



Detectors & Mechanical

W.J. Llope

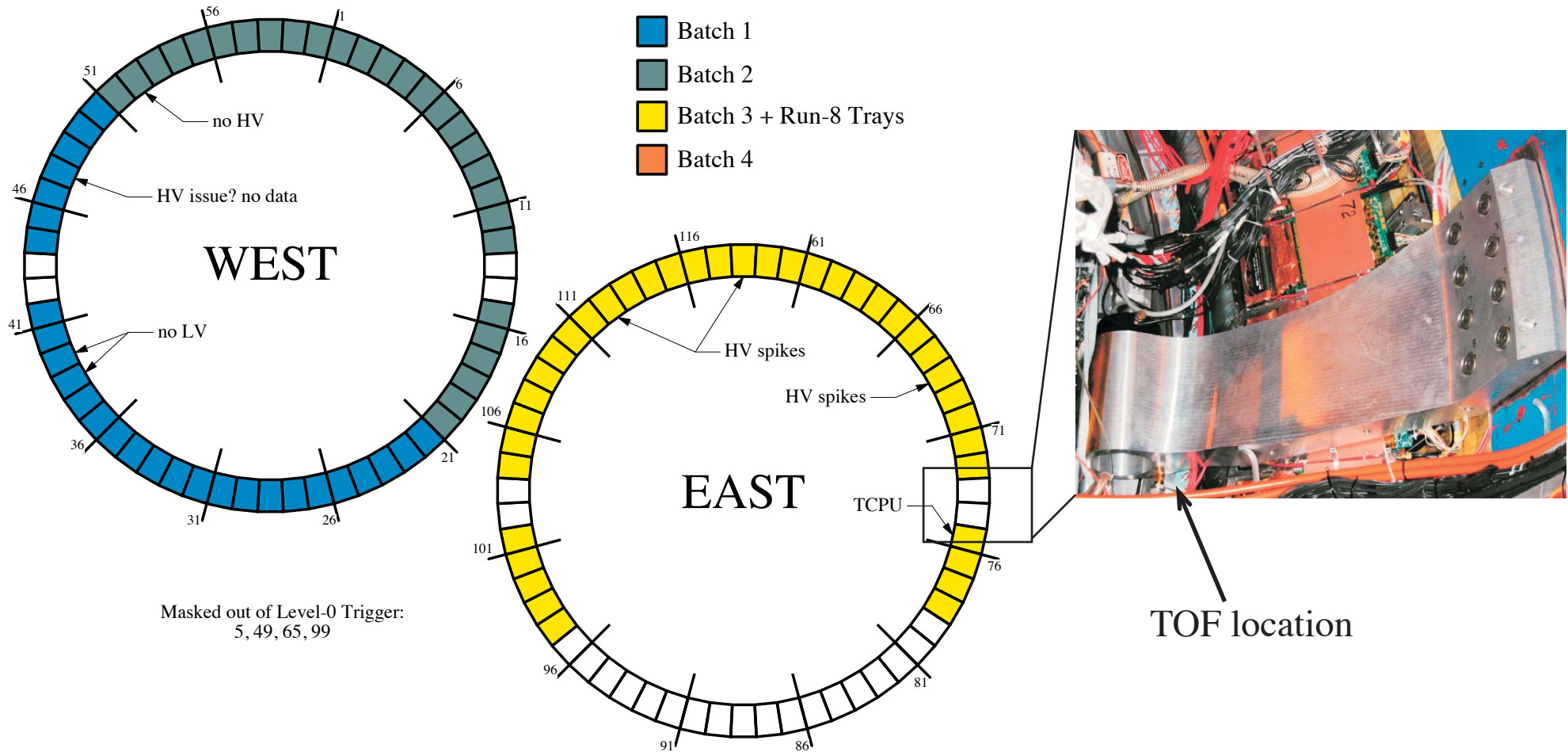
US DOE review of STAR TOF
BNL, August 10-11, 2009

Outline:

- TPC Support Fixture
- Start Detector & TPMDst

Tray Mechanical	- Jerry
Gas System	- Lijuan
Voltage Systems	- Bertrand

TPC Support Fixture



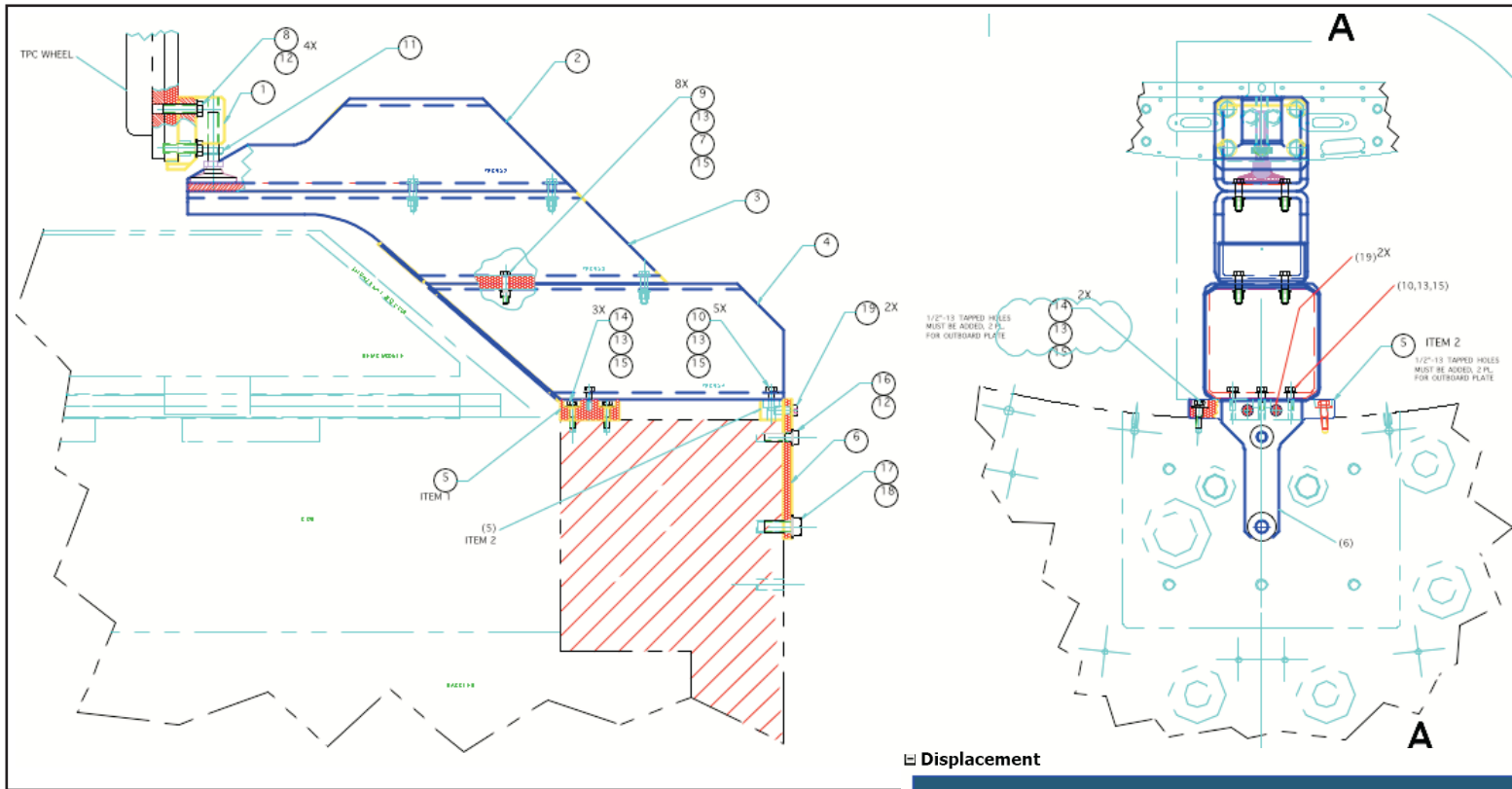
Eight Trays “behind” the Four TPC Support Arms.

Need fixture to support TPC while one arm is removed (East, 3 o’clock)
then install, cable, & test two west and two east trays

Then repeat for East 9 o’clock

Use eight commissioned trays from Run-9 in these locations.

...designed by J. Scheblein (BNL)

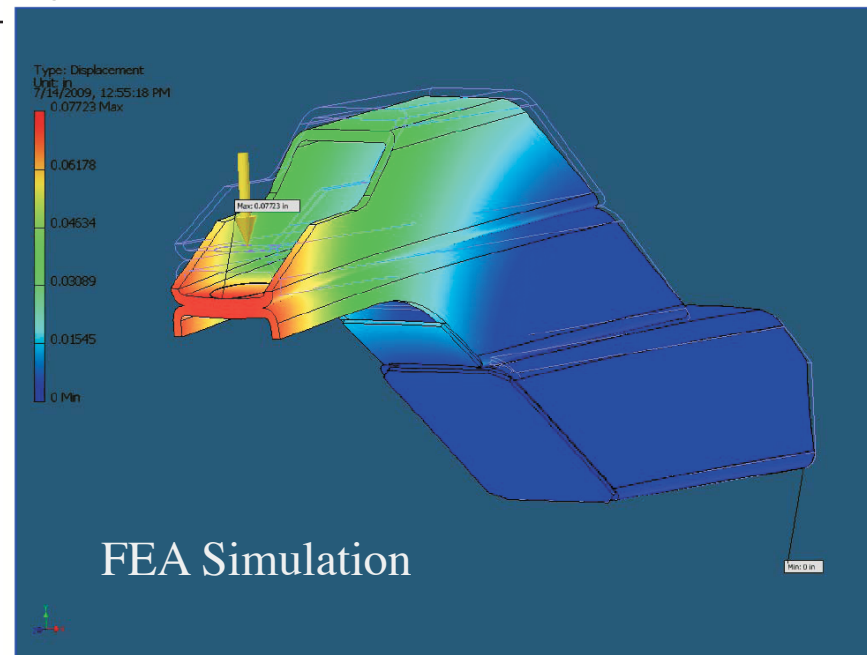


Displacement

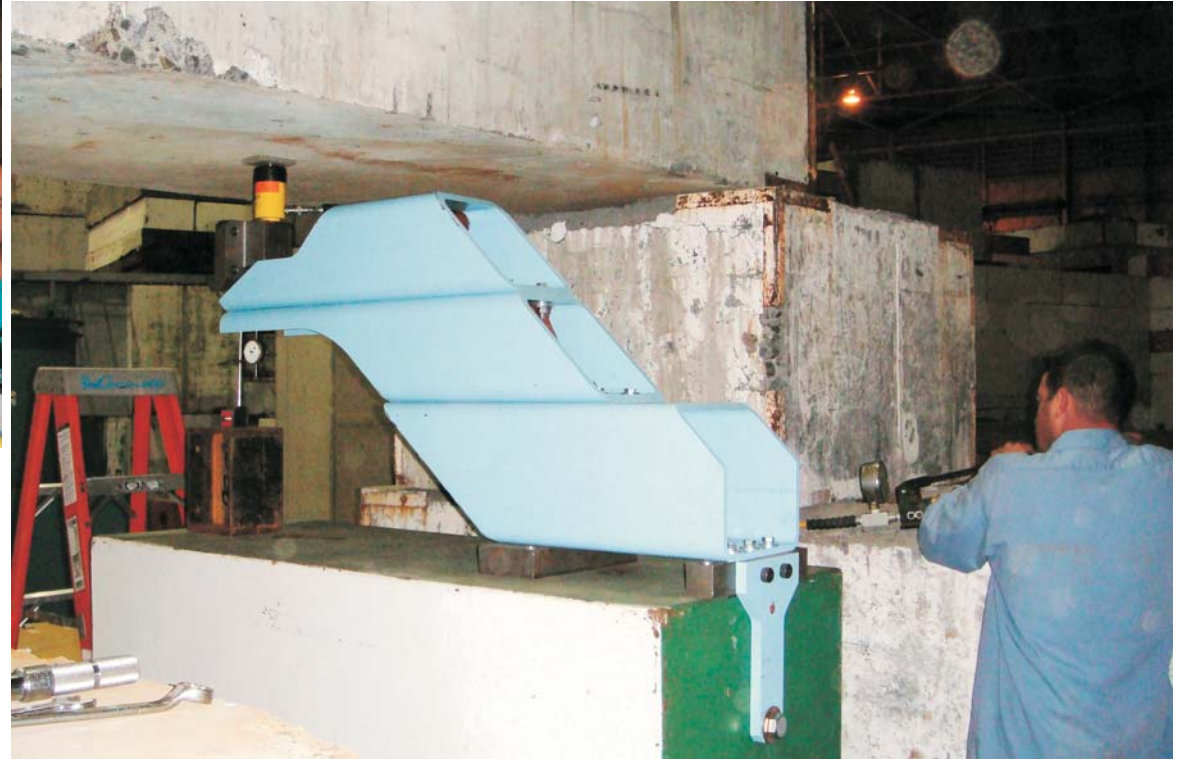
Expected load = 6 tons

Test Load = 7.5 tons (125%)

Design Safety Factor = 6



The fixture has been fabricated and is undergoing load testing.



Trays to go behind the support arms are identified...

Expected to be installed by first week of October...

Start Detector Status

2x19 detectors, each Pb/Sci/R5946
 $|Z| \sim 5.7$ m, $4.24 < |\eta| < 5.1$

Cosmic tests before Run-6

single detector $\sigma_0 \sim 125$ ps

Run-6:

only 2 weeks of data
MOSFET-base failures at \sim one/day.

Run-7 (Au+Au)

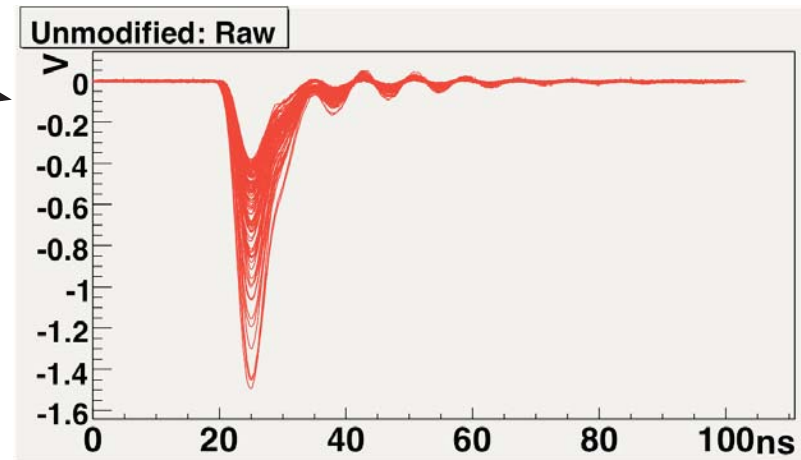
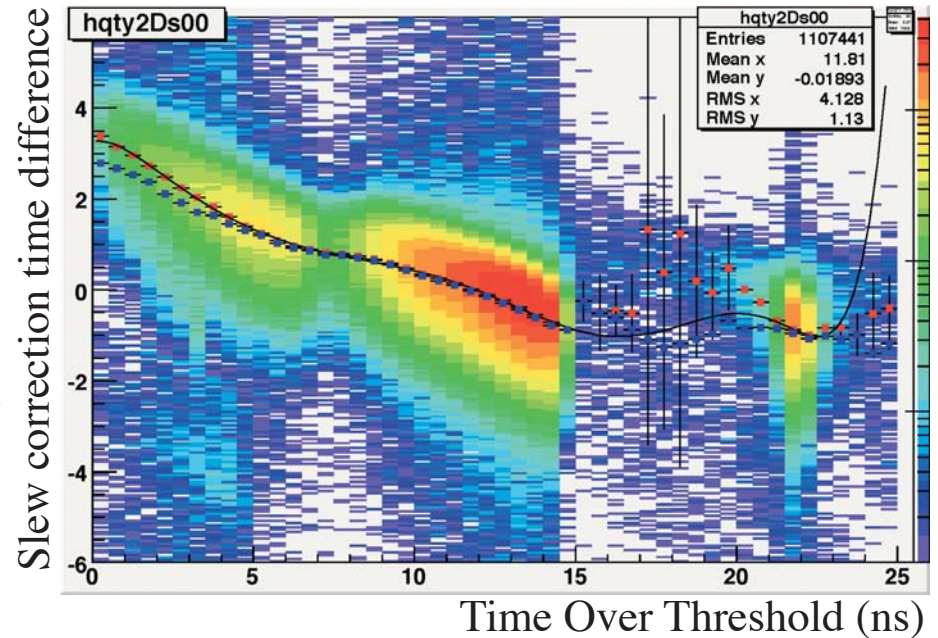
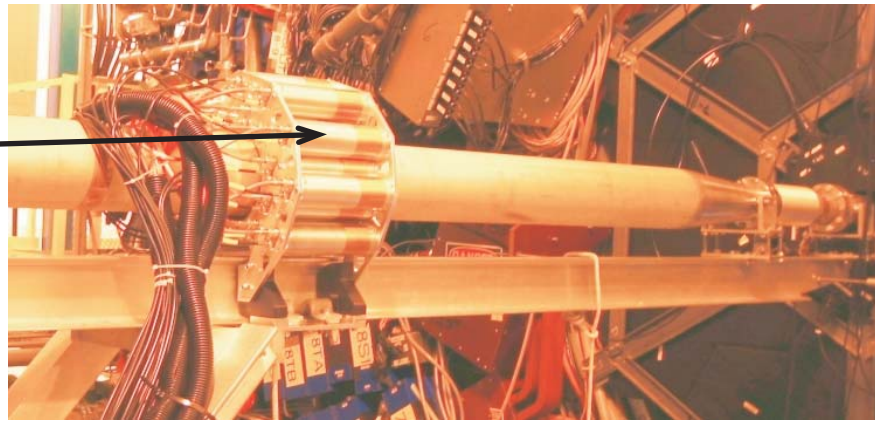
new linear bases
primary input to STAR min.bias trigger
trigger Zvtx resn ~ 5 cm
only TOF-digitized data from last 2 days
canbus data (no event structure)
un-triggered events
west side only
single detector $\sigma_0 \sim 170$ ps

recognized some ringing before Run-8

additional 12ns & 24ns cable sections used
to avoid HPTDC cross-talk

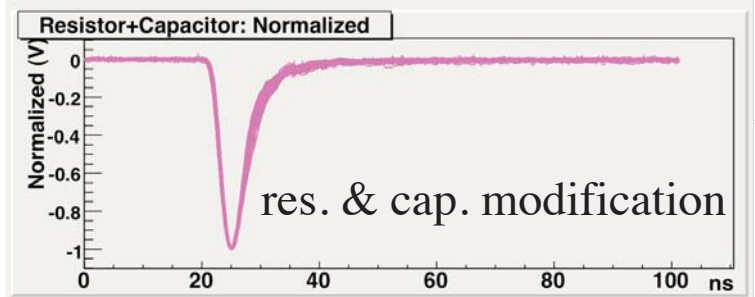
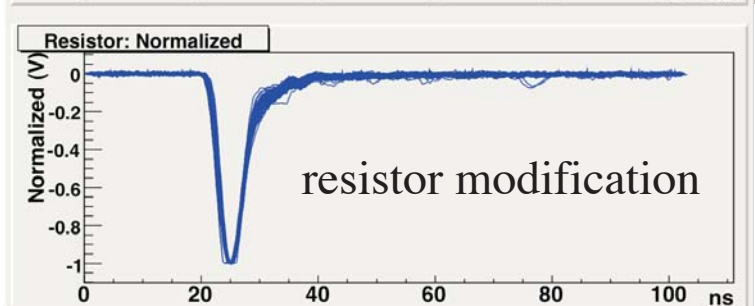
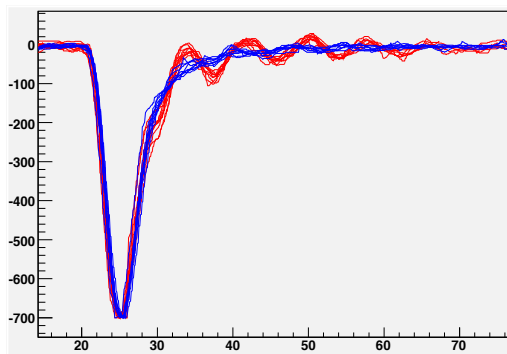
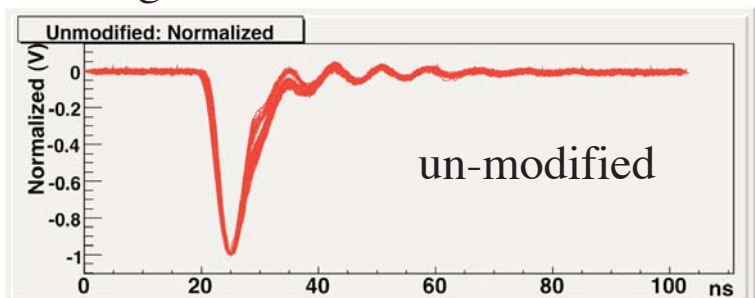
Run-8 (d+Au, p+p, & 9 GeV Au+Au)

again, an input to STAR trigger
single detector $\sigma_0 \sim 130$ - 140 ps
in both p+p and d+Au

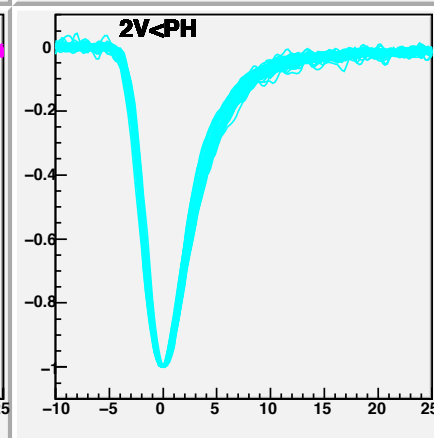
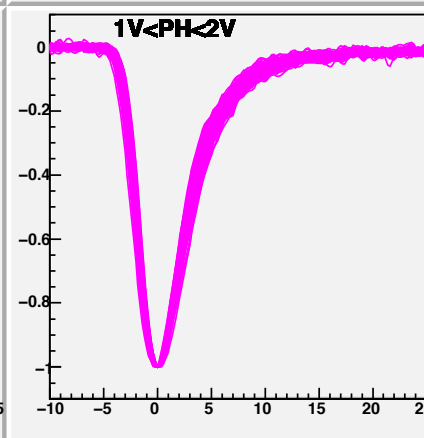
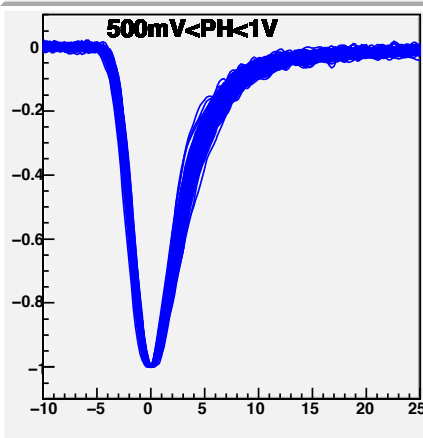
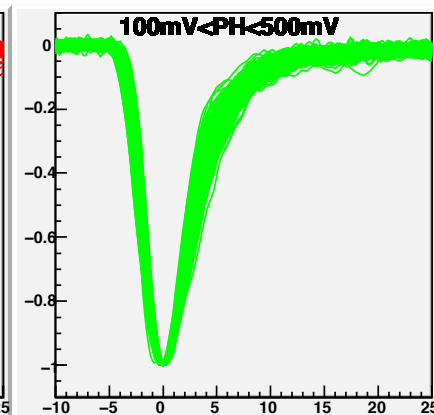
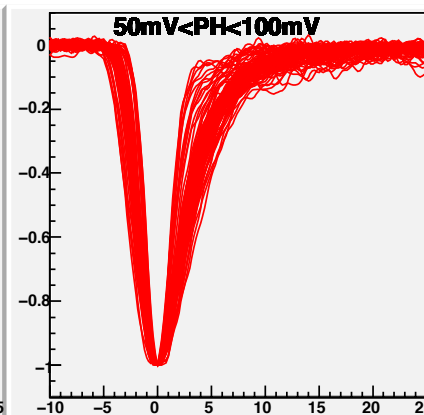
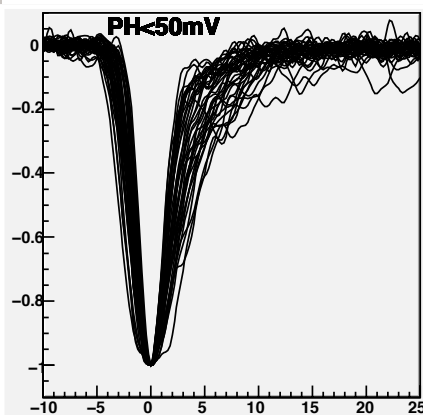


Basic problem was “parasitic inductance”
some leads/traces too long

Investigated several “blue-wire” fixes...



decided instead to simply build new bases (few k\$)

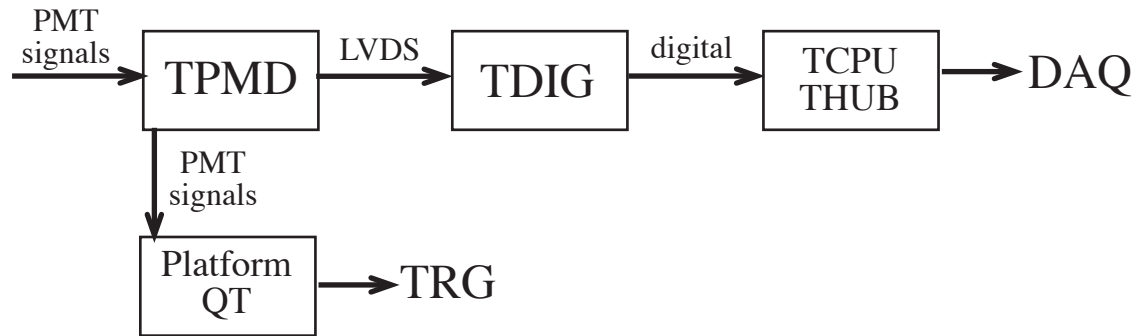


Used throughout Run-9, PMT ToT distributions much smoother than in Run-8

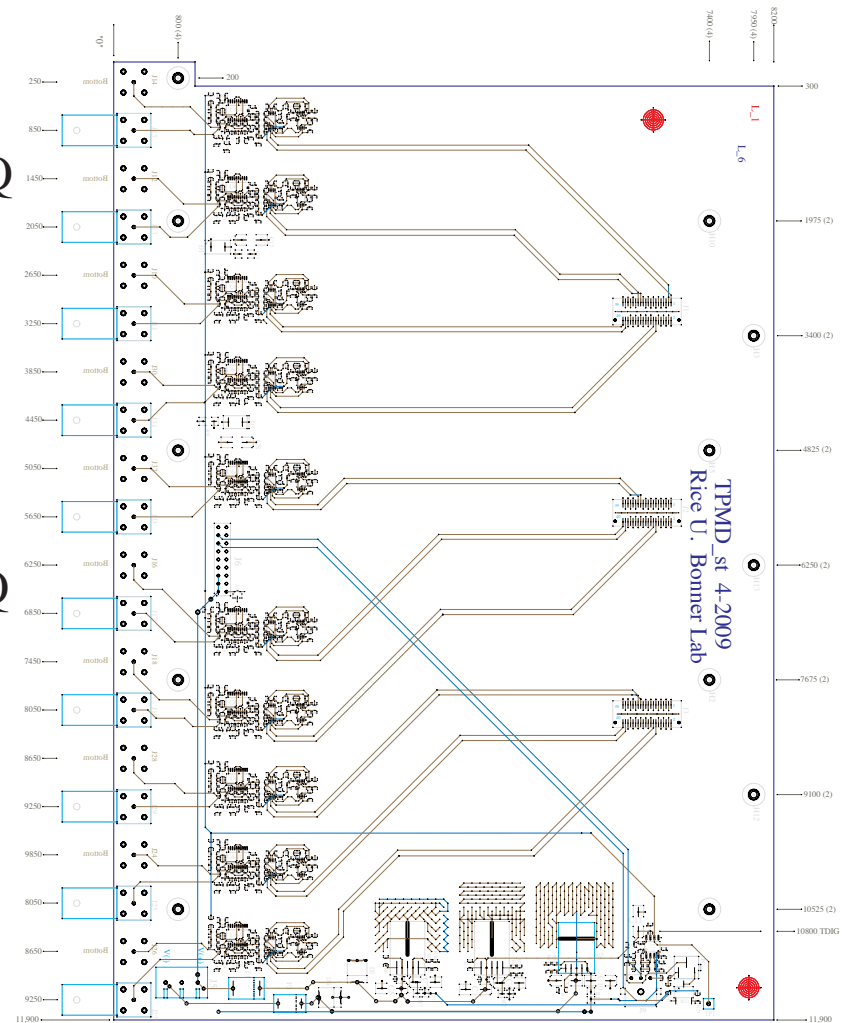
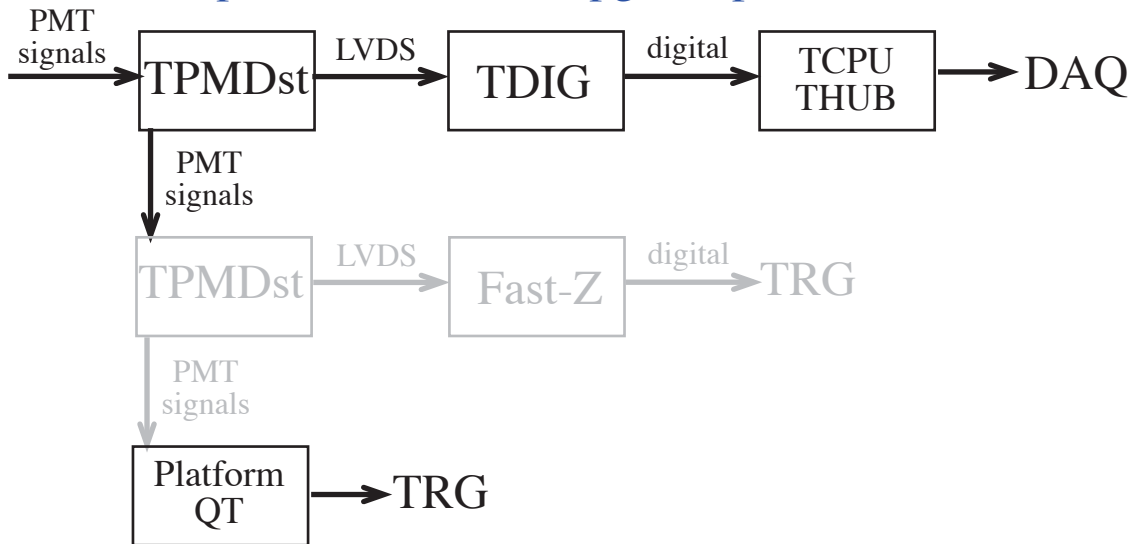
New TPMD ("TPMDst")

- Connector mapping now matches final TDIG to readout (6ch → 10ch)
5 boards → 3 boards, now all boards are easily accessible in the start-boxes.
- pulse stretching circuit (as on stop-side) to measure LE and TE stamps in the same channels.
- additional technical improvements

Present

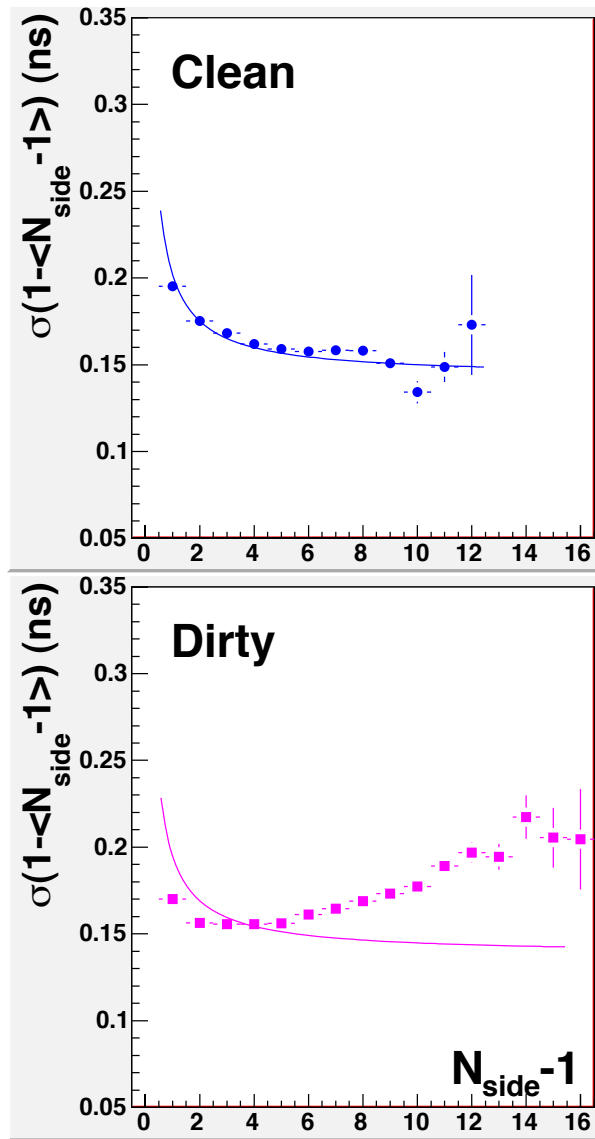


Run-10 (+ possible "Fast-Z" upgrade path)



18 TPMDst boards assembled & tested, all functional... Ready for Run-10

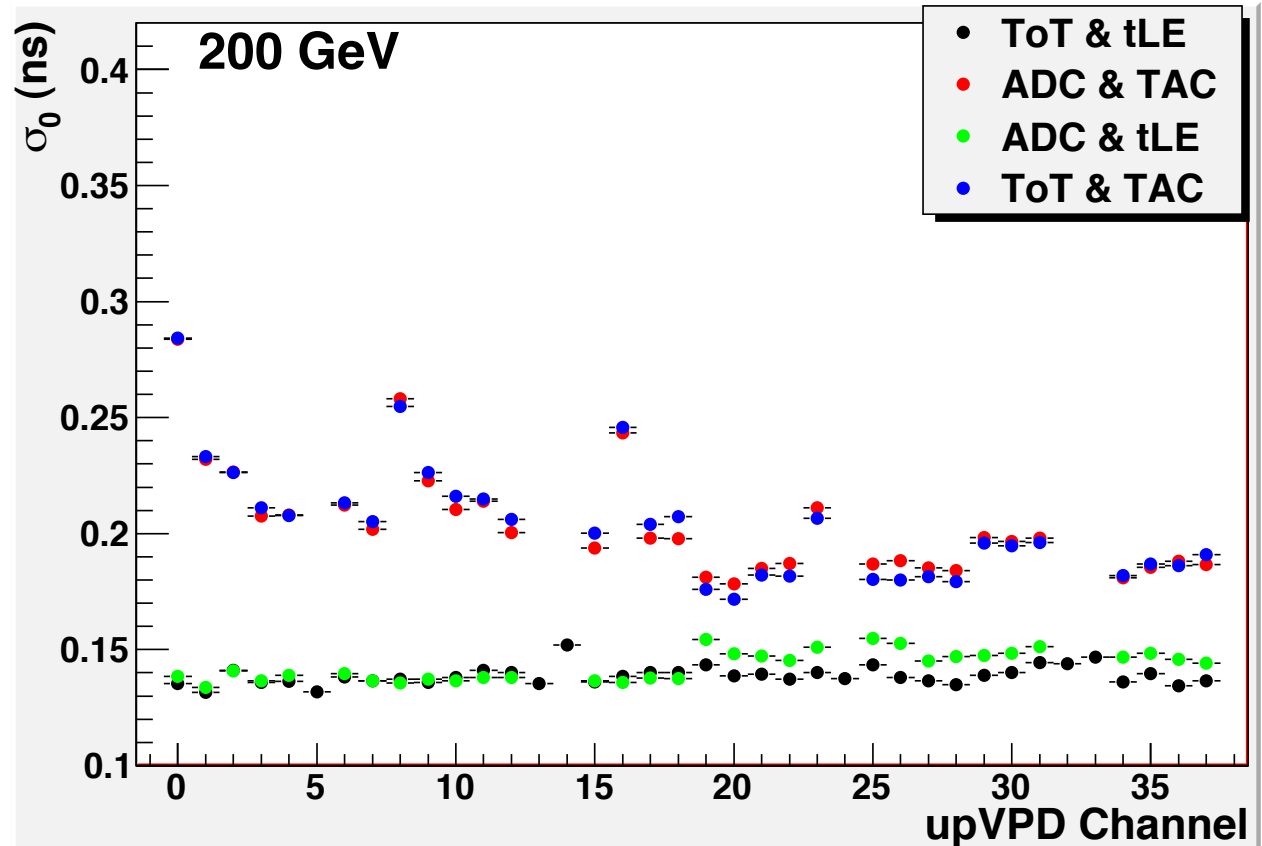
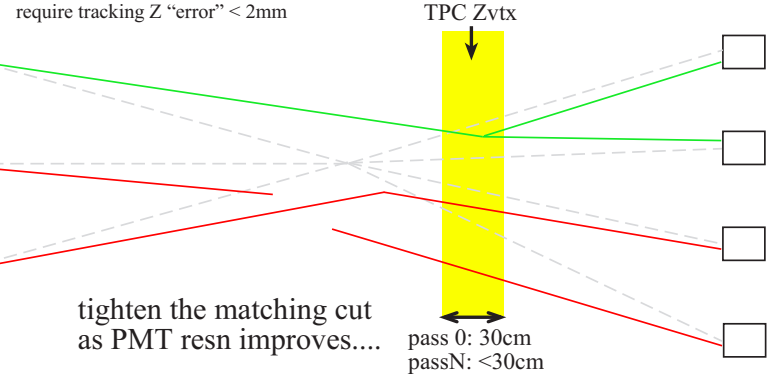
upVPD Performance in Run-9



independent analyses using a different outlier rejection scheme by Zebo Tang & Xiaoping Zhang as well

“Backgrounds” (*i.e.* good hit confusion) increasing every run..... requires careful outlier rejection & multiple collision ID

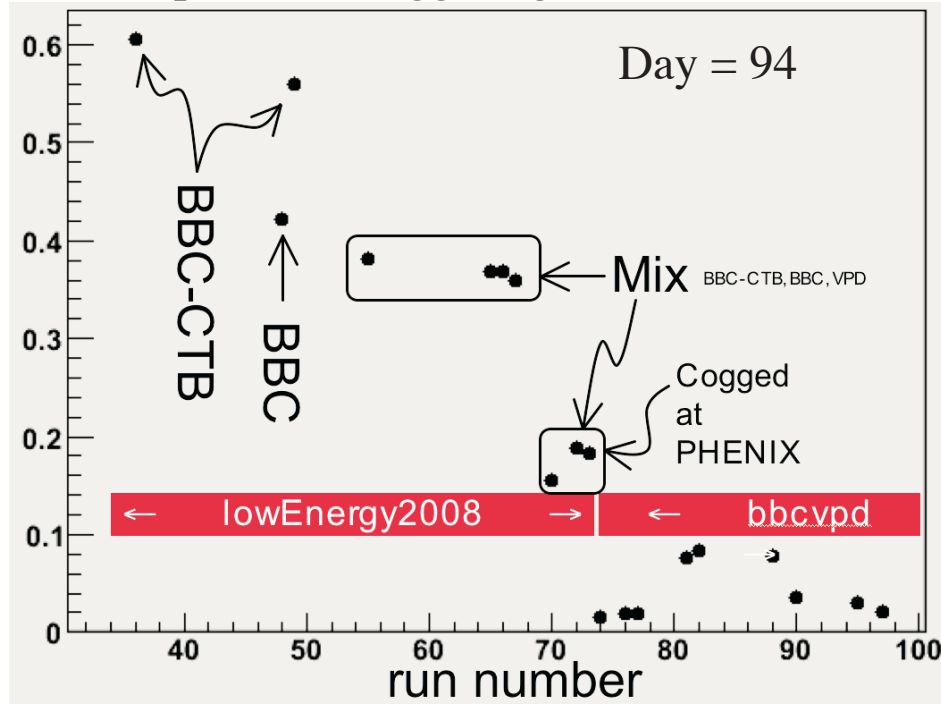
measure Z from timing for all pairs of lit PMTs
compare to Z from tracking, keep the PMTs in “good” pairs.....



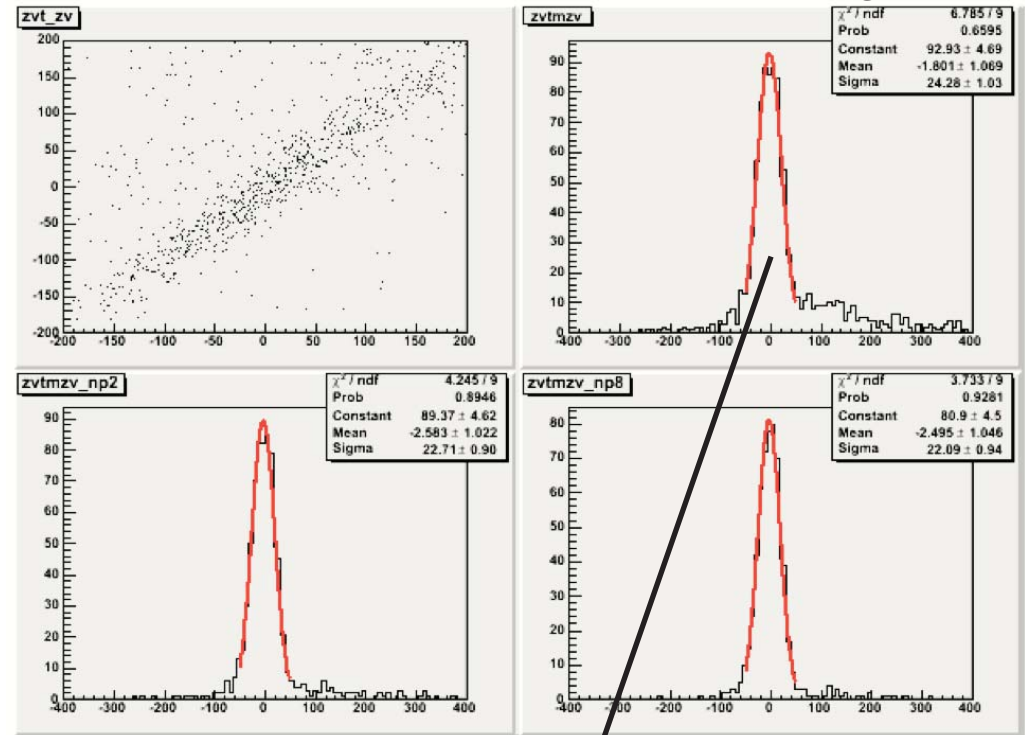
Single Detector resolution ~140 ps, consistent with Run-8 result.

Start Detector in Low Energy Run-8 (9 GeV)

some ☆ problems triggering on actual collisions



Zvtx from upVPD timing vs Zvtx from tracking...



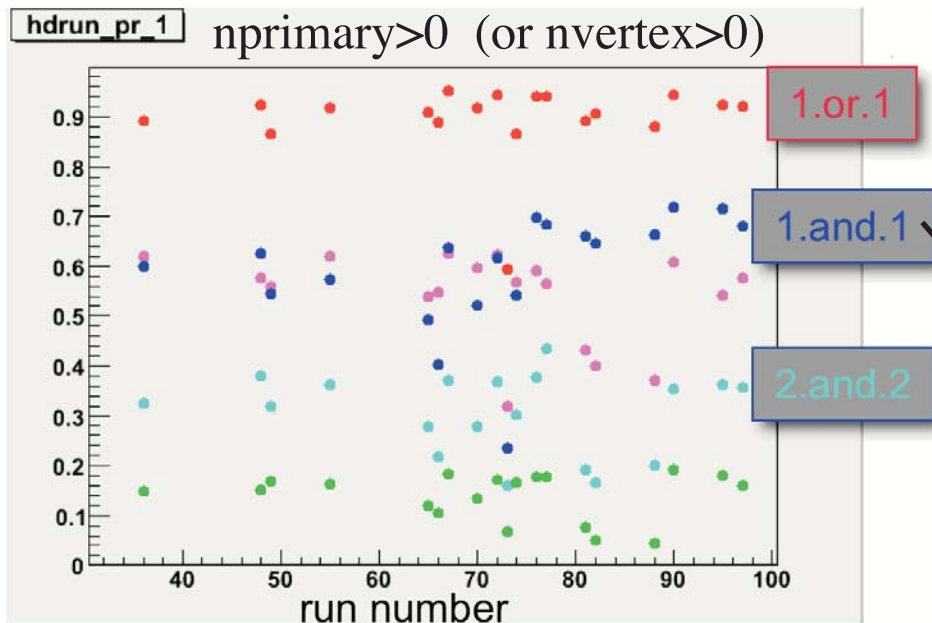
Zvtx resn ~ 22-24 cm

no upVPD slewing correction
earliest hits on east and west

→ single det $\sigma \sim 1$ ns (as expected!)

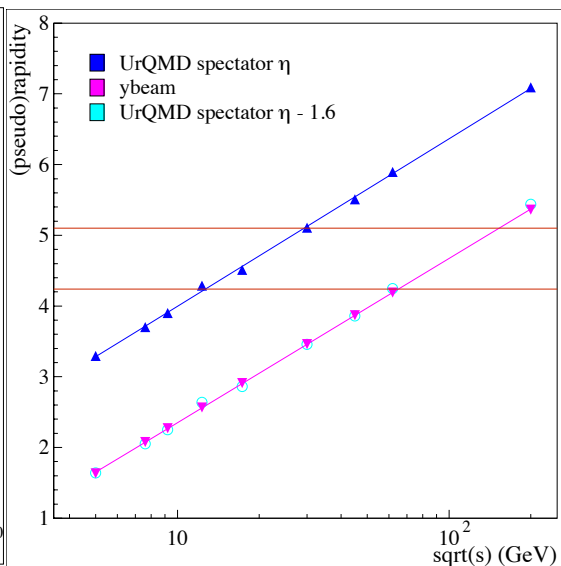
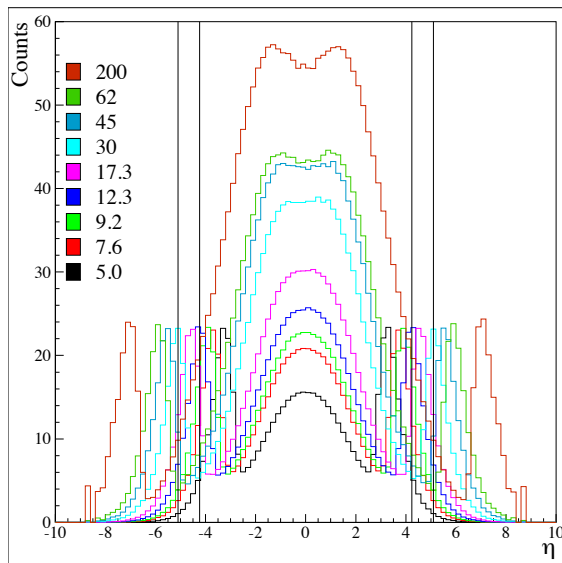
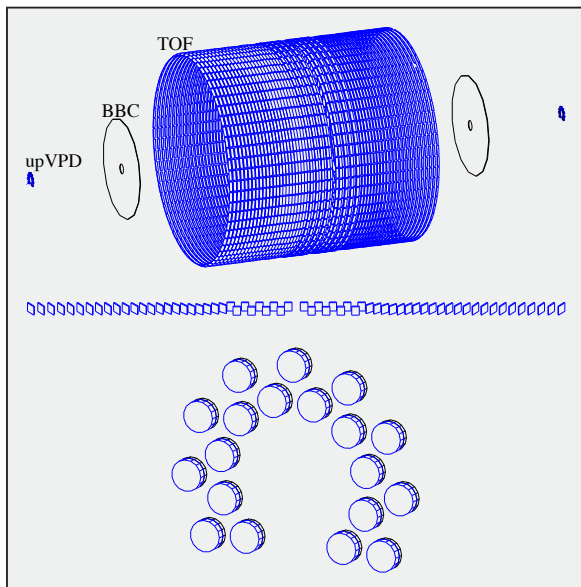
upVPD coincidence efficiency ~ 60%

...heavily biased to peripheral collisions though

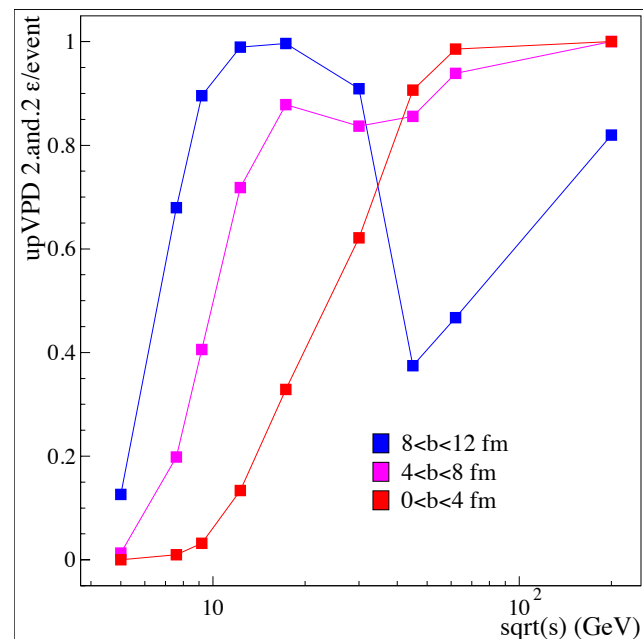
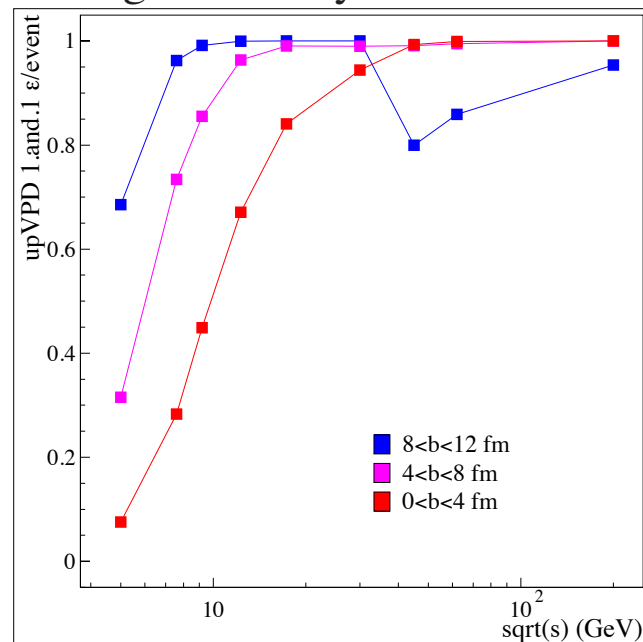


Efficiency vs Beam Energy Simulation

- UrQMD 2.3 events
- exact detector positioning
- simplified STAR geometry



Resulting Efficiency/event vs \sqrt{s} and b



→ need simple reshaping of BToFCalibrationMaker
in progress now.... (needed early 2010)

Deliverables & Requirements

Start Detector

38 channel “upVPD” built and in use since Run-7

System Total Time Resolution

requirement is $\sigma_{\text{total}} = \sigma_{\text{start}} \oplus \sigma_{\text{stop}} < 100 \pm 15$ ps in full-energy Au+Au

use single detector resolution $\sigma_0 = 140$ ps value seen in p+p Run-8 & 9

(*very conservative* for Au+Au based on pVPD experience in Runs 2-5)

average number of dets/side w/ prompt hits

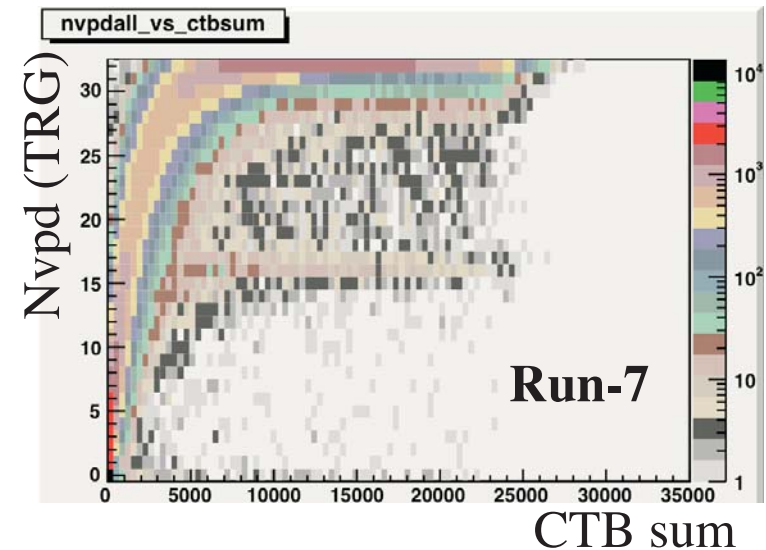
$N_{\text{side}} = 19$ for centrality $\sim 60\% \rightarrow 0\%$

$N_{\text{side}} = 5$ for centrality $\sim 80\% \rightarrow 60\%$

$$\sigma_{\text{side}} = \sigma_0 / \sqrt{N_{\text{side}}} \rightarrow \sigma_{\text{start}} = \sigma_0 / \sqrt{(2N_{\text{side}})}$$

$$\rightarrow \sigma_{\text{start}} = 23 \text{ ps (60\%-0\%)}$$

$$\rightarrow \sigma_{\text{start}} = 44 \text{ ps (80\%-60\%)}$$



take $\sigma_{\text{stop}} = 85$ ps from Runs 8 & 9... (see subsequent talks)

$$\rightarrow \sigma_{\text{total}} = 88 \text{ ps (60\%-0\%)}$$

$$\rightarrow \sigma_{\text{total}} = 96 \text{ ps (80\%-60\%)}$$

Summary

- TPC Support Fixture fabricated and under test

(Scheblein, Soja, Christie, Pendzick, *et al.*)

- upVPD

2x19 channel “start” detector in use since Run-7

also a major component to STAR Level-0 minbias triggers

New PMT bases for Run-9

performed well, no failures

18 improved TPMD boards (“TPMDst”) tested & ready for use

numerous improvements w.r.t. TPMD

installation underway now

Single-detector time resolution in p+p ~ 140ps, consistent with Run-8
implies system total time resolution $\sigma_{\text{total}} \leq 96$ ps in full energy Au+Au
backgrounds/out-of-time hits becoming a significant issue

Efficiency vs \sqrt{s} and b in the Beam Energy Scan simulated
at lowest \sqrt{s} : efficiency drops with b.....

work started on a reshaped offline software to address this