• TRICK A Tracking Ring Imaging Cherenkov Detector G. Mezzadri – gmezzadr@fe.infn.it



The idea: RICH+TPC

Combine two esisting well-working detection techinques into one single volume to extend their capabilities and perform a 5D readout Similar idea of hadron blind calorimeters¹

The technologies

- one 9x9 cm², n = 1.045, Japanese produced aerogel
- four H12700 HAMAMATSU MA-PMTs²
- one Triple-GEM
- readout by TIGER-based electronics with full readout chain³

The expected performance

Spatial resolution $\sigma_x \sim 100$ um on the 3 views Time resolution σ_{t} better than 1 ns π/K separation with angle reconstruction up to 4 GeV/c

Expected improvements:

1) third spatial coordinate reconstruction with precise t_o from Cherenkov photons;

2) standalone tracking in Cherenkov ring measurements + possibility to operate in magnetic field*

*Given the proper photodetectors

Mechanical developments Mechanical drawings completed.

Software simulation

Basic tools are available to extract geometry and field configuration



XV anode will be useful to reduce uncertainty on the coordinate perpendicular to the beam axis

Prototype to be assembled to start cosmic data taking for TPC validation in a dedicated black box

Study the reconstruction before and during the data acquisition.

Geometry simulation in GEANT4





Field uniformity with wire field cage

with ANSYS

Software ready to start reconstruction of TRICK tracks and rings owing to the experience of CLAS12 RICH⁴ and **BESIII CGEM-IT⁵ groups**

TIGER Electronics



Torino Integrated GEM Electronics for Readout is a family of ASICs developed within BESIIICGEM project. They have 64 channel analog readout for precise time and charge measurement.



TIGER-GEM⁶ is used to read the triple-GEM. Extensively tested within BESIII CGEM-IT⁴ detector

TIGER-MED⁷ has 8 configurable gains to read different

TIGER-MED signal seen on the oscilloscope



TIGER FEBs

range of input charges. First test with MA-PMTs for single photon applications



TIGER-MED time walk measured while reading a signal from an external laser source



TRICK is a two-year project funded by INFN CSN5 to build and test a demonstrator of a new reconstruction technique that can extend the functionality of existing working technologies by combining them to meet the challenges for detectors at future colliders

Bibliography: 1) IEEE Trans.Nucl.Sci. 66 (2019) 8, 1984-1992; 2) NIM A 952 (2020) 16212; 3) JINST 16 (2021) 08, P08065; 4) NIM A 964 (2020) 163791; 5) Symmetry 14 (2022) 5; 6) NIM A 924 (2019) 181; 7) JINST 14 (2019) 08, P08013