RCET Report to the ATC Steering Committee

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RCET Team

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RCET Scope of Work

Develop a secure auto-anonymizing upload and auto-archiving patient database resources for institutions participating in advanced technology clinical trials, to allow efficient and secure archiving of diagnostic images, treatment planning images, radiotherapy plan data, and demographic information.

Rationale -

- use web-based technology to provide word-wide access to clinical trial data
- allow clinical trial personnel control and access to their own data and QA process

RCET Scope of Work

Provide the advanced technical resources necessary to improve radiotherapy patient outcomes. The RCET has built a foundation of advanced medical informatics infrastructure to facilitate education, collaboration, and peer review, as well as provide an environment in which clinical investigators can receive, share, and analyze voluminous multi-modality clinical trials data.

Rationale -

Paradigm shift from QA centers of “experts” to decentralized peer review of clinical data by the trial PIs

The RCET System

It is a Radiotherapy data submission, archive, and review infrastructure

- Auto-archiving database
- Web-based Secure Object Archiving Network System (SOANS)
  - Secure Wide Area Network DICOM-RT PACS
- Integrated client tools for upload and review
  - WebSys, NetSys and Rapid Review tools

RTOG Data

DICOM-RT Objects

DICOM Network services

Rapid Review

WebSys

RCET INFRASTRUCTURE

Database

Server

SOAN

RCET Modules

Fast DRR

Dose matrix algebra

2D and 3D visualization

2D and 3D Contour and ROI

2D, 3D segmentation Image processing

Brachytherapy Modules

NetSys

Image Feature based Data Mining

Context based Data Mining

Data Mining

Wavelet Transforms

Image Transmission and Storage

RCET System Components

1) SOANS

- Database
  - A collection of database tables
  - Database scheme, which is designed as a combination of DICOM object hierarchy and the requirements of the data collection and review process for protocol based data submission system.
  - A collection of stored procedures
  - An access application client designed for database management
- A collection of ASP pages for Web-based database management
- Network installation and interface facilities
- Support for 12 bit gray scale clinical images

RCET System Components

2)*NetSys Web-Services -Provides Secure Web Communication over WAN between archiving system & client

- ASP components
- ASP scripts
- XML-SOAP components for the Web Server service extension
- SOAP run-time components

*A Patent Pending Technology

RCET System Components

3) WebSys 2.4 Client -Provides a secure uploading and downloading of anonymized data

- Implementation of full reading, writing and analysis of DICOM radiotherapy objects.
- Implementation of full reading, writing and analysis of RTOG formatted data sets.
- Two-way communication with RCET server(s), based RCET Web-Services.
- Ability to submit and retrieve DICOM and RTOG data sets to the RCET server.

RCET System Components

4) NetSys 3.6 Client - Provides data analysis and presentation tools for preparing and reviewing 2D and 3D

- Image Scanner
- Uploader
- Database-Browser

  - Currently in use by the NCIC for MA20 phase three clinical trial

RCET System Components

5) *NetSys 4.0 -Provides extended functionality over *v*3

- Implementation of full reading, writing and analysis of DICOM radiotherapy objects and RTOG formatted data sets.
- Two-way communication with RCET server(s), based RCET Web-Services.
- Ability to submit and retrieve DICOM and RTOG data sets to the RCET server.
- Visualization of DICOM-RT objects in 2D and 3D.
- Support for a local database.
- Contains a local DICOM server, supporting DIMSE services.

*A Patent Pending technology

RCET System Components

6) Rapid Review Facility

- Java Applets
- Java Servlets
- Java Database connectivity
- Support for 12 bit gray scale clinical images.

RCET System Components

7) Web Server (MS IIS 6).

8) Java Application Server

9) Web Portal; a web site for users to learn about the system, register, download data, review the submitted data.

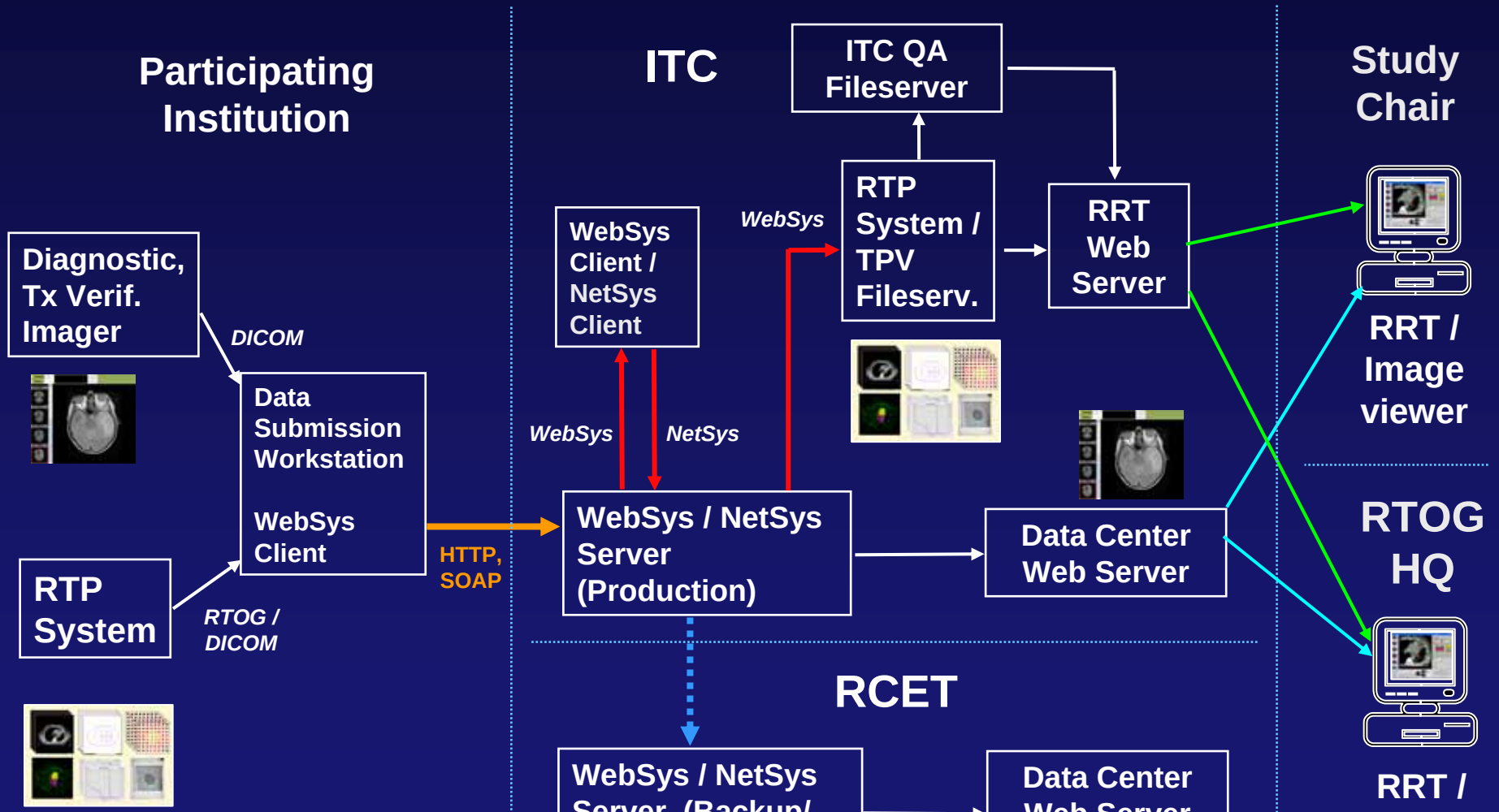
Unique Value of the RCET System

- The RCET System is designed and built specifically for Clinical Trials in Radiation Oncology
  - Why? - because the market is nonexistent and there is no commercial equivalent
- Data archive has a market and is necessary, but not sufficient for clinical trials
  - Why? - we need to manage, view, and manipulate all RT Data and this is not supported by commercial systems
- The RCET System design is driven by radiation oncology professionals and utilizes the latest software technology

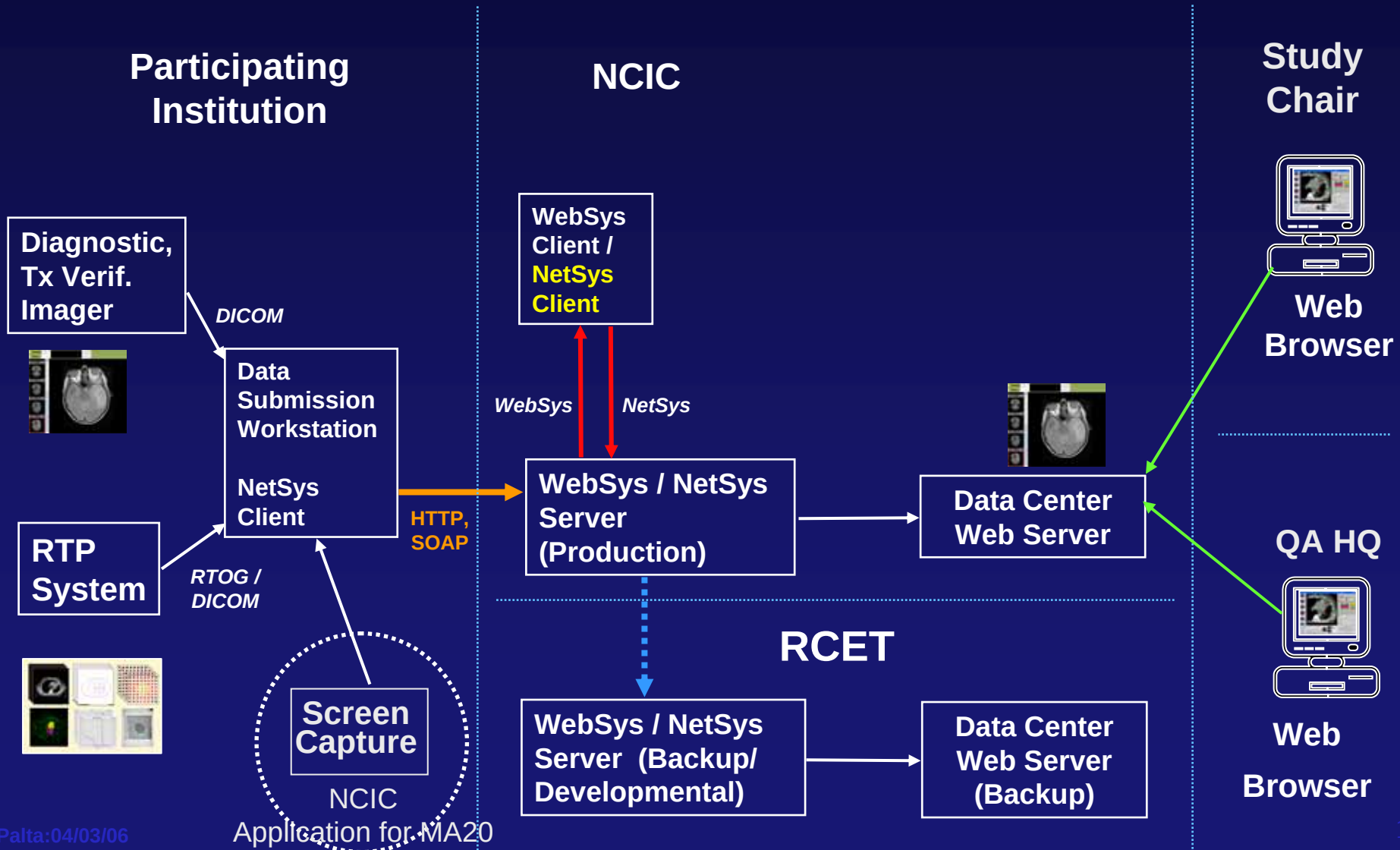
Unique Value of the RCET System

- Further, the RCET System is based on patent pending technology
- The University of Florida is filing patents on:
  - Web-services for DICOM PACS (WAN DICOM PACS)
  - The distributed client application for visualization
- The RCET System will always be available to the radiation oncology clinical trials community free of charge

ATC Method 2 (WebSys Services)

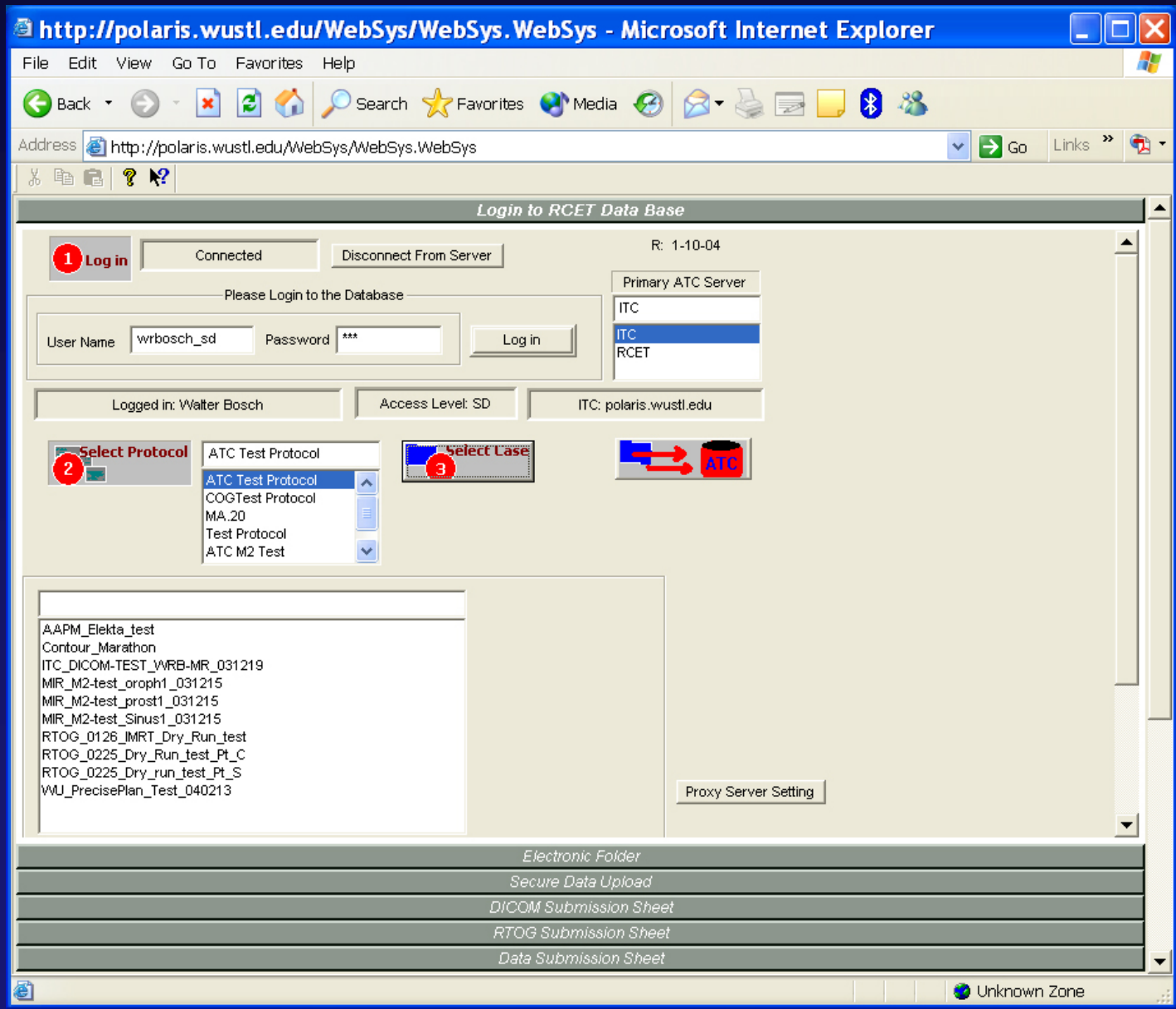


ATC Method 3 (NetSys Services)

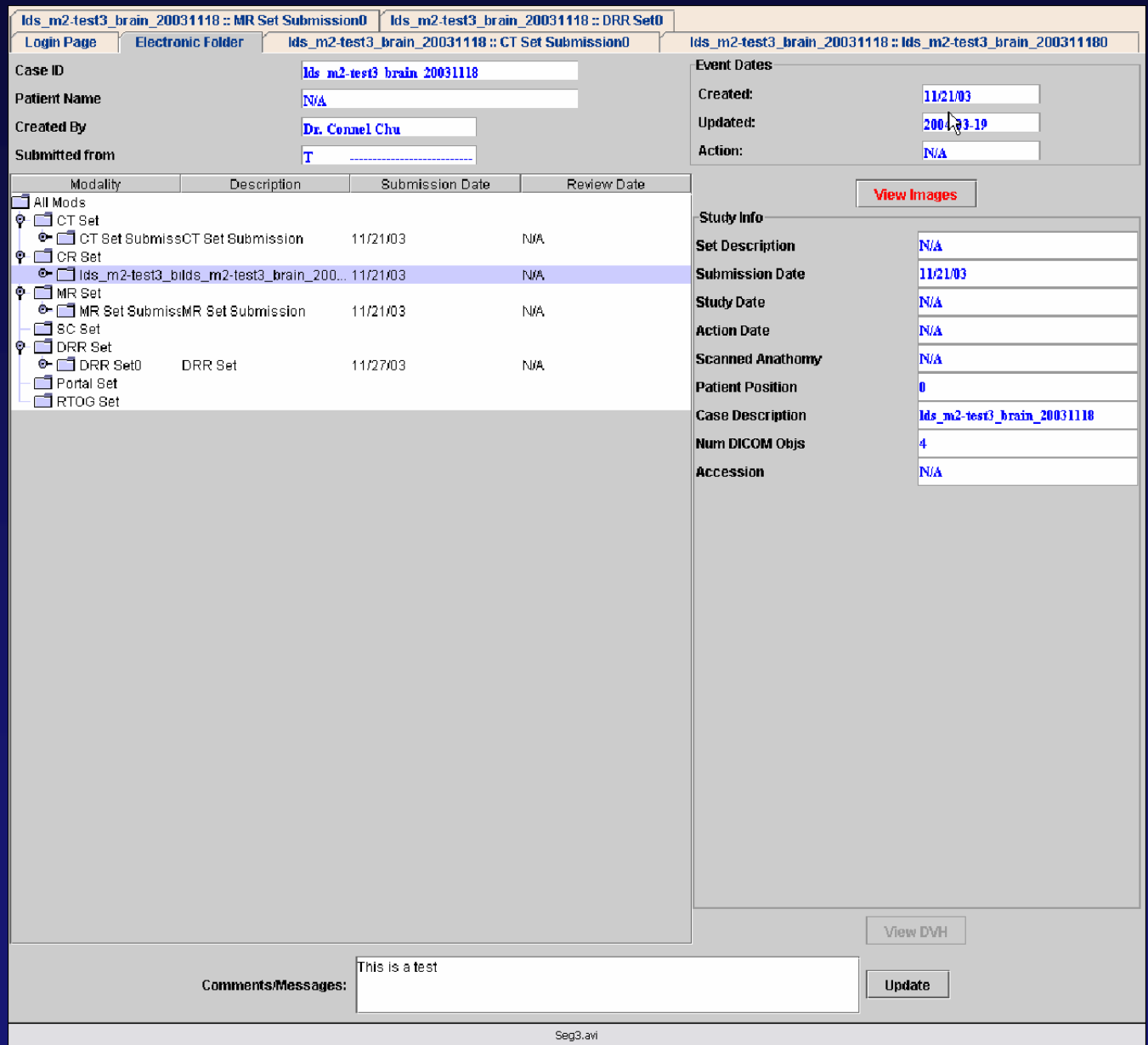


WebSys

- Secure upload of images and treatment planning data
- Supports DICOM and RTOG Data Exchange format
- Images and data are anonymized and encrypted prior to upload

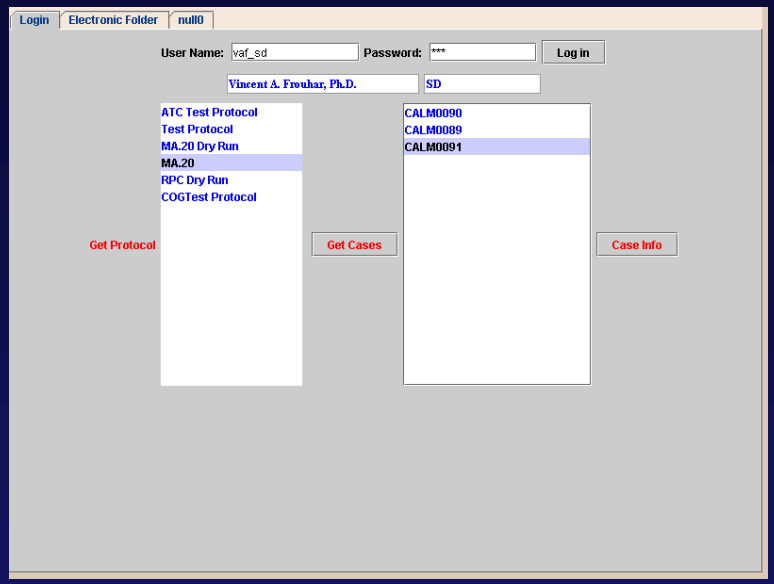


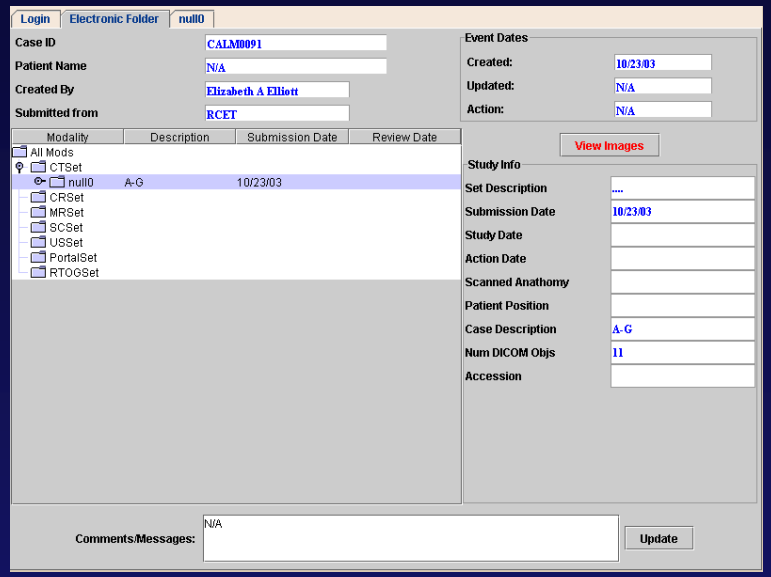
Electronic Chart



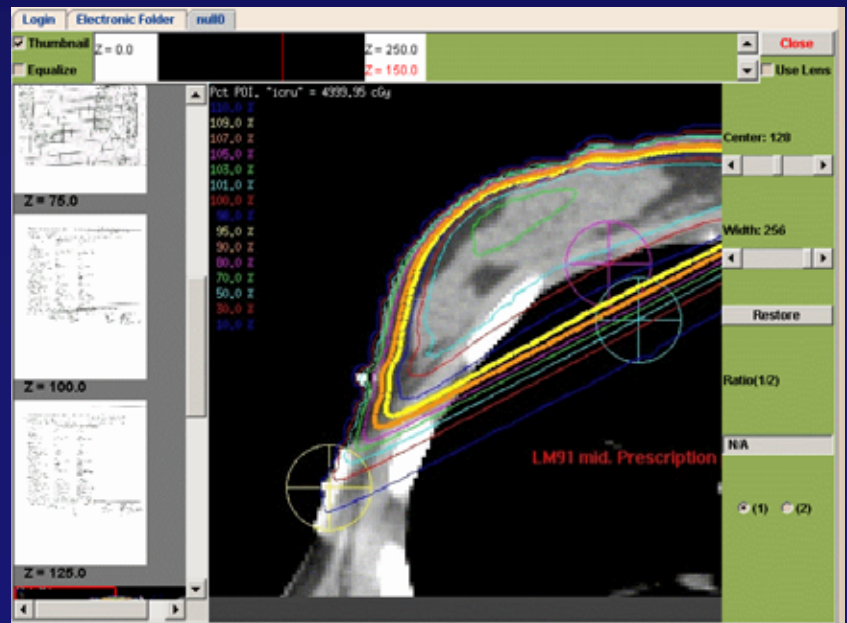
ATC Advanced Technology Consortium

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

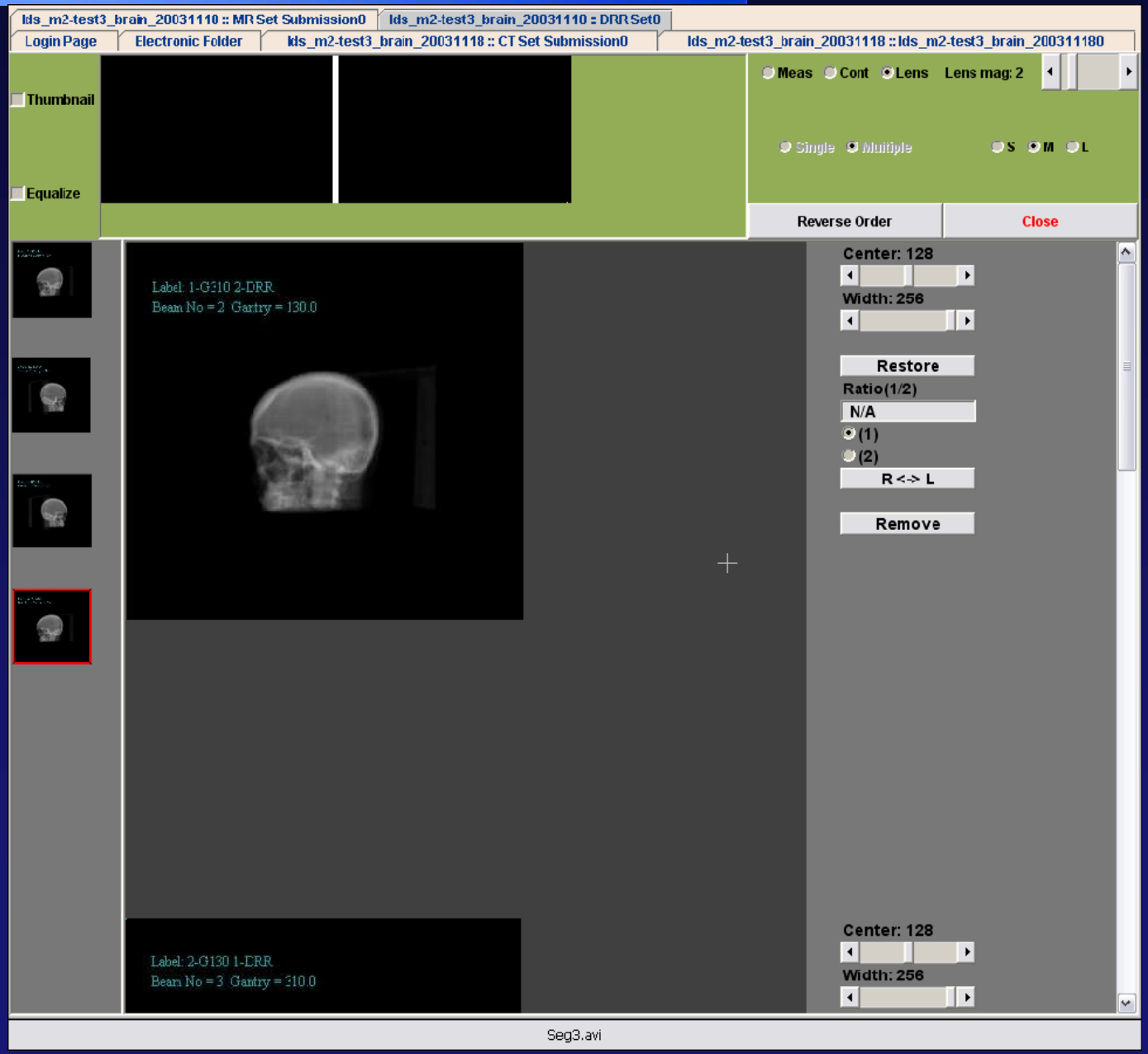




Rapid Review



RT Image Review



ATC AdvancedTechnologyConsortium

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

NetSys3.6

Where is the RCET System Today?

- Design and Architecture of the RCET System
  - Initial System Designed by UF Faculty in 1st Funding Cycle
  - NCIC collaborated with RCET to establish new Clinical Software Requirement Specifications as a trial group end user
- Implementation of System Improvements
  - New WebSys & NetSys Software Developed during 2004-2005
- Deployment of the New System - In Progress
  - Testing , Debugging, and Validation with NCIC and ITC

Summary

- The RCET System capabilities have been extended to handle different flavors of DICOM-RT objects
- The RCET team is continuing its effort in making RCET Infrastructure for data archive, retrieval and review more robust through “bug” fixes.
- RCET Data Server has been replicated at NCIC. It will be used to accrue and remotely review 3D RT data using WebSys and NetSys modules.
- The RCET team is continuing its effort to add new modules to the NetSys5.0 and WebSys2.5

Summary

- The ITC and RCET team members are continuing to play an important role in the development of IHE-RO initiative and DICOM committee.
  - This endeavor is likely to accelerate the implementation of common DICOM and DICOM-RT standards.
- The research and development of data mining tools and data compression for storage and transmission using Wavelet Transforms is on-going.
- An integration of RCET infrastructure, IMPAC database, and UF Outcome database is under way at UFPTI for outcome studies.

Infrastructure for Clinical QA and Outcome Studies @UF

RCET System (Treatment Planning Data)

Clinical Research System (Site specific coding sheets)

IMPAC

(Treatment Data)

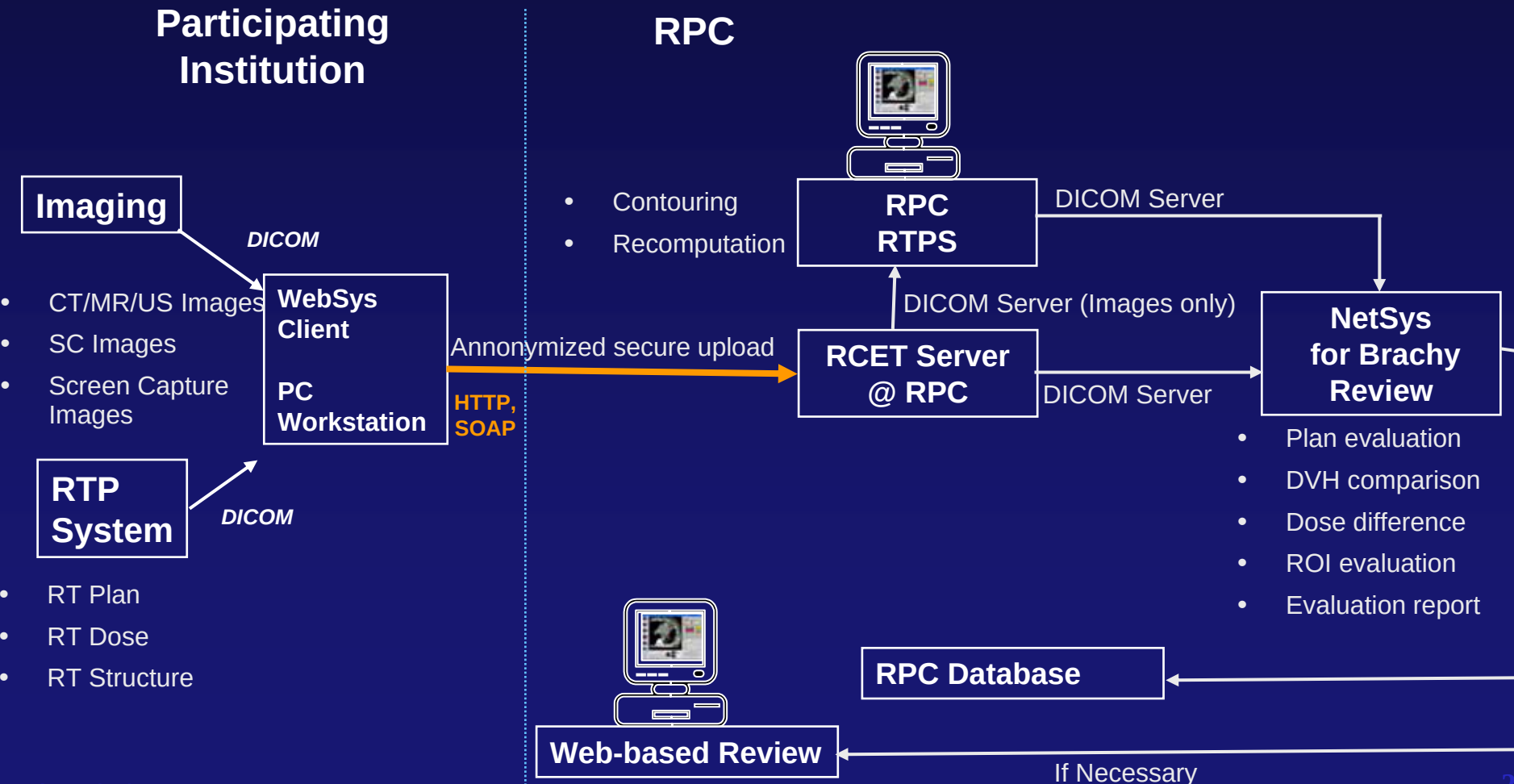
Clinic-wide review/data entry

Activities: clinical review, data entry, data mining

Integrator

RCET DB

Clinical Research DB

IMPAC DB

Brachytherapy Data Archive and Review System (A Proposal)