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character of today's radiation therapy processes (1st Generation originated from a model of one-time planning, which is outdated today)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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