

IHE Work Item Proposal (Short)

1. Proposed Work Item: Multi Energy CT (MECT)

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Domain: Radiology

DICOM multi-energy CT support was introduced in Supplement 188, in 2019. Multi-energy CT workflow shares many features of conventional CT, however, there are additional requirements to ensure interoperability and user needs for image display.

2. The Problem

Commercial multi-energy CT solutions were established prior to the development of Supplement 188. These relied on a combination of private attributes and dedicated display applications to address user needs for image display. As multi-energy CT has become increasingly more routine, demand has also increased to present multi-energy CT studies on general radiology PACS displays. This profile will help make multi-energy display features more commonly available.

3. Key Use Case

A patient undergoes a multi-energy CT study that is networked to the image manager/archive. Relevant prior CT studies are prefetched for comparison. Comparison studies are potentially monoenergetic or multi-energy, from a different vendor or model CT scanner, and may be from a different institution.

The interpreting radiologist requires that the current and prior studies be displayed with the additional features required to properly display multi-energy objective, material quantification and material visualization images without resorting to the need for an acquisition-vendor-specific proprietary workstation.

A few months later, at an external facility, the virtual monoenergetic images are imported into a legacy display system that supports the Enhance CT SOP class, however this system does not recognize the study as multi-energy. The images are properly labeled, providing an indication to

the reviewer that CT pixel values in virtual monoenergetic images are different from those in conventional CT images, avoiding confusion or misinterpretation.

4. Standards & Systems

DICOM CT Image Storage SOP Class

DICOM Enhanced CT SOP Class

DICOM Blending Softcopy Presentation State SOP Class

DICOM Segmentation SOP Class

[NIST XCOM Photon Cross Sections Database](#)

5. Discussion

The informational content pertaining to multi-energy CT in [PS3.17](#) offers an outline for several topics to be expanded upon in an IHE profile. There are also additional areas that would benefit modalities and image displays. Some of these were considered in earlier drafts of Supplement 188, but were not ultimately published, and include:

- Indexing for multi-frame dimensions and stacks. For example,
 - Clarify [Table C.8-130](#), Image Type and Frame Type Value 4 Common is to be extended with additional defined multi-energy terms from [C.8.2.1.1.1](#) Image Type, and
 - when encoding VMI and material images in the same multi frame object, provide consistency for the Dimension Index Pointer (e.g. Monoenergetic Energy Equivalent tag to differentiate VMI energy levels versus Material Code Sequence to differentiate material images)
- Attributes to establish hanging protocols
- Color material visualization
- Image display annotation requirements (kV, detector path)
- Image display functionality (ROI, plot, histogram)
- Evidence creation
- Attribute consistency in post processing IODs
- Query /return keys

Additionally, the profile provides an opportunity to address several concepts relevant to the adoption of this profile such as:

- Managing enhanced and legacy objects in a “mixed” environment
- Safe display on a legacy, multi-energy naïve display