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Meeting Minutes

DICOM WORKING GROUP SEVEN (RADIOTHERAPY)

Meeting Location	Online Meeting	
Dates and Times	Monday, April 12, 2021	9:00 – 13:00 EDT
	Tuesday, April 13, 2021	9:00 – 13:00 EDT
	Tuesday, April 27, 2021	9:00 – 13:00 EDT
	Wednesday, April 28, 2021	9:00 – 13:00 EDT
Presiding Officers	Christof Schadt, Co-Chair Jim Percy, Co-Chair	
Secretary	Shayna Knazik, MITA	

Participants

Affiliation	Name	Mon Apr 12	Tue Apr 13	Tue Apr 27	Wed Apr 28
AAPM	Walter Bosch	x	x	x	x
AAPM	Bruce Curran	x	x	x	x
AAPM	Yulong Yan	x	x	x	x
Accuray	Jim Beck	x	x	x	
Accuray	Bob Pekarek				x
Brainlab	Christof Schadt	x	x	x	x
Elekta	Jim Percy	x	x	x	x
IBA	David Wikler			x	x
ICT	Harold Beunk				
Mevion	Bruce Rakes	x	x	x	x
MITA/NEMA	Shayna Knazik	x	x	x	x
RaySearch	Marcus Bergman	x	x	x	x
RaySearch	Stefan Pall Boman	x	x		
RaySearch	Jon Treffert	x			
Self	Ulrich Busch	x	x	x	x
Sun Nuclear	Chris Pauer		x		
Varian	Kari Jyrkkälä	x	x	x	x
Varian	Thomas Schwere				

Actual Week Schedule

	Monday Apr 12	Tuesday Apr 13	Tuesday Apr 27	Wednesday Apr 28
Session 1 09:00-09:55	Setup, Administrative, Opening Group Status	CPs	General Discussions ("Beam Name") "regular" CPs	CPs for WG-06 June meeting
Session 2 10:00-10:50	ORGAN vs AVOIDANCE 1 st Gen vs. 2 nd Gen	CPs	Discuss hybrid adaption proposals	CPs for WG-06 June meeting
Session 3 11:10-12:00	1 st Gen vs. 2 nd Gen	CPs	Discuss hybrid adaption proposals	Discuss hybrid adaption proposals
Session 4 12:05-13:00	1 st Gen vs. 2 nd Gen	Hybrid 1 st / 2 nd Gen architecture	Discuss hybrid adaption proposals	

Minutes

Administrative

- Introductions, participants were identified.
- Shayna Knazik reminded the group of DICOM's antitrust rules and Patent Disclosure Policy.
- The group reviewed the agenda and revised as needed.
- Meeting minutes from the last meeting were reviewed and approved.

Subgroups and related Group Status

Updated reports were presented as needed:

- Brachytherapy Subgroup – reconsidering future of 2nd Gen objects
- Ion Subgroup – meeting in a few weeks, work on Radiations is nearing completion.
- Motion Management Subgroup – meeting next week
- IHE-RO – see notes below on organ vs. avoidance notes.
- IEC – none at this time.
- WG-28 – Supplement 212 XA Protocol Storage and Supplement 214 Cone Beam RDSR were both approved for Final Text. They are now turning their focus to a new Supplement on RDSR Informative Annex.
- Other Subgroup reports as needed: none at this time.

Organizational

Teams vs ftp for CPs – the group decided to maintain CPs working drafts in Teams, then to copy the final version to the FTP. Let Shayna know if you have any issues saving to the FTP.

General Discussions

ORGAN vs. AVOIDANCE

What RT ROI Interpreted Type to use for an OAR? See also CP RT 174 below. This issue came up during the recent IHE-RO 2021A Connectathon.

- Some confusion regarding usage of defined terms for RT Interpreted Type
- Coding (2nd Gen) defines what an ROI is and what role it plays
- RT Interpreted Type expresses the role played by the ROI

Proposed CPs

- Add OAR defined term for RT ROI Interpreted Type
- Add Baseline CIDs to coding attributes in RT Structure Set
- Clarify semantics of ROI Interpreted Type defined terms

ACTION: Christof to draft CPs for #1, #2

1st Gen vs. 2nd Gen

Follow-up with the discussion of the last TCon, March 31st, and see if other opinions came up.

1. Proposal (Uli) to focus on export of treatment planning data to research and clinical trials in initial implementation.
 - Clinical trials use (mostly) commercial infrastructure
2. Implementation challenges vs deadlock?
 - How can management be motivated to choose development of a better technology?
 - Can we identify the gaps?
 - It is always difficult to justify the cost of infrastructure development to management
 - Engineering bandwidth is a significant limitation
3. Clinical trends (Yulong)
 - New workflow: increased importance of adaptive RT
 - New technology
4. As long as no TMS supports 2nd Gen Radiation Sets, there is no motivation for TPS vendors to develop 2nd Gen support.
5. Motivation comes from customers and government.
6. Would a demonstration of the benefits of 2nd Gen help motivate development?
7. Companies are generally resource-limited. DICOM connectivity allows changes to a product stack.
8. Low-hanging fruit
 - What enables new capabilities. e.g., Prescription (consider separating prescription and dose tracking)
 - Physician Intent
 - Adaptive Workflow management, including RT Course.
 - Patient setup
 - Verification imaging
9. How to communicate benefits of 2nd Gen to the users that influence vendors (physicians, esp., health system leadership)?

Preparation for detailed discussion

1. List of 1st and 2nd Gen IODs, include those envisioned.
 - a. Data model / real-world model
 - b. Identify dependencies for each IOD
2. Options to explore
 - a. Prescription IOD
 - b. Consider “new machine” RT Plan extensions of non-C-arm vendors
3. Re-consider modifications of 1st Gen IODs
 - a. Safety is paramount – any change must avoid unsafe misinterpretation

Correction Proposals

CPs new to WG-07

cp RT174 Align RT Structure Set Codes with Segmentations

Based on the discussion regarding the semantics of defined terms of RT ROI Interpreted Type, this CP adds the **OAR** defined term (as defined in ICRU Report 50) to the RT Interpreted Type attribute. This CP was approved for reading by WG-06.

cp RT175 Retire Beam Dose Depth Parameters

Continue the discussion which QA vendors to contact and how to proceed. Attributes include Beam Dose Point Depth, Beam Dose Point Equivalent Depth, Referenced Dose Reference Sequence.

CPs 614, 935, 1138, 1658 addressed beam dose depth parameters. Parameters were moved to provide support for multiple targets.

WG-07 members to contact QA vendors to check on their use of Standard Attributes for secondary dose calculation. The list of vendors and assigned WG-07 members can be found here:

https://nemaorg137.sharepoint.com/sites/DICOMWG-07Radiotherapy/_layouts/15/Doc.aspx?OR=teams&action=edit&sourcedoc={BF20AB0B-EA33-42E7-9F07-BD6D06ECAA46}

The group will reconsider whether to maintain or retire the original parameters.

- It was noted that the original parameters did not support dose calculation for multiple targets.
- The group should also check to assure support for Ion Plan dose calculation.

cp RT166 Differentiate Geometric Types of CT Imaging Sources

Shayna contacted WG-28 who recommended to forward the CP to WG-21. From there we received feedback on the document, see details [here](#).

A definition of Cone Beam CT is needed. Response from WG-21 suggests referencing an IEC definition. Relevant IEC documents appear to be 60601-2-44 (X-ray Equipment for CT) and 60601-2-68 (X-ray Based Equipment). However, review of these documents did not yield any helpful definitions: CONE BEAM COMPUTED TOMOGRAPHY (CBCT) = computed tomography performed using a cone beam of X-RADIATION.

ACTION: Yulong to search for publication(s) to reference for definitions CBCT and related concepts, including half-fan geometry. E.g., references in AAPM TG-180.

cp 179 Treatment Record update for IEC60601-1-1 ED4

Kari presented a draft CP to record an interlock in a RT Beams Treatment Record.

The Interlock Macro was reviewed.

- Interlock Resolution User Sequence – for interlocks which will terminate the treatment, there is nothing for the user to resolve. Sequence was changed to Type 2.
- Delivered Treatment Time – should this attribute include beam hold intervals? -Choose include or exclude and review PC responses from treatment delivery device vendors.
- Beam Hold Transition states – add reference to IEC
- Beam Hold Originating Device Sequence – Type 1C (required there are multiple devices that can hold the beam)

Add Calibration Parameters / Keys to Treatment Record

- Recorded Parameters are those received in the RT Plan (if present) and checked against calibration parameters in the machine (if matched)

cp 178 Treatment Plan update for IEC60601-1-1 ED4

CP includes requirements for RT Plans needed to implement IEC safety standard.

- Dose Calibration Conditions Sequence (Type 3)
 - Calibration information: Absorbed Dose to Meterset Ratio
 - Beam Opening
 - Calibration reference point depth
 - Source to surface distance
- Calibration Key(s) Sequence (Type 2)

ACTION: Kari to update both CPs for review in two weeks.

Hybrid 1st Gen / 2nd Gen RT Objects Discussion

Goals of discussion

1. Solve current problems with 2nd Gen RT concepts
2. Define a realistic path to adoption of 2nd Gen RT objects

The group reviewed a hybrid data model diagram and 1st Gen Maintenance issue list (spreadsheet)

1. RT Plan at center, references other objects
 - a. Prescription
 - b. Segment Annotation / (Surface) Segmentation / RT Structure Set

- c. Radiation / Radiation Set
 - d. Dose
 - e. Treatment Preparation
 - f. Record
2. RT Radiation Set, RT Radiation reference RT Plan
 3. Dose Map – make references to RT Plan and RT Radiation Set mutually exclusive?
 4. RT Physician Intent is nearly ready to use.

Proposal to create an enhanced RT Plan Module to reference 2nd Gen objects.

Adaptive RT issues include fraction counting, management of segmentation/plan revisions, and dose compositing.

Proposals for adapting existing IODs to be prepared for discussion April 27-28:

- RT Plan Module (Uli)
- RT Dose (Christof)
- RT Physician Intent (Kari)
- RT Patient Treatment Preparation / Setup (Jim)
- KOS (Yulong)

Meeting adjourned 12:56pm ET 4/13/21

General Discussion

“Beam Name”

WG-07 discussed an issue raised on the MedPhys list. There is inconsistent usage of beam identifiers and descriptions among TMS manufacturers.

At least one system uses a private tag as the beam identifier displayed to the user. Some concern that the Beam Name (Type 3, limited to 16 chars by IHE) is not sufficient for clinical descriptions and Beam Description (Type 3, 1024 chars) is too long to be useful for beam summary information.

- Proposal: Reuse the Entity Long Label (3010,0038) from 2nd Gen. Add Entity Long Label to RT Plan as a Type 3 Attribute.
- **ACTION:** Christof to draft CP for discussion 4/28

Block and Slabs

David Wikler discussed an issue involving physical blocks used in ion therapy that are constructed from multiple slabs (because of their weight).

- The Ion Block Sequence contains a Block Slab Sequence to describe multiple slabs. An Accessory Code (300A,00F9) is used to distinguish slabs of a block.
- The RT Ion Beams Treatment Record does not contain a Block Slab Sequence. It reports Accessory Code, but cannot explicitly indicate the block slabs used for treatment.
- If there are multiple aperture blocks, only a single physical block may be present.

Proposal: Add Recorded Block Slab Sequence (containing an Accessory Code) to RT Ion Beams Treatment Record.

- Is the Referenced Block Slab Number useful?
- **ACTION:** David to draft a CP (#181) with the changes discussed.

Assigned CPs

cp 178 Treatment Plan update (continued)

The CP adds the following calibrate parameters to RT Beams Module

1. Dose Calibration Conditions Sequence
 - a. Absorbed Dose to Meterset Ratio
 - b. Beam Opening
 - c. Calibration Reference Point Depth
 - d. Source to surface distance
 - e. Calibration DateTime (Type 2) is needed for decaying sources
2. Radiation Device Configuration and Commissioning Key Sequence

For the RT Beams Treatment Record, the parameters are the calibration conditions of the machine. Add the following

1. Dose Calibration Conditions Verified Flag (YES, NO)
2. Dose Calibration Conditions Sequence and Radiation Device Configuration and Commissioning Key Sequence are Type 1C, required if Dose Calibration Conditions Verified Flag is present and YES. May be present otherwise.
3. Dose Calibration Conditions Sequence is required only if Radiation Device Configuration and Commissioning Key Sequence is absent. May be present if Radiation Device Configuration and Commissioning Key Sequence is present.
4. Radiation Device Configuration and Commissioning Key Sequence is required only if Dose Calibration Conditions Sequence is absent. May be present if Dose Calibration Conditions Sequence is present.

If multiple keys are present in the RT Beams Module, then ALL specified keys must match keys on the machine.

ACTION: CP 178 draft to be forwarded to WG-06 for review in June 2021.

cp 179 Treatment Record update (continued)

The group reviewed edits to this CP.

Interlock Macro – describes an interlock of a device that interrupts normal operation. (Macro is not RT specific.)

- Interlock Resolution User Sequence – changed from Type 1 to Type 2.
- Interlock Resolution Code Sequence – changed from Type 1 to Type 2. (Interlock resolved by terminating treatment.)
- Delivered Treatment Time – need to clarify whether this includes beam holds
- Gating Beam Hold Transition Sequence – records beam hold due to beam gating function
 - Beam Hold Transition
 - Beam Hold Transition DateTime
 - Beam Hold Transition Originating Device
-

ACTION: CP 179 draft to be forwarded to WG-06 for review in June 2021

RT Dose Issue

Discussion of RT Dose linkage to Structure Set. Proposed changes include the following:

1. Add Referenced Structure Set Sequence
2. Add Defined Term (UNKNOWN_PLAN) to Dose Summation Type --> no reference to RT Plan

3. Add "Surrogate Sequence" Required if Dose Summation Type is UNKNOWN_PLAN, may be present otherwise. Single item. Sequence to include
 - a. # fractions represented (Type 1)
 - b. Rx Dose/Fraction (Type 2)
 - c. Rx Site (Type 2)
 - d. RT Plan Label (Type 2)
4. Entity Labeling Macro

Adjourned for the day 1:05pm ET 4/27

Resumed meeting 4/28 at 9:15am ET

RT Dose (continued)

Review of CP draft prepared by Christof. Issues discussed include

- Reference to ROI for Prescription Overview Sequence
- Plan Overview Sequence
 - More than one items indicates that the dose is not a multiple of a single fraction dose.
 - Required if Dose Summation Type is UNKNOWN_PLAN, may be used otherwise.
- Plan Overview Sequence (1+ items)
 - Plan Overview Index
 - RT Plan Label
 - Number of Fractions
 - Treatment Site Code Sequence
 - Prescription Overview Sequence
 - Total Prescription Dose
 - Referenced ROI Number
 - Referenced Structure Set Sequence
- **ACTION:** Christof to finish TODOs and forward to WG-06

Hybrid Discussion

1. Shayna has created "1st Gen Hybrid Extension" channel in Teams
2. Conceptual Volume / Prescription (Kari)
 - a. How to Prescription in RT Plan?
 - Reference to RT Prescription is straightforward
 - Conceptual Volume is more challenging, especially the CV Originating Sequence.
 - Clean up (simplify) RT Prescription IOD?

- Proposed changes to be discussed at the next meeting. A new Supplement is not needed.
3. RT Plan Extensions (Uli)
 - a. Use of Dose Contribution Module
 - b. Use of 2nd Gen Macros in RT Beams Module
 4. Constituent Mapping for RT Plan (CP RT155) (Christof)
 5. RT Dose (Christof)
 - a. Removed Parametric Map
 - b. Created Enhanced RT Dose Module in RT Dose IOD
 - i. Dose Context Macro
 - ii. Conceptual Volume
 - c. Use Dose Context rather than Dose Summation Type
 - d. Changes require a Supplement
 6. Enhanced RT Image (Jim)
 - a. What is required to reference RT Plan from Enhanced RT Image?
 - b. Patient Position Acquisition Instructions apply to beams in RT Plan.
 - c. New geometric paradigm for correcting patient position in 2nd Gen.
 7. KOS Solutions in RT (Yulong)
 - a. KOS defined in Supp 59
 - b. Purpose of Reference is very weak.
 - c. No support for change in TID in WG-06
 - d. Adding semantics would involve substantial effort

CP Reviews

1. CP_RT180 Add Entity Long Label to Beam Sequence in RT Beams Module (Christof)
 - a. Note was revised
 - b. ACTION: Approved to forward to WG-06
2. CP_RT181_AddBlockSlabSeqToIonRecord (David)
 - a. Adds Recorded Number of Block Slab Items and Recorded Block Slab Sequence to RT Ion Beams Treatment Record
 - i. Add Accessory Code in Recorded Block Slab Sequence to identify the slab that was recorded.
 - b. Clarifies that Number of Blocks is the number of blocks (shielding or aperture) that was present during treatment.
 - c. Clarify Referenced Block Number

- d. **ACTION:** Approved to forward to WG-06
3. CP_RT182_AddAnatomicRegionToRTPlan
- a. Adds Treatment Site to RT Plan to satisfy IEC requirements
 - b. Options discussed:
 - i. Use existing Treatment Site Attribute?
 - ii. Use Anatomic Region Codes and retire Treatment Site Attribute?
 - 1. General Anatomy Optional Macro or General Anatomy Required Macro?
 - c. WG-07 to finish review of this CP in June.

Next meeting

- June 7-8, 14-15, 2021

Meeting adjourned at 1:03pm ET 4/28/21

Prepared by Walter Bosch
Submitted by Shayna Knazik
Reviewed by Counsel 6/10/21