

Technical Publications

DOC0611467
Revision 3

Motion VUE 2

**CONFORMANCE STATEMENT
for DICOM**

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REVISION HISTORY

*****Note: This revision history documents the changes for the MyWorkshop review/approval only. It does not document the changes made for final direction 5343420-100. Throughout document, the Direction number used in ePDM has been replaced by the MyWorkshop document number.**

REV	DATE	REASON FOR CHANGE
1	3 May 2009	First Draft for Direction 5343420-100 Rev 1. Updates throughout MyWorkshop versions documented in HII review log DOC0614008.
2	28 July 2009	Updated to include changes based on HII review log DOC0614008.
3	10 Aug 2011	Updated The document for including new tag information used in MotionVue2 program. The tags (0015, xx3F), (0015, xx40) , (0015, xx41), (0015, xx42), (0015, xx43) are added to the Table 4.6-1 of Section 4.6. Updated Table 4.6-1, Section 3.5, removed reference to v3.0 from DICOM and updated the copyright info to reflect the current year instead of 2009, to incorporate the DCS review comments.
3	27 Sep 2011	Updated the documents with Comments from Herve. Updated the Product Version, paragraph related to MyWorkshop in Cover Page. Replaced the strange character, with a # in Table 5.5-11 in section 5.5.8.1. Section 4.5.1.1, 3.4.1.1 & 5.5.1.1 was updated to include (0010, 0021), (0010, 0024), (0010, 1002) tags. Section 5.5.8.1, 4.6, 3.5, 1, 1.1 have all been modified. Sec 1.6 updated with references to AW4.4, 4.5, 4.6 Dicom conformance Directions. Updated Section 2 to include 2.1 to 2.6. Provided the Implementation UID and Version Names for the Motion VUE2 app. Updated the table 3.5-14 & reverted back the Secondary Capture as SCU in Table 0.1

CONFORMANCE STATEMENT OVERVIEW

Motion VUE2 is a PET image display and analysis application developed for use on the GE Advantage Workstation Revision 4.4 and higher. Motion VUE2 does not provide or use any network services directly. Motion VUE2 reads and displays PET and CT images from the Advantage Workstation database. The images are stored on the Advantage Workstation database as DIOCOM Part 10 files. All network services are provided by the Advantage Workstation directly. For a complete description of the networking services of the Advantage Workstation, refer to the AW 4.4 Conformance Statement, Direction 5324648-100.

Table 0.1 provides an overview of the network services supported by Motion VUE2

Table 0.1 – NETWORK SERVICES

SOP Classes	User of Service (SCU)	Provider of Service (SCP)
Transfer		
CT Image Storage	No	Yes
Secondary Capture Image Storage	Yes	No
Positron Emission Tomography Image Storage	No	Yes

There are no Media Storage Application Profiles supported by Motion VUE2.

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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 (Network Storage Conformance Statement), which specifies the GE HEALTHCARE equipment compliance to the DICOM requirements for the implementation of Networking features.

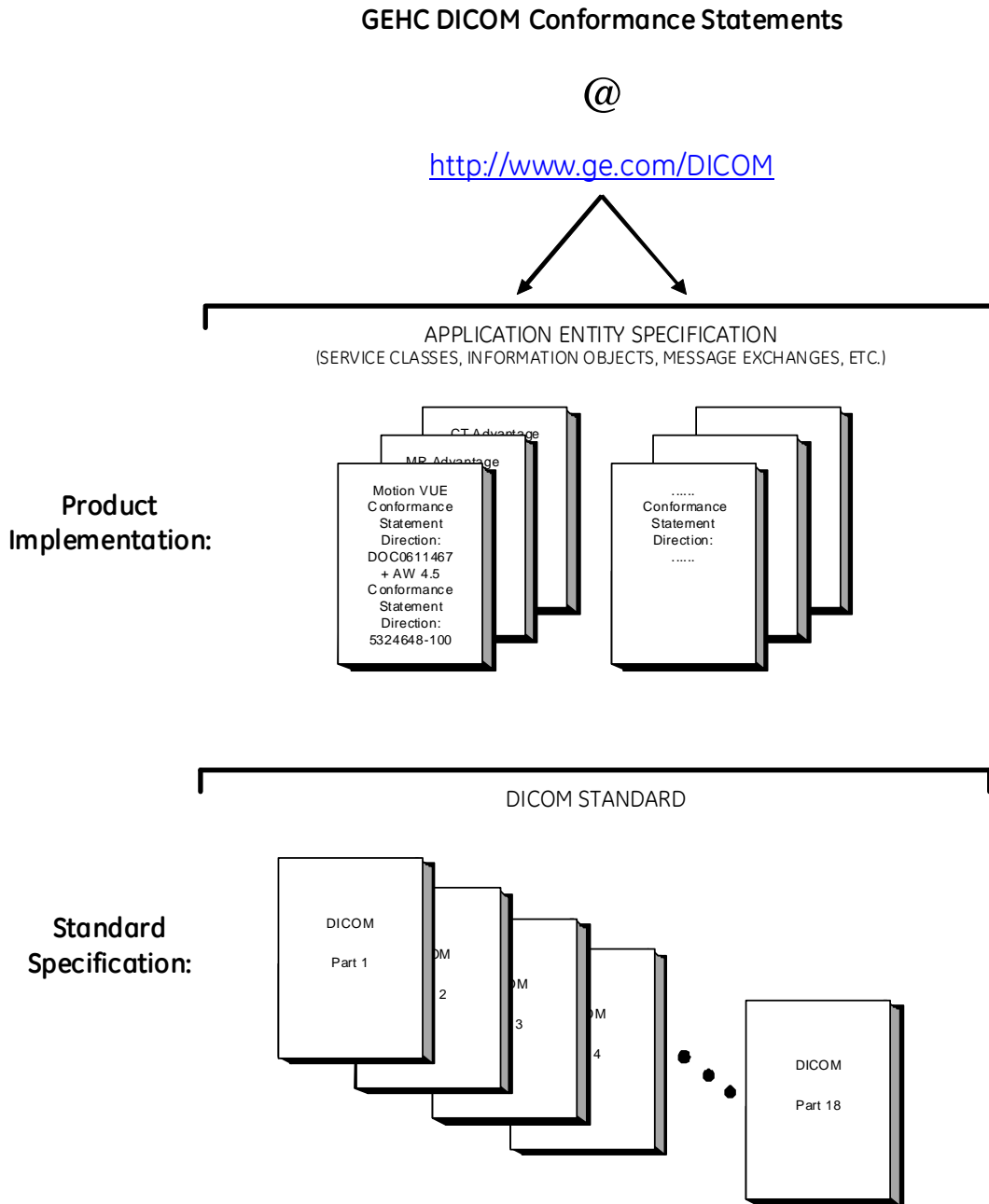
Section 3 (CT Information Object Implementation), which specifies the GE HEALTHCARE equipment compliance to DICOM requirements for the implementation of a CT Information Object.

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

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

1.2 OVERALL DICOM CONFORMANCE STATEMENT DOCUMENT STRUCTURE

The Documentation Structure of the GE HEALTHCARE 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:

*Motion VUE 2
Conformance Statement for DICOM*

Direction: DOC0611467

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

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

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:

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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 v3.0), and of this introduction and associated DICOM Conformance Statements when interoperability with non-GE equipment is desired. The responsibility to analyze the applications requirements and to design a solution that integrates GE imaging equipment with non-GE systems is the **user's** responsibility and should not be underestimated. The **user** is strongly advised to ensure that such an integration analysis is correctly performed.
- **Validation** - Testing the complete range of possible interactions between any GE device and non-GE devices, before the connection is declared operational, should not be overlooked. Therefore, the **user** should ensure that any non-GE provider accepts full responsibility for all validation required for their connection with GE devices. This includes the accuracy of the image data once it has crossed the interface between the GE imaging equipment and the non-GE device and the stability of the image data for the intended applications.

Such a validation is required before any clinical use (diagnosis and/or treatment) is performed. It applies when images acquired on GE imaging equipment are processed/displayed on a non-GE device, as well as when images acquired on non-GE equipment is processed/displayed on a GE console or workstation.

- **Future Evolution** - GE understands that the DICOM Standard will evolve to meet the user's growing requirements. GE is actively involved in the development of the DICOM 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) described 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/>

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
CSE	Customer Service Engineer
CT	Computed Tomography
DICOM	Digital Imaging and Communications in Medicine
IOD	Information Object Definition
ISO	International Organization for Standards
JPEG	Joint Photographic Experts Group
LUT	Look-up Table
MR	Magnetic Resonance Imaging
NM	Nuclear Medicine

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PET	Positron Emission Tomography
PDU	Protocol Data Unit
SC	Secondary Capture
SCP	Service Class Provider
SCU	Service Class User
SOP	Service-Object Pair
TCP/IP	Transmission Control Protocol/Internet Protocol
VR	Value Representation

2. CONFORMANCE STATEMENT

2.1. INTRODUCTION

This section of the DICOM Conformance Statement specifies the Motion VUE compliance to DICOM requirements for **Networking and Media Storage** features.

Motion VUE is a software application developed for use on the Advantage Windows workstation, versions AW4.4 and higher. This means that networking and media storage features are inherited from this platform.

Motion VUE does not have an intrinsic DICOM Network feature. It does not directly invoke the DICOM Server AE. For some detailed information on DICOM features of Advantage Windows platform, refer to the respective Conformance Statement of the platform where Motion VUE application is running (See 1.6 References).

The application uses DICOM images to create reformatted slices. The slices displayed by the application are saved in DICOM format (Secondary Capture). These images can be loaded and displayed by other GE HEALTHCARE applications (such as Volume Viewer or the Image Viewer).

The application parses the following DICOM objects:

Modality	SOP Class
CT	1.2.840.10008.5.1.4.1.1.2
PET	1.2.840.10008.5.1.4.1.1.128

The application creates the following DICOM objects:

Modality	SOP Class
SC	1.2.840.10008.5.1.4.1.1.7

2.2. IMPLEMENTATION MODEL

2.2.1. Application Data Flow Diagram

Refer to the respective Conformance Statement - Advantage Workstation where Motion VUE application is running (See 1.6 References).

2.2.2. Functional Definition of AE's

Motion VUE is a visualization tool that loads gated PET and/or gated CT images and displays PET only, CT only, or PET/CT fused images. The application is intended to reduce the respiratory motion induced blur within a PET image volume by utilization of gating during the PET acquisition followed by application of a global non-rigid registration of the PET gated images to a reference gate.

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

- The DICOM CT IODs that are required to reconstruct a 3-dimensional volume (section 3),

- The DICOM PET IODs that are required to reconstruct a 3-dimensional volume (section 4),
- The DICOM SC IODs written by the application (section 5).

2.2.3. Sequencing of Real-World Activities

Non Applicable

2.3. AE SPECIFICATIONS

2.3.1. Motion VUE AE Specification

The Motion VUE Application Entity provides Standard Conformance to the following DICOM SOP Classes as an **SCU** and/or as an **SCP**:

SOP Class Name	SOP Class UID	SCU	SCP
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	No	Yes
PET Image Storage	1.2.840.10008.5.1.4.1.1.128	No	Yes
SC Image Storage	1.2.840.10008.5.1.4.1.1.7	Yes	No

2.3.1.1. Implementation Identifying Information

The Implementation UID for this DICOM Implementation is:

Motion VUE Implementation UID	1.2.840.113619.6.325
Motion VUE Implementation Version Name	MOTIONVUE02

2.4. SUPPORT OF EXTENDED CHARACTER SETS

Motion VUE accepts only DICOM input with ISO IR 100 as Specific Character Set (0008,0005) if Specific Character Set defined. Other inputs will be rejected with an error message. DICOM output will be generated with either ISO IR 100 as Specific Character Set (0008,0005) tag or without Specific character set

2.5. CODES AND CONTROLLED TERMINOLOGY

The product uses no coded terminology.

2.6. SECURITY PROFILES

The product does not conform to any defined DICOM Security Profiles.

It is assumed that the product is used within a secured environment. It is assumed that a secured environment includes at a minimum:

1. Firewall or router protections to ensure that only approved external hosts have network access to the product.
2. Firewall or router protections to ensure that the product only has network access to approved external hosts and services.
3. Any communications with external hosts and services outside the locally secured environment use appropriate secure network channels (such as a Virtual Private Network (VPN))

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 used by this implementation. Corresponding attributes are conveyed using the module construct. The contents of this section are:

3.2 CT Entity-Relationship Model

3.3 IOD MODULE TABLE

3.4 INFORMATION MODULE DEFINITIONS

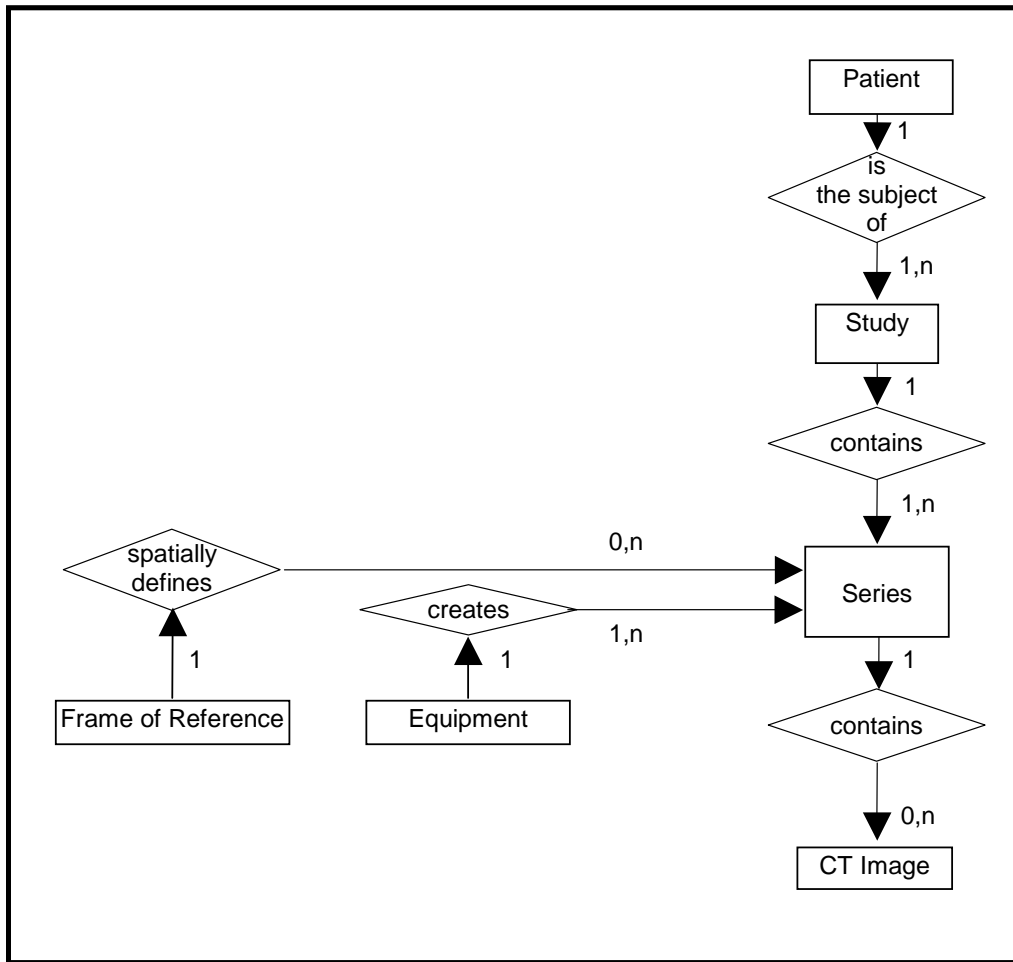
3.2 CT ENTITY-RELATIONSHIP MODEL

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 Mapping of DICOM entities

TABLE 3.2-1
 MAPPING OF DICOM ENTITIES TO APPLICATION ENTITIES

DICOM	Application Entity
Patient	Patient
Study	Exam
Series	Series
Image	Image
Frame	Not Applicable

3.3 IOD MODULE TABLE

Within an entity of the DICOM CT IOD, attributes are grouped into related set of attributes. A set of related attributes is termed a module. A module facilitates the

understanding of the semantics concerning the attributes and how the attributes are related with each other. A module grouping does not infer any encoding of information into datasets.

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

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

**TABLE 3.3-1
 CT IMAGE IOD MODULES**

Entity Name	Module Name	Reference
Patient	Patient	3.4.1.1
Study	General Study	3.4.2.1
	Patient Study	3.4.2.2
Series	General Series	3.4.3.1
Frame of Reference	Frame of Reference	3.4.4.1
Equipment	General Equipment	3.4.5.1
Image	General Image	3.4.6.1
	Image Plane	3.4.6.2
	Image Pixel	3.4.6.3
	Contrast/Bolus	3.4.6.3
	CT Image	3.4.9.1
	Overlay Plane	Not Used
	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 from where these values are obtained. Associated tables contain expectations of the use of entities within the application. No CT images are generated by the application. It should be noted that they are the same ones as defined in the DICOM Standard Part 3 (Information Object Definitions).

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
Patient ID	(0010,0020)	2	Used
Patient's Birth Date	(0010,0030)	2	Used
Patient's Sex	(0010,0040)	2	Used
Referenced Patient Sequence	(0008,1120)	3	Ignored
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
Patient's Birth Time	(0010,0032)	3	Ignored
Other Patient IDs	(0010,1000)	3	Ignored
Other Patient Names	(0010,1001)	3	Ignored
Ethnic Group	(0010,2160)	3	Ignored
Patient Comments	(0010,4000)	3	Ignored
Issuer of Patient ID	(0010,0021)	3	Ignored
Issuer of Patient ID Qualifiers Sequence	(0010,0024)	3	Ignored
Other Patient IDs Sequence	(0010,1002)	3	Ignored

3.4.2 Common Study Entity Modules

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

3.4.2.1 General Study Module

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

**TABLE 3.4-2
GENERAL STUDY MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Study Instance UID	(0020,000D)	1	Mandatory
Study Date	(0008,0020)	2	Used
Study Time	(0008,0030)	2	Used
Referring Physician's Name	(0008,0090)	2	Ignored
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	Ignored
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	

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
Patient's Age	(0010,1010)	3	Used
Patient's Size	(0010,1020)	3	Ignored
Patient's Weight	(0010,1030)	3	Ignored
Occupation	(0010,2180)	3	Ignored
Additional Patient's History	(0010,2180)	3	Ignored

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 Defined Terms: CT = Computed Tomography
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	Ignored
Protocol Name	(0018,1030)	3	Ignored
Series Description	(0008,103E)	3	Used
Operators' Name	(0008,1070)	3	Ignored
Referenced Performed Procedure Step Sequence	(0008,1111)	3	Ignored
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
Related Series Sequence	(0008,1250)	3	Ignored
Body Part Examined	(0018,0015)	3	Ignored
Patient Position	(0018,5100)	2C	Used The Defined Terms are: HFP = Head First-Prone HFS = Head First-Supine HFDR = Head First-Decubitus Right HFDL = Head First-Decubitus Left FFDR = Feet First-Decubitus Right FFDL = Feet First-Decubitus Left FFP = Feet First-Prone FFS = Feet First-Supine
Smallest Pixel Value in Series	(0028,0108)	3	Ignored
Largest Pixel Value in Series	(0028,0109)	3	Ignored
Request Attributes Sequence	(0040,0275)	3	Ignored
>Requested Procedure ID	(0040,1001)	1C	
>Accession Number	(0008,0050)	3	
>Study Instance UID	(0020, 000D)	3	
>Referenced Study Sequence	(0008,1110)	3	
>>Referenced SOP Class UID	(0008,1150)	1C	

>>Referenced SOP Instance UID	(0008,1155)	1C	
>Requested Procedure Description	(0032,1050)	3	
>Requested Procedure Code Sequence	(0032,1064)	3	
>>Code Value	(0008,0100)	1C	
>>Code Scheme Designator	(0008,0102)	1C	
>>Code Meaning	(0008,0104)	1C	
>Reason for the Requested Procedure	(0040,1002)	3	
>Reason for Requested Procedure Code Sequence	(0040,100A)	3	
>>Code Value	(0008,0100)	1C	
>>Code Scheme Designator	(0008,0102)	1C	
>>Code Meaning	(0008,0104)	1C	
>Scheduled Procedure Step ID	(0040,0009)	1C	
>Scheduled Procedure Step Description	(0040,0007)	3	
>Scheduled Protocol Code Sequence	(0040,0008)	3	
>>Code Value	(0008,0100)	1C	
>>Code Scheme Designator	(0008,0102)	1C	
>>Code Meaning	(0008,0104)	1C	
>>Protocol Context Sequence	(0040,0440)	3	
>>Content Item Modifier Sequence	(0040,0441)	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
>Code Value	(0008,0100)	1C	
>Code Scheme Designator	(0008,0102)	1C	
>Code Meaning	(0008,0104)	1C	

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

CT images should share the same Frame Of Reference UID as a necessary conditions to be in the same 3D model. However, this is not sufficient, because images have also to share the same geometry (be parallel with compatible centers), have the same size, the same pixel size, the same tilt, the same study ID, the same reconstruction algorithm, and 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
Position Reference Indicator	(0020,1040)	2	Ignored

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.

**TABLE 3.4-6
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	Ignored
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

3.4.6 Common Image Entity Modules

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

3.4.6.1 General Image Module

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

**TABLE 3.4-7
GENERAL IMAGE MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Image Number	(0020,0013)	2	Used
Patient Orientation	(0020,0020)	2C	Ignored
Image Date	(0008,0023)	2C	Used
Image Time	(0008,0033)	2C	Used
Image Type	(0008,0008)	3	Used (expect ORIGINAL\PRIMARY)
Acquisition Number	(0020,0012)	3	Used
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
Source Image Sequence	(0008,2112)	3	Ignored
>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
Quality Control Image	(0028,0300)	3	Ignored
Burned In Annotations	(0028,0301)	3	Ignored
Lossy Image Compression	(0028,2110)	3	Ignored
Lossy Image Compression Ratio	(0028,2112)	3	Ignored

3.4.6.1.1.1 Lossy Image Compression

Application does not support reading compressed images.

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
Image Orientation (Patient)	(0020,0037)	1	Mandatory
Image Position (Patient)	(0020,0032)	1	Mandatory
Slice Thickness	(0018,0050)	2	Used
Slice Location	(0020,1041)	3	Ignored

3.4.6.3 Image Pixel Module

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

**TABLE 3.4-9
IMAGE PIXEL MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Samples per Pixel	(0028,0002)	1	Ignored (expect "1")
Photometric Interpretation	(0028,0004)	1	Ignored
Rows	(0028,0010)	1	Mandatory (expect from 256 to 1024)
Columns	(0028,0011)	1	Mandatory (expect from 256 to 1024)
Bits Allocated	(0028,0100)	1	Ignored (expect "16")
Bits Stored	(0028,0101)	1	Ignored
High Bit	(0028,0102)	1	Ignored
Pixel Representation	(0028,0103)	1	Ignored (expect "1")
Pixel Data	(7FE0,0010)	1	Used
Planar Configuration	(0028,0006)	1C	Ignored
Pixel Aspect Ratio	(0028,0034)	1C	Ignored
Smallest Image Pixel Value	(0028,0106)	3	Ignored

Largest Image Pixel Value	(0028,0107)	3	Ignored
Red Palette Color Lookup Table Descriptor	(0028,1101)	1C	Ignored
Green Palette Color Lookup Table Descriptor	(0028,1102)	1C	Ignored
Blue Palette Color Lookup Table Descriptor	(0028,1103)	1C	Ignored
Red Palette Color Lookup Table Data	(0028,1201)	1C	Ignored
Green Palette Color Lookup Table Data	(0028,1202)	1C	Ignored
Blue Palette Color Lookup Table Data	(0028,1203)	1C	Ignored

**TABLE 3.4-10
CONTRAST/BOLUS MODULE ATTRIBUTES**

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

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

>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).
Window Width	(0028,1051)	1C	Ignored at load (an automatic W/L is computed on the whole series).
Window Center & Width Explanation	(0028,1055)	3	Ignored

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
SOP Instance UID	(0008,0018)	1	Used
Specific Character Set	(0008,0005)	1C	Used Only the "ISO_IR 100" character sets are 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

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

3.5 PRIVATE DATA

The following private elements are used within the application.

TABLE 3.5-14
PRIVATE MOTION VUE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Private Creator	(0015, 00XX)	3	GEMS_PETD_01: Used
Gating Type	(0015, XX1A)	3	Used
Total Number of Bins	(0015, XX1B)	3	Used
Percent Phase Value	(0015, XX1C)	3	Used

4. PET INFORMATION OBJECT IMPLEMENTATION

4.1 INTRODUCTION

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

4.2 PET IOD DESCRIPTION

4.3 PET ENTITY-RELATIONSHIP MODEL

4.4 IOD MODULE TABLE

4.5 INFORMATION MODULE DEFINITIONS

4.2 PET IOD DESCRIPTION

The Positron Emission Tomography (PET) Image Information Object Definition specifies an image which has been created by a Positron Tomograph imaging device, including dedicated PET cameras and Nuclear Medicine imaging devices operating in coincidence mode. This includes data created by external detection devices which create images of the distribution of administered radioactive materials, specifically positron emitters, in the body. Depending on the specific radiopharmaceuticals administered and the particular imaging procedure performed, problems involving changes in metabolism, function, or physiology can be investigated and various region pathologies can be studied. For these problems, quantitation of image data in absolute activity and physiological units is important. In addition, the PET Image IOD specifies attenuation (transmission) images used for correction and anatomical reference of emission images.

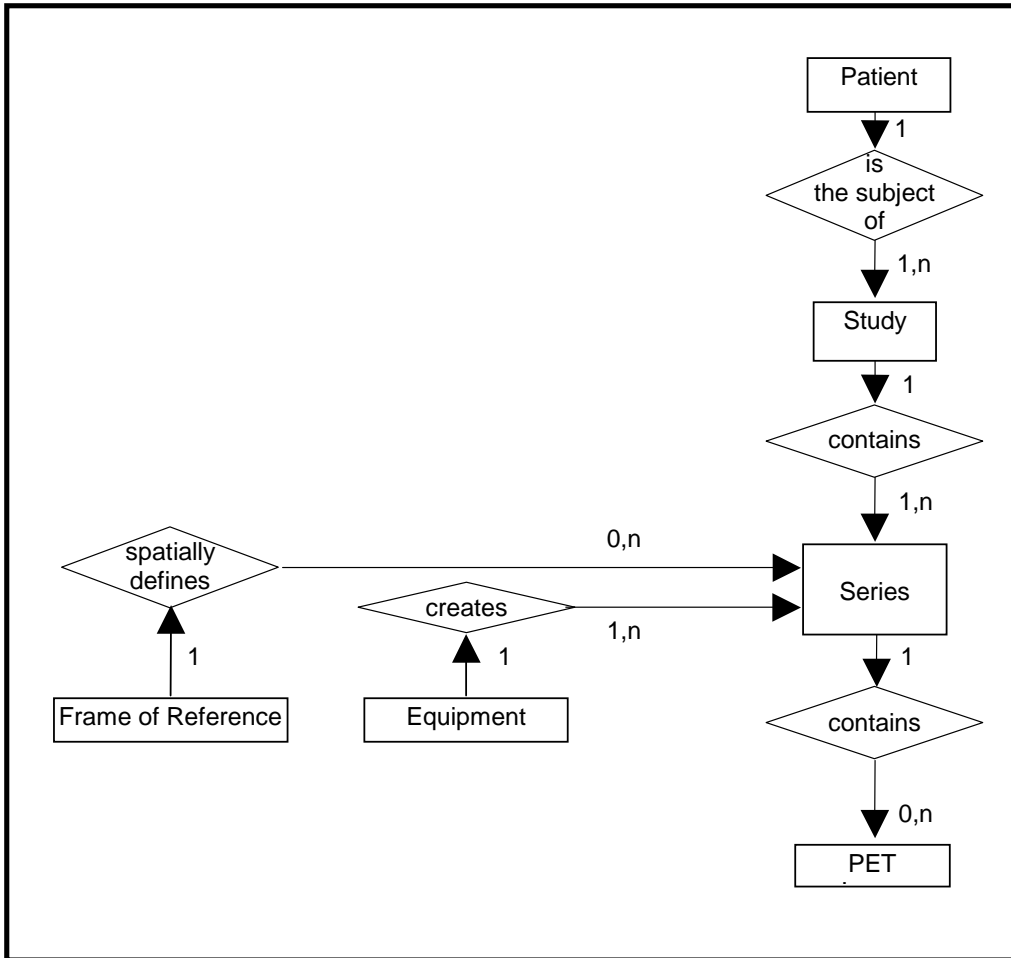
4.3 PET ENTITY-RELATIONSHIP MODEL

The Entity-Relationship diagram for the PET Image interoperability schema is shown in. In this figure Illustration-4.3.1, 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 – 4.3-1
 PET IMAGE ENTITY RELATIONSHIP DIAGRAM



4.3.1 Entity Descriptions

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

4.3.2 Motion VUE Mapping of DICOM entities

TABLE 4.3-1
 MAPPING OF DICOM ENTITIES TO MOTION VUE ENTITIES

DICOM	Motion VUE Entity
Patient	Patient
Study	Exam
Series	Series
Image	Image
Frame	Not Applicable

4.4 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.

Table 4.4-1 identifies the defined modules within the entities that 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 4.4-1
 PET IMAGE IOD MODULES**

Entity Name	Module Name	Reference
Patient	Patient	4.5.1.1
Study	General Study	4.5.2.1
	Patient Study	4.5.2.2
Series	General Series	4.5.3.1
	PET Series	4.5.9.1
	PET Isotope	4.5.9.2
	PET Multi-gated Acquisition	4.5.9.3
	NM/PET Patient Orientation	4.5.9.4
Frame of Reference	Frame of Reference	4.5.4.1
Equipment	General Equipment	4.5.5.1
Image	General Image	4.5.6.1
	Image Plane	4.5.6.2
	Image Pixel	4.5.6.3
	PET Image	4.5.9.5
	Overlay Plane	Not Used
	VOI LUT	4.5.7.1
	SOP Common	4.5.8.1

4.5 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. Associated tables contain expectations of the use of entities within the application. No PET images are generated by the application. It should be noted that they are the same ones as defined in the DICOM Standard Part 3 (Information Object Definitions).

4.5.1 Common Patient Entity Modules**4.5.1.1 Patient Module**

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

TABLE 4.5-1
□PATIENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Patient's Name	(0010,0010)	2	Used
Patient ID	(0010,0020)	2	Used
Patient's Birth Date	(0010,0030)	2	Used
Patient's Sex	(0010,0040)	2	Used
Referenced Patient Sequence	(0008,1120)	3	Ignored
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
Patient's Birth Time	(0010,0032)	3	Ignored
Other Patient IDs	(0010,1000)	3	Ignored
Other Patient Names	(0010,1001)	3	Ignored
Ethnic Group	(0010,2160)	3	Ignored
Patient Comments	(0010,4000)	3	Ignored
Issuer of Patient ID	(0010,0021)	3	Ignored
Issuer of Patient ID Qualifiers Sequence	(0010,0024)	3	Ignored
Other Patient IDs Sequence	(0010,1002)	3	Ignored

4.5.2 Common Study Entity Modules

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

4.5.2.1 General Study Module

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

**TABLE 4.5-2
GENERAL STUDY MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Study Instance UID	(0020,000D)	1	Mandatory
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	

4.5.2.2 Patient Study Module

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

**TABLE 4.5-3
PATIENT STUDY MODULE ATTRIBUTES**

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

4.5.3 Common Series Entity Modules

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

4.5.3.1 General Series Module

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

TABLE 4.5-4
GENERAL SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	Used Defined Terms: PT = Positron Emission Tomography
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 Sequence	(0008,1111)	3	Ignored
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
Related Series Sequence	(0008,1250)	3	Ignored
Body Part Examined	(0018,0015)	3	Ignored
Patient Position	(0018,5100)	2C	Ignored
Smallest Pixel Value in Series	(0028,0108)	3	Ignored
Largest Pixel Value in Series	(0028,0109)	3	Ignored
Request Attributes Sequence	(0040,0275)	3	Ignored
>Requested Procedure ID	(0040,1001)	1C	
>Accession Number	(0008,0050)	3	
>Study Instance UID	(0020, 000D)	3	
>Referenced Study Sequence	(0008,1110)	3	
>>Referenced SOP Class UID	(0008,1150)	1C	
>>Referenced SOP Instance UID	(0008,1155)	1C	
>Requested Procedure Description	(0032,1050)	3	
>Requested Procedure Code Sequence	(0032,1064)	3	
>>Code Value	(0008,0100)	1C	

>>Code Scheme Designator	(0008,0102)	1C	
>>Code Meaning	(0008,0104)	1C	
>Reason for the Requested Procedure	(0040,1002)	3	
>Reason for Requested Procedure Code Sequence	(0040,100A)	3	
>>Code Value	(0008,0100)	1C	
>>Code Scheme Designator	(0008,0102)	1C	
>>Code Meaning	(0008,0104)	1C	
>Scheduled Procedure Step ID	(0040,0009)	1C	
>Scheduled Procedure Step Description	(0040,0007)	3	
>Scheduled Protocol Code Sequence	(0040,0008)	3	
>>Code Value	(0008,0100)	1C	
>>Code Scheme Designator	(0008,0102)	1C	
>>Code Meaning	(0008,0104)	1C	
>>Protocol Context Sequence	(0040,0440)	3	
>>Content Item Modifier Sequence	(0040,0441)	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
>Code Value	(0008,0100)	1C	
>Code Scheme Designator	(0008,0102)	1C	
>Code Meaning	(0008,0104)	1C	

4.5.4 Common Frame Of Reference Entity Modules

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

TABLE 4.5-5
FRAME OF REFERENCE MODULE ATTRIBUTES

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

4.5.4.1 Frame Of Reference UID

Images should share the same Frame Of Reference UID as a necessary condition to be in the same 3D model.

Orthogonal or oblique reformatted PET Images shall have the frame of reference UID copied.

4.5.5 Common Equipment Entity Modules

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

4.5.5.1 General Equipment Module

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

This module will then be generated according to the System on which the series was created and the name of the application creating it.

**TABLE 4.5-6
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

4.5.6 Common Image Entity Modules

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

4.5.6.1 General Image Module

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

**TABLE 4.5-7
GENERAL IMAGE MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Instance Number	(0020,0013)	2	Used
Patient Orientation	(0020,0020)	2C	Ignored
Content Date	(0008,0023)	2C	Used

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Content Time	(0008,0033)	2C	Used
Image Type	(0008,0008)	3	Used
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
Source Image Sequence	(0008,2112)	3	Ignored
>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
Quality Control Image	(0028,0300)	3	Ignored
Burned In Annotations	(0028,0301)	3	Ignored
Lossy Image Compression	(0028,2110)	3	Ignored
Lossy Image Compression Ratio	(0028,2112)	3	Ignored

4.5.6.1.1 General Image Attribute Descriptions

4.5.6.1.1.1 Patient Orientation

The application uses Image Orientation Patient (0020,0037) and Image Position Patient (0020,0032).

4.5.6.1.1.2 Image Type

The expected image type for used images is

Value 1 has the following value:

- ORIGINAL all images used are original images from the PET image acquisition system. Application does not support source data (raw scan data).

Value 2 has the following value:

- PRIMARY assumes all images used are part of initial patient examination.

Value 3 has the following value:

- AXIAL assumes all images used contain a transaxial orientation as part of initial patient examination.

4.5.6.1.1.3 Derivation Description and Source Image Sequence

The Derivation Description tag is not used.

4.5.6.1.1.4 Lossy Image Compression

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

4.5.6.2 Image Plane Module

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

TABLE 4.5-8
 IMAGE PLANE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Pixel Spacing	(0028,0030)	1	Mandatory /Used
Image Orientation (Patient)	(0020,0037)	1	Mandatory
Image Position (Patient)	(0020,0032)	1	Mandatory
Slice Thickness	(0018,0050)	2	Used
Slice Location	(0020,1041)	3	Used

4.5.6.2.1 Pixel Spacing

The Pixel spacing is calculated by the application for all images. Summing over time operation will result in copied pixel spacing. All others are generated. **The pixel spacing is truncated to two decimal space for reformatted save.**

4.5.6.2.2 Image Orientation

Summing over time operation will result in copied Orientation. All others are generated.

4.5.6.2.3 Image Position

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

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

All images saved by the application are encoded with Image Position as the center of the first pixel of the image. Thus converting from the upper left hand corner to the center as necessary.

4.5.6.2.4 Slice Thickness

The Slice Thickness shall be used for loaded images.

4.5.6.3 Image Pixel Module

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

TABLE 4.5-9
 IMAGE PIXEL MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Samples per Pixel	(0028,0002)	1	Ignored (expect "1")
Photometric Interpretation	(0028,0004)	1	Ignored (expect "MONOCHROME2")
Rows	(0028,0010)	1	Mandatory (expect from 64 to 256)
Columns	(0028,0011)	1	Mandatory (expect from 64 to 256)
Bits Allocated	(0028,0100)	1	Ignored (expect "16")

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Bits Stored	(0028,0101)	1	Ignored (expect "16")
High Bit	(0028,0102)	1	Ignored (expect "15")
Pixel Representation	(0028,0103)	1	Ignored (expect "1")
Pixel Data	(7FE0,0010)	1	Used
Planar Configuration	(0028,0006)	1C	Ignored
Pixel Aspect Ratio	(0028,0034)	1C	Ignored
Smallest Image Pixel Value	(0028,0106)	3	Ignored
Largest Image Pixel Value	(0028,0107)	3	Ignored
Red Palette Color Lookup Table Descriptor	(0028,1101)	1C	Ignored
Green Palette Color Lookup Table Descriptor	(0028,1102)	1C	Ignored
Blue Palette Color Lookup Table Descriptor	(0028,1103)	1C	Ignored
Red Palette Color Lookup Table Data	(0028,1201)	1C	Ignored
Green Palette Color Lookup Table Data	(0028,1202)	1C	Ignored
Blue Palette Color Lookup Table Data	(0028,1203)	1C	Ignored

4.5.7 Common Lookup Table Modules

4.5.7.1 VOI LUT module

This section specifies the Attributes that describe the VOI LUT.

TABLE 4.5-10
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	Ignored at load (an automatic W/L is computed on the whole series)
Window Width	(0028,1051)	1C	Ignored at load (an automatic W/L is computed on the whole series)
Window Center & Width Explanation	(0028,1055)	3	Ignored

4.5.7.1.1 Window Center and Width

Generated from the current W/L max and min for the series.

4.5.8 General Modules

The SOP Common Module is mandatory for all DICOM IODs.

4.5.8.1 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 4.5-11
SOP COMMON MODULE ATTRIBUTES

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

4.5.9 PET Modules

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

4.5.9.1 PET Series

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

TABLE 4.5-12
PET SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Series Date	(0008,0021)	1	Used
Series Time	(0008,0031)	1	Used
Units	(0054,1001)	1	Used
Counts Source	(0054,1002)	1	Ignored
Series Type	(0054,1000)	1	Used
Reprojection Method	(0054,1004)	2C	Ignored
Number of R-R Intervals	(0054,0061)	1C	Ignored

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Number of Time Slots	(0054,0071)	1C	Used
Number of Time Slices	(0054,0101)	1C	Ignored
Number of Slices	(0054,0081)	1	Used
Corrected Image	(0028,0051)	2	Used
Randoms Correction Method	(0054,1100)	3	Used
Attenuation Correction Method	(0054,1101)	3	Ignored
Scatter Correction Method	(0054,1105)	3	Ignored
Decay Correction	(0054,1102)	1	Used
Reconstruction Diameter	(0018,1100)	3	Used
Convolution Kernel	(0018,1210)	3	Ignored
Reconstruction Method	(0054,1103)	3	Used
Detector Lines of Response Used	(0054,1104)	3	Ignored
Acquisition Start Condition	(0018,0073)	3	Ignored
Acquisition Start Condition Data	(0018,0074)	3	Ignored
Acquisition Termination Condition	(0018,0071)	3	Ignored
Acquisition Termination Condition Data	(0018,0075)	3	Ignored
Field of View Shape	(0018,1147)	3	Ignored
Field of View Dimensions	(0018,1149)	3	Ignored
Gantry/Detector Tilt	(0018,1120)	3	Ignored
Gantry/Detector Slew	(0018,1121)	3	Ignored
Type of Detector Motion	(0054,0202)	3	Ignored
Collimator Type	(0018,1181)	2	Used
Collimator/Grid Name	(0018,1180)	3	Ignored
Axial Acceptance	(0054,1200)	3	Ignored
Axial Mash	(0054,1201)	3	Ignored
Transverse Mash	(0054,1202)	3	Ignored
Detector Element Size	(0054,1203)	3	Ignored
Coincidence Window Width	(0054,1210)	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
Secondary Counts Type	(0054,1220)	3	Ignored

4.5.9.2 PET Isotope

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

TABLE 4.5-13
PET ISOTOPE MODULE ATTRIBUTES

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

4.5.9.3 PET Multi-gated Acquisition

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

TABLE 4.5-14
PET MULTI-GATED ACQUISITION MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Beat Rejection Flag	(0018,1080)	2	Ignored
Trigger Source or Type	(0018,1061)	3	Ignored

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PVC Rejection	(0018,1085)	3	Used
Skip Beats	(0018,1086)	3	Ignored
Heart Rate	(0018,1088)	3	Ignored
Cardiac Framing Type	(0018,1064)	3	Used

4.5.9.4 NM/PET Patient Orientation

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

TABLE 4.5-15
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	

4.5.9.5 PET Image Module

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

TABLE 4.5-16
PET IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Image Type	(0008,0008)	1	Used
Samples per Pixel	(0028,0002)	1	Ignored (expect 1)
Photometric Interpretation	(0028,0004)	1	Ignored (expect "MONOCHROME2")
Bits Allocated	(0028,0100)	1	Shall be 16
Bits Stored	(0028,0101)	1	Ignored (expect 16)
High Bit	(0028,0102)	1	Ignored (expect 15)
Rescale Intercept	(0028,1052)	1	Used
Rescale Slope	(0028,1053)	1	Used
Frame Reference Time	(0054,1300)	1	Used
Trigger Time	(0018,1060)	1C	Used
Frame Time	(0018,1063)	1C	Used
Low R-R Value	(0018,1081)	1C	Ignored

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High R-R Value	(0018,1082)	1C	Ignored
Lossy Image Compression	(0028,2110)	1C	Ignored
Image Index	(0054,1330)	1	Used
Acquisition Date	(0008,0022)	2	Used
Acquisition Time	(0008,0032)	2	Used
Actual Frame Duration	(0018,1242)	2	Used
Nominal Interval	(0018,1062)	3	Ignored
Intervals Acquired	(0018,1083)	3	Used
Intervals Rejected	(0018,1084)	3	Used
Primary (Prompts) Counts Accumulated	(0054,1310)	3	Used
Secondary Counts Accumulated	(0054,1311)	3	Ignored
Slice Sensitivity Factor	(0054,1320)	3	Ignored
Decay Factor	(0054,1321)	1C	Used
Dose Calibration Factor	(0054,1322)	3	Ignored
Scatter Fraction Factor	(0054,1323)	3	Ignored
Dead Time Factor	(0054,1324)	3	Ignored
Anatomic Region Sequence	(0008,2218)	3	Ignored
>Code Value	(0008,0100)	1C	
>Code Scheme Designator	(0008,0102)	1C	
>Code Meaning	(0008,0104)	3	
>Anatomic Region Modifier Sequence	(0008,2220)	3	Ignored
>>Code Value	(0008,0100)	1C	
>>Code Scheme Designator	(0008,0102)	1C	
>>Code Meaning	(0008,0104)	3	
Primary Anatomic Structure Sequence	(0008,2228)	3	Ignored
>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
>>Code Value	(0008,0100)	1C	
>>Code Scheme Designator	(0008,0102)	1C	
>>Code Meaning	(0008,0104)	3	
View Code Sequence	(0054,0220)	3	Used
> Code Value	(0008,0100)	1C	
> Coding Scheme Designator	(0008,0102)	1C	
> Code Meaning	(0008,0104)	3	
Slice Progression Direction	(0054,0500)	3	Used

4.5.9.6 Image Type

The following values are expected in used images.

Value 1 :ORIGINAL

Value 2 :PRIMARY

Value 3: AXIAL

4.5.9.7 Rescale Slope

The computed rescale slope will be the same for all input images, it's the maximum rescale slope of all the bins.

4.6 PRIVATE DATA

The following private elements are used:

TABLE 4.6-1
PRIVATE MOTION VUE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Private Creator	(0009, 00XX)	3	GEMS_PETD_01: Used
Scan Time	(0009, XX0D)	3	Used
Tracer Activity	(0009, XX38)	3	Used
Measured Time	(0009, XX39)	3	Used
Administrated Time	(0009, XX3B)	3	Used
Post Injected Activity	(0009, XX3C)	3	Used
Post Injected Time	(0009, XX3D)	3	Used
Half Life	(0009, XX3F)	3	Used
Private Creator	(0015, 00XX)	3	GEMS_PETD_01: Used
Phased Matched Series	(0015, XX1d)	3	Used
CTAC Percent Value	(0015, XX1e)	3	Used
NRR Version	(0015, XX3F)	3	Used
NRR Source Series	(0015, XX40)	3	Used
NRR Reference Phase	(0015, XX41)	3	Used
NRR Type	(0015, XX42)	3	Used
NRR App Name	(0015, XX43)	3	Used

5. SECONDARY CAPTURE INFORMATION OBJECT IMPLEMENTATION

5.1 INTRODUCTION

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

- 5.2 SC IOD Implementation
- 5.3 SC Entity-Relationship Model
- 5.4 IOD MODULE TABLE
- 5.5 INFORMATION MODULE DEFINITIONS

5.2 SC IOD IMPLEMENTATION

The Secondary Image (SC) Image Information Object Definition (IOD) specifies images that are converted from a non-DICOM format to a modality independent DICOM format.

Examples of types of equipment that create Secondary Capture Images include:

- a. Video interfaces that convert an analog video signal into a digital image.
- b. Digital interfaces that are commonly used to transfer non-DICOM digital images from an imaging device to a laser printer.
- c. Film digitizers that convert an analog film image to digital data

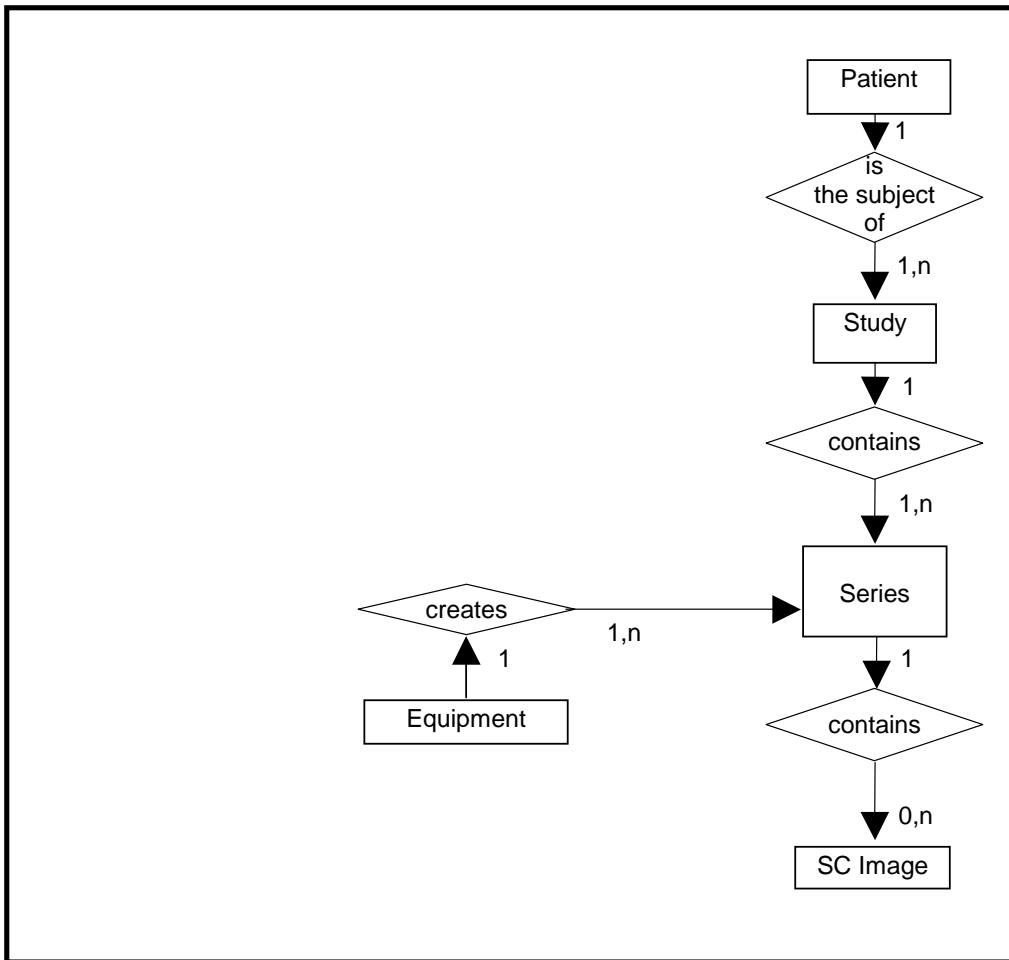
5.3 SC ENTITY-RELATIONSHIP MODEL

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

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

The relationships are fully defined with the maximum number of possible entities in the relationship shown. In other words, the relationship between Series and Image can have up to n Images per Series, but the Patient to Study relationship has 1 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 5.3-1
 SC IMAGE ENTITY RELATIONSHIP DIAGRAM



5.3.1 ENTITY DESCRIPTIONS

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

5.3.2 Mapping of DICOM entities

TABLE 5.3-1
 MAPPING OF DICOM ENTITIES TO APPLICATION ENTITIES

DICOM	Application Entity
Patient	Patient
Study	Exam
Series	Series
Image	Image
Frame	Not Applicable

5.4 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 5.4-1 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.

All elements described as "Copied" are copied from the originating series for PET and CT secondary captures, respectively. For the creation of a fused image secondary capture or full screen capture, the application copies all elements from the originating PET image series.

**TABLE 5.4-1
 SC IMAGE IOD MODULES**

Entity Name	Module Name	Reference
Patient	Patient	5.5.1.1
Study	General Study	5.5.2.1
	Patient Study	5.5.2.2
Series	General Series	5.5.3.1
Equipment	General Equipment	5.5.4.1
	SC Equipment	5.5.8.1
Image	General Image	5.5.5.1
	Image Pixel	5.5.5.2
	SC Image	5.5.8.2
	Overlay Plane	Not Sent
	Modality LUT	5.5.6.2
	VOI LUT	5.5.6.1
	SOP Common	5.5.7.1

5.5 INFORMATION MODULE DEFINITIONS

Please refer to DICOM 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).

5.5.1 Common Patient Entity Modules**5.5.1.1 Patient Module**

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

**TABLE 5.5-1
PATIENT MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Patient's Name	(0010,0010)	2	Copied
Patient ID	(0010,0020)	2	Copied
Patient's Birth Date	(0010,0030)	2	Copied
Patient's Sex	(0010,0040)	2	Copied
Referenced Patient Sequence	(0008,1120)	3	Copied
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
Patient's Birth Time	(0010,0032)	3	Copied
Other Patient IDs	(0010,1000)	3	Copied
Other Patient Names	(0010,1001)	3	Copied
Ethnic Group	(0010,2160)	3	Copied
Patient Comments	(0010,4000)	3	Copied
Issuer of Patient ID	(0010,0021)	3	Ignored
Issuer of Patient ID Qualifiers Sequence	(0010,0024)	3	Ignored
Other Patient IDs Sequence	(0010,1002)	3	Ignored

5.5.2 Common Study Entity Modules

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

5.5.2.1 General Study Module

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

**TABLE 5.5-2
GENERAL STUDY MODULE ATTRIBUTES**

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

5.5.2.2 Patient Study Module

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

**TABLE 5.5-3
PATIENT STUDY MODULE ATTRIBUTES**

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

5.5.3 Common Series Entity Modules

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

5.5.3.1 General Series Module

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

TABLE 5.5-4
GENERAL SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	Copied Defined Terms: PT = PET CT = CT
Series Instance UID	(0020,000E)	1	Generated
Series Number	(0020,0011)	2	Generated
Laterality	(0020,0060)	2C	Generated: ""
Series Date	(0008,0021)	3	Copied
Series Time	(0008,0031)	3	Copied
Performing Physicians' Name	(0008,1050)	3	Copied
Protocol Name	(0018,1030)	3	Removed
Series Description	(0008,103E)	3	Generated
Operators' Name	(0008,1070)	3	Generated
Referenced Performed Procedure Sequence	(0008,1111)	3	Removed
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
Body Part Examined	(0018,0015)	3	Copied
Patient Position	(0018,5100)	2C	Copied The Defined Terms are: HFP = Head First-Prone HFS = Head First-Supine HFDR = Head First-Decubitus Right HFDL = Head First-Decubitus Left FFDR = Feet First-Decubitus Right FFDL = Feet First-Decubitus Left FFP = Feet First-Prone FFS = Feet First-Supine
Smallest Pixel Value in Series	(0028,0108)	3	Removed
Largest Pixel Value in Series	(0028,0109)	3	Removed
Request Attributes Sequence	(0040,0275)	3	Ignored
>Requested Procedure ID	(0040,1001)	1C	
>Accession Number	(0008,0050)	3	
>Study Instance UID	(0020, 000D)	3	
>Referenced Study Sequence	(0008,1110)	3	
>>Referenced SOP Class UID	(0008,1150)	1C	

>>Referenced SOP Instance UID	(0008,1155)	1C	
>Requested Procedure Description	(0032,1050)	3	
>Requested Procedure Code Sequence	(0032,1064)	3	
>>Code Value	(0008,0100)	1C	
>>Code Scheme Designator	(0008,0102)	1C	
>>Code Meaning	(0008,0104)	1C	
>Reason for the Requested Procedure	(0040,1002)	3	
>Reason for Requested Procedure Code Sequence	(0040,100A)	3	
>>Code Value	(0008,0100)	1C	
>>Code Scheme Designator	(0008,0102)	1C	
>>Code Meaning	(0008,0104)	1C	
>Scheduled Procedure Step ID	(0040,0009)	1C	
>Scheduled Procedure Step Description	(0040,0007)	3	
>Scheduled Protocol Code Sequence	(0040,0008)	3	
>>Code Value	(0008,0100)	1C	
>>Code Scheme Designator	(0008,0102)	1C	
>>Code Meaning	(0008,0104)	1C	
>>Protocol Context Sequence	(0040,0440)	3	
>>Content Item Modifier Sequence	(0040,0441)	3	
Performed Procedure Step ID	(0040,0253)	3	Removed
Performed Procedure Step Start Date	(0040,0244)	3	Removed
Performed Procedure Step Start Time	(0040,0245)	3	Removed
Performed Procedure Step Description	(0040,0254)	3	Removed
Performed Protocol Code Sequence	(0040,0260)	3	Removed
>Code Value	(0008,0100)	1C	
>Code Scheme Designator	(0008,0102)	1C	
>Code Meaning	(0008,0104)	1C	

5.5.4 Common Equipment Entity Modules

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

5.5.4.1 General Equipment Module

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

**TABLE 5.5-5
GENERAL EQUIPMENT MODULE ATTRIBUTES**

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

5.5.5 Common Image Entity Modules

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

5.5.5.1 General Image Module

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

**TABLE 5.5-6
GENERAL IMAGE MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Image Number	(0020,0013)	2	Generated
Patient Orientation	(0020,0020)	2C	Generated. See 5.5.5.1.1.1
Image Date	(0008,0023)	2C	Empty. See 5.5.5.1.1.2
Image Time	(0008,0033)	2C	Empty. See 5.5.5.1.1.2
Image Type	(0008,0008)	3	Generated. See 5.5.5.1.1.3
Acquisition Number	(0020,0012)	3	Copied
Acquisition Date	(0008,0022)	3	Copied
Acquisition Time	(0008,0032)	3	Copied
Referenced Image Sequence	(0008,1140)	3	Copied
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	

Derivation Description	(0008,2111)	3	Removed. See 5.5.5.1.1.4
Source Image Sequence	(0008,2112)	3	Ignored See 5.5.5.1.1.4
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
Images in Acquisition	(0020,1002)	3	Removed
Image Comments	(0020,4000)	3	Removed
Quality Control Image	(0028,0300)	3	Removed
Burned In Annotations	(0028,0301)	3	Removed
Lossy Image Compression Ratio	(0028,2112)	3	Removed 5.5.5.1.1.5
Lossy Image Compression	(0028,2110)	3	Removed

5.5.5.1.1 General Image Attribute Descriptions

5.5.5.1.1.1 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".

5.5.5.1.1.2 Image Date and Time

When the application 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
- Application 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
- Application might set it to the original image date, but it does not make sense for reformatted images which are derived from several images

For these reasons, the application will set an empty tag to avoid possible ambiguities.

5.5.5.1.1.3 Image Type

Value 1 has the following value:

- DERIVED identifies a Derived Image

Value 2 has the following value:

- SECONDARY identifies a Secondary Image

Value 3 has the following value:

- SCREEN SAVE identifies a Multi Planar Reformatted Image

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

- MIP identifies a Maximum Intensity Projection Image

5.5.5.1.1.4 Derivation Description and Source Image Sequence

These tags are ignored.

5.5.5.1.1.5 Lossy Image Compression

The application does not use compression when saving images, nor does it decompress images. The application will ignore these tags.

5.5.5.2 Image Pixel Module

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

TABLE 5.5-7
IMAGE PIXEL MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Samples per Pixel	(0028,0002)	1	Generated <ul style="list-style-type: none"> "1" for grayscale images "3" for color images
Photometric Interpretation	(0028,0004)	1	Generated <ul style="list-style-type: none"> "MONOCHROME2" or "MONOCHROME1" for grayscale images "RGB" for color images
Rows	(0028,0010)	1	Generated (256, 512, 1024)
Columns	(0028,0011)	1	Generated (256, 512, 1024)
Bits Allocated	(0028,0100)	1	Generated <ul style="list-style-type: none"> "16" for grayscale images "8" for color images
Bits Stored	(0028,0101)	1	Generated <ul style="list-style-type: none"> "16" for grayscale images "8" for color images
High Bit	(0028,0102)	1	Generated <ul style="list-style-type: none"> "15" for grayscale images "7" for color images
Pixel Representation	(0028,0103)	1	Generated <ul style="list-style-type: none"> "1" for grayscale images "0" for color images
Pixel Data	(7FE0,0010)	1	Used
Planar Configuration	(0028,0006)	1C	Generated <ul style="list-style-type: none"> Removed for grayscale images "0" for color images
Pixel Aspect Ratio	(0028,0034)	1C	Removed
Smallest Image Pixel Value	(0028,0106)	3	Removed
Largest Image Pixel Value	(0028,0107)	3	Removed
Red Palette Color Lookup Table Descriptor	(0028,1101)	1C	Removed
Green Palette Color Lookup Table Descriptor	(0028,1102)	1C	Removed
Blue Palette Color Lookup Table Descriptor	(0028,1103)	1C	Removed
Red Palette Color Lookup Table Data	(0028,1201)	1C	Removed

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

5.5.6 Common Lookup Table Modules

5.5.6.1 VOI LUT module

This section specifies the Attributes that describe the VOI LUT.

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

**TABLE 5.5-8
VOI LUT MODULE ATTRIBUTES**

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

5.5.6.2 Modality LUT module

This section specifies the Attributes that describe the Modality LUT.

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

**TABLE 5.5-9
MODALITY LUT MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Modality LUT Sequence	(0028,3000)	3	Removed
>LUT Descriptor	(0028,3002)	1C	Specify values created or supported.
>LUT Explanation	(0028,3003)	3	
>Modality LUT Type	(0028,3004)	1C	Specify Defined Terms used: OD = Optical density US = Unspecified
>LUT Data	(0028,3006)	1C	
Rescale Intercept	(0028,1052)	1C	Generated
Rescale Slope	(0028,1053)	1C	Generated "1"
Rescale Type	(0028,1054)	1C	Generated <ul style="list-style-type: none"> "HU" for CT "US" for other modalities

5.5.7 General Modules

The SOP Common Module is mandatory for all DICOM IODs.

5.5.7.1 SOP Common Module

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

TABLE 5.5-10
SOP COMMON MODULE ATTRIBUTES

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

5.5.8 SC Modules

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

5.5.8.1 SC Equipment Module

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

TABLE 5.5-11
 SC IMAGE EQUIPMENT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Conversion Type	(0008,0064)	1	Generated: WSD = Workstation
Modality	(0008,0060)	3	Generated See 5.5.3.1 for Enumerated Values.
Secondary Capture Device ID	(0018,1010)	3	Generated from gethostname()
Secondary Capture Device Manufacturer	(0018,1016)	3	Generated "GE Healthcare"
Secondary Capture Device Manufacturer's Model Name	(0018,1018)	3	Generated: the name of the application. Motion VUE
Secondary Capture Device Software Version	(0018,1019)	3	Generated: App Version version "###-###"
Video Image Format Acquired	(0018,1022)	3	Removed
Digital Image Format Acquired	(0018,1023)	3	Removed

5.5.8.2 SC Image Module

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

TABLE 5.5-12
 SC IMAGE MODULE ATTRIBUTES

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