Performance of the PHENIX Muon Tracking System in Run–2

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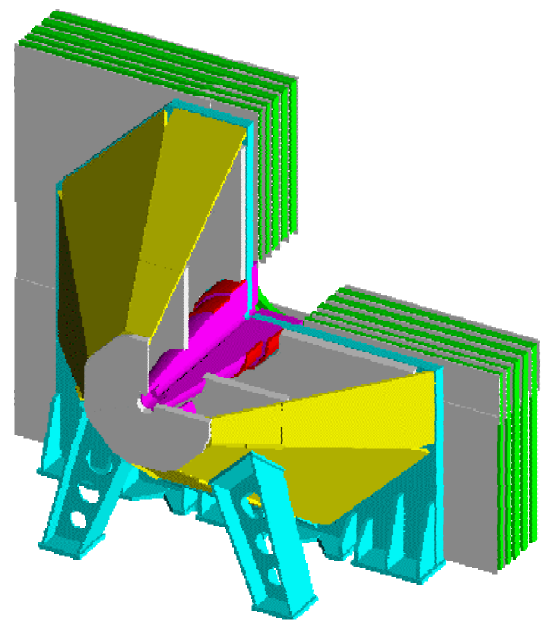
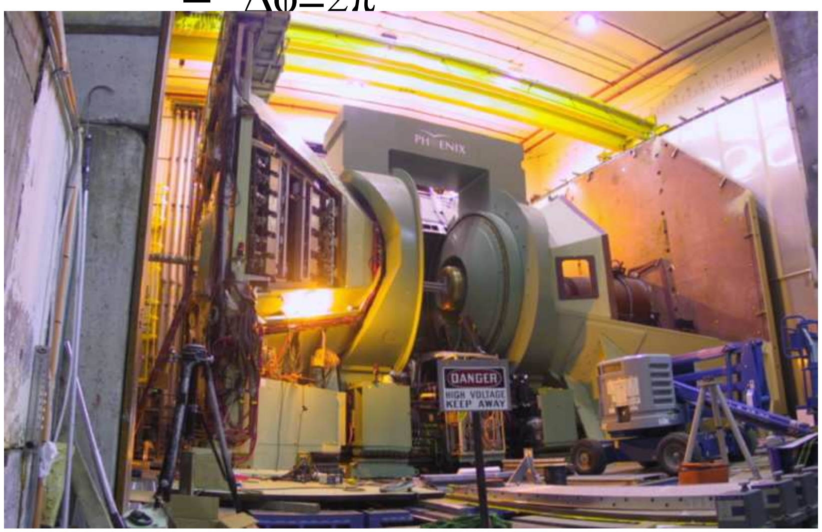
(for the PHENIX Collaboration)

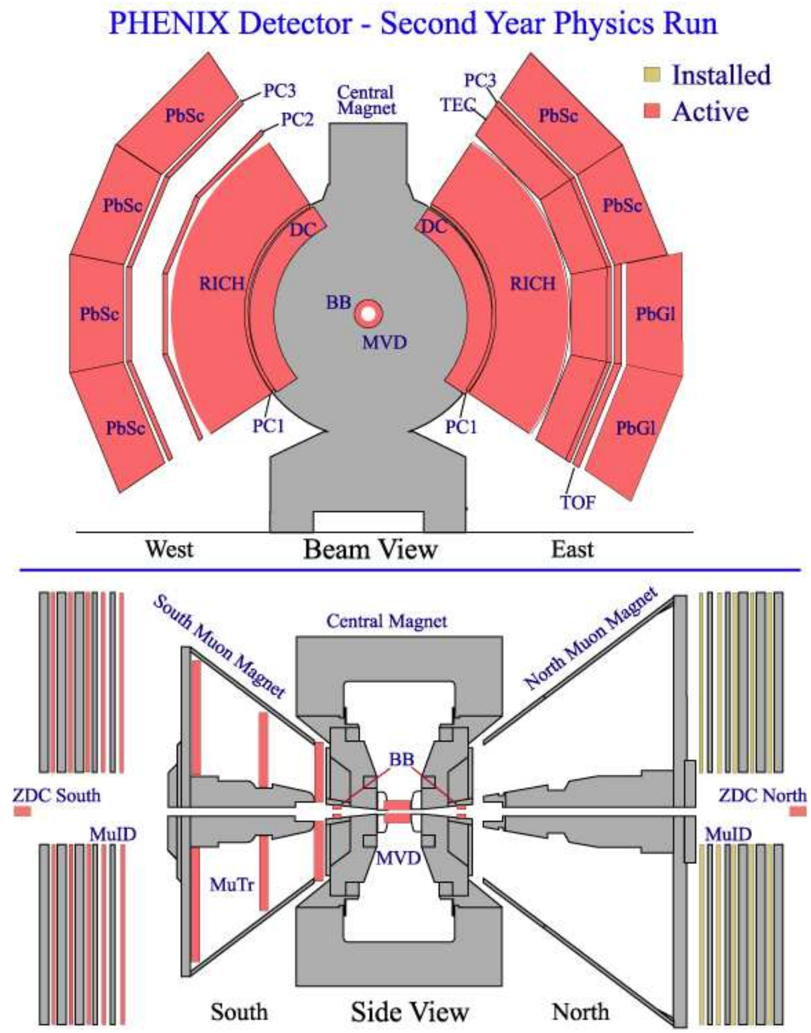
- Detector Commissioning
- Detector Performance
- Results from Raw Data



PHENIX Experiment:Run–2

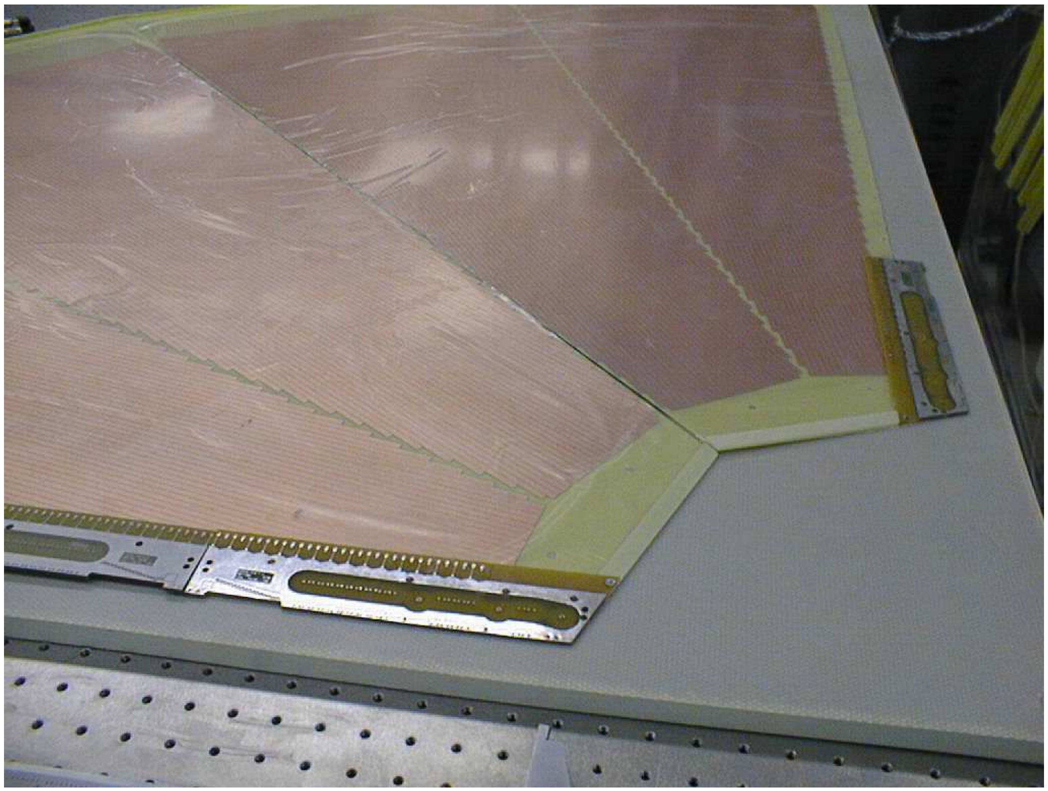
- Central Arms
  - Tracking,EMCal,PID
  - $|\eta| < 0.35$
- Muon Arms
  - Tracking+MuID
  - $1.2 < |\eta| < 2.4$
  - $\Delta\phi = 2\pi$

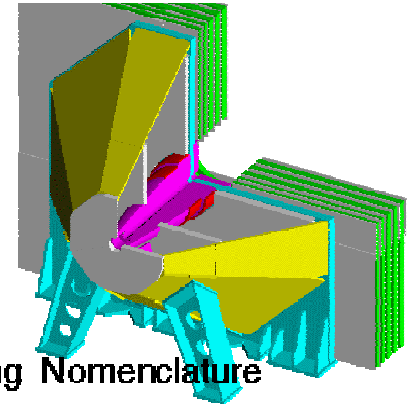




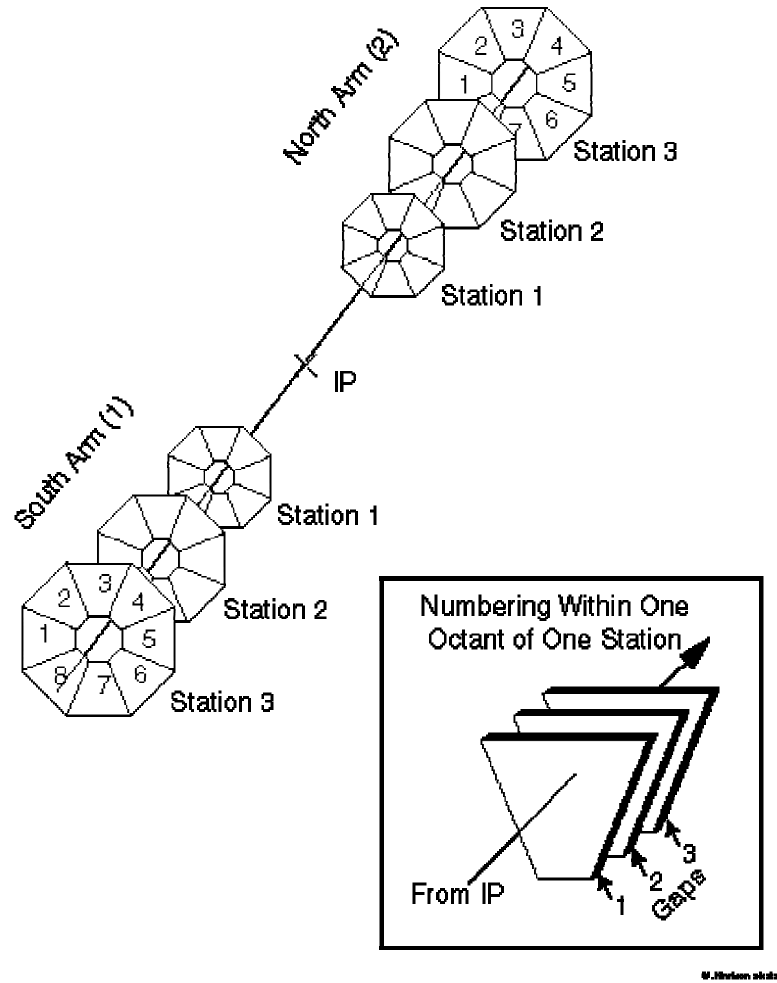
Muon Tracking Chamber

0.5 cm Cathode Strip Chamber





Muon Tracking Nomenclature



Muon Front–End Electronic

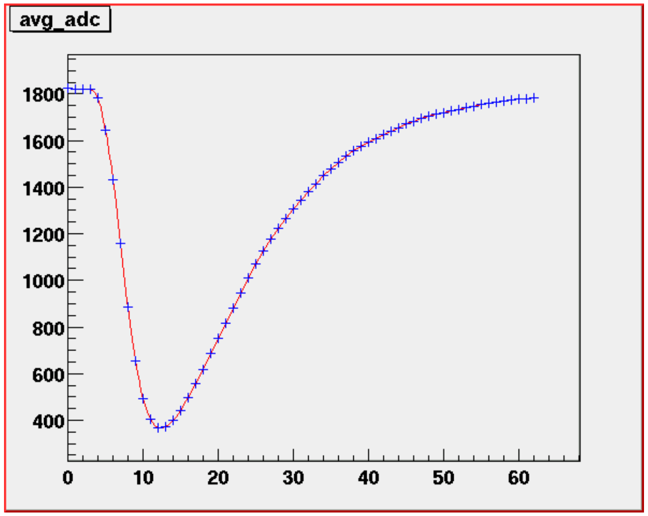
- Low noise high speed FEM

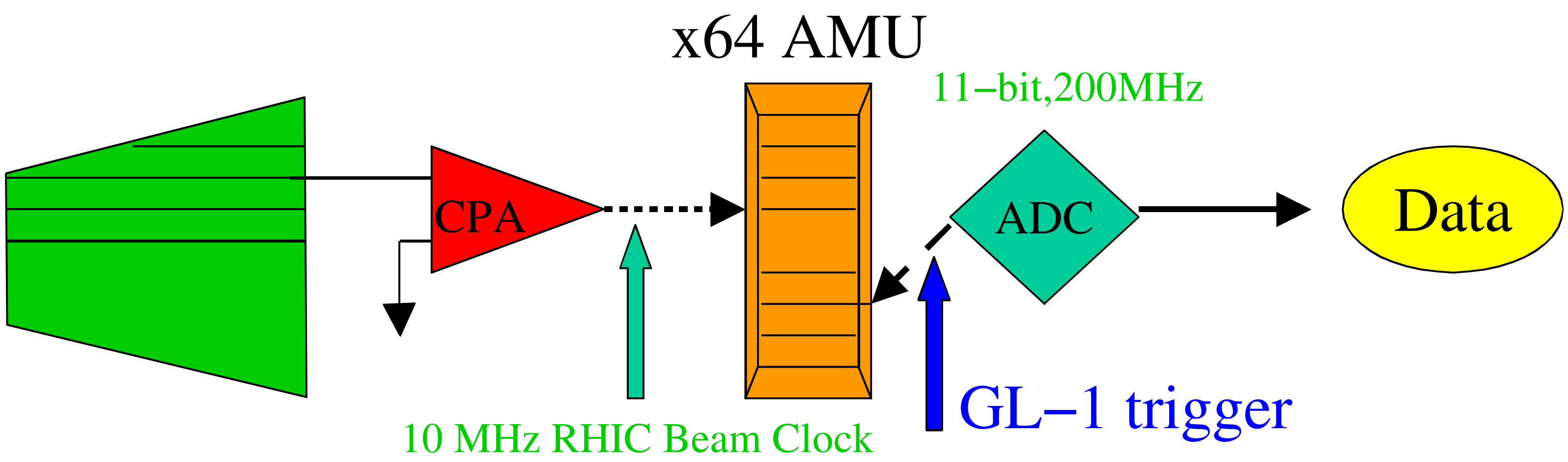
$$resolution: 100\mu m = x \cdot 1cm \Rightarrow x = 1\%$$

$$noise: Q' = 80\,fC \cdot 1\% = 0.8\,fC$$

$$Thermal\ noise:$$

$$\frac{1}{2}\frac{Q_{thermal}^{2}}{C_{\det}} = \frac{1}{2}kT \Rightarrow Q_{thermal} = 0.65\,fC$$





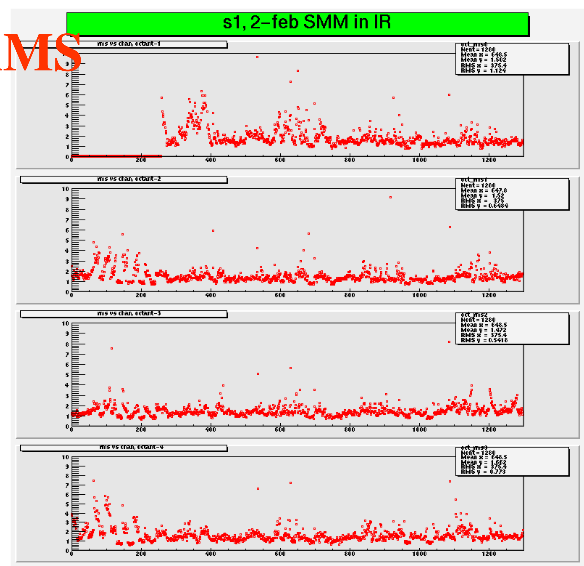
Detector Commissioning

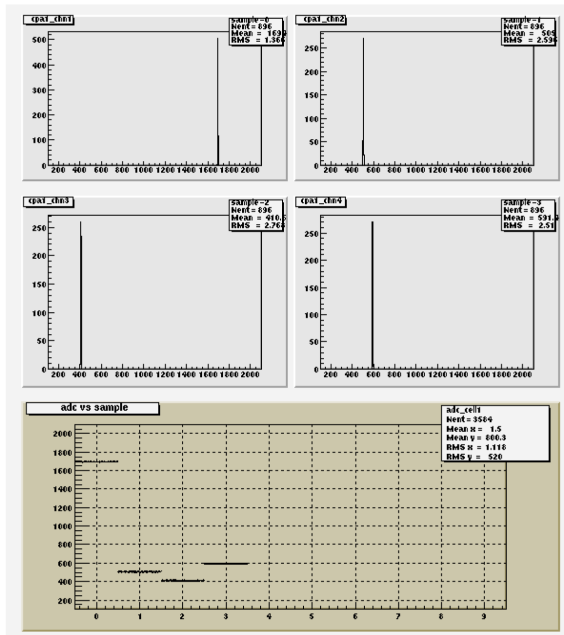
- Electronics
- HV
- Gas

  CF4:CO2:Ar =0.2:0.3:0.5

- Timing in Detector

RMS

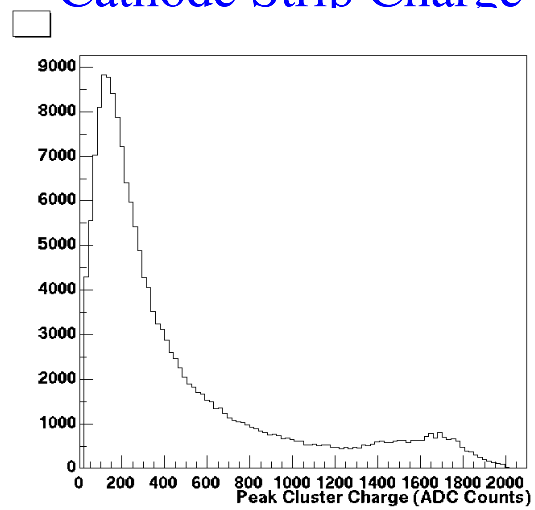




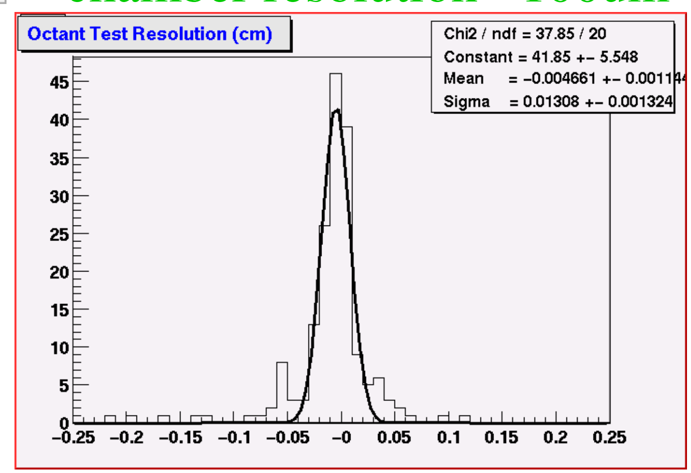
Good Timing

Low noise
rms~ 2 ADCs

Cathode Strip Charge

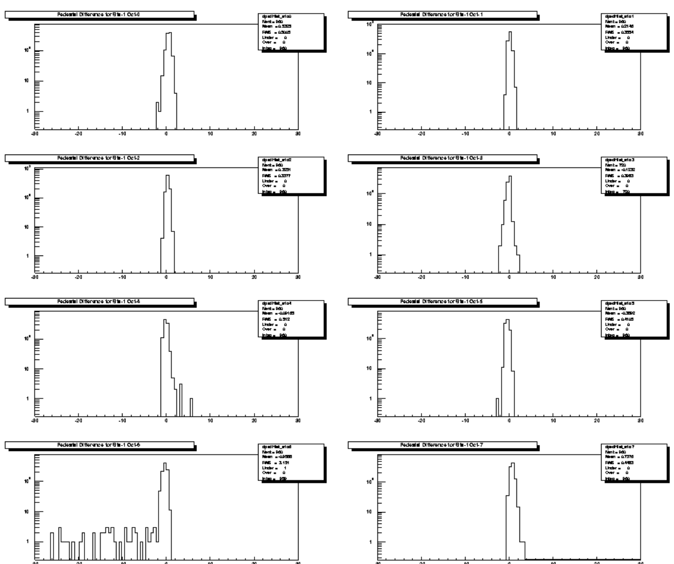


chamber resolution ~100um

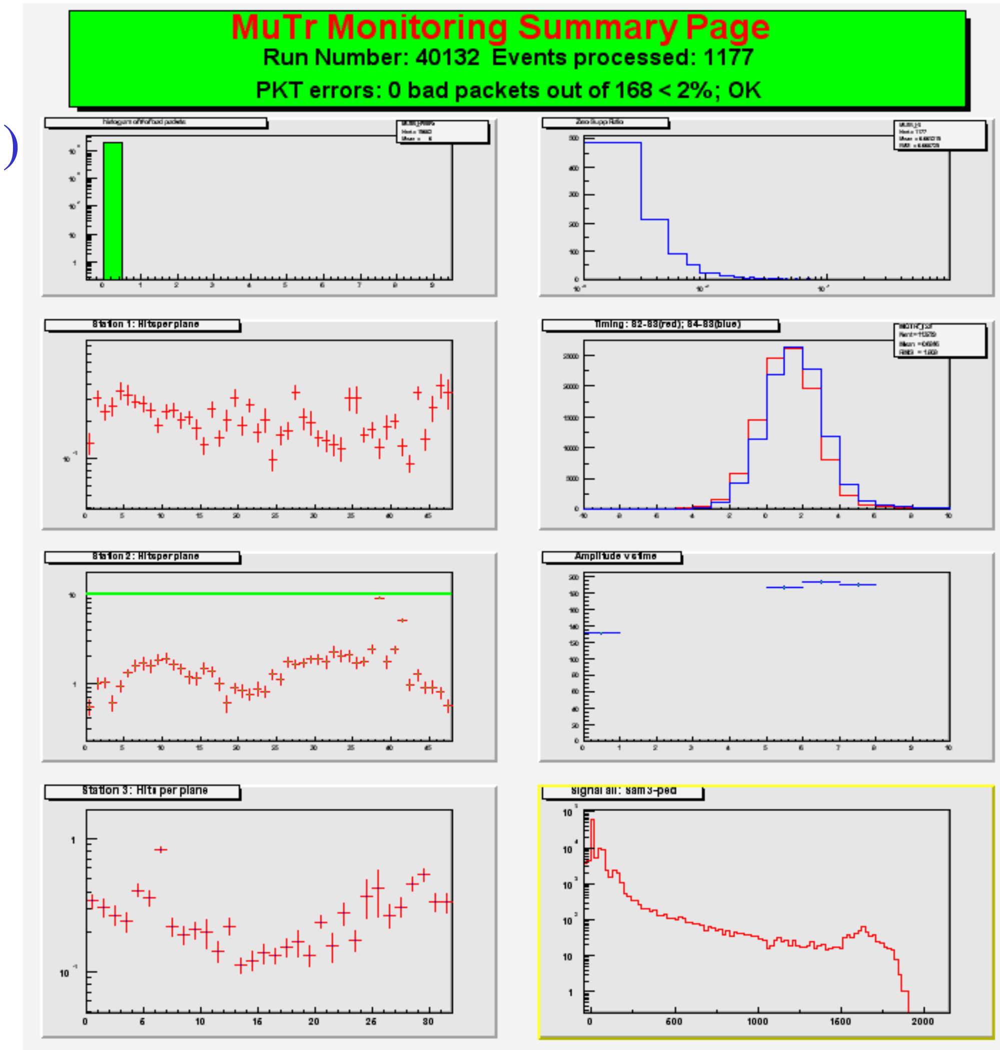


Data QA: calib. & online monitor

- 4 Samples' relative timing
  - (1,6,7,8) beam–crossings
- DAQ Zero–Suppression (<5%)
  - (peak – pedestal)>3*rms
- Stable Pedestals and Gains
  - daily calibration
- Signal Dynamic range

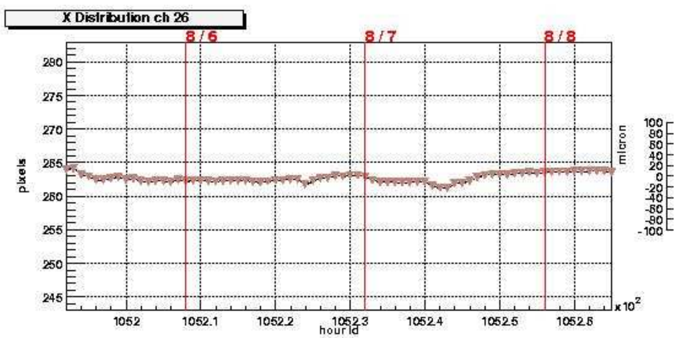


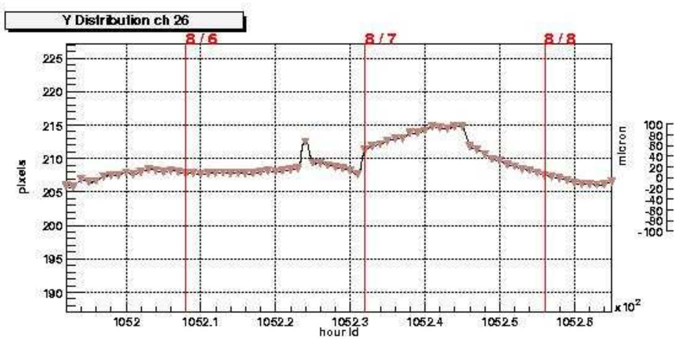
Pedestals from calibration data

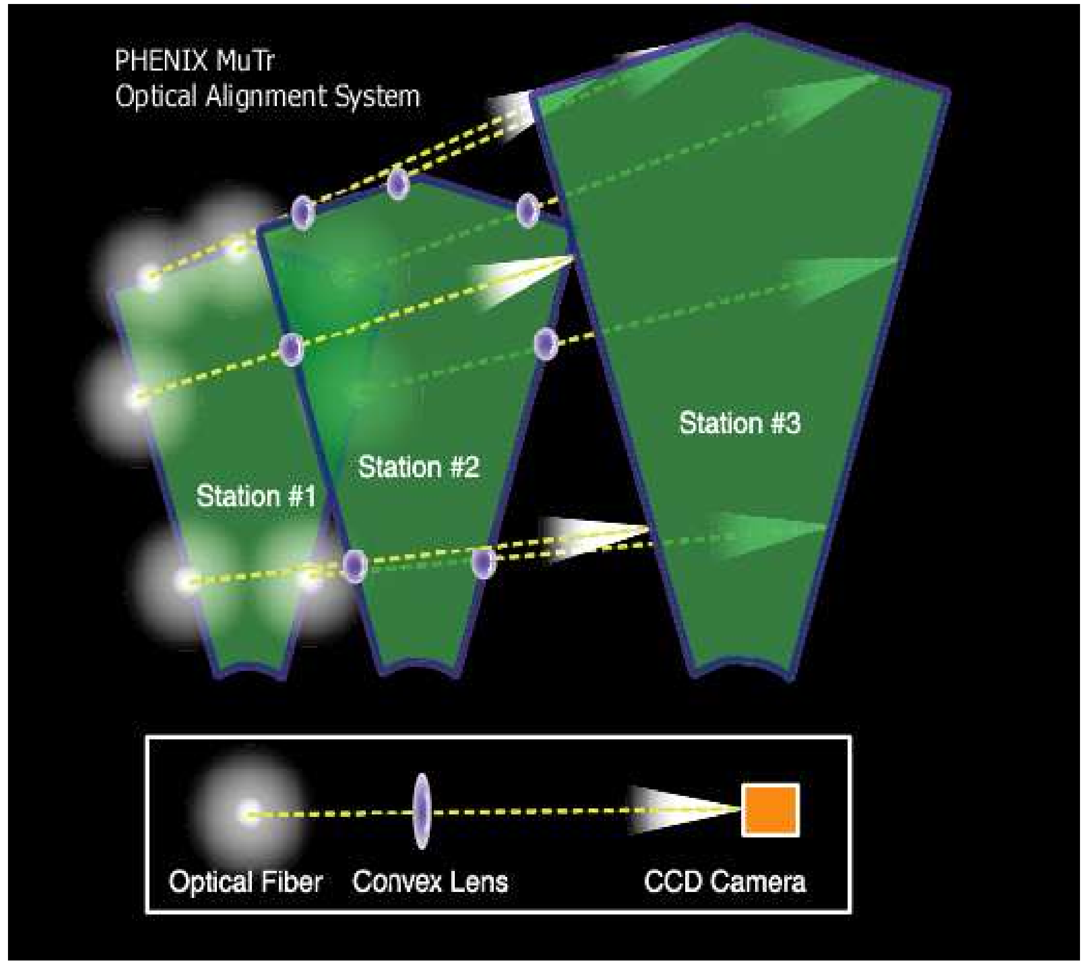


Chamber Alignment Monitoring

A good track resolution:
- low electronics noise
- stable gain
- geometry and

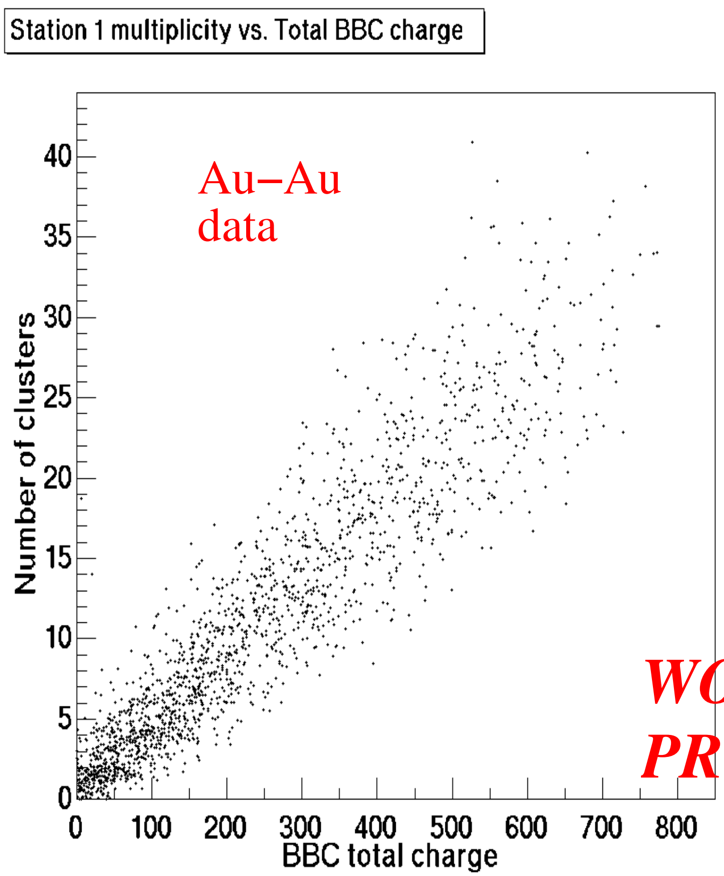






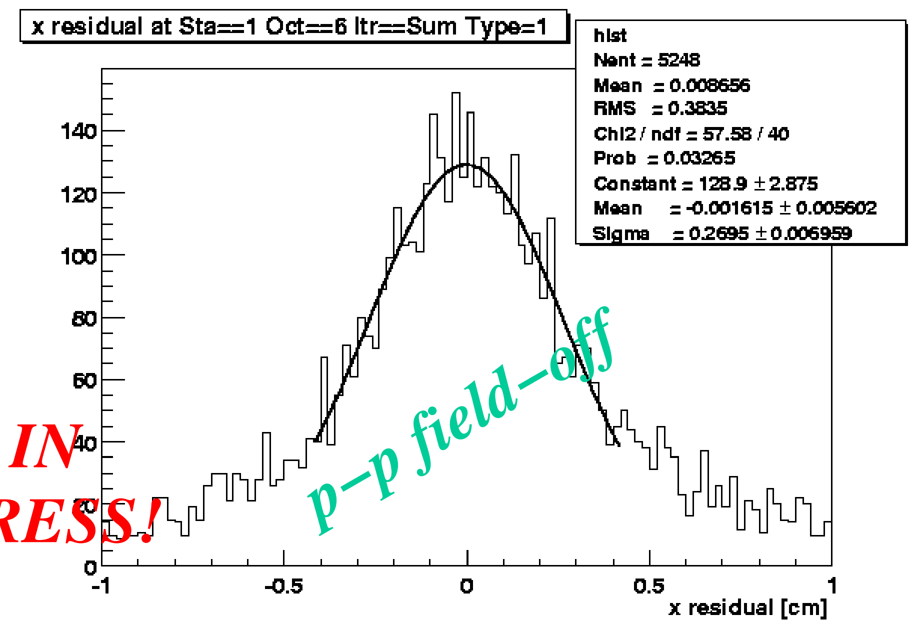
Detector Performance

Muon Tracker Multiplicity
vs. Beam–beam counter
total charge (centrality)



Chamber response

Geometry and Global Alignment:
projection errors at station–2



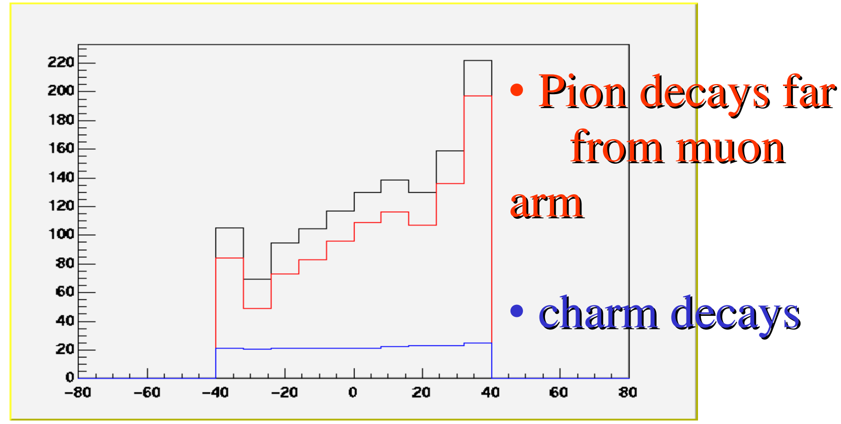
WORK IN PROGRESS!

Alignment

A. Hoover October 18,2001 Maui
APS

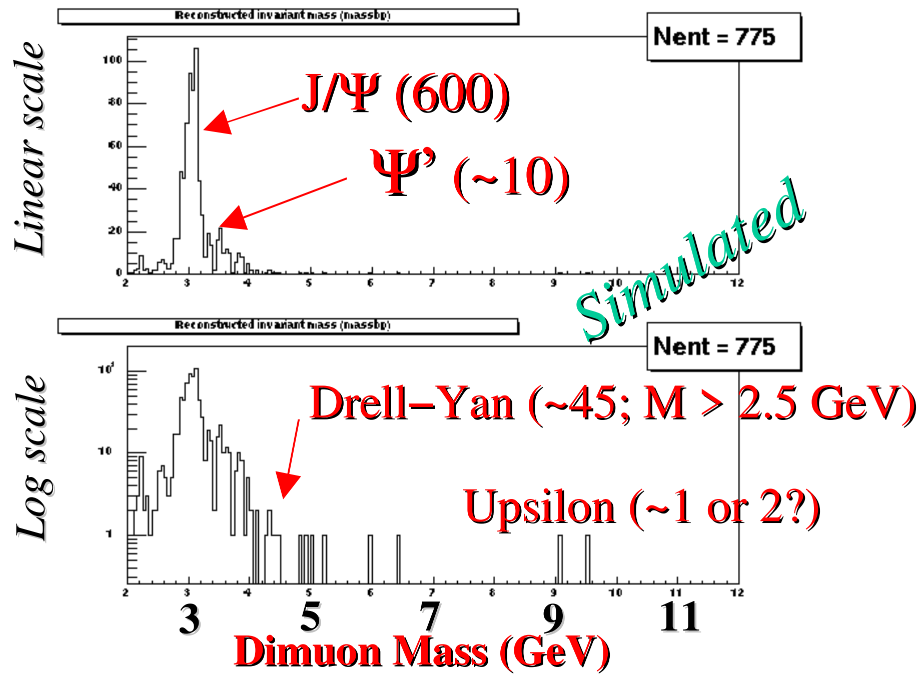
Expectations from MC Simulations

Vertices for single–muons are peaked at locations farther from South muon arm as expected for muons from pion and Kaon decays



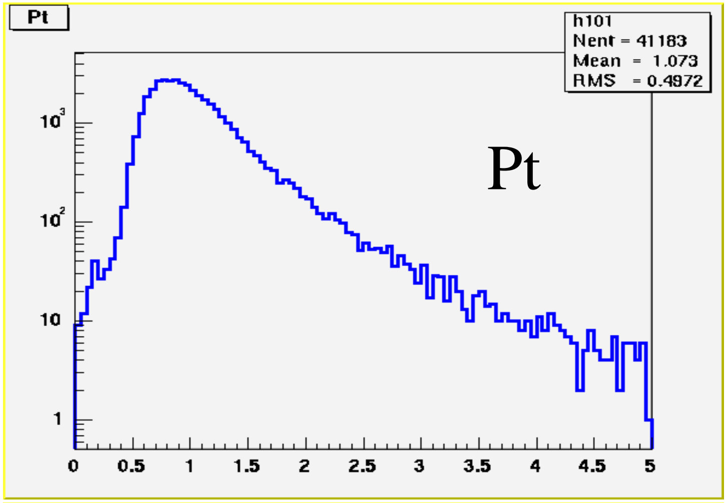
Expected J/Ψ efficiency in muon tracker: ~ 50% (FEE ~ 60%, HV ~ 90%)

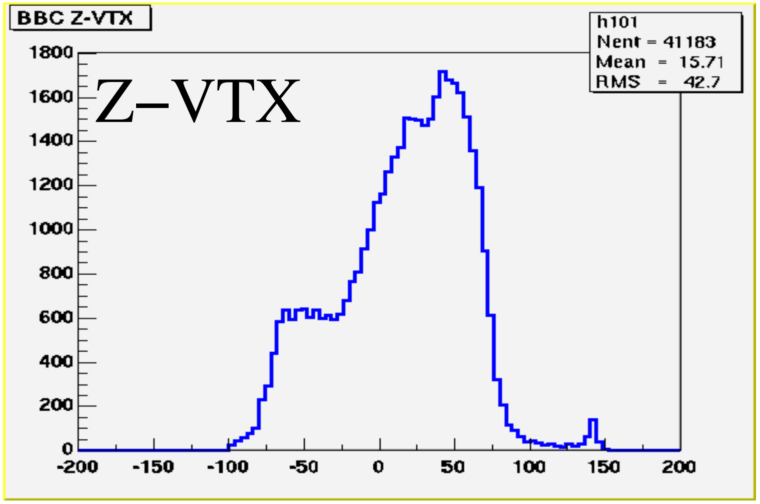
Simulated dimuon mass Spectrum for expected Run–II statistics (signals only)

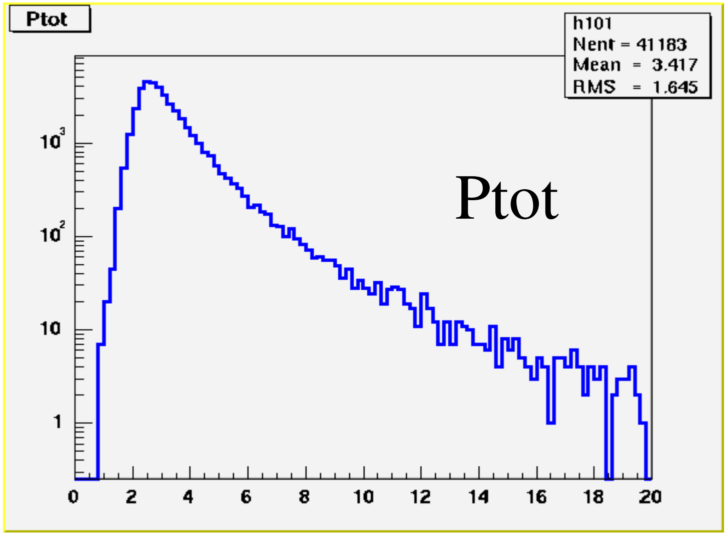


Plots from raw data

- Single muons
  - Dimuon–triggered samples
  - Good muon candidates
  - ~2GeV Ptot Threshold







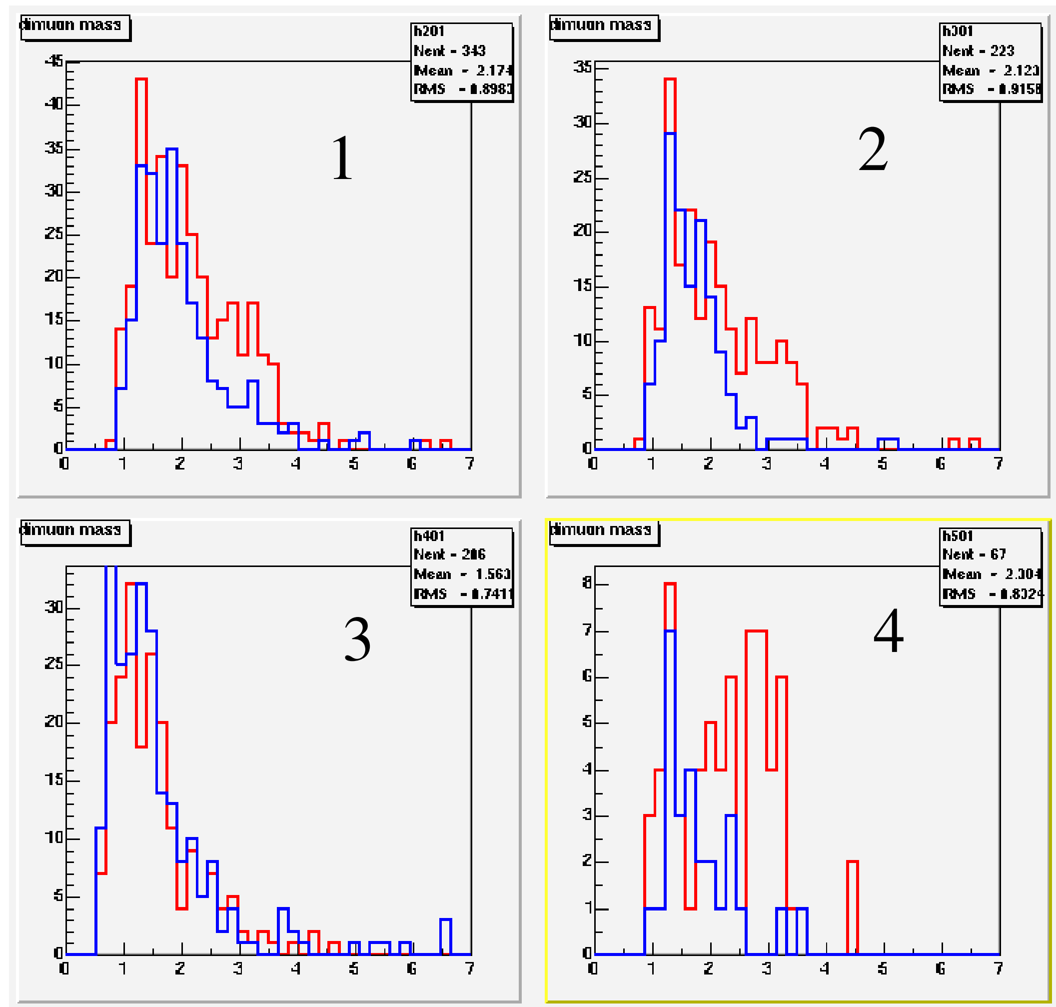
Plots from raw data

- Dimuon–mass

  red = +–

  blue= ++, ––

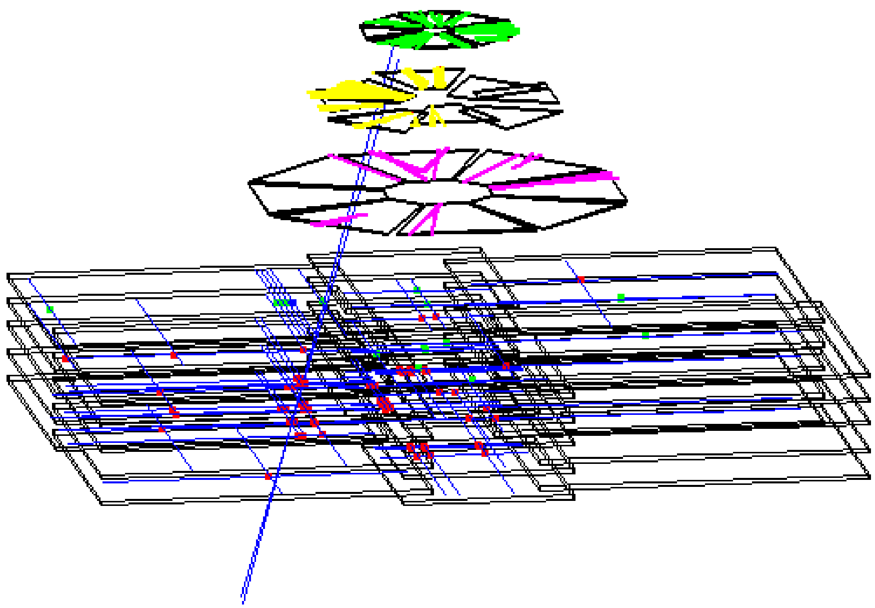
  1. good muons
  2. best muons
  3. no–BBC vtx
  4. –100 < ZVTX < 0



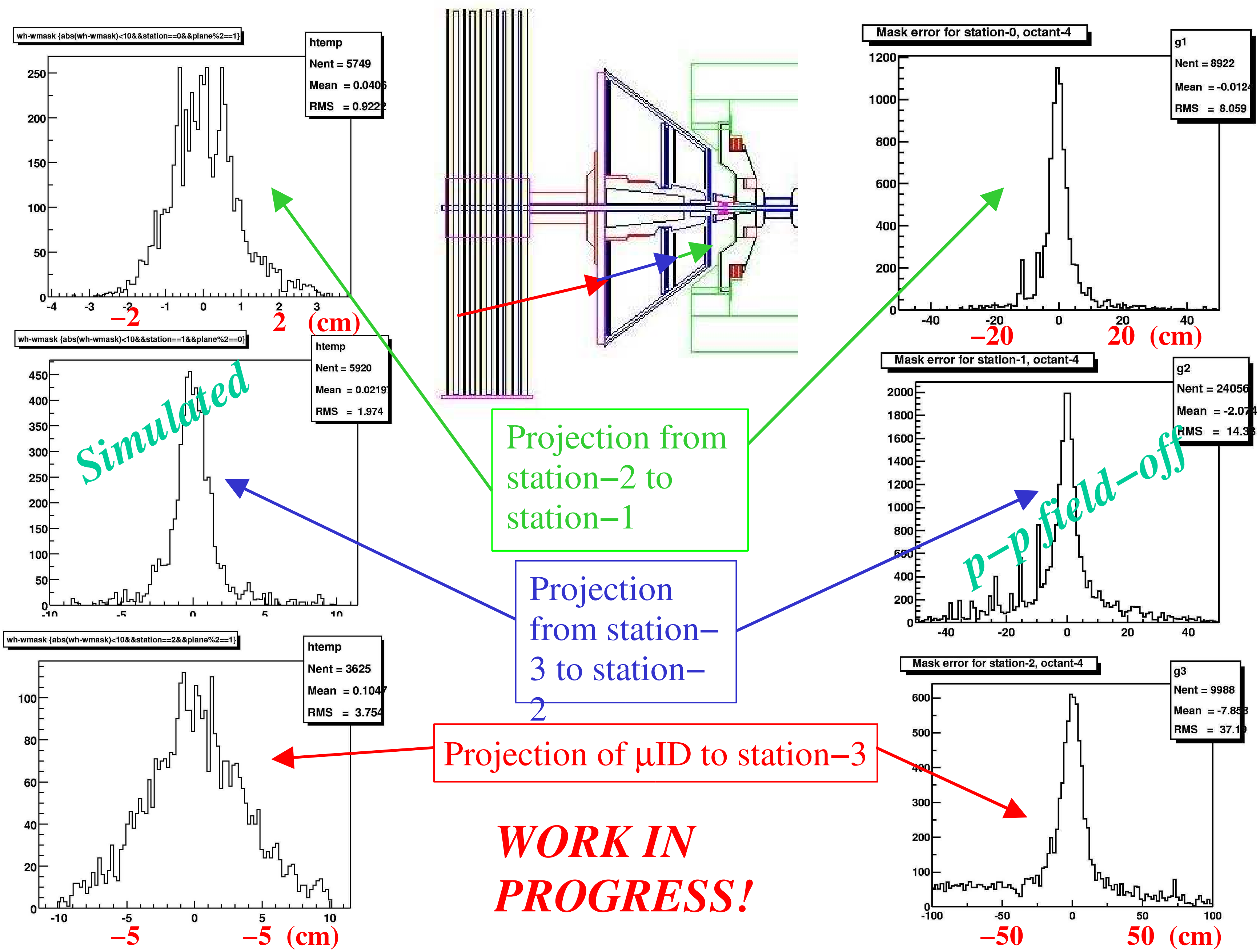
Dimuon Mass (GeV)

Summary and Outlook

First collision events were observed on 07/18/2001



- Successfully installed and commissioned muon detector in the PHENIX
- Collected significant a mount of data from both Au–Au and p–p runs
- Lots of progress in understanding detector response and geometry
- Expect physics results very soon, stay tuned!



wh-wmask {abs(wh-wmask)<10&&station==0&&plane%2==1}
htemp
Nent = 5749
Mean = 0.0406
RMS = 0.9222
−2
2 (cm)
wh-wmask {abs(wh-wmask)<10&&station==1&&plane%2==0}
htemp
Nent = 5920
Mean = 0.02197
RMS = 1.974
Simulated
wh-wmask {abs(wh-wmask)<10&&station==2&&plane%2==1}
htemp
Nent = 3625
Mean = 0.1047
RMS = 3.754
−5
−5 (cm)
Mask error for station-0, octant-4
g1
Nent = 8922
Mean = -0.0124
RMS = 8.059
−20
20 (cm)
Mask error for station-1, octant-4
g2
Nent = 24056
Mean = -2.074
RMS = 14.38
p−p field−off
Mask error for station-2, octant-4
g3
Nent = 9988
Mean = -7.858
RMS = 37.19
−50
50 (cm)
Projection from station−2 to station−1
Projection from station−3 to station−2
Projection of μID to station−3
WORK IN PROGRESS!