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A feasibility study of dosimetry for low energy protons with radiochromic films

Summary

In radiotherapy, an accurate dose determination and a precise dose delivery to the planned target volume are directly associated with better treatment outcomes in terms of higher tumour control and lower post irradiation complications [1]. In this context, radiochromic films are a powerful tool for dose verifications, which offer high spatial resolution and near tissue equivalence.
Moreover, the use of proton and ion beams for cancer treatment has increased in recent years, because of their excellent depth-dose profile, exhibiting a low dose in the entrance channel and a distinct dose maximum (Bragg peak) near the end of range in tissue.
This work aims to study the response of a special type of radiochromic films (EBT3 Gafchromic) when irradiated with protons, in the region of the Bragg peak. Such studies can be important to supply an accessible way of measuring dose distributions in proton cancer therapy centers. Since the quantification of the dose in this region is experimentally difficult, a special beam optimization is required [2].
The 3 MV Tandem accelerator installed at the National Centre of Accelerators (CNA) in Seville allows to perform measurements with protons of a maximum energy of 6 MeV. These energies are particularly useful to study the region of the Bragg peak. In this work we present the preparation of a beamline of this accelerator for irradiation with proton beams of low energy and uniform intensity profile at the position of irradiation, together with the setup implemented for the dose calibration of radiochromic films for proton energies at which maximum deposition occurs in their active layer. Results obtained with different techniques of beam energy degradation (using as degraders air and mylar foils) will be compared to Geant4 simulations and to ionization chamber measurements.

Bibliography

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