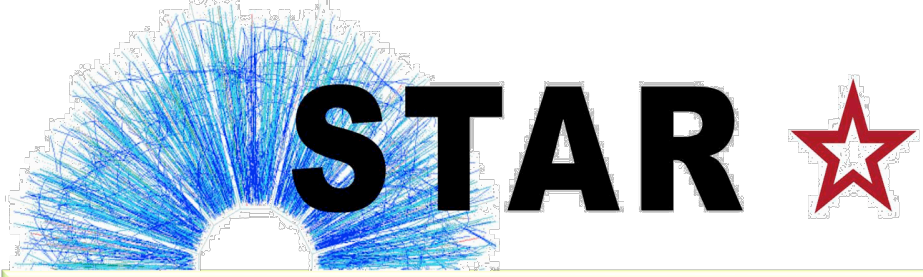


University of Illinois at Chicago

UIC

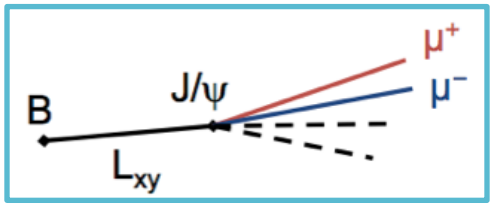
Prospects of Non-Prompt J/ψ Measurements at STAR

- Introduction
- New STAR detectors
- Simulation with HFT and MTD
- Summary

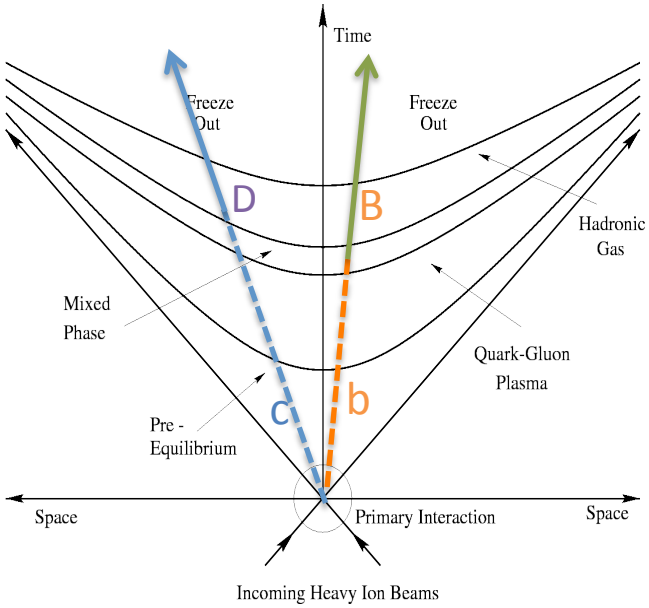
Zaochen Ye (for STAR Collaboration)

Introduction

1. What is QGP?
2. How to create QGP ?
3. Why heavy flavor quarks?
4. Why non-prompt J/ψ ?



$$\ell_{J/\psi} = L_{xy}\frac{m_{J/\psi}}{p_T}$$



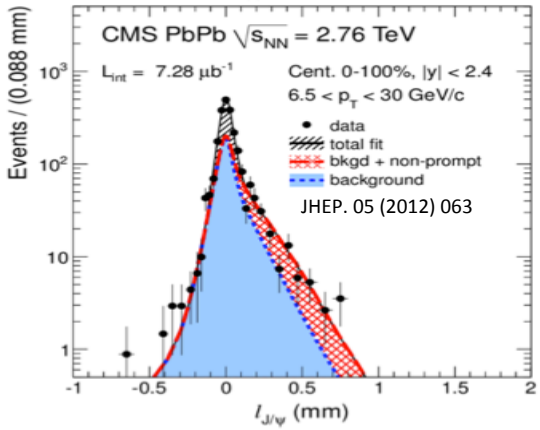
Due to the color charge and mass difference, it is expected that:

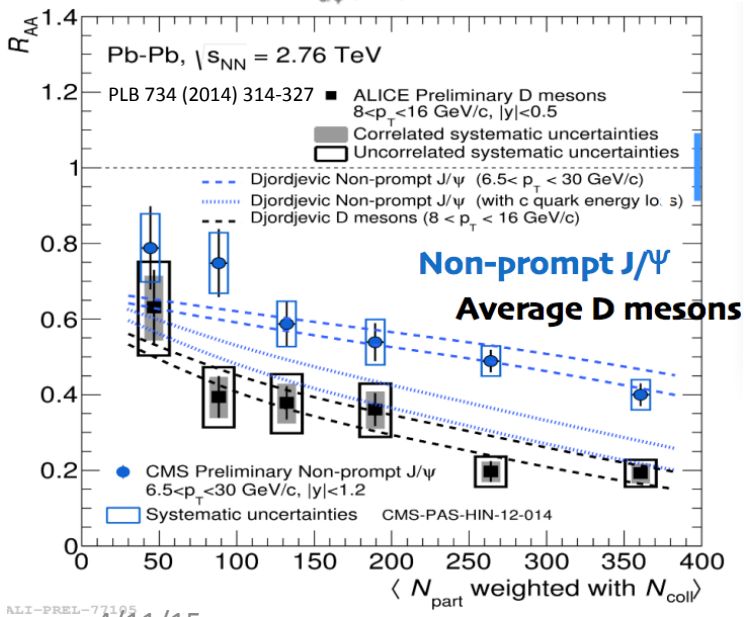
$\Delta E_g > \Delta E_{u,d,s} > \Delta E_{charm} > \Delta E_{beauty} \longrightarrow R_{AA}^{\pi}(p_T) < R_{AA}^{D}(p_T) < R_{AA}^{B}(p_T)$?

Nuclear Modificaton Factor: $R_{AA}(p_T) = \frac{dN_{AA}/dp_T}{< T_{AA} > d\sigma_{pp}/dp_T}$

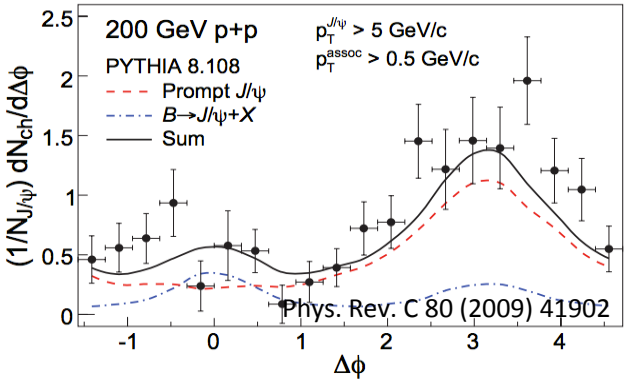
Current measurement status

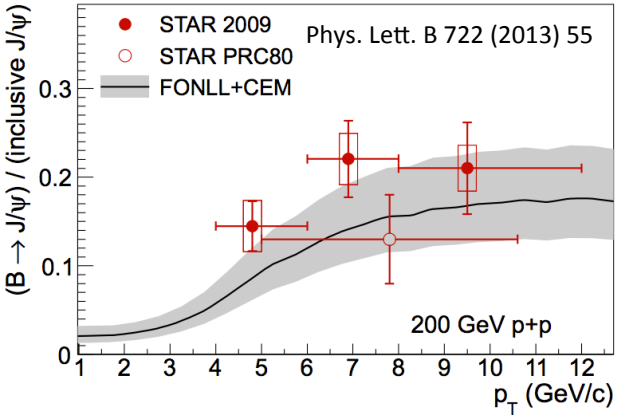
At CMS and ALICE (LHC)





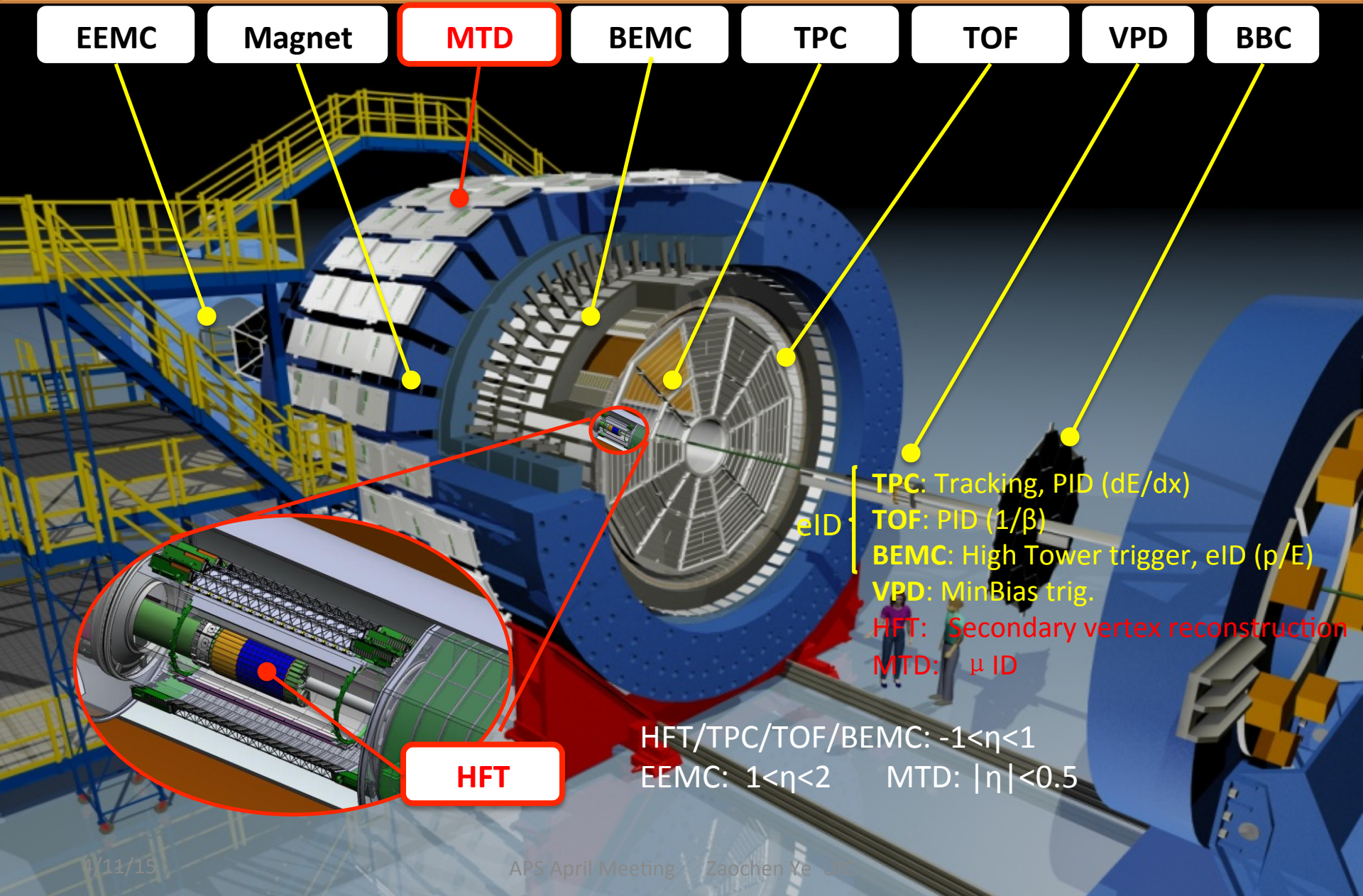
At STAR (RHIC)



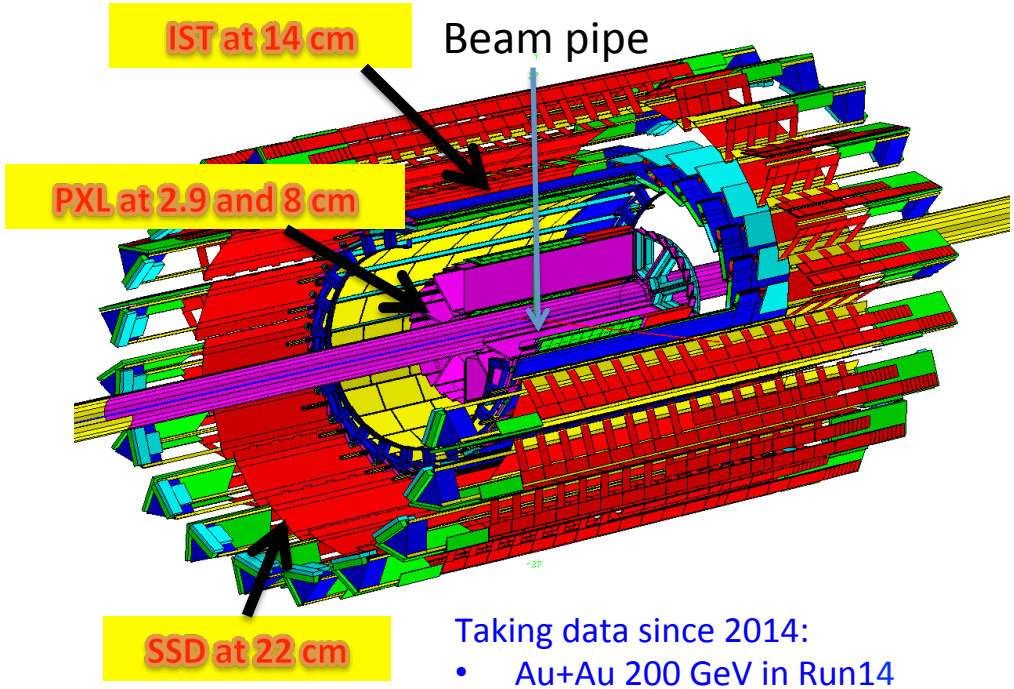


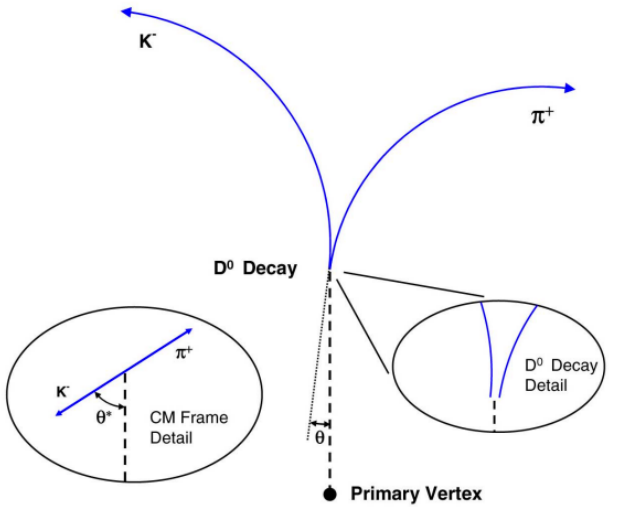
Now STAR is ready to do the same measurement as LHC at RHIC energies. Anything new ?

New STAR detectors HFT and MTD



Heavy Flavor Tracker



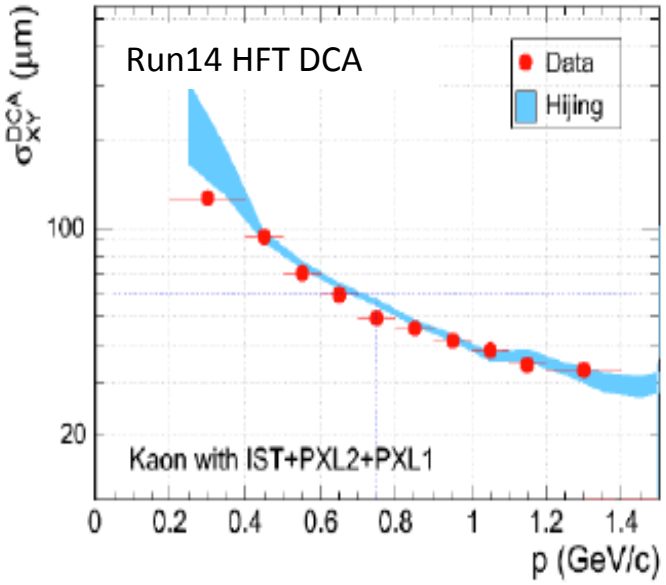


Taking data since 2014:

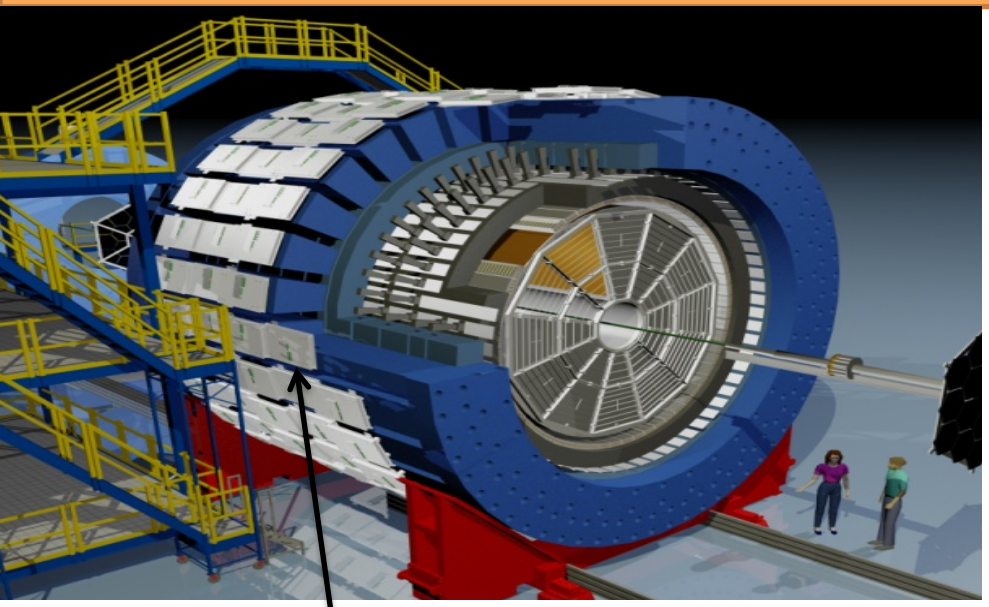
- Au+Au 200 GeV in Run14

Detector	Radius (cm)	Hit Resolution R/φ - Z (μm)	Radiation length
SSD	22	20 / 740	1% X_0
IST	14	170 / 1800	<1.5 %X_0
PXL	8	12 / 12	~0.6 %X_0
	2.9	12 / 12	~0.4% X_0

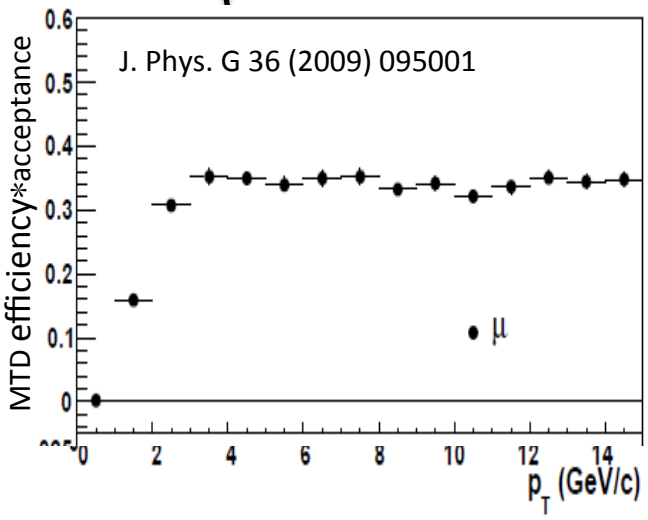
TPC~mm → HFT 10s of μm !!!

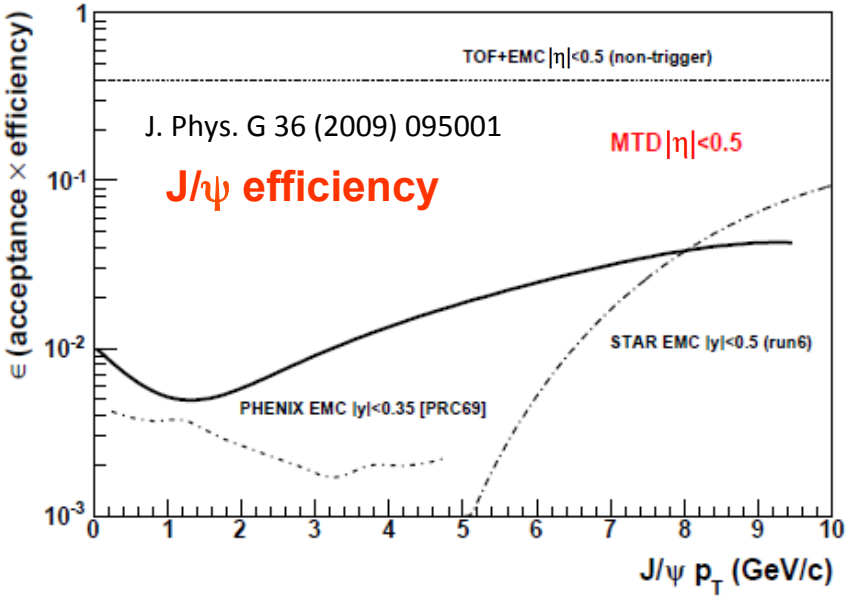


Muon Telescope Detector

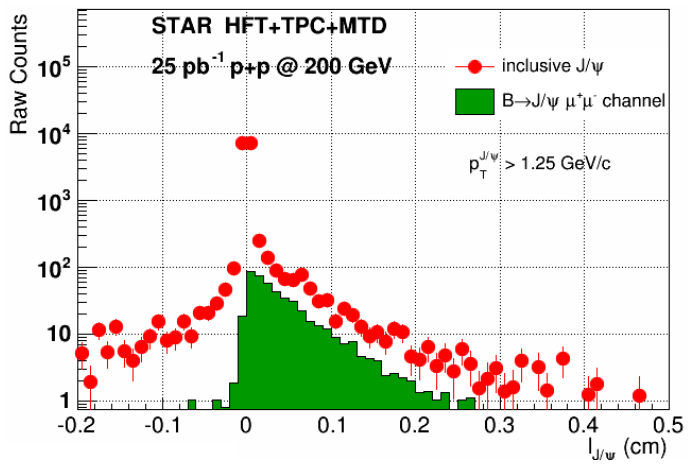


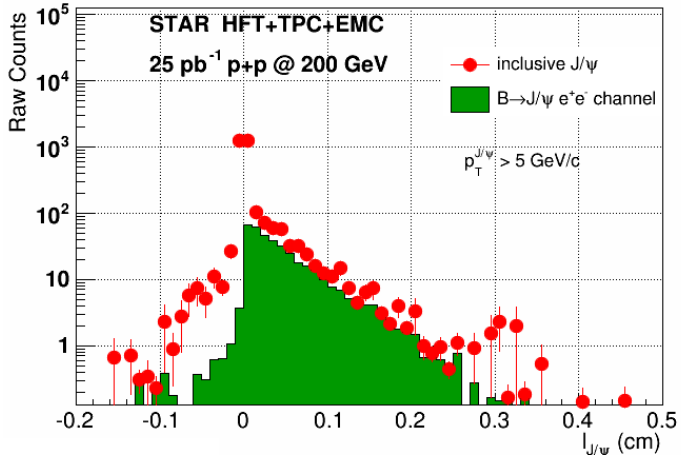
- Multi-gap Resistive Plate Chamber:
- Electronics same as STAR-TOF
- Acceptance: 45% at $|\eta|<0.5$
- Intrinsic timing resolution: <100 ps
- Spatial resolution: ~1 cm
- Trigger threshold p_T~ 1.2 GeV/c
- 60% in 2013, 100% installed and taken data since 2014

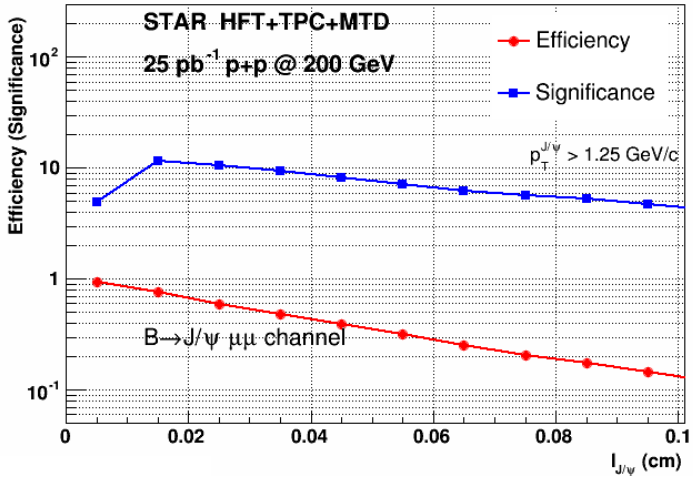


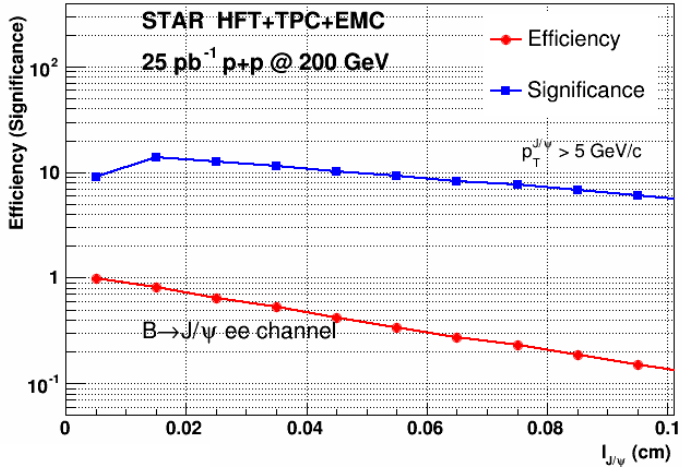


Decay length projection





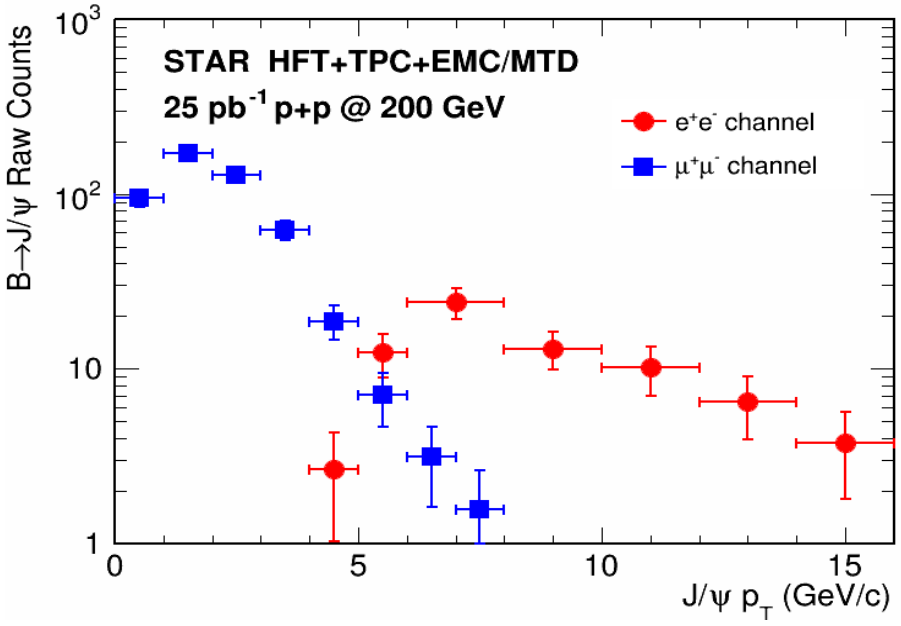




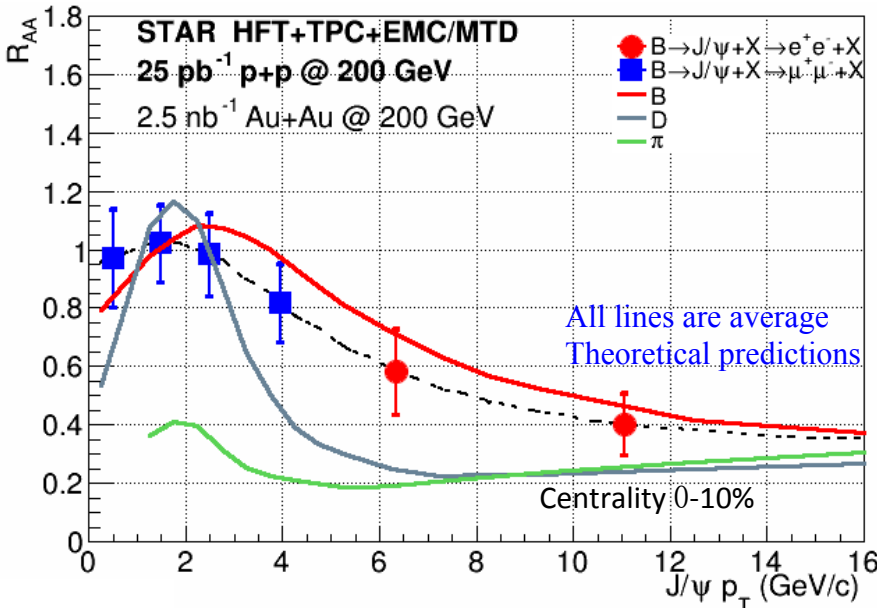
The B-decay J/ψ and inclusive J/ψ are normalized according to CEM

Pythia+ GEANT Simulations

R_{AA} Projection



J/ψ measurements in di-electron and di-muon channels are complementary to each other in p_T coverage



The yield of Au+Au collisions is obtained from p+p simulation according to the scaling of number of binary collisions

Pythia+ GEANT Simulations

Summary

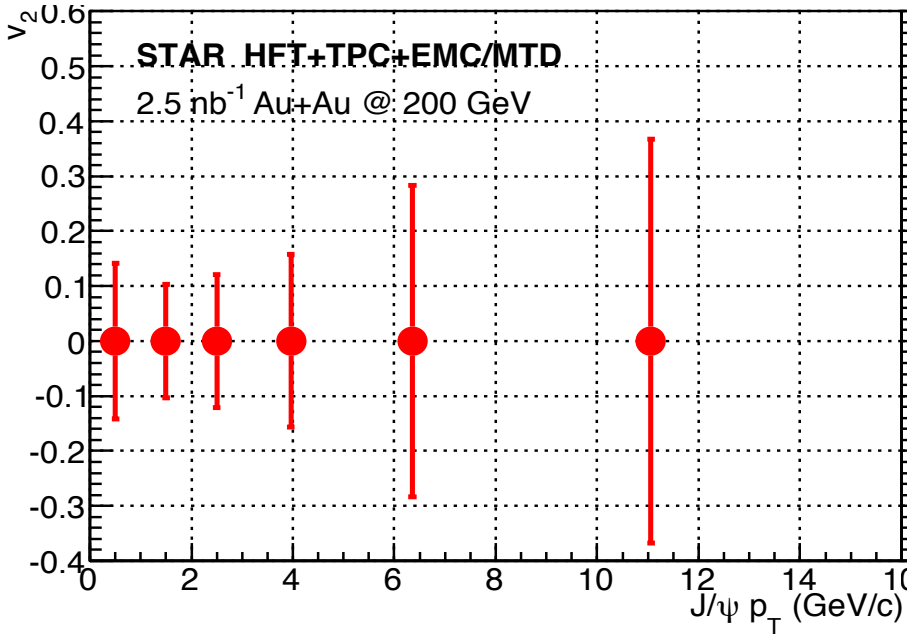
- B-decay J/ψ production is good tool to study interactions between b quark and the medium
- Measurement at RHIC energy will be an important complement to LHC results
- Newly installed HFT allows separation between prompt and non-prompt J/ψ
- Newly installed MTD allows J/ψ reconstruction by di-muon channel at low pt, which will be complementary to di-electron J/ψ reconstruction at high pt.
- Future data taking plan:

  p+p, p+Au 200 GeV in Run15

  Au+Au 200 GeV in Run16

Backup

uncertainty projection of v_2 (B→J/ψ)



$$\frac{2\pi}{N}\frac{dN}{d\varphi} = [1 + 2v_1\cos(\varphi - \Psi_{RP}) + 2v_2\cos[2(\varphi - \Psi_{RP})] + \cdots]$$

Charm and light flavor measurement at STAR