AbstractID: 10789 Title: Correction for angular dependence of the MatriXX^{Evolution} ionization chamber array

Purpose: The MatriXX^{Evolution} ionchamber array (IBA Dosimetry) is an attractive tool for plan verification of both conventional IMRT and rotational therapies (RapidArc, VMAT, TomoTherapy, etc). However, the response of this array has a significant angular dependence. We have quantified this dependence, and developed a correction method suitable for plan verification.

Method and Materials: A MatriXX phantom (MatriXX^{Evolution} ionchamber array + solid water) and a reference phantom (A12 ionchamber + solid water) were irradiated from different gantry angles (0°-360°, steps of 10°, with finer steps of 3° for lateral angles). Reference measurements were taken using a phantom of the equivalent dimensions. The calibration factor was calculated as the ratio of the MatriXX dose to the A12 dose for a given gantry angle.

The water equivalent thickness of the MatriXX^{Evolution} reported by the manufacturer was also examined in the TPS and by measuring 6MV attenuation due to MatriXX^{Evolution} vs. solid water for variable total thickness of the phantom.

Three patient-specific IMRT and two VMAT cumulative plan verifications were delivered to the MatriXX phantom. Dose measurements collected by MatriXX^{Evolution} were then corrected with in-house software. Measurements were then repeated to the reference phantom. Corrected MatriXX, uncorrected MatriXX and A12 measurements were compared to the treatment planning system.

Results: The angular response of the MatriXX array was found to vary as much as 11%, depending on the irradiation angle. The most variation was found to occur around 91-110° and 260-269°, and also close to 180°. The corrected MatriXX doses were found to agree within 1.0% of the A12 ion chamber dose, vs. 2.5% for uncorrected.

Conclusion: The MatriXX^{Evolution} ionchamber array has an angular dependent response which is clinically significant, and must be corrected. We have developed and tested the use of an angular-dependent correction factor which corrects for these response variations.