



Benefit of large area array without discrete detector spacing for SRS/SBRT QA vs. smaller arrays with low detector density

This document demonstrates that the large area myQA® SRS detector array provides efficiency for SRS/SBRT patient QA without compromising measurement resolution. Film-equivalent SRS plan verification is performed with the myQA® SRS detector according to current PQA standards and recommendations. No additional workload associated with film dosimetry or usage of smaller area arrays is needed.

Background

Measurement-based patient QA performed with an electronic detector device compares calculated dose distribution from the treatment planning system with measurement performed on the treatment device (linac). Best practices in patient QA procedures are established from multi-center research studies and have been presented to the medical physics community.¹

In the United States, ACR accreditation requires conformance with AAPM TG-218 recommendations² in patient QA procedures. Safe delivery of patient SRS treatments is of the utmost importance, therefore it is essential to comply with these recommendations when choosing SRS dosimetry equipment.

This document shows how myQA® SRS increases the efficiency of stereotactic plan verification compared to smaller arrays and is compliant with selected best practices¹ in patient-specific QA and TG-218 recommendations.

“Patient-specific QA of new . . . techniques or class solutions should be evaluated using measurement devices with high dosimetric accuracy and high spatial resolution.”¹

Below find a summary of the key characteristics of myQA® SRS vs. smaller arrays with low detector density over the measurement area.

myQA® SRS

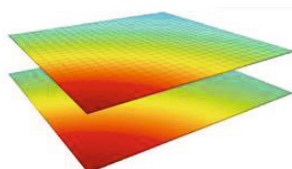
12 × 14 cm² field size

105,000 measurement points

0.4 mm² single detector size

Zero spacing between detectors

Measurement with film resolution and 100% coverage of the active area



Alternative detector array solutions

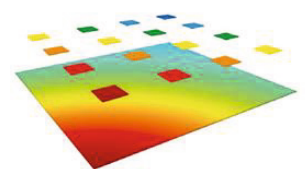
6.5 to 7.7 cm² field size

700-1,100 measurement points

0.48 - 2.5 mm² single detector size

2.47 to 2.5 mm detector spacing

Measurement resolution worse than film and limited coverage of the detector area



This comparison clearly shows that myQA® SRS complies with the recommendation and is the best choice for commissioning, clinical implementation, and routine SRS plan verification with high dosimetric accuracy.^{3,4}

Here we consider the clinical example of multiple brain metastases.

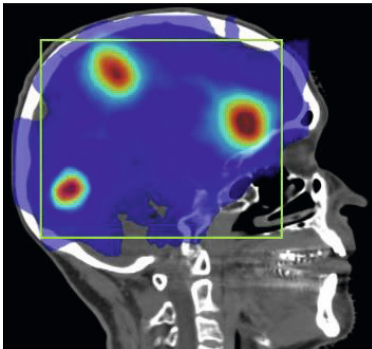
SRS/SBRT treatments are not only about delivering very high doses to the targets with high accuracy and precision; they are also about respecting very strict dose constraints for the organs at risk such as healthy brain tissue, brainstem, and optic nerves.

One of the recommendations for PQA best practices¹ states:

“The patient-specific QA detector should be set up to maximize measurement of the relevant clinical region.”¹

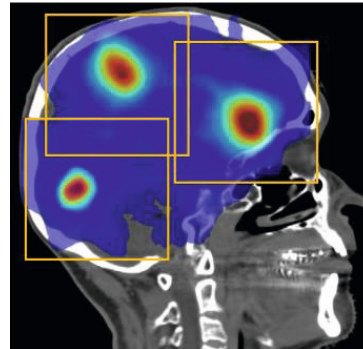
Measurement of both the high and low doses is essential for stereotactic plan QA; even doses within 10% of the plan maximum are already significant in the SRS treatment delivery.

myQA[®] SRS



Sagittal view of the brain with multiple targets. myQA[®] SRS active area superimposed as rectangle in green.

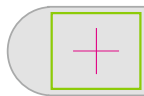
Alternative detector array solutions



Sagittal view of the brain with multiple targets. Yellow rectangles depict three positions of the smaller size detector array needed to cover all targets and correspond to three different measurement setups.

One detector setup

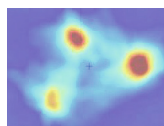
Deliver one plan to the detector in isocenter²



One measurement for all clinically relevant areas (high and low doses)

Reduce time for analysis with only one QA plan calculation

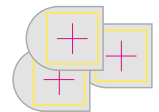
Evaluate whole dose distribution once with film-like resolution



Faster than film, save linac time, and treat more patients

Multiple detector setups

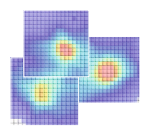
3 QA plans delivered with isocenter shift



3 separate measurements, each capturing part of the clinically relevant area

Spend more time with 3 QA plan calculations

More time for analysis of the discrete dose "patches" **in low resolution**



Three times longer QA compared to film, valuable machine time spent on QA

Conclusion

myQA[®] SRS maximizes efficiency of stereotactic QA measurements for the whole clinically relevant region for the plans delivered in a true composite setup as recommended by TG-218 and best practices in patient QA. For this typical example linac time for SRS patient plan verification is reduced by 67% compared to using smaller arrays.

Additional benefits for verification accuracy and precision are provided by a single measurement with film-like resolution.

For further information, see the following references:

- 1) Best Practice Guidance for Patient-Specific Quality Assurance for IMRT and VMAT Plan Delivery Verification. AAPM Virtual Meeting. Chan G. 07/12/20; 301363; PO-GeP-P-97
- 2) Report No.218 -Tolerance Limits and Methodologies for IMRT Measurement-Based Verification QA: Recommendations of AAPM Task Group No. 218 [2018]
- 3) A.Rusnak et al. Evaluation of a new high-resolution digital detector array for SRS and SBRT quality assurance. AAPM 2021
- 4) C. Stepanek et al. Clinical evaluation of the myQA[®] SRS detector for stereotactic body radiotherapy plan verification PH-0323. ESTRO 2021

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