GE Medical Systems

Technical Publications

Direction Number 5344139-100
Revision 2

Volume Viewer and its applications (Release 9.x) CONFORMANCE STATEMENT for DICOM

Including:
AutoBone,
AVA / VesselIQ Xpress,
MR VesselIQ Xpress,
AdvantageALA / Lung VCAR,
AdvantageCTC / Colon VCAR,
CardIQ Xpress,
CardIQ Function Xpress,
CardIQ Fusion,
CardEP,
Dynamic Shuttle,
Integrated Registration,
PET VCAR,
Thoracic VCAR,
Volume Viewer,
Volume Viewer PET,
Volume Viewer Innova,
Synchro3D

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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 specifies the GEMS equipment compliance to the DICOM requirements.

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

Section 4 (MR Information Object Implementation), which specifies the GEMS equipment compliance to DICOM requirements for the implementation of a MR Information Object.

Section 5 (Nuclear Medicine Information Object Implementation), which specifies the GEMS equipment compliance to DICOM requirements for the implementation of a Nuclear Medicine Information Object.

Section 6 (PET Information Object Implementation), which specifies the GEMS equipment compliance to DICOM requirements for the implementation of a PET Information Object.

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

Section 8 (SR Information Object Implementation), which specifies the GEMS equipment compliance to DICOM requirements for the implementation of a basic text, enhanced or comprehensive SR Information Object.

Section 9 (3D Information Object Implementation), which specifies the GEMS equipment description of the private implementation of the 3D information Object.

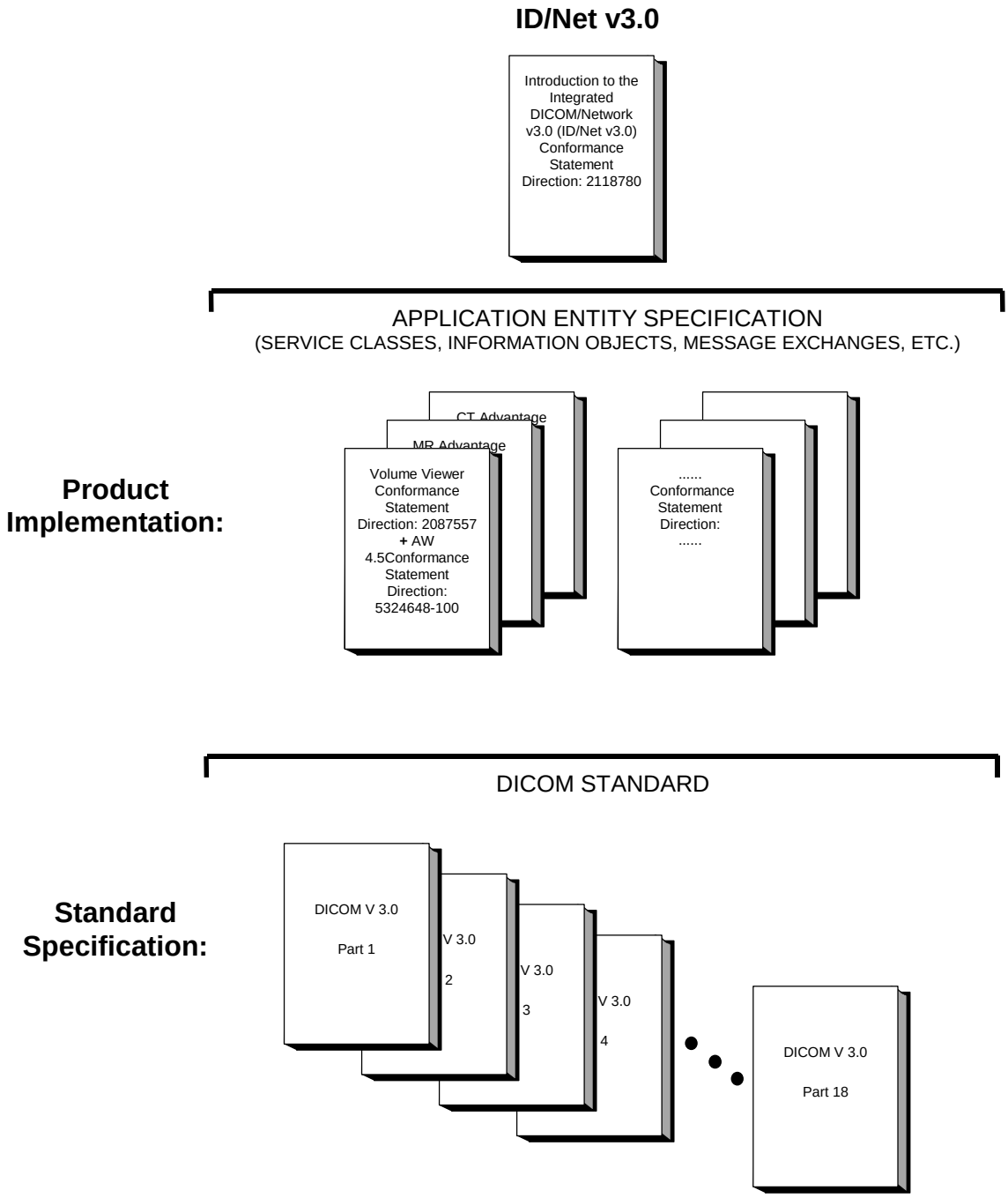
Section 10 and 11 (RTSS Information Object Implementation), which specifies the GEMS equipment description of the implementation of the RTSS information Object.

Section 12 (KOS Information Object Implementation), which specifies the GEMS equipment description of the implementation of the Key Object Selection information Object.

Section 13 (Spatial Registration Information Object Implementation), which specifies the GEMS equipment description of the implementation of the Key Object Selection information Object.

1.2 OVERALL DICOM CONFORMANCE STATEMENT DOCUMENT STRUCTURE

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



This document specifies the DICOM implementation. It is entitled:

Volume Viewer Applications
Conformance Statement for DICOM
Direction: ***2087557-100***

This DICOM Conformance Statement documents the DICOM 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 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, copies of the Standard may be obtained on the Internet at http://medical.nema.org. Comments on the Standard may be addressed to:

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

1.3 INTENDED AUDIENCE

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

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

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 Conformance Statement and is necessary to ensure proper processing and interpretation of GEMS medical data exchanged using DICOM. 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 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 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), 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 Standard. DICOM will incorporate new features and technologies and GE may follow the evolution of the Standard. The GEMS protocol is based on DICOM as specified in each DICOM

Conformance Statement. Evolution of the Standard may require changes to devices which have implemented DICOM. **In addition, GE reserves the right to discontinue or make changes to the support of communications features (on its products) reflected on by these 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*.

1.9 TERMS DEFINITIONS

In the following conformance statement, the following terms describe the use of each of the DICOM tags. When Volume Viewer is loading DICOM data files, we use the following terms:

- **Ignored**: the software will ignore the value of the tag
- **Used**: the software might use at some point the value of this tag; the value could be use for computations, for display, or to regenerate the value of a secondary capture
- **Mandatory**: the software will need a valid value for this tag; this value will be used for computations and an invalid value will prevent the software to load the data

When Volume Viewer is saving some reformatted or secondary capture images, we use the following terms:

- **Removed**: the tag is removed of the module and will be absent from the data set
- **Generated**: the software will generate a value, generally by computing a new value
- **Copied**: the software will try as much as possible to duplicate the value found in the source images if the value is the same on all the source images; if the value is

not constant, the tag will be absent from the data set if “Ignored” at load or possibly regenerated if “Used” at load

2. CONFORMANCE STATEMENT

Volume Viewer is a software application designed to be used on the Advantage Windows workstation. This means that networking and media storage features are inherited from this platform. Volume Viewer uses DICOM images to reconstructs 3-dimensional volume. The views of 3-dimensional volumes displayed by the application are saved in DICOM format (Secondary Capture or modality reformatted images). These images can be loaded and displayed by other GEMS applications (such as the Image Viewer).

For a complete description of the networking conformance, refer to the AW4.5 conformance statement, direction 5324648-100. If Volume Viewer is running on a different platform than an AW workstation (CT or MR device, AW Enterprise Server), please refer to the corresponding Dicom Conformance Statement.

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 Voxtool at a later date for follow-up processing. These are deprecated in favor of 3D Save State based on Secondary Capture objects.

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

- the DICOM CT IODs that are required to reconstruct a 3-dimensional volume and post processed reformatted CT IODs written by the application (section 3),
- the DICOM MR IODs that are required to reconstruct a 3-dimensional volume and post processed reformatted MR IODs written by the application (section 4),
- the DICOM NM IODs that are required to reconstruct a 3-dimensional volume (section 5),
- the DICOM PET IODs that are required to reconstruct a 3-dimensional volume (section 6),
- the DICOM SC IODs written by the application (section 7),
- the DICOM SR IODs written by the application (section 8),
- the DICOM 3D private IODs that are required to reconstruct a 3-dimensional volume and written by the application (section 9),
- the DICOM RTSS IODs written by the application (section 10 and 11).
- the DICOM KOS IODs written by the application (section12).
- the DICOM SPATIAL REGISTRATION IODs written by the application (section 13).

Modality	SOP Class	Input	Output	Remarks
CT	1.2.840.10008.5.1.4.1.1.2	Yes	Yes	Starting from VV 9.x, XACT images generated by the 3DXR software is also supported. XACT images have a CT SOP class UID but a XA modality. See the Innova 3DXR 1.1 Dicom Conformance Statement 5342650-100.
MR	1.2.840.10008.5.1.4.1.1.4	Yes	Yes	
NM	1.2.840.10008.5.1.4.1.1.20	Yes	No	Limited basically to “RECON TOMO” objects. Refer to section 5 for more details.
PET	1.2.840.10008.5.1.4.1.1.128	Yes	Yes	
SC	1.2.840.10008.5.1.4.1.1.7	No	Yes	VV does not read SC images as such. However, Save State are implemented as SC objects and can be read and written, but the image pixels are not meaningful in this case and only the private elements are actually used (see section 7.5.1 for more information on 3D State).
SR	1.2.840.10008.5.1.4.1.1.88.22	No	Yes	Supported through the SRDom library.
3D	1.2.840.113619.4.26	Yes	Yes	Private Object
RTSS	1.2.840.10008.5.1.4.1.1.481.3	Yes	Yes	Those objects are used only for the purpose of saving the contouring data of the segmentations of the ALA application. Only self-created objects can be reloaded.
KOS	1.2.840.10008.5.1.4.1.1.88.59	No	Yes	Key Object Selection
REG	1.2.840.10008.5.1.4.1.1.66.1	No	Yes	Spatial Registration

3. CT INFORMATION OBJECT IMPLEMENTATION

3.1 INTRODUCTION

This section specifies the use of the DICOM CT Image IOD to represent the information included in CT images or "XA images" read and written by this implementation. The "XA images" will have the modality to XA inside a CT IOD. This enables to benefit to all the CT tools with XACT images created by the Innova system. See the Innova 3DXR 1.1 Dicom Conformance Statement 5342650-100. Corresponding attributes are conveyed using the module construct. The contents of this section are:

3.2 - IOD Entity-Relationship Model

3.3 - IOD Module Table

3.4 - IOD Module Definition

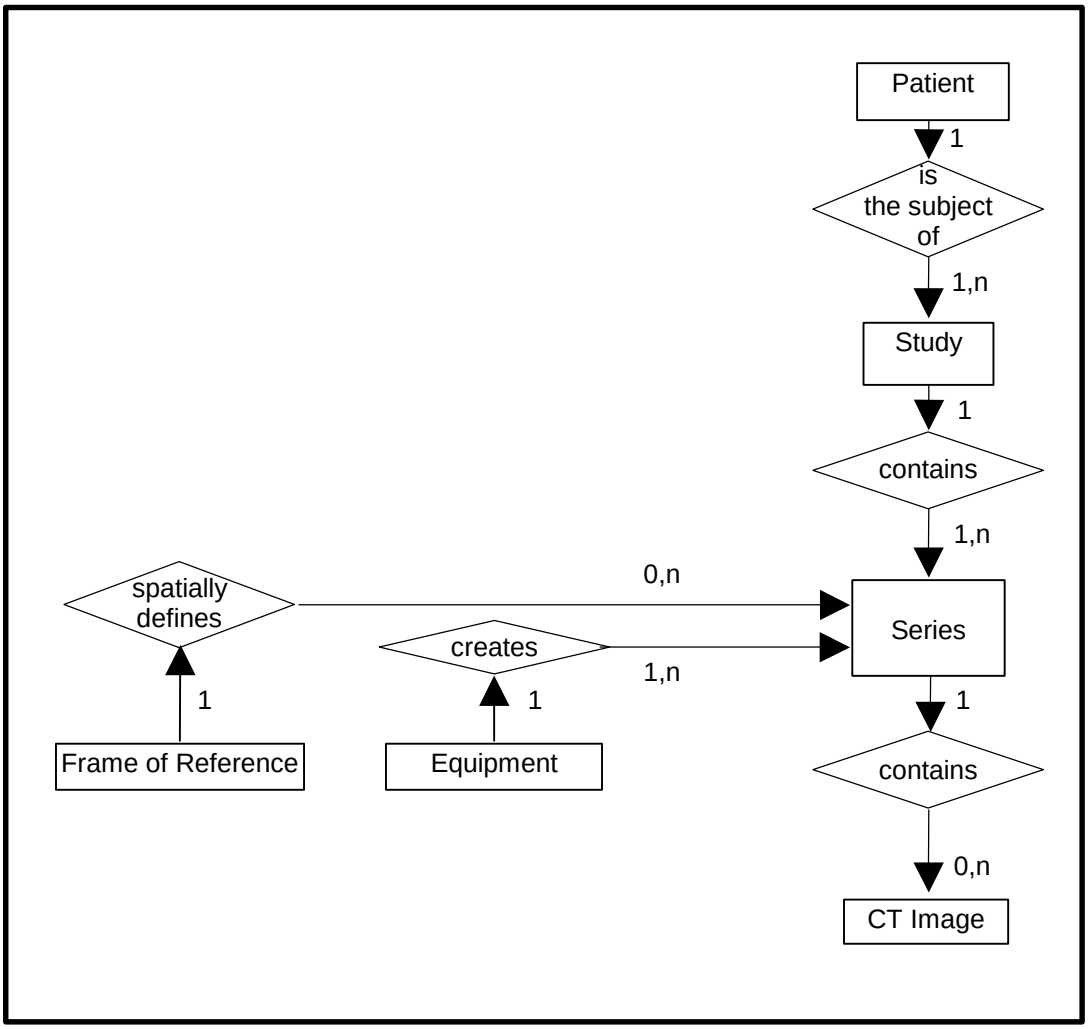
3.2 CT ENTITY-RELATIONSHIP MODEL

The Entity-Relationship diagram for the CT Image interoperability schema is shown in Illustration 3.2-1**.** In this figure, the following diagrammatic convention is established to represent the information organization:

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

The relationships are fully defined with the maximum number of possible entities in the relationship shown. In other words, the relationship between Series and Image can have up to n Images per Series, but the Patient to Study relationship has 1 Patient for each Study (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 3.2-1
CT IMAGE ENTITY RELATIONSHIP DIAGRAM



3.2.1 ENTITY DESCRIPTIONS

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

3.2.2 Volume Viewer Mapping of DICOM entities

TABLE 3.2-1
MAPPING OF DICOM ENTITIES TO VOLUME VIEWER ENTITIES

DICOM	Volume Viewer Entity
Patient	Patient
Study	Exam
Series	Series
Image	Image
Frame	Not Applicable

3.3 IOD MODULE TABLE

Within an entity of the DICOM CT 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 3.3-1 identifies the defined modules within the entities which comprise the DICOM CT IOD. Modules are identified by Module Name.

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

TABLE 3.3-1
CT IMAGE IOD MODULES

Entity Name	Module Name	Reference
Patient	Patient	3.4.1.1
Study	General Study	3.4.2.1
	Patient Study	3.4.2.2
Series	General Series	3.4.3.1
Frame of Reference	Frame of Reference	3.4.4.1
Equipment	General Equipment	3.4.5.1
Image	General Image	3.4.6.1
	Image Plane	3.4.6.2
	Image Pixel	3.4.6.3
	Contrast/Bolus	3.4.6.4
	CT Image	3.4.9.1
	Overlay Plane	Not used / Not copied
	VOI LUT	3.4.7.1
	SOP Common	3.4.8.1

3.4 INFORMATION MODULE DEFINITIONS

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

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

If an element is not listed below, it means that it will be ignored at reading and not copied at writing.

3.4.1 Common Patient Entity Modules

3.4.1.1 Patient Module

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

TABLE 3.4-1
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
Referenced Patient Sequence	(0008,1120)	3	Ignored / Copied
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
Patient's Birth Time	(0010,0032)	3	Ignored / Copied
Other Patient IDs	(0010,1000)	3	Ignored / Copied
Other Patient Names	(0010,1001)	3	Ignored / Copied
Ethnic Group	(0010,2160)	3	Ignored / Copied
Patient Comments	(0010,4000)	3	Ignored / Copied

3.4.2 Common Study Entity Modules

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

3.4.2.1 General Study Module

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

TABLE 3.4-2
GENERAL STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Study Instance UID	(0020,000D)	1	Mandatory / Copied
Study Date	(0008,0020)	2	Used / 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
Physician(s) of Record	(0008,1048)	3	Ignored / Copied
Name of Physician(s) Reading Study	(0008,1060)	3	Used / Copied
Referenced Study Sequence	(0008,1110)	3	Ignored / Copied
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
Procedure Code Sequence	(0008,1032)	3	Ignored / Copied
>Code Value	(0008,0100)	1C	
>Code Scheme Designator	(0008,0102)	1C	
>Code Meaning	(0008,0104)	1C	

3.4.2.2 Patient Study Module

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

TABLE 3.4-3
PATIENT STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Admitting Diagnoses Description	(0008,1080)	3	Ignored / Copied
Patient's Age	(0010,1010)	3	Used / Copied
Patient's Size	(0010,1020)	3	Ignored / Copied
Patient's Weight	(0010,1030)	3	Used / Copied
Occupation	(0010,2180)	3	Ignored / Copied
Additional Patient’s History	(0010,21B0)	3	Used / Copied

3.4.3 Common Series Entity Modules

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

3.4.3.1 General Series Module

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

TABLE 3.4-4
GENERAL SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	Used / Copied Defined Terms: CT = Computed Tomography XA = Xray Angiography
Series Instance UID	(0020,000E)	1	Mandatory / Generated To generate a unique ID, the process concatenates the Implementation Root UID, serial number (computed from the MAC address), the process ID number, the timestamp and a counter incremented each time.
Series Number	(0020,0011)	2	Used / Generated
Laterality	(0020,0060)	2C	Ignored / Generated: “” (empty as the software cannot know semantically the laterality)
Series Date	(0008,0021)	3	Used / Generated: current date
Series Time	(0008,0031)	3	Used / Generated: current time
Performing Physicians’ Name	(0008,1050)	3	Used / Copied
Protocol Name	(0018,1030)	3	Used / Copied
Series Description	(0008,103E)	3	Used / Generated
Operators' Name	(0008,1070)	3	Used / Copied
Referenced Performed Procedure Step Sequence	(0008,1111)	3	Ignored / Removed on AW, Generated on CT/MR consoles if PPS feature is activated
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
Body Part Examined	(0018,0015)	3	Ignored / Copied
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
Smallest Pixel Value in Series	(0028,0108)	3	Ignored / Removed
Largest Pixel Value in Series	(0028,0109)	3	Ignored / Removed

Request Attributes Sequence	(0040,0275)	3	Ignored / Copied (Entire sequence copied)
>Requested Procedure ID	(0040,1001)	1C	
>Accession Number	(0008,0050)	3	
>Study Instance UID	(0020,000D)	3	
>Referenced Study Sequence	(0008,1110)	3	
>Requested Procedure Description	(0032,1060)	3	
>Requested Procedure Code Sequence	(0032,1064)	3	
>Reason for the Requested Procedure	(0040,1002)	3	
>Reason for Requested Procedure Code Sequence	(0040,100A)	3	
>Scheduled Procedure Step ID	(0040,0009)	1C	
>Scheduled Procedure Step Description	(0040,0007)	3	
>Scheduled Protocol Code Sequence	(0040,0008)	3	
Performed Procedure Step ID	(0040,0253)	3	Ignored / Removed on AW, Generated on CT/MR consoles if PPS feature is activated
Performed Procedure Step Start Date	(0040,0244)	3	Ignored / Removed on AW, Generated on CT/MR consoles if PPS feature is activated
Performed Procedure Step Start Time	(0040,0245)	3	Ignored / Removed on AW, Generated on CT/MR consoles if PPS feature is activated
Performed Procedure Step Description	(0040,0254)	3	Ignored / Removed on AW, Generated on CT/MR consoles if PPS feature is activated
Performed Protocol Code Sequence	(0040,0260)	3	Ignored / Removed on AW, Generated on CT/MR consoles if PPS feature is activated

3.4.4 Common Frame Of Reference Entity Modules

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

3.4.4.1 Frame Of Reference Module

Images should share the same Frame Of Reference UID as a necessary conditions to be in the same 3D model. However, this is not sufficient, because images have also to share the same geometry (be parallel with compatible centers), have the same size, the same pixel size, the same tilt, the same study ID, the same reconstruction algorithm (Convolution Kernel), the same patient name.

TABLE 3.4-5
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

3.4.5 Common Equipment Entity Modules

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

3.4.5.1 General Equipment Module

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

As Voxtool can simulate the generation of an image by the scanner, we have chosen to copy this module, but to omit the fields that could be altered by the reformation

TABLE 3.4-6
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

3.4.6 Common Image Entity Modules

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

3.4.6.1 General Image Module

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

TABLE 3.4-7
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 3.4.6.1.1.1
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. See3.4.9.1.1.1.
Acquisition Number	(0020,0012)	3	Used / Copied if unique across source series
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	
>Referenced SOP Instance UID	(0008,1155)	1C	
Derivation Description	(0008,2111)	3	Ignored / Removed. See 3.4.6.1.1.2
Source Image Sequence	(0008,2112)	3	Ignored / Removed. See 3.4.6.1.1.2
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
Images in Acquisition	(0020,1002)	3	Ignored / Removed
Image Comments	(0020,4000)	3	Ignored / Removed
Quality Control Image	(0028,0300)	3	Ignored / Removed
Burned In Annotations	(0028,0301)	3	Ignored / Generated
Lossy Image Compression	(0028,2110)	3	Used / Copied See 3.4.6.1.1.3.
Lossy Image Compression Ratio	(0028,2112)	3	Ignored / Copied

3.4.6.1.1 General Image Attribute Descriptions

3.4.6.1.1.1 Patient Orientation

Since the coordinates of the image are always written, this field is never used and not present in the created images.

3.4.6.1.1.2 Derivation Description and Source Image Sequence

These tags are not yet used.

3.4.6.1.1.3 Lossy Image Compression

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

3.4.6.2 Image Plane Module

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

TABLE 3.4-8
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
Slice Location	(0020,1041)	3	Ignored / Removed

3.4.6.2.1 Image Position

The Image Position is treated as the position of the upper left hand corner of the first pixel of the image for images coming from GE (Manufacturer is “GE MEDICAL SYSTEMS”).

Otherwise, the Image Position is treated as the position of the center of the first pixel of the image.

3.4.6.3 Image Pixel Module

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

TABLE 3.4-9
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	Used (expect "MONOCHROME2" and reject "MONOCHROME1") / Generated "MONOCHROME2" or "MONOCHROME1"
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	
Planar Configuration	(0028,0006)	1C	Ignored / Removed (see Samples per Pixels)
Pixel Aspect Ratio	(0028,0034)	1C	Ignored / Removed (Image Plane is mandatory for CT)
Smallest Image Pixel Value	(0028,0106)	3	Ignored / Removed
Largest Image Pixel Value	(0028,0107)	3	Ignored / Removed
Red Palette Color Lookup Table Descriptor	(0028,1101)	1C	Ignored / Removed
Green Palette Color Lookup Table Descriptor	(0028,1102)	1C	Ignored / Removed
Blue Palette Color Lookup Table Descriptor	(0028,1103)	1C	Ignored / Removed
Red Palette Color Lookup Table Data	(0028,1201)	1C	Ignored / Removed
Green Palette Color Lookup Table Data	(0028,1202)	1C	Ignored / Removed
Blue Palette Color Lookup Table Data	(0028,1203)	1C	Ignored / Removed

3.4.6.4 Contrast/Bolus Module

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

3.4.6.4.1 Contrast annotation mark (+c)

The "+c" annotation appears if a contrast agent is present (0018,0010) in the data set) and the Contrast/Bolus Route contains "IV" or something different than "Oral". This means that if the Contrast/Bolus Route contains "Oral", the "+c" annotation will not appear.

TABLE 3.4-10
CONTRAST/BOLUS MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Contrast/Bolus Agent	(0018,0010)	2	Used / Copied
Contrast/Bolus Agent Sequence	(0018,0012)	3	Ignored / Copied
>Code Value	(0008,0100)	1C	
>Coding Scheme Designator	(0008,0102)	1C	
>Code Meaning	(0008,0104)	3	
Contrast/Bolus Route	(0018,1040)	3	Used / Copied
Contrast/Bolus Administration Route Sequence	(0018,0014)	3	Ignored / Copied
>Code Value	(0008,0100)	1C	
>Coding Scheme Designator	(0008,0102)	1C	
>Code Meaning	(0008,0104)	3	
>Additional Drug Sequence	(0018,002A)	3	
>>Code Value	(0008,0100)	1C	
>>Coding Scheme Designator	(0008,0102)	1C	
>>Code Meaning	(0008,0104)	3	
Contrast/Bolus Volume	(0018,1041)	3	Ignored / Copied
Contrast/Bolus Start Time	(0018,1042)	3	Ignored / Copied
Contrast/Bolus Stop Time	(0018,1043)	3	Ignored / Copied
Contrast/Bolus Total Dose	(0018,1044)	3	Ignored / Copied
Contrast Flow Rate(s)	(0018,1046)	3	Ignored / Copied
Contrast Flow Duration(s)	(0018,1047)	3	Ignored / Copied
Contrast/Bolus Ingredient	(0018,1048)	3	Ignored / Copied
Contrast/Bolus Ingredient Concentration	(0018,1049)	3	Ignored / Copied

3.4.7 Common Lookup Table Modules

3.4.7.1 VOI LUT module

This section specifies the Attributes that describe the VOI LUT.

TABLE 3.4-11
VOI LUT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
VOI LUT Sequence	(0028,3010)	3	Ignored / Removed
>LUT Descriptor	(0028,3002)	1C	
>LUT Explanation	(0028,3003)	3	
>LUT Data	(0028,3006)	1C	
Window Center	(0028,1050)	1C	Used at load (ignored if multiple values and defaults to an automatic W/L is computed on the whole series). At save, a value generated from the current value used in the saved view.

Window Width	(0028,1051)	1C	Used at load (ignored if multiple values and defaults to an automatic W/L is computed on the whole series). At save, a value generated from the current value used in the saved view.
Window Center & Width Explanation	(0028,1055)	3	Ignored / Removed

3.4.8 General Modules

The SOP Common Module is mandatory for all DICOM IODs.

3.4.8.1 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 3.4-12
SOP COMMON MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008,0016)	1	Used / Generated: "1.2.840.10008.5.1.4.1.1.2"
SOP Instance UID	(0008,0018)	1	Used / Generated To generate a unique ID, the process concatenates the Implementation Root UID, serial number (computed from the MAC address), the process ID number, the timestamp and a counter incremented each time.
Specific Character Set	(0008,0005)	1C	Used / Copied Only the "ISO_IR 100" character sets are supported.
Instance Creation Date	(0008,0012)	3	Ignored / Generated: current date
Instance Creation Time	(0008,0013)	3	Ignored / Generated: current time
Instance Creator UID	(0008,0014)	3	Ignored / Removed
Time zone Offset From UTC	(0008,0201)	3	Ignored / Removed
Instance Number	(0020,0013)	3	Used / Generated
SOP Instance Status	(0100,0410)	3	Ignored / Removed
SOP Authorization Date and Time	(0100,0420)	3	Ignored / Removed
SOP Authorization Comment	(0100,0414)	3	Ignored / Removed
Authorization Equipment Certification Number	(0100,0416)	3	Ignored / Removed

3.4.9 CT Modules

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

3.4.9.1 CT Image Module

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

TABLE 3.4-13
CT IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Image Type	(0008,0008)	1	See 3.4.9.1.1.1.
Samples per Pixel	(0028,0002)	1	Shall be 1.
Photometric Interpretation	(0028,0004)	1	Used (expect "MONOCHROME2" and reject "MONOCHROME1") / Generated "MONOCHROME2" or "MONOCHROME1"
Bits Allocated	(0028,0100)	1	Shall be 16.
Bits Stored	(0028,0101)	1	Ignored (expect 16) / Generated (write 16)
High Bit	(0028,0102)	1	Ignored (expect 15) / Generated (write 15)
Rescale Intercept	(0028, 1052)	1	Used (default to –1024 if not found) / Generated
Rescale Slope	(0028,1053)	1	Used / Generated (write 1)
KVP	(0018,0060)	2	Used / Copied
Acquisition Number	(0020,0012)	2	Ignored / Copied
Scan Options	(0018,0022)	3	Used / Copied
Data Collection Diameter	(0018,0090)	3	Used / Copied
Reconstruction Diameter	(0018,1100)	3	Ignored
Distance Source to Detector	(0018,1110)	3	Ignored / Copied
Distance Source to Patient	(0018,1111)	3	Ignored / Copied
Gantry/Detector Tilt	(0018,1120)	3	Used / Removed
Table Height	(0018,1130)	3	Ignored / Copied
Rotation Direction	(0018,1140)	3	Ignored / Copied
Exposure Time	(0018,1150)	3	Used / Copied
X-ray Tube Current	(0018,1151)	3	Used / Copied
Exposure	(0018,1152)	3	Ignored / Copied
Exposure in μAs	(0018,1152)	3	Ignored / Copied
Filter Type	(0018,1160)	3	Ignored / Copied
Generator Power	(0018,1170)	3	Ignored / Copied
Focal Spot	(0018,1190)	3	Ignored / Copied
Convolution Kernel	(0018,1210)	3	Used / Copied

3.4.9.1.1 CT Image Attribute Descriptions

3.4.9.1.1.1 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

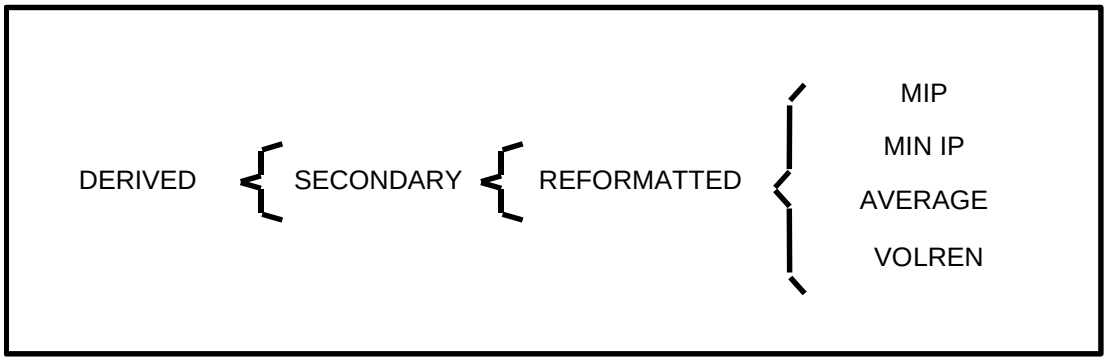
Value 3 has the following value:

- REFORMATTED identifies a Reformatted Image

Value 4, if defined, 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 3.4-1
CT IMAGE TYPE DECISION TREE



When reading images, all values are accepted except if Value 3 is:

- PJN or PROJECTION IMAGE collapsed images are not suitable for 3D
- LOCALIZER are 2D images so are rejected

3.5 PRIVATE DATA

The following private elements are used.

PRIVATE ADVANTAGE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Private Creator	(0019, 00xx)	3	GEMS_ACQU_01: Used / Copied
Table Speed	(0019, xx23)	3	Used / Copied
Midscan Time	(0019, xx24)	3	Used / Removed
Gantry Velocity	(0019, xx27)	3	Used / Copied
SFOV Type	(0019, xx39)	3	Used / Copied
Dependent on #views processed	(0019, xx6A)	3	Used/Copied
Private Creator	(0031, 00xx)	3	GEMS_3D_XA_01: Used / Copied
Structure of Interest	(0031, xx01)	3	Used/Copied
Missing Frame Status	(0031, xx02)	3	Used/Copied
Anatomy	(0031, xx03)	3	Used/Copied
Volume Substracted Mode	(0031, xx04)	3	Used/Copied
Modality	(0031, xx07)	3	Used/Copied (value = “XA”)
Pos Calibration Date	(0031, xx09)	3	Used/Copied
Pos Calibration Status	(0031, xx0b)	3	Used/Copied
Private Creator	(0043, 00xx)	3	GEMS_PARM_01: Used / Copied
Pitch Ratio	(0043, xx27)	3	Used / Copied
Private Scan Options	(0043, xx2B)	3	Used/Copied
motCorr	(0043, xx65)	3	Used/Copied
IBOCorr	(0043, xx67)	3	Used/Copied
Private Creator	(0045, 00xx)	3	GEMS_HELIOS_01: Used / Copied
Sigma Mode	(0045, xx13)	3	Ignored / Copied
Ibone Flag	(0045, xx21)	3	Used / Copied
Peris Flag	(0045, xx22)	3	Used / Copied
Cardiac Recon Algo	(0045, xx30)	3	Used / Removed
Average Heart Rate	(0045, xx31)	3	Used / Generated
Temporal Resolution	(0045, xx32)	3	Used / Removed
Cardiac Phase Number	(0045, xx33)	3	Used / Copied
ActualRpeakFixedTimeDelay	(0045, xx3F)	3	Used / Copied
Private Group Creator	(0047, 00xx)	3	GEMS_VXTL_USERDATA_01: Used / Generated
Private User Data	(0047, xx11)	3	Used / Generated. If contains “Registered series” the saved volume has been moved due to registration.
Private Group Creator	(0059, 00xx)	3	GEMS_VXTL_REGISTRATION_01: Used / Generated
Deformed Flag	(0059, xx00)	3	Used / Generated. Generated if the saved volume is geometrically deformed regarding its original data, hence distance, area, volume or angle measurements are invalid.

4. MR INFORMATION OBJECT IMPLEMENTATION

4.1 INTRODUCTION

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

4.2 – IOD Entity-Relationship Model

4.3 – IOD Module Table

4.4 – IOD Module Definition

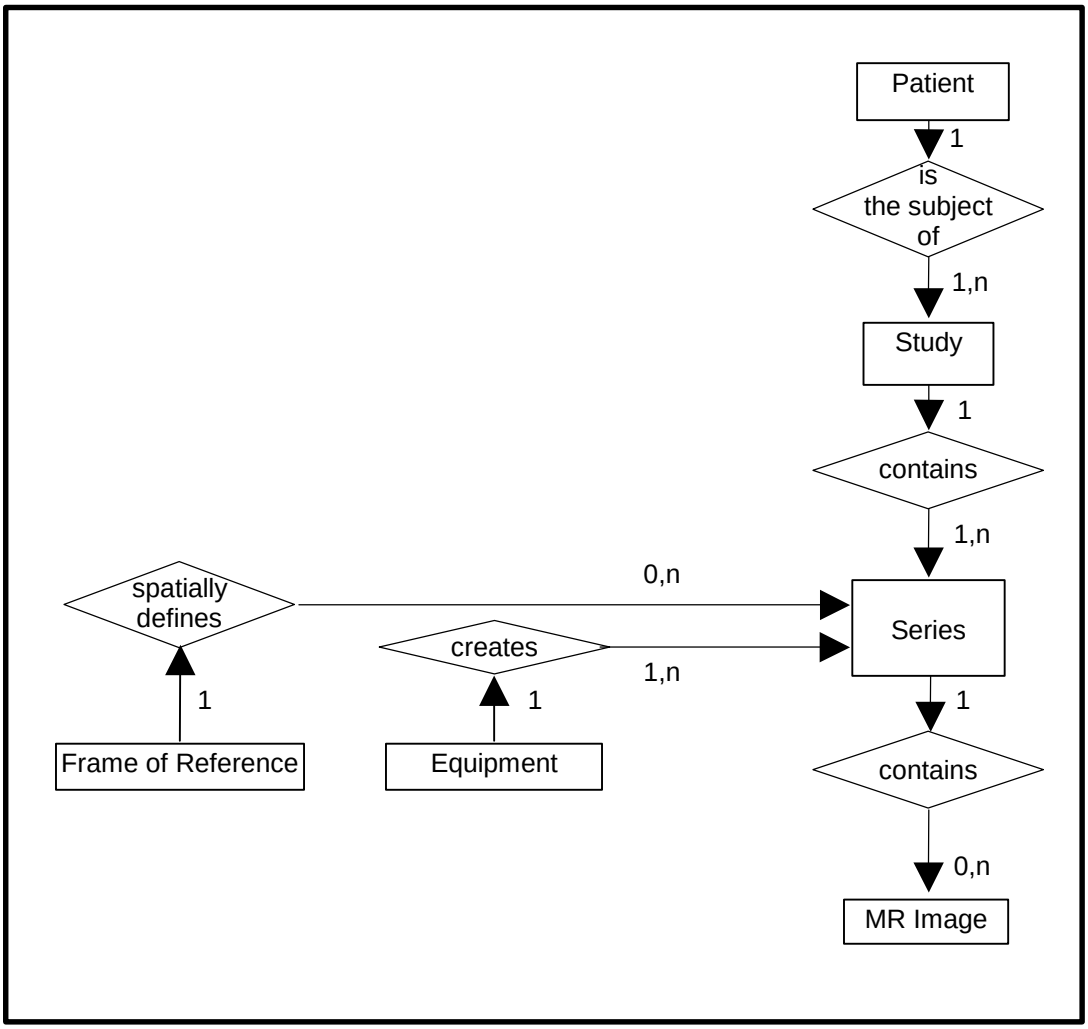
4.2 MR ENTITY-RELATIONSHIP MODEL

The Entity-Relationship diagram for the MR Image interoperability schema is shown in Illustration 4.2-1. In this figure, the following diagrammatic convention is established to represent the information organization :

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

The relationships are fully defined with the maximum number of possible entities in the relationship shown. In other words, the relationship between Series and Image can have up to n Images per Series, but the Patient to Study relationship has 1 Patient for each Study (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 4.2-1
MR IMAGE ENTITY RELATIONSHIP DIAGRAM



4.2.1 ENTITY DESCRIPTIONS

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

4.2.2 Volume Viewer Mapping of DICOM entities

TABLE 4.2-1
MAPPING OF DICOM ENTITIES TO VOLUME VIEWER ENTITIES

DICOM	Volume Viewer Entity
Patient	Patient
Study	Exam
Series	Series
Image	Image
Frame	Not Applicable

4.3 IOD MODULE TABLE

Within an entity of the DICOM 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 4.3-1 identifies the defined modules within the entities which comprise the DICOM MR IOD. Modules are identified by Module Name.

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

TABLE 4.3-1
MR IMAGE IOD MODULES

Entity Name	Module Name	Reference
Patient	Patient	4.4.1.1
Study	General Study	4.4.2.1
	Patient Study	4.4.2.2
Series	General Series	4.4.3.1
Frame of Reference	Frame of Reference	4.4.4.1
Equipment	General Equipment	4.4.5.1
Image	General Image	4.4.6.1
	Image Plane	4.4.6.2
	Image Pixel	4.4.6.3
	Contrast/Bolus	4.4.6.4
	MR Image	4.4.9.1
	Overlay Plane	Not used / Not copied
	VOI LUT	4.4.7.1
	SOP Common	4.4.8.1

4.4 INFORMATION MODULE DEFINITIONS

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

If an element is not listed below, it means that it will be ignored at reading and not copied at writing.

4.4.1 Common Patient Entity Modules

4.4.1.1 Patient Module

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

TABLE 4.4-1
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
Referenced Patient Sequence	(0008,1120)	3	Ignored / Copied
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
Patient's Birth Time	(0010,0032)	3	Ignored / Copied
Other Patient Ids	(0010,1000)	3	Ignored / Copied
Other Patient Names	(0010,1001)	3	Ignored / Copied
Ethnic Group	(0010,2160)	3	Ignored / Copied
Patient Comments	(0010,4000)	3	Ignored / Copied

4.4.2 Common Study Entity Modules

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

4.4.2.1 General Study Module

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

TABLE 4.4-2
GENERAL STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Study Instance UID	(0020,000D)	1	Mandatory / Copied
Study Date	(0008,0020)	2	Used / 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
Physician(s) of Record	(0008,1048)	3	Ignored / Copied
Name of Physician(s) Reading Study	(0008,1060)	3	Used / Copied
Referenced Study Sequence	(0008,1110)	3	Ignored / Copied
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
Procedure Code Sequence	(0008,1032)	3	Ignored / Copied
>Code Value	(0008,0100)	1C	
>Code Scheme Designator	(0008,0102)	1C	
>Code Meaning	(0008,0104)	1C	

4.4.2.2 Patient Study Module

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

TABLE 4.4-3
PATIENT STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Admitting Diagnoses Description	(0008,1080)	3	Ignored / Copied
Patient's Age	(0010,1010)	3	Used / Copied
Patient's Size	(0010,1020)	3	Ignored / Copied
Patient's Weight	(0010,1030)	3	Used / Copied
Occupation	(0010,2180)	3	Ignored / Copied
Additional Patient's History	(0010,21B0)	3	Used / Copied

4.4.3 Common Series Entity Modules

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

4.4.3.1 General Series Module

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

TABLE 4.4-4
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
Laterality	(0020,0060)	2C	Ignored / Generated: “” (empty as the software cannot know semantically the laterality)
Series Date	(0008,0021)	3	Used / Generated: current date
Series Time	(0008,0031)	3	Used / Generated: current time
Performing Physicians’ Name	(0008,1050)	3	Used / Copied
Protocol Name	(0018,1030)	3	Used / Copied
Series Description	(0008,103E)	3	Used / Generated
Operators’ Name	(0008,1070)	3	Used / Copied
Referenced Performed Procedure Step Sequence	(0008,1111)	3	Ignored / Removed on AW, Generated on CT/MR consoles if PPS feature is activated
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
Body Part Examined	(0018,0015)	3	Ignored / Copied
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
Smallest Pixel Value in Series	(0028,0108)	3	Ignored / Removed
Largest Pixel Value in Series	(0028,0109)	3	Ignored / Removed
Request Attributes Sequence	(0040,0275)	3	Ignored / Copied (Entire sequence copied)
>Requested Procedure ID	(0040,1001)	1C	
>Accession Number	(0008,0050)	3	
>Study Instance UID	(0020,000D)	3	
>Referenced Study Sequence	(0008,1110)	3	

>Requested Procedure Description	(0032,1060)	3	
>Requested Procedure Code Sequence	(0032,1064)	3	
>Reason for the Requested Procedure	(0040,1002)	3	
>Reason for Requested Procedure Code Sequence	(0040,100A)	3	
>Scheduled Procedure Step ID	(0040,0009)	1C	
>Scheduled Procedure Step Description	(0040,0007)	3	
>Scheduled Protocol Code Sequence	(0040,0008)	3	
Performed Procedure Step ID	(0040,0253)	3	Ignored / Removed on AW, Generated on CT/MR consoles if PPS feature is activated
Performed Procedure Step Start Date	(0040,0244)	3	Ignored / Removed on AW, Generated on CT/MR consoles if PPS feature is activated
Performed Procedure Step Start Time	(0040,0245)	3	Ignored / Removed on AW, Generated on CT/MR consoles if PPS feature is activated
Performed Procedure Step Description	(0040,0254)	3	Ignored / Removed on AW, Generated on CT/MR consoles if PPS feature is activated
Performed Protocol CodeSequence	(0040,0260)	3	Ignored / Removed on AW, Generated on CT/MR consoles if PPS feature is activated

4.4.4 Common Frame Of Reference Entity Modules

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

4.4.4.1 Frame Of Reference Module

Images should share the same Frame Of Reference UID as a necessary conditions to be in the same 3D model. However, this is not sufficient, because images have also to share the same geometry (be parallel with compatible centers), have the same size, the same pixel size, the same tilt, the same study ID, the same patient name.

TABLE 4.4-5
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

4.4.5 Common Equipment Entity Modules

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

4.4.5.1 General Equipment Module

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

TABLE 4.4-6
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

4.4.6 Common Image Entity Modules

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

4.4.6.1 General Image Module

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

TABLE 4.4-7
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 4.4.6.1.1.1
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 4.4.9.1.1.1
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	

>Referenced SOP Instance UID	(0008,1155)	1C	
Derivation Description	(0008,2111)	3	Ignored / Removed. See 4.4.6.1.1.2
Source Image Sequence	(0008,2112)	3	Ignored / Removed. See 4.4.6.1.1.2
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
Images in Acquisition	(0020,1002)	3	Ignored / Removed
Image Comments	(0020,4000)	3	Ignored / Removed
Quality Control Image	(0028,0300)	3	Ignored / Removed
Burned In Annotations	(0028,0301)	3	Ignored / Generated
Lossy Image Compression	(0028,2110)	3	Used / Copied. See 4.4.6.1.1.3
Lossy Image Compression Ratio	(0028,2110)	3	Ignored / Copied

4.4.6.1.1 General Image Attribute Descriptions

4.4.6.1.1.1 Patient Orientation

Since the coordinates of the image are always present, this field is never used and not present in the created images.

4.4.6.1.1.2 Derivation Description and Source Image Sequence

These tags are not yet used.

4.4.6.1.1.3 Lossy Image Compression

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

4.4.6.2 Image Plane Module

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

TABLE 4.4-8
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
Slice Location	(0020,1041)	3	Ignored / Removed

4.4.6.2.1 Image Position

The Image Position is treated as the position of the upper left hand corner of the first pixel of the image for images coming from GE (Manufacturer is “GE MEDICAL SYSTEMS”), which software version (first value of Software Version) is strictly inferior to 11.

The Image Position is treated as the position of the center of the first pixel of the image for images coming from other manufacturer than GE or MR GE systems that have MR 11.0 software (Excite II, …) and above.

4.4.6.3 Image Pixel Module

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

TABLE 4.4-9
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	Used (expect "MONOCHROME2" and reject "MONOCHROME1") / Generated "MONOCHROME2" or "MONOCHROME1"
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	
Planar Configuration	(0028,0006)	1C	Ignored / Removed (see Samples per Pixels)
Pixel Aspect Ratio	(0028,0034)	1C	Ignored / Removed (Image Plane is mandatory for MR)
Smallest Image Pixel Value	(0028,0106)	3	Used / Removed
Largest Image Pixel Value	(0028,0107)	3	Used / Removed
Red Palette Color Lookup Table Descriptor	(0028,1101)	1C	Ignored / Removed
Green Palette Color Lookup Table Descriptor	(0028,1102)	1C	Ignored / Removed
Blue Palette Color Lookup Table Descriptor	(0028,1103)	1C	Ignored / Removed
Red Palette Color Lookup Table Data	(0028,1201)	1C	Ignored / Removed
Green Palette Color Lookup Table Data	(0028,1202)	1C	Ignored / Removed
Blue Palette Color Lookup Table Data	(0028,1203)	1C	Ignored / Removed

4.4.6.4 Contrast/Bolus Module

4.4.6.4.1 Contrast annotation mark (+c)

The "+c" annotation appears if a contrast agent is present ((0018,0010) in the data set) and the Contrast/Bolus Route contains "IV" or something different than "Oral". This means that if the Contrast/Bolus Route contains "Oral", the "+c" annotation will not appear.

TABLE 4.4-10
CONTRAST/BOLUS MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Contrast/Bolus Agent	(0018,0010)	2	Used / Copied
Contrast/Bolus Agent Sequence	(0018,0012)	3	Ignored / Copied
>Code Value	(0008,0100)	1C	
>Coding Scheme Designator	(0008,0102)	1C	
>Code Meaning	(0008,0104)	3	
Contrast/Bolus Route	(0018,1040)	3	Used / Copied
Contrast/Bolus Administration Route Sequence	(0018,0014)	3	Ignored / Copied
>Code Value	(0008,0100)	1C	
>Coding Scheme Designator	(0008,0102)	1C	
>Code Meaning	(0008,0104)	3	
>Additional Drug Sequence	(0018,002A)	3	
>>Code Value	(0008,0100)	1C	
>>Coding Scheme Designator	(0008,0102)	1C	
>>Code Meaning	(0008,0104)	3	
Contrast/Bolus Volume	(0018,1041)	3	Ignored / Copied
Contrast/Bolus Start Time	(0018,1042)	3	Ignored / Copied
Contrast/Bolus Stop Time	(0018,1043)	3	Ignored / Copied
Contrast/Bolus Total Dose	(0018,1044)	3	Ignored / Copied
Contrast Flow Rate(s)	(0018,1046)	3	Ignored / Copied
Contrast Flow Duration(s)	(0018,1047)	3	Ignored / Copied
Contrast/Bolus Ingredient	(0018,1048)	3	Ignored / Copied
Contrast/Bolus Ingredient Concentration	(0018,1049)	3	Ignored / Copied

4.4.7 Common Lookup Table Modules

4.4.7.1 VOI LUT module

This section specifies the Attributes that describe the VOI LUT.

TABLE 4.4-11
VOI LUT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
VOI LUT Sequence	(0028,3010)	3	Ignored / Removed
>LUT Descriptor	(0028,3002)	1C	
>LUT Explanation	(0028,3003)	3	
>LUT Data	(0028,3006)	1C	
Window Center	(0028,1050)	3	Used at load (ignored if multiple values and defaults to an automatic W/L is computed on the whole series). At save, Generated from the current value used in the saved view.

Window Width	(0028,1051)	1C	Used at load (ignored if multiple values and defaults to an automatic W/L is computed on the whole series). At save, Generated from the current value used in the saved view.
Window Center & Width Explanation	(0028,1055)	3	Ignored / Removed

4.4.8 General Modules

The SOP Common Module is mandatory for all DICOM IODs.

4.4.8.1 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 4.4-12
SOP COMMON MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008,0016)	1	Used / Generated: "1.2.840.10008.5.1.4.1.1.4"
SOP Instance UID	(0008,0018)	1	Used / Generated To generate a unique ID, the process concatenates the Implementation Root UID, serial number, the process ID number, the timestamp and a counter incremented each time.
Specific Character Set	(0008,0005)	1C	Used / Copied Only the "ISO_IR 100" character sets is supported.
Instance Creation Date	(0008,0012)	3	Ignored / Generated: current date
Instance Creation Time	(0008,0013)	3	Ignored / Generated: current time
Instance Creator UID	(0008,0014)	3	Ignored / Removed
Time zone Offset From UTC	(0008,0201)	3	Ignored / Removed
Instance Number	(0020,0013)	3	Used / Generated
SOP Instance Status	(0100,0410)	3	Ignored / Removed
SOP Authorization Date and Time	(0100,0420)	3	Ignored / Removed
SOP Authorization Comment	(0100,0414)	3	Ignored / Removed
Authorization Equipment Certification Number	(0100,0416)	3	Ignored / Removed

4.4.9 MR Modules

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

4.4.9.1 MR Image Module

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

TABLE 4.4-13
MR IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Image Type	(0008,0008)	1	See 4.4.9.1.1.1.
Samples per Pixel	(0028,0002)	1	Shall be 1.
Photometric Interpretation	(0028,0004)	1	Used (expect "MONOCHROME2" and reject "MONOCHROME1") / Generated "MONOCHROME2" or "MONOCHROME1"
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
Echo Train Length	(0018,0091)	2	Used / Copied
Inversion Time	(0018,0082)	2C	Used / Copied
Trigger Time	(0018,1060)	2C	Used / Copied
Sequence Name	(0018,0024)	3	Ignored / Copied
Angio Flag	(0018,0025)	3	Ignored / Copied
Number of Averages	(0018,0083)	3	Used / Copied
Imaging Frequency	(0018,0084)	3	Used / Copied
Imaged Nucleus	(0018,0085)	3	Ignored / Copied
Echo Number	(0018,0086)	3	Used / Copied
Magnetic Field Strength	(0018,0087)	3	Used / Copied
Spacing Between Slices	(0018,0088)	3	Ignored / Removed
Number of Phase Encoding Steps	(0018,0089)	3	Ignored / Copied
Percent Sampling	(0018,0093)	3	Used / Copied
Percent Phase Field of View	(0018,0094)	3	Ignored / Copied
Pixel Bandwidth	(0018,0095)	3	Used / Copied
Nominal Interval	(0018,1062)	3	Ignored / Copied
Beat Rejection Flag	(0018,1080)	3	Ignored / Copied
Low R-R Value	(0018,1081)	3	Ignored / Copied
High R-R Value	(0018,1082)	3	Ignored / Copied
Intervals Acquired	(0018,1083)	3	Ignored / Copied
Intervals Rejected	(0018,1084)	3	Ignored / Copied

PVC Rejection	(0018,1085)	3	Ignored / Copied
Skip Beats	(0018,1086)	3	Ignored / Copied
Heart Rate	(0018,1088)	3	Ignored / Copied
Cardiac Number of Images	(0018,1090)	3	Used / Copied
Trigger Window	(0018,1094)	3	Ignored / Copied
Reconstruction Diameter	(0018,1100)	3	Ignored
Receiving Coil	(0018,1250)	3	Used / Copied
Transmitting Coil	(0018,1251)	3	Ignored / Copied
Acquisition Matrix	(0018,1310)	3	Used / Copied
Phase Encoding Direction	(0018,1312)	3	Ignored / Copied
Flip Angle	(0018,1314)	3	Used / Copied
SAR	(0018,1316)	3	Ignored / Copied
Variable Flip Angle Flag	(0018,1315)	3	Ignored / Copied
dB/dt	(0018,1318)	3	Ignored / Copied
Temporal Position Identifier	(0020,0100)	3	Used / Copied
Number of Temporal Positions	(0020,0105)	3	Used/ Copied
Temporal Resolution	(0020,0110)	3	Ignored / Copied
Stack ID	(0020,9056)	3	Used/Ignored

4.4.9.1.1 MR Image Attribute Descriptions

4.4.9.1.1.1 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:

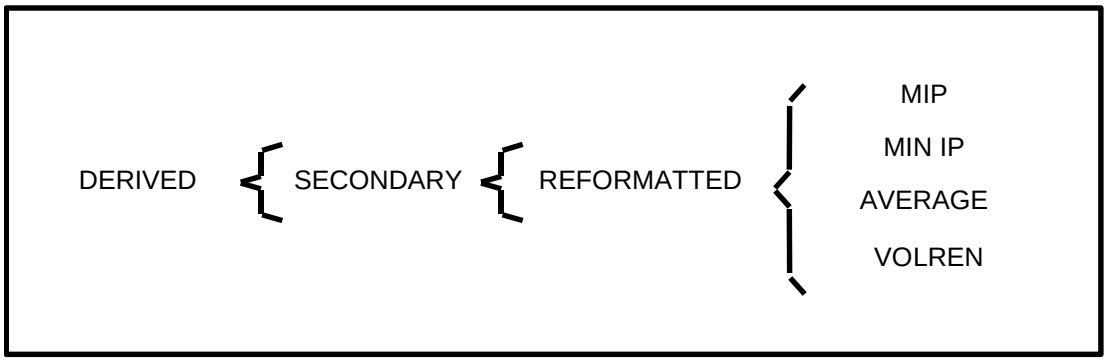
- PJN identifies a MIP reconstructed image
- REFORMATTED identifies a Multi Planar Reformatted Image

  PJN is the same than PROJECTION IMAGE, and REFORMATTED is the same than MPR, but it kept in order to ensure the image can be pushed on old GE MR system.

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 4.4-1
MR IMAGE TYPE DECISION TREE



When reading images, all values are accepted except if Value 3 is:

– PJN or PROJECTION IMAGE collapsed images are not suitable for 3D

4.5 PRIVATE DATA DICTIONARY

In the case of a GE image (manufacturer 0008,0070 starts with GE MEDICAL SYSTEMS), the following private groups are copied:

0x09, 0x11, 0x19, 0x21, 0x23, 0x25, 0x27, 0x29, 0x43

This should ensure that these images can be pushed back on GE non DICOM native consoles.

TABLE 4.5-14
PRIVATE ADVANTAGE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Private Creator	(0009, 00xx)	3	GEMS_IDEN_01: Used / Copied
Genesis Full Fidelity Flag	(0009, xx01)	3	Ignored / Copied
Suite ID	(0009, xx02)	3	Ignored / Copied
Product ID	(0009, xx04)	3	Ignored / Copied
Unique Service ID	(0009, xx30)	3	Ignored / Copied
Mobile Location Number	(0009, xx31)	3	Ignored / Copied
Equipment UID	(0009, xxE3)	3	Ignored / Copied
Genesis Version – Now	(0009, xxE6)	3	Ignored / Copied
Private Creator	(0019, 00xx)	3	GEMS_ACQU_01: Used / Copied
Series Pulse Sequence	(0019, xx12)	3	Ignored / Copied
Display FOV-Y	(0019, xx1E)	3	Ignored / Copied
Duration of scan	(0019, xx5A)	3	Used / Copied
Number of echos	(0019, xx7E)	3	Used / Copied
Continuous slices flag	(0019, xx81)	3	Ignored / Copied
actual receive gain analog	(0019, xx8A)	3	Ignored / Copied
actual receive gain digital	(0019, xx8B)	3	Ignored / Copied
Swap Phase/Freq. Axis	(0019, xx8F)	3	Used / Copied
Pause Time	(0019, xx91)	3	Ignored / Copied
Pulse Sequence Name	(0019, xx9C)	3	Used / Copied
Coil Type	(0019, xx9F)	3	Ignored / Copied
SAT fat/water/bone	(0019, xxA4)	3	Used / Copied
User Variable0	(0019, xxA7)	3	Ignored / Copied
User Variable1	(0019, xxA8)	3	Ignored / Copied
User Variable2	(0019, xxA9)	3	Ignored / Copied
User Variable3	(0019, xxAA)	3	Ignored / Copied
User Variable4	(0019, xxAB)	3	Ignored / Copied
User Variable5	(0019, xxAC)	3	Ignored / Copied
User Variable6	(0019, xxAD)	3	Ignored / Copied
User Variable7	(0019, xxAE)	3	Ignored / Copied
User Variable8	(0019, xxAF)	3	Ignored / Copied
User Variable9	(0019, xxB0)	3	Ignored / Copied

User Variable10	(0019, xxB1)	3	Ignored / Copied
User Variable11	(0019, xxB2)	3	Ignored / Copied
User Variable12	(0019, xxB3)	3	Ignored / Copied
User Variable13	(0019, xxB4)	3	Ignored / Copied
User Variable14	(0019, xxB5)	3	Ignored / Copied
User Variable15	(0019, xxB6)	3	Ignored / Copied
User Variable16	(0019, xxB7)	3	Ignored / Copied
User Variable17	(0019, xxB8)	3	Ignored / Copied
User Variable18	(0019, xxB9)	3	Ignored / Copied
User Variable19	(0019, xxBA)	3	Ignored / Copied
User Variable20	(0019, xxBB)	3	Ignored / Copied
User Variable21	(0019, xxBC)	3	Ignored / Copied
User Variable22	(0019, xxBD)	3	Ignored / Copied
Saturation Planes	(0019, xxC0)	3	Used / Copied
Surface Coil Intensity Correction Flag	(0019, xxC1)	3	Used / Copied
Phase contrast flow axis	(0019, xxCB)	3	Used / Copied
Velocity Encoding	(0019, xxCC)	3	Used / Copied
Fractional Echo/EffectiveTE	(0019, xxD5)	3	Used / Copied
Cardiac Phase Number	(0019, xxD7)	3	Used / Copied
variable echo flag	(0019, xxD8)	3	Used / Copied
Concatenated Sat Type flg	(0019, xxD9)	3	Used / Copied
User Variable23	(0019, xxDF)	3	Ignored / Copied
User Variable24	(0019, xxE0)	3	Ignored / Copied
Number of Phases	(0019, xxF2)	3	Used / Copied
Transmit Gain	(0019, xxF9)	3	Ignored / Copied
Private Creator	(0021, 00xx)	3	GEMS_RELA_01: Used / Copied
Series fr which prescribed	(0021, xx03)	3	Ignored / Copied
ex_verscur ?	(0021, xx05)	3	Ignored / Copied
series fr which prescribed	(0021, xx35)	3	Ignored / Copied
Image fr which prescribed	(0021, xx36)	3	Ignored / Copied
Screen Format	(0021, xx37)	3	Ignored / Generated
Row Axis Rot from src img	(0021, xx51)	3	Ignored / Generated for PJN only
Col Axis Rot from src img	(0021, xx52)	3	Ignored / Generated for PJN only
Normal Axis Rot from src img	(0021, xx53)	3	Ignored / Generated for PJN only
Slop int 1	(0021, xx56)	3	Ignored / Copied
Slop int 2	(0021, xx57)	3	Ignored / Copied
Slop int 3	(0021, xx58)	3	Ignored / Copied
Slop int 4	(0021, xx59)	3	Ignored / Copied
Slop int 5	(0021, xx5A)	3	Ignored / Copied
Slop float 1	(0021, xx5B)	3	Ignored / Copied
Slop float 2	(0021, xx5C)	3	Ignored / Copied

Slop float 3	(0021, xx5D)	3	Ignored / Copied
Slop float 4	(0021, xx5E)	3	Ignored / Copied
Slop float 5	(0021, xx5F)	3	Ignored / Copied
Private Creator	(0025, 00xx)	3	GEMS_SERS_01: Used / Copied
Primary Receiver	(0025, xx1A)	3	Ignored / Copied
Private Creator	(0027, 00xx)	3	GEMS_IMAG_01: Used / Copied
Imaging Mode	(0027, xx31)	3	Ignored / Copied
Pulse Sequence	(0027, xx32)	3	Used / Copied
Imaging Options	(0027, xx33)	3	Ignored / Copied
Plane Type	(0027, xx35)	3	Ignored / Generated
RAS letter of image loc	(0027, xx40)	3	Ignored / Generated
Image Location	(0027, xx41)	3	Ignored / Generated
Image Dimension – X	(0027, xx60)	3	Ignored / Copied
Image Dimension – Y	(0027, xx61)	3	Ignored / Copied
Number of Excitations	(0027, xx62)	3	Ignored / Copied
Private Creator	(0029, 00xx)	3	GEMS_IMPS_01: Used / Copied
ver of the hdr structure	(0029, xx26)	3	Ignored / Copied
Lower Range of Pixels 1	(0029, xx15)	3	Ignored / Generated for PJN only
Upper Range of Pixels 1	(0029, xx16)	3	Ignored / Generated for PJN only
Private Creator	(0043, 00xx)	3	GEMS_PARM_01: Used / Copied
bitmap of prescan options	(0043, xx01)	3	Ignored / Copied
number of EPI shots	(0043, xx06)	3	Ignored / Copied
views per segment	(0043, xx07)	3	Ignored / Copied
respiratory rate	(0043, xx08)	3	Ignored / Copied
respiratory trigger point	(0043, xx09)	3	Ignored / Copied
type of receiver used	(0043, xx0A)	3	Ignored / Copied
pk rate of chg of Grad fld	(0043, xx0B)	3	Ignored / Copied
Limit in units per percent	(0043, xx0C)	3	Ignored / Copied
version of header structure	(0043, xx26)	3	Ignored / Copied
Collapse Image	(0043, xx30)	3	Ignored / Generated for PJN only: 6
user_usage_tag	(0043, xx35)	3	Ignored / Copied
User Variable25…User Variable48	(0043, xx38)	3	Ignored / Copied
Slop Int 6 ... 9	(0043, xx39)	3	Ignored / Copied
Slop Int 10 ... 17	(0043, xx60)	3	Ignored / Copied
scanner study entity uid	(0043, xx61)	3	Ignored / Copied
scanner study uid	(0043, xx62)	3	Ignored / Copied
table Position / angle / offset / WholeOrZoom	(0043, xx6F)	3	Ignored / Copied
Number of Stacks	(0043,xx9A)	3	Used / Ignored
Private Group Creator	(0047, 00xx)	3	GEMS_VXTL_USERDATA_01: Used / Generated

Private User Data	(0047, xx11)	3	Used / Generated. If contains “Registered series” the saved volume has been moved due to registration.
Private Group Creator	(0059, 00xx)	3	GEMS_VXTL_REGISTRATION_01: Used / Generated
Deformed Flag	(0059, xx00)	3	Used / Generated. Generated if the saved volume is geometrically deformed regarding its original data, hence distance, area, volume or angle measurements are invalid.

5. NUCLEAR MEDICINE (NM) INFORMATION OBJECT IMPLEMENTATION

5.1 INTRODUCTION

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

5.2 - IOD Entity-Relationship Model

5.3 - IOD Module Table

5.4 - IOD Module Definition

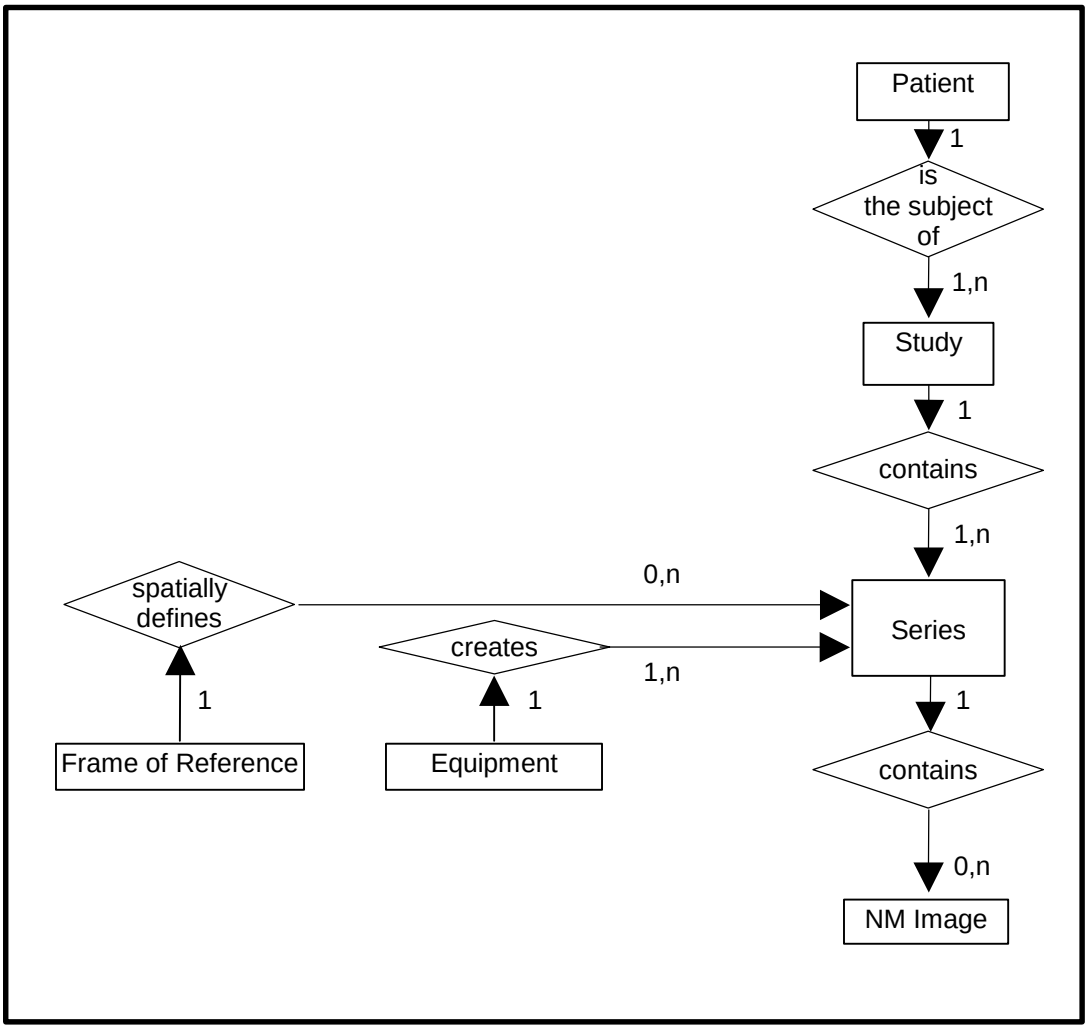
5.2 NM ENTITY-RELATIONSHIP MODEL

The Entity-Relationship diagram for the NM Image interoperability schema is shown in Illustration 5.2-1**.** In this figure, the following diagrammatic convention is established to represent the information organization :

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

The relationships are fully defined with the maximum number of possible entities in the relationship shown. In other words, the relationship between Series and Image can have up to n Images per Series, but the Patient to Study relationship has 1 Patient for each Study (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 5.2-1
NM IMAGE ENTITY RELATIONSHIP DIAGRAM



5.2.1 ENTITY DESCRIPTIONS

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

5.2.2 Volume Viewer Mapping of DICOM entities

TABLE 5.2-1
MAPPING OF DICOM ENTITIES TO VOLUME VIEWER ENTITIES

DICOM	Volume Viewer Entity
Patient	Patient
Study	Exam
Series	Series
Image	Image
Frame	Not Applicable

5.3 IOD MODULE TABLE

Within an entity of the DICOM NM 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 5.3-1 identifies the defined modules within the entities which comprise the DICOM NM IOD. Modules are identified by Module Name.

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

TABLE 5.3-1
NM IMAGE IOD MODULES

Entity Name	Module Name	Reference
Patient	Patient	5.4.1.1
Study	General Study	5.4.2.1
	Patient Study	5.4.2.2
Series	General Series	5.4.3.1
	NM/PET Patient Orientation	5.4.9.1
Frame of Reference	Frame of Reference	5.4.4.1
Equipment	General Equipment	5.4.5.1
Image	General Image	5.4.6.1
	Image Pixel	5.4.6.2
	NM Image Pixel	5.4.9.2
	Multi-frame	5.4.6.3
	NM Multi-frame	5.4.9.3
	NM Image	5.4.9.4
	NM Isotope	5.4.9.5
	NM Detector	5.4.9.6
	NM TOMO Acquisition	5.4.9.7
	NM Multi-gated Acquisition	5.4.9.8
	NM Phase	5.4.9.9
	NM Reconstruction	5.4.9.10
	Overlay Plane	Not used
	Multi-frame Overlay	Not used
	Curve	Not used
	VOI LUT	5.4.7.1
	SOP Common	5.4.8.1

5.4 INFORMATION MODULE DEFINITIONS

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

5.4.1 Common Patient Entity Modules

5.4.1.1 Patient Module

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

TABLE 5.4-1
PATIENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Patient's Name	(0010,0010)	2	Used
Patient ID	(0010,0020)	2	Used
Patient's Birth Date	(0010,0030)	2	Used
Patient's Sex	(0010,0040)	2	Used
Referenced Patient Sequence	(0008,1120)	3	Ignored
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
Patient's Birth Time	(0010,0032)	3	Ignored
Other Patient IDs	(0010,1000)	3	Ignored
Other Patient Names	(0010,1001)	3	Ignored
Ethnic Group	(0010,2160)	3	Ignored
Patient Comments	(0010,4000)	3	Ignored

5.4.2 Common Study Entity Modules

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

5.4.2.1 General Study Module

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

TABLE 5.4-2
GENERAL STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Study Instance UID	(0020,000D)	1	Mandatory
Study Date	(0008,0020)	2	Used
Study Time	(0008,0030)	2	Used
Referring Physician's Name	(0008,0090)	2	Used
Study ID	(0020,0010)	2	Used
Accession Number	(0008,0050)	2	Used
Study Description	(0008,1030)	3	Used
Physician(s) of Record	(0008,1048)	3	Ignored
Name of Physician(s) Reading Study	(0008,1060)	3	Used
Referenced Study Sequence	(0008,1110)	3	Ignored
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
Procedure Code Sequence	(0008,1032)	3	Ignored
>Code Value	(0008,0100)	1C	
>Code Scheme Designator	(0008,0102)	1C	
>Code Meaning	(0008,0104)	1C	

5.4.2.2 Patient Study Module

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

TABLE 5.4-3
PATIENT STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Admitting Diagnoses Description	(0008,1080)	3	Ignored
Pati'nt's Age	(0010,1010)	3	Used
Pati'nt's Size	(0010,1020)	3	Ignored
Pati'nt's Weight	(0010,1030)	3	Used
Occupation	(0010,2180)	3	Ignored
Additional Patient's History	(0010,21B0)	3	Used

5.4.3 Common Series Entity Modules

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

5.4.3.1 General Series Module

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

TABLE 5.4-4
GENERAL SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	Used Defined Terms: NM = Nuclear Medicine
Series Instance UID	(0020,000E)	1	Mandatory
Series Number	(0020,0011)	2	Used
Laterality	(0020,0060)	2C	Ignored
Series Date	(0008,0021)	3	Used
Series Time	(0008,0031)	3	Used
Performing Physicians' Name	(0008,1050)	3	Used
Protocol Name	(0018,1030)	3	Used
Series Description	(0008,103E)	3	Used
Operat'rs' Name	(0008,1070)	3	Used
Referenced Performed Procedure Step Sequence	(0008,1111)	3	Ignored
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
Body Part Examined	(0018,0015)	3	Ignored
Patient Position	(0018,5100)	2C	Used 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	Ignored
Largest Pixel Value in Series	(0028,0109)	3	Ignored
Request Attributes Sequence	(0040,0275)	3	Ignored
>Requested Procedure ID	(0040,1001)	1C	
>Accession Number	(0008,0050)	3	
>Study Instance UID	(0020,000D)	3	
>Referenced Study Sequence	(0008,1110)	3	
>Requested Procedure Description	(0032,1060)	3	
>Requested Procedure Code Sequence	(0032,1064)	3	
>Reason for the Requested Procedure	(0040,1002)	3	
>Reason for Requested Procedure Code Sequence	(0040,100A)	3	

>Scheduled Procedure Step ID	(0040,0009)	1C	
>Scheduled Procedure Step Description	(0040,0007)	3	
>Scheduled Protocol Code Sequence	(0040,0008)	3	
Performed Procedure Step ID	(0040,0253)	3	Ignored
Performed Procedure Step Start Date	(0040,0244)	3	Ignored
Performed Procedure Step Start Time	(0040,0245)	3	Ignored
Performed Procedure Step Description	(0040,0254)	3	Ignored
Performed Protocol Code Sequence	(0040,0260)	3	Ignored

5.4.4 Common Frame Of Reference Entity Modules

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

5.4.4.1 Frame Of Reference Module

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

Since NM objects are multi frame, all the frames share automatically the same Frame Of Reference.

TABLE 5.4-5
FRAME OF REFERENCE MODULE ATTRIBUTES

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

5.4.5 Common Equipment Entity Modules

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

5.4.5.1 General Equipment Module

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

TABLE 5.4-6
GENERAL EQUIPMENT MODULE ATTRIBUTES

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

5.4.6 Common Image Entity Modules

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

5.4.6.1 General Image Module

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

TABLE 5.4-7
GENERAL IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Image Number	(0020,0013)	2	Mandatory
Patient Orientation	(0020,0020)	2C	Ignored
Image Date	(0008,0023)	2C	Used
Image Time	(0008,0033)	2C	Used
Image Type	(0008,0008)	3	Used See5.4.9.4.1.1.
Acquisition Number	(0020,0012)	3	Ignored
Acquisition Date	(0008,0022)	3	Used
Acquisition Time	(0008,0032)	3	Used
Referenced Image Sequence	(0008,1140)	3	Ignored
>Referenced SOP Class UID	(0008,1150)	1C	

>Referenced SOP Instance UID	(0008,1155)	1C	
Derivation Description	(0008,2111)	3	Ignored See 5.4.6.1.1.1.
Source Image Sequence	(0008,2112)	3	Ignored See 5.4.6.1.1.1.
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
Images in Acquisition	(0020,1002)	3	Ignored
Image Comments	(0020,4000)	3	Ignored
Burned In Annotations	(0028,0301)	3	Ignored
Lossy Image Compression	(0028,2110)	3	Ignored
Lossy Image Compression Ratio	(0028,2110)	3	Ignored

5.4.6.1.1 General Image Attribute Descriptions

5.4.6.1.1.1 Derivation Description and Source Image Sequence

These tags are not yet used.

5.4.6.2 Image Pixel Module

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

TABLE 5.4-8
IMAGE PIXEL MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Samples per Pixel	(0028,0002)	1	Ignored (expect “1”)
Photometric Interpretation	(0028,0004)	1	Ignored (expect “MONOCHROME2”)
Rows	(0028,0010)	1	Mandatory (expect from 256 to 1024)
Columns	(0028,0011)	1	Mandatory (expect from 256 to 1024)
Bits Allocated	(0028,0100)	1	Ignored (expect “16”)
Bits Stored	(0028,0101)	1	Ignored (expect “16”)
High Bit	(0028,0102)	1	Ignored (expect “15”)
Pixel Representation	(0028,0103)	1	Ignored (expect “1”)
Pixel Data	(7FE0,0010)	1	
Planar Configuration	(0028,0006)	1C	Ignored
Pixel Aspect Ratio	(0028,0034)	1C	Ignored
Smallest Image Pixel Value	(0028,0106)	3	Used
Largest Image Pixel Value	(0028,0107)	3	Used
Red Palette Color Lookup Table Descriptor	(0028,1101)	1C	Ignored
Green Palette Color Lookup Table Descriptor	(0028,1102)	1C	Ignored
Blue Palette Color Lookup Table Descriptor	(0028,1103)	1C	Ignored
Red Palette Color Lookup Table Data	(0028,1201)	1C	Ignored
Green Palette Color Lookup Table Data	(0028,1202)	1C	Ignored
Blue Palette Color Lookup Table Data	(0028,1203)	1C	Ignored

5.4.6.3 Multi-Frame Module

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

TABLE 5.4-9
MULTI-FRAME MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Number of Frames	(0028,0008)	1	Mandatory
Frame Increment Pointer	(0028,0009)	1	Mandatory See 5.4.6.3.1.1 for further explanation.

5.4.6.3.1 Multi-Frame Attribute Descriptions

5.4.6.3.1.1 Frame Increment Pointer

Only the "RECON TOMO" image type is supported and can be loaded in this software. This means that only a single attribute reference (0054,0080) is supported for the Frame Increment Pointer.

5.4.6.4 Frame Pointers Module

This section specifies the attributes of a Frame Pointer Module.

This module is not used by this software.

TABLE 5.4-10
FRAME POINTERS MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Representative Frame Number	(0028,6010)	3	Ignored
Frame Numbers Of Interest (FOI)	(0028,6020)	3	Ignored
Frame Of Interest Description	(0028,6022)	3	Ignored
Frame of Interest Type	(0028,6023)	3	Ignored

5.4.7 Common Lookup Table Modules

5.4.7.1 VOI LUT module

This section specifies the Attributes that describe the VOI LUT.

TABLE 5.4-11
VOI LUT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
VOI LUT Sequence	(0028,3010)	3	Ignored
>LUT Descriptor	(0028,3002)	1C	
>LUT Explanation	(0028,3003)	3	
>LUT Data	(0028,3006)	1C	
Window Center	(0028,1050)	3	Used (ignored if multiple values and defaults to an automatic W/L is computed)
Window Width	(0028,1051)	1C	Used (ignored if multiple values and defaults to an automatic W/L is computed)
Window Center & Width Explanation	(0028,1055)	3	Ignored

5.4.8 General Modules

The SOP Common Module is mandatory for all DICOM IODs.

5.4.8.1 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 5.4-12
SOP COMMON MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008,0016)	1	Mandatory: "1.2.840.10008.5.1.4.1.1.20"
SOP Instance UID	(0008,0018)	1	Ignored
Specific Character Set	(0008,0005)	1C	Used Only the "ISO_IR 100" character sets is supported.
Instance Creation Date	(0008,0012)	3	Ignored
Instance Creation Time	(0008,0013)	3	Ignored
Instance Creator UID	(0008,0014)	3	Ignored
Time zone Offset From UTC	(0008,0201)	3	Ignored
Instance Number	(0020,0013)	3	Used
SOP Instance Status	(0100,0410)	3	Ignored
SOP Authorization Date and Time	(0100,0420)	3	Ignored
SOP Authorization Comment	(0100,0414)	3	Ignored
Authorization Equipment Certification Number	(0100,0416)	3	Ignored

5.4.9 Nuclear Medicine Modules

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

5.4.9.1 NM/PET Patient Orientation Module

This section specifies the Attributes that describe the NM/PET Patient Orientation.

TABLE 5.4-13
NM/PET PATIENT ORIENTATION MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Patient Orientation Code Sequence	(0054,0410)	2	Ignored
> Code Value	(0008,0100)	1C	
> Coding Scheme Designator	(0008,0102)	1C	
> Code Meaning	(0008,0104)	3	
> Patient Orientation Modifier Code Sequence	(0054,0412)	2C	Ignored
>> Code value	(0008,0100)	1C	
>> Coding Scheme Designator	(0008,0102)	1C	
>> Code Meaning	(0008,0104)	3	

Patient Gantry Relationship Code Sequence	(0054,0414)	2	Ignored
> Code Value	(0008,0100)	1C	
> Coding Scheme Designator	(0008,0102)	1C	
> Code Meaning	(0008,0104)	3	

5.4.9.2 NM Image Pixel Module

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

TABLE 5.4-14
NM IMAGE PIXEL MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Samples per Pixel	(0028,0002)	1	The value shall be 1.
Photometric Interpretation	(0028,0004)	1	Ignored (expect “MONOCHROME2”)
Bits Allocated	(0028,0100)	1	Ignored (expect 16)
Bits Stored	(0028,0101)	1	Ignored (expect 16)
High Bit	(0028,0102)	1	Ignored (expect 15)
Pixel Spacing	(0028,0030)	2	Mandatory

5.4.9.3 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.

Only the "RECON TOMO" image type is supported and can be loaded in this software. This means that only a single attribute reference (0054,0080) is supported for the Frame Increment Pointer.

TABLE 5.4-15
NM MULTI-FRAME MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Frame Increment Pointer	(0028,0009)	1	Mandatory See 5.4.9.3.1.1
Energy Window Vector	(0054,0010)	1C	Ignored
Number of Energy Windows	(0054,0011)	1	Ignored
Detector Vector	(0054,0020)	1C	Ignored
Number of Detectors	(0054,0021)	1	Ignored
Phase Vector	(0054,0030)	1C	Ignored
Number of Phases	(0054,0031)	1C	Ignored
Rotation Vector	(0054,0050)	1C	Ignored
Number of Rotations	(0054,0051)	1C	Ignored
R-R Interval Vector	(0054,0060)	1C	Ignored
Number of R-R Intervals	(0054,0061)	1C	Ignored
Time Slot Vector	(0054,0070)	1C	Ignored
Number of Time Slots	(0054,0071)	1C	Ignored
Slice Vector	(0054,0080)	1C	Mandatory
Number of Slices	(0054,0081)	1C	Mandatory
Angular View Vector	(0054,0090)	1C	Ignored
Time Slice Vector	(0054,0100)	1C	Ignored

5.4.9.3.1 NM Multi-Frame Attribute Descriptions

5.4.9.3.1.1 Frame Increment Pointer

Only the "RECON TOMO" for the value 3 of Image Type is supported and can be loaded in this software. This means that only a single attribute reference (0054,0080) is supported in the Frame Increment Pointer.

5.4.9.4 NM Image Module

This section contains the Attributes that describe Nuclear Medicine Images.

TABLE 5.4-16
NM IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Image Type	(0008,0008)	1	Mandatory See 5.4.9.4.1.1 for specialization.
Image ID	(0054,0400)	3	Ignored
Lossy Image Compression	(0028,2110)	1C	Used
Counts Accumulated	(0018,0070)	2	Ignored
Acquisition Termination Condition	(0018,0071)	3	Ignored
Table Height	(0018,1130)	3	Ignored
Table Traverse	(0018,1131)	3	Ignored
Actual Frame Duration	(0018,1242)	1C	Ignored
Count Rate	(0018,1243)	3	Ignored
Processing Function	(0018,5020)	3	Ignored
Corrected Image	(0028,0051)	3	Ignored
Whole Body Technique	(0018,1301)	3	Ignored
Scan Velocity	(0018,1300)	2C	Ignored
Scan Length	(0018,1302)	2C	Ignored
Trigger Source or Type	(0018,1061)	3	Ignored
Anatomic Region Sequence	(0008,2218)	3	Ignored
> Code Value	(0008,0100)	1C	
> Coding Scheme Designator	(0008,0102)	1C	
> Code Meaning	(0008,0104)	3	
> Anatomic Region Modifier Sequence	(0008,2220)	3	Ignored
>> Code Value	(0008,0100)	1C	
>> Coding Scheme Designator	(0008,0102)	1C	
>> Code Meaning	(0008,0104)	3	
Primary Anatomic Structure Sequence	(0008,2228)	3	Ignored
> Code Value	(0008,0100)	1C	
> Coding Scheme Designator	(0008,0102)	1C	
> Code Meaning	(0008,0104)	3	
> Primary Anatomic Structure Modifier Sequence	(0008,2230)	3	Ignored
>> Code Value	(0008,0100)	1C	
>> Coding Scheme Designator	(0008,0102)	1C	
>> Code Meaning	(0008,0104)	3	

5.4.9.4.1 NM Image Module Attribute Descriptions

5.4.9.4.1.1 Image Type

Here are the values of Image Type (0008,0008) that may be accepted.

Value 1 may have the following Enumerated Values:

- ORIGINAL identifies an Original Image
- DERIVED identifies a Derived Image

Value 2 may have the following Enumerated Value:

- PRIMARY identifies a Primary Image

Value 3 may have the following Enumerated Value:

- RECON TOMO

Value 4 may have the following Enumerated Value:

- EMISSION
- TRANSMISSION

5.4.9.5 NM Isotope Module

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

TABLE 5.4-17
NM ISOTOPE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Energy Window Information Sequence	(0054,0012)	2	Ignored
> Energy Window Name	(0054,0018)	3	Ignored
>Energy Window Range Sequence	(0054,0013)	3	Ignored
>> Energy Window Lower Limit	(0054,0014)	3	Ignored
>> Energy Window Upper Limit	(0054,0015)	3	Ignored
Radiopharmaceutical Information Sequence	(0054,0016)	2	Ignored
> Radionuclide Code Sequence	(0054,0300)	2C	Ignored
>> Code Value	(0008,0100)	1C	
>> Coding Scheme Designator	(0008,0102)	1C	
>> Code Meaning	(0008,0104)	3	
> Radiopharmaceutical Route	(0018,1070)	3	Ignored
> Administration Route Code Sequence	(0054,0302)	3	Ignored
>> Code Value	(0008,0100)	1C	
>> Coding Scheme Designator	(0008,0102)	1C	
>> Code Meaning	(0008,0104)	3	
> Radiopharmaceutical Volume	(0018,1071)	3	Ignored
> Radiopharmaceutical Start Time	(0018,1072)	3	Ignored
> Radiopharmaceutical Stop Time	(0018,1073)	3	Ignored
> Radionuclide Total Dose	(0018,1074)	3	Ignored
> Calibration Data Sequence	(0054,0306)	3	Ignored
>> Energy Window Number	(0054,0308)	1C	Ignored
>> Syringe Counts	(0018,1045)	3	Ignored
>> Residual Syringe Counts	(0054,0017)	3	Ignored
> Radiopharmaceutical	(0018,0031)	3	Ignored
> Radiopharmaceutical Code Sequence	(0054,0304)	3	Ignored
>> Code Value	(0008,0100)	1C	
>> Coding Scheme Designator	(0008,0102)	1C	
>> Code Meaning	(0008,0104)	3	
Intervention Drug Information Sequence	(0018,0026)	3	Ignored
>Intervention Drug Name	(0018,0034)	3	Ignored
>Intervention Drug Code Sequence	(0018,0029)	3	Ignored
>> Code Value	(0008,0100)	1C	
>> Coding Scheme Designator	(0008,0102)	1C	
>> Code Meaning	(0008,0104)	3	
> Administration Route Code Sequence	(0054,0302)	3	Ignored
>> Code Value	(0008,0100)	1C	

>> Coding Scheme Designator	(0008,0102)	1C	
>> Code Meaning	(0008,0104)	3	
>Intervention Drug Start Time	(0018,0035)	3	Ignored
>Intervention Drug Stop Time	(0018,0027)	3	Ignored
>Intervention Drug Dose	(0018,0028)	3	Ignored

5.4.9.6 NM Detector Module

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

TABLE 5.4-18
NM DETECTOR MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Detector Information Sequence	(0054,0022)	2	Mandatory
> Collimator/Grid Name	(0018,1180)	3	Ignored
> Collimator Type	(0018,1181)	2C	Ignored
> Field of View Shape	(0018,1147)	3	Ignored
> Field of View Dimension(s)	(0018,1149)	3	Ignored
> Focal Distance	(0018,1182)	2C	Ignored
> X Focus Center	(0018,1183)	3	Ignored
> Y Focus Center	(0018,1184)	3	Ignored
> Zoom Center	(0028,0032)	3	Ignored
> Zoom Factor	(0028,0031)	3	Ignored
> Center of Rotation Offset	(0018,1145)	3	Ignored
> Gantry/Detector Tilt	(0018,1120)	3	Ignored
> Distance Source to Detector	(0018,1110)	2C	Ignored
> Start Angle	(0054,0200)	3	Ignored
> Radial Position	(0018,1142)	3	Ignored
> Image Orientation (Patient)	(0020,0037)	2C	Mandatory
> Image Position (Patient)	(0020,0032)	2C	Mandatory
> View Code Sequence	(0054,0220)	3	Ignored
>> Code Value	(0008,0100)	1C	Ignored
>> Coding Scheme Designator	(0008,0102)	1C	Ignored
>> Code Meaning	(0008,0104)	3	Ignored
>> View Angulation Modifier Code Sequence	(0054,0222)	2C	Ignored
>>> Code value	(0008,0100)	1C	Ignored
>>> Coding Scheme Designator	(0008,0102)	1C	Ignored
>>> Code Meaning	(0008,0104)	3	Ignored

5.4.9.7 NM TOMO Acquisition Module

This section contains IOD Attributes that describe Nuclear TOMO Acquisition module used to produce an image.

TABLE 5.4-19
NM TOMO ACQUISITION MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Rotation Information Sequence	(0054,0052)	2	Ignored
> Start Angle	(0054,0200)	1C	Ignored
> Angular Step	(0018,1144)	1C	Ignored
> Rotation Direction	(0018,1140)	1C	Ignored
> Scan Arc	(0018,1143)	1C	Ignored
> Actual Frame Duration	(0018,1242)	1C	Ignored
> Radial Position	(0018,1142)	3	Ignored
> Distance Source to Detector	(0018,1110)	2C	Ignored
> Number of Frames in Rotation	(0054,0053)	1C	Ignored
> Table Traverse	(0018,1131)	3	Ignored
> Table Height	(0018,1130)	3	Ignored
Type of Detector Motion	(0054,0202)	3	Ignored

5.4.9.8 NM Multi-gated Acquisition Module

This section contains Attributes that describe a multi-gated acquisition image performed on the patient. This refers to frames acquired while the patient is connected to a gating device.

TABLE 5.4-20
NM MULTI-GATED ACQUISITION MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Beat Rejection Flag	(0018,1080)	3	Ignored
PVC Rejection	(0018,1085)	3	Ignored
Skip Beats	(0018,1086)	3	Ignored
Heart Rate	(0018,1088)	3	Ignored
Gated Information Sequence	(0054,0062)	2C	Ignored
> Trigger Time	(0018,1060)	3	Ignored
> Framing Type	(0018,1064)	3	Ignored
> Data Information Sequence	(0054,0063)	2C	Ignored
>> Frame Time	(0018,1063)	1C	Ignored
>> Nominal Interval	(0018,1062)	3	Ignored
>> Low R-R Value	(0018,1081)	3	Ignored
>> High R-R Value	(0018,1082)	3	Ignored
>> Intervals Acquired	(0018,1083)	3	Ignored
>> Intervals Rejected	(0018,1084)	3	Ignored
>> Time Slot Information Sequence	(0054,0072)	2C	Ignored
>>> Time Slot Time	(0054,0073)	3	Ignored

5.4.9.9 NM Phase Module

This section contains Attributes that describe dynamic phases of a dynamic acquisition image performed on the patient.

TABLE 5.4-21
NM PHASE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Phase Information Sequence	(0054,0032)	2C	Ignored
> Phase Delay	(0054,0036)	1C	Ignored
> Actual Frame Duration	(0018,1242)	1C	Ignored
> Pause Between Frames	(0054,0038)	1C	Ignored
> Number of Frames in Phase	(0054,0033)	1C	Ignored
>Trigger Vector	(0054,0210)	3	Ignored
>Number of Triggers in Phase	(0054,0211)	1C	Ignored
>Phase Description	(0054,0039)	3	Ignored

5.4.9.10 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.

TABLE 5.4-22
NM RECONSTRUCTION MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Spacing Between Slices	(0018,0088)	2	Mandatory
Reconstruction Diameter	(0018,1100)	3	Ignored
Convolution Kernel	(0018,1210)	3	Ignored
Slice Thickness	(0018,0050)	2	Used
Slice Location	(0020,1041)	3	Ignored
Slice Progression Direction	(0054,0500)	3	Ignored

6. PET INFORMATION OBJECT IMPLEMENTATION

6.1 INTRODUCTION

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

6.2 - IOD Entity-Relationship Model

6.3- IOD Module Table

6.4- IOD Module Definition

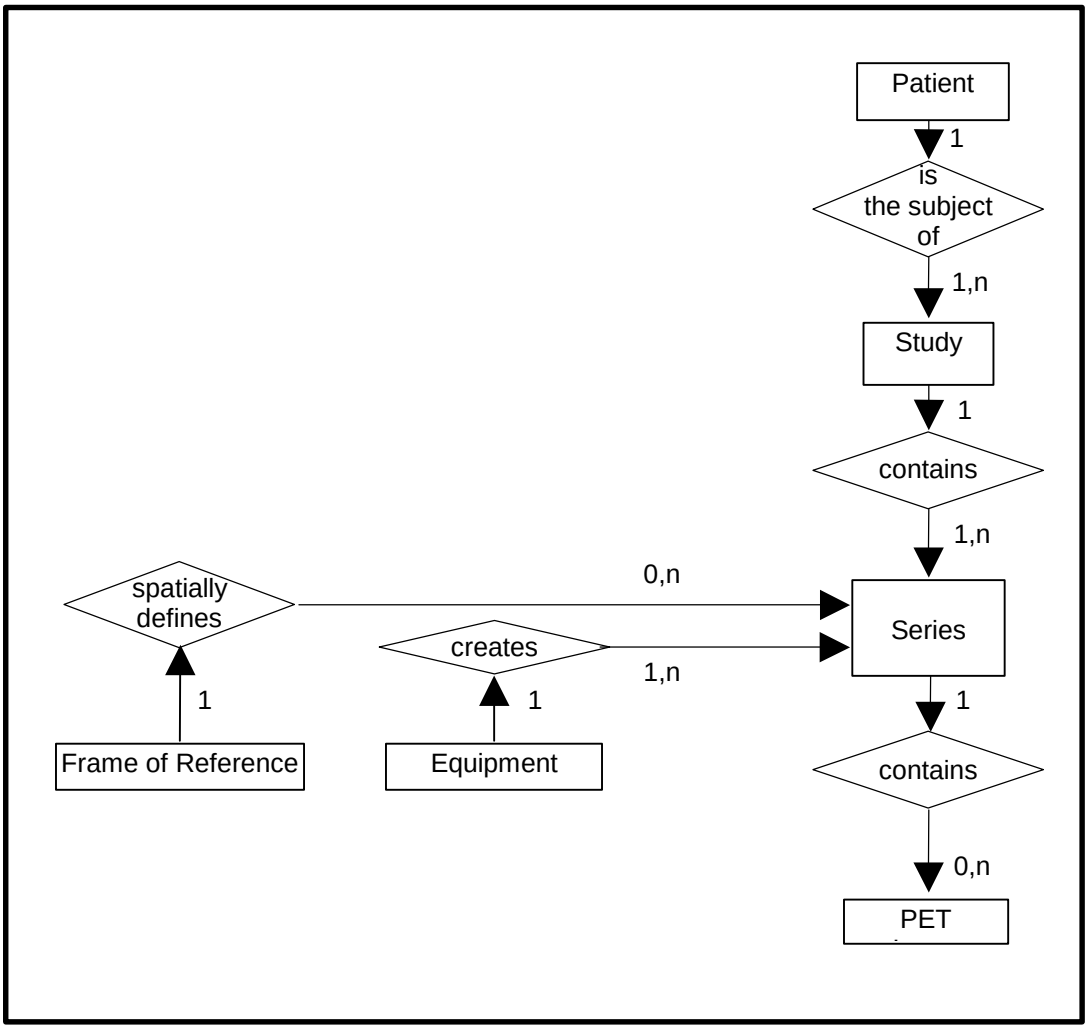
6.2 PET ENTITY-RELATIONSHIP MODEL

The Entity-Relationship diagram for the PET Image interoperability schema is shown in Illustration 3.2-1**.** In this figure, the following diagrammatic convention is established to represent the information organization :

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

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

ILLUSTRATION 6.2-1
PET IMAGE ENTITY RELATIONSHIP DIAGRAM



6.2.1 ENTITY DESCRIPTIONS

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

6.2.2 Volume Viewer Mapping of DICOM entities

TABLE 6.2-1
MAPPING OF DICOM ENTITIES TO VOLUME VIEWER ENTITIES

DICOM	Volume Viewer Entity
Patient	Patient
Study	Exam
Series	Series
Image	Image
Frame	Not Applicable

6.3 IOD MODULE TABLE

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

The table below identifies the defined modules within the entities which comprise the DICOM PET IOD. Modules are identified by Module Name.

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

TABLE 6.3-1
PET IMAGE IOD MODULES

Entity Name	Module Name	Reference
Patient	Patient	6.4.1.1
Study	General Study	6.4.2.1
	Patient Study	6.4.2.2
Series	General Series	6.4.3.1
	PET Series	6.4.9.1
	PET Isotope	6.4.9.2
	PET Multi-gated Acquisition	6.4.9.3
	NM/PET Patient Orientation	6.4.9.4
Frame of Reference	Frame of Reference	6.4.4.1
Equipment	General Equipment	6.4.5.1
Image	General Image	6.4.6.1
	Image Plane	6.4.6.1.1
	Image Pixel	6.4.6.3
	PET Image	6.4.9.5
	Overlay Plane	Not Used / Not Copied
	VOI LUT	6.4.7.1
	SOP Common	6.4.8.1

6.4 INFORMATION MODULE DEFINITIONS

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

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

If an element is not listed below, it means that it will be ignored at reading and not copied at writing.

6.4.1 Common Patient Entity Modules

6.4.1.1 Patient Module

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

TABLE 6.4-1
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 / Generated (SUV panel)
Referenced Patient Sequence	(0008,1120)	3	Ignored / Copied
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
Patient's Birth Time	(0010,0032)	3	Ignored / Copied
Other Patient IDs	(0010,1000)	3	Ignored / Copied
Other Patient Names	(0010,1001)	3	Ignored / Copied
Ethnic Group	(0010,2160)	3	Ignored / Copied
Patient Comments	(0010,4000)	3	Ignored / Copied

6.4.2 Common Study Entity Modules

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

6.4.2.1 General Study Module

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

TABLE 6.4-2
GENERAL STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Study Instance UID	(0020,000D)	1	Mandatory / Copied
Study Date	(0008,0020)	2	Used / 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
Physician(s) of Record	(0008,1048)	3	Ignored / Copied
Name of Physician(s) Reading Study	(0008,1060)	3	Used / Copied
Referenced Study Sequence	(0008,1110)	3	Ignored / Copied
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
Requested Procedure ID	(0040,1001)		
Procedure Code Sequence	(0008,1032)	3	Ignored / Copied
>Code Value	(0008,0100)	1C	
>Code Scheme Designator	(0008,0102)	1C	
>Code Meaning	(0008,0104)	1C	

6.4.2.2 Patient Study Module

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

TABLE 6.4-3
PATIENT STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Admitting Diagnoses Description	(0008,1080)	3	Ignored / Copied
Patient's Age	(0010,1010)	3	Used / Copied
Patient's Size	(0010,1020)	3	Used / Generated (SUV panel)
Patient's Weight	(0010,1030)	3	Used / Generated (SUV panel)
Occupation	(0010,2180)	3	Ignored / Copied
Additional Patient’s History	(0010,21B0)	3	Used / Copied

6.4.3 Common Series Entity Modules

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

6.4.3.1 General Series Module

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

TABLE 6.4-4
GENERAL SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	Used / Generated Defined Terms: PT = Computed Tomography
Series Instance UID	(0020,000E)	1	Mandatory / Generated
Series Number	(0020,0011)	2	Used / Generated
Laterality	(0020,0060)	2C	Ignored / Generated (empty as the software cannot know semantically the laterality)
Series Date	(0008,0021)	3	Used / Copied
Series Time	(0008,0031)	3	Used / Copied
Performing Physicians' Name	(0008,1050)	3	Used / Copied
Protocol Name	(0018,1030)	3	Used / Copied
Series Description	(0008,103E)	3	Used / Generated
Operators' Name	(0008,1070)	3	Used / Copied
Referenced Performed Procedure Step Sequence	(0008,1111)	3	Ignored / Removed on AW, Generated on CT/MR consoles if PPS feature is activated
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
Body Part Examined	(0018,0015)	3	Ignored / Copied
Patient Position	(0018,5100)	2C	Used / Generated 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	Ignored / Removed
Largest Pixel Value in Series	(0028,0109)	3	Ignored / Removed
Request Attributes Sequence	(0040,0275)	3	Ignored / Copied (Entire sequence copied)
>Accession Number	(0008,0050)	3	
>Study Instance UID	(0020,000D)	3	
>Referenced Study Sequence	(0008,1110)	3	
>Requested Procedure Description	(0032,1060)	3	

>Requested Procedure Code Sequence	(0032,1064)	3	
>Reason for the Requested Procedure	(0040,1002)	3	
>Reason for Requested Procedure Code Sequence	(0040,100A)	3	
>Requested Procedure ID	(0040,1001)	1C	
>Scheduled Procedure Step ID	(0040,0009)	1C	
>Scheduled Procedure Step Description	(0040,0007)	3	
>Scheduled Protocol Code Sequence	(0040,0008)	3	
Performed Procedure Step ID	(0040,0253)	3	Ignored / Removed on AW, Generated on CT/MR consoles if PPS feature is activated
Performed Procedure Step Start Date	(0040,0244)	3	Ignored / Removed on AW, Generated on CT/MR consoles if PPS feature is activated
Performed Procedure Step Start Time	(0040,0245)	3	Ignored / Removed on AW, Generated on CT/MR consoles if PPS feature is activated
Performed Procedure Step Description	(0040,0254)	3	Ignored / Removed on AW, Generated on CT/MR consoles if PPS feature is activated
Performed Protocol CodeSequence	(0040,0260)	3	Ignored / Removed on AW, Generated on CT/MR consoles if PPS feature is activated

6.4.4 Common Frame Of Reference Entity Modules

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

6.4.4.1 Frame Of Reference Module

Images should share the same Frame Of Reference UID as a necessary conditions to be in the same 3D model. However, this is not sufficient, because images have also to share the same geometry (be parallel with compatible centers), have the same size, the same pixel size, the same tilt, the same study ID, the same patient name.

TABLE 6.4-5
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

6.4.5 Common Equipment Entity Modules

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

6.4.5.1 General Equipment Module

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

As Voxtool can simulate the generation of an image by the scanner, we have chosen to copy this module, but to omit the fields that could be altered by the reformation

TABLE 6.4-6
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

6.4.6 Common Image Entity Modules

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

6.4.6.1 General Image Module

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

TABLE 6.4-7
GENERAL IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Image Number	(0020,0013)	2	Used / Generated
Patient Orientation	(0020,0020)	2C	Ignored / Generated
Image Date	(0008,0023)	2C	Used / Generated
Image Time	(0008,0033)	2C	Used / Generated
Image Type	(0008,0008)	3	Used / Generated
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 / Removed
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
Derivation Description	(0008,2111)	3	Ignored / Removed
Source Image Sequence	(0008,2112)	3	Used / Removed
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
Images in Acquisition	(0020,1002)	3	Ignored / Removed
Image Comments	(0020,4000)	3	Ignored / Removed
Quality Control Image	(0028,0300)	3	Ignored / Removed
Burned In Annotations	(0028,0301)	3	Ignored / Generated
Lossy Image Compression	(0028,2110)	3	Used / Copied
Lossy Image Compression Ratio	(0028,2112)	3	Ignored / Copied

6.4.6.1.1 General Image Attribute Descriptions

6.4.6.1.1.1 Patient Orientation

Since the coordinates of the image are always written, this field is never used and not present in the created images.

6.4.6.1.1.2 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

When reading images, all values are accepted.

6.4.6.1.1.3 Derivation Description and Source Image Sequence

These tags are not yet used.

6.4.6.1.1.4 Lossy Image Compression

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

6.4.6.2 Image Plane Module

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

TABLE 6.4-8
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
Slice Location	(0020,1041)	3	Ignored / Removed

6.4.6.2.1 Image Position

The Image Position is treated as the position of the upper left hand corner of the first pixel of the image for images coming from GE (Manufacturer is “GE MEDICAL SYSTEMS”) where the Manufacturer Model Name is “Advance”, “Discovery LS” or “Discovery QX/i”.

Otherwise, the Image Position is treated as the position of the center of the first pixel of the image.

6.4.6.3 Image Pixel Module

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

TABLE 6.4-9
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” or “MONOCHROME1”
Rows	(0028,0010)	1	Mandatory (expect from 256 to 1024) / Generated
Columns	(0028,0011)	1	Mandatory (expect from 256 to 1024) / Generated
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 / Generated
Planar Configuration	(0028,0006)	1C	Ignored
Pixel Aspect Ratio	(0028,0034)	1C	Ignored
Smallest Image Pixel Value	(0028,0106)	3	Ignored
Largest Image Pixel Value	(0028,0107)	3	Ignored
Red Palette Color Lookup Table Descriptor	(0028,1101)	1C	Ignored

Green Palette Color Lookup Table Descriptor	(0028,1102)	1C	Ignored
Blue Palette Color Lookup Table Descriptor	(0028,1103)	1C	Ignored
Red Palette Color Lookup Table Data	(0028,1201)	1C	Ignored
Green Palette Color Lookup Table Data	(0028,1202)	1C	Ignored
Blue Palette Color Lookup Table Data	(0028,1203)	1C	Ignored

6.4.7 Common Lookup Table Modules

6.4.7.1 VOI LUT module

This section specifies the Attributes that describe the VOI LUT.

TABLE 6.4-10
VOI LUT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
VOI LUT Sequence	(0028,3010)	3	Ignored / Removed
>LUT Descriptor	(0028,3002)	1C	
>LUT Explanation	(0028,3003)	3	
>LUT Data	(0028,3006)	1C	
Window Center	(0028,1050)	3	Ignored at load (an automatic W/L is computed on the whole series) At save, a value generated from the current value used in the saved view.
Window Width	(0028,1051)	1C	Ignored at load (an automatic W/L is computed on the whole series) At save, a value generated from the current value used in the saved view.
Window Center & Width Explanation	(0028,1055)	3	Ignored / Removed

6.4.8 General Modules

The SOP Common Module is mandatory for all DICOM IODs.

6.4.8.1 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 6.4-11
SOP COMMON MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008,0016)	1	Used / Generated: "1.2.840.10008.5.1.4.1.1.128"
SOP Instance UID	(0008,0018)	1	Used / Generated
Specific Character Set	(0008,0005)	1C	Used / Copied Only the "ISO_IR 100" character sets is supported.
Instance Creation Date	(0008,0012)	3	Ignored / Generated
Instance Creation Time	(0008,0013)	3	Ignored / Generated
Instance Creator UID	(0008,0014)	3	Ignored / Removed
Time zone Offset From UTC	(0008,0201)	3	Ignored / Removed
Instance Number	(0020,0013)	3	Used / Generated
SOP Instance Status	(0100,0410)	3	Ignored / Removed
SOP Authorization Date and Time	(0100,0420)	3	Ignored / Removed
SOP Authorization Comment	(0100,0414)	3	Ignored / Removed
Authorization Equipment Certification Number	(0100,0416)	3	Ignored / Removed

6.4.9 PET Modules

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

6.4.9.1 PET Series

The table in this Section contains IOD Attributes that describe PET Series.

TABLE 6.4-12
PET SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Series Date	(0008,0021)	1	Used / Copied
Series Time	(0008,0031)	1	Used / Copied
Units	(0054,1001)	1	Used / Copied
Counts Source	(0054,1002)	1	Ignored / Copied
Series Type	(0054,1000)	1	Ignored / Copied
Reprojection Method	(0054,1004)	2C	Ignored / Copied
Number of R-R Intervals	(0054,0061)	1C	Ignored / Copied
Number of Time Slots	(0054,0071)	1C	Used / Copied
Number of Time Slices	(0054,0101)	1C	Ignored / Copied
Number of Slices	(0054,0081)	1	Used/Generated: for free saved this number is arbitrary set to 100, for batch saved it is saved to the known number of images.
Corrected Image	(0028,0051)	2	Used / Copied
Randoms Correction Method	(0054,1100)	3	Ignored / Copied
Attenuation Correction Method	(0054,1101)	3	Ignored / Copied
Scatter Correction Method	(0054,1105)	3	Ignored / Copied
Decay Correction	(0054,1102)	1	Ignored / Copied
Reconstruction Diameter	(0018,1100)	3	Ignored / Removed
Convolution Kernel	(0018,1210)	3	Ignored / Copied
Reconstruction Method	(0054,1103)	3	Ignored / Copied
Detector Lines of Response Used	(0054,1104)	3	Ignored / Copied
Acquisition Start Condition	(0018,0073)	3	Ignored / Copied
Acquisition Start Condition Data	(0018,0074)	3	Ignored / Copied
Acquisition Termination Condition	(0018,0071)	3	Ignored / Copied
Acquisition Termination Condition Data	(0018,0075)	3	Ignored / Copied
Field of View Shape	(0018,1147)	3	Ignored / Copied
Field of View Dimensions	(0018,1149)	3	Ignored / Copied
Gantry/Detector Tilt	(0018,1120)	3	Used: images with tilt are rejected / Removed
Gantry/Detector Slew	(0018,1121)	3	Used: images with slew are rejected / Removed
Type of Detector Motion	(0054,0202)	3	Ignored / Copied
Collimator Type	(0018,1181)	2	Used / Copied
Collimator/Grid Name	(0018,1180)	3	Ignored / Copied

Axial Acceptance	(0054,1200)	3	Ignored / Copied
Axial Mash	(0054,1201)	3	Ignored / Copied
Transverse Mash	(0054,1202)	3	Ignored / Copied
Detector Element Size	(0054,1203)	3	Ignored / Copied
Coincidence Window Width	(0054,1210)	3	Ignored / Copied
Energy Window Range Sequence	(0054,0013)	3	Ignored / Copied
>Energy Window Lower Limit	(0054,0014)	3	Ignored / Copied
>Energy Window Upper Limit	(0054,0015)	3	Ignored / Copied
Secondary Counts Type	(0054,1220)	3	Ignored / Copied

`

6.4.9.2 PET Isotope

The table in this Section contains IOD Attributes that describe PET Series.

TABLE 6.4-13
PET ISOTOPE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Radiopharmaceutical Information Sequence	(0054,0016)	2	Used / Copied
>Radionuclide Code Sequence	(0054,0300)	2	Ignored / Copied
>>Code Value	(0008,0100)	1C	
>>Code Scheme Designator	(0008,0102)	1C	
>>Code Meaning	(0008,0104)	3	
>Radiopharmaceutical Route	(0018,1070)	3	Ignored / Copied
>Administration Route Code Sequence	(0054,0302)	3	Ignored / Copied
>>Code Value	(0008,0100)	1C	
>>Code Scheme Designator	(0008,0102)	1C	
>>Code Meaning	(0008,0104)	3	
>Radiopharmaceutical Volume	(0018,1071)	3	Ignored / Copied
>Radiopharmaceutical Start Time	(0018,1072)	3	Used / Copied
>Radiopharmaceutical Stop Time	(0018,1073)	3	Ignored / Copied
>Radionuclide Total Dose	(0018,1074)	3	Used / Copied
>Radionuclide Half Life	(0018,1075)	3	Used / Copied
>Radionuclide Positron Fraction	(0018,1076)	3	Ignored / Copied
>Radiopharmaceutical Specific Activity	(0018,1077)	3	Ignored / Copied
>Radiopharmaceutical	(0018,0031)	3	Ignored / Copied
>Radiopharmaceutical Code Sequence	(0054,0304)	3	Ignored / Copied
>>Code Value	(0008,0100)	1C	
>>Code Scheme Designator	(0008,0102)	1C	
>>Code Meaning	(0008,0104)	3	
Intervention Drug Information Sequence	(0018,0026)	3	Ignored / Copied
>Intervention Drug Name	(0018,0034)	3	Ignored / Copied
>Intervention Drug Code Sequence	(0018,0029)	3	Ignored / Copied

>>Code Value	(0008,0100)	1C	
>>Code Scheme Designator	(0008,0102)	1C	
>>Code Meaning	(0008,0104)	3	
>Intervention Drug Start Time	(0018,0035)	3	Ignored / Copied
>Intervention Drug Stop Time	(0018,0027)	3	Ignored / Copied
>Intervention Drug Dose	(0018,0028)	3	Ignored / Copied

6.4.9.3 PET Multi-gated Acquisition

The table in this Section contains IOD Attributes that describe PET Series.

TABLE 6.4-14
PET MULTI-GATED ACQUISITION MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Beat Rejection Flag	(0018,1080)	2	Ignored / Copied
Trigger Source or Type	(0018,1061)	3	Ignored / Removed
PVC Rejection	(0018,1085)	3	Ignored /Removed
Skip Beats	(0018,1086)	3	Ignored / Removed
Heart Rate	(0018,1088)	3	Ignored / Removed
Framing Type	(0018,1064)	3	Ignored / Removed

6.4.9.4 NM/PET Patient Orientation

The table in this Section contains IOD Attributes that describe NM/PET Patient Orientation.

TABLE 6.4-15
NM/PET PATIENT ORIENTATION MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Patient Orientation Code Sequence	(0054,0410)	2	Ignored / Copied
> Code Value	(0008,0100)	1C	
> Coding Scheme Designator	(0008,0102)	1C	
> Code Meaning	(0008,0104)	3	
> Patient Orientation Modifier Code Sequence	(0054,0412)	2C	Ignored / Copied
>> Code value	(0008,0100)	1C	
>> Coding Scheme Designator	(0008,0102)	1C	
>> Code Meaning	(0008,0104)	3	
Patient Gantry Relationship Code Sequence	(0054,0414)	2	Ignored / Copied
> Code Value	(0008,0100)	1C	
> Coding Scheme Designator	(0008,0102)	1C	
> Code Meaning	(0008,0104)	3	

6.4.9.5 PET Image Module

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

TABLE 6.4-16
PET IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Image Type	(0008,0008)	1	Used / Generated
Samples per Pixel	(0028,0002)	1	Ignored (expect 1) / Generated "1"
Photometric Interpretation	(0028,0004)	1	Ignored (expect "MONOCHROME2") / Generated "MONOCHROME2" or "MONOCHROME1"
Bits Allocated	(0028,0100)	1	Shall be 16 / Generated "16"
Bits Stored	(0028,0101)	1	Ignored (expect 16) / Generated "16"
High Bit	(0028,0102)	1	Ignored (expect 15) / Generated "15"
Rescale Intercept	(0028,1052)	1	Ignored (recomputed) / Generated
Rescale Slope	(0028,1053)	1	Used / Generated
Frame Reference Time	(0054,1300)	1	Ignored / Copied
Trigger Time	(0018,1060)	1C	Used / Copied
Frame Time	(0018,1063)	1C	Used / Copied
Low R-R Value	(0018,1081)	1C	Ignored / Copied
High R-R Value	(0018,1082)	1C	Ignored / Copied
Lossy Image Compression	(0028,2110)	1C	Used / Copied
Image Index	(0054,1330)	1	Used / Copied
Acquisition Date	(0008,0022)	2	Used / Copied
Acquisition Time	(0008,0032)	2	Used / Copied
Actual Frame Duration	(0018,1242)	2	Used / Copied
Nominal Interval	(0018,1062)	3	Ignored / Removed
Intervals Acquired	(0018,1083)	3	Used / Removed
Intervals Rejected	(0018,1084)	3	Ignored / Removed
Primary (Prompts) Counts Accumulated	(0054,1310)	3	Ignored / Removed
Secondary Counts Accumulated	(0054,1311)	3	Ignored / Removed
Slice Sensitivity Factor	(0054,1320)	3	Ignored / Removed
Decay Factor	(0054,1321)	1C	Ignored / Copied
Dose Calibration Factor	(0054,1322)	3	Ignored / Removed
Scatter Fraction Factor	(0054,1323)	3	Ignored / Removed
Dead Time Factor	(0054,1324)	3	Ignored / Removed
Referenced Overlay Sequence	(0008,1130)	3	Ignored / Removed
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
Referenced Curve Sequence	(0008,1145)	3	Ignored / Removed
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
Anatomic Region Sequence	(0008,2218)	3	Ignored / Removed

>Code Value	(0008,0100)	1C	
>Code Scheme Designator	(0008,0102)	1C	
>Code Meaning	(0008,0104)	3	
>Anatomic Region Modifier Sequence	(0008,2220)	3	Ignored / Removed
>>Code Value	(0008,0100)	1C	
>>Code Scheme Designator	(0008,0102)	1C	
>>Code Meaning	(0008,0104)	3	
Primary Anatomic Structure Sequence	(0008,2228)	3	Ignored / Removed
>Code Value	(0008,0100)	1C	
>Code Scheme Designator	(0008,0102)	1C	
>Code Meaning	(0008,0104)	3	
>Primary Anatomic Structure Modifier Sequence	(0008,2230)	3	Ignored / Removed
>>Code Value	(0008,0100)	1C	
>>Code Scheme Designator	(0008,0102)	1C	
>>Code Meaning	(0008,0104)	3	

6.5 PRIVATE DATA

The following private elements are used:

PRIVATE ADVANTAGE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Private Creator	(0009, 00xx)	3	GEMS_PETD_01: Used / Removed
Scan Time	(0009, xx0D)	3	Used / Removed
Tracer Activity	(0009, xx38)	3	Used / Removed
Measured Time	(0009, xx39)	3	Used / Removed
Administrated Time	(0009, xx3B)	3	Used / Removed
Post Injected Activity	(0009, xx3C)	3	Used / Removed
Post Injected Time	(0009, xx3D)	3	Used / Removed
Half Life	(0009, xx3F)	3	Used / Removed
Private Group Creator	(0047, 00xx)	3	GEMS_VXTL_USERDATA_01: Used / Generated
Private User Data	(0047, xx11)	3	Used / Generated. If contains “Registered series” the saved volume has been moved due to registration.
Private Group Creator	(0059, 00xx)	3	GEMS_VXTL_REGISTRATION_01: Used / Generated
Deformed Flag	(0059, xx00)	3	Used / Generated. Generated if the saved volume is geometrically deformed regarding its original data, hence distance, area, volume or angle measurements are invalid.

7. SC INFORMATION OBJECT IMPLEMENTATION

7.1 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:

7.2 - IOD Entity-Relationship Model

7.3 - IOD Module Table

7.4 - IOD Module Definition

SC Images are also used as a vector to store the internal states of the Volume Viewer Applications, called Save State. This type of object can be read or written, but only the private fields are used in that case, as the other fields are only used to have the object stored in the same Patient. Actual data are retrieved from the original images that the Save State points to. The third value of Image Type is then “VXTL STATE”. See section 7.5.1 for a description of these private tags.

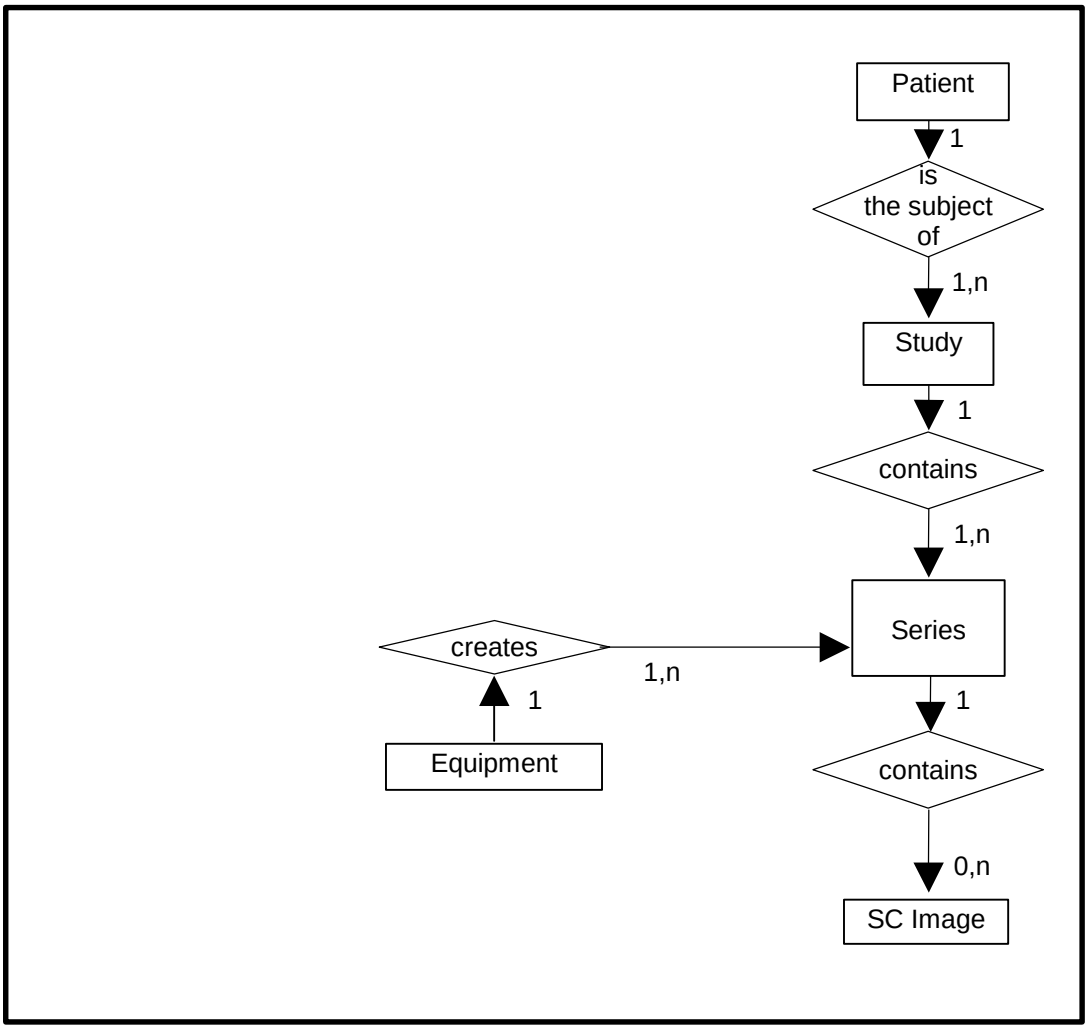
7.2 SC ENTITY-RELATIONSHIP MODEL

The Entity-Relationship diagram for the SC Image interoperability schema is shown in Illustration 7.2-1**.** In this figure, the following diagrammatic convention is established to represent the information organization :

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

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

ILLUSTRATION 7.2-1
SC IMAGE ENTITY RELATIONSHIP DIAGRAM



7.2.1 ENTITY DESCRIPTIONS

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

7.2.2 Volume Viewer Mapping of DICOM entities

TABLE 7.2-1
MAPPING OF DICOM ENTITIES TO VOLUME VIEWER ENTITIES

DICOM	Volume Viewer Entity
Patient	Patient
Study	Exam
Series	Series
Image	Image
Frame	Not Applicable

7.3 IOD MODULE TABLE

Within an entity of the DICOM 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 7.3-1 identifies the defined modules within the entities which comprise the DICOM SC IOD. Modules are identified by Module Name.

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

TABLE 7.3-1
SC IMAGE IOD MODULES

Entity Name	Module Name	Reference
Patient	Patient	7.4.1.1
Study	General Study	7.4.2.1
	Patient Study	7.4.2.2
Series	General Series	7.4.3.1
Equipment	General Equipment	7.4.4.1
	SC Equipment	7.4.8.1
Image	General Image	7.4.5.1
	Image Pixel	7.4.5.2
	SC Image	7.4.8.2
	Overlay Plane	Not used / Not copies
	Modality LUT	7.4.6.2
	VOI LUT	7.4.6.1
	SOP Common	7.4.7.1

7.4 INFORMATION MODULE DEFINITIONS

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

If an element is not listed below, it means that it will be ignored at reading and not copied at writing.

7.4.1 Common Patient Entity Modules

7.4.1.1 Patient Module

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

TABLE 7.4-1
PATIENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Patient's Name	(0010,0010)	2	Copied
Patient ID	(0010,0020)	2	Copied
Patient's Birth Date	(0010,0030)	2	Copied
Patient's Sex	(0010,0040)	2	Copied
Referenced Patient Sequence	(0008,1120)	3	Copied
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
Patient's Birth Time	(0010,0032)	3	Copied
Other Patient IDs	(0010,1000)	3	Copied
Other Patient Names	(0010,1001)	3	Copied
Ethnic Group	(0010,2160)	3	Copied
Patient Comments	(0010,4000)	3	Copied

7.4.2 Common Study Entity Modules

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

7.4.2.1 General Study Module

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

TABLE 7.4-2
GENERAL STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Study Instance UID	(0020,000D)	1	Copied
Study Date	(0008,0020)	2	Copied
Study Time	(0008,0030)	2	Copied
Referring Physician's Name	(0008,0090)	2	Copied
Study ID	(0020,0010)	2	Copied
Accession Number	(0008,0050)	2	Copied
Study Description	(0008,1030)	3	Copied
Physician(s) of Record	(0008,1048)	3	Copied
Name of Physician(s) Reading Study	(0008,1060)	3	Copied
Referenced Study Sequence	(0008,1110)	3	Copied
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
Procedure Code Sequence	(0008,1032)	3	Copied
>Code Value	(0008,0100)	1C	
>Code Scheme Designator	(0008,0102)	1C	
>Code Meaning	(0008,0104)	1C	

7.4.2.2 Patient Study Module

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

TABLE 7.4-3
PATIENT STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Admitting Diagnoses Description	(0008,1080)	3	Copied
Patient's Age	(0010,1010)	3	Copied
Patient's Size	(0010,1020)	3	Copied
Patient's Weight	(0010,1030)	3	Copied
Occupation	(0010,2180)	3	Copied
Additional Patient’s History	(0010,21B0)	3	Copied

7.4.3 Common Series Entity Modules

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

7.4.3.1 General Series Module

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

TABLE 7.4-4
GENERAL SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	Copied Defined Terms: CT = Computed Tomography MR = Magnetic Resonance NM = Nuclear Medicine PT = PET XA = X-Ray Angiography OT = OTHER for fused viewports
Series Instance UID	(0020,000E)	1	Generated
Series Number	(0020,0011)	2	Generated
Laterality	(0020,0060)	2C	Generated: “” (empty as the software cannot know semantically the laterality)
Series Date	(0008,0021)	3	Generated: current date
Series Time	(0008,0031)	3	Generated: current time
Performing Physicians’ Name	(0008,1050)	3	Copied
Protocol Name	(0018,1030)	3	Removed
Series Description	(0008,103E)	3	Used / Generated (see section 7.5)
Operators' Name	(0008,1070)	3	Copied
Referenced Performed Procedure Step Sequence	(0008,1111)	3	Removed on AW, Generated on CT/MR consoles if PPS feature is activated
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
Body Part Examined	(0018,0015)	3	Copied
Patient Position	(0018,5100)	2C	Copied for CT, MR and XA 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	Removed
Largest Pixel Value in Series	(0028,0109)	3	Removed
Request Attributes Sequence	(0040,0275)	3	Copied (Entire sequence copied)
>Requested Procedure ID	(0040,1001)	1C	

>Accession Number	(0008,0050)	3	
>Study Instance UID	(0020,000D)	3	
>Referenced Study Sequence	(0008,1110)	3	
>Requested Procedure Description	(0032,1060)	3	
>Requested Procedure Code Sequence	(0032,1064)	3	
>Reason for the Requested Procedure	(0040,1002)	3	
>Reason for Requested Procedure Code Sequence	(0040,100A)	3	
>Scheduled Procedure Step ID	(0040,0009)	1C	
>Scheduled Procedure Step Description	(0040,0007)	3	
>Scheduled Protocol Code Sequence	(0040,0008)	3	
Performed Procedure Step ID	(0040,0253)	3	Removed on AW, Generated on CT/MR consoles if PPS feature is activated
Performed Procedure Step Start Date	(0040,0244)	3	Removed on AW, Generated on CT/MR consoles if PPS feature is activated
Performed Procedure Step Start Time	(0040,0245)	3	Removed on AW, Generated on CT/MR consoles if PPS feature is activated
Performed Procedure Step Description	(0040,0254)	3	Removed on AW, Generated on CT/MR consoles if PPS feature is activated
Performed Protocol Code Sequence	(0040,0260)	3	Removed on AW, Generated on CT/MR consoles if PPS feature is activated

7.4.4 Common Equipment Entity Modules

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

7.4.4.1 General Equipment Module

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

TABLE 7.4-5
GENERAL EQUIPMENT MODULE ATTRIBUTES

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

7.4.5 Common Image Entity Modules

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

7.4.5.1 General Image Module

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

TABLE 7.4-6
GENERAL IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Image Number	(0020,0013)	2	Generated
Patient Orientation	(0020,0020)	2C	Generated. See 7.4.5.1.1.1
Image Date	(0008,0023)	2C	Generated, empty “”. See 7.4.5.1.1.2
Image Time	(0008,0033)	2C	Generated, empty “”. See 7.4.5.1.1.2
Image Type	(0008,0008)	3	Generated. See 7.4.5.1.1.3
Acquisition Number	(0020,0012)	3	Copied
Acquisition Date	(0008,0022)	3	Copied
Acquisition Time	(0008,0032)	3	Copied
Referenced Image Sequence	(0008,1140)	3	Copied
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
Derivation Description	(0008,2111)	3	Removed. See 7.4.5.1.1.4
Source Image Sequence	(0008,2112)	3	Used / Removed. See 7.4.5.1.1.4 and 7.5
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
Images in Acquisition	(0020,1002)	3	Removed
Image Comments	(0020,4000)	3	Removed
Quality Control Image	(0028,0300)	3	Removed
Burned In Annotations	(0028,0301)	3	Removed
Lossy Image Compression Ratio	(0028,2112)	3	Copied. See 7.4.5.1.1.5
Lossy Image Compression	(0028,2110)	3	Copied

7.4.5.1.1 General Image Attribute Descriptions

7.4.5.1.1.1 Patient Orientation

Since Secondary Captures do not include the patient orientation, this field must be present. This field will be filled for 2D reformatted and 3D views, and will be empty (zero length) for other views.

The precision depth could be up to 3 characters, for example “LAF\FAR ”, but can be less if the view is oriented along a baseline, like “L\FA” or “L\F ”.

7.4.5.1.1.2 Image Date and Time

When Volume Viewer is saving a secondary capture:

- the condition to set these tags should be used if the image are temporally related, but is not clearly met for reformatted images ; anyway, since most AE will expect this tag to be present, we have decided to set this tag
- Volume Viewer might set this content date to the time the reformatted image is created, but then might move away from the purpose of this date which is linked to the acquisition
- Volume Viewer might set it to the original image date, but it does not make sense for reformatted images which are derived from several images

For these reasons, Volume Viewer will set an empty tag to avoid possible ambiguities.

7.4.5.1.1.3 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:

- SCREEN SAVE identifies a Multi Planar Reformatted Image
- VXTL STATE identifies a Voxtool state SC: private data of the screen save holds information to restore the state of the application
- DLO Identifies an Innova registration object: private data of the screen save holds information to register the 3D information of the Save State with the patient based coordinate system of the original volume(s) present in the Save State.

Value 4, if defined, indicates the rendering algorithm of the view, and can have the following values:

- MIP identifies a Maximum Intensity Projection Image
- MIN IP identifies a Minimum Intensity Projection Image
- AVERAGE identifies a Average Image
- VOLREN identifies a Volume Rendered Image
- SURFACE identifies a surface shaded Image
- RAYSUM identifies a RaySum Image
- INTEGRAL identifies a Integral Image

When reading images, only image type with Value 3 equal to VXTL STATE is accepted.

7.4.5.1.1.4 Derivation Description and Source Image Sequence

The Derivation Description tag is not used.

The Source Image Sequence is used only when the secondary capture comes from the Direct3D / Volume Auto View software. In this case, the Series Description contains "Direct3D State" and the actual Direct3D state is stored in the private group 0x0047 "GEMS_3DSTATE_001" (see the private dictionary at section 7.5). This state contains all the parameters useful to reconstruct a Volume Rendered view similar to the one shown in this secondary capture. The Source Image Sequence address the list of the original images used.

7.4.5.1.1.5 Lossy Image Compression

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

7.4.5.2 Image Pixel Module

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

TABLE 7.4-7
IMAGE PIXEL MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Samples per Pixel	(0028,0002)	1	Generated • "1" for greyscale images • "3" for color images
Photometric Interpretation	(0028,0004)	1	Generated • "MONOCHROME2" or "MONOCHROME1" for greyscale images • "RGB" for color images
Rows	(0028,0010)	1	Generated (256, 512, 1024)
Columns	(0028,0011)	1	Generated (256, 512, 1024)
Bits Allocated	(0028,0100)	1	Generated • "16" for greyscale images • "8" for color images
Bits Stored	(0028,0101)	1	Generated • "16" for greyscale images • "8" for color images
High Bit	(0028,0102)	1	Generated • "15" for greyscale images • "7" for color images
Pixel Representation	(0028,0103)	1	Generated • "1" for greyscale images • "0" for color images
Pixel Data	(7FE0,0010)	1	
Planar Configuration	(0028,0006)	1C	Generated • Removed for greyscale images • "0" for color images
Pixel Aspect Ratio	(0028,0034)	1C	Removed
Smallest Image Pixel Value	(0028,0106)	3	Removed
Largest Image Pixel Value	(0028,0107)	3	Removed
Red Palette Color Lookup Table Descriptor	(0028,1101)	1C	Removed
Green Palette Color Lookup Table Descriptor	(0028,1102)	1C	Removed
Blue Palette Color Lookup Table Descriptor	(0028,1103)	1C	Removed
Red Palette Color Lookup Table Data	(0028,1201)	1C	Removed

Green Palette Color Lookup Table Data	(0028,1202)	1C	Removed
Blue Palette Color Lookup Table Data	(0028,1203)	1C	Removed

7.4.6 Common Lookup Table Modules

7.4.6.1 VOI LUT module

This section specifies the Attributes that describe the VOI LUT.

This module is not saved for color ("RGB") images.

TABLE 7.4-8
VOI LUT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
VOI LUT Sequence	(0028,3010)	3	Removed
>LUT Descriptor	(0028,3002)	1C	
>LUT Explanation	(0028,3003)	3	
>LUT Data	(0028,3006)	1C	
Window Center	(0028,1050)	3	A value generated from the current value used in the saved view
Window Width	(0028,1051)	1C	A value generated from the current value used in the saved view
Window Center & Width Explanation	(0028,1055)	3	Removed

7.4.6.2 Modality LUT module

This section specifies the Attributes that describe the Modality LUT.

This module is not saved for color ("RGB") images. It is also only saved for CT and MR modality.

TABLE 7.4-9
MODALITY LUT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Modality LUT Sequence	(0028,3000)	3	Removed
>LUT Descriptor	(0028,3002)	1C	
>LUT Explanation	(0028,3003)	3	
>Modality LUT Type	(0028,3004)	1C	
>LUT Data	(0028,3006)	1C	
Rescale Intercept	(0028,1052)	1C	Generated
Rescale Slope	(0028,1053)	1C	Generated "1"
Rescale Type	(0028,1054)	1C	Generated • "HU" for CT • "US" for other modalities

7.4.7 General Modules

The SOP Common Module is mandatory for all DICOM IODs.

7.4.7.1 SOP Common Module

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

TABLE 7.4-10
SOP COMMON MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008,0016)	1	Generated: "1.2.840.10008.5.1.4.1.1.7"
SOP Instance UID	(0008,0018)	1	Generated To generate a unique ID, the process concatenates the Implementation Root UID, serial number, the process ID number, the timestamp and a counter incremented each time.
Specific Character Set	(0008,0005)	1C	Copied Only the "ISO_IR 100" character sets is supported.
Instance Creation Date	(0008,0012)	3	Generated: current date
Instance Creation Time	(0008,0013)	3	Generated: current time
Instance Creator UID	(0008,0014)	3	Removed
Time zone Offset From UTC	(0008,0201)	3	Removed
Instance Number	(0020,0013)	3	Generated
SOP Instance Status	(0100,0410)	3	Removed
SOP Authorization Date and Time	(0100,0420)	3	Removed
SOP Authorization Comment	(0100,0414)	3	Removed
Authorization Equipment Certification Number	(0100,0416)	3	Removed

7.4.8 SC Modules

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

7.4.8.1 SC Equipment Module

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

TABLE 7.4-11
SC IMAGE EQUIPMENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Conversion Type	(0008,0064)	1	Generated: WSD = Workstation
Modality	(0008,0060)	3	Generated See 7.4.3.1 for Enumerated Values.
Secondary Capture Device ID	(0018,1010)	3	Generated from gethostname()
Secondary Capture Device Manufacturer	(0018,1016)	3	Generated “GE MEDICAL SYSTEMS”
Secondary Capture Device Manufacturer's Model Name	(0018,1018)	3	Generated: the name of the application. One of: Reformat, Volume Viewer, CT Colonography, Advanced Lung Analysis, AutoBone, CardIQ, CardEP
Secondary Capture Device Software Version	(0018,1019)	3	Generated: Voxtool version “vxtl_x_y_z”
Video Image Format Acquired	(0018,1022)	3	Removed
Digital Image Format Acquired	(0018,1023)	3	Removed

7.4.8.2 SC Image Module

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

TABLE 7.4-12
SC IMAGE MODULE ATTRIBUTES

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

7.5 PRIVATE DATA DICTIONARY

In the case of a secondary capture coming from the Direct3D software, the following private group is read. Note that this group is read only if the Series Description contains "Direct3D State". In this case, the SC object belongs to a Standard Extended SOP Class based on the SC SOP class. Note that Volume Viewer does not create that extended objects, but just read them.

For a complete description of the tags, see the conformance statement of Direct3D.

TABLE 7.5-13
3D STATE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Private Group Creator	(0047,00xx)	3	“GEMS_3DSTATE_001”
General Description	(0047,xxD6)	3	Used
TDRT	(0047,xxD7)	3	Used
NVRP	(0047,xxD8)	3	Used
CVRPN	(0047,xxD9)	3	Used
Volume Rendering Presets Sequence	(0047,xxDA)	3	Used
> Preset Name	(0047,xxDB)	3	Used
> Opacity Curve X	(0047,xxDC)	3	Used
> Opacity Curve Y	(0047,xxDD)	3	Used
> NOCP	(0047,xxDE)	3	Used
> Color Curve X	(0047,xxDF)	3	Used
> Color Curve Y	(0047,xxE0)	3	Used
> NCCP	(0047,xxE1)	3	Used
> GSA	(0047,xxE2)	3	Used
> VRSF	(0047,xxE3)	3	Used
> AF	(0047,xxE4)	3	Ignored
> DF	(0047,xxE5)	3	Ignored
> SCF	(0047,xxE6)	3	Ignored
> SPF	(0047,xxE7)	3	Ignored
Orthogonal Clipping Planes	(0047,xxE8)	3	Used
CP	(0047,xxE9)	3	Used
CFP	(0047,xxEA)	3	Used
CVU	(0047,xxEB)	3	Used
RFOV	(0047,xxEC)	3	Used
PPRP	(0047,xxED)	3	Ignored
3DWW	(0047,xxEE)	3	Used
3DWL	(0047,xxEF)	3	Used
BBV	(0047,xxF0)	3	Ignored
ERF	(0047,xxF1)	3	Used
TDRMS	(0047,xxF2)	3	Ignored
TDSSS	(0047,xxF3)	3	Ignored

This is the Voxtool Save State object. These private elements will be found when the third value of Image Type (0008,0008) is "VXTL STATE". This object is purely private to Voxtool to save and reload its state. In this case, the SC object belongs to a Standard Extended SOP Class based on the SC SOP class. The attribute description, in particular the mention if this tag is mandatory, is related to the purpose of this Extended SOP Class.

TABLE 7.5-14
VOXTOOL SAVE STATE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Private Group Creator	(0057,00xx)	3	"GEMS_ADWSoft_3D2"
Views Layout	(0057,xx04)	3	Used / Generated
Private Group Creator	(0057,00xx)	3	"GEMS_VXTLSTATE_001"
SState_Version	(0057,xx14)	3	Mandatory/ Generated. Required if 3rd value of Image Type is "VXTL STATE".
Volumes_Info	(0057,xx05)	3	Mandatory/ Generated. Required if 3rd value of Image Type is "VXTL STATE".
> Series UID	(0020,000e)	3	Mandatory/ Generated
> Image_UIDs	(0057,xx06)	3	Mandatory/ Generated
>> Referenced SOP Class UID	(0008,1150)	3	Mandatory/ Generated
>> Referenced SOP Instance UID	(0008,1155)	3	Mandatory/ Generated
> SUV_ScanTime	(0057,xx07)	3	Used / Generated
> SUV_AdministredTime	(0057,xx08)	3	Used / Generated
> SUV_MeasuredTime	(0057,xx09)	3	Used / Generated
> SUV_PostInjectedTime	(0057,xx10)	3	Used / Generated
> SUV_TracerActivity	(0057,xx11)	3	Used / Generated
> SUV_PostInjectedActivity	(0057,xx12)	3	Used / Generated
> SUV_HalfLife	(0057,xx13)	3	Used / Generated
> SegList_Seq	(0057,xx15)	3	Mandatory/ Generated
>> SegList_Count	(0057,xx16)	3	Used / Generated
>> SegList_List	(0057,xx17)	3	Mandatory/ Generated
>> SegList_Name	(0057,xx18)	3	Mandatory/ Generated
>> SegList_Label	(0057,xx20)	3	Mandatory/ Generated
>> SegList_Slots	(0057,xx38)	3	Used / Generated
>> SegList_PrettyName	(0057,xx58)	3	Mandatory/ Generated
>> SegList_Segmented_Object	(0057, xx59)	3	Mandatory/ Generated
>> SegList_Derived_From	(0057, xx60)	3	Mandatory/ Generated
>> Seglist_Threshold	(0057,xx80)	3	Mandatory/ Generated
>> Seglist_Dens_Max	(0057,xx81)	3	Mandatory/ Generated
> Volume_Filename	(0057,xx19)	3	Mandatory/ Generated
> Bookmark_Seq	(0057,xx21)	3	Used / Generated
>> Bookmark	(0057,xx22)	3	Used / Generated
> VT_Points	(0057,xx40)	3	Used / Generated
> VT_Meas	(0057,xx42)	3	Used / Generated
> VT_Tree	(0057,xx44)	3	Used / Generated
> VT_TreeContext	(0057,xx84)	3	Used / Generated

> Thrombuses	(0057,xx89)	3	Used / Generated
> Volume_Zcomb_Filter	(0057,xx52)	3	Used / Generated
> Registration_R	(0057,xx87)	3	Used / Generated
> Registration_C	(0057,xx88)	3	Used / Generated
> PhaseRegistration_NbPhase	(0057, xx78)	3	Used / Generated
> PhaseRegistration_Phase	(0057, xx79)	3	Used / Generated
Views_Info	(0057,xx26)	3	Mandatory/ Generated. Required if 3rd value of Image Type is "VXTL STATE".
> Bookmark_Seq	(0057,xx21)	3	Used / Generated
>> Bookmark	(0057,xx22)	3	Used / Generated
> Cursor_Position	(0057,xx23)	3	Used / Generated
> View_Slot	(0057,xx27)	3	Mandatory/ Generated
> View_Resized_Previous_Slot	(0057,xx86)	3	Used / Generated
> Wireframe	(0057,xx29)	3	Mandatory/ Generated
> Annotation	(0057,xx31)	3	Mandatory/ Generated
> Camera_Position	(0057,xx55)	3	Used / Generated
> HideVol_Seq	(0057, xx69)	3	Mandatory/ Generated
>> HideVol_Name	(0057, xx70)	3	Mandatory/ Generated
>> HideVol_Hide	(0057, xx71)	3	Mandatory/ Generated
> Curved_Geom_Type	(0057, xx72)	3	Mandatory/ Generated
> Curved_Forced_Geom	(0057, xx73)	3	Mandatory/ Generated
> Curved_Unseg_Display	(0057, xx74)	3	Mandatory/ Generated
> Curved_Angle	(0057, xx75)	3	Mandatory/ Generated
> Curved_Thickness	(0057, xx76)	3	Mandatory/ Generated
> Curved_PrimaryView_Slot	(0057,xx85)	3	Used / Generated
> MixVol_Name	(0057,xx91)	3	Used / Generated
> Registration Volume ID	(0057,xx0A)	3	Mandatory / Generated. Must exists for SState_Version >= 14
Slider_State	(0057,xx32)	3	Used / Generated
Proto_Name	(0057,xx33)	3	Mandatory/ Generated. Required if 3rd value of Image Type is "VXTL STATE".
Proto_Title	(0057,xx34)	3	Mandatory/ Generated. Required if 3rd value of Image Type is "VXTL STATE".
Proto_FilmName	(0057,xx35)	3	Mandatory/ Generated. Required if 3rd value of Image Type is "VXTL STATE".
Proto_Scenario	(0057, xx77)	3	Mandatory/ Generated. Required if 3rd value of Image Type is "VXTL STATE".
Proto_Step	(0057,xx36)	3	Mandatory/ Generated. Required if 3rd value of Image Type is "VXTL STATE".
Cardiac_Shortaxis_Orientation	(0057, xx61)	3	Used / Generated
Cardiac_Longaxis_Orientation	(0057, xx62)	3	Used / Generated
Cardiac_Verticallongaxis_Orientation	(0057, xx63)	3	Used / Generated
Cardiac_Valve_Position	(0057, xx64)	3	Used / Generated
Cardiac_Apex_Position	(0057,xx82)	3	Used / Generated

Cardiac_ES_Position	(0057, xx65)	3	Used / Generated
Cardiac_ED_Position	(0057, xx66)	3	Used / Generated
Cardiac_ES_Phase	(0057, xx67)	3	Used / Generated
Cardiac_ED_Phase	(0057, xx68)	3	Used / Generated
Image_File_Name	(0057,xx90)	3	Used / Generated
VT_Preset	(0057,xx47)	3	Used / Generated
Fusion_Factor	(0057,xx92)	3	Used / Generated
VT_State	(0057,xx49)	3	Used / Generated
Preferences	(0057,xx51)	3	Used / Generated
SegList_Perfusion_Mean	(0057xx93)	3	Used / Generated
SegList_Perfusion_Std	(0057xx94)	3	Used / Generated
Cardiac_Patient_EDAP	(0057xx95)	3	Used / Generated
Cardiac_Patient_CVP	(0057xx96)	3	Used / Generated
Cardiac_Patient_PCWP	(0057xx97)	3	Used / Generated
Cardiac_Patient_Height	(0057xx98)	3	Used / Generated
Cardiac_Patient_Weight	(0057xx99)	3	Used / Generated
Cardiac_Patient_HeartRate	(0057xx9A)	3	Used / Generated
Cardiac_Patient_ESAP	(0057xx9B)	3	Used / Generated
Cardiac_Patient_EDBP	(0057xx9C)	3	Used / Generated
Cardiac_Patient_ESBP	(0057xx9D)	3	Used / Generated
Cardiac_Valve_Position_For_MA	(0057xx9E)	3	Used / Generated
Cardiac_Apex_Position_For_MA	(0057xx9F)	3	Used / Generated
SState_Type	(0057xxA0)	3	Used / Generated
VT_Auto_Points	(0057xxA2)	3	Used / Generated
Proto_Java_Step	(0057xxA3)	3	Used / Generated
Nb_Volumes_Stored	(0057xxA4)	3	Used / Generated
Lumen_Angle	(0057xxA5)	3	Used / Generated
Cardiac_Calcifs_Thresh	(0057xxA6)	3	Used / Generated
Is_Saline_Flush	(0057xxA7)	3	Used / Generated
Proto_Scenario_Type	(0057xxA8)	3	Used / Generated
Proto_Scenario_Anatomy	(0057xxA9)	3	Used / Generated
SegList_Is_In_Default_3DVols	(0057xxAA)	3	Used / Generated
HTML_Page	(0057,xx54)	3	Used / Generated
Private Group Creator	(0047,00xx)	3	“GEMS_3DSTATE_001”
General Description	(0047,xxD6)	3	Used
Registration Reference	(0057,xx0D)	3	Mandatory / Generated. Must exists for SState_Version >= 14 Refer to an existing Registration Volume ID or 0
Registration Moving	(0057,xx0E)	3	Mandatory / Generated. Must exists for SState_Version >= 14 Refer to an existing Registration Volume ID or 0

Registration Volume Information Sequence	(0057,xx0B)	3	Mandatory / Generated. Must exists for SState_Version >= 14.
> Registration Volume ID	(0057,xx0A)	3	Mandatory / Generated. Must exists for SState_Version >= 14
> Registration Volume Group	(0057,xx1A)	3	Mandatory / Generated. Must exists for SState_Version >= 14
> Registration Volume ROI State	(0057,xx1B)	3	Mandatory / Generated. Must exists for SState_Version >= 14
> Registration Volume ROI	(0057,xx1C)	3	Mandatory / Generated. Must exists for SState_Version >= 14 Must contain six numbers. First three are the minimal coordinates of the ROI, last three are the maximal coordinates of the ROI. Coordinates are in Voxtool orthogonal coordinate system.
Registration Landmark Information Sequence	(0057,xx0C)	3	Mandatory / Generated. Must exists for SState_Version >= 14
> Registration Landmark ID	(0057,xx2A)	3	Mandatory / Generated. Must exists for SState_Version >= 14
> Registration Landmark Volume Type	(0057,xx3D)	3	Mandatory / Generated. Must exists for SState_Version >= 14
> Registration Landmark Volume Info Sequence	(0057,xx2B)	3	Mandatory / Generated. Must exists for SState_Version >= 14
>> Registration Volume ID	(0057,xx0A)	3	Mandatory / Generated. Must exists for SState_Version >= 14
>> Registration Landmark Volume State	(0057,xx3B)	3	Mandatory / Generated. Must exists for SState_Version >= 14
>> Registration Landmark Volume Position	(0057,xx3C)	3	Mandatory / Generated. Must exists for SState_Version >= 14 Must contain three number representing coordinates of a 3D point. Coordinates are in Voxtool orthogonal coordinate system.

7.5.1 3D State Attribute Descriptions

7.5.1.1 General Description

A simple text field which gives a general, free form description of the current study.

7.5.1.2 TDRT - 3D Rendering Type

Enumerated parameter which records type of rendering to be applied.

VRSF: {1, 2, 3, 4, 5} 1=Volume Rendering, 2=MIP, 3=MinIP, 4=RaySum, 5=Integral.

Note: The typical setting will be Volume Rendering for the first release of VAV, although MIP could also be selected.

7.5.1.3 NVRP - Number of Volume Rendering Presets

The number of volume rendering presets, NVRP, defined in the VAV 3D state object. It will be desirable to save as many as 5 presets which are applicable to the current study.

NVRP: [0 .. 5]. 0: Volume Rendering is not applicable.

Note: NVRP will routinely be 5 for a VAV study.

7.5.1.4 CVRPN - Current Volume Rendering Preset Number

Set number preset number, CVRPN, which specifies which of the defined presets is currently applied.
CVRPN: [1 - NVRP]

7.5.1.5 Volume Rendering Presets Sequence

Set of volume rendering presets

7.5.1.6 Preset Name

Simple textual name associated with this preset. Appropriate for labeling a preset button on the user interface of the 3D application for example.

7.5.1.7 Opacity Curve X

The X values of the opacity curve coordinates. This field must contain NOCP values (see 2.5.8.3.1.9).

Hounsfield units (a CT#), [-1024 .. 3071]

7.5.1.8 Opacity Curve Y

The Y values of the opacity curve coordinates. This field must contain NOCP values (see 2.5.8.3.1.9).

A measure of opacity / mm, [0.0 .. 1.0]

7.5.1.9 NOCP - Number of Opacity Curve Points

The number of points which make up the opacity curve.
NOCP: [2 .. 64].

7.5.1.10 Color Curve X

The X values of the color curves. This field must contain NCCP values (see 2.5.8.3.1.12).

Hounsfield units (a CT#), [-1024 .. 3071]

Linear interpolation is always applied between points along a color curve. (i.e., if a step function is desirable, it will be built into to VAV curve itself)

For all Hounsfield values less than the smallest X contained in the above set of points, a color of (0, 0, 0) should be assigned. For all Hounsfield values

greater than the largest X contained in the above set of points, a color of (0, 0, 0) should be assigned.

7.5.1.11 Color Curve Y

The Y values of the color curves. This field must contain 3*NCCP values (see 2.5.8.3.1.12).

A color value represented as an RGB floating point triplet, ([0.0..1.0], [0.0..1.0], [0.0..1.0])

7.5.1.12 **NCCP -** Number of Color Curve Points

NCCP: [2 - 64]

7.5.1.13 **GSA -** Gray Scale Applied

Simple boolean flag, GSA, which specifies if gray scale rendering is currently being applied (versus 3 channel color) for this preset.

GSA: [0, 1]

Note: If the gray scale flag is set, each point of the VAV color curve will be an RGB triplet corresponding to a gray scale value (i.e., R=G=B). If shading is also on (see parameter below), a non-zero gray scale flag should map to Voxtool's monochrome option being applied.

7.5.1.14 **VRSF -** Volume Rendering Shading Flag

Simple boolean flag, VRSF, which specifies whether shading (gray scale or color) is applied for this preset.

VRSF: [0, 1]

Note: Voxtool does not currently support an optimized path for gray scale shading. But this case should be addressed in that each point of the VAV color curve will be an RGB triplet to a gray scale value (i.e., R=G=B).

7.5.1.15 **AF** - Ambient Factor

The ambient factor term in the general lighting equation, applicable if shading is On.

AF: a percentage, [0.0 ... 1.0]

Constraint: AF + DF + SCF <= 1.0

7.5.1.16 **DF -** Diffuse Factor

The diffuse factor term in the general lighting equation, applicable if shading is On.

DF: a percentage, [0.0 ... 1.0]

Constraint: AF + DF + SCF <= 1.0

7.5.1.17 SCF - Specular Contribution Factor

The specular contribution factor term in the general lighting equation, applicable if shading is On.

SCF: a percentage, [0.0 ... 1.0]

Constraint: AF + DF + SCF <= 1.0

Note: For the initial release of VAV, the SCF term will always be zero. Likewise, Voxtool does not currently support specular lighting.

7.5.1.18 SPF - Specular Power Factor

The specular power factor term in the general lighting equation, applicable if shading is On.

SPF: a floating point value >= 0.0

7.5.1.19 Orthogonal Clipping Planes

Specifies up to six clipping planes which define our sub volume of interest. The general equation for a plane in the RAS system will be utilized.

$$A_1 r + B_1 a + C_1 s + D_1 = 0$$

$$A_2 r + B_2 a + C_2 s + D_2 = 0$$

$$A_3 r + B_3 a + C_3 s + D_3 = 0$$

$$A_4 r + B_4 a + C_4 s + D_4 = 0$$

$$A_5 r + B_5 a + C_5 s + D_5 = 0$$

$$A_6 r + B_6 a + C_6 s + D_6 = 0$$

A total of 24 floating point coefficients define the 6 arbitrary planes. The sign convention regarding the plane normals is as follows: the normal for a given clipping plane should point away from the portion of the volume that we wish to cut away.

These 24 points will be stored as a list of floats (A1, B1, C1, D1, A2, B2, ..., C6, D6).

If fewer than 6 clipping planes are required, each coefficient for an unused clipping plane should be set to zero.

Note: For the first release of VAV, only simple orthogonal clipping planes will be utilized. Thus the general plane equations above reduces to the following (where only the non-zero terms are shown):

$$A_1 r + D_1 = 0$$

$$A_2 r + D_2 = 0$$

$$B_3 a + D_3 = 0$$

$$B_4 a + D_4 = 0$$

$$C_5 s + D_5 = 0$$

$$C_6 s + D_6 = 0$$

7.5.1.20 CP - Camera Position

RAS Location of camera

CP: patient relative 3D point, (R, A, S) in mm.

7.5.1.21 CFP - Camera Focal Point

RAS Location of camera focal point, CFP, essentially the center of the 3D scene.

CFP: patient relative 3D point, (R, A, S) in mm.

Note: The camera position and focal point uniquely define the camera viewing vector.

7.5.1.22 CVU - Camera "View Up" Vector

Unit length RAS vector, CVU, which, when combined with the computed camera viewing vector, uniquely defines the orientation of the the 3D projection image.

CVU: patient relative unit length vector, (R_{grad}, A_{grad}, S_{grad}).

7.5.1.23 RFOV - Rendering Field Of View

Field of View, RFOV, of the 3D projection image.

RFOV: floating point value in mm.

7.5.1.24 PPRP - Camera Position

Flag, PPRR, which specifies where perspective or parallel ray rendering is done.

PPRR: (0, 1), 0 = Parallel, 1 = Perspective.

Note: The perspective mode, the camera viewing angle, or frustum, can be calculated from the above camera parameters. The RFOV in this case is measured in the plane which includes the CFP and is normal to the viewing vector.

7.5.1.25 3DWW

Window Width parameter describing how to display the 3D projection image.

3DWW: [0.0 ... 4096.0]

7.5.1.26 3DWL

Window Level parameter describing how to display the 3D projection image.

3DWL: [-1024.0 ... 3071.0]

7.5.1.27 BBV - Bounding Box Visible

Simple boolean flag, BBV, which specifies whether the volume bound box should be visible in the resultant 3D image.

BBV: [0. 1]

7.5.1.28 ERF - Enhanced Resolution Flag

Simple boolean flag, ERF, which specifies if volume rendering should be perfomed in "enhanced resolution" mode

ERF: [0. 1]

7.5.1.29 TDRMS - 3D Render Matrix Size

The size of the image matrix used during the 3D rendering process (not to be confused with the window size which displays the final 3D result).

TDRMS: {128, 256, 512, 768, 1024}

Note: TDRMS will typically be 512 for a VAV study.

7.5.1.30 TDSSS - 3D Sample Step Size

The distance between samples, TDSSS (along a ray or between parallel textures) in mm used during 3D processing.

TDSSS: > 0.0 mm

7.5.1.31 Views Layout

This text string holds an XML describing the organization of views on the screen.

7.5.1.32 Volumes_Info

This sequence describes the exams to be reloaded.

7.5.1.33 Image_UIDs

This sequence contains the UIDs of the images that need to be reloaded into the software.

7.5.1.34 SUV_ScanTime

Used for PET Save State only: scan time / acquisition time. Derived from (0009, GEMS_PETD_01, 0D) or standard Acquisition Date.

7.5.1.35 SUV_AdministredTime

Used for PET Save State only: administration time. Derived from (0009, GEMS_PETD_01, 3B) or Series Date / Time.

7.5.1.36 SUV_MeasuredTime

Used for PET Save State only: measured time. Derived from (0009, GEMS_PETD_01, 39) or Series Date / Time.

7.5.1.37 SUV_PostInjectedTime

Used for PET Save State only: post injected time. Derived from (0009, GEMS_PETD_01, 3B) or Series Date / Time.

7.5.1.38 SUV_TracerActivity

Used for PET Save State only: tracer activity. Derived from (0009, GEMS_PETD_01, 38) or the standard Radionuclide Total Dose.

7.5.1.39 SUV_PostInjectedActivity

Used for PET Save State only: post injected activity. Derived from (0009, GEMS_PETD_01, 3C).

7.5.1.40 SUV_HalfLife

Used for PET Save State only: administration time. Derived from (0009, GEMS_PETD_01, 3F) or the standard Radionuclide Half Life.

7.5.1.41 SState_Version

Version number of the format of this Save Sate object.

7.5.1.42 SegList_Seq

This sequence describes the volumes of data (series) that need to be reloaded by the save state.

7.5.1.43 SegList_Count

Number of values in the Seglist_list.

7.5.1.44 SegList_List

A list of 16 bits values describing which voxels should be reloaded from the image.

7.5.1.45 SegList_Name

Voxtool internal name of the volume. Must be unique.

7.5.1.46 SegList_Pretty_Name

Display name of the volume.

7.5.1.47 SegList_Segmented_Object

Describes the type of segmentation which has been applied to the volume

7.5.1.48 SegList_Derived_From

Name of the master volume which has been used for the segmentation of the volume

7.5.1.49 Volume_Filename

Public name of the volume.

7.5.1.50 SegList_Label

Save State internal name of the volume. Linked volumes will have the same label.

7.5.1.51 Bookmark_Seq

This sequence describes the list of bookmarks deposited on the exams.

7.5.1.52 Bookmark

This text string is an XML describing the deposited bookmark.

7.5.1.53 Cursor_Position

This value contains the 3D vector describing the position of 3D cursor.

7.5.1.54 Color_Value_Field

Colors of the 3D Surface / Navigator views

7.5.1.55 Color_Value_Field_Count

Number of colors in Color_Value_Field.

7.5.1.56 Views_Info

This sequence describes information for saved views (position, orientation, annotations and wireframes).

7.5.1.57 View_Slot

Position of the view on the screen.

7.5.1.58 Wireframe

This XML string describes the wireframes (traces) of the view.

7.5.1.59 Annotation

This XML string describes the user annotation on the view.

7.5.1.60 Slider_State

The type of slider review controller to be restored.

7.5.1.61 Proto_Name, Proto_Title, Proto_FilmName, Proto_Scenario

Defines the names of the protocols used to originally build the volumes.

7.5.1.62 Proto_Step

The stage number of the wizard protocol.

7.5.1.63 Cardiac_Shortaxis_Orientation

Cardiac short axis orientation

7.5.1.64 Cardiac_Longaxis_Orientation

Cardiac long axis orientation

7.5.1.65 Cardiac_Verticallongaxis_Orientation

Cardiac vertical long axis orientation

7.5.1.66 Cardiac_Valve_Position

Cardiac valve location

7.5.1.67 Cardiac_ES_Position

Cardiac end of systole location

7.5.1.68 Cardiac_ED_Position

Cardiac end of diastole location

7.5.1.69 Cardiac_ES_Phase

Cardiac end of systole volume phase

7.5.1.70 Cardiac_ED_Phase

Cardiac end of diastole volume phase

7.5.1.71 SegList_Slots

List of the slots which will be assigned the given volume data.

7.5.1.72 VT_Points

This XML contains the tracking points of a protocol.

7.5.1.73 VT_Meas

Not used yet.

7.5.1.74 VT_Tree

This XML contains information for tracking processes.

7.5.1.75 VT_Preset

This XML contains information for tracking protocols.

7.5.1.76 VT_State

This XML describes the status of the tracking algorithm.

7.5.1.77 Preferences

This XML contains Voxtool preferences. Currently, it stores only the presence of reference images.

7.5.1.78 SegList_Perfusion_Mean

Computed mean for the Perfusion tool

7.5.1.79 SegList_Perfusion_Std

Computed standard deviation for the Perfusion tool

7.5.1.80 Cardiac_Patient_EDAP

End diastolic arterial pressure (entered by the user)

7.5.1.81 Cardiac_Patient_CVP

Central venous pressure (entered by the user)

7.5.1.82 Cardiac_Patient_PCWP

Pulmonary capillary wedge pressure (entered by the user)

7.5.1.83 Cardiac_Patient_Height

Patient’s height (entered by the user or read from DICOM)

7.5.1.84 Cardiac_Patient_Weight

Patient’s weight (entered by the user or read from DICOM)

7.5.1.85 Cardiac_Patient_HeartRate

Patient’s heart rate (entered by the user or read from DICOM)

7.5.1.86 Cardiac_Patient_ESAP

End systolic arterial pressure (entered by the user)

7.5.1.87 Cardiac_Patient_EDBP

End diastolic blood pressure (entered by the user)

7.5.1.88 Cardiac_Patient_ESBP

End systolic blood pressure (entered by the user)

7.5.1.89 Cardiac_Valve_Position_For_MA

Valve position for Myocardium Analysis

7.5.1.90 Cardiac_Apex_Position_For_MA

Apex position for Myocardium Analysis

7.5.1.91 SState_Type

The type of the SaveState (generated by the user, generated automatically or generated during preprocessing)

7.5.1.92 VT_Auto_Points

This XML contains the tracking points generated by the auto-tracking

7.5.1.93 Proto_Java_Step

Current step for the Java wizards

7.5.1.94 Nb_Volumes_Stored

Number of volumes stored in the SaveState

7.5.1.95 Lumen_Angle

Angle value for the lumen views

7.5.1.96 Cardiac_Calcifs_Thresh

Threshold value for cardiac calcifications

7.5.1.97 Is_Saline_Flush

If cardiac exam is saline flush

7.5.1.98 Proto_Scenario_Type

Type of the current scenario

7.5.1.99 Proto_Scenario_Anatomy

Anatomy for the current scenario

7.5.1.100 SegList_Is_In_Default_3Dvols

Flag to indicate if a volume is contained in the Default3DVols list

7.5.1.101 Volume_ZComb_Filter

This integer holds the type of filter to be applied during CardIQ loading.

7.5.1.102 PhaseRegistration_NbPhase

Number of phase indexes used for Phase Registration Protocol

7.5.1.103 PhaseRegistration_Phase

Phase indexes used for Phase Registration Protocol

7.5.1.104 HTML_Page

This XML contains the path of the HTML page to open when loading.

7.5.1.105 Camera_Position

This value contains the 3D vector describing the position of point of view.

7.5.1.106 HideVol_Seq

Sequence of data related to HideVol_Name and HideVol_Hide to indicate if a volume is displayed or not in case of multi-volumes rendering

7.5.1.107 HideVol_Name

Name of the volumes to display or not in case of multi-volumes rendering

7.5.1.108 HideVol_Hide

State of the volumes to display or not in case of multi-volumes rendering

7.5.1.109 Curved_Geom_Type

Geometry type of curved view

7.5.1.110 Curved_Angle

Angle of curved view

7.5.1.111 Curved_Thickness

Thickness of curved view

7.5.1.112 Curved_Forced_Geom, Curved_Unseg_Display

Other data for curved view

7.5.1.113 Seglist_Threshold, Seglist_Dens_Max

Minimum and maximum values of a thresholded volume

7.5.1.114 Cardiac_Apex_Position

Location of apex point in the volume of the heart for Ejection Fraction protocol.

7.5.1.115 VT_TreeContext_Size, VT_TreeContext

This XML contains information for tracking processes in case of Dynamic AVA.

7.5.1.116 Curved_PrimaryView_Slot

View that is used to created the curved.

7.5.1.117 View_Resized_Previous_Slot

Slot index of the view prior to enlargement to full screen

7.5.1.118 Registration_R, Registration_C

Registration matrix and center in case of multi volume

7.5.1.119 Thrombuses

Xml line containing information resulting from thrombus extraction.

7.5.1.120 MixVol_Name

In case of fused view name of the second volume displayed in the view.

7.5.2 3D State Private Dictionary

TABLE 7.5-15
PRIVATE CREATOR IDENTIFICATION (GEMS_3DSTATE_001)

Attribute Name	Tag	VR	VM
General Description	(0047,xxD6)	ST	1
TDRT	(0047,xxD7)	CS	1
NVRP	(0047,xxD8)	US	1
CVRPN	(0047,xxD9)	US	1
Volume Rendering Presets Sequence	(0047,xxDA)	SQ	1
Preset Name	(0047,xxDB)	LO	1
Opacity Curve X	(0047,xxDC)	SS	1-n
Opacity Curve Y	(0047,xxDD)	FL	1-n
NOCP	(0047,xxDE)	US	1
Color Curve X	(0047,xxDF)	SS	1-n
Color Curve Y	(0047,xxE0)	FL	3-3*n
NCCP	(0047,xxE1)	US	1
GSA	(0047,xxE2)	CS	1
VRSF	(0047,xxE3)	CS	1
AF	(0047,xxE4)	FL	1
DF	(0047,xxE5)	FL	1
SCF	(0047,xxE6)	FL	1
SPF	(0047,xxE7)	FL	1
Orthogonal Clipping Planes	(0047,xxE8)	FL	24
CP	(0047,xxE9)	FL	3

CFP	(0047,xxEA)	DS	3
CVU	(0047,xxEB)	DS	3
RFOV	(0047,xxEC)	FL	1
PPRP	(0047,xxED)	CS	1
3DWW	(0047,xxEE)	DS	1
3DWL	(0047,xxEF)	DS	1
BBV	(0047,xxF0)	CS	1
ERF	(0047,xxF1)	CS	1
TDRMS	(0047,xxF2)	US	1
TDSSS	(0047,xxF3)	FL	1

TABLE 7.5-16
PRIVATE CREATOR IDENTIFICATION (GEMS_ADWSOFT_3D2)

Attribute Name	Tag	VR	VM
Views Layout	(0057,xx04)	UT	1

TABLE 7.5-17
PRIVATE CREATOR IDENTIFICATION (GEMS_VXTLSTATE_001)

Attribute Name	Tag	VR	VM
Volumes_Info	(0057,xx05)	SQ	1
Image_UIDs	(0057,xx06)	SQ	1
SUV_ScanTime	(0057,xx07)	DT	1
SUV_AdministredTime	(0057,xx08)	DT	1
SUV_MeasuredTime	(0057,xx09)	DT	1
SUV_PostInjectedTime	(0057,xx10)	DT	1
SUV_TracerActivity	(0057,xx11)	FL	1
SUV_PostInjectedActivity	(0057,xx12)	FL	1
SUV_HalfLife	(0057,xx13)	FL	1
SState_Version	(0057,xx14)	LO	1
SegList_Seq	(0057,xx15)	SQ	1
SegList_Count	(0057,xx16)	IS	1
SegList_List	(0057,xx17)	OW	1
SegList_Name	(0057,xx18)	LO	1
Volume_Filename	(0057,xx19)	LO	1
SegList_Label	(0057,xx20)	LO	1
Bookmark_Seq	(0057,xx21)	SQ	1
Bookmark	(0057,xx22)	LT	1
Cursor_Position	(0057,xx23)	FL	3
Color_Value_Field	(0057,xx24)	UL	3-3*n
Color_Value_Field_Count	(0057,xx25)	IS	1
Views_Info	(0057,xx26)	SQ	1
View_Slot	(0057,xx27)	LT	1

Wireframe_Size	(0057,xx28)	IS	1
Wireframe	(0057,xx29)	UT	1
Annotation_Size	(0057,xx30)	IS	1
Annotation	(0057,xx31)	LT	1
Slider_State	(0057,xx32)	IS	1
Proto_Name	(0057,xx33)	LO	1
Proto_Title	(0057,xx34)	LO	1
Proto_FilmName	(0057,xx35)	LO	1
Proto_Step	(0057,xx36)	LO	1
SegList_Slots	(0057,xx38)	LT	1
VT_Points_Size	(0057,xx39)	IS	1
VT_Points	(0057,xx40)	UT	1
VT_Meas_Size	(0057,xx41)	IS	1
VT_Meas	(0057,xx42)	UT	1
VT_Tree_Size	(0057,xx43)	IS	1
VT_Tree	(0057,xx44)	UT	1
VT_Preset_Size	(0057,xx46)	IS	1
VT_Preset	(0057,xx47)	LT	1
VT_State_Size	(0057,xx48)	IS	1
VT_State	(0057,xx49)	LT	1
Preferences_Size	(0057,xx50)	IS	1
Preferences	(0057,xx51)	LT	1
Volume_ZComb_Filter	(0057,xx52)	IS	1
HTML_Page_Size	(0057,xx53)	IS	1
HTML_Page	(0057,xx54)	LT	1
Camera_Position	(0057,xx55)	FL	3
Slider_Size	(0057,xx56)	IS	1
Slider	(0057,xx57)	LT	1
SegList_Pretty_Name	(0057,xx58)	LO	1
SegList_Segmented_Object	(0057,xx59)	IS	1
SegList_Derived_From	(0057,xx60)	LO	1
Cardiac_Shortaxis_Orientation	(0057,xx61)	FL	9
Cardiac_Longaxis_Orientation	(0057,xx62)	FL	9
Cardiac_Verticallongaxis_Orientation	(0057,xx63)	FL	9
Cardiac_Valve_Position	(0057,xx64)	FL	3
Cardiac_ES_Position	(0057,xx65)	FL	3
Cardiac_ED_Position	(0057,xx66)	FL	3
Cardiac_ES_Phase	(0057,xx67)	FL	1
Cardiac_ED_Phase	(0057,xx68)	FL	1
HideVol_Seq	(0057,xx69)	SQ	1
HideVol_Name	(0057,xx70)	LO	1
HideVol_Hide	(0057,xx71)	IS	1

Curved_Geom_Type	(0057,xx72)	IS	1
Curved_Forced_Geom	(0057,xx73)	IS	1
Curved_Unseg_Display	(0057,xx74)	IS	1
Curved_Angle	(0057,xx75)	FL	1
Curved_Thickness	(0057,xx76)	FL	1
Proto_Scenario	(0057,xx77)	LO	1
PhaseRegistration_NbPhase	(0057,xx78)	IS	1
PhaseRegistration_Phase	(0057,xx79)	IS	1-n
Seglist_Threshold	(0057,xx80)	IS	1
Seglist_Dens_Max	(0057,xx81)	IS	1
Cardiac_Apex_Position	(0057,xx82)	FL	3
VT_TreeContext_Size	(0057,xx83)	UT	1
VT_TreeContext	(0057,xx84)	UT	1
Curved_PrimaryView_Slot	(0057,xx85)	LT	1
View_Resized_Previous_Slot	(0057,xx86)	LT	1
Registration_R	(0057,xx87)	FL	9
Registration_C	(0057,xx88)	FL	3
Thrombuses	(0057,xx89)	LT	1
Image_File_Name	(0057,xx90)	LT	3
MixVol_Name	(0057,xx91)	LO	1
Fusion_Factor	(0057,xx92)	FL	3
SegList_Perfusion_Mean	(0057,xx93)	FL	3
SegList_Perfusion_Std	(0057,xx94)	FL	3
Cardiac_Patient_EDAP	(0057,xx95)	FL	3
Cardiac_Patient_CVP	(0057,xx96)	FL	3
Cardiac_Patient_PCWP	(0057,xx97)	FL	3
Cardiac_Patient_Height	(0057,xx98)	FL	3
Cardiac_Patient_Weight	(0057,xx99)	FL	3
Cardiac_Patient_HeartRate	(0057,xx9A)	FL	3
Cardiac_Patient_ESAP	(0057,xx9B)	FL	3
Cardiac_Patient_EDBP	(0057,xx9C)	FL	3
Cardiac_Patient_ESBP	(0057,xx9D)	FL	3
Cardiac_Valve_Position_For_MA	(0057,xx9E)	FL	3
Cardiac_Apex_Position_For_MA	(0057,xx9F)	FL	3
SState_Type	(0057,xxA0)	IS	3
VT_Auto_Points	(0057,xxA2)	UT	3
Proto_Java_Step	(0057,xxA3)	IS	3
Nb_Volumes_Stored	(0057,xxA4)	IS	3
Lumen_Angle	(0057,xxA5)	FD	3
Cardiac_Calcifs_Thresh	(0057,xxA6)	IS	3
Is_Saline_Flush	(0057,xxA7)	IS	3
Proto_Scenario_Type	(0057,xxA8)	IS	3

Proto_Scenario_Anatomy	(0057,xxA9)	IS	3
SegList_Is_In_Default_3DVols	(0057,xxAA)	IS	3

7.5.3 Innova State Private Dictionary

The following private attributes are present in the Secondary Capture object when it is created together with the Save State object in order to ensure compatibility with the Innova applications. These attributes contain the data necessary to register the 3D information of the Save State with the patient based coordinate system of the original volume(s) present in the Save State.

This Secondary Capture object with Innova registration data is for private usage of Volume Viewer and Innova applications. These private elements are present when the third value of Image Type (0008,0008) is "DLO". In this case, the SC object belongs to a Standard Extended SOP Class based on the SC SOP class.

TABLE 7.5-18
INNOVA REGISTRATION DATA MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Private Group Creator	(0047,00xx)	3	"GEMS_ADWSoft_3D1"
Volume Voxel Count	(0047,xx50)	3	Used/Generated
Volume Slice Count	(0047,xx54)	3	Used/Generated
Volume Voxel Ratio	(0047,xx57)	3	Used/Generated
Volume Voxel Size	(0047,xx58)	3	Used/Generated
Density to RAS Transformation Matrix	(0047,xxA0)	3	Used/Generated
Number of Voxels in I Direction	(0047,xxA1)	3	Used/Generated
Number of Voxels in J Direction	(0047,xxA2)	3	Used/Generated
Number of Voxels in K Direction	(0047,xxA3)	3	Used/Generated
Series UID of the Original volume	(0047,xxA4)	3	Used/Generated
Volume Density List	(0047,xxD3)	3	Used/Generated

7.5.4 Innova Registration Data Attribute Descriptions

7.5.4.1 Volume Voxel Count

Number of voxels of the Volume Density List (0047,xxD3), it shall be equal to Ni x Nj x Nk, where Ni is the attribute (0047,xxA1), Nj is the attribute (0047,xxA2), and Nk is the attribute (0047,xxA3).

7.5.4.2 Volume Slice Count

Number of slices of the Volume Density List, it shall be equal to Nk.

7.5.4.3 Volume Voxel Ratio

Ratio between the size of the voxels in the K direction (slice spacing of the Volume Density List) and in the I direction (column spacing of the Volume Density List).

7.5.4.4 Volume Voxel Size

Size of the Voxel in mm, in the I direction (i.e. column spacing), which is assumed in Volume Viewer to be equal to the size of the voxel in the J direction (i.e. row spacing).

7.5.4.5 Density to RAS Transformation Matrix

Elements of the matrix that allows to transform from the Volume Density List to the patient based coordinate system, listed in row-major order (M11, M12, M13…).

7.5.4.6 Number of Voxels in I, J, K Directions

Ni, Nj, and Nk respectively. Correspond to the number of columns, rows, and slices respectively of the Volume Density List

7.5.4.7 Series UID of the Original volume

Series UID of the Original volume

7.5.4.8 Volume Density List

Density value of the voxels of the Volume, listed in row order, then column order and finally slice order.

7.5.5 Innova Registration Data Private Dictionary

TABLE 7.5-19
PRIVATE CREATOR IDENTIFICATION (GEMS_ADWSOFT_3D1)

Attribute Name	Tag	VR	VM
Volume Voxel Count	(0047,xx50)	UL	1
Volume Slice Count	(0047,xx54)	US	1
Volume Voxel Ratio	(0047,xx57)	DS	1
Volume Voxel Size	(0047,xx58)	DS	1
Density to RAS Transformation Matrix	(0047,xxA0)	DS	16
Number of Voxels in I Direction	(0047,xxA1)	US	1
Number of Voxels in J Direction	(0047,xxA2)	US	1
Number of Voxels in K Direction	(0047,xxA3)	US	1
Series UID of the Original volume	(0047,xxA4)	UI	1
Volume Density List	(0047,xxD3)	OB	1

8. ENHANCED STRUCTURED REPORT INFORMATION OBJECT IMPLEMENTATION

8.1 INTRODUCTION

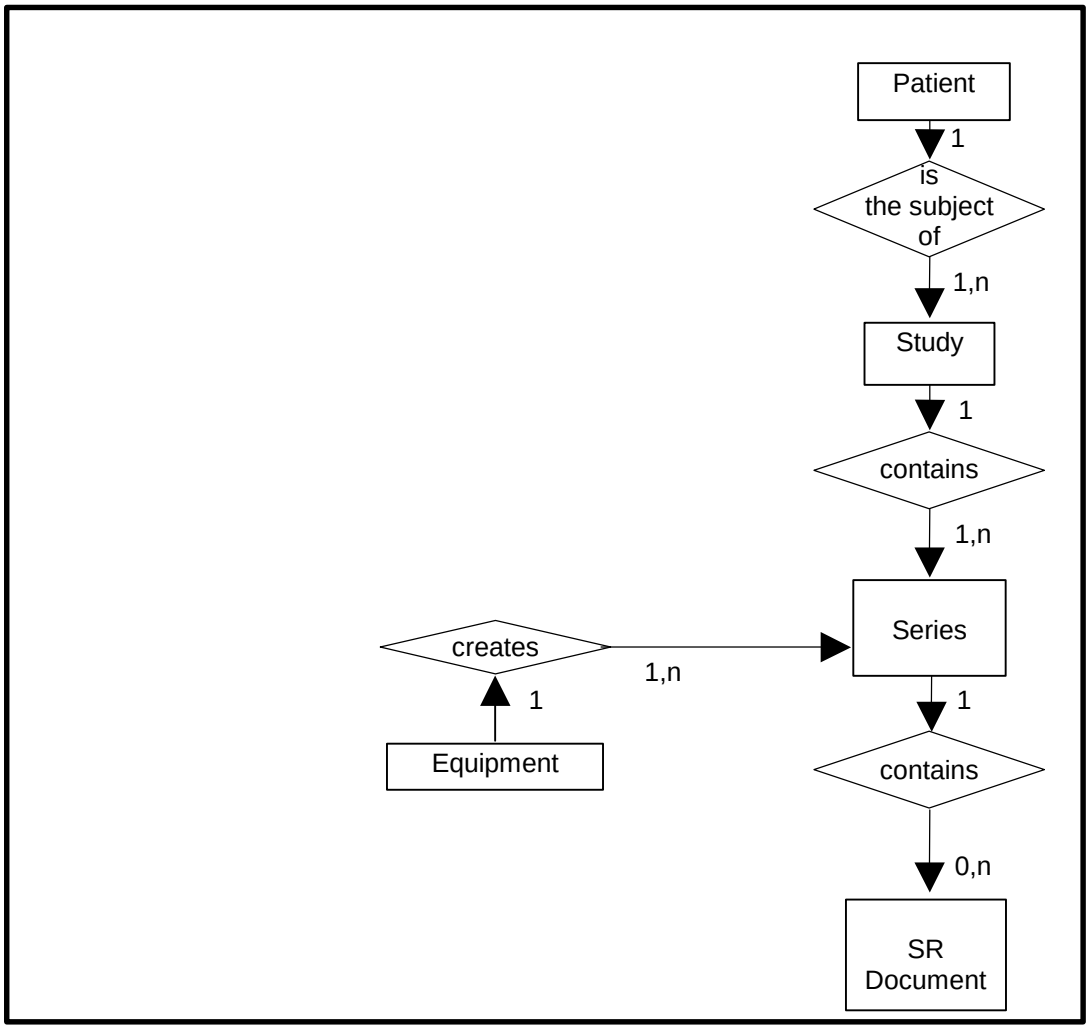
This section describes the SR Document Information Object implementation generated the applications.

8.1.1 SR Entity Relationship model

The Entity-Relationship diagram for the SR interoperability schema is shown in the illustration below**.** 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 SR can have up to n SRs per Series, but the Patient to Study relationship has 1 Patient for each Study (a Patient can have more than one Study on the system, however each Study will contain all of the information pertaining to that Patient).



8.1.2 ENTITY DESCRIPTIONS

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

8.1.3 Volume Viewer Mapping of DICOM entities

TABLE 8.1-1
MAPPING OF DICOM ENTITIES TO VOLUME VIEWER ENTITIES

DICOM	Volume Viewer Entity
Patient	Patient
Study	Exam
Series	Series
Document	Document
Equipment	Equipment

8.2 IOD MODULE TABLE

The **Enhanced** Structured Report Information Object Definitions comprise the modules of the following tables, plus Standard Extended and Private attributes. SR specific modules are described in Section 8.3. Standard Extended and Private attributes are described in Section 8.4.

The contents of the SR Document Content are constrained by the supported template, as identified in Section 8.3.7.1.1. Standard Extended and Private templates are further described in Section 8.5.

TABLE 8.2-1
ENHANCED SR IOD MODULES

Information Entity	Module	Usage	Reference
Patient	Patient	Used	8.3.1
	Specimen Identification	Not used	N/A
Study	General Study	Used	8.3.2
	Patient Study	Used	8.3.3
Series	SR Document Series	Used	8.3.4
Equipment	General Equipment	Used	8.3.5
Document	SR Document General	Used	8.3.6
	SR Document Content	Used	8.3.7
	SOP Common	Used	8.3.8

8.3 BASIC TEXT, ENHANCED AND COMPREHENSIVE SR - INFORMATION MODULE DEFINITIONS

Please refer to DICOM Part 3 (Information Object Definitions) for a description of each of the entities, modules, and attributes contained within the SR Information Objects.

8.3.1 Patient Module

TABLE 8.3-1
PATIENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Patient's Name	(0010,0010)	2	Copied from source header.
Patient ID	(0010,0020)	2	Copied from source header.
Patient's Birth Date	(0010,0030)	2	Copied from source header or entered by the user.
Patient's Sex	(0010,0040)	2	Copied from source header or entered by the user. Enumerated Values: M = male F = female O = other
Patient's Birth Time	(0010,0032)	3	Copied from source header.
Ethnic Group	(0010,2160)	3	Copied from source header or entered by the user.
Patient Comments	(0010,4000)	3	Copied from source header.

8.3.2 General Study Module

TABLE 8.3-2
GENERAL STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Study Instance UID	(0020,000D)	1	Copied from source header.
Study Date	(0008,0020)	2	Copied from source header.
Study Time	(0008,0030)	2	Copied from source header.
Referring Physician's Name	(0008,0090)	2	Copied from source header or entered by the user.
Study ID	(0020,0010)	2	Copied from source header.
Accession Number	(0008,0050)	2	Copied from source header.
Study Description	(0008,1030)	3	Copied from source header.

8.3.3 Patient Study Module

TABLE 8.3-3
PATIENT STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Patient's Age	(0010,1010)	3	Copied from source header.
Patient's Size	(0010,1020)	3	Copied from source header or entered by the user.
Patient's Weight	(0010,1030)	3	Copied from source header or entered by the user.
Occupation	(0010,2180)	3	Copied from source header.
Additional Patient’s History	(0010,21B0)	3	Copied from source header.

8.3.4 SR Document Series Module

TABLE 8.3-4
SR DOCUMENT SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	Copied from source header. Enumerated Value: SR = SR Document
Series Instance UID	(0020,000E)	1	Generated with the Implementation Root UID, serial number, the process ID number, the timestamp and a counter incremented each time.
Series Number	(0020,0011)	1	Copied from source header or generated.
Series Description	(0008,103E)	3	Generated
Referenced Performed Procedure Step Sequence	(0008,1111)	2	Empty

8.3.5 General Equipment Module

TABLE 8.3-5
GENERAL EQUIPMENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Manufacturer	(0008,0070)	2	Copied from source header.
Institution Name	(0008,0080)	3	Copied from source header.
Institution Address	(0008,0081)	3	Copied from source header.
Station Name	(0008,1010)	3	Copied from source header.
Institutional Department Name	(0008,1040)	3	Copied from source header.
Manufacturer's Model Name	(0008,1090)	3	Copied from source header.
Device Serial Number	(0018,1000)	3	Copied from source header.

8.3.6 SR Document General Module

TABLE 8.3-6
SR DOCUMENT GENERAL MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Instance Number	(0020,0013)	1	Generated
Completion Flag	(0040,A491)	1	Set to PARTIAL
Completion Flag Description	(0040,A492)	3	Empty
Verification Flag	(0040,A493)	1	Set to UNVERIFIED
Content Date	(0008,0023)	1	Current date of creation.
Content Time	(0008,0033)	1	Current time of creation.
Verifying Observer Sequence	(0040,A073)	1C	
>Verifying Observer Name	(0040,A075)	1	Copied from source header or entered by the user.
>Verifying Observer Identification Code Sequence	(0040,A088)	2	Empty.
>Verifying Organization	(0040,A027)	1	Copied from source header or entered by the user.
>Verification DateTime	(0040,A030)	1	Current date and time of verification.
Predecessor Documents Sequence	(0040,A360)	1C	Not used
Identical Documents Sequence	(0040,A525)	1C	Not used
Referenced Request Sequence	(0040,A370)	1C	Copied from source header.
Performed Procedure Code Sequence	(0040,A372)	2	Copied from source header.
Current Requested Procedure Evidence Sequence	(0040,A375)	1C	List of Composite SOP Instances that are referenced in the content tree.
Pertinent Other Evidence Sequence	(0040,A385)	1C	Not used

8.3.7 SR Document Content Module

TABLE 8.3-7
SR DOCUMENT CONTENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Use

Observation DateTime	(0040,A032)	1C	Report creation date
Content Template Sequence	(0040,A504)	1C	Send when PVCAR_100 is used.
> 'Template Identification Macro'			
Value Type	(0040,A040)	1	Defined Terms: TEXT NUM CODE DATETIME DATE TIME UIDREF PNAME COMPOSITE IMAGE WAVEFORM SCOORD TCOORD CONTAINER
Continuity of Content	(0040,A050)	1C	SEPARATE
Concept Name Code Sequence	(0040,A043)	1C	See Context ID vv_codes
> 'Code Sequence Macro'			
Concept Value attribute(s)			
Content Sequence	(0040,A730)	1C	See TID tables
> Relationship Type	(0040,A010)	1	Defined Terms: CONTAINS HAS PROPERTIES HAS OBS CONTEXT HAS ACQ CONTEXT INFERRED FROM SELECTED FROM HAS CONCEPT MOD
> Referenced Content Item Identifier	(0040,DB73)	1C	Not used in Basic Text and Enhanced SR SOP Classes
> SR DocumentContent Module			*Recursive inclusion to create document content tree*

8.3.7.1 SR Document Content Descriptions

8.3.7.1.1 Content Template

The product supports the following root Templates for SR SOP Instances created, processed, or displayed by the product.

TABLE 8.3-8
SR ROOT TEMPLATES

SOP Class	Template ID	Template Name	Use

Enhanced SR	TID vv_0001	VV_REPORT	Create
Enhanced SR	TID vv_0011	VV_CARDIAC_FUNCTION_REPORT	Create
Enhanced SR	TID PVCAR_100	PET VCAR Document Root	Create

8.3.8 SOP Common Module

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

TABLE 8.3-9
SOP COMMON MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008,0016)	1	Enumerated Values: 1.2.840.10008.5.1.4.1.1.88.22
SOP Instance UID	(0008,0018)	1	Generated with the Implementation Root UID, serial number, the process ID number, the timestamp and a counter incremented each time.
Specific Character Set	(0008,0005)	1C	Copied from source header or "ISO_IR 100".
Instance Creation Date	(0008,0012)	3	Current date of creation
Instance Creation Time	(0008,0013)	3	Current time of creation
Instance Creator UID	(0008,0014)	3	Empty
Instance Number	(0020,0013)	3	Generated

8.4 STANDARD EXTENDED AND PRIVATE DATA ATTRIBUTES

The Product supports the Standard and Private Attributes defined in the following sections in Standard Extended SR SOP Instances as Type 3 data elements.

8.4.1 Private Group GEMS_0039

TABLE 8.4-1
PRIVATE GROUP GEMS_0039 (REPORT_FROM_APP)

Attribute Name	Tag	VR	VM	Attribute Description and Use
Application specific data	(0039,1095)	LO	1	VV#<application_version>#<application_name>

8.5 STANDARD EXTENDED AND PRIVATE TEMPLATES

The Product supports the Standard Extended and Private Templates defined in the following sections.

8.5.1 Standard Extended Templates

Not used.

8.5.2 Private Templates

The Product supports the following private templates for SOP Instances created by this product.

8.5.2.1 Template ID GEMS-AW-VV001 Volume_Viewer_SR_Template

TID vv_0001
VV_REPORT
Type: (Non-)Extensible

	NL	Relationship With Parent	Value TypeT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	EV(18748-4, LN, "Diagnostic Imaging Report")	1	M		
2	>	CONTAINS	INCLUDE	DTID(vv_0002)"VV_REPORT_PRE_EXAM"	1	M		
3	>	CONTAINS	CONTAINER	EV(VV-024, 99GEMS, "General Images")	1	UC	If at least one image is in the general image part.	
4	>>	CONTAINS	INCLUDE	DTID(vv_0009)"VV_REPORT_CAPTURE"	1-n	UC	If there are images in the general image part.	
5	>	CONTAINS	INCLUDE	DTID(vv_0003)"VV_REPORT_FINDING_GENERIC"	1-n	UC	If there are generic findings.	
6	>	CONTAINS	INCLUDE	DTID(vv_0004)"VV_REPORT_FINDING_CARDIAC"	1-n	UC	If there are cardiac findings.	
7	>	CONTAINS	INCLUDE	DTID(vv_0005)"VV_REPORT_FINDING_CTC"	1-n	UC	If there are ctc findings.	
8	>	CONTAINS	INCLUDE	DTID(vv_0010)"VV_REPORT_FINDING_CTC"	1	M		

TID vv_0002
VV_REPORT_PRE_EXAM
Type: (Non-)Extensible

	NL	Relationship With Parent	Value TypeT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	DT(VV-020, 99GEMS, “Pre Exam”)	1	M		
2	>	CONTAINS	TEXT	(R-0025D, SNM3, "Patient name")	1	U		
3	>	CONTAINS	TEXT	(F-08600, SNM3, "Age")	1	U		
4	>	CONTAINS	TEXT	(F-01850, SNM3, "Body height")	1	U		
5	>	CONTAINS	TEXT	(VV-021, 99GEMS, "Family Medical history")	1	U		
6	>	CONTAINS	TEXT	(VV-022, 99GEMS, "Patient history")	1	U		
7	>	CONTAINS	TEXT	(VV-023, 99GEMS, "Exam procedure")	1	U		
8	>	CONTAINS	TEXT	(J-06170, SNM3, "Radiologist")	1	U		
9	**>**	**CONTAINS**	**TEXT**	**(J-0612B, SNM3, "Cardiologist")**	**1**	**UC**	**Filled by the user only in Cardiac protocols**	
10	>	CONTAINS	TEXT	(J-0016E, SNM3, "Doctor")	1	U		
11	>	CONTAINS	TEXT	(VV-072, 99GEMS, "Scan dose")	1	U		
12	>	CONTAINS	CODE	(S-32000, SNM3, "Smoker")	1	UC	May be present only if (VV-070, 99GEMS, "Yes") or (VV-071, 99GEMS, "No")	
13	>	CONTAINS	CODE	(F-02A18, SNM3, "Overweight")	1	UC	May be present only if (VV-070, 99GEMS, "Yes") or (VV-071, 99GEMS, "No")	
14	>	CONTAINS	CODE	(VV-050, 99GEMS, "Diabetes")	1	UC	May be present only if (VV-070, 99GEMS, "Yes") or (VV-071, 99GEMS, "No")	
15	>	CONTAINS	TEXT	(F-63980, SNM3, "Cholesterol")	1	U		
16	>	CONTAINS	CODE	(CAR-029, 99GEMS, "Indications for study")	1	UC	May be present only if one of the item is present	Value = CAD, Chest pain, Cardiomyopathy, Other
17	>	CONTAINS	CODE	(G-C2CB, SNM3, "Ventricular dominance")	1	UC	May be present only if one of the item is present	Value = Right, Left, Co
18	>	CONTAINS	NUM	(8277-6, LN, " Body Surface Area ")	1	UC	May be present if Weight Height specified by user	UNIT = (m2 , UCUM, “square meter”)
19	>	CONTAINS	TEXT	(8278-4, LN, " Body Surface Area Formula ")	1	UC	Must be present if (8277-6, LN, " Body Surface Area ") is present	

TID vv_0003

VV_REPORT_FINDING_GENERIC
Type: (Non-)Extensible

	NL	Relationship With Parent	Value TypeT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	DT(121071, 99GEMS, “Finding”)	1	M		
2	>	HAS CONCEPT MOD	TEXT	EV(VV-008, 99GEMS, " Name")	1	M		
3	>	CONTAINS	TEXT	EV(121106, SNM3, "Comment ")	1	M		
4	>	CONTAINS	INCLUDE	DTID(vv_0009)”VV_REPORT_CAPTURE”	1-n	UC	If Finding has captures	
5	>	CONTAINS	INCLUDE	DTID(vv_0006)”VV_REPORT_MEASURE	1-n	UC	If Finding has Measure	
6	>	CONTAINS	INCLUDE	DTID(vv_0007)”VV_REPORT_ROI	1-n	UC	If Finding has Roi	

TID vv_0004
VV_REPORT_FINDING_CARDIAC
Type: (Non-)Extensible

	NL	Relationship With Parent	Value TypeT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	DT(121071, 99GEMS, “Finding”)	1	M		Can also have : (“Cardiac Finding”, “Plaque”, “Aneurysm”)
2	>	HAS CONCEPT MOD	TEXT	EV(VV-008, 99GEMS, " Name")	1	M		
2	>	CONTAINS	TEXT	EV(CAR-030, 99GEMS, " Branch Name")	1	M		
3	>	CONTAINS	CODE	(G-C1E8, SNM3, "Location")	1	UC	May be present only if location attribute is defined	Value = Proximal, Middle, Distal, Other
4	>	CONTAINS	CODE	(G-D70D, SNM3, "Type")	1	UC	May be present only if type attribute is defined.	Value = Normal, Mild, Mod, Severe
5	>	CONTAINS	TEXT	EV(VV-025, 99GEMS, "Risk comment")	1	U		
6	>	CONTAINS	CODE	EV (CAR-031, 99GEMS, "Characterization")	1	UC	May be present only if characterization attribute is defined.	Value = Atheromatous, Fibroatheromatous, Calcified, Fibrocalcified, Fibrous
7	>	CONTAINS	CODE	EV (CAR-032, SNM3, "Description")	1	UC	May be present only if description 1 attribute is defined.	Value = Eccentric, Concentric
8	>	CONTAINS	CODE	EV (CAR-032, SNM3, "Description")	1	UC	May be present only if description 2 attribute is defined.	Value = Heterogeneous, Homogenous
9	>	CONTAINS	CODE	EV (CAR-032, SNM3, "Description")	1	UC	May be present only if description 3 attribute is defined.	Value = Regular
10	>	CONTAINS	CODE	EV (CAR-032, SNM3, "Description")	1	UC	May be present only if description 4 attribute is defined.	Value = Smooth
11	>	CONTAINS	CODE	EV (CAR-032, SNM3, "Description")	1	UC	May be present only if aneurysm description attribute is defined.	Value = Saccular, Fusiform, Focal, Focal Ectasia, Pseudoaneurysm
12	>	CONTAINS	CODE	EV (CAR-032, SNM3, "Description")	1	UC	May be present only if Thrombus attribute is defined.	Value = (M-35100 , SNM3, “Thrombus”)
13	>	CONTAINS	TEXT	EV(121106, SNM3, "Comment ")	1	M		
14	>	CONTAINS	INCLUDE	DTID(vv_0009)”VV_REPORT_CAPTURE”	1-n	UC	If Finding has captures	
15	>	CONTAINS	INCLUDE	DTID(vv_0006)”VV_REPORT_MEASURE	1-n	UC	If Finding has Measure	
16	>	CONTAINS	INCLUDE	DTID(vv_0007)”VV_REPORT_ROI	1-n	UC	If Finding has Roi	

TID vv_0005
VV_REPORT_FINDING_CTC
Type: (Non-)Extensible

	NL	Relationship With Parent	Value TypeT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	DT(M-76800, SNM3, “Polyp”)	1	M		Can also have : (“Cardiac Finding”, “Plaque”, “Aneurysm”)
2	>	HAS CONCEPT MOD	TEXT	EV(VV-008, 99GEMS, " Name")	1	M		
3	>	CONTAINS	CODE	EV(G-C1E8, SNM3, "Location")	1	UC	May be present only if location attribute is defined	Value = Rectum, Sigmoid, Descending, Transverse, Ascending, Cecum, Other
4	>	CONTAINS	CODE	EV(G-C2FE, SNM3, "Shape")	1	UC	May be present only if shape attribute is defined.	Value = Sessile, Pedonculated, Flat,, Other
5	>	CONTAINS	NUM	EV(CTC-004, 99GEMS, " Lesion size")	1	UC	May be present only if lesion size attribute is defined.	UNIT = (mm , UCUM, “millimeter”)
6	>	CONTAINS	NUM	EV(CTC-003, 99GEMS, " Distance from Rectum")	1	UC	May be present only if “distance from rectum” attribute is defined.	UNIT = (cm , UCUM, “centimeter”)
7	>	CONTAINS	TEXT	EV(121106, SNM3, "Comment ")	1	M		

8	>	CONTAINS	INCLUDE	DTID(vv_0009)"VV_REPORT_CAPTURE"	1-n	UC	If Finding has captures	
9	>	CONTAINS	INCLUDE	DTID(vv_0006)"VV_REPORT_MEASURE	1-n	UC	If Finding has Measure	
10	>	CONTAINS	INCLUDE	DTID(vv_0007)"VV_REPORT_ROI	1-n	UC	If Finding has Roi	

TID vv_0006
VV_REPORT_MEASURE
Type: (Non-)Extensible

	NL	Relationship With Parent	Value TypeT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	EV(R-40831, SNM3, "Measurements")	1	M		
2	>	CONTAINS	NUM	DT(Measure, Diameter, Length, Area, Volume, Angle, Percentage, HU value, Mass, Vascular Resistance, VolumePerMinut, MassIndex, VolumeIndex)	1	M	May be present only if value != -10000	UNITS= UCUM UNITS= 99GEMS
3	>>	HAS CONCEPT MOD	TEXT	DT (VV-008, 99GEMS, "Name")	1	M		
4	>>	HAS_PROPERTIES	NUM	(R-00363, SNM3, "+/- range of measurement")	1	UC	May be present only if the value != 0.	UNITS= UCUM
5	>	CONTAINS	TEXT	(121106, SNM3, "Comment ")	1	M		
6	>	CONTAINS	INCLUDE	DTID(vv_0009)"VV_REPORT_CAPTURE"	1	UC	If Measure has associated capture	

TID vv_0007
VV_REPORT_ROI
Type: (Non-)Extensible

	NL	Relationship With Parent	Value TypeT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	EV(R-40831, SNM3, "Measurements")	1	M		
2	>	HAS CONCEPT MOD	TEXT	EV(VV-008, 99GEMS, "Name")	1	M		
3	>	CONTAINS	NUM	DT(VV-032, 99GEMS, "Minimum HU value")	1	UC	May be present only if value is != -10000	UNITS=(HU, 99GEMS, "Hounsfield unit")
4	>	CONTAINS	NUM	DT(VV-033, 99GEMS, "Maximum HU value")	1	UC	May be present only if value is != -10000	UNITS=(HU, 99GEMS, "Hounsfield unit")
5	>	CONTAINS	NUM	DT(VV-034, 99GEMS, "Average HU value")	1	UC	May be present only if value is != -10000	UNITS=(HU, 99GEMS, "Hounsfield unit")
6	>	CONTAINS	NUM	DT(VV-036, 99GEMS, "Standard Deviation HU value")	1	UC	May be present only if value is != -10000 or value !=0.	UNITS=(HU, 99GEMS, "Hounsfield unit")
7	>	CONTAINS	INCLUDE	DTID(vv_0008)"VV_ROI_STATS"	1-n	UC	If Color Coded plaque	
8	>	CONTAINS	TEXT	(121106, SNM3, "Comment ")	1	M		
9	>	CONTAINS	INCLUDE	DTID(vv_0009)"VV_REPORT_CAPTURE"	1	UC	If ROI has associated capture	

TID vv_0008
VV_ROI_STATS
Type: (Non-)Extensible

	NL	Relationship With Parent	Value TypeT	Concept Name	VM	Req Type	Condition	Value Set Constraint

1		CONTAINS	CONTAINER	EV(VV-CCP, SNM3, “Color coded plaque statistics”)	1	M		
2	>	HAS CONCEPT MOD	TEXT	EV(VV-008, 99GEMS, "name ")	1	U		
3	>	HAS CONCEPT MOD	TEXT	EV(VV-035, 99GEMS, " RGB Color")	1	U		
4	>	HAS CONCEPT MOD	TEXT	EV(VV-030, 99GEMS, " Hounsfield range ")	1	U		
5	>	CONTAINS	NUM	DT(G-D705, SNM3, “Volume”)	1	U		UNITS=(mm3, UCUM, “cubic millimeter”)
6	>	CONTAINS	NUM	DT(VV-031, 99GEMS, “Volume pct”)	1	U		UNITS=(%, SNM3, "%")

TID vv_0009
VV_REPORT_CAPTURE
Type: (Non-)Extensible

	NL	Relationship With Parent	Value TypeT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1		CONTAINS	CONTAINER	EV(CAPTURE, DICOM, “Image Capture”)	1	M		
2	>	HAS CONCEPT MOD	TEXT	EV(VV-008, 99GEMS, "name ")	1	M		
3	>	CONTAINS	TEXT	EV(G-D70D, SNM3, " Type")	1	M		
4	>	INFERED FROM	IMAGE	EV(VV-030, 99GEMS, " Hounsfield range ")	1	M		
5	>	CONTAINS	CODE	DT(111028, DICOM, “Image Library”)	1	MC	If capture is automatic or manual	Value can be (G-D231, SNM3, “Automatic”) or (G-D221, SNM3, “Manual”)
6	>	CONTAINS	TEXT	(121106, SNM3, "Comment ")	1	M		

TID vv_0010
VV_REPORT_POST_EXAM
Type: (Non-)Extensible

	NL	Relationship With Parent	Value TypeT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	DT(VV-020, 99GEMS, “Post Exam”)	1	M		
2	>	CONTAINS	TEXT	(121106, SNM3, "Comment ")	1	M		

TID vv_0011
VV_CARDIAC_FUNCTION_REPORT
Type: (Non-)Extensible

	NL	Relationship With Parent	Value TypeT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	EV(122600, DCM, “Cardiovascular Analysis Report”)	1	M		
	>	CONTAINS	TEXT	EV(121106, SNM3, "Comment ")	1	M		
2	>	CONTAINS	INCLUDE	DTID(vv_0002)”VV_REPORT_PRE_EXAM”	1	M		
3	>	CONTAINS	CONTAINER	EV(121076, DCM, “Concusions”)	1	M		
4	>	CONTAINS	TEXT	EV(121077, SNM3, "Conclusion ")	1	M		

5	>	CONTAINS	CONTAINER	EV(VV-024, 99GEMS, “General Images”)	1	UC	If at least one image is in the general image part.	
6	>>	CONTAINS	INCLUDE	DTID(vv_0009)”VV_REPORT_CAPTURE”	1-n	UC	If there are images in the general image part.	
7	>	CONTAINS	INCLUDE	DTID(vv_0012)”VV_REPORT_FINDING_CARDIAC_FUNCTION”	1	UC	If there are CardIQ Function findings	
8		CONTAINS	INCLUDE	DTID(vv_0010)”VV_REPORT_POST_EXAM”	1	UC	If Comment part filled by user	

TID vv_0012
VV_REPORT_FINDING_CARDIAC_FUNCTION
Type: (Non-)Extensible

	NL	Relationship With Parent	Value TypeT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	DT(F-32000, SRT, “Cardiac Function”)	1	M		
2	>	CONTAINS	CONTAINER	EV(T-32600, SRT, “Left Ventricle)	1	M		
3	>>	CONTAINS	CONTAINER	DTID(vv_0006)”VV_REPORT_MEASURE	1-n	UC	May be present if EV(T-32600, SRT, “Left Ventricle) is present	Value can be: (CAR-018, 99GEMS, End Systolic Volume); UNIT=(ml,UCUM,milliliter) and (CAR-020, 99GEMS, End Systolic Phase) ; UNIT=(%,UCUM,%) and (CAR-017, 99GEMS, End Diastolic Volume) ; UNIT=(ml,UCUM,milliliter) and (CAR-019, 99GEMS, End Diastolic Phase) ; UNIT=(%,UCUM,%) and (F-32120, SRT, Stroke Volume) ; UNIT=(ml,UCUM,milliliter) and (F-32070, SRT, Ejection Fraction) ; UNIT=(%,UCUM,%) and (F-32120, SRT, Cardiac Output) ; UNIT=(ml,UCUM,milliliter) and (122447, DCM, Wall Mass) ; UNIT=(g,UCUM,gram) and (CAR-043, 99GEMS, Myocardial Mass Index) UNIT=(g/m2,99GEMS,g/m2)
4	>>	CONTAINS	CONTAINER	EV(CAR-042, 99GEMS, “Phase Volume Table“)	1	UC	May be present if EV(T-32600, SRT, “Left Ventricle) is present	
5	>>>	CONTAINS	CONTAINER	DTID(vv_0006)”VV_REPORT_MEASURE	1-n	UC	Must be present if EV(CAR-042, 99GEMS, “Phase Volume Table“) is present	Value can be: (G-D705, SNM3, Volume); UNIT=(ml,UCUM,milliliter)
6	>>	CONTAINS	CONTAINER	EV(122445, DCM, “Wall Thickness“)	1	UC	May be present if EV(T-32600, SRT, “Left Ventricle) is present	
7	>>>	CONTAINS	CONTAINER	DTID(vv_0006)”VV_REPORT_MEASURE	1-n	UC	Must be present if EV(122445, DCM, “Wall Thickness“) is present	Value can be: (G-A22A, SRT, Length); UNIT=(mm,UCUM,millimeter)
8	>>	CONTAINS	CONTAINER	EV(F-32050, SRT, “Cardiac Wall Motion“)	1	UC	May be present if EV(T-32600, SRT, “Left Ventricle) is present	
9	>>>	CONTAINS	CONTAINER	DTID(vv_0006)”VV_REPORT_MEASURE	1-n	UC	Must be present if EV(F-32050, SRT, “Cardiac Wall Motion“)is present	Value can be: (G-A22A, SRT, Length); UNIT=(mm,UCUM,millimeter)
10	>>	CONTAINS	CONTAINER	EV(122607, DCM, “Thickening Analysis“)	1	UC	May be present if EV(T-32600, SRT, “Left Ventricle) is present	
11	>>>	CONTAINS	CONTAINER	DTID(vv_0006)”VV_REPORT_MEASURE	1-n	UC	Must be present if (122607, DCM, “Thickening Analysis“) is present	Value can be: (G-A22A, SRT, Length); UNIT=(mm,UCUM,millimeter)

12	>>	CONTAINS	CONTAINER	DTID(vv_0009)"VV_REPORT_CAPTURE"	1-n	UC	If EV(T-32600, SRT, "Left Ventricle) has captures	
13	>	CONTAINS	CONTAINER	EV(T-32500, SRT, "Right Ventricle)	1	M		
14	>>	CONTAINS	CONTAINER	DTID(vv_0006)"VV_REPORT_MEASURE	1-n	UC	May be present if EV(T-32500, SRT, "Right Ventricle) is present	Value can be: (CAR-018, 99GEMS, End Systolic Volume); UNIT=(ml,UCUM,milliliter) and (CAR-020, 99GEMS, End Systolic Phase) ; UNIT=(%,UCUM,%) and (CAR-017, 99GEMS, End Diastolic Volume) ; UNIT=(ml,UCUM,milliliter) and (CAR-019, 99GEMS, End Diastolic Phase) ; UNIT=(%,UCUM,%) and (F-32120, SRT, Stroke Volume) ; UNIT=(ml,UCUM,milliliter) and (F-32070, SRT, Ejection Fraction) ; UNIT=(%,UCUM,%) and (F-32120, SRT, Cardiac Output) ; UNIT=(ml,UCUM,milliliter)
15	>>	CONTAINS	CONTAINER	EV(CAR-042, 99GEMS, "Phase Volume Table")	1	UC	May be present if EV(T-32500, SRT, "Right Ventricle) is present	
16	>>>	CONTAINS	CONTAINER	DTID(vv_0006)"VV_REPORT_MEASURE	1-n	UC	Must be present if EV(CAR-042, 99GEMS, "Phase Volume Table") is present	Value can be: (G-D705, SNM3, Volume); UNIT=(ml,UCUM,milliliter)
17	>>	CONTAINS	CONTAINER	DTID(vv_0009)"VV_REPORT_CAPTURE"	1-n	UC	If EV(T-32500, SRT, "Right Ventricle) has captures	
18	>	CONTAINS	CONTAINER	EV(T-32300, SRT, "Left Atrium)	1	M		
19	>>	CONTAINS	CONTAINER	DTID(vv_0006)"VV_REPORT_MEASURE	1-n	UC	May be present EV(T-32300, SRT, "Left Atrium)is present	Value can be: (F-32070, SRT, Ejection Fraction) ; UNIT=(%,UCUM,%) and (CAR-044, 99GEMS, Left Atrium Index) UNIT=(ml/m2,99GEMS,ml/m2)
20	>>	CONTAINS	CONTAINER	EV(CAR-042, 99GEMS, "Phase Volume Table")	1	UC	May be present if EV(T-32300, SRT, "Left Atrium)is present	
21	>>>	CONTAINS	CONTAINER	DTID(vv_0006)"VV_REPORT_MEASURE	1-n	UC	Must be present if EV(CAR-042, 99GEMS, "Phase Volume Table") is present	Value can be: (G-D705, SNM3, Volume); UNIT=(ml,UCUM,milliliter)
22	>>	CONTAINS	CONTAINER	DTID(vv_0009)"VV_REPORT_CAPTURE"	1-n	UC	If EV(T-32300, SRT, "Left Atrium)has captures	
23	>	CONTAINS	CONTAINER	EV(T-32200, SRT, "Right Atrium)	1	M		
24	>>	CONTAINS	CONTAINER	DTID(vv_0006)"VV_REPORT_MEASURE	1-n	UC	May be present EV(T-32200, SRT, "Right Atrium)is present	Value can be: (CAR-039, 99GEMS, Min Volume) ; UNIT=(ml, UCUM, ml) and (CAR-041, 99GEMS, Min Phase) ; UNIT=(%, UCUM, %) and (CAR-038, 99GEMS, Max Volume) ; UNIT=(ml, UCUM, ml) and (CAR-040, 99GEMS, Max Phase) ; UNIT=(%, UCUM, %)
25	>>	CONTAINS	CONTAINER	EV(CAR-042, 99GEMS, "Phase Volume Table")	1	UC	May be present if EV(T-32200, SRT, "Right Atrium)is present	
26	>>>	CONTAINS	CONTAINER	DTID(vv_0006)"VV_REPORT_MEASURE	1-n	UC	Must be present if EV(CAR-042, 99GEMS, "Phase Volume Table") is present	Value can be: (G-D705, SNM3, Volume); UNIT=(ml,UCUM,milliliter)
27	>>	CONTAINS	CONTAINER	DTID(vv_0009)"VV_REPORT_CAPTURE"	1-n	UC	If EV(T-32200, SRT, "Right Atrium)has captures	
28	>	CONTAINS	INCLUDE	DTID(vv_0009)"VV_REPORT_CAPTURE"	1-n	UC	If DT(F-32000, SRT, "Cardiac Function") has captures	
29	>	CONTAINS	INCLUDE	DTID(vv_0006)"VV_REPORT_MEASURE	1-n	UC	If DT(F-32000, SRT, "Cardiac Function") has Measure	

Context ID vv_codes

Type: Extensible Version: <20040901>

Coding Scheme Designator	Code Value	Code Meaning
99GEMS	CAR-001	Ejection fraction results
99GEMS	CAR-002	Cardiac reformat
99GEMS	CAR-003	Cardiac Angles at End Systole
99GEMS	CAR-004	Cardiac Angles at End Diastole
99GEMS	CAR-005	Cardiac heart
99GEMS	CAR-006	Heart graft
99GEMS	CAR-007	Cardiac tree VR
99GEMS	CAR-008	Cardiac enhanced tree
99GEMS	CAR-009	Entire cardiac
99GEMS	CAR-010	Cardiac Transparency
99GEMS	CAR-011	Coronaries Transparency
99GEMS	CAR-012	LV Transparency
99GEMS	CAR-013	RV Transparency
99GEMS	CAR-014	Muscle Transparency
99GEMS	CAR-015	Bone Transparency
99GEMS	CAR-016	Angiographic View
99GEMS	CAR-017	End Diastolic Volume
99GEMS	CAR-018	End Systolic Volume
99GEMS	CAR-019	End Diastolic Phase
99GEMS	CAR-020	End Systolic Phase
99GEMS	CAR-021	Plaque description
99GEMS	CAR-022	Fibroatheromatous
99GEMS	CAR-023	Calcified
99GEMS	CAR-024	Fibrocalcified
99GEMS	CAR-025	Eccentric
99GEMS	CAR-026	Heterogeneous
99GEMS	CAR-027	Homogenous
99GEMS	CAR-028	Aneurysm description
99GEMS	CAR-029	Indications for study
99GEMS	CAR-029	CAD
99GEMS	CAR-030	Branch Name
99GEMS	CAR-031	Characterization
99GEMS	CAR-032	Description
99GEMS	CAR-033	Right
99GEMS	CAR-034	Left
99GEMS	CAR-035	Co
99GEMS	CAR-036	Beta-Blockers
99GEMS	CAR-037	Nitro
99GEMS	CAR-038	Max Volume
99GEMS	CAR-039	Min Volume
99GEMS	CAR-040	Max Phase
99GEMS	CAR-041	Min Phase
99GEMS	CAR-042	Phase Volume Table
99GEMS	CAR-043	Myocardial Mass Index
99GEMS	CAR-044	Left Atrium Index
99GEMS	CTC-001	Colonoscopy report
99GEMS	CTC-002	Pedonculated
99GEMS	CTC-003	Distance from Rectum
99GEMS	CTC-004	Lesion size

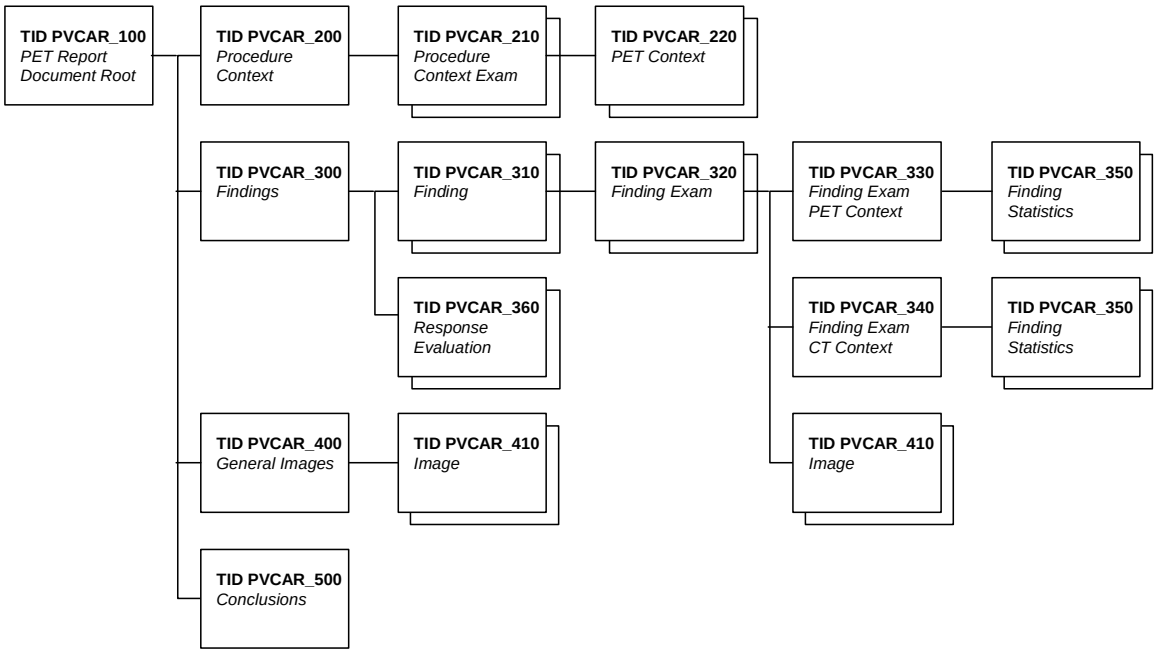
Coding Scheme Designator	Code Value	Code Meaning
99GEMS	CTC-005	Auto Dissection
99GEMS	CTC-006	Colon Lesion
99GEMS	CTC-007	Lesion Type
99GEMS	CTC-008	Extra colonic
99GEMS	CTC-009	Sigmoid
99GEMS	CTC-010	Colonography
99GEMS	CTC-011	Virtual Dissection
99GEMS	HU	Hounsfield unit
99GEMS	VA-001	Vessel Analysis
99GEMS	VV-001	Extra informations
99GEMS	VV-002	Extra images
99GEMS	VV-003	Extra information
99GEMS	VV-004	Extra Group
99GEMS	VV-005	Extra Findings
99GEMS	VV-006	Extra Finding
99GEMS	VV-007	Name concept modifier
99GEMS	VV-008	Name
99GEMS	VV-009	Nickname
99GEMS	VV-011	Point of interest
99GEMS	VV-014	Code
99GEMS	VV-016	Exam procedure
99GEMS	VV-017	Patient history
99GEMS	VV-018	3D
99GEMS	VV-019	Post Exam
99GEMS	VV-020	Pre Exam
99GEMS	VV-021	Family Medical history
99GEMS	VV-022	Patient history
99GEMS	VV-023	Exam procedure
99GEMS	VV-024	General Images
99GEMS	VV-025	Risk comment
99GEMS	VV-030	Hounsfield range
99GEMS	VV-031	Percent of total volume
99GEMS	VV-032	Min
99GEMS	VV-033	Max
99GEMS	VV-034	Avg
99GEMS	VV-035	RGB Color
99GEMS	VV-036	Std
99GEMS	VV-042	Angle
99GEMS	VV-043	Percentage
99GEMS	VV-044	HU value
99GEMS	VV-050	Diabetes
99GEMS	VV-060	Focal ectasia
99GEMS	VV-061	Protocol
99GEMS	VV-070	Yes
99GEMS	VV-071	No
99GEMS	VV-072	Scan dose
99GEMS	VV-CCP	Color coded plaque statistics
99GEMS	g/m2	g/m2
99GEMS	ml/m2	ml/m2
UCUM	%	%
SNM3	R-00363	+/- range of measurement
SNM3	F-08600	Age
SNM3	T-D0000	Anatomic region
SNM3	M-32200	Aneurysm

Coding Scheme Designator	Code Value	Code Meaning
SNM3	G-A166	Area
SNM3	G-A599	Ascending
SNM3	M-52100	Atheromatous plaque
SNM3	M-52100	Atheromous
SNM3	G-D231	Automatic
SNM3	G-A147	Axial
SNM3	F-01850	Body height
SNM3	M-52101	Calcified
SNM3	F-30164	Cardiac Finding
SRT	F-32000	Cardiac Function
SRT	F-32120	Cardiac Output
SRT	F-32050	Cardiac Wall Motion
SNM3	D3-20000	Cardiomyopathy
SNM3	T-59100	Cecum
UCUM	cm	centimeter
SNM3	F-37000	Chest pain
SNM3	F-63980	Cholesterol
SNM3	T-59300	Colon
SNM3	R-4211B	Colonic
DCM	121106	Comment
SNM3	R-4047B	Concentric
DCM	121077	Conclusion
DCM	123011	Contrast/Bolus Agent
SNM3	G-A138	Coronal
SNM3	T-43000	Coronary artery
UCUM	cm3	cubic centimeter
UCUM	mm3	cubic millimeter
DCM	121064	Current Procedure Description
UCUM	deg	degree
UCUM	°	degree
SNM3	G-A600	Descending
SNM3	M-02550	Diameter
SNM3	G-A119	Distal
SNM3	J-0016E	Doctor
SNM3	F-32070	Ejection Fraction
DCM	109022	End diastole
DCM	109070	End of systole
SNM3	M-78260	Fibrous
SNM3	M-78260	Fibrous plaque
DCM	121071	Finding
DCM	121070	Findings
SNM3	G-A485	Flat
SNM3	G-A351	Focal
SNM3	M-02130	Fusiform
SNM3	M-32350	Fusiform aneurysm
UCUM	g	Gram
SNM3	T-D3032	Heart
UCUM	hnsf'U	Hounsfield unit
DCM	CAPTURE	Image Capture
DCM	111028	Image Library
UCUM	kV	kilo volt
SRT	T-32300	Left Atrium
SNM3	T-43100	Left coronary artery
SRT	T-32600	Left Ventricle

Coding Scheme Designator	Code Value	Code Meaning
G-A22A	SRT	Length
SNM3	M-01000	Lesion
SNM3	P0-020D8	Localization
SNM3	G-C1E8	Location
SNM3	G-D221	Manual
SNM3	R-40831	Measurement
SNM3	G-A109	Middle
SNM3	R-404FA	Mild
UCUM	mA	milli Ampere
UCUM	ml	Milliliter
UCUM	mm	Millimeter
UCUM	mm/h	millimeter per hour
UCUM	mm/s	millimeter per second
SNM3	G-A002	Moderate
SNM3	G-A460	Normal
SNM3	G-A609	Other
SNM3	F-02A18	Overweight
SNM2	R-0025D	Patient name
SNM3	G-A604	Phase
SNM3	M-01470	Plaque
SNM3	G-D70D	Plaque type
SNM3	M-76800	Polyp
SNM3	G-A118	Proximal
SNM3	M-32390	Pseudoaneurysm
UCUM	rad	Radian
SNM3	J-06170	Radiologist
DCM	121074	Recommendations
SNM3	T-59609	Rectum
SNM3	G-A403	Regular
SNM3	T-43200	Right coronary artery
SRT	T-32500	Right Ventricle
SNM3	F-01500	Risk factor
SNM3	G-A154	Saccular
SNM3	M-32340	Saccular aneurysm
SNM3	G-A145	Sagittal
SNM3	G-A175	Section
SNM3	R-42186	Segment
SNM3	T-D07DF	Segment of coronary artery
SNM3	G-A530	Sessile
SNM3	G-A003	Severe
SNM3	G-C2FE	Shape
GEMS-IT	65039	Sigmoid polyp
SNM3	S-32000	Smoker
SNM3	G-A545	Smooth
UCUM	mm2	square millimeter
SNM3	F-32120	Stroke Volume
DCM	122607	Thickening Analysis
SNM3	M-35100	Thrombus
SNM3	G-A117	Transverse
SNM3	G-D70D	Type
SNM3	R-41198	Unknown
SNM3	R-41198	Unknown
SNM3	G-C2CB	Ventricular dominance
SNM3	G-C57F	Vessel

Coding Scheme Designator	Code Value	Code Meaning
SNM3	G-C57F	Vessel
SNM3	G-D705	Volume
DCM	122447	Wall Mass
DCM	122445	Wall Thickness

8.5.2.2 PET VCAR Report Template



8.5.2.2.1 TID PVCAR_100 PET VCAR Document Root Template

This template forms the top of a content tree for reports generated from PET VCAR.

TID PVCAR_100
PET VCAR DOCUMENT ROOT

Type: Non-Extensible

	NL	Relation with Parent	Value Type	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	EV (PVCAR-0001, 99GEMS, "PET Report")	1	M		
2	>	HAS CONCEPT MOD	INCLUDE	DTID (1204) Language of Content Item and Descendants	1	M		
3	>	CONTAINS	INCLUDE	**DTID (PVCAR_200)** PET VCAR Procedure Context	1	M		
4	>	CONTAINS	INCLUDE	**DTID (PVCAR_300)** PET VCAR Findings	1	M		
5	>	CONTAINS	INCLUDE	**DTID (PVCAR_400)** PET VCAR General Images	1	U		
6	>	CONTAINS	INCLUDE	**DTID (PVCAR_500)** PET VCAR Conclusions	1	U		

8.5.2.2.2 TID PVCAR_200 PET VCAR Procedure Context Template

This template describes procedure context information.

TID PVCAR_200
PET VCAR PROCEDURE CONTEXT

Type: Non-Extensible

	NL	Relation with Parent	Value Type	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	EV (G-C32C, SRT, "Procedure Context")	1	M		
2	>	CONTAINS	INCLUDE	**DTID (PVCAR_210)** PET VCAR Procedure Context Exam	1-n	M		

8.5.2.2.3 TID PVCAR_210 PET VCAR Procedure Context Exam Template

This template describes procedure context information for one PET exam.

TID PVCAR_210
PET VCAR PROCEDURE CONTEXT EXAM

Type: Non-Extensible

	NL	Relation with Parent	Value Type	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	EV (PVCAR-0100, 99GEMS, "Exam")	1	M		
2	>	CONTAINS	UIDREF	EV (110180, DCM, "Study Instance UID")	1	M		
3	>	CONTAINS	DATE	EV (G-D802, SRT, "Date")	1	M		
4	>	CONTAINS	CODE	EV (121079, DCM, "Baseline")	1	MC	Shall be present if this exam is the baseline for comparisons.	DCID (230) Yes-No

5	>	CONTAINS	NUM	EV (G-D217, SRT, "Interval")	1	M		UNITS = DCID (6046) Units of Follow-up Interval
6	>	CONTAINS	NUM	EV (8302-2, LN, “Patient Height”)	1	U		UNITS = EV (cm, UCUM, “cm”)
7	>	CONTAINS	NUM	EV (29463-7, LN, “Patient Weight”)	1	U		UNITS = EV (kg, UCUM, “kg”)
8	>	CONTAINS	TEXT	EV (T-D00A1, SRT, "Anatomical landmark")	1	U		
9	>	CONTAINS	CODE	EV (PVCAR-0300, 99GEMS, "Respiratory Gating")	1	U		
10	>	CONTAINS	INCLUDE	**DTID (PVCAR_220)** PET VCAR PET Context	1-n	M		
11	>	CONTAINS	CONTAINER	EV (PVCAR-0050, 99GEMS, “CT”)	1	M		
12	>>	CONTAINS	UIDREF	EV (112002, DCM, “Series Instance UID”)	1	M		

8.5.2.2.4 TID PVCAR_220 PET VCAR PET Context Template

This template describes PET context for a PET series.

TID PVCAR_220
PET VCAR PET CONTEXT

Type: Non-Extensible

	NL	Relation with Parent	Value Type	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	EV (PVCAR-0010, 99GEMS, "PET Context")	1	M		
2	>	CONTAINS	UIDREF	EV (112002, DCM, "Series Instance UID")	1	M		
3	>	HAS CONCEPT MOD	TEXT	EV (125010, DCM, "Identifier")	1	U		
4	>	HAS ACQ CONTEXT	DATETIME	EV (PVCAR-0006, 99GEMS, "Acquisition DateTime")	1	M		
5	>	HAS ACQ CONTEXT	CODE	EV (123001, DCM, "Radiopharmaceutical")	1	M		
6	>>	HAS PROPERTIES	CODE	EV (C-B1000, SRT, "Diagnostic Radioisotope")	1	M		
7	>>	HAS PROPERTIES	DATETIME	EV (123003, DCM, "Radiopharmaceutical Start Time")	1	M		
8	>>	HAS PROPERTIES	DATETIME	EV (123004, DCM, "Radiopharmaceutical Stop Time")	1	M		
9	>>	HAS PROPERTIES	NUM	EV (123005, DCM, "Radiopharmaceutical Volume")	1	M		
10	>>	HAS PROPERTIES	NUM	EV (123006, DCM, "Radionuclide Total Dose")	1	M		
11	>	CONTAINS	NUM	EV (F-0194E, SRT, "Blood Glucose Level")	1	U		
12	>	CONTAINS	NUM	EV (PVCAR-0090, 99GEMS, "Reference SUV Mean")	1	U		

8.5.2.2.5 TID PVCAR_300 PET VCAR Findings Template

The contents of this template describe the findings generated from PET VCAR.

TID PVCAR_300
PET VCAR FINDINGS

Type: Non-Extensible

	NL	Relation with Parent	Value Type	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	EV (121070, DCM, "Findings")	1	M		
2	>	CONTAINS	CODE	EV (R-40831, SRT, "Measurement")	1-n	M		
3	>>	HAS PROPERTIES	CODE	EV (R-4286C, SRT, "Unit")	1	M		
4	>	CONTAINS	INCLUDE	**DTID (PVCAR_310)** PET VCAR Finding	1-n	M		
5	>	CONTAINS	INCLUDE	**DTID (PVCAR_360)** PET VCAR Response Evaluation	1-n	M		

8.5.2.2.6 TID PVCAR_310 PET VCAR Finding Template

This template describes one single or multi exam finding.

TID PVCAR_310
PET VCAR FINDING

Type: Non-Extensible

	NL	Relation with Parent	Value Type	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	EV (121071, DCM, "Finding")	1	M		
2	>	CONTAINS	TEXT	EV (112039, DCM, "Tracking Identifier")	1	M		
3	>	CONTAINS	INCLUDE	**DTID (PVCAR_320)** PET VCAR Finding Exam	1-n	M		

8.5.2.2.7 TID PVCAR_320 PET VCAR Finding Exam Template

This template describes a finding in one particular exam.

TID PVCAR_320
PET VCAR FINDING EXAM

Type: Non-Extensible

	NL	Relation with Parent	Value Type	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	EV (PVCAR-0100, 99GEMS, "Exam")	1	M		
2	>	CONTAINS	UIDREF	EV (110180, DCM, "Study Instance UID")	1	M		
3	>	CONTAINS	DATE	EV (G-D802, SRT, "Date")	1	M		
4	>	CONTAINS	CODE	EV (G-C284, SRT, "Status")	1	U		**DCID (PVCAR-010)** Finding State
5	>	CONTAINS	CODE	EV (G-D7FD, SRT, "Type")	1	U		**DCID (PVCAR-020)** Accepted Finding Types or **DCID (PVCAR-030)** Rejected Finding Types
6	>	CONTAINS	CODE	EV (G-A471, SRT, "New")	1	U		**DCID (230)** Yes-No
7	>	CONTAINS	INCLUDE	**DTID (PVCAR_330)** PET VCAR Finding Exam PET Context	1	M		

8	>	CONTAINS	INCLUDE	**DTID (PVCAR_340)** PET VCAR Finding Exam CT Context	1	U		
9	>	CONTAINS	TEXT	EV (121106, DCM, "Comment")	1	U		
10	>	CONTAINS	INCLUDE	**DTID (PVCAR_410)** PET VCAR Image	1-n	U		$Image = EV (121080, DCM, "Best illustration of finding")
11	>>	HAS CONCEPT MOD	TEXT	EV (G-C27A, SRT, "View")	1	U		
12	>>	HAS CONCEPT MOD	CODE	EV (G-D7FD, SRT, "Type")	1	U		**DCID (PVCAR-040)** Image Types

8.5.2.2.8 TID PVCAR_330 PET VCAR Finding Exam PET Context Template

This template describes PET statistics of a finding in one particular exam.

TID PVCAR_330
PET VCAR FINDING EXAM PET CONTEXT

Type: Non-Extensible

	NL	Relation with Parent	Value Type	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	EV (PVCAR-0010, 99GEMS, "PET Context")	1	M		
2	>	CONTAINS	NUM	EV (G-A100, SRT, "Right")	1	U		UNITS = EV (1,UCUM,"no units")
3	>	CONTAINS	NUM	EV (G-A105, SRT, "Anterior")	1	U		UNITS = EV (1,UCUM,"no units")
4	>	CONTAINS	NUM	EV (G-A116, SRT, "Superior")	1	U		UNITS = EV (1,UCUM,"no units")
5	>	CONTAINS	TEXT	EV (ALA-084, 99GEMS, "Slice Index")	1	U		
6	>	CONTAINS	INCLUDE	**DTID (PVCAR_350)** PET VCAR Finding Statistics	1	U		$Statistics = **DCID (PVCAR-330)** PET Statistics

8.5.2.2.9 TID PVCAR_340 PET VCAR Finding Exam CT Context Template

This template describes CT statistics of a finding in one particular exam.

TID PVCAR_340
PET VCAR FINDING EXAM CT CONTEXT

Type: Non-Extensible

	NL	Relation with Parent	Value Type	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	EV (PVCAR-0050, 99GEMS, "CT")	1	M		
2	>	CONTAINS	NUM	EV (G-A100, SRT, "Right")	1	U		UNITS = EV (1,UCUM,"no units")
3	>	CONTAINS	NUM	EV (G-A105, SRT, "Anterior")	1	U		UNITS = EV (1,UCUM,"no units")
4	>	CONTAINS	NUM	EV (G-A116, SRT, "Superior")	1	U		UNITS = EV (1,UCUM,"no units")
5	>	CONTAINS	INCLUDE	**DTID (PVCAR_350)** PET VCAR Finding Statistics	1	U		$Statistics = **DCID (PVCAR-340)** CT Statistics

8.5.2.2.10 TID PVCAR_350 PET VCAR Finding Statistics Template

This template describes the general structure of one PET statistics of a finding. This structure is instantiated by inclusion of this Template with specific contextual parameters from a parent Template.

TID PVCAR_350 Parameters

Parameter Name	Parameter Usage
$Statistics	Coded term or Context Group for Concept Name of statistics
$Units	Units of statistics

TID PVCAR_350
PET VCAR FINDING STATISTICS

Type: Non-Extensible

	NL	Relation with Parent	Value Type	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			NUM	$Statistics	1	MC	XOR row 2	Units = $Units
2			TEXT	$Statistics	1	MC	XOR row 1	
3	>	HAS PROPERTIES	TEXT	EV (R-21358, SRT, "Response to Treatment")	1	U		

8.5.2.2.11 TID PVCAR_360 PET VCAR Response Evaluation Template

This template describes response evaluation.

TID PVCAR_360
PET VCAR RESPONSE EVALUATION

Type: Non-Extensible

	NL	Relation with Parent	Value Type	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	EV (112020, DCM, "Response Evaluation")	1	M		
2	>	HAS OBS CONTEXT	CODE	EV (112021, DCM, "Response Evaluation Method")	1	MC	XOR row 3	
3	>	HAS OBS CONTEXT	TEXT	EV (112021, DCM, "Response Evaluation Method")	1	MC	XOR row 2	
4	>	CONTAINS	CONTAINER	EV (R-21358, SRT, "Response to Treatment")	1-n	U		
5	>>	HAS CONCEPT MOD	TEXT	EV (125010, DCM, "Identifier")	1	M		
6	>>	HAS CONCEPT MOD	TEXT	EV (CAR-032, 99GEMS, "Description")	1	M		
7	>>	HAS CONCEPT MOD	TEXT	EV (112034, DCM, "Calculation Description")	1	M		
8	>>	HAS CONCEPT MOD	TEXT	EV (VV-035, 99GEMS, "RGB Color")	1	M		

8.5.2.2.12 TID PVCAR_400 PET VCAR General Images Template

This template describes PETVCAR general images.

TID PVCAR_400
PET VCAR GENERAL IMAGES

Type: Non-Extensible

	NL	Relation with Parent	Value Type	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	EV (VV-024, 99GEMS, "General Images")	1	U		
2	>	CONTAINS	INCLUDE	**DTID (PVCAR_410)** PET VCAR Image	1-n	U		

8.5.2.2.13 TID PVCAR_410 PET VCAR Image Template

This template describes a PET VCAR image.

TID PVCAR_410 Parameters

Parameter Name	Parameter Usage
$Image	Coded term or Context Group for Concept Name of image.

TID PVCAR_410
PET VCAR IMAGE

Type: Non-Extensible

	NL	Relation with Parent	Value Type	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			IMAGE	$Image	1	U		
2	>	HAS CONCEPT MOD	TEXT	EV (G-C27A, SRT, "View")	1	U		
3	>	HAS CONCEPT MOD	CODE	EV (G-D7FD, SRT, "Type")	1	U		**DCID (PVCAR-040)** Image Types

8.5.2.2.14 TID PVCAR_500 PET VCAR Conclusions Template

This template describes PET VCAR conclusions for a single or multiple exams.

TID PVCAR_500
PET VCAR CONCLUSIONS

Type: Non-Extensible

	NL	Relation with Parent	Value Type	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	EV (121076, DCM, "Conclusions")	1	U		
2	>	CONTAINS	TEXT	EV (121077, DCM, " Conclusions ")	1-n	U		
3	>>	HAS PROPERTIES	UIDREF	EV (110180, DCM, "Study Instance UID")	1	M		
4	>>	HAS PROPERTIES	DATE	EV (G-D802, SRT, "Date")	1	M		

8.5.2.2.15 CID PVCAR-010 Finding State

Context ID PVCAR-010

Finding State

Type: Non-Extensible Version: 20071128

Coding Scheme Designator (0008,0102)	Coding Scheme Version (0008,0103)	Code Value (0008,0100)	Code Meaning (0008,0104)
SRT		G-D2FC	Accepted
99GEMS		PVCAR-0005	Rejected
99GEMS		PVCAR-0007	Not Reviewed

8.5.2.2.16 CID PVCAR-020 Accepted Finding Types

Context ID PVCAR-020

Accepted Finding Types

Type: Non-Extensible Version: 20071128

Coding Scheme Designator (0008,0102)	Coding Scheme Version (0008,0103)	Code Value (0008,0100)	Code Meaning (0008,0104)
SRT		G-F150	T category
SRT		R-40030	N category
SRT		R-40031	M category

8.5.2.2.17 CID PVCAR-030 Rejected Finding Types

Context ID PVCAR-030

Rejected Finding Types

Type: Extensible Version: 20071128

Coding Scheme Designator (0008,0102)	Coding Scheme Version (0008,0103)	Code Value (0008,0100)	Code Meaning (0008,0104)
SRT		T-D002E	Normal anatomy
SRT		M-40000	Inflammation
SRT		T-1A040	Brown fat
SRT		G-A421	Contaminated
SRT		D9-85013	Stress related problem
SRT		R-420AE	Muscular

8.5.2.2.18 CID PVCAR-040 Image Types

Context ID PVCAR-040

Image Types

Type: Non-Extensible Version: 20071128

Coding Scheme Designator (0008,0102)	Coding Scheme Version (0008,0103)	Code Value (0008,0100)	Code Meaning (0008,0104)
SRT		G-D221	Manual
SRT		G-D231	Automatic

8.5.2.2.19 CID PVCAR-330 PET Statistics

Context ID PVCAR-330

PET Statistics

Type: Extensible Version: 20071128

Coding Scheme Designator (0008,0102)	Coding Scheme Version (0008,0103)	Code Value (0008,0100)	Code Meaning (0008,0104)
99GEMS		PVCAR-0110	SUV Max
99GEMS		PVCAR-0120	SUV Max change
99GEMS		PVCAR-0130	SUV Mean
99GEMS		PVCAR-0135	SUV Mean change
99GEMS		PVCAR-0140	Functional Volume
99GEMS		PVCAR-0150	Functional Volume change
99GEMS		PVCAR-0160	TLG
99GEMS		PVCAR-0170	TLG change
99GEMS		PVCAR-0180	Product of Diameters
99GEMS		PVCAR-0185	Product of Diameters change
99GEMS		PVCAR-0190	Glucose normalized SUV Max
99GEMS		PVCAR-0200	Glucose normalized SUV Max change
99GEMS		PVCAR-0230	Glucose normalized SUV Mean
99GEMS		PVCAR-0240	Glucose normalized SUV Mean change
99GEMS		PVCAR-0250	Background normalized SUV Max
99GEMS		PVCAR-0260	Background normalized SUV Max change
99GEMS		PVCAR-0270	Background normalized SUV Mean
99GEMS		PVCAR-0280	Background normalized SUV Mean change
SRT		G-A185	Long axis
99GEMS		PVCAR-0290	Long axis change
SRT		G-A186	Short axis
99GEMS		PVCAR-0310	Short axis change
99GEMS		PVCAR-0320	Glucose normalized TLG
99GEMS		PVCAR-0330	Glucose normalized TLG change

8.5.2.2.20 CID PVCAR-340 CT Statistics

Context ID PVCAR-340

CT Statistics

Type: Extensible Version: 20071128

Coding Scheme Designator (0008,0102)	Coding Scheme Version (0008,0103)	Code Value (0008,0100)	Code Meaning (0008,0104)
99GEMS		PVCAR-0210	Anatomical Volume
99GEMS		PVCAR-0220	Anatomical Volume change

8.5.2.2.21 PET-VCAR Codes in 99GEMS

PET-VCAR Codes in 99GEMS

Coding Scheme Designator (0008,0102)	Coding Scheme Version (0008,0103)	Code Value (0008,0100)	Code Meaning (0008,0104)
99GEMS		PVCAR-0001	PET Report
99GEMS		PVCAR-0005	Rejected
99GEMS		PVCAR-0006	Acquisition DateTime
99GEMS		PVCAR-0007	Not Reviewed
99GEMS		PVCAR-0010	PET Context
99GEMS		PVCAR-0050	CT
99GEMS		PVCAR-0090	Reference SUV Mean
99GEMS		PVCAR-0100	Exam
99GEMS		PVCAR-0110	SUV Max
99GEMS		PVCAR-0120	SUV Max change
99GEMS		PVCAR-0130	SUV Mean
99GEMS		PVCAR-0135	SUV Mean change
99GEMS		PVCAR-0140	Functional Volume
99GEMS		PVCAR-0150	Functional Volume change
99GEMS		PVCAR-0160	TLG
99GEMS		PVCAR-0170	TLG change
99GEMS		PVCAR-0180	Product of Diameters
99GEMS		PVCAR-0185	Product of Diameters change
99GEMS		PVCAR-0190	Glucose normalized SUV Max
99GEMS		PVCAR-0200	Glucose normalized SUV Max change
99GEMS		PVCAR-0210	Anatomical Volume
99GEMS		PVCAR-0220	Anatomical Volume change
99GEMS		PVCAR-0230	Glucose normalized SUV Mean
99GEMS		PVCAR-0240	Glucose normalized SUV Mean change
99GEMS		PVCAR-0250	Background normalized SUV Max
99GEMS		PVCAR-0260	Background normalized SUV Max change
99GEMS		PVCAR-0270	Background normalized SUV Mean
99GEMS		PVCAR-0280	Background normalized SUV Mean change
99GEMS		PVCAR-0290	Long axis change
99GEMS		PVCAR-0300	Respiratory Gating
99GEMS		PVCAR-0310	Short axis change
99GEMS		PVCAR-0320	Glucose normalized TLG
99GEMS		PVCAR-0330	Glucose normalized TLG change

Coding Scheme Designator (0008,0102)	Coding Scheme Version (0008,0103)	Code Value (0008,0100)	Code Meaning (0008,0104)
99GEMS		PVCAR-0500	EORTC/NCI
99GEMS		PVCAR-0600	Revised Response Criteria for Malignant Lymphoma

9. 3D MODEL INFORMATION OBJECT IMPLEMENTATION

9.1 INTRODUCTION

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

9.2 - IOD Entity-Relationship Model

9.3 - IOD Module Table

9.4 - IOD Module Definition

9.2 3D MODEL ENTITY-RELATIONSHIP MODEL

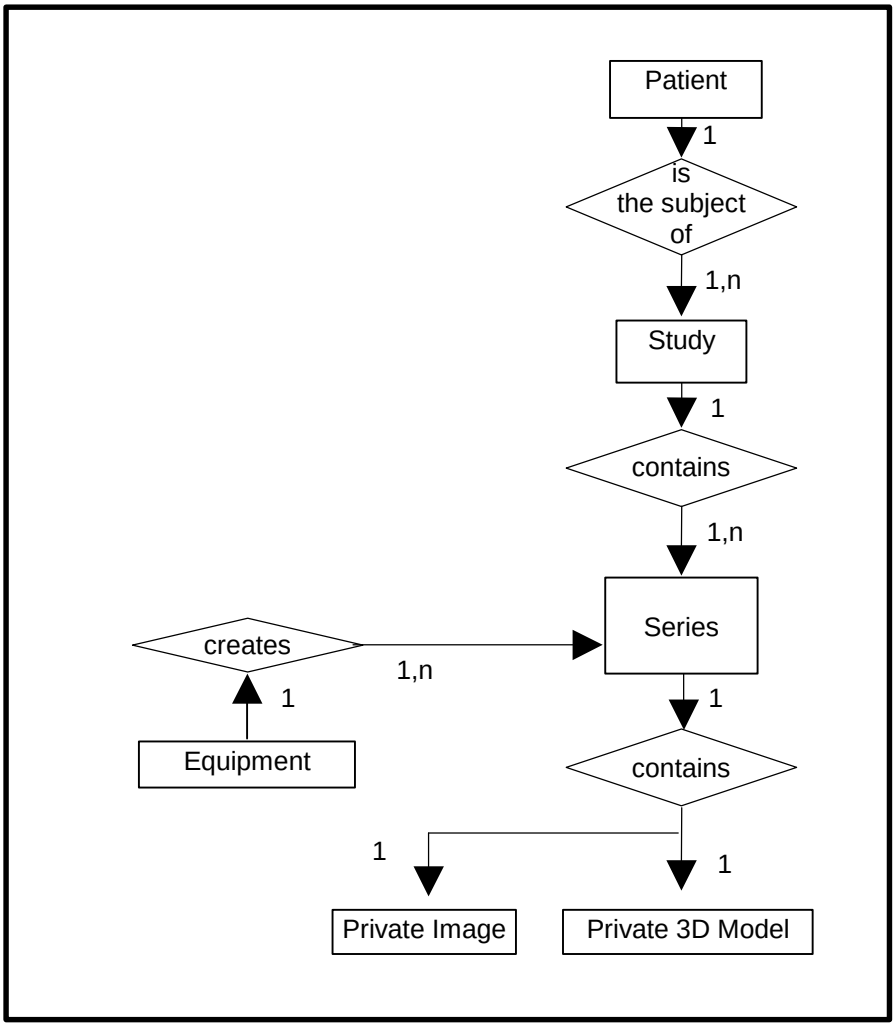
The Entity-Relationship diagram for the 3D Model interoperability schema is shown in **Illustration 3.2-1.** In this figure, the following diagrammatic convention is established to represent the information organization :

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

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

The object will always contain exactly one private image and one private 3D model. The first is a fallback for the AW viewer; the second is the heart of the object.

ILLUSTRATION 9.2-1
3D MODEL ENTITY RELATIONSHIP DIAGRAM



9.2.1 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).

9.2.1.1 Patient Entity Description

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

9.2.1.2 Study Entity Description

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

9.2.1.3 Series Entity Description

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

9.2.1.4 Equipment Entity Description

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

9.2.1.5 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.

9.2.1.6 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 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.

9.2.2 Voxtool Mapping of DICOM entities

TABLE 9.2-1
MAPPING OF DICOM ENTITIES TO VOXTOOL ENTITIES

DICOM	Voxtool Entity
Patient	Patient
Study	Exam
Series	Series
Image	Private Image

9.3 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.

The table below identifies the defined modules within the entities which comprise the 3D Model IOD. Modules are identified by Module Name.

See DICOM 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**.

The attributes description can take one of the following values :

- Generated: this attribute is written by the application,
- Generated: “XXX”: this attribute is written by the application, and its value is XXX,
- Copied: this attribute is a copy of the original (present in the original images used to generate the 3-dimensional volume),
- Removed: this attribute is not saved.
- Used: this attribute is read by the application

- Mandatory: the application may refuse to load the data if this information is missing

- Ignored: the application does not read this information.

TABLE 9.3-2
3D MODEL IOD MODULES

Entity Name	Module Name	Reference	Usage
Patient	Patient	9.4.1.1	M
Study	General Study	9.4.2.1	M
	Patient Study	9.4.2.2	U
Series	General Series	9.4.3.1	M
Equipment	General Equipment	9.4.4.1	M
Private Image	General Image	9.4.6.1	M
	Image Pixel	9.4.6.2	M
Private 3D Model	Common Private Entity	9.4.5.1	M
	Reconstruction Parameter Sequence	9.4.5.2	M
	> CT Reconstruction Parameters	9.4.5.2	C - Required if modality = CT
	> MR Reconstruction Parameters	9.4.5.2	C- Required if modality = MR
	> XA Reconstruction Parameters	9.4.5.2	C- Required if modality = XA
	Volumic Data	9.4.5.3	M
	Wireframe data	9.4.5.4	U
	SOP Common	9.4.7.1	M

9.4 INFORMATION MODULE DEFINITIONS

Please refer to DICOM Standard Part 3 (Information Object Definitions) for a description of each of the entities and modules contained within the 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 Standard Part 3 (Information Object Definitions). **Type 3 attributes that are not mentioned are not saved** by the application.

9.4.1 Common Patient Entity Modules

9.4.1.1 Patient Module

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

TABLE 9.4-1
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
Referenced Patient Sequence	(0008,1120)	3	Ignored / Copied
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
Patient's Birth Time	(0010,0032)	3	Ignored / Copied
Other Patient IDs	(0010,1000)	3	Ignored / Copied
Other Patient Names	(0010,1001)	3	Ignored / Copied
Ethnic Group	(0010,2160)	3	Ignored / Copied
Patient Comments	(0010,4000)	3	Ignored / Copied

9.4.2 Common Study Entity Modules

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

9.4.2.1 General Study Module

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

TABLE 9.4-2
GENERAL STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Study Instance UID	(0020,000D)	1	Mandatory / Copied
Study Date	(0008,0020)	2	Used / 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
Physician(s) of Record	(0008,1048)	3	Ignored / Copied
Name of Physician(s) Reading Study	(0008,1060)	3	Used / Copied
Referenced Study Sequence	(0008,1110)	3	Ignored / Copied
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
Procedure Code Sequence	(0008,1032)	3	Ignored / Copied
>Code Value	(0008,0100)	1C	
>Code Scheme Designator	(0008,0102)	1C	
>Code Meaning	(0008,0104)	1C	

9.4.2.2 Patient Study Module

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

TABLE 9.4-3
PATIENT STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Admitting Diagnoses Description	(0008,1080)	3	Ignored / Copied
Patient's Age	(0010,1010)	3	Used / Copied
Patient's Size	(0010,1020)	3	Ignored / Copied
Patient's Weight	(0010,1030)	3	Used / Copied
Occupation	(0010,2180)	3	Ignored / Copied
Additional Patient’s History	(0010,21B0)	3	Used / Copied

9.4.3 Common Series Entity Modules

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

9.4.3.1 General Series Module

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

TABLE 9.4-4
GENERAL SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	Used / Copied Defined Terms: CT = Computed Tomography MR = Magnetic Resonance XA = Xray Angiography
Series Instance UID	(0020,000E)	1	Mandatory / Generated
Series Number	(0020,0011)	2	Used / Generated
Laterality	(0020,0060)	2C	Ignored / Generated: “”
Series Date	(0008,0021)	3	Used / Generated: current date
Series Time	(0008,0031)	3	Used / Generated: current time
Performing Physicians’ Name	(0008,1050)	3	Used / Copied
Protocol Name	(0018,1030)	3	Used / Copied
Series Description	(0008,103E)	3	Used / Generated
Operators' Name	(0008,1070)	3	Used / Copied
Referenced Performed Procedure Step Sequence	(0008,1111)	3	Ignored / Removed on AW, Generated on CT/MR consoles if PPS feature is activated
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
Body Part Examined	(0018,0015)	3	Ignored / Copied
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
Smallest Pixel Value in Series	(0028,0108)	3	Ignored / Removed
Largest Pixel Value in Series	(0028,0109)	3	Ignored / Removed
Request Attributes Sequence	(0040,0275)	3	Ignored / Copied (Entire sequence copied)
>Requested Procedure Description	(0032,1060)	3	
>Requested Procedure ID	(0040,1001)	1C	
>Accession Number	(0008,0050)	3	

>Study Instance UID	(0020,000D)	3	
>Referenced Study Sequence	(0008,1110)	3	
>Requested Procedure Description	(0032,1060)	3	
>Requested Procedure Code Sequence	(0032,1064)	3	
>Reason for the Requested Procedure	(0040,1002)	3	
>Reason for Requested Procedure Code Sequence	(0040,100A)	3	
>Scheduled Procedure Step ID	(0040,0009)	1C	
>Scheduled Procedure Step Description	(0040,0007)	3	
>Scheduled Protocol Code Sequence	(0040,0008)	3	
Performed Procedure Step ID	(0040,0253)	3	Ignored / Removed on AW, Generated on CT/MR consoles if PPS feature is activated
Performed Procedure Step Start Date	(0040,0244)	3	Ignored / Removed on AW, Generated on CT/MR consoles if PPS feature is activated
Performed Procedure Step Start Time	(0040,0245)	3	Ignored / Removed on AW, Generated on CT/MR consoles if PPS feature is activated
Performed Procedure Step Description	(0040,0254)	3	Ignored / Removed on AW, Generated on CT/MR consoles if PPS feature is activated
Performed Protocol Code Sequence	(0040,0260)	3	Ignored / Removed on AW, Generated on CT/MR consoles if PPS feature is activated

9.4.4 Common Equipment Entity Modules

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

9.4.4.1 General Equipment Module

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

TABLE 9.4-5
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

9.4.5 3D Model Entity Modules

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

9.4.5.1 Common Private Entity Module

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

TABLE 9.4-6
COMMON PRIVATE ENTITY MODULE ATTRIBUTES

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

9.4.5.1.1 Common Private Entity Attribute Descriptions

9.4.5.1.1.1 Private Entity Number

Identifies the private entity instance.

9.4.5.1.1.2 Private Entity Date

Defines the creation date of this private entity.

9.4.5.1.1.3 Private Entity Time

Defines the creation time of this private entity.

9.4.5.1.1.4 Private Entity Launch Command

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

9.4.5.1.1.5 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.

9.4.5.2 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 semantical confusions.

Next table gives the reconstruction parameters that do not depend on the type of the original images used to build the 3-dimensional volume. These attributes are saved for all 3D Models. The description of GEMS private attribute is given at the end of this section.

TABLE 9.4-7
RECONSTRUCTION PARAMETER SEQUENCE MODULE ATTRIBUTES
(FOR ALL ORIGINAL IMAGES TYPES)

Attribute Name	Tag	Type	Attribute Description
Reconstruction Parameters Sequence	(0047, xx01)	1	Used / Generated
> Contrast/Bolus Agent	(0018,0010)	2	Used / Copied
> Slice thickness	(0018, 0050)	2	Used / Copied
> Spacing between Slices	(0018, 0088)	3	Used / Generated
> 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	Ignored / 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 wich corresponds to the Data Element (0x47, 0xXX01)

TABLE 9.4-8
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
Duration of scan	(0019, xx5A)	3	Used / Copied
Number of Echos	(0019, xx7E)	3	Used / Copied
Swap Phase/Freq. 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 CT 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 wich corresponds to the Data Element (0x47, 0xXX01)

TABLE 9.4-9
RECONSTRUCTION PARAMETER SEQUENCE MODULE ATTRIBUTES
(FOR CT MODALITY ORIGINAL IMAGES)

Attribute Name	Tag	Type	Attribute Description
KPV	(0018, 0060)	3	Used / Copied
Gantry Tilt	(0018, 1120)	3	Used / Copied
Exposure Time	(0018, 1150)	3	Used / Copied
X-Ray Tube Current	(0018, 1151)	3	Used / Copied
Convolution Kernel	(0018, 1210)	3	Used / Copied
Table Speed	(0019, xx23)	3	Used / Copied
Gantry Velocity	(0019, xx27)	3	Used / Copied
Axial Type	(0019, xx39)	3	Used / Copied
Delta Start Time	(0043, xx1E)	3	Used / Copied
Pitch Ratio	(0043, xx27)	3	Used / Copied
Sigma mode	(0045,xx13)	3	Used / Copied
Iboneflag	(0043,xx21)	3	Used / Copied
perisflag	(0043,xx22)	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 wich corresponds to the Data Element (0x47, 0xXX01)

TABLE 9.4-10
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

Device Serial Number	(0018, 1000)	3	Ignored / Copied
Intensifier Size	(0018, 1162)	3	Used / Copied
ip address	(0019, xx20)	1	Used / Copied
Frame of Reference UID	(0020, 0052)	3	Used / Copied
Structure Of Interest	(0031, xx01)	3	Used / Copied
Missing Frames Status	(0031, xx02)	3	Used / Copied
Anatomy	(0031, xx03))	3	Used / Copied
Volume Subtraction Mode	(0031, xx04)	1	Used / Copied
Acquisition DLX Identifier	(0047, xx80)	3	Used / 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
> SOP instance UID	(0008, 0018)	3	Used / Copied
> Series Date	(0008, 0021)	3	Used / Copied
> Acquisition Date	(0008, 0022)	3	Used / Copied
> Series Time	(0008, 0031)	3	Used / Copied
> Acquisition Time	(0008, 0032)	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
> grid	(0018, 1166)	3	Ignored / Copied
> Focal Spot	(0018, 1190)	3	Ignored / 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 Instance UID	(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
> FOV dimension double	(0019, xx0B)	3	Ignored / Copied
> Table vertical position	(0019, xx21)	3	Ignored / Copied
> Table longitudinal position	(0019, xx22))	3	Ignored / Copied
> Table lateral position	(0019, xx23)	3	Ignored / Copied
> Angle 1 increment	(0019, xx97)	3	Ignored / Copied
> Angle 2 increment	(0019, xx98)	3	Ignored / Copied
> Angle 3 increment	(0019, xx99)	3	Ignored / Copied
> Auto injection enabled	(0019, xxA4)	3	Ignored / Copied
> Injection phase	(0019, xxA5)	3	Ignored / Copied
> Injection delay	(0019, xxA6)	3	Ignored / Copied
> Reference injection frame number	(0019, xxA7)	3	Ignored / Copied
> KVp actual vector	(0019, xxAF)	3	Ignored / Copied
> mAs actual vector	(0019, xxB0)	3	Ignored / Copied
> pw actual vector	(0019, xxC2)	3	Ignored / Copied
> Preselected pivot rotation speed	(0019, xxC5)	3	Ignored / Copied
> 3Dspin expected number of frames	(0019, xxCA)	1	Ignored / Copied
> spectral filter thickness	(0019, xxC4)	3	Ignored / Copied
> Instance Number	(0020, 0013)	3	Ignored / 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	Used / Copied, required if Transform Count > 0
> Transform Translation Vector	(0047, xx9B)	1C	Used / Copied, required if Transform Count > 0
> Transform Label	(0047, xx9C)	1C	Used / Copied, required if Transform Count > 0

9.4.5.2.1 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 foolowing documents :

- DLX related private attributes : see **Advantx DLX DICOM 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).

9.4.5.2.1.1 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.

9.4.5.2.1.2 Acquisition DLX identifier

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

9.4.5.2.1.3 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.

9.4.5.2.1.4 Frame Count

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

9.4.5.2.1.5 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.

9.4.5.2.1.6 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 whitin 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.

9.4.5.2.1.7 Exposure Time List

Defines the value of exposure time used to acquire each Frame of the Acquisition Series. Since this value may change whitin 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.

9.4.5.2.2 Number of injections

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

9.4.5.2.3 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.

9.4.5.2.4 Used frames

Identifies the Frames of the current Series that were used to chieve 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 »).

9.4.5.2.5 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.

9.4.5.2.6 Reconstruction Algorithm Version

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

9.4.5.2.7 DLX Calibration Date

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

9.4.5.2.8 DLX Calibration Time

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

9.4.5.2.9 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 ».

9.4.5.2.10 Transform Count

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

9.4.5.2.11 Transform Sequence

Each Item of this Sequence attribute describes a geometrical tranform. 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.

9.4.5.2.12 Transform Rotation Matrix

Defines the rotation matrix that corresponds to the current transform.

9.4.5.2.13 Transform Translation Vector

Defines the translation vector that corresponds to the current transform.

9.4.5.2.14 Transform Label

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

9.4.5.3 Volumic Data Module

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

TABLE 9.4-11
VOLUMIC DATA MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Volume Color	(0047, xx49)	3	Used / Generated
Volume Voxel Count	(0047, xx50)	1	Used / Generated
Volume Segment Count	(0047, xx51)	1	Used / Generated
Volume Slice Size	(0047, xx53)	1	Used / Generated
Volume Slice Count	(0047, xx54)	1	Used / Generated
Volume Threshold Value	(0047, xx55)	2C	Used / Generated
Volume Voxel Ratio	(0047, xx57)	1	Used / Generated
Volume Voxel Size	(0047, xx58)	1	Used / Generated
Volume Z Position Size	(0047, xx59)	1	Used / Generated
Volume Base Line	(0047, xx60)	1	Used / Generated
Volume Center Point	(0047, xx61)	1	Used / Generated
Volume Skew Base	(0047, xx63)	1	Used / Generated

Volume Registration Transform Rotation Matrix	(0047, xx64)	3	Used / Generated
Volume Registration Transform Translation Vector	(0047, xx65)	3	Used / Generated
Volume Tilt	(0047, xx66)	3	Used / Generated: required for CT
Volume Upper Left High Corner RAS	(0047, xxC0)	1	Used / Generated
Volume Slice to RAS Rotation Matrix	(0047, xxC1)	1	Used / Generated
Volume Upper Left High Corner TLOC	(0047, xxC2)	1	Used / Generated
Volume Volume Segment List	(0047, xxD1)	1	Used / Generated
Volume Gradient List	(0047, xxD2)	1	Used / Generated
Volume Density List	(0047, xxD3)	1	Used / Generated
Volume Z Position List	(0047, xxD4)	1	Used / Generated
Volume Original Index List	(0047, xxD5)	1	Used / Generated
Volume Name(s)	(0047,xxF4)	1	Used / Generated
Min original density	(0047,xxF5)	3	Not used
Max original density	(0047,xxF6)	3	Not used
Min Converted Density	(0047,xxF7)	3	Not used
Max Converted Density	(0047,xxF8)	3	Not used
Protocol Name	(0047,xxFE)	1C	Used / Generated, if this object saves the state of a CardIQ Express protocol
Protocol Title	(0047,xxFF)	1C	Used / Generated, if this object saves the state of a CardIQ Express protocol
Protocol Film Name	(0047,xxF9)	1C	Used / Generated, if this object saves the state of a CardIQ Express protocol
Protocol Resolution	(0047,xxFA)	1C	Used / Generated, if this object saves the state of a CardIQ Express protocol
Phase Number (percent)	(0047,xxFB)	2C	Used / Generated, if this object saves the state of a CardIQ Express protocol
Volume Registered Phases List	(0047,xxFD)	1C	Used / Generated, if this object saves the state of a CardIQ Express protocol or if this phase has been registered
Volume Midscan Times List	(0047,xxFC)	3	Copied from image tags (0019, GEMS_ACQU_01, xx24)
Cardiac Reconstruction Algorithm List	(0057,xx01)	3	Copied from image tags (0045, GEMS_HELIOS_01, xx30)
Average Heart Rate for Image List	(0057,xx02)	3	Copied from image tags (0045, GEMS_HELIOS_01, xx31)
Temporal Resolution List	(0057,xx03)	3	Copied from image tags (0045, GEMS_HELIOS_01, xx32)
Layout Preset	(0057,xx04)	3	Used / Generated: describe the layout of the views.

9.4.5.3.1 Volumic Data Attribute Descriptions

9.4.5.3.1.1 Volume Color

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

9.4.5.3.1.2 Voxel Count

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

9.4.5.3.1.3 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-valuated : each value gives the number of segments of each volume.

9.4.5.3.1.4 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.

9.4.5.3.1.5 Threshold Value

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

9.4.5.3.1.6 Ratio

Defines the ratio between slice spacing and voxel size.

9.4.5.3.1.7 Voxel size

Defines the size of a voxel (cubic element).

9.4.5.3.1.8 Z Position size

Defines the z location of the original slices.

9.4.5.3.1.9 Base Line

3x3 matrix that defines the slices orientation.

9.4.5.3.1.10 Center Point

Defines the coordinates of the volume center point.

9.4.5.3.1.11 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.

9.4.5.3.1.12 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.

9.4.5.3.1.13 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.

9.4.5.3.1.14 Slice To RAS Rotation Matrix

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

9.4.5.3.1.15 Upper Left High Corner TLOC

9.4.5.3.1.16 Segment List

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

9.4.5.3.1.17 Gradient List

Describes the gradients for each voxel of the Segment List.

9.4.5.3.1.18 Density List

Defines the value of each voxel of the Segment List.

9.4.5.3.1.19 Z Position List

Defines the Z location of original slices.

9.4.5.3.1.20 Original Index List

Defines the rank index list of original slices.

9.4.5.3.1.21 Protocol Name, Protocol Title, Protocol Film Name

Defines the names of the protocols used to create the vessel tracking.

9.4.5.3.1.22 Phase Number

Defines the phase number of the tracked phase. These are integer numbers encoded in Little Endian.

9.4.5.3.1.23 Volume Registered Phase List

Defines the phase number used to register this volume. These are integer numbers encoded in Little Endian.

9.4.5.3.1.24 Volume Midscan Times List

Compiled array of midscan time from original images

9.4.5.3.1.25 Cardiac Reconstruction Algorithm List

Compiled array of Cardiac Reconstruction Algorithm from original images

9.4.5.3.1.26 Average Heart Rate for Image List

Compiled array of Average Heart Rate from original images

9.4.5.3.1.27 Temporal Resolution List

Compiled array of Temporal Resolution from original images

9.4.5.4 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 9.4-12
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

9.4.5.4.1 wireframe Attribute Descriptions

9.4.5.4.1.1 Wireframe Count

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

9.4.5.4.1.2 Location System

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

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

Required if Wireframe Count has a non-null value.

9.4.5.4.1.3 Wireframe List

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

9.4.5.4.1.4 Wireframe Name

Label that identifies the wirefame (type 3 attribute).

9.4.5.4.1.5 Wireframe Group Name

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

9.4.5.4.1.6 Wireframe Color

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

9.4.5.4.1.7 Wireframe Attributes

Defines the attributes of the wireframe.

9.4.5.4.1.8 Wireframe Point Count

Defines the number of points that compose this wireframe..

9.4.5.4.1.9 Wireframe Timestamp

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

9.4.5.4.1.10 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.

9.4.5.4.1.11 Point Coordinates

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

9.4.6 Common Image Entity Modules

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

9.4.6.1 General Image Module

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

TABLE 9.4-13
GENERAL IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Image Number	(0020,0013)	2	Ignored / Generated
Image Date	(0008,0023)	3	Used / Copied
Image Time	(0008,0033)	3	Used / Copied
Image Comments	(0020,4000)	3	Used / Copied
Image Type	(0008,0008)	3	Used / Generated: "DERIVED\SECONDARY"
Source Image Sequence	(0008,2112)	3	Used / Generated : when saving a AVA tracking, this points to the original images used to compute the filtered 3D model

> Referenced SOP Class UID	(0008,1150)	1C	Used / Generated
> Referenced SOP Instance UID	(0008,1155)	1C	Used / Generated

9.4.6.2 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 9.4-14
IMAGE PIXEL MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Samples per Pixel	(0028,0002)	1	Ignored / Generated:1 or 3
Photometric Interpretation	(0028,0004)	1	Generated: « MONOCHROME2 » or « RGB »
Rows	(0028,0010)	1	Ignored / Generated
Columns	(0028,0011)	1	Ignored / Generated
Bits Allocated	(0028,0100)	1	Ignored / Generated: 8 or 16
Bits Stored	(0028,0101)	1	Ignored / Generated: 8 or 12
High Bit	(0028,0102)	1	Ignored / Generated: 7 or 15
Pixel Representation	(0028,0103)	1	Ignored / Generated: 0
Planar Configuration	(0028,0006)	1C	Ignored / Generated: 0, Required for RGB icons
Pixel Data	(7FE0,0010)	1	Ignored / Generated

9.4.7 General Modules

The SOP Common Module is mandatory for all DICOM IODs.

9.4.7.1 VOI LUT Module

TABLE 9.4-15
VOI LUT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Window Center	(0028,1050)	3	Used / Copied
Window Width	(0028,1051)	3	Used / Copied

9.4.7.2 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 9.4-16
SOP COMMON MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008,0016)	1	Used / Generated: « 1.2.840.113619.4.26 »
SOP Instance UID	(0008,0018)	1	Ignored / Generated
Specific Character Set	(0008,0005)	3	Used / Copied

9.5 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 9.5-17
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
ip address	(0019, xx20)	LO	1
Table vertical position	(0019, xx21)	DS	1
Table longitudinal position	(0019, xx22)	DS	1
Table lateral position	(0019, xx23)	DS	1
Private Creator « GEMS_DL_IMG_01 »	(0019, 00xx)	LO	1
FOV dimension double	(0019, xxOB)	DS	1-2
Angle 1 increment	(0019, xx97)	DS	1-N
Angle 2 increment	(0019, xx98)	DS	1-N

Angle 3 increment	(0019, xx99)	DS	1-N
Auto injection enabled	(0019, xxA4)	CS	1
Injection phase	(0019, xxA5)	CS	1
Injection delay	(0019, xxA6)	DS	1
Reference injection frame number	(0019, xxA7)	IS	1
kVp actual vector	(0019, xxAF)	DS	1-N
mAs actual vector	(0019, xxBO)	DS	1-N
pw actual vector	(0019, xxC2)	DS	1-N
Preselected pivot rotation speed	(0019, xxC5)	FL	1
3Dspin expected number of frames	(0019, xxCA)	IS	1
spectral filter thickness	(0019, xxC4)	IS	1
Private Creator « GEMS_3D_XA_01 »	(0031, 00xx)	LO	1
Structure Of Interest	(0031, xx01)	CS	1
Missing Frames Status	(0031, xx02)	CS	1
Anatomy	(0031, xx03)	CS	1
Volume Subtraction Mode	(0031, xx04)	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)	SS	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
Volume Tilt	(0047, xx66)	DS	1
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
Volume Name(s)	(0047,xxF4)	LO	1-N
Min original density	(0047,xxF5)	DS	1-N
Max original density	(0047,xxF6)	DS	1-N
Min Converted Density	(0047,xxF7)	DS	1-N
Max Converted Density	(0047,xxF8)	DS	1-N
Protocol Film Name	(0047,xxF9)	LO	1
Protocol Resolution	(0047,xxFA)	US	1
Phase Number (percent)	(0047,xxFB)	US	1
Volume midscan times list	(0047,xxFC)	OB	1
Volume Registered Phases List	(0047,xxFD)	OB	1
Protocol Name	(0047,xxFE)	LO	1
Protocol Title	(0047,xxFF)	LO	1
Private Creator « GEMS_ADWSoft_3D2 »	(0057, 00xx)	LO	1
Cardiac Reconstruction Algorithm List	(0057,xx01)	OB	1
Average Heart Rate for Image List	(0057,xx02)	OB	1
Temporal Resolution List	(0057,xx03)	OB	1
Layout View Preset	(0057,xx04)	UT	1

10. RT STRUCTURE SET INFORMATION OBJECT IMPLEMENTATION 1

10.1 INTRODUCTION

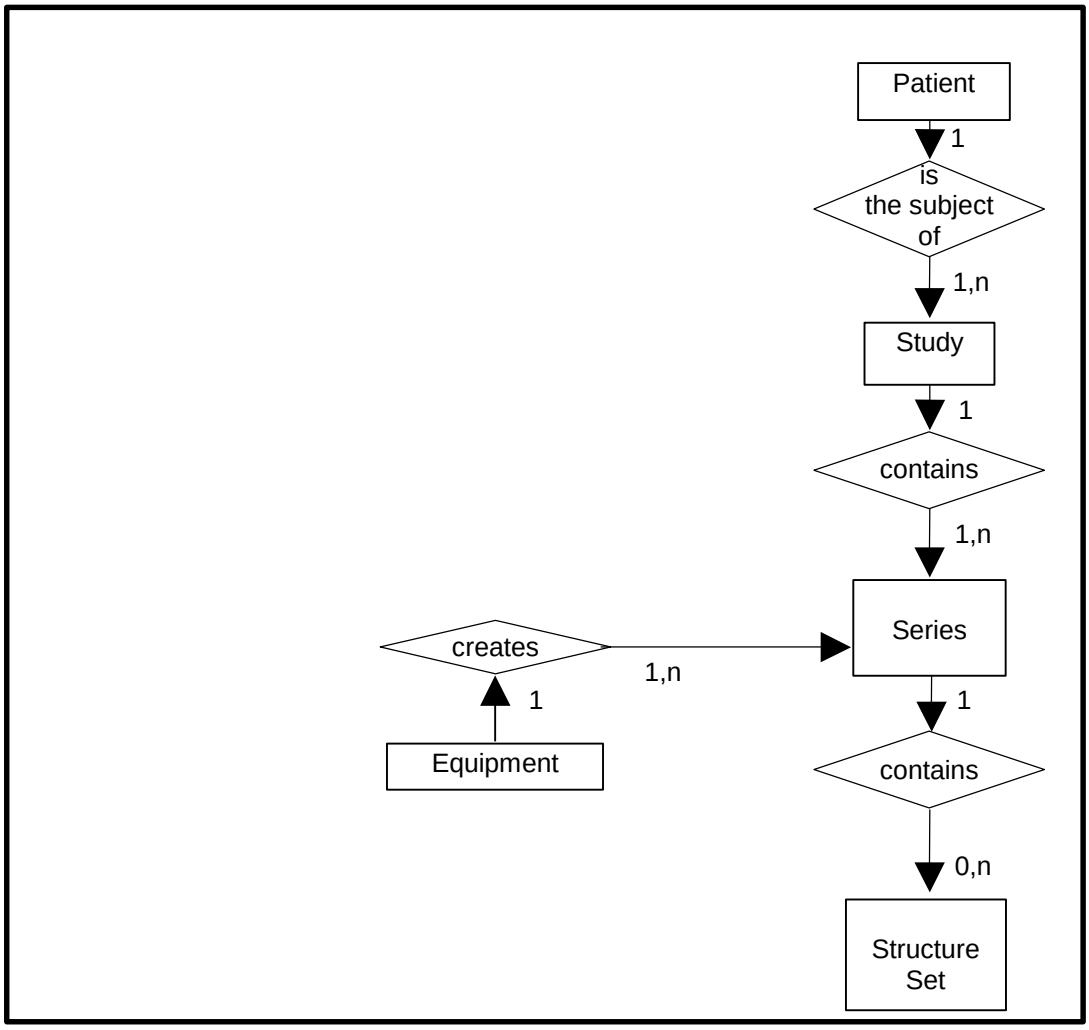
This section describes the RT Structure Set Information Object Implementation generated from PET VCAR. See below for RTSS generated by other protocols than PET VCAR.

10.1.1 RTSS Entity Relationship model

The Entity-Relationship diagram for the RTSS interoperability schema is shown in the illustration below**.** 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 RTSS can have up to n RTSSs per Series, but the Patient to Study relationship has 1 Patient for each Study (a Patient can have more than one Study on the system, however each Study will contain all of the information pertaining to that Patient).



10.1.2 ENTITY DESCRIPTIONS

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

10.1.3 Volume Viewer Mapping of DICOM entities

TABLE 10.1-1
MAPPING OF DICOM ENTITIES TO VOLUME VIEWER ENTITIES

DICOM	Volume Viewer Entity
Patient	Patient
Study	Exam
Series	Series
Structure Set	Structure Set
Equipment	Equipment

10.2 IOD MODULE TABLE

Within an entity of the DICOM RTSS 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.

The table below identifies the defined modules within the entities which comprise the DICOM RTSS IOD. Modules are identified by Module Name.

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

10.3 IOD MODULE TABLE

The RT Structure Set Information Object Implementation comprises the modules of the following tables. They are generated from PET VCAR. See below for RTSS generated by other protocols than PET VCAR.

TABLE 11-1
RTSS IOD MODULES

Information Entity	Module	Usage	Reference
Patient	Patient	Used	10.4.2
	Clinical Trial Subject	Not used	N/A
Study	General Study	Used	10.4.3
	Patient Study	Not used	N/A
	Clinical Trial Study	Not used	N/A
Series	RT Series	Used	10.4.4
	Clinical Trial Series	Not used	N/A
Equipment	General Equipment	Used	10.4.5
Structure Set	Structure Set	Used	10.4.6
	ROI Contour	Used	10.4.7
	RT ROI Observations	Used	10.4.8
	Approval	Not used	N/A
SOP Common	SOP Common	Used	10.4.1

10.4 RT STRUCTURE SET INFORMATION MODULE DEFINITIONS

Please refer to DICOM Part 3 (Information Object Definitions) for a description of each of the entities, modules, and attributes contained within the RTSS Information Objects.

10.4.1 SOP COMMON MODULE ATTRIBUTES C.12.1

Attribute Name	Element Tag	Type	Notes
Specific Character Set	0008, 0005	1C	Copied
SOP Class UID	0008, 0016	1	"1.2.840.10008.5.1.4.1.1.481.3"
SOP Instance UID	0008, 0018	1	Generated

10.4.2 PATIENT MODULE ATTRIBUTES C.7.1.1

Attribute Name	Element Tag	Type	Notes

Patient's Name	0010, 0010	2	Patient's name from Original images
Patient's ID	0010, 0020	2	Patient's ID from Original images
Patient's Birth Date	0010, 0030	2	Patient's birth date from Original images
Patient's Sex	0010, 0040	2	Patient's sex from Original images

10.4.3 GENERAL STUDY MODULE ATTRIBUTES C.7.2.1

Attribute Name	Element Tag	Type	Notes
Study Instance UID	0020, 000D	1	Study UID from Original images
Study Date	0008, 0020	2	Study date from Original images
Study Time	0008, 0030	2	Study time from Original images
Referring Physician's Name	0008, 0090	2	Referring Physician's Name from Original images
Study ID	0020, 0010	2	Study ID from DICOM images
Accession Number	0008, 0050	2	Accession Number from Original images
Study Description	0008, 1030	3	Study Description from Original images

10.4.4 RT SERIES MODULE ATTRIBUTES C.8.8.1

Attribute Name	Element Tag	Type	Notes
Modality	0008, 0060	1	"RTSTRUCT"
Series Instance UID	0020, 000E	1	Generated
Series Number	0020, 0011	2	"103"
Series Description	0008, 103E	3	"PETVCAR RTSS - <description given at save>"

10.4.5 GENERAL EQUIPMENT MODULE ATTRIBUTES C.7.5.1

Attribute Name	Element Tag	Type	Notes
Manufacturer	0008, 0070	2	"GE MEDICAL SYSTEMS"
Manufacturer's Model Name	0008, 1090	3	"PET VCAR"
Station Name	0008, 1010	3	Hostname
Device Serial Number	0018, 1000	3	Vxtlhostid
Software Versions	0018, 1020	3	Generated

10.4.6 STRUCTURE SET MODULE ATTRIBUTES C.8.8.5

Attribute Name	Element Tag	Type	Notes
Structure Set Label	3006, 0002	1	"PETVCAR_RTSS".
Structure Set Name	3006, 0004	3	"PETVCAR_RTSS"
Structure Set Date	(3006,0008)	2	Ignored / Generated: current time
Structure Set Time	(3006,0009)	2	Ignored / Generated: current time
Referenced Frame of Reference Sequence	3006, 0010	3	Contains items corresponding to the CT and PET series of the ROIs.
>Frame of Reference UID	0020, 0052	1C	Frame of Reference UID from Original images
>RT Referenced Study Sequence	3006, 0012	3	Sequence contains one item, corresponding to the study containing the series of the ROIs
>>Referenced SOP Class UID	0008, 1150	1C	"1.2.840.10008.3.1.2.3.1"
>>Referenced SOP Instance UID	0008, 1155	1C	Study Instance UID of the referenced study
>>RT Referenced Series Sequence	3006, 0014	1C	Contains items corresponding to the referenced series
>>>Series Instance UID	0020, 000E	1C	Series instance UID of the referenced series
>>>Contour Image Sequence	3006, 0016	1C	Sequence will contain all images in the series, even if some images, or all have no corresponding contour.
>>>>Referenced SOP Class UID	0008, 1150	1C	SOP Class UID of the the image
>>>>Referenced SOP Instance UID	0008, 1155	1C	SOP Instance UID of the image

Structure Set ROI Sequence	3006, 0020	3	Contains items corresponding to the ROIs
>ROI Number	3006, 0022	1C	ROI index in Volume Viewer
>Referenced Frame of Reference UID	3006, 0024	1C	Reference ID of the ROI's volume (PET)
>ROI Name	3006, 0026	2C	ROI index in Volume Viewer
>ROI Volume	3006, 002C	3	Functional volume of the ROI in cm3
>ROI Generation Algorithm	3006, 0036	2C	"SEMIAUTOMATIC"
>ROI Description	3006, 0028	3	Description given by the user
>ROI Generation Description	3006, 0038	3	Name of the algorithm used to generate the ROI

10.4.7 ROI CONTOUR MODULE ATTRIBUTES C.8.8.6

Attribute Name	Element Tag	Type	Notes
ROI Contour Sequence	3006, 0039	1	Each item in it corresponds to an ROI defined in the Structure Set ROI Sequence (3006,0020).
>Referenced ROI Number	3006, 0084	1	The ROI Number the contour corresponds to
>ROI Display Color	3006, 002A	3	"255", "0", "0" - color given in RGB
>Contour Sequence	3006, 0040	3	Provided if ROI has contour.
>>Contour Image Sequence	3006, 0016	3	Sequence will always contain exactly one item (referenced CT image)
>>>Referenced SOP Class UID	0008, 1150	1C	Class UID of the referenced CT series
>>>Referenced SOP Instance UID	0008, 1155	1C	Instance UID of the referenced CT series
>>Contour Geometric Type	3006, 0042	1C	"CLOSED_PLANAR"
>>Number of Contour Points	3006, 0046	1C	Generated
>>Contour Data	3006, 0050	1C	List of coordinates of the points in the contour. Positions are given in DICOM coordinate system; Z coordinates always fit the referenced acquisition slice.

10.4.8 RT ROI OBSERVATIONS MODULE ATTRIBUTES C.8.8.8

Attribute Name	Element Tag	Type	Notes
RT ROI Observations Sequence	3006, 0080	1	Each item corresponds to an ROI defined in the Structure Set ROI Sequence (3006,0020).
>Observation Number	3006, 0082	1	Index of the ROI the observation sequence corresponds to
>Referenced ROI Number	3006, 0084	1	Index of the ROI the observation sequence corresponds to
>RT ROI Interpreted Type	3006, 00A4	2	Empty
>ROI_Interpreter	3006, 00A6	2	Empty

11. RT STRUCTURE SET INFORMATION OBJECT IMPLEMENTATION 2

11.1 INTRODUCTION

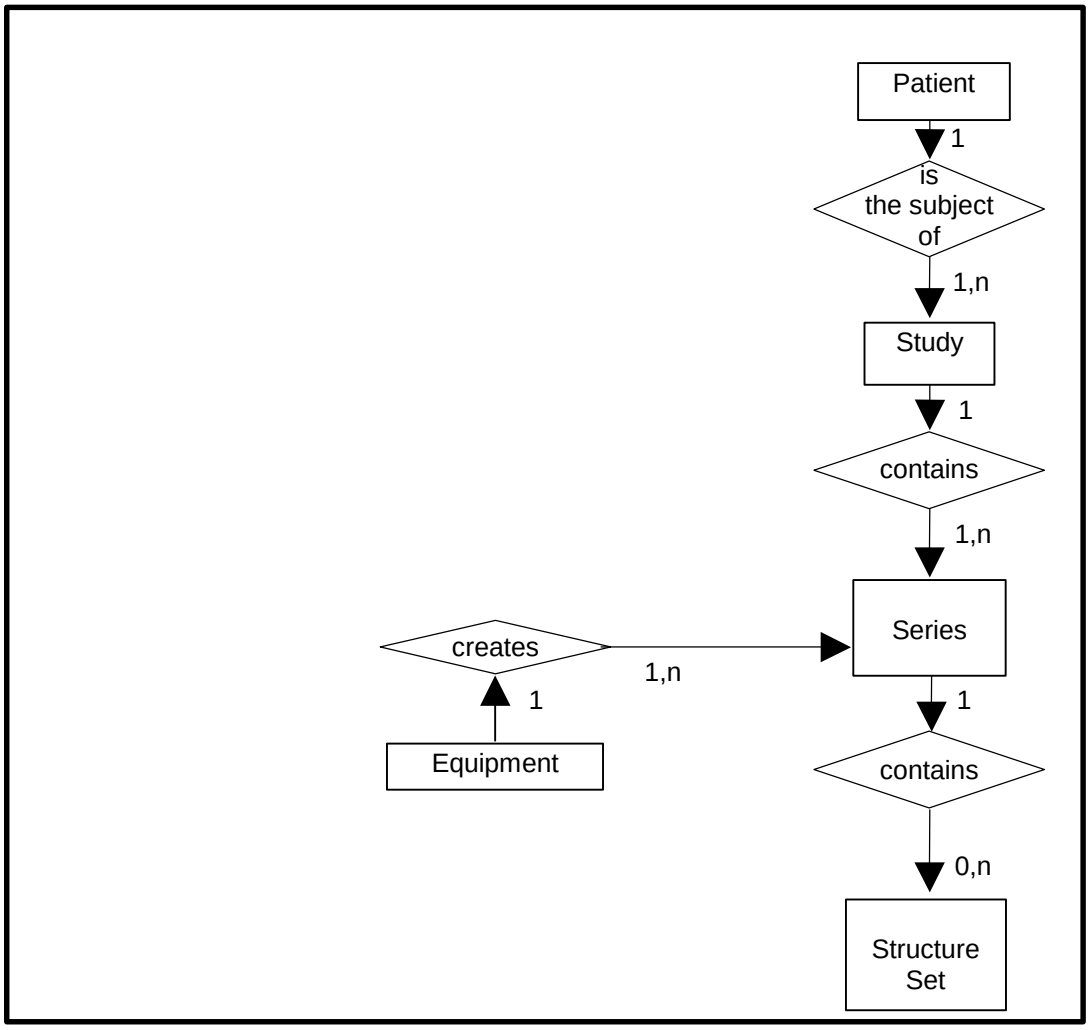
This RT Structure Set Information Object read or generated by the manual contouring tool functionality of different Volume Viewer protocols (currently only from Integrated Registration protocols).

11.1.1 RTSS Entity Relationship model

The Entity-Relationship diagram for the RTSS interoperability schema is shown in the illustration below**.** 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 RTSS can have up to n RTSSs per Series, but the Patient to Study relationship has 1 Patient for each Study (a Patient can have more than one Study on the system, however each Study will contain all of the information pertaining to that Patient).



11.1.2 ENTITY DESCRIPTIONS

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

11.1.3 Volume Viewer Mapping of DICOM entities

TABLE 11.1-1
MAPPING OF DICOM ENTITIES TO VOLUME VIEWER ENTITIES

DICOM	Volume Viewer Entity
Patient	Patient
Study	Exam
Series	Series
Structure Set	Structure Set
Equipment	Equipment

11.2 IOD MODULE TABLE

Within an entity of the DICOM RTSS 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.

The table below identifies the defined modules within the entities which comprise the DICOM RTSS IOD. Modules are identified by Module Name.

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

IE	Module	Reference
Patient	Patient	11.3.1
	Clinical Trial Subject	11.3.2
Study	General Study	11.4.1
	Patient Study	11.4.2
	Clinical Trial Study	11.4.3
Series	RT Series	11.5.1
	Clinical Trial Series	11.5.2
Equipment	General Equipment	11.6.1
Structure Set	Structure Set	11.7.1
	ROI Contour	11.7.2
	RT ROI Observations	11.7.3
	Approval	11.7.4
	SOP Common	11.7.5

11.3 IE PATIENT

11.3.1 Patient Module

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

11.3.2 Clinical Trial Subject module

No attributes used / generated.

11.4 IE STUDY

11.4.1 General Study Module

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

11.4.2 Patient Study Module

No attributes used / generated.

11.4.3 Clinical Trial Study Module

No attributes used / generated.

11.5 IE SERIES

11.5.1 RT Series Module

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	Used / Generated. Enumerated Value: RTSTRUCT = RT Structure Set
Series Instance UID	(0020,000E)	1	Used / Generated
Series Number	(0020,0011)	2	Ignored / Generated
Series Description	(0008,103E)	3	Ignored / Generated

11.5.2 Clinical Trial Series Module

Ignored / no attributes generated.

11.6 IE EQUIPMENT

11.6.1 General Equipment Module

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

11.7 IE STRUCTURE SET

11.7.1 Structure Set Module

Attribute Name	Tag	Type	Attribute Description
Structure Set Label	(3006,0002)	1	Ignored / Generated. “INTREG_RTSS”
Structure Set Name	(3006,0004)	3	Used / Generated. User-defined name for Structure Set.
Structure Set Date	(3006,0008)	2	Ignored / Generated: current time
Structure Set Time	(3006,0009)	2	Ignored / Generated: current time
Referenced Frame of Reference Sequence	(3006,0010)	3	Used / Generated
>Frame of Reference UID	(0020,0052)	1	Used / Generated
>RT Referenced Study Sequence	(3006,0012)	3	Used / Generated
>>Referenced SOP Class UID	(0008,1150)	1	Used / Generated
>>Referenced SOP Instance UID	(0008,1155)	1	Used / Generated
>>RT Referenced Series Sequence	(3006,0014)	1	Used / Generated
>>>Series Instance UID	(0020,000E)	1	Used / Generated
>>>Contour Image Sequence	(3006,0016)	1	Used / Generated
>>>>Referenced SOP Class UID	(0008,1150)	1	Used / Generated
>>>>Referenced SOP Instance UID	(0008,1155)	1	Used / Generated
Structure Set ROI Sequence	(3006,0020)	3	Used / Generated
>ROI Number	(3006,0022)	1	Used / Generated
>Referenced Frame of Reference UID	(3006,0024)	1	Used / Generated
>ROI Name	(3006,0026)	2	Used / Generated
>ROI Generation Algorithm	(3006,0036)	2	Ignored / Generated. Defined Terms: MANUAL = user-entered ROI

11.7.2 ROI Contour Module

Attribute Name	Tag	Type	Attribute Description
ROI Contour Sequence	(3006,0039)	1	Used / Generated
>Referenced ROI Number	(3006,0084)	1	Used / Generated
>ROI Display Color	(3006,002A)	3	Used / Generated
>Contour Sequence	(3006,0040)	3	Used / Generated
>>Contour Image Sequence	(3006,0016)	3	Ignored / Generated
>>>Referenced SOP Class UID	(0008,1150)	1	Ignored / Generated
>>>Referenced SOP Instance UID	(0008,1155)	1	Ignored / Generated
>>Contour Geometric Type	(3006,0042)	1	Used / Generated. Enumerated Value: CLOSED_PLANAR = closed contour
>>Number of Contour Points	(3006,0046)	1	Used / Generated
>>Contour Data	(3006,0050)	1	Used / Generated.

11.7.3 RT ROI Observations Module

Attribute Name	Tag	Type	Attribute Description
RT ROI Observations Sequence	(3006,0080)	1	Ignored / Generated

>Observation Number	(3006,0082)	1	Ignored / Generated
>Referenced ROI Number	(3006,0084)	1	Ignored / Generated
>RT ROI Interpreted Type	(3006,00A4)	2	Ignored / Generated: “” (attribute containing empty string)
>ROI Interpreter	(3006,00A6)	2	Ignored / Generated: “” (attribute containing empty string)

11.7.4 Approval Module

No attributes used/generated.

11.7.5 SOP Common Module

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008,0016)	1	Used / Generated
SOP Instance UID	(0008,0018)	1	Used / Generated
Specific Character Set	(0008,0005)	1C	Ignored / Generated
Instance Creation Date	(0008,0012)	3	Used / Generated: current time.
Instance Creation Time	(0008,0013)	3	Used / Generated: current time.
Instance Creator UID	(0008,0014)	3	Used to check if RTSS has been generated by Advantage Sim 3.0 or 4.0, which are not supported. Not Generated.
SOP Instance Status	(0100,0410)	3	Ignored /Generated. Enumerated Values: AO (authorized original)
SOP Authorization Date and Time	(0100,0420)	3	Ignored / Generated: current time.

12. KEY OBJECT SELECTION INFORMATION OBJECT IMPLEMENTATION

12.1 INTRODUCTION

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

12.2 - KEY OBJECT SELECTION Entity-Relationship Model

12.3 - KEY OBJECT SELECTION-IOD MODULE TABLE

12.4 - KEY OBJECT SELECTION -INFORMATION MODULE DEFINITIONS

12.5 - KEY OBJECT SELECTION – TEMPLATE IDENTIFICATION

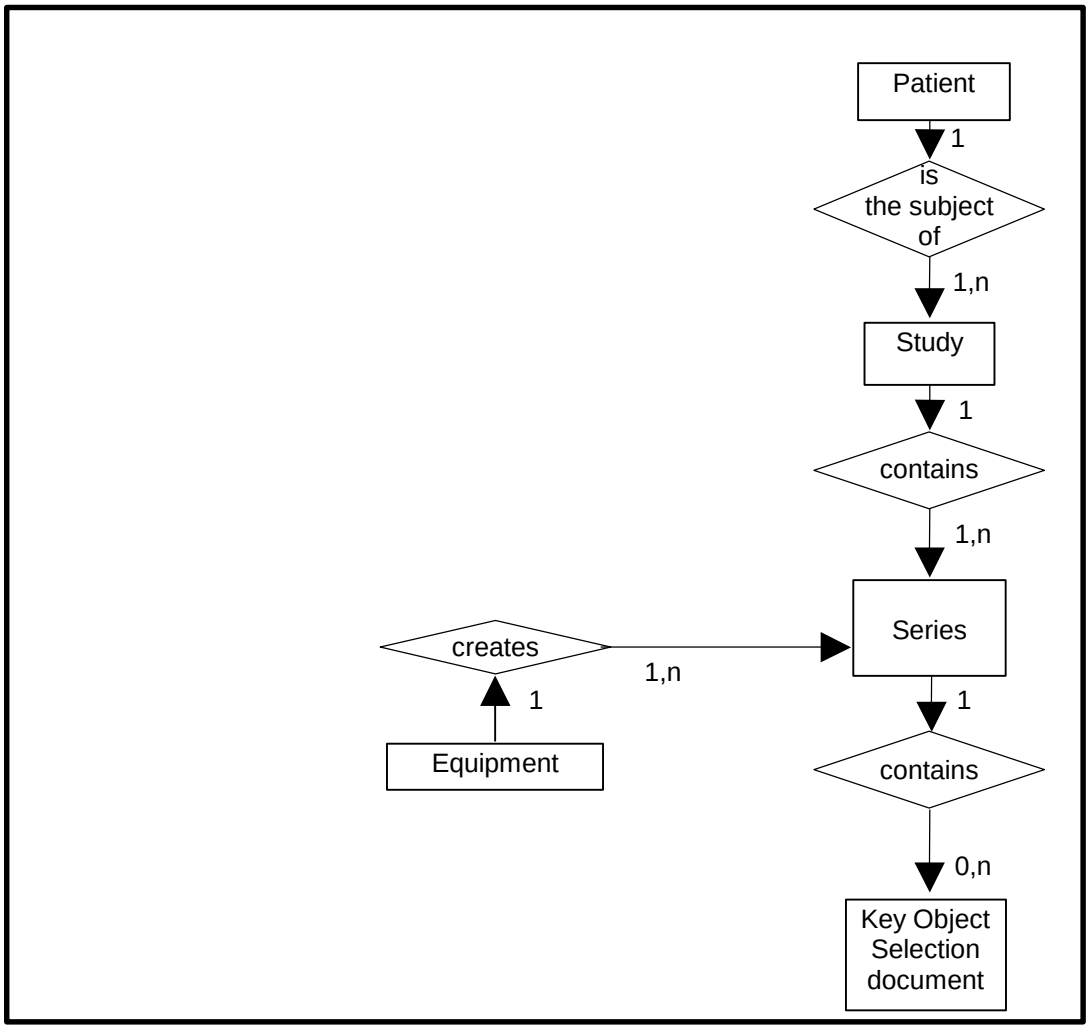
12.2 KEY OBJECT SELECTION ENTITY-RELATIONSHIP MODEL

The Entity-Relationship diagram for the Key Object Selection interoperability schema is shown in **Illustration 12.2.1.** In this figure, the following diagrammatic convention is established to represent the information organization:

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

The relationships are fully defined with the maximum number of possible entities in the relationship shown. In other words, the relationship between Series and Image can have up to n Images per Series, but the Study to Patient relationship has 1 Patient for each Study (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 12.2-1
KEY OBJECT SELECTION IMAGE ENTITY RELATIONSHIP DIAGRAM



12.2.1 ENTITY DESCRIPTIONS

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

12.2.2 Volume Viewer Mapping of DICOM entities

TABLE 12.2-1
MAPPING OF DICOM ENTITIES TO VOLUME VIEWER ENTITIES

DICOM	Volume Viewer Entity
Patient	Patient
Study	Exam
Series	Series
Equipment	Equipment
Key Object Selection document	Key Object Selection document

12.3 KEY OBJECT SELECTION-IOD MODULE TABLE

Within an entity of the DICOM KEY OBJECT SELECTION 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 12.3.1 identifies the defined modules within the entities which comprise the DICOM KEY OBJECT SELECTION IOD. Modules are identified by Module Name.

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

TABLE 12.3-1
KEY OBJECT SELECTION DOCUMENT IOD MODULES

Entity Name	Module Name	Reference
Patient	Patient	**12.4.1.1**
	Specimen Identification	**N/A**
	Clinical Trial Subject	**N/A**
Study	General Study	**12.4.2.1**
	Patient Study	**12.4.2.2**
	Clinical Trial Study	**N/A**
Series	Key Object Document Series	**12.4.3.1**
	Clinical Trial Series	**N/A**
Equipment	General Equipment	**12.4.4.1**
Document	Key Object Document	**12.4.5.1**
	SR document Content	**12.4.5.2**
	SOP Common	**12.4.6.1**

12.4 KEY OBJECT SELECTION -INFORMATION MODULE DEFINITIONS

Please refer to DICOM Standard Part 3 (Information Object Definitions) for a description of each of the entities and modules contained within the KEY OBJECT SELECTION 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 from where these values are obtained. It should be noted that they are the same ones as defined in the DICOM Standard Part 3 (Information Object Definitions).

The Key Object Selection IOD described here is the one generated by the applications 'Viewer' and 'Filmer' of Advantage Workstation on which the application is running.

In the following chapter, all new study, series and image instance UID are generated from Volume Viewer base UID: 1.2.840.113619.2.80.

12.4.1 Common Patient Entity Modules

12.4.1.1 Patient Module

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

TABLE 12.4-1
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

12.4.2 Common Study Entity Modules

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

12.4.2.1 General Study Module

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

TABLE 12.4-2
GENERAL STUDY MODULE ATTRIBUTES

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

12.4.2.2 Patient Study Module

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

TABLE 12.4-3
PATIENT STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Patient's Age	(0010,1010)	3	Original
Patient's Size	(0010,1020)	3	Original
Patient's Weight	(0010,1030)	3	Original

12.4.3 Key Object Document Series Entity Modules

The following Key Object Document Series IE Modules are common to all Composite Image IODs that reference the Key Object Document Series IE.

12.4.3.1 Key Object Document Series Module

This section specifies the attributes that identify and describe general information about the Key Object Document Series within a Study.

TABLE 12.4-4
KEY OBJECT SELECTION DOCUMENT SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	KO
Series Instance UID	(0020,000E)	1	Generated
Series Number	(0020,0011)	1	Generated
Series Description	(0008,103E)	3	"Of Interest"
Series Date	(0008,0021)	3	Not present
Series Time	(0008,0031)	3	Not present
Referenced Performed Procedure Step Sequence	(0008,1111)	2	Empty

12.4.4 Common Equipment Entity Modules

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

12.4.4.1 General Equipment Module

This section specifies the attributes that identify and describe the piece of equipment that produced a Series of Images.

TABLE 12.4-5
GENERAL EQUIPMENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Manufacturer	(0008,0070)	2	GE MEDICAL SYSTEMS
Institution Name	(0008,0080)	3	Hospital Name provided on the platform
Station Name	(0008,1010)	3	Host name provided on the platform
Manufacturer's Model Name	(0008,1090)	3	Copied from source header.
Software Versions	(0018,1020)	3	Software version build identifier

12.4.5 Key Object document Entity Modules

The following Key Object document Modules are common to all Composite Image IODs that reference the Image IE.

12.4.5.1 Key Object document

This section specifies the attributes that identify and describe the Key Object document.

TABLE 12.4-6
KEY OBJECT DOCUMENT GENERAL MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Instance Number	(0020, 0013)	1	Generated
Content Date	(0008, 0023)	1	Generated at the date when the Key Object is created
Content Time	(0008, 0033)	1	Generated at the time when the Key Object is created
Referenced Request Sequence	(0040,A370)	1C	N/A
Current Requested Procedure Evidence Sequence	(0040,A375)	1C	List of images referenced within the Key Object Selection
> Study Instance UID	(0020,000D)	1	Refer to (0040,A375)
> Referenced Series Sequence	(0008,1115)	1	Refer to (0040,A375)
>> Series Instance UID	(0020,000E)	1	Refer to (0040,A375)
>> Referenced SOP Sequence	(0008,1199)	1	Refer to (0040,A375)
>>> Referenced SOP Class UID	(0008,1150)	1	Refer to (0040,A375)
>>> Referenced SOP Instance UID	(0008,1155)	1	Refer to (0040,A375)

12.4.5.2 SR Document Content Module

This section specifies the attributes that identify and describe the SR Document content

TABLE 12.4-7
SR DOCUMENT CONTENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Value Type	(0040, A040)	1	CONTAINER
Concept Name code Sequence	(0040, A043)	1C	Describe Title in DCID(7010) Key Object Selection Document Titles. See 12.5.4 Note: For Volume Viewer, title is forced to "Of Interest"
> Code Value	(0008, 0100)	1C	See (0040, A043) Sequence
> Coding Scheme Designator	(0008, 0102)	1C	See (0040, A043) Sequence
> Code Meaning	(0008, 0104)	1C	See (0040, A043) Sequence
Continuity Of Content	(0040, A050)	1C	SEPARATE
Content Template Sequence	(0040, A504)	1C	Template that describes the content of the content item
> Mapping Resource	(0008, 0105)	1	DCMR
> Template Identifier	(0040, DB00)	1	2010
Observation Date Time	(0040, A032)	1C	Generated at the date and time when the Key Object is created
Content Sequence	(0040, A730)	1C	Content of the DICOM KEY OBJECT SELECTION – See 12.5

12.4.6 General Modules

The SOP Common Module is mandatory for all DICOM IODs.

12.4.6.1 SOP Common Module

This section defines the Attributes that 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 12.4-4
SOP COMMON MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008,0016)	1	1.2.840.10008.5.1.4.1.1.88.59
SOP Instance UID	(0008,0018)	1	Generated from GE Based UID, <station configuration> and timestamp.
Specific Character Set	(0008,0005)	1C	Used / Copied Only the "ISO_IR 100" character sets are supported.

12.5 KEY OBJECT SELECTION – TEMPLATE IDENTIFICATION

This section describes the Key Object Selection Template – TID 2010

This template describes how the SR Document Content Module of the Key Object Selection Information Object Definition is constrained. This template is the standard TID 2010.

12.5.1 TID 2010 Key Object Selection

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	DCID(7010) Key Object Selection Document Title	1	M		Root node
2	>	HAS CONCEPT MOD	CODE	EV (113011, DCM, "Document Title Modifier")	1-n	U		Not used
3	>	HAS CONCEPT MOD	CODE	EV (113011, DCM, "Document Title Modifier")	1	UC	IF Row 1 Concept Name = (113001, DCM, "Rejected for Quality Reasons") or (113010, DCM," Quality Issue")	DCID (7011)
4	>	HAS CONCEPT MOD	CODE	EV (113011, DCM, "Document Title Modifier")	1	MC	IF Row 1 Concept Name = (113013, DCM, "Best In Set")	DCID (7012)
5	>	HAS CONCEPT MOD	INCLUDE	DTID(1204) Language of Content Item and Descendants	1	U		Not used
6	>	HAS OBS CONTEXT	INCLUDE	DTID(1002) Observer Context	1-n	U		Present
7	>	CONTAINS	TEXT	EV(113012, DCM, ”Key Object Description”)	1	U		“Of Interest”
8	>	CONTAINS	IMAGE	Purpose of Reference shall not be present	1-n	MC		Present

12.5.2 TID 1002 Observer Context

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1		HAS OBS CONTEXT	CODE	EV (121005,DCM, “Observer Type”)	1	MC		EV (121006,DCM, “Person”)
2		HAS OBS CONTEXT	INCLUDE	DTID (1003) Person observer identifying attributes	1	MC		

12.5.3 TID 1003 Person Observer Identifying Attributes

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			PNAME	EV (121008,DCM, “Person Observer Name”)	1	M		Name of the current user
2			TEXT	EV (121009,DCM, “ Person Observer’s Organization Name”)	1	U		Hospital Name provided on the platform

12.5.4 Extension of CID 7010 Key Object Selection Document Title

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
DCM	113000	Of Interest
DCM	113001	Rejected for Quality Reasons
DCM	113002	For Referring Provider
DCM	113003	For Surgery
DCM	113004	For Teaching
DCM	113005	For Conference
DCM	113006	For Therapy
DCM	113007	For Patient
DCM	113008	For Peer Review
DCM	113009	For Research
DCM	113010	Quality Issue
DCM	113013	Best In Set
DCM	113018	For Printing
DCM	113020	For Report Attachment
DCM	113030	Manifest
DCM	113031	Signed Manifest
DCM	113032	Complete Study Content
DCM	113033	Signed Complete Study Content
DCM	113034	Complete Acquisition Content
DCM	113035	Signed Complete Acquisition Content
DCM	113036	Group of Frames for Display

13. SPATIAL REGISTRATION INFORMATION OBJECT

13.1 INTRODUCTION

This section specifies the use of the DICOM Spatial Registration IOD to represent the information included in Spatial Registration Object produced by this implementation

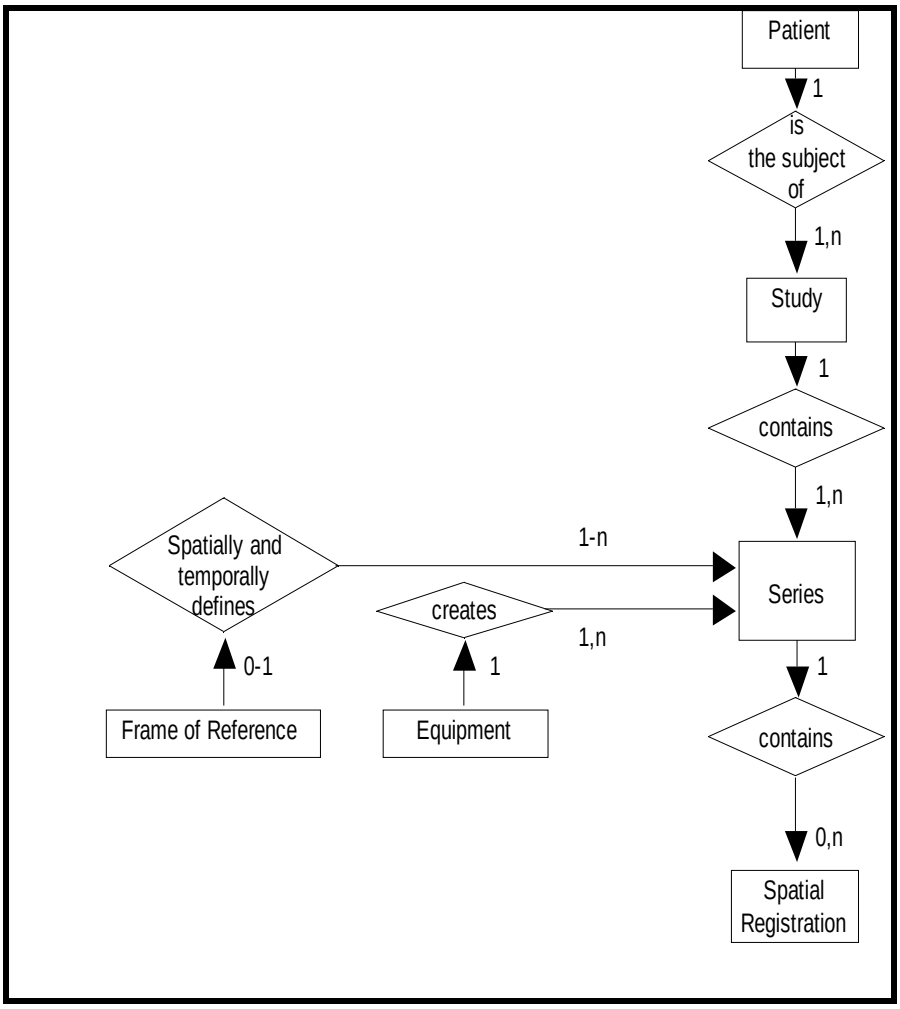
13.1.1 Spatial Information Object Entity-Relationship model

The Entity-Relationship diagram for the Spatial Registration schema is shown in **Illustration** 13.1.1-1**.** 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 Study to Patient relationship has 1 Patient for each Study (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 13.1.1-1
SPATIAL REGISTRATION OBJECT ENTITY-RELATIONSHIP



13.1.2 ENTITY DESCRIPTIONS

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

13.1.3 Volume Viewer Mapping of DICOM entities

TABLE 13.1-1
MAPPING OF DICOM ENTITIES TO VOLUME VIEWER ENTITIES

DICOM	Volume Viewer Entity
Patient	Patient
Study	Exam
Series	Series
Equipment	Equipment
Frame of Reference	Frame of Reference
Spatial Registration	Spatial Registration

13.2 IOD MODULE TABLE

Within an entity of the DICOM Spatial Registration 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.

The table below identifies the defined modules within the entities which comprise the DICOM Spatial Registration IOD. Modules are identified by Module Name.

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

Table 13.2-1 SPATIAL REGISTRATION IOD MODULES

IE	Module	Reference
Patient	Patient	13.3.1
	Specimen Identification	13.3.2
	Clinical Trial Subject	13.3.3
Study	General Study	13.4.1
	Patient Study	13.4.2
	Clinical Trial Study	13.4.3
Series	General Series	13.5.1
	Clinical Trial Series	13.5.2
	Spatial Registration Series	13.5.3
Frame of Reference	Frame of Reference	13.6.1
Equipment	General Equipment	13.7.1
Spatial Registration	Spatial Registration	13.8.1
General	Common Instance Reference	13.9.1
	SOP Common	13.9.2

13.3 IE PATIENT

13.3.1 Patient Module

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

13.3.2 Specimen Identification Module

No attributes generated.

13.3.3 Clinical Trial Subject

No attributes generated.

13.4 IE STUDY

13.4.1 General Study Module

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

13.4.2 Patient Study

No attributes generated.

13.4.3 Clinical Trial Study

No attributes generated.

13.5 IE SERIES

13.5.1 General Series Module

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	Generated. Defined Terms: REG = Registration Object (This attribute also part of Spatial Registration Series Module)
Series Instance UID	(0020,000E)	1	Generated To generate a unique ID, the process concatenates the Implementation Root UID, serial number (computed from the MAC address), the process ID number, the timestamp and a counter incremented each time.
Series Number	(0020,0011)	2	Generated
Series Date	(0008,0021)	3	Generated: current date
Series Time	(0008,0031)	3	Generated: current time
Series Description	(0008,103E)	3	Generated
Patient Position	(0018,5100)	2C	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

13.5.2 Clinical Trial Series Module

No attributes generated.

13.5.3 Spatial Registration Series Module

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	Generated. Defined Terms: REG = Registration Object (This attribute also part of General Series Module)

13.6 IE FRAME OF REFERENCE

13.6.1 Frame of Reference Module

Attribute Name	Tag	Type	Attribute Description
Frame of Reference UID	(0020,0052)	1	Generated.
Position Reference Indicator	(0020,1040)	2	Generated: “” (empty string)

13.7 IE EQUIPMENT

13.7.1 General Equipment Module

Attribute Name	Tag	Type	Attribute Description
Manufacturer	(0008,0070)	2	Generated: “GE MEDICAL SYSTEMS”
Station Name	(0008,1010)	3	Generated
Manufacturer's Model Name	(0008,1090)	3	Generated
Device Serial Number	(0018,1000)	3	Generated
Software Versions	(0018,1020)	3	Generated

13.8 IE SPATIAL REGISTRATION

13.8.1 Spatial Registration Module

Attribute Name	Tag	Type	Attribute Description
Content Date	(0008,0023)	1	Generated. Current date
Content Time	(0008,0033)	1	Generated. Current time
Instance Number	(0020,0013)	1	Generated (This attribute also part of SOP Common Module)
Content Label	(0070,0080)	1	Generated
Content Description	(0070,0081)	2	Generated
Content Creator’s Name	(0070,0084)	2	Generated

Registration Sequence	(0070,0308)	1	Generated. Contains 2 items
> Matrix Registration Sequence	(0070,0309)	1	Generated
>> Matrix Sequence	(0070,030a)	1	Generated
>>> Frame of Reference Transformation Matrix Type	(0070,030c)	1	Generated. “RIGID”
>>> Frame of Reference Transformation Matrix	(3006,00C6)	1	Generated
>> Registration Type Code Sequence	(0070,030d)	1	Generated
>>> [Code Sequence Macro]		1	Code sequence 125025 DCM “Visual Alignment”
> Referenced Image Sequence	(0008,1140)	1	Generated
>> Referenced SOP Class UID	(0008,1150)	1	Generated
>> Referenced SOP Instance UID	(0008,1155)	1	Generated

13.9 IE GENERAL

13.9.1 Common Instance Reference

Attribute Name	Tag	Type	Attribute Description
Referenced Series Sequence	(0008,1115)	1	Generated. Contains 2 items
> Series Instance UID	(0020,000e)	1	Generated
> Referenced Instance Sequence	(0008,114a)	1	Generated
>> Referenced SOP Class UID	(0008,1150)	1	Generated
>> Referenced SOP Instance UID	(0008,1155)	1	Generated
Studies Containing Other Referenced Instances Sequence	(0008,1200)	1C	Generated if if this Instance references Instances in other Studies
>Study Instance UID	(0020,000D)	1	Generated
>Referenced Series Sequence	(0008,1115)	1	Generated. Contains 2 items
>> Series Instance UID	(0020,000e)	1	Generated
>> Referenced Instance Sequence	(0008,114a)	1	Generated
>>> Referenced SOP Class UID	(0008,1150)	1	Generated
>>> Referenced SOP Instance UID	(0008,1155)	1	Generated

13.9.2 SOP Common Module

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008,0016)	1	Used / Generated
SOP Instance UID	(0008,0018)	1	Used / Generated
Specific Character Set	(0008,0005)	1C	Generated.
Instance Creation Date	(0008,0012)	3	Generated: current date
Instance Creation Time	(0008,0013)	3	Generated: current time
Instance Number	(0020,0013)	3	Generated (This attribute also part of Spatial Registration Module)