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A high pressure gas TPC detector for reactor neutrino : Canceled

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A high pressure gas TPC detector has been developed in IHEP, in China, which aims to measure the reactor neutrino energy spectrum by elastic scattering with an energy resolution of less 3%@1 MeV. The whole detector with a 200-kg target will installed nearby reactor of about 20 m. On the one hand, the energy spectrum can provide an input with a model-independent nuclear database for Jiangmen Underground Neutrino Observatory (JUNO). Additionally, the gas TPC detector has other physics potentials, such as measurement of the neutrino magnetic moment, the weak mixing angle and the search for sterile neutrino.

At present, we have finished the pre-study of physics potential and simulation based on the 200-kg conceptual detector. To achieve good performance target materials with high event rate, high spatial resolution, and high energy resolution, we select the working gas with high density of free electrons, and small drift diffusion and attachment. Using the simulation tools of Garfield and Geant4, we simulated the drift properties of various gases and reconstructed the electron tacks. We found that the doping of polyatomic gases (such as TMA or iC4H10) in Ar and Ne gases is effective to decrease the electron drift diffusion, increase the drift velocity, and reduce the fluctuation of the original ionized electron. In addition, pure CF4 gas with good properties and high electron density, is also selected as the candidate working gases. To verify the selection of target material and the detector design, we developed a prototype detector with an effective volume of about 4.5 L. Some measurement results have been also achieved of the prototype detector. These results also provide more references for the large detector.

Author: YAN, WENQI (IHEP)

Presenter: YAN, WENQI (IHEP)

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