

BIOR informatics tools relevant to ATC efforts

Aditya Apte, MS, Divya Khullar, MS, Dan
Mullen, MS, Jing Cui, PhD, Yu Wu, MS, James
Alaly, BS, Kevin Karsch, Walter Bosch, DSc, Joe
Deasy, PhD

Division of Bioinformatics and Outcomes
Research, WUSTL

Scott Davidson*, BS, David Followill*, PhD
Radiological Physics Center

Tools [1/2]

- Web-based automated plan reporting
- Outcomes quality assurance database
- Monte Carlo dose recalculations
- QA tool for RPC
- Ca-BIG enabled version of CERR

Tools [2/2]

- Extensions of CERR
 - PLUNC importing
 - Old GammaKnife importing
- Near-term efforts
 - CERR V4
 - Deformable imaging tools built-in
 - Mesh-based representations
 - New data type: geometric transform (includes deformable/DICOM friendly)

Web-based plan reporting and review

- Goal is to provide detailed reporting on treatment plan quality in convenient manner
- Analysis by CERR and CERR scripts
- Database-centric
- Workflow/review management
- MySQL/Ruby/Ruby on Rails/AJAX

Treatment planning at a cross-roads:

Visual review of data is inadequate,

but

Detailed plan reporting tools are not
available in planning systems.

login - Windows Internet Explorer

Http://localhost:3000/account/login


login

Washington University in St. Louis
SCHOOL OF MEDICINE

WEB BASED TREATMENT PLAN REVIEW

Department of Radiation Oncology

Please login



Login:

Password:

Login >

First time user [Sign Up](#)

Done Local intranet 100%



WEB BASED TREATMENT PLAN REVIEW



[SETTING / LOG OUT](#)

Unapproved Plans

- [Approved List](#)
- [Unapproved List](#)
- [List All](#)
- [Contact](#)

Filter on Last Name:

Number of Plans found : 3

Plan ID	Last Name	First Name	Date Created	Date Approved	Planner	Planning System	Status
plan11	Apte	Aditya	Fri Apr 20 12:00:00 Central Daylight Time 2007		Divya	Tommo	unapproved
							<input type="button" value="Approve"/>
plan12	Mullen	Dan	Fri Apr 20 12:30:00 Central Daylight Time 2007		Jing	Pinnacle	unapproved
							<input type="button" value="Approve"/>
Plan16	Mast	Anand	Tue Mar 27 12:30:00 Central Daylight Time 2007		JD	Pinnacle	unapproved
							<input type="button" value="Approve"/>

WEB BASED TREATMENT PLAN REVIEW



Approved List

Unapproved List

List All

Contact

Unapproved Plans

Filter on Last Name:

Number of Plans found : 1

Plan ID	Last Name	First Name	Date Created	Date Approved	Planner	Planning System	Status
plan11	Apte	Aditya	Fri Apr 20 12:00:00 Central Daylight Time 2007		Divya	Tommo	unapproved

Approve



Aditya Apte
plan11

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Transverse Sagittal Coronal DVH Planning Params

1 2 3 4

The main content area displays four medical imaging windows, numbered 1 through 4. Window 1 shows a Transverse view of a cross-section of a head. Window 2 shows a Sagittal view of a head cross-section. Window 3 shows a Coronal view of a head cross-section. Window 4 shows a DVH (Dose-Volume Histogram) plot. Each window includes a main large image and several smaller thumbnail images on the right side. The windows are set against a dark grey background.



Aditya Apte
plan11

- Approved List
- Unapproved List
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- Contact

Transverse
Sagittal
Coronal
DVH
Planning Params

Dose

Tra: 37/73
z: 0.35cm

Scan

26.9 26.9

0 0

Sag: 128/258
x: -1.44896

Cor: 128/258
y: 0.046875

Legend

- BODY
- CORD
- L LUNG
- PTV
- R LUNG
- heart1
- rnilama

New Comment

- Divya Said**
2 months ago

comment for image 2
- Divya Said**
28 days ago

fdadf
- Divya Said**
14 days ago

check linking 2
- Divya Said**
1 day ago

hello Mona
- Divya Said**
1 day ago

summer i am a good programmer
- Divya Said**
about 6 hours ago

hello Dr. Deasy



Aditya Apte
plan11

[SETTING / LOG OUT](#)

Transverse	Sagittal	Coronal	DVH	Planning Params
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WASHINGTON UNIVERSITY IMRT DOSE QA TABLE

Head and Neck Target Volume Goals for Protocol 06-0001

Approved List

Unapproved List

List All

Contact

ROI	Vol (cc)	Goal	Meet Goal				
PTV Coverage Goals							
PTV 66	46	99% Vol > 93% Rx (65.1 Gy) 20% Vol ≤ 110% Rx (77 Gy)	Yes Yes	93% Rx=	99.50%	6243 Gy	PTV 6
				% Vol ≥ 102% Rx=	5%	6937 Gy	
				% Vol ≥ 110% Rx=	1%	7260 Gy	
				% Vol ≥ 120% Rx=	0%	N/A Gy	
PTV 63	75	99% Vol > 93% Rx (63 Gy) 20% Vol ≤ 110% Rx (63 Gy)	Yes Yes	99% Vol=	99.2% Rx	6249 Gy	PTV 6
				20% Vol=	32.4% Rx	6526 Gy	
				10% Vol=	12.5% Rx	6728 Gy	
				2% Vol=	6.5% Rx	7234 Gy	
PTV 56	104	99% Vol > 93% Rx (56 Gy) 20% Vol ≤ 110% Rx (56 Gy)	Yes Yes	99% Vol=	99.9% Rx	6229 Gy	PTV 5
				20% Vol=	34.5% Rx	6500 Gy	
				10% Vol=	13% Rx	6721 Gy	
				2% Vol=	4.5% Rx	7002 Gy	

Critical Structure Constraints

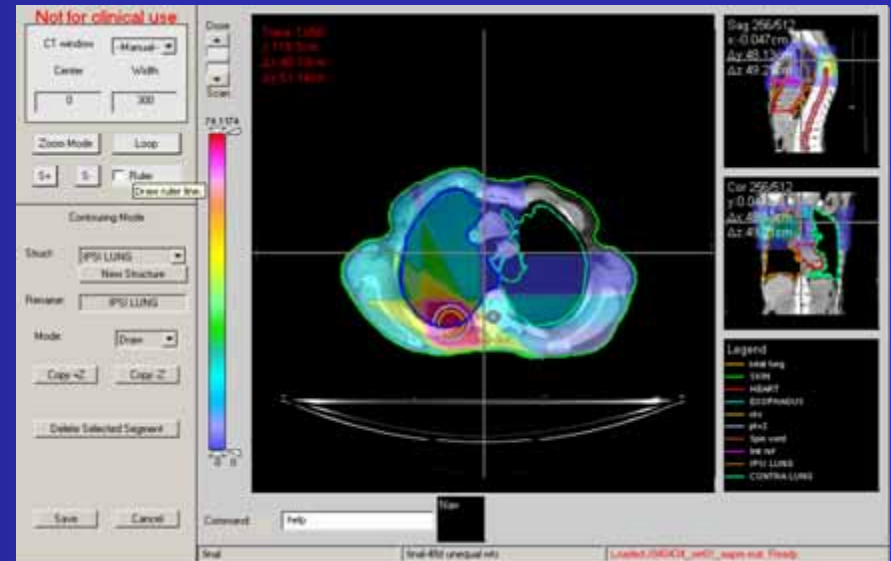
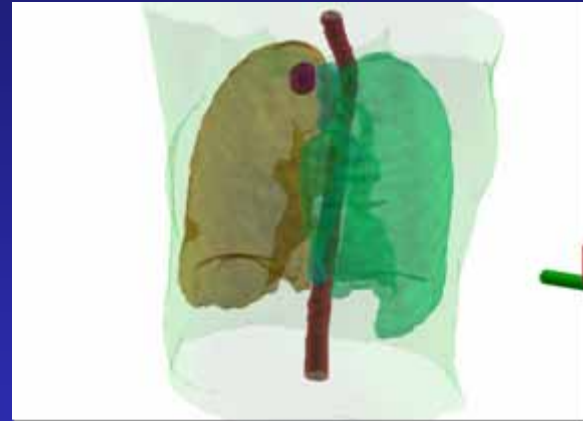
Cord	0.1 cc Vol ≤ 45 Gy	Yes	0.1 cc = 3700 cGy Max = 3894 cGy
Brainstem	0.1 cc Vol ≤ 60 Gy 1% ≤ 60 Gy	Yes	0.1 cc = 5834 cGy Max = 5994 cGy
Brain	1% ≤ 60 Gy 5 cc ≤ 65 Gy	No Yes	60 Gy Volume= 1.50% 5 cc Max = 6137 cGy

The Computational Environment for Radiotherapy Research: New Tools and Present Status

Aditya Apte, Issam El Naqa, Gita
Suneja, Andres Hope, Patricia Lindsay,
James Alaly, Yi Mu, J. Deasy

Computational Environment for Radiotherapy Research (CERR)

- Matlab-based
- 3-D plans exported from planning systems, archived, and converted to CERR format
- Converts plans from
 - DICOM
 - RTOG format
 - PLUNC (in beta test)
- Exports to DICOM
- Freely available from <http://radium.wustl.edu/cerr>



CERR FORUM | Google Groups - Mozilla Firefox


File Edit View History Bookmarks Tools Help

http://groups.google.com/group/cerr-forum


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 **CERR FORUM**

Home



Computational Environment
For Radiotherapy Research

Welcome to CERR forum. Let's learn from each other !

Discussions 9 of 44 messages [view all »](#)

- [New Release: CERR 3.0 Beta 5](#)
By Divya Khullar - 11:31am - 1 author - 0 replies
- [PROBLEMS WITH DICOM IMPORT FROM ECLIPSE](#)
By Khullar, Divya - 7:10am - 2 authors - 1 reply
- [HOW TO GET RTOG DATA FILE](#)
By APP - May 19 - 5 authors - 8 replies
- [Control panel missing GUI buttons](#)
By divya khullar - May 16 - 1 author - 0 replies
- [How to import a standalone dose array?](#)
By Joe Deasy - May 14 - 4 authors - 4 replies
- [CERR main panel no GUI buttons](#)
By Joe Deasy - May 14 - 2 authors - 1 reply
- [Error saving RTOG format file using pre-compiled CERR](#)
By amartignano - May 8 - 3 authors - 7 replies
- [Questions about CERR features.](#)
By Ostapiak Orest - Apr 25 - 4 authors - 10 replies
- [Merging Plans](#)
By Apte, Aditya - Apr 24 - 1 author - 0 replies

Files 1 file [view all »](#)

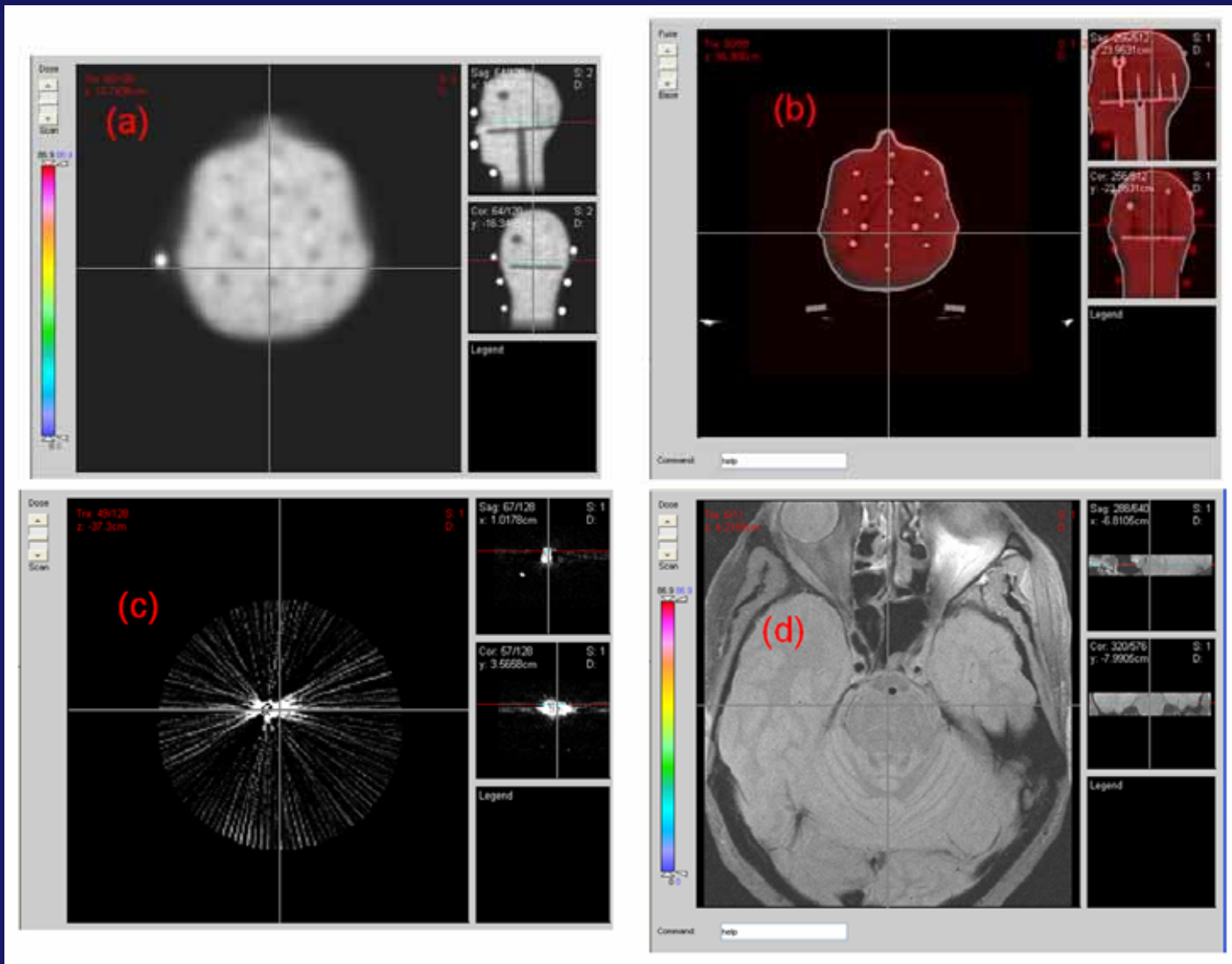
- [cerr_picture.bmp](#)
Last updated by cerr.user.gr...@gmail.com - Feb 6

Support is provided through a 'Google Group': CERR-Forum

Currently there are 101 members

CERR can automatically extract...

- GTV volumes
- DVHs
- DVH-based parameters
- Dose surface histograms
- Positional information (e.g., structure center of mass)
- Anything that can be programmed in Matlab...



New multimodality image review capabilities within CERR: (a) PET import into CERR, (b) fused/overlaid PET-CT image, (c) SPECT head and neck scan, and (d) MRI import.

Development of phantom
dosimetry/planning comparison
tool w/RPC

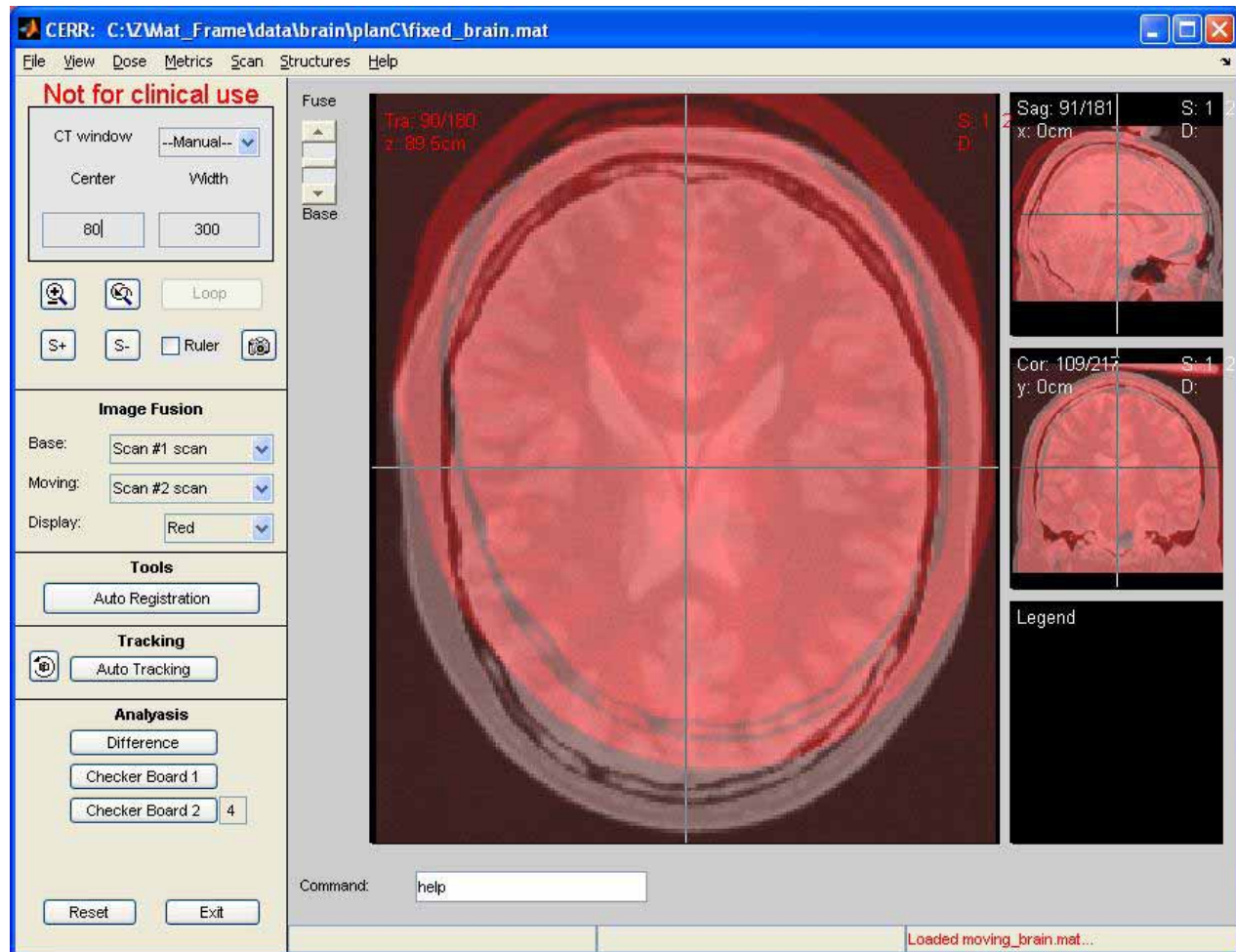
CERR Registration

Introduction (minutes of software review)

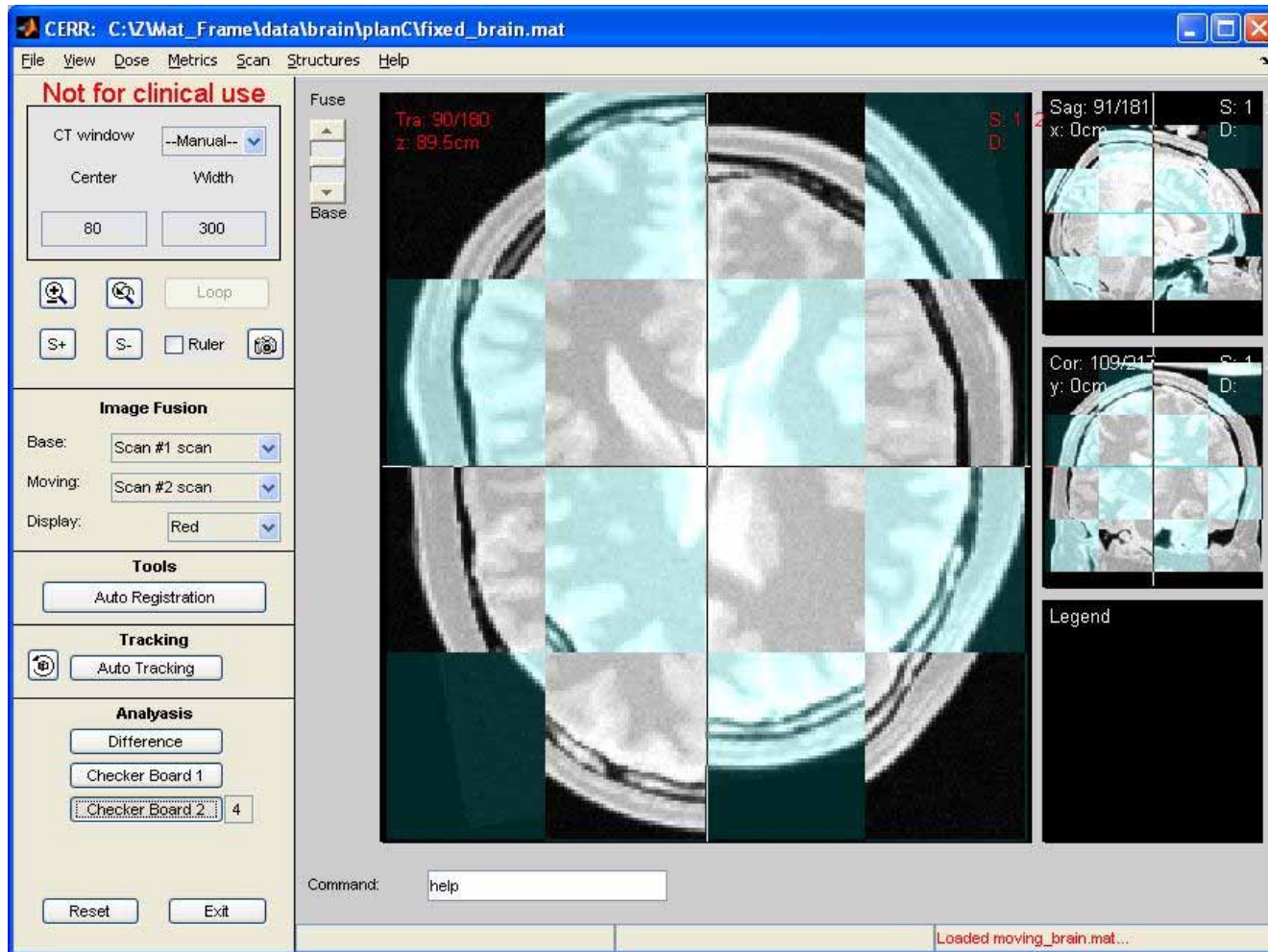
Yu Wu

Image Fusion Frame

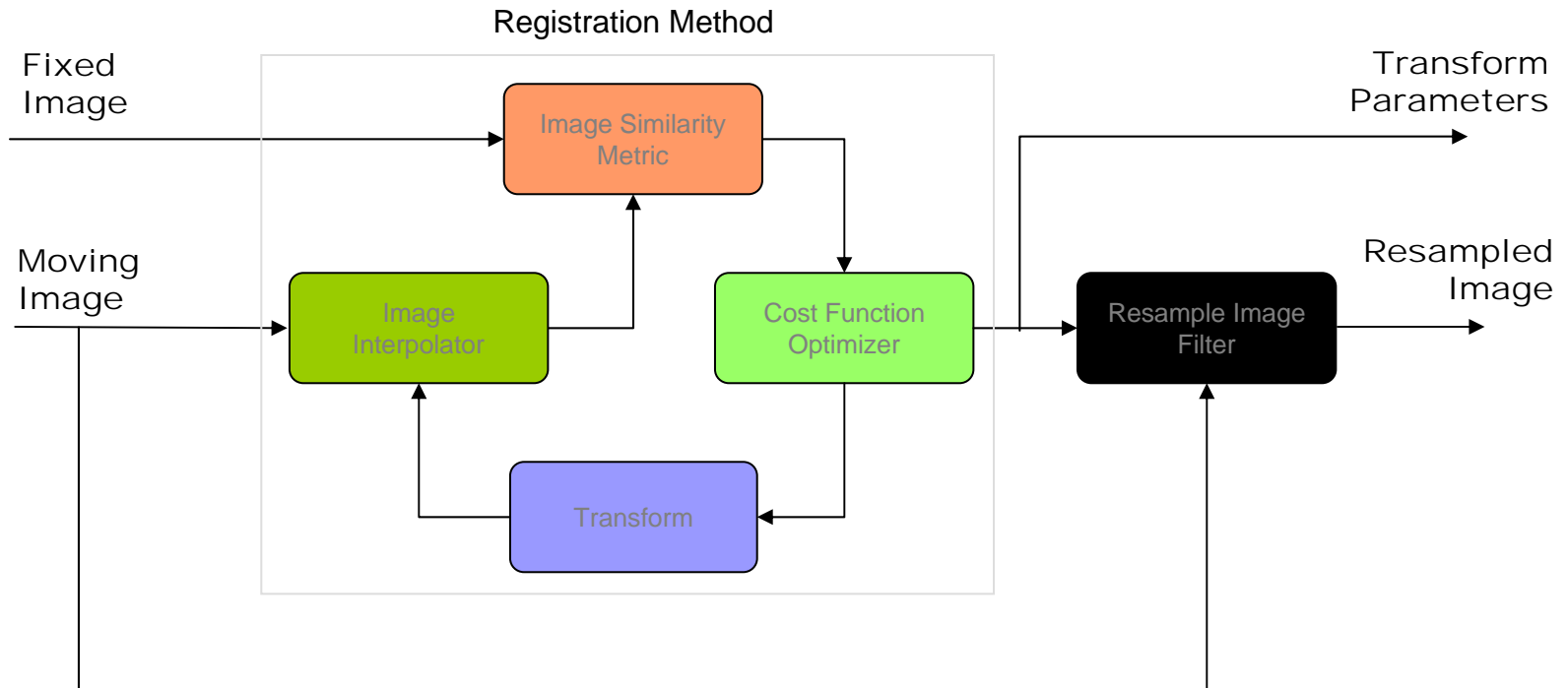
- Moving image overlapped onto the Base image.



CheckerBoard View before Registration



Registration Framework



- The *transform* component represents the spatial mapping of points from the fixed image space to points in the moving image space.
- The *interpolator* is used to evaluate moving image intensities at non-grid positions.
- The *metric* component provides a measure of how well the fixed image is matched by the transformed moving image.
- The *optimizer* is used to optimize the metric over the searching space defined by the transform parameters.

Registration Setup Form

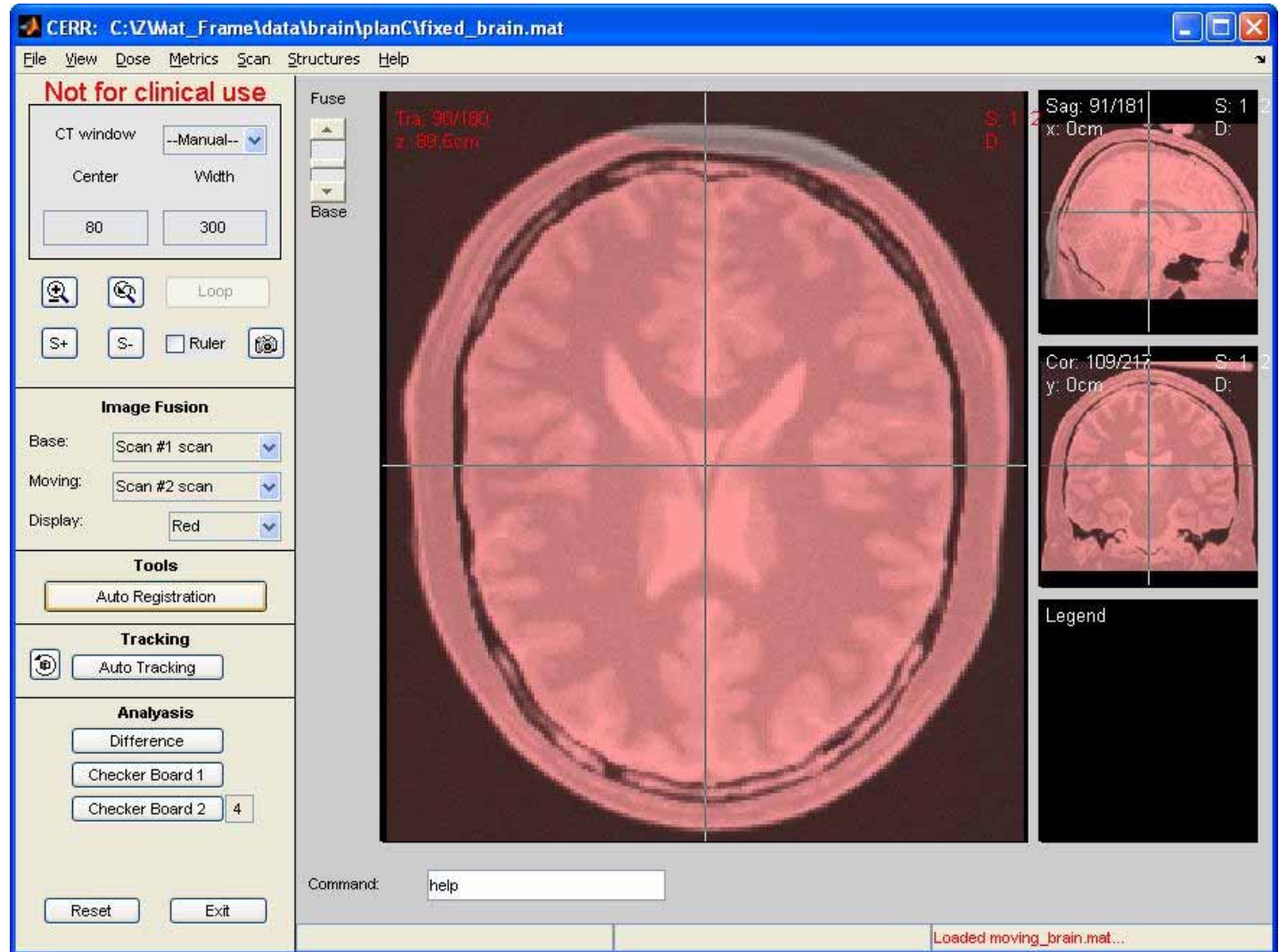
- This form provides users some options for selecting particular registration profile, composing registration method with different components, and tuning registration parameters according to the output information.

The screenshot shows the 'Registration Setup' dialog box with the following sections:

- Registration Profile:** A tree view showing three main categories: Rigid_Single_Modality (with sub-items CT_CT, MRI_MRI, PET_PET), Rigid_Multi_Modality (with sub-items CT_MRI, CT_PET, MRI_PET), and Non_Rigid (with sub-items Demons, Demons3D).
- Image Registration Method:** Four dropdown menus: Transform (Similarity Transform), Interpolator (Linear Interpolate), Similarity Metric (Mean Squares), and Optimizer (RegularStepGradientDescent).
- Registration Parameters:** Seven input fields: Scale Factor (10.0), Rotation Scale (1.0), Translation Scale (0.0001), Initial Angle(Degree) (0), Minimum Step (1), Maximum Step (10), and Iteration Number (200).
- Registration Levels:** An input field with the value 3.
- Options:** A checkbox for 'downSample(2x2x2)' which is checked, and a 'doRegistration' button.
- Output:** A text area displaying registration results: Rotation Angle Z = 9.9617, Translation X = 2.6334, Translation Y = 17.4462, Translation Z = -0.016806, Number of Iterations = 5, Best Value = 19.153, Rotation Center X = 0.37061, Rotation Center Y = 1.0052, Rotation Center Z = 100.966, and Scale = 0.00061.

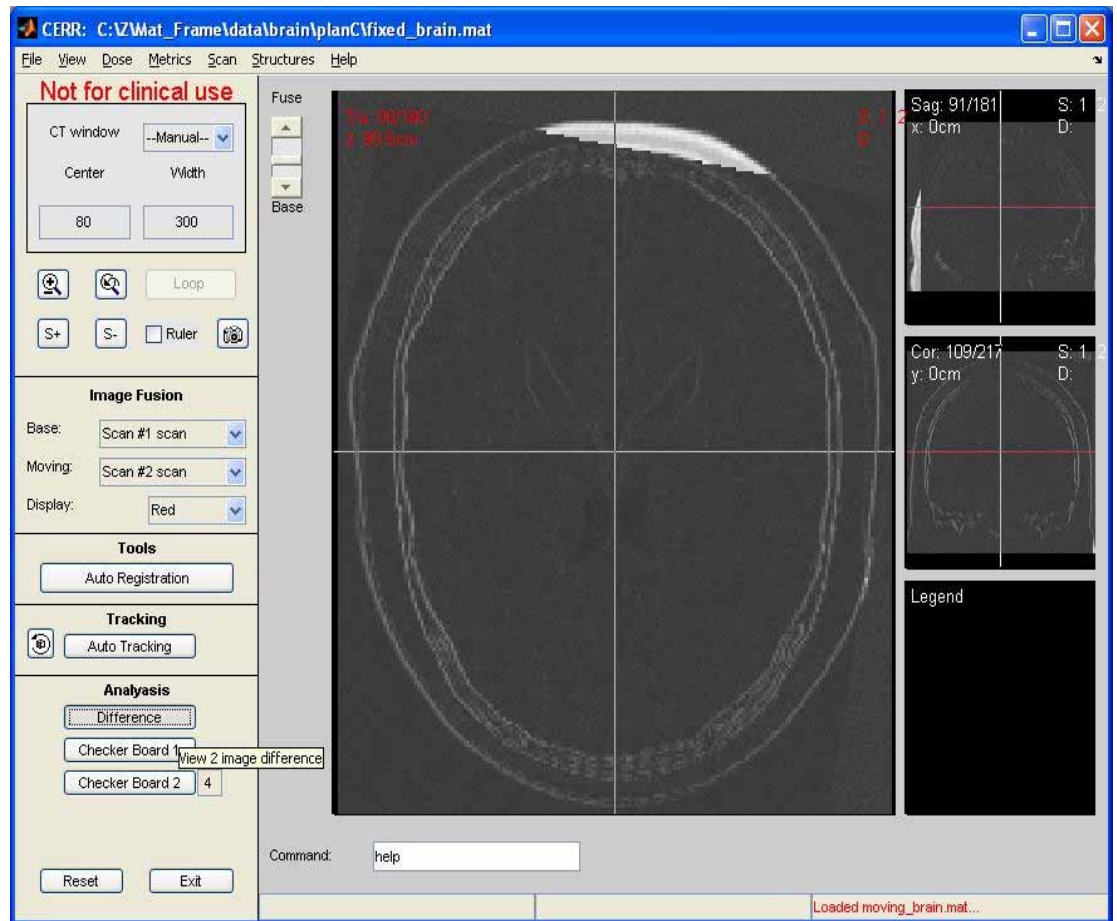
Image Fusion after registration

- Fusion of base dataset and transformed moving dataset.

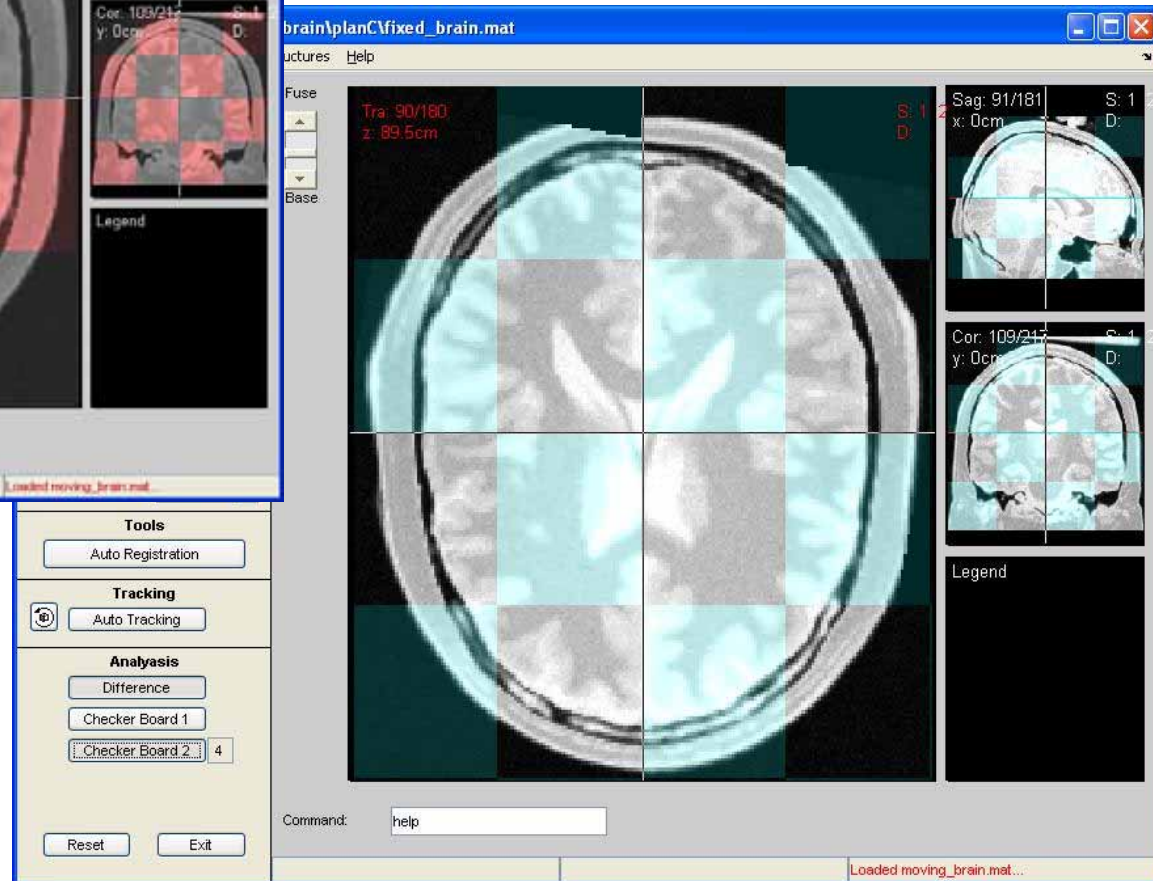
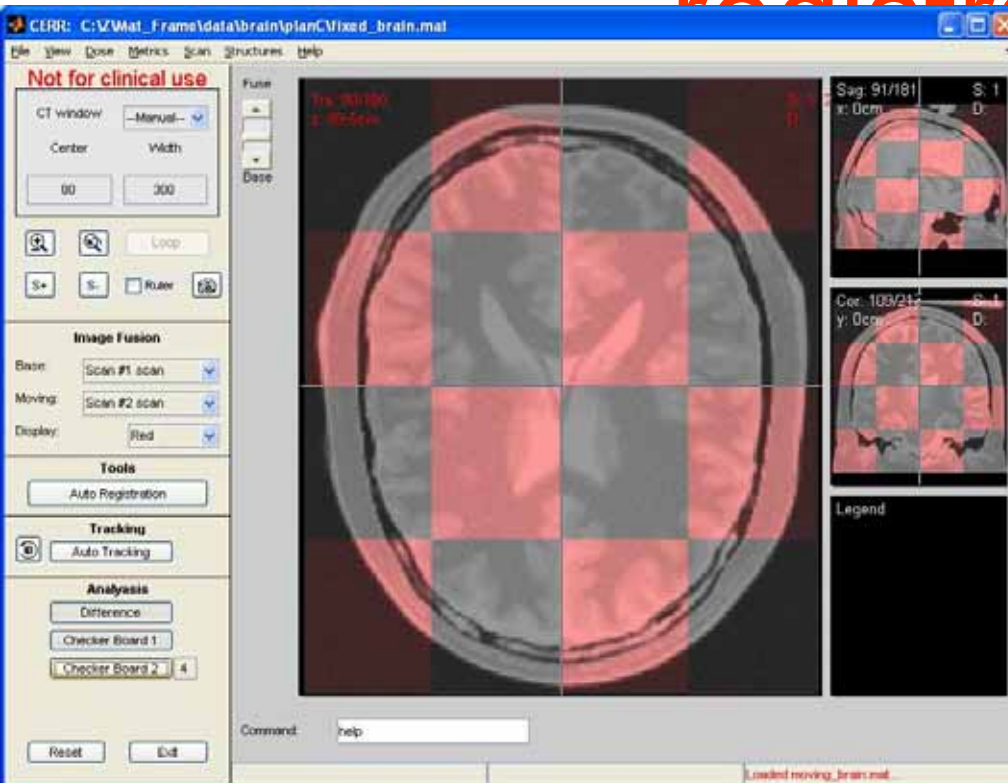


Registration result analysis

- Difference view between based image and registered moving image.



Checkerboard view after registration



A Versatile Source Model for Monte Carlo Dose Calculations of External Radiotherapy

J Cui¹, S Davidson², K Zakaryan³, I El Naqa¹, V
Willcut¹, M Wiesmeyer⁴, D Followill², J Deasy¹

(1) Washington University School of Medicine; (2) UT MD
Anderson Cancer Center; (3) Sun Nuclear Corporation; (4)
Virginia Commonwealth University

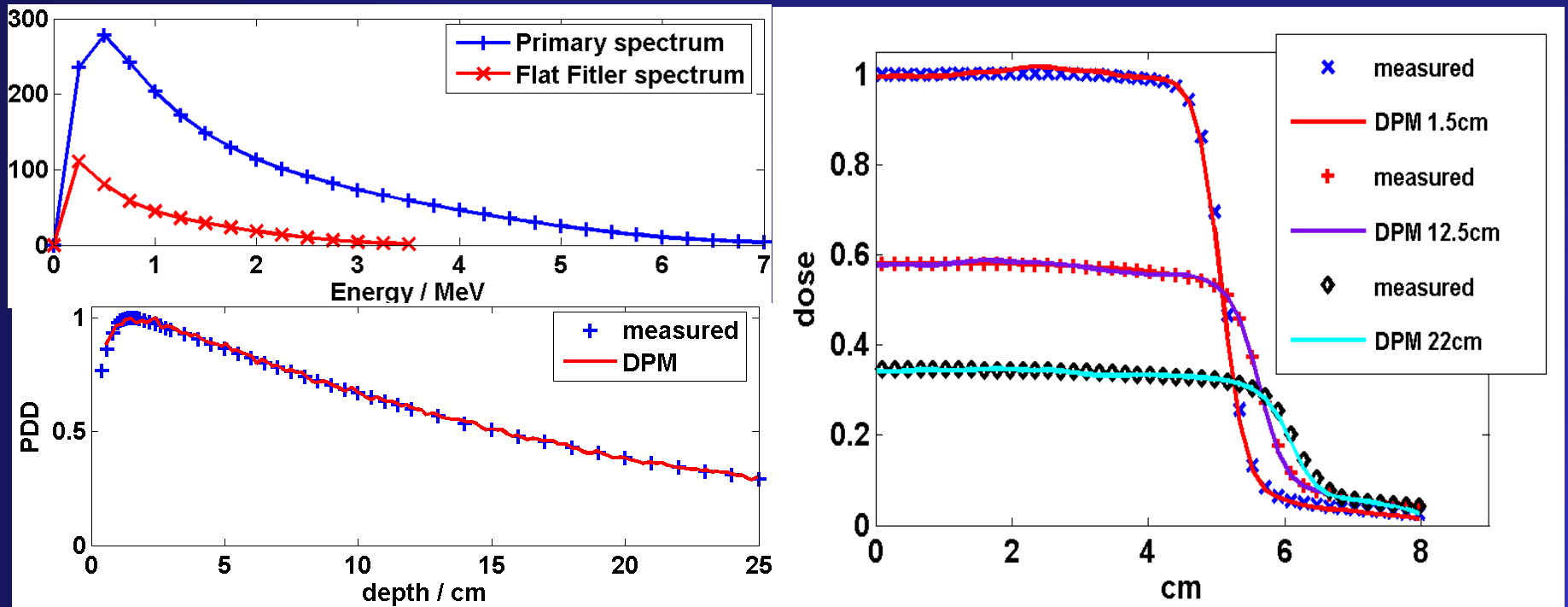
Components of the Source Model

Fast Monte Carlo Dose Engine:

Dose Planning Method (DPM, *Sempau, 2000*)

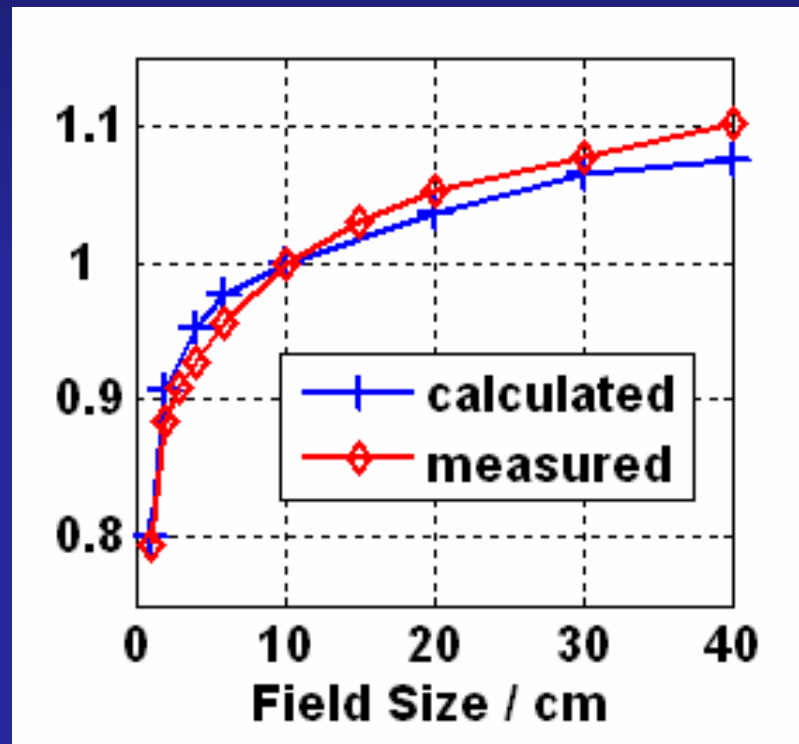
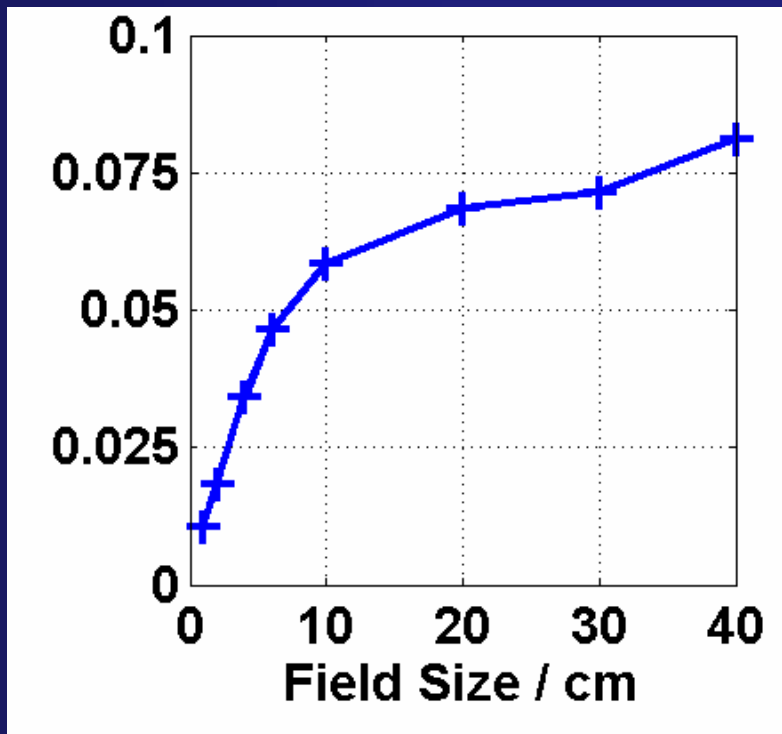
- Primary source: point source
 - Energy spectrum (Fatigue-Fermi)
 - Off-axis softening (*Taylor, 1998*)
 - Horn effect (piecewise linear)
- Flattening filter
 - Exponential spatial distribution (*Liu, 1997*)
 - Energy spectrum (Fatigue-Fermi)
- Electron contaminations (*Fippel, 2002*)
- Ion chamber size effect (Gaussian convolution)

Commissioned Results for Varian 6MV DPM vs. IC measured in water phantom Field size: 10 x10 cm²



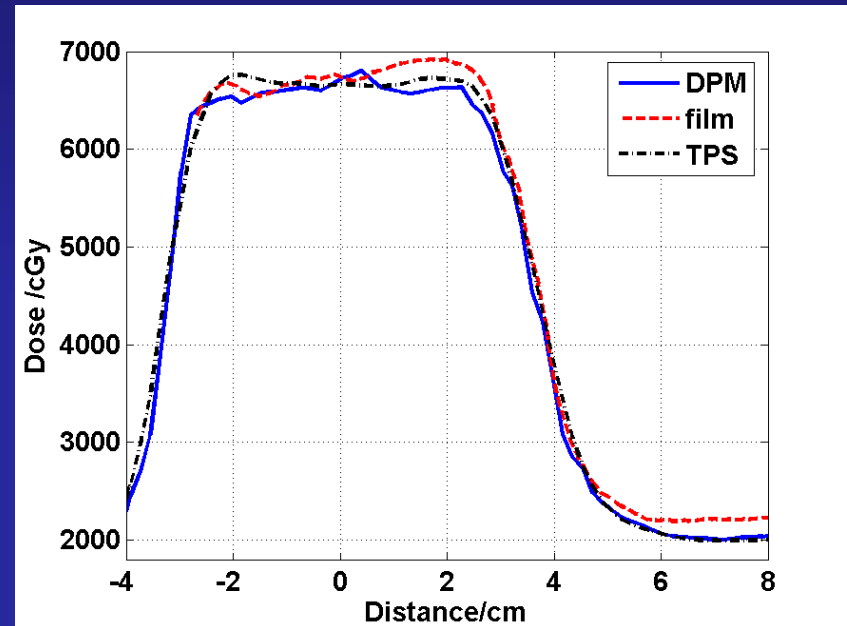
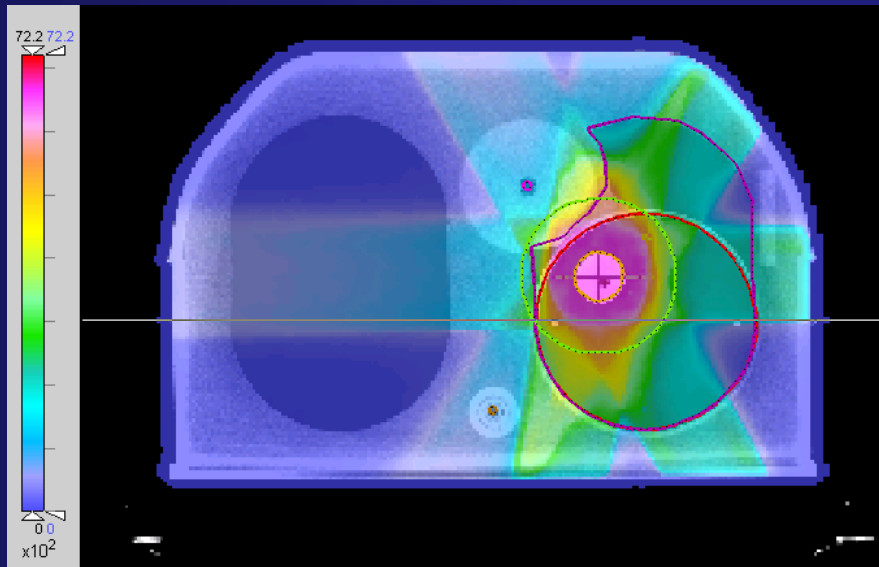
- Upper Left: Spectra for primary source and flattening filter
- Lower Left: PDD; Right: Lateral dose profiles at various depths

Commissioned Results for Varian 6MV output factors in various field sizes: 1 x1 cm² up to 40x40 cm²



- Left: Dose contribution from the flattening filter relative to the primary dose at $d_{max} = 1.5$ cm
- Right: output factor at $d_{max} = 1.5$ cm; calculated vs. IC measurement

Model Validation: an IMRT plan in an Anthropomorphic Lung Phantom



- Left: IMRT lung plan, calculated using the source model
- Right: Lateral dose profile across the isocenter, obtained using the source model with DPM, radiochromic film measurement, and Pinnacle Treatment Planning System (TPS)

RTOG Bioinformatics Committee

- Focusing on enabling investigations of mixed data, i.e., dose, images, biomarkers
- Near-term agenda:
 - Development of RTOG Data Survey
 - What patients do we have all of data types A, B, C?
 - For a given set of patients, what data types do we have?
 - ACRIN (PET, MRI, CT), ITC (RT-Objects), Tissue Data Bank
 - Demonstrate the ability to analyze biomarkers and dose outcome determinants within the same framework
- 8-9 AM, Tomorrow

Tools [1/2]

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