AbstractID: 5077 Title: Investigation of MLC Effects on Secondary Neutron Spectra for Varian, Siemens, and Elekta

Purpose: To compare the secondary neutron spectra in accelerators with different multileaf collimator (MLC) configurations. The addition of MLC, have lead to design modifications in modern linear accelerators; Elekta has replaced upper collimating jaws with MLC, Siemens has replaced lower jaws with MLC, Varian added tertiary level MLC.
Method and Materials: Measurements were made of the neutron fluence and energy spectra for several modern accelerators. The detector consisted of ^{197}Au activation foils, which were placed on the surface of the holder and inserted into Bonner Spheres. An HPGe detector was used to measure counts under the 411keV photopeak for each foil. Data were unfolded with the MXD_FC33 code with a response matrix specifically calculated for this measurement system using MCNP5. In this investigation, neutron spectra, fluence per MU, and ambient dose equivalent are reported for 18MV x-ray beams generated by Varian 21EX, Siemens Oncor, and Elekta Precise accelerators. The impact of the jaw and MLC configuration were further studied for the Varian 21EX by taking measurements following the complete removal of the MLC.
Results: Jaws and MLC closed: similar spectra for the Siemens and Elekta but the Varian spectrum has a lower energy distribution. Varian X and Y jaws closed: With MLC in place, less neutrons are detected and spectrum shifts to lower energies (compared to MLC removed). MLC attenuates neutrons created higher in treatment head. Varian X and Y jaws retracted: With MLC in place more neutrons are detected and the spectra shifts to lower energies (compared to MLC removed). The MLC attenuate neutrons created higher in treatment head but MLC become the primary source of contamination neutrons when jaws retracted. **Conclusion:** Secondary neutron spectra are different in accelerators with different MLC configurations. This difference translates to a difference in ambient dose equivalent to patients receiving high-energy radiation therapy.