PHENIX TOF.W Run-7 Performance Results

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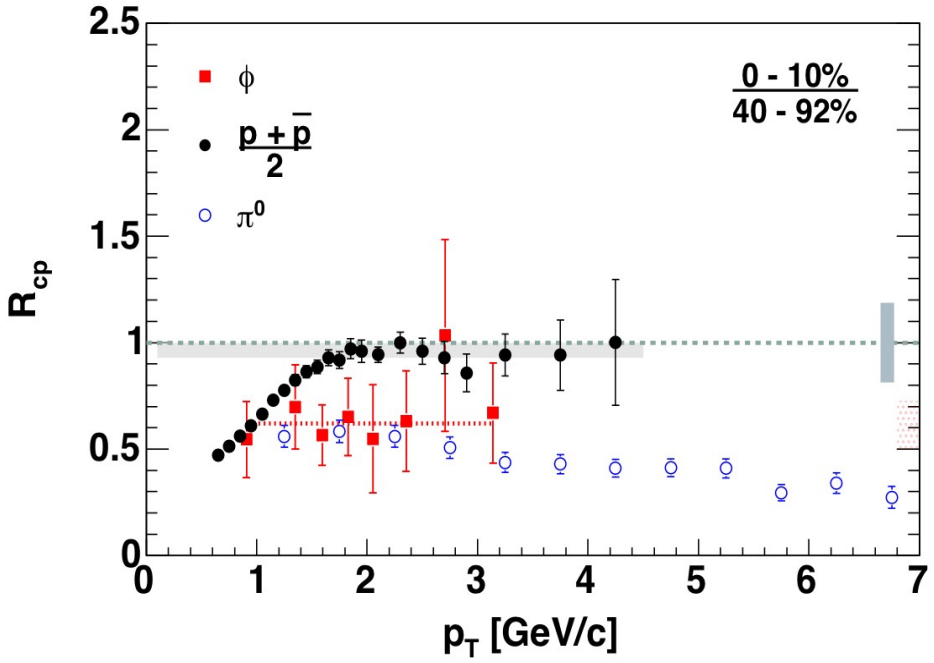
VANDERBILT UNIVERSITY

PHENIX

Outline

1. Physics motivation
   - PHENIX high p_T particle identification (PID) upgrade project
2. Multi-gap Resistive Plate Chamber (MRPC) Time-of-Flight (TOF) Design
3. Detector Performance
   - Run-7 results
4. Summary and Outlook

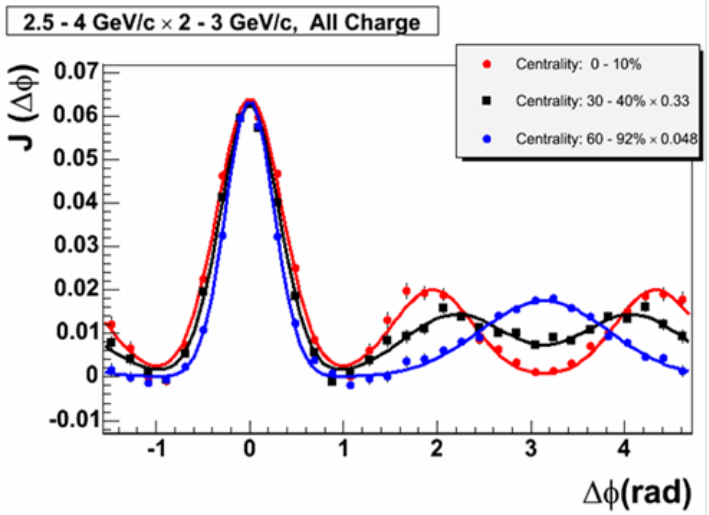
Physics Motivations

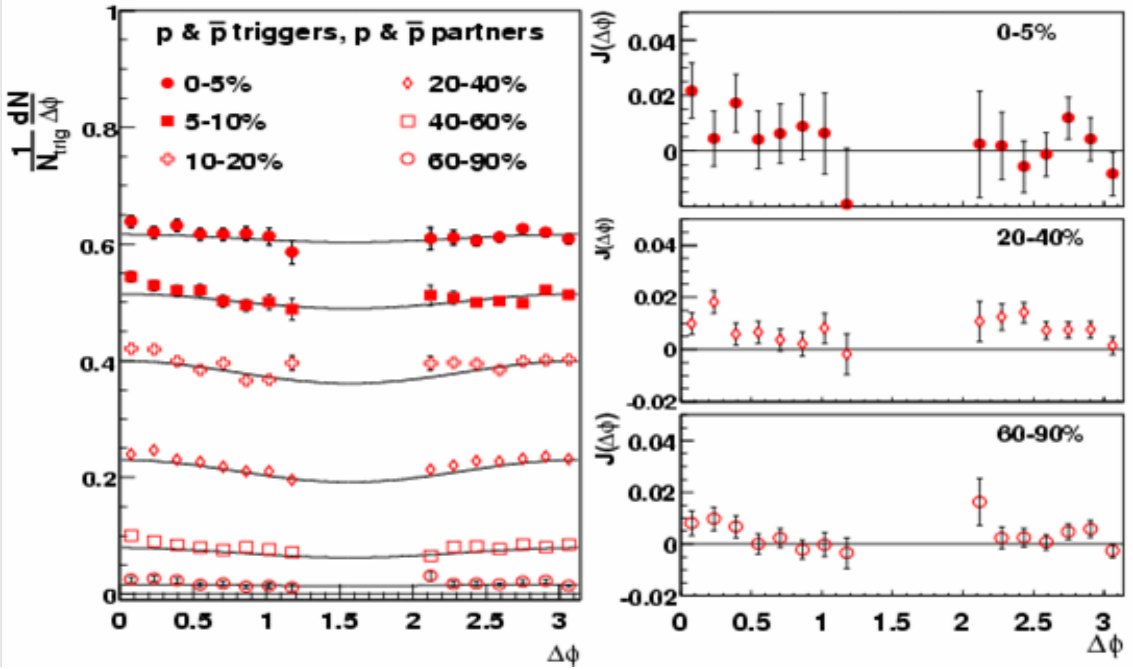


PHENIX: Phys. Rev. C 72, 014903 (2005)
Au+Au collisions at $\sqrt{s_{NN}}$ = 200 GeV

- Two very important physics results from RHIC:
  - Strong suppression of π^0 yields above p_T ~ 2 GeV/c
  - No suppression for baryons at intermediate p_T (2-5 GeV/c)
- Need to understand the hadronization mechanism
- **Need better experimental constraints:**
  - **Seamless PID from low to high p_T for hadron sprectra**
  - **Track-by-track PID for jet correlations**

Physics Motivations II





PHENIX: Phys. Lett. B 649 (2007) 359-369
Au+Au collisions at $\sqrt{s_{NN}}$ = 200 GeV

- **Importance of track-by-track PID for jet correlation measurements**
- TOF can be placed in strategically advantageous position for this purpose

PHENIX High p_T PID Upgrade

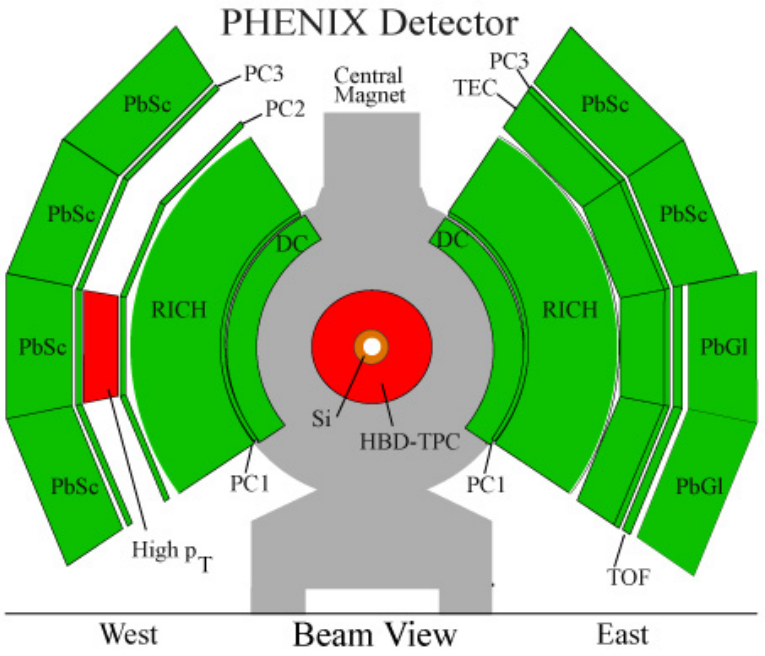
Aerogel & Time-of-Flight

- Together with the Aerogel, TOF, and RICH, we can extend the PID **out to p_T ~ 9 GeV/c**

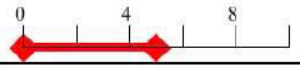
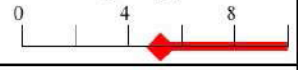
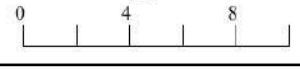
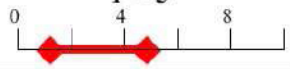
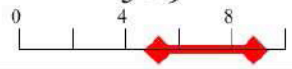
AEROGEL Cherenkov detector:

- n = 1.0113
- Completed full installation for Run5

Additional TOF counter is required for K/p separation below 5 GeV/c



Extension of PID Capability

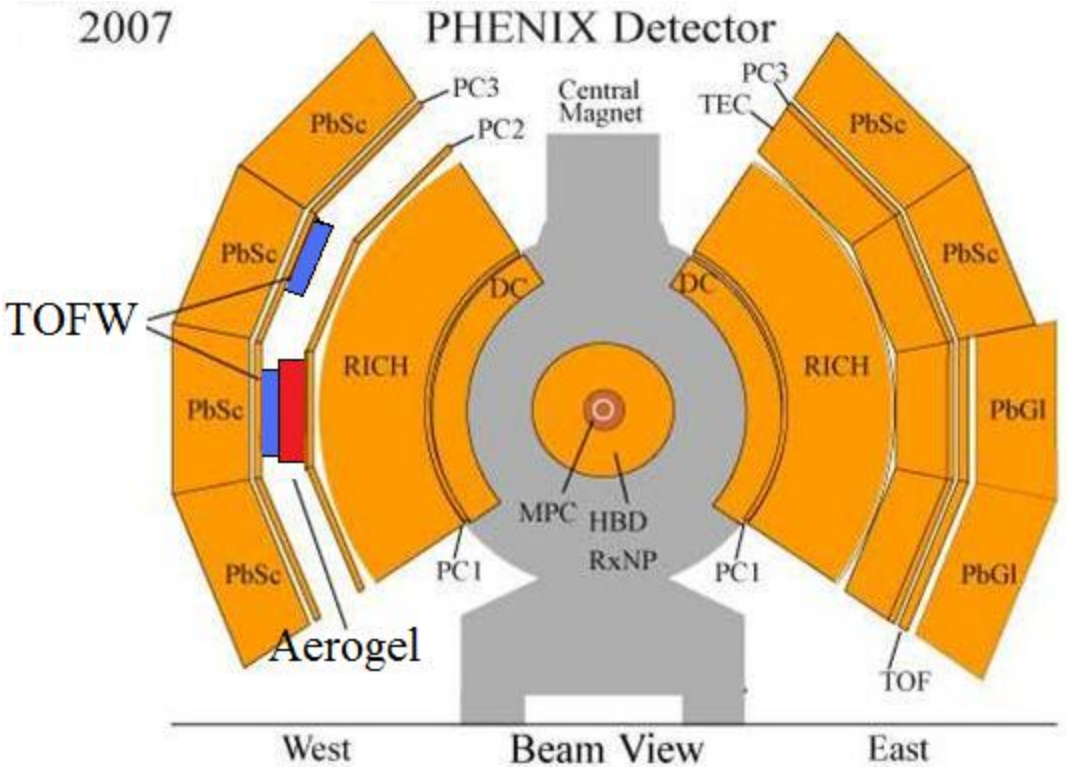
		Pion-Kaon separation	Kaon-Proton separation
TOF	σ~100 ps	0 - 2.5 	- 5 
RICH	n=1.00044 γth~34	5 - 17 	17 - 
Aerogel	n=1.01 γth~8.5	1 - 5 	5 - 9 

Aerogel together with TOF can extend the PID capability < 10 GeV/c

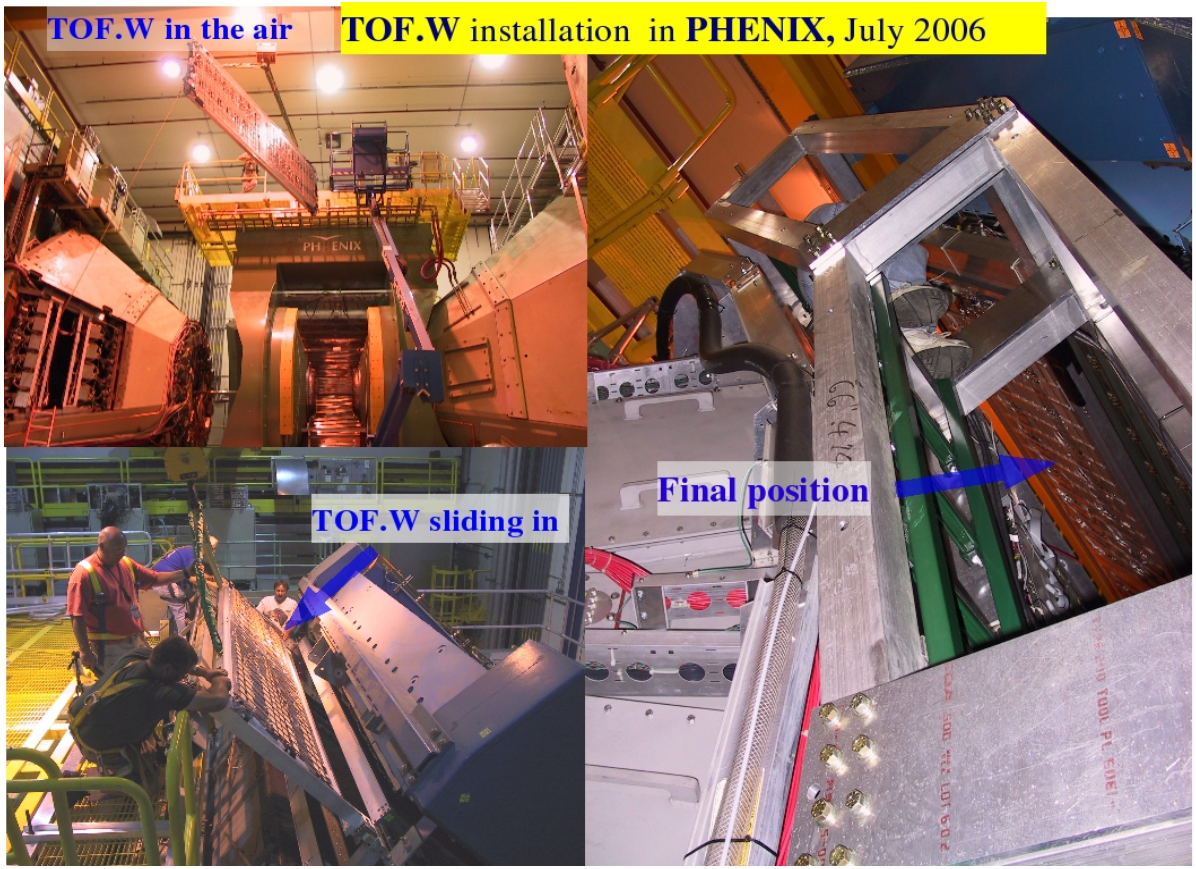
A TOF detector is needed for π/K separation below 1 GeV/c and for K/p separation below 5 GeV/c

Location and Specifications

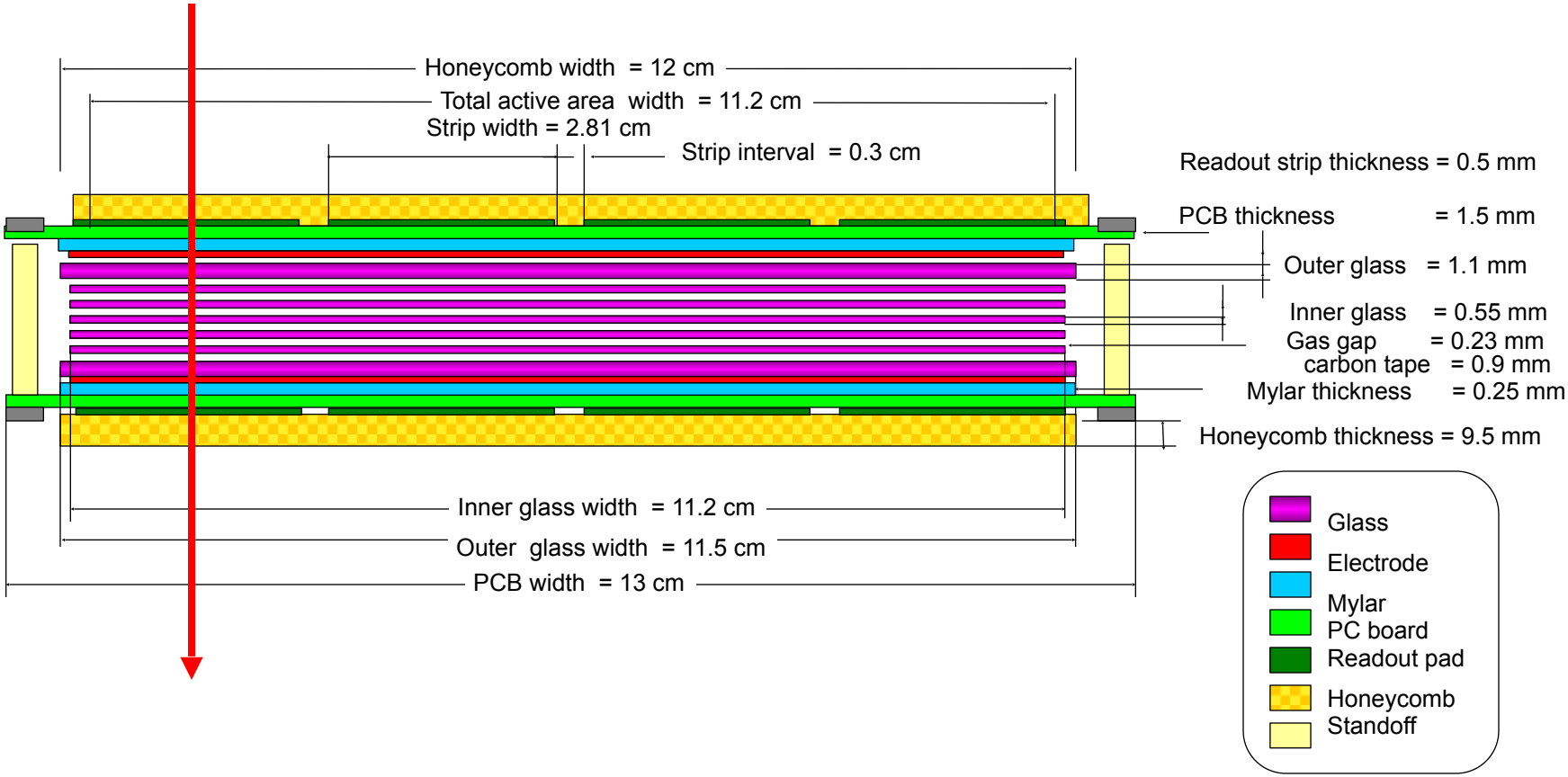
- Coverage area of 4 m^2
- Two sectors
- 128 MRPCs
- 516 dual readout strips (1024 readout channels)



The Installation for Run-7

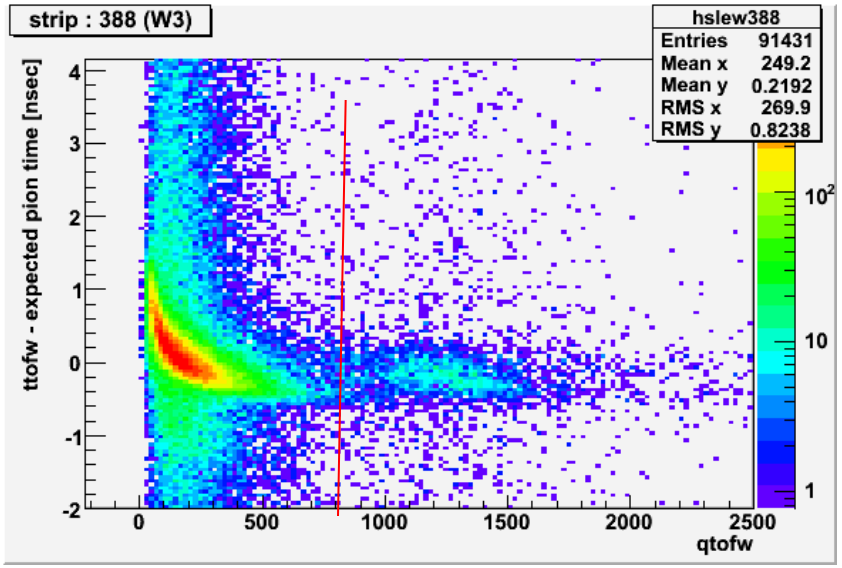


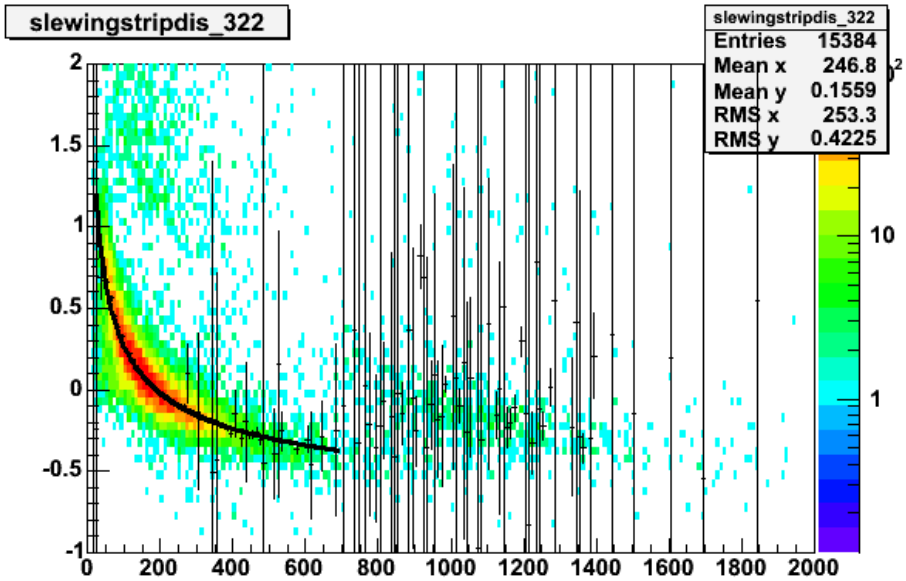
PHENIX-MRPC: Detail



- 6 gaps (230 micron)
- Gas mixture: R134A (95%), Isobutane (5%)
- HV: ±7.0 kV

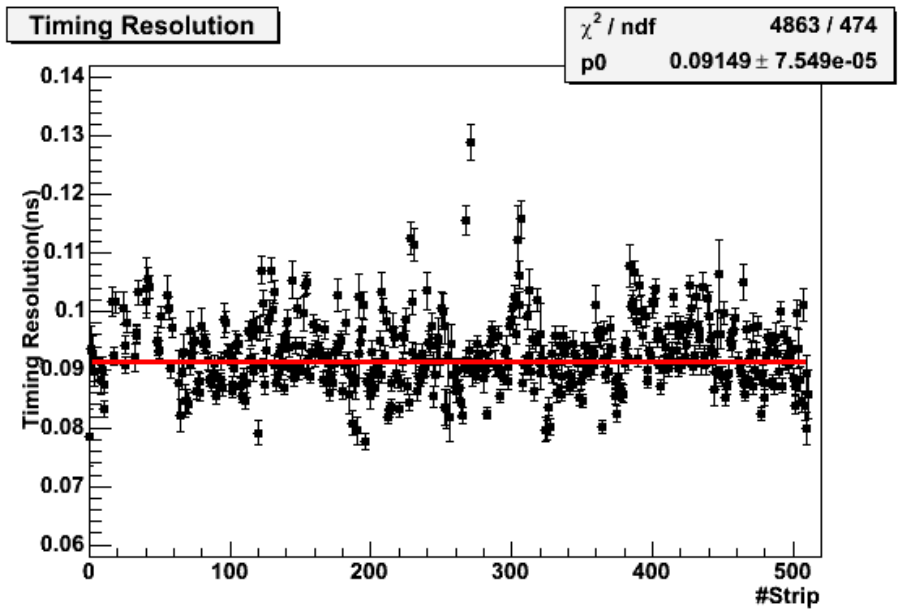
Calibration

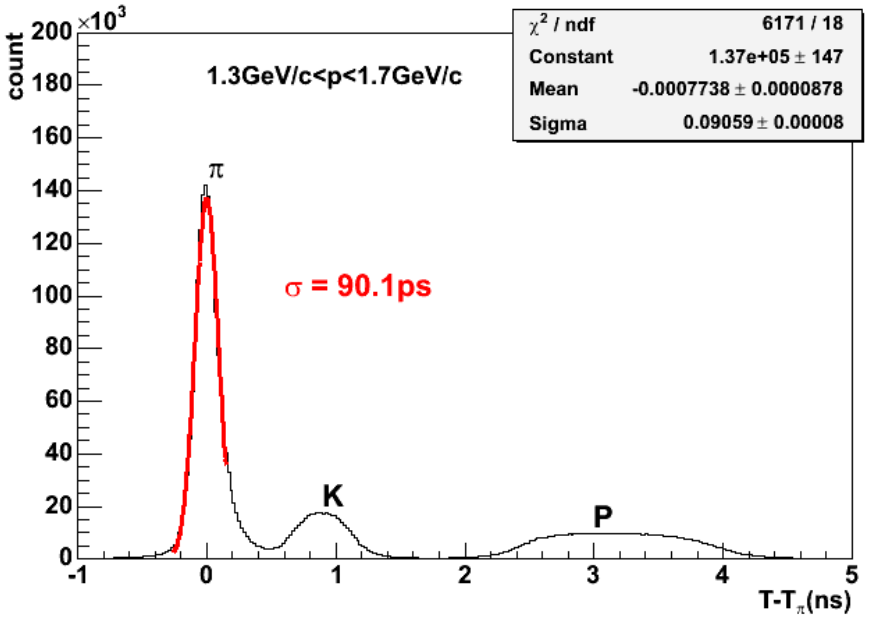




- Streamers occur above ADC ~ 800
- Have worse timing resolution
- Account for 4% of total yield

Performance Results (I)

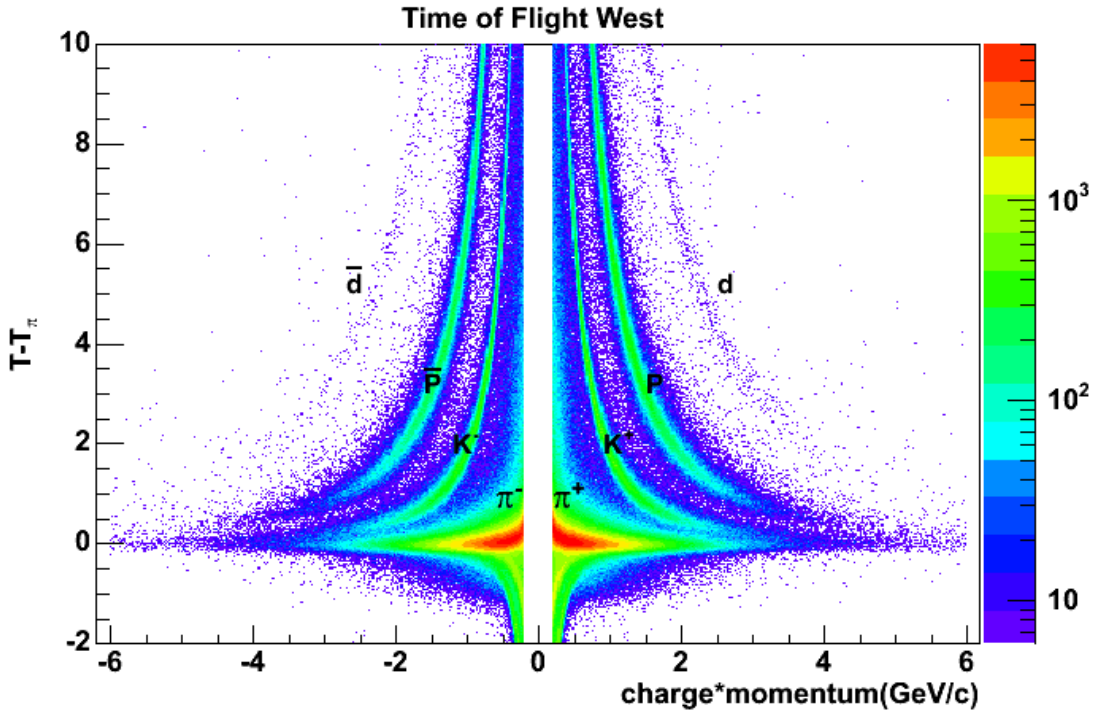




- 90 ps σ_t total in situ timing resolution
- Intrinsic timing resolution of 80 ps
- And that's averaged over all strips!

Performance Results (II)

- Clear and distinct particle bands
- π/K separation up to 2.8 GeV
- K/p separation up to 4.5 Gev



Summary and Outlook

- PHENIX High p_T PID upgrade is now complete
- All design specifications have been met or exceeded
- Track-by-track PID is extended to 9 GeV/c
- Correlation measurements with PID will be available with full phi acceptance

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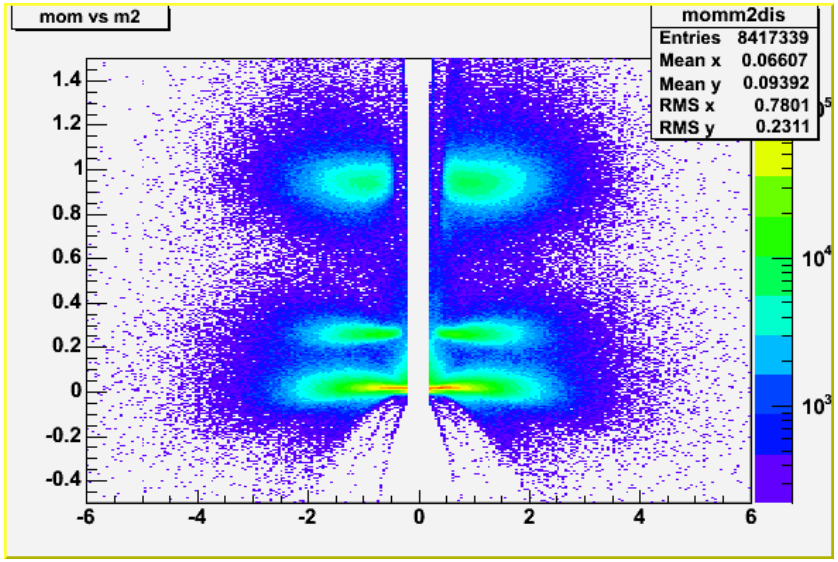
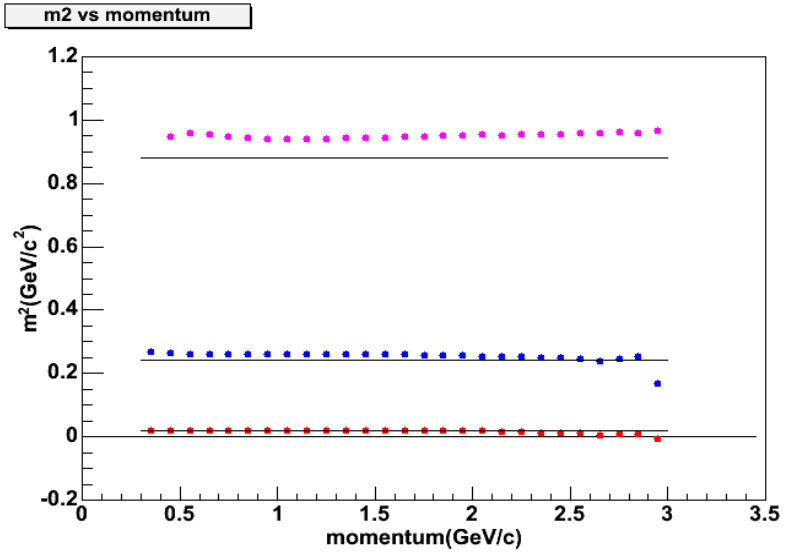
PHENIX

Backup

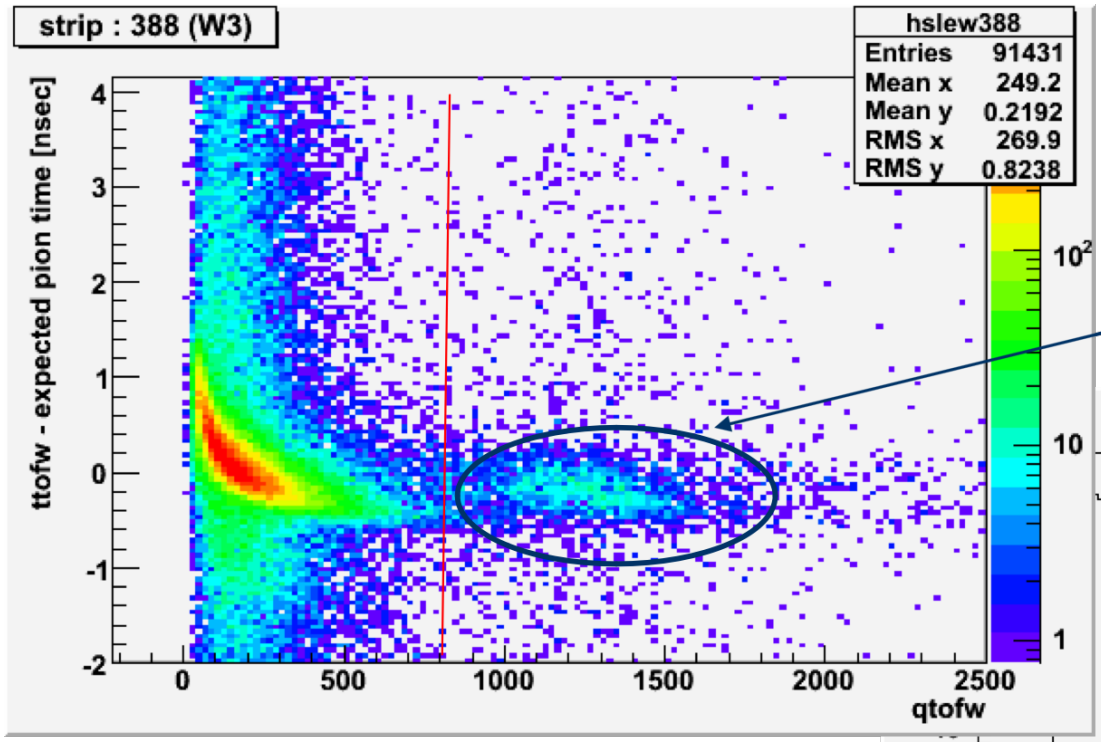
Performance Results (III)

- Mass centroids show very little momentum dependence
- All differences have been properly recalibrated

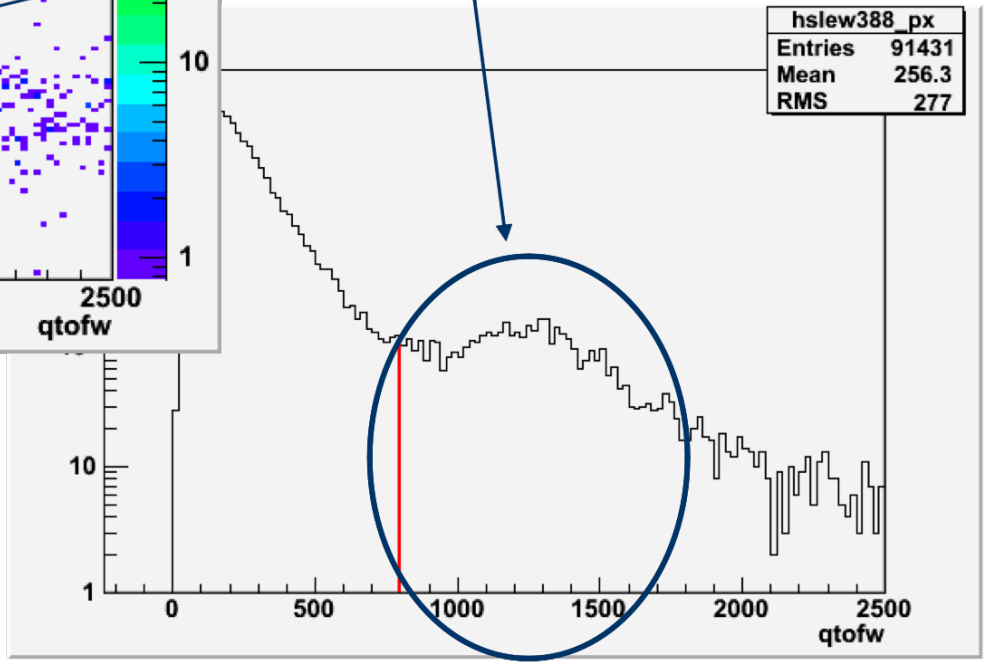




Streamers

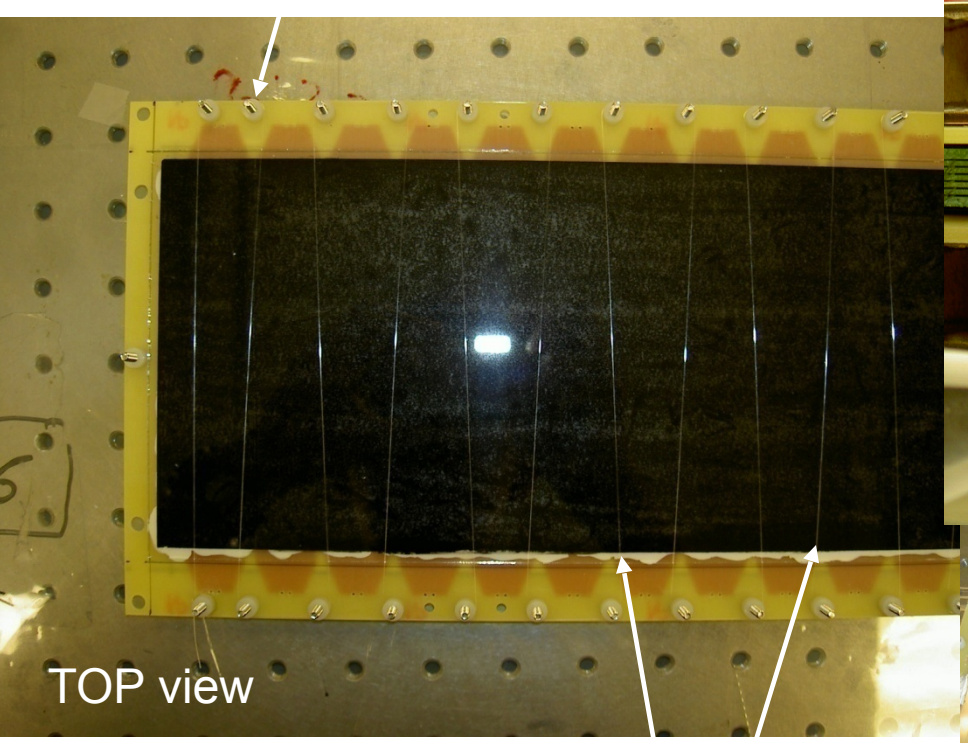


Streamer<4%

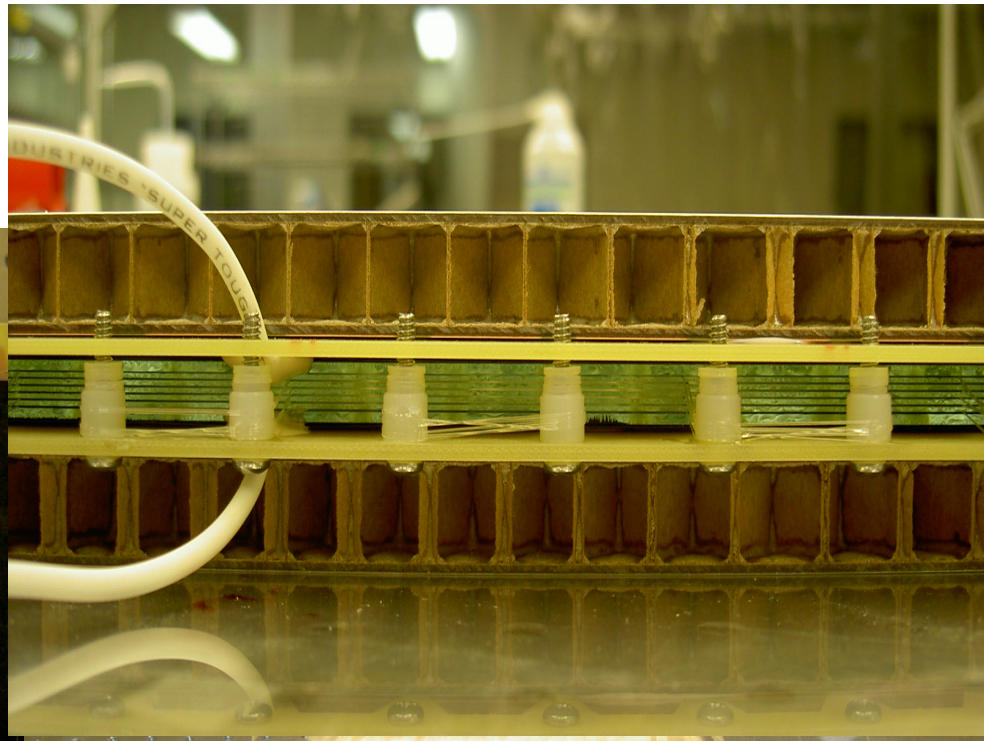


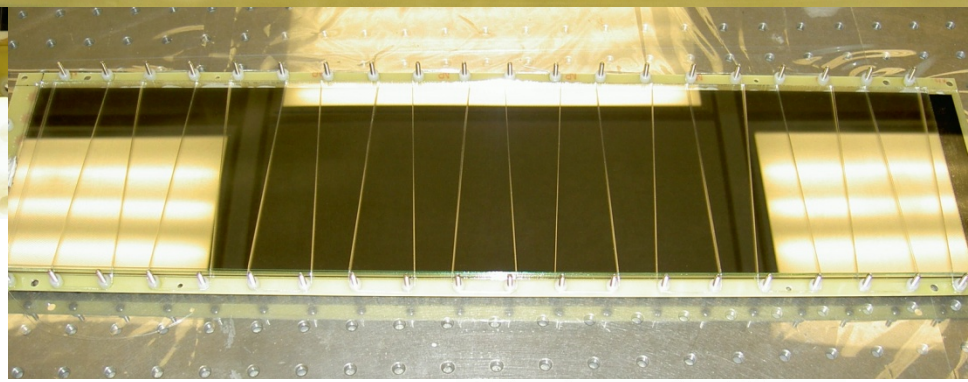
Assembly Pictures

Nylon standoff

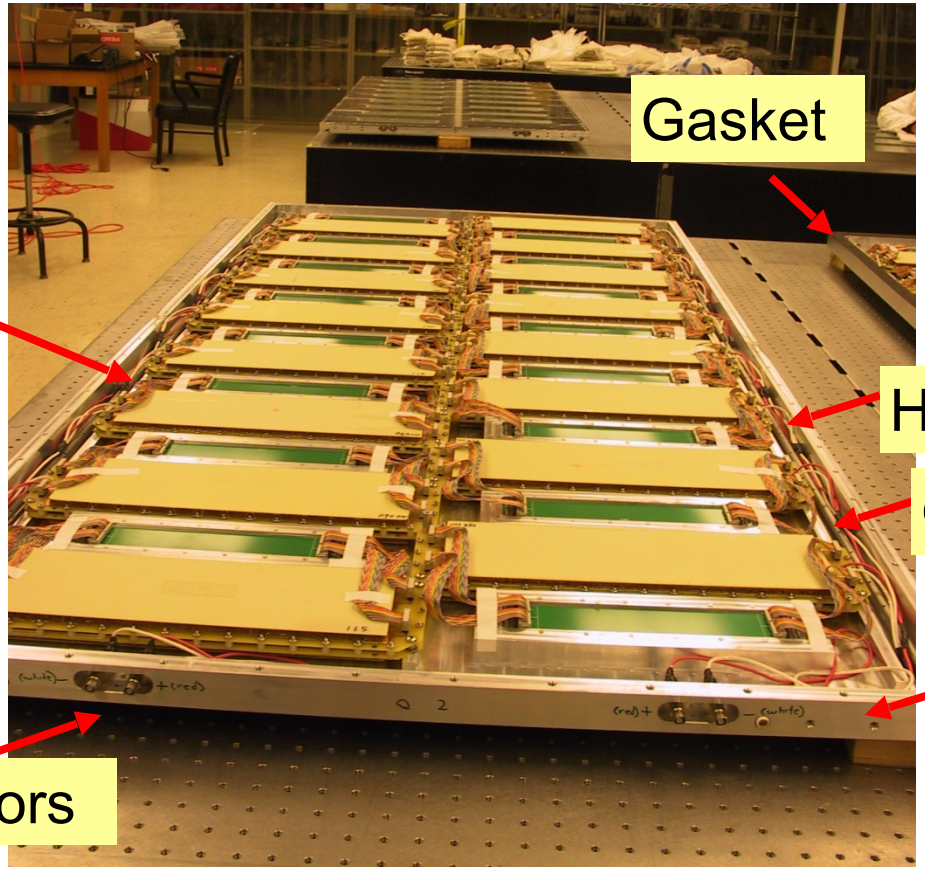


Fishing line



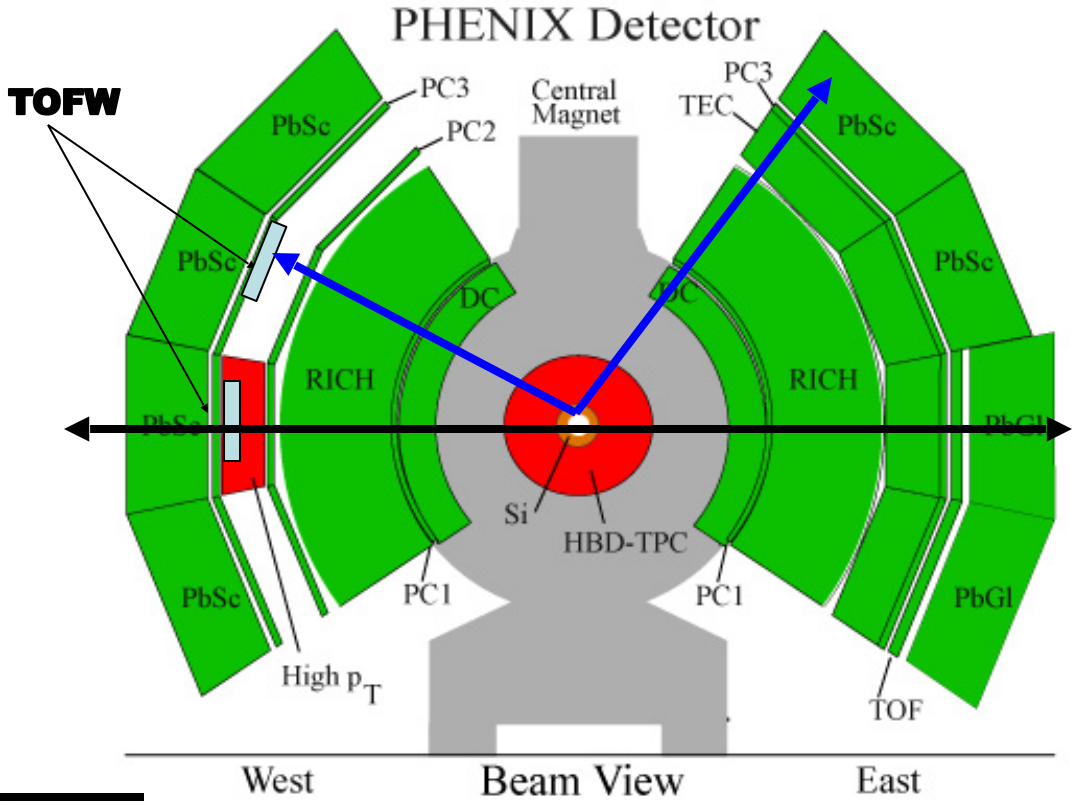


Mechanical Construction



- **MRPCs and Mechanical Structure produced at Vanderbilt**

TOFW (Final Configuration & Position)



- Coverage Area of 4 m^2
- 128 Chambers
- 1024 Readout Channels
- Two Sectors

PID Upgrade Completed

Track Correlation Methods