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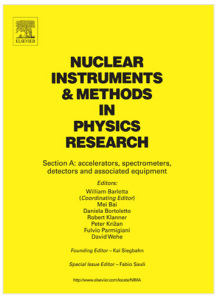

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NUCLEAR INSTRUMENTS & METHODS IN PHYSICS RESEARCH
Section A

A GEM-TPC in twin configuration for the Super-FRS tracking of heavy ions at FAIR

F. García*[1], C. Caesar[3], T. Grahn[1,2], H. Heggen[3], J. Hoffmann[3], A. Jokinen[1,2], C. Kaya[3], J. Kunkel[3], N. Kurz[3], C. Nociforo[3], A. Prochazka[3], S. Rinta-Antila[1,2], H. Risch[3], I. Rusanov[3], C. J. Schmidt[3], H. Simon[3], C. Simons[3], R. Turpeinen[1], B. Voss[3], J. Äystö[1,2], M. Winkler[3]

[1] *Helsinki Institute of Physics, University of Helsinki, 00014 University of Helsinki, Finland*

[2] *Department of Physics, University of Jyväskylä, 40014 University of Jyväskylä, Finland*

[3] *GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt 64291, Germany*

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Abstract

The GEM-TPC[1] described herein will be part of the standard beam-diagnostics equipment of the Super-FRS[2]. This chamber will provide tracking information for particle identification at rates up to 1 MHz on an event-by-event basis. The key requirements of operation for these chambers are: close to 100% tracking efficiency under conditions of high counting rate, spatial resolution below 1 mm and a superb large dynamic range covering projectiles from Z=1 up to Z=92. The current prototype consists of two GEM-TPCs inside a single vessel, which are operating independently and have electrical drift fields in opposite directions. The *twin configuration* is done by flipping one of the GEM-TPCs on the middle plane with respect to the second one. In order to put this development in context, the evolution of previous prototypes will be described and its performances discussed. Finally, this chamber was tested at the University of Jyväskylä accelerator with proton projectiles and at GSI with Uranium, Xenon, fragments and Carbon beams. The results obtained have shown a position resolution between 120 to 300 μm at moderate counting rate under conditions of full tracking efficiency.

Gas Electron Multiplier; Time Projection Chamber; Super-FRS; Tracking; Radioactive Ion Beam; Beam Adjustment; FAIR; Fragment Separator; GSI

1. Introduction

THE facility for antiproton and ion research (FAIR)[3,4], will provide an extensive range of beams; from protons, antiprotons to uranium at intensities up to 10^{11} particles/spill and with excellent beam quality in the longitudinal and transverse phase space.

The Superconducting Fragment Separator (Super-FRS)[5] is a powerful in-flight device which will provide spatially separated isotopic beams up to uranium projectiles. Its superiority to the present FRS[6] is the incorporation of more separation stages and larger aperture superconducting magnets. Due to the high-resolution achromatic mode of the Super-FRS, the tracking detectors are crucial to obtain