

**DICOM**

**Second Generation Radiotherapy**

**Ion Therapy And Brachytherapy**

**Radiation IODs**

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## Ion Therapy and Brachytherapy in 2<sup>nd</sup> 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

*(2<sup>nd</sup> Gen integration path available)*

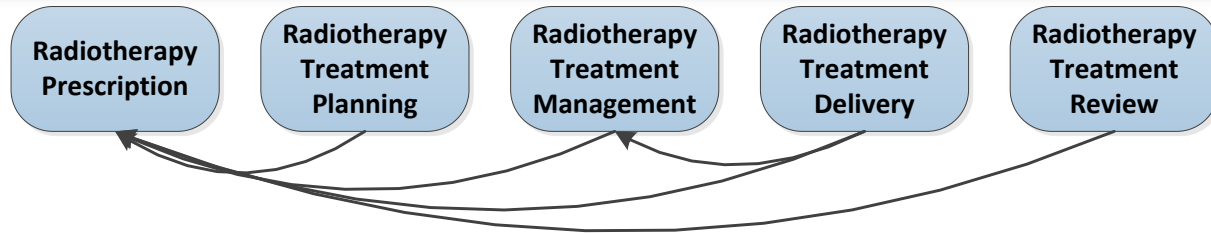
- Niche technologies without interoperability stakeholders
- Upcoming future technologies

## Shortcomings current 'RT 1<sup>st</sup> 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  
    (1<sup>st</sup> Generation originated from a model of one-time planning, which is outdated today)
- → Hard to use 1<sup>st</sup> Generation IODs in a dynamic workflow environment

# Rationale (2<sup>nd</sup> Gen General)



Positioning

C-Arm  
Conventional  
Linac

Brachy  
Therapy

C-Arm  
Ion

Others

RT Plan IOD

RT Ion Plan IOD

Conventional  
Treatment Record  
IOD

Brachy Therapy  
Treatment Record  
IOD

Ion Treatment  
Record IOD

## 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.

## Shortcomings of 1<sup>st</sup> 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 Extensibility 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

## Shortcomings of 1<sup>st</sup> 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

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

- **Exploit 2<sup>nd</sup> 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 Goals for 2<sup>nd</sup> 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**

## 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 Brachytherapy
  - 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

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