DICOM Correction Proposal

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Correction Number CP1488
Log Summary: Clarify RT Image Exposure Attributes in case of MPEG Encoding
Name of Standard PS3.3 2015c
Rationale for Correction: Multi-frame RT Images may encode a continuous acquisition as MPEG. This in case, a typical sample rate maybe 25 Hz (40 ms). However, the Exposure Sequence (3002,0030) is not (TBD) written at this sampling rate, but at a lower rate, like 1 Hz. Otherwise the sequence would become very large without any benefit, since the number of frames maybe in the range of several thousands. In this cases the question is, how the Exposure Time (0018,1150) and Meterset Exposure (3002,0032) attributes should be used: These attributes may contain the exposure values comprising the X-Ray exposure during the acquisition of the single frame referenced by the Referenced Frame Number (0008,1160) only. Alternatively these attributes may contain the exposure between of the referenced frame and the frame referenced in the next item of the Exposure Sequence (3002,0030). The latter one would include exposures of frame, which to not have a corresponding sequence item in the Exposure Sequence (3002,0030). Current approaches observed uses the approach to write the time and meterset values only for the referenced frame. Additionally it would be useful to have the exposure values starting from the current frame to the subsequently referenced frame as well – so that the total exposure is known. The change proposal clarifies the use of the current attributes and introduces attributes to convey the total between exposures as well.
Correction Wording:

Add the following attributes and section to PS3.3, Module C.8.8.2 RT Image Module

C.8.8.2 RT Image Module

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Table C.8-38. RT Image Module Attributes

Attribute Name	Tag	Type	Attribute Description
Samples per Pixel	(0028,0002)	1	Number of samples (planes) in this image. See Section C.8.8.2.6.1 for specialization.
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Exposure Sequence	(3002,0030)	3	Sequence of Exposure parameter sets, corresponding to exposures used in generating the image.

Attribute Name	Tag	Type	Attribute Description
			One or more items are permitted in this sequence. See Section C.8.8.2.4.
>Referenced Frame Number	(0008,1160)	1C	Identifies corresponding image frame in multi-frame image. Required if there is more than one item in Exposure Sequence (3002,0030), and image is a multi-frame image.
>KVP	(0018,0060)	2C	Peak kilo voltage output (kV) of X-Ray generator used to acquire image. Required if Value 3 of Image Type (0008,0008) is PORTAL, SIMULATOR or RADIOGRAPH.
>Primary Fluence Mode Sequence	(3002,0050)	3	Sequence defining whether the primary fluence of the treatment beam uses a non-standard fluence-shaping. Only a single Item is permitted in this sequence.
…			
>X-Ray Tube Current	(0018,1151)	2C	Imaging device X-Ray Tube Current (mA). Required if Value 3 of Image Type (0008,0008) is SIMULATOR or RADIOGRAPH. May be present otherwise.
>X-Ray Tube Current in mA	(0018,9330)	3	X-Ray Tube Current in mA. An average in the case of fluoroscopy (continuous radiation mode).
>Exposure Time	(0018,1150)	2C	Time of X-Ray exposure (msec). Required if Value 3 of Image Type (0008,0008) is SIMULATOR or RADIOGRAPH. May be present otherwise. **See C.8.8.2.X.**
>Exposure Time in ms	(0018,9328)	3	Duration of X-Ray exposure ~~in (~~msec~~)~~. **See C.8.8.2.X.**
>Meterset Exposure	(3002,0032)	2C	Treatment machine Meterset duration over which image has been acquired, specified in Monitor units (MU) or minutes as defined by Primary Dosimeter Unit (300A,00B3). Required if Value 3 of Image Type (0008,0008) is PORTAL. **See C.8.8.2.X.**
Exposure Time	**(0018,1150)**	**3**	**Time of X-Ray exposure (msec).** **See C.8.8.2.X.**
Exposure Time in ms	**(0018,9328)**	**3**	**Duration of X-Ray exposure (msec).** **See C.8.8.2.X.**
Meterset Exposure	**(3002,0032)**	**3**	**Treatment machine Meterset duration over which image has been acquired, specified in Monitor units (MU) or minutes as defined by Primary Dosimeter Unit (300A,00B3).** **See C.8.8.2.X.**

C.8.8.2.1 Multi-frame Image Data

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C.8.8.2.X Exposure Time and Meterset Exposure

Multi-frame RT Images may encode a continuous acquisition. In this case, the Exposure Sequence (3002,0030) may not reference all frames.

The attributes Exposure Time (00018,1150), Exposure Time in ms (0018,9328) and Meterset Exposure (3002,0032) attributes in the Exposure Sequence (3002,0030), if present with values, contain the exposure values encompassing the X-Ray exposure during the acquisition of the single frame referenced by the Referenced Frame Number (0008,1160). Note that not all frames may be referenced in this sequence and therefore the sum of these values may not equal the total exposure value.

The attributes Exposure Time (00018,1150), Exposure Time in ms (0018,9328) and Meterset Exposure (3002,0032) attributes outside the Exposure Sequence (3002,0030) may be used to record the total exposure values.