



# **Technical Publications**

**Direction 2227918-100**

**Revision E**

## ***GENIE*<sup>™</sup> *Processing & Review R2.1* Conformance Statement for DICOM V3.0**

### **Document Structure Information:**

The DICOM Print Services for GENIE Processing & Review, R2.1 are defined in a separate document published by ISG Technologies, Inc. The ISG document “Conformance Statement for ISG Hardcopy Server as DICOM Print Management SCU” has been attached to the end of this document (Appendix B) with permission.



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## **GE Medical Systems**

*GE Medical Systems: telex 3797371  
P.O. Box 414, Milwaukee, Wisconsin, 53201 U.S.A.  
(Asia, Pacific, Latin America, North America)*

*GE Medical Systems - Europe: Telex 698626  
283 rue de la Minière, B.P.34, 78533, Buc Cedex, France*

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# SECTION 1 INTRODUCTION

## 1.1 OVERVIEW

This DICOM Conformance Statement is divided into Sections and Appendices 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 the DICOM requirements for the implementation of Networking features.

**Section 3 - Nuclear Medicine Information Object Implementation**, which specifies the GEMS equipment compliance to DICOM requirements for the implementation of a Nuclear Medicine Information Object.

**Section 4 - Patient Root Query/Retrieve Information Model**, which specifies the information model used for the implementation of the Patient Root Query/Retrieve Information Model.

**Section 5 - Study Root Query/Retrieve Information Model**, which specifies the information model used for the implementation of the Study Root Query/Retrieve Information Model.

**Section 6 - Secondary Capture Information Object Implementation**, which specifies the GEMS equipment compliance to DICOM requirements for the implementation of a Secondary Capture Information Model.

**Section 7 - Independent Curve Information Object Implementation**, which specifies the GEMS equipment compliance to DICOM requirements for the implementation of a Independent Curve Information Model.

**Section 8 - Region Of Interest (ROI) Information Object Implementation**, which specifies the GEMS equipment compliance to DICOM requirements for the implementation of a Region Of Interest Information Model.

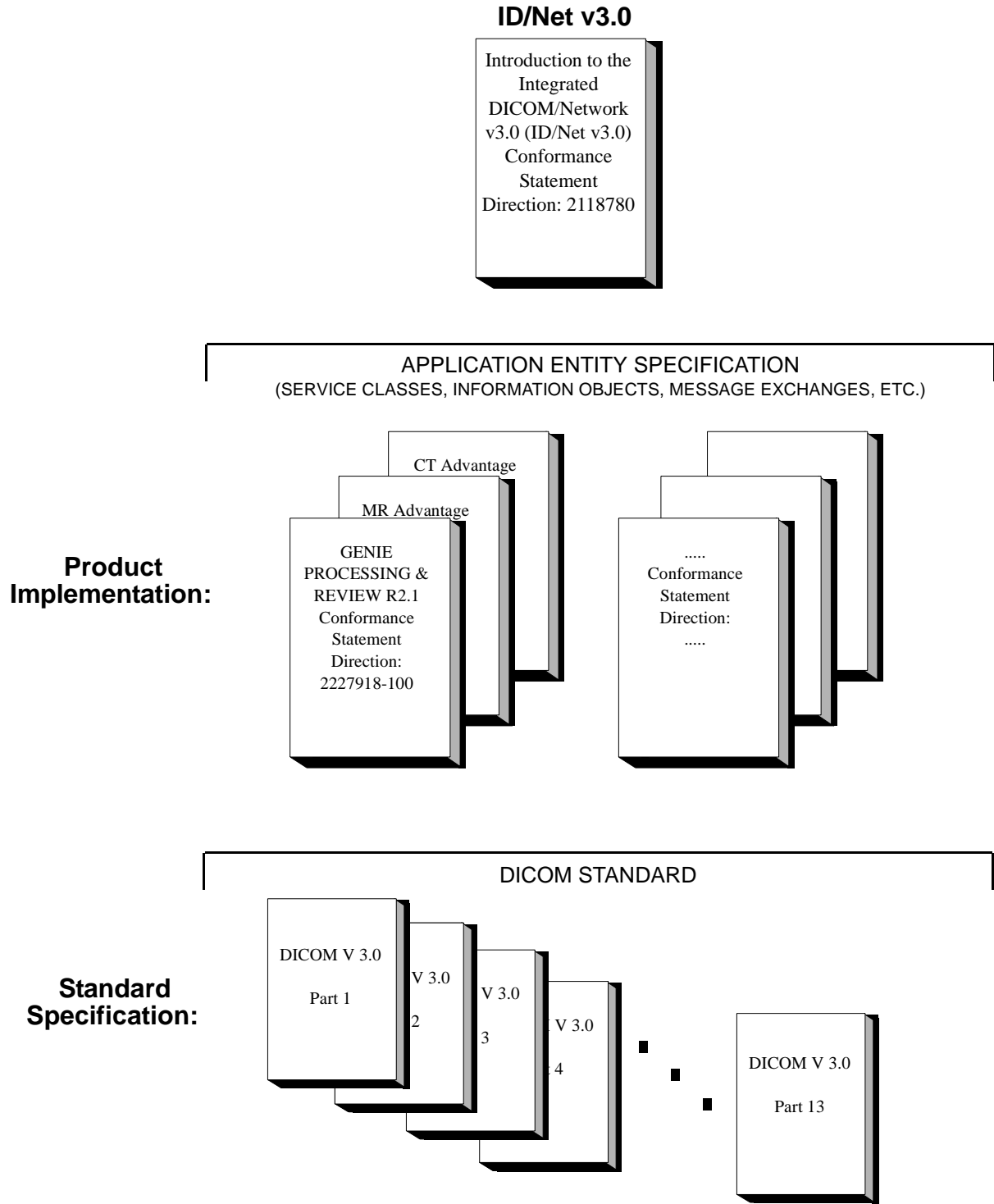
**Section 9 - GENIE Protocol Data Object Implementation**, which specifies the GEMS equipment compliance to DICOM requirements for the implementation of a Private GENIE Protocol Data Object.

**Appendix A - GENIE Private Data Dictionary**

**Appendix B - GENIE DICOM Print Conformance Statement**

## 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 1-1](#).



**Illustration 1-1.** Documentation Structure

This document specifies the DICOM v3.0 implementation.

It 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  
Phone: (703) 841-3200  
Dat\_Wall@nema.org

## 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 ID/Net 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.

- **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).

## 1.7 DEFINITIONS

A set of definitions which is applicable to all GEMS Conformance Statements is included in the *Introduction to the IDICOM/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*.



## SECTION 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.

GENIE P&R provides sophisticated image processing and storage functions on nuclear image data acquired through the front end acquisition system. In view of the requirements to conform to a global standard that permits interoperability across equipment produced by different vendors, GENIE P & R will provide support for DICOM 3.0.

This section details the roles and DICOM Service Classes supported by the GENIE P&R product in its version R2.1.

The GENIE Processing & Review DICOM implementation allows the user to send Nuclear Medicine image data, acquired through a front-end 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 GENIE station. In this situation GENIE is providing the DICOM C-STORE service as a service class user (SCU). GENIE is capable of receiving DICOM Data Sets from another DICOM compliant station. GENIE 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 GENIE 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).

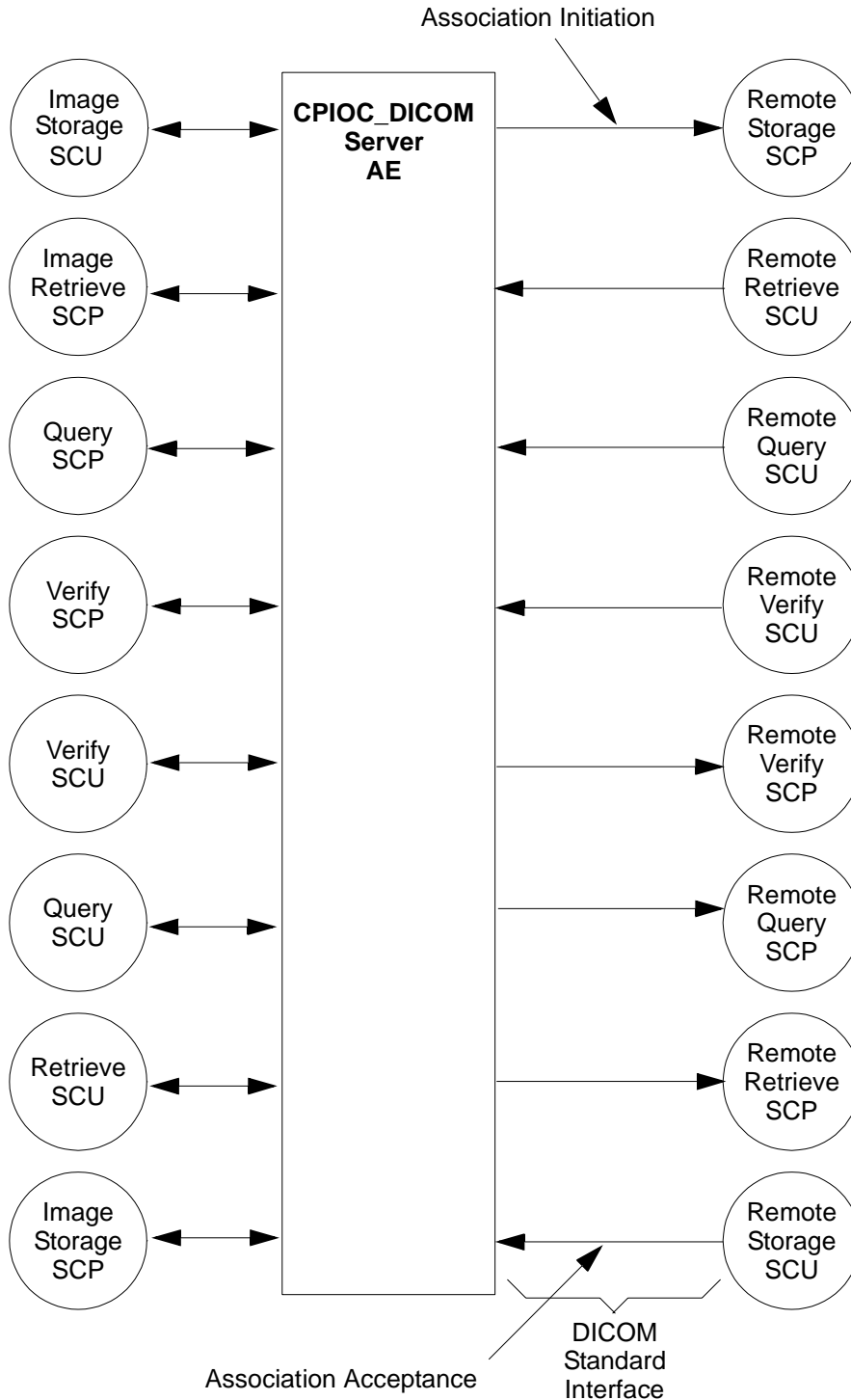
The GENIE DICOM implementation also provides a verification mechanism by which a remote application entity (AE) can verify application-level communication with the GENIE DICOM Server. Also provided is a mechanism by which a GENIE user can verify application-level communication with a remote DICOM AE. In these situations, GENIE provides the DICOM C-ECHO service as both a SCP and SCU, respectively.

### 2.2 IMPLEMENTATION MODEL

All DICOM functionality on the GENIE P&R product is logically provided by the CIPIC\_DICOM Server AE. The CIPIC\_DICOM Server AE is commanded to perform DICOM services through the use of the GENIE user interface. The CIPIC\_DICOM Server AE also listens on a pre-defined port for incoming connections from remote DICOM AEs.

### 2.2.1 Application Data Flow Diagram

The Basic and Specific Application models for this device are shown in [Illustration 2-1](#), below.



**Illustration 2-1.** Basic and Specific Application Models

## 2.2.2 Functional Definitions of Application Entities

The GENIE CIPIC\_DICOM Server Application Entity (AE) initiates the following functions:

- *Store*: Initiates a DICOM association in order to send images to a remote AE. If the remote AE accepts a presentation context applicable to the image(s) being sent, the CIPIC\_DICOM Server will send the images 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 CIPIC\_DICOM Server will receive appropriate query responses via the C-FIND service.
- *Retrieve*: Initiates a DICOM association in order to fetch images from a remote AE. If the remote AE accepts a presentation context applicable to the retrieve request(s), the remote AE initiates a DICOM association for C-STORE-RQ to the CIPIC\_DICOM Server AE. If this is acceptable to the CIPIC\_DICOM Server AE, then, the image(s) is(are) sent to the CIPIC\_DICOM Server AE.

The GENIE CIPIC\_DICOM Server AE responds to the following functions:

- *Store*: Responds to incoming C-STORE -RQ messages by storing the incoming data stream 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 image(s) and returning each via a C-STORE-RQ message. The CIPIC\_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 DICOM 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
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7
GENIE Private SOP Class Storage	1.2.840.113619.4.27
Stand-alone Curve Storage	1.2.840.10008.5.1.4.1.1.9
Study Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1
Study Root Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2
Verification - ECHO	1.2.840.10008.1.1

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

SOP Class Name	SOP Class UID
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20
MR Image Storage	1.2.840.10008.5.1.4.1.1.4
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7
GENIE Private SOP Class Storage	1.2.840.113619.4.27
Stand-alone Curve Storage	1.2.840.10008.5.1.4.1.1.9
CT Image Storage	1.2.840.10008.5.1.4.1.1.2
Patient Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.1.1
Patient Root Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.1.2
Study Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1
Study Root Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2
Verification - ECHO	1.2.840.10008.1.1

### 2.3.1.1 Association Establishment Policies

#### 2.3.1.1.1 General

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

Application Context Name	1.2.840.10008.3.1.1.1
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The Maximum Length PDU negotiation is included in all association establishment requests. The maximum length PDU for an association initiated by the CIPIC\_DICOM Server is:

Maximum Length PDU	4 Kbytes
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The SOP Class Extended Negotiation is not supported.

The maximum number of Presentation Context Items that will be proposed is 8. Note that the same Abstract Syntax may be offered multiple times with different Transfer Syntaxes.

The user information Items sent by this product are:

- Maximum PDU Length
- Implementation UID

#### 2.3.1.1.2 Number of Associations

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

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

#### 2.3.1.1.3 Asynchronous Nature

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

#### 2.3.1.1.4 Implementation Identifying Information

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

GENIE Processing & ReImplementation UID	1.2.840.113619.6.53
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## 2.3.1.2 Association Initiation Policy

The CIPIC\_DICOM Server AE initiates a new association

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

### 2.3.1.2.1 Real-World Activity: Image Send

#### 2.3.1.2.1.1 Associated Real-World Activity

The operator must both select image(s) to be transferred from the Patient Selector and select a destination from the Network Card. Once these selections have been made, the operator pushes the "Send" button to initiate an image send operation. The CIPIC\_DICOM Server will then initiate an association with the remote AE in order to send the selected image(s).

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

The UI will indicate the status of the dataset being transferred. The status can be one of CONNECTING, ACTIVE, COMPLETED or FAILED. The associated error messages due to a failed status can be one of the following -

- Fatal System Error! Cannot Send
- Out of system memory: Cannot Send!
- Exceeded the Maximum Job Limit
- Error in Database Access
- DICOM Station Configuration Error
- DICOM Configuration Error
- Failed to connect to DICOM Station
- DICOM Protocol Error
- Failed to disconnect from DICOM station
- Remote Database Write Error
- Remote DICOM station failed to respond or Remote station is down
- Unknown Error returned from Remote Station and one warning
- Warning! Dataset does not match SOP Class or Coercion of Data Elements.

### 2.3.1.2.1.2 Proposed Presentation Context Table

The following table shows the proposed presentation contexts for the CIPIC\_DICOM Server AE after real-world activity “Image Send” has been initiated:

Presentation Context Table - Proposed					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	Implicit VR Little Endian	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		
Stand-alone Curve Storage	1.2.840.10008.5.1.4.1.1.9	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		
GENIE Private SOP Class Storage	1.2.840.113619.4.27	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		
Secondary Image Capture Storage	1.2.840.10008.5.1.4.1.1.7	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		

#### 2.3.1.2.1.2.1 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 Warning, this implementation will consider the current request to be a failure but will continue to attempt to send any remaining images in the request on a different association.

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 10000 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.

Each C-STORE operation supports a configurable “C-STORE Timer.” This timer starts when a C\_STORE request is sent and stops when a C-STORE response is received. The default time-out value is 400 seconds.

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 **Storage SCP** equipment:

Service Status	Status Codes	Further Meaning	Application Behavior When receiving Status Codes
Refused	A700	Insufficient Memory for processing on the SCP side.	The message "DICOM Protocol Error" posted on the Log Card
	A710	Dataset not written into remote SCP's database.	The message "Remote Database could not write dataset" posted to the network Log card.
	A720	Internal Error in the remote SCP	The message "Internal Error on the Remote Station" posted to the network Log card.
	A730	Conversion to DICOM Format failed	The message "Error! Translation Failed. Cannot send Dataset" posted to the network Log card.
	A740	SOP Class not Supported	The message "Error! Remote Station could not find Pixel Data" posted to the network Log card.
Error	Cxxx	Cannot Understand	The message "Unknown Error returned from Remote Station" posted to the network Log card.
	A9xx	Data Set does not match SOP Class	The message "Warning!! Dataset does not match SOP Class or Coercion of data elements" posted to the network Log card. The report about store failure is also posted to the network Log card
Warning	B000	Coercion of Data Elements	The message "Warning!! Dataset does not match SOP Class or Coercion of data elements" posted to the network Log card.
	B007	Data Set does not match SOP Class	The message "Warning!! Dataset does not match SOP Class or Coercion of data elements" posted to the network Log card.
	B006	Elements Discarded	The message "Warning!! Dataset does not match SOP Class or Coercion of data elements" posted to the network Log card.
Success	0000		The message "Dataset Transfer Completed" posted to the network Log card.

**Note**

The error codes A700-A740 are GENIE Private Status Codes. GENIE 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. GENIE uses them to provide more information to the GENIE user in case of an Image Send failure.

If Non-GENIE stations return the same status code, GENIE will interpret them as per the table above. The non-GENIE station's interpretation of the status code will not be considered.



### 2.3.1.2.2 Real-World Activity: Verify

#### 2.3.1.2.2.1 Associated real-World Activity

Service personnel invoke the utility “sendecho” from the UNIX command line. The AE Title of the remote is supplied on the command line along with the IP address and the port number of the remote DICOM station. The CIPIC\_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.

#### 2.3.1.2.2.2 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	SCU	None

#### 2.3.1.2.2.2.1 SOP Specific DICOM Conformance Statement for Verification SOP Class

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

### 2.3.1.2.3 Real-World Activity: Query

#### 2.3.1.2.3.1 Associated Real-World Activity

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

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

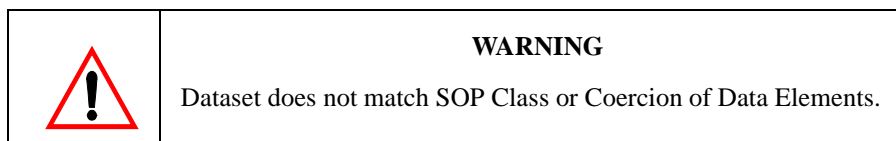
The Second Level Query operation is initiated by the selection of one or more search results on the Search/Fetch UI and then pushing the “Search Again” button to initiate the operation. The CIPIC\_DICOM Server will then initiate an association with the remote AE in order to query the remote AE for the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

GENIE makes use of the Study Root Query Model to initiate a Search/Query operation. Details of this model are provided in Section 5 of this document.

Note that for each level of a query operation, a single association is established.

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

- Fatal System Error! Cannot Send
- Out of system memory: Cannot Send!
- Exceeded the Maximum Job Limit
- DICOM Station Configuration Error
- DICOM Configuration Error
- Failed to connect to DICOM Station
- DICOM Protocol Error
- Failed to disconnect from DICOM station
- Unknown Error returned from Remote Station
- DICOM Query Formatting Error
- DICOM Query Failed
- DICOM Query Initialization Failed
- Remote DICOM station <station Name> refused to Query
- Failed to Query remote DICOM station
- Remote DICOM station <station Name> failed while processing query request
- Remote DICOM station failed to respond or Remote station is down and one warning



### 2.3.1.2.3.2 Proposed Presentation Context Table

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

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		

#### 2.3.1.2.3.2.1 SOP Specific DICOM Conformance Statement for all Query SOP Classes

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

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

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

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

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

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 10000 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.

Each C-FIND operation supports a configurable “C-FIND Timer.” This timer starts when a C\_FIND request is sent and stops when a first C-FIND response is received. The default time-out value is 400 seconds.

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 **Query SCP** equipment:

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

### 2.3.1.2.4 Real-World Activity: Retrieve

#### 2.3.1.2.4.1 Associated Real-World Activity

The GENIE P & R operator can fetch data from a remote DICOM AE in two ways. The first mechanism requires the operator to push the "Search/Fetch Template" button on GENIE's Search/Fetch UI. This pops-up a Search/Fetch Template with Patient Name, Patient Id, Study From Date, Study To Date and Study Id (Search Parameters).

The operator must indicate the Image Retrieve/Fetch criteria by entering the fetch parameters and then push the "Fetch" button to initiate the Retrieve operation. The CIPIC\_DICOM Server will then initiate an association with the remote AE in order to fetch DICOM imagesets from the remote AE for the given Fetch Parameters. The status of the operation is logged onto the Search/Fetch Log Card.

The second mechanism involves invocation of the Fetch operation by the selection of one or more search results (Patient/Study/Series/Image results) on the Search/Fetch UI and then pushing the "Fetch" button to initiate the operation. This mechanism assumes that the operator has preceded the Fetch with a Query operation. The CIPIC\_DICOM Server will then initiate an association with the remote AE in order to fetch DICOM imagesets from the remote AE for the given Patient/Study/Series/Image selection. The status of the operation is logged onto the Search/Fetch Log Card.

GENIE makes use of the Study Root Query Model to initiate a Fetch/Retrieve operation. Details of this model are

provided in Section 5 of this document.

Note that for each level of a retrieve operation, a single association is established.

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

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

### 2.3.1.2.4.2 Proposed Presentation Context Table

The following table shows the proposed presentation contexts for the C-PIPC\_DICOM Server AE after real-world activity "Image Retrieve" has been initiated:

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		

### 2.3.1.2.4.2.1 SOP Specific DICOM Conformance Statement for all Retrieve SO lasses

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

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

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

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

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

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 10000 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.

Each C-MOVE operation supports a configurable "C-MOVE Timer." This timer starts when a C-MOVE request is send and stops when a C-MOVE response is received. The default time-out value is 400 seconds.

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 **Retrieve** SCP equipment:

Service Status	Status Codes	Further Meaning	Application Behavior When receiving Status Codes
Refused	A701	Out of resources - Unable to calculate number of matches	The message "Remote DICOM Station unable to send datasets" will be posted on the Search/Fetch Log Card.
	A702	Out of resources - Unable to perform sub-operations	The message "Remote DICOM Station unable to send datasets" will be posted on the Search/Fetch Log Card.
	A801	Move Destination Unknown	The message "Remote DICOM Station is not aware of Destination to send datasets" will be posted on the Search/Fetch Log Card.
Failed	A900	Identifier does not match SOP Class	The message "Remote DICOM Station - Database Retrieve Request Failed" will be posted on the Search/Fetch Log Card.
	Cxxx	Unable to process	The message "Remote DICOM Station - Unable to process retrieve request" will be posted on the Search/Fetch Log Card.
Cancel	FE00	Sub-operations terminated due to a Cancel indication	The message "Cancelling in progress. Cannot initiate another search until cancel is complete." is posted to the Search/Fetch Log Card. The message "Search Cancelled. Cancel Acknowledgment Received." is posted to the Search/Fetch Log Card.
Warning	B000	Sub-operations Complete - One or more Failures.	A warning message is logged in a log file but is not visible to the operator.
Success	0000	Sub-operations Complete - No Failure	The message "Fetch Completed" is posted to the Search/Fetch Log Card.
Pending	FF00	Sub-operations are continuing	No Visible User Output -

### **2.3.1.3 Association Acceptance Policy**

The CIPIC\_DICOM Server AE places no limitation on whom may connect to it.

The CIPIC\_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 GENIE P & R database. Any Remote AE can send images (CT/MR/NM/SC/Stand alone Curve/GENIE Private Data) to GENIE P & R to be stored in the local GENIE P & R database.

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

The CIPIC\_DICOM Server AE responds to query requests from remote AE's and responds with matching responses. Any remote AE can also request the CIPIC\_DICOM Server AE to retrieve image data from GENIE P & R, and to store this data in the database of the remote AE.

#### **2.3.1.3.1 Real-World Activity: Image Storage SCP**

##### **2.3.1.3.1.1 Associated Real-World Activity**

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

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

CT and MR images accepted by GENIE P&R are stored in the GENIE database format rather than the original DICOM CT and MR Image Object format. Most attributes are saved and can be viewed by the user, but the original images are not accessible by other systems as CT and MR data. If sets of CT or MR data are received with related image orientations, the GENIE system will attempt to organize the images into multiframe datasets to be compatible with related Nuclear Medicine datasets for viewing. If GENIE is asked to send back any CT or MR images, it will be sent as NM images and will lose its specific properties.

### 2.3.1.3.1.2 Accepted Presentation Context Table

Presentation Context Table - Accepted					
Abstract Syntax		Transfer Syntax		Role	Extended
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
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
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
Stand-alone Curve Storage	1.2.840.10008.5.1.4.1.1.9	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
GENIE Private SOP Class Storage	1.2.840.113619.4.27	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
Secondary Image Capture Storage	1.2.840.10008.5.1.4.1.1.7	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		



### 2.3.1.3.1.2.1 SOP Specific DICOM Conformance Statement for the STORE SOP Class

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

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

**Note**

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

If Non-GENIE station SCP returns the same status code, GENIE SCU will interpret them as per the table above. The non-GENIE station's interpretation of the status code will not be considered.

GENIE supports level 1 SCP storage.

### 2.3.1.3.1.3 Presentation Context Acceptance Criterion

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

### 2.3.1.3.1.4 Transfer Syntax Selection Policies

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

### 2.3.1.3.2 Real-World Activity: Query SCP

#### 2.3.1.3.2.1 Associated Real-World Activity

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

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

#### 2.3.1.3.2.2 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 - FIND	1.2.840.10008.5.1.4.1.2.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
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	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		

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

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

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

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

### 2.3.1.3.2.3 Presentation Context Acceptance Criterion

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

### 2.3.1.3.2.4 Transfer Syntax Selection Policies

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

### 2.3.1.3.3 Real-World Activity: Image Retrieve SCP

#### 2.3.1.3.3.1 Associated Real-World Activity

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

The real-world activity associated with the Image Retrieve request is to send all images corresponding to the C-MOVE request to the specified destination AE through a separate association.

#### 2.3.1.3.3.2 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	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
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	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		

<b>Note</b>	This implementation does not support extended negotiation for the C-MOVE Service, including that for relational-retrieve
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### 2.3.1.3.3.2.1 SOP Specific DICOM Conformance Statement for the Patient Root Query/Retrieve Information Model - MOVE and Study Root Query/Retrieve Information Model - MOVE SOP Classes

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

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

### 2.3.1.3.4 Real-World Activity: Verify SCP

#### 2.3.1.3.4.1 Associated Real-World Activity

The CIPIC\_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.

#### 2.3.1.3.4.2 Accepted Presentation Context Table

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

#### 2.3.1.3.4.2.1 SOP Specific DICOM Conformance Statement for Verification SOP Class

The CIPIC\_DICOM Server AE provides standard conformance to the DICOM verification service class.

#### 2.3.1.3.4.3 Presentation Context Acceptance Criterion

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

#### 2.3.1.3.4.4 Transfer Syntax Selection Policies

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

## **2.4 COMMUNICATION PROFILES**

### **2.4.1 Support Communication Stacks (PS 3.8, PS 3.9)**

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

### **2.4.2 OSI Stack**

The OSI Communication Stack is not supported by this implementation.

### **2.4.3 TCP/IP Stack**

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

#### **2.4.3.1 API**

Not applicable to this product.

### **2.4.3.2 Physical Media Support**

Ethernet 802.3 provides the physical network layer for this product.

### **2.4.4 Point-to-Point Stack**

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

## 2.5 EXTENSIONS / SPECIALIZATIONS / PRIVATIZATIONS

### 2.5.1 Standard Extended/Specialized/Private SOPs

GENIE's NM Images are Standard Extended NM Image Storage SOP Class (see Section 3.6 for a complete description).

GENIE implements a transfer SOP class for full fidelity transfer of protocol data between GENIE systems. The protocol data object conveys information about image processing steps, results data, and display formatting. Protocol data objects are not visible on the GENIE patient selector, but are generally sent automatically with image data if the entire series is selected for transfer. For details of the GENIE Private Protocol Data Object refer to [Section 9](#).

### 2.5.2 Private Transfer Syntaxes

GENIE does not implement any private transfer syntaxes.

## 2.6 CONFIGURATION

The GENIE 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 GENIE user interface.

### 2.6.1 AE Title/Presentation Address Mapping

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

### 2.6.2 Configuration Parameters

The following parameters are configurable for the CIPIC\_DICOM Server AE:

- Local AE Title (set to hostname of GENIE computer)
- Local IP address
- Association Timers

Note that the port on which GENIE Processing & Review receives DICOM incoming TCP/IP connections is **2030**. The configuration of IP routers and subnet mask is available on a OS level.

## 2.7 SUPPORT OF EXTENDED CHARACTER SETS

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



## SECTION 3 NUCLEAR MEDICINE (NM) INFORMATION OBJECT IMPLEMENTATION

### 3.1 INTRODUCTION

This section specifies the use of the DICOM NM Image IOD to represent the information included in NM images produced by this implementation. Corresponding attributes are conveyed using the module construct. The contents of this section are:

- [Section 3.2 - NM IOD Implementation](#)
- [Section 3.3 - NM Entity-Relationship Mode](#)
- [Section 3.4 - IOD Module Table](#)
- [Section 3.5 - Information Module Definitions](#)
- [Section 3.6 - Private Data Dictionary](#)

### 3.2 NM IOD IMPLEMENTATION

The GENIE P&R implementation of DICOM uses the Nuclear Medicine multi-frame image format when creating image objects. In order to preserve full fidelity when transferring data to a GENIE Processing and Review station, 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 GENIE private data dictionary is included in [Section 3.6 - Private Data Dictionary](#). Nevertheless, GENIE is able to process NM DICOM images without any private data elements, provided a relevant for a processing type 2 and type 3 elements are available.

### 3.3 NM ENTITY-RELATIONSHIP MODE

The Entity-Relationship diagram for the NM Image interoperability schema is shown in [Illustration 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. For example, the relationship between Series and Image can have up to n NM Images per Series, but the NM Image can only belong to 1 Series.

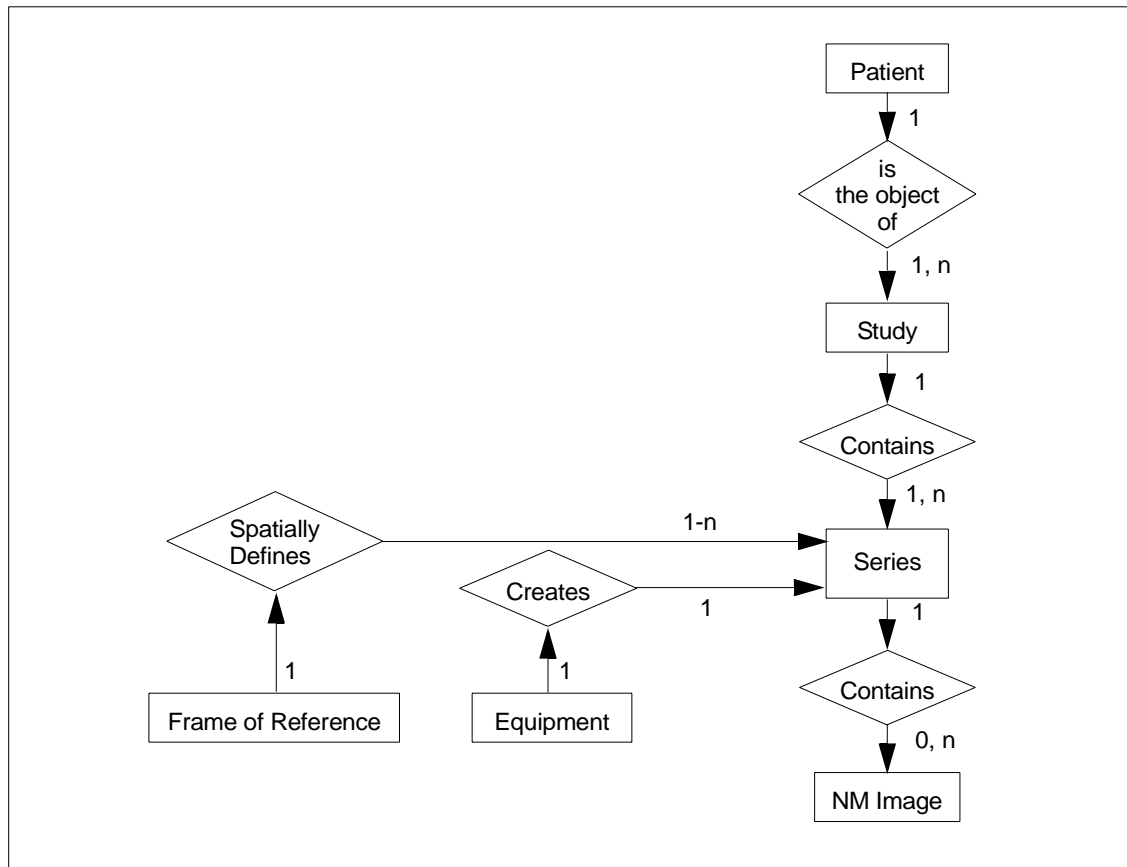


Illustration 3-1. NM Image Entity Relationship Diagram

### 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 NM 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 NM Image Entity Description

The NM Image Entity defines the attributes which describe the pixel data of a NM 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 GENIE P&R Mapping of DICOM Entities

**Table 3-1. Mapping of DICOM Entities to GENIE P&R Entities**

DICOM	GENIE P&R Entity
Patient	Patient
Study	Study
Series	Series
Image	Imageset
Frame	Not Applicable

### 3.4 IOD MODULE TABLE

Within an entity of the DICOM v3.0 NM IOD, attributes are grouped into related sets 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 to each other. A module grouping does not infer any encoding of information into datasets.

Table 3-2 identifies the defined modules within the entities which comprise the DICOM v3.0 NM IOD. Modules are identified by Module Name.

Please refer to the DICOM v3.0 Standard Part 3 for a complete definition of the entities, modules, and attributes.

**Table 3-2. NM Image IOD Modules**

Entity Name	Module Name	Reference
Patient	Patient	<a href="#">Section 3.5.1.1</a>
	GENIE Patient	<a href="#">Section 3.5.1.2</a>
Study	General Study	<a href="#">Section 3.5.2.1</a>
	Patient Study	<a href="#">Section 3.5.2.2</a>
	GENIE Study	<a href="#">Section 3.5.2.3</a>
Series	General Series	<a href="#">Section 3.5.3.1</a>
	NM Series	<a href="#">Section 3.5.8.1</a>
	GENIE Series	<a href="#">Section 3.5.3.2</a>
Frame of Reference	Frame of Reference	<a href="#">Section 3.5.4.1</a>
Equipment	General Equipment	<a href="#">Section 3.5.5.1</a>
Image	General Image	<a href="#">Section 3.5.6.1</a>
	GENIE Image	<a href="#">Section 3.5.6.2</a>
	Image Pixel	<a href="#">Section 3.5.6.3</a>
	NM Image Pixel	<a href="#">Section 3.5.8.2</a>
	GENIE Image Pixel	<a href="#">Section 3.5.6.4</a>
	Multi-frame	<a href="#">Section 3.5.6.5</a>
	NM Multi-frame	<a href="#">Section 3.5.8.3</a>
	NM Image	<a href="#">Section 3.5.8.4</a>
	NM Isotope	<a href="#">Section 3.5.8.5</a>
	GENIE Isotope	<a href="#">Section 3.5.8.6</a>
	NM Detector	<a href="#">Section 3.5.8.7</a>
	GENIE Detector	<a href="#">Section 3.5.8.8</a>
	NM TOMO	<a href="#">Section 3.5.8.9</a>
	GENIE TOMO	<a href="#">Section 3.5.8.10</a>
	NM Multi-gated	<a href="#">Section 3.5.8.11</a>
	GENIE Multi-gated	<a href="#">Section 3.5.8.12</a>
	NM Phase	<a href="#">Section 3.5.8.13</a>
	NM Reconstruction Module	<a href="#">Section 3.5.8.14</a>
	GENIE Private SPECT Reconstruction Module	<a href="#">Section 3.5.8.15</a>
	GENIE Private SPECT Backprojection Module	<a href="#">Section 3.5.8.16</a>
GENIE Private SPECT Oblique Reformat Module	<a href="#">Section 3.5.8.17</a>	
SOP Common	<a href="#">Section 3.5.7.1</a>	

## 3.5 INFORMATION MODULE DEFINITIONS

Please refer to the DICOM v3.0 Standard Part 3 (Information Object Definitions) for a description of each of the Standard entities and modules contained within the NM 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 as those defined in the DICOM v3.0 Standard Part 3 (Information Object Definitions).

GENIE Private attributes are defined in private modules, each of which follow the related Standard module. Private data element tags are assigned following the rules given in Part 5 of the DICOM v3.0 Standard, and are identified using the (gggg,xxxx) format, where xx represents a reserved block of element numbers within the group gggg.

### 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 3-3. Patient Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Patient's Name	(0010,0010)	2	Patient Name
Patient ID	(0010,0020)	2	Patient ID
Patient's Birth Date	(0010,0030)	2	Patient Date Of Birth
Patient's Sex	(0010,0040)	2	Patient Sex
Referenced Patient Sequence	(0008,1120)	3	Not used.
>Referenced SOP Class UID	(0008,1150)	1C	Not used.
>Referenced SOP Instance UID	(0008,1155)	1C	Not used.
Patient's Birth Time	(0010,0032)	3	Not used.
Other Patient IDs	(0010,1000)	3	Other Patient IDs
Other Patient Names	(0010,1001)	3	Other Patient Names
Ethnic Group	(0010,2160)	3	Ethnic Group
Patient Comments	(0010,4000)	3	Patient Comments field.

### 3.5.1.2 GENIE Private 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 *private* Attributes that convey information not contained in the related DICOM Standard v3.0 Module.

**Table 3-4. GENIE Private Patient Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Patient Object Name	(0009,xx40)	3	Name of the Database Patient Object
Patient Flags	(0009,xx41)	3	Defines patient information.
Patient Creation Date	(0009,xx4)	3	Date of Patient Entity creation (yyyy.mm.dd format).
Patient Creation Time	(0009,xx43)	3	Time of Patient Entity creation (hh:mm:ss.f format).

### 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 Modules contain Attributes of the patient and study that are needed for diagnostic interpretation of the image.

#### 3.5.2.1 General Study Modules

This section specifies the Attributes which describe and identify the study performed upon the patient.

**Table 3-5. General Study Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Study Instance UID	(0020,000D)	1	Internally generated.
Study Date	(0008,0020)	2	Creation date of study entity.
Study Time	(0008,0030)	2	Creation time of study entity.
Referring Physician's Name	(0008,0090)	2	Referring Physician field.
Study ID	(0020,0010)	2	Study Name (Processing Tag field).
Accession Number	(0008,0050)	2	Accession Number
Study Description	(0008,1030)	3	Study Description (comments)
Physician(s) of Record	(0008,1048)	3	Not used.
Name of Physician(s) Reading Study	(0008,1060)	3	Name of Physician(s) Reading Study
Referenced Study Sequence	(0008,1110)	3	Not used.
>Referenced SOP Class UID	(0008,1150)	1C	Not used.
>Referenced SOP Instance UID	(0008,1155)	1C	Not used.

### 3.5.2.2 Patient Study Modules

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

**Table 3-6. Patient Study Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Admitting Diagnoses Description	(0008,1080)	3	Not used.
Patient's Age	(0010,1010)	3	Patient Age field.
Patient's Size	(0010,1020)	3	Patient Height field.
Patient's Weight	(0010,1030)	3	Patient Weight field.
Occupation	(0010,2180)	3	Patient Occupation field.
Additional Patient's History	(0010,21B0)	3	Other Patient History field.

### 3.5.2.3 GENIE Private Study Module

This section specifies the Attributes which describe and identify the Study performed upon the Patient. This Module contains *private* Attributes that convey information not contained in the related DICOM Standard v3.0 Module.

**Table 3-7. GENIE Private Study Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Study Name	(0009,xx10)	3	Name of the Database Study Object
Study Flags	(0009,xx11)	3	Defines study information.
Study Type	(0009,xx12)	3	Defines type of study.
Study Comments	(0013,xx26)	3	User-defined additional information about the study.

### 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 Modules

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

**Table 3-8. General Series Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	Internally set to "NM" for data created on this system.
Series Instance UID	(0020,000E)	1	Internally generated.
Series Number	(0020,0011)	2	Internally generated.
Laterality	(0020,0060)	2C	Body Part Laterality, if present.
Series Date	(0008,0021)	3	Date of Series Creation or acquisition completion.
Series Time	(0008,0031)	3	Time of Series Creation or acquisition completion.
Performing Physicians' Name	(0008,1050)	3	Not used.
Protocol Name	(0018,1030)	3	Protocol Name
Series Description	(0008,103E)	3	Series ID
Operators' Name	(0008,1070)	3	Operator's Name
Referenced Study Component Sequence	(0008,1111)	3	Not used.
>Referenced SOP Class UID	(0008,1150)	1C	Not used.
>Referenced SOP Instance UID	(0008,1155)	1C	Not used.
Body Part Examined	(0018,0015)	3	Body Part field.
Patient Position	(0018,5100)	2C	Patient Position The Defined Terms are: HFP = Head First-Prone HFS = Head First-Supine HFDR = Head First-Decubitus Right HFDL = Head First-Decubitus Left FFDR = Feet First-Decubitus Right FFDL = Feet First-Decubitus Left FFP = Feet First-Prone FFS = Feet First-Supine
Smallest Pixel Value in Series	(0028,0108)	3	Min Pixel field
Largest Pixel Value in Series	(0028,0109)	3	Max Pixel field



### 3.5.3.2 GENIE Private Series Module

This section specifies the Attributes which identify and describe general information about the Series within a Study. This Module contains *private* Attributes that convey information not contained in related DICOM Standard v3.0 Module(s).

**Table 3-9. GENIE Private Series Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Series Name	(0009,xx21)	3	Name of the Database Series Object.
Series Flags	(0009,xx21)	3	Defines series information.
User Orientation	(0009,xx22)	3	User specified patient orientation.
Initiation Type	(0009,xx23)	3	Acquisition initiation type. The Defined Terms are: 0 = started on count rate 1 = started after time delay 2 = started manually
Initiation Delay	(0009,xx24)	3	Acquisition start delay time.
Initiation Count Rate	(0009,xx25)	3	Acquisition start count rate
Number Energy Sets	(0009,xx26)	3	Number of energy sets in this Series.
Number Detectors	(0009,xx27)	3	Number of detectors.
Number R-R Windows	(0009,xx28)	3	Number of R-R Interval Windows.
Number MG Time Slots	(0009,xx29)	3	Number of R-R Interval time bins.
Number View Sets	(0009,xx2A)	3	Number of view sets in this Series.
Trigger History UID	(0009,xx2B)	3	Trigger History UID.
Series Comments	(0009,xx2C)	3	User-defined additional information about the series.
Distance Prescribed	(0009,xx2E)	3	User prescribed whole body scanning distance.
Series Type	(0011,xx0A)	3	Defines type of series. The Defined Terms are: 0 = static 1 = whole body 3 = multi-gated 6 = dynamic 9 = tomographic
Effective Series Duration	(0011,xx0B)	3	Duration of series acquisition.
Number Beats	(0011,xx0C)	3	Number of physiological triggers during acquisition.

### 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 Modules

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.

GENIE P&R systems group spatially and/or temporally related Images in the same Series. Acquisition data created on other systems may be missing frame of reference information, and for these cases the attribute contains a null value.

**Table 3-10. Frame of Reference Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Frame of Reference UID	(0020,0052)	1	Frame of Reference UID, if available.
Position Reference Indicator	(0020,1040)	2	Position Reference Indicator, if available.

### 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. For Series created on the GENIE system, the values are generally copied from the original data.

**Table 3-11. General Equipment Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Manufacturer	(0008,0070)	2	Manufacturer
Institution Name	(0008,0080)	3	Institution Name
Institution Address	(0008,0081)	3	Not used.
Station Name	(0008,1010)	3	Station Name
Institutional Department Name	(0008,1040)	3	Not used.
Manufacturer's Model Name	(0008,1090)	3	Manufacturer's Model Name
Device Serial Number	(0018,1000)	3	Device Serial Number
Software Versions	(0018,1020)	3	Software Versions
Spatial Resolution	(0018,1050)	3	Not used.
Date of Last Calibration	(0018,1200)	3	Not used.
Time of Last Calibration	(0018,1201)	3	Not used.
Pixel Padding Value	(0028,0120)	3	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 3-12. General Image Module Attributes**

Attribute Name	Tag	Type	Attribute Description
<b>Table 3-13. Image Number</b>	(0020,0013)	2	Dataset Image Number
Patient Orientation	(0020,0020)	2C	Not required for NM.
Image Date	(0008,0023)	2C	Image Date
Image Time	(0008,0033)	2C	Image Time
Image Type	(0008,0008)	3	See NM Image module.
Acquisition Number	(0020,0012)	3	Not used.
Acquisition Date	(0008,0022)	3	Dataset Start Date
Acquisition Time	(0008,0032)	3	Dataset Start Time
Referenced Image Sequence	(0008,1140)	3	Not used.
>Referenced SOP Class UID	(0008,1150)	1C	Not used.
>Referenced SOP Instance UID	(0008,1155)	1C	Not used.
Derivation Description	(0008,2111)	3	Not used.
Source Image Sequence	(0008,2112)	3	Not used.
>Referenced SOP Class UID	(0008,1150)	1C	Not used.
>Referenced SOP Instance UID	(0008,1155)	1C	Not used.
Images in Acquisition	(0020,1002)	3	Not used.
Image Comments	(0020,4000)	3	Dataset Comments
Lossy Image Compression	(0028,2110)	3	Not used.

### 3.5.6.2 GENIE Private Image Module

This section specifies the Attributes which identify and describe an image within a particular series. This Module contains *private* Attributes that convey information not contained in the related DICOM Standard v3.0 Module. The private attributes are required for full fidelity transfer between GENIE systems.

**Table 3-14. GENIE Private Image Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Radio Nuclide Name	(0011,xx0D)	3	Name of radionuclide used.
Dataset Object Name	(0011,xx10)	3	Name of the Database Dataset Object.
Dataset Modified	(0011,xx11)	3	Dataset Modified Flag
Dataset Name	(0011,xx12)	3	Dataset Name
Dataset Type	(0011,xx13)	3	Defines type of dataset. The Defined Terms are: 0 = static 2 = whole body 8 = dynamic 11 = multi-gated 12 = tomographic planar
Completion Time	(0011,xx14)	3	Completion Time
Detector Number	(0011,xx15)	3	Detector number image was acquired by.
Energy Number	(0011,xx16)	3	Energy set number.
RR Interval Window Number	(0011,xx17)	3	R-R interval number (TIAR number).
MG Bin Number	(0011,xx18)	3	Multi-gated time bin number.
Radius Of Rotation	(0011,xx19)	3	Distance to the center of detector rotation.
Detector Count Zone	(0011,xx1A)	3	FOV zone for count-based acquisition termination criteria. The Defined Terms are: 0 = none specified 1 = total (all) counts 2 = counts in energy set 3 = counts inside an ROI 4 = counts outside an ROI
Num Energy Windows	(0011,xx1B)	3	Number of energy windows in energy set.
Image Orientation	(0011,xx1F)	3	Orientation of the image. The Defined Terms are: 0 = no rotation, no mirroring 1 = no rotation, mirrored
Table Orientation	(0011,xx26)	3	Orientation of the table for whole body acquisition. The Defined Terms are: 0 = direction in/out 1 = direction left/right
ROI Top Left	(0011,xx27)	3	Acquisition count zone ROI, top left coordinate.
ROI Bottom Right	(0011,xx28)	3	Acquisition count zone ROI, bottom right coordinate.
View X Adjustment	(0011,xx2C)	3	View X Adjustment
View Y Adjustment	(0011,xx2D)	3	View Y Adjustment
Pixel Overflow Flag	(0011,xx2E)	3	Pixel Overflow Flag (Starcam)
Pixel Overflow Level	(0011,xx2F)	3	Pixel Overflow Level
Acquisition Parent UID	(0011,xx31)	3	Acquisition Parent UID
Processing Parent UID	(0011,xx32)	3	Processing Parent UID

**Table 3-14. GENIE Private Image Module Attributes**

Energy Correct Name	(0011,xx33)	3	Name of applied energy correction.
Spatial Correct Name	(0011,xx34)	3	Name of applied spatial correction.
Tuning Calib Name	(0011,xx35)	3	Name of applied tuning calibration data.
Uniformity Correct Name	(0011,xx36)	3	Name of associated uniformity correction.
Acquisition Specific Correct Name	(0011,xx37)	3	Name(s) of associated acquisition specific correction(s).
Dataset Flags	(0011,xx3F)	3	Defines dataset information.
Period	(0011,xx55)	3	Period
Elapsed Time	(0011,xx56)	3	Elapsed Time
FOV	(0011,xx57)	3	FOV
Digital FOV	(0013,xx10)	3	Digital FOV
Source Translator	(0013,xx11)	3	Source Translator
RAL Flags	(0013,xx12)	3	RAL Flags
GENIE Frame Sequence	(0013,xx13)	3	GENIE Frame Sequence
>Frame Termination Condition	(0013,xx)	3	Frame Termination Condition
>Frame Termination Value	(0013,xx)	3	Frame Termination Value
>Original Image Number	(0013,xx)	3	Original Image Number

### 3.5.6.3 Image Pixel Module

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

**Table 3-15. Image Pixel Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Samples per Pixel	(0028,0002)	1	See NM and SC Image Pixel modules.
Photometric Interpretation	(0028,0004)	1	See NM and SC Image Pixel modules.
Rows	(0028,0010)	1	Rows
Columns	(0028,0011)	1	Columns
Bits Allocated	(0028,0100)	1	See NM Image Pixel module.
Bits Stored	(0028,0101)	1	See NM Image Pixel module.
High Bit	(0028,0102)	1	See NM Image Pixel module.
Pixel Representation	(0028,0103)	1	Pixel Representation (see the NM and SC Pixel Modules)
Pixel Data	(7FE0,0010)	1	Pixel Data (see details in the NM and SC Pixel Modules)
Planar Configuration	(0028,0006)	1C	Planar Configuration
Pixel Aspect Ratio	(0028,0034)	1C	Pixel Aspect Ratio
Smallest Image Pixel Value	(0028,0106)	3	Set to minimum pixel value in image.
Largest Image Pixel Value	(0028,0107)	3	Set to maximum pixel value in image.
Red Palette Color Lookup Table Descriptor	(0028,1101)	1C	Not used.
Green Palette Color Lookup Table Descriptor	(0028,1102)	1C	Not used.
Blue Palette Color Lookup Table Descriptor	(0028,1103)	1C	Not used.
Red Palette Color Lookup Table Data	(0028,1201)	1C	Not used.
Green Palette Color Lookup Table Data	(0028,1202)	1C	Not used.
Blue Palette Color Lookup Table Data	(0028,1203)	1C	Not used.

### 3.5.6.4 GENIE Private Image Pixel Module

This section specifies the Attributes that describe the pixel data of the image. This Module contains *private* Attributes that convey information not contained in the related DICOM Standard v3.0 Module. The private attributes are required for full fidelity transfer between GENIE systems.

**Table 3-16. GENIE Private Image Pixel Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Picture Name	(0011,xx30)	3	Name of the database Picture Object
Byte Order	(0011,xx38)	3	Defines pixel data byte order. The Defined Terms are: 76 = little endian 66 = big endian
Compression Type	(0011,xx39)	3	Compression information
Picture Format	(0011,xx3A)	3	GENIE IAP image format
Pixel Scale	(0011,xx3B)	3	Set to 1.0.
Pixel Offset	(0011,xx3C)	3	Set to 0.0.
Viewing Name	(0011,xx40)	3	Name of the database Viewing Object
Orientation Angle	(0011,xx41)	3	Orientation Angle
Rotation Angle	(0011,xx42)	3	Rotation Angle
Window Inverse Flag	(0011,xx43)	3	Window Inverse Flag
Threshold Center	(0011,xx44)	3	(2048.0)
Threshold Width	(0011,xx45)	3	(4096.0)
Interpolation Type	(0011,xx46)	3	(2)
Where Name	(0011,xx50)	3	Name of the database Where Object
FScalar	(0013,xx15)	3	Scaling Factor for Floating Point pixel data

### 3.5.6.5 Multi-Frame Module

This section specifies the Attributes of a Multi-frame pixel data Image.

**Table 3-17. Multi-Frame Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Number of Frames	(0028,0008)	1	Set to total number of frames in image.
Frame Increment Pointer	(0028,0009)	1	See for further explanation.

#### 3.5.6.5.1 Multi-Frame Attribute Descriptions

##### 3.5.6.5.1.1 Frame Increment Pointer

See the NM Multi-Frame Module for further information.

### 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 3-18. SOP Common Module Attributes**

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008,0016)	1	Set to "1.2.840.10008.5.1.4.1.1.20", Nuclear Medicine Image Storage SOP Class UID.
SOP Instance UID	(0008,0018)	1	Internally generated.
Specific Character Set	(0008,0005)	1C	Not used when the default character set (ISO 646) is used. Set to "ISO_IR 100" when extended character sets are used.
Instance Creation Date	(0008,0012)	3	Date of instance creation.
Instance Creation Time	(0008,0013)	3	Time of instance creation.
Instance Creator UID	(0008,0014)	3	Set to the Implementation UID (see <a href="#">Section 2.3.1.1.4</a> )

### 3.5.8 Nuclear Medicine Modules

This Section describes Nuclear Medicine Series, and Image Modules. These Modules contain Attributes that are specific to the NM Image IOD.

NM images always use the NM Multi-frame module and the appropriate frame vectors even if there is only one frame in the Image sent. If the user selects an entire Series for one Send operation, individual datasets in the Series will be combined into multi-frame NM Images as appropriate.

If the user selects and sends individual datasets within a Series, then each is sent as a separate DICOM Image. For example, for Multi-gated Tomographic acquisitions, if the dataset for each gate interval is sent individually, then each is encoded into a separate SOP Instance as a separate Multi-gated Tomographic image. It is valid for the receiving AE to recombine the SOP Instances, per the structure of the NM IOD, to form a new SOP Instance.

#### 3.5.8.1 NM Series Module

This section specifies the Attributes that describe the NM Series.

**Table 3-19. NM Series Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Patient Orientation Code Sequence	(0054,0410)	2	Not used.
> Code Value	(0008,0100)	1C	Not used.
> Coding Scheme Designator	(0008,0102)	1C	Not used.
> Code Meaning	(0008,0104)	3	Not used.
> Patient Orientation Modifier Code Sequence	(0054,0412)	2C	Not used.
>> Code value	(0008,0100)	1C	Not used.
>> Coding Scheme Designator	(0008,0102)	1C	Not used.
>> Code Meaning	(0008,0104)	3	Not used.
Patient Gantry Relationship Code Sequence	(0054,0414)	2	Not used.
> Code Value	(0008,0100)	1C	Not used.
> Coding Scheme Designator	(0008,0102)	1C	Not used.
> Code Meaning	(0008,0104)	3	Not used.



### 3.5.8.2 NM Image Pixel Module

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

**Table 3-20. NM Image Pixel Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Samples per Pixel	(0028,0002)	1	Samples per Pixel (always 1 for NM)
Photometric Interpretation	(0028,0004)	1	Photometric Interpretation (always MONOCHROME2)
Bits Allocated	(0028,0100)	1	Bits Allocated (8 or 16)
Bits Stored	(0028,0101)	1	Bits Stored (same as Bits Allocated)
High Bit	(0028,0102)	1	High Bit.
Pixel Spacing	(0028,0030)	2	Pixel Spacing

### 3.5.8.3 NM Multi-Frame Module

This section specifies the Attributes of a NM Multi-frame Image. This module is always included in a NM SOP instance, even if there is only one frame in the image.

**Table 3-21. NM Multi-Frame Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Frame Increment Pointer	(0028,0009)	1	See for specialization by NM image type.
Energy Window Vector	(0054,0010)	1C	Defines energy set window to which each frame belongs.
Number of Energy Windows	(0054,0011)	1	Number of energy set windows in SOP Instance.
Detector Vector	(0054,0020)	1C	Defines detector to which each frame belongs.
Number of Detectors	(0054,0021)	1	Number of detectors in SOP Instance.
Phase Vector	(0054,0030)	1C	Defines phase to which each frame belongs.
Number of Phases	(0054,0031)	1C	Number of phases in SOP Instance.
Rotation Vector	(0054,0050)	1C	Defines rotation to which each frame belongs.
Number of Rotations	(0054,0051)	1C	Number of Rotations in SOP Instance.
R-R Interval Vector	(0054,0060)	1C	Defines R-R Interval to which each frame belongs.
Number of R-R Intervals	(0054,0061)	1C	Number of R-R Intervals in SOP Instance.
Time Slot Vector	(0054,0070)	1C	Defines time slot, within cardiac cycle, to which each frame belongs.
Number of Time Slots	(0054,0071)	1C	Number of time slots in SOP Instance.
Slice Vector	(0054,0080)	1C	Defines image slice to which each frame belongs.
Number of Slices	(0054,0081)	1C	Number of images slices in SOP Instance.
Angular View Vector	(0054,0090)	1C	Defines angular view number to which each frame belongs.
Time Slice Vector	(0054,0100)	1C	Defines frame numbers within each phase.

### 3.5.8.3.1 NM Multi-Frame Attribute Description

#### 3.5.8.3.1.1 Frame Increment Pointer

The Frame Increment Pointer (0028,0009) defines which frame index vectors are present in the NM Image instance. The Frame Increment Pointer is supported per the DICOM specification for all image types defined in [Table 3-22](#).

**Table 3-22. Enumerated Values for Frame Increment Pointer**

Image Type (0008,0008), Value 3	Frame Increment Pointer (0028,0009)
STATIC or WHOLE BODY	0054H 0010H \ 0054H 0020H Sequencing is by Energy Window Vector (0054,0010), Detector Vector (0054,0020)
DYNAMIC	0054H 0010H \ 0054H 0020H \ 0054H 0030H \ 0054H 0100H Sequencing is by Energy Window Vector (0054,0010), Detector Vector (0054,0020) Phase Vector (0054,0030), Time Slice Vector (0054,0100)
GATED	0054H 0010H \ 0054H 0020H \ 0054H 0060H \ 0054H 0070H Sequencing is by Energy Window Vector (0054,0010), Detector Vector (0054,0020), R-R Interval Vector (0054,0060), Time Slot Vector (0054,0070)
TOMO	0054H 0010H \ 0054H 0020H \ 0054H 0050H \ 0054H 0090H Sequencing is by Energy Window Vector (0054,0010), Detector Vector (0054,0020), Rotation Vector (0054,0050), Angular View Vector (0054,0090)
GATED TOMO	0054H 0010H \ 0054H 0020H \ 0054H 0050H \ 0054H 0060H \ 0054H 0070H \ 0054H 0090H Sequencing is by Energy Window Vector (0054,0010), Detector Vector (0054,0020), Rotation Vector (0054,0050), R-R Interval Vector (0054,0060), Time Slot Vector (0054,0070), Angular View Vector (0054,0090).
RECON TOMO	0054H 0080H Sequencing is by Slice Vector (0054,0080)

### 3.5.8.4 NM Image Module

This section contains the Attributes that describe Nuclear Medicine Images.

**Table 3-23. NM Image Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Image Type	(0008,0008)	1	Dataset Type (See for specialization)
Image ID	(0054,0400)	3	Set to name of imageset.
Lossy Image Compression	(0028,2110)	1C	Compression (Not used).
Counts Accumulated	(0018,0070)	2	Detector Counts (number of counts in imageset)
Acquisition Termination Condition	(0018,0071)	3	Defined Terms used: CNTS = count limit reached DENS = count limit reached within ROI MANU = manual TIME = time limit reached TRIG = number of beats limit reached

**Table 3-23. NM Image Module Attributes**

Table Height	(0018,1130)	3	Table Height - Height of table at acquisition start.
Table Traverse	(0018,1131)	3	Table longitudinal position at acquisition start.
Actual Frame Duration	(0018,1242)	1C	Duration of each frame in imageset.
Count Rate	(0018,1243)	3	Maximum count rate during image acquisition.
Processing Function	(0018,5020)	3	Not Used
Corrected Image	(0028,0051)	3	Not Used
Whole Body Technique	(0018,1301)	3	Enumerated Values used: 1PS, 2PS, PCN, MSP
Scan Velocity	(0018,1300)	2C	Whole body scan speed
Scan Length	(0018,1302)	2C	Whole body scan length
Referenced Overlay Sequence	(0008,1130)	3	Not used.
>Referenced SOP Class UID	(0008,1150)	1C	Not used.
>Referenced SOP Instance UID	(0008,1155)	1C	Not used.
Referenced Curve Sequence	(0008,1145)	3	Not used.
>Referenced SOP Class UID	(0008,1150)	1C	Not used.
>Referenced SOP Instance UID	(0008,1155)	1C	Not used.
Trigger Source or Type	(0018,1061)	3	Defined Terms used: EKG
Anatomic Region Sequence	(0008,2218)	3	Not used.
> Code Value	(0008,0100)	1C	Not used.
> Coding Scheme Designator	(0008,0102)	1C	Not used.
> Code Meaning	(0008,0104)	3	Not used.
> Anatomic Region Modifier Sequence	(0008,2220)	3	Not used.
>> Code Value	(0008,0100)	1C	Not used.
>> Coding Scheme Designator	(0008,0102)	1C	Not used.
>> Code Meaning	(0008,0104)	3	Not used.
Primary Anatomic Structure Sequence	(0008,2228)	3	Not used.
> Code Value	(0008,0100)	1C	Not used.
> Coding Scheme Designator	(0008,0102)	1C	Not used.
> Code Meaning	(0008,0104)	3	Not used.
> Primary Anatomic Structure Modifier Sequence	(0008,2230)	3	Not used.
>> Code Value	(0008,0100)	1C	Not used.
>> Coding Scheme Designator	(0008,0102)	1C	Not used.
>> Code Meaning	(0008,0104)	3	Not used.

### 3.5.8.4.1 NM Image Module Attribute Description

#### 3.5.8.4.1.1 Image Type

The following Image Type (0008,0008) values are sent:

- Value 1 shall have one of the following Enumerated Values:
  - 1 ORIGINAL Identifies an Original Image
  - 2 DERIVED An image modified by processing steps
- Value 2 shall have the following Enumerated Value:
  - 1 PRIMARY Identifies a Primary Image
- Value 3 shall have the following Enumerated Values:
  - 1 STATIC Identifies a Static Image
  - 2 DYNAMIC Identifies a Dynamic Image
  - 3 GATED Identifies a Multi-gated Image
  - 4 WHOLE BODY Identifies a Whole Body Image
  - 5 TOMO Identifies a Tomographic Image
  - 6 RECON TOMO Identifies a reconstructed Tomographic Image
  - 7 GATED TOMO Identifies a Multi-gated Tomographic Image
  - 8 RECON GATED TOMO A reconstructed Multi-gated Tomographic Image
- Value 4 shall have the following Enumerated Values:
  - 1 MISSION Transmission source NOT active during image acquisition
  - 2 TRANSMISSION Transmission source active during image acquisition

### 3.5.8.5 NM ISotope Module

This section contains Attributes that describe the isotope administered for the acquisition.

**Table 3-24. NM Isotope Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Energy Window Information Sequence	(0054,0012)	2	Energy window information.
> Energy Window Name	(0054,0018)	3	Not Used
>Energy Window Range Sequence	(0054,0013)	3	Sequence describing window energy limits.
>> Energy Window Lower Limit	(0054,0014)	3	Lower energy limit in KeV.
>>> Energy Window Upper Limit	(0054,0015)	3	Upper energy limit in KeV.
Radiopharmaceutical Information Sequence	(0054,0016)	2	Information on radiopharmaceutical(s) used.
> Radionuclide Code Sequence	(0054,0300)	2C	Null Sequence
>> Code Value	(0008,0100)	1C	Not used.
>> Coding Scheme Designator	(0008,0102)	1C	Not used.
>> Code Meaning	(0008,0104)	3	Not used.
> Radiopharmaceutical Route	(0018,1070)	3	Not used.
> Administration Route Code Sequence	(0054,0302)	3	Not used.
>> Code Value	(0008,0100)	1C	Not used.
>> Coding Scheme Designator	(0008,0102)	1C	Not used.
>> Code Meaning	(0008,0104)	3	Not used.
> Radiopharmaceutical Volume	(0018,1071)	3	Not Used
> Radiopharmaceutical Start Time	(0018,1072)	3	Not used.
> Radiopharmaceutical Stop Time	(0018,1073)	3	Not used.
> Radionuclide Total Dose	(0018,1074)	3	Total Dose field.
> Calibration Data Sequence	(0054,0306)	3	Not Used
>> Energy Window Number	(0054,0308)	1C	Not Used
>> Syringe Counts	(0018,1045)	3	Not Used
>>> Residual Syringe Counts	(0054,0017))	3	Not Used
> Radiopharmaceutical	(0018,0031)	3	Entered on Energy/Isotope card, Pharm field.
> Radiopharmaceutical Code Sequence	(0054,0304)	3	Not used.
>> Code Value	(0008,0100)	1C	Not used.
>> Coding Scheme Designator	(0008,0102)	1C	Not used.
>> Code Meaning	(0008,0104))	3	Not used.
Intervention Drug Information Sequence	(0018,0026)	3	Not used.
>Intervention Drug Name	(0018,0034)	3	Not used.
>Intervention Drug Code Sequence	(0018,0029)	3	Not used.
>> Code Value	(0008,0100)	1C	Not used.
>> Coding Scheme Designator	(0008,0102)	1C	Not used.
>> Code Meaning	(0008,0104)	3	Not used.
> Administration Route Code Sequence	(0054,0302)	3	Not used.
>> Code Value	(0008,0100))	1C	Not used.
>> Coding Scheme Designator	(0008,0102)	1C	Not used.
>> Code Meaning	(0008,0104)	3	Not used.
>Intervention Drug Start Time	(0018,0035)	3	Not used.
>Intervention Drug Stop Time	(0018,0027)	3	Not used.
>Intervention Drug Dose	(0018,0028)	3	Not used.

### 3.5.8.6 GENIE Private Isotope Module

This section contains Attributes that describe the isotope administered for the acquisition. This Module contains *private* Attributes that convey information not contained in the related DICOM Standard v3.0 Module.

**Table 3-25. GENIE Private Isotope Module Attributes**

Attribute Name	Tag	Type	Attribute Description
GENIE Energy Window Information Sequence	(0055,xx12)	3	
>GENIE Energy Window Range Sequence	(0055,xx13)	3	
>>Energy Offset	(0011,xx1C)	3	Energy window offset as a percentage of the energy peak.
>>Energy Range	(0011,xx1D)	3	The Defined Terms are: 0 = low energy range, X-series detector 1 = high energy range, X-series detector 2 = GE 511 Camera Range 3 = Unknown
>>AutoTrack Peak	(0013,xx16)	3	Optima AutoTrack energy peak.
>>AutoTrack Width	(0013,xx17))	3	Optima AutoTrack energy width.

### 3.5.8.7 NM Detector Module

This section contains IOD Attributes that describe Nuclear Medicine Detectors used to produce an image.

**Table 3-26. NM Detector Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Detector Information Sequence	(0054,0022)	2	Detector information.
> Collimator/Grid Name	(0018,1180)	3	Name of collimator used on this detector.
> Collimator Type	(0018,1181)	2C	Defined Terms used: PARA = Parallel PINH = Pinhole FANB = Fan-beam CONE = Cone-beam SLNT = Slant hole ASTG = Astigmatic DIVG = Diverging NONE = No collimator UNKN = Unknown
> Field of View Shape	(0018,1147)	3	Defined Terms used: RECTANGLE ROUND HEXAGONAL
> Field of View Dimension(s)	(0018,1149)	3	Dimensions of the field of view.
> Focal Distance	(0018,1182)	2C	Focal distance.
> X Focus Center	(0018,1183)	3	Center point of the focus position.
> Y Focus Center	(0018,1184)	3	Center point of the focus position.
> Zoom Center	(0028,0032)	3	Image center offset from field of view center.
> Zoom Factor	(0028,0031)	3	Zoom factor, typical range: 1.00 to 4.00.
> Center of Rotation Offset	(0018,1145)	3	Offset between detector center and mechanical center
> Gantry/Detector Tilt	(0018,1120)	3	Detector tilt position
> Distance Source to Detector	(0018,1110)	2C	Distance between transmission source and detector during transmission scanning.
> Start Angle	(0054,0200)	3	Start Angle
> Radial Position	(0018,1142)	3	Detector radial position at start of acquisition.
> Image Orientation (Patient)	(0020,0037)	2C	Set for first frame in dataset
> Image Position (Patient)	(0020,0032)	2C	Set for first frame in dataset
> View Code Sequence	(0054,0220)	3	Not used.
>> Code Value	(0008,0100)	1C	Not used.
>> Coding Scheme Designator	(0008,0102)	1C	Not used.
>> Code Meaning	(0008,0104)	3	Not used.
>> View Angulation Modifier Code Sequence	(0054,0222)	2C	Not used.
>>> Code value	(0008,0100)	1C	Not used.
>>> Coding Scheme Desi	(0008,0102)	1C	Not used.
>>> Code Meaning	(0008,0104)	3	Not used.

### 3.5.8.8 GENIE Private Detector Module

This section contains Attributes that describe Nuclear Medicine Detectors used to produce an image. This Module contains *private* Attributes that convey information not contained in the related DICOM Standard v3.0 Module.

**Table 3-27. GENIE Private Detector Module Attributes**

Attribute Name	Tag	Type	Attribute Description
GENIE Detector Information Sequence	(0055,xx22)	3	GENIE detector information.
>Use FOV Mask	(0011,xx23)	3	Whether FOV mask used during image acquisition. The Defined Terms are: 0 = no mask used 1 = FOV mask used
>FOV Mask Y Cutoff Distance	(0011,xx24)	3	Hexagonal FOV mask Y cutoff angle.
>FOV Mask Cutoff Angle	(0011,xx25)	3	Hexagonal FOV mask cutoff angle.
>Uniformity Mean	(0011,xx29)	3	Uniformity Mean value
>FOV Shape	(0011,xx3E)	3	GEMS NM system detector type. The Defined Terms are: 1 = 400AC 6 = Optima 7 = MAXXUS 8 = Millennium MPS 9 = Millennium MPR 10 = Millennium MG
>Transmission Scan Time	(0013,xx18)	3	Attenuation correction transmission scan duration.
>Transmission Mask Width	(0013,xx19)	3	Attenuation correction transmission scan mask width.
>Copper Attenuator Thickness	(0013,xx1A)	3	Thickness of transmission scan copper attenuator.
>Tomo View Offset	(0013,xx1E)	3	Tomo view detector offset (vector)
>Start Angle	(0035,xx01)	3	Detector start angle



### 3.5.8.9 NM TOMO Module

This section contains Attributes that describe Rotation information of a tomographic image performed on the patient. This module is present when the Image Type (0008,0008) Value 3, is equal to TOMO, GATED TOMO or RECON TOMO.

**Table 3-28. NM TOMO Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Rotation Information Sequence	(0054,0052)	2	Provides TOMO rotation information.
> Start Angle	(0054,0200)	1C	Detector start angle at start of acquisition.
> Angular Step	(0018,1144)	1C	Incremental rotational angle change per view.
> Rotation Direction	(0018,1140)	1C	Direction of rotation.
> Scan Arc	(0018,1143)	1C	Total rotation angle.
> Actual Frame Duration	(0018,1242)	1C	Duration of a view.
> Radial Position	(0018,1142)	3	Detector radial position at start of acquisition.
> Distance Source to Detector	(0018,1110)	2C	Distance between transmission source and detector during transmission scanning.
> Number of Frames in Rotation	(0054,0053)	1C	Number of tomographic views acquired.
> Table Traverse	(0018,1131)	3	Table longitudinal position at acquisition start.
> Table Height	(0018,1130)	3	Height of table above floor at acquisition start.
Type of Detector Motion	(0054,0202)	3	Enumerated Values used: STEP AND SHOOT CONTINUOUS ACQ DURING STEP

### 3.5.8.10 GENIE Private TOMO Acquisition Module

This section contains Attributes that describe Rotation information of a tomographic acquisition image performed on the patient. This Module contains *private* Attributes that convey information not contained in the related DICOM Standard v3.0 Module. Note that only one rotation is provided for in GENIE acquisition data.

**Table 3-29. GENIE Private TOMO Acquisition Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Rotational Continuous Speed	(0009,xx33)	3	Rotational Continuous Speed
Gantry Locus Type	(0009,xx35)	3	Locus type of gantry motion during acquisition. The Defined Terms are: 0 = circular 1 = elliptical
Num ECT Phases	(0015,xx12)	3	Number of ECT Phases
Num WB Scans	(0015,xx13)	3	Number of WB Scans
Det Ang Separation	(0013,xx1B)	3	Detector Ang Separation
GENIE Rotation Information Sequence	(0055,xx52)	3	
>ECT Phase Num	(0015,xx14)	3	ECT Phase Number
>WB Scan Num	(0015,xx15)	3	WB Scan Number
>Comb Head Number	(0015,xx16)	3	Comb Head Number
>Axial Acceptance Angle	(0013,xx1C)	3	Axial Acceptance Angle
>Theta Acceptance Value	(0013,xx1D)	3	Theta Acceptance Value
>Tomo View Offset	(0013,xx1E)	3	Table of offsets from COR during acquisition.

### 3.5.8.11 NM Multi-Gated Acquisition Module

This section contains Attributes that describe a multi-gated acquisition performed on the patient. This refers to frames acquired while the patient is connected to a gating device. This module is present when the Image Type (0008,0008) Value 3, is equal to GATED or GATED TOMO.

**Table 3-30. NM Multi-Gated Acquisition Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Beat Rejection Flag	(0018,1080)	3	Whether a bad beat rejection algorithm used. Enumerated values: Y = bad beat rejection algorithm used N = bad beat rejection algorithm NOT used
PVC Rejection	(0018,1085)	3	Not used
Skip Beats	(0018,1086)	3	Beats skipped for each rejected beat
Heart Rate	(0018,1088)	3	Average heart rate during acquisition.
Gated Information Sequence	(0054,0062)	2C	One set of attributes per R-R acceptance window
> Trigger Time	(0018,1060)	3	Not used.
> Framing Type	(0018,1064)	3	Not used.
> Data Information Sequence	(0054,0063)	2C	Only one set is used (all sets have same attributes)
>> Frame Time	(0018,1063)	1C	Gated frame duration in the imageset.
>> Nominal Interval	(0018,1062)	3	Not used.
>> Low R-R Value	(0018,1081)	3	Minimum R-R interval value accepted.
>> High R-R Value	(0018,1082)	3	Maximum R-R interval value accepted.
>> Intervals Acquired	(0018,1083)	3	Number of accepted intervals.
>> Intervals Rejected	(0018,1084)	3	Number of rejected intervals.
>> Time Slot Information Sequence	(0054,0072)	2C	Not used.
>>> Time Slot Time	(0054,0073)	3	Not used.

### 3.5.8.12 GENIE Private Multi-Gated Acquisition Module

This section contains Attributes that describe a multi-gated acquisition performed on the patient. This refers to frames acquired while the patient is connected to a gating device. This Module contains *private* Attributes that convey information not contained in the related DICOM Standard v3.0 Module.

**Table 3-31. GENIE Private Multi-Gated Acquisition Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Starting Heart Rate	(0009,xx37)	3	Heart rate at start of acquisition.
Track Beat Average	(0009,xx2D)	3	Heart rate tracking used during acquisition.
Percent Cycle Imaged	(0009,xx3A)	3	Percent Cycle Imaged
Preceding Beat	(0015,xx17)	3	Preceding Beat
GENIE Gated Information Sequence	(0055,xx62)	3	
>GENIE Data Information Sequence	(0055,xx63)	3	
>>RR Window Width	(0009,xx38)	3	Width of RR acceptance window as percentage of rate.
>>RR Window Offset	(0009,xx39)	3	Offset of RR acceptance window as percentage of rate.
>>Accepted Beat Time	(0013,xx20)	3	Accepted Beat Time

### 3.5.8.13 NM Phase Module

This section contains Attributes that describe dynamic phases of a dynamic acquisition image performed on the patient. This module is present when the Image Type (0008,0008) Value 3, is equal to DYNAMIC.

**Table 3-32. NM Phase Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Phase Information Sequence	(0054,0032)	2C	One sequence item per dynamic phase.
> Phase Delay	(0054,0036)	1C	Phase Delay
> Actual Frame Duration	(0018,1242)	1C	Frame Duration (same for all frames in this phase)
> Pause Between Frames	(0054,0038)	1C	Pause Between Frames
> Number of Frames in Phase	(0054,0033)	1C	Number of frames in this phase.
>Trigger Vector	(0054,0210)	3	Trigger Vector for gated data
>Number of Triggers in Phase	(0054,0211)	1C	Number of Triggers in Phase

### 3.5.8.14 NM Reconstruction Module

This section contains Attributes that describe Nuclear Medicine reconstructed volumes. Reconstructed volumes are created by applying a transformation (reconstruction) process to the acquired TOMO frames. Define the conditions under which this module is present. This module is present only when the Image Type (0008,0008), Value 3, is equal to RECON TOMO or RECON GATED TOMO.

**Table 3-33. NM reconstruction Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Spacing Between Slices	(0018,0088)	2	Spacing Between Slices
Reconstruction Diameter	(0018,1100)	3	Not used
Convolution Kernel	(0018,1210)	3	Not used
Slice Thickness	(0018,0050)	2	Slice Thickness
Slice Location	(0020,1041)	3	Not used

### 3.5.8.15 GENIE Private SPECT Reconstruction Module

This section contains Attributes that describe Nuclear Medicine reconstructed volumes. Reconstructed volumes are created by applying a transformation (reconstruction) process to the acquired TOMO frames. Define the conditions under which this module is present. This module is present only when the Image Type (0008,0008), Value 3, is equal to RECON TOMO or RECON GATED TOMO. This Module contains *private* Attributes that convey information not contained in the related DICOM Standard v3.0 Module. Note that each of these attributes may have multiple values when gated reconstructed data is combined into a single DICOM dataset.

**Table 3-34. GENIE Private SPECT Reconstruction Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Image Size	(0011,xx61)	3	Image Size
Linear FOV	(0011,xx62)	3	Linear FOV
Spatial Offset	(0011,xx63)	3	Spatial Offset
Spatial Orientation	(0011,xx64)	3	Spatial Orientation
ReferenceDatasetUID	(0011,xx65)	3	Reference Dataset UID
Starcam Reference Dataset	(0011,xx66)	3	Starcam Reference Dataset
Reference Frame Number	(0011,xx67)	3	Reference Frame Number
Cursor Length	(0011,xx68)	3	Cursor Length
Number of Cursors	(0011,xx69)	3	Number of Cursors
Cursor Coordinates	(0011,xx6A)	3	Cursor Coordinates
Recon Options Flag	(0011,xx6B)	3	Recon Options Flag
Motion Threshold	(0011,xx6C)	3	Motion Threshold
Motion Curve UID	(0011,xx6D)	3	Motion Curve UID
UnifDateTime	(0013,xx23)	3	Unif Date Time

### 3.5.8.16 GENIE Private SPECT Backprojection Module

This section contains Attributes that describe Nuclear Medicine reconstructed volumes. Reconstructed volumes are created by applying a transformation (reconstruction) process to the acquired TOMO frames. Define the conditions under which this module is present. This module is present only when the Image Type (0008,0008), Value 3, is equal to RECON TOMO or RECON GATED TOMO. This Module contains *private* Attributes that convey information not contained in the related DICOM Standard v3.0 Module. Note that each of these attributes may have multiple values when gated reconstructed data is combined into a single DICOM dataset.

**Table 3-35. GENIE Private SPECT Backprojection Module Attributes**

Attribute Name	Tag	Type	Attribute Name
Recon Type	(0011,xx6E)	3	Recon Type
Pre Filter Type	(0011,xx6F)	3	Pre Filter Type
Back Proj Filter Type	(0011,xx71)	3	Back Proj Filter Type
Recon Arc	(0011,xx72)	3	Recon Arc
Recon Pan AP Offset	(0011,xx73)	3	Recon Pan AP Offset
Recon Pan LR Offset	(0011,xx74)	3	Recon Pan LR Offset
Recon Area	(0011,xx75)	3	Recon Area
Start View	(0011,xx76)	3	Start View
Attenuation Type	(0011,xx77)	3	Attenuation Type
Dual Energy Processing	(0011,xx78)	3	Dual Energy Processing
Pre Filter Param	(0011,xx79)	3	Pre Filter Param
Pre Filter Param 2	(0011,xx7A)	3	Pre Filter Param 2
BackProjFilterParam	(0011,xx7B)	3	Back Proj Filter Param
Back Proj Filter Param 2	(0011,xx7C)	3	Back Proj Filter Param 2
Attenuation Coef	(0011,xx7D)	3	Attenuation Coef
Ref Slice Width	(0011,xx7E)	3	Ref Slice Width
Ref Trans Pixel Volume	(0011,xx7F)	3	Ref Trans Pixel Volume
Attenuation Threshold	(0011,xx81)	3	Attenuation Threshold
Interpolation Distance	(0011,xx82)	3	Interpolation Distance
Interpolation Center X	(0011,xx83)	3	Interpolation Center X
Interpolation Center Y	(0011,xx84)	3	Interpolation Center Y
Quant Filter Flag	(0011,xx85)	3	Quant Filter Flag
Head Conversion	(0011,xx86)	3	Head Conversion
Slice Width Pixels	(0013,xx87)	3	Slice Width Pixels

### 3.5.8.17 GENIE Private SPECT Oblique Reformat Module

This section contains Attributes that describe Nuclear Medicine reconstructed volumes. Reconstructed volumes are created by applying a transformation (reconstruction) process to the acquired TOMO frames. Define the conditions under which this module is present. This module is present only when the Image Type (0008,0008) Value 3, is equal to RECON TOMO or RECON GATED TOMO. Note that each of these attributes may have multiple values when gated reconstructed data is combined into a single DICOM dataset.

**Table 3-36. GENIE Private SPECT Oblique Reformat Module Attributes**

Attribute Name	Tag	Type	Attribute Name
Rfmtr Trans Ref	(0011,xx88)	3	Rfmtr Trans Ref
Rfmtr Trans Ref mm	(0011,xx89)	3	Rfmtr Trans Ref mm
Two Line Trans Ref	(0011,xx8A)	3	Two Line Trans Ref
Three-D Zero	(0011,xx8B)	3	Three-D Zero
Three-D Zero Length	(0011,xx8C)	3	Three-D Zero Length
Three-D Zero In	(0011,xx8D)	3	Three-D Zero In
Threshold	(0013,xx21)	3	Threshold
LinearDepth	(0013,xx22)	3	Linear Depth

### 3.6 PRIVATE DATA DICTIONARY

This section provides value representation and multiplicity information for all of the Private Attributes used by this implementation. Private Attributes contained within the Information Model are described in the preceding sections.

**Table 3-37. Private Creator Identification - GENIE P&R R2.1 (GEMS)GENIE\_2)**

Attribute Name	Tag	VR	VM
Private Creator Identification	(0009,0010)	LO	1
Study Name	(0009,xx10)	LO	1
Study Flags	(0009,xx11)	SL	1
Study Type	(0009,xx12)	SL	1
Dataset UID	(0009,xx1E)	UI	1
Series Object Name	(0009,xx20)	LO	1
Series Flags	(0009,xx21)	SL	1
User Orientation	(0009,xx22)	SH	1
Initiation Type	(0009,xx23)	SL	1
Initiation Delay	(0009,xx24)	SL	1
Initiation Count Rate	(0009,xx25)	SL	1
Number Energy Sets	(0009,xx26)	SL	1
Number Detectors	(0009,xx27)	SL	1
Number RR Windows	(0009,xx28)	SL	1
Number MG Time Slots	(0009,xx29)	SL	1
Number View Sets	(0009,xx2A)	SL	1
Trigger History UID	(0009,xx2B)	LO	1
Series Comments	(0009,xx2C)	LO	1
Track Beat Average	(0009,xx2D)	SL	1
Distance Prescribed	(0009,xx2E)	FD	1
Table Direction	(0009,xx2F)	SL	1
Rotational Continuous Speed	(0009,xx33)	FD	1
Gantry Motion Type (retired)	(0009,xx34)	SL	1
Gantry Locus Type	(0009,xx35)	SL	1
Starting Heart Rate	(0009,xx37)	SL	1
RR Window Width	(0009,xx38)	SL	1
RR Window Offset	(0009,xx39)	SL	1
Percent Cycle Imaged	(0009,xx3A)	SL	1
Patient Object Name	(0009,xx40)	PN	1
Num Views Acquired (retired)	(0009,xx44)	SL	
Patient Flags	(0009,xx41)	SL	1
Patient Creation Date	(0009,xx42)	DA	1



**Table 3-37. Private Creator Identification - GENIE P&R R2.1 (GEMS)GENIE\_2)**

Patient Creation Time	(0009,xx43)	TM	1
Private Creator Identification	(0011,0010)	LO	1
Series Type	(0011,xx0A)	SL	1
Effective Series Duration	(0011,xx0B)	SL	1
Num Beats	(0011,xx0C)	SL	1
Radio Nuclide Name	(0011,xx0D)	LO	1
Dataset Object Name	(0011,xx10)	LO	1
Dataset Modified	(0011,xx11)	IS	1
Dataset Name	(0011,xx12)	LO	1
Dataset Type	(0011,xx13)	SL	1
Completion Time	(0011,xx14)	SH	1
Detector Number	(0011,xx15)	SL	1
Energy Number	(0011,xx16)	SL	1
RR Interval Window Number	(0011,xx17)	SL	1
MG Bin Number	(0011,xx18)	SL	1
Radius Of Rotation	(0011,xx19)	FD	1
Detector Count Zone	(0011,xx1A)	SL	1
Num Energy Windows	(0011,xx1B)	SL	1
Energy Offset	(0011,xx1C)	SL	4
Energy Range	(0011,xx1D)	SL	1
Energy Width (retired)	(0011,xx1E)	SL	4
Image Orientation	(0011,xx1F)	SL	1
Acq Zoom (retired)	(0011,xx21)	DS	1
Acq Pan (retired)	(0011,xx22)	DS	1
Use FOV Mask	(0011,xx23)	SL	1
FOV Mask Y Cutoff Distance	(0011,xx24)	SL	1
FOV Mask Cutoff Angle	(0011,xx25)	SL	1
Table Orientation	(0011,xx26)	SL	1
ROI Top Left	(0011,xx27)	SL	2
ROI Bottom Right	(0011,xx28)	SL	2
Uniformity Mean	(0011,xx29)	SL	1
Phase Duration (retired)	(0011,xx2A)	FD	1
View X Adjustment	(0011,xx2C)	FD	1
View Y Adjustment	(0011,xx2D)	FD	1
Pixel Overflow Flag	(0011,xx2E)	SL	1
Overflow Level	(0011,xx2F)	SL	1
Picture Object Name	(0011,xx30)	LO	1

**Table 3-37. Private Creator Identification - GENIE P&R R2.1 (GEMS)GENIE\_2)**

Acquisition Parent UID	(0011,xx31)	LO	1
Processing Parent UID	(0011,xx32)	LO	1
Energy Correct Name	(0011,xx33)	LO	1
Spatial Correct Name	(0011,xx34)	LO	1
Tuning Calib Name	(0011,xx35)	LO	1
Uniformity Correct Name	(0011,xx36)	LO	1
Acquisition Specific Correction Name	(0011,xx37)	LT	1
Byte Order	(0011,xx38)	SL	1
Compression Type	(0011,xx39)	SL	1
Picture Format	(0011,xx3A)	SL	1
Pixel Scale	(0011,xx3B)	FD	1
Pixel Offset	(0011,xx3C)	FD	1
Energy Peak (retired)	(0011,xx3D)	SL	4
FOV Shape	(0011,xx3E)	SL	1
Dataset Flags	(0011,xx3F)	SL	1
Viewing Object Name	(0011,xx40)	LO	1
Orientation Angle	(0011,xx41)	SL	1
Rotation Angle	(0011,xx42)	FD	1
Window Inverse Flag	(0011,xx43)	SL	1
Threshold Center	(0011,xx44)	FD	1
Threshold Width	(0011,xx45)	FD	1
Interpolation Type	(0011,xx46)	SL	1
Where Object Name	(0011,xx50)	LO	1
Period	(0011,xx55)	FD	1
Elapsed Time	(0011,xx56)	FD	1
FOV	(0011,xx57)	FD	2
Image Size	(0011,xx61)	SL	1
Linear FOV	(0011,xx62)	FD	1
Spatial Offset	(0011,xx63)	FD	1
Spatial Orientation	(0011,xx64)	FD	1
Reference Dataset UID	(0011,xx65)	LO	1
Starcam Reference Dataset	(0011,xx66)	SH	1
Reference Frame Number	(0011,xx67)	SL	1
Cursor Length	(0011,xx68)	SL	1
Number of Cursors	(0011,xx69)	SL	1
Cursor Coordinates	(0011,xx6A)	SL	1
Recon Options Flag	(0011,xx6B)	SL	1

**Table 3-37. Private Creator Identification - GENIE P&R R2.1 (GEMS)GENIE\_2)**

Motion Threshold	(0011,xx6C)	FD	1
Motion Curve UID	(0011,xx6D)	UI	1
Recon Type	(0011,xx6E)	SL	1
Pre Filter Type	(0011,xx6F)	SL	1
Back Proj Filter Type	(0011,xx71)	SL	1
Recon Arc	(0011,xx72)	SL	1
Recon Pan AP Offset	(0011,xx73)	FD	1
Recon Pan LR Offset	(0011,xx74)	FD	1
Recon Area	(0011,xx75)	FD	1
Start View	(0011,xx76)	SL	1
Attenuation Type	(0011,xx77)	SL	1
Dual Energy Processing	(0011,xx78)	SL	1
Pre Filter Param	(0011,xx79)	SH	1
Pre Filter Param 2	(0011,xx7A)	SH	1
Back Proj Filter Param	(0011,xx7B)	SH	1
Back Proj Filter Param 2	(0011,xx7C)	SH	1
Attenuation Coef	(0011,xx7D)	SH	1
Ref Slice Width	(0011,xx7E)	SL	1
Ref Trans Pixel Volume	(0011,xx7F)	FD	1
Attenuation Threshold	(0011,xx81)	SH	1
Interpolation Distance	(0011,xx82)	FD	1
Interpolation Center X	(0011,xx83)	FD	1
Interpolation Center Y	(0011,xx84)	FD	1
Quant Filter Flag	(0011,xx85)	SL	1
Head Conversion	(0011,xx86)	SL	1
Slice Width Pixels	(0011,xx87)	SL	1
Rfmtr Trans Ref	(0011,xx88)	SL	1
Rfmtr Trans Ref mm	(0011,xx89)	FD	1
Two Line Trans Ref	(0011,xx8A)	SL	1
Three-D Zero	(0011,xx8B)	SL	1
Three-D Zero Length	(0011,xx8C)	SL	1
Three-D Zero In	(0011,xx8D)	SL	1
Private Creator Identification	(0013,0010)	LO	1
Digital FOV	(0013,xx10)	FD	2
Source Translator	(0013,xx11)	SL	1
RAL Flags	(0013,xx12)	UL	1
GENIE Frame Sequence	(0013,xx13)	SQ	1

**Table 3-37. Private Creator Identification - GENIE P&R R2.1 (GEMS)GENIE\_2)**

Original Image Num	(0013,xx14)	SL	1
Fscalar	(0013,xx15)	FD	1
AutoTrack Peak	(0013,xx16)	SL	1
AutoTrack Width	(0013,xx17)	SL	1
Transmission Scan Time	(0013,xx18)	FD	1
Transmission Mask Width	(0013,xx19)	FD	1
Copper Attenuator Thickness	(0013,xx1A)	FD	1
Det Ang Separation	(0013,xx1B)	FD	1
Axial Acceptance Angle	(0013,xx1C)	SL	1
Theta Acceptance Value	(0013,xx1D)	SL	1
Tomo View Offset	(0013,xx1E)	FD	1-n
Accepted Beats Time	(0013,xx20)	FD	1
Threshold	(0013,xx21)	FD	2
Linear Depth	(0013,xx22)	FD	2
Unif Date Time	(0013,xx23)	LO	1
Series Accepted Beats	(0013,xx24)	SL	1
Series Rejected Beats	(0013,xx25)	SL	1
Study Comments	(0013,xx26)	LT	1
Private Creator Data Element	(0015,0010)	SH	1
GENIE Frame Sequence	(0013,xx13)	SQ	1
Frame Termination Condition	(0015,xx10)	SL	1
Frame Termination Value	(0015,xx11)	SL	1
Original Image Number	(0013,xx)	SL	1
Num ECT Phases	(0015,xx12)	SL	1
Num WB Scans	(0015,xx13)	SL	1
ECT Phase Num	(0015,xx14)	SL	1
WB Scan Num	(0015,xx15)	SL	1
Comb Head Number	(0015,xx16)	SL	1
Preceding Beat	(0015,xx17)	UL	1
Orig SOP Instance UID	(0033,xx07)	SQ	1-n
Start Angle	(0035,xx01)	FD	N
GENIE Energy Window Information Sequence	(0055,xx12)	SQ	1
GENIE Energy Window Range Sequence	(0055,xx13)	SQ	1
GENIE Detector Information Sequence	(0055,xx22)	SQ	1
GENIE Rotation Information Sequence	(0055,xx52)	SQ	1
GENIE Gated Information Sequence	(0055,xx62)	SQ	1
GENIE Data Information Sequence	(0055,xx63)	SQ	1

**Table 3-37. Private Creator Identification - GENIE P&R R2.1 (GEMS)GENIE\_2)**

GENIE Data Object Type	(0033,xx08)	CS	1
Modified	(0033,xx10)	SL	1
Name	(0033,xx11)	LO	1
ProtocolDataUID	(0033,xx16)	LO	1
Date	(0033,xx17)	SH	1
Time	(0033,xx18)	SH	1
ProtocoldataFlags	(0033,xx19)	UL	1
ProtocolName	(0033,xx1A)	UL	1
RelevantDataUID	(0033,xx1B)	LO	1
BulkData	(0033,xx1C)	LO	1
IntData	(0033,xx1D)	SL	1-n
DoubleData	(0033,xx1E)	FD	1-n
StringData	(0033,xx1F)	LT	1-n
BulkDataFormat	(0033,xx20)	LT	1-n
IntDataFormat	(0033,xx21)	LT	1-n
DoubleDataFormat	(0033,xx22)	LT	1-n
StringDataFormat	(0033,xx23)	LT	1-n
Description	(0033,xx24)	LT	1
SDODoubleData SQ	(0055,xx64)	SQ	1
DoubleData	(0033,xx1E)	FD	1
Modified	(5001,xx01)	SL	1
Name	(5001,xx02)	LO	1
Cid	(5001,xx03)	SL	1
Srid	(5001,xx04)	SL	1
SOPClassUID	(5001,xx05)	LO	1
SOPInstanceUID	(5001,xx06)	LO	1
CurveType	(5001,xx07)	SI	1
GraphType	(5001,xx08)	SL	1
Legend	(5001,xx09)	LO	1
XUnits	(5001,xx0A)	LO	1
YUnits	(5001,xx0B)	LO	1
Edit	(5001,xx0C)	SL	1
Suspend	(5001,xx0D)	SL	1
StyleLine	(5001,xx0E)	SL	1
StyleFill	(5001,xx0F)	SL	1
StyleColour	(5001,xx10)	LO	1
StyleWidth	(5001,xx11)	SL	1

**Table 3-37. Private Creator Identification - GENIE P&R R2.1 (GEMS)GENIE\_2)**

StylePoint	(5001,xx12)	SL	1
StylePColour	(5001,xx13)	LO	1
StylePSize	(5001,xx14)	SL	1
Segments	(5001,xx15)	SI	1
SegType	(5001,xx16)	SL	1
SegStart	(5001,xx17)	FD	1-n
SegEnd	(5001,xx18)	FD	1-n
SegStyleLine	(5001,xx19)	SL	1-n
SegStyleFill	(5001,xx1A)	SL	1-n
SegStyleColour	(5001,xx1B)	LO	1
SegStyleWidth	(5001,xx1C)	SL	1-n
SegStylePoint	(5001,xx1D)	SL	1-n
SegStylePColour	(5001,xx1E)	SL	1
SegStylePSize	(5001,xx1F)	SL	1
SegName	(5001,xx20)	LO	1
SegAllowDirInt	(5001,xx21)	SL	1-n
TextAnnots	(5001,xx22)	SL	1
TxtX	(5001,xx23)	FD	1-n
TxtY	(5001,xx24)	FD	1-n
TxtText	(5001,xx25)	LO	1
TxtName	(5001,xx26)	LO	1
ROIName	(5001,xx30)	LO	1
DerivedFromImageUID	(5001,xx31)	LO	1
DerivedFromImages	(5001,xx32)	SL	1-n
CurveFlags	(5001,xx33)	UL	1
CurveName	(5001,xx34)	LO	1
DatasetName	(5001,xx35)	LO	1
CurveUID	(5001,xx36)	LO	1
ROIArea	(5001,xx37)	FD	1
Modified	(50xx,xx38)	SI	1
Name	(50xx,xx39)	LO	1
Software version	(50xx,xx3A)	LO	1
StartDate	(50xx,xx3B)	SH	1
CompletionDate	(50xx,xx3C)	SH	1
DetectorName	(50xx,xx3D)	LO	1

## SECTION 4

# PATIENT ROOT QUERY/RETRIEVE INFORMATION MODEL DEFINITION

### 4.1 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:

- [Section 4.2 - Patient Root Information Model Description](#)
- [Section 4.3 - Patient Root Information Model Entity-Relationship Model](#)
- [Section 4.4 - Information Model keys](#)

### 4.2 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

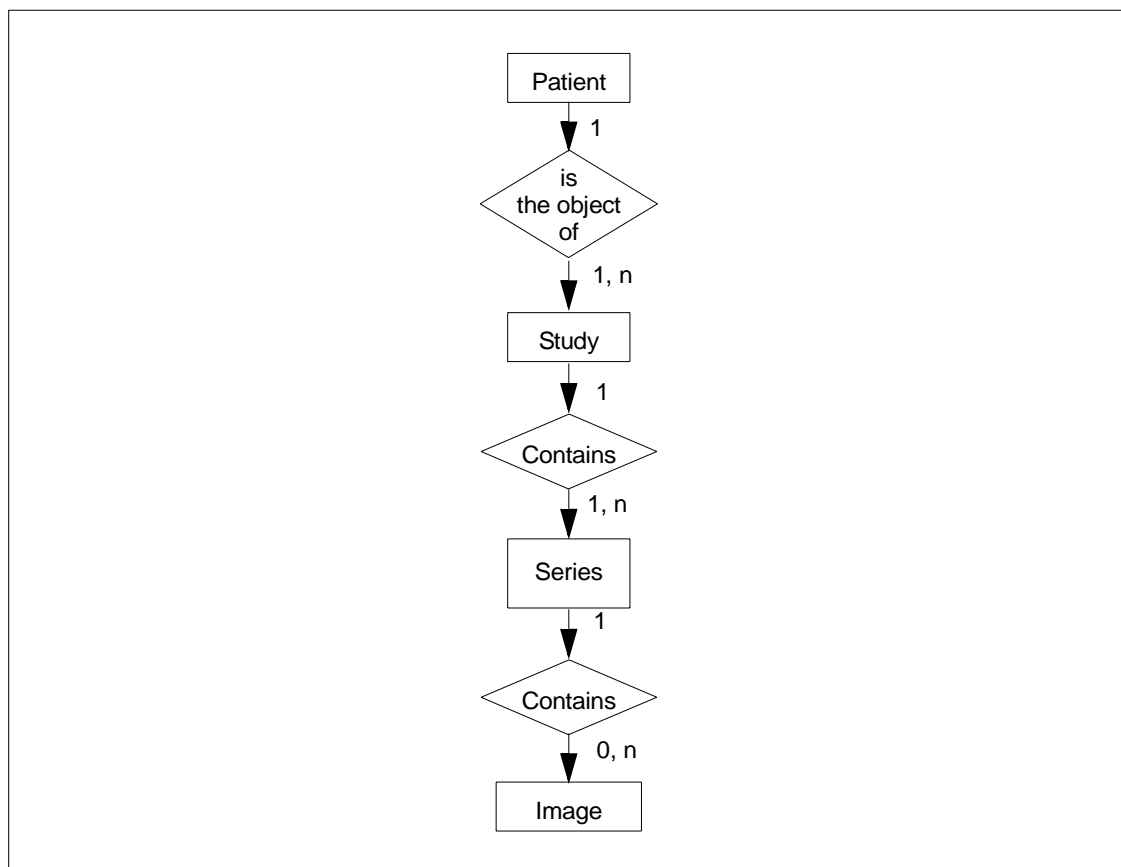
The lowest level is the image level and contains Attributes associated with the Image IE of Image IODs. An image belongs to a single series. A single series may contain multiple images. Image IEs are modality dependent

### 4.3 PATIENT ROOT INFORMATION MODEL ENTITY-RELATIONSHIP MODEL

The Entity-Relationship diagram for the Patient Root Information Model schema is shown in [Illustration 4-1](#). 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 4-1.** Patient Root Query/Retrieve Information Model E/R Diagram



### 4.3.1 Entity Descriptions

Please refer to the DICOM v3.0 Standard PS 3.4 (Service Class Specifications) for a description of each of the levels contained within the Patient Root Query/Retrieve Information Model

#### 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 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).

### 4.3.2 GENIE Acquisition Mapping of DICOM Entities

Table 4-1. Mapping of DICOM Entities to GENIE Entities

DICOM	GENIE Entity
Patient	Patient
Study	Study
Series	Series
Image	Dataset

## 4.4 INFORMATION MODEL KEYS

Please refer to the DICOM v3.0 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 which data elements are supported and what type of filtering 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).

### 4.4.1 Supported Filtering

Following are the types of matching that are supported by this implementation:

- 1 Single Value matching
- 2 Wild Card Matching
- 3 Range of date, Range of Time

### 4.4.2 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 4-2. 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.

**Table 4-3. Patient Level and Location for the Retrieve Attributes**

Attribute Name	Tag	Type	Note
Query Retrieve Level	(0008,0052)	-	Value = PATIENT

### 4.4.3 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 4-4. Study Level Attributes for the Patient Room Query/Retrieve Information Model**

Attribute Name	Tag	Type	Note
Study Date	(0008,0020)	R	Matched.
Study Time	(0008,0030)	R	Matched.
Accession Number	(0008,0050)	R	Matched
Study ID	(0020,0010)	R	Matched.
Study Instance UID	(0020,000D)	U	Matched.
Study Description	(0008,1030)	O	Returned.

**Table 4-5. Q/R Study Level and Location for Retrieve Attributes**

Attribute Name	Tag	Type	Note
Query Retrieve Level	(0008,0052)	-	Value = STUDY

### 4.4.4 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 4-6. Series Level Attributes for the Patient Root Query/Retrieve Information Model**

Attribute Name	Tag	Type	Note
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.

**Table 4-7. Q/R Series Level and Location for Retrieve Attributes**

Attribute Name	Tag	Type	Note
Query Retrieve Level	(0008,0052)	-	Value = SERIES

## 4.4.5 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 4-8. Image Level Attributes for the Patient Root Query/Retrieve Information Model**

Attribute Name	Tag	Type	Note
Image Number	(0020,0013)	R	Matched.
SOP Instance UID	(0008,0018)	U	Matched.
Image Type	(0008,0008)	O	Returned.
Image ID	(0054,0400)	O	Returned.
Rows	(0028,0010)	O	Returned.
Columns	(0028,0011)	O	Returned.
Number of Frames	(0028,0008)	O	Returned.

**Table 4-9. Q/R Image Level and Location for Retrieve Attributes**

Attribute Name	Tag	Type	Note
Query Retrieve Level	(0008,0052)	-	Value = IMAGE

## 4.5 PRIVATE DATA DICTIONARY

There are no private query key attributes defined for this implementation.

## SECTION 5

# STUDY ROOT QUERY/RETRIEVE INFORMATION MODEL DEFINITION

### 5.1 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:

- [Section 5.2 - Study Root Information Model Description](#)
- [Section 5.3 - Study Root Information Model Entity-Relationship Model](#)
- [Section 5.4 - Information Model Keys](#)

### 5.2 STUDY ROOT INFORMATION MODEL DESCRIPTION

The Study Root Query/Retrieve Information Model is based upon a three level hierarchy:

- 1 Study
- 2 Series
- 3 Image

The study level is the top level and contains Attributes associated 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

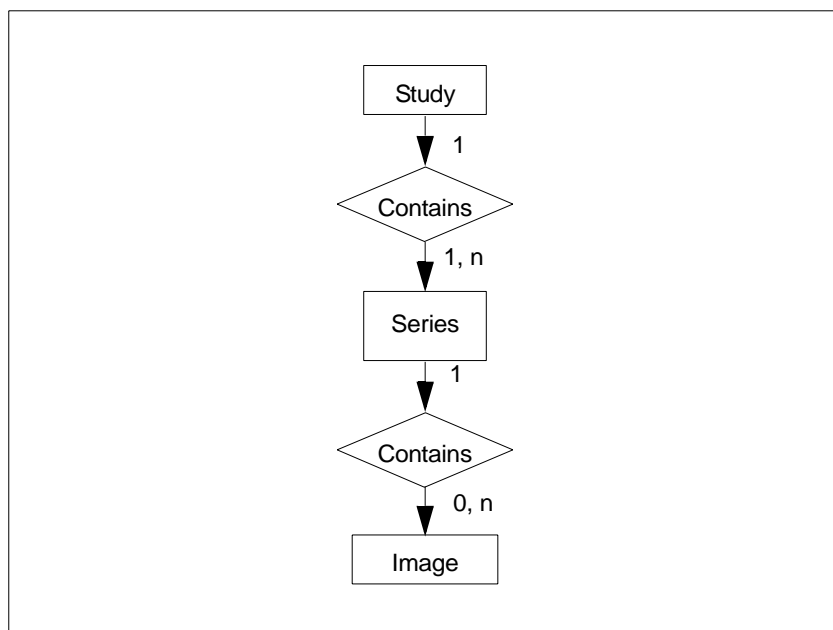
The lowest level is the image level and contains Attributes associated with the Image IE of Image IODs. An image belongs to a single series. A single series may contain multiple images. Image IEs are modality dependent

### 5.3 STUDY ROOT INFORMATION MODEL ENTITY-RELATIONSHIP MODEL

The Entity-Relationship diagram for the Study Root Information Model schema is shown in [Illustration 5-1](#). 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 5-1.** Study Root Query/Retrieve Information Model, E/R Diagram

### 5.3.1 Entity Description

Please refer to the DICOM v3.0 Standard PS 3.4 (Service Class Specifications) for a description of each of the levels contained within the Study Root Query/Retrieve Information Model.

#### 5.3.1.1 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. Each study is associated with exactly one patient.

#### 5.3.1.2 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.

#### 5.3.1.3 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).

### 5.3.2 GENIE Mapping of DICOM Entities

Table 5-1. Mapping of DICOM entities to GENIE Entities

DICOM	GENIE Entity
Study	Study
Series	Series
Image	Dataset

## 5.4 INFORMATION MODEL KEYS

Please refer to the DICOM v3.0 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 filtering 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 Filtering

Following are the types of matching that are supported by this implementation:

- 1 Single Value matching
- 2 Wild Card Matching
- 3 Range of date, Range of Time

## 5.4.2 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 5-2. Study Level Attributes for the 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.
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 ID	(0020,0010)	R	Matched.
Study Instance UID	(0020,000D)	U	Matched.
Study Description	(0008,1030)	O	Returned.

**Table 5-3. Q/R Study Level and Location for Retrieve Attributes**

Attribute Name	Tag	Type	Note
Query Retrieve Level	(0008,0052)	-	Value = STUDY

## 5.4.3 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 5-4. Series Level Attributes for the 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.

**Table 5-5. Q/R Series Level and Location for Retrieve Attributes**

Attribute Name	Tag	Type	Note
Query Retrieve Level	(0008,0052)	-	Value = SERIES



## 5.4.4 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 5-6. Image Level Attributes for the Root Query/Retrieve Information Model**

Attribute Name	Tag	Type	Attribute Description
Image Number	(0020,0013)	R	Matched.
SOP Instance UID	(0008,0018)	U	Matched.
Image Number	(0020,0013)	O	Returned.
Image Type	(0008,0008)	O	Returned.
Rows	(0028,0010)	O	Returned.
Columns	(0028,0011)	O	Returned.
Number of Frames	(0028,0008)	O	Returned.

**Table 5-7. Q/R Image Level and Location for Retrieve Attributes**

Attribute Name	Tag	Type	Note
Query Retrieve Level	(0008,0052)	-	Value = IMAGE

## 5.5 PRIVATE DATA DICTIONARY

There are no private query key attributes defined for this implementation.

## SECTION 6

### SC INFORMATION OBJECT IMPLEMENTATION

#### 6.1 INTRODUCTION

This section specifies the use of the DICOM SC Image IOD to represent the information included in SC images produced by this implementation. SC Object attributes are conveyed using the module construct. The contents of this section are:

- [Section 6.2 - SC IOD Implementation](#)
- [Section 6.3 - SC Entity-Relationship Model](#)
- [Section 6.4 - IOD Module Table](#)
- [Section 6.5 - Information Module Definitions](#)
- [Section 6.6 - Private Data Dictionary](#)

#### 6.2 SC IOD IMPLEMENTATION

Screen Save images created on the GENIE P&R system are sent as DICOM Secondary Capture images. In the patient data selector these are identified as type "FF". GENIE is able to process SC DICOM images without any private data elements.

#### 6.3 SC ENTITY-RELATIONSHIP MODEL

The Entity-Relationship diagram for the SC Image interoperability schema is shown in [Illustration 6-1](#). In this figure, the following diagrammatic convention is established to represent the information organization:

- Each entity is represented by a rectangular box
- Each relationship is represented by a diamond shaped box.
- The fact that a relationship exists between two entities is depicted by lines connecting the corresponding entity boxes to the relationship boxes.

The relationships are fully defined with the maximum number of possible entities in the relationship shown. For example, the relationship between Series and SC Image can have up to n SC Images per Series, but the SC Image can only belong to 1 Series.

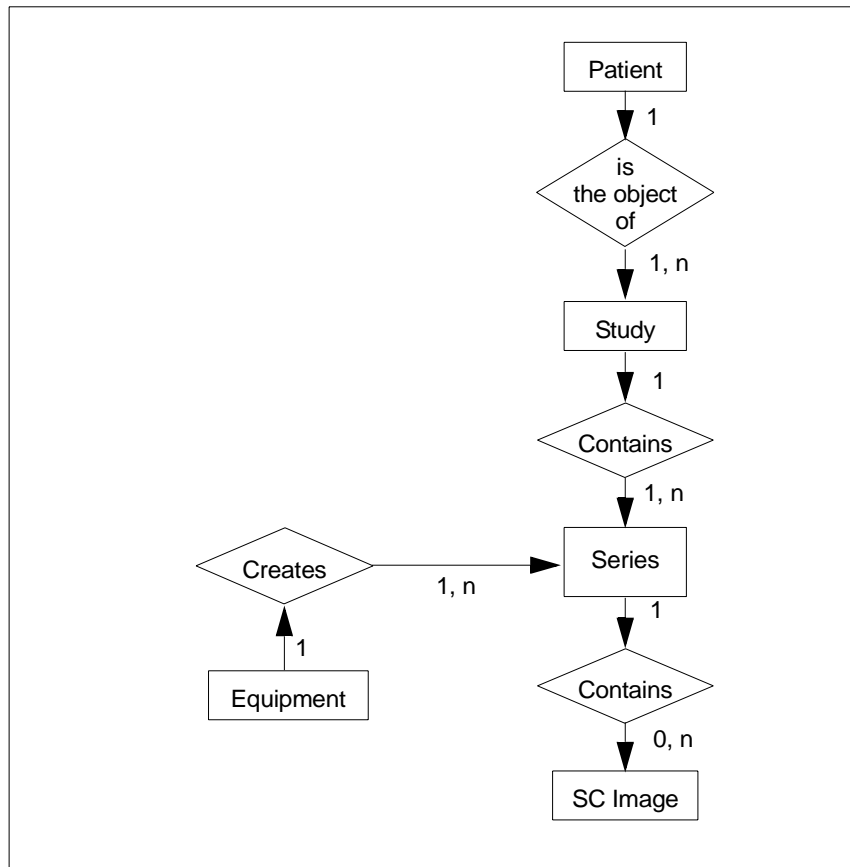


Illustration 6-1. SC Image Entity Relationship Diagram

### 6.3.1 Entity Descriptions

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

#### 6.3.1.1 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.

#### 6.3.1.2 Study Entity Description

The Study Entity describes 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.

### 6.3.1.3 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.

### 6.3.1.4 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.

### 6.3.1.5 SC Image Entity Description

The SC 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 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)

## 6.3.2 GENIE P&R Mapping of DICOM Entities

Table 6-1. Mapping DICOM Entities to GENIE P&R Entities

DICOM	GENIE P&R Entity
Patient	Patient
Study	Exam
Series	Series
Equipment	Equipment
Image	Image

## 6.4 IOD MODULE TABLE

Within an entity of the DICOM v3.0 SC 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 DICOM datasets.

Table 6-2 identifies the defined modules within the entities which comprise the DICOM v3.0 SC IOD. Modules are identified by Module Name.

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

**Table 6-2. SC Image IOD Modules**

Entity Name	Module Name	Reference
Patient	Patient	<a href="#">Section 6.5.1.1</a>
	GENIE Patient	<a href="#">Section 6.5.1.2</a>
Study	General Study	<a href="#">Section 6.5.2.1</a>
	Patient Study	<a href="#">Section 6.5.2.2</a>
	GENIE Study	<a href="#">Section 6.5.2.3</a>
Series	General Series	<a href="#">Section 6.5.3.1</a>
	GENIE Series	<a href="#">Section 6.5.3.2</a>
Equipment	General Equipment	<a href="#">Section 6.5.4.1</a>
	SC Equipment	<a href="#">Section 6.5.6.3</a>
Image	General Image	<a href="#">Section 6.5.5.1</a>
	GENIE Image	<a href="#">Section 6.5.5.2</a>
	Image Pixel	<a href="#">Section 6.5.5.3</a>
	GENIE Image Pixel	<a href="#">Section 6.5.5.1.1.1</a>
	SC Image	<a href="#">Section 6.5.6.3</a>
	SOP Common	<a href="#">Section 6.5.6.1</a>

## 6.5 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 SC Information Object.

The following modules are included to convey Enumerated Values, Defined Terms, and Optional Attributes supported. Attributes from the DICOM Standard modules 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).

## 6.5.1 Common Patient Entity Modules

### 6.5.1.1 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 6-3. Patient Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Patient's Name	(0010,0010)	2	Patient's Name
Patient ID	(0010,0020)	2	Patient ID
Patient's Birth Date	(0010,0030)	2	Patient's Birth Date
Patient's Sex	(0010,0040)	2	Patient's Sex
Referenced Patient Sequence	(0008,1120)	3	Not used
>Referenced SOP Class UID	(0008,1150)	1C	Not used
>Referenced SOP Instance UID	(0008,1155)	1C	Not used
Patient's Birth Time	(0010,0032)	3	Not used
Other Patient IDs	(0010,1000)	3	Other Patient IDs
Other Patient Names	(0010,1001)	3	Other Patient Names
Ethnic Group	(0010,2160)	3	Ethnic Group
Patient Comments	(0010,4000)	3	Patient Comments

### 6.5.1.2 GENIE Private 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 *private* Attributes that convey information not contained in the related DICOM Standard v3.0 Module. If the SC object instance was derived from GENIE original images, then some of the attributes listed in the table below may be set to values copied from the original images.

**Table 6-4. GENIE Private Patient Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Patient Object Name	(0009,xx40)	3	Name of the Database Patient Object
Patient Flags	(0009,xx41)	3	Defines patient information.
Patient Creation Date	(0009,xx42)	3	Date of Patient Entity creation (yyyy.mm.dd format).
Patient Creation Time	(0009,xx43)	3	Time of Patient Entity creation (hh:mm:ss.f format).

## 6.5.2 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.

### 6.5.2.1 General Study Module

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

**Table 6-5. General Study Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Study Instance UID	(0020,000D)	1	Study Instance UID
Study Date	(0008,0020)	2	Study Date
Study Time	(0008,0030)	2	Study Time
Referring Physician's Name	(0008,0090)	2	Referring Physician's Name
Study ID	(0020,0010)	2	Study ID
Accession Number	(0008,0050)	2	Accession Number
Study Description	(0008,1030)	3	Study Description
Physician(s) of Record	(0008,1048)	3	Not used
Name of Physician(s) Reading Study	(0008,1060)	3	Name of Physician(s) Reading Study
Referenced Study Sequence	(0008,1110)	3	Not used
>Referenced SOP Class UID	(0008,1150)	1C	Not used
>Referenced SOP Instance UID	(0008,1155)	1C	Not used

### 6.5.2.2 Patient Study Module

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

**Table 6-6. Patient Study Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Admitting Diagnoses Description	(0008,1080)	3	Not Used
Patient's Age	(0010,1010)	3	Patient's Age
Patient's Size	(0010,1020)	3	Patient's height
Patient's Weight	(0010,1030)	3	Patient's Weight
Occupation	(0010,2180)	3	Occupation
Additional Patient's History	(0010,21B0)	3	Additional Patient's History

### 6.5.2.3 GENIE Private Study Module

This section specifies the Attributes which describe and identify the Study performed upon the Patient. This Module contains *private* Attributes that convey information not contained in the related DICOM Standard v.0 Module. If the SC object instance was derived from GENIE original images, then some of the attributes listed in the table below may be set to values copied from the original images.

**Table 6-7. GENIE Private Study Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Study Name	(0009,xx10)	3	Name of the Database Study Object
Study Flags	(0009,xx11)	3	Defines study information.
Study Type	(0009,xx12)	3	Defines type of study.
Study Comments	(0013,xx26_	3	User-defined additional information about the study.



### 6.5.3 Common Series Entity Modules

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

#### 6.5.3.1 General Series Module

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

**Table 6-8. General Series Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	SC Images created by GENIE P&R generally have this attribute set to the value found in the original image. Defined Terms: CR = Computed Radiography CT = Computed Tomography MR = Magnetic Resonance NM = Nuclear Medicine US = Ultrasound OT = Other AS = Angioscopy BI = Biomagnetic imaging CD = Color flow Doppler CP = Culposcopy CS = Cystoscopy DD = Duplex Doppler DG = Diaphanography DM = Digital microscopy EC = Echocardiography ES = Endoscopy FA = Fluorescein angiography FS = Fundoscopy LP = Laparoscopy LS = Laser surface scan MA = MRA MS = MRS PT = PET RG = Radiographic imaging ST = SPECT TG = Thermography XA = X-Ray Angiography RF = Radio Fluoroscopy
Series Instance UID	(0020,000E)	1	Series Instance UID
Series Number	(0020,0011)	2	Series Number
Laterality	(0020,0060)	2C	Laterality
Series Date	(0008,0021)	3	Series Date
Series Time	(0008,0031)	3	Series Time
Performing Physicians' Name	(0008,1050)	3	Not used

**Table 6-8. General Series Module Attributes**

Protocol Name	(0018,1030)	3	Protocol Name
Series Description	(0008,103E)	3	Series Description
Operators' Name	(0008,1070)	3	Operators' Name
Referenced Study Component Sequence	(0008,1111)	3	Not used
>Referenced SOP Class UID	(0008,1150)	1C	Not used
>Referenced SOP Instance UID	(0008,1155)	1C	Not used
Body Part Examined	(0018,0015)	3	Body Part Examined
Patient Position	(0018,5100)	2C	The Defined Terms are: HFP = Head First-Prone HFS = Head First-Supine HFDR = Head First-Decubitus Right HFDL = Head First-Decubitus Left FFDR = Feet First-Decubitus Right FFDL = Feet First-Decubitus Left FFP = Feet First-Prone FFS = Feet First-Supine
Smallest Pixel Value in Series	(0028,0108)	3	Smallest Pixel Value in Series
Largest Pixel Value in Series	(0028,0109)	3	Largest Pixel Value in Series

### 6.5.3.2 GENIE Private Series Module

This section specifies the Attributes which identify and describe general information about the Series within a Study. This Module contains *private* Attributes that convey information not contained in the related DICOM Standard v3.0 Module.

**Table 6-9. GENIE Private Series Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Series Name	(0009,xx20)	3	Name of the Database Series Object.
Series Flags	(0009,xx21)	3	Not used
User Orientation	(0009,xx22)	3	Not used
Initiation Type	(0009,xx23)	3	Not used
Initiation Delay	(0009,xx24)	3	Not used
Initiation Count Rate	(0009,xx25)	3	Not used
Number Energy Sets	(0009,xx26)	3	Not used
Number Detectors	(0009,xx27)	3	Not used
Number R-R Windows	(0009,xx28)	3	Not used
Number MG Time Slots	(0009,xx29)	3	Not used
Number View Sets	(0009,xx2A)	3	Not used
Trigger History UID	(0009,xx2B)	3	Not used
Series Comments	(0009,xx2C)	3	Not used
Distance Prescribed	(0009,xx2E)	3	Not used
Series Type	(0011,xx0A)	3	Not used
Effective Series Duration	(0011,xx0B)	3	Not used
Number Beats	(0011,xx0C)	3	Not used

## 6.5.4 Common Equipment Entity Modules

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

### 6.5.4.1 General Equipment Module

This section specifies the Attributes which identify and describe the piece of equipment which produced a Series of Images. If the SC object instance was derived from GENIE original images, then some of the attributes listed in the table below may be set to values copied from the original images.

**Table 6-10. General Equipment Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Manufacturer	(0008,0070)	2	Manufacturer
Institution Name	(0008,0080)	3	Institution Name
Institution Address	(0008,0081)	3	Not used
Station Name	(0008,1010)	3	Station Name
Institutional Department Name	(0008,1040))	3	Not used
Manufacturer's Model Name	(0008,1090))	3	Manufacturer's Model Name
Device Serial Number	(0018,1000)	3	Device Serial Number
Software Versions	(0018,1020)	3	Software Versions
Spatial Resolution	(0018,1050)	3	Not used
Date of Last Calibration	(0018,1200))	3	Not used
Time of Last Calibration	(0018,1201)	3	Not used
Pixel Padding Value	(0028,0120)	3	Not used

## 6.5.5 Common Image Entity Modules

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

### 6.5.5.1 General Image Module

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

**Table 6-11. General Image Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Image Number	(0020,0013)	2	Image Number
Patient Orientation	(0020,0020)	2C	Not used
Image Date	(0008,0023)	2C	Image Date
Image Time	(0008,0033)	2C	Image Time
Image Type	(0008,0008)	3	Image Type, See <a href="#">6.5.5.1.1.1</a>
Acquisition Number	(0020,0012)	3	Not used
Acquisition Date	(0008,0022)	3	Acquisition Date
Acquisition Time	(0008,0032)	3	Acquisition Time
Referenced Image Sequence	(0008,1140)	3	Not used
>Referenced SOP Class UID	(0008,1150)	1C	Not used
>Referenced SOP Instance UID	(0008,1155)	1C	Not used
Derivation Description	(0008,2111)	3	Not used
Source Image Sequence	(0008,2112)	3	Not used
>Referenced SOP Class UID	(0008,1150)	1C	Not used
>Referenced SOP Instance UID	(0008,1155)	1C	Not used
Images in Acquisition	(0020,1002)	3	Not used
Image Comments	(0020,4000)	3	Image Comments
Lossy Image Compression	(0028,2110)	3	Not used

#### 6.5.5.1.1 General Image Attribute Description

##### 6.5.5.1.1.1 Image Type

Value 1 shall have the following Enumerated Value:

- 1 DERIVED identifies a Derived Image

Value 2 shall have the following Enumerated Value:

- 2 SECONDARY identifies a Secondary Image

## 6.5.5.2 GENIE Private Image Module

This section specifies the Attributes which identify and describe an image within a particular series. This Module contains *private* Attributes that convey information not contained in the related DICOM Standard v3.0 Module. The private attributes are required for full fidelity transfer between GENIE systems. If the SC object instance was derived from GENIE original images, then some of the attributes listed in the table below may be set to values copied from the original images.

**Table 6-12. GENIE Private Image Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Radio Nuclide Name	(0011,xx0D)	3	Not used
Dataset Object Name	(0011,xx10)	3	Name of the Database Dataset Object.
Dataset Modified	(0011,xx11)	3	Not used
Dataset Name	(0011,xx12)	3	Dataset Name
Dataset Type	(0011,xx13)	3	Defines type of dataset. The Defined Terms are: 0 = static 2 = whole body 8 = dynamic 11 = multi-gated 12 = tomographic planar
Completion Time	(0011,xx14)	3	Not used
Detector Number	(0011,xx15)	3	Not used
Energy Number	(0011,xx16)	3	Not used
RR Interval Window Number	(0011,xx17)	3	Not used
MG Bin Number	(0011,xx18)	3	Not used
Radius Of Rotation	(0011,xx19)	3	Not used
Detector Count Zone	(0011,xx1A)	3	Not used
Num Energy Windows	(0011,xx1B)	3	Not used
Image Orientation	(0011,xx1F)	3	Not used
Table Orientation	(0011,xx26)	3	Not used
ROI Top Left	(0011,xx27)	3	Not used
ROI Bottom Right	(0011,xx28)	3	Not used
View X Adjustment	(0011,xx2C)	3	Not used
View Y Adjustment	(0011,xx2D)	3	Not used
Pixel Overflow Flag	(0011,xx2E)	3	Not used
Pixel Overflow Level	(0011,xx2F)	3	Not used
Acquisition Parent UID	(0011,xx31)	3	Not used
Processing Parent UID	(0011,xx32)	3	Not used
Energy Correct Name	(0011,xx33)	3	Not used
Spatial Correct Name	(0011,xx34)	3	Not used
Tuning Calib Name	(0011,xx35)	3	Not used
Uniformity Correct Name	(0011,xx36)	3	Not used
Acquisition Specific Correct Name	(0011,xx37)	3	Not used
Dataset Flags	(0011,xx3F)	3	Dataset Flags - defines Dataset status
Period	(0011,xx55)	3	Not used
Elapsed Time	(0011,xx56)	3	Not used

**Table 6-12. GENIE Private Image Module Attributes**

FOV	(0011,xx57)	3	Field Of View
Digital FOV	(0013,xx10)	3	Not used
Source Translator	(0013,xx11)	3	Source Translator
RAL Flags	(0013,xx12)	3	Not used
GENIE Frame Sequence	(0013,xx13)	3	Not used
>Frame Termination Condition	(0013,xx)	3	Not used
>Frame Termination Value	(0013,xx)	3	Not used
>Original Image Number	(0013,xx)	3	Not used

### 6.5.5.3 Image Pixel Module

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

**Table 6-13. Image Pixel Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Samples per Pixel	(0028,0002)	1	1 for MONOCHROME2, 3 for RGB
Photometric Interpretation	(0028,0004)	1	Defined Terms: MONOCHROME2 RGB
Rows	(0028,0010)	1	See <a href="#">Table 6-14</a>
Columns	(0028,0011)	1	See <a href="#">Table 6-14</a>
Bits Allocated	(0028,0100)	1	See <a href="#">Table 6-14</a>
Bits Stored	(0028,0101)	1	See <a href="#">Table 6-14</a>
High Bit	(0028,0102)	1	See <a href="#">Table 6-14</a>
Pixel Representation	(0028,0103)	1	See <a href="#">Table 6-14</a>
Pixel Data	(7FE0,0010)	1	See <a href="#">Table 6-14</a>
Planar Configuration	(0028,0006)	1C	Not used
Image Pixel Spacing	(0028,0030)	3	<b>Note:</b> This attribute is from the NM Image Pixel Module, and does not belong in the SC Image Object (has no meaning for this type of data)
Pixel Aspect Ratio	(0028,0034)	1C	Not used
Smallest Image Pixel Value	(0028,0106)	3	Not used
Largest Image Pixel Value	(0028,0107)	3	Not used
Red Palette Color Lookup Table Descriptor	(0028,1101)	1C	Not used
Green Palette Color Lookup Table Descriptor	(0028,1102)	1C	Not used
Blue Palette Color Lookup Table Descriptor	(0028,1103)	1C	Not used
Red Palette Color Lookup Table Data	(0028,1201)	1C	Not used
Green Palette Color Lookup Table Data	(0028,1202)	1C	Not used
Blue Palette Color Lookup Table Data	(0028,1203)	1C	Not used

### 6.5.5.3.1 Image Pixel Characteristics for GENIE Generated SC Images

The GENIE P&R Release 2.1 system can generate DICOM SC Images from the screen capture menu in 3 different 8-bit formats. The pixel representation attributes for these formats are given in the table below

**Table 6-14. GENIE Screen Capture Image Pixel Module Attributes**

Attribute	1024 x 1024 B&W	512 x 512 B&W	1024 x 1024 Color
Photometric Interpretation	MONOCHROME2	MONOCHROME2	RGB
Rows	1024	512	1024
Columns	1024	512	1024
Bits Allocated	8	8	8
Bits Stored	8	8	8
High Bit	7	7	7
Pixel Representation	0	0	0

### 6.5.5.4 GENIE Private Image Pixel Module

This section specifies the Attributes that describe the pixel data of the image. This Module contains *private* Attributes that convey information not contained in the related DICOM Standard v3.0 Module. The private attributes are required for full fidelity transfer between GENIE systems. If the SC object instance was derived from GENIE original images, then some of the attributes listed in the table below may be set to values copied from the original images.

**Table 6-15. GENIE Private Image Pixel Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Picture Name	(0011,xx30)	3	Not used
Byte Order	(0011,xx38)	3	Not used
Compression Type	(0011,xx39)	3	Not used
Picture Format	(0011,xx3A)	3	Not used
Pixel Scale	(0011,xx3B)	3	Not used
Pixel Offset	(0011,xx3C)	3	Not used
Viewing Name	(0011,xx40)	3	Not used
Orientation Angle	(0011,xx41)	3	Not used
Rotation Angle	(0011,xx42)	3	Not used
Window Inverse Flag	(0011,xx43)	3	Not used
Threshold Center	(0011,xx44)	3	(2048.0)
Threshold Width	(0011,xx45)	3	(4096.0)
Interpolation Type	(0011,xx46)	3	(2)
Where Name	(0011,xx50)	3	Not used
FScalar	(0013,xx15)	3	Not used

## 6.5.6 General Modules

The SOP Common Module is mandatory for all DICOM IODs.

### 6.5.6.1 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 6-16. SOP Common Module Attributes**

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008,0016)	1	SOP Class UID
SOP Instance UID	(0008,0018)	1	SOP Instance UID
Specific Character Set	(0008,0005)	1C	Not used when the default character set (ISO 646) is used. Set to "ISO_IR 100" when extended character sets are used.
Instance Creation Date	(0008,0012)	3	Not used
Instance Creation Time	(0008,0013)	3	Not used
Instance Creator UID	(0008,0014)	3	Not used

### 6.5.6.2 SC Equipment Module

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

**Table 6-17. SC Image Equipment Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Conversion Type	(0008,0064)	1	Workstation image conversion "WSD"
Modality	(0008,0060)	3	Modality
Secondary Capture Device ID	(0018,1010)	3	Secondary Capture Device ID
Secondary Capture Device Manufacturer	(0018,1016)	3	Secondary Capture Device Manufacturer
Secondary Capture Device Manufacturer's Model Name	(0018,1018)	3	Secondary Capture Device Manufacturer's Model Name
Secondary Capture Device Software Version	(0018,1019)	3	Secondary Capture Device Software Version
Video Image Format Acquired	(0018,1022)	3	Not used
Digital Image Format Acquired	(0018,1023)	3	Not used



### 6.5.6.3 SC Image Module

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

**Table 6-18. SC Image Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Date of Secondary Capture	(0018,1012)	3	Not Used
Time of Secondary Capture	(0018,1014)	3	Not Used

## 6.6 PRIVATE DATA DICTIONARY

The GENIE Private Data Dictionary for the Nuclear Medicine Image Object implementation also applies to the Secondary Capture Image Object implementation. See Section [Section 3.6 - Private Data Dictionary](#) for the Data Dictionary.

## SECTION 7

# INDEPENDENT CURVE INFORMATION OBJECT IMPLEMENTATION

### 7.1 INTRODUCTION

The DICOM Standalone Curve Object (SOP Class 1.2.840.10008.5.1.4.1.1.9) is implemented for conveying curve and ROI data. This section specifies the use of the DICOM Standalone Curve IOD to represent the information included in curve data produced by this implementation. GENIE Curve objects include time activity curves, image profile histograms, and acquisition energy spectrum histograms. Curve object attributes are described using the module construct. The contents of this section are:

- [Section 7.2 - Standalone Curve IOD Implementation](#)
- [Section 7.3 - Curve Entity-Relationship Model](#)
- [Section 7.4 - IOD Module Table](#)
- [Section 7.5 - Information Module Definitions](#)

The GENIE implementation of ROI data using the Curve IOD is covered in another major section of this document.

### 7.2 STANDALONE CURVE IOD IMPLEMENTATION

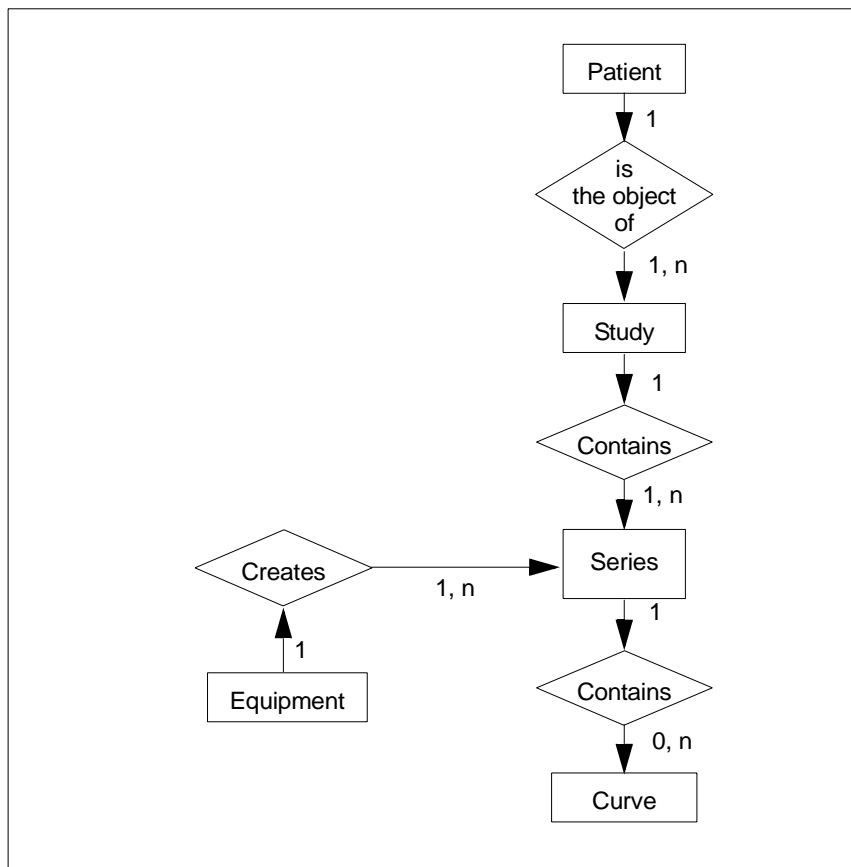
The DICOM Standalone Curve Object implementation is used for DICOM transfer of curve and ROI data listed in the patient selector on GENIE P&R R2.1. Standard and private elements are used in representing curve data for preserving all database attributes between compatible GENIE systems.

### 7.3 CURVE ENTITY-RELATIONSHIP MODEL

The Entity-Relationship diagram for the independent 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. For example, the relationship between Series and Curve can have up to n Curves per Series, but the Curve can only belong to 1 Series.



**Illustration 7-1.** Curve Entity Relationship Diagram

### 7.3.1 Entity Description

Please refer to DICOM Standard Part 3 (Information Object Definitions) for a description of each of the entities contained within the Curve 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 represents graphical information which can be defined as a series of connected points. The independent curve may be associated with an image, as for an irregular ROI, or it may represent data derived from images or other data.

## 7.3.2 GENIE P&R Mapping of DICOM Entities

Table 7-1. Mapping of DICOM Entities to GENIE P&R Entities

DICOM	GENIE P&R Entity
Patient	Patient
Study	Exam
Series	Series
Equipment	Equipment
Curve	Curve
Curve	ROI (Region of Interest)

## 7.4 IOD MODULE TABLE

Within an entity of the DICOM v3.0 Curve IOD, attributes are grouped into related sets 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 DICOM datasets.

Table 7-2 identifies the defined modules within the entities which comprise the DICOM v3.0 Curve IOD. Modules are identified by Module Name.

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

**Table 7-2. GENIE Curve IOD Modules**

Entity Name	Module Name	Reference
Patient	Patient	<a href="#">Section 7.5.1.1</a>
	GENIE Patient	<a href="#">Section 7.5.1.2</a>
Study	General Study	<a href="#">Section 7.5.2.1</a>
	Patient Study	<a href="#">Section 7.5.2.2</a>
	GENIE Study	<a href="#">Section 7.5.2.3</a>
	Study Classification	
Series	General Series	<a href="#">Section 7.5.3.1</a>
	NM Series	
	GENIE General Series	<a href="#">Section 7.5.3.2</a>
Equipment	General Equipment	<a href="#">Section 7.5.4.1</a>
Curve	Curve Identification	<a href="#">Section 7.5.5.1</a>
	Standard Curve	<a href="#">Section 7.5.5.2</a>
	Meta4 Private Curve	<a href="#">Section 7.5.5.3</a>
	GENIE Private Curve	<a href="#">Section 7.5.5.4</a>
	GENIE Spectrum Acquisition	<a href="#">Section 7.5.5.5</a>
	SOP Common	<a href="#">Section 7.5.5.6</a>

## 7.5 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. Attributes from the DICOM Standard modules 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 7-3. Patient Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Patient's Name	(0010,0010)	2	Patient's Name
Patient ID	(0010,0020)	2	Patient ID
Patient's Birth Date	(0010,0030)	2	Patient's Birth Date
Patient's Sex	(0010,0040)	2	Patient's Sex
Referenced Patient Sequence	(0008,1120)	3	Not used
>Referenced SOP Class UID	(0008,1150)	1C	Not used
>Referenced SOP Instance UID	(0008,1155)	1C	Not used
Patient's Birth Time	(0010,0032)	3	Not used
Other Patient IDs	(0010,1000)	3	Other Patient IDs
Other Patient Names	(0010,1001)	3	Other Patient Names
Ethnic Group	(0010,2160)	3	Ethnic Group
Patient Comments	(0010,4000)	3	Patient Comments

### 7.5.1.2 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 *private* Attributes that convey information not contained in the related DICOM Standard v3.0 Module.

**Table 7-4. GENIE Private Patient Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Patient Object Name	(0009,xx40)	3	Name of the Database Patient Object
Patient Flags	(0009,xx41)	3	Defines patient information.
Patient Creation Date	(0009,xx42)	3	Date of Patient Entity creation (yyyy.mm.dd format).
Patient Creation Time	(0009,xx43)	3	Time of Patient Entity creation (hh:mm:ss.f format).

### 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. General Study Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Study Instance UID	(0020,000D)	1	Study Instance UID
Study Date	(0008,0020)	2	Study Date
Study Time	(0008,0030)	2	Study Time
Referring Physician's Name	(0008,0090)	2	Referring Physician's Name
Study ID	(0020,0010)	2	Study ID
Accession Number	(0008,0050)	2	Accession Number
Study Description	(0008,1030)	3	Study Description
Physician(s) of Record	(0008,1048)	3	Not used
Name of Physician(s) Reading Study	(0008,1060)	3	Name of Physician(s) Reading Study
Referenced Study Sequence	(0008,1110)	3	Not used
>Referenced SOP Class UID	(0008,1150)	1C	Not used
>Referenced SOP Instance UID	(0008,1155))	1C	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 7-6. Patient Study Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Admitting Diagnoses Description	(0008,1080)	3	Not Used
Patient's Age	(0010,1010)	3	Patient's Age
Patient's Size	(0010,1020)	3	Patient's height
Patient's Weight	(0010,1030)	3	Patient's Weight
Occupation	(0010,2180)	3	Occupation
Additional Patient's History	(0010,21B0))	3	Additional Patient's History

### 7.5.2.3 GENIE Private Study Module

This section specifies the Attributes which describe and identify the Study performed upon the Patient. This Module contains *private* Attributes that convey information not contained in the related DICOM Standard v3.0 Module.

**Table 7-7. GENIE Private Study Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Study Name	(0009,xx10)	3	Name of the Database Study Object
Study Flags	(0009,xx11)	3	Defines study information.
Study Type	(0009,xx12)	3	Defines type of study.
Study Comments	(0013,xx26)	3	User-defined additional information about the study.



## 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 7-8. General Series Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	SC Images created by GENIE P&R generally have this attribute set to the value found in the original image. Defined Terms: CR = Computed Radiography CT = Computed Tomography MR = Magnetic Resonance NM = Nuclear Medicine US = Ultrasound OT = Other AS = Angioscopy BI = Biomagnetic imaging CD = Color flow Doppler CP = Culposcopy CS = Cystoscopy DD = Duplex Doppler DG = Diaphanography DM = Digital microscopy EC = Echocardiography ES = Endoscopy FA = Fluorescein angiography FS = Fundoscopy LP = Laparoscopy LS = Laser surface scan MA = MRA MS = MRS PT = PET RG = Radiographic imaging ST = SPECT TG = Thermography XA = X-Ray Angiography RF = Radio Fluoroscopy
Series Instance UID	(0020,000E)	1	Series Instance UID
Series Number	(0020,0011)	2	Series Number
Laterality	(0020,0060)	2C	Laterality
Series Date	(0008,0021)	3	Series Date
Series Time	(0008,0031)	3	Series Time
Performing Physicians' Name	(0008,1050)	3	Not used
Protocol Name	(0018,1030)	3	Protocol Name

**Table 7-8. General Series Module Attributes**

Series Description	(0008,103E)	3	Series Description
Operators' Name	(0008,1070)	3	Operators' Name
Referenced Study Component Sequence	(0008,1111)	3	Not used
>Referenced SOP Class UID	(0008,1150)	1C	Not used
>Referenced SOP Instance UID	(0008,1155)	1C	Not used
Body Part Examined	(0018,0015)	3	Body Part Examined
Patient Position	(0018,5100)	2C	The Defined Terms are: HFP = Head First-Prone HFS = Head First-Supine HFDR = Head First-Decubitus Right HFDL = Head First-Decubitus Left FFDR = Feet First-Decubitus Right FFDL = Feet First-Decubitus Left FFP = Feet First-Prone FFS = Feet First-Supine
Smallest Pixel Value in Series	(0028,0108)	3	Smallest Pixel Value in Series
Largest Pixel Value in Series	(0028,0109)	3	Largest Pixel Value in Series

### 7.5.3.2 GENIE Private Series Module

This section specifies the Attributes which identify and describe general information about the Series within a Study. This Module contains *private* Attributes that convey information not contained in the related DICOM Standard v3.0 Module.

**Table 7-9. GENIE Private Series Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Series Name	(0009,xx21)	3	Name of the Database Series Object.
Series Flags	(0009,xx21)	3	Not used
User Orientation	(0009,xx22)	3	Not used
Initiation Type	(0009,xx23)	3	Not used
Initiation Delay	(0009,xx24)	3	Not used
Initiation Count Rate	(0009,xx25)	3	Not used
Number Energy Sets	(0009,xx26)	3	Not used
Number Detec	(0009,xx27)	3	Not used
Number R-R Windows	(0009,xx28)	3	Not used
Number MG Time Slots	(0009,xx29)	3	Not used
Number View Sets	(0009,xx2A)	3	Not used
Trigger History UID	(0009,xx2B)	3	Not used
Series Comments	(0009,xx2C)	3	Not used
Distance Prescribed	(0009,xx2E)	3	Not used
Series Type	(0011,xx0A)	3	Not used
Effective Series Duration	(0011,xx0B)	3	Not used
Number Beats	(0011,xx0C)	3	Not used

## 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. If the Curve object instance was derived from GENIE images, then some of the attributes listed in the table below may be set to values copied from the image attributes.

**Table 7-10. General Equipment Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Manufacturer	(0008,0070)	2	Manufacturer
Institution Name	(0008,0080)	3	Institution Name
Institution Address	(0008,0081)	3	Not used
Station Name	(0008,1010)	3	Station Name
Institutional Department Name	(0008,1040)	3	Not used
Manufacturer's Model Name	(0008,1090)	3	Manufacturer's Model Name
Device Serial Number	(0018,1000)	3	Device Serial Number
Software Versions	(0018,1020)	3	Software Versions
Spatial Resolution	(0018,1050)	3	Not used
Date of Last Calibration	(0018,1200)	3	Not used
Time of Last Calibration	(0018,1201)	3	Not used
Pixel Padding Value	(0028,0120)	3	Not used

## 7.5.5 Independent Curve Entity Modules

The following Modules define the attributes for the Curve IE.

### 7.5.5.1 Curve Identification Module

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

**Table 7-11. Curve Identification Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Curve Number	(0020,0024)	2	Not used
Curve Date	(0008,0025)	3	Creation date
Curve Time	(0008,0035)	3	Creation time
Referenced Image Sequence	(0008,1140)	3	Not used
>Referenced SOP Class UID	(0008,1150)	1C	Not used
>Referenced SOP Instance UID	(0008,1155)	1C	Not used
Referenced Overlay Sequence	(0008,1130)	3	Not used
>Referenced SOP Class UID	(0008,1150)	1C	Not used
>Referenced SOP Instance UID	(0008,1155)	1C	Not used
Referenced Curve Sequence	(0008,1145)	3	Not used
>Referenced SOP Class UID	(0008,1150)	1C	Not used
>Referenced SOP Instance UID	(0008,1155)	1C	Not used

## 7.5.5.2 Standard Curve Module

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

**Table 7-12. Standard Curve Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Curve Dimensions	(50xx,0005)	1	Curve Dimensions
Number of Points	(50xx,0010)	1	Number of Points
Type of Data	(50xx,0020)	1	Type of Data: TAC for discrete interval plots HIST for discrete interval bar graphs PROF for image profile plots
Data Value Representation	(50xx,0103)	1	Data Value Representation: set to 0003H = Floating Point Double (DICOM type FD)
Curve Data	(50xx,3000)	1	Curve Data
Curve Description	(50xx,0022)	3	Curve Legend or Curve Name
Axis Units, value 1 Axis Units, value 2	(50xx,0030)	3	x-units y-units
Axis Labels	(50xx,0040)	3	Set to defaults for export. Not used for import.
Minimum Coordinate Value	(50xx,0104)	3	value 1 = x, value 2 = y
Maximum Coordinate Value	(50xx,0105)	3	value 1 = x, value 2 = y
Curve Range	(50xx,0106)	3	not used
Curve Data Descriptor	(50xx,0110)	1C	not used
Coordinate Start Value	(50xx,0112)	1C	not used
Coordinate Step Value	(50xx,0114)	1C	not used
Curve Label	(50xx,2500)	3	Curve Label (Curve Legend or Curve Name)
Referenced Overlay Sequence	(50xx,2600)	3	not used
> Referenced SOP Class UID	(0008,1150)	1	not used
> Referenced SOP Instance UID	(0008,1155)	1	not used
> Referenced Overlay Group	(50xx,2610)	1	not used

### 7.5.5.3 Meta4 Private Curve Module

This section specifies the Attributes used for Meta4 curve manipulation and display. This module is a private extended set of the DICOM curve attributes. These attributes are required for full fidelity transfer of curve data between GENIE systems.

**Table 7-13. Meta4 Private Curve Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Modified	(5001,xx01)	3	Modified
Name	(5001,xx02)	3	Name
Cid	(5001,xx03)	3	Cid
Srid	(5001,xx04)	3	Srid
SOPClassUID	(5001,xx05)	3	SOPClassUID
SOPInstanceUID	(5001,xx06)	3	SOPInstanceUID
CurveType	(5001,xx07)	3	CurveType
GraphType	(5001,xx08)	3	GraphType
Legend	(5001,xx09)	3	Legend
XUnits	(5001,xx0A)	3	XUnits
YUnits	(5001,xx0B)	3	YUnits
Edit	(5001,xx0C)	3	Edit
Suspend	(5001,xx0D)	3	Suspend
StyleLine	(5001,xx0E)	3	StyleLine
StyleFill	(5001,xx0F)	3	StyleFill
StyleColour	(5001,xx10)	3	StyleColour
StyleWidth	(5001,xx11)	3	StyleWidth
StylePoint	(5001,xx12)	3	StylePoint
StylePColour	(5001,xx13)	3	StylePColour
StylePSize	(5001,xx14)	3	StylePSize
Segments	(5001,xx15)	3	Segments
SegType	(5001,xx16)	3	SegType
SegStart	(5001,xx17)	3	SegStart
SegEnd	(5001,xx18)	3	SegEnd
SegStyleLine	(5001,xx19)	3	SegStyleLine
SegStyleFill	(5001,xx1A)	3	SegStyleFill
SegStyleColour	(5001,xx1B)	3	SegStyleColour
SegStyleWidth	(5001,xx1C)	3	SegStyleWidth
SegStylePoint	(5001,xx1D)	3	SegStylePoint
SegStylePColour	(5001,xx1E)	3	SegStylePColour
SegStylePSize	(5001,xx1F)	3	SegStylePSize
SegName	(5001,xx20)	3	SegName
SegAllowDirInt	(5001,xx21)	3	SegAllowDirInt

**Table 7-13. Meta4 Private Curve Module Attributes**

TextAnnots	(5001,xx22)	3	TextAnnots
TxtX	(5001,xx23)	3	TxtX
TxtY	(5001,xx24)	3	TxtY
TxtText	(5001,xx25)	3	TxtText
TxtName	(5001,xx26)	3	TxtName

#### 7.5.5.4 GENIE Private Curve Module

This section specifies the Attributes used for GENIE curve manipulation and display. This module is a private extended set of the DICOM curve attributes. These attributes describe the parental image and ROI objects, and are required for full fidelity transfer of curve data between GENIE systems.

**Table 7-14. GENIE PRIVATE Curve Module Attributes**

Attribute Name	Tag	Type	Attribute Description
ROIName	(5001,xx30)	3	ROIName
DerivedFromImageUID	(5001,xx31)	3	DerivedFromImageUID
DerivedFromImages	(5001,xx32)	3	DerivedFromImages
CurveFlags	(5001,xx33)	3	CurveFlags
CurveName	(5001,xx34)	3	CurveName
DatasetName	(5001,xx35)	3	DatasetName
CurveUID	(5001,xx36)	3	CurveUID
ROIArea	(5001,xx37)	3	ROIArea

### 7.5.5.5 GENIE Private Energy Spectrum Module

This section specifies the Attributes used for GENIE energy spectrum histograms. This module is a private extended set of the DICOM curve attributes. These attributes describe related image acquisition information, and are required for full fidelity transfer of curve data between GENIE systems.

**Table 7-15. GENIE Private Spectrum Acquisition Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Modified	(50xx,xx38)	3	Modified
Name	(50xx,xx39)	3	Name
Software version	(50xx,xx3A)	3	Software version
StartDate	(50xx,xx3B)	3	StartDate
CompletionDate	(50xx,xx3C)	3	CompletionDate
DetectorName	(50xx,xx3D)	3	DetectorName
Counts Accumulated	(0018,0070)	3	DetectorCounts
Count Rate	(0018,1243)	3	DetectorCountRate
Smallest Pixel Value in Series	(0028,0108)	3	MinCount
Largest Pixel Value in Series	(0028,0109)	3	MaxCount
Radionuclide	(0018,0030)	3	RadioNuclideName
Radiopharmaceutical	(0018,0031)	3	RadioPharmaceutical

### 7.5.5.6 SOP Common Module

This section defines the Attributes which are required for proper functioning and identification of the SOP Instances. They do not specify any semantics about the Real-World Object represented by the IOD.

**Table 7-16. SOP Common Module Attributes**

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008,0016)	1	SOP Class UID
SOP Instance UID	(0008,0018)	1	SOP Instance UID
Specific Character Set	(0008,0005)	1C	Not used when the default character set ISO IR6 is used. Set to "ISO_IR 100" when extended character sets are used.
Instance Creation Date	(0008,0012)	3	Not used
Instance Creation Time	(0008,0013)	3	Not used
Instance Creator UID	(0008,0014)	3	Not used



## SECTION 8

# REGION OF INTEREST (ROI) INFORMATION OBJECT IMPLEMENTATION

### 8.1 INTRODUCTION

The DICOM Standalone Curve Object (SOP Class 1.2.840.10008.5.1.4.1.1.9) is implemented for conveying curve and Region Of Interest data. This section specifies the use of the DICOM Standalone Curve IOD to represent the information included in ROI data produced by this implementation. ROI Object attributes are described using the module construct. The contents of this section are:

[Section 8.2 - Standalone Curve IOD Implementation](#)

[Section 8.3 - ROI Entity-Relationship Model](#)

[Section 8.3 - ROI Entity-Relationship Model](#)

[Section 8.4 - IOD Module Table](#)

[Section 8.5 - Information Module Definitions](#)

### 8.2 STANDALONE CURVE IOD IMPLEMENTATION

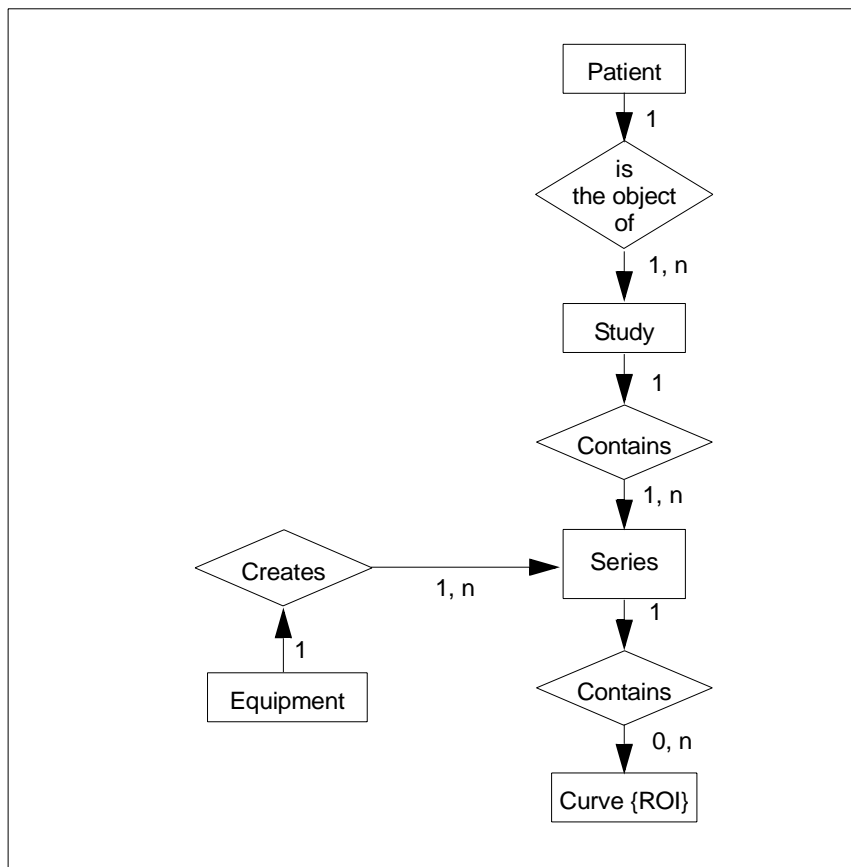
The DICOM Standalone Curve Object implementation is used for DICOM transfer of ROI data associated with image datasets listed in the patient selector on GENIE P&R R2.1. Standard and private elements are used in representing ROI data for preserving all database attributes between compatible GENIE systems.

### 8.3 ROI ENTITY-RELATIONSHIP MODEL

The Entity-Relationship diagram for the DICOM independent Curve interoperability schema is shown in [Illustration 8-1](#). 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. For example, the relationship between Series and ROI can have up to n ROIs per Series, but a ROI can only belong to 1 Series.



**Illustration 8-1.** ROI Entity Relationship Diagram

### 8.3.1 Entity Description

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

#### 8.3.1.1 Patient, Study, Series and Equipment Entity Description

Please see [Section 7.3.1.1](#), [Section 7.3.1.2](#), [Section 7.3.1.3](#) and [Section 7.3.1.4](#) for descriptions.

#### 8.3.1.2 Curve Entity Description

The Curve Entity represents graphical information which can be defined as a series of connected points. The independent curve may be associated with an image, as for an irregular ROI, or it may represent data derived from images or other data. The GENIE ROI is represented by the Curve Entity.

## **8.4 IOD MODULE TABLE**

Please see [Section 7.4 - IOD Module Table](#) description.

## **8.5 INFORMATION MODULE DEFINITIONS**

Please see [Section 7.5 - Information Module Definitions](#) description.

## SECTION 9 GENIE PROTOCOL DATA OBJECT IMPLEMENTATION

### 9.1 INTRODUCTION

The GENIE non-image data objects described in this section include the Protocol Data Object, the Series Data Object, and the Q Script Object. A related object for Review Data is defined in another section. All of these objects are implemented using a GENIE private DICOM SOP class. The object type is determined by the use of an object type attribute, as defined in the tables.

### 9.2 GENIE PROTOCOL DATA IOD IMPLEMENTATION

The GENIE protocol data objects are used for storage of image processing data that is beyond the image attributes defined in the GENIE database. The format for protocol data is defined individually by application software for an unlimited number of different protocols. A protocol data object is associated with a Study or a Series, and not associated with an Image. For this reason a stand-alone private object is defined for transferring protocol data between GENIE systems.

### 9.3 IOD MODULE TABLE

This section of the mapping document defines a GENIE private Protocol Data Object that consists of the DICOM standard Patient, Study, Series, and SOP Common modules, and the GENIE Private Protocol Data Module. The private module is based on the Protocol Data Table and Series Data Table that are defined in the GENIE Database Schema Document.

The GENIE Private Protocol Data Object Module Table is shown below. The Patient, Study, and other standard modules use all of the standard mapping tables defined in the image data parts of the mapping document. The Nuclear Medicine specific tables and the GENIE private tables from the image IODs are not a part of the Protocol Data Object. Only the modules shown are included in the private object.

The GENIE private data dictionary will be extended to show the value representation and other characteristics of the private elements shown in the table.

The GENIE Protocol Data Object contains the following modules. Series Data object instances use all of the modules shown. Protocol Data object instances use all but the Series module.

**Table 9-1. Protocol Data IOD Modules**

Entity	Module	Reference	Usage
Patient	Patient	<a href="#">Section 7.5.1.1</a>	PDO,SDO
Study	General Study	<a href="#">Section 7.5.2.1</a>	PDO,SDO
Series	General Series	<a href="#">Section 7.5.3.1</a>	SDO
GENIE Data	GENIE Protocol Data	<a href="#">Section 9.4.4</a>	PDO,SDO
	SOP Common	<a href="#">Section 7.5.5.6</a>	PDO,SDO

## 9.4 INFORMATION MODULE DEFINITIONS

The table below shows the GENIE to DICOM mappings for the Protocol Data Object and the Series Data Object. The same private object definition is used for both of the GENIE objects. Most of the module attributes are identical between the two objects. Two of the attributes have separate entries for the PDO and SDO, but the types are the same, and the export/import rules are the same.

### 9.4.1 GENIE Protocol Data Module Attributes

The following table shows the mapping for Protocol Data Objects and Series Data Objects to the GENIE private object.

**Table 9-2. Private Data Module Attributes**

Tag	DICOM Attribute Name	Genie Module	Genie Db Name	EXPORT Mapping Function	IMPORT Mapping Function	Default Value
(0033,xx08)	GENIE Data Object Type	PDO/SDO	(N.A. - see Note 1)	-	-	-
(0033,xx10)	Modified	PDO/SDO	Modified	copy	copy	0
(0033,xx11)	Name	PDO/SDO	Name	copy	copy	“Protocol Data”
(0008,0016)	SOPClassUID	PDO/SDO	SOPClassUID	copy	copy	CREATE
(0008,0018)	SOPInstanceUID	PDO/SDO	SOPInstanceUID	copy	copy	CREATE
(0033,xx16)	ProtocolDataUID	PDO SDO	ProtocolDataUID SeriesDataUID	copy	copy	CREATE CREATE
(0033,xx17)	Date	PDO/SDO	Date	copy	copy	current date
(0033,xx18)	Time	PDO/SDO	Time	copy	copy	current time
(0033,xx19)	ProtocoldataFlags	PDO/SDO	ProtocoldataFlags	copy	copy	0
(0033,xx1A)	ProtocolName	PDO/SDO	ProtocolName	copy	copy	“DICOM_Prdata”
(0033,xx1B)	<b>RelevantDataUID</b>	PDO SDO	<b>StudyID</b> <b>RelevantDataUID</b>	copy	copy	Study UID Series UID
(0033,xx1C)	BulkData	PDO/SDO	BulkData	copy Note 2	copy	0
(0033,xx1D)	IntData	PDO/SDO	IntData	copy	copy	0
(0033,xx1E)	DoubleData	PDO/SDO	DoubleData	copy	copy	0
(0033,xx1F)	StringData	PDO/SDO	StringData	copy Note 3	copy	null
(0033,xx20)	BulkDataFormat	PDO/SDO	BulkDataFormat	copy Note 3	copy	null
(0033,xx21)	IntDataFormat	PDO/SDO	IntDataFormat	copy Note 3	copy	null
(0033,xx22)	DoubleDataFormat	PDO/SDO	DoubleDataFormat	copy Note 3	copy	null
(0033,xx23)	StringDataFormat	PDO/SDO	StringDataFormat	copy Note 3	copy	null
(0033,xx24)	Description	PDO/SDO	Description	copy	copy	“Protocol Data”
(0055,xx64)	SDODoubleData SQ	PDO/SDO	Description	Note 4		
(0033,xx1E)	DoubleData	SDO	DoubleData	copy	copy	0

**Notes**

1. The Object Type attribute is created when the data is exported. Its value can be PROTOCOL DATA | SERIES DATA | Q SCRIPT | REVIEW DATA. When the Protocol Data object is imported, this attribute is used to create the appropriate GENIE database object
2. The Bulk Data is formatted as OB type.
3. These attributes are stored as two dimensional array of strings in GENIE SDO/PDO objects. While formatting to DICOM NULL strings are represented as ""\*\*"" which are ignored by the GENIE SCP.
4. The SDO DoubleData is too huge whose length is too large to fit in 2bytes of length field of DICOM Element. To overcome this it is decided to fragment to DoubleData into number of SQ items whose length is less than the 65352.

### **9.4.2 General Mapping Rules for Protocol Data**

All of the GENIE database attributes in the Patient, Study, and Series modules are copied directly to or from the DICOM dataset as defined in the image mapping tables for the parent Patient/Study/Series.

### **9.4.3 Export Notes for Protocol Datasets**

Every GENIE database attribute in the protocol data module is copied directly into the DICOM dataset. There are no defaults on export. If there is no value in the database, then the elements may be left out of the DICOM dataset.

### **9.4.4 Import Notes for Protocol Datasets**

A GENIE PDO or SDO is created, header attributes are copied, created or set by default, and the protocol data and data formats are copied directly. There are no mandatory attributes

## APPENDIX A GENIE PRIVATE DATA DICTIONARY

**Table A-1. GENIE Private Patient Module Attributes**

<b>Attribute Name</b>	<b>Tag</b>	<b>Type</b>	<b>Attribute Description</b>
Patient Object Name	(0009,xx40)	3	Name of the Database Patient Object
Patient Flags	(0009,xx41)	3	Defines patient information.
Patient Creation Date	(0009,xx42)	3	Date of Patient Entity creation (yyyy.mm.dd format).
Patient Creation Time	(0009,xx43)	3	Time of Patient Entity creation (hh:mm:ss.f format).

**Table A-2. GENIE Private Study Module Attributes**

<b>Attribute Name</b>	<b>Tag</b>	<b>Type</b>	<b>Attribute Description</b>
Study Name	(0009,xx10)	3	Name of the Database Study Object
Study Flags	(0009,xx11)	3	Defines study information.
Study Type	(0009,xx12)	3	Defines type of study.
Study Comments	(0013,xx26)	3	User-defined additional information about the study.

**Table A-3. GENIE Private Series Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Series Name	(0009,xx21)	3	Name of the Database Series Object.
Series Flags	(0009,xx21)	3	Defines series information.
User Orientation	(0009,xx22)	3	User specified patient orientation.
Initiation Type	(0009,xx23)	3	Acquisition initiation type. The Defined Terms are: 0 = started on count rate 1 = started after time delay 2 = started manually
Initiation Delay	(0009,xx24)	3	Acquisition start delay time.
Initiation Count Rate	(0009,xx25))	3	Acquisition start count rate
Number Energy Sets	(0009,xx26)	3	Number of energy sets in this Series.
Number Detectors	(0009,xx27))	3	Number of detectors.
Number R-R Windows	(0009,xx28)	3	Number of R-R Interval Windows.
Number MG Time Slots	(0009,xx29)	3	Number of R-R Interval time bins.
Number View Sets	(0009,xx2A)	3	Number of view sets in this Series.
Trigger History UID	(0009,xx2B)	3	Trigger History UID.
Series Comments	(0009,xx2C)	3	User-defined additional information about the series.
Distance Prescribed	(0009,xx2E)	3	User prescribed whole body scanning distance.
Series Type	(0011,xx0A)	3	Defines type of series. The Defined Terms are: 0 = static 1 = whole body 3 = multi-gated 6 = dynamic 9 = tomographic
Effective Series Duration	(0011,xx0B)	3	Duration of series acquisition.
Number Beats	(0011,xx0C)	3	Number of physiological triggers during acquisition.



**Table A-4. GENIE Private Image Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Radio Nuclide Name	(0011,xx0D)	3	Name of radionuclide used.
Dataset Object Name	(0011,xx10)	3	Name of the Database Dataset Object.
Dataset Modified	(0011,xx11)	3	Not Used
Dataset Name	(0011,xx12)	3	Dataset Name
Dataset Type	(0011,xx13)	3	Defines type of dataset. The Defined Terms are: 0 = static 2 = whole body 8 = dynamic 11 = multi-gated 12 = tomographic planar
Completion Time	(0011,xx14)	3	Completion Time
Detector Number	(0011,xx15)	3	Detector number image was acquired by.
Energy Number	(0011,xx16)	3	Energy set number.
RR Interval Window Number	(0011,xx17)	3	R-R interval number (TIAR number).
MG Bin Number	(0011,xx18)	3	Multi-gated time bin number.
Radius Of Rotation	(0011,xx19)	3	Distance to the center of detector rotation.
Detector Count Zone	(0011,xx1A)	3	FOV zone for count-based acquisition termination criteria. The Defined Terms are: 0 = none specified 1 = total (all) counts 2 = counts in energy set 3 = counts inside an ROI 4 = counts outside an ROI
Num Energy Windows	(0011,xx1B)	3	Number of energy windows in energy set.
Image Orientation	(0011,xx1F)	3	Orientation of the image. The Defined Terms are: 0 = no rotation, no mirroring 1 = no rotation, mirrored
Table Orientation	(0011,xx26)	3	Orientation of the table for whole body acquisition. The Defined Terms are: 0 = direction in/out 1 = direction left/right
ROI Top Left	(0011,xx27)	3	Acquisition count zone ROI, top left coordinate.
ROI Bottom Right	(0011,xx28)	3	Acquisition count zone ROI, bottom right coordinate.
View X Adjustment	(0011,xx2C)	3	View X Adjustment
View Y Adjustment	(0011,xx2D)	3	View Y Adjustment
Pixel Overflow Flag	(0011,xx2E)	3	Pixel Overflow Flag (Starcam)
Pixel Overflow Level	(0011,xx2F)	3	Pixel Overflow Level
Acquisition Parent UID	(0011,xx31)	3	Acquisition Parent UID
Processing Parent UID	(0011,xx32)	3	Processing Parent UID
Energy Correct Name	(0011,xx33)	3	Name of applied energy correction.
Spatial Correct Name	(0011,xx34)	3	Name of applied spatial correction.
Tuning Calib Name	(0011,xx35)	3	Name of applied tuning calibration data.

**Table A-4. GENIE Private Image Module Attributes**

Uniformity Correct Name	(0011,xx36)	3	Name of associated uniformity correction.
Acquisition Specific Correct Name	(0011,xx37)	3	Name(s) of associated acquisition specific correction(s).
Dataset Flags	(0011,xx3F)	3	Defines dataset information.
Period	(0011,xx55)	3	Period
Elapsed Time	(0011,xx56)	3	Elapsed Time
FOV	(0011,xx57)	3	FOV
Digital FOV	(0013,xx10)	3	Digital FOV
Source Translator	(0013,xx11)	3	Source Translator
RAL Flags	(0013,xx12)	3	RAL Flags
GENIE Frame Sequence	(0013,xx13)	3	GENIE Frame Sequence
>Frame Termination Condition	(0013,xx)	3	Frame Termination Condition
>Frame Termination Value	(0013,xx)	3	Frame Termination Value
>Original Image Number	(0013,xx)	3	Original Image Number

**Table A-5. GENIE Private Image Pixel Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Picture Name	(0011,xx30)	3	Name of the database Picture Object
Byte Order	(0011,xx38)	3	Defines pixel data byte order. The Defined Terms are: = little endian 66 = big endian
Compression Type	(0011,xx39)	3	Compression information
Picture Format	(0011,xx3A)	3	GENIE IAP image format
Pixel Scale	(0011,xx3B)	3	Set to 1.0.
Pixel Offset	(0011,xx3C)	3	Set to 0.0.
Viewing Name	(0011,xx40)	3	Name of the database Viewing Object
Orientation Angle	(0011,xx41)	3	Orientation Angle
Rotation Angle	(0011,xx42)	3	Rotation Angle
Window Inverse Flag	(0011,xx43)	3	Window Inverse Flag
Threshold Center	(0011,xx44)	3	(2048.0)
Threshold Width	(0011,xx45)	3	(4096.0)
Interpolation Type	(0011,xx46)	3	(2)
Where Name	(0011,xx50)	3	Name of the database Where Object
FScalar	(0013,xx15)	3	Scaling Factor for Floating Point pixel data

**Table A-6. GENIE Private Isotope Module Attributes**

Attribute Name	Tag	Type	Attribute Description
GENIE Energy Window Information Sequence	(0055,xx12)	3	
>GENIE Energy Window Range Sequence	(0055,xx13)	3	
>>Energy Offset	(0011,xx1C))	3	Energy window offset as a percentage of the energy peak.
>>Energy Range	(0011,xx1D)	3	The Defined Terms are: 0 = low energy range, X-series detector 1 = high energy range, X-series detector 2 = GE 511 Camera Range 3 = Unknown
>>AutoTrack Peak	(0013,xx16)	3	Optima AutoTrack energy peak.
>>AutoTrack Width	(0013,xx17)	3	Optima AutoTrack energy width.

**Table A-7. GENIE Private Detector Module Attributes**

Attribute Name	Tag	Type	Attribute Description
GENIE Detector Information Sequence	(0055,xx22)	3	GENIE detector information.
>Use FOV Mask	(0011,xx23)	3	Whether FOV mask used during image acquisition. The Defined Terms are: 0 = no mask used 1 = FOV mask used
>FOV Mask Y Cutoff Distance	(0011,xx24)	3	Hexagonal FOV mask Y cutoff angle.
>FOV Mask Cutoff Angle	(0011,xx25)	3	Hexagonal FOV mask cutoff angle.
>Uniformity Mean	(0011,xx29)	3	Uniformity Mean value
>FOV Shape	(0011,xx3E)	3	GEMS NM system detector type. The Defined Terms are: 1 = 400AC 6 = Optima 7 = MAXXUS 8 = Millennium MPS 9 = Millennium MPR 10 = Millennium MG
>Transmission Scan Time	(0013,xx18)	3	Attenuation correction transmission scan duration.
>Transmission Mask Width	(0013,xx19)	3	Attenuation correction transmission scan mask width.
>Copper Attenuator Thickness	(0013,xx1A)	3	Thickness of transmission scan copper attenuator.
>Tomo View Offset	(0013,xx1E)	3	Tomo view detector offset (vector)
>Start Angle	(0035,xx01)	3	Detector start angle

**Table A-8. GENIE Private TOMO Acquisition Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Rotational Continuous Speed	(0009,xx33)	3	Rotational Continuous Speed
Gantry Locus Type	(0009,xx35)	3	Locus type of gantry motion during acquisition. The Defined Terms are: 0 = circular 1 = elliptical
Num ECT Phases	(0015,xx12)	3	Number of ECT Phases
Num WB Scans	(0015,xx13)	3	Number of WB Scans
Det Ang Separation	(0013,xx1B)	3	Detector Ang Separation
GENIE Rotation Information Sequence	(0055,xx52)	3	
>ECT Phase Num	(0015,xx14)	3	ECT Phase Number
>WB Scan Num	(0015,xx15)	3	WB Scan Number
>Comb Head Number	(0015,xx16)	3	Comb Head Number
>Axial Acceptance Angle	(0013,xx1C)	3	Axial Acceptance Angle
>Theta Acceptance Value	(0013,xx1D)	3	Theta Acceptance Value
>Tomo View Offset	(0013,xx1E)	3	Table of offsets from COR during acquisition.

**Table A-9. GENIE Private Multi-Gated Acquisition Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Starting Heart Rate	(0009,xx37)	3	Heart rate at start of acquisition.
Track Beat Average	(0009,xx2D)	3	Heart rate tracking used during acquisition.
Percent Cycle Imaged	(0009,xx3A)	3	Percent Cycle Imaged
Preceding Beat	(0015,xx17)	3	Preceding Beat
GENIE Gated Information Sequence	(0055,xx62)	3	
>GENIE Data Information Sequence	(0055,xx63)	3	
>>RR Window Width	(0009,xx38)	3	Width of RR acceptance window as percentage of rate.
>>RR Window Offset	(0009,xx39)	3	Offset of RR acceptance window as percentage of rate.
>>Accepted Beat Time	(0013,xx20)	3	Accepted Beat Time

**Table A-10. GENIE Private SPECT Reconstruction Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Image Size	(0011,xx61)	3	Image Size
Linear FOV	(0011,xx62)	3	Linear FOV
Spatial Offset	(0011,xx63)	3	Spatial Offset
Spatial Orientation	(0011,xx64)	3	Spatial Orientation
ReferenceDatasetUID	(0011,xx65)	3	Reference Dataset UID
Starcam Reference Dataset	(0011,xx66)	3	Starcam Reference Dataset
Reference Frame Number	(0011,xx67)	3	Reference Frame Number
Cursor Length	(0011,xx68)	3	Cursor Length
Number of Cursors	(0011,xx69)	3	Number of Cursors
Cursor Coordinates	(0011,xx6A)	3	Cursor Coordinates
Recon Options Flag	(0011,xx6B)	3	Recon Options Flag
Motion Threshold	(0011,xx6C)	3	Motion Threshold
Motion Curve UID	(0011,xx6D)	3	Motion Curve UID
UnifDateTime	(0013,xx23)	3	Unif Date Time

**Table A-11. GENIE Private SPECT Backprojection Module Attributes**

Attribute Name	Tag	Type	Attribute Name
Recon Type	(0011,xx6E)	3	Recon Type
Pre Filter Type	(0011,xx6F)	3	Pre Filter Type
Back Proj Filter Type	(0011,xx71)	3	Back Proj Filter Type
Recon Arc	(0011,xx72)	3	Recon Arc
Recon Pan AP Offset	(0011,xx73)	3	Recon Pan AP Offset
Recon Pan LR Offset	(0011,xx74)	3	Recon Pan LR Offset
Recon Area	(0011,xx75)	3	Recon Area
Start View	(0011,xx76)	3	Start View
Attenuation Type	(0011,xx77)	3	Attenuation Type
Dual Energy Processing	(0011,xx78)	3	Dual Energy Processing
Pre Filter Param	(0011,xx79)	3	Pre Filter Param
Pre Filter Param 2	(0011,xx7A)	3	Pre Filter Param 2
BackProjFilterParam	(0011,xx7B)	3	Back Proj Filter Param
Back Proj Filter Param 2	(0011,xx7C)	3	Back Proj Filter Param 2
Attenuation Coef	(0011,xx7D)	3	Attenuation Coef
Ref Slice Width	(0011,xx7E)	3	Ref Slice Width
Ref Trans Pixel Volume	(0011,xx7F)	3	Ref Trans Pixel Volume
Attenuation Threshold	(0011,xx81)	3	Attenuation Threshold
Interpolation Distance	(0011,xx82)	3	Interpolation Distance
Interpolation Center X	(0011,xx83)	3	Interpolation Center X
Interpolation Center Y	(0011,xx84)	3	Interpolation Center Y
Quant Filter Flag	(0011,xx85)	3	Quant Filter Flag
Head Conversion	(0011,xx86)	3	Head Conversion
Slice Width Pixels	(0013,xx87)	3	Slice Width Pixels

**Table A-12. GENIE Private SPECT Oblique Reformat Module Attributes**

Attribute Name	Tag	Type	Attribute Name
Rfmtr Trans Ref	(0011,xx88)	3	Rfmtr Trans Ref
Rfmtr Trans Ref mm	(0011,xx89)	3	Rfmtr Trans Ref mm
Two Line Trans Ref	(0011,xx8A)	3	Two Line Trans Ref
Three-D Zero	(0011,xx8B)	3	Three-D Zero
Three-D Zero Length	(0011,xx8C)	3	Three-D Zero Length
Three-D Zero In	(0011,xx8D))	3	Three-D Zero In
Threshold	(0013,xx21)	3	Threshold
LinearDepth	(0013,xx22)	3	Linear Depth

**Table A-13. Private Creation Information - GENIE P&R R2.1 (GEMS\_GENIE\_2)**

Attribute Name	Tag	VR	VM
Private Creator Identification	(0009,0010)	LO	1
Study Name	(0009,xx10)	LO	1
Study Flags	(0009,xx11)	SL	1
Study Type	(0009,xx12)	SL	1
Dataset UID	(0009,xx1E)	UI	1
Series Object Name	(0009,xx20)	LO	1
Series Flags	(0009,xx21)	SL	1
User Orientation	(0009,xx22)	SH	1
Initiation Type	(0009,xx23)	SL	1
Initiation Delay	(0009,xx24)	SL	1
Initiation Count Rate	(0009,xx25)	SL	1
Number Energy Sets	(0009,xx26)	SL	1
Number Detectors	(0009,xx27)	SL	1
Number RR Windows	(0009,xx28)	SL	1
Number MG Time Slots	(0009,xx29)	SL	1
Number View Sets	(0009,xx2A)	SL	1
Trigger History UID	(0009,xx2B)	LO	1
Series Comments	(0009,xx2C)	LO	1
Track Beat Average	(0009,xx2D)	SL	1
Distance Prescribed	(0009,xx2E)	FD	1
Table Direction	(0009,xx2F)	SL	1
Rotational Continuous Speed	(0009,xx33)	FD	1
<i>Gantry Motion Type (retired)</i>	<i>(0009,xx34)</i>	SL	1
Gantry Locus Type	(0009,xx35)	SL	1
Starting Heart Rate	(0009,xx37)	SL	1
RR Window Width	(0009,xx38)	SL	1
RR Window Offset	(0009,xx39)	SL	1
Percent Cycle Imaged	(0009,xx3A)	SL	1
Trigger File Present	(0009,xx3D)		
Patient Object Name	(0009,xx40)	PN	1
Num Views Acquired (retired)	(0009,xx44)	SL	
Patient Flags	(0009,xx41)	SL	1
Patient Creation Date	(0009,xx42)	DA	1
Patient Creation Time	(0009,xx43)	TM	1
Private Creator Identification	(0011,0010)	LO	1
Series Type	(0011,xx0A)	SL	1

Table A-13. Private Creation Information - GENIE P&amp;R R2.1 (GEMS\_GENIE\_2)

Effective Series Duration	(0011,xx0B)	SL	1
Num Beats	(0011,xx0C)	SL	1
Radio Nuclide Name	(0011,xx0D)	LO	1
Dataset Object Name	(0011,xx10)	LO	1
Dataset Modified	(0011,xx11)	IS	1
Dataset Name	(0011,xx12)	LO	1
Dataset Type	(0011,xx13)	SL	1
Completion Time	(0011,xx14)	SH	1
Detector Number	(0011,xx15)	SL	1
Energy Number	(0011,xx16)	SL	1
RR Interval Window Number	(0011,xx17)	SL	1
MG Bin Number	(0011,xx18)	SL	1
Radius Of Rotation	(0011,xx19)	FD	1
Detector Count Zone	(0011,xx1A)	SL	1
Num Energy Windows	(0011,xx1B)	SL	1
Energy Offset	(0011,xx1C)	SL	4
Energy Range	(0011,xx1D)	SL	1
<i>Energy Width (retired)</i>	<i>(0011,xx1E)</i>	<i>SL</i>	<i>4</i>
Image Orientation	(0011,xx1F)	SL	1
<b>&gt;Uniformity Mean</b>	(0011,xx29)	SL	?
<b>&gt;FOV Shape</b>	(0011,xx3E)	SL	?
<i>Acq Zoom (retired)</i>	<i>(0011,xx21)</i>	<i>DS</i>	<i>1</i>
<i>Acq Pan (retired)</i>	<i>(0011,xx22)</i>	<i>DS</i>	<i>1</i>
Use FOV Mask	(0011,xx23)	SL	1
FOV Mask Y Cutoff Distance	(0011,xx24)	SL	1
FOV Mask Cutoff Angle	(0011,xx25)	SL	1
Table Orientation	(0011,xx26)	SL	1
ROI Top Left	(0011,xx27)	SL	2
ROI Bottom Right	(0011,xx28)	SL	2
Uniformity Mean	(0011,xx29)	SL	1
<i>Phase Duration (retired)</i>	<i>(0011,xx2A)</i>	<i>FD</i>	<i>1</i>
View X Adjustment	(0011,xx2C)	FD	1
View Y Adjustment	(0011,xx2D)	FD	1
Pixel Overflow Flag	(0011,xx2E)	SL	1
Overflow Level	(0011,xx2F)	SL	1
Picture Object Name	(0011,xx30)	LO	1
Acquisition Parent UID	(0011,xx31)	LO	1
Processing Parent UID	(0011,xx32)	LO	1
Energy Correct Name	(0011,xx33)	LO	1



**Table A-13. Private Creation Information - GENIE P&R R2.1 (GEMS\_GENIE\_2)**

Spatial Correct Name	(0011,xx34)	LO	1
Tuning Calib Name	(0011,xx35)	LO	1
Uniformity Correct Name	(0011,xx36)	LO	1
Acquisition Specific Correction Name	(0011,xx37)	LT	1
Byte Order	(0011,xx38)	SL	1
Compression Type	(0011,xx39)	SL	1
Picture Format	(0011,xx3A)	SL	1
Pixel Scale	(0011,xx3B)	FD	1
Pixel Offset	(0011,xx3C)	FD	1
<i>Energy Peak (retired)</i>	<i>(0011,xx3D)</i>	<i>SL</i>	<i>4</i>
FOV Shape	(0011,xx3E)	SL	1
Dataset Flags	(0011,xx3F)	SL	1
Viewing Object Name	(0011,xx40)	LO	1
Orientation Angle	(0011,xx41)	SL	1
Rotation Angle	(0011,xx42)	FD	1
Window Inverse Flag	(0011,xx43)	SL	1
Threshold Center	(0011,xx44)	FD	1
Threshold Width	(0011,xx45)	FD	1
Interpolation Type	(0011,xx46)	SL	1
Where Object Name	(0011,xx50)	LO	1
Period	(0011,xx55)	FD	1
Elapsed Time	(0011,xx56)	FD	1
FOV	(0011,xx57)	FD	2
Image Size	(0011,xx61)	SL	1
Linear FOV	(0011,xx62)	FD	1
Spatial Offset	(0011,xx63)	FD	1
Spatial Orientation	(0011,xx64)	FD	1
Reference Dataset UID	(0011,xx65)	LO	1
Starcam Reference Dataset	(0011,xx66)	SH	1
Reference Frame Number	(0011,xx67)	SL	1
Cursor Length	(0011,xx68)	SL	1
Number of Cursors	(0011,xx69)	SL	1
Cursor Coordinates	(0011,xx6A)	SL	1
Recon Options Flag	(0011,xx6B)	SL	1
Motion Threshold	(0011,xx6C)	FD	1
Motion Curve UID	(0011,xx6D)	UI	1
Recon Type	(0011,xx6E)	SL	1
Pre Filter Type	(0011,xx6F)	SL	1
Back Proj Filter Type	(0011,xx71)	SL	1

**Table A-13. Private Creation Information - GENIE P&R R2.1 (GEMS\_GENIE\_2)**

Recon Arc	(0011,xx72)	SL	1
Recon Pan AP Offset	(0011,xx73)	FD	1
Recon Pan LR Offset	(0011,xx74)	FD	1
Recon Area	(0011,xx75)	FD	1
Start View	(0011,xx76)	SL	1
Attenuation Type	(0011,xx77)	SL	1
Dual Energy Processing	(0011,xx78)	SL	1
Pre Filter Param	(0011,xx79)	SH	1
Pre Filter Param 2	(0011,xx7A)	SH	1
Back Proj Filter Param	(0011,xx7B)	SH	1
Back Proj Filter Param 2	(0011,xx7C)	SH	1
Attenuation Coef	(0011,xx7D)	SH	1
Ref Slice Width	(0011,xx7E)	SL	1
Ref Trans Pixel Volume	(0011,xx7F)	FD	1
Attenuation Threshold	(0011,xx81)	SH	1
Interpolation Distance	(0011,xx82)	FD	1
Interpolation Center X	(0011,xx83)	FD	1
Interpolation Center Y	(0011,xx84)	FD	1
Quant Filter Flag	(0011,xx85)	SL	1
Head Conversion	(0011,xx86)	SL	1
Slice Width Pixels	(0011,xx87)	SL	1
Rfmtr Trans Ref	(0011,xx88)	SL	1
Rfmtr Trans Ref mm	(0011,xx89)	FD	1
Two Line Trans Ref	(0011,xx8A)	SL	1
Three-D Zero	(0011,xx8B)	SL	1
Three-D Zero Length	(0011,xx8C)	SL	1
Three-D Zero In	(0011,xx8D)	SL	1
Private Creator Identification	(0013,0010)	LO	1
Digital FOV	(0013,xx10)	FD	2
Source Translator	(0013,xx11)	SL	1
RAL Flags	(0013,xx12)	UL	1
GENIE Frame Sequence	(0013,xx13)	SQ	1
>Original Image Num	(0013,xx14)	SL	1
FScalar	(0013,xx15)	FD	1
AutoTrack Peak	(0013,xx16)	SL	1
AutoTrack Width	(0013,xx17)	SL	1
Transmission Scan Time	(0013,xx18)	FD	1
Transmission Mask Width	(0013,xx19)	FD	1
Copper Attenuator Thickness	(0013,xx1A)	FD	1

**Table A-13. Private Creation Information - GENIE P&R R2.1 (GEMS\_GENIE\_2)**

Det Ang Separation	(0013,xx1B)	FD	1
Axial Acceptance Angle	(0013,xx1C)	SL	1
Theta Acceptance Value	(0013,xx1D)	SL	1
Tomo View Offset	(0013,xx1E)	FD	1-n
Accepted Beats Time	(0013,xx20)	FD	1
Threshold	(0013,xx21)	FD	2
Linear Depth	(0013,xx22)	FD	2
Unif Date Time	(0013,xx23)	LO	1
Series Accepted Beats	(0013,xx24)	SL	1
Series Rejected Beats	(0013,xx25)	SL	1
Study Comments	(0013,xx26)	LT	1
Private Creator Data Element	(0015,0010)	SH	1
>Frame Termination Condition	(0015,xx10)	SL	1
>Frame Termination Value	(0015,xx11)	SL	1
Num ECT Phases	(0015,xx12)	SL	1
Num WB Scans	(0015,xx13)	SL	1
ECT Phase Num	(0015,xx14)	SL	1
WB Scan Num	(0015,xx15)	SL	1
Comb Head Number	(0015,xx16)	SL	1
Preceding Beat	(0015,xx17)	UL	1
Orig SOP Instance UID	(0033,xx07)	SQ	1-n
Start Angle	(0035,xx01)	FD	N
GENIE Energy Window Information Sequence	(0055,xx12)	SQ	1
GENIE Energy Window Range Sequence	(0055,xx13)	SQ	1
GENIE Detector Information Sequence	(0055,xx22)	SQ	1
GENIE Rotation Information Sequence	(0055,xx52)	SQ	1
GENIE Gated Information Sequence	(0055,xx62)	SQ	1
GENIE Data Information Sequence	(0055,xx63)	SQ	1
GENIE Data Object Type	(0033,xx08)	CS	1
Modified	(0033,xx10)	SL	S
Name	(0033,xx11)	LO	S
ProtocolDataUID	(0033,xx16)	LO	S
Date	(0033,xx17)	SH	S
Time	(0033,xx18)	SH	S
ProtocoldataFlags	(0033,xx19)	UL	S
ProtocolName	(0033,xx1A)	LO	S
RelevantDataUID	(0033,xx1B)	LO	S
BulkData	(0033,xx1C)	OB	S
IntData	(0033,xx1D)	SL	M

**Table A-13. Private Creation Information - GENIE P&R R2.1 (GEMS\_GENIE\_2)**

DoubleData	(0033,xx1E)	FD	M
StringData	(0033,xx1F)	LT	M
BulkDataFormat	(0033,xx20)	LT	M
IntDataFormat	(0033,xx21)	LT	M
DoubleDataFormat	(0033,xx22)	LO	M
StringDataFormat	(0033,xx23)	LT	M
Description	(0033,xx24)	LT	S
SDODoubleData SQ	(0055,xx64)	SQ	M
>DoubleData	(0033,xx1E)	FD	M
Modified	(5001,xx01)	SL	S
Name	(5001,xx02)	LO	S
Cid	(5001,xx03)	SL	S
Srid	(5001,xx04)	SL	S
SOPClassUID	(5001,xx05)	LO	S
SOPInstanceUID	(5001,xx06)	LO	S
CurveType	(5001,xx07)	SL	S
GraphType	(5001,xx08)	SL	S
Legend	(5001,xx09)	LO	S
XUnits	(5001,xx0A)	Lo	S
YUnits	(5001,xx0B)	LO	S
Edit	(5001,xx0C)	SL	S
Suspend	(5001,xx0D)	SL	S
StyleLine	(5001,xx0E)	SL	S
StyleFill	(5001,xx0F)	SL	S
StyleColour	(5001,xx10)	LO	S
StyleWidth	(5001,xx11)	SL	S
StylePoint	(5001,xx12)	SL	S
StylePColour	(5001,xx13)	LO	S
StylePSize	(5001,xx14)	S:L	S
Segments	(5001,xx15)	SL	S
SegType	(5001,xx16)	SL	S
SegStart	(5001,xx17)	FD	M
SegEnd	(5001,xx18)	FD	M
SegStyleLine	(5001,xx19)	SL	M
SegStyleFill	(5001,xx1A)	SL	M
SegStyleColour	(5001,xx1B)	LO	S
SegStyleWidth	(5001,xx1C)	SL	M

**Table A-13. Private Creation Information - GENIE P&R R2.1 (GEMS\_GENIE\_2)**

SegStylePoint	(5001,xx1D)	SL	M
SegStylePColour	(5001,xx1E)	LO	S
SegStylePSize	(5001,xx1F)	SL	M
SegName	(5001,xx20)	LO	S
SegAllowDirInt	(5001,xx21)	SL	M
TextAnnots	(5001,xx22)	SL	S
TxtX	(5001,xx23)	FD	M
TxtY	(5001,xx24)	FD	M
TxtText	(5001,xx25)	LO	S
TxtName	(5001,xx26)	LO	S
ROIName	(5001,xx30)	LO	S
DerivedFromImageUID	(5001,xx31)	LO	S
DerivedFromImages	(5001,xx32)	SL	M
CurveFlags	(5001,xx33)	UL	S
CurveName	(5001,xx34)	LO	S
DatasetName	(5001,xx35)	LO	S
CurveUID	(5001,xx36)	LO	S
ROIArea	(5001,xx37)	FD	S
Modified	(50xx,xx38)	SL	S
Name	(50xx,xx39)	LO	S
Software version	(50xx,xx3A)	LO	S
StartDate	(50xx,xx3B)	SH	S
CompletionDate	(50xx,xx3C)	SH	S
DetectorName	(50xx,xx3D)	LO	S

# Conformance Statement for ISG Hardcopy Server as DICOM Print Management SCU

Document Number: 286-213-0174-00-00

Updated: \$Date: 1996/04/17 20:03:28 \$

cvsv: \$Revision: 1.2 \$

Repository: \$Source: /isg/proj/iap/rcs/doc/designs/printing/docPrnDICOM/PrnDICOM.conf.ms,v \$

Circulation:

Author	<b>Darek Tomaszewski</b>	_____	_____
Program Manager	John Collins *	_____	_____
Platforms Director	Loris Sartor		
Architect DcS, ArS, HcS	Gerrit Visser†		
Project Leader	David Ty†		
Account Manager	Peter Bak		

---

† *Mandatory reviewers.*

\* *The signature of the Program Manager attests that the mandatory reviewers have approved this document.*

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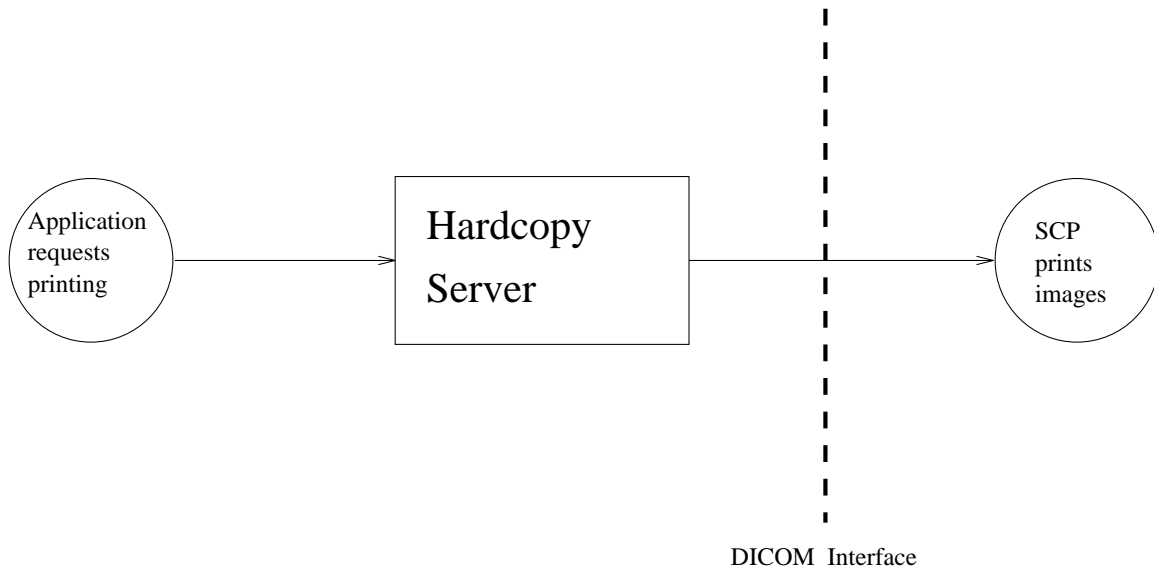
# 1. Introduction

The ISG Hardcopy Server (*hcserver*) supports printing to DICOM Print Management SCP. The *hcserver* acts as an SCU of the DICOM print management SOP classes. It uses a configuration file for specifying the behaviour specific to different DICOM SCPs.

## 2. Implementation Model

### 2.1. Application Data Flow Diagram

The relationship of the *hcserver* use of DICOM to real world activities is presented in the following diagram.

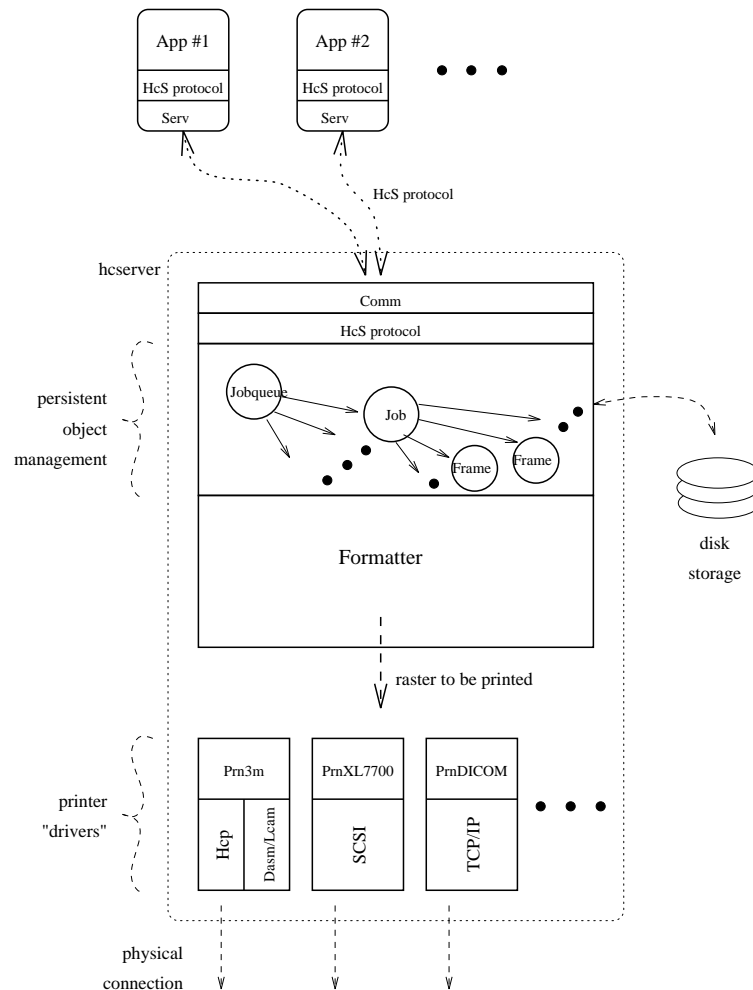




The application using the Hardcopy Server requests printing to a print device. The Hardcopy Server initiates an association with a DICOM print SCP for the purpose of printing the job requested by the application. The Hardcopy Server can handle simultaneous associations with a number of DICOM print SCPs.

## 2.2. Functional Definition of Application Entities

The model of the *hcserver* is presented in the following diagram.



Multiple client applications are connected to an instance of the Hardcopy server. Each connection can be made locally, if both the client and the server are executing on the same machine, or remotely, when the client and the server are running on different machines connected via networking.

The Hardcopy server consists of a Comm layer, which handles the communications, and a layer for interpreting the HcS command and data protocol. Commands and data result in various objects being created:

**Jobqueue** A jobqueue in the model of IAP Hardcopy server consists of several jobs, queued in priority and FIFO order. This permits pre-emptive printing of high priority jobs, if desired.

**Job** A job is composed of several frames, each of which defines a physical region of a film and the contents thereof. A job has an associated set of formatting commands, which specify such details as film layout, number of copies, choice of printer, and other parameters that pertain to the entire job.

**Frame** A frame is a set of formatting commands, such as commands to display an image with overlay text and graphics, the location of the image on the film, and other relevant information required for printing images onto films.

When a job appears at the front of a queue, the Formatter will prepare the job prior to sending it to the printer. Image viewing transformations are applied, contrast and brightness adjustment are performed, and text and graphics overlays are added. A formatted image is passed to the appropriate printer driver, which handles the physical link to the printer, the data communication between the host computer and the printer, and the processing of status and error messages from the printer.

For printing to a DICOM print server, a DICOM print SCU driver is provided. Multiple instances of DICOM print SCU driver can co-exist, and each instance handles the association with one DICOM print server.

### 2.3. Sequencing of Real-World Activities

N/A.

## 3. Application Entity (AE) Specifications

The *hcsrvr* represents a single Application Entity. It acts independently of other DICOM applications that may be running on the same system. The *hcsrvr* can support printing to multiple DICOM printers at the same time, each printer being uniquely identified by an Application Entity Title.

### 3.1. AE Print User - Specification

The *hcsrvr* provides Standard Conformance to the following DICOM 3.0 SOP Classes as an SCU:

SOP Class Name	SOP Class UID
Basic Grayscale Print Management Meta SOP Class	1.2.840.10008.5.1.1.9
Basic Color Print Management Meta SOP Class	1.2.840.10008.5.1.1.18

#### 3.1.1. Association Establishment Policies

##### 3.1.1.1. General

The *hcsrvr* maintains a separate association with each DICOM SCP. It releases the association with DICOM SCP if no operation is done on the association in a selected time period.

##### 3.1.1.2. Number of Associations

There is no limit on the number of associations maintained simultaneously with one or different DICOM SCPs.

##### 3.1.1.3. Asynchronous Nature

The *hcsrvr* does not support asynchronous operations and will not perform asynchronous window negotiation.

##### 3.1.1.4. Implementation Identifying Information

The *hcsrvr* implementation class UID is 2.16.124.113531.1.3.1, the implementation version name is ISG\_HCS\_V1.0.96.

#### 3.1.2. Association Initiation Policy

The *hcsrvr* maintains a list of valid print servers and can present that list to the applications upon request. When the application submits a print job designated for a listed print server to the *hcsrvr*, the *hcsrvr* will request an association with the selected print server.

### 3.1.2.1. Printing encoded with Implicit or Explicit VR

#### 3.1.2.1.1. Associated Real-World Activity

The application's print request causes the *hcs* server to initiate an Association.

#### 3.1.2.1.2. Proposed Presentation Contexts

The *hcs* server will propose one of the presentation contexts listed in the Presentation Context Table.

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Basic GrayScale Print Management	1.2.840.10008.5.1.1.9	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCU	None
Basic Color Print Management	1.2.840.10008.5.1.1.18	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCU	None

#### 3.1.2.1.2.1. SOP Specific Conformance to Basic Grayscale Print Management Meta SOP Class

The *hcs* server supports the following mandatory SOP classes which are defined under the Basic Grayscale Print Management Meta SOP Class:

Name	UID
Basic Film Session SOP Class	1.2.840.10008.5.1.1.1
Basic Film Box SOP Class	1.2.840.10008.5.1.1.2
Basic Grayscale Image Box SOP Class	1.2.840.10008.5.1.1.4
Printer SOP Class	1.2.840.10008.5.1.1.14

The *hcs* server supports the following optional SOP class attributes and DIMSE services for the Basic Grayscale Print Management Meta SOP Class.

SOP Class	DISME Service	Optional Attribute	Tag
Basic Film Session SOP Class	N-CREATE	Number of Copies	(2000,0010)
		Print Priority	(2000,0020)
		Medium Type	(2000,0030)
		Film Destination	(2000,0040)
		Film Session Label	(2000,0050)
		Memory Allocation	(2000,0060)
Basic Film Box SOP Class	N-CREATE	Film Orientation	(2010,0040)
		Film Size ID	(2010,0050)
		Magnification Type	(2010,0060)
		Max Density	(2010,0130)
		Configuration Information	(2010,0150)
		Smoothing Type	(2010,0080)
		Border Density	(2010,0100)
		Empty Image Density	(2010,0110)
		Min Density	(2010,0120)
	Trim	(2010,0140)	
	N-DELETE		
Basic Grayscale Image Box SOP Class	N-SET	Polarity	(2020,0020)
Printer SOP Class	N-GET		

#### 3.1.2.1.2.1.1. Basic Film Session SOP Class (1.2.840.10008.5.1.1.1) attributes

The *hcs* server supports the following mandatory and optional attribute values in this SOP class:

Attribute Name	Tag	Supported values
Number of Copies	(2000,0010)	Integer String
Print Priority	(2000,0020)	HIGH, MED, LOW
Medium Type	(2000,0030)	PAPER, CLEAR FILM, BLUE FILM
Film Destination	(2000,0040)	MAGAZINE, PROCESSOR
Film Session Label	(2000,0050)	Long String
Memory Allocation	(2000,0060)	Integer String

#### 3.1.2.1.2.1.2. Basic Film Box SOP Class (1.2.840.10008.5.1.1.2) attributes

The *hcs* server supports the following mandatory and optional attribute values in this SOP class:

Attribute Name	Tag	Supported values
Image Display Format	(2010,0010)	STANDARD, ROW, COL, SLIDE, SUPERSLIDE, CUSTOM
Film Orientation	(2010,0040)	PORTRAIT, LANDSCAPE
Film Size ID	(2010,0050)	8INX10IN, 10INX14IN, 14INX14IN, 24CMX24CM, 10INX12IN, 11INX14IN, 14INX17IN, 24CMX30CM
Magnification Type	(2010,0060)	REPLICATE, BILINEAR, CUBIC, NONE
Smoothing Type	(2010,0080)	SCP specific
Border Density	(2010,0100)	BLACK, WHITE, i where i represents the desired density in hundredths of OD
Empty Image Density	(2010,0110)	BLACK, WHITE, i where i represents the desired density in hundredths of OD
Min Density	(2010,0120)	Unsigned Short
Max Density	(2010,0130)	Unsigned Short
Trim	(2010,0140)	YES, NO
Configuration Information	(2010,0150)	SCP specific

### 3.1.2.1.2.1.3. Basic Grayscale Image Box SOP Class (1.2.840.10008.5.1.1.4) attributes

The *hcs* server supports the following mandatory and optional attributes in this SOP class:

Attribute Name	Tag	Supported values
Image Position	(2020,0010)	Unsigned Short
Polarity	(2020,0020)	NORMAL, REVERSE
Magnification Type	(2010,0060)	REPLICATE, BILINEAR, CUBIC, NONE
Smoothing Type	(2010,0080)	SCP specific
Requested Image Size	(2020,0030)	Unsigned Short
Preformatted Grayscale Image Sequence	(2020,0110)	
>Samples Per Pixel	(0028,0002)	1
>Photometric Interpretation	(0028,0004)	MONOCHROME1, MONOCHROME2
>Rows	(0028,0010)	Unsigned Short
>Columns	(0028,0011)	Unsigned Short
>Pixel Aspect Ratio	(0028,0034)	1:1
>Bits Allocated	(0028,0100)	8
>Bits Stored	(0028,0101)	8
>High Bit	(0028,0102)	7
>Pixel Representation	(0028,0103)	0000H (unsigned integer)
>Pixel Data	(7FE0,0010)	Other Byte String

### 3.1.2.1.2.1.4. Printer SOP Class (1.2.840.10008.5.1.1.14) attributes

The *hcs* server makes use of the following attributes and attribute values in this SOP class:

Attribute Name	Tag	Supported values
Printer Status	(2110,0010)	NORMAL, WARNING, FAILURE
Printer Status Info	(2110,0020)	SUPPLY EMPTY, SUPPLY LOW, RECEIVER FULL, FILM JAM
Printer Name	(2110,0030)	Long String
Manufacturer	(0008,0070)	Long String
Manufacturer Model Name	(0008,1090)	Long String
Device Serial Number	(0018,1000)	Long String
Software Versions	(0018,1020)	Long String(s)

### 3.1.2.1.2.2. SOP Specific Conformance to Basic Color Print Management Meta SOP Class

The *hcserver* supports the following mandatory SOP classes which are defined under the Basic Color Print Management Meta SOP Class.

Name	UID
Basic Film Session SOP Class	1.2.840.10008.5.1.1.1
Basic Film Box SOP Class	1.2.840.10008.5.1.1.2
Basic Color Image Box SOP Class	1.2.840.10008.5.1.1.4.1
Printer SOP Class	1.2.840.10008.5.1.1.14

The optional SOP class attributes and DIMSE services for the Basic Film Session, Basic Film Box and Printer SOP classes are listed in the SOP Specific Conformance section for the Basic Grayscale Print Management Meta SOP Class.

The *hcserver* supports the following optional SOP class attributes and DIMSE services for the Basic Color Image Box SOP Class.

SOP Class	DIMSE Service	Optional Attribute	Tag
Basic Color Image Box SOP Class	N-SET	Polarity	(2020,0020)

#### 3.1.2.1.2.2.1. Basic Color Image Box SOP Class (1.2.840.10008.5.1.1.4.1) attributes

The *hcserver* supports the following attributes in this SOP class:

Image Position	(2020,0010)	Unsigned Short
Polarity	(2020,0020)	NORMAL, REVERSE
Magnification Type	(2010,0060)	REPLICATE, BILINEAR, CUBIC, NONE
Smoothing Type	(2010,0080)	SCP specific
Requested Image Size	(2020,0030)	Unsigned Short
Preformatted Color Image Sequence	(2020,0111)	
>Samples Per Pixel	(0028,0002)	3
>Photometric Interpretation	(0028,0004)	RGB
>Rows	(0028,0010)	Unsigned Short
>Columns	(0028,0011)	Unsigned Short
>Pixel Aspect Ratio	(0028,0034)	1:1
>Bits Allocated	(0028,0100)	8
>Bits Stored	(0028,0101)	8
>High Bit	(0028,0102)	7
>Pixel Representation	(0028,0103)	0000H (unsigned integer)
>Pixel Data	(7FE0,0010)	Other Byte String

### 3.1.3. Association Acceptance Policy

The *hcs* server does not accept associations.

## 4. Communication Profiles

### 4.1. TCP/IP Stack

The *hcs* server provides DICOM V3.0 TCP/IP Network Communication Support as defined in Part 8 of the DICOM Standard.

#### 4.1.1. TCP/IP API

The *hcs* server uses the TCP/IP stack upon which it executes.

#### 4.1.2. Physical Media Support

The *hcs* server is indifferent to the physical medium over which TCP/IP executes.

## 5. Extensions/Specifications/Privatisations

N/A.

## 6. Configuration

The *hcs* server configuration is loaded into the running server.

## 6.1. AE Title/ Presentation Address Mapping

A DICOM print server is identified by a "printer name" with associated parameters such as AE title, host name and port number. The IP address corresponding to a given host name is determined using the name lookup database mechanisms provided on the hosting platform.

## 6.2. Definition of Target Print Servers

The list of target print servers is loaded into the running *hcserver*.

## 6.3. Configurable Parameters

The following parameters may be configured for the *hcserver*

- Application Entity Title (Default ISG\_PRINT\_SCU).

- Film layout formats.

- Association timeout.

## 6.4. Support of Extended Character Sets

The *hcserver* provides no support for extended character sets in the communication with DICOM SCPs.



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