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Imaging in TPC detectors equipped with high granularity charge readout: transfering techology from rare event searches

Imaging techniques are essential for medical diagnosis. The traditional scintillation detectors have limited efficiency and resolution, while new semiconductor detectors are expensive. Gas chamber detectors equipped with high granularity charge readout working with high pressure could be an attractive alternative that offers good energy resolution and excellent spatial resolution, a competitive efficiency, uniform response without dead zones, low cost and the ability to scan large areas, as it would include the entire body. These novel detectors are in the frontier of technology development and the more and more used in particle physics due to their high performance.

In the group of the University of Zaragoza, as part of the T-REX project, a number of R&D and prototyping activities have been carried out during the last years to explore the applicability of gaseous Time Projection Chambers (TPCs) with Micromesh Gas Structures (Micromegas) in rare event searches like double beta decay, axion research and low-mass WIMP searches where the pattern recognition of the signal is crucial. Microbulk Micromegas are able to image events with high quality measuring its energy deposition with an excellent resolution. The group has also developed as open source software, RESTSoft, suitable for simulations, analysis and event reconstruction. This technology and the software are ready to be transferred to medical diagnosis.

We will show here some examples of imaging in a quite large detector (TREX-BB) working up to 10 bars in a mixture of Xe and trimethylamine (TMA), which reduces diffusion and improves event reconstruction.

Summary

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