

# DICOM Correction Proposal

STATUS	March 2020 Voting Package
Date of Last Update	2020-01-20
Person Assigned	Björn Nolte
Submitter Name	Till Hoenig (till.hoenig@siemens-healthineers.com)
Submission Date	2019/09/04

Correction Number	CP-1977
Log Summary: Correct Multi-energy Sequence Nesting	
Name of Standard DICOM PS3.x 2019c	
Rationale for Correction: Besides others Sup188 introduced two additional macros, describing Multi-Energy parameters: <ul style="list-style-type: none"> <li>- C.8.15.3.12 Multi-energy CT Characteristics Macro</li> <li>- C.8.15.3.13 Multi-energy CT Processing Macro</li> </ul> To be consistent with other functional group macros (e.g. CT X-Ray Details Macro) the multi energy macros shall enclose the macro attributes by a suitable sequence head attribute directly inside the macro. Erroneous, the sequence head attribute was added without the body in the CT Image Module, with the sequence body in the CT Enhanced image.	
Correction Wording:	

<Modify PS3.3 C.8.2.2 Multi-energy CT Image Module>

**Table C.8.2.2-1. Multi-energy CT Image Module Attributes**

Attribute Name	Tag	Type	Attribute Description
...			
<u>Multi-energy CT Processing Sequence</u>	<u>(0018,9363)</u>	<u>3</u>	<u>How the acquired Multi-energy data was processed to generate this image.</u> <u>Only a single Item is permitted in this Sequence.</u>
<i>≥Include Table C.8.15.3.13-1 "Multi-energy CT Processing Attributes"</i>			
<u>Multi-energy CT Characteristics Sequence</u>	<u>(0018,9364)</u>	<u>1C</u>	<u>Multi-energy characteristics of the generated image.</u> <u>Required if Image Type (0008,0008) Value 4 is VMI. May be present otherwise.</u> <u>Only a single Item shall be included in this Sequence.</u>

Attribute Name	Tag	Type	Attribute Description
≥Include Table C.8.15.3.12-1 "Multi-energy CT Characteristics Macro Attributes"			

<Modify PS3.3 C.8.15.3.12 Multi-energy CT Characteristics Macro>

**Table C.8.15.3.12-1. Multi-energy CT Characteristics Macro Attributes**

Attribute Name	Tag	Type	Attribute Description
<b><u>Multi-energy CT Characteristics Sequence</u></b>	<b><u>(0018,9364)</u></b>	<b><u>1C</u></b>	<b><u>Multi-energy characteristics of the generated image.</u></b> <b><u>Required if Image Type (0008,0008) Value 4 is VMI.</u></b> <b><u>May be present otherwise.</u></b> <b><u>Only a single Item shall be included in this Sequence.</u></b>
≥Monoenergetic Energy Equivalent	(xxx1,yyy1)	1C	Single energy equivalent in keV. Required if Image Type (0008,0008) Value 4 is EQUAL to VMI. May be present otherwise.  Note  If the Image Type Value 4 is (MAT_REMOVED, MAT_MODIFIED) and a VMI image was used as the source then this value reflects the keV value of the VMI image.
≥Derivation Algorithm Sequence	(0022,1612)	3	Software algorithm that performed the derivation.
≥>Include Table 10-19 "Algorithm Identification Macro Attributes"			
≥Performed Processing Parameters Sequence	(0074,1212)	3	Parameters used to perform the derivation algorithm.  Note  Implementers are encouraged to put the Algorithm Parameters here instead of in Algorithm Parameters (0066,0032) in the Algorithm Identification Macro  One or more items are permitted in this Sequence.
≥>Include Table 10.2.1-1 "Content Item with Modifiers Macro Attributes"			

<Modify PS3.3 C.8.15.3.13 Multi-energy CT Processing Macro>

**Table C.8.15.3.13-1. Multi-energy CT Processing Attributes**

Attribute Name	Tag	Type	Attribute Description
<b><u>Multi-energy CT Processing Sequence</u></b>	<b><u>(0018,9363)</u></b>	<b><u>3</u></b>	<b><u>How the acquired Multi-energy data was processed to generate this image.</u></b>

Attribute Name	Tag	Type	Attribute Description
			<b><u>Only a single Item is permitted in this Sequence.</u></b>
≥Decomposition Method	(0018,937E)	1	Method used to decompose the acquired Multi-energy CT data into basis data. Defined Terms: <b>PROJECTION_BASED</b> The acquired projection data was fully decomposed into basis projection data (i.e. sinograms). <b>IMAGE_BASED</b> The acquired projection data was fully reconstructed into images before being decomposed into basis image data. <b>HYBRID</b> The acquired projection data was reconstructed using knowledge in both projection and image space to produce basis image data. Decomposition and image reconstruction may be performed in a one-step approach.  Note 1. Basis images and basis projection data are not necessarily instantiated as DICOM instances. 2. There may be additional processing steps (e.g. linear combination of basis data) creating the result image.
≥Decomposition Description	(0018,937F)	3	Description of decomposition method
≥Decomposition Algorithm Identification Sequence	(0018,9380)	3	Algorithm used for decomposition of the acquired data. One or more Items are permitted in this Sequence.
≥>Include Table 10-19 "Algorithm Identification Macro Attributes"			
≥Decomposition Material Sequence	(0018,9381)	3	Basis materials used in the decomposition process. Two or more Items are permitted in this Sequence.
≥>Material Code Sequence	(0018,937D)	1	Nominal material for Multi-energy CT processing. Only a single Item shall be included in this Sequence.
≥>>Include Table 8.8-1 "Code Sequence Macro Attributes"			BCID 300 "Multi-energy Relevant Materials".
≥>Material Attenuation Sequence	(0018,9382)	3	Attenuation curve of the material, defined as a set of points. Two or more Items are permitted in this Sequence.  Note Attenuation curves for non-standard materials can be generated by NIST <a href="http://physics.nist.gov/PhysRefData/Xcom/html/xcom1.html">http://physics.nist.gov/PhysRefData/Xcom/html/xcom1.html</a> .
≥>>Photon Energy	(0018,9383)	1	Photon energy in keV.
≥>>X-Ray Mass Attenuation Coefficient	(0018,9384)	1	Attenuation of this material at the specific Photon Energy (0018,9383), normalized to material density.

*Note for editors:*

The log summary is a *MS-Word Fields* that shall be changed by the 'Edit Field ...' function in the popup menu reached by clicking on the example text in the template. Change the text in the Field Properties window that is shown (New title) and click OK.

The log summary is the displayed as document title when the cursor is hovered over the file name in Explorer.