

Creating a High Quality Reference Data Set for SRS Cones

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Objectives: To create a robust reference beam data set for cone based stereotactic radiosurgery (SRS) using averaged data from a collection of small field detectors.

Methods: A Varian TrueBeam equipped with cones was used to create a 6MV FFF & 10MV FFF beam models. Lateral profiles, tissue maximum ratios, and relative output factors were measured using a 3D tank with five different detectors. The data was measured and minimal post processing was completed. All scans accounted for the effective point of measurement and used tank centering and leveling corrections. The IAEA TRS483 field size dependent correction methodology was followed for all point measurements. An in-house code was written to average the data from all detectors, which was imported into the treatment planning system to be used as the reference model for each energy. This resultant beam model was validated against the measured beam data as well as a second set of measurements taken on a second TrueBeam with the same cone configuration. A subset of the original commissioning data measurements were repeated with a single detector in a 3D water tank. Finally, an end-to-end test was completed in an anthropomorphic SRS phantom.

Results: The results of averaging multiple high-resolution data sets across detectors produced a final average data set that represents a significant improvement in the currently available representative data set from the vendor. The resultant beam model was found to be largely within 1%/0.5mm from the reference data set.

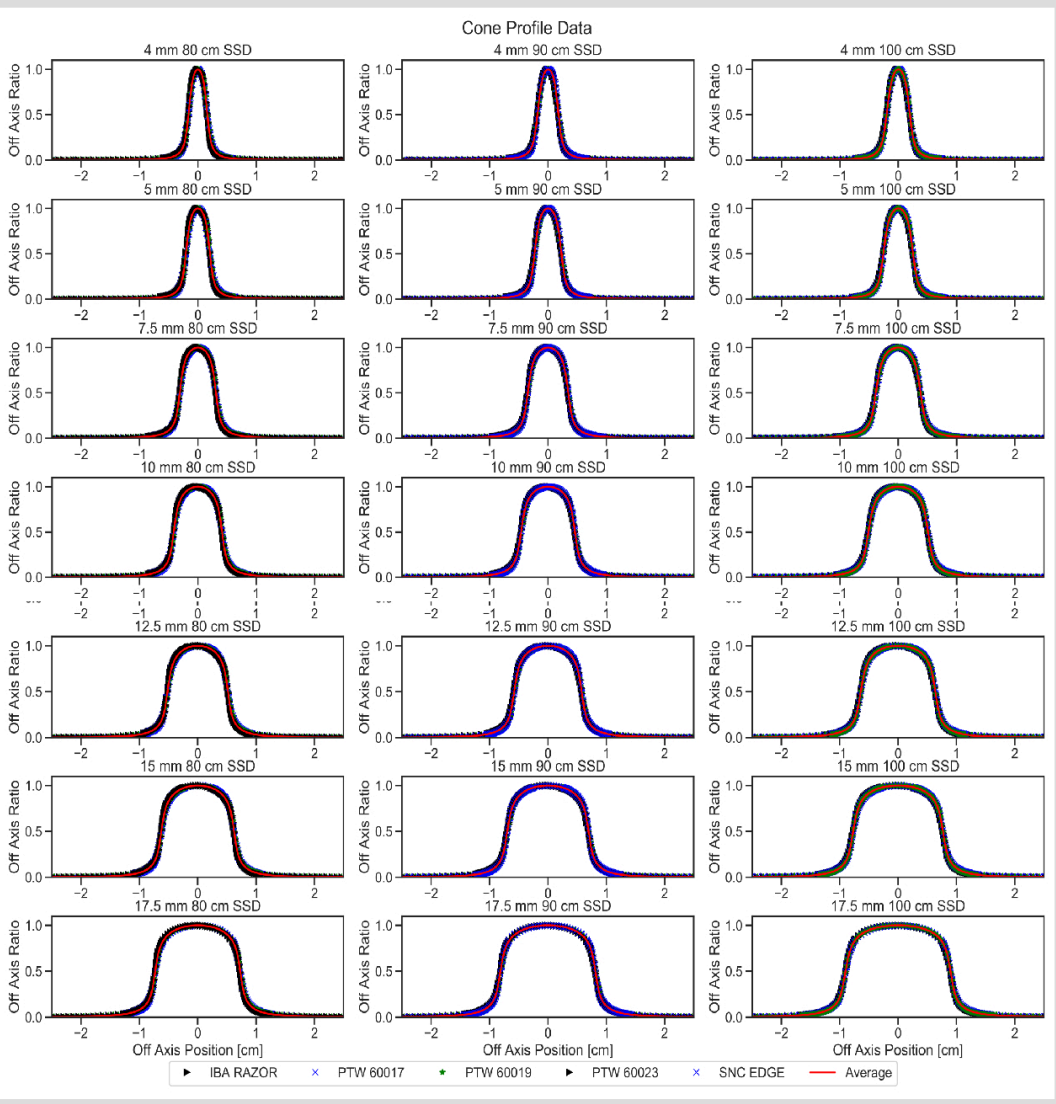


Figure 1: Off axis profile measurements taken with multiple detectors and the resultant average of these profiles.

Results continued: The validation measurements taken on the second TrueBeam were within 2.5% or 0.5 mm for all measurements including the end-to-end test.

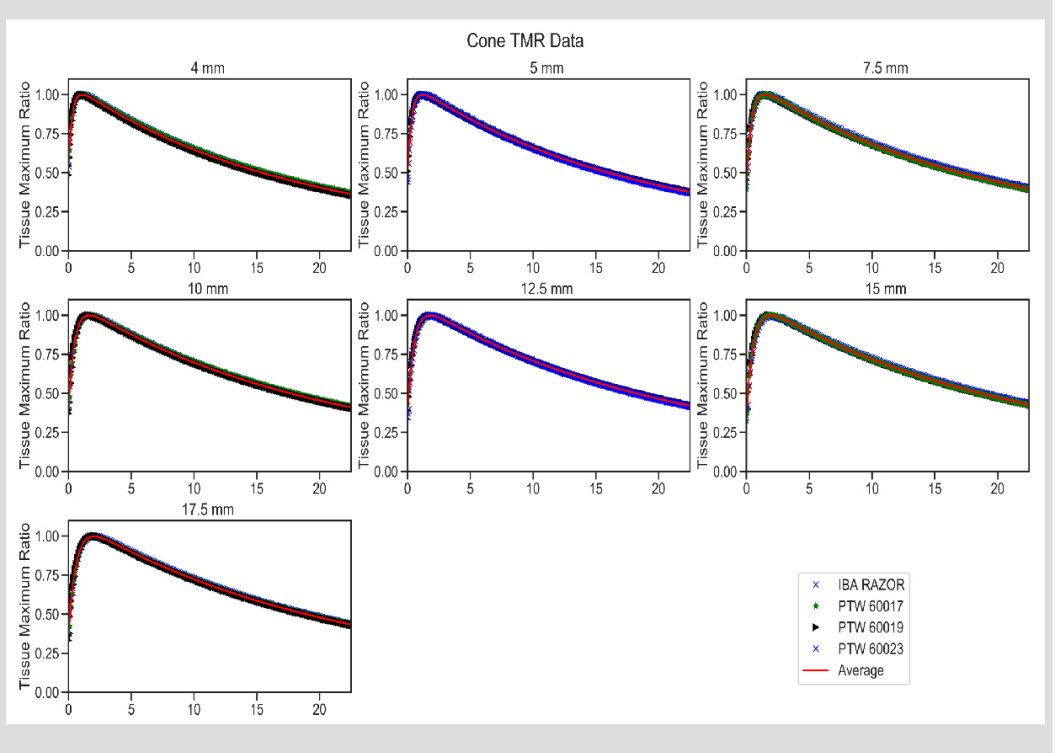


Figure 2: Tissue maximum ratio measurements completed with multiple detectors and the resultant average of these measurements.

Conclusions: The use of multiple detectors with careful measurement allows the user to leverage the average of multiple measurements to produce higher quality SRS cone reference data sets less dependent on the characteristics of a single detector.