# AbstractID: 12794 Title: Design and initial performance of a large cross-section multi-element ionization chamber system for water equivalent range measurements of pristine proton fields

**Purpose:**
To describe the design and initial testing of a large diameter, multi-layer ionization chamber (MLIC) system for water equivalent range measurements of pristine proton fields.

**Method and Materials:**
The MLIC uses a large 120 mm physical diameter collecting cross-section in a stacked, vented, parallel plate geometry of 180 layers spaced 0.8 mm apart. The plates are fabricated from printed circuit board material where copper traces have been etched to form the conductive elements for the ionization chambers. In addition a dedicated software package was developed to assist with device calibration, data acquisition and analysis.

Computer modeling of the MLIC was performed with the Monte Carlo (MC) code FLUKA. Radiological testing was performed in a dedicated proton pencil beam scanning (PBS) therapeutic delivery system. The energies tested varied from 100-230 MeV. A series of 10 pristine depth profiles were first acquired for reference within this energy range by longitudinally scanning a discrete parallel plate ionization chamber of 84 mm diameter in a water phantom. After a calibration routine was applied to the MLIC, the same energies were tested with the MLIC and the results compared. Additional tests were performed at different fluence rates to evaluate changes in response to detector bias and charge quantum (QC) settings.

**Results:**
The analyzed data from the MC simulation and MLIC physical data compared within one mm to the water phantom reference data under the conditions tested. The MLIC results were not sensitive to bias setting but depended with fluence rate on the QC setting.

**Conclusion:**
The initial test of the new MLIC prototype provided satisfactory results with regard to water equivalent range accuracy in comparison to reference measurements from the PBS system. Some flexibility is provided with different fluence rates by adjusting the QC. The detailed results will be presented and discussed.