



Detectors & Mechanical

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US DOE review of STAR TOF
BNL, August 11-12, 2008

Outline:

- First delivery & WAH test stand
- Gas system
- Water system
- Installation - procedure & fixture
- Start detector

WAH Testing

Flow Freon, raise HV

show HV stability and “low currents”

Apply LV one tray at a time

show “low noise rates” and search for any dead channels

Repeat tests later (improved gas quality)

Before Run-8

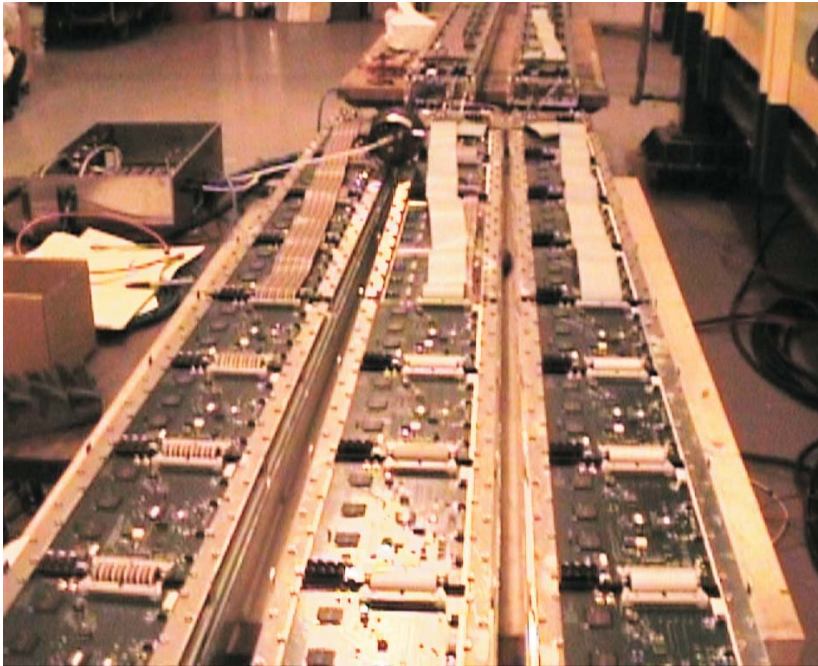
5 trays

3 large tables

all facilities from platform

temporary gas runs from NE corner

trays tested open



wrong model for testing 25-30 trays at a time
...new test stand constructed at UT



First delivery of final trays to WAH on Monday June 30, 2008



Test Stand Reassembled
trays unpacked & installed
connected to gas system
and HV system
by Thursday July 3, 2008

Successful BNL Safety Review of teststand area
Tuesday July 1, 2008

- no loading trays above shoulder height w/out manlifts
- no unattended voltage

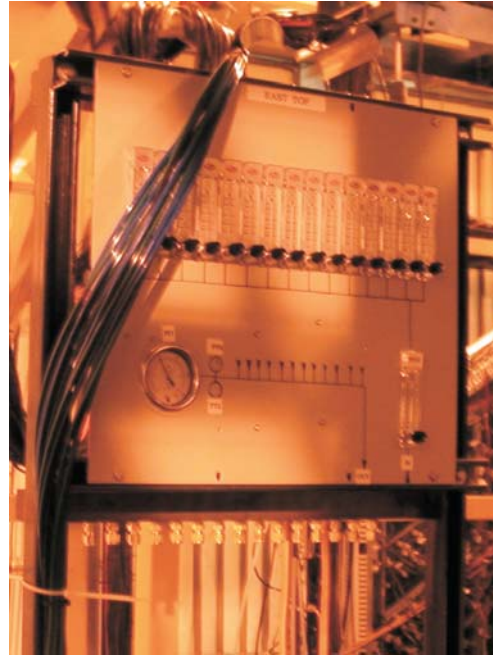


Gas System

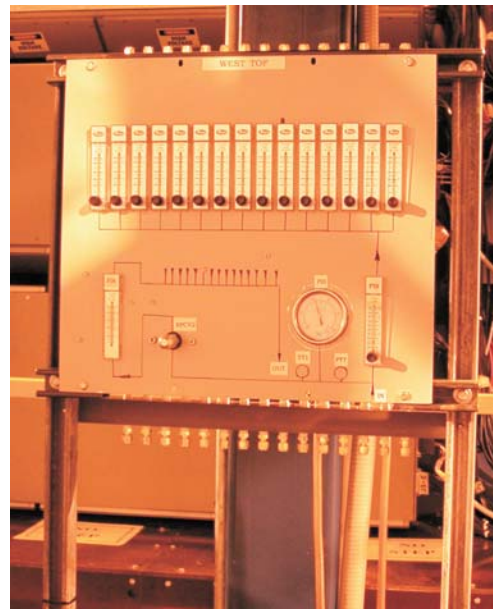
main control panel



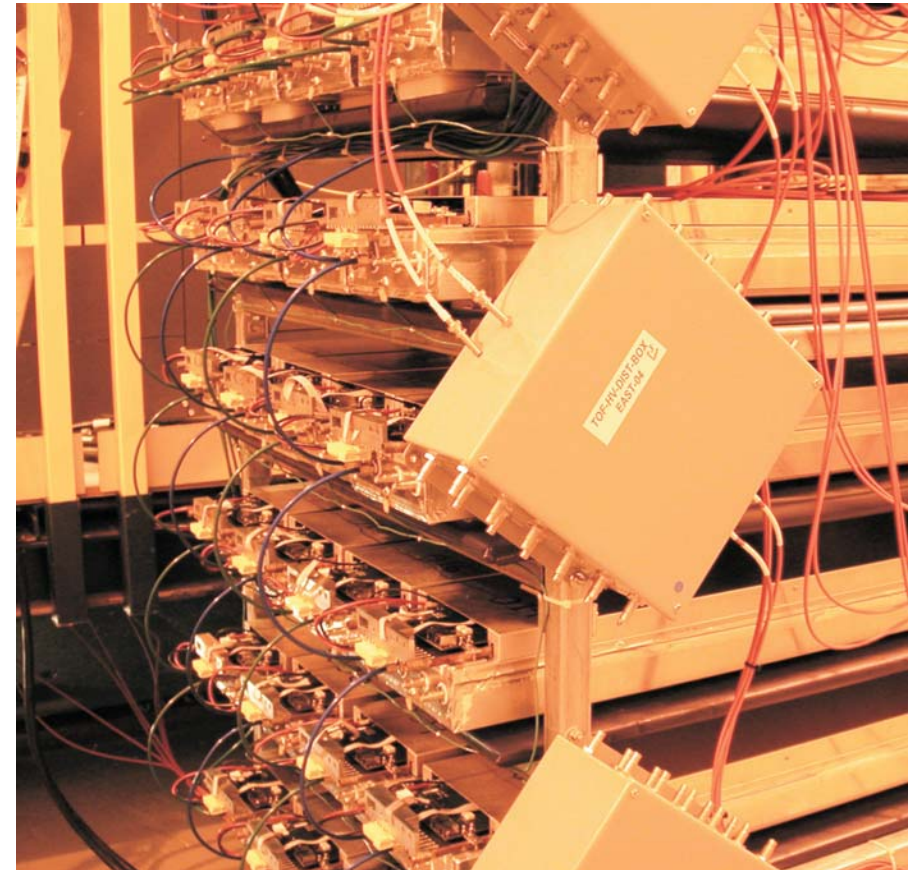
east distribution



west distribution



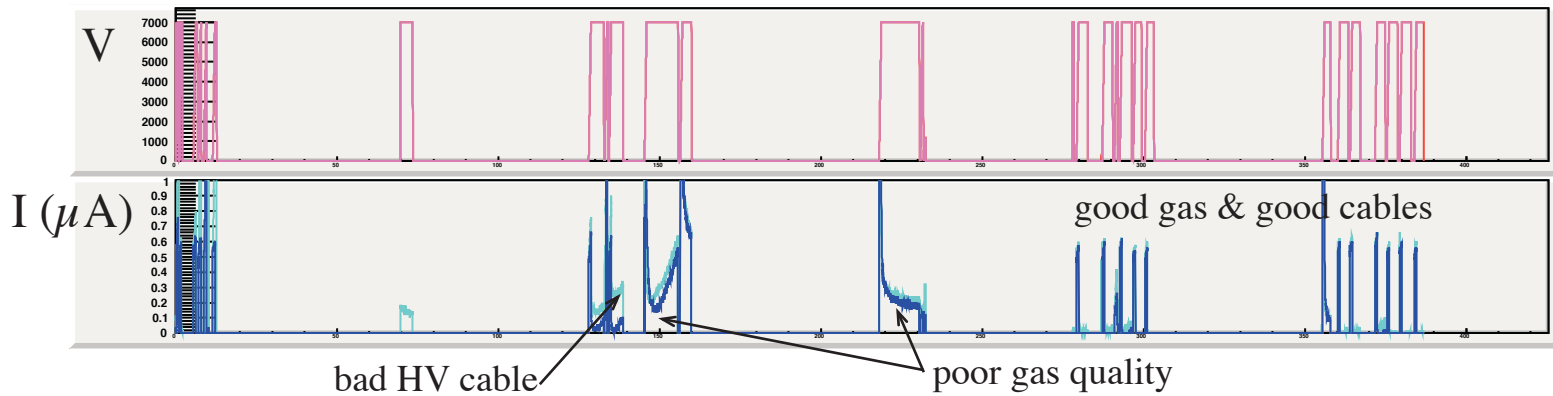
six supply-return loops to teststand
5 trays per loop



Quite some growing pains getting used
to full gas system & dist. panels

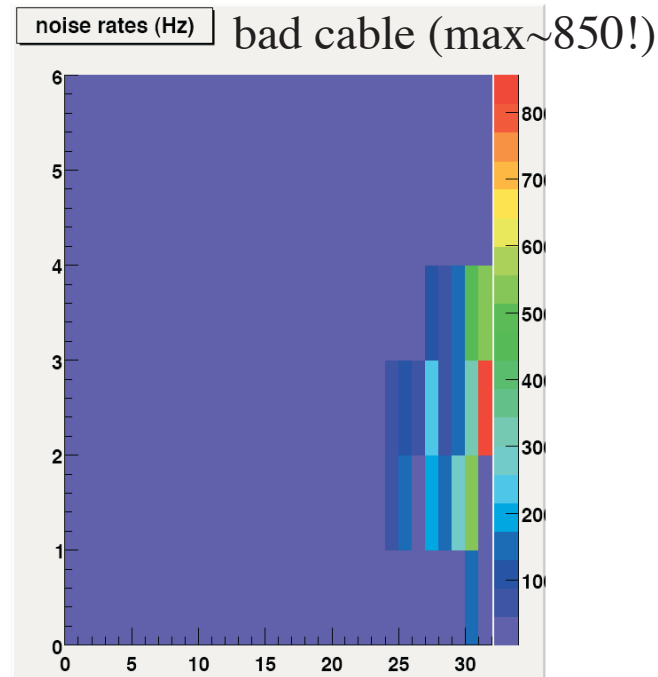
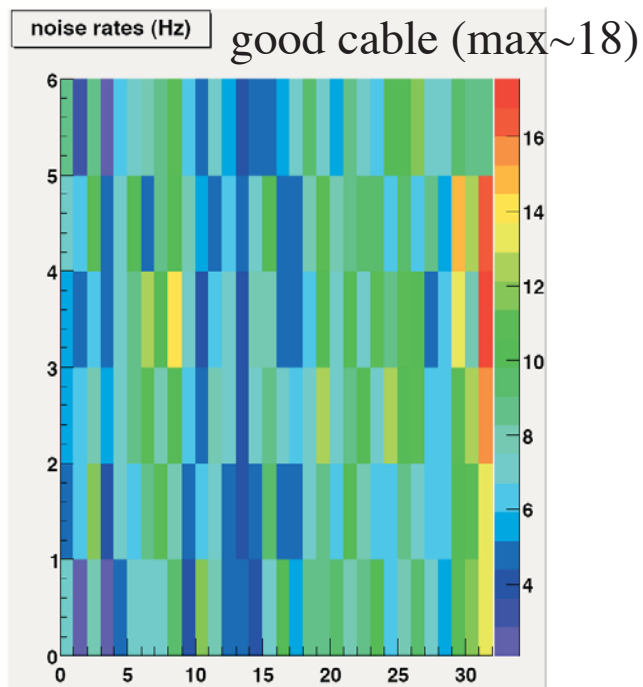
Not yet recirculating gas
a return line needs to be cleaned
planned October 2008

Test Stand Results (HV Stability, HV current draw, noise rates)



Cable #	I+	I-
26	0	0
27	0	0.02
28	0.02	0
29	0.02	0.02
30	0.04	0.04
31	0.04	0.04
32	0	0
33		
34	0.4	0
35	0	1.5
36	0	0.2
37	0	0.34
38	0.08	0
39	0	0
40	0.14	3.08
41	0	0.02
42	0	0.4
43	4	0.1
44	0.04	0
45	0	0.04
46	0	0.02
47	0.04	0
48	0.56	0
49	4.6	0
50	0.06	0.46
51	0.02	0.04
52	0.1	0
53	0.56	0.02
54	0.2	0.06
55	0	0.02

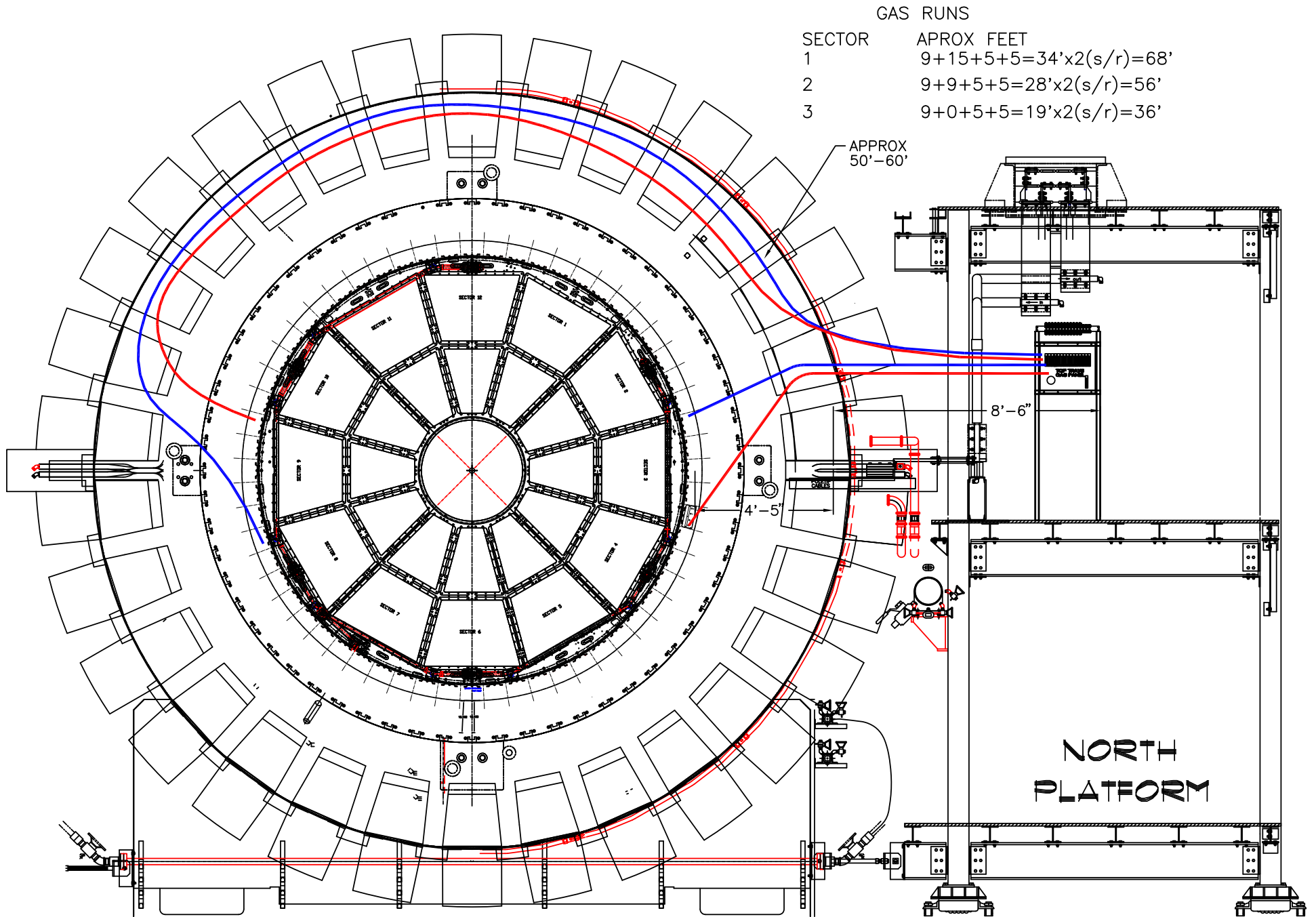
Significant leakage current from some HV cables!
 Also increases “noise rates” for MRPCs close to HV feed-throughs!



All trays ramped with good cables.
 All noise rates < 50Hz once gas quality improved
 One new dead channel

Gas distribution runs defined (J. Scheblein STSG), total tubing = 3000 feet.

Z:\Dwgs\TOF\TOF-TRAY-GAS-RUN-Llope.dwg, 8/5/2008 4:08:49 PM



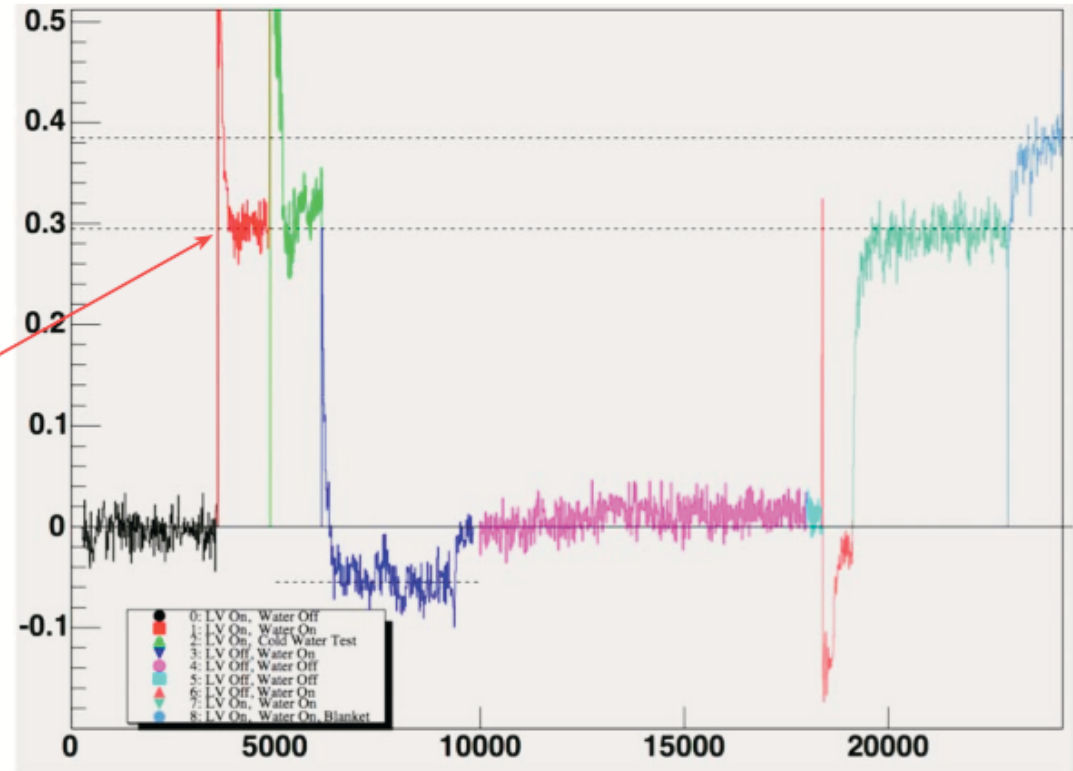
Water System -- copper water loop running between TINO & TDIG

Power tests of TOFr5

140W total
square loop + shims
perforated tray cover

water $T_{input} \sim 31$ deg C
flow rate ~ 1.36 Gpm
water $\Delta T \sim 0.295$ deg C

$P(\text{water}) \sim 105$ W
 $P(\text{radiative}) \sim 35$ W
 $P(\text{convective}) < 1$ W



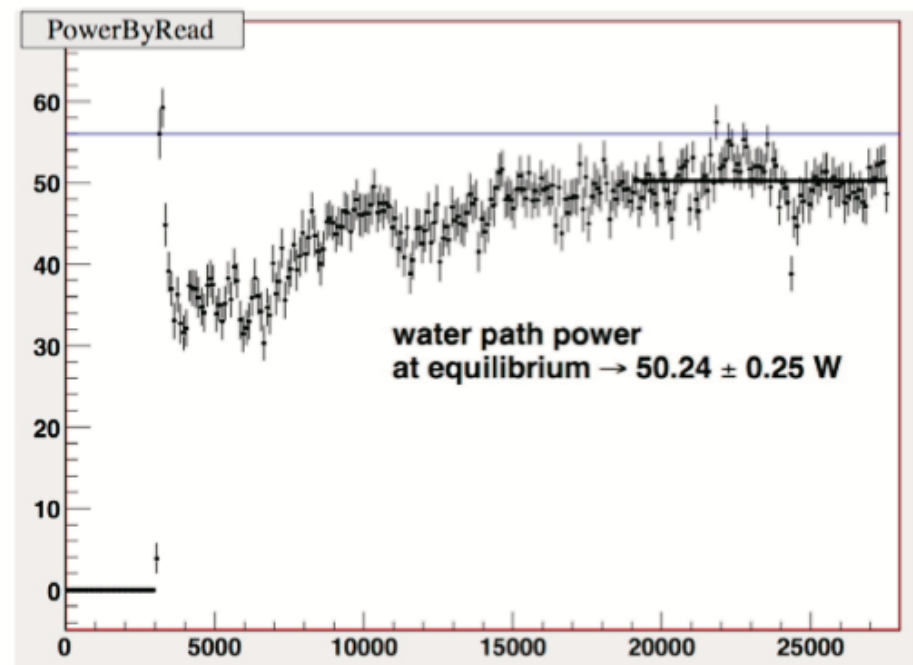
Power tests w/ early TDIG-Ds

55W total
rectangular loop + thinner shims
solid tray cover

water $T_{input} \sim 31$ deg C

$\Delta T \sim 0.07$ deg C

$P(\text{water}) \sim 50$ W



Water System (cont.)

Requirements:

- leakless
- Temperature ~25 deg C
- Pressure ~50 psi
- Flow rate ~1-2 Gpm

No leaks in for single trays in Runs 4-6
(no water for Run-3 tray)

5 trays in Run-8

two leaks during and afterwards

1 during run req. pole-tip removal

1 on July 3, 2008

leaks occurred at connection of
vinyl braided hose to Tray Cu loop barbs

Will use more expensive high-performance
clamps from now on.

re-torque after 2 weeks

Additional TOF cooling loop delivered
to BNL with first batch of 30 trays to
long-term-test leaklessness....

Distribution system design (from STSG)

- source is MCW not TPC water
T ~ 16 deg C
- 2 manifolds on each side of STAR
- 3/4" hose from manifolds to new fan-outs
- 6 ports on each fan-out
→ 24 ports total

5 trays on each water loop, same as the
5 trays on each gas loop, same as
1 TPC sector

(open question) is water too cold?

heating required to control condensation?

to be discussed during an TOF+STSG

“infrastructure” discussion tomorrow morning.

MCW system shared with other subsystems



Bridge Opening T-Bolt
Hose Clamps

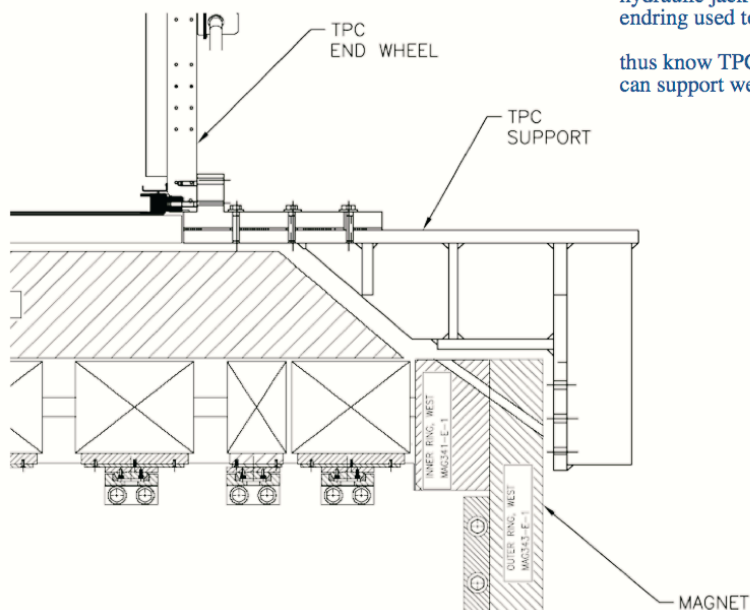
Tray Installation

large TPC support arms at 3 and 9 o'clock



requires special fixture to support TPC while inserting trays at these locations

TPC 6 o'clock Support Concept



During BEMC installation, hydraulic jack on TPC support ending used to support TPC.

thus know TPC support endings can support weight of TPC.

fixture is designed, and will be available during run-10 shurdown

First 30 trays to go on West 2 - 8 o'clock installed from the east

Next 30 trays complete the West ring

Next 30 trays to go on East 2 - 8 o'clock

Final 30 trays behind support arms and complete the East ring

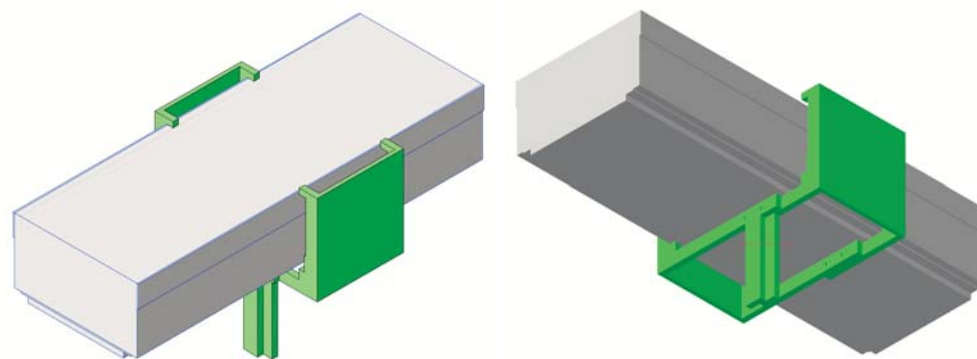
Lots of discussion about an insertion fixture

- “squeezing” trays might stress MRPCs
- need to limit stress on tray feet

~~TPC Rail on spreader arm hung from crane~~

~~Rail bolted to magnet end-rings~~

Special tray clamps to protect tray skin



Choreography of insertion procedure, touch-points, etc, part of TOF+STSG discussion tomorrow morning

Start Detector Status

Cosmic tests before Run-6

single detector $\sigma \sim 125$ 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 $\sigma \sim 170$ ps

recognized some ringing before Run-8

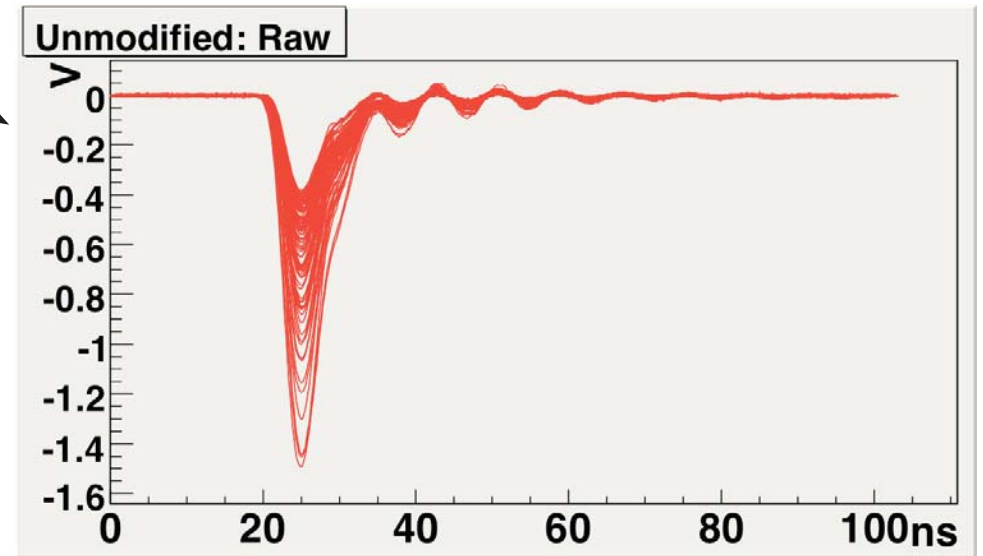
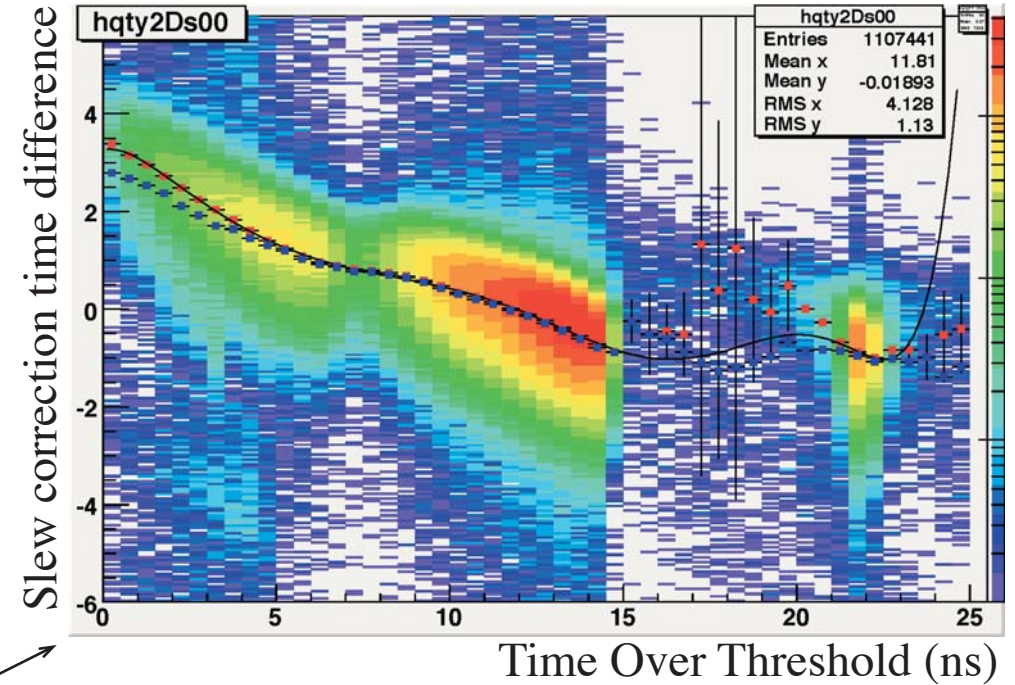
additional 12ns & 24ns cable sections used
to avoid HPTDC cross-talk

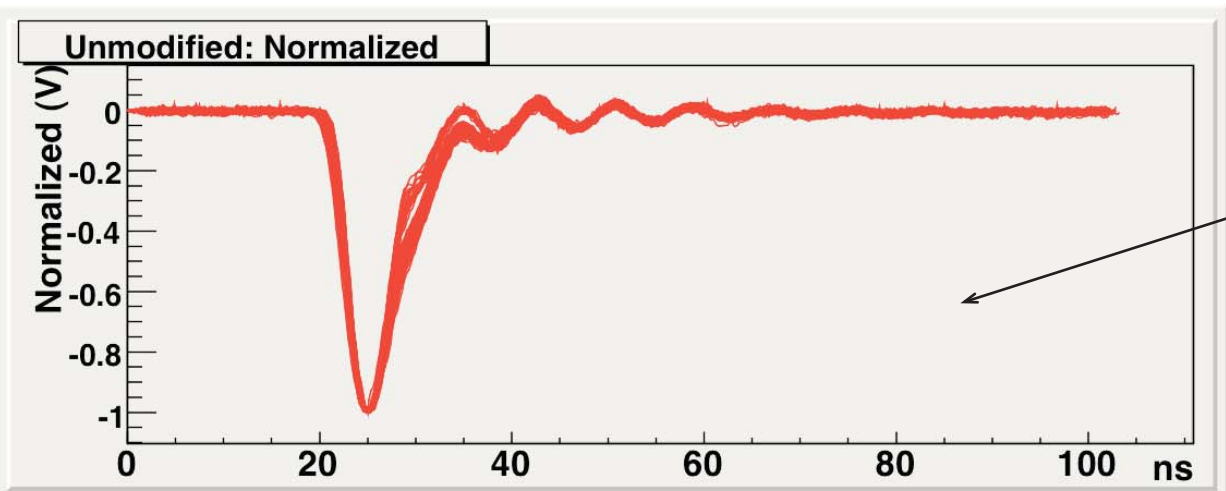
Run-8 (d+Au, p+p, & 9 GeV Au+Au)

again, an input to STAR trigger

single detector $\sigma \sim 130-140$ ps

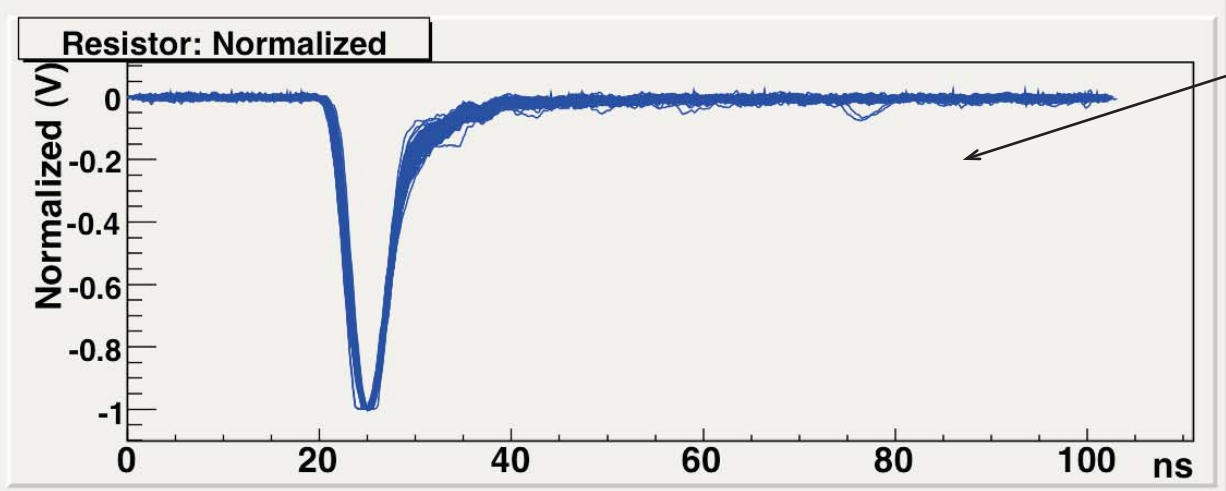
in both p+p and d+Au





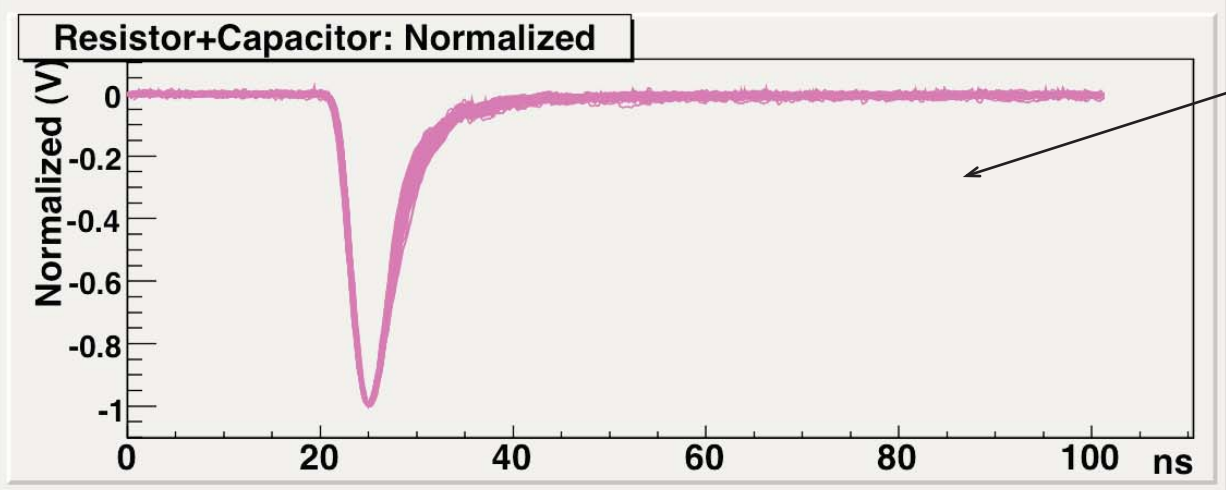
Normalized to 1V pulse height

un-modified



resistor modification

all bases now have this modification



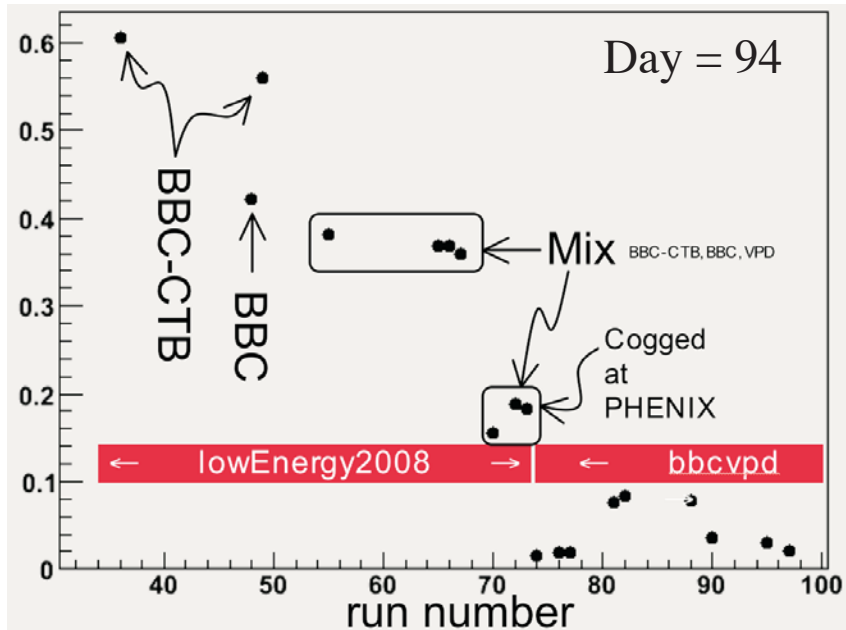
resistor + capacitor modification

additional small improvement
but more difficult to solder

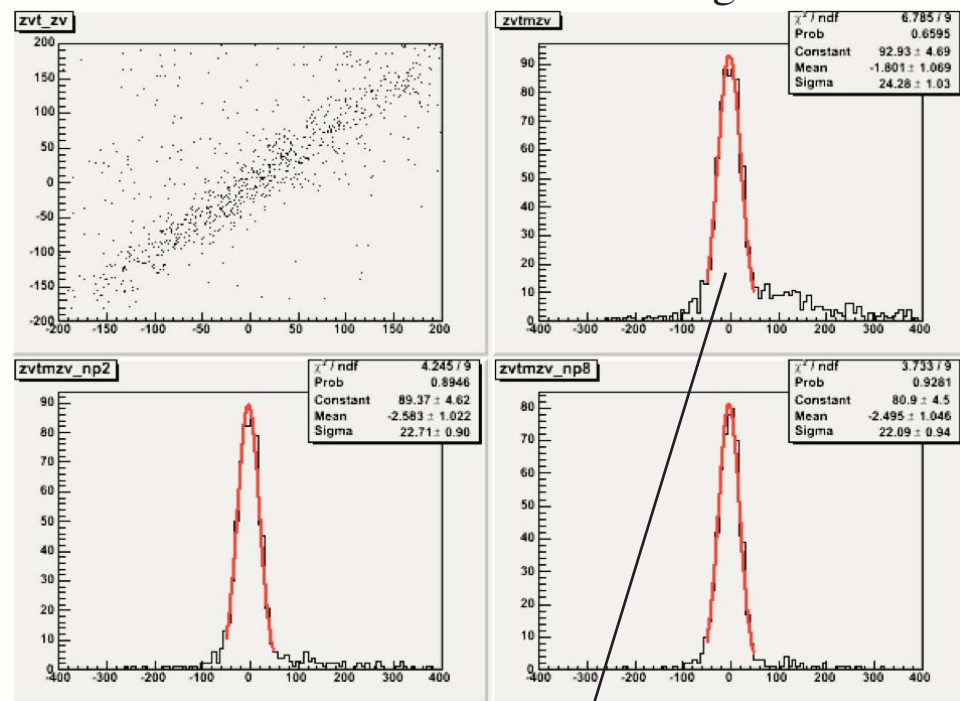
will be done too

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

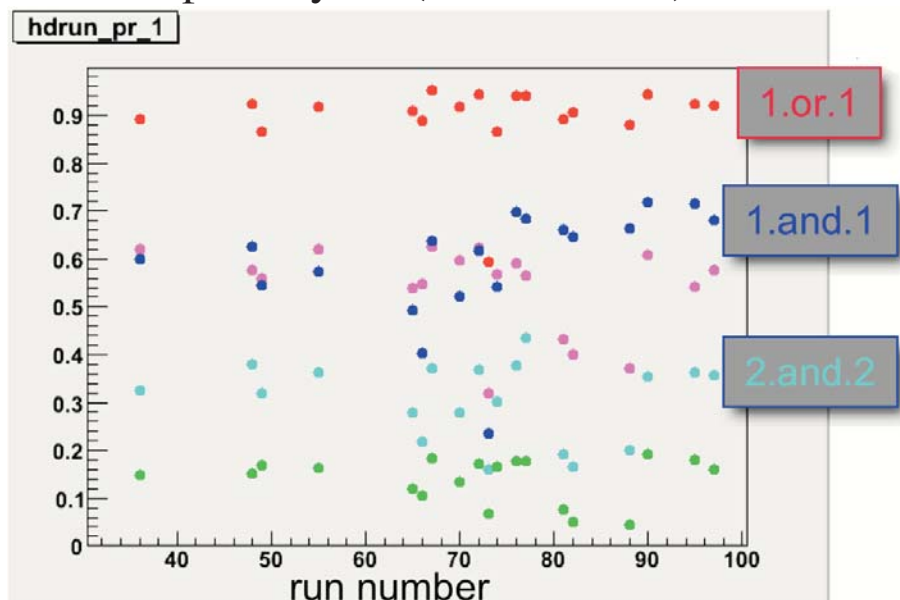
some ☆ problems triggering on actual collisions



Zvtx from upVPD timing vs Zvtx from tracking...



nprimary>0 (or nvertex>0)



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% !!!

Summary

- test stand now “permanent” part of south section of WAH & BNL Safety Committee-approved facilities needed for testing (HV, LV, and gas) use the full-system interfaces, which tests these too. available for all subsequent tray shipments.
- first delivery of 30 trays was “successful”
 - all trays pass on-site test suite, one new dead channel
 - now total of 3 dead channels in 35 delivered trays ($3/6720 = 0.04\%$)
 - only issue is measurable leakage current in some of the short HV cables ($\sim 1\text{-}2\text{ M}\Omega$)
- gas system nearly complete, not yet commissioned
 - some growing pains in the last few weeks....
 - some pipes need to be cleaned, etc, but the full system is now coming “on-shell”
 - not recirculating gas yet
- water and gas distribution networks now designed by STSG, parts ordering now underway
 - water - major improvement to the clamp connection to each tray
 - gas - gas runs defined, parts ordered, installation beginning mid-August.
- tray insertion fixturing involving specific mechanical devices does not seem practical...
 - present approach is instead a rigorous definition of the choreography and touch points.
- important meeting between STSG and TOF tomorrow morning to work through these & other issues
- TPC support structure designed. to be made available in the next shutdown.
- Start detector is (somewhat surprisingly) highly-efficient ($\sim 60\%$) during the 9 GeV test run in Run-8
 - Start Detector base “ringing” now reduced via electronic modifications