

## **Development of a Micromegas TPC for low energy heavy ions measurement for nuclear fission and astrophysics applications**

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Time Projection Chambers are widely used since many years for tracking and identification of charged particles in high energy physics. We aim to present a new R&D project to investigate the feasibility of a Micromegas TPC for low energy heavy ions detection. Two physics cases are relevant for this project. The first is the study of the nuclear fission of actinides by measuring the fission fragments properties (mass, nuclear charge, kinetic energy). These measurements, which are important both for fundamental physics and for applications, will be performed at different installations and in particular at the NFS facility to be built in the framework of the SPIRAL2 project in GANIL. A second physics case is the study of heavy ion reactions, like  $(\alpha,\gamma)$ ,  $(\alpha,p)$ ,  $(\alpha,n)$  and all the "inverse" reactions in the energy range between 1.5 and 3 AMeV using both stable and radioactive beams (SPIRAL2, ISOLDE, S-DALINAC). These reactions have a key role in p process in nuclear astrophysics to explain the synthesis of heavy proton-rich nuclei.

The project is in its initial stage and a large effort is devoted to Mont-Carlo simulations. In particular, we will present a detailed benchmark of different simulation codes (SRIM, GEANT4, Lise++) on the energy loss and ranges of heavy ions at low energy. A new approach for simulating the ion charge state evolution in GEANT4 will be also presented. Finally, preliminary results on the TPC simulation will be discussed, in comparison with experimental tests on prototypes.

Together with the simulation studies, we have made experimental tests using a prototype Micromegas TPC made in Demokritos to detect fragments from the spontaneous fission of a Cf source. The prototype is equipped with a digital Front End Electronics, called AFTER, and developed at CEA for the T2K neutrino experiment. We will present the results of these preliminary tests and we will discuss the following steps of the R&D, mainly a measurement campaign using a 2D Micromegas TPC in a magnetic field (up to 8T).