

# 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 worldwide 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

## RCET INFRASTRUCTURE

Database  
Server  
SOAN

## RCET Modules

RTOG Data

DICOM-RT Objects

DICOM Network  
services

Rapid Review

### WebSys

Image Feature based  
Data Mining

Context based Data  
Mining

### Data Mining

Wavelet Transforms

### Image Transmission and Storage

Fast DRR

Dose matrix  
algebra

2D and 3D visualization

2D and 3D Contour and  
ROI

2D, 3D segmentation  
Image processing

Brachytherapy  
Modules

### NetSys

# 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 v3

- 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.

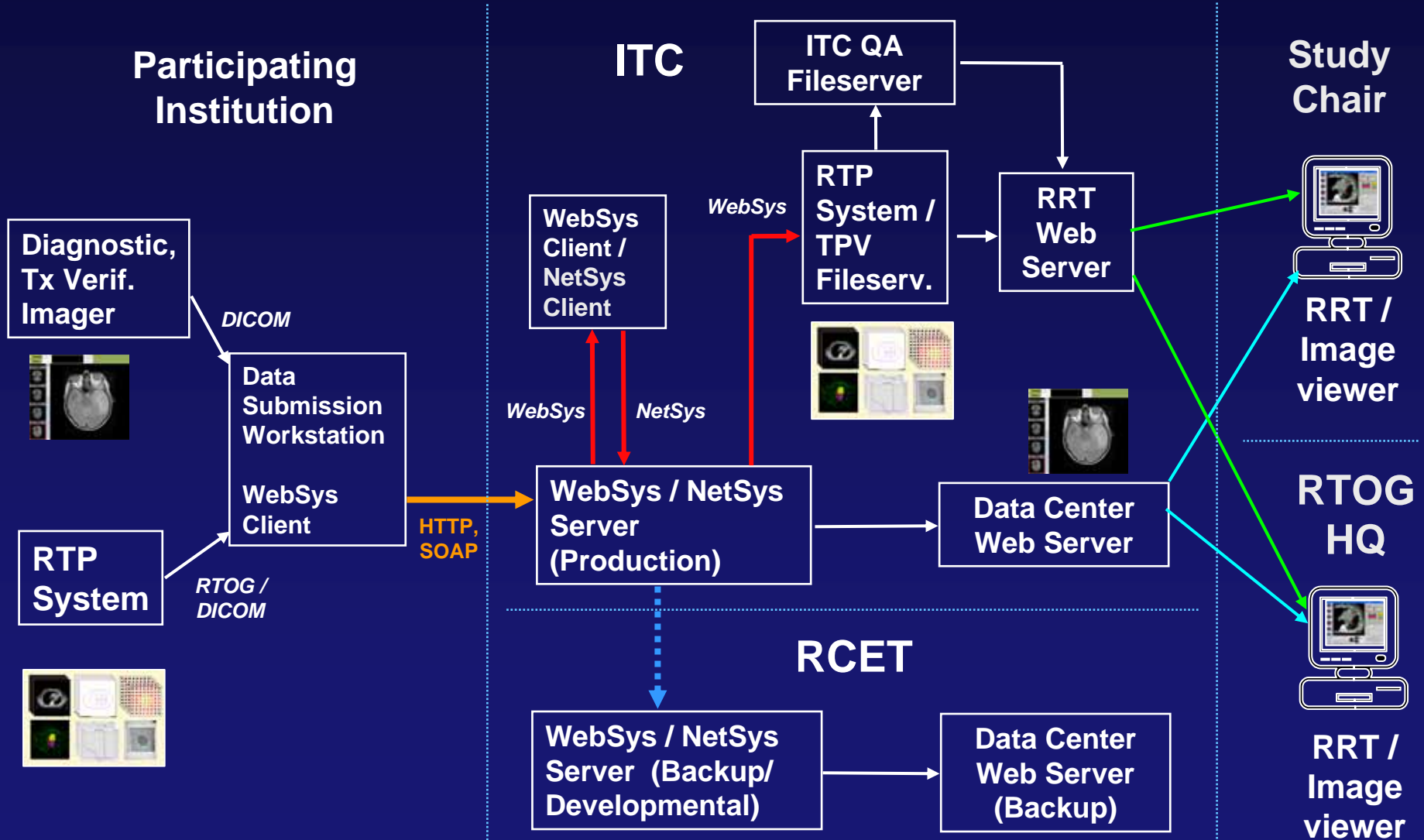
# Unique Value of the RCET System

- 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

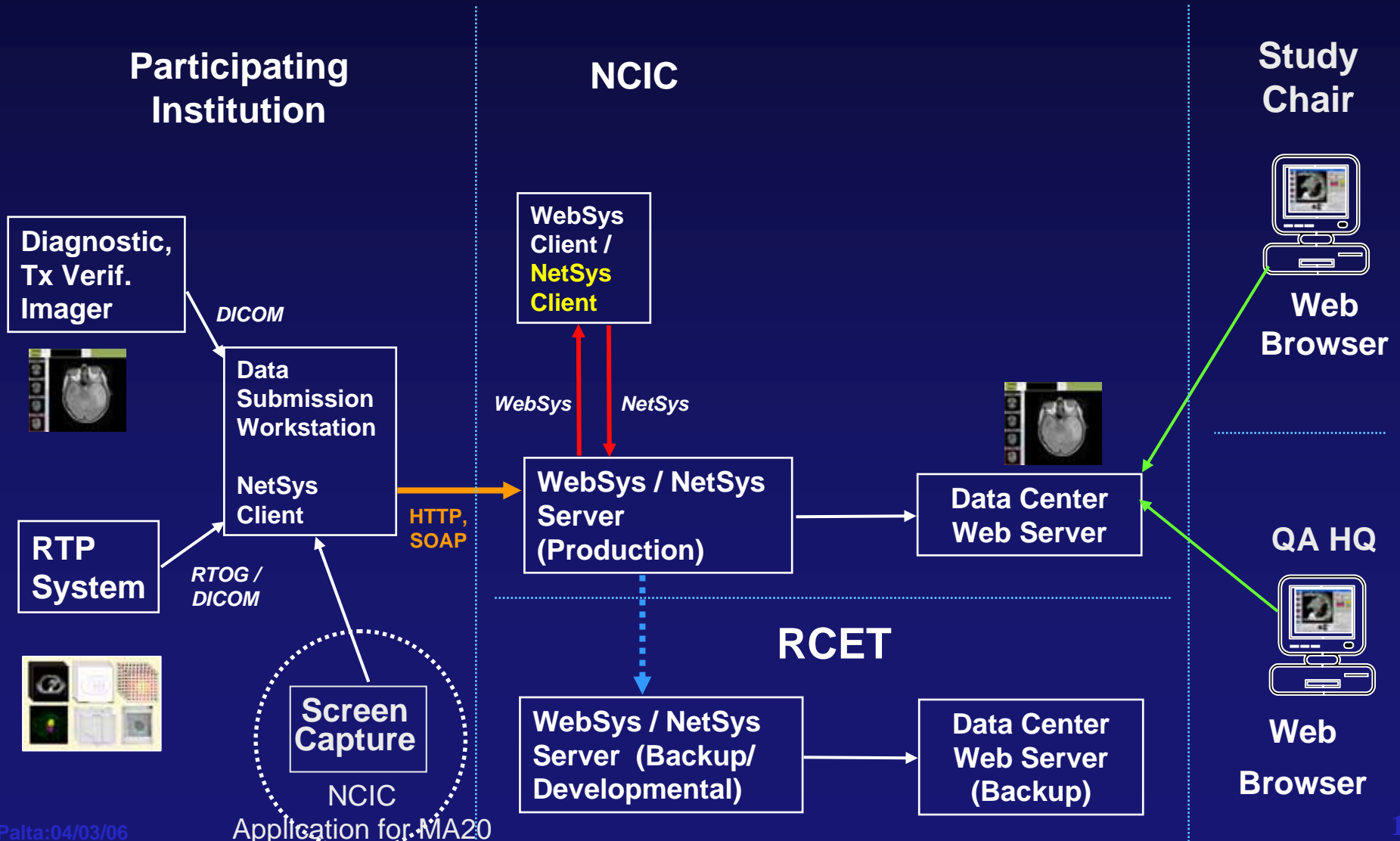
- Further, the RCET System is based on patent pending technology
- The University of Florida is filing patents on:
  - Web-services for DICOM PACS (WAN DICOM PACS)
  - The distributed client application for visualization
- The RCET System will always be available to the radiation oncology clinical trials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

# ATC Method 2 (WebSys Services)



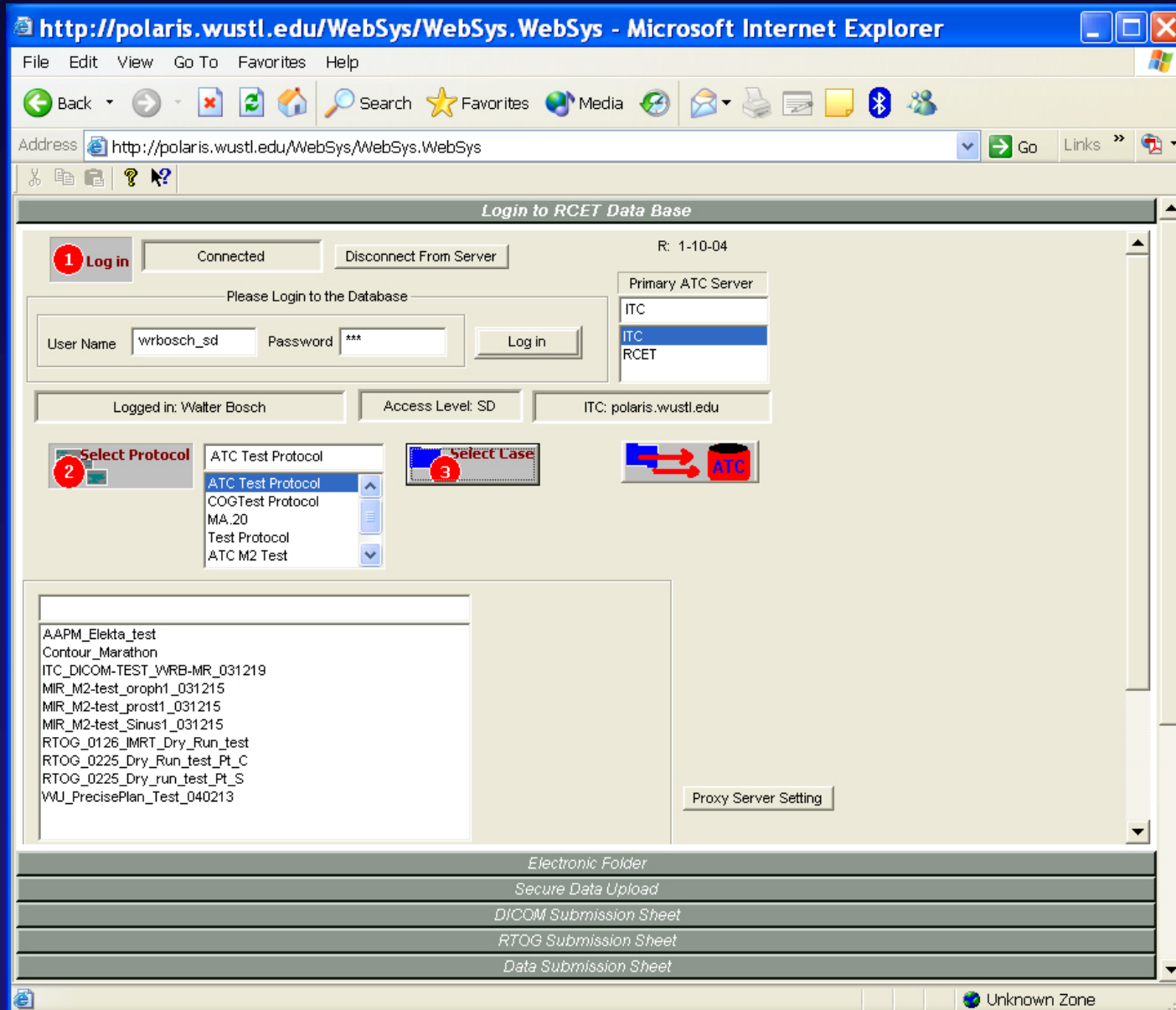


# ATC Method 3 (NetSys Services)



# 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

Ids\_m2-test3\_brain\_20031118 :: MR Set Submission0
Ids\_m2-test3\_brain\_20031118 :: DRR Set0

Login Page
Electronic Folder
Ids\_m2-test3\_brain\_20031118 :: CT Set Submission0
Ids\_m2-test3\_brain\_20031118 :: Ids\_m2-test3\_brain\_200311180

**Case ID**

**Patient Name**

**Created By**

**Submitted from**

Modality	Description	Submission Date	Review Date
All Mods			
CT Set			
CT Set Submiss	CT Set Submission	11/21/03	N/A
CR Set			
Ids_m2-test3_bilds_m2-test3_brain_200...		11/21/03	N/A
MR Set			
MR Set Submiss	MR Set Submission	11/21/03	N/A
SC Set			
DRR Set			
DRR Set0	DRR Set	11/27/03	N/A
Portal Set			
RTOG Set			

**Event Dates**

**Created:**

**Updated:**

**Action:**

[View Images](#)

**Study Info**

**Set Description**

**Submission Date**

**Study Date**

**Action Date**

**Scanned Anatomy**

**Patient Position**

**Case Description**

**Num DICOM Objs**

**Accession**

[View DVH](#)

**Comments/Messages:**

Login | Electronic Folder | null0  
 User Name: vaf\_sd Password: \*\*\* Log in  
 Vincent A. Frowhar, Ph.D. SD

ATC Test Protocol	CALM0090
Test Protocol	CALM0089
MA20 Dry Run	CALM0091
MA20	
RPC Dry Run	
COGTest Protocol	

Get Protocol | Get Cases | Case Info

Login | Electronic Folder | null0  
 Case ID: CALM0091  
 Patient Name: N/A  
 Created By: Elizabeth A Elliott  
 Submitted from: RCET

Event Dates  
 Created: 10/23/03  
 Updated: N/A  
 Action: N/A

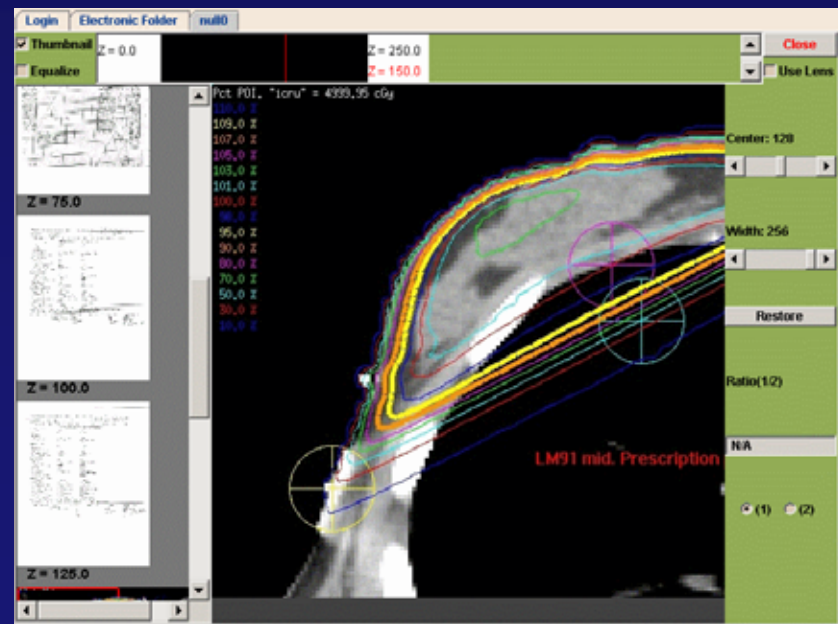
Modality	Description	Submission Date	Review Date
<input type="checkbox"/> All Mods			
<input type="checkbox"/> CTSet			
<input checked="" type="checkbox"/> null0	A-G	10/23/03	
<input type="checkbox"/> CRSet			
<input type="checkbox"/> MRSet			
<input type="checkbox"/> SCSet			
<input type="checkbox"/> USSet			
<input type="checkbox"/> PortalSet			
<input type="checkbox"/> RTOGSet			

View Images

Study Info  
 Set Description: ....  
 Submission Date: 10/23/03  
 Study Date:  
 Action Date:  
 Scanned Anathomy:  
 Patient Position:  
 Case Description: A-G  
 Num DICOM Objs: 11  
 Accession:

Comments/Messages: N/A Update

# Rapid Review



## RT Image Review

Ids\_m2-test3\_brain\_20031110 :: MR Set Submission0    Ids\_m2-test3\_brain\_20031110 :: DRR Set0

Login Page    Electronic Folder    Ids\_m2-test3\_brain\_20031118 :: CT Set Submission0    Ids\_m2-test3\_brain\_200311180


Meas     Cont     Lens    Lens mag: 2

Single     Multiple     S     M     L

Reverse Order    Close

Thumbnail    Equalize

Label: 1-G110 2-DRR  
Beam No = 2    Gantry = 130.0



Center: 128  
Width: 256

Restore

Ratio(1/2)  
N/A

(1)  
 (2)

R <-> L

Remove

Label: 2-G130 1-DRR  
Beam No = 3    Gantry = 210.0

Center: 128  
Width: 256

Seg3.avi



Operations Configuration Preferences GUI Layout Options

Analyzer Off Set View kidle> Case ID: Proton\_Case 3

1X1 View  
2X1 Views  
1X2 Views  
3X2

ROI Interface  
Dose Interface  
DVH Interface

Reset Views  
Marks Off  
Clear Markings

Center Win

1100 500

Z=46 mm Z=44 mm Z=41 mm Z=39 mm Z=36 mm Z=34 mm Z=31 mm Z

Contrast Ct

First Step

16 1

# 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)



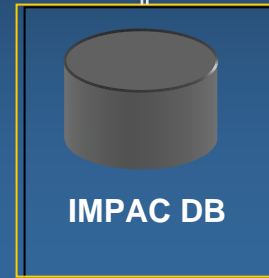
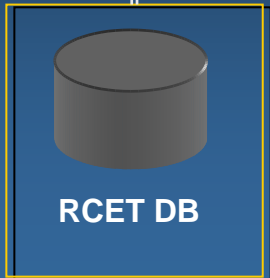
**Clinical Research System** (Site specific coding sheets)



**IMPAC** (Treatment Data)

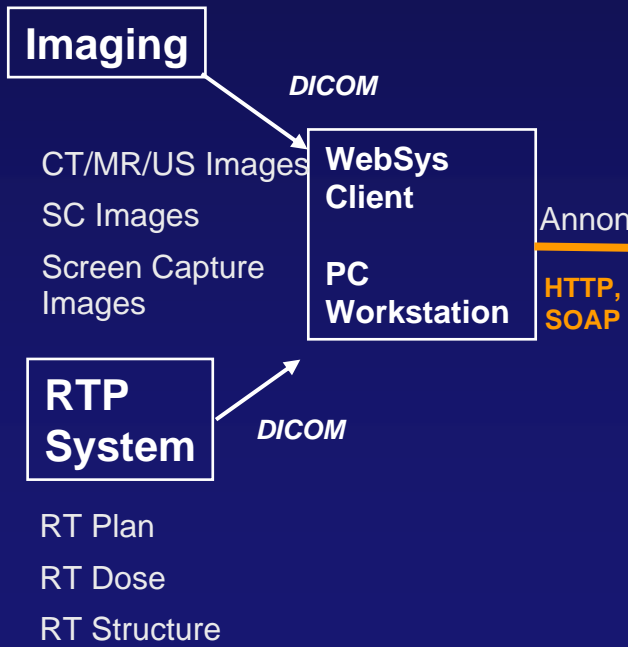
Clinic-wide review/data entry  
Activities: clinical review, data entry, data mining

**Integrator**

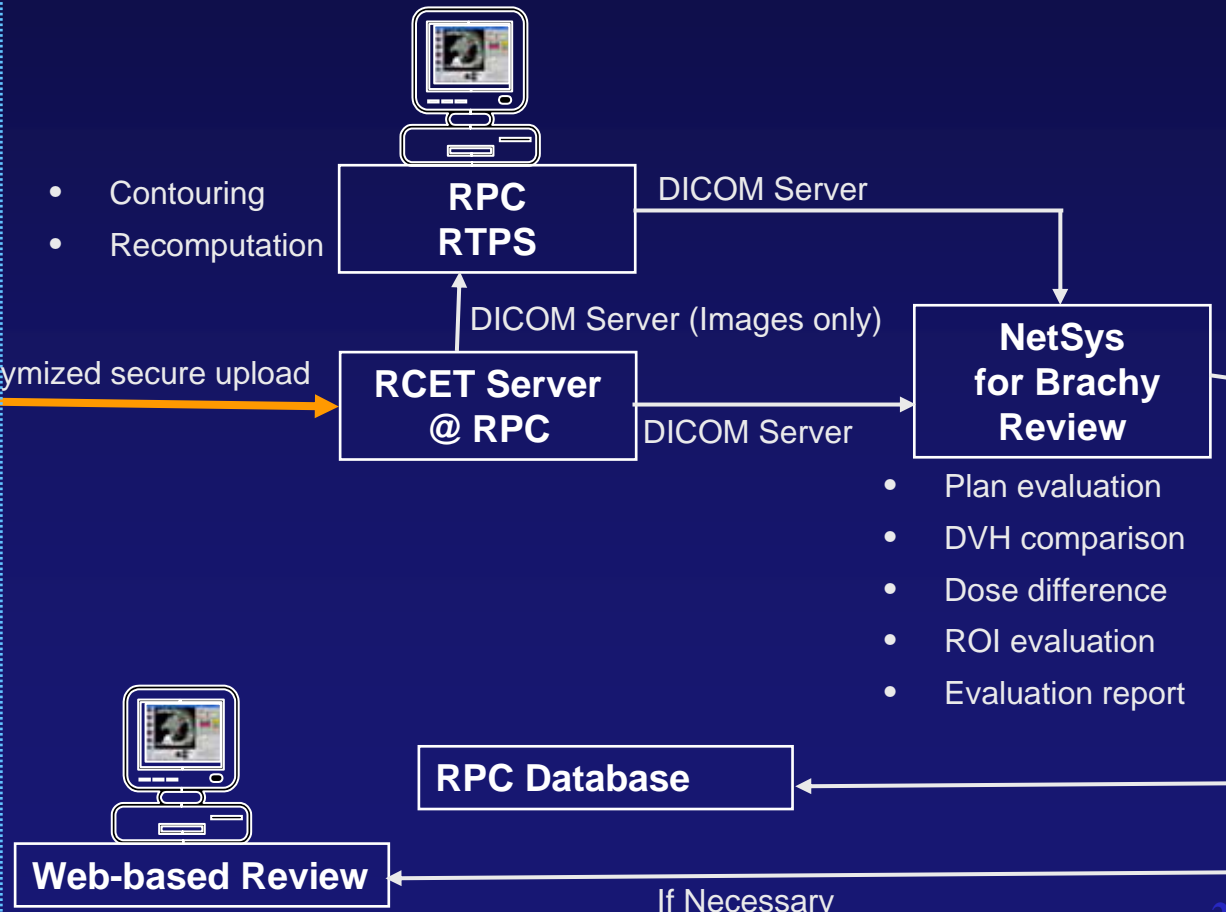


# Brachytherapy Data Archive and Review System (A Proposal)

## Participating Institution



## RPC



- Contouring
- Recomputation

- Plan evaluation
- DVH comparison
- Dose difference
- ROI evaluation
- Evaluation report