

STAR RUN 16 REPORT

DAVID TLUSTY (RICE UNIVERSITY)
FOR THE STAR COLLABORATION



U.S. DEPARTMENT OF
ENERGY

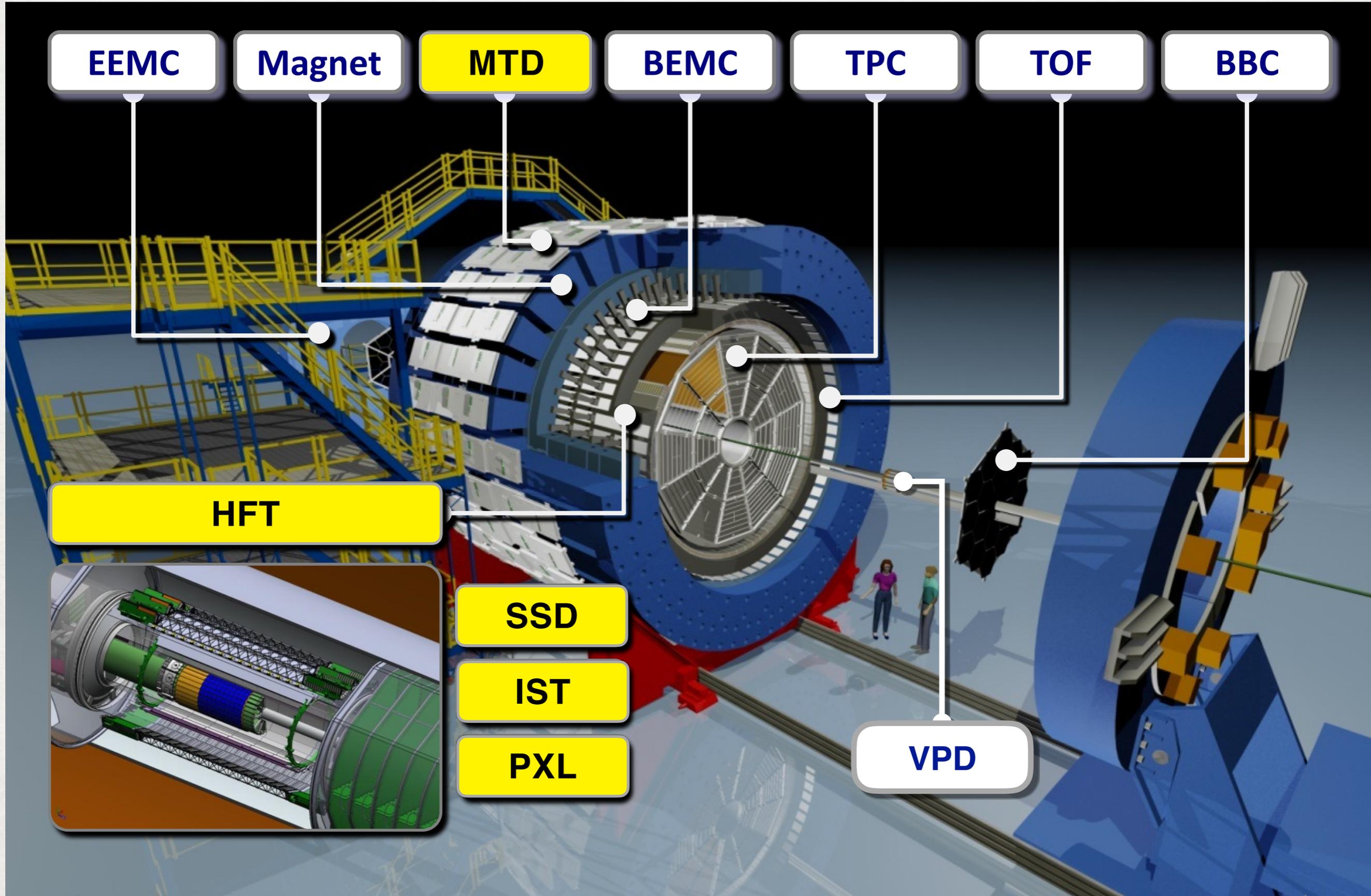


OUTLINE

- ★ Beam User Request (BUR) for Run 16 and PAC recommendation
 - Run 16 is predominantly last run of Heavy Flavor (HF) program and continuation of Run 14
- ★ Detector Upgrades and Improvements
- ★ Detector performance
- ★ Run Performance
- ★ Summary



THE STAR DETECTOR IN THE RUN





BEAM USE REQUEST FOR RUN 16

★ BUR 16+17

Energy	Duration	System	Goals	Priority	Seqence
$\sqrt{s_{NN}}=200$ GeV	13-wk	Au+Au	Heavy Flavor	1	1
$\sqrt{s_{NN}}=62$ GeV	13-wk	Au+Au	Gamma jet	4	2
$\sqrt{s_{NN}}=19.6$ GeV	13-wk	d+Au	BES	4	3

★ PAC Recommendations

Energy	Duration	System	Goals	Priority	Seqence
$\sqrt{s_{NN}}=200$ GeV	10-wk	Au+Au	Heavy Flavor	1	1
$\sqrt{s_{NN}}=200$ GeV	1-wk	d+Au	BES	4	2
$\sqrt{s_{NN}}=62.4$ GeV	1-wk	d+Au	BES	4	3
$\sqrt{s_{NN}}=19.6$ GeV	1.5-wk	d+Au	BES	4	4
$\sqrt{s_{NN}}=39$ GeV	1-wk	d+Au	BES	4	5

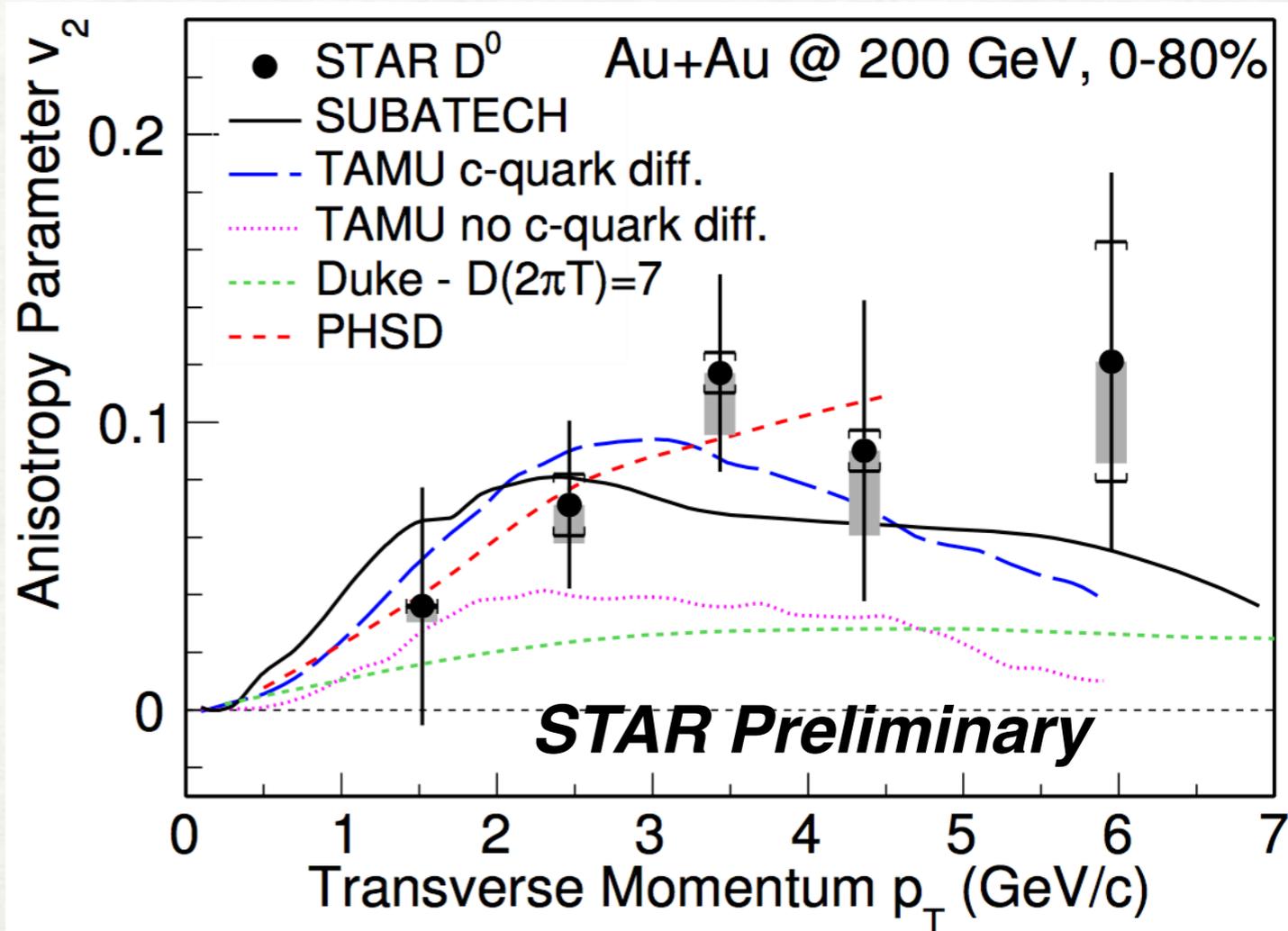
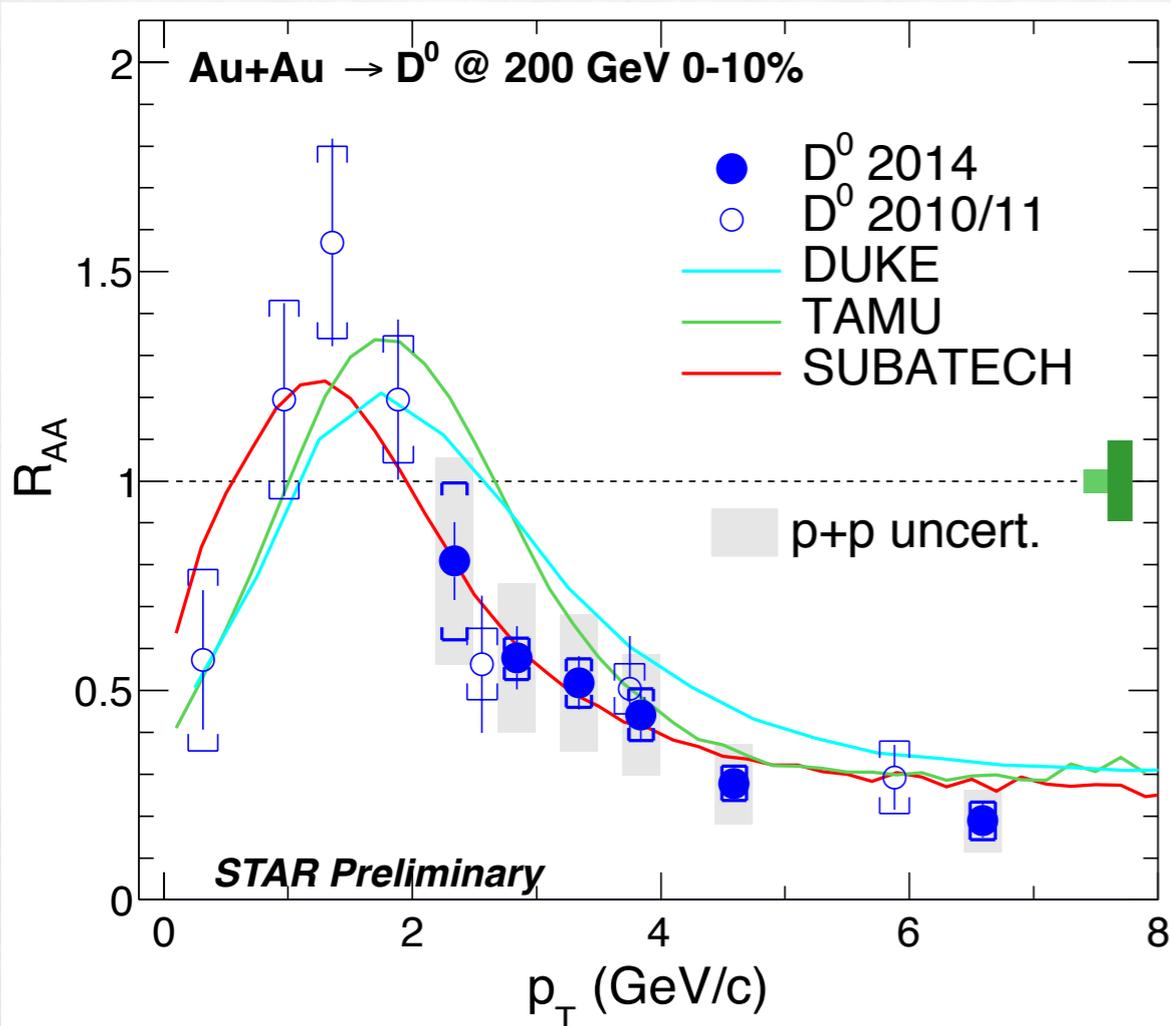


HEAVY FLAVOR HADRONS PROGRAM (HFT)

★ Carry out systematic measurements of HF hadrons (D mesons, Λ_c , B^0)

→ 1.2B Minimum Bias (MB) events collected in Run14

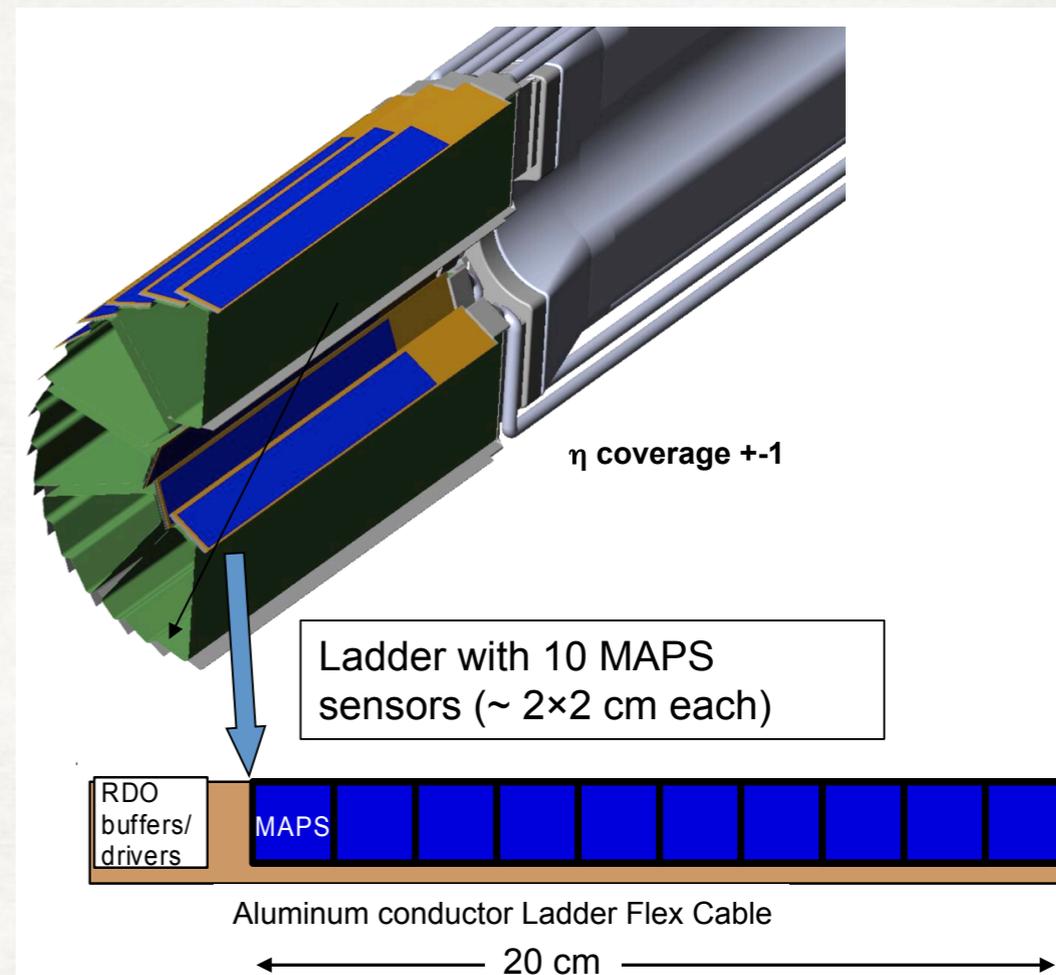
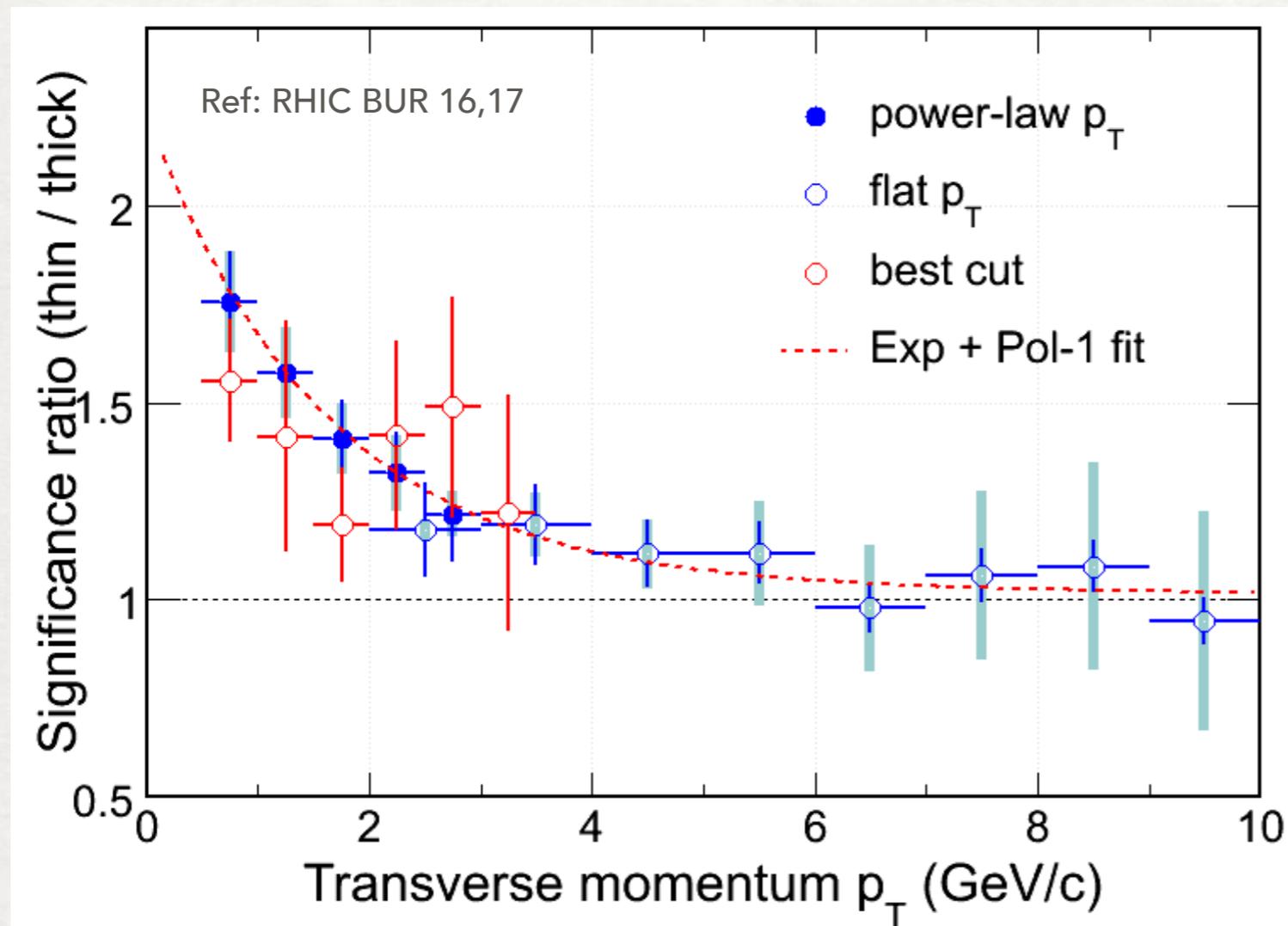
→ Need another 2B MB + 250M central events in Run 16 for $R_{cp}(\Lambda_c)/R_{cp}(D^0)$ measurement



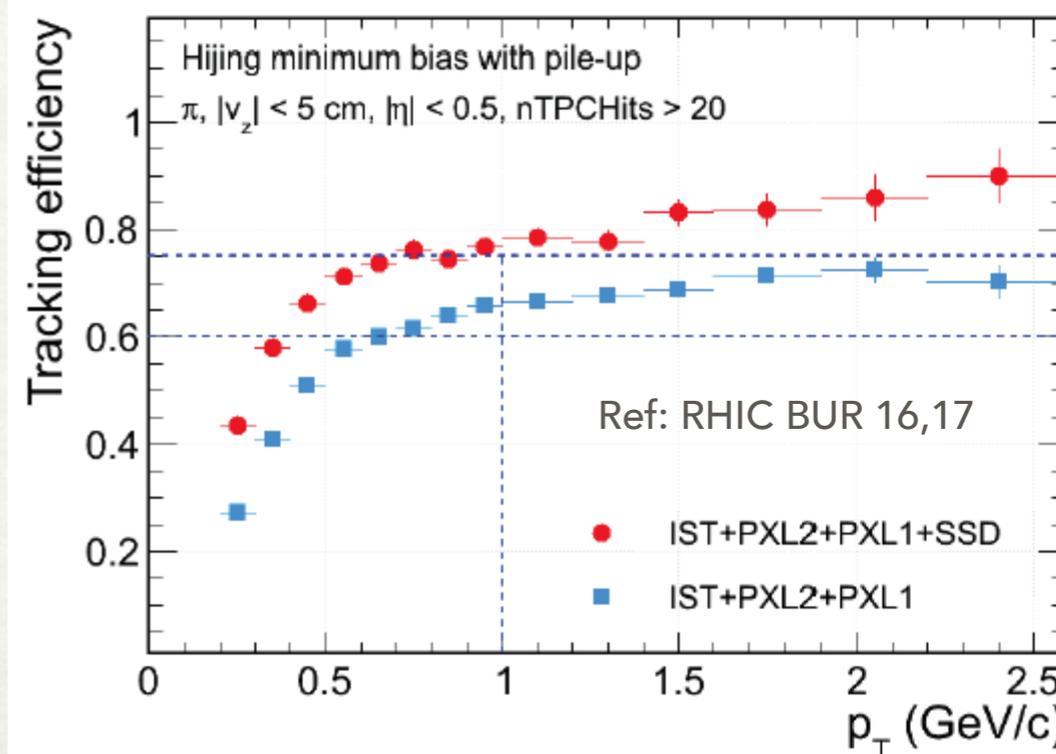


HEAVY FLAVOR HADRONS PROGRAM (HFT)

- pointing resolution improved (Cu → Al flex cables for PXL, material budget $0.52\%X_0 \rightarrow 0.37\%X_0$)



- Including SSD should improve the tracking efficiency by $\sim 15\%$

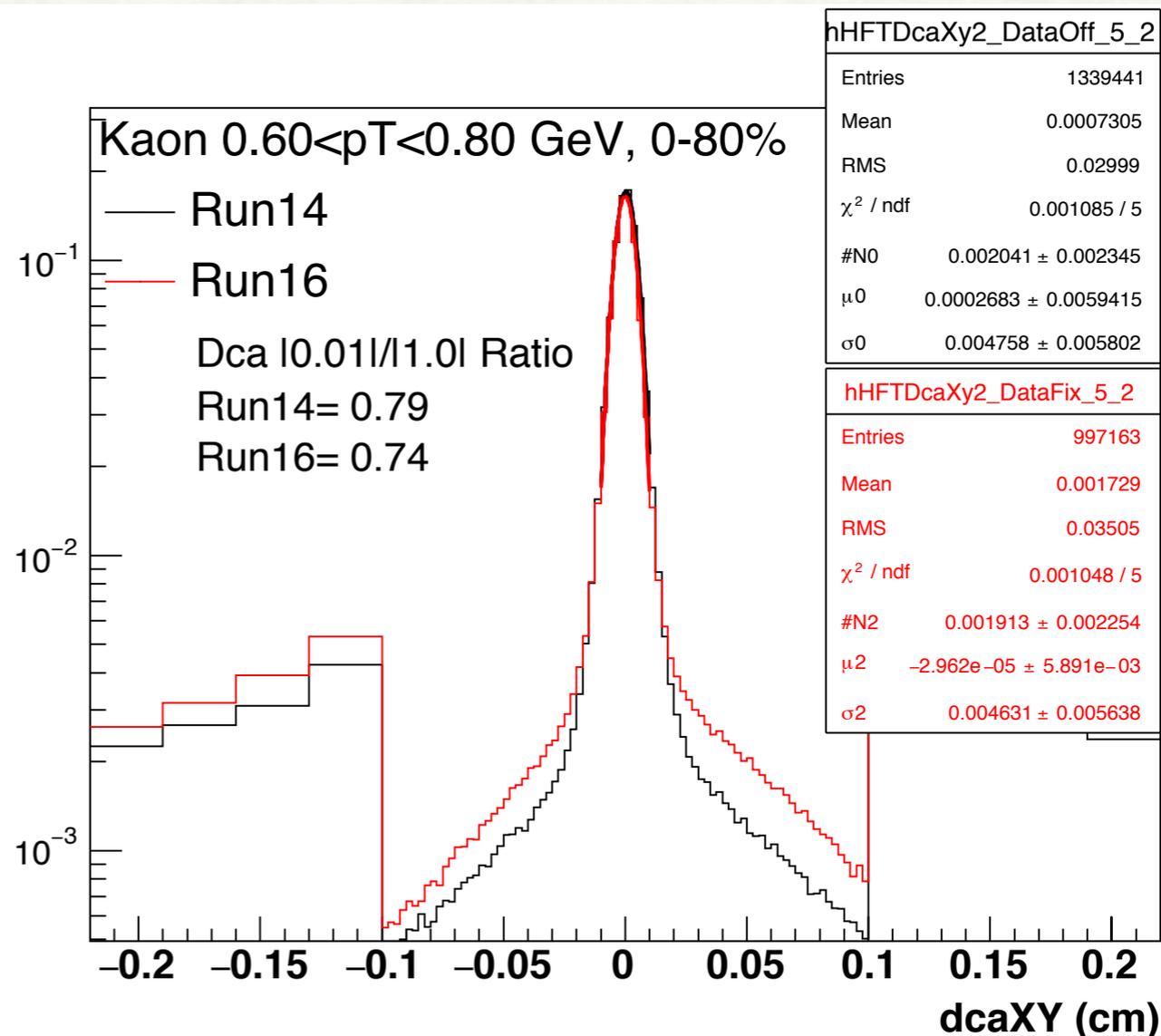
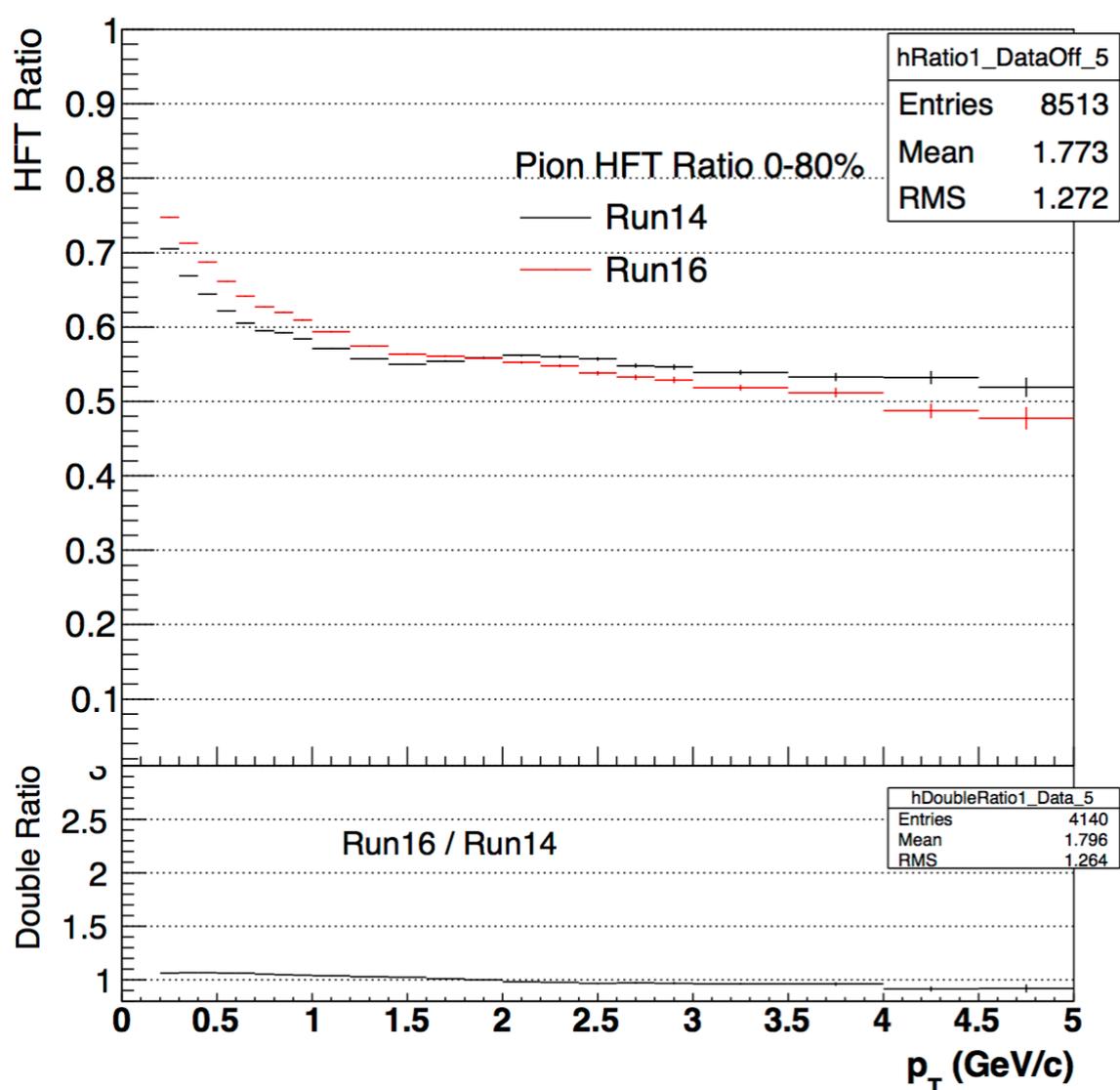




HFT PRELIMINARY PERFORMANCE (RUN 16)

★ With preliminary calibrations, Run16 HFT matching and DCA resolution show a comparable or slightly better performance w.r.t Run14

- different luminosity level
- different trigger setup for pileup protection



STAR HEAVY FLAVOR HADRONS PROGRAM (MTD)

★ J/ψ R_{AA}, v_2

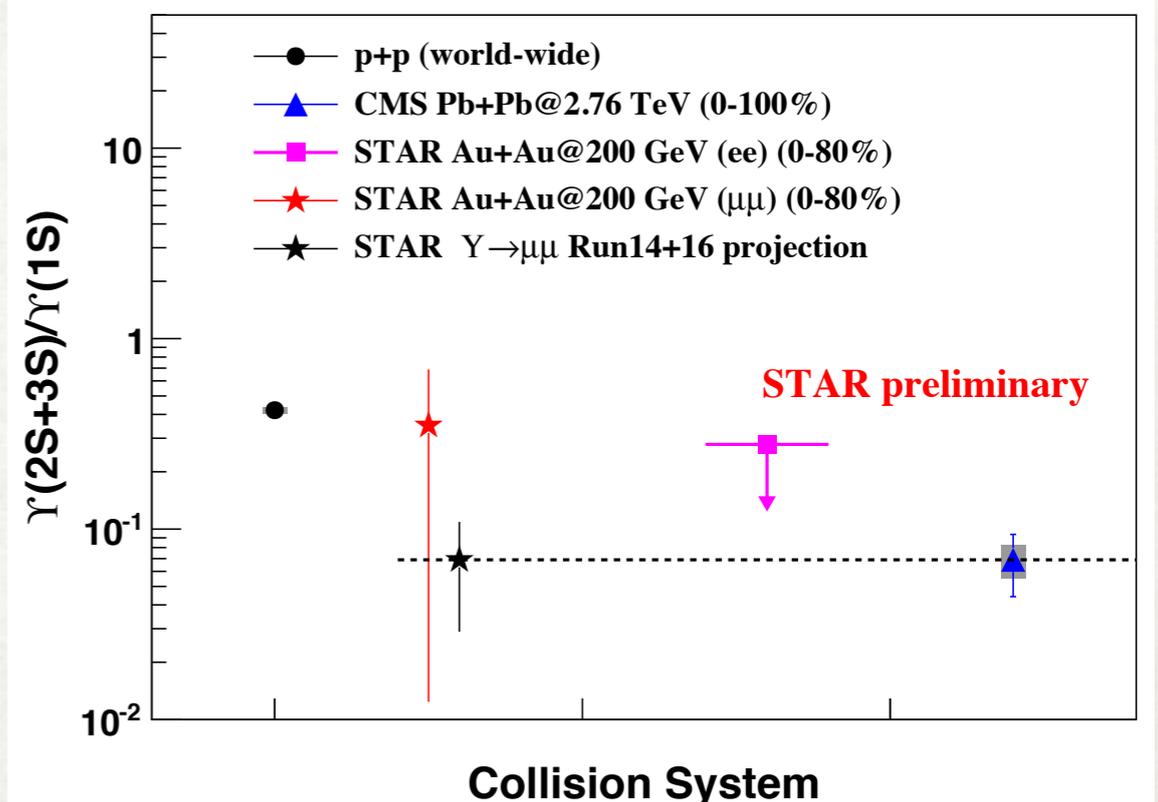
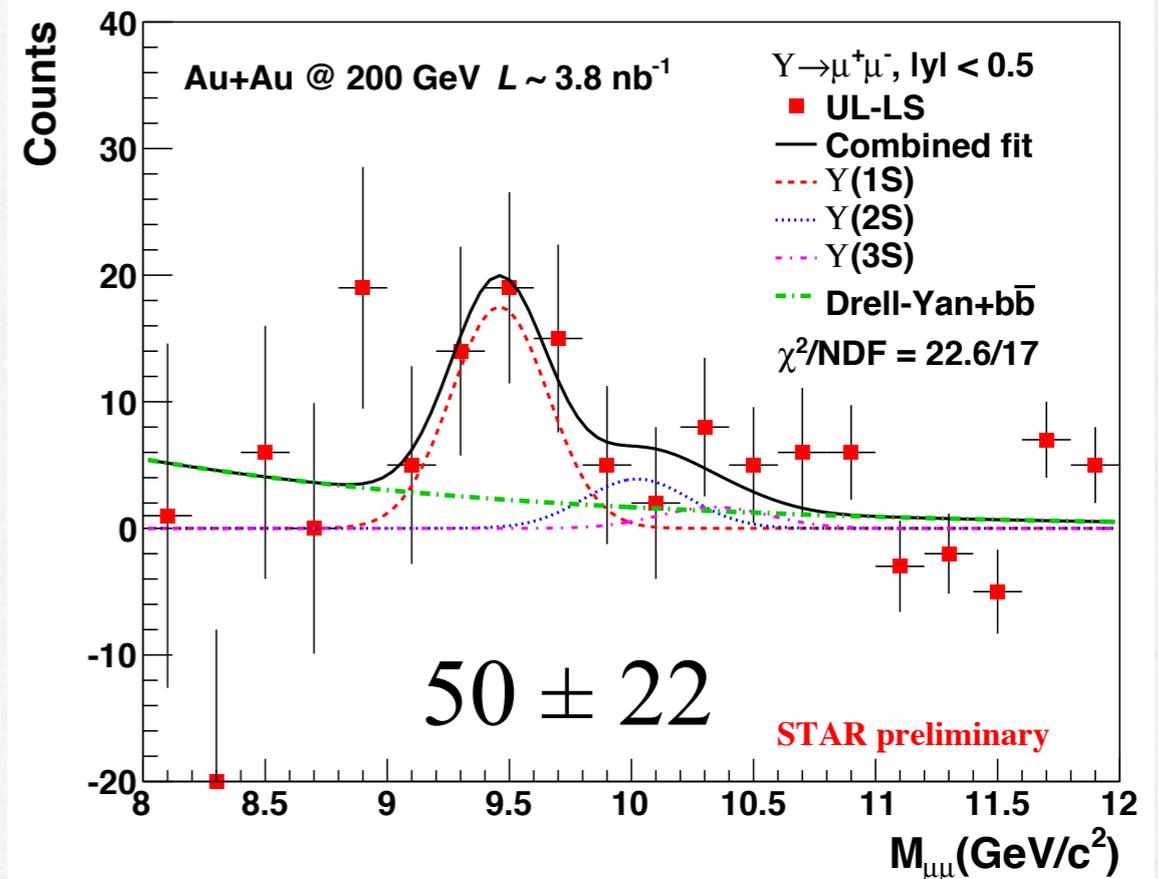
★ Υ suppression

★ Di-muon, $e-\mu$ correlations

★ 11 nb^{-1} collected in Run 14

★ 20 nb^{-1} goal in Run 14+16

★ Run 14 data already produced
(took 9 months!)



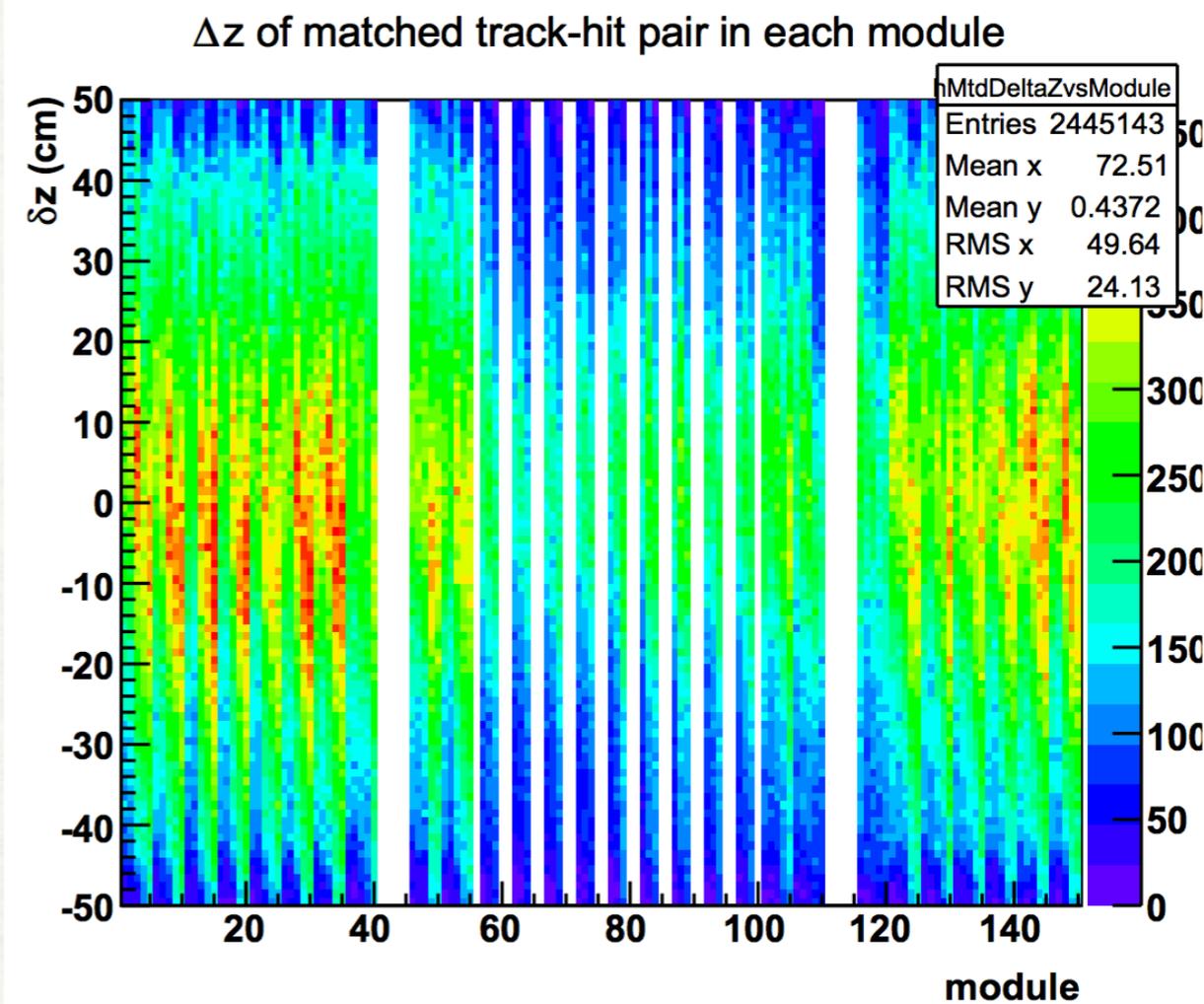
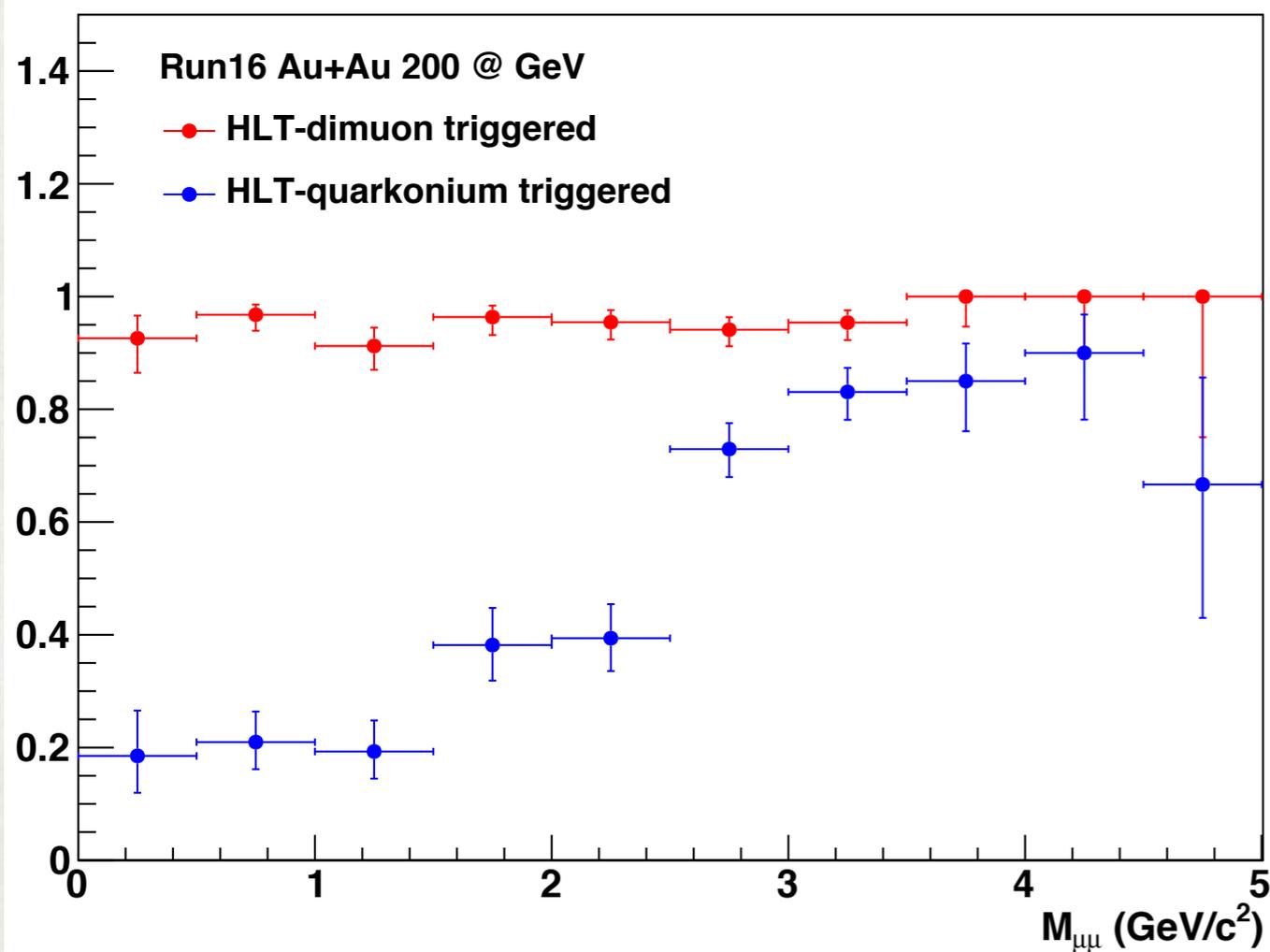


HEAVY FLAVOR HADRONS PROGRAM (MTD)

★ MTD trigger in HLT

- Reject events triggered by background
- Select a small quarkonium-rich sample

★ Matching algorithm improved, $\epsilon = 40\%$ (Run 14) $\rightarrow 90\%$





OTHER PROGRAMS

★ Gamma-jet for Au+Au at

$$\sqrt{s_{NN}} = 200 \text{ GeV}$$

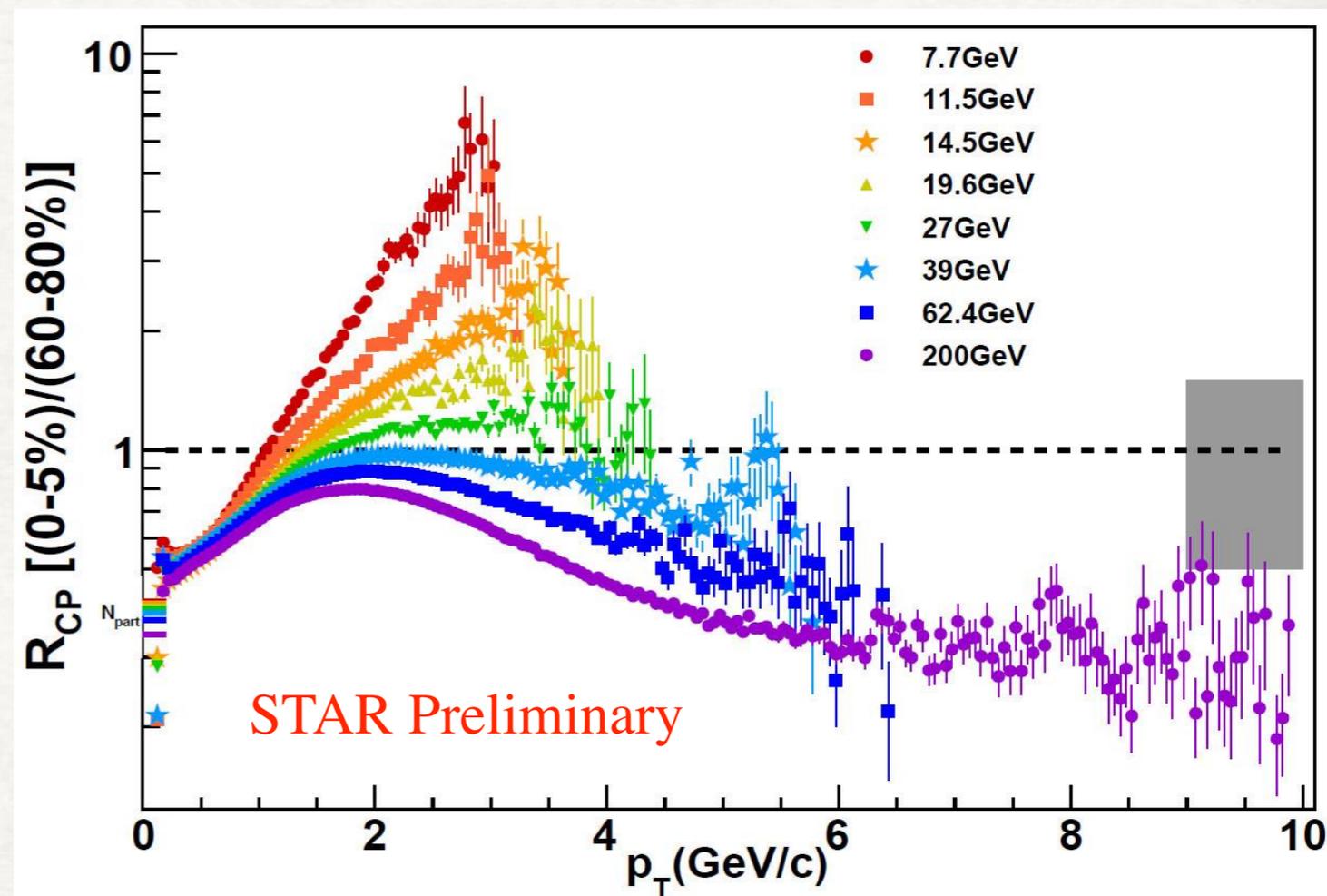
→ parton energy loss in the medium

★ dAu Beam Energy Scan

→ CNM effects

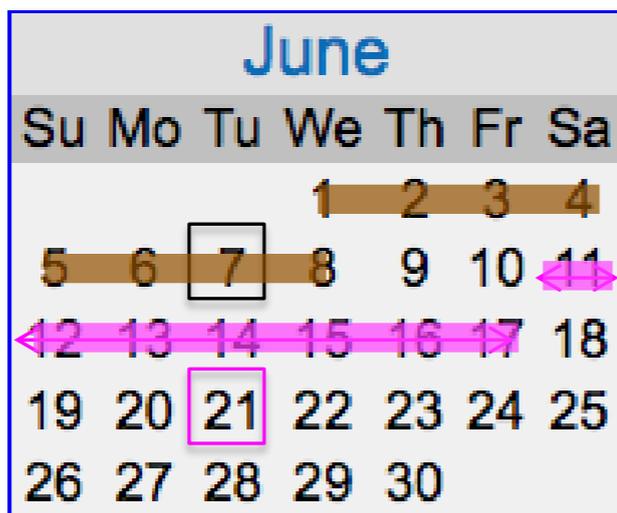
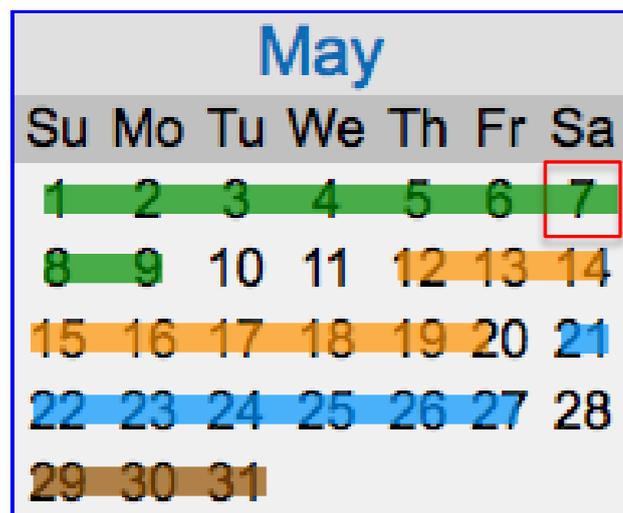
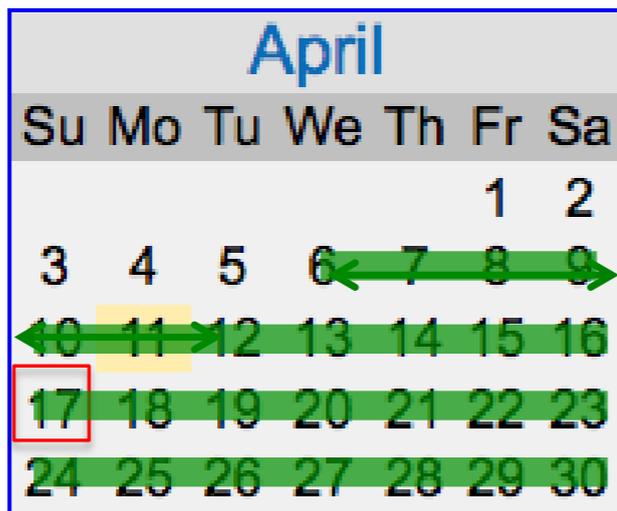
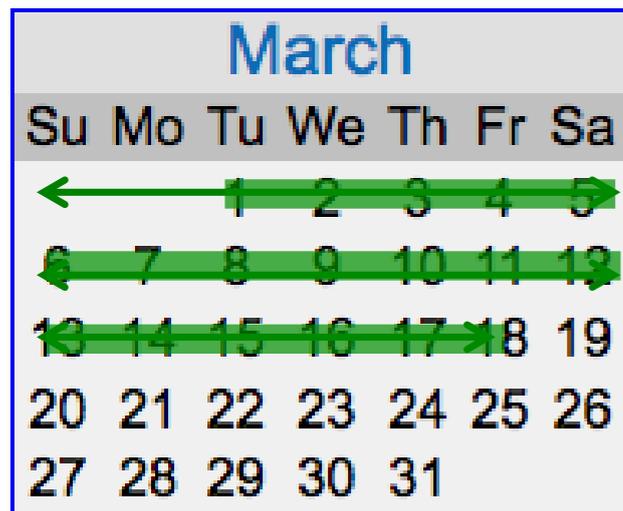
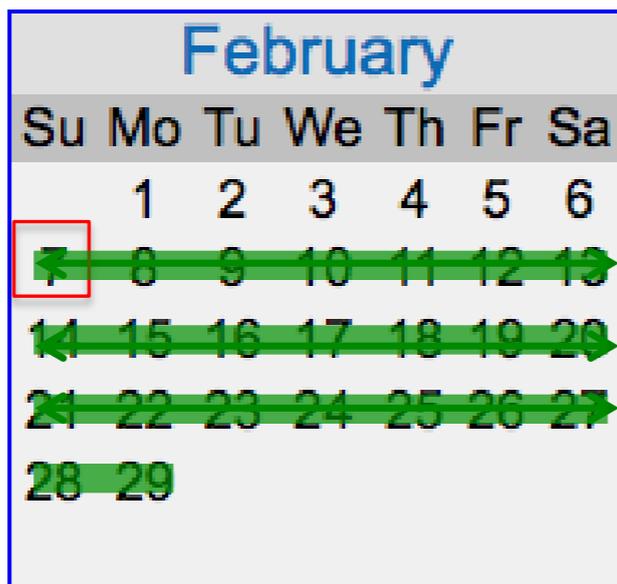
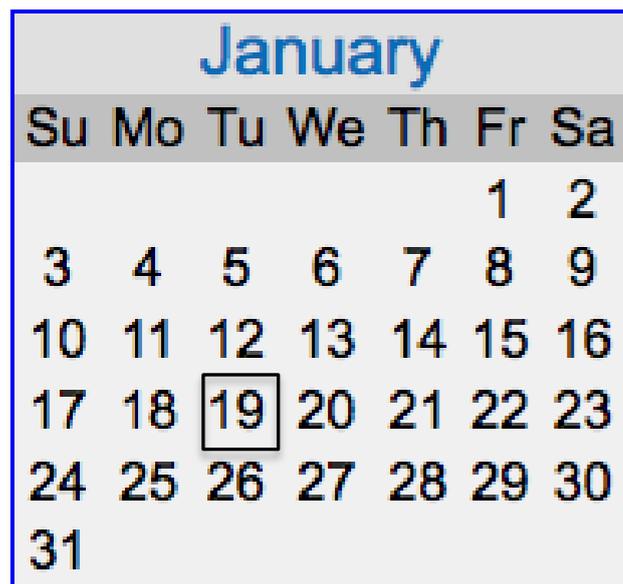
★ Ultra-peripheral collisions

→ photo-nuclear interactions

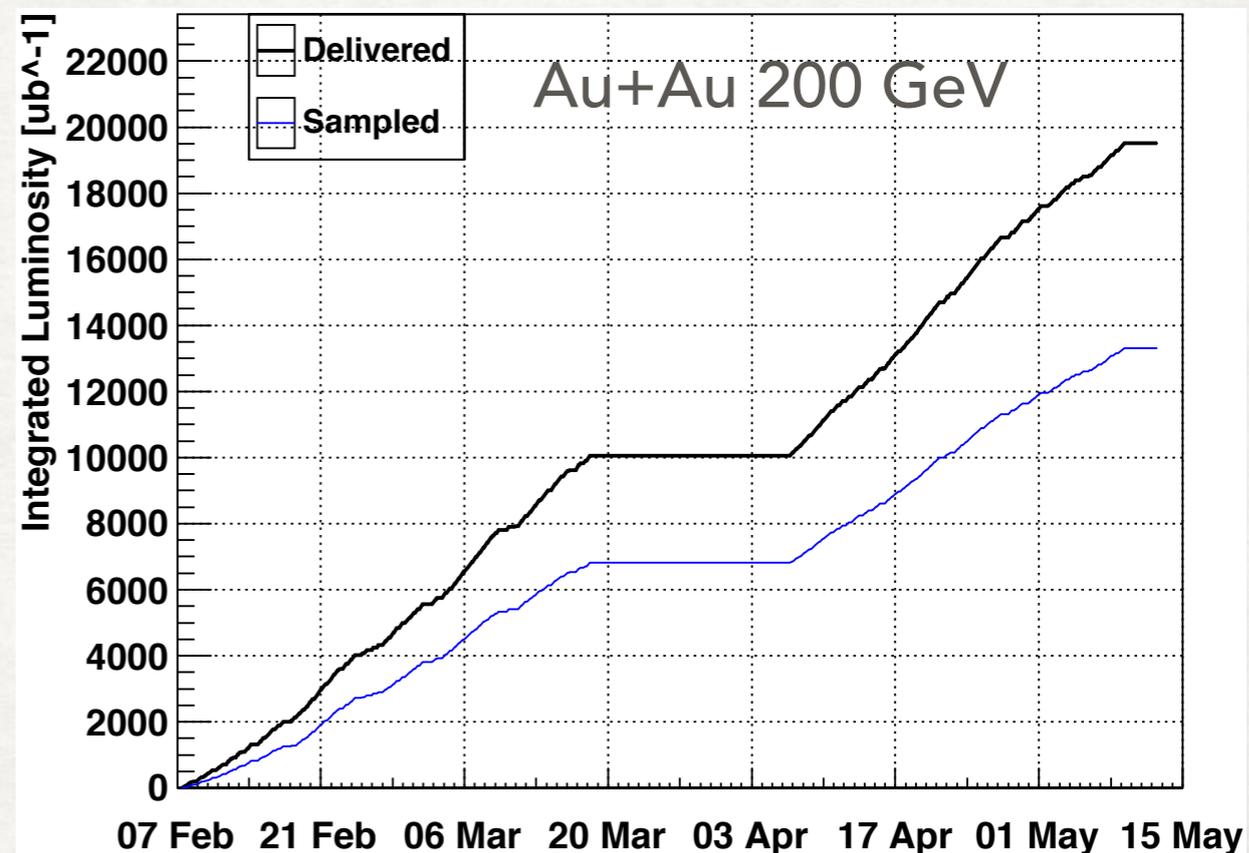




TIME SCHEDULE AND LUMINOSITY

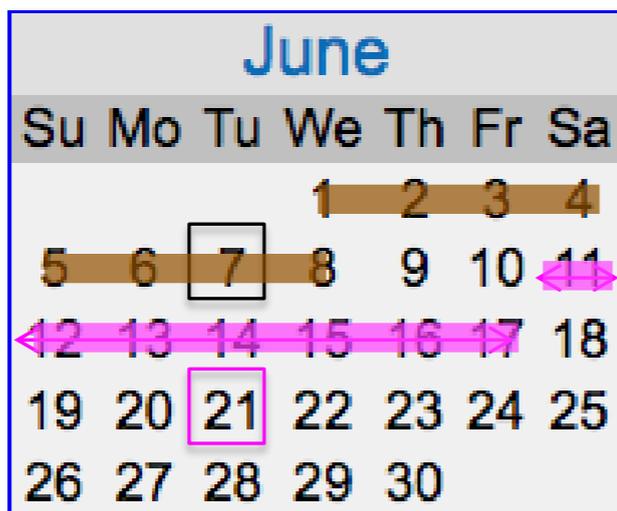
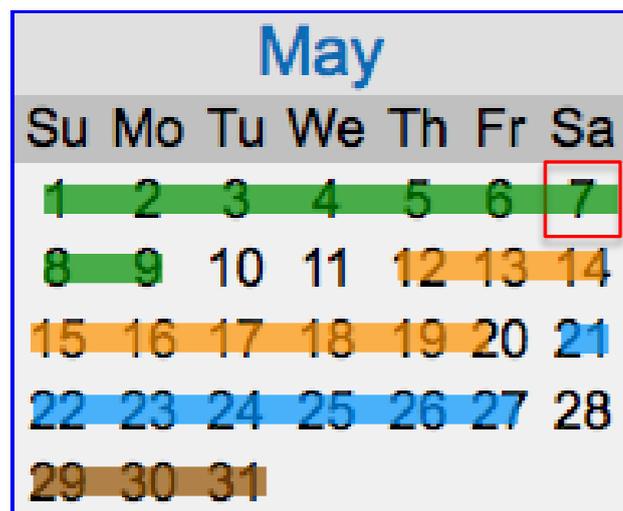
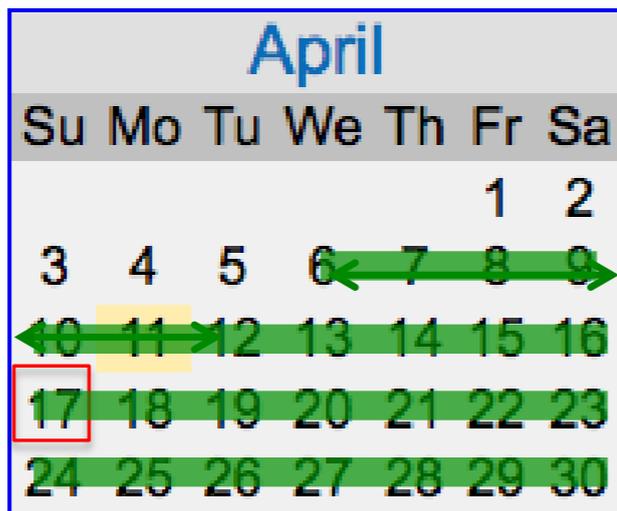
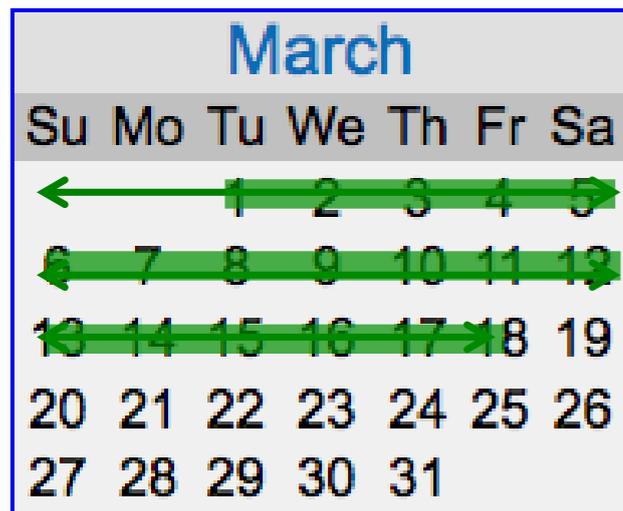
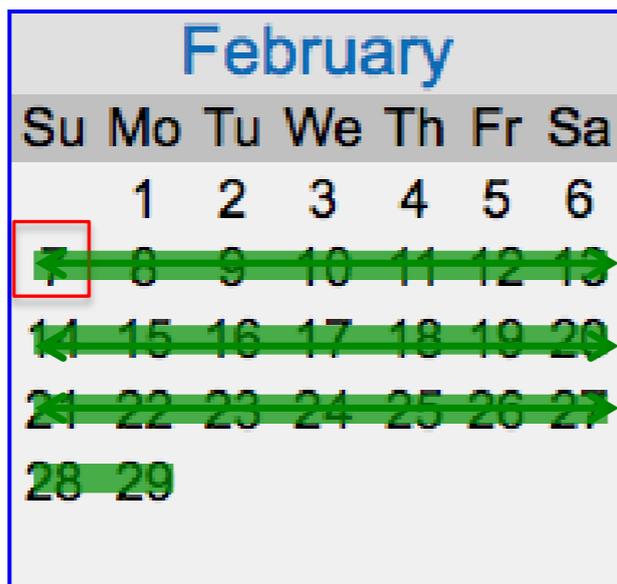


- Au+Au 200 GeV
- d+Au 200 GeV
- d+Au 62.4 GeV
- d+Au 19.6 GeV
- d+Au 39 GeV

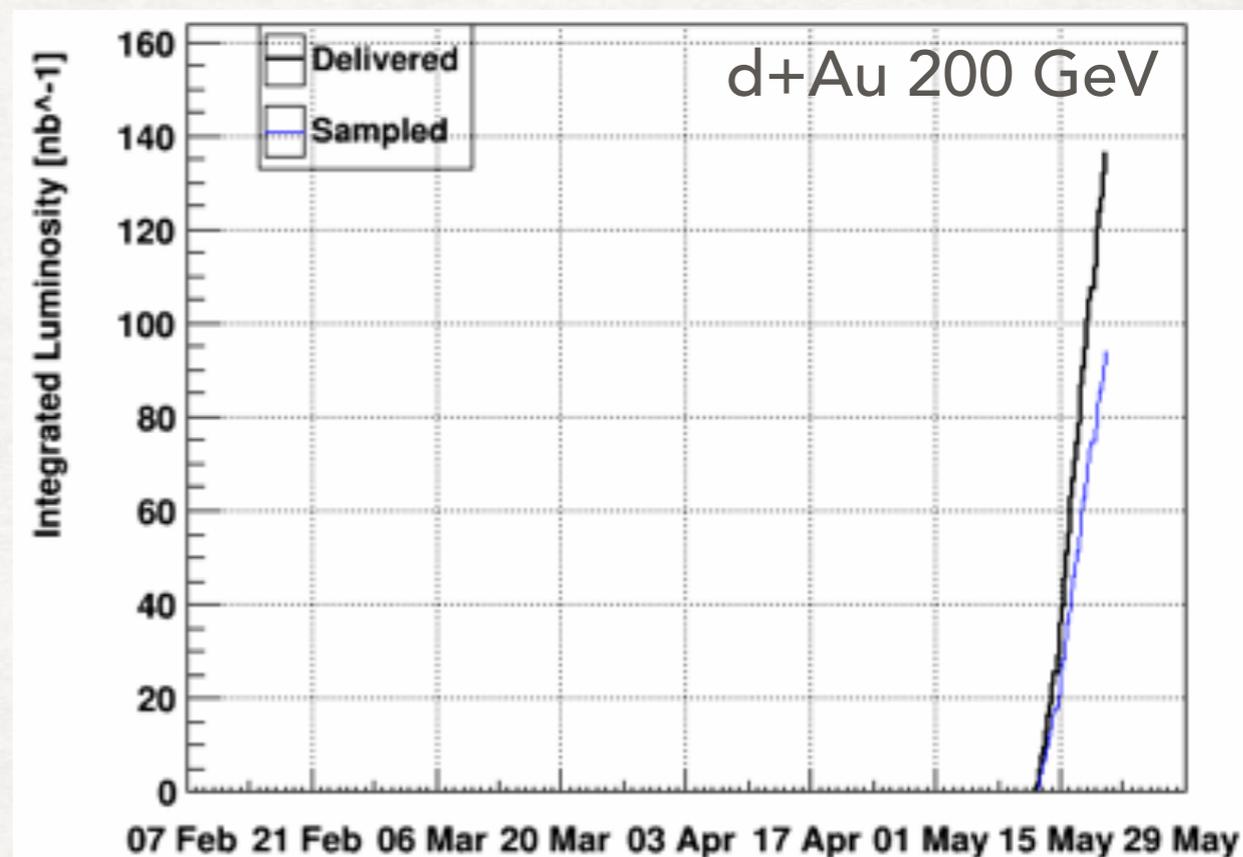




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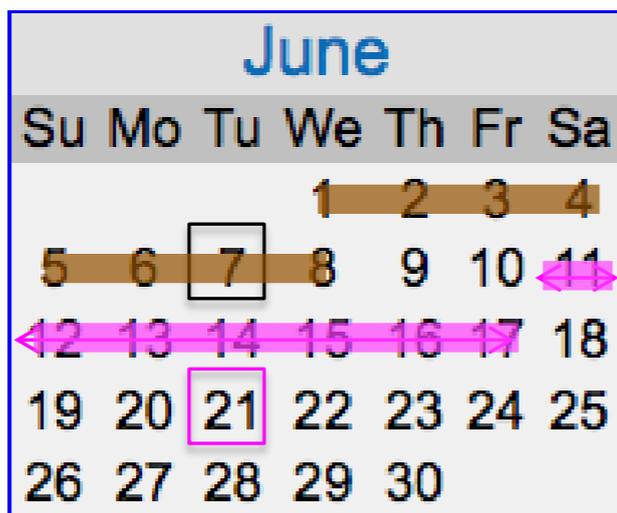
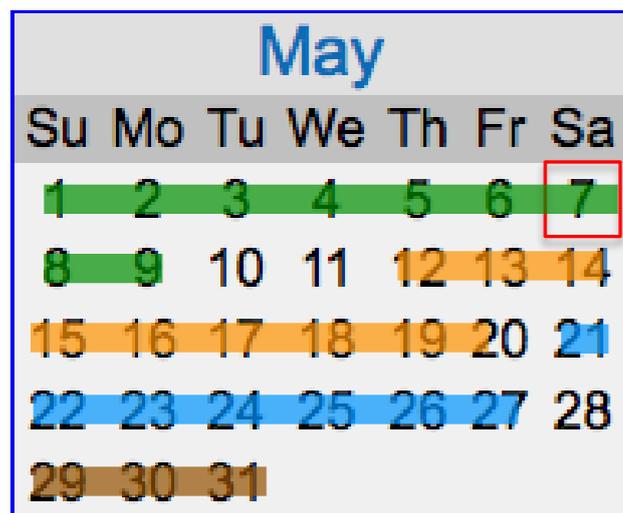
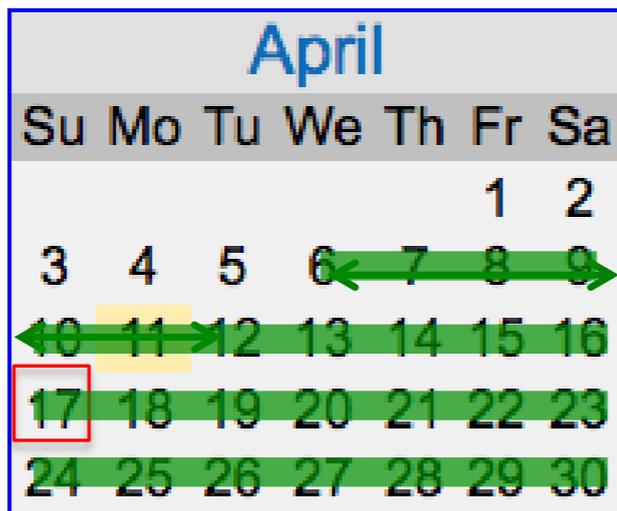
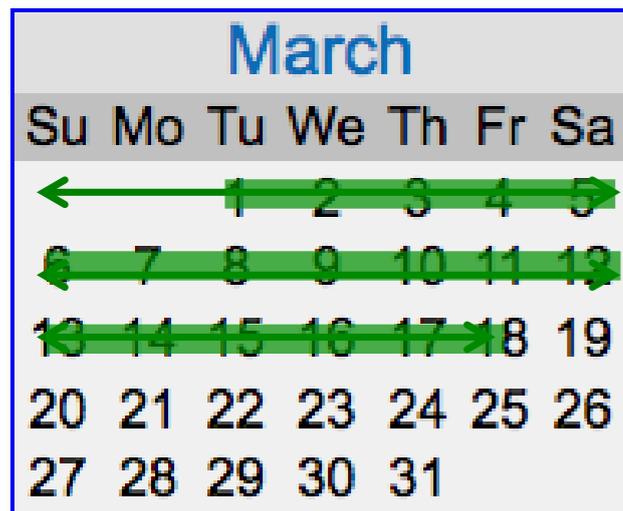
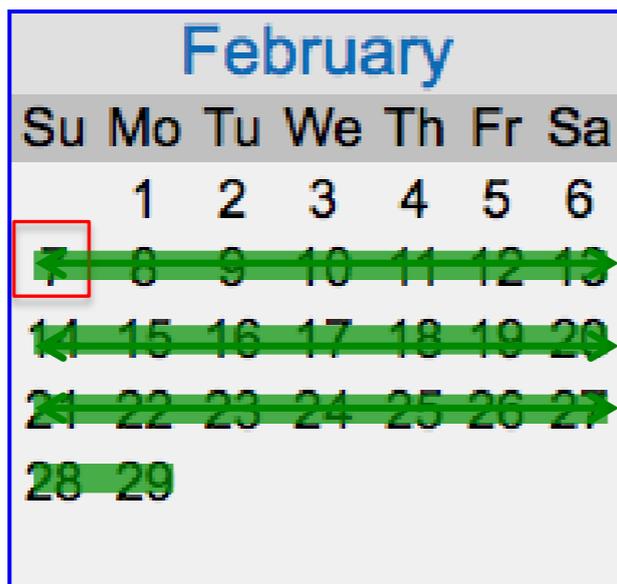


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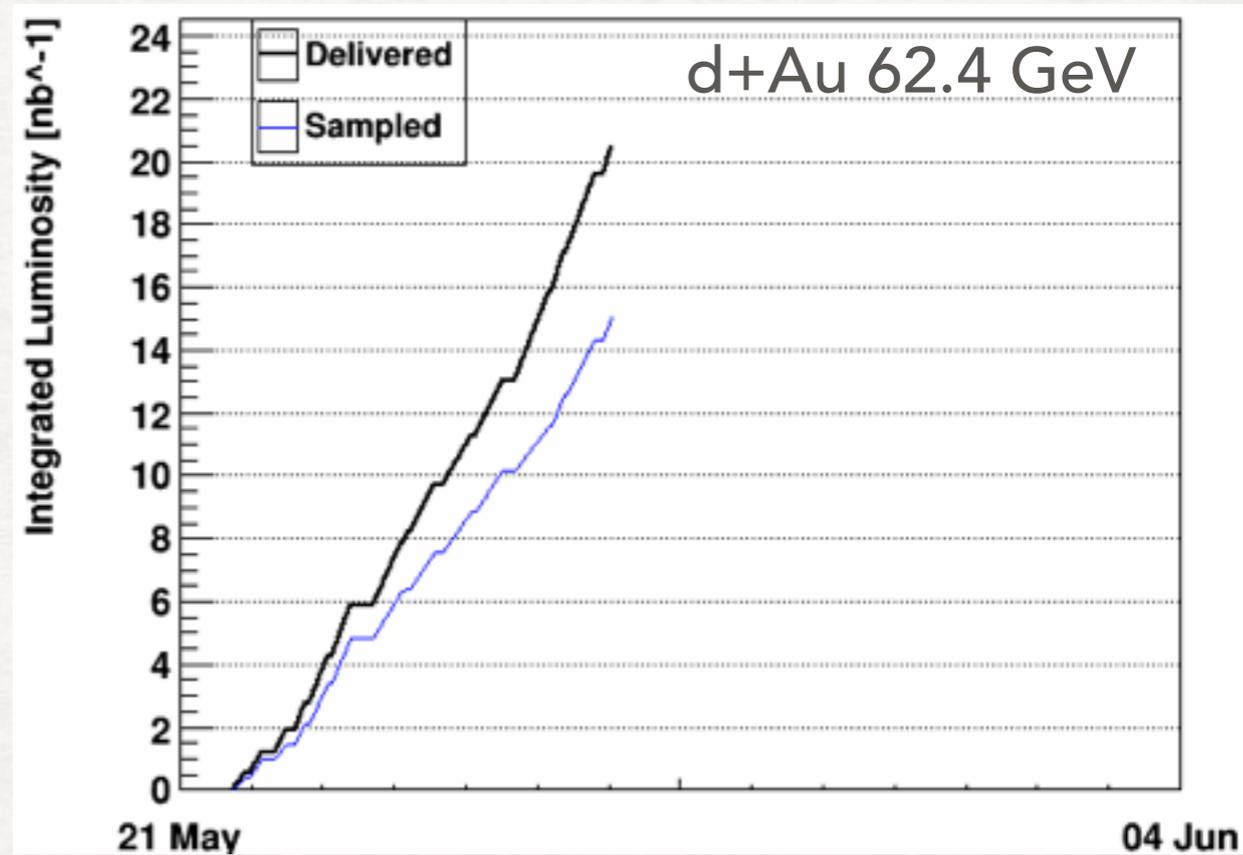




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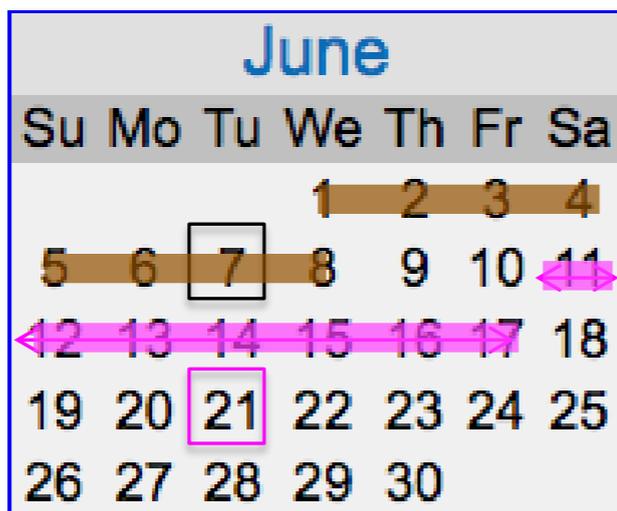
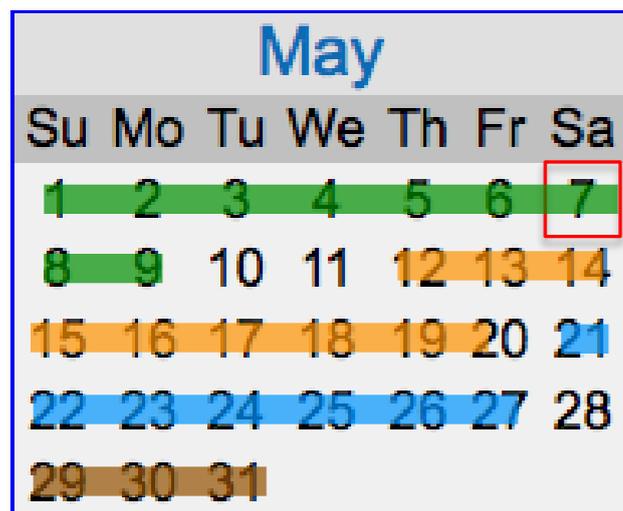
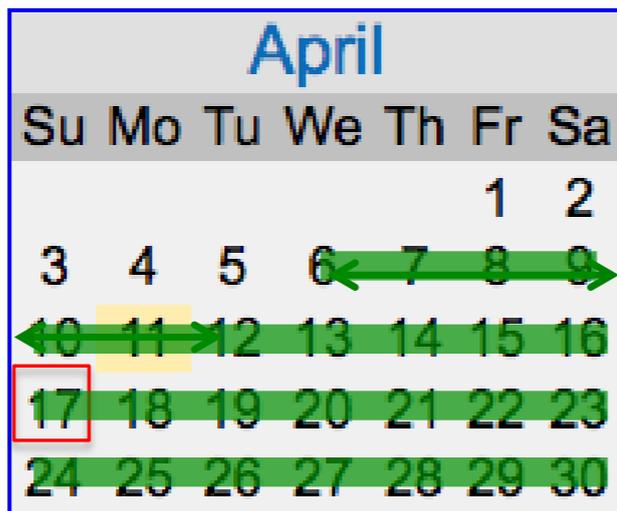
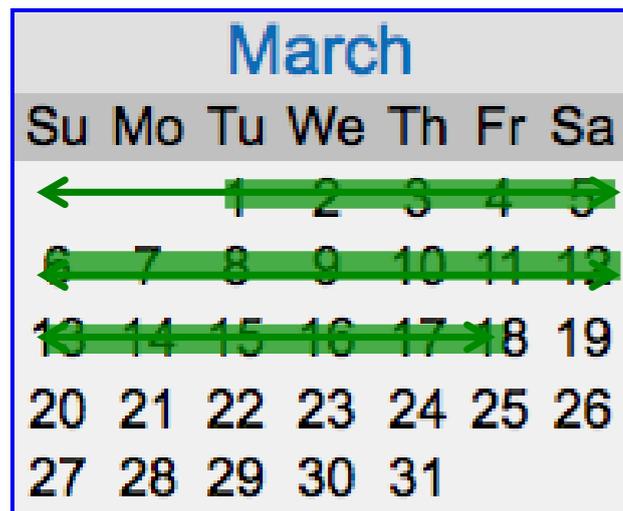
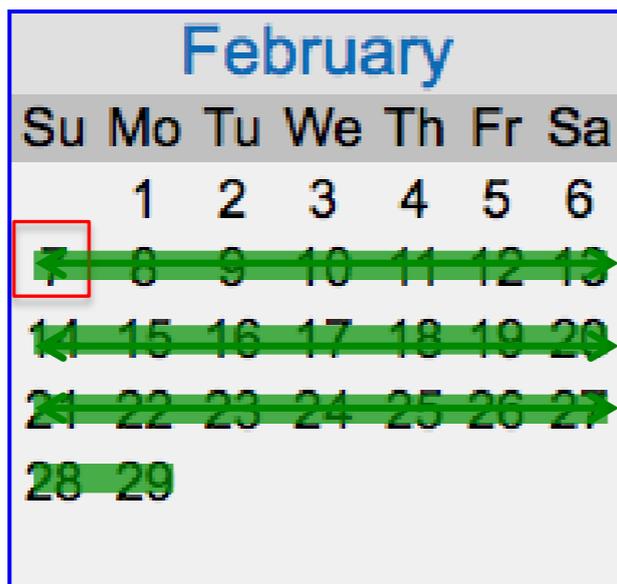
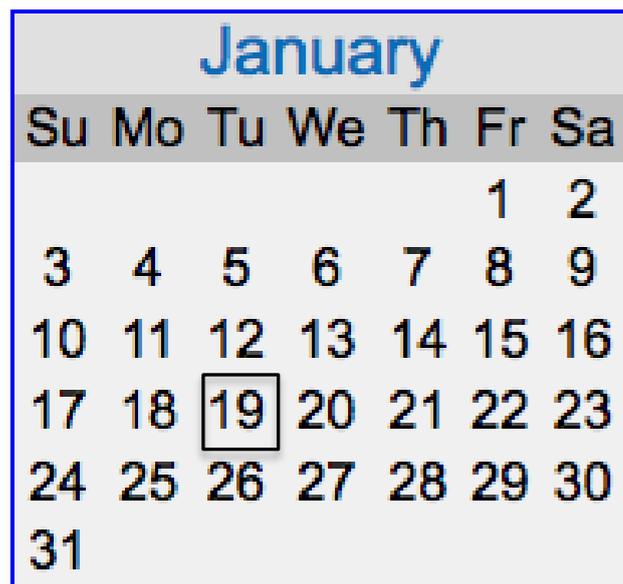


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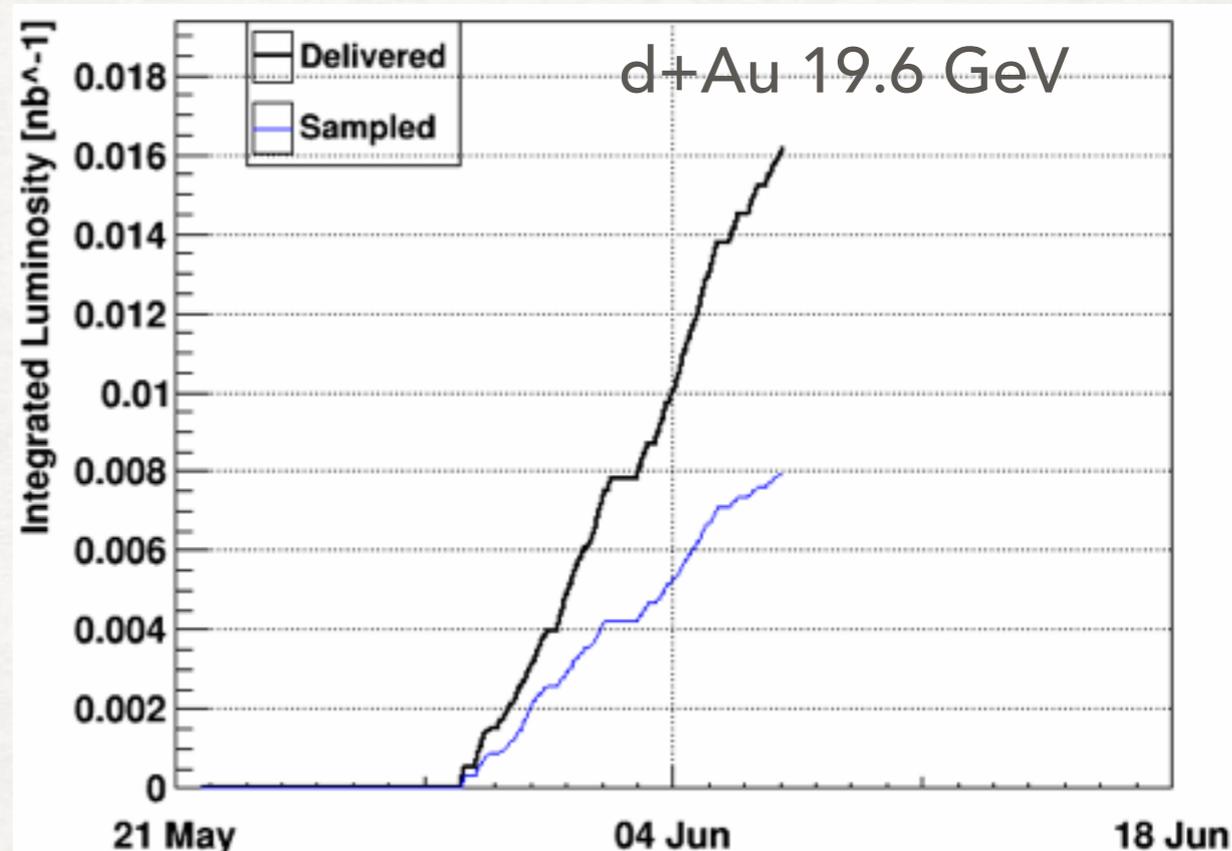




TIME SCHEDULE AND LUMINOSITY



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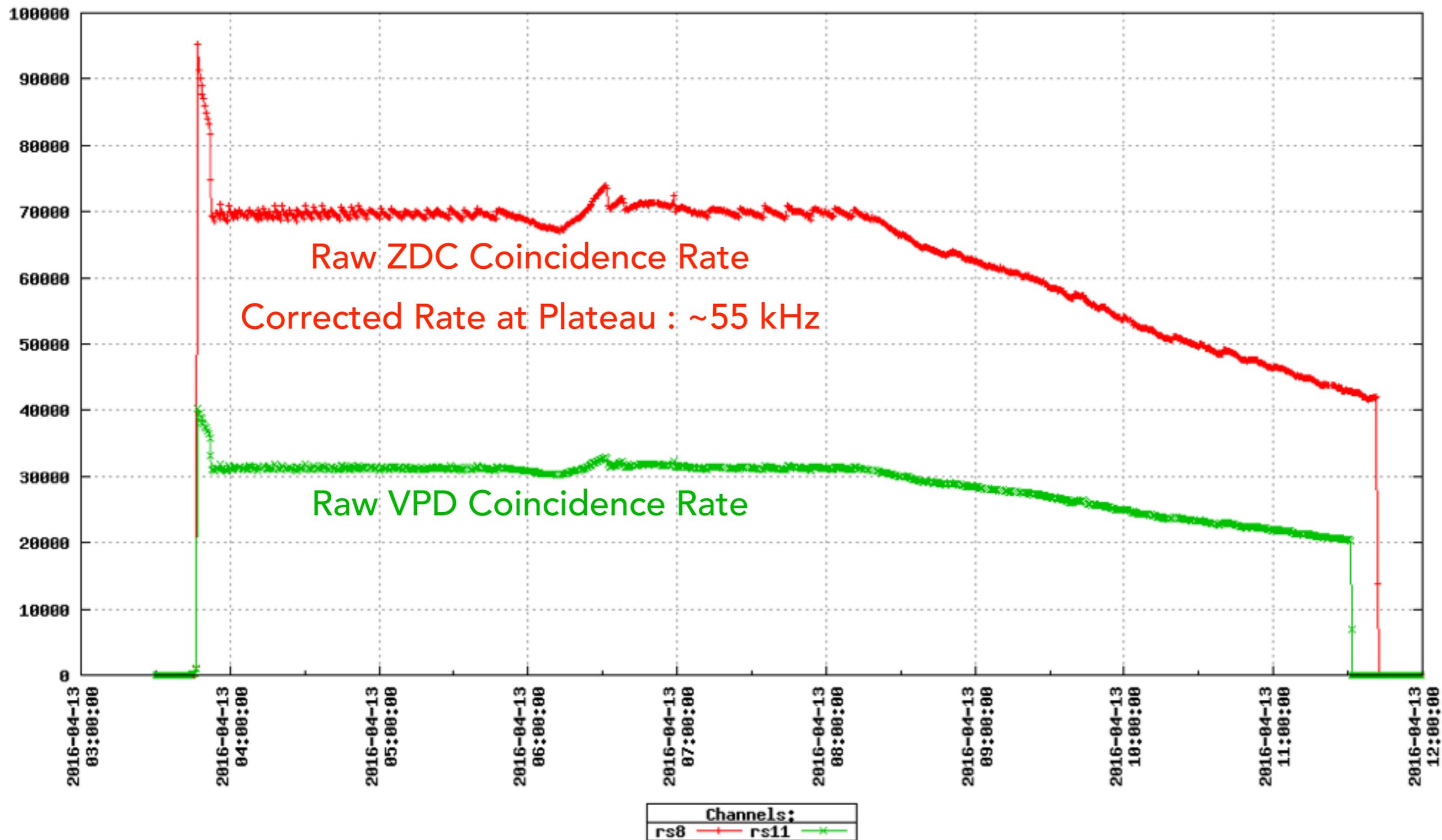
TRIGGERS FOR AU+AU AT $\sqrt{s_{NN}} = 200$ GeV

- ★ Challenging goals in Run 16
- ★ Designed to maximize the bandwidth
- ★ Projections assume running 13.5 hour/day on average

Trigger	Goal	Rate(zDC @50 kHz)	ps	Projection
MB	2B events	700	n	2.38B × 0.85
Central	250M	80	n	270M × 0.85
Dimuon	10 nb ⁻¹	670	1	14 nb ⁻¹ × 0.7
High-p _T	10 nb ⁻¹	33	1	14 nb ⁻¹
UPC	10 nb ⁻¹	27	1	14 nb ⁻¹

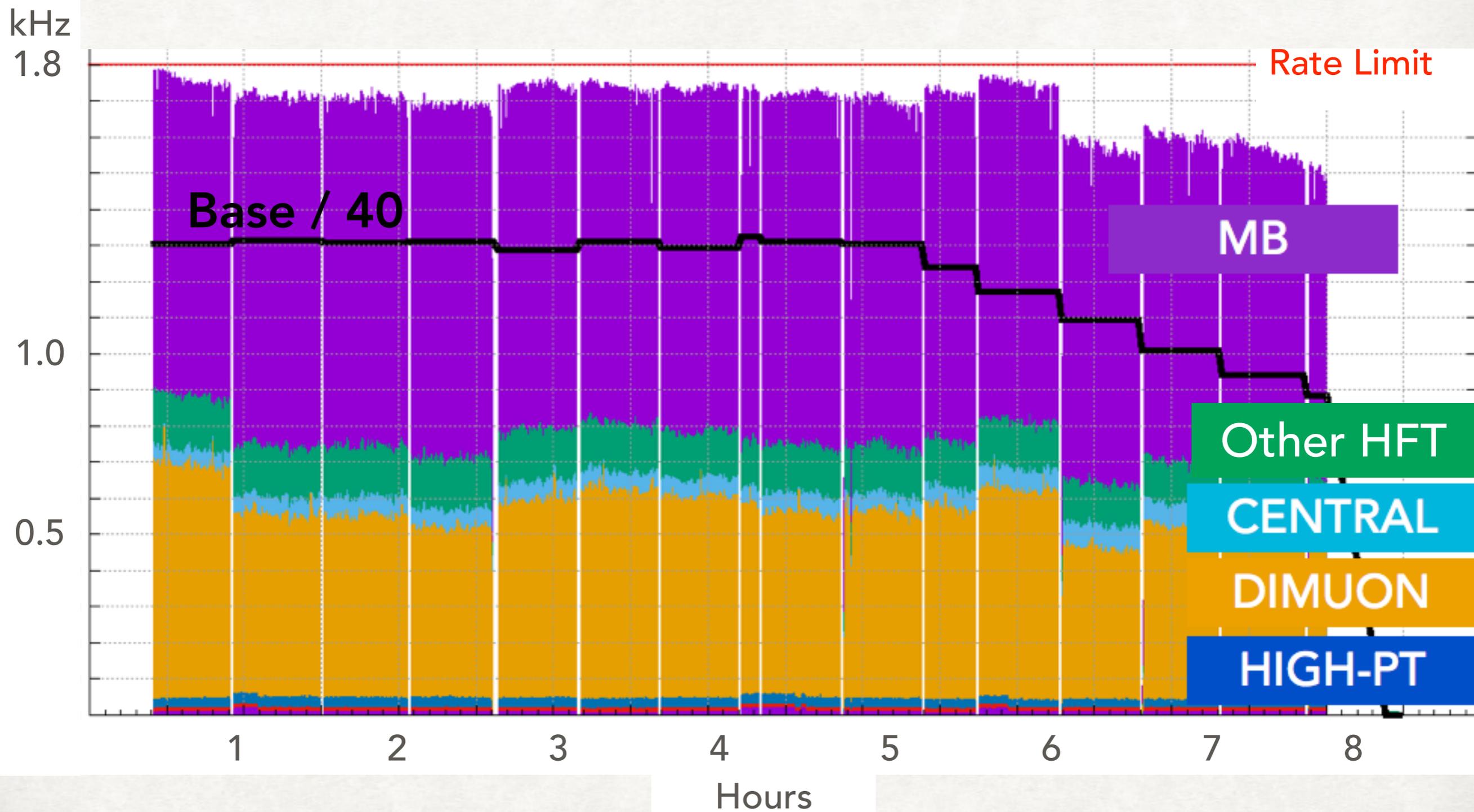


TRIGGER BANDWIDTH IN AU+AU AT $\sqrt{s_{NN}} = 200$ GeV





TRIGGER BANDWIDTH IN AU+AU AT $\sqrt{s_{NN}} = 200$ GeV

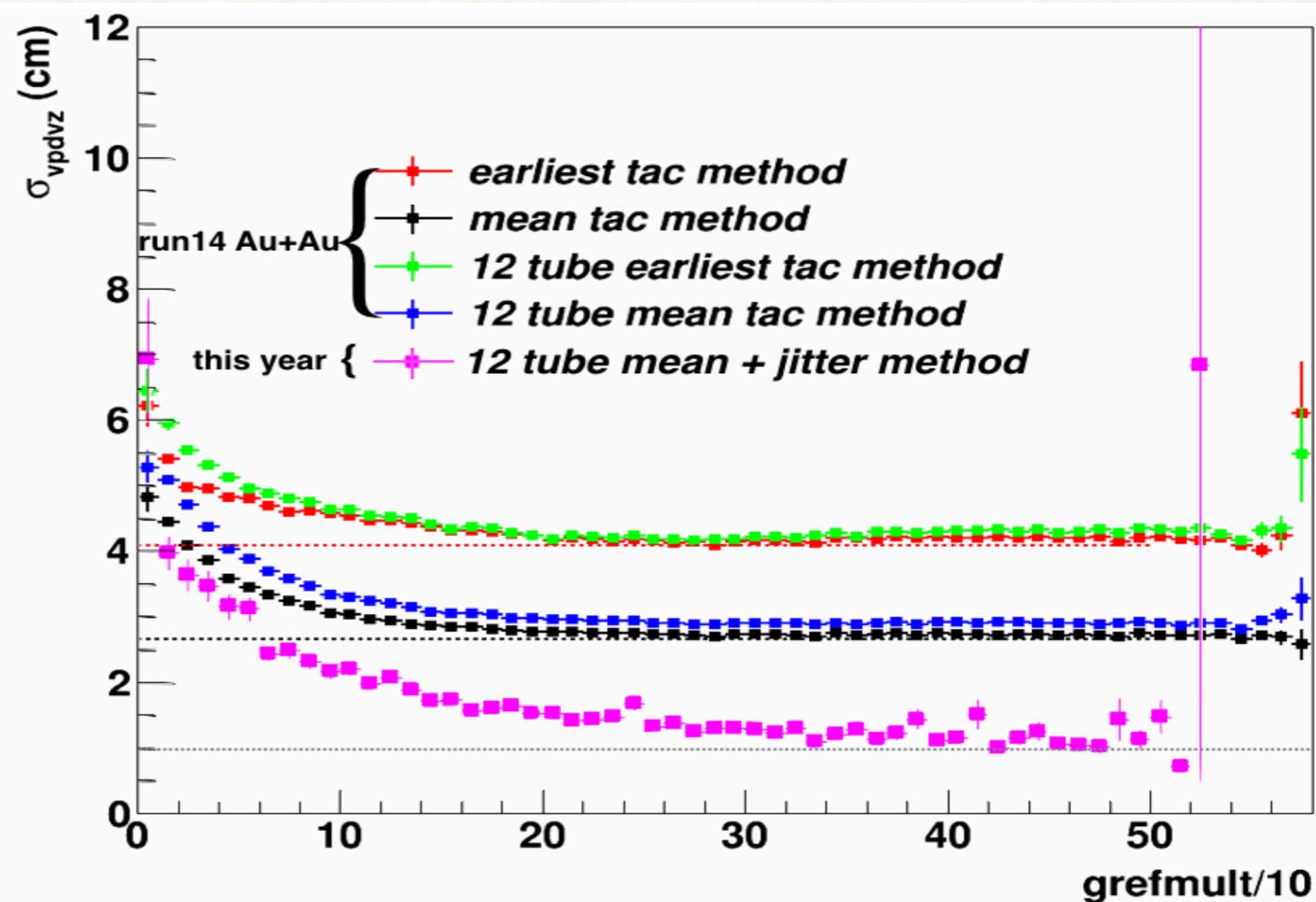




MINIMUM BIAS TRIGGER PURITY

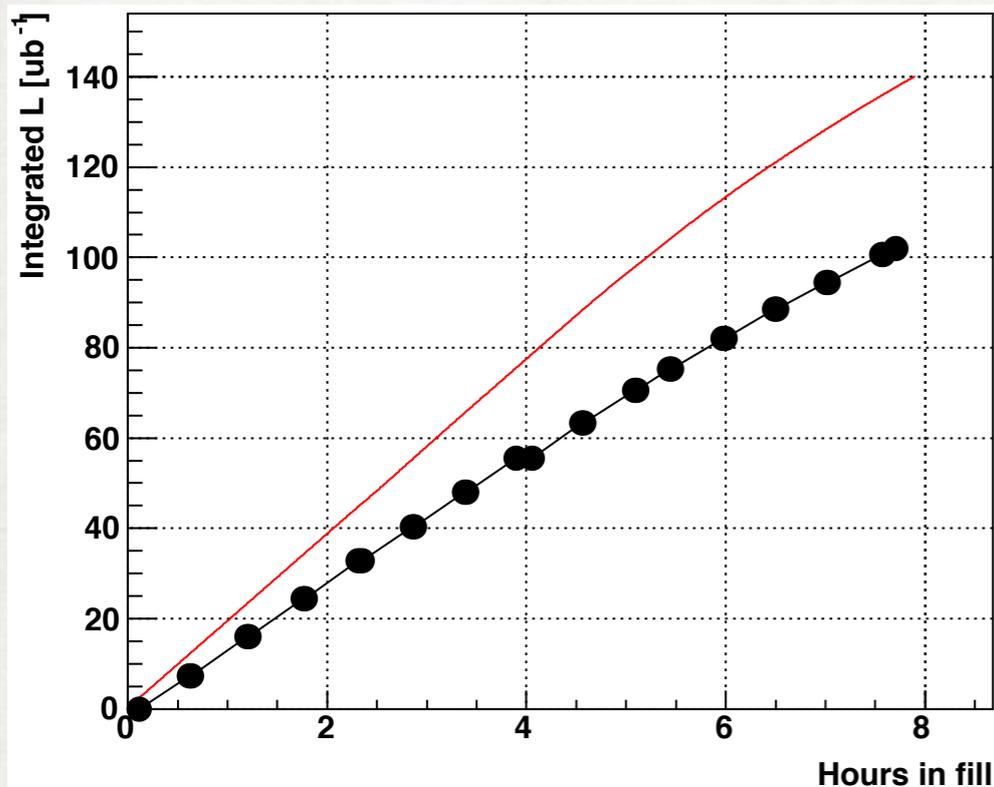
- ★ Due to HFT acceptance only events within $|V_z| < 6$ cm are being analysed using HFT
- ★ Improvements to the online selection with the Vertex Position Detector significantly increased the MB trigger purity

- Jitter reduced using pulser signals
- Earliest TAC → average of TACs
- MB Trigger Purity increased from ~73% (Run 14) to 85%



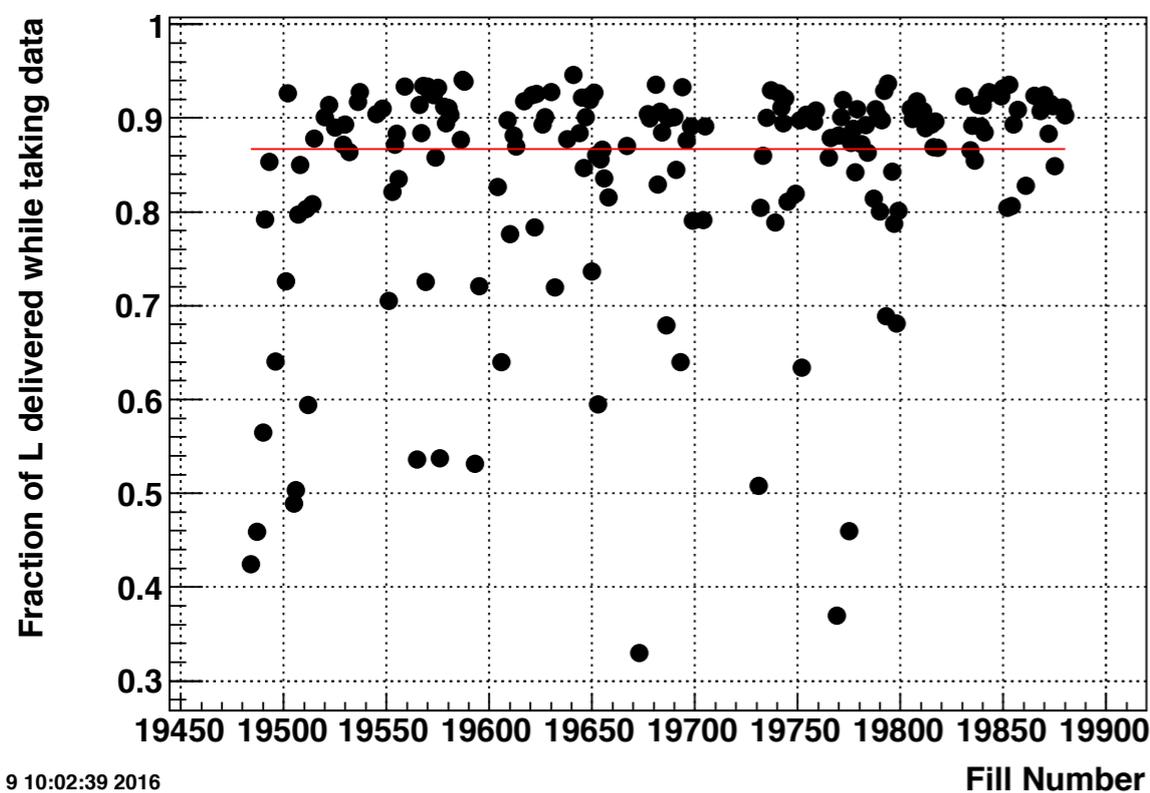


AU+AU AT $\sqrt{s_{NN}} = 200$ GeV PERFORMANCE



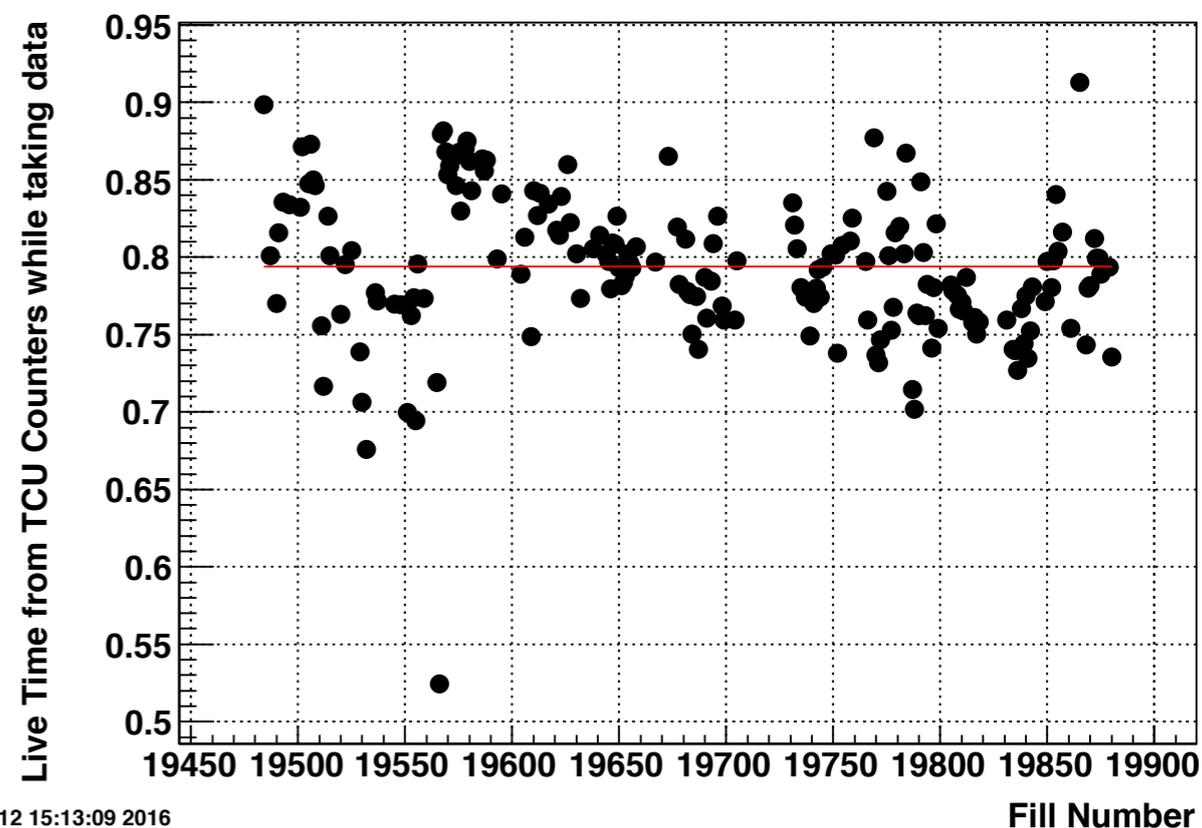
- ★ Very smooth operations
- ★ Average DAQ dead time 20% (Dimuon)
- ★ optimized balance of triggers

Fraction of L delivered while taking data



Mon May 9 10:02:39 2016

Live Time from TCU Counters while taking data

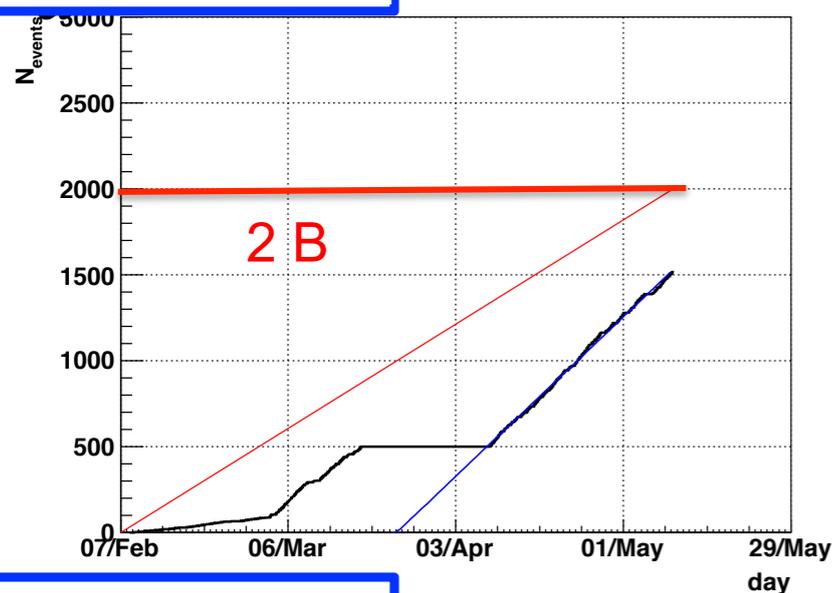


Thu May 12 15:13:09 2016

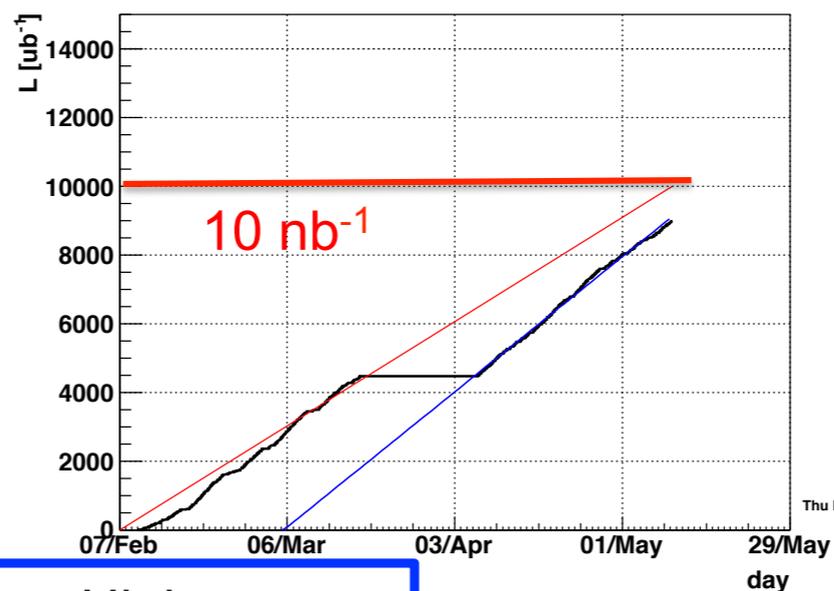


AU+AU AT $\sqrt{s_{NN}} = 200$ GeV PERFORMANCE

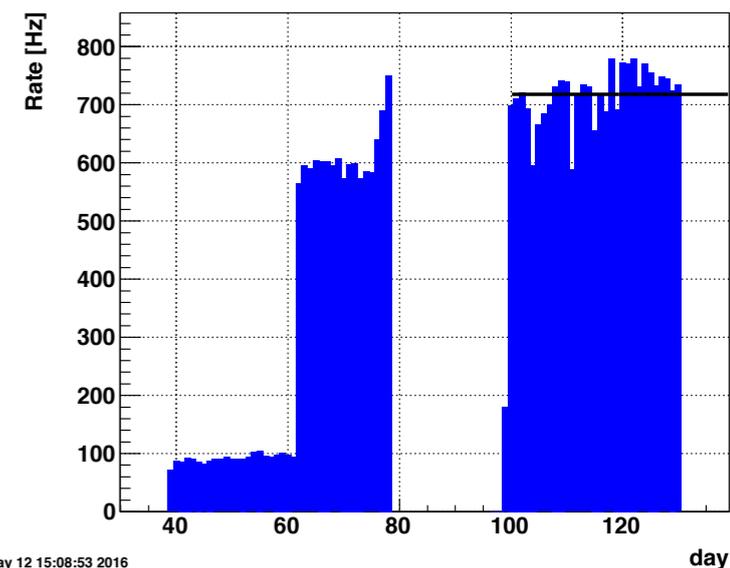
MB



Dimuon

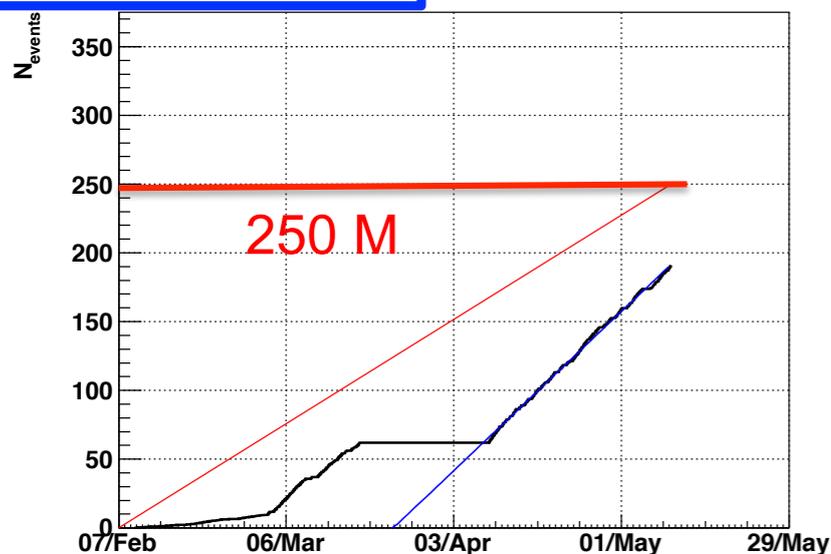


VPDMB-5-p-effective Average Rate [Hz] PXL+IST

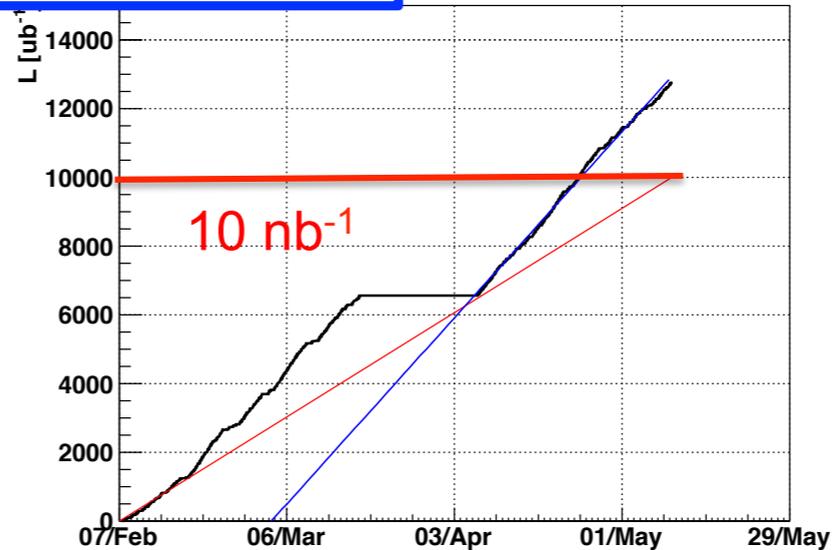


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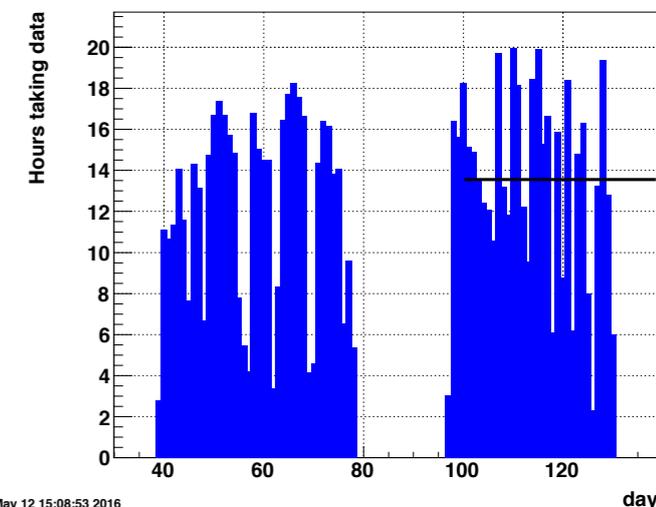
Central



High p_T



hours_perday_pxlist.txt

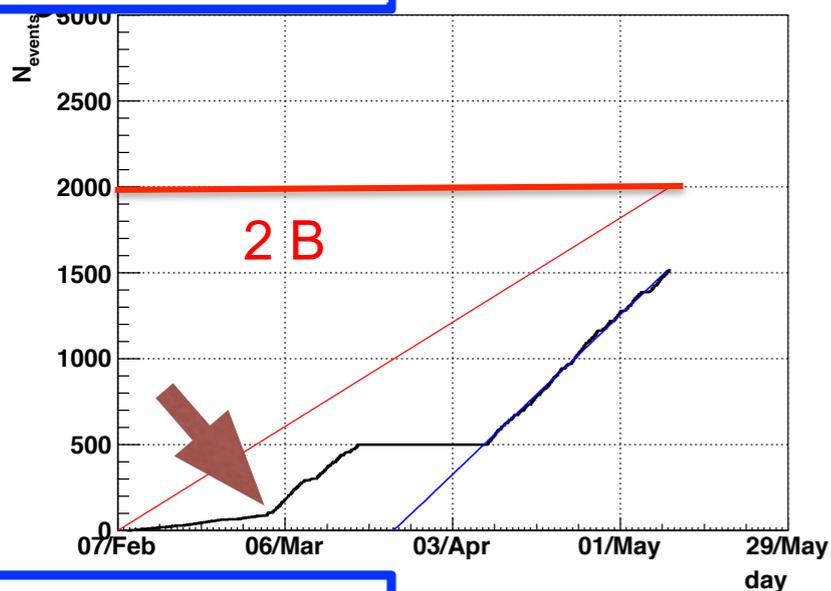


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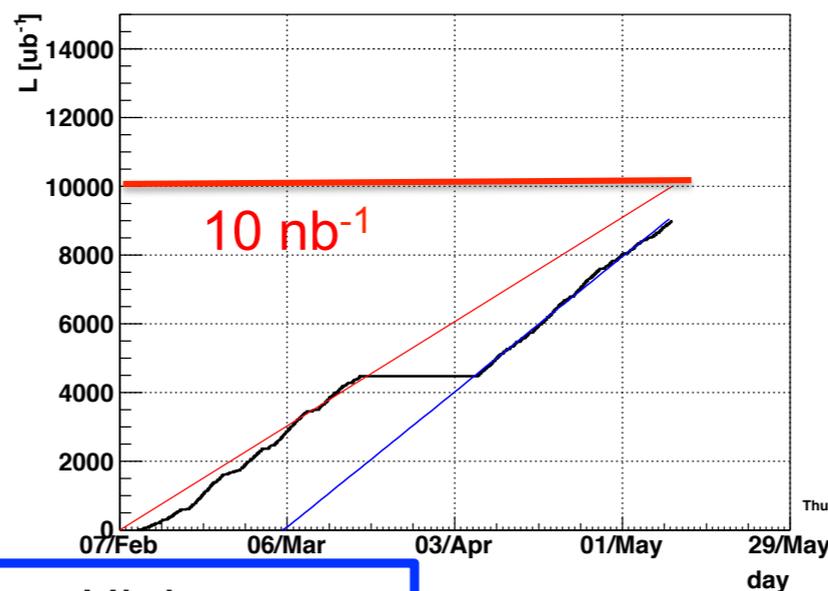


AU+AU AT $\sqrt{s_{NN}} = 200$ GeV PERFORMANCE

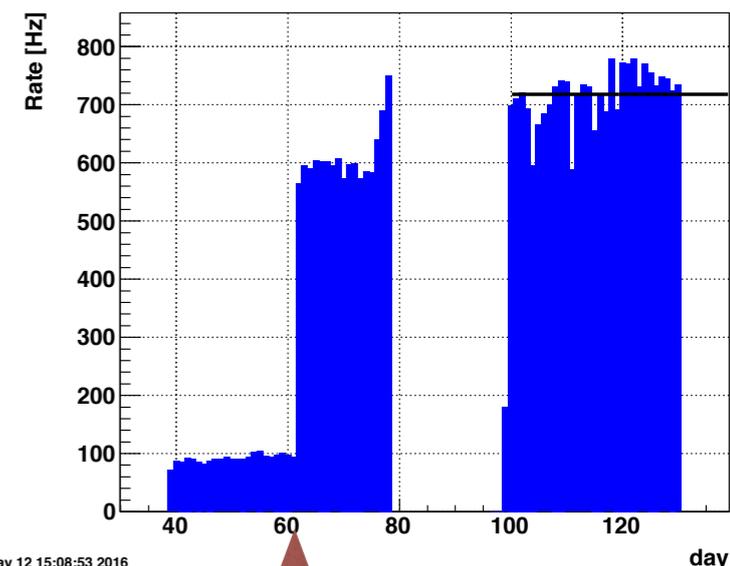
MB



Dimuon

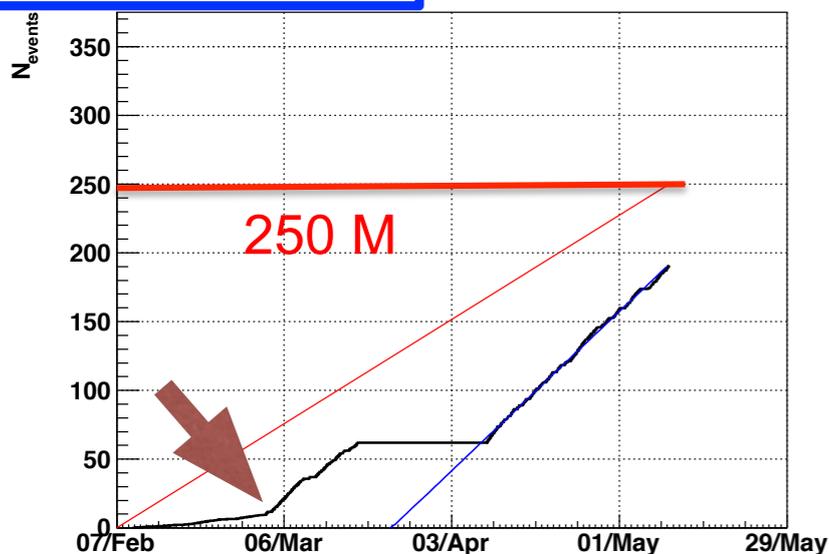


VPDMB-5-p-effective Average Rate [Hz] PXL+IST

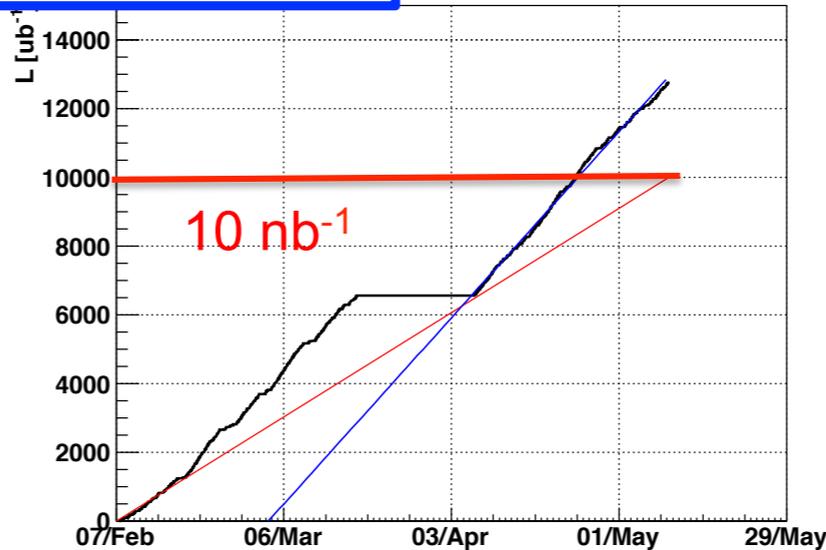


Thu May 12 15:08:53 2016

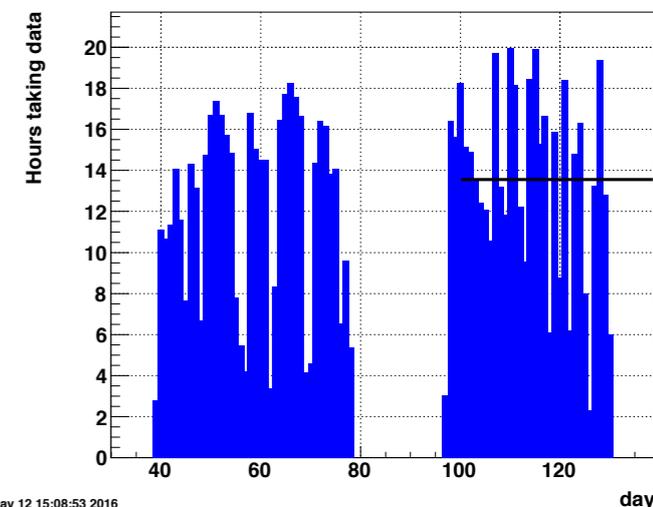
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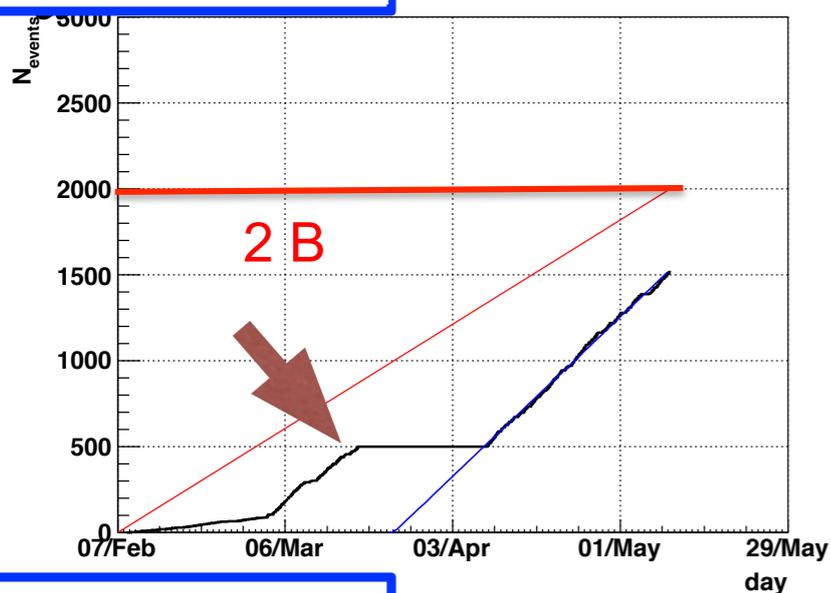
★ Upload of Run 14 HFT RDO firmware

→ Run 15 firmware caused drop in the matching ratio of tracks with at least 3 HFT hits and TPC tracks

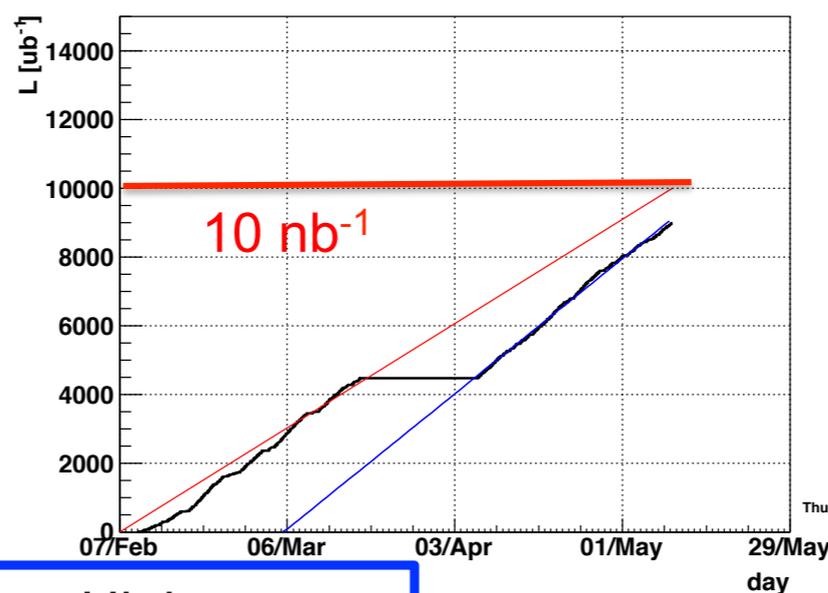


AU+AU AT $\sqrt{s_{NN}} = 200$ GeV PERFORMANCE

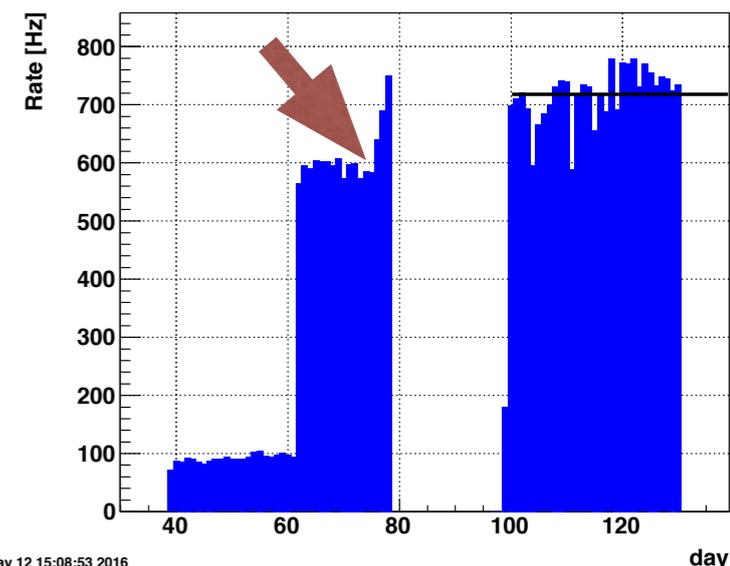
MB



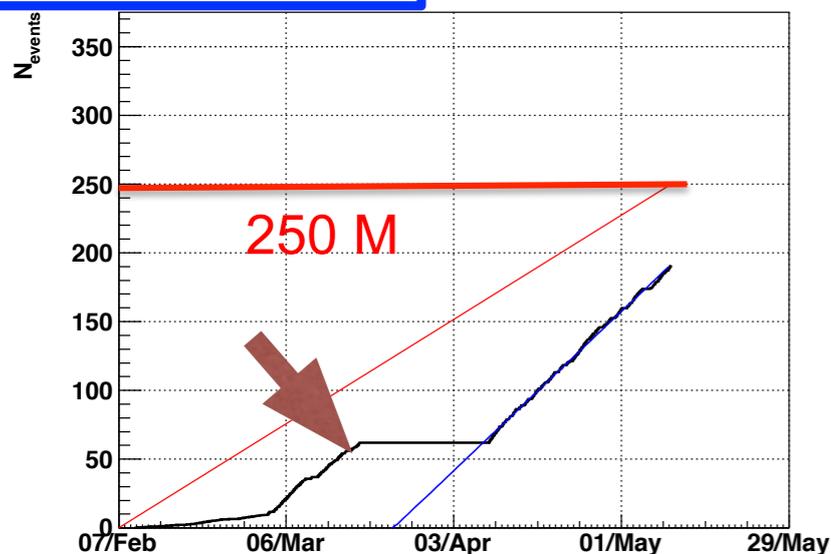
Dimuon



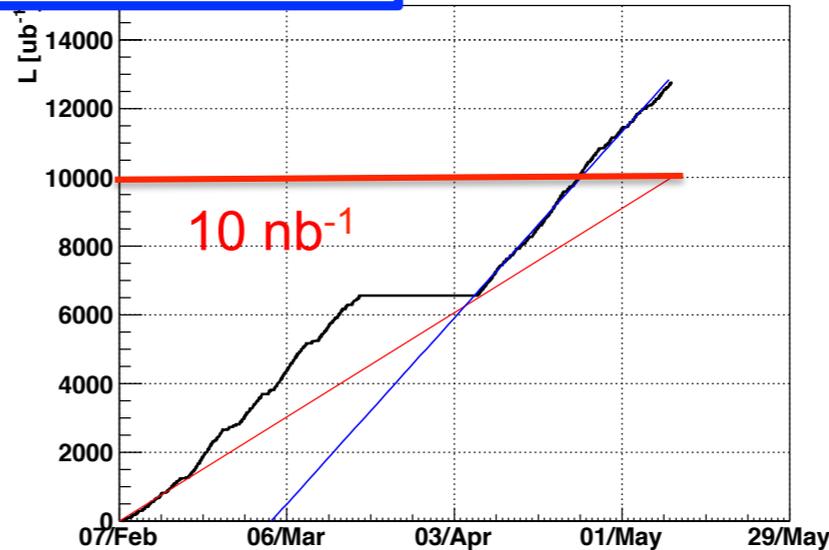
VPDMB-5-p-effective Average Rate [Hz] PXL+IST



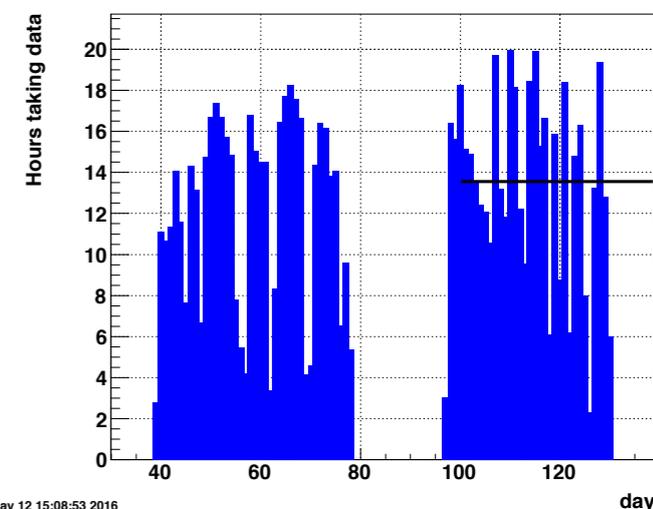
Central



High p_T



hours_perday_pxlhist.txt



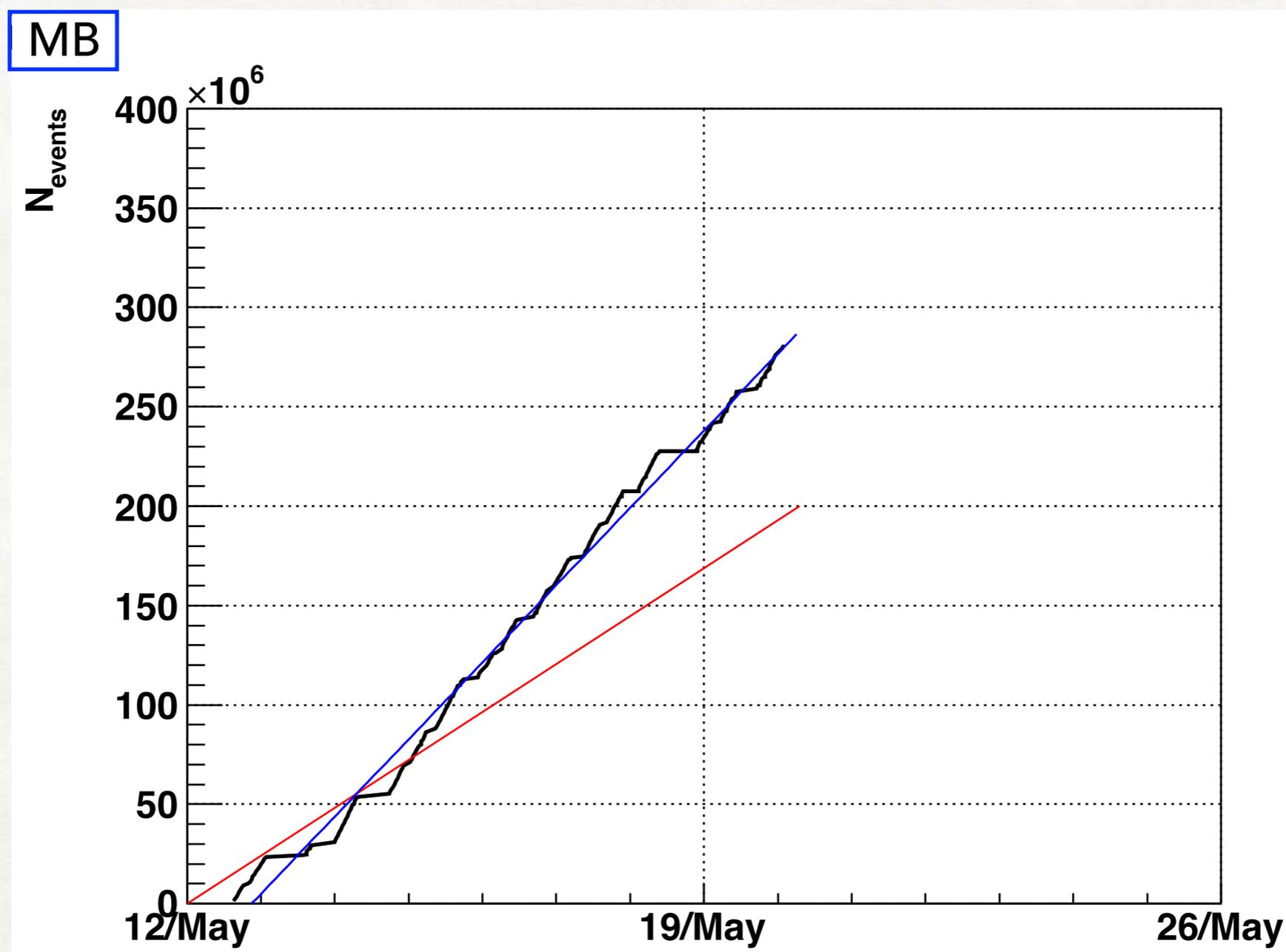
★ Upload of Run 14 HFT RDO firmware

→ Run 15 firmware caused drop in the matching ratio of tracks with at least 3 HFT hits and TPC tracks

★ New VPD trigger algorithm implemented



d+AU AT $\sqrt{s_{NN}} = 200$ GeV PERFORMANCE



★ 280M MB events collected

→ Will be useful to do the job of Run 15 p+Au dataset



SUMMARY

- ★ Run 16 concludes STAR Heavy Flavor Program
- ★ Major upgrades and improvements
 - PXL material budget reduction
 - MTD in HLT trigger performance
 - MB trigger purity improvement
- ★ We are on good path to reach >90% of our main goals
 - expect last week to switch back to Au+Au at $\sqrt{s_{NN}}=200$ GeV
- ★ STAR looks forward to analyzing these data and soon present its results
- ★ Stay tuned

THANK YOU
C-AD