DICOM
Second Generation Radiotherapy

Supplement 175
C-Arm RT Treatment Modalities

DICOM Working Group 07

Radiotherapy

Rationale

Shortcomings of current Radiotherapy Objects ‘RT 1st Generation’

Radiotherapy Workflow Representation:

- Basically all function points in one IOD: RT Plan (beside Treatment Records)
- No independent IOD for Prescription
- Not suited for adaptive character of today’s radiation therapy processes (1st Generation originated from a model of one-time planning, which is outdated today)

-> Hard to use 1st Generation IODs in a dynamic workflow environment

Conclusions:

- New set of IODs is needed
- Partitioned along the different function points of the workflow
- Each object has its dedicated role
- Extensible for new treatment techniques, positioning technologies, etc.

Rationale

Shortcomings of RT Plan IOD

Over-extended Scope

- Treatment parameter definition for treatment delivery: OK
- Besides delivery, various other workflow elements are represented in the same object (prescription, positioning etc.)
- Prescription: only basic information and scope of data not defined
- Positioning: just basic information, no extensibility
  No way to cover new technologies (unless extending the RT Plan even further)

Not Extensible for new Treatment Technologies

- Unbalanced, historically grown structure:
  - Photon / Electron Beam and Brachytherapy together in one IOD
  - Ion Therapy as separate IOD
  - Three Treatment Record IODs for two plan IODs
- No concept how to represent new treatment delivery devices

RT Radiation Set IOD

Main Object of a Radiotherapy Treatment Fraction

- Container of all contributions of therapeutic radiation dose
- Represents the therapeutic radiation dose
  - In a generic way
  - Uses Conceptual Volumes as dose tracking entities
  - Concept of physical and radiobiological dose addressed

Independent of Treatment Device and Treatment Technique

- References RT Radiation IODs of any device
- New RT Radiation IODs can be integrated seamlessly

Overview

RT Treatment Fraction Level
(Technique-independent)

RT Radiation Set IOD

Modalities of Sup 175

- C-Arm Photon RT Radiation IOD
- C-Arm Electron RT Radiation IOD

Modalities of Sup 176

- Tomotherapeutic RT Radiation IOD
- Multi Fixed Source RT Radiation IOD
- Robotic RT Radiation IOD

Future IODs for known Techniques

- Ion RT Radiation IOD
- Brachy Therapy RT Radiation IOD

More Future IODs, any time as needed

- New ABC RT Radiation IOD
- New DEF RT Radiation IOD

Radiation IOD

Technique-independent Modules

- Serve as container of all Radiation IODs which constitute a radiotherapy treatment fraction
- Represent the therapeutic radiation dose
  - Generically (although concept of physical and radiobiological dose are addressed)

Technique-specific Modules

- Accommodate specific treatment parameters
- Use of generic building blocks as needed by the specific technique

Radiation IOD

Control Points

- Proven concept kept in place
- Optimized value change representation

Energy and Radiation Type

- Rich model, including Beam Generation Modes (“FFF”, etc.)
- Re-usable representation

Device-Components, Beam Modifiers

Re-usable build blocks (Macros) for:

- Beam Limiting Devices (Collimators, MLCs)
- Applicators
- Compensators
- Blocks
- Wedges
- Others in future as needed

Generic scheme for identification and classification

- High re-use of ‘header data’

Radiation IOD

Generalized Geometric Information

- IEC 61217 coordinate system where applicable
- Other coordinate systems possible as well
- Always based on Frame Of Reference Formalism
  - Generic registration of Patient FOR to Device FOR
  - Transformation instead of specific Patient Positioner Parameters
  - Specific Patient Positioner Parameters as annotation available, too

Reduced Optionality

- Essential Information mandatory (Type 1)

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