

# Status of ATC Method 2 Implementation at NCIC CTG

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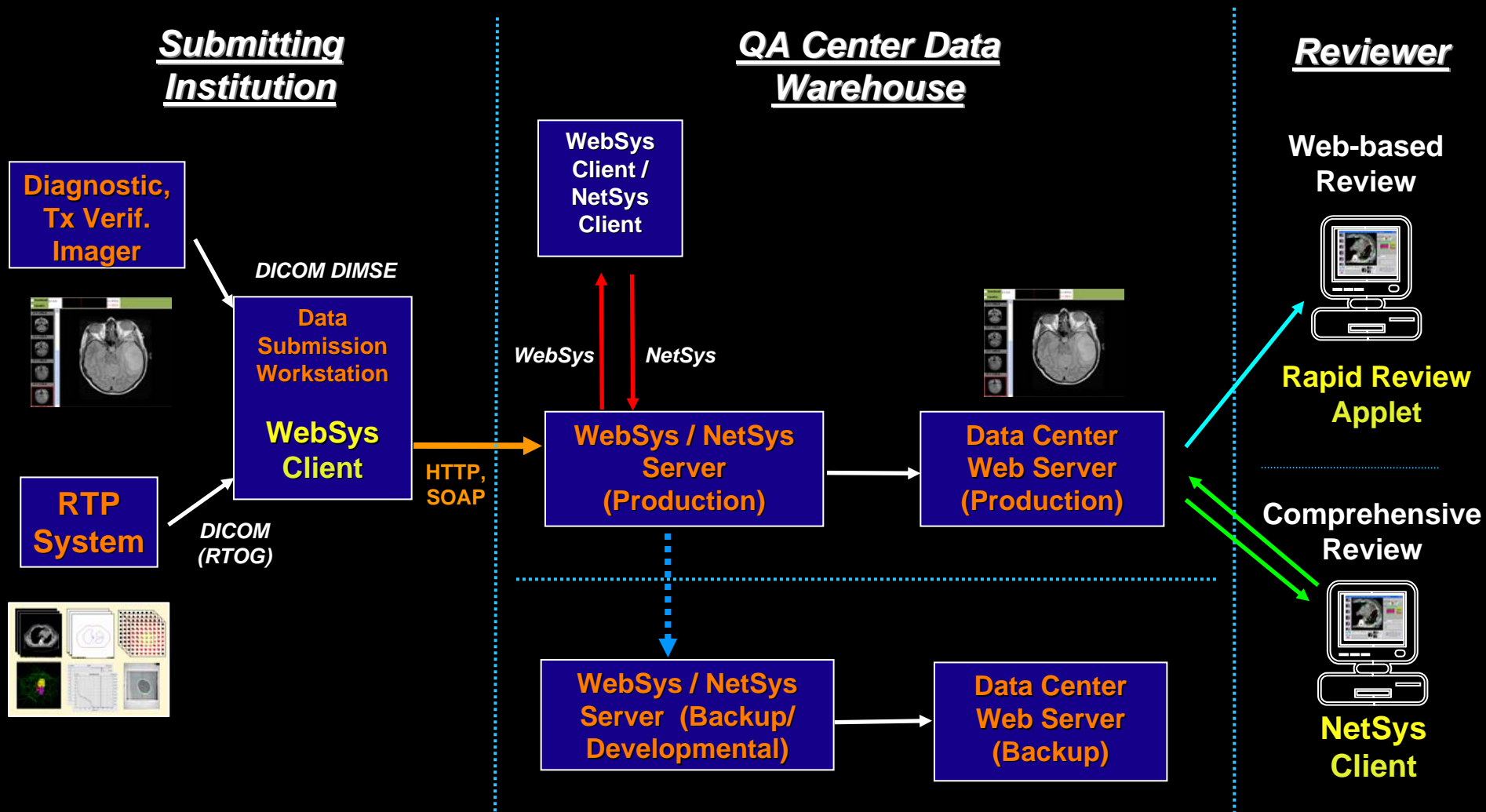
# Overview

- Definition of Method 2
- Software documentation
- Administration software tools
- Testing
  - Procedure
  - Test results
  - Bug fixes
- Timelines for production use



# NCIC CTG Use of Method 2

- Applications: WebSys, NetSys, Rapid Review Applet
- Data Warehouse: Production and Developmental Database and Web servers



# 1. Data Collection (TPS)

- Dicom3 Images: CT and MR studies with uniform and non-uniform slice spacing
- Dicom-RT Structure: bifurcated structures
- Dicom-RT Plan: MLC, block, EDW, physical wedges, IMRT fields (step & shoot and sliding window), photon and electron fields
- Dicom-RT Image: DRRs containing overlaid field shape
- Dicom-RT Dose: 2D and 3D dose matrices and DVHs
- Due to current limitations in data export from treatment planning systems, merging components from RTOG formatted files is required



## 2. Data Transfer (WebSys)

- The data is anonymized and transmitted by encrypted and secure techniques using open source web technology and **compliant with HIPPA, 21CFR Part 11.**
- The data elements to be anonymized include: patient name, birth date, ID#, institution, referring physician.
- The submitted data is stored in its original format on the DB server before being modified for storage on the data warehouse.
- All data will be stored in a secure computing environment on a dedicated database.
- The procedure for the submission and the user interface will be simple and robust.
- The DICOM data will also be formatted for use by Rapid Review software. Rapid Review software can be used to confirm the correct submission of data.



### *3. Data Storage (Databases)*

- Independent Production and Developmental Databases
- The day-to-day support, maintenance and backup responsibilities of this system must be under the control of the NCIC CTG.
- Standard query-able database
- On-site and off-site backup procedures
- User account creation and access control
- Data authoring and versioning control



## 4. Data Review (RapidReview & NetSys)

- View and quickly page through transverse, sagittal, and coronal CT images.
- Display of color coded structures on transverse, sagittal, and coronal images with color legend defining structures.
- User selectable display of specific isodose levels.  
User selectable dose normalization (absolute, % of max dose, % of isocentre dose, % of user specified reference dose).  
Dose displayed as either isodose contour lines or color wash.
- Beam edges should be shown graphically on a slice by slice basis.
- Display DRRs with window/level, and zoom/pan tools.  
Measurement tools reporting distances at reference distance.  
Field outline, central axis optionally displayed.
- Display DVHs with user selection of specific structures.  
Display of absolute and relative volumes and doses.
- Measurement tools, zoom/pan, and level/window tools on transverse, sagittal and coronal views.  
Point dose display & CT pixel value display.





# Documentation

- User manuals developed during testing by one centre
  - WebSys
  - NetSys
  - Rapid Review (Java installation)
- Software documentation ?
- 21CFR Part 11 compliance ?





# Administration software tools

- Web tools:
  - Add / remove user
  - Add / remove protocol
- NetSys configuration
  - Data centres
  - NetSys\_4\_Conf.Config.txt
  - System\_Conf.Config.txt
- WebSys configuration
  - WebSys\_Conf.Config.txt
  - Server information



Treatment Planning Systems			Treatment Modality					
Vendor	System	Version *	Exchange Format	3DCRT	IMRT	Seed Brachy	HDR Brachy	Protons
<a href="#"><u>CMS</u></a>	Focus/XiO	3.1	R	✓	✓	✓		✓
	XiO	4.3.1 **	D	✓	✓			
<a href="#"><u>Elekta</u></a>	RenderPlan 3D		R	✓				
	PrecisePlan	2.01	D	✓	✓			
<a href="#"><u>Nomos</u></a>	Corvus		R		++			
<a href="#"><u>Nucletron</u></a>	Helax TMS		R	✓	✓			
	TheraPlan Plus		R	✓				
	PLATO RTS	2.62	D	✓				
	PLATO BPS	14.2.6	D				✓	
<a href="#"><u>Philips</u></a>	Pinnacle <sup>3</sup>		R	✓	✓			
	AcqPlan	4.9	R	✓				
<a href="#"><u>Rosses Medical</u></a>	Strata Suite CTPlan	4.0	R			✓		
<a href="#"><u>RTek</u></a>	PIPER	2.1.2	R			✓		
<a href="#"><u>Varian</u></a>	BrachyVision	6.5 (Build 7.1.67)	D				✓	
	Eclipse	7.1	D	✓	✓			✓
	VariSeed	7.1	D			✓		

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

# Test Centres

Test Centre	Treatment Planning Systems
<ul style="list-style-type: none"><li>• Cross Cancer Institute Edmonton, AB (CCI)</li></ul>	<ul style="list-style-type: none"><li>• Eclipse 6.5, Application build 7.3.10 [Sp 3]</li></ul>
<ul style="list-style-type: none"><li>• Vancouver Island Cancer Centre, Victoria, BC (VICC)</li></ul>	<ul style="list-style-type: none"><li>• Eclipse 6.5, Application build 7.3.10 [Sp3]</li></ul>
<ul style="list-style-type: none"><li>• Juravinski Cancer Centre, Hamilton, ON (JCC)</li></ul>	<ul style="list-style-type: none"><li>• Pinnacle<sup>3</sup> version 7.4f and DICOM-RT version 2.4</li></ul>
<ul style="list-style-type: none"><li>• Princess Margaret Hospital, Toronto, ON (PMH)</li></ul>	<ul style="list-style-type: none"><li>• Pinnacle<sup>3</sup></li></ul>



# Testing Process

The steps in the testing process were:

- Obtain an account from <http://rcetsystem.org>
- Download the latest version of WebSys (v2.4.4) and Rapid Review
- Upload a test case to the RCET server in Gainesville
- Look at the uploaded test cases with the Rapid Review applet
- Download the test case to a local computer using WebSys 2.4.4

Once a new version of NetSys is available, then

- Install a new version of NetSys
- Review these cases with NetSys, checking accuracy of CT study, Structures, Plan, Dose, DVHs, DRRs
- Ensure dataset uploaded to RCET data warehouse and then downloaded to reviewer's local computer contains the same information
- Identify problems, suggest improvements, and summarize findings



# Initial Test Cases

Task	CCI-1	CCI-2	VICC-1	JCC-1
General Description	Simple 4 field prostate	RTOG Prostate 0126 2 phase plan,	4-Field Partial Breast	PROFIT prostate
Dicom3 - CT or MR study - number of slices - uniformly spaced slices or not - slice thickness	47 CT slices, 3mm slice thickness, non-uniform spacing.	71 CT slices, 3mm slice thickness, non-uniform spacing	79 CT slices, uniform spacing 5 mm thick	96 uniformly spaced CT slices
Dicom-RT Structure - number of volumes of interest (VOIs) - number of points of interest (POIs)	7 VOIs, 0 POIs	1 structure set	13 VOIs & 1 point of interest	12 VOIs and 5 POIs
Dicom-RT Plan - number & type of beams - linac type and energies - summary of field shaping and beam modifiers	4 photon fields, Varian 6 or 15 MV 120 leaf MLC used to shape fields	2 plans (Phase 1 & 2), Varian 6 or 15 MV, fixed wedges, 120 leaf MLC	4 photons Beams, Varian 6EX, 6MV, 80 leaf Millennium MLC, all fields with EDW	7 step and shoot photon beams + 2 reference beams
Dicom-RT Dose - 2D or 3D dose file	3D dose file	2 3D dose files	3D Dose file	Not exported by Pinnacle
Dicom-RT Image - number of Images - type of image (DRR, verification image: portal, kVCT, MVCT) - graphics overlaid on image (e.g. field shape)	4 DRRs, no graphic overlays	8 DRRs, 4 for each phase, graphic overlaid	0	0



# Times

Task	Time (minutes) for Test Case			
	CCI-1	CCI-2	VICC-1	JCC-1
Time to install WebSys 2.4.4	5-10	n/a	1	5
Time to export data from planning system (non WebSys activity)	n/a	5	4	5
Time to convert and upload Dicom files to RCET (using WebSys)	15	12	27	~30
Time to review CT & structures (using Rapid Review Applet)	9	5	n/a	20
Time to download the files from RCET to local PC (using WebSys)	5	3	4	13



# Preliminary Multi-centre Test Results

- No problems with installation of WebSys v 2.4.4 or the Rapid Review Applet (using draft user manuals)
- Time to export the radiotherapy data from TPS in the Dicom-RT format took 4-5 minutes for 71-96 CT slices and associated plans, structures, and doses
- Time to convert and upload the Dicom files took 12-30 minutes, and could indicate differences in the amount of data being uploaded and differences in network speed
- Time to review CT and structures varied from 5-20 minutes and is highly dependent upon the reviewer and the level of detail that the review is performed
- Time to download the files from RCET to a local computer varied from 3-13 minutes and is dependent upon the data transfer size and the network speed





# Bug Fixes, Additional Functionality Required

## WebSys (testing ended 12-Jan-2007)

- Validation of HIPPA, 21 CFR Part 11 compliance
- Integration of RTOG formatted dose files

## Rapid Review (testing ended 12-Jan-2007)

- Don't dim CT image when contours are displayed (fixed)
- Make the info check box 'sticky'
- Provide display of dose, DVH, and plan information
- CCI-1, CCI-2: Contours not displayed on some non-uniformly spaced slices. Eclipse identifies this as a potential problem with the message "Some structure contours are not coplanar with real image slices"
- VICC-1: images could not be loaded by the Rapid Review Applet
- JCC-1: presence of points of interest (POIs) appear to interfere with the display of regions of interest (ROIs)

## NetSys (testing ended 21-Oct-2006)

- Mis-registration of dose matrix with CT study
- Inability to display contours on sagittal and coronal slices
- No display of beam information on CT images or DRRs
- No user selectable dose normalization

Incorrect differential DVHs

No point dose display or CT pixel value display



# Timelines for Production Use

Task	Completion Date
Review deliverables	03-Feb-2007
Bug fixes for WebSys, RapidReview, NetSys	28-Feb-2007
Testing of new software versions	30-Mar-2007
Provide software installers at NCIC-CTG	30-Apr-2007
Upgrade database at NCIC CTG (merge with MA.20 data)	31-May-2007
Test NCIC CTG System	29-Jun-2007
Identify Protocol for Clinical Use (RAPID and PR.12 are using other techniques)	27-Jul-2007



# Conclusions

- Specifications for collection, transfer, storage and review of 3D radiotherapy data were established for NCIC CTG clinical trials
- Two treatment planning systems were initially evaluated for their ability to collect the required Dicom-RT data
  - Varian Eclipse 6.5: some minor limitations identified
  - Philips Pinnacle3 7.4f: new version required to support full Dicom-RT export
- Initial testing of WebSys, NetSys, and Rapid Review occurred
  - WebSys is a functional tool for uploading and downloading Dicom-RT objects
  - a few 'bug fixes' and software enhancements are needed to make the Rapid Review Applet equally functional
  - major development of NetSys is required to address current limitations, and additional software functionality is needed
- After new software is released which addresses the currently identified bugs, significantly more testing is required with different Dicom-RT datasets from different centres



# Comments, Questions

- ???

