**PRESENTATION TITLE**

Experimental determination of the intra-type variation of ionization chamber’s response in magnetic fields

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**ABSTRACT**

**Purpose:**  
The response of ionization chambers is influenced by external magnetic fields. As MR-linacs combine magnetic fields with magnetic flux densities up to 1.5 T with medical linear accelerators, the usage of ionization chambers for dosimetric measurements is problematic. Recent publications have shown that small changes in the geometry of ionization chambers have a significant impact on this type of measurements. Furthermore, it has been shown that the signal of ionization chambers is highly dependent on the ionization chamber’s orientation relative to the radiation beam and the magnetic field axis. The idea of the experiment presented here was to collect data on the intra-type variation of the responses of typical Farmer ionization chambers in magnetic fields.

**Materials & Methods:**  
In this experiment, the relative response of three ionization chambers of the same type (PTW 30013) was measured for magnetic flux densities ranging up to 1.4 T. Each measurement was repeated twice for each ionization chamber. The ionization chambers were placed between the poles of a large electromagnet (Bruker E073) in a 21 cm x 7 cm x 21 cm water phantom in front of a Elekta Precise linear accelerator (SSD = 110 cm). The reference points of the ionization chambers were positioned at a water-equivalent depth of 10 cm. The chambers were irradiated in a high-energy photon beam with a nominal accelerating voltage of 6 MV and a field size of 5 cm x 10 cm. The direction of the magnetic field was chosen in such a way that the secondary electrons were deflected by the magnetic field toward the ionization chambers’ tips and the chamber readings were measured relative to the reading of a large area transmission monitor chamber mounted at the shadow tray of the linear accelerator outside the magnetic field.
**Results:**
The maximum deviation between the responses obtained in all measurements was found to be 0.2 % at a magnetic flux density of 1.4 T. The stability of the chamber readings (relative standard error of the mean) during measurements ranged between 0.02 % and 0.04 %, for each individual measurement.

![Figure 1: Relative response curves of PTW30013 ionization chambers.](image)

**Conclusions:**
While a complete uncertainty budget is still under preparation, it can be stated that the intra-type variation of the response of different ionization chambers of the type PTW 30013 in magnetic fields is within 0.2 %. Therefore, corrections for the influence of the magnetic field that are based on relative response measurements are also applicable to other ionization chambers of the same type.