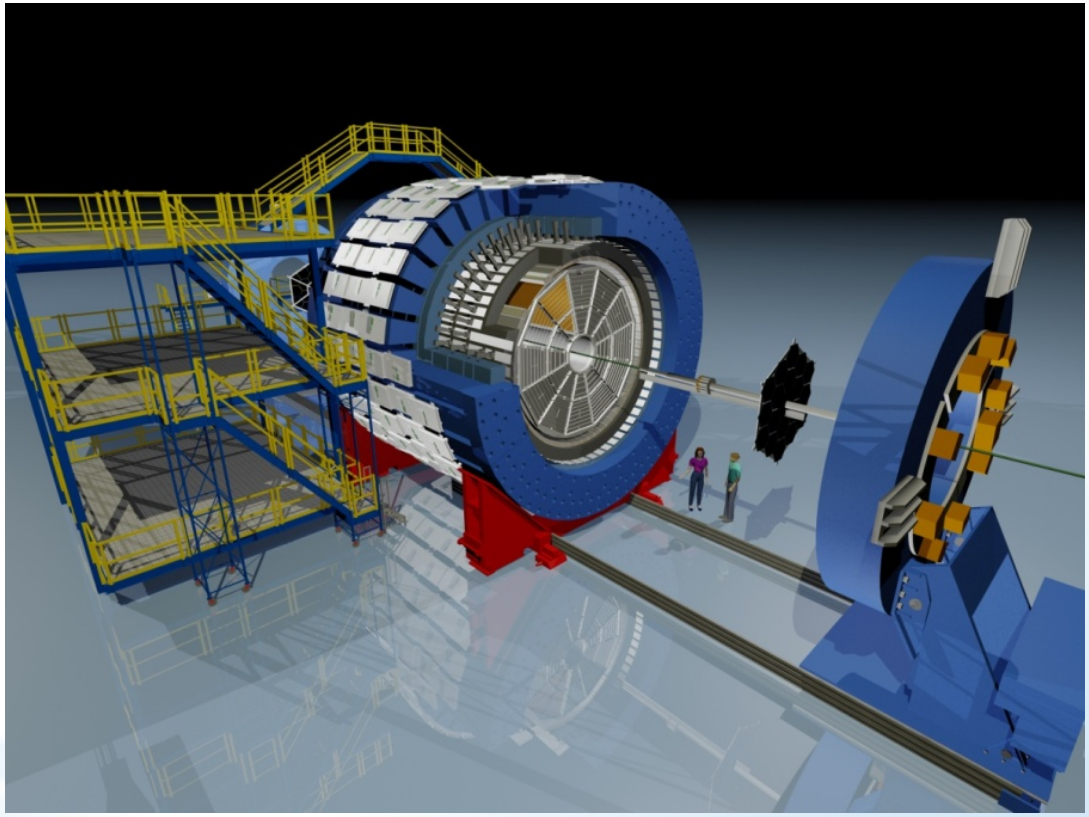
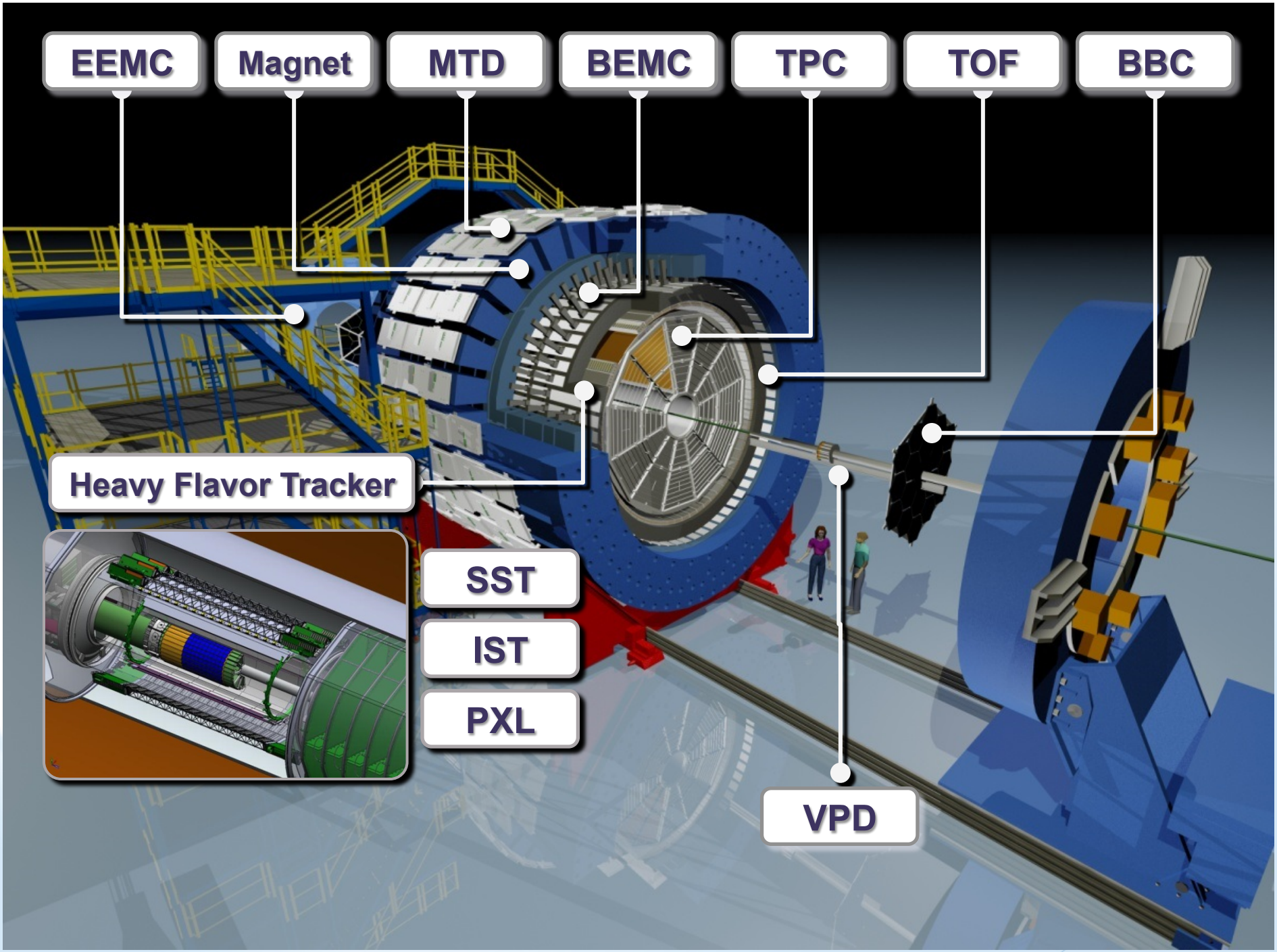
Outline

- New/enhanced/removed detector sub systems for Run 16
- Data set Goals and achievements
- STAR's Running Efficiency
- Desired luminosity profile for Run 17 510 GeV transverse pp
- Comments on Run 16
- Summary




EEMC
Magnet
MTD
BEMC
TPC
TOF
BBC
Heavy Flavor Tracker
SST
IST
PXL
VPD

SUBSTANTIAL INVESTMENTS TO REACH OUR BUR GOALS
-- MANY IMPROVEMENTS SINCE RUN14

Open Charm (HFT) related: (MB events)

- Cables: Cu => Al Cable for HFT readout: up to x2 better S/B low-p_T D^0
- Refurbished PXL and SSD firmware: ~18% PXL dead in Run-14
  SSD improves tracking 10% (20% for Ds)

Overall factor of 3.6 improvement for D^0

- Vertex Cut quality improvement (~15%)
- Pile-up protection study w/o 30% more data volume and 10% worse efficiency
  optimize protection (10%)
- Re-populate TPC ASIC and RDO, DAQ software optimization, online disk and network, +50% faster readout speed, reduced deadtime
- Bring up detector at RHIC Flattop and detector ramp down for beam dump
  Run 16: 7 (5) minutes vs Run 14: 9 (11) minutes

Quarkonia (MTD) related: (triggered/luminosity)

- High-Level Trigger dedicated to online dimuon selection
- Express stream of Upsilon candidates x10 reduction
- Reduce monitoring triggers to minimum required

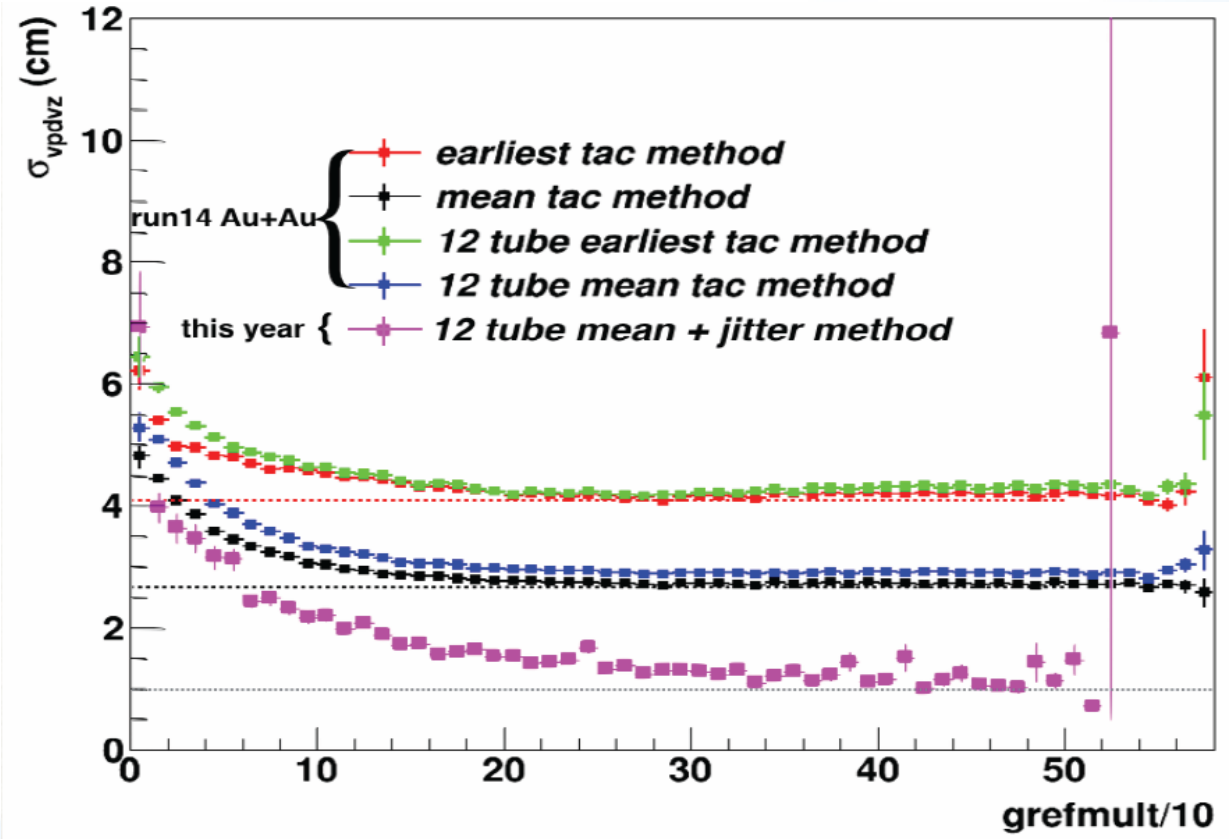
MINIMUM BIAS TRIGGER PURITY

- Due to HFT acceptance only events within |Vz| < 6 cm are being analyzed using HFT
- Improvements to the online selection with the Vertex Position Detector significantly increased the MB trigger purity

➡ Earliest TAC ➔ average of TACs

➡ Jitter reduced using pulser signals

➡ MB Trigger Purity increased from ~73% (Run 14) to 85%



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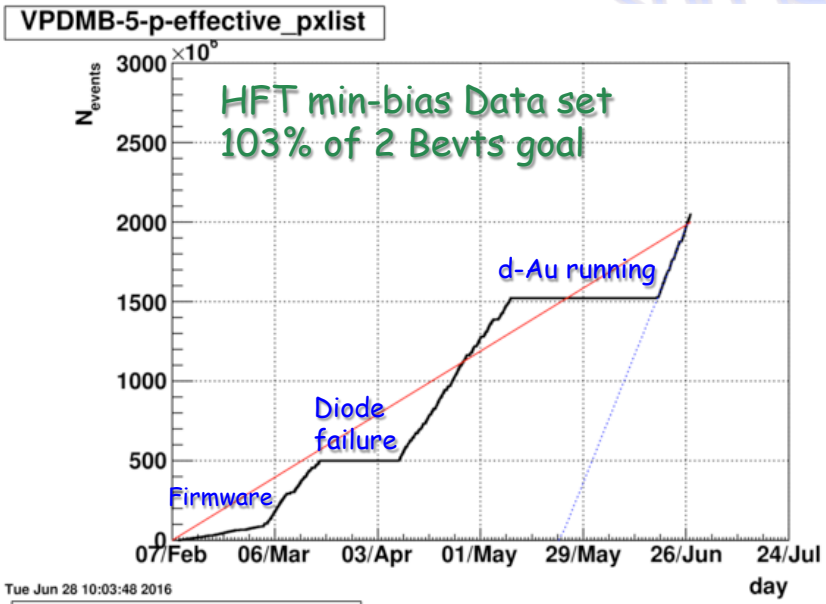
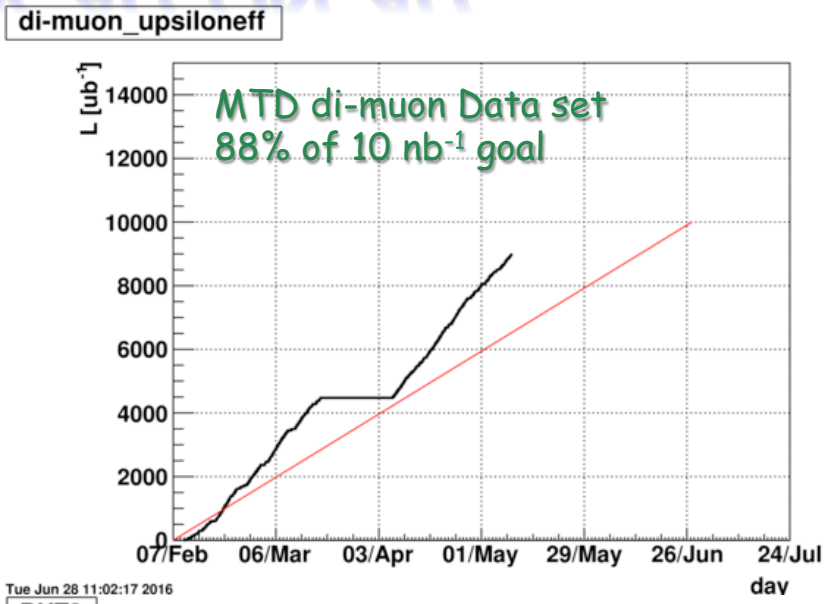
Run 16 as run based on 23.5 weeks cryo operation

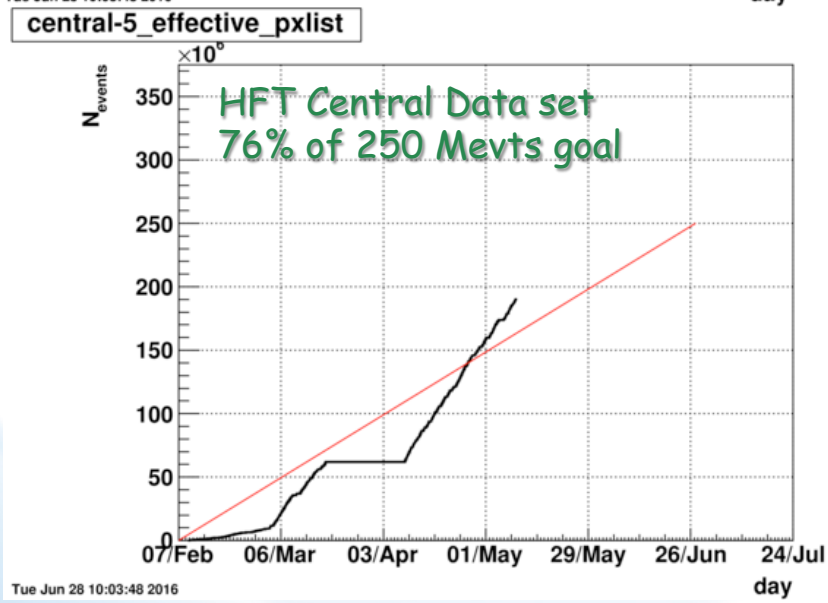
- 19 Jan, Begin cool-down to 4.5K
- 25 Jan, Beam in Yellow
- 26 Jan, Beam in Blue
- Feb 3, First Collisions
- 7 Feb, Begin 10 week $\sqrt{s}$=200 GeV/n AuAu physics run
- 7 am March 18th, RHIC Operations halted for Blue ring Diode issue
- 7 pm April 6th, RHIC Operations resumed (19.5 days offline)
- Decision made to add 19.5 days to the AuAu running to account for the Diode related down time
- 9 May, End 10 week (+ 2 days) $\sqrt{s}$=200 GeV/n AuAu physics run
- 12 May, Begin 1 week $\sqrt{s}$=200 GeV/n dAu physics run
- 20 May, End ~1 week $\sqrt{s}$=200 GeV/n dAu physics run
- 21 May, Begin 1 week $\sqrt{s}$=62 GeV/n dAu physics run
- 27 May, End ~1 week $\sqrt{s}$=62 GeV/n dAu physics run
- 28 May, Begin 1.5 week $\sqrt{s}$=19.6 GeV/n dAu physics run
- 8 June, End 1.5 week $\sqrt{s}$=19.6 GeV/n dAu physics run
- 10 June, Begin 1 week $\sqrt{s}$=39 GeV/n dAu physics run
- 17 June, End 1 week $\sqrt{s}$=39 GeV/n dAu physics run
- 17 June, Begin ~8 day Return to 200 GeV/n AuAu physics run
- 27 June, End of 200 GeV/n AuAu physics run
- 27 June, begin cryo warm-up
- 1 July, Cryo warm-up complete, *23.5 cryo weeks* of operation

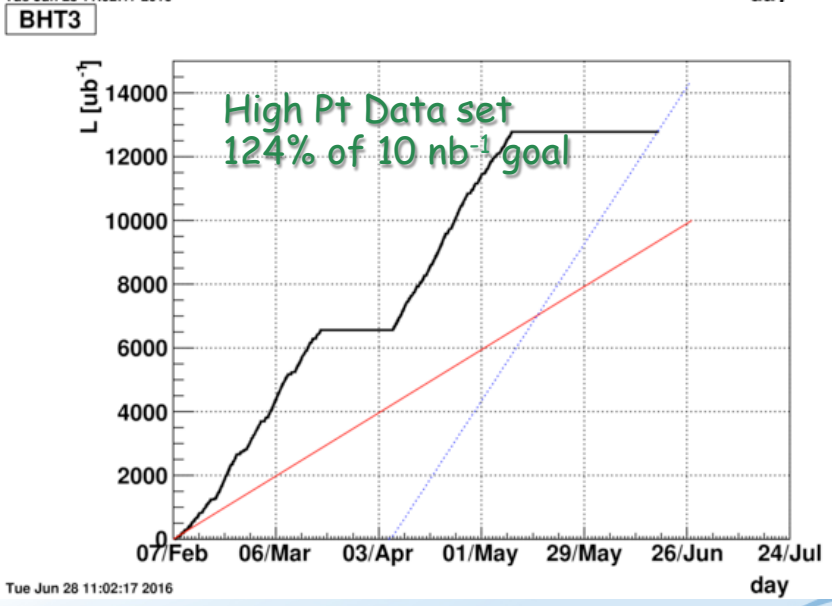
SUMMARY OF DATA SET GOALS AND DATA SETS ACCUMULATED

200 GEV AU ON AU



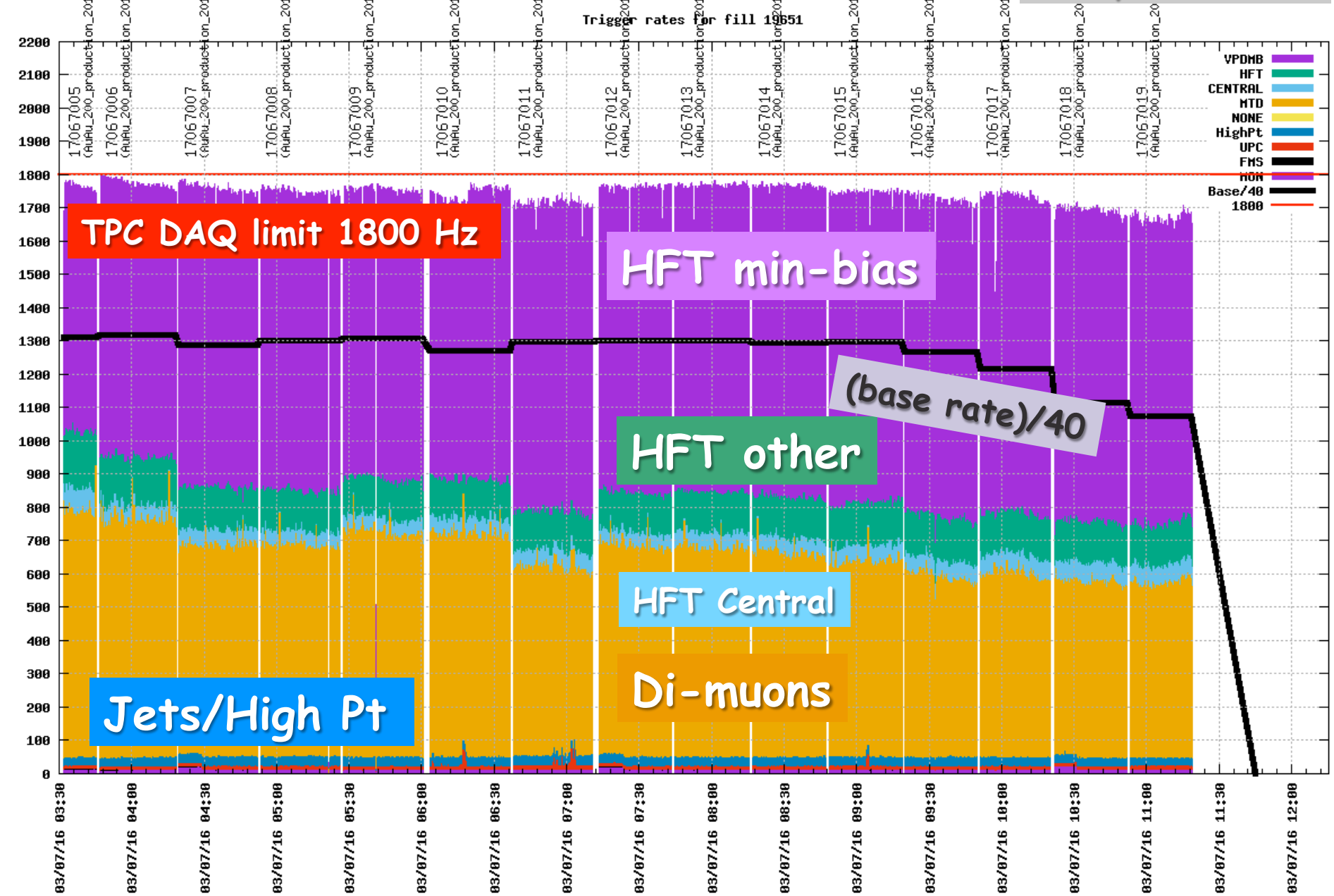






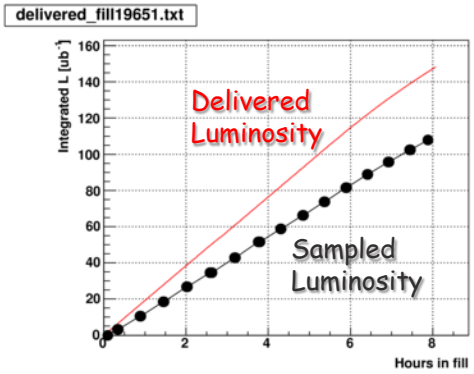
TPC BANDWIDTH IN AU + AU

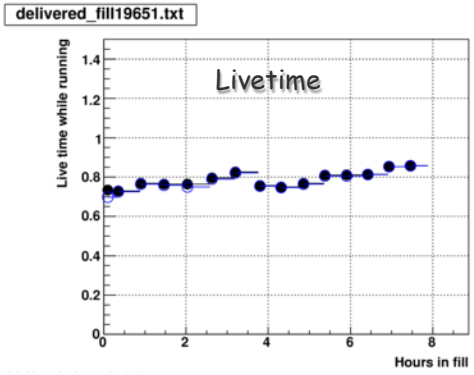
example fill 19651

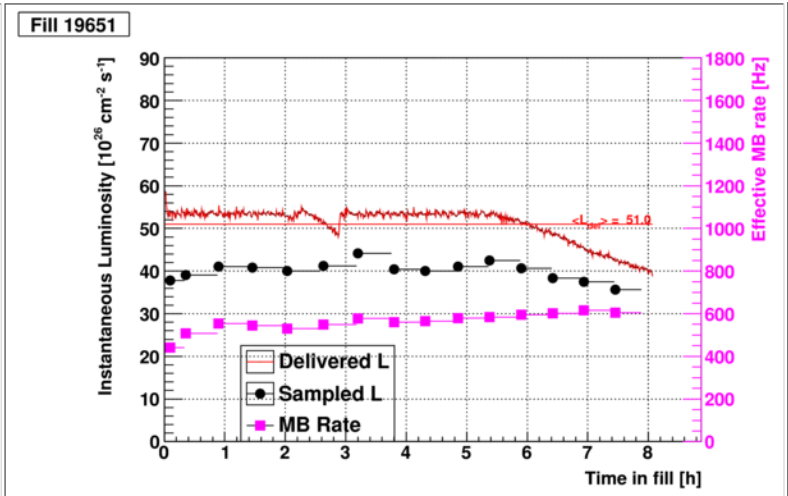


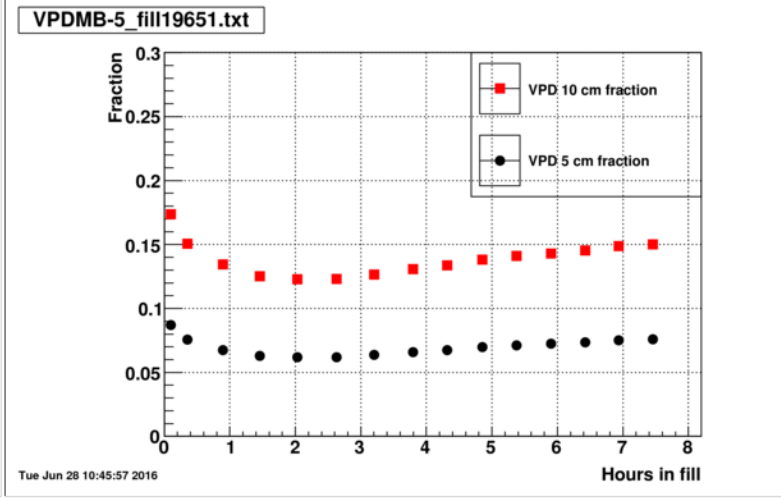
RUNNING EFFICIENCY DEFINITIONS

Fill 19651
Started Mon Mar 7 03:25:39 2016
Ended Mon Mar 7 11:29:58 2016
8.1 Hours
0.9 Hours since last fill
Total delivered: 148.238 ub^-1
Average delivered: 51.013x10^26 cm^-2s^-1
Sampled Fraction: 0.724
after correction by average TCULive/Live: 0.995
Fraction of L delivered while taking data: 0.927
Fraction of hours delivered while taking data: 0.924
Minutes lost before first run: 5.9 Frac: 0.012
Minutes lost after last run: 11.2 Frac: 0.023
Luminosity fraction lost before first run: 0.012
Luminosity fraction lost after last run: 0.018
Average Live Time while taking data: 0.786
Live Time from TCU Counters while taking data: 0.782







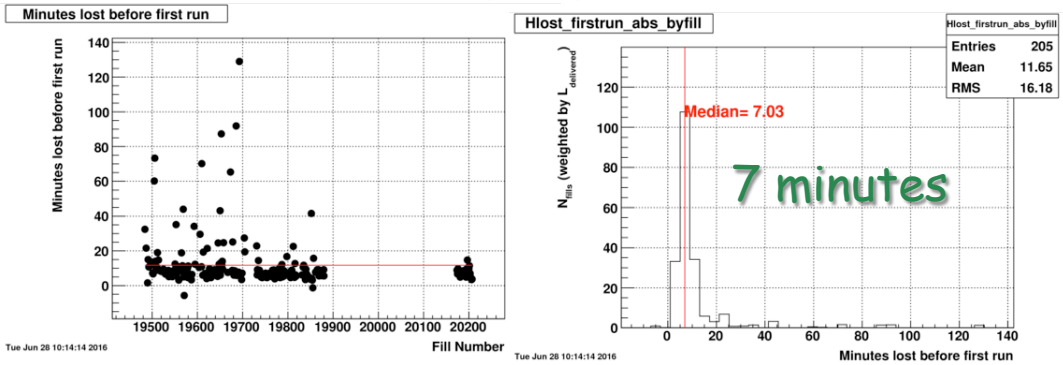


The next slide will show distributions for these quantities for all Fills in the AuAu 200 GeV run

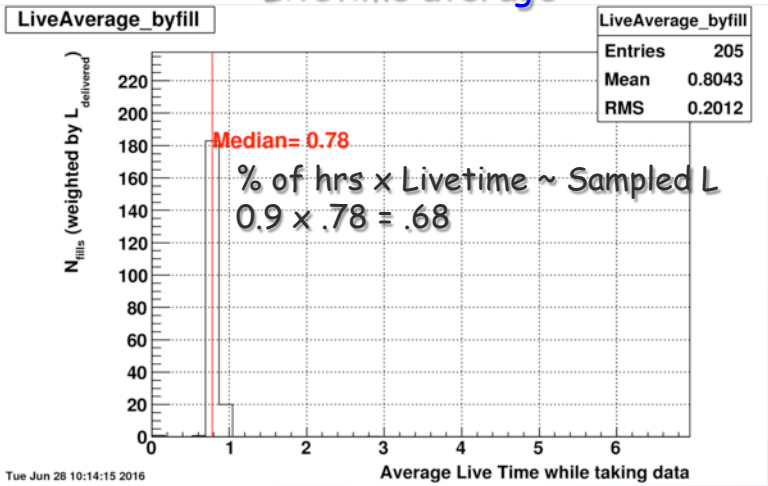
These plots come from a Web page that Jaime Dunlop constructs and maintains for STAR

RUNNING EFFICIENCIES FOR THE 200 GEV AUAU RUN

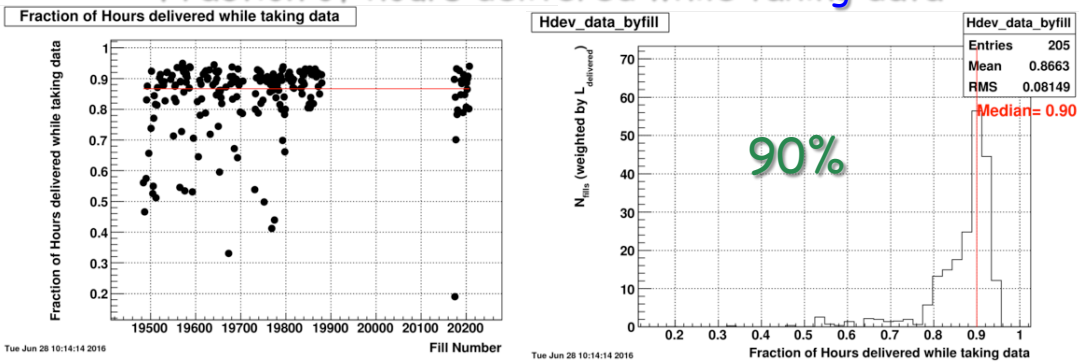
Minutes before first data run



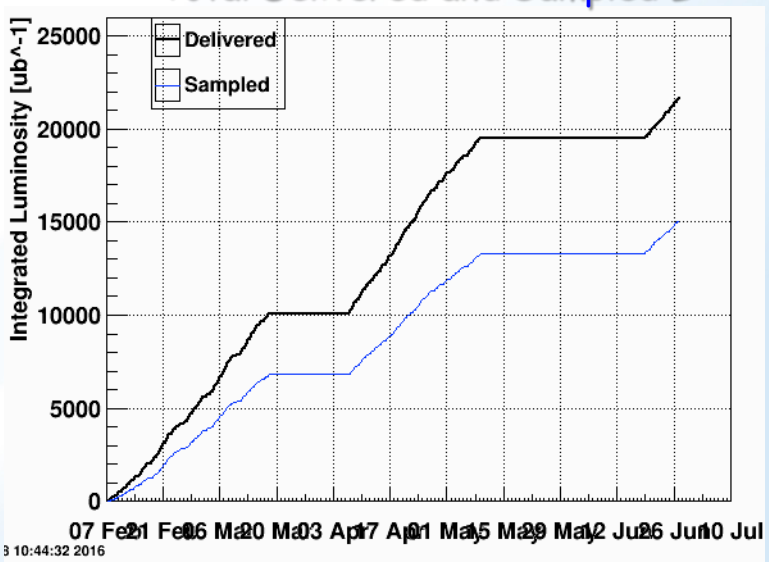
Livetime average



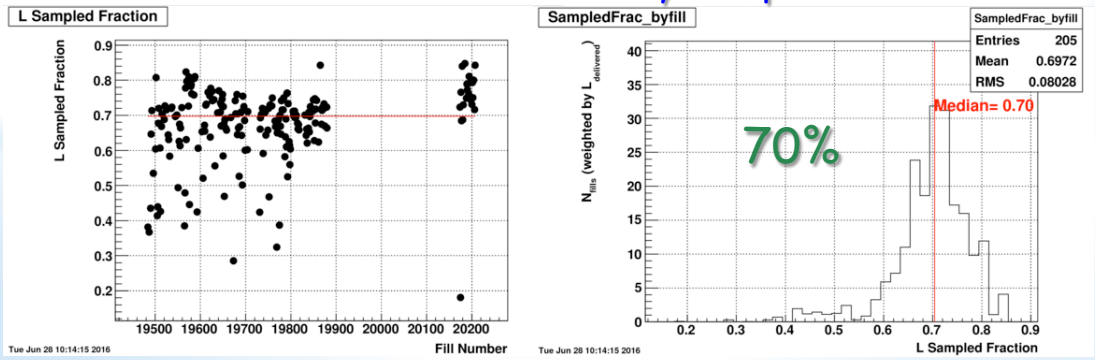
Fraction of hours delivered while taking data



Total Delivered and Sampled L



Fraction of luminosity Sampled



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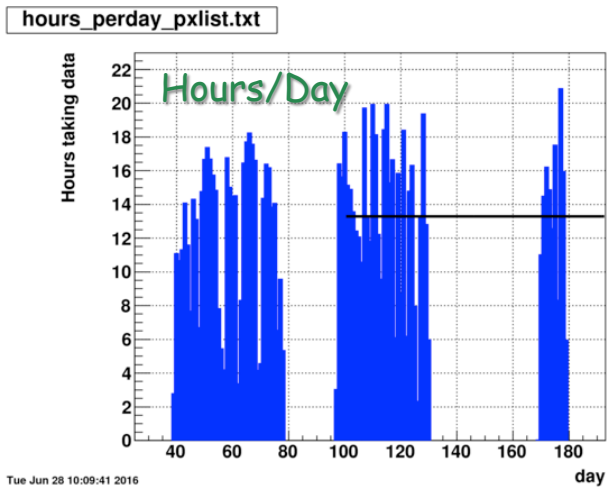
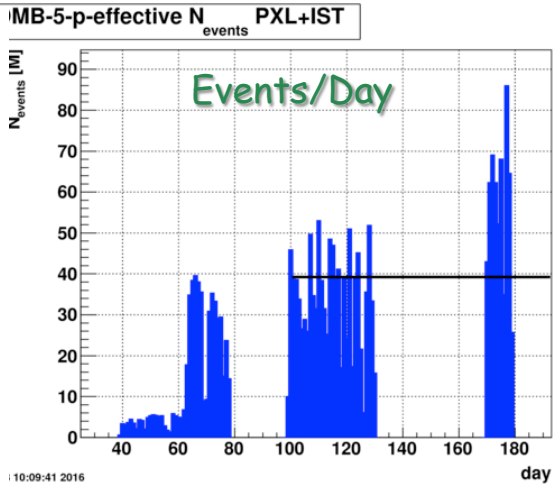
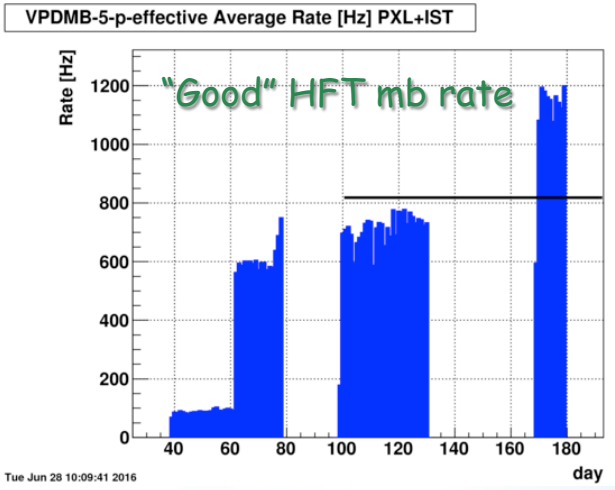
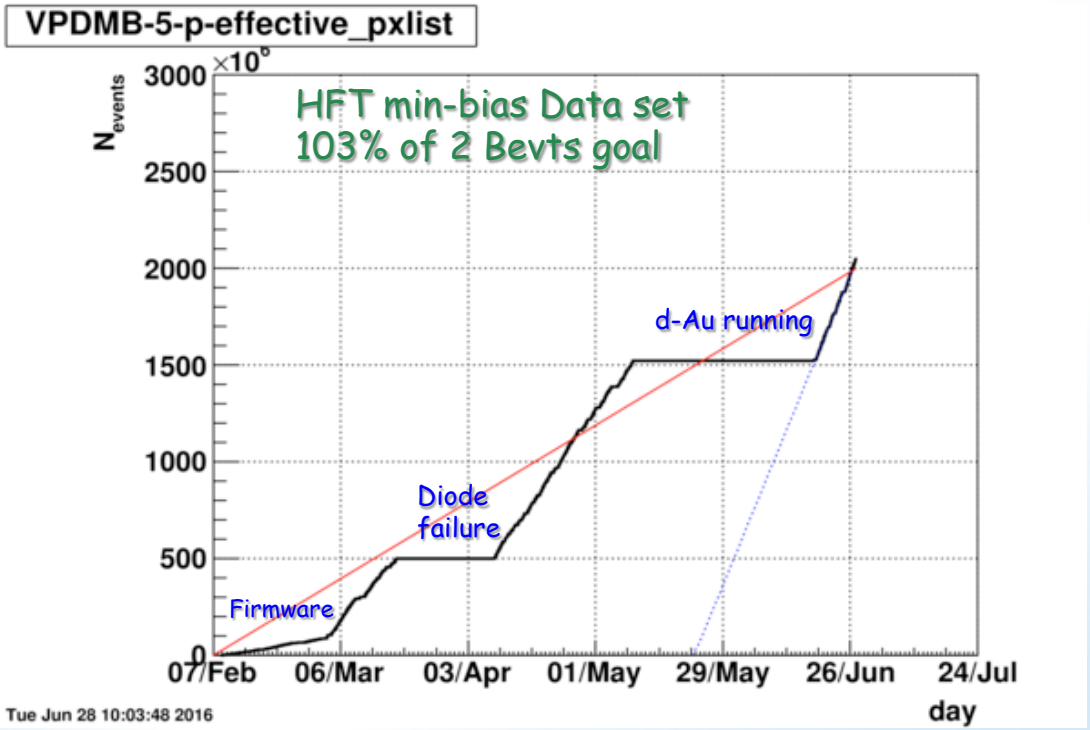
HFT MIN-BIAS DATA SET SUMMARY







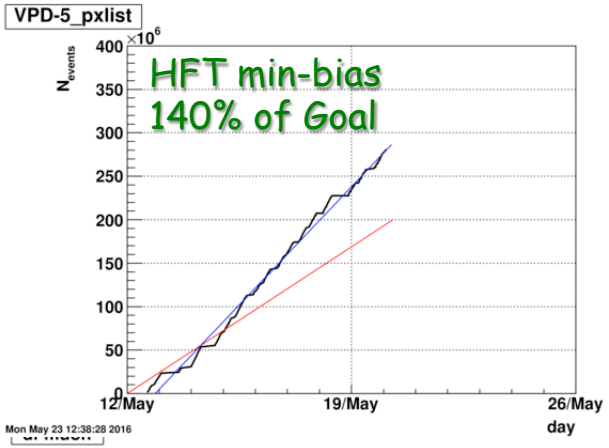


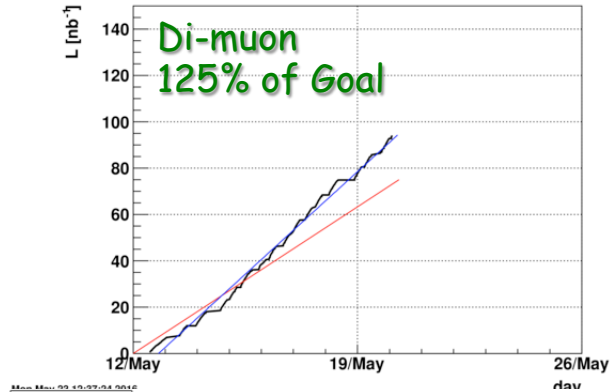
A Reminder of what STAR requested for Run 16

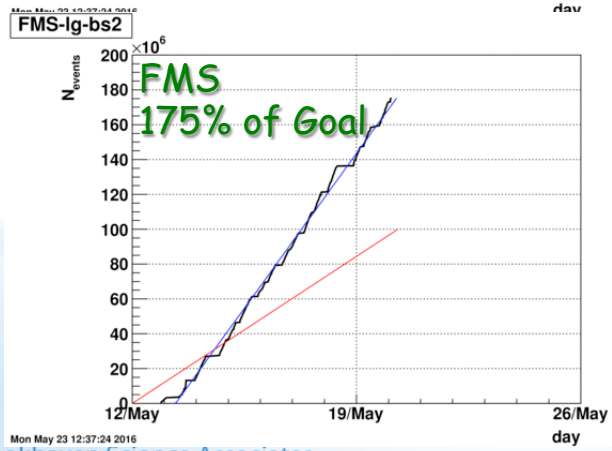
2015 BUR → RUN 16

Run	Energy	Duration	System	Goals	priority	Sequence
16	$\sqrt{s_{NN}}$=200 GeV	13-wk	Au+Au	L_c, D v_2, R_{AA}, Υ R_{AA} 10nb^{-1}, 2billion MB	1	1
	$\sqrt{s_{NN}}$=62 GeV	4-wk	Au+Au	1.5B MB (1B w/ HFT)	4	2
	$\sqrt{s_{NN}}$=19.6 GeV	1-wk	d+Au	100M MB	4	3

200 GEV DEUTERON + GOLD

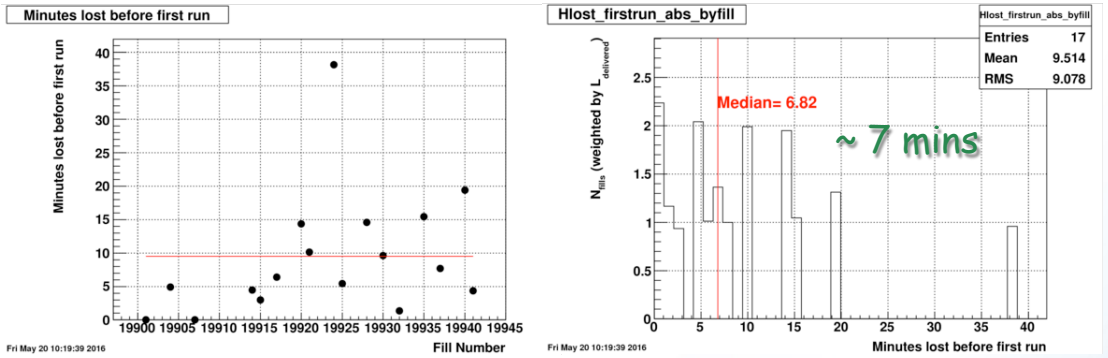




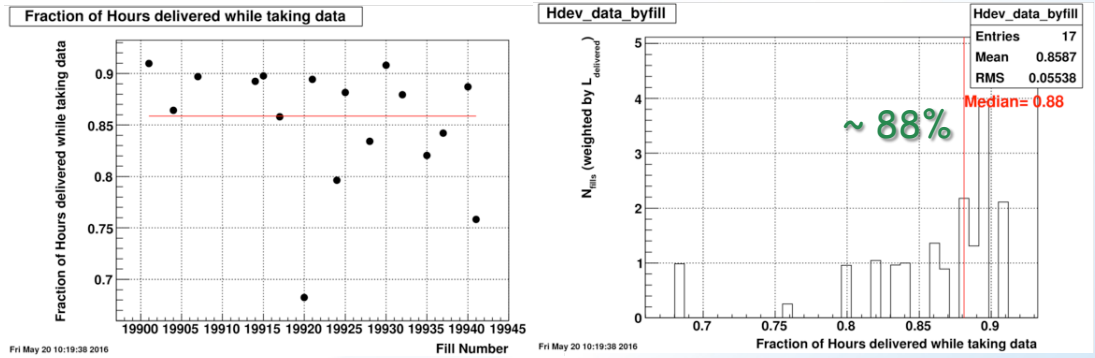


Running Efficiency

Minutes before first Run



Fraction of hours delivered while taking data

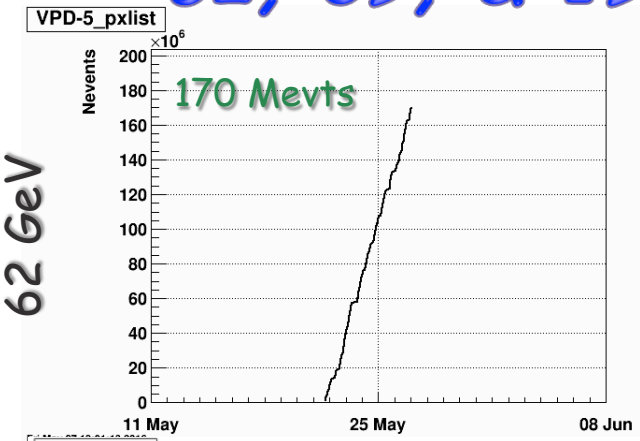


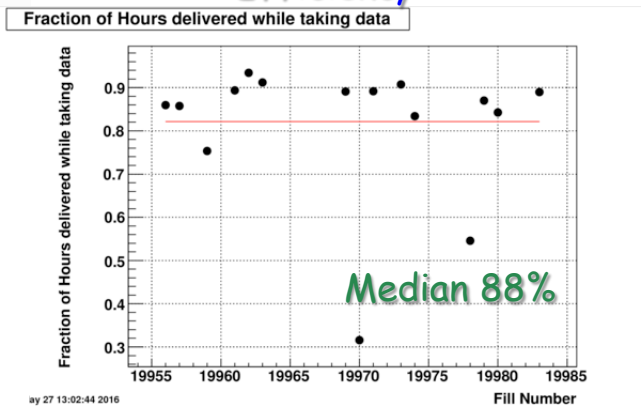
Though STAR didn't request 200 GeV d-Au, due to firmware issues with the PXL in Run 15, we were very glad to get this data set.

62, 39, & 19.6 GEV DEUTERON + GOLD

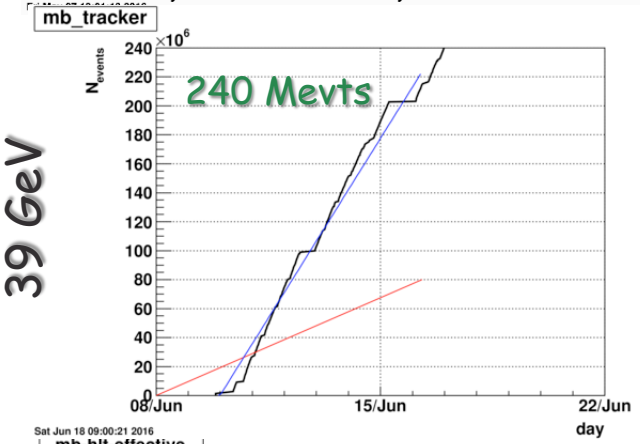
Efficiency

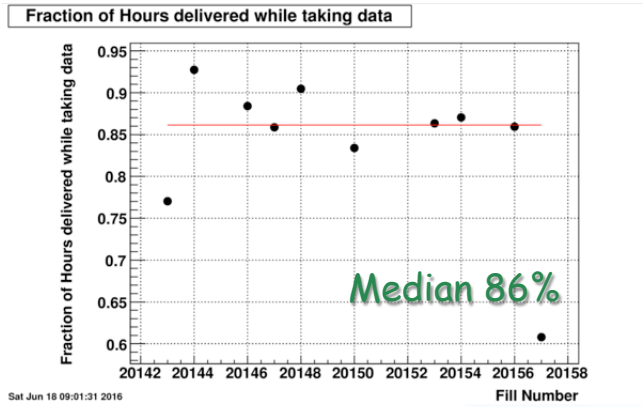
62 GeV



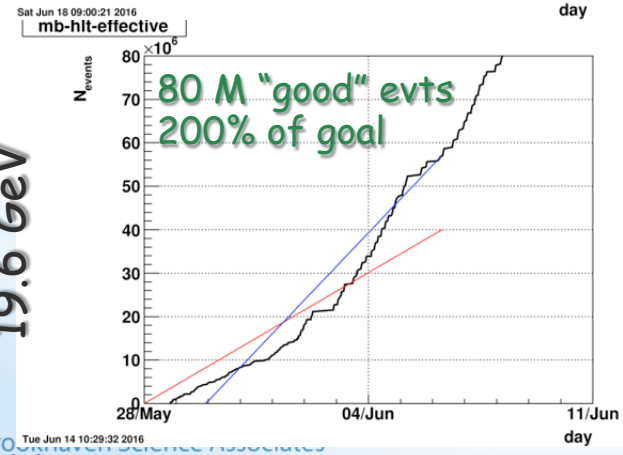


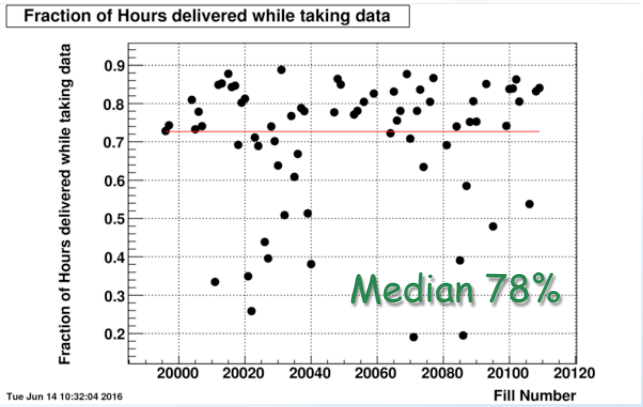
39 GeV





19.6 GeV





STAR Accumulated four good d+Au data sets

✓

Requested by STAR

BROOKHAVEN NATIONAL LABORATORY

NEXT YEAR – RUN 17

BUR EXECUTIVE SUMMARY TABLE

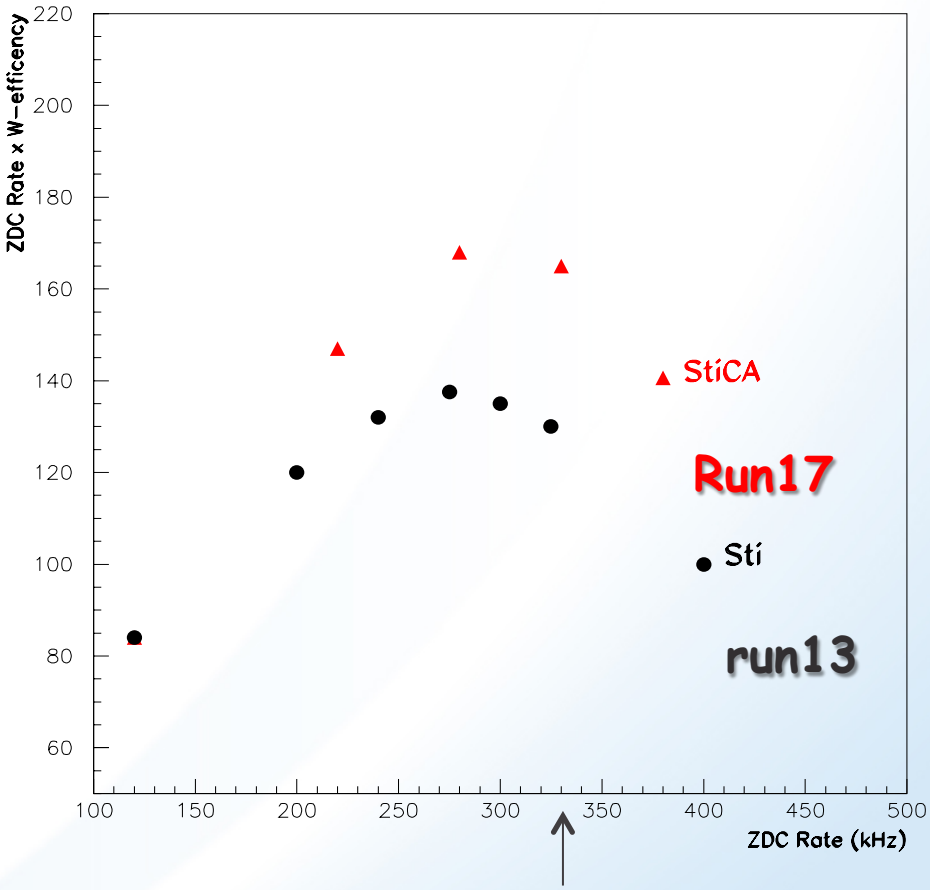
Run	Energy	Duration	System	Goals	priority	Sequence
17	$\sqrt{s_{NN}}$=500 GeV	13-wk	Transverse p+p	A_N of $W^{\pm}$, Υ, Drell-Yan, L=400 pb^{-1}, 55% pol	1	1
		1-wk	p+p	RHICf		2
		2-wk	CeC			
	$\sqrt{s_{NN}}$=62.4 GeV	4-wk	Au+Au	Jets, dileptons, NPE 1.5B MB	3	3
18	?s_{NN} =200 GeV	3.5-wk	Ru+Ru	1.2B MB	2	4
	?s_{NN}=200 GeV	3.5-wk	Zr+Zr	1.2B MB	2	5
	?s_{NN}=27 GeV	2-wk	Au+Au	>500M MB	3	6

Options from guidance:

1) 24 cryo-weeks in run 17, 13 weeks in run 18
2) 19 cryo-weeks in run 17, 13 weeks in run 18
3) If only 15 weeks in run 17, all for pp500

PP500 OPERATION MODE FOR W-BOSON

- STAR TPC event pile-up affects tracking efficiency
- The W-boson reconstruction efficiency was obtained from the data measured in 2011 to 2013 and with improved Tracking Algorithm.
- The highest FoM is reached at a ZDC rate of 330 kHz corresponding to a luminosity of 1.5×10^{32} $cm^{-2}s^{-1}$.
- Optimization of delivered luminosity with dynamic beta* squeeze.
- Requires 13 weeks to reach $400pb^{-1}$



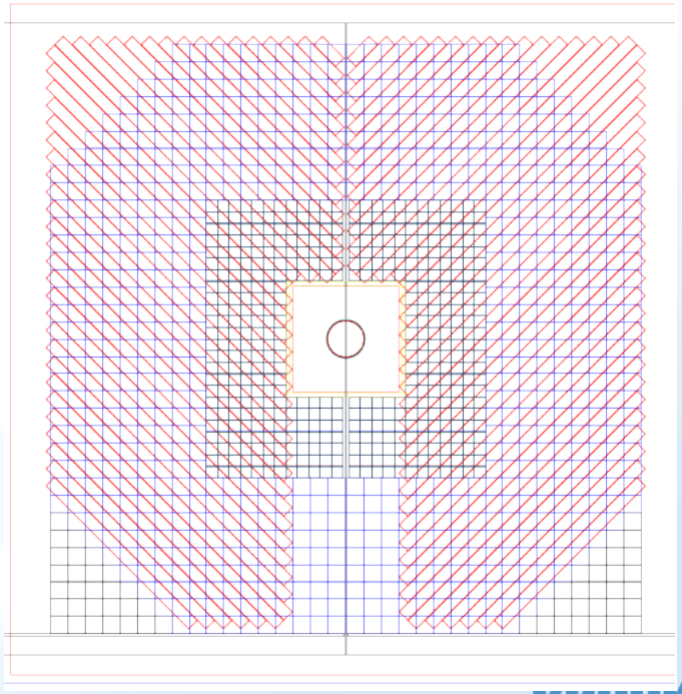
FORWARD DETECTOR PREPARATION FOR RUN 17

Forward Meson Spectrometer (FMS) + FMS Pre-shower + FMS Poster-Shower

Installation of pre-shower for run 15

1. All three detector subsystems:
   existing FMS, Pre-shower
   Add new post-shower
2. Add UV lights to cure FMS radiation

https://drupal.star.bnl.gov/STAR/system/files/STAR.FMS_.Postshower.v2.pdf



FMS radiation cure by UV lights

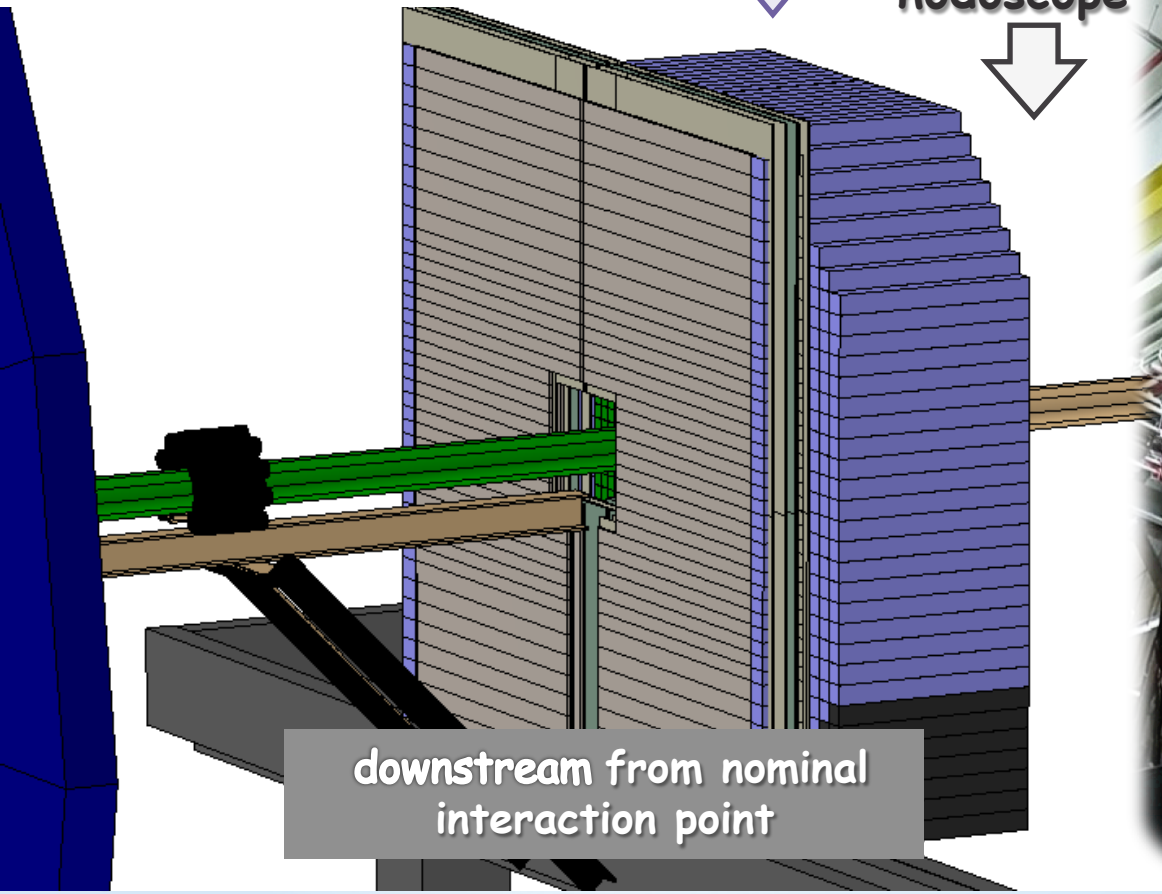
PRESHOWER AT FORWARD RAPIDITIES

Forward Meson Spectrometer

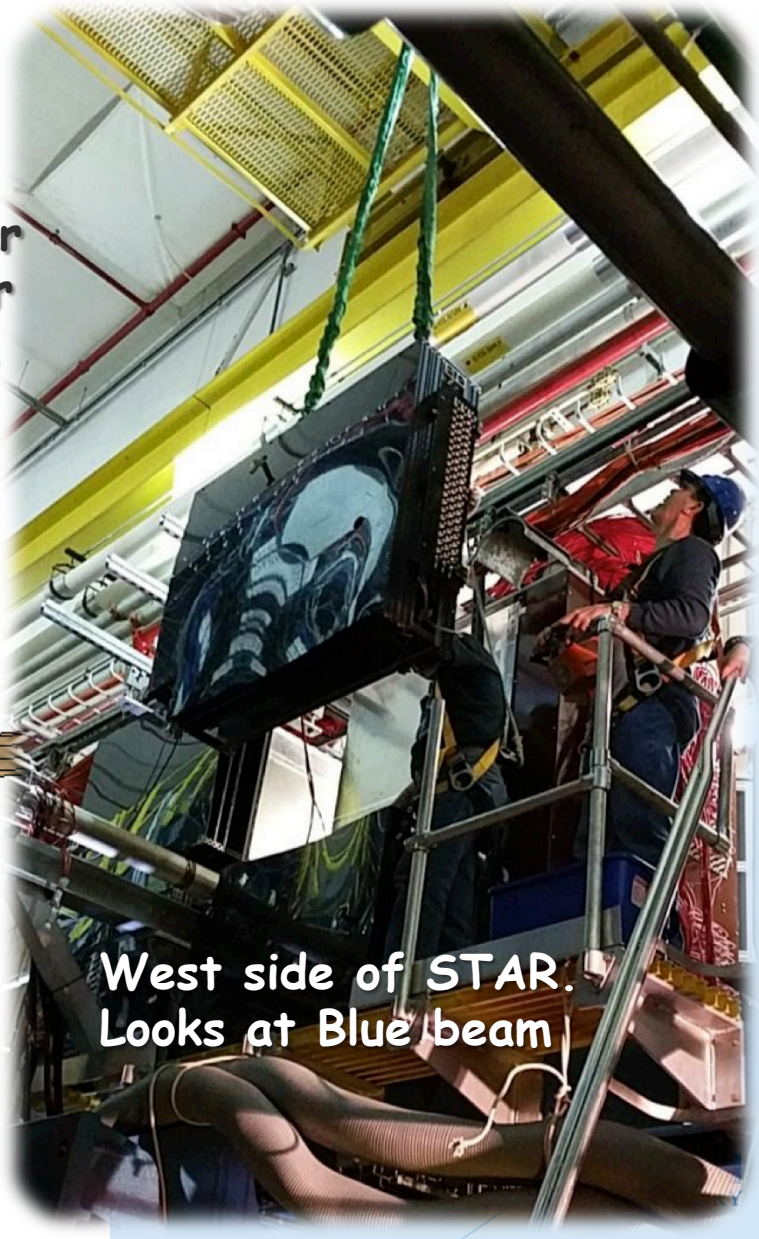
Preshower scintillator hodoscope

476+788 PbGl towers

Postshower scintillator hodoscope



downstream from nominal interaction point

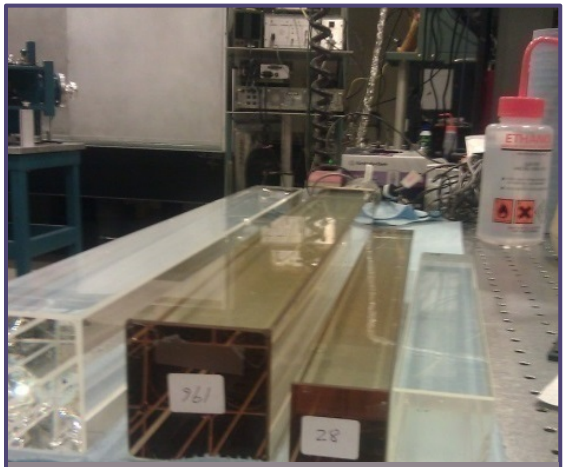


West side of STAR. Looks at Blue beam

FMS REFURBISHING IN 2014

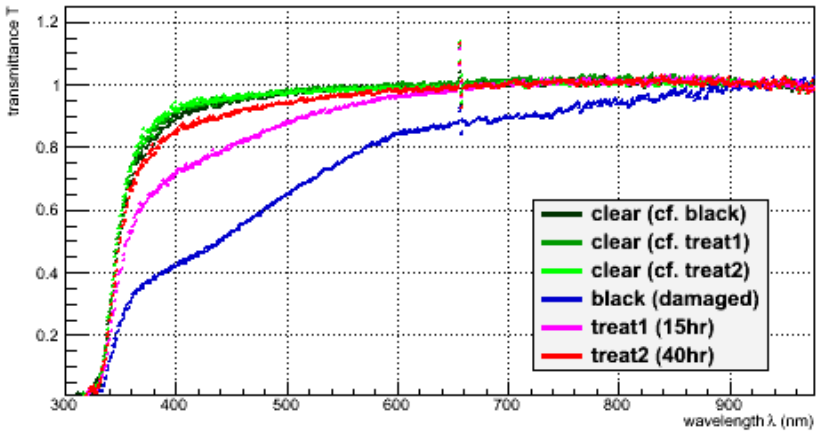
Pb-glass was annealed in sunlight. New system to anneal in place with UV

Replacement of PMT and bases



Curing of radiation damage

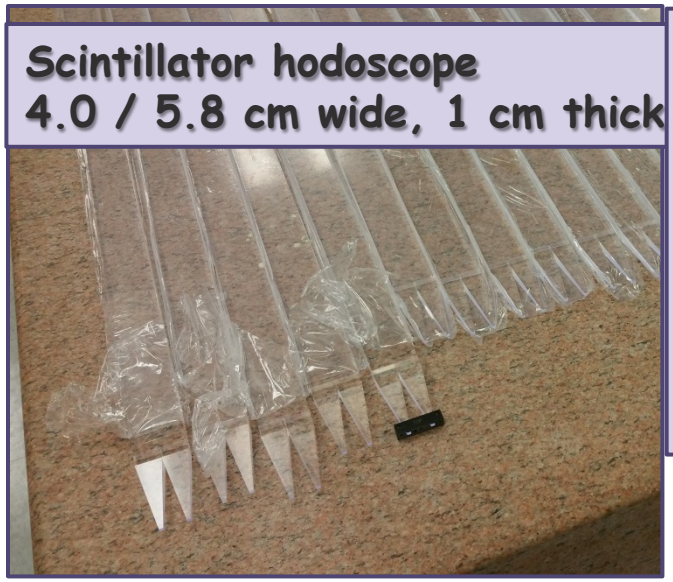
PbGl transparency after UV curing



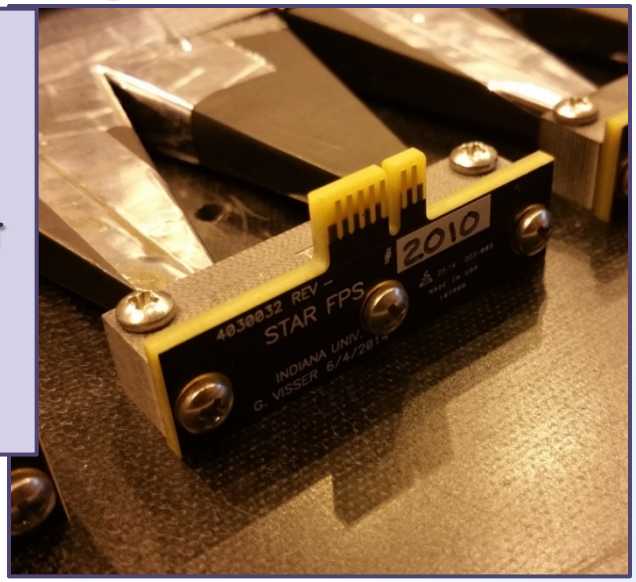
FORWARD PRESHOWER CONSTRUCTION

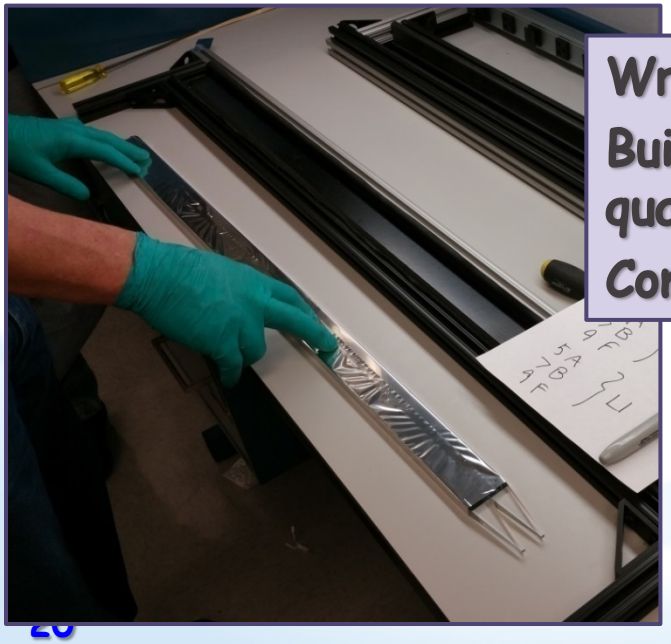
Post Shower detector will use similar fabrication/design, no Pb converter.

Scintillator hodoscope
4.0 / 5.8 cm wide, 1 cm thick

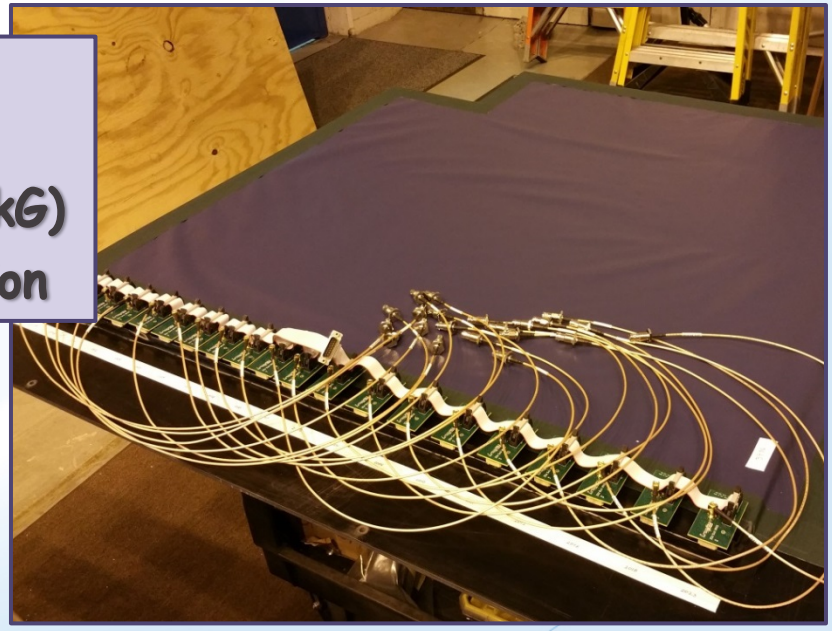


- Double pyramid light guide
- SiPM readout
- Three layers for 2d hit reconstruction
- channels
- Pb converter (~1 X_0)

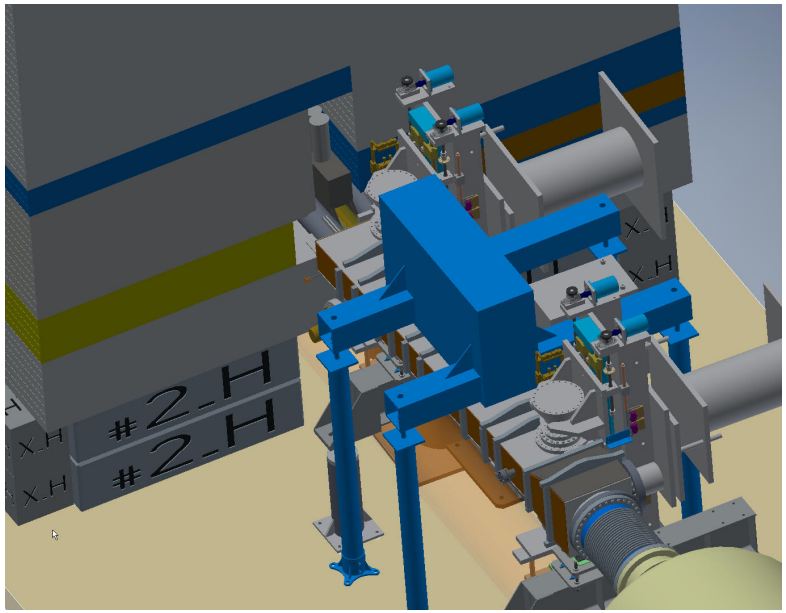


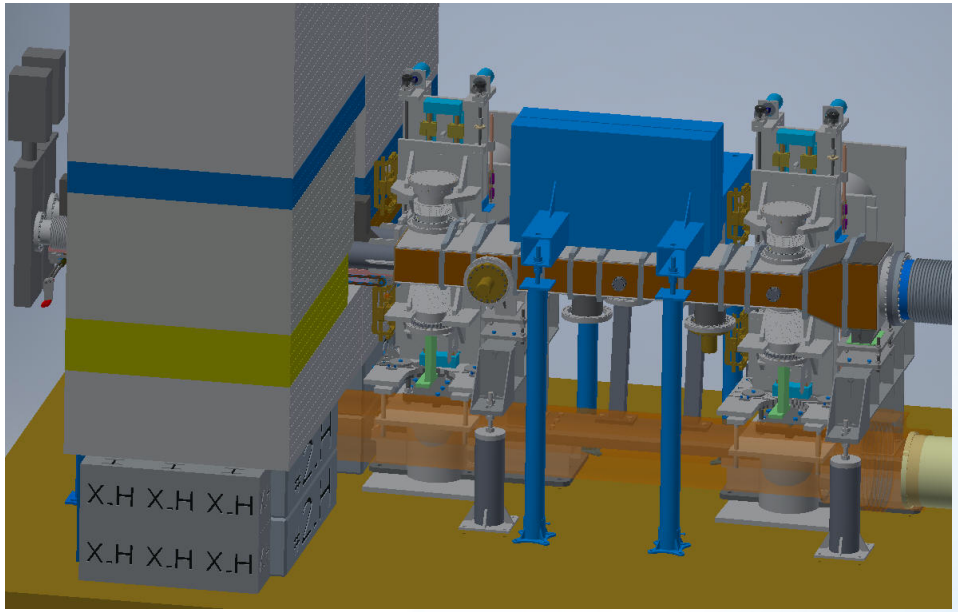


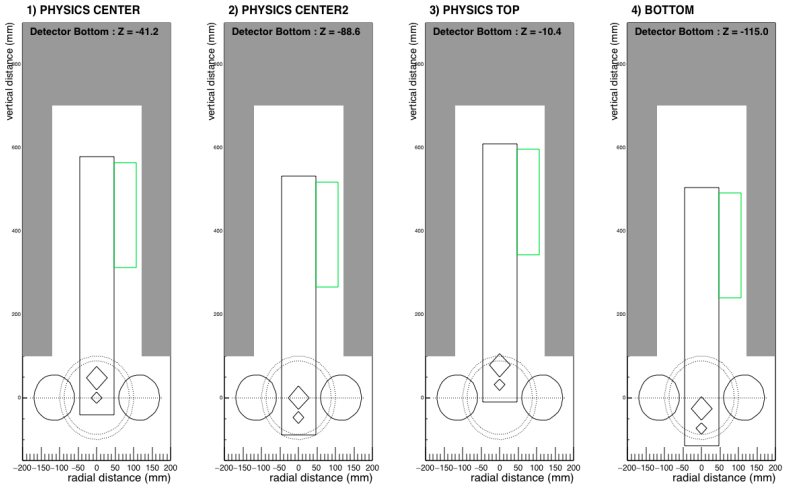
Wrapping at BNL
Built in complete quadrants (~ 100 kG)
Compact installation



RHICF INSTALLATION ON THE WEST SIDE OF STAR







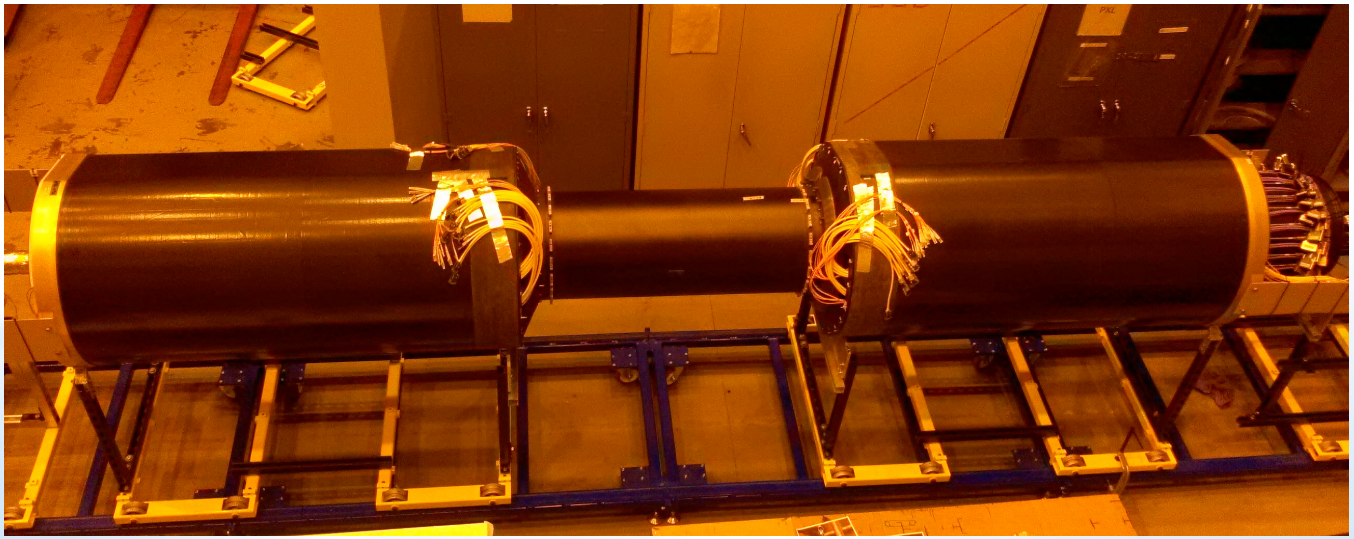
The RHICf setup is a position sensitive calorimeter system to be positioned just in front of the ZDCs on the West side of STAR.

It will measure cross sections for particles traveling in the Blue beam direction.

BROOKHAVEN NATIONAL LABORATORY

CHANGING INNER CONE AND BEAM PIPE FOR RUN 17

Shown at left is the original STAR inner Carbon Fiber support cone. This will be reinstalled, along with the original 8 cm diameter beam pipe for Run 17.



The HFT inner support cone, along will all the Silicon detector (PXL, IST, and SSD), and the 4 cm diameter beam pipe will be removed.

COMMENTS ON RHIC RUN 16

The 200 GeV Au on Au running went very well:

- With few exceptions, the RHIC Operations crews did a good job keeping the luminosity profile flat at STAR for the majority of the store lengths.
- The Stochastic cooling operation, with the strength (aka "fear factor") adjustments during the stores, worked well.
- One aspect of the 200 GeV Au on Au running that could have been done better would have been to stay with this initial run configuration until STAR had achieved the highest priority goal for Run 16 (the 2 Bevts HFT min-bias goal). This would have removed one of the six beam set ups during the run.

The d on Au Energy Scan running went very well:

- The four beam setups for the d-Au Energy scan were all done very quickly and efficiently. I believe it is correct to say that they all took less time than estimated.
- The fluid interleaving of the maintenance days, APEX sessions, and CeC commissioning time with the Physics running led to uncertain short range schedules, but it actually worked out OK.

COMMENTS ON RHIC RUN 16 (2)

The communication between the RHIC Scheduling Physicist and the STAR Experiment was nothing short of Excellent. Best it has ever been!

SUMMARY

- STAR set ambitious data set goals for the RHIC Run 16 200 GeV Au on Au running. They were ambitious with the requested 13 weeks, and extremely ambitious with the PAC recommended 10 weeks. The combination of the multiple improvements that STAR made in preparation for, and during the run, the very efficient operation of the STAR detector, and the exceptionally good time at store provided by RHIC, allowed us to achieve the highest priority HFT data set goal, as well as 88% of our high priority di-muon data set goal.

- The efficiency displayed by the entire RHIC complex and personnel in executing the d-Au energy scan program was exceptional.

- STAR looks forward to the exciting 510 GeV transversely polarized pp physics program planned for Run 17.

- STAR extends its thanks and appreciation to the C-AD department for a very successful RHIC Run 16