

DICOM Correction Proposal Form

Tracking Information - Administration Use Only	
Correction Proposal Number	CP-927
STATUS	Assigned
Date of Last Update	2008/10/20
Person Assigned	Bas Revet bas.revet@philips.com
Submitter Name	WG 2 (Bas Revet bas.revet@philips.com)
Submission date	2008/08/18

Correction Number	CP-927
Log Summary: Change Applicable Frame Range attribute name	
Type of Modification	Name of Standard
Correction	PS 3.3 and 3.6 2008
Rationale for Correction The applicable frame range as specified in attribute (0028,6102) is pointing to the contrast frames for a subtraction operation. Proposed is the change the name of the attribute to reflect this equal as for the mask frames.	
Sections of documents affected PS 3.3 C.7.6.10, C.7.6.16.2.14.1, C.11.13 and PS 3.6 6	
Correction Wording:	

C.7.6.10 Mask Module

Table C.7-16 specifies the Attributes that describe mask operations for a Multi-frame image.

**Table C.7-16
 MASK MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Mask Subtraction Sequence	(0028,6100)	1	Defines a sequence that describes mask subtraction operations for a Multi-frame Image. One or more items may be included in this sequence.
>Mask Operation	(0028,6101)	1	Defined Term identifying the type of mask operation to be performed. See C.7.6.10.1 for further explanation.
>Subtraction Item ID	(0028,9416)	1C	Identification of the Subtraction Item used to associate a certain Mask Sub-Pixel Shift (0028,6114) in the Frame Pixel Shift Functional Group. See C.7.6.16.2.14.1. Required if SOP Class UID (0008,0016) equals "1.2.840.10008.5.1.4.1.1.12.1.1" or "1.2.840.10008.5.1.4.1.1.12.2.1". May be present otherwise.
>Applicable Contrast Frame Range	(0028,6102)	1C	Each pair of numbers in this multi-valued attribute specify a beginning and ending frame number inclusive of a range where this particular mask operation is valid. Discontinuous ranges are represented by multiple pairs of numbers. Frames in a Multi-frame Image are specified by sequentially increasing number values beginning with 1. If this Attribute is missing in this particular sequence item, then the mask operation is applicable throughout the entire Multi-frame Image, subject to certain limits as described in C.7.6.10.1.1. Required if Mask Operation (0028,6101) equals REV_TID. May be present otherwise.
>Mask Frame Numbers	(0028,6110)	1C	Specifies the frame numbers of the pixel data used to generate this mask. Frames in a Multi-frame Image are specified by sequentially increasing number values beginning with 1. Required if the Mask Operation (0028,6101) is AVG_SUB.
>Contrast Frame Averaging	(0028,6112)	3	Specifies the number of contrast

			frames to average together before performing the mask operation. If the Attribute is missing, no averaging is performed.
>Mask Sub-pixel Shift	(0028,6114)	3	<p>A pair of floating point numbers specifying the fractional vertical [adjacent row spacing] and horizontal [adjacent column spacing] pixel shift applied to the mask before subtracting it from the contrast frame. See Section C.7.6.10.1.2.</p> <p>Note: When the Frame Pixel Shift Functional Group is present the values of the Mask Pixel Shift attribute of that Functional Group prevails over the values specified in this module.</p>
>TID Offset	(0028,6120)	2C	<p>If Mask Operation is TID, specifies the offset to be subtracted from the current frame number in order to locate the mask frame in TID mode.</p> <p>If Mask Operation is REV_TID, specifies the initial offset to be subtracted from the first contrast frame number. See section C.7.6.10.1.1.</p> <p>If zero length, TID Offset defaults to 1. Required if Mask Operation (0028,6101) is TID or REV_TID.</p>
>Mask Operation Explanation	(0028,6190)	3	Free form explanation of this particular mask operation.
>Mask Selection Mode	(0028,9454)	3	<p>Specifies the method of selection of the mask operations of this item.</p> <p>Defined Terms:</p> <p style="text-align: center;">SYSTEM USER</p>
Recommended Viewing Mode	(0028,1090)	2	<p>Specifies the recommended viewing protocol(s).</p> <p>Defined terms:</p> <p>SUB = for subtraction with mask images; NAT = native viewing of image as sent.</p> <p>Note: If an implementation does not recognize the defined term for Recommended Viewing Mode (0028,1090) , reverting to native display mode is recommended.</p>

Note: Frame numbers begin at 1.

C.7.6.10.1 Mask Subtraction Attribute Descriptions

C.7.6.10.1.1 Mask Operation

Mask Operation (0028,6101) specifies a type of mask operation to be performed. The Defined Terms identifying the mask operation to be performed are as follows:

NONE (No Subtraction) No mask subtraction operation is specified;

AVG_SUB (Average Subtraction) The frames specified by the Mask Frame Numbers (0028,6110) are averaged together, shifted by the amount specified in the Mask Sub-pixel Shift (0028,6114), then subtracted from the contrast frames in the range specified in the Applicable **Contrast** Frame Range (0028,6102). Contrast Frame Averaging (0028,6112) number of frames starting with the current frame are averaged together before the subtraction. If the Applicable **Contrast** Frame Range is not present in this sequence item, the Applicable **Contrast** Frame Range is assumed to end at the last frame number of the image minus Contrast Frame Averaging (0028,6112) plus one;

TID (Time Interval Differencing) The mask for each frame within the Applicable **Contrast** Frame Range (0028,6102) is selected by subtracting TID Offset (0028,6120) from the respective frame number. If the Applicable **Contrast** Frame Range is not present in this sequence item, the Applicable **Contrast** Frame Range is assumed to be a range where TID offset subtracted from any frame number with the range results in a valid frame number within the Multi-frame image.

Note: A positive value for TID Offset (0028,6120) means that the mask frame numbers are lower than the subtracted frame numbers. A negative TID Offset means that the mask frame numbers are higher than the subtracted frame numbers.

REV_TID (Reversed Time Interval Differencing) The number of the mask frame for each contrast frame within the Applicable **Contrast** Frame Range (0028,6102) is calculated by subtracting the TID Offset (0028,6120) from the first frame within the Applicable **Contrast** Frame Range, the TID Offset (0028,6120) +2 from the second frame within the Applicable **Contrast** Frame Range, the TID Offset (0028,6120) +4 from the third frame and so on. The Applicable **Contrast** Frame Range (0028,6102) shall be present.

When multiple pairs of frame numbers are specified in the Applicable **Contrast** Frame Range attribute, the beginning frame numbers (i.e. the first frame number in each pair) shall be in increasing order.

Algorithm to calculate the Mask Frame Number:

$$MFN = (FCFN - TID \text{ Offset}) - (CFN - FCFN)$$

In which:

MFN = Mask Frame Number

CFN = Contrast Frame Number

FCFN = First Contrast Frame Number, the first frame number of the first pair in the Applicable **Contrast** Frame Range

Note: A positive value for TID Offset (0028,6120) means that the mask frame numbers are lower than the subtracted frame numbers. A negative TID Offset

means that the mask frame numbers are higher than the subtracted frame numbers.

Note: Example of TID Offset, see Figure C.7.6.10-1:

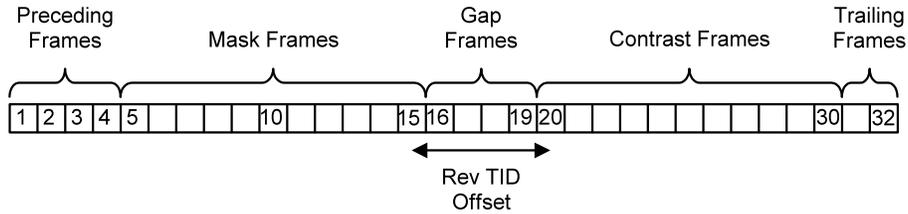


Figure C.7.6.10-1

Number of Frames: 32
 Applicable **Contrast** Frame Range: 20 to 30
 TID Offset: 5

For Calculating the TID Offset for Mask Operation REV_TID see table C.7.6.10-1:

Table C.7.6.10-1
Example Mask Frame Numbers
for Mask Operation REV_TID

Contrast Frame Number (CFN) (Absolute value)	Mask Frame Number (MFN) (Absolute value)
20	15
21	14
22	13
...	...
28	7
29	6
30	5

In this example the acquisition of the mask frames starts with frame 5 and ends with frame 15. The acquisition of the contrast frames starts with frame 20 and ends with frame 30 (Applicable **Contrast** Frame Range). The number 5 for TID Offset indicates a gap between “end of mask frames” and “begin of contrast frames” of 4 frames, e.g. injection phase and/or time needed to drive C-arm in reverse. Additionally, in this example, the first 4 frames and the last two frames are not used for this Reversed Time Interval Differencing loop.

C.7.6.10.1.2 Mask Sub-pixel Shift

A pair of floating point numbers specifying the fractional vertical [adjacent row spacing] and horizontal [adjacent column spacing] pixel shift applied to the mask before subtracting it from the contrast frame. The row offset results in a shift of the pixels along the column axis. The column offset results in a shift of the pixels along the row axis. A positive row offset is a shift toward the

pixels of the lower row of the pixel plane. A positive column offset is a shift toward the pixels of the left hand side column of the pixel plane.

C.7.6.16.2.14.1 Subtraction Item ID Description

...

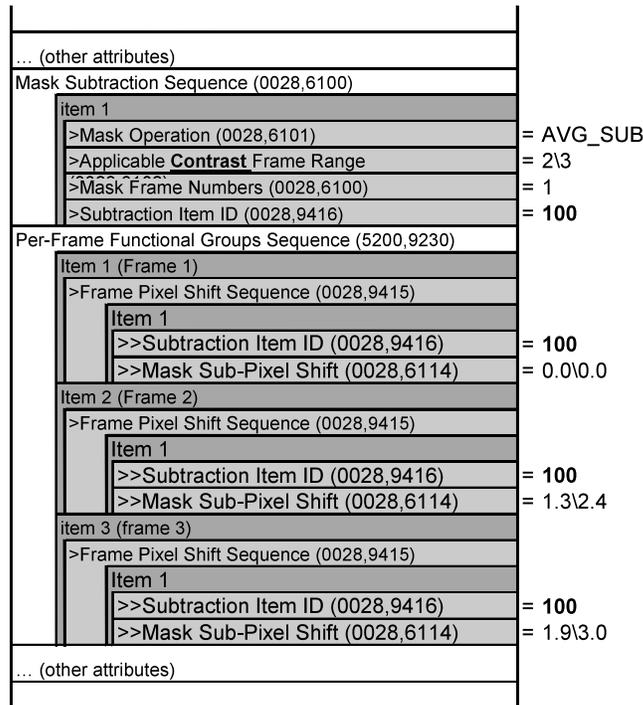


Figure C.7.6.16-8
 Example of usage of Subtraction Item ID in a per-frame Macro

C.11.13 Presentation State Mask Module

Table C.11.13-1 contains Attributes that specialize the use of masks in a Presentation State.

Table C.11.13-1
PRESENTATION STATE MASK MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Mask Subtraction Sequence	(0028,6100)	1C	Required if Mask Module is present. Only one Item shall be present. Applicable Contrast Frame Range (0028,6102) shall not be included in the Sequence Item. See C.7.6.10 for a complete definition of the Attributes in the Items of this Sequence other than Mask Operation(0028,6101) and Applicable Contrast Frame Range

			(0028,6102). Notes: 1. This Sequence is replicated here in order to specify one Item, additional conditions on Mask Operation (0028,6101) and to forbid Applicable Contrast Frame Range (0028,6102). 2. The role of Applicable Contrast Frame Range (0028,6102) is replaced by Referenced Frame Number (0008,1160).
>Mask Operation	(0028,6101)	1	Type of mask operation to be performed Enumerated Values: AVG_SUB TID See C.7.6.10.1 for further explanation. Note: The requirement in this module is for Enumerated Values which override the requirements of the Mask Module.
>Contrast Frame Averaging	(0028,6112)	1C	Specified the number of contrast frames to average together before performing the mask operation. Required if Mask Frame Numbers (0028,6110) specifies more than one frame (i.e. is multi-valued). Note: The requirement in this module is conditional and overrides the optional requirements of the Mask Module.
Recommended Viewing Mode	(0028,1090)	1C	Specifies the recommended viewing protocol(s). Enumerated Value: SUB = for subtraction with mask images Required if Mask Subtraction Sequence (0028,6100) is present. Note: The requirement in this module is type 1C and an Enumerated Value is specified which override the requirements of the Mask Module.

6 Registry of DICOM data elements

Tag	Name	VR	VM
...			
(0028,6102)	Applicable Contrast Frame Range	US	2-2n

CP-927
Change Applicable Frame Range attribute name

Date 2008/10/20
Status: Assigned

...