ATC IT Task Group Report
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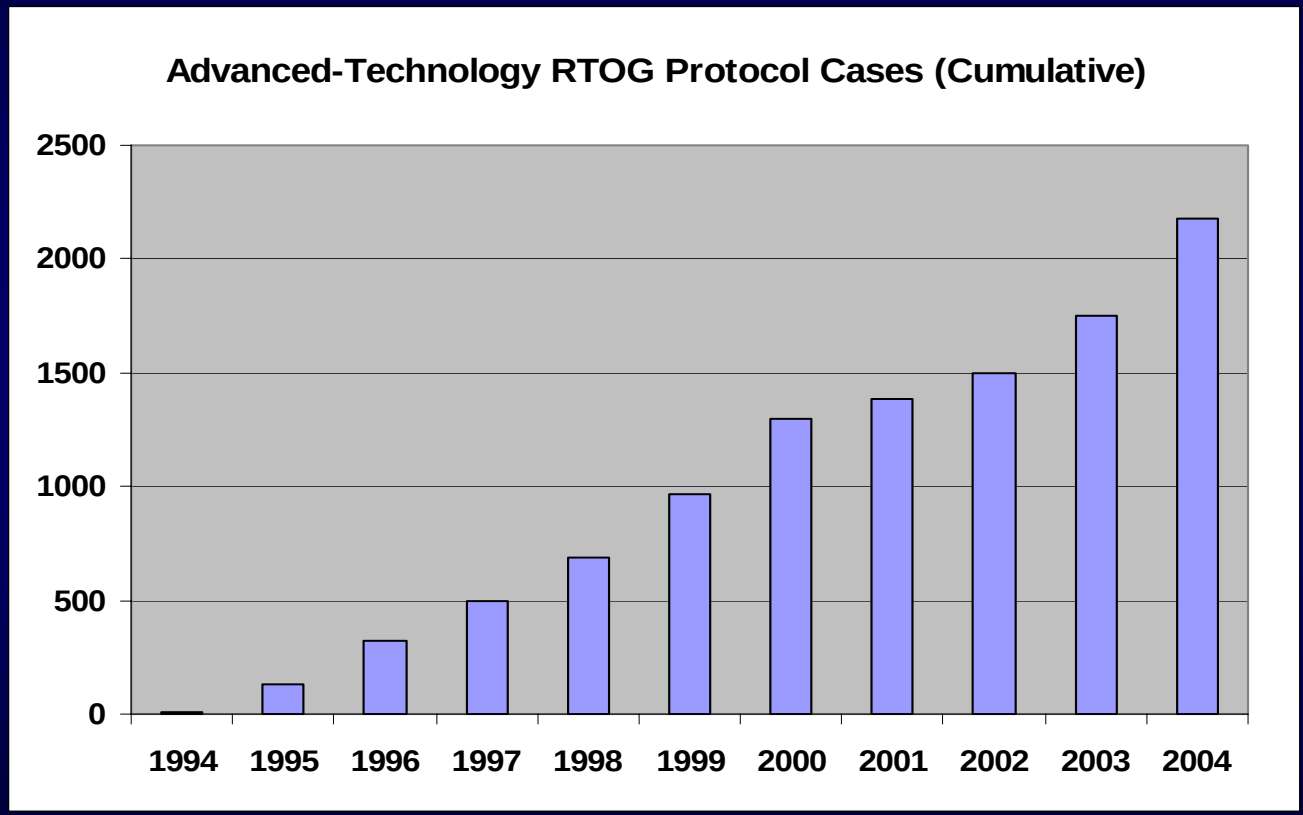
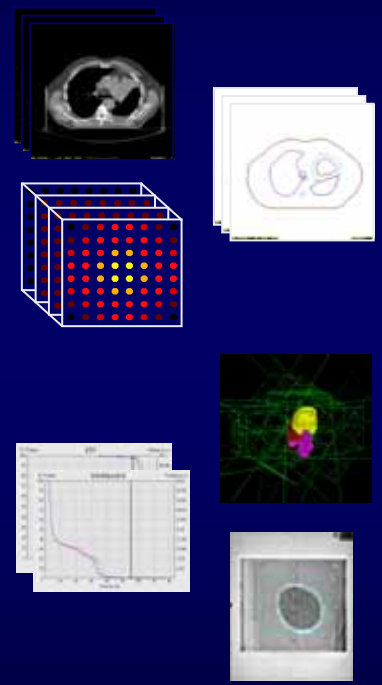
ATC IT Task Group Report

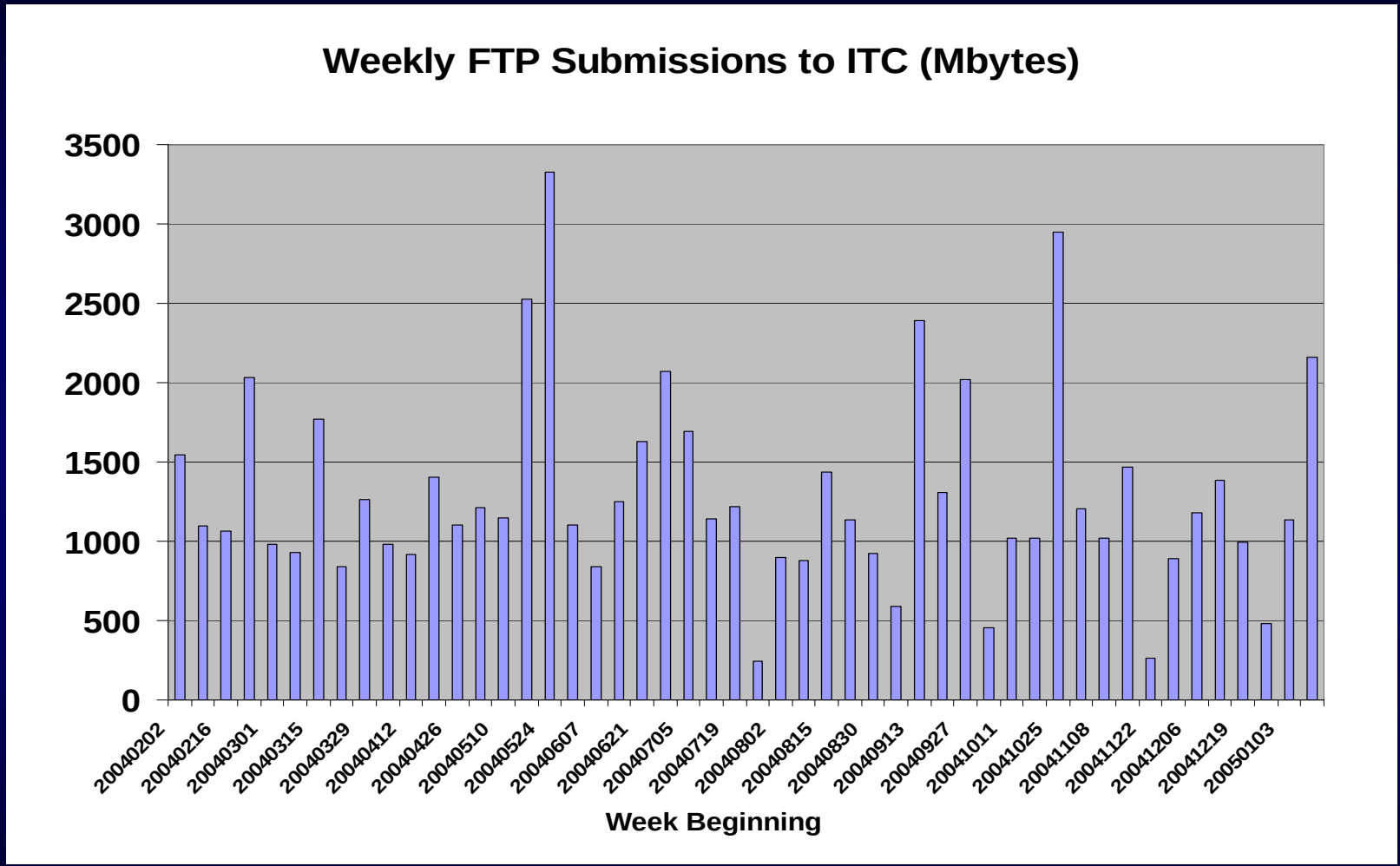
- ATC Method 1 Data Submissions to ITC
- Status of ATC Method 1 at QARC
- Status of ATC Method 2 at ITC
- What is needed long term to make Method 2 functional?
- PET/CT Fusion for Target Volume Evaluation
- ATC-Compliant Treatment Planning Systems

2180 Complete Digital Data Sets Submitted Over 10 Year Period



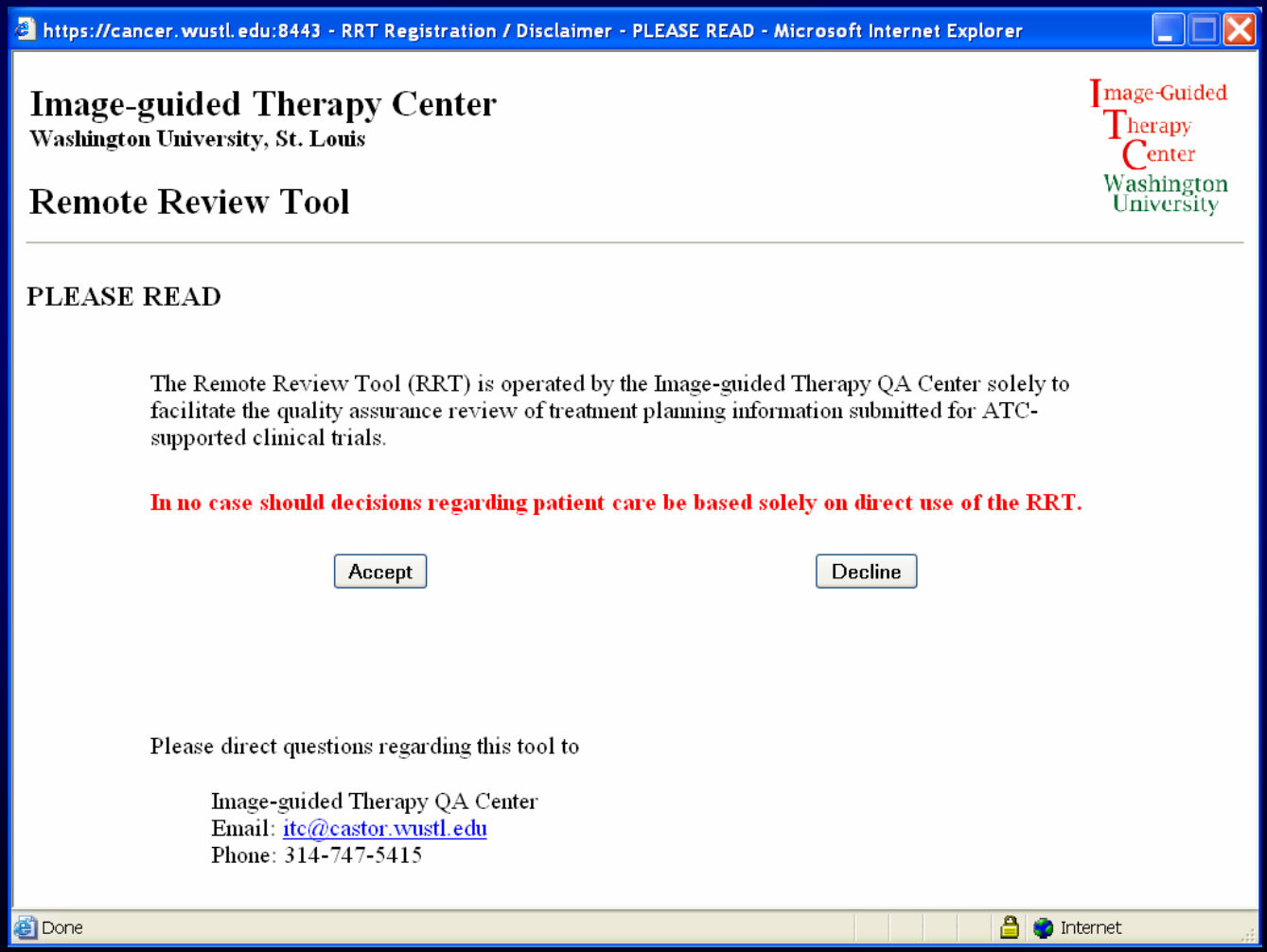


- **14 commercial RTP systems have implemented export capability (see http://atc.wustl.edu)**
- **166 institutions able to submit data**



- Average rate of FTP data submission to ITC is 1.29 Gb/week (from 15 users in 26 data sets)

RRT Disclaimer Regarding Clinical Use



Status of ATC Method 1 at QARC

- At the ATC meeting in June 2004, ITC was given the task of developing a Linux platform for the receipt and QA of digital data at QARC and RPC.
- This platform is intended to provide these centers with more efficient access to the volumetric imaging and dosimetry data currently submitted using ATC Method 1.
- Drs. Bosch and Matthews developed a prototype RRT server and DICOM/RTOG data import tool (part of the ATC/AAPM/NEMA DICOM Demonstration at AAPM 2004 annual meeting.)
- ITC was granted permission by CMS for limited use of proprietary software components for support of ATC activities at QARC, pending formal license agreement between ITC and CMS..

ATC Method 1 at QARC (2)

- Linux Workstation purchased by QARC was delivered 7/2004
  - DELL Precision 650n Workstation (dual-Xeon)
  - Red Hat Linux WS (v.3) operating system
  - ~500Gb RAID storage
- Configured for network access from ITC 9/2004
  - QARC firewall configuration
  - SSH access from ITC supports command shell, secure file transfer, X11 graphical applications

ATC Method 1 at QARC (3)

- RRT and data import tools installed on QARC-ITC workstation 11/2004
  - Data Import tools accessed via X server on ATC-Review1 workstation.
  - RRT displays on any web browser at QARC
- ITC acquires small DELL Linux workstation to facilitate support 12/2004
  - Mirrors software installed at QARC for testing and debugging at ITC.
  - Same Linux OS version as QARC-ITC

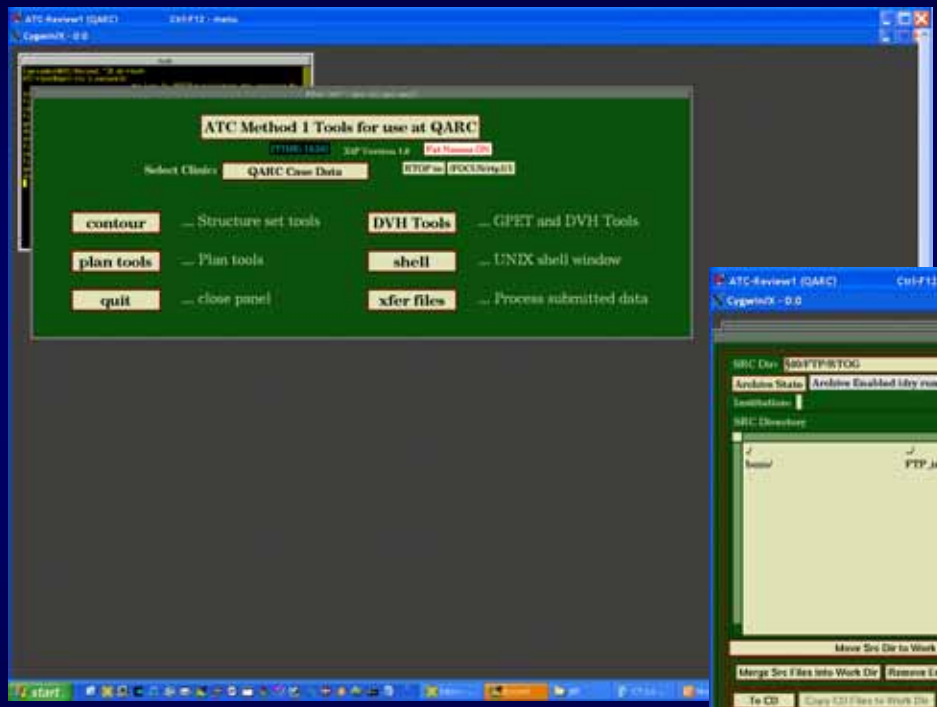
QARC-ITC Method 1 Software

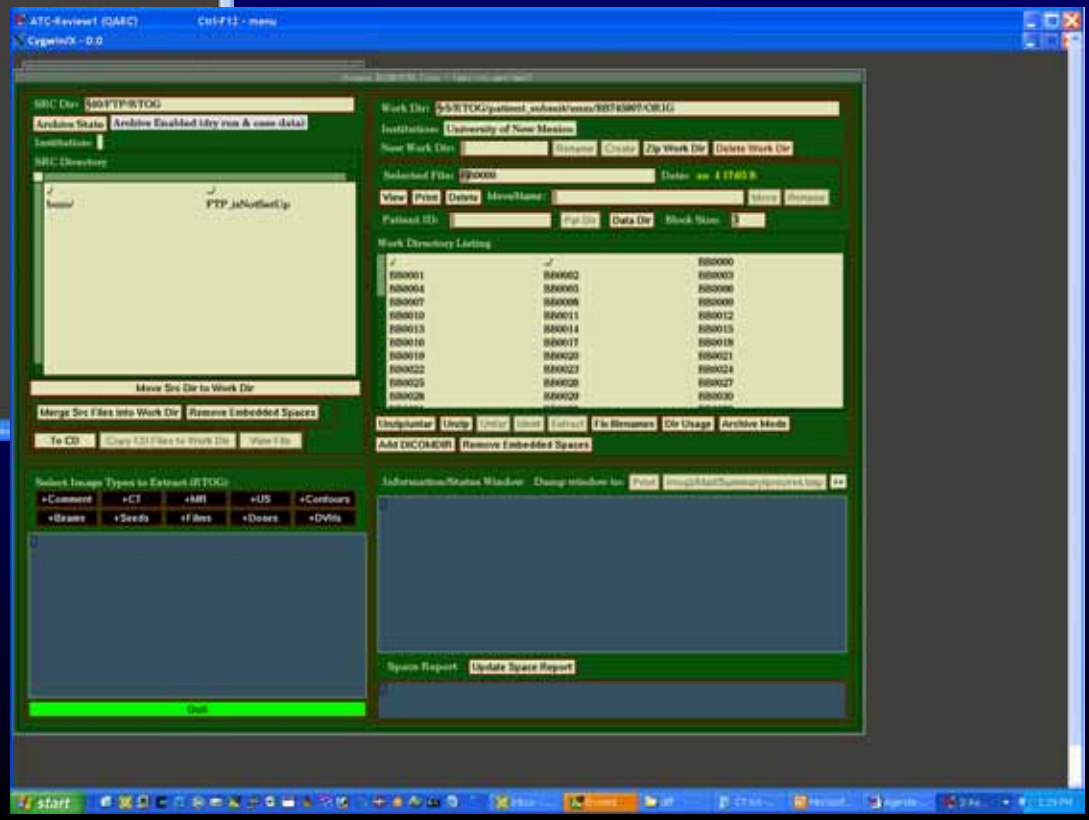
- Digital Data Import
  - Linux executables for DICOM, RTOG format import into internal format accessed by RRT
  - XtPanel graphical user interface tools for extracting/decompressing submitted data files and invoking import utilities
- Remote Review Tool
  - Apache Web Server
  - CGI scripts/Java applets/image-rendering utilities

QARC-ITC Method 1 Support Environment

- Secure Shell (SSH) to Linux workstation
  - Command-line shell for system configuration, maintenance
  - Secure file transfer, direct X-window access from ITC
- Remote Administrator to ATC-Review1 (Windows) workstation
  - Allows sharing of keyboard/mouse/screen between ITC and QARC on ATC-Review1 workstation to facilitate training and support.
- X Server
  - Runs in Cygwin, under Windows on ATC-Review1 workstation
  - Displays data import panels, running on Linux workstation

QARC-ITC Method 1 Support Environment (2)





Views (from ITC) of ATC-Review1 workstation desktop located at QARC showing data import tools running on QARC-ITC Linux workstation.

QARC-ITC Method 1 Teleconferences

11/18/2004	ITC gave system overview, demonstrated data import panels; QARC requests documents, RRT grayscale controls
12/2/2004	ITC provide draft procedure documents
12/14/2004	R. Hanusik, W. Bosch discuss QARC patient hierarchy and integration of RRT into QARC QA process
12/16/2004	Discussion of protocol templates for QARC-supported protocols; QARC to identify protocols with institutions capable of submitting digital data
12/29/2004	Discussion of QARC data preparation preferences, demonstration of import of digital data from CD-ROM (at QARC) and from FTP (via ITC), QARC identified COG ACNS0331 and several possible institutions to be asked to submit digital data, ITC to configure template for this protocol
1/6/2005	Dr. Fitzgerald reviews target volumes for pediatric CNS patient using RRT
1/13/2005	Discussion of hardcopy reports (data import log, plan summaries)

Status of ATC Method 2 Testing

- Testing of Method 2 continues (at a reduced priority) within the ITC.
- Separate servers are being maintained for production (at ITC) and development (at RCET).
- The ITC test suite includes DICOM and RTOG format treatment planning data sets (two from each of eight manufacturers).
- Sean O'Leary (ITC) has been assigned the task of performing uploads, downloads, and comparisons of datasets.

ATC Method 2 Testing Methodology

1. Upload test data sets to WebSys server at ITC (POLARIS).
2. Verify that data are registered in server database and viewable using Rapid Image Viewer tool.
3. Download test data sets from ITC WebSys server.
4. Use DICOM dump utility to compare corresponding files (one each of CTs, RT Structure Set, RT Plan, RT Dose, etc.) from original and retrieved copies of data sets.
5. Report discrepancies between original and retrieved files, as well as unexpected behavior in WebSys client and Rapid Image Viewer tool.

ATC Method 2 Testing – Comparing submitted, retrieved data

Differences between submitted (>) and retrieved (<) objects

RD.txt - Notepad

File Edit Format View Help

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File Edit Format View Help

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```

DICOM "Dump"

WebSys Test Summary

v. 2.1.1b Delivered on POLARIS 7/14/2004 – greatly improved efficiency in scanning large number of DICOM images, based on tests with PBTC data

- WebSys generates illegal DICOM "NULL" attributes

v. 2.1.2b Delivered on POLARIS 10/18/2004 with web-based database management tools (10/26/2004).

- WebSys client crashes on upload due to failure in creation of JPEG "thumbnail" images for 8-bit DRRs.
- WebSys generates DICOM "NULL" attributes with non-zero length

v. 2.1.3b Delivered on POLARIS 12/21/2004 – improved case selection (by Case ID, Submission Date, Description, Institution)

- WebSys client crashes while scanning certain RT Dose objects
- Selected files may be omitted from upload without warning
- Database error resulting in loss of non-CT DICOM objects

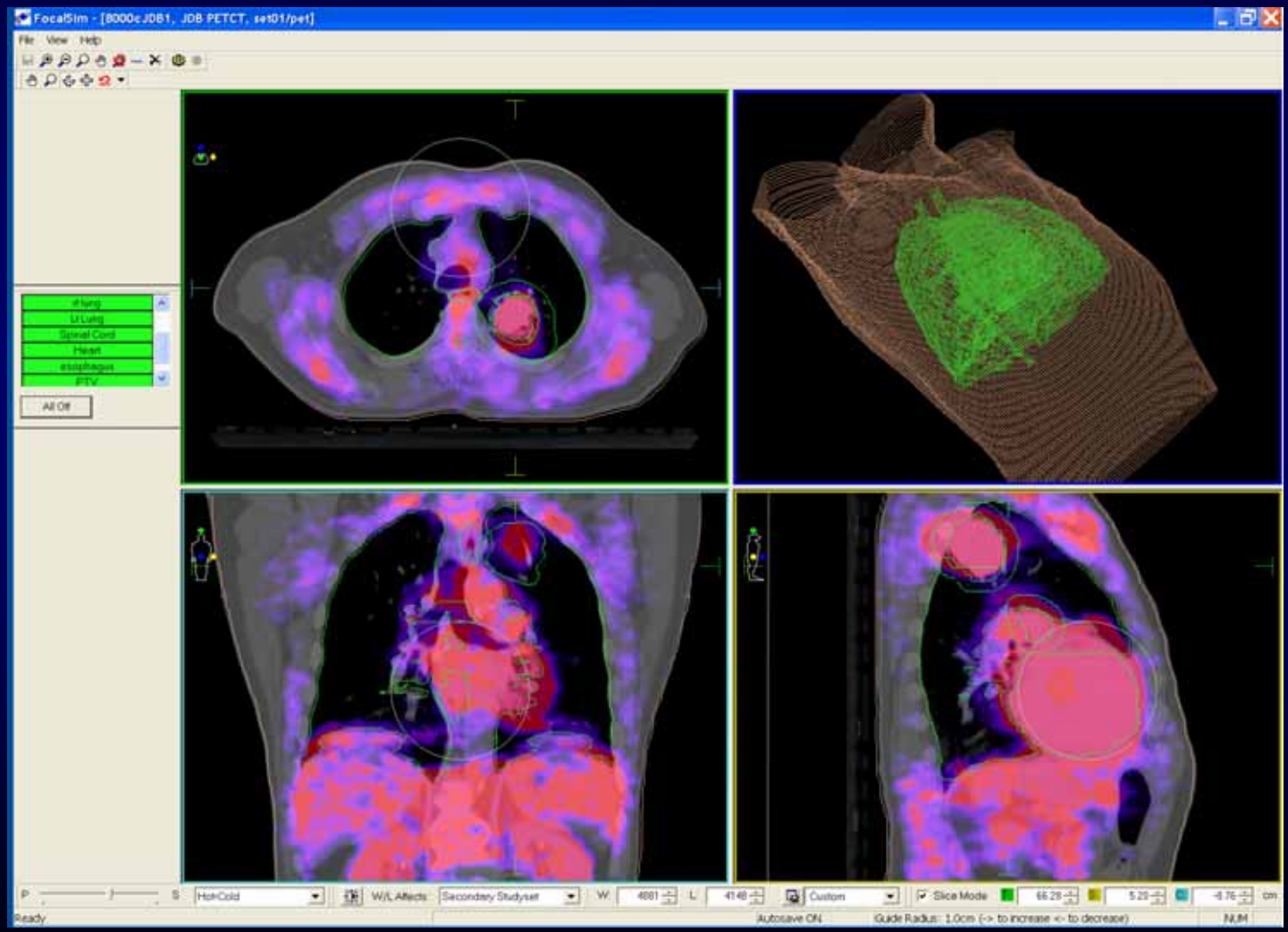
What is needed long term to make Method 2 functional?

- Deployment of ATC Method 3 at NCIC (NetSys) should serve as a model for the more demanding use of this system for ATC Method 2.
- Suggestions for new strategies are welcome!

PET/CT Fusion for Target Volume Evaluation

- Test of PET/CT data import and review, using
  - DICOM PET Image files (single frame per object), and
  - Treatment planning CT and target volume contours – DICOM (CT, RTSS) or RTOG Data Exchange.
- Import TP data using ATC Method 1 utilities and send patient dataset to ITC's Focal Workstation
- Send DICOM PET images directly to Focal workstation.
- Register CT and PET studies using maximum mutual information auto-registration in Focal.

PET/CT Fusion for Target Volume Evaluation (2)



ATC Compliant Treatment Planning Systems Per Modality

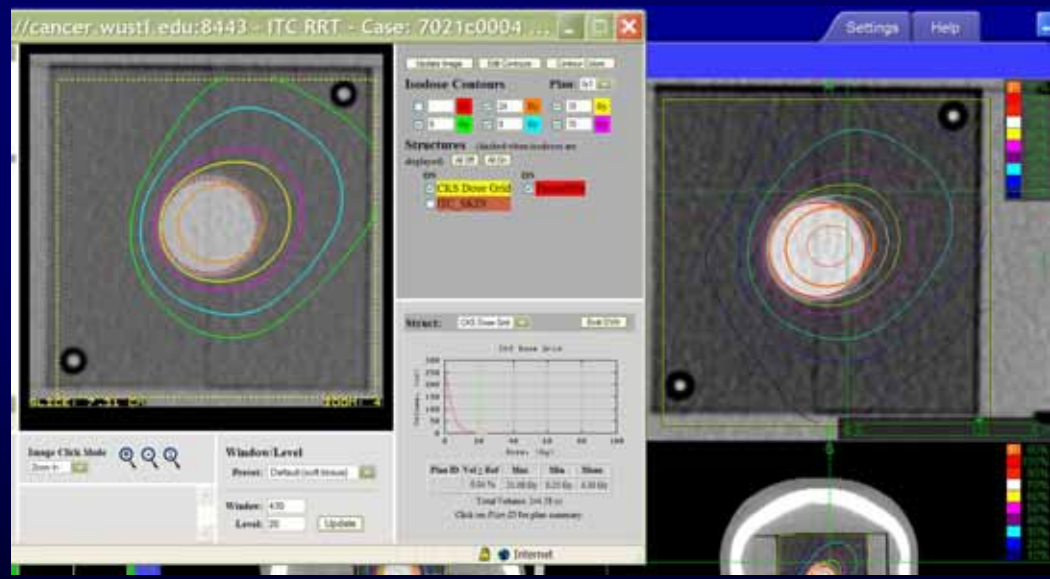
Treatment planning systems deemed to be *ATC Compliant* are listed in the table below. They are those with which ATC protocol participants have submitted *complete, reviewable* protocol data sets.

Treatment Planning Systems			Exchange Format	Treatment Modality				
Vendor	System	Version*		3DCRT	IMRT	Seed Brachy	HDR Brachy	Protons
CMS	Focus/XiO	3.1	R	✓	✓	✓		
Elekta	RenderPlan 3D		R	✓				
	PrecisePlan	2.01	D	✓	✓			
Nomos	Corvus		R		++			
Nucletron	Helax TMS		R	✓	✓			
	TheraPlan Plus		R	✓				
	PLATO RTS	2.62	D	✓				
	PLATO BPS	14.2.6	D				✓	
Philips	Pinnacle^3		R	✓	✓			
	AcqPlan	4.9	R	✓				
Rosses Medical	Strata Suite CTPlan	4.0	R			✓		
RTek	PIPER	2.1.2	R			✓		
Varian	Eclipse	7.1	D	✓	✓			
	VariSeed	7.1	D			✓		

Exchange formats for submission of ATC Protocol Data: **D** = DICOM RT Objects **R** = RTOG Data Exchange Format

TPS Vendors Working with ITC to Develop ATC Compliant Export Capability (1/18/2004)

- "Vendor Complete"
  - CMS (XiO)
  - TomoTherapy (Hi-Art)
  - Varian (BrachyVision)
- In-Progress/Nearly Complete
  - 3DLine (Ergo)
  - BrainLab (BrainScan)
  - AccuRay (CyberKnife)
  - Nucletron (Oncentra)
  - Siemens (Dosimetrist Workspace/Konrad)



Screen capture from AccuRay (1/18/05) showing comparison of RRT (left) and CyberKnife iso-dose displays for test data set.

JAPAN CLINICAL ONCOLOGY GROUP PROTOCOL JCOG 0403
A PHASE II STUDY OF STEREOTACTIC BODY RADIATION THERAPY IN PATIENTS WITH T1N0M0 NON-SMALL CELL LUNG CANCER

- Institutions participating in protocol JCOG 0403 submit digital data representing CT images, structure sets, treatment plans, 3D dose distributions, and DVHs to Dr. Satoshi Ishikura at the National Cancer Center Hospital East, Kashiwa, JAPAN.
- Dr. Ishikura forwards these data to the ITC for processing.
- Data are reviewed by Dr. Ishikura or his delegate using the ITC Remote Review Tool.

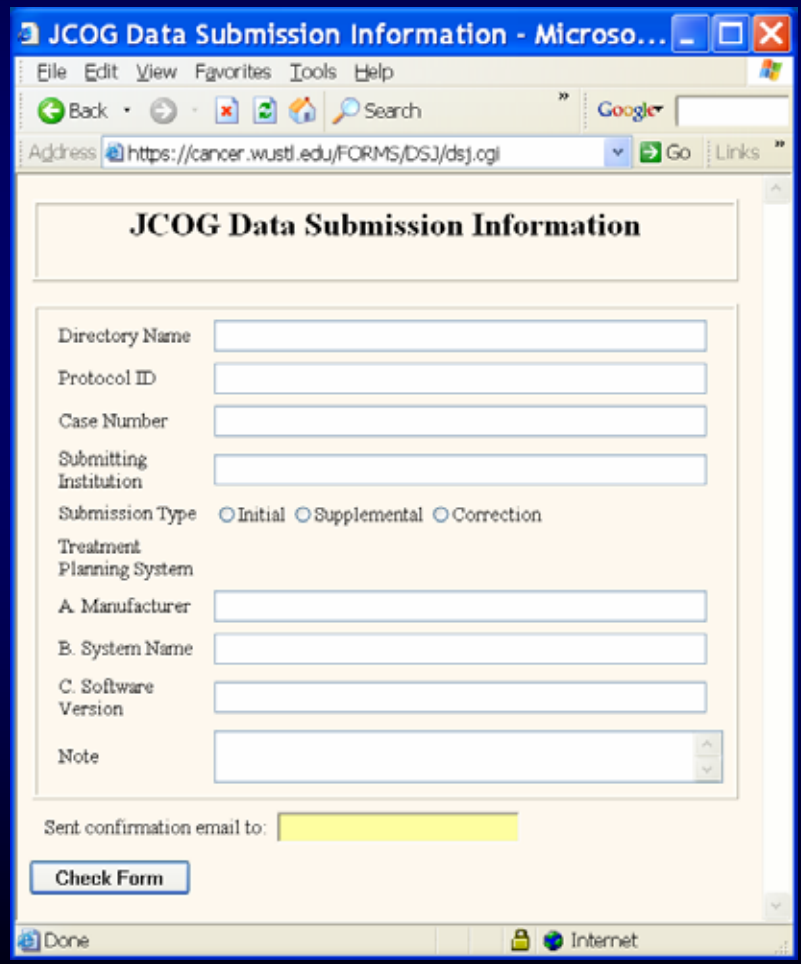
JAPAN CLINICAL ONCOLOGY GROUP PROTOCOL JCOG 0403

- Currently, 13 institutions are eligible to enroll patients and capable of digital data submission on JCOG 0403. (One other institution, which is eligible to enroll patients but NOT capable of digital data submission, has been exceptionally allowed to participate in the study.)

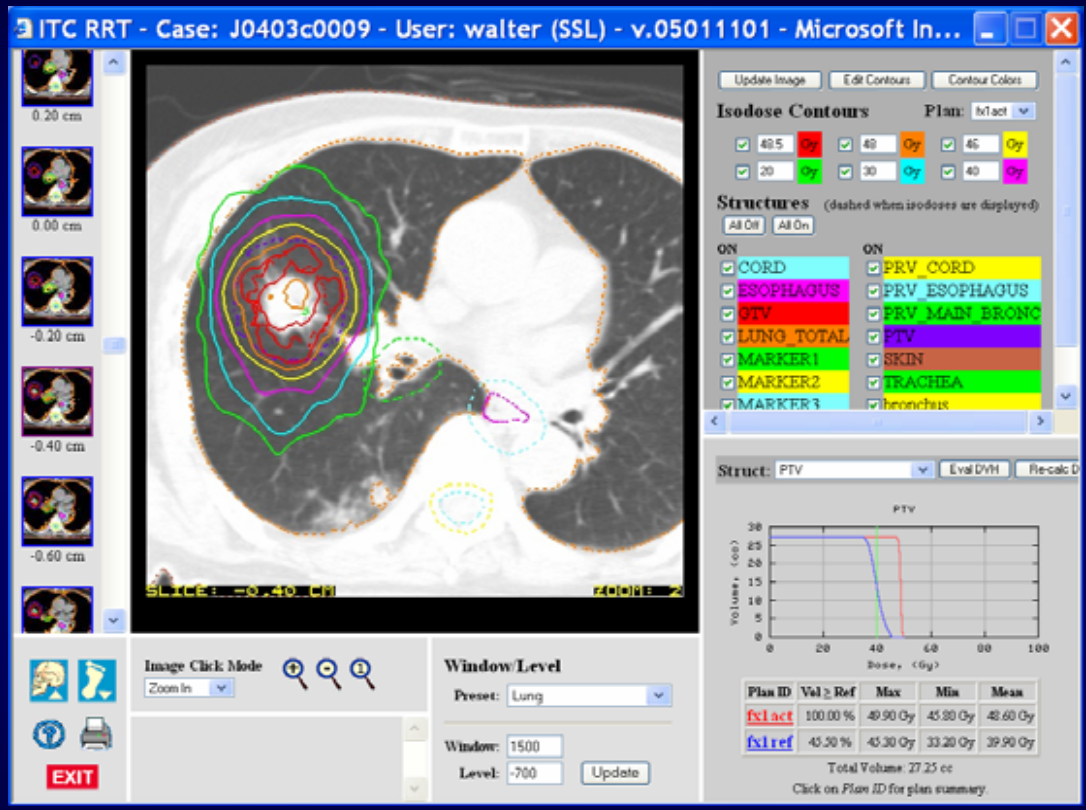
Institution	Location	RTP System	Approval Date
Hiroshima University	Hiroshima, Japan	Philips Pinnacle3	Nov 5, 2004
Hokkaido University	Sapporo, Japan	CMS FOCUS/Xio	Aug 11, 2004
Institute of Biomedical Research and Innovation	Kobe, Japan	CMS FOCUS/Xio	Aug 6, 2004
Keio University	Tokyo, Japan	CMS FOCUS/Xio	Nov 2, 2004
Kitasato University	Sagamihara, Japan	Philips Pinnacle3	Dec 27, 2004
Kyoto University	Kyoto, Japan	Varian Eclipse	Aug 25, 2004
Kyushu University	Fukuoka, Japan	Varian Eclipse	Nov 24, 2004
Nihon University	Tokyo, Japan	CMS FOCUS/Xio	Oct 21, 2004
Sapporo Medical University	Sapporo, Japan	CMS FOCUS/Xio	Sep 27, 2004
Tohoku University	Sendai, Japan	Varian Eclipse	Oct 1, 2004
Tokyo Metropolitan Komagome Hospital	Tokyo, Japan	CMS FOCUS/Xio	Sep 3, 2004
Tokyo Women's Medical University	Tokyo, Japan	CMS FOCUS/Xio	Dec 27, 2004
University of Yamanashi	Tamaho, Japan	CMS FOCUS/Xio	Jul 29, 2004

JAPAN CLINICAL ONCOLOGY GROUP PROTOCOL JCOG 0403

- Dr. Ishikura uses the online JCOG Data Submission Information form on the ATC web site to announce the submission of data to the ITC FTP server.



JAPAN CLINICAL ONCOLOGY GROUP PROTOCOL JCOG 0403



- As of 1/17/2004, four SBRT data sets (cases 3, 7, 9, and 10) have been received and prepared for review using the RRT.

ATC Supported RTOG Protocols

Protocol	Description	Institutions Credentialed	Cases Accrued
9406	Ph I/II 3DCRT Prostate Dose Escalation	54	1084
9311	Ph I/II 3DCRT Lung Dose Escalation	27	180
9803	Ph I/II 3DCRT GBM Dose Escalation	46	210
0022	Ph I/II 3DCRT/IMRT Oropharynx	31	69
0319	Ph I/II 3DCRT Partial Breast	31	58
0117	Ph I/II 3DCRT/chemo Lung	39	20
0126	Ph III 3DCRT/IMRT Prostate	108 (35 IMRT)	452 (50 IMRT)
0225	Ph I/II 3DCRT/IMRT Nasopharynx	31	38
0232	Ph III Ext Beam/TIPPB Prostate	50	88
0236	Ph II SBRT Lung	3	3
0321	Ph I/II HDR/Ext Beam Prostate	2	1

WHITE = open protocols BLUE = closed protocols