PERFORMANCE OF THE PHENIX SOUTH MUON ARM

Kenneth F. Read
Oak Ridge National Lab
& University of Tennessee
for the PHENIX Collaboration

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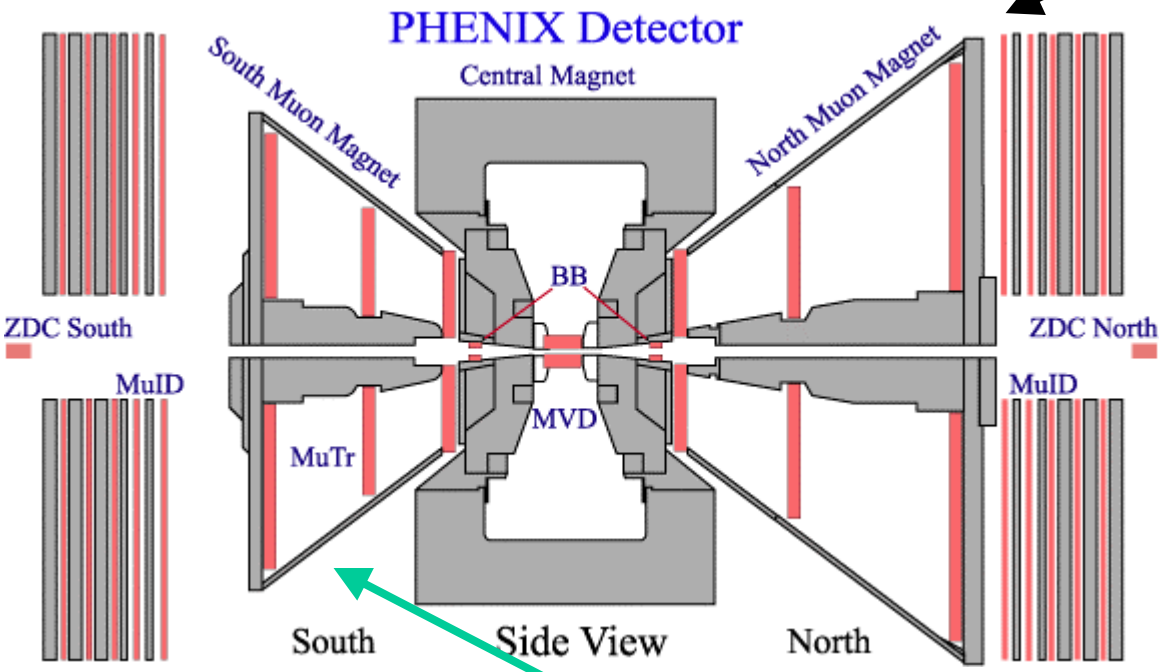
PHENIX MUON ARMS

North muon arm being commissioned this summer



South muon tracker (MuTR)

3 octagonal stations of cathode strip chambers per arm

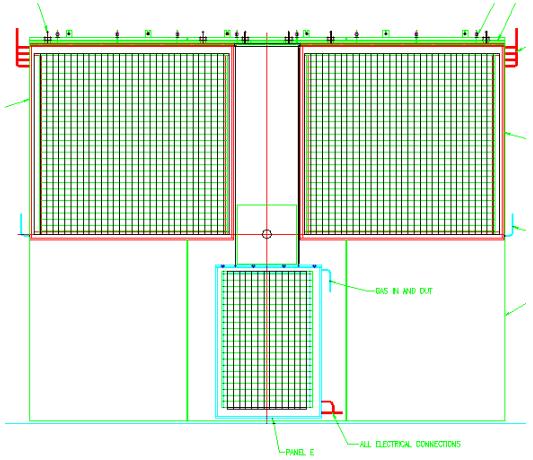
South muon identifier (MuID)

5 gaps per arm filled with planes of transversely oriented Iarocci tubes

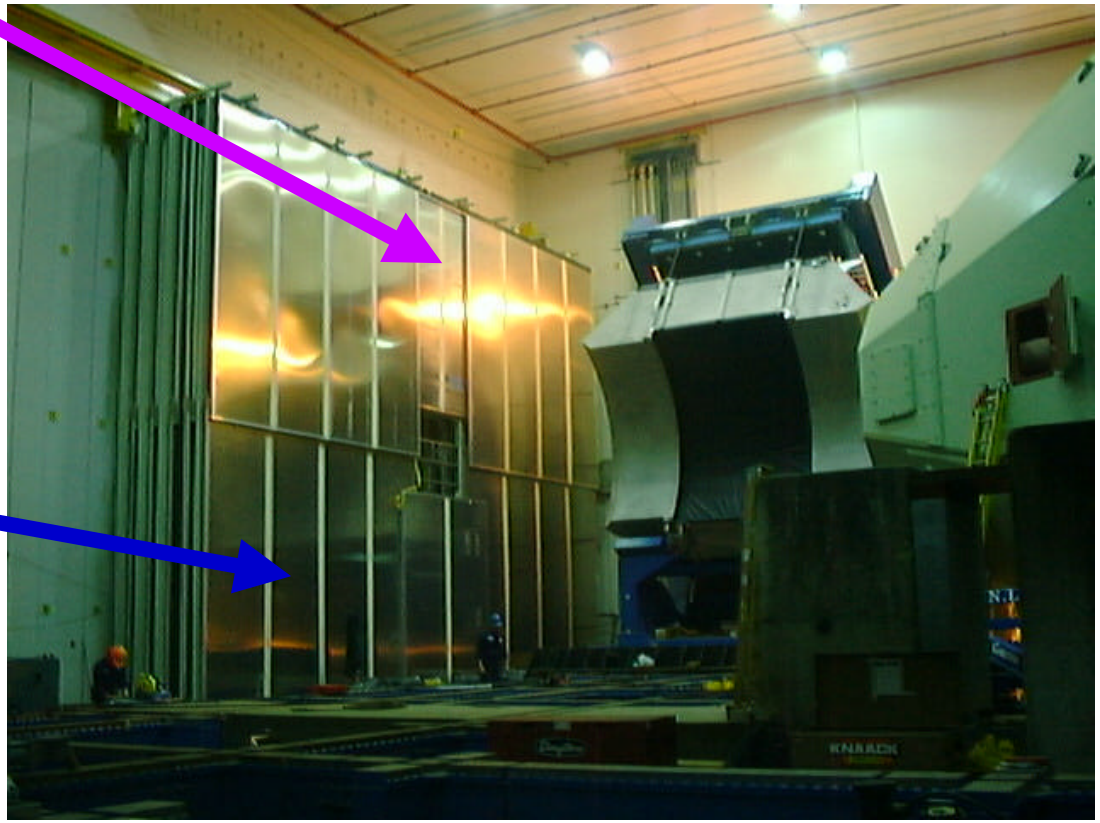
MUON IDENTIFIER

Small panel

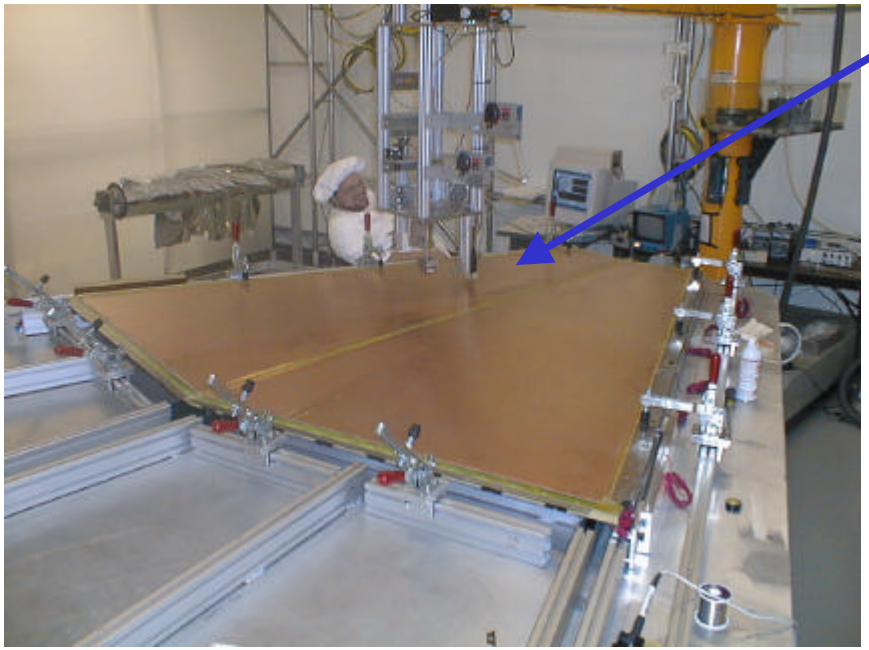
Large panel



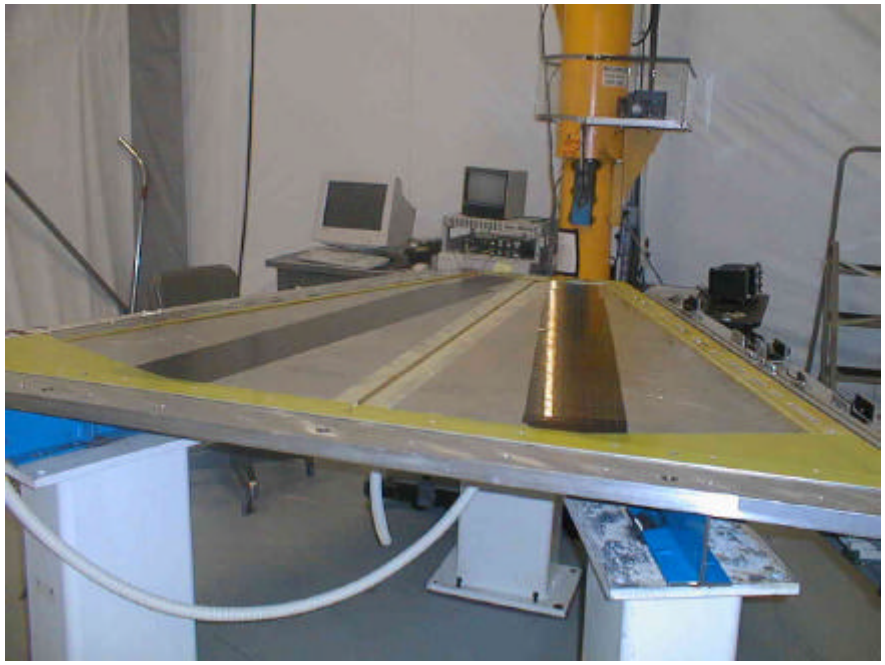
The South Muon Identifier



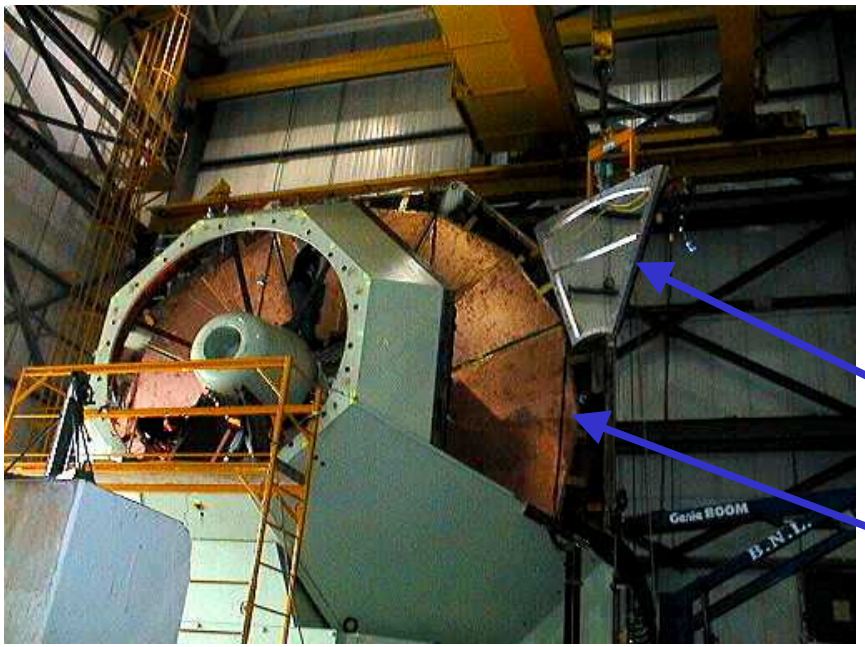
MUON TRACKER



Winding anode wires
for a station 3 octant



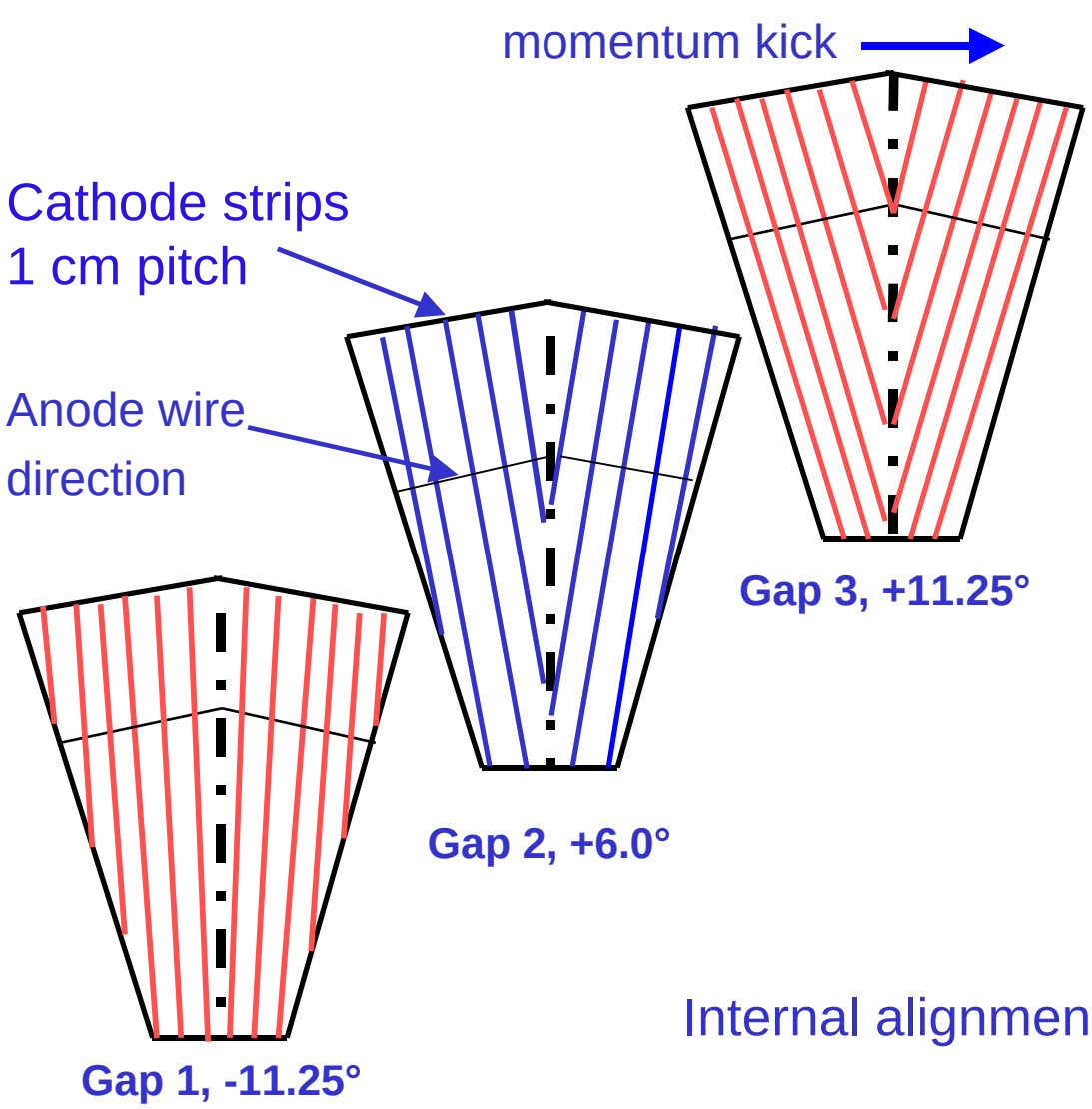
Station 2 octant under construction

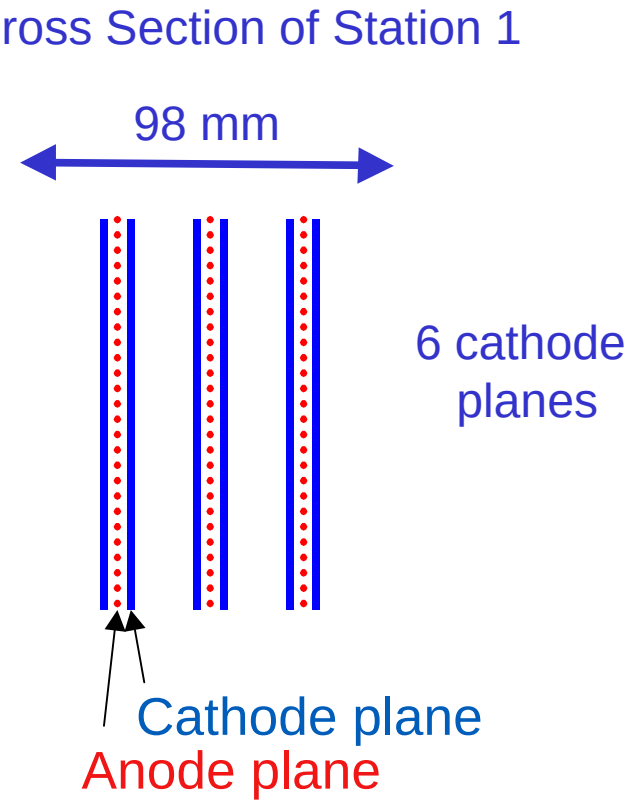


Installing a station 2 octant
into the south magnet

Station 3 octants already installed

STRUCTURE OF A STATION





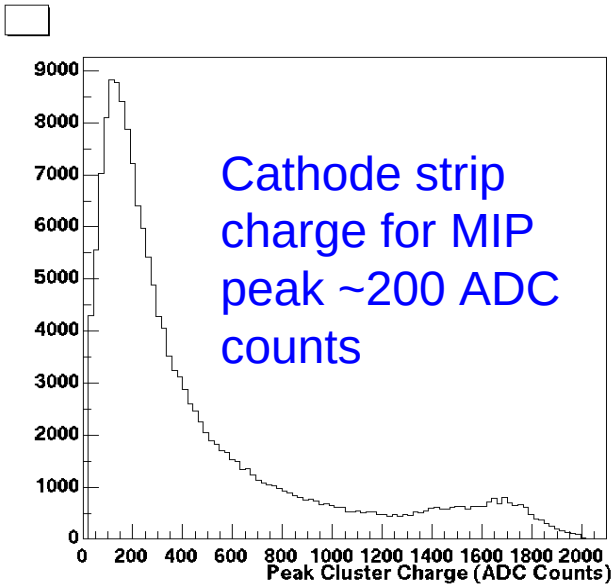
Internal alignment <25 microns

NOISE PERFORMANCE

Noise goal = 2 ADC counts (indicated by 2 →)

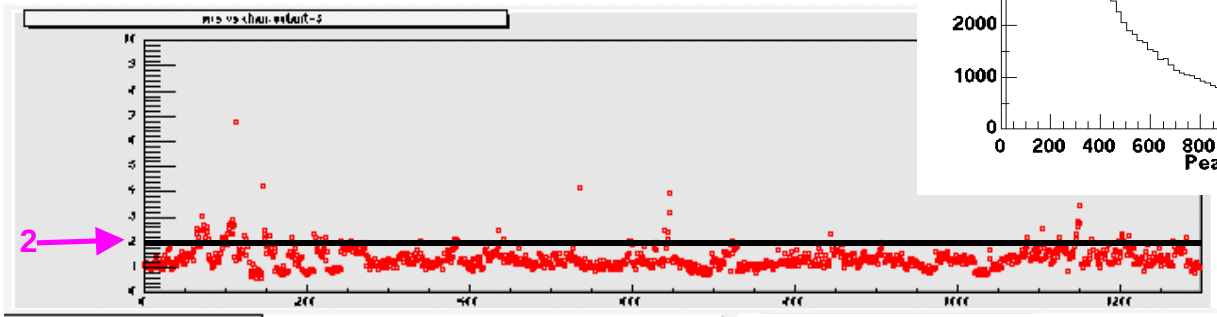
The average noise per channel is already at this level.

Further improvement anticipated for next year.

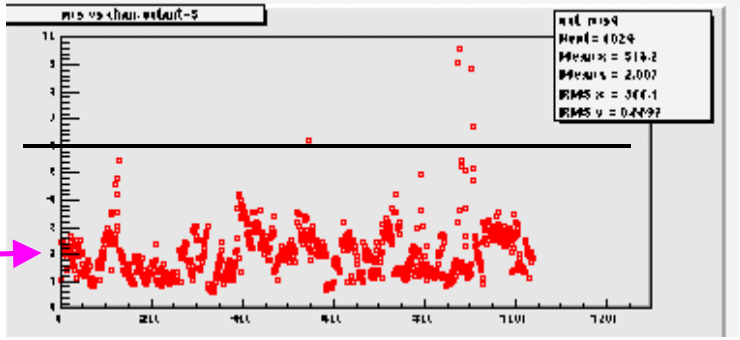


Cathode strip charge for MIP peak ~200 ADC counts

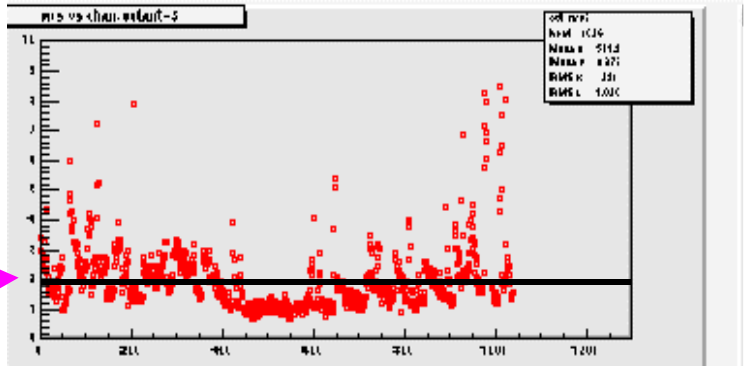
Station 1
σ = 1.5-2.0 ADC

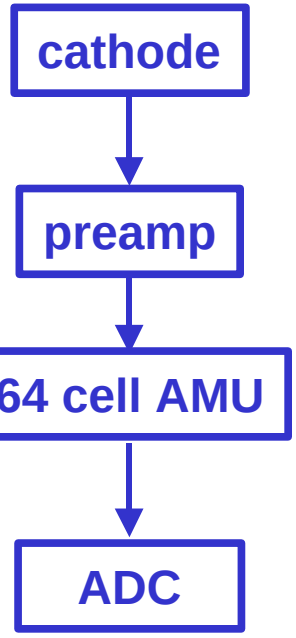


Station 2
σ = 2.0-4.0 ADC

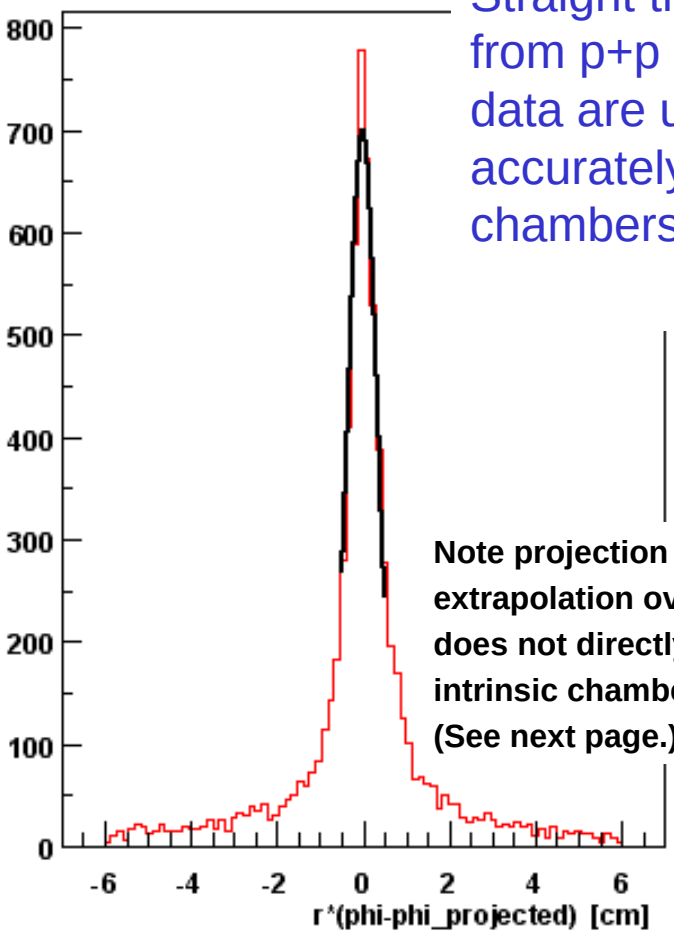


Station 3
σ = 1.5-4.0 ADC





TRACKER CHAMBER ALIGNMENT

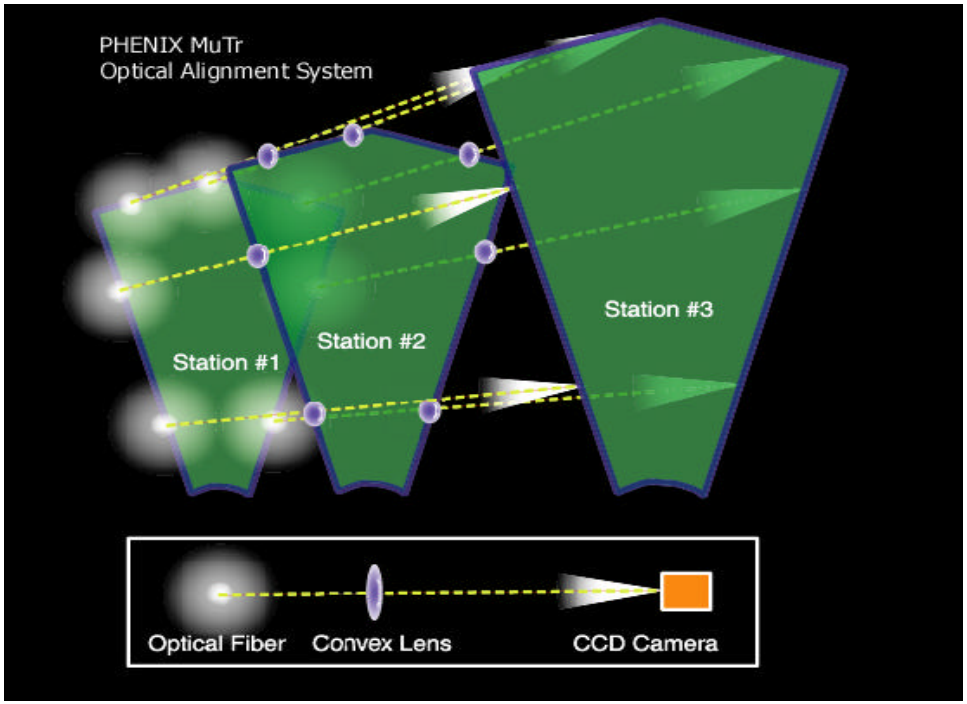


Straight tracks from p+p field off data are used to accurately align chambers.

Note projection error includes extrapolation over ~2 m and does not directly indicate intrinsic chamber resolution. (See next page.)

Projection errors at station 3 (for a typical half-octant) for p+p field-off data. Precisely centered at zero.

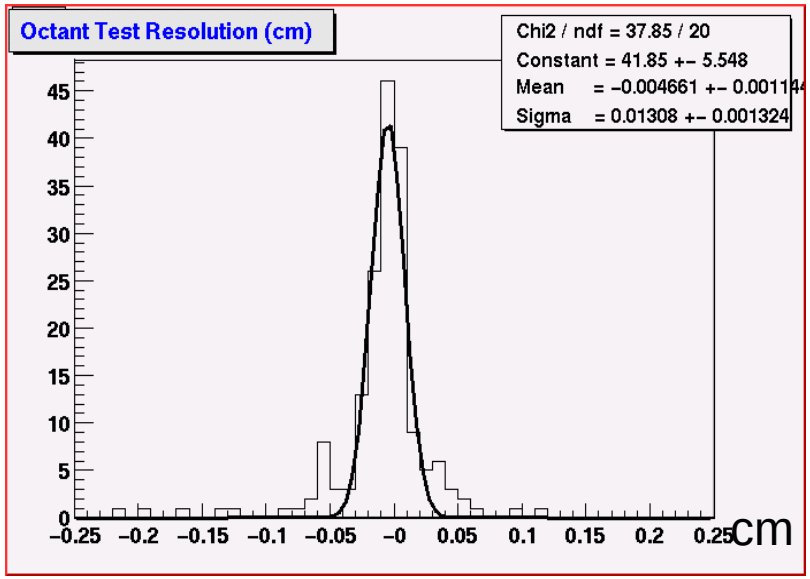
Optical alignment system has 7 sets of straightness monitors per octant. Can correct for changes in alignment due to temperature or magnetic field.



Performance of Production Chambers

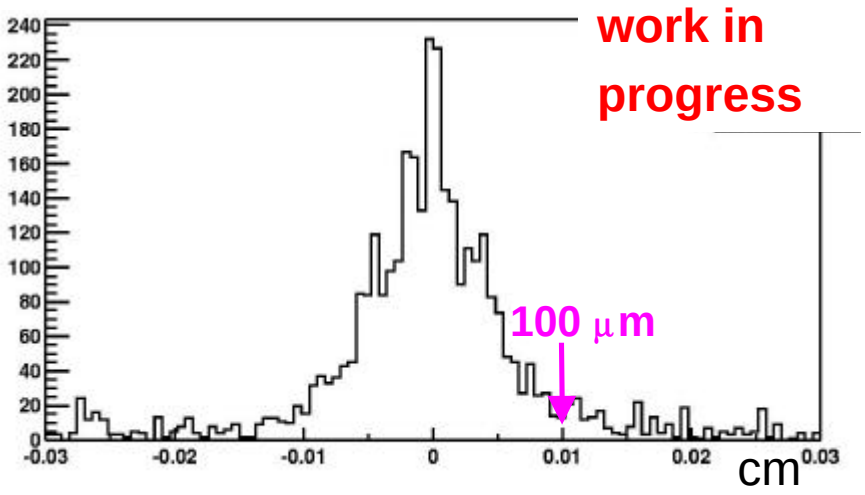
Resolution goal: 100 microns

Station 2 Octant Test Resolution



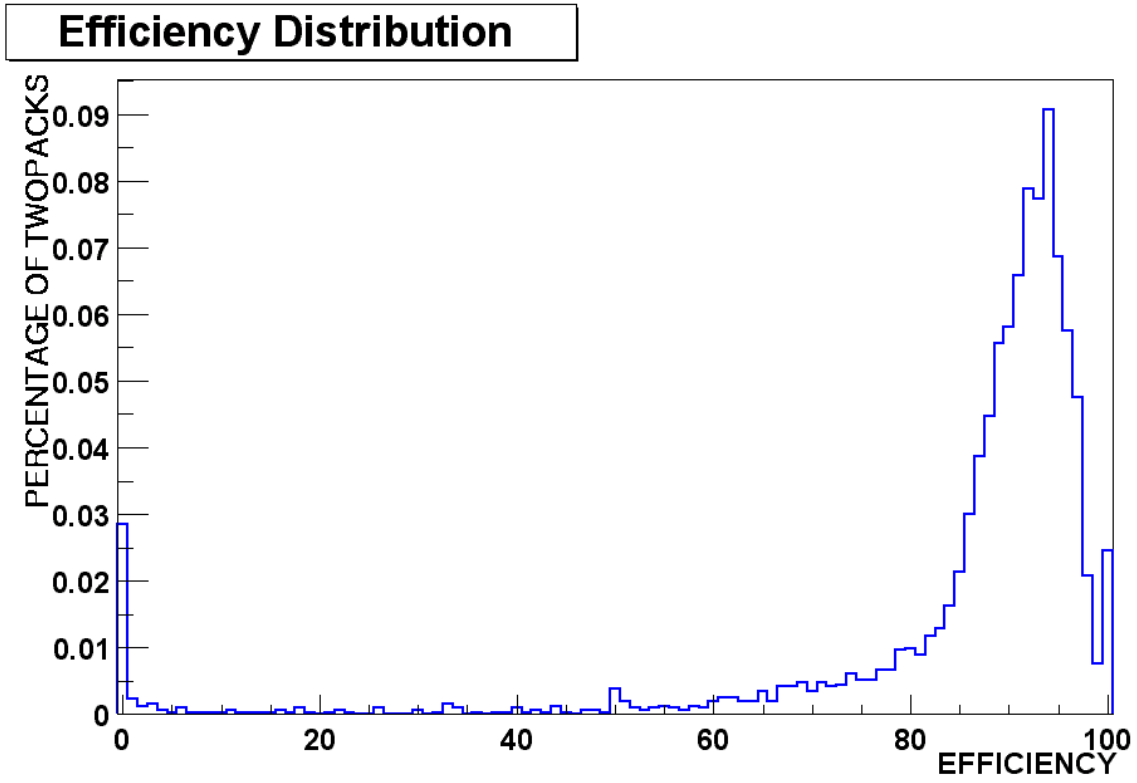
Composite chamber plus projection error of 131 microns is consistent with 100 micron specification for this production chamber octant.

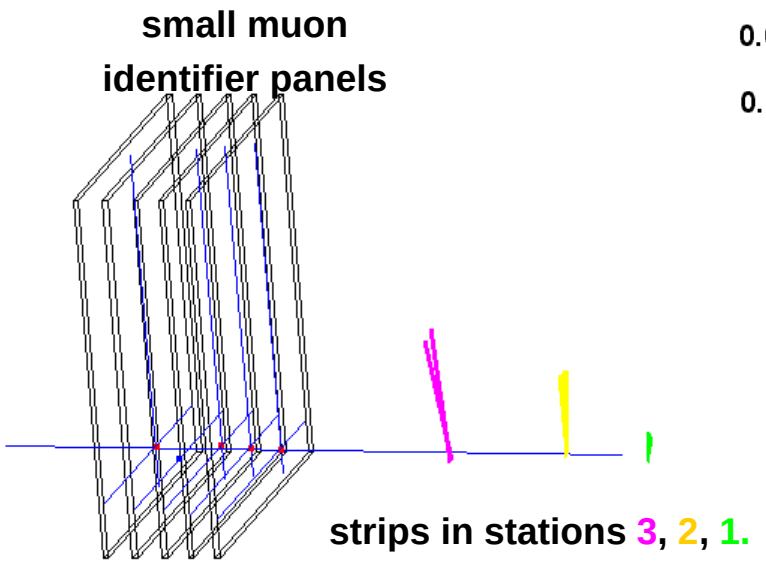
Station 1 Track Stub Residuals



Residuals for track stub projections within station 1 after installation using p+p field-off data are better than 100 microns.

CHANNEL-BY-CHANNEL EFFICIENCIES

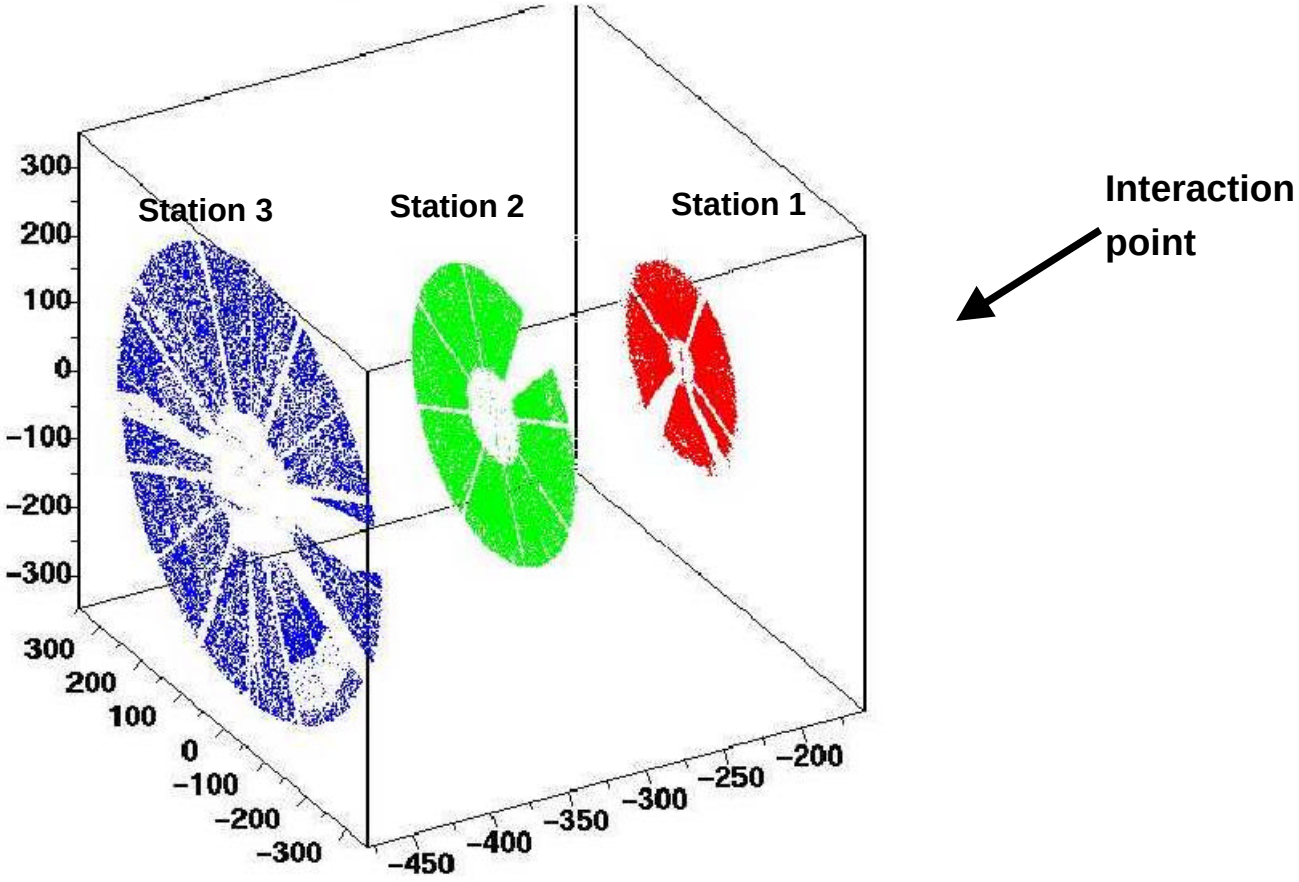




Cosmic ray tracks are used to measure the efficiency of each pair of muon identifier tubes. The distribution is broadened due to insufficient statistics.

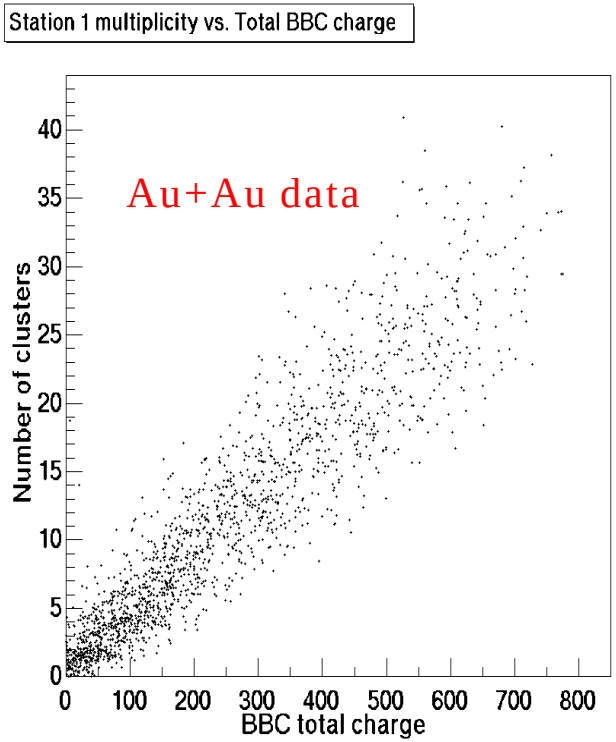
Identifier road projecting to struck strips in tracker for cosmic ray event

ACTIVE MUON TRACKER CHANNELS



Visualization of active regions of three tracking stations. Dead regions are due to problems with HV and front end modules during 2001-2 run. Majority of problems corrected for next run.

COLLISIONS!



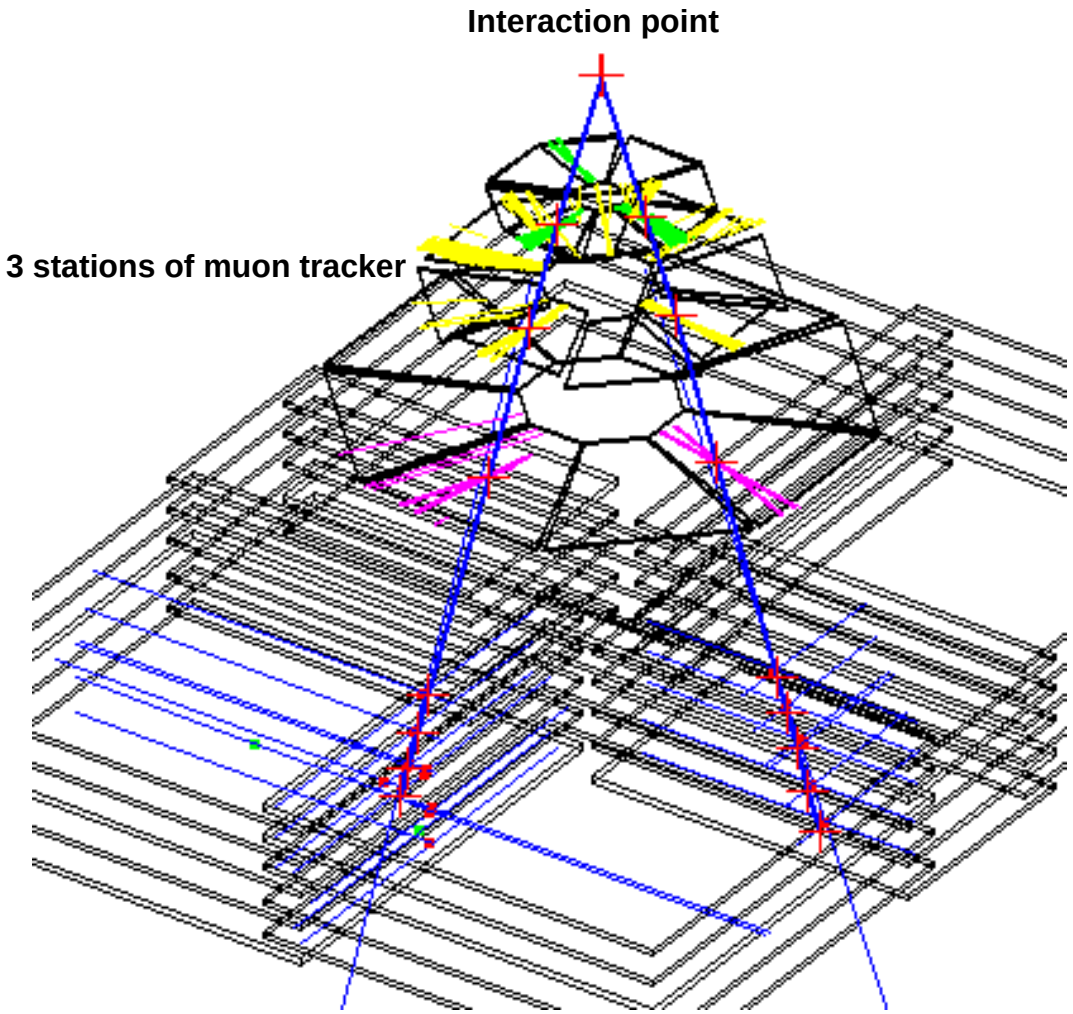
Tracker occupancy increases with multiplicity as expected.

Muon Tracker Multiplicity vs. Beam-Beam counter total charge (a measure of multiplicity)

PHENIX sampled 24 μb^{-1} of Au+Au data and 150 nb^{-1} of p+p data in Run 2 (2001-2).

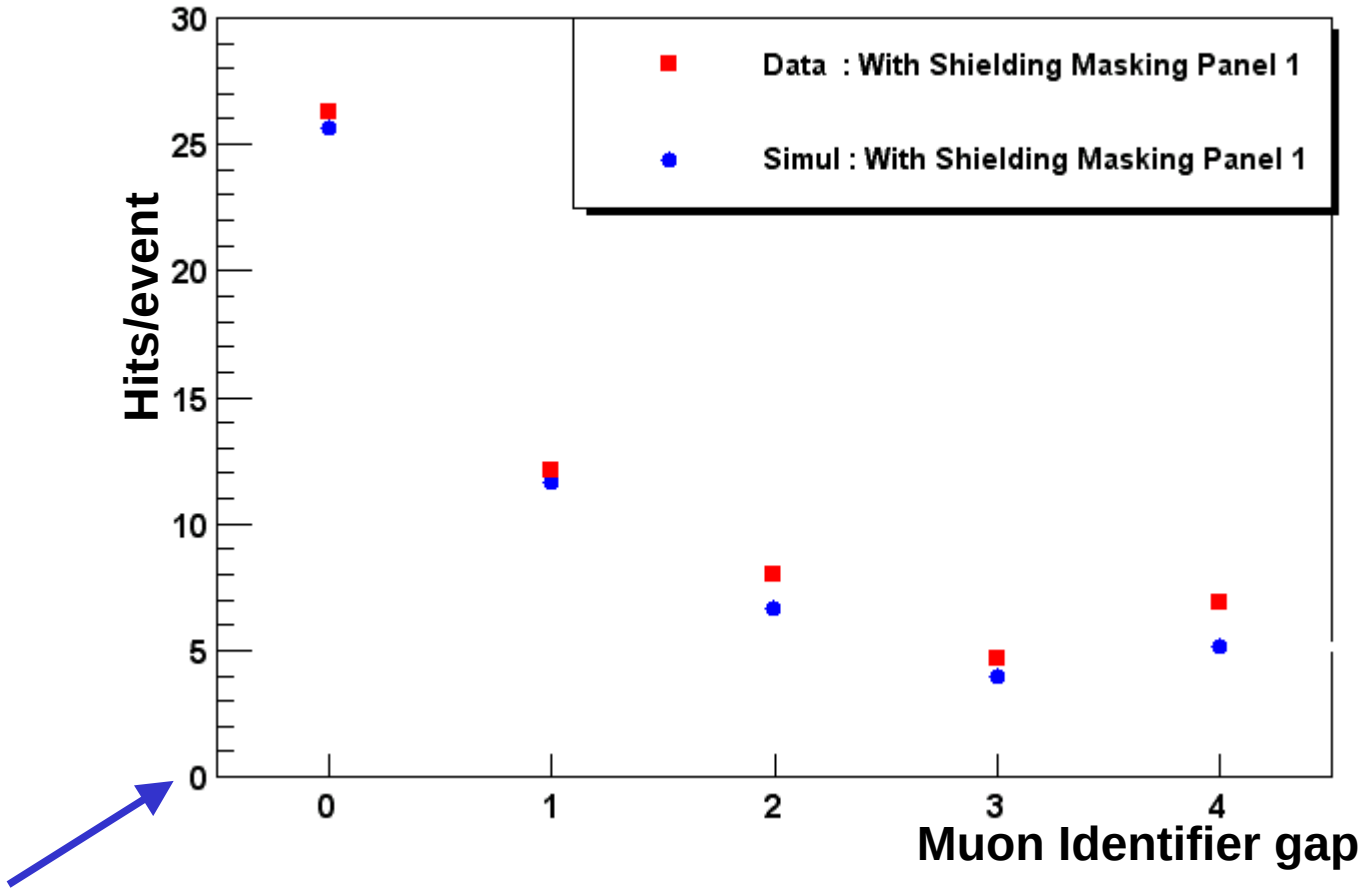
DIMUON CANDIDATE

Dimuon candidate from p+p collision (rotated for clarity with beam line running vertically)



OCCUPANCY

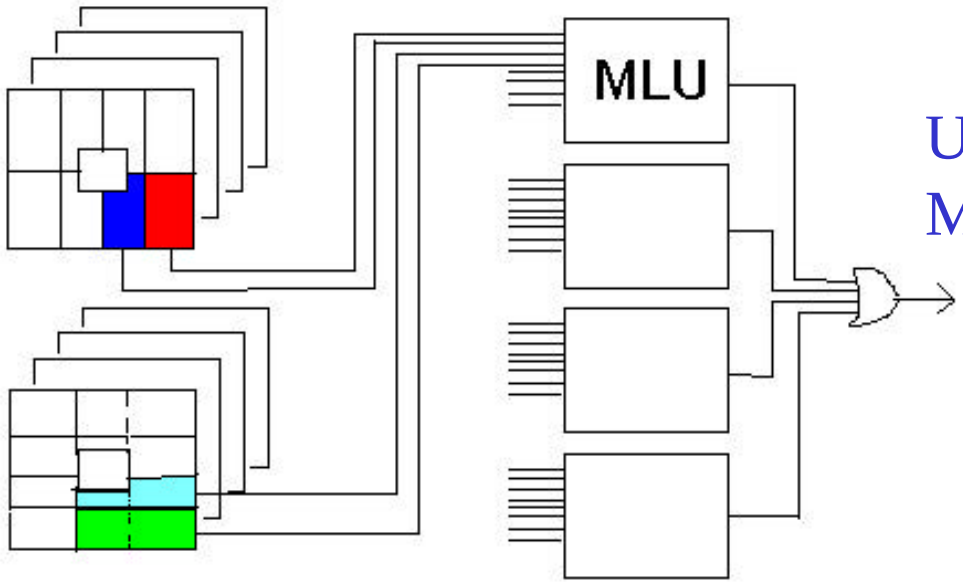
Occupancy as a function of depth in identifier



Occupancy observed in muon identifier for data agrees closely with expectations from simulation gap-by-gap. Occupancy generally decreases with depth in the identifier. The small increase for last gap is due to secondaries striking material in the square hole and is consistent with expectations from simulation.

MUON IDENTIFIER LEVEL-1 TRIGGER

- **NIM Logic LVL-1 Trigger used during 2001-2**
  - **LVL-1 rejection is not required for Au+Au until RHIC significantly exceeds design luminosity.**
  - **LVL-1 rejection is required for lighter species, notably p+p**
  - **Used for stand-alone cosmic ray (diagnostic) trigger**
  - **4 gaps in trigger, each with 2 orientations. Trigger required hits in 6 out of 8 gap/orientations per quadrant.**



Use gaps 0,2,3,4. One MLU per quadrant.

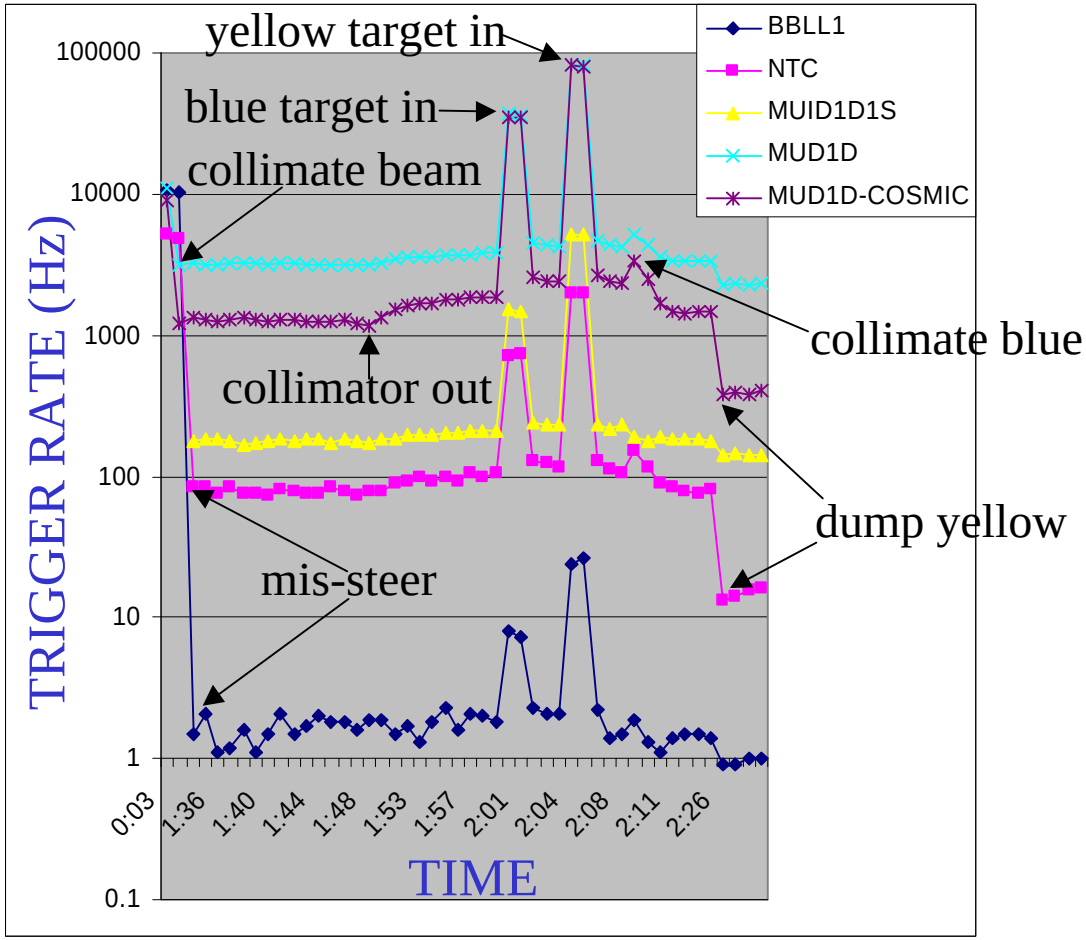
MUON LEVEL-2 TRIGGER

- **Available LVL-2 requirements:**
  - minimum polar angle of muon(s) (12° or 15°)
  - opening angle between two muons
  - centrality of event (measured by PHENIX)
  - For Run 3: match to station 3 of the muon tracker
  - For Run 3: require minimum invariant mass of dimuon pair!
- **Efficient for muons from the vertex, good rejection of hadrons**

Trigger Name	Rejection Factor
DiMuon	44
DiMuonPeripheral	570
SingleMuon	7
SingleMuonPeripheral	56

Measured rejection factors

BACKGROUND STUDIES



After β* = 1 m achieved, significant non-collision background observed. Studied problem with help from RHIC during p+p running by mis-steering beam and seeing panel currents remain high. Rates very sensitive to beam scrape. Collimation helps tremendously. RHIC expects to further investigate and improve this situation.

OUTLOOK

- **The south muon arm performed well during its first (2001-2) run and is producing physics results.**
- **See related posters by D.-J. Kim, J. Newby, M. Liu, and H. Sato.**
- **For more information see www.phenix.bnl.gov.**
- **The north muon arm will be commissioned this summer and fall.**