Radiation Therapy Clinical Trials
Digital Data Submission Overview

Wm. B. Harms, Sr.
Image-Guided Therapy Center
Value of Digital Data Collection for Advanced RT Trials

- CT (and other) image and contour data
  - Ensure protocol imaging requirements met
  - Ensure image segmentation consistent with protocol
- Beam geometry or permanent seed implant data
  - Ensure planned delivery consistent with protocol
  - Recalculation potential
- Volumetric dose data
  - Useful in toxicity and tumor control modeling
- DRR and port film data
  - Ensure delivery consistent with planning
Rationale for Current (RTOG) Interim Exchange

- Advanced RT trials required an exchange method
- Relatively simple to implement
- Advanced RT trials pre-date DICOM-RT extensions
  - Initiated the RT extensions to DICOM 3.0
Historical Review

- Originated with:
  - AAPM Report #10

- Used and/or modified by:
  - NCI Particle Beam CWG
  - NCI External Photon Beam CWG
  - NCI External Electron Beam CWG
  - Image-Guided Therapy Center
Patient Data and Transport

- Prior to ITC extensions:
  - comments (ASCII)
  - CT scans (binary)
  - contours (ASCII)
  - dose matrices (ASCII)

- Exchange media:
  - 9-track magnetic tape (1600 BPI)
Patient Data and Transport

- Added by ITC extensions:
  - MR and Ultrasound images
  - beam geometry & fractionation (ASCII)
  - Permanent seed implants
  - Binary dose
  - digital film (binary)
  - dose-volume histograms (ASCII)
- Media supported:
  - magnetic (9-track, 8mm, DAT, QIC)
  - network file exchange
Typical File Set

- A typical file set might consist of:
  - Directory file (only 1 per file set)
  - 90 CT scan data files
  - 7 Structure data files
  - 12 Beam Geometry data files
  - 24 Digital Film data files
  - 2 Dose file
  - 7 DVH files
Compliant Implementation Endorsement Requirements (RTOG or DICOM 3.0)

- RTP vendor works with ITC to test implementation
- Clinical site (not involved in exchange code development) demonstration of correct function
  - Special data sets or environments may result in vendor test working and user test not
- Worst case prior to setting these two rules
  - One year from time ITC indicated vendor system worked until it actually did!
Seven Demonstrated Commercial RTOG Implementations

- CT, contours, beams, doses, DVHs
  - ADAC Pinnacle3
  - Helax TMS
  - Marconi AcQPlan
  - Elektaq RenderPlan3D, Precise Plan
  - Nomos Corvus (less beams)
- CT, contours, beams, DRRs, doses, DVHs
  - MDS-Nordion Theraplan Plus
- CT, contours, beams, seeds, DRRs, doses, DVHs
  - CMS Focus
Developed Assistance

- The ITC provides assistance in evaluating the correct implementation of both RTOG data exchange and DICOM 3.0 file set creators. For assistance, send email to:

  itc@castor.wustl.edu
### Complex MIR ROC UI Implementation

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<tr>
<th>Patients</th>
<th>Structures</th>
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<tr>
<td>Patient Name: A Patient</td>
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<td>Case #: 1024</td>
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<td>Dose Level: [9406] Level 2 (73.8 Gy)</td>
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<td>Protocol: RTOG 94-06 Prostate 3D CRT Ph I/II</td>
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<td>Writer: Paul Flanick</td>
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<td>Physician: Carlos A. Perez, M.D.</td>
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<td>Physician: Russell Gerber, M.S.</td>
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<td>Dosimetrist: Stacey Ballard</td>
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<td>Submission: Initial</td>
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### Specify Plan Information:

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<tr>
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### Submission STATUS:

- Comments
- Scans
- Structs
- Plans
- Submit
- Quit

### Submission (MAIL) Notes

This is a sample submission screen. Note the granularity of the data selected for submission to the RTOG 3D QA Center.
Problems With MIR ROC UI Implementation

- Allowed sub-selection of data
- Allowed multitudes of user errors
- Fell significantly short of the J.A. Purdy desire of “one-button” submissions
- Inappropriate for “legitimate” DICOM 3.0
Minimum Recommended UI Features

- Patient selection
  - May be implicit in system depending upon file set creation location within application

- Treatment plan selection
  - Implicit definition of image set and structure set
  - Implicit selection of all associated beams, DRR and other RT Images
  - Implicit selection of DVHs
ITC Web Site (http://itc.wustl.edu)

- Contains protocol specific forms, guides, etc.
- Identifies credentialed clinical facilities, their RTP systems and means of submission
- Contains identification of compliant systems
- Contains sample RTOG code (where possible) and other documents to assist developers
  - Pointers to other commercial and non-commercial sites with code available