Comparative Performance Evaluation of two liquid ion detector arrays in Single-Isocenter Multiple Metastasis Stereotactic Radiosurgery

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1. Backround-Aim

Multiple metastases single isocenter stereotactic radiosurgery (SI-SRS) presents unique challenges in accurately targeting and delivering radiation doses to several small, discrete lesions within the brain. The efficacy of SI-SRS demands patient specific quality assurance (PSQA) measurements, where detector arrays play a pivotal role in verifying the accuracy of dose delivery.

o **This study aims to compare the performance of two advanced detector arrays in the context of multiple metastases SRS by evaluating their overall performance in dose measurement.**
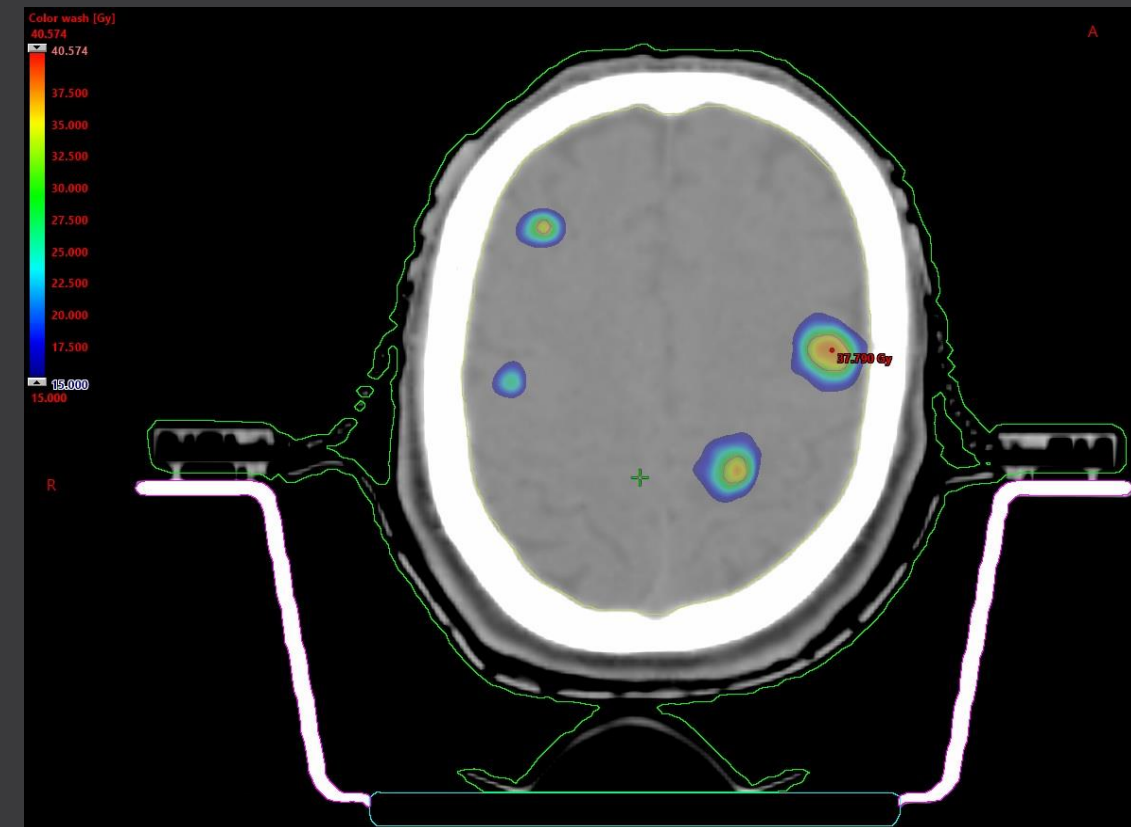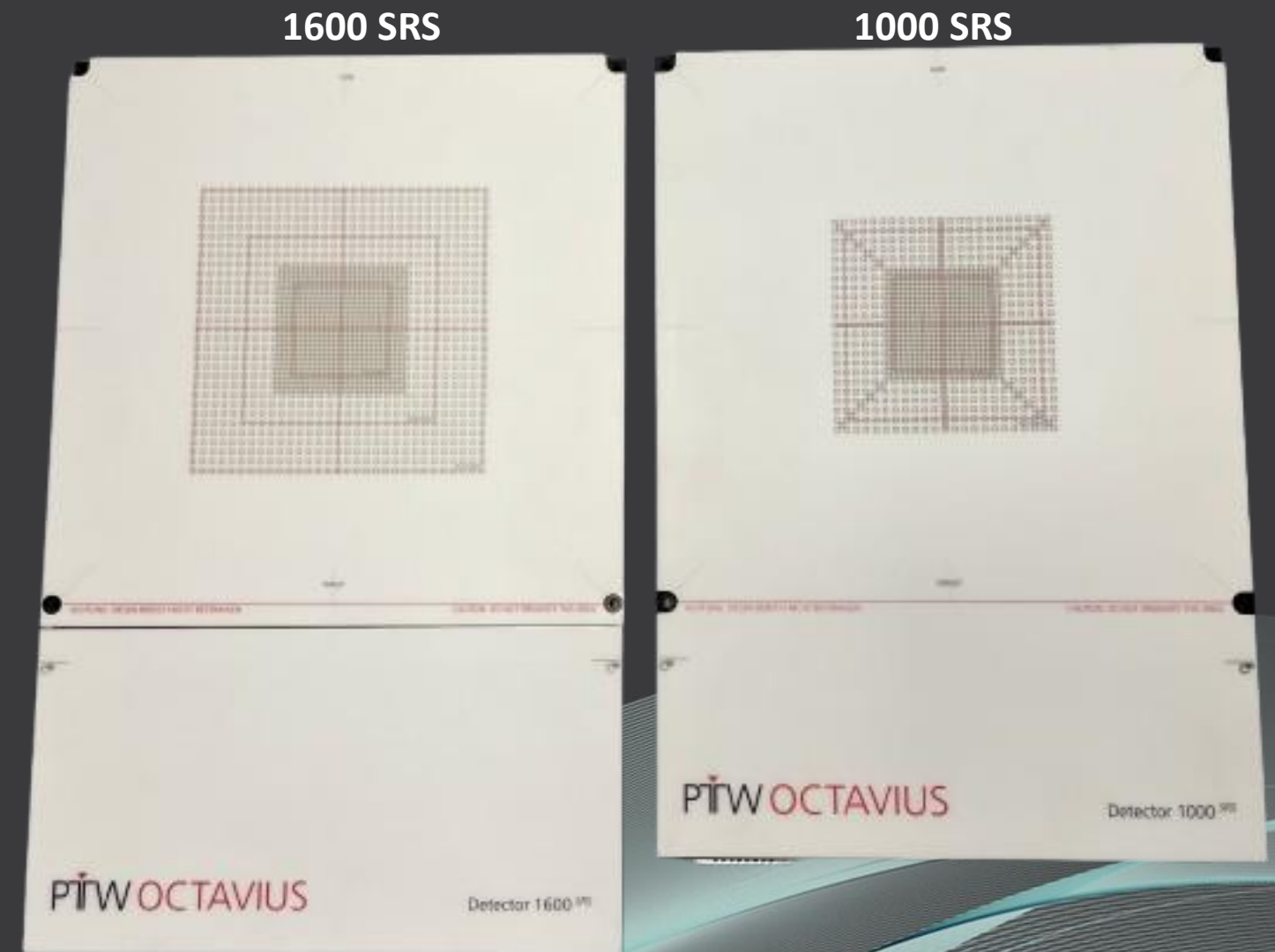
2. Materials & Methods

PTW 1600SRS and 1000SRS liquid ion chamber arrays were evaluated in terms of:

- Accuracy
- Reproducibility
- Linearity
- Dose rate
- Field size dependence with reference field size of 5x5cm2.

PSQA was performed for ten SI-SRS cases with two to ten metastases, comparing the g-passing-rates (GPR) with 5%, 1mm acceptance criteria and a cut-off threshold of 10%.

1600 SRS

1000 SRS

3. Results

1000 SRS

- Accuracy was 4.7%
- Coefficient of variation was 0.1%
- Slope of linear equation was 0.9619
- Maximum dose rate variation from 800 to 1400 MU/min was 0.57%
- Maximum dose variation dependent on field size was 3.53% at 2x2cm2
- GPR median values was 97.4% (92.4%-98.7%)

1600 SRS

- Accuracy was 2.2%
- Coefficient of variation was 0.022%
- Slope of linear equation was 0.9936
- Maximum dose rate variation from 800 to 1400 MU/min was 1.11%
- Maximum dose variation dependent on field size was -4.27% at 2x2cm2
- GPR median values was 97.3% (93%-99.4%)

Patients	Octavius 1000	Octavius 1600
	1mm/5%	1mm/5%
1	92,4	93
2	97,4	97
3	98	95,4
4	97,3	96,8
5	97,4	97,6
6	98,6	99,4
7	98,7	98,7
8	97,1	98
9	95,4	97,1
10	98,7	98,9

No statistical significance was found for the GPR differences of the two arrays.

4. Conclusions

Both detector arrays demonstrated high accuracy and reproducibility, with the 1600SRS exhibiting slightly better accuracy and linearity.

The GPR were comparable for both arrays.

Both detector arrays are suitable for clinical use in SI-SRS. The 1600SRS may offer a slight advantage in certain aspects of dose measurement and verification in terms of the larger effective area of measurement.