

DICOM

Second Generation Radiotherapy

Supplement 176

Tomotherapeutic, Multiple Fixed Source and Robotic Treatment Modalities

Scope and Field of Application

Following the definition of the RT Radiation composite IOD for the most common external beam radiation therapy machine (C-Arm Linac), this supplement adds IOD definitions for three external beam radiation therapy machines that do not fit the C-Arm Linac geometry.

In this way, the structure of data that is being established for 2nd Generation RT can be maintained while defining the right format of data for these particular machines.

General shortcomings of current Radiotherapy Objects in 'RT 1st Generation'

Radiotherapy Workflow Representation:

- Basically all function points of RT Workflow in one IOD: RT Plan (besides Treatment Recording)
 - 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character of today's radiation therapy processes (1st Generation originated from a model of one-time planning, which is outdated today)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.

2nd Gen Overview

Sup 175

RT Treatment Fraction
(Technique-independent)

RT Radiation Set IOD

Generic Parts of RT Radiation IODs

Modalities of Sup 175

**C-Arm Photon
RT Radiation IOD**

**C-Arm Electron
RT Radiation IOD**

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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**

**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**

Sup 175:

Introducing general concepts: see later slides

- Concept of RT Radiation Set IOD
- Concepts of RT Radiation IODs
- Various Payload Concepts like
 - Control Points
 - Dose Accumulation
 - Beam Modifier Macros

Introducing one 2nd Gen RT Radiation IOD for:

- conventional Photon / Electron C-Arm Linacs

Sup 176:

Introducing three more 2nd Gen RT Radiation IODs for:

- Tomotherapeutic Treatment Devices
- Multi-Source Treatment Devices
- Robotic Treatment Devices

based on Sup 175 Concepts

represents also template for future additions of new RT Radiation IODs for more treatment devices

A.VV.1.6 Tomotherapeutic Radiation IOD

This machine is characterized by its ability to continuously rotate within a covered gantry (like a CT) while the patient is moved through the bore longitudinally by the treatment table top. It uses a binary MLC for modulating the beam and thus its beam limiting device (a Multi-Leaf Collimator or MLC) only has an in or out setting rather than a millimeter position setting.

Device-specific IOD Content:

- Photon/Electron radiation type
- Multi-revolution Arc Treatment (using 2nd Gen Continuous Angle representation)
- Binary MLC
- Fractional leaf opening
- Couch speed
- IEC 61217-like Device Geometry



A.VV.1.9 Multiple Fixed Source Radiation IOD

This machine is characterized by a fixed mounting of many decaying sources (Cobalt 60, but potentially others as well) in a large, semi hemispherical dome that fits over the patient's head and neck area. The object defines the source locations, directions and source sizes to use for the desired treatment. The patient is not moved during treatment.

Device-specific IOD Content:

- Use of decaying Radiation Sources
- Specification of source strength
- Grouping of sources
- Use of delivery pattern
- Time-driven
- Spherical Device Geometry



A.VV.1.10 Robotic Radiation IOD

This machine characterized by a small linear accelerator mounted on a robotic arm. There is only one source of radiation but it can be directed from a large number of directions that is no longer constrained by mounting on a C-Arm. These directions are achieved by combinations of gantry and table top angles that are being reported by this object. The beam limiting device of this machine can be a fixed cone size or an MLC.

Device-specific IOD Content:

- Photon/Electron radiation type
- Path definitions
- Definition of treatment along patterns
- 3D Room Device Geometry
- Specification of Source and Target point as 3D coordinates



2nd Gen Radiation IODs



For details regarding the underlying RT Radiation Concepts, please review the presentation for Supplement 175.

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