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Meeting Minutes

DICOM WORKING GROUP SEVEN (RADIOTHERAPY)

Meeting Location	Online Meeting	
Dates and Times	Monday, Oct 24, 2022	9:00 – 13:00 EDT
	Wednesday, Oct 26, 2022	9:00 – 13:00 EDT
	Wednesday, Nov 09, 2022	9:00 – 13:00 EDT
	Thursday, Nov 10, 2022	9:00 – 13:00 EDT
Presiding Officers	Christof Schadt, Co-Chair	
	Jim Percy, Co-Chair	
Secretary	Shayna Knazik, MITA	

Participants

Company/Organization	Represented by	10/24	10/26	11/9	11/10
AAPM	Walter Bosch	x	x	x	x
AAPM	Bruce Curran			x	x
AAPM	Yulong Yan	x	x	x	x
Accuray	Bob Pekarek	x	x	x	x
Advanced Oncotherapy	Ondrej Sevela			x	
Brainlab	Christof Schadt	x	x		
Elekta	Jim Percy	x	x	x	x
IBA	David Wikler	x	x	x	x
Mevion	Bruce Rakes	x	x	x	x
MITA/DICOM	Shayna Knazik	x	x		
RaySearch	Marcus Bergman	x	x	x	x
RaySearch	Stefan Páll Boman	x		x	
RaySearch	Jon Treffert	x	x	x	x
Self	Ulrich Busch	x	x	x	x
Varian	Kari Jyrkkälä	x	x	x	x
Reflexion	Michael Owens				x
Sordina IORT	Giuseppe Felici				x
Accuray	Jeffrey Lewis				x
Sordina IORT	Massimo Di Francesco				x
Elekta	Andreas Eriksson Jariden				x
Elekta	Bjorn Somell				x
Sordina IORT	Lorenzo Galluzzo				x

Actual Week Schedule

Meeting Focus:

	Monday, Oct 24	Wednesday, Oct 26	Wednesday, Nov 09	Thursday, Nov 10
Session 1 09:00-09:55	Setup, Administrative, Opening General Discussions	CPs	CPs	New RT Plan with non C-arm vendors
Session 2 10:00-10:50	General Discussions	CPs	Hybrid RT Dose	Hybrid RT Plan
Session 3 11:10-12:00	General Discussions	CPs	Hybrid RT Plan	Hybrid RT Plan
Session 4 12:05-13:00	General Discussions CPs	CPs Sup 213	Hybrid RT Plan	Wrap-up Next meetings Review Action Items

For details on the topics, see the sections below.

Details

Administrative

- The meeting was called to order October 24, 2022 at 9:05am EDT.
- Introductions, identify participants.
- Shayna reminded the group of NEMA anti-trust rules and DICOM Patent Disclosure Policy
- Reviewed the agenda and revise as needed.
- Reviewed meeting minutes from the last meeting(s).
 - Action items from the Aug 30-31, Sep 6-7, 2022 minutes were reviewed.
 - Minutes from the Aug 30-31, Sep 6-7, 2022 WG meeting were approved without objection or abstention.

Meeting overlap with IHE-RO

For the December meeting there is an overlap on Dec 7. Decision to move Dec 7 meeting to Dec 14, keep Dec 8 meeting.

Subgroups and related Group Status

Update reports will be only presented as needed:

- Brachytherapy Subgroup
- Ion Subgroup
- Motion Management Subgroup
- IHE-RO – HDSS Profile was presented to IHE-RO TC, to be presented to PC; DOSE profile
- IEC – working group to meet in the coming weekend.
- WG-28
- Other Subgroup reports as needed.

Organizational

TBD

General Discussions

Dose Reference UID vs. Conceptual Volume UID

During the definition of BRTO-III a discussion took place whether to include the Conceptual Volume in the RT Structure Set. Despite from a future use, the question came up what the benefit for existing profiles would be. One idea was that once a Dose Reference UID is put out for an ROI, the value of the UID shall be the same as the one defined in the RT Structure Set as the Conceptual Volume UID. WG-07 discussed whether this understanding should be strengthened in the DICOM Standard, aside from any hybrid RT Plan discussions.

- Further explanation of Dose Reference semantics is needed. Conceptual Volume and Dose Reference are not synonymous. “Dose Reference” is somewhat misleading.

- **ACTION:** Christof to draft clarification of Dose Reference semantics.

Consistent Dose for External Beam (IHE-RO)

During discussion of the CDEB profile by the IHE-RO TC the following questions came up:

Cumulated Dose Contributions for a Dose Reference

The CDEB profile, like the 2nd Gen Dose Contribution Module's Radiation Dose Values Parameters, distinguishes between two use cases for providing Dose: Tracking and QA. Depending on the specific use case, the dose contributions by all beams in a 1st Gen DICOM RT Plan, may either sum up to represent a nominal value (e.g. for dose tracking in the TMS a physician expects the prescribed value) or an actual dose value at a given coordinate (e.g. for re-calculation by a QA system).

But this semantic difference whether it is nominal or actual in the cumulated dose is not clear. The differentiation is made for the Beam Dose (see the Beam Dose Meaning (300A,008B)) within the Fraction Group, but there is no statement what this means for the contributions to Dose References.

The group should discuss whether this differentiation is needed and if so, how to convey the information.

Beam Dose

The topic was raised whether the Beam Dose is still relevant today. The following questions were raised:

- 1) If the Beam Dose (which is a type 3 attribute) is not present, what does this mean for the Cumulative Dose Reference Coefficient and the related calculations to determine the dose contributions by the beams?
- 2) As a more extreme approach: shouldn't the Beam Dose be always 1.0Gy (either by value, or if absent by definition) and thus the Cumulative Dose Reference Coefficients basically become absolute coefficients?

If so, it could also be considered to just introduce a Cumulative Dose Reference Dose in Gy.

This would for sure break some current implementations but would remove the need to differentiate between nominal and actual dose values. This approach was not considered to be practical.

Discussion

- Beam Dose (Gy) is not well defined. Concern expressed that there is confusion regarding the meaning of Beam Doses. Expanding the explanation of Cumulative Dose Reference Coefficient C.8.8.14.7 was discussed.
- Need to distinguish between QA (calculated) and Tracking (nominal) doses without requiring that they be separated into different instances.

ACTION: Christof to prepare a CP to add attribute(s) indicating dose value purpose to the Dose Reference Sequence for discussion in Dec 2022.

WG-21 Discussion – Cone Beam CT Indicator

Proposal to include Detector Geometry attribute (CURVED, FLAT) was rejected by WG-21.

What aspects of CBCT need to be identified? HU quality?

Proposal to meet with WG-21 chairs: “We need to know if an image is CBCT because...” Need to be clear about what we want to indicate. Why do we want this flag?

- Incomplete images
- Artifacts
- Uncertainty of HU

Discussion of using value 4 of Image Type (used for multi-energy CT). This is an orthogonal concept.

X-ray Angiography IOD has been suggested as a solution. Why can't we use this IOD?

What are the key needs for RT use of Cone Beam CT?

ACTION: Yulong to create a list of gaps in existing DICOM IODs for CBCT use in radiotherapy verification imaging.

CPs

See also: [WG-07 CP Status List](#)

CPs in Work

CP-1319 Frame of Reference Reliability

Uli Busch reviewed feedback from WG-2/21.

The group discussed the draft CP, including the wording of section C.20.2.1.X to clarify the semantics of Image SOP Instances in the Referenced Image Sequence. The text of this section describes some difficult concepts. WG members to review for discussion 10/26.

Further discussion (10/26) of the proposed wording for section C.20.2.1.X. A majority of the group felt that addition of the text was not needed.

Decision to cancel CP-1319. Uli to inform David Clunie and chairs of WG-2 and WG-21.

[Adjourned for the day 10/24 at 1:00pm EDT]

[Resume meeting 10/26 at 9:00am EDT]

CPs new to WG-07

cp_RT218 Add First Gen References to Treatment Preparation IOD

The RT Treatment Preparation IOD can be used in connection with RT 1st Generation RT Plans as well as with RT 2nd Generation Radiation Sets. However, the current Module does not support references to RT 1st Generation modules.

The RT Patient Position Scope Sequence is changed to include a referencing Macro (RT Patient Position Scope With Legacy Support Macro) which supports RT 1st Generation and RT 2nd Generation objects.

Approved for review with WG-06.

cp RT219 Update Interlock Codes for Ions

The CP adds codes to describe the interlocks that are specific to Ion treatments. Addition of codes was considered valuable. Discussion of additional (more generic) codes.

Action: Vendors were asked to review and provide input on any additional codes to be included.

cp RT220 Cleanup ROI Module

Clean-up of incorrect wording referencing “ROI Module” in RT ROI Observations Sequence Attribute Description.

Approved for review with WG-06.

cp RT221 Dose Reference UID vs Conceptual Volume UID

CP drafted by Christof.

With CP 2184 the Conceptual Volume UID was introduced to the RT Structure Set. The Dose Reference UID in the DICOM RT Plan is an existing concept that can directly benefit from the presence of a Conceptual Volume UID. Add a statement to the Standard to explain the relationship.

In addition, to strengthen this semantics, the Conceptual Volume Macro is added to the RT Prescription Module.

Discussion of the meaning of the “entity” that is linked by a Dose Reference UID.

The original intent of Dose Reference UID was to identify what location (volume or point) is irradiated and not to the dose limits to that location.

It was emphasized that a Dose Reference is not the same as a Prescription.

Discussion of what a Dose Reference represents and what it does not represent.

It is essential to clarify what is a Dose Reference for the IHE-RO BRTO-III and CDEB Profiles.

ACTION: Group members to write down their understanding of Dose Reference and include use cases for December meeting.

cp RT222 Strengthen Dose Semantics of Dose References

CP drafted by Christof.

With today’s clinical practice there exist two main use cases for the items in the Dose Reference Sequence: the use of a prescribed dose in a Treatment Management System for tracking progress of a treatment and for billing, and the definition of point dose values for QA purposes

to verify the correctness of the plan.

To strengthen the dose semantics of Dose References, the CP adds two attributes to the Dose Reference Sequence (300A,0010):

- The Dose Value Purpose (300A,061D), introduced with the RT Radiation Set IOD, to indicate the use case (TRACKING vs QA).
- A new attribute Dose Value Interpretation (gggg,eeee), to indicate how the accumulated dose is to be interpreted (NOMINAL vs ACTUAL).

An example plan with two Dose References was discussed. The Purpose and Interpretation attributes represent two distinct concepts. Both are needed.

ACTION: Christof to continue work on CP with examples for permutations of Purpose and Interpretation. Could we combine RT221 and RT222 as a single CP?

Supplements

Supplement 213: Enhanced RT Image and Rt Patient Position Acquisition Instruction

Uli reviewed updated conditions for the presence of various modality Acquisition Parameters Sequences in the Acquisition Instruction, based on Acquisition Signal Type and Acquisition Modality Attribute values rather than CIDs used. This was rejected by WG-06, who proposed a weaker condition: “required if parameters apply”.

Uli has proposed to stay on a stricter approach based on the value of work item codes in CID SUP21310. A similar approach has been used for RT Prescription. No objections were raised to this proposal.

ACTION: Uli to defend the current approach of the LB draft of Supplement 213 for review with WG-06.

[Adjourned for the day 10/26 at 1:01pm EDT]

[Resume meeting 11/9 at 9:05am EST]

IEC 62C Working Group 1

Kari reported on IEC standards discussed at the Oct 28, 2022 IEC working group meeting in San Francisco.

- 61217 Ed 3. Coordinates – WG7 expressed concern regarding inconsistencies with the existing standards

The IEC Working Group is currently limited to face-to-face meetings.

Cp RT221 and cp RT222

Discussion of these CPs was deferred, since Christof was unable to attend the meetings 11/9 and 11/10.

CPs in Work

cp_RT216 Extend RT Structure Set Definition

Deferred.

cp_RTNNN Reference Multiple RT Structure Sets from RT Plan

This is still pending, depending on the Hybrid RT Plan approach.

CP-RT214 4D Imaging Support

Kari discussed a proposal to include a Temporal Reconstruction Module in the CT Image IOD. This Module would define the Temporal Reconstruction Type (MaxIP, MinIP, Average, or Phase) and specify Temporal Phase.

Use of existing cardiac and respiratory synchronization macros (in the Enhanced CT Image IOD) was discussed. These macros are present at both the Instance and the Frame level. Discussion of whether these synchronization macros are usable for the 4DCT use case. In practice, only the nominal percentage of respiratory phase attribute is useful.

Temporal Phase Descriptor has three values: ordinal phase number, number of slices within the phase, number of phases.

ACTION: Kari to continue discussions with his CT colleagues in Siemens to prepare a proposal for WG-21.

CP-2229 Support of New MLC Types

Uli reviewed cp2229_vp2_SupportOfNewMLCTypes.docx with the group.

Enhanced RT Beam Limiting Device Definition Flag Attributes indicates the use of enhanced MLC specification, which is a breaking change for existing delivery systems. The group discussed a comment that this flag is redundant (can use another, conditional Sequence as an indicator). Consensus that binding the flag to any of the Sequences would be too arbitrary. Use of the Enhanced RT Beam Limiting Device Definition Flag enhances safety by making the conditions centralized and explicit.

Discussion of recoding the same plan using existing and new MLC representations. As long as there are no changes to the data (plan semantics), no change in Instance UID is required.

cp_RT219 Update Interlock Codes for Ions (revisited)

The CP adds codes to describe the interlocks that are specific to Ion treatments. Vendor comments on additional codes were reviewed.

- “Secondary Dose Monitoring System Interlock” – is this redundant with existing “Secondary Fluence Monitoring System” code?

[Continued work 11/10/22]

Bruce Rakes has included a complete set of existing codes and definitions in the CP to facilitate cleanup of additional codes. Existing code definitions were reviewed and revised for consistency with IEC terminology. Reference IEC standard 60601-2-1.

ACTION: Uli to clean up IEC references.

CPs with WG-06

CP-2185 Extend use of Treatment Session UID

In Letter Ballot.

New CPs

CP-RT223 Remove Scanning Spot Size from RT Ion Record

David Wikler reviewed a draft CP to remove the single Scanning Spot Size (300A,0398) Attribute from the RT Ion Beams Session Record Module to encourage use of the Scan Spot Size Delivered (300A,0399) Attribute (data stream of (x,y) pairs).

ACTION: David to upload draft CP. Christof to request CP number from WG-06.

Supplements

Supplement NNN – Assertion Collection

Workitem proposal for to be read with WG-06 in Nov 2022.

Hybrid RT

Hybrid RT Dose

Review of RT Dose IOD Modules from Sup 177 draft

1. RT DVH – add CV reference? should it be retired?
2. RT Dose Metrics - replacement for DVH? Should Dose Metrics be a separate SOP Class?
3. Enhanced RT Dose (C – required if Dose Summation Type is CONTEXT_DEFINED)
4. RT Dose Parameters (C – required if Dose Summation Type is CONTEXT_DEFINED)

Re-evaluation of the scope of RT Dose.

Use of Dose Summation Type value of “CONTEXT_DEFINED” was discussed. Is there a better switch for Enhanced RT Dose and Dose Parameters information?

Consider including “Iso-dose display parameters” (presentation state) in RT Dose IOD.

Hybrid RT Plan

WG-07 discussed representation of plans for non-C-arm treatment devices, including considerations for hybrid RT Plan usage (assumes dedicated treatment planning environment)

- Data needs for QA vendors
- PACS storage – store plan details encapsulated as a Raw Data SOP Instance
- Other considerations?

Options for representing non-C-arm plans:

- Hybrid RT Plan with flag to indicate hybrid/enhanced plan (breaking change).
- New SOP Class as a wrapper to encapsulate plan details and expose dose tracking information to a TMS.

Open Questions/Tasks from last meeting:

1. Jim and Kari to interview colleagues internally regarding their minimum need for plan/ record information for their TMS.
2. Jon to contact Viewray, Zap; Jim to contact GammaKnife; Christof to contact Reflexion to invite them to join the Oct/Nov 2022 WG-07 meeting. Background is what they would expect from a 1st Gen Plan: cover the “new” machines completely, or basically allow for dose tracking and recording only?

[Adjourned for the day 11/9 at 12:59pm EST]

[Resumed meeting 11/10 at 9:00am EST]

Discussion of new RT Plan with non-C-arm vendors

Representatives of non-C-arm delivery device vendors were invited to discuss their connectivity needs with WG-07.

- Plan Delivery but TMS update slowly

- 3rd Party Integration (including QA)
- Long Term Archive
- Patient Prep

Michael Owens (Reflexion)

- Customer expectations of connectivity represent a barrier to new vendors
- Working to implement “incomplete” RT Plan files
- Need for a “manifest” to provide plan information for integration with third party TMS, imaging applications
- Need patient setup, imaging and plan for ROIS
- Dose exists at multiple levels – no way to reference the context.

Giuseppe Felici (Sordina IORT Technologies)

- Robotic (non-isocentric) linac
- Challenging application for data
- Working on pre-op/operative image fusion

Discussion

- Some non-C-arm data is unique, other needs to be shared for integration.
- Need container that can reference DICOM objects and can be referenced by other DICOM objects.
- What needs to be shared?
 - Imaging information
 - Treatment record
- Can the standard be loosened by removing mandatory requirements on geometry?
- Dosimetric tracking
- Session recording

Summary / Hybrid RT Plan (continued)

- No isocenter, no CP dependency
- Good image review linking
- Use of “Manifest” to encapsulate proprietary data within RT Plan
- Public versus private boundaries
 - Need Association with dose delivery
 - Indication of treatment progress
- From the Tx Record what needs to be persisted? Plan information is used for scheduling, recording, billing
- Parallel operations are hard to represent on a single CP Sequence (e.g., breathing cycle on top of a delivery CP Sequence)

ACTION: Working Group members to examine RT Beams Treatment Record and RT Plan for breaking C-arm dependency.

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

Schedule

The list should be reviewed again, whether any adaptations are required since the last meeting.

[Teams Meeting List](#)

Next meeting (virtual) is scheduled for Dec 8, 2022 and Dec 14, 2022.

(The Dec 7, 2022 meeting was rescheduled to avoid conflict with IHE-RO XRTS Workshop.)

Anticipated face-to-face meeting June 5-9, 2023 in Europe.

ACTION: Venue to be decided in December meeting.

Appendix: General Information

I. Project List

The list of major projects pursued by WG-07 can be found [here](#).

II. Presentation Material for 2nd Generation RT Objects

A folder is maintained containing material of presentations on 2nd Generation topics.

Everyone is invited to use any material out of that folder for presentations.

In turn everyone should to add his presentations to this folder, if they could be of general use. As needed, take care to remove any company- or institution-confidential parts before posting.

<ftp://medical.nema.org/MEDICAL/Private/Dicom/WORKGRPS/Wg07/2ndGeneration/Presentations>

Minutes prepared by Walter Bosch and submitted by Shayna Knazik

Legal Bezalel Stern 12-22-23