

PHENIX TOF.W Run-7 Performance Results

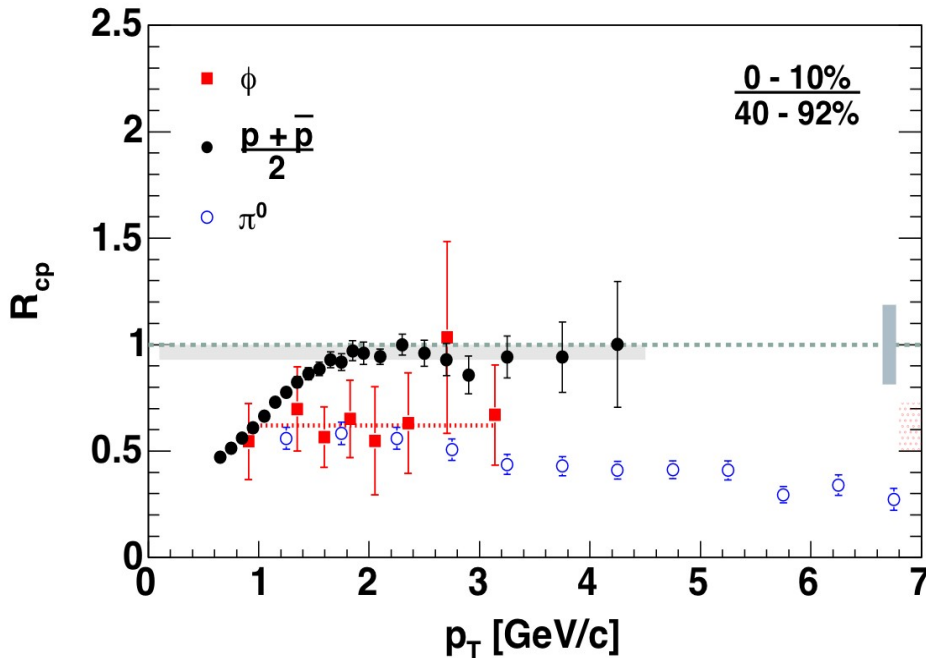
Ron Belmont
Vanderbilt University
(for the PHENIX Collaboration)



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 $p_T \sim 2$ 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 spectra
 - Track-by-track PID for jet correlations

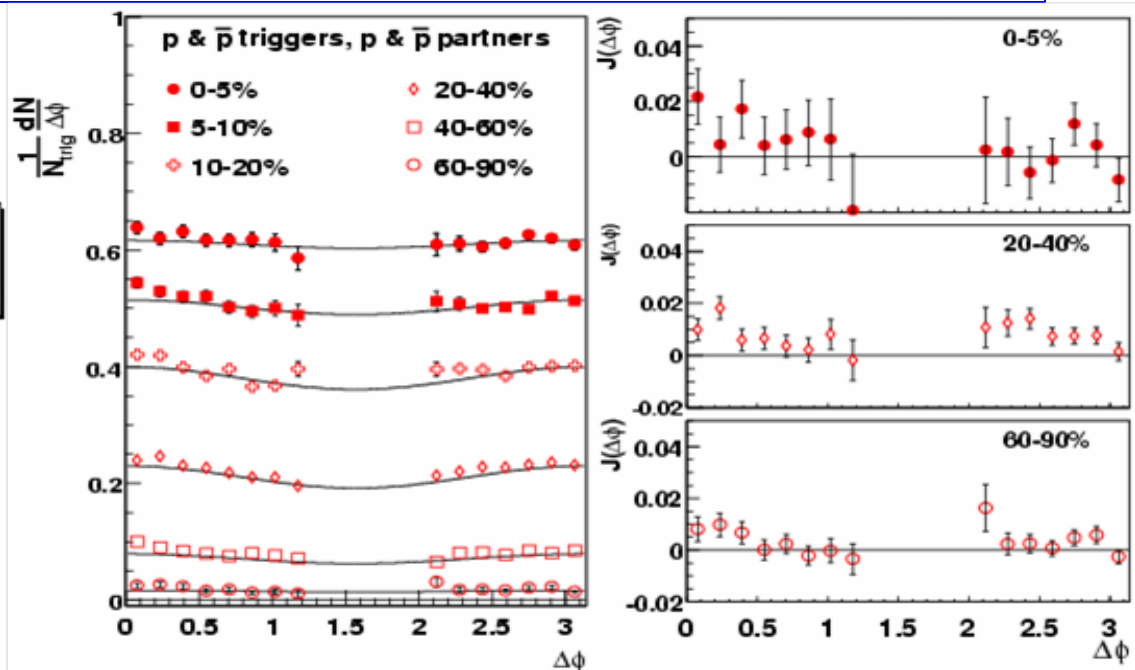
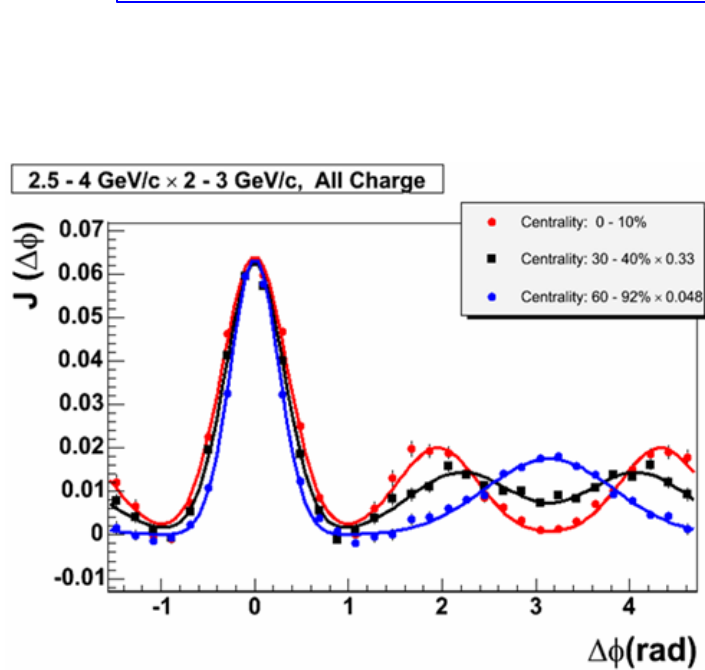


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Physics Motivations II



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



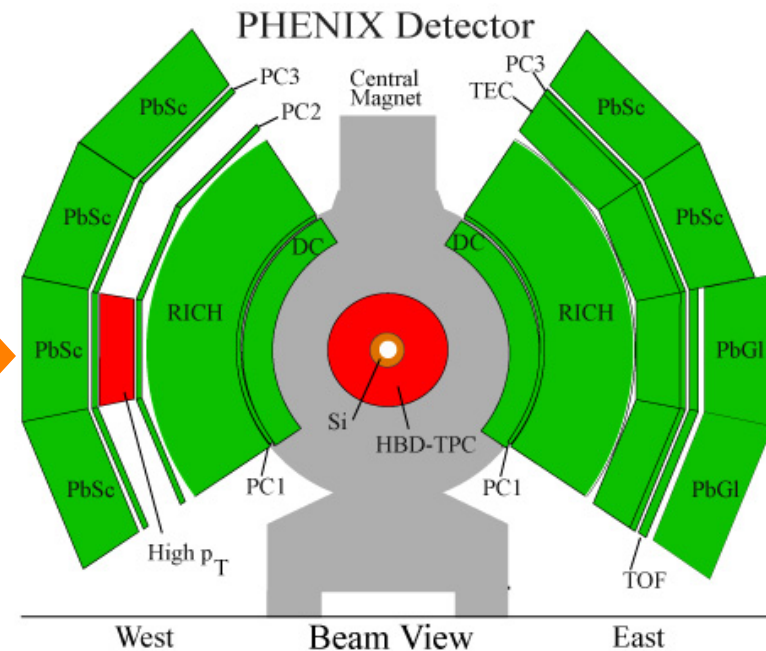
AEROGEL Cherenkov detector:

- $n = 1.0113$
- Completed full installation for Run5

Additional TOF counter is required

Aerogel & Time-of-Flight

- Together with the Aerogel, TOF, and RICH, we can extend the PID out to $p_T \sim 9 \text{ GeV}/c$

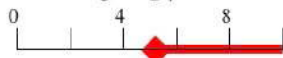
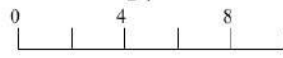
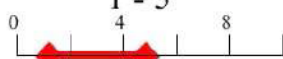
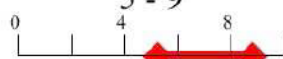


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Extension of PID Capability

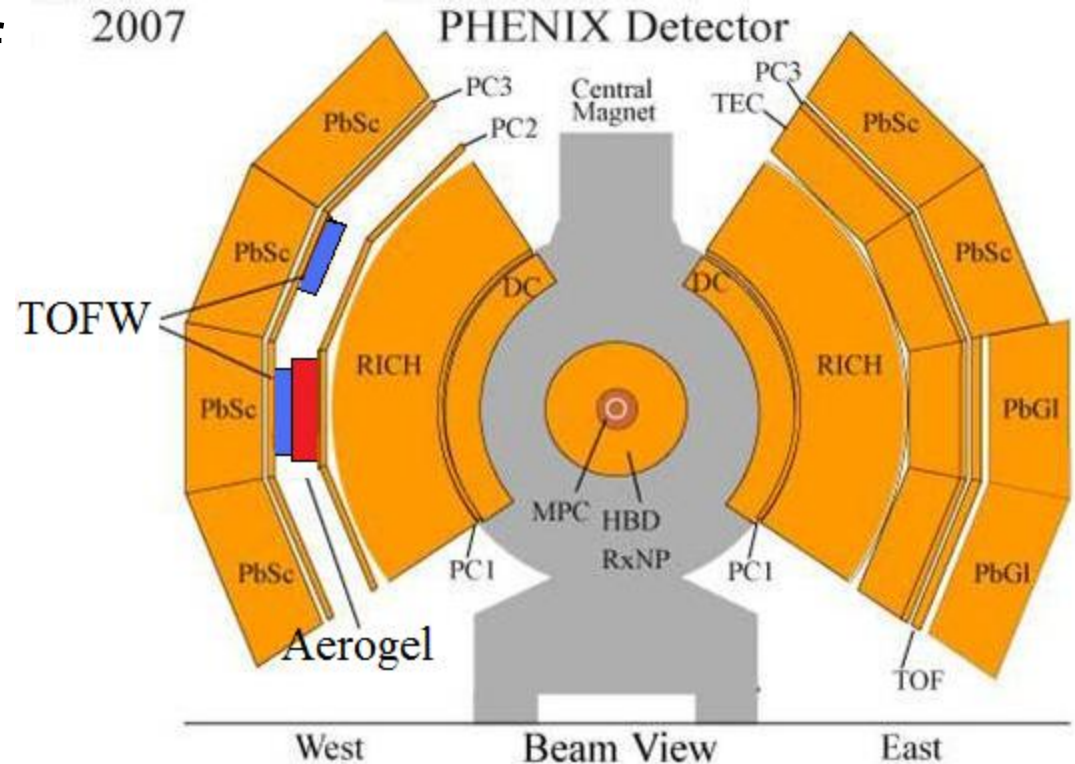
		Pion-Kaon separation	Kaon-Proton separation
TOF	$\sigma \sim 100$ ps	0 - 2.5 	- 5 
RICH	$n=1.00044$ $\gamma_{th} \sim 34$	5 - 17 	17 - 
Aerogel	$n=1.01$ $\gamma_{th} \sim 8.5$	1 - 5 	5 - 9 

Aerogel together with TOF can extend the PID capability to 9 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 8 m^2
- Two sectors
- 128 MRPCs
- 512 dual readout strips (1024 readout channels)



The Installation for Run-7

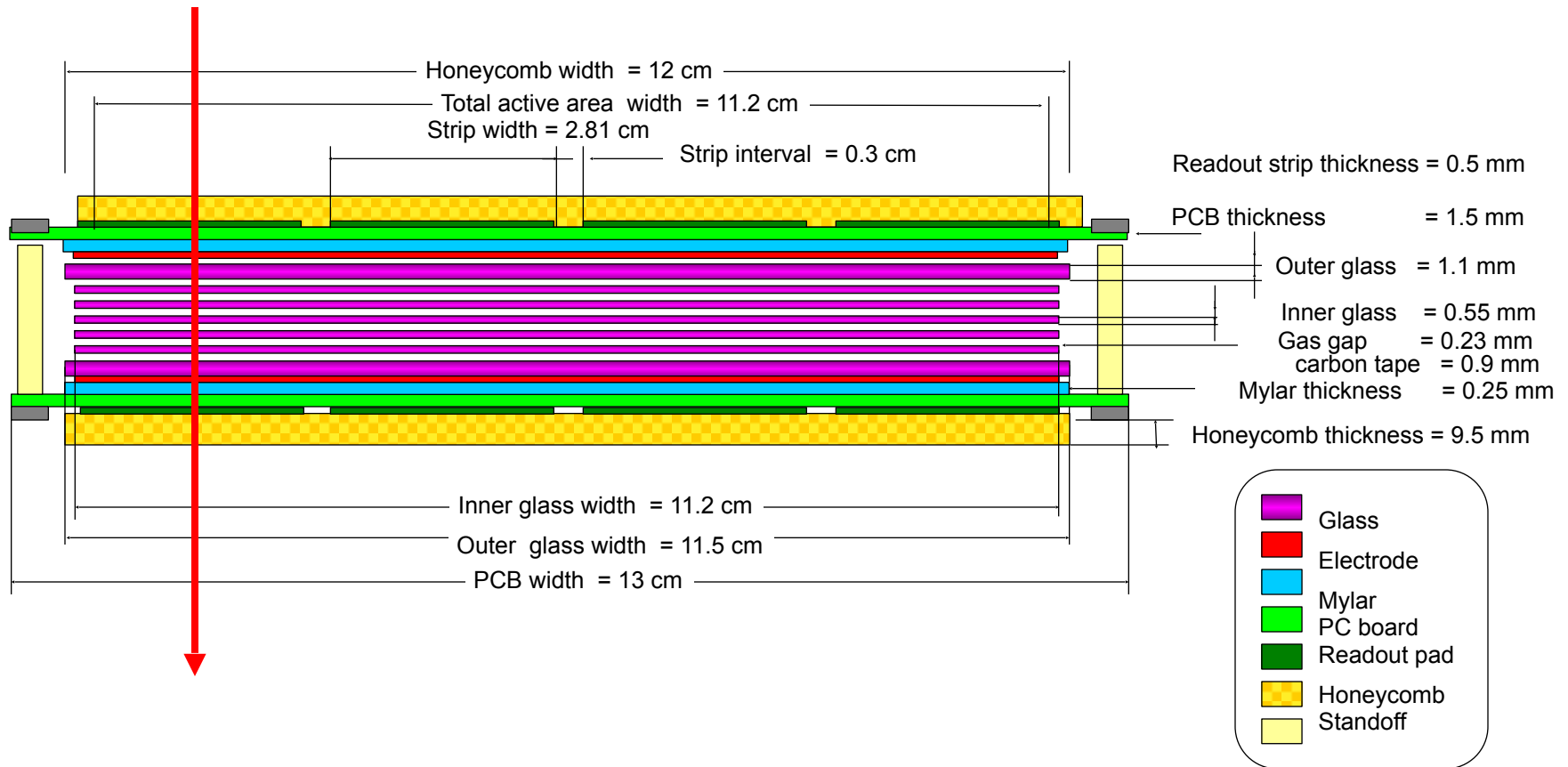


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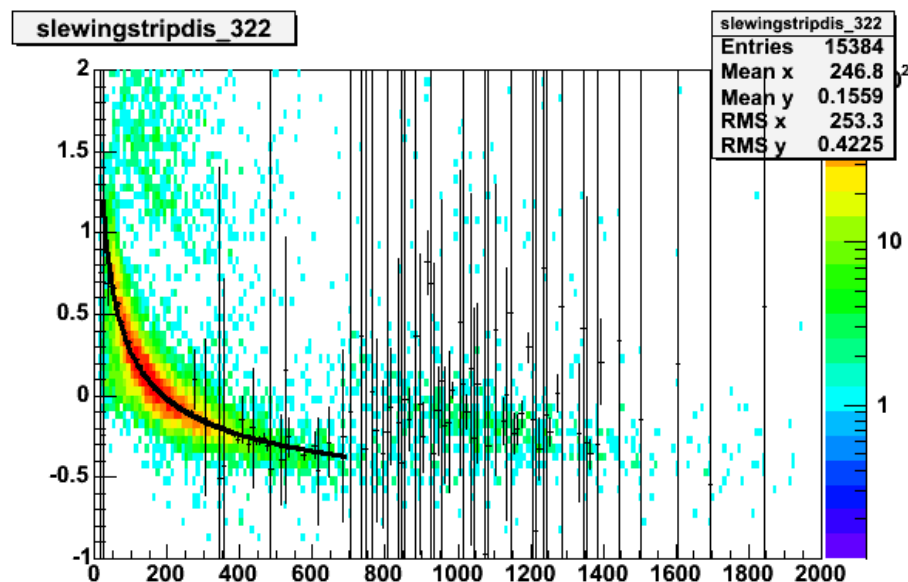
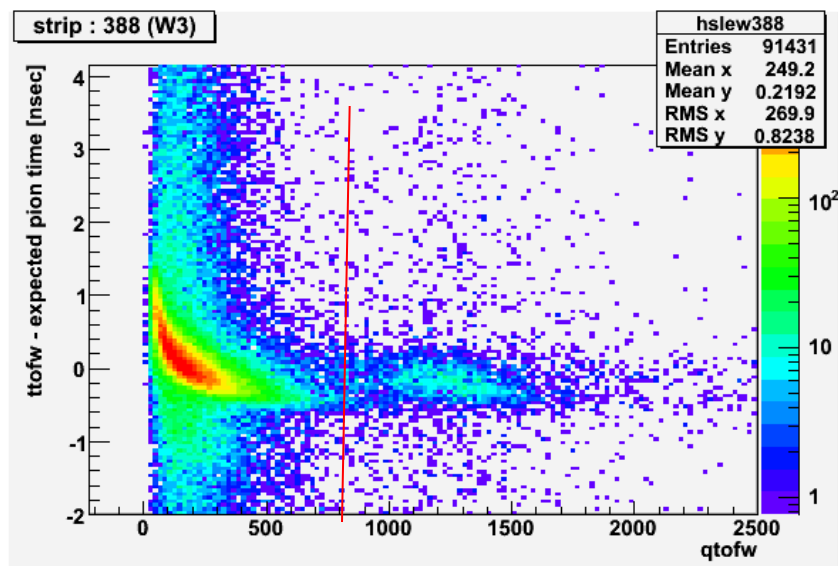


PHENIX-MRPCC: Detail



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

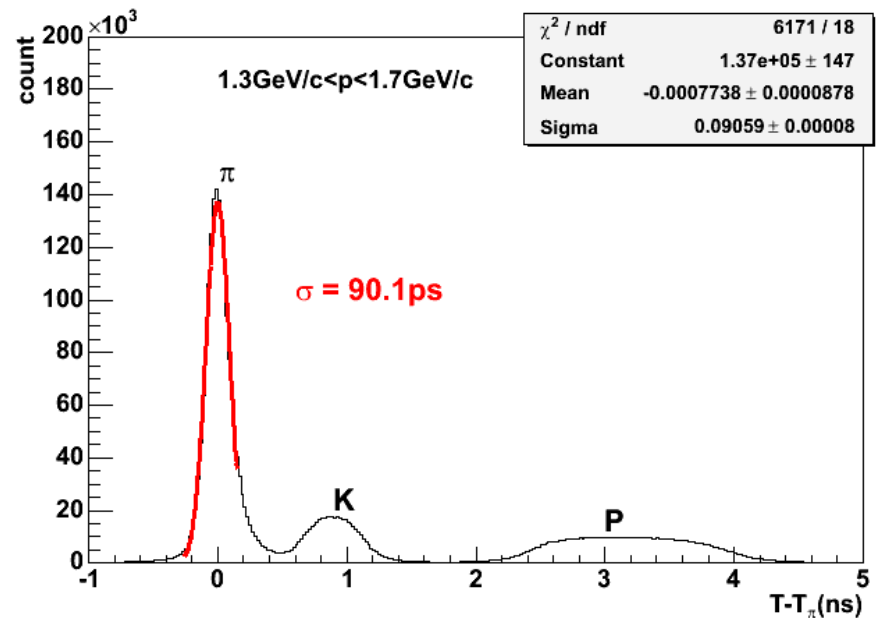
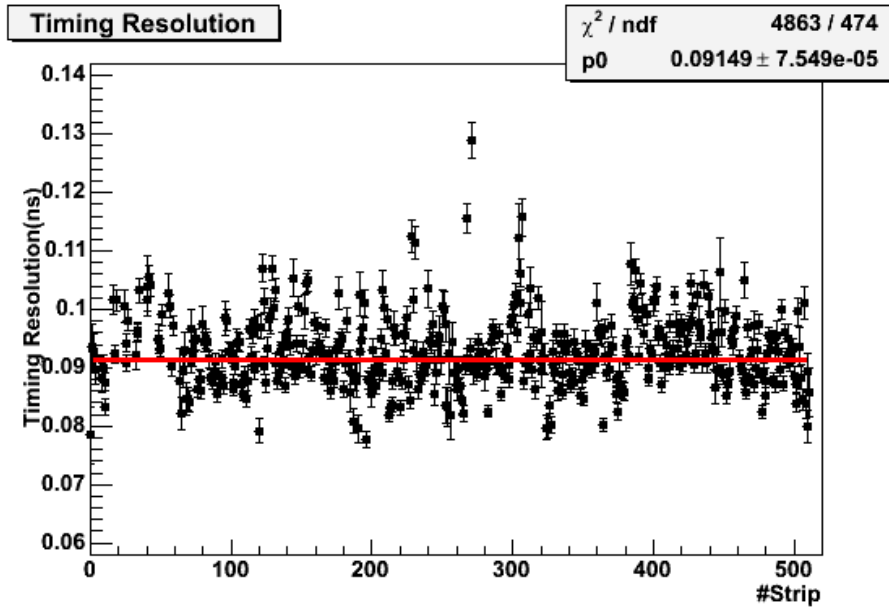
Calibration



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



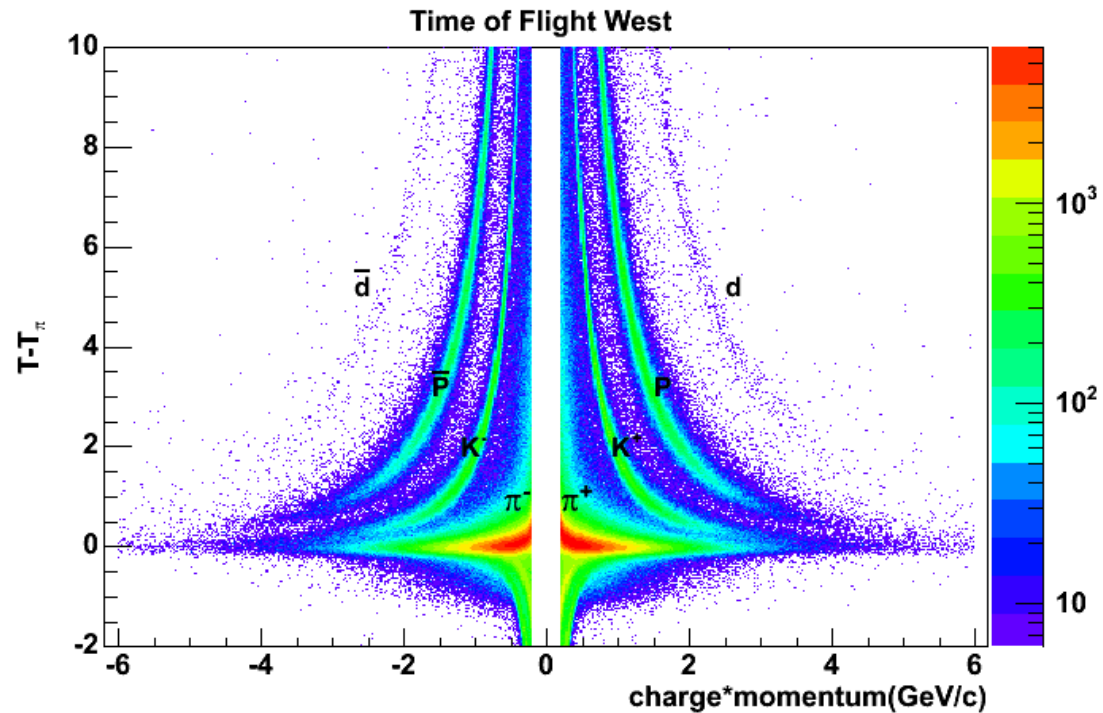
Performance Results (I)



- 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 ϕ acceptance

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14 Countries; 69 Institutions



July 2007

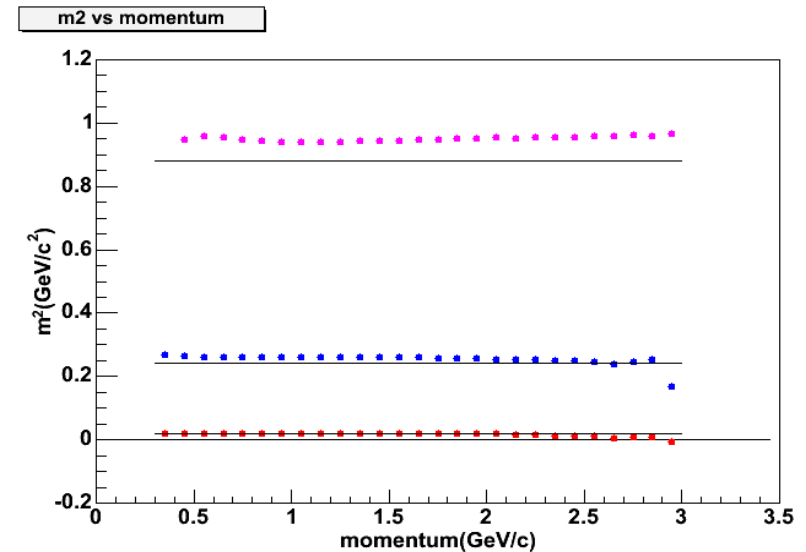
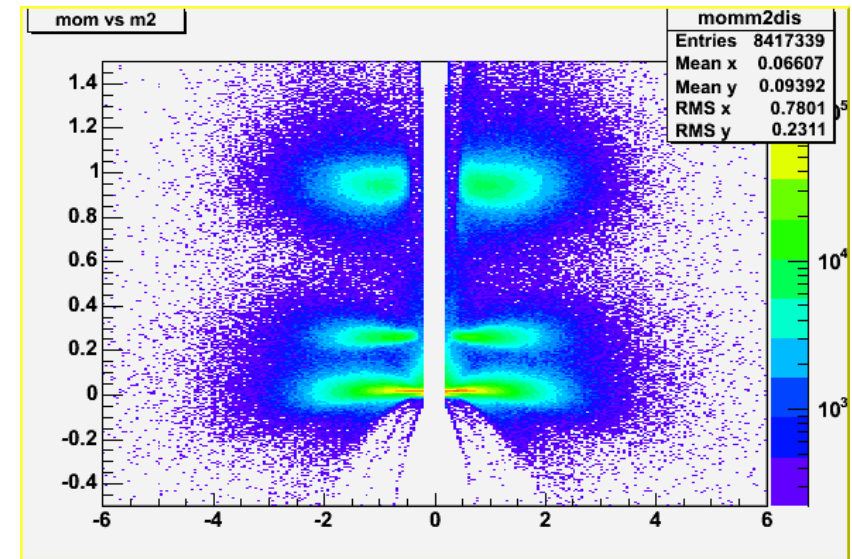
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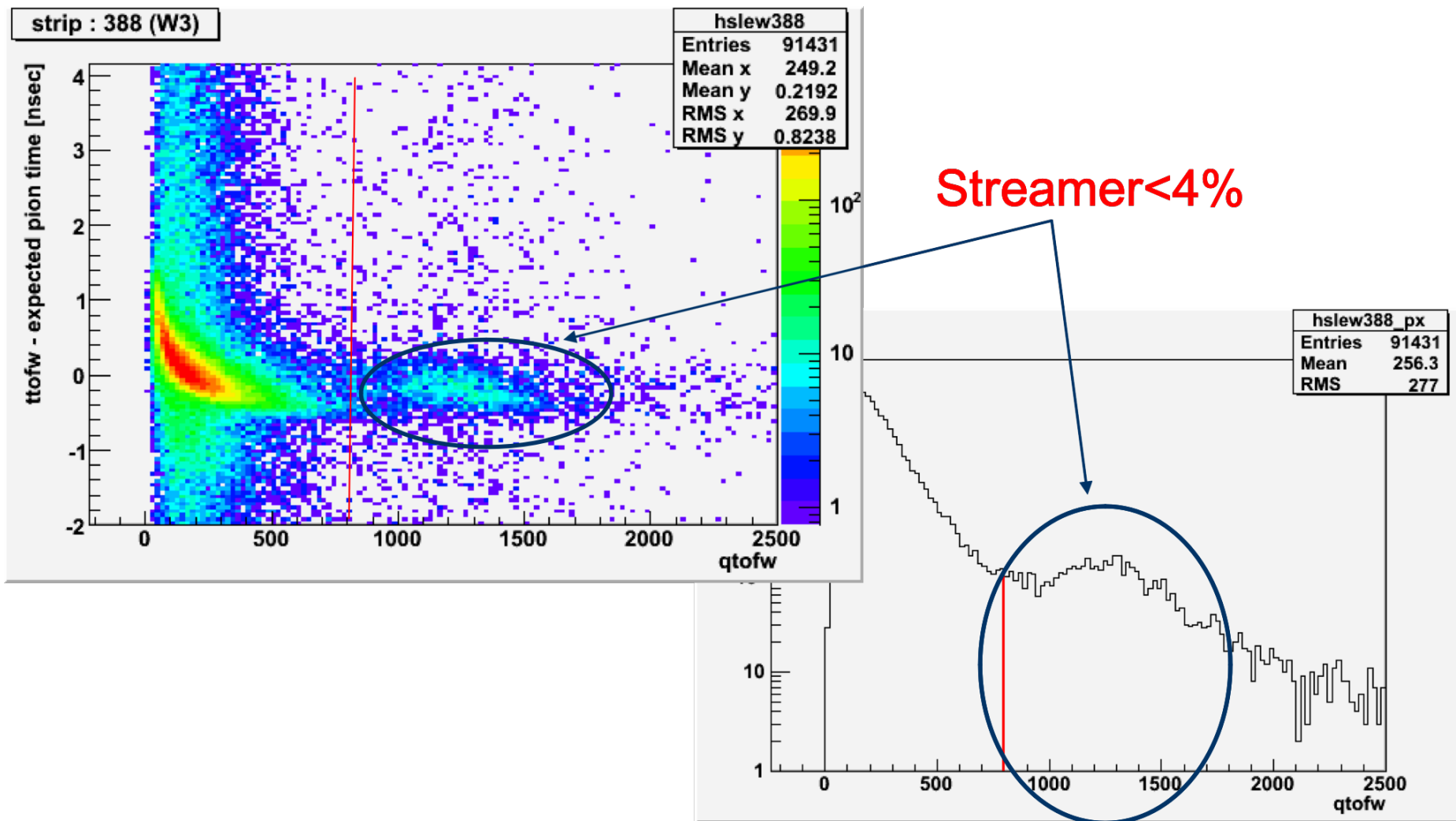
Backup

Performance Results (III)

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

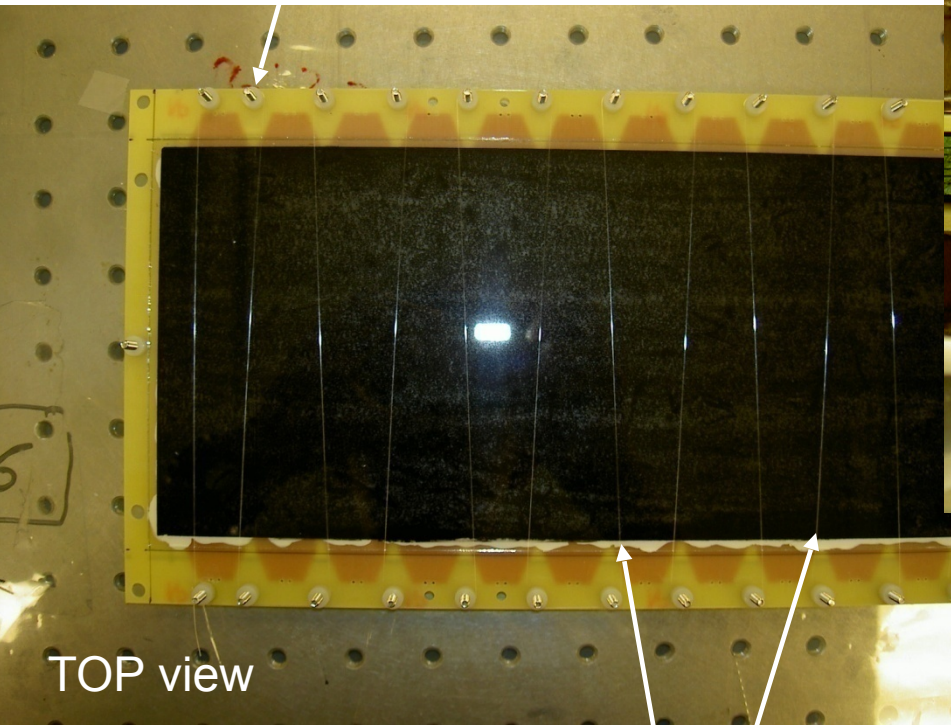


Streamers



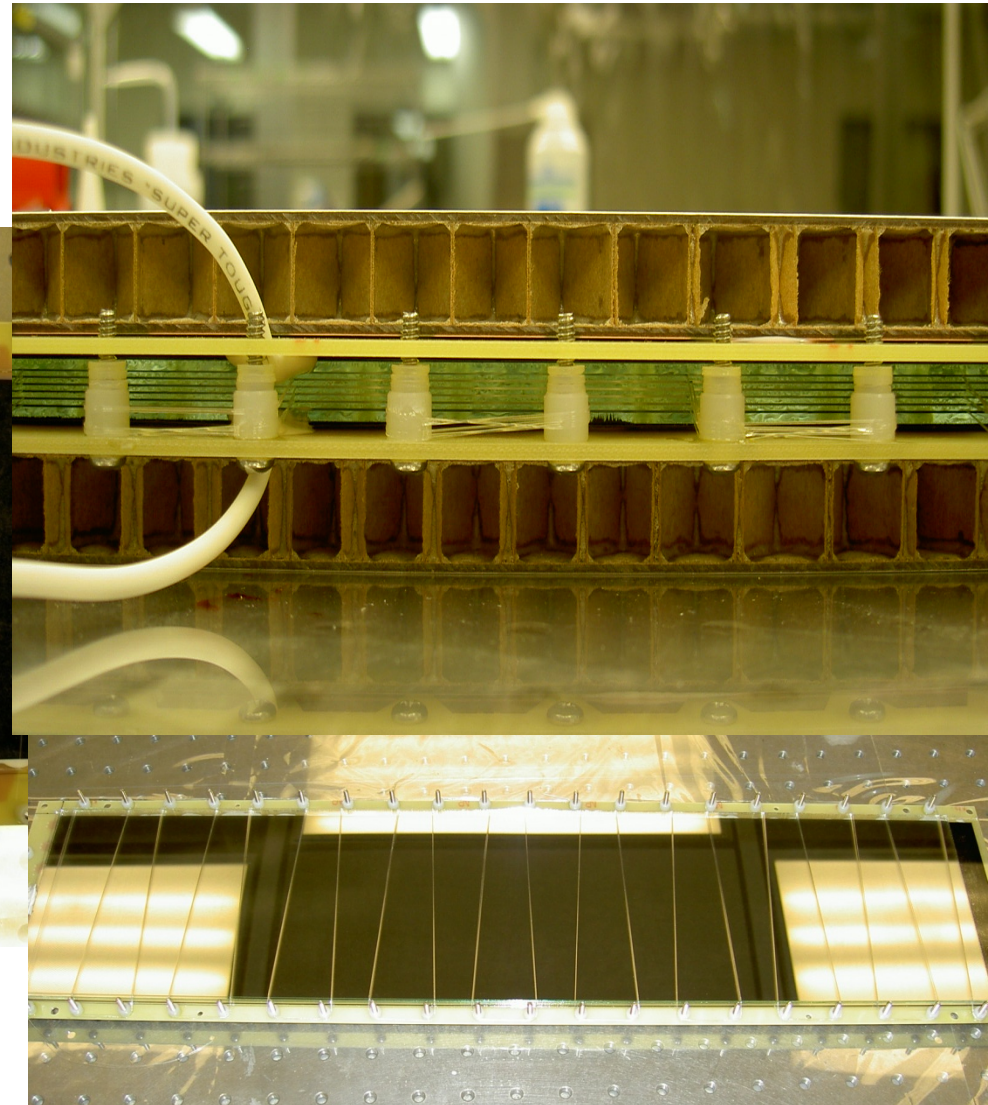
Assembly Pictures

Nylon standoff



TOP view

Fishing line

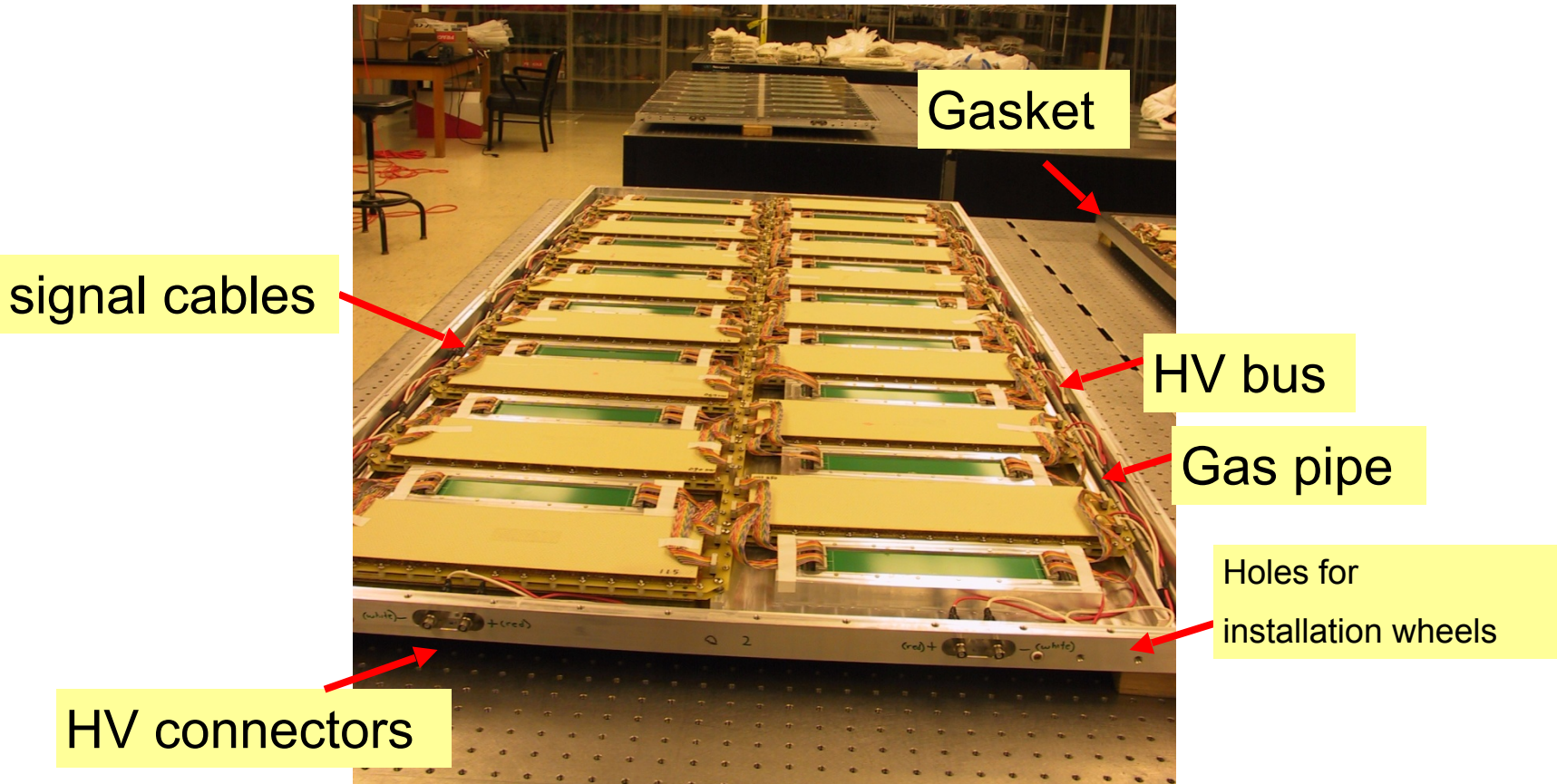


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Mechanical Construction



•MRPCs and Mechanical Structure produced at Vanderbilt

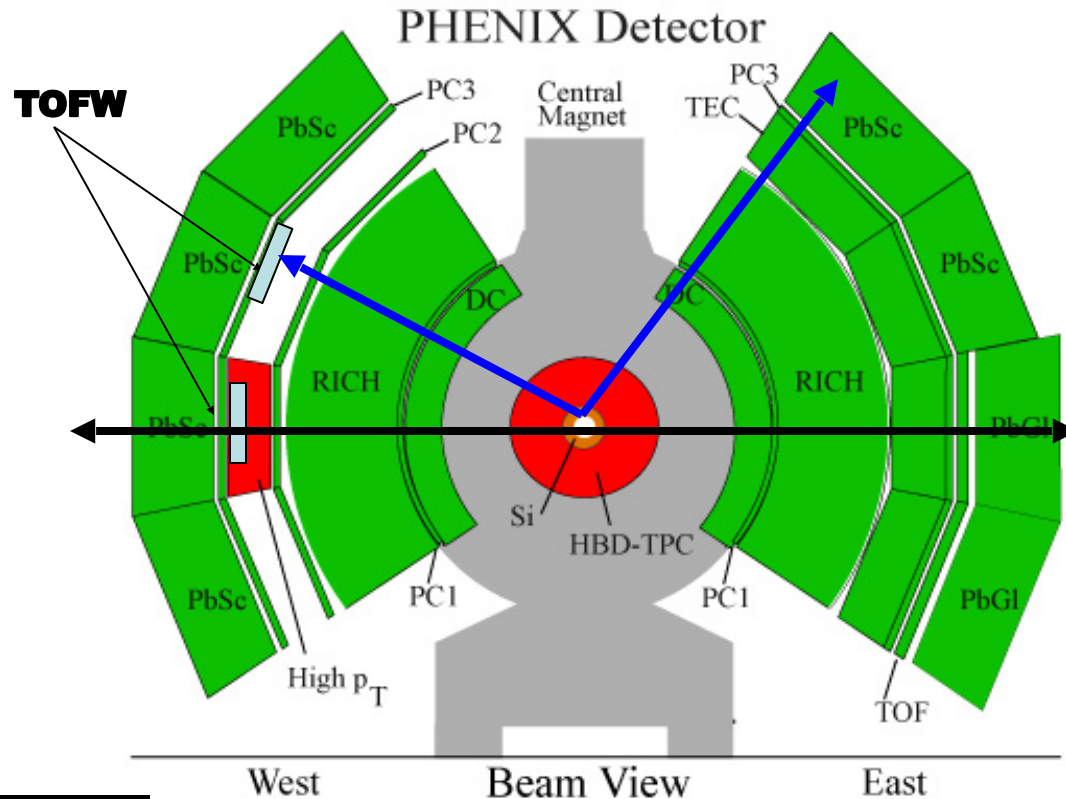


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TOFW (Final Configuration & Position)



- Coverage Area of 8 m²
- 128 Chambers
- 1024 Readout Channels
- Two Sectors

PID Upgrade Completed

Track Correlation Methods



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