

TOF Start Detector ("upVPD") and Run-8.

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Outline:

- Mechanical details
- Simulations
- History and experimental results
- Run-8

physics from upVPD + 5 tray TOF in Run-8:
see subsequent talk from Zhangbu
survey of PWG comments



Primary Function

provide start-time needed to form $1/\beta$ from the stop-side data
calibrates independently from stop-side
calibration does not require any information other than that from the upVPD itself

Secondary Function

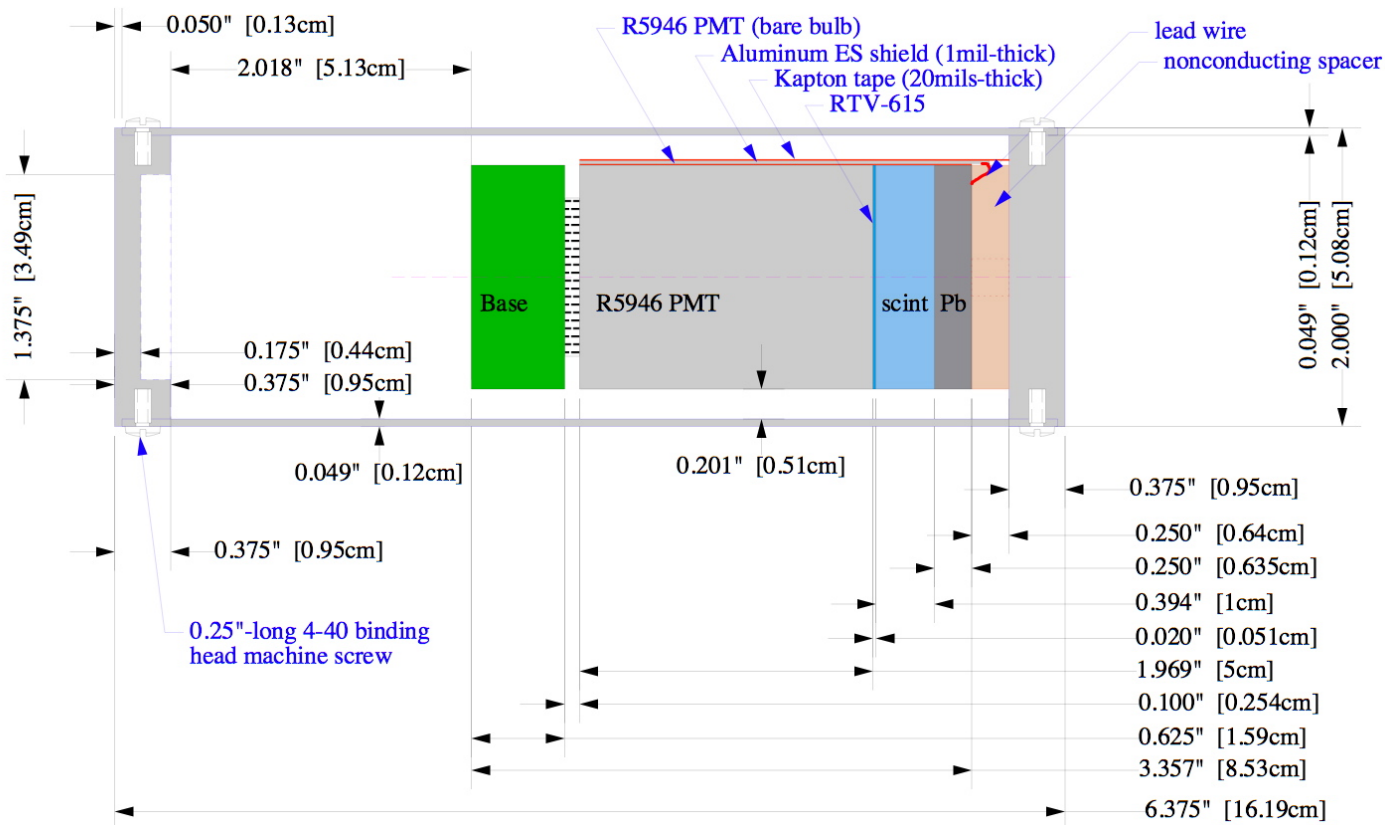
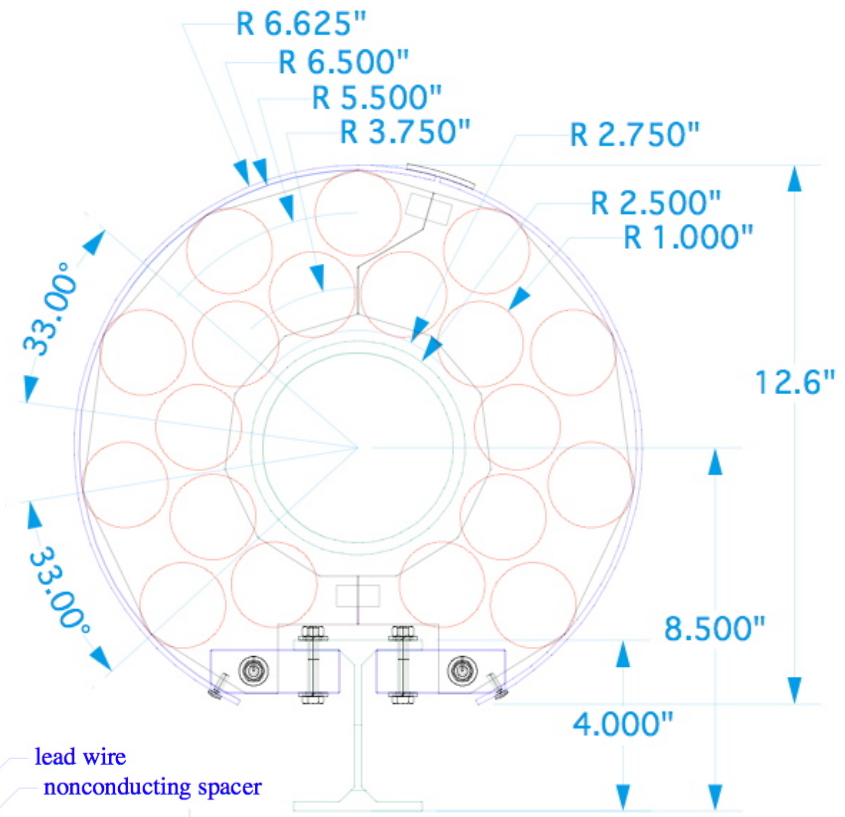
measurement of Z-location of primary vertex via East-West time differences
not needed by TOF but potentially of interest to ☆ (low-level triggering)

upVPD Mechanical Details

19 detector channels per side, 2.0" OD
 in same integration volume as pVPD
 no Steel or magnetic shielding, light-weight

Inner radius $\sim 2.75'' = 6.98\text{cm}$
 Outer radius $\sim 6.50'' = 16.51\text{cm}$
 STAR $|Z| \sim 570\text{ cm}$
 $4.24 < |\eta| < 5.10$

Pb converter, 1.5" OD, 1/4"-thick (1.13 radiation lengths)
 inner ring converter min $|\eta| = 4.60$
 inner ring converter middle $|\eta| = 4.79$
 outer ring: $\sim 1/3$ of azimuth covered, $4.2 < |\eta| < 4.6$

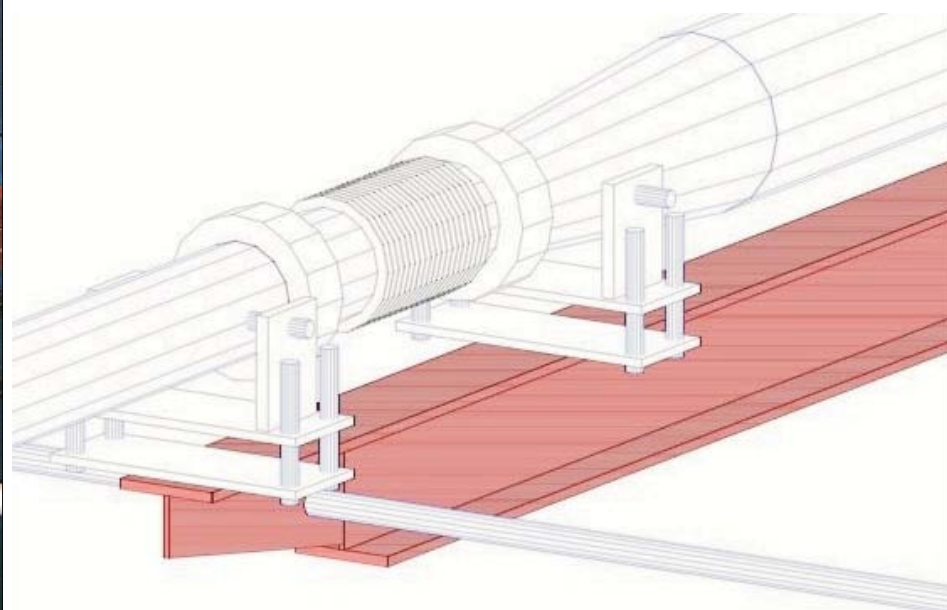
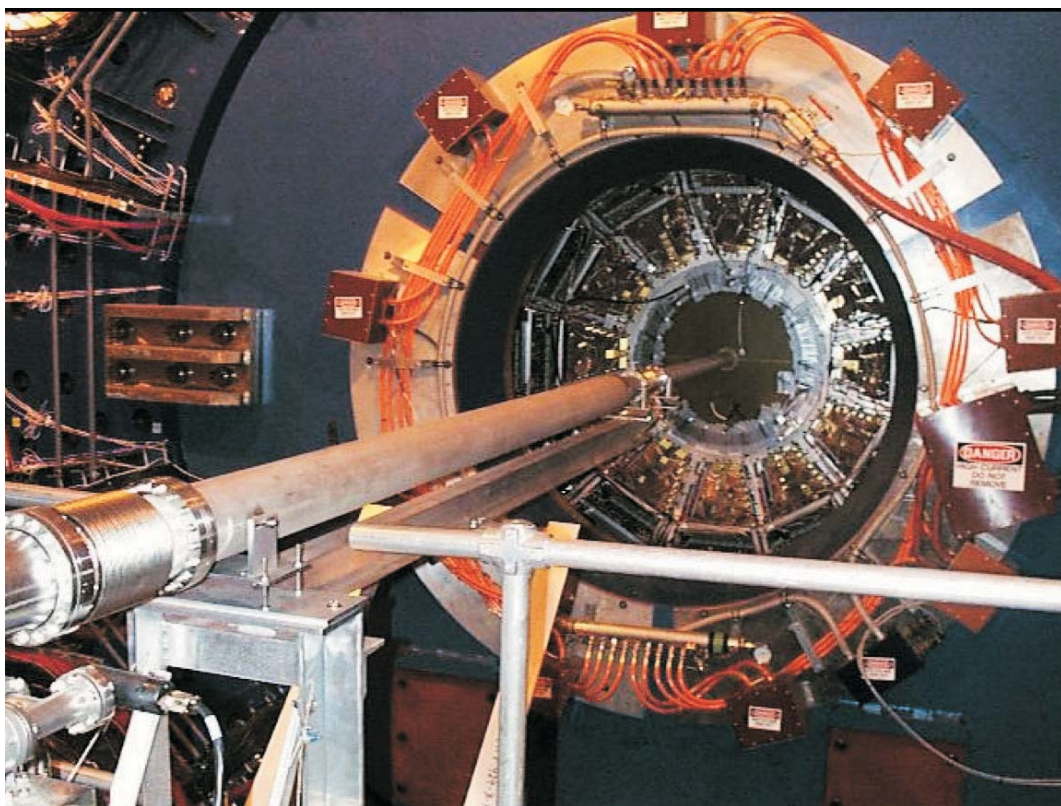


Simulations

upVPD: <http://wjlllope.rice.edu/~TOF/upVPD/ForwardSimulations/>
pVPD: SN0416

2 goals:

new description of many pieces of metal not previously in STAR simulations
exploration of performance of upVPD in Au+Au and p+p collisions in Hijing & Pythia events
comparison to known “real” performance of pVPD

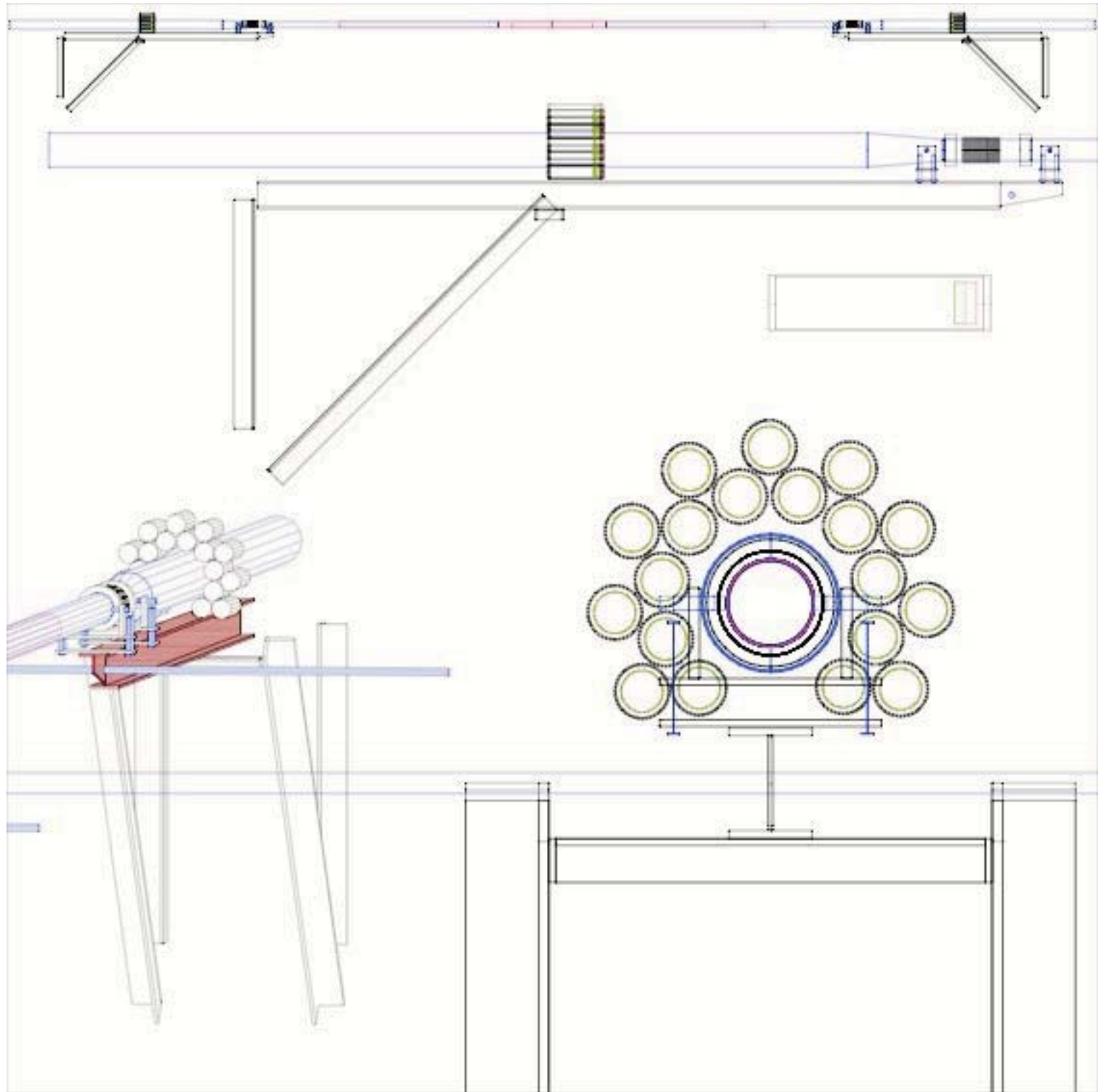


... quite a bit of forward metal is in STAR but not (typically) in STAR's geant
pipe support brackets, i-Beam sway bar, i-Beam support

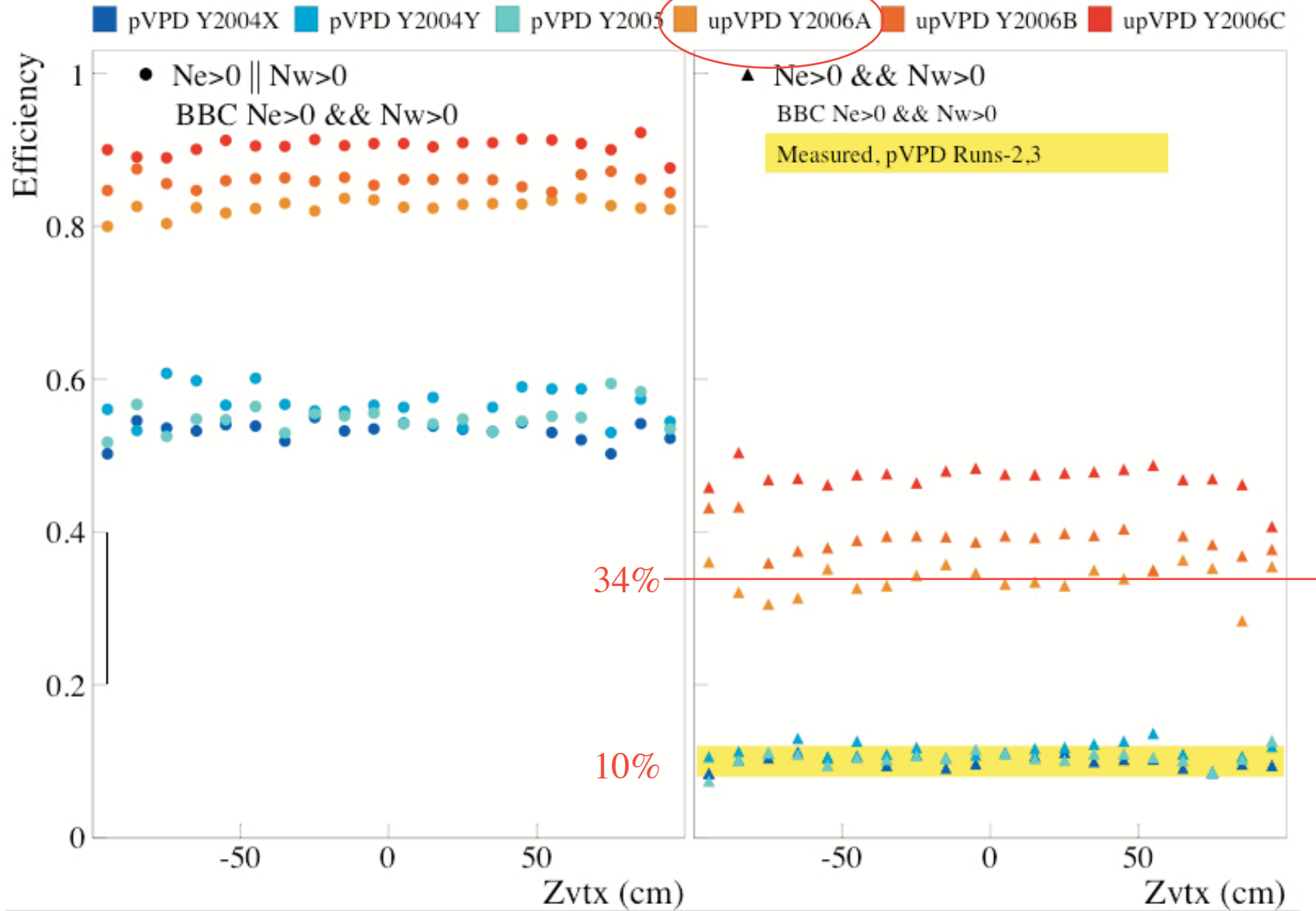
any new simulations (w/ or w/out upVPD detectors) should include these pieces

vpddgeo.g
Y2006A

available in CVS



STAR's pythia, min bias (MSEL 2), no P_T limits or thresholds, $|\eta| \leq \pm 8$



Au+Au simulation (figure 9 on same web page)

efficiency/event = 100% out to $b \sim 11-12$ fm.

slight improvement in efficiency at $b=14$ fm (pvpd~80%, upvpd~92%)

History and experimental results

pVPD runs 2 through 5... (three chs/side, heavy shielding, gain-limited R2083 linear PMTs)
ion+ion: $\sim 100\%$ efficient (full-occupancy, multi-particle timing), almost all data is “3.and.3”
light ion: “1.and.1” efficiency per STAR-triggered event
 p+p $\sim 10\%$
 d+Au $\sim 25\%$

upVPD is a deliverable of the STAR TOF Project, approved by ☆ (Mar 2004), DOE approved (Aug 2005)
→ we need show performance in ☆ (PMTs recycled from TOFp!)

upVPD Run-6

2-weeks of data in early part of the run, then detector removed from beam-line
we got 10M events (short runs once/day @ $\sim 4\text{kHz}$!) but base failures, also at rate of $\sim 1/\text{day}$
→ no data supporting calibration/resn estimates...

bases replaced. cosmics testing indicates single detector resn = 120 ps for single m.i.p.’s...

upVPD Run-7

16 chs/side read-out by TRG CDBs and TACs, supported $\sim 5\text{cm}$ and $\sim 30\text{cm}$ Zvtx triggers all run
long cables, different digitization electronics
difficult to extrapolate performance to that if using TOF electronics (short cables, HPTDC)
TOF electronics available & alive only in last 10 spills of the run, local untriggered readout
just flat stream of timestamps over canbus from one side only, not “1.and.1” events
no interaction w/ DAQ or TRG, infer “events” via timestamp correlations
calibration of very ugly data performed, but results carry no confidence to running TOF in ☆
→ still no data for a realistic calibration/resn estimate...

upVPD uses same read-out electronics (TDIG) as stop-side (this is good design, simplifies calibrations)
Final electronics for both start and stop sides have never produced a successful calibration in ☆

→ TOF very badly needs start and stop data in Run-8
(to calibrate and insure adequate performance of both upVPD and TDIG deliverables)

Run-8

TOF recognizes this run is important to FMS so we want to be as invisible as possible...

TOF very badly needs new data this run that includes the upVPD (& final trays & electronics)...
and enough of it to calibrate and evaluate the new full-TOF-system performance in ☆...

some discussion points from the TOF technical perspective:

(Zhangbu will present the TOF physics perspective)

repeating a simulation of some FMS physics observable(s) but w/ and w/out the upVPD detectors
(but with more realistic pipe-support mechanics) would give some sense of scale at least.

TOF would of course like to have the upVPD installed the entire run
multiplicities (hence efficiencies) are low in p+p and d+Au on both start and stop sides
at present $|Z| \sim 570\text{cm}$, or slightly downstream if necessary (w/ some loss of TOF efficiency)

If the upVPD is only present for a fraction of Run-8,

- d+Au preferred
 - higher multiplicity events allow stronger statements on upVPD and TDIG performance
- can we trigger on the stop-side multiplicity (5 trays)? do we need to?

Hank *et al.* proposed a new pVPD-like detector near the pipe (& inside the FMS on the west)...

- details?
- will same detectors also be on the east?
- can we split the signals at the detector, one set going over short cables to TOF electronics?

TOF could make use of those signals if the upVPD isn't installed the whole time...

- would allow side-by-side comparisons of efficiency and performance of the two detectors
and potentially increase TOF stop-start data sample.