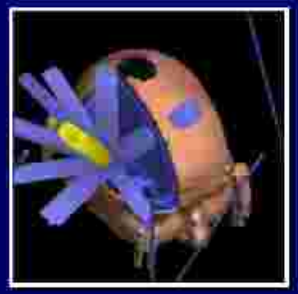

Planning aspect of Precision Radiotherapy

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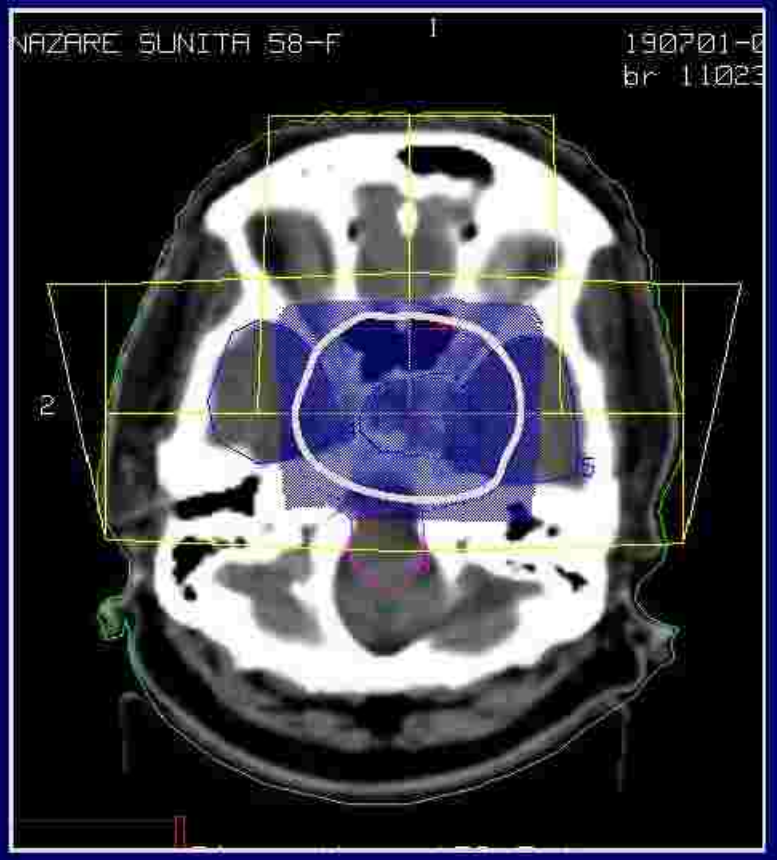
Conventional Radiotherapy planning

Simulator

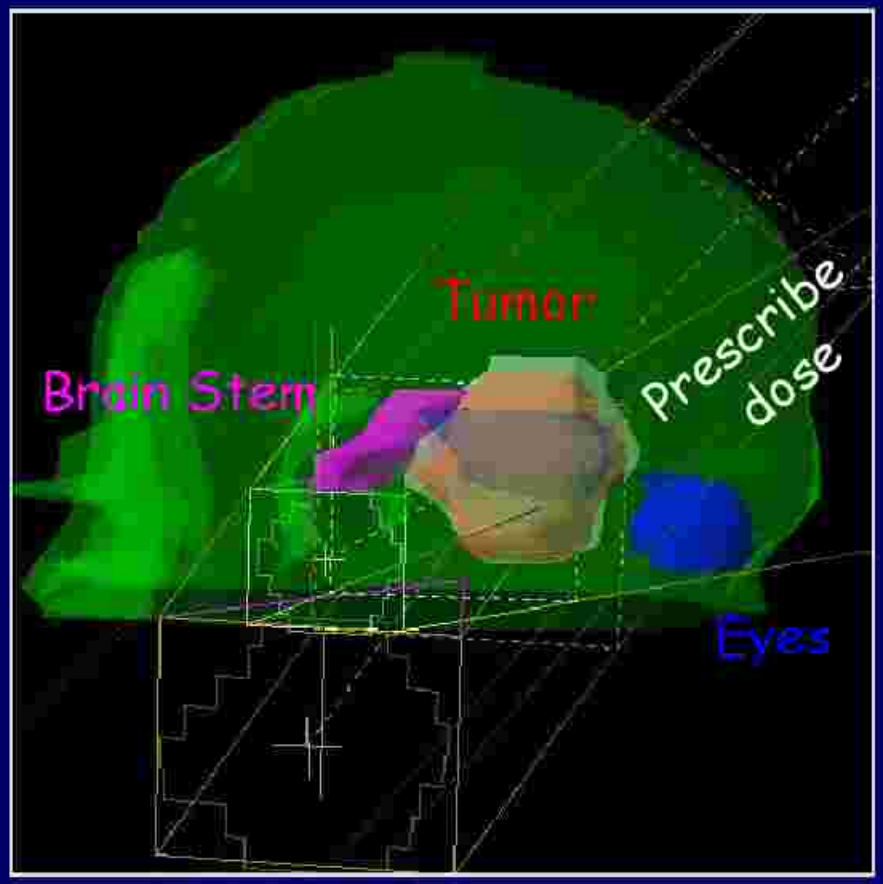
- Based primarily on 2D planar radiographs
- Usually done with the aid of a Simulator
- Planned Treatment Portals by collimating rectangular fields that circumscribed the presumed tumor location on the basis of bony landmarks
- 2 to 3 beams are arrange in a standard geometry
- use Standard or Customize blocks for irregular fields & shielding of critical organs

Shortcoming of conventional planning

- Lack of 3D appreciations of tumor volume and its location w.r.t. sensitive organs
- 2D beam planning of a 3D tumor
- Dose computation perform on a single transverse plane
- Dose computation does not take in to account of scatter contribution from adjacent body tissue



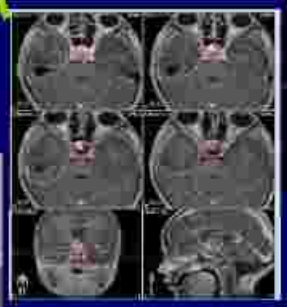
Three Dimensional Conformal Radiotherapy (3DCRT)

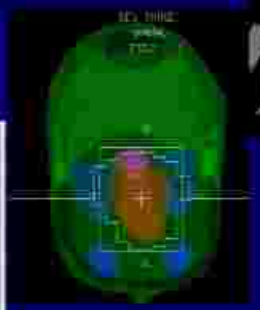


Tightly Conformed image defined 3D shape of Tumor by therapeutic dose volume and conformally avoid surrounding normal tissue

- In this Fig: Ideally White envelop (prescription dose) should paint on to the Red Volume (Tumor).
- Gap between dose & tumor volume mean extra normal tissue irradiated with prescription dose
- Red seen outside white mean fraction of tumor not receiving the prescription dose

Steps of 3DCRT





TPS

3D Imaging

Immobilization

Delineation of
Target & critical organs

Beam
Shaping
Block , MLC

Plan Evaluation
Physical dose

Dose computation

Plan
Implementation

Plan Evaluation
Biological dose

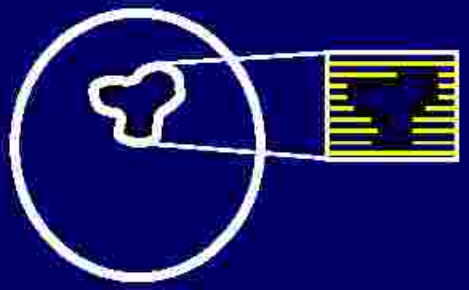
Treatment
delivery

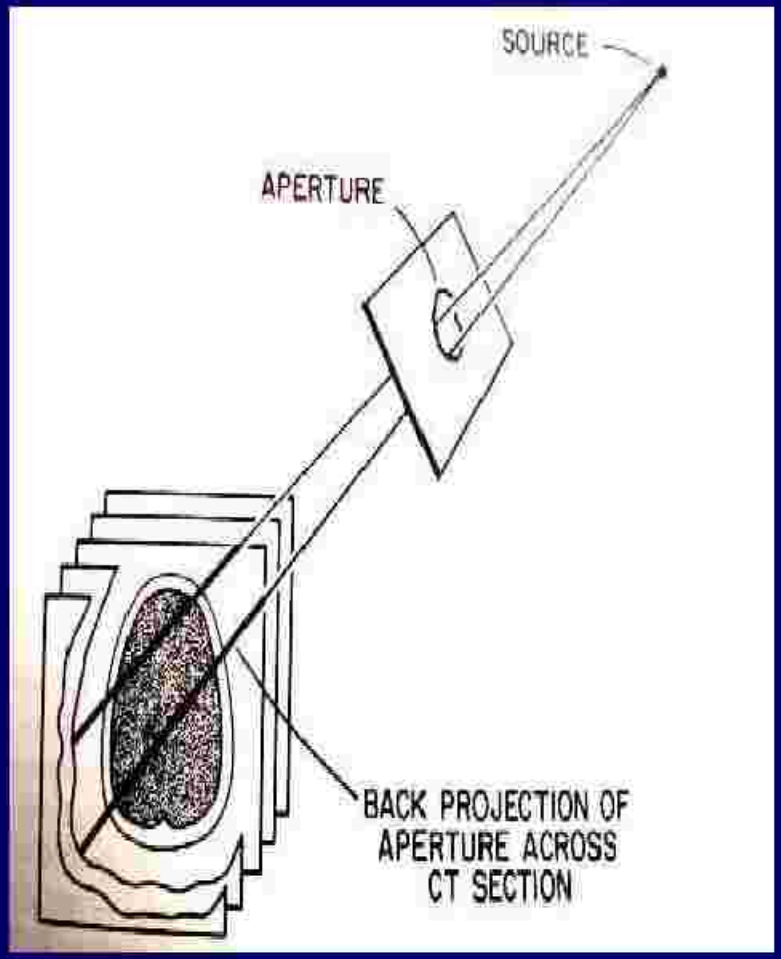
Pre treatment
verification

Reporting

Total Uncertainty (Error) ????

Beam's eye view (BEV) planning - 1978





provides the user with accurate reproduction of anatomic features from the viewpoint of treatment source.

Beam Planning

Done using Beam's Eye View (BEV) in TPS

Thumbs rule:

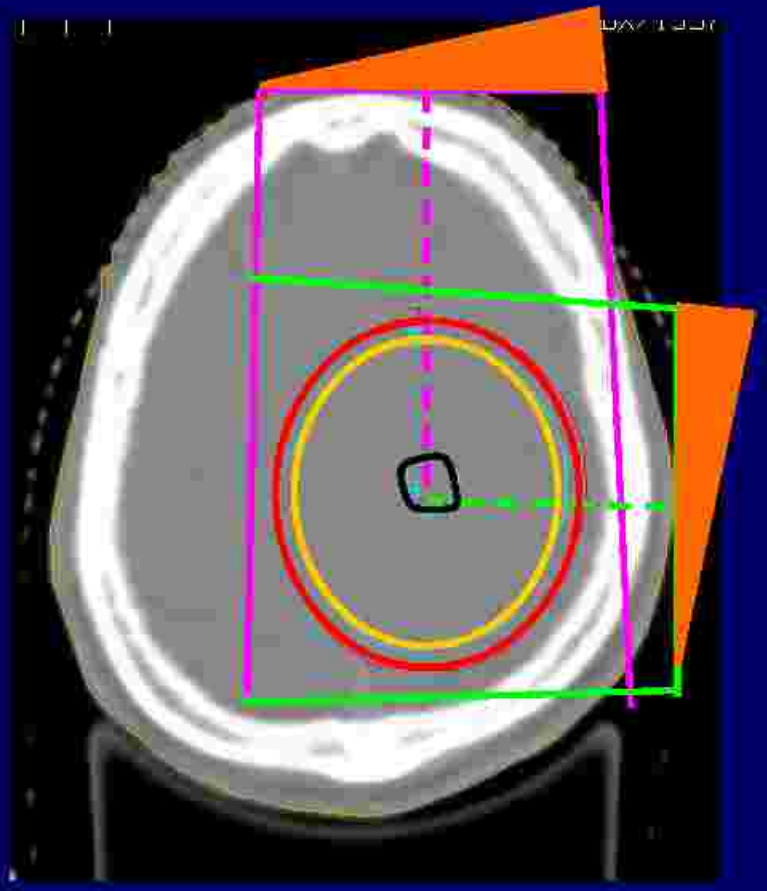
a) beam geometry should separate PTV and OAR

b) Less beam entry length

c) wide hinge angle

d) beam geometry should preferably take the shape of PTV

G
B
M

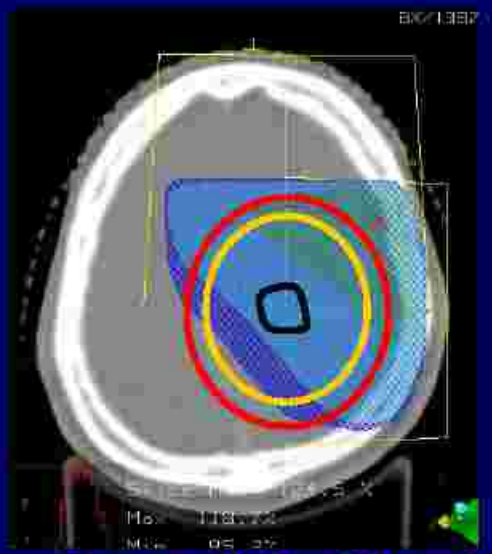


60%

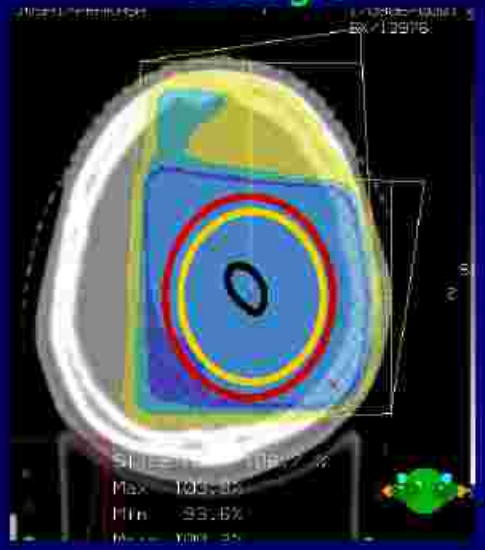
80%

95%

108 %

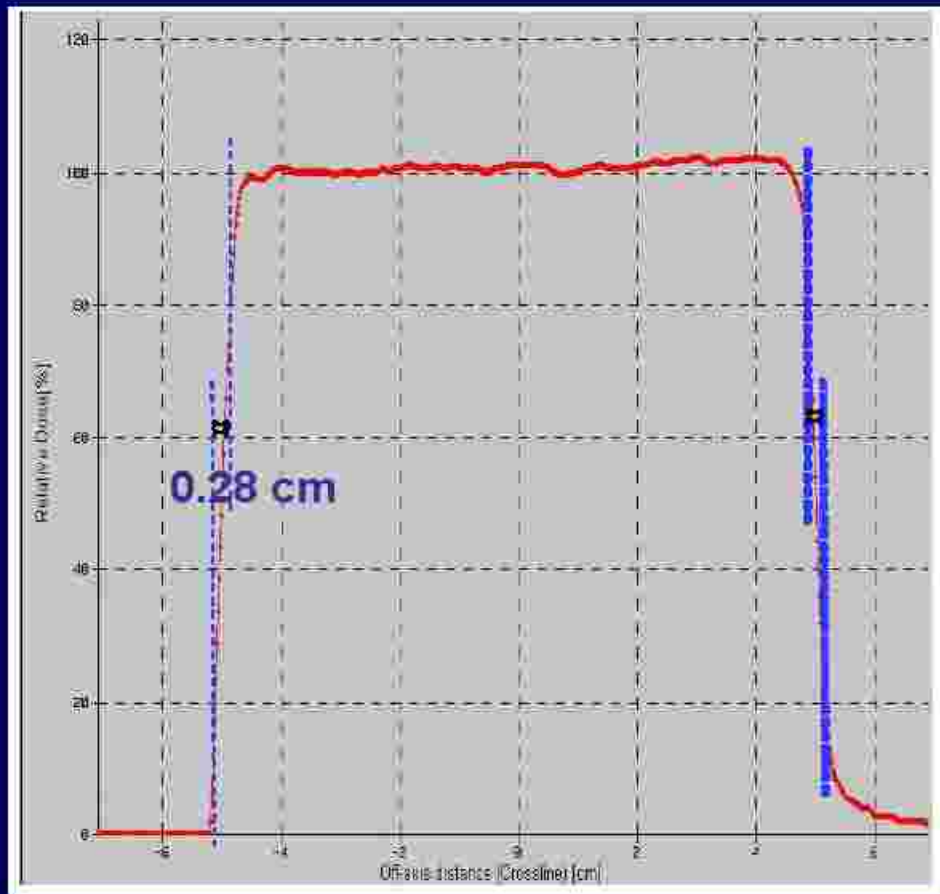


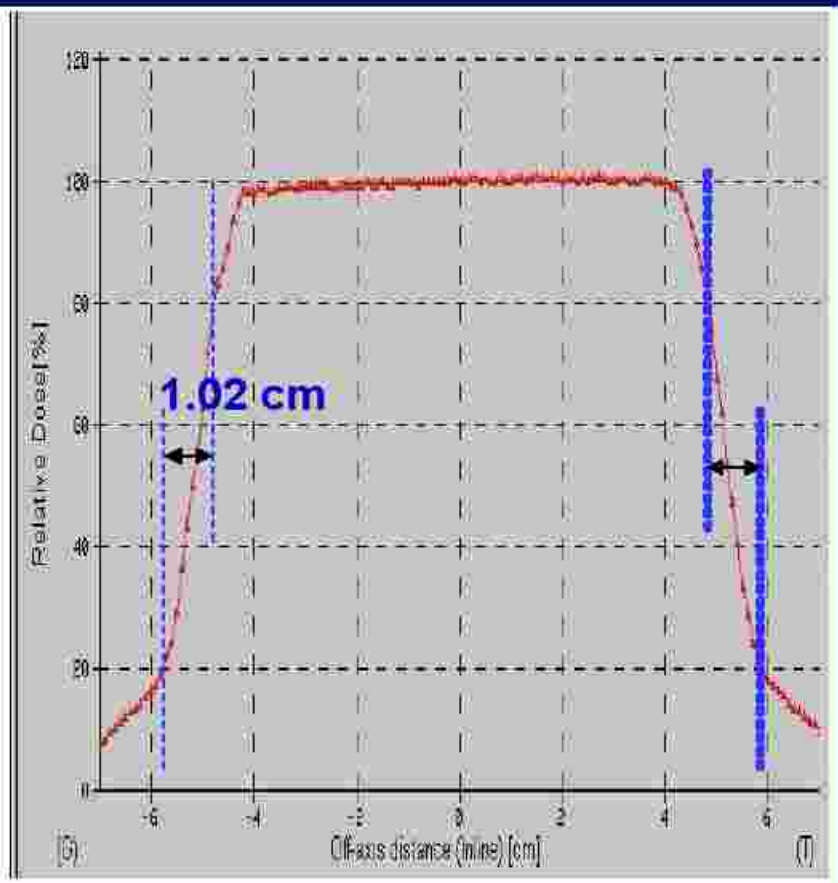
Dose dist without Wedge



Dose dist with Wedge

Penumbra



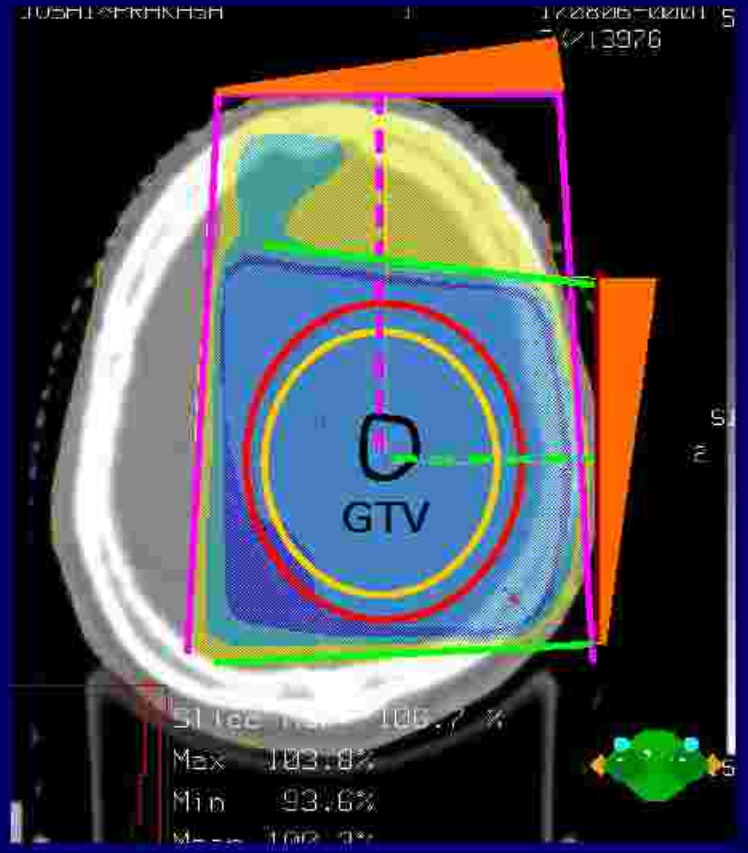


6MV X-ray from LA

C0-60 from Telegama

Case: GBM

Plan1: Ant+Lat Vs Post+Lat



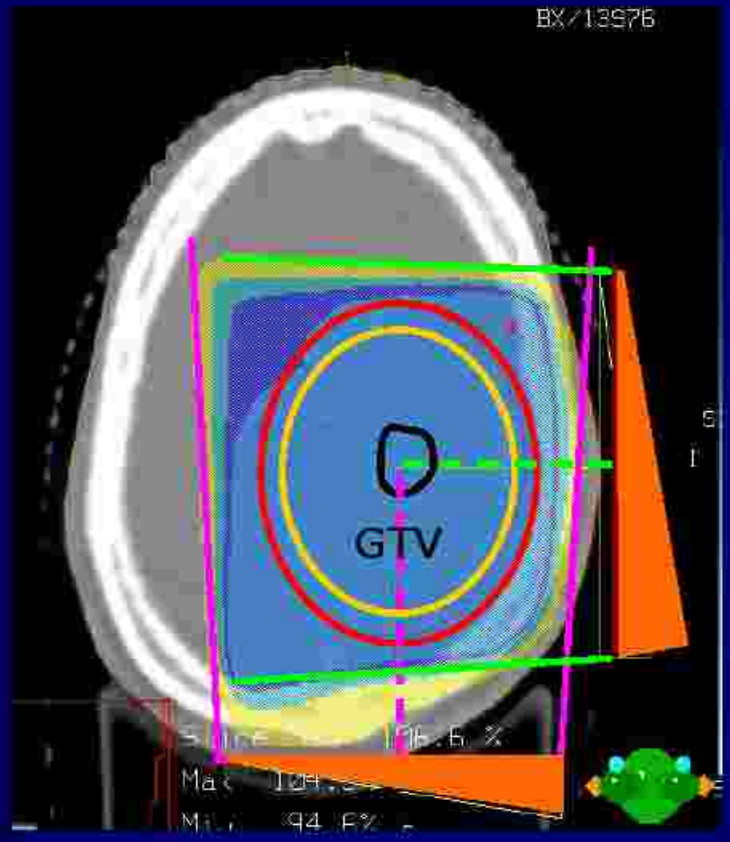
60%

80%

90%

95%

108 %



Ant + Lt Lat

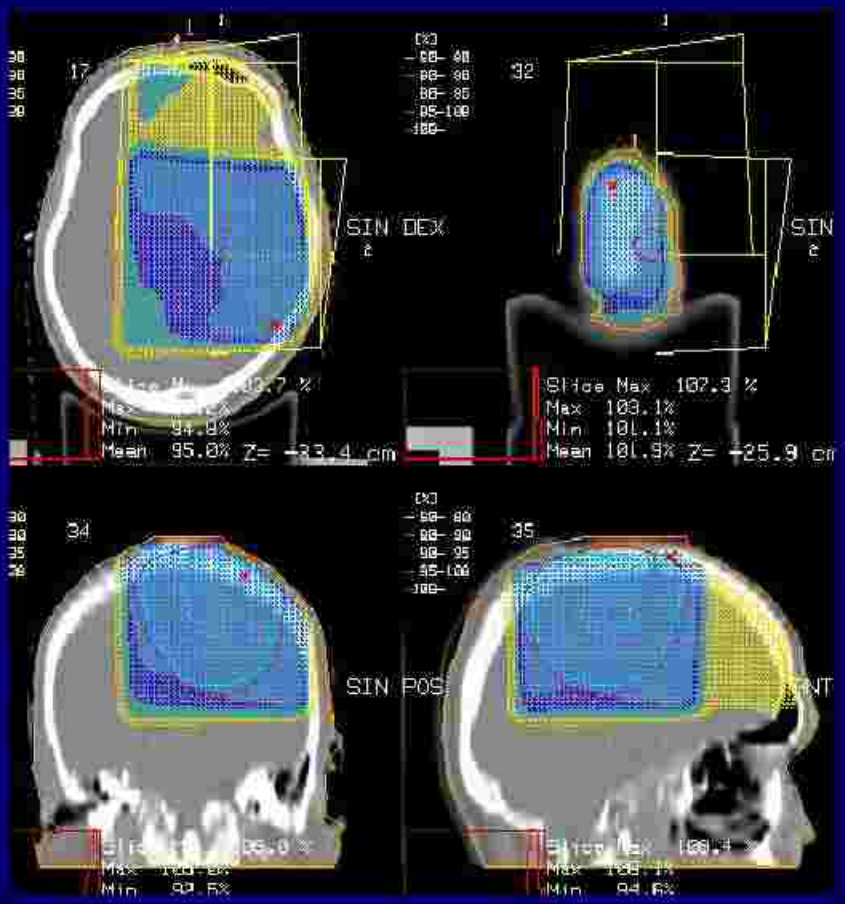
Ant TSD=90.4cm

Post + Lt Lat

Ant TSD=92.7

Case: GBM

Plan1: Ant+Lat Vs Post+Lat



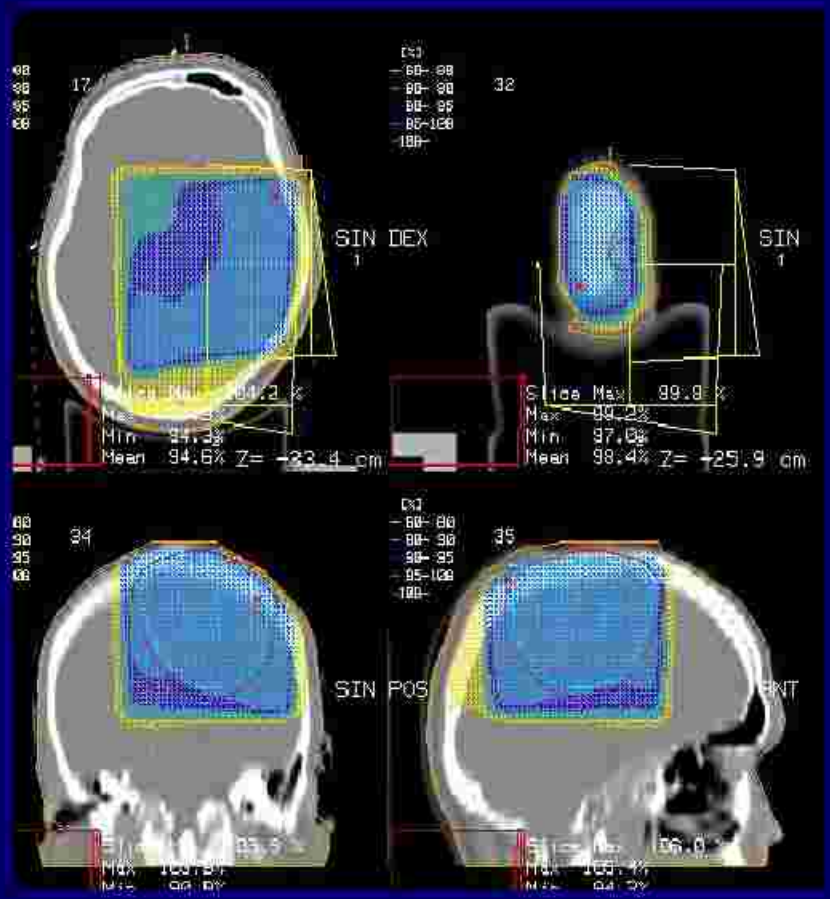
60%

80%

90%

95%

108 %

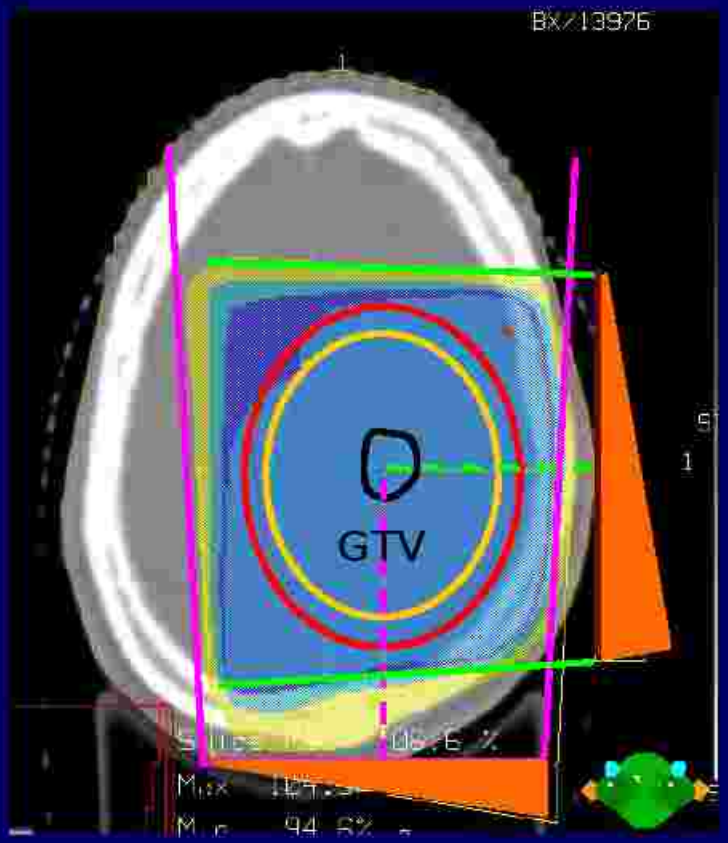


Ant + Lt Lat

Post + Lt Lat

Case: GBM

Plan2: 2F_Post+Lat Vs 3F_ant+post+ltlat



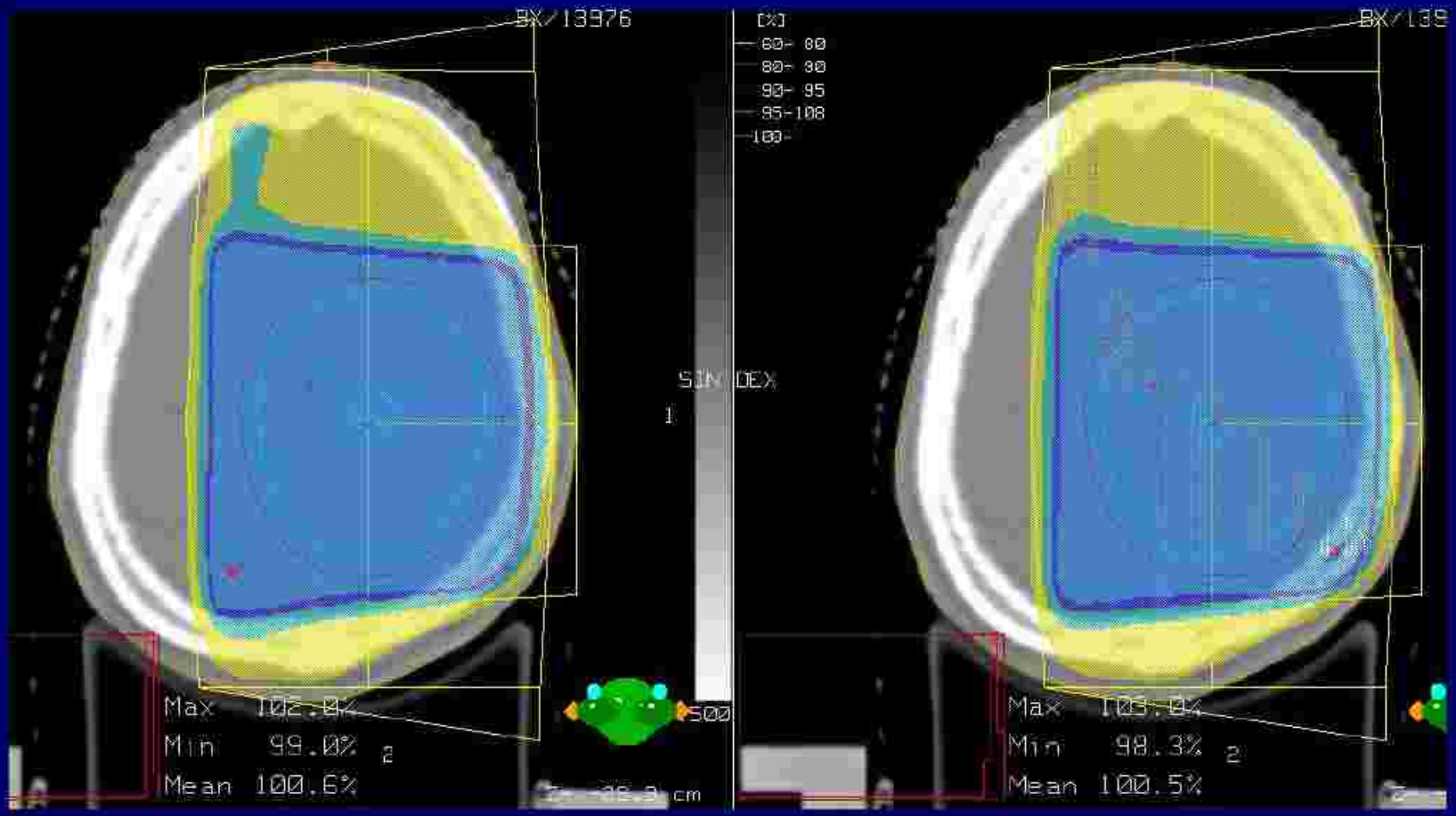
Post + Lt Lat

Ant + Post + Lt Lat

Case: GBM

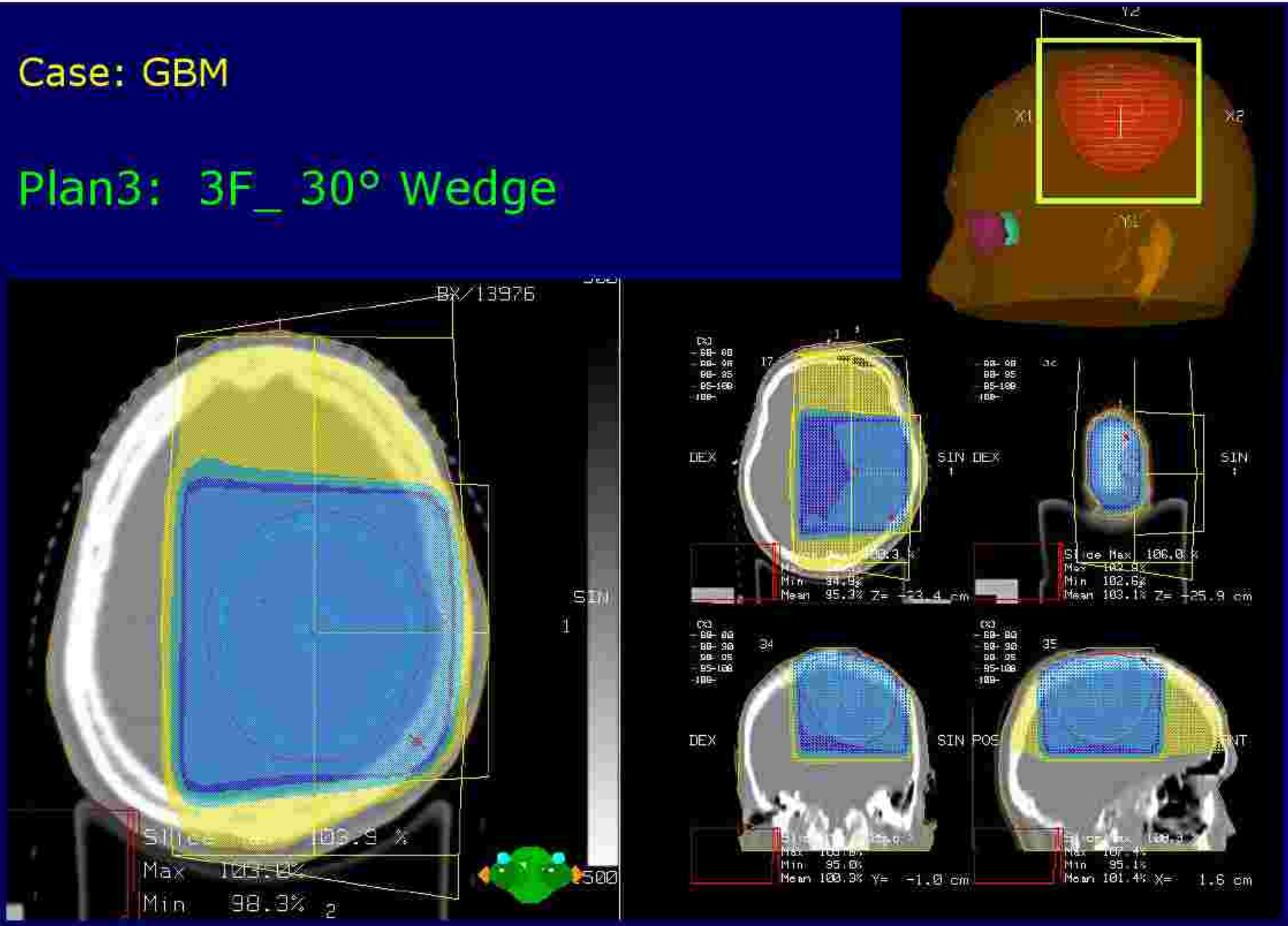
Plan3: 3F_ 45° Wedge Vs 30° Wedge

Wedge angle = 90-Hinge angle/2



Case: GBM

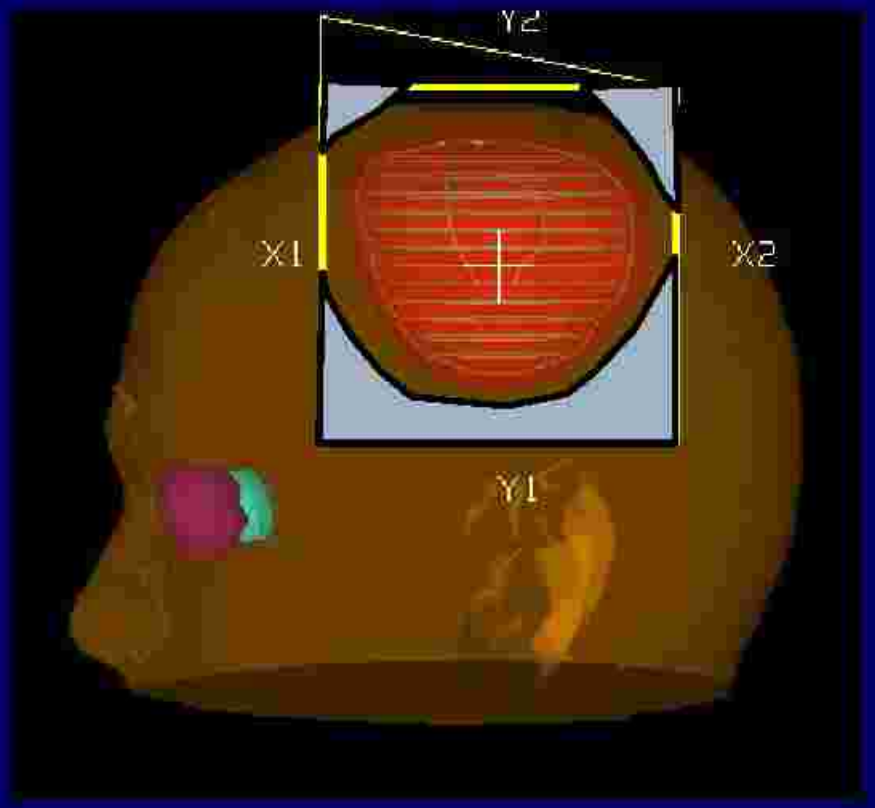
Plan3: 3F_ 30° Wedge

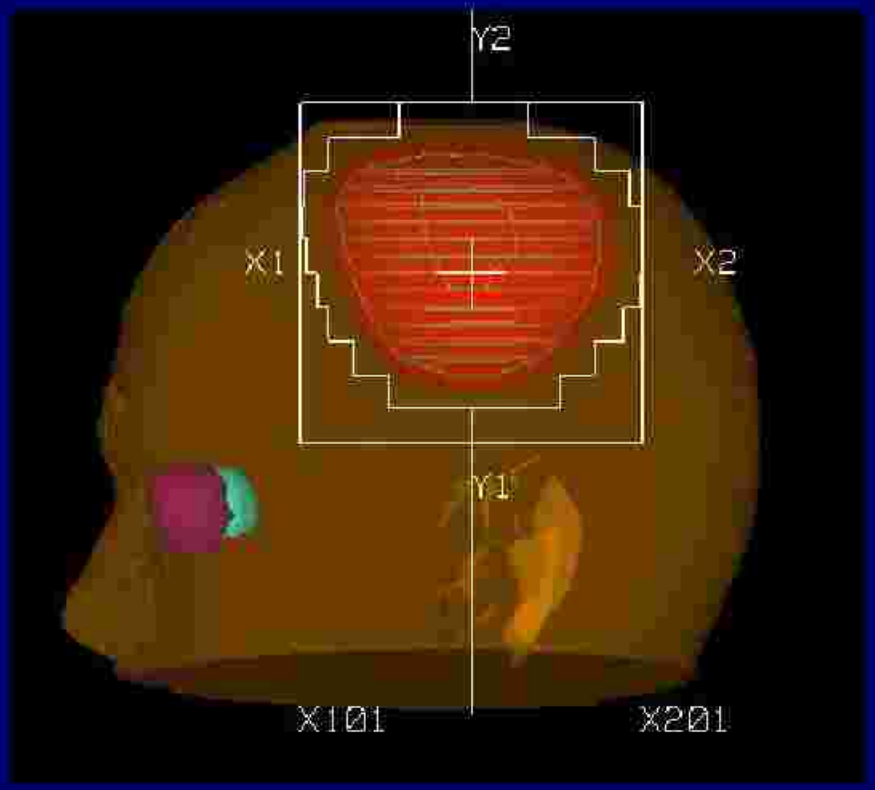


Dose not conformed to PTV

Case: GBM

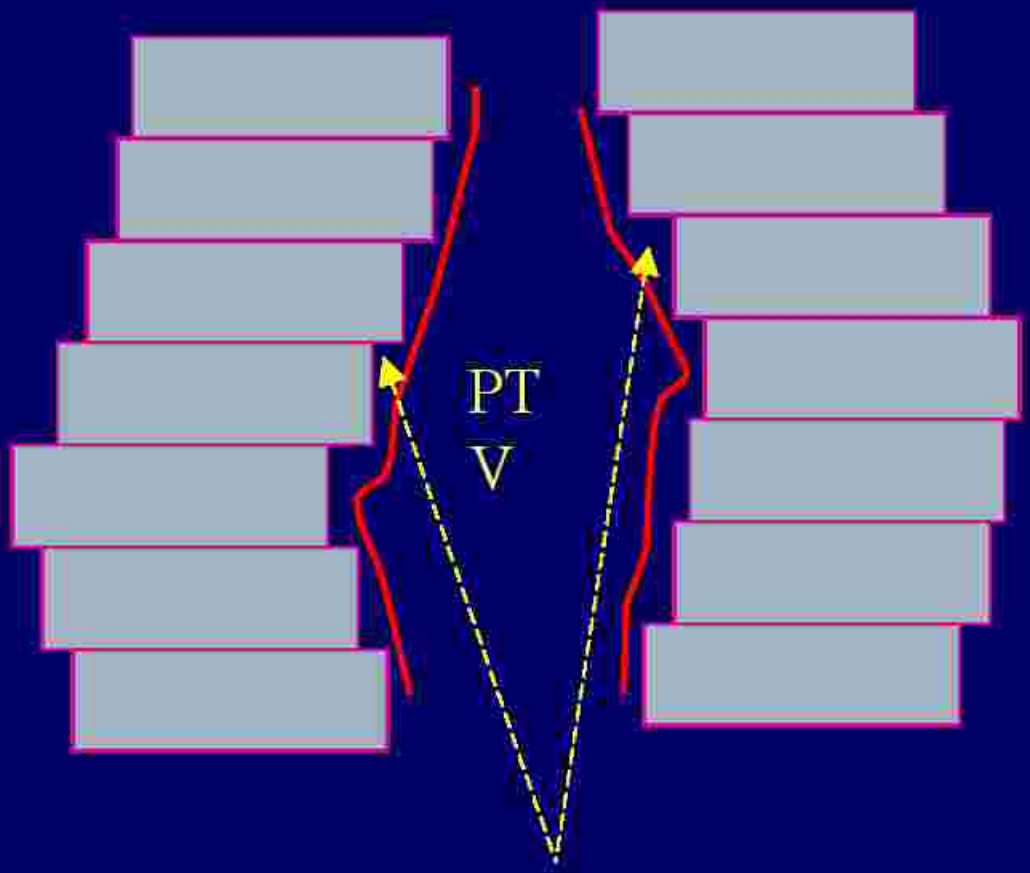
Plan4: 3F_ Conformal beam





MLC

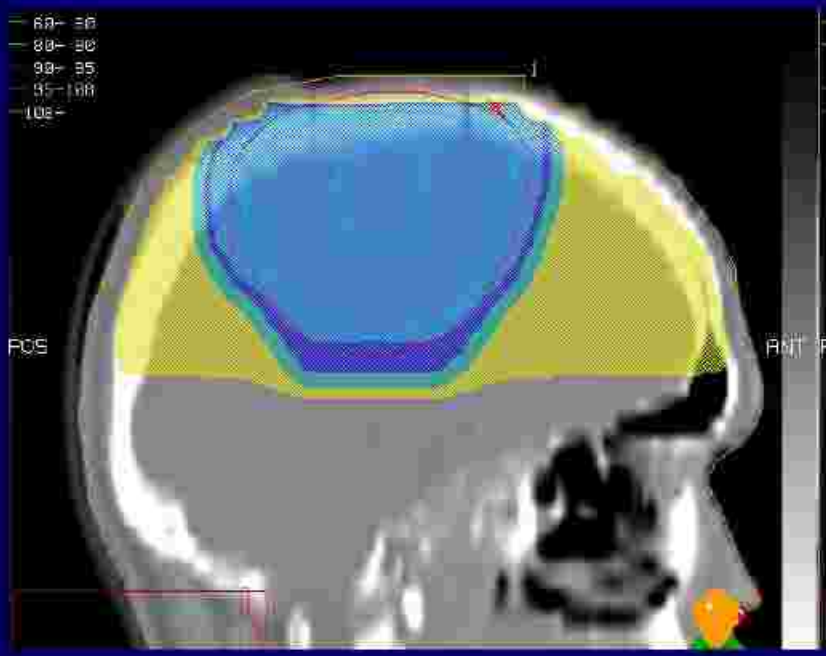
Conformal block

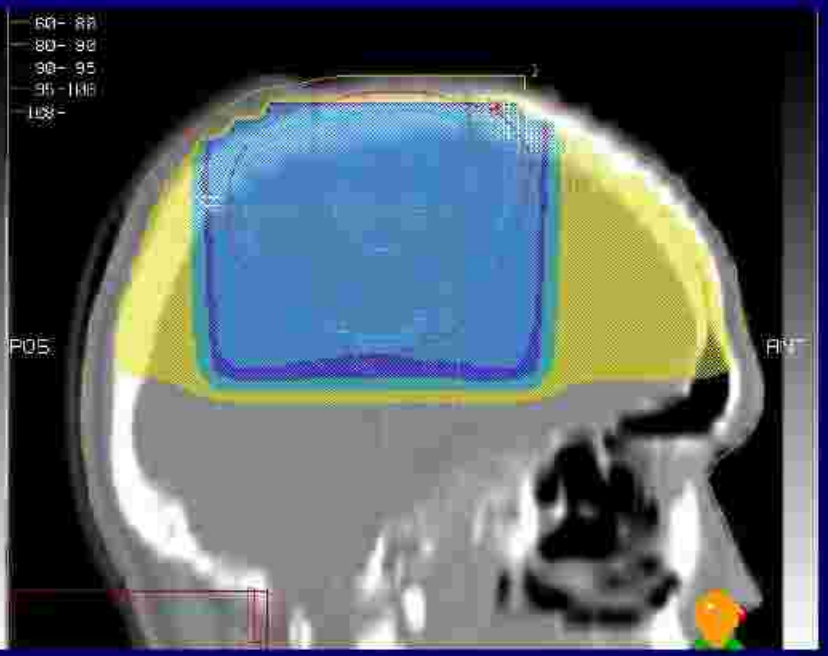


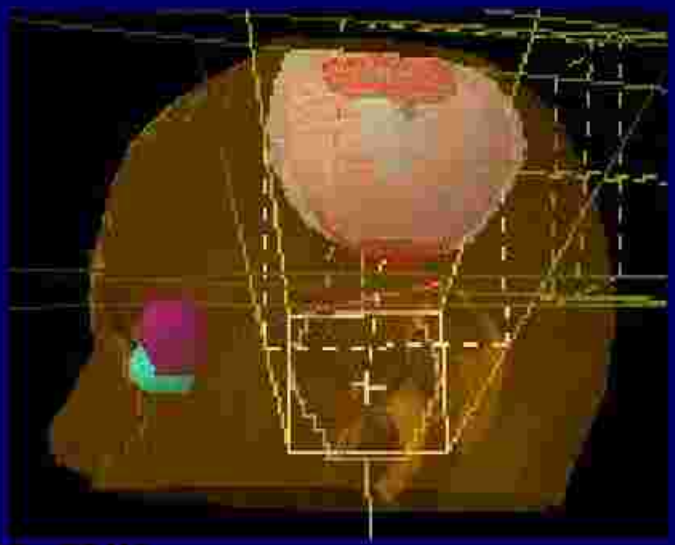
scalloping effect

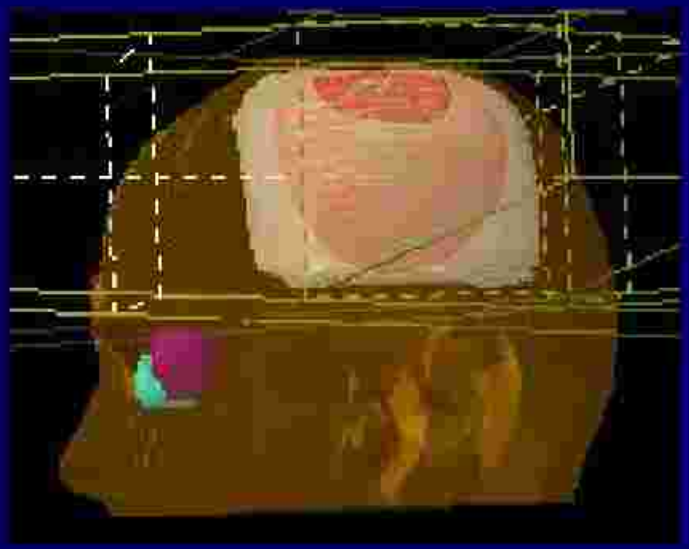
MLC shape field

rectangular field



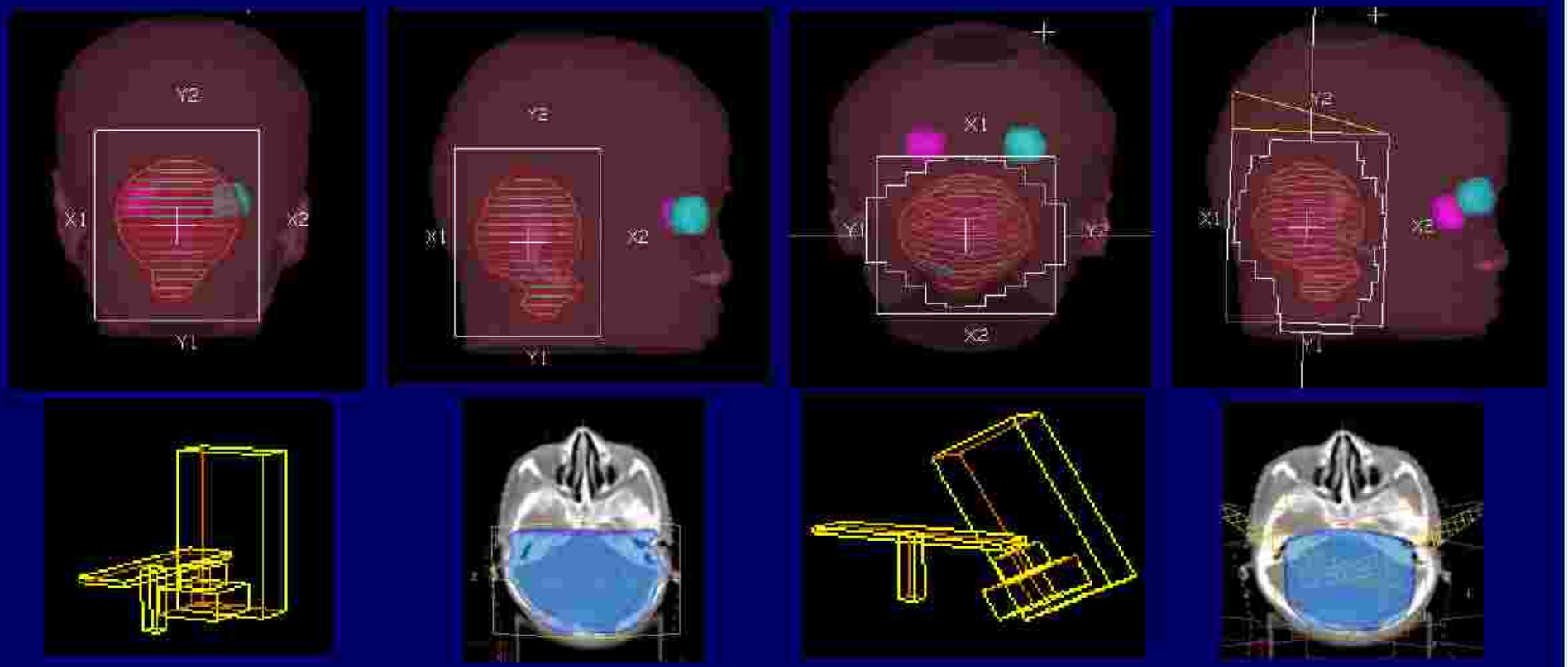






Case: Meduloblastome (Post fossa)

Parallel oppose Vs 3F_NCP



Co-planer

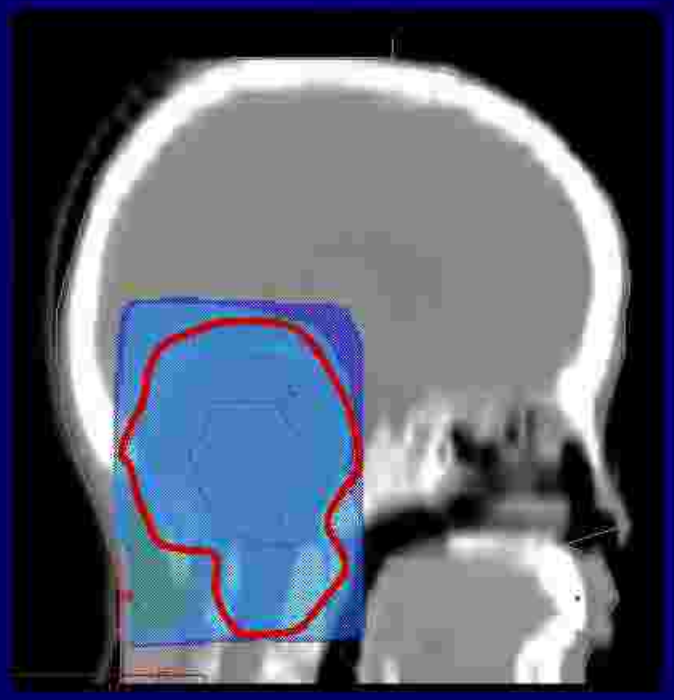
T=0, G=90
T=0, G=270

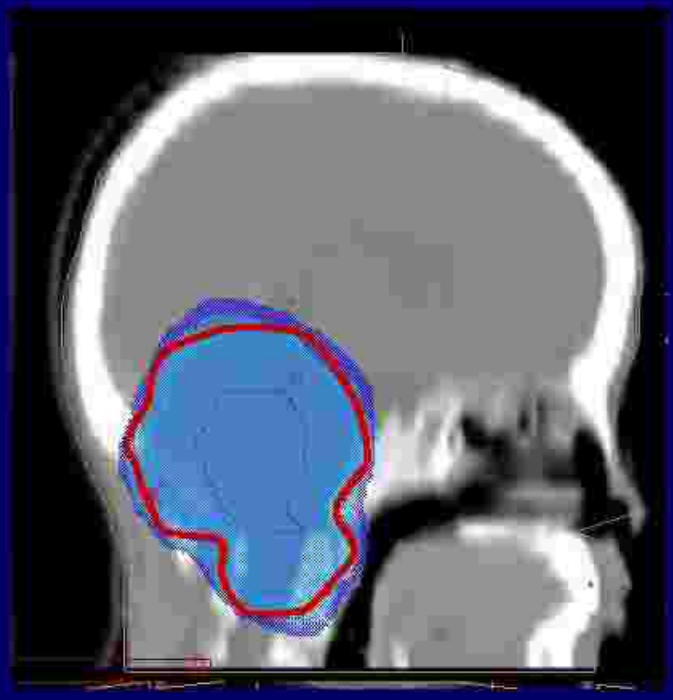
Non Co-planer

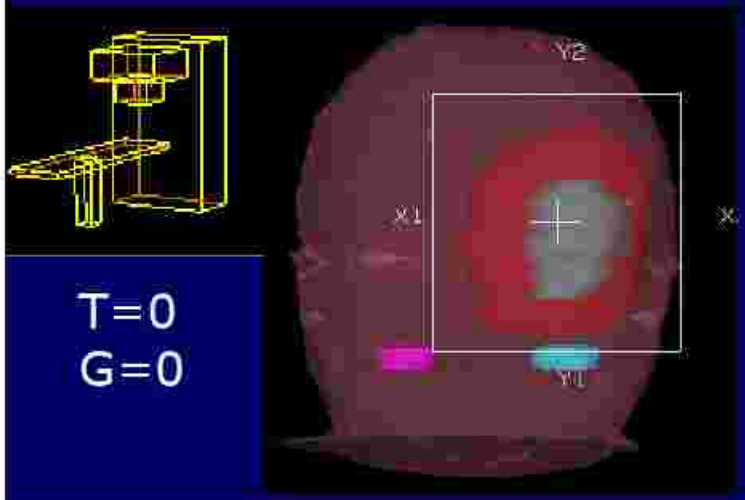
T=90, G=150-160
T=350, G=100
T=10, G=260

Case: Post fossa

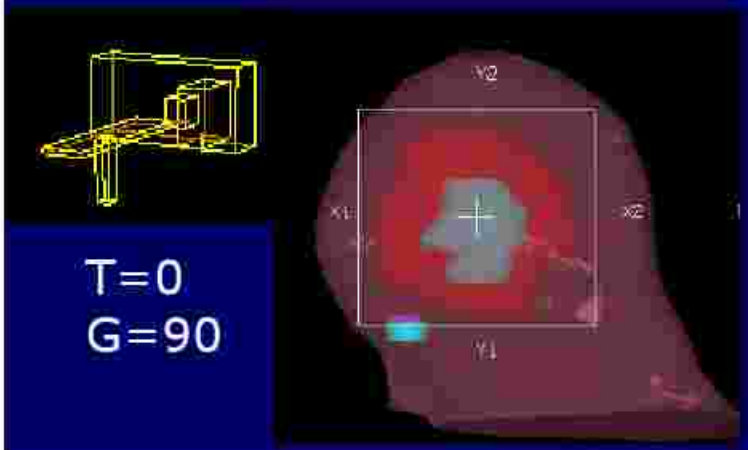
Parallel oppose Vs 3F_NCP



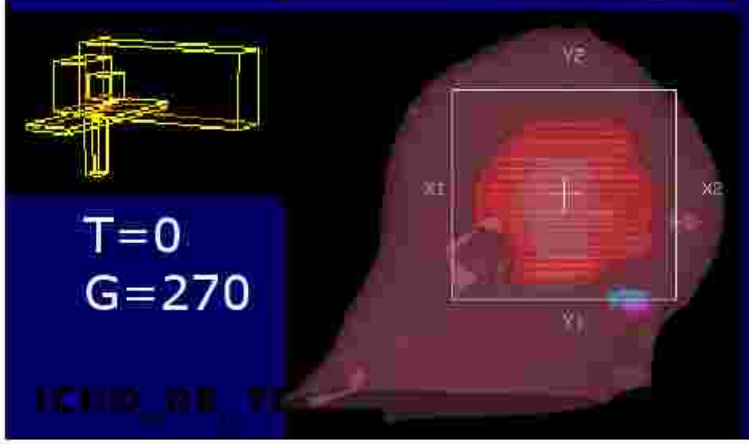




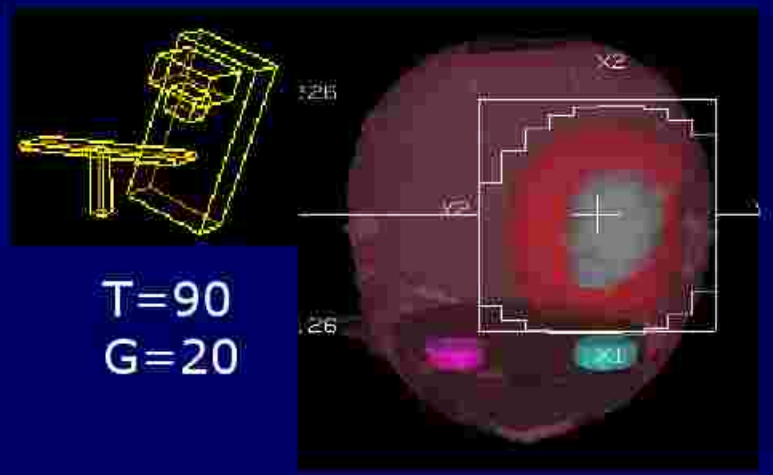
T=0
G=0



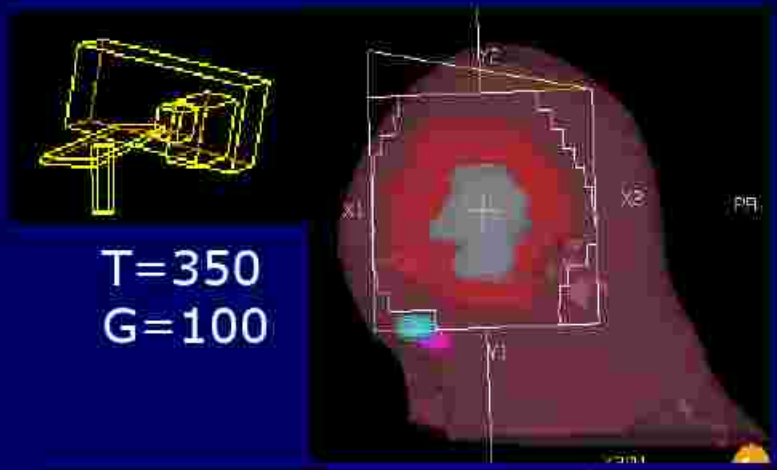
T=0
G=90



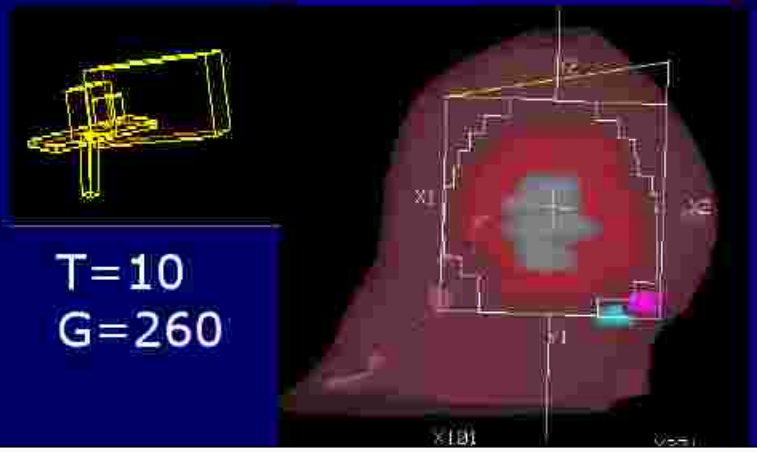
T=0
G=270



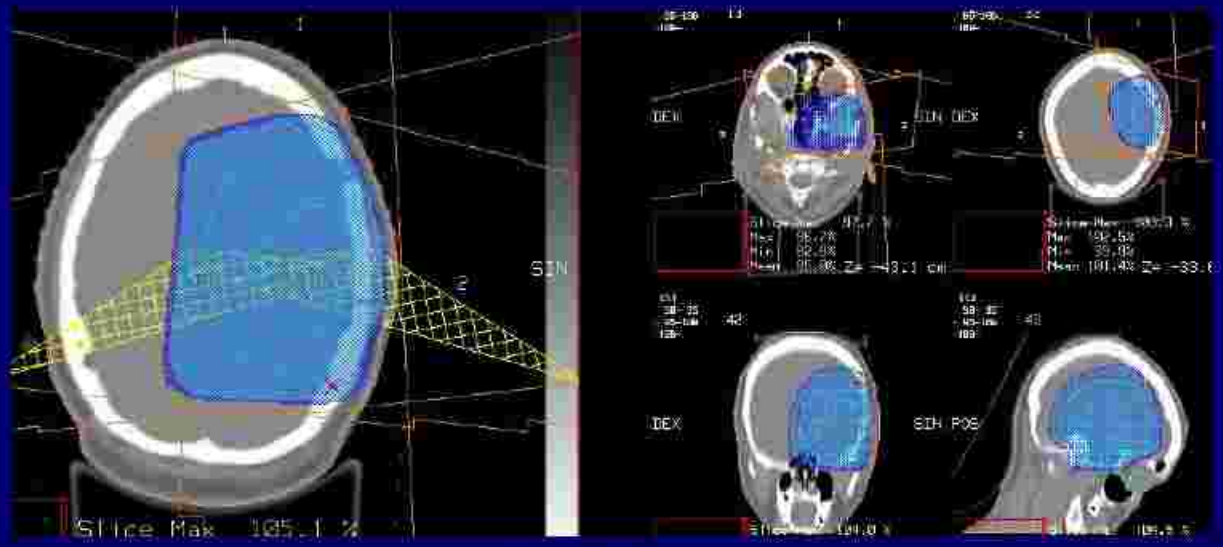
T=90
G=20



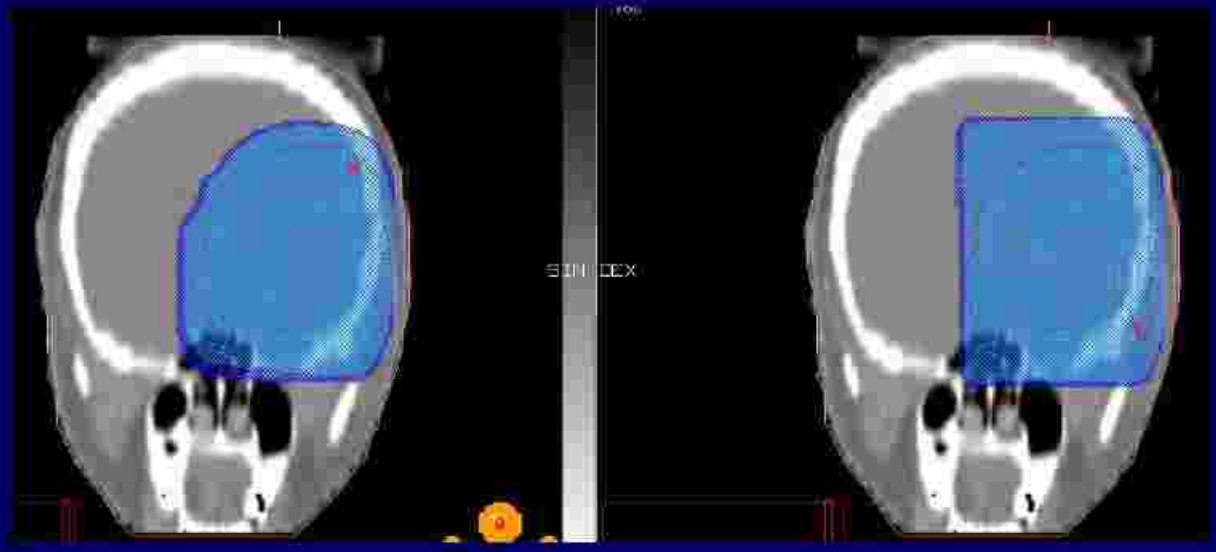
T=350
G=100



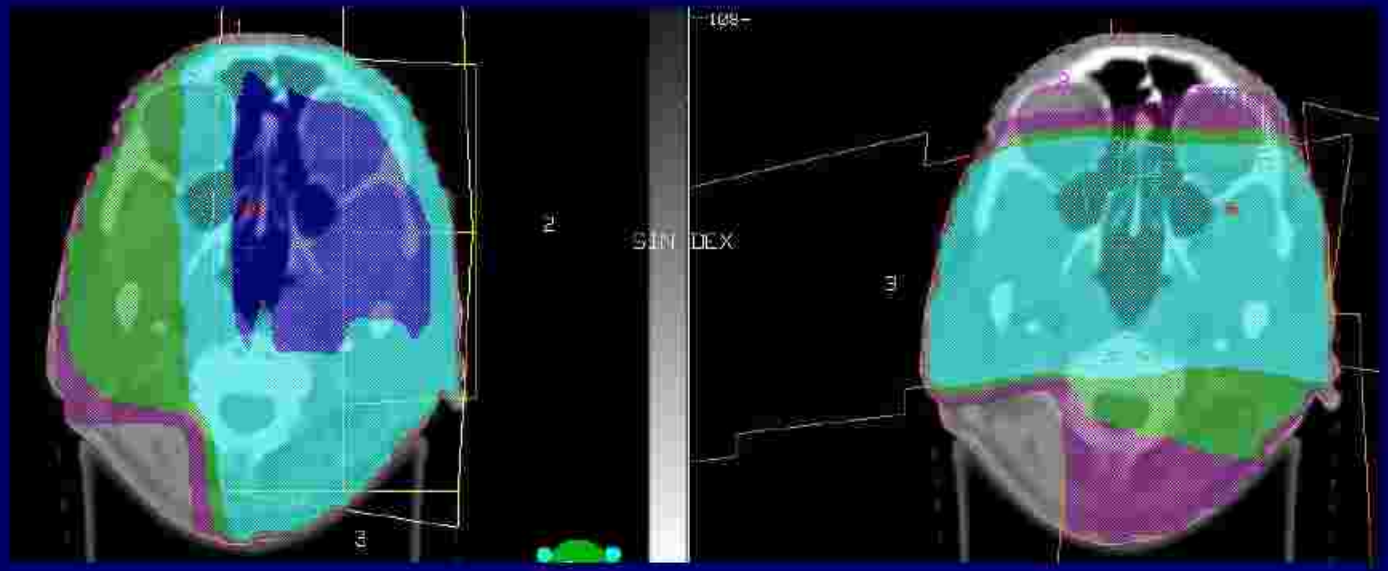
T=10
G=260



NCP

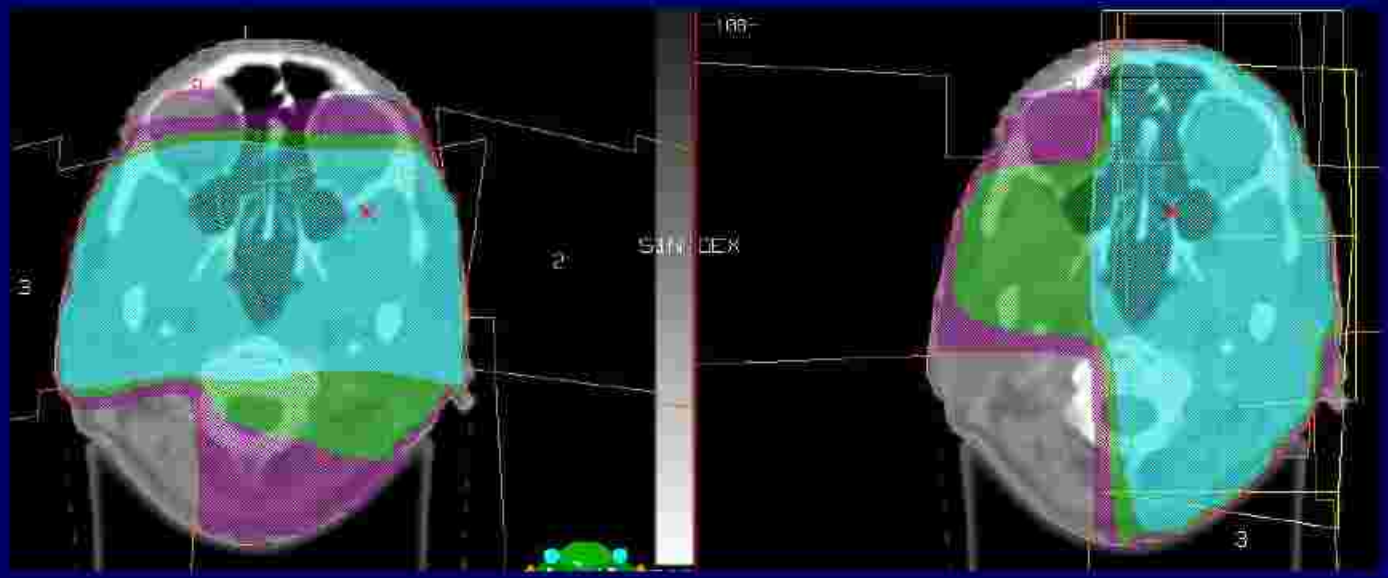


NCP conventional

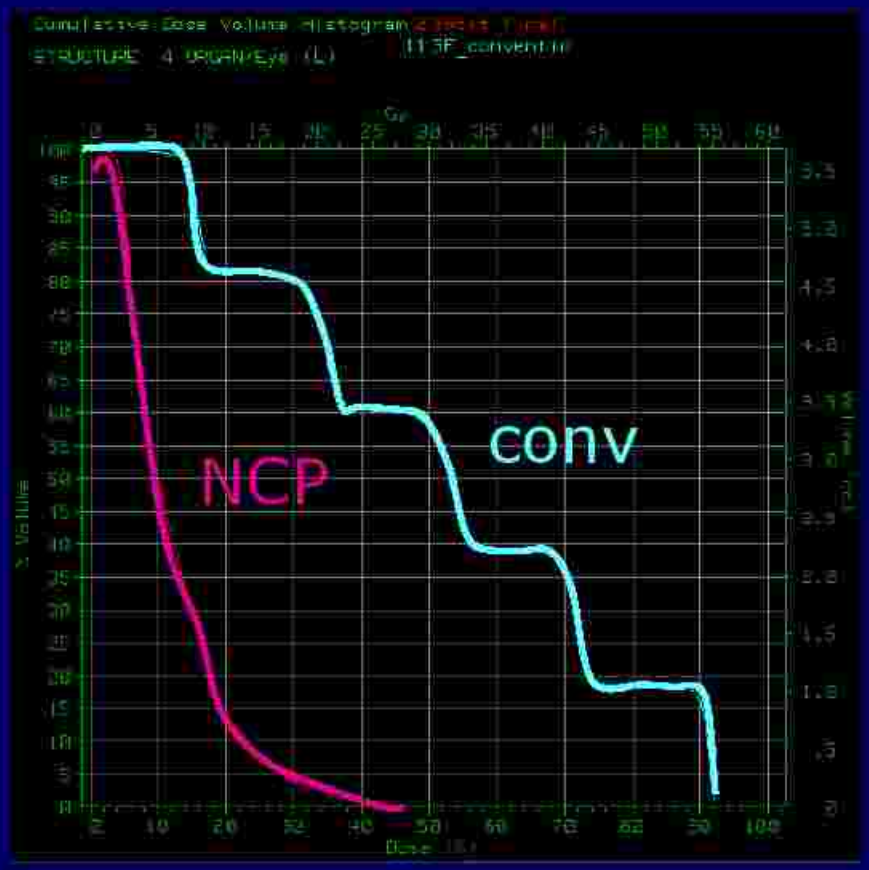


Conventional

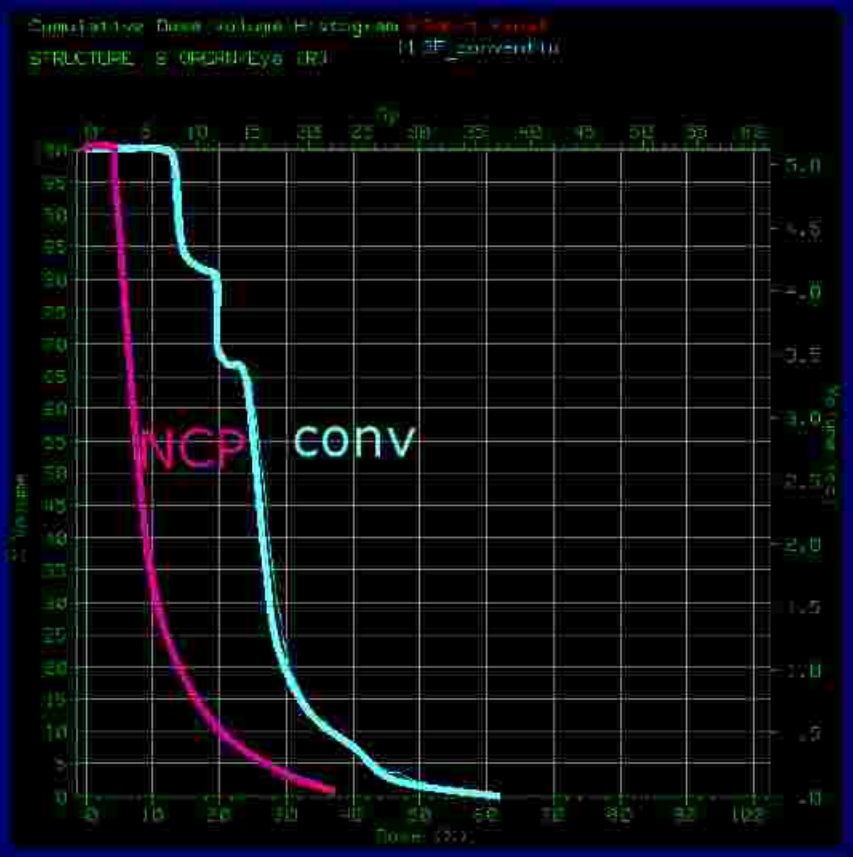
NCP



90%
30%
20%
10%



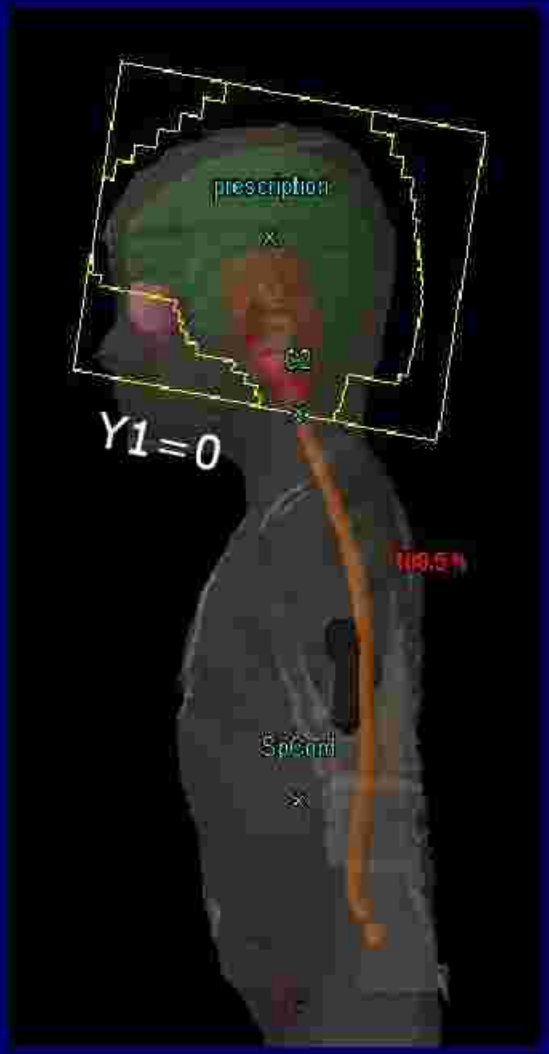
Lt. eye



Rt.Eye

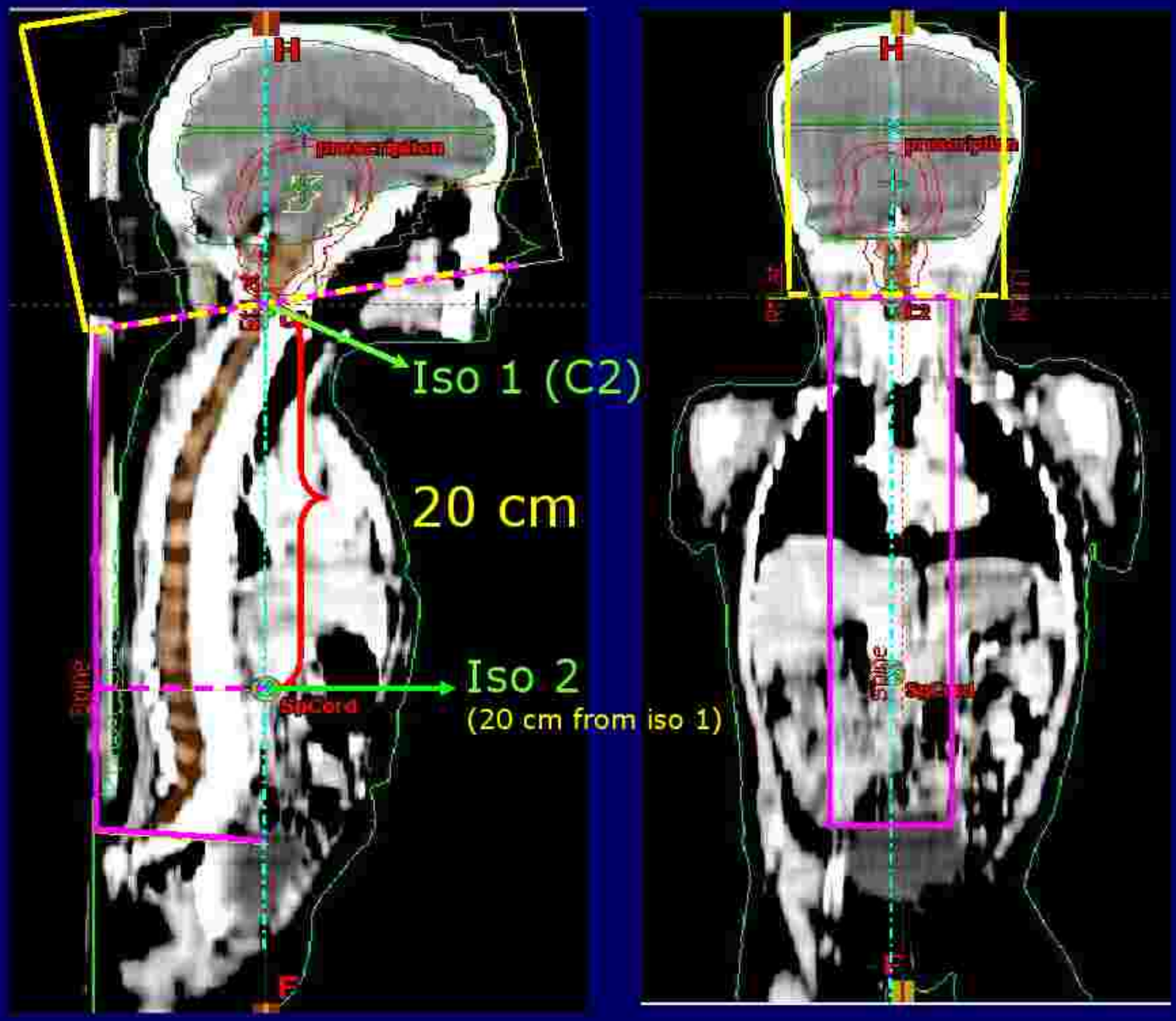
Supine treatment for CSI

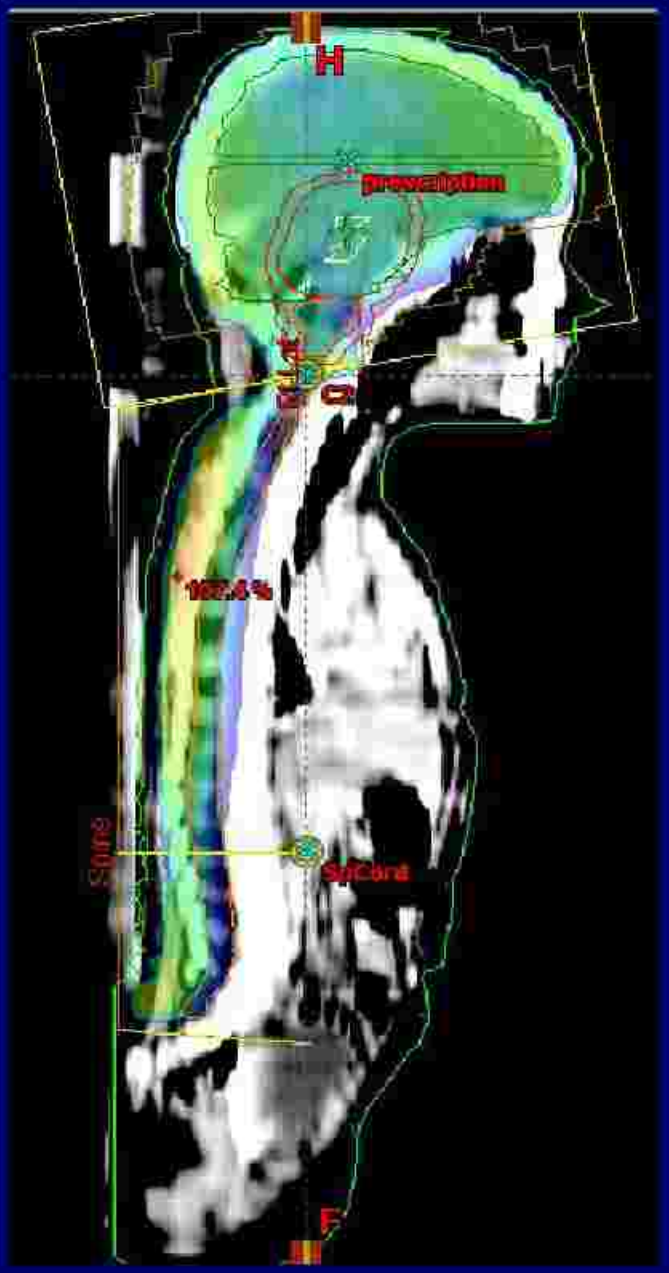
T=0, G=270, C=9



T=0, G=90, C=351

T=0, G=180, C=0


H
Iso 1 (C2)
20 cm
Iso 2
(20 cm from iso 1)
H

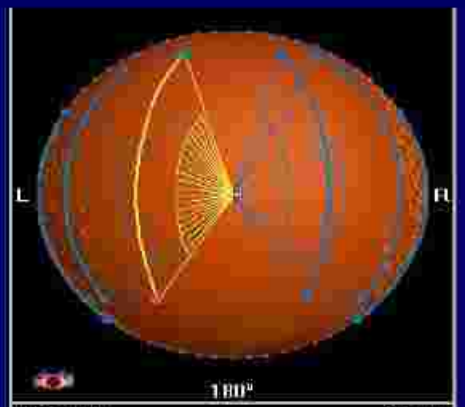

H
prescription
C2
108.4 %
Spine
SpCord
F

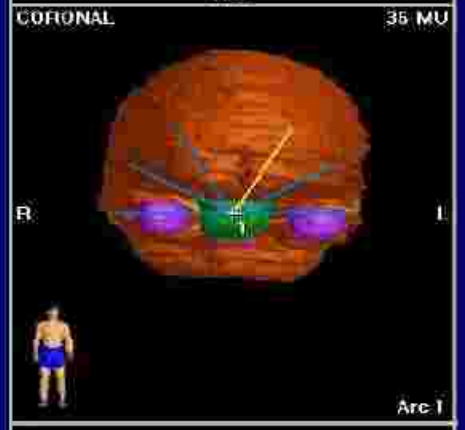
95%-108%

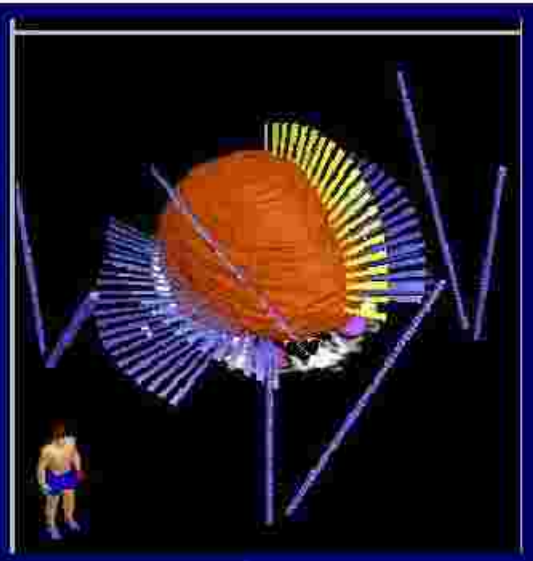

H
prescription
C2
108.4 %
Spine
SpCord
F

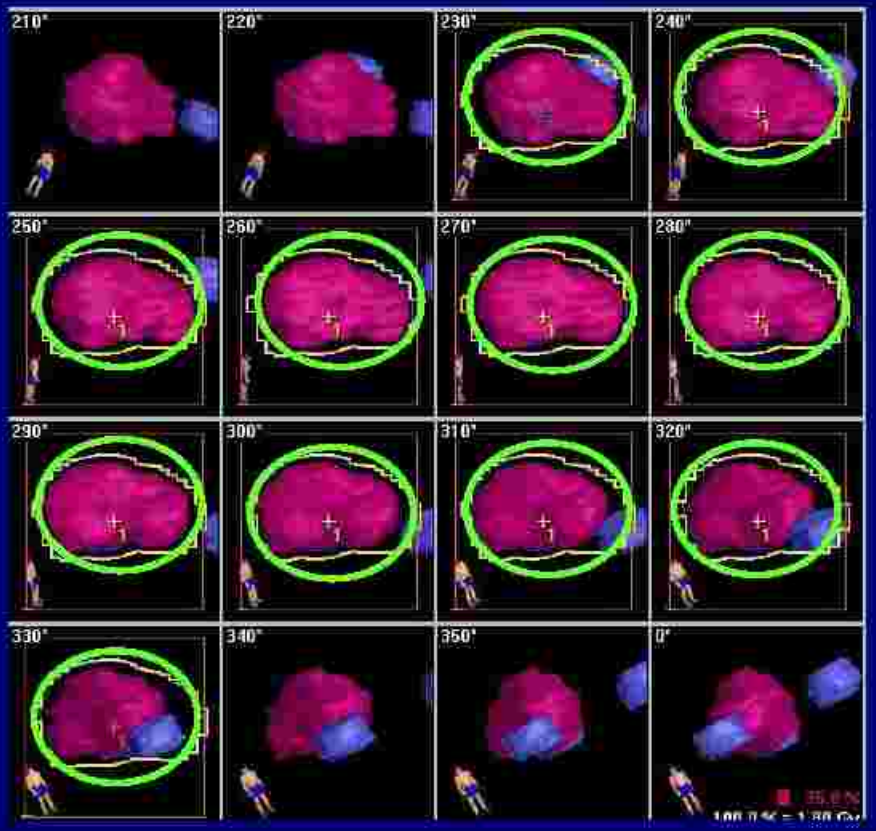
60%-108%

SRT ARC

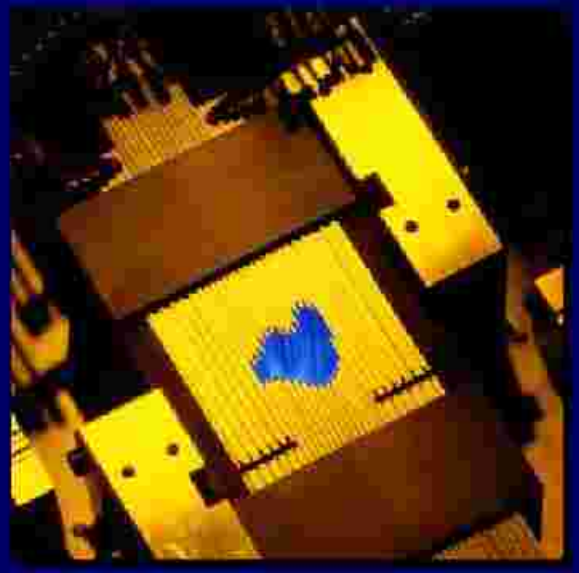

L
R
180°

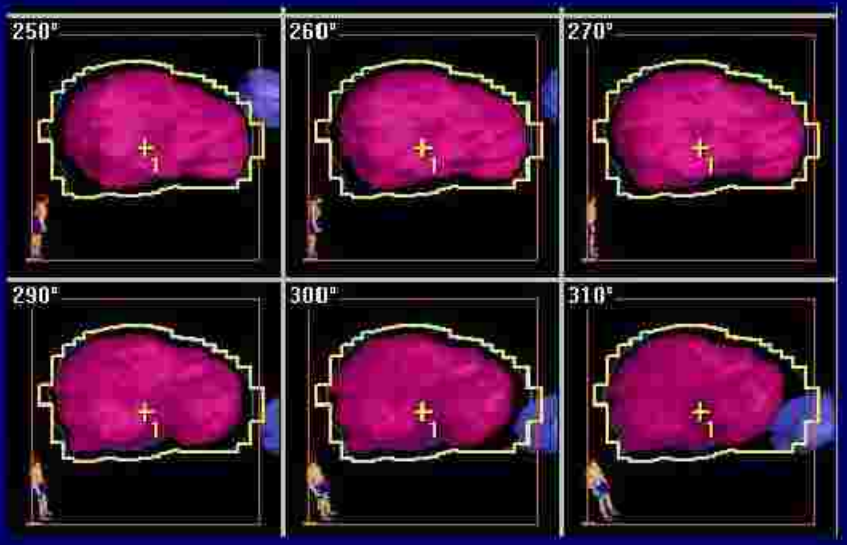

CORONAL
35 MU
R
L
Arc 1



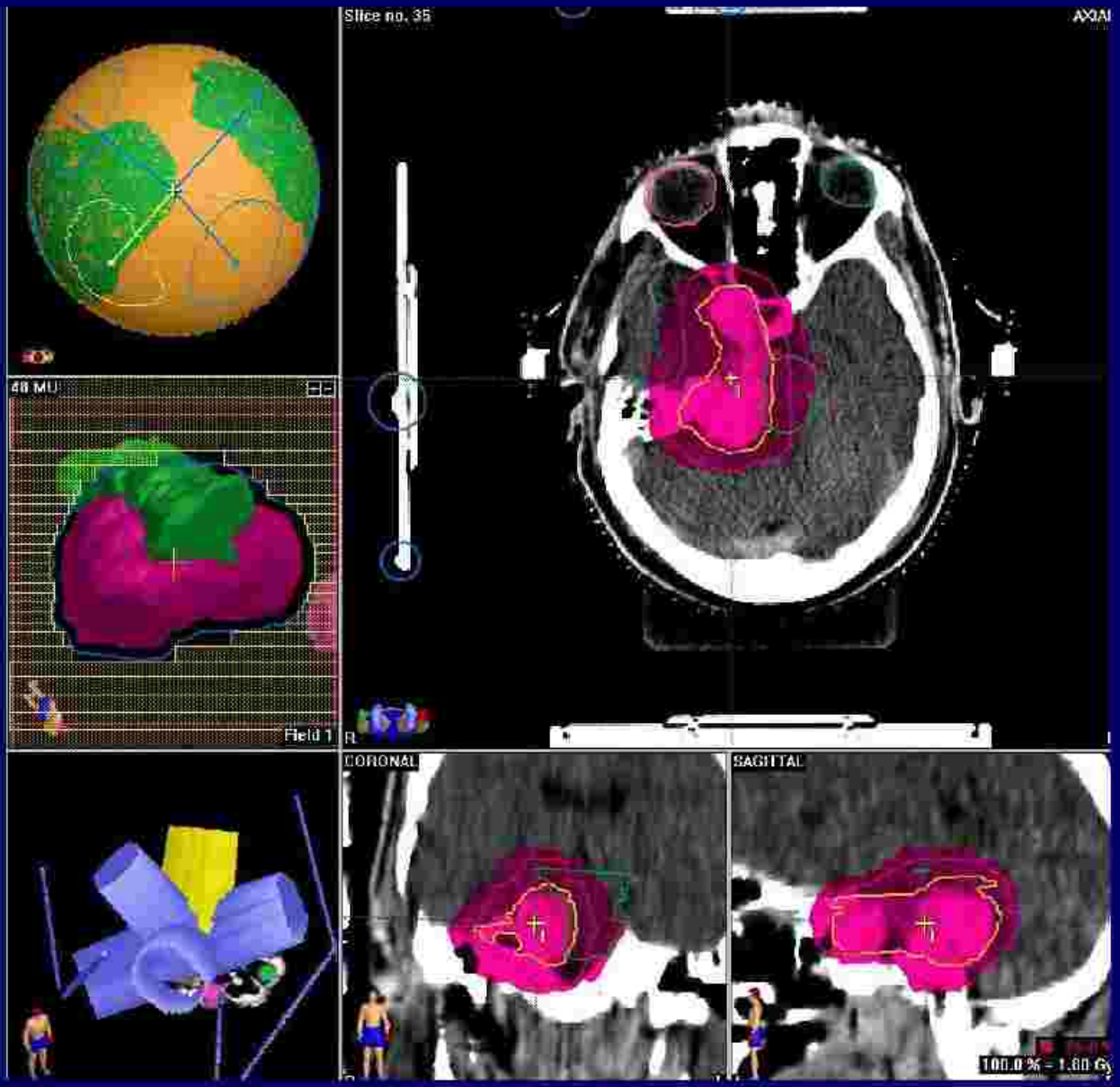

210°
220°
230°
240°
250°
260°
270°
280°
290°
300°
310°
320°
330°
340°
350°
0°

Static conformal beam using mMLC





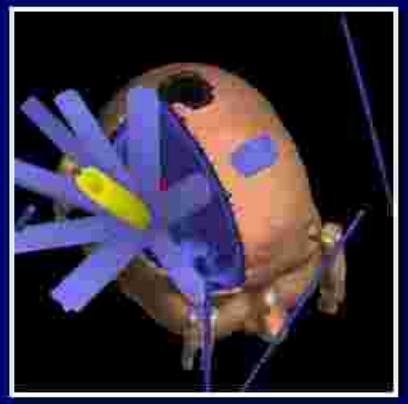
Static conformal beam

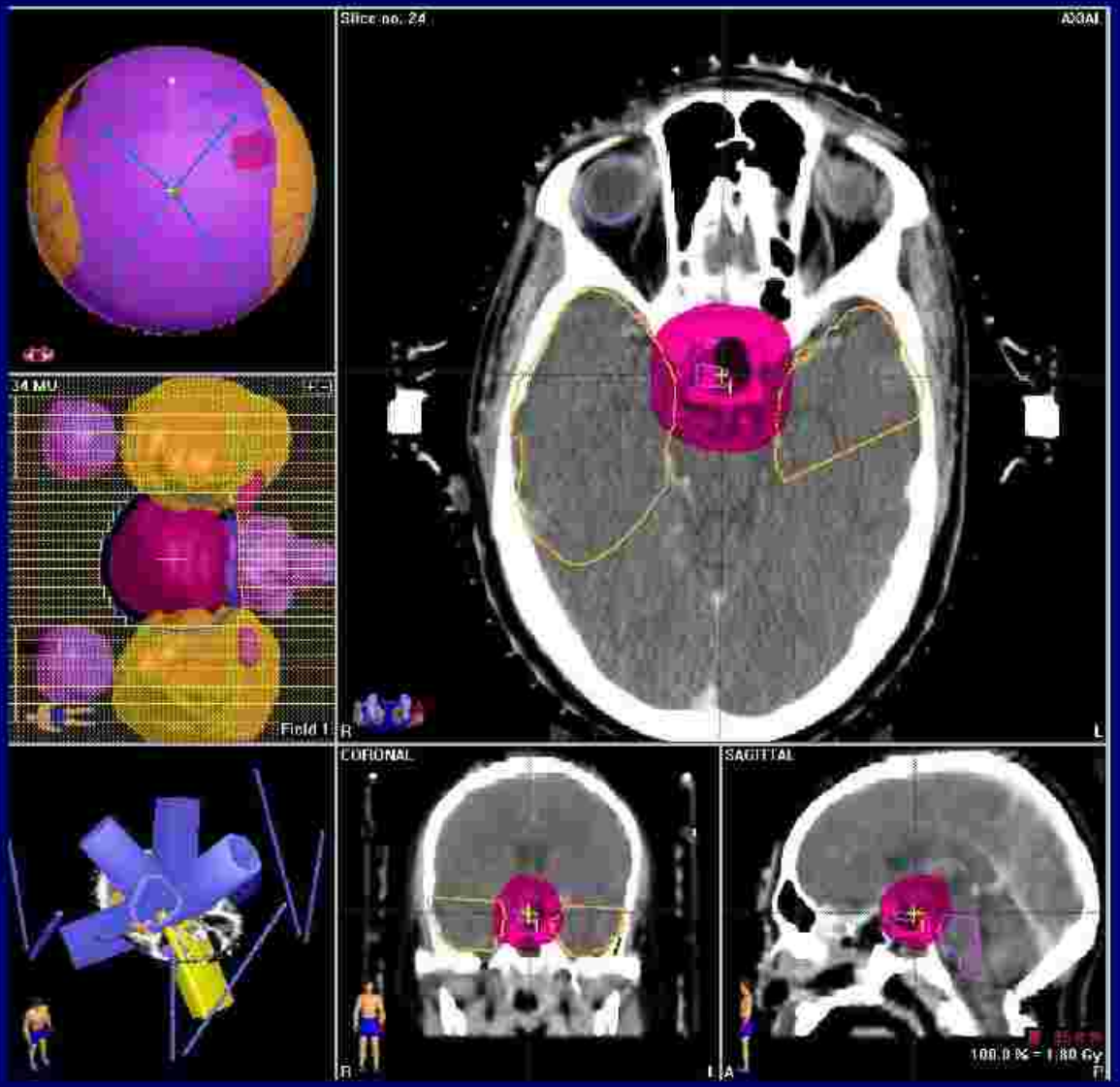


TMH Gold Standard

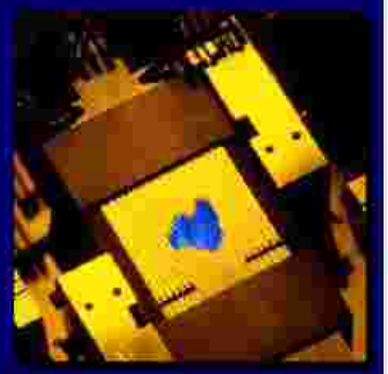
T=60, G=60
T=60, G=120
T=300, G=300
T=300, G=240
T=10, G=260
T=350, G=100

Static conformal beam





Cone vs. mMLC based SRS/SRT



-Clear physical and geometrical advantage over fixed fields for small spherical targets

-For large irregular target

-multiple Isocenters are necessary

-Large dose inhomogeneity

- All the disadvantages in cone based system are overcome with micro MLC
- Single Isocenter with uniform dose distribution