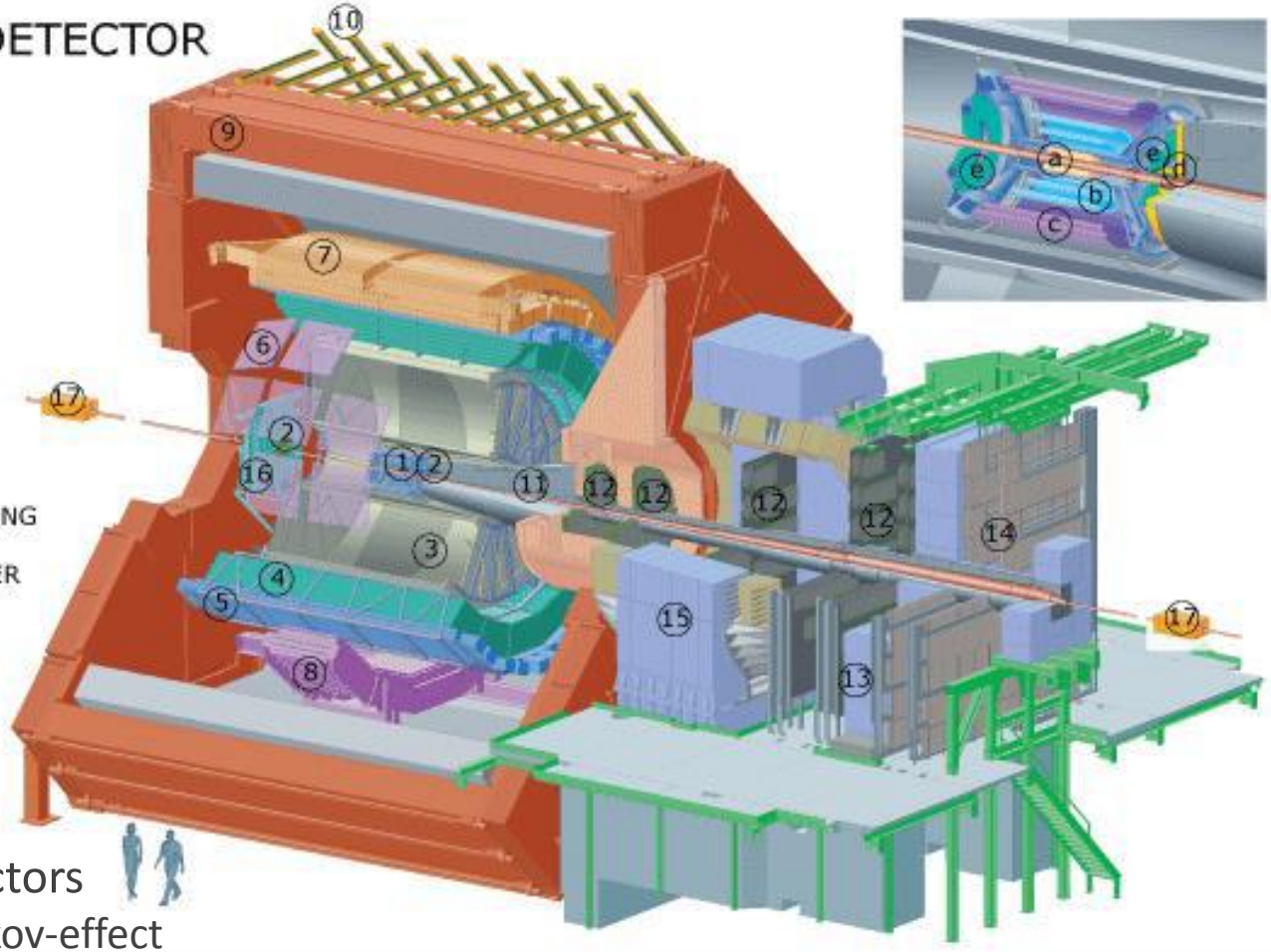
High Momentum Particle Identification Detector (HMPID ALICE)

SOMA BENEDEK FABER

TOMAS STEFANOV

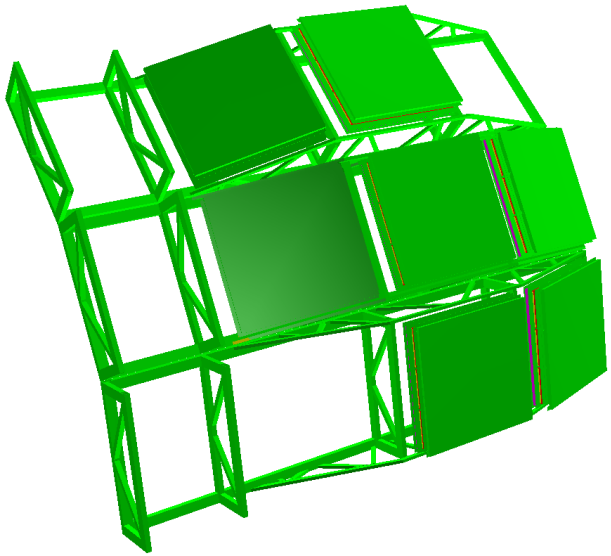
THE ALICE DETECTOR

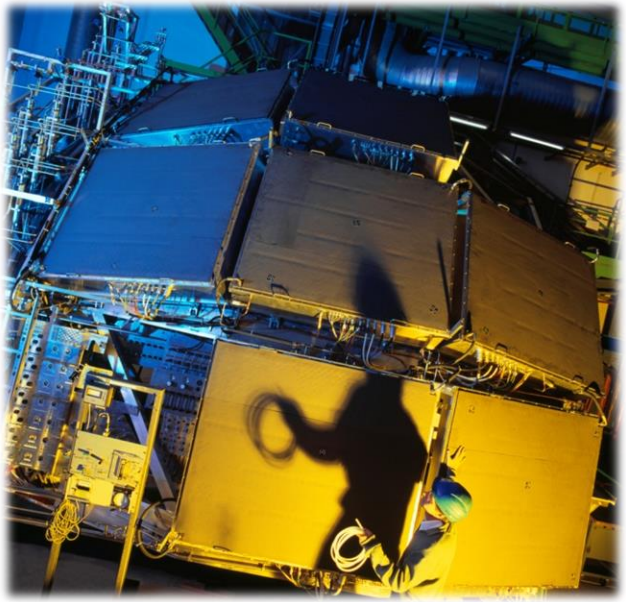


- Trigger detectors
  - T0-cherenkov-effect
  - V0-scintillator
  - Muon trigger
- Tracking detectors
  - ITS-silicon detector
  - TRD-Transition Radiation Detector
- Particle identification detectors
  - TOF-time of flight
  - EMCAL
  - HMPID
  - TPC-gas detector

HMPID

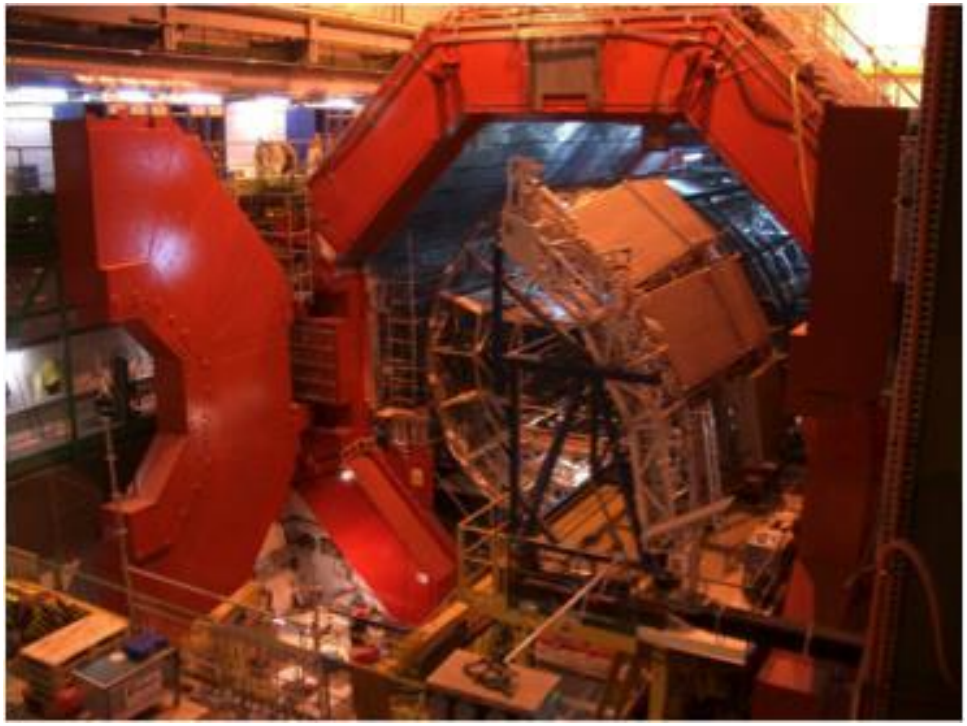
- The HMPID detector identifies charged particles
  - K
  - p
  - π
- Based on the Cherenkov effect
- π and K up to 3 GeV/c, and p up to 5 GeV/c

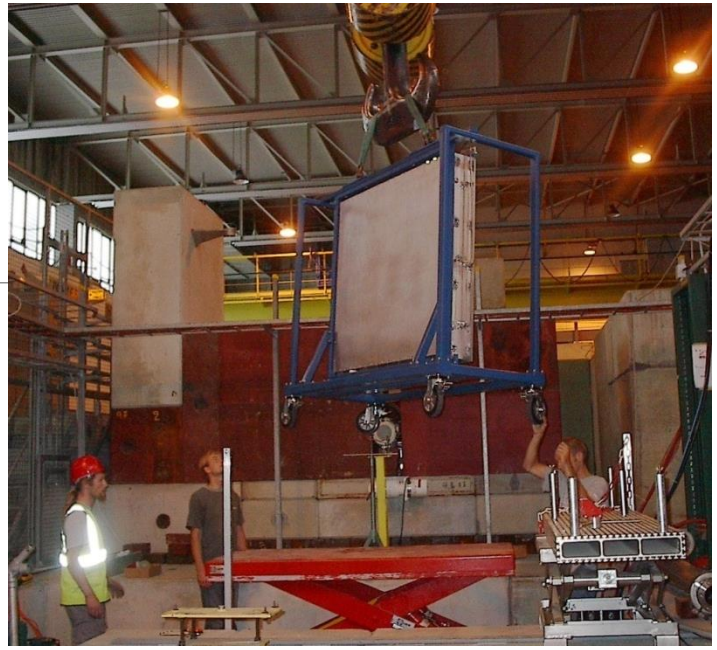




RICH modules
(Ring-imaging Cherenkov detector)

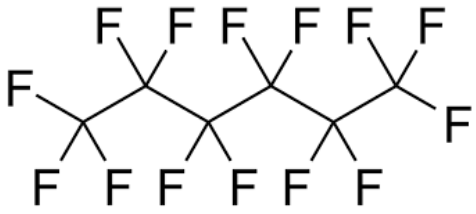
- 7 modules
- 1.3x1.3m



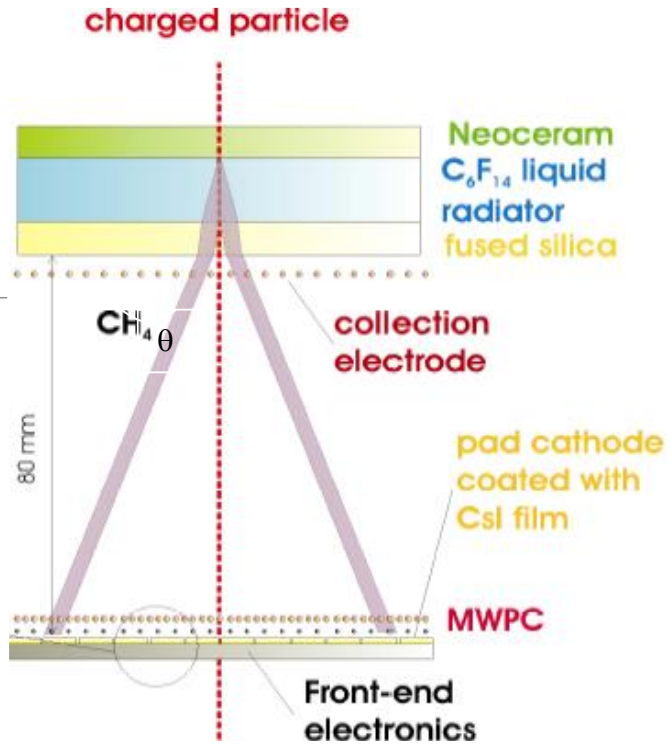


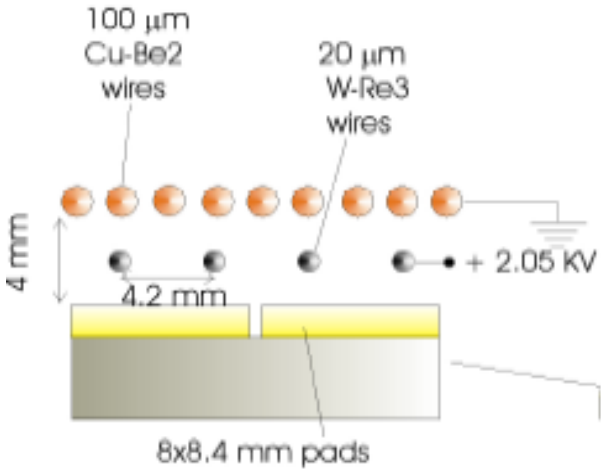
- active area of 11 m^2
- (RICH only for rich people)
- very expensive

Principle and structure



- Radiator: 15mm C_6F_{14}
  - n =1.2989
  - Circulation of liquid
  - cos θ = 1/ nβ
  - Emission of photons (visible,UV)
- 300 nm thick reflective layer of CsI
  - emission of electrons
- HV = 2050 V
- CH_4
  - Amplification 10 000x
    ($e^- + CH_4 \rightarrow CH_4^+ + 2\ e^-$)





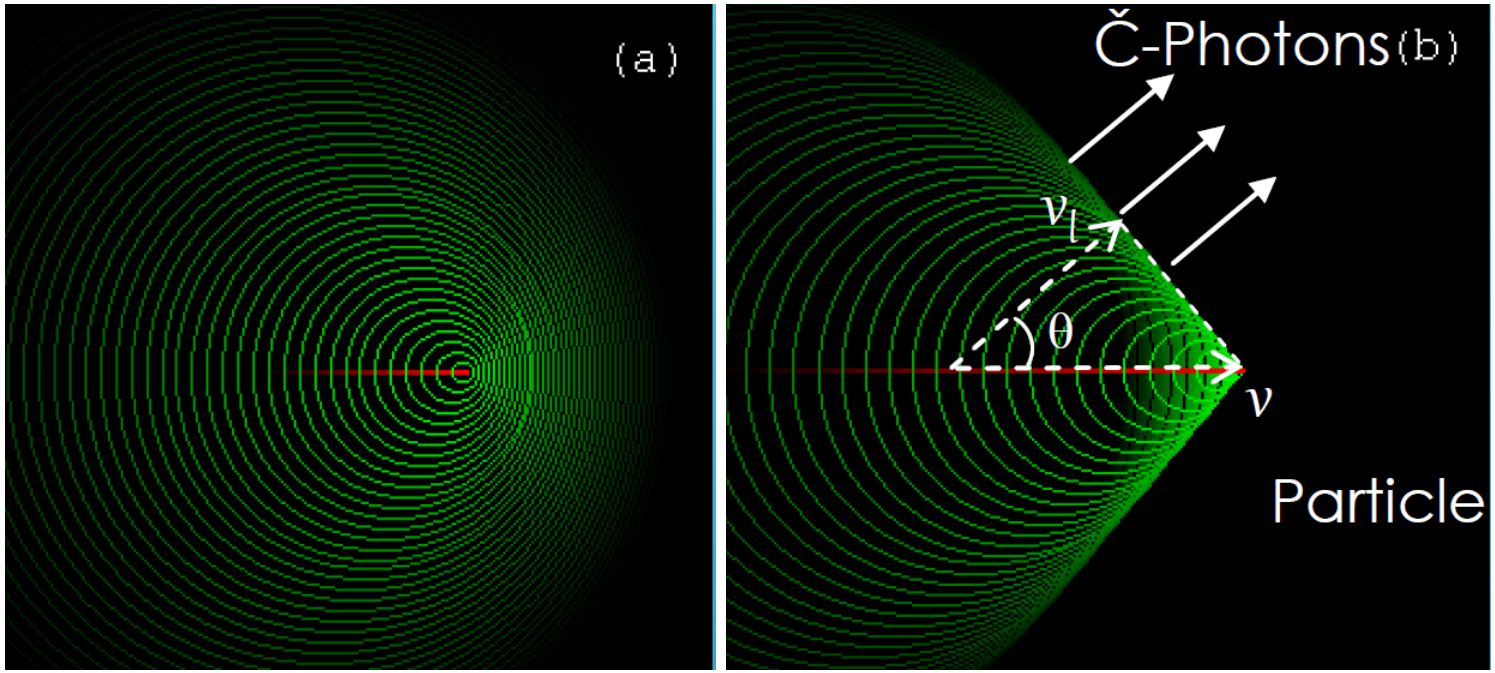
Cherenkov effect

$\cos \theta = 1/ n\beta = c/nv$

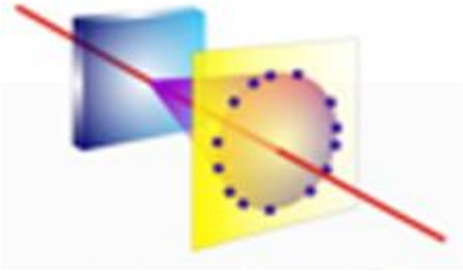
$\beta = v/c$

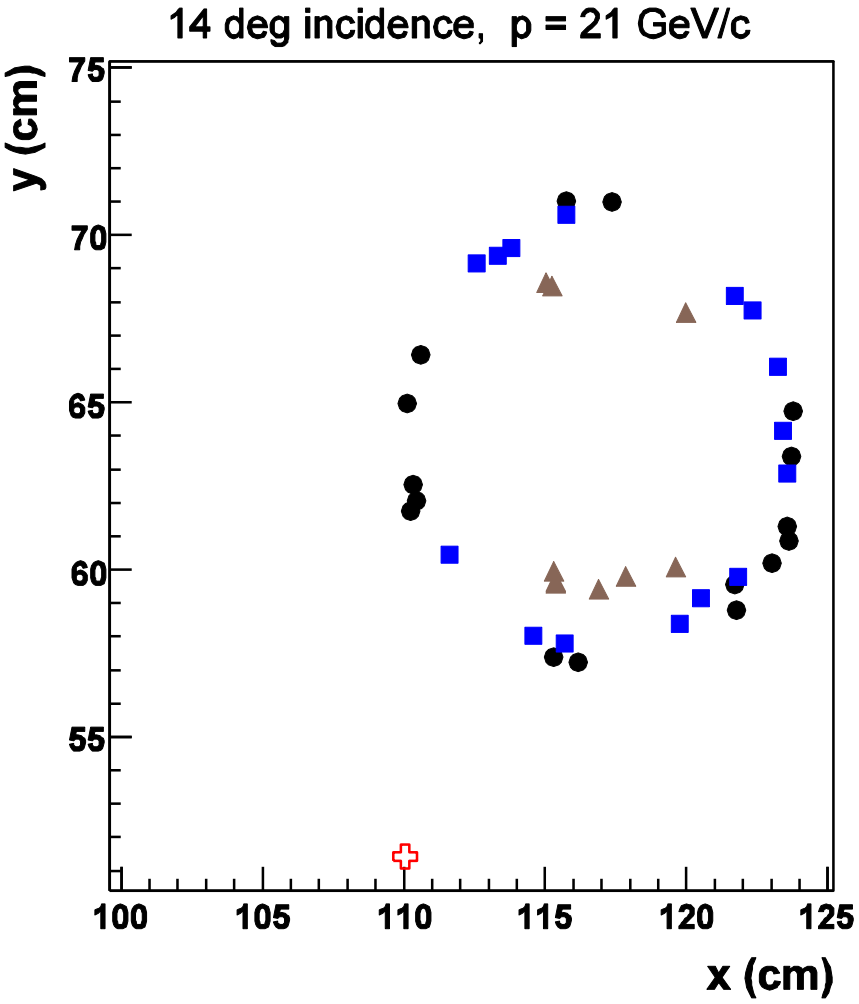
$p = m\beta\gamma$

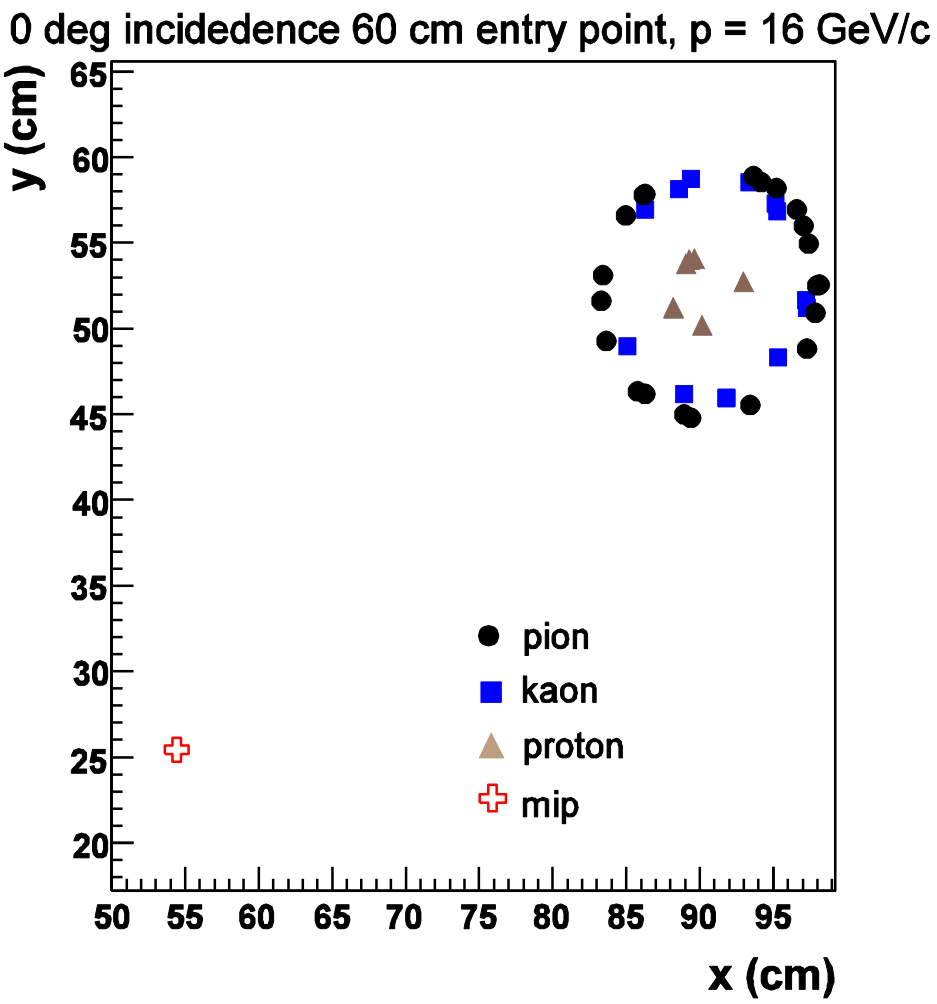
$\gamma = \sqrt{(1/1- \beta^2)}$



Detecting particles







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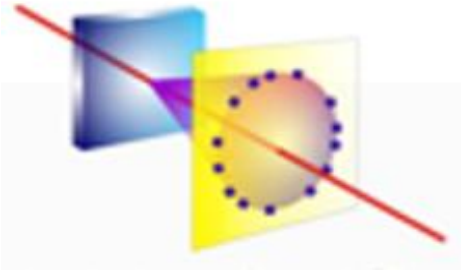
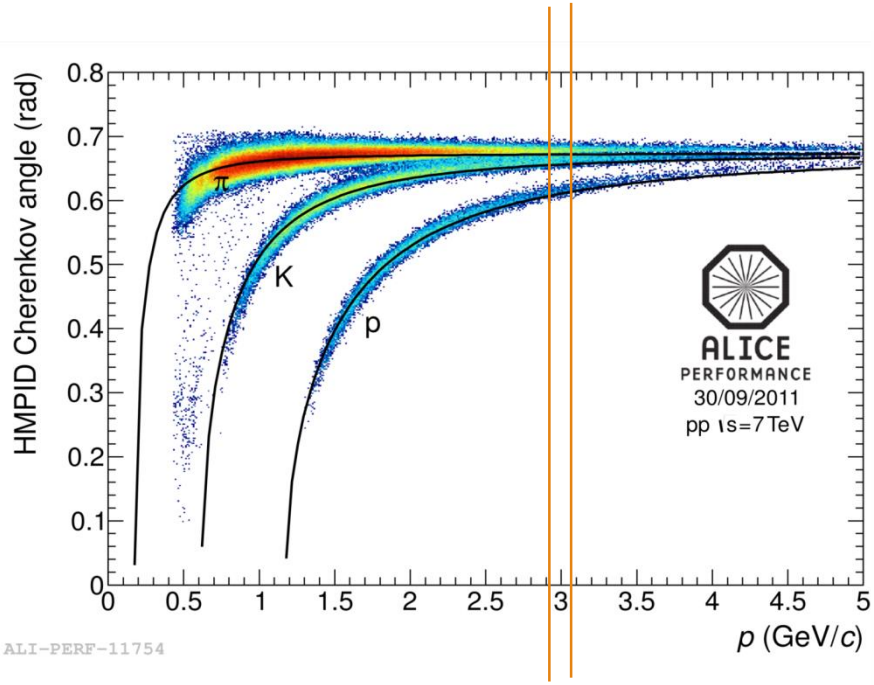
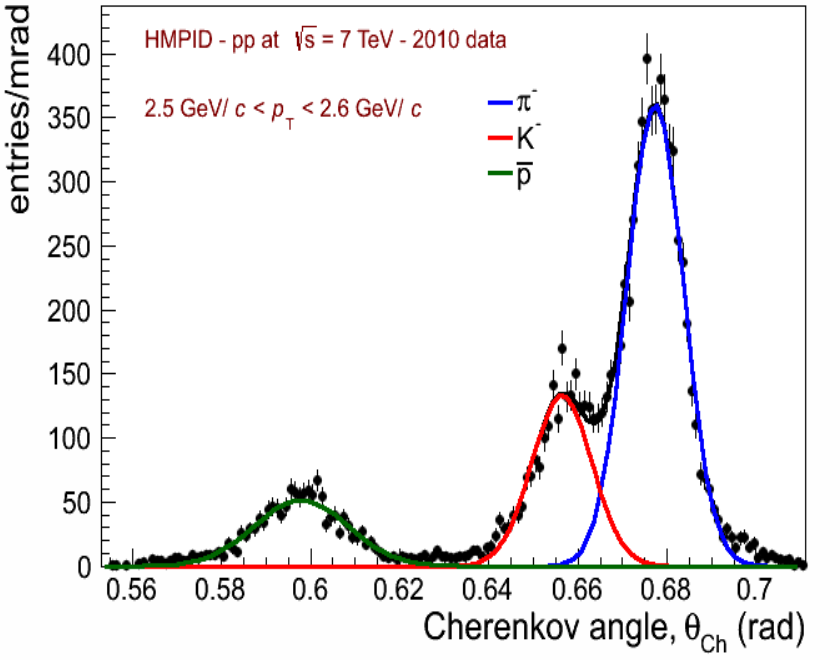


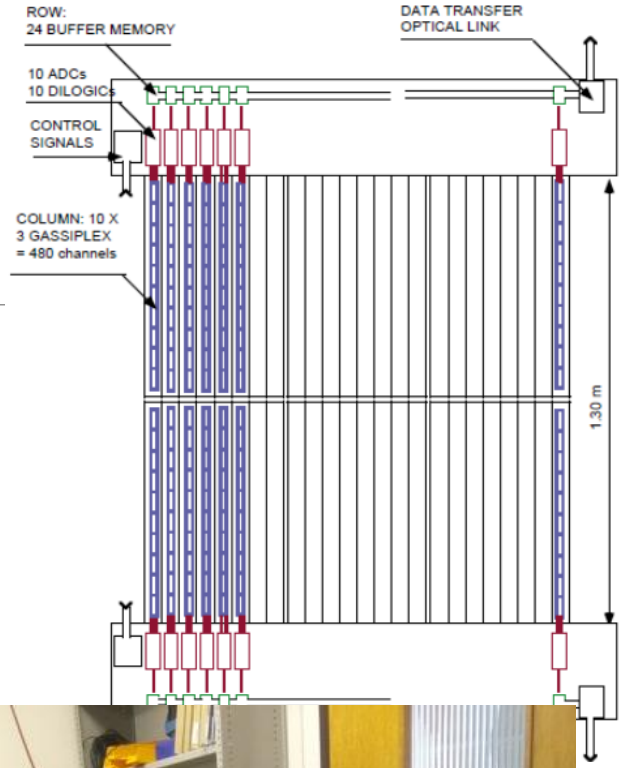


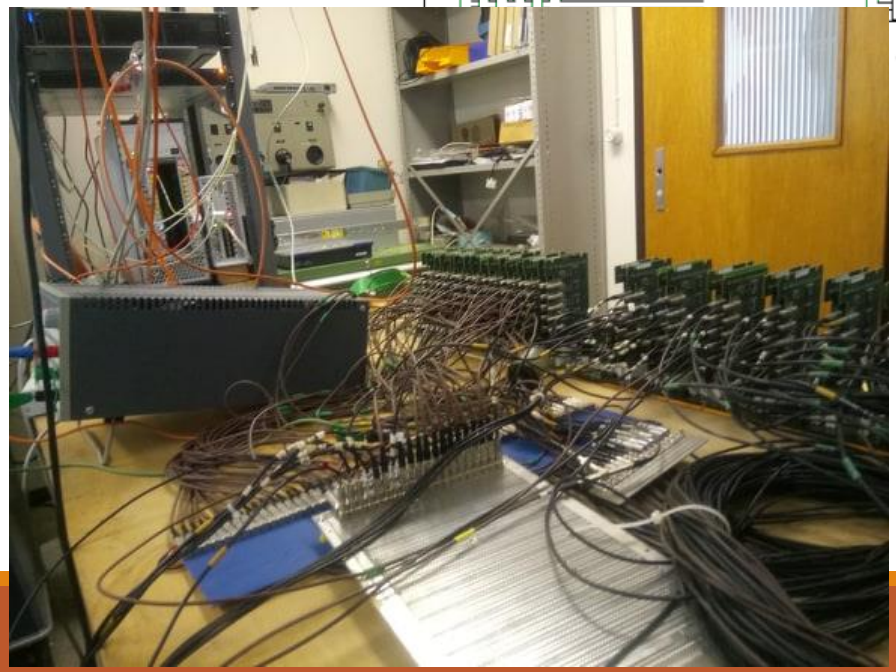


Measured Cherenkov angle as a function of track momentum. The black curves represent the theoretical values of the expected Cherenkov angle.

Electronics

- GAS card – 3 Gasipmlex chips
  - 48 (3x16) output line to 1 cable
- Amplifier , x100
- The analogue informations are stored in capacitors, while the trigger make the decision
- ADC
- DILOGIC
- Threshold
- FPGA for a collum, 10 DILOGIC
- p-p collisions
  - Detector: 14 kHz , collision: 40MHz
- Pb-Pb
  - Detector: 8 kHz , collision: 50kHz





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