Active Target and Time Projection Chamber

Project Information

**ACTAR TPC**  
Grant agreement ID: 335593

**Status**  
Closed project

**Start date**  
1 February 2014

**End date**  
31 January 2019

**Funded under**  
FP7-IDEAS-ERC

**Overall budget**  
€ 1 290 000

**EU contribution**  
€ 1 290 000

**Hosted by**  
GRAND ACCELERATEUR NATIONAL D'IONS LOURDS  
France

Final Report Summary - ACTAR TPC (Active Target and Time Projection Chamber)

The active target and time projection chamber (ACTAR TPC) is a novel gas-filled detection system that will permit new studies into the structure and decays of the most exotic nuclei. The use of a gas volume that acts as a sensitive detection medium and as the reaction target itself (an “active target”) offers considerable advantages over traditional nuclear physics detectors and techniques. The core detection system consists of a micro-pattern gaseous detector coupled to a highly pixelated pad plane with a pitch of 2x2 mm^2. Both the channel density (25 channels/cm^2) and the total number of electronics channels (16384) are the highest that have been achieved by any nuclear physics detector to date. This design has required new developments in high-density electronics and data-acquisition systems. New experiments in regions of the nuclear chart that could not be previously contemplated have become feasible with the novel ACTAR TPC detector.
The main objective of the project was to design and construct a state-of-the-art gas filled detection system for nuclear physics experiments. The ultimate scientific goal was to use this detector to perform several key experiments using accelerated beams of rare isotopes. The first experiment focused on studying rare decay modes of an excited resonance in 18Ne that plays an important role in the 14O(α,p)17F reaction rate. This reaction is one of two possible breakout pathways from the HCNO cycle that occurs in explosive astrophysical environments such as novae and X-ray bursts. The second experiment will probe the nature of the decay mechanism for nuclei that decay by a very rare and recently discovered decay mode known as 2-proton radioactivity. These experiments were selected based upon their scientific importance and the potential impact that their results could provide to the domain of nuclear physics and nuclear astrophysics. All of these experiments cannot be performed using conventional detectors and techniques and thus required a new and more sensitive device to be developed.

The first 3 years of the project were primarily focused on the mechanical design and fabrication process as well as the software and electronics hardware developments that were required to operate the system. In the final 2 years, the detector was assembled, its performance was tested and characterized and a full commissioning experiment was performed using an accelerated beam delivered by the GANIL facility. The detector is now fully operational and its performances meet, or even exceed, our expectations. With the detector now online, we expect that it will continue to serve the subatomic physics community for at least the next decade.

Last update: 2 July 2019
Record number: 386226