150) | 1C | UI | 1 | Not Used | |
| > Referenced SOP Instance UID | (0008,1155) | 1C | UI | 1 | Not Used | |
| Images in Acquisition | 0020,1002) | 3 | IS | 1 | Not Used | |
| Image Comments | 0020,4000) | 3 | LT | 1 | Not Used | |
| Lossy Image Compression | 0028,2110) | 3 | CS | 1 | superceded by PETImage.Lossy Image Compression (28,2110) | |

NOTE: The Image Number (0020, 0013) is a function of the following four parameters – Scan.scan_mode, image_location, image_time and image_bin_time. Also, the images are to be transferred ONLY after the complete scan is done and not in between frames for the Image Numbers to be correct.

### B.1.4.6.2 Image Plane Module

This section specifies the Attributes which define the transmitted pixel array of a two dimensional image plane.

**TABLE 2.4-12**
**IMAGE PLANE MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Attribute (GE Discovery LS PET Image table unless otherwise specified) | Notes |
|---|---|---|---|---|---|---|
| **Pixel Spacing** | **(0028,0030)** | **1** | **DS** | **2** | **Value 1 = pixel_width<br>Value 2 = pixel_height** | |
| **Image Orientation (Patient)** | **(0020,0037)** | **1** | **DS** | **6** | **ImageSet.patient_row_cos_l<br>ImageSet.patient_row_cos_p<br>ImageSet.patient_row_cos_s<br>ImageSet.patient_col_cos_l<br>ImageSet.patient_col_cos_p<br>ImageSet.patient_col_cos_s** | |
| **Image Position (Patient)** | **(0020,0032)** | **1** | **DS** | **3** | **patient_l<br>patient_p<br>patient_s** | |
| **Slice Thickness** | **(0018,0050)** | **2** | **DS** | **1** | **image_thickness** | |
| **Slice Location** | **(0020,1041)** | **3** | **DS** | **1** | **image_location** | |

### B.1.4.6.3 Image Pixel Module

This section specifies the Attributes that describe the pixel data of the image.

**TABLE 2.4-13**
**IMAGE PIXEL MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Attribute (GE Discovery LS PET Image table unless otherwise specified) | Notes |
|---|---|---|---|---|---|---|
| **Samples per Pixel** | **(0028,0002)** | **1** | **US** | **1** | **superceded by PET Image.Samples Per Pixel (28,02)** | |
| **Photometric Interpretation** | **(0028,0004)** | **1** | **CS** | **1** | **superceded by PET Image.Photometric Interpretation (28,04)** | |
| **Rows** | **(0028,0010)** | **1** | **US** | **1** | **image_array_height** | |
| **Columns** | **(0028,0011)** | **1** | **US** | **1** | **image_array_width** | |
| **Bits Allocated** | **(0028,0100)** | **1** | **US** | **1** | **superceded by PET Image.Bits Allocated (28,100)** | |
| **Bits Stored** | **(0028,0101)** | **1** | **US** | **1** | **superceded by PET Image.Bits Stored (28,101)** | |
| **High Bit** | **(0028,0102)** | **1** | **US** | **1** | **superceded by PET Image.High Bit (28,102)** | |
| **Pixel Representation** | **(0028,0103** | **1** | **US** | **1** | **= 0001H (2's complement)** | |

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Attribute (GE Discovery LS PET Image table unless otherwise specified) | Notes |
|---|---|---|---|---|---|---|
| | ) | | | | | |
| **Pixel Data** | **(7FE0,0010)** | **1** | **OB/OW** | **1** | **pixel_data (send as OW)** | |
| **Planar Configuration** | **(0028,0006)** | **1C** | **US** | **1** | **Not Used** | |
| **Pixel Aspect Ratio** | **(0028,0034)** | **1C** | **IS** | **2** | **Not Used** | |
| **Smallest Image Pixel Value** | **(0028,0106)** | **3** | **US/SS** | **1** | **Not Used** | |
| **Largest Image Pixel Value** | **(0028,0107)** | **3** | **US/SS** | **1** | **Not Used** | |
| **Red Palette Color Lookup Table Descriptor** | **(0028,1101)** | **1C** | **US/US or SS/US** | **3** | **Not Used** | |
| **Green Palette Color Lookup Table Descriptor** | **(0028,1102)** | **1C** | **US/US or SS/US** | **3** | **Not Used** | |
| **Blue Palette Color Lookup Table Descriptor** | **(0028,1103)** | **1C** | **US/US or SS/US** | **3** | **Not Used** | |
| **Red Palette Color Lookup Table Data** | **(0028,1201)** | **1C** | **US or SS** | **1-n** | **Not Used** | |
| **Green Palette Color Lookup Table Data** | **(0028,1202)** | **1C** | **US or SS** | **1-n** | **Not Used** | |
| **Blue Palette Color Lookup Table Data** | **(0028,1203)** | **1C** | **US or SS** | **1-n** | **Not Used** | |

### B.1.4.6.4 PET Image Module

This section specifies the Attributes that describe the image within a particular PET Series.

**TABLE 2.4-14**
**PET IMAGE MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Attribute (GE Discovery LS PET Image table unless otherwise specified) | Notes |
|---|---|---|---|---|---|---|
| **Image Type** | **(0008,0008)** | **3** | **CS** | **1-n** | **Use ImageSet.is_source** | |
| **Samples per Pixel** | **(0028,0002)** | **1** | **US** | **1** | **1** | |
| **Photometric** | **(0028,0004** | **1** | **CS** | **1** | **"MONOCHROME2"** | |

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Attribute (GE Discovery LS PET Image table unless otherwise specified) | Notes |
|---|---|---|---|---|---|---|
| **Interpretation** | **)** | | | | | |
| **Bits Allocated** | **(0028,0100 )** | **1** | **US** | **1** | **image_depth (always 16)** | |
| **Bits Stored** | **(0028,0101 )** | **1** | **US** | **1** | **image_depth (always 16)** | |
| **High Bit** | **(0028,0102 )** | **1** | **US** | **1** | **15** | |
| **Rescale Intercept** | **(0028,1052 )** | **1** | **DS** | **1** | **0** | |
| **Rescale Slope** | **(0028,1053 )** | **1** | **DS** | **1** | **Use scale_factor, ImageSet.units** | **Refer Note Below** |
| **Frame Reference Time** | **(0054,1300 )** | **1** | **DS** | **1** | **IF (frame_ref_time != NULL) THEN = frame_ref_time ELSE = image_time** | |
| **Trigger Time** | **(0018,1060 )** | **1C** | **DS** | **1** | **IF (Scan.scan_mode == [gated]) THEN = image_bin_time ELSE = NULL** | |
| **Frame Time** | **(0018,1063 )** | **1C** | **DS** | **1** | **IF (Scan.scan_mode == [gated]) THEN = image_bin_dur ELSE = NULL** | |
| **Low R-R Value** | **(0018,1081 )** | **1C** | **IS** | **1** | **Scan.lower_reject_limit** | |
| **High R-R Value** | **(0018,1082 )** | **1C** | **IS** | **1** | **Scan.upper_reject_limit** | |
| **Lossy Image Compression** | **(0028,2110 )** | **1C** | **CS** | **1** | **IF ( compression == [ none ] ) THEN = 00H ELSE IF ( compression == [ lossy ] ) THEN = 01H** | |
| **Image Index** | **(0054,1330 )** | **1** | **US** | **1** | **Scan.scan_mode image_location image_time image_bin_time** | |
| **Acquisition Date** | **(0008,0022 )** | **2** | **DA** | **1** | **= extract date from Scan.scan_datetime + Image.image_time** | |
| **Acquisition Time** | **(0008,0032 )** | **2** | **TM** | **1** | **= extract time from Scan.scan_datetime + Image.image_time** | |
| **Actual Frame Duration** | **(0018,1242 )** | **1C** | **IS** | **1** | **image_duration (Converted from seconds in DB to milliseconds)** | |

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Attribute (GE Discovery LS PET Image table unless otherwise specified) | Notes |
|---|---|---|---|---|---|---|
| Nominal Interval | (0018,1062) | 3 | IS | 1 | Not Used | |
| Intervals Acquired | (0018,1083) | 3 | IS | 1 | Scan.triggers_acquired | |
| Intervals Rejected | (0018,1084) | 3 | IS | 1 | Scan.triggers_rejected | |
| Primary Counts (Prompts) Accumulated | (0054,1310) | 3 | IS | 1 | total_prompts | |
| Secondary Counts Accumulated | (0054,1311) | 3 | IS | 1-n | Value 1 = total_delays | |
| Slice Sensitivity Factor | (0054,1320) | 3 | DS | 1 | IF ( coefficient != NULL) THEN = coefficient ELSE = 1.0 | |
| Decay Factor | (0054,1321) | 1C | DS | 1 | decay_factor | |
| Dose Calibration Factor | (0054,1322) | 3 | DS | 1 | = activity_factor * 1.0e+06 (convert MBq/ml to Bq/ml) | |
| Scatter Fraction Factor | (0054,1323) | 3 | DS | 1 | = scatter_subtracted / total_counts | |
| Dead Time Factor | (0054,1324) | 3 | DS | 1 | deadtime_factor | |
| Referenced Overlay Sequence | (0008,1130) | 3 | SQ | 1 | Not Used | |
| >Referenced SOP Class UID | (0008,1150) | 1 | UI | 1 | Not Used | |
| >Referenced SOP Instance UID | (0008,1155) | 1 | UI | 1 | Not Used | |
| Referenced Curve Sequence | (0008,1145) | 3 | SQ | 1 | Not Used | |
| >Referenced SOP Class UID | (0008,1150) | 1 | UI | 1 | Not Used | |
| >Referenced SOP Instance UID | (0008,1155) | 1 | UI | 1 | Not Used | |
| Anatomic Region Sequence | (0008,2218) | 3 | SQ | 1 | Not Used | |
| > Code Value | (0008,0100) | 1 | SH | 1 | Not Used | |
| > Coding Scheme Designator | (0008,0102) | 1 | SH | 1 | Not Used | |
| > Code Meaning | (0008,0104) | 3 | LO | 1 | Not Used | |

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Attribute (GE Discovery LS PET Image table unless otherwise specified) | Notes |
|---|---|---|---|---|---|---|
| **> Anatomic Region Modifier Sequence** | **(0008,2220)** | **3** | **SQ** | **1** | **Not Used** | |
| **>> Code Value** | **(0008,0100)** | **1** | **SH** | **1** | **Not Used** | |
| **>> Coding Scheme Designator** | **(0008,0102)** | **1** | **SH** | **1** | **Not Used** | |
| **>> Code Meaning** | **(0008,0104)** | **3** | **LO** | **1** | **Not Used** | |
| **Primary Anatomic Structure Sequence** | **(0008,2228)** | **3** | **SQ** | **1** | **Not Used** | |
| **> Code Value** | **(0008,0100)** | **1** | **SH** | **1** | **Not Used** | |
| **> Coding Scheme Designator** | **(0008,0102)** | **1** | **SH** | **1** | **Not Used** | |
| **> Code Meaning** | **(0008,0104)** | **3** | **LO** | **1** | **Not Used** | |
| **> Primary Anatomic Structure Modifier Sequence** | **(0008,2230)** | **3** | **SQ** | **1** | **Not Used** | |
| **>> Code Value** | **(0008,0100)** | **1** | **SH** | **1** | **Not Used** | |
| **>> Coding Scheme Designator** | **(0008,0102)** | **1** | **SH** | **1** | **Not Used** | |
| **>> Code Meaning** | **(0008,0104)** | **3** | **LO** | **1** | **Not Used** | |

Translation of Image.scale_factor (PET Database field)

Image.scale_factor = RescaleSlope (0028,1053) * units_conversion * decay_conversion

where:

If PET Series.Units (0054,1001) is "BQML":

units_conversion = 1.0e-06

Otherwise

units_conversion = 1.0

If PET Series.Decay Correction (0054, 1102) is "ADMIN":

decay_conversion = exp( ln(2) *

(Scan.admin_datetime (0009,103B) -Scan.scan_datetime (0009,100D))/Scan.half_life (0009,103F))

Otherwise:

decay_conversion = 1.0

NOTE: Decay correction is typically only applied for Dynamic data, not static/wholebody. In the case of static data, data_conversion field would be 1.0.

### B.1.4.6.5 Overlay Plane Module

This section contains Attributes that describe characteristics of an Overlay Plane. Overlay Planes are not currently used in GE Discovery LS PET AE.

**TABLE 2.4-15**
**OVERLAY PLANE MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Attribute (Image table unless otherwise specified) | Notes |
|---|---|---|---|---|---|---|
| **None** | | | | | | |

### B.1.4.6.6 VOI LUT Module

This section specifies the Attributes that describe the VOI LUT.

**TABLE 2.4-16**
**VOI LUT MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Attribute (ImageSet table unless otherwise specified) | Notes |
|---|---|---|---|---|---|---|
| **VOI Lut Sequence** | **(0028,3010)** | **3** | **SQ** | **1** | **Not Used** | |
| **> LUT Descriptor** | **(0028,3002)** | **1C** | **US\US or SS\US** | **3** | **Not Used** | |
| **> LUT Explanation** | **(0028,3003)** | **3** | **LO** | **1** | **Not Used** | |
| **> LUT Data** | **(0028,3006)** | **1C** | **US or SS** | **1-n** | **Not Used** | |
| **Window Center** | **(0028,1050)** | **3** | **DS** | **1-n** | **window_center** *(converted from 12 bit to scaled value using image.scale_factor)* | |
| **Window Width** | **(0028,1051)** | **1C** | **DS** | **1-n** | **window_width** *(converted from 12 bit to scaled value using image.scale_factor)* | |
| **Window Center & Width Explanation** | **(0028,1055)** | **3** | **LO** | **1-n** | **Not Used** | |

### B.1.4.6.7 GE Discovery LS PET Image

Refer to Section B.2.7 for details.

### B.1.4.6.8 GE Discovery LS PET Frame

Refer to Section B.2.5 for details.

### B.1.4.6.9 GE Discovery LS PET ROI

Refer to Section B.2.8 for details.

#### B.1.4.6.10 GE Discovery LS PET Annotation

Refer to Section B.2.9 for details.

### B.1.4.7 General Modules

The SOP Common Module is mandatory for all DICOM IODs.

#### B.1.4.7.1 SOP Common Module

This section defines the Attributes which are required for proper functioning and identification of the associated SOP Instances. They do not specify any semantics about the Real-World Object represented by the IOD.

**TABLE 2.4-17**
**SOP COMMON MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Attribute (GE Discovery LS PET Image table unless otherwise specified) | Notes |
|---|---|---|---|---|---|---|
| **SOP Class UID** | **(0008,0016)** | **1** | **UI** | **1** | | **TR[48]** |
| **SOP Instance UID** | **(0008,0018)** | **1** | **UI** | **1** | | **TR[49]** |
| **Specific Character Set** | **(0008,0005)** | **1C** | **CS** | **1** | **= NULL** | |
| **Instance Creation Date** | **(0008,0012)** | **3** | **DA** | **1** | **current_date** | |
| **Instance Creation Time** | **(0008,0013)** | **3** | **TM** | **1** | **current_time** | |
| **Instance Creator UID** | **(0008,0014)** | **3** | **UI** | **1** | **= 1.2.840.113619.1.131.<dbcode>** | |

T[48]Translate value as follows:

```
IF (PET Image Transfer) THEN
        SOP Class UID (08,16) = 1.2.840.10008.5.1.4.1.1.128
ELSE IF (Secondary Capture Transfer) THEN
        SOP Class UID (08,16) = 1.2.840.10008.5.1.4.1.1
ELSE IF (Curve Transfer) THEN
        CASE ( Curve.curve_type ) OF :
                [ blood sample ], [ rates ] :
                        /*  PET Curve  */
                        SOP Class UID (08,16) = 1.2.840.10008.5.1.4.1.1.129
                        break;
                [ profile ], [ histogram ], [ volume activity curve ], [ foreign ] :
                [ area ], [ patlak ], [ tac midframe ], [ tac effective ] :
                        /*  Standalone Curve  */
                        SOP Class UID (08,16) = 1.2.840.10008.5.1.4.1.1.9
                        break;
ELSE IF (Polar Map Transfer) THEN
        Reject Transfer;
```

49Translate value as follows:

```
IF (SOP Class UID (08,16) == ”1.2.840.10008.5.1.4.1.1.128”)  /*  PET Image  */
        ||    /* OR */
IF (SOP Class UID (08,16) == ”1.2.840.10008.5.1.4.1.1.7”)    /* Secondary Capture */
        THEN:     SOP Instance UID (08,18) = Image.image_id
ELSE IF (SOP Class UID (08,16) == ”1.2.840.10008.5.1.4.1.1.129”) THEN  /*  PET Curve  */
    IF (Type of Data (50xx,0020) != ”CPM”) THEN
        Reject Transfer;
    /*Standalone Curve */
    ELSE IF (SOP Class UID (08,16) == ”1.2.840.10008.5.1.4.1.1.9”) THEN
        SOP Instance UID (08,18) = Curve.curve_id
```

## B.2 Private data dictionary

### B.2.1 Private Creator Identification Information

**TABLE 2.4-1**
**PRIVATE CREATOR IDENTIFICATION (GEMS_PETD_01)**

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Type |
|---|---|---|---|---|---|
| **Private Creator Data Element** | **(0009,0010)** | **1** | **SH** | **1** | **n/a** |
| **GE Discovery LS PET Implementation Version Name** | **(0009,1001)** | **3** | **LO** | **2** | **n/a** |

### B.2.2 GE Discovery LS PET Patient Module

**TABLE 2.4-2**

**GE DISCOVERY LS PET PATIENT MODULE PRIVATE ELEMENTS**
**PRIVATE CREATOR IDENTIFICATION (GEMS_ PETD_01)**

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Type |
|---|---|---|---|---|---|
| **GE Discovery LS PET Patient.patient_id** | **(0009,1002)** | **3** | **LO** | **1** | **20A** |
| **GE Discovery LS PET Patient.compatible_version** | **(0009,1003)** | **3** | **SH** | **1** | **5A** |
| **GE Discovery LS PET Patient.software_version** | **(0009,1004)** | **3** | **SH** | **1** | **5A** |
| **GE Discovery LS PET Patient.patient_datetime** | **(0009,1005)** | **3** | **DT** | **1** | **D** |
| **GE Discovery LS PET Patient.type** | **(0009,1006)** | **3** | **SL** | **1** | **L** |

### B.2.3 GE Discovery LS PET Exam Module

**TABLE 2.4-3**

**GE DISCOVERY LS PET EXAM MODULE PRIVATE ELEMENTS**
**PRIVATE CREATOR IDENTIFICATION (GEMS_ PETD_01)**

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Type |
|---|---|---|---|---|---|
| GE Discovery LS PET Exam.exam_id | (0009,1007) | 3 | UI | 1 | 64A |
| GE Discovery LS PET Exam.compatible_version | (0009,1008) | 3 | SH | 1 | 5A |
| GE Discovery LS PET Exam.software_version | (0009,1009) | 3 | SH | 1 | 5A |

### B.2.4 GE Discovery LS PET Scan Module

**TABLE 2.4-4**

**GE DISCOVERY LS PET SCAN MODULE PRIVATE ELEMENTS**
**PRIVATE CREATOR IDENTIFICATION (GEMS_ PETD_01)**

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Type |
|---|---|---|---|---|---|
| GE Discovery LS PET Scan.scan_id | (0009,100A) | 3 | UI | 1 | 64A |
| GE Discovery LS PET Scan.compatible_version | (0009,100B) | 3 | SH | 1 | 5A |
| GE Discovery LS PET Scan.software_version | (0009,100C) | 3 | SH | 1 | 5A |
| GE Discovery LS PET Scan.scan_datetime | (0009,100D) | 3 | DT | 1 | D |
| GE Discovery LS PET Scan.scan_ready | (0009,100E) | 3 | DT | 1 | D |
| GE Discovery LS PET Scan.scan_description | (0009,100F) | 3 | UI | 1 | 64A |
| GE Discovery LS PET Scan.hospital_name | (0009,1010) | 3 | LO | 1 | 32A |
| GE Discovery LS PET Scan.scanner_desc | (0009,1011) | 3 | LO | 1 | 32A |
| GE Discovery LS PET Scan.manufacturer | (0009,1012) | 3 | LO | 1 | 64A |
| GE Discovery LS PET Scan.for_identifier | (0009,1013) | 3 | UI | 1 | 64A |
| GE Discovery LS PET Scan.landmark_name | (0009,1014) | 3 | LO | 1 | 64A |
| GE Discovery LS PET Scan.landmark_abbrev | (0009,1015) | 3 | SH | 1 | 2A |
| GE Discovery LS PET | (0009,1016) | 3 | SL | 1 | L |

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Type |
|---|---|---|---|---|---|
| **Scan.patient_position** | | | | | |
| **GE Discovery LS PET Scan.scan_perspective** | **(0009,1017)** | **3** | **SL** | **1** | **L** |
| **GE Discovery LS PET Scan.scan_type** | **(0009,1018)** | **3** | **SL** | **1** | **L** |
| **GE Discovery LS PET Scan.scan_mode** | **(0009,1019)** | **3** | **SL** | **1** | **L** |
| **GE Discovery LS PET Scan.start_condition** | **(0009,101A)** | **3** | **SL** | **1** | **L** |
| **GE Discovery LS PET Scan.start_cond_data** | **(0009,101B)** | **3** | **SL** | **1** | **L** |
| **GE Discovery LS PET Scan.sel_stop_cond** | **(0009,101C)** | **3** | **SL** | **1** | **L** |
| **GE Discovery LS PET Scan.sel_stop_cond_data** | **(0009,101D)** | **3** | **SL** | **1** | **L** |
| **GE Discovery LS PET Scan.collect_deadtime** | **(0009,101E)** | **3** | **SL** | **1** | **L** |
| **GE Discovery LS PET Scan.collect_singles** | **(0009,101F)** | **3** | **SL** | **1** | **L** |
| **GE Discovery LS PET Scan.collect_countrate** | **(0009,1020)** | **3** | **SL** | **1** | **L** |
| **GE Discovery LS PET Scan.countrate_period** | **(0009,1021)** | **3** | **SL** | **1** | **L** |
| **GE Discovery LS PET Scan.delayed_events** | **(0009,1022)** | **3** | **SL** | **1** | **L** |
| **GE Discovery LS PET Scan.delayed_bias** | **(0009,1023)** | **3** | **SL** | **1** | **L** |
| **GE Discovery LS PET Scan.word_size** | **(0009,1024)** | **3** | **SL** | **1** | **L** |
| **GE Discovery LS PET Scan.axial_acceptance** | **(0009,1025)** | **3** | **SL** | **1** | **L** |
| **GE Discovery LS PET Scan.axial_angle_3d** | **(0009,1026)** | **3** | **SL** | **1** | **L** |
| **GE Discovery LS PET Scan.theta_compression** | **(0009,1027)** | **3** | **SL** | **1** | **L** |
| **GE Discovery LS PET Scan.axial_compression** | **(0009,1028)** | **3** | **SL** | **1** | **L** |
| **GE Discovery LS PET Scan.gantry_tilt_angle** | **(0009,1029)** | **3** | **FL** | **1** | **F** |
| **GE Discovery LS PET Scan.collimation** | **(0009,102A)** | **3** | **SL** | **1** | **L** |
| **GE Discovery LS PET Scan.scan_fov** | **(0009,102B)** | **3** | **SL** | **1** | **L** |
| **GE Discovery LS PET Scan.axial_fov** | **(0009,102C)** | **3** | **SL** | **1** | **L** |
| **GE Discovery LS PET Scan.event_separation** | **(0009,102D)** | **3** | **SL** | **1** | **L** |
| **GE Discovery LS PET Scan.mask_width** | **(0009,102E)** | **3** | **SL** | **1** | **L** |
| **GE Discovery LS PET Scan.binning_mode** | **(0009,102F)** | **3** | **SL** | **1** | **L** |
| **GE Discovery LS PET Scan.trig_rej_method** | **(0009,1030)** | **3** | **SL** | **1** | **L** |

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Type |
|---|---|---|---|---|---|
| GE Discovery LS PET Scan.number_for_reject | (0009,1031) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.lower_reject_limit | (0009,1032) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.upper_reject_limit | (0009,1033) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.triggers_acquired | (0009,1034) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.triggers_rejected | (0009,1035) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.tracer_name | (0009,1036) | 3 | LO | 1 | 40A |
| GE Discovery LS PET Scan.batch_description | (0009,1037) | 3 | LO | 1 | 40A |
| GE Discovery LS PET Scan.tracer_activity | (0009,1038) | 3 | FL | 1 | F |
| GE Discovery LS PET Scan.meas_datetime | (0009,1039) | 3 | DT | 1 | D |
| GE Discovery LS PET Scan.pre_inj_volume | (0009,103A) | 3 | FL | 1 | F |
| GE Discovery LS PET Scan.admin_datetime | (0009,103B) | 3 | DT | 1 | D |
| GE Discovery LS PET Scan.post_inj_activity | (0009,103C) | 3 | FL | 1 | F |
| GE Discovery LS PET Scan.post_inj_datetime | (0009,103D) | 3 | DT | 1 | D |
| GE Discovery LS PET Scan.radionuclide_name | (0009,103E) | 3 | SH | 1 | 6A |
| GE Discovery LS PET Scan.half_life | (0009,103F) | 3 | FL | 1 | F |
| GE Discovery LS PET Scan.positron_fraction | (0009,1040) | 3 | FL | 1 | F |
| GE Discovery LS PET Scan.source1_holder | (0009,1041) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.source1_activity | (0009,1042) | 3 | FL | 1 | F |
| GE Discovery LS PET Scan.source1_meas_dt | (0009,1043) | 3 | DT | 1 | D |
| GE Discovery LS PET Scan.source1_radnuclide | (0009,1044) | 3 | SH | 1 | 6A |
| GE Discovery LS PET Scan.source1_half_life | (0009,1045) | 3 | FL | 1 | F |
| GE Discovery LS PET Scan.source2_holder | (0009,1046) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.source2_activity | (0009,1047) | 3 | FL | 1 | F |
| GE Discovery LS PET | (0009,1048) | 3 | DT | 1 | D |

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Type |
|---|---|---|---|---|---|
| **Scan.source2_meas_dt** | | | | | |
| **GE Discovery LS PET Scan.source2_radnuclide** | **(0009,1049)** | **3** | **SH** | **1** | **6A** |
| **GE Discovery LS PET Scan.source2_half_life** | **(0009,104A)** | **3** | **FL** | **1** | **F** |
| **GE Discovery LS PET Scan.source_speed** | **(0009,104B)** | **3** | **SL** | **1** | **L** |
| **GE Discovery LS PET Scan.source_location** | **(0009,104C)** | **3** | **FL** | **1** | **F** |
| **GE Discovery LS PET Scan.emission_present** | **(0009,104D)** | **3** | **SL** | **1** | **L** |
| **GE Discovery LS PET Scan.lower_axial_acc** | **(0009,104E)** | **3** | **SL** | **1** | **L** |
| **GE Discovery LS PET Scan.upper_axial_acc** | **(0009,104F)** | **3** | **SL** | **1** | **L** |
| **GE Discovery LS PET Scan.lower_coinc_limit** | **(0009,1050)** | **3** | **SL** | **1** | **L** |
| **GE Discovery LS PET Scan.upper_coinc_limit** | **(0009,1051)** | **3** | **SL** | **1** | **L** |
| **GE Discovery LS PET Scan.coinc_delay_offset** | **(0009,1052)** | **3** | **SL** | **1** | **L** |
| **GE Discovery LS PET Scan.coinc_output_mode** | **(0009,1053)** | **3** | **SL** | **1** | **L** |
| **GE Discovery LS PET Scan.upper_energy_limit** | **(0009,1054)** | **3** | **SL** | **1** | **L** |
| **GE Discovery LS PET Scan.lower_energy_limit** | **(0009,1055)** | **3** | **SL** | **1** | **L** |
| **GE Discovery LS PET Scan.normal_cal_id** | **(0009,1056)** | **3** | **UI** | **1** | **64A** |
| **GE Discovery LS PET Scan.normal_2d_cal_id** | **(0009,1057)** | **3** | **UI** | **1** | **64A** |
| **GE Discovery LS PET Scan.blank_cal_id** | **(0009,1058)** | **3** | **UI** | **1** | **64A** |
| **GE Discovery LS PET Scan.wc_cal_id** | **(0009,1059)** | **3** | **UI** | **1** | **64A** |
| **GE Discovery LS PET Scan.derived** | **(0009,105A)** | **3** | **SL** | **1** | **L** |
| **GE Discovery LS PET Scan.contrast_agent** | **(0009,105B)** | **3** | **LO** | **1** | **64A** |
| **GE Discovery LS PET Scan.ctac_conv_scale** | **(0009, 10D1)** | **3** | **LO** | **1** | **64A** |
| **GE Discovery LS PET Scan.vqc_x_axis_trans** | **(0009, 10CB)** | **3** | **FL** | **1** | **F** |
| **GE Discovery LS PET Scan.vqc_x_axis_tilt** | **(0009, 10CC)** | **3** | **FL** | **1** | **F** |
| **GE Discovery LS PET Scan.vqc_y_axis_trans** | **(0009, 10CD)** | **3** | **FL** | **1** | **F** |

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Type |
|---|---|---|---|---|---|
| GE Discovery LS PET Scan.vqc_y_axis_swivel | (0009, 10CE) | 3 | FL | 1 | F |
| GE Discovery LS PET Scan.vqc_z_axis_trans | (0009, 10CF) | 3 | FL | 1 | F |
| GE Discovery LS PET Scan.vqc_z_axis_roll | (0009, 10D0) | 3 | FL | 1 | F |

### B.2.5 GE Discovery LS PET Frame Module

**TABLE 2.4-5**

**GE DISCOVERY LS PET FRAME MODULE PRIVATE ELEMENTS**
**PRIVATE CREATOR IDENTIFICATION (GEMS_ PETD_01)**

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Type |
|---|---|---|---|---|---|
| GE Discovery LS PET Frame.frame_id | (0009,105C) | 3 | UI | 1 | 64A |
| GE Discovery LS PET Frame.scan_id | (0009,105D) | 3 | UI | 1 | 64A |
| GE Discovery LS PET Frame.exam_id | (0009,105E) | 3 | UI | 1 | 64A |
| GE Discovery LS PET Frame.patient_id | (0009,105F) | 3 | LO | 1 | 20A |
| GE Discovery LS PET Frame.compatible_version | (0009,1060) | 3 | SH | 1 | 5A |
| GE Discovery LS PET Frame.software_version | (0009,1061) | 3 | SH | 1 | 5A |
| GE Discovery LS PET Frame.where_is_frame | (0009,1062) | 3 | ST | 1 | 256A |
| GE Discovery LS PET Frame.frame_size | (0009,1063) | 3 | SL | 1 | L |
| GE Discovery LS PET Frame.file_exists | (0009,1064) | 3 | SL | 1 | L |
| GE Discovery LS PET Frame.patient_entry | (0009,1065) | 3 | SL | 1 | L |
| GE Discovery LS PET Frame.table_height | (0009,1066) | 3 | FL | 1 | F |
| GE Discovery LS PET Frame.table_z_position | (0009,1067) | 3 | FL | 1 | F |
| GE Discovery LS PET Frame.landmark_datetime | (0009,1068) | 3 | DT | 1 | D |
| GE Discovery LS PET Frame.slice_count | (0009,1069) | 3 | SL | 1 | L |
| GE Discovery LS PET Frame.start_location | (0009,106A) | 3 | FL | 1 | F |
| GE Discovery LS PET Frame.acq_delay | (0009,106B) | 3 | SL | 1 | L |
| GE Discovery LS PET Frame.acq_start | (0009,106C) | 3 | DT | 1 | D |
| GE Discovery LS PET Frame.acq_duration | (0009,106D) | 3 | SL | 1 | L |

| | | | | | |
|---|---|---|---|---|---|
| GE Discovery LS PET Frame.acq_bin_dur | (0009,106E) | 3 | SL | 1 | L |
| GE Discovery LS PET Frame.acq_bin_start | (0009,106F) | 3 | SL | 1 | L |
| GE Discovery LS PET Frame.actual_stop_cond | (0009,1070) | 3 | SL | 1 | L |
| GE Discovery LS PET Frame.total_prompts | (0009,1071) | 3 | FD | 1 | Dbl |
| GE Discovery LS PET Frame.total_delays | (0009,1072) | 3 | FD | 1 | Dbl |
| GE Discovery LS PET Frame.frame_valid | (0009,1073) | 3 | SL | 1 | L |
| GE Discovery LS PET Frame.validity_info | (0009,1074) | 3 | SL | 1 | L |
| GE Discovery LS PET Frame.archived | (0009,1075) | 3 | SL | 1 | L |
| GE Discovery LS PET Frame.compression | (0009,1076) | 3 | SL | 1 | L |
| GE Discovery LS PET Frame.uncompressed_size | (0009,1077) | 3 | SL | 1 | L |
| GE Discovery LS PET Frame.accum_bin_dur | (0009,1078) | 3 | SL | 1 | L |

### B.2.6 GE Discovery LS PET ImageSet Module

**TABLE 2.4-6**

**GE DISCOVERY LS PET IMAGESET MODULE PRIVATE ELEMENTS**
**PRIVATE CREATOR IDENTIFICATION (GEMS_ PETD_01)**

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Type |
|---|---|---|---|---|---|
| GE Discovery LS PET ImageSet.compatible_version | (0009,1079) | 3 | SH | 1 | 5A |
| GE Discovery LS PET ImageSet.software_version | (0009,107A) | 3 | SH | 1 | 5A |
| GE Discovery LS PET ImageSet.is_datetime | (0009,107B) | 3 | DT | 1 | D |
| GE Discovery LS PET ImageSet.is_source | (0009,107C) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.is_contents | (0009,107D) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.is_type | (0009,107E) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.is_reference | (0009,107F) | 3 | FL | 3 | F |
| GE Discovery LS PET ImageSet.multi_patient | (0009,1080) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.number_of_normals | (0009,1081) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.color_map_id | (0009,1082) | 3 | UI | 1 | 64A |

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Type |
|---|---|---|---|---|---|
| GE Discovery LS PET ImageSet.window_level_type | (0009,1083) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.rotate | (0009,1084) | 3 | FL | 1 | F |
| GE Discovery LS PET ImageSet.flip | (0009,1085) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.zoom | (0009,1086) | 3 | FL | 1 | F |
| GE Discovery LS PET ImageSet.pan_x | (0009,1087) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.pan_y | (0009,1088) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.window_level_min | (0009,1089) | 3 | FL | 1 | F |
| GE Discovery LS PET ImageSet.window_level_max | (0009,108A) | 3 | FL | 1 | F |
| GE Discovery LS PET ImageSet.recon_method | (0009,108B) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.attenuation | (0009,108C) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.atten_coefficient | (0009,108D) | 3 | FL | 1 | F |
| GE Discovery LS PET ImageSet.bp_filter | (0009,108E) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.bp_filter_cutoff | (0009,108F) | 3 | FL | 1 | F |
| GE Discovery LS PET ImageSet.bp_filter_order | (0009,1090) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.bp_center_l | (0009,1091) | 3 | FL | 1 | F |
| GE Discovery LS PET ImageSet.bp_center_p | (0009,1092) | 3 | FL | 1 | F |
| GE Discovery LS PET ImageSet.atten_smooth | (0009,1093) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.atten_smooth_param | (0009,1094) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.angle_smooth_param | (0009,1095) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.wellcountercal_id | (0009,1096) | 3 | UI | 1 | 64A |
| GE Discovery LS PET ImageSet.trans_scan_id | (0009,1097) | 3 | UI | 1 | 64A |
| GE Discovery LS PET ImageSet.norm_cal_id | (0009,1098) | 3 | UI | 1 | 64A |
| GE Discovery LS PET ImageSet.blnk_cal_id | (0009,1099) | 3 | UI | 1 | 64A |
| GE Discovery LS PET | (0009,109A) | 3 | FL | 1 | F |

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Type |
|---|---|---|---|---|---|
| ImageSet.cac_edge_threshold | | | | | |
| GE Discovery LS PET ImageSet.cac_skull_offset | (0009,109B) | 3 | FL | 1 | F |
| GE Discovery LS PET ImageSet.emiss_sub_id | (0009,109C) | 3 | UI | 1 | 64A |
| GE Discovery LS PET ImageSet.radial_filter_3d | (0009,109D) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.radial_cutoff_3d | (0009,109E) | 3 | FL | 1 | F |
| GE Discovery LS PET ImageSet.axial_filter_3d | (0009,109F) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.axial_cutoff_3d | (0009,10A0) | 3 | FL | 1 | F |
| GE Discovery LS PET ImageSet.axial_start | (0009,10A1) | 3 | FL | 1 | F |
| GE Discovery LS PET ImageSet.axial_spacing | (0009,10A2) | 3 | FL | 1 | F |
| GE Discovery LS PET ImageSet.axial_angles_used | (0009,10A3) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.ir_num_iterations | (0009,10B2) | 3 | SL | 1 | F |
| GE Discovery LS PET ImageSet.ir_num_subsets | (0009,10B3) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.ir_recon_fov | (0009,10B4) | 3 | FL | 1 | F |
| GE Discovery LS PET ImageSet.ir_corr_model | (0009,10B5) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.ir_loop_filter | (0009,10B6) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.ir_pre_filt_parm | (0009,10B7) | 3 | FL | 1 | F |
| GE Discovery LS PET ImageSet.ir_loop_filt_parm | (0009,10B8) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.response_filt_parm | (0009,10B9) | 3 | FL | 1 | F |
| GE Discovery LS PET ImageSet.post_filter | (0009,10BA) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.post_filt_parm | (0009,10BB) | 3 | FL | 1 | F |
| GE Discovery LS PET ImageSet.ir_regularize | (0009,10BC) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.regularize_parm | (0009,10BD) | 3 | FL | 1 | F |

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Type |
|---|---|---|---|---|---|
| GE Discovery LS PET ImageSet.ac_bp_filter | (0009,10BE) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.ac_bp_filt_cut_off | (0009,10BF) | 3 | FL | 1 | F |
| GE Discovery LS PET ImageSet.ac_bp_filt_order | (0009,10C0) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.ac_img_smooth | (0009,10C1) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.ac_img_smooth_parm | (0009,10C2) | 3 | FL | 1 | F |
| GE Discovery LS PET ImageSet.scatter_method | (0009,10C3) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.scatter_num_iter | (0009,10C4) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.scatter_parm | (0009,10C5) | 3 | FL | 1 | F |
| GE Discovery LS PET imageset.ctac_conv_scale | (0009, 10D4) | 3 | LO | 1 | L |

### B.2.7 GE Discovery LS PET Image Module

**TABLE 2.4-7**

**GE DISCOVERY LS PET IMAGE MODULE PRIVATE ELEMENTS**
**PRIVATE CREATOR IDENTIFICATION (GEMS_ PETD_01)**

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Type |
|---|---|---|---|---|---|
| GE Discovery LS PET Image.compatible_version | (0009,10A4) | 3 | SH | 1 | 5A |
| GE Discovery LS PET Image.software_version | (0009,10A5) | 3 | SH | 1 | 5A |
| GE Discovery LS PET Image.slice_number | (0009,10A6) | 3 | SL | 1 | L |
| GE Discovery LS PET Image.total_counts | (0009,10A7) | 3 | FL | 1 | F |
| GE Discovery LS PET Image.other_atts | (0009,10A8) | 3 | OB | 1 | Bt |
| GE Discovery LS PET Image.other_atts_size | (0009,10A9) | 3 | SL | 1 | L |
| GE Discovery LS PET Image.archived | (0009,10AA) | 3 | SL | 1 | L |
| GE Discovery LS PET Image.bp_center_x | (0009,10AB) | 3 | FL | 1 | F |
| GE Discovery LS PET Image.bp_center_y | (0009,10AC) | 3 | FL | 1 | F |
| GE Discovery LS PET Image.trans_frame_id | (0009,10AD) | 3 | UI | 1 | 64A |

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Type |
|---|---|---|---|---|---|
| **GE Discovery LS PET Image.tpluse_frame_id** | **(0009,10AE)** | **3** | **UI** | **1** | **64A** |
| **GE Discovery LS PET Image.seg_qc_parm** | **(0009,10C6)** | **3** | **FL** | **1** | **F** |
| **GE Discovery LS PET Image.overlap** | **(0009,10C7)** | **3** | **SL** | **1** | **L** |
| **GE Discovery LS PET Image.ovlp_frm_id** | **(0009,10C8)** | **3** | **UI** | **1** | **64A** |
| **GE Discovery LS PET Image.ovlp_trans_frm_id** | **(0009,10C9)** | **3** | **UI** | **1** | **64A** |
| **GE Discovery LS PET Image.ovlp_tpulse_frm_id** | **(0009,10CA)** | **3** | **UI** | **1** | **64A** |

### B.2.8 GE Discovery LS PET ROI Module

**TABLE 2.4-8**

**GE DISCOVERY LS PET ROI MODULE PRIVATE ELEMENTS**
**PRIVATE CREATOR IDENTIFICATION (GEMS_ PETD_01)**

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Type |
|---|---|---|---|---|---|
| **Private Creator Data Element** | **(0011,0010)** | **1** | **SH** | **1** | **n/a** |
| **GE Discovery LS PET ROI Sequence** | **(0011,1001)** | **3** | **SQ** | **1** | n/a |
| **> GE Discovery LS PET ROI.roi_id** | **(0011,1002)** | **3** | **UI** | **1** | 64A |
| > GE Discovery LS PET ROI.image_id | **(0011,1003)** | **3** | **UI** | **1** | 64A |
| > GE Discovery LS PET ROI.compatible_version | **(0011,1004)** | **3** | **SH** | **1** | 5A |
| > GE Discovery LS PET ROI.software_version | **(0011,1005)** | **3** | **SH** | **1** | 5A |
| > GE Discovery LS PET ROI.roi_name | **(0011,1006)** | **3** | **LO** | **1** | 32A |
| > GE Discovery LS PET ROI.roi_datetime | **(0011,1007)** | **3** | **DT** | **1** | D |
| > GE Discovery LS PET ROI.roi_type | **(0011,1008)** | **3** | **SL** | **1** | L |
| > GE Discovery LS PET ROI.center_x | **(0011,1009)** | **3** | **FL** | **1** | F |
| > GE Discovery LS PET ROI.center_y | **(0011,100A)** | **3** | **FL** | **1** | F |
| > GE Discovery LS PET ROI.width | **(0011,100B)** | **3** | **FL** | **1** | F |
| > GE Discovery LS PET ROI.height | **(0011,100C)** | **3** | **FL** | **1** | F |
| > GE Discovery LS PET ROI.angle | **(0011,100D)** | **3** | **FL** | **1** | F |
| > GE Discovery LS PET ROI.number_of_points | **(0011,100E)** | **3** | **SL** | **1** | L |
| > GE Discovery LS PET ROI.roi_data | **(0011,100F)** | **3** | **OB** | **1** | Bt |
| > GE Discovery LS PET ROI.roi_size | **(0011,1010)** | **3** | **SL** | **1** | L |
| > GE Discovery LS PET ROI.color | **(0011,1011)** | **3** | **LO** | **1** | 20A |
| > GE Discovery LS PET ROI.line_type | **(0011,1012)** | **3** | **SL** | **1** | L |

| | | | | | |
|---|---|---|---|---|---|
| > GE Discovery LS PET ROI.line_width | **(0011,1013)** | **3** | **SL** | **1** | L |
| > GE Discovery LS PET ROI.roi_number | **(0011,1014)** | **3** | **SL** | **1** | L |
| > GE Discovery LS PET ROI.convex | **(0011,1015)** | **3** | **SL** | **1** | L |
| > GE Discovery LS PET ROI.atten_corr_flag | **(0011,1016)** | **3** | **SL** | **1** | L |

### B.2.9 GE Discovery LS PET Annotation Module

**TABLE 2.4-9**

**GE DISCOVERY LS PET ANNOTATION MODULE PRIVATE ELEMENTS**
**PRIVATE CREATOR IDENTIFICATION (GEMS_ PETD_01)**

| **Attribute Name** | Tag | Type | VR | VM | **GE Discovery LS PET Type** |
|---|---|---|---|---|---|
| **Private Creator Data Element** | **(0013,0010)** | **1** | **SH** | **1** | **n/a** |
| **GE Discovery LS PET Annotation Sequence** | **(0013,1001)** | **3** | **SQ** | **1** | n/a |
| **> GE Discovery LS PET Annotation.annotation_id** | **(0013,1002)** | **3** | **UI** | **1** | 64A |
| > GE Discovery LS PET Annotation.image_id | **(0013,1003)** | **3** | **UI** | **1** | 64A |
| > GE Discovery LS PET Annotation.compatible_version | **(0013,1004)** | **3** | **SH** | **1** | 5A |
| > GE Discovery LS PET Annotation.software_version | **(0013,1005)** | **3** | **SH** | **1** | 5A |
| > GE Discovery LS PET Annotation.type | **(0013,1006)** | **3** | **SL** | **1** | L |
| > GE Discovery LS PET Annotation.font_name | **(0013,1007)** | **3** | **LO** | **1** | 32A |
| > GE Discovery LS PET Annotation.font_size | **(0013,1008)** | **3** | **SH** | **1** | 2A |
| > GE Discovery LS PET Annotation.foreground_color | **(0013,1009)** | **3** | **LO** | **1** | 20A |
| > GE Discovery LS PET Annotation.background_color | **(0013,100A)** | **3** | **LO** | **1** | 20A |
| > GE Discovery LS PET Annotation.coordinate_system | **(0013,100B)** | **3** | **SL** | **1** | L |
| > GE Discovery LS PET Annotation.start_x | **(0013,100C)** | **3** | **FL** | **1** | F |
| > GE Discovery LS PET Annotation.start_y | **(0013,100D)** | **3** | **FL** | **1** | F |
| > GE Discovery LS PET Annotation.end_x | **(0013,100E)** | **3** | **FL** | **1** | F |
| > GE Discovery LS PET Annotation.end_y | **(0013,100F)** | **3** | **FL** | **1** | F |
| > GE Discovery LS PET Annotation.start_symbol | **(0013,1010)** | **3** | **SL** | **1** | L |
| > GE Discovery LS PET Annotation.end_symbol | **(0013,1011)** | **3** | **SL** | **1** | L |
| > GE Discovery LS PET Annotation.annotation_data | **(0013,1012)** | **3** | **OB** | **1** | Bt |
| > GE Discovery LS PET Annotation.annotation_size | **(0013,1013)** | **3** | **SL** | **1** | L |

| | | | | | |
|---|---|---|---|---|---|
| > GE Discovery LS PET Annotation.label_id | **(0013,1014)** | **3** | **LO** | **1** | 64A |

### B.3 Private Data Elements

Enclosed is a listing of private data elements used in this implementation for CT/MR Image IOD definition.

# C DICOMDIR Directory Information

Enclosed here is a listing of only the optional (conditional) modules and optional attributes used by this implementation in the DICOMDIR definition. All standard attributes as defined in Part 3 Addendum (Basic Directory Information Object) are supported by this implementation but not listed here.

### C.1 Basic Directory IOD Definition

| Module | Reference | Usage | Notes |
|---|---|---|---|
| Directory Information | B.X.3.2.1 (DICOM PS3.10) | U | |

### C.2 Directory Information Module

| Attribute Name | Tag | Type | Notes |
|---|---|---|---|
| Offset of the Next Directory Record | (0004,1400) | 1C | |
| Record In-use Flag | (0004,1410) | 1C | |
| Offset of Referenced Lower-Level Directory Entity | (0004,1420) | 1C | |
| Directory Record Type | (0004,1430) | 1C | PATIENT, STUDY, SERIES and IMAGE |
| Referenced File ID | (0004,1500) | 1C | Present only in IMAGE Directory Record |
| Referenced SOP Class UID in file | (0004,1510) | 1C | Present only in IMAGE Directory Record |
| Referenced SOP Instance UID in File | (0004,1511) | 1C | Present only in IMAGE Directory Record |
| Referenced Transfer Syntax UID in File | (0004,1512) | 1C | Present only in IMAGE Directory Record |

### C.3 Directory Record Selection Keys

As indicated in table C.1.2, the PRI-CTMR-MOD12 application profile will have only the Patient, Study, Series and Image directory record types. Given below are the list of attributes supported under each of these directories.

### C.3.1 Patient Keys

| Attribute Name | Tag | Type | Notes |
|---|---|---|---|
| Specific Character Set | (0008,0005) | 1C | ISO_IR 100 |
| Patient's Name | (0010,0010) | 2 | |
| Patient ID | (0010,0020) | 1 | |

### C.3.2 Study Keys

| Attribute Name | Tag | Type | Notes |
|---|---|---|---|
| Specific Character Set | (0008,0005) | 1C | ISO_IR 100 |
| Study Date | (0008,0020) | 1 | |
| Study Time | (0008,0030) | 1 | |
| Accession Number | (0008,0050) | 2 | |
| Study Description | (0008,1030) | 2 | |
| Study Instance UID | (0020,000D) | 1C | |
| Study ID | (0020,0010) | 1 | |

### C.3.3 Series Keys

| Attribute Name | Tag | Type | Notes |
|---|---|---|---|
| Specific Character Set | (0008,0005) | 1C | ISO_IR 100 |
| Image Type | (0008,0008) | 3 | |
| Modality | (0008,0060) | 1 | |
| Manufacturer's Id | (0008,0070) | 3 | |
| Series Description | (0008,103E) | 3 | |
| Manuf. Model Name | (0008,1090) | 3 | |
| Series Instance UID | (0020,000E) | 1 | |
| Series Number | (0020,0011) | 1 | |

### C.3.4 Image Keys

| Attribute Name | Tag | Type | Notes |
|---|---|---|---|
| Specific Character Set | (0008,0005) | 1C | ISO_IR 100 |
| SOP Instance UID | (0008,0018) | 3 | Redundant to (0004,1511) |
| Referenced Image Sequence | (0008,1140) | 1C | Not included. |
| Sequence Variant | (0018,0021) | 3 | |
| Slice Thickness | (0018,0050) | 3 | |
| Repetition Time | (0018,0080) | 3 | |
| Echo Time | (0018,0081) | 3 | |
| Inversion Time | (0018,0082) | 3 | |
| Number of Averages | (0018,0083) | 3 | |
| Echo Number | (0018,0086) | 3 | MRI profile only. |
| Spacing Between Slices | (0018,0088) | 3 | |
| Data Collection Diameter | (0018,0090) | 3 | |
| Contrast/Bolus Route | (0018,1040) | 3 | |
| Trigger Time | (0018,1060) | 3 | |
| Reconstruction Diameter | (0018,1100) | 3 | |

| | | | |
|---|---|---|---|
| Gantry/Detector Tilt | (0018,1120) | 3 | |
| Convolution Kernel | (0018,1210) | 3 | |
| Flip Angle | (0018,1314) | 3 | |
| Image Number | (0020,0013) | 1 | |
| Image Position (Patient) | (0020,0032) | 1C | |
| Image Orientation (Patient) | (0020,0037) | 1C | |
| Frame of Reference UID | (0020,0052) | 1C | Absent from PRI-CTMR-MOD12 |
| Slice Location | (0020,1041) | 3 | |
| Samples Per Pixel | (0028,0002) | R | |
| Photometric Interpretation | (0028,0004) | R | Absent from all profiles. |
| Rows | (0028,0010) | 1 | |
| Columns | (0028,0011) | 1 | |
| Pixel Spacing | (0028,0030) | 1C | |
| Bits Allocated | (0028,0100) | R | |
| Bits Stored | (0028,0101) | R | MRI – Absent from profiles. |
| High Bit | (0028,0102) | R | MRI – Absent from profiles. |

# D Standalone PET curve INFORMATION OBJECT IMPLEMENTATION

## D.1 introduction

This section specifies the use of the DICOM Standalone PET Curve IOD (referred to as the PET Curve IOD in other parts of this section) to represent the information included in PET curves produced by this implementation. Corresponding attributes are conveyed using the module construct. The contents of this section are:

D.2- IOD Description

D.3- IOD Entity-Relationship Model

D.4- IOD Module Table

D.5- IOD Module Definition

## D.2 PET Curve IOD Implementation

The GE Discovery LS PET AE implementation of DICOM uses the PET Curve format when creating curve objects. In order to preserve full fidelity when transferring data to a GE Discovery LS PET AE workstation, some specialized database information is encoded as private DICOM attributes. All of the Standard and private attributes used are defined in the module tables. The GE Discovery LS PET AE private data dictionary is included in Section D.6. Nevertheless, the GE Discovery LS PET AE is able to process PET DICOM curves without any private data elements.

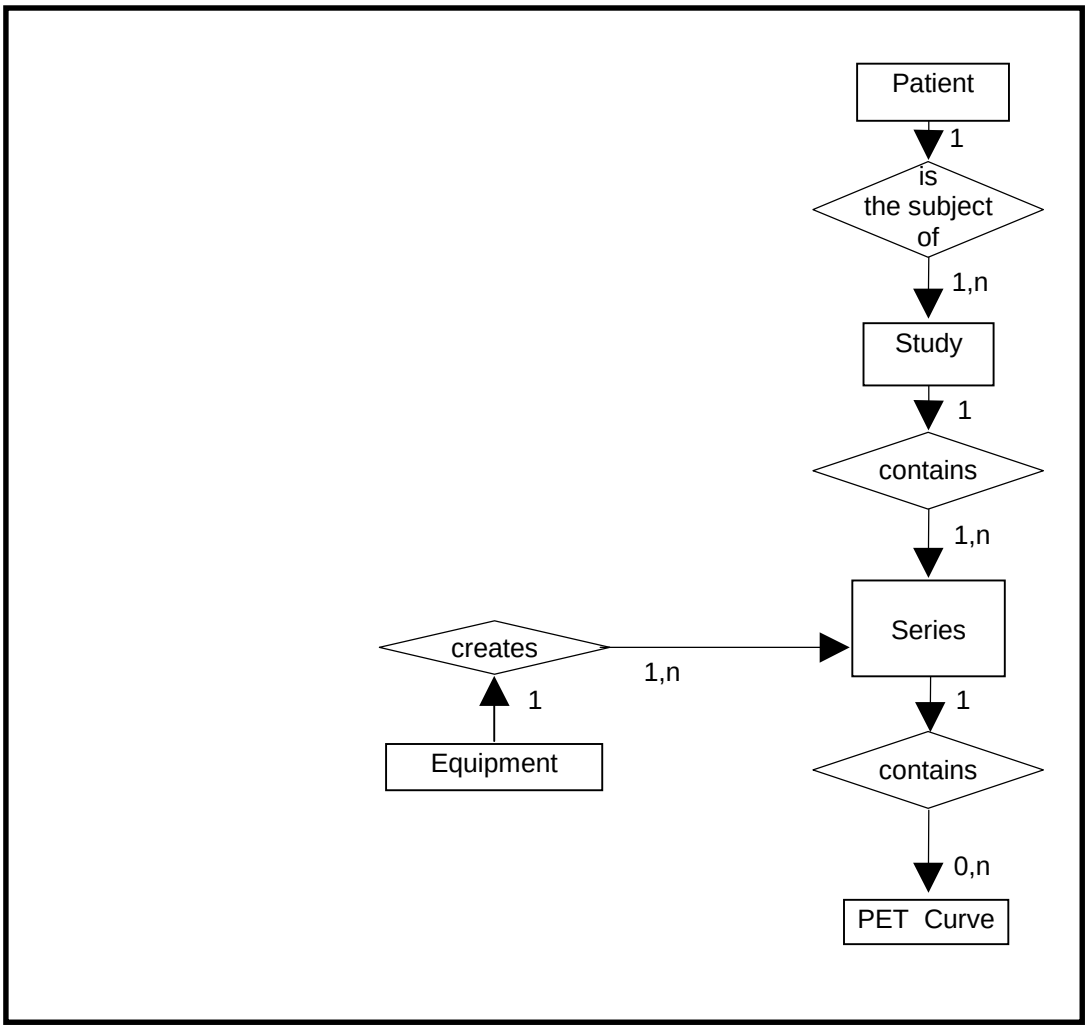
## D.3 PET curve Entity-Relationship Model

The Entity-Relationship diagram for the PET Curve interoperability schema is shown in **Illustration 6-1 .** In this figure, the following diagrammatic convention is established to represent the information organization:

- each entity is represented by a rectangular box
- each relationship is represented by a diamond shaped box.
- the fact that a relationship exists between two entities is depicted by lines connecting the corresponding entity boxes to the relationship boxes.

The relationships are fully defined with the maximum number of possible entities in the relationship shown. In other words, the relationship between Series and Curve can have up to n Curves per Series, but the Patient to Study relationship has 1 Study for each Patient (a Patient can have more than one Study on the system, however each Study will contain all of the information pertaining to that Patient).

**ILLUSTRATION 6-1**
**PET CURVE ENTITY RELATIONSHIP DIAGRAM**




### D.3.1 ENTITY DESCRIPTIONS

Please refer to DICOM Standard Part 3 (Information Object Definitions) for a description of each of the entities contained within the PET Information Object.

#### D.3.1.1 Patient Entity Description

The Patient Entity defines the characteristics of a patient who is the subject of one or more medical studies which produce medical images.

#### D.3.1.2 Study Entity Description

The Study Entity defines the characteristics of a medical study performed on a patient. A study is a collection of one or more series of medical images which are logically related for the purpose of diagnosing a patient. Each study is associated with exactly one patient.

### D.3.1.3 Series Entity Description

The Series Entity defines the attributes which are used to group images into distinct logical sets. Each series is associated with exactly one study.

### D.3.1.4 Equipment Entity Description

The Equipment Entity describes the particular imaging device which produced the series of images. An imaging device may produce one or more series within a study. The Equipment Entity does not describe the data acquisition or image creation Attributes used to generate images within a series.

### D.3.1.5 PET Curve Entity Description

The PET Curve Entity defines the attributes which describe the curve data of a PET curve.

### D.3.2 GE Discovery LS PET AE Mapping of DICOM entities

**TABLE 2.4-1**
**MAPPING OF DICOM ENTITIES TO DISCOVERY LS PET ENTITIES**

| DICOM | *Discovery LS PET* Entity |
|---|---|
| Patient | Patient |
| Study | Exam |
| Series | Imageset |
| Curve | Curve, Graph, Curve Presentation |

## D.4 PET CURVE IOD MODULE TABLE

Within an entity of the DICOM PET IOD, attributes are grouped into related set of attributes. A set of related attributes is termed a module. A module facilitates the understanding of the semantics concerning the attributes and how the attributes are related with each other. A module grouping does not infer any encoding of information into datasets.
**Table 2.4-1** identifies the defined modules within the entities which comprise the DICOM PET IOD. Modules are identified by Module Name.
See DICOM Part 3 for a complete definition of the entities, modules, and attributes.

**TABLE 2.4-1**
**PET CURVE IOD MODULES**

| Entity Name | Module Name | Reference |
|---|---|---|
| Patient | Patient | D.5.1.1 |
| | GE Discovery LS PET Patient | D.5.1.2 |
| Study | General Study | D.5.2.1 |
| | Patient Study | D.5.2.2 |
| | GE Discovery LS PET Exam | D.5.2.3 |
| Series | General Series | D.5.3.1 |
| | PET Series | D.5.3.2 |
| | PET Isotope | D.5.3.3 |
| | PET Multi-gated Acquisition | D.5.3.4 |
| | GE Discovery LS PET Imageset | D.5.3.5 |
| | GE Discovery LS PET Scan | D.5.3.6 |
| Equipment | General Equipment | D.5.4.1 |
| Curve | Curve Identification | D.5.5.1 |
| | Curve | D.5.5.2 |
| | PET Curve | D.5.5.3 |
| | GE Discovery LS PET Curve | D.5.5.4 |
| | GE Discovery LS PET Graph | D.5.5.5 |
| | GE Discovery LS PET Curve Presentation | D.5.5.6 |
| General Modules | SOP Common | D.5.6.1 |

## D.5 PET CURVE INFORMATION MODULE DEFINITIONS

Please refer to DICOM Standard Part 3 (Information Object Definitions) for a description of each of the entities and modules contained within the PET Information Object.
The following modules are included to convey Enumerated Values, Defined Terms, and Optional Attributes supported. Type 1 & Type 2 Attributes are also included for completeness and to define what values they may take and where these values are obtained from. It should be noted that they are the same ones as defined in the DICOM Standard Part 3 (Information Object Definitions).

### D.5.1 Common Patient Entity Modules

#### D.5.1.1 Patient Module

This section specifies the Attributes of the Patient that describe and identify the Patient who is the subject of a diagnostic Study. This Module contains Attributes of the patient that are needed for diagnostic interpretation of the Image and are common for all studies performed on the patient.

**TABLE 2.4-1**
**PATIENT MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Attribute (Discovery LS PET Patient table unless otherwise specified) | Notes |
|---|---|---|---|---|---|---|
| **Patient's Name** | **(0010,0010)** | **2** | **PN (64)** | **1** | **patient_name** | |
| **Patient ID** | **(0010,0020)** | **2** | **LO (64)** | **1** | **patient_identifier** | |
| **Patient's Birth Date** | **(0010,0030)** | **2** | **DA (26)** | **1** | **birthdate** | |
| **Patient's Sex** | **(0010,0040)** | **2** | **CS (16)** | **1** | **sex** | |
| **Referenced Patient Sequence** | **(0008,1120)** | **3** | **SQ** | **1** | **Not Used** | |
| **>Referenced SOP Class UID** | **(0008,1150)** | **1C** | **UI** | **1** | **Not Used** | |
| **>Referenced SOP Instance UID** | **(0008,1155)** | **1C** | **UI** | **1** | **Not Used** | |
| **Patient's Birth Time** | **(0010,0032)** | **3** | **TM** | **1** | **Not Used** | |
| **Other Patient IDs** | **(0010,1000)** | **3** | **LO** | **1-n** | **Not Used** | |
| **Other Patient Names** | **(0010,1001)** | **3** | **PN** | **1-n** | **Not Used** | |
| **Ethnic Group** | **(0010,2160)** | **3** | **SH** | **1** | **Not Used** | |
| **Patient Comments** | **(0010,4000)** | **3** | **LT** | **1** | **Not Used** | |

### D.5.1.2 GE Discovery LS PET Patient

Refer to Section D.6.2 for details.

### D.5.2 Common Study Entity Modules

The following Study IE Modules are common to all Composite Image IODs which reference the Study IE. These Module contain Attributes of the patient and study that are needed for diagnostic interpretation of the image.

### D.5.2.1 General Study Module

This section specifies the Attributes which describe and identify the Study performed upon the Patient.

**TABLE 2.4-2**
**GENERAL STUDY MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Attribute (GE Discovery LS PET Exam table unless otherwise specified) | Notes |
|---|---|---|---|---|---|---|
| **Study Instance UID** | **(0020,000 D)** | **1** | **UI** | **1** | **study_uid** | |
| **Study Date** | **(0008,0020 )** | **2** | **DA** | **1** | **extract date from exam_datetime** | |
| **Study Time** | **(0008,0030 )** | **2** | **TM** | **1** | **extract time exam_datetime** | |
| **Referring Physician's Name** | **(0008,0090 )** | **2** | **PN** | **1** | **ref_physician** | |
| **Study ID** | **(0020,0010 )** | **2** | **SH** | **1** | **study_identifier** | |
| **Accession Number** | **(0008,0050 )** | **2** | **SH** | **1** | **requisition** | |
| **Study Description** | **(0008,1030 )** | **3** | **LO** | **1** | **exam_desc** | |
| **Physician(s) of Record** | **(0008,1048 )** | **3** | **PN** | **1-n** | Not Used | |
| **Name of Physician(s) Reading Study** | **(0008,1060 )** | **3** | **PN** | **1-n** | **diagnostician** | |
| **Referenced Study Sequence** | **(0008,1110 )** | **3** | **SQ** | **1** | Not Used | |
| **> Referenced SOP Class UID** | **(0008,1150 )** | **1C** | **UI** | **1** | Not Used | |
| **> Referenced SOP Instance UID** | **(0008,1155 )** | **1C** | **UI** | **1** | Not Used | |

### D.5.2.2 Patient Study Module

This section defines Attributes that provide information about the Patient at the time the Study was performed.

**TABLE 2.4-3**
**PATIENT STUDY MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Attribute (GE Discovery LS PET Exam table unless otherwise specified) | Notes |
|---|---|---|---|---|---|---|

| | | | | | | |
|---|---|---|---|---|---|---|
| **Admitting Diagnosis Description** | **(0008,1080)** | **3** | **LO** | **1-n** | **Not Used** | |
| **Patient's Age** | **(0010,1010)** | **3** | **AS** | **1** | **truncate years from (Exam.exam_datetime - Patient.patient_birthdate)** | |
| **Patient's Size** | **(0010,1020)** | **3** | **DS** | **1** | **patient_ht / 100.0 (convert cm to m)** | |
| **Patient's Weight** | **(0010,1030)** | **3** | **DS** | **1** | **patient_wt** | |
| **Occupation** | **(0010,2180)** | **3** | **SH** | **1** | **Not Used** | |
| **Additional Patient's History** | **(0010,21B0)** | **3** | **LT** | **1** | **patient_history** | |

### D.5.2.3 GE Discovery LS PET Exam Module

Refer to Section D.6.3 for details.

### D.5.3 Common Series Entity Modules

The following Series IE Modules are common to all Composite Image IODs which reference the Series IE.

### D.5.3.1 General Series Module

This section specifies the Attributes which identify and describe general information about the Series within a Study.

**TABLE 2.4-4**
**GENERAL SERIES MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Attribute (GE Discovery LS PET ImageSet table unless otherwise specified) | Notes |
|---|---|---|---|---|---|---|
| **Modality** | **(0008,0060)** | **1** | **CS** | **1** | **Imageset.modality** | |
| **Series Instance UID** | **(0020,000E)** | **1** | **UI** | **1** | **IF (SOP Class UID == "1.2.840.113619.4.30") THEN = Scan.scan_id ELSE = image_set_id** | |
| **Series Number** | **(0020,0011)** | **2** | **IS** | **1** | **series_number** | |
| **Laterality** | **(0020,0060)** | **2C** | **CS** | **1** | **Not Used** | |
| **Series Date** | **(0008,0021)** | **3** | **DA** | **1** | **superceded by PET Series.Series Date (0008,0021)** | |

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Attribute (GE Discovery LS PET ImageSet table unless otherwise specified) | Notes |
|---|---|---|---|---|---|---|
| **Series Time** | **(0008,0031)** | **3** | **TM** | **1** | **superceded by PET Series.Series Time (0008,0031)** | |
| **Performing Physician's Name** | **(0008,1050)** | **3** | **PN** | **1-n** | **Not Used** | |
| **Protocol Name** | **(0018,1030)** | **3** | **LO** | **1** | **Not Used** | |
| **Series Description** | **(0008,103E)** | **3** | **LO** | **1** | **IF (SOP Class UID == "1.2.840.113619.4.30") THEN = Scan.scan_description ELSE = is_description** | |
| **Operators' Name** | **(0008,1070)** | **3** | **PN** | **1-n** | **Exam.operator** | |
| **Referenced Study Component Sequence** | **(0008,1111)** | **3** | **SQ** | **1** | **Not Used** | |
| **> Referenced SOP Class UID** | **(0008,1150)** | **1C** | **UI** | **1** | **Not Used** | |
| **> Referenced SOP Instance UID** | **(0008,1155)** | **1C** | **UI** | **1** | **Not Used** | |
| **Body Part Examined** | **(0018,0015)** | **3** | **CS** | **1** | **Not Used** | |
| **Patient Position** | **(0018,5100)** | **2C** | **CS** | **1** | **Scan.patient_position, Frame.patient_entry** | |
| **Smallest Pixel Value in Series** | **(0028,0108)** | **3** | **US/SS** | **1** | **Not Used** | |
| **Largest Pixel Value in Series** | **(0028,0109)** | **3** | **US/SS** | **1** | **Not Used** | |

### D.5.3.2 PET Series Module

**TABLE 2.4-5**
**PET SERIES MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Attribute (GE Discovery LS PET ImageSet table unless otherwise specified) | Notes |
|---|---|---|---|---|---|---|
| **Series Date** | **(0008,0021)** | **1** | **DA** | **1** | **extract date from Scan.scan_datetime** | |
| **Series Time** | **(0008,0031)** | **1** | **TM** | **1** | **extract time from Scan.scan_datetime** | |
| **Counts Source** | **(0054,1002)** | **1** | **CS** | **1** | **Scan.scan_type** | |

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Attribute (GE Discovery LS PET ImageSet table unless otherwise specified) | Notes |
|---|---|---|---|---|---|---|
| **Units** | **(0054,1001)** | **1** | **CS** | **1** | **units** | |
| **Series Type** | **(0054,1000)** | **1** | **CS** | **2** | **is_contents Scan.scan_mode** | |
| **Reprojection Method** | **(0054,1004)** | **2C** | **CS** | **1** | **is_contents** | |
| **Number of R-R Intervals** | **(0054,0061)** | **1C** | **US** | **1** | **IF (Scan.scan_mode == [ gated ] ) THEN Count the unique image.image_bin_time for images with Image.image_set_id = thisSOPInstance.ImageSetID ELSE = NULL** | |
| **Number of Time Slots** | **(0054,0071)** | **1C** | **US** | **1** | **IF (Scan.scan_mode == [ gated ] ) THEN = 1 ELSE = NULL** | |
| **Number of Time Slices** | **(0054,0101)** | **1C** | **US** | **1** | **Count the unique image.image_time for images with Image.image_set_id = thisSOPInstance.ImageSetID** | |
| **Number of Slices** | **(0054,0081)** | **1** | **US** | **1** | **Count the unique image.image_location for images with Image.image_set_id = thisSOPInstance.ImageSetID** | |
| **Corrected Image** | **(0028,0051)** | **2** | **CS** | **1-n** | **many** | |
| **Randoms Correction Method** | **(0054,1100)** | **3** | **CS** | **1** | **IF (Scan.scan_type = [ emission ] THEN TR 14: emiss_randoms trans_randoms = NULL ELSE TR 14: trans_randoms emiss_randoms = NULL** | |
| **Attenuation Correction Method** | **(0054,1101)** | **3** | **LO** | **1** | **attenuation atten_coefficient atten_smooth** | |
| **Scatter Correction Method** | **(0054,1105)** | **3** | **LO** | **1** | **scatter** | |
| **Decay Correction** | **(0054,1102)** | **1** | **CS** | **1** | **decay** | |
| **Reconstruction Diameter** | **(0018,1100)** | **3** | **DS** | **1** | **bp_dfov * 10.0 (cm to mm)** | |
| **Convolution Kernel** | **(0018,1210** | **3** | **SH** | **1-n** | **many** | |

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Attribute (GE Discovery LS PET ImageSet table unless otherwise specified) | Notes |
|---|---|---|---|---|---|---|
| | ) | | | | | |
| Reconstruction Method | (0054,1103) | 3 | LO | 1 | recon_method | |
| Detector Lines of Response Used | (0054,1104) | 3 | LO | 1 | axial_angles_used | |
| Acquisition Start Condition | (0018,0073) | 3 | CS | 1 | Scan.start_condition | |
| Acquisition Start Condition Data | (0018,0074) | 3 | IS | 1 | Scan.start_cond_data | |
| Acquisition Termination Condition | (0018,0071) | 3 | CS | 1 | Scan.sel_stop_cond | |
| Acquisition Termination Condition Data | (0018,0075) | 3 | IS | 1 | Scan.sel_stop_cond_data | |
| Field of View Shape | (0018,1147) | 3 | CS | 1 | IF is_type == [ native PET images] THEN = ”CYLINDRICAL RING” | |
| Field of View Dimensions | (0018,1149) | 3 | IS | 1-2 | 10.0*Scan.scan_fov \ Scan.axial_fov | |
| Gantry /Detector Tilt | (0018,1120) | 3 | DS | 1 | Scan.gantry_tilt_angle | |
| Gantry/Detector Slew | (0018,1121) | 3 | DS | 1 | | |
| Type of Detector Motion | (0054,0202) | 3 | CS | 1 | IF is_type == [ native PET images] THEN = ”NONE” | |
| Collimator Type | (0018,1181) | 2 | CS | 1 | Scan.collimation | |
| Collimator/Grid Name | (0018,1180) | 3 | SH | 1 | Not Used | |
| Axial Acceptance | (0054,1200) | 3 | DS | 1 | Scan.axial_acceptance acceptance_flag axial_angle_3d | |
| Axial Mash | (0054,1201) | 3 | IS | 2 | Scan.axial_acceptance acceptance_flag | |
| Transverse Mash | (0054,1202) | 3 | IS | 1 | Scan.theta_compression | |
| Detector Element Size | (0054,1203) | 3 | DS | 2 | Not Used | |
| Coincidence Window Width | (0054,1210) | 3 | DS | 1 | Scan.upper_coinc_limit - Scan.lower_coinc_limit | |
| Energy Window Range Sequence | (0054,0013) | 3 | SQ | 1 | | |

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Attribute (GE Discovery LS PET ImageSet table unless otherwise specified) | Notes |
|---|---|---|---|---|---|---|
| **> Energy Window Lower Limit** | **(0054,0014)** | **3** | **DS** | **1** | **Scan.lower_energy_limit** | |
| **> Energy Window Upper Limit** | **(0054,0015)** | **3** | **DS** | **1** | **Scan.upper_energy_limit** | |
| **Secondary Counts Type** | **(0054,1220)** | **3** | **CS** | **1-n** | **IF (Scan.delayed_events == [ separate ] ) THEN = ”DLYD”** | |

### D.5.3.3 PET Isotope Module

**TABLE 2.4-6**
**PET ISOTOPE MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Attribute (GE Discovery LS PET Scan table unless otherwise specified) | Notes |
|---|---|---|---|---|---|---|
| **Radiopharmaceutical Information Sequence** | **(0054,0016)** | **2** | **SQ** | **1** | **Single item sequence** | |
| **> Radionuclide Code Sequence** | **(0054,0300)** | **2** | **SQ** | **1** | **Single item sequence** | |
| **>> Code Value** | **(0008,0100)** | **1C** | **SH** | **1** | **Value is based on radionuclide_name** | |
| **>> Coding Scheme Designator** | **(0008,0102)** | **1C** | **SH** | **1** | **99SDM** | |
| **>> Code Meaning** | **(0008,0104)** | **3** | **LO** | **1** | **radionuclide_name** | |
| **> Radiopharmaceutical Route** | **(0018,1070)** | **3** | **LO** | **1** | **Not Used** | |
| **> Administration Route Code Sequence** | **(0054,0302)** | **3** | **SQ** | **1** | **Not Used** | |
| **>> Code Value** | **(0008,0100)** | **1C** | **SH** | **1** | **Not Used** | |
| **>> Coding Scheme Designator** | **(0008,0102)** | **1C** | **SH** | **1** | **Not Used** | |
| **>> Code Meaning** | **(0008,0104)** | **3** | **LO** | **1** | **Not Used** | |
| **> Radiopharmaceutical Volume** | **(0018,1071)** | **3** | **DS** | **1** | **pre_inj_volume** | |
| **> Radiopharmaceutical Start Time** | **(0018,1072)** | **3** | **TM** | **1** | **admin_datetime** | |
| **> Radiopharmaceutical Stop Time** | **(0018,1073)** | **3** | **TM** | **1** | **Not Used** | |

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Attribute (GE Discovery LS PET Scan table unless otherwise specified) | Notes |
|---|---|---|---|---|---|---|
| **> Radionuclide Total Dose** | **(0018,1074)** | **3** | **DS** | **1** | **tracer_activity, post_inj_activity, half_life, meas_datetime, admin_datetime, post_inj_datetime** | |
| **> Radionuclide Half Life** | **(0018,1075)** | **3** | **DS** | **1** | **half_life** | |
| **> Radionuclide Positron Fraction** | **(0018,1076)** | **3** | **DS** | **1** | **positron_fraction** | |
| **> Radiopharmaceutical Specific Activity** | **(0018,1077)** | **3** | **DS** | **1** | **Not Used** | |
| **> Radiopharmaceutical** | **(0018,0031)** | **3** | **LO** | **1** | **tracer_name** | |
| **> Radiopharmaceutical Code Sequence** | **(0054,0304)** | **3** | **SQ** | **1** | **Single item sequence** | |
| **>> Code Value** | **(0008,0100)** | **1C** | **SH** | **1** | **Value is based on tracer_name** | |
| **>> Coding Scheme Designator** | **(0008,0102)** | **1C** | **SH** | **1** | **99SDM** | |
| **>> Code Meaning** | **(0008,0104)** | **3** | **LO** | **1** | **tracer_name** | |
| **Intervention Drug Information Sequence** | **(0018,0026)** | **3** | **SQ** | **1** | **Not Used** | |
| **> Intervention Drug Name** | **(0018,0034)** | **3** | **LO** | **1** | **Not Used** | |
| **> Intervention Drug Code Sequence** | **(0018,0029)** | **3** | **SQ** | **1** | **Not Used** | |
| **>> Code Value** | **(0008,0100)** | **1C** | **SH** | **1** | **Not Used** | |
| **>> Coding Scheme Designator** | **(0008,0102)** | **1C** | **SH** | **1** | **Not Used** | |
| **>> Code Meaning** | **(0008,0104)** | **3** | **LO** | **1** | **Not Used** | |
| **> Intervention Drug Start Time** | **(0018,0035)** | **3** | **TM** | **1** | **Not Used** | |
| **> Intervention Drug Stop Time** | **(0018,0027)** | **3** | **TM** | **1** | **Not Used** | |
| **> Intervention Drug Dose** | **(0018,0028)** | **3** | **DS** | **1** | **Not Used** | |

### D.5.3.4 PET Multi-gated Acquisition Module

**TABLE 2.4-7**

**PET ISOTOPE MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Attribute (GE Discovery LS PET Scan table unless otherwise specified) | Notes |
|---|---|---|---|---|---|---|
| **Beat Rejection Flag** | **(0018,1080)** | **2** | **CS** | **1** | **IF ( trig_rej_method == [ none ] ) THEN = "N" ELSE = "Y"** | |
| **Trigger Source or Type** | **(0018,1061)** | **3** | **LO** | **1** | **Not Used** | |
| **PVC Rejection** | **(0018,1085)** | **3** | **LO** | **1** | **trig_rej_method** | |
| **Skip Beats** | **(0018,1086)** | **3** | **IS** | **1** | **number_for_reject** | |
| **Heart Rate** | **(0018,1088)** | **3** | **IS** | **1** | **Not Used** | |
| **Framing Type** | **(0018,1064)** | **3** | **LO** | **1** | **binning_mode** | |

### D.5.3.5 GE Discovery LS PET ImageSet Module

Refer to Section D.6.6 for details.

### D.5.3.6 GE Discovery LS PET Scan Module

Refer to Section D.6.4 for details.

### D.5.4 Common Equipment Entity Modules

The following Equipment IE Module is common to all Composite Image IODs which reference the Equipment IE.

### D.5.4.1 General Equipment Module

This section specifies the Attributes which identify and describe the piece of equipment which produced a Series of Images.

**TABLE 2.4-8**
**GENERAL EQUIPMENT MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Attribute (GE Discovery LS PET Exam table unless otherwise specified) | Notes |
|---|---|---|---|---|---|---|
| **Manufacturer** | **(0008,0070)** | **2** | **LO** | **1** | **manufacturer** | |
| **Institution Name** | **(0008,0080)** | **3** | **LO** | **1** | **hospital_name** | |
| **Institution Address** | **(0008,008** | **3** | **ST** | **1** | **Not Used** | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | 1) | | | | | |
| Station Name | (0008,1010) | 3 | SH | 1 | Not Used | |
| Institutional Department Name | (0008,1040) | 3 | LO | 1 | Not Used | |
| Manufacturer's Model Name | (0008,1090) | 3 | LO | 1 | scanner_desc | |
| Device Serial Number | (0018,1000) | 3 | LO | 1 | Not Used | |
| Software Versions | (0018,1020) | 3 | LO | 1 | Image.software_version<br>Curve.software_version<br>Frame.software_version | |
| Spatial Resolution | (0018,1050) | 3 | DS | 1 | Not Used | |
| Date of Last Calibration | (0018,1200) | 3 | DA | 1-n | Not Used | |
| Time of Last Calibration | (0018,1201) | 3 | TM | 1-n | Not Used | |
| Pixel Padding Value | (0028,0120) | 3 | US or SS | 1 | Not Used | |

### D.5.5 Common Curve Entity Modules

The following Image IE Modules are common to all Composite Image IODs which reference the Image IE.

#### D.5.5.1 Curve Identification Module

This section specifies the Attributes which identify and describe an curve within a particular series.

**TABLE 2.4-9**
**CURVE IDENTIFICATION MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Attribute (GE Discovery LS PET Curve table unless otherwise specified) | Notes |
|---|---|---|---|---|---|---|
| Curve Number | (0020,0024) | 2 | IS | 1 | 1 | |
| Curve Date | (0008,0025) | 3 | DA | 1 | extract date from curve_datetime | |
| Curve Time | (0008,0035) | 3 | TM | 1 | extract time from curve_datetime | |
| Referenced Image Sequence | (0008,1140) | 3 | SQ | 1 | Not Used | |
| >Referenced SOP Class UID | (0008,1150) | 1 | UI | 1 | | |

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Attribute (GE Discovery LS PET Curve table unless otherwise specified) | Notes |
|---|---|---|---|---|---|---|
| **>Referenced SOP Instance UID** | **(0008,1155)** | **1** | **UI** | **1** | | |
| **Referenced Overlay Sequence** | **(0008,1130)** | **3** | **SQ** | **1** | **Not Used** | |
| **>Referenced SOP Class UID** | **(0008,1150)** | **1** | **UI** | **1** | | |
| **>Referenced SOP Instance UID** | **(0008,1155)** | **1** | **UI** | **1** | | |
| **Referenced Curve Sequence** | **(0008,1145)** | **3** | **SQ** | **1** | **Not Used** | |
| **>Referenced SOP Class UID** | **(0008,1150)** | **1** | **UI** | **1** | | |
| **>Referenced SOP Instance UID** | **(0008,1155)** | **1** | **UI** | **1** | | |

### D.5.5.2 Curve Module

This section specifies the Attributes which identify and describe an curve within a particular series.

**TABLE 2.4-10**
**CURVE MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Attribute (GE Discovery LS PET Curve table unless otherwise specified) | Notes |
|---|---|---|---|---|---|---|
| **Curve Dimensions** | **(50xx,0005)** | **1** | **US** | **1** | **use curve_type** | |
| **Number of Points** | **(50xx,0010)** | **1** | **US** | **1** | **curve_size / sizeof (curvePoint) /* struct curvePoint in idbBlobStructs.h */** | |
| **Type of Data** | **(50xx,0020)** | **1** | **CS** | **1** | **curve_type<br>SYSRATE = system count rate<br>SLICERATE = slice count rate<br>BLDSMPL = blood samples** | **Refer Note Below** |
| **Data Value Representation** | **(50xx,0103)** | **1** | **US** | **1** | **0002H** | |
| **Curve Data** | **(50xx,3000)** | **1** | **OW/OB** | **1** | **curve_data** | |
| **Curve Description** | **(50xx,0022)** | **3** | **LO** | **1** | **curve_name** | |
| **Axis Units** | **(50xx,0030** | **3** | **SH** | **1-n** | **Graph.x_axis_units ** | **Refer** |

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Attribute (GE Discovery LS PET Curve table unless otherwise specified) | Notes |
|---|---|---|---|---|---|---|
| | ) | | | | Graph.y_axis_units | Note below |
| Axis Labels | (50xx,0040) | 3 | SH | 1-n | Graph.x_axis_label \ Graph.y_axis_label (truncate from 32A to 16A) | |
| Minimum Coordinate Value | (50xx,0104) | 3 | US | 1-n | Not Used | |
| Maximum Coordinate Value | (50xx,0105) | 3 | US | 1-n | Not Used | |
| Curve Range | (50xx,0106) | 3 | SH | 1-n | Graph.x_axis_min \ Graph.x_axis_max \ Graph.y_axis_min \ Graph.y_axis_max | |
| Curve Data Descriptor | (50xx,0110) | 1C | US | 1-n | Not Used | |
| Coordinate Start Value | (50xx,0112) | 1C | US | 1 | Not Used | |
| Coordinate Step Value | (50xx,0114) | 1C | US | 1 | Not Used | |
| Curve Label | (50xx,2500) | 3 | LO | 1 | CurvePresentation.curve_label | |
| Referenced Overlay Sequence | (50xx,2600) | 3 | SQ | 1 | Not Used | |
| >Referenced SOP Class UID | (0008,1150) | 1 | UI | 1 | Not Used | |
| >Referenced SOP Instance UID | (0008,1155) | 1 | UI | 1 | Not Used | |
| >Referenced Overlay Group | (50xx,2610) | 1 | US | 1 | Not Used | |

**Note:**

IF ( curve_type == [ blood sample ] ) THEN
CASE x_axis_units OF :
[ msec ], [ sec ] : break;/* MILS and SEC ok */
[ min ]: Axis Units (50xx,0030) Value 1 = SEC
DEFAULT: Reject send

CASE y_axis_units OF :
[ counts/sec] :break;/* BQML and CPS ok */
DEFAULT:Reject send

```
IF ( curve_type == [ rate ] ) THEN
    CASE  x_axis_units OF :
            [ msec ], [ sec ] :  break;    /*  MLS, SEC ok  */
            [ min ]:  Axis Units (50xx,0030) Value 1 = SEC
            DEFAULT: Reject send

    CASE y_axis_units OF :
            [ counts/sec] :    break;    /*  CPS ok  */
            DEFAULT: Reject send
```

**Note:** *Cardiac Polar Maps are not supported as part of the PET Curve IOD.*

### D.5.5.3 PET Curve Module

This section specifies the Attributes that describe the PET Curve Module.

**TABLE 2.4-11**
**PET CURVE MODULE ATTRIBUTES**

| **Attribute Name** | Tag | Type | VR | VM | Discovery LS PET Attribute (GE Discovery LS PET Curve table unless otherwise specified) | Notes |
|---|---|---|---|---|---|---|
| **Curve Dimensions** | **(50xx,0005)** | **1** | **US** | **1** | **2** | |
| **Type of Data** | **(50xx,0020)** | **1** | **CS** | **1** | **curve_type** | |
| **Curve Data** | **(50xx,3000)** | **1** | **OW/OB** | **1** | **curve_data** | |
| **Axis Units** | **(50xx,0030)** | **3** | **SH** | **1-n** | **Graph.x_axis_units \ Graph.y_axis_units** | |
| Dead Time Correction Flag | (0054,1401) | 1C | CS | 1 | IF (curve_type == [ blood sample ] THEN = deadtime | |
| Counts Included | (0054,1400) | 2C | CS | 1-n | IF (Axis Units (50xx,0030) contains CPS or CNTS) THEN ImageSet.scatter or ImageSet.emiss_randoms | |
| Processing Function | (0018,5020) | 3 | LO | 1 | Not Used | |

**Note:** *Cardiac Polar Maps are not supported as part of the PET Curve IOD.*

### D.5.5.4 GE Discovery LS PET Curve

Refer to Section D.6.7 for details.

### D.5.5.5 GE Discovery LS PET Graph

Refer to Section D.6.8 for details.

### D.5.5.6 GE Discovery LS PET Curve Presentation

Refer to Section D.6.9 for details.

### D.5.6 General Modules

The SOP Common Module is mandatory for all DICOM IODs.

#### D.5.6.1 SOP Common Module

This section defines the Attributes which are required for proper functioning and identification of the associated SOP Instances. They do not specify any semantics about the Real-World Object represented by the IOD.

**TABLE 2.4-12**
**SOP COMMON MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Attribute (GE Discovery LS PET Image table unless otherwise specified) | Notes |
|---|---|---|---|---|---|---|
| **SOP Class UID** | **(0008,0016)** | **1** | **UI** | **1** | | **TR[48]** |
| **SOP Instance UID** | **(0008,0018)** | **1** | **UI** | **1** | | **TR[49]** |
| **Specific Character Set** | **(0008,0005)** | **1C** | **CS** | **1** | **= NULL** | |
| **Instance Creation Date** | **(0008,0012)** | **3** | **DA** | **1** | **current_date** | |
| **Instance Creation Time** | **(0008,0013)** | **3** | **TM** | **1** | **current_time** | |
| **Instance Creator UID** | **(0008,0014)** | **3** | **UI** | **1** | **= 1.2.840.113619.1.131.<dbcode>** | |

T[48]Translate value as follows:

```
IF (PET Image Transfer) THEN
        SOP Class UID (08,16) = 1.2.840.10008.5.1.4.1.1.128
ELSE IF (Curve Transfer)
        CASE ( Curve.curve_type ) OF :
                [ blood sample ], [ rates ] :
                        /*  PET Curve  */
                        SOP Class UID (08,16) = 1.2.840.10008.5.1.4.1.1.129
                        break;
                [ profile ], [ histogram ], [ volume activity curve ], [ foreign ] :
                [ area ], [ patlak ], [ tac midframe ], [ tac effective ] :
                        /*  Standalone Curve  */
                        SOP Class UID (08,16) = 1.2.840.10008.5.1.4.1.1.9
                        break;
ELSE IF (Polar Map Transfer) THEN
        Reject Transfer;
```

[49]Translate value as follows:

```
IF (SOP Class UID (08,16) == ”1.2.840.10008.5.1.4.1.1.128”) THEN  /*  PET Image  */
        SOP Instance UID (08,18) = Image.image_id
ELSE IF (SOP Class UID (08,16) == ”1.2.840.10008.5.1.4.1.1.129”) THEN  /*  PET Curve  */
        IF (Type of Data (50xx,0020) != ”CPM”) THEN
```

/* Polar map */
Reject Transfer
/*Standalone Curve */

ELSE IF (SOP Class UID (08,16) == ”1.2.840.10008.5.1.4.1.1.9”) THEN
SOP Instance UID (08,18) = Curve.curve_id

## D.6 Private data dictionary

### D.6.1 Private Creator Identification Information

**TABLE 2.4-1**
**PRIVATE CREATOR IDENTIFICATION (GEMS_PETD_01)**

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Type |
|---|---|---|---|---|---|
| **Private Creator Data Element** | **(0009,0010)** | **1** | **SH** | **1** | **n/a** |
| **GE Discovery LS PET Implementation Version Name** | **(0009,1001)** | **3** | **LO** | **2** | **n/a** |

### D.6.2 GE Discovery LS PET Patient Module

**TABLE 2.4-2**

**GE DISCOVERY LS PET PATIENT MODULE PRIVATE ELEMENTS**
**PRIVATE CREATOR IDENTIFICATION (GEMS_ PETD_01)**

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Type |
|---|---|---|---|---|---|
| **GE Discovery LS PET Patient.patient_id** | **(0009,1002)** | **3** | **LO** | **1** | **20A** |
| **GE Discovery LS PET Patient.compatible_version** | **(0009,1003)** | **3** | **SH** | **1** | **5A** |
| **GE Discovery LS PET Patient.software_version** | **(0009,1004)** | **3** | **SH** | **1** | **5A** |
| **GE Discovery LS PET Patient.patient_datetime** | **(0009,1005)** | **3** | **DT** | **1** | **D** |
| **GE Discovery LS PET Patient.type** | **(0009,1006)** | **3** | **SL** | **1** | **L** |

### D.6.3 GE Discovery LS PET Exam Module

**TABLE 2.4-3**

**GE DISCOVERY LS PET EXAM MODULE PRIVATE ELEMENTS**
**PRIVATE CREATOR IDENTIFICATION (GEMS_ PETD_01)**

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Type |
|---|---|---|---|---|---|
| **GE Discovery LS PET Exam.exam_id** | **(0009,1007)** | **3** | **UI** | **1** | **64A** |
| **GE Discovery LS PET Exam.compatible_version** | **(0009,1008)** | **3** | **SH** | **1** | **5A** |
| **GE Discovery LS PET Exam.software_version** | **(0009,1009)** | **3** | **SH** | **1** | **5A** |

### D.6.4 GE Discovery LS PET Scan Module

**TABLE 2.4-4**

**GE DISCOVERY LS PET SCAN MODULE PRIVATE ELEMENTS**
**PRIVATE CREATOR IDENTIFICATION (GEMS_ PETD_01)**

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Type |
|---|---|---|---|---|---|
| GE Discovery LS PET Scan.scan_id | (0009,100A) | 3 | UI | 1 | 64A |
| GE Discovery LS PET Scan.compatible_version | (0009,100B) | 3 | SH | 1 | 5A |
| GE Discovery LS PET Scan.software_version | (0009,100C) | 3 | SH | 1 | 5A |
| GE Discovery LS PET Scan.scan_datetime | (0009,100D) | 3 | DT | 1 | D |
| GE Discovery LS PET Scan.scan_ready | (0009,100E) | 3 | DT | 1 | D |
| GE Discovery LS PET Scan.scan_description | (0009,100F) | 3 | UI | 1 | 64A |
| GE Discovery LS PET Scan.hospital_name | (0009,1010) | 3 | LO | 1 | 32A |
| GE Discovery LS PET Scan.scanner_desc | (0009,1011) | 3 | LO | 1 | 32A |
| GE Discovery LS PET Scan.manufacturer | (0009,1012) | 3 | LO | 1 | 64A |
| GE Discovery LS PET Scan.for_identifier | (0009,1013) | 3 | UI | 1 | 64A |
| GE Discovery LS PET Scan.landmark_name | (0009,1014) | 3 | LO | 1 | 64A |
| GE Discovery LS PET Scan.landmark_abbrev | (0009,1015) | 3 | SH | 1 | 2A |
| GE Discovery LS PET Scan.patient_position | (0009,1016) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.scan_perspective | (0009,1017) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.scan_type | (0009,1018) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.scan_mode | (0009,1019) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.start_condition | (0009,101A) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.start_cond_data | (0009,101B) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.sel_stop_cond | (0009,101C) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.sel_stop_cond_data | (0009,101D) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.collect_deadtime | (0009,101E) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.collect_singles | (0009,101F) | 3 | SL | 1 | L |

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Type |
|---|---|---|---|---|---|
| GE Discovery LS PET Scan.collect_countrate | (0009,1020) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.countrate_period | (0009,1021) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.delayed_events | (0009,1022) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.delayed_bias | (0009,1023) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.word_size | (0009,1024) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.axial_acceptance | (0009,1025) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.axial_angle_3d | (0009,1026) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.theta_compression | (0009,1027) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.axial_compression | (0009,1028) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.gantry_tilt_angle | (0009,1029) | 3 | FL | 1 | F |
| GE Discovery LS PET Scan.collimation | (0009,102A) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.scan_fov | (0009,102B) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.axial_fov | (0009,102C) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.event_separation | (0009,102D) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.mask_width | (0009,102E) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.binning_mode | (0009,102F) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.trig_rej_method | (0009,1030) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.number_for_reject | (0009,1031) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.lower_reject_limit | (0009,1032) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.upper_reject_limit | (0009,1033) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.triggers_acquired | (0009,1034) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.triggers_rejected | (0009,1035) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.tracer_name | (0009,1036) | 3 | LO | 1 | 40A |
| GE Discovery LS PET Scan.batch_description | (0009,1037) | 3 | LO | 1 | 40A |
| GE Discovery LS PET Scan.tracer_activity | (0009,1038) | 3 | FL | 1 | F |

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Type |
|---|---|---|---|---|---|
| GE Discovery LS PET Scan.meas_datetime | (0009,1039) | 3 | DT | 1 | D |
| GE Discovery LS PET Scan.pre_inj_volume | (0009,103A) | 3 | FL | 1 | F |
| GE Discovery LS PET Scan.admin_datetime | (0009,103B) | 3 | DT | 1 | D |
| GE Discovery LS PET Scan.post_inj_activity | (0009,103C) | 3 | FL | 1 | F |
| GE Discovery LS PET Scan.post_inj_datetime | (0009,103D) | 3 | DT | 1 | D |
| GE Discovery LS PET Scan.radionuclide_name | (0009,103E) | 3 | SH | 1 | 6A |
| GE Discovery LS PET Scan.half_life | (0009,103F) | 3 | FL | 1 | F |
| GE Discovery LS PET Scan.positron_fraction | (0009,1040) | 3 | FL | 1 | F |
| GE Discovery LS PET Scan.source1_holder | (0009,1041) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.source1_activity | (0009,1042) | 3 | FL | 1 | F |
| GE Discovery LS PET Scan.source1_meas_dt | (0009,1043) | 3 | DT | 1 | D |
| GE Discovery LS PET Scan.source1_radnuclide | (0009,1044) | 3 | SH | 1 | 6A |
| GE Discovery LS PET Scan.source1_half_life | (0009,1045) | 3 | FL | 1 | F |
| GE Discovery LS PET Scan.source2_holder | (0009,1046) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.source2_activity | (0009,1047) | 3 | FL | 1 | F |
| GE Discovery LS PET Scan.source2_meas_dt | (0009,1048) | 3 | DT | 1 | D |
| GE Discovery LS PET Scan.source2_radnuclide | (0009,1049) | 3 | SH | 1 | 6A |
| GE Discovery LS PET Scan.source2_half_life | (0009,104A) | 3 | FL | 1 | F |
| GE Discovery LS PET Scan.source_speed | (0009,104B) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.source_location | (0009,104C) | 3 | FL | 1 | F |
| GE Discovery LS PET Scan.emission_present | (0009,104D) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.lower_axial_acc | (0009,104E) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.upper_axial_acc | (0009,104F) | 3 | SL | 1 | L |

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Type |
|---|---|---|---|---|---|
| GE Discovery LS PET Scan.lower_coinc_limit | (0009,1050) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.upper_coinc_limit | (0009,1051) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.coinc_delay_offset | (0009,1052) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.coinc_output_mode | (0009,1053) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.upper_energy_limit | (0009,1054) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.lower_energy_limit | (0009,1055) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.normal_cal_id | (0009,1056) | 3 | UI | 1 | 64A |
| GE Discovery LS PET Scan.normal_2d_cal_id | (0009,1057) | 3 | UI | 1 | 64A |
| GE Discovery LS PET Scan.blank_cal_id | (0009,1058) | 3 | UI | 1 | 64A |
| GE Discovery LS PET Scan.wc_cal_id | (0009,1059) | 3 | UI | 1 | 64A |
| GE Discovery LS PET Scan.derived | (0009,105A) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.contrast_agent | (0009,105B) | 3 | LO | 1 | 64A |

### D.6.5 GE Discovery LS PET Frame Module

**TABLE 2.4-5**

**GE DISCOVERY LS PET FRAME MODULE PRIVATE ELEMENTS**
**PRIVATE CREATOR IDENTIFICATION (GEMS_ PETD_01)**

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Type |
|---|---|---|---|---|---|
| GE Discovery LS PET Frame.frame_id | (0009,105C) | 3 | UI | 1 | 64A |
| GE Discovery LS PET Frame.scan_id | (0009,105D) | 3 | UI | 1 | 64A |
| GE Discovery LS PET Frame.exam_id | (0009,105E) | 3 | UI | 1 | 64A |
| GE Discovery LS PET Frame.patient_id | (0009,105F) | 3 | LO | 1 | 20A |
| GE Discovery LS PET Frame.compatible_version | (0009,1060) | 3 | SH | 1 | 5A |
| GE Discovery LS PET Frame.software_version | (0009,1061) | 3 | SH | 1 | 5A |
| GE Discovery LS PET Frame.where_is_frame | (0009,1062) | 3 | ST | 1 | 256A |
| GE Discovery LS PET Frame.frame_size | (0009,1063) | 3 | SL | 1 | L |

| | | | | | |
|---|---|---|---|---|---|
| **GE Discovery LS PET Frame.file_exists** | **(0009,1064)** | **3** | **SL** | **1** | L |
| **GE Discovery LS PET Frame.patient_entry** | **(0009,1065)** | **3** | **SL** | **1** | L |
| **GE Discovery LS PET Frame.table_height** | **(0009,1066)** | **3** | **FL** | **1** | F |
| **GE Discovery LS PET Frame.table_z_position** | **(0009,1067)** | **3** | **FL** | **1** | F |
| **GE Discovery LS PET Frame.landmark_datetime** | **(0009,1068)** | **3** | **DT** | **1** | D |
| **GE Discovery LS PET Frame.slice_count** | **(0009,1069)** | **3** | **SL** | **1** | L |
| **GE Discovery LS PET Frame.start_location** | **(0009,106A)** | **3** | **FL** | **1** | F |
| **GE Discovery LS PET Frame.acq_delay** | **(0009,106B)** | **3** | **SL** | **1** | L |
| **GE Discovery LS PET Frame.acq_start** | **(0009,106C)** | **3** | **DT** | **1** | D |
| **GE Discovery LS PET Frame.acq_duration** | **(0009,106D)** | **3** | **SL** | **1** | L |
| **GE Discovery LS PET Frame.acq_bin_dur** | **(0009,106E)** | **3** | **SL** | **1** | L |
| **GE Discovery LS PET Frame.acq_bin_start** | **(0009,106F)** | **3** | **SL** | **1** | L |
| **GE Discovery LS PET Frame.actual_stop_cond** | **(0009,1070)** | **3** | **SL** | **1** | L |
| **GE Discovery LS PET Frame.total_prompts** | **(0009,1071)** | **3** | **FD** | **1** | Dbl |
| **GE Discovery LS PET Frame.total_delays** | **(0009,1072)** | **3** | **FD** | **1** | Dbl |
| **GE Discovery LS PET Frame.frame_valid** | **(0009,1073)** | **3** | **SL** | **1** | L |
| **GE Discovery LS PET Frame.validity_info** | **(0009,1074)** | **3** | **SL** | **1** | L |
| **GE Discovery LS PET Frame.archived** | **(0009,1075)** | **3** | **SL** | **1** | L |
| **GE Discovery LS PET Frame.compression** | **(0009,1076)** | **3** | **SL** | **1** | L |
| **GE Discovery LS PET Frame.uncompressed_size** | **(0009,1077)** | **3** | **SL** | **1** | L |
| **GE Discovery LS PET Frame.accum_bin_dur** | **(0009,1078)** | **3** | **SL** | **1** | L |

### D.6.6 GE Discovery LS PET ImageSet Module

**TABLE 2.4-6**

**GE DISCOVERY LS PET IMAGESET MODULE PRIVATE ELEMENTS**
**PRIVATE CREATOR IDENTIFICATION (GEMS_ PETD_01)**

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Type |
|---|---|---|---|---|---|
| **GE Discovery LS PET ImageSet.compatible_version** | **(0009,1079)** | **3** | **SH** | **1** | **5A** |
| **GE Discovery LS PET ImageSet.software_version** | **(0009,107A)** | **3** | **SH** | **1** | **5A** |
| **GE Discovery LS PET** | **(0009,107B)** | **3** | **DT** | **1** | **D** |

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Type |
|---|---|---|---|---|---|
| ImageSet.is_datetime | | | | | |
| GE Discovery LS PET ImageSet.is_source | (0009,107C) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.is_contents | (0009,107D) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.is_type | (0009,107E) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.is_reference | (0009,107F) | 3 | FL | 3 | F |
| GE Discovery LS PET ImageSet.multi_patient | (0009,1080) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.number_of_normals | (0009,1081) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.color_map_id | (0009,1082) | 3 | UI | 1 | 64A |
| GE Discovery LS PET ImageSet.window_level_type | (0009,1083) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.rotate | (0009,1084) | 3 | FL | 1 | F |
| GE Discovery LS PET ImageSet.flip | (0009,1085) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.zoom | (0009,1086) | 3 | FL | 1 | F |
| GE Discovery LS PET ImageSet.pan_x | (0009,1087) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.pan_y | (0009,1088) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.window_level_min | (0009,1089) | 3 | FL | 1 | F |
| GE Discovery LS PET ImageSet.window_level_max | (0009,108A) | 3 | FL | 1 | F |
| GE Discovery LS PET ImageSet.recon_method | (0009,108B) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.attenuation | (0009,108C) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.atten_coefficient | (0009,108D) | 3 | FL | 1 | F |
| GE Discovery LS PET ImageSet.bp_filter | (0009,108E) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.bp_filter_cutoff | (0009,108F) | 3 | FL | 1 | F |
| GE Discovery LS PET ImageSet.bp_filter_order | (0009,1090) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.bp_center_l | (0009,1091) | 3 | FL | 1 | F |
| GE Discovery LS PET ImageSet.bp_center_p | (0009,1092) | 3 | FL | 1 | F |
| GE Discovery LS PET ImageSet.atten_smooth | (0009,1093) | 3 | SL | 1 | L |

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Type |
|---|---|---|---|---|---|
| GE Discovery LS PET ImageSet.atten_smooth_param | (0009,1094) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.angle_smooth_param | (0009,1095) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.wellcountercal_id | (0009,1096) | 3 | UI | 1 | 64A |
| GE Discovery LS PET ImageSet.trans_scan_id | (0009,1097) | 3 | UI | 1 | 64A |
| GE Discovery LS PET ImageSet.norm_cal_id | (0009,1098) | 3 | UI | 1 | 64A |
| GE Discovery LS PET ImageSet.blnk_cal_id | (0009,1099) | 3 | UI | 1 | 64A |
| GE Discovery LS PET ImageSet.cac_edge_threshold | (0009,109A) | 3 | FL | 1 | F |
| GE Discovery LS PET ImageSet.cac_skull_offset | (0009,109B) | 3 | FL | 1 | F |
| GE Discovery LS PET ImageSet.emiss_sub_id | (0009,109C) | 3 | UI | 1 | 64A |
| GE Discovery LS PET ImageSet.radial_filter_3d | (0009,109D) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.radial_cutoff_3d | (0009,109E) | 3 | FL | 1 | F |
| GE Discovery LS PET ImageSet.axial_filter_3d | (0009,109F) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.axial_cutoff_3d | (0009,10A0) | 3 | FL | 1 | F |
| GE Discovery LS PET ImageSet.axial_start | (0009,10A1) | 3 | FL | 1 | F |
| GE Discovery LS PET ImageSet.axial_spacing | (0009,10A2) | 3 | FL | 1 | F |
| GE Discovery LS PET ImageSet.axial_angles_used | (0009,10A3) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.ir_num_iterations | (0009,10B2) | 3 | SL | 1 | F |
| GE Discovery LS PET ImageSet.ir_num_subsets | (0009,10B3) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.ir_recon_fov | (0009,10B4) | 3 | FL | 1 | F |
| GE Discovery LS PET ImageSet.ir_corr_model | (0009,10B5) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.ir_loop_filter | (0009,10B6) | 3 | SL | 1 | L |

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Type |
|---|---|---|---|---|---|
| **GE Discovery LS PET ImageSet.ir_pre_filt_parm** | **(0009,10B7)** | **3** | **FL** | **1** | **F** |
| **GE Discovery LS PET ImageSet.ir_loop_filt_parm** | **(0009,10B8)** | **3** | **SL** | **1** | **L** |
| **GE Discovery LS PET ImageSet.response_filt_parm** | **(0009,10B9)** | **3** | **FL** | **1** | **F** |
| **GE Discovery LS PET ImageSet.post_filter** | **(0009,10BA)** | **3** | **SL** | **1** | **L** |
| **GE Discovery LS PET ImageSet.post_filt_parm** | **(0009,10BB)** | **3** | **FL** | **1** | **F** |
| **GE Discovery LS PET ImageSet.ir_regularize** | **(0009,10BC)** | **3** | **SL** | **1** | **L** |
| **GE Discovery LS PET ImageSet.regularize_parm** | **(0009,10BD)** | **3** | **FL** | **1** | **F** |
| **GE Discovery LS PET ImageSet.ac_bp_filter** | **(0009,10BE)** | **3** | **SL** | **1** | **L** |
| **GE Discovery LS PET ImageSet.ac_bp_filt_cut_off** | **(0009,10BF)** | **3** | **FL** | **1** | **F** |
| **GE Discovery LS PET ImageSet.ac_bp_filt_order** | **(0009,10C0)** | **3** | **SL** | **1** | **L** |
| **GE Discovery LS PET ImageSet.ac_img_smooth** | **(0009,10C1)** | **3** | **SL** | **1** | **L** |
| **GE Discovery LS PET ImageSet.ac_img_smooth_parm** | **(0009,10C2)** | **3** | **FL** | **1** | **F** |
| **GE Discovery LS PET ImageSet.scatter_method** | **(0009,10C3)** | **3** | **SL** | **1** | **L** |
| **GE Discovery LS PET ImageSet.scatter_num_iter** | **(0009,10C4)** | **3** | **SL** | **1** | **L** |
| **GE Discovery LS PET ImageSet.scatter_parm** | **(0009,10C5)** | **3** | **FL** | **1** | **F** |

### D.6.7 GE Discovery LS PET Curve Module

**TABLE 2.4-7**

**GE DISCOVERY LS PET CURVE MODULE PRIVATE ELEMENTS**
**PRIVATE CREATOR IDENTIFICATION (GEMS_ PETD_01)**

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Type |
|---|---|---|---|---|---|
| **Private Creator Data Element** | **(5001,0010)** | **1** | **SH** | **1** | **n/a** |
| GE Discovery LS PET Curve.curve_id | **(5001,1001)** | **3** | **UI** | **1** | 64A |
| GE Discovery LS PET Curve.compatible_version | **(5001,1002)** | **3** | **SH** | **1** | 5A |

| | | | | | |
|---|---|---|---|---|---|
| GE Discovery LS PET Curve.software_version | **(5001,1003)** | **3** | **SH** | **1** | 5A |
| GE Discovery LS PET Curve.statistics_type | **(5001,1004)** | **3** | **SL** | **1** | L |
| GE Discovery LS PET Curve.how_derived | **(5001,1005)** | **3** | **LT** | **1** | Bt |
| GE Discovery LS PET Curve.how_derived_size | **(5001,1006)** | **3** | **SL** | **1** | L |
| GE Discovery LS PET Curve.multi_patient | **(5001,1007)** | **3** | **SL** | **1** | L |
| GE Discovery LS PET Curve.deadtime | **(5001,1008)** | **3** | **SL** | **1** | L |

### D.6.8 GE Discovery LS PET Graph Module

**TABLE 2.4-8**

**GE DISCOVERY LS PET GRAPH MODULE PRIVATE ELEMENTS**
**PRIVATE CREATOR IDENTIFICATION (GEMS_ PETD_01)**

| **Attribute Name** | Tag | Type | VR | VM | **Discovery LS PET Type** |
|---|---|---|---|---|---|
| **Private Creator Data Element** | **(5003,0010)** | **1** | **SH** | **1** | **n/a** |
| **GE Discovery LS PET Graph Sequence** | **(5003,1001)** | **3** | **SQ** | **1** | n/a |
| > GE Discovery LS PET Graph.graph_id | **(5003,1002)** | **3** | **UI** | **1** | 64A |
| > GE Discovery LS PET Graph.compatible_version | **(5003,1003)** | **3** | **SH** | **1** | 5A |
| > GE Discovery LS PET Graph.software_version | **(5003,1004)** | **3** | **SH** | **1** | 5A |
| > GE Discovery LS PET Graph.title | **(5003,1005)** | **3** | **LO** | **1** | 32A |
| > GE Discovery LS PET Graph.graph_datetime | **(5003,1006)** | **3** | **DT** | **1** | D |
| > GE Discovery LS PET Graph.graph_description | **(5003,1007)** | **3** | **ST** | **1** | 128A |
| > GE Discovery LS PET Graph.title_font_name | **(5003,1008)** | **3** | **LO** | **1** | 32A |
| > GE Discovery LS PET Graph.title_font_size | **(5003,1009)** | **3** | **SH** | **1** | 2A |
| > GE Discovery LS PET Graph.footer | **(5003,100A)** | **3** | **LO** | **1** | 64A |
| > GE Discovery LS PET Graph.footer_font_size | **(5003,100B)** | **3** | **SH** | **1** | 2A |
| > GE Discovery LS PET Graph.foreground_color | **(5003,100C)** | **3** | **LO** | **1** | 20A |
| > GE Discovery LS PET Graph.background_color | **(5003,100D)** | **3** | **LO** | **1** | 20A |
| > GE Discovery LS PET Graph.graph_border | **(5003,100E)** | **3** | **SL** | **1** | L |
| > GE Discovery LS PET Graph.graph_width | **(5003,100F)** | **3** | **SL** | **1** | L |
| > GE Discovery LS PET Graph.graph_height | **(5003,1010)** | **3** | **SL** | **1** | L |
| > GE Discovery LS PET Graph.grid | **(5003,1011)** | **3** | **SL** | **1** | L |
| > GE Discovery LS PET Graph.label_font_name | **(5003,1012)** | **3** | **LO** | **1** | 32A |
| > GE Discovery LS PET Graph.label_font_size | **(5003,1013)** | **3** | **SH** | **1** | 2A |
| > GE Discovery LS PET Graph.axes_color | **(5003,1014)** | **3** | **LO** | **1** | 20A |
| > GE Discovery LS PET Graph.x_axis_label | **(5003,1015)** | **3** | **LO** | **1** | 32A |
| > GE Discovery LS PET Graph.x_axis_units | **(5003,1016)** | **3** | **SL** | **1** | L |
| > GE Discovery LS PET Graph.x_major_tics | **(5003,1017)** | **3** | **FL** | **1** | F |

| | | | | | |
|---|---|---|---|---|---|
| > GE Discovery LS PET Graph.x_axis_min | **(5003,1018)** | **3** | **FL** | **1** | F |
| > GE Discovery LS PET Graph.x_axis_max | **(5003,1019)** | **3** | **FL** | **1** | F |
| > GE Discovery LS PET Graph.y_axis_label | **(5003,101A)** | **3** | **LO** | **1** | 32A |
| > GE Discovery LS PET Graph.y_axis_units | **(5003,101B)** | **3** | **SL** | **1** | L |
| > GE Discovery LS PET Graph.y_major_tics | **(5003,101C)** | **3** | **FL** | **1** | F |
| > GE Discovery LS PET Graph.y_axis_min | **(5003,101D)** | **3** | **FL** | **1** | F |
| > GE Discovery LS PET Graph.y_axis_max | **(5003,101E)** | **3** | **FL** | **1** | F |
| > GE Discovery LS PET Graph.legend_font_name | **(5003,101F)** | **3** | **LO** | **1** | 32A |
| > GE Discovery LS PET Graph.legend_font_size | **(5003,1020)** | **3** | **SH** | **1** | 2A |
| > GE Discovery LS PET Graph.legend_location_x | **(5003,1021)** | **3** | **SL** | **1** | L |
| > GE Discovery LS PET Graph.legend_location_y | **(5003,1022)** | **3** | **SL** | **1** | L |
| > GE Discovery LS PET Graph.legend_width | **(5003,1023)** | **3** | **SL** | **1** | L |
| > GE Discovery LS PET Graph.legend_height | **(5003,1024)** | **3** | **SL** | **1** | L |
| > GE Discovery LS PET Graph.legend_border | **(5003,1025)** | **3** | **SL** | **1** | L |
| > GE Discovery LS PET Graph.multi_patient | **(5003,1026)** | **3** | **SL** | **1** | L |

### D.6.9 GE Discovery LS PET Curve Presentation Module

**TABLE 2.4-9**

**GE DISCOVERY LS PET CURVE PRESENTATION MODULE PRIVATE ELEMENTS PRIVATE CREATOR IDENTIFICATION (GEMS_ PETD_01)**

| **Attribute Name** | Tag | Type | VR | VM | **Discovery LS PET Type** |
|---|---|---|---|---|---|
| **Private Creator Data Element** | **(5005,0010)** | **1** | **SH** | **1** | **n/a** |
| **GE Discovery LS PET CurvePresentation Sequence** | **(5005,1001)** | **3** | **SQ** | **1** | n/a |
| > GE Discovery LS PET CurvePresentation.curvepresent_id | **(5005,1002)** | **3** | **UI** | **1** | 64A |
| > GE Discovery LS PET CurvePresentation.graph_id | **(5005,1003)** | **3** | **UI** | **1** | 64A |
| > GE Discovery LS PET CurvePresentation.curve_id | **(5005,1004)** | **3** | **UI** | **1** | 64A |
| > GE Discovery LS PET CurvePresentation.compatible_version | **(5005,1005)** | **3** | **SH** | **1** | 5A |
| > GE Discovery LS PET CurvePresentation.software_version | **(5005,1006)** | **3** | **SH** | **1** | 5A |
| > GE Discovery LS PET CurvePresentation.curve_label | **(5005,1007)** | **3** | **LO** | **1** | 60A |
| > GE Discovery LS PET CurvePresentation.color | **(5005,1008)** | **3** | **LO** | **1** | 20A |
| > GE Discovery LS PET CurvePresentation.line_type | **(5005,1009)** | **3** | **SL** | **1** | L |

| | | | | | |
|---|---|---|---|---|---|
| > GE Discovery LS PET CurvePresentation.line_width | **(5005,100A)** | **3** | **SL** | **1** | L |
| > GE Discovery LS PET CurvePresentation.point_symbol | **(5005,100B)** | **3** | **SL** | **1** | L |
| > GE Discovery LS PET CurvePresentation.point_symbol_dim | **(5005,100C)** | **3** | **SL** | **1** | L |
| > GE Discovery LS PET CurvePresentation.point_color | **(5005,100D)** | **3** | **LO** | **1** | 20A |

# E PATIENT ROOT QUERY/RETRIEVE INFORMATION MODEL Definition

## E.1 introduction

This section specifies the use of the DICOM Patient Root Query/Retrieve Model used to organize data and against which a Query/Retrieve will be performed. The contents of this section are:

E.2 - Patient Root Information Model Description

E.3 - Patient Root Information Model Entity-Relationship Model

E.4 - Patient Root Information Model Keys

## E.2 Patient Root Information Model Description

The Patient Root Query/Retrieve Information Model is based upon a four level hierarchy:

–1 Patient

–2 Study

–3 Series

–4 Image

The patient level is the top level and contains Attributes associated with the Patient Information Entity (IE) of Image IODs. Patient IEs are modality independent.
The study level is below the patient level and contains Attributes associated with the Study IE of Image IODs. A study belongs to a single patient. A single patient may have multiple studies. Study IEs are modality independent.
The series level is below the study level and contains Attributes associated with the Series, Frame of Reference and Equipment IEs of Image IODs. A series belongs to a single study. A single study may have multiple series. Series IEs are modality dependent
The lowest level is the image level and contains Attributes associated with the Image IE of Image IODs. An image belongs to a single series. A single series may contain multiple images. Image IEs are modality dependent

**Note:** The GE Discovery LS PET AE ***TM*** supports the Patient Root Model as the DICOM Query SCP only.

## E.3 Patient Root Information Model Entity-Relationship Model

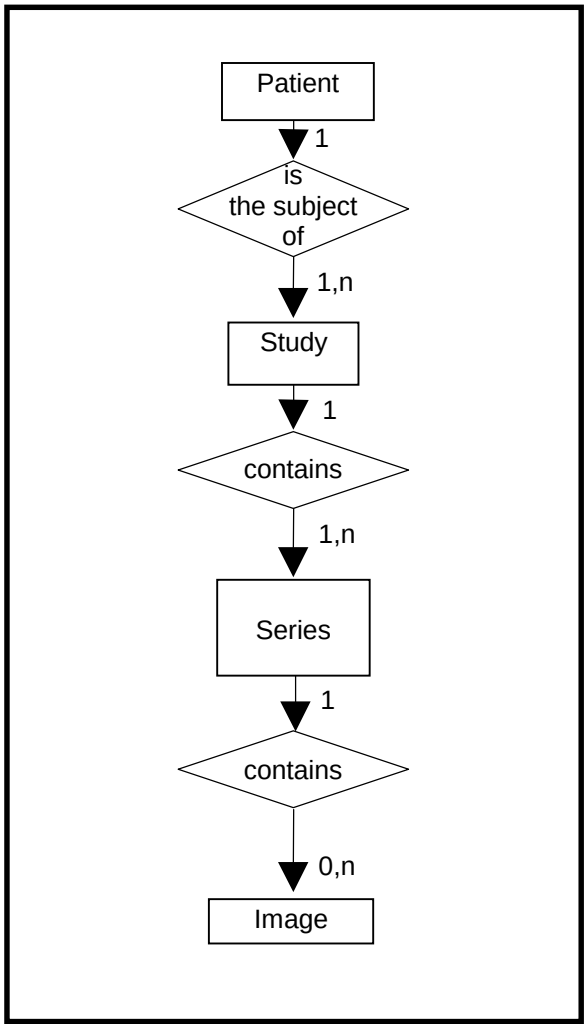
The Entity-Relationship diagram for the Patient Root Information Model schema is shown in Illustration E.3-1**.** In this figure, the following diagrammatic convention is established to represent the information organization :

- each entity is represented by a rectangular box

- each relationship is represented by a diamond shaped box.
- the fact that a relationship exists between two entities is depicted by lines connecting the corresponding entity boxes to the relationship boxes.

The relationships are fully defined with the maximum number of possible entities in the relationship shown. In other words, the relationship between Series and Image can have up to n Images per Series, but the Patient to Study relationship has 1 Study for each Patient (a Patient can have more than one Study on the system, however each Study will contain all of the information pertaining to that Patient).

**ILLUSTRATION E.3-1**
**PATIENT ROOT QUERY/RETRIEVE INFORMATION MODEL E/R DIAGRAM**




### E.3.1 ENTITY DESCRIPTIONS

Please refer to DICOM Standard PS 3.4 (Service Class Specifications) for a description of each of the levels contained within the Patient Root Query/Retrieve Information Model.

### E.3.1.1 Patient Entity Description

The Patient Entity defines the characteristics of a patient who is the subject of one or more medical studies which produce medical images.

### E.3.1.2 Study Entity Description

The Study Entity defines the characteristics of a medical study performed on a patient. A study is a collection of one or more series of medical images which are logically related for the purpose of diagnosing a patient. Each study is associated with exactly one patient.

### E.3.1.3 Series Entity Description

The Series Entity defines the attributes which are used to group images into distinct logical sets. Each series is associated with exactly one study.

### E.3.1.4 Image Entity Description

The Image Entity defines the attributes which describe the pixel data of an image. The pixel data is generated as a direct result of patient scanning (an Original image). An image is defined by its image plane, pixel data characteristics gray scale and/or color mapping characteristics and modality specific characteristics (acquisition parameters and image creation information).

### E.3.2 GE Discovery LS PET AE Mapping of DICOM entities

**TABLE 2.4-1**
**MAPPING OF DICOM ENTITIES TO DISCOVERY LS PET ENTITIES**

| DICOM | *Discovery LS PET* Entity |
|---|---|
| Patient | Patient |
| Study | Exam |
| Series | ImageSet, Scan |
| Image | Image, Frame |

## E.4 INFORMATION Model Keys

Please refer to DICOM Standard PS 3.4 (Service Class Specifications) for a description of each of the levels contained within the Patient Root Query/Retrieve Information Model.
The following Level descriptions are included to specify what data elements are supported and what type of matching can be applied. It should be noted that they are the same ones as defined in the DICOM Standard PS 3.4 (Service Class Specifications).

### E.4.1 Supported Matching

The GE Discovery LS PET AE Query SCP supports the following types of matching:

- Single Value matching
- List of UID matching
- Universal Matching
- Wild Card Matching
- Range of date, Range of Time

### E.4.2 Patient Level

This section defines the keys at the Patient Level of the Patient Root Query/Retrieve Information Model that are supported by this implementation.

**TABLE E.4-1**
**PATIENT LEVEL ATTRIBUTES FOR THE PATIENT ROOT QUERY/RETRIEVE INFORMATION MODEL**

| Attribute Name | Tag | Type | Note |
|---|---|---|---|
| Patient's Name | (0010,0010) | R | Matched. Matching performed without regard to the PN VR individual component values. |
| Patient ID | (0010,0020) | U | Matched. |
| Patient's Sex | (0010,0040) | O | Returned |

**TABLE E.4-2**
**Q/R PATIENT LEVEL AND LOCATION FOR RETRIEVE ATTRIBUTES**

| Attribute Name | Tag | Type | Note |
|---|---|---|---|
| Query Retrieve Level | (0008,0052) | - | Value = PATIENT |
| Retrieve AE Title | (0008,0054) | - | AE Title of the local system (i.e. the system being queried) |

### E.4.3 Study Level

This section defines the keys at the Study Level of the Patient Root Query/Retrieve Information Model that are supported by this implementation.

**TABLE E.4-3**
**STUDY LEVEL ATTRIBUTES FOR THE PATIENT ROOT QUERY/RETRIEVE INFORMATION MODEL**

| Attribute Name | Tag | Type | Attribute Description |
|---|---|---|---|
| Study Date | (0008,0020) | R | Matched |
| Study Time | (0008,0030) | R | Matched |
| Accession Number | (0008,0050) | R | Matched based on exam.requisition |
| Modalities in Study | (0008,0061) | O | Matched |
| Study ID | (0020,0010) | R | Matched |
| Study Instance UID | (0020,000D) | U | Matched |
| Referring Physician's Name | (0008,0090) | O | Returned |
| Study Description | (0008,1030) | O | Returned |
| Name of Physician(s) Reading Study | (0008,1060) | O | Returned |
| Patient’s Size | (0010,1020) | O | Returned |
| Patient’s Weight | (0010,1030) | O | Returned |
| Number of Study Related Series | (0020,1206) | O | Returned |

**TABLE E.4-4**

**Q/R STUDY LEVEL AND LOCATION FOR RETRIEVE ATTRIBUTES**

| Attribute Name | Tag | Type | Note |
|---|---|---|---|
| Query Retrieve Level | (0008,0052) | - | Value = STUDY |
| Retrieve AE Title | (0008,0054) | - | AE Title of the local system (i.e. the system being queried) |

### E.4.4 Series Level

This section defines the keys at the Series Level of the Patient Root Query/Retrieve Information Model that are supported by this implementation.

**TABLE E.4-5**
**SERIES LEVEL ATTRIBUTES FOR THE PATIENT ROOT QUERY/RETRIEVE INFORMATION MODEL**

| Attribute Name | Tag | Type | Attribute Description |
|---|---|---|---|
| Modality | (0008,0060) | R | Matched |
| Series Number | (0020,0011) | R | Matched |
| Series Instance UID | (0020,000E) | U | Matched |
| Series Date | (0008,0021) | O | Returned |
| Series Time | (0008,0031) | O | Returned |
| Series Description | (0008,103E) | O | Returned |
| Operator's Name | (0008,1070) | O | Returned |
| Radio Pharmaceutical | (0008,1070) | O | Returned |
| Series Number of Images | (0020,1209) | O | Returned |
| Series Type | (0054,1000) | O | Returned |
| Counts Source | (0054,1002) | O | Returned |
| Imageset Source | (0009,107C) | O | Returned |
| Imageset Contents | (0009,107D) | O | Returned |

**TABLE E.4-6**
**Q/R SERIES LEVEL AND LOCATION FOR RETRIEVE ATTRIBUTES**

| Attribute Name | Tag | Type | Note |
|---|---|---|---|
| Query Retrieve Level | (0008,0052) | - | Value = SERIES |
| Retrieve AE Title | (0008,0054) | - | AE Title of the local system (i.e. the system being queried) |

### E.4.5 Image Level

This section defines the keys at the Image Level of the Patient Root Query/Retrieve Information Model that are supported by this implementation.

**TABLE E.4-7**
**IMAGE LEVEL ATTRIBUTES FOR THE PATIENT ROOT**

**QUERY/RETRIEVE INFORMATION MODEL**

| Attribute Name | Tag | Type | Attribute Description |
|---|---|---|---|
| Image Number | (0020,0013) | R | Matched |
| SOP Instance UID | (0008,0018) | U | Matched |
| Rows | (0028,0010) | O | Returned |
| Columns | (0028,0011) | O | Returned |

**TABLE E.4-8**
**Q/R IMAGE LEVEL AND LOCATION FOR RETRIEVE ATTRIBUTES**

| Attribute Name | Tag | Type | Note |
|---|---|---|---|
| Query Retrieve Level | (0008,0052) | - | Value = IMAGE |
| Retrieve AE Title | (0008,0054) | - | AE Title of the local system (i.e. the system being queried) |

### E.4.6 Private data dictionary

The Type of a Private Attribute is determined by the level of the Information Model in which it is used, and hence is not listed in this dictionary.

**TABLE 2.44-9**
**PRIVATE CREATOR IDENTIFICATION (GEMS_PETD_01)**

**SERIES LEVEL PRIVATE ATTRIBUTES FOR THE PATIENT ROOT MODEL**

| Attribute Name | Tag | VR | VM |
|---|---|---|---|
| Imageset Source | (0009,107C) | SL | 1 |
| Imageset Contents | (0009,107D) | SL | 1 |

# F Study ROOT QUERY/RETRIEVE INFORMATION MODEL Definition

## F.1 introduction

This section specifies the use of the DICOM Study Root Query/Retrieve Model used to organize data and against which a Query/Retrieve will be performed. The contents of this section are:

F.2 - Study Root Information Model Description

F.3 - Study Root Information Model Entity-Relationship Model

F.4 - Study Root Information Model Keys

## F.2 Study Root Information Model Description

The Study Root Query/Retrieve Information Model is based upon a three level hierarchy:

– Study

- Series
- Image

The study level is the top level and contains Attributes associated with the Study IE of Image IODs. Attributes of patients are considered to be attributes of studies. Study IEs are modality independent.
The series level is below the study level and contains Attributes associated with the Series, Frame of Reference and Equipment IEs of Image IODs. A series belongs to a single study. A single study may have multiple series. Series IEs are modality dependent
The lowest level is the image level and contains Attributes associated with the Image IE of Image IODs. An image belongs to a single series. A single series may contain multiple images. Image IEs are modality dependent

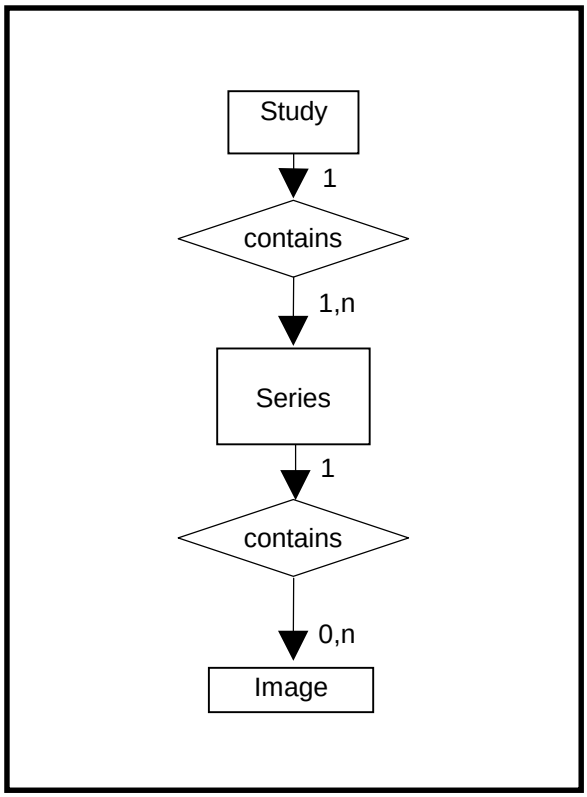
## F.3 Study Root Information Model Entity-Relationship Model

The Entity-Relationship diagram for the Study Root Information Model schema is shown in Illustration F.3-1**.** In this figure, the following diagrammatic convention is established to represent the information organization :

- each entity is represented by a rectangular box
- each relationship is represented by a diamond shaped box.
- the fact that a relationship exists between two entities is depicted by lines connecting the corresponding entity boxes to the relationship boxes.

The relationships are fully defined with the maximum number of possible entities in the relationship shown. In other words, the relationship between Series and Image can have up to n Images per Series.

**ILLUSTRATION F.3-1**
**STUDY ROOT QUERY/RETRIEVE INFORMATION MODEL E/R DIAGRAM**




### F.3.1 Entity Descriptions

Please refer to DICOM Standard PS 3.4 (Service Class Specifications) for a description of each of the levels contained within the Study Root Query/Retrieve Information Model.

#### F.3.1.1 Study Entity Description

The Study Entity defines the characteristics of a medical study performed on a patient. A study is a collection of one or more series of medical images which are logically related for the purpose of diagnosing a patient.

#### F.3.1.2 Series Entity Description

The Series Entity defines the attributes which are used to group images into distinct logical sets. Each series is associated with exactly one study.

#### F.3.1.3 Image Entity Description

The Image Entity defines the attributes which describe the pixel data of an image. The pixel data is generated as a direct result of patient scanning (an Original image). An image is defined by its image plane, pixel data characteristics gray scale and/or color mapping characteristics and modality specific characteristics (acquisition parameters and image creation information).

### F.3.2 GE Discovery LS PET AE Mapping of DICOM entities

**TABLE 2.4-1**
**MAPPING OF DICOM ENTITIES TO DISCOVERY LS PET ENTITIES**

| DICOM | *Discovery LS PET* Entity |
|---|---|
| Study | Exam |
| Series | Imageset, Scan |
| Image | Image, Frame |

## F.4 INFORMATION Model Keys

Please refer to DICOM Standard PS 3.4 (Service Class Specifications) for a description of each of the levels contained within the Study Root Query/Retrieve Information Model. The following Level descriptions are included to specify what data elements are supported and what type of matching can be applied. It should be noted that they are the same ones as defined in the DICOM Standard PS 3.4 (Service Class Specifications).

### F.4.1 Supported Matching

The GE Discovery LS PET AE Query SCU request the following type(s) of matching:

- Wild Card Matching
- Single Value matching
- Range of date

The GE Discovery LS PET AE Query SCP supports the following types of matching:

- Single Value matching
- List of UID matching
- Universal Matching
- Wild Card Matching
- Range of date, Range of Time
- Sequence Matching

### F.4.2 Study Level

This section defines the keys at the Study Level of the Study Root Query/Retrieve Information Model that are supported by this implementation.

**TABLE F.4-2**
**STUDY LEVEL ATTRIBUTES FOR THE STUDY ROOT QUERY/RETRIEVE INFORMATION MODEL**

| Attribute Name | Tag | Type | Note |
|---|---|---|---|
| Patient's Name | (0010,0010) | R | Matched. Matching performed without regard to the PN VR individual component values. |
| Patient ID | (0010,0020) | R | Matched. |
| Study Date | (0008,0020) | R | Matched |
| Study Time | (0008,0030) | R | Matched |
| Accession Number | (0008,0050) | R | Matched based on exam.requisition |
| Modalities in Study | (0008,0061) | O | Matched |

| | | | |
|---|---|---|---|
| Study ID | (0020,0010) | R | Matched |
| Study Instance UID | (0020,000D) | U | Matched |
| Referring Physician's Name | (0008,0090) | O | Returned |
| Study Description | (0008,1030) | O | Returned |
| Name of Physician(s) Reading Study | (0008,1060) | O | Returned |
| Patient's Size | (0010,1020) | O | Returned |
| Patient's Weight | (0010,1030) | O | Returned |
| Patient's Sex | (0010,0040) | O | Returned |
| Number of Study Related Series | (0020,1206) | O | Returned |

**TABLE F.4-3**
**Q/R STUDY LEVEL AND LOCATION FOR RETRIEVE ATTRIBUTES**

| Attribute Name | Tag | Type | Note |
|---|---|---|---|
| Query Retrieve Level | (0008,0052) | - | Value = STUDY |
| Retrieve AE Title | (0008,0054) | - | AE Title of the local system (i.e. the system being queried) |

### F.4.3 Series Level

This section defines the keys at the Series Level of the Study Root Query/Retrieve Information Model that are supported by this implementation.

**TABLE F.4-4**
**SERIES LEVEL ATTRIBUTES FOR THE STUDY ROOT QUERY/RETRIEVE INFORMATION MODEL**

| Attribute Name | Tag | Type | Attribute Description |
|---|---|---|---|
| Modality | (0008,0060) | R | Matched |
| Series Number | (0020,0011) | R | Matched |
| Series Instance UID | (0020,000E) | U | Matched |
| Series Date | (0008,0021) | O | Returned |
| Series Time | (0008,0031) | O | Returned |
| Series Description | (0008,103E) | O | Returned |
| Operator's Name | (0008,1070) | O | Returned |
| Radio Pharmaceutical | (0008,1070) | O | Returned |
| Series Number of Images | (0020,1209) | O | Returned |
| Series Type | (0054,1000) | O | Returned |
| Counts Source | (0054,1002) | O | Returned |
| Imageset Source | (0009,107C) | O | Returned |
| Imageset Contents | (0009,107D) | O | Returned |

**TABLE F.4-5**
**Q/R SERIES LEVEL AND LOCATION FOR RETRIEVE ATTRIBUTES**

| Attribute Name | Tag | Type | Note |
|---|---|---|---|
| Query Retrieve Level | (0008,0052) | - | Value = SERIES |
| Retrieve AE Title | (0008,0054) | - | AE Title of the local system (i.e. the system being queried) |

### F.4.4 Image Level

This section defines the keys at the Image Level of the Study Root Query/Retrieve Information Model that are supported by this implementation.

**TABLE F.4-6**
**IMAGE LEVEL ATTRIBUTES FOR THE STUDY ROOT QUERY/RETRIEVE INFORMATION MODEL**

| Attribute Name | Tag | Type | Attribute Description |
|---|---|---|---|
| Image Number | (0020,0013) | R | Matched |
| SOP Instance UID | (0008,0018) | U | Matched |
| Rows | (0028,0010) | O | Returned |
| Columns | (0028,0011) | O | Returned |

**TABLE F.4-7**
**Q/R IMAGE LEVEL AND LOCATION FOR RETRIEVE ATTRIBUTES**

| Attribute Name | Tag | Type | Note |
|---|---|---|---|
| Query Retrieve Level | (0008,0052) | - | Value = IMAGE |
| Retrieve AE Title | (0008,0054) | - | AE Title of the local system (i.e. the system being queried) |

### F.4.5 Private data dictionary

The Type of a Private Attribute is determined by the level of the Information Model in which it is used, and hence is not listed in this dictionary.

**TABLE 2.44-8**
**PRIVATE CREATOR IDENTIFICATION (GEMS_PETD_01)**

**SERIES LEVEL PRIVATE ATTRIBUTES FOR THE STUDY ROOT MODEL**

| Attribute Name | Tag | VR | VM |
|---|---|---|---|
| Imageset Source | (0009,107C) | SL | 1 |
| Imageset Contents | (0009,107D) | SL | 1 |

# G Standalone curve INFORMATION OBJECT IMPLEMENTATION

## G.1 introduction

This section specifies the use of the DICOM Standalone Curve IOD (referred to as the Curve IOD in other parts of this section) to represent the information included in curves produced by this implementation. Corresponding attributes are conveyed using the module construct. The contents of this section are:

G.2- Standalone Curve IOD Description

G.3- Standalone Curve IOD Entity-Relationship Model

G.4- Standalone Curve IOD Module Table

G.5- IOD Module Definition

## G.2 STANDALONE CURVE IOD Implementation

The GE Discovery LS PET AE implementation of DICOM uses the Standalone Curve format when creating curve objects. The GE Discovery LS PET AE Curve object includes time activity curves, volume activity curves, image profile histograms, energy spectrum histograms and area curves. In order to preserve full fidelity when transferring data to a GE Discovery LS PET AE workstation, some specialized database information is encoded as private DICOM attributes. All of the Standard and private attributes used are defined in the module tables. The GE Discovery LS PET AE private data dictionary is included in Section G.6. Nevertheless, the GE Discovery LS PET AE is able to process DICOM curves without any private data elements.

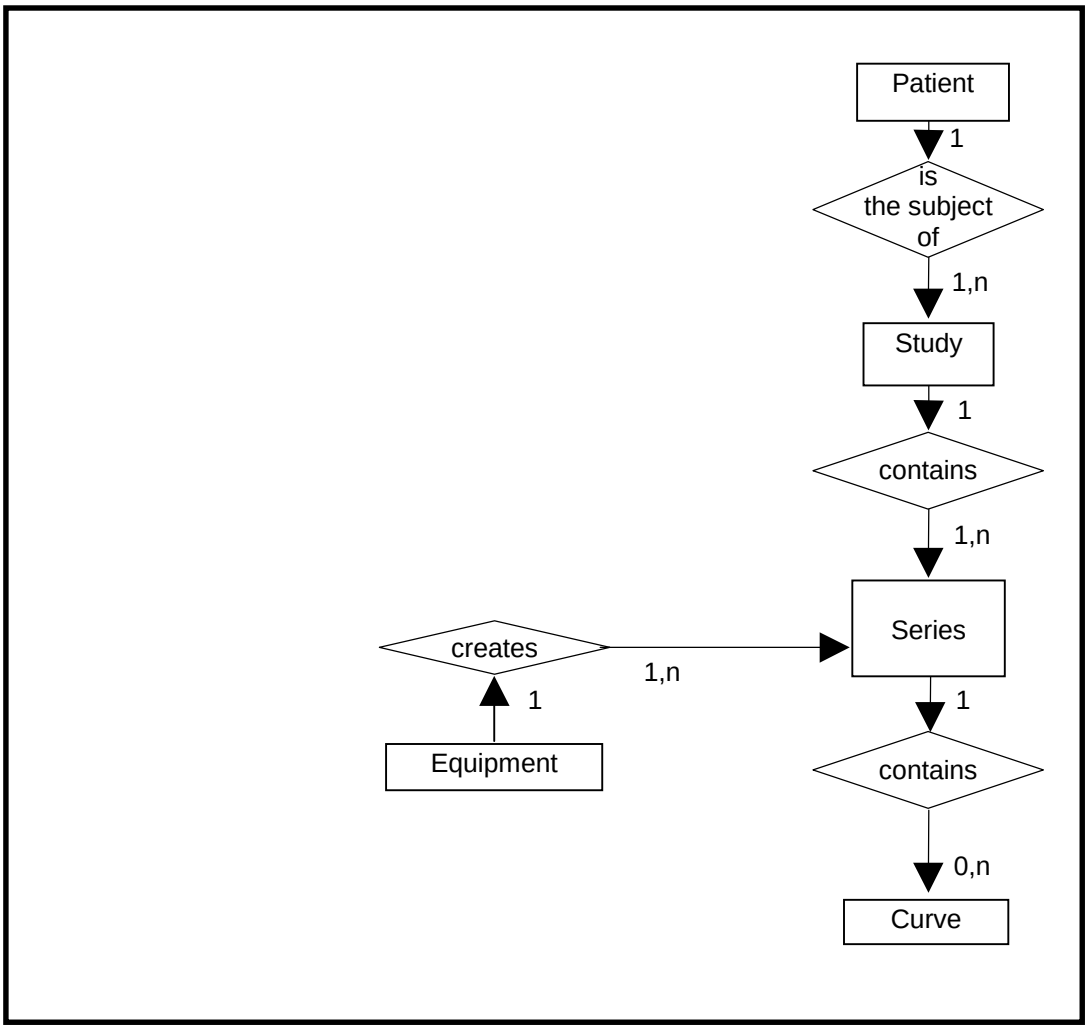
## G.3 STANDALONE CURVE Entity-Relationship Model

The Entity-Relationship diagram for the Curve interoperability schema is shown in **Illustration 7.3-1 .** In this figure, the following diagrammatic convention is established to represent the information organization :

- each entity is represented by a rectangular box
- each relationship is represented by a diamond shaped box.
- the fact that a relationship exists between two entities is depicted by lines connecting the corresponding entity boxes to the relationship boxes.

The relationships are fully defined with the maximum number of possible entities in the relationship shown. In other words, the relationship between Series and Curve can have up to n Curves per Series, but the Patient to Study relationship has 1 Study for each Patient (a Patient can have more than one Study on the system, however each Study will contain all of the information pertaining to that Patient).

**ILLUSTRATION 7.3-1**
**CURVE ENTITY RELATIONSHIP DIAGRAM**




## G.3.1 ENTITY DESCRIPTIONS

Please refer to DICOM Standard Part 3 (Information Object Definitions) for a description of each of the entities contained within the Information Object.

### G.3.1.1 Patient Entity Description

The Patient Entity defines the characteristics of a patient who is the subject of one or more medical studies which produce medical images.

### G.3.1.2 Study Entity Description

The Study Entity defines the characteristics of a medical study performed on a patient. A study is a collection of one or more series of medical images which are logically related for the purpose of diagnosing a patient. Each study is associated with exactly one patient.

### G.3.1.3 Series Entity Description

The Series Entity defines the attributes which are used to group images into distinct logical sets. Each series is associated with exactly one study.

### G.3.1.4 Equipment Entity Description

The Equipment Entity describes the particular imaging device which produced the series of images. An imaging device may produce one or more series within a study. The Equipment Entity does not describe the data acquisition or image creation Attributes used to generate images within a series.

### G.3.1.5 Curve Entity Description

The Curve Entity defines the attributes which describe the curve data of a curve.

### G.3.2 GE Discovery LS PET AE Mapping of DICOM entities

**TABLE 2.4-1**
**MAPPING OF DICOM ENTITIES TO DISCOVERY LS PET ENTITIES**

| DICOM | *Discovery LS PET* Entity |
|---|---|
| Patient | Patient |
| Study | Exam |
| Series | Imageset |
| Curve | Curve, Graph, Curve Presentation |

## G.4 Standalone curve IOD MODULE TABLE

Within an entity of the DICOM IOD, attributes are grouped into related set of attributes. A set of related attributes is termed a module. A module facilitates the understanding of the semantics concerning the attributes and how the attributes are related with each other. A module grouping does not infer any encoding of information into datasets.
**Table 2.4-1** identifies the defined modules within the entities which comprise the DICOM Standalone Curve IOD. Modules are identified by Module Name.
See DICOM Part 3 for a complete definition of the entities, modules, and attributes.

**TABLE 2.4-1**
**CURVE IOD MODULES**

| Entity Name | Module Name | Reference |
|---|---|---|
| Patient | Patient | G.5.1.1 |
| | GE Discovery LS PET Patient | G.5.1.2 |
| Study | General Study | G.5.2.1 |
| | Patient Study | G.5.2.2 |
| | GE Discovery LS PET Exam | G.5.2.3 |
| Series | General Series | G.5.3.1 |
| | GE Discovery LS PET Imageset | G.5.3.2 |
| | GE Discovery LS PET Scan | G.5.3.3 |
| Equipment | General Equipment | G.5.4.1 |
| Curve | Curve Identification | G.5.5.1 |
| | Curve | G.5.5.2 |
| | GE Discovery LS PET Curve | G.5.5.3 |
| | GE Discovery LS PET Graph | G.5.5.4 |
| | GE Discovery LS PET Curve Presentation | G.5.5.5 |
| General Modules | SOP Common | G.5.6.1 |

## G.5 STANDALONE CURVE INFORMATION MODULE DEFINITIONS

Please refer to DICOM Standard Part 3 (Information Object Definitions) for a description of each of the entities and modules contained within the Standalone Curve Information Object.
The following modules are included to convey Enumerated Values, Defined Terms, and Optional Attributes supported. Type 1 & Type 2 Attributes are also included for completeness and to define what values they may take and where these values are obtained from. It should be noted that they are the same ones as defined in the DICOM Standard Part 3 (Information Object Definitions).

### G.5.1 Common Patient Entity Modules

#### G.5.1.1 Patient Module

This section specifies the Attributes of the Patient that describe and identify the Patient who is the subject of a diagnostic Study. This Module contains Attributes of the patient that are needed for diagnostic interpretation of the Image and are common for all studies performed on the patient.

**TABLE 2.4-1**
**PATIENT MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Attribute (Discovery LS PET Patient table | Notes |
|---|---|---|---|---|---|---|

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | unless otherwise specified) | |
| **Patient's Name** | **(0010,0010)** | **2** | **PN (64)** | **1** | **patient_name** | |
| **Patient ID** | **(0010,0020)** | **2** | **LO (64)** | **1** | **patient_identifier** | |
| **Patient's Birth Date** | **(0010,0030)** | **2** | **DA (26)** | **1** | **birthdate** | |
| **Patient's Sex** | **(0010,0040)** | **2** | **CS (16)** | **1** | **sex** | |
| **Referenced Patient Sequence** | **(0008,1120)** | **3** | **SQ** | **1** | **Not Used** | |
| **>Referenced SOP Class UID** | **(0008,1150)** | **1C** | **UI** | **1** | **Not Used** | |
| **>Referenced SOP Instance UID** | **(0008,1155)** | **1C** | **UI** | **1** | **Not Used** | |
| **Patient's Birth Time** | **(0010,0032)** | **3** | **TM** | **1** | **Not Used** | |
| **Other Patient IDs** | **(0010,1000)** | **3** | **LO** | **1-n** | **Not Used** | |
| **Other Patient Names** | **(0010,1001)** | **3** | **PN** | **1-n** | **Not Used** | |
| **Ethnic Group** | **(0010,2160)** | **3** | **SH** | **1** | **Not Used** | |
| **Patient Comments** | **(0010,4000)** | **3** | **LT** | **1** | **Not Used** | |

### G.5.1.2 GE Discovery LS PET Patient

Refer to Section G.6.2 for details.

### G.5.2 Common Study Entity Modules

The following Study IE Modules are common to all Composite Image IODs which reference the Study IE. These Module contain Attributes of the patient and study that are needed for diagnostic interpretation of the image.

### G.5.2.1 General Study Module

This section specifies the Attributes which describe and identify the Study performed upon the Patient.

**TABLE 2.4-2**
**GENERAL STUDY MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Attribute (GE Discovery LS PET Exam table unless otherwise specified) | Notes |
|---|---|---|---|---|---|---|
| **Study Instance UID** | **(0020,000D)** | **1** | **UI** | **1** | **study_uid** | |
| **Study Date** | **(0008,0020)** | **2** | **DA** | **1** | **extract date from exam_datetime** | |
| **Study Time** | **(0008,0030)** | **2** | **TM** | **1** | **extract time exam_datetime** | |
| **Referring Physician's Name** | **(0008,0090)** | **2** | **PN** | **1** | **ref_physician** | |
| **Study ID** | **(0020,0010)** | **2** | **SH** | **1** | **study_identifier** | |
| **Accession Number** | **(0008,0050)** | **2** | **SH** | **1** | **requisition** | |
| **Study Description** | **(0008,1030)** | **3** | **LO** | **1** | **exam_desc** | |
| **Physician(s) of Record** | **(0008,1048)** | **3** | **PN** | **1-n** | Not Used | |
| **Name of Physician(s) Reading Study** | **(0008,1060)** | **3** | **PN** | **1-n** | **diagnostician** | |
| **Referenced Study Sequence** | **(0008,1110)** | **3** | **SQ** | **1** | Not Used | |
| **> Referenced SOP Class UID** | **(0008,1150)** | **1C** | **UI** | **1** | Not Used | |
| **> Referenced SOP Instance UID** | **(0008,1155)** | **1C** | **UI** | **1** | Not Used | |

### G.5.2.2 Patient Study Module

This section defines Attributes that provide information about the Patient at the time the Study was performed.

**TABLE 2.4-3**
**PATIENT STUDY MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Attribute (GE Discovery LS PET Exam table unless otherwise specified) | Notes |
|---|---|---|---|---|---|---|

| | | | | | | |
|---|---|---|---|---|---|---|
| **Admitting Diagnosis Description** | **(0008,1080)** | **3** | **LO** | **1-n** | **Not Used** | |
| **Patient's Age** | **(0010,1010)** | **3** | **AS** | **1** | **truncate years from (Exam.exam_datetime - Patient.patient_birthdate)** | |
| **Patient's Size** | **(0010,1020)** | **3** | **DS** | **1** | **patient_ht / 100.0 (convert cm to m)** | |
| **Patient's Weight** | **(0010,1030)** | **3** | **DS** | **1** | **patient_wt** | |
| **Occupation** | **(0010,2180)** | **3** | **SH** | **1** | **Not Used** | |
| **Additional Patient's History** | **0010,21B0)** | **3** | **LT** | **1** | **patient_history** | |

### G.5.2.3 GE Discovery LS PET Exam Module

Refer to Section G.6.3 for details.

### G.5.3 Common Series Entity Modules

The following Series IE Modules are common to all Composite Image IODs which reference the Series IE.

### G.5.3.1 General Series Module

This section specifies the Attributes which identify and describe general information about the Series within a Study.

**TABLE 2.4-4**
**GENERAL SERIES MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Attribute (GE Discovery LS PET ImageSet table unless otherwise specified) | Notes |
|---|---|---|---|---|---|---|
| **Modality** | **(0008,0060)** | **1** | **CS** | **1** | **Imageset.modality** | |
| **Series Instance UID** | **(0020,000E)** | **1** | **UI** | **1** | **IF (SOP Class UID == "1.2.840.113619.4.30") THEN = Scan.scan_id ELSE = image_set_id** | |
| **Series Number** | **(0020,0011)** | **2** | **IS** | **1** | **series_number** | |
| **Laterality** | **(0020,0060)** | **2C** | **CS** | **1** | **Not Used** | |
| **Series Date** | **(0008,0021)** | **3** | **DA** | **1** | **extract date from imageset.datetime** | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Series Time** | **(0008,0031)** | **3** | **TM** | **1** | **extract time from imageset.datetime** | |
| **Performing Physician's Name** | **(0008,1050)** | **3** | **PN** | **1-n** | **Not Used** | |
| **Protocol Name** | **(0018,1030)** | **3** | **LO** | **1** | **Not Used** | |
| **Series Description** | **(0008,103E)** | **3** | **LO** | **1** | **IF (SOP Class UID == "1.2.840.113619.4.30") THEN = Scan.scan_description ELSE = is_description** | |
| **Operators' Name** | **(0008,1070)** | **3** | **PN** | **1-n** | **Exam.operator** | |
| **Referenced Study Component Sequence** | **(0008,1111)** | **3** | **SQ** | **1** | **Not Used** | |
| **> Referenced SOP Class UID** | **(0008,1150)** | **1C** | **UI** | **1** | **Not Used** | |
| **> Referenced SOP Instance UID** | **(0008,1155)** | **1C** | **UI** | **1** | **Not Used** | |
| **Body Part Examined** | **(0018,0015)** | **3** | **CS** | **1** | **Not Used** | |
| **Patient Position** | **(0018,5100)** | **2C** | **CS** | **1** | **Scan.patient_position, Frame.patient_entry** | |
| **Smallest Pixel Value in Series** | **(0028,0108)** | **3** | **US/SS** | **1** | **Not Used** | |
| **Largest Pixel Value in Series** | **(0028,0109)** | **3** | **US/SS** | **1** | **Not Used** | |

### G.5.3.2 GE Discovery LS PET ImageSet Module

Refer to Section G.6.5 for details.

### G.5.3.3 GE Discovery LS PET Scan Module

Refer to Section G.6.4 for details.

### G.5.4 Common Equipment Entity Modules

The following Equipment IE Module is common to all Composite Image IODs which reference the Equipment IE.

#### G.5.4.1 General Equipment Module

This section specifies the Attributes which identify and describe the piece of equipment which produced a Series of Images.

**TABLE 2.4-5**
**GENERAL EQUIPMENT MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Attribute (GE Discovery LS PET Exam table unless otherwise specified) | Notes |
|---|---|---|---|---|---|---|
| **Manufacturer** | **(0008,0070)** | **2** | **LO** | **1** | **manufacturer** | |
| **Institution Name** | **(0008,0080)** | **3** | **LO** | **1** | **hospital_name** | |
| **Institution Address** | **(0008,0081)** | **3** | **ST** | **1** | **Not Used** | |
| **Station Name** | **(0008,1010)** | **3** | **SH** | **1** | **Not Used** | |
| **Institutional Department Name** | **(0008,1040)** | **3** | **LO** | **1** | **Not Used** | |
| **Manufacturer's Model Name** | **(0008,1090)** | **3** | **LO** | **1** | **scanner_desc** | |
| **Device Serial Number** | **(0018,1000)** | **3** | **LO** | **1** | **Not Used** | |
| **Software Versions** | **(0018,1020)** | **3** | **LO** | **1** | **Image.software_version Curve.software_version Frame.software_version** | |
| **Spatial Resolution** | **(0018,1050)** | **3** | **DS** | **1** | **Not Used** | |
| **Date of Last Calibration** | **(0018,1200)** | **3** | **DA** | **1-n** | **Not Used** | |
| **Time of Last Calibration** | **(0018,1201)** | **3** | **TM** | **1-n** | **Not Used** | |
| **Pixel Padding Value** | **(0028,0120)** | **3** | **US or SS** | **1** | **Not Used** | |

### G.5.5 Common Curve Entity Modules

The following Image IE Modules are common to all Composite Image IODs which reference the Image IE.

#### G.5.5.1 Curve Identification Module

This section specifies the Attributes which identify and describe an curve within a particular series.

**TABLE 2.4-6**
**CURVE IDENTIFICATION MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Attribute (GE Discovery LS PET Curve table unless otherwise specified) | Notes |
|---|---|---|---|---|---|---|
| **Curve Number** | **(0020,0024)** | **2** | **IS** | **1** | **1** | |
| **Curve Date** | **(0008,0025)** | **3** | **DA** | **1** | **extract date from curve_datetime** | |
| **Curve Time** | **(0008,0035)** | **3** | **TM** | **1** | **extract time from curve_datetime** | |
| **Referenced Image Sequence** | **(0008,1140)** | **3** | **SQ** | **1** | **Not Used** | |
| **>Referenced SOP Class UID** | **(0008,1150)** | **1** | **UI** | **1** | | |
| **>Referenced SOP Instance UID** | **(0008,1155)** | **1** | **UI** | **1** | | |
| **Referenced Overlay Sequence** | **(0008,1130)** | **3** | **SQ** | **1** | **Not Used** | |
| **>Referenced SOP Class UID** | **(0008,1150)** | **1** | **UI** | **1** | | |
| **>Referenced SOP Instance UID** | **(0008,1155)** | **1** | **UI** | **1** | | |
| **Referenced Curve Sequence** | **(0008,1145)** | **3** | **SQ** | **1** | **Not Used** | |
| **>Referenced SOP Class UID** | **(0008,1150)** | **1** | **UI** | **1** | | |
| **>Referenced SOP Instance UID** | **(0008,1155)** | **1** | **UI** | **1** | | |

### G.5.5.2 Curve Module

This section specifies the Attributes which identify and describe an curve within a particular series.

**TABLE 2.4-7**
**CURVE MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Attribute (GE Discovery LS PET Curve table unless otherwise specified) | Notes |
|---|---|---|---|---|---|---|
| **Curve Dimensions** | **(50xx,0005)** | **1** | **US** | **1** | **use curve_type** | |
| **Number of Points** | **(50xx,0010)** | **1** | **US** | **1** | **curve_size / sizeof (curvePoint) /* struct curvePoint in idbBlobStructs.h */** | |
| **Type of Data** | **(50xx,0020)** | **1** | **CS** | **1** | **curve_type<br>SYSRATE = system count rate<br>SLICERATE = slice count rate<br>BLDSMPL = blood samples** | **Refer Note Below** |
| **Data Value Representation** | **(50xx,0103)** | **1** | **US** | **1** | **0002H** | |
| **Curve Data** | **(50xx,3000)** | **1** | **OW/OB** | **1** | **curve_data** | |
| **Curve Description** | **(50xx,0022)** | **3** | **LO** | **1** | **curve_name** | |
| **Axis Units** | **(50xx,0030)** | **3** | **SH** | **1-n** | **Graph.x_axis_units \ Graph.y_axis_units** | **Refer Note below** |
| **Axis Labels** | **(50xx,0040)** | **3** | **SH** | **1-n** | **Graph.x_axis_label \ Graph.y_axis_label (truncate from 32A to 16A)** | |
| **Minimum Coordinate Value** | **(50xx,0104)** | **3** | **US** | **1-n** | **Not Used** | |
| **Maximum Coordinate Value** | **(50xx,0105)** | **3** | **US** | **1-n** | **Not Used** | |
| **Curve Range** | **(50xx,0106)** | **3** | **SH** | **1-n** | **Graph.x_axis_min \ Graph.x_axis_max \ Graph.y_axis_min \ Graph.y_axis_max** | |
| **Curve Data Descriptor** | **(50xx,0110)** | **1C** | **US** | **1-n** | **Not Used** | |
| **Coordinate Start Value** | **(50xx,0112)** | **1C** | **US** | **1** | **Not Used** | |
| **Coordinate Step Value** | **(50xx,0114)** | **1C** | **US** | **1** | **Not Used** | |
| **Curve Label** | **(50xx,2500)** | **3** | **LO** | **1** | **CurvePresentation.curve_label** | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Referenced Overlay Sequence** | **(50xx,2600)** | **3** | **SQ** | **1** | **Not Used** | |
| **>Referenced SOP Class UID** | **(0008,1150)** | **1** | **UI** | **1** | **Not Used** | |
| **>Referenced SOP Instance UID** | **(0008,1155)** | **1** | **UI** | **1** | **Not Used** | |
| **>Referenced Overlay Group** | **(50xx,2610)** | **1** | **US** | **1** | **Not Used** | |

**Note:**

```
IF ( curve_type == [ blood sample ] ) THEN
    CASE  x_axis_units OF :
            [ msec ], [ sec ] :  break;/*  MILS and SEC ok  */
            [ min ]:  Axis Units (50xx,0030) Value 1 = SEC
            DEFAULT: Reject send

    CASE y_axis_units OF :
            [ counts/sec] :break;/*  BQML and CPS ok  */
            DEFAULT:Reject send

IF ( curve_type == [ rate ] ) THEN
    CASE  x_axis_units OF :
            [ msec ], [ sec ] :  break;    /*  MLS, SEC ok  */
            [ min ]:  Axis Units (50xx,0030) Value 1 = SEC
            DEFAULT: Reject send

    CASE y_axis_units OF :
            [ counts/sec] :    break;    /*  CPS ok  */
            DEFAULT: Reject send
```

### G.5.5.3 GE Discovery LS PET Curve

Refer to Section G.6.6 for details.

### G.5.5.4 GE Discovery LS PET Graph

Refer to Section G.6.7 for details.

### G.5.5.5 GE Discovery LS PET Curve Presentation

Refer to Section G.6.8 for details.

### G.5.6 General Modules

The SOP Common Module is mandatory for all DICOM IODs.

#### G.5.6.1 SOP Common Module

This section defines the Attributes which are required for proper functioning and identification of the associated SOP Instances. They do not specify any semantics about the Real-World Object represented by the IOD.

**TABLE 2.4-8**
**SOP COMMON MODULE ATTRIBUTES**

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Attribute (GE Discovery LS PET Image table unless otherwise specified) | Notes |
|---|---|---|---|---|---|---|
| **SOP Class UID** | **(0008,0016)** | **1** | **UI** | **1** | | **TR[48]** |
| **SOP Instance UID** | **(0008,0018)** | **1** | **UI** | **1** | | **TR[49]** |
| **Specific Character Set** | **(0008,0005)** | **1C** | **CS** | **1** | **= NULL** | |
| **Instance Creation Date** | **(0008,0012)** | **3** | **DA** | **1** | **current_date** | |
| **Instance Creation Time** | **(0008,0013)** | **3** | **TM** | **1** | **current_time** | |
| **Instance Creator UID** | **(0008,0014)** | **3** | **UI** | **1** | **= 1.2.840.113619.1.131.<dbcode>** | |

T[48]Translate value as follows:

```
IF (PET Image Transfer) THEN
        SOP Class UID (08,16) = 1.2.840.10008.5.1.4.1.1.128
ELSE IF (Curve Transfer)
        CASE ( Curve.curve_type ) OF :
                [ blood sample ], [ rates ] :
                        /*  PET Curve  */
                        SOP Class UID (08,16) = 1.2.840.10008.5.1.4.1.1.129
                        break;
                [ profile ], [ histogram ], [ volume activity curve ], [ foreign ] :
                [ area ], [ patlak ], [ tac midframe ], [ tac effective ] :
                        /*  Standalone Curve  */
                        SOP Class UID (08,16) = 1.2.840.10008.5.1.4.1.1.9
                        break;
ELSE IF (Polar Map Transfer) THEN
        Reject Transfer;
```

[49]Translate value as follows:

```
IF (SOP Class UID (08,16) == ”1.2.840.10008.5.1.4.1.1.128”) THEN  /*  PET Image  */
        SOP Instance UID (08,18) = Image.image_id
ELSE IF (SOP Class UID (08,16) == ”1.2.840.10008.5.1.4.1.1.129”) THEN  /*  PET Curve  */
        IF (Type of Data (50xx,0020) != ”CPM”) THEN
```

/* Polar map */
Reject Transfer
/*Standalone Curve */

ELSE IF (SOP Class UID (08,16) == ”1.2.840.10008.5.1.4.1.1.9”) THEN
SOP Instance UID (08,18) = Curve.curve_id

## G.6 Private data dictionary

### G.6.1 Private Creator Identification Information

**TABLE 2.4-1**
**PRIVATE CREATOR IDENTIFICATION (GEMS_PETD_01)**

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Type |
|---|---|---|---|---|---|
| **Private Creator Data Element** | **(0009,0010)** | **1** | **SH** | **1** | **n/a** |
| **GE Discovery LS PET Implementation Version Name** | **(0009,1001)** | **3** | **LO** | **2** | **n/a** |

### G.6.2 GE Discovery LS PET Patient Module

**TABLE 2.4-2**

**GE DISCOVERY LS PET PATIENT MODULE PRIVATE ELEMENTS**
**PRIVATE CREATOR IDENTIFICATION (GEMS_ PETD_01)**

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Type |
|---|---|---|---|---|---|
| **GE Discovery LS PET Patient.patient_id** | **(0009,1002)** | **3** | **LO** | **1** | **20A** |
| **GE Discovery LS PET Patient.compatible_version** | **(0009,1003)** | **3** | **SH** | **1** | **5A** |
| **GE Discovery LS PET Patient.software_version** | **(0009,1004)** | **3** | **SH** | **1** | **5A** |
| **GE Discovery LS PET Patient.patient_datetime** | **(0009,1005)** | **3** | **DT** | **1** | **D** |
| **GE Discovery LS PET Patient.type** | **(0009,1006)** | **3** | **SL** | **1** | **L** |

### G.6.3 GE Discovery LS PET Exam Module

**TABLE 2.4-3**

**GE DISCOVERY LS PET EXAM MODULE PRIVATE ELEMENTS**
**PRIVATE CREATOR IDENTIFICATION (GEMS_ PETD_01)**

| Attribute Name | Tag | Type | VR | VM | Discovery LS |
|---|---|---|---|---|---|

| | | | | | PET Type |
|---|---|---|---|---|---|
| **GE Discovery LS PET Exam.exam_id** | **(0009,1007)** | **3** | **UI** | **1** | **64A** |
| **GE Discovery LS PET Exam.compatible_version** | **(0009,1008)** | **3** | **SH** | **1** | **5A** |
| **GE Discovery LS PET Exam.software_version** | **(0009,1009)** | **3** | **SH** | **1** | **5A** |

### G.6.4 GE Discovery LS PET Scan Module

**TABLE 2.4-4**

**GE DISCOVERY LS PET SCAN MODULE PRIVATE ELEMENTS**
**PRIVATE CREATOR IDENTIFICATION (GEMS_ PETD_01)**

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Type |
|---|---|---|---|---|---|
| **GE Discovery LS PET Scan.scan_id** | **(0009,100A)** | **3** | **UI** | **1** | **64A** |
| **GE Discovery LS PET Scan.compatible_version** | **(0009,100B)** | **3** | **SH** | **1** | **5A** |
| **GE Discovery LS PET Scan.software_version** | **(0009,100C)** | **3** | **SH** | **1** | **5A** |
| **GE Discovery LS PET Scan.scan_datetime** | **(0009,100D)** | **3** | **DT** | **1** | **D** |
| **GE Discovery LS PET Scan.scan_ready** | **(0009,100E)** | **3** | **DT** | **1** | **D** |
| **GE Discovery LS PET Scan.scan_description** | **(0009,100F)** | **3** | **UI** | **1** | **64A** |
| **GE Discovery LS PET Scan.hospital_name** | **(0009,1010)** | **3** | **LO** | **1** | **32A** |
| **GE Discovery LS PET Scan.scanner_desc** | **(0009,1011)** | **3** | **LO** | **1** | **32A** |
| **GE Discovery LS PET Scan.manufacturer** | **(0009,1012)** | **3** | **LO** | **1** | **64A** |
| **GE Discovery LS PET Scan.for_identifier** | **(0009,1013)** | **3** | **UI** | **1** | **64A** |
| **GE Discovery LS PET Scan.landmark_name** | **(0009,1014)** | **3** | **LO** | **1** | **64A** |
| **GE Discovery LS PET Scan.landmark_abbrev** | **(0009,1015)** | **3** | **SH** | **1** | **2A** |
| **GE Discovery LS PET Scan.patient_position** | **(0009,1016)** | **3** | **SL** | **1** | **L** |
| **GE Discovery LS PET Scan.scan_perspective** | **(0009,1017)** | **3** | **SL** | **1** | **L** |
| **GE Discovery LS PET Scan.scan_type** | **(0009,1018)** | **3** | **SL** | **1** | **L** |
| **GE Discovery LS PET Scan.scan_mode** | **(0009,1019)** | **3** | **SL** | **1** | **L** |
| **GE Discovery LS PET Scan.start_condition** | **(0009,101A)** | **3** | **SL** | **1** | **L** |
| **GE Discovery LS PET Scan.start_cond_data** | **(0009,101B)** | **3** | **SL** | **1** | **L** |

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Type |
|---|---|---|---|---|---|
| GE Discovery LS PET Scan.sel_stop_cond | (0009,101C) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.sel_stop_cond_data | (0009,101D) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.collect_deadtime | (0009,101E) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.collect_singles | (0009,101F) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.collect_countrate | (0009,1020) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.countrate_period | (0009,1021) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.delayed_events | (0009,1022) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.delayed_bias | (0009,1023) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.word_size | (0009,1024) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.axial_acceptance | (0009,1025) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.axial_angle_3d | (0009,1026) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.theta_compression | (0009,1027) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.axial_compression | (0009,1028) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.gantry_tilt_angle | (0009,1029) | 3 | FL | 1 | F |
| GE Discovery LS PET Scan.collimation | (0009,102A) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.scan_fov | (0009,102B) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.axial_fov | (0009,102C) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.event_separation | (0009,102D) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.mask_width | (0009,102E) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.binning_mode | (0009,102F) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.trig_rej_method | (0009,1030) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.number_for_reject | (0009,1031) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.lower_reject_limit | (0009,1032) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.upper_reject_limit | (0009,1033) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.triggers_acquired | (0009,1034) | 3 | SL | 1 | L |

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Type |
|---|---|---|---|---|---|
| GE Discovery LS PET Scan.triggers_rejected | (0009,1035) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.tracer_name | (0009,1036) | 3 | LO | 1 | 40A |
| GE Discovery LS PET Scan.batch_description | (0009,1037) | 3 | LO | 1 | 40A |
| GE Discovery LS PET Scan.tracer_activity | (0009,1038) | 3 | FL | 1 | F |
| GE Discovery LS PET Scan.meas_datetime | (0009,1039) | 3 | DT | 1 | D |
| GE Discovery LS PET Scan.pre_inj_volume | (0009,103A) | 3 | FL | 1 | F |
| GE Discovery LS PET Scan.admin_datetime | (0009,103B) | 3 | DT | 1 | D |
| GE Discovery LS PET Scan.post_inj_activity | (0009,103C) | 3 | FL | 1 | F |
| GE Discovery LS PET Scan.post_inj_datetime | (0009,103D) | 3 | DT | 1 | D |
| GE Discovery LS PET Scan.radionuclide_name | (0009,103E) | 3 | SH | 1 | 6A |
| GE Discovery LS PET Scan.half_life | (0009,103F) | 3 | FL | 1 | F |
| GE Discovery LS PET Scan.positron_fraction | (0009,1040) | 3 | FL | 1 | F |
| GE Discovery LS PET Scan.source1_holder | (0009,1041) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.source1_activity | (0009,1042) | 3 | FL | 1 | F |
| GE Discovery LS PET Scan.source1_meas_dt | (0009,1043) | 3 | DT | 1 | D |
| GE Discovery LS PET Scan.source1_radnuclide | (0009,1044) | 3 | SH | 1 | 6A |
| GE Discovery LS PET Scan.source1_half_life | (0009,1045) | 3 | FL | 1 | F |
| GE Discovery LS PET Scan.source2_holder | (0009,1046) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.source2_activity | (0009,1047) | 3 | FL | 1 | F |
| GE Discovery LS PET Scan.source2_meas_dt | (0009,1048) | 3 | DT | 1 | D |
| GE Discovery LS PET Scan.source2_radnuclide | (0009,1049) | 3 | SH | 1 | 6A |
| GE Discovery LS PET Scan.source2_half_life | (0009,104A) | 3 | FL | 1 | F |
| GE Discovery LS PET Scan.source_speed | (0009,104B) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.source_location | (0009,104C) | 3 | FL | 1 | F |

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Type |
|---|---|---|---|---|---|
| GE Discovery LS PET Scan.emission_present | (0009,104D) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.lower_axial_acc | (0009,104E) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.upper_axial_acc | (0009,104F) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.lower_coinc_limit | (0009,1050) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.upper_coinc_limit | (0009,1051) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.coinc_delay_offset | (0009,1052) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.coinc_output_mode | (0009,1053) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.upper_energy_limit | (0009,1054) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.lower_energy_limit | (0009,1055) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.normal_cal_id | (0009,1056) | 3 | UI | 1 | 64A |
| GE Discovery LS PET Scan.normal_2d_cal_id | (0009,1057) | 3 | UI | 1 | 64A |
| GE Discovery LS PET Scan.blank_cal_id | (0009,1058) | 3 | UI | 1 | 64A |
| GE Discovery LS PET Scan.wc_cal_id | (0009,1059) | 3 | UI | 1 | 64A |
| GE Discovery LS PET Scan.derived | (0009,105A) | 3 | SL | 1 | L |
| GE Discovery LS PET Scan.contrast_agent | (0009,105B) | 3 | LO | 1 | 64A |

### G.6.5 GE Discovery LS PET ImageSet Module

**TABLE 2.4-5**

**GE DISCOVERY LS PET IMAGESET MODULE PRIVATE ELEMENTS**
**PRIVATE CREATOR IDENTIFICATION (GEMS_ PETD_01)**

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Type |
|---|---|---|---|---|---|
| GE Discovery LS PET ImageSet.compatible_version | (0009,1079) | 3 | SH | 1 | 5A |
| GE Discovery LS PET ImageSet.software_version | (0009,107A) | 3 | SH | 1 | 5A |
| GE Discovery LS PET | (0009,107B) | 3 | DT | 1 | D |

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Type |
|---|---|---|---|---|---|
| ImageSet.is_datetime | | | | | |
| GE Discovery LS PET ImageSet.is_source | (0009,107C) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.is_contents | (0009,107D) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.is_type | (0009,107E) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.is_reference | (0009,107F) | 3 | FL | 3 | F |
| GE Discovery LS PET ImageSet.multi_patient | (0009,1080) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.number_of_normals | (0009,1081) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.color_map_id | (0009,1082) | 3 | UI | 1 | 64A |
| GE Discovery LS PET ImageSet.window_level_type | (0009,1083) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.rotate | (0009,1084) | 3 | FL | 1 | F |
| GE Discovery LS PET ImageSet.flip | (0009,1085) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.zoom | (0009,1086) | 3 | FL | 1 | F |
| GE Discovery LS PET ImageSet.pan_x | (0009,1087) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.pan_y | (0009,1088) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.window_level_min | (0009,1089) | 3 | FL | 1 | F |
| GE Discovery LS PET ImageSet.window_level_max | (0009,108A) | 3 | FL | 1 | F |
| GE Discovery LS PET ImageSet.recon_method | (0009,108B) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.attenuation | (0009,108C) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.atten_coefficient | (0009,108D) | 3 | FL | 1 | F |
| GE Discovery LS PET ImageSet.bp_filter | (0009,108E) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.bp_filter_cutoff | (0009,108F) | 3 | FL | 1 | F |
| GE Discovery LS PET ImageSet.bp_filter_order | (0009,1090) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.bp_center_l | (0009,1091) | 3 | FL | 1 | F |
| GE Discovery LS PET ImageSet.bp_center_p | (0009,1092) | 3 | FL | 1 | F |
| GE Discovery LS PET ImageSet.atten_smooth | (0009,1093) | 3 | SL | 1 | L |

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Type |
|---|---|---|---|---|---|
| GE Discovery LS PET ImageSet.atten_smooth_param | (0009,1094) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.angle_smooth_param | (0009,1095) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.wellcountercal_id | (0009,1096) | 3 | UI | 1 | 64A |
| GE Discovery LS PET ImageSet.trans_scan_id | (0009,1097) | 3 | UI | 1 | 64A |
| GE Discovery LS PET ImageSet.norm_cal_id | (0009,1098) | 3 | UI | 1 | 64A |
| GE Discovery LS PET ImageSet.blnk_cal_id | (0009,1099) | 3 | UI | 1 | 64A |
| GE Discovery LS PET ImageSet.cac_edge_threshold | (0009,109A) | 3 | FL | 1 | F |
| GE Discovery LS PET ImageSet.cac_skull_offset | (0009,109B) | 3 | FL | 1 | F |
| GE Discovery LS PET ImageSet.emiss_sub_id | (0009,109C) | 3 | UI | 1 | 64A |
| GE Discovery LS PET ImageSet.radial_filter_3d | (0009,109D) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.radial_cutoff_3d | (0009,109E) | 3 | FL | 1 | F |
| GE Discovery LS PET ImageSet.axial_filter_3d | (0009,109F) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.axial_cutoff_3d | (0009,10A0) | 3 | FL | 1 | F |
| GE Discovery LS PET ImageSet.axial_start | (0009,10A1) | 3 | FL | 1 | F |
| GE Discovery LS PET ImageSet.axial_spacing | (0009,10A2) | 3 | FL | 1 | F |
| GE Discovery LS PET ImageSet.axial_angles_used | (0009,10A3) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.ir_num_iterations | (0009,10B2) | 3 | SL | 1 | F |
| GE Discovery LS PET ImageSet.ir_num_subsets | 09,10B4) | 3 | FL | 1 | F |
| GE Discovery LS PET ImageSet.ir_corr_model | (0009,10B5) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.ir_loop_filter | (0009,10B6) | 3 | SL | 1 | L |
| GE Discovery LS PET ImageSet.ir_pre_filt_parm | (0009,10B7) | 3 | FL | 1 | F |

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Type |
|---|---|---|---|---|---|
| **GE Discovery LS PET ImageSet.ir_loop_filt_parm** | **(0009,10B8)** | **3** | **SL** | **1** | **L** |
| **GE Discovery LS PET ImageSet.response_filt_parm** | **(0009,10B9)** | **3** | **FL** | **1** | **F** |
| **GE Discovery LS PET ImageSet.post_filter** | **(0009,10BA)** | **3** | **SL** | **1** | **L** |
| **GE Discovery LS PET ImageSet.post_filt_parm** | **(0009,10BB)** | **3** | **FL** | **1** | **F** |
| **GE Discovery LS PET ImageSet.ir_regularize** | **(0009,10BC)** | **3** | **SL** | **1** | **L** |
| **GE Discovery LS PET ImageSet.regularize_parm** | **(0009,10BD)** | **3** | **FL** | **1** | **F** |
| **GE Discovery LS PET ImageSet.ac_bp_filter** | **(0009,10BE)** | **3** | **SL** | **1** | **L** |
| **GE Discovery LS PET ImageSet.ac_bp_filt_cut_off** | **(0009,10BF)** | **3** | **FL** | **1** | **F** |
| **GE Discovery LS PET ImageSet.ac_bp_filt_order** | **(0009,10C0)** | **3** | **SL** | **1** | **L** |
| **GE Discovery LS PET ImageSet.ac_img_smooth** | **(0009,10C1)** | **3** | **SL** | **1** | **L** |
| **GE Discovery LS PET ImageSet.ac_img_smooth_parm** | **(0009,10C2)** | **3** | **FL** | **1** | **F** |
| **GE Discovery LS PET ImageSet.scatter_method** | **(0009,10C3)** | **3** | **SL** | **1** | **L** |
| **GE Discovery LS PET ImageSet.scatter_num_iter** | **(0009,10C4)** | **3** | **SL** | **1** | **L** |
| **GE Discovery LS PET ImageSet.scatter_parm** | **(0009,10C5)** | **3** | **FL** | **1** | **F** |

### G.6.6 GE Discovery LS PET Curve Module

**TABLE 2.4-6**

**GE DISCOVERY LS PET CURVE MODULE PRIVATE ELEMENTS**
**PRIVATE CREATOR IDENTIFICATION (GEMS_ PETD_01)**

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Type |
|---|---|---|---|---|---|
| **Private Creator Data Element** | **(5001,0010)** | **1** | **SH** | **1** | **n/a** |
| GE Discovery LS PET Curve.curve_id | **(5001,1001)** | **3** | **UI** | **1** | 64A |
| GE Discovery LS PET Curve.compatible_version | **(5001,1002)** | **3** | **SH** | **1** | 5A |
| GE Discovery LS PET Curve.software_version | **(5001,1003)** | **3** | **SH** | **1** | 5A |

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Type |
|---|---|---|---|---|---|
| GE Discovery LS PET Curve.statistics_type | **(5001,1004)** | **3** | **SL** | **1** | L |
| GE Discovery LS PET Curve.how_derived | **(5001,1005)** | **3** | **LT** | **1** | Bt |
| GE Discovery LS PET Curve.how_derived_size | **(5001,1006)** | **3** | **SL** | **1** | L |
| GE Discovery LS PET Curve.multi_patient | **(5001,1007)** | **3** | **SL** | **1** | L |
| GE Discovery LS PET Curve.deadtime | **(5001,1008)** | **3** | **SL** | **1** | L |

### G.6.7 GE Discovery LS PET Graph Module

**TABLE 2.4-7**

**GE DISCOVERY LS PET GRAPH MODULE PRIVATE ELEMENTS**
**PRIVATE CREATOR IDENTIFICATION (GEMS_ PETD_01)**

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Type |
|---|---|---|---|---|---|
| **Private Creator Data Element** | **(5003,0010)** | **1** | **SH** | **1** | **n/a** |
| **GE Discovery LS PET Graph Sequence** | **(5003,1001)** | **3** | **SQ** | **1** | n/a |
| > GE Discovery LS PET Graph.graph_id | **(5003,1002)** | **3** | **UI** | **1** | 64A |
| > GE Discovery LS PET Graph.compatible_version | **(5003,1003)** | **3** | **SH** | **1** | 5A |
| > GE Discovery LS PET Graph.software_version | **(5003,1004)** | **3** | **SH** | **1** | 5A |
| > GE Discovery LS PET Graph.title | **(5003,1005)** | **3** | **LO** | **1** | 32A |
| > GE Discovery LS PET Graph.graph_datetime | **(5003,1006)** | **3** | **DT** | **1** | D |
| > GE Discovery LS PET Graph.graph_description | **(5003,1007)** | **3** | **ST** | **1** | 128A |
| > GE Discovery LS PET Graph.title_font_name | **(5003,1008)** | **3** | **LO** | **1** | 32A |
| > GE Discovery LS PET Graph.title_font_size | **(5003,1009)** | **3** | **SH** | **1** | 2A |
| > GE Discovery LS PET Graph.footer | **(5003,100A)** | **3** | **LO** | **1** | 64A |
| > GE Discovery LS PET Graph.footer_font_size | **(5003,100B)** | **3** | **SH** | **1** | 2A |
| > GE Discovery LS PET Graph.foreground_color | **(5003,100C)** | **3** | **LO** | **1** | 20A |
| > GE Discovery LS PET Graph.background_color | **(5003,100D)** | **3** | **LO** | **1** | 20A |
| > GE Discovery LS PET Graph.graph_border | **(5003,100E)** | **3** | **SL** | **1** | L |
| > GE Discovery LS PET Graph.graph_width | **(5003,100F)** | **3** | **SL** | **1** | L |
| > GE Discovery LS PET Graph.graph_height | **(5003,1010)** | **3** | **SL** | **1** | L |
| > GE Discovery LS PET Graph.grid | **(5003,1011)** | **3** | **SL** | **1** | L |
| > GE Discovery LS PET Graph.label_font_name | **(5003,1012)** | **3** | **LO** | **1** | 32A |
| > GE Discovery LS PET Graph.label_font_size | **(5003,1013)** | **3** | **SH** | **1** | 2A |
| > GE Discovery LS PET Graph.axes_color | **(5003,1014)** | **3** | **LO** | **1** | 20A |
| > GE Discovery LS PET Graph.x_axis_label | **(5003,1015)** | **3** | **LO** | **1** | 32A |

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Type |
|---|---|---|---|---|---|
| > GE Discovery LS PET Graph.x_axis_units | **(5003,1016)** | **3** | **SL** | **1** | L |
| > GE Discovery LS PET Graph.x_major_tics | **(5003,1017)** | **3** | **FL** | **1** | F |
| > GE Discovery LS PET Graph.x_axis_min | **(5003,1018)** | **3** | **FL** | **1** | F |
| > GE Discovery LS PET Graph.x_axis_max | **(5003,1019)** | **3** | **FL** | **1** | F |
| > GE Discovery LS PET Graph.y_axis_label | **(5003,101A)** | **3** | **LO** | **1** | 32A |
| > GE Discovery LS PET Graph.y_axis_units | **(5003,101B)** | **3** | **SL** | **1** | L |
| > GE Discovery LS PET Graph.y_major_tics | **(5003,101C)** | **3** | **FL** | **1** | F |
| > GE Discovery LS PET Graph.y_axis_min | **(5003,101D)** | **3** | **FL** | **1** | F |
| > GE Discovery LS PET Graph.y_axis_max | **(5003,101E)** | **3** | **FL** | **1** | F |
| > GE Discovery LS PET Graph.legend_font_name | **(5003,101F)** | **3** | **LO** | **1** | 32A |
| > GE Discovery LS PET Graph.legend_font_size | **(5003,1020)** | **3** | **SH** | **1** | 2A |
| > GE Discovery LS PET Graph.legend_location_x | **(5003,1021)** | **3** | **SL** | **1** | L |
| > GE Discovery LS PET Graph.legend_location_y | **(5003,1022)** | **3** | **SL** | **1** | L |
| > GE Discovery LS PET Graph.legend_width | **(5003,1023)** | **3** | **SL** | **1** | L |
| > GE Discovery LS PET Graph.legend_height | **(5003,1024)** | **3** | **SL** | **1** | L |
| > GE Discovery LS PET Graph.legend_border | **(5003,1025)** | **3** | **SL** | **1** | L |
| > GE Discovery LS PET Graph.multi_patient | **(5003,1026)** | **3** | **SL** | **1** | L |

### G.6.8 GE Discovery LS PET Curve Presentation Module

**TABLE 2.4-8**

**GE DISCOVERY LS PET CURVE PRESENTATION MODULE PRIVATE ELEMENTS PRIVATE CREATOR IDENTIFICATION (GEMS_ PETD_01)**

| Attribute Name | Tag | Type | VR | VM | Discovery LS PET Type |
|---|---|---|---|---|---|
| **Private Creator Data Element** | **(5005,0010)** | **1** | **SH** | **1** | **n/a** |
| **GE Discovery LS PET CurvePresentation Sequence** | **(5005,1001)** | **3** | **SQ** | **1** | n/a |
| > GE Discovery LS PET CurvePresentation.curvepresent_id | **(5005,1002)** | **3** | **UI** | **1** | 64A |
| > GE Discovery LS PET CurvePresentation.graph_id | **(5005,1003)** | **3** | **UI** | **1** | 64A |
| > GE Discovery LS PET CurvePresentation.curve_id | **(5005,1004)** | **3** | **UI** | **1** | 64A |
| > GE Discovery LS PET CurvePresentation.compatible_version | **(5005,1005)** | **3** | **SH** | **1** | 5A |
| > GE Discovery LS PET | **(5005,1006)** | **3** | **SH** | **1** | 5A |

| | | | | | |
|---|---|---|---|---|---|
| CurvePresentation.software_version | | | | | |
| > GE Discovery LS PET CurvePresentation.curve_label | **(5005,1007)** | **3** | **LO** | **1** | 60A |
| > GE Discovery LS PET CurvePresentation.color | **(5005,1008)** | **3** | **LO** | **1** | 20A |
| > GE Discovery LS PET CurvePresentation.line_type | **(5005,1009)** | **3** | **SL** | **1** | L |
| > GE Discovery LS PET CurvePresentation.line_width | **(5005,100A)** | **3** | **SL** | **1** | L |
| > GE Discovery LS PET CurvePresentation.point_symbol | **(5005,100B)** | **3** | **SL** | **1** | L |
| > GE Discovery LS PET CurvePresentation.point_symbol_dim | **(5005,100C)** | **3** | **SL** | **1** | L |
| > GE Discovery LS PET CurvePresentation.point_color | **(5005,100D)** | **3** | **LO** | **1** | 20A |