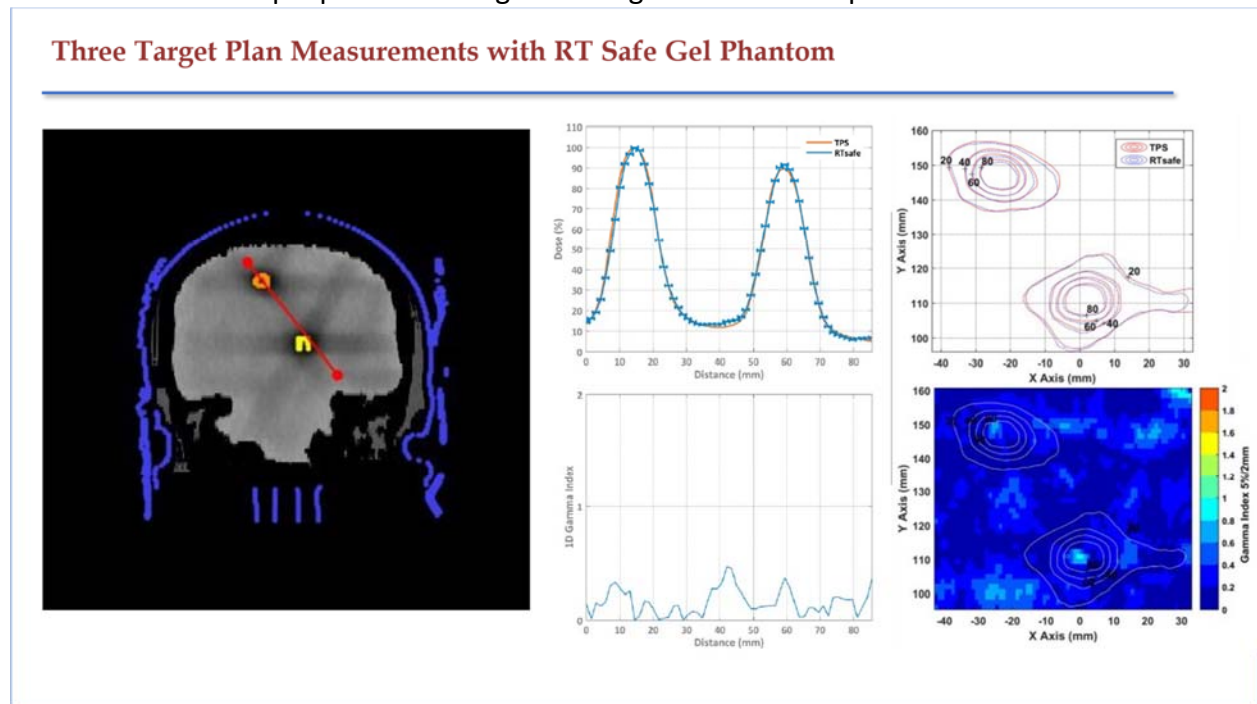


Thank you for the question. We use Multiple Mets Element and the question applies differently for MME vs. Cranial SRS. Given that the planning and delivery methods for MME are dynamic conformal arcs and not VMAT, our institutional policies now allow for reduction of the patient specific quality assurance to secondary independent calculations. With that said, we have done dosimetry for the first 12 MME patients that can be applied for the Cranial SRS Element as well.

The Brainlab MME uses Enhanced Dynamic Conformal Arc method. Multiple methods have been employed to validate the dosimetric and geometric accuracy of the MME system prior to clinical use. MME was validated to be locationally and dosimetrically accurate for clinical use. For the first 12 cases treated, we have performed extensive phantom measurements, including a validation using a 3D printed RTsafe phantom (RTsafe PC, Athens, Greece). Using patient's skull and internal anatomical bony structures, RTsafe prints a phantom that is filled with polymer gel dosimeter material. This method allows for 3D dosimetric validation.

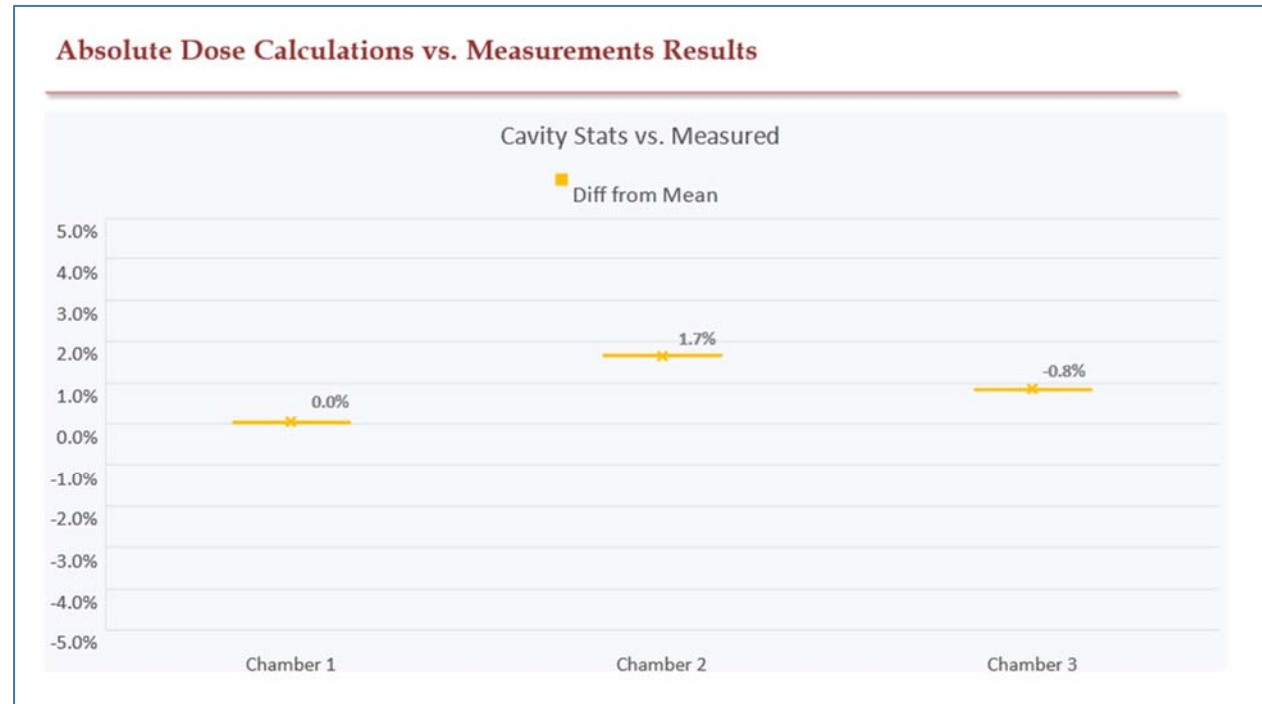
Here we show example profiles through two targets in a coronal plane.



Additionally, we made a decision to order a 3-D printed 3 ion chamber phantom, for most reliable absolute dosimetry measurements. This accommodates small ion chambers, but perhaps not appropriate for very small targets.

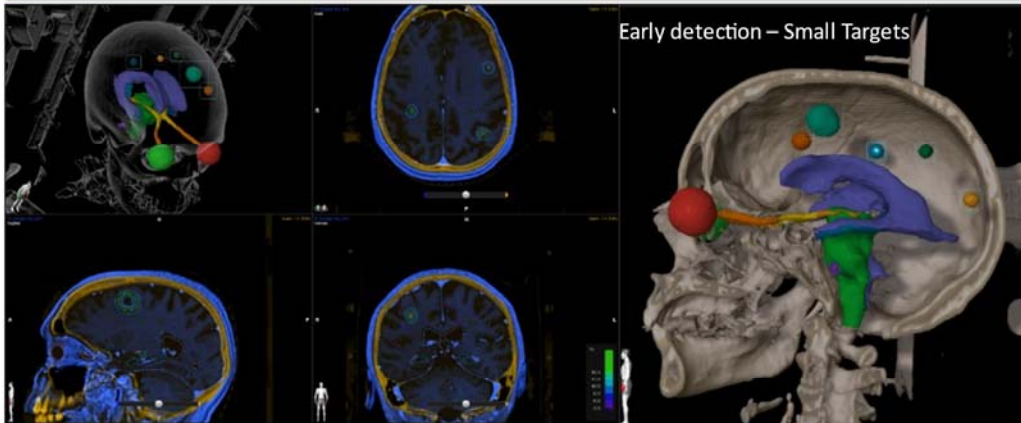


And here we show percent differences between the calculation and measurements. The maximum deviation from the three measurement from a specific plan to be less than 2%.



The clinical example below includes 5 metastases, 4 targets on the Left and one target on the Right. All targets were prescribed to 18Gy to cover 99% of these targets. Left Superior Frontal Target measured 2.6 cubic centimeter. The rest of the targets were smaller, less than ½ cubic centimeter

### Clinical Case - Five Metastases - 18 y.o. male with osteoblastic osteosarcoma



Object Name	Object Type DICOM	Dose / Fraction [Gy]	No. of Fractions	Prescribed Dose [Gy]	Prescribed Volume [%]	Volume [cm <sup>3</sup> ]	Size [cm]
1LAtFrnt	PTV	18.00	1	18.00	99.0	0.568	1.11
2LInPrtl	PTV	18.00	1	18.00	99.0	0.294	0.88
3LPrtl	PTV	18.00	1	18.00	99.0	0.230	0.80
4LSuFrnt	PTV	18.00	1	18.00	99.0	2.590	1.96
5RFrnt	PTV	18.00	1	18.00	99.0	0.337	0.92

Two larger targets were measured with an Ion Chamber  
Left Superior Frontal Target was prescribed 18Gy and the ion chamber measurement shows agreement within 3%.

### Ion Chamber Measurements for Brain Metastases - Five Mets

Beams	MU	Calculated Dose (Gy)	Ion Chamber Reading	Measured Dose (Gy)	% Diff
1	1124	7.4200	2.8330	7.2449	-2.42
2	1432	9.0200	3.4420	8.8023	-2.47
3	1466	0.0800	0.0330	0.0844	5.20
4	1162	0.1400	0.0439	0.1123	-24.70
5	675	0.0400	0.0100	0.0256	-56.41

Left Superior Frontal Target (2.59cc)

Total Dose	5859	16.7000	6.3619	16.2695	-2.65
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Beams	MU	Calculated Dose (Gy)	Ion Chamber Reading	Measured Dose (Gy)	% Diff
1	1124	6.6600	2.5800	6.5979	-0.94
2	1432	0.3600	0.1848	0.4726	23.82
3	1466	8.8800	3.2810	8.3906	-5.83
4	1162	0.0800	0.0260	0.0665	-20.32
5	675	0.0200	0.0064	0.0164	-22.20

Left Anterior Frontal Target (0.568cc)

Total Dose	5859	16.0000	6.0782	15.5440	-2.93
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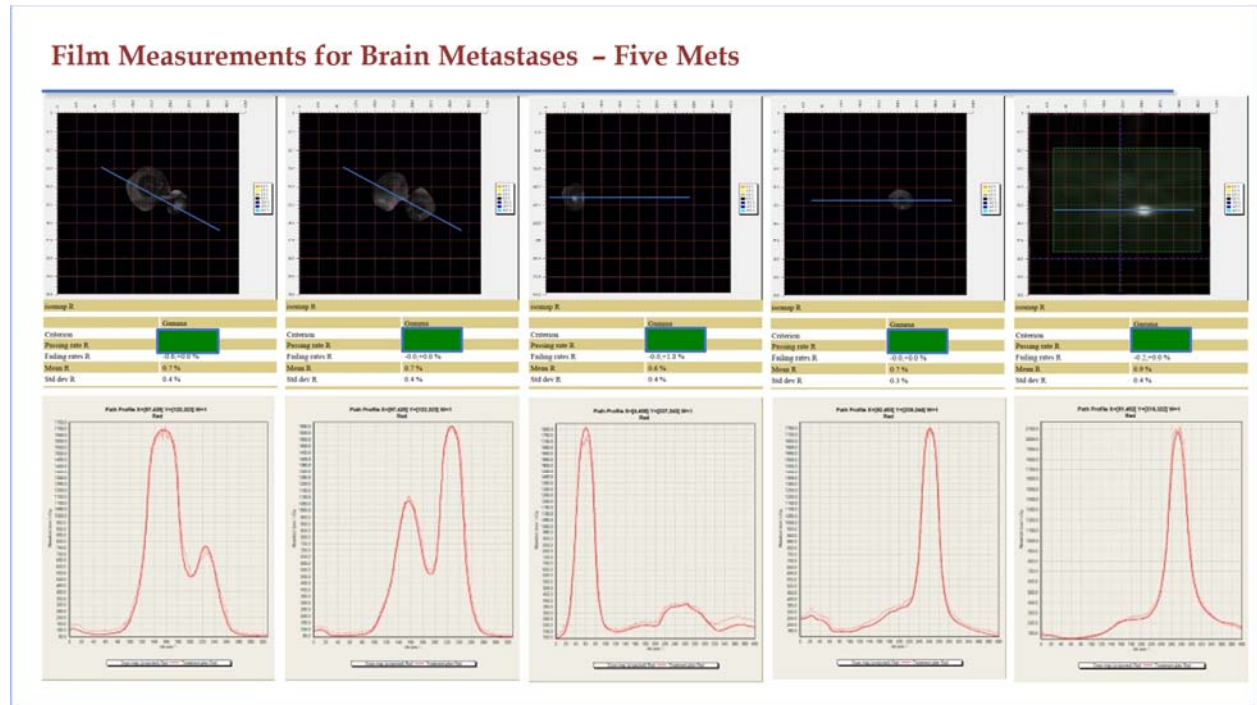
Object Name	Object Type DICOM	Dose / Fraction [Gy]	No. of Fractions	Prescribed Dose [Gy]	Prescribed Volume [%]	Volume [cm <sup>3</sup> ]	Size [cm]
1LAtFrnt	PTV	18.00	1	18.00	99.0	0.568	1.11
2LInPrtl	PTV	18.00	1	18.00	99.0	0.294	0.88
3LPrtl	PTV	18.00	1	18.00	99.0	0.230	0.80
4LSuFrnt	PTV	18.00	1	18.00	99.0	2.590	1.96
5RFrnt	PTV	18.00	1	18.00	99.0	0.337	0.92

With that said

All five targets were measured with EBT XD Film

We are showing absolute dose comparisons with excellent 1D profile results and

All five targets pass 2D Gamma with 2mm and 2% criteria better than 98%



I hope some of this information may be useful for you and your customers.