AbstractID: 14141 Title: Matching of Flattening-Filter-Less (FFL) to Standard (STD) linac beams based on Monte Carlo simulations

Purpose: Flattening-Filter-Less (FFL) linacs increase the dose rate and therefore decrease treatment time, which may minimize the possibility of intra-fraction motion. However, up till now only a few FFL linac studies have been reported and FFL beam characteristics are not completely known. **Method&Materials:** This study tries to investigate the impact of the MLC-modulation for the same prescribed dose using FFL instead of STD linac, by matching two linac penetration (PDD) and dose output (calibration dose per MU for given reference conditions) and by determining the field size and depth dependence of the relative beam intensities across the field and relative MLC properties for the two linacs. We commissioned Monte Carlo (MC) dose calculation for Varian21EX(6MV) standard machine by matching the golden beam dose data (GBD). The electron beam energy was determined to be $E_{STD} \equiv E_{GBD}$=6.5MeV. Next, beam properties were determined for FFL($E_{FFL}=E_{STD}$). Linac matching procedure was then performed by first matching the PDD by the increasing the energy, and by calculating the MU-correction factor F_{MU} equal to dose ratio FFL_{match}/STD. Next, relative beam intensities $F_{OAR}(x,d,c)=OAR_{STD}(x,d,c)/OAR_{FFLmatch}(x,d,c)$ were determined for open beams and parameterized for different field sizes c and depths d. Similar properties were determined for sweeping gap dynamic MLC motion tests for various gap sizes (G=1,5,10,20mm) and other more complex MLC tests. Finally, relative MLC transmission properties were determined $F_{MLC}=T_{STD}/T_{FFLmatch}$. Additional beam data was generated for IMRT-relevant symmetric and asymmetric rectangular fields for open and MLC-modulated beams for both linacs. **Results:** Adjusted electron energy for FFL was 8.0MeV to 8.5MeV, depending of the field size. Monitor Unit correction factor was $F_{MU}\approx$1.8 and 3.3 for FFL and FFL_{match} linacs correspondingly. The other factors were: F_{MLC}=1.2, $F_{OAR}(x,40)=1.003+0.003\cdot x^2-0.000003\cdot x^4+0.1\cdot Erf[0.2\cdot x]^2$ for c=40cm and $F_{OAR}(x,c)\approx F_{OAR}(x\cdot(1+40/c),40)$ for other field sizes c. **Conclusion:** Presented parameterization of beam data is essential in analysis of factors influencing IMRT on FFL linacs.