The ALICE Muon Forward Tracker upgrade project

L. VALENCIA PALOMO

For the ALICE Collaboration

Laboratoire de Physique Corpusculaire (CNRS-IN2P3, Université Blaise Pascal, Clermont-Ferrand, France)

Physics motivations

Heavy-ion collisions at the LHC ➔ Quark Gluon Plasma: deconfined state of quarks and gluons.

- Studying the Quark Gluon Plasma with (di)leptons:
  - Heavy flavours (1,2,3):
    - Created in the first instants of the collision.
    - QCD & dead cone effect ➔ colour-charge and mass dependence of energy loss $R^{1<2}_{m} < R^{2<1}_{m}$
  - Quarkonia (4,5,6):
    - Suppression due to colour charge screening.
    - Sequential suppression of quarkonium states.
    - Regeneration by heavy quark recombination?
  - Low mass dileptons (7,8):
    - Strangeness enhancement (6).
    - In medium modifications of particle properties $\Delta E$ due to partial chiral symmetry restoration.
    - Thermal radiation from QGP.

ALICE and the Muon Spectrometer

Alice (9) is the heavy-ion dedicated experiment at the LHC.

Distance of tracking chambers from Interaction Point [IP] + multiple scattering in the front absorber ➔ details of the vertex region are smeared out.

Detector general layout

The MFT consists of CMOS Monolithic Active Pixels sensors, with pixel pitch of 25 x 25 μm², 50 μm thick and 0.4% X/μ, material budget per plane.

- Pixels are integrated on a support by using a flexible printed circuit to form ladders.
- Ladders are fixed onto a support and perpendicular to the half cone structure.
- Inner border.

- The MFT data flow will be sent out from the CMOS sensors using e-links on FPCs and GigaBit Transceiver (GBT) concentrators located on PCBs up to the Common Readout Unit (CRU) of ALICE.

Integration

The five half disks are installed into a half cone made of carbon fibre.

- Each half cone is hermetically closed by kapton films around the structure and a carbon fibre cover around the beam pipe support.
- Thermal simulations show that air cooling is enough to extract heat from planes and to maintain the detector temperature at 35°C.
- Required services: electrical power for sensors and front end electronics, optical fibers for the slow control and the data transfer to DAQ and finally the air flow for cooling.

- At the location of the MFT, the beam pipe should be held permanently.

- The two halves of the MFT cone are fixed on two cages in order to be inserted, positioned and fixed to the beam pipe support cage.

- The half cages are inserted from the A side and positioned by sliding wheels. This cage will also help to bring the remaining services to the MFT.

Muons track reconstruction performance

The MFT performance presented here has been evaluated by considering central Pb-Pb collisions with Hijing at $\sqrt{s_{NN}} = 5.0$ TeV. A pile-up scenario of two central Pb-Pb interactions within the recorded event is also taken into account.

A two dimensional $p_{T}$ vs. $y$ plot, at the single muon level, indicates the available phase space of muons reconstructed from the MFT and the MFT.

- Correct matching between MS and MFT tracks increases with $p_{T}$ and rapidity. Correct matching falls below 50% for $p_{T} < 1$ GeV/c. Correct matching improves with no pile-up scenario: cluster density in MFT decreases.

- Offset resolution along X ($\eta > 130$ μm for $p_{T} = 0.5$ GeV/c and saturates at 60 μm for $p_{T} = 4$ GeV/c. Blue and red points represent tracks with $\eta < -3.2$ and $\eta > -3.2$, respectively.

References