Advanced-Technology QA Consortium
DICOM Workshop:

ATC Conformance Statement Overview

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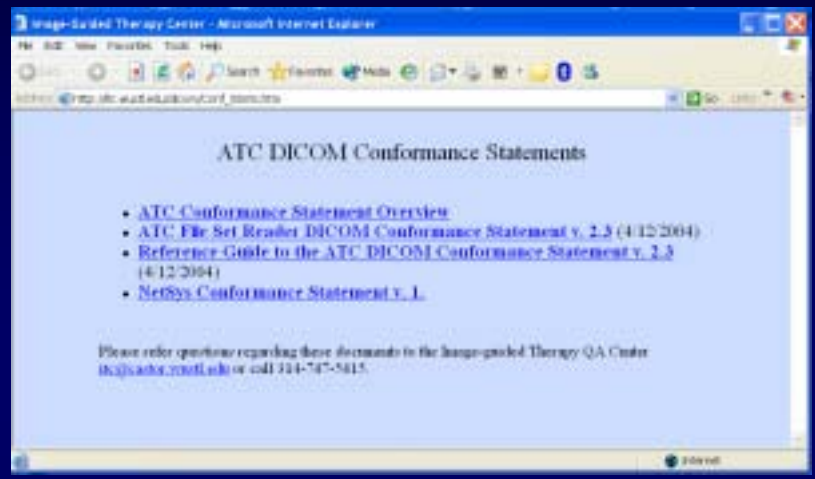
Providing support in quality assurance and data management for radiation therapy clinical trials

ATC DICOM Conformance Statement

- Overview
- DICOM Part 10 File Set Reader Application (ITC) – Defines DICOM Information Objects needed to submit a protocol-compliant data set



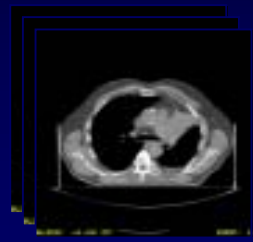
- NetSys DICOM Storage Service Class Provider Application (RCET) – DICOM (DIMSE) receiver/Data Submission application
- "Reference Guide for ITC DICOM File Set Reader Conformance Statement" – ATC Special Requirements for DICOM Objects

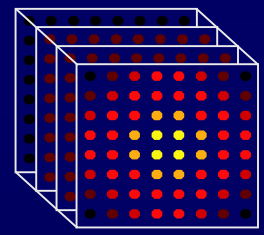
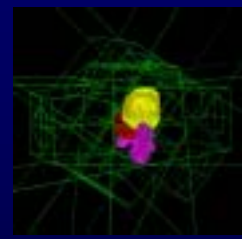
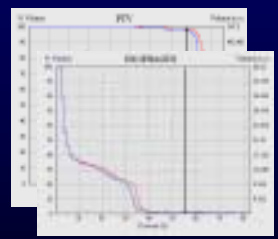
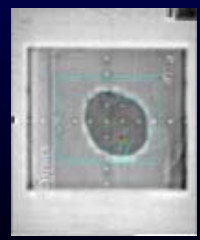
Caveat!

- The ATC DICOM Conformance Statement describes a DICOM-conformant file set, which complies with ATC requirements for clinical trials digital data submission.
- However, the ATC File Set Reader *may* accept data which is *not* entirely DICOM conformant.

Data for Advanced-Technology Clinical Trials in Radiotherapy

- **Primary data** (patient model, dosimetry)
  - Patient Volumetric Image (CT)
  - Structures: GTV, CTV, PTV, OAR
  - 3-D Dose Distribution (including fractionation information)
- **Secondary data** (QA of primary data)
  - Beam/Source Geometry
  - Dose-Volume Histograms
  - Digital Simulator and Portal Images



ATC Methodology for Support of RT Clinical Trials

- Examine all modules for supported IODs
  - Type M must be supported
  - Type C, U are supported if appropriate for clinical trials
- Examine each attribute of the supported modules to identify
  - Type 1, 2 – are there any special issues?
  - Type 1C, 2C – is the condition met?
  - Type 2 – do we need non-NULL value?
  - Type 3 – do we need the attribute?

Attributes Listed in Conformance Statement

- Attributes listed in Conformance Statement tables must be present in DICOM objects submitted to the ATC.
- Additional requirements for attributes listed as type 2* or 3
- Be sure to check conditions on type 1C, 2C attributes.

Type	DICOM Requirement	ATC Requirement
1	Must be non-NULL	Must be non-NULL
2	May be NULL	May be NULL
2*	May be NULL	Must be non-NULL
3	May be absent	Must be non-NULL

A.9.4.1-A.9.4.8 SOP Class Descriptions

MR Image IOD						
Ref #	**DICOM Module**	**Attribute Name**	**Tag**	**Type**	**VR**	**Comments**
C.8.3.1	MR IMAGE (IMAGE PIXEL)	Bits Allocated	(0028,0100)	1	US	
C.8.3.1	MR IMAGE	Scanning Sequence	(0018,0020)	1	CS	See note on ITC recommended usage, below

- Ref # – references a section in DICOM PS 3.3
- DICOM Module – indicates the Information Object Module in which attribute is defined. (IMAGE PIXEL) indicates a modality-specific specialization of an attributed defined in the IMAGE PIXEL module.
- Attribute Name
- Tag
- Type: 1, 2, 2*, 3
- VR
- Comments – indicates usage requirements specific to ATC

Clinical Trials Identification

- Data for a clinical patient must be de-identified and associated with a clinical trial subject.
- DICOM Supplement 70 (Jan. 2003) introduced Clinical Trials ID modules which include 10 new attributes can be added to any DICOM object to identify
  - Clinical trial sponsor
  - Clinical trial protocol
  - Clinical trial subject

Clinical Trials Identification Attributes

Field	Tag	Type	Comment
Clinical Trial Sponsor Name	**(0012,0010)**	**1**	**Protoocol Sponsor**
Clinical Trial Protocol ID	**(0012,0020)**	**1**	**Protocol Number**
Clinical Trial Protocol Name	(0012,0021)	2	(not needed)
Clinical Trial Subject ID	**(0012,0040)**	**1C**	**Case number**
Clinical Trial Subject Reading ID	(0012,0042)	1C	(not used)
Clinical Trial Site ID	(0012,0030)	2	(RPC RTF number ??)
Clinical Trial Site Name	(0012,0031)	2	(Institution name ??)
Clinical Trial Time Point ID	(0012,0050)	2	(optional: “INITIAL”, “FINAL”, “SUPPLEMENTAL”)
Clinical Trial Time Point Description	(0012,0051)	3	(not used)
Clinical Trial Coordinating Center Name	(0012,0080)	2	(not used)

Inclusion of Objects in File Sets

- Context for interpreting objects
  - RT Structure Set → CT Image
  - RT Plan → RT Structure Set
  - RT Dose → RT Plan, RT Structure Set
  - RT Image → RT Plan
- ***RULE OF INCLUSION***: If an Object Instance is referenced (by UID) within a DICOM File Set, then it must be present in that File Set. (***COROLLARY:*** Always include everything.)
- Object references (SOP instance UIDs, Frame of Reference UIDs) must be correct. (This is especially important for automated processing of submitted data.)

Maintaining Object Linkage

- Submission software should check that referenced objects are available for submission.
- References are by SOP Class UID/ SOP Instance UID (RT objects), or by Frame of Reference UID (Images)

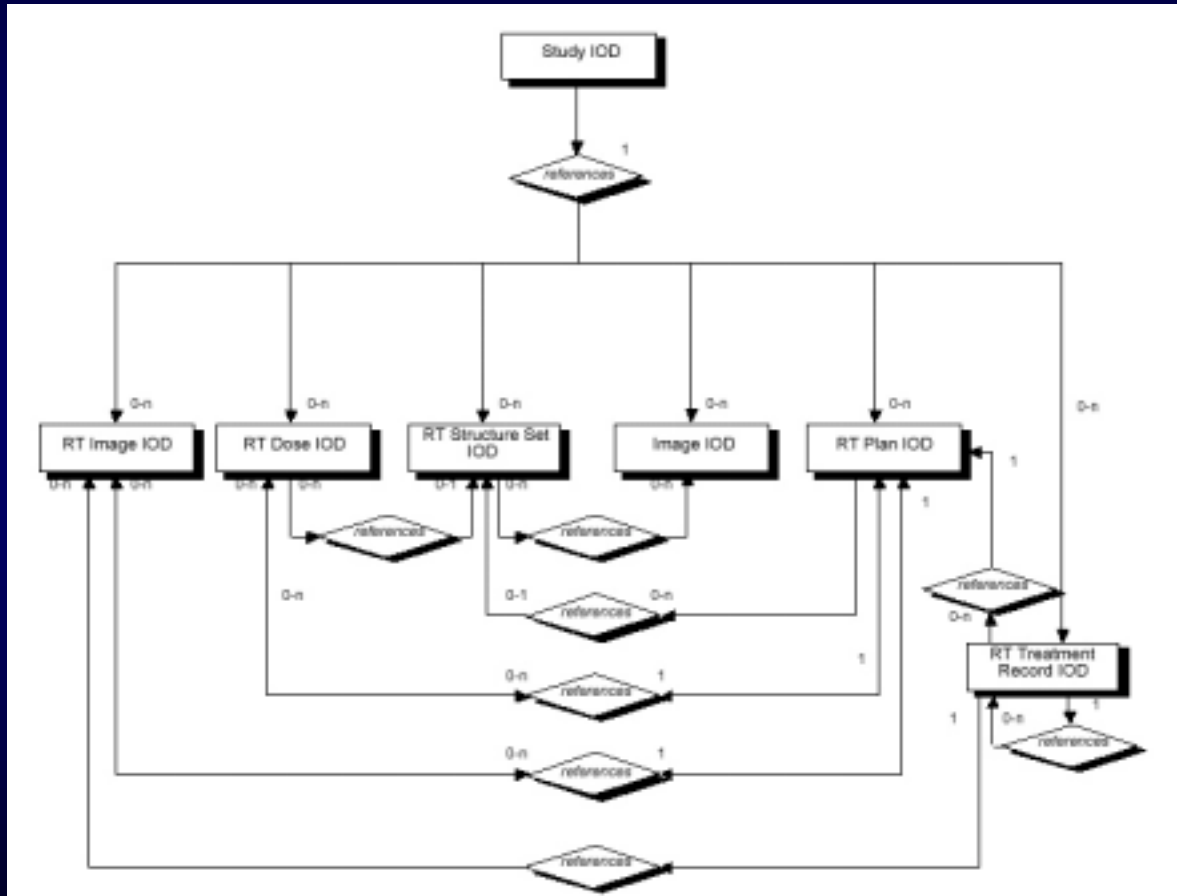


Figure 7-2c
DICOM INFORMATION MODEL - RADIOTHERAPY

Additional Defined Values for Attributes

- Example: additional values defined for Dose Type (3004,0004) to indicate whether heterogeneity correction was used in calculating the dose represented in the RT Dose IOD:
  - PHYSICAL_HETERO = physical dose computed with heterogeneity correction
  - PHYSICAL_HOMO = physical dose computed without heterogeneity correction.
  - CP 442 may obviate the use of these defined values.

Some Current Implementation Issues

- Axial positions of image planes and RT Structure Set contours
- Tissue density used for dose calculation (CP442)
- Interpretation of Grid Frame Offset Vector (3004,000C) attribute in RT Dose IOD (CP434)
- Definition of “Fraction group” *vs.* “Fraction” (treatment) in Dose Summation Type
- Definition of DVH Data: bin width *vs.* dose value