GE Healthcare

Technical Publications

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Revision 2

Volume Viewer and its applications (Release 10.x) CONFORMANCE STATEMENT for DICOM

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RECORD OF CHANGES

Revision	Version	Date	Author	Description of content changed	Reason for change / change control number
1	1	October 13, 2010	Csongor Nagy	Initial version of document	-
1	2	December 17, 2010	Csongor Nagy	Fixes made based on HII document DOC0896458	DOC0896458
1	3	December 21, 2010	Csongor Nagy	Fixes made based on lines 81, 113, 158, 168, 199 and 229 from HII document DOC0896458	DOC0896458
2	1	January 17, 2011	Csongor Nagy	Added and set the tags Issuer of Patient ID (0010,0021), Other Patient IDs (0010,1000), Other Patient Names (0010,1001) and Other Patient IDs Sequence (0010,1002) as Removed in table 8.3-1 and 12.4-1 Added the tag Other Patient Names (0010,1001) in 10.4.2, 11.4.1 and 13.3.1	INTge 21561

CONFORMANCE STATEMENT OVERVIEW

Volume Viewer is a software application designed to be used on the Advantage Windows workstation, so networking and media storage features are inherited from this platform. Volume Viewer uses DICOM images to reconstruct 3-dimensional volumes, and the views of these 3-dimensional volumes displayed by the application can be saved in DICOM format (Secondary Capture or modality reformatted images), which can be loaded and displayed by other GEHC applications (such as the Image Viewer) or by other non-GE applications conformant to the DICOM Standard. Volume Viewer is also capable to load and display Secondary Capture images saved by Volume Viewer or by Filmer, an application running on the same platform which generates some outputs, specifically SC. Furthermore this application can save Structured Report objects to archive the post processing results, can load and save contours in RT Structure Set objects, is capable to save two series' relative position in Spatial Registration objects and is able to save Key Object Selections to mark selected images.

Table 0.1 provides an overview of the network services supported by Volume Viewer.

Table 0.1 – NETWORK SERVICES

SOP Classes	User of Service (SCU)	Provider of Service (SCP)
	Object output (write)	Object input (read)
CT Image Storage	Yes	Yes
MR Image Storage	Yes	Yes
Secondary Capture Image Storage	Yes	Yes (only those generated by Volume Viewer or Filmer)
Nuclear Medicine Image Storage	No	Yes
Spatial Registration Storage	Yes	No
Enhanced SR	Yes	No
Key Object Selection Document	Yes	No
Positron Emission Tomography Image Storage	Yes	Yes
RT Structure Set Storage	Yes	Yes

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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 GEHC equipment compliance to the DICOM requirements.

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

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

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

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

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

Section 8 (SR Information Object Implementation), which specifies the GEHC 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 GEHC equipment description of the private implementation of the 3D information Object.

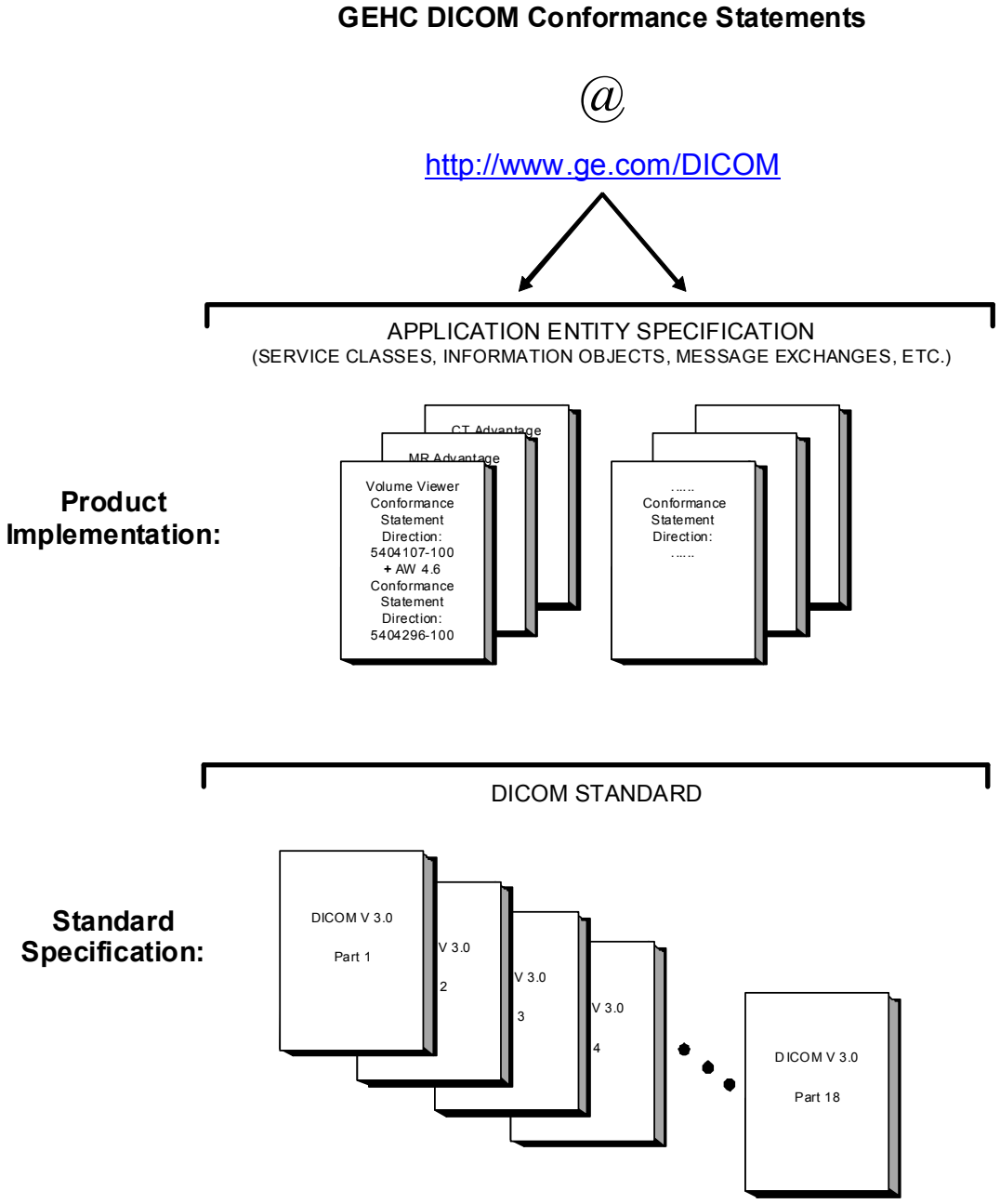
Section 10 and 11 (RTSS Information Object Implementation), which specifies the GEHC equipment description of the implementation of the RTSS information Object.

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

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

1.2 OVERALL DICOM CONFORMANCE STATEMENT DOCUMENT STRUCTURE

The Documentation Structure of the GEHC 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: ***5404107-100***

This DICOM Conformance Statement documents the DICOM Conformance Statement and Technical Specification required to interoperate with the GEHC network interface.

The GEHC 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 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 1752
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.

1.4 SCOPE AND FIELD OF APPLICATION

It is the intent of this document to provide an unambiguous specification for GEHC implementations. This specification, called a Conformance Statement, includes a DICOM Conformance Statement and is necessary to ensure proper processing and interpretation of GEHC medical data exchanged using DICOM. The GEHC Conformance Statements are available to the public.

The reader of this DICOM Conformance Statement should be aware that different GEHC devices are capable of using different Information Object Definitions. For example, a GEHC 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 GEHC implementation. If the user encounters unspecified private data elements while parsing a GEHC 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 GEHC 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 GEHC 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

NEMA PS3:	Digital Imaging and Communications in Medicine (DICOM) Standard, available free at http://medical.nema.org/
AW 4.6 DCS:	AW 4.6 DICOM Conformance Statement, direction number 5404296-100.
Innova 3DXR DCS:	Innova 3DXR 1.1 DICOM Conformance Statement, direction number 5342650-100.
DLX DCS:	Advantx DLX DICOM Conformance Statement, direction 2142506-100.
HiSpeed Advantage DCS:	HiSpeed Advantage CT/i Conformance Statement, direction 2162114-100.
GSI Viewer DCS:	Gemstone Spectral Images Viewer DICOM Conformance Statement, DOC0636569

1.7 DEFINITIONS

Informal definitions are provided for the following terms used in this Conformance Statement. The DICOM Standard is the authoritative source for formal definitions of these terms.

Abstract Syntax – the information agreed to be exchanged between applications, generally equivalent to a Service/Object Pair (SOP) Class. Examples: Verification SOP Class, Modality Worklist Information Model Find SOP Class, Computed Radiography Image Storage SOP Class.

Application Entity (AE) – an end point of a DICOM information exchange, including the DICOM network or media interface software; i.e., the software that sends or receives DICOM information objects or messages. A single device may have multiple Application Entities.

Application Entity Title – the externally known name of an *Application Entity*, used to identify a DICOM application to other DICOM applications on the network.

Application Context – the specification of the type of communication used between *Application Entities*. Example: DICOM network protocol.

Association – a network communication channel set up between *Application Entities*.

Attribute – a unit of information in an object definition; a data element identified by a *tag*. The information may be a complex data structure (Sequence), itself composed of lower level data elements. Examples: Patient ID (0010,0020), Accession Number (0008,0050), Photometric Interpretation (0028,0004), Procedure Code Sequence (0008,1032).

Information Object Definition (IOD) – the specified set of *Attributes* that comprise a type of data object; does not represent a specific instance of the data object, but rather a class of similar data objects that have the same properties. The *Attributes* may be specified as Mandatory (Type 1), Required but possibly unknown (Type 2), or Optional (Type 3), and there may be conditions associated with the use of an Attribute (Types 1C and 2C). Examples: MR Image IOD, CT Image IOD, Print Job IOD.

Joint Photographic Experts Group (JPEG) – a set of standardized image compression techniques, available for use by DICOM applications.

Media Application Profile – the specification of DICOM information objects and encoding exchanged on removable media (e.g., CDs)

Module – a set of *Attributes* within an *Information Object Definition* that are logically related to each other. Example: Patient Module includes Patient Name, Patient ID, Patient Birth Date, and Patient Sex.

Negotiation – first phase of *Association* establishment that allows *Application Entities* to agree on the types of data to be exchanged and how that data will be encoded.

Presentation Context – the set of DICOM network services used over an *Association*, as negotiated between *Application Entities*; includes *Abstract Syntaxes* and *Transfer Syntaxes*.

Protocol Data Unit (PDU) – a packet (piece) of a DICOM message sent across the network. Devices must specify the maximum size packet they can receive for DICOM messages.

Security Profile – a set of mechanisms, such as encryption, user authentication, or digital signatures, used by an *Application Entity* to ensure confidentiality, integrity, and/or availability of exchanged DICOM data

Service Class Provider (SCP) – role of an *Application Entity* that provides a DICOM network service; typically, a server that performs operations requested by another *Application Entity* (*Service Class User*). Examples: Picture Archiving and Communication System (image storage SCP, and image query/retrieve SCP), Radiology Information System (modality worklist SCP).

Service Class User (SCU) – role of an *Application Entity* that uses a DICOM network service; typically, a client. Examples: imaging modality (image storage SCU, and modality worklist SCU), imaging workstation (image query/retrieve SCU)

Service/Object Pair (SOP) Class – the specification of the network or media transfer (service) of a particular type of data (object); the fundamental unit of DICOM interoperability specification. Examples: Ultrasound Image Storage Service, Basic Grayscale Print Management.

Service/Object Pair (SOP) Instance – an information object; a specific occurrence of information exchanged in a *SOP Class*. Examples: a specific x-ray image.

Tag – a 32-bit identifier for a data element, represented as a pair of four digit hexadecimal numbers, the "group" and the "element". If the "group" number is odd, the tag is for a private (manufacturer-specific) data element. Examples: (0010,0020) [Patient ID], (07FE,0010) [Pixel Data], (0019,0210) [private data element]

Transfer Syntax – the encoding used for exchange of DICOM information objects and messages. Examples: *JPEG* compressed (images), little endian explicit value representation.

Unique Identifier (UID) – a globally unique "dotted decimal" string that identifies a specific object or a class of objects; an ISO-8824 Object Identifier. Examples: Study Instance UID, SOP Class UID, SOP Instance UID.

Value Representation (VR) – the format type of an individual DICOM data element, such as text, an integer, a person's name, or a code. DICOM information objects can be transmitted with either explicit identification of the type of each data element (Explicit VR), or without explicit identification (Implicit VR); with Implicit VR, the receiving application must use a DICOM data dictionary to look up the format of each data element.

1.8 SYMBOLS AND ABBREVIATIONS

AE Application Entity

AET Application Entity Title

CR Computed Radiography

CT Computed Tomography

DICOM Digital Imaging and Communications in Medicine

DX	Digital X-ray
GEHC	General Electric HealthCare
GSI	Gemstone Spectral Imaging
GSPS	Grayscale Softcopy Presentation State
IOD	Information Object Definition
KO	Key Object Selection
LUT	Look-up Table
MD	Material Decomposition (Density)
MG	Mammography (X-ray)
MR	Magnetic Resonance Imaging
NM	Nuclear Medicine
O	Optional (Key Attribute)
PACS	Picture Archiving and Communication System
PET	Positron Emission Tomography
R	Required (Key Attribute)
RF	Radiofluoroscopy
RT	Radiotherapy
SC	Secondary Capture
SCP	Service Class Provider
SCU	Service Class User
SOP	Service-Object Pair
SR	Structured Reporting
U	Unique (Key Attribute)
US	Ultrasound
VAV	Volume Auto View, application on CT scanner to display the 3D volume while the CT images are reconstructed during an acquisition
VR	Value Representation
XA	X-ray Angiography

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 used 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, also referred to as Voxtool, 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 reconstruct 3-dimensional volumes. 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 GEHC applications (such as the Image Viewer) or by other non-GE applications conformant to the DICOM Standard.

Additionally, the complete information of a 3-dimensional volume can be saved in DICOM format using 3D Save State based on Secondary Capture objects. These objects can be loaded on Volume Viewer at a later date for follow-up processing. For legacy purposes Volume Viewer can load 3-dimensional volumes from another DICOM format, called 3D Model, which uses a private DICOM Information Object, but discontinued to be saved by Volume Viewer due to compatibility reasons.

Volume Viewer also uses several additional DICOM formats. Structured Report objects' private implementation is used to generate reports of the post processing, to archive its results. RT Structure Set objects are generated and loaded by Volume Viewer in order to save the contours created by the user in PET VCAR and IR applications. Also the IR application creates Spatial Registration objects to save the relative position of two image series registered together. Volume Viewer is capable to save Key Object Selection objects to mark the images with high relevance for diagnosis.

Volume Viewer is a post processing application running on different platforms (acquisition platforms, PACS, AW) and all networking features are provided by these, while Volume Viewer loads, displays, processes and saves diagnostically relevant data.

For a complete description of the networking conformance, refer to the AW4.6 conformance statement (see section 1.6 REFERENCES). 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.

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).

SOP Class Name	SOP Class UID	Input	Output	Remarks
CT Image Storage	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 listed in section 1.6 REFERENCES. Starting from VV 10.x, MD CT Images which are created by the GSI Viewer Application are also supported. Additional details can be found in the GSI Viewer DICOM Conformance Statement listed in section 1.6 REFERENCES.
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	Yes	Yes	
Nuclear Medicine Image Storage	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.
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128	Yes	Yes	
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Yes	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).
Enhanced SR	1.2.840.10008.5.1.4.1.1.88.22	No	Yes	Supported through the SRDom library.
GE Private 3D Model Storage	1.2.840.113619.4.26	Yes	Yes	Private Object
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3	Yes	Yes	These objects are used for the purpose of saving the contouring data from PET VCAR and IR applications.
Key Object Selection Document	1.2.840.10008.5.1.4.1.1.88.59	No	Yes	Key Object Selection
Spatial Registration Storage	1.2.840.10008.5.1.4.1.1.66.1	No	Yes	Spatial Registration

2.1 IMPLEMENTATION IDENTIFYING INFORMATION

Application Name	Implementation Class UID

All applications	1.2.840.113619.6.80

2.2 SUPPORT OF EXTENDED CHARACTER SETS

All applications fully support the `ISO_IR 100` (Latin alphabet No. 1) extended character set.

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, “XACT images” or MD images read and written by this implementation.

The “XACT images” are standard CT SOP Class images representing a volume derived from X-ray Angiographic imaging, which have the modality XA inside a CT IOD. This enables the use of all the Volume Viewer CT tools with XACT images created by the Innova system. See the Innova 3DXR 1.1 Dicom Conformance Statement listed in section 1.6 REFERENCES.

The MD images are material decomposition (density) images created from GSI CT images, identified with private tag (0053, xx73) containing the string "Material Density", representing the amount or density of two materials that would be needed to produce the measured X-ray attenuation in the dual energy projection.

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

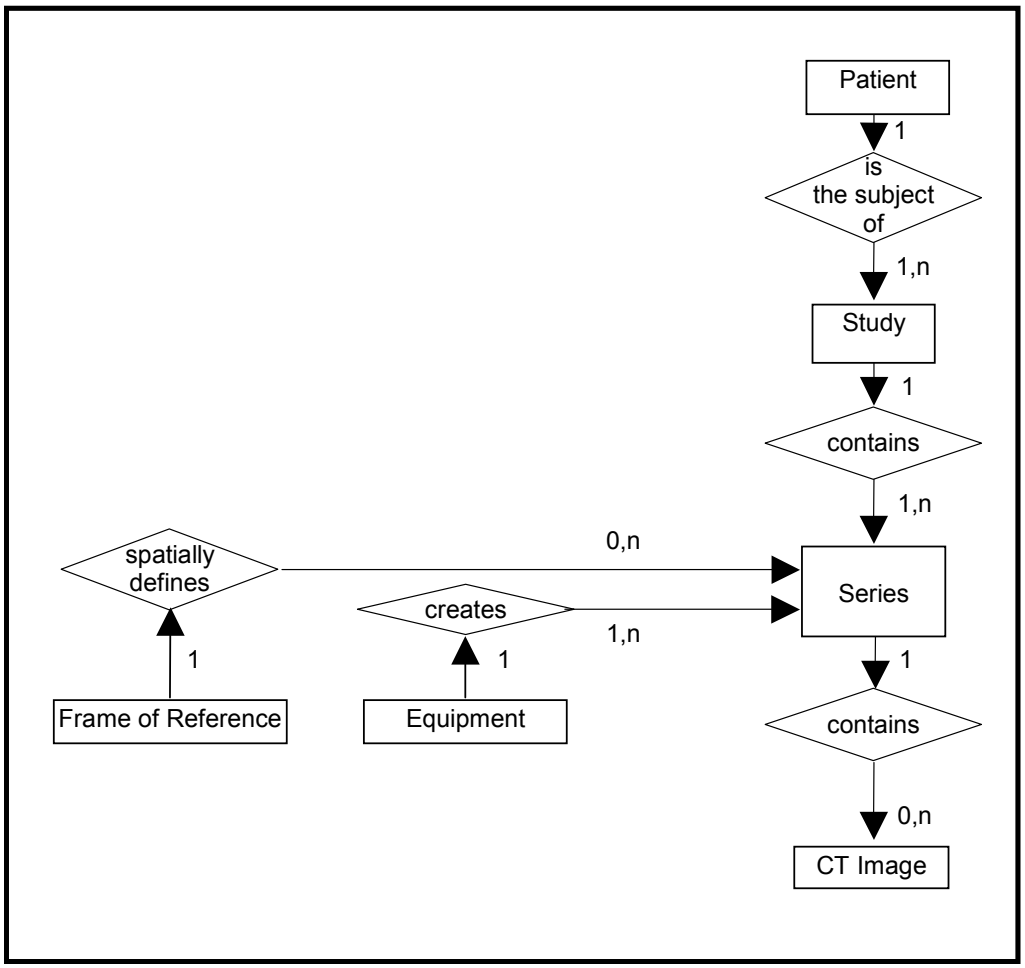
3.2 CT ENTITY-RELATIONSHIP MODEL

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

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
	Clinical Trial Subject	Not used / Not copied
Study	General Study	3.4.2.1
	Patient Study	3.4.2.2
	Clinical Trial Study	Not used / Not copied
Series	General Series	3.4.3.1
	Clinical Trial Series	Not used / Not copied
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
	Device	Not used / Not copied
	Specimen	Not used / Not copied
	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
Issuer of Patient ID	(0010,0021)	3	Ignored / 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
Other Patient IDs Sequence	(0010,1002)	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 Modules 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 image embedded in CT IOD, XACT images
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 / Generated The generated value is the current user's full name or the value of GECOS environment variable or if both were empty then it is the operator name from the original image.
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	
>Issuer of Accession Number Sequence	(0008,0051)	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 condition 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
Patient Orientation	(0020,0020)	2C	Ignored / Removed See 3.4.6.1.1.1
Content Date	(0008,0023)	2C	Used / Generated: current date
Content Time	(0008,0033)	2C	Used / Generated: current time
Image Type	(0008,0008)	3	Used / Generated. See 3.4.9.1.1.1.
Acquisition Number	(0020,0012)	3	Used / Copied if unique across source series, set empty otherwise
Acquisition Date	(0008,0022)	3	Used / Copied: the oldest acquisition date if different
Acquisition Time	(0008,0032)	3	Used / Copied: the oldest acquisition time if different
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. 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 generated 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 decompresses 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 See 3.4.6.2.1
Slice Thickness	(0018,0050)	2	Used / Generated
Slice Location	(0020,1041)	3	Ignored / Generated

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 at the middle of the slice for images coming from GE (Manufacturer is “GE MEDICAL SYSTEMS”), except if the Manufacturer Model Name is “RT Innovation”.

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

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	Mandatory (expect “1”) / Generated “1”
Photometric Interpretation	(0028,0004)	1	Mandatory (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	Mandatory (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
Contributing Equipment Sequence	(0018,A001)	3	Ignored / Generated
>Purpose of Reference Code Sequence	(0040,A170)	1	Ignored / Generated Following triplets are used when generating: (109101, DCS, Acquisition Equipment) (109102, DCS, Processing Equipment)
>>Code Value	(0008,0100)	1C	Ignored / Generated
>>Code Scheme Designator	(0008,0102)	1C	Ignored / Generated
>>Code Meaning	(0008,0104)	1C	Ignored / Generated

>Manufacturer	(0008,0070)	1	Ignored / Generated
>Institution Name	(0008,0080)	3	Ignored / Generated
>Institution Address	(0008,0081)	3	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

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	Mandatory (Shall be 1).
Photometric Interpretation	(0028,0004)	1	Mandatory (expect “MONOCHROME2” and reject “MONOCHROME1”) / Generated “MONOCHROME2” or “MONOCHROME1”
Bits Allocated	(0028,0100)	1	Shall be 16.
Bits Stored	(0028,0101)	1	Mandatory (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)
Rescale Type	(0028,1054)	1C	Used for MD images / Copied for MD images • “mg/cm^3”
KVP	(0018,0060)	2	Used / Copied
Acquisition Number	(0020,0012)	2	Ignored / Copied if unique across source series, set empty otherwise
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

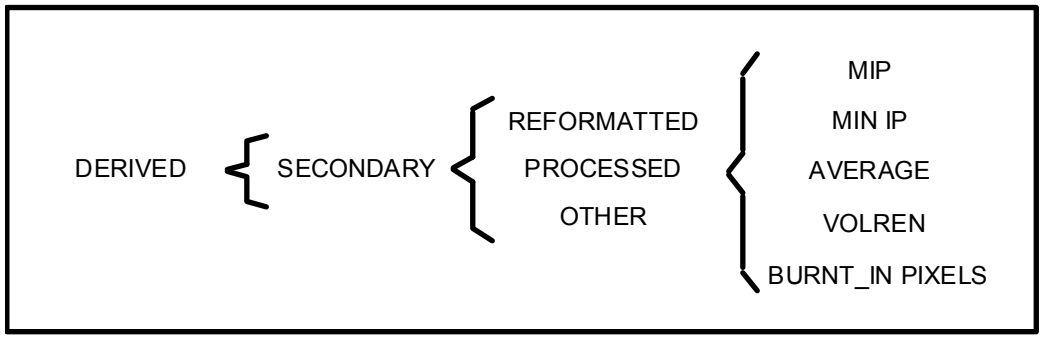
Value 3 has the following value:

- REFORMATTED identifies a Reformatted Image
- PROCESSED identifies a functional image
- OTHER

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
- BURNT_IN PIXELS identifies burnt pixels images

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.

TABLE 3.5-14
PRIVATE ADVANTAGE ATTRIBUTES

Attribute Name	Tag	VR	VM	Type	Attribute Description
Private Creator	(0019, 00xx)	LO	1	3	GEMS_ACQU_01: Used / Copied
Table Speed	(0019, xx23)	DS	1	3	Used / Copied
Midscan Time	(0019, xx24)	DS	1	3	Used / Removed
Gantry Velocity	(0019, xx27)	DS	1	3	Used / Copied
SFOV Type	(0019, xx39)	SS	1	3	Used / Copied
Dependent on #views processed	(0019, xx6A)	SS	1	3	Used/Copied
Private Creator	(0031, 00xx)	LO	1	3	GEMS_3D_XA_01: Used / Copied
Structure of Interest	(0031, xx01)	CS	1	3	Used/Copied
Missing Frame Status	(0031, xx02)	CS	1	3	Used/Copied
Anatomy	(0031, xx03)	CS	1	3	Used/Copied
Volume Substracted Mode	(0031, xx04)	CS	1	3	Used/Copied
Modality	(0031, xx07)	CS	1	3	Used/Copied (value = “XA”)
Pos Calibration Date	(0031, xx09)	DA	1	3	Used/Copied
Pos Calibration Status	(0031, xx0B)	CS	1	3	Used/Copied
Spin Phase of Volume	(0031,xx20)	CS	1	3	Used / Copied
Private Creator	(0043, 00xx)	LO	1	3	GEMS_PARM_01: Used / Copied
Pitch Ratio	(0043, xx27)	SH	1	3	Used / Copied
Private Scan Options	(0043, xx2B)	SS	1	3	Used/Copied
motCorr	(0043, xx65)	US	1	3	Used/Copied
IBOCorr	(0043, xx67)	US	1	3	Used/Copied
Private Creator	(0045, 00xx)	LO	1	3	GEMS_HELIOS_01: Used / Copied
Sigma Mode	(0045, xx13)	SS	1	3	Ignored / Copied
Ibone Flag	(0045, xx21)	SS	1	3	Used / Copied
Peris Flag	(0045, xx22)	SS	1	3	Used / Copied
Cardiac Recon Algo	(0045, xx30)	CS	1	3	Used / Removed
Average Heart Rate	(0045, xx31)	CS	1	3	Used / Generated
Temporal Resolution	(0045, xx32)	FL	1	3	Used / Removed
Cardiac Phase Number	(0045, xx33)	CS	1	3	Used / Copied
Noise Reduction Image Filter Description	(0045, xx33)	LO	1	3	Used / Copied
Actual Rpeak Fixed Time Delay	(0045, xx3F)	CS	1	3	Used / Copied
Private Group Creator	(0047, 00xx)	LO	1	3	GEMS_VXTL_USERDATA_01: Used / Generated
Private User Data	(0047, xx11)	LT	1	3	Used / Generated. If contains “Registered series” the saved volume has been moved due to registration.
Private creator	(0051,00xx)	LO	1	3	“GEMS_FUNCTOOL_01”

Group name	(0051,xx01)	LO	1	3	Used / Generated: Functional analysis applications classify theirs functions into groups of functions like Perfusion, Standard, and General… VV use only "NO GROUP"
Function name	(0051,xx02)	LO	1	3	Used / Generated: Name of the function used to get the current functional map
Bias	(0051,xx03)	SL	1	3	Used / Generated: Bias to be applied to data, i.e. Real value = (data + bias) * scale
Scale	(0051,xx04)	FL	1	3	Used / Generated: Scale to be applied to data, i.e. Real value = (data + bias) * scale
Parameter count	(0051,xx05)	SL	1	3	Used / Generated: Length in characters of the parameter string element 0x05
Parameters	(0051,xx06)	LT	1	3	Used / Generated: String containing functional parameter level, name and value stored respectively delimited by "\n" and are stored in the order of their declaration in the functional protocol.
Version	(0051,xx07)	LO	1	3	Used / Generated: String containing the software version (for example, 2.5.30)
Color ramp index	(0051,xx08)	SL	1	3	Used / Generated: Color ramp index (0=rainbow, 1=Hot iron…)
Window width	(0051,xx09)	SL	1	3	Used / Generated: Window width of the view from which the functional map has been saved
Window level	(0051,xx0A)	SL	1	3	Used / Generated: Window level of the view from which the functional map has been saved
BValue	(0051,xx0B)	SL	1	3	Ignored/Removed
Wizard state data size	(0051,xx0C)	SL	1	3	Ignored/Removed: Bytes size of the wizard sate data saved in binary format.
Wizard State	(0051,xx0D)	OB	1	3	Ignored/Removed: Binary data containing description of wizard state.
Hidden	(0051,xx0E)	SL	1	3	Used / Generated: Boolean tag setup to true when functional map shall be hidden to user
Private Creator	(0053,00xx)	LO	1	3	GEHC_CT_ADVAPP_001: Used / Copied
Type of Shuttle Acquisition	(0053,xx20)	IS	1	3	Used / Copied
ASIR Information	(0053,xx40)	SH	1	3	Used / Copied
High Resolution Mode	(0053,xx61)	SH	1	3	Used / Copied
Image Position Patient Setting	(0053,xx63)	CS	1	3	Used / Copied
Multi Energy Image Type	(0053,xx73)	LO	1	3	Used / Copied
Monochromatic Energy	(0053,xx75)	DS	1	3	Used / Copied
Sub Optimal IQ String	(0053,xx7D)	LO	1	3	Used / Copied
Annotation mA	(0053,xx83)	DS	1	3	Used / Copied
Multi Energy KV Annot Name	(0053,xx88)	SH	1	3	Used / Copied
Multi Energy KV Unit Label	(0053,xx89)	SH	1	3	Used / Copied
Material Type #1	(0053,xx8A)	LO	1	3	Used / Copied

Material Type #2	(0053,xx8B)	LO	1	3	Used / Copied
GSI Scan Mode Preset	(0053,xx8C)	LO	1	3	Used / Copied
MARs Annotation	(0053,xx9D)	LO	1	3	Used / Copied
Private Group Creator	(0059, 00xx)	LO	1	3	GEMS_VXTL_REGISTRATION_01: Used / Generated
Deformed Flag	(0059, xx00)	IS	1	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

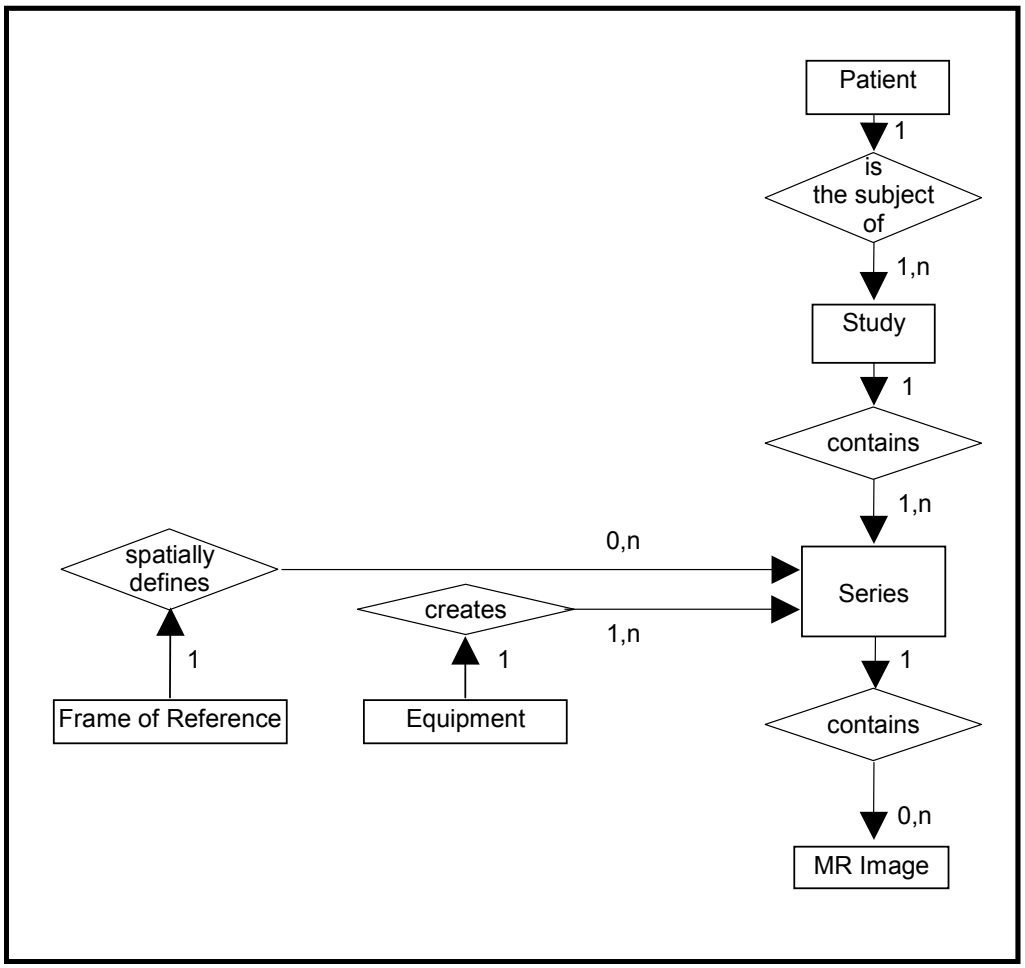
4.2 MR ENTITY-RELATIONSHIP MODEL

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

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
	Clinical Trial Subject	Not used / Not copied
Study	General Study	4.4.2.1
	Patient Study	4.4.2.2
	Clinical Trial Study	Not used / Not copied
Series	General Series	4.4.3.1
	Clinical Trial Series	Not used / Not copied
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
	Device	Not used / Not copied
	Specimen	Not used / Not copied
	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
Issuer of Patient ID	(0010,0021)	3	Ignored / 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
Other Patient IDs Sequence	(0010,1002)	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 Modules 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 / Generated The generated value is the current user’s full name or the value of GECOS environment variable or if both were empty then it is the operator name from the original image.
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	
>Issuer of Accession Number Sequence	(0008,0051)	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

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 condition 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.

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 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
Patient Orientation	(0020,0020)	2C	Ignored / Removed. See 4.4.6.1.1.1
Content Date	(0008,0023)	2C	Used / Generated: current date
Content 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	Used / Copied only for Spectroscopy images
>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 generated 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 decompresses 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 See 4.4.6.2.1
Slice Thickness	(0018,0050)	2	Used / Generated
Slice Location	(0020,1041)	3	Ignored / Generated

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 at the middle of the slice 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 at the middle of the slice 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	Mandatory (expect "1") / Generated "1"
Photometric Interpretation	(0028,0004)	1	Mandatory (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	Mandatory (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 set 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
Contributing Equipment Sequence	(0018,A001)	3	Ignored / Generated

>Purpose of Reference Code Sequence	(0040,A170)	1	Ignored / Generated Following triplets are used when generating: (109101, DCS, Acquisition Equipment) (109102, DCS, Processing Equipment)
>>Code Value	(0008,0100)	1C	Ignored / Generated
>>Code Scheme Designator	(0008,0102)	1C	Ignored / Generated
>>Code Meaning	(0008,0104)	1C	Ignored / Generated
>Manufacturer	(0008,0070)	1	Ignored / Generated
>Institution Name	(0008,0080)	3	Ignored / Generated
>Institution Address	(0008,0081)	3	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

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	Mandatory (Shall be 1).
Photometric Interpretation	(0028,0004)	1	Mandatory (expect “MONOCHROME2” and reject “MONOCHROME1”) / Generated “MONOCHROME2” or “MONOCHROME1”
Bits Allocated	(0028,0100)	1	Shall be 16.
Bits Stored	(0028,0101)	1	Mandatory (expect “16”) / Generated “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:

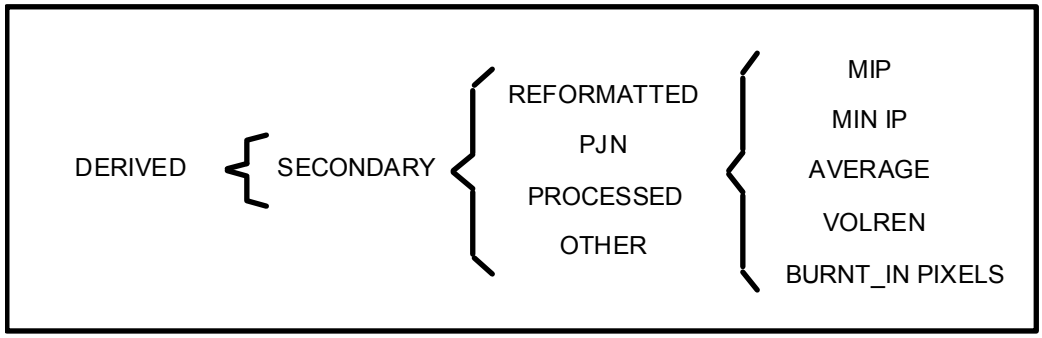
- PJN identifies a MIP reconstructed image
- REFORMATTED identifies a Multi Planar Reformatted Image

  PJN is the same as PROJECTION IMAGE, and REFORMATTED is the same as MPR, but it is kept in order to ensure the image can be pushed on old GE MR system.
- PROCESSED identifies a functional image
- OTHER

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
- BURNT_IN PIXELS identifies burnt pixels images

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:

0009, 0019, 0021, 0025, 0027, 0029, 0043, 0047, 0051, 0059

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	VR	VM	Type	Attribute Description
Private Creator	(0009, 00xx)	LO	1	3	GEMS_IDEN_01: Used / Copied
Genesis Full Fidelity Flag	(0009, xx01)	LO	1	3	Used / Copied
Suite ID	(0009, xx02)	SH	1	3	Ignored / Copied
Product ID	(0009, xx04)	SH	1	3	Used / Copied
Series Type	(0009,xx1A)	US	1	3	Used / Removed
Unique Service ID	(0009, xx30)	SH	1	3	Ignored / Copied
Mobile Location Number	(0009, xx31)	SH	1	3	Ignored / Copied
Equipment UID	(0009, xxE3)	UI	1	3	Ignored / Copied
Genesis Version – Now	(0009, xxE6)	SH	1	3	Ignored / Copied
Private Creator	(0019, 00xx)	LO	1	3	GEMS_ACQU_01: Used / Copied
Series Pulse Sequence	(0019, xx12)	SS	1	3	Ignored / Copied
Display FOV-Y	(0019, xx1E)	DS	1	3	Ignored / Copied
Duration of scan	(0019, xx5A)	FL	1	3	Used / Copied
Number of echos	(0019, xx7E)	SS	1	3	Used / Copied
Continuous slices flag	(0019, xx81)	SS	1	3	Ignored / Copied
actual receive gain analog	(0019, xx8A)	SS	1	3	Ignored / Copied
actual receive gain digital	(0019, xx8B)	SS	1	3	Ignored / Copied
Swap Phase/Freq. Axis	(0019, xx8F)	SS	1	3	Used / Copied
Pause Time	(0019, xx91)	DS	1	3	Ignored / Copied
Pulse Sequence Name	(0019, xx9C)	LO	1	3	Used / Copied
Coil Type	(0019, xx9F)	SS	1	3	Ignored / Copied
SAT fat/water/bone	(0019, xxA4)	SS	1	3	Used / Copied
User Variable0	(0019, xxA7)	SS	1	3	Ignored / Copied
User Variable1	(0019, xxA8)	DS	1	3	Ignored / Copied
User Variable2	(0019, xxA9)	DS	1	3	Ignored / Copied
User Variable3	(0019, xxAA)	DS	1	3	Ignored / Copied
User Variable4	(0019, xxAB)	DS	1	3	Ignored / Copied
User Variable5	(0019, xxAC)	DS	1	3	Ignored / Copied
User Variable6	(0019, xxAD)	DS	1	3	Ignored / Copied
User Variable7	(0019, xxAE)	DS	1	3	Ignored / Copied

User Variable8	(0019, xxAF)	DS	1	3	Used / Copied
User Variable9	(0019, xxB0)	DS	1	3	Used / Copied
User Variable10	(0019, xxB1)	DS	1	3	Used / Copied
User Variable11	(0019, xxB2)	DS	1	3	Used / Copied
User Variable12	(0019, xxB3)	DS	1	3	Used / Copied
User Variable13	(0019, xxB4)	DS	1	3	Used / Copied
User Variable14	(0019, xxB5)	DS	1	3	Ignored / Copied
User Variable15	(0019, xxB6)	DS	1	3	Ignored / Copied
User Variable16	(0019, xxB7)	DS	1	3	Ignored / Copied
User Variable17	(0019, xxB8)	DS	1	3	Ignored / Copied
User Variable18	(0019, xxB9)	DS	1	3	Ignored / Copied
User Variable19	(0019, xxBA)	DS	1	3	Ignored / Copied
User Variable20	(0019, xxBB)	DS	1	3	Ignored / Copied
User Variable21	(0019, xxBC)	DS	1	3	Ignored / Copied
User Variable22	(0019, xxBD)	DS	1	3	Ignored / Copied
Saturation Planes	(0019, xxC0)	SS	1	3	Used / Copied
Surface Coil Intensity Correction Flag	(0019, xxC1)	SS	1	3	Used / Copied
Phase contrast flow axis	(0019, xxCB)	SS	1	3	Used / Copied
Velocity Encoding	(0019, xxCC)	SS	1	3	Used / Copied
Fractional Echo/EffectiveTE	(0019, xxD5)	SS	1	3	Used / Copied
Cardiac Phase Number	(0019, xxD7)	SS	1	3	Used / Copied
variable echo flag	(0019, xxD8)	SS	1	3	Used / Copied
Concatenated Sat Type flg	(0019, xxD9)	DS	1	3	Used / Copied
User Variable23	(0019, xxDF)	DS	1	3	Ignored / Copied
User Variable24	(0019, xxE0)	DS	1	3	Ignored / Copied
Number of Phases	(0019, xxF2)	SS	1	3	Used / Copied
Transmit Gain	(0019, xxF9)	DS	1	3	Ignored / Copied
Private Creator	(0021, 00xx)	LO	1	3	GEMS_RELA_01: Used / Copied
Series from which prescribed	(0021, xx03)	SS	1	3	Ignored / Copied
Genesis Version	(0021, xx05)	SH	1	3	Ignored / Copied
Series from which prescribed	(0021, xx35)	SS	1	3	Ignored / Copied
Image from which prescribed	(0021, xx36)	SS	1	3	Ignored / Copied
Screen Format	(0021, xx37)	SS	1	3	Ignored / Generated
Row Axis Rot from src img	(0021, xx51)	DS	1	3	Ignored / Generated for PJN only
Col Axis Rot from src img	(0021, xx52)	DS	1	3	Ignored / Generated for PJN only
Normal Axis Rot from src img	(0021, xx53)	DS	1	3	Ignored / Generated for PJN only
Slop int 1	(0021, xx56)	SL	1	3	Ignored / Copied
Slop int 2	(0021, xx57)	SL	1	3	Ignored / Copied
Slop int 3	(0021, xx58)	SL	1	3	Ignored / Copied
Slop int 4	(0021, xx59)	SL	1	3	Ignored / Copied
Slop int 5	(0021, xx5A)	SL	1	3	Ignored / Copied

Slop float 1	(0021, xx5B)	DS	1	3	Ignored / Copied
Slop float 2	(0021, xx5C)	DS	1	3	Ignored / Copied
Slop float 3	(0021, xx5D)	DS	1	3	Ignored / Copied
Slop float 4	(0021, xx5E)	DS	1	3	Ignored / Copied
Slop float 5	(0021, xx5F)	DS	1	3	Ignored / Copied
Private Creator	(0025, 00xx)	LO	1	3	GEMS_SERS_01: Used / Copied
Primary Receiver	(0025, xx1A)	SH	1	3	Ignored / Copied
Private Creator	(0027, 00xx)	LO	1	3	GEMS_IMAG_01: Used / Copied
Imaging Mode	(0027, xx31)	SS	1	3	Ignored / Copied
Pulse Sequence	(0027, xx32)	SS	1	3	Used / Copied
Imaging Options	(0027, xx33)	SL	1	3	Ignored / Copied
Plane Type	(0027, xx35)	SS	1	3	Ignored / Generated
RAS letter of image loc	(0027, xx40)	SH	1	3	Ignored / Generated
Image Location	(0027, xx41)	FL	1	3	Ignored / Generated
Image Dimension – X	(0027, xx60)	FL	1	3	Ignored / Copied
Image Dimension – Y	(0027, xx61)	FL	1	3	Ignored / Copied
Number of Excitations	(0027, xx62)	FL	1	3	Ignored / Copied
Private Creator	(0029, 00xx)	LO	1	3	GEMS_IMPS_01: Used / Copied
Version of the hdr structure	(0029, xx26)	SS	1	3	Ignored / Copied
Lower Range of Pixels 1	(0029, xx15)	SL	1	3	Ignored / Generated for PJN only
Upper Range of Pixels 1	(0029, xx16)	SL	1	3	Ignored / Generated for PJN only
Private Creator	(0043, 00xx)	LO	1	3	GEMS_PARM_01: Used / Copied
Bitmap of prescan options	(0043, xx01)	SS	1	3	Ignored / Copied
Number of EPI shots	(0043, xx06)	SS	1	3	Ignored / Copied
Views per segment	(0043, xx07)	SS	1	3	Ignored / Copied
Respiratory rate	(0043, xx08)	SS	1	3	Ignored / Copied
Respiratory trigger point	(0043, xx09)	SS	1	3	Ignored / Copied
Type of receiver used	(0043, xx0A)	SS	1	3	Ignored / Copied
Peak rate of change of Gradient field	(0043, xx0B)	DS	1	3	Ignored / Copied
Limit in units per percent	(0043, xx0C)	DS	1	3	Ignored / Copied
Version of header structure	(0043, xx26)	US	6	3	Ignored / Copied
Filter Mode	(0043, xx2D)	LO	1	3	Used / Removed
Image Type	(0043, xx2F)	SS	1	3	Used / Removed
Collapse Image	(0043, xx30)	SS	1	3	Ignored / Generated for PJN only: 6
User usage tag	(0043, xx35)	UL	1	3	Ignored / Copied
User Variable25…User Variable48	(0043, xx38)	FL	24	3	Ignored / Copied
Slop Int 6 ... 9	(0043, xx39)	IS	4	3	Ignored / Copied
Slop Int 10 ... 17	(0043, xx60)	IS	8	3	Ignored / Copied
Scanner Study Entity UID	(0043, xx61)	UI	1	3	Ignored / Copied
Scanner Study UID	(0043, xx62)	SH	1	3	Ignored / Copied

Table Position / angle / offset / WholeOrZoom	(0043, xx6F)	DS	3-4	3	Ignored / Copied
eDWI Scale Factor	(0043,xx7F)	DS	1	3	Used / Removed
Additional Asset Data	(0043, xx84)	LO	7	3	Used / Removed
Spectro Parameters	(0043, xx8F)	DS		3	Used / Removed
Image filtering parameters	(0043, xx97)	LO	9	3	Ignored / Copied
Number of Stacks	(0043,xx9A)	IS	1	3	Used / Ignored
ASL Contrast Technique	(0043, xxA3)	CS	1	3	Used / Removed
Detailed Text Describing Used Labeling Technique	(0043, xxA4)	LO	1	3	Used / Removed
Duration of the Label or Control Pulse	(0043, xxA5)	IS	1	3	Used / Removed
Private Group Creator	(0047, 00xx)	LO	1	3	GEMS_VXTL_USERDATA_01: Used / Generated
Private User Data	(0047, xx11)	LT	1	3	Used / Generated. If contains “Registered series” the saved volume has been moved due to registration.
Private creator	(0051,00xx)	LO	1	3	“GEMS_FUNCTOOL_01”
Group name	(0051,xx01)	LO	1	3	Used / Generated: Functional analysis applications classify theirs functions into groups of functions like Perfusion, Standard, and General… VV use only “NO GROUP”
Function name	(0051,xx02)	LO	1	3	Used / Generated: Name of the function used to get the current functional map
Bias	(0051,xx03)	SL	1	3	Used / Generated: Bias to be applied to data, i.e. Real value = (data + bias) * scale
Scale	(0051,xx04)	FL	1	3	Used / Generated: Scale to be applied to data, i.e. Real value = (data + bias) * scale
Parameter count	(0051,xx05)	SL	1	3	Used / Generated: Length in characters of the parameter string element 0x05
Parameters	(0051,xx06)	LT	1	3	Used / Generated: String containing functional parameter level, name and value stored respectively delimited by “\n” and are stored in the order of their declaration in the functional protocol.
Version	(0051,xx07)	LO	1	3	Used / Generated: String containing the software version (for example, 2.5.30)
Color ramp index	(0051,xx08)	SL	1	3	Used / Generated: Color ramp index (0=rainbow, 1=Hot iron…)
Window width	(0051,xx09)	SL	1	3	Used / Generated: Window width of the view from which the functional map has been saved

Window level	(0051,xx0A)	SL	1	3	Used / Generated: Window level of the view from which the functional map has been saved
BValue	(0051,xx0B)	SL	1	3	Ignored/Removed
Wizard state data size	(0051,xx0C)	SL	1	3	Ignored/Removed: Bytes size of the wizard sate data saved in binary format.
Wizard State	(0051,xx0D)	OB	1	3	Ignored/Removed: Binary data containing description of wizard state.
Hidden	(0051,xx0E)	SL	1	3	Used / Generated: Boolean tag setup to true when functional map shall be hidden to user
Private Group Creator	(0059, 00xx)	LO	1	3	GEMS_VXTL_REGISTRATION_01: Used / Generated
Deformed Flag	(0059, xx00)	IS	1	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

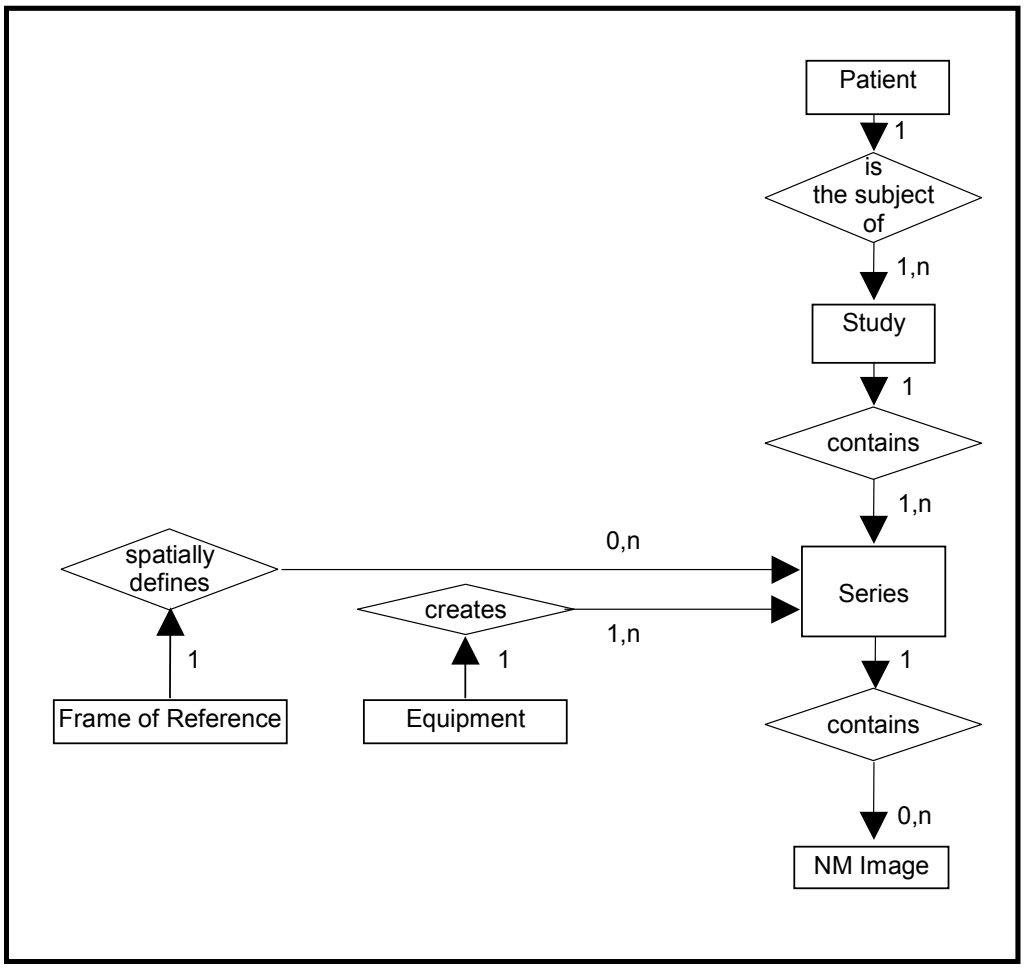
5.2 NM ENTITY-RELATIONSHIP MODEL

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
	Clinical Trial Subject	Not used
Study	General Study	5.4.2.1
	Patient Study	5.4.2.2
	Clinical Trial Study	Not used
Series	General Series	5.4.3.1
	Clinical Trial Series	Not used
	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
	Acquisition Context	Not used
	Device	Not used
	Specimen	Not used
	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
	VOI LUT	5.4.7.1
	SOP Common	5.4.8.1

	Frame Extraction	Not used

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.

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

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
Issuer of Patient ID	(0010,0021)	3	Ignored
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
Other Patient IDs Sequence	(0010,1002)	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 Modules 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
Patient's Age	(0010,1010)	3	Used
Patient's Size	(0010,1020)	3	Ignored
Patient'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
Operators' 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	
>Issuer of Accession Number Sequence	(0008,0051)	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
Manufacturer'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
Patient Orientation	(0020,0020)	2C	Ignored
Content Date	(0008,0023)	2C	Used
Content Time	(0008,0033)	2C	Used
Image Type	(0008,0008)	3	Used. See 5.4.9.4.1.1.
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	Used
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	Mandatory (expect "1")
Photometric Interpretation	(0028,0004)	1	Mandatory (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	Mandatory (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 set 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	Mandatory (The value shall be 1).
Photometric Interpretation	(0028,0004)	1	Mandatory (expect “MONOCHROME2”)
Bits Allocated	(0028,0100)	1	Ignored (expect 16)
Bits Stored	(0028,0101)	1	Mandatory (expect 16)
High Bit	(0028,0102)	1	Ignored (expect 15)
Pixel Spacing	(0028,0030)	2	Mandatory with value

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 with one item
> 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 with a value in first item
> Image Position (Patient)	(0020,0032)	2C	Mandatory with a value in first item
> 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 with value
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

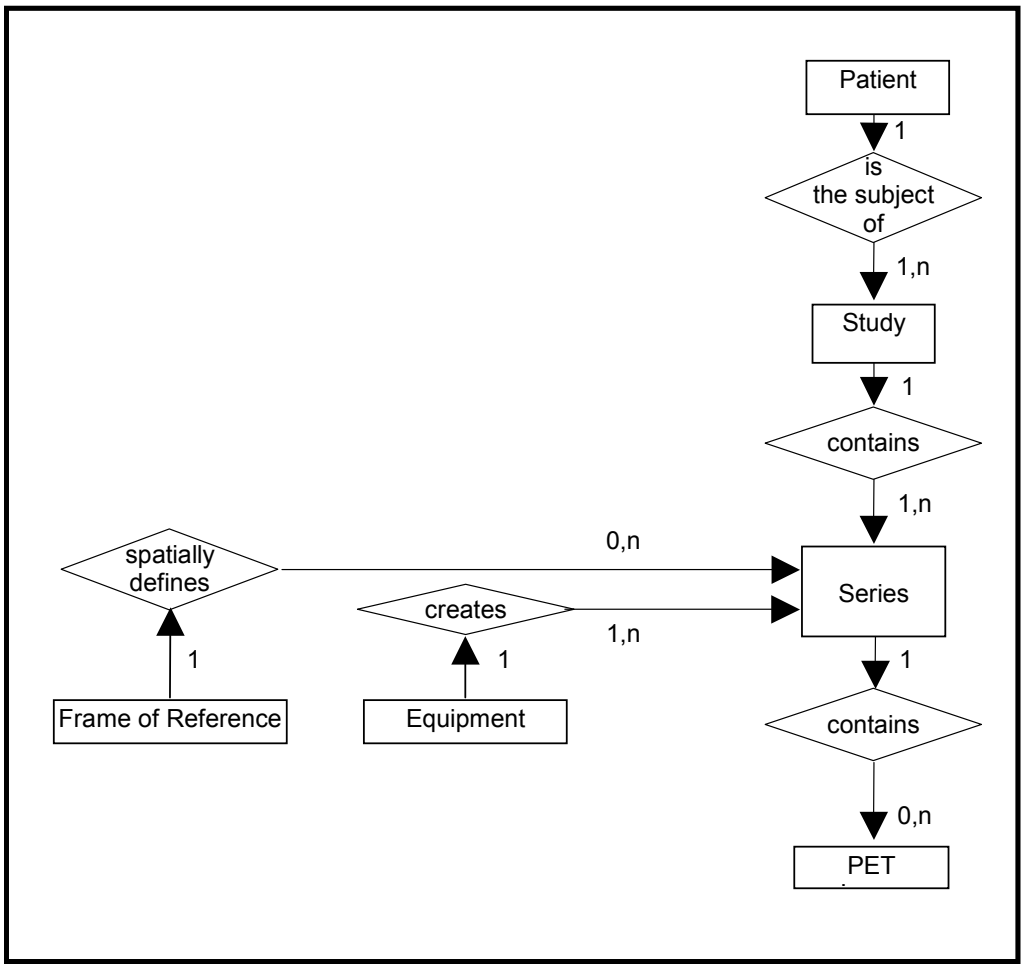
6.2 PET ENTITY-RELATIONSHIP MODEL

The Entity-Relationship diagram for the PET Image interoperability schema is shown in **Illustration 6.2-1.** 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

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
	Clinical Trial Subject	Not Used / Not Copied
Study	General Study	6.4.2.1
	Patient Study	6.4.2.2
	Clinical Trial Study	Not Used / Not Copied
Series	General Series	6.4.3.1
	Clinical Trial Series	Not Used / Not Copied
	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
	Device	Not Used / Not Copied
	Specimen	Not Used / Not Copied
	PET Image	6.4.9.5
	Overlay Plane	Not Used / Not Copied
	VOI LUT	6.4.7.1
	Acquisition Context	Not Used / Not Copied
	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
Issuer of Patient ID	(0010,0021)	3	Ignored / 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
Other Patient IDs Sequence	(0010,1002)	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 Modules 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 / Generated The generated value is the current user's full name or the value of GECOS environment variable or if both were empty then it is the operator name from the original image.
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	
>Issuer of Accession Number Sequence	(0008,0051)	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 Code Sequence	(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 condition 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
Patient Orientation	(0020,0020)	2C	Ignored / Removed See 6.4.6.1.1.1
Content Date	(0008,0023)	2C	Used / Generated
Content Time	(0008,0033)	2C	Used / Generated
Image Type	(0008,0008)	3	Used / Generated See 6.4.6.1.1.2
Acquisition Number	(0020,0012)	3	Ignored / Copied
Acquisition Date	(0008,0022)	3	Used / Copied
Acquisition Time	(0008,0032)	3	Used / Copied

Referenced Image Sequence	(0008,1140)	3	Ignored / 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 generated 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:

- PRIMARY identifies a Primary Image

Value 3 has the following value:

- REFORMATTED identifies a Reformatted Image
- PROCESSED identifies a functional image
- OTHER

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
- BURNT_IN PIXELS identifies burnt pixels images

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 decompresses 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. See 6.4.6.2.1
Slice Thickness	(0018,0050)	2	Used / Generated
Slice Location	(0020,1041)	3	Ignored / Generated

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 at the middle of the slice 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 at the middle of the slice.

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	Mandatory (expect “1”) / Generated “1”
Photometric Interpretation	(0028,0004)	1	Mandatory (expect “MONOCHROME2”) / Generated “MONOCHROME2”
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	Mandatory (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 / Removed (see Samples per Pixels)
Pixel Aspect Ratio	(0028,0034)	1C	Ignored / Removed (Image Plane is mandatory for PET)

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

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 set 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
Contributing Equipment Sequence	(0018,A001)	3	Ignored / Generated
>Purpose of Reference Code Sequence	(0040,A170)	1	Ignored / Generated Following triplets are used when generating: (109101, DCS, Acquisition Equipment) (109102, DCS, Processing Equipment)
>>Code Value	(0008,0100)	1C	Ignored / Generated
>>Code Scheme Designator	(0008,0102)	1C	Ignored / Generated
>>Code Meaning	(0008,0104)	1C	Ignored / Generated
>Manufacturer	(0008,0070)	1	Ignored / Generated
>Institution Name	(0008,0080)	3	Ignored / Generated
>Institution Address	(0008,0081)	3	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

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 copied from original images, 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	

Attribute Name	Tag	Type	Attribute Description
> 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	Mandatory (expect 1) / Generated “1”
Photometric Interpretation	(0028,0004)	1	Mandatory (expect “MONOCHROME2”) / Generated “MONOCHROME2”
Bits Allocated	(0028,0100)	1	Shall be 16 / Generated “16”
Bits Stored	(0028,0101)	1	Mandatory (expect 16) / Generated “16”
High Bit	(0028,0102)	1	Ignored (expect 15) / Generated “15”
Rescale Intercept	(0028,1052)	1	Ignored / 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
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	VR	VM	Type	Attribute Description
Private Creator	(0009, 00xx)	LO	1	3	GEMS_PETD_01: Used / Removed
Scan Time	(0009, xx0D)	DT	1	3	Used / Removed
Tracer Activity	(0009, xx38)	FL	1	3	Used / Removed
Measured Time	(0009, xx39)	DT	1	3	Used / Removed
Administrated Time	(0009, xx3B)	DT	1	3	Used / Removed
Post Injected Activity	(0009, xx3C)	FL	1	3	Used / Removed
Post Injected Time	(0009, xx3D)	DT	1	3	Used / Removed
Half Life	(0009, xx3F)	FL	1	3	Used / Removed
PET Phase Percentage	(0009,xxE3)	FL	1	3	Used / Removed
Private Group Creator	(0047, 00xx)	LO	1	3	GEMS_VXTL_USERDATA_01: Used / Generated
Private User Data	(0047, xx11)	LT	1	3	Used / Generated. If contains “Registered series” the saved volume has been moved due to registration.
Private Group Creator	(0059, 00xx)	LO	1	3	GEMS_VXTL_REGISTRATION_01: Used / Generated
Deformed Flag	(0059, xx00)	IS	1	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 and read 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.

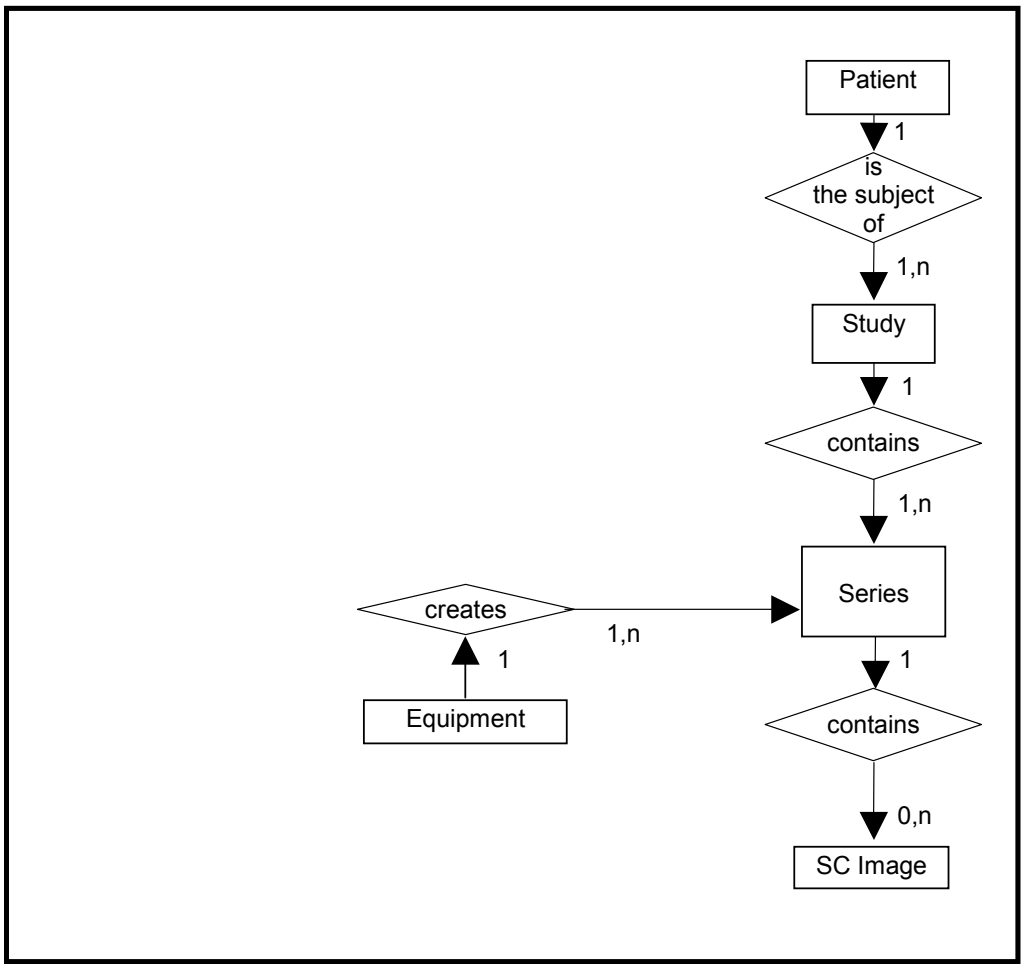
7.2 SC ENTITY-RELATIONSHIP MODEL

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

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
	Clinical Trial Subject	Not used / Not copied
Study	General Study	7.4.2.1
	Patient Study	7.4.2.2
	Clinical Trial Study	Not used / Not copied
Series	General Series	7.4.3.1
	Clinical Trial Series	Not used / Not copied
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
	Device	Not used / Not copied
	Specimen	Not used / Not copied
	SC Image	7.4.8.2
	Overlay Plane	Not used / Not copied
	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	Used / Copied
Patient ID	(0010,0020)	2	Used / Copied
Issuer of Patient ID	(0010,0021)	3	Ignored / 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
Other Patient IDs Sequence	(0010,1002)	3	Ignored / Copied
Ethnic Group	(0010,2160)	3	Ignored / Copied
Patient Comments	(0010,4000)	3	Ignored / 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 Modules 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	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	

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	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

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	Used / 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	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 / Removed
Series Description	(0008,103E)	3	Used / Generated (see section 7.5)
Operators' Name	(0008,1070)	3	Used / Generated The generated value is the current user’s full name or the value of GECOS environment variable or if both were empty then it is the operator name from the original image.
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 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	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	
>Issuer of Accession Number Sequence	(0008,0051)	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

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	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

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
Patient Orientation	(0020,0020)	2C	Ignored / Generated. See 7.4.5.1.1.1
Content Date	(0008,0023)	2C	Used / Generated, empty "". See 7.4.5.1.1.2
Content Time	(0008,0033)	2C	Used / Generated, empty "". See 7.4.5.1.1.2
Image Type	(0008,0008)	3	Used / Generated. See 7.4.5.1.1.3
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 only for MR Spectroscopy images
>Referenced SOP Class UID	(0008,1150)	1C	

>Referenced SOP Instance UID	(0008,1155)	1C	
Derivation Description	(0008,2111)	3	Ignored / 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	Ignored / Removed
Image Comments	(0020,4000)	3	Ignored / Removed
Quality Control Image	(0028,0300)	3	Ignored / Removed
Burned In Annotations	(0028,0301)	3	Ignored / Removed
Lossy Image Compression Ratio	(0028,2112)	3	Used / Copied. See 7.4.5.1.1.5
Lossy Image Compression	(0028,2110)	3	Ignored / 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 Content 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 content date, but it does not make sense for reformatted images which are derived from several images

Taken in consideration the reasons above, Volume Viewer will set an empty tag to avoid possible misinterpretation of some applications using this tag as creation date and time of the secondary captured image or the original scan time.

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 screen capture or a generated 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 an Average Image
- VOLREN identifies a Volume Rendered Image
- SURFACE identifies a surface shaded Image
- RAYSUM identifies a RaySum Image
- INTEGRAL identifies an Integral Image

When reading images, only those with Value 3 equal to VXTL STATE and images with Secondary Capture Device Manufacturer's Model Name (0018,1018) tag containing the string “Volume Viewer” or “FILMER” are 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 addresses 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 decompresses 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	Mandatory / Generated • “1” for greyscale images • “3” for color images
Photometric Interpretation	(0028,0004)	1	Mandatory / Generated • “MONOCHROME2” or “MONOCHROME1” for greyscale images • “RGB” for color images

Rows	(0028,0010)	1	Mandatory / Generated
Columns	(0028,0011)	1	Mandatory / Generated
Bits Allocated	(0028,0100)	1	Ignored / Generated • "16" for greyscale images • "8" for color images
Bits Stored	(0028,0101)	1	Mandatory / Generated • "16" for greyscale images • "8" for color images
High Bit	(0028,0102)	1	Ignored / Generated • "15" for greyscale images • "7" for color images
Pixel Representation	(0028,0103)	1	Ignored / Generated • "1" for greyscale images • "0" for color images
Pixel Data	(7FE0,0010)	1	
Planar Configuration	(0028,0006)	1C	Ignored / Generated • Removed for greyscale images • "0" for color images
Pixel Aspect Ratio	(0028,0034)	1C	Ignored / Removed
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

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	Ignored / Removed
>LUT Descriptor	(0028,3002)	1C	

>LUT Explanation	(0028,3003)	3	
>LUT Data	(0028,3006)	1C	
Window Center	(0028,1050)	3	Used / Generated (value generated from the current value used in the saved view)
Window Width	(0028,1051)	1C	Used / Generated (value generated from the current value used in the saved view)
Window Center & Width Explanation	(0028,1055)	3	Ignored / 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 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	Ignored / 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	Used / Generated
Rescale Slope	(0028,1053)	1C	Ignored / Generated "1"
Rescale Type	(0028,1054)	1C	Ignored / Generated • "mg/cm^3" for MD • "HU" for other 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	Used / Generated: "1.2.840.10008.5.1.4.1.1.7"
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 set is supported.
Instance Creation Date	(0008,0012)	3	Used for VXTL STATE type image only / Generated: current date
Instance Creation Time	(0008,0013)	3	Used for VXTL STATE type image only / 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
Contributing Equipment Sequence	(0018,A001)	3	Ignored / Generated
>Purpose of Reference Code Sequence	(0040,A170)	1	Ignored / Generated Following triplets are used when generating: (109101, DCS, Acquisition Equipment) (109102, DCS, Processing Equipment)
>>Code Value	(0008,0100)	1C	Ignored / Generated
>>Code Scheme Designator	(0008,0102)	1C	Ignored / Generated
>>Code Meaning	(0008,0104)	1C	Ignored / Generated

>Manufacturer	(0008,0070)	1	Ignored / Generated
>Institution Name	(0008,0080)	3	Ignored / Generated
>Institution Address	(0008,0081)	3	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

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	Ignored / Generated: WSD = Workstation
Modality	(0008,0060)	3	Used / Generated See 7.4.3.1 for Enumerated Values.
Secondary Capture Device ID	(0018,1010)	3	Ignored / Generated from gethostname()
Secondary Capture Device Manufacturer	(0018,1016)	3	Ignored / Generated "GE MEDICAL SYSTEMS"
Secondary Capture Device Manufacturer's Model Name	(0018,1018)	3	Used / Generated: the name of the application. One of: Reformat, Volume Viewer, CT Colonography, Advanced Lung Analysis, AutoBone, CardIQ, CardEP, PET VCAR
Secondary Capture Device Software Version	(0018,1019)	3	Ignored / Generated: Voxtool version "vxtl_x_y_z"
Video Image Format Acquired	(0018,1022)	3	Ignored / Removed
Digital Image Format Acquired	(0018,1023)	3	Ignored / 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	Ignored / Generated: current date
Time of Secondary Capture	(0018,1014)	3	Ignored / 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 those extended objects, but just reads 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 Scan Time	(0057,xx07)	3	Used / Generated
> SUV Administred Time	(0057,xx08)	3	Used / Generated
> SUV Measured Time	(0057,xx09)	3	Used / Generated
> SUV PostInjected Time	(0057,xx10)	3	Used / Generated
> SUV Tracer Activity	(0057,xx11)	3	Used / Generated
> SUV PostInjected Activity	(0057,xx12)	3	Used / Generated
> SUV Half Life	(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 Pretty Name	(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 Primary View 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 Film Name	(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 Width	(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.
SState Onco	(0057,xxBA)	3	Added when Save State is generated from an onco-compatible protocol (isOncoCompatible=”yes”) and when the OncoQuant license is available.
SState Onco Info Seq	(0057,xxBB)	3	Can exist if SState Onco is present.
> SState Onco Info	(0057,xxBC)	3	Contained by sequence SState Onco Info Seq. At least one element in sequence if SState Onco Info Seq is present.
SState Summary Table Info Seq	(0057,xxBD)	3	Can exist if SState Onco is present.

> SState Summary Table Info	(0057,xxBE)	3	Contained by sequence SState Summary Table Info Seq. At least one element in sequence if SState Summary Table Info Seq is present.

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.

TDRT: {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 7.5.1.9).

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 7.5.1.9).

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 7.5.1.12).

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 7.5.1.12).

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 Width

Patient's width (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.

7.5.1.121 SState Onco

It identifies a Save State object created by an onco-compatible protocol with an active OncoQuant license. Such "onco" Save States have the ability to be loaded along with other series in order to do the follow-up of a patient.

7.5.1.122 SState Onco Info Seq

Sequence of SState Onco Info blocks in an onco Save State.

7.5.1.123 SState Onco Info

Oncology follow-up information: Baseline, Nadir, Morphological Criteria, persistent safety messages.

7.5.1.124 SState Summary Table Info Seq

Sequence of SState Summary Table Info blocks in an onco Save State.

7.5.1.125 SState Summary Table Info

Measurements information: linked measurements of the same finding, findings characterization.

7.5.1.126 Plaques

Xml line containing cardiac Plaque detection information

7.5.1.127 Cardiac Top

Cardiac anatomy: top point of the cardiac window

7.5.1.128 Cardiac Lumen Min Value

Cardiac coronaries lumen min density

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	1
MixVol Name	(0057,xx91)	LO	1
Fusion Factor	(0057,xx92)	FL	1
SegList Perfusion Mean	(0057,xx93)	FL	1
SegList Perfusion Std	(0057,xx94)	FL	1
Cardiac Patient EDAP	(0057,xx95)	FL	1

Cardiac Patient CVP	(0057,xx96)	FL	1
Cardiac Patient PCWP	(0057,xx97)	FL	1
Cardiac Patient Height	(0057,xx98)	FL	1
Cardiac Patient Width	(0057,xx99)	FL	1
Cardiac Patient HeartRate	(0057,xx9A)	FL	1
Cardiac Patient ESAP	(0057,xx9B)	FL	1
Cardiac Patient EDBP	(0057,xx9C)	FL	1
Cardiac Patient ESBP	(0057,xx9D)	FL	1
Cardiac Valve Position For MA	(0057,xx9E)	FL	3
Cardiac Apex Position For MA	(0057,xx9F)	FL	3
SState Type	(0057,xxA0)	IS	1
VT Auto Points	(0057,xxA2)	UT	1
Proto Java Step	(0057,xxA3)	IS	1
Nb Volumes Stored	(0057,xxA4)	IS	1
Lumen Angle	(0057,xxA5)	FD	1
Cardiac Calcifs Thresh	(0057,xxA6)	IS	1
Is Saline Flush	(0057,xxA7)	IS	1
Proto Scenario Type	(0057,xxA8)	IS	1
Proto Scenario Anatomy	(0057,xxA9)	IS	1
SegList Is In Default 3DVols	(0057,xxAA)	IS	1
SState Onco	(0057,xxBA)	IS	1
SState Onco Info Seq	(0057,xxBB)	SQ	1
SState Onco Info	(0057,xxBC)	LT	1
SState Summary Table Info Seq	(0057,xxBD)	SQ	1
SState Summary Table Info	(0057,xxBE)	LT	1
Plaques	(0057,xxAB)	LT	1
Cardiac Top	(0057,xxAD)	FL	3
Cardiac Lumen Min Value	(0057,xxB6)	IS	1

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.

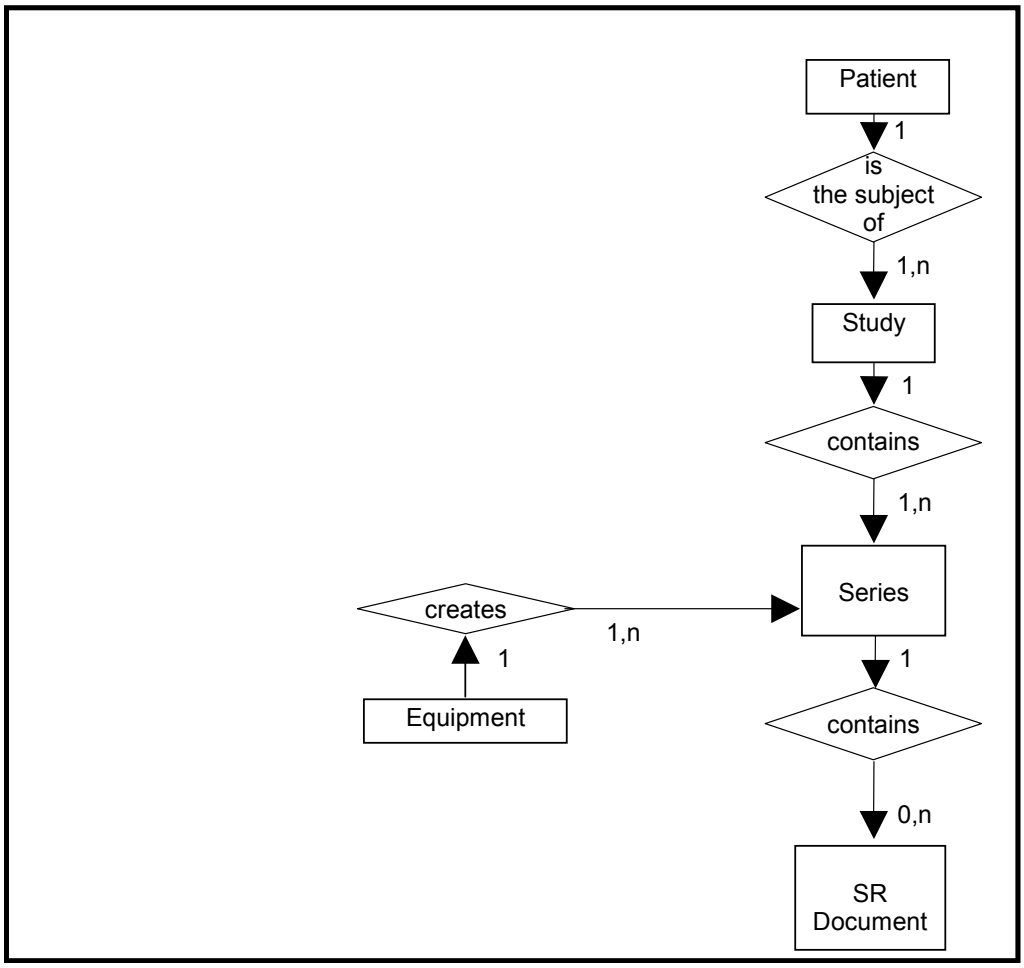
Warning: The Structured Report SOP Instances created by this application, as described in this section, use private templates and both standard and private coded terminology, as allowed by the DICOM Standard. However, the use of DICOM and SNOMED coded terminology in those private templates may not be fully conformant to the semantics of those coding systems. Users are cautioned to interpret the coded terminology in accordance with the intended meanings described in this section.

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

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
	Clinical Trial Subject	Not used	N/A
Study	General Study	Used	8.3.2
	Patient Study	Used	8.3.3
	Clinical Trial Study	Not used	N/A
Series	SR Document Series	Used	8.3.4
	Clinical Trial Series	Not used	N/A
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 ENHANCED 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.

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

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.
Issuer of Patient ID	(0010,0021)	3	Removed
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.
Other Patient IDs	(0010,1000)	3	Removed
Other Patient Names	(0010,1001)	3	Removed
Other Patient IDs Sequence	(0010,1002)	3	Removed
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	Generated as empty sequence.

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	Not used.
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 as described in 8.3.7.1.1
> '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_100	Volume Viewer Generic Report Document Root	Create
	TID CARDIQ_100	Cardiac Document Root	Create
	TID CARDIQ_FUN_100	Cardiac Function Document Root	Create
	TID LUNGVCAR_100	Lung VCAR Document Root	Create
	TID COLONVCAR_100	Colon VCAR Document Root	Create
	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 Volume Viewer Common Report Templates

8.5.2.1.1 TID VV_10 - Volume Viewer Pre Exam Template

TID VV_10

Volume Viewer Pre Exam

Type: Non-Extensible

	NL	Relation with Parent	Value Type	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	EV (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	>	HAS CONCEPT MOD	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	U		**DCID (VV-010)** Yes-No
13	>	CONTAINS	CODE	(F-02A18, SNM3, "Overweight")	1	U		**DCID (VV-010)** Yes-No
14	>	CONTAINS	CODE	(VV-050, 99GEMS, "Diabetes")	1	U		**DCID (VV-010)** Yes-No
15	>	CONTAINS	TEXT	(F-63980, SNM3, "Cholesterol")	1	U		
16	>	CONTAINS	TEXT	(CAR-036, 99GEMS, “Beta-Blockers”)	1	U		
17	>	CONTAINS	TEXT	(CAR-037, 99GEMS, “Nitro”)	1	U		
18	>	CONTAINS	NUM	(8867-4, LN, "Heart Rate")	1	U		
19	>	CONTAINS	CODE	(121109, DCM, "Indications for Procedure")	1	U		**DCID (VV-015)** Indications for study
20	>	CONTAINS	CODE	(G-C2CB, SNM3, "Ventricular dominance")	1	U		**DCID (VV-017)** Ventricular dominance
21	>	CONTAINS	NUM	(8277-6, LN, "Body Surface Area")	1	UC	May be present if Weight Height specified by user	UNIT = (m2, UCUM, “square meter”)
22	>	INFERRED FROM	CODE	(8278-4, LN, "Body Surface Area Formula")	1	UC	Must be present if (8277-6, LN, "Body Surface Area") is present	

8.5.2.1.2 TID VV_15 - Volume Viewer Image Template

This template describes a Volume Viewer image.

TID VV_15

Volume Viewer Image

Type: Non-Extensible

	NL	Relationship With Parent	Value Type	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	EV (CAPTURE, DCM, “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	>	CONTAINS	CODE	DT (111028, DCM, “Image Library”)	1	M		EV (G-D231, SNM3, “Automatic”) or EV (G-D221, SNM3, “Manual”)
5	>	CONTAINS	TEXT	EV (121106, DCM, "Comment")	1	M		

8.5.2.1.3 TID VV_20 - Volume Viewer Measurement Template

TID VV_20 Parameters

Parameter Name	Parameter Usage
$Measurement	Coded term or Context Group for Concept Name of measurement.
$Units	Units of Measurement.

TID VV_20

Volume Viewer Measurement

Type: Non-Extensible

	NL	Relation with Parent	Value Type	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	EV (R-40831, SNM3, “Measurement”)	1	M		
2	>	CONTAINS	NUM	$Measurement	1	M		$Units
3	>>	HAS CONCEPT MOD	TEXT	DT (VV-008, 99GEMS, "Name")	1	M		
4	>>	HAS_PROPERTIES	NUM	(R-00363, SNM3, “+/- range of measurement”)	1	U		
5	>>	HAS CONCEPT MOD	TEXT	EV (121106, DCM, "Comment")	1	U		
6	>	CONTAINS	INCLUDE	**DTID (VV_15)** Volume Viewer Image	1	U		

8.5.2.1.4 TID VV_30 - Volume Viewer ROI Template

This template describes Region Of Interest (ROI) related measurements.

TID VV_30
Volume Viewer ROI
Type: Non-Extensible

	NL	Relation with Parent	Value Type	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	EV (R-40831, SNM3, “Measurement”)	1	M		
2	>	HAS CONCEPT MOD	TEXT	EV (VV-008, 99GEMS, "Name")	1	M		
3	>	CONTAINS	NUM	DT(VV-032, 99GEMS, “Min”)	1	UC	May be present only if it has a valid value	UNITS=(HU, 99GEMS, “Hounsfield unit”)
4	>	CONTAINS	NUM	DT (VV-033, 99GEMS, “Max”)	1	UC	May be present only if it has a valid value	UNITS=(HU, 99GEMS, “Hounsfield unit”)
5	>	CONTAINS	NUM	DT (VV-034, 99GEMS, “Avg”)	1	UC	May be present only if it has a valid value	UNITS=(HU, 99GEMS, “Hounsfield unit”)
6	>	CONTAINS	NUM	DT (VV-036, 99GEMS, “Std”)	1	UC	May be present only if it has a valid value	UNITS=(HU, 99GEMS, “Hounsfield unit”)
7	>	CONTAINS	INCLUDE	**DTID (VV_35)** Volume Viewer ROI Statistics	1-n	U		
8	>	HAS CONCEPT MOD	TEXT	EV (121106, DCM, "Comment")	1	M		
9	>	CONTAINS	INCLUDE	**DTID (VV_15)** Volume Viewer Image	1	U		

8.5.2.1.5 TID VV_35 - Volume Viewer ROI Statistics Template

TID VV_35

Volume Viewer ROI Statistics

Type: Non-Extensible

	NL	Relation with Parent	Value Type	Concept Name	VM	Req Type	Condition	Value Set Constraint

1			CONTAINER	EV (VV-CCP, 99GEMS, “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	EV (G-D705, SNM3, "Volume")	1	U		UNITS = (mm3, UCUM, “cubic millimeter”)
6	>	CONTAINS	NUM	EV (VV-031, 99GEMS, “Percent of total volume”)	1	U		UNITS = (%, UCUM, "percent")

8.5.2.1.6 TID VV_60 - Volume Viewer General Images Template

This template describes general images added to a Volume Viewer report.

TID VV_60

Volume Viewer General Images

Type: Non-Extensible

	NL	Relationship With Parent	Value Type	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	EV (VV-024, 99GEMS, “General Images”)	1	M		
2	>	CONTAINS	INCLUDE	**DTID (VV_15)** Volume Viewer Image	1-n	M		

8.5.2.1.7 TID VV_70 - Volume Viewer Conclusions Template

This template describes Volume Viewer conclusions.

TID VV_70

Volume Viewer 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	M		
2	>	CONTAINS	TEXT	EV (121077, DCM, "Conclusion")	1	M		

8.5.2.2 Volume Viewer Generic Report Template

8.5.2.2.1 TID VV_100 - Volume Viewer Generic Report Document Root Template

This template forms the top of the content tree for reports generated from generic Volume Viewer protocols.

TID VV_100

Volume Viewer Generic Report Document Root

Type: Non-Extensible

	NL	Relation with Parent	Value Type	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	EV (18748-4, LN, “Diagnostic Imaging Report”)	1	M		

2	>	HAS CONCEPT MOD	INCLUDE	**DTID (1204)** Language of Content Item and Descendants	1	M		
3	>	CONTAINS	INCLUDE	**DTID (VV_10)** Volume Viewer Pre Exam	1	M		
4	>	CONTAINS	INCLUDE	**DTID (VV_200)** Volume Viewer Generic Finding	1-n	U		
5	>	CONTAINS	INCLUDE	**DTID (VV_60)** Volume Viewer General Images	1	U		
6	>	CONTAINS	INCLUDE	**DTID (VV_70)** Volume Viewer Conclusions	1	U		

8.5.2.2.2 TID VV_200 - Volume Viewer Generic Finding Template

TID VV_200

Volume Viewer Generic Finding

Type: Non-Extensible

	NL	Relation with Parent	Value Type	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	**DCID (VV-20)** Volume Viewer Generic Findings	1	M		
2	>	HAS CONCEPT MOD	TEXT	EV (VV-008, 99GEMS, "Name")	1	M		
3	>	CONTAINS	TEXT	EV (121106, DCM, "Comment")	1	M		
4	>	CONTAINS	INCLUDE	**DTID (VV_210)** Volume Viewer Generic Finding Items	1-n	U		

8.5.2.2.3 TID VV_210 - Volume Viewer Generic Finding Items Template

TID VV_210

Volume Viewer Generic Finding Items

Type: Non-Extensible

	NL	Relation with Parent	Value Type	Concept Name	VM	Req Type	Condition	Value Set Constraint
1		CONTAINS	INCLUDE	**DTID (VV_15)** Volume Viewer Image	1	MC	XOR Row 2, 3	
2		CONTAINS	INCLUDE	**DTID (VV_20)** Volume Viewer Measurement	1	MC	XOR Row 1, 3	
3		CONTAINS	INCLUDE	**DTID (VV_30)** Volume Viewer ROI	1	MC	XOR Row 1, 2	

8.5.2.3 CardIQ Report Template

8.5.2.3.1 TID CARDIQ_100 - CardIQ Document Root Template

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

TID CARDIQ_100

CardIQ Document Root

Type: Non-Extensible

	NL	Relation with Parent	Value Type	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	EV (18748-4, LN, "Diagnostic Imaging Report")	1	M		
2	>	HAS CONCEPT MOD	INCLUDE	**DTID (1204)** Language of Content Item and Descendants	1	M		
3	>	CONTAINS	INCLUDE	**DTID (VV_10)** Volume Viewer Pre Exam	1	M		
4	>	CONTAINS	INCLUDE	**DTID (CARDIQ_200)** CardIQ Finding	1-n	U		
5	>	CONTAINS	INCLUDE	**DTID (VV_60)** Volume Viewer General Images	1	U		
6	>	CONTAINS	INCLUDE	**DTID (VV_70)** Volume Viewer Conclusions	1	U		

8.5.2.3.2 TID CARDIQ_200 - CardIQ Finding Template

TID CARDIQ_200

CardIQ Finding

Type: Non-Extensible

	NL	Relation with Parent	Value Type	Concept Name	VM	Req Type	Condition	Value Set Constraint
1		CONTAINS	INCLUDE	**DTID (CARDIQ_300)** CardIQ Finding Cardiac	1	MC	XOR Row 2	
2		CONTAINS	INCLUDE	**DTID (VV_200)** Volume Viewer Generic Finding	1	MC	XOR Row 1	

8.5.2.3.3 TID CARDIQ_300 - CardIQ Finding Cardiac Template

TID CARDIQ_300

CardIQ Finding Cardiac

Type: Non-Extensible

	NL	Relation with Parent	Value Type	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	**DCID (CARDIQ-10)** Cardiac Findings	1	M		
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	EV (G-C1E8, SNM3, "Location")	1	U		**DCID (CARDIQ-20)** Cardiac Location Modifiers
4	>	CONTAINS	CODE	EV (G-D70D, SNM3, "Type")	1	U		**DCID (CARDIQ-30)** Cardiac Severity Modifiers
5	>	HAS CONCEPT MOD	TEXT	EV (VV-025, 99GEMS, "Risk comment")	1	U		
6	>	CONTAINS	CODE	EV (CAR-031, 99GEMS, "Characterization")	1	U		**DCID (CARDIQ-40)** Cardiac Characterization Modifiers

7	>	CONTAINS	CODE	EV (CAR-032, SNM3, "Description")	1	U		EV (CAR-025, 99GEMS, “Eccentric”) or EV (R-4047B, SNM3, “Concentric”)
8	>	CONTAINS	CODE	EV (CAR-032, SNM3, "Description")	1	U		EV (CAR-026, 99GEMS, “Heterogeneous”) or EV (CAR-027, 99GEMS, “Homogenous”)
9	>	CONTAINS	CODE	EV (CAR-032, SNM3, "Description")	1	U		EV (G-A403, SNM3, “Regular”)
10	>	CONTAINS	CODE	EV (CAR-032, SNM3, "Description")	1	U		EV (G-A545, SNM3, “Smooth”)
11	>	CONTAINS	CODE	EV (CAR-032, SNM3, "Description")	1	UC	IFF Row 1 = (M-32200, SNM3, “Aneurysm”)	**DCID (CARDIQ-50)** Cardiac Aneurysm Modifiers
12	>	CONTAINS	CODE	EV (CAR-032, SNM3, "Description")	1	UC	IFF Row 1 = (M-32200, SNM3, “Aneurysm”)	EV (M-35100, SNM3, “Thrombus”)
13	>	CONTAINS	TEXT	EV (121106, DCM, "Comment")	1	U		
14	>	CONTAINS	INCLUDE	**DTID (VV_210)** Volume Viewer Generic Finding Items	1-n	U		

8.5.2.4 CardIQ Function Report Template

8.5.2.4.1 TID CARDIQ_FUN_100 - CardIQ Function Document Root Template

This template forms the top of a content tree for reports generated from CardIQ Function.

TID CARDIQ_FUN_100

CardIQ Function Document Root

Type: Non-Extensible

	NL	Relation with Parent	Value Type	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	EV (122600, DCM, “Cardiovascular Analysis Report”)	1	M		
2	>	HAS CONCEPT MOD	INCLUDE	**DTID (1204)** Language of Content Item and Descendants	1	M		
3	>	CONTAINS	INCLUDE	**DTID (VV_10)** Volume Viewer Pre Exam	1	M		
4	>	CONTAINS	INCLUDE	**DTID (VV_70)** Volume Viewer Conclusions	1	M		
5	>	CONTAINS	INCLUDE	**DTID (CARDIQ_FUN_200)** CardIQ Function Finding	1	U		
6	>	CONTAINS	INCLUDE	**DTID (VV_60)** Volume Viewer General Images	1	U		

8.5.2.4.2 TID CARDIQ_FUN_200 - CardIQ Function Finding Template

TID CARDIQ_FUN_200

CardIQ Function Finding

Type: Non-Extensible

	NL	Relation with Parent	Value Type	Concept Name	VM	Req Type	Condition	Value Set Constraint

1			CONTAINER	EV (F-32000, SRT, “Cardiac Function”)	1	M		
2	>	CONTAINS	TEXT	EV (121106, DCM, "Comment")	1	U		
3	>	CONTAINS	INCLUDE	**DTID (CARDIQ_FUN_300)** CardIQ Function Left Ventricle	1	U		
4	>	CONTAINS	INCLUDE	**DTID (CARDIQ_FUN_210)** CardIQ Function Cavity Finding	1	U		$Cavity = EV (T-32500, SRT, “Right Ventricle) $Measurement = **DCID (CARDIQ_FUN-30)** Right Ventricle Measurements
5	>	CONTAINS	INCLUDE	**DTID (CARDIQ_FUN_210)** CardIQ Function Cavity Finding	1	U		$Cavity = EV (T-32300, SRT, “Left Atrium) $Measurement = **DCID (CARDIQ_FUN-40)** Left Atrium Measurements
6	>	CONTAINS	INCLUDE	**DTID (CARDIQ_FUN_210)** CardIQ Function Cavity Finding	1	U		$Cavity = EV (T-32200, SRT, “Right Atrium) $Measurement = **DCID (CARDIQ_FUN-50)** Right Atrium Measurements

8.5.2.4.3 TID CARDIQ_FUN_210 - CardIQ Function Cavity Finding Template

TID CARDIQ_FUN_210 Parameters

Parameter Name	Parameter Usage
$Cavity	Coded term or Context Group for Concept Name of cavity.
$Measurement	Coded term or Context Group for Concept Name of measurement.

TID CARDIQ_FUN_210

CardIQ Function Cavity Finding

Type: Non-Extensible

	NL	Relation with Parent	Value Type	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	$Cavity	1	M		
2	>	CONTAINS	INCLUDE	**DTID (VV_20)** Volume Viewer Measurement	1-n	U		$Measurement = $Measurement $Units = determined by $Measurement
3	>	CONTAINS	INCLUDE	**DTID (CARDIQ_FUN_220)** CardIQ Function Phase Volume	1	U		
4	>	CONTAINS	INCLUDE	**DTID (VV_15)** Volume Viewer Image	1-n	U		

8.5.2.4.4 TID CARDIQ_FUN_220 - CardIQ Function Phase Volume Template

TID CARDIQ_FUN_220

CardIQ Function Phase Volume

Type: Non-Extensible

	NL	Relation with Parent	Value Type	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	EV (CAR-042, 99GEMS, “Phase Volume Table”)	1	M		

2	>	CONTAINS	INCLUDE	**DTID (VV_20)** Volume Viewer Measurement	1-n	M		$Measurement = EV (G-D705, SNM3, "Volume") $Units = EV (ml, UCUM, "milliliter")

8.5.2.4.5 TID CARDIQ_FUN_300 - CardIQ Function Left Ventricle Template

TID CARDIQ_FUN_300

CardIQ Function Left Ventricle

Type: Non-Extensible

	NL	Relation with Parent	Value Type	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	EV (T-32600, SRT, "Left Ventricle)	1	M		
2	>	CONTAINS	INCLUDE	**DTID (VV_20)** Volume Viewer Measurement	1-n	U		$Measurement = **DCID (CARDIQ_FUN-20)** Left Ventricle Measurements $Units = determined by $Measurement
3	>	CONTAINS	INCLUDE	**DTID (CARDIQ_FUN_220)** CardIQ Function Phase Volume	1	U		
4	>	CONTAINS	CONTAINER	EV (122445, DCM, "Wall Thickness")	1	U		
5	>>	CONTAINS	INCLUDE	**DTID (VV_20)** Volume Viewer Measurement	1-n	M		$Measurement = EV (G-A22A, SRT, "Length") $Units = EV (mm, UCUM, "millimeter")
6	>	CONTAINS	CONTAINER	EV (F-32050, SRT, "Cardiac Wall Motion")	1	U		
7	>>	CONTAINS	INCLUDE	**DTID (VV_20)** Volume Viewer Measurement	1-n	M		$Measurement = EV (G-A22A, SRT, "Length") $Units = EV (mm, UCUM, "millimeter")
8	>	CONTAINS	CONTAINER	EV (122607, DCM, "Thickening Analysis")	1	U		
9	>>	CONTAINS	INCLUDE	**DTID (VV_20)** Volume Viewer Measurement	1-n	M		$Measurement = EV (G-A22A, SRT, "Length") $Units = EV (mm, UCUM, "millimeter")
10	>	CONTAINS	INCLUDE	**DTID (VV_15)** Volume Viewer Image	1-n	U		

8.5.2.5 Colon VCAR Report Template

8.5.2.5.1 TID COLONVCAR_100 - Colon VCAR Document Root Template

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

TID COLONVCAR_100

Colon VCAR Document Root

Type: Non-Extensible

	NL	Relation with Parent	Value Type	Concept Name	VM	Req Type	Condition	Value Set Constraint

1			CONTAINER	EV (18748-4, LN, “Diagnostic Imaging Report”)	1	M		
2	>	HAS CONCEPT MOD	INCLUDE	**DTID (1204)** Language of Content Item and Descendants	1	M		
3	>	CONTAINS	INCLUDE	**DTID (VV_10)** Volume Viewer Pre Exam	1	M		
4	>	CONTAINS	INCLUDE	**DTID (COLONVCAR_200)** Colon VCAR Finding	1-n	U		
5	>	CONTAINS	INCLUDE	**DTID (VV_60)** Volume Viewer General Images	1	U		
6	>	CONTAINS	INCLUDE	**DTID (VV_70)** Volume Viewer Conclusions	1	U		

8.5.2.5.2 TID COLONVCAR_200 - Colon VCAR Finding Template

TID COLONVCAR_200

Colon VCAR Finding

Type: Non-Extensible

	NL	Relation with Parent	Value Type	Concept Name	VM	Req Type	Condition	Value Set Constraint
1		CONTAINS	INCLUDE	**DTID (COLONVCAR_300)** Colon VCAR Polyp	1	MC	XOR Row 2	
2		CONTAINS	INCLUDE	**DTID (VV_200)** Volume Viewer Generic Finding	1	MC	XOR Row 1	

8.5.2.5.3 TID COLONVCAR_300 - Colon VCAR Polyp Template

TID COLONVCAR_300

Colon VCAR Polyp

Type: Non-Extensible

	NL	Relation with Parent	Value Type	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	EV (M-76800, SNM3, “Polyp”)	1	M		
2	>	HAS CONCEPT MOD	TEXT	EV (VV-008, 99GEMS, "Name")	1	M		
3	>	CONTAINS	CODE	EV (G-C1E8, SNM3, "Location")	1	U		**DCID (COLONVCAR-10)** Location in Colon
4	>	CONTAINS	CODE	EV (G-C2FE, SNM3, "Shape")	1	U		**DCID (COLONVCAR-20)** Polyp Shape
5	>	CONTAINS	NUM	EV (CTC-004, 99GEMS, "Lesion size")	1	U		UNIT = (mm, UCUM, “millimeter”)
6	>	CONTAINS	NUM	EV (CTC-003, 99GEMS, "Distance from Rectum")	1	U		UNIT = (cm, UCUM, “centimeter”)
7	>	CONTAINS	TEXT	EV (121106, DCM, "Comment")	1	U		
8	>	CONTAINS	INCLUDE	**DTID (VV_210)** Volume Viewer Generic Finding Items	1-n	U		

8.5.2.6 Lung VCAR Report Template

8.5.2.6.1 TID LUNGVCAR_100 - Lung VCAR Document Root Template

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

TID LUNGVCAR_100

Lung VCAR Document Root

Type: Non-Extensible

	NL	Relation with Parent	Value Type	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	EV (18748-4, LN, "Diagnostic Imaging Report")	1	M		
2	>	HAS CONCEPT MOD	INCLUDE	**DTID (1204)** Language of Content Item and Descendants	1	M		
3	>	CONTAINS	INCLUDE	**DTID (VV_10)** Volume Viewer Pre Exam	1	M		
4	>	CONTAINS	INCLUDE	**DTID (LUNGVCAR_200)** Lung VCAR Procedure Context	1	U		
5	>	CONTAINS	INCLUDE	**DTID (LUNGVCAR_300)** Lung VCAR Lung	1	U		
6	>	CONTAINS	INCLUDE	**DTID (LUNGVCAR_400)** Lung VCAR Finding	1-n	U		
7	>	CONTAINS	INCLUDE	**DTID (VV_60)** Volume Viewer General Images	1	U		
8	>	CONTAINS	INCLUDE	**DTID (VV_70)** Volume Viewer Conclusions	1	M		

8.5.2.6.2 TID LUNGVCAR_200 - Lung VCAR Procedure Context Template

This template describes procedure context information.

TID LUNGVCAR_200

Lung VCAR Procedure Context

Type: Non-Extensible

	NL	Relation with Parent	Value Type	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	EV (ALA-029, 99GEMS, "Scan Parameters ")	1	M		
2	>	CONTAINS	INCLUDE	**DTID (LUNGVCAR_210)** Lung VCAR Procedure Context Exam	1-n	M		

8.5.2.6.3 TID LUNGVCAR_210 - Lung VCAR Procedure Context Exam Template

This template describes procedure context information for one Lung exam.

TID LUNGVCAR_210

Lung 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 (ALA-085, 99GEMS, "Scan Exam")	1	M		
2	>	CONTAINS	DATE	EV (ALA-011, 99GEMS, "Exam Date")	1	M		
3	>	CONTAINS	TIME	EV (ALA-012, 99GEMS, "Exam Time")	1	M		

4	>	CONTAINS	NUM	EV (ALA-032, 99GEMS, “Voltage”)	1	M		UNIT = (kV, UCUM, “kilo volt”)
5	>	CONTAINS	NUM	EV (ALA-033, 99GEMS, “Current”)	1	M		UNIT = (mA, UCUM, “milli Ampere”)
6	>	CONTAINS	NUM	EV (ALA-037, 99GEMS, “Dose”)	1	M		UNIT = (mAs, 99GEMS, “mili Ampere second”)
7	>	CONTAINS	TEXT	EV (ALA-030, 99GEMS, “Recon Name”)	1	M		
8	>	CONTAINS	TEXT	EV (ALA-031, 99GEMS, “Manufacturer”)	1	M		
9	>	CONTAINS	NUM	EV (ALA-034, 99GEMS, “Pixel Size”)	1	M		UNIT = (mm, UCUM, “millimeter”)
10	>	CONTAINS	NUM	EV (ALA-035, 99GEMS, “Thickness”)	1	M		UNIT = (mm, UCUM, “millimeter”)
11	>	CONTAINS	NUM	EV (ALA-036, 99GEMS, “Spacing”)	1	M		UNIT = (mm, UCUM, “millimeter”)

8.5.2.6.4 TID LUNGVCAR_300 - Lung VCAR Lung Template

TID LUNGVCAR_300

Lung VCAR Lung

Type: Non-Extensible

	NL	Relation with Parent	Value Type	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	EV (T-28000, SRT, “Lung “)	1	M		
2	>	CONTAINS	INCLUDE	**DTID (LUNGVCAR_310)** Lung VCAR Lung Exam	1-n	M		

8.5.2.6.5 TID LUNGVCAR_310 - Lung VCAR Lung Exam Template

TID LUNGVCAR_310

Lung VCAR Lung Exam

Type: Non-Extensible

	NL	Relation with Parent	Value Type	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	EV (ALA-041, 99GEMS, “Lung Exam”)	1	M		
2	>	CONTAINS	DATE	EV (ALA-011, 99GEMS, “Exam Date”)	1	M		
3	>	CONTAINS	TIME	EV (ALA-012, 99GEMS, “Exam Time”)	1	M		
4	>	CONTAINS	NUM	EV (G-D705, SNM3, “Volume”)	1	M		UNITS = (mm3, UCUM, “cubic millimeter”) (cm3, UCUM “cubic centimeter”)

8.5.2.6.6 TID LUNGVCAR_400 - Lung VCAR Finding Template

TID LUNGVCAR_400

Lung VCAR Finding

Type: Non-Extensible

	NL	Relation with Parent	Value Type	Concept Name	VM	Req Type	Condition	Value Set Constraint
1		CONTAINS	INCLUDE	**DTID (LUNGVCAR_500)** Lung VCAR Nodule	1	MC	XOR Row 2	
2		CONTAINS	INCLUDE	**DTID (VV_200)** Volume Viewer Generic Finding	1	MC	XOR Row 1	

8.5.2.6.7 TID LUNGVCAR_500 - Lung VCAR Nodule Template

TID LUNGVCAR_500

Lung VCAR Nodule

Type: Non-Extensible

	NL	Relation with Parent	Value Type	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	EV (M-03010, SRT, “Nodule”)	1	M		
2	>	HAS CONCEPT MOD	TEXT	EV (VV-008, 99GEMS, “Name”)	1	M		
3	>	CONTAINS	CODE	EV (T-28770, SRT, “Lobe of lung”)	1	M		**DCID (LUNGVCAR-10)** Lobe of lung
4	>	CONTAINS	TEXT	EV (121106, DCM, ”Comment”)	1	M		
	>	CONTAINS	INCLUDE	**DTID (LUNGVCAR_510)** Lung VCAR Finding Exam	1-n	M		

8.5.2.6.8 TID LUNGVCAR_510 - Lung VCAR Finding Exam Template

TID LUNGVCAR_510

Lung VCAR Finding Exam

Type: Non-Extensible

	NL	Relation with Parent	Value Type	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	EV (ALA-010, 99GEMS, “Nodule Exam”)	1	M		
2	>	CONTAINS	DATE	EV (ALA-011, 99GEMS, “Exam Date”)	1	M		
3	>	CONTAINS	CODE	EV (111009, DCM, “Calcification”)	1	U		**DCID (VV-010)** Yes-No
4	>	CONTAINS	CODE	EV (112118, DCM, “Density”)	1	M		**DCID (LUNGVCAR-20)** Nodule density
5	>	CONTAINS	CODE	EV (G-C2FE, SNM3, “Shape”)	1	U		**DCID (LUNGVCAR-30)** Nodule shape
6	>	CONTAINS	CODE	EV (G-A168, SRT, “Surface”)	1	U		**DCID (LUNGVCAR-40)** Nodule surface
7	>	CONTAINS	CODE	EV (G-C197, SRT, “Severity”)	1	U		**DCID (LUNGVCAR-50)** Nodule severity
8	>	CONTAINS	NUM	EV (ALA-081, 99GEMS, “% Growth”)	1	UC	When comparing to baseline exam.	UNIT = (%, UCUM, "percent")

9	>	CONTAINS	NUM	EV (ALA-080, 99GEMS, “Doubling Time”)	1	UC	When comparing to baseline exam.	UNIT = (d, UCUM, “Days”)
10	>	CONTAINS	NUM	EV (ALA-082, 99GEMS, “Days Growth”)	1	UC	When comparing to baseline exam.	UNIT = (d, UCUM, “Days”)
11	>	CONTAINS	NUM	EV (ALA-100, 99GEMS, “L-R”)	1	M		UNIT = (mm, UCUM, “millimeter”)
12	>	CONTAINS	NUM	EV (ALA-101, 99GEMS, “A-P”)	1	M		UNIT = (mm, UCUM, “millimeter”)
13	>	CONTAINS	NUM	EV (ALA-102, 99GEMS, “I-S”)	1	M		UNIT = (mm, UCUM, “millimeter”)
14	>	CONTAINS	NUM	EV (VV-033, 99GEMS, “Max”)	1	M		UNIT=(HU, 99GEMS, “Hounsfield unit”)
15	>	CONTAINS	NUM	EV (VV-032, 99GEMS, “Min”)	1	M		UNIT=(HU, 99GEMS, “Hounsfield unit”)
16	>	CONTAINS	NUM	EV (VV-034, 99GEMS, “Avg”)	1	M		UNIT=(HU, 99GEMS, “Hounsfield unit”)
17	>	CONTAINS	NUM	EV (VV-036, 99GEMS, “Std”)	1	M		UNIT=(HU, 99GEMS, “Hounsfield unit”)
18	>	CONTAINS	NUM	EV (G-D705, SNM3, “Volume”)	1	M		UNITS = (mm3, UCUM, “cubic millimeter”) (cm3, UCUM “cubic centimeter”)
19	>	CONTAINS	TEXT	EV (ALA-084, 99GEMS, “Slice Index”)	1	M		
20	>	CONTAINS	INCLUDE	**DTID (VV_210)** Volume Viewer Generic Finding Items	1-n	U		

8.5.2.7 Context Groups

8.5.2.7.1 CID VV-010 Yes-No

Context ID VV-010

Yes-No

Type: Non-Extensible Version: 20071128

Coding Scheme Designator (0008,0102)	Coding Scheme Version (0008,0103)	Code Value (0008,0100)	Code Meaning (0008,0104)
99GEMS		VV-070	Yes
99GEMS		VV-071	No

8.5.2.7.2 CID VV-015 - Indications for study

Context ID VV-015

Indications for study

Type: Non-Extensible Version: 20101028

Coding Scheme Designator (0008,0102)	Coding Scheme Version (0008,0103)	Code Value (0008,0100)	Code Meaning (0008,0104)
SRT		D3-13040	Coronary artery disease
SNM3		F-37000	Chest pain

Coding Scheme Designator (0008,0102)	Coding Scheme Version (0008,0103)	Code Value (0008,0100)	Code Meaning (0008,0104)
SNM3		D3-20000	Cardiomyopathy
SNM3		G-A609	Other

8.5.2.7.3 CID VV-017 – Ventricular dominance

Context ID VV-017

Ventricular dominance

Type: Non-Extensible Version: 20101028

Coding Scheme Designator (0008,0102)	Coding Scheme Version (0008,0103)	Code Value (0008,0100)	Code Meaning (0008,0104)
99GEMS		CAR-033	Right
99GEMS		CAR-034	Left
99GEMS		CAR-035	Co

8.5.2.7.4 CID VV-20 - Cardiac Findings

Context ID VV-20

Volume Viewer Generic Findings

Type: Non-Extensible Version: 20071128

Coding Scheme Designator (0008,0102)	Coding Scheme Version (0008,0103)	Code Value (0008,0100)	Code Meaning (0008,0104)
99GEMS		VV-006	Extra Finding
DCM		121071	Finding

8.5.2.7.5 CID CARDIQ-10 - Cardiac Findings

Context ID CARDIQ-10

Cardiac Findings

Type: Non-Extensible Version: 20071128

Coding Scheme Designator (0008,0102)	Coding Scheme Version (0008,0103)	Code Value (0008,0100)	Code Meaning (0008,0104)
SNM3		M-32200	Aneurysm
SNM3		F-30164	Cardiac Finding
SNM3		M-01470	Plaque

8.5.2.7.6 CID CARDIQ-20 - Cardiac Location Modifiers

Context ID CARDIQ-20

Cardiac Location Modifiers

Type: Non-Extensible Version: 20071128

Coding Scheme Designator (0008,0102)	Coding Scheme Version (0008,0103)	Code Value (0008,0100)	Code Meaning (0008,0104)
SNM3		G-A119	Distal
SNM3		G-A109	Middle
SNM3		G-A118	Proximal

8.5.2.7.7 CID CARDIQ-30 - Cardiac Severity Modifiers

Context ID CARDIQ-30

Cardiac Severity Modifiers

Type: Non-Extensible Version: 20071128

Coding Scheme Designator (0008,0102)	Coding Scheme Version (0008,0103)	Code Value (0008,0100)	Code Meaning (0008,0104)
SNM3		R-404FA	Mild
SNM3		G-A002	Moderate
SNM3		G-A460	Normal
SNM3		G-A003	Severe

8.5.2.7.8 CID CARDIQ-40 - Cardiac Characterization Modifiers

Context ID CARDIQ-40

Cardiac Characterization Modifiers

Type: Non-Extensible Version: 20071128

Coding Scheme Designator (0008,0102)	Coding Scheme Version (0008,0103)	Code Value (0008,0100)	Code Meaning (0008,0104)
SNM3		M-52100	Atheromatous plaque
SNM3		M-52101	Calcified
99GEMS		CAR-022	Fibroatheromatous
99GEMS		CAR-024	Fibrocalcified
SNM3		M-78260	Fibrous plaque

8.5.2.7.9 CID CARDIQ-50 - Cardiac Aneurysm Modifiers

Context ID CARDIQ-50

Cardiac Aneurysm Modifiers

Type: Non-Extensible Version: 20071128

Coding Scheme Designator (0008,0102)	Coding Scheme Version (0008,0103)	Code Value (0008,0100)	Code Meaning (0008,0104)
SNM3		G-A351	Focal
99GEMS		VV-060	Focal ectasia
SNM3		M-02130	Fusiform
SNM3		M-32390	Pseudoaneurysm

Coding Scheme Designator (0008,0102)	Coding Scheme Version (0008,0103)	Code Value (0008,0100)	Code Meaning (0008,0104)
SNM3		G-A154	Saccular

8.5.2.7.10 CID CARDIQ_FUN-10 - Cardiac Cavities

Context ID CARDIQ_FUN-10

Cardiac Cavities

Type: Non-Extensible Version: 20071128

Coding Scheme Designator (0008,0102)	Coding Scheme Version (0008,0103)	Code Value (0008,0100)	Code Meaning (0008,0104)
SRT		T-32200	Right Atrium
SRT		T-32300	Left Atrium
SRT		T-32500	Right Ventricle
SRT		T-32600	Left Ventricle

8.5.2.7.11 CID CARDIQ_FUN-20 - Left Ventricle Measurements

Context ID CARDIQ_FUN-20

Left Ventricle Measurements

Type: Non-Extensible Version: 20071128

Coding Scheme Designator (0008,0102)	Coding Scheme Version (0008,0103)	Code Value (0008,0100)	Code Meaning (0008,0104)
INCLUDE CID CARDIQ_FUN-30 Right Ventricle Measurements			
SRT		F-03E86	Pulmonary Vascular Resistance
SRT		F-02B35	Systemic Vascular Resistance
DCM		122447	Wall Mass
99GEMS		CAR-043	Myocardial Mass Index

8.5.2.7.12 CID CARDIQ_FUN-30 - Right Ventricle Measurements

Context ID CARDIQ_FUN-30

Right Ventricle Measurements

Type: Non-Extensible Version: 20071128

Coding Scheme Designator (0008,0102)	Coding Scheme Version (0008,0103)	Code Value (0008,0100)	Code Meaning (0008,0104)
99GEMS		CAR-017	End Diastolic Volume
99GEMS		CAR-018	End Systolic Volume
99GEMS		CAR-019	End Diastolic Phase
99GEMS		CAR-020	End Systolic Phase
SRT		F-32070	Ejection Fraction
SRT		F-32120	Stroke Volume
SRT		F-32100	Cardiac Output

8.5.2.7.13 CID CARDIQ_FUN-40 - Left Atrium Measurements

Context ID CARDIQ_FUN-40

Left Atrium Measurements

Type: Non-Extensible Version: 20071128

Coding Scheme Designator (0008,0102)	Coding Scheme Version (0008,0103)	Code Value (0008,0100)	Code Meaning (0008,0104)
SRT		F-32070	Ejection Fraction
99GEMS		CAR-044	Left Atrium Index

8.5.2.7.14 CID CARDIQ_FUN-50 - Right Atrium Measurements

Context ID CARDIQ_FUN-50

Right Atrium Measurements

Type: Non-Extensible Version: 20071128

Coding Scheme Designator (0008,0102)	Coding Scheme Version (0008,0103)	Code Value (0008,0100)	Code Meaning (0008,0104)
99GEMS		CAR-038	Max Volume
99GEMS		CAR-039	Min Volume
99GEMS		CAR-040	Max Phase
99GEMS		CAR-041	Min Phase

8.5.2.7.15 CID COLONVCAR-10 - Location in Colon

Context ID COLONVCAR-10

Location in Colon

Type: Non-Extensible Version: 20071128

Coding Scheme Designator (0008,0102)	Coding Scheme Version (0008,0103)	Code Value (0008,0100)	Code Meaning (0008,0104)
SNM3		G-A599	Ascending
SNM3		T-59100	Cecum
SNM3		G-A600	Descending
SNM3		G-A609	Other
SNM3		T-59609	Rectum
99GEMS		CTC-009	Sigmoid
SNM3		G-A117	Transverse

8.5.2.7.16 CID COLONVCAR-20 - Polyp Shape

Context ID COLONVCAR-20

Polyp Shape

Type: Non-Extensible Version: 20071128

Coding Scheme Designator (0008,0102)	Coding Scheme Version (0008,0103)	Code Value (0008,0100)	Code Meaning (0008,0104)
SNM3		G-A485	Flat
SNM3		T-58650	Ileocecal valve
SNM3		G-A609	Other

Coding Scheme Designator (0008,0102)	Coding Scheme Version (0008,0103)	Code Value (0008,0100)	Code Meaning (0008,0104)
99GEMS		CTC-002	Pedunculated
SNM3		M-76800	Polyp
SNM3		G-A530	Sessile
SNM3		D5-44106	Spasm
SNM3		D5-42030	Stenosis of colon
SNM3		M-8FFFF	Tumor

8.5.2.7.17 CID LUNGVCAR-10 – Lobe of lung

Context ID LUNGVCAR-10

Lobe of lung

Type: Non-Extensible Version: 20101029

Coding Scheme Designator (0008,0102)	Coding Scheme Version (0008,0103)	Code Value (0008,0100)	Code Meaning (0008,0104)
99GEMS		ALA-003	Left Upper
99GEMS		ALA-004	Left Lower
99GEMS		ALA-005	Right Upper
99GEMS		ALA-006	Right Middle
99GEMS		ALA-007	Right Lower

8.5.2.7.18 CID LUNGVCAR-20 – Nodule density

Context ID LUNGVCAR-20

Nodule density

Type: Non-Extensible Version: 20101029

Coding Scheme Designator (0008,0102)	Coding Scheme Version (0008,0103)	Code Value (0008,0100)	Code Meaning (0008,0104)
99GEMS		ALA-015	Solid
99GEMS		ALA-016	Partial-solid
99GEMS		ALA-017	Non-solid

8.5.2.7.19 CID LUNGVCAR-30 – Nodule shape

Context ID LUNGVCAR-30

Nodule shape

Type: Non-Extensible Version: 20101029

Coding Scheme Designator (0008,0102)	Coding Scheme Version (0008,0103)	Code Value (0008,0100)	Code Meaning (0008,0104)
99GEMS		ALA-018	Round
99GEMS		ALA-019	Non-round

8.5.2.7.20 CID LUNGVCAR-40 – Nodule surface

Context ID LUNGVCAR-40

Nodule surface

Type: Non-Extensible Version: 20101029

Coding Scheme Designator (0008,0102)	Coding Scheme Version (0008,0103)	Code Value (0008,0100)	Code Meaning (0008,0104)
SNM3		G-A545	Smooth
DCM		112136	Spiculated
DCM		112135	Lobulated

8.5.2.7.21 CID LUNGVCAR-50 – Nodule severity

Context ID LUNGVCAR-50

Nodule severity

Type: Non-Extensible Version: 20101029

Coding Scheme Designator (0008,0102)	Coding Scheme Version (0008,0103)	Code Value (0008,0100)	Code Meaning (0008,0104)
99GEMS		ALA-024	Not suspicious
99GEMS		ALA-025	Possibly suspicious
99GEMS		ALA-026	Likely suspicious
99GEMS		ALA-027	Probably suspicious
99GEMS		ALA-028	Definitely suspicious

Context ID vv codes

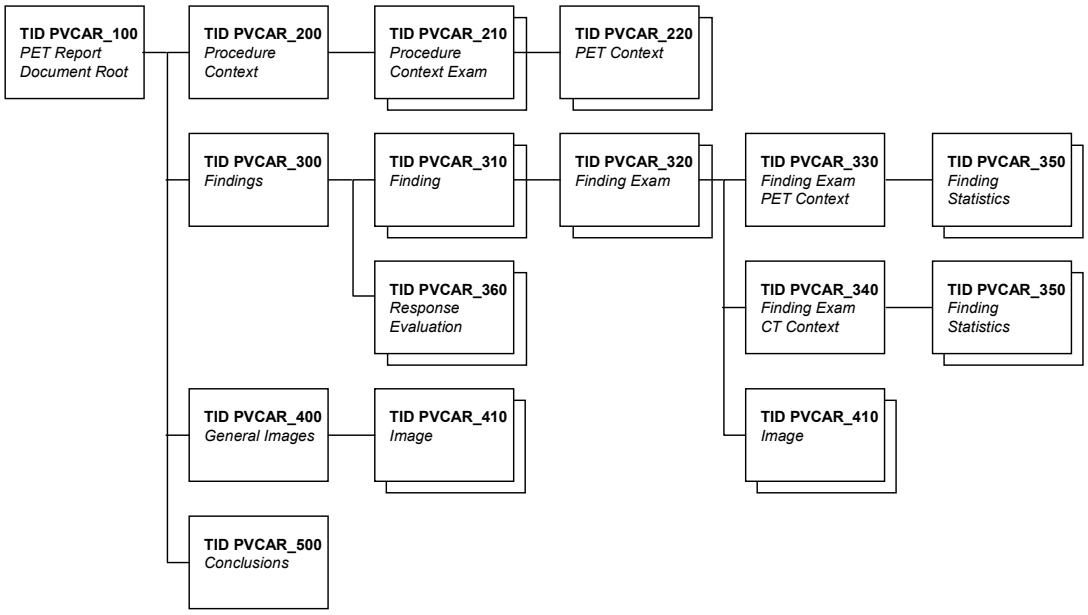
Type: Extensible Version: <20040901>

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-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

Coding Scheme Designator	Code Value	Code Meaning
99GEMS	CTC-002	Pedunculated
99GEMS	CTC-003	Distance from Rectum
99GEMS	CTC-004	Lesion size
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

Coding Scheme Designator	Code Value	Code Meaning
99GEMS	VV-CCP	Color coded plaque statistics
99GEMS	g/m2	g/m2
99GEMS	ml/m2	ml/m2
GEMS-IT	65039	Sigmoid polyp
99GEMS	ALA-003	Left Upper
99GEMS	ALA-004	Left Lower
99GEMS	ALA-005	Right Upper
99GEMS	ALA-006	Right Middle
99GEMS	ALA-007	Right Lower
99GEMS	ALA-015	Solid
99GEMS	ALA-016	Partial-solid
99GEMS	ALA-017	Non-solid
99GEMS	ALA-018	Round
99GEMS	ALA-019	Non-round
99GEMS	ALA-024	Not suspicious
99GEMS	ALA-025	Possibly suspicious
99GEMS	ALA-026	Likely suspicious
99GEMS	ALA-027	Probably suspicious
99GEMS	ALA-028	Definitely suspicious

8.5.2.8 PET VCAR Report Template



8.5.2.8.1 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		

8.5.2.8.2 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		

8.5.2.8.3 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	U		
12	>>	CONTAINS	UIDREF	EV (112002, DCM, “Series Instance UID”)	1	M		

8.5.2.8.4 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	U		
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		

8.5.2.8.5 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		

8.5.2.8.6 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		

8.5.2.8.7 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")

8.5.2.8.8 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 (mm, UCUM, ”millimeter”)
3	>	CONTAINS	NUM	EV (G-A105, SRT, "Anterior")	1	U		UNITS = EV (mm, UCUM, ”millimeter”)
4	>	CONTAINS	NUM	EV (G-A116, SRT, "Superior")	1	U		UNITS = EV (mm, UCUM, ”millimeter”)
5	>	CONTAINS	TEXT	EV (ALA-084, 99GEMS, "Slice Index")	1	U		
6	>	CONTAINS	INCLUDE	**DTID (PVCAR_350)** PET VCAR Finding Statistics	1-n	U		$Statistics = **DCID (PVCAR-330)** PET Statistics $Units = determined by $Statistics

8.5.2.8.9 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 (mm, UCUM, ”millimeter”)
3	>	CONTAINS	NUM	EV (G-A105, SRT, "Anterior")	1	U		UNITS = EV (mm, UCUM, ”millimeter”)
4	>	CONTAINS	NUM	EV (G-A116, SRT, "Superior")	1	U		UNITS = EV (mm, UCUM, ”millimeter”)

5	>	CONTAINS	INCLUDE	**DTID (PVCAR_350)** PET VCAR Finding Statistics	1-n	U		$Statistics = **DCID (PVCAR-340)** CT Statistics

8.5.2.8.10 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 3	Units = $Units
2	>	HAS PROPERTIES	TEXT	EV (R-21358, SRT, "Response to Treatment")	1	U		
3			TEXT	$Statistics	1	MC	XOR row 1	
4	>	HAS PROPERTIES	TEXT	EV (R-21358, SRT, "Response to Treatment")	1	U		

8.5.2.8.11 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		

8.5.2.8.12 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		

8.5.2.8.13 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

8.5.2.8.14 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
3			CONTAINER	EV (121076, DCM, "Conclusions")	1	U		
4	>	CONTAINS	TEXT	EV (121077, DCM, "Conclusion")	1-n	U		

5	>>	HAS PROPERTIES	UIDREF	EV (110180, DCM, "Study Instance UID")	1	M		
6	>>	HAS PROPERTIES	DATE	EV (G-D802, SRT, "Date")	1	M		

8.5.2.8.15 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

8.5.2.8.16 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

8.5.2.8.17 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

8.5.2.8.18 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

8.5.2.8.19 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

8.5.2.8.20 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

8.5.2.8.21 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
99GEMS		PVCAR-0500	EORTC/NCI

Coding Scheme Designator (0008,0102)	Coding Scheme Version (0008,0103)	Code Value (0008,0100)	Code Meaning (0008,0104)
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 GEHC 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

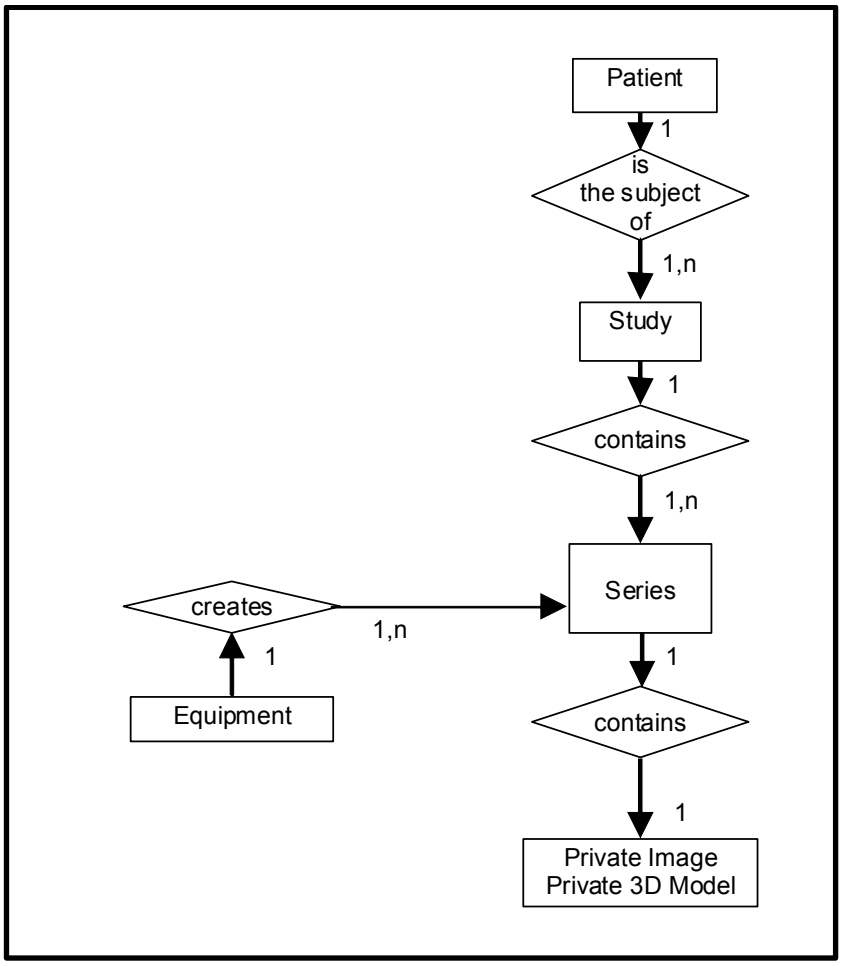
The Entity-Relationship diagram for the 3D Model interoperability schema is shown in **Illustration 9.2-1.** In this figure, the following diagrammatic convention is established to represent the information organization:

- 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 only 1 Image per Series, and 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 GEHC 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 (GEHC 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 GEHC **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 GEHC 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 GEHC private ones). Note that some attributes of the 3D Model entity are GEHC **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 GEHC 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
Issuer of Patient ID	(0010,0021)	3	Ignored / 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
Other Patient IDs Sequence	(0010,1002)	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 Modules 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 / Generated The generated value is the current user’s full name or the value of GECOS environment variable or if both were empty then it is the operator name from the original image.
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	
>Issuer of Accession Number Sequence	(0008,0051)	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 GEHC 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 GEHC 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 (expect 1 item) / 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 GEHC 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 (0047, xx01)

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 GEHC 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 (0047, xx01)

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 GEHC 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 (0047, xx01)

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 (expect 1 or more items) / 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	Used / Copied
> mAs actual vector	(0019, xxB0)	3	Used / 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 (expect 1 or more items) / 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 GEHC private attributes, whose group number is (0x0047). A complete description of other GEHC private attributes can be found in the following 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 GEHC 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 GEHC 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 Xpress 2.0 protocol
Protocol Title	(0047,xxFF)	1C	Used / Generated, if this object saves the state of a CardIQ Xpress 2.0 protocol
Protocol Film Name	(0047,xxF9)	1C	Used / Generated, if this object saves the state of a CardIQ Xpress 2.0 protocol
Protocol Resolution	(0047,xxFA)	1C	Used / Generated, if this object saves the state of a CardIQ Xpress 2.0 protocol
Phase Number (percent)	(0047,xxFB)	2C	Used / Generated, if this object saves the state of a CardIQ Xpress 2.0 protocol
Volume Registered Phases List	(0047,xxFD)	1C	Used / Generated, if this object saves the state of a CardIQ Xpress 2.0 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 GEHC 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

Content Date	(0008,0023)	3	Used / Copied
Content 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	Mandatory/ Generated:1 or 3
Photometric Interpretation	(0028,0004)	1	Mandatory / 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	Mandatory/ 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
Instance Number	(0020,0013)	3	Ignored / Generated
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 Only the “ISO_IR 100” character sets are supported.

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 this 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)	LO	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, xx0B)	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, xxB0)	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

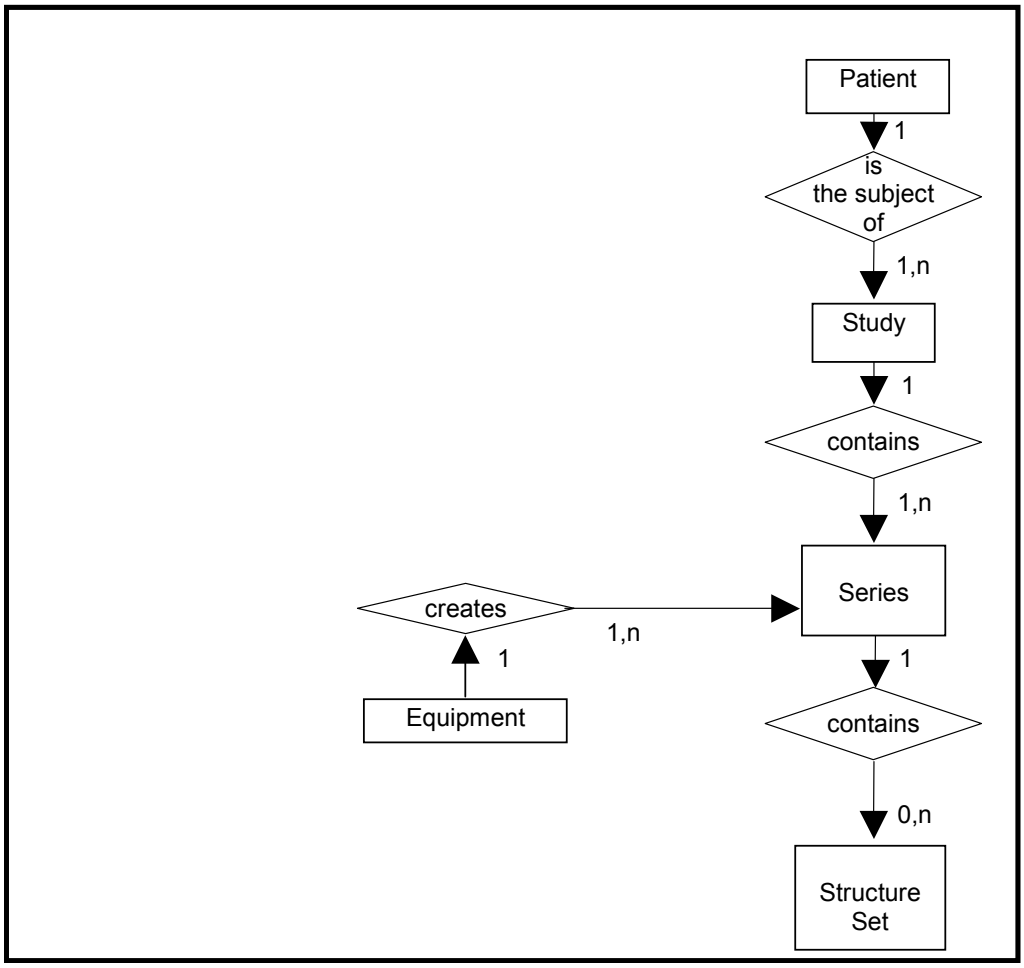
This section describes the RT Structure Set Information Object Implementation generated from PET VCAR. See section 11 for RTSS generated by other protocols than PET VCAR.

10.2 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).



10.2.1 ENTITY DESCRIPTIONS

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

10.2.2 Volume Viewer Mapping of DICOM entities

TABLE 10.2-1
MAPPING OF DICOM ENTITIES TO VOLUME VIEWER ENTITIES

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

10.3 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.

The RT Structure Set Information Object Implementation comprises the modules of the following tables. They are generated from PET VCAR. See section 11 for RTSS generated by other protocols than PET VCAR.

TABLE 10.3-1
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.

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

10.4.1 SOP COMMON MODULE ATTRIBUTES C.12.1

Attribute Name	Element Tag	Type	Notes
Specific Character Set	(0008, 0005)	1C	Copied Only the “ISO_IR 100” character sets are supported.
SOP Class UID	(0008, 0016)	1	"1.2.840.10008.5.1.4.1.1.481.3"
SOP Instance UID	(0008, 0018)	1	Generated
Instance Creation Date	(0008, 0012)	3	Generated: current time.
Instance Creation Time	(0008, 0013)	3	Generated: current time.

SOP Instance Status	(0100,0410)	3	Generated: Enumerated Values: AO (authorized original)
SOP Authorization Date and Time	(0100,0420)	3	Generated: current time.
Contributing Equipment Sequence	(0018,A001)	3	Generated
>Purpose of Reference Code Sequence	(0040,A170)	1	Generated Following triplets are used when generating: (109101, DCS, Acquisition Equipment) (109102, DCS, Processing Equipment)
>>Code Value	(0008,0100)	1C	Generated
>>Code Scheme Designator	(0008,0102)	1C	Generated
>>Code Meaning	(0008,0104)	1C	Generated
>Manufacturer	(0008,0070)	1	Generated
>Station Name	(0008,1010)	3	Generated
>Manufacturer's Model Name	(0008,1090)	3	Generated
>Software Versions	(0018,1020)	3	Generated

10.4.2 PATIENT MODULE ATTRIBUTES C.7.1.1

Attribute Name	Element Tag	Type	Notes
Patient's Name	(0010, 0010)	2	Copied
Patient's ID	(0010, 0020)	2	Copied
Issuer of Patient ID	(0010, 0021)	3	Copied
Patient's Birth Date	(0010, 0030)	2	Copied
Patient's Sex	(0010, 0040)	2	Copied
Other Patient IDs	(0010, 1000)	3	Copied
Other Patient Names	(0010, 1001)	3	Copied
Other Patient IDs Sequence	(0010, 1002)	3	Copied

10.4.3 GENERAL STUDY MODULE ATTRIBUTES C.7.2.1

Attribute Name	Element Tag	Type	Notes
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

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	Generated: current time
Structure Set Time	(3006, 0009)	2	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	Copied
>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 or all images have got no corresponding contour.
>>>>Referenced SOP Class UID	(0008, 1150)	1C	SOP Class UID of 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

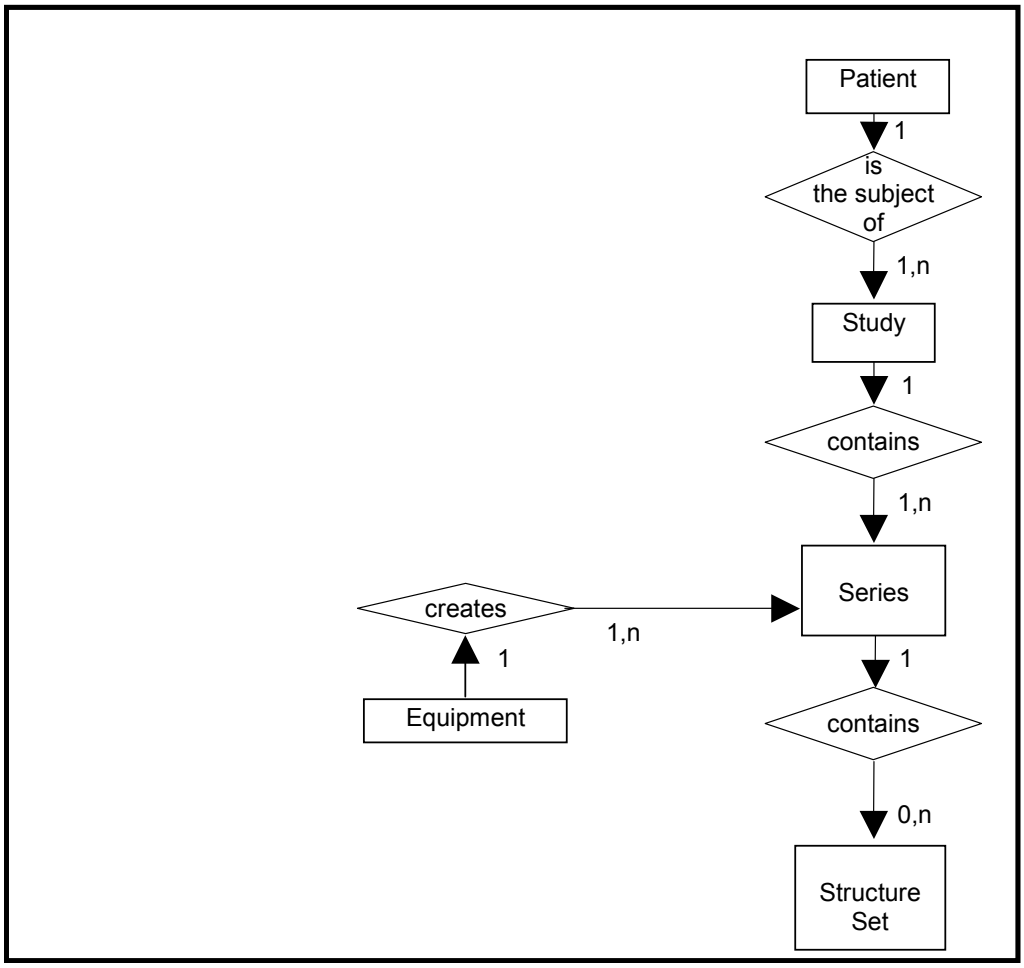
This RT Structure Set Information Object read or generated by the manual contouring tool functionality of different Volume Viewer protocols (currently only from Integrated Registration protocols).

11.2 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).



11.2.1 ENTITY DESCRIPTIONS

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

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

11.2.2 Volume Viewer Mapping of DICOM entities

TABLE 11.2-1
MAPPING OF DICOM ENTITIES TO VOLUME VIEWER ENTITIES

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

11.3 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	11.4.1
	Clinical Trial Subject	11.4.2
Study	General Study	11.5.1
	Patient Study	11.5.2
	Clinical Trial Study	11.5.3
Series	RT Series	11.6.1
	Clinical Trial Series	11.6.2
Equipment	General Equipment	11.7.1
Structure Set	Structure Set	11.8.1
	ROI Contour	11.8.2
	RT ROI Observations	11.8.3
	Approval	11.8.4
	SOP Common	11.8.5

11.4 IE PATIENT

11.4.1 Patient Module

Attribute Name	Tag	Type	Attribute Description
Patient's Name	(0010,0010)	2	Used / Copied
Patient ID	(0010,0020)	2	Used / Copied
Issuer of Patient ID	(0010,0021)	3	Ignored / Copied
Patient's Birth Date	(0010,0030)	2	Used / Copied
Patient's Sex	(0010,0040)	2	Used / Copied
Other Patient IDs	(0010,1000)	3	Ignored / Copied
Other Patient Names	(0010,1001)	3	Ignored / Copied
Other Patient IDs Sequence	(0010,1002)	3	Ignored / Copied

11.4.2 Clinical Trial Subject module

No attributes used / generated.

11.5 IE STUDY

11.5.1 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

11.5.2 Patient Study Module

No attributes used / generated.

11.5.3 Clinical Trial Study Module

No attributes used / generated.

11.6 IE SERIES

11.6.1 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

11.6.2 Clinical Trial Series Module

Ignored / no attributes generated.

11.7 IE EQUIPMENT

11.7.1 General Equipment Module

Attribute Name	Tag	Type	Attribute Description
Manufacturer	(0008,0070)	2	Ignored / Generated: “GE MEDICAL SYSTEMS”

Station Name	(0008,1010)	3	Ignored / Generated: hostname
Manufacturer's Model Name	(0008,1090)	3	Ignored / Generated: “Integrated Registration”
Device Serial Number	(0018,1000)	3	Ignored / Generated: vxtlhostid
Software Versions	(0018,1020)	3	Ignored / Generated

11.8 IE STRUCTURE SET

11.8.1 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

11.8.2 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.

11.8.3 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)

11.8.4 Approval Module

No attributes used/generated.

11.8.5 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 Only the "ISO_IR 100" character sets are supported.
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.
Contributing Equipment Sequence	(0018,A001)	3	Ignored / Generated
>Purpose of Reference Code Sequence	(0040,A170)	1	Ignored / Generated Following triplets are used when generating: (109101, DCS, Acquisition Equipment) (109102, DCS, Processing Equipment)
>>Code Value	(0008,0100)	1C	Ignored / Generated
>>Code Scheme Designator	(0008,0102)	1C	Ignored / Generated

>>Code Meaning	(0008,0104)	1C	Ignored / Generated
>Manufacturer	(0008,0070)	1	Ignored / Generated
>Station Name	(0008,1010)	3	Ignored / Generated
>Manufacturer's Model Name	(0008,1090)	3	Ignored / Generated
>Software Versions	(0018,1020)	3	Ignored / Generated

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

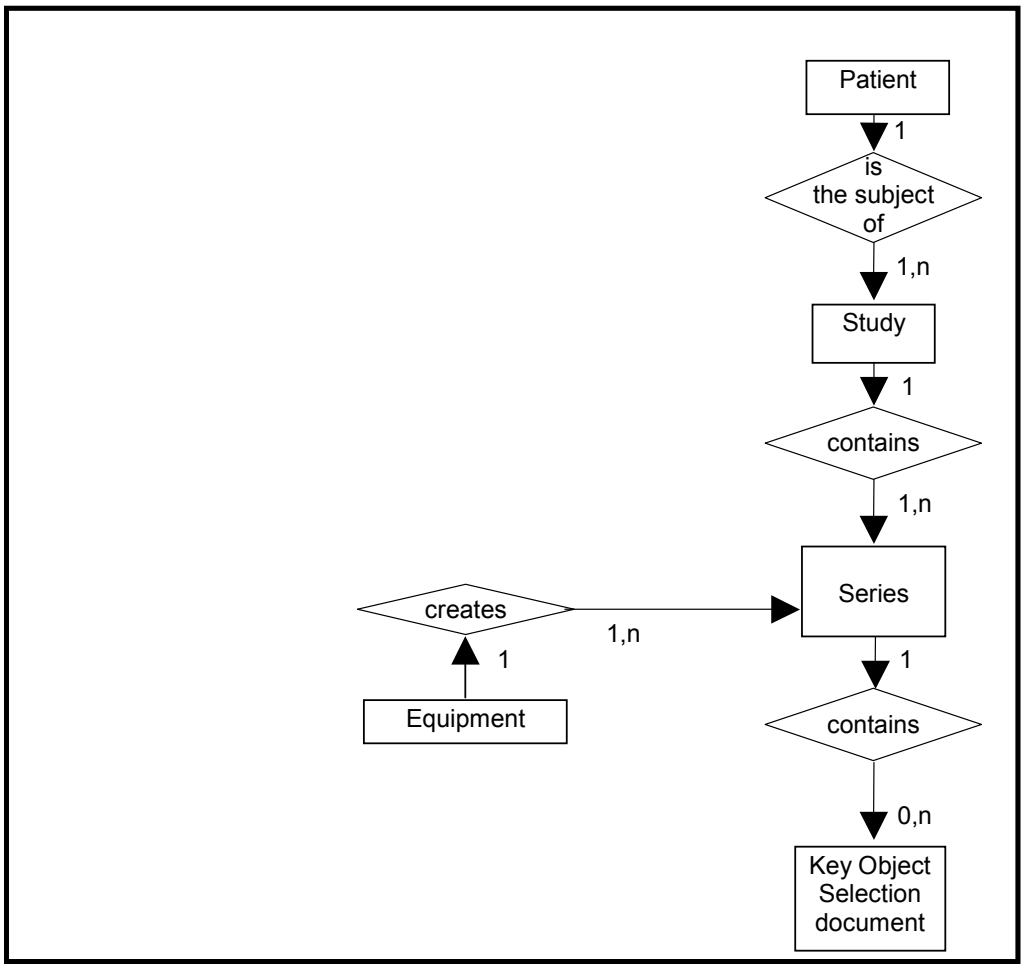
12.2 KEY OBJECT SELECTION ENTITY-RELATIONSHIP MODEL

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**
	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.

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

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).

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	Copied
Patient ID	(0010,0020)	2	Copied
Issuer of Patient ID	(0010,0021)	3	Removed
Patient's Birth Date	(0010,0030)	2	Copied
Patient's Sex	(0010,0040)	2	Copied
Other Patient IDs	(0010,1000)	3	Removed
Other Patient Names	(0010,1001)	3	Removed
Other Patient IDs Sequence	(0010,1002)	3	Removed

12.4.2 Common Study Entity Modules

The following Study IE Modules are common to all Composite 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	Copied
Study Date	(0008,0020)	2	Copied
Study Time	(0008,0030)	2	Copied
Accession Number	(0008,0050)	2	Copied
Referring Physician's Name	(0008,0090)	2	Copied
Study Description	(0008,1030)	3	Copied
Study ID	(0020,0010)	2	Copied

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	Copied
Patient's Size	(0010,1020)	3	Copied
Patient's Weight	(0010,1030)	3	Copied

12.4.3 Key Object Document Series Entity Modules

The following Key Object Document Series IE Modules are common to all Composite 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 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	Generated: the name of the application. One of: Reformat, Volume Viewer, CT Colonography, Advanced Lung Analysis, AutoBone, CardIQ, CardEP, PET VCAR
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 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	(113000, DCM, "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	Copied Only the "ISO_IR 100" character sets are supported.
Instance Number	(0020, 0013)	3	Generated

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		(113000, DCM, "Of interest")
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")	Not applicable
4	>	HAS CONCEPT MOD	CODE	EV (113011, DCM, "Document Title Modifier")	1	MC	IF Row 1 Concept Name = (113013, DCM, "Best In Set")	Not applicable
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	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

13. SPATIAL REGISTRATION INFORMATION OBJECT

13.1 INTRODUCTION

This section specifies the use of the DICOM Spatial Registration IOD to represent the transformation resulting of a registration of two CT, XACT, MR, PET or NM series in any combination, included in Spatial Registration Object produced by this implementation.

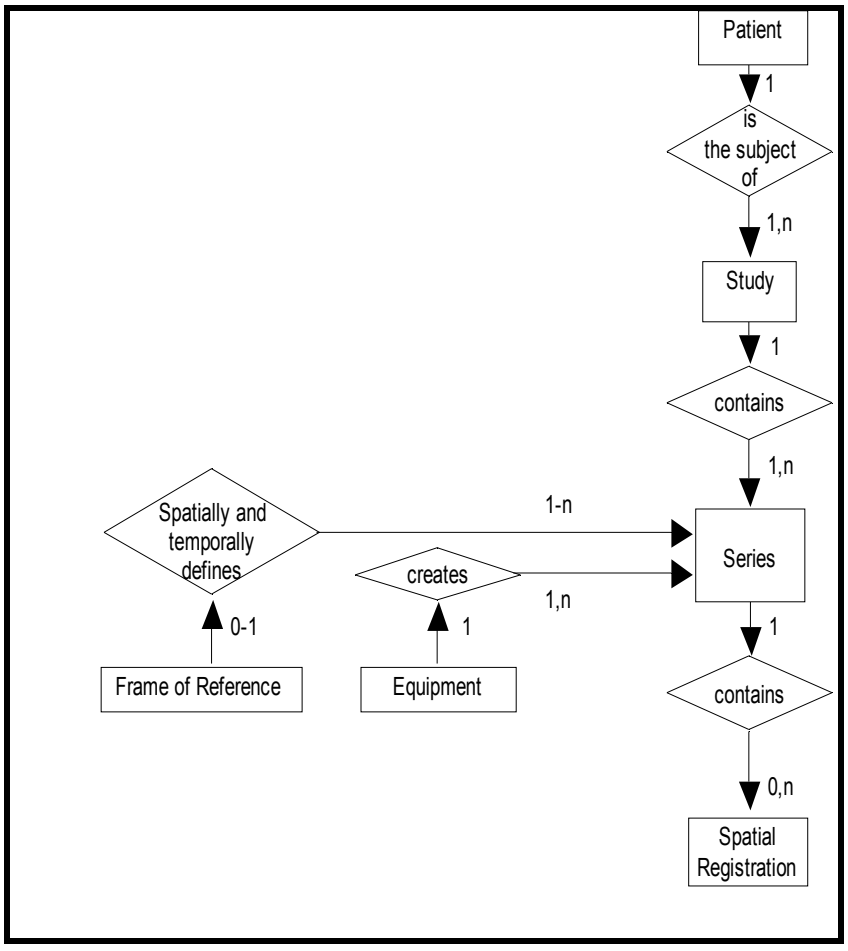
13.1.1 Spatial Information Object Entity-Relationship model

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.

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

Table 13.2-1 SPATIAL REGISTRATION IOD MODULES

IE	Module	Reference
Patient	Patient	13.3.1
	Clinical Trial Subject	13.3.2
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
Issuer of Patient ID	(0010,0021)	3	Copied
Patient's Birth Date	(0010,0030)	2	Copied
Patient's Sex	(0010,0040)	2	Copied
Other Patient IDs	(0010,1000)	3	Copied
Other Patient Names	(0010,1001)	3	Copied
Other Patient IDs Sequence	(0010,1002)	3	Copied

13.3.2 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	Generated: "" (empty string)

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: “IntReg”
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: “INTREG”
Content Description	(0070,0081)	2	Generated: “” (empty string)

Content Creator's Name	(0070,0084)	2	Generated: the current user's name or ""
Registration Sequence	(0070,0308)	1	Generated. Contains 2 items
> Matrix Registration Sequence	(0070,0309)	1	Generated
>> Matrix Sequence	(0070,030A)	1	Generated. Contains 1 item
>>> 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)	2	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	Copied
>> Referenced SOP Instance UID	(0008,1155)	1	Copied

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	Generated
SOP Instance UID	(0008,0018)	1	Generated
Specific Character Set	(0008,0005)	1C	Generated. Only the "ISO_IR 100" character sets are supported.
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)
Contributing Equipment Sequence	(0018,A001)	3	Generated
>Purpose of Reference Code Sequence	(0040,A170)	1	Generated Following triplets are used when generating: (109101, DCS, Acquisition Equipment) (109102, DCS, Processing Equipment)
>>Code Value	(0008,0100)	1C	Generated
>>Code Scheme Designator	(0008,0102)	1C	Generated
>>Code Meaning	(0008,0104)	1C	Generated
>Manufacturer	(0008,0070)	1	Generated
>Station Name	(0008,1010)	3	Generated
>Manufacturer's Model Name	(0008,1090)	3	Generated
>Software Versions	(0018,1020)	3	Generated