

Technical Publications

5248182-100
Revision 1

Dynamic VUE

CONFORMANCE STATEMENT for DICOM

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REVISION HISTORY

REV	AUTHOR	DATE	REASON FOR CHANGE
1	Ramakanth V R	13 September 2007	Revision for M3

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

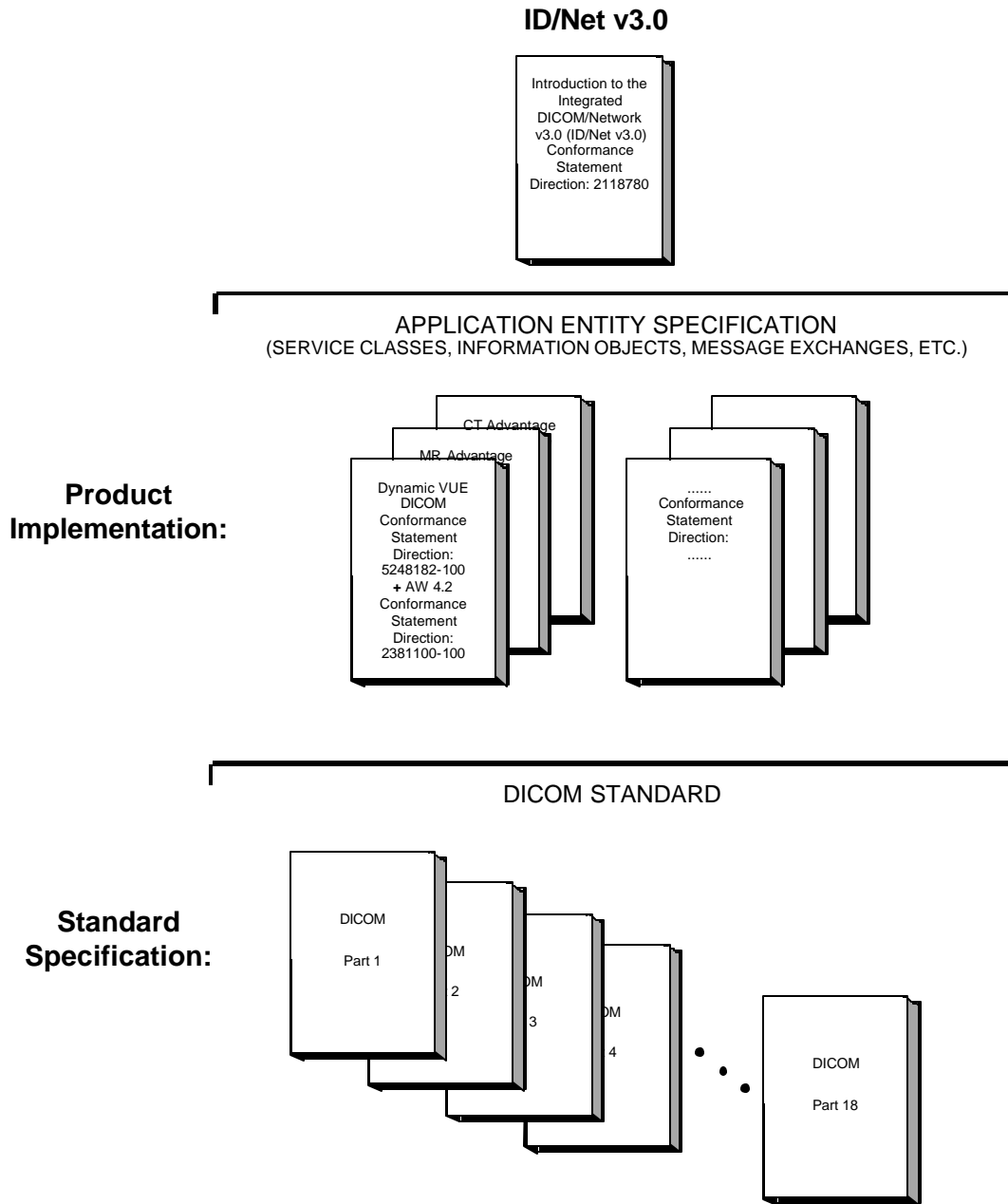
Section 3 (Media Storage Conformance Statement), which specifies the GE HEALTHCARE equipment compliance to the DICOM requirements for the implementation of Media Storage features.

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 (SC 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:

Dynamic VUE Conformance Statement for DICOM Direction: **DOC0267787**

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This DICOM Conformance Statement documents the *DICOM* Conformance Statement and Technical Specification required interoperating with the GE HEALTHCARE 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 Introduction familiarizes the reader with DICOM terminology and general concepts. It should be read prior to reading the individual products' GE HEALTHCARE Conformance Statements.

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

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

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

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

1.3 Intended Audience

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

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

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

1.4 Scope And Field Of The Application

It is the intent of this document, in conjunction with the *Introduction to the Integrated DICOM/Network v3.0 (ID/Net v3.0) Conformance Statement, Direction: 2118780*, to provide an unambiguous specification for GE HEALTHCARE implementations. This specification, called a Conformance Statement, includes a *DICOM* Conformance Statement and is necessary to ensure proper processing and interpretation of GE HEALTHCARE medical data exchanged using *DICOM*. The GE HEALTHCARE Conformance Statements are available to the public.

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

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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 GE HEALTHCARE protocol is based on *DICOM* as specified in each DICOM Conformance Statement. Evolution of the Standard may require changes to devices that 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. Failures to do so will likely result in the loss of function and/or connectivity as the DICOM Standard changes and GE Products are enhanced to support these changes.
- **Interaction** - It is the sole responsibility of the **non-GE provider** to ensure that communication with the interfaced equipment does not cause degradation of GE imaging equipment performance and/or function.

1.6 References

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

The information object implementation refers to DICOM PS 3.3 (Information Object Definition).

1.7 Definitions

A set of definitions which is applicable to all GE HEALTHCARE Conformance Statements is included in the *Introduction to the Integrated DICOM/Network v3.0 (ID/Net v3.0) Conformance Statement, Direction: 2118780.*

1.8 Symbols and Abbreviations

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

1.9 Terms Definitions

In the following conformance statement, the following terms describe the use of each of the DICOM tags. When

Dynamic VUE is loading DICOM data files, we use the following terms:

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- **Ignored** the software will ignore the value of the tag
- **Used** the software might use at some point the value of this tag; the value could be use for computations, for display, or to regenerate the value of a secondary capture
- **Mandatory** the software will need a valid value for this tag; this value will be used for computations and an invalid value will prevent the software to load the data. When the application 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 consistent, the tag will be absent from the data set if “Ignored” at load or possibly regenerated if “Used” at load

2 NETWORK CONFORMANCE STATEMENT

Dynamic VUE is a software application designed for use on the Advantage Windows workstation. This means that networking and media storage features are inherited from this platform. Dynamic VUE will display any PET image. It is primarily used to display images from PET dynamic and gated scans. PET Dynamic allows the user to sum the series over time or location and save the results to a new series. The results series can be viewed in other applications.

For a complete description of the networking conformance, refer to the AW 4.4 conformance statement, direction 5181424-100.

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

- The DICOM PET IODs that are required for use in Dynamic VUE and the (section 4),
- The DICOM PET IODs that written Dynamic VUE and the (section 4)

Modality	SOP Class	FSR	FSC	Remarks
PET	1.2.840.10008.5.1.4.1.1.128	Yes	Yes	

3 MEDIA STORAGE CONFORMANCE STATEMENT

Dynamic VUE is a software application designed for use on the Advantage Windows workstation. This means that networking and media storage features are inherited from this platform. Dynamic VUE will display any PET image. It is primarily used to display images from PET dynamic and gated scans. PET Dynamic allows the user to sum the series over time or location and save the results to a new series. The results series can be viewed in other applications.

For a complete description of the media storage conformance, refer to the AW 4.4 conformance statement, direction 5181424-100.

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

- The DICOM PET IODs that are required for use in Dynamic VUE (section 4),
- The DICOM PET IODs that written Dynamic VUE (section 4),

Modality	SOP Class	FSR	FSC	Remarks
PET	1.2.840.10008.5.1.4.1.1.128	Yes	Yes	

4 PET INFORMATION OBJECT IMPLEMENTATION

4.0 INTRODUCTION

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

[4.1 – IOD Description](#)

[4.2- IOD Entity-Relationship Model](#)

[4.3- IOD Module Table](#)

[4.4 - IOD Module Definition](#)

4.1 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, quantization 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.

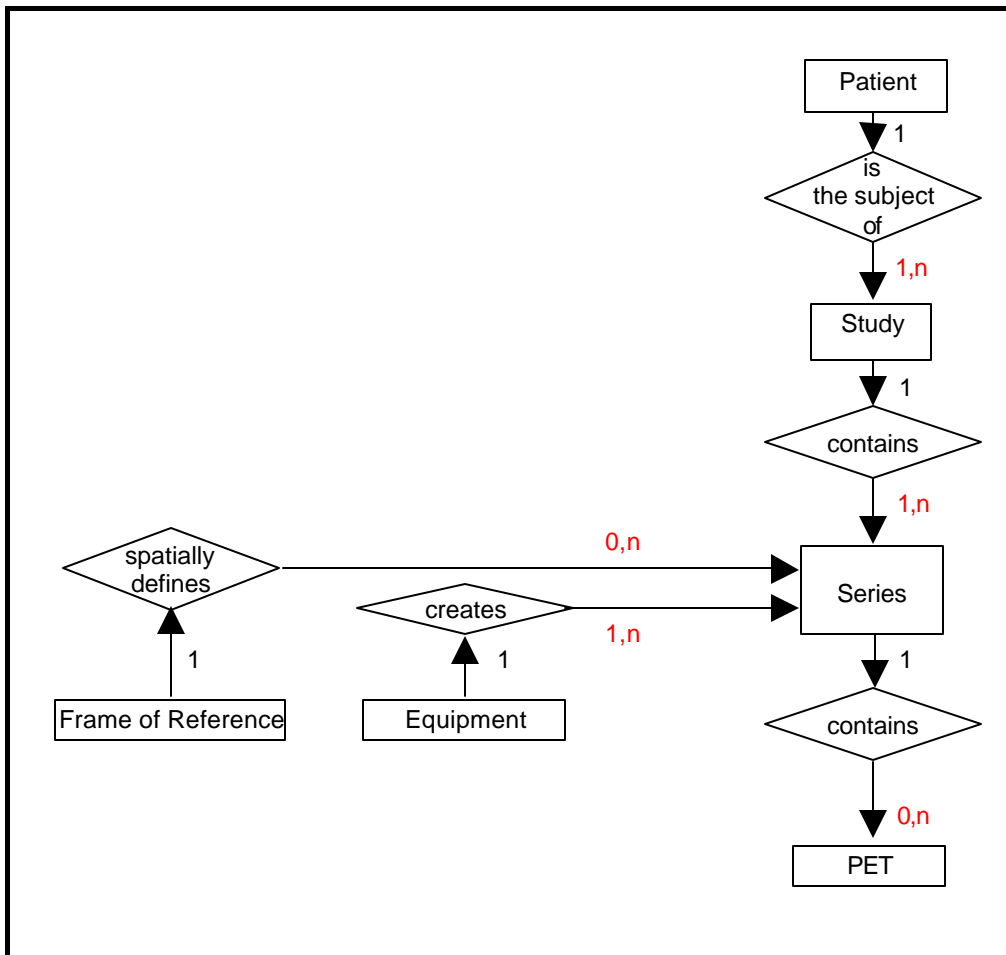
4.2 PET ENTITY-RELATIONSHIP MODEL

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 Study for each Patient (a Patient can have more than one Study on the system, however each Study will contain all of the information pertaining to that Patient).

ILLUSTRATION – 4.3.1
PET 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 PET Information Object.

4.2.2 Dynamic VUE Mapping of DICOM entities

TABLE 4.4-1
MAPPING OF DICOM ENTITIES TO DYNAMIC VUE ENTITIES

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

4.3 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.

Table 4.4-1 identifies the defined modules within the entities that comprise the DICOM PET IOD. Module Name identifies modules.

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

**TABLE 4.4-2
PET IMAGE IOD MODULES**

Entity Name	Module Name	Reference
Patient	Patient	4.4.1.1
Study	General Study	4.4.2.1
	Patient Study	4.4.2.2
Series	General Series	4.4.3.1
	PET Series	4.4.10.1
	PET Isotope	4.4.10.2
	PET Multi-gated Acquisition	4.4.10.3
	NM/PET Patient Orientation	4.4.10.4
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	4.5.6.2
	Image Pixel	4.5.6.3
	PET Image	4.4.10.5
	Overlay Plane	4.4.7.1
	VOI LUT	4.4.8.1
	SOP Common	4.4.9.1

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 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. It should be noted that they are the same ones as defined in the DICOM Standard Part 3 (Information Object Definitions).

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 4.5-3
PATIENT MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Patient's Name	(0010,0010)	2	Used / Copied
Patient ID	(0010,0020)	2	Used / Copied
Patient's Birth Date	(0010,0030)	2	Used / Copied
Patient's Sex	(0010,0040)	2	Used / Copied / Generated (if null and provided as a part of SUV Panel for SUV Calculations)
Referenced Patient Sequence	(0008,1120)	3	Ignored / Copied
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
Patient's Birth Time	(0010,0032)	3	Ignored / Copied
Other Patient IDs	(0010,1000)	3	Ignored / Copied
Other Patient Names	(0010,1001)	3	Ignored / Copied
Ethnic Group	(0010,2160)	3	Ignored / Copied
Patient Comments	(0010,4000)	3	Ignored / Copied

4.4.2 Common Study Entity Modules

The following Study IE Modules are common to all Composite Image IODs, which reference the Study IE. These 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 that describe and identify the Study performed upon the Patient.

TABLE 4.5-4
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)	1C	Ignored / Copied
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 4.5-5
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 / Copied / Generated (if null and provided as a part of SUV Panel for SUV Calculations)
Patient's Weight	(0010,1030)	3	Used / Copied / Generated (if null and provided as a part of SUV Panel for SUV Calculations)
Occupation	(0010,2180)	3	Ignored / Copied
Additional Patient's History	(0010,21B0)	3	Ignored / Copied

4.4.3 Common Series Entity Modules

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

4.4.3.1 General Series Module

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

**TABLE 4.4-6
GENERAL SERIES MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	Used / Copied / Generated Defined Terms: PT = Positron Emission Tomography
Series Instance UID	(0020,000E)	1	Mandatory / Generated
Series Number	(0020,0011)	2	Ignored / Generated
Laterality	(0020,0060)	2C	Ignored / Copied
Series Date	(0008,0021)	3	Used / Copied
Series Time	(0008,0031)	3	Used / Copied
Performing Physicians' Name	(0008,1050)	3	Used / Copied
Protocol Name	(0018,1030)	3	Used / Copied
Series Description	(0008,103E)	3	Used / Generated
Operators' Name	(0008,1070)	3	Used / Copied
Referenced Study Component Sequence	(0008,1111)	3	Ignored / Removed
>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
Smallest Pixel Value in Series	(0028,0108)	3	Used / Generated
Largest Pixel Value in Series	(0028,0109)	3	Used / Generated
Request Attributes Sequence	(0040,0275)	3	Ignored / Copied
>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	
>>Code Value	(0008,0100)	1C	
>>Code Scheme Designator	(0008,0102)	1C	
>>Code Meaning	(0008,0104)	1C	
Performed Procedure Step ID	(0040,0253)	3	Ignored / Copied
Performed Procedure Step Start Date	(0040,0244)	3	Ignored / Copied
Performed Procedure Step Start Time	(0040,0245)	3	Ignored / Copied
Performed Procedure Step Description	(0040,0254)	3	Ignored / Copied
Performed Action Item Sequence	(0040,0260)	3	Ignored / Copied
>Code Value	(0008,0100)	1C	

>Code Scheme Designator	(0008,0102)	1C	
>Code Meaning	(0008,0104)	1C	

4.4.3.1.1 General Series Attribute Descriptions

4.4.3.1.1.1 Series Date and Time

The Series Date and Time refer to the scan date and time. They cannot be changed, since they are the reference point for all temporal measurements in the images.

4.4.4 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.

4.4.4.1 Frame Of Reference Module

The Frame of Reference Module is copied to the result images. There are no modifications to frame of reference by this application.

**TABLE 4.4-6
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	Used / Copied

4.4.5 Common Equipment Entity Modules

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

4.4.5.1 General Equipment Module

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

Dynamic VUE can create derived series. This module will then be generated according to the System on which the application is running and the name of the application creating it.

**TABLE 4.5-7
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 / Generated (Version of the Dynamic VUE software)
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

4.4.6 Common Image Entity Modules

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

4.4.6.1 General Image Module

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

**TABLE 4.4-8
GENERAL IMAGE MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Image Number	(0020,0013)	2	Used / Generated Becomes same as Image Index (0054,1330).
Patient Orientation	(0020,0020)	2C	Ignored / Copied
Image Date	(0008,0023)	2C	Used / Generated
Image Time	(0008,0033)	2C	Used / Generated
Image Type	(0008,0008)	3	Used / Generated
Acquisition Number	(0020,0012)	3	Ignored / Copied
Acquisition Date	(0008,0022)	3	Used / Copied
Acquisition Time	(0008,0032)	3	Used / Copied
Referenced Image Sequence	(0008,1140)	3	Ignored / Removed

>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
Derivation Description	(0008,2111)	3	Ignored / Generated
Source Image Sequence	(0008,2112)	3	Ignored / Generated
>Referenced SOP Class UID	(0008,1150)	1C	Generated from contributing images
>Referenced SOP Instance UID	(0008,1155)	1C	Generated from contributing images
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	(0028,2110)	3	Used / Copied
Lossy Image Compression Ratio	(0028,2112)	3	Ignored / Copied

4.4.6.1.1 General Image Attribute Descriptions

4.4.6.1.1.1 Patient Orientation

PET images use Image Orientation Patient (0020,0037) and Image Position Patient (0020,0032).

4.4.6.1.1.2 Image Date and Time

This is the current system time when the image was created.

4.4.6.1.1.3 Image Type

Images created in Dynamic VUE will have

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:

- SUMMED identifies a Summed Image

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

- TIME identifies a image created by summing over time.
- LOCATION identifies a image created by summing over location.
- REFRAME identifies a image created by adding frames or bins

4.4.6.1.1.4 Lossy Image Compression

Dynamic VUE does not use compression or decompression..

4.4.6.1.1.5 Derivation Description

SUM OVER TIME
SUM OVER LOCATION
REFRAME

4.4.6.2 Image Plane Module

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

**TABLE 4.4-9
IMAGE PLANE MODULE ATTRIBUTES**

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

4.4.6.2.1 Image Position

The Image Position is treated as 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 center of the first pixel of the image.

All images saved by Dynamic VUE 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.

Images created by summing over location have a Image Position computed to be the center of the upper left hand pixel. In the case of summing the region is considered to have a cumulative thickness. For example axial images summed over location will have the L and P coordinates copied and the S coordinate will be computed as the center of the summed region.

4.4.6.2.2 Slice Thickness

The Slice Thickness will be copied for images summed over time.

The Slice Thickness will be summed for images summed over location.

4.4.6.3 Image Pixel Module

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

**TABLE 4.4-6
IMAGE PIXEL MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Samples per Pixel	(0028,0002)	1	Ignored (expect "1") / Generated "1"
Photometric Interpretation	(0028,0004)	1	Ignored (expect "MONOCHROME2") / Generated "MONOCHROME2" or "MONOCHROME1"
Rows	(0028,0010)	1	Mandatory (expect from 64 to 256) / Copied
Columns	(0028,0011)	1	Mandatory (expect from 64 to 256) / Copied
Bits Allocated	(0028,0100)	1	Ignored (expect "16") / Generated "16"
Bits Stored	(0028,0101)	1	Ignored (expect "16") / Generated "16"
High Bit	(0028,0102)	1	Ignored (expect "15") / Generated "15"
Pixel Representation	(0028,0103)	1	Ignored (expect "1") / Generated "1"
Pixel Data	(7FB0,0010)	1	Used / Generated

Planar Configuration	(0028,0006)	1C	Ignored
Pixel Aspect Ratio	(0028,0034)	1C	Ignored
Smallest Image Pixel Value	(0028,0106)	3	Ignored / Generated
Largest Image Pixel Value	(0028,0107)	3	Ignored / Generated
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

4.4.7 Common Overlay Modules

4.4.7.1 Overlay plane module

This section contains Attributes that describe characteristics of an Overlay Plane.

This module is not currently supported by Dynamic VUE and will be ignored.

**TABLE 4.4-7
OVERLAY PLANE MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Overlay Rows	(60xx,0010)	1	Module Unsupported
Overlay Columns	(60xx,0011)	1	Module Unsupported
Overlay Type	(60xx,0040)	1	Module Unsupported
Origin	(60xx,0050)	1	Module Unsupported
Overlay Bits Allocated	(60xx,0100)	1	Module Unsupported
Bit Position	(60xx,0102)	1	Module Unsupported
Overlay Data	(60xx,3000)	1C	Module Unsupported
Overlay Description	(60xx,0022)	3	Module Unsupported
Overlay Subtype	(60xx,0045)	3	Module Unsupported
Overlay Label	(60xx,1500)	3	Module Unsupported
ROI Area	(60xx,1301)	3	Module Unsupported
ROI Mean	(60xx,1302)	3	Module Unsupported
ROI Standard Deviation	(60xx,1303)	3	Module Unsupported
Overlay Descriptor - Gray	(60xx,1100)	3	Module Unsupported
Overlay Descriptor - Red	(60xx,1101)	3	Module Unsupported
Overlay Descriptor - Green	(60xx,1102)	3	Module Unsupported
Overlay Descriptor - Blue	(60xx,1103)	3	Module Unsupported
Overlays - Gray	(60xx,1200)	3	Module Unsupported
Overlays - Red	(60xx,1201)	3	Module Unsupported
Overlays - Green	(60xx,1202)	3	Module Unsupported
Overlays - Blue	(60xx,1203)	3	Module Unsupported

4.4.8 Common Lookup Table Modules

4.4.8.1 VOILUT module

This section specifies the Attributes that describe the VOILUT.

TABLE 4.4-8
VOILUT MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
VOILUT 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 (an automatic W/L is computed on the whole series) / Generated
Window Width	(0028,1051)	1C	Ignored at load (an automatic W/L is computed on the whole series) / Generated
Window Center & Width Explanation	(0028,1055)	3	Ignored / Removed

4.4.9 General Modules

The SOP Common Module is mandatory for all DICOM IODs.

4.4.9.1 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 4.4-9
SOP COMMON MODULE ATTRIBUTES

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	Used / Copied Only the "ISO_IR 100" character sets is supported.
Instance Creation Date	(0008,0012)	3	Ignored / Generated
Instance Creation Time	(0008,0013)	3	Ignored / Generated
Instance Creator UID	(0008,0014)	3	Ignored / Removed
Time zone Offset From UTC	(0008,0014)	3	Ignored / Removed
Instance Number	(0020,0013)	3	Used / Generated
SOP Instance Status	(0100,0410)	3	Ignored / Removed
SOP Authorization Date and Time	(0100,0420)	3	Ignored / Removed
SOP Authorization Comment	(0100,0414)	3	Ignored / Removed
Authorization Equipment Certification Number	(0100,0416)	3	Ignored / Removed

4.4.10 PET Modules

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

4.4.10.1 PET Series

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

**TABLE 4.4-10
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 / Generated
Counts Source	(0054,1002)	1	Used / Copied
Series Type	(0054,1000)	1	Used / Copied
Reprojection Method	(0054,1004)	2C	Ignored / Copied
Number of R-R Intervals	(0054,0061)	1C	Used / Copied
Number of Time Slots	(0054,0071)	1C	Used / Copied
Number of Time Slices	(0054,0101)	1C	Used / Copied
Number of Slices	(0054,0081)	1	Used / Copied
Corrected Image	(0028,0051)	2	Used / Copied / Modified (Decay correction may be added)
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 / Generated = START
Reconstruction Diameter	(0018,1100)	3	Ignored / Copied
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	Ignored / Copied
Gantry/Detector Slew	(0018,1121)	3	Ignored / Copied
Type of Detector Motion	(0054,0202)	3	Ignored / Copied
Collimator Type	(0018,1181)	2	Ignored / 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

4.4.10.2 PET Isotope

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

**TABLE 4.4-11
PET ISOTOPE MODULE ATTRIBUTES**

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

4.4.10.3 PET Multi-gated Acquisition

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

**TABLE 4.4-12
PET MULTI-GATED ACQUISITION MODULE ATTRIBUTES**

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

4.4.10.4 NM/PET Patient Orientation

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

**TABLE 4.4-13
NM/PET PATIENT ORIENTATION MODULE ATTRIBUTES**

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

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

TABLE 4.4-14
PET IMAGE MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Image Type	(0008,0008)	1	Used / Generated
Samples per Pixel	(0028,0002)	1	Ignored (expect 1) / Generated "1"
Photometric Interpretation	(0028,0004)	1	Ignored (expect "MONOCHROME2") / Generated "MONOCHROME2" or "MONOCHROME1"
Bits Allocated	(0028,0100)	1	Shall be 16 / Generated "16"
Bits Stored	(0028,0101)	1	Ignored (expect 16) / Generated "16"
High Bit	(0028,0102)	1	Ignored (expect 15) / Generated "15"
Rescale Intercept	(0028,1052)	1	Used (expect 0 / Generated (Set to 0)
Rescale Slope	(0028,1053)	1	Used / Computed
Frame Reference Time	(0054,1300)	1	Ignored / Copied / Computed
Trigger Time	(0018,1060)	1C	Ignored / Copied / Computed
Frame Time	(0018,1063)	1C	Ignored / Copied / Computed
Low R-R Value	(0018,1081)	1C	Ignored / Copied
High R-R Value	(0018,1082)	1C	Ignored / Copied
Lossy Image Compression	(0028,2110)	1C	(Unsupported)
Image Index	(0054,1330)	1	Used / Generated
Acquisition Date	(0008,0022)	2	Used / Copied
Acquisition Time	(0008,0032)	2	Used / Copied
Actual Frame Duration	(0018,1242)	2	Used / Copied / Computed
Nominal Interval	(0018,1062)	3	Ignored / Copied
Intervals Acquired	(0018,1083)	3	Ignored / Copied
Intervals Rejected	(0018,1084)	3	Ignored / Copied
Primary (Prompts) Counts Accumulated	(0054,1310)	3	Used / Generated
Secondary Counts Accumulated	(0054,1311)	3	Used / Generated
Slice Sensitivity Factor	(0054,1320)	3	Ignored / Copied / Removed
Decay Factor	(0054,1321)	1C	Used / Generated
Dose Calibration Factor	(0054,1322)	3	Ignored / Removed
Scatter Fraction Factor	(0054,1323)	3	Ignored / Removed
Dead Time Factor	(0054,1324)	3	Ignored / Removed
Referenced Overlay Sequence	(0008,1130)	3	Ignored / Removed
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
Referenced Curve Sequence	(0008,1145)	3	Ignored / Removed
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
Anatomic Region Sequence	(0008,2218)	3	Ignored / Removed

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

4.4.10.6 Image Type

Value 1 : DERIVED
Value 2 : SECONDARY
Value 3 : SUMMED

4.4.10.7 Rescale Slope

The computed rescale slope will be the same for all images in the resulting series.

4.4.10.8 Frame Reference Time

For all series summed over location, the value is copied.
For Gated series summed over time, the value is copied.
For Dynamic series summed over time, the value is taken to be the Frame Reference Time for the frame earliest in the sum.

4.4.10.9 Trigger Time

The trigger time is copied for summing over location.
The trigger time from the earliest bin in the sum is used for a series summed over time.

4.4.10.10 Frame Time

The frame time is copied for summing over location.
For summing over time, the computed frame time is the sum of the frame times.

4.4.10.11 Actual Frame Duration

For summing over location, this is copied.
For summing over time of gated, this is copied.
For summing over time of dynamic, the individual frame durations are summed for the result.

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4.4.10.12 Primary Counts Accumulated

The result is the sum of all contributing images primary counts.

4.4.10.13 Secondary Counts Accumulated

The result is the sum of all contributing images secondary counts.

4.4.10.14 Slice Sensitivity Factor

Copied for summing over time.
Removed for summing over location.

4.4.10.15 Decay Factor

Copied for summing over location.

If decay correction was applied to the original images, then decay is reapplied to the summed over time images. The images are divided by the original decay factor, summed and a new decay correction factor is computed according to:

$$\begin{aligned} \text{ScanStartTime} &= \text{Series Time (0008, 0031)} \\ \text{FrameStartTime} &= \text{Acquisition Date (0008, 0022)} + \text{Acquisition Time (0008, 0032)} \\ \\ \text{FrameDuration} &= \text{Actual Frame Duration (0018, 1242)} \\ T_{1/2} &= \text{Radionuclide Half Life (0018, 1075) in seconds.} \\ \lambda &= \ln(2) / T_{1/2} \\ \text{durationFactor} &= \lambda * (\text{FrameDuration}) \\ \text{startFactor} &= \lambda * (\text{Frame Reference Time (0054, 1300)} * (0.001 \text{ sec/msec})) \\ \text{decayFactor} &= \{ \text{durationFactor} * \exp(-\text{startFactor}) \} / \{ 1 - \exp(-\text{durationFactor}) \} \end{aligned}$$

4.5 PRIVATE DATA

The following private elements are used:

PRIVATE ADVANTAGE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Private Creator	(0009, 00xx)	3	GEMS_PETD_01: Used / Copied
Scan Date Time	(0009, 100D)	3	Used / Copied
Mid Phase Percentage	(0009, 10E3)	3	Used / Generated
Phase Duration	(0009, 10E9)	3	Used / Generated
Land Mark Name	(0009, 1014)	3	Used / Copied
Uptake time	(0009, 1036)	3	Used / Copied
Tracer Activity	(0009, 1038)	3	Used / Copied
Measured Date Time	(0009, 1039)	3	Used / Copied
Administrated Date Time	(0009, 103B)	3	Used / Copied
Post Injected Activity	(0009, 103C)	3	Used / Copied
Post Injected Time	(0009, 103D)	3	Used / Copied
Half life	(0009, 103F)	3	Used / Copied
Tracer Name	(0009, 1054)	3	Used / Copied
Raw Data Path	(0009, 1062)	3	Used / Copied
Frame Time	(0009, 106E)	3	Used / Generated

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Trigger Time	(0009,106F)	3	Used / Generated
Recon Date Time	(0009,107B)	3	Used / Copied
Accumulated Frame Duration	(0009,1078)	3	Used / Copied
Recon Algorithm	(0009,108B)	3	Used / Copied
Attenuation Correction Method	(0009,108C)	3	Used / Copied
Recon Center Left	(0009,1091)	3	Used / Copied
Recon Center Posterior	(0009,1092)	3	Used / Copied