

# STAR Goals for Run 10, Beam Studies for STAR



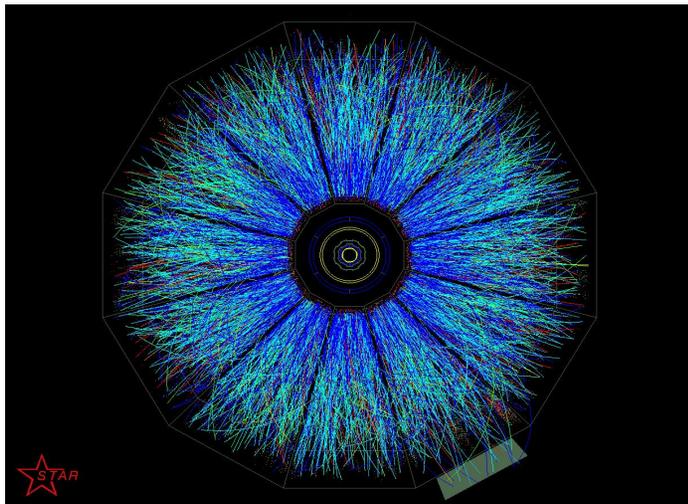
W.B. Christie, BNL

*APEX Workshop*

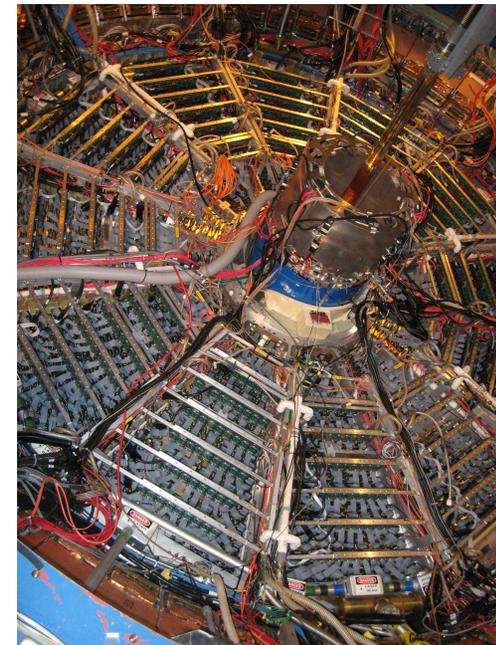
*Nov. 12, 2009.*

## Outline

- Changes to STAR for Run 10
- Summary of Shutdown activities
- Goals for Run 10
- Beam Studies for STAR



Load Testing TPC Support



New TPC Electronics

# DAQ1000 Completed for Run 9



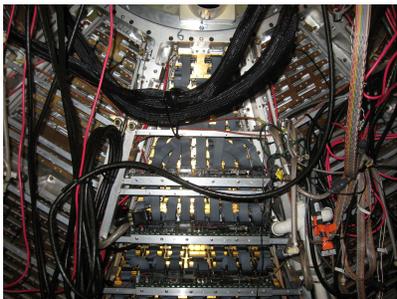
FEE Board



RDO Board

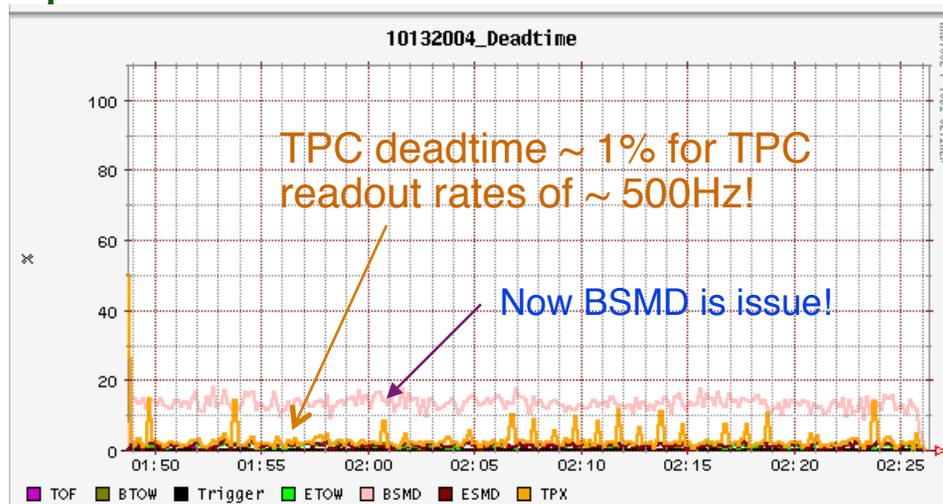


FEE Testing



First sector installed & Tested

- All new Readout Boards (RDO, ~ 200) were received, tested, and installed.
- All FEE boards (~5000) were received, tested, and installed. Completed on schedule.
- All LV power supplies were removed, modified, reinstalled, and tested.
- The new TPC (aka TPX) electronics was fully installed, commissioned and operational in Run 9!



Modifying LV Supplies



Installing FEES/RDOs



Boards Arriving

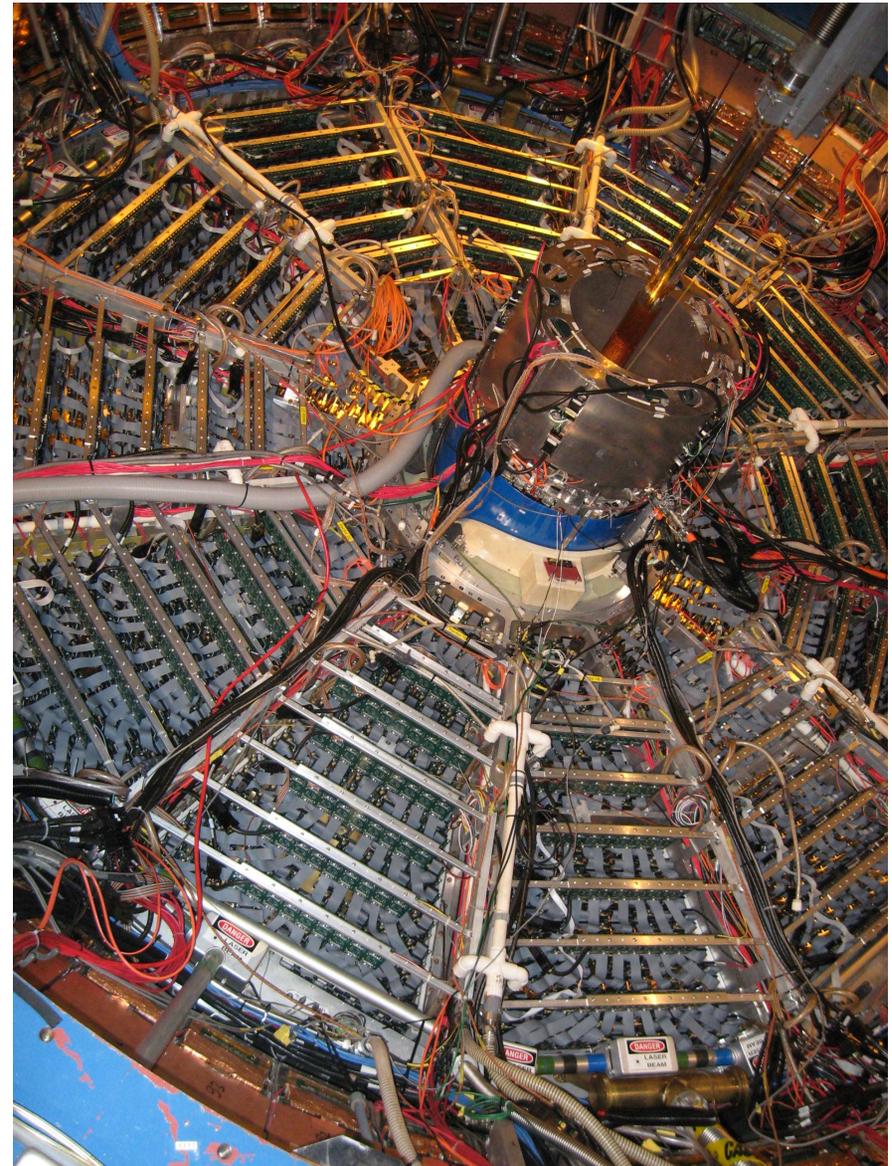
## DAQ1000 TPC Electronics Upgrade Complete



New TPC Low Voltage supplies installed

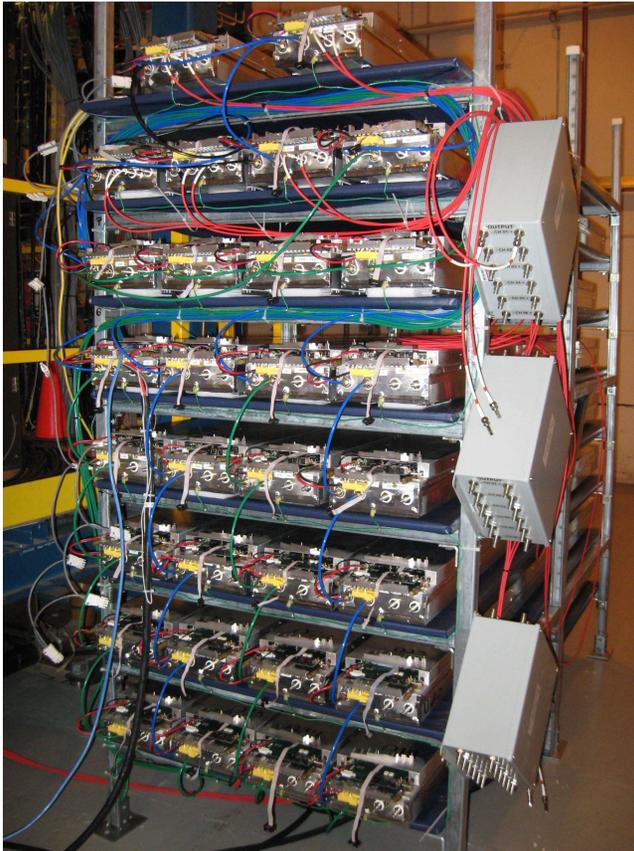


New TPC readout computers installed



New TPC FEEs, RDOs, cables, and fibers installed

# TOF Test Stand and one of two Gas Manifolds



TOF Tray Installation Complete.

- Goal for FY08 Shutdown was to get somewhere between  $\frac{1}{2}$  (I.e. 60) and  $\frac{3}{4}$  (I.e. 90) TOF trays installed for Run 9.
- We ended up slightly better than the high end goal, with 94 (out of 120) TOF trays installed.
- **Remaining Tray installation completed on 10/01/09.**

# Overview of tasks for the FY09 Maintenance Period



## Shutdown started on Monday, July 6<sup>th</sup>:

- Pull both Poletips
- Diagnose/debug/repair TPC FEEs, RDOs, and LV supplies.
  - 8 FEEs (out of ~ 4,400) repaired or replaced
  - 6 RDO's diagnosed and repaired.
  - Power-up firmware modified to alleviate bulk of LV issues.
  - Full system repaired and tested by 1<sup>st</sup> week of September.
  - 1) New TPC RDO firmware with automatic recovery in case of Single Bit Upsets due to high beam intensity.
  - 2) DAQ hardware (PCs, RORCs, fibers) and software for the new BSMD FOB readout installed.
  - 3) DAQ hardware (PC, RORC, fibers) and software for the expected FGT test readout system installed.
  - 4) **New DAQ Event Builder prototype computer installed and tested. Expect full system installation for FY10. [necessary for top energy AuAu at high rates].**
  - 5) PMD trigger input system revised to accept more than 100 tokens.
- Propose, get approval, and modify fusing on all 8 BSMD and 4 BPSD crates**
  - Work completed, and crates reinstalled and cabled in time for system testing starting September 10<sup>th</sup>.
- Fabricate, load test, and install new temporary TPC support
  - Pull select TOF trays (best) and install all remaining TOF trays not behind TPC arms
  - Remove (one side at a time) TPC support arms, remove CTB trays, install, cable & plumb, and test TOF trays. Reinstall support arms.
  - All 120 TOF trays are in the system. Testing continues.
- **Design, fabrication, and testing of new BSMD Fiber Output Boards (FOB)**
  - **When complete will lead to a fixed 313 us/evt BSMD readout (~ 16% deadtime @ 500 Hz)**
- FTPCs extracted from TPC inner cone for FEE & RDO repair
- Numerous routine electronics repair and maintenance
- **Further Trigger Control Unit (TCU) testing**
  - 11 PMD sectors replaced, work done on LV dist. & trigger interface.
  - TPC documentation pages extensively reworked and updated.
  - monitoring added to the voltage of the BLM detector as well as remote power on and off capability

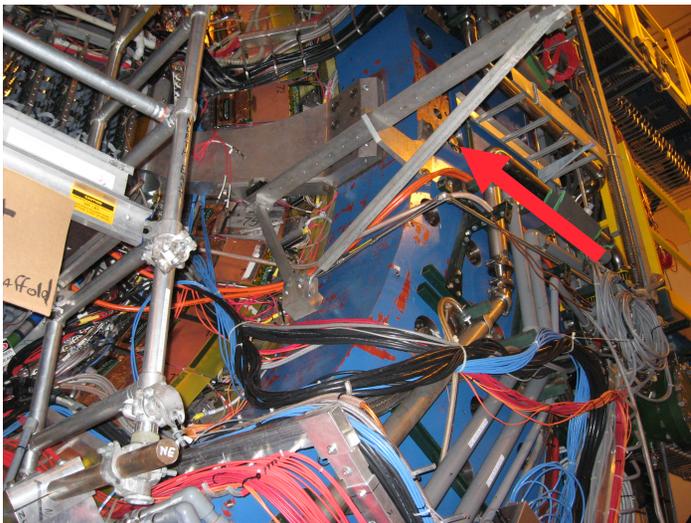
CTB Trays removed, and TOF trays installed behind TPC supports



Load testing the temporary TPC support



Temporary TPC support holding the TPC

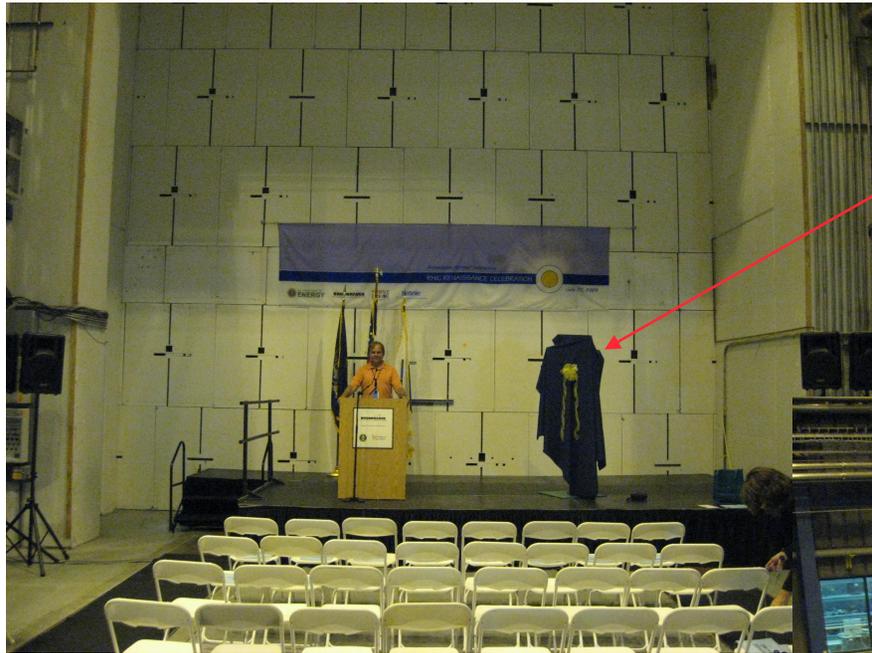


Fixture installed for removing TPC support



Rigging TPC support to floor

STAR Assembly Hall turned into a Theater for a day (Renaissance Celebration)



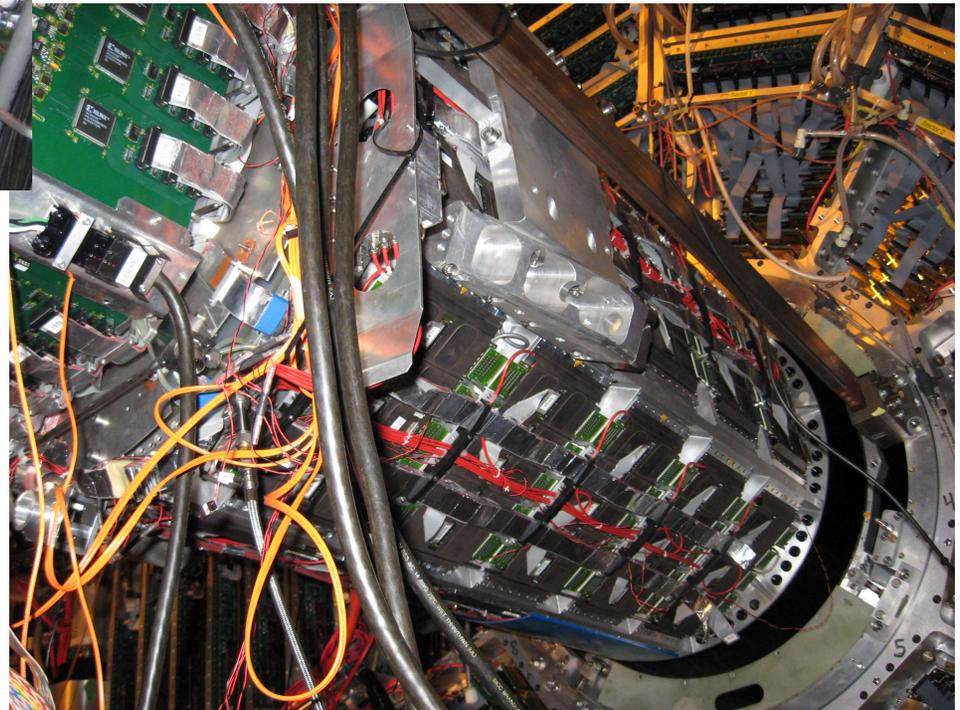
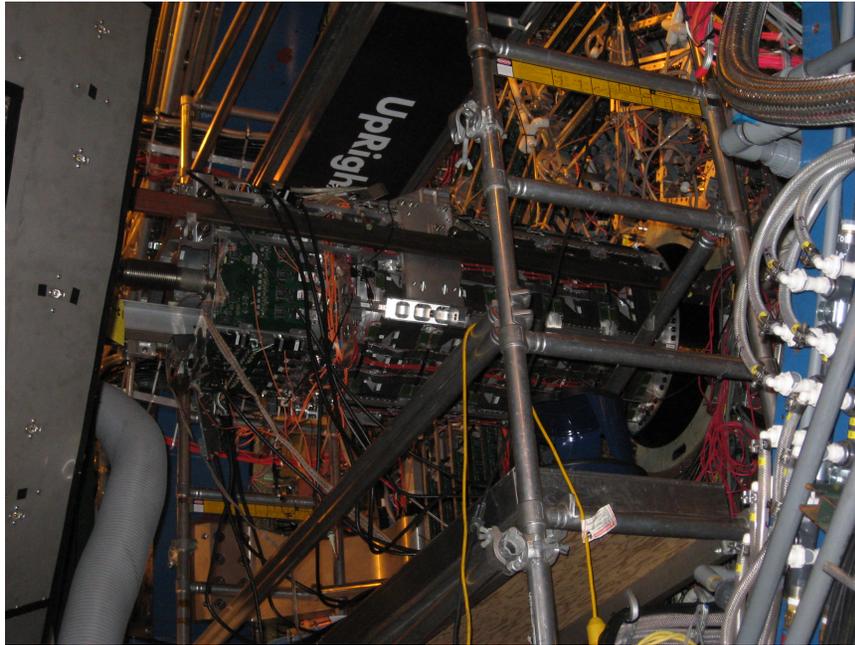
Street sign to be unveiled

Ring Road renamed Renaissance Circle

Now have blue carpet in Assembly Hall!



# West FTPC extracted from cone for FEE and RDO repairs



## Summary (FY09 Shutdown)

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TPC maintenance complete, testing and tweaking underway

New firmware updates for DAQ1000 readout system (*robustness*)

Re-Fusing for BSMD and BPSD crates complete (*robustness*)

BEMC maintenance complete

EEMC maintenance started first week of Nov., after West poletip installation

PMD sector maintenance complete, trigger/daq interface work in progress

Remaining 26 TOF trays have been installed, completing the TOF Project (*physics*)

FTPC maintenance is complete

Some TCU testing has been done, more to be done (*flexibility*)

Downstream (i.e. fibers, computers, etc) installation complete for new BSMD FOB (*deadtime*)

..... (i.e. various other maintenance tasks accomplished)

### Possible Concerns:

- TCU thoroughly tested and ready prior to run
- Reworked Networking for South Platform (*robustness*)

# STAR Goals for Run 10, 200 GeV AuAu



## A few Caveats:

- No RHIC budget yet, but rumors are that we'll have 25 (+?) Cryo wk run.
- Will show two run plans, Steve Vigdor's 25 Cyro wk plan, and possible STAR alternative (still some discussion within STAR on alternative plan).

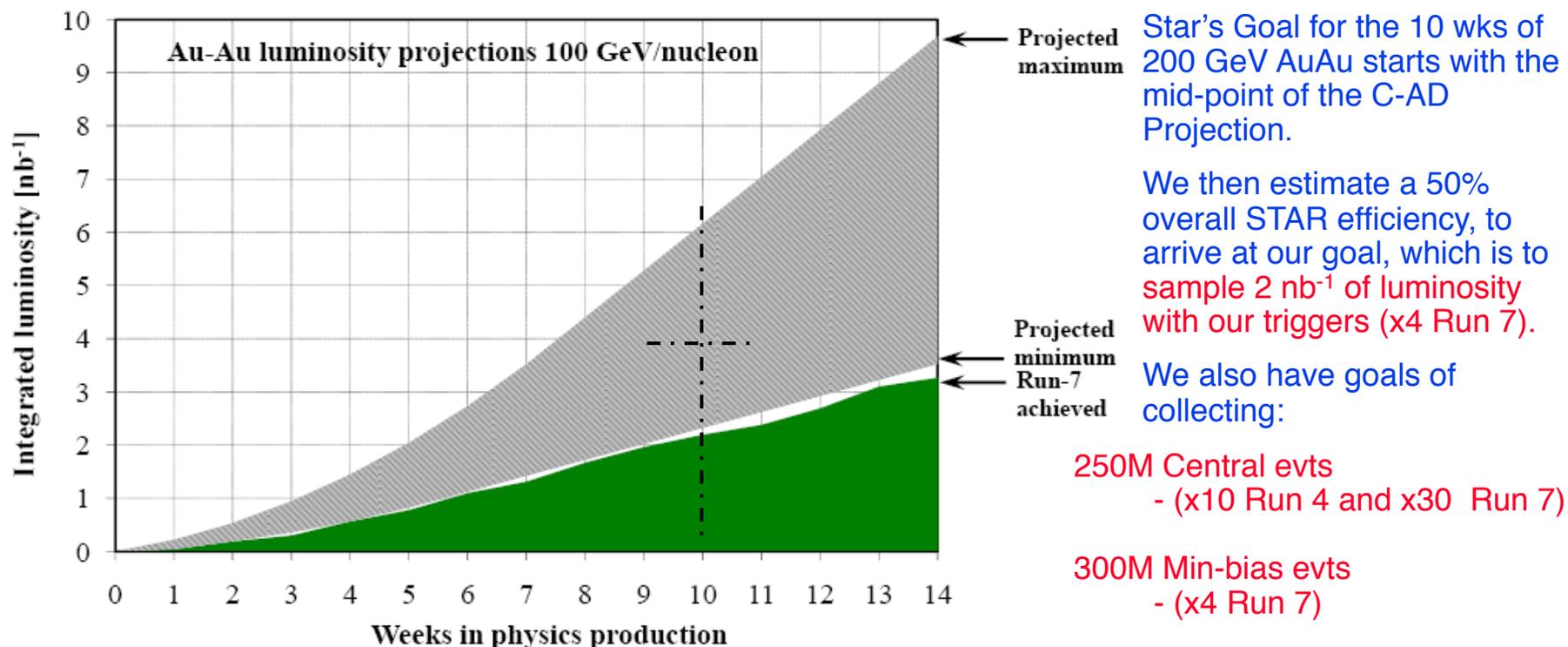


Figure 2: Projected minimum and maximum integrated luminosities for gold-gold collisions at 100 GeV beam energy, assuming linear weekly luminosity ramp-up in 6 weeks for the minimum and 8 weeks for the maximum.

Run 10 plans, from Steve Vigdor's RHIC News Article



$\sqrt{s_{NN}}$ (GeV) for Au+Au	# weeks in 25-cryoweeek scenario	# weeks in 30-cryoweeek scenario
200	10	10
62.4	4	4
39	1.0	1.5
27	2.5	4.5
18	0	1.5
11.5	1.5	2.5
7.7	1.0	1.0



## STAR BES Physics Programs

**Table II:**

Beam Energy (GeV)	$\mu_B$ (MeV)	STAR BUR (run10)	Steve (Weeks)	STAR (Weeks)
200	25	8	10	10
62.4			4	4
39	110	0.7	1	1
27	160	1.7	2.5	0
14.5	260	2.3	0	0
10.5	340	2.7	1.5	0
7.7	420	8	1	5
6.0	500			
5.0	550			

N.B. STAR didn't request any 62.4 GeV running, and at this point has no goal for running at this energy.



## “Low Energy” Running Goals

### Assumptions used in calculating “Low Energy” Milestone estimates

- Overall efficiency for the “low energy” ( $\leq 39$  GeV) running is such that STAR is collecting data for 10 hours/day. This overall efficiency includes RHIC time at store for physics, STAR efficiency, time taken for beam development, scheduled access days, APEX, etc. This means that for each week of running at a planned energy shown below STAR is taking data for 70 hours.
- At the calculated collisions rates below, STAR takes all of the delivered events during the 10 hours/day that it is collecting data.
- The AuAu cross section for all of the energies is assumed to be 7 b.

Table 1. Milestone estimates for “Low Energy” portion of RHIC Run 10(Steve’s 25 wk Plan).

$\sqrt{s}$ (GeV)	# of wks	Collision rate (Hz)	Total events scanned(delivered) Mevts	$\int Ldt$ ( $\mu\text{b}^{-1}$ )	pp equiv. ( $\text{nb}^{-1}$ )
39	1.0	190	48	6.7	268
27	2.5	92	58	8.3	322
18	0	33	8 (/wk)	1.2 (/wk)	47 (/wk)
11.5	1.5	10	3.6	0.5	21
7.7	1.0	2.7	0.7	0.1	4

In the possible alternative STAR plan, the 39 GeV goal stays the same.

For the 7.7 GeV running we’d push to try and record as many events as possible. With the assumptions used above one calculates we’d record  $\sim 3.5$  M evts. What we’d like for this energy is 5 M evts.



Bill,

There are a number of issues from previous years.

There is the 9 MHz cavity to reduce the vertex width.

There is the 10 Hz vibrations and how close they can run to the 2/3rds resonance.

I hope they already have these on their list.

Bill,

We have observed high radiation loss near the beampipe just before physics running starts. This produces damage to ours and the Phenix silicon vertex detectors.

We would like to see if C-AD can minimize the radiation so that the lifetime of the silicon detectors can be increased. This loss of beam also reduces the beam intensity during the our data taking.

Another study that we would like to see is that we find that the radiation to the STAR detector increases as a function of Z near the beam pipe. (Phenix sees the same thing.)

We would like this studied.

There will be a concern about radiation damage to the new Silicon detectors at STAR (undergoing a DOE CD-1 review as we speak). An APEX study that may address this could be collimation of the beam up the energy ramp. Is this possible? Appropriate for an APEX study?

The high luminosity during the 500 GeV pp running stresses/ages the detector components. One way to reduce this could be to steer the beams out of collision at STAR anytime it is not ready to take physics data. Could such a capability be put in place (i.e. rapid local steering out of, then back into, collisions)? Would this be appropriate for an APEX study?