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## Development of Gaseous Tracking Devices for WIMPs Search

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Time Projection Chamber (TPC) has been recognized as a potentially powerful detector for the WIMPs search by measuring the directions of nuclear recoils, in which the most convincing signature of WIMPs caused by the earth's motion around the Galaxy appears [1]. Since the energy deposits of WIMPs to nuclei are only a few tens of keV and the ranges of nuclei are limited, such TPCs should have very fine spatial resolutions and should be operated in low pressures. We are developing a "micro-TPC" based on a gaseous 2D imaging detector with micro pixel electrodes, " $\mu$ -PIC" [2]. The prototype micro-TPC has a detection volume of  $10 \times 10 \times 10$  cm<sup>3</sup>. Normal pressure gas flow operations show that it possesses sufficient ability to detect the tracks and the Bragg curves (which sense the direction of tracks) of charged particles with track length of down to 3 mm, and we expect that the  $dE/dx$  threshold of better than 10 keV/cm can be achieved [2, 3].

Assuming these thresholds of the prototype micro-TPC, it turned out that 20 torr operation of CF<sub>4</sub> and 5 torr operation of Xe are feasible for WIMPs detection. We describe the first results of the performance study of the low pressure operation of the micro-TPC with Ar+C<sub>2</sub>H<sub>6</sub> (90:10). The micro-TPC was put into an aluminum vessel and operated at 0.2 atm for the first step. It was operated with a gas gain of 1500 and its stability was checked over 60 hours. Then, we evaluated its tracking performance with the irradiation of gamma rays and neutrons from <sup>252</sup>Cf. Electron recoils and proton recoils were clearly separated by plotting the track length as a function of recoil energy due to the difference of their  $dE/dx$ . We could observe proton tracks and their Bragg curves with energies of as low as below 100 keV. We also tested 0.2 atm operation with CF<sub>4</sub> gas and Xe gas. These results show that the micro-TPC can provide accurate measurements of the recoil directions and will have the sensitivity to the signature of WIMPs.

A larger detection volume ( $30 \times 30 \times 30$  cm<sup>3</sup>) micro-TPC is now being developed. We are going to operate it at lower pressures and measure longer tracks of not only protons but also C, F, and Xe recoils.

### References

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