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**Digital Imaging and Communications  
in Medicine (DICOM)**

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**Supplement 7  
Nuclear Medicine Image Object**

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## 2 Foreword

4 NEMA (the National Electrical Manufacturers Association) and the ACR (the American College  
6 of Radiology) formed a joint ad-hoc Committee to further expand the Standard for Digital  
8 Imaging and Communications in Medicine initially developed by ACR and NEMA. The  
10 corresponding Supplements to the DICOM Standard were developed according to the NEMA  
12 Procedures.

14 This Supplement to the Standard is developed in liaison with other Standards Organizations  
16 including CEN TC251 in Europe and JIRA in Japan, with review also by other member  
18 organizations of the ANSI HISPP in the USA which include IEEE, HL7 and X12.

20 The DICOM standard is structured as a multi-part document using the guidelines established in  
22 the following document:

- 24 - ISO/IEC Directives, 1989 Part 3 - Drafting and Presentation of International Standards.

26 This document is a Supplement to the DICOM Standard. It is an extension to Part 3, 4 and 6 of  
28 the published DICOM Standard which consists of the following parts:

30	PS 3.1	—	Introduction and Overview
32	PS 3.2	—	Conformance
34	PS 3.3	—	Information Object Definitions
36	PS 3.4	—	Service Class Specifications
38	PS 3.5	—	Data Structures and Encoding
40	PS 3.6	—	Data Dictionary
	PS 3.7	—	Message Exchange
	PS 3.8	—	Network Communication Support for Message Exchange
	PS 3.9	—	Point-to-Point Communication Support for Message Exchange
	PS 3.10	—	Media Storage and File Formats for Data Interchange
	PS 3.11	—	Media Storage Application Profiles
	PS 3.12	—	Storage Functions and Media Formats for Data Interchange
	PS 3.13	—	Print Management - Point-to-point Communication Support

These Parts are independent but related documents.

This Supplement includes the definition of the Nuclear Medicine Image Objects and of the  
corresponding Media and Network Storage Service Class. This Supplement may be used in  
conjunction with PS 3.11 Annex X which specifies the Media Format and Physical Media, to  
provide the ability to interchange Nuclear Medicine Images.

## Scope and Field of Application

2 This Supplement to the DICOM Standard specifies a DICOM image Information Object  
4 Definition for Nuclear Medicine. It specifies the semantic content of NM Images. It is  
commonly abbreviated the NM IOD. It also includes the corresponding Storage SOP Class so  
that this IOD can be used in Network and Media Storage exchanges.

6 Since this document proposes changes to existing parts of DICOM the reader should have a  
working understanding of the Standard.

8 This proposed Supplement includes a number of Addenda to existing Parts of DICOM:  
10

- 12 1. Part 3 Addenda (Modifications to Annex A and C)
- 14 2. Part 4 Addenda (Modifications to Annex B)
- 16 3. Part 6 Addenda (Modifications to Section 6 and Annex A)

**ACR-NEMA**

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# **Digital Imaging and Communications in Medicine (DICOM)**

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## **Part 3 Addendum Nuclear Medicine Information Object Definition**

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2 **Changes for section A.1.4, Overview of the composite IOD module content**

4

6 **Item #1.1**  
**Change Table A.1-1 - all modifications to the existing table are shown in BOLD font.**

8 **Table A.1-1 - Composite Information Object Modules Overview**

Modules	IODs	CR	CT	MR	NM	NM	US	US-mf	Sec. Capt	St. Overlay	St. Curve	Study Descr.	St. Mod LUT	St. VOI LUT
Patient		M	M	M	<b>M</b>	<b>M</b>	M	M	M	M	M		M	M
Patient Summary												M		
General Study		M	M	M	<b>M</b>	<b>M</b>	M	M	M	M	M		M	M
Patient study		U	U	U	<b>U</b>	<b>U</b>	U	U	U	U	U		U	U
Study Content												M		
General Series		M	M	M	<b>M</b>	<b>M</b>	M	M	M	M	M		M	M
CR Series		M												
NM Series					<b>M</b>	<b>M</b>								
Frame Of Reference			M	M	<b>U</b>	<b>U</b>	U	U						
US Frame of Ref.							C	C						
General Equipment		M	M	M	<b>U</b>	<b>M</b>	M	M	U	M	M		M	M
<b>NM Equipment</b>					<b>U</b>									
SC Equipment									M					
General Image		M	M	M	<b>M*</b>	<b>M</b>	M*	M	M					
Image Plane			M	M	<b>U*</b>									
Image Pixel		M	M	M	<b>M*</b>	<b>M</b>	M*	M	M					
NM Image Pixel						<b>M</b>								
Contrast/Bolus		C	C	C			C*	C						
Cine					<b>€</b>			C						
Multi-frame					<b>€</b>	<b>M</b>		M						
<b>NM Multi-frame</b>						<b>M</b>								
CR Image		M												
CT Image			M											
MR Image				M										
<b>NM Image</b>					<b>M*</b>									
<b>NM SPECT</b>					<b>€</b>									
<b>NM Multi-Gated</b>					<b>€</b>									
<b>NM Image</b>						<b>M</b>								
<b>NM Isotope</b>						<b>M</b>								
<b>NM Detector</b>						<b>M</b>								
<b>NM TOMO Acquisition</b>						<b>C</b>								
<b>NM Multi-Gated Acquisition</b>						<b>C</b>								
<b>NM Phase</b>						<b>C</b>								
<b>NM Reconstruction</b>						<b>C</b>								

US Region Calibration						U*	U						
US Image						M*	M						
SC Image								M					
Overlay Identification				M*					M				
Overlay Plane	U	U	U	M*	U	U*		U	M				
Multi-frame Overlay				U	U								
Curve Identification				M*		M*	M*			M			
Curve				M*	U	M*	M*			M			
Audio						U	U						
Modality LUT	U							U				M	
VOI LUT	U	U	U	U*	U	U*	U	U					M
LUT Identification												M	M
SOP Common	M	M	M	M*	M	M*	M*	M	M	M	M	M	M

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\* The notation next to M and U indicates a special condition for these modules. Refer to the corresponding Information Object Definitions in this Annex for details.

8

**Note:** The original NM Image IOD, and the associated NM Storage SOP Class UID have been retired. A completely new NM Image IOD is defined, as shown in Table A.1-1.

10



**Changes for section A.5, Nuclear medicine image information object definition**

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4  
6  
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**Item #2.1.**  
**Retire Section A.5.3 and Table A.5-1**

**Item #2.2.**  
**Add Section A.X and Table A.X-Y**

**A.X NM Image IOD Module Table**

**Table A.X-Y -- NM Image IOD Modules**

12

<b>IE</b>	<b>Module</b>	<b>Reference</b>	<b>Usage</b>
Patient	Patient	C.7.1.1	M
Study	General Study	C.7.2.1	M
	Patient Study	C.7.2.2	U
Series	General Series	C.7.3.1	M
	NM Series	C.8.4.6	M
Frame of Reference	Frame of Reference	C.7.4.1	U
Equipment	General Equipment	C.7.5.1	M
Image	General Image	C.7.6.1	M
	Image Pixel	C.7.6.3	M
	NM Image Pixel	C.8.4.7	M
	Multi-frame	C.7.6.6	M
	NM Multi-frame	C.8.4.8	M
	NM Image	C.8.4.9	M
	NM Isotope	C.8.4.10	M
	NM Detector	C.8.4.11	M
	NM TOMO Acquisition	C.8.4.12	C - Required if Image Type (0008,0008) Value 3 is TOMO, GATED TOMO, RECON TOMO or RECON GATED TOMO
	NM Multi-gated Acquisition	C.8.4.13	C - Required if Image Type (0008,0008) Value 3 is GATED, GATED TOMO, or RECON GATED TOMO

NM Phase	C.8.4.14	C - Required if Image Type (0008,0008) Value 3 is DYNAMIC
NM Reconstruction	C.8.4.15	C - Required if Image Type (0008,0008) Value 3 is RECON TOMO or RECON GATED TOMO
Overlay Plane	C.9.2	U
Multi-frame Overlay	C.9.3	U
Curve	C.10.2	U
VOI LUT	C.11.2	U
SOP Common	C.12.1	M

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***Item #2.3.  
Retire section A.5.3.1***

6

2 **Changes for section C.7, Common composite image IOD modules**

4 **Item #3.1**  
 6 **In Table C.7-7, revise the Attribute Description for Patient Orientation(0020,0020) as shown**  
 8 **in BOLD font. follows-**  
 10 **Rationale: The Patient orientation is currently required “if image is part of a series which**  
 12 **does not require the Image Plane Module”. The NM object does not use the Image Plane**  
**Module (although it does include the same patient orientation elements as the Image Plane**  
**Module), so this would always be required. To get around this we suggest rewording the**  
**description to key on the Image orientation elements themselves.**

Patient Orientation	(0020,0020)	2C	<b>Patient direction of the rows and columns of the image. Required if image does not require Image Orientation (0020,0037) and Image Position (0020,0032). See C.7.6.1.1.1 for more explanation.</b>
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**Item #4.1.**  
**Add the following text, shown in BOLD, to section C.8.4**

4

## 6 **C.8.4 Nuclear Medicine**

8 This Section describes Nuclear Medicine Image Modules. These Modules contain Attributes that are specific to the NM Image IOD.

10 **Note:** There are some cases where it may be necessary to use several SOP Instances to encode a single  
12 **NM acquisition. For example, the matrix size must remain constant within a SOP instance.**  
14 **Multiple matrix sizes require multiple SOP instances. Similarly, multiple gated stress levels**  
**require separate SOP instances for each stress level. However, a receiving AE is not expected to**  
**recombine them.**

16

**Item #4.2.**  
**Retire Section C.8.4.1.**

18

20 The NM Series Module is retired.

22

**Item #4.3.**  
**Retire section C.8.4.2.**

24

26 The NM Equipment Module is retired.

28

**Item #4.4.**  
**Retire section C.8.4.3.**

30

32 The NM Image Module is retired.

34

**Item #4.5.**  
**Retire section C.8.4.4.**

36

38 The NM SPECT Acquisition Image Module is retired.

2

***Item #4.6.***  
***Retire section C.8.4.5.***

4

The NM Multi-Gated Acquisition Image Module is retired.

6

2 **Item #4.7.**  
 Add the following sections to the end of section C.8.4.

4

**C.8.4.6 NM Series Module**

6 Table C.8-Y specifies the Attributes that describe the NM Series.

8

**Table C.8-Y-- NM Series Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Patient Orientation Code Sequence	(0054,0410)	2	Sequence that describes the orientation of the patient with respect to gravity. See C.8.4.6.1.1 for further explanation.
> Code Value	(0008,0100)	1C	The code value (defined by the coding scheme) that represents the patient orientation. <u>Required if a sequence Item is present.</u>
> Coding Scheme Designator	(0008,0102)	1C	The code from Annex D designating the coding scheme which maps the Code Value (0008,0100) onto the Code Meaning (0008,0104). Enumerated Values: 99SDM <u>Required if a sequence Item is present.</u>
> Code Meaning	(0008,0104)	3	The patient orientation that is represented by the Code Value (0008,0100).
> Patient Orientation Modifier Code Sequence	(0054,0412)	2C	Patient Orientation Modifier. Required if needed to fully specify the orientation of the patient with respect to gravity. See C.8.4.6.1.2 for further explanation.
>> Code value	(0008,0100)	1C	The code value (defined by the coding scheme) that represents the patient orientation modifier. <u>Required if a sequence Item is present.</u>

>> Coding Scheme Designator	(0008,0102)	1C	The code from Annex D designating the coding scheme which maps the Code value (0008,0100) onto the Code Meaning (0008,0104). Enumerated Values: 99SDM <a href="#">Required if a sequence Item is present.</a>
>> Code Meaning	(0008,0104)	3	The patient orientation modifier that is represented by the Code Value (0008,0100).
Patient Gantry Relationship Code Sequence	(0054,0414)	2	Sequence which describes the orientation of the patient with respect to the gantry. See section C.8.4.6.1.3 for further explanation.
> Code Value	(0008,0100)	1C	The code value (defined by the coding scheme) that represents the patient orientation with respect to the gantry. <a href="#">Required if a sequence Item is present.</a>
> Coding Scheme Designator	(0008,0102)	1C	The code from Annex D designating the coding scheme which maps the Code Value (0008,0100) onto the Code Meaning (0008,0104). Enumerated Values: 99SDM <a href="#">Required if a sequence Item is present.</a>
> Code Meaning	(0008,0104)	3	The patient <del>relationship orientation</del> <a href="#">gantry relationship orientation</a> that is represented by the Code Value (0008,0100).

2 **[C.8.4.6.1 NM Series Attribute Descriptions](#)**

4 Note: Patient Orientation Code Sequence (0054,0410), Patient Orientation Modifier Code Sequence  
6 (0054,0412), and Patient Gantry Relationship Code Sequence (0054,0414) specify value 99SDM from Annex D for Coding Scheme Designator. It is expected that this value will evolve when Coding Scheme Designator UIDs are available from a registration authority.

8 **[C.8.4.6.1 NM Series Attribute Descriptions](#)**

10 **[C.8.4.6.1.1 Patient Orientation Code Sequence](#)**

2 The Patient Orientation Code Sequence (0054,0410) is used to describe the orientation of the  
4 patient with respect to gravity, and is independent of the position in the gantry. Only a single  
Item shall be permitted in this sequence.

6 ~~The Coding Scheme for the Patient Orientation Code Sequence (0054,0410) shall be the~~  
8 ~~SNOMED/DICOM Microglossary Patient Orientations list.~~  
10 The Coding Scheme Designator (0008,0102) for the Patient Orientation Code Sequence  
12 (0054,0410) shall be the SNOMED DICOM Microglossary. The Code Value (0008,0100) for  
the Patient Orientation Code Sequence (0054,0410) shall be the Source UID value from a  
SNOMED DICOM Microglossary record. This record shall have a Source value of “SNMI”,  
any Context value, and a Semantic Type value of “body position”.

#### C.8.4.6.1.2 Patient Orientation Modifier Code Sequence

14 The Patient Orientation Modifier Code Sequence (0054,0412) is used to modify or enhance the  
16 orientation specified by Patient Orientation Code Sequence (0054,0410). Only a single Item shall  
be permitted in this sequence.

18 ~~The Coding Scheme for the Patient Orientation Modifier Code Sequence (0054,0412) shall be~~  
20 ~~the SNOMED/DICOM Microglossary Patient Orientation Modifiers list.~~  
22 The Coding Scheme Designator (0008,0102) for the Patient Orientation Modifier Code Sequence (0054,0412) shall  
24 be the SNOMED DICOM Microglossary. The Code Value (0008,0100) for the Patient  
26 Orientation Modifier Code Sequence (0054,0412) shall be the Source UID value from a  
SNOMED DICOM Microglossary record. This record shall have a Source value of “SNMI”,  
any Context value, and a Semantic Type value of “body position modifier”.

#### C.8.4.6.1.3 Patient Gantry Relationship Code Sequence

28 Patient Gantry Relationship Code Sequence (0054,0414) is used to describe the patient direction  
30 within the gantry, such as head-first or feet-first. When imaging the extremities, these directions  
are related to normal anatomic position.

32 Example: In normal anatomic position, the fingers point towards the feet.

34 Only a single Item shall be permitted in this sequence.

36 ~~The Default Coding Scheme for the Patient Gantry Relationship Code Sequence (0054,0414)~~  
38 ~~shall be the SNOMED/DICOM Microglossary Patient Gantry Relationships list.~~  
40 The Coding Scheme Designator (0008,0102) for the Patient Gantry Relationship Code Sequence (0054,0414)  
42 shall be the SNOMED DICOM Microglossary. The Code Value (0008,0100) for the Patient  
44 Gantry Relationship Code Sequence (0054,0414) shall be the Source UID value from a  
SNOMED DICOM Microglossary record. This record shall have a Source value of “SNMI”,  
any Context value, and a Semantic Type value of “patient gantry relationship”.



**C.8.4.7 NM Image Pixel Module**

2 Table C.8-Y specifies the Attributes that describe the pixel data of a NM image.

4 **Table C.8-Y-- NM Image Pixel Module Attributes**

<b>Attribute Name</b>	<b>Tag</b>	<b>Type</b>	<b>Attribute Description</b>
Samples per Pixel	(0028,0002)	1	Number of samples (color planes) in this image. The value shall be 1.
Photometric Interpretation	(0028,0004)	1	Specifies the intended interpretation of the pixel data. See C.8.4.7.1.1 for further explanation.
Bits Allocated	(0028,0100)	1	Number of bits allocated for each pixel sample. Each sample shall have the same number of bits allocated. Enumerated values: 8, 16.
Bits Stored	(0028,0101)	1	Number of bits stored for each pixel sample. Each sample shall have the same number of bits stored. The value shall be the same as the value in Bits Allocated (0028,0100).
High Bit	(0028,0102)	1	Most significant bit for pixel sample data. Each sample shall have the same high bit. Shall be one less than the value in Bits Stored (0028,0101).
Pixel Spacing	(0028,0030)	2	Physical distance in the patient between the center of each pixel, specified by a numeric pair - adjacent row spacing (delimiter) adjacent column spacing, in mm .

6 **C.8.4.7.1 NM Image Pixel Attribute Descriptions**

**C.8.4.7.1.1 Photometric Interpretation**

8 For NM Images, Photometric Interpretation (0028,0004) shall have one of the following Enumerated Values:

- 10 MONOCHROME2
- 11 PALETTE COLOR

12 See C.7.6.3.1.2 for definition of these terms.

**C.8.4.8 NM Multi-frame Module**

2 Table C.8-Y specifies the Attributes of a NM Multi-frame Image. This module is always  
 4 included in a NM SOP instance, even if there is only one frame in the image.

6 A NM Image object is always a multi-dimensional multi-frame image. The order and  
 8 organization of the frames within each image is defined by the Frame Increment Pointer  
 10 (0028,0009). The Frame Increment Pointer (0028,0009) references one or more indexing  
 vectors. An indexing vector is a 1 dimensional array with exactly one element for each frame in  
 the image. The value of the n<sup>th</sup> element in the indexing vector represents the index for the n<sup>th</sup>  
 frame, in that dimension. Indices are always numbered starting from 1.

12 Note: The scheme for encoding a multi-dimensional array of frames into a single image object is as follows.  
 14 First, the definition of the data element called the Frame Increment Pointer is changed so that it can be  
 multi-valued (i.e. its VM is now 1-n). Each value of the Frame Increment Pointer represents one of the  
 dimensions of the array, with the last value representing the most rapidly changing index.

16 Each value of the Frame Increment Pointer is the tag of a data element which is an indexing vector.  
 18 An indexing vector is a 1 dimensional array with exactly one element for each frame in the image. The  
 value of the n<sup>th</sup> element in the indexing vector represents the index for the n<sup>th</sup> frame, in that dimension.  
 20 For example, suppose you are encoding a Dynamic image consisting of 2 phases (containing 5 and 2  
 frames, respectively), from each of two detectors, using one isotope, which gives a total of 14 frames  
 in the image. For a Dynamic image, the Frame Increment Pointer is defined as:

22 Frame Increment Pointer = Energy Window Vector (0054,0010) \ Detector Vector (0054,0020) \ Phase  
 Vector (0054,0030) \ Time Slice Vector (0054,0100)

24 The Pixel Data (7FE0,0010) would contain the frames in the following order:

Frame	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Energy Window #	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Detector #	1	1	1	1	1	1	1	2	2	2	2	2	2	2
Phase #	1	1	1	1	1	2	2	1	1	1	1	1	2	2
Time Slice #	1	2	3	4	5	1	2	1	2	3	4	5	1	2

26 and the four vectors would be defined as:

28 Energy Window Vector = 1,1,1,1,1,1,1,1,1,1,1,1,1,1,1

Detector Vector = 1,1,1,1,1,1,1,2,2,2,2,2,2,2,2

30 Phase Vector = 1,1,1,1,1,2,2,1,1,1,1,1,2,2

Time Slice Vector = 1,2,3,4,5,1,2,1,2,3,4,5,1,2

32 The receiver can tell the relationship of all the frames from these four vectors. For instance, looking at  
 34 the 11th value in these four vectors tells you that the 11th frame in this multi-frame object is time slice  
 4 of phase 1 from detector 2 and isotope 1.

The Energy Window, Detector, Phase, Rotation, R-R Interval, and Time Slot Vectors have corresponding sequence elements which contain exactly one sequence item for each of the index values in the vector. The sequence item contains a set of data elements which are specific to that group of frames, but change from one group to the next. In the above example there would be a detector sequence element, an isotope sequence element and a phase sequence element (for dynamics, no frame sequence element is needed). The detector and phase sequence elements would contain two sequence items (because there were 2 detectors and 2 phases).

**Table C.8-Y -- NM Multi-frame Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Frame Increment Pointer	(0028,0009)	1	Contains the Data Element Tags of one or more frame index vectors. See C.8.4.8.1.1 for further specialization.
Energy Window Vector	(0054,0010)	1C	An array which contains the energy window number for each frame. Required if the value of the Frame Increment Pointer (0028,0009) includes the Tag for Energy Window Vector (0054,0010). See C.8.4.8.1.2 for specialization.
Number of Energy Windows	(0054,0011)	1	Number of energy window groupings. See C.8.4.8.1.2 for specialization.
Detector Vector	(0054,0020)	1C	An array which contains the detector number for each frame. Required if the value of the Frame Increment Pointer (0028,0009) includes the Tag for Detector Vector (0054,0020). See C.8.4.8.1.3 for specialization.
Number of Detectors	(0054,0021)	1	Number of detectors. See C.8.4.8.1.3 for specialization.
Phase Vector	(0054,0030)	1C	An array which contains the phase number for each frame. Required if the value of the Frame Increment Pointer (0028,0009) includes the Tag for Phase Vector (0054,0030). See C.8.4.8.1.4 for specialization.
Number of Phases	(0054,0031)	1C	Number of phases. Required if the value of the Frame Increment Pointer (0028,0009) includes the Tag for Phase Vector (0054,0030). See C.8.4.8.1.4 for specialization.

Rotation Vector	(0054,0050)	1C	An array which contains the rotation number for each frame. Required if the value of the Frame Increment Pointer (0028,0009) includes the Tag for Rotation Vector (0054,0050). See C.8.4.8.1.5 for specialization.
Number of Rotations	(0054,0051)	1C	Number of rotations. Required if Image Type (0008,0008), Value 3 is TOMO, GATED TOMO, RECON TOMO, or RECON GATED TOMO. See C.8.4.8.1.5 for specialization.
R-R Interval Vector	(0054,0060)	1C	An array which contains the R-R interval number for each frame. Required if the value of the Frame Increment Pointer (0028,0009) includes the Tag for R-R Interval Vector (0054,0060). See C.8.4.8.1.6 for specialization.
Number of R-R Intervals	(0054,0061)	1C	Number of R-R intervals. Required if the value of the Frame Increment Pointer (0028,0009) includes the Tag for R-R Interval Vector (0054,0060). See C.8.4.8.1.6 for specialization.
Time Slot Vector	(0054,0070)	1C	An array which contains the time slot number for each frame. Required if the value of the Frame Increment Pointer (0028,0009) includes the Tag for Time Slot Vector (0054,0070). See C.8.4.8.1.7 for specialization.
Number of Time Slots	(0054,0071)	1C	Number of time slots. Required if the value of the Frame Increment Pointer (0028,0009) includes the Tag for Time Slot Vector (0054,0070). See C.8.4.8.1.7 for specialization.
Slice Vector	(0054,0080)	1C	An array which contains the spatial slice number for each frame. Required if the value of the Frame Increment Pointer (0028,0009) includes the Tag for Slice Vector (0054,0080). See C.8.4.8.1.8 for specialization.
Number of Slices	(0054,0081)	1C	Number of slices. Required if the value of the Frame Increment Pointer (0028,0009) includes the Tag for Slice Vector(0054,0080). See C.8.4.8.1.8 for specialization.

Angular View Vector	(0054,0090)	1C	An array which contains the angular view number for each frame. Required if the value of the Frame Increment Pointer (0028,0009) includes the Tag for Angular View Vector (0054,0090). See C.8.4.8.1.9 for specialization.
Time Slice Vector	(0054,0100)	1C	An array which contains the time slice number for each frame. Required if the value of the Frame Increment Pointer (0028,0009) includes the Tag for Time Slice Vector (0054,0100). See C.8.4.8.1.10 for specialization.

2 **C.8.4.8.1 NM Multi-Frame Attribute Descriptions**

4 Note: Per the rules in ~~section~~ PS 3.5, if a data element of Type 12C or 23C is not required, it ~~is shall~~ not ~~be~~ included in the data set.

6 **C.8.4.8.1 NM Multi-Frame Attribute Descriptions**

8 **C.8.4.8.1.1 Frame Increment Pointer**

10 By definition, NM Images are multi-dimensional Multi-frame Images. The value of the Frame  
 12 Increment Pointer (0028,0009) contains the Tag for one or more frame indexing vectors. This  
 14 determines the number of dimensions of frame indices in the image, and the order in which these  
 indices vary from one frame to the next, with the last Tag indicating the most rapidly changing  
 index. The Enumerated Values for the Frame Increment Pointer (0028,0009) are determined by  
 the Image Type (0008,0008), Value 3, as shown in Table C.8-Y:

16 **Table C.8-Y -- Enumerated Values for Frame Increment Pointer**

Image Type (0008,0008), Value 3	Frame Increment Pointer (0028,0009)
STATIC or WHOLE BODY	0054H 0010H \ 0054H 0020H Sequencing is by Energy Window Vector (0054,0010), Detector Vector (0054,0020).
DYNAMIC	0054H 0010H \ 0054H 0020H \ 0054H 0030H \ 0054H 0100H Sequencing is by Energy Window Vector (0054,0010), Detector Vector (0054,0020), Phase Vector (0054,0030), Time Slice Vector (0054,0100)

GATED	0054H 0010H \ 0054H 0020H \ 0054H 0060H \ 0054H 0070H Sequencing is by Energy Window Vector (0054,0010), Detector Vector (0054,0020), R-R Interval Vector(0054,0060), Time Slot Vector (0054,0070)
TOMO	0054H 0010H \ 0054H 0020H \ 0054H 0050H \ 0054H 0090H Sequencing is by Energy Window Vector (0054,0010), Detector Vector (0054,0020), Rotation Vector (0054,0050), Angular View Vector (0054,0090)
GATED TOMO	0054H 0010H \ 0054H 0020H \ 0054H 0050H \ 0054H 0060H \ 0054H 0070H \ 0054H 0090H Sequencing is by Energy Window Vector (0054,0010), Detector Vector (0054,0020), Rotation Vector (0054,0050), R-R Interval Vector (0054,0060), Time Slot Vector (0054,0070), Angular View Vector (0054,0090).
RECON TOMO	0054H 0080H Sequencing is by Slice Vector (0054,0080)
RECON GATED TOMO	0054H 0060H \ 0054H 0070H \ 0054H 0080H Sequencing is by R-R Interval Vector (0054,0060), Time Slot Vector (0054,0070), Slice Vector (0054,0080)

2 **C.8.4.8.1.2 Number of Energy Windows and Energy Window Vector**

4 Number of Energy Windows (0054,0011) is the number of distinct energy window groupings  
 6 acquired in this image. See C.8.4.10.1. When Image Type (0008,0008), Value 3, is RECON  
 TOMO or RECON GATED TOMO, then the Number of Energy Windows (0054,0011) shall be  
 1.

8 Energy Window Vector (0054,0010) is an indexing vector. The value of the n<sup>th</sup> element of this  
 10 vector is the energy window number for the n<sup>th</sup> frame in this image, and shall have a value from 1  
 to Number of Energy Windows (0054,0011).

12 **C.8.4.8.1.3 Number of Detectors and Detector Vector**

14 Number of Detectors (0054,0021) is the number of separate detectors which differentiate the  
 frames in this image. When Image Type (0008,0008), Value 3, is RECON TOMO or RECON  
 16 GATED TOMO, then the Number of Detectors (0054,0021) shall be 1.

18 Note: Number of Detectors (0054,0021) does not necessarily represent the actual number of detectors used  
 during data acquisition.

20 Example 1: In a TOMO acquisition in which frames from 2 or more detectors are interleaved to form  
 one continuous set of frames, then no distinction is made between frames on the basis of which  
 detector created them. In this case, the Number of Detectors (0054,0021) would be 1.

22 Example 2: In a WHOLE BODY acquisition in which a single detector acquires anterior and posterior  
 views in two separate passes, the Number of Detectors (0054,0021) would be 2.

2 Detector Vector (0054,0020) is an indexing vector. The value of the  $n^{\text{th}}$  element of this vector is  
4 the detector number of the  $n^{\text{th}}$  frame in this image, and shall have a value from 1 to Number of  
Detectors (0054,0021).

#### 6 **C.8.4.8.1.4 Number of Phases and Phase Vector**

8 Number of Phases (0054,0031) is the number of dynamic phases, independent of the number of  
Detectors and Isotopes. See section C.8.4.14 for definition of a phase.

10 Phase Vector (0054,0030) is an indexing vector. The value of the  $n^{\text{th}}$  element of this vector is the  
12 phase number of the  $n^{\text{th}}$  frame in this image, and shall have a value from 1 to Number of Phases  
(0054,0031).

14

#### **C.8.4.8.1.5 Number of Rotations and Rotation Vector**

16 Number of Rotations (0054,0051) is the number of separate rotations. See section C.8.4.12 for  
18 definition of a rotation. When Image Type (0008,0008), Value 3, is RECON TOMO, [GATED](#)  
[TOMO](#) or RECON GATED TOMO, then the Number of Rotations (0054,0051) shall be 1.

20 Rotation Vector (0054,0050) is an indexing vector. The value of the  $n^{\text{th}}$  element of this vector is  
22 the rotation number of the  $n^{\text{th}}$  frame in this image, and shall have a value from 1 to Number of  
Rotations (0054,0051).

#### 24 **C.8.4.8.1.6 Number of R-R Intervals and R-R Interval Vector**

26 Number of R-R Intervals (0054,0061) is the number of ranges of heartbeat durations collected.  
A gated acquisition may employ one R-R Interval to collect data from normal beats, a second R-  
28 R-Interval to collect data from ectopic beats, and possibly others. Each R-R Interval accepts  
beats whose duration is greater than its Low R-R Value (0018,1081) and shorter than its High R-  
30 R-Value (0018,1082). Beats which do not fall within these ranges may be accepted by another  
R-R Interval, or may be rejected.

32 The Number of R-R Intervals (0054,0061) is the total number of such ranges.

34 R-R Interval Vector (0054,0060) is an indexing vector. The value of the  $n^{\text{th}}$  element of this vector  
is the interval number of the  $n^{\text{th}}$  frame in this image, and shall have a value from 1 to Number of  
36 R-R Intervals (0054,0061).

#### **C.8.4.8.1.7 Number of Time Slots and Time Slot Vector**

38 Number of Time Slots (0054,0071) is the number of frames into which each gating event is  
divided in a gated acquisition. For example, in a cardiac gated acquisition, data from a number  
40 of heartbeats are then combined by summing together the first frames from all beats into a  
summed first frame, all the second frames into a summed second frame, and so on. The result  
42 has the same number of frames as the Number of Time Slots in each beat.

2 Time Slot Vector (0054,0070) is an indexing vector. The value of the  $n^{\text{th}}$  element of this vector  
is the time slot number of the  $n^{\text{th}}$  frame in this image, and shall have a value from 1 to Number  
of Time Slots (0054,0071).

#### 4 **C.8.4.8.1.8 Number of Slices and Slice Vector**

6 Number of Slices (0054,0081) is the number of slices in each separate volume.

8 | Note: For images with Image Type (0008,0008), Value 3, equal to RECON GATED TOMO this implies that  
Number of Slices (0054,0081) is the same for all R-R Intervals and Time Slots.

10 Slice Vector (0054,0080) is an indexing vector. The value of the  $n^{\text{th}}$  element of this vector is the  
12 slice number of the  $n^{\text{th}}$  frame in this image, and shall have a value from 1 to Number of  
Slices(0054,0081).

#### 14 **C.8.4.8.1.9 Angular View Vector**

16 Angular View Vector (0054,0090) is an indexing vector. The value of the  $n^{\text{th}}$  element of this  
vector is the angular view number of the  $n^{\text{th}}$  frame in this image. If Image Type (0008,0008),  
18 Value 3, is TOMO or GATED TOMO, then the value shall be from 1 to Number of Frames in  
Rotation (0054,0053).

#### **C.8.4.8.1.10 Time Slice Vector**

20 Time Slice Vector (0054,0100) is an indexing vector. The value of the  $n^{\text{th}}$  element of this vector  
is the time slice number of the  $n^{\text{th}}$  frame in this image, and shall have a value from 1 to Number  
22 of Frames in Phase (0054,0033).



## 2 C.8.4.9 NM Image Module

The table in this Section contains the Attributes that describe Nuclear Medicine Images.

4

**Table C.8-Y -- NM Image Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Image Type	(0008,0008)	1	Image identification characteristics. See C.8.4.9.1.1 for specialization.
Image ID	(0054,0400)	3	User or equipment generated Image identifier.
Lossy Image Compression	(0028,2110)	1C	Specifies whether an Image has undergone lossy compression. Enumerated Values: 00 = Image has NOT been subjected to lossy compression. 01 = Image has been subjected to lossy compression. See C.7.6.1.1.5 Required if Lossy Compression has been performed on the Image.
Counts Accumulated	(0018,0070)	2	Sum of all gamma events for all frames in the image. See C.8.4.9.1.2 for specialization.
Acquisition Termination Condition	(0018,0071)	3	Description of how the data collection was stopped. Defined Terms: CNTS = counts DENS = density MANU = manual OVFL = data overflow TIME = time TRIG = physiological trigger See C.8.4.9.1.3 for specialization.
Table Height	(0018,1130)	3	The height of the patient table in mm. The range and values of this element are determined by the manufacturer. Should not be included if Image Type (0008,0008), Value 3, is TOMO, GATED TOMO, RECON TOMO or RECON GATED TOMO.

Table Traverse	(0018,1131)	3	Location of the patient table (or gantry relative to the table) in mm. The range and values of this element are determined by the manufacturer. Should not be included if Image Type (0008,0008), Value 3, is TOMO, GATED TOMO, RECON TOMO or RECON GATED TOMO.
Actual Frame Duration	(0018,1242)	1C	Elapsed time for data acquisition in msec. Required if Image Type (0008,0008) Value 3 is WHOLE BODY or STATIC. See C.8.4.9.1.4 for specialization.
Count Rate	(0018,1243)	3	Maximum count rate achieved during the acquisition in counts/sec.
Processing Function	(0018,5020)	3	Code or description of processing functions applied to the data.
Corrected Image	(0028,0051)	3	A value that indicates which, if any, corrections have been applied to the image. Corrections are applied to all frames in the image. Defined Terms: UNIF = flood corrected COR = center of rotation corrected NCO = non-circular orbit corrected DECY = decay corrected ATTN = attenuation corrected SCAT = scatter corrected DTIM = dead time corrected NRGY = energy corrected LIN = linearity corrected MOTN = motion corrected CLN = count loss normalization; Any type of normalization applied to correct for count loss in Time Slots.
Whole Body Technique	(0018,1301)	3	The type of scan performed. Used only if Image Type (0008,0008), Value 3, contains the value WHOLE BODY. Enumerated Values: 1PS = one pass 2PS = two pass PCN = patient contour following employed MSP = multiple static frames collected into a whole body frame.

Scan Velocity	(0018,1300)	2C	The speed of the camera motion over the body in mm/sec. Required if Image Type (0008,0008) Value 3 contains the value WHOLE BODY.
Scan Length	(0018,1302)	2C	Size of the imaged area in the direction of scanning motion, in mm. Required if Image Type (0008,0008) Value 3 contains the value WHOLE BODY.
Referenced Overlay Sequence	(0008,1130)	3	A sequence which provides reference to a set of SOP Class/Instance pairs which are related independent Overlays. Uniquely identifies Overlays significantly related to this Image. Encoded as sequence of items: (0008,1150) and (0008,1155). Zero or more Items may be included in this sequence.
>Referenced SOP Class UID	(0008,1150)	1C	Uniquely identifies the referenced SOP Class. <a href="#">Required if a sequence Item is present.</a>
>Referenced SOP Instance UID	(0008,1155)	1C	Uniquely identifies the referenced SOP Instance. <a href="#">Required if a sequence Item is present.</a>
Referenced Curve Sequence	(0008,1145)	3	A sequence which provides reference to a set of SOP Class/Instance pairs which are related independent Curves. Uniquely identifies Curves significantly related to this Image. Encoded as sequence of items: (0008,1150) and (0008,1155). Zero or more Items may be included in this sequence.
>Referenced SOP Class UID	(0008,1150)	1C	Uniquely identifies the referenced SOP Class. <a href="#">Required if a sequence Item is present.</a>
>Referenced SOP Instance UID	(0008,1155)	1C	Uniquely identifies the referenced SOP Instance. <a href="#">Required if a sequence Item is present.</a>
Trigger Source or Type	(0018,1061)	3	Text indicating trigger source. Defined Terms: EKG
Anatomic Region Sequence	(0008,2218)	3	Sequence of one Item that identifies the anatomic region of interest in this image (i.e. external anatomy, surface anatomy, or general region of the body). See Section C.8.4.9.1.5.

> Code Value	(0008,0100)	1C	The code value (defined by the coding scheme) that represents the anatomic region. <a href="#">Required if a sequence Item is present.</a>
> Coding Scheme Designator	(0008,0102)	1C	The code from Annex D designating the coding scheme which maps the Code Value (0008,0100) onto the Code Meaning (0008,0104). <a href="#">Defined TermsEnumerated Values:</a> 99SDM <a href="#">Required if a sequence Item is present.</a>
> Code Meaning	(0008,0104)	3	The anatomic region that is represented by the Code Value (0008,0100).
> Anatomic Region Modifier Sequence	(0008,2220)	3	Sequence of one or more Items that modifies the anatomic region of interest in this image (i.e. prone, supine, decubitus right). See Section C.8.4.9.1.5.
>> Code Value	(0008,0100)	1C	The code value (defined by the coding scheme) that represents the anatomic region modifier term. <a href="#">Required if a sequence Item is present.</a>
>> Coding Scheme Designator	(0008,0102)	1C	The code from Annex D designating the coding scheme which maps the Code Value (0008,0100) onto the Code Meaning (0008,0104). <a href="#">Defined TermsEnumerated Values:</a> 99SDM <a href="#">Required if a sequence Item is present.</a>
>> Code Meaning	(0008,0104)	3	The anatomic region modifier term that is represented by the Code Value (0008,0100).
Primary Anatomic Structure Sequence	(0008,2228)	3	Sequence of one or more Items that identifies the primary anatomic structure of interest in this image. See Section C.8.4.9.1.6.
> Code Value	(0008,0100)	1C	The code value (defined by the coding scheme) that represents the primary anatomic structure. <a href="#">Required if a sequence Item is present.</a>

> Coding Scheme Designator	(0008,0102)	1 <u>C</u>	The code from Annex D designating the coding scheme which maps the Code Value (0008,0100) onto the Code Meaning (0008,0104). <u>Defined Terms Enumerated Values:</u> 99SDM <u>Required if a sequence Item is present.</u>
> Code Meaning	(0008,0104)	3	The anatomic structure that is represented by the Code Value (0008,0100).
> Primary Anatomic Structure Modifier Sequence	(0008,2230)	3	Sequence of one or more Items that modifies the primary anatomic structure of interest in this image. See Section C.8.4.9.1.6.
>> Code Value	(0008,0100)	1 <u>C</u>	The code value (defined by the coding scheme) that represents the anatomic structure modifier term. <u>Required if a sequence Item is present.</u>
>> Coding Scheme Designator	(0008,0102)	1 <u>C</u>	The code from Annex D designating the coding scheme which maps the Code Value (0008,0100) onto the Code Meaning (0008,0104). <u>Defined Terms Enumerated Values:</u> 99SDM <u>Required if a sequence Item is present.</u>
>> Code Meaning	(0008,0104)	3	The anatomic structure modifier term that is represented by the Code Value (0008,0100).

2

**C.8.4.9.1 NM Image Module Attribute Descriptions**

4

Note: 1) Image Date (0008,0023) and Image Time (0008,0033) are included in the General Image Module, Table C.7-7, whenever the images are temporally related. For this purpose, all NM Images are considered temporally related, so that these elements are included in an NM Image.

6

8

2) Anatomic Region Sequence (0008,2218), Anatomic Region Modifier Sequence (0008,2220), Primary Anatomic Structure Sequence (0008,2228), and Primary Anatomic Structure Modifier Sequence (0008,2230) specify value 99SDM from Annex D for Coding Scheme Designator. It is expected that this value will evolve when Coding Scheme Designator UIDs are available from a registration authority.

10

12

**C.8.4.9.1 NM Image Module Attribute Descriptions**

### 2 **C.8.4.9.1.1 Image Type**

4 For NM images, Image Type (0008,0008) Value 3 is specified to be Type 1 and use one of the following Enumerated Values:

6           STATIC  
7           DYNAMIC  
8           GATED  
9           WHOLE BODY  
10          TOMO  
11          GATED TOMO  
12          RECON TOMO  
13          RECON GATED TOMO

14 For NM images, Image Type (0008,0008) Value 4 is specified to use one of the following Enumerated Values:

18           EMISSION  
19           TRANSMISSION

20

22 Note: For NM images, Image Type (0008,0008) Value 1 will be ORIGINAL for all raw data and reconstructed images. DERIVED may be appropriate for some other results images.

For NM images, Image Type (0008,0008) Value 2 will be PRIMARY.

24

### **C.8.4.9.1.2 Counts Accumulated**

26 Counts Accumulated (0018,0070) is the total of all gamma events accumulated in all frames of this Image. This attribute applies to acquisition data, and often does not apply to processed images (DERIVED, SECONDARY).

### 30 **C.8.4.9.1.3 Acquisition Termination Condition**

32 Acquisition Termination Condition (0018,0071) is the method of acquisition termination which was actually applied to the data collection. The Defined Terms and definitions are:

34

CNTS           =       preset count limit was reached

36

DENS           =       preset count density was reached

38

MANU           =       acquisition was terminated manually

40

OVFL           =       acquisition was terminated automatically by pixel data overflow condition

42

TIME           =       preset time limit was reached

2 TRIG = preset number of physiological triggers was reached

#### 4 **C.8.4.9.1.4 Actual Frame Duration**

6 Actual Frame Duration (0018,1242) is defined as the elapsed time in msec for a single frame of  
8 an acquisition. For some types of multi-frame images, Actual Frame Duration (0018,1242) may  
have a more specialized meaning as defined in the appropriate IOD Module.

#### 10 **C.8.4.9.1.5 Anatomic Region**

10 The general region of the body (e.g. the anatomic region, organ, or body cavity being examined)  
12 may be identified by the Anatomic Region Sequence (0008,2218). Characteristics of the  
14 anatomic region being examined, such as its orientation relative to gravity (e.g. prone, supine,  
semi-erect), sub-region (e.g. medial, lateral, superior, inferior, lobe, quadrant), and laterality (e.g.  
right, left, both), and so on, may be refined by the Anatomic Region Modifier Sequence  
(0008,2220).

16 ~~If The Coding Scheme for the Anatomic Region Sequence (0008,2218) shall be the~~  
18 ~~SNOMED/DICOM Microglossary Topography module.the Coding Scheme Designator~~  
20 ~~(0008,0102) for the Anatomic Region Code Sequence (0008,2218) is 99SDM, then the Code~~  
22 ~~Value (0008,0100) for the Anatomic Region Code Sequence (0008,2218) shall be the Source~~  
24 ~~UID value from a SNOMED DICOM Microglossary record. This record shall have a Source~~  
26 ~~value of “SNMI”, any Context value, and a Semantic Type value of “anatomic region or~~  
28 ~~structure”.~~

30 ~~The Coding Scheme for the Anatomic Region Modifier Sequence (0008,2220) shall be the~~  
32 ~~SNOMED/DICOM Microglossary General Linkage/Modifiers module.If the Coding Scheme~~  
34 ~~Designator (0008,0102) for the Anatomic Region Modifier Sequence (0008,2220) is 99SDM,~~  
36 ~~then the Code Value (0008,0100) for the Anatomic Region Modifier Sequence (0008,2220) shall~~  
38 ~~be the Source UID value from a SNOMED DICOM Microglossary record. This record shall~~  
40 ~~have a Source value of “SNMI”, any Context value, and a Semantic Type value of “anatomic~~  
42 ~~region modifier”.~~

32 Note: These Data Elements allow the specification of the information encoded by the Body Part Examined  
34 (0018,0015) and Patient Position (0018,5100) Data Attributes (in the General Series Module) in a more  
robust, consistent way.

#### 36 **C.8.4.9.1.6 Primary Anatomic Structure**

36 The specific anatomic structures of interest within the image (e.g. a particular artery within the  
38 anatomic region) is identified by the Primary Anatomic Structure Sequence (0008,2228).  
40 Characteristics of the anatomic structure, such as its location (e.g. subcapsular, peripheral,  
central), configuration (e.g. distended, contracted), and laterality (e.g. right, left, both), and so on,  
may be refined by the Primary Anatomic Structure Modifier Sequence (0008,2230).

42 ~~The Coding Scheme for the Primary Anatomic Structure Sequence (0008,2228) shall be the~~  
44 ~~SNOMED/DICOM Microglossary Topography module.If the Coding Scheme Designator~~  
(0008,0102) for the Primary Anatomic Structure Sequence (0008,2228) is 99SDM, then the

2 | Code Value (0008,0100) for the Primary Anatomic Structure Sequence (0008,2228) shall be the  
4 | Source UID value from a SNOMED DICOM Microglossary record. This record shall have a  
6 | Source value of “SNMI”, any Context value, and a Semantic Type value of “anatomic region or  
8 | structure”.

6 | ~~The Coding Scheme for the Primary Anatomic Structure Modifier Sequence (0008,2230) shall~~  
8 | ~~be the SNOMED/DICOM Microglossary General Linkage/Modifiers module.~~If the Coding  
10 | Scheme Designator (0008,0102) for the Primary Anatomic Structure Modifier Sequence  
12 | (0008,2230) is 99SDM, then the Code Value (0008,0100) for the Primary Anatomic Structure  
14 | Modifier Sequence (0008,2230) shall be the Source UID value from a SNOMED DICOM  
16 | Microglossary record. This record shall have a Source value of “SNMI”, any Context value,  
18 | and a Semantic Type value of “anatomic structure modifier”.

Note: 1) These Data Elements are intended to replace the Anatomic Structure (0008,2208) Data Element.



**C.8.4.10 NM Isotope Module**

2 The table in this Section contains Attributes that describe the isotope administered for the acquisition.

4

**Table C.8-Y -- NM Isotope Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Energy Window Information Sequence	(0054,0012)	2	Sequence of Repeating Items that describe the energy window groups used. The number of items shall be equal to Number of Energy Windows (0054,0011). The first item corresponds to frames with value of 1 in the <a href="#">Energy Window-Isotope</a> Vector (0054,0010), the second item with value 2, etc.
> Energy Window Name	(0054,0018)	3	A user defined name which describes this Energy Window.
>Energy Window Range Sequence	(0054,0013)	3	Sequence of Repeating Items that describes <a href="#">these each</a> energy window group.
>> Energy Window Lower Limit	(0054,0014)	3	The lower limit of the energy window in KeV. See C.8.4.10.1.1 for further explanation.
>> Energy Window Upper Limit	(0054,0015)	3	The upper limit of the energy window in KeV. See C.8.4.10.1.2 for further explanation.
Radiopharmaceutical Information Sequence	(0054,0016)	2	Sequence of Repeating Items that describe isotope information. One or more Items may be included in this sequence.
> Radionuclide Code Sequence	(0054,0300)	<a href="#">2C</a>	Sequence that identifies the radionuclide. This sequence shall contain exactly one item. See section C.8.4.10.1.3 for further explanation. <a href="#">Required if a sequence Item is present.</a>
>> Code Value	(0008,0100)	<a href="#">1C</a>	The code value (defined by the coding scheme) that represents the radionuclide. <a href="#">Required if a sequence Item is present.</a>

>> Coding Scheme Designator	(0008,0102)	1C	The code from Annex D designating the coding scheme which maps the Code Value (0008,0100) onto the Code Meaning (0008,0104). Enumerated Values: 99SDM <a href="#">Required if a sequence Item is present.</a>
>> Code Meaning	(0008,0104)	3	The radionuclide that is represented by the Code Value (0008,0100).
> Radiopharmaceutical Route	(0018,1070)	3	Route of injection.
> <del>Administration Radiopharmaceutical</del> Route Code Sequence	(0054,0302)	3	Sequence that identifies the <a href="#">administration route for the rRadiopharmaceutical Route</a> . This sequence shall contain exactly one item. See section C.8.4.10.1.4 for further explanation
>> Code Value	(0008,0100)	1C	The code value (defined by the coding scheme) that represents the <a href="#">rRadiopharmaceutical rRoute</a> . <a href="#">Required if a sequence Item is present.</a>
>> Coding Scheme Designator	(0008,0102)	1C	The code from Annex D designating the coding scheme which maps the Code Value (0008,0100) onto the Code Meaning (0008,0104). <a href="#">Defined Terms:</a> <a href="#">99SDM</a> <a href="#">Required if a sequence Item is present.</a>
>> Code Meaning	(0008,0104)	3	The <a href="#">rRadiopharmaceutical rRoute</a> that is represented by the Code Value (0008,0100).
> Radiopharmaceutical Volume	(0018,1071)	3	Volume of injection in cubic cm.
> Radiopharmaceutical Start Time	(0018,1072)	3	Time of start of injection. See C.8.4.10.1.5 for further explanation.
> Radiopharmaceutical Stop Time	(0018,1073)	3	Time of end of injection. See C.8.4.10.1.6 for further explanation.
> Radionuclide Total Dose	(0018,1074)	3	Total amount of radionuclide injected. See C.8.4.10.1.7 for further explanation.
> Calibration Data Sequence	(0054,0306)	3	Sequence that contains calibration data.

>> Energy Window Number	(0054,0308)	1C	The Item number in the Energy Window Information Sequence to which the following calibration data relates. The Items are numbered starting from 1. <a href="#">Required if a sequence Item is present.</a>
>> Syringe Counts	(0018,1045)	3	Pre-injection syringe count rate in counts/sec. See C.8.4.10.1.8 for further explanation.
>> Residual Syringe Counts	(0054,0017)	3	Post-injection residue syringe count rate in counts/sec. See C.8.4.10.1.9 for further explanation.
> Radiopharmaceutical	(0018,0031)	3	Name of the radiopharmaceutical.
> Radiopharmaceutical Code Sequence	(0054,0304)	3	Sequence that identifies the radiopharmaceutical. This sequence shall contain exactly one item. <a href="#">See section C.8.4.10.1.10 for further explanation.</a>
>> Code Value	(0008,0100)	1C	The code value (defined by the coding scheme) that represents the radiopharmaceutical. <a href="#">Required if a sequence Item is present.</a>
>> Coding Scheme Designator	(0008,0102)	1C	The code from Annex D designating the coding scheme which maps the Code Value (0008,0100) onto the Code Meaning (0008,0104). <a href="#">Defined Terms:</a> <a href="#">99SDM</a> <a href="#">Required if a sequence Item is present.</a>
>> Code Meaning	(0008,0104)	3	The radiopharmaceutical that is represented by the Code Value (0008,0100).
Intervention Drug Information Sequence	(0018,0026)	3	Sequence of Repeating Items that describes the intervention drugs used. Zero or more Items may be included in this sequence.
> Intervention Drug Name	(0018,0034)	3	Name of intervention drug.
> Intervention Drug Code Sequence	(0018,0029)	3	Sequence that identifies the intervention drug name. <a href="#">See section C.8.4.10.1.11 for further explanation.</a>
>> Code Value	(0008,0100)	1C	The code value (defined by the coding scheme) that represents the intervention drug name. <a href="#">Required if a sequence Item is present.</a>

>> Coding Scheme Designator	(0008,0102)	1C	The code from Annex D designating the coding scheme which maps the Code Value (0008,0100) onto the Code Meaning (0008,0104). <u>Defined Terms:</u> <u>99SDM</u> <u>Required if a sequence Item is present.</u>
>> Code Meaning	(0008,0104)	3	The intervention drug that is represented by the Code Value (0008,0100).
> <u>Administration Route Code Sequence</u>	<u>(0054,0302)</u>	<u>3</u>	<u>Sequence that identifies the administration route for the intervention drug. This sequence shall contain exactly one item. See section C.8.4.10.1.4 for further explanation</u>
>> <u>Code Value</u>	<u>(0008,0100)</u>	<u>1C</u>	<u>The code value (defined by the coding scheme) that represents the intervention drug route. Required if a sequence Item is present.</u>
>> <u>Coding Scheme Designator</u>	<u>(0008,0102)</u>	<u>1C</u>	<u>The code from Annex D designating the coding scheme which maps the Code Value (0008,0100) onto the Code Meaning (0008,0104). <u>Defined Terms:</u> <u>99SDM</u> <u>Required if a sequence Item is present.</u></u>
>> <u>Code Meaning</u>	<u>(0008,0104)</u>	<u>3</u>	<u>The intervention drug route that is represented by the Code Value (0008,0100).</u>
>Intervention Drug Start Time	(0018,0035)	3	Time of administration of the intervention drug, using the same time <u>base</u> as for the Acquisition Start Time (0008,0032).
>Intervention Drug Stop Time	(0018,0027)	3	Time of completion of administration of the intervention drug, using the same time <u>base</u> as for the Acquisition Start Time (0008,0032).
>Intervention Drug Dose	(0018,0028)	3	Intervention drug dose, in mg.

2 **C.8.4.10.1 NM Isotope Module Attribute Descriptions**

4 Note: Radionuclide Code Sequence (0054,0300) and ~~Administration Radiopharmaceutical~~ Route Code Sequence (0054,0302) specify value 99SDM from Annex D for Coding Scheme Designator. It is

2 expected that this value will evolve when Coding Scheme Designator UIDs are available from a  
3 registration authority.

#### 4 **C.8.4.10.1 NM Isotope Module Attribute Descriptions**

##### 6 **C.8.4.10.1.1 Energy Window Lower Limit**

8 Energy Window Lower Limit (0054,0014) is the acquisition energy window lower limit in KeV  
9 for acceptance of scintillation events into this Isotope.

##### 10 **C.8.4.10.1.2 Energy Window Upper Limit**

12 Energy Window Upper Limit (0054,0015) is the acquisition energy window upper limit in KeV  
13 for acceptance of scintillation events into this Isotope.

14

##### **C.8.4.10.1.3 Radionuclide Code Sequence**

16 ~~The Coding Scheme for the Radionuclide Code Sequence (0054,0300) shall be the~~  
17 ~~SNOMED/DICOM Microglossary Radionuclides list. The Coding Scheme Designator~~  
18 ~~(0008,0102) for the Radionuclide Code Sequence (0054,0300) shall be the SNOMED DICOM~~  
19 ~~Microglossary. The Code Value (0008,0100) for the Radionuclide Code Sequence (0054,0300)~~  
20 ~~shall be the Source UID value from a SNOMED DICOM Microglossary record. This record~~  
21 ~~shall have a Source value of “SNMI”, any Context value, and a Semantic Type value of~~  
22 ~~“diagnostic radionuclide”.~~

##### 24 **C.8.4.10.1.4 Administration Radiopharmaceutical Route Code Sequence**

26 ~~The Coding Scheme for the Radiopharmaceutical Route Code Sequence (0054,0302) shall be~~  
27 ~~the SNOMED/DICOM Microglossary Radiopharmaceutical Routes list. If the Coding Scheme~~  
28 ~~Designator (0008,0102) for the Administration Route Code Sequence (0054,0302) is 99SDM,~~  
29 ~~then the Code Value (0008,0100) for the Administration Route Code Sequence (0054,0302) shall~~  
30 ~~be the Source UID value from a SNOMED DICOM Microglossary record. This record shall~~  
31 ~~have a Source value of “SNMI”, any Context value, and a Semantic Type value of “drug~~  
32 ~~administration route”.~~

##### 32 **C.8.4.10.1.5 Radiopharmaceutical Start Time**

34 Radiopharmaceutical Start Time (0018,1072) is the actual time of radiopharmaceutical  
35 administration to the patient for imaging purposes, using the same time base as for the  
36 Acquisition Start Time (0008,0032).

##### 36 **C.8.4.10.1.6 Radiopharmaceutical Stop Time**

2 Radiopharmaceutical Stop Time (0018,1073) is the actual ending time of radiopharmaceutical  
administration to the patient for imaging purposes, using the same time base as for the  
Acquisition Start Time (0008,0032).

#### 4 **C.8.4.10.1.7 Radionuclide Total Dose**

6 Radionuclide Total Dose (0018,1074) is the radiopharmaceutical dose administered to the patient  
measured in MegaBecquerels (Mbg) at the Radiopharmaceutical Start Time.

#### 8 **C.8.4.10.1.8 Syringe Counts**

8 Syringe Counts (0018,1045) is the pre-injection syringe acquisition count rate measured in  
counts/sec, corrected to the Acquisition Start Time (0008,0032) if necessary.

#### 10 **C.8.4.10.1.9 Residual Syringe Counts**

12 Residual Syringe Counts (0054,0017) is the syringe acquisition count rate following patient  
injection, measured in counts/sec, corrected to the Acquisition Start Time (0008,0032) if  
14 necessary.

#### 16 **C.8.4.10.1.10 Radiopharmaceutical Code Sequence**

18 If the Coding Scheme Designator (0008,0102) for the Radiopharmaceutical Code Sequence  
(0054,0304) is 99SDM, then the Code Value (0008,0100) for the Radiopharmaceutical Code  
Sequence (0054,0304) shall be the Source UID value from a SNOMED DICOM Microglossary  
record. This record shall have a Source value of “SNMI”, any Context value, and a Semantic  
Type value of “radiopharmaceutical agent”.

#### 22 **C.8.4.10.1.11 Intervention Drug Code Sequence**

24 If the Coding Scheme Designator (0008,0102) for the Intervention Drug Code Sequence  
(0018,0029) is 99SDM, then the Code Value (0008,0100) for the Intervention Drug Code  
Sequence (0018,0029) shall be the Source UID value from a SNOMED DICOM Microglossary  
record. This record shall have a Source value of “SNMI”, any Context value, and a Semantic  
Type value of “angio-interventional drug”.

2 **C.8.4.11 NM Detector Module**

4 The table in this Section contains IOD Attributes that describe Nuclear Medicine Detectors used to produce an image.

6 **Table C.8-Y -- NM Detector Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Detector Information Sequence	(0054,0022)	2	Sequence of Repeating Items that describe the detectors used. The number of items shall be equal to Number of Detectors (0054,0021). The first item corresponds to frames with value of 1 in the Detector Vector (0054,0020), the second item with value 2, etc.
> Collimator/grid name	(0018,1180)	3	Label describing the collimator used (LEAP, hires, etc.)
> Collimator Type	(0018,1181)	2C	Collimator type. Defined Terms: PARA = Parallel (default) PINH = Pinhole FANB = Fan-beam CONE = Cone-beam SLNT = Slant hole ASTG = Astigmatic DIVG = Diverging NONE = No collimator UNKN = Unknown <a href="#">Required if a sequence Item is present.</a>
> Field of View Shape	(0018,1147)	3	Shape of the field of view of the Nuclear Medicine detector. Defined Terms: RECTANGLE ROUND HEXAGONAL
> Field of View Dimension-(s)	(0018,1149)	3	Dimensions of the <del>f</del> Field of <del>v</del> View, (0018,1147) in mm. If <a href="#">Field of View Shape (0018,1147)</a> is: <del>RECTANGLE: Rectangle,</del> row dimension followed by column, <del>if ROUND: ound,</del> diameter, <del>if HEXAGONAL: exagonal,</del> diameter of a circumscribed circle.

> Focal Distance	(0018,1182)	2C	Focal distance, in mm. A value of 0 means infinite distance for parallel collimation. See C.8.4.11.1.1 for further specialization. <a href="#">Required if a sequence Item is present.</a>
> X Focus Center	(0018,1183)	3	Center of focus along a row. See C.8.4.11.1.2 for further explanation.
> Y Focus Center	(0018,1184)	3	Center of focus along a column. See C.8.4.11.1.2 for further explanation.
> Zoom Center	(0028,0032)	3	The amount of offset from (0,0) applied to each pixel in the image before application of the zoom factor, specified by a numeric pair: row value (delimiter) column value (in mm). See C.8.4.11.1.3 for further explanation.
> Zoom Factor	(0028,0031)	3	The amount of magnification applied to each pixel in the image, specified by a numeric pair: row value (delimiter) column value. See C.8.4.11.1.4 for further explanation.
> Center of Rotation Offset	(0018,1145)	3	Average center of rotation offset of Nuclear Medicine detector in mm. See C.8.4.11.1.5 for further explanation.
> Gantry/Detector Tilt	(0018,1120)	3	Angle of tilt in degrees of the detector. See C.8.4.11.1.6 for further explanation.
> Distance Source to Detector	(0018,1110)	2C	Distance in mm from transmission source to the detector face. Required if Image Type (0008,0008) Value 4 is TRANSMISSION, <del>and</del> Value 3 is not TOMO, <del>and a sequence Item is present.</del>
> Start Angle	(0054,0200)	3	Position of the detector about the patient for the start of the acquisition, in degrees. Zero degrees is referenced to the origin at the patient's back. Viewing from the patient's feet, angle increases in a counter-clockwise direction (detector normal rotating from the patient's back towards the patient's left side). Should not be included if Image Type (0008,0008), Value 3, is TOMO, GATED TOMO, RECON TOMO or RECON GATED TOMO.



> Radial Position	(0018,1142)	3	Radial distance of the detector from the center of rotation, in mm. Should not be included if Image Type (0008,0008), Value 3, is TOMO, GATED TOMO, RECON TOMO or RECON GATED TOMO.
> Image Orientation (Patient)	(0020,0037)	2C	The direction cosines of the first row and the first column with respect to the patient. See C.7.6.2.1.1 for further explanation. <a href="#">Required if a sequence Item is present.</a>
> Image Position (Patient)	(0020,0032)	2C	The x, y, and z coordinates of the upper left hand corner (first pixel transmitted) of the image. See C.7.6.2.1.1 for further explanation. <a href="#">Required if a sequence Item is present.</a>
> View Code Sequence	(0054,0220)	3	Sequence that describes the projection of the anatomic region of interest on the image receptor. See section C.8.4.11.1.7 for further explanation.
>> Code Value	(0008,0100)	1C	The code value (defined by the coding scheme) that represents the view. <a href="#">Required if a sequence Item is present.</a>
>> Coding Scheme Designator	(0008,0102)	1C	The code from Annex D designating the coding scheme which maps the Code Value (0008,0100) onto the Code Meaning (0008,0104). <a href="#">Defined Terms Enumerated Values:</a> 99SDM <a href="#">Required if a sequence Item is present.</a>
>> Code Meaning	(0008,0104)	3	The view that is represented by the Code Value (0008,0100).
>> View Angulation Modifier Code Sequence	(0054,0222)	2C	View Modifier. Required if needed to fully specify the View. See section C.8.4.11.1.8 for further explanation.
>>> Code value	(0008,0100)	1C	The code value (defined by the coding scheme) that represents the view angulation modifier. <a href="#">Required if a sequence Item is present.</a>

>>> Coding Scheme Designator	(0008,0102)	1C	The code from Annex D designating the coding scheme which maps the Code value (0008,0100) onto the Code Meaning (0008,0104). <a href="#">Defined Terms Enumerated Values:</a> 99SDM <a href="#">Required if a sequence Item is present.</a>
>>> Code Meaning	(0008,0104)	3	The view modifier that is represented by the Code Value (0008,0100).

[Note: View Code Sequence \(0054,0220\) and View Angulation Modifier Code Sequence \(0054,0222\) specify value 99SDM from Annex D for Coding Scheme Designator. It is expected that this value will evolve when Coding Scheme Designator UIDs are available from a registration authority.](#)

## C.8.4.11.1 NM Detector Attribute Descriptions

### C.8.4.11.1.1 Focal Distance

Focal Distance (0018,1182) for NM Image data is the focal distance, in mm for converging or diverging collimators, measured from the front face of the collimator to the focus. Positive values indicate converging and negative values indicate diverging collimators. A value of 0 means infinite distance for parallel collimation.

### C.8.4.11.1.2 Focus Center

X Focus Center (0018,1183) and Y Focus Center (0018,1184) for NM Image data is used to define the projection of the focus for a converging or diverging collimator within the un-zoomed Field of View. It is defined in mm for row and column relative to the center of the un-zoomed Field of View.

### C.8.4.11.1.3 Zoom Center

Zoom Center (0028,0032) is the offset between the un-zoomed camera field of view and field of view, measured from the center of the un-zoomed camera field of view to the center the of the zoomed field of view. The offset is measured in mm in the un-zoomed camera FOV dimensions. Positive values are to the right and down from the un-zoomed center, as viewed from the image plane. When this attribute is not given, the Zoom Center is assumed to be 0,0.

### C.8.4.11.1.4 Zoom Factor

Zoom Factor (0028,0031) is the magnification factor that was used during the acquisition. When this attribute is not given, it is assumed to be 1.0,1.0.

Note: Zoom Factor (0028,0031) is informational only. Pixel Spacing (0028,0030) already takes account of this and any other changes to pixel size.

#### C.8.4.11.1.5 Center of Rotation Offset

Center of Rotation Offset (0018,1145) is the average amount of offset in mm between the Detector Field of View center and the physical center of rotation of the gantry for circular orbital scans. Positive values indicate the physical center is to the right of the image plane center.

#### C.8.4.11.1.6 Gantry/Detector Tilt

Gantry/Detector Tilt (0018,1120) for NM Image data is the angle in degrees of the detector face relative to the patient's major (Head to Feet) axis (or the table supporting the patient). Positive tilt is towards the patient's feet.

#### C.8.4.11.1.7 View Code Sequence

Only a single Item shall be permitted in this sequence.

~~The Coding Scheme for the View Code Sequence (0054,0220) shall be the SNOMED/DICOM Microglossary Views list. If the Coding Scheme Designator (0008,0102) for the View Code Sequence (0054,0220) is 99SDM, then the Code Value (0008,0100) for the View Code Sequence (0054,0220) shall be the Source UID value from a SNOMED DICOM Microglossary record. This record shall have a Source value of "SNMI", any Context value, and a Semantic Type value of "imaging view".~~

#### C.8.4.11.1.8 View Angulation Modifier Code Sequence

Only a single Item shall be permitted in this sequence.

~~The Coding Scheme for the View Angulation Modifier Code Sequence (0054,0222) shall be the SNOMED/DICOM Microglossary View Angulation Modifiers list. If the Coding Scheme Designator (0008,0102) for the View Angulation Modifier Code Sequence (0054,0222) is 99SDM, then the Code Value (0008,0100) for the View Angulation Modifier Code Sequence (0054,0222) shall be the Source UID value from a SNOMED DICOM Microglossary record. This record shall have a Source value of "SNMI", any Context value, and a Semantic Type value of "cranio-caudal angulation modifier".~~

**C.8.4.12 NM TOMO Acquisition Module**

2 This Module applies to a TOMO Multi-frame Image. This module is present when the Image  
 4 Type (0008,0008) Value 3, is equal to TOMO, GATED TOMO, RECON TOMO, or RECON  
 GATED TOMO. The elements found in this module describe the acquisition of the Image.

6 **Table C.8-Y -- NM TOMO Acquisition Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Rotation Information Sequence	(0054,0052)	2	Sequence of Repeating Items that describe TOMO rotational groups. A new rotation is defined whenever the direction of the detector motion changes, or the Table Traverse (0018,1131) changes. The number of items shall be equal to Number of Rotations (0054,0021). If Rotation Vector (0054,0050) is present, the first item corresponds to frames with value of 1 in the Rotation Vector (0054,0050), the second item with value 2, etc.
> Start Angle	(0054,0200)	1C	Position of the detector about the patient for the start of <a href="#">this rotation acquisition</a> , in degrees. Zero degrees is referenced to the origin at the patient's back. Viewing from the patient's feet, angle increases in a counter-clockwise direction (detector normal rotating from the patient's back towards the patient's left side). <a href="#">Required if a sequence Item is present.</a>
> Angular Step	(0018,1144)	1C	The angular scan arc step between views of the TOMO acquisition, in degrees. See C.8.4.12.1.1 for further explanation. <a href="#">Required if a sequence Item is present.</a>
> Rotation Direction	(0018,1140)	1C	Direction of rotation of the detector about the patient. See Start Angle (0054,0200) for further explanation of direction. Enumerated Values: CW = clockwise (decreasing angle) CC = counter-clockwise (increasing angle). <a href="#">Required if a sequence Item is present.</a>

> Scan Arc	(0018,1143)	1C	The effective angular range of the scan data in degrees. The value shall be positive. <a href="#">Required if a sequence Item is present.</a>
> Actual Frame Duration	(0018,1242)	1C	Nominal acquisition time per angular position, in msec. <a href="#">Required if a sequence Item is present.</a>
> Radial Position	(0018,1142)	3	Radial distance of the detector from the center of rotation, in mm. It shall have a single value which is an average value for this rotation, or it shall have one value per angular view.
> Distance Source to Detector	(0018,1110)	2C	Distance in mm from transmission source to the detector face. Required if Image Type (0008,0008), Value 4, is TRANSMISSION <a href="#">and a sequence Item is present.</a>
> Number of Frames in Rotation	(0054,0053)	1C	Number of angular views in this rotation. <a href="#">Required if a sequence Item is present.</a>
> Table Traverse	(0018,1131)	3	Location of the patient table (or gantry relative to the table) in mm. The range and values of this element are determined by the manufacturer.
> Table Height	(0018,1130)	3	The distance in mm of the top of the patient table to the center of rotation. Table height below the center of rotation has a positive value.
Type of Detector Motion	(0054,0202)	3	Describes the detector motion during acquisition. Enumerated Values: STEP AND SHOOT = Interrupted motion, acquire only while stationary. CONTINUOUS = Gantry motion and acquisition are simultaneous and continuous. ACQ DURING STEP = Interrupted motion, acquisition is continuous.

## 2 C.8.4.12.1 NM TOMO Acquisition Attribute Descriptions

### C.8.4.12.1.1 Angular Step

- 4 Angular Step (0018,1144) is the nominal frame-to-frame incremental angle for TOMO and GATED TOMO acquisition images, defined in degrees. The Angular Step (0018,1144) shall be
- 6 a positive number. Summation of Angular Step values is not defined to give accurate Angular

- 2 Position or Scan Arc values. The Angular Step is the effective angular spacing between resultant frames of the Multi-framed planar image data.

### C.8.4.13 NM Multi-gated Acquisition Module

2 The table in this Section contains Attributes that describe a multi-gated acquisition image  
4 performed on the patient. This refers to frames acquired while the patient is connected to a gating device.

6 **Table C.8-Y-- NM Multi-gated Acquisition Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Beat Rejection Flag	(0018,1080)	3	Heart beat duration sorting has been applied. Enumerated Values: Y = yes N = no
PVC Rejection	(0018,1085)	3	Description of type of arrhythmic beat rejection criteria used.
Skip Beats	(0018,1086)	3	Number of beats skipped after a detected arrhythmia
Heart Rate	(0018,1088)	3	Average number of heart beats per minute for the collection period for these frames. This shall include all accepted beats as well as rejected beats.
Gated Information Sequence	(0054,0062)	2C	Sequence of Repeating Items that describe R-R intervals. Each gated interval is defined by an upper and lower range of heart beat durations. Required if the Frame Increment Pointer (0028,0009) contains the Tag for R-R Interval Vector (0054,0060). The number of items shall be equal to Number of R-R Intervals (0054,0061). The first item corresponds to frames with value of 1 in the R-R Interval Vector (0054,0060), the second item with value 2, etc.
> Trigger Time	(0018,1060)	3	Time interval measured in msec from the start of the R-wave to the beginning of the data taking.
> Framing Type	(0018,1064)	3	Description of type of framing performed such as forward, backward, forward/backward by percentage.
> Data Information Sequence	(0054,0063)	2C	Sequence of Repeating Items that describe gating criteria. See C.8.4.13.1. <a href="#">Required if a sequence Item is present.</a>

>> Frame Time	(0018,1063)	1C	Nominal time per individual frame in msec. <a href="#">Required if a sequence Item is present.</a>
>> Nominal Interval	(0018,1062)	3	Average duration of accepted beats, in msec.
>> Low R-R Value	(0018,1081)	3	R-R interval lower limit for beat rejection, in msec
>> High R-R Value	(0018,1082)	3	R-R interval upper limit for beat rejection, in msec
>> Intervals Acquired	(0018,1083)	3	Number of heartbeats that fall within Low R-R Value (0018,1081) and High R-R Value (0018,1082), and were therefore accepted and contribute gamma events to this R-R Interval.
>> Intervals Rejected	(0018,1084)	3	Number of heartbeats that fall outside Low R-R (0018,1081) and High R-R Value (0018,1082), and do not contribute gamma events to this R-R Interval. However, they may contribute gamma events to other R-R Intervals.
>> Time Slot Information Sequence	(0054,0072)	2C	Sequence of Repeating Items that describe Time Slot Information. Required if the Frame Increment Pointer (0028,0009) contains the Tag for Time Slot Vector (0054,0070). The number of items shall be equal to Number of Time Slots (0054,0071). The first item corresponds to frames with value of 1 in the Time Slot Vector (0054,0070), the second item with value 2, etc.
>>> Time Slot Time	(0054,0073)	3	The total amount of time, in msec, that the acquisition accumulates gamma events into this frame. See C.8.4.13.2.

## 2 C.8.4.13 NM Multi-gated Acquisition Attribute Descriptions

### C.8.4.13.1 Data Information Sequence

- 4 Data Information Sequence (0054,0063) shall contain a single sequence item which applies to the sum of all angular views, except when Image Type (0008,0008) Value 3 is GATED TOMO.
- 6 In this case it shall have either a single item which applies to the sum of all angular views, or it shall have one item for each angular view.

8



**C.8.4.13.2 Time Slot Time**

- 2 The Time Slot Time (0054,0073) records the effective imaging time of each Time Slot. For  
example, if some of the accepted beats are shorter than others then the last frames may not  
4 receive a contribution from the shorter beats. The Time Slot Time for a Time Slot is the total  
acquisition time for that Time Slot. It is approximately equal to the Frame Time (0018,1063)  
6 multiplied by the number of accepted beats contributing to the Time Slot.

**C.8.4.14 NM Phase Module**

2 The table in this Section contains Attributes that describe dynamic phases of a dynamic  
 4 acquisition image performed on the patient. This module is present only when Image Type  
 6 (0008,0008), Value 3, is equal to DYNAMIC. A phase is defined as a collection of frames in  
 8 which the acquisition time per frame and the time delay between frames remains constant. A new  
 phase shall be defined whenever there is a change in the time between frames, the acquisition  
 time per frame, or the position of the patient relative to the detector.

**Table C.8-Y-- NM Phase Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Phase Information Sequence	(0054,0032)	2C	Sequence of Repeating Items that describes each dynamic phase. Required if the Frame Increment Pointer (0028,0009) contains the Tag for Phase Vector (0054,0030). The number of items shall be equal to Number of Phases (0054,0031). The first item corresponds to frames with value of 1 in the Phase Vector (0054,0030), the second item with value 2, etc.
> Phase Delay	(0054,0036)	1C	Time paused between the last frame of the previous phase and the first frame of this phase, in msec. <a href="#">Required if a sequence Item is present.</a>
> Actual Frame Duration	(0018,1242)	1C	Nominal time of acquisition per individual frame, in msec. <a href="#">Required if a sequence Item is present.</a>
> Pause Between Frames	(0054,0038)	1C	Time paused between each frame of this phase (in msec). <a href="#">Required if a sequence Item is present.</a>
> Number of Frames in Phase	(0054,0033)	1C	Number of frames in this phase. <a href="#">Required if a sequence Item is present.</a>
>Trigger Vector	(0054,0210)	3	An array of trigger times when gating information is acquired simultaneously with the dynamic image data. See section C.8.4.14.1.1 for further explanation.
>Number of Triggers in Phase	(0054,0211)	1C	The number of entries in the Trigger Vector (0054,0210) for this phase. <a href="#">Required if Trigger Vector (0054,0210) is present.</a>

10

**C.8.4.14.1 NM Phase Module Attributes Description**

#### 2 **C.8.4.14.1.1 Trigger Vector**

4 Trigger Vector (0054,0210) is an array containing a list of the inter-trigger interval times in  
6 milliseconds in the order in which they were acquired, with the first being measured from the  
start time of the first frame of the image data in the Phase. If this element is used, the start times  
are required to be the same so that a mathematical correlation can be made between trigger times  
and frame start times.

**C.8.4.15 NM Reconstruction Module**

2 The Table in this section contains Attributes that describe Nuclear Medicine reconstructed  
 4 volumes. Reconstructed volumes are created by applying a transformation (reconstruction)  
 6 process to the acquired TOMO frames. This module is present only when the Image Type  
 (0008,0008), Value 3, is equal to RECON TOMO or RECON GATED TOMO.

**Table C.8-Y-- NM Reconstruction Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Spacing Between Slices	(0018,0088)	2	Spacing between slices, in mm, measured from center-to-center of each slice along the normal to the first image. The sign of the Spacing Between Slices (0018,0088) determines the direction of stacking. The normal is determined by the cross product of the direction cosines of the first row and first column of the first frame, such that a positive spacing indicates slices are stacked behind the first slice and a negative spacing indicates slices are stacked in front of the first slice. See Image Orientation (0020,0037) in the NM Detector module.
Reconstruction Diameter	(0018,1100)	3	Diameter, in mm, of the region from within which the data was used in creating the reconstruction of the image. Data may exist outside this region and portions of the patient may exist outside this region.
Convolution Kernel	(0018,1210)	3	A label describing the convolution kernel or algorithm used to reconstruct the data.
Slice Thickness	(0018,0050)	2	Nominal slice thickness, in mm.
Slice Location	(0020,1041)	3	Relative position of exposure expressed in mm. C.7.6.2.1.2 for further explanation.

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**Changes for section C.9, Overlays**

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**Item #5.1.**  
**Add the following text, shown in BOLD, to Table C.9-2, Overlay plane module attributes, in section C.9.2**

8

<b>Attribute Name</b>	<b>Tag</b>	<b>Type</b>	<b>Attribute Description</b>
<b>Overlay Description</b>	<b>(60xx,0022)</b>	<b>3</b>	<b>User-defined comments about the overlay.</b>
<b>Overlay Label</b>	<b>(60xx,1500)</b>	<b>3</b>	<b>A user defined text string which may be used to label or name this overlay.</b>

**Changes for section C.10, Curves**

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**Item #5.1.**  
**Add the following text, shown in BOLD, to Table C.10-2, Curve module attributes, in section C.10.2**

<b>Attribute Name</b>	<b>Tag</b>	<b>Type</b>	<b>Attribute Description</b>
<b>Curve Label</b>	<b>(50xx,2500)</b>	<b>3</b>	<b>A user defined text string which may be used to label or name this curve.</b>
<b>Referenced Overlay Sequence</b>	<b>(50xx,2600)</b>	<b>3</b>	<b>A Sequence which provides reference to a set of related overlays used to generate this curve.</b>
<b>&gt; Referenced SOP Class UID</b>	<b>(0008,1150)</b>	<b>1</b>	<b>Uniquely identifies the referenced SOP Class.</b>
<b>&gt; Referenced SOP Instance UID</b>	<b>(0008,1155)</b>	<b>1</b>	<b>Uniquely identifies the referenced SOP Instance.</b>
<b>&gt; Referenced Overlay Group</b>	<b>(50xx,2610)</b>	<b>1</b>	<b>The Group number of the related overlay.</b>

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**Changes for Appendix D, Diagnostic Coding schemes**

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***Item #6.1.***  
***Add the following Diagnostic coding scheme designator to Table D-1, Appendix D.***

4

Coding Scheme	Coding Scheme Designator
SNOMED / DICOM Microglossary	99SDM

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**ACR-NEMA**

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# **Digital Imaging and Communications in Medicine (DICOM)**

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## **Part 4 Addendum Nuclear Medicine Image Storage SOP Class**

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**B.5 Standard SOP Classes**

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**Item #1**  
*Add the following to Section B.5 of Part 4:*

4

SOP Class Name	SOP Class UID
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20

6

**Item #2**  
*Retire the following in Section B.5 of Part 4:*

8

SOP Class Name	SOP Class UID
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.5

**ACR-NEMA**

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# **Digital Imaging and Communications in Medicine (DICOM)**

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## **Part 6 Addendum Nuclear Medicine Data Dictionary**

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**Item #1**  
**Add the following Data Elements to Part 6 Section 6:**

Tag	Name	VR	VM
[0018,0026]	Intervention Drug Information Sequence	SQ	1
[0018,0027]	Intervention Drug Stop Time	TM	1
[0018,0028]	Intervention Drug Dose	DS	1
[0018,0029]	Intervention Drug Code Sequence	SQ	1
[0054,0000]	Group Length	UL	1
[0054,0010]	Energy Window Vector	US	n
[0054,0011]	Number of Energy Windows	US	1
[0054,0012]	Energy Window Information Sequence	SQ	1
[0054,0013]	Energy Window Range Sequence	SQ	1
[0054,0014]	Energy Window Lower Limit	DS	1
[0054,0015]	Energy Window Upper Limit	DS	1
[0054,0016]	Radiopharmaceutical Information Sequence	SQ	1
[0054,0017]	Residual Syringe Counts	IS	1
[0054,0018]	Energy Window Name	SH	1
[0054,0020]	Detector Vector	US	n
[0054,0021]	Number of Detectors	US	1
[0054,0022]	Detector Information Sequence	SQ	1
[0054,0030]	Phase Vector	US	n
[0054,0031]	Number of Phases	US	1
[0054,0032]	Phase Information Sequence	SQ	1
[0054,0033]	Number of Frames in Phase	US	1
[0054,0036]	Phase Delay	IS	1
[0054,0038]	Pause Between Frames	IS	1
[0054,0050]	Rotation Vector	US	n
[0054,0051]	Number of Rotations	US	1
[0054,0052]	Rotation Information Sequence	SQ	1
[0054,0053]	Number of Frames in Rotation	US	1
[0054,0060]	R-R Interval Vector	US	n
[0054,0061]	Number of R-R Intervals	US	1
[0054,0062]	Gated Information Sequence	SQ	1
[0054,0063]	Data Information Sequence	SQ	1
[0054,0070]	Time Slot Vector	US	n
[0054,0071]	Number of Time Slots	US	1
[0054,0072]	Time Slot Information Sequence	SQ	1
[0054,0073]	Time Slot Time	DS	1
[0054,0080]	Slice Vector	US	n
[0054,0081]	Number of Slices	US	1
[0054,0090]	Angular View Vector	US	n
[0054,0100]	Time Slice Vector	US	n
[0054,0200]	Start Angle	DS	1
[0054,0202]	Type of Detector Motion	CS	1
[0054,0210]	Trigger vector	IS	n
[0054,0211]	Number of Triggers in Phase	US	1
[0054,0220]	View Code Sequence	SQ	1
[0054,0222]	View Angulation Modifier Code Sequence	SQ	1
[0054,0300]	Radionuclide Code Sequence	SQ	1
[0054,0302]	<del>Administration Radiopharmaceutical</del> Route Code Sequence	SQ	1
[0054,0304]	Radiopharmaceutical Code Sequence	SQ	1
[0054,0306]	Calibration Data Sequence	SQ	1
[0054,0308]	Energy Window Number	US	1
[0054,0400]	Image ID	SH	1
[0054,0410]	Patient Orientation Code Sequence	SQ	1

[0054,0412]	Patient Orientation Modifier Code Sequence	SQ	1
[0054,0414]	Patient Gantry Relationship Code Sequence	SQ	1
[50xx,2500]	Curve Label	LO	1
[50xx,2600]	Referenced Overlay Sequence	SQ	1
[50xx,2610]	Referenced Overlay Group	US	1
[60xx,0022]	Overlay Description	LO	1
[60xx,1500]	Overlay Label	LO	1

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**Item #2**  
*Retire the following Data Elements in Part 6 Section 6:*

6

Tag	Name	VR	VM
[0008,0042]	Nuclear Medicine Series Type	<i>Ret</i>	
[0018,0030]	Radionuclide	<i>Ret</i>	
[0018,0032]	Energy Window Centerline	<i>Ret</i>	
[0018,0033]	Energy Window Width	<i>Ret</i>	
[0018,1146]	Rotation Offset	<i>Ret</i>	
[0020,0014]	Isotope Number	<i>Ret</i>	
[0020,0015]	Phase Number	<i>Ret</i>	
[0020,0016]	Interval Number	<i>Ret</i>	
[0020,0017]	Time Slot Number	<i>Ret</i>	
[0020,0018]	Angle Number	<i>Ret</i>	

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**Item #3**  
*Revise the definitions of the following Data Elements to Part 6 Section 6. Changes are shown in BOLD:*

12

Tag	Name	VR	VM
[0018,0031]	Radiopharmaceutical	LO	<b>1</b>
[0018,1045]	Syringe counts	IS	<b>1</b>
[0018,1070]	<b>Radiopharmaceutical</b> Route	LO	<b>1</b>
[0018,1071]	<b>Radiopharmaceutical</b> Volume	DS	<b>1</b>
[0018,1072]	<b>Radiopharmaceutical</b> Start Time	TM	<b>1</b>
[0018,1073]	<b>Radiopharmaceutical</b> Stop Time	TM	<b>1</b>
[0018,1074]	Radionuclide Total Dose	DS	<b>1</b>
[0018,1182]	Focal Distance	IS	<b>1-2</b>
[0018,1183]	X Focus Center	DS	<b>1-2</b>
[0018,1184]	Y Focus Center	DS	<b>1-2</b>
[0018,1300]	Scan Velocity	<b>DS</b>	<b>1</b>
[0018,5020]	<b>Processing Function</b>	LO	<b>1</b>
[0028,0009]	Frame Increment Pointer	AT	<b>1-n</b>
[0028,0051]	Corrected Image	CS	<b>1-n</b>

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**Item #4**  
*Add the following UID to Part 6, Annex A, Table A-1:*

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UID Value	UID Name	UID Type	Part
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1.2.840.10008.5.1.4.1.1.20	Nuclear Medicine Image Storage	SOP Class	PS 3.4
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<p><b>Item #5</b>  <b>Retire the following UID in Part 6, Annex A, Table A-1:</b></p>
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4

UID Value	UID Name	UID Type	Part
1.2.840.10008.5.1.4.1.1.5	Nuclear Medicine Image Storage	SOP Class	PS 3.4

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