AbstractID: 11170 Title: The Development of a Precise Electron Irradiator for Small Animal Studies

Purpose: This study focuses on the development, validation, and evaluation of a precise MV-electron irradiator. Compared with all other prototypes which use photons to irradiate small animals, an electron irradiator has many advantages in its shallow dose distribution. **Method and Materials:** Two major approaches including simulation and measurement were used to evaluate the feasibility of an electron animal irradiator. These simulations/measurements were taken in three different fields (a 6 cm square field, and 30 and 4 mm diameter circular fields) and with two different energies (6 and 18 MeV). A PTW Semiflex chamber in a PTW-MP3 water tank, a PTW Markus chamber type 23343, a PTW diamond detector type 60003, and KODAK XV films were used to measure PDDs, lateral beam profiles, and output factors for either optimizing parameters of Monte Carlo simulation or to verify Monte Carlo simulation in small fields. **Results:** Results show good agreement for the comparisons of PDD ($\leq$ 2.5% for 6 MeV e; $\leq$ 1.8% for 18 MeV e) and profiles (FWHM $\leq$ 0.5 *mm*) between simulations and measurements on the 6 cm field. Greater deviation can be observed in the 4 mm field due to the partial volume effects of detectors. The output factor for the 18 MeV electron beam is 0.970 in the 30 mm field, and 0.610 in the 4 mm field; the FWHM of profiles for the 18 MeV electron beam is 32.6 mm in the 30 mm field, and 4.7 mm in the 4 mm field at the d_{90}. Two different digital phantoms were also constructed, including a homogeneous cylindrical water phantom and a CT-based heterogeneous mouse phantom, and were implemented into Monte Carlo to simulate the dose distribution with different electron irradiations. **Conclusion:** These results ensure that our proposed electron irradiator is feasible for precise small animal irradiation.