DICOM
Second Generation Radiotherapy

Ion Therapy And Brachytherapy Radiation IODs

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Functional Scope

Ion Therapy and Brachytherapy in 2nd Generation RT

Current Coverage of RT Treatment Modalities:

In Work (Reading for LB):

- Sup 175: Conventional C-Arm IODs
- Sup 176: Other Photon Modalities IODs

In preparation:

- Ion Therapy IODs
- Brachytherapy IODs

(above 2 sectors cover 95+% of Radiotherapy)

Remainders: No activity

(2nd Gen integration path available)

- Niche technologies without interoperability stakeholders
- Upcoming future technologies

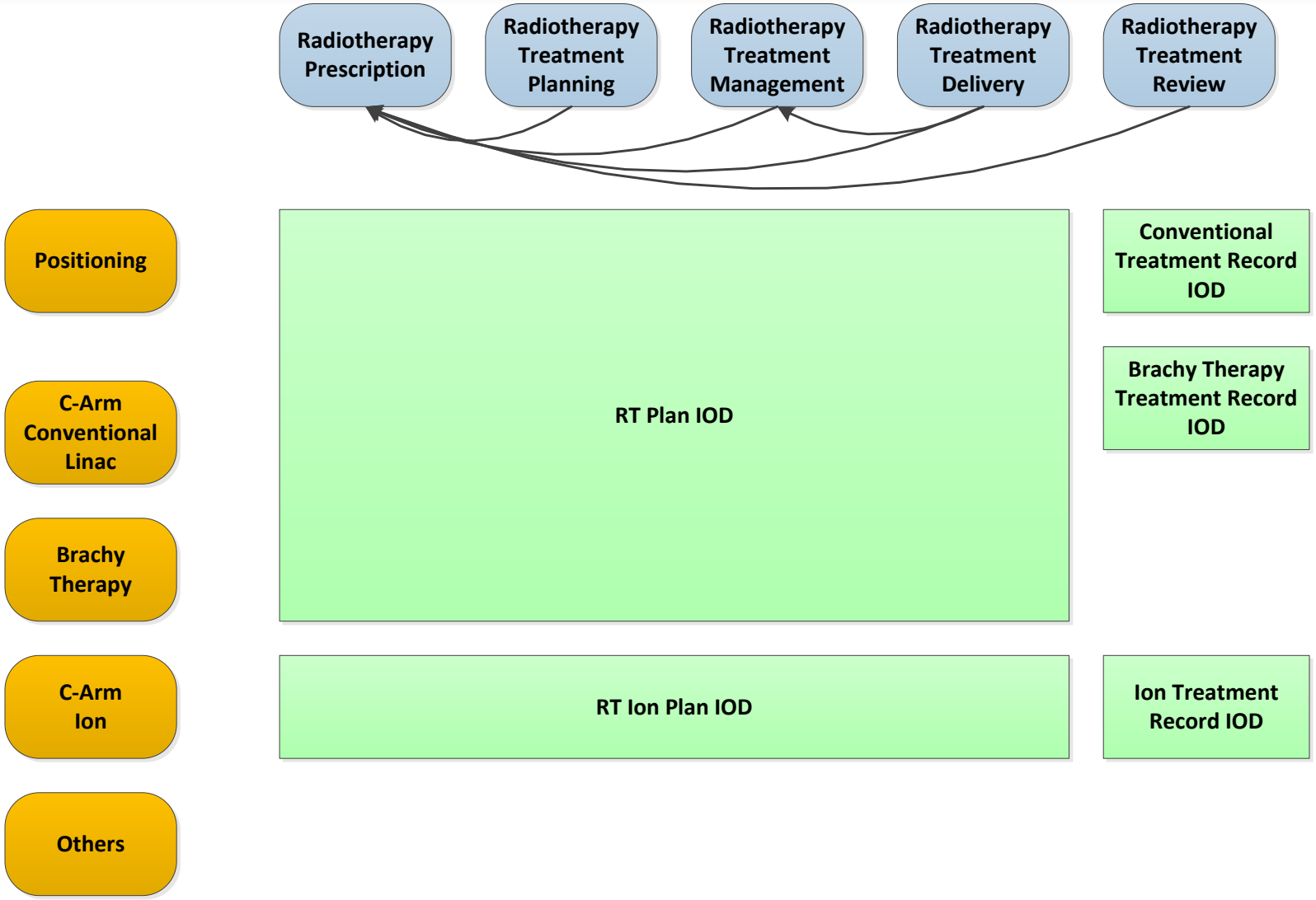
Rationale (2nd Gen General)

Shortcomings current 'RT 1st Generation'

IOD Representation of Radiotherapy Workflow:

- Almost all functionality in just one IOD:
  RT Plan
  (besides Treatment Recording)
- Unbalanced IOD structure
- 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  (1st Generation originated from a model of one-time planning, which is outdated today)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

Rationale (2nd Gen General)



Rationale (2nd Gen General)

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 (Treatment Plans)

Shortcomings of 1st Generation RT Plan IOD

Over-extended Scope

- Treatment parameter definition for treatment delivery: Kind of OK
- Tries to cover more than delivery, various other workflow elements are represented in the same IOD (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)

No Extensibilty 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

Rationale (Treatment Plans)

Shortcomings of 1st Generation RT Plan IOD

Treatment Content

- Historically grown beam representation
- No general device description approach
- No generic building blocks for beam modifiers
  - Beam Elements (Jaws, MLCs, Cones, Wedges, Blocks etc…)
  - Beam Parameters (Generic Control Point Framework)

No generalized geometric concepts

- C-Arm only
- or Brachytherapy-specific annotations
- General 3D concepts missing

Data Representation

- Various detailed issues with current attributes
- Hardly any coding
- Different IODs

General Goals

Bring Ion Therapy and Brachytherapy in line with 2nd Generation RT

- **Exploit 2nd Gen Achievements**
  - E.g. Conceptual Volume for Dose Tracking
- **Do the same as for Modalities which are covered already**
  - By Supplement 175, 176
- **Enable cross-modality workflows**
- **Integrate Brachytherapy and Ion Therapy into new 2nd Generation RT Framework**

2nd Gen Systematics

Sup 175

RT Treatment Framework
(Technique-independent)

- RT Radiation Set IOD
- Generic Parts of RT Radiation IODs

Conventional C-Arm

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

Sup 176

Other Photon Modalities

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

New Sups

Ion and Brachytherapy

- Ion RT Radiation IOD
- Brachytherapy RT Radiation IOD

More Future IODs ...
...any time as needed

- New Device A RT Radiation IOD
- New Device B RT Radiation IOD
- ... RT Radiation IOD

Main Workitem Goals

Main Goals for 2nd Generation RT Radiation IODs

- **Well-defined Scope for specific IODs**
- **Re-use of Generality versus Specificity**
- **Extensibility (new Treatment Techniques)**
- **Precision, Cleanness, Efficiency**
- **Re-usable Building Blocks**
- **Generalized Geometry**

Workitem Content

Modality–specific Content

Ion Therapy: appr. 4 IODs

- Modulated Scanning
- Line Scanning
- Uniform Scanning
- Single / Double Scattering)

Brachytherapy: appr. 2 IODs

- High-Dose Brachytherapy
  - HDR (High-dose rate)
  - HDR (Pulsed-dose rate)
- Low-Dose Brachtytherapy
  - Temporary Seeds
  - Permanent Seeds

General Content

None

- Generic framework available:
  (as explained in Rationale slides)
- provided by Supplement 147 and 175
- Workitem can focus on specific treatment modality only

Contacts

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