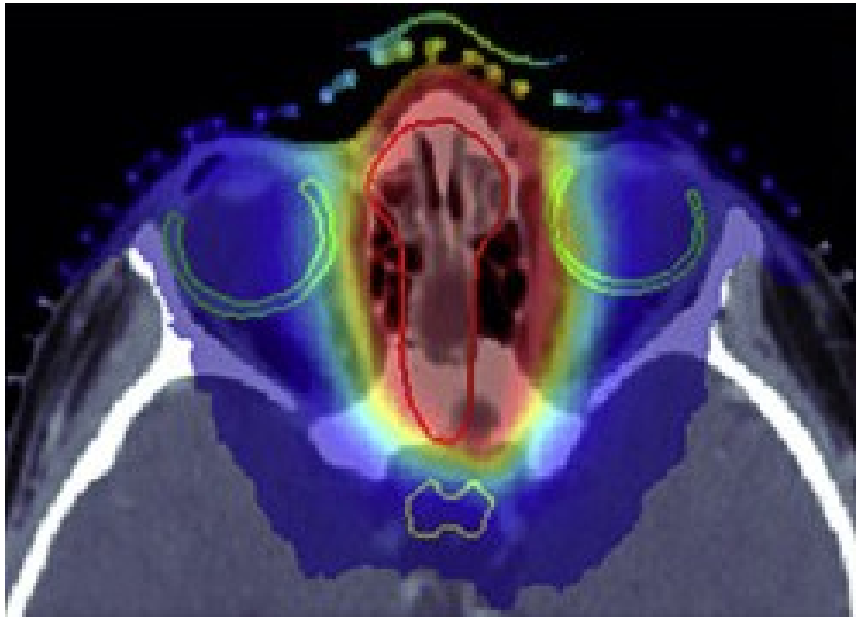
MASSACHUSETTS
GENERAL HOSPITAL

RADIATION ONCOLOGY

National Alliance for Medical Image Computing



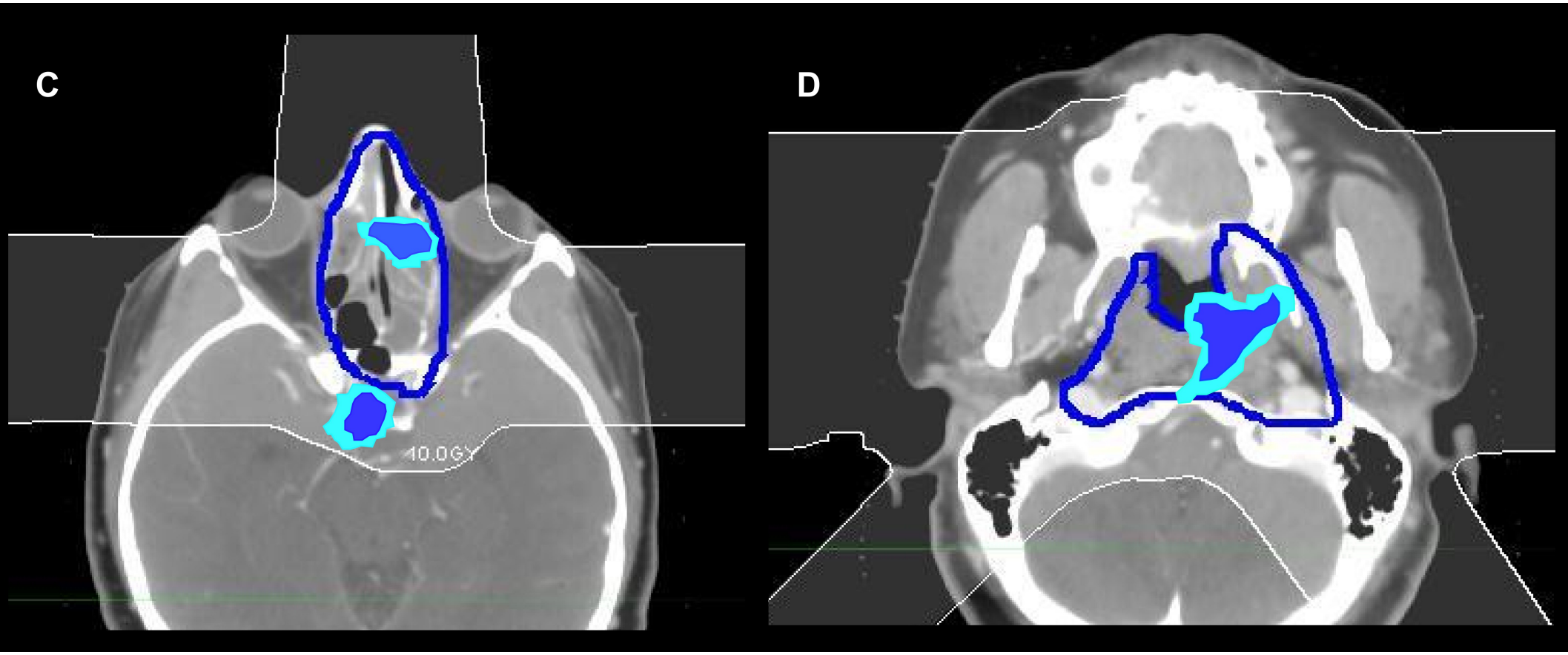
# DBP: Head and Neck Cancer

Gregory C. Sharp, PhD
Department of Radiation Oncology
Massachusetts General Hospital

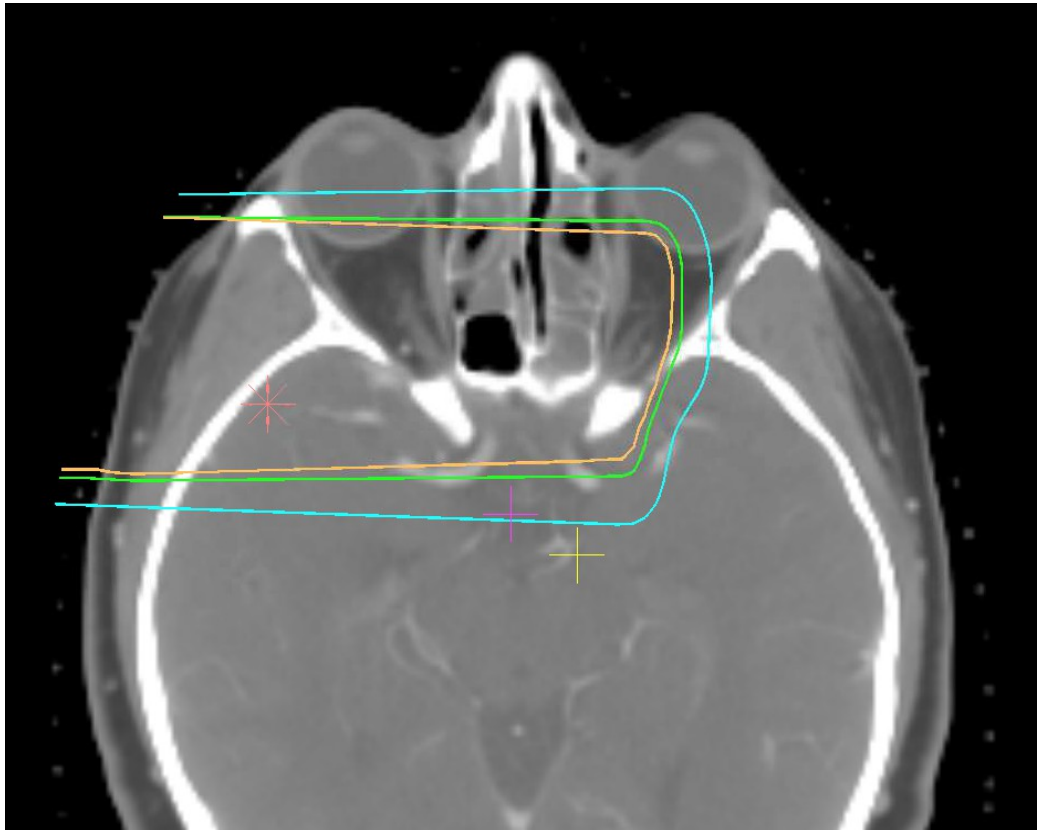
NA-MIC AHM January 9, 2014

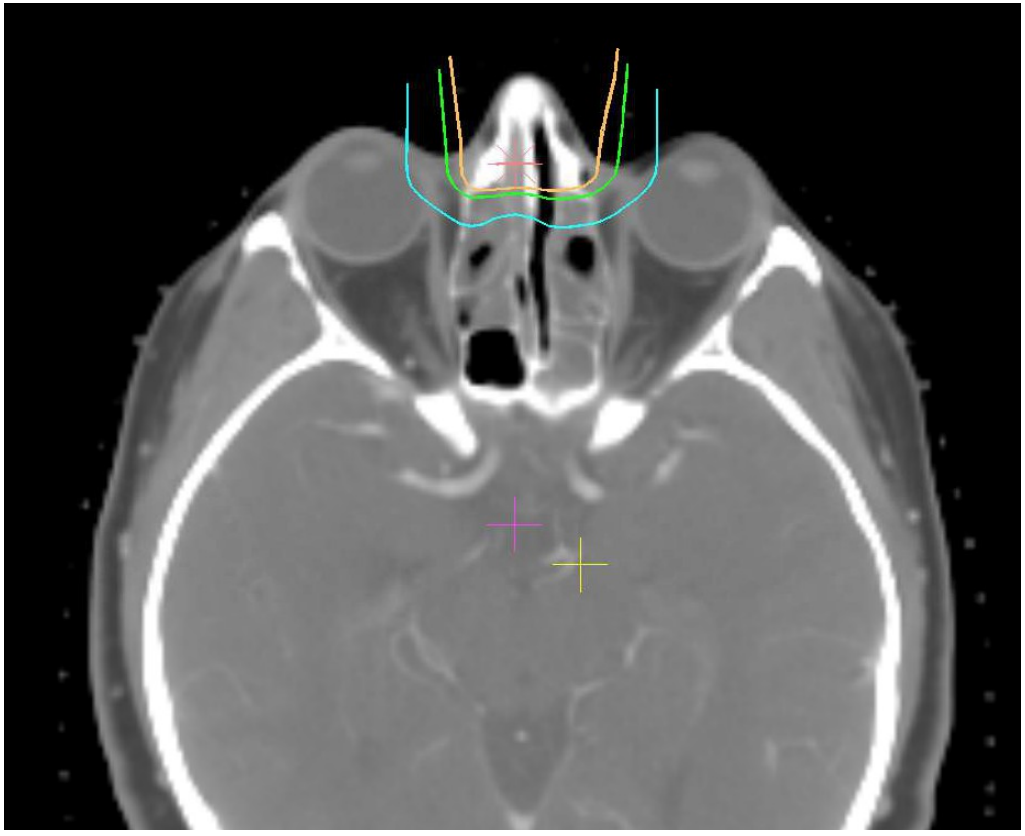
# As previously reported...

- Hot & cold spots in tumor



# Patching



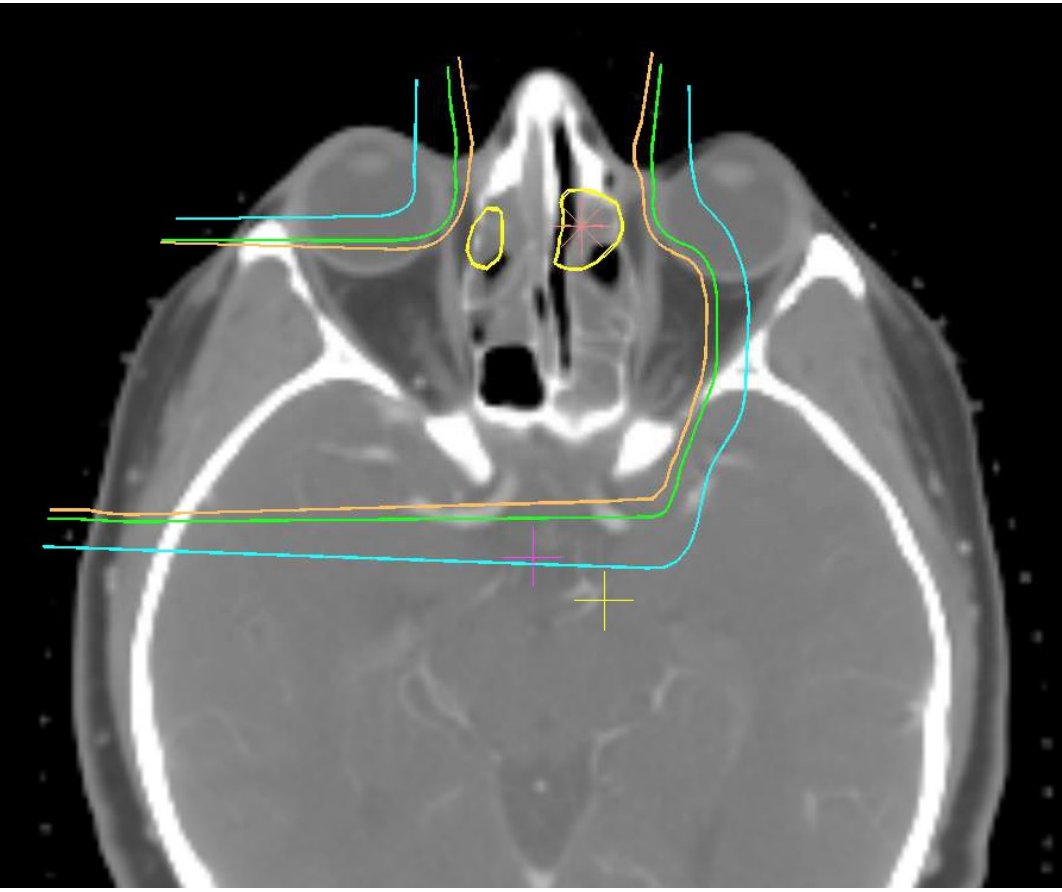


50%

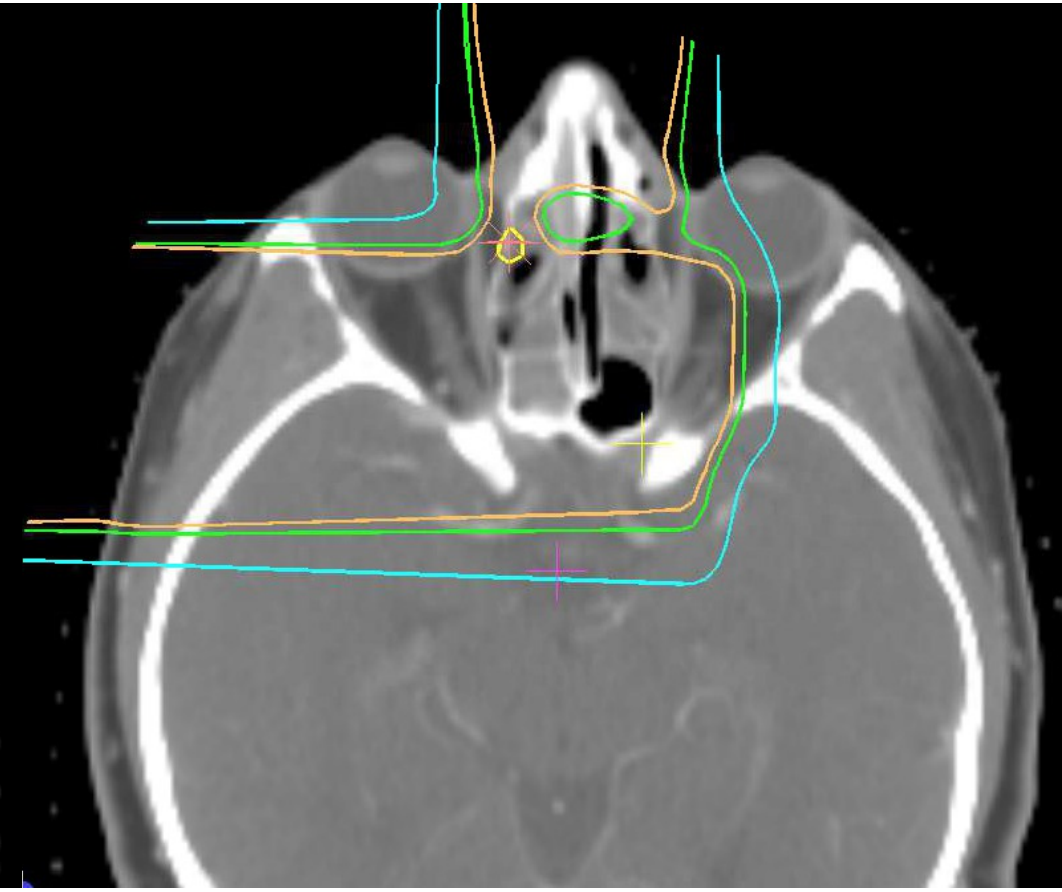
90%

100%

# Patching

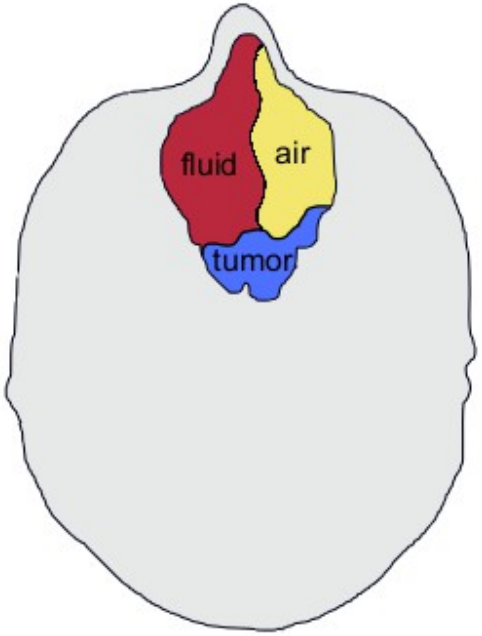


Pre-treatment

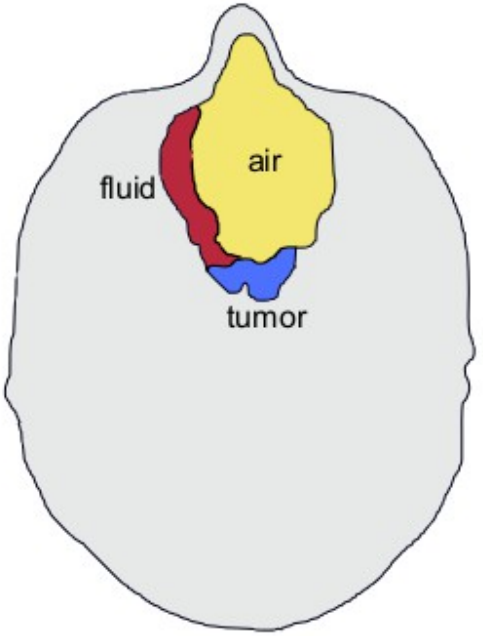


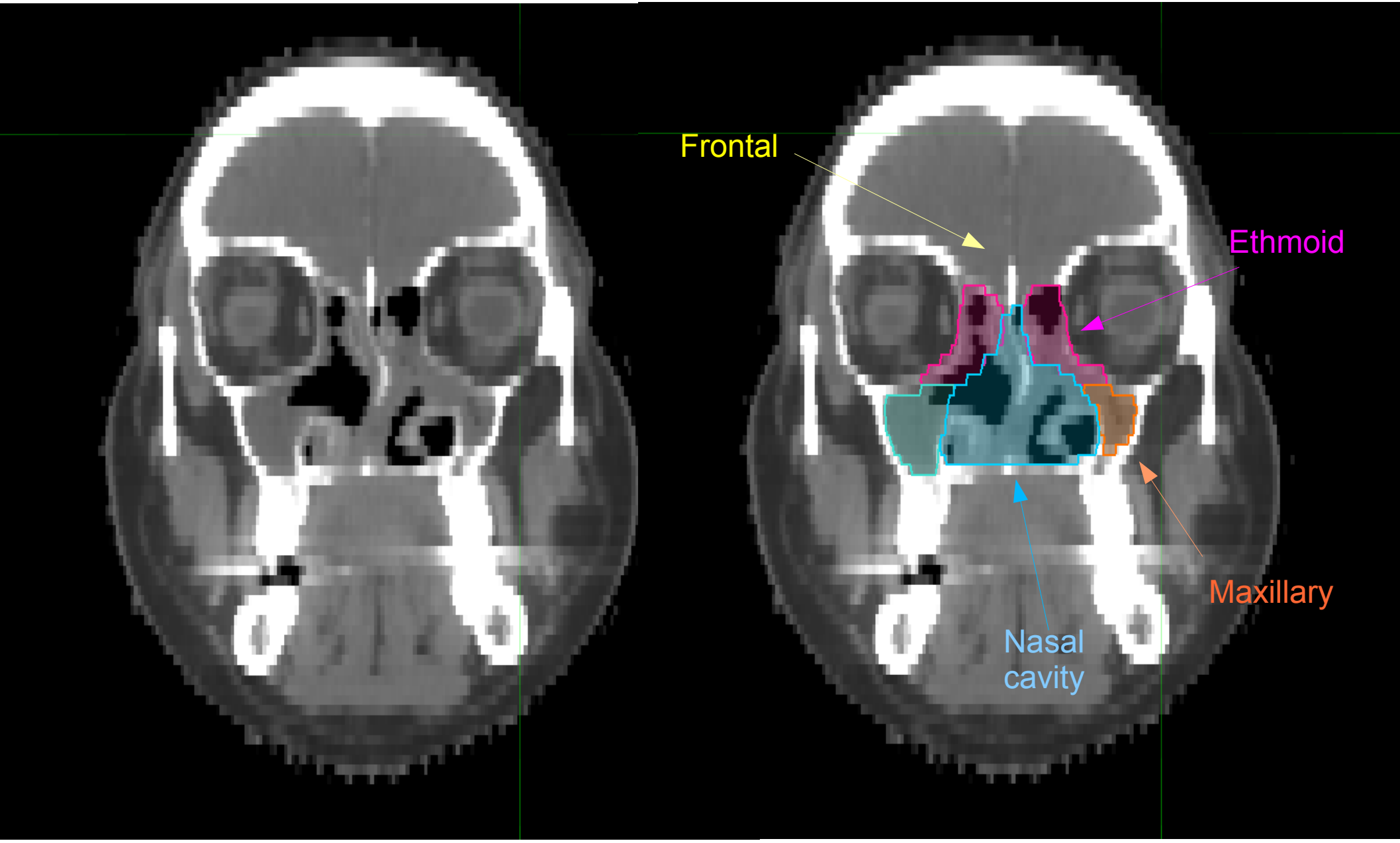
Mid-treatment

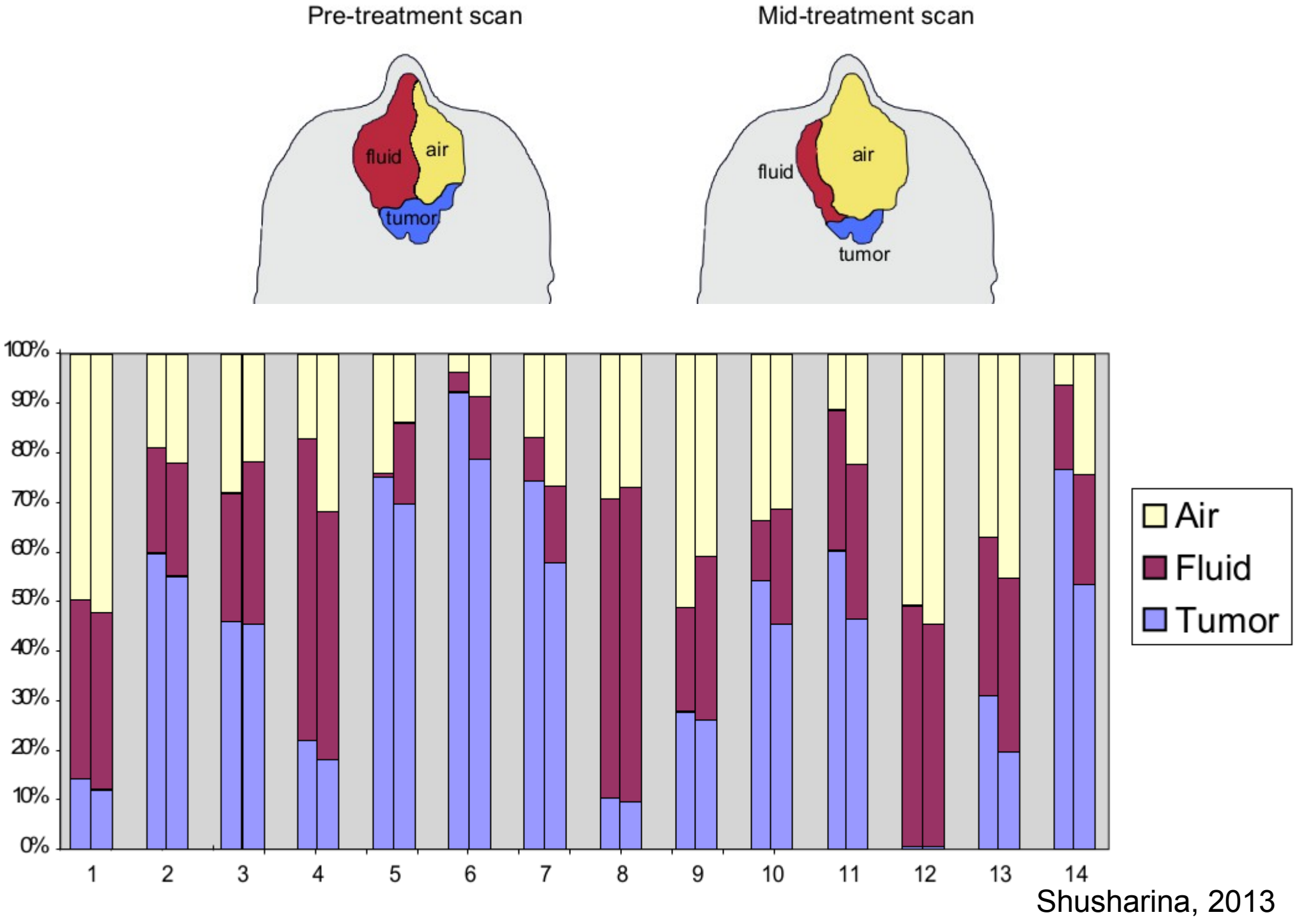
Pre-treatment scan




Mid-treatment scan




Frontal
Ethmoid
Maxillary
Nasal
cavity

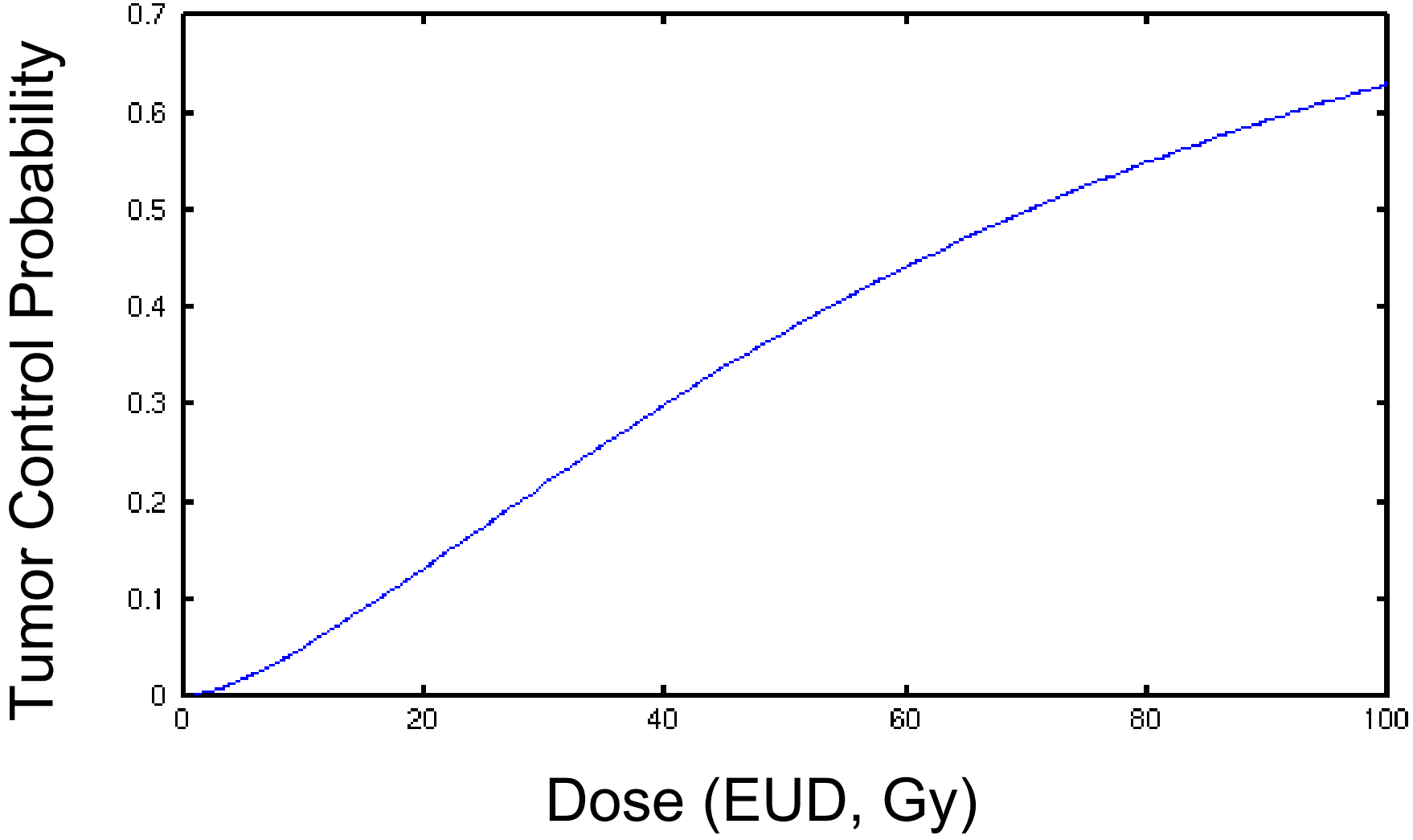



Shusharina, 2013

# RTOG 0617

- Locally advanced non-small-cell lung cancer
- Randomized trial: 60 Gy vs 72 Gy
- 423 participants enrolled 2007-2011

# Radiobiology theory




*** TCP model by Niemerko, NSCLC parameters by Martel

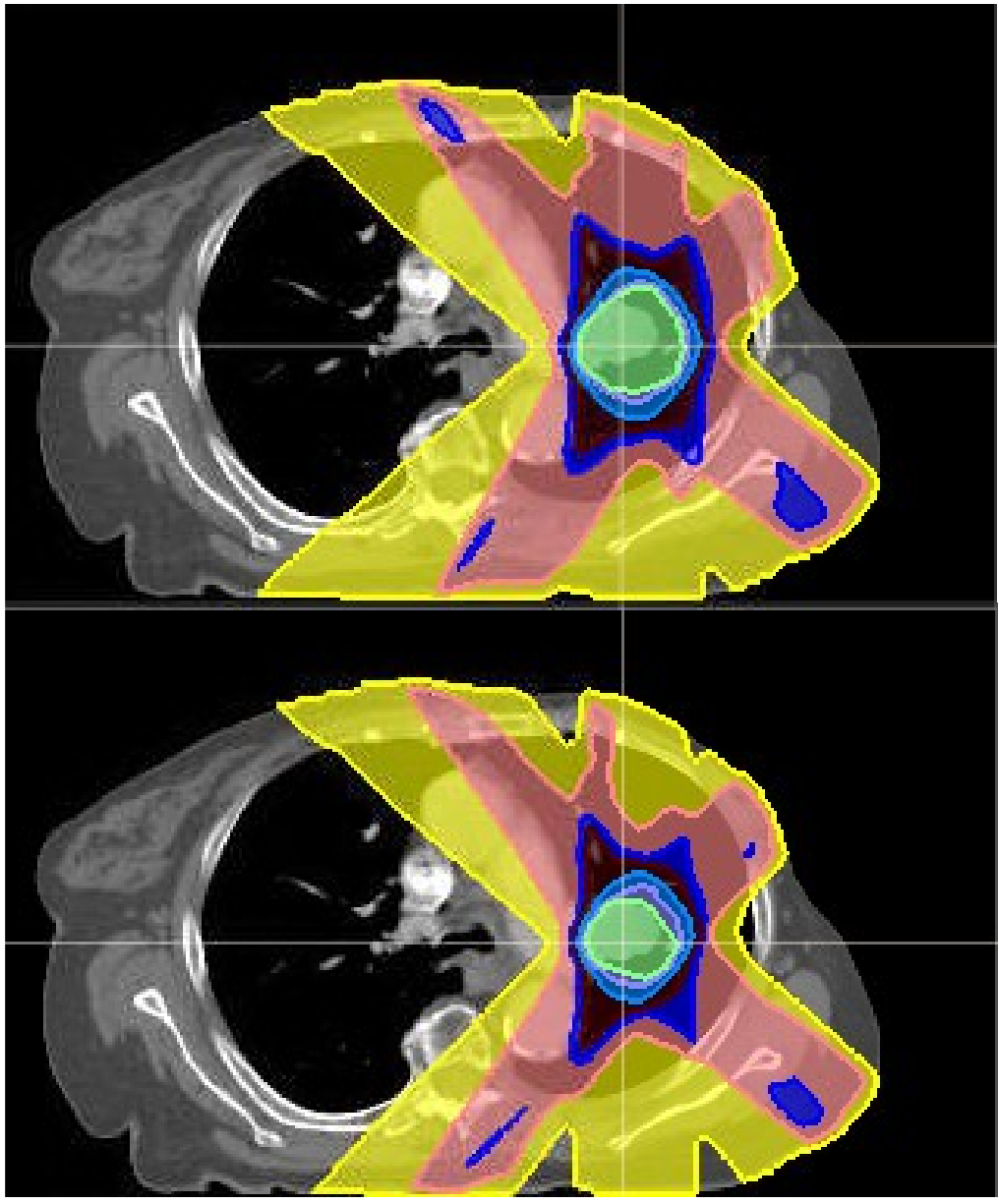
# RTOG 0617

- Locally advanced non-small-cell lung cancer
- Randomized trial: 60 Gy vs 72 Gy
- 423 participants enrolled 2007-2011

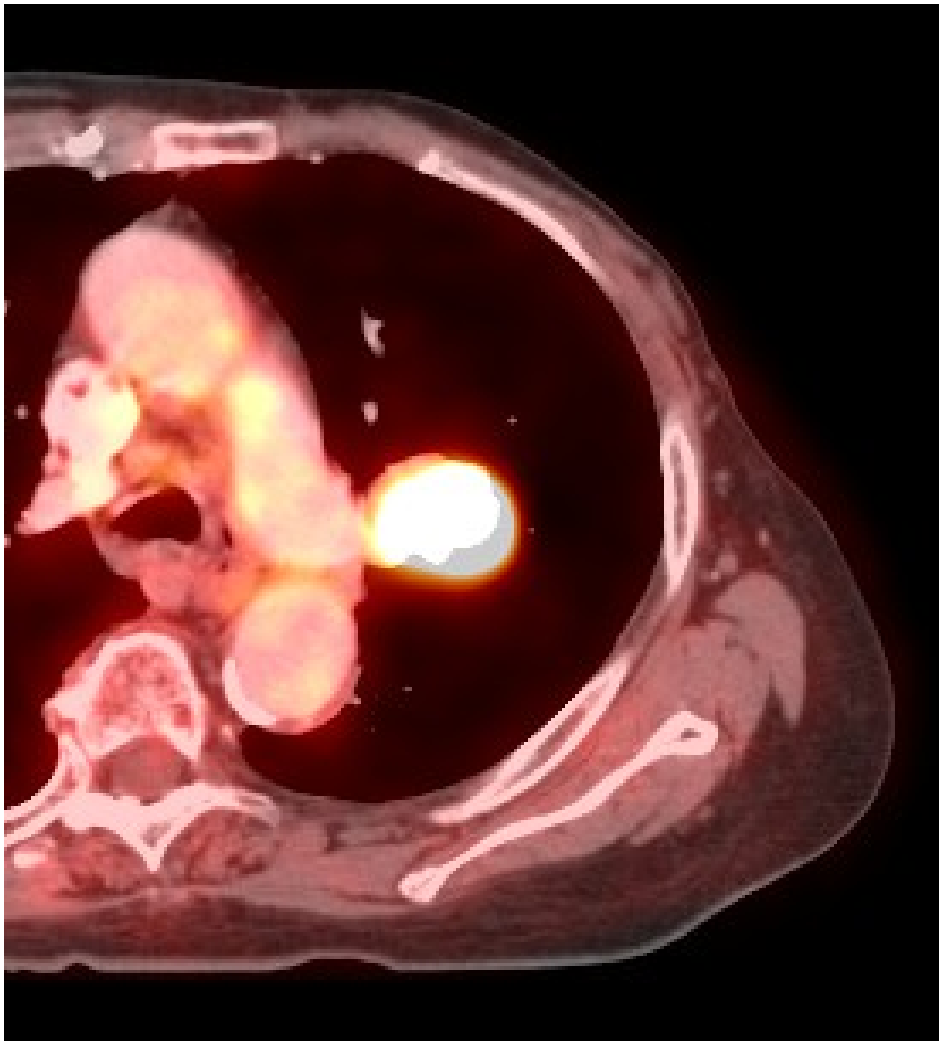
- Lower medial survival for high dose
  (19.6 mo vs 28.7 mo)
- Lower QOL for high dose

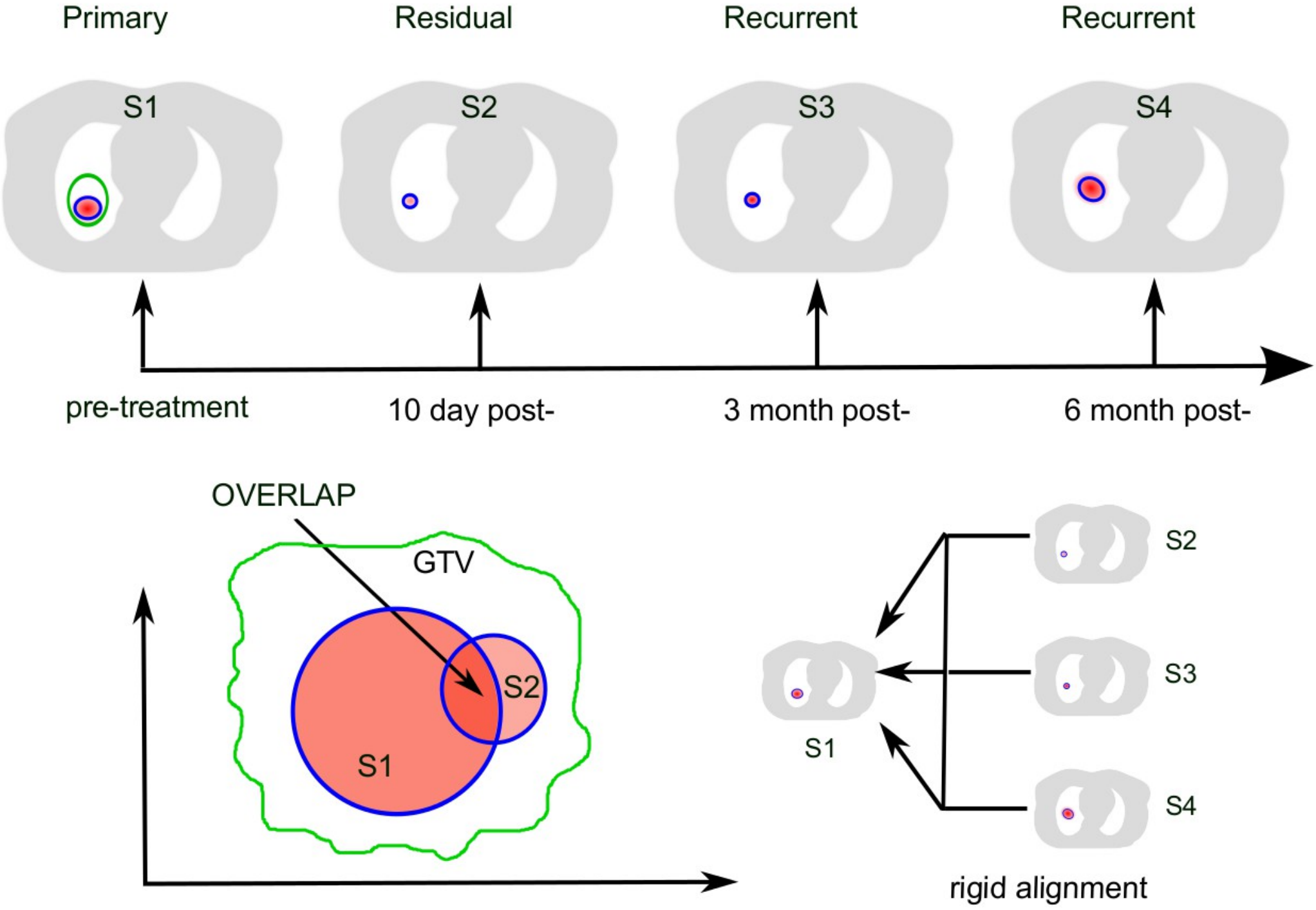
Bradley et al., ASTRO 2011
Movsas et al., ASTRO 2013

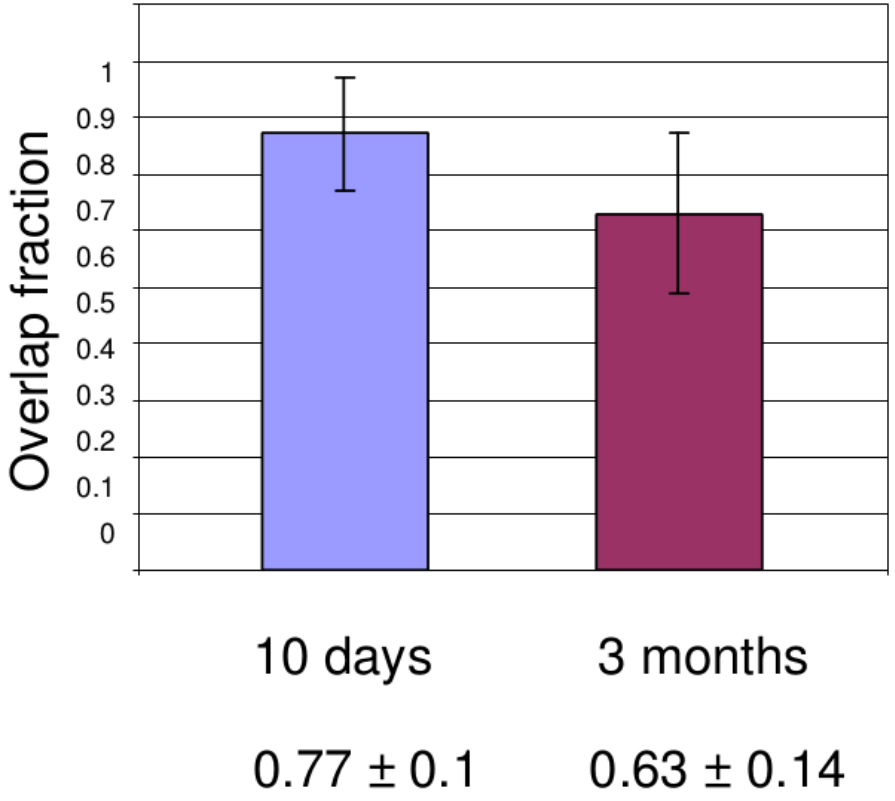
# PET in Lung Cancer



# PET in Lung Cancer




Primary
Residual
Recurrent
Recurrent
S1
S2
S3
S4
pre-treatment
10 day post-
3 month post-
6 month post-
OVERLAP
GTV
S2
S1
S2
S3
S1
S4
rigid alignment

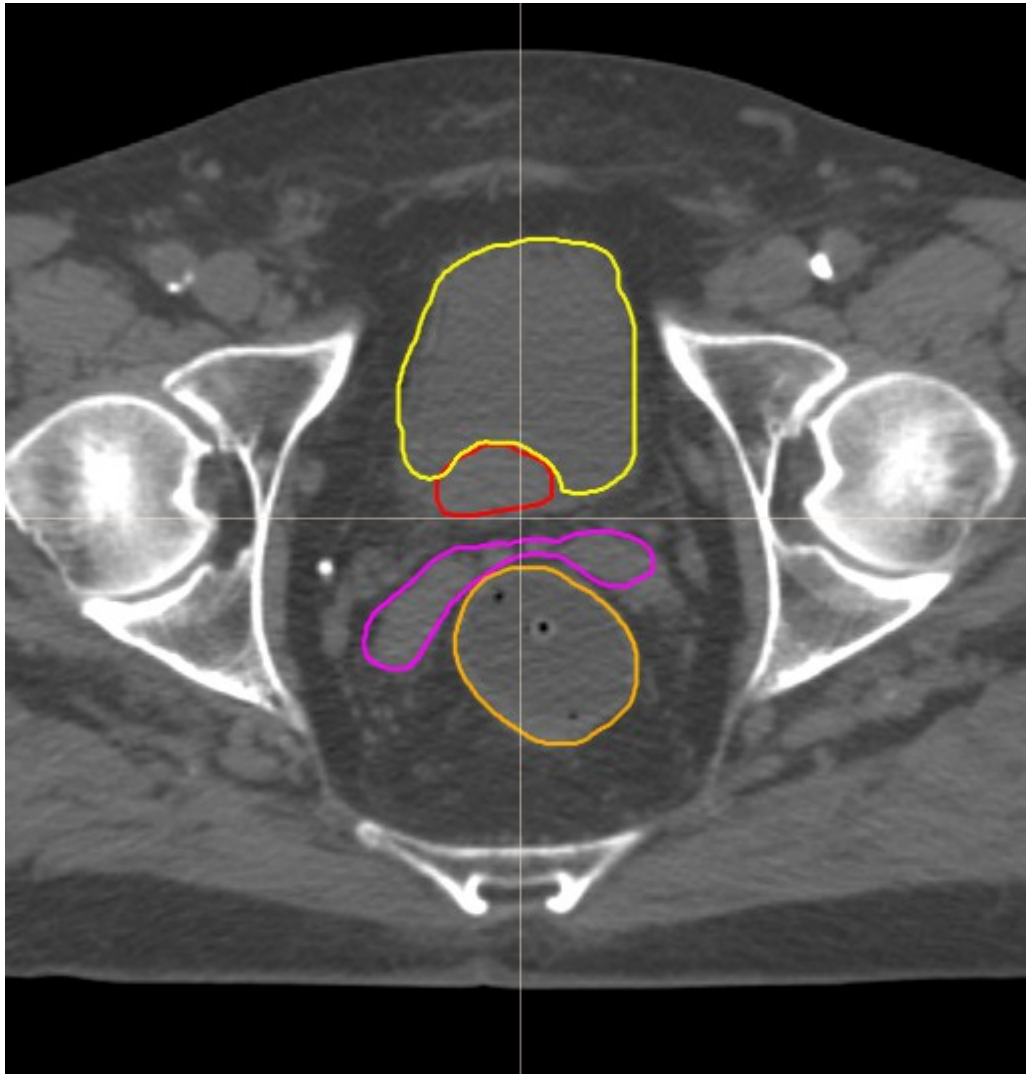



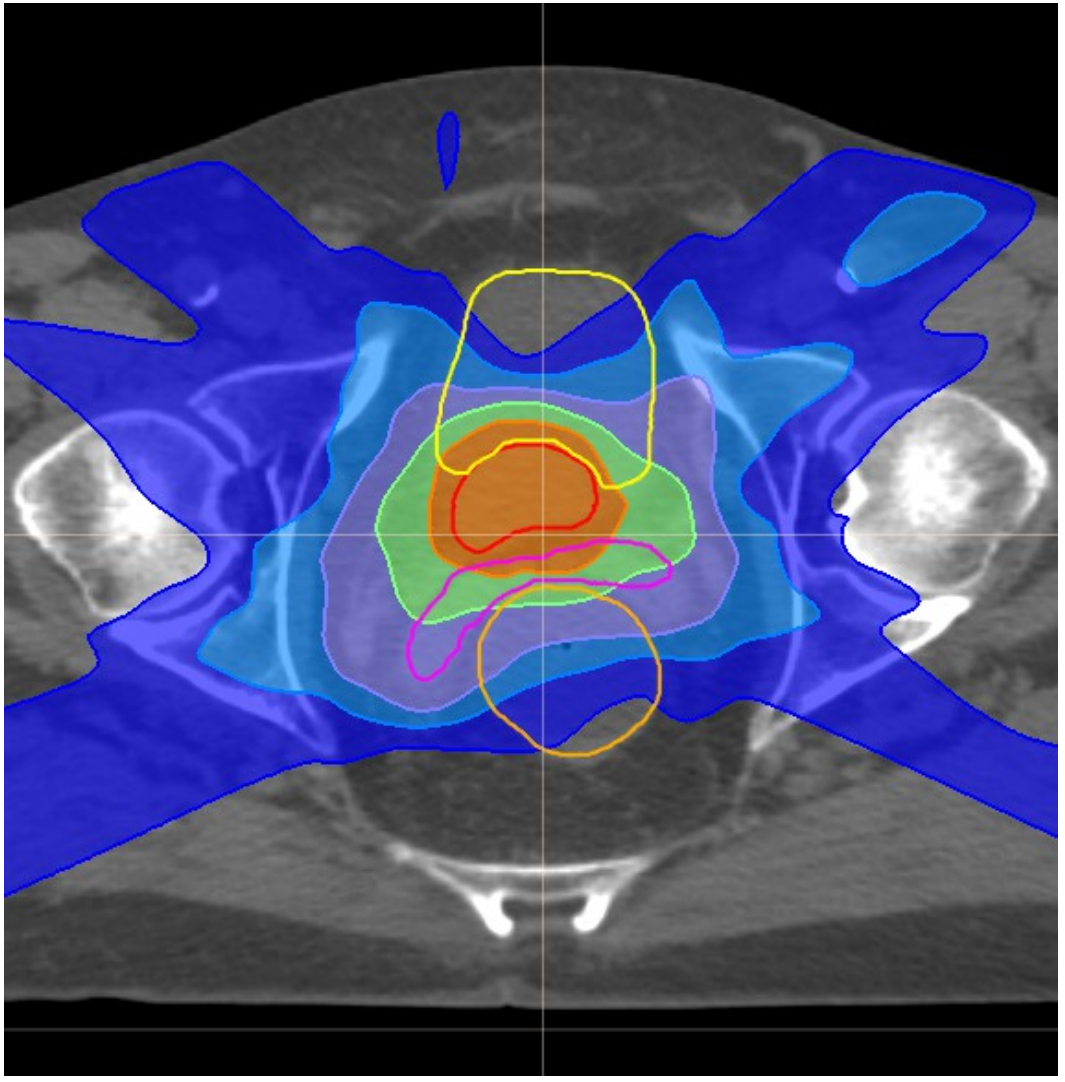

Reason for displacement of the site of recurrence:

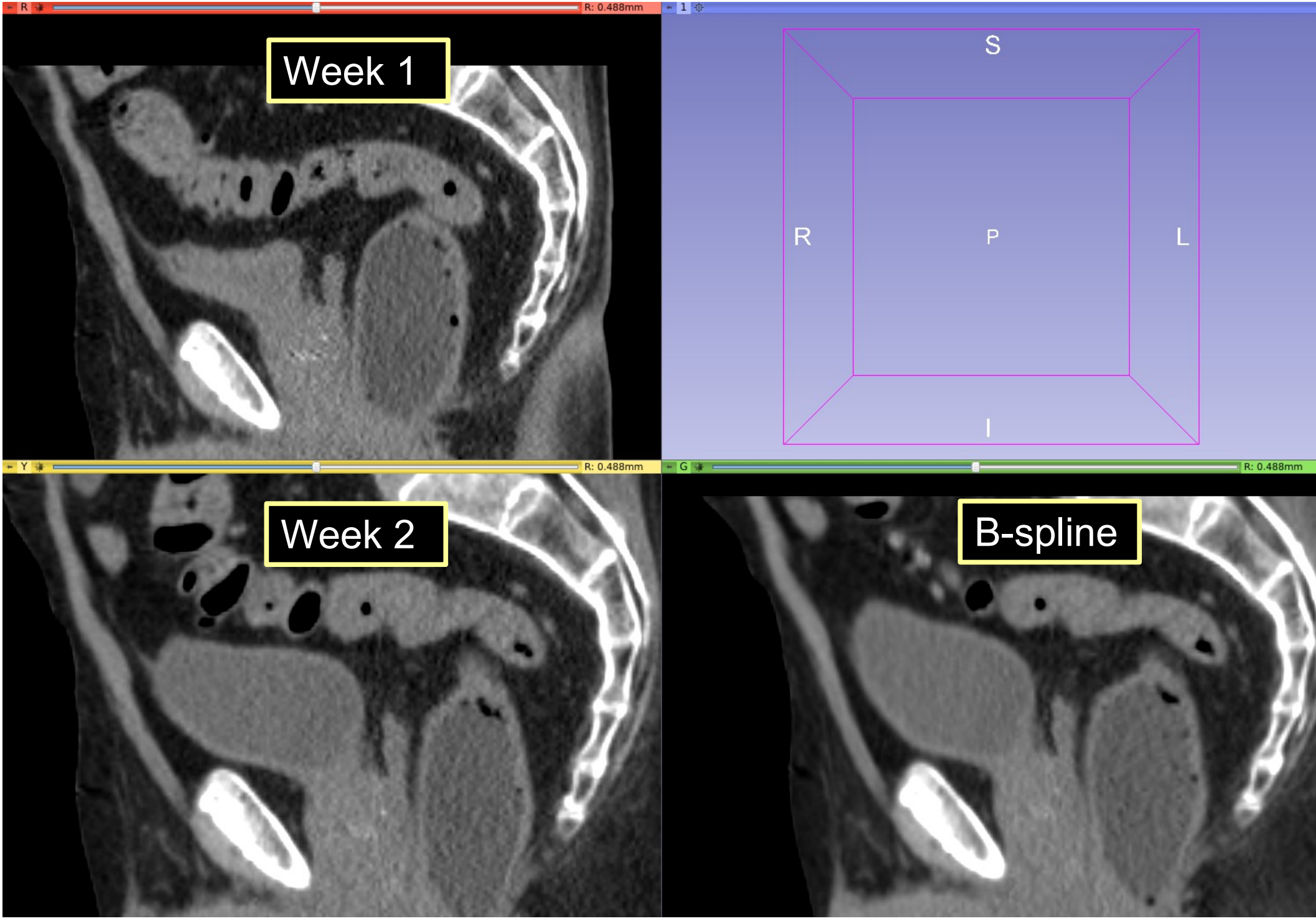
- direction of tumor growth

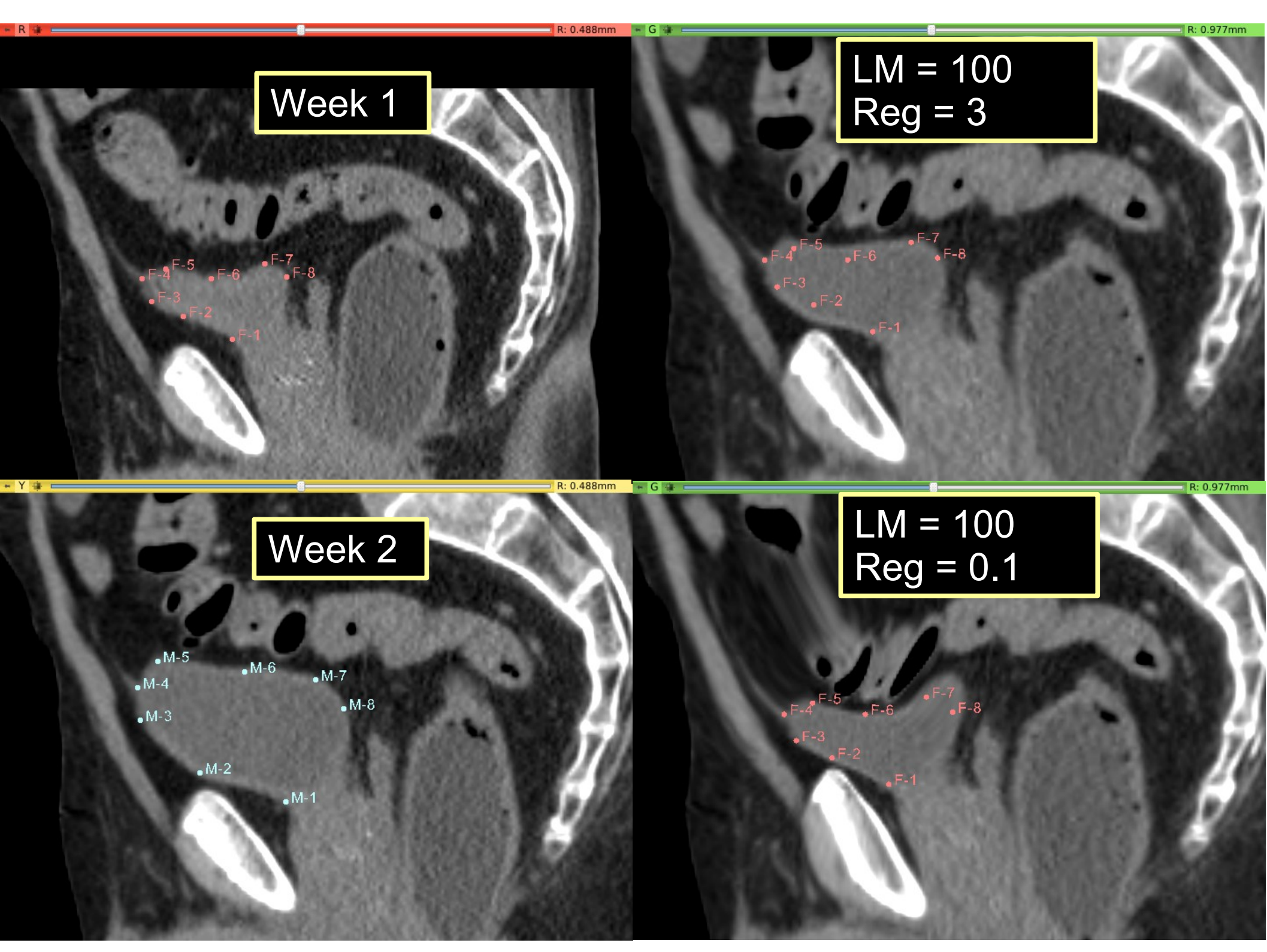
Shusharina, 2013

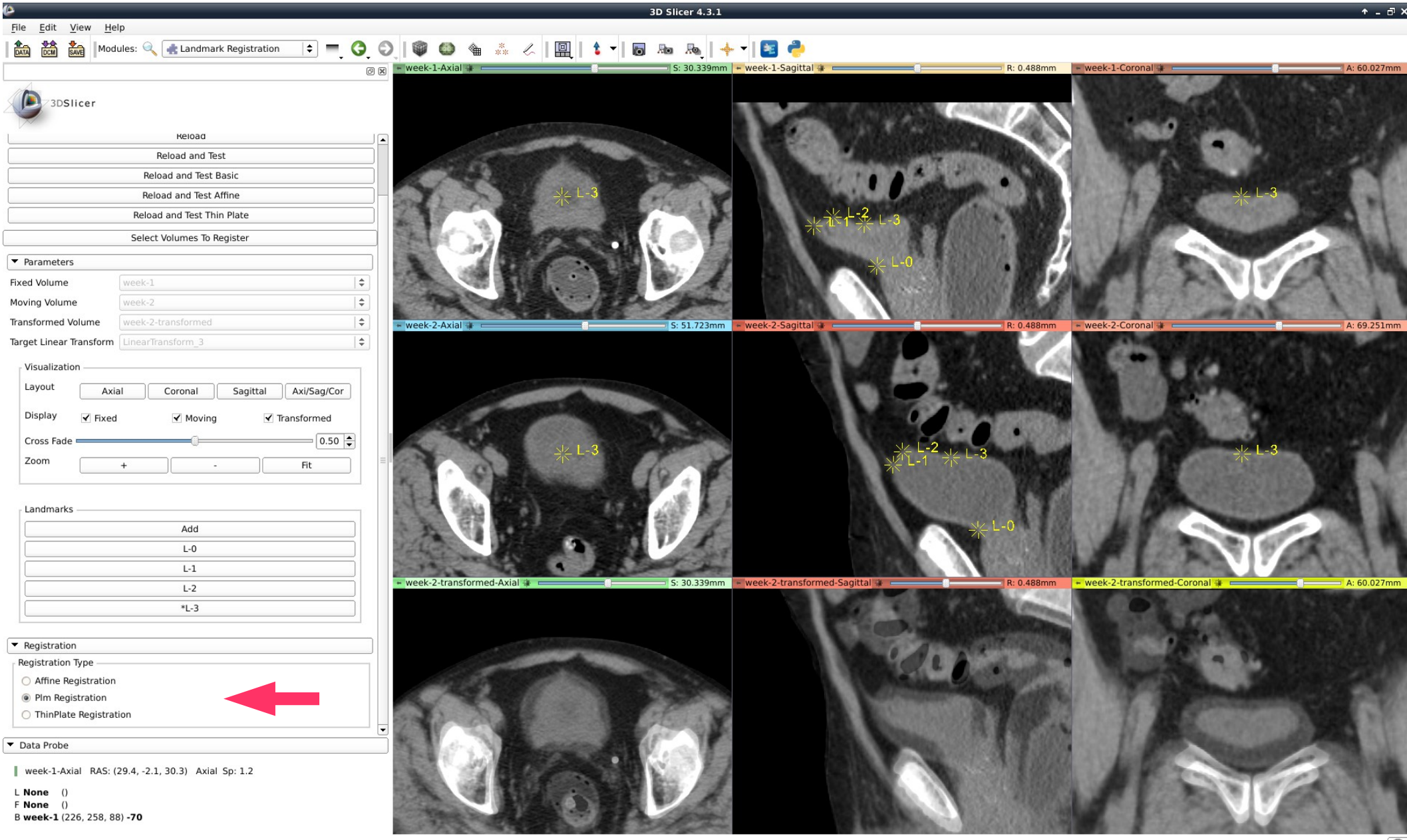
# Dose accumulation in prostate cancer





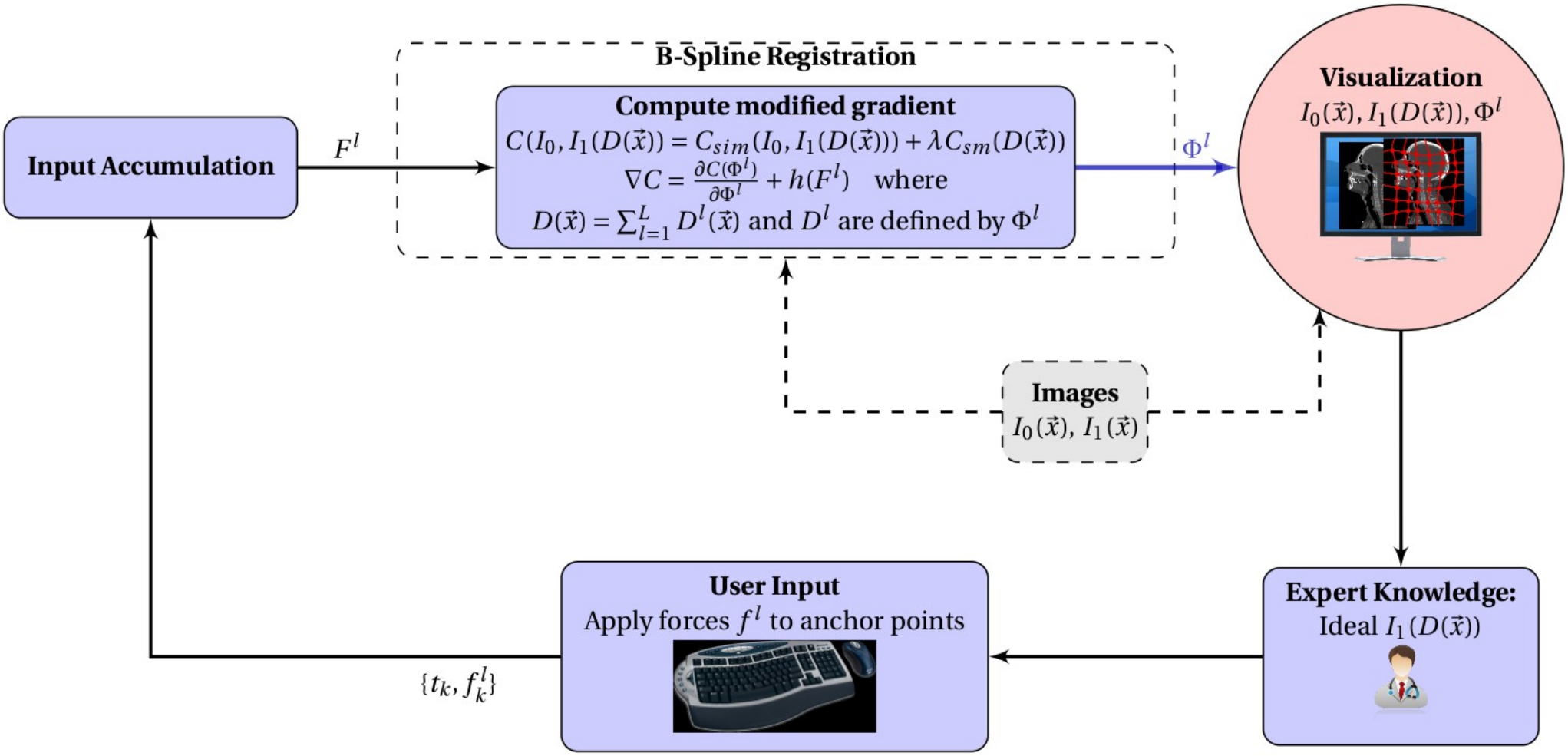

R: 0.488mm
Week 1
1
S
R
P
L
I
Y
R: 0.488mm
Week 2
G
R: 0.488mm
B-spline


R: 0.488mm
Week 1
F-4
F-5
F-6
F-7
F-8
F-3
F-2
F-1
G
R: 0.977mm
LM = 100
Reg = 3
F-4
F-5
F-6
F-7
F-8
F-3
F-2
F-1
Y
R: 0.488mm
Week 2
M-5
M-6
M-7
M-4
M-8
M-3
M-2
M-1
G
R: 0.977mm
LM = 100
Reg = 0.1
F-4
F-5
F-6
F-7
F-8
F-3
F-2
F-1


3D Slicer 4.3.1
File
Edit
View
Help
Modules:
Landmark Registration
3DSlicer
Reload
Reload and Test
Reload and Test Basic
Reload and Test Affine
Reload and Test Thin Plate
Select Volumes To Register
Parameters
Fixed Volume
week-1
Moving Volume
week-2
Transformed Volume
week-2-transformed
Target Linear Transform
LinearTransform_3
Visualization
Layout
Axial
Coronal
Sagittal
Axi/Sag/Cor
Display
Fixed
Moving
Transformed
Cross Fade
0.50
Zoom
+
-
Fit
Landmarks
Add
L-0
L-1
L-2
*L-3
Registration
Registration Type
Affine Registration
Plm Registration
ThinPlate Registration
Data Probe
week-1-Axial RAS: (29.4, -2.1, 30.3) Axial Sp: 1.2
L None ()
F None ()
B week-1 (226, 258, 88) -70
week-1-Axial
S: 30.339mm
week-1-Sagittal
R: 0.488mm
week-1-Coronal
A: 60.027mm
week-2-Axial
S: 51.723mm
week-2-Sagittal
R: 0.488mm
week-2-Coronal
A: 69.251mm
week-2-transformed-Axial
S: 30.339mm
week-2-transformed-Sagittal
R: 0.488mm
week-2-transformed-Coronal
A: 60.027mm
L-0
L-1
L-2
L-3

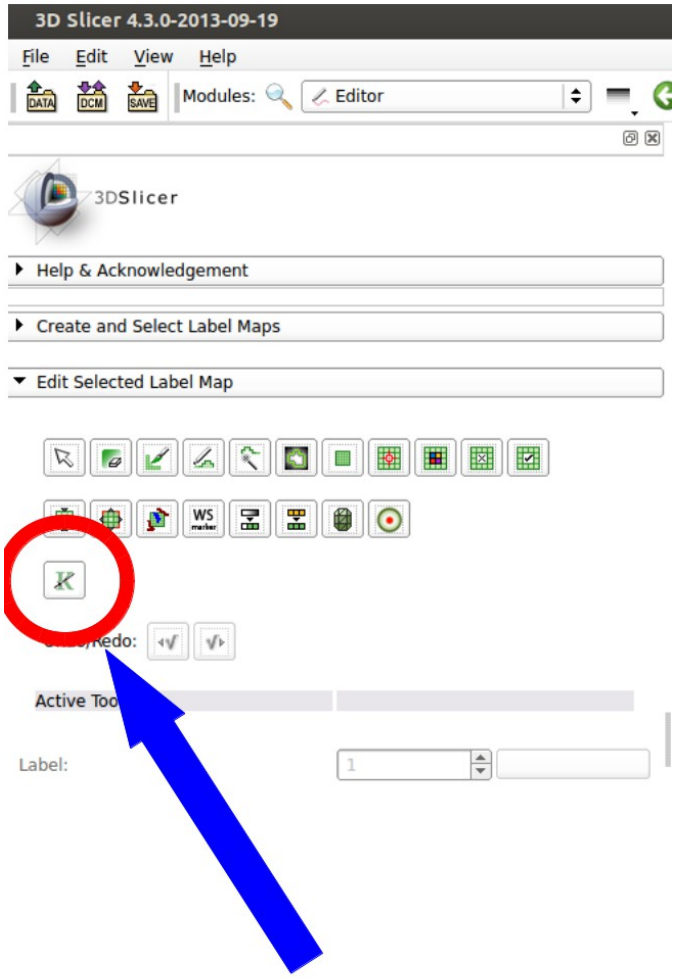
Pieper 2013

# Interactive registration

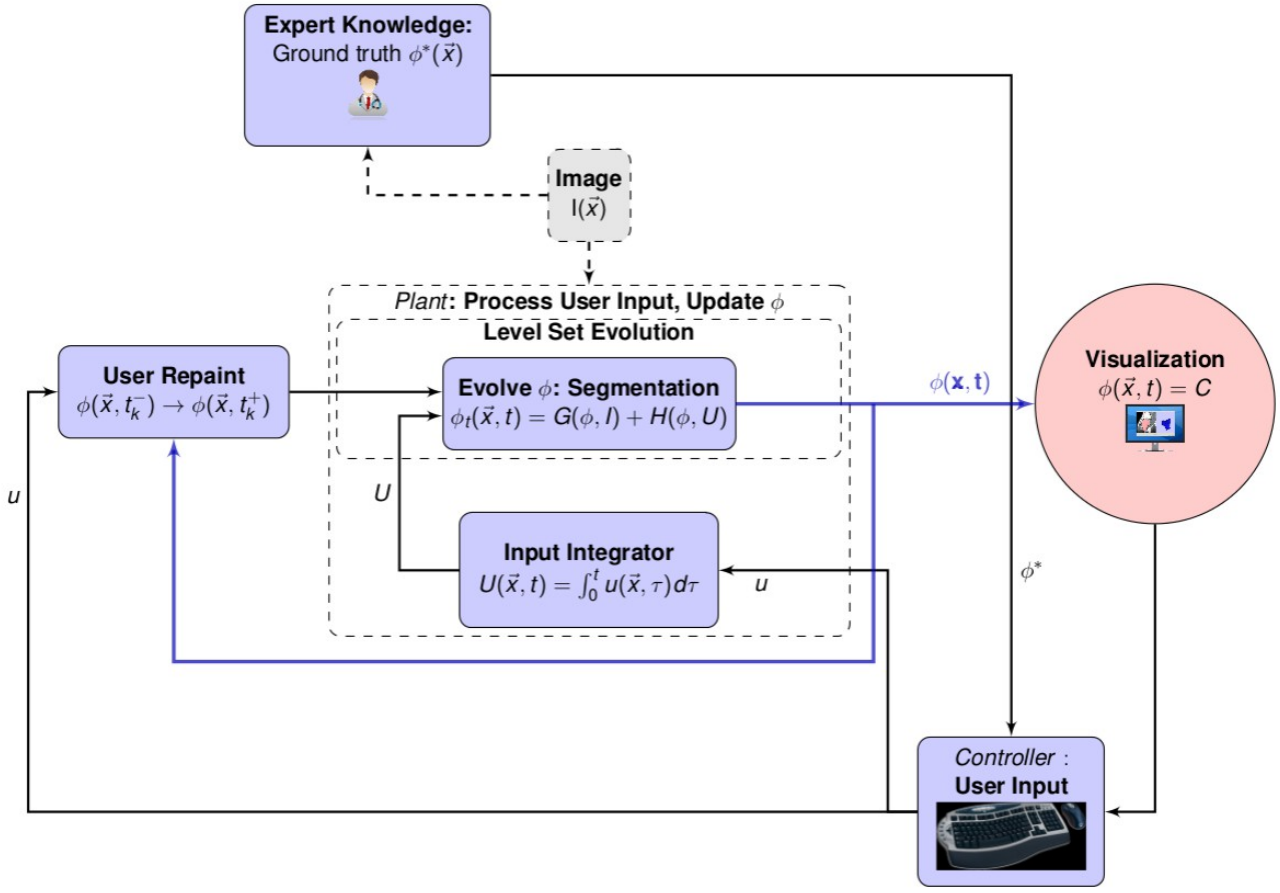



Kolesov 2014

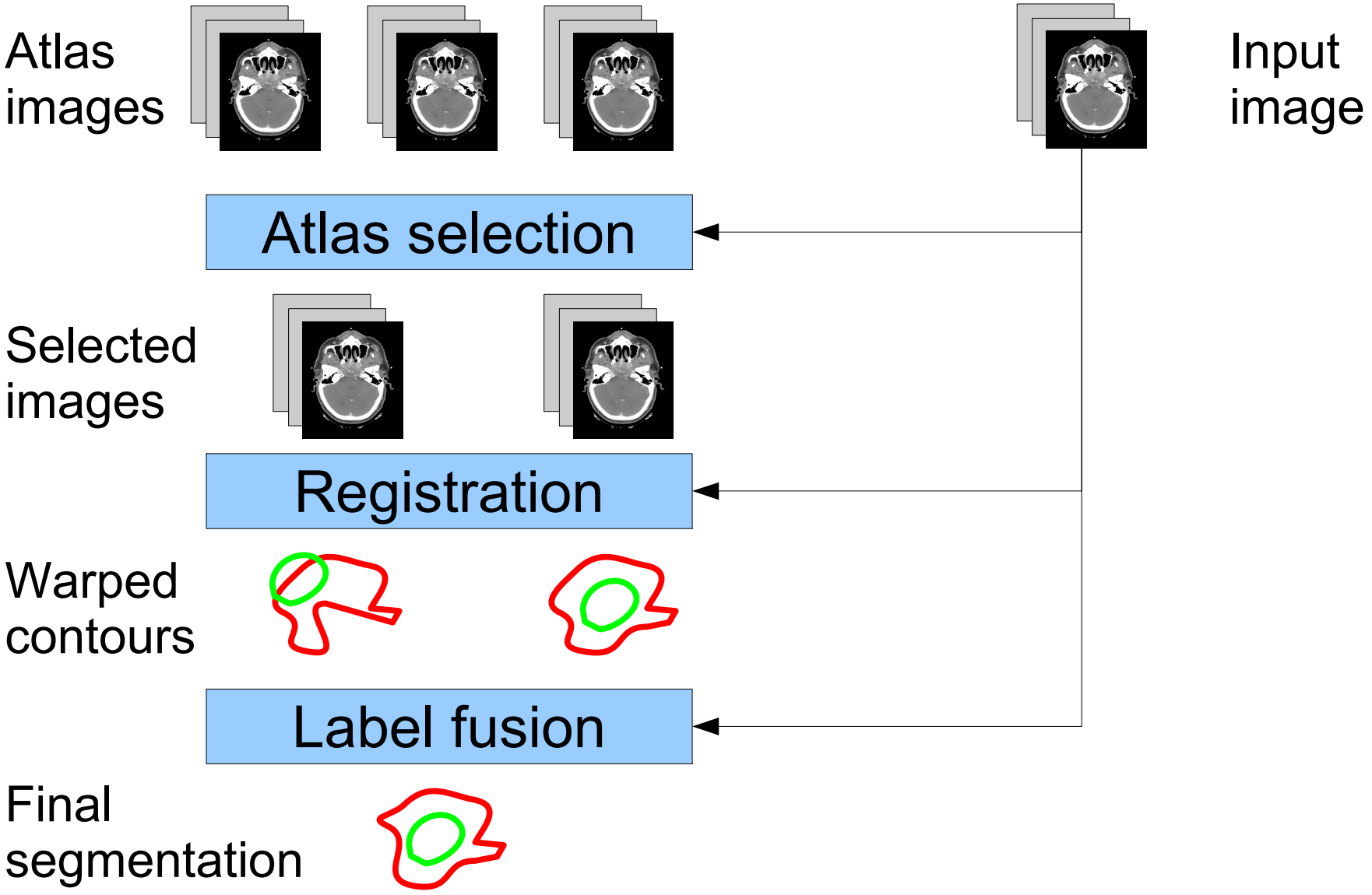
# KSlice Interactive Segmentation



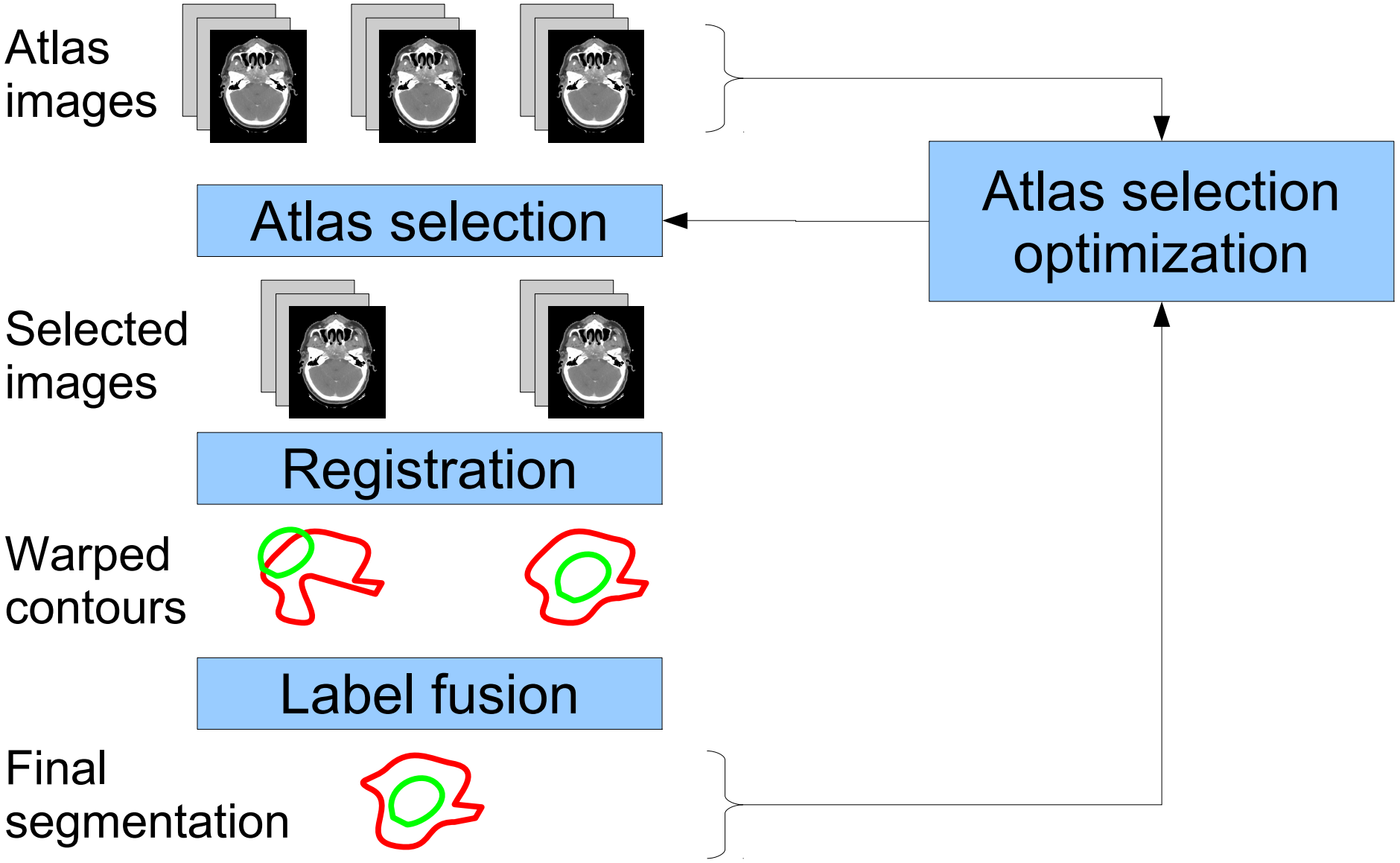

- Editor module
- Inter-slice interpolation
- Control of user input function
- Choice for image cost functional
- Selection of tools for input



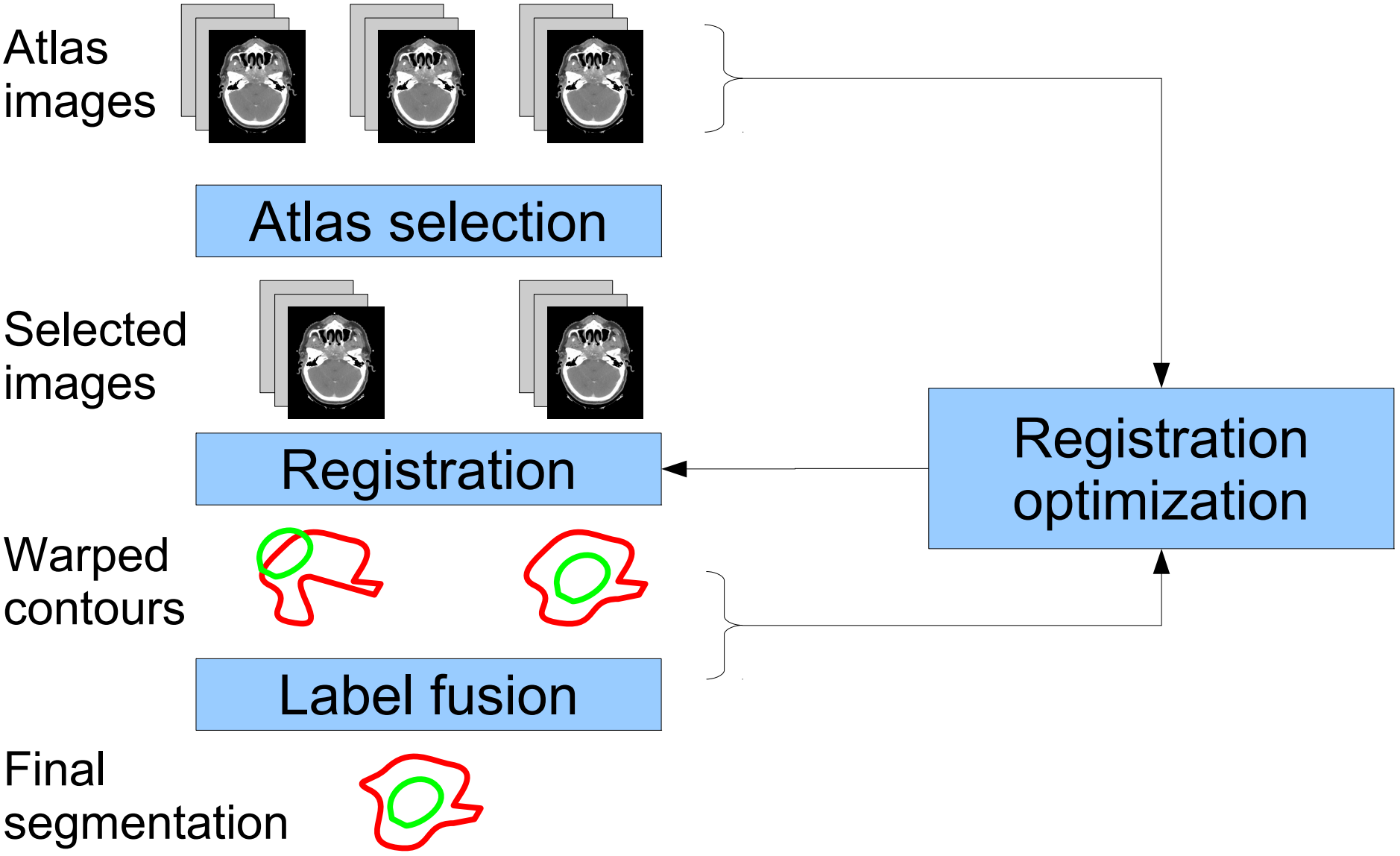
# ** MABS **
# Multi Atlas Based Segmentation



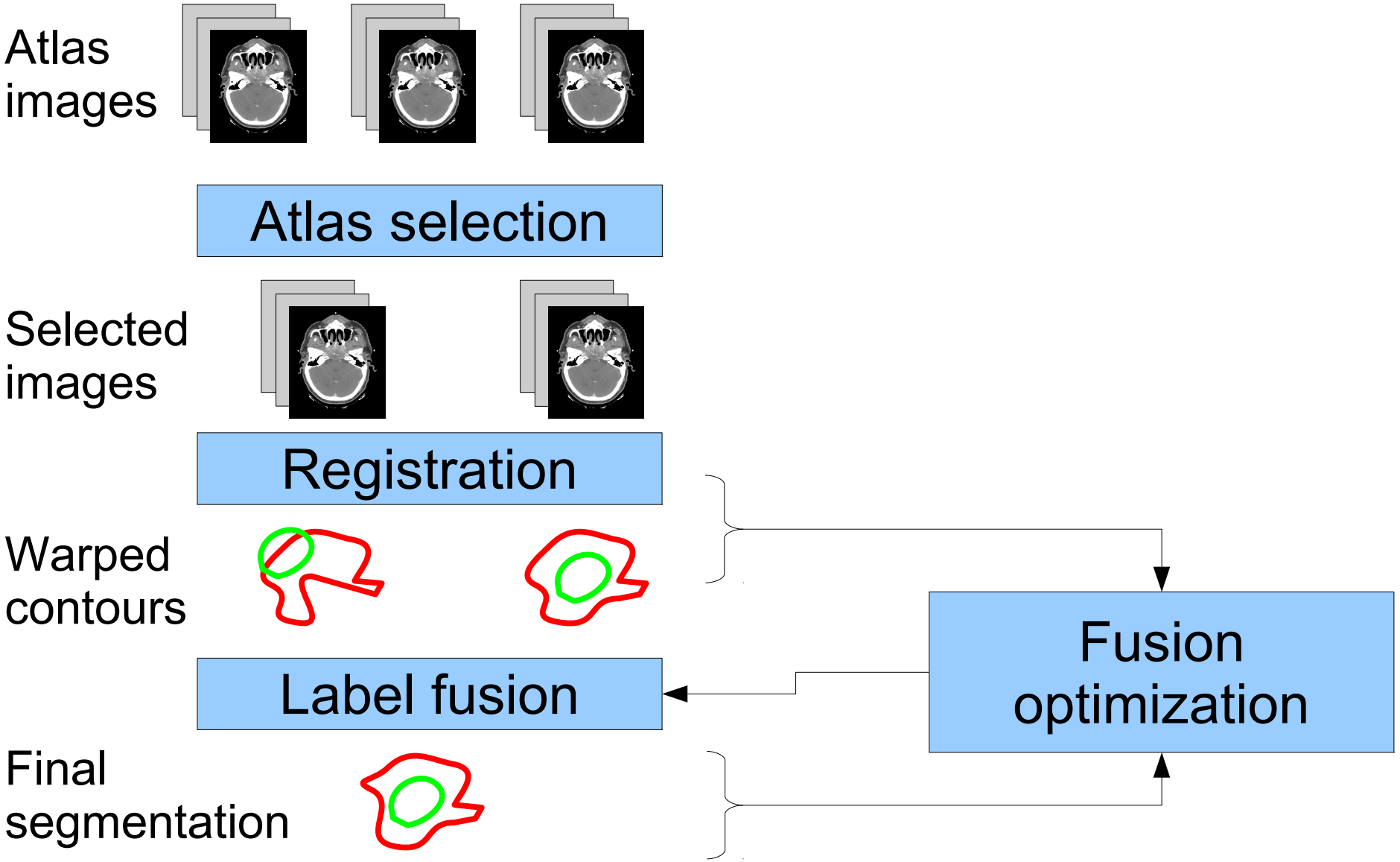
# ** MABS **
# Multi Atlas Based Segmentation



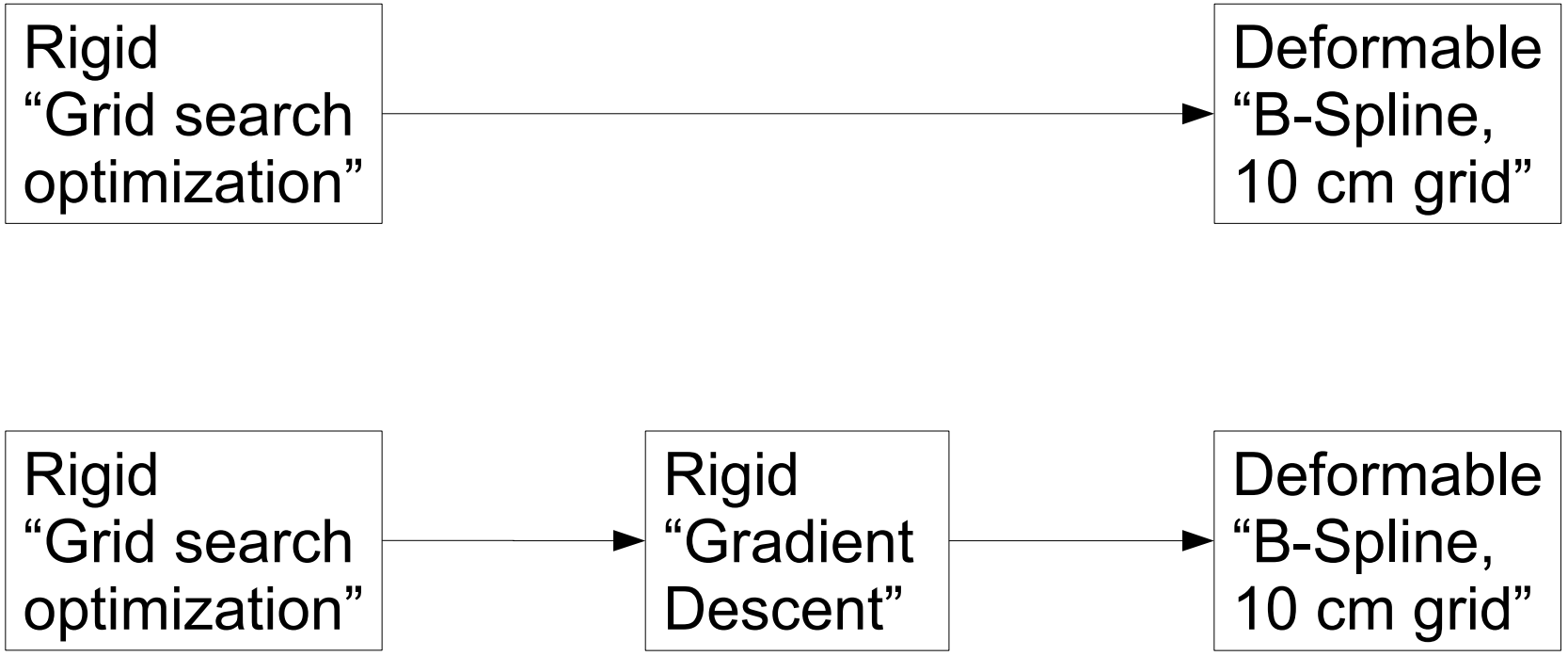
# ** MABS **
# Multi Atlas Based Segmentation



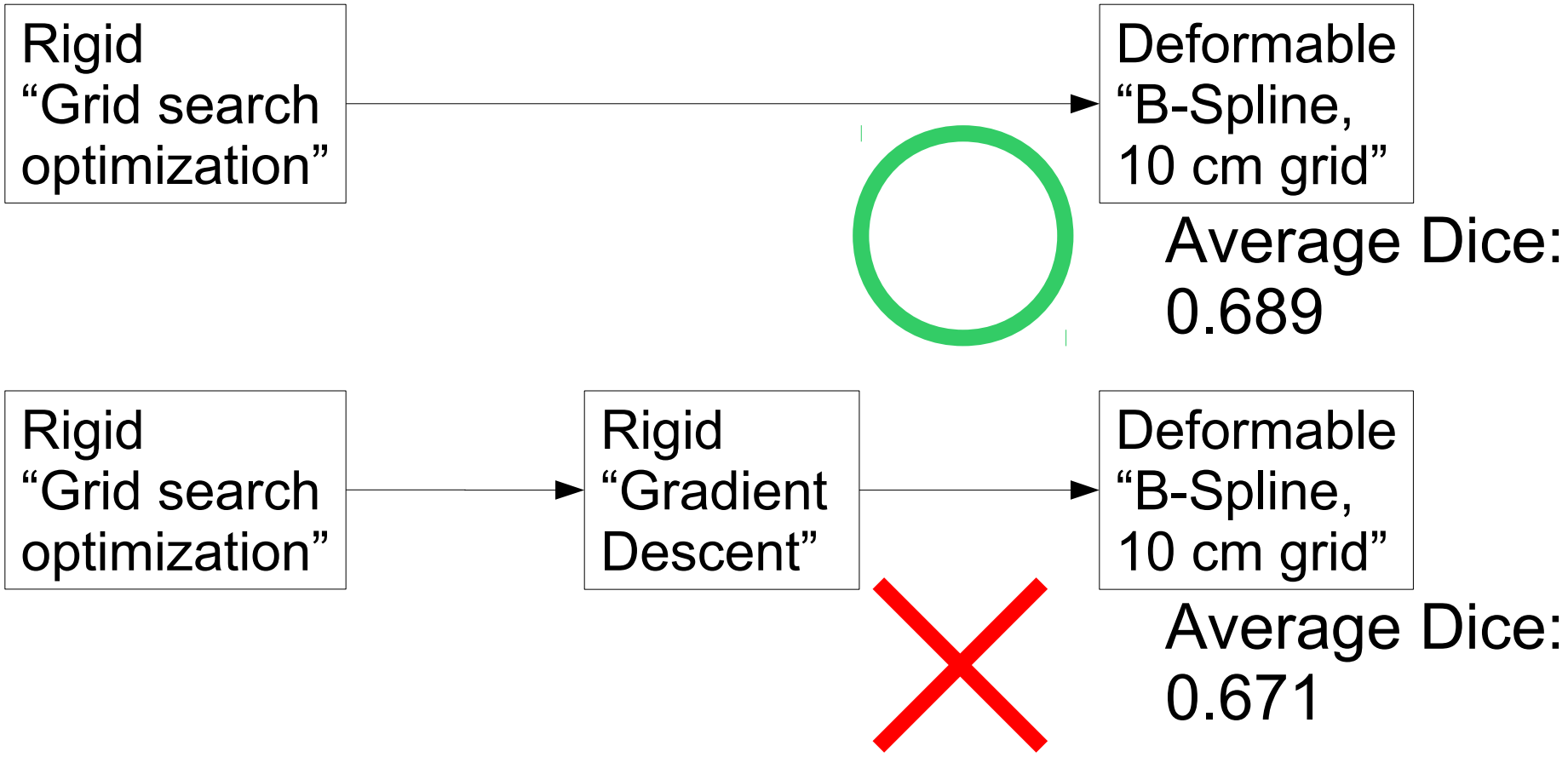
# ** MABS **
# Multi Atlas Based Segmentation



# Registration optimization

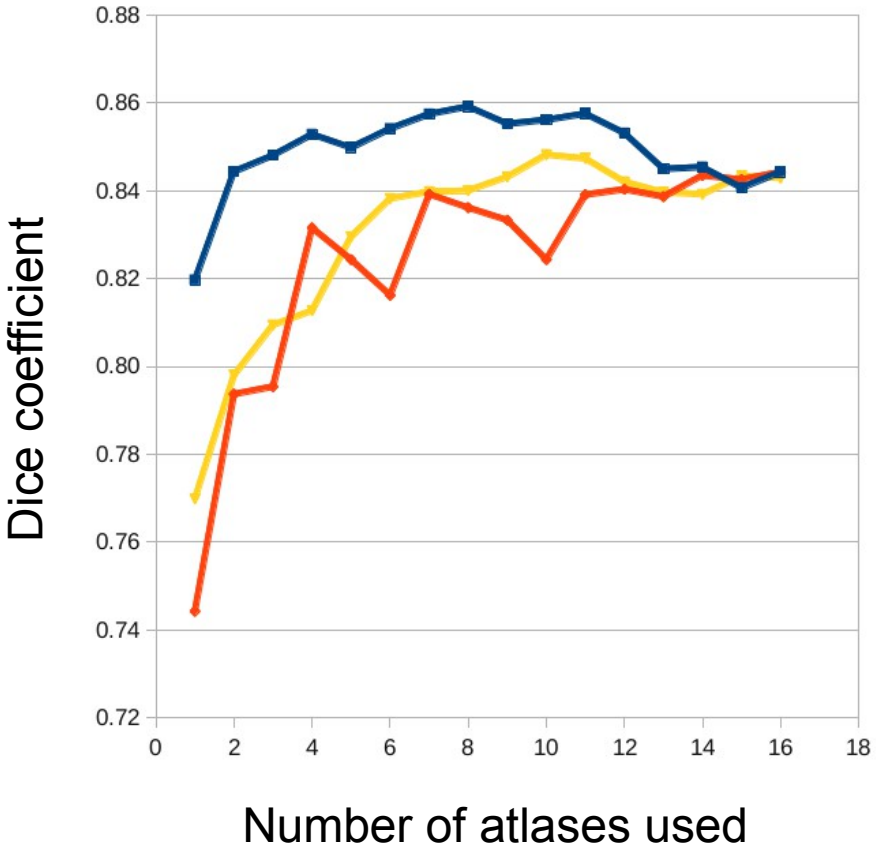


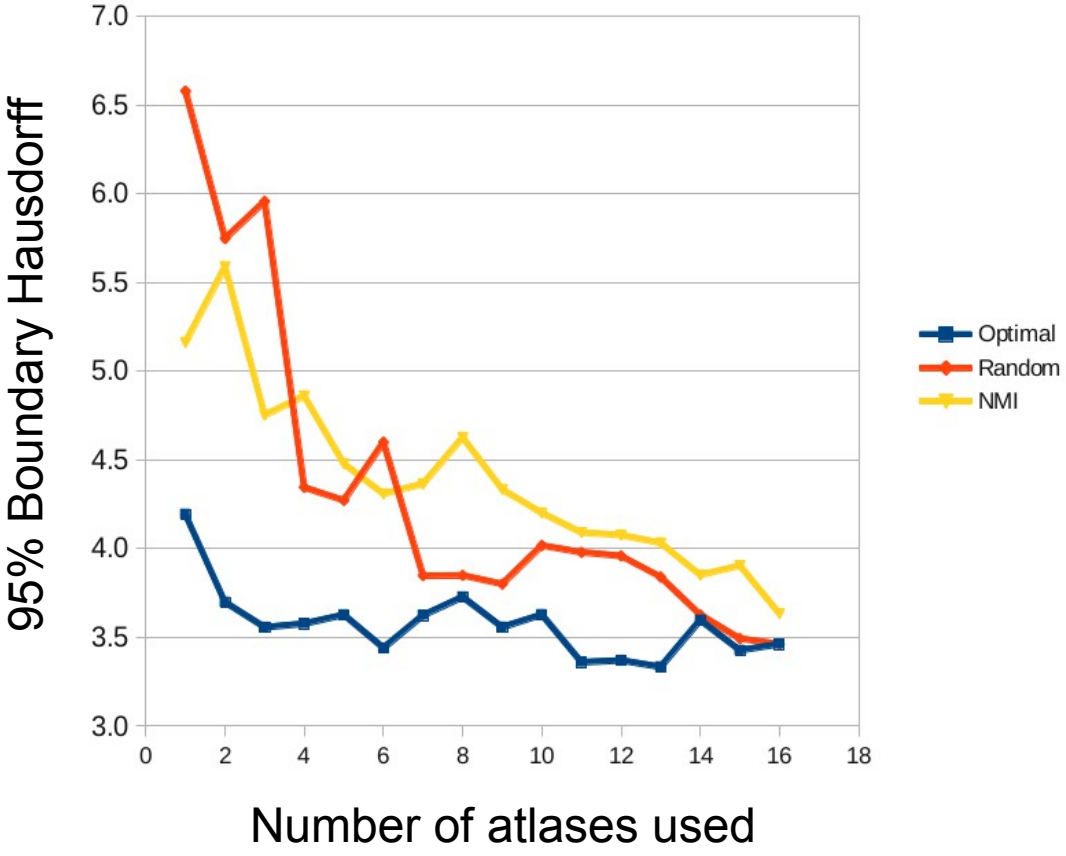
# Registration optimization



# Atlas selection optimization

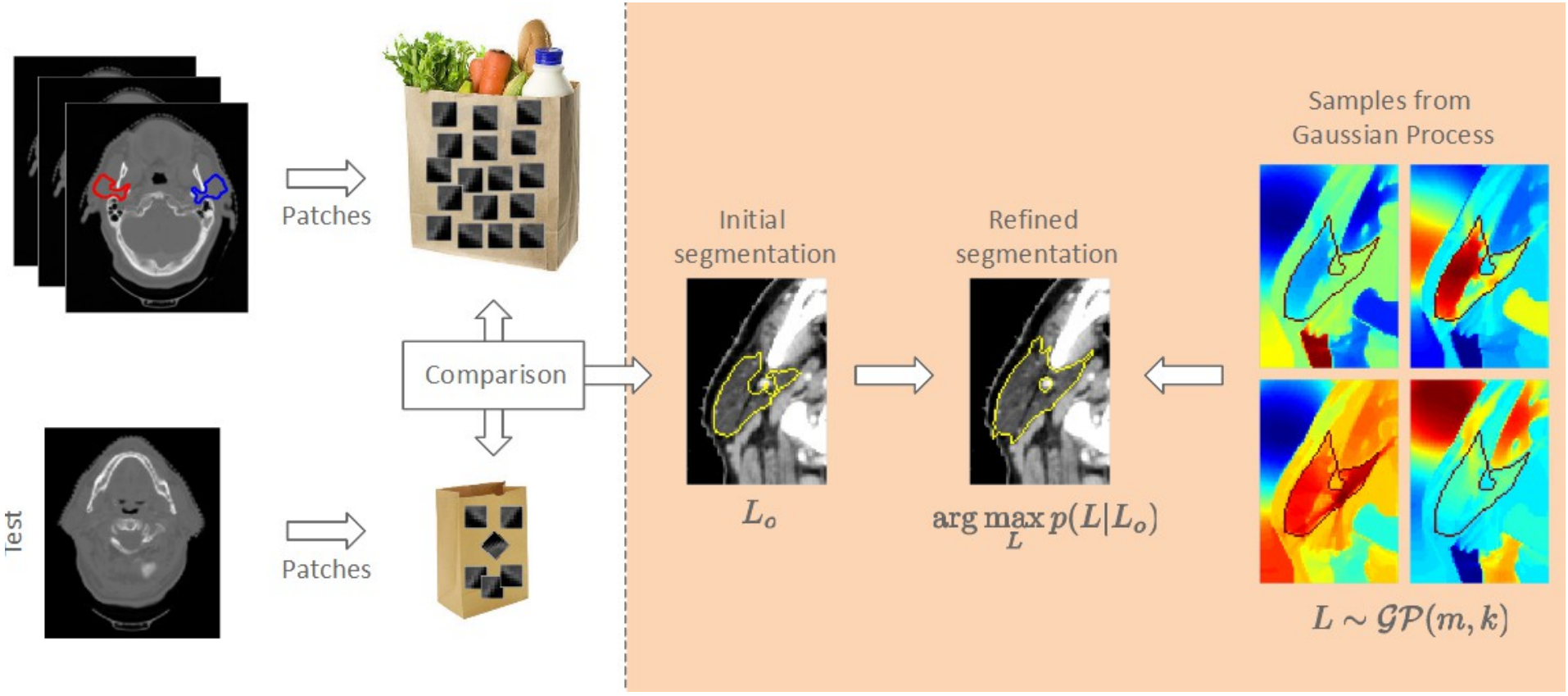
## Parotid gland



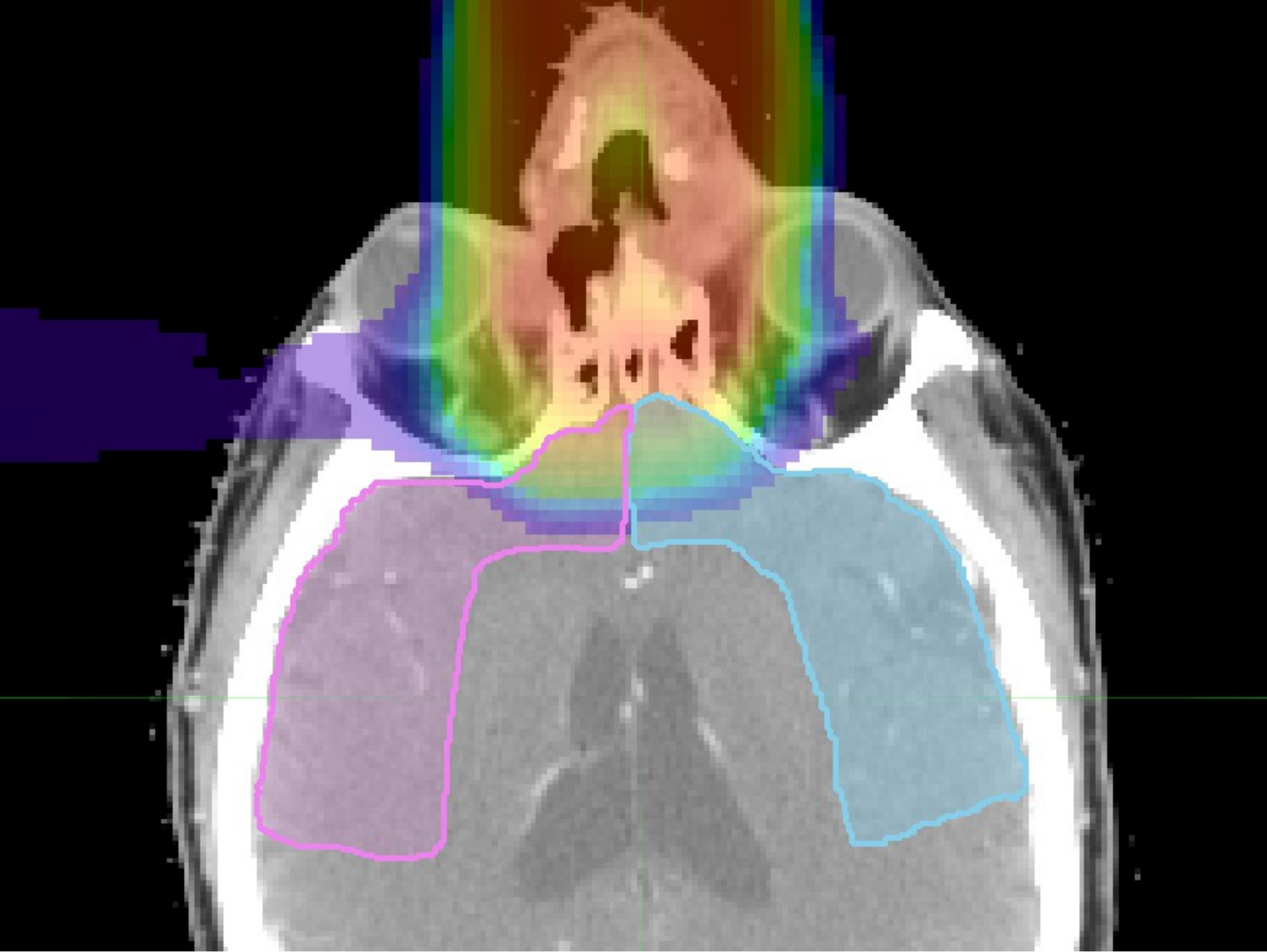




Zaffino, ESTRO 2014

# Segmentation using Learning and Regularization




Christian Wachinger, MICCAI 2013



** Thank you from the DBP team **

MGH: Nadya Shusharina, Karl Fritscher, Annie Chan, Greg Sharp

MIT: Christian Wachinger, Polina Golland

Stony Brook: Ivan Kolesov, Allen Tannenbaum

Catanzaro: Paolo Zaffino, Maria Francesca Spadea

Isomics: Steve Pieper