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Neutron and beta imaging with Micromegas detectors with optical readout

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Recent developments have shown that coupling a Micromegas gaseous detector on a glass substrate with a transparent anode and a CMOS camera enables the optical readout of Micromegas detectors. Efficient X-ray radiography has been demonstrated due to the integrated imaging approach inherent to optical readout. Spatial resolutions of better than σ = 200 µm have been demonstrated for low-energy X-rays from radioactive sources and X-ray generators taking advantage of image sensors with several megapixel resolution. This test opens the way to different applications. Here we will focus on two applications: neutron imaging for non-destructive examination of highly gamma-ray emitting objects and a beta imaging for the single cell activity tagging in the field of oncology drug studies. Both applications require gas simulations for the optimization of photon yields and sensitive camera as well as design of the detectors in view of the specific constraints of reactor dismantling and medical applications: spatial resolution and strong gamma suppression for neutron imaging and precise rate and energy spectrum measurements for the beta. A dedicated system consisting of a glass Micromegas detector and a low-noise camera has been designed and assembled. Results from the characterization of the detectors using X-rays, tritium and neutrons will be shown. First measurements investigating the achievable spatial resolution and rapid imaging capabilities of the Micromegas glass detector at the SOLEIL synchrotron facility with a high-intensity, flat irradiation field will be shown.

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