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Novel ionizing radiation detectors based on perovskite films

Hybrid organic/inorganic perovskites (HOIPs) represent a breakthrough in the direct detection of ionizing radiation thanks to their solution processability, and their scalability over large areas on flexible plastic substrates. Flexible perovskite X-ray detectors are lightweight devices that can be operated at low-voltages and strongly limit the use of toxic materials and precursors. Polycrystalline films are thus preferred to foresee the implementation of the technology.
Recent results on direct X-ray detectors fabricated with solution-grown polycrystalline 2-dimensional (2D) layered perovskites films will be reported. Perovskites films are directly deposited onto pre-patterned electrodes on flexible substrate by low-temperature solution process. The films provide excellent opto-electrical properties, stability, and ultra-fast response. As a result of high X-ray stopping power and ultra-low dark current, the performances of the devices as ionizing radiation detectors exhibit remarkable sensitivity, excellent Limit of Detection, and ultra-stable response under continuous operation.
We will present the design and characterization of mixed 3D/2D perovskite films-based direct proton beam detector. The work has been carried on in the framework of the experiment INFN-CSN5 ANEMONE, that aim to develop the first perovskite film-based real-time direct detector for protons and ions, as beam monitor for hadron therapy.

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