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Minutes F2F

DICOM WORKING GROUP SEVEN (RADIOTHERAPY)

Meeting Location	SunNuclear 3275 Suntree Blvd Melbourne, FL 32940
Dates and Times	Monday, November 18, 2019 8:30 – 17:30 Tuesday November 19, 2019 8:30 – 17:30 Wednesday, November 20, 2019 8:30 – 17:30 Thursday, November 21, 2019 8:30 – 17:30 Friday, November 22, 2019 8:30 – 11:30
Presiding Officer	Jim Percy, Co-Chair
Secretary	Luiza Kowalczyk, DICOM Secretary

Attendees

Name	Affiliation	Mon	Tue	Wed	Thur	Fri
Kari Jyrkkälä	Varian	X	X	X	X	X
Bruce Rakes	Mevion	X	X	X	X	X
Bob Pekarek	Accuray	X	X	X	X	X
Luiza Kowalczyk	MITA	P	P	P	P	P
Jim Percy	Elekta	X	X	X	X	X
Christof Schadt	Brainlab	P	P	P	P	P
Yulong Yan	AAPM	X	X	X	X	X
Walter Bosch	AAPM	X	X	X	X	X
Thomas Schwere	Varian		P	P		
James Zug	Reflexion	P				
Michael Owens	Reflexion	P				
Chris Pauer	SunNuclear	P	P	P	P	P

Details

1. Administrative

- Introductions, identify participants.
- Remind anti-trust rules and DICOM Patent Disclosure Policy
- The agenda was reviewed adjusted to accommodate remote access for European participants. Discussion of Supp 176 was deferred to later in the week.
- Review of Minutes from last Meeting

2. Subgroups and related Group Status

- Brachytherapy Subgroup
- Ion Subgroup
- Motion Management Subgroup
- IHE-RO
- AAMI/AdvaMed RT-03 Machine Characterization
- IEC
- WG-28 meets with WG-02

3. General Topics

3.1 Reflexion X1

Michael Owens reviewed a proposed Radiation IOD for Rotational Beam Station Treatment

- Couch is stationary at each beam station
- Beam is off between beam stations
- Delivery can be biologically guided (or not)
- High-speed gantry rotation and beam firing
- BgRT requires one or more Planning PET (one for each target)
- Completion status is measured in terms of fluence, rather than MU or sec.
- Proposed new Radiation IOD (“Rotational Beam Station RT Radiation”)
 - o Uses IEC 61217 coordinate system
 - o Rotational Beam Module
 - o Nominal control point sequence is modified in real time to move with tumor/biological signal (PET data).
- A new, standalone Supplement for Rotational Beam Station RT Radiation IOD appears to be the best path forward for this treatment modality. Other options (CP to SUP176 to add Rotational Beam Station IOD or combining with SUP215) are not feasible.

4. Change Proposal Review

4.1 CPs new to WG-07

CP RT143 Dose Reference UID in Brachy Application Setup Sequence

Add Referenced Dose Reference UID (300A,0083) to Referenced Brachy Application Sequence (300C,000A) for consistency with external beam consistent dose. This proposal has been reviewed and accepted in the Brachy subgroup. WG-07 consensus to accept this CP.

CP RT144 FOR Missing Composite IOD Table

Corrects typographical error in Composite IOD table to makes Frame of Reference Module of Type U in RT Structure Set.

CP RT145 Unattached Contours

Use of Attached contours in RT Structure Set is overly complicated and has not been implemented. The CP deprecates this feature. The proposal defines two modes of representation for contours:

ATTACHED = (current mode) uses image references to define contour planes

UNATTACHED = defines Contour Plane Separation for (regularly-space, arbitrarily-oriented) contour planes

Need to know all possible contour plane positions so gaps can be inferred.

Assume contour planes all have the same normal (but may be arbitrarily oriented with respect to image planes)

Contour Plane Separation indicates distance between planes to indicate gaps between contoured segments – Type 3 attribute or 1C (required for UNATTACHED contours)

No thickness is defined for planar contours: they are 2D objects.

Calculating ROI volumes requires additional assumptions (on the part of implementers) regarding how the 3D surface of an ROI relates to the contours – this is not inherent in the Standard.

Contour Definition Type identifies how contours are defined: DEFAULT (existing Structure Set) and UNATTACHED (do not reference a contour image).

Christof to advance proposed CP (Tcon in Dec 2019) for presentation to WG-06.

CP RT146 Extension of Segmentation Type

Iso-value surface in Segmentation IOD: can ENUMERATED values be extended to indicate ISO-VALUE?

4.2 CPs in Work

CP 1969 (RT139) RT Anatomic Prescription Color

The CP proposes to add a recommended color to the prescription for a specific Conceptual Volume.

CP 1970 (RT140) Clarifications For Modulated Scan Mode Types

This change proposal clarifies the existing Scan Mode Types and retires some terms.

This topic came up at the IHE-RO TC meeting in Florida: Make it more explicit in the RT Beams Delivery Instruction what the term VERIFY means. Currently it states “Beam verification only”. Make sure that this includes the verification of a beam for a given patient position and not the verification of the beam.

See the usage of the term in the Delivery Verification Image Sequence. To be discussed whether this really is an issue?

CP 1971 (RT141) Scan Spot Size Record

This change proposal clarifies the specification by adding a new attribute to capture all the delivered spot sizes.

CP 1972 (RT142) Add Workitem Code for Emergency Treatment

This CP introduces a new code for unplanned treatment, e.g. emergency treatments.

CP RT136

Make Frame Anatomy in Parametric Map optional.

For the use of Parametric Maps as a container for dose values, the Frame Anatomy cannot always be provided and would force users to make up a value in order to satisfy the DICOM Standard. The CP proposes a breaking change of the DICOM Standard to make these attributes optional.

Evaluate appropriate codes for Frame Anatomy and trade-offs in using Parametric Maps vs. re-implementing multi-frame dose image.

Review also DICOM Standard Part 16 Table L-1. "Corresponding Codes and Terms for Human Use" that maps Anatomic Region Sequence (0008,2218) and Body Part Examined (0018,0015).

Group consensus was to propose making Frame Anatomy optional. An alternative is to use generic codes for Frame Anatomy.

Action Item: Jim and Christof to forward this CP to WG-06 to discuss this topic.

4.3 CPs with WG-06

See the CP status list on the ftp server.

5. Supplements

5.1 Status

For the status of the Supplements and the corresponding naming conventions and nomenclatures see documents on top level of the Supplement folder on the ftp server:

<ftp://medical.nema.org/MEDICAL/Private/Dicom/WORKGRPS/Wg07/Sup/>

5.2 Supplement 176 – Tomotherapeutic, Multiple Fixed Source and Robotic Treatment Modalities

Review the comments from the Letter Ballot period.

Main topics:

- The Multiple Fixed Source IOD was removed.
- The approach for the table position in the Control Point requires discussion, as this is represented by a registration between the Patient-based Coordinate System and the Equipment Coordinate System.

During review of the Supplement:

1. Clarify definition of Robotic Arm coordinate system.
2. The Tomotherapeutic Leaf Open Duration and Tomotherapeutic Leaf Initial Closed Duration reference behavior for the interval following a control point.
3. Meterset Units for Robotic Radiations were “seconds”. This was corrected to “MU”.
4. UCUM Code Syntax was corrected for CID SUP176006 – SUP176009
5. Improved wording for section C.36.F2.1 Tomotherapeutic Leaf Closed and Open Fractions (changed to “Tomotherapeutic Leaf Closed and Open Durations”) Check that “Fractions” is replaced by “Durations” everywhere.
6. Define “Path” and “Node” in
7. Edit section A.86.1.N5.1 Robotic Arm Radiation IOD Description. Define
 - a. “Robotic Path” = set of Robotic Nodes
 - b. “Robotic Node” = source position for robotic therapy device.
 - c. “Head Set” = set of nodes used for targets in the head
 - d. “Body Set”
 - e. “Trigeminal Set”
 - f. “Orthogonal QA Node Path”
 - g. “Single QA Note”
8. Jim to clean up use of “Robotic Nodes” and “Paths”

Diagram illustrating specification of binary MLC open durations at Tomotherapeutic Radiation Control Points.

5.3 Supplement 177 – RT Dose Modalities

R61 MonteCarlo codes – detailed algorithm codes may not be useful. Need to identify

- Vendor
- Product
- Version
- User-specified parameters

Dose Reporting Material (Water, Tissue, Medium) CID SUP177042 → replace SRT codes with SCT codes

Removed Gamma Index.

Removed Ensemble Doses and Metrics

Yulong Yan to discuss dose type concepts.

Reviewed Calculated vs. Measured vs. Specified Doses

Reviewed Dose Context UID – the same dose with different spatial sampling.

5.4 Supplement 199 – RT Treatment Records

Page 34-35

Considered removing Treatment Termination Status (Enumerated Values) – consensus to make this an Enumerated Value: NORMAL, ABNORMAL

Make Treatment Termination Reason Code Type 2C (required if Treatment Termination Status is not NORMAL)

Define Abnormal Termination Codes

- Illness
- Death
- Machine Interlock
- Operator Decision
- Physician Decision
- Patient Decision
- Secondary Dose Monitoring System
- Timer
- Door Interlock
- Patient Motion

Treatment Session UID – identifies Radiation Record and Radiation Record Set Instances for a Treatment Session

- Clinical Fraction Number = cumulative count of
- RT Radiation Set Delivery Number = ordinal count of delivery for a Radiation Set
- Session number

Two examples illustrating (a) split delivery of a fraction in two sessions and (b) adaptation of a Radiations Set.

Referenced Expected In Vivo Measurement Value Index

Referenced Control Point Index – references CP in recorded Radiation Instance

Recorded RT Control Point DateTime = date/time when delivery of Radiation Control Point was started (for last CP, when it was completed).

Manual Radiation Record Control Point Sequence includes Private Attributes that contain Raw Data information. – How are these to be encoded? **Is this data relevant for Manual Recording?**

Review of VRs for Sup199 attributes. Short Text (1024 bytes) is used for most of the Descriptions.

Creator Version UID (0008,9123) – identifies the equipment and software version for Additional Parameter Recording Instance Sequence - is this valuable information? **Keep this attribute as Type 2.**

Separate Interlock related codes into a new CID SUP19908 – TREATMENT INTERLOCK CODES

Alternate value for overrides is specified using Attribute-Value Macro.

Manual Radiation Record Module – capture minimal

- Start Meterset (Type 2)
- Delivered Meterset (Type 1) = total Meterset delivered = End Meterset – Start Meterset
- Nominal Energy (Type 2)

Examine Usage requirement for Manual Radiation Record IOD Modules – some may not be Mandatory.

5.4.1 Experiences from private implementation

1. Image to Equipment Mapping Matrix is mandatory also for manual records (implementation can always copy it from the source radiation)
2. Recording of field size is challenging. The X and Y sizes are identified by the order of the items within the sequence in the source Radiation IOD (and not even an index)
3. Recording of energy and particle type kind of breaks the model, these attributes are not really part of the control point, in the Radiation IOD they are just referenced with an index.

5.5 Supplement 160 – Patient Setup and Positioning

The group reviewed rev 22 of the supplement (sup160_22).

Currently Includes instructions for acquiring patient position (imaging) and excludes re-positioning/position correction instruction.

Discussed options for referencing devices: A) RT accessory device (like Radiation IOD) and B) generic device model and identifier

Review General Radiation Imaging Geometry Macro – This macro can be used to define geometry for 2D projection images. Change name to “2D (Projection?) Imaging Geometry”?

- Need to define “Origin Location” in Imaging Source to Origin Location Sequence (see Delivery Device Common Module)

Fraction number **TODO: make text in C.36.m1.1.2 consistent with corresponding section in Sup 199 (or create new note)**

- Clinical Fraction Number – ordinal count of fractions
- RT Radiation Set Delivery Number – ordinal count of fractions delivered an RT Radiation

Some attributes in RT Patient Treatment Setup Module are redundant with setup information in RT Radiations – should they be retained? made conditional? Placed in a (conditional) Sequence?

Radiation Record Set – A Radiation Record Set Instance references Radiation Record that are (a) treated in the same Session and (b) have the same Clinical Fraction Number.

RT Radiation Set Completion Status – flag to indicate complete delivery of Radiations in a Radiation Set with NORMAL termination in this Session.

Patient Orientation Information has been copied from Sup 175 – for treatment delivery instruction, this is redundant with RT Radiation. It is needed only for the cone-beam acquisition instruction case.

Reviewed Codes for Treatment Techniques, Shielding devices, Additional Setup Devices

5.6 Supplement 215 – RT Ion Radiation Objects

The group reviewed a generic model for a proton therapy nozzle and its components. Currently (Sup 175 Delivery Device Common) there is only one reference location. This limits flexibility for ion therapy. Perhaps, additional reference point(s) could be added at a lower level in the device hierarchy.

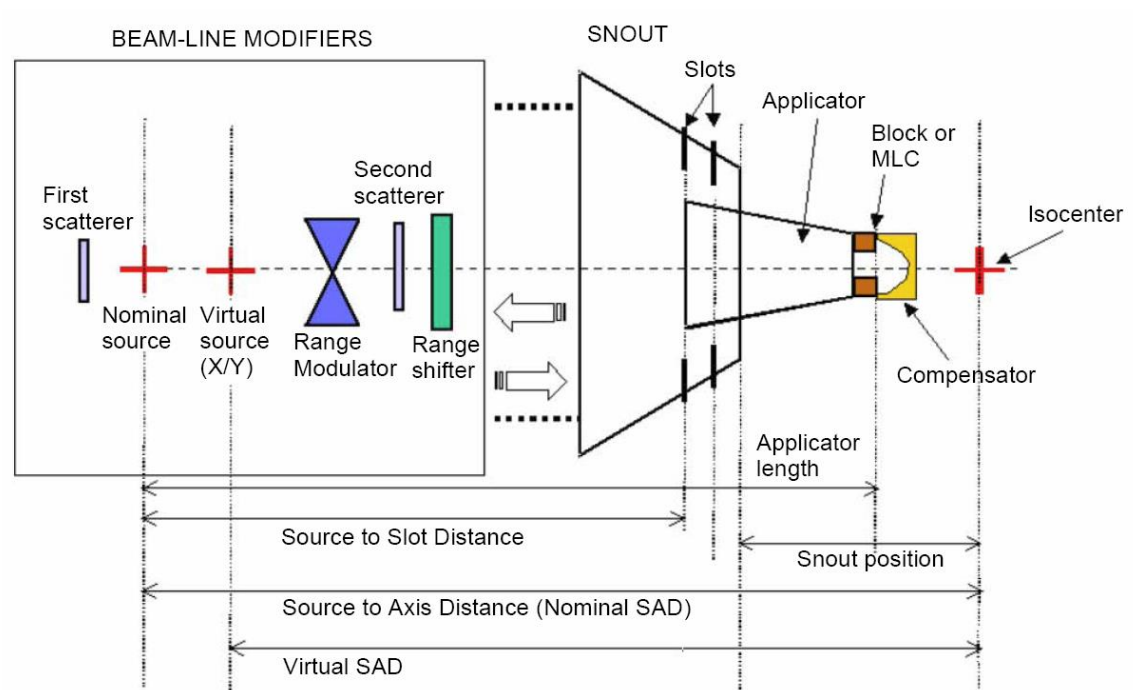


Figure 3-1 Schematic Layout of a Proton Nozzle

Accessory and Accessory Holders Definitions for RT Ion Radiations

- **Moveable Accessories (device holder) positions are defined with respect to isocenter and are specified at the CP level (using a continuous position parameter)**
- **Accessory device positions are specified at fixed locations relative to the reference position (distal edge) of the device holder on which they are mounted.**

Group members to document their understanding of accessory device position configuration and control.

In Control Point Sequence

RT accessory Device Holder Position Sequence

>Referenced RT Accessory Device Holder

>RT Accessory Device Holder Position

Summary:

- Devices (MLC) reference the Slot in a Device Holder
- Device Holders define (a) a reference location (distal edge) and (b) a set of slots/slot positions (distances to reference location).
- Device Center Location indicates mid-point between Proximal and Distal ends.
- Reference location for BLDs: If more than one, must be specified for each.

5.7 Supplement NN6 – Motion Management

Bob Pekarek reviewed a slide presentation of Sup NN6 prepared for WG-06.

- It is proposed to define RT Motion Management Instruction IOD and RT Motion Management Results IODs.
- A diagram indicating the relationship to existing and Supplement IODs was discussed. It was suggested to organize it in two columns: one for instruction and one for results. It may be helpful to separate the *order* and *dependency* of information objects.

6. Future Meeting Dates, Agenda for the Next Meeting and other Administrative Topics

6.1 Schedule

For the current list of Meetings see the MeetingsList.xlsx sheet under <ftp://medical.nema.org/MEDICAL/Private/Dicom/WORKGRPS/Wg07/Meetings/> on the ftp server.

Prepared by: Christof Schaf

Submitted by: Carolyn Hull 3/2/2020

Reviewed by counsel: Clark Silcox, March 2, 2020.