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Status of low-pressure Time Projection Chamber for ion identification in Accelerator Mass Spectrometry

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The Accelerator Mass Spectrometry technique makes it possible to measure rare long-lived isotopes such as 10Be, 14C, 26Al, 129I. The content of these isotopes can be at the level of 10^{-15} of the total element content. The Accelerator Mass Spectrometer developed by Budker Institute of Nuclear Physics (BINP AMS) successfully measures the concentration of 14C relative 12C. However, there is a problem of separating the 10B isobaric background from 10Be. Beryllium-10 is used to date geological objects on a time scale from 1 thousand years to 10 million years.

To solve this problem we have proposed a new technique for ion identification based on measuring both ion track ranges and ion energies in a low-pressure Time-Projection Chamber (TPC) with Gas Electron Multiplier (GEM) readout. We have developed the TPC with a dedicated thin silicon nitride window for an efficient passage of ions. To begin with, the characteristic of the low-pressure TPC were studied in isobutane at a pressure of 50 torr using alpha particle sources.

In this work, we set up the low-pressure TPC on BINP AMS facility and successfully measured track ranges and energies of ions from samples containing 14C. At the next stage, we are going to carry out measurements with samples containing 10Be. However, using the obtained results and SRIM simulation we have already shown that the isobaric boron and beryllium ions can be separated by more than 10 sigma. This technique is proposed to be applied in AMS for dating geological objects, namely for geochronology of Cenozoic era.

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