The PHENIX's MPC-EX Detector

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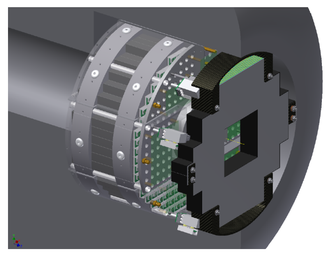
Physics Case

Study of forward production in polarised p+p, polarised p+A and A+A collisions:



- Proton spin structure
- Parton distribution functions
- Gluon distribution at low x in nuclei
- Medium effect in quarkonia and HF dynamics
- Collectivity

arXiv:1301.1096 [nucl-ex]

Energy detection

- A small fraction of the particle's energy is left behind during the pre shower

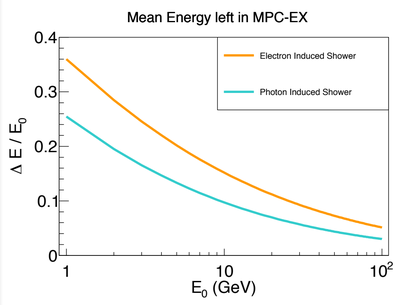


Figure 2: Expected mean energy left in the MPC-EX computed based on its material budget

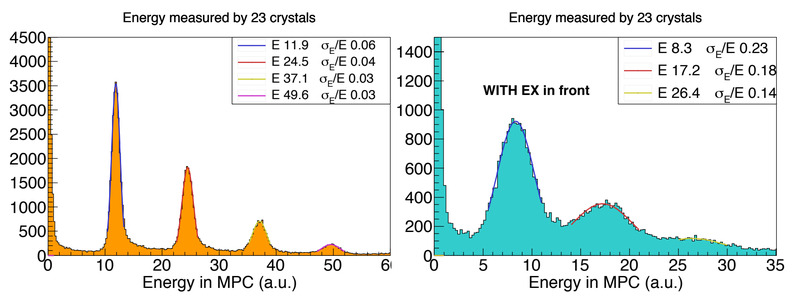
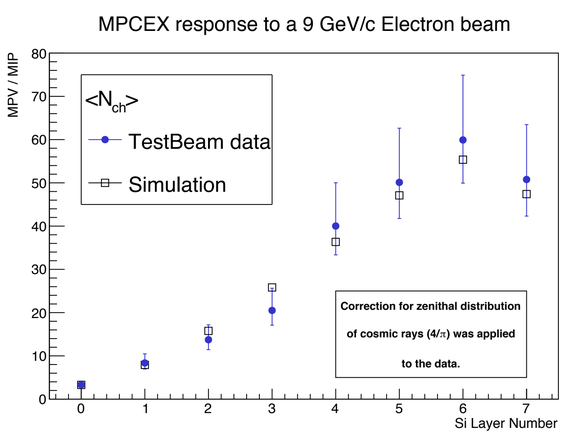


Figure 3: (testbeam) Energy and energy resolution measured in the MPC from a 12 GeV/c electron beam showing singles, doubles, triplets. Left: no pre shower detector in front; Right: full system.

Shower multiplicity

- Two dynamic range modes per pad:
  - High sensitivity: ~[0,1.5] MeV (256 channels)
  - Low sensitivity: ~[0,5.0] MeV (256 channels)

Figure 4: (testbeam) Total energy per layer in one row of sensors (8) subject to a 9 GeV/c electron beam. The events were reconstructed using an old firmware version. The digitalisation is the same as was installed in PHENIX. The total signal peak was fitted to a Landau distribution where the Most Probable Value (MPV) was extracted. Those values were in turn converted to multiplicities using a calibration of the sensors to cosmic rays. The MIP was adjusted to account for the zenith angular dispersion of cosmic rays (4/pi). A full simulation of the response to electrons using Geant4 is also shown.



Pre shower detection

- Material budget ~4.6 χ_0
- Moliere radius ~9.3 mm
- Fiducial Pitch 1.8 x 15 mm^2
- Eight layers per arm
- $3.1 < |\eta| < 4.2$

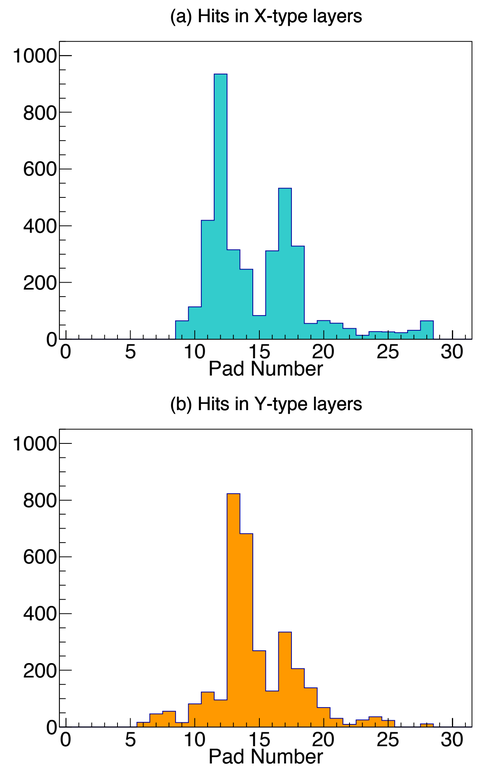
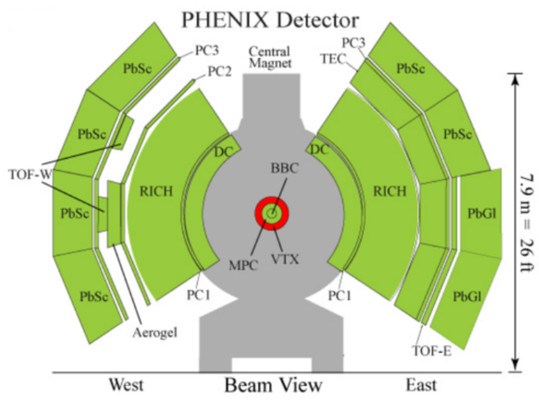
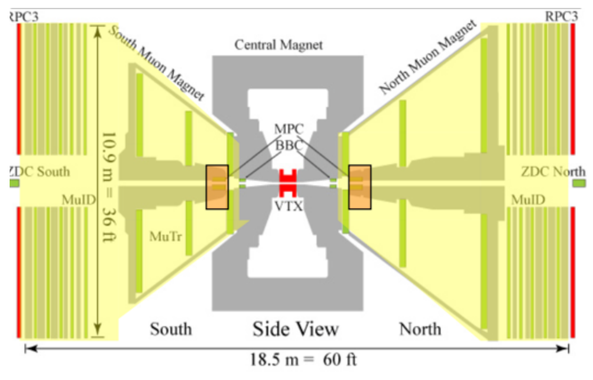


Figure 1: (testbeam) Hits produced by two 9 GeV/c electrons going through the MPCEX

- Two track separation
- Opening angle
- Photon isolation
- MIPs
- Complementary calorimetry

Installation in the PHENIX experiment





- Pre shower for both arms (scan of x)
- MPC-EX detector fully installed in Jan 2015

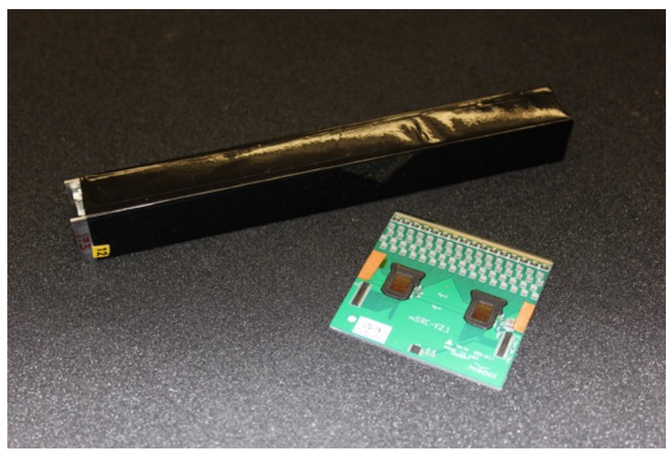


Figure 5: A MPC PbW crystal attached to its APD and a MPC-EX sensor showing its two SVXs and 2x128 channels

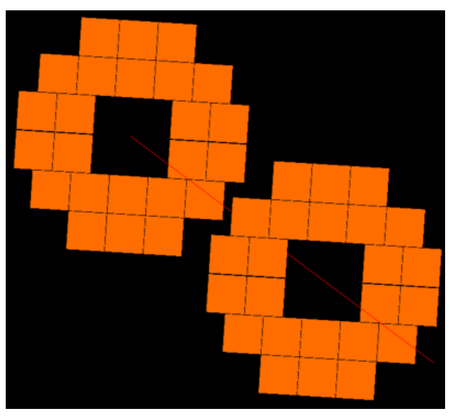


Figure 6: Geant4 drawing of MPC-EX array showing the 24 sensors per layer

Data collected 2015: pp, pAu, pAl

- Currently aligning energy response and working on first observables

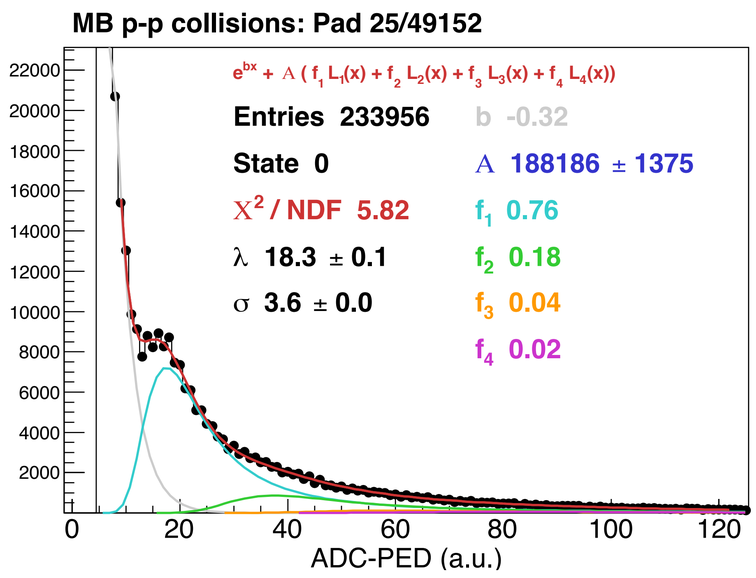


Figure 7: (polarised pp collisions) ADC signal of one pad in the 4th layer of the south arm. The response is fitted using a Landau probability function accounting for (more than) one MIP

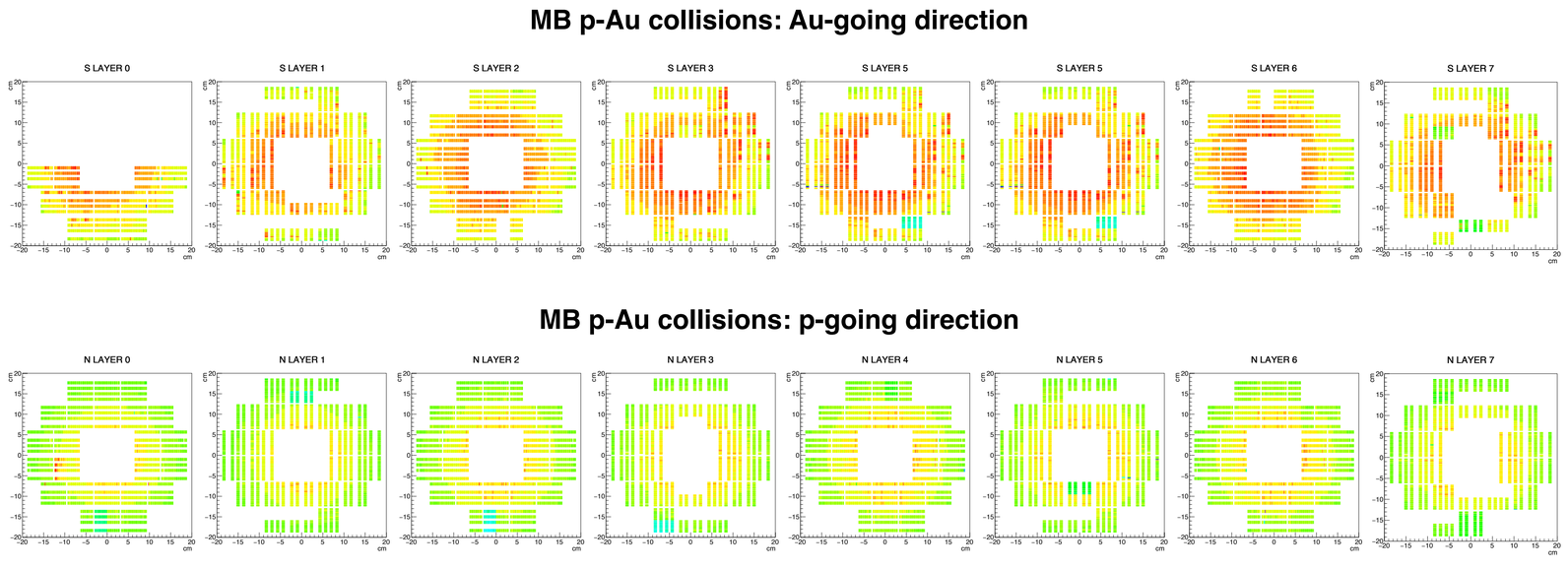


Figure 8: (polarised p-Au collisions) Accumulated shower multiplicity in the whole system from Minimum Bias pAu collisions. Top row corresponds to the Au going direction; bottom row, to the p going direction.

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