

AbstractID: 9132 Title: Dosimetry for hybrid 1.5 T MRI radiotherapy system: impact of the magnetic field on a NE2571 ionisation chamber

In collaboration with Elekta and Philips Research Hamburg we are constructing a prototype radiotherapy accelerator with integrated 1.5 T MRI functionality for on-line soft tissue based treatment guidance. In such a system radiation dosimetry has to be performed in the presence of a magnetic field.

This paper investigates the feasibility of using a Farmer NE2571 chamber (NE Technology Limited, Berkshire RG7 5PR, England) for dosimetry. A laboratory magnet was installed next to an accelerator. The NE2571 chamber was placed in a build-up cap at the center of the magnet and the relative response was measured as function of a homogeneous magnetic field ranging from 0-1.2 T. The measurements were done for two orientations of the chamber, 1)perpendicular and 2)parallel to the radiation beam, while perpendicular to the magnetic field. These set-ups were also simulated.

A second set of simulations is performed to determine the impact of the magnetic field ranging from 0-1.5T on the NE2571 under calibration conditions, i.e. in a sleeve in a NE2528/3A phantom. In this set-up a third orientation is simulated too: 3)perpendicular to the incident beam while parallel to the magnetic field.

Both measurements and simulations show that the response for orientation 1 increases until 1 T by approximately 10% and then start to decrease. For orientation 2 the response is opposite, it decreases until 1 T by approximately 10% and then starts to increase again. For orientation 3 only simulations are available and the response is constant as function of the magnetic field.

The behaviour of the NE2571 for absolute dosimetry as function of the magnetic field can be simulated using Geant4 simulations and is in correspondence with measurements. The exact response is determined by the orientation of the chamber with respect to the magnetic field and the radiation beam.