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R&D of Time Projection Chamber for particle tracking

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The Time Projection Chamber (TPC) [1] has the capability of three-dimensional particle tracking. We are developing a bulk Micromegas [2] based prototype TPC at SINP. In the present work, we have measured the detector gain, energy resolution, and electron transparency of the 128 μm Micromegas in argon-based gas mixtures to optimize the operating drift and amplification field. We observe the Fe55 spectrum in the Argon CO₂ gas mixture with a volumetric ratio of 90:10. We have found the photo peak of Fe55 can be resolved with 100 V/cm drift and a 38 kV/cm amplification field in a test box. We also calculated the effective drift field from a finite element field solver named COMSOL. We have used a drift field of 113 V/cm along the central axis of the prototype TPC and a 38.28 kV/cm field in the amplification region of the Micromegas detector to observe the Fe55 X-ray source photo peak spectrum in the prototype TPC. This is a preliminary result and proof of concept that our TPC is working. In the future, we will make a segmented anode to observe the alpha particle tracks with pure helium, methane, and isobutane gas.

[1] D. R. Nygren, "Proposal to Investigate the feasibility of a Novel Concept in Particle Detection", LBL internal report,(1974)

[2] S. Anvar et al., Large bulk Micromegas detectors for TPC applications, Nucl. Instrum. Meth., A 602 (2009) 415.

Session

Future Experiments and Detector Development

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