Contribution ID: **90** Type: **Oral contribution**

A study of dosimetry and energy for low energy protons with ionization chambers, radiochromic films and silicon detector.

Friday, 9 September 2016 15:10 (20 minutes)

In recent years, the use of proton and ion beams applied in cancer treatment is increasing 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. However the quantification of the dose in this region is experimentally difficult and requires beam optimization and the implementation of new dosimetry techniques. Such studies can be important to supply an accessible way of measuring dose distributions in proton cancer therapy centers. 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, firstly we present the preparation of a beamline for irradiation with proton beams of low energy and uniform intensity profile at the position of irradiation. Then we will show how this setup is applied to learn about the dose calibration of radiochromic films for proton energies at which maximum deposition occurs in their active layer. Results with different techniques of beam energy degradation (using as degraders air and mylar foils) will be compared to Geant4 simulations.
The computations will be validated by using the direct measurement of the beam energies for the experimental configurations mentioned above. Such energies were measured with an ion implanted silicon detector placed at the same position of the samples irradiated in air.

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Session Classification: Targetry, Diagnostics and Dosimetry