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GE Medical Systems

Technical Publications

Direction 2339295-100
Revision 0

PET Advance^{TM} *6.0* CONFORMANCE STATEMENT for DICOM V3.0

Document Structure Information:

The Dicom Print Services for **PET Advance**^{TM} 6.0 are defined in a separate document published by Cedara Software Corp. Please refer to the Cedara document, "Conformance Statement for ISG Hardcopy Server as Dicom Print Management SCU" which can be found at:
http://www.cedara.com/support/pdf/cedara_printscu.pdf
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0. REVISION HISTORY

A	2002-01-04	Generated from Advance 5.1 Conformance Statement (direction number **2293013-100**) for the PET Advance™ 5.1 release. Changes from **2293013-100** include the following: • Updated Section 2 (including 21 through 2.7) to describe new operations supported in PET Advance™ 6.0: 1. Added Secondary Capture IOD support as Storage SCU and Storage SCP to ADVANCE_DICOM implemention. 2. Added CT and MR IOD support as Storage SCP to ADVANCE_DICOM implementation. *Previously,* PET Advance™ 5.1*supported CT and MR IOD as Storage SCP for a separate implementation (referered to as DICOMRecv implementation) which did not allow Advance to Query/Retrieve CT and MR images as SCU. In 6.0, adding CT and MR IODs to ADVANCE_DICOM implementation enables Query/Retrieve as SCU for CT and MR images.* • Added Section 8 to describe DICOM Secondary Capture SOP class support, new in PET Advance™ 6.0.
B	2002-03-05	Updated per review with GE Global Connectivity Center.
C	2002-04-02	Updated per review with GE Global Connectivity Center. Added new Direction Number.
D	2002-06-24	Addes Section 9 to describe DICOM Modality Worklist SOP class support, new in PET Advance™ 6.0.
0	2002-08-20	Updated per review with GE Global Connectivity Center regarding MWL content

1. INTRODUCTION

1.1 OVERVIEW

This DICOM Conformance Statement is divided into Sections as described below:

Section 1 (Introduction), which describes the overall structure, intent, and references for this Conformance Statement

Section 2 (Network Conformance Statement), which specifies the GEMS equipment compliance to DICOM requirements for the implementation of Networking Features.

Section 3 (Positron Emission Tomography Image Information Object Implementation), which specifies the GEMS equipment compliance to DICOM requirements for the implementation of a Positron Emission Tomography Information Object.

Section 4 (Standalone PET Curve Information Object Implementation), which specifies the GEMS equipment compliance to DICOM requirements for the implementation of a Stand Alone PET Curve Information Object.

Section 5 (Patient Root Query/Retrieve Information Model), which specifies the information model used for the implementation of the Patient Root Query/Retrieve Information Model.

Section 6 (Study Root Query/Retrieve Information Model), which specifies the information model used for the implementation of the Study Root Query/Retrieve Information Model.

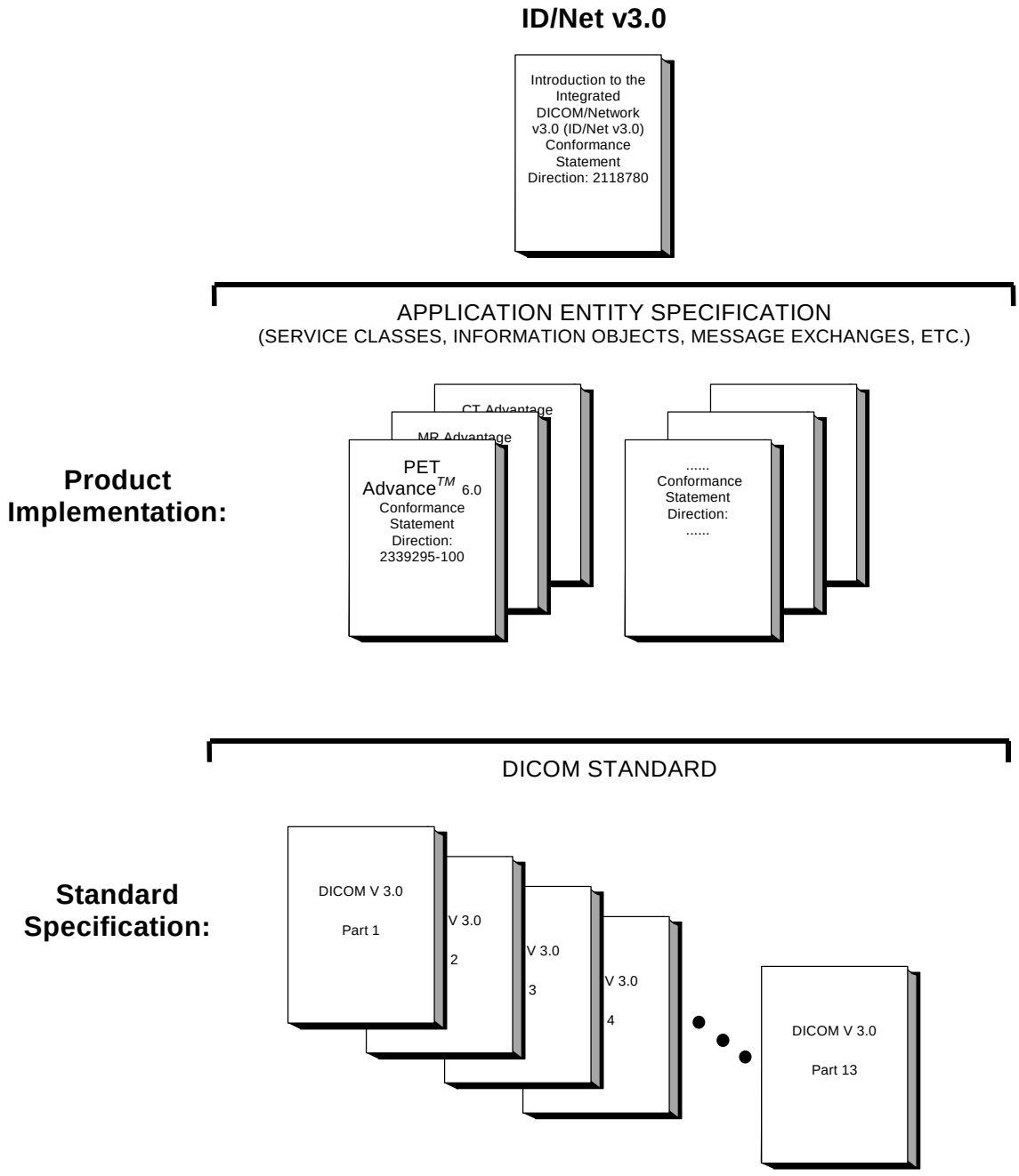
Section 7 (Stand Alone Curve Information Object Implementation), which specifies the GEMS equipment compliance to DICOM requirements for the implementation of a Stand Alone Curve Information Object.

Section 8 (Secondary Capture Information Object Implementation), which specifies the GEMS equipment compliance to DICOM requirements for the implementation of a Secondary Capture Information Object

Section 9 (Modality Worklist Implementation), which specifies the GEMS equipment compliance to DICOM requirements for the implementation of a Modality Worklist.

1.2 OVERALL DICOM CONFORMANCE STATEMENT DOCUMENT STRUCTURE

The Documentation Structure of the GEMS Conformance Statements and their relationship with the DICOM v3.0 Conformance Statements is shown in the Illustration below.



This document specifies the DICOM v3.0 implementation. It is entitled:

PET Advance™ *6.0*
Conformance Statement for DICOM v3.0
Direction 2339295-100

This DICOM Conformance Statement documents the DICOM v3.0 Conformance Statement and Technical Specification required to interoperate with the GEMS network interface. Introductory information, which is applicable to all GEMS Conformance Statements, is described in the document:

Introduction to the Integrated DICOM/Network v3.0 (ID/Net v3.0)
Conformance Statement
Direction: 2118780.

This Introduction familiarizes the reader with DICOM terminology and general concepts. It should be read prior to reading the individual products' GEMS Conformance Statements.

The GEMS 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 v3.0 Part 8 standard.

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

For the convenience of software developers, there is "collector" Direction available. By ordering the collector, the Introduction described above and all of the currently published GEMS Product Conformance Statements will be received. The collector Direction is:

ID/Net v3.0 Conformance Statements
Direction: 2117016

For more information regarding DICOM v3.0, copies of the Standard may be obtained by written request or phone by contacting:

NEMA Publication
1300 North 17th Street
Suite 1847
Rosslyn, VA 22209
USA
Dat_Wall@nema.org
Phone: (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 v3.0 Standards and with the terminology and concepts which are used in those Standards.

If readers are unfamiliar with DICOM v3.0 terminology they should first refer to the document listed below, then read the DICOM v3.0 Standard itself, prior to reading this DICOM Conformance Statement document.

Introduction to the Integrated DICOM/Network v3.0 (ID/Net v3.0) Conformance Statement
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 v3.0 (ID/Net v3.0) Conformance Statement, Direction: 2118780*, to provide an unambiguous specification for GEMS implementations. This specification, called a Conformance Statement, includes a DICOM v3.0 Conformance Statement and is necessary to ensure proper processing and interpretation of GEMS medical data exchanged using DICOM v3.0. The GEMS Conformance Statements are available to the public.

The reader of this DICOM Conformance Statement should be aware that different GEMS devices are capable of using different Information Object Definitions. For example, a GEMS CT Scanner may send images using the CT Information Object, MR Information Object, Secondary Capture Object, etc.

Included in this DICOM Conformance Statement are the Module Definitions which define all data elements used by this GEMS implementation. If the user encounters unspecified private data elements while parsing a GEMS Data Set, the user is well advised to ignore those data elements (per the DICOM v3.0 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 re-transmit all of the private data elements which are sent by GEMS devices.

1.5 IMPORTANT REMARKS

The use of these DICOM Conformance Statements, in conjunction with the DICOM v3.0 Standards, is intended to facilitate communication with GE imaging equipment. However, **by itself, it is not sufficient to ensure 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 v3.0), and of this introduction and associated DICOM 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 an 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 v3.0 Standard. DICOM v3.0 will incorporate new features and technologies and GE may follow the evolution of the Standard. The GEMS protocol is based on DICOM v3.0 as specified in each DICOM Conformance Statement. Evolution of the Standard may require changes to devices which have implemented DICOM v3.0. **In addition, GE reserves the right to discontinue or make changes to the support of communications features (on its products) reflected on by these DICOM Conformance Statements**. The **user** should ensure that any non–GE provider, which connects with GE devices, also plans for the 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.
- **To be informed of the evolution of the implementation described in this document, the User is advised to regularly check the GE Internet Server, accessible via anonymous ftp (GE Internet Server Address: ftp.med.ge.com, 192.88.230.11).**
- **Interaction** - It is the sole responsibility of the **non–GE provider** to ensure that communication 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 GEMS Conformance Statements is included in the *Introduction to the Integrated DICOM/Network v3.0 (ID/Net v3.0) Conformance Statement, Direction: 2118780*.

The information object implementation refers to DICOM PS 3.3 (Information Object Definition). The Positron Emission Tomography Information Object Definition is provided as part of DICOM Supplement 12.

1.7 DEFINITIONS

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

1.8 SYMBOLS AND ABBREVIATIONS

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

2. NETWORK CONFORMANCE STATEMENT

2.1 INTRODUCTION

This section of the DICOM Conformance Statement specifies the 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.

The PET Advance™ provides sophisticated image processing and storage functions on Positron Emission Tomography (PET) data. In view of the requirements to conform to a global standard that permits interoperability across equipment produced by different vendors, PET Advance™ will provide support for DICOM 3.0.

If the Secondary Capture software license is installed on the PET Advance™ system, the user has the capability to create and display Secondary Capture images, and transfer Secondary Capture images via DICOM. The Secondary Capture option allows the user to capture and store, in DICOM format, the presentation state of images as they are displayed on the PET Advance™ Image Display viewer. 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. Furthermore, the ability to Send Secondary Captures allows greater portability of data acquired in PET Studies: many DICOM workstations support Secondary Capture IOD, but may not support the PET IOD. The user can view Secondary Capture images from a PET study on DICOM Workstations that do not support the PET IOD. The ability to Receive Secondary Capture images allows the user to display such captured images on the PET Advance™ Image Display viewer.

The ability to Receive DICOM CT/MR images onto the PET Advance™ scanner allows Advance users to co-register and fuse the anatomical detail of the CT/MR images with the Functional PET images. This leverages the strengths of both modalities and maximizes Patient Treatment planning and tracking.

The PET Advance™ DICOM implementation allows the user to send PET Image, PET Curve, Secondary Capture image data through the acquisition system or received from any other DICOM Compliant system to another DICOM station. For example, the user may wish to send data to another PET Advance™ station. In this situation PET Advance™ is providing the DICOM C-STORE service as a service class user (SCU). Advance is capable of receiving DICOM Data Sets from another DICOM compliant station. PET Advance™ 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 PET Advance™ 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).

The PET Advance™ DICOM implementation also provides a verification mechanism by which a remote application entity (AE) can verify application-level communication with the PET Advance™ DICOM Server. Also provided is a mechanism by which a PET Advance™ user can verify application-level communication with a remote DICOM AE.

In these situations, the PET Advance™ provides the C-ECHO service both as a SCP and SCU, respectively.

If the DICOM Modaliy Worklist option is installed on the PET Advance™ system, the MWL option 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, MWL is providing the DICOM C-FIND service as a service class user (SCU).

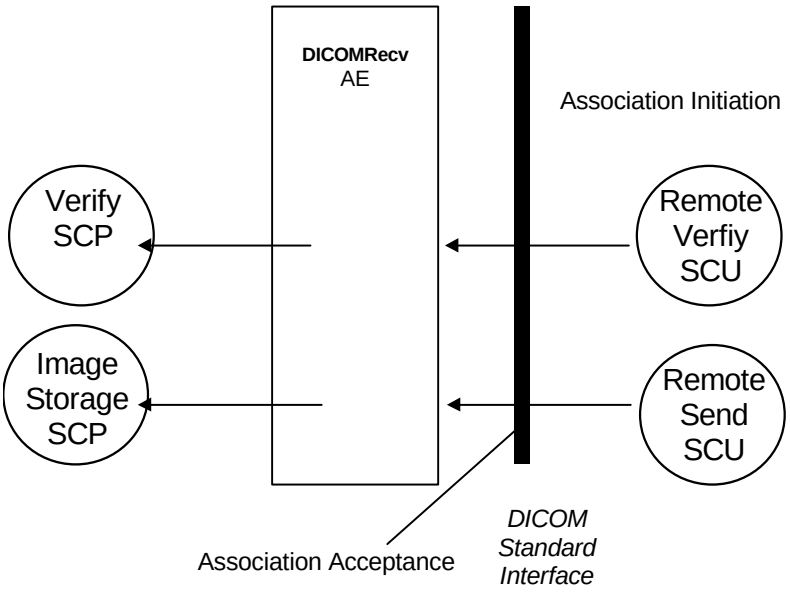
2.2 IMPLEMENTATION MODEL

The DICOM Query functionality, and the ability to Send/Receive/Query-Retrieve PET DICOM images and Curves, the ability to Send/Receive/Query-Retrieve Secondary Capture DICOM images, and the ability to Receive/Query-Retrieve CT and MR DICOM images on the PET Advance™ product is logically provided by the ADVANCE_DICOM Server AE. The ADVANCE_DICOM Server AE is commanded to perform DICOM services through the use of the PET Advance™ Network Operations User Interface. The ADVANCE_DICOM Server AE also listens on a pre-defined port (4030) for incoming connections from remote DICOM AEs.

CT/MR DICOM Receive (C-STORE SCP) functionality on the PET Advance scanner can also be handled by the DicomRecv Server Application Entity (AE). The DicomRecv server AE is listening to a pre-defined port (4050) for incoming connections. The DicomRecv Application Entity can only receive CT/MR images pushed from a remote AE – query/retrieve is not available. The Specific Application model for this device is shown in Ill 1.1.1.

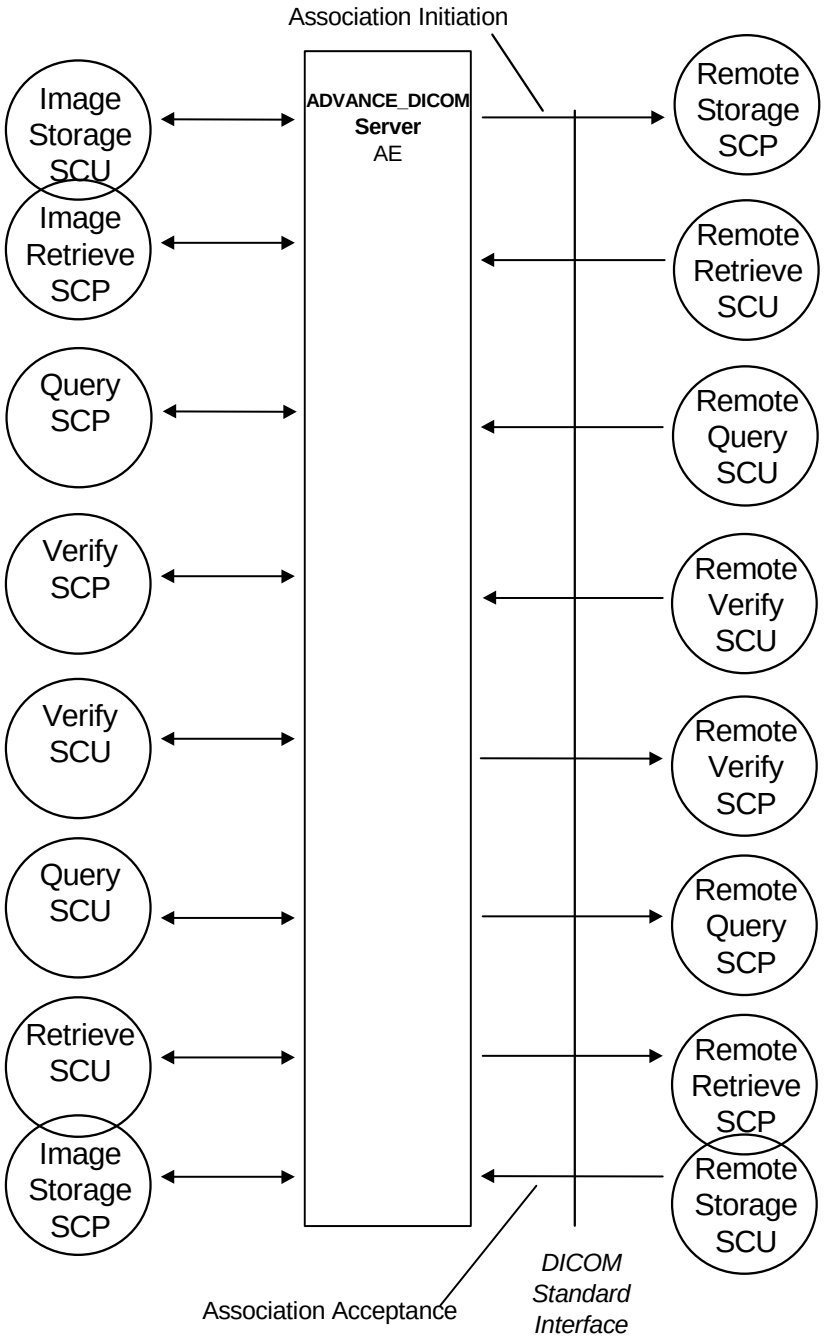
2.2.1 Application Data Flow Diagram

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



There is no local real world event required for the DicomRecv AE to respond to an incoming CT/MR DICOM Store. The DicomRecv AE is always prepared to respond to a Image Store by any remote DicomRecv AE. The DicomRecv Server AE will perform the Real-World Activity Image Installation after the remote AE sends an image to the PET Advance™ Scanner.

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 :



2.2.2 Functional Definition of AE's

The CT/MR Dicom Receive Server AE supports the following functions:

- Responds to DICOM associations transmitting CT or MR images to be stored.

The ADVANCE_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 ADVANCE_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 ADVANCE_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 ADVANCE_DICOM Server AE. If this is acceptable to the ADVANCE_DICOM Server AE, then, the image(s)/curve(s) data is(are) sent to the ADVANCE_DICOM Server AE.

The ADVANCE_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 ADVANCE_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."

2.2.3 Sequencing of Real-World Activities

Not Applicable.

2.3 AE SPECIFICATIONS

2.3.1 DICOMRecv AE Specification

This Application Entity provides Standard Conformance to the following DICOM V3.0 SOP classes as an **SCP**:

SOP Class Name	SOP Class UID
Verification SOP Class – ECHO	1.2.840.10008.1.1
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

2.3.2 ADVANCE_DICOM AE Specification

This Application Entity provides Standard Conformance to the following DICOM V3.0 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 V3.0 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

2.3.2.1 Association Establishment Policies

2.3.2.1.1 General

The DICOM Application Context Name for DICOMRecv AE, which is supported, is :

Application Context Name	1.2.840.10008.3.1.1.1

The Maximum Length PDU offered by the DicomRecv AE is:

Maximum Length PDU	10Kbytes

The SOP class Extended Negotiation is not supported. The user info items supported by this product are:

- Maximum PDU Length and,
- Implementation UID

Note: Max PDU length is not configurable at run time.

The DICOM Application Context Name (ACN) for ADVANCE_DICOM_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 ADVANCE_DICOM AE is:

Maximum Length PDU	4 Kbytes

Note- The ADVANCE_DICOM_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

2.3.2.1.2 Number of Associations

The DicomRecv AE can have a maximum of 4 DICOM associations open simultaneously to receive an image store or respond to an echo. It should be noted, however, that system response time for the association will degrade with increasing simultaneous incoming associations. The slow response could trigger timers in remote systems. The system administrator should be aware of this situation.

The ADVANCE_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

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

2.3.2.1.3 Asynchronous Nature

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

2.3.2.1.4 Implementation Identifying Information

The Implementation UID for this DICOM v3.0 Implementation is:

***DicomRecv* Implementation UID**	**1.2.840.113619.6.8.1**
***Advance* Implementation UID**	**1.2.840.113619.6.99**

The Implementation Version Name for this DICOM v3.0 Implementation is:

***Advance* Implementation Version Name**	**"GE Advance"**

2.3.2.2 Association Initiation Policy

The DICOMRecv AE does not attempt to initiate any associations.

The ADVANCE_DICOM AE initiates a new association:

- Due to an image send operation being initiated from the PET Advance™ 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 PET Advance™ Network Operations User interface.
- Due to image data being Retrieved from a Remote AE, where the retrieve operation is initiated from the PET Advance™ Network Operations User interface.

2.3.2.2.1 Real-World Activity : Send/Image Store

2.3.2.2.1.1 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 ADVANCE_DICOM Server 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 PET Advance™ 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.

2.3.2.2.1.2 Proposed Presentation Context Table

The following table shows the proposed presentation contexts for the ADVANCE_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 Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 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 Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 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 Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 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 Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	None

2.3.2.2.1.2.1 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 PET Advance™ 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 *Advance*.	(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 *Advance*.	(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 *Advance*.	(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 *Advance*.	(0000,0902)
	A713	Remote SCP could not determine header data offset for Data IOD transmission	The message "NetDicom: Remote system unable to determine data offset in temporary file. Status <a713>" is posted onto the Error Log Utility on the *Advance*.	(0000,0902)
	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 *Advance*.	(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 *Advance*.	(0000,0902)

Service Status	Status Codes	Further Meaning	Application Behavior When receiving Status Codes	Related Fields Processed if received
	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 *Advance*.	(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 *Advance*.	(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 *Advance*.	(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 *Advance*.	(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 *Advance*.	(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 *Advance*.	(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 *Advance*.	(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 *Advance*.	(0000,0901) (0000,0902)
	B006	Elements Discarded	The message "NetDicom: Remote system warning. Data elements discarded. Status <b006>" is posted onto the Error Log Utility on the *Advance*.	(0000,0901) (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 Advance Private Status Codes.* PET Advance™ *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. Advance uses them to provide more information to the Advance user in case of an Image Send failure.*

2.3.2.2.2 Real-World Activity: Verify

2.3.2.2.2.1 Associated Real-World Activity

Service personnel invoke the utility "DICOMping" from the UNIX command line. The ADVANCE_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.

2.3.2.2.2.2 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

2.3.2.2.2.2.1 SOP Specific DICOM Conformance Statement for Verification SOP Class

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

2.3.2.2.3 Real-World Activity: Query

2.3.2.2.3.1 Associated Real-World Activity

The PET Advance™ 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 PET Advance™ Network Operations UI in order to initiate the DICOM Query operation. The ADVANCE_DICOM Server will the initiate an association with the remote AE in order to query the remote AE. The PET Advance™ 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 PET Advance™ 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 ADVANCE_DICOM Server 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 PET Advance™ Error Log Utility.

The PET Advance™ 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 PET Advance™ 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.

2.3.2.2.3.2 Proposed Presentation Context Table

The following table shows the proposed presentation contexts for the ADVANCE_DICOM 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	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		

2.3.2.2.3.2.1 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 PET Advance™ 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 *Advance*.	(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 *Advance*.	(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 *Advance*.	(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

2.3.2.2.4 Real-World Activity: Retrieve

2.3.2.2.4.1 Associated Real-World Activity

The ***Advance*** 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 ADVANCE_DICOM Server 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 PET Advance™ 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.

2.3.2.2.4.2 Proposed Presentation Context Table

The following table shows the proposed presentation contexts for the ADVANCE_DICOM 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	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		

2.3.2.2.4.2.1 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 PET Advance™ 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) (0000,1022) (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) (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 UI.	(0000,0901) (0000,0902)
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) (0000,1021) (0000,1022) (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) (0000,1022) (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) (0000,1022) (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) (0000,1021) (0000,1022) (0000,1023)

2.3.2.3 Association Acceptance Policy

The DICOMRecv AE Server does not place any limitation on who may connect to it. The operator need not configure the AE Title, Port Number, and IP Address of remote workstations sending CT/MR images.

The ADVANCE_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 ADVANCE_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 PET Advance™ database. Any Remote AE can send images (PET Image/Stand alone Curve/PET Curve/GE Advance Data) to the PET Advance™ to be stored in the local database.

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

The ADVANCE_DICOM Server AE responds to query requests from remote AE's and responds with matching responses if remote AE is configured in PET Advance™. Remote AE can also request the ADVANCE_DICOM Server AE to retrieve image data from the PET Advance™, and to store this data in the database of the remote AE.

2.3.2.3.1 Real-World Activity - Image Store SCP

2.3.2.3.1.1 Associated Real-World Activity

When the DICOMRecv Server AE accepts an association, it will receive DICOM CT or MR images transmitted on that association and store the images on disk. This AE is indefinitely listening for associations. No operator action is required to receive an image. The Real world activity associated with the C-STORE operation is a two-step storage of the DICOM CT/MR image received into the PET Advance™ Scanner Database.First, DICOM CT/MR images are received and written to a Unix file (one file per image). A second process reads these Unix file, translates the data into the PET Advance™ Database format and then writes the image into the PET Advance™ Database.

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.

2.3.2.3.1.2 Accepted Presentation Context Table

The following are the Presentation Context supported by DICOMRecv AE Server.

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	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

The following are the Presentation Context supported by ADVANCE_DICOM_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 Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 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 Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 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 Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 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 Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 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

2.3.2.3.1.2.1 SOP Specific DICOM Conformance Statement for all Storage SOP Classes

The DICOMRecv AE Server provides standard conformance to the DICOM Storage Service Class. The DICOMRecv AE conforms to the SOP's of the Storage Service Class at Level 0 (local). A list of attributes saved can be found in the Appendix A. CT/MR images received into PET Advance™ cannot be exported via DICOM.

The PET Advance™ 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 PET Advance™ 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 the SCU.	Unable to access-determine filesize of incoming data.	(0000,0902)
	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)

Service Status	Status Codes	Further Meaning	Status Code sending explanation	Related Fields sent back to the SCU
	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 Advance Private Status Codes.* PET Advance™ *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.* PET Advance™ *uses them to provide more information to the user in case of an Image Send failure.*

2.3.2.3.1.3 Presentation Context Acceptance Criterion

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

2.3.2.3.1.4 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 ADVANCE_DICOM Server. However, if the ADVANCE_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 ADVANCE_DICOM Server does not support any of the transfer syntax proposed by the SCU, the association negotiation shall fail.

2.3.2.3.2 Real-World Activity: Query SCP

2.3.2.3.2.1 Associated Real-World Activity

The ADVANCE_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.”

2.3.2.3.2.2 Accepted Presentation Context Table

2.3.2.3.2.2.1 SOP Specific DICOM Conformance Statement for the Patient Root Query/Retrieve Information Model - FIND, Study Root Query/Retrieve Information Model - FIND, and Patient/Study Only Query/Retrieve Information Model - FIND SOP Classes

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 Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 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 Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 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, Study Root Query/Retrieve Information Model - FIND and Patient/Study Only 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	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) (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) (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	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
		Required Keys.		
	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

2.3.2.3.2.3 Presentation Context Acceptance Criterion

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

2.3.2.3.2.4 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 ADVANCE_DICOM Server. However, if the ADVANCE_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 ADVANCE_DICOM Server does not support any of the transfer syntax proposed by the SCU, the association negotiation shall fail.

2.3.2.3.3 Real-World Activity: Image Retrieve SCP

2.3.2.3.3.1 Associated Real-World Activity

The ADVANCE_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.

2.3.2.3.3.2 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 Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 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 Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCP	None

		Explicit VR Big Endian	1.2.840.10008.1.2.2		

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

2.3.2.3.3.2.1 SOP Specific DICOM Conformance Statement for the Patient Root Query/Retrieve Information Model - MOVE , 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) (0000,1022) (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) (0000,0902)
	C000	Unable to process	Returned if the DICOM Server cannot successfully interpret the C-MOVE-RQ message.	(0000,0901) (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) (0000,1021) (0000,1022) (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) (0000,1022) (0000,1023)
Success	0000	Sub-operations Complete - No Failure.	Returned after the transfer of the last image.	(0000,1021) (0000,1022) (0000,1023)
Pending	FF00	Sub-operations are continuing -	Returned after the transfer of each imageset (series) except for the last.	(0000,1020) (0000,1021) (0000,1022) (0000,1023)

2.3.2.3.3.3 Presentation Context Acceptance Criterion

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

2.3.2.3.3.4 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 ADVANCE_DICOM Server. However, if the ADVANCE_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 ADVANCE_DICOM Server does not support any of the transfer syntax proposed by the SCU, the association negotiation shall fail.

2.3.2.3.4 Real-World Activity: Verify SCP

2.3.2.3.4.1 Associated Real-World Activity

The ADVANCE_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.

2.3.2.3.4.2 Accepted Presentation Context Table

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

2.3.2.3.4.2.1 SOP Specific DICOM Conformance Statement for Verification SOP Class

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

2.3.2.3.4.3 Presentation Context Acceptance Criterion

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

2.3.2.3.4.4 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 ADVANCE_DICOM Server. However, if the ADVANCE_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 ADVANCE_DICOM Server does not support any of the transfer syntax proposed by the SCU, the association negotiation shall fail.

2.4 COMMUNICATION PROFILES

2.4.1 Supported Communication Stacks (PS 3.8, PS 3.9)

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

2.4.2 OSI Stack

OSI stack not supported

2.4.3 TCP/IP Stack

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

2.4.3.1 API

Not applicable to this product.

2.4.3.2 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 PET Advance™ please refer to the Product Data Sheet.

2.4.4 Point-to-Point Stack

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

2.5 EXTENSIONS / SPECIALIZATIONS / PRIVATIZATIONS

2.5.1 Standard Extended /Specialized/Private SOPs

2.5.2 Private Transfer Syntaxes

The PET Advance™ does not implement any private transfer syntaxes.

2.6 CONFIGURATION

The PET Advance™ 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 PET Advance™ user interface.

2.6.1 AE Title/Presentation Address Mapping

The PET Advance™ 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.

2.6.2 Configurable Parameters

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

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

Note that the port on which the PET Advance™ 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 port on which DicomRecv receives DICOM incoming TCP/IP connections is **4050** (for CT/MR Receive).

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:

- 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.

2.7 SUPPORT OF EXTENDED CHARACTER SETS

No extended character sets are supported.

3. PET INFORMATION OBJECT IMPLEMENTATION

3.1 INTRODUCTION

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:

3.2- PET Image IOD Description

3.3- PET Image IOD Entity-Relationship Model

3.4- PET Image IOD Module Table

3.5- PET Image Information Module Definitions

3.2 PET IMAGE IOD IMPLEMENTATION

The PET Advance™ implementation of DICOM uses the PET image format when creating image objects. In order to preserve full fidelity when transferring data to a PET Advance™ 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. PET Advance™ private data dictionary is included in Section 3.6.

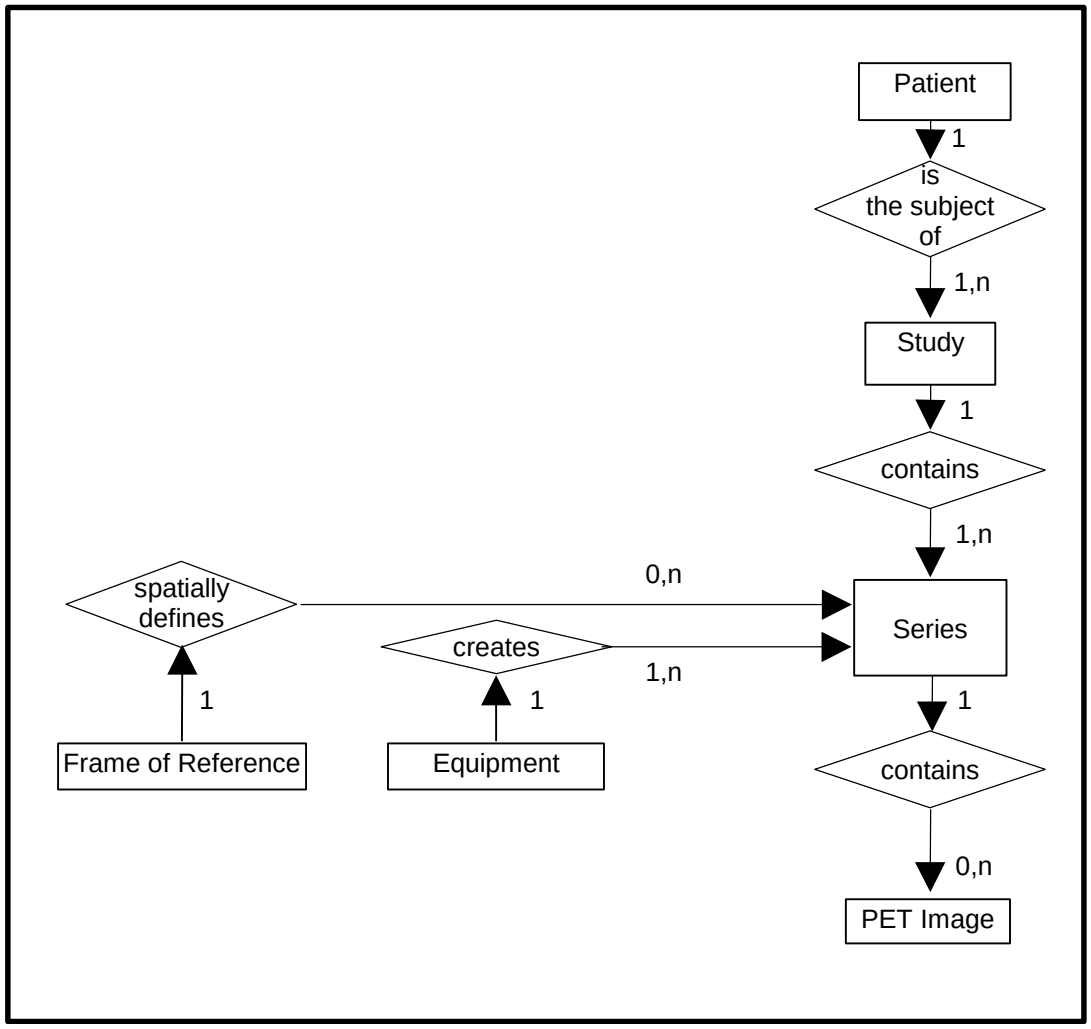
3.3 PET IMAGE ENTITY-RELATIONSHIP MODEL

The Entity-Relationship diagram for the PET Image interoperability schema is shown in Illustration 3.3-1**.** 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 3.3-1
PET IMAGE ENTITY RELATIONSHIP DIAGRAM



3.3.1 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.

3.3.1.1 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.

3.3.1.2 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.

3.3.1.3 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.

3.3.1.4 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.

3.3.1.5 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.

3.3.1.6 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).

3.3.2 PET Advance™ Mapping of DICOM entities

TABLE 3.3-1
MAPPING OF DICOM ENTITIES TO ADVANCE ENTITIES

DICOM	*Advance* Entity
Patient	Patient
Study	Exam
Series	Imageset
Image	Image

3.4 PET IMAGE IOD MODULE TABLE

Within an entity of the DICOM v3.0 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 3.4-1 identifies the defined modules within the entities which comprise the DICOM v3.0 PET IOD. Modules are identified by Module Name.

See DICOM v3.0 Part 3 for a complete definition of the entities, modules, and attributes.

TABLE 3.4-1
PET IMAGE IOD MODULES

Entity Name	Module Name	Reference
Patient	Patient	3.5.1.1
	GE Advance Patient	3.5.1.2
Study	General Study	3.5.2.1
	Patient Study	3.5.2.2
	GE Advance Exam	3.5.2.3
Series	General Series	3.5.3.1
	PET Series	3.5.3.2
	PET Isotope	3.5.3.3
	PET Multi-gated Acquisition	3.5.3.4
	NM/PET Patient Orientation	3.5.3.5
	GE Advance Imageset	3.5.3.6
	GE Advance Scan	3.5.3.7
Frame of Reference	Frame of Reference	3.5.4.1
Equipment	General Equipment	3.5.5.1
Image	General Image	3.5.6.1
	Image Plane	3.5.6.2
	Image Pixel	3.5.6.3
	PET Image	3.5.6.4
	Overlay Plane	3.5.6.5
	VOI LUT	3.5.6.6
	GE Advance Image	3.5.6.6
	GE Advance Frame	3.5.6.8
	GE Advance ROI	3.5.6.9
	GE Advance Annotation	3.5.6.10
General Modules	SOP Common	3.5.7.1

3.5 PET IMAGE INFORMATION MODULE DEFINITIONS

Please refer to DICOM v3.0 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 PET Advance™ Database. It should be noted that they are the same ones as defined in the DICOM v3.0 Standard Part 3 (Information Object Definitions).

3.5.1 Common Patient Entity Modules

3.5.1.1 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 3.5-1
PATIENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	VR	VM	Advance Attribute (Advance 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	

3.5.1.2 GE Advance Patient

Refer to Section 3.6.2 for details.

3.5.2 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.

3.5.2.1 General Study Module

This section specifies the Attributes which describe and identify the Study performed upon the Patient.

TABLE 3.5-2
GENERAL STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	VR	VM	Advance Attribute (GE Advance 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	

3.5.2.2 Patient Study Module

This section defines Attributes that provide information about the Patient at the time the Study was performed.

TABLE 3.5-3
PATIENT STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	VR	VM	Advance Attribute (GE Advance 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	

3.5.2.3 GE Advance Exam Module

Refer to Section 3.6.3 for details.

3.5.3 Common Series Entity Modules

The following Series IE Modules are common to all Composite Image IODs which reference the Series IE.

3.5.3.1 General Series Module

This section specifies the Attributes which identify and describe general information about the Series within a Study.

TABLE 3.5-4
GENERAL SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Type	VR	VM	Advance Attribute (GE Advance ImageSet table unless otherwise specified)	Notes
Modality	0008,0060)	1	CS	1	Exam.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)	
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	

3.5.3.2 PET Series Module

TABLE 3.5-5
PET SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Type	VR	VM	Advance Attribute (GE Advance 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	
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	
Reconstruction Method	(0054,1103)	3	LO	1	recon_method	
Detector Lines of Response	(0054,1104)	3	LO	1	axial_angles_used	

Attribute Name	Tag	Type	VR	VM	Advance Attribute (GE Advance ImageSet table unless otherwise specified)	Notes
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		
> 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”	

3.5.3.3 PET Isotope Module

TABLE 3.5-6
PET ISOTOPE MODULE ATTRIBUTES

Attribute Name	Tag	Type	VR	VM	Advance Attribute (GE Advance 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	
> 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	99SDM	
>> Coding Scheme Designator	(0008,0102)	1C	SH	1	tracer_name	
>> 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	

Attribute Name	Tag	Type	VR	VM	Advance Attribute (GE Advance Scan table unless otherwise specified)	Notes
>> 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	

3.5.3.4 PET Multi-gated Acquisition Module

TABLE 3.5-7
PET MULTI-GATED ACQUISITION MODULE ATTRIBUTES

Attribute Name	Tag	Type	VR	VM	Advance Attribute (GE Advance 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	

3.5.3.5 NM/PET Patient Orientation Module

TABLE 3.5-8
NM/PET PATIENT ORIENTATION MODULE ATTRIBUTES

Attribute Name	Tag	Type	VR	VM	GE Advance 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 Designator	(0008,0102)	1C	SH	1		
> Code Meaning	(0008,0104)	3	LO	1		

3.5.3.6 GE Advance ImageSet Module

Refer to Section 3.6.6 for details.

3.5.3.7 GE Advance Scan Module

Refer to Section 3.6.4 for details.

3.5.4 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.

3.5.4.1 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 3.5-9
FRAME OF REFERENCE MODULE ATTRIBUTES

Attribute Name	Tag	Type	VR	VM	GE Advance 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	

3.5.5 Common Equipment Entity Modules

The following Equipment IE Module is common to all Composite Image IODs which reference the Equipment IE.

3.5.5.1 General Equipment Module

This section specifies the Attributes which identify and describe the piece of equipment which produced a Series of Images.

TABLE 3.5-10
GENERAL EQUIPMENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	VR	VM	Advance Attribute (GE Advance 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		
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	

3.5.6 Common Image Entity Modules

The following Image IE Modules are common to all Composite Image IODs which reference the Image IE.

3.5.6.1 General Image Module

This section specifies the Attributes which identify and describe an image within a particular series.

TABLE 3.5-11
GENERAL IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	VR	VM	Advance Attribute (GE Advance Image table unless otherwise specified)	Notes
Image Number	(0020,0013)	2	IS	1	IF (is_source = [pet dicom]) THEN = image_number ELSE = slice_number	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) should not be used to sort/order the images when displaying PET images generated by PET Advance™ . Sorting images by Image Number can result in mis-ordering of images for Multiframe series. PET images should be sorted by the Image Index DICOM tag (0054, 1330), which is part of the PET Image module, outlined on Table 3.5-14.

3.5.6.2 Image Plane Module

This section specifies the Attributes which define the transmitted pixel array of a two dimensional image plane.

TABLE 3.5-12
IMAGE PLANE MODULE ATTRIBUTES

Attribute Name	Tag	Type	VR	VM	Advance Attribute (GE Advance Image table unless otherwise specified)	Notes
Pixel Spacing	(0028,0030)	1	DS	2	Value 1 = pixel_width Value 2 = pixel_height	
Image Orientation (Patient)	(0020,0037)	1	DS	6	ImageSet.patient_row_cos_l ImageSet.patient_row_cos_p ImageSet.patient_row_cos_s ImageSet.patient_col_cos_l ImageSet.patient_col_cos_p ImageSet.patient_col_cos_s	
Image Position (Patient)	(0020,0032)	1	DS	3	patient_l patient_p patient_s	
Slice Thickness	(0018,0050)	2	DS	1	image_thickness	
Slice Location	(0020,1041)	3	DS	1	image_location	

3.5.6.3 Image Pixel Module

This section specifies the Attributes that describe the pixel data of the image.

TABLE 3.5-13
IMAGE PIXEL MODULE ATTRIBUTES

Attribute Name	Tag	Type	VR	VM	Advance Attribute (GE Advance 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)	
Pixel Data	(7FE0,0010)	1	OB/OW	1	pixel_data (send as OW)	
Planar Configuration	(0028,0006)	1C	US	1	Not Used	

Attribute Name	Tag	Type	VR	VM	Advance Attribute (GE Advance Image table unless otherwise specified)	Notes
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	

3.5.6.4 PET Image Module

This section specifies the Attributes that describe the image within a particular PET Series.

TABLE 3.5-14
PET IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	VR	VM	Advance Attribute (GE Advance 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 Interpretation	(0028,0004)	1	CS	1	”MONOCHROME2”	
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	

Attribute Name	Tag	Type	VR	VM	Advance Attribute (GE Advance Image table unless otherwise specified)	Notes
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)	
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	

Attribute Name	Tag	Type	VR	VM	Advance Attribute (GE Advance Image table unless otherwise specified)	Notes
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	
> 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.

3.5.6.5 Overlay Plane Module

This section contains Attributes that describe characteristics of an Overlay Plane.

Overlay Planes are not currently used in PET Advance™.

TABLE 3.5-15
OVERLAY PLANE MODULE ATTRIBUTES

Attribute Name	Tag	Type	VR	VM	Advance Attribute (Image table unless otherwise specified)	Notes
None						

3.5.6.6 VOI LUT Module

This section specifies the Attributes that describe the VOI LUT.

TABLE 3.5-16
VOI LUT MODULE ATTRIBUTES

Attribute Name	Tag	Type	VR	VM	Advance 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	
Window Width	(0028,1051)	1C	DS	1-n	window_width	
Window Center & Width Explanation	(0028,1055)	3	LO	1-n	Not Used	

3.5.6.7 GE Advance Image

Refer to Section 3.6.7 for details.

3.5.6.8 GE Advance Frame

Refer to Section 3.6.5 for details.

3.5.6.9 GE Advance ROI

Refer to Section 3.6.8 for details.

3.5.6.10 GE Advance Annotation

Refer to Section 3.6.9 for details.

3.5.7 General Modules

The SOP Common Module is mandatory for all DICOM IODs.

3.5.7.1 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 3.5-17
SOP COMMON MODULE ATTRIBUTES

Attribute Name	Tag	Type	VR	VM	Advance Attribute (GE Advance 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	= 1.2.840.113619.1.99.<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
```

3.6 PRIVATE DATA DICTIONARY

3.6.1 Private Creator Identification Information

TABLE 3.6-1
PRIVATE CREATOR IDENTIFICATION (GEMS_PETD_01)

Attribute Name	Tag	Type	VR	VM	Advance Type
Private Creator Data Element	(0009,0010)	1	SH	1	n/a
GE Advance Implementation Version Name Value 1: "GE Advance" Value 2: IDB_SOFTWARE_VERSION	(0009,1001)	3	LO	2	n/a

3.6.2 GE Advance Patient Module

TABLE 3.6-2
GE ADVANCE PATIENT MODULE PRIVATE ELEMENTS
PRIVATE CREATOR IDENTIFICATION (GEMS_ PETD_01)

Attribute Name	Tag	Type	VR	VM	Advance Type
GE Advance Patient.patient_id	(0009,1002)	3	LO	1	20A
GE Advance Patient.compatible_version	(0009,1003)	3	SH	1	5A
GE Advance Patient.software_version	(0009,1004)	3	SH	1	5A
GE Advance Patient.patient_datetime	(0009,1005)	3	DT	1	D
GE Advance Patient.type	(0009,1006)	3	SL	1	L

3.6.3 GE Advance Exam Module

TABLE 3.6-3
GE ADVANCE EXAM MODULE PRIVATE ELEMENTS
PRIVATE CREATOR IDENTIFICATION (GEMS_ PETD_01)

Attribute Name	Tag	Type	VR	VM	Advance Type
GE Advance Exam.exam_id	(0009,1007)	3	UI	1	64A
GE Advance Exam.compatible_version	(0009,1008)	3	SH	1	5A
GE Advance Exam.software_version	(0009,1009)	3	SH	1	5A

3.6.4 GE Advance Scan Module

TABLE 3.6-4
GE ADVANCE SCAN MODULE PRIVATE ELEMENTS
PRIVATE CREATOR IDENTIFICATION (GEMS_ PETD_01)

Attribute Name	Tag	Type	VR	VM	Advance Type
GE Advance Scan.scan_id	(0009,100A)	3	UI	1	64A
GE Advance Scan.compatible_version	(0009,100B)	3	SH	1	5A
GE Advance Scan.software_version	(0009,100C)	3	SH	1	5A
GE Advance Scan.scan_datetime	(0009,100D)	3	DT	1	D
GE Advance Scan.scan_ready	(0009,100E)	3	DT	1	D
GE Advance Scan.scan_description	(0009,100F)	3	UI	1	64A

Attribute Name	Tag	Type	VR	VM	Advance Type
GE Advance Scan.hospital_name	(0009,1010)	3	LO	1	32A
GE Advance Scan.scanner_desc	(0009,1011)	3	LO	1	32A
GE Advance Scan.manufacturer	(0009,1012)	3	LO	1	64A
GE Advance Scan.for_identifier	(0009,1013)	3	UI	1	64A
GE Advance Scan.landmark_name	(0009,1014)	3	LO	1	64A
GE Advance Scan.landmark_abbrev	(0009,1015)	3	SH	1	2A
GE Advance Scan.patient_position	(0009,1016)	3	SL	1	L
GE Advance Scan.scan_perspective	(0009,1017)	3	SL	1	L
GE Advance Scan.scan_type	(0009,1018)	3	SL	1	L
GE Advance Scan.scan_mode	(0009,1019)	3	SL	1	L
GE Advance Scan.start_condition	(0009,101A)	3	SL	1	L
GE Advance Scan.start_cond_data	(0009,101B)	3	SL	1	L
GE Advance Scan.sel_stop_cond	(0009,101C)	3	SL	1	L
GE Advance Scan.sel_stop_cond_data	(0009,101D)	3	SL	1	L
GE Advance Scan.collect_deadtime	(0009,101E)	3	SL	1	L
GE Advance Scan.collect_singles	(0009,101F)	3	SL	1	L
GE Advance Scan.collect_countrate	(0009,1020)	3	SL	1	L
GE Advance Scan.countrate_period	(0009,1021)	3	SL	1	L
GE Advance Scan.delayed_events	(0009,1022)	3	SL	1	L
GE Advance Scan.delayed_bias	(0009,1023)	3	SL	1	L
GE Advance Scan.word_size	(0009,1024)	3	SL	1	L
GE Advance Scan.axial_acceptance	(0009,1025)	3	SL	1	L
GE Advance Scan.axial_angle_3d	(0009,1026)	3	SL	1	L
GE Advance Scan.theta_compression	(0009,1027)	3	SL	1	L
GE Advance Scan.axial_compression	(0009,1028)	3	SL	1	L
GE Advance Scan.gantry_tilt_angle	(0009,1029)	3	FL	1	F
GE Advance Scan.collimation	(0009,102A)	3	SL	1	L
GE Advance Scan.scan_fov	(0009,102B)	3	SL	1	L
GE Advance Scan.axial_fov	(0009,102C)	3	SL	1	L
GE Advance Scan.event_separation	(0009,102D)	3	SL	1	L
GE Advance Scan.mask_width	(0009,102E)	3	SL	1	L
GE Advance Scan.binning_mode	(0009,102F)	3	SL	1	L
GE Advance Scan.trig_rej_method	(0009,1030)	3	SL	1	L
GE Advance Scan.number_for_reject	(0009,1031)	3	SL	1	L
GE Advance Scan.lower_reject_limit	(0009,1032)	3	SL	1	L
GE Advance Scan.upper_reject_limit	(0009,1033)	3	SL	1	L
GE Advance Scan.triggers_acquired	(0009,1034)	3	SL	1	L
GE Advance Scan.triggers_rejected	(0009,1035)	3	SL	1	L
GE Advance Scan.tracer_name	(0009,1036)	3	LO	1	40A
GE Advance Scan.batch_description	(0009,1037)	3	LO	1	40A
GE Advance Scan.tracer_activity	(0009,1038)	3	FL	1	F
GE Advance Scan.meas_datetime	(0009,1039)	3	DT	1	D
GE Advance Scan.pre_inj_volume	(0009,103A)	3	FL	1	F

Attribute Name	Tag	Type	VR	VM	Advance Type
GE Advance Scan.admin_datetime	(0009,103B)	3	DT	1	D
GE Advance Scan.post_inj_activity	(0009,103C)	3	FL	1	F
GE Advance Scan.post_inj_datetime	(0009,103D)	3	DT	1	D
GE Advance Scan.radionuclide_name	(0009,103E)	3	SH	1	6A
GE Advance Scan.half_life	(0009,103F)	3	FL	1	F
GE Advance Scan.positron_fraction	(0009,1040)	3	FL	1	F
GE Advance Scan.source1_holder	(0009,1041)	3	SL	1	L
GE Advance Scan.source1_activity	(0009,1042)	3	FL	1	F
GE Advance Scan.source1_meas_dt	(0009,1043)	3	DT	1	D
GE Advance Scan.source1_radnuclide	(0009,1044)	3	SH	1	6A
GE Advance Scan.source1_half_life	(0009,1045)	3	FL	1	F
GE Advance Scan.source2_holder	(0009,1046)	3	SL	1	L
GE Advance Scan.source2_activity	(0009,1047)	3	FL	1	F
GE Advance Scan.source2_meas_dt	(0009,1048)	3	DT	1	D
GE Advance Scan.source2_radnuclide	(0009,1049)	3	SH	1	6A
GE Advance Scan.source2_half_life	(0009,104A)	3	FL	1	F
GE Advance Scan.source_speed	(0009,104B)	3	SL	1	L
GE Advance Scan.source_location	(0009,104C)	3	FL	1	F
GE Advance Scan.emission_present	(0009,104D)	3	SL	1	L
GE Advance Scan.lower_axial_acc	(0009,104E)	3	SL	1	L
GE Advance Scan.upper_axial_acc	(0009,104F)	3	SL	1	L
GE Advance Scan.lower_coinc_limit	(0009,1050)	3	SL	1	L
GE Advance Scan.upper_coinc_limit	(0009,1051)	3	SL	1	L
GE Advance Scan.coinc_delay_offset	(0009,1052)	3	SL	1	L
GE Advance Scan.coinc_output_mode	(0009,1053)	3	SL	1	L
GE Advance Scan.upper_energy_limit	(0009,1054)	3	SL	1	L
GE Advance Scan.lower_energy_limit	(0009,1055)	3	SL	1	L
GE Advance Scan.normal_cal_id	(0009,1056)	3	UI	1	64A
GE Advance Scan.normal_2d_cal_id	(0009,1057)	3	UI	1	64A
GE Advance Scan.blank_cal_id	(0009,1058)	3	UI	1	64A
GE Advance Scan.wc_cal_id	(0009,1059)	3	UI	1	64A
GE Advance Scan.derived	(0009,105A)	3	SL	1	L
GE Advance Scan.contrast_agent	(0009,105B)	3	LO	1	64A

3.6.5 GE Advance Frame Module

TABLE 3.6-5
GE ADVANCE FRAME MODULE PRIVATE ELEMENTS
PRIVATE CREATOR IDENTIFICATION (GEMS_ PETD_01)

Attribute Name	Tag	Type	VR	VM	Advance Type
GE Advance Frame.frame_id	(0009,105C)	3	UI	1	64A
GE Advance Frame.scan_id	(0009,105D)	3	UI	1	64A
GE Advance Frame.exam_id	(0009,105E)	3	UI	1	64A
GE Advance Frame.patient_id	(0009,105F)	3	LO	1	20A
GE Advance Frame.compatible_version	(0009,1060)	3	SH	1	5A
GE Advance Frame.software_version	(0009,1061)	3	SH	1	5A
GE Advance Frame.where_is_frame	(0009,1062)	3	ST	1	256A
GE Advance Frame.frame_size	(0009,1063)	3	SL	1	L
GE Advance Frame.file_exists	(0009,1064)	3	SL	1	L
GE Advance Frame.patient_entry	(0009,1065)	3	SL	1	L
GE Advance Frame.table_height	(0009,1066)	3	FL	1	F
GE Advance Frame.table_z_position	(0009,1067)	3	FL	1	F
GE Advance Frame.landmark_datetime	(0009,1068)	3	DT	1	D
GE Advance Frame.slice_count	(0009,1069)	3	SL	1	L
GE Advance Frame.start_location	(0009,106A)	3	FL	1	F
GE Advance Frame.acq_delay	(0009,106B)	3	SL	1	L
GE Advance Frame.acq_start	(0009,106C)	3	DT	1	D
GE Advance Frame.acq_duration	(0009,106D)	3	SL	1	L
GE Advance Frame.acq_bin_dur	(0009,106E)	3	SL	1	L
GE Advance Frame.acq_bin_start	(0009,106F)	3	SL	1	L
GE Advance Frame.actual_stop_cond	(0009,1070)	3	SL	1	L
GE Advance Frame.total_prompts	(0009,1071)	3	FD	1	Dbl
GE Advance Frame.total_delays	(0009,1072)	3	FD	1	Dbl
GE Advance Frame.frame_valid	(0009,1073)	3	SL	1	L
GE Advance Frame.validity_info	(0009,1074)	3	SL	1	L
GE Advance Frame.archived	(0009,1075)	3	SL	1	L
GE Advance Frame.compression	(0009,1076)	3	SL	1	L
GE Advance Frame.uncompressed_size	(0009,1077)	3	SL	1	L
GE Advance Frame.accum_bin_dur	(0009,1078)	3	SL	1	L

3.6.6 GE Advance ImageSet Module

TABLE 3.6-6
GE ADVANCE IMAGESET MODULE PRIVATE ELEMENTS
PRIVATE CREATOR IDENTIFICATION (GEMS_ PETD_01)

Attribute Name	Tag	Type	VR	VM	Advance Type
GE Advance ImageSet.compatible_version	(0009,1079)	3	SH	1	5A
GE Advance ImageSet.software_version	(0009,107A)	3	SH	1	5A
GE Advance ImageSet.is_datetime	(0009,107B)	3	DT	1	D
GE Advance ImageSet.is_source	(0009,107C)	3	SL	1	L
GE Advance ImageSet.is_contents	(0009,107D)	3	SL	1	L
GE Advance ImageSet.is_type	(0009,107E)	3	SL	1	L
GE Advance ImageSet.is_reference	(0009,107F)	3	FL	3	F
GE Advance ImageSet.multi_patient	(0009,1080)	3	SL	1	L
GE Advance ImageSet.number_of_normals	(0009,1081)	3	SL	1	L
GE Advance ImageSet.color_map_id	(0009,1082)	3	UI	1	64A
GE Advance ImageSet.window_level_type	(0009,1083)	3	SL	1	L
GE Advance ImageSet.rotate	(0009,1084)	3	FL	1	F
GE Advance ImageSet.flip	(0009,1085)	3	SL	1	L
GE Advance ImageSet.zoom	(0009,1086)	3	FL	1	F
GE Advance ImageSet.pan_x	(0009,1087)	3	SL	1	L
GE Advance ImageSet.pan_y	(0009,1088)	3	SL	1	L
GE Advance ImageSet.window_level_min	(0009,1089)	3	FL	1	F
GE Advance ImageSet.window_level_max	(0009,108A)	3	FL	1	F
GE Advance ImageSet.recon_method	(0009,108B)	3	SL	1	L
GE Advance ImageSet.attenuation	(0009,108C)	3	SL	1	L
GE Advance ImageSet.atten_coefficient	(0009,108D)	3	FL	1	F
GE Advance ImageSet.bp_filter	(0009,108E)	3	SL	1	L
GE Advance ImageSet.bp_filter_cutoff	(0009,108F)	3	FL	1	F
GE Advance ImageSet.bp_filter_order	(0009,1090)	3	SL	1	L
GE Advance ImageSet.bp_center_l	(0009,1091)	3	FL	1	F
GE Advance ImageSet.bp_center_p	(0009,1092)	3	FL	1	F
GE Advance ImageSet.atten_smooth	(0009,1093)	3	SL	1	L
GE Advance ImageSet.atten_smooth_param	(0009,1094)	3	SL	1	L
GE Advance ImageSet.angle_smooth_param	(0009,1095)	3	SL	1	L
GE Advance ImageSet.wellcountercal_id	(0009,1096)	3	UI	1	64A
GE Advance ImageSet.trans_scan_id	(0009,1097)	3	UI	1	64A
GE Advance ImageSet.norm_cal_id	(0009,1098)	3	UI	1	64A
GE Advance ImageSet.blnk_cal_id	(0009,1099)	3	UI	1	64A
GE Advance ImageSet.cac_edge_threshold	(0009,109A)	3	FL	1	F
GE Advance ImageSet.cac_skull_offset	(0009,109B)	3	FL	1	F
GE Advance ImageSet.emiss_sub_id	(0009,109C)	3	UI	1	64A
GE Advance ImageSet.radial_filter_3d	(0009,109D)	3	SL	1	L
GE Advance ImageSet.radial_cutoff_3d	(0009,109E)	3	FL	1	F

Attribute Name	Tag	Type	VR	VM	Advance Type
GE Advance ImageSet.axial_filter_3d	(0009,109F)	3	SL	1	L
GE Advance ImageSet.axial_cutoff_3d	(0009,10A0)	3	FL	1	F
GE Advance ImageSet.axial_start	(0009,10A1)	3	FL	1	F
GE Advance ImageSet.axial_spacing	(0009,10A2)	3	FL	1	F
GE Advance ImageSet.axial_angles_used	(0009,10A3)	3	SL	1	L
GE Advance ImageSet.ir_num_iterations	(0009,10B2)	3	SL	1	F
GE Advance ImageSet.ir_num_subsets	(0009,10B3)	3	SL	1	L
GE Advance ImageSet.ir_recon_fov	(0009,10B4)	3	FL	1	F
GE Advance ImageSet.ir_corr_model	(0009,10B5)	3	SL	1	L
GE Advance ImageSet.ir_loop_filter	(0009,10B6)	3	SL	1	L
GE Advance ImageSet.ir_pre_filt_parm	(0009,10B7)	3	FL	1	F
GE Advance ImageSet.ir_loop_filt_parm	(0009,10B8)	3	SL	1	L
GE Advance ImageSet.response_filt_parm	(0009,10B9)	3	FL	1	F
GE Advance ImageSet.post_filter	(0009,10BA)	3	SL	1	L
GE Advance ImageSet.post_filt_parm	(0009,10BB)	3	FL	1	F
GE Advance ImageSet.ir_regularize	(0009,10BC)	3	SL	1	L
GE Advance ImageSet.regularize_parm	(0009,10BD)	3	FL	1	F
GE Advance ImageSet.ac_bp_filter	(0009,10BE)	3	SL	1	L
GE Advance ImageSet.ac_bp_filt_cut_off	(0009,10BF)	3	FL	1	F
GE Advance ImageSet.ac_bp_filt_order	(0009,10C0)	3	SL	1	L
GE Advance ImageSet.ac_img_smooth	(0009,10C1)	3	SL	1	L
GE Advance ImageSet.ac_img_smooth_parm	(0009,10C2)	3	FL	1	F
GE Advance ImageSet.scatter_method	(0009,10C3)	3	SL	1	L
GE Advance ImageSet.scatter_num_iter	(0009,10C4)	3	SL	1	L
GE Advance ImageSet.scatter_parm	(0009,10C5)	3	FL	1	F

3.6.7 GE Advance Image Module

TABLE 3.6-7
GE ADVANCE IMAGE MODULE PRIVATE ELEMENTS
PRIVATE CREATOR IDENTIFICATION (GEMS_ PETD_01)

Attribute Name	Tag	Type	VR	VM	Advance Type
GE Advance Image.compatible_version	(0009,10A4)	3	SH	1	5A
GE Advance Image.software_version	(0009,10A5)	3	SH	1	5A
GE Advance Image.slice_number	(0009,10A6)	3	SL	1	L
GE Advance Image.total_counts	(0009,10A7)	3	FL	1	F
GE Advance Image.other_atts	(0009,10A8)	3	OB	1	Bt
GE Advance Image.other_atts_size	(0009,10A9)	3	SL	1	L
GE Advance Image.archived	(0009,10AA)	3	SL	1	L
GE Advance Image.bp_center_x	(0009,10AB)	3	FL	1	F
GE Advance Image.bp_center_y	(0009,10AC)	3	FL	1	F
GE Advance Image.trans_frame_id	(0009,10AD)	3	UI	1	64A
GE Advance Image.tpluse_frame_id	(0009,10AE)	3	UI	1	64A
GE Advance Image.seg_qc_parm	(0009,10C6)	3	FL	1	F

Attribute Name	Tag	Type	VR	VM	Advance Type
GE Advance Image.overlap	(0009,10C7)	3	SL	1	L
GE Advance Image.ovlp_frm_id	(0009,10C8)	3	UI	1	64A
GE Advance Image.ovlp_trans_frm_id	(0009,10C9)	3	UI	1	64A
GE Advance Image.ovlp_tpulse_frm_id	(0009,10CA)	3	UI	1	64A

3.6.8 GE Advance ROI Module

TABLE 3.6-8
GE ADVANCE ROI MODULE PRIVATE ELEMENTS
PRIVATE CREATOR IDENTIFICATION (GEMS_ PETD_01)

Attribute Name	Tag	Type	VR	VM	Advance Type
Private Creator Data Element	(0011,0010)	1	SH	1	n/a
GE Advance ROI Sequence	(0011,1001)	3	SQ	1	n/a
> GE Advance ROI.roi_id	(0011,1002)	3	UI	1	64A
> GE Advance ROI.image_id	(0011,1003)	3	UI	1	64A
> GE Advance ROI.compatible_version	(0011,1004)	3	SH	1	5A
> GE Advance ROI.software_version	(0011,1005)	3	SH	1	5A
> GE Advance ROI.roi_name	(0011,1006)	3	LO	1	32A
> GE Advance ROI.roi_datetime	(0011,1007)	3	DT	1	D
> GE Advance ROI.roi_type	(0011,1008)	3	SL	1	L
> GE Advance ROI.center_x	(0011,1009)	3	FL	1	F
> GE Advance ROI.center_y	(0011,100A)	3	FL	1	F
> GE Advance ROI.width	(0011,100B)	3	FL	1	F
> GE Advance ROI.height	(0011,100C)	3	FL	1	F
> GE Advance ROI.angle	(0011,100D)	3	FL	1	F
> GE Advance ROI.number_of_points	(0011,100E)	3	SL	1	L
> GE Advance ROI.roi_data	(0011,100F)	3	OB	1	Bt
> GE Advance ROI.roi_size	(0011,1010)	3	SL	1	L
> GE Advance ROI.color	(0011,1011)	3	LO	1	20A
> GE Advance ROI.line_type	(0011,1012)	3	SL	1	L
> GE Advance ROI.line_width	(0011,1013)	3	SL	1	L
> GE Advance ROI.roi_number	(0011,1014)	3	SL	1	L
> GE Advance ROI.convex	(0011,1015)	3	SL	1	L
> GE Advance ROI.atten_corr_flag	(0011,1016)	3	SL	1	L

3.6.9 GE Advance Annotation Module

TABLE 3.6-9
GE ADVANCE ANNOTATION MODULE PRIVATE ELEMENTS
PRIVATE CREATOR IDENTIFICATION (GEMS_ PETD_01)

Attribute Name	Tag	Type	VR	VM	Advance Type
Private Creator Data Element	(0013,0010)	1	SH	1	n/a
GE Advance Annotation Sequence	(0013,1001)	3	SQ	1	n/a

> GE Advance Annotation.annotation_id	(0013,1002)	3	UI	1	64A
> GE Advance Annotation.image_id	(0013,1003)	3	UI	1	64A
> GE Advance Annotation.compatible_version	(0013,1004)	3	SH	1	5A
> GE Advance Annotation.software_version	(0013,1005)	3	SH	1	5A
> GE Advance Annotation.type	(0013,1006)	3	SL	1	L
> GE Advance Annotation.font_name	(0013,1007)	3	LO	1	32A
> GE Advance Annotation.font_size	(0013,1008)	3	SH	1	2A
> GE Advance Annotation.foreground_color	(0013,1009)	3	LO	1	20A
> GE Advance Annotation.background_color	(0013,100A)	3	LO	1	20A
> GE Advance Annotation.coordinate_system	(0013,100B)	3	SL	1	L
> GE Advance Annotation.start_x	(0013,100C)	3	FL	1	F
> GE Advance Annotation.start_y	(0013,100D)	3	FL	1	F
> GE Advance Annotation.end_x	(0013,100E)	3	FL	1	F
> GE Advance Annotation.end_y	(0013,100F)	3	FL	1	F
> GE Advance Annotation.start_symbol	(0013,1010)	3	SL	1	L
> GE Advance Annotation.end_symbol	(0013,1011)	3	SL	1	L
> GE Advance Annotation.annotation_data	(0013,1012)	3	OB	1	Bt
> GE Advance Annotation.annotation_size	(0013,1013)	3	SL	1	L
> GE Advance Annotation.label_id	(0013,1014)	3	LO	1	64A

4. STANDALONE PET CURVE INFORMATION OBJECT IMPLEMENTATION

4.1 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:

4.2- IOD Description

4.3- IOD Entity-Relationship Model

4.4- IOD Module Table

4.5- IOD Module Definition

4.2 PET CURVE IOD IMPLEMENTATION

The PET Advance™ implementation of DICOM uses the PET Curve format when creating curve objects. In order to preserve full fidelity when transferring data to a PET Advance™ 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 PET Advance™ private data dictionary is included in Section 4.6. Nevertheless, the PET Advance™ is able to process PET DICOM curves without any private data elements.

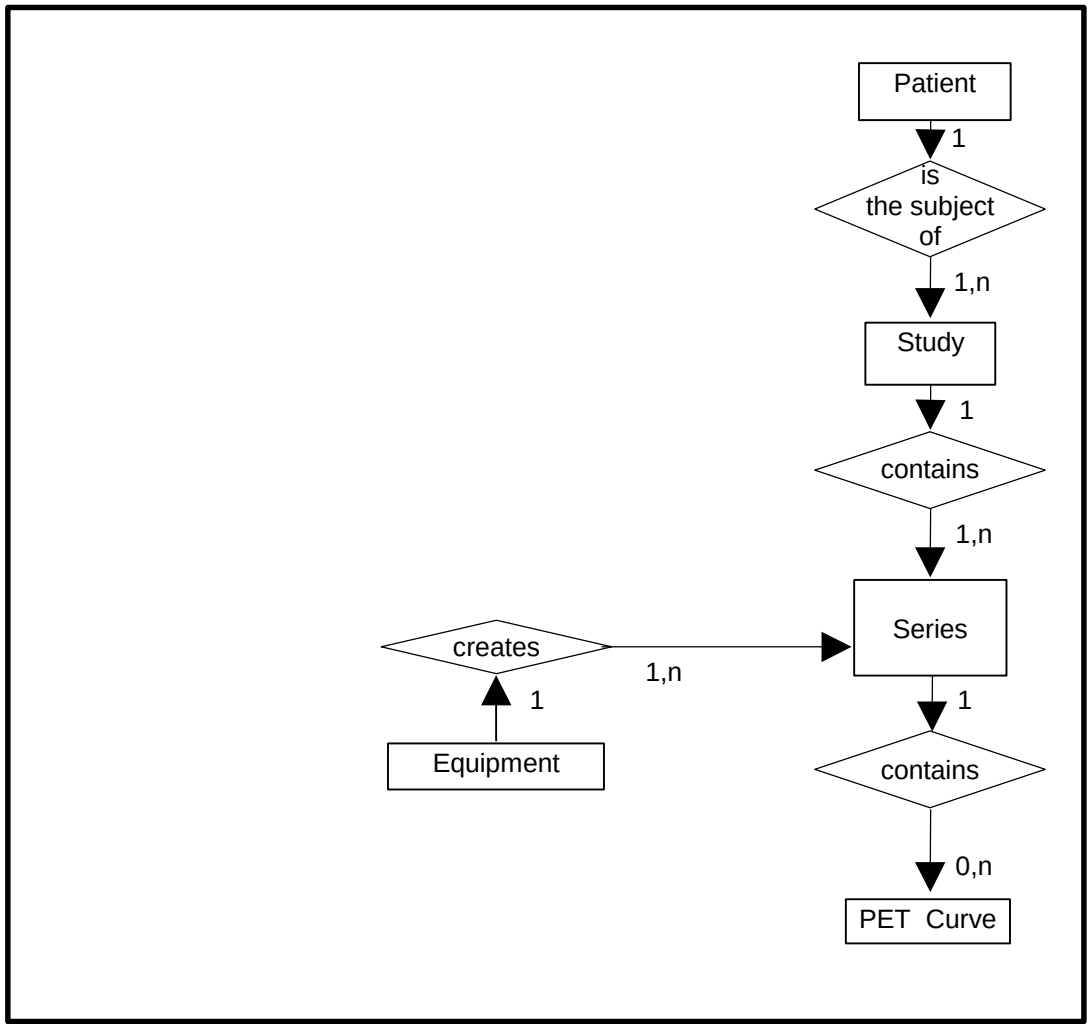
4.3 PET CURVE ENTITY-RELATIONSHIP MODEL

The Entity-Relationship diagram for the PET Curve interoperability schema is shown in **Illustration 7-1 .** 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 7-1
PET CURVE ENTITY RELATIONSHIP DIAGRAM



4.3.1 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.

4.3.1.1 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.

4.3.1.2 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.

4.3.1.3 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.

4.3.1.4 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.

4.3.1.5 PET Curve Entity Description

The PET Curve Entity defines the attributes which describe the curve data of a PET curve.

4.3.2 PET Advance™ Mapping of DICOM entities

TABLE 4.3-1
MAPPING OF DICOM ENTITIES TO ADVANCE ENTITIES

DICOM	*Advance* Entity
Patient	Patient
Study	Exam
Series	Imageset
Curve	Curve, Graph, Curve Presentation

4.4 PET CURVE IOD MODULE TABLE

Within an entity of the DICOM v3.0 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 4.4-1 identifies the defined modules within the entities which comprise the DICOM v3.0 PET IOD. Modules are identified by Module Name.

See DICOM v3.0 Part 3 for a complete definition of the entities, modules, and attributes.

TABLE 4.4-1
PET CURVE IOD MODULES

Entity Name	Module Name	Reference
Patient	Patient	4.5.1.1
	GE Advance Patient	4.5.1.2
Study	General Study	4.5.2.1
	Patient Study	4.5.2.2
	GE Advance Exam	4.5.2.3
Series	General Series	4.5.3.1
	PET Series	4.5.3.2
	PET Isotope	4.5.3.3
	PET Multi-gated Acquisition	4.5.3.4
	GE Advance Imageset	4.5.3.5
	GE Advance Scan	4.5.3.6
Equipment	General Equipment	4.5.4.1
Curve	Curve Identification	4.5.5.1
	Curve	4.5.5.2
	PET Curve	4.5.5.3
	GE Advance Curve	4.5.5.4
	GE Advance Graph	4.5.5.5
	GE Advance Curve Presentation	4.5.5.6
General Modules	SOP Common	4.5.6.1

4.5 PET CURVE INFORMATION MODULE DEFINITIONS

Please refer to DICOM v3.0 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 v3.0 Standard Part 3 (Information Object Definitions).

4.5.1 Common Patient Entity Modules

4.5.1.1 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 4.5-1
PATIENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	VR	VM	Advance Attribute (Advance 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	

4.5.1.2 GE Advance Patient

Refer to Section 4.6.2 for details.

4.5.2 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.

4.5.2.1 General Study Module

This section specifies the Attributes which describe and identify the Study performed upon the Patient.

TABLE 4.5-2
GENERAL STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	VR	VM	Advance Attribute (GE Advance 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	

4.5.2.2 Patient Study Module

This section defines Attributes that provide information about the Patient at the time the Study was performed.

TABLE 4.5-3
PATIENT STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	VR	VM	Advance Attribute (GE Advance 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	

4.5.2.3 GE Advance Exam Module

Refer to Section 4.6.3 for details.

4.5.3 Common Series Entity Modules

The following Series IE Modules are common to all Composite Image IODs which reference the Series IE.

4.5.3.1 General Series Module

This section specifies the Attributes which identify and describe general information about the Series within a Study.

TABLE 4.5-4
GENERAL SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Type	VR	VM	Advance Attribute (GE Advance ImageSet table unless otherwise specified)	Notes
Modality	(0008,0060)	1	CS	1	Exam.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)	
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	

Attribute Name	Tag	Type	VR	VM	Advance Attribute (GE Advance ImageSet table unless otherwise specified)	Notes
Largest Pixel Value in Series	(0028,0109)	3	US/SS	1	Not Used	

4.5.3.2 PET Series Module

TABLE 4.5-5
PET SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Type	VR	VM	Advance Attribute (GE Advance 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	
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	Advance Attribute (GE Advance 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 Sequence	(0054,0013)	3	SQ	1		
> 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”	

4.5.3.3 PET Isotope Module

TABLE 4.5-6
PET ISOTOPE MODULE ATTRIBUTES

Attribute Name	Tag	Type	VR	VM	Advance Attribute (GE Advance 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	
> 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	(0018,0027)	3	TM	1	Not Used	

Attribute Name	Tag	Type	VR	VM	Advance Attribute (GE Advance Scan table unless otherwise specified)	Notes
Time						
> Intervention Drug Dose	(0018,0028)	3	DS	1	Not Used	

4.5.3.4 PET Multi-gated Acquisition Module

TABLE 4.5-7
PET ISOTOPE MODULE ATTRIBUTES

Attribute Name	Tag	Type	VR	VM	Advance Attribute (GE Advance 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	

4.5.3.5 GE Advance ImageSet Module

Refer to Section 4.6.6 for details.

4.5.3.6 GE Advance Scan Module

Refer to Section 4.6.4 for details.

4.5.4 Common Equipment Entity Modules

The following Equipment IE Module is common to all Composite Image IODs which reference the Equipment IE.

4.5.4.1 General Equipment Module

This section specifies the Attributes which identify and describe the piece of equipment which produced a Series of Images.

TABLE 4.5-8
GENERAL EQUIPMENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	VR	VM	Advance Attribute (GE Advance 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	

4.5.5 Common Curve Entity Modules

The following Image IE Modules are common to all Composite Image IODs which reference the Image IE.

4.5.5.1 Curve Identification Module

This section specifies the Attributes which identify and describe an curve within a particular series.

TABLE 4.5-9
CURVE IDENTIFICATION MODULE ATTRIBUTES

Attribute Name	Tag	Type	VR	VM	Advance Attribute (GE Advance 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		

4.5.5.2 Curve Module

This section specifies the Attributes which identify and describe an curve within a particular series.

TABLE 4.5-10
CURVE MODULE ATTRIBUTES

Attribute Name	Tag	Type	VR	VM	Advance Attribute (GE Advance 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 SYSRATE = system count rate SLICERATE = slice count rate 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

Note: *Cardiac Polar Maps are not supported as part of the PET Curve IOD.*

4.5.5.3 PET Curve Module

This section specifies the Attributes that describe the PET Curve Module.

TABLE 4.5-11
PET CURVE MODULE ATTRIBUTES

Attribute Name	Tag	Type	VR	VM	Advance Attribute (GE Advance 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.*

4.5.5.4 GE Advance Curve

Refer to Section 4.6.7 for details.

4.5.5.5 GE Advance Graph

Refer to Section 4.6.8 for details.

4.5.5.6 GE Advance Curve Presentation

Refer to Section 4.6.9 for details.

4.5.6 General Modules

The SOP Common Module is mandatory for all DICOM IODs.

4.5.6.1 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 4.5-12
SOP COMMON MODULE ATTRIBUTES

Attribute Name	Tag	Type	VR	VM	Advance Attribute (GE Advance 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	= 1.2.840.113619.1.99.<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
```

4.6 PRIVATE DATA DICTIONARY

4.6.1 Private Creator Identification Information

TABLE 4.6-1
PRIVATE CREATOR IDENTIFICATION (GEMS_PETD_01)

Attribute Name	Tag	Type	VR	VM	Advance Type
Private Creator Data Element	(0009,0010)	1	SH	1	n/a
GE Advance Implementation Version Name Value 1: "GE Advance" Value 2: IDB_SOFTWARE_VERSION	(0009,1001)	3	LO	2	n/a

4.6.2 GE Advance Patient Module

TABLE 4.6-2
GE ADVANCE PATIENT MODULE PRIVATE ELEMENTS
PRIVATE CREATOR IDENTIFICATION (GEMS_ PETD_01)

Attribute Name	Tag	Type	VR	VM	Advance Type
GE Advance Patient.patient_id	(0009,1002)	3	LO	1	20A
GE Advance Patient.compatible_version	(0009,1003)	3	SH	1	5A
GE Advance Patient.software_version	(0009,1004)	3	SH	1	5A
GE Advance Patient.patient_datetime	(0009,1005)	3	DT	1	D
GE Advance Patient.type	(0009,1006)	3	SL	1	L

4.6.3 GE Advance Exam Module

TABLE 4.6-3
GE ADVANCE EXAM MODULE PRIVATE ELEMENTS
PRIVATE CREATOR IDENTIFICATION (GEMS_ PETD_01)

Attribute Name	Tag	Type	VR	VM	Advance Type
GE Advance Exam.exam_id	(0009,1007)	3	UI	1	64A
GE Advance Exam.compatible_version	(0009,1008)	3	SH	1	5A
GE Advance Exam.software_version	(0009,1009)	3	SH	1	5A

4.6.4 GE Advance Scan Module

TABLE 4.6-4
GE ADVANCE SCAN MODULE PRIVATE ELEMENTS
PRIVATE CREATOR IDENTIFICATION (GEMS_ PETD_01)

Attribute Name	Tag	Type	VR	VM	Advance Type
GE Advance Scan.scan_id	(0009,100A)	3	UI	1	64A
GE Advance Scan.compatible_version	(0009,100B)	3	SH	1	5A
GE Advance Scan.software_version	(0009,100C)	3	SH	1	5A
GE Advance Scan.scan_datetime	(0009,100D)	3	DT	1	D
GE Advance Scan.scan_ready	(0009,100E)	3	DT	1	D
GE Advance Scan.scan_description	(0009,100F)	3	UI	1	64A

Attribute Name	Tag	Type	VR	VM	Advance Type
GE Advance Scan.hospital_name	(0009,1010)	3	LO	1	32A
GE Advance Scan.scanner_desc	(0009,1011)	3	LO	1	32A
GE Advance Scan.manufacturer	(0009,1012)	3	LO	1	64A
GE Advance Scan.for_identifier	(0009,1013)	3	UI	1	64A
GE Advance Scan.landmark_name	(0009,1014)	3	LO	1	64A
GE Advance Scan.landmark_abbrev	(0009,1015)	3	SH	1	2A
GE Advance Scan.patient_position	(0009,1016)	3	SL	1	L
GE Advance Scan.scan_perspective	(0009,1017)	3	SL	1	L
GE Advance Scan.scan_type	(0009,1018)	3	SL	1	L
GE Advance Scan.scan_mode	(0009,1019)	3	SL	1	L
GE Advance Scan.start_condition	(0009,101A)	3	SL	1	L
GE Advance Scan.start_cond_data	(0009,101B)	3	SL	1	L
GE Advance Scan.sel_stop_cond	(0009,101C)	3	SL	1	L
GE Advance Scan.sel_stop_cond_data	(0009,101D)	3	SL	1	L
GE Advance Scan.collect_deadtime	(0009,101E)	3	SL	1	L
GE Advance Scan.collect_singles	(0009,101F)	3	SL	1	L
GE Advance Scan.collect_countrate	(0009,1020)	3	SL	1	L
GE Advance Scan.countrate_period	(0009,1021)	3	SL	1	L
GE Advance Scan.delayed_events	(0009,1022)	3	SL	1	L
GE Advance Scan.delayed_bias	(0009,1023)	3	SL	1	L
GE Advance Scan.word_size	(0009,1024)	3	SL	1	L
GE Advance Scan.axial_acceptance	(0009,1025)	3	SL	1	L
GE Advance Scan.axial_angle_3d	(0009,1026)	3	SL	1	L
GE Advance Scan.theta_compression	(0009,1027)	3	SL	1	L
GE Advance Scan.axial_compression	(0009,1028)	3	SL	1	L
GE Advance Scan.gantry_tilt_angle	(0009,1029)	3	FL	1	F
GE Advance Scan.collimation	(0009,102A)	3	SL	1	L
GE Advance Scan.scan_fov	(0009,102B)	3	SL	1	L
GE Advance Scan.axial_fov	(0009,102C)	3	SL	1	L
GE Advance Scan.event_separation	(0009,102D)	3	SL	1	L
GE Advance Scan.mask_width	(0009,102E)	3	SL	1	L
GE Advance Scan.binning_mode	(0009,102F)	3	SL	1	L
GE Advance Scan.trig_rej_method	(0009,1030)	3	SL	1	L
GE Advance Scan.number_for_reject	(0009,1031)	3	SL	1	L
GE Advance Scan.lower_reject_limit	(0009,1032)	3	SL	1	L
GE Advance Scan.upper_reject_limit	(0009,1033)	3	SL	1	L
GE Advance Scan.triggers_acquired	(0009,1034)	3	SL	1	L
GE Advance Scan.triggers_rejected	(0009,1035)	3	SL	1	L
GE Advance Scan.tracer_name	(0009,1036)	3	LO	1	40A
GE Advance Scan.batch_description	(0009,1037)	3	LO	1	40A
GE Advance Scan.tracer_activity	(0009,1038)	3	FL	1	F
GE Advance Scan.meas_datetime	(0009,1039)	3	DT	1	D
GE Advance Scan.pre_inj_volume	(0009,103A)	3	FL	1	F

Attribute Name	Tag	Type	VR	VM	Advance Type
GE Advance Scan.admin_datetime	(0009,103B)	3	DT	1	D
GE Advance Scan.post_inj_activity	(0009,103C)	3	FL	1	F
GE Advance Scan.post_inj_datetime	(0009,103D)	3	DT	1	D
GE Advance Scan.radionuclide_name	(0009,103E)	3	SH	1	6A
GE Advance Scan.half_life	(0009,103F)	3	FL	1	F
GE Advance Scan.positron_fraction	(0009,1040)	3	FL	1	F
GE Advance Scan.source1_holder	(0009,1041)	3	SL	1	L
GE Advance Scan.source1_activity	(0009,1042)	3	FL	1	F
GE Advance Scan.source1_meas_dt	(0009,1043)	3	DT	1	D
GE Advance Scan.source1_radnuclide	(0009,1044)	3	SH	1	6A
GE Advance Scan.source1_half_life	(0009,1045)	3	FL	1	F
GE Advance Scan.source2_holder	(0009,1046)	3	SL	1	L
GE Advance Scan.source2_activity	(0009,1047)	3	FL	1	F
GE Advance Scan.source2_meas_dt	(0009,1048)	3	DT	1	D
GE Advance Scan.source2_radnuclide	(0009,1049)	3	SH	1	6A
GE Advance Scan.source2_half_life	(0009,104A)	3	FL	1	F
GE Advance Scan.source_speed	(0009,104B)	3	SL	1	L
GE Advance Scan.source_location	(0009,104C)	3	FL	1	F
GE Advance Scan.emission_present	(0009,104D)	3	SL	1	L
GE Advance Scan.lower_axial_acc	(0009,104E)	3	SL	1	L
GE Advance Scan.upper_axial_acc	(0009,104F)	3	SL	1	L
GE Advance Scan.lower_coinc_limit	(0009,1050)	3	SL	1	L
GE Advance Scan.upper_coinc_limit	(0009,1051)	3	SL	1	L
GE Advance Scan.coinc_delay_offset	(0009,1052)	3	SL	1	L
GE Advance Scan.coinc_output_mode	(0009,1053)	3	SL	1	L
GE Advance Scan.upper_energy_limit	(0009,1054)	3	SL	1	L
GE Advance Scan.lower_energy_limit	(0009,1055)	3	SL	1	L
GE Advance Scan.normal_cal_id	(0009,1056)	3	UI	1	64A
GE Advance Scan.normal_2d_cal_id	(0009,1057)	3	UI	1	64A
GE Advance Scan.blank_cal_id	(0009,1058)	3	UI	1	64A
GE Advance Scan.wc_cal_id	(0009,1059)	3	UI	1	64A
GE Advance Scan.derived	(0009,105A)	3	SL	1	L
GE Advance Scan.contrast_agent	(0009,105B)	3	LO	1	64A

4.6.5 GE Advance Frame Module

TABLE 4.6-5
GE ADVANCE FRAME MODULE PRIVATE ELEMENTS
PRIVATE CREATOR IDENTIFICATION (GEMS_ PETD_01)

Attribute Name	Tag	Type	VR	VM	Advance Type
GE Advance Frame.frame_id	(0009,105C)	3	UI	1	64A
GE Advance Frame.scan_id	(0009,105D)	3	UI	1	64A
GE Advance Frame.exam_id	(0009,105E)	3	UI	1	64A
GE Advance Frame.patient_id	(0009,105F)	3	LO	1	20A
GE Advance Frame.compatible_version	(0009,1060)	3	SH	1	5A
GE Advance Frame.software_version	(0009,1061)	3	SH	1	5A
GE Advance Frame.where_is_frame	(0009,1062)	3	ST	1	256A
GE Advance Frame.frame_size	(0009,1063)	3	SL	1	L
GE Advance Frame.file_exists	(0009,1064)	3	SL	1	L
GE Advance Frame.patient_entry	(0009,1065)	3	SL	1	L
GE Advance Frame.table_height	(0009,1066)	3	FL	1	F
GE Advance Frame.table_z_position	(0009,1067)	3	FL	1	F
GE Advance Frame.landmark_datetime	(0009,1068)	3	DT	1	D
GE Advance Frame.slice_count	(0009,1069)	3	SL	1	L
GE Advance Frame.start_location	(0009,106A)	3	FL	1	F
GE Advance Frame.acq_delay	(0009,106B)	3	SL	1	L
GE Advance Frame.acq_start	(0009,106C)	3	DT	1	D
GE Advance Frame.acq_duration	(0009,106D)	3	SL	1	L
GE Advance Frame.acq_bin_dur	(0009,106E)	3	SL	1	L
GE Advance Frame.acq_bin_start	(0009,106F)	3	SL	1	L
GE Advance Frame.actual_stop_cond	(0009,1070)	3	SL	1	L
GE Advance Frame.total_prompts	(0009,1071)	3	FD	1	Dbl
GE Advance Frame.total_delays	(0009,1072)	3	FD	1	Dbl
GE Advance Frame.frame_valid	(0009,1073)	3	SL	1	L
GE Advance Frame.validity_info	(0009,1074)	3	SL	1	L
GE Advance Frame.archived	(0009,1075)	3	SL	1	L
GE Advance Frame.compression	(0009,1076)	3	SL	1	L
GE Advance Frame.uncompressed_size	(0009,1077)	3	SL	1	L
GE Advance Frame.accum_bin_dur	(0009,1078)	3	SL	1	L

4.6.6 GE Advance ImageSet Module

TABLE 4.6-6
GE ADVANCE IMAGESET MODULE PRIVATE ELEMENTS
PRIVATE CREATOR IDENTIFICATION (GEMS_ PETD_01)

Attribute Name	Tag	Type	VR	VM	Advance Type
GE Advance ImageSet.compatible_version	(0009,1079)	3	SH	1	5A
GE Advance ImageSet.software_version	(0009,107A)	3	SH	1	5A
GE Advance ImageSet.is_datetime	(0009,107B)	3	DT	1	D
GE Advance ImageSet.is_source	(0009,107C)	3	SL	1	L
GE Advance ImageSet.is_contents	(0009,107D)	3	SL	1	L
GE Advance ImageSet.is_type	(0009,107E)	3	SL	1	L
GE Advance ImageSet.is_reference	(0009,107F)	3	FL	3	F
GE Advance ImageSet.multi_patient	(0009,1080)	3	SL	1	L
GE Advance ImageSet.number_of_normals	(0009,1081)	3	SL	1	L
GE Advance ImageSet.color_map_id	(0009,1082)	3	UI	1	64A
GE Advance ImageSet.window_level_type	(0009,1083)	3	SL	1	L
GE Advance ImageSet.rotate	(0009,1084)	3	FL	1	F
GE Advance ImageSet.flip	(0009,1085)	3	SL	1	L
GE Advance ImageSet.zoom	(0009,1086)	3	FL	1	F
GE Advance ImageSet.pan_x	(0009,1087)	3	SL	1	L
GE Advance ImageSet.pan_y	(0009,1088)	3	SL	1	L
GE Advance ImageSet.window_level_min	(0009,1089)	3	FL	1	F
GE Advance ImageSet.window_level_max	(0009,108A)	3	FL	1	F
GE Advance ImageSet.recon_method	(0009,108B)	3	SL	1	L
GE Advance ImageSet.attenuation	(0009,108C)	3	SL	1	L
GE Advance ImageSet.atten_coefficient	(0009,108D)	3	FL	1	F
GE Advance ImageSet.bp_filter	(0009,108E)	3	SL	1	L
GE Advance ImageSet.bp_filter_cutoff	(0009,108F)	3	FL	1	F
GE Advance ImageSet.bp_filter_order	(0009,1090)	3	SL	1	L
GE Advance ImageSet.bp_center_l	(0009,1091)	3	FL	1	F
GE Advance ImageSet.bp_center_p	(0009,1092)	3	FL	1	F
GE Advance ImageSet.atten_smooth	(0009,1093)	3	SL	1	L
GE Advance ImageSet.atten_smooth_param	(0009,1094)	3	SL	1	L
GE Advance ImageSet.angle_smooth_param	(0009,1095)	3	SL	1	L
GE Advance ImageSet.wellcountercal_id	(0009,1096)	3	UI	1	64A
GE Advance ImageSet.trans_scan_id	(0009,1097)	3	UI	1	64A
GE Advance ImageSet.norm_cal_id	(0009,1098)	3	UI	1	64A
GE Advance ImageSet.blnk_cal_id	(0009,1099)	3	UI	1	64A
GE Advance ImageSet.cac_edge_threshold	(0009,109A)	3	FL	1	F
GE Advance ImageSet.cac_skull_offset	(0009,109B)	3	FL	1	F
GE Advance ImageSet.emiss_sub_id	(0009,109C)	3	UI	1	64A
GE Advance ImageSet.radial_filter_3d	(0009,109D)	3	SL	1	L
GE Advance ImageSet.radial_cutoff_3d	(0009,109E)	3	FL	1	F

Attribute Name	Tag	Type	VR	VM	Advance Type
GE Advance ImageSet.axial_filter_3d	(0009,109F)	3	SL	1	L
GE Advance ImageSet.axial_cutoff_3d	(0009,10A0)	3	FL	1	F
GE Advance ImageSet.axial_start	(0009,10A1)	3	FL	1	F
GE Advance ImageSet.axial_spacing	(0009,10A2)	3	FL	1	F
GE Advance ImageSet.axial_angles_used	(0009,10A3)	3	SL	1	L
GE Advance ImageSet.ir_num_iterations	(0009,10B2)	3	SL	1	F
GE Advance ImageSet.ir_num_subsets	(0009,10B3)	3	SL	1	L
GE Advance ImageSet.ir_recon_fov	(0009,10B4)	3	FL	1	F
GE Advance ImageSet.ir_corr_model	(0009,10B5)	3	SL	1	L
GE Advance ImageSet.ir_loop_filter	(0009,10B6)	3	SL	1	L
GE Advance ImageSet.ir_pre_filt_parm	(0009,10B7)	3	FL	1	F
GE Advance ImageSet.ir_loop_filt_parm	(0009,10B8)	3	SL	1	L
GE Advance ImageSet.response_filt_parm	(0009,10B9)	3	FL	1	F
GE Advance ImageSet.post_filter	(0009,10BA)	3	SL	1	L
GE Advance ImageSet.post_filt_parm	(0009,10BB)	3	FL	1	F
GE Advance ImageSet.ir_regularize	(0009,10BC)	3	SL	1	L
GE Advance ImageSet.regularize_parm	(0009,10BD)	3	FL	1	F
GE Advance ImageSet.ac_bp_filter	(0009,10BE)	3	SL	1	L
GE Advance ImageSet.ac_bp_filt_cut_off	(0009,10BF)	3	FL	1	F
GE Advance ImageSet.ac_bp_filt_order	(0009,10C0)	3	SL	1	L
GE Advance ImageSet.ac_img_smooth	(0009,10C1)	3	SL	1	L
GE Advance ImageSet.ac_img_smooth_parm	(0009,10C2)	3	FL	1	F
GE Advance ImageSet.scatter_method	(0009,10C3)	3	SL	1	L
GE Advance ImageSet.scatter_num_iter	(0009,10C4)	3	SL	1	L
GE Advance ImageSet.scatter_parm	(0009,10C5)	3	FL	1	F

4.6.7 GE Advance Curve Module

TABLE 4.6-7
GE ADVANCE CURVE MODULE PRIVATE ELEMENTS
PRIVATE CREATOR IDENTIFICATION (GEMS_ PETD_01)

Attribute Name	Tag	Type	VR	VM	Advance Type
Private Creator Data Element	(5001,0010)	1	SH	1	n/a
GE Advance Curve.curve_id	(5001,1001)	3	UI	1	64A
GE Advance Curve.compatible_version	(5001,1002)	3	SH	1	5A
GE Advance Curve.software_version	(5001,1003)	3	SH	1	5A
GE Advance Curve.statistics_type	(5001,1004)	3	SL	1	L
GE Advance Curve.how_derived	(5001,1005)	3	LT	1	Bt
GE Advance Curve.how_derived_size	(5001,1006)	3	SL	1	L
GE Advance Curve.multi_patient	(5001,1007)	3	SL	1	L
GE Advance Curve.deadtime	(5001,1008)	3	SL	1	L

4.6.8 GE Advance Graph Module

TABLE 4.6-8
GE ADVANCE GRAPH MODULE PRIVATE ELEMENTS
PRIVATE CREATOR IDENTIFICATION (GEMS_ PETD_01)

Attribute Name	Tag	Type	VR	VM	Advance Type
Private Creator Data Element	(5003,0010)	1	SH	1	n/a
GE Advance Graph Sequence	(5003,1001)	3	SQ	1	n/a
> GE Advance Graph.graph_id	(5003,1002)	3	UI	1	64A
> GE Advance Graph.compatible_version	(5003,1003)	3	SH	1	5A
> GE Advance Graph.software_version	(5003,1004)	3	SH	1	5A
> GE Advance Graph.title	(5003,1005)	3	LO	1	32A
> GE Advance Graph.graph_datetime	(5003,1006)	3	DT	1	D
> GE Advance Graph.graph_description	(5003,1007)	3	ST	1	128A
> GE Advance Graph.title_font_name	(5003,1008)	3	LO	1	32A
> GE Advance Graph.title_font_size	(5003,1009)	3	SH	1	2A
> GE Advance Graph.footer	(5003,100A)	3	LO	1	64A
> GE Advance Graph.footer_font_size	(5003,100B)	3	SH	1	2A
> GE Advance Graph.foreground_color	(5003,100C)	3	LO	1	20A
> GE Advance Graph.background_color	(5003,100D)	3	LO	1	20A
> GE Advance Graph.graph_border	(5003,100E)	3	SL	1	L
> GE Advance Graph.graph_width	(5003,100F)	3	SL	1	L
> GE Advance Graph.graph_height	(5003,1010)	3	SL	1	L
> GE Advance Graph.grid	(5003,1011)	3	SL	1	L
> GE Advance Graph.label_font_name	(5003,1012)	3	LO	1	32A
> GE Advance Graph.label_font_size	(5003,1013)	3	SH	1	2A
> GE Advance Graph.axes_color	(5003,1014)	3	LO	1	20A
> GE Advance Graph.x_axis_label	(5003,1015)	3	LO	1	32A
> GE Advance Graph.x_axis_units	(5003,1016)	3	SL	1	L
> GE Advance Graph.x_major_tics	(5003,1017)	3	FL	1	F
> GE Advance Graph.x_axis_min	(5003,1018)	3	FL	1	F
> GE Advance Graph.x_axis_max	(5003,1019)	3	FL	1	F
> GE Advance Graph.y_axis_label	(5003,101A)	3	LO	1	32A
> GE Advance Graph.y_axis_units	(5003,101B)	3	SL	1	L
> GE Advance Graph.y_major_tics	(5003,101C)	3	FL	1	F
> GE Advance Graph.y_axis_min	(5003,101D)	3	FL	1	F
> GE Advance Graph.y_axis_max	(5003,101E)	3	FL	1	F
> GE Advance Graph.legend_font_name	(5003,101F)	3	LO	1	32A
> GE Advance Graph.legend_font_size	(5003,1020)	3	SH	1	2A
> GE Advance Graph.legend_location_x	(5003,1021)	3	SL	1	L
> GE Advance Graph.legend_location_y	(5003,1022)	3	SL	1	L
> GE Advance Graph.legend_width	(5003,1023)	3	SL	1	L
> GE Advance Graph.legend_height	(5003,1024)	3	SL	1	L
> GE Advance Graph.legend_border	(5003,1025)	3	SL	1	L
> GE Advance Graph.multi_patient	(5003,1026)	3	SL	1	L

4.6.9 GE Advance Curve Presentation Module

TABLE 4.6-9
GE ADVANCE CURVE PRESENTATION MODULE PRIVATE ELEMENTS
PRIVATE CREATOR IDENTIFICATION (GEMS_ PETD_01)

Attribute Name	Tag	Type	VR	VM	Advance Type
Private Creator Data Element	(5005,0010)	1	SH	1	n/a
GE Advance CurvePresentation Sequence	(5005,1001)	3	SQ	1	n/a
> GE Advance CurvePresentation.curvepresent_id	(5005,1002)	3	UI	1	64A
> GE Advance CurvePresentation.graph_id	(5005,1003)	3	UI	1	64A
> GE Advance CurvePresentation.curve_id	(5005,1004)	3	UI	1	64A
> GE Advance CurvePresentation.compatible_version	(5005,1005)	3	SH	1	5A
> GE Advance CurvePresentation.software_version	(5005,1006)	3	SH	1	5A
> GE Advance CurvePresentation.curve_label	(5005,1007)	3	LO	1	60A
> GE Advance CurvePresentation.color	(5005,1008)	3	LO	1	20A
> GE Advance CurvePresentation.line_type	(5005,1009)	3	SL	1	L
> GE Advance CurvePresentation.line_width	(5005,100A)	3	SL	1	L
> GE Advance CurvePresentation.point_symbol	(5005,100B)	3	SL	1	L
> GE Advance CurvePresentation.point_symbol_dim	(5005,100C)	3	SL	1	L
> GE Advance CurvePresentation.point_color	(5005,100D)	3	LO	1	20A

5. PATIENT ROOT QUERY/RETRIEVE INFORMATION MODEL DEFINITION

5.1 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:

5.2 - Patient Root Information Model Description

5.3 - Patient Root Information Model Entity-Relationship Model

5.4 - Patient Root Information Model Keys

5.2 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 PET Advance™ supports the Patient Root Model as the DICOM Query SCP only.

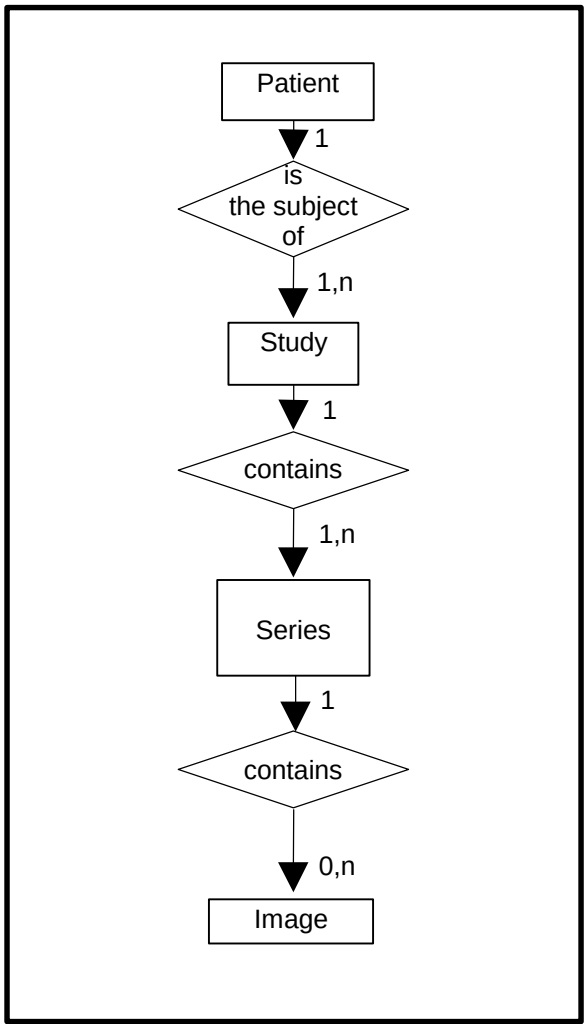
5.3 PATIENT ROOT INFORMATION MODEL ENTITY-RELATIONSHIP MODEL

The Entity-Relationship diagram for the Patient Root Information Model schema is shown in Illustration 5.3-1**.** 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 5.3-1
PATIENT ROOT QUERY/RETRIEVE INFORMATION MODEL E/R DIAGRAM



5.3.1 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.

5.3.1.1 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.

5.3.1.2 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.

5.3.1.3 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.

5.3.1.4 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).

5.3.2 PET Advance™ Mapping of DICOM entities

TABLE 5.3-1
MAPPING OF DICOM ENTITIES TO ADVANCE ENTITIES

DICOM	*Advance* Entity
Patient	Patient
Study	Exam
Series	ImageSet, Scan
Image	Image, Frame

5.4 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 v3.0 Standard PS 3.4 (Service Class Specifications).

5.4.1 Supported Matching

The PET Advance™ 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

5.4.2 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 5.4-1
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 5.4-2
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)

5.4.3 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 5.4-3
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

Attribute Name	Tag	Type	Attribute Description
Number of Study Related Series	(0020,1206)	O	Returned

TABLE 5.4-4
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)

5.4.4 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 5.4-5
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 5.4-6
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)

5.4.5 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 5.4-7
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 5.4-8
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)

5.4.6 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 5.44-9
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

6. STUDY ROOT QUERY/RETRIEVE INFORMATION MODEL DEFINITION

6.1 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:

6.2 - Study Root Information Model Description

6.3 - Study Root Information Model Entity-Relationship Model

6.4 - Study Root Information Model Keys

6.2 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

6.3 STUDY ROOT INFORMATION MODEL ENTITY-RELATIONSHIP MODEL

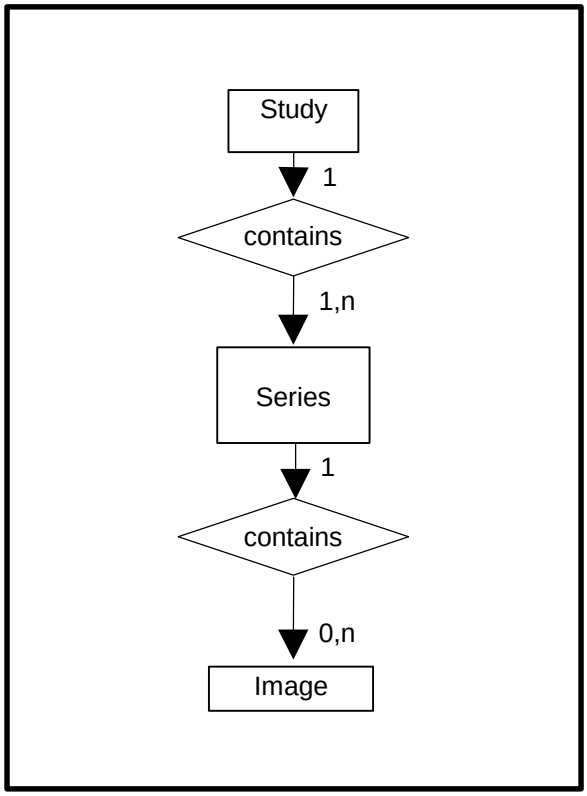
The Entity-Relationship diagram for the Study Root Information Model schema is shown in Illustration 6.3-1**.** In this figure, the following diagrammatic convention is established to represent the information organization :

- 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 6.3-1
STUDY ROOT QUERY/RETRIEVE INFORMATION MODEL E/R DIAGRAM



6.3.1 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.

6.3.1.1 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.

6.3.1.2 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.

6.3.1.3 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).

6.3.2 PET Advance™ Mapping of DICOM entities

TABLE 6.3-1
MAPPING OF DICOM ENTITIES TO ADVANCE ENTITIES

DICOM	*Advance* Entity
Study	Exam
Series	Imageset, Scan
Image	Image, Frame

6.4 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 v3.0 Standard PS 3.4 (Service Class Specifications).

6.4.1 Supported Matching

The PET Advance™ Query SCU request the following type(s) of matching:

- Wild Card Matching
- Single Value matching
- Range of date

The PET Advance™ 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

6.4.2 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 6.4-2
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 6.4-3
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)

6.4.3 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 6.4-4
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 6.4-5
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)

6.4.4 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 6.4-6
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 6.4-7
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)

6.4.5 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 6.44-8
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

7. STANDALONE CURVE INFORMATION OBJECT IMPLEMENTATION

7.1 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:

7.2- Standalone Curve IOD Description

7.3- Standalone Curve IOD Entity-Relationship Model

7.4- Standalone Curve IOD Module Table

7.5- IOD Module Definition

7.2 STANDALONE CURVE IOD IMPLEMENTATION

The PET Advance™ implementation of DICOM uses the Standalone Curve format when creating curve objects. The PET Advance™ 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 PET Advance™ 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 PET Advance™ private data dictionary is included in Section 7.6. Nevertheless, the PET Advance™ is able to process DICOM curves without any private data elements.

7.3 STANDALONE CURVE ENTITY-RELATIONSHIP MODEL

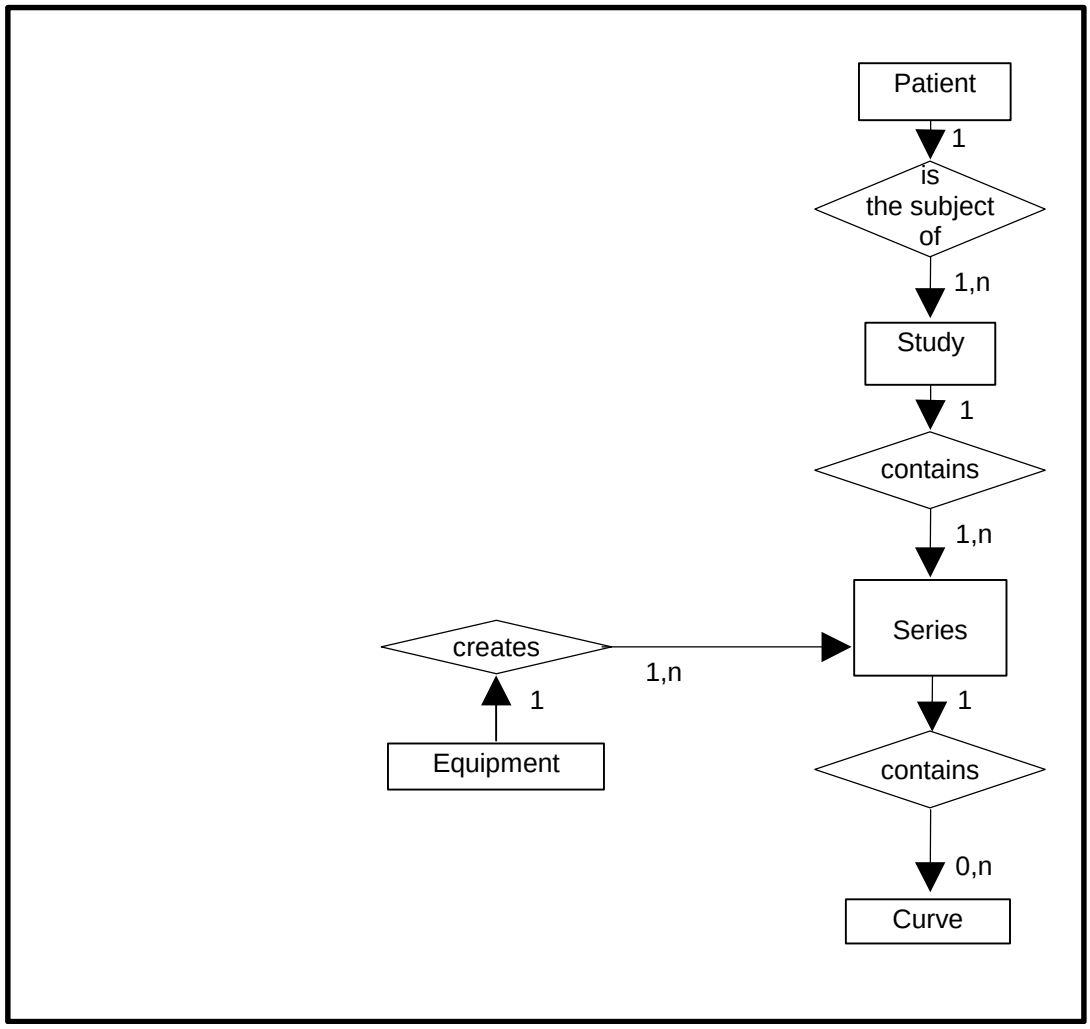
The Entity-Relationship diagram for the Curve interoperability schema is shown in **Illustration 7.3-1 .** In this figure, the following diagrammatic convention is established to represent the information organization :

- 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



7.3.1 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.

7.3.1.1 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.

7.3.1.2 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.

7.3.1.3 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.

7.3.1.4 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.

7.3.1.5 Curve Entity Description

The Curve Entity defines the attributes which describe the curve data of a curve.

7.3.2 PET Advance™ Mapping of DICOM entities

TABLE 7.3-1
MAPPING OF DICOM ENTITIES TO ADVANCE ENTITIES

DICOM	*Advance* Entity
Patient	Patient
Study	Exam
Series	Imageset
Curve	Curve, Graph, Curve Presentation

7.4 STANDALONE CURVE IOD MODULE TABLE

Within an entity of the DICOM v3.0 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 7.4-1 identifies the defined modules within the entities which comprise the DICOM v3.0 Standalone Curve IOD. Modules are identified by Module Name.

See DICOM v3.0 Part 3 for a complete definition of the entities, modules, and attributes.

TABLE 7.4-1
CURVE IOD MODULES

Entity Name	Module Name	Reference
Patient	Patient	7.5.1.1
	GE Advance Patient	7.5.1.2
Study	General Study	7.5.2.1
	Patient Study	7.5.2.2
	GE Advance Exam	7.5.2.3
Series	General Series	7.5.3.1
	GE Advance Imageset	7.5.3.2
	GE Advance Scan	7.5.3.3
Equipment	General Equipment	7.5.4.1
Curve	Curve Identification	7.5.5.1
	Curve	7.5.5.2
	GE Advance Curve	7.5.5.3
	GE Advance Graph	7.5.5.4
	GE Advance Curve Presentation	7.5.5.5
General Modules	SOP Common	7.5.6.1

7.5 STANDALONE CURVE INFORMATION MODULE DEFINITIONS

Please refer to DICOM v3.0 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 v3.0 Standard Part 3 (Information Object Definitions).

7.5.1 Common Patient Entity Modules

7.5.1.1 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 7.5-1
PATIENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	VR	VM	Advance Attribute (Advance 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	

7.5.1.2 GE Advance Patient

Refer to Section 7.6.2 for details.

7.5.2 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.

7.5.2.1 General Study Module

This section specifies the Attributes which describe and identify the Study performed upon the Patient.

TABLE 7.5-2
GENERAL STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	VR	VM	Advance Attribute (GE Advance	Notes

					Exam table unless otherwise specified)	
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	

7.5.2.2 Patient Study Module

This section defines Attributes that provide information about the Patient at the time the Study was performed.

TABLE 7.5-3
PATIENT STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	VR	VM	Advance Attribute (GE Advance 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	

7.5.2.3 GE Advance Exam Module

Refer to Section 7.6.3 for details.

7.5.3 Common Series Entity Modules

The following Series IE Modules are common to all Composite Image IODs which reference the Series IE.

7.5.3.1 General Series Module

This section specifies the Attributes which identify and describe general information about the Series within a Study.

TABLE 7.5-4
GENERAL SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Type	VR	VM	Advance Attribute (GE Advance ImageSet table unless otherwise specified)	Notes
Modality	(0008,0060)	1	CS	1	Exam.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	

7.5.3.2 GE Advance ImageSet Module

Refer to Section 7.6.5 for details.

7.5.3.3 GE Advance Scan Module

Refer to Section 7.6.4 for details.

7.5.4 Common Equipment Entity Modules

The following Equipment IE Module is common to all Composite Image IODs which reference the Equipment IE.

7.5.4.1 General Equipment Module

This section specifies the Attributes which identify and describe the piece of equipment which produced a Series of Images.

TABLE 7.5-5
GENERAL EQUIPMENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	VR	VM	Advance Attribute (GE Advance 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	

7.5.5 Common Curve Entity Modules

The following Image IE Modules are common to all Composite Image IODs which reference the Image IE.

7.5.5.1 Curve Identification Module

This section specifies the Attributes which identify and describe an curve within a particular series.

TABLE 7.5-6
CURVE IDENTIFICATION MODULE ATTRIBUTES

Attribute Name	Tag	Type	VR	VM	Advance Attribute (GE Advance 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		

7.5.5.2 Curve Module

This section specifies the Attributes which identify and describe an curve within a particular series.

TABLE 7.5-7
CURVE MODULE ATTRIBUTES

Attribute Name	Tag	Type	VR	VM	Advance Attribute (GE Advance 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 SYSRATE = system count rate	Refer Note

					SLICERATE = slice count rate BLDSMPL = blood samples	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
```

7.5.5.3 GE Advance Curve

Refer to Section 7.6.6 for details.

7.5.5.4 GE Advance Graph

Refer to Section 7.6.7 for details.

7.5.5.5 GE Advance Curve Presentation

Refer to Section 7.6.8 for details.

7.5.6 General Modules

The SOP Common Module is mandatory for all DICOM IODs.

7.5.6.1 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 7.5-8
SOP COMMON MODULE ATTRIBUTES

Attribute Name	Tag	Type	VR	VM	Advance Attribute (GE Advance 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	= 1.2.840.113619.1.99.<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
```

7.6 PRIVATE DATA DICTIONARY

7.6.1 Private Creator Identification Information

TABLE 7.6-1
PRIVATE CREATOR IDENTIFICATION (GEMS_PETD_01)

Attribute Name	Tag	Type	VR	VM	Advance Type
Private Creator Data Element	(0009,0010)	1	SH	1	n/a
GE Advance Implementation Version Name Value 1: "GE Advance" Value 2: IDB_SOFTWARE_VERSION	(0009,1001)	3	LO	2	n/a

7.6.2 GE Advance Patient Module

TABLE 7.6-2
GE ADVANCE PATIENT MODULE PRIVATE ELEMENTS
PRIVATE CREATOR IDENTIFICATION (GEMS_ PETD_01)

Attribute Name	Tag	Type	VR	VM	Advance Type
GE Advance Patient.patient_id	(0009,1002)	3	LO	1	20A
GE Advance Patient.compatible_version	(0009,1003)	3	SH	1	5A
GE Advance Patient.software_version	(0009,1004)	3	SH	1	5A
GE Advance Patient.patient_datetime	(0009,1005)	3	DT	1	D
GE Advance Patient.type	(0009,1006)	3	SL	1	L

7.6.3 GE Advance Exam Module

TABLE 7.6-3
GE ADVANCE EXAM MODULE PRIVATE ELEMENTS
PRIVATE CREATOR IDENTIFICATION (GEMS_ PETD_01)

Attribute Name	Tag	Type	VR	VM	Advance Type
GE Advance Exam.exam_id	(0009,1007)	3	UI	1	64A
GE Advance Exam.compatible_version	(0009,1008)	3	SH	1	5A
GE Advance Exam.software_version	(0009,1009)	3	SH	1	5A

7.6.4 GE Advance Scan Module

TABLE 7.6-4
GE ADVANCE SCAN MODULE PRIVATE ELEMENTS
PRIVATE CREATOR IDENTIFICATION (GEMS_ PETD_01)

Attribute Name	Tag	Type	VR	VM	Advance Type
GE Advance Scan.scan_id	(0009,100A)	3	UI	1	64A
GE Advance Scan.compatible_version	(0009,100B)	3	SH	1	5A
GE Advance Scan.software_version	(0009,100C)	3	SH	1	5A
GE Advance Scan.scan_datetime	(0009,100D)	3	DT	1	D

Attribute Name	Tag	Type	VR	VM	Advance Type
GE Advance Scan.scan_ready	(0009,100E)	3	DT	1	D
GE Advance Scan.scan_description	(0009,100F)	3	UI	1	64A
GE Advance Scan.hospital_name	(0009,1010)	3	LO	1	32A
GE Advance Scan.scanner_desc	(0009,1011)	3	LO	1	32A
GE Advance Scan.manufacturer	(0009,1012)	3	LO	1	64A
GE Advance Scan.for_identifier	(0009,1013)	3	UI	1	64A
GE Advance Scan.landmark_name	(0009,1014)	3	LO	1	64A
GE Advance Scan.landmark_abbrev	(0009,1015)	3	SH	1	2A
GE Advance Scan.patient_position	(0009,1016)	3	SL	1	L
GE Advance Scan.scan_perspective	(0009,1017)	3	SL	1	L
GE Advance Scan.scan_type	(0009,1018)	3	SL	1	L
GE Advance Scan.scan_mode	(0009,1019)	3	SL	1	L
GE Advance Scan.start_condition	(0009,101A)	3	SL	1	L
GE Advance Scan.start_cond_data	(0009,101B)	3	SL	1	L
GE Advance Scan.sel_stop_cond	(0009,101C)	3	SL	1	L
GE Advance Scan.sel_stop_cond_data	(0009,101D)	3	SL	1	L
GE Advance Scan.collect_deadtime	(0009,101E)	3	SL	1	L
GE Advance Scan.collect_singles	(0009,101F)	3	SL	1	L
GE Advance Scan.collect_countrate	(0009,1020)	3	SL	1	L
GE Advance Scan.countrate_period	(0009,1021)	3	SL	1	L
GE Advance Scan.delayed_events	(0009,1022)	3	SL	1	L
GE Advance Scan.delayed_bias	(0009,1023)	3	SL	1	L
GE Advance Scan.word_size	(0009,1024)	3	SL	1	L
GE Advance Scan.axial_acceptance	(0009,1025)	3	SL	1	L
GE Advance Scan.axial_angle_3d	(0009,1026)	3	SL	1	L
GE Advance Scan.theta_compression	(0009,1027)	3	SL	1	L
GE Advance Scan.axial_compression	(0009,1028)	3	SL	1	L
GE Advance Scan.gantry_tilt_angle	(0009,1029)	3	FL	1	F
GE Advance Scan.collimation	(0009,102A)	3	SL	1	L
GE Advance Scan.scan_fov	(0009,102B)	3	SL	1	L
GE Advance Scan.axial_fov	(0009,102C)	3	SL	1	L
GE Advance Scan.event_separation	(0009,102D)	3	SL	1	L
GE Advance Scan.mask_width	(0009,102E)	3	SL	1	L
GE Advance Scan.binning_mode	(0009,102F)	3	SL	1	L
GE Advance Scan.trig_rej_method	(0009,1030)	3	SL	1	L
GE Advance Scan.number_for_reject	(0009,1031)	3	SL	1	L
GE Advance Scan.lower_reject_limit	(0009,1032)	3	SL	1	L
GE Advance Scan.upper_reject_limit	(0009,1033)	3	SL	1	L
GE Advance Scan.triggers_acquired	(0009,1034)	3	SL	1	L
GE Advance Scan.triggers_rejected	(0009,1035)	3	SL	1	L
GE Advance Scan.tracer_name	(0009,1036)	3	LO	1	40A
GE Advance Scan.batch_description	(0009,1037)	3	LO	1	40A

Attribute Name	Tag	Type	VR	VM	Advance Type
GE Advance Scan.tracer_activity	(0009,1038)	3	FL	1	F
GE Advance Scan.meas_datetime	(0009,1039)	3	DT	1	D
GE Advance Scan.pre_inj_volume	(0009,103A)	3	FL	1	F
GE Advance Scan.admin_datetime	(0009,103B)	3	DT	1	D
GE Advance Scan.post_inj_activity	(0009,103C)	3	FL	1	F
GE Advance Scan.post_inj_datetime	(0009,103D)	3	DT	1	D
GE Advance Scan.radionuclide_name	(0009,103E)	3	SH	1	6A
GE Advance Scan.half_life	(0009,103F)	3	FL	1	F
GE Advance Scan.positron_fraction	(0009,1040)	3	FL	1	F
GE Advance Scan.source1_holder	(0009,1041)	3	SL	1	L
GE Advance Scan.source1_activity	(0009,1042)	3	FL	1	F
GE Advance Scan.source1_meas_dt	(0009,1043)	3	DT	1	D
GE Advance Scan.source1_radnuclide	(0009,1044)	3	SH	1	6A
GE Advance Scan.source1_half_life	(0009,1045)	3	FL	1	F
GE Advance Scan.source2_holder	(0009,1046)	3	SL	1	L
GE Advance Scan.source2_activity	(0009,1047)	3	FL	1	F
GE Advance Scan.source2_meas_dt	(0009,1048)	3	DT	1	D
GE Advance Scan.source2_radnuclide	(0009,1049)	3	SH	1	6A
GE Advance Scan.source2_half_life	(0009,104A)	3	FL	1	F
GE Advance Scan.source_speed	(0009,104B)	3	SL	1	L
GE Advance Scan.source_location	(0009,104C)	3	FL	1	F
GE Advance Scan.emission_present	(0009,104D)	3	SL	1	L
GE Advance Scan.lower_axial_acc	(0009,104E)	3	SL	1	L
GE Advance Scan.upper_axial_acc	(0009,104F)	3	SL	1	L
GE Advance Scan.lower_coinc_limit	(0009,1050)	3	SL	1	L
GE Advance Scan.upper_coinc_limit	(0009,1051)	3	SL	1	L
GE Advance Scan.coinc_delay_offset	(0009,1052)	3	SL	1	L
GE Advance Scan.coinc_output_mode	(0009,1053)	3	SL	1	L
GE Advance Scan.upper_energy_limit	(0009,1054)	3	SL	1	L
GE Advance Scan.lower_energy_limit	(0009,1055)	3	SL	1	L
GE Advance Scan.normal_cal_id	(0009,1056)	3	UI	1	64A
GE Advance Scan.normal_2d_cal_id	(0009,1057)	3	UI	1	64A
GE Advance Scan.blank_cal_id	(0009,1058)	3	UI	1	64A
GE Advance Scan.wc_cal_id	(0009,1059)	3	UI	1	64A
GE Advance Scan.derived	(0009,105A)	3	SL	1	L
GE Advance Scan.contrast_agent	(0009,105B)	3	LO	1	64A

7.6.5 GE Advance ImageSet Module

TABLE 7.6-5
GE ADVANCE IMAGESET MODULE PRIVATE ELEMENTS
PRIVATE CREATOR IDENTIFICATION (GEMS_ PETD_01)

Attribute Name	Tag	Type	VR	VM	Advance Type
GE Advance ImageSet.compatible_version	(0009,1079)	3	SH	1	5A
GE Advance ImageSet.software_version	(0009,107A)	3	SH	1	5A
GE Advance ImageSet.is_datetime	(0009,107B)	3	DT	1	D
GE Advance ImageSet.is_source	(0009,107C)	3	SL	1	L
GE Advance ImageSet.is_contents	(0009,107D)	3	SL	1	L
GE Advance ImageSet.is_type	(0009,107E)	3	SL	1	L
GE Advance ImageSet.is_reference	(0009,107F)	3	FL	3	F
GE Advance ImageSet.multi_patient	(0009,1080)	3	SL	1	L
GE Advance ImageSet.number_of_normals	(0009,1081)	3	SL	1	L
GE Advance ImageSet.color_map_id	(0009,1082)	3	UI	1	64A
GE Advance ImageSet.window_level_type	(0009,1083)	3	SL	1	L
GE Advance ImageSet.rotate	(0009,1084)	3	FL	1	F
GE Advance ImageSet.flip	(0009,1085)	3	SL	1	L
GE Advance ImageSet.zoom	(0009,1086)	3	FL	1	F
GE Advance ImageSet.pan_x	(0009,1087)	3	SL	1	L
GE Advance ImageSet.pan_y	(0009,1088)	3	SL	1	L
GE Advance ImageSet.window_level_min	(0009,1089)	3	FL	1	F
GE Advance ImageSet.window_level_max	(0009,108A)	3	FL	1	F
GE Advance ImageSet.recon_method	(0009,108B)	3	SL	1	L
GE Advance ImageSet.attenuation	(0009,108C)	3	SL	1	L
GE Advance ImageSet.atten_coefficient	(0009,108D)	3	FL	1	F
GE Advance ImageSet.bp_filter	(0009,108E)	3	SL	1	L
GE Advance ImageSet.bp_filter_cutoff	(0009,108F)	3	FL	1	F
GE Advance ImageSet.bp_filter_order	(0009,1090)	3	SL	1	L
GE Advance ImageSet.bp_center_l	(0009,1091)	3	FL	1	F
GE Advance ImageSet.bp_center_p	(0009,1092)	3	FL	1	F
GE Advance ImageSet.atten_smooth	(0009,1093)	3	SL	1	L
GE Advance ImageSet.atten_smooth_param	(0009,1094)	3	SL	1	L
GE Advance ImageSet.angle_smooth_param	(0009,1095)	3	SL	1	L
GE Advance ImageSet.wellcountercal_id	(0009,1096)	3	UI	1	64A
GE Advance ImageSet.trans_scan_id	(0009,1097)	3	UI	1	64A
GE Advance ImageSet.norm_cal_id	(0009,1098)	3	UI	1	64A
GE Advance ImageSet.blnk_cal_id	(0009,1099)	3	UI	1	64A
GE Advance ImageSet.cac_edge_threshold	(0009,109A)	3	FL	1	F
GE Advance ImageSet.cac_skull_offset	(0009,109B)	3	FL	1	F

Attribute Name	Tag	Type	VR	VM	Advance Type
GE Advance ImageSet.emiss_sub_id	(0009,109C)	3	UI	1	64A
GE Advance ImageSet.radial_filter_3d	(0009,109D)	3	SL	1	L
GE Advance ImageSet.radial_cutoff_3d	(0009,109E)	3	FL	1	F
GE Advance ImageSet.axial_filter_3d	(0009,109F)	3	SL	1	L
GE Advance ImageSet.axial_cutoff_3d	(0009,10A0)	3	FL	1	F
GE Advance ImageSet.axial_start	(0009,10A1)	3	FL	1	F
GE Advance ImageSet.axial_spacing	(0009,10A2)	3	FL	1	F
GE Advance ImageSet.axial_angles_used	(0009,10A3)	3	SL	1	L
GE Advance ImageSet.ir_num_iterations	(0009,10B2)	3	SL	1	F
GE Advance ImageSet.ir_num_subsets	09,10B4)	3	FL	1	F
GE Advance ImageSet.ir_corr_model	(0009,10B5)	3	SL	1	L
GE Advance ImageSet.ir_loop_filter	(0009,10B6)	3	SL	1	L
GE Advance ImageSet.ir_pre_filt_parm	(0009,10B7)	3	FL	1	F
GE Advance ImageSet.ir_loop_filt_parm	(0009,10B8)	3	SL	1	L
GE Advance ImageSet.response_filt_parm	(0009,10B9)	3	FL	1	F
GE Advance ImageSet.post_filter	(0009,10BA)	3	SL	1	L
GE Advance ImageSet.post_filt_parm	(0009,10BB)	3	FL	1	F
GE Advance ImageSet.ir_regularize	(0009,10BC)	3	SL	1	L
GE Advance ImageSet.regularize_parm	(0009,10BD)	3	FL	1	F
GE Advance ImageSet.ac_bp_filter	(0009,10BE)	3	SL	1	L
GE Advance ImageSet.ac_bp_filt_cut_off	(0009,10BF)	3	FL	1	F
GE Advance ImageSet.ac_bp_filt_order	(0009,10C0)	3	SL	1	L
GE Advance ImageSet.ac_img_smooth	(0009,10C1)	3	SL	1	L
GE Advance ImageSet.ac_img_smooth_parm	(0009,10C2)	3	FL	1	F
GE Advance ImageSet.scatter_method	(0009,10C3)	3	SL	1	L
GE Advance ImageSet.scatter_num_iter	(0009,10C4)	3	SL	1	L
GE Advance ImageSet.scatter_parm	(0009,10C5)	3	FL	1	F

7.6.6 GE Advance Curve Module

TABLE 7.6-6
GE ADVANCE CURVE MODULE PRIVATE ELEMENTS
PRIVATE CREATOR IDENTIFICATION (GEMS_ PETD_01)

Attribute Name	Tag	Type	VR	VM	Advance Type
Private Creator Data Element	(5001,0010)	1	SH	1	n/a
GE Advance Curve.curve_id	(5001,1001)	3	UI	1	64A
GE Advance Curve.compatible_version	(5001,1002)	3	SH	1	5A
GE Advance Curve.software_version	(5001,1003)	3	SH	1	5A
GE Advance Curve.statistics_type	(5001,1004)	3	SL	1	L
GE Advance Curve.how_derived	(5001,1005)	3	LT	1	Bt
GE Advance Curve.how_derived_size	(5001,1006)	3	SL	1	L
GE Advance Curve.multi_patient	(5001,1007)	3	SL	1	L

Attribute Name	Tag	Type	VR	VM	Advance Type
GE Advance Curve.deadtime	(5001,1008)	3	SL	1	L

7.6.7 GE Advance Graph Module

TABLE 7.6-7
GE ADVANCE GRAPH MODULE PRIVATE ELEMENTS
PRIVATE CREATOR IDENTIFICATION (GEMS_ PETD_01)

Attribute Name	Tag	Type	VR	VM	Advance Type
Private Creator Data Element	(5003,0010)	1	SH	1	n/a
GE Advance Graph Sequence	(5003,1001)	3	SQ	1	n/a
> GE Advance Graph.graph_id	(5003,1002)	3	UI	1	64A
> GE Advance Graph.compatible_version	(5003,1003)	3	SH	1	5A
> GE Advance Graph.software_version	(5003,1004)	3	SH	1	5A
> GE Advance Graph.title	(5003,1005)	3	LO	1	32A
> GE Advance Graph.graph_datetime	(5003,1006)	3	DT	1	D
> GE Advance Graph.graph_description	(5003,1007)	3	ST	1	128A
> GE Advance Graph.title_font_name	(5003,1008)	3	LO	1	32A
> GE Advance Graph.title_font_size	(5003,1009)	3	SH	1	2A
> GE Advance Graph.footer	(5003,100A)	3	LO	1	64A
> GE Advance Graph.footer_font_size	(5003,100B)	3	SH	1	2A
> GE Advance Graph.foreground_color	(5003,100C)	3	LO	1	20A
> GE Advance Graph.background_color	(5003,100D)	3	LO	1	20A
> GE Advance Graph.graph_border	(5003,100E)	3	SL	1	L
> GE Advance Graph.graph_width	(5003,100F)	3	SL	1	L
> GE Advance Graph.graph_height	(5003,1010)	3	SL	1	L
> GE Advance Graph.grid	(5003,1011)	3	SL	1	L
> GE Advance Graph.label_font_name	(5003,1012)	3	LO	1	32A
> GE Advance Graph.label_font_size	(5003,1013)	3	SH	1	2A
> GE Advance Graph.axes_color	(5003,1014)	3	LO	1	20A
> GE Advance Graph.x_axis_label	(5003,1015)	3	LO	1	32A
> GE Advance Graph.x_axis_units	(5003,1016)	3	SL	1	L
> GE Advance Graph.x_major_tics	(5003,1017)	3	FL	1	F
> GE Advance Graph.x_axis_min	(5003,1018)	3	FL	1	F
> GE Advance Graph.x_axis_max	(5003,1019)	3	FL	1	F
> GE Advance Graph.y_axis_label	(5003,101A)	3	LO	1	32A
> GE Advance Graph.y_axis_units	(5003,101B)	3	SL	1	L
> GE Advance Graph.y_major_tics	(5003,101C)	3	FL	1	F
> GE Advance Graph.y_axis_min	(5003,101D)	3	FL	1	F
> GE Advance Graph.y_axis_max	(5003,101E)	3	FL	1	F
> GE Advance Graph.legend_font_name	(5003,101F)	3	LO	1	32A
> GE Advance Graph.legend_font_size	(5003,1020)	3	SH	1	2A
> GE Advance Graph.legend_location_x	(5003,1021)	3	SL	1	L

Attribute Name	Tag	Type	VR	VM	Advance Type
> GE Advance Graph.legend_location_y	(5003,1022)	3	SL	1	L
> GE Advance Graph.legend_width	(5003,1023)	3	SL	1	L
> GE Advance Graph.legend_height	(5003,1024)	3	SL	1	L
> GE Advance Graph.legend_border	(5003,1025)	3	SL	1	L
> GE Advance Graph.multi_patient	(5003,1026)	3	SL	1	L

7.6.8 GE Advance Curve Presentation Module

TABLE 7.6-8
GE ADVANCE CURVE PRESENTATION MODULE PRIVATE ELEMENTS
PRIVATE CREATOR IDENTIFICATION (GEMS_ PETD_01)

Attribute Name	Tag	Type	VR	VM	Advance Type
Private Creator Data Element	(5005,0010)	1	SH	1	n/a
GE Advance CurvePresentation Sequence	(5005,1001)	3	SQ	1	n/a
> GE Advance CurvePresentation.curvepresent_id	(5005,1002)	3	UI	1	64A
> GE Advance CurvePresentation.graph_id	(5005,1003)	3	UI	1	64A
> GE Advance CurvePresentation.curve_id	(5005,1004)	3	UI	1	64A
> GE Advance CurvePresentation.compatible_version	(5005,1005)	3	SH	1	5A
> GE Advance CurvePresentation.software_version	(5005,1006)	3	SH	1	5A
> GE Advance CurvePresentation.curve_label	(5005,1007)	3	LO	1	60A
> GE Advance CurvePresentation.color	(5005,1008)	3	LO	1	20A
> GE Advance CurvePresentation.line_type	(5005,1009)	3	SL	1	L
> GE Advance CurvePresentation.line_width	(5005,100A)	3	SL	1	L
> GE Advance CurvePresentation.point_symbol	(5005,100B)	3	SL	1	L
> GE Advance CurvePresentation.point_symbol_dim	(5005,100C)	3	SL	1	L
> GE Advance CurvePresentation.point_color	(5005,100D)	3	LO	1	20A

8. SECONDARY CAPTURE INFORMATION OBJECT IMPLEMENTATION

8.1 INTRODUCTION

This section specifies the use of the DICOM Secondary Capture 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:

8.2- Secondary Capture Image IOD Description

8.3- Secondary Capture Image IOD Entity-Relationship Model

8.4- Secondary Capture IOD Module Table

8.5- Secondary Capture Image Information Module Definitions

8.2 SECONDARY CAPTURE IMAGE IOD IMPLEMENTATION

The PET Advance™ implementation of DICOM can use the Secondary Capture image format when creating image objects. In order to preserve full fidelity when transferring data to a PET Advance™ 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.

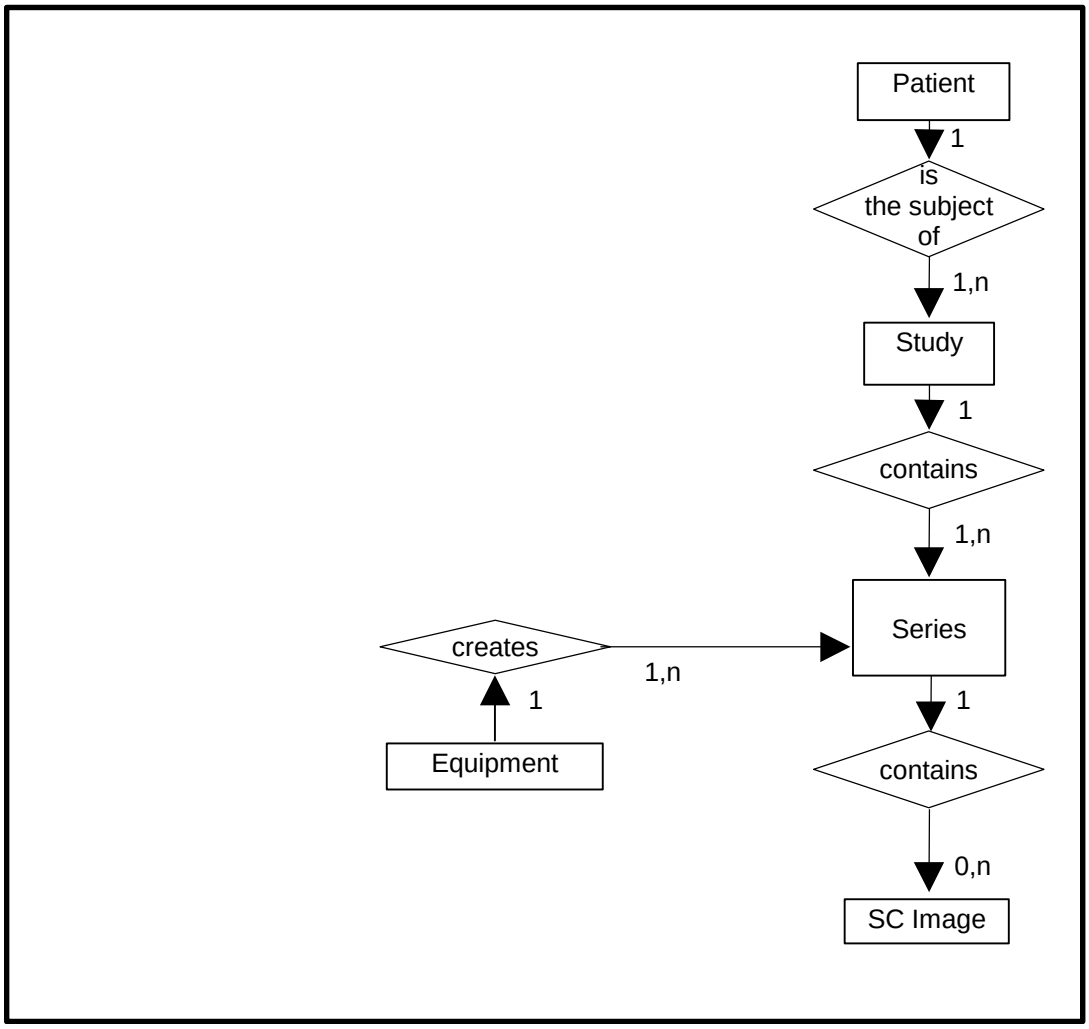
8.3 SECONDARY CAPTURE IMAGE ENTITY-RELATIONSHIP MODEL

The Entity-Relationship diagram for the Secondary Capture Image interoperability schema is shown in Illustration 8.3-1**.** 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 8.3-1
SECONDARY CAPTURE IMAGE ENTITY RELATIONSHIP DIAGRAM



8.3.1 ENTITY DESCRIPTIONS

Please refer to DICOM Standard Part 3 (Information Object Definitions) for a description of each of the entities contained within the Secondary Capture Information Object.

8.3.1.1 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.

8.3.1.2 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.

8.3.1.3 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.

8.3.1.4 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.

8.3.1.5 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.

8.3.1.6 Secondary Capture Image Entity Description

The Secondary Capture Image Entity defines the attributes which describe the pixel data of a Secondary Capture image. The pixel data is derived from an original image through screen capture (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).

8.3.2 PET Advance™ Mapping of DICOM entities

TABLE 8.3-1
MAPPING OF DICOM ENTITIES TO ADVANCE ENTITIES

DICOM	***Advance* Entity**
Patient	Patient
Study	Exam
Series	Imageset
Image	Image

8.4 SECONDARY CAPTURE IMAGE IOD MODULE TABLE

Within an entity of the DICOM v3.0 Secondary Capture 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 8.4-1 identifies the defined modules within the entities that comprise the DICOM v3.0 Secondary Capture IOD. Modules are identified by Module Name.

TABLE 8.4-1
SECONDARY CAPTURE IMAGE IOD MODULES

Entity Name	Module Name	Reference
Patient	Patient	8.5.1.1
	GE Advance Patient	8.5.1.2
Study	General Study	8.5.2.1
	Patient Study	8.5.2.2
Series	General Series	8.5.3.1
Frame of Reference	Frame of Reference	8.5.4.1
Equipment	General Equipment	8.5.5.1
	SC Equipment	8.5.5.2
Image	General Image	8.5.6.1
	Image Pixel	8.5.6.2
	SC Image	8.5.6.3
	Overlay Plane	8.5.6.4
	Modality LUT	8.5.6.5
	VOI LUT	8.5.6.6
General Modules	SOP Common	8.5.7.1

8.5 SECONDARY CAPTURE IMAGE INFORMATION MODULE DEFINITIONS

8.5.1 Common Patient Entity Modules

8.5.1.1 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 needed for diagnostic interpretation of the Image and are common for all studies performed on the patient.

TABLE 8.5-1
PATIENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	VR	VM	Advance Attribute (Advance 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	

8.5.1.2 GE Advance Patient

Refer to Section 3.6.2 for details.

8.5.2 Common Study Entity Module

The following Study IE Modules are common to all Composite Image IODs which reference the Study IE. These Modules contain Attributes of the patient and study needed for diagnostic interpretation of the image.

8.5.2.1 General Study Module

This section specifies the Attributes which describe and identify the Study performed upon the Patient.

TABLE 8.5-2
GENERAL STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	VR	VM	Advance Attribute (GE Advance 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	

8.5.2.2 Patient Study Module

This section defines Attributes that provide information about the Patient at the time the Study was performed.

TABLE 8.5-3
PATIENT STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	VR	VM	Advance Attribute (GE Advance 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	

8.5.3 Common Series Entity Modules

The following Series IE Modules are common to all Composite Image IODs which reference the Series IE.

8.5.3.1 General Series Module

This section specifies the Attributes which identify and describe general information about the Series within a Study.

TABLE 8.5-4
GENERAL SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Type	VR	VM	Advance Attribute (GE Advance ImageSet table unless otherwise specified)	Notes
Modality	(0008,0060)	1	CS	1	Exam.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 SC Series.Series Date (0008,0021)	
Series Time	(0008,0031)	3	TM	1	superceded by SC 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	

Attribute Name	Tag	Type	VR	VM	Advance Attribute (GE Advance ImageSet table unless otherwise specified)	Notes
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	

8.5.4 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.

8.5.4.1 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 8.5-5
FRAME OF REFERENCE MODULE ATTRIBUTES

Attribute Name	Tag	Type	VR	VM	GE Advance 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	

8.5.5 Common Equipment Entity Modules

The following Equipment IE Module is common to all Composite Image IODs which reference the Equipment IE.

8.5.5.1 General Equipment Module

This section specifies the Attributes which identify and describe the piece of equipment which produced a Series of Images.

TABLE 8.5-6
GENERAL EQUIPMENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	VR	VM	Advance Attribute (GE Advance 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	

8.5.5.2 SC Equipment Module

This Module describes equipment used to convert images into a DICOM format.

TABLE 8.5-7
SC IMAGE EQUIPMENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	VR	VM	Attribute Description	Notes
Conversion Type	(0008,0064)	1	CS	1	WSD	
Modality	(0008,0060)	3	CS	1	Exam.modality	
Secondary Capture Device ID	(0018,1010)	3		1	Not Used	
Secondary Capture Device Manufacturer	(0018,1016)	3		1	Not Used	
Secondary Capture Device Manufacturer's Model Name	(0018,1018)	3		1	Not Used	

Secondary Capture Device Software Version	(0018,1019)	3		1	Not Used	
Video Image Format Acquired	(0018,1022)	3		1	Not Used	
Digital Image Format Acquired	(0018,1023)	3		1	Not Used	

8.5.6 Common Image Entity Modules

The following Image IE Modules are common to all Composite Image IODs which reference the Image IE.

8.5.6.1 General Image Module

This section specifies the Attributes which identify and describe an image within a particular series.

TABLE 8.5-8
GENERAL IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	VR	VM	Advance Attribute (GE Advance Image table unless otherwise specified)	Notes
Image Number	(0020,0013)	2	IS	1	IF (is_source = [pet dicom]) THEN = image_number ELSE = slice_number	Refer
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	“Derived\Secondary”	
Acquisition Number	0020,0012)	3	IS	1	Not Used	
Acquisition Date	0008,0022)	3	DA	1	extract date from Scan.scan_datetime	
Acquisition Time	0008,0032)	3	TM	1	extract time from Scan.scan_datetime	
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	Not Used	
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	“00”	

8.5.6.2 Image Pixel Module

This section specifies the Attributes that describe the pixel data of the image.

TABLE 8.5-9
IMAGE PIXEL MODULE ATTRIBUTES

Attribute Name	Tag	Type	VR	VM	Advance Attribute (GE Advance Image table unless otherwise specified)	Notes
Samples per Pixel	(0028,0002)	1	US	1	"1"	
Photometric Interpretation	(0028,0004)	1	CS	1	"MONOCHROME2"	
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	image_depth (always 16)	
Bits Stored	(0028,0101)	1	US	1	image_depth (always 16)	
High Bit	(0028,0102)	1	US	1	15	
Pixel Representation	(0028,0103)	1	US	1	= 0001H (2's complement)	
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	

8.5.6.3 SC Image Module

The table in this Section contains IOD Attributes that describe SC images.

TABLE 8.5-10
SC IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	VR	VM	Advance Attribute (GE Advance Image table unless otherwise specified)	Notes
Date of Secondary Capture	(0018,1012)	3	DA	1	Not Used	
Time of Secondary Capture	(0018,1014)	3	TM	1	Not Used	

8.5.6.4 Overlay plane module

This section contains Attributes that describe characteristics of an Overlay Plane.

Overlay Planes are not currently used in PET Advance™.

TABLE 8.5-11
OVERLAY PLANE MODULE ATTRIBUTES

Attribute Name	Tag	Type	VR	VM	Advance Attribute (GE Advance Image table unless otherwise specified)	Notes

8.5.6.5 Modality LUT module

TABLE 8.5-12
MODALITY LUT MODULE ATTRIBUTES

Attribute Name	Tag	Type	VR	VM	Advance Attribute (GE Advance Image table unless otherwise specified)	Notes
Modality LUT Sequence	(0028,3000)	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	
>Modality LUT Type	(0028,3004)	1C	LO	1	Not Used	
>LUT Data	(0028,3006)	1C	US or SS	1-n	Not Used	
Rescale Intercept	(0028,1052)	1C	DS	1	0	
Rescale Slope	(0028,1053)	1C	DS	1	scale_factor	
Rescale Type	(0028,1054)	1C	LO	1	“none”	

8.5.6.6 VOI LUT module

This section specifies the Attributes that describe the VOI LUT.

The VOI LUT module is not currently used in PET Advance™.

TABLE 8.5-13
VOI LUT MODULE ATTRIBUTES

Attribute Name	Tag	Type	VR	VM	Advance Attribute (GE Advance Image table unless otherwise specified)	Notes

8.5.7 General Modules

The SOP Common Module is mandatory for all DICOM IODs.

8.5.7.1 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 8.5-5
SOP COMMON MODULE ATTRIBUTES

Attribute Name	Tag	Type	VR	VM	Advance Attribute (GE Advance 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	= 1.2.840.113619.1.99.<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;
```

50Translate 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
```

9. MODALITY WORKLIST IMPLEMENTATION

9.1 INTRODUCTION

This section of the DICOM Conformance Statement specifies the 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.

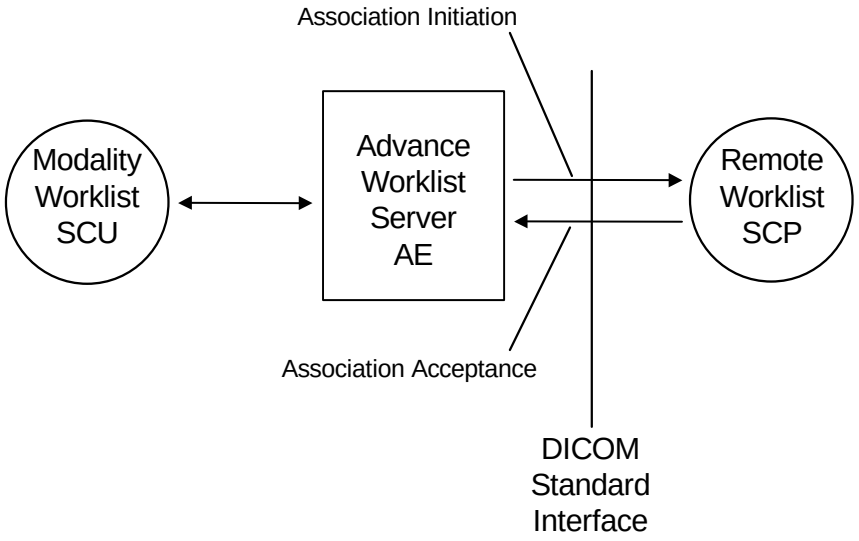
The MWL feature, which is enabled by a software option license key, allows a user to query for and display DICOM modality Worklist information from a remote hospital or radiology department information system computer. For example, a user may wish to query for all procedures scheduled to be performed on the scanner, where MWL provides the DICOM C-FIND service as a service class user (SCU).

9.2 IMPLEMENTATION MODEL

The Worklist Server DICOM AE logically provides all DICOM functionality provided by the MWL feature. The Worklist Server DICOM AE is commanded to perform DICOM modality Worklist query services through the use of the Advance 6.0 user interface.

9.2.1 Application Data Flow Diagram

The Basic and Specific Application models for this device are shown in the following illustration:



9.2.2 Functional Definition of AE's

The MWL Worklist 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 MWL 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.

9.2.3 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 that match the query parameters.

3. Items from the returned Worklist responses are presented to the user.

4. On selecting a record for scan, this is data loaded to the Acquisition.

9.3 AE SPECIFICATIONS

9.3.1 Worklist Server AE Specification

This Application Entity provides Standard Conformance to the following DICOM v3.0 SOP Classes as an **SCU**:

SOP Class Name	SOP Class UID
Modality Worklist Information Model – FIND	1.2.840.10008.5.1.4.31

9.3.1.1 Association Establishment Policies

9.3.1.1.1 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.

The user information Items sent by this product are:

- Maximum PDU Length
- Implementation UID

9.3.1.1.2 Number of Associations

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

9.3.1.1.3 Asynchronous Nature

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

9.3.1.1.4 Implementation Identifying Information

The Implementation UID for this DICOM v3.0 Implementation is:

GE Advance MWL 1.0	1.2.840.113619.6.123

9.3.1.2 Association Initiation Policy

The Worklist Server AE initiates a new association due to an update operation being initiated from the Advance 6.0 user interface.

9.3.1.2.1 Real-World Activity: Worklist Query

9.3.1.2.2 Associated Real-World Activity

The operator of the system initiates a query for a modality Worklist by either opening the Patient Scheduler screen or by opening the Patient Scheduler screen and pressing the Update button, depending on the configuration. 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 that 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 effects on Worklist query parameters are given below:

This Scanner:

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

This Modality:

- Modality, (0008,0060) - set to PT (default can be changed in the $MWLCONFIG/WLSystem.cfg file).
- Scheduled Station AE Title, (0040,0001) - zero-length (universal matching)

All Scanners:

- Modality, (0008,0060) – set to PT (default can be changed in the $MWLCONFIG/WLSystem.cfg file).
- 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 effects 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)

The above mentioned configurations can be made by either pressing the Preferences button for default values or just before a query on pressing the Update button.

9.3.1.2.3 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
Name	UID	Name List	UID List		Negotiation
Modality Worklist Information Model - FIND	1.2.840.10008.5.1.4.31	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	No

9.3.1.2.3.1.1 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

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 have failed. Any previously received Worklist items are discarded.

9.3.1.2.3.1.2 Record Acceptance Policy

The Advance™ 6.0 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. Any previously received Worklist items are discarded. 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

9.3.1.3 Association Acceptance Policy

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

9.4 COMMUNICATION PROFILES

9.4.1 Supported Communication Stacks (PS 3.8, PS 3.9)

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

9.4.2 OSI Stack

The OSI Communication Stack is not supported by this implementation.

9.4.3 TCP/IP Stack

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

9.4.3.1 API

Not applicable to this product.

9.4.3.2 Physical Media Support

Ethernet 802.3 provides the physical network layer for this product.

9.4.4 Point-to-Point Stack

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

9.5 EXTENSIONS / SPECIALIZATIONS / PRIVATIZATIONS

9.5.1 Standard Extended /Specialized/Private SOPs

MWL for Advance™ 6.0 does not implement any private transfer SOP classes for MWL.

9.5.2 Private Transfer Syntaxes

MWL for Advance™ 6.0 does not implement any private transfer syntaxes for MWL.

9.6 CONFIGURATION

GEMS Field Service engineers configure the MWL feature. The DICOM configuration items below are configurable or re-configurable by a Field Service Engineer and are also accessible by users through the Advance™ 6.0 interface.

9.6.1 AE Title/Presentation Address Mapping

MWL allows for the configuration of the following parameters that 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
- Remote AE (HIS/RIS) Title - AE Title of SCP

These parameters define where Worklist queries will be directed. GEMS Field Service engineers using the MWL installation facilities perform configuration of these parameters.

9.6.2 Configurable Parameters

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

- Local (Worklist Server) AE Title

The following parameters are configurable by changing their values in the configuration file **$MWLCONFIG/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

9.7 SUPPORT OF EXTENDED CHARACTER SETS

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

9.8 MODALITY WORKLIST INFORMATION MODEL DEFINITION

9.8.1 Introduction

This section specifies the use of the DICOM Modality Worklist Information Model used to organize data and against which a Modality Worklist Query will be performed. The contents of this section are:

- Information Model Description
- Information Model Entity-Relationship Model
- Information Model Module Table
- Information Model Keys

9.8.2 Modality Worklist Information Model Description

In order to serve as a Service Class Provider (SCP) of the Modality Worklist Service Class, a DICOM Application Entity (AE) possesses information about the attributes of a number of managed Worklist items. These items are organized into Modality Worklist Information

Modules. In this Service Class, the Information Model plays a role similar to an Information Object Definition of most other DICOM Service Classes.

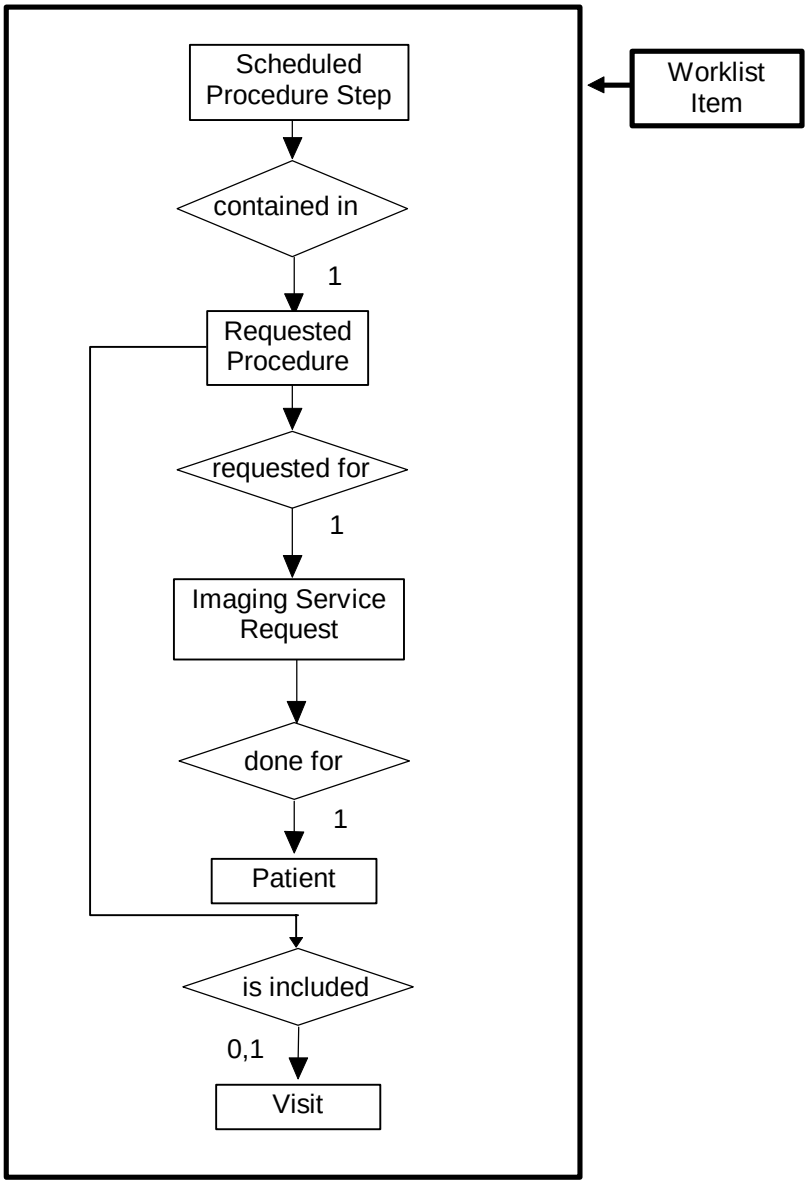
9.8.3 Modality Worklist Information Model Entity-Relationship Model

The Entity-Relationship diagram for the Modality Worklist Information Model schema is shown in Illustration 3.3-1. It represents the information that composes a Worklist Item. 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.

Illustration 9.8.3-1
Modality Worklist Information Model E/R DIAGRAM



9.8.4 ENTITY DESCRIPTIONS

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.

9.8.4.1 Scheduled Procedure Step

A Scheduled Procedure Step is an arbitrarily defined scheduled unit of service that is specified by the Procedure Plan for a Requested

Procedure. It specifies one or more Action Items (events) involving equipment (i.e. imaging modality equipment), human resources, location and time (i.e. start time, stop time, duration).

9.8.4.2 Requested Procedure Entity Description

A Requested Procedure is an instance of a Procedure of a given Procedure Type. An instance of a Requested Procedure includes all of the items of information that are specified by an instance of a Procedure Plan that is selected for the Requested Procedure by the imaging service provider.

9.8.4.3 Imaging Service Request Entity Description

An Imaging Service Request is a set of one or more Requested Procedures selected from a list of Procedure Types. An Imaging Service Request is submitted by one authorized imaging service requester to one authorized imaging service provider in the context of one Service Episode.

9.8.4.4 Visit Entity Description

A Visit is the context in which the treatment or management of an arbitrary subset of a Patient's medical conditions occurs. A Visit is limited to the description of a Patient's activities at a single facility.

9.8.4.5 Patient Entity Description

A Patient is a person receiving, or registered to receive, healthcare services.

9.8.5 MWL Mapping of DICOM Entities

TABLE 9. 8.5-1
MAPPING OF DICOM ENTITIES TO MWL ENTITIES

DICOM	MWL Entity
Scheduled Procedure Step	Exam
Requested Procedure	Exam
Imaging Service Request	Exam
Visit	Exam
Patient	Patient

9.8.6 Information Model MODULE TABLE

Within an entity of the DICOM v3.0 Modality Worklist Information Model, attributes are grouped together into related set of attributes

called modules. A module facilitates the understanding of the semantics concerning the attributes and how the attributes relate to one another. A module grouping does not infer any encoding of information into datasets.

Table 9.8.6-2 identifies the defined modules within the entities which comprise the DICOM v3.0 Modality Worklist Information Model. Modules are identified by Module Name.

See DICOM v3.0 PS 3.3 and PS 3.4 for a complete definition of the entities, modules, and attributes.

Table 9.8.6-2

Modality Worklist Information Model Modules

Entity Name	Module Name
Scheduled Procedure Step	SOP Common
	Scheduled Procedure Step
Requested Procedure	Requested Procedure
Imaging Service Request	Imaging Service Request
Visit	Visit Identification
	Visit Status
	Visit Relationship
	Visit Admission
Patient	Patient Relationship
	Patient Identification
	Patient Demographic
	Patient Medical

9.8.7 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 that 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 v3.0 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.

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.

9.8.8 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

9.8.9 Scheduled Procedure Step Entity

9.8.9.1 SOP Common Module

TABLE 9.8.9-1
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	

9.8.9.2 Scheduled Procedure Step Module

TABLE 9.8.9.2-1
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 select-able.
>Scheduled Procedure Step Start Date	(0040,0002)	R	1	No	Matching is supported as one of the following; this is user select-able: • All days, • Today only, • Today and a number of days before today, • Today and a number of days after today, • Today and a number of days before today and a number of days after today. Number of days before/after is specified by the user. 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: scanner's Modality is supplied for matching;
>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	No	
>Scheduled Station Name	(0040,0010)	O	2	No	

>Scheduled Procedure Step Location	(0040,0011)	O	2	No	
>Scheduled Protocol Code Sequence	(0040,0008)	O	1C	No	Attempt to map the sequence to an existing Protocol Code Sequence configured on the scanner. (On the Advance Protocol Management tool, the operator can configure protocol numbers on the scanner to map to a specific Protocol Code sequence.). Each Protocol Code is mapped to **One** protocol number. So a Protocol Code sequence having multiple Protocol Codes will result in a list of protocol numbers scheduled for the patient.
>>Code Value	(0008,0100)	O	1C	No	Map to Value assigned to protocol number
>>Coding Scheme Designator	(0008,0102)	O	1C	No	Not Supported
>>Code Meaning	(0008,0104)	O	3	No	
>Pre-Medication	(0040,0012)	O	2C	No	
>Scheduled Procedure Step ID	(0040,0009)	O	1	No	Displayed on “More Info” Screen.
>Requested Contrast Agent	(0032,1070)	O	2C	No	

9.8.10 Requested Procedure Entity

9.8.10.1 Requested Procedure Module

TABLE 9.8.10.1-1
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.
Requested Procedure Description	(0032,1060)	O	1C	Yes	
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	
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	

9.8.11 Imaging Service Request Entity

9.8.11.1 Imaging Service Request Module

TABLE 9.8.11.1-1
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. Supports maximum of 16 characters.
Requesting Physician	(0032,1032)	O	2	No	
Referring Physician's Name	(0008,0090)	O	2	Yes	Truncated to 64 characters
Requesting Service	(0032,1033)	O	3	No	

9.8.12 Visit Entity

9.8.12.1 Visit Identification

TABLE 9.8.12.1-1
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	

9.8.12.2 Visit Status

TABLE 9.8.12.2-1
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.

9.8.12.3 Visit Relationship

TABLE 9.8.12.3-1
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	

9.8.12.4 Visit Admission

No data elements are requested from the Visit Admission Module.

9.8.13 Patient Entity

9.8.13.1 Patient Relationship

No data elements are requested from the Patient Relationship Module.

9.8.13.2 Patient Identification

TABLE 9.8.13.2-1
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	User will be able to enter value for Patient Name prior to query
Patient ID	(0010,0020)	R	1	Yes	User will be able to enter value for Patient ID prior to query

Note 1:

- *Modality Worklist server supports 64 characters for patient Name*
- *Supports DICOM format for patient Name (with "^" as delimiters)*
- *If patient name in Worklist has more than 64 characters then worklist will be accepted by the server*
  - *User can increase the Worklist Browser's display width dynamically.*
  - *"More Info" screen will display the first 64 characters of patient name, and only the first 64 characters are loaded into Acquisition.*
  - *The implementation does not support '|' (pipe) character in any C-FIND response from the HIS/RIS*

- *If a C-FIND response contains multiple Scheduled Procedure Steps that have the same Patient Name, Patient Id, Requested Procedure Id, and SPS Id, only the first of such Scheduled Procedure Steps will be taken. The other records will be considered duplicates, and ignored. All Scheduled Procedure Steps in a C-Find response. In other words, if each Scheduled Procedure Step in a C-Find response does not have a unique combination of these fields, the duplicate SPS will be rejected.*

- *If any Scheduled Procedure Step in a C-FIND response lacks SPS Id and/or Requested Procedure Id, the Scheduled Procedure Step will be rejected.*

TABLE 9.8.13.2-2
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	
Patient's Sex	(0010,0040)	O	2	Yes	
Patient's Weight	(0010,1030)	O	2	Yes	Limited to maximum value of 400 lbs.
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	

9.8.13.3 Patient Medical

TABLE 9.8.13.3-1
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	Displayed on "More Info" screen.
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	No	

9.9 PRIVATE DATA DICTIONARY

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

9.10 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 Advance 6.0 user interface, can submit a Worklist query that will cause non-zero values to be sent for these attributes.

TABLE 9.10-1
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

(0010,1020) 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

(0010,21b0) LT (no value available) # 0, 1 AdditionalPatientHistory

(0010,21c0) US (no value available) # 0, 0 PregnancyStatus

(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

(0040,3001) 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    [PT]                #     2,  1  Modality
```

If the query is for records for this Scanner, the Modality will be filled in with PT 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 PTRoom1.

```
(0040,0001) AE    [PTRoom1]           #     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
```

9.11 USE OF SPECIFIC DICOM DATA

This section details the use of the DICOM data returned by remote AEs during Worklist queries. The Advance™ 6.0 user interface fields which display the data is presented in the table.

TABLE 9.11-1
SPECIFIC DATA USAGE

DICOM Worklist Data Element	Patient Scheduler Screen Field	Advance 6.0 DICOM Image Data Element
Accession Number (0008,0050)	Accession #	Exam.requisition Supports maximum of 16 characters.

Patient ID (0010,0020)	Patient ID	Maps to 2 fields: 1. Maximum of 64 characters stored in **patient.patient_identifier.** Images generated for this patient will have the full 64 character Patient ID (0010, 0020) since mapped from patient.patient_identifier. 2. The first 12 characters stored in **patient.patient_id,** which must be unique across all patients. Thus, if the first 12 characters are the same for 2 patients, then when selecting the second patient, the user must type a new, unique ID for the patient.patient_id field. The original Patient ID (0010, 0020) from the SCP will be preserved in **patient.patient_identifier** and mapped to the header in generated images
Patient Name (0010,0010)	Patient Name	Patient.patient_name Supports maximum of 64 characters.
Patient's Birth Date (0010,0030)	Date Of Birth	Patient.birthdate
Patient's Sex (0010,0040)	Sex	Patient.sex
Patient's Weight (0010,1030)	Weight in Kg/ Lbs (Configurable)	Exam.patient_wt
Requested Procedure Description (0032,1060)	Procedure Description	Exam.exam_desc
Scheduled Procedure Step Start Date (0040,0002)	Exam Date	<Defaults to data of exam>
Scheduled Procedure Step Start Time (0040,0003)	Exam Time	<Defaults to time of exam>.
Study Instance UID (0020,000d)	Study instance UID (displayed on the "More Info" screen)	Exam.study_uid Exam.exam_id
Requested Procedure Id (0040,1001)	Procedure ID	Not available
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.
Current Patient Location (0038,0300)	Current Patient Location (only displayed on the "More Info Screen)	Not available.
Scheduled Procedure Step ID (0040, 0009)	SPS ID (only displayed on "More Info" screen)	Not available.

Patient Data Confidentiality Constraint Description (0400, 3001)	Confidentiality Constraint (only displayed on "More Info" screen)	Not available
Referring Physician's Name (0008,0090)	Referring Physician	Exam.ref_physician

9.12 SETTING USER PREFERENCES

9.12.1 Setting "Update Schedule Automatically" Option

Setting this option to "**Update when opening Scheduler**" will initiate a C_FIND query to the SCP, based on default query parameters or based on custom query options. If this option is set to "**No**" then a query has to be initiated explicitly on clicking Update.

- Click on "Patient Scheduler"
- Click on "Preferences" button
- Set the option "Update Schedule Automatically", to either "**Update when opening Scheduler**" or "**No**"

9.12.2 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 Scheduler"
- 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
    - Patient ID
    - Select a desired System Type (This System, All Systems, All PET Systems)
    - Desired date range for the query.

Default Query Parameters can be provided through the Preferences.

- Click on “Patient Scheduler”
- Click on “Preferences” button and set the values in “Default Query Parameters” section.

9.12.3 Setting Overwrite Edited Record Option

Any patient/scan information contained in a Scheduled Procedure Step that originated from the HIS/RIS cannot be edited on the Scheduler. However, if the HIS/RIS did not send a value for fields that are necessary to complete the procedure (such as “Operator”, or “Patient Height”), the user may locally add this information to the Scheduled Procedure Step on the Scheduler.

The “Overwrite Edited Record” preference allows the user to choose whether or not subsequent HIS/RIS queries overwrite Scheduled Procedure Steps to which the user has added information. For instance, if the user chooses to overwrite edited records, then after locally adding information to the scheduled procedure step, a subsequent HIS/RIS query that matches the edited SPS will result in re-writing that SPS with the original information (and therefore loss of the added information). Conversely, if the user chooses not to overwrite edited records, then subsequent queries will not replace the appended SPS with the original.

Appendix A

SOP Specific Conformance for Image Storage SOP Classes for DICOMRecv AE Server:

Attribute	*Tag*
SOP class UID	**(0008,0016)**
SOP Instance UID	**(0008,0018)**
Study Date	**(0008,0020)**
Series Date	**(0008,0021)**
Scan Date	**(0008,0022)**
Image Date	**(0008,0023)**
Study Time	**(0008,0030)**
Series Time	**(0008,0031)**
Scan Time	**(0008,0032)**
Image Time	**(0008,0033)**
Accession Number	**(0008,0050)**
Modality	**(0008,0060)**
Manufacturer	**(0008,0070)**
Institution Name	**(0008,0080)**
Referring Physician Name	**(0008,0090)**
Station ID	**(0008,1010)**
Study Description	**(0008,1030)**
Series Description	**(0008,103E)**
Name of Physician Reading Study	**(0008,1060)**
Operator	**(0008,1070)**
Manufacture Model Name	**(0008,1090)**
Patient Name	**(0010,0010)**

Attribute	*Tag*
Patient ID	**(0010,0020)**
Patients Birth Date	**(0010,0030)**
Patient's Sex	**(0010,0040)**
Patient's Weight	**(0010,1030)**
Other Patient History	**(0010,21B0)**
Contrast Agent	**(0018,0010)**
Slice Thickness	**(00018,0050)**
Echo Number	**(0018,0086)**
Patient Position	**(0018,5100)**
Study Instance UID	**(0020,000D)**
Series Instance UID	**(0020,000E)**
Study Identifier	**(0020,0010)**
Series Number	**(0020,0011)**
Image Number	**(0020,0013)**
Image Position (Patient)	**(0020,0032)**
Image Orientation	**(0020,0037)**
Frame Reference UID	**(0020,0052)**
Position Reference Indicator	**(0020,1040)**
Slice Location	**(0020,1041)**
Rows	**(0028,0010)**
Columns	**(0028,0011)**
Pixel_Spacing	**(0028,0030)**
Image.Bits_Allocated	**(0028,0100)**
Pixel Padding Value	**(0028,0120)**
Smallest Image Pixel Value	**(0028,0106)**

Attribute	*Tag*
Largest Pixel Value	**(0028,0107)**
Image.Pixel_Data	**(7FE0,0010)**
Data Size	**(7FE0,0000)**