DICOM Correction Proposal

STATUS	Final Text
Date of Last Update	2024/01/14
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Correction Number CP-2296
Log Summary: Provide additional ROI parameters to avoid parsing strings
Name of Standard PS3.3, PS3.6, PS3.15, PS3.16 2023e
Rationale for Correction: The existing RT Structure Set is missing attributes that leads to combining information that cannot be encoded in distinct attributes in single text strings (such as the ROI Name (3006,0026) or ROI Description (3006,0028)) and requiring consumers to be able to parse strings. AAPM Task Group 263 created a document that describes a standardized way how to format such strings, but it should not be required to combine information in the first place. Therefore, additional attributes are added to the RT Structure Set to address this issue. The following use cases are addressed: - The RT Structure Set has date and time only on the Instance/set level. But clinical practice requires to have this on an ROI and ROI Observation level, too. - There is a ROI Interpreter (VR: PN) in the ROI Observation Module, but not for the ROI definition, but it has to be possible to distinguish clinically who created the ROI and who added the semantics. - With increased use of automated segmentation tools, encoding the ROI Creator or the ROI Interpreter as PN is not future-proof and is to be based on the “Identified Person or Device Macro” instead - ROI definitions are typically based on clinical protocols that have to be identifiable for each ROI. - Source on which the ROI was defined: From a clinical perspective it is important to know on which data set/modality an ROI was defined. Currently there are two issues: 1) As the RT Plan SOP Class can only reference a single RT Structure Set Instance it is typical practice to resample ROIs from other image series in the “primary” image series referenced from the Referenced Frame of Reference Sequence (3006,0010) in the RT Structure Set. In this case the source of definition is lost. 2) With the introduction of the Source Pixel Planes Characteristics Sequence (3006,004A) it may happen that no Contour Image can be referenced in the Contour Image Sequence (3006,0016), therefore there is no relation to an image series at all anymore. Therefore, a Source Series Information Sequence is defined along with meta-information from the referenced Image Series, and a Source Series Sequence that identifies the Image Series on which the ROI was defined, so that it is not required to also consume such contributing Image Series. - Contextual information of an ROI (such as whether the ROI is defined for a full/empty rectum or bladder, during inhalation or exhalation, or pre-/post-surgical) is currently lost and is added using coded concepts.
Correction Wording:

Update PS3.3, C.8.8.5

C.8.8.5 Structure Set Module

A structure set defines a set of areas of significance. Each area can be associated with a Frame of Reference and zero or more images. Information that can be transferred with each region of interest (ROI) includes geometrical and display parameters, and generation technique.

Table C.8-41. Structure Set Module Attributes

Attribute Name	Tag	Type	Attribute Description
Structure Set Label	(3006,0002)	1	User-defined label for Structure Set.
Structure Set Name	(3006,0004)	3	User-defined name for Structure Set.
Structure Set Description	(3006,0006)	3	User-defined description for Structure Set.
Instance Number	(0020,0013)	3	A number that identifies this object Instance.
Structure Set Date	(3006,0008)	2	Date at which **the content of the** Structure Set was last modified.
Structure Set Time	(3006,0009)	2	Time at which **the content of the** Structure Set was last modified.
Referenced Frame of Reference Sequence	(3006,0010)	3	Sequence describing Frames of Reference in which the ROIs are defined. One or more Items are permitted in this Sequence. See Section C.8.8.5.1.
>Frame of Reference UID	(0020,0052)	1	Uniquely identifies Frame of Reference within Structure Set.
>RT Referenced Study Sequence	(3006,0012)	3	Sequence of Studies containing Series to be referenced. One or more Items are permitted in this Sequence. See Section C.8.8.5.4.
>>Include Table 10-11 "SOP Instance Reference Macro Attributes"			
>>RT Referenced Series Sequence	(3006,0014)	1	Sequence describing Series of images within the referenced Study that are used in defining the Structure Set. One or more Items shall be included in this Sequence.
>>>Series Instance UID	(0020,000E)	1	Unique identifier for the Series containing the images.
>>>Contour Image Sequence	(3006,0016)	1	Sequence of Items describing images in a given Series used in defining the Structure Set (typically CT or MR images). One or more Items shall be included in this Sequence.
>>>>Include Table 10-3 "Image SOP Instance Reference Macro Attributes"			
Source Series Information Sequence	**(3006,004C)**	**3**	**Information about Image Series that are sources of ROIs in this Instance.** **This also includes Series present in the RT Referenced Series Sequence (3006,0014).** **The Image Series may have been the source of the definition, but the ROI has been resampled to the Image**

Attribute Name	Tag	Type	Attribute Description
			Series referenced in the Referenced Frame of Reference Sequence (3006,0010). **One or more Items are permitted in this Sequence.**
>Modality	**(0008,0060)**	**1**	**Type of device, process or method that originally acquired or produced the data used to create the Instances in this Series.**
>Series Date	**(0008,0021)**	**1**	**Date the Series started.**
>Series Time	**(0008,0031)**	**1**	**Time the Series started.**
>Series Description	**(0008,103E)**	**1**	**Description of the Series.**
>Series Instance UID	**(0020,000E)**	**1**	**Unique identifier of the Series.**
>Series Number	**(0020,0011)**	**1**	**A number that identifies this Series.**
Structure Set ROI Sequence	(3006,0020)	1	ROIs for current Structure Set. One or more Items shall be included in this Sequence.
>ROI Number	(3006,0022)	1	Identification number of the ROI. The value of ROI Number (3006,0022) shall be unique within the Structure Set in which it is created.
…			
>Referenced Frame of Reference UID	(3006,0024)	1	Uniquely identifies Frame of Reference in which ROI is defined, specified by Frame of Reference UID (0020,0052) in Referenced Frame of Reference Sequence (3006,0010).
>ROI Name	(3006,0026)	2	User-defined name for ROI.
>ROI Description	(3006,0028)	3	User-defined description for ROI.
>ROI Volume	(3006,002C)	3	Volume of ROI (cubic centimeters).
>ROI DateTime	**(3006,002D)**	**3**	**DateTime when this ROI was created.**
>ROI Generation Algorithm	(3006,0036)	2	Type of algorithm used to generate ROI. Defined Terms: **AUTOMATIC** calculated ROI **SEMIAUTOMATIC** ROI calculated with user assistance **MANUAL** user-entered ROI
>ROI Generation Description	(3006,0038)	3	User-defined description of technique used to generate ROI.
>RT Protocol Code Sequence	**(3010,005B)**	**3**	**The protocol(s) selected by the RT Physician.** **One or more Items are permitted in this Sequence.** **See Section C.36.5.1.2.**
>>Include Table 8.8-1 "RT Protocol Code Sequence Attributes"			**No Baseline CID is defined.**
>ROI Creator Sequence	**(3006,004D)**	**3**	**The person or device that last modified this ROI.**

Attribute Name	Tag	Type	Attribute Description
			Only a single Item is permitted in this Sequence.
>>Include Table C.17-3b "Identified Person or Device Macro"			**Organizational Role Code Sequence (0044,010A) DCID 9555 "Radiotherapy Treatment Planning Person Role"**
>ROI Derivation Algorithm Identification Sequence	(3006,0037)	3	Software algorithm that derived the ROI. Only a single Item is permitted in this Sequence.
>>Include Table 10-19 "Algorithm Identification Macro Attributes".			
>Derivation Code Sequence	(0008,9215)	3	A coded description of how this ROI was derived. One or more Items are permitted in this Sequence. See Section C.8.8.5.3 for further explanation.
>>Include Table 8.8-1 "Code Sequence Macro Attributes".			*Enumerated Value (113085, DCM, "Spatial resampling").*
>Definition Source Sequence	(0008,1156)	3	Instances containing the source of the ROI Contour information. Only a single Item is permitted in this Sequence.
>>Include Table 10-11 "SOP Instance Reference Macro Attributes".			
>>Referenced Segment Number	(0062,000B)	1C	The value of Segment Number (0062,0004) in the referenced SOP Instance that identifies the segment that is the source of the ROI Contour information. Required if Referenced SOP Class UID (0008,1150) is Segmentation Storage ("1.2.840.10008.5.1.4.1.1.66.4").
>>Referenced Fiducial UID	(0070,031B)	1C	The value of Fiducials UID (0070,031A) in the referenced SOP Instance that identifies the fiducial that is the source of the ROI Contour information. Required if Referenced SOP Class UID (0008,1150) is Spatial Fiducials Storage ("1.2.840.10008.5.1.4.1.1.66.2").
Predecessor Structure Set Sequence	(3006,0018)	3	The Structure Set that has been used to derive the current Structure Set. Only a single Item is permitted in this Sequence.
>Include Table 10-11 "SOP Instance Reference Macro Attributes"			

Update PS3.3, C.8.8.6

C.8.8.6 ROI Contour Module

In general, a ROI can be defined by either a sequence of overlays or a sequence of contours. This Module, if present, is used to define the ROI as a set of contours. Each ROI contains a sequence of one or more contours, where a contour is either a single point (for a point ROI) or more than one point (representing an open or closed polygon).

Table C.8-42. ROI Contour Module Attributes

Attribute Name	Tag	Type	Attribute Description
ROI Contour Sequence	(3006,0039)	1	Sequence of Contour Sequences defining ROIs. One or more Items shall be included in this Sequence.
>Referenced ROI Number	(3006,0084)	1	Uniquely identifies the referenced ROI described in the Structure Set ROI Sequence (3006,0020).
…			
>Source Pixel Planes Characteristics Sequence	(3006,004A)	3	The characteristics of the pixel planes from which the grid-based representation of the Contours was derived. Only a single Item is permitted in this Sequence. See Section C.8.8.6.4. Note This is not useful if Contour Geometric Type (3006,0042) equals POINT, OPEN_PLANAR or OPEN_NONPLANAR
>>Pixel Spacing	(0028,0030)	1	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. See Section 10.7.1.3 for further explanation.
>>Spacing Between Slices	(0018,0088)	1	Spacing between adjacent slices, in mm. The spacing is measured from the center-to-center of each slice, and shall not be negative.
>>Image Orientation (Patient)	(0020,0037)	1	The direction cosines of the first row and the first column with respect to the patient. See Section C.7.6.2.1.1.
>>Image Position (Patient)	(0020,0032)	1	The x, y and z coordinates in mm of the upper left hand corner of the pixel matrix in the Patient-Based Coordinate System described in Section C.7.6.2.1.1.
>>Number of Frames	(0028,0008)	1	Number of source pixel planes
>>Rows	(0028,0010)	1	Number of rows in the source pixel planes
>>Columns	(0028,0011)	1	Number of columns in the source pixel planes
>Source Series Sequence	**(3006,004B)**	**3**	**Identifies the Image Series on which the ROI was defined.** **One or more Items are permitted in this Sequence.** **Note: 1. The referenced Series may or may not have the same Frame of Reference UID (0020,0052) as this Instance, and there may be more than one referenced Series within the same Frame of Reference UID (0020,0052).** **2. The referenced Series may or may not contain the images referenced in the Contour Image Sequence (3006,0016).**
>>Series Instance UID	**(0020,000E)**	**1**	**Unique identifier of the Series containing the referenced Instances.**

Attribute Name	Tag	Type	Attribute Description
>Contour Sequence	(3006,0040)	3	Sequence of Contours defining ROI. One or more Items are permitted in this Sequence.
>>Contour Number	(3006,0048)	3	Identification number of the contour. The value of Contour Number (3006,0048) shall be unique within the Contour Sequence (3006,0040) in which it is defined. No semantics or ordering shall be inferred from this Attribute.
>>Contour Image Sequence	(3006,0016)	3	Sequence of images containing the contour. One or more Items are permitted in this Sequence. See Section C.8.8.6.4.
>>>Include Table 10-3 "Image SOP Instance Reference Macro Attributes"			
>>Contour Geometric Type	(3006,0042)	1	Geometric type of contour. See Section C.8.8.6.1. Enumerated Values: **POINT** single point **OPEN_PLANAR** open contour containing coplanar points **OPEN_NONPLANAR** open contour containing non-coplanar points **CLOSED_PLANAR** closed contour (polygon) containing coplanar points **CLOSEDPLANAR_XOR** closed contour (polygon) containing coplanar points of an inner or outer contour combined using an XOR operator
>>Number of Contour Points	(3006,0046)	1	Number of points (triplets) in Contour Data (3006,0050).
>>Contour Data	(3006,0050)	1	Sequence of (x,y,z) triplets defining a contour in the Patient-Based Coordinate System described in Section C.7.6.2.1.1 (mm). See Section C.8.8.6.1 and Section C.8.8.6.3. See Section C.8.8.6.4. Note Contour Data may not be properly encoded if Explicit VR Transfer Syntax is used and the VL of this Attribute exceeds 65534 bytes.

Update PS3.3, C.8.8.8

C.8.8.8 RT ROI Observations Module

The RT ROI Observations Module specifies the identification and interpretation of an ROI specified in the Structure Set Module and ROI Contour Module.

Table C.8-44. RT ROI Observations Module Attributes

Attribute Name	Tag	Type	Attribute Description
RT ROI Observations Sequence	(3006,0080)	1	Sequence of observations related to ROIs defined in the ROI Module.

Attribute Name	Tag	Type	Attribute Description
			One or more Items shall be included in this Sequence.
>Observation Number	(3006,0082)	1	Identification number of the Observation. The value of Observation Number (3006,0082) shall be unique within the RT ROI Observations Sequence (3006,0080).
>Referenced ROI Number	(3006,0084)	1	Uniquely identifies the referenced ROI described in the Structure Set ROI Sequence (3006,0020).
>ROI Observation DateTime	**(3006,002E)**	**3**	**DateTime this ROI Observation was created.**
>ROI Observation Context Code Sequence	**(3006,004F)**	**3**	**The contexts in which the ROI was defined.** **One or more Items are permitted in this Sequence.**
>>Include Table 8.8-1 "Code Sequence Macro Attributes"			**BCID 9272 "RT ROI Image Acquisition Context"**
…			
>ROI Interpreter	(3006,00A6)	2	Name of person performing the interpretation.
>ROI Interpreter Sequence	**(3006,004E)**	**1C**	**Person or device performing the interpretation.** **Required if ROI Creator Sequence (3006,004D) is present in the Structure Set Module, and the person or device performing the interpretation differs from ROI Creator Sequence (3006,004D). May be present otherwise.** **Only a single Item shall be included in this Sequence.**
>>Include Table C.17-3b "Identified Person or Device Macro"			**Organizational Role Code Sequence (0044,010A) DCID 9555 "Radiotherapy Treatment Planning Person Role"**
>Material ID	(300A,00E1)	3	User-supplied identifier for ROI material.
>ROI Physical Properties Sequence	(3006,00B0)	3	Sequence describing physical properties associated with current ROI interpretation. One or more Items are permitted in this Sequence.
…			

Add to PS 3, Part 6, Chapter 6

Table 6-1. Registry of DICOM Data Elements

Tag	Name	Keyword	VR	VM	
…					
(3006,002D)	**ROI DateTime**	**ROIDateTime**	**DT**	**1**	
(3006,002E)	**ROI Observation DateTime**	**ROIObservationDateTime**	**DT**	**1**	
…					

Tag	Name	Keyword	VR	VM	
(3006,004B)	Source Series Sequence	SourceSeriesSequence	SQ	1	
(3006,004C)	Source Series Information Sequence	SourceSeriesInformationSequence	SQ	1	
(3006,004D)	ROI Creator Sequence	ROICreatorSequence	SQ	1	
(3006,004E)	ROI Interpreter Sequence	ROIInterpreterSequence	SQ	1	
(3006,004F)	ROI Observation Context Code Sequence	ROIObservationContextCodeSequence	SQ	1	

Add to PS3.6 Annex A, Table A-3

Table A-3 CONTEXT GROUP UID VALUES

Context UID	Context Identifier	Context Group Name
1.2.840.10008.6.1.1481	9272	RT ROI Image Acquisition Context

In PS 3.15, Section E.1.1. De-identifier update Table E.1-1 as follows:

Attribute Name	Tag	Retd. (from PS3.6)	In Std. Comp. IOD (from PS3.3)	Basic Prof.	Rtn. Safe Priv. Opt.	Rtn. UIDs Opt.	Rtn. Dev. Id. Opt.	Rtn. Inst. Id. Opt.	Rtn. Pat. Chars. Opt.	Rtn. Long. Full Dates Opt.	Rtn. Long. Modif. Dates Opt.	Clean Desc. Opt.	Clean Struct. Cont. Opt.	Clean Graph. Opt.
…														
ROI DateTime	(3006,002D)	N	Y	X						K	C			
ROI Observation DateTime	(3006,002E)	N	Y	X						K	C			
ROI Creator Sequence	(3006,004D)	N	Y	X										
ROI Interpreter Sequence	(3006,004E)	N	Y	X										
…														

Add to PS3.16, Annex B

CID 9272 RT ROI Image Acquisition Context

Resources: HTML | FHIR JSON | FHIR XML | IHE SVS XML
Type: Extensible
Version: 20240114
UID: 1.2.840.10008.6.1.1481

Table CID 9272 RT ROI Image Acquisition Context

Coding Scheme Designator	Code Value	Code Meaning	SNOMED-RT ID	UMLS Concept Unique ID
Include CID 3823 "Respiratory Status"				
DCM	109134	Prior to voiding		
DCM	109135	Post voiding		
SCT	249602003	Full Rectum	F-5012D	
SCT	249599008	Empty Rectum	F-5012A	
DCM	130833	Pre-surgical anatomy		
SCT	245849007	Post-surgical anatomy	T-D0169	

Add to PS3.16, Annex D

Code Value	Code Meaning	Definition	Notes
130833	Pre-surgical anatomy	The anatomy of the subject prior to the effect of a surgical procedure.	