A 2D scintillator-based proton detector for high repetition rate experiments

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Spatial and energy characterization of the proton beams can play nowadays an important role for the potential use of such sources for several applications in different fields of physics, chemistry and material science as well as biology, medicine and cultural heritage. The first demonstration of laser-driven proton production was carried out in laser systems working at single shot mode and one of the most used diagnostic consists of a series of Radiochromic films (RCF) placed one after each other and able to recover the spatial distribution as a function of the proton energy. The possibility to extend this technique to HRR mode of operation is nowadays a challenge in the laser plasma community and several laboratories and research groups are working on this. The main idea is to substitute the active RCF layers with scintillator detectors capable of transforming the ion energy deposition into light that can be then transported and collected. Several research groups have proposed special online configurations to imitate the RCF stacks. Researchers from Dresden proposed a stack of scintillators placed one after each other as the RCF stack with a readout system looking at the transversal scintillation emission. Such devices have been tested in a proton beam accelerator and is currently used in the Dresden laboratory [1]. Here we present a scintillator-based detector able to measure both the proton energy and its transversal spatial distribution along the particle propagation axis and capable of being setting at HRR. The detector has been designed and built at the Spanish Center for Pulsed Lasers (CLPU) in Salamanca, it consists of a series of scintillators placed similarly as an RCF stack but positioned with a relative angle one respect to the others in order to leave a free field of view for an imaging system looking at the back side of each layer and the imaging system can be arranged depending on the spatial constraint of the experiment [2]. The system has been firstly tested with the linear accelerator of the *Centro de Micro-Análisis de Materiales* (CMAM) located in Madrid. Then we tested it with a real laser-plasma interaction with the Draco laser at the *Helmholtz-Zentrum Dresden - Rossendorf, Institute of Radiation Physics* in Dresden. Here preliminary results will be shown.

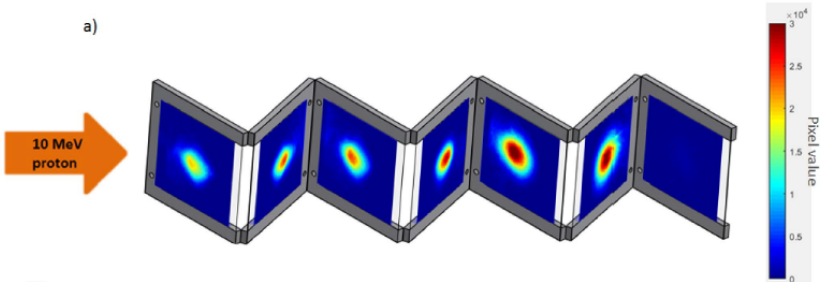

Figure 1 Experimental signal obtained by the CCD camera during irradiation with a 10 MeV proton beam, with the colour scale giving pixel values artificially overlaid on a 3D representation of the detector.

References

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