

Angular dependency of the measurements of the novel SRS MapCheck device in the magnetic field

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INTRODUCTION

Emergence of the MRI-guided radiation therapy created the need for a reliable QA tools for small field measurements. SRS MapCheck, a novel tool for patient-specific stereotactic QA specifically designed to provide small field measurements, is being introduced to the market by SunNuclear corporation. It is specifically calibrated to provide the accurate dosimetry and analysis for the SBRT type treatment, boasting both high resolution and accuracy^{1,2}. However, angular dependency of the SRS MapCheck, particularly when used in the presence of magnetic field, remains unexplored.



Figure 1 - SRS MapCheck (image provided by Sun Nuclear Corporation)

AIM

The following study aims to investigate the differences in the dose distribution as measured within and without the presence of the magnetic field in order to provide recommendations about the structural composition of the device

METHOD

Angular dependency of the device has been investigated by exposing the SRS MapCheck to an open radiation field of varying field sizes at different angles. All measurements were taken at 6 MV FFF, 100 Mus per reading, at 15° gantry rotation interval. Measurements were taken on a MRidian ViewRay LINAC, with a constant magnetic field of 0.35T³. Control sets of measurements were taken at Varian Edge linear accelerator. Following datasets have been acquired:

- 5x5 cm and 2.5x2.5 cm field size, no lateral offset, SRS MapCheck device parallel to the couch (0 degree angular offset)
- 5x5 and 2.5x2.5 cm field size, lateral offset of 2.5 cm (both right and left laterality), SRS MapCheck device parallel to the couch (0 degree angular offset)
- 5x5 cm field size, no lateral offset, SRS MapCheck device perpendicular to the couch (90 degrees angular offset)

RESULTS

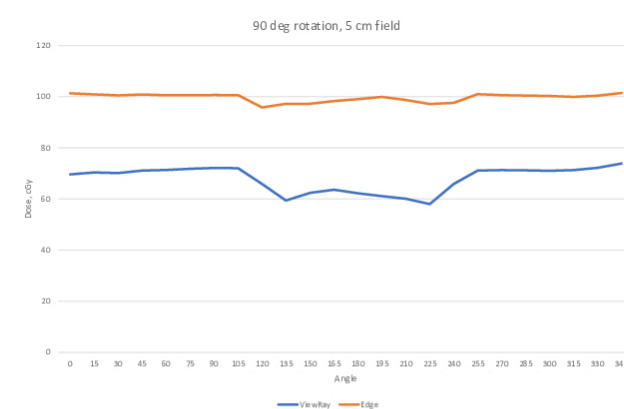
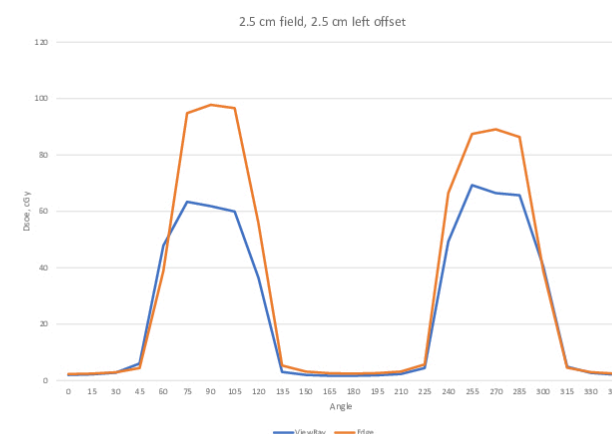
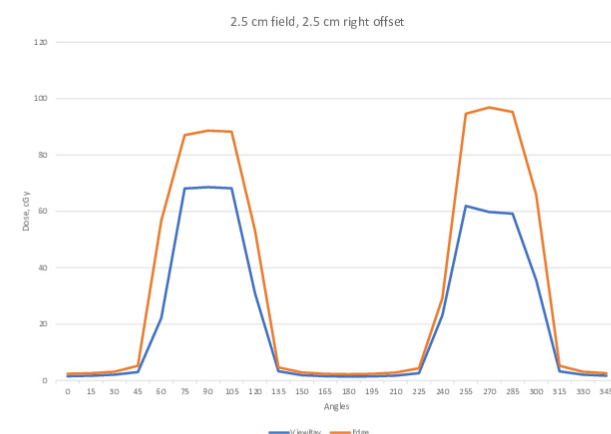
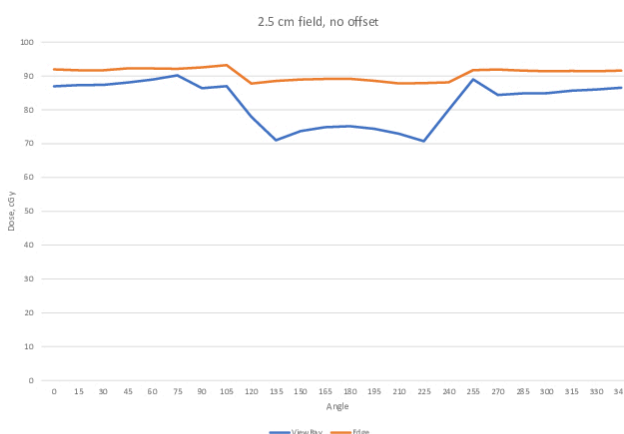
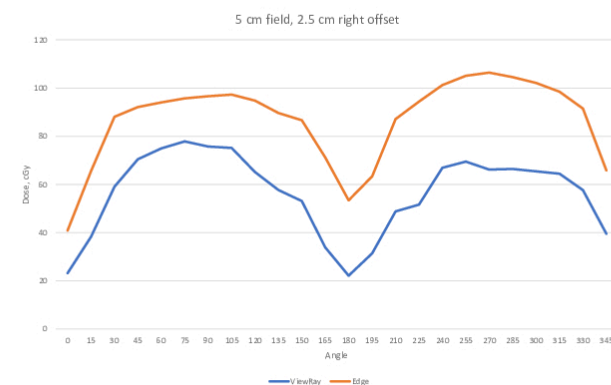
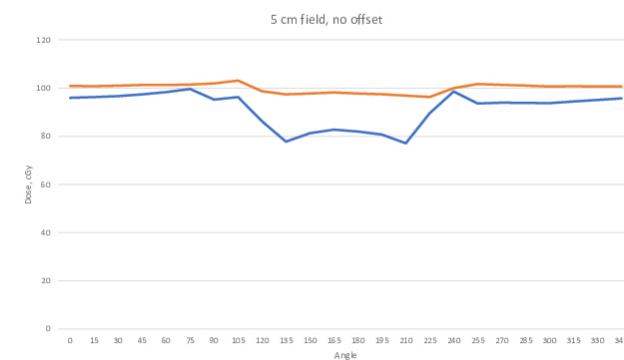


Figure 2 – ViewRay linear accelerator.
Image courtesy of
<https://www.itnonline.com/content/henry-ford-cancer-institute-first-world-install-viewray-mridian-linac>



Figure 3 – Varian Edge linear accelerator
Image courtesy of <https://www.medgadget.com/2013/01/varian-edge-radiosurgery-system-with-advanced-motion-management-cleared-in-u-s.html>

CONCLUSIONS

A clear angular dependency trend can be observed for the SRS MapCheck for both sets of measurements. The difference in reading with and without the magnetic field becomes more pronounced with the smaller fields and fields shifted off-center, as well as rotated 90 degrees to the couch (angular offset). Absolute measurement readings for the CAX are lower in the presence of the magnetic field (ViewRay) vs in absence (Edge), with possible explanation being the air pockets inside the device having a stronger effect on the readings in the presence of a magnetic field.

Further set of readings with the air pockets in the SRS MapCheck device filled would allow us to understand in greater details the angular dependency of the CAX reading on the presence or absence of the magnetic field, and whether or not certain design changes need to be introduced to match the readings under the same calibration conditions.

ACKNOWLEDGEMENTS

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