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First results of a combined fast-neutron & gamma-ray LXe imaging detector with gaseous photomultiplier readout

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We are developing a new detector concept for simultaneous imaging and spectroscopy of fast neutrons and gammas; it combines a liquid-Xe (LXe) scintillator coupled to a UV-sensitive gaseous imaging photomultiplier (GPM).

The research focuses on validating this new idea for simultaneously detecting concealed explosives, comprising low-Z materials, and high-Z fissile materials, utilizing respectively fast-neutron resonant transmission radiography and dual discrete gamma-ray radiography. Neutron spectroscopy is performed by Time-Of-Flight; gamma-ray analysis requires pulse-height analysis. Imaging of both relies on scintillation-light localization from a liquid xenon (LXe) converter, with a UV-sensitive, cascaded-THGEM/CsI gaseous photomultiplier (GPM).

The properties of an imaging-GPM, in Ne/CH₄ mixtures at cryogenic temperatures, will be presented. Localization properties will be given for low-energy gammas and fast neutrons, using pad readout electronics, in combination with LXe-filled capillary neutron and gamma-ray converter. The experimental results, obtained with gamma-ray and fast-neutron sources will be compared with that of extended GEANT-4 simulations.

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