during radiotherapy facilities. This is especially important in SRS/SBRT modalities which employ higher therapeutic doses in daily fraction.

EP-1771 Measuring the influence of magnetic fields on the dose distributions of clinical electron beams

R. Kueng[1], B.M. Oborn[2], N. Roberts[2], T. Causer[2], M.F.M. Stampanoni[3], P. Manser[1], P. Keall[4], M.K. Fix[1]
[1]Inselspital- University Hospital Bern, Division of Medical Radiation Physics, Bern, Switzerland ; [2]University of Wollongong, Centre for Medical Radiation Physics, Wollongong, Australia ; [3]University of Zurich and Swiss Federal Institute of Technology ETH, Institute for Biomedical Engineering, Zurich, Switzerland ; [4]Sydney Medical School- University of Sydney, ACRF Image X Institute, Sydney, Australia

Purpose or Objective

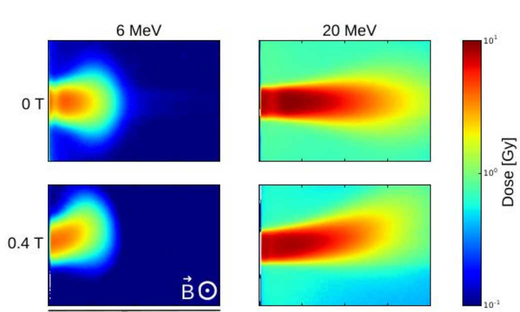
MRI-Linacs are a fast-growing area of cancer radiotherapy. To date only MRI-Linac photon beams have been investigated. However, radiotherapy quality can be improved for a wide range of clinical indications by using electron beams alone or in combination with photon beams. The objective of this work is to investigate the dosimetric impact of a magnetic field with different field strengths and orientations on therapeutic electron beams for three beam energies. For this purpose, an experimental setup for measuring dose distributions of clinical electron beams generated by a conventional linac in the presence of a magnetic field is established.

Material and Methods

A permanent magnet device was used to generate a magnetic field surrounding a solid water slab phantom. The magnetic field including maximal field strength B_{max} was varied by moving the permanent magnet banks and by insertion of focusing steel cones. Electron beams (6, 12 and 20 MeV) from a clinical linear accelerator (Varian Clinac 2100C) were incident perpendicular (transverse setup) and parallel (inline setup) to the main magnetic field direction. The magnet device was placed at a source to isocenter distance of 150 cm and the electron beams were collimated to a circle of 1 cm diameter and a square of 1.5 cm side length, respectively. Gafchromic EBT3 film was placed inside the homogeneous slab phantom, parallel to the beam (transverse setup) and perpendicular to the beam (inline setup) to measure two-dimensional dose distributions. Reference conditions with zero magnetic field were established by using identical collimation in an aluminum frame setup.

Results

As expected, for the transverse setup, substantial deflection of the electron beam was observed in the magnetic field, as indicated in figure (1). Consequently, a shift of lateral dose profiles and shift in distal dose fall-off (R50 up to -5 mm) was measured for all three electron beam energies. For the inline setup, focusing of electron beams was observed in magnetic fields compared to the zero field reference setup. An increase of measured dose of up to 100% (6 MeV beam, 0 vs. 0.7 T magnetic field) was shown, yielding a steeper lateral penumbra for a given dose level (FWHM -1.5 mm in 2 cm depth).



Conclusion

Propagating in a magnetic field, substantial deflection (transverse setup) and focusing (inline setup) of all measured electron beams was observed. The inline setup shows steeper lateral penumbra of electron fields and thus the potential for enhanced plan quality for electron treatments.

EP-1772 MLC parameters evaluation in a RT-dedicated MC environment (PRIMO) from static fields to VMAT plans

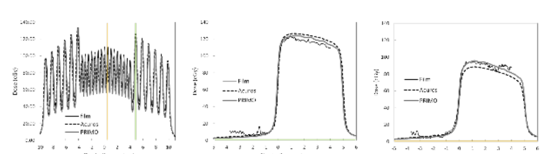
L. Paganini[1], G. Reggiori[1], A. Stravato[1], V. Palumbo[1], P. Mancosu[1], F. Lobefalo[1], A. Gaudino[1], S. Tomatis[1], M. Scorsetti[1,2]
[1]Humanitas Clinical and Research Center, Radiosurgery and Radiotherapy, Rozzano, Italy ; [2]Humanitas University, Department of Biomedical Sciences, Rozzano, Italy

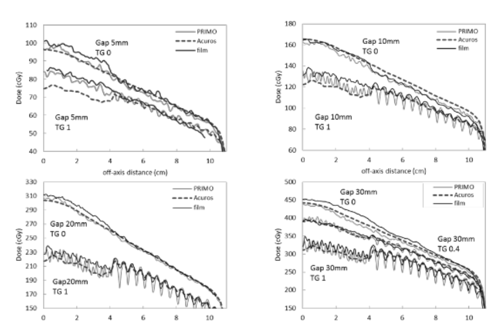
Purpose or Objective

PRIMO is a graphical environment for MonteCarlo (MC) simulations based on the Dose Planning Method (DPM), a fast MC algorithm specifically built for the simulation of the deposited dose in radiotherapy. The objective of this work was to validate the beams calculated by DPM against the ones from our Linac EDGE (Varian) and to compare PRIMO with the clinical algorithm Acuros (Varian) and film measurements with particular focus on the MLC parameters.

Material and Methods

In a first phase a full characterization of the 10MV FFF beam was performed. Then the 120 HD MLC modeling, particularly the Tongue and Groove effect, was investigated with two types of tests: static MLC fields in different settings and MLC plans configured in 'dynamic fence patterns'. These dynamic tests were planned with increasing leaf-ends, gap size and degree of TG effect. The dose distributions were measured using the IBA MultiCube phantom with GafChromic films positioned horizontally at 10cm depth. Finally a set of four clinical plans was selected from our database. All VMAT plans were optimized with 10MV FFF beam in Eclipse and calculated with Acuros. The DICOM files (plan, structures and images) were imported in PRIMO. DPM was used to calculate dose distribution in patients. The dose distributions were compared in terms of gamma analysis within BODY and PTV.





Results

Concerning the MLC modelling, static fields showed a good agreement between Acuros, PRIMO and film measurements, with slight differences in transmitted dose (Fig1). The comparison between dose profiles for the