

A High Level online tracking Trigger (HLT)

Jan Balewski (MIT), Gene Van Buren (BNL), Yuri Fisyak (BNL),
Yury Gorbunov (Creighton), Jeff Landgraf (BNL), Jerome Lauret (BNL),
Tonko Ljubcic (BNL), Hao Qiu (IMP), Xiangming Sun (LBL),
Bernd Surrow (MIT), Aihong Tang (BNL), Zhangbu Xu (BNL) + IIT ...



Motivation

- Large luminosity at RHIC II and eRHIC : We need a highly efficient trigger to reduce events to tape.
 - RHIC II, ($8 \times 10^{27} \text{ cm}^{-2}\text{s}^{-1}$ for AuAu and $3 \times 10^{32} \text{ cm}^{-2}\text{s}^{-1}$ for pp)
(4B events/year, if record all, it takes multiple years to reconstruct with projected CPU capability).
 - eRHIC, peak luminosity, $2.6 \times 10^{33} \text{ cm}^{-2}\text{s}^{-1}$ (EIC Collab. Mtg 07)
- Great potential for many interesting physics topics.
 - Heavy flavors, high p_t , anti-Hypernuclei etc.
(for example, trigger on dilepton pairs for J/ψ , trigger on dE/dx for Anti-hypertriton.)

While we are (will be) pleased by the high luminosity, we have to make sure we can take the full advantage of it.



An example of reduction rate for high p_T and di-Lepton trigger

Facts : RHIC II collisions rate is 50k Hz for AuAu and 1M Hz for pp.

STAR can operate at a rate of ~ 500 Hz

Trigger has to be effective by a factor of 100 and 2k in AuAu and pp collisions, respectively.

3.6 billions events/year on tape with 12-week run at 500 Hz

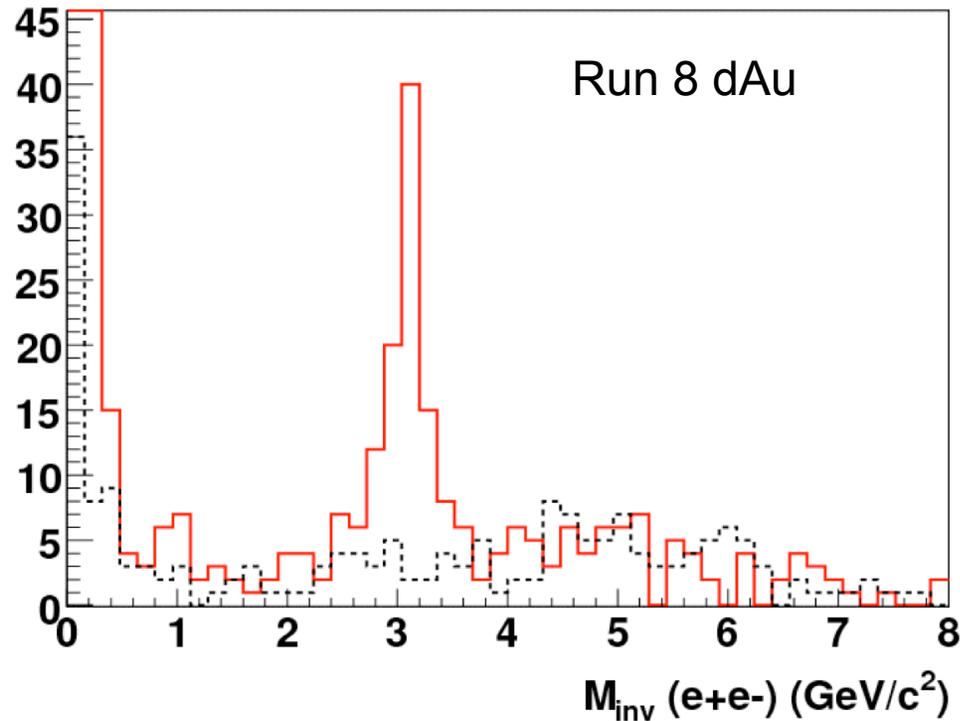
Species	p_T (GeV/c)	Rate per event	#events after trigger
Au+Au 0—5%	>4	0.065	236M
Au+Au 0—5%	>5	0.014	50M
Au+Au 0—5%	>6	0.0042	15M
p+p	>4	0.00031	1.1M
p+p	>5	0.000065	237K
p+p	>6	0.000020	72K

Dilepton p_T (GeV/c)	Electron per event	Rejection factor
>1.0	0.31	10
>1.5	0.06	278
>2.0	0.016	4000

Great reduction in events to tape.



HLT, current status and future needs



J/ψ peak from online tracking !
Rejection rate of 99% on High Tower triggered events.

- We are exploring a few options to speed up online tracking. We foresee funding is needed in the future for computing equipments.

- For now a **postdoc** with expertise is needed at minimum for this project to carry on.