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The FOXFIRE Liquid Xenon Detector R&D Project

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The FOXFIRE R&D project (FIRB On a Xenon detector with Frontend for Ionization Real-time Extraction) aims at studying and developing new techniques for the detection of rare processes in elementary particle physics by means of condensed noble gases detectors. Noble liquids, notably liquid xenon, present in fact a unique set of characteristics (high density and stopping power, high light yield) which makes them an ideal choice as a detector active material. Particles in noble liquids release energy in the form of both scintillation light and electron-ion pair formation. Many research groups investigated the combination of charge and light information for improved energy resolution and particle discrimination in the low-energy (from ten keV up to \sim MeV), low-rate regime, ideal for measuring rare processes such as neutrino-less double-beta decay or weakly interacting dark matter interactions. We are studying the extension of these techniques towards high-rate, high-energy (tens of MeV) environments with particular emphasis on real-time event reconstruction. This requires facing new problems from the point of view of both mechanical design and electronic signal handling.

Preliminary studies on simultaneous readout of scintillation light and ionization charge with a liquid xenon detector prototype built at INFN Pisa will be presented together with future developments.

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