

Development of a spherical proportional counter, as antineutrino detector, for nuclear reactor monitoring

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Abstract:

This project focuses on the study of the conditions for the detection of neutrinos from nuclear reactors, with the Spherical Proportional Counter, by exploiting the neutrino-nucleus coherent elastic scattering. The Spherical Proportional Counter is a novel proportional gaseous detector, developed to exploit the many advantages of the spherical geometry. These advantages are presented here, along with the characteristics of the detector. Different parameters of the detector are taken into account, such as the threshold energy, the gas filling (Ar, Xe) and the size of the detector. Nuclear reactors, during the operation, are high flux neutrino sources. So, the detection of the neutrinos emitted by them, offers important applications such as the precise control of the nuclear reactor. The online measurement of the nuclear reactor neutrinos, give information on the fuel composition and the operation conditions.

The Spherical Proportional Counter is tested to the detection of nuclear recoils (Ar nuclei), by exploiting the neutron-nucleus elastic scattering, from which we have low energy recoils. As neutron source is used an AmBe source. The possible shielding of the detector is studied by simulation.