

DICOM Correction Item

Correction Number	CP- 1098
Log Summary:	Clarify behavior of HP Filter-by Operator if the selected attribute value is absent
Type of Modification	Name of Standard
Modification	PS 3.3-2011
<p>Rationale for Correction:</p> <p>The current specification does not clearly define the behavior of the HP Filter-by Operator, if the selected attribute value is absent in the image.</p> <p>C.23.3.1.1 Filter Operations Sequence</p> <p>only specifies the behavior:</p> <p>“If the attribute identified by Selector Attribute is not present in an image of the referenced Image Set, then the image is included in the filter output.”</p> <p>Adjusting this sentence to “If the attribute value identified by ..” would not allow to select only images with a particular value of a multi-valued attribute (e.g. Image Type Value 3 = LOCALIZER) and to exclude images which contain the attribute – therefore you cannot exclude them by Filter-by Attribute Presence = PRESENT – but do not contain a value of it with the specified Selector Value Number (e.g. Secondary Capture images with no Image Type Value 3) from the Display Set.</p> <p>This proposal suggests to enable to explicitly specify the behavior for absent attribute (values) by reusing attribute Image Set Selector Usage Flag (0072,0024) from the Hanging Protocol Definition Module.</p> <p>Except for the MEMBER_OF and the NOT_MEMBER_OF, it is also not specified, if all or only one of the values of the image have to match, to include it in the filter output.</p>	
<p>Sections of documents affected</p> <p>PS 3.3 Section C.23.3</p>	
<p>Correction Wording:</p>	

Table C.23.3-1
Hanging Protocol Display Module Attributes

Attribute Name	Tag	Type	Attribute Description
...			
>Filter Operations Sequence	(0072,0400)	2	Sequence that defines filter criteria to be applied to the image set identified by Image Set Number (0072,0032). Zero or more items shall be included in this sequence. See C.23.3.1.1.
>>Filter-by Category	(0072,0402)	1C	Category of the filter operation. See C.23.3.1.1. Defined terms: IMAGE_PLANE Required if Selector Attribute (0072,0026) is not present.
>>Filter-by Attribute Presence	(0072,0404)	1C	Operation to be applied based on the presence or absence of the attribute represented by Selector Attribute (0072,0026) in each image of the Image Set. Required if Selector Attribute (0072,0026) is

Attribute Name	Tag	Type	Attribute Description
			<p>present and Filter-by Operator (0072,0406) is not present.</p> <p>Enumerated Values:</p> <p>PRESENT: Include the image if the attribute is present</p> <p>NOT_PRESENT: Include the image if the attribute is not present</p>
>>Selector Attribute	(0072,0026)	1C	<p>Data Element Tag of an Attribute from an Image IOD to use as a filter. See C.23.3.1.1 for potential attributes.</p> <p>Required if Filter-by Category (0072,0402) is not present.</p>
>>Selector Attribute VR	(0072,0050)	1C	<p>The Value Representation of the Selector Attribute (0072,0026).</p> <p>Required if Selector Attribute (0072,0026) or Filter-by Category (0072,0402), and Filter-by Operator (0072,0406) are present.</p>
<i>>>Include Hanging Protocol Selector Attribute Context Macro Table C.23.4-1</i>			
<i>>>Include Hanging Protocol Selector Attribute Value Macro Table C.23.4-2</i>			
>>Selector Value Number	(0072,0028)	1C	<p>Positive integer identifying which value of the attribute identified by Selector Attribute (0072,0026) is to be used for filtering. The value 1 identifies the first value. The value zero identifies any value.</p> <p>Required if Selector Attribute (0072,0026) and Filter-by Operator (0072,0406) are present.</p>
>>Filter-by Operator	(0072,0406)	1C	<p>Operation to be applied between the value(s) in the Hanging Protocol Selector Attribute Value Macro ("selector"), and the value(s) of the attribute identified by Selector Attribute (0072,0026) <u>(or the value implied by the Filter-by Category (0072,0402))</u> in each image of the Image Set. See C.23.3.1.1.</p> <p>Required if Filter-by Category (0072,0402) is present, or if Selector Attribute (0072,0026) is present and Filter-by Attribute Presence (0072,0404) is not present.</p> <p>Enumerated Values:</p> <p>RANGE_INCL: the all values lie within the specified range, or are equal to the endpoints; applies only to numeric, date or time Selector Attribute (0072,0026); two values shall be present in the selector, the first of which is less than or equal to the second.</p> <p>RANGE_EXCL: the all values lie outside the specified range, and are not equal to the endpoints; applies only to numeric Selector Attribute (0072,0026); two values shall be present in the selector, the first of which is less than or equal to the second.</p>

Attribute Name	Tag	Type	Attribute Description
			<p>GREATER_OR_EQUAL: <u>all values are greater than or equal to the value of the selector;</u> applies only to numeric Selector Attribute (0072,0026).</p> <p>LESS_OR_EQUAL: <u>all values are less than or equal to the value of the selector;</u> applies only to numeric Selector Attribute (0072,0026).</p> <p>GREATER_THAN: <u>all values are greater than the value of the selector;</u> applies only to numeric Selector Attribute (0072,0026).</p> <p>LESS_THAN: <u>all values are less than the value of the selector;</u> applies only to numeric Selector Attribute (0072,0026).</p> <p>MEMBER_OF: one of the values in the image is present in the values of the selector; if one value is present in each, this is an “equal to” operator.</p> <p>NOT_MEMBER_OF: none of the values in the image is present in the values of the selector; if one value is present in each, this is a “not equal to” operator.</p>
<u>>>Image Set Selector Usage Flag</u>	<u>(0072,0024)</u>	<u>3</u>	<p><u>Specifies the behavior of the Filter-by Operator (0072,0406) when the Selector Attribute (0072,0026) is not available in the image or does not contain a value specified by Selector Value Number (0072,0028).</u></p> <p><u>If this attribute is not present in this sequence item, MATCH shall be assumed.</u></p> <p><u>Shall be ignored if Filter-by Operator (0072,0406) is not present.</u></p> <p><u>Enumerated Values:</u></p> <p><u>MATCH - include the image in the filter output.</u></p> <p><u>NO_MATCH - do not include the image in the filter output.</u></p>

...
C.23.3.1.1 Filter Operations Sequence

The items in the Filter Operations Sequence (0072,0400) determine which subset of the images in the identified Image Set are to be displayed in the associated Display Set image boxes. If there are multiple Items in the Filter Operations Sequence (0072,0400), the filter operations shall be applied in Item order, and the output of the preceding filter shall serve as the input to the succeeding filter (i.e., an AND operation).

When Filter-by Category (0072,0402) has a value of IMAGE_PLANE, Selector Attribute VR (0072,0050) shall have a value of “CS”, and abstract enumerated values shall be used for the value of the associated Selector CS Value (0072,0062) attribute, which may be computed from the values of Image Orientation (Patient) (0020,0037) or Patient Orientation (0020,0020). Enumerated Values: TRANSVERSE, CORONAL, SAGITTAL, OBLIQUE. **The MEMBER_OF and NOT_MEMBER_OF values of Filter-by Operator (0072,0406) are then applicable.**

Note: Cross-sectional images do not normally contain a categorical description of the image plane, but rather only a patient-relative row and column direction cosines that are unit vectors. The category of image plane can

be determined first by categorizing the row and column major directions (or detecting if the orientation is oblique according to a pre-specified threshold), and then using those categories to select a plan category.

The following pseudo-code can be used to determine the major axis (R or L, A or P, H or F) from a single direction cosine that is an (x,y,z) tuple (as defined in C.7.6.2.1.1):

```

if (abs(x) > threshold)
    axis = "RL"
else if (abs(y) > threshold)
    axis = "AP"
else if (abs(z) > threshold)
    axis = "HF"
else
    is OBLIQUE
    
```

Having determined the major axis of the row and column, the category of plane can be obtained from a table lookup:

Column	Row		
	RL	AP	HF
RL		TRANSVERSE	CORONAL
AP	TRANSVERSE		SAGITTAL
HF	CORONAL	SAGITTAL	

Alternatively, one can obtain a single vector that is the normal to the orientation (cross product of the row and column unit vectors), then find which of the x, y and z components has the maximum absolute value that is above threshold; if x then SAGITTAL, if y then CORONAL, if z then TRANSVERSE; if all of the components are below threshold then the orientation is OBLIQUE.

Since it is also necessary to determine whether or not to flip or rotate the image into the preferred orientation (as specified by Display Set Patient orientation (0072,0700)) for the category of plane (e.g., sagittals are normally viewed with row direction posteriorly and column direction towards the feet), the categorical row and column direction to use can be obtained as above, additional accounting for the sign of the direction cosine, e.g.:

```

if x < 0 then orientationX = "R" else orientationX = "L"
if y < 0 then orientationY = "A" else orientationY = "P"
if z < 0 then orientationZ = "F" else orientationZ = "H"
if (abs(x) > threshold)
    orientation = orientationX
...
    
```

An application that is applying a Hanging Protocol Instance shall support any value for Selector Attribute (0072,0026). ~~If the attribute identified by Selector Attribute is not present in an image of the referenced Image Set, then the image is included in the filter output.~~ **The Image Set Selector Usage Flag (0072,0024) specifies whether or not the image is included in the filter output when the attribute or value identified by the Selector Attribute (0072,0026) is not available in an image.** The attributes of the Hanging Protocol Selector Attribute Context Macro specify whether the Selector Attribute (0072,0026) is contained in a Sequence, Functional Group Sequence, or Private Group.