



MASSACHUSETTS
GENERAL HOSPITAL

RADIATION ONCOLOGY



*National
Alliance for
Medical Image
Computing*

DBP3: Head and Neck Cancer

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NA-MIC AHM January 13, 2011

Head & Neck Cancer: Statistics

- Between 4-6% of all new cancer cancers
- About 60,000 new cases per year
- 60% present with advanced disease
- 5 year survival: about 50%
- Multimodal treatment

Head & Neck Cancer Sites

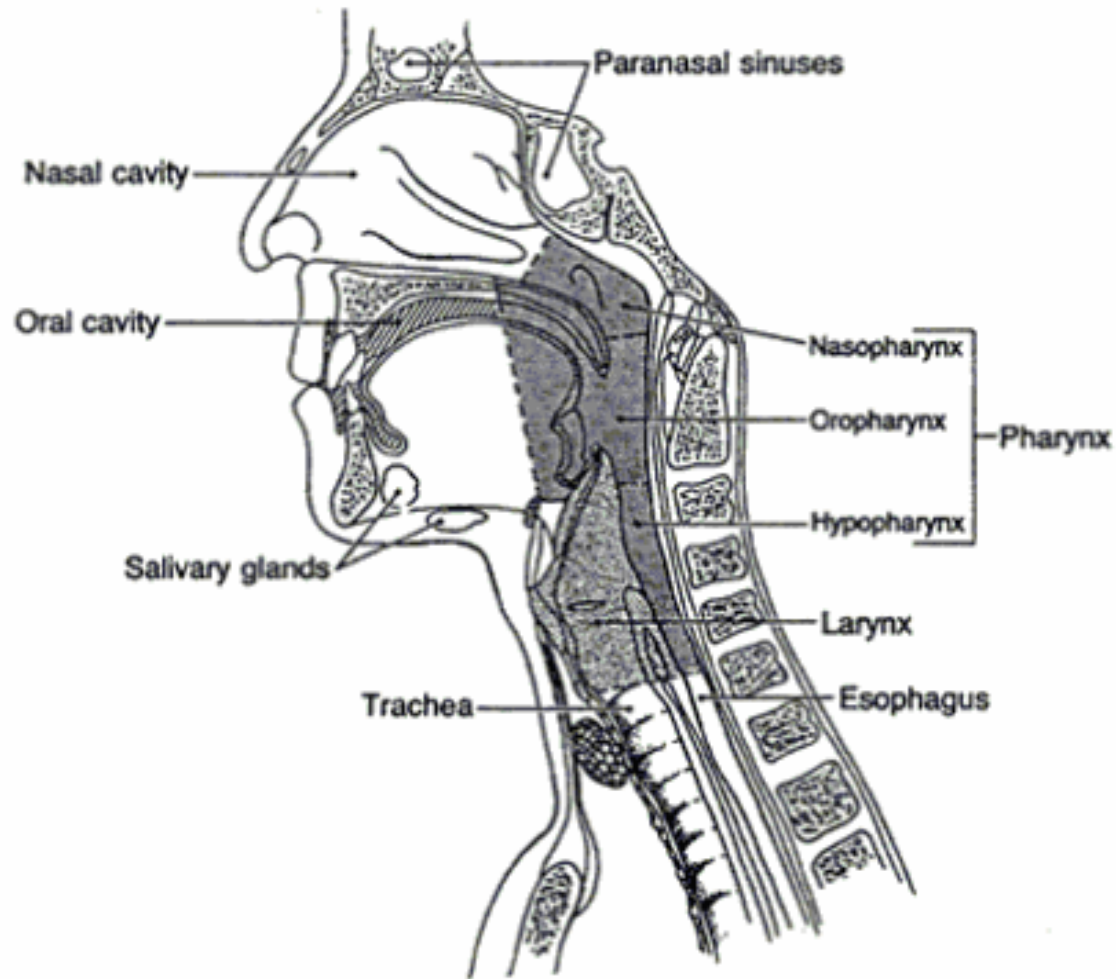
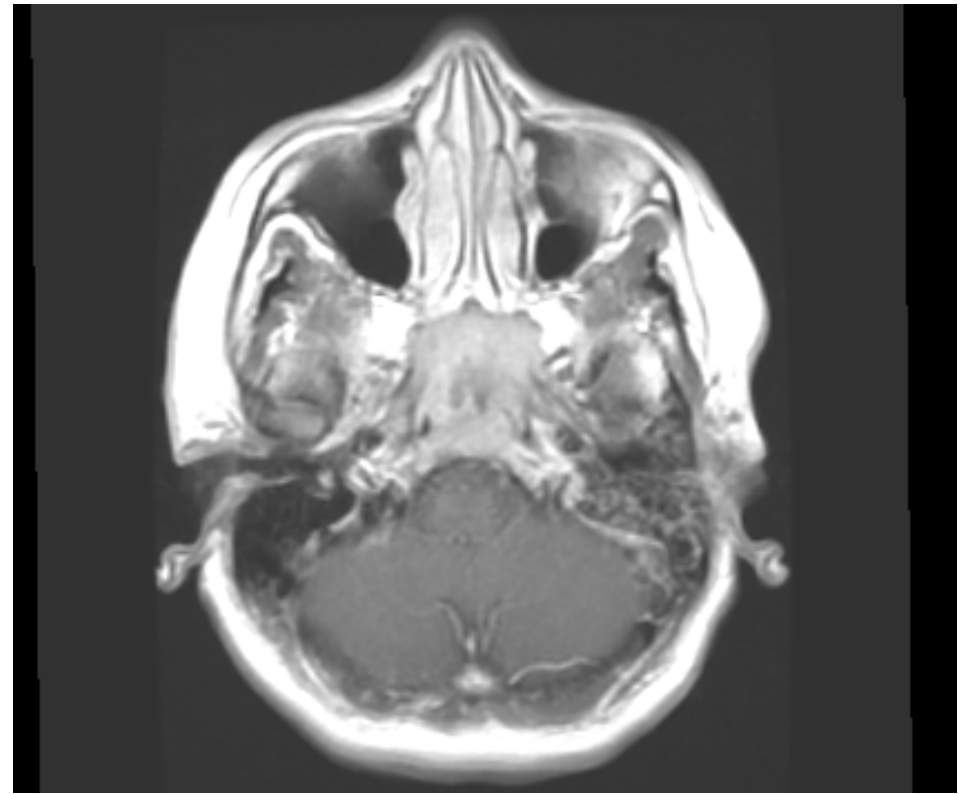
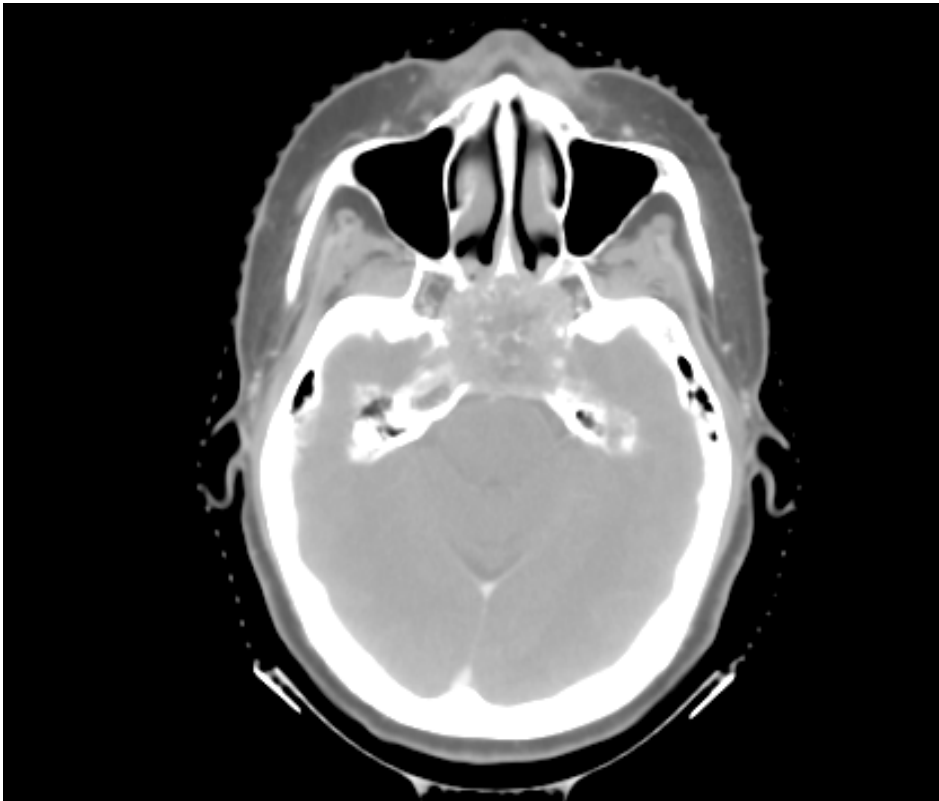


Image credit: American Cancer Society (www.cancer.org)

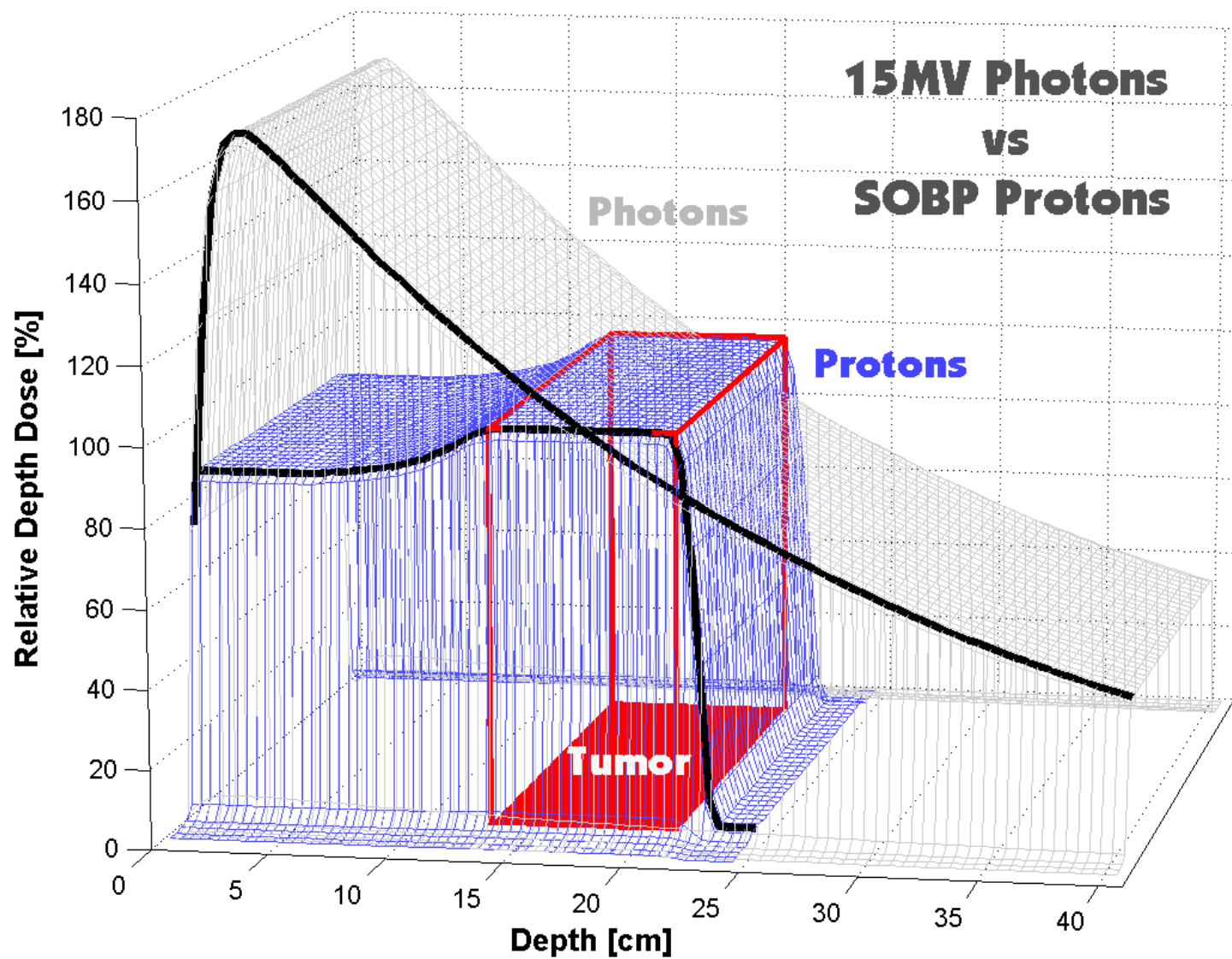
Cancer in the Base of Skull



Biology of Radiation Therapy

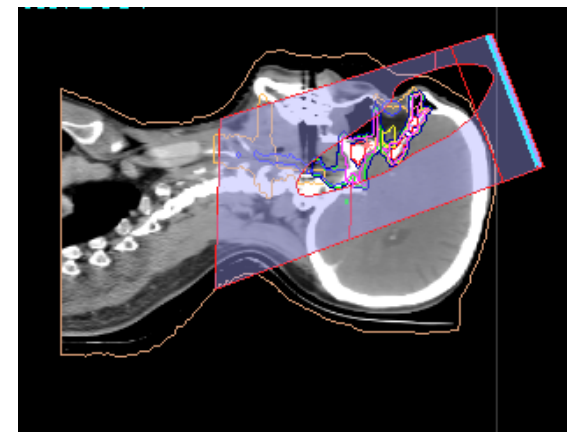
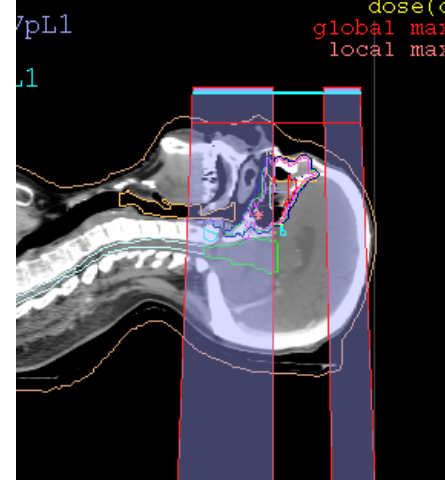
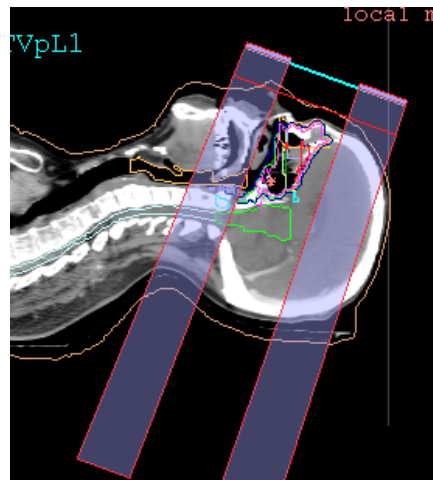
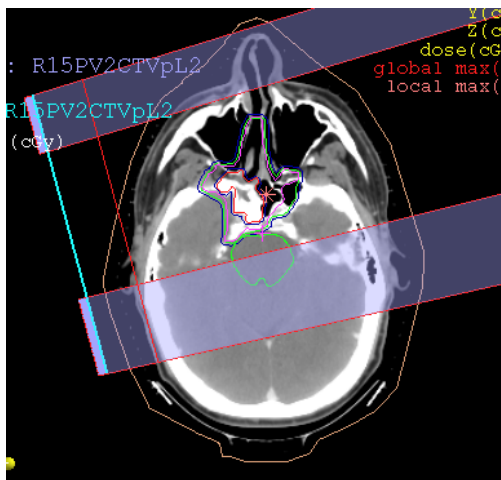
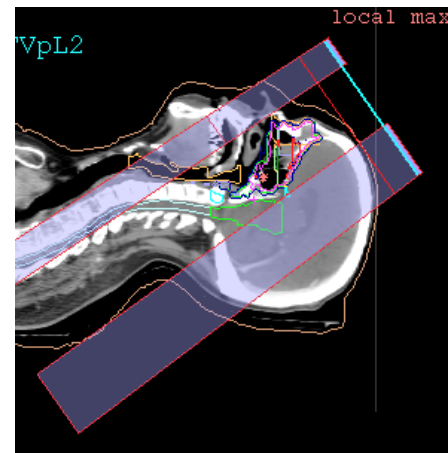
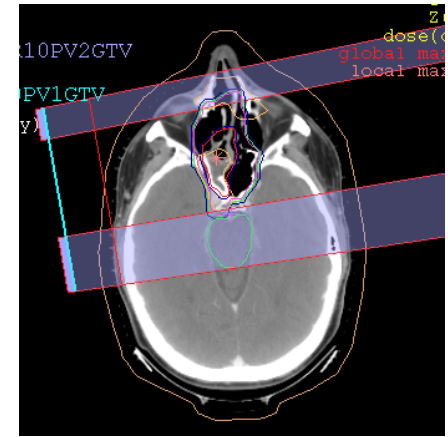
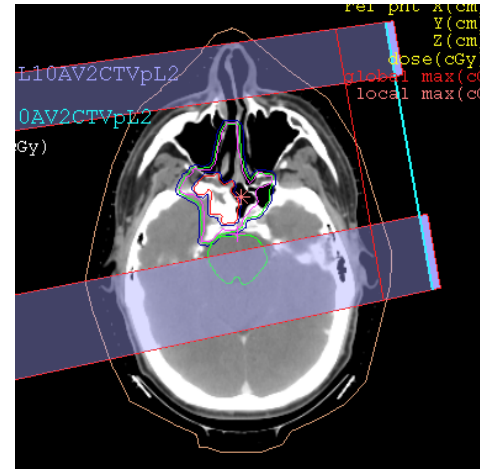
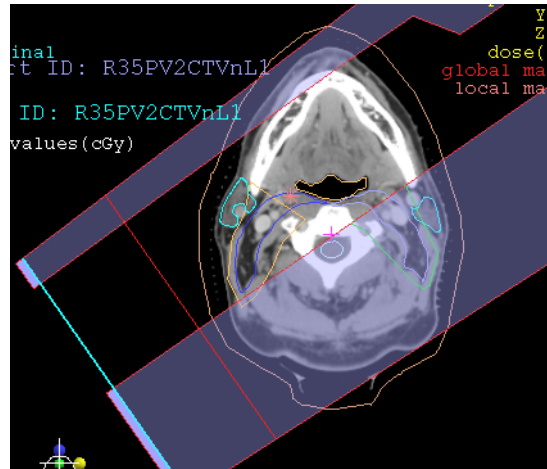
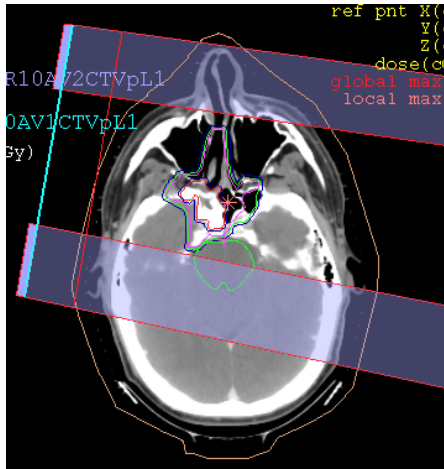
- Physics
 - Ionizing radiation generates free radicals
- Chemistry
 - Free radicals (esp. OH^*) bind with molecules
- Biology
 - DNA is damaged, cell cannot reproduce

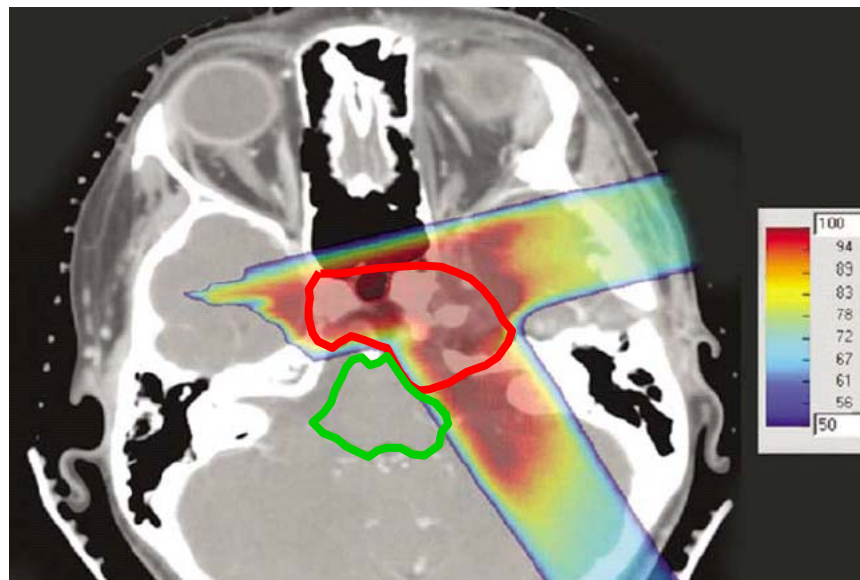
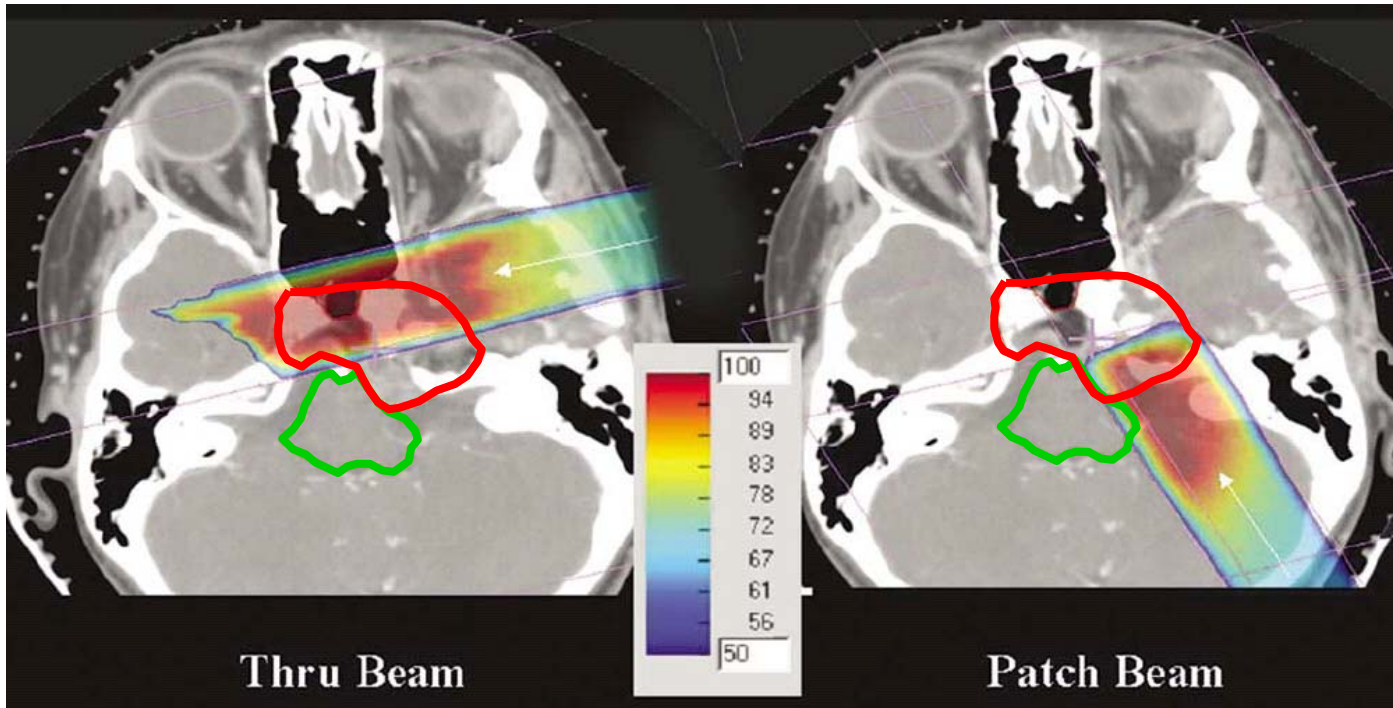
Proton Therapy



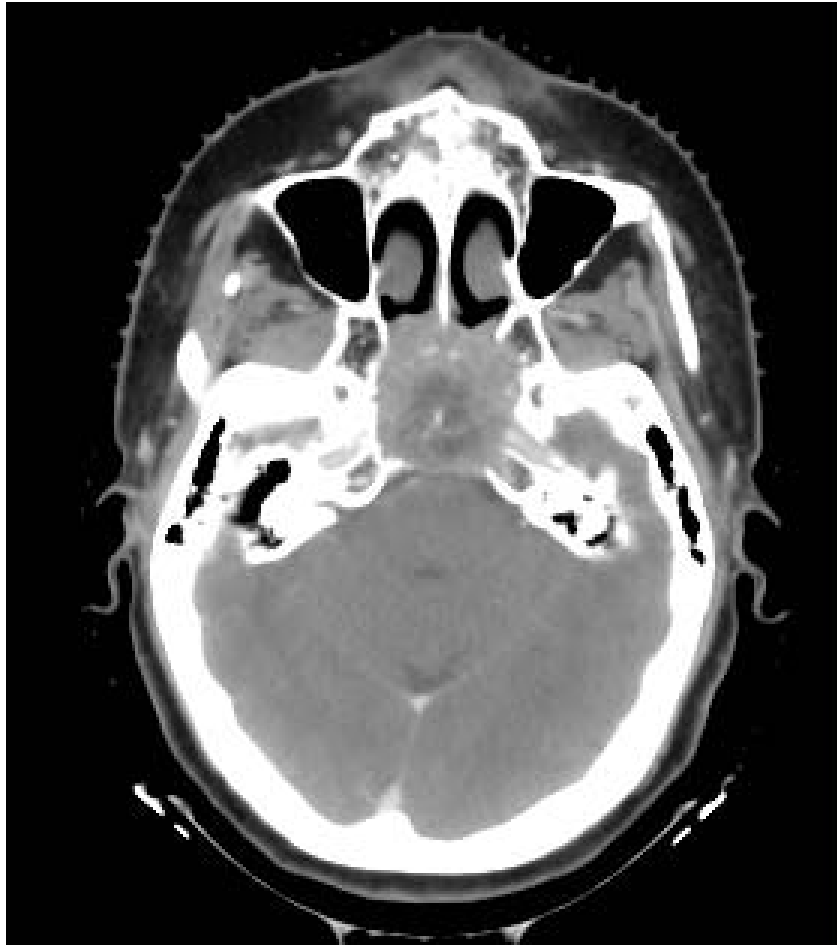
Proton Treatments in the Base of Skull

Typical plan ~15 beams

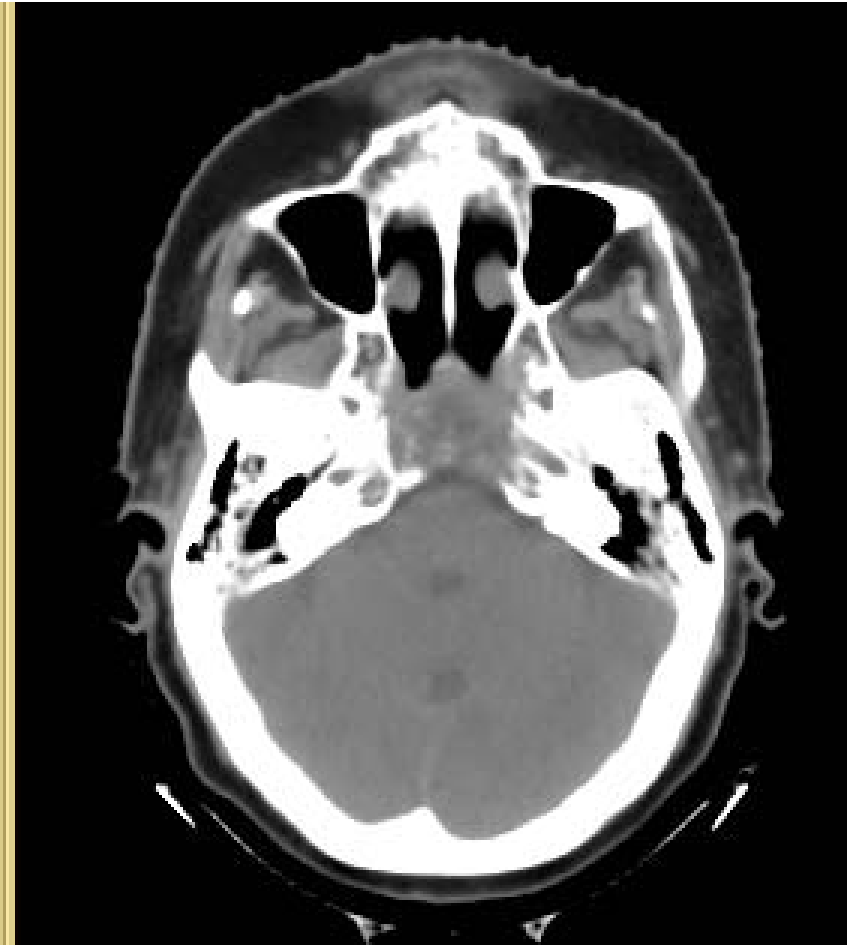




Anatomic Change

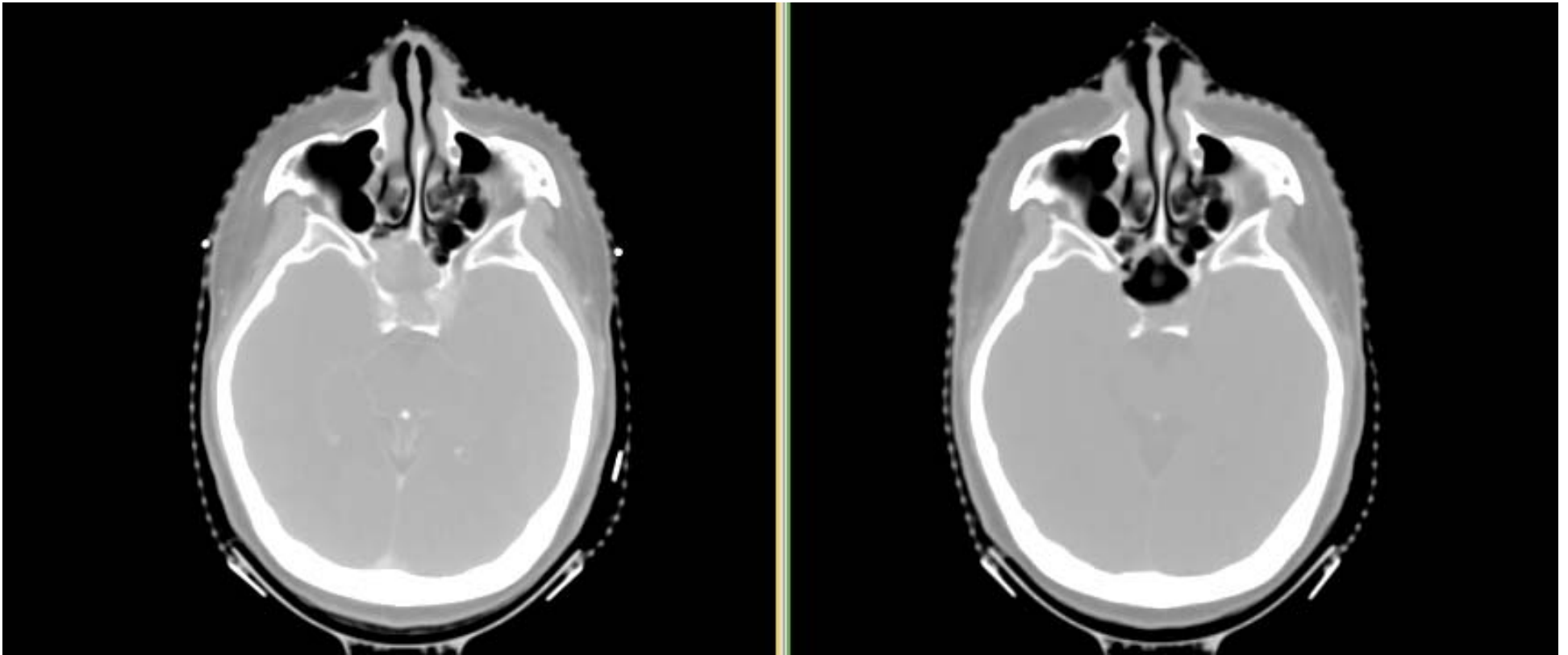


Pre-treatment



Mid-treatment

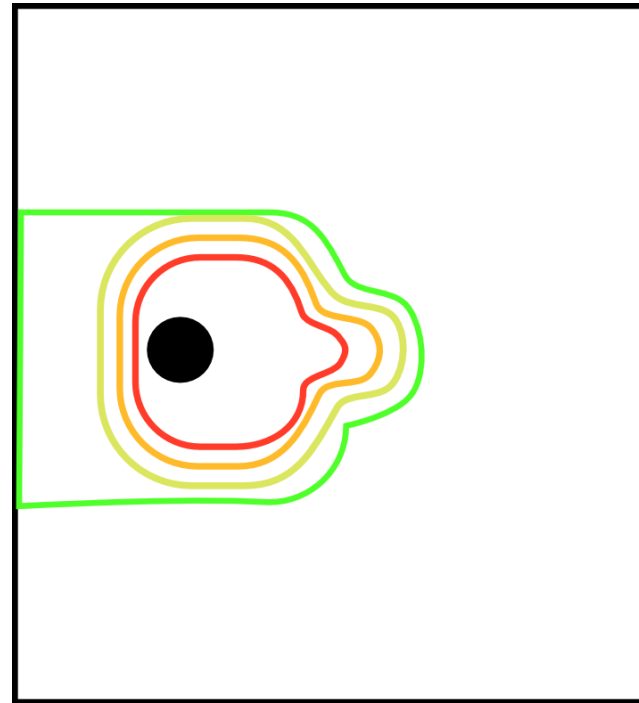
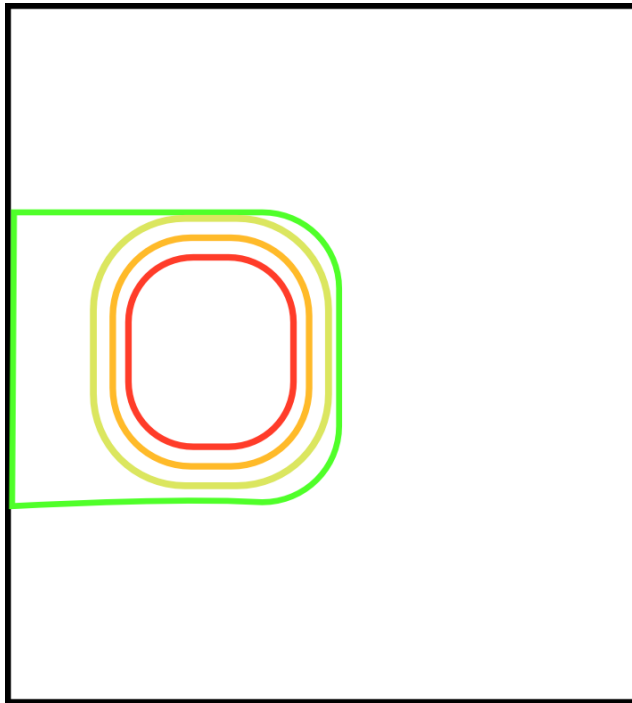
Anatomic Change



Pre-treatment

Mid-treatment

Implications of Anatomic Change

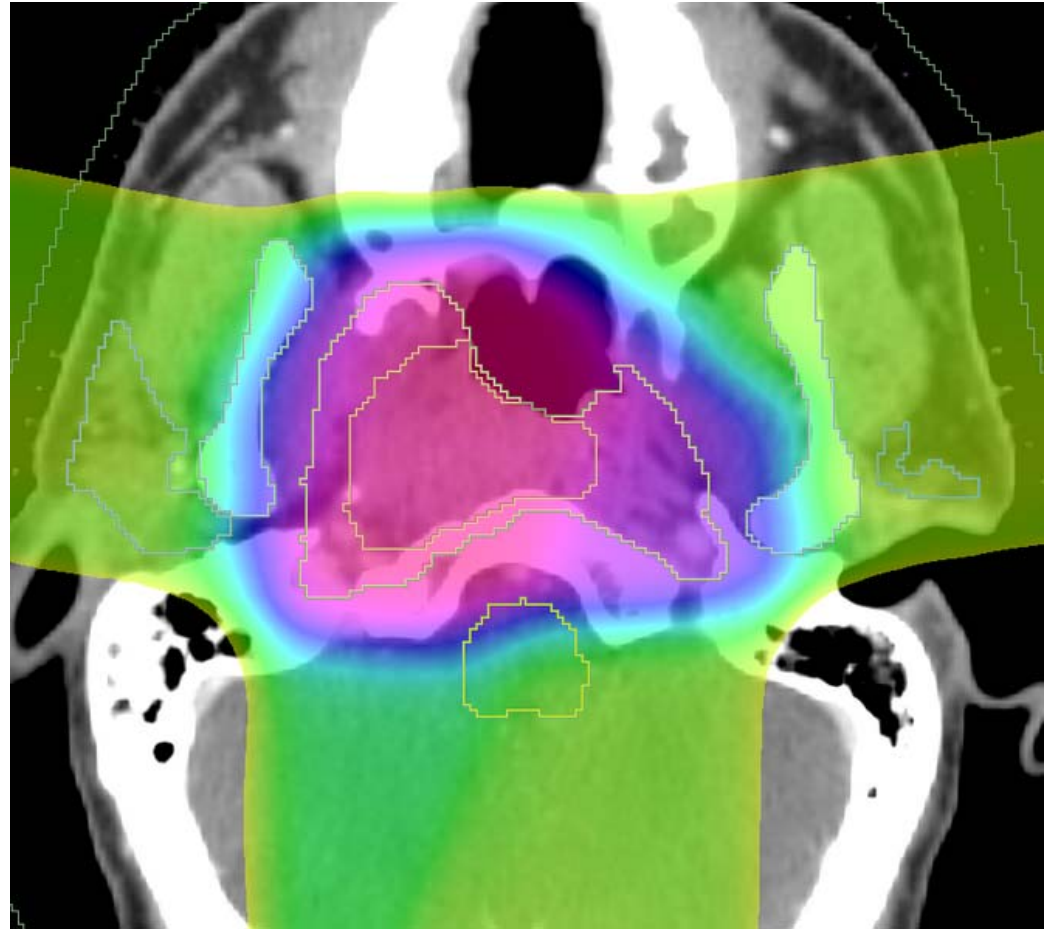


Engineering Plan

- Support for adaptive radiotherapy in NA-MIC
- Four goals
 - DICOM-RT interchange
 - Structure and dose warping
 - Interactive deformable registration
 - Plan review

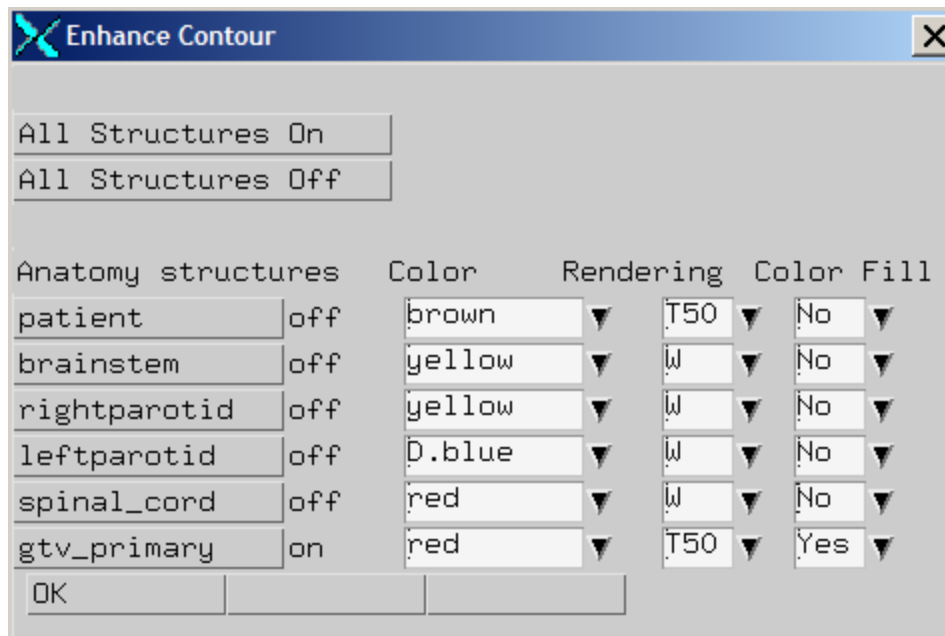
DICOM-RT Interchange

- RT Dose
 - Dose in Gray
- RT Structure Sets
 - Polyline contours of organs of interest
- RT Plan
 - Beam arrangements



Structure Set Manipulation

- Overlapping structures
- Individual control of visibility, style
- Names and colors grouped with structures



Structure and Dose Warping

- Evaluate registration algorithms for CT
- Workflow for structure and dose warping



Help & Acknowledgement

Display & Modify Scene

MRML Tree

- Scene
 - View5
 - Default Scene Camera
 - ct15
 - Fast Nonrigid BSpline registration Transform
 - ct23

Display MRML ID's

MRML Node Inspector

Panel with sliders and icons for 'ct23'.

88 2.28

An axial CT scan of a human head, showing the brain, sinuses, and skull. The image is displayed in a grayscale format on a black background.

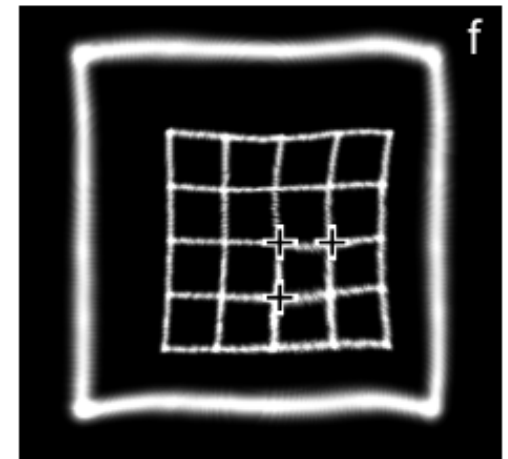
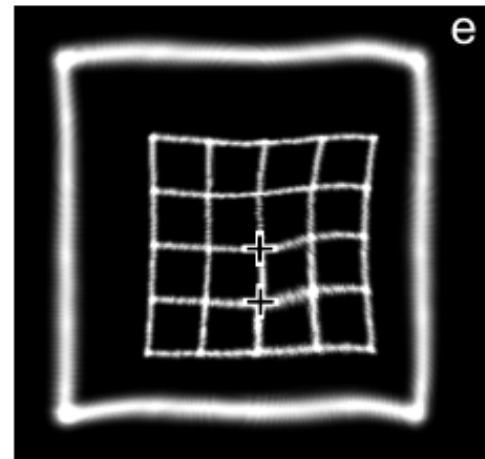
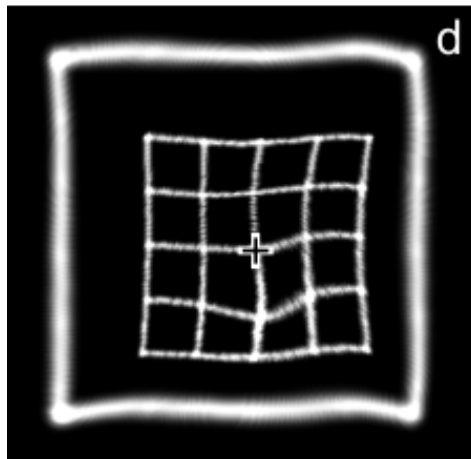
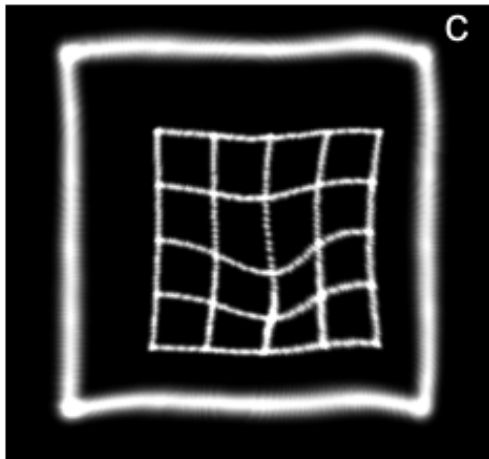
3D Slicer Version 3.8.1 1.0

Can't apply non linear transform to the node: ct23, of type: vtkMRMLScalarVolumeNode

OK

Interactive Deformable Registration

- Landmark-based method
- Make local corrections to registration results



Plan Review

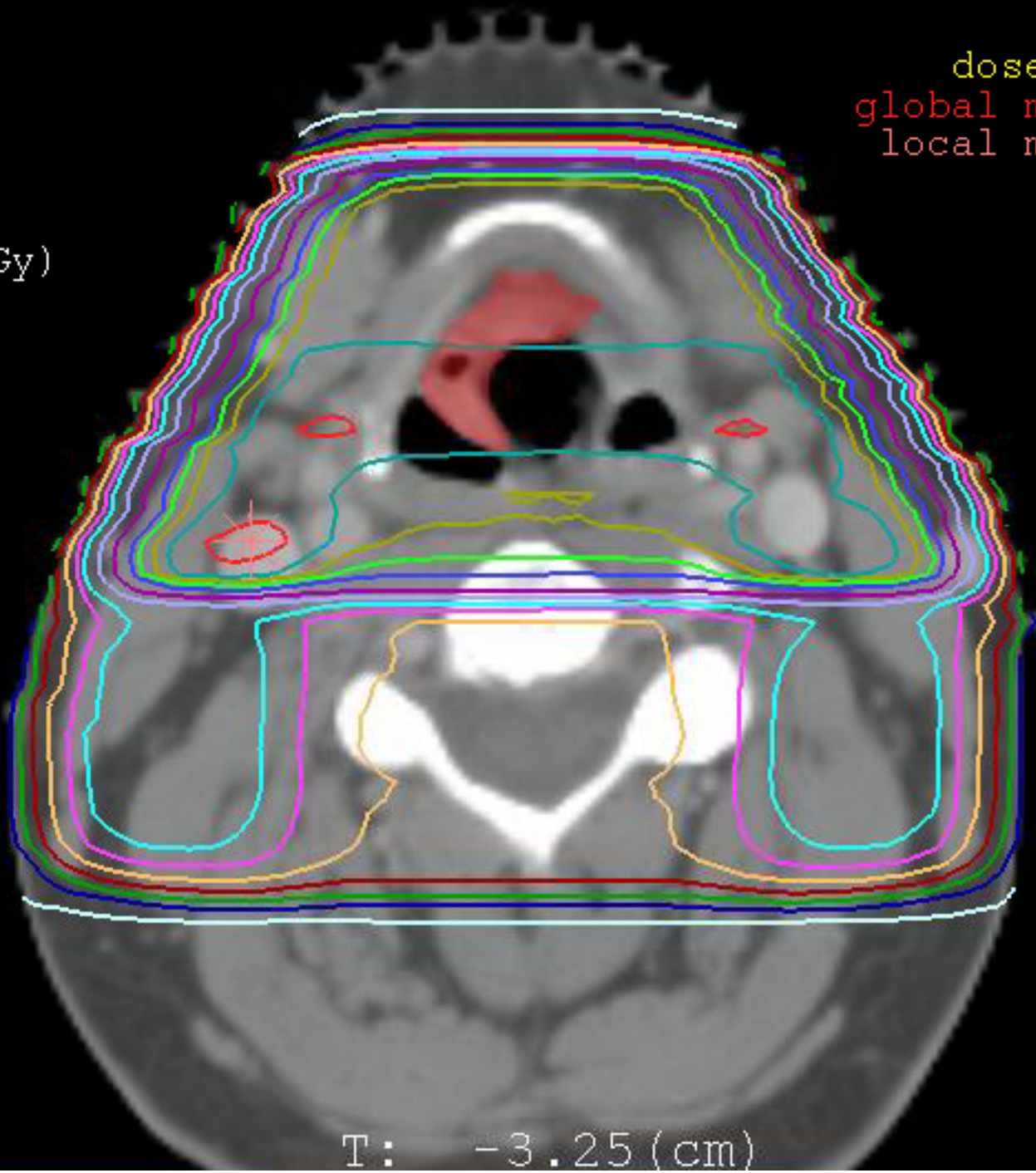
- Isodose display
- Dose volume histograms (DVH)
- Dose comparison tools

Norm: Abs

ref pnt X(cm): 0.15
Y(cm): -3.50
Z(cm): 6.00
dose (cGy): 7410.8
global max (cGy): 8001.4
local max (cGy): 7875.4

Isovalues (cGy)

- 7900.0
- 7800.0
- 7600.0
- 7400.0
- 7200.0
- 7000.0
- 6500.0
- 6000.0
- 5400.0
- 5000.0
- 4500.0
- 4000.0
- 3500.0
- 3000.0
- 2000.0



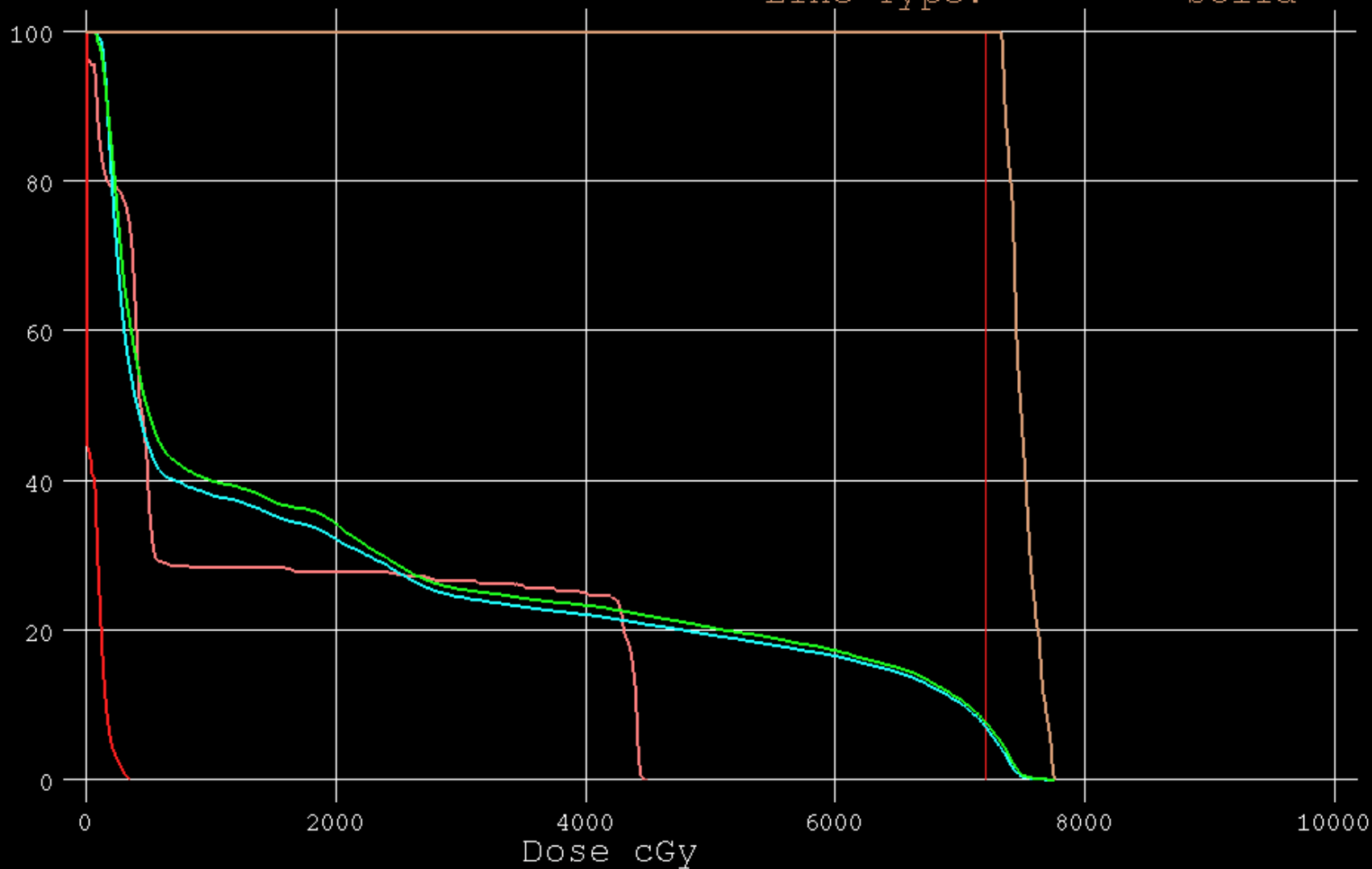
T: -3.25 (cm)

Scale=1: 1.04

1.gtv_primary
1.brainstem
1.rightparotid
1.leftparotid
1.spinal_cord

Total Volume: 5.64 cc
Inclusion: 100 %
Minimum Dose: 7324.0 cGy
Maximum Dose: 7764.0 cGy
Mean Dose: 7502.0 cGy
Cursor Volume: 100.00 %
Plan ID: *3615
Line Type: Solid

V
o
l
u
m
e
%



7200
Maximized

Thank you for your attention,
And welcome to the DBP3 team!

MGH: Greg Sharp, Annie Chan, George TY Chen,
Nadya Shusharina

MIT: Polina Golland, Amelia Arbisser

GT: Allen Tannenbaum, Ivan Kolesov

Isomics: Steve Pieper