

RCET Report

January, 20, 2005

RCET Team

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

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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 Activities

ATC directed:

- Testing and “bug” fixes of **ATC Method 2** (In progress)
- Installation and testing of **ATC Method 3** at NCIC (In progress)
- Draft guidelines for the use of IMRT in clinical trials (submitted 12/04)

Other areas:

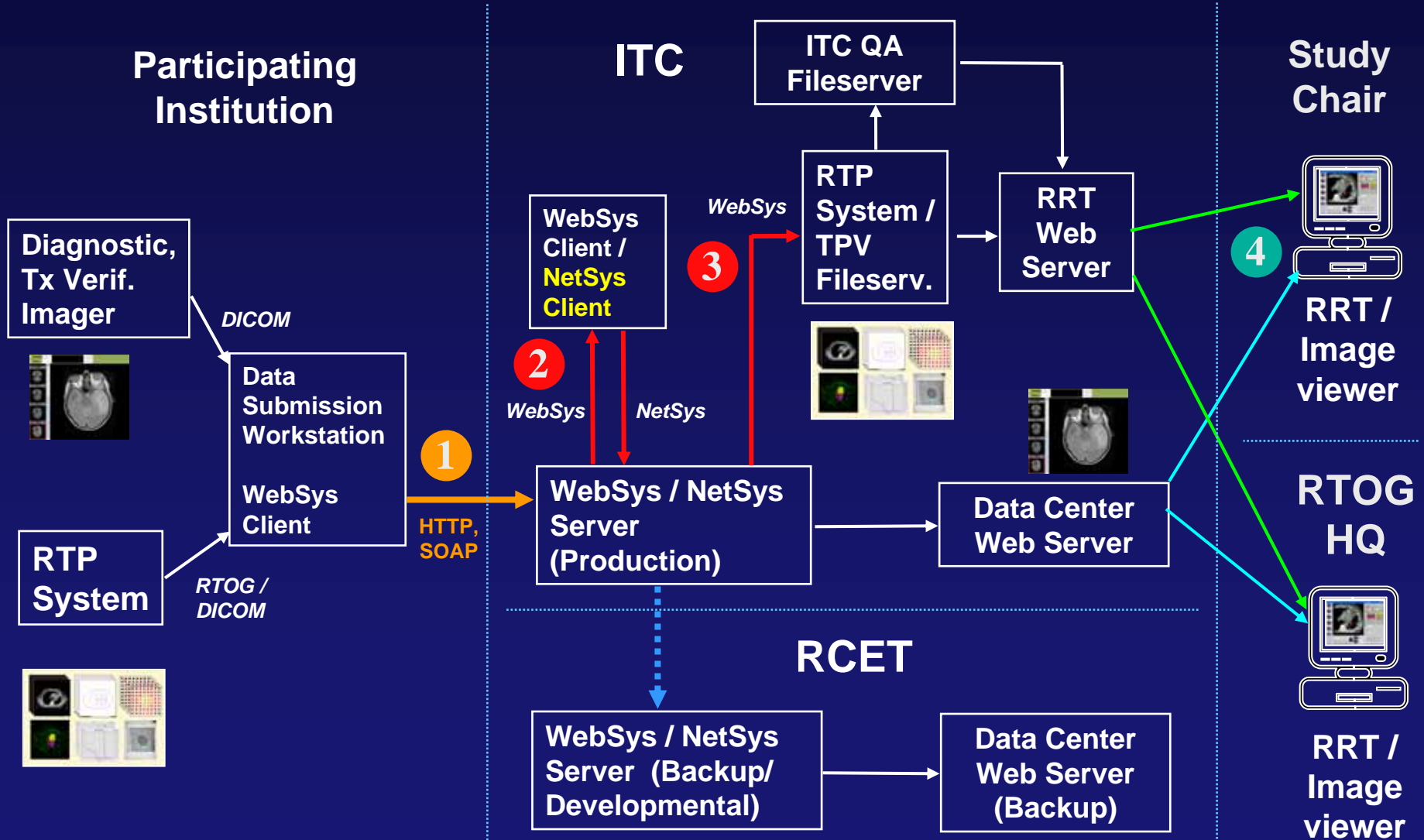
- Integrating the Healthcare Enterprise in Radiation Oncology (IHE-RO)
 - An ASTRO initiative
 - Seamless connectivity in Radiation Therapy
- NCI Cancer Experts Corps
 - Provide an infrastructure for remote peer-review
 - Web-based services (WebSys enabled rapid review)

RCET Activities

RCET research and development:

- Development of data mining algorithm (image feature and context based)
- Advanced algorithms for imaging data transmission and storage (Wavelet transforms)
- New modules for NetSys
 - Fast DRR
 - Dose matrix algebra
 - 2D and 3D visualization
 - 2D and 3D contours and ROI
 - Image segmentation and image processing
 - LDR Intracavitary Brachytherapy

ATC Method 2 (WebSys Services)



ATC Method 2 (Current Status)

For Elekta (Precise Plan), CMS (Focus and XIO), MDS Nordion, Philips (Pinnacle), and Varian (Eclipse), ATC Method 2 can accomplish the following:

- Data (DICOM and RTOG) submission using a secure networking mechanism, which is conformant with HIPPA requirements.
- All data submitted through ATC Method 2 is auto-registered with a central database.
- Electronic folder reports all accepted modalities with a summary for the dataset.
- Submitted data are immediately available for retrieval using electronic folder.
- For diagnostic DICOM datasets, images are available immediately for rapid-review via the Rapid-Review applet.

ATC Digital Data Submission Server

Provides links to

- WebSys – secure upload/download
- RRT – image segmentation and dosimetry review
- Rapid Image Viewer – diagnostic image display

Advanced Technology QA Consortium (ATC) - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Forward Stop Refresh Home Search

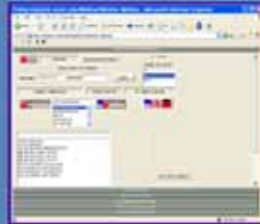
Address http://polaris.wustl.edu/Main_40.asp

ATC Website: <http://atc.wustl.edu>

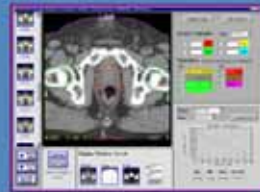
ATC Digital Data Submission/Review Server

Welcome to the [Advanced Technology QA Consortium Digital Data Submission Server](#) located at the Image-guided Therapy Center (ITC), at Washington University, in St. Louis, Missouri. The ATC Digital Data Submission System is operated jointly by the ITC and the Resource Center for Emerging Technologies (RCET) in Gainesville, Florida. The ATC provides resources to facilitate the conduct of NCI sponsored advanced technology radiation therapy clinical trials while maintaining patient confidentiality.

Please note: the resources linked on this page are for the use of investigators, QA centers, and participants in ATC-supported clinical trials. A valid user account is required for their use. Please contact the Image-guided Therapy QA Center (ITC) at itc@castor.wustl.edu or call 314-747-5415 to request a user account.



WebSys is a web-based application for *submitting* and *retrieving* images and treatment planning data for ATC-supported advanced-technology clinical trials. WebSys uses *secure web services communication* with the ATC database. DICOM and RTOG Data Exchange data sets are automatically anonymized and registered with the ATC database when they are uploaded. Datasets available for download can be accessed using WebSys via an electronic folder for each protocol case.



Remote Review Tool is a web-based application for interactive review of images and treatment planning data. The Remote Review Tool displays axial images, organ- and target-volume contours, iso-dose curves, point doses, and DVHs for ATC-supported protocol data sets.



Rapid Image Viewer is a web-based application for reviewing diagnostic image series and treatment verification images for ATC-supported clinical trials. This application requires the installation of the Java Runtime Library your computer (available for download [here](#)).

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

http://polaris.wustl.edu/WebSys/WebSys.WebSys - Microsoft Internet Explorer

File Edit View Go To Favorites Help

Address http://polaris.wustl.edu/WebSys/WebSys.WebSys

Login to RCET Data Base

1 Log in Connected Disconnect From Server R: 1-10-04

Please Login to the Database

User Name wrbosch_sd Password **** Log in

Primary ATC Server

ITC
ITC
RCET

Logged in: Walter Bosch Access Level: SD ITC: polaris.wustl.edu

2 Select Protocol ATC Test Protocol
ATC Test Protocol
COGTest Protocol
MA,20
Test Protocol
ATC M2 Test

3 Select Case

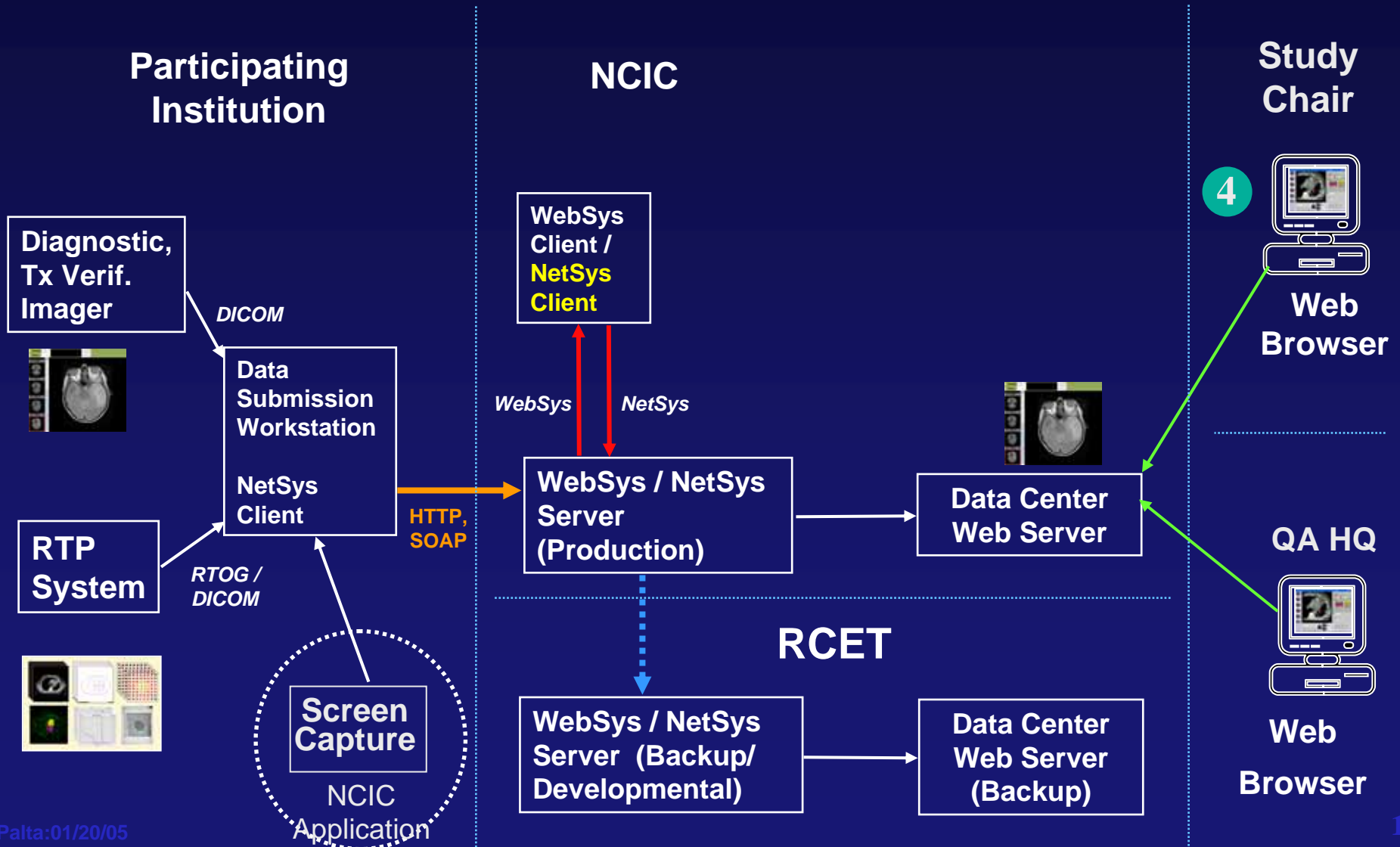
A,APM_Elekt_a_test
Contour_Marathon
ITC_DICOM-TEST_VWRB-MR_031219
MIR_M2-test_oroph1_031215
MIR_M2-test_prost1_031215
MIR_M2-test_Sinus1_031215
RTOG_0126_IMRT_Dry_Run_test
RTOG_0225_Dry_Run_test_Pt_C
RTOG_0225_Dry_run_test_Pt_S
WU_PrecisePlan_Test_040213

Proxy Server Setting

Electronic Folder
Secure Data Upload
DICOM Submission Sheet
RTOG Submission Sheet
Data Submission Sheet

Unknown Zone

ATC Method 3 (NetSys Services)



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

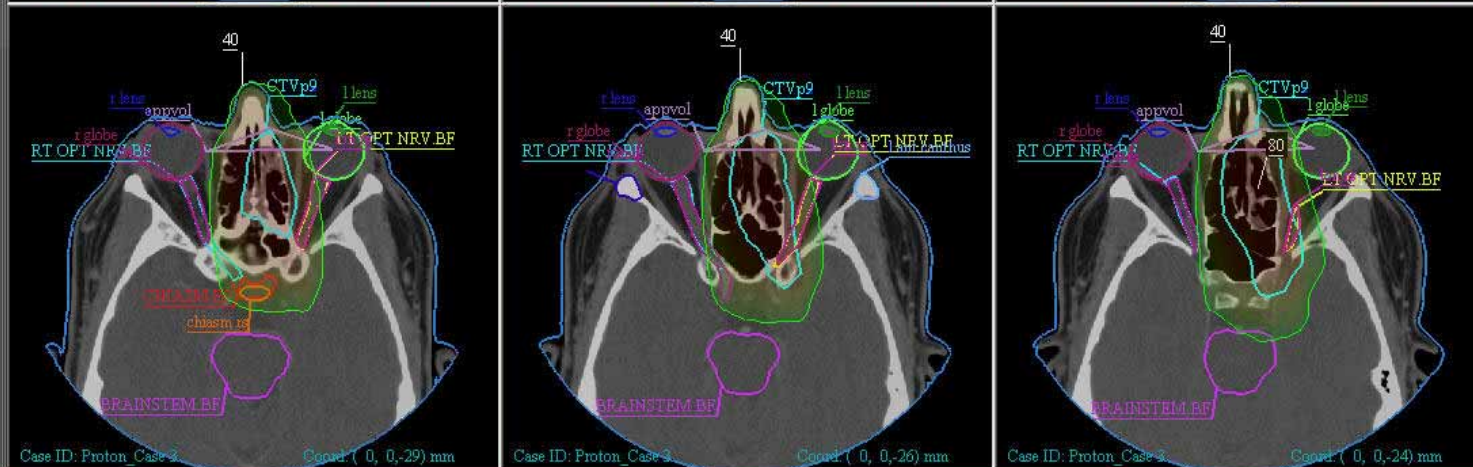
Accession

[View DVH](#)

Comments/Messages:

Operations Configuration Preferences GUI Layout Options

Analyzer Off Set View kide> 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

Contrast Ctl

First Step

16 1

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

Thumbnail Equalize

Meas Cont Lens Lens mag: 2


Single Multiple S M L

Reverse Order Close

Center: 128
Width: 256

Restore
Ratio(1/2)
N/A
 (1)
 (2)
R <-> L
Remove

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



Center: 128
Width: 256

Label: 2-G130 1-DRR
Beam No = 3 Gantry = 110.0

Seg3.avi

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

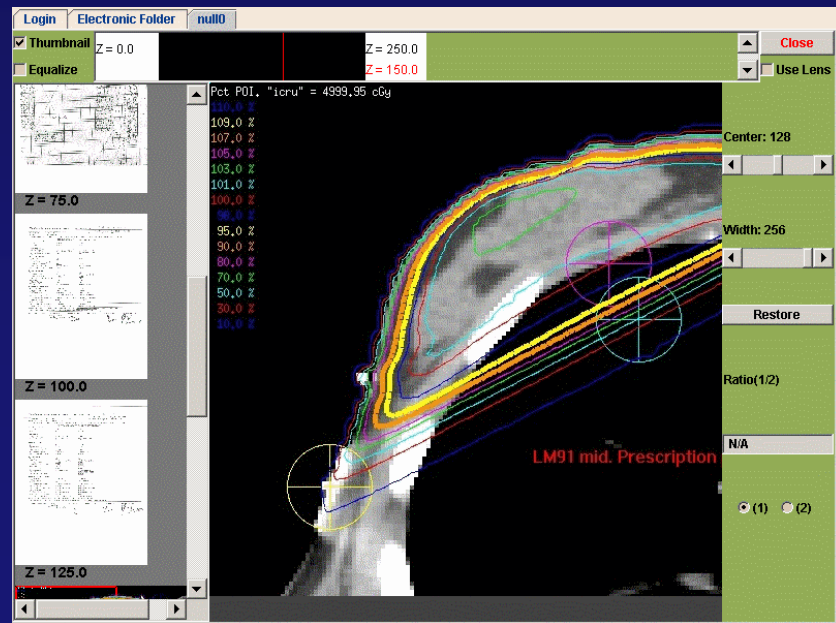
Modality	Description	Submission Date	Review Date
<input type="checkbox"/> All Mods			
<input checked="" type="checkbox"/> CTSet			
<input checked="" type="checkbox"/> null0	A-G	10/23/03	
<input type="checkbox"/> CRSet			
<input type="checkbox"/> MRSet			
<input type="checkbox"/> SCSet			
<input type="checkbox"/>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





Integrating the Healthcare Enterprise In Radiation Oncology

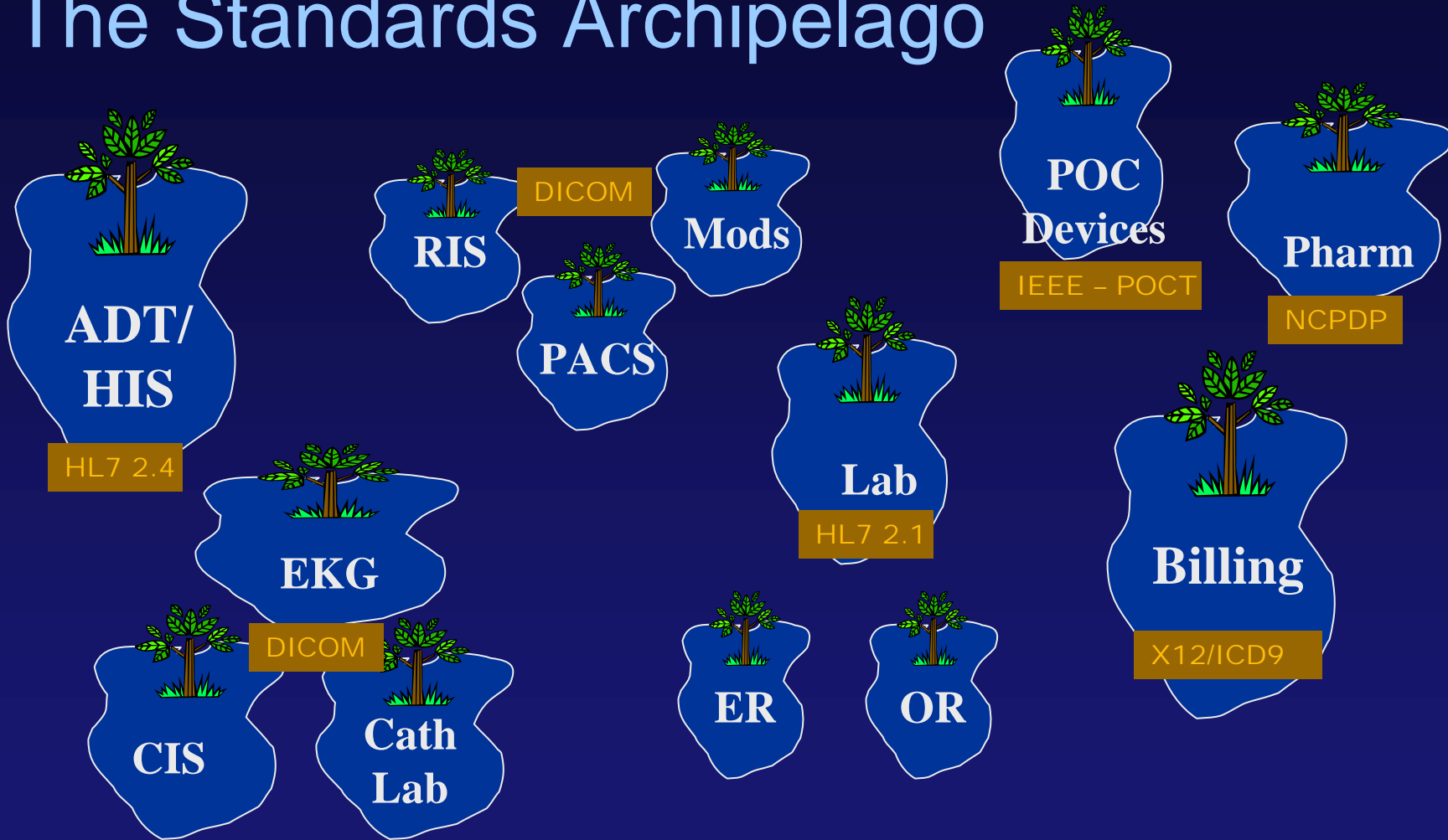
IHE-RO

An initiative spearheaded by Palta and Tripuraneni on behalf of
ASTRO

IHE grew from DICOM experience

- Integrating the Healthcare Enterprise:
 - an initiative by healthcare professionals and industry to improve the way computer systems in healthcare share information
 - promotes the coordinated use of established standards such as HL7 and DICOM to address specific clinical needs
 - leads to systems that communicate better, are easier to implement, and enable care providers to use information more effectively

The Standards Archipelago



Islands of data across the healthcare enterprise

IHERO Participants

- Societies Representing Healthcare Segments
 - RSNA, HIMSS, **ASTRO**, **AAPM**, **ACR**, **ESTRO**,
- Users
 - Radiation Oncologists, Medical Physicists, Radiation Therapists, Administrators, ...
- NCI, ATC
- Treatment Planning System Vendors
- Facility Management Systems Vendors
- Therapy Delivery Systems Vendors
- Standards Development Organizations (SDOs)
 - NEMA, DICOM, HL7, ISO ...

IHERO Process

- Users identify desired functionalities that require coordination and communication among multiple systems
 - E.g., radiotherapy workflow, single registration, cross-device sharing of data
 - Find and document standards-based transactions among systems to achieve desired functionality
 - Apply necessary constraints to eliminate useless wiggle room
- Provide process and tools to encourage vendors to implement
 - software test tools (for example, tools such as MESA)
 - Connectathon interoperability testing event
- Provide tools and education to help users acquire and integrate systems using these solutions
 - Connectathon results and public demonstrations
 - Integration statements

IHERO Planning Committee (Cooper, La Plain; Co-Chair)

Develop Clinical Use Cases

Connections and Public Demonstration

IHERO Technical Committee (Curran, Swerdloff; Co-Chair)

supervises

Establishes Integration Profiles and identifies standards

Appoints Co-Chairs

IHERO

Task Force

Tripuraneni, Palta; Co-Chair

ASTRO Initiative

IHERO Domain-related Technical Working Group

contribute

Users

Global Development:
Radiation Oncology Planning and Delivery Systems, IT Infrastructure, etc.

Global



Interoperability

IHERO Organizational Structure

IHERO Deliverables

- Integration Profiles
 - Describe clinical need and use cases
 - provide a more precise definition of how standards are implemented
- Technical Framework
 - Provides implementation specification for each transaction by specific reference to Standards
- Connectathon
 - Vendors implement these profiles and test their systems with software tools and at a face-to-face Connectathon, where they test interoperability with other vendors' systems.
- Public Demonstrations
 - Vendors publish IHE Integration Statements to document the integration profiles supported by their products

IHERO Clinical Use Case #1

A patient arrives in the clinic and is registered into the Facility Management System (FMS)

The patient is registered on the CT scanner using exactly the same Medical Record Number (one to one mapping) as used in the FMS. A CT study is obtained and transferred to the contouring workstation (only if CT unit is not a dedicated CT-Sim)..... (Tests DICOM image export from CT scanner to Sim software, and both DICOM image and RT structure export to RTPS)

The patient is registered on the Radiation Therapy Treatment Planning System (RTPS) using exactly the same Medical Record Number (one to one mapping) as used in the FMS. The patient CT and contours are then transferred to the RTPS. (Tests DICOM image and RT structure import)

A treatment is generated on the RTPS including all DRRs.

The patient treatment plan (which includes all treatment delivery parameters, treatment schedule, dose and dose per fraction, and DRRs) is transferred to the FMS. (Tests DICOM image, RT structure, and RT plan export from RTPS to FMS)

On the first day of treatment, the patient is setup and filmed on the treatment delivery system using electronically transferred parameters in the FMS. (Tests RT plan and RT dose import from FMS to Treatment Delivery System)

Images are compared with the planning system DRRs. Films are approved and treatment commences.

Alternate, films are incorrect, corrections made, and the information transferred back to the planning system for corrected dose calculation. . . . (Tests RT plan import from FMS to RTPS)

Cancer Experts Corps (CEC)

An initiative originating from the NCI and supported by the Foundation for the National Institute of Health (FNIH), a Non-Government Organization

- It is designed to offer international assistance to cancer facilities and organizations in underserved parts of the world with the ultimate goal of promoting clinical cancer research and clinical trials
- The CEC arises on the background of a domestic program, the Cancer Disparity Partnership
- The international support for CEC is currently being sought

The NCI vision as articulated by Dr. Coleman is to use parts of ATC infrastructure (WebSys/Rapid Review) for remote proactive QA of target and critical structure delineation and peer-review

Summary of RCET Activities

- The RCET team is continuing its effort in making ATC Method 2 for data archive and retrieval more robust through “bug” fixes and extending its capability to handle different flavors of DICOM-RT objects
- RCET Data Server has been replicated at NCIC to accrue MA20 clinical trial data using ATC Method 3. The RCET staff is working towards transferring day-to-day responsibilities of managing the Data Server to the NCIC IT staff.
- The RCET team is continuing its effort to add new modules to the NetSys and WebSys

Summary of RCET Activities

- The research and development of data mining tools and data compression for storage and transmission using Wavelet Transforms is on-going. A prototype of these developments will be demonstrated at the next ATC meeting
 - A research abstract has been submitted to the 2005 BIROW meeting and two abstracts are planned for submission to the 2005 AAPM meeting. The manuscripts to peer-review journal will follow.
- An integration of RCET infrastructure, IMPAC database, and UF Outcome database is under way at UF for outcome studies.
 - A research abstract for submission to the ASTRO 2005 and a manuscript in the Red Journal is planned

Summary of RCET Activities

- The ITC and RCET team members are continuing to play an important role in the development of IHE-RO initiative.
 - This endeavor is likely to accelerate the implementation of common DICOM and DICOM-RT standards.
- The Rapid-Review Applets are being redesigned to facilitate peer-review of DICOM images and RT-Structures.
 - This enhancement will facilitate remote peer-review, which is one of the key requirements for the CEC initiative.

RCET System Architecture

