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Recent advances in MicroScint beam profiler technology

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This work illustrates some recent advances based on the so-called MicroScint, a technology developed by CERN and EPFL in recent years aimed to realize a beam transverse profiler with high spatial resolution based on a microfluidic device, obtained by a standard Silicon microfabricated structure filled with an organic liquid scintillator. The signals at each channel's segments end are readout by a photodiodes array interfaced with a microcontroller. The Silicon microfabrication allows improving the detector spatial resolution (up to ˜30 μm in this work) with respect to commercial scintillating fiber-based devices, limited to the minimum available size of 250 μm. Different MicroScint geometries have been fabricated and are described in this paper, together with preliminary experimental results obtained with UV light at 260 nm. In the perspective to obtain a more robust and easy-to-fabricate detector, the paper also presents the development of scintillating resin-based devices, obtained through PDMS moulds. The new design achieves a spatial resolution of ˜15 μm. The same readout and characterization setup of the microfluidic devices has been used on these prototypes. Substituting the scintillating liquid with the resin opens up the possibility to 3D-print the active area of the scintillating devices without using any costly process. The developed detectors are designed to suit all types of proton or heavy ion accelerators, namely cyclotrons, synchrotrons, and linacs for beams starting from tens of MeV, DC or pulsed. In particular the simulations focused on a proton-therapy beam with typical intensity of 1.5e9 protons/s. The presented beam detectors could also be used for dosimetry, X-ray imaging or for fundamental physics experiments such as the generation of vortex beams and more generally for providing a novel diagnostic tool for experiments aimed at manipulating the wavefunction of fundamental particles.

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