

Abstract:

Pure hydrogen targets developments at CEA/IRFU

In spectroscopic studies of unstable nuclei, hydrogen targets are of key importance for reactions inverse kinematics. In this study, the CEA /IRFU has been developing two systems with a liquid hydrogen target for the MINOS project (acronym for Magic Numbers Off Stability) and a solid hydrogen target for the CHyMENE project (French acronym meaning: Cible d'Hydrogène Mince pour l'Etude des Noyaux Exotiques).

The MINOS project represents both a physics program and a device. The physics program aims at investigating the properties of the in-medium NN interaction through the spectroscopy of the most exotic nuclei produced at fragmentation facilities. The device is composed of a thick cryogenic liquid hydrogen target (60 to 200 mm in length with an effective diameter of 38 mm) surrounded by a cylindrical time projection chamber devoted to determine the reaction vertex by tracking charged particles produced in knockout reactions. The system has been used successfully in spring 2014 at the Radioactive Isotope Beam facility of RIKEN.

The CHyMENE Project aims to provide to the nuclear physics community a thin and pure solid windowless hydrogen or deuterium target an alternative solution to CH₂ targets commonly used for the study of nuclear reactions in inverse kinematics. Cryogenic H₂ targets will improve the luminosity without contribution from carbon (C) atoms. The thickness of the target is a crucial parameter to achieve the detection of the reaction products. We are presently developing a rectangular shaped windowless target with a width of 10 mm and a thickness in the range of 30-50-100 microns necessary for the physics objectives. The adopted technique is continuous extrusion in the vacuum of a reaction chamber.