AbstractID: 2515 Title: Dosimetric Properties of Photon Beams from a Flattening Filter Free Clinical Accelerator

Purpose: Investigation of the basic dosimetric properties of 6-MV and 18-MV photon beams, generated by a clinical accelerator, without the flattening filter. Comparison with flattened beams. Exploration of potential benefits of using nonflattened beams in radiation therapy. Application of a flattening filter free accelerator in intensity modulated radiation treatments.

Methods and Materials: In a Varian Clinac 2100 accelerator the flatting filter was removed from the beamline. Dosimetric properties of 6-MV and 18-MV photon beams were measured using ionization chambers and radiographic films.

Results: As a result of removing the flattening filter: (1) the dose rate on the central axis increases by factors of 2.3 (6-MV) and 5.5 (18-MV), in 10×10 cm^2 fields at the depth of 10 cm; (2) the penumbra width decreases by 4-5% (6-MV) and 8-20% (18-MV) at small depths; (3) out of field dose close to the treatment field edge decreases by 15% (6-MV), 30-40% (18-MV) and tends to decrease more, farther away from the field; (4) the total scatter factor varies less with the field size; (5) multileaf collimator transmission decreases by 20% (6-MV) and 10% (18-MV); (6) dose per monitor unit increases to 2.15 cGy (6-MV) and 3.81 cGy (18-MV), according to the TG51 protocol; (7) the energy spectra of the nonflattened beams become softer, especially on the central axis; (8) dose close to the surface increases; (9) the ratio of dose on the central axis to that at 80% of field width (for 4×4 to 40×40 fields) increases to 1.1-1.7 (6-MV) and 1.2-3.2 (18-MV); (10) shapes of 6-MV lateral profiles change less with depth.

Conclusion: With the flattening filter free accelerator potentially better treatments can be developed, characterized by substantially shorter delivery times, sharper penumbras, and reduced out of field doses.

Conflict of Interest: Research is supported by Varian Medical Systems