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Dosimetric Analysis Report

Date of report:	-
Phantom type:	PseudoPatient
Phantom S/N:	-
Treatment delivery unit:	Varian Linac
Treatment Planning System:	Eclipse
Number of target volumes (PTVs):	1

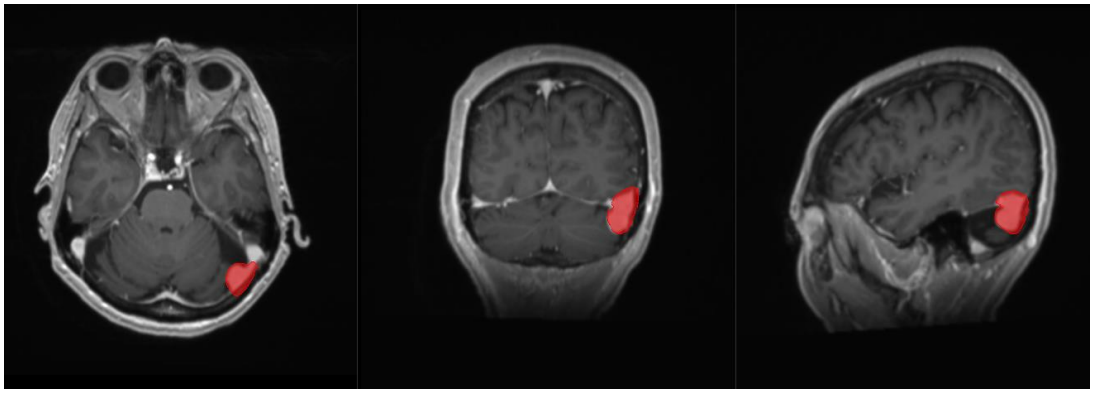
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3D Relative Dosimetry (Gel)

PART I: *Patient data*

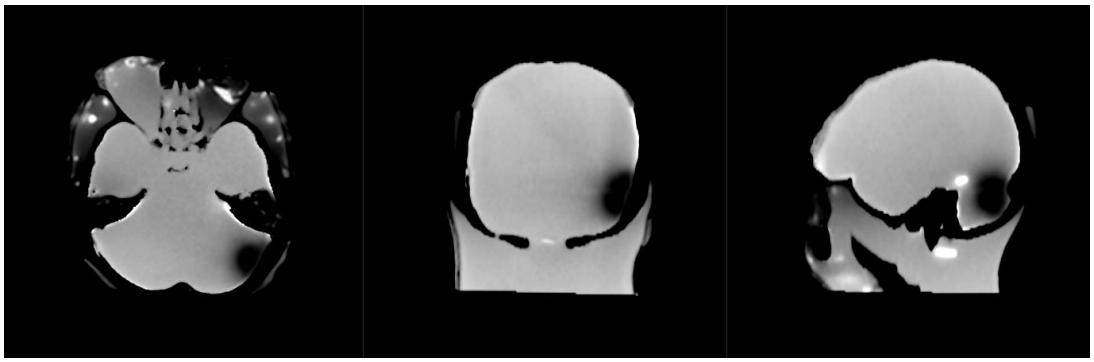
A spatial image registration comparing the patient's MR images and phantom's post-irradiation MR images against the planned target volume (PTV). By overlaying these datasets, this section demonstrates the spatial coincidence between the planned treatment location and the area that was actually irradiated during the gel measurements.



Patient's MRI with the corresponding PTV



Phantom's MRI with the corresponding PTV

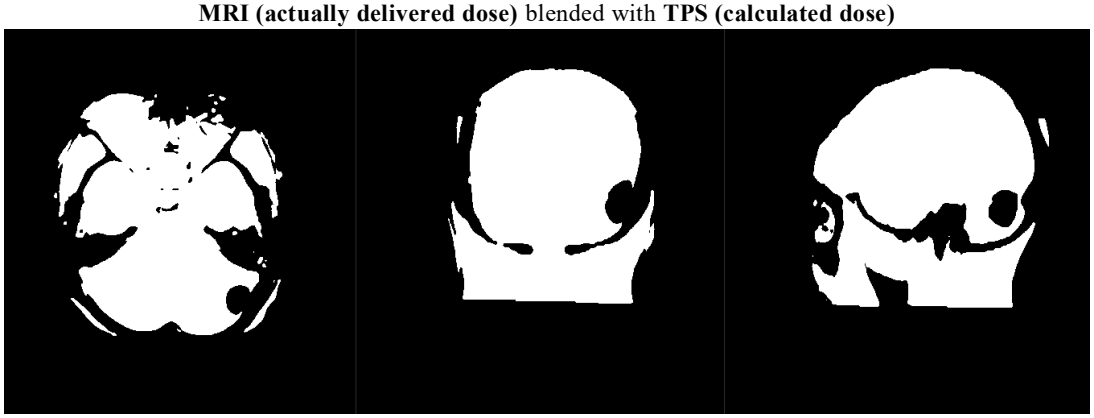


Phantom's MRI
(Brightness and contrast adjusted so that only low dose areas are depicted)

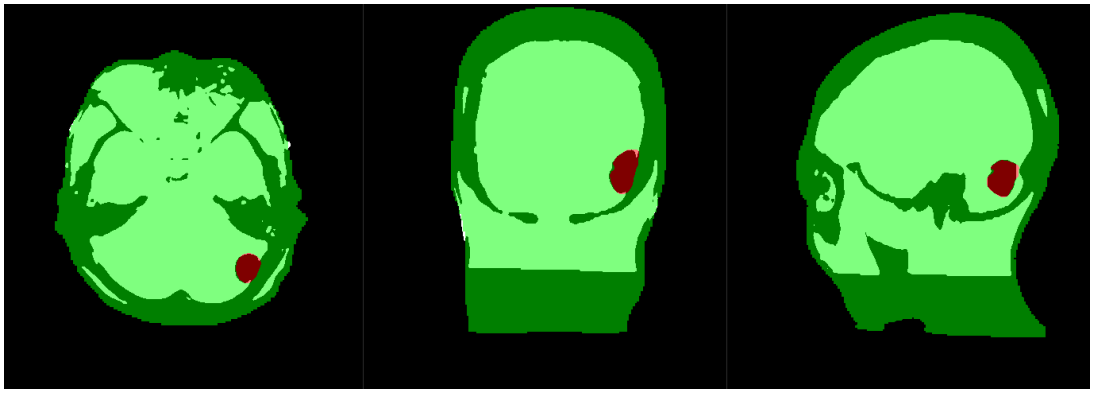
PART II: *Qualitative comparison*

Image registration between post-irradiation MRI and planning RTDose TPS data with structures of the Gel phantom. This is to demonstrate the coincidence of each treated target to its planned location.

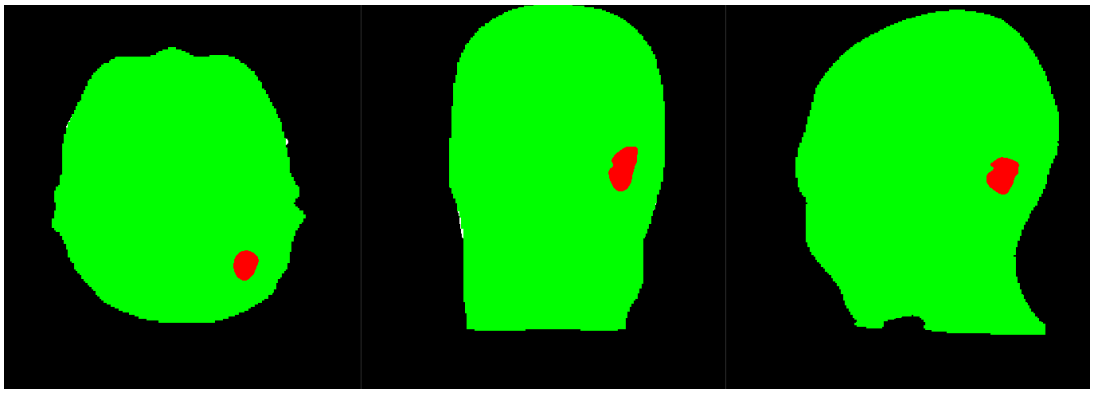
MRI (actually delivered dose) blended with **TPS (calculated dose)**



MRI 100% - RTDOSE TPS 0%

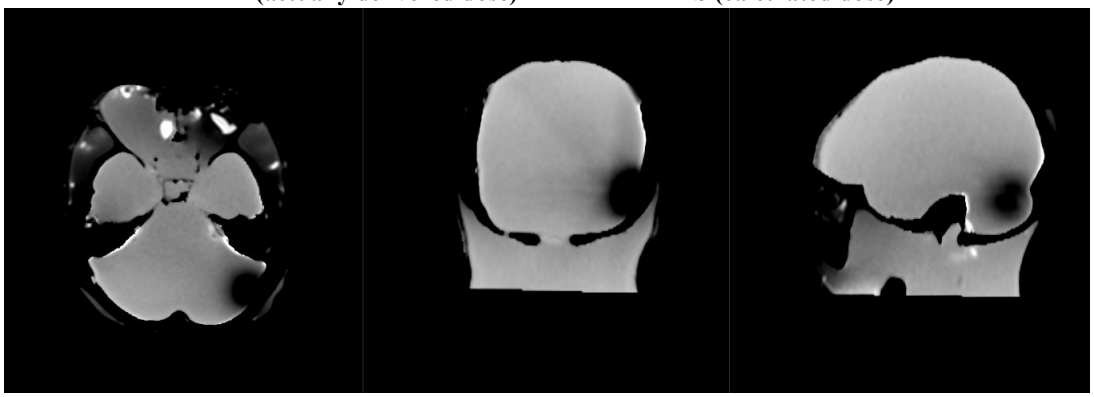


MRI 50% - RTDOSE TPS 50%

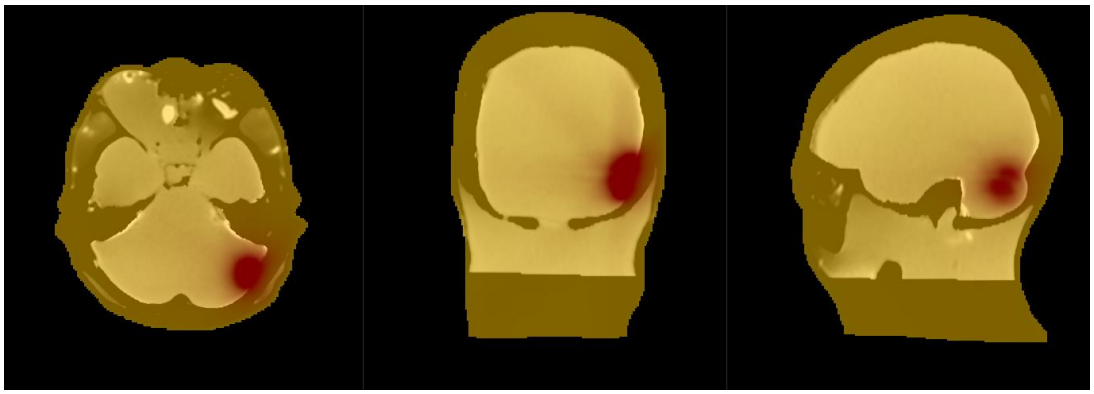


MRI 0% - RTDOSE TPS 100%
(Brightness and contrast adjusted so that only high dose areas are depicted)

MRI (actually delivered dose) blended with **TPS (calculated dose)**



MRI 100% - RTDOSE TPS 0%



MRI 50% - RTDOSE TPS 50%



MRI 0% - RTDOSE TPS 100%
(Brightness and contrast adjusted so that also low dose areas are depicted)

PART III: *Profiles comparison*

Indicatively, a number of relative dose profiles for both the measured and TPS-calculated datasets are presented in the following figures. In order to quantitatively assess agreement between the two datasets, 1D gamma index calculations are also included. Passing criteria were 2 mm distance-to-agreement and 5% dose difference.

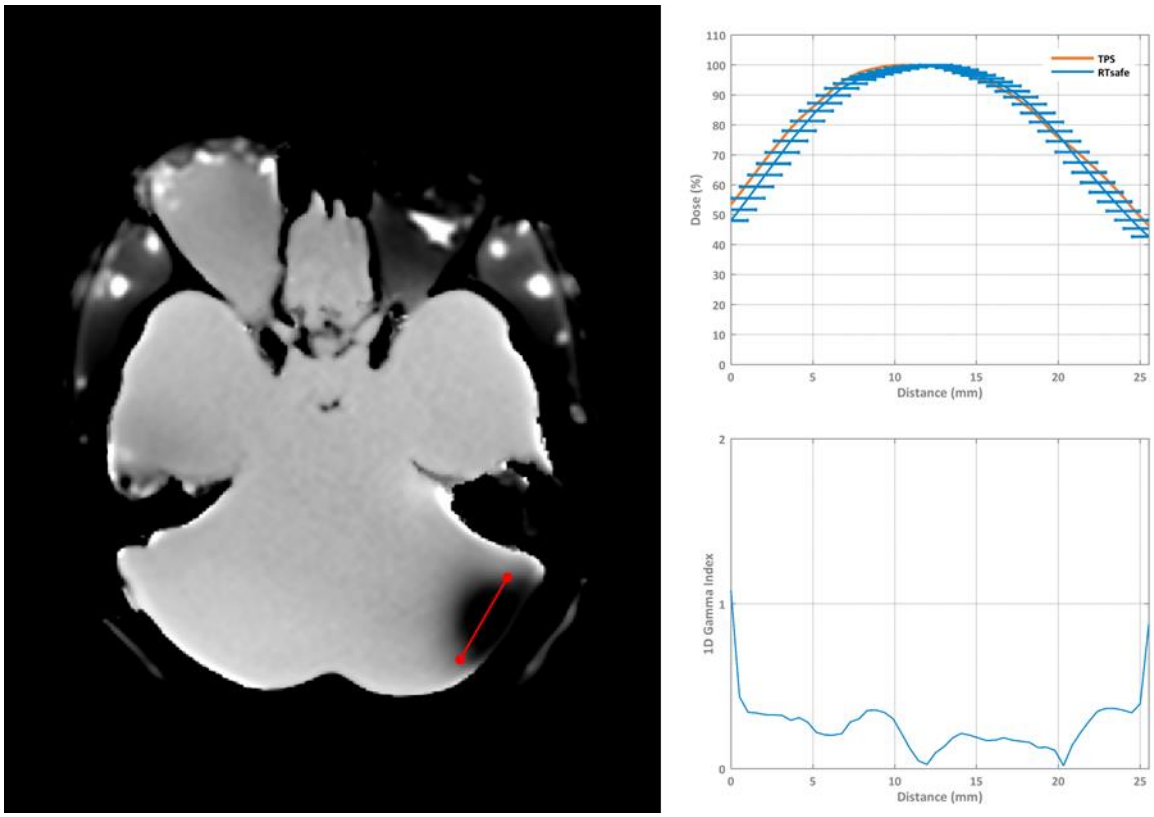
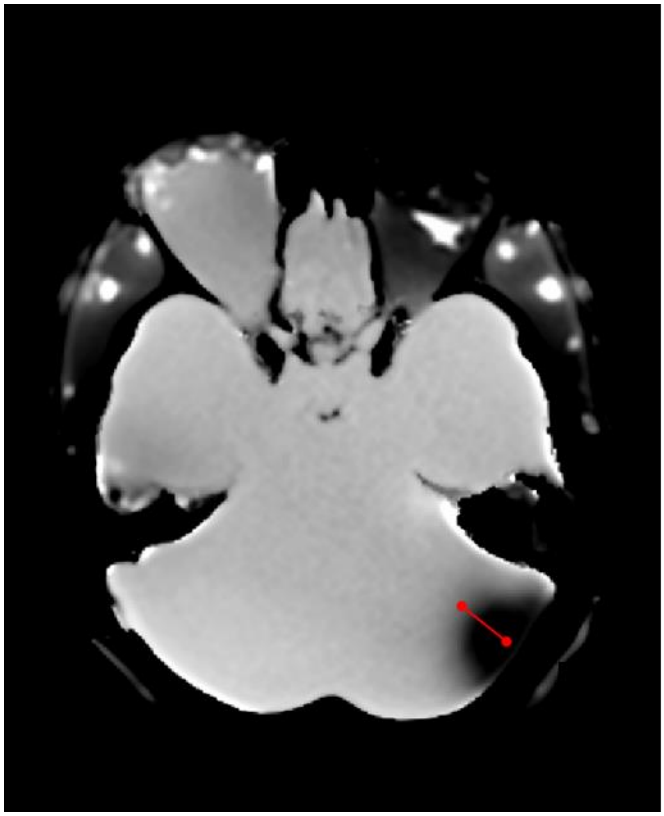
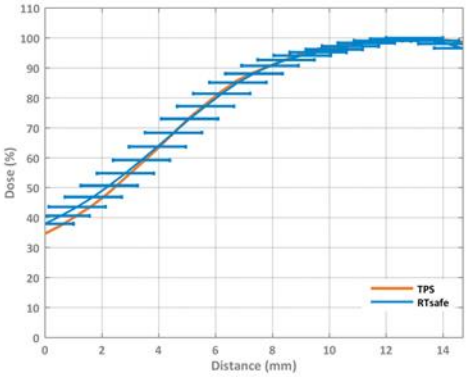
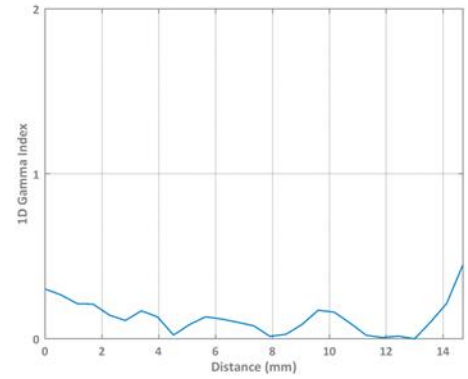


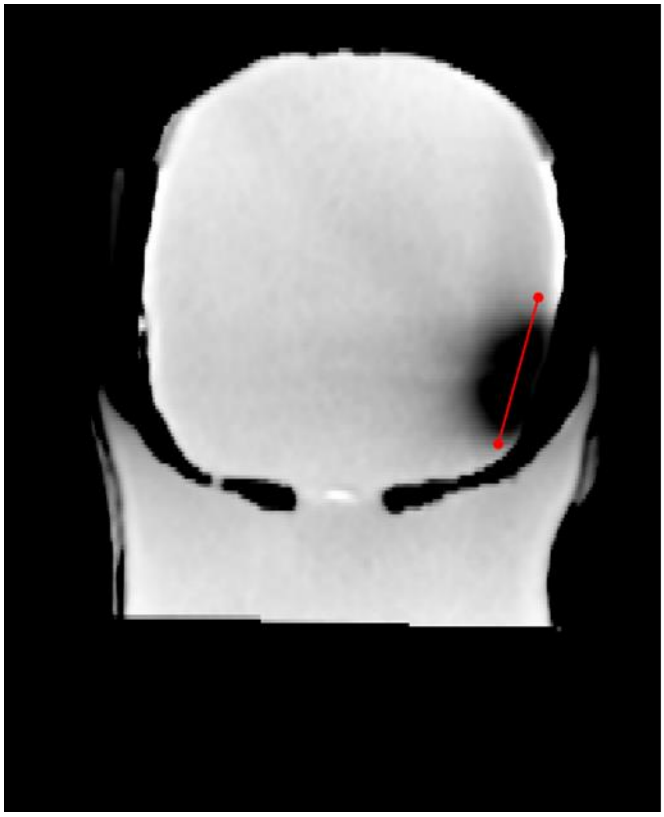
Figure: (left) Slice of the derived T2 maps of the irradiated phantom. High dose regions correspond to darker areas. (right) 1D profile comparison between calculated (TPS) and measured (RTsafe) dose distributions at the location depicted by the red line. Error bars correspond to ± 1mm spatial uncertainty. 1D gamma index calculations are also given using passing criteria 5%/2mm.

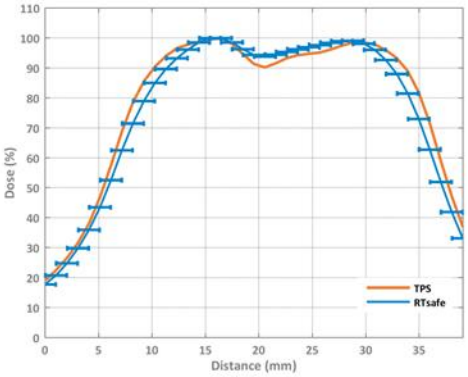
The same figure caption applies to all following figures in Part II.

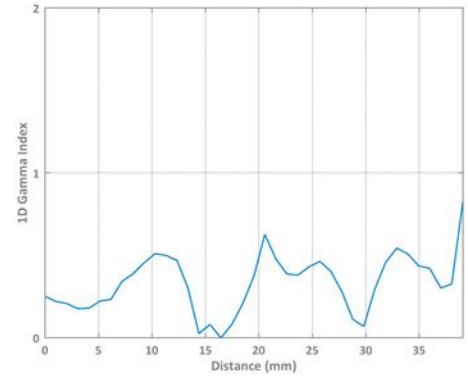


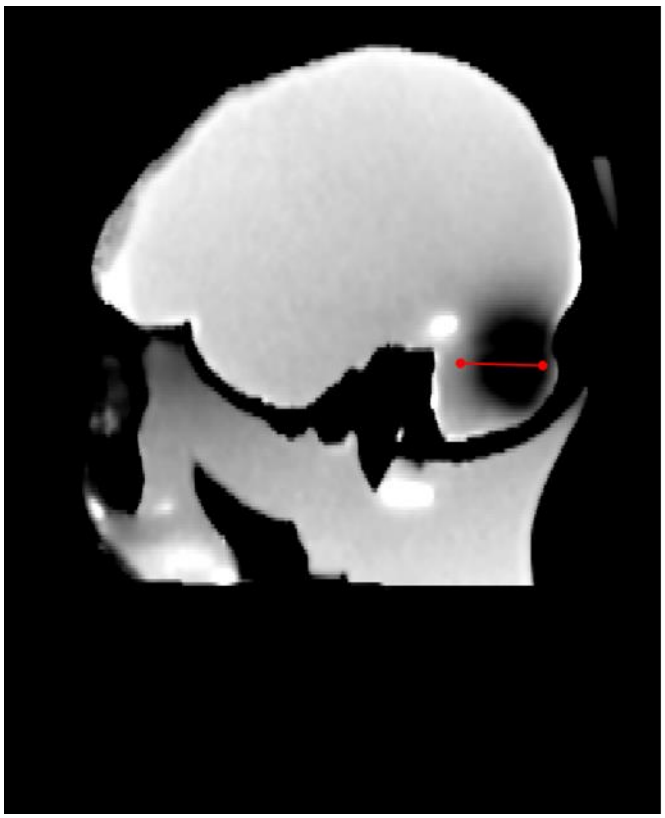

Dose (%)
Distance (mm)
TPS
RTsafe

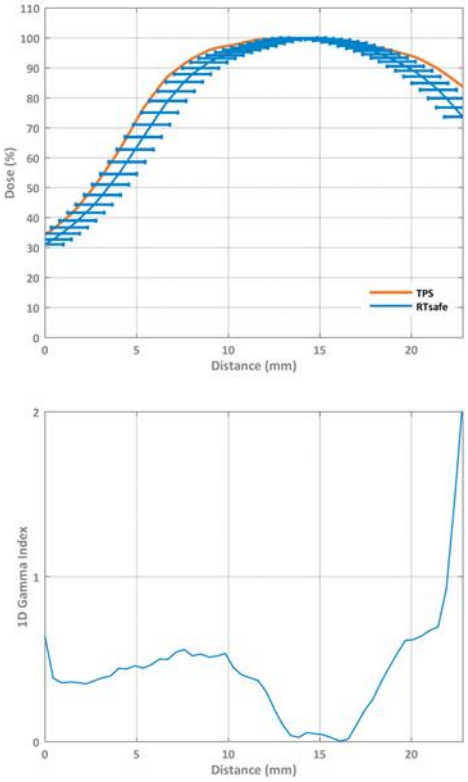

1D Gamma Index
Distance (mm)



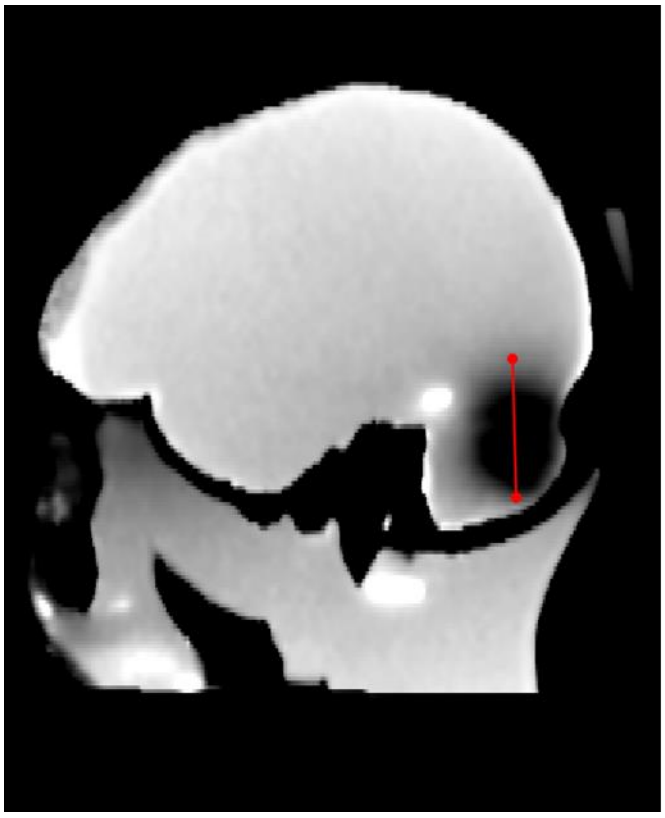

Dose (%)
Distance (mm)
TPS
RTsafe

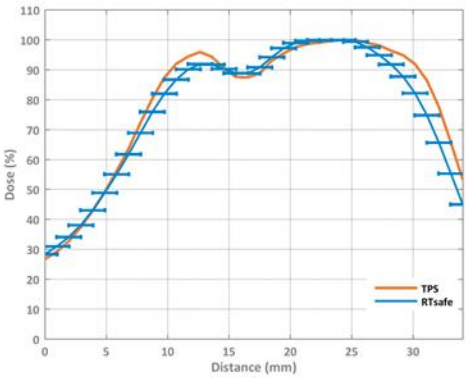

1D Gamma Index
Distance (mm)

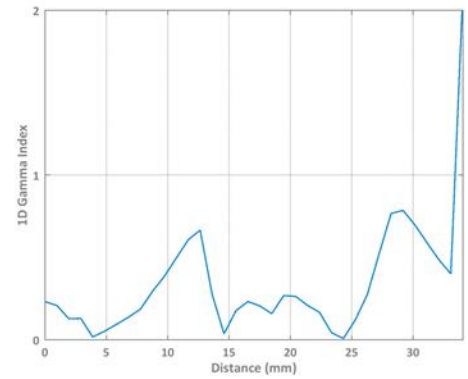



Dose (%)
Distance (mm)
TPS
RTsafe

1D Gamma Index
Distance (mm)




Dose (%)
Distance (mm)
TPS
RTsafe


1D Gamma Index
Distance (mm)

PART IV: *2D Gamma Index comparison*

For selected slices of the irradiated phantom, 2D gamma index calculations are presented in the following figures. Again, passing criteria were 2 mm distance-to-agreement and 5% dose difference. However, a dose threshold of 1% has been applied to exclude corresponding voxels from the gamma index calculations. Isodose lines are also plotted to assist comparison.

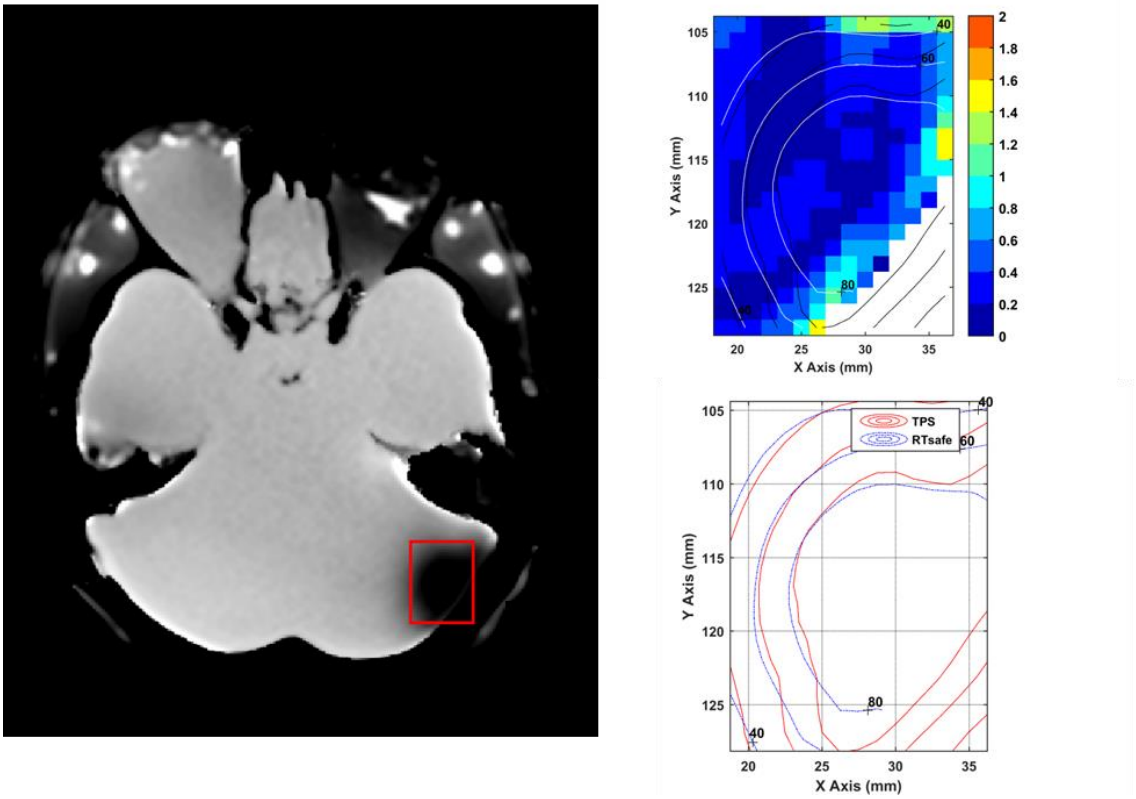
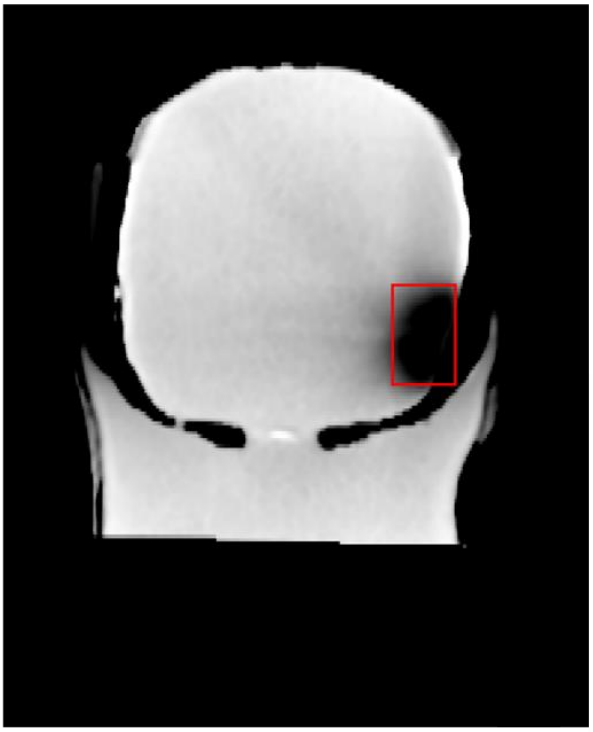
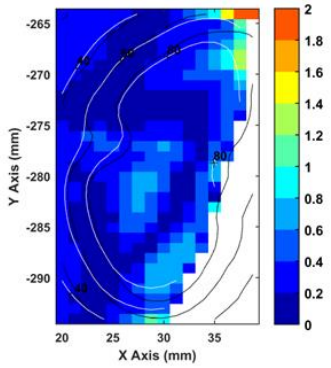
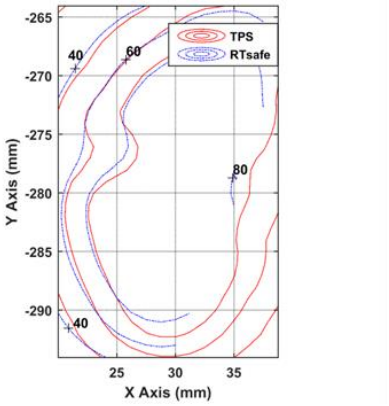


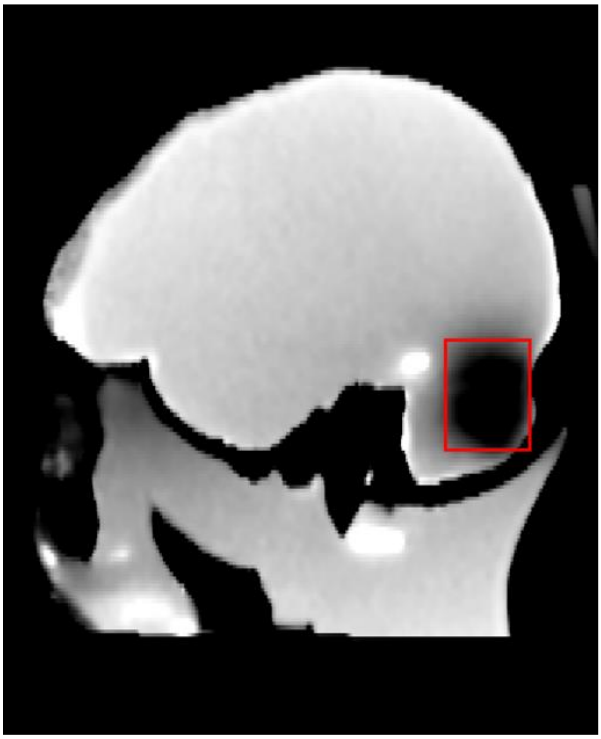
Figure: (left) Slice of the derived T2 maps of the irradiated phantom. High dose regions correspond to darker areas. (right) 2D comparison between calculated (TPS) and measured (RTsafe) dose distributions at the location depicted by the red contour. 2D gamma index calculations are also given using passing criteria 5%/2mm.

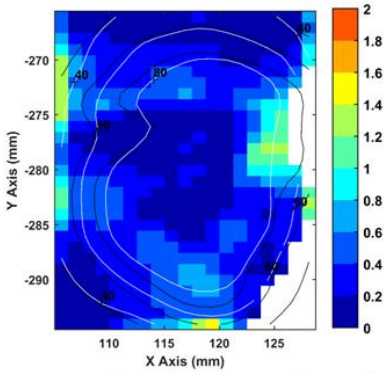
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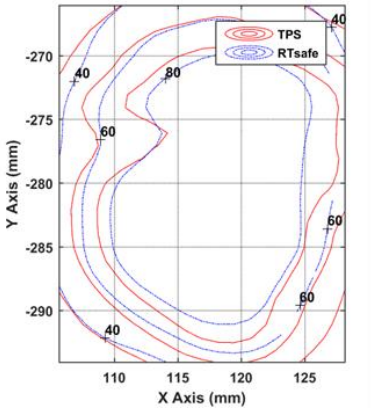



Y Axis (mm)
X Axis (mm)


TPS
RTsafe
Y Axis (mm)
X Axis (mm)




Y Axis (mm)
X Axis (mm)


TPS
RTsafe
Y Axis (mm)
X Axis (mm)

PART V: *Geometry metric - Offset*

Spatial offsets are measured independently for each target by comparing in 3D the center-of-mass of the polymerized area with the center-of-mass of the planned high-dose area. The center of mass of each distribution was calculated by averaging the center of masses of the distributions derived by applying a range of dose thresholds, taking into account the dose gradient of each target. Results are given in the following table.

Table: Distance from isocenter and Distance between the center-of-masses of TPS and RTsafe 3D dose distributions (Geometry metric) for the structures considered.

Structure	Distance from ISO (mm)	Geometry metric - Offset (mm)
PTV	0.18	1.60

PART VI: *DVH comparison*

Comparison between planned and measured relative dose distributions is presented in the following figures, in term of cumulative Dose Volume Histograms (DVHs) for the Organs at Risk (OARs). All dose distributions were normalized to be the corresponding $D_{50\%}$ metric (i..e, the minimum dose received by at least the 50% of the volume) of each structure.

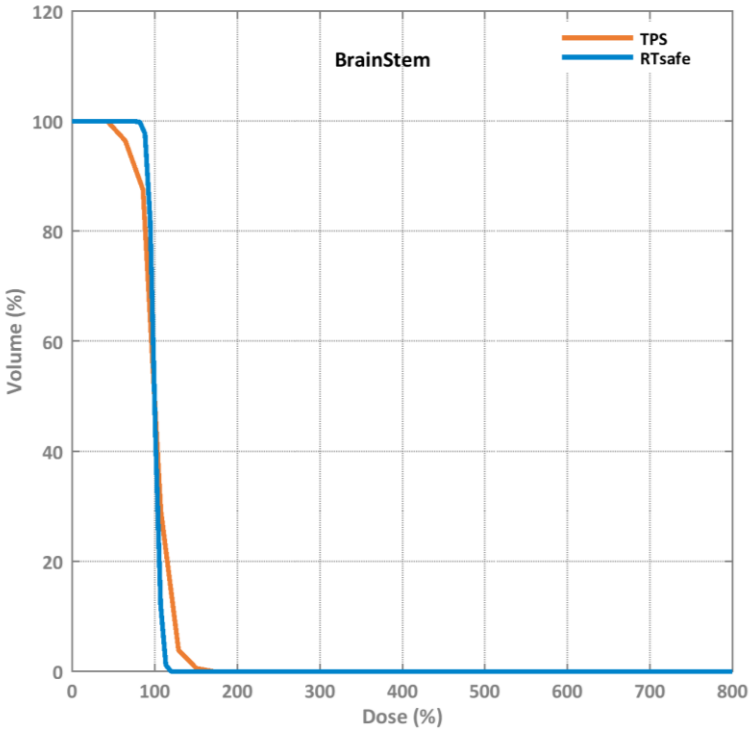
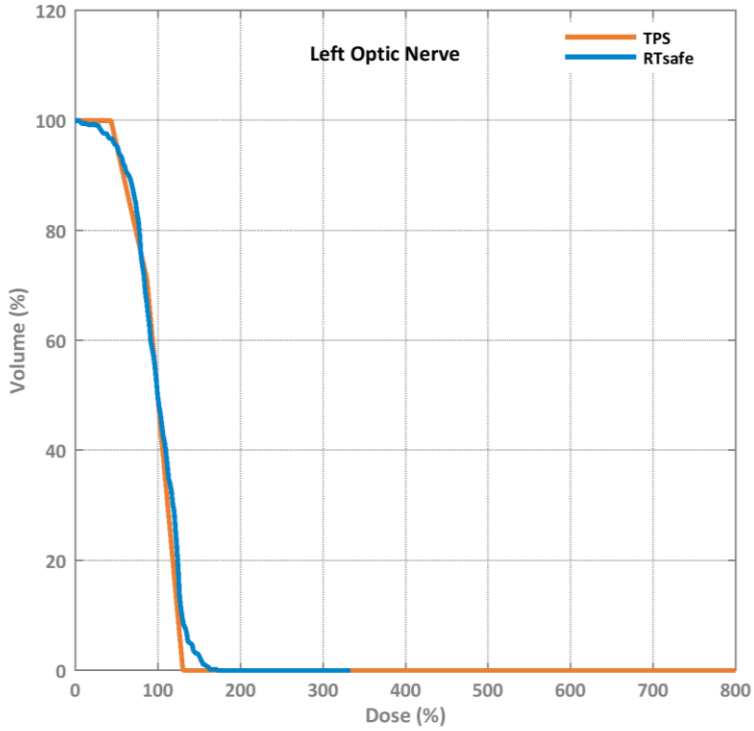
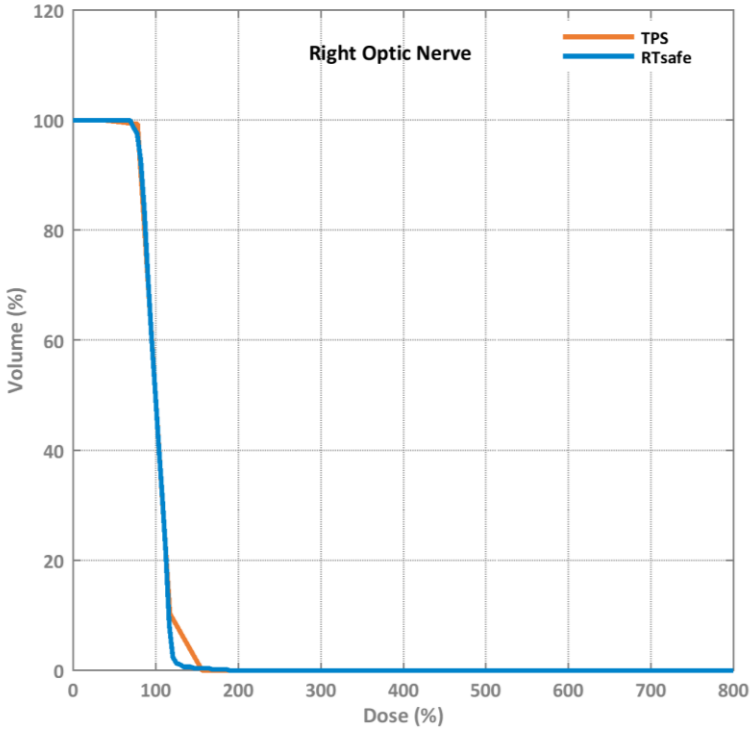


Figure: Cumulative Dose Volume Histograms derivedd from the calculated (TPS) and measured (RTsafe) dose distributions for all the structures considered.

The same figure caption applies to all following figures in Part V.


Left Optic Nerve
TPS
RTsafe
Volume (%)
Dose (%)
0
20
40
60
80
100
120
0
100
200
300
400
500
600
700
800


Right Optic Nerve
TPS
RTsafe
Volume (%)
Dose (%)
0
20
40
60
80
100
120
0
100
200
300
400
500
600
700
800

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Results presented in this report were deduced based on an experimental procedure performed by the end-user following the guidelines of RTsafe staff. Results are provided "as is". No warranties, express or implied, that these results are free of error, or is consistent with any particular standard of merchantability, or that it will meet your requirements for any particular application, is made. No responsibility for any physical or technical limitations of the procedures and functions which make up this experimental methodology is accepted. The presented dosimetric report should not be relied on for solving a problem whose incorrect solution could result in injury to a person or loss of property. RTsafe shall not, in any event, be liable for any damages, whether direct or indirect, special or general, consequential or incidental, arising from the use of the results of this report. RTsafe does not suggest any specific actions for improving your radiotherapy treatment protocol. The interpretation of the presented results is entirely at your own risk.