1	Status	Submitted
2	Date of Last Update	2021/02/19
3	Person Assigned	David Clunie
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5	Submitter Name	Tobias Weihs
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7	Submission Date	2021/02/19

8	Correction Number CP-nnnn
9	Log Summary: Per-segment multiple algorithms and creators
10	Name of Standard
11	PS3.3
12	Rationale for Correction:
13 14	Currently, only one content creator per Segmentation Instance is permitted, yet different creators may create individual segments. Factor out content creator macro and add content creator macro invocation to each segment.
15 16	Currently, only one algorithm is described per sequence, yet more than one algorithm may contribute to creation, modification, etc. Allow Sequence to have multiple items. The precedent for this approach has been established in the Tractography object.
17 18	*[Ed.Note: Is there a need to describe more than one Content Creator per segment (e.g., creator, modifier)? Could nest in a sequence +/- augment with role à la PS3.16 (113875, DCM, "Person Role in Procedure") (as opposed to Role in Organization).]*
19	Correction Wording:

1 *Amend DICOM PS3.3 as follows (changes to existing text are bold and **underlined** for additions and ~~struckthrough~~ for removals):*

2 C.8.20.2 Segmentation Image Module

3 Table C.8.20-2 defines the general Attributes of the Segmentation Image Module.

4 **Table C.8.20-2. Segmentation Image Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Image Type	(0008,0008)	1	Value 1 shall be DERIVED. Value 2 shall be PRIMARY. No other values shall be present.
Include Table 10-12 "Content Identification Macro Attributes"			
...			
Segment Sequence	(0062,0002)	1	Describes the segments that are contained within the data. One or more Items shall be included in this Sequence.
>*Include Table C.8.20-4 "Segment Description Macro Attributes"*			
>Segment Algorithm Name	(0062,0009)	1C	Name of algorithm used to generate the segment. Required if Segment Algorithm Type (0062,0008) is not MANUAL.
>Segmentation Algorithm Identification Sequence	(0062,0007)	3	A description of how this segment was derived. Algorithm Name (0066,0036) within this Sequence may be identical to Segment Algorithm Name (0062,0009). ~~Only a single Item is~~**One or more Items are** permitted in this Sequence. **Note** Previously, the Segment Surface Generation Algorithm Identification Code Sequence (0066,002D) was used, but it has been replaced in this Module, since not all segmentation algorithms involve surface generation. See PS3.3 2016d.
>>*Include Table 10-19 "Algorithm Identification Macro Attributes"*			BCID 7162 "Surface Processing Algorithm Families".
>Recommended Display Grayscale Value	(0062,000C)	3	A default single gray unsigned value in which it is recommended that the maximum pixel value in this segment be rendered on a monochrome display. The units are specified in P-Values from a minimum of 0000H (black) up to a maximum of FFFFH (white). **Note** The maximum P-Value for this Attribute may be different from the maximum P-Value from the output of the Presentation LUT, which may be less than 16 bits in depth.
>Recommended Display CIELab Value	(0062,000D)	3	A default triplet value in which it is recommended that segment be rendered on a color display. The units are specified in PCS-Values, and the value is encoded as CIELab. See Section C.10.7.1.1.

40 C.8.20.2.4 Segment Number

41 Segment Number (0062,0004) shall be unique within each Instance, start at a value of 1, and increase monotonically by 1.

C.8.20.4 Segmentation Macros

The following sections contain Macros specific to the Segmentation IOD.

C.8.20.4.1 Segment Description Macro

Table C.8.20-4 specifies the Attributes of the Segment Description Macro.

Table C.8.20-4. Segment Description Macro Attributes

Attribute Name	Tag	Type	Attribute Description
Segment Number	(0062,0004)	1	Identification number of the segment. The value of Segment Number (0062,0004) shall be unique within the Segmentation Instance in which it is created. See Section C.8.20.2.4.
Segment Label	(0062,0005)	1	User-defined label identifying this segment. This may be the same as Code Meaning (0008,0104) of Segmented Property Type Code Sequence (0062,000F).
Segment Description	(0062,0006)	3	User-defined description for this segment.
Segment Algorithm Type	(0062,0008)	1	Type of algorithm used to generate the segment. **Enumerated Values:** **AUTOMATIC** calculated segment **SEMIAUTOMATIC** calculated segment with user assistance **MANUAL** user-entered segment
Include Table 10-7b "Multiple Site General Anatomy Optional Macro Attributes"			*May not be necessary if the anatomy is implicit in the Segmented Property Type Code Sequence.* *More than one Item in Anatomic Region Sequence (0008,2218) may be used when a region of interest spans multiple anatomical locations and there is not a single pre-coordinated code describing the combination of locations. There is no requirement that the multiple locations be contiguous.*
Segmented Property Category Code Sequence	(0062,0003)	1	Sequence defining the general category of the property the segment represents. Only a single Item shall be included in this Sequence.
>*Include Table 8.8-1 "Code Sequence Macro Attributes"*			*BCID 7150 "Segmentation Property Categories".*

Segmented Property Type Code Sequence	(0062,000F)	1	Sequence defining the specific property the segment represents.
			
			    Note
			
			    "Property" is used in the sense of meaning "what the segmented voxels represent", whether it be a physical or biological object, be real or conceptual, having spatial, temporal or functional extent or not. I.e., it is what the segment "is" (as opposed to some feature, attribute, quality, or characteristic of it, like color or shape or size).
			
			Only a single Item shall be included in this Sequence.

>*Include Table 8.8-1 "Code Sequence Macro Attributes"*			*BCID 7151 "Segmentation Property Types".*
>Segmented Property Type Modifier Code Sequence	(0062,0011)	3	Sequence defining the modifier of the property type of this segment. One or more Items are permitted in this Sequence.

Attribute Name	Tag	Type	Attribute Description
>>*Include Table 8.8-1 "Code Sequence Macro Attributes"*			*DCID 244 "Laterality".*
			Note
			For Retinal Segmentation Surfaces, laterality is not typically specified.
Tracking ID	(0062,0020)	1C	A text label used for tracking a finding or feature, potentially across multiple reporting objects, over time. This label shall be unique within the domain in which it is used.
			Required if Tracking UID (0062,0021) is present.
			Note
			1. May or may not have the same value as Segment Label (0062,0005).
			2. Related SR Instances may exist, for example, to record measurements related to this segment, but need not exist for this Attribute to be used.
			3. This Attribute will have the same value as the value of the (112039, DCM, "Tracking Identifier") Content Item in SR Instances that reference this Segment in this Segmentation Instance.
Tracking UID	(0062,0021)	1C	A unique identifier used for tracking a finding or feature, potentially across multiple reporting objects, over time.
			Required if Tracking ID (0062,0020) is present.
			Note
			1. Related SR Instances may exist, for example, to record measurements related to this segment, but need not exist for this Attribute to be used.
			2. This Attribute will have the same value as the value of the (112040, DCM, "Tracking Unique Identifier") Content Item in SR Instances that reference this Segment in this Segmentation Instance.
Definition Source Sequence	(0008,1156)	3	Instances containing the source of the Segment information. Only a single Item is permitted in this Sequence.
>*Include Table 10-11 "SOP Instance Reference Macro Attributes".*			
>Referenced ROI Number	(3006,0084)	1C	The value of ROI Number (3006,0022) in the referenced SOP Instance that identifies the ROI that is the origin of the Segment information. Required if Referenced SOP Class UID (0008,1150) is RT Structure Set Storage ("1.2.840.10008.5.1.4.1.1.481.3").
Include Table 10.9.3-1 "Content Creator Macro"			

C.8.23 Surface Segmentation

This section describes the specific Modules for the Surface Segmentation IOD.

1   ## C.8.23.1 Surface Segmentation Module

2   Table C.8.23-1 defines the general Attributes of the Surface Segmentation Module.

3   **Table C.8.23-1. Surface Segmentation Module Attributes**

Attribute Name	Tag	Type	Attribute Description
Include Table 10-12 "Content Identification Macro Attributes"			
Content Date	(0008,0023)	1	The date the content creation started.
Content Time	(0008,0033)	1	The time the content creation started.
Segment Sequence	(0062,0002)	1	Describes the segments that are contained within the data. One or more Items shall be included in this Sequence.
>Include Table C.8.20-4 "Segment Description Macro Attributes"			
>Surface Count	(0066,002A)	1	The number of surfaces that comprise this segment. Shall be greater than zero.
>Referenced Surface Sequence	(0066,002B)	1	Sequence referencing the surfaces composed to construct this segment. One or more Items shall be included in this Sequence. The number of Items shall equal the value of Surface Count (0066,002A).
>>Referenced Surface Number	(0066,002C)	1	Identifies the Surface Number (0066,0003) within the Surface Sequence (0066,0002) to which this reference applies.
>>Segment Surface Generation Algorithm Identification Sequence	(0066,002D)	1	A description of how this segment surface was derived. ~~Only a single Item~~One or more Items shall be included in this Sequence.
>>>Include Table 10-19 "Algorithm Identification Macro Attributes"			*For Algorithm Family Code Sequence (0066,002F) BCID 7162 "Surface Processing Algorithm Families".*
>>Segment Surface Source Instance Sequence	(0066,002E)	2	A Sequence that identifies the set of Instances by their SOP Class/Instance pair that were used to derive this segment surface. Zero or more Items shall be included in this Sequence.
>>>Include Table 10-3 "Image SOP Instance Reference Macro Attributes"			

34   # 10.9 Content Identification Macro

35   Table 10-12 describe the Attributes for identifying a SOP Instance potentially created by a human user interacting with an application.

36   **Table 10-12. Content Identification Macro Attributes**

Attribute Name	Tag	Type	Attribute Description
Instance Number	(0020,0013)	1	A number that identifies this SOP Instance.
Content Label	(0070,0080)	1	A label that is used to identify this SOP Instance.
Content Description	(0070,0081)	2	A description of the content of the SOP Instance.
Concept Name Code Sequence	(0040,A043)	3	A coded description of the content of the SOP Instance. Only a single Item is permitted in this Sequence.

Attribute Name	Tag	Type	Attribute Description
>Include Table 8.8-1 "Code Sequence Macro Attributes"			No Baseline CID is defined.
Alternate Content Description Sequence	(0070,0087)	3	A Sequence containing alternate descriptions suitable for presentation to the user, e.g., in different languages. One or more Items are permitted in this Sequence. **Note** The values of Specific Character Set for the entire Data Set need to be sufficient to encode all Items of this Sequence correctly, e.g., using a single value with broad support such as UTF-8, or multiple values with escape sequences.
>Content Description	(0070,0081)	1	An alternate description that is used to identify this SOP Instance.
>Language Code Sequence	(0008,0006)	1	The language in which Content Description (0070,0081) within this Item is written. A single Item shall be present.
>>Include Table 8.8-1 "Code Sequence Macro Attributes"			DCID 5000 "Languages".
>Concept Name Code Sequence	(0040,A043)	3	An alternate coded description of the content of the SOP Instance. Only a single Item is permitted in this Sequence.
>>Include Table 8.8-1 "Code Sequence Macro Attributes"			No Baseline CID is defined.
~~Content Creator's Name~~	~~(0070,0084)~~	~~2~~	~~Name of operator (such as a technologist or physician) creating the content of the SOP Instance.~~
~~Content Creator's Identification Code Sequence~~	~~(0070,0086)~~	~~3~~	~~Identification of the person who created the content. Only a single Item is permitted in this Sequence.~~
~~>Include Table 10-1 "Person Identification Macro Attributes Description"~~			
Include Table 10.9.3-1 "Content Creator Macro"			

10.9.1 Enhanced Content Identification Macro

The Enhanced Content Identification Macro identifies content using a label supporting lower case characters and specified character sets. If a Code String is required, see Section 10.9 "Content Identification Macro".

Table 10.9.1-1. Enhanced Content Identification Macro Attributes

Attribute Name	Tag	Type	Attribute Description
User Content Label	(3010,0033)	1	User-defined label for this SOP Instance. See Section 10.9.1.1.1.
Content Description	(0070,0081)	2	User-defined description for the content of this SOP Instance. See Section 10.9.1.1.1.
~~Content Creator"s Name~~	~~(0070,0084)~~	~~2~~	~~Name of operator (such as a technologist or physician) creating the content of the SOP Instance.~~
~~Content Creator"s Identification Code Sequence~~	~~(0070,0086)~~	3	~~Identification of the person who created the content.~~ ~~Only a single Item is permitted in this Sequence.~~

Attribute Name	Tag	Type	Attribute Description
>*Include Table 10-1 "Person Identification Macro Attributes Description"*			
Include Table 10.9.3-1 "Content Creator Macro"			

10.9.1.1 Enhanced Content Identification Macro Attribute Descriptions

10.9.1.1.1 User Content Label and Content Description

User Content Label (3010,0033) shall represent a user-defined short free text providing the primary identification of this entity to other users. Content Description (0070,0081) allows a longer string containing additional descriptive identifying text.

This information is intended for display to human readers. Shall not be used for structured processing.

10.9.2 Extended Content Identification Macro

The Extended Content Identification Macro identifies content using a label supporting lower case characters and specified character sets. If a Code String is required, see Section 10.9 "Content Identification Macro".

Table 10.9.2-1. Extended Content Identification Macro Attributes

Attribute Name	Tag	Type	Attribute Description
User Content Long Label	(3010,0034)	1	User-defined label for the content of this SOP Instance. See Section 10.9.2.1.1.
Content Description	(0070,0081)	2	User-defined description for the content of this SOP Instance. See Section 10.9.2.1.1.
~~Content Creator's Name~~	~~(0070,0084)~~	~~2~~	~~Name of operator (such as a technologist or physician) creating the content of the SOP Instance.~~
~~Content Creator's Identification Code Sequence~~	~~(0070,0086)~~	~~3~~	~~Identification of the person who created the content.~~ ~~Only a single Item is permitted in this Sequence.~~
>*Include Table 10-1 "Person Identification Macro Attributes Description"*			
Include Table 10.9.3-1 "Content Creator Macro"			

10.9.2.1 Extended Content Identification Macro Attribute Descriptions

10.9.2.1.1 User Content Long Label and Content Description

User Content Long Label (3010,0034) shall represent a user-defined free text providing the primary identification of this entity to other users. Content Description (0070,0081) allows a longer string containing additional descriptive identifying text.

This information is intended for display to human readers. Shall not be used for structured processing.

1 **10.9.3 <u>Content Creator Macro</u>**

2 **Table 10.9.3-1. <u>Content Creator Macro</u>**

Attribute Name	Tag	Type	Attribute Description
<u>Content Creator's Name</u>	**<u>(0070,0084)</u>**	**<u>2</u>**	**<u>Name of operator (such as a technologist or physician) creating the content of the SOP Instance.</u>**
<u>Content Creator's Identification Code Sequence</u>	**<u>(0070,0086)</u>**	**<u>3</u>**	**<u>Identification of the person who created the content.</u>** **<u>Only a single Item is permitted in this Sequence.</u>**
<u>>Include Table 10-1 "Person Identification Macro Attributes Description"</u>			

12 *For reference DICOM PS3.3 unchanged:*

13 # 10.1 Person Identification Macro

14 This Macro may be invoked to specify a coded representation of a person such as a healthcare worker, and the organization to which
15 they are responsible.

16 **Note**

17 1. This Macro is typically invoked within a Sequence Item used to identify an individual such as a physician or a device
18   operator.

19 2. The free-text name of the individual is not included in this Macro since there are already widely used specific Attributes
20   to hold such values.

21 3. No Baseline, Defined or Enumerated CIDs are defined nor is any particular coding scheme specified. In practice,
22   workers are usually identified by using a locally or nationally specific coding scheme. For example, a local Coding
23   Scheme Designator might be used and the individual's internal hospital ID number user in Code Value.

24 4. The organization is specified by either a coded Sequence or a free text name but not both. A Baseline CID of standard
25   organizations is provided for the purpose of identifying standard organizations responsible for creation of Well Known
26   Instances.

27 **Table 10-1. Person Identification Macro Attributes Description**

Attribute Name	Tag	Type	Attribute Description
Person Identification Code Sequence	(0040,1101)	1	A coded entry that identifies a person. The Code Meaning Attribute, though it will be encoded with a VR of LO, may be encoded according to the rules of the PN VR (e.g., caret '^' delimiters shall separate name components), except that a single component (i.e., the whole name unseparated by caret delimiters) is not permitted. Name component groups for use with multi-byte character sets are permitted, as long as they fit within the 64 characters (the length of the LO VR). One or more Items shall be included in this Sequence.
>Include Table 8.8-1 "Code Sequence Macro Attributes"			*No Baseline CID is defined.*
Person's Address	(0040,1102)	3	Person's mailing address
Person's Telephone Numbers	(0040,1103)	3	Person's telephone number(s)

Attribute Name	Tag	Type	Attribute Description
Person's Telecom Information	(0040,1104)	3	The person's telecommunication contact information, including telephone, email, or other telecom addresses. **Note** 1. This Attribute may have internal format or structure in accordance with local agreement or profile. In the absence of such agreement or prior formatting, use of ITU-T E.123 is suggested. 2. It is recommended that this Attribute be treated as equivalent to HL7v2 (v2.5 or later) field ROL-12, and be formatted in accordance with the HL7v2 XTN data type (without escapes for HL7 message structure reserved characters). See additional notes in the Module invoking this Macro.
Institution Name	(0008,0080)	1C	Institution or organization to which the identified individual is responsible or accountable. Required if Institution Code Sequence (0008,0082) is not present.
Institution Address	(0008,0081)	3	Mailing address of the institution or organization to which the identified individual is responsible or accountable.
Institution Code Sequence	(0008,0082)	1C	Institution or organization to which the identified individual is responsible or accountable. Required if Institution Name (0008,0080) is not present. Only a single Item shall be included in this Sequence.
>*Include Table 8.8-1 "Code Sequence Macro Attributes"*			*BCID 5002 "Organizations".*
Institutional Department Name	(0008,1040)	3	The Department, Unit or Service within the healthcare facility.
Institutional Department Type Code Sequence	(0008,1041)	3	A coded description of the type of Department or Service within the healthcare facility. **Note** This might be obtained from a corresponding HL7v2 message containing PV1:10 Hospital Service. Only a single Item is permitted in this Sequence.
>*Include Table 8.8-1 "Code Sequence Macro Attributes"*			*BCID 7030 "Institutional Departments, Units and Services".*

10.5 General Anatomy Macros

Table 10-7b. Multiple Site General Anatomy Optional Macro Attributes

Attribute Name	Tag	Type	Attribute Description
Anatomic Region Sequence	(0008,2218)	3	Sequence that identifies the anatomic region of interest in this Instance (i.e., external anatomy, surface anatomy, or general region of the body). One or more Items are permitted in this Sequence.
>*Include Table 8.8-1 "Code Sequence Macro Attributes"*			*CID may be defined in the Macro invocation.*

Attribute Name	Tag	Type	Attribute Description
>Anatomic Region Modifier Sequence	(0008,2220)	3	Sequence of Items that modifies the anatomic region of interest in this Instance One or more Items are permitted in this Sequence.
>>*Include Table 8.8-1 "Code Sequence Macro Attributes"*			*DCID 2 "Anatomic Modifier", unless otherwise defined in the Macro invocation.*
Include Table 10-8 "Primary Anatomic Structure Macro Attributes"			*CID may be defined in the Macro invocation.*

Table 10-8. Primary Anatomic Structure Macro Attributes

Attribute Name	Tag	Type	Attribute Description
Primary Anatomic Structure Sequence	(0008,2228)	3	Sequence of Items that identifies the primary anatomic structure(s) of interest in this Instance. One or more Items are permitted in this Sequence.
>*Include Table 8.8-1 "Code Sequence Macro Attributes"*			*CID may be defined in the Macro invocation.*
>Primary Anatomic Structure Modifier Sequence	(0008,2230)	3	Sequence of Items that modifies the primary anatomic structure of interest in this Instance. One or more Items are permitted in this Sequence.
>>*Include Table 8.8-1 "Code Sequence Macro Attributes"*			*DCID 2 "Anatomic Modifier".*

10.16 Algorithm Identification Macro

Table 10-19 describes the Attributes for encoding the algorithm used to create or derive a SOP Instance contents. An algorithm is described by the Algorithm Family, a specific Algorithm Name, and an Algorithm Version. A character string containing parameters that were used in the algorithm can be included.

Table 10-19. Algorithm Identification Macro Attributes

Attribute Name	Tag	Type	Attribute Description
Algorithm Family Code Sequence	(0066,002F)	1	The family of algorithm(s) that best describes the software algorithm used. Only a single Item shall be included in this Sequence.
>*Include Table 8.8-1 "Code Sequence Macro Attributes"*			*CID may be defined in the Macro invocation.*
Algorithm Name Code Sequence	(0066,0030)	3	The code assigned by a manufacturer to a specific software algorithm. Only a single Item is permitted in this Sequence.
>*Include Table 8.8-1 "Code Sequence Macro Attributes"*			*No Baseline CID is defined.*
Algorithm Name	(0066,0036)	1	The name assigned by a manufacturer to a specific software algorithm.
Algorithm Version	(0066,0031)	1	The software version identifier assigned by a manufacturer to a specific software algorithm.
Algorithm Parameters	(0066,0032)	3	The input parameters used by a manufacturer to configure the behavior of a specific software algorithm.
Algorithm Source	(0024,0202)	3	Source of the algorithm, e.g., the name of the manufacturer, researcher, university, etc.

C.8.33.2 Tractography Results Module

Table C.8.33-2 specifies the Attributes that describe the tracks and measurements in the tractography results.

Table C.8.33-2. Tractography Results Module Attributes

Attribute Name	Tag	Type	Attribute Description
...			...
>Tracking Algorithm Identification Sequence	(0066,0104)	1	The tractography algorithms used to derive this track set. See Section C.8.33.2.2 for more details. One or more Items shall be included in this Sequence.
>>*Include Table 10-19 "Algorithm Identification Macro Attributes"*			*Algorithm Family Code Sequence (0066,002F) DCID 7262 "Diffusion Tractography Algorithm Families".*
...			

C.8.33.2.2 Acquisition, Model and Algorithm Attributes

The Attributes Diffusion Acquisition Code Sequence (0066,0133), Diffusion Model Code Sequence (0066,0134) and Tracking Algorithm Identification Sequence (0066,0104) describe the main parameters influencing the tractography calculation. They are for documentation purposes. With these parameters, a receiver may infer an assessment of the reliability or quality of the tractography result.