Commissioning and Performance of the PHENIX Muon Identifier

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for the PHENIX collaboration

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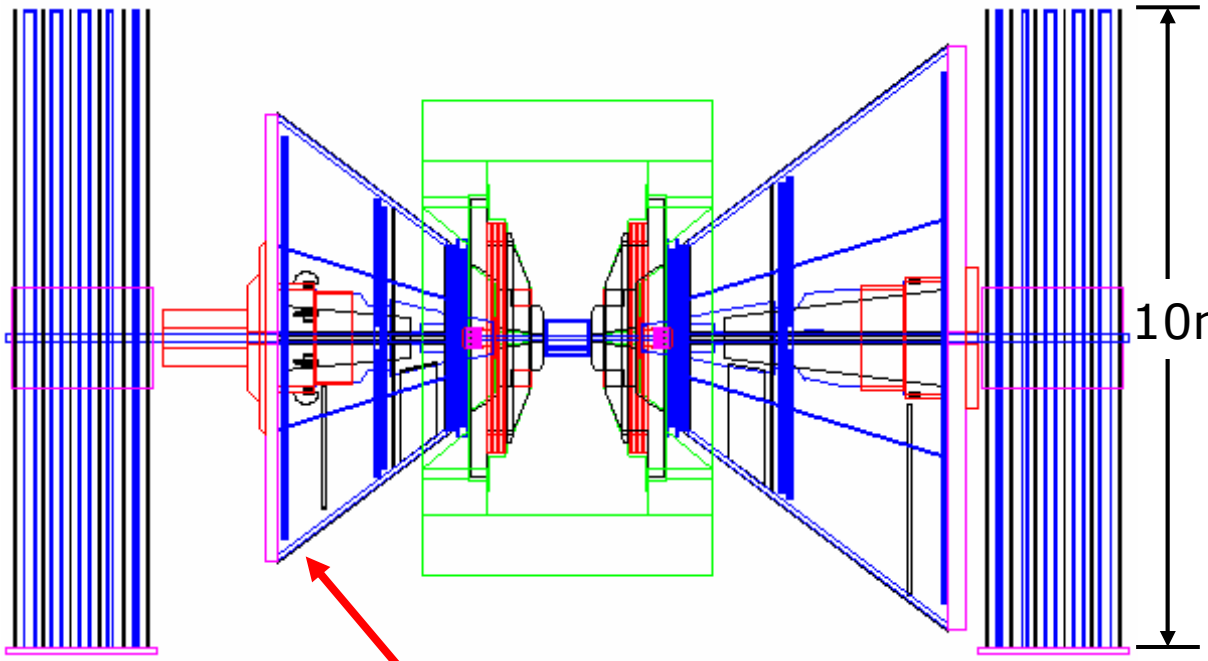
PHENIX Muon Arms

South:

Active
Last run



North:

Active
Next run

Station 3 of south muon tracker (MuTR)

South muon identifier (MuID)

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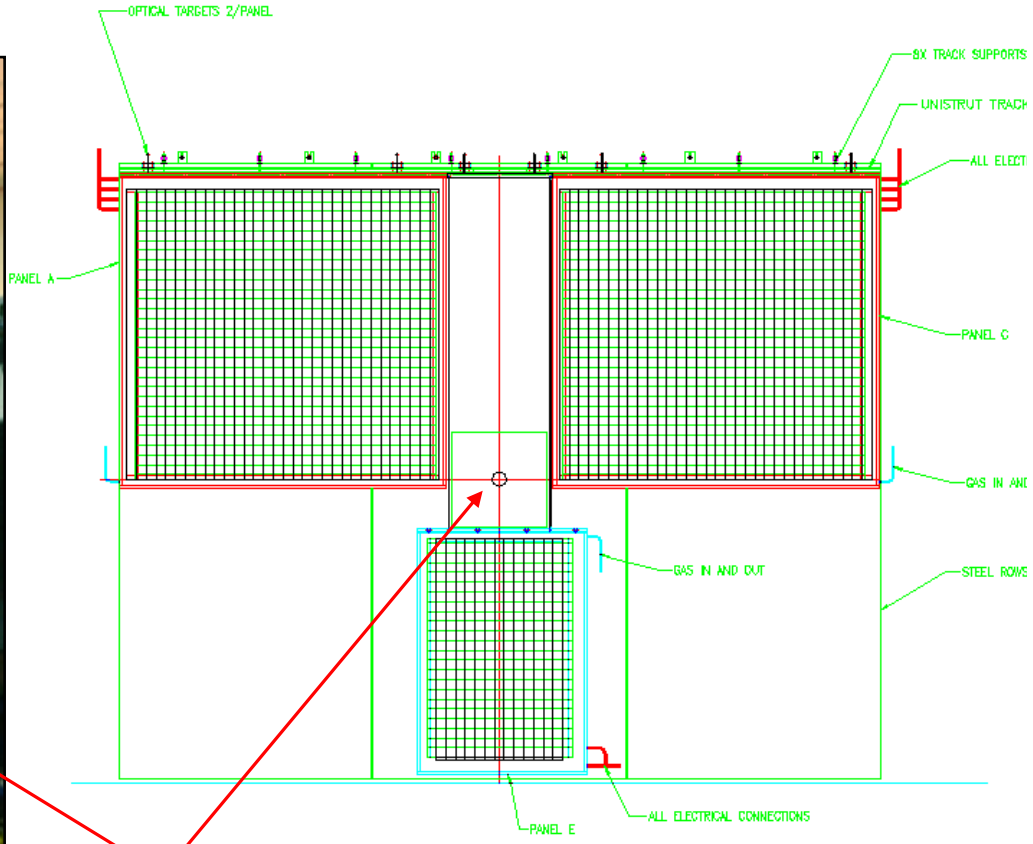
Phenix Muon Identifier

5 gaps per arm filled with planes of transversely oriented plastic proportional (Iarocci) tubes (6340 per arm)



"Square hole" where beam enters

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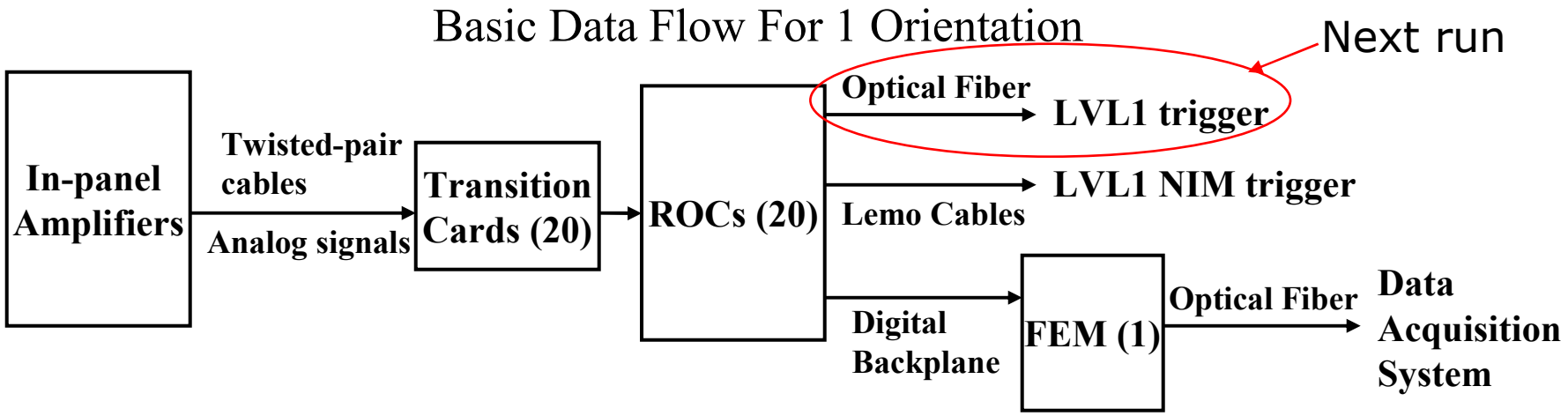
MuID Main Components

Commissioned in 2001

- Gas System
  - Exchanged 1 volume of 91% CO_2 plus 9% Isobutane per day. Very Stable.
- Front End Electronics
  - Minor noise issues early in commissioning. Very Stable during run.
- High Voltage System
  - Few sparking connectors, some communication issues. Generally good performance
- Trigger
  - Level1 NIM Logic trigger used for cosmic ray and p+p
  - Level2 software trigger used for Au+Au

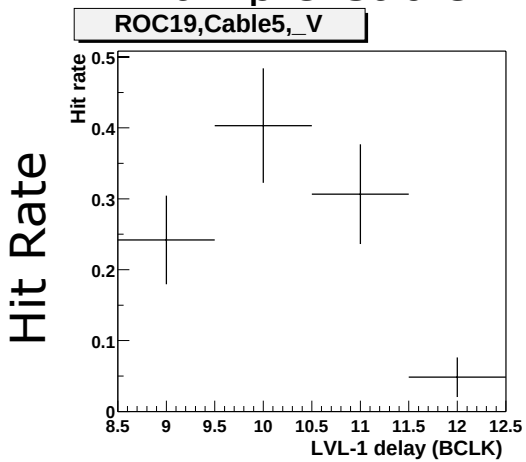
Front End Electronics

- In-panel Amplifiers
- Readout Cards (ROCs)
- Front End Module Cards (FEMs)

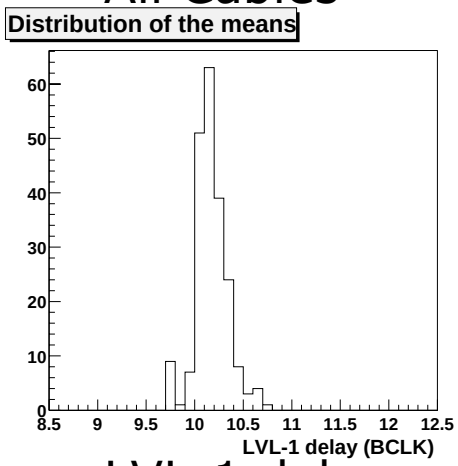


Electronics Commisioning

Example Cable

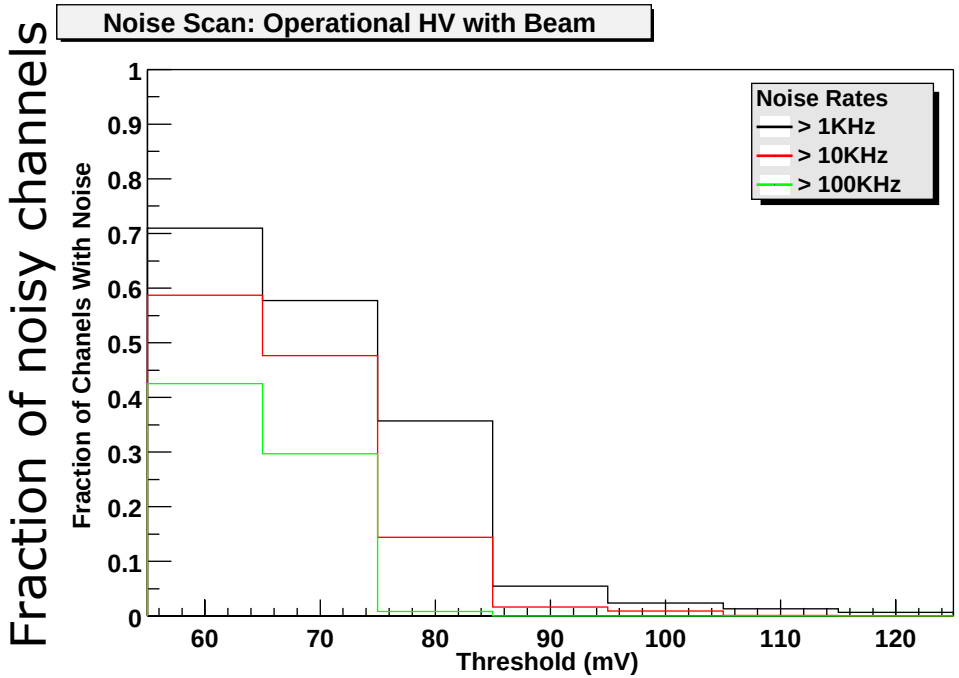


All Cables



LVL-1 delay

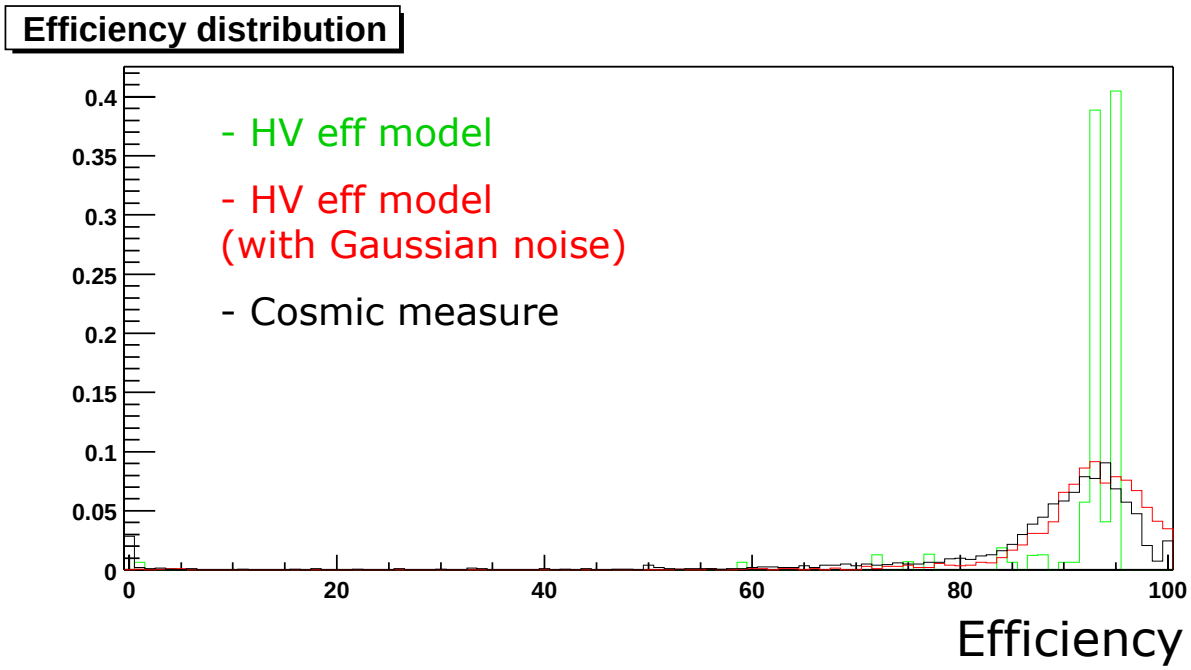
Timing and Theshold scans



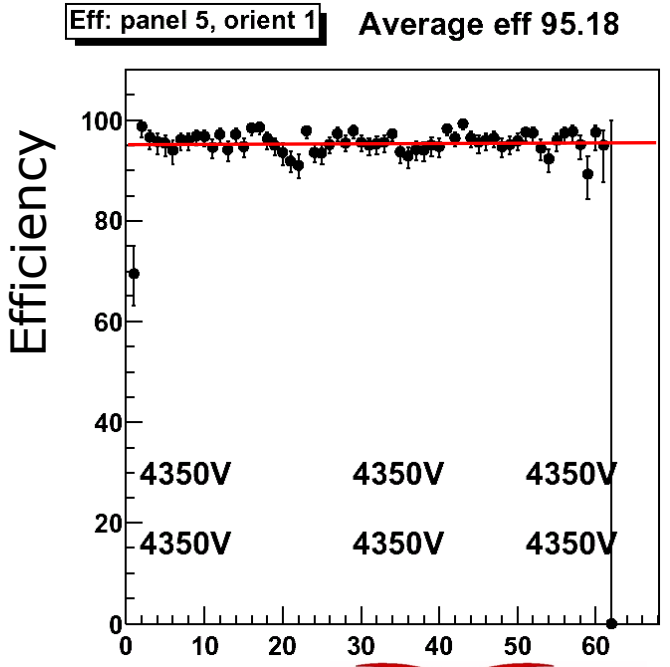
DAC threshold (same for all channels)

High Voltage System

- Generally very good performance.
- Needed to fix some sparking connectors at panel bulkhead.
- Needed to modify MuID HV control GUI, speed up refresh of HV data, reduce communication, and improve logging.
- Some modules needed to be repaired.

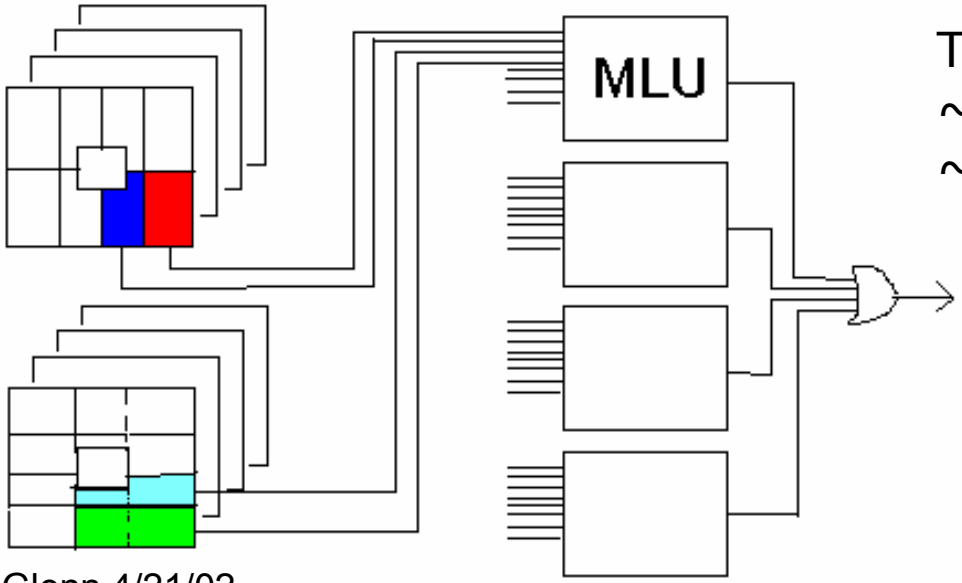


Example Panel Orientation



Level1 Trigger

- NIM Logic LVL-1 Trigger
  - LVL-1 rejection is not required for Au+Au until RHIC reaches several times design luminosity.
  - LVL-1 rejection was required for p+p.
  - Used for stand-alone cosmic ray (diagnostic) trigger
  - Provided enough rejection power to avoid scaledown of di-muon trigger



Trigger-circuit efficiency is
~ 96% for single mu
~ 98% for di-mu

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

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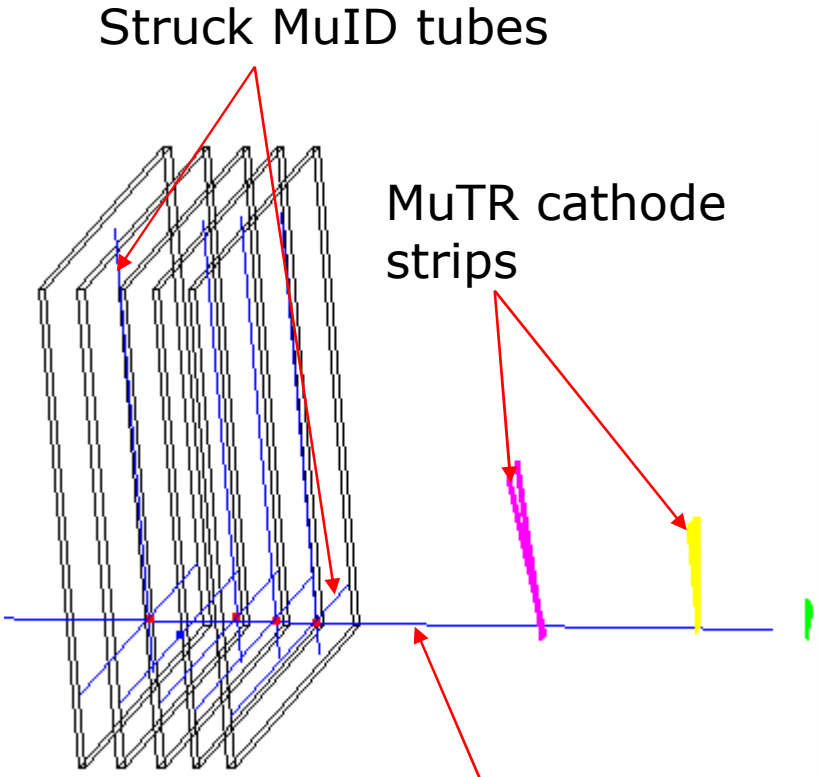
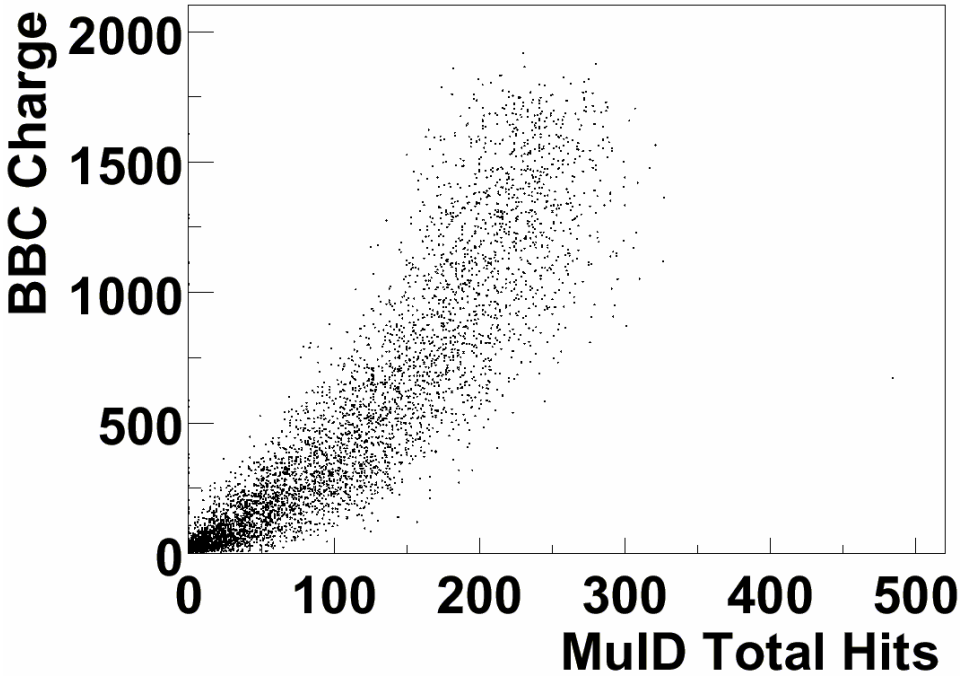
Collisions





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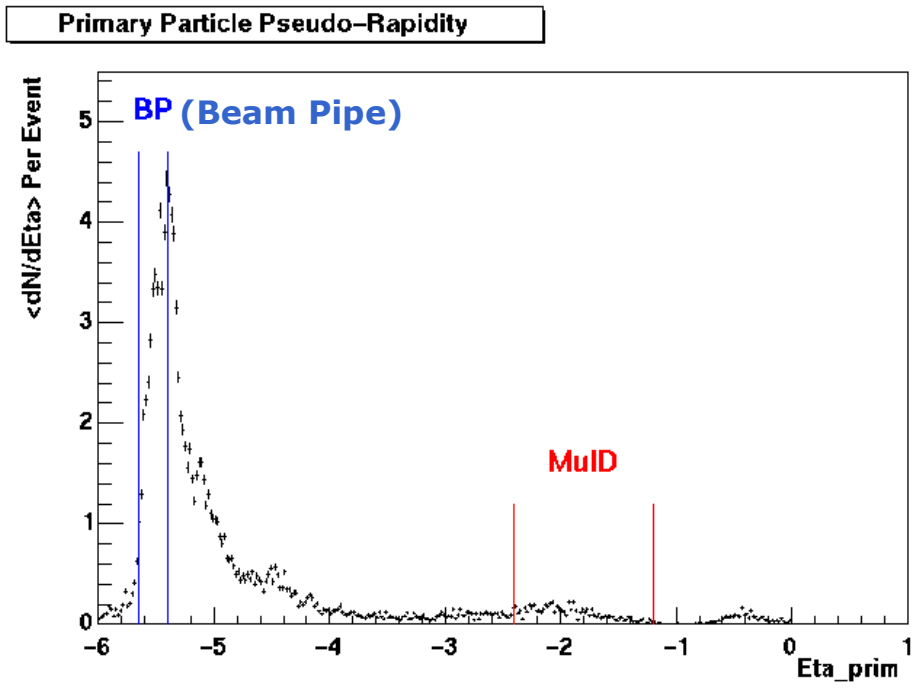
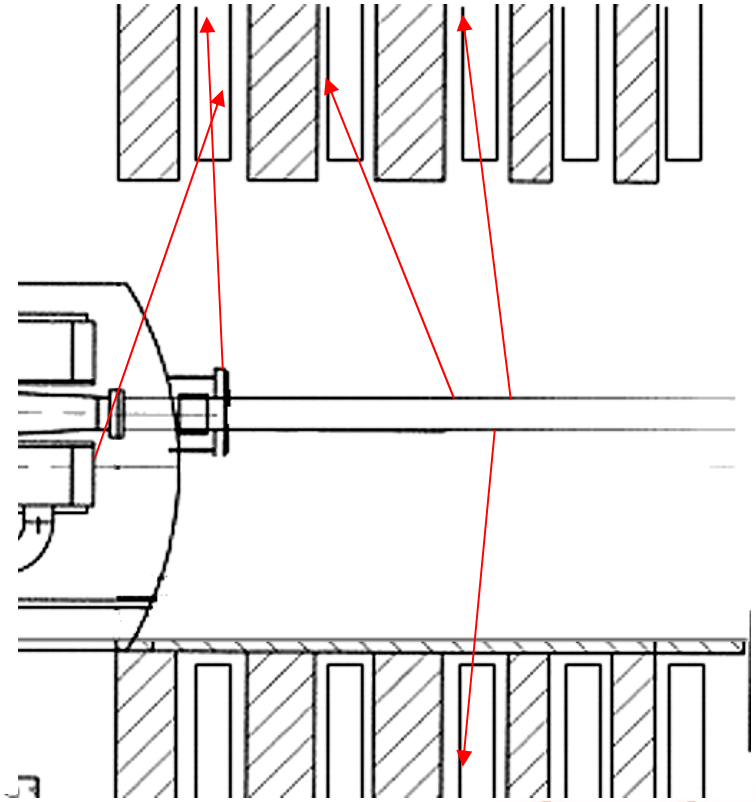
Unexpected Background

- Significant collision-related background observed
  - Rejection factors worse than simulated data
  - Secondaries emitted inside square hole perpendicular to beam line





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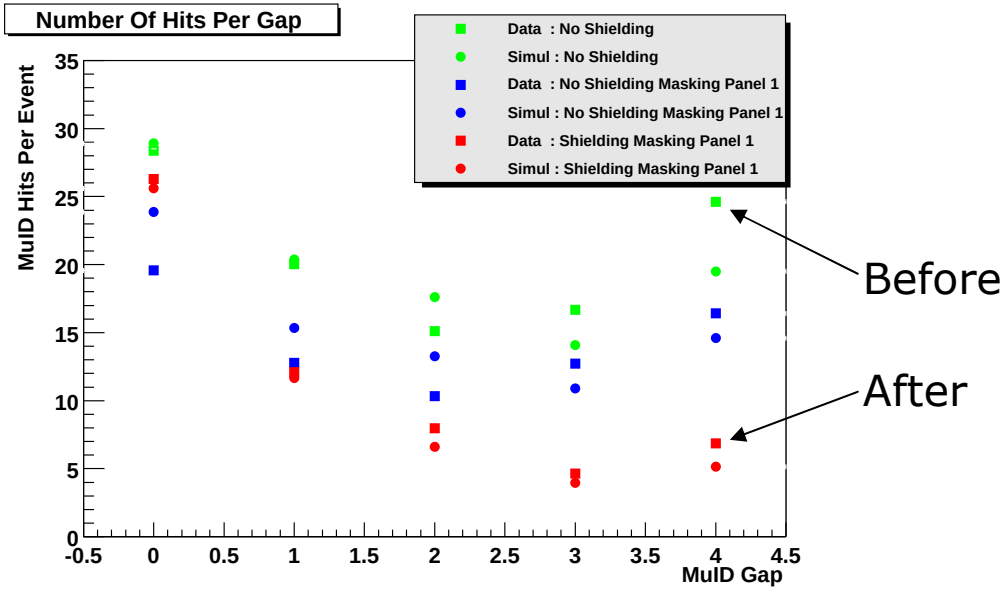
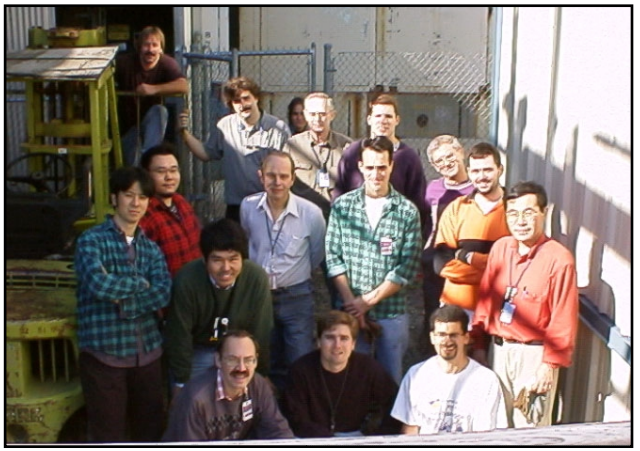
Shielding Solution

- Simulated and tested trial shielding configurations
- Hand-stacked 7 tons of iron bricks





Level2 Au+Au Rejection Factors

Trigger Name	RF BEFORE (Measured)	RF AFTER (Measured)
DiMuon	5	44
DiMuonPeripheral	75	570
SingleMuon	2	7
SingleMuonPeripheral	13	56

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Non Beam-Beam Collision Background

- After $\beta^* = 1$ m achieved, significant background observed. Caused increased panel/tube currents.
- Mis-steering the beam and seeing panel currents remain high confirmed that the background was not due to beam-beam interactions.
- Studied with help from RHIC during p+p running
- Study Results Summary
  - Very sensitive to beam scrape
  - A specific RHIC triplet is known to have been associated with problem and is being investigated
  - Possible contribution from beam gas
  - Collimation helps tremendously

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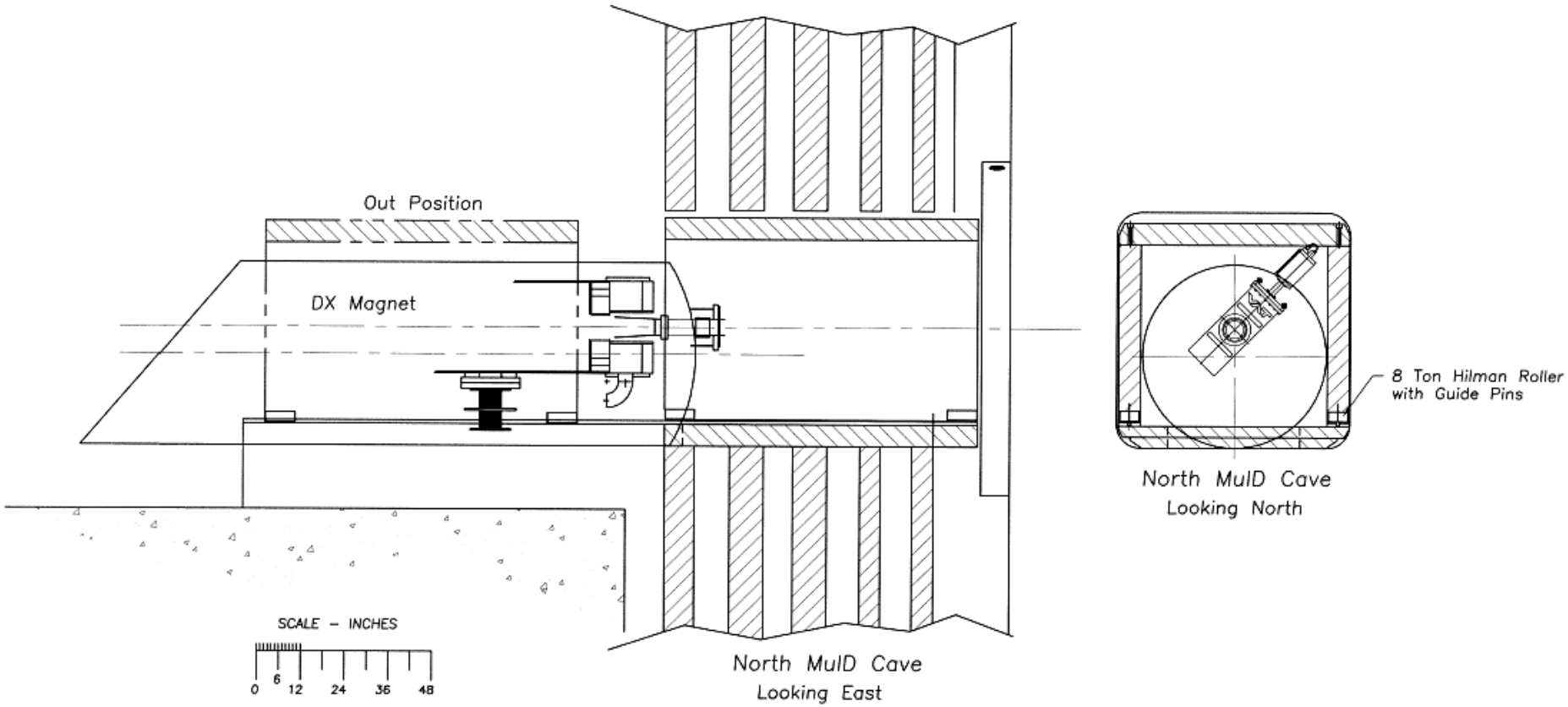
Conclusions

- All of the individual elements of the PHENIX south muon identifier performed well (and most better than expected) during their first data taking run.
- The system as a whole faced some unexpected challenges which were quickly and effectively addressed.

Shielding Next Run



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