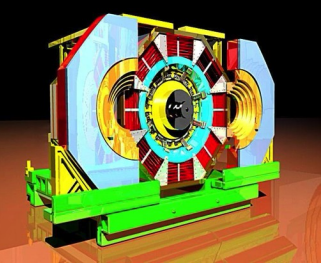
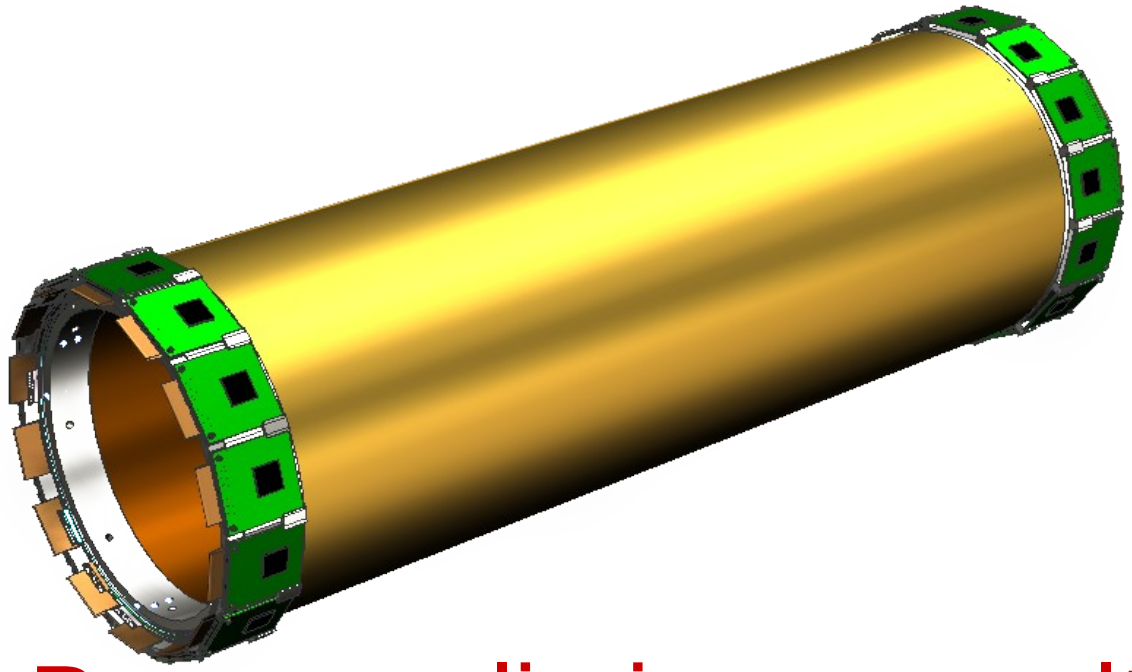




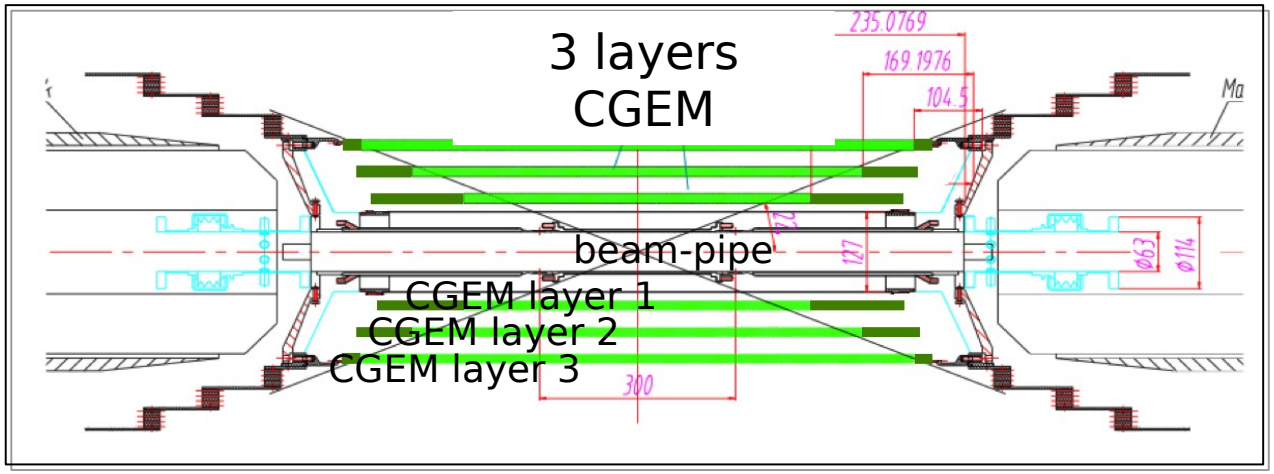
Test Beam preliminary results of the GEM prototypes for the BESIII-IT

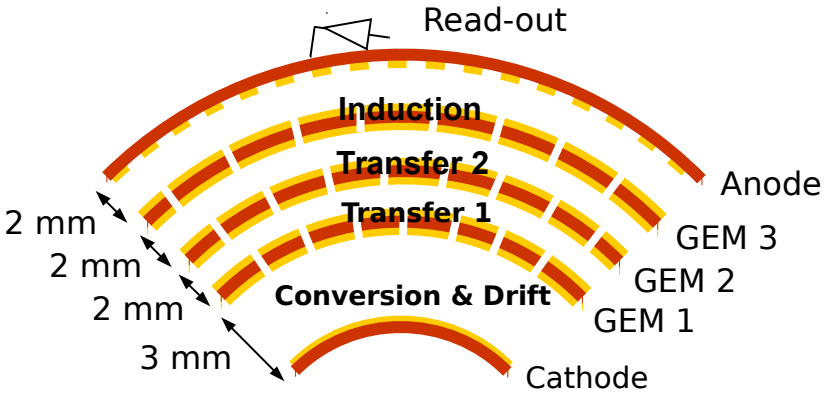
Riccardo Farinelli
on behalf of the
BesIII-CGEM group

Outline

- BESIII experiment
- Results from previous TB
- Prototype and Test Beam (TB) setup
- Motivation of this TB
- Data acquired
- Problems in the data taking

A CGEM Inner Tracker for BESIII

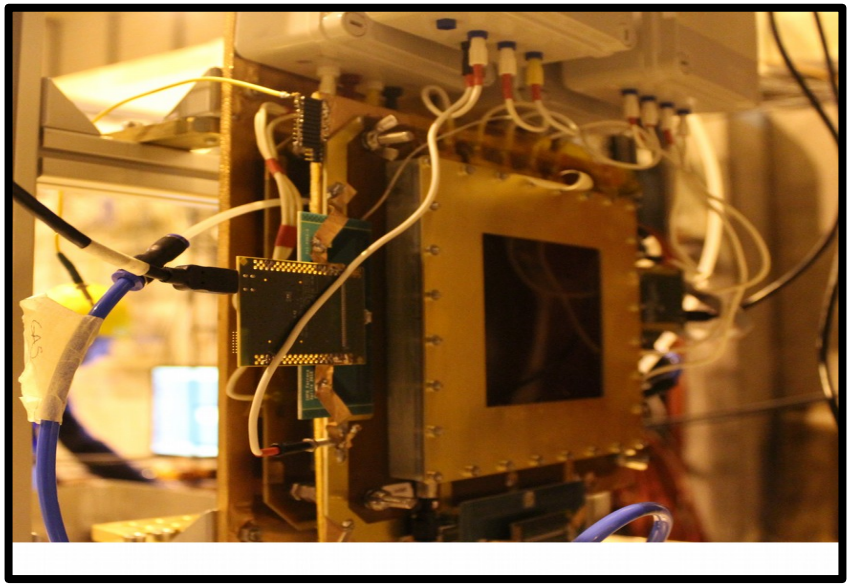




Requirements

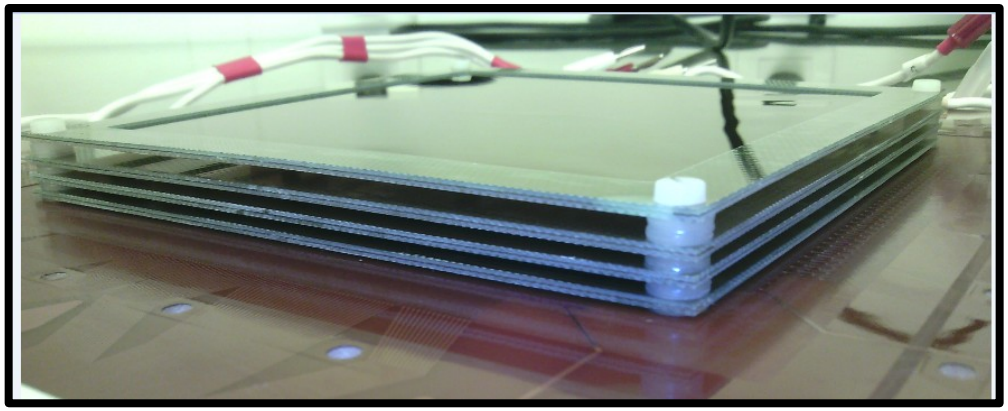
- Rate capability: ~10^4 Hz/cm^2
- Spatial resolution: s_{xy} =~130μm : s_z=~1 mm
- Momentum resolution:: σ_{Pt}/P_t =~0.5% @1GeV
- Efficiency = ~98%
- Material budget ≤ 1.5% of X_0 all layers
- Coverage: 93% 4π
- Operation duration ~ 5 years

Tested chamber

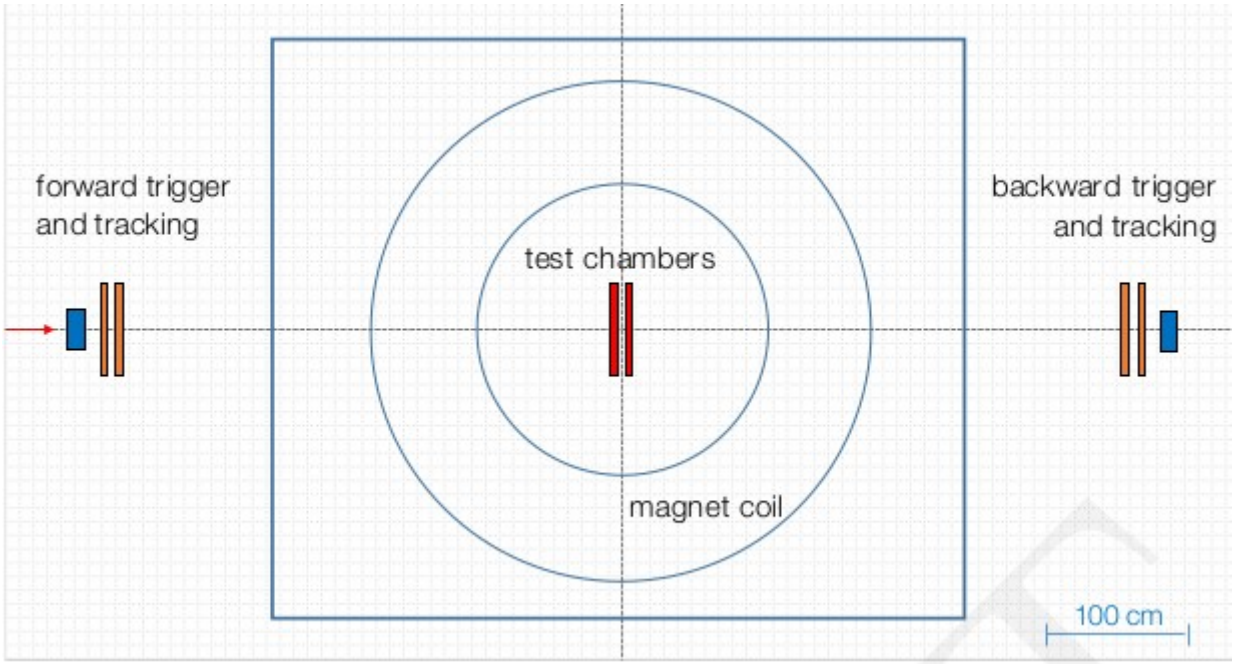


The tested chamber are 10x10 cm^2 triple-GEM with:

- ArCO2 (70/30) and/or ArIso (90/10) gas mixtures
- XV or XY readout anode with 650 µm pitch strip



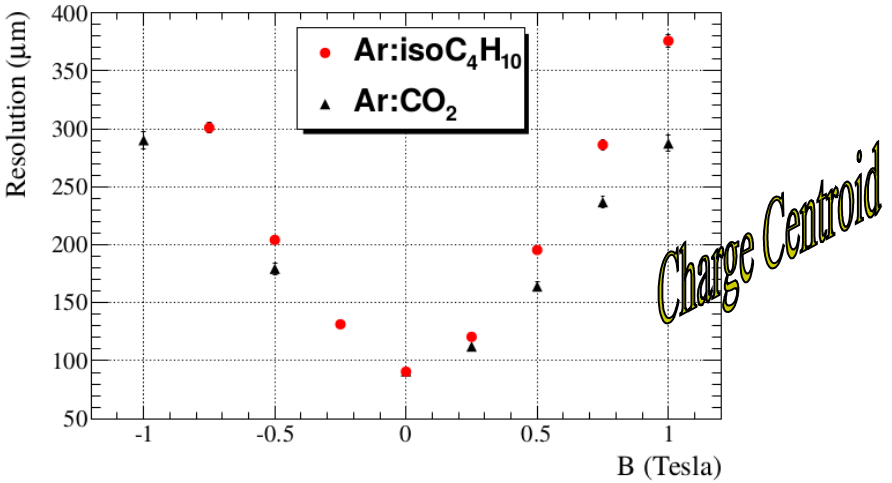
Previous TB setup

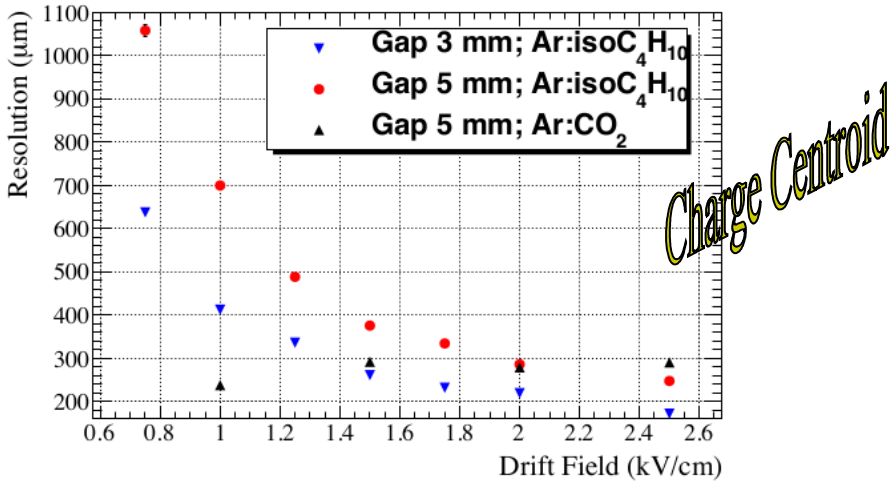


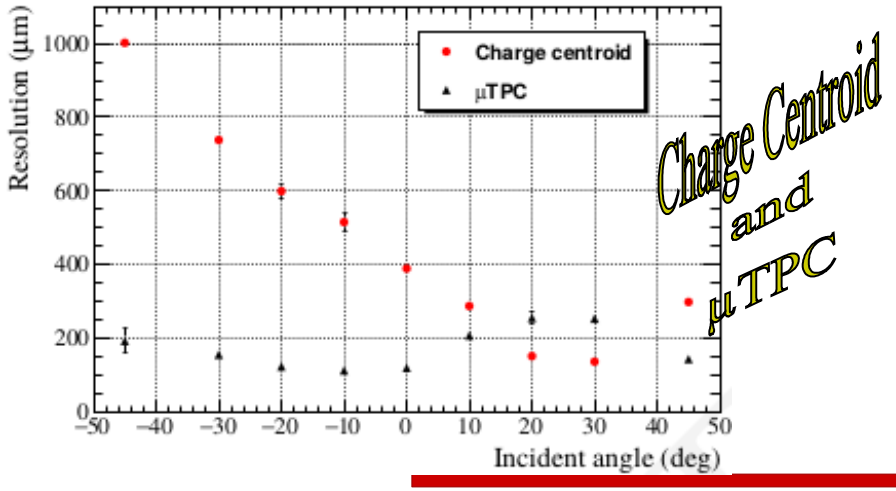
Previous purpose:

- Study of GEM performance (efficiency, spatial resolution, noise, …) in magnetic field with different conditions (gas, gain, E field, …)
- Study and optimize the Charge Centroid method
- First development of the µTPC reconstruction method

Previous Results



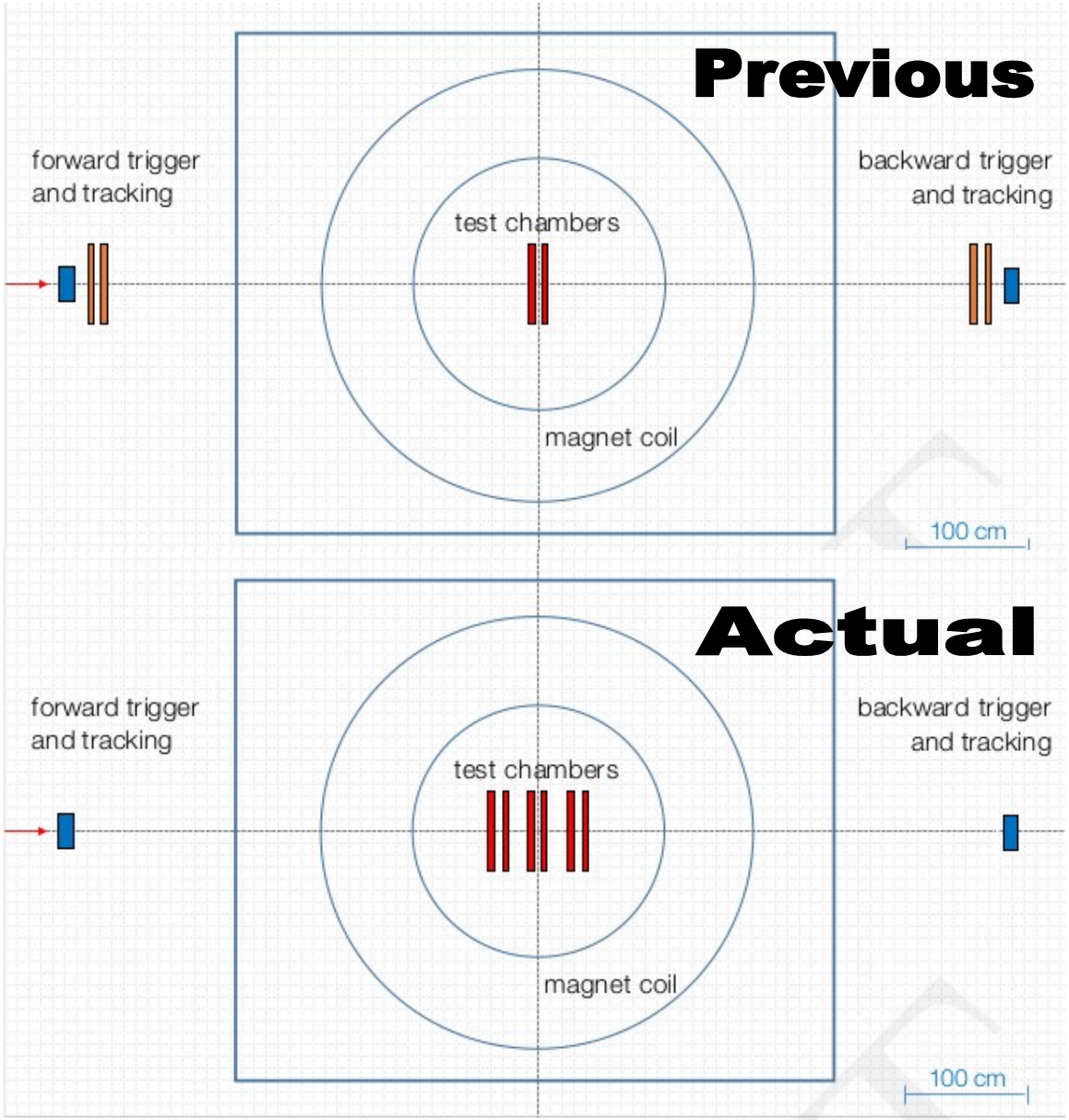




- Charge centroid resolution degrades with the increasing of the magnetic field
- An optimization of the CC is possible varying the drift field.
  We reach a spatial resolution of 190μm with a drift field of 2.5 kV/cm and ArIso gas mixture (90/10)
- μTPC has been studied as function of the incident angle and it reaches a spatial resolution of ~ 130μm in most of the angle range

→ for full review of the results see the talk from Giulio Mezzadri at WG2

Actual TB setup

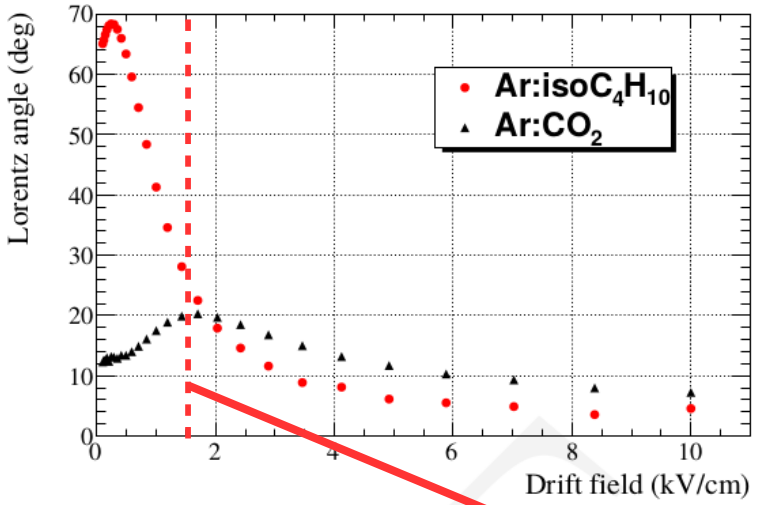


Setup:
6 planar triple-GEM inside the magnet to avoid the systematics from the external tracking with the μTPC measurement. Two back-to-back chambers for each station.

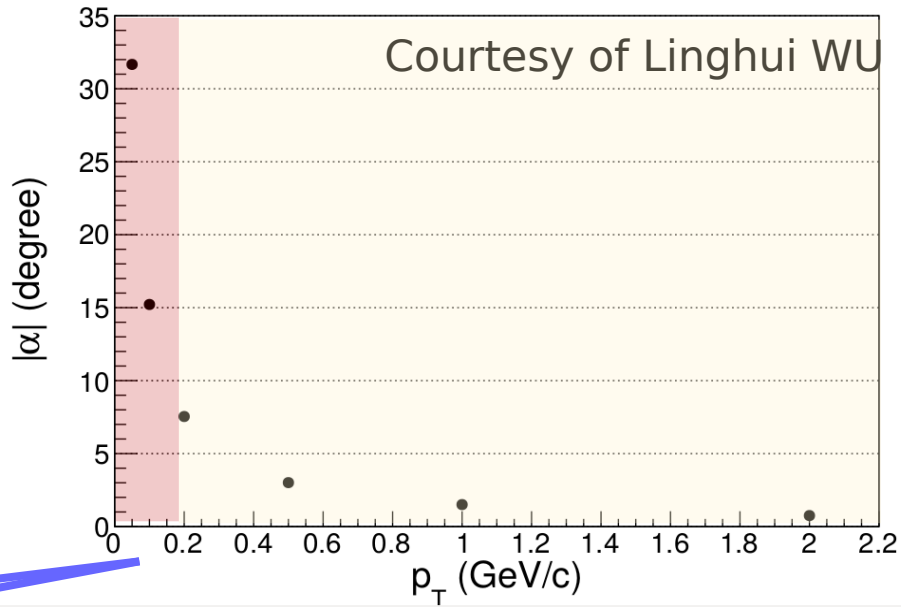
Purpose of this TB:

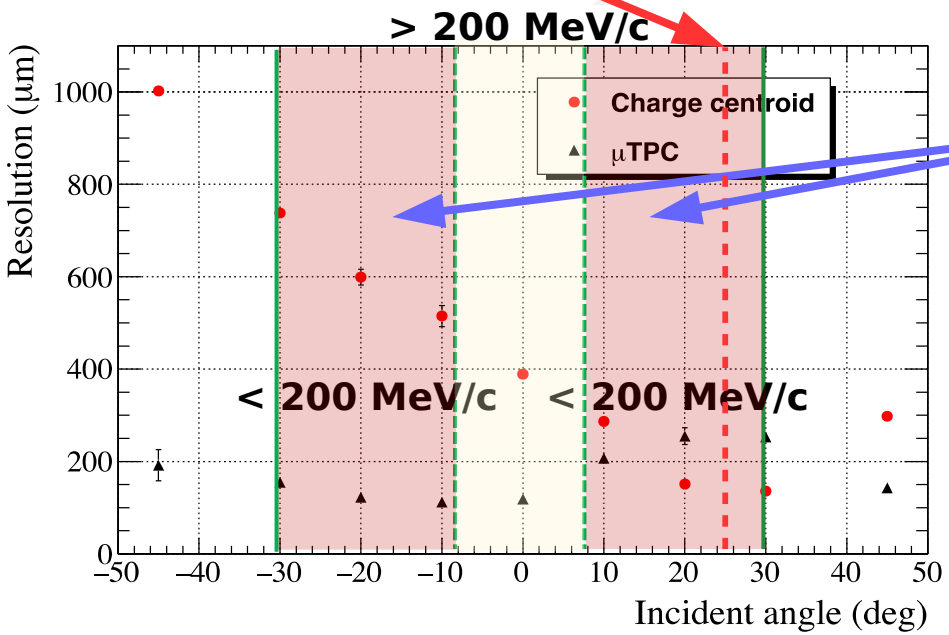
- Optimize the μTPC reconstruction method as function of the drift field
- Study the behavior of 3 planes of triple-GEM tracking system for different orientation of the triple-GEM, i.e. :
  - straight-reverse-straight
  - straight-straight-straight

The Goal



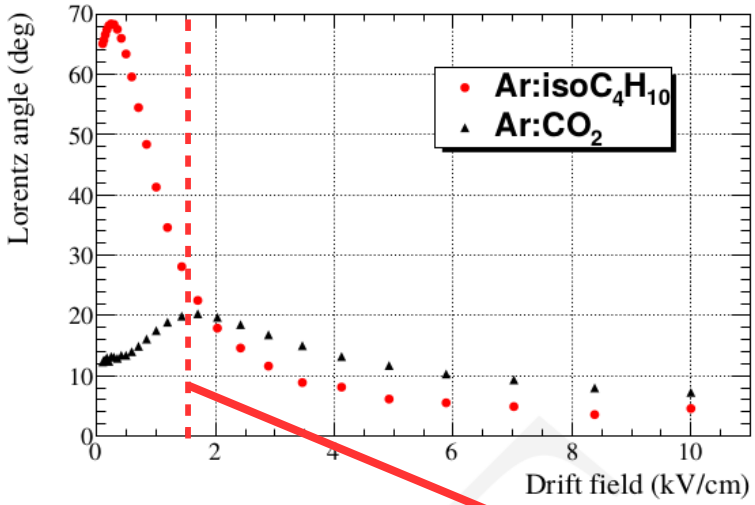
Expected entrance angle at the outer radius of CGEM-IT (primary vertex particles)

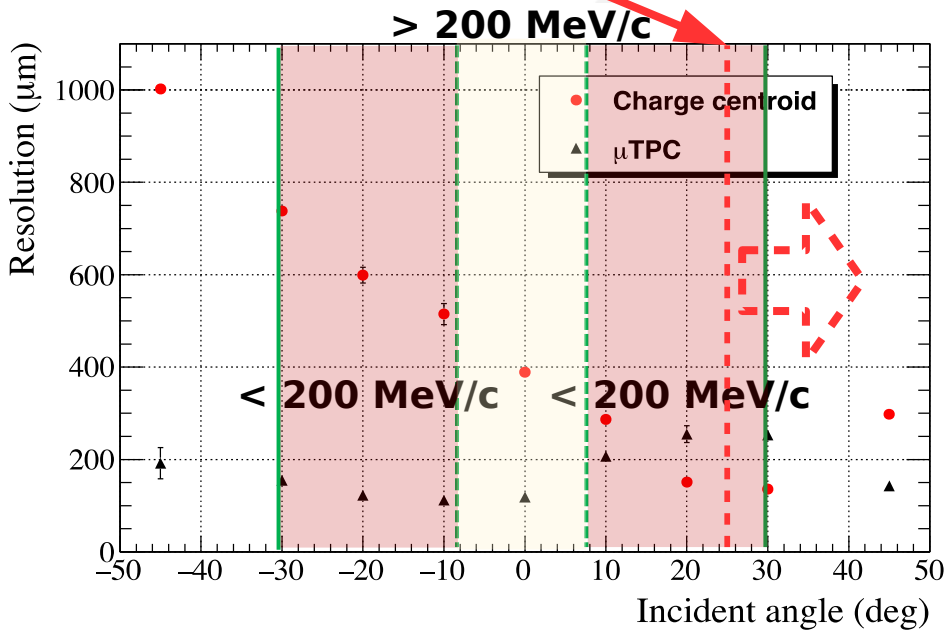




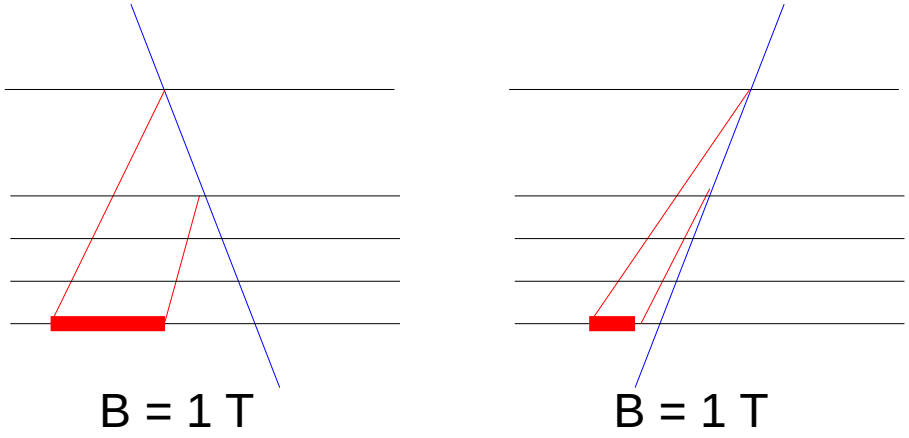
The incident angle of the majority of the BESIII tracks is between -15° and 15°, we have to reach the best resolution in this angular range

The Idea





Understand the results ...



… to understand the optimization

The behavior of the μTPC resolution strongly depend by the Lorentz angle. When the incident angle coincides with the Lorentz angle then the μTPC resolution degrades

The idea is to optimize the drift field in order to shift the Lorentz angle and to keep the resolution stable in the interested region

Data plan

- HV and magnetic field scan to confirm the previous results
- Drift scan from 0.5 to 2 kV/cm for incident angles between 0° and 45°
- REDO these mesurement for ArCO2 (70/30) and ArIso(90/10) gas mixtures
- High rate pion runs to test the multi-track performance of 3 planar triple-GEM

A short list of problems

DATA ACQUISITION

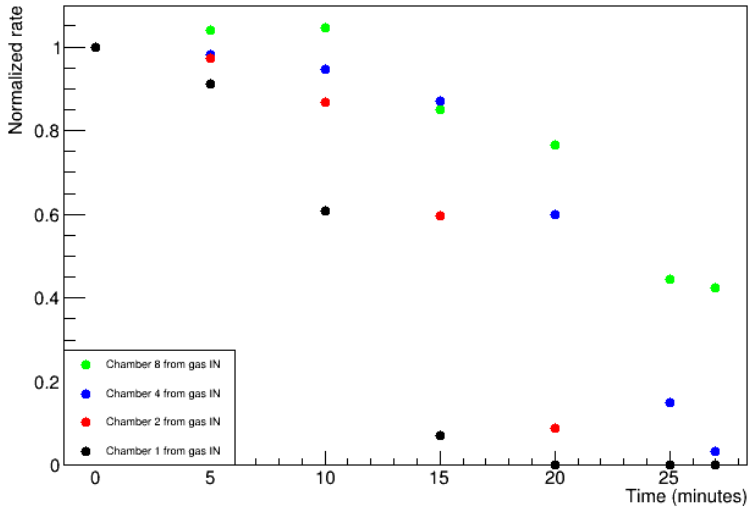
- mmDAQ crashes without any apparent reason when some runs are stopped
- mmDAQ crashes at the begin of the data taking
- SRS returns errors as “bad frame count” or “no fafa frame”

FACILITY

- A measurement of the beam line inside Goliath has been performed with a laser system. The previous line was not in agreement with our.

SETUP DEATH

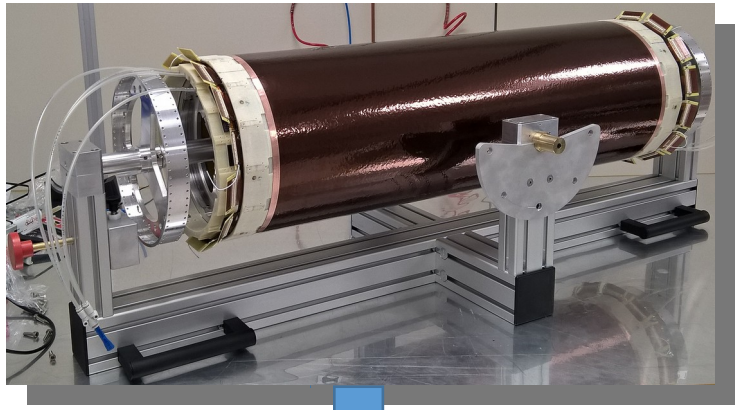
- An unexpected total loss of the activity of the chambers during the last main user period.
  In the picture is shown that this happened in around 30 minutes and if has affected the chamber from the first in the gas line to the last one.



Future TB

- No other TB are planned in 2016 in the H4 line.

- Another TB is planned in the H2 line during August 2016 to test the first prototype of cylindrical GEM to study the performance of a big detector with respect to a small planar prototype.



M1 magnet at H2 in SPS CERN
- Up to 3.5 T solenoidal magnetic field
- 1400 mm of internal diameter
- 820 mm of distance between the two cryostats

A special thanks to Eraldo, Yorgos and the entire RD51 collaboration for the effort during these test beam