Update on ATC QuASA²R Clinical Trials QA Review System
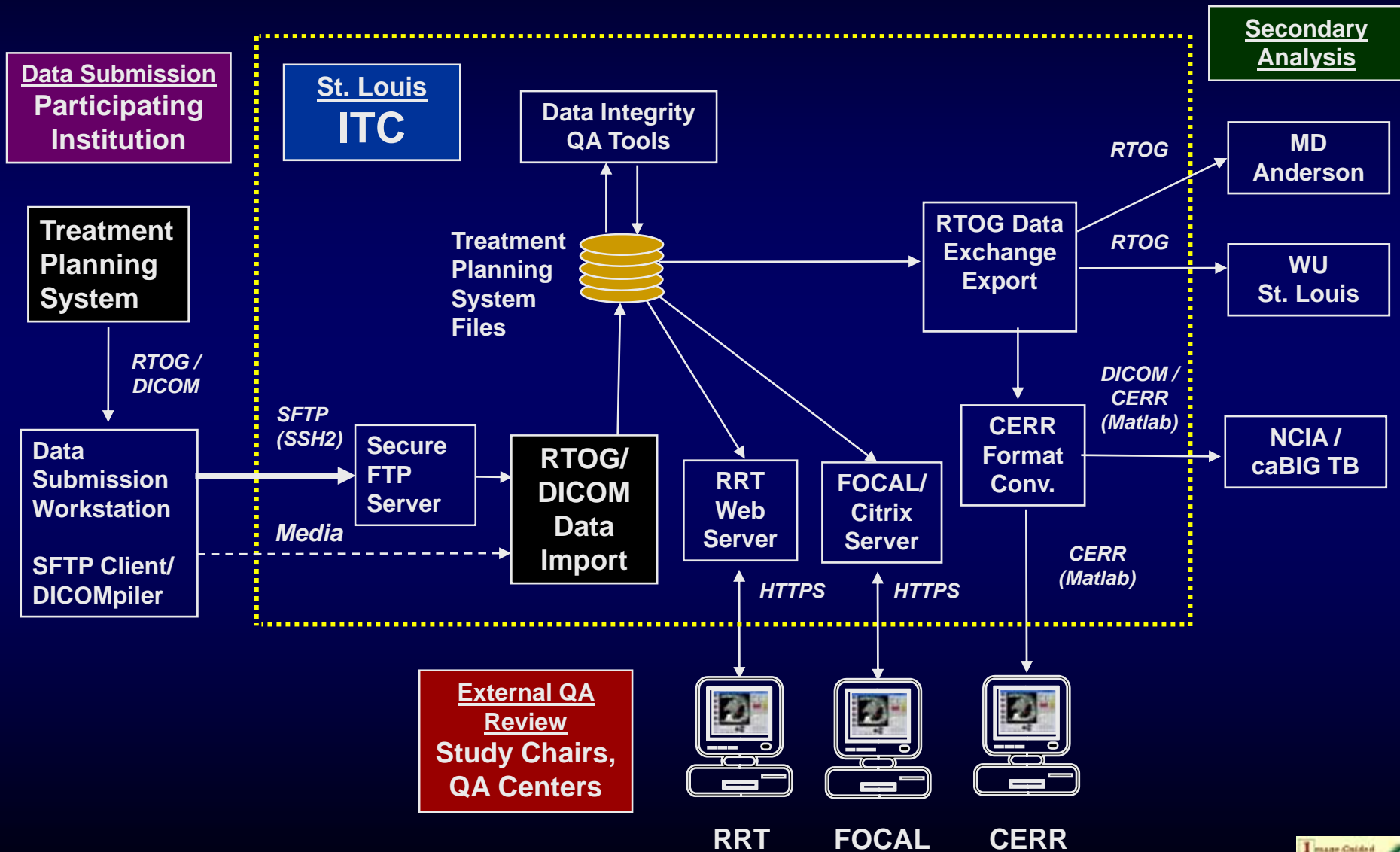
Walter R. Bosch, D.Sc.

ATC Meeting

March 27, 2008

Saint Louis, Missouri

ATC • AdvancedTechnologyConsortium

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

QuASA²R – *Current Components and Data Flow*

Robust Storage for Existing and Future ITC Archive Data

- Existing SFTP server, DDIQA tools, and review tools.
  - Current ITC Archive
    - \> 9000 Datasets
      - ~ 6500 protocol cases
      - ~ 1900 dry runs
      - ~ 550 phantoms
      - ~ 50 immobilization tests
    - ~ 650 GBytes
    - + 350 GBytes (compressed backup)
- TeraMedica DICOM Archive
  - Database
  - DICOM file storage

Pillar Data Axiom 500 NAS System

- 10 TB Redundant Disk Array
- Modular design for flexible, affordable system growth
- High-availability system: critical components have duplicate, active backups
  - Redundant disk array (RAID) with error detection/correction
  - Dual, independent (active/passive) storage management units
  - Dual (active/active) storage control units
  - Redundant power supplies and UPS
- Policy-based hardware allocation
- Performance, system health monitoring
- Data management utilities: data migration, snapshots, deltas

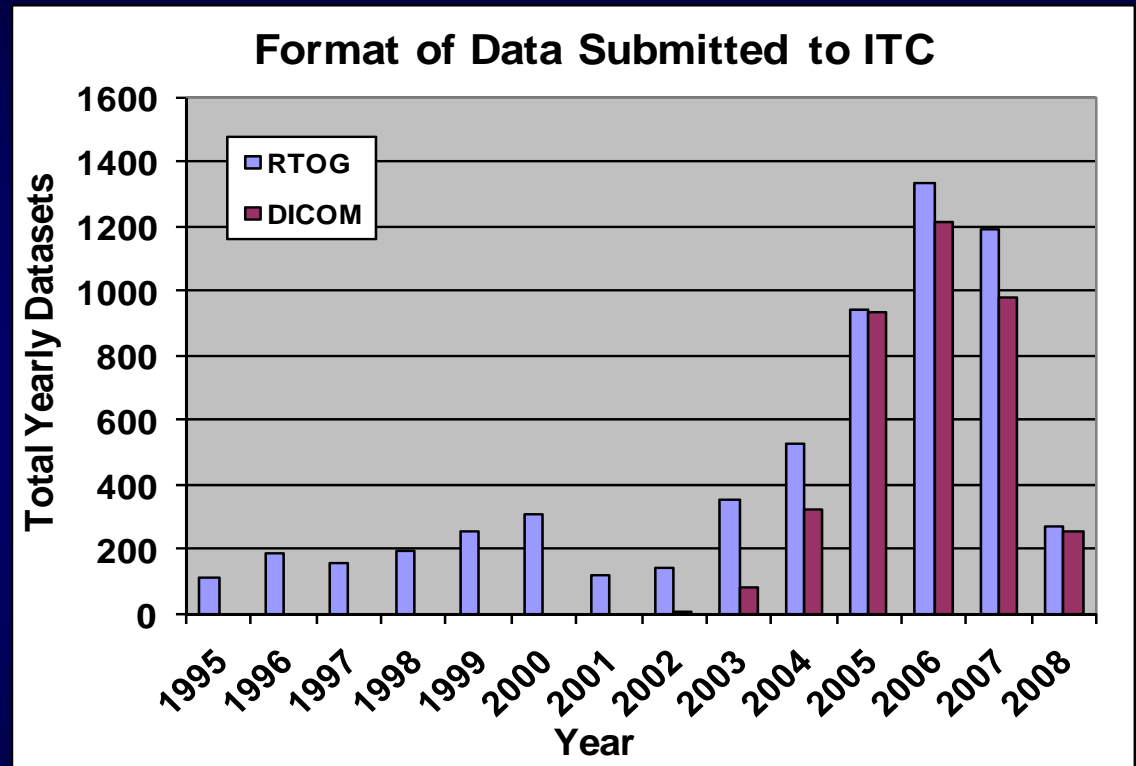# Pillar Data Network Attached Storage: Progress to Date

- System installed at ITC – Jan 2008
  - Setup, training, filesystem creation
- SFTP server integration – Feb 2008
  - Data upload and download tests
  - Used for exchange of vendor DICOM Spatial Registration data for IHE-RO Domain Pre-testing
- ITC data backup system integration – Feb 2008
  - Nightly updates of compressed backup datasets
- RRT secure HTTP server integration – started Feb 2008, in progress
  - RTOG closed protocol cases accessible on RRT
  - Faster throughput, latency issues under investigation

ITC TeraMedica Evercore® Archive

- System Specification (Jan 2008)
  - Two DELL PowerEdge 2950 Servers, each with quad-core 3GHz Xeon processor, 16 GB RAM, GB ethernet
    - Primary database server, secondary archive server
    - Primary archive server, secondary database server
  - Software
    - OS: Windows 2003 Server Enterprise x64
    - Database: MS SQL Server 2005 x64
    - TeraMedica Evercore archive
- Software License Contract
  - Negotiations in progress

RTOG/DICOM TP Data Formats

- Approximately 50% of data submitted to ITC is in RTOG Data Exchange Format.
- The proportion of DICOM is expected to grow as updated TP systems with DICOM export are installed
    - Pinnacle[3] (7.6, 8.0)
    - XiO (4.3.x)

Format of Data Submitted to ITC

Datasets processed as of Mar. 20, 2008
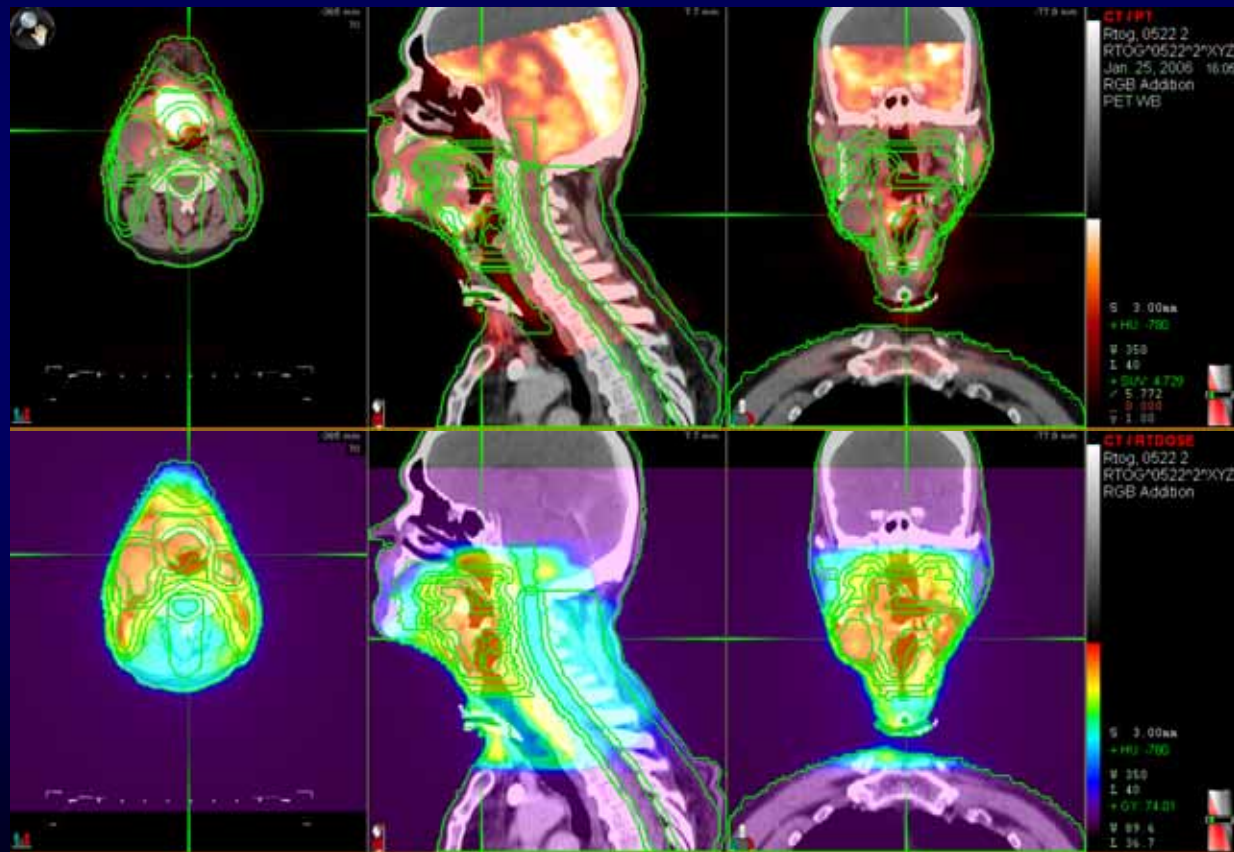
Data Format Conversion using CERR

- Export of CERR, DICOM data to NCIA
- Post-DDIQA Export of Phantom Data to RPC
  - CERR data for Film Dosimetry tool
  - Dose resampling (Tomo, Corvus, BrainLab)
- CERR Batch Import – work in progress
  - Efficient, automatic conversion of DICOM and RTOG datasets to CERR
  - Error logging

Diagnostic Image Review Tools

- MIMvista
  - Multi-modality support: CT, MR, PET, CBCT
  - Quantitative PET review
  - Automatic/ manual registration
  - 3D/Multi-planar contouring
  - Image/contour deformation
  - Atlas-based segmentation
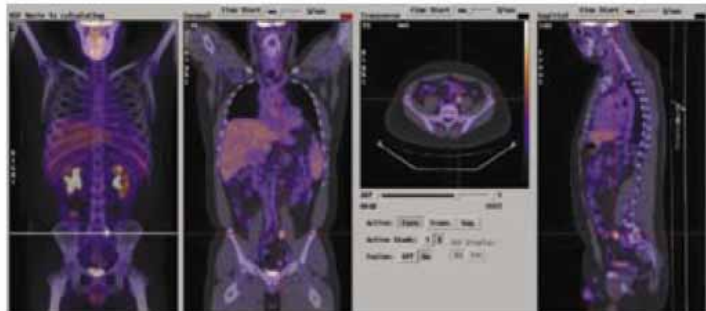 - IGRT, 4DCT tools
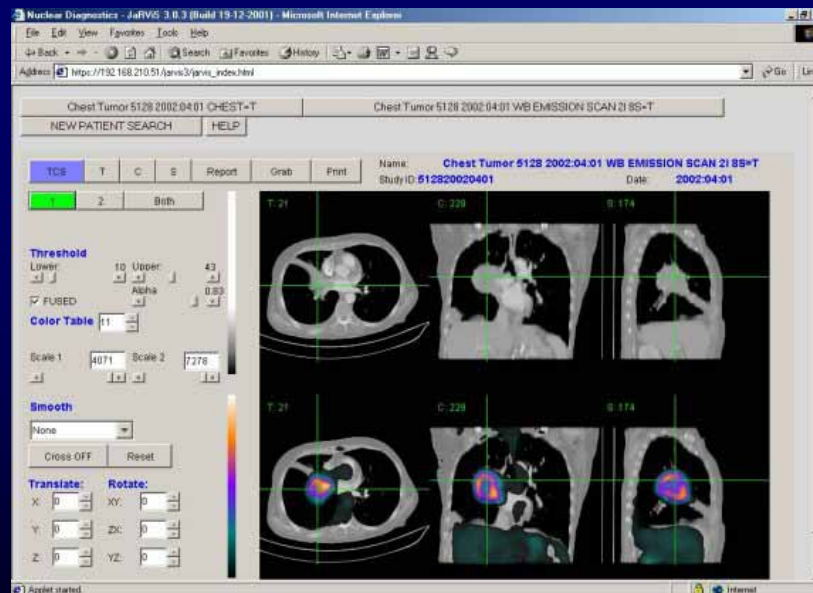
Diagnostic Image Review

- HERMES
  - Diagnostic multimodality workstation & storage server
  - PC based multimodality image viewer
  - Remote access for image review
  - Java Remote Viewing Station (JARVIS) – web-based image review
  - Quantitative PET Review

Lymphoma case courtesy of Brigham & Women's Hospital, Department of Nuclear Medicine, Boston, MA, USA.

Timeline for QuASA^{2}R Upgrades (1)

	Project	Date
1	Pillar Data Storage System •Stable support for existing QuASA^{2}R components •Flexible foundation for DICOM Archive	Installed Jan 2008 •Data backup, SFTP operational •NFS issues
2	DICOM-based RT Archive (TeraMedica) •Support for wide range of imaging and RT datasets	Work in progress •System specs Jan 2008 •Software license contract in progress
3	Data format conversion tools •DICOM conv. for legacy (RTOG) data •CERR conv. for phantom dosimetry •CERR conv. for distributed case review	Work in progress •Starting Jan 2007 •In use: Feb 2008 •Demo RSNA 2007
4	Diagnostic Image Review Tools •MIMvista •Hermes	Evaluation in progress

Timeline for QuASA^{2}R Upgrades (2)

	Project	Date
5	Digital Data Integrity QA workflow tools (CERR) • DDIQA Server • Data anonymization / ID reconciliation • Archive loading • Case data management (inventory, revision) • DICOM consistency checks (DVTk) • Structure naming / Structure editing / Dose summation?	Begin Summer 2008
6	ITC DDIQA Server/Tape Backup Upgrade	Begin Summer 2008
7	QuASA^{2}R / Commercial TPS Integration •Eclipse •Pinnacle •CMS	Begin Fall 2008

Timeline for QuASA^{2}R Upgrades (3)

	Project	Date
8	Evaluate MAX Server for QA Workflow Management at ITC	Begin Summer 2008
9	Evaluate ACRIN TRIAD for Diagnostic Image Collection at ITC	Begin Summer 2008
10	Grid-enabled CERR for production case review at ITC • Secure download, seamless review • Anticipatory data push	Begin Fall 2008
11	Server-side review tools • Image Digest / QA Report Generator (CERR) • Multi-planar (T/S/C) tool for contour and dose review	Begin Spring 2009

QuASA²R / TRIAD Feature Comparison

Feature	TRIAD	QuASA²R	QuASA²R / Evercore/ MIMvista / …
DICOM receiver	Site server	DICOMpiler	DICOMpiler
Data submission via	Site server (HTTPS)	SFTP/SSH2 Client	SFTP/SSH2 Client
Data Submission Format	DICOM	RTOG, DICOM, JPG, other	RTOG, DICOM, JPG, other
Data Objects Supported	Images	Images, RT	Images, RT
Data Objects Managed	Images	RT	Images, RT
Data Object Export	DICOM	RTOG, DICOM, CERR	DICOM, CERR, (RTOG)
Integrated Image / RT Review		CERR, MIMvista, TPS (FOCAL,etc.)	CERR, MIMvista, TPS (FOCAL,etc.)
Web-based Review	TRIAD viewer	RRT	Enhanced RRT
Client-based Review	TRIAD Rich Client	CERR	Grid-CERR, TPS
Data Integrity QA Tools	TRIAD viewer ?	ITC Panels	CERR QA Tools
Data Mining Tools	CTMS integration ?	DVA scripts, CERR tools	CERR tools, Evercore database
caBIG Integration via	NCIA instance ?		Grid-enabled CERR, Grid-PACS