GE Medical Systems

Technical Publications

2365523-100
Revision 1

Xray/MR FUSION DICOM CONFORMANCE STATEMENT for DICOM V3.0

REVISION HISTORY

REV	DATE	REASON FOR CHANGE
0	Nov. 15, 2002	Initial revision.
1	March 3, 2003	Issued from review.

LIST OF EFFECTIVE PAGES

TABLE OF CONTENTS

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1. INTRODUCTION

1.1 OVERVIEW

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

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

Section 2 (Conformance Statement), which defines the subset of options selected from those offered by the DICOM standard.

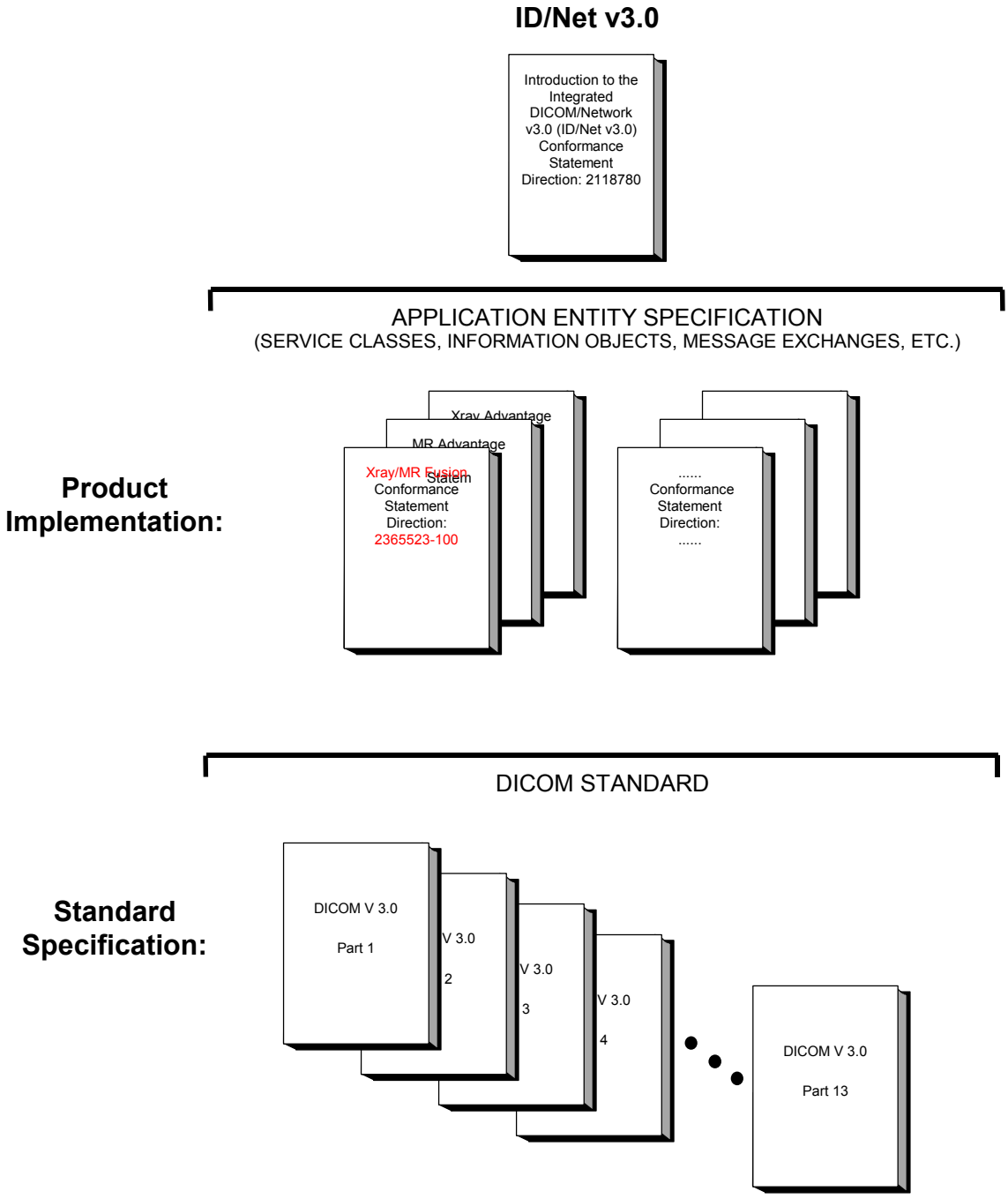
Section 3 (MR Information Object Implementation), which specifies the GEMS equipment compliance to DICOM requirements for the implementation of a MR Information Object.

Section 4 (3D Model Information Object Implementation), which specifies the GEMS equipment compliance to DICOM requirements for the implementation of a 3D Model Information Object (GEMS private DICOM Information Object)

Section 5 (SC Information Object Implementation), which specifies the GEMS equipment compliance to DICOM requirements for the implementation of the Secondary Capture Information Object Implementation.

1.2 OVERALL DICOM CONFORMANCE STATEMENT DOCUMENT STRUCTURE

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



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

Xray/MR FUSION
Conformance Statement for DICOM v3.0
2365523-100

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

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

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

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

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

For more information regarding DICOM v3.0, copies of the Standard may be obtained on the Internet at <http://medical.nema.org>. Comments on the Standard may be addressed to:

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

1.3 INTENDED AUDIENCE

The reader of this document is concerned with software design and/or system integration issues. It is assumed that the reader of this document is familiar with the DICOM 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 ID/Net 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 Integrated DICOM/Network v3.0 (ID/Net v3.0) Conformance Statement, Direction: 2118780*.

1.8 SYMBOLS AND ABBREVIATIONS

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

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2. NETWORK CONFORMANCE STATEMENT

2.1 INTRODUCTION

This section of the conformance statement (CS) specifies the Xray/MR Fusion compliance to DICOM conformance requirements for the relevant **Networking** features.

Xray/MR Fusion is a software application designed to be used on the Advantage workstation. It uses in input DICOM images to reconstruct 3-dimensional volume on MR series, or DICOM 3D Xray or MR models. The views of 3-dimensional volumes displayed by the application are saved in DICOM format (MR series or Secondary Capture). These MR series or Secondary Captures can be loaded and displayed by other GEMS applications (such as the Image Viewer).

Besides, the complete information of a 3-dimensional volume can be saved in DICOM format (3D Model), creating thus a **private** DICOM Information Object. Such 3D Models can be loaded on Xray/MR Fusion at a later date for follow-up processings.

Xray/MR Fusion does not have intrinsic network feature. It does not directly invoke the DICOM Server AE. For more detailed information on the DICOM features of the Advantage Workstation, refer to the respective Conformance Statement:

- Advantage Workstation 4.0 Conformance Statement for DICOM (ID/Net v3.0), Direction 2261302-100, Rev. 1.
- Advantage Workstation 4.1 Conformance Statement for DICOM (ID/Net v3.0), Direction 2340652-100, Rev. 1.

The **goal of this document** is to give a detailed description of:

- the DICOM IODs (MR) that are required to reconstruct a 3-dimensional volume (sections 3),
- the private IOD (3D Xray or MR Models) that contains the information of a 3-dimensional volume (section 4),
- the SC IOD (Secondary Capture image) generated from the view of a 3-dimensional volume (section 5),

2.2 REAL WORLD ACTIVITIES: LOADING / PROCESSING / SAVING OF IMAGE DATA

The operator clicks on the “Xray/MR Fusion” button of the AW. The following sequence describes the workflow of the Xray/MR Fusion application:

1 Selection and loading of image data set.
   - Loading of a Xray and a MR exams
   - Definition of a pair of matching points
   - Automatic registration based on the pair of points
2 Manual registration
   - Acceptance or not of this automatic registration
   - Definition of at least three pairs of matching points
3 Display of fused views

- Display of fused views according to the registration calculated

4 Trajectory planning

- Definition of a trace simulating the trajectory of a nail in the body
- Locking the cursor on the trace and display of a VR view perpendicular to this trace

5 Contouring

- Definition of a volume in the 3d Xray view
- Pasting of the previously defined volume on MR views and modifications of the contours
- Merging of the contours on the 3D Xray View.

6 Saving

- Saving of reformatted fused MR views containing Xray pixels over a defined threshold.
- Saving of reformatted MR views on which the contours are burnt
- Saving of the trajectory as series of MR views perpendicular to the trace
- Saving of the presvious registration

3. MR INFORMATION OBJECT IMPLEMENTATION

3.1 INTRODUCTION

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

3.2 - IOD Description

3.3 - IOD Entity-Relationship Model

3.4 - IOD Module Table

3.5 - IOD Module Definition

3.2 MR IOD IMPLEMENTATION

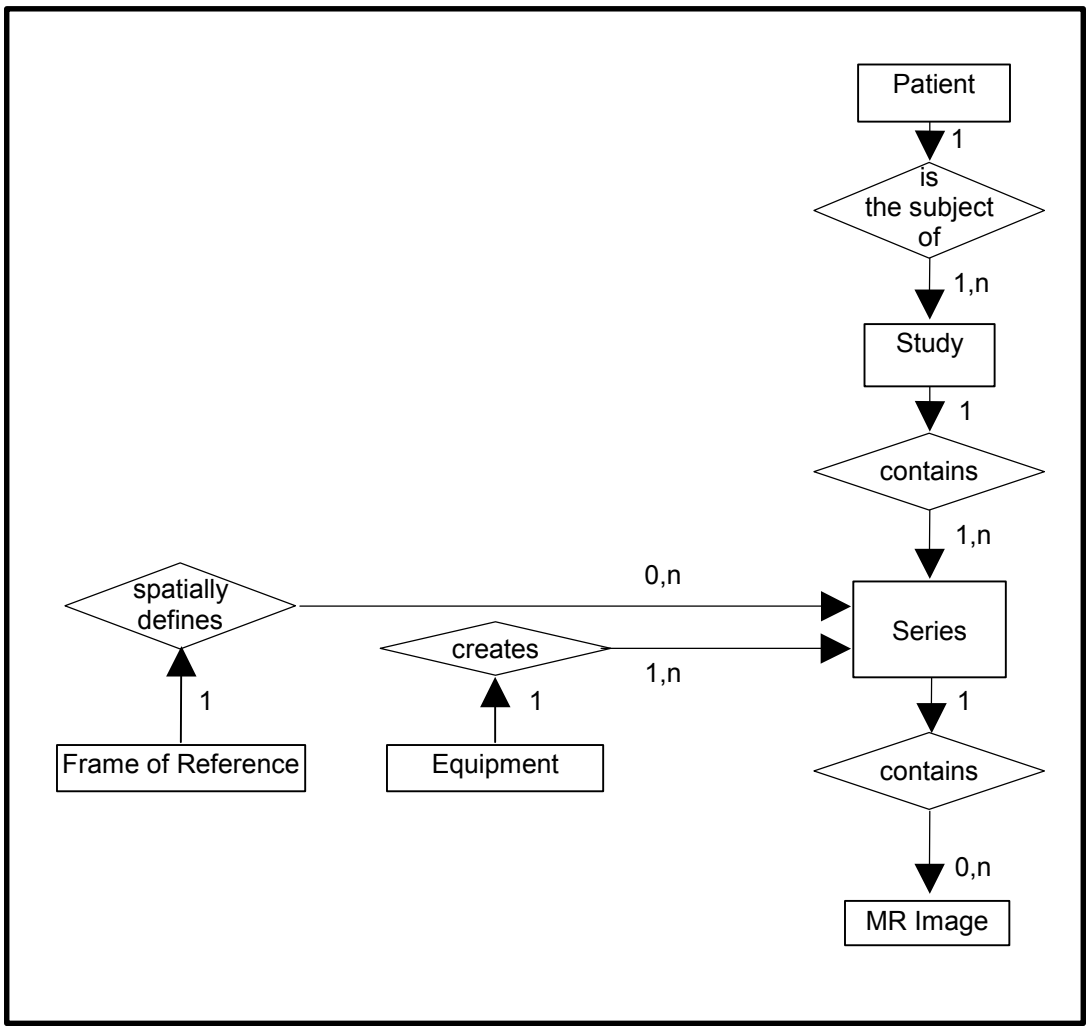
3.3 MR ENTITY RELATIONSHIP MODEL

The Entity-Relationship diagram for the MR Image interoperability schema is shown in Illustration 3.3-1**.** In this figure, the following diagrammatic convention is established to represent the information organization :

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

The relationships are fully defined with the maximum number of possible entities in the relationship shown. In other words, the relationship between Series and Image can have up to n Images per Series, but the Patient to Study relationship has 1 Study for each Patient (a Patient can have more than one Study on the system, however each Study will contain all of the information pertaining to that Patient).

ILLUSTRATION 3.3-1
MR 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 MR Information Object.

3.3.2 Xray/MR Fusion Mapping of DICOM entities

TABLE 3.3-1
MAPPING OF DICOM ENTITIES TO XRAY/MR FUSION ENTITIES

DICOM	Xray/MR Fusion Entity
Patient	Patient
Study	Exam
Series	Series
Image	Image
Frame	Not Applicable

3.4 IOD MODULE TABLE

Within an entity of the DICOM v3.0 MR IOD, attributes are grouped into related set of attributes. A set of related attributes is termed a module. A module facilitates the understanding of the semantics concerning the attributes and how the attributes are related with each other. A module grouping does not infer any encoding of information into datasets.

Table 3.4-1 identifies the defined modules within the entities which comprise the DICOM v3.0 MR IOD. Modules are identified by Module Name.

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

TABLE 3.4-1
MR IMAGE IOD MODULES

Entity Name	Module Name	Reference
Patient	Patient	3.5.1.1
Study	General Study	3.5.2.1
	Patient Study	3.5.2.2
Series	General Series	3.5.3.1
Frame of Reference	Frame of Reference	3.5.4.1
Equipment	General Equipment	3.5.5.1
Image	General Image	3.5.6.1
	Image Plane	3.5.6.1.1
	Image Pixel	3.5.6.3
	Contrast/Bolus	3.5.6.4
	MR Image	3.5.8.1
	SOP Common	3.5.7.1

3.5 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 MR Information Object.

The following modules are included to convey Enumerated Values, Defined Terms, and Optional Attributes supported. Type 1 & Type 2 Attributes are also included for completeness and to define what values they may take and where these values are obtained from. It should be noted that they are the same ones as defined in the DICOM v3.0 Standard Part 3 (Information Object Definitions).

In the following tables, the first value indicated in the attribute description describes if the attribute is read (used or not), and the second value describes the way the attribute is sent (copied, generated or empty).

3.5.1 Common Patient Entity Modules

3.5.1.1 Patient Module

This section specifies the Attributes of the Patient that describe and identify the Patient who is the subject of a diagnostic Study. This Module contains Attributes of the patient that are needed for diagnostic interpretation of the Image and are common for all studies performed on the patient.

TABLE 3.5-1
PATIENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Patient's Name	(0010,0010)	2	Used / Copied
Patient ID	(0010,0020)	2	Used / Copied
Patient's Birth Date	(0010,0030)	2	Used / Copied
Patient's Sex	(0010,0040)	2	Used / Copied

3.5.2 Common Study Entity Modules

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

3.5.2.1 General Study Module

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

TABLE 3.5-2
GENERAL STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Study Instance UID	(0020,000D)	1	Used / Copied
Study Date	(0008,0020)	2	Used / Copied
Study Time	(0008,0030)	2	Used / Copied
Referring Physician's Name	(0008,0090)	2	Used / Copied
Study ID	(0020,0010)	2	Used / Copied
Accession Number	(0008,0050)	2	Used / Copied
Study Description	(0008,1030)	3	Used / Copied

3.5.2.2 Patient Study Module

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

TABLE 3.5-3
PATIENT STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Patient's Age	(0010,1010)	3	Used / Copied
Patient's Weight	(0010,1030)	3	Used / Copied

3.5.3 Common Series Entity Modules

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

3.5.3.1 General Series Module

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

TABLE 3.5-4
GENERAL SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	Used / Copied Defined Terms: MR = Magnetic Resonance
Series Instance UID	(0020,000E)	1	Mandatory / Generated
Series Number	(0020,0011)	2	Used / Generated
Patient Position	(0018,5100)	2C	Used / Copied 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

3.5.4 Common Frame Of Reference Entity Modules

The following Frame of Reference IE Module is common to all Composite Image IODs which reference the Frame of Reference IE.

3.5.4.1 Frame Of Reference Module

This section specifies the Attributes necessary to uniquely identify a frame of reference which insures the spatial relationship of Images within a Series. It also allows Images across multiple Series to share the same Frame Of Reference. This Frame Of Reference (or coordinate system) shall be constant for all Images related to a specific Frame Of Reference.

TABLE 3.5-5
FRAME OF REFERENCE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Frame of Reference UID	(0020,0052)	1	Mandatory / Copied
Position Reference Indicator	(0020,1040)	2	Ignored / Copied

3.5.5 Common Equipment Entity Modules

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

3.5.5.1 General Equipment Module

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

TABLE 3.5-6
GENERAL EQUIPMENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Manufacturer	(0008,0070)	2	Used / Copied
Institution Name	(0008,0080)	3	Used / Copied
Institution Address	(0008,0081)	3	Ignored / Copied
Station Name	(0008,1010)	3	Used / Copied
Institutional Department Name	(0008,1040)	3	Ignored / Copied
Manufacturer's Model Name	(0008,1090)	3	Used / Copied
Device Serial Number	(0018,1000)	3	Ignored / Copied
Software Versions	(0018,1020)	3	Ignored / Copied
Spatial Resolution	(0018,1050)	3	Ignored / Removed
Date of Last Calibration	(0018,1200)	3	Ignored / Copied
Time of Last Calibration	(0018,1201)	3	Ignored / Copied
Pixel Padding Value	(0028,0120)	3	Ignored / Copied

3.5.6 Common Image Entity Modules

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

3.5.6.1 General Image Module

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

TABLE 3.5-7
GENERAL IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Image Number	(0020,0013)	2	Used / Generated
Patient Orientation	(0020,0020)	2C	Ignored / Removed. See 3.5.6.1.1.1
Image Date	(0008,0023)	2C	Used / Generated: current date
Image Time	(0008,0033)	2C	Used / Generated: current time
Image Type	(0008,0008)	3	Used / Generated. See 3.5.6.1.1.2
Acquisition Number	(0020,0012)	3	Ignored / Copied
Acquisition Date	(0008,0022)	3	Used / Copied
Acquisition Time	(0008,0032)	3	Used / Copied
Referenced Image Sequence	(0008,1140)	3	Ignored / Copied
>Referenced SOP Class UID	(0008,1150)	1C	Not Used
>Referenced SOP Instance UID	(0008,1155)	1C	Not Used
Derivation Description	(0008,2111)	3	Ignored / Removed. See 3.5.6.1.1.3
Source Image Sequence	(0008,2112)	3	Ignored / Removed. See 3.5.6.1.1.3
>Referenced SOP Class UID	(0008,1150)	1C	Not Used
>Referenced SOP Instance UID	(0008,1155)	1C	Not Used
Images in Acquisition	(0020,1002)	3	Ignored / Removed
Image Comments	(0020,4000)	3	Ignored / Removed
Lossy Image Compression	(0028,2110)	3	Used / Copied. See 3.5.6.1.1.4

3.5.6.1.1 General Image Attribute Descriptions

3.5.6.1.1.1 Patient Orientation

Since the coordinates of the image are always present, this field is never used

3.5.6.1.1.2 Image Type

When generating images, here are the values that may be sent.

Value 1 has the following value:

- DERIVED identifies a Derived Image

Value 2 has the following value:

- SECONDARY identifies a Secondary Image

Value 3 has the following value:

- REFORMATTED identifies a Reformatted Image

Value 4, if defined, can have the following values:

- MIP identifies a thick Maximum Intensity Projection Image
- MIN IP identifies a thick Minimum Intensity Projection Image
- AVERAGE identifies a thick Average Image
- VOLREN identifies a thick Volume Rendered Image

3.5.6.1.1.3 Derivation Description and Source Image Sequence

These tags are not yet used.

3.5.6.1.1.4 Lossy Image Compression

Volume Analysis does not use compression when saving images, nor it decompress images. So this field is just copied.

3.5.6.2 Image Plane Module

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

TABLE 3.5-8
IMAGE PLANE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Pixel Spacing	(0028,0030)	1	Mandatory / Generated
Image Orientation (Patient)	(0020,0037)	1	Mandatory / Generated
Image Position (Patient)	(0020,0032)	1	Mandatory / Generated
Slice Thickness	(0018,0050)	2	Used / Generated

3.5.6.3 Image Pixel Module

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

TABLE 3.5-9
IMAGE PIXEL MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Samples per Pixel	(0028,0002)	1	Ignored (expect “1”) / Generated “1”

Photometric Interpretation	(0028,0004)	1	Ignored (expect "MONOCHROME2") / Generated "MONOCHROME2"
Rows	(0028,0010)	1	Mandatory (expect from 256 to 1024) / Generated (256, 512, 1024)
Columns	(0028,0011)	1	Mandatory (expect from 256 to 1024) / Generated (256, 512, 1024)
Bits Allocated	(0028,0100)	1	Ignored (expect "16") / Generated "16"
Bits Stored	(0028,0101)	1	Ignored (expect "16") / Generated "16"
High Bit	(0028,0102)	1	Ignored (expect "15") / Generated "15"
Pixel Representation	(0028,0103)	1	Ignored (expect "1") / Generated "1"
Pixel Data	(7FE0,0010)	1	Used
Smallest Image Pixel Value	(0028,0106)	3	Used / Removed
Largest Image Pixel Value	(0028,0107)	3	Used / Removed

3.5.6.4 Contrast/Bolus Module

This section specifies the Attributes that describe the contrast /bolus used in the acquisition of the Image.

TABLE 3.5-10
CONTRAST/BOLUS MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Contrast/Bolus Agent	(0018,0010)	2	Used / Copied
Contrast/Bolus Route	(0018,1040)	2	Used / Copied

3.5.7 General Modules

The SOP Common Module is mandatory for all DICOM IODs.

3.5.7.1 SOP Common Module

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

TABLE 3.5-11
SOP COMMON MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008,0016)	1	Used, should be 1.2.840.10008.5.1.4.1.1.4
SOP Instance UID	(0008,0018)	1	Ignored / Generated (root = 1.2.840.113619.6.80)
Specific Character Set	(0008,0005)	1C	Used / Copied Only the "ISO_IR 100" character sets is supported.

3.5.8 MR Modules

This Section describes MR Series, Equipment, and Image Modules. These Modules contain Attributes that are specific to MR Image IOD.

3.5.8.1 MR Image Module

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

TABLE 3.5-12
MR IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Image Type	(0008,0008)	1	See 3.5.8.1.1.1
Samples per Pixel	(0028,0002)	1	Shall be 1.
Photometric Interpretation	(0028,0004)	1	Ignored (expect "MONOCHROME2") / Generated (write "MONOCHROME2")
Bits Allocated	(0028,0100)	1	Shall be 16.
Scanning Sequence	(0018,0020)	1	Used / Copied
Sequence Variant	(0018,0021)	1	Used / Copied
Scan Options	(0018,0022)	2	Used / Copied
MR Acquisition Type	(0018,0023)	2	Used / Copied
Repetition Time	(0018,0080)	2C	Used / Copied
Echo Time	(0018,0081)	2	Used / Copied
Inversion Time	(0018,0082)	2C	Used / Copied
Echo Train Length	(0018,0091)	2	Used / Copied
Trigger Time	(0018,1060)	2C	Used / Copied
Number of Averages	(0018,0083)	3	Used / Copied
Imaging Frequency	(0018,0084)	3	Used / Copied
Echo Number	(0018,0086)	3	Used / Copied
Magnetic Field Strength	(0018,0087)	3	Used / Copied
Percent Sampling	(0018,0093)	3	Used / Copied
Acquisition Matrix	(0018,1310)	3	Used / Copied
Cardiac Number of Images	(0018,1090)	3	Used / Copied
Receiving Coil	(0018,1250)	3	Used / Copied
Pixel Bandwith	(0018,0095)	3	Used / Copied
Flip Angle	(0018,1314)	3	Used / Copied

3.5.8.1.1 MR Image Attribute Descriptions

3.5.8.1.1.1 Image Type

Value 1 has the following value:

- DERIVED identifies a Derived Image

Value 2 has the following value:

- SECONDARY identifies a Secondary Image

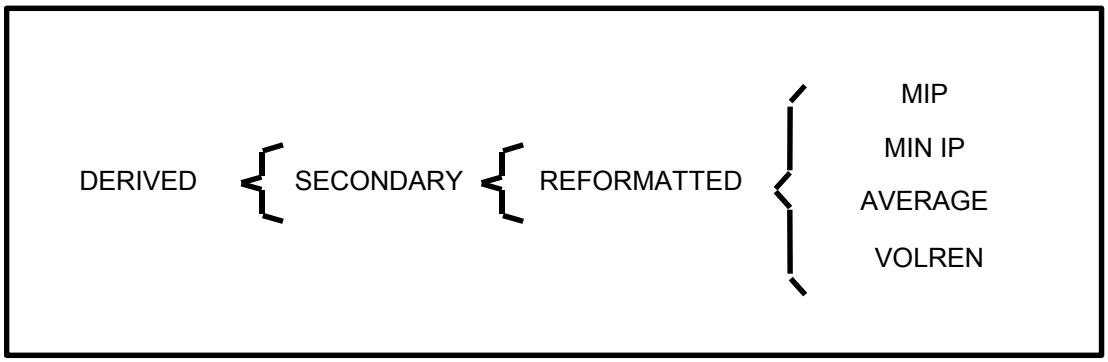
Value 3 has the following value:

- REFORMATTED identifies a Multi Planar Reformatted Image

Value 4, if defined, indicates that the image has a slice thickness superior to the pixel size; the rendering algorithm over the thickness can have the following values:

- MIP identifies a thick Maximum Intensity Projection Image
- MIN IP identifies a thick Minimum Intensity Projection Image
- AVERAGE identifies a thick Average Image
- VOLREN identifies a thick Volume Rendered Image

ILLUSTRATION 3.5-1
MR IMAGE TYPE DECISION TREE



3.6 LIST OF MANDATORY ATTRIBUTES REQUIRED BY THIS APPLICATION

Following table recalls the list of attributes that are used by this application to achieve the 3D processings. Note that some of them are not type 1 in DICOM standard. Besides, some type 1 attributes do not appear in the following table because they are not explicitly used by the application, yet they must be included in the Data Set of the MR Image Information Object.

TABLE 3.6-1
MR IMAGE IOD ATTRIBUTES REQUIRED BY THIS APPLICATION

Attribute Name	Tag	Type	Attribute Description
Series Instance UID	(0020,000E)	1	Mandatory / Generated
Image Position (Patient)	(0020,0032)	1	Mandatory / Copied
Image Orientation (Patient)	(0020,0037)	1	Mandatory / Generated
Frame of Reference UID	(0020,0052)	1	Mandatory / Generated
Rows	(0028,0010)	1	Mandatory / Generated
Columns	(0028,0011)	1	Mandatory (expect from 256 to 1024) / Generated (256, 512, 1024)
Pixel Spacing	(0028,0030)	1	Mandatory (expect from 256 to 1024) / Generated (256, 512, 1024)

4. 3D MODEL INFORMATION OBJECT IMPLEMENTATION

4.1 INTRODUCTION

This section specifies the use of the GEMS private DICOM 3D Model IOD to represent the information included in 3-dimensional volumes used by this implementation. Corresponding attributes are conveyed using the module construct. The contents of this section are:

4.2- IOD Description

4.3- IOD Entity-Relationship Model

4.4- IOD Module Table

4.5- IOD Module Definition

4.2 3D MODEL IOD IMPLEMENTATION

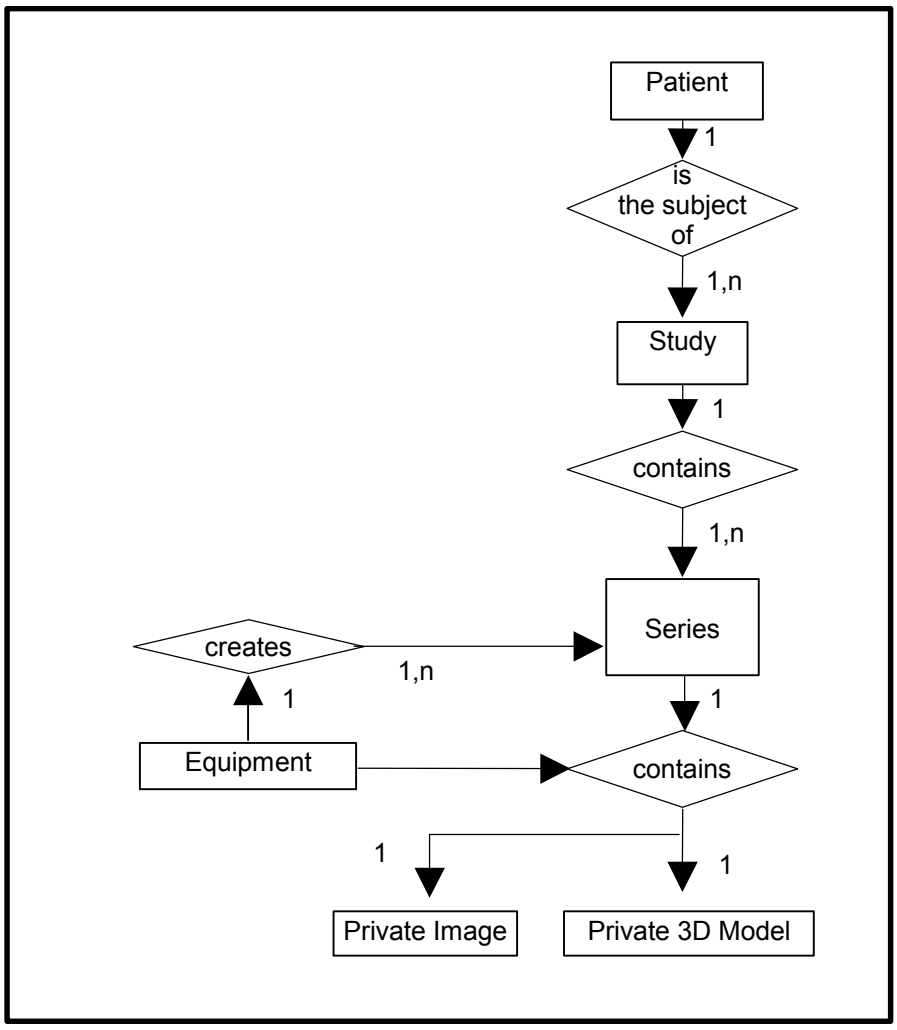
4.3 3D MODEL ENTITY-RELATIONSHIP MODEL

The Entity-Relationship diagram for the 3D Model interoperability schema is shown in 4-3-1**.** In this figure, the following diagrammatic convention is established to represent the information organization :

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

The relationships are fully defined with the maximum number of possible entities in the relationship shown. In other words, the relationship between Series and Image can only have 1 Image per Series, and 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 4.3-1
3D MODEL ENTITY RELATIONSHIP DIAGRAM



4.3.1 ENTITY DESCRIPTIONS

Please refer to DICOM Standard Part 3 (Information Object Definitions) for a description of the entities contained within the 3D Model Information Object (except GEMS private 3D Model and Image entities).

4.3.1.1 Patient Entity Description

Please refer to DICOM Standard.

4.3.1.2 Study Entity Description

Please refer to DICOM Standard.

4.3.1.3 Series Entity Description

Please refer to DICOM Standard.

4.3.1.4 Equipment Entity Description

Please refer to DICOM Standard.

4.3.1.5 Private Image Entity Description

The Private Image Information Entity defines the attributes that describe the pixel data of an image that represents a view of the 3-dimensional volume generated by the application. Unlike DICOM Image Information Entity, this Private Image Information Entity does not convey modality specific characteristics : this information is already contained in the 3D Model Entity Description.

4.3.1.6 3D Model Entity Description

The 3D Model Information Entity (GEMS private) describes the 3-dimensional volume reconstructed by this application. This Information Entity also contains a description of the parameters used to achieve such reconstruction. Most of these data are described by **DICOM v3.0 attributes**, but some of them are described by GEMS **private attributes**. A list of all private attributes defined here can be found at the end of this section.

4.3.2 Xray/MR Fusion Mapping of DICOM entities

TABLE 4.3-2
MAPPING OF DICOM ENTITIES TO XRAY/MR FUSION ENTITIES

DICOM	Xray/MR Fusion Entity
Patient	Patient
Study	Exam
Series	Series
Image	Private Image

4.4 IOD MODULE TABLE

Within an entity of the GEMS private 3D Model IOD, attributes are grouped into related set of attributes. A set of related attributes is termed a module. A module facilitates the understanding of the semantics concerning the attributes and how the attributes are related with each other. A module grouping does not infer any encoding of information into datasets.

Table 4.4-2 identifies the defined modules within the entities which comprise the 3D Model IOD. Modules are identified by Module Name.

See DICOM v3.0 Part 3 for a complete definition of the entities, modules, and attributes (except GEMS private ones). Note that some attributes of the 3D Model entity are GEMSE **private attributes**.

TABLE 4.4-2
3D MODEL IOD MODULES

Entity Name	Module Name	Reference	Usage
Patient	Patient	4.5.1.1	M
Study	General Study	4.5.2.1	M
	Patient Study	4.5.2.2	U
Series	General Series	4.5.3.1	M
Equipment	General Equipment	4.5.4.1	M
Private Image	General Image	4.5.6.1	M
	Image Pixel	4.5.6.2	M
Private 3D Model	Common Private Entity	4.5.5.1	M
	Reconstruction Parameter Sequence	4.5.5.2	M
	> MR Reconstruction Parameters		C- Required if modality = MR
	> XA Reconstruction Parameters		C- Required if modality = XA

	Volumic Data	4.5.5.3	M
	Wireframe	4.5.5.4	
General Modules	SOP Common	4.5.7.1	M

4.5 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 3D Model Information Object (except GEMS private 3D Model related module).

The following modules are included to convey Enumerated Values, Defined Terms, and Optional Attributes supported. Type 1 & Type 2 Attributes are also included for completeness and to define what values they may take and where these values are obtained from. It should be noted that they are the same ones as defined in the DICOM v3.0 Standard Part 3 (Information Object Definitions). **Type 3 attributes that are not mentioned are not saved** by the application.

In the following tables, the first value indicated in the attribute description describes if the attribute is read (used or not), and the second value describes the way the attribute is sent (copied, generated or empty).

4.5.1 Common Patient Entity Modules

4.5.1.1 Patient Module

This section specifies the Attributes of the Patient that describe and identify the Patient who is the subject of a diagnostic Study. This Module contains Attributes of the patient that are needed for diagnostic interpretation of the Image and are common for all studies performed on the patient.

TABLE 4.5-1
PATIENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Patient's Name	(0010,0010)	2	Used / Copied
Patient ID	(0010,0020)	2	Used / Copied
Patient's Birth Date	(0010,0030)	2	Used / Copied
Patient's Sex	(0010,0040)	2	Used / Copied

4.5.2 Common Study Entity Modules

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

4.5.2.1 General Study Module

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

TABLE 4.5-2
GENERAL STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Study Instance UID	(0020,000D)	1	Mandatory / Copied
Study Date	(0008,0020)	2	Used / Generated
Study Time	(0008,0030)	2	Used / Generated
Referring Physician's Name	(0008,0090)	2	Used / Copied
Study ID	(0020,0010)	2	Used / Copied
Accession Number	(0008,0050)	2	Used / Empty

Study Description	(0008,1030)	3	Used / Generated

4.5.2.2 Patient Study Module

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

TABLE 4.5-3
PATIENT STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Patient's Age	(0010,1010)	3	Used / Copied
Patient's Weight	(0010,1030)	3	Used / Copied

4.5.3 Common Series Entity Modules

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

4.5.3.1 General Series Module

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

TABLE 4.5-4
GENERAL SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	Mandatory / Copied
Series Instance UID	(0020,000E)	1	Used / Generated
Series Number	(0020,0011)	2	Used / Generated
Laterality	(0020,0060)	2C	Ignored / Empty
Series Description	(0008,103E)	3	Used / Generated
Patient Position	(0018,5100)	2C	Used / Copied

4.5.4 Common Equipment Entity Modules

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

4.5.4.1 General Equipment Module

This section specifies the Attributes which identify and describe the piece of equipment which produced the 3D Model.

TABLE 4.5-5
GENERAL EQUIPMENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Manufacturer	(0008,0070)	2	Used / Generated
Institution Name	(0008,0080)	3	Used / Generated
Station Name	(0008,1010)	3	Used / Generated
Manufacturer's Model Name	(0008,1090)	3	Used / Generated
Device Serial Number	(0018,1000)	3	Used / Empty
Software Versions	(0018,1020)	3	Used / Generated

4.5.5 3D Model Entity Modules

The following Modules specify all the attributes which describe a 3-dimensional volume reconstructed by the application.

4.5.5.1 Common Private Entity Module

This section specifies the attributes that are common to all GEMSE Private DICOM Entities.

TABLE 5.5-6
COMMON PRIVATE ENTITY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Private Entity Number	(0039,xx80)	1	Ignored / Generated
Private Entity Date	(0039,xx85)	1	Ignored / Generated
Private Entity Time	(0039,xx90)	1	Ignored / Generated
Private Entity Launch Command	(0039,xx95)	2	Ignored / Generated: « start_vxtl »
Private Entity Type	(0039,xxAA)	1	Ignored / Generated: « 3DDPO »

4.5.5.1.1 Common Private Entity Attribute Descriptions

4.5.5.1.1.1 Private Entity Number

Identifies the private entity instance.

4.5.5.1.1.2 Private Entity Date

Defines the creation date of this private entity.

4.5.5.1.1.3 Private Entity Time

Defines the creation time of this private entity.

4.5.5.1.1.4 Private Entity Launch Command

Defines the command that should be called to launch the application corresponding to the Private Entity (Xray/MR Fusion, in our case).

4.5.5.1.1.5 Private Entity Type

Defines the type of this private entity. Here we use the string « 3DDPO » to indicate that this private entity corresponds to a 3-dimensional volume.

4.5.5.2 Reconstruction Parameter Sequence Module

This section specifies the Attributes which describe the parameters that where used to achieve the 3-dimensional reconstruction.

Note that these attributes are **encapsulated in a private Sequence** item : we use standard attributes to code the reconstruction parameters. In DICOM Standard, these attributes are related to the Image Entity, whereas here they are related to the 3D Model Private Entity. The encapsulation avoids possible semantic confusions.

TABLE 5.5-7
RECONSTRUCTION PARAMETER SEQUENCE MODULE ATTRIBUTES
(FOR ALL ORIGINAL IMAGES TYPES)

Attribute Name	Tag	Type	Attribute Description
Reconstruction Parameters Sequence	(0047, xx01)	1	Mandatory / Generated

> Contrast/Bolus Agent	(0018,0010)	2	Used / Copied
> Slice thickness	(0018, 0050)	2	Used / Copied
> Spacing between Slices	(0018, 0088)	3	Used / Copied
> Contrast/Bolus Route	(0018,1040)	3	Used / Copied
> Patient Position	(0018, 5100)	2C	Used / Copied, required for CT and MR modalities
> Pixel Spacing	(0028, 0030)	1	Used / Copied
> Pixel Padding Value	(0028, 0120)	3	Used / Copied
> Largest Image Value	(0028, 0107)	3	Used / Copied

Next table gives the reconstruction parameters that are saved only when the 3-dimensional volume has been reconstructed from MR Images. Hence, all these attributes are conditional type. Remember that they are all encapsulated in the Reconstruction Parameters Sequence attribute. The description of GEMS private attribute is given at the end of this section.

NOTE: Following Module is intended to be part of a sequence item of the Reconstruction Parameter Sequence which corresponds to the Data Element (0x47, 0xXX01)

TABLE 5.5-8
RECONSTRUCTION PARAMETER SEQUENCE MODULE ATTRIBUTES
(FOR MR MODALITY ORIGINAL IMAGES)

Attribute Name	Tag	Type	Attribute Description
Scanning Sequence	(0018, 0020)	1	Used / Copied
Scan Options	(0018, 0022)	2	Used / Copied
MR Acquisition Type	(0018, 0023)	2	Used / Copied
Repetition Time	(0018, 0080)	3	Used / Copied
Echo Time	(0018, 0081)	3	Used / Copied
Inversion Time	(0018, 0082)	3	Used / Copied
Number of Averages	(0018, 0083)	3	Used / Copied
Imaging Frequency	(0018, 0084)	3	Used / Copied
Echo Number	(0018, 0086)	3	Used / Copied
Magnetic Field Strength	(0018, 0087)	3	Used / Copied
Trigger Time	(0018, 1060)	3	Used / Copied
Cardiac Number of images	(0018, 1090)	3	Used / Copied
Echo Train Length	(0018, 0091)	2	Used / Copied
Pixel Bandwidth	(0018, 0095)	3	Used / Copied

Receiving Coil	(0018, 1250)	3	Used / Copied
Acquisition Matrix	(0018,1310)	3	Used / Copied
Flip	(0018, 1314)	3	Used / Copied
Swap Phase / Frequency Axis	(0019, xx8F)	3	Used / Copied
Pulse Sequence Name	(0019, xx9C)	3	Used / Copied
Coil Type	(0019, xx9F)	3	Used / Copied
SAT fat/water/none	(0019, xxA4)	3	Used / Copied
Bitmap of SAT Selections	(0019, xxC0)	3	Used / Copied
Surfacel Coil Intensity Correction Flag	(0019, xxC1)	3	Used / Copied
Phase Contrast Flow Axis	(0019, xxCB)	3	Used / Copied
Phase Contrast Velocity Encoding	(0019, xxCC)	3	Used / Copied
Fractional Echo	(0019, xxD5)	3	Used / Copied
Cardiac phases	(0019, xxD7)	3	Used / Copied
Variable Echo Flag	(0019, xxD8)	3	Used / Copied
Concatenated Sat	(0019, xxD9)	3	Used / Copied
Number of Phases	(0019, xxF2)	3	Used / Copied

Next table gives the reconstruction parameters that are saved only when the 3-dimensional volume has been reconstructed from X-Ray Series. Hence, all these attributes are conditional type. Remember that they are all **encapsulated** in the Reconstruction Parameters Sequence attribute. The description of GEMS private attribute is given at the end of this section.

NOTE: Following Module is intended to be part of a sequence item of the Reconstruction Parameter Sequence which corresponds to the Data Element (0x47, 0xXX01)

TABLE 5.5-9
RECONSTRUCTION PARAMETER SEQUENCE MODULE ATTRIBUTES
(FOR XA MODALITY ORIGINAL IMAGES)

Attribute Name	Tag	Type	Attribute Description
Manufacturer	(0008, 0070)	3	Used / Copied
Manufacturer Model Name	(0008, 1090)	3	Used / Copied
Software Versions	(0018,1020)	3	Used / Copied
Intensifier Size	(0018, 1162)	3	Used / Copied
Acquisition DLX Identifier	(0047, xx80)	3	Ignored / Copied
Acquisition DLX 2D Series Count	(0047, xx81)	1	Used / Copied
Acquisition DLX 2D Series Sequence	(0047, xx85)	1C	Used / Copied, required if Acquisition DLX 2D Series Count is greater than zero
> Series Date	(0008, 0021)	3	Used / Copied

> Series Time	(0008, 0031)	3	Used / Copied
> Contrast Flow Rates	(0018, 1046)	3	Used / Copied
> Injections Duration	(0018, 1047)	3	Used / Copied
> Frame Delay	(0018, 1066)	3	Used / Copied
> Frame Time Vector	(0018, 1065)	3	Used / Copied
> Sid	(0018, 1110)	3	Used / Copied
> Table Height	(0018, 1130)	3	Used / Copied
> Table Traverse	(0018, 1131)	3	Used / Copied
> Table Motion	(0018, 1134)	2	Used / Copied
> Table Vertical Increment	(0018, 1135)	3	Used / Copied
> Table Lateral Increment	(0018, 1136)	3	Used / Copied
> Table Longitudinal Increment	(0018, 1137)	3	Used / Copied
> Table Angle	(0018, 1138)	3	Used / Copied
> Fov	(0018, 1149)	3	Used / Copied
> Positioner Motion	(0018, 1500)	2C	Used / Copied, required if multi-frame data
> Positioner Primary Angle	(0018,1510)	3	Used / Copied
> Positioner Secondary Angle	(0018,1511)	3	Used / Copied
> Positioner Primary Angle Increment	(0018,1520)	3	Used / Copied
> Positioner Secondary Angle Increment	(0018,1521)	3	Used / Copied
> DLX Series Number	(0020, 0011)	3	Used / Copied
>Series Identifier	(0020, 000E)	3	Used / Copied
> Rows	(0028, 0010)	3	Used / Copied
> Columns	(0028, 0011)	3	Used / Copied
> Bits Stored	(0028, 0101)	3	Used / Copied
> Angle Value 1	(0019, xx01)	3	Used / Copied
> Angle Value 2	(0019, xx02)	3	Used / Copied
> Angle Value 3	(0019, xx03)	3	Used / Copied
> Angle Label 1	(0019, xx04)	3	Used / Copied
> Angle Label 2	(0019, xx05)	3	Used / Copied

> Angle Label 3	(0019, xx06)	3	Used / Copied
> Dlx Exam Name	(0019, xx08)	3	Used / Copied
> Dlx Record View	(0019, xx0A)	3	Used / Copied
> Dlx Injector Delay	(0019, xx10)	3	Used / Copied
> Dlx Dose	(0019, xx1C)	3	Used / Copied
> KPV List	(0047, xx70)	3	Used / Copied
>X-Ray Tube Current List	(0047, xx71)	3	Used / Copied
> Exposure Time List	(0047, xx72)	3	Used / Copied
> Number Of Injections	(0047, xx8A)	2	Used / Copied
> Frame Count	(0047, xx8B)	3	Used / Copied
> Contrast Agent Volume List	(0047, xx89)	3	Used / Copied
> Used Frames	(0047, xx96)	3	Used / Copied
XA 3D Reconstruction Algorithm Name	(0047, xx91)	3	Used / Copied
XA 3D Reconstruction Algorithm Version	(0047, xx92)	3	Used / Copied
DLX Calibration Date	(0047, xx93)	3	Used / Copied
DLX Calibration Time	(0047, xx94)	3	Used / Copied
DLX Calibration Status	(0047, xx95)	3	Used / Copied
Transform Count	(0047, xx98)	1	Used / Copied
Transform Sequence	(0047, xx99)	1C	Used / Copied, required if Transform Count > 0
> Transform Rotation Matrix	(0047, xx9A)	1C	Mandatory / Copied, required if Transform Count > 0
> Transform Translation Vector	(0047, xx9B)	1C	Mandatory / Copied, required if Transform Count > 0
> Transform Label	(0047, xx9C)	1C	Used / Copied, required if Transform Count > 0

4.5.5.2.1 Reconstruction Parameters Attribute Descriptions

We describe here only the new GEMS private attributes, whose group number is (0x0047). A complete description of other GEMS private attributes can be found in the following documents :

- DLX related private attributes : see **Advantx DLX DICOM V3.0 Conformance Statement** (direction 2142506-100),
- MR Images related private attributes : see **HiSpeed Advantage CT/i Conformance Statement** (direction 2162114-100),

- CT Images related private attributes : see **HiSpeed Advantage CT/i Conformance Statement** (direction 2162114-100).

4.5.5.2.1.1 Reconstruction Parameters Sequence

This GEMSE private Sequence contains only one Sequence Item. This item is used to encapsulate the reconstruction parameters attributes to avoid possible confusions with the Image Entity.

4.5.5.2.1.2 Acquisition DLX identifier

Identifies the DLX device that acquired the images used to generate the 3-dimensional volume.

4.5.5.2.1.3 Acquisition DLX 2D Series Sequence

Each Item contained in this Sequence Data Element describes a Series acquired by the DLX device. These Series were used to build the 3-dimensional volume. One or more Frames are acquired within each Series.

4.5.5.2.1.4 Frame Count

Defines the number of Frames that were acquired within the current Series.

4.5.5.2.1.5 KPV List

Defines the value of KPV used to acquire each Frame of the Acquisition Series. Since this value may change within the same Acquisition Series, this attribute is described by a multi-valued string. We use a private attribute instead of the KPV data element (0018, 0060) in order to allow a Value Multiplicity greater than one.

4.5.5.2.1.6 X-ray Tube Current List

Defines the value of X-ray tube current used to acquire each Frame of the Acquisition Series. Since this value may change within the same Acquisition Series, this attribute is described by a multi-valued string. We use a private attribute instead of the X-ray Tube Current attribute (0018, 1151) in order to allow a Value Multiplicity greater than one.

4.5.5.2.1.7 Exposure Time List

Defines the value of exposure time used to acquire each Frame of the Acquisition Series. Since this value may change within the same Acquisition Series, this attribute is described by a multi-valued string. We use a private attribute instead of the Exposure Time attribute (0018, 1152) in order to allow a Value Multiplicity greater than one.

4.5.5.2.2 Number of injections

Defines the number of contrast agent injections performed during the current Series.

4.5.5.2.3 Contrast Agent Volume List

Defines the volume of contrast agent corresponding to each injection. We use a private attribute instead of the Contrast/Bolus Volume Data Element (0018, 1041) in order to allow a Value Multiplicity greater than one.

4.5.5.2.4 Used frames

Identifies the Frames of the current Series that were used to achieve the 3-dimensional reconstruction. this attribute is described by a multi-valued integer string. Each item of this string codes the index of one of these frames (first frame of the Series is represented by « 1 »).

4.5.5.2.5 Reconstruction Algorithm Name

Defines the algorithm used to reconstruct the 3-dimensional volume from all the acquired Series. This attribute is described by a mono-valued string whose value is user-defined.

4.5.5.2.6 Reconstruction Algorithm Version

Identifies the version of the algorithm used to reconstruct the 3-dimensional volume from all the acquired Series.

4.5.5.2.7 DLX Calibration Date

Date of last measure of the helix used to reconstruct the 3-dimensional volume.

4.5.5.2.8 DLX Calibration Time

Time of last measure of the helix used to reconstruct the 3-dimensional volume.

4.5.5.2.9 DLX Calibration Status

Defines the validity of the DLX device calibration when the Series were acquired. This attribute is described by a string. Three terms are defined: « VALID », « OLD » and « UNKNOWN ».

4.5.5.2.10 Transform Count

Some geometrical transforms can be related to the 3-dimensional reconstruction from the acquired DLX Series. The Transform Count attribute defines the number of geometrical transforms.

4.5.5.2.11 Transform Sequence

Each Item of this Sequence attribute describes a geometrical transform. The geometrical parameters that define such a transform are a rotation matrix and a translation vector. These geometrical parameters are related to the slice-relative referential.

4.5.5.2.12 Transform Rotation Matrix

Defines the rotation matrix that corresponds to the current transform.

4.5.5.2.13 Transform Translation Vector

Defines the translation vector that corresponds to the current transform.

4.5.5.2.14 Transform Label

Identifies the current transform. The value of this label is user-defined.

4.5.5.3 Volumic Data Module

This section specifies the Attributes which describe the 3-dimensional volumic data. Most of them are GEMS private.

TABLE 5.5-11
VOLUMIC DATA MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Volume Color	(0047, xx49)	3	Used / Generated
Volume Voxel Count	(0047, xx50)	1	Mandatory / Generated
Volume Segment Count	(0047, xx51)	1	Mandatory / Generated

Volume Slice Size	(0047, xx53)	1	Mandatory / Generated
Volume Slice Count	(0047, xx54)	1	Mandatory / Generated
Volume Threshold Value	(0047, xx55)	2C	Used / Generated
Volume Voxel Ratio	(0047, xx57)	1	Used / Generated
Volume Voxel Size	(0047, xx58)	1	Mandatory / Generated
Volume Z Position Size	(0047, xx59)	1	Used / Generated
Volume Base Line	(0047, xx60)	1	Mandatory / Generated
Volume Center Point	(0047, xx61)	1	Mandatory / Generated
Volume Skew Base	(0047, xx63)	1	Used / Generated
Volume Registration Transform Rotation Matrix	(0047, xx64)	3	Mandatory / Generated
Volume Registration Transform Translation Vector	(0047, xx65)	3	Mandatory / Generated
Volume Upper Left High Corner RAS	(0047, xxC0)	1	Ignored / Generated
Volume Slice to RAS Rotation Matrix	(0047, xxC1)	1	Ignored / Generated
Volume Upper Left High Corner TLOC	(0047, xxC2)	1	Ignored / Generated
Volume Volume Segment List	(0047, xxD1)	1	Mandatory / Generated
Volume Gradient List	(0047, xxD2)	1	Used / Generated
Volume Density List	(0047, xxD3)	1	Mandatory / Generated
Volume Z Position List	(0047, xxD4)	1	Used / Generated
Volume Original Index List	(0047, xxD5)	1	Mandatory / Generated

4.5.5.3.1 Volumic Data Attribute Descriptions

4.5.5.3.1.1 Volume Color

Multi-valued string that describes the color used to display the three-dimensional model. This color is described through the RGB code.

4.5.5.3.1.2 Voxel Count

Defines the number of volumic elements (« voxels ») used to describe the three-dimensional reconstruction.

4.5.5.3.1.3 Segment Count

The voxels are grouped into sets called « segments ». This attribute defines the number of segments used to describe the three-dimensional reconstruction. In multi-volume mode, this value is multi-valued : each value gives the number of segments of each volume.

4.5.5.3.1.4 Slice Count

The 3-dimensional volume can be seen as a superposition of voxel slices. This attribute defines the number of slices used to describe the three-dimensional reconstruction.

4.5.5.3.1.5 Threshold Value

Defines the value of the threshold applied to the volumic data. If no threshold is applied, set this attribute to zero.

4.5.5.3.1.6 Ratio

Defines the ratio between slice spacing and voxel size.

4.5.5.3.1.7 Voxel size

Defines the size of a voxel (cubic element).

4.5.5.3.1.8 Z Position size

Defines the z location of the original slices.

4.5.5.3.1.9 Base Line

3x3 matrix that defines the slices orientation.

4.5.5.3.1.10 Center Point

Defines the coordinates of the volume center point.

4.5.5.3.1.11 Registration Transform Rotation Matrix

3x3 matrix that defines the rotation matrix associated to the transform from the slice-relative referential to another arbitrary referential. Set to null matrix if no transformation is defined.

4.5.5.3.1.12 Registration Transform Translation Vector

3x1 vector that defines the translation vector associated to the transform from the slice-relative referential to another arbitrary referential. Set to null vector if no transformation is defined.

4.5.5.3.1.13 Upper Left High Corner RAS

3x1 vector that defines the coordinates of the Upper Left High Corner (i.e. first voxel of the first slice) in the RAS referential.

4.5.5.3.1.14 Slice To RAS Rotation Matrix

3x3 matrix that defines the rotation matrix associated to the transform from the RAS referential to slice-relative referential.

4.5.5.3.1.15 Upper Left High Corner TLOC

4.5.5.3.1.16 Segment List

Describes the list of segments used to describe the three-dimensional reconstruction.

4.5.5.3.1.17 Gradient List

Describes the gradients for each voxel of the Segment List.

4.5.5.3.1.18 Density List

Defines the value of each voxel of the Segment List.

4.5.5.3.1.19 Z Position List

Defines the Z location of original slices.

4.5.5.3.1.20 Original Index List

Defines the rank index list of original slices.

4.5.5.4 Wireframe Module

This section specifies the attributes which describe the 3-dimensional wireframes (if any) attached to 3-dimensional volume. All of them are GEMS private.

TABLE 5.5-12
WIREFRAME MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Wireframe Count	(0047, xxB1)	1	Used / Generated
Location System	(0047, xxB2)	2C	Used / Generated
Wireframe List	(0047, xxB0)	1C	Used / Generated
> Wireframe Name	(0047, xxB5)	3	Used / Generated
> Wireframe Group Name	(0047, xxB6)	3	Used / Generated
> Wireframe Color	(0047, xxB7)	3	Used / Generated
> Wireframe Attributes	(0047, xxB8)	3	Used / Generated
> Wireframe Point Count	(0047, xxB9)	1	Used / Generated
> Wireframe Timestamp	(0047, xxBA)	3	Used / Generated
> Wireframe Point List	(0047, xxBB)	1C	Used / Generated
> > Wireframe Points Coordinates	(0047, xxBC)	1	Used / Generated

4.5.5.4.1 wireframe Attribute Descriptions

4.5.5.4.1.1 Wireframe Count

Defines the number of wireframes attached to the three-dimensional reconstruction.

4.5.5.4.1.2 Location System

Enumerated value that defines the location system for which the points coordinates are given. The defined values are:

0: slice relative, 1: center relative, 2: RAS relative, 3: auxiliar relative, 4: auxiliar relative (polar), 5: registration relative, 6: registration relative(polar). Default value is 0.

Required if Wireframe Count has a non-null value.

4.5.5.4.1.3 Wireframe List

Describes each wireframe as a Sequence Item. Required if Wireframe Count has a non-null value.

4.5.5.4.1.4 Wireframe Name

Label that identifies the wireframe (type 3 attribute).

4.5.5.4.1.5 Wireframe Group Name

Label that identifies the group of the wireframe (type 3 attribute).

4.5.5.4.1.6 Wireframe Color

Label that defines the wirefame's color (type 3 attribute).

4.5.5.4.1.7 Wireframe Attributes

Defines the attributes of the wireframe.

4.5.5.4.1.8 Wireframe Point Count

Defines the number of points that compose this wireframe..

4.5.5.4.1.9 Wireframe Timestamp

Defines a time stamp attached to the wireframe (type 3 attribute).

4.5.5.4.1.10 Wireframe Point List

Describes each point of the wireframe as a Sequence Item. There is as many Sequence Items as points. Required if Wireframe Point Count has a non-null value.

4.5.5.4.1.11 Point Coordinates

3x1 vector that describes the point coordinates relative to the location system specified by the Location System attribute.

4.5.6 Common Image Entity Modules

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

4.5.6.1 General Image Module

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

TABLE 4.5-13
GENERAL IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Image Number	(0020,0013)	2	Ignored / Generated

4.5.6.2 Image Pixel Module

This section specifies the Attributes that describe the pixel data of the image. This image represents a view of the 3-dimensional volume.

TABLE 4.5-14
IMAGE PIXEL MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Samples per Pixel	(0028,0002)	1	Ignored / Generated:1
Photometric Interpretation	(0028,0004)	1	Ignored / Generated: « MONOCHROME2 »
Rows	(0028,0010)	1	Used / Generated: 64
Columns	(0028,0011)	1	Used / Generated: 64

Bits Allocated	(0028,0100)	1	Ignored / Generated: 8
Bits Stored	(0028,0101)	1	Used / Generated: 8
High Bit	(0028,0102)	1	Ignored / Generated: 8
Pixel Representation	(0028,0103)	1	Ignored / Generated: 0
Pixel Data	(7FE0,0010)	1	Ignored / Generated

4.5.7 General Modules

The SOP Common Module is mandatory for all DICOM IODs.

4.5.7.1 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 4.5-15
SOP COMMON MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008,0016)	1	Mandatory / Generated: « 1.2.840.113619.4.26 »
SOP Instance UID	(0008,0018)	1	Ignored / Generated

4.6 PRIVATE DATA DICTIONARY

The Type of a Private Attribute is determined by the module of the IOD in which it is used, and hence is not listed in this dictionary. Private Attributes contained within these list are described in the preceding sections in the appropriate module.

TABLE 5.6-1
3D MODEL IOD PRIVATE ATTRIBUTES

Attribute Name	Tag	VR	VM
Private Creator « GEMS_ACQU_01 **»**	(0019, 00xx)	LO	1
Axial Type	(0019, xx39)	SS	1
Swap Phase / Frequency Axis	(0019, xx8F)	SS	1
Pulse Sequence Name	(0019, xx9C)	SS	1
Coil Type	(0019, xx9F)	SS	1
SAT fat/water/none	(0019, xxA4)	SS	1
Bitmap of SAT Selections	(0019, xxC0)	SS	1
Surfacel Coil Intensity Correction Flag	(0019, xxC1)	SS	1
Phase Contrast Flow Axis	(0019, xxCB)	SS	1
Phase Contrast Velocity Encoding	(0019, xxCC)	SS	1
Fractional Echo	(0019, xxD5)	SS	1
Variable Echo Flag	(0019, xxD8)	SS	1
Concatenated Sat	(0019, xxD9)	DS	1
Number of Phases	(0019, xxF2)	SS	1
Private Creator « DLX_SERIE_01 »	(0019, 00xx)	LO	1
Angle Value 1	(0019, xx01)	DS	1

Angle Value 2	(0019, xx02)	DS	1
Angle Value 3	(0019, xx03)	DS	1
Angle Label 1	(0019, xx04)	CS	1
Angle Label 2	(0019, xx05)	CS	1
Angle Label 3	(0019, xx06)	CS	1
DLX Exam Name	(0019, xx08)	ST	1
Dlx Record View	(0019, xx0A)	IS	1
Dlx Injector Delay	(0019, xx10)	DS	1
Dlx Dose	(0019, xx1C)	CS	1
Private Creator « GEMS_ADWSoft_DPO1 »	(0039, 00xx)	LO	1
Private Entity Number	(0039,xx80)	IS	1
Private Entity Date	(0039,xx85)	DA	1
Private Entity Time	(0039,xx90)	TM	1
Private Entity Launch Command	(0039,xx95)	LO	1
Private Entity Type	(0039,xxAA)	CS	1
Private Creator « GEMS_PARM_01 **»**	(0043, 00xx)	LO	1
Delta Start Time	(0043, xx1E)	DS	1
Pitch Ratio	(0043, xx27)	SH	1
Private Creator « GEMS_ADWSoft_3D1 »	(0047, 00xx)	LO	1
Reconstruction Parameters Sequence	(0047, xx01)	SQ	1
Volume Color	(0047, xx49)	UL	3-N
Volume Voxel Count	(0047, xx50)	UL	1
Volume Segment Count	(0047, xx51)	UL	1-N
Volume Slice Size	(0047, xx53)	US	1
Volume Slice Count	(0047, xx54)	US	1
Volume Threshold Value	(0047, xx55)	SL	1
Volume Voxel Ratio	(0047, xx57)	DS	1
Volume Voxel Size	(0047, xx58)	DS	1
Volume Z Position Size	(0047, xx59)	US	1
Volume Base Line	(0047, xx60)	DS	9
Volume Center Point	(0047, xx61)	DS	3
Volume Skew Base	(0047, xx63)	SL	1
Volume Registration Transform Rotation Matrix	(0047, xx64)	DS	9
Volume Registration Transform Translation Vector	(0047, xx65)	DS	3
KPV List	(0047, xx70)	DS	1-N
X-Ray Tube Current List	(0047, xx71)	IS	1-N
Exposure List	(0047, xx72)	IS	1-N
Acquisition DLX Identifier	(0047, xx80)	LO	1
Acquisition DLX 2D Series Count	(0047, xx81)	IS	1
Acquisition DLX 2D Series Sequence	(0047, xx85)	SQ	1

Contrast Agent Volume List	(0047, xx89)	DS	1-N
Number Of Injections	(0047, xx8A)	US	1
Frame Count	(0047, xx8B)	US	1
Used Frames	(0047, xx96)	IS	1-N
XA 3D Reconstruction Algorithm Name	(0047, xx91)	LO	1
XA 3D Reconstruction Algorithm Version	(0047, xx92)	CS	1
DLX Calibration Date	(0047, xx93)	DA	1
DLX Calibration Time	(0047, xx94)	TM	1
DLX Calibration Status	(0047, xx95)	CS	1
Transform Count	(0047, xx98)	US	1
Transform Sequence	(0047, xx99)	SQ	1
Transform Rotation Matrix	(0047, xx9A)	DS	9
Transform Translation Vector	(0047, xx9B)	DS	3
Transform Label	(0047, xx9C)	LO	1
Wireframe Count	(0047, xxB1)	US	1
Location System	(0047, xxB2)	US	1
Wireframe List	(0047, xxB0)	SQ	1
Wireframe Name	(0047, xxB5)	LO	1
Wireframe Group Name	(0047, xxB6)	LO	1
Wireframe Color	(0047, xxB7)	LO	1
Wireframe Attributes	(0047, xxB8)	SL	1
Wireframe Point Count	(0047, xxB9)	SL	1
Wireframe Timestamp	(0047, xxBA)	SL	1
Wireframe Point List	(0047, xxBB)	SQ	1
Wireframe Points Coordinates	(0047, xxBC)	DS	3
Volume Upper Left High Corner RAS	(0047, xxC0)	DS	3
Volume Slice To RAS Rotation Matrix	(0047, xxC1)	DS	9
Volume Upper Left High Corner TLOC	(0047, xxC2)	DS	1
Volume Segment List	(0047, xxD1)	OB	1
Volume Gradient List	(0047, xxD2)	OB	1
Volume Density List	(0047, xxD3)	OB	1
Volume Z Position List	(0047, xxD4)	OB	1
Volume Original Index List	(0047, xxD5)	OB	1

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5. SC INFORMATION OBJECT IMPLEMENTATION

5.1 INTRODUCTION

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

5.2 - IOD Description

5.3 - IOD Entity-Relationship Model

5.4 - IOD Module Table

5.5 - IOD Module Definition

5.2 SC IOD IMPLEMENTATION

This section defines the implementation of SC image information object. It refers to the DICOM Standard, Part 3 (Information Object definition).

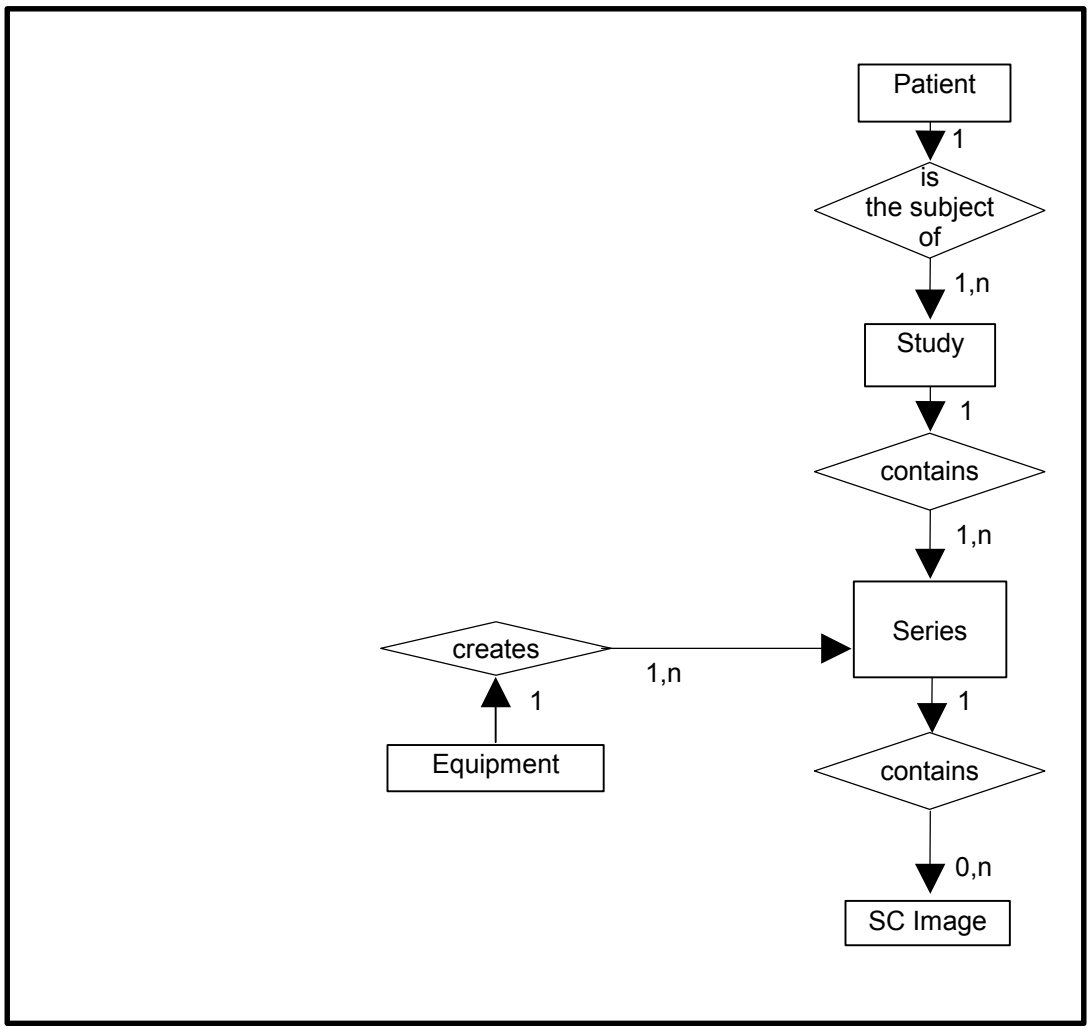
5.3 SC ENTITY RELATIONSHIP MODEL

The Entity-Relationship diagram for the SC Image interoperability schema is shown in Illustration 5.3-1**.** In this figure, the following diagrammatic convention is established to represent the information organization :

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

The relationships are fully defined with the maximum number of possible entities in the relationship shown. In other words, the relationship between Series and Image can have up to n Images per Series, but the Patient to Study relationship has 1 Study for each Patient (a Patient can have more than one Study on the system, however each Study will contain all of the information pertaining to that Patient).

ILLUSTRATION 5.3-1
SC IMAGE ENTITY RELATIONSHIP DIAGRAM



5.3.1 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.

5.3.2 Xray/MR Fusion Mapping of DICOM entities

TABLE 5.3-1
MAPPING OF DICOM ENTITIES TO XRAY/MR FUSION ENTITIES

DICOM	Xray/MR Fusion Entity
Patient Entity	Patient Entity
Study Entity	Examination Entity
Series Entity	Series Entity
Secondary Capture Image Entity	Screen Save Image

5.4 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 datasets.

Table 5.4-1 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 5.4-1
SC IMAGE IOD MODULES

Entity Name	Module Name	Reference
Patient	Patient	5.5.1.1
Study	General Study	5.5.2.1
	Patient Study	5.5.2.2
Series	General Series	5.5.3.1
Equipment	General Equipment	5.5.4.1
	SC Equipment	5.5.8.1
Image	General Image	5.5.5.1
	Image Pixel	5.5.5.2
	SC Image	5.5.8.2
	Modality LUT	5.5.6.2
	VOI LUT	5.5.6.1
	SOP Common	5.5.7.1

5.5 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. Type 1 & Type 2 Attributes are also included for completeness and to define what values they may take and where these values are obtained from. It should be noted that they are the same ones as defined in the DICOM v3.0 Standard Part 3 (Information Object Definitions).

5.5.1 Common Patient Entity Modules

5.5.1.1 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 5.5-1
PATIENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Patient's Name	(0010,0010)	2	Original
Patient ID	(0010,0020)	2	Original
Patient's Birth Date	(0010,0030)	2	Original

Patient's Sex	(0010,0040)	2	Original

5.5.2 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.

5.5.2.1 General Study Module

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

TABLE 5.5-2
GENERAL STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Study Instance UID	(0020,000D)	1	Original
Study Date	(0008,0020)	2	Generated
Study Time	(0008,0030)	2	Generated
Referring Physician's Name	(0008,0090)	2	Original
Study ID	(0020,0010)	2	Original
Accession Number	(0008,0050)	2	Original
Study Description	(0008,1030)	3	Original

5.5.2.2 Patient Study Module

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

TABLE 5.5-3
PATIENT STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Patient's Age	(0010,1010)	3	Original
Patient's Weight	(0010,1030)	3	Original

5.5.3 Common Series Entity Modules

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

5.5.3.1 General Series Module

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

TABLE 5.5-4
GENERAL SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	Original
Series Instance UID	(0020,000E)	1	Generated
Series Number	(0020,0011)	2	Generated
Laterality	(0020,0060)	2C	Empty
Series Description	(0008,103E)	3	Generated

Patient Position	(0018,5100)	2C	Original, required for CT and MR images

5.5.4 Common Equipment Entity Modules

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

5.5.4.1 General Equipment Module

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

TABLE 5.5-5
GENERAL EQUIPMENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Manufacturer	(0008,0070)	2	Original
Institution Name	(0008,0080)	3	Original
Station Name	(0008,1010)	3	Original
Manufacturer's Model Name	(0008,1090)	3	Original

5.5.5 Common Image Entity Modules

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

5.5.5.1 General Image Module

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

TABLE 5.5-6
GENERAL IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Image Number	(0020,0013)	2	Generated
Patient Orientation	(0020,0020)	2C	Empty.
Image Date	(0008,0023)	2C	Generated
Image Time	(0008,0033)	2C	Generated
Image Type	(0008,0008)	3	Generated DERIVED\SECONDARY\3D
Lossy Image Compression	(0028,2110)	3	Generated
Burned In Annotation	(0028,0301)	3	Empty

5.5.5.2 Image Pixel Module

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

TABLE 5.5-7
IMAGE PIXEL MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Samples per Pixel	(0028,0002)	1	1
Photometric Interpretation	(0028,0004)	1	MONOCHROME2

Rows	(0028,0010)	1	Generated
Columns	(0028,0011)	1	Generated
Bits Allocated	(0028,0100)	1	16
Bits Stored	(0028,0101)	1	16
High Bit	(0028,0102)	1	15
Pixel Representation	(0028,0103)	1	1
Pixel Data	(7FE0,0010)	1	Generated

5.5.6 Common Lookup Table Modules

5.5.6.1 VOI LUT module

This section specifies the Attributes that describe the VOI LUT.

TABLE 5.5-8
VOI LUT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Window Center	(0028,1050)	3	Generated
Window Width	(0028,1051)	1C	Generated

5.5.6.2 Modality LUT module

This section specifies the Attributes that describe the Modality LUT.

TABLE 5.5-9
MODALITY LUT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Rescale Intercept	(0028,1052)	1C	Generated
Rescale Slope	(0028,1053)	1C	1

5.5.7 General Modules

The SOP Common Module is mandatory for all DICOM IODs.

5.5.7.1 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 5.5-10
SOP COMMON MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008,0016)	1	1.2.840.10008.5.1.4.1.1.7
SOP Instance UID	(0008,0018)	1	Generated (RootUID = 1.2.840.113619.2.80)

5.5.8 SC Modules

This Section describes SC Equipment, and Image Modules. These Modules contain Attributes that are specific to SC Image IOD.

5.5.8.1 SC Equipment Module

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

TABLE 5.5-11
SC IMAGE EQUIPMENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Conversion Type	(0008,0064)	2	WSD
Secondary Capture Device Manufacturer	(0018,1016)	3	Generated = GE MEDICAL SYSTEMS
Secondary Capture Device Manufacturer's Model Name	(0018,1018)	3	Generated
Secondary Capture Software Version	(0018,1019)	3	Generated

5.5.8.2 SC Image Module

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

TABLE 5.5-12
SC IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Date of Secondary Capture	(0018,1012)	3	Generated
Time of Secondary Capture	(0018,1014)	3	Generated

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