AbstractID: 13689 Title: Dosimetric characterization of a new prototype Varian linear accelerator

Purpose: To characterize the dosimetric properties of a novel Varian linac, Trilogy-MX, and compare them with those of C-series Trilogy. The new design employs digital control electronics with new embedded computer architecture. The energy switch, bending magnet, and carousel assembly are redesigned. Trilogy-MX allows three flattened and two high-dose-rate (>1000 MU/min) flattening filter free (FFF) photons modes.

Method and Materials: Depth dose, transverse profiles and output factors are obtained using a Scanditronix CC04 ion chamber (0.04 cm^3) in a water tank. Depth doses are normalized at 10 cm depth. Photon output factors are measured at 10 cm depth, 90 cm SSD

Results: The 6MV and 18MV modes of the two designs match in PDD to within experimental uncertainty for fields <20×20cm^2. Differences of ~1% are observed for depths >20cm in the 6MV mode, and in the buildup region for the 18MV beam for fields >30×30cm^2. Output factors also match well, with maximum deviations ~1% for 6MV and ~1.5% for 18MV observed for fields > 20×20cm^2. The PDD for 6MV-FFF and 10MV-FFF modes fall faster than their flattened counterparts due to lack of beam hardening and reduced scatter from off-axis regions. At 10 cm depth for a 20×20 field, the transverse gradients are ~ 1.5%/cm and ~3.5%/cm for the 6MV-FFF and 10MV-FFF modes respectively. For fields < 5×5, the flattened and unflattened 6MV beams have similar transverse profiles. The electron beams match within 1mm in PDD, but deviate by ~3% in transverse profiles for the largest field sizes for higher energies.

Conclusion: The common modes between the C-series and Trilogy-MX are clinically interchangeable. Small adjustments in beam modeling can remove the small differences observed, particularly for electrons. The 6MV-FFF mode is useful for stereotactic treatments because of their high dose rates and reasonably flat transverse profile for small fields.