AbstractID: 8542 Title: Commissioning and Validation of the BrainLab Monte Carlo Dose Calculation Algorithm

Purpose: To validate the accuracy of photon beam modeling for a new commercially available Monte Carlo tool and to assess its performance in clinical settings.

Method and Materials: The XVMC photon dose calculation algorithm has been commissioned for 6 MV and 15 MV Varian Trilogy beams with BrainLAB M3 and Varian Millennium MLC devices. Depth doses, profiles, and beam output factors were measured in water with photon diode and results were compared with those calculated by XVMC algorithm in the same geometry. The MLC characterization of beam models were tested in homogeneous phantoms for various combinations of MLC patterns using film and ion chamber measurements. The effects of leaf thickness, intra/inter-leaf transmission, rounded leaf transmission have been investigated using film and ion-chamber dosimetry. The accuracy of XVMC dose predictions in tissue inhomogeneities and near interfaces have been investigated with TLD, ion-chamber, and film measurements in various inhomogeneous phantoms after measurements were corrected for dose in-medium.

Results: XVMC dose calculations in homogeneous phantom predicted the depth doses and profiles within 1%, indicating accurate modeling of beam energy spectra and penumbra, for both 6MV and 15 MV photon beam models using either collimating systems. The rounded leaf end and intra-leaf transmission were modeled accurately within 2% as determined with film measurements. XVMC dose calculations in tissue inhomogeneities and near interfaces have been verified within 2-3% with TLD and ion chamber measurements, after the measurements were corrected for dose in medium.

Conclusion: XVMC algorithm commissioned for 6 and15 MV photon beams was shown to accurately predict dose buildup/down effects in tissue interfaces in clinically relevant situations increasing the ability to accurately calculate patient dose.

Conflict of Interest (only if applicable): XVMC/iPlanDose4.0beta was provided under a clinical cooperation agreement with BrainLAB.