GEM - TPC Prototype Development for the S-FRS Diagnostic System

OUTLINE

- INTRODUCTION and MOTIVATION
- GEM DETECTOR DEVELOPMENT
- PREVIOUS DEVELOPMENT in GEM based TPC
- TRACKING TPC DESIGN
- DETECTOR FABRICATION
- ONGOING ACTIVITIES

INTRODUCTION

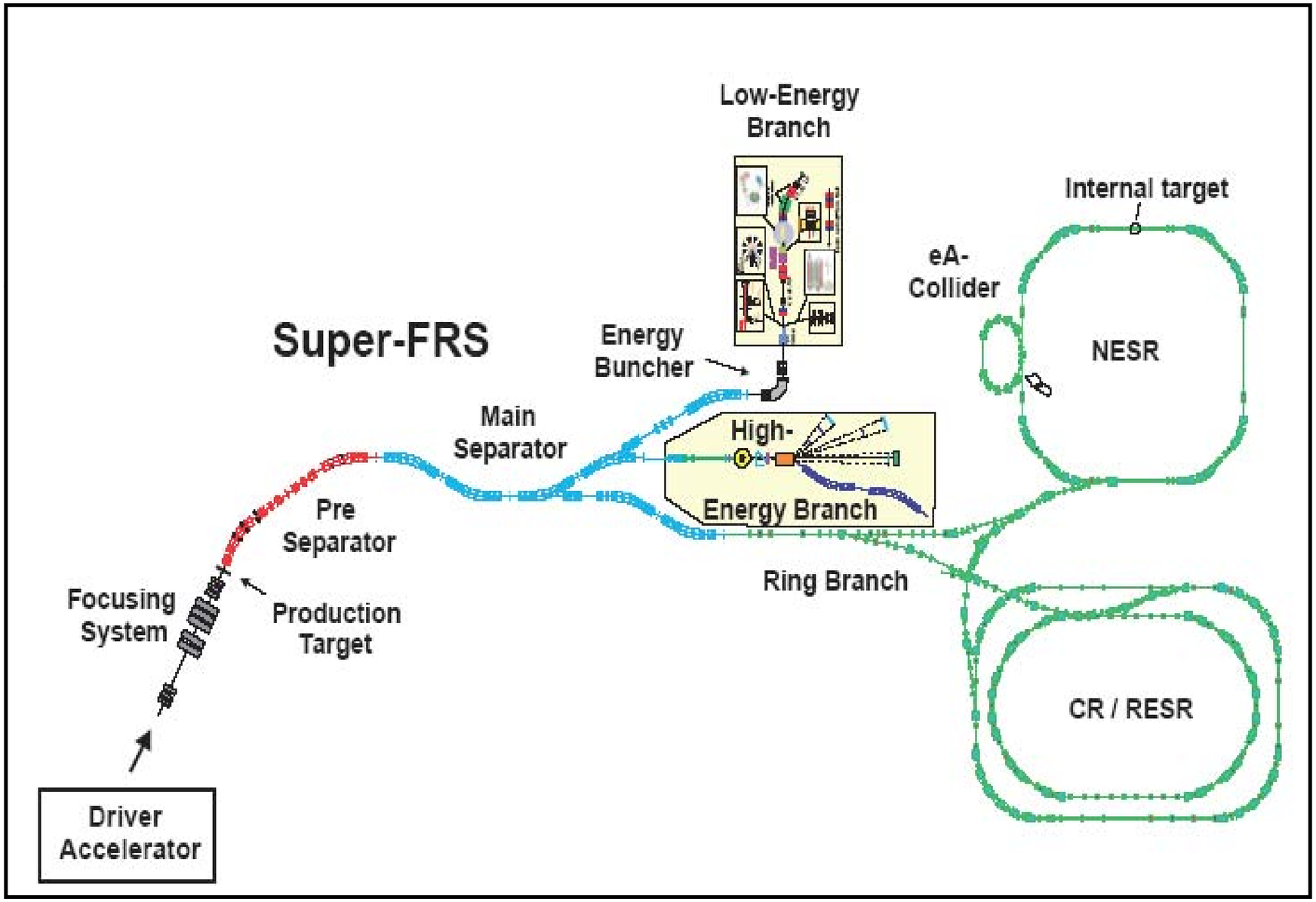
FAIR is Facility for Antiproton and Ion Research. The concept of the FAIR Facility aims for a multifaceted forefront science program, beams of stable and unstable nuclei as well as antiprotons in a wide range of intensities and energies, with optimum beam qualities

Time Table spans till end 2016

MOTIVATION

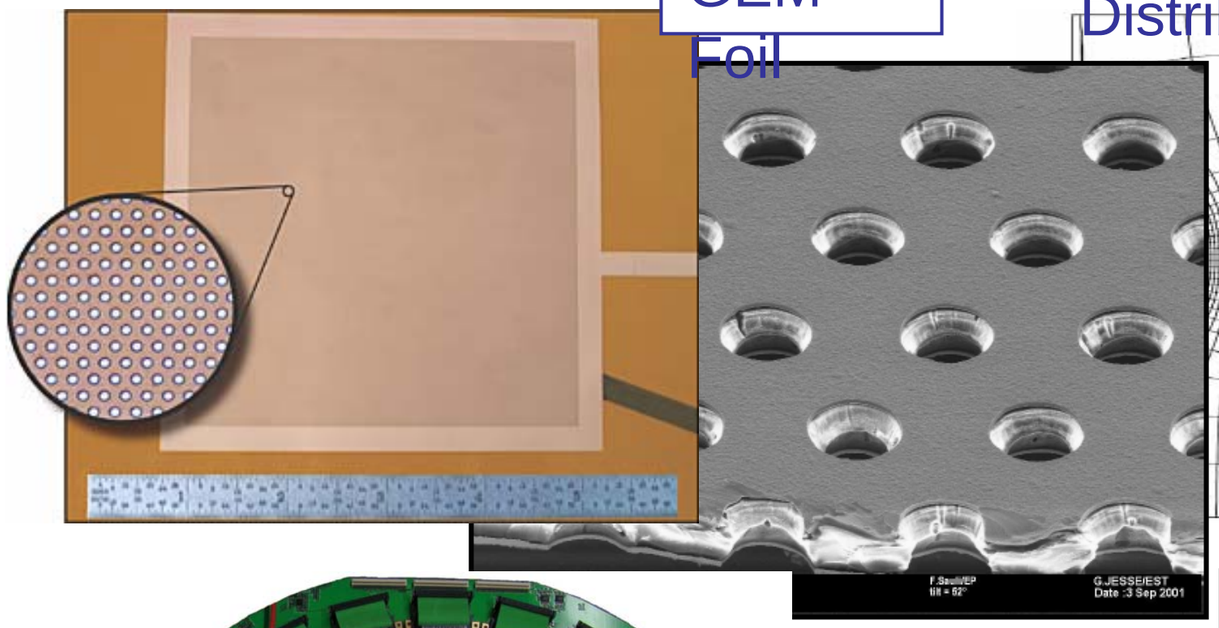
NUSTAR collaboration (Nuclear Structure, Astrophysics, and Reactions) has more than 700 members in total.

Part of the Finnish Contribution will be in the superconducting in-flight separator (Super-FRS) Diagnostic systems

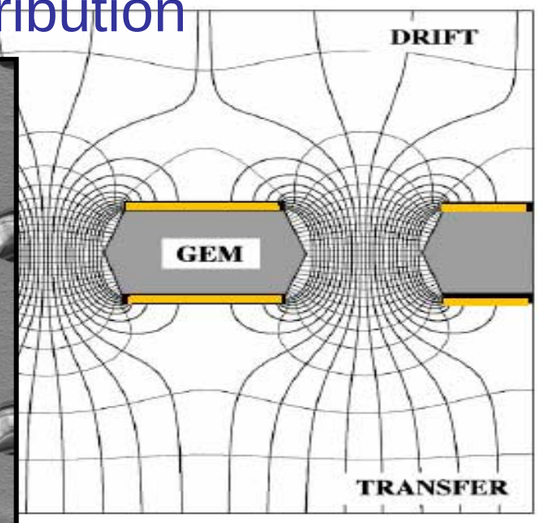


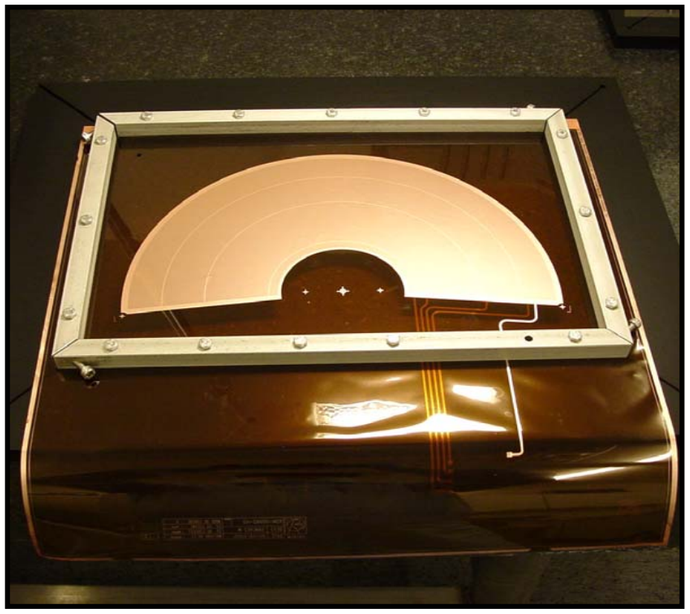
Development of GEM detectors

GEM Foil



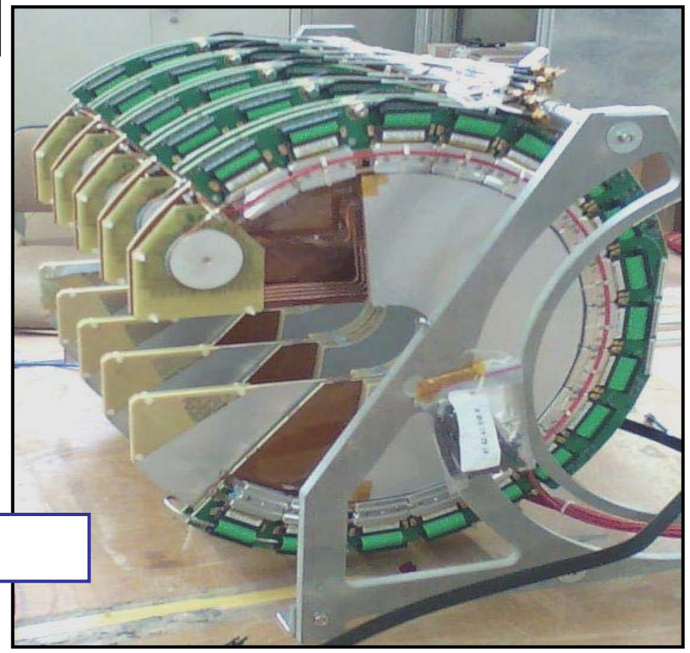
Electric Field Distribution



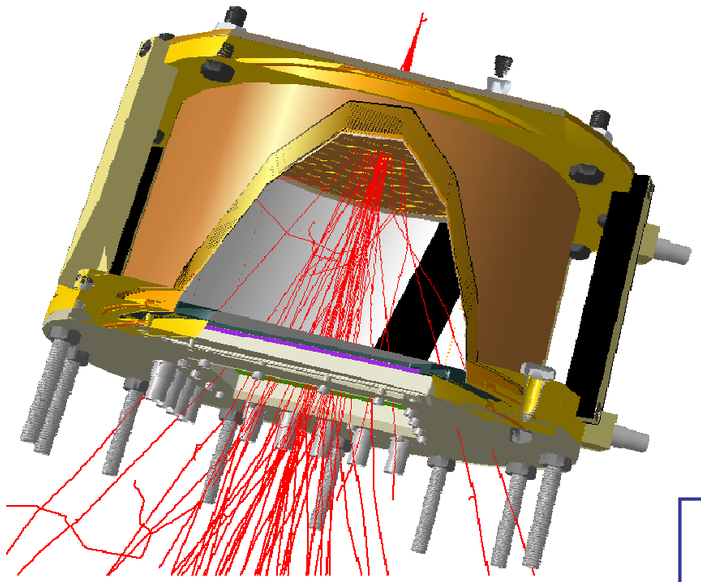


TOTEM GEM Detector

TOTEM T2 Tracker

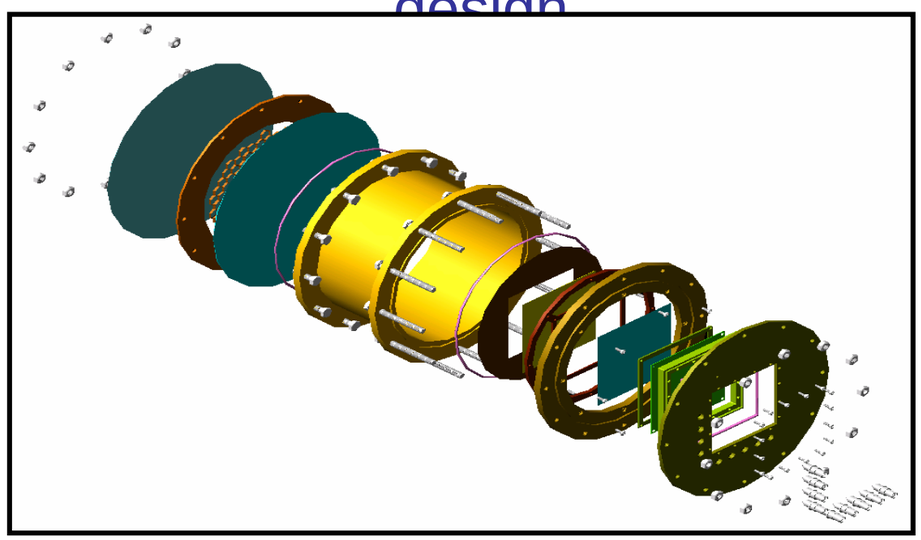


Previous Development of GEM - TPC

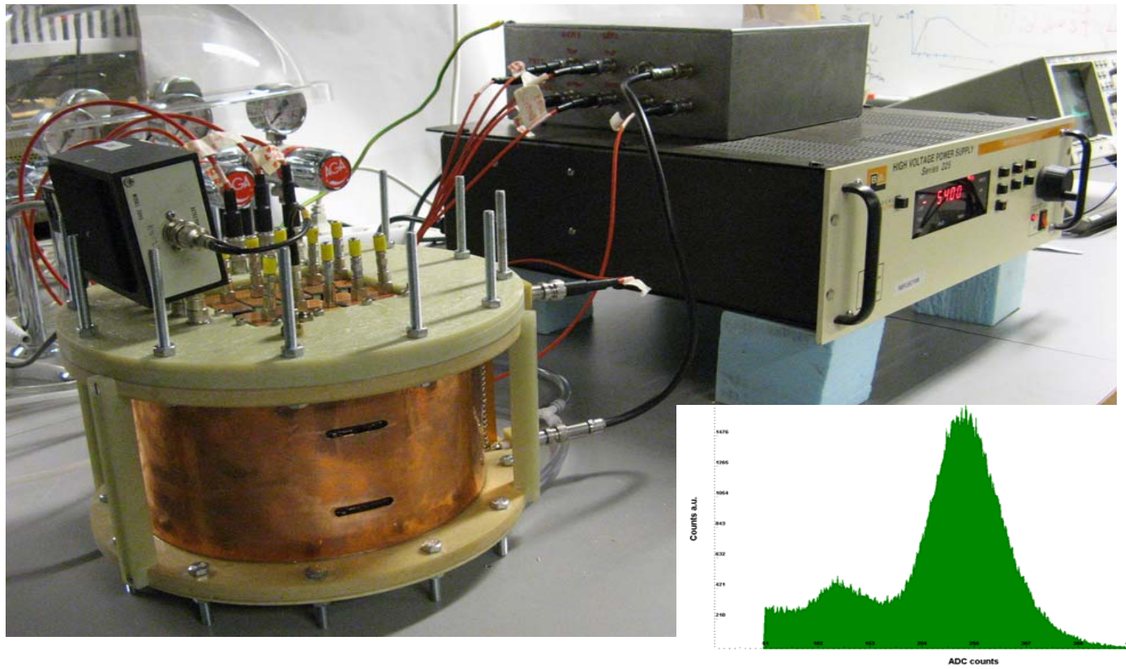


GEANT4 Model

CAD TPC design



Test Setup

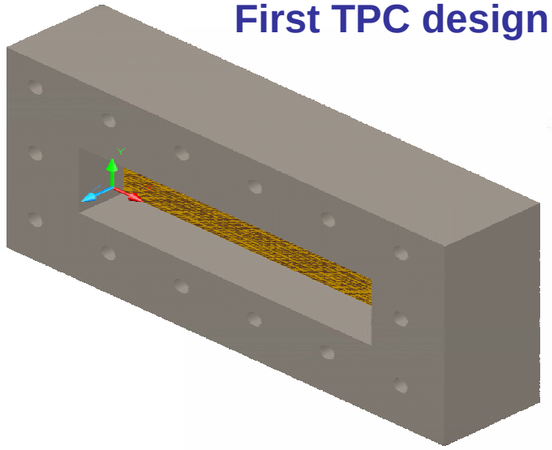


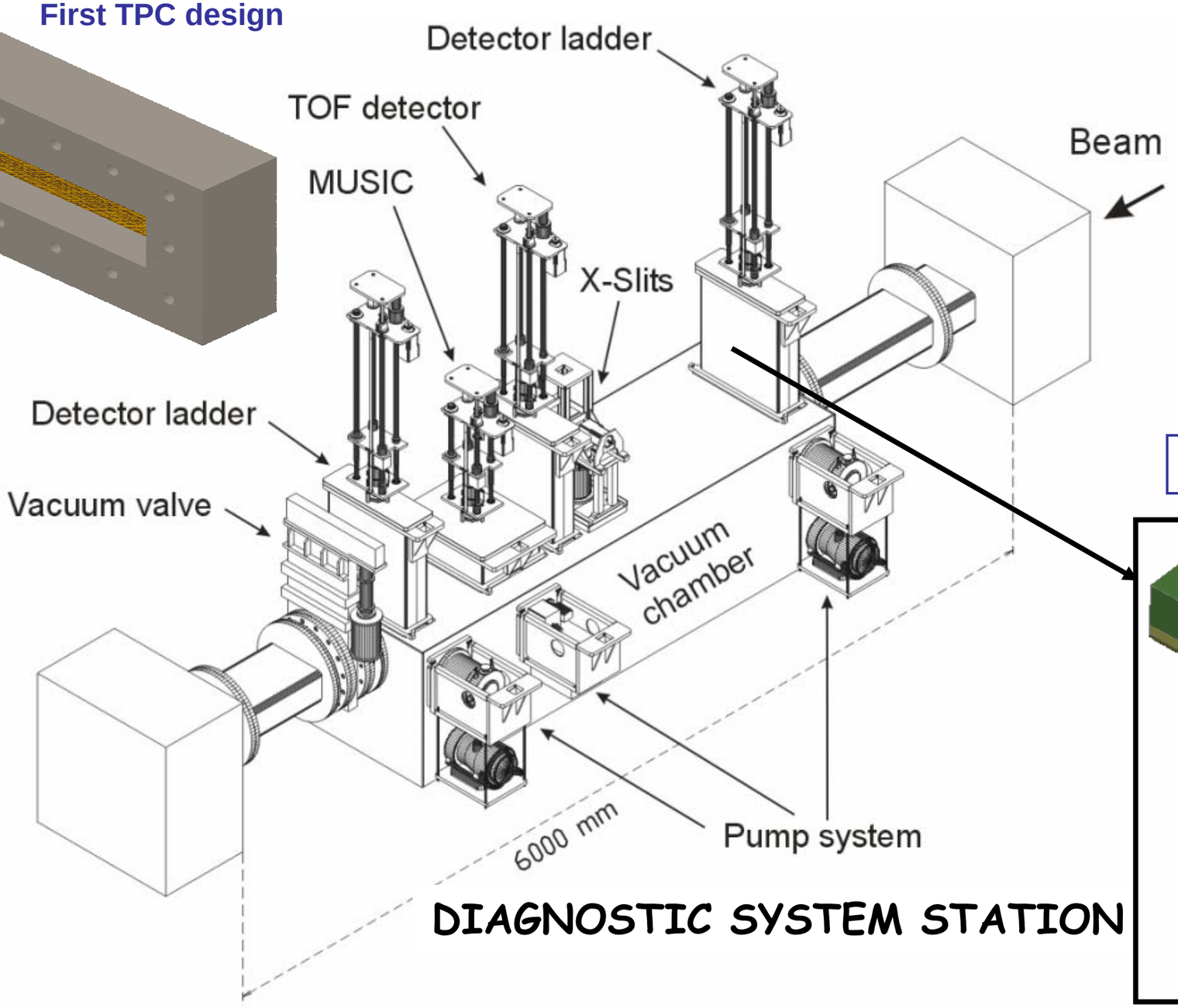
^{55}Fe spectra with energy resolution ΔE = 25 %

Development of the GEM stage for the PANDA TCP Prototype

TRACKING TPC DESIGN

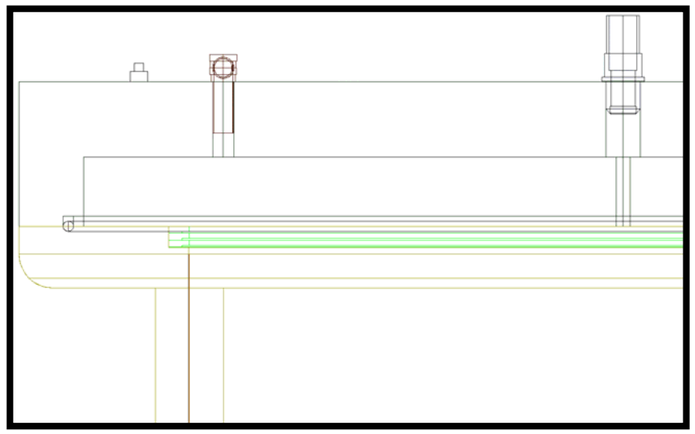
First TPC design



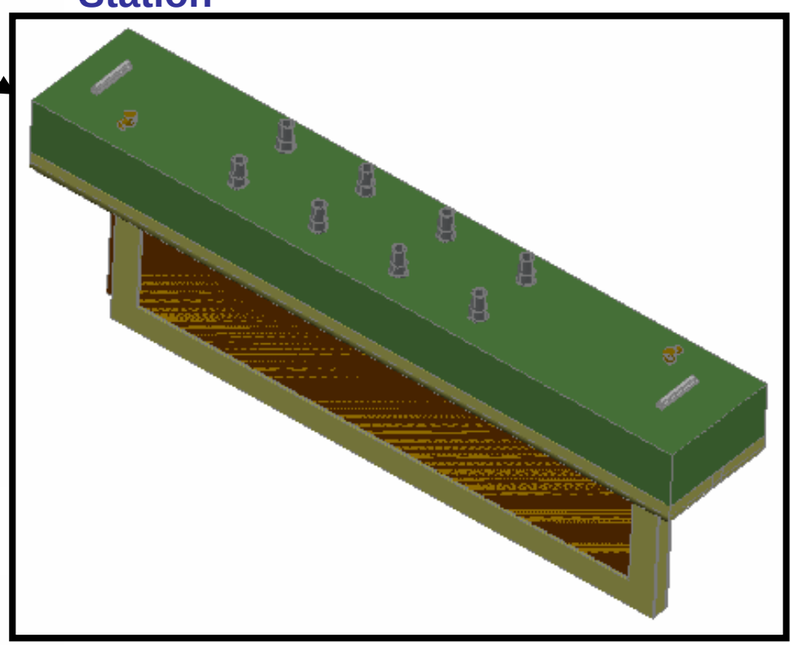


DIAGNOSTIC SYSTEM STATION

TPC Flange design



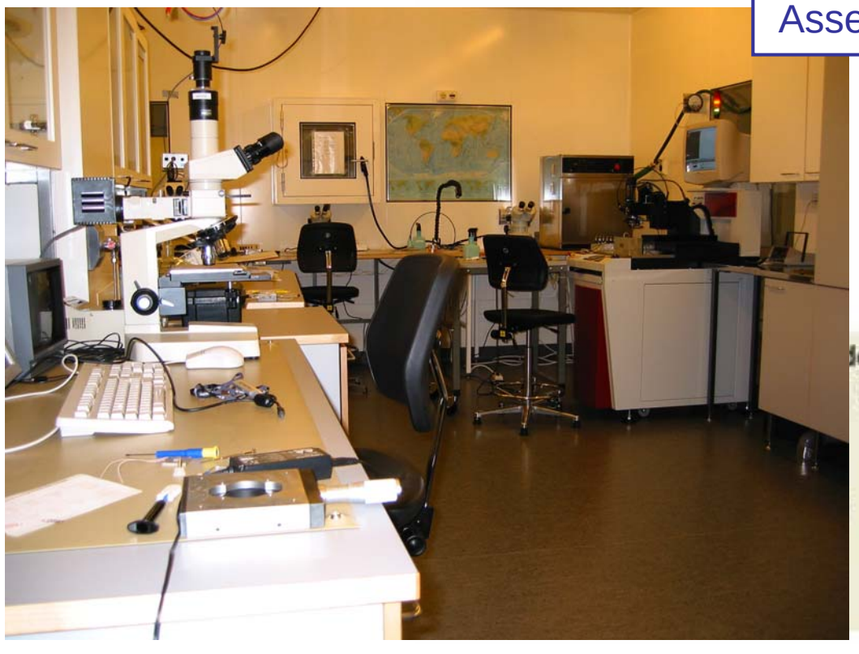
TPC mounted on Diagnostic Station



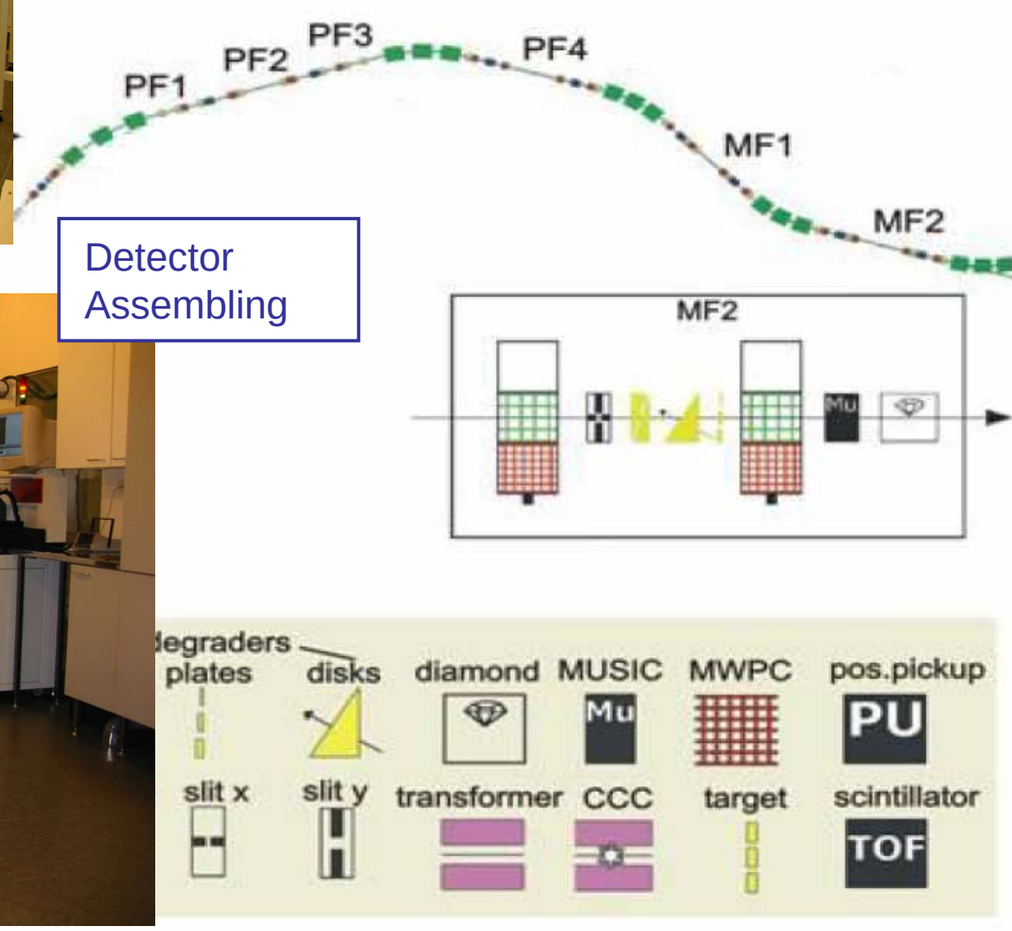
DETECTOR FABRICATION

Detector Testing

UP TO 50 DETECTORS



Detector Assembling



DETECTOR FABRICATION (cont.)

Plan of Activities

Task	Contribution	Responsible
1	Detector environment simulations	GSI
2	Field Cage, GEM Stack and Gas System	HIP
3	Readout Electrodes Plane	CERN workshop/ Kytkentälevy Oy
4	Readout Electronics: ASIC (N-XYTER), FEC and DAQ	GSI, JYU
5	Preliminary tests	HIP
6	Beam Test – FRS	GSI, HIP, JYU
7	Integration and Commissioning	GSI, JYU

ONGOING ACTIVITIES

- Feasibility studies for the introduction of new materials of the components like carbon composite

- Simulations of occupancies, energy deposition for different ions, hits of secondaries and the optimization of the readout electrodes geometry

- Investigation of how the current detector affects the beam optics in terms of momenta resolution

- Mechanical integration into the Diagnostic Stations – dimensions, services and vacuum constraints

- Readout Electronics integration – chip n-XYTER + DAQ