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Dosimetric Analysis Report

Date of report:	----------
Date of irradiation:	----------
Treatment Planning System:	----------
Number of target volumes (PTVs):	7
Institution:	----------

Table of Contents

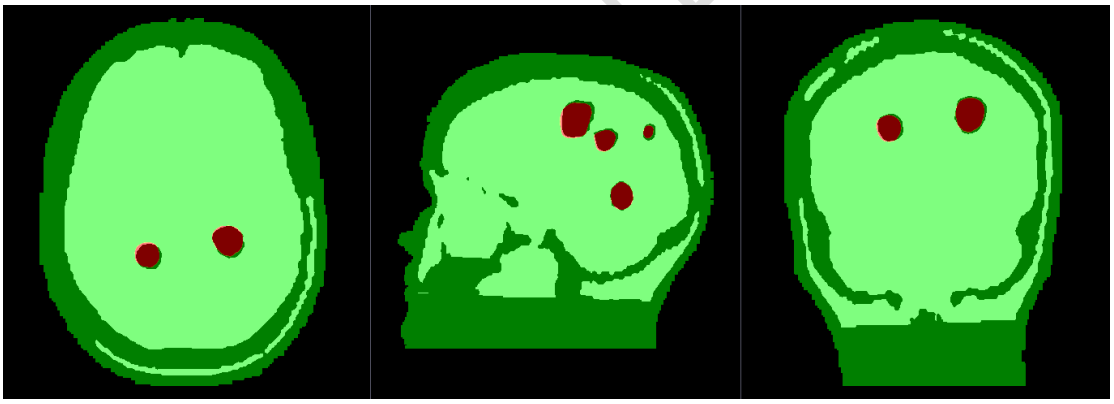
3D Relative Dosimetry Report (Gel)

PART I: 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%

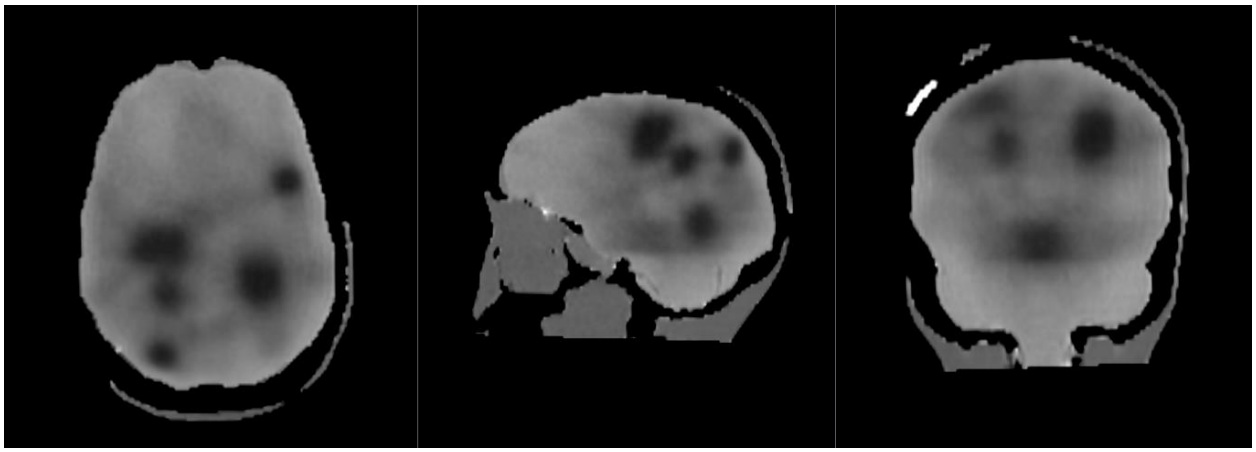


MRI 50% - RTDOSE TPS 50%

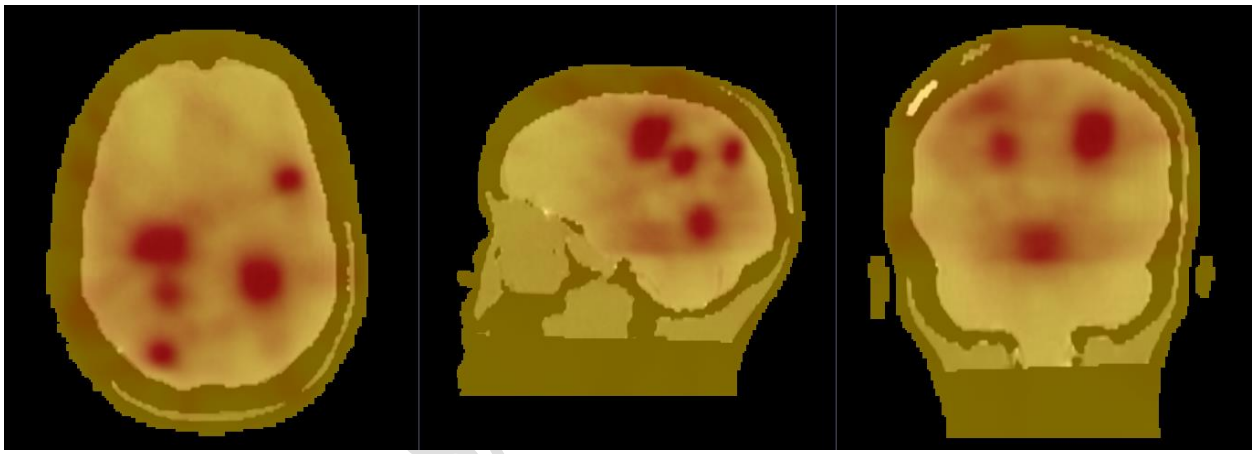
MRI 0% - RTDOSE TPS 100%

(Brightness and contrast adjusted so that only high dose areas are depicted)

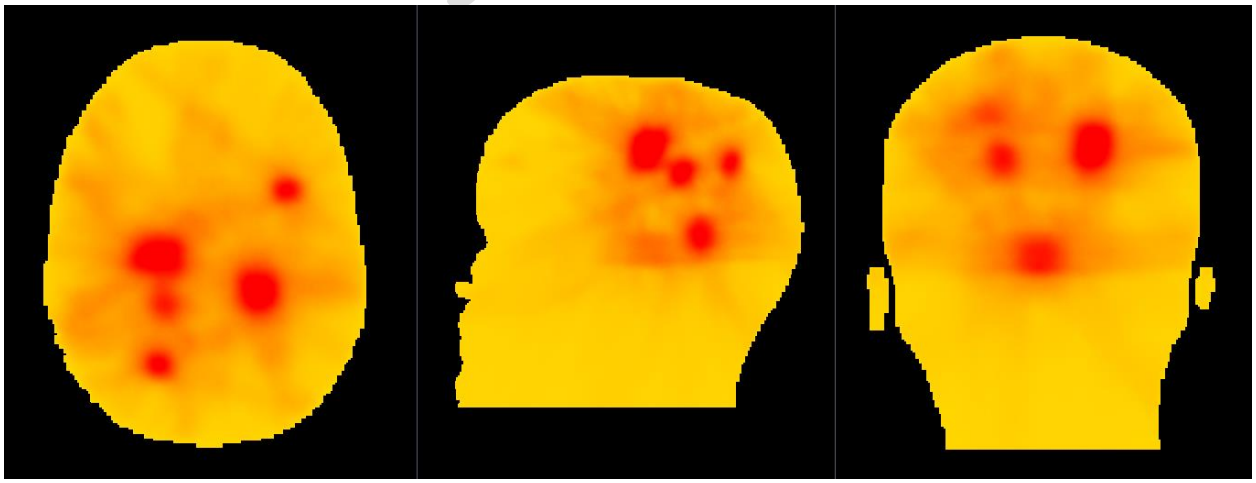
MRI (actually delivered dose) blended with **TPS (calculated dose)**



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 II: *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.

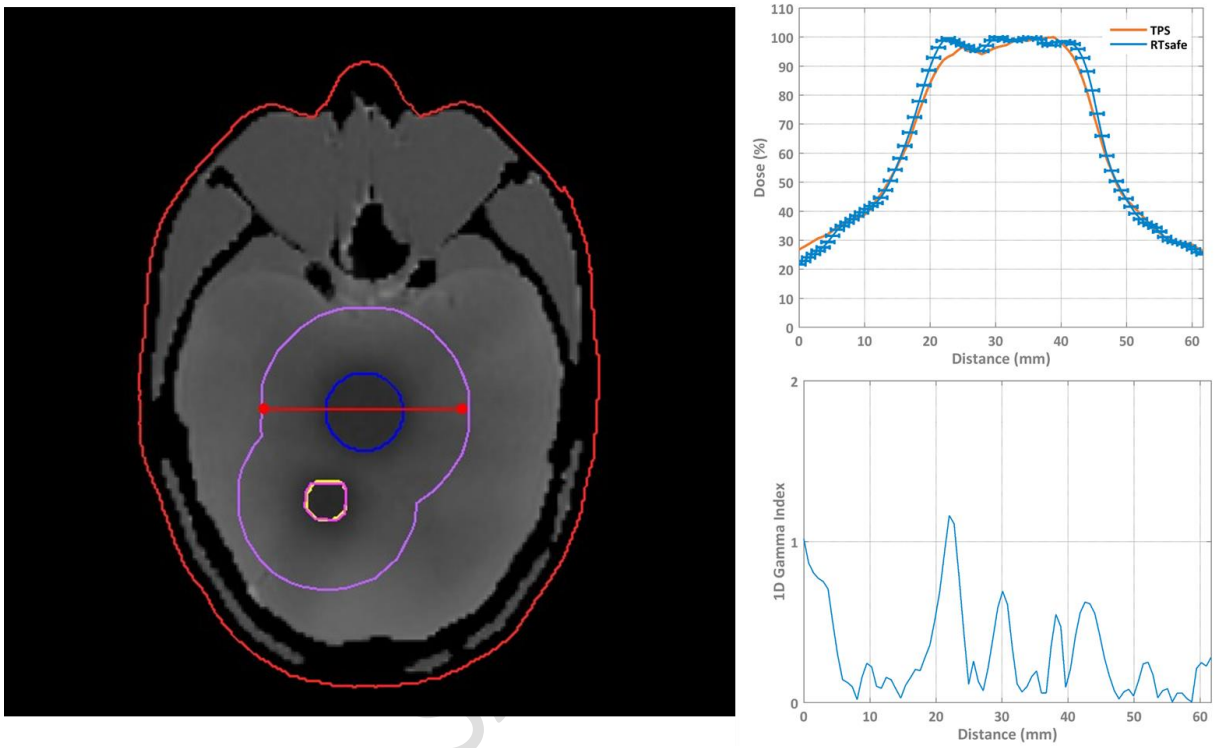
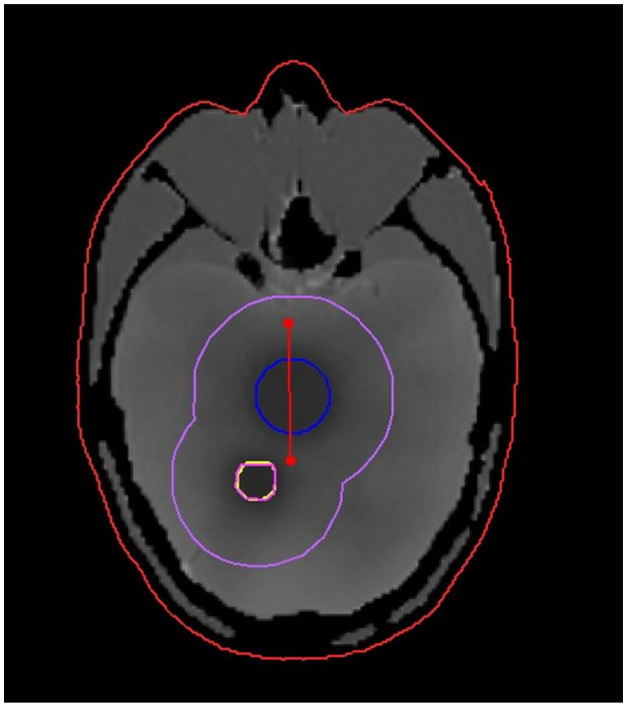
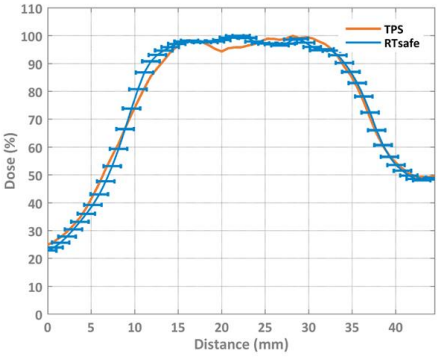
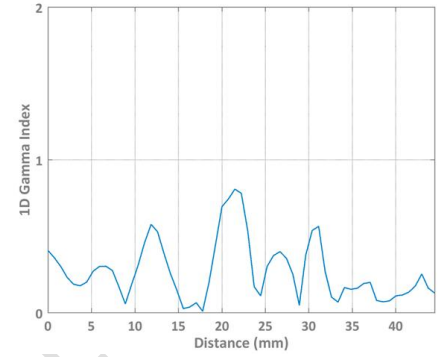


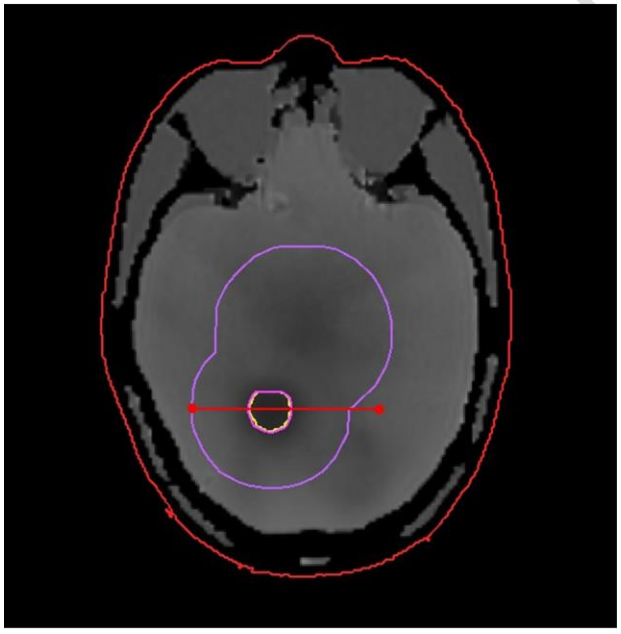
Figure: (left) Slice of the derived T2 maps of the irradiated phantom. High dose regions correspond to darker areas. (right) 1D profile comparison between calculated (TPS) and measured (RTsafe) dose distributions at the location depicted by the red line. Error bars correspond to ± 1mm spatial uncertainty.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

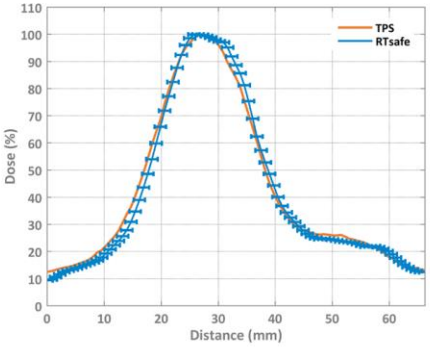
The same figure caption applies to all following figures in Part II.

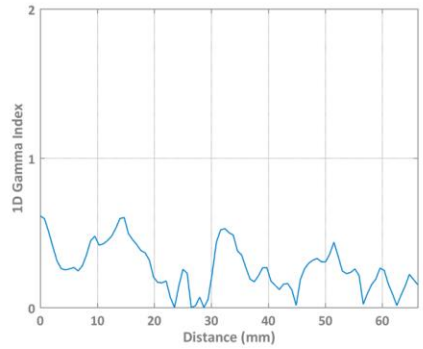


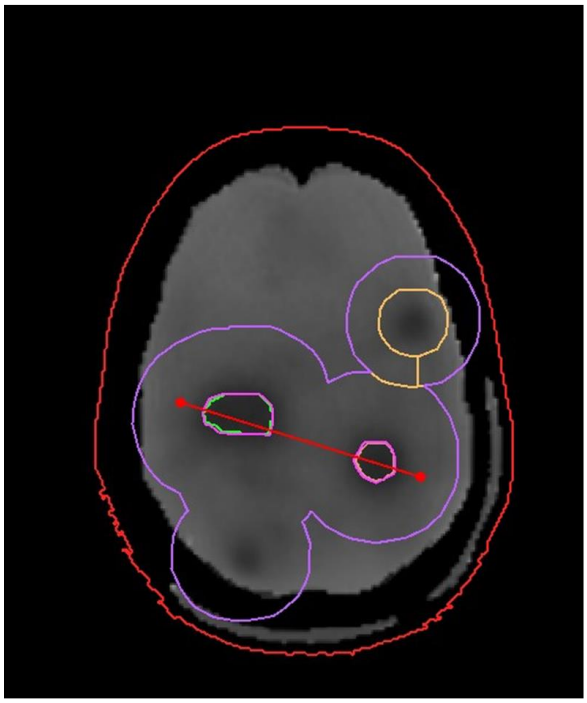

TPS
RTsafe
Dose (%)
Distance (mm)

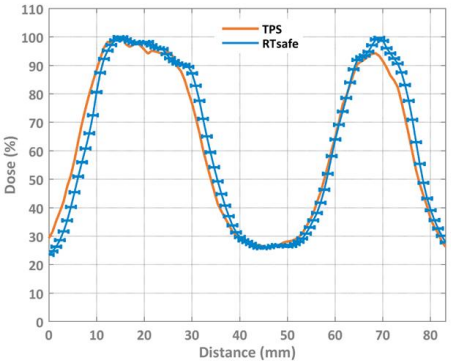

1D Gamma Index
Distance (mm)

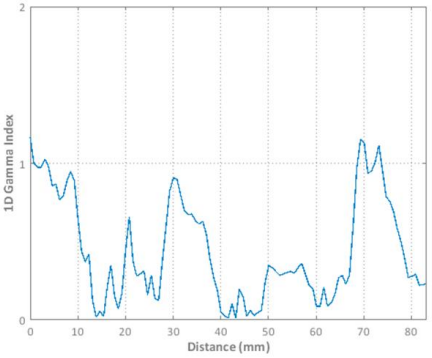


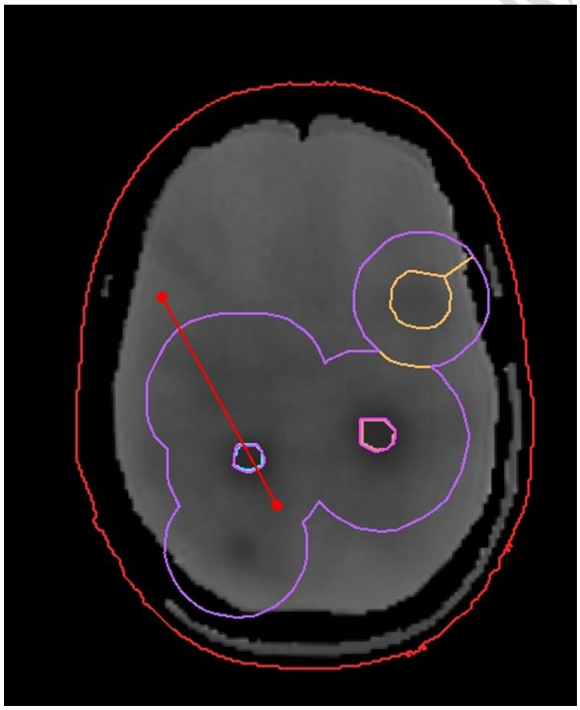

TPS
RTsafe
Dose (%)
Distance (mm)

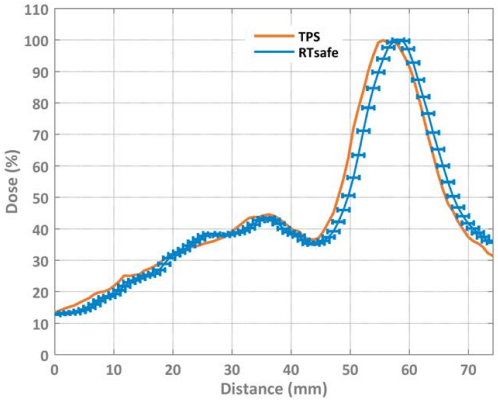

1D Gamma Index
Distance (mm)

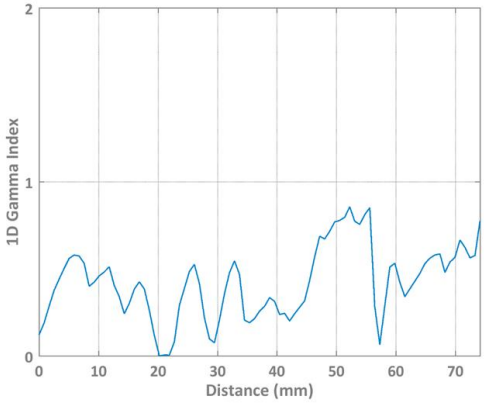


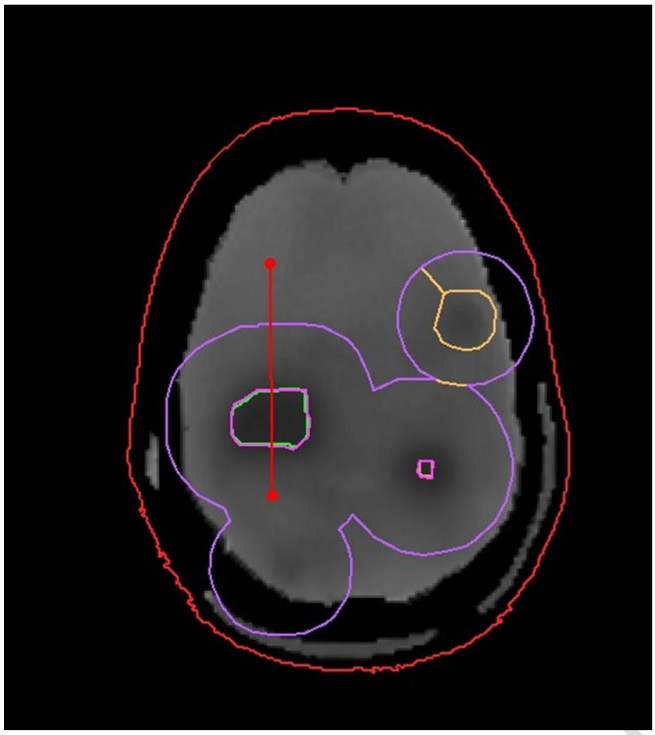

TPS
RTsafe
Dose (%)
Distance (mm)

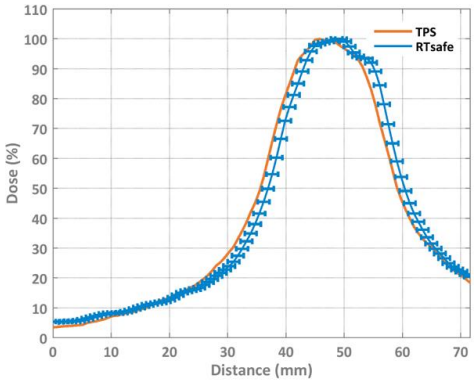

1D Gamma Index
Distance (mm)

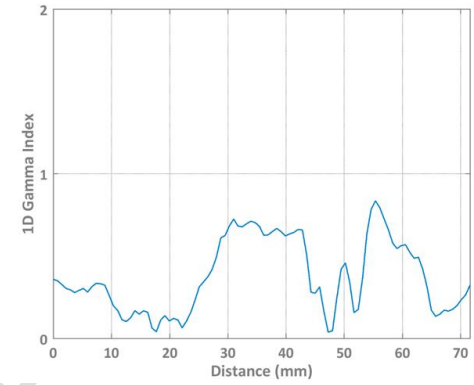


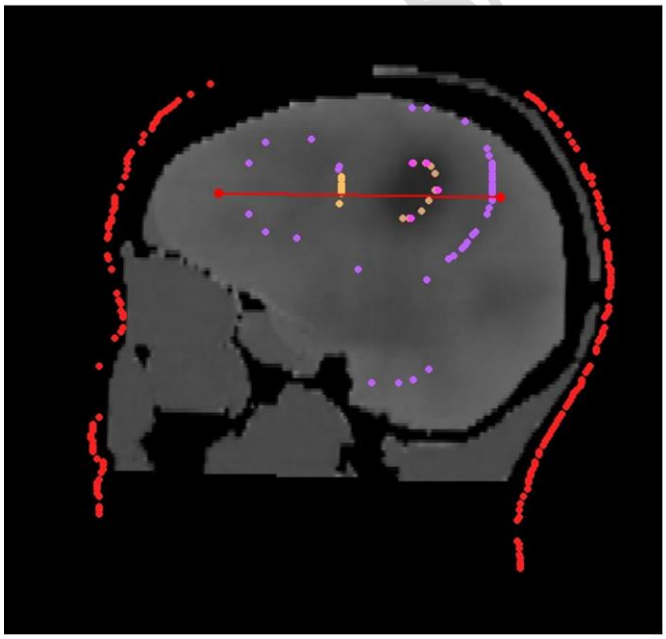

TPS
RTsafe
Dose (%)
Distance (mm)

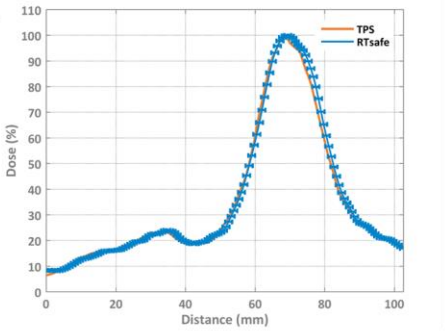

1D Gamma Index
Distance (mm)

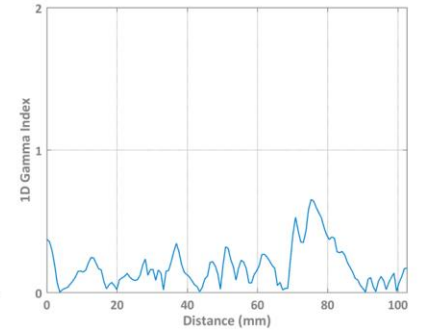


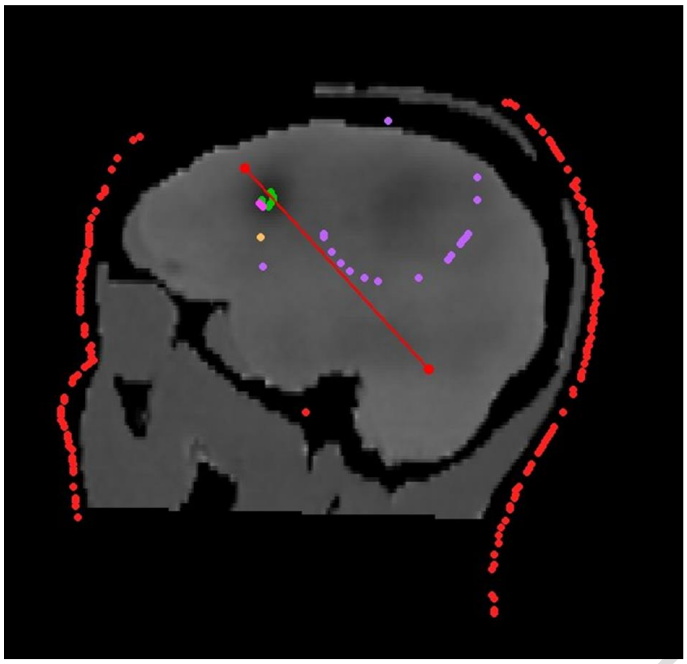

TPS
RTsafe
Dose (%)
Distance (mm)

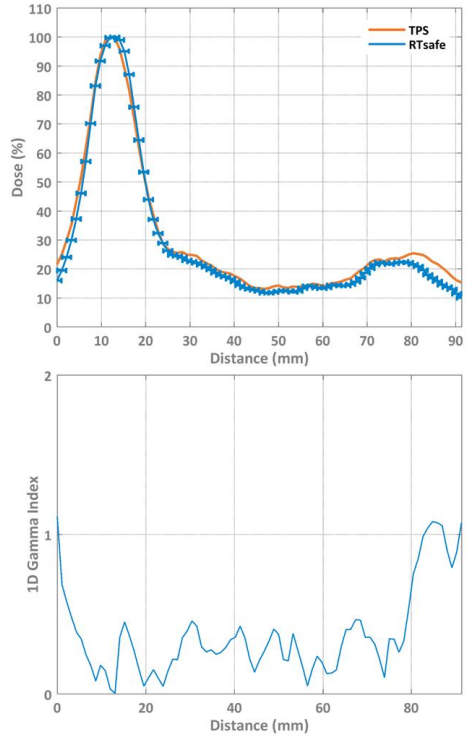

1D Gamma Index
Distance (mm)

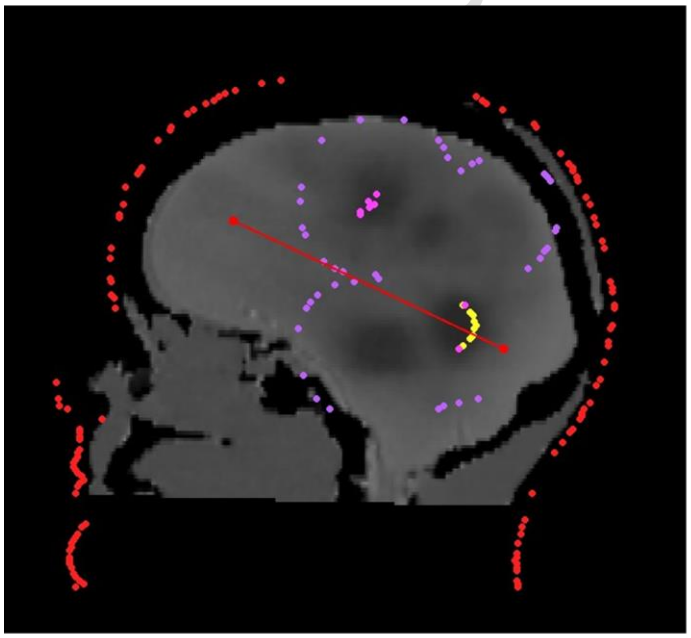


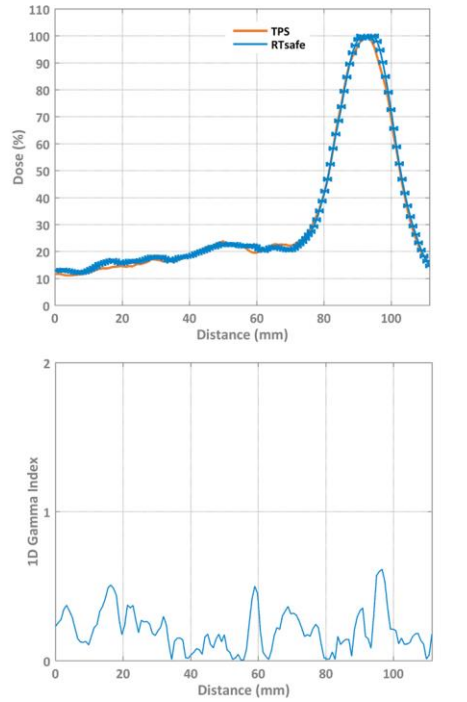

TPS
RTsafe
Dose (%)
Distance (mm)

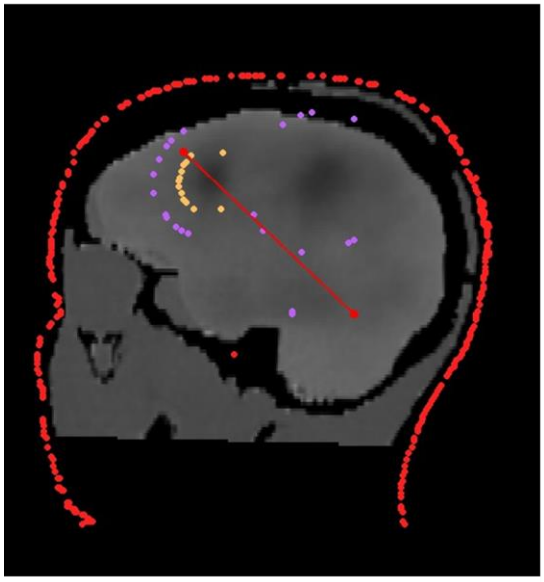

1D Gamma Index
Distance (mm)

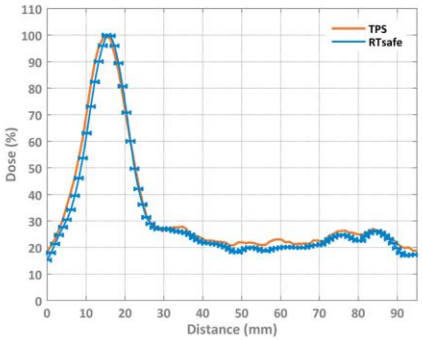


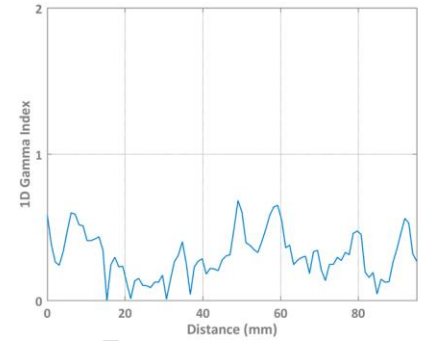

TPS
RTsafe
Dose (%)
Distance (mm)
1D Gamma Index
Distance (mm)

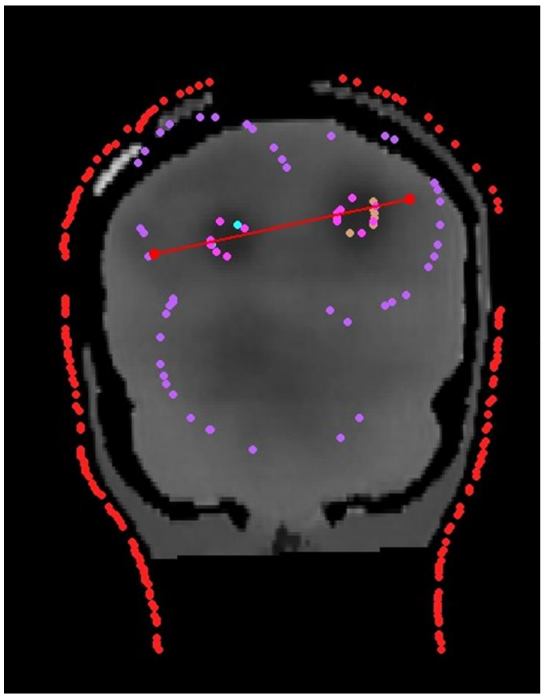


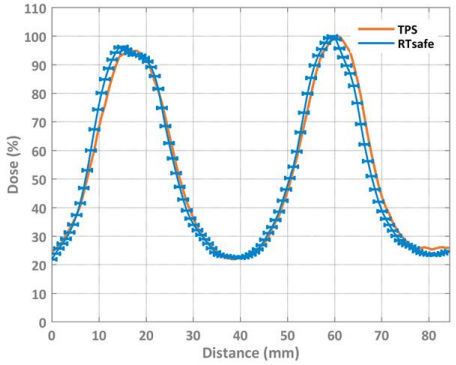

TPS
RTsafe
Dose (%)
Distance (mm)
1D Gamma Index
Distance (mm)

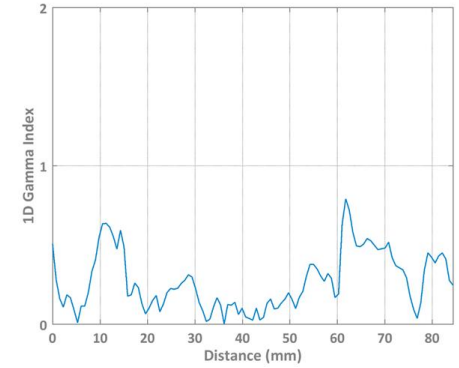


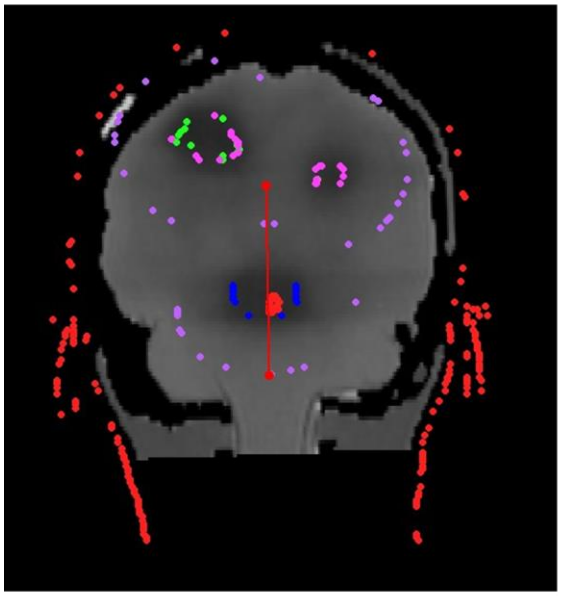

TPS
RTsafe
Dose (%)
Distance (mm)

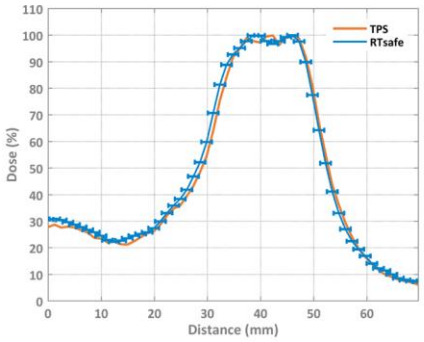

1D Gamma Index
Distance (mm)




TPS
RTsafe
Dose (%)
Distance (mm)


1D Gamma Index
Distance (mm)

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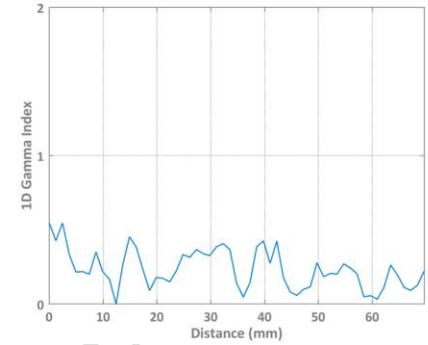
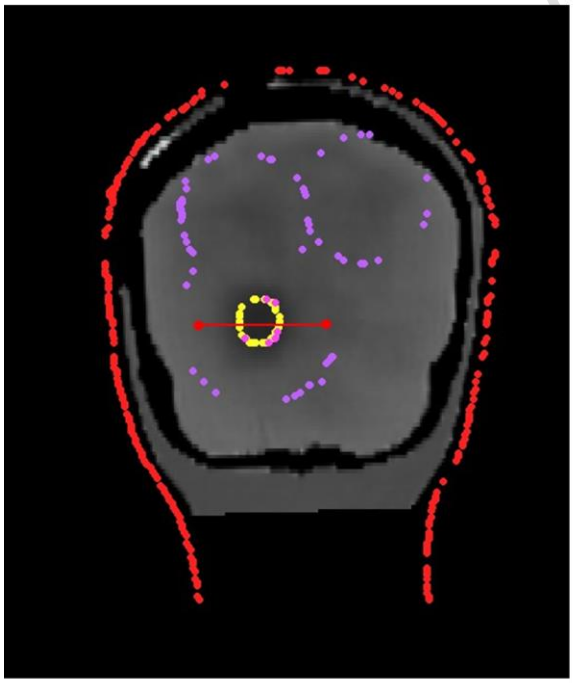
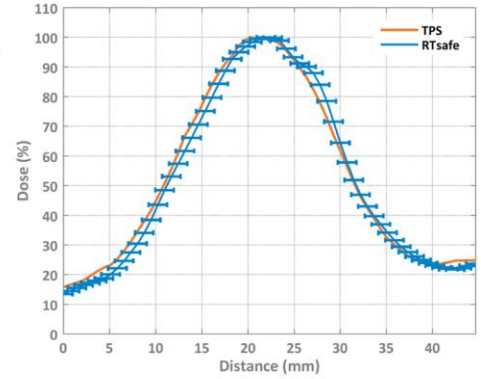
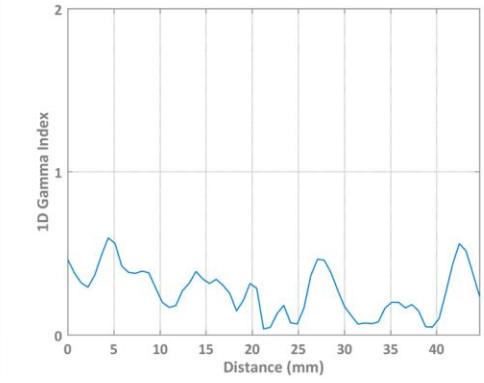
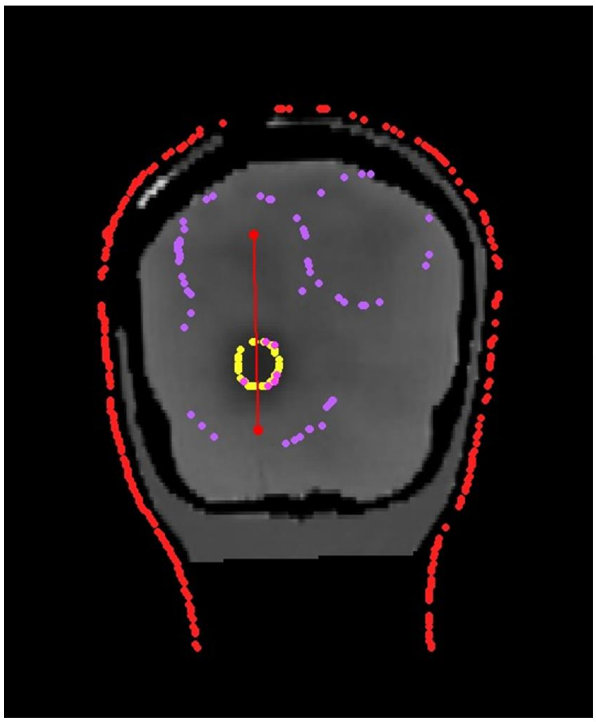
RTsafe
Dose (%)
Distance (mm)

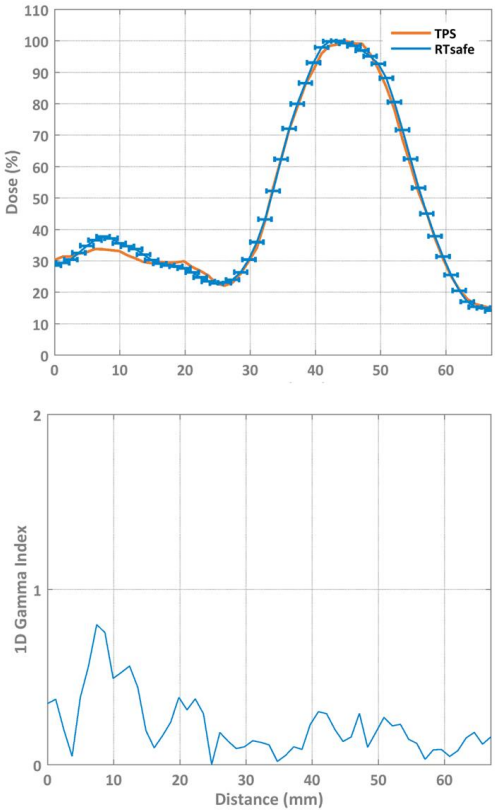

1D Gamma Index
Distance (mm)




TPS
RTsafe
Dose (%)
Distance (mm)


1D Gamma Index
Distance (mm)





PART III: *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. Isodose lines are also plotted to assist comparison.

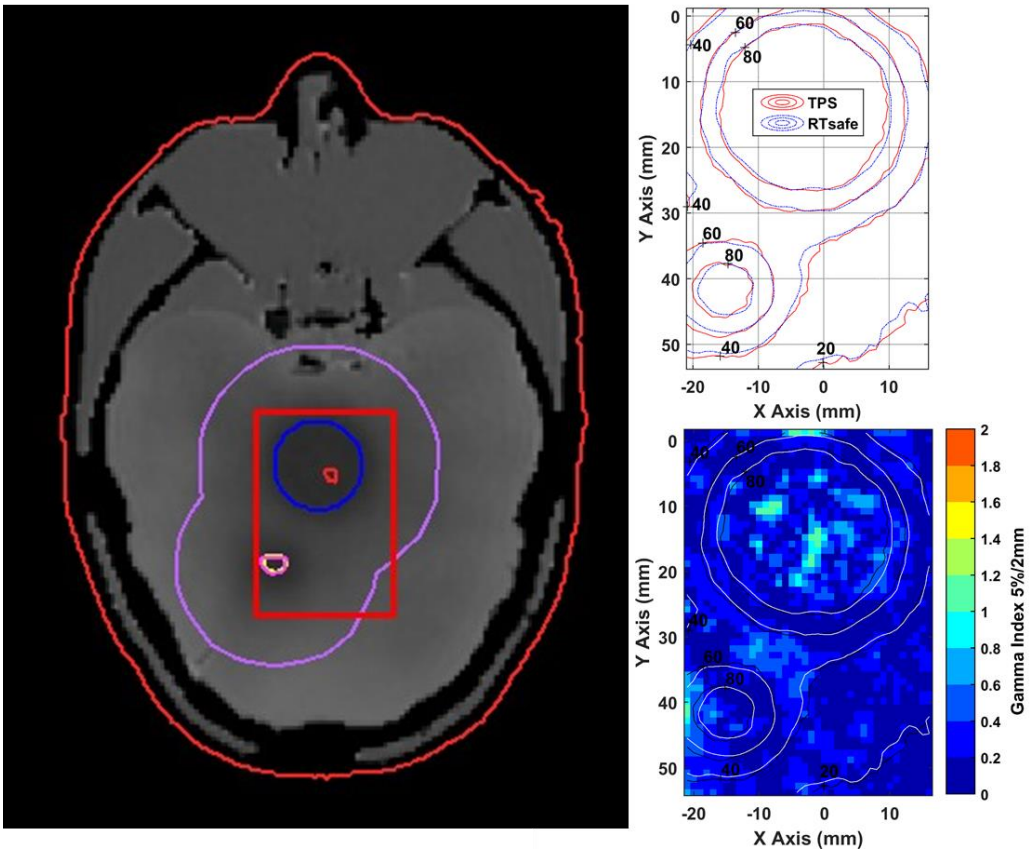
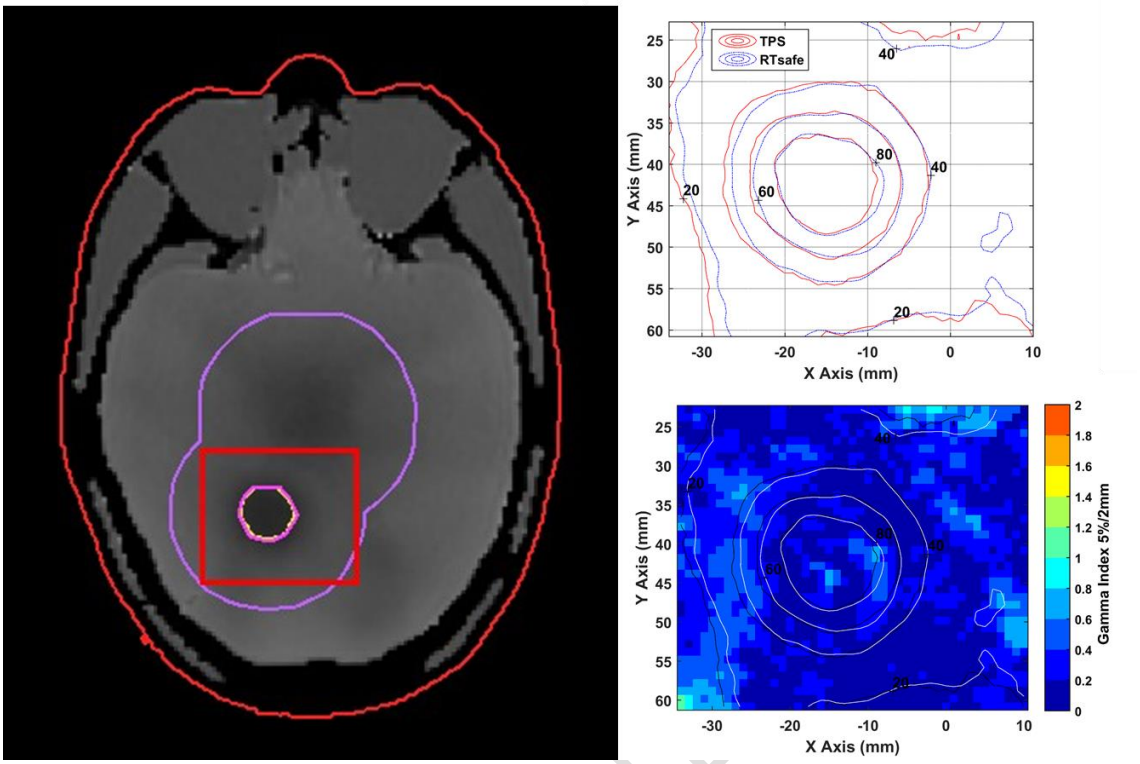
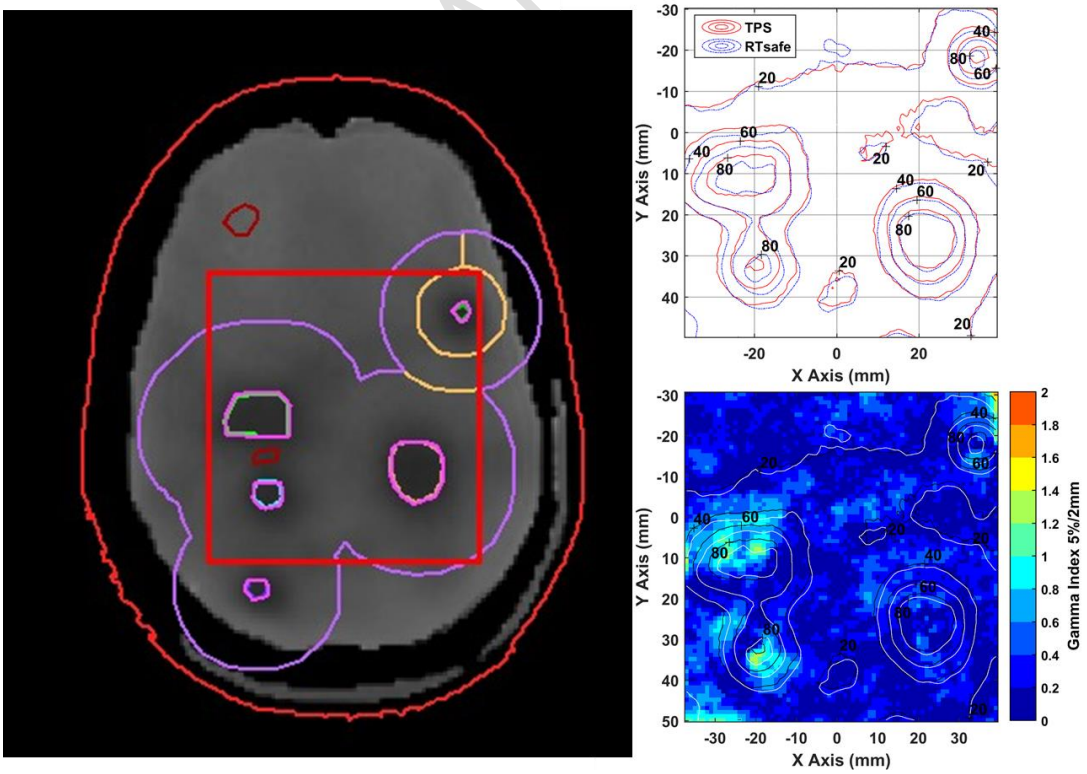
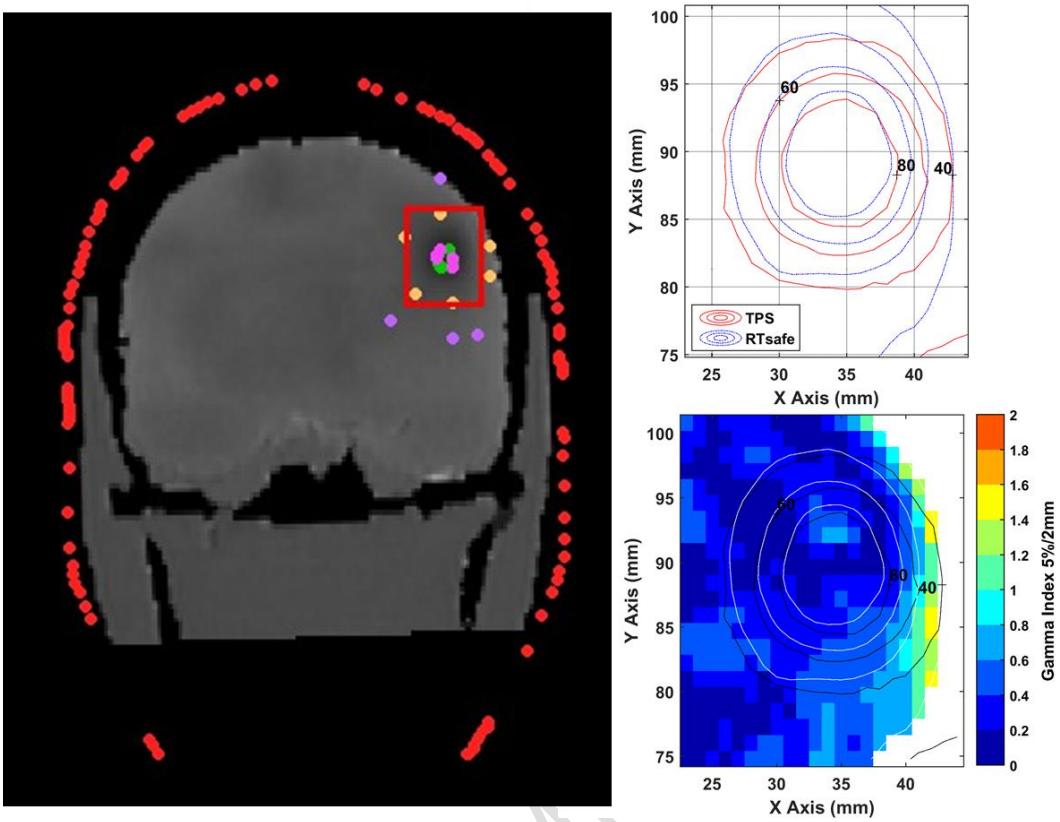


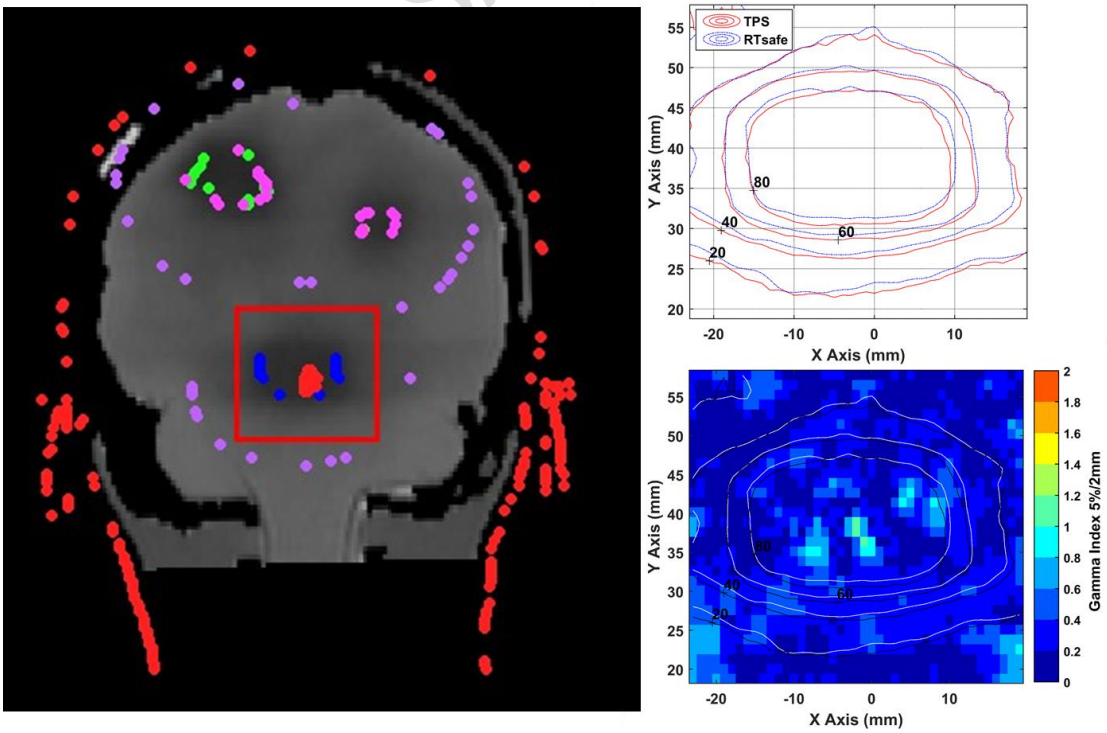
Figure: (left) Slice of the derived T2 maps of the irradiated phantom. High dose regions correspond to darker areas. (right) 2D comparison between calculated (TPS) and measured (RTsafe) dose distributions at the location depicted by the red contour. 2D gamma index calculations are also given using passing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

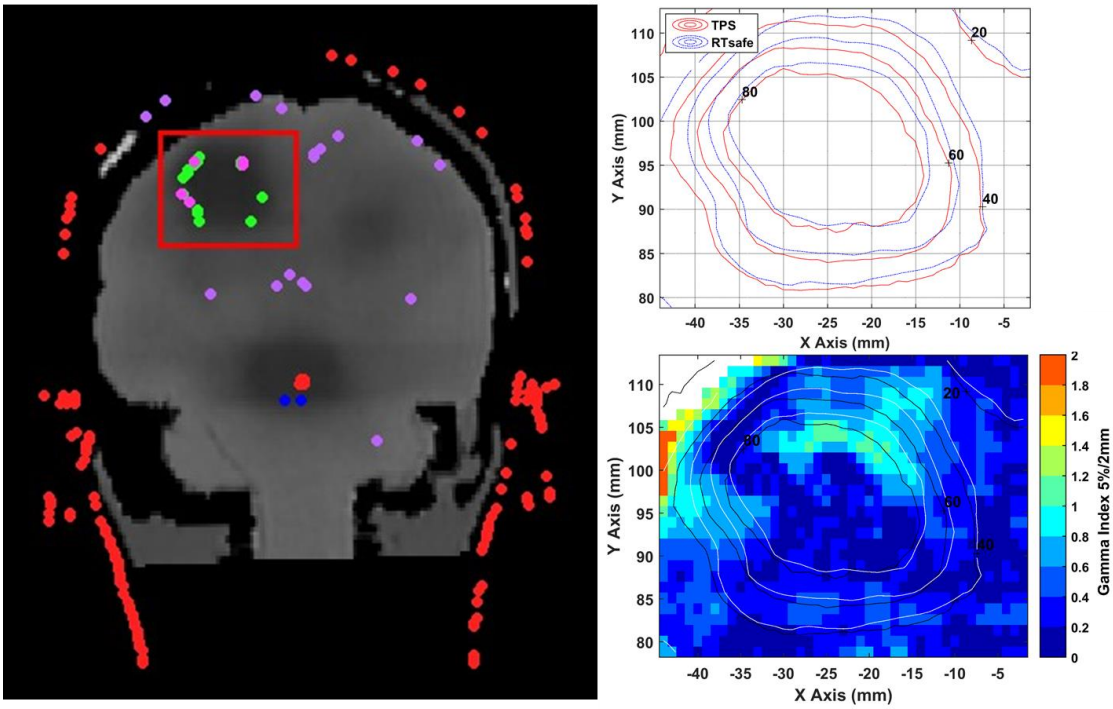
The same figure caption applies to all following figures in Part III.

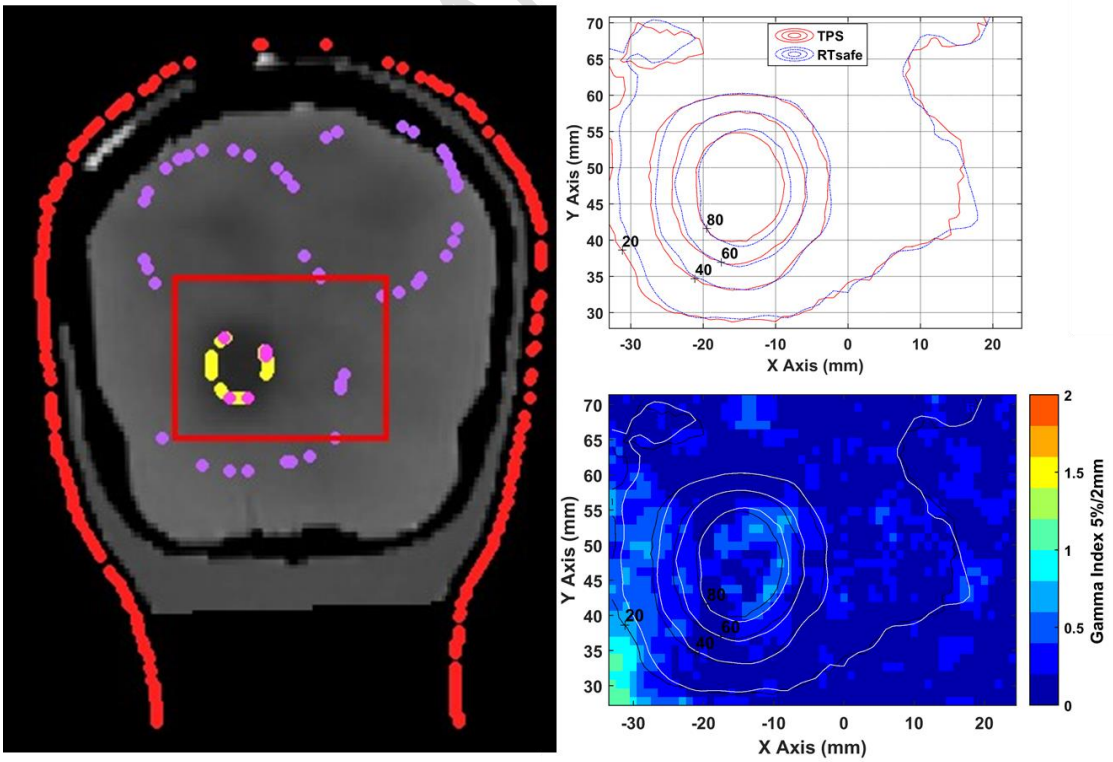

TPS
RTsafe
Y Axis (mm)
X Axis (mm)
Gamma Index 5%/2mm

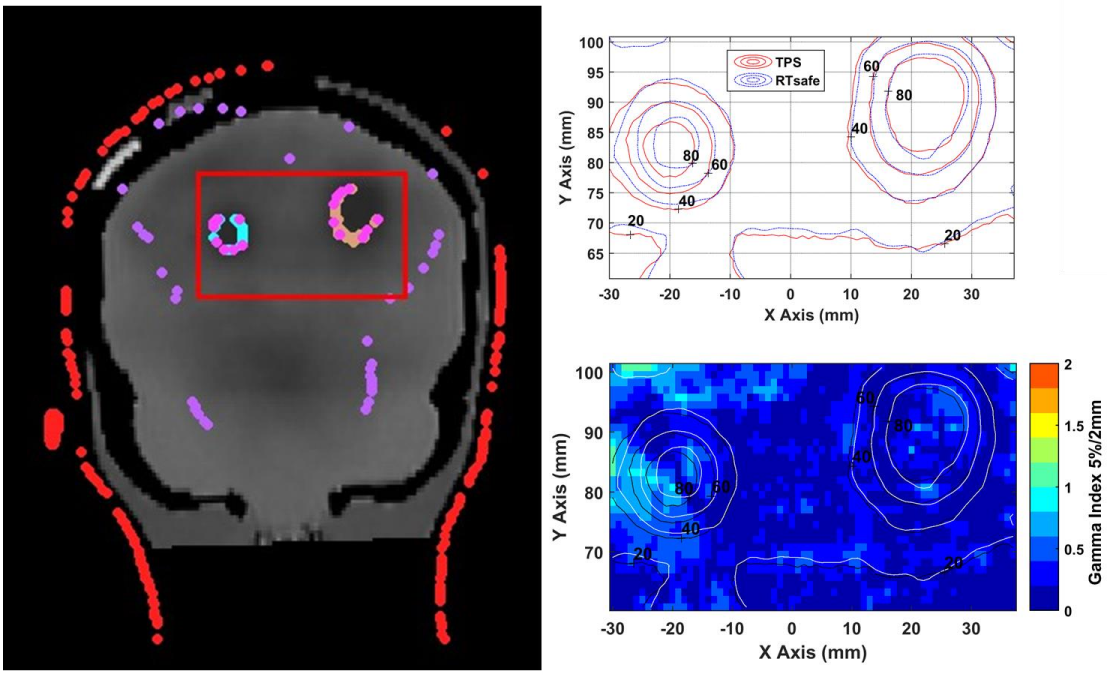

TPS
RTsafe
Y Axis (mm)
X Axis (mm)
Gamma Index 5%/2mm

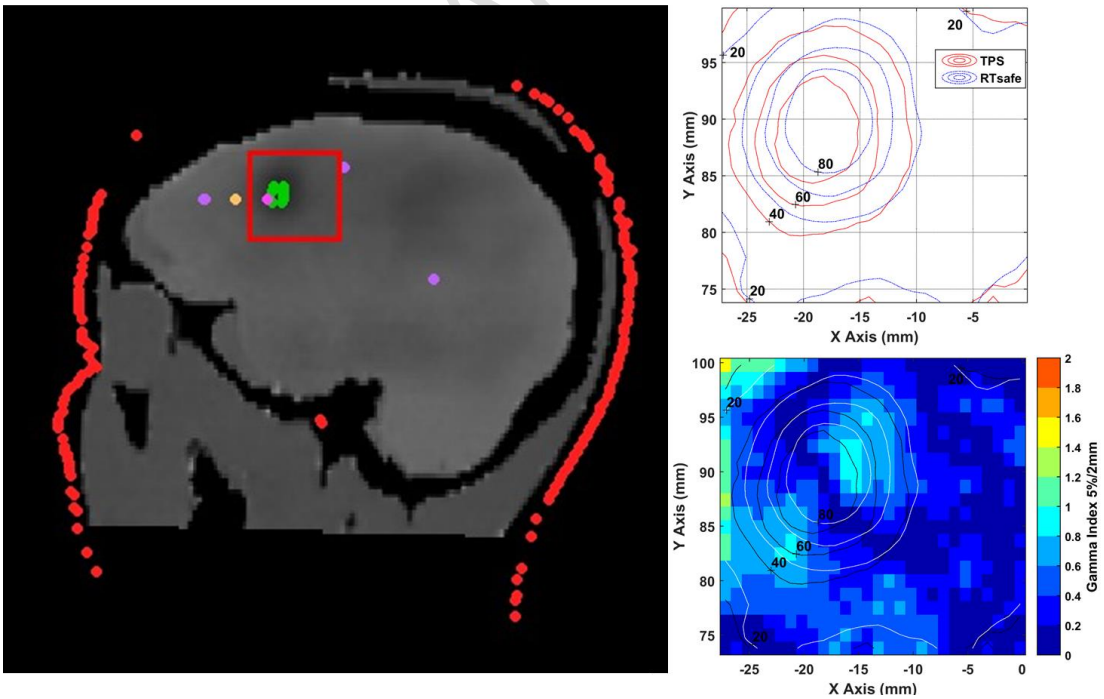

TPS
RTsafe
60
80
40
Y Axis (mm)
X Axis (mm)
Gamma Index 5%/2mm


TPS
RTsafe
80
60
40
20
Y Axis (mm)
X Axis (mm)
Gamma Index 5%/2mm


TPS
RTsafe
20
80
60
40
Y Axis (mm)
X Axis (mm)
Gamma Index 5%/2mm


TPS
RTsafe
20
80
60
40
Y Axis (mm)
X Axis (mm)
Gamma Index 5%/2mm


TPS
RTsafe
Y Axis (mm)
X Axis (mm)
Gamma Index 5%/2mm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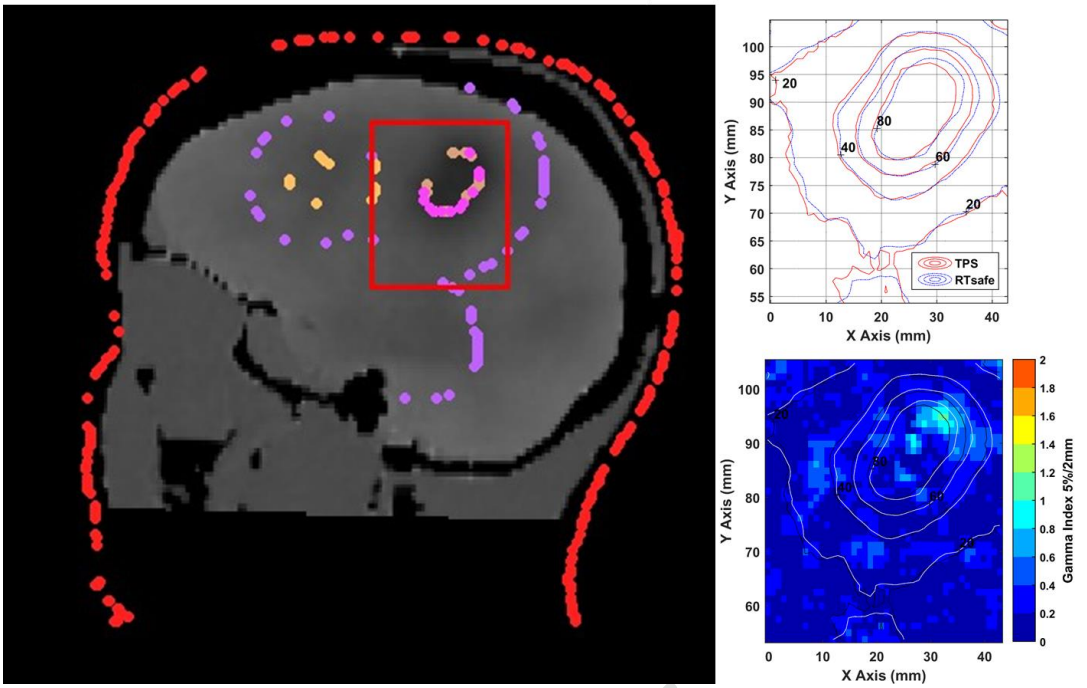
RTsafe
Y Axis (mm)
X Axis (mm)
Gamma Index 5%/2mm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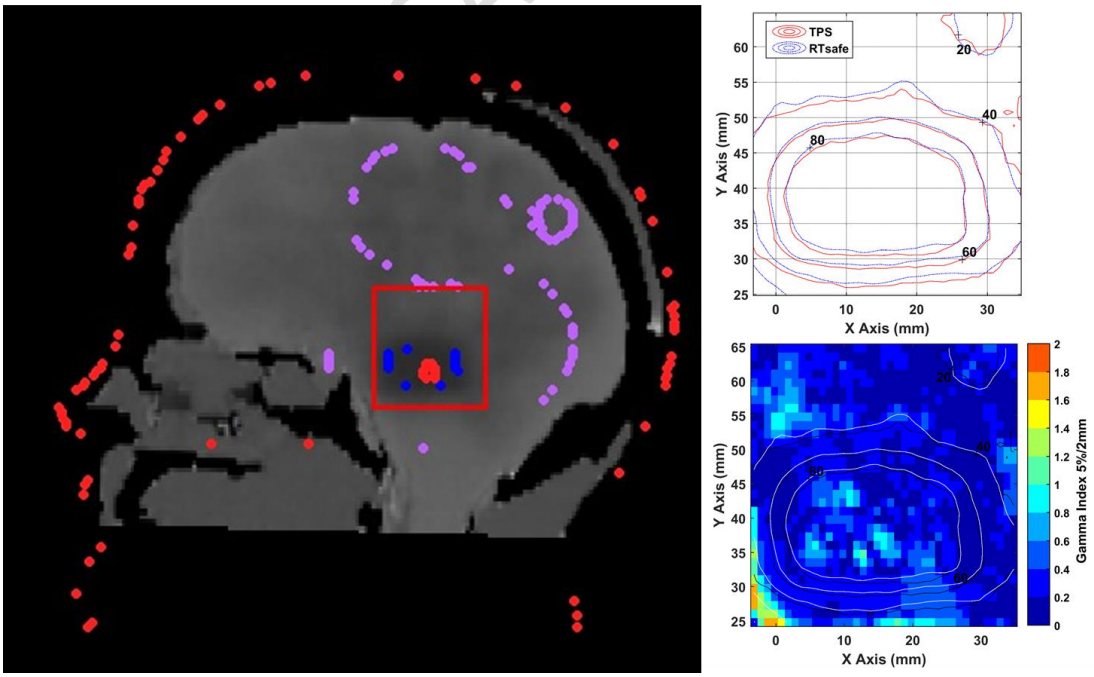
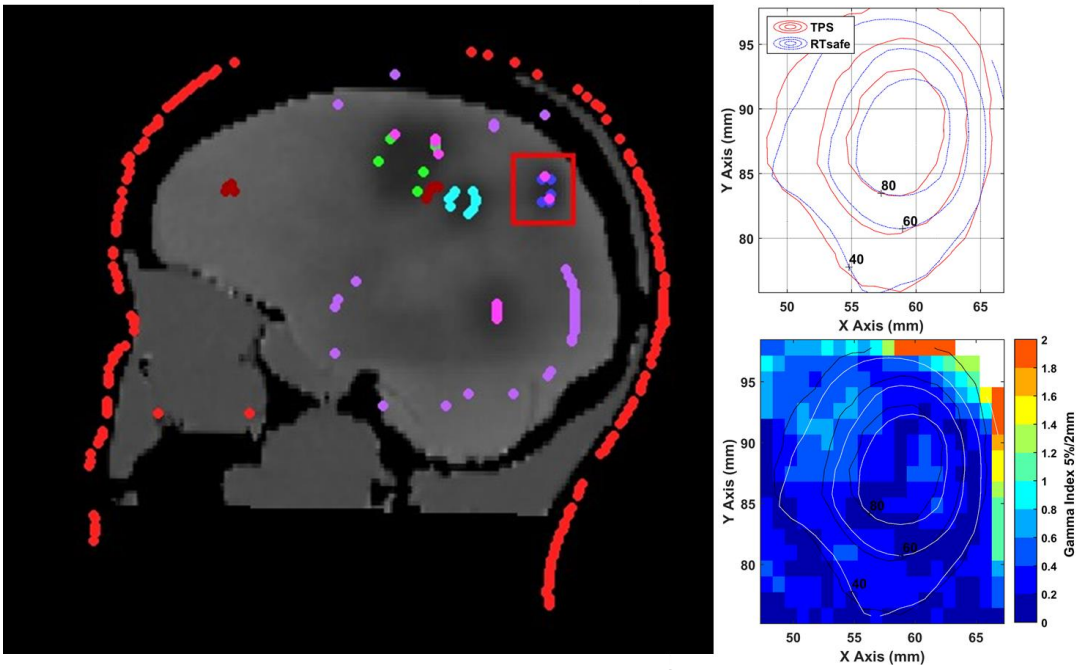
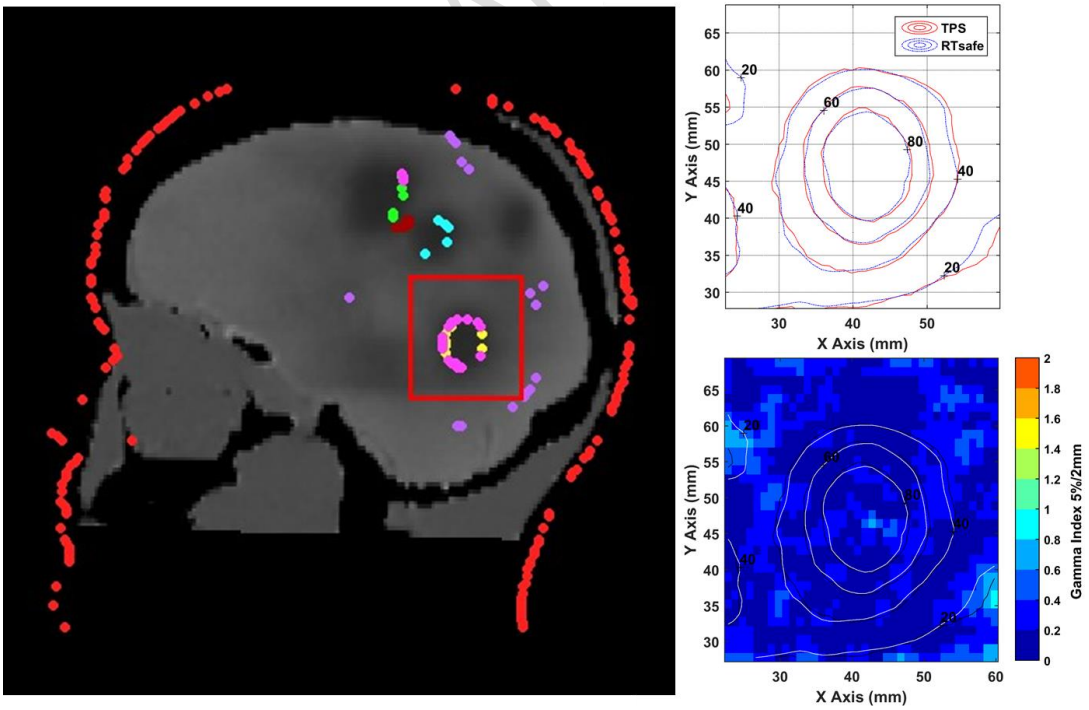
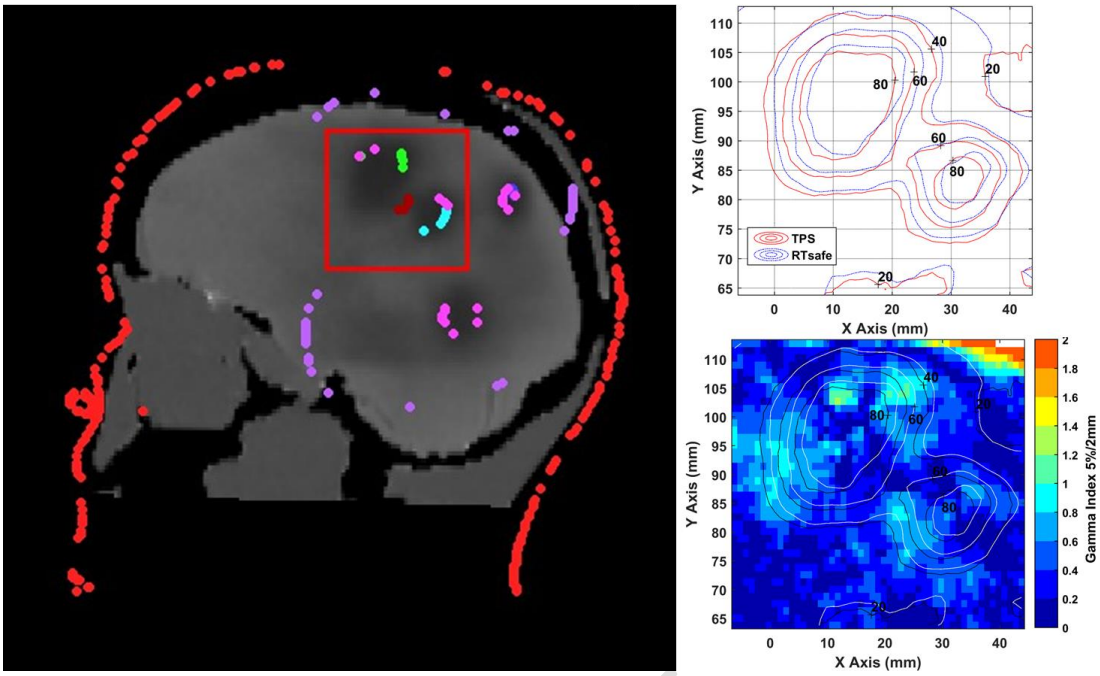
RTsafe
Y Axis (mm)
X Axis (mm)
Gamma Index 5%/2mm


TPS
RTsafe
Y Axis (mm)
X Axis (mm)
Gamma Index 5%/2mm


TPS
RTsafe
Y Axis (mm)
X Axis (mm)
80
60
40
Gamma Index 5%/2mm


TPS
RTsafe
Y Axis (mm)
X Axis (mm)
20
60
80
40
Gamma Index 5%/2mm



PART IV: *3D Gamma Index comparison*

Gamma index calculations were also performed in 3D using a variety of passing criteria and a low-dose cut off threshold of 1%. For the indicative targets considered, gamma index comparison was performed within a volume of interest that includes the target(s) along with an extended region of surrounding soft tissue, after locally normalizing each distribution. Corresponding results are summarized in the following table. Moreover, histograms of the corresponding 3D gamma values are given in the following figures.

Table: Results for the 3D gamma index test, comparing gel-measured (reference) with the TPS-calculated (evaluated) dose distributions using a variety of passing criteria. Note that the volume of interest considered for each target includes the total contoured volume along with an extended area of surrounding soft tissue.

Structure	Passing criteria		Passing Rate
	DTA (mm)	DD (%)	GI≤1 (%)
FilmTarget	2	5	98.59
	1	5	96.31
	2	3	96.94
T1-13mm	2	5	99.15
	1	5	85.53
	2	3	95.74
T2-21mm	2	5	99.93
	1	5	99.39
	2	3	99.66
T3-6mm	2	5	99.57
	1	5	89.42
	2	3	98.85
T4-25mm	2	5	97.02
	1	5	84.28
	2	3	94.76
T5-9mm	2	5	98.19
	1	5	89.52
	2	3	94.95
T6-17mm	2	5	99.92
	1	5	99.67
	2	3	98.81

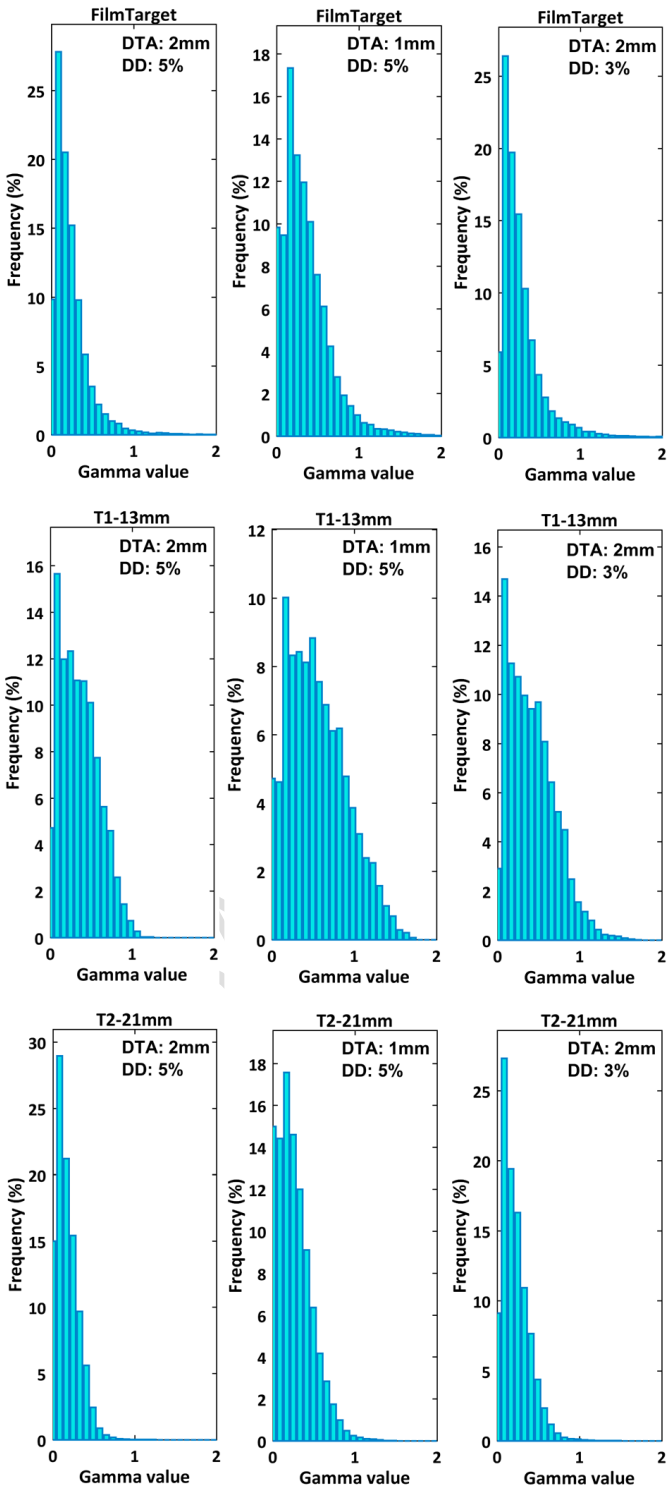
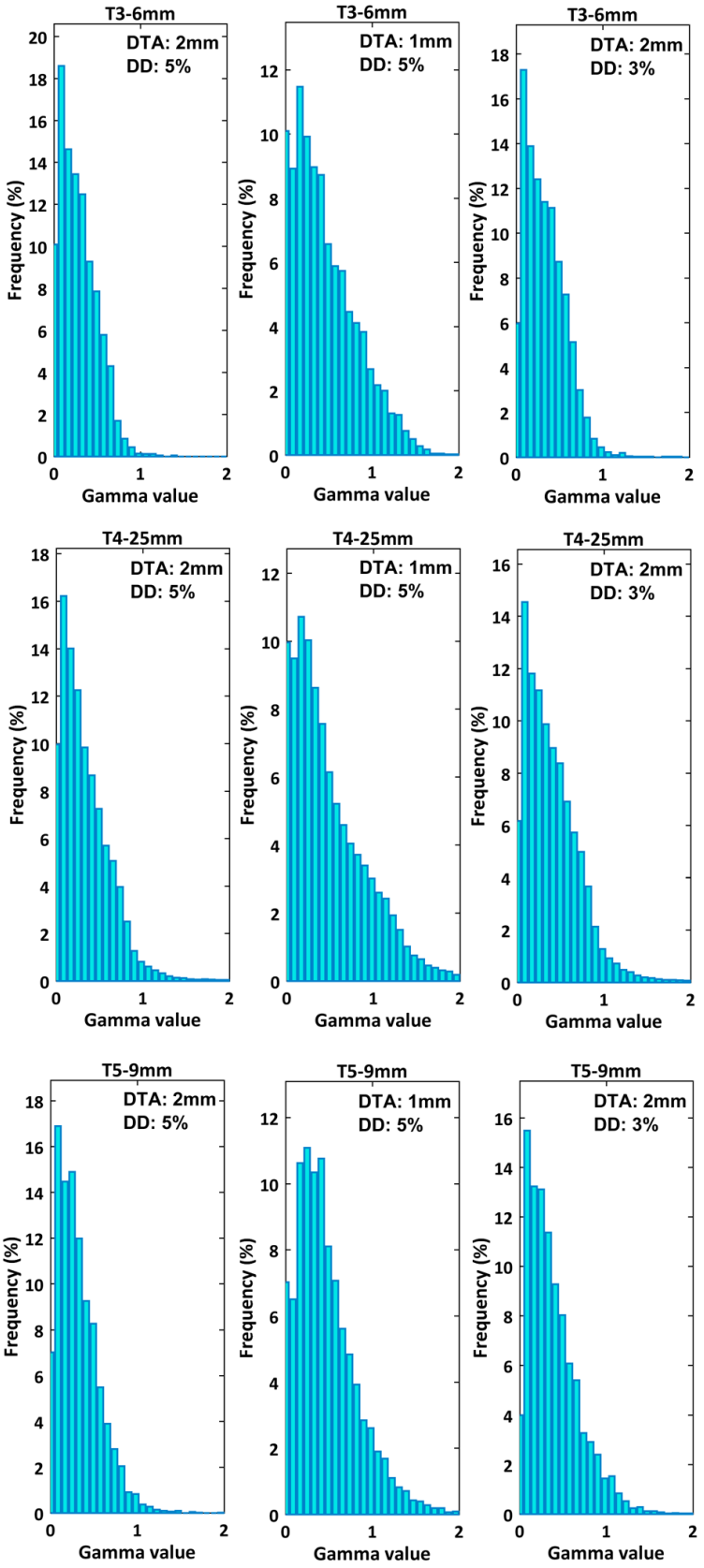
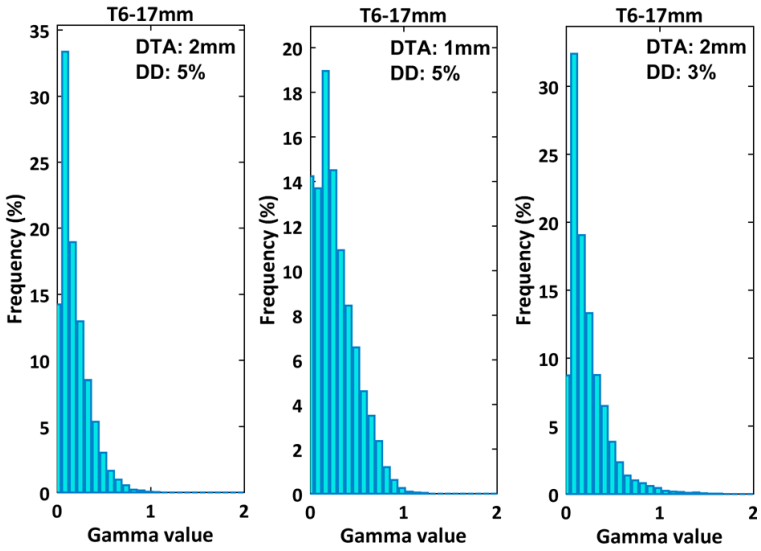


Figure: Histograms for the calculated gamma values of the 3D gamma index comparison test using a variety of passing criteria. The volume of interest considered for each target includes the total contoured volume along with an extended area of surrounding soft tissue.

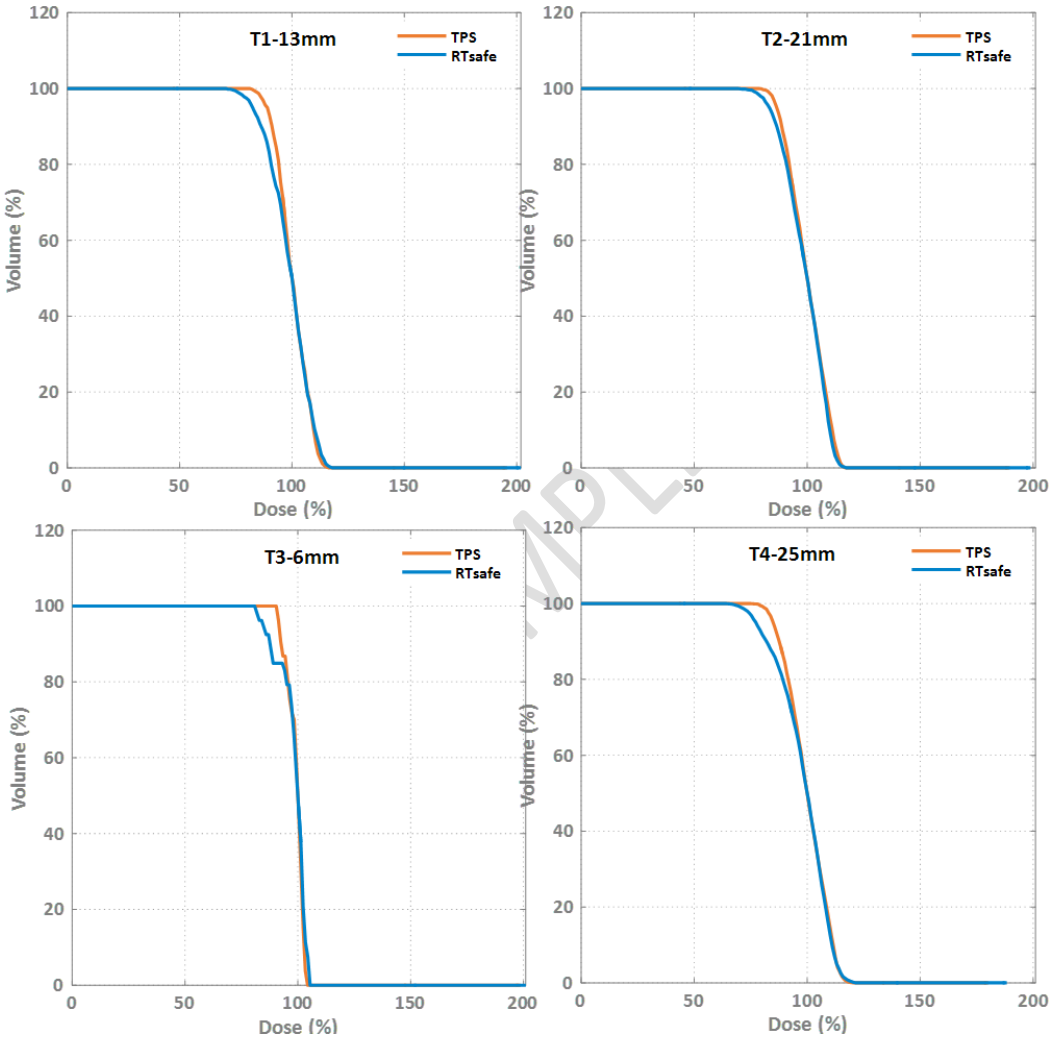
The same figure caption applies to all following figures in Part IV.


T3-6mm
DTA: 2mm
DD: 5%
T3-6mm
DTA: 1mm
DD: 5%
T3-6mm
DTA: 2mm
DD: 3%
T4-25mm
DTA: 2mm
DD: 5%
T4-25mm
DTA: 1mm
DD: 5%
T4-25mm
DTA: 2mm
DD: 3%
T5-9mm
DTA: 2mm
DD: 5%
T5-9mm
DTA: 1mm
DD: 5%
T5-9mm
DTA: 2mm
DD: 3%
Frequency (%)
Gamma value


T6-17mm
DTA: 2mm
DD: 5%
Frequency (%)
Gamma value
T6-17mm
DTA: 1mm
DD: 5%
Frequency (%)
Gamma value
T6-17mm
DTA: 2mm
DD: 3%
Frequency (%)
Gamma value

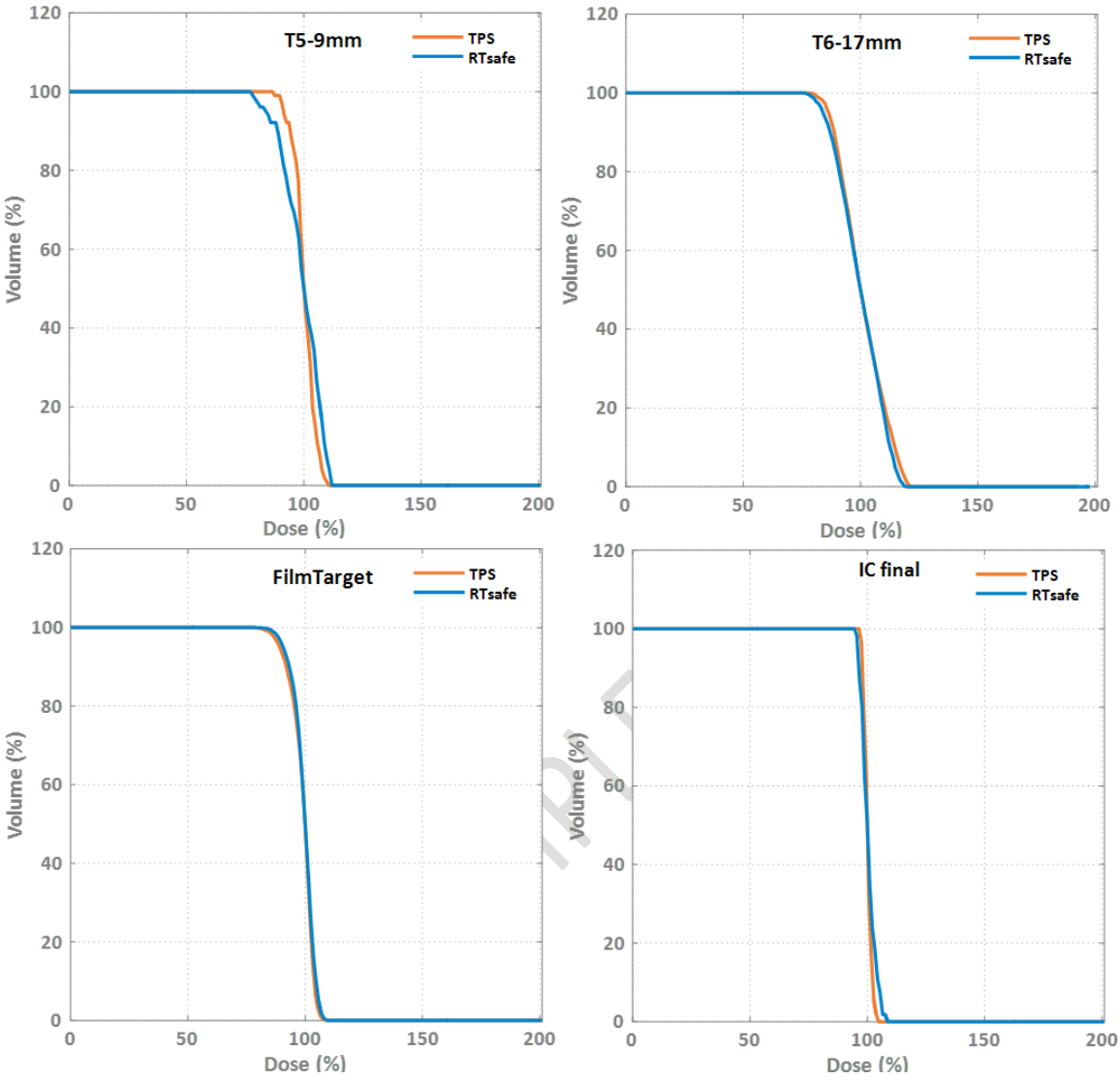
PART V: *DVH comparison*

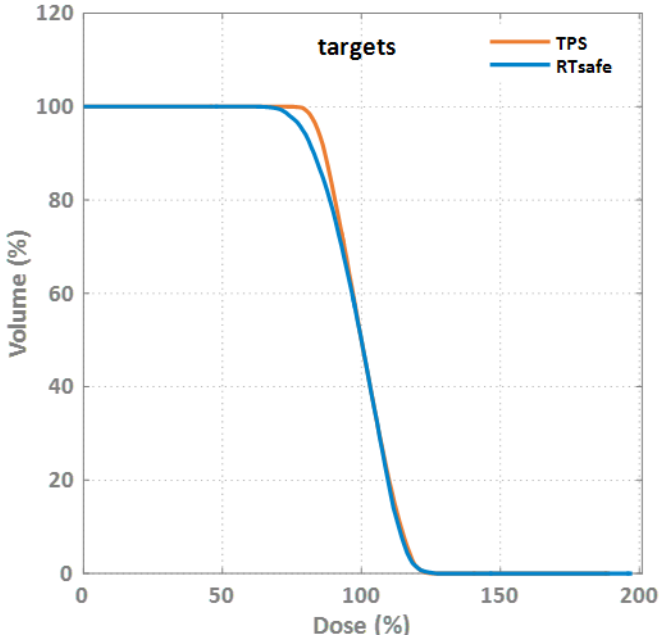
Comparison between planned and measured relative dose distributions is presented in the following figures, in terms of cumulative Dose Volume Histograms (DVHs) for all PTVs. All dose distributions were normalized to the corresponding $D_{50\%}$ metric (i.e., the minimum dose received by at least the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



Figures: cumulative Dose Volume Histograms derived 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.


T5-9mm
TPS
RTsafe
Volume (%)
Dose (%)
T6-17mm
TPS
RTsafe
Volume (%)
Dose (%)
FilmTarget
TPS
RTsafe
Volume (%)
Dose (%)
IC final
TPS
RTsafe
Volume (%)
Dose (%)


targets
TPS
RTsafe
Volume (%)
Dose (%)
120
100
80
60
40
20
0
0
50
100
150
200

PART VI: *DVH metrics comparison*

Using the aforementioned normalization (100% corresponds to $D_{50\%}$), metrics derived from the above DVHs are given in the following table.

Table: Indicative dose volume metrics for the structures considered.

	Mean (%)		D95 (%)	
Structure	**TPS**	**Meas.**	**TPS**	**Meas.**
T1-13mm	100.15	98.87	88.98	82.43
T2-21mm	99.97	98.99	86.49	83.23
T3-6mm	99.00	98.21	91.63	84.24
T4-25mm	99.83	98.37	84.93	77.30
T5-9mm	100.14	99.27	91.31	83.80
T6-17mm	100.81	99.96	86.33	83.99
FilmTarget	98.87	99.41	89.14	90.61
targets	100.25	99.01	84.33	78.85
IC_final	100.09	100.24	97.58	95.87

2D Absolute Dosimetry (Film)

PART I: *1D comparison*

A number of absolute dose profiles for corresponding film-measured and TPS-calculated datasets are presented in the following figures.

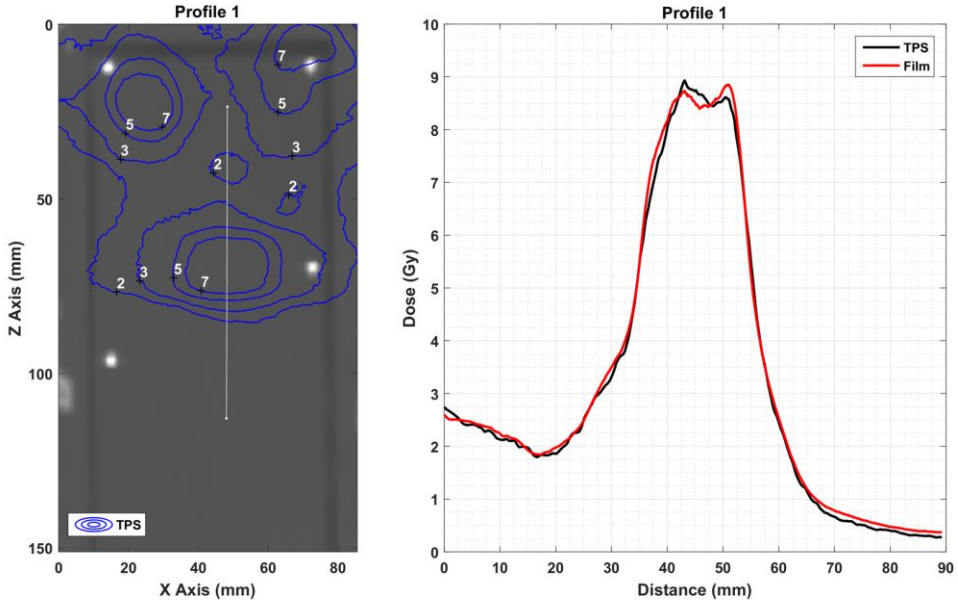
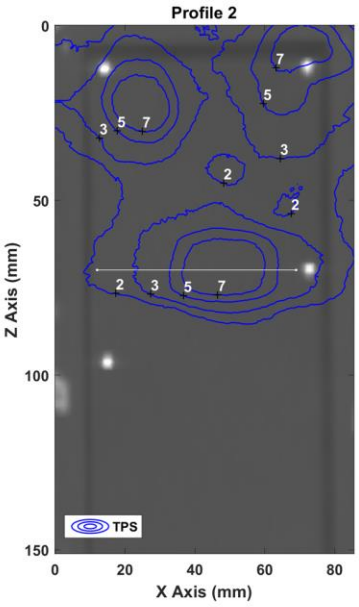
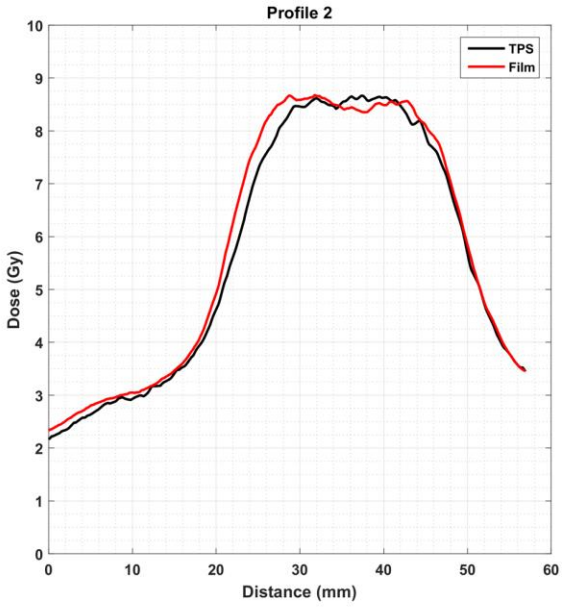
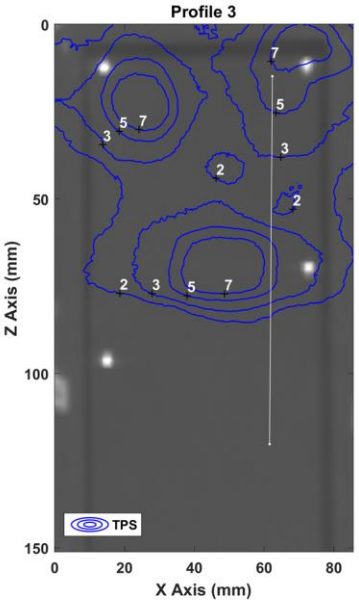


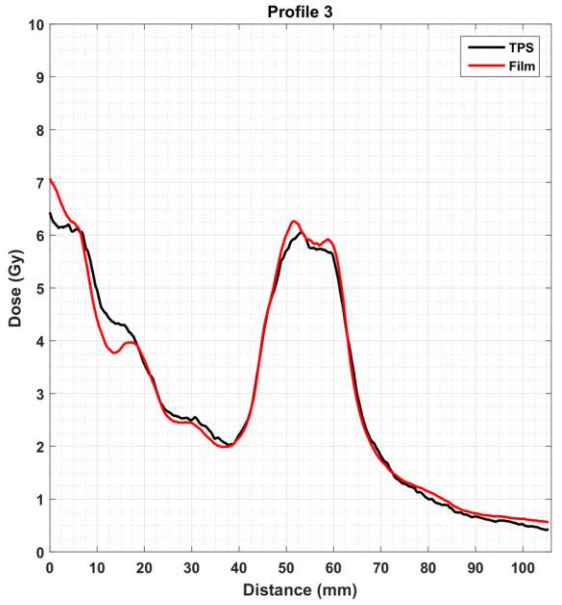
Figure: (left) Slice of the reconstructed CT scan of the film phantom. Contours correspond to TPS calculations in Gy (blue). (right) 1D profile comparison between calculated (TPS) and measured (Film) dose distributions at the location depicted by the white line.

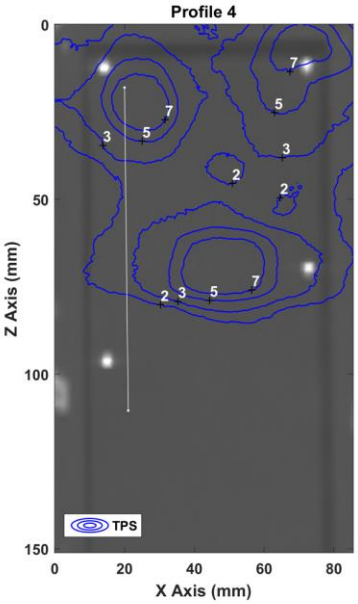
The same figure caption applies to all following figures in Part I.

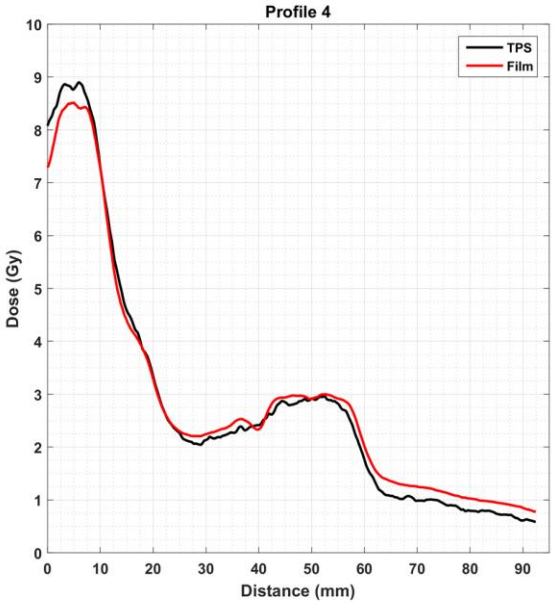

Profile 2
Z Axis (mm)
X Axis (mm)
TPS

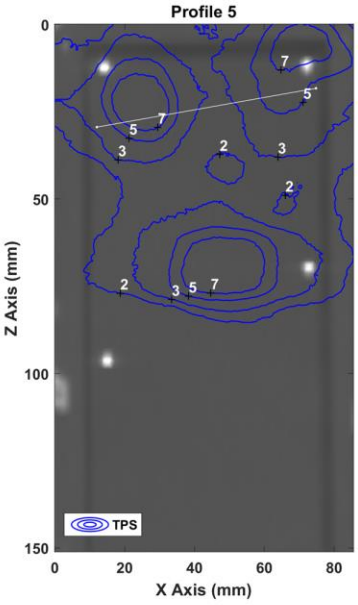

Profile 2
Dose (Gy)
Distance (mm)
TPS
Film

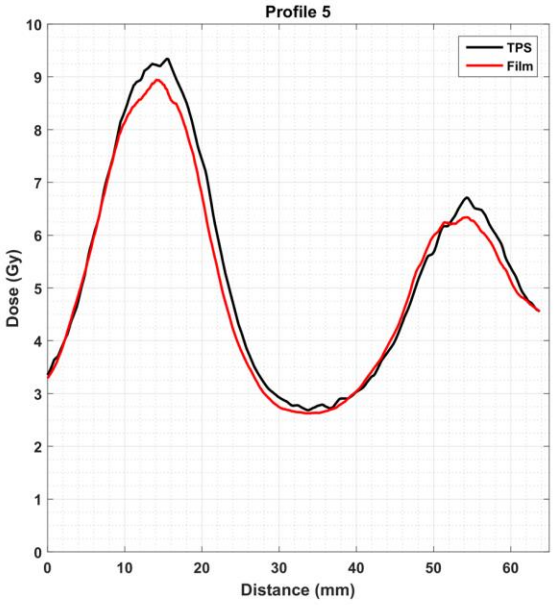

Profile 3
Z Axis (mm)
X Axis (mm)
TPS

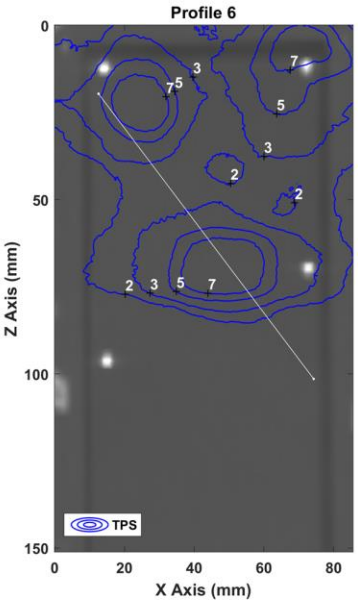

Profile 3
Dose (Gy)
Distance (mm)
TPS
Film

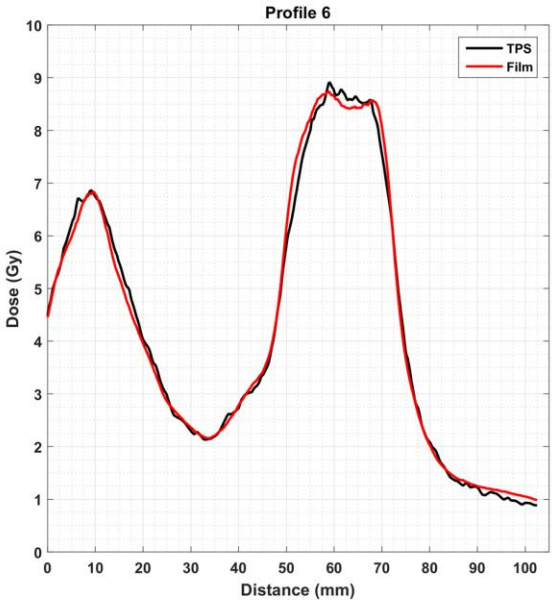

Profile 4
Z Axis (mm)
X Axis (mm)
TPS

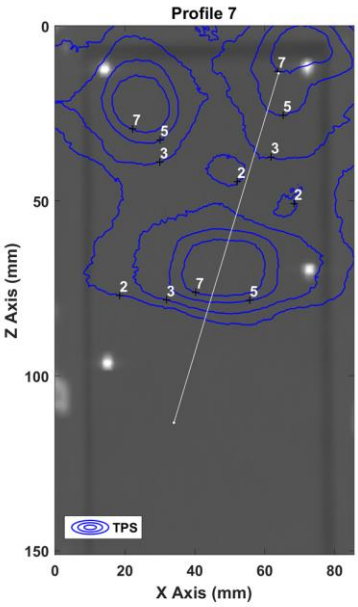

Profile 4
TPS
Film
Dose (Gy)
Distance (mm)

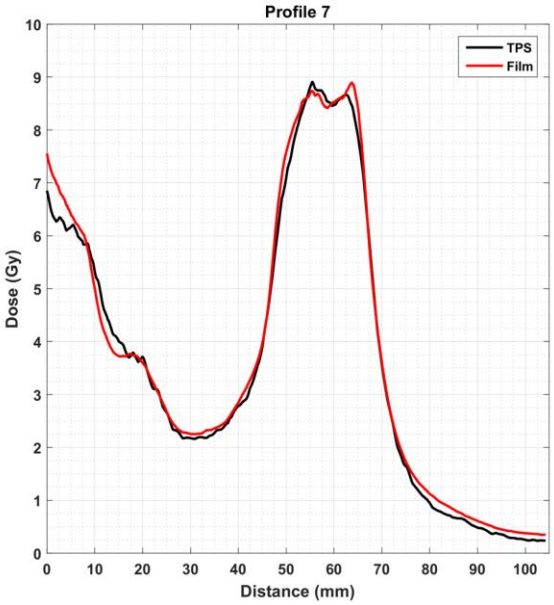

Profile 5
Z Axis (mm)
X Axis (mm)
TPS


Profile 5
TPS
Film
Dose (Gy)
Distance (mm)


Profile 6
Z Axis (mm)
X Axis (mm)
TPS


Profile 6
TPS
Film
Dose (Gy)
Distance (mm)


Profile 7
Z Axis (mm)
X Axis (mm)
TPS


Profile 7
TPS
Film
Dose (Gy)
Distance (mm)

PART II: *Gamma Index comparison*

For the slice between film insert slabs of the film phantom, 3D gamma index calculations (i.e., reference data: 2D film measurements, evaluated data: 3D TPS calculations) are presented in the following figure. Passing criteria were 3 mm distance-to-agreement and 3% dose difference, 2 mm and 3%, 1 mm and 3%, as well as 2 mm and 2%. Isodose lines are also plotted to assist comparison.

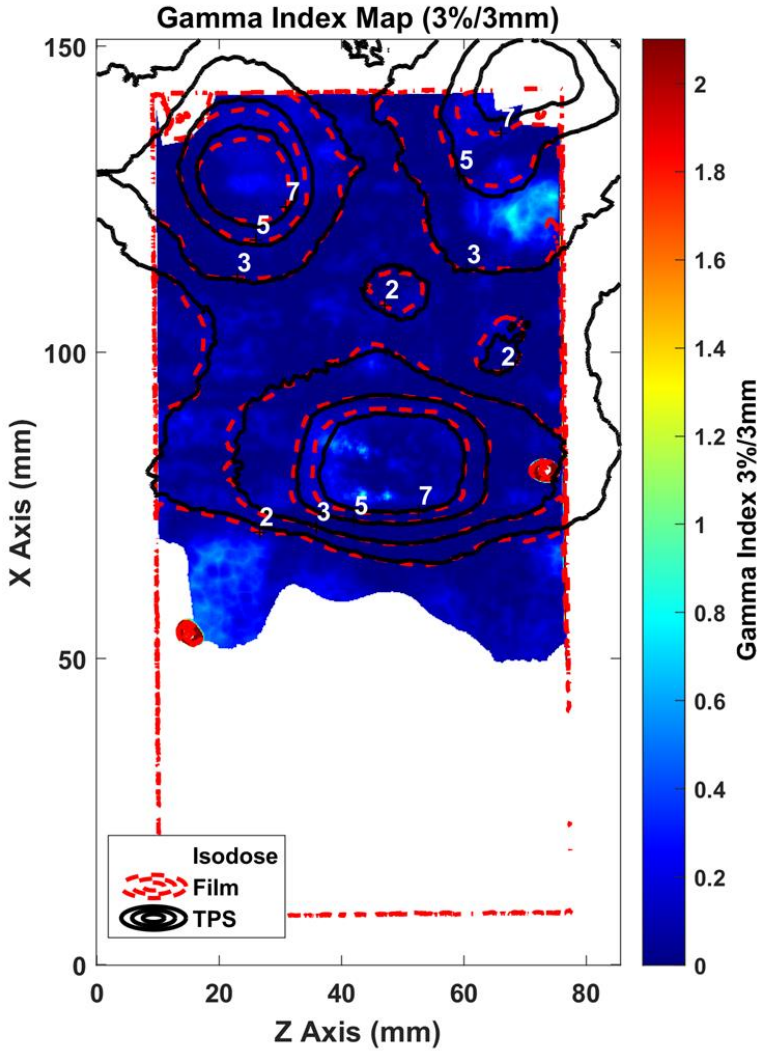


Figure: 2D comparison between calculated (TPS) and measured (Film) dose distributions in Gy values applying a threshold of 1 Gy. 3D gamma index calculations are given using passing criteria 3%/3mm.

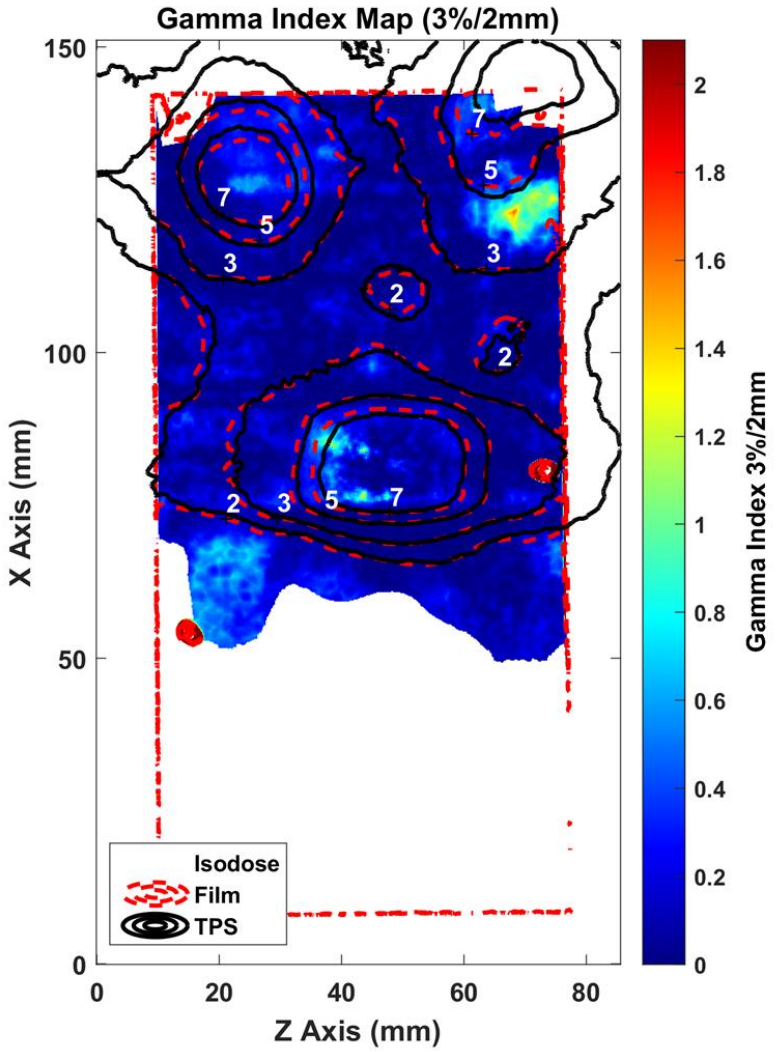


Figure: 2D comparison between calculated (TPS) and measured (Film) dose distributions in Gy values applying a threshold of 1 Gy. 3D gamma index calculations are given using passing criteria 3%/2mm.

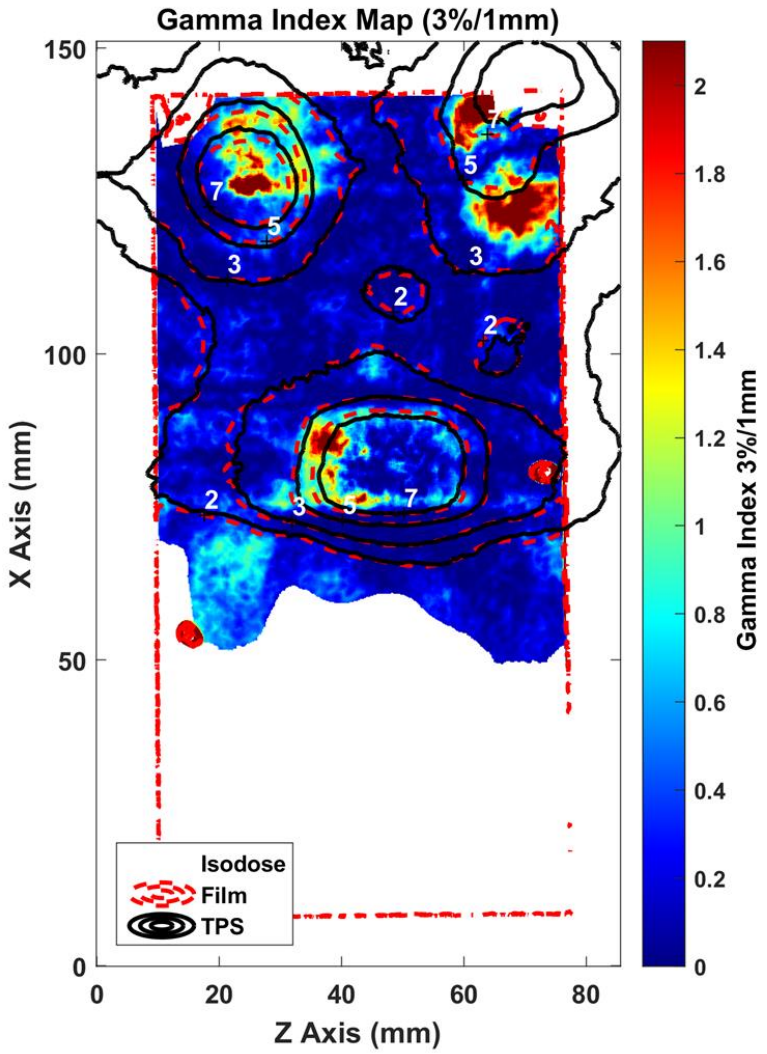


Figure: 2D comparison between calculated (TPS) and measured (Film) dose distributions in Gy values applying a threshold of 1 Gy. 3D gamma index calculations are given using passing criteria 3%/1mm.

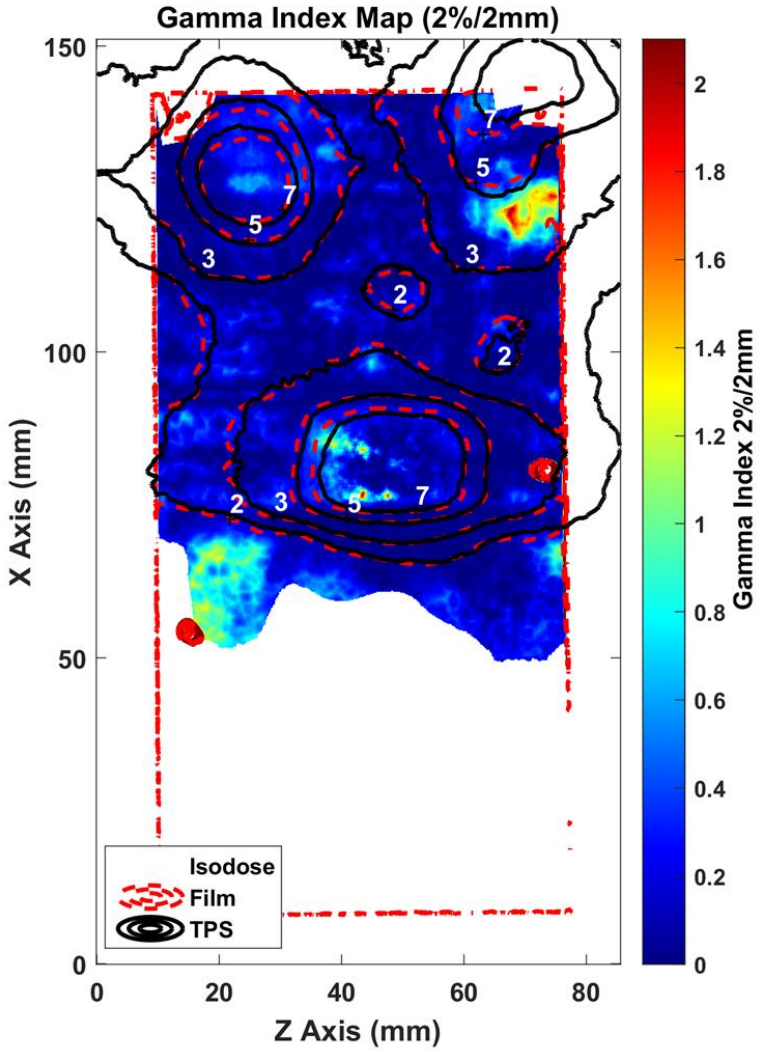


Figure: 2D comparison between calculated (TPS) and measured (Film) dose distributions in Gy values applying a threshold of 1 Gy. 3D gamma index calculations are given using passing criteria 2%/2mm.

Table: Results for the 3D gamma index test, comparing film-measured (reference) with the TPS-calculated (evaluated) dose distributions using a variety of passing criteria. Note that passing rates were calculated using a threshold of 1 Gy.

Passing criteria		Passing Rate
DTA (mm)	DD (%)	GI≤1 (%)
3	3	98.76
2	3	98.22
1	3	91.73
2	2	96.92

Point Absolute Dosimetry (Ion Chamber)

PART I: *Point dose comparison*

The ion chamber's sensitive volume was identified in the reference CT scan and a relevant structure (labeled as "IC_final") was contoured. Mean TPS calculated dose in the structure was compared against corresponding IC absolute dose measurements.

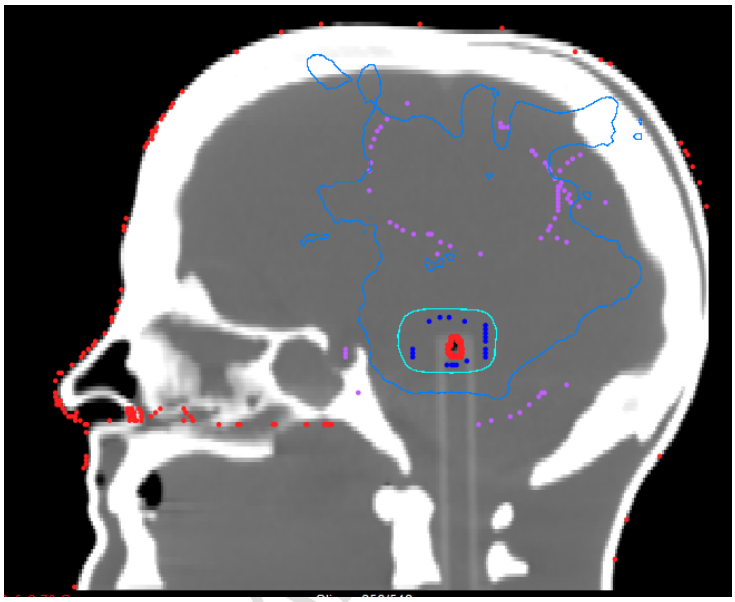


Figure: A central sagittal slice of the phantom CT scan. The contoured ion chamber sensitive volume is depicted in red. Blue contour corresponds to the "FilmTarget" PTV.

Table: Results for the absolute point dose comparison. Absolute ion chamber dose measurement (reference) is compared with the TPS-calculated (evaluated) mean dose in the "IC_final" contoured structure.

	Mean Dose (Gy)		Difference (%)
Structure	**TPS**	**Meas.**	
IC_final	8.337	8.412	0.9

Disclaimer

Results presented in this report were deduced based on an experimental procedure performed by the end-user following the guidelines of RTsafe stuff. 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 use of the results of this report. RTsafe does not suggest any specific actions for improving your radiotherapy treatment protocol. Interpretation of the presented results is entirely at your own risk.