

Clinical Note

Smaller, High-Density Arrays vs. Larger, Lower-Density Arrays for Stereotactic QA

Performing patient-specific stereotactic QA on plans with multiple targets and a single isocenter can be complex. Radiation therapy teams rely on arrays to ensure treatments will be delivered as expected. This clinical note explores the importance of detector density in arrays for measuring stereotactic patient QA.

Background

Guidelines for SRS

Available SRS arrays have different ways to address task group requirements for SRS, including:

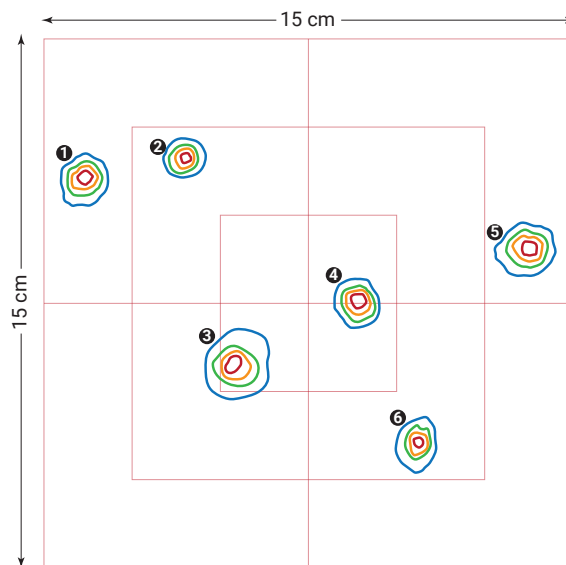
- To minimize volume averaging errors, TG-101 suggests that SRS measurements should be performed with a detector <1mm.
- TG-218 requires that angular dependencies be accounted for in 2D arrays to match the results of film.
- The Nyquist sampling theorem states that “a sampling step width not exceeding 2.5 mm” is necessary for accurate SRS measurements

Clinical Example

Large Field, Single-Isocenter Multiple-Target (SIMT)

Plan with 6 Targets

As targets are further away from isocenter, accurately performing patient-specific QA becomes more complicated. Follow this clinical example, as measured by a larger, lower-density array versus a smaller, high-density array.



This example illustrates a six-target plan with high dose targets ranging from just over 2.5 mm to approximately 5 mm in average diameter.

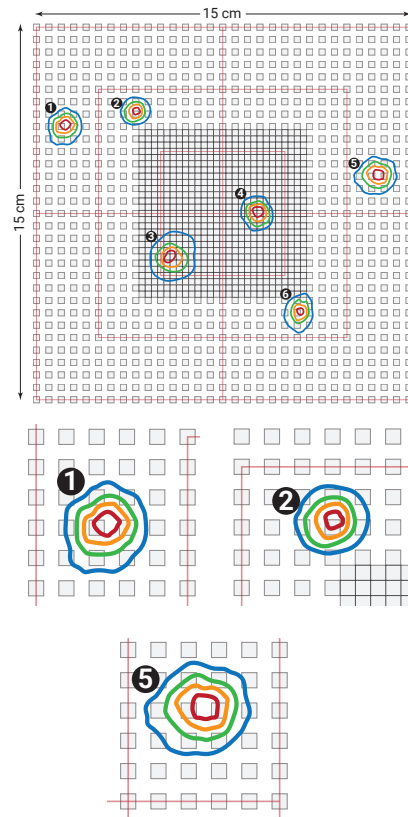
Clinical Example

Large Field, Single-Isocenter Multiple-Target (SIMT) Plan with 6 Targets

Larger, Lower Density Array Coverage

With this array, only two targets are covered with the high-density inner portion of the array. The other four are in the lower density (5 mm separation) area. This results in:

- High dose regions not being fully covered by a single detector for some targets
- Partial volume effects in the measurement from lower density and larger detectors, resulting in inaccurate dose measurements in high dose regions

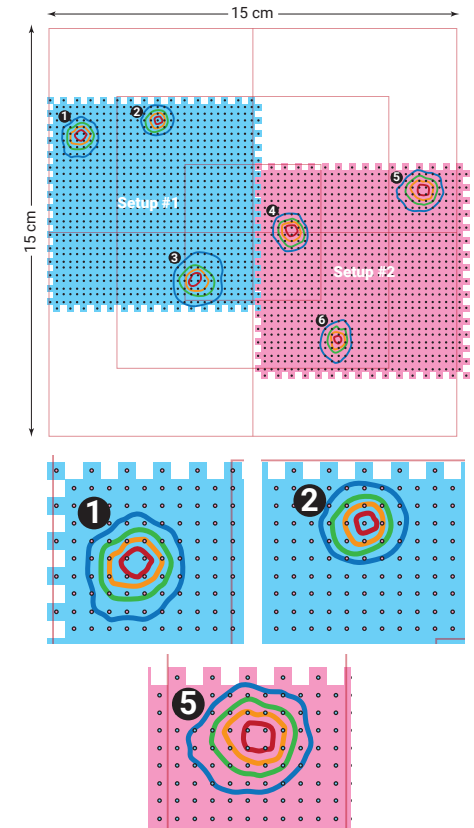


SRS MapCHECK®

Array Coverage

With this array, all targets are covered in the high-density area in two measurements.

- The QA Setup Tool within SRS MapCHECK's SNC Patient™ software simplifies the task of determining shifts needed to capture all targets in as few setups as possible.
- For **Target #1**, two diodes are completely encompassed in the high-dose region. Even in a high-dose region as small as 2.5 mm, a diode is fully encompassed for accurate measurement of **Target #2**.
- For **Target #5** four diodes fall within the high-dose region of the target.



Higher Density Arrays are Better for Stereotactic QA

As evidenced above, for accurate measurement of stereotactic deliveries, two factors must be met: very small detectors and high-resolution. While some arrays on the market claim enhanced SRS capabilities due to a larger array area, we can see from the example above that a larger size array is not indicative of more accurate SRS QA. Instead, arrays with a higher density of diodes are better for accurate stereotactic QA. The SRS MapCHECK includes 1,013 SunPoint® 2 diodes in a 7.7 x 7.7 cm array. Each diode is 0.48 mm x 0.48 mm, far exceeding TG-101 recommendations for detectors smaller than 1 mm, making it ideal for accurate SRS Patient QA. The addition of the QA Setup Tool within the SNC Patient software enables efficient setup when shifts are needed.