AbstractID: 10249 Title: Investigation of humidity effects on beam monitor performance in a proton clinical gantry

Purpose: To investigate the effect of ambient humidity on performance characteristics of ionization chambers used as beam monitors in two clinical proton gantry systems, and to choose optimal electrode materials. **Method and Materials:** Dose calibration results for two identical, vented beam monitors, with electrodes constructed of Mylar film with graphite coating, and each installed in a gantry nozzle, were analyzed for stability over a period of 1 year. Additionally, two ion chambers of similar design, but constructed using Kapton for base layer and either i) gold-plated copper or ii) graphite paint for electrodes, were fabricated for testing purposes. The test chambers were placed in a controlled humidity environment and their performance was evaluated in a proton beam under various humidity conditions. **Results:** Mylar-based electrodes of the gantry beam monitors provide a dose calibration that varied within ±2% (maximum deviation from mean), over a period of 1 year while room's relative humidity (RH) varied from 20% to 70%, with brief excursions to 15% and 80%. Kapton-based copper gold-plated electrodes provided linear (±1%) response in dose rates up to 180 Gy/min, and were stable within ±1% in terms of measured charge per monitor unit, in the range of 10%-90% RH. The response of Kapton-based carbon paint electrodes was linear (±1%) in dose rate up to 8 Gy/min and showed a slight rising trend (about 3% increase) in the 50% - 80% RH range. **Conclusion:** Treatment room humidity may affect the performance of Mylar-based electrodes in a beam monitor with open-to-atmosphere design. When humidity of 70% RH or higher is possible, copper gold-plated electrodes on Kapton show superior performance compared with graphite paint electrodes. **Conflict of Interest (only if applicable):** None