AbstractID: 9395 Title: Investigation of ionization chamber cable irradiation: a study of signal-to-noise ratio in radiation dosimetry

Ionization chambers connected with cables may give rise to spurious currents (Compton, extracameral and leakage) due to irradiation of all or part of the ionization chamber ensemble and thus cause inaccurate dose measurement. In the case of large field or intensity-modulated radiation therapy (IMRT), the signal-to-noise ratio (SNR) may be significant where a large amount of cable is exposed for a longer period of time. For IMRT dosimetry, small volume chambers are popular due to the fine spatial resolution required at steep dose gradients. However the combination of small chamber volume with low chamber sensitivity may lead to a lower SNR. Six different cables from various manufacturers were connected to two different ionization chambers, a PTW 0.6cm^3 chamber and an Exradin 0.007cm^3 chamber. The cable and ionization chamber responses were analyzed for photon and electron beams, dose rate dependence at 100-600MU/min, varying irradiated cable length (1-5m) and SNR. The dose rate measured dependence increased by approximately –3 to –4.5pA per 100MU/min for a 16MeV beam and by 3.3 to 8pA per 100MU/min for a 10MV beam. The leakage currents measured for changing energy were 2.1 to 17.1pA and 10.1 to 24.8pA for 6 and 10MV photons respectively and –2.0 to –12.9pA for 16MeV electrons among various cables. The response to changing cable length was approximately 3.5 to 8pA/m. In conclusion, caution must be exercised where a large length of cable is exposed and radiation-induced cable leakage must be accounted for in the charge collected when estimating dose.