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Characterization of a Spherical Proportional Counter in argon-based mixtures

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The Spherical Proportional Counter is a novel type of radiation detector, with a low energy threshold (typically below 100 eV) and good energy resolution. This detector is being developed by the network NEWs, which includes several applications. We can name between many others Dark Matter searches, low level radon and neutron counting or low energy neutrino detection from supernovas or nuclear reactors via neutrino-nucleus elastic scattering. In this context, this works will present the characterization of a spherical detector of 1 meter diameter using two argon-based mixtures (with methane and isobutane) and for gas pressures between 50 and 1500 mbar. In each case, the energy resolution shows its best value in a wide range of gains, limited by the ballistic effect at low gains and by feedback at high gains. Moreover, the best energy resolution shows a degradation with pressure. These two effects will be discussed in terms of gas avalanche properties. Finally, the effect of an electrical field corrector in the homogeneity of the gain and the energy threshold measured in our setup will be also discussed.

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