

DICOM Correction Proposal

STATUS	Final Text
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Correction Number	CP- 1200
Log Summary:	Add attributes to Surface Mesh Module
Name of Standard	PS 3.3, PS 3.6 2011
Rationale for Correction:	<p>The discussion of using Surface Segmentation Objects (SSO) to exchange important Markers, Trajectories or similar between imaging systems and surgery planning/supporting systems identified some missing attributes for certain primitives. The existing Recommended Presentation attributes</p> <ul style="list-style-type: none"> - Recommended Display Grayscale Value (0062,000C) - Recommended Display CIELab Value (0062,000D) - Recommended Presentation Opacity (0066,000C) - Recommended Presentation Type (0066,000D) <p>are fine to be used with the Triangle and Facet mesh primitives, but of limited use with the Vertex, Edge and Line primitives. Those do not have a "surface" that allows rendering according to color or style attributes.</p> <p>Since this is needed, attributes that allow the interpretation of a line or point primitive as surface should be added for optional use.</p> <p>Furthermore the Line primitive does not connect the last point with the start point and therefore does not exhibit a surface. Therefore the ordering does not define a Normal, but rather the direction of the line.</p>
Correction Wording:	Amend the Surface Mesh Module Attribute table in PS 3.3 and add attribute to PS 3.6 Data Dictionary

Add new attributes to PS 3.3. Table C.27-1 section C.27.1
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**Table C.27-1
SURFACE MESH MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Number of Surfaces	(0066,0001)	1	Number of surfaces contained in the Instance. Shall be 1 or more. Shall be the same as the number of Items in Surface Sequence (0066,0002).

Surface Sequence	(0066,0002)	1	The surfaces that are described within the data. One or more Items shall be included in this sequence. There shall be Number of Surfaces (0066,0001) Items in the sequence. See C.27.1.1.1.
>Surface Number	(0066,0003)	1	Identification number of the surface. Uniquely identifies a surface within this SOP instance. Shall start at a value of 1, and increase monotonically by 1.
>Surface Comments	(0066,0004)	3	User-defined comments describing the surface.
>Surface Processing	(0066,0009)	2	Specifies whether the surface has been modified subsequent to the original generation of the surface. Enumerated Values: YES NO See C.27.1.1.2.
>Surface Processing Ratio	(0066,000A)	2C	The Ratio of Remaining points to Original points after processing. Required if Surface Processing (0066,0009) is YES.
>Surface Processing Description	(0066,000B)	3	A textual description of the surface processing performed.
>Surface Processing Algorithm Identification Sequence	(0066,0035)	2C	Describes the processing method. Zero or one Item shall be included in this sequence. Required if Surface Processing (0066,0009) is YES.
>>Include 'Algorithm Identification Macro' Table 10-19			<i>Baseline Context ID for Algorithm Family Code Sequence (0066,002F) is 7162.</i>
>Recommended Display Grayscale Value	(0062,000C)	1	A default single gray unsigned value in which it is recommended that the maximum pixel value in this surface 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)	1	A default triplet value in which it is recommended that the surface be rendered on a color display. The units are specified in PCS-Values, and the value is encoded as CIELab. See C.10.7.1.1

>Recommended Presentation Opacity	(0066,000C)	1	Specifies the opacity in which it is recommended that the surface be rendered. See C.27.1.1.3.
>Recommended Presentation Type	(0066,000D)	1	Specifies the presentation type in which it is recommended that the surface be rendered. See C.27.1.1.3.
<u>>Recommended Point Radius</u>	<u>(0066,0037)</u>	<u>3</u>	<u>Specifies the radius of the vertex points defined in the Vertex Point Index List (0066,0025) with which it is recommended that the point be rendered.</u> <u>The units shall be the same as the units of the coordinate system in which the point coordinates are specified.</u>
<u>>Recommended Line Thickness</u>	<u>(0066,0038)</u>	<u>3</u>	<u>Specifies the thickness of each edge or line defined in the Edge Point Index List (0066,0024) or Line Sequence (0066,0028) with which it is recommended that the line be rendered.</u> <u>The units shall be the same as the units of the coordinate system in which the point coordinates are specified.</u>
>Finite Volume	(0066,000E)	1	Indicates, whether the surface represents a solid (“waterproof”) object with an outside and an inside. Enumerated Values: YES = Contains a finite volume NO = Does not contain a finite volume UNKNOWN = Might or might not contain a finite volume See C.27.1.1.4.
>Manifold	(0066,0010)	1	Indicates whether the surface is describing an n-1 dimensional manifold in the underlying n-dimensional vector space. Enumerated Values: YES = Manifold in every point NO = Does contain non-manifold points UNKNOWN = Might or might not contain non-manifold points See C.27.1.1.5.
>Surface Points Sequence	(0066,0011)	1	The point positions representing vertices of the surface. Only a single item shall be included in this sequence.
>> Include 'Points Macro' Table C.27-2			

>Surface Points Normals Sequence	(0066,0012)	2	The normals on the surface for each point. Zero or one item shall be included in this sequence. See C.27.1.1.6.
>>Include 'Vectors Macro' Table C.27-3			<i>The Number of Vectors (0066,001E) shall equal Number of Surface Points (0066,0015) in this Surface Sequence Item..</i> <i>The Vector Dimensionality (0066,001F) shall be 3.</i> <i>If Finite Volume (0066,000E) is YES, the normals of the vertices shall point toward the outside of the object. If Finite Volume (0066,000E) is not YES, the direction of the normals shall be consistent where possible.</i>
>Surface Mesh Primitives Sequence	(0066,0013)	1	Only a single item shall be included in this sequence.
>>Include 'Surface Mesh Primitives Macro Table' C.27-4			<i>The primitives' indices shall not exceed Number of Surface Points (0066,0015) in this Surface Sequence Item..</i>

Add additional description to PS 3.3 section C.27.4.1

C.27.4.1 Surface Mesh Primitives Macro Attribute Descriptions

The Surface Mesh Primitives Macro uses point indices to reference the point rather than repeating point coordinates. All of the point coordinates used are specified within the Surface Points Sequence (0066,0011) of the same Surface Sequence (0066,0002) item. Point indices are described in C.27.2.1.1.

A Surface Mesh shall contain one or more of the following primitive types:

- Vertex a single Vertex, referencing a single point
- Edge an Edge, referencing two points
- Line a series of connected points describing a path
- Triangle a Triangle, referencing three points:
- Triangle Strip a Triangle Strip with n triangles, referencing n+2 points. The first three referenced points describe the first triangle, the second, third and fourth referenced points describe the second triangle.
- Triangle Fan a Triangle Fan with n triangles, referencing n+2 points. The first referenced point is in the center of the fan. Together with two subsequent referenced points, it describes a complete triangle.
- Facet a closed planar polygon, referencing n points. The final point in the point index list shall be connected to the first point in the point index list to close the facet.

If the Surface Points Normals Sequence (0066,0012) is not present, the default normals can be derived from the Surface Mesh Primitives.

For the Triangle Strip, Triangle Fan, **Line**, and Facet the Primitive Point Index List (0066,0029) the ordering of the point references implies the direction of the primitive's normal: The normal points in the direction from which the referenced points are specified in a counterclockwise order. For finite volumes this shall be the outward direction.

For the Line primitive, the ordering of the point references defines a directed path, starting with the first point and ending with the last point referenced in each Primitive Point Index List (0066,0029).

For Primitives of type Triangle Strip or Triangle Fan, the orientation of the normals is given by the order of the points in the first triangle.

Note: These points may be used to compute normals to the primitive. (See section C.27.1.1.6.) The order these point references are presented in the Primitive Point Index List (0066,0029) will affect the direction the computed normal points. If the order of the point references is reversed, the direction of the normals will be reversed as well.

Add new attributes to data dictionary PS 3.6

<i>Tag</i>	<i>Name</i>	<i>Keyword</i>	<i>VR</i>	<i>VM</i>
<u>(0066,0037)</u>	<u>Recommended Point Radius</u>	<u>RecommendedPointRadius</u>	<u>FL</u>	<u>1</u>
<u>(0066,0038)</u>	<u>Recommended Line Thickness</u>	<u>RecommendedLineThickness</u>	<u>FL</u>	<u>1</u>