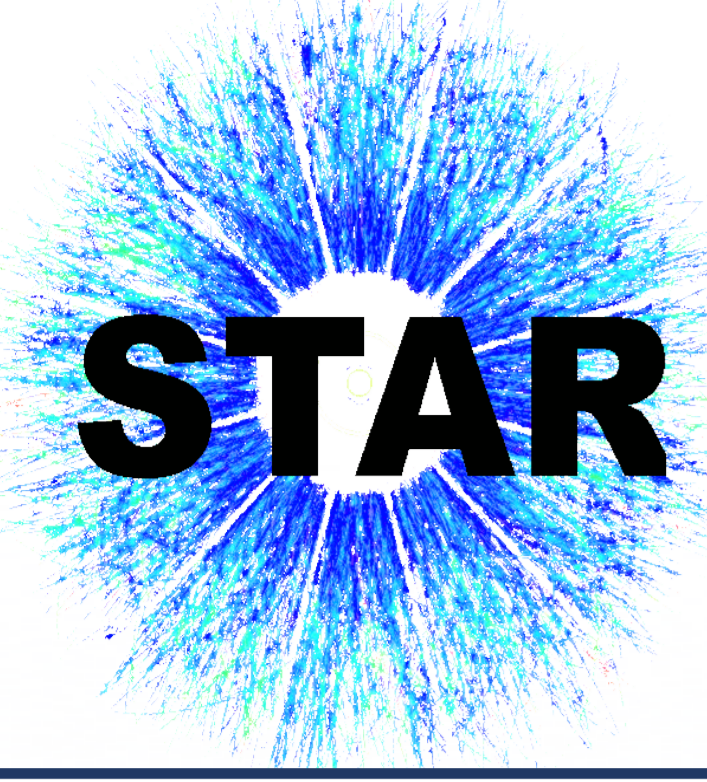


Non-prompt D^0 -meson production in Au+Au collisions at

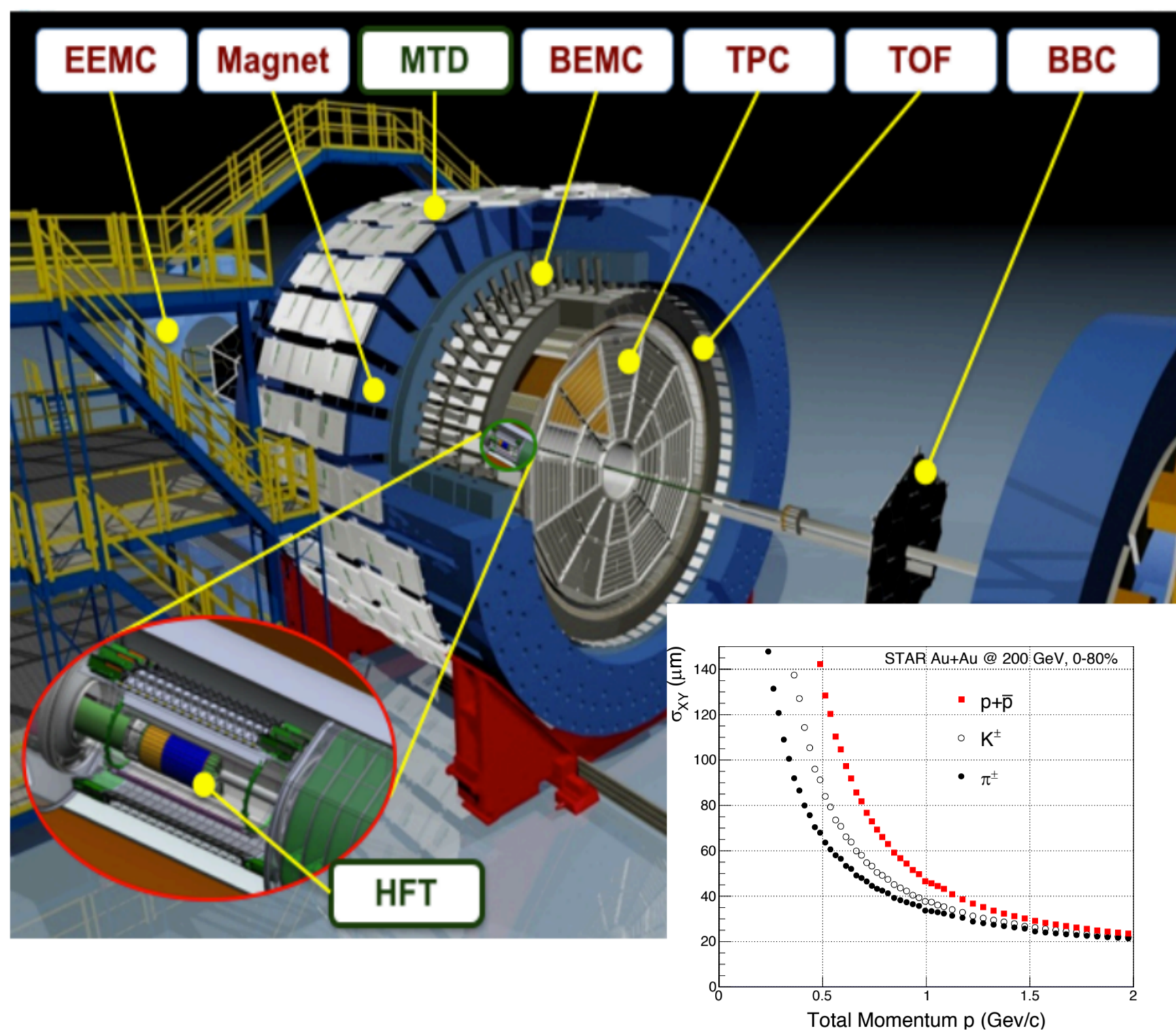
$$\sqrt{s_{NN}} = 200 \text{ GeV in STAR}$$

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Abstract: Heavy flavor quarks (c, b) are produced dominantly by the interactions of the initial incoming partons, and thus experience the entire evolution of the hot and dense medium created in high-energy nuclear collisions. Systematic investigations of charm and bottom hadron production in heavy-ion collisions will shed light on the parton energy loss mechanism and constrain the transport parameters of the Quark-Gluon Plasma (QGP) medium. In this poster, we present the first measurement of non-prompt D^0 meson production from bottom hadron decays, using the STAR Heavy Flavor Tracker (HFT), in Au+Au collisions at $\sqrt{s_{NN}} = 200$ GeV. Distributions of the Distance of Closest Approach (DCA) for reconstructed D^0 mesons are fit with templates for prompt and non-prompt D^0 mesons obtained from Monte Carlo simulations. Fractions of non-prompt D^0 mesons are extracted for the transverse momentum range of $3 < p_T < 8$ GeV/c. The results are compared to model calculations and physics implications on the bottom production are discussed.

STAR detector



Time Projection Chamber

- $|\eta| < 1$, full azimuth
- Tracking, momentum
- PID through dE/dx

Time of Flight

- $|\eta| < 0.9$, full azimuth
- PID through velocity ($1/\beta$)
- Timing resolution: ~ 85 ps

Heavy Flavor Tracker

- $|\eta| < 1$, full azimuth
- DCA resolution in the transverse plane to the beam direction (DCA_{xy}) $\sim 35 \mu\text{m}$ @ 1 GeV/c (p)

Inclusive D^0 signals in different DCA bins

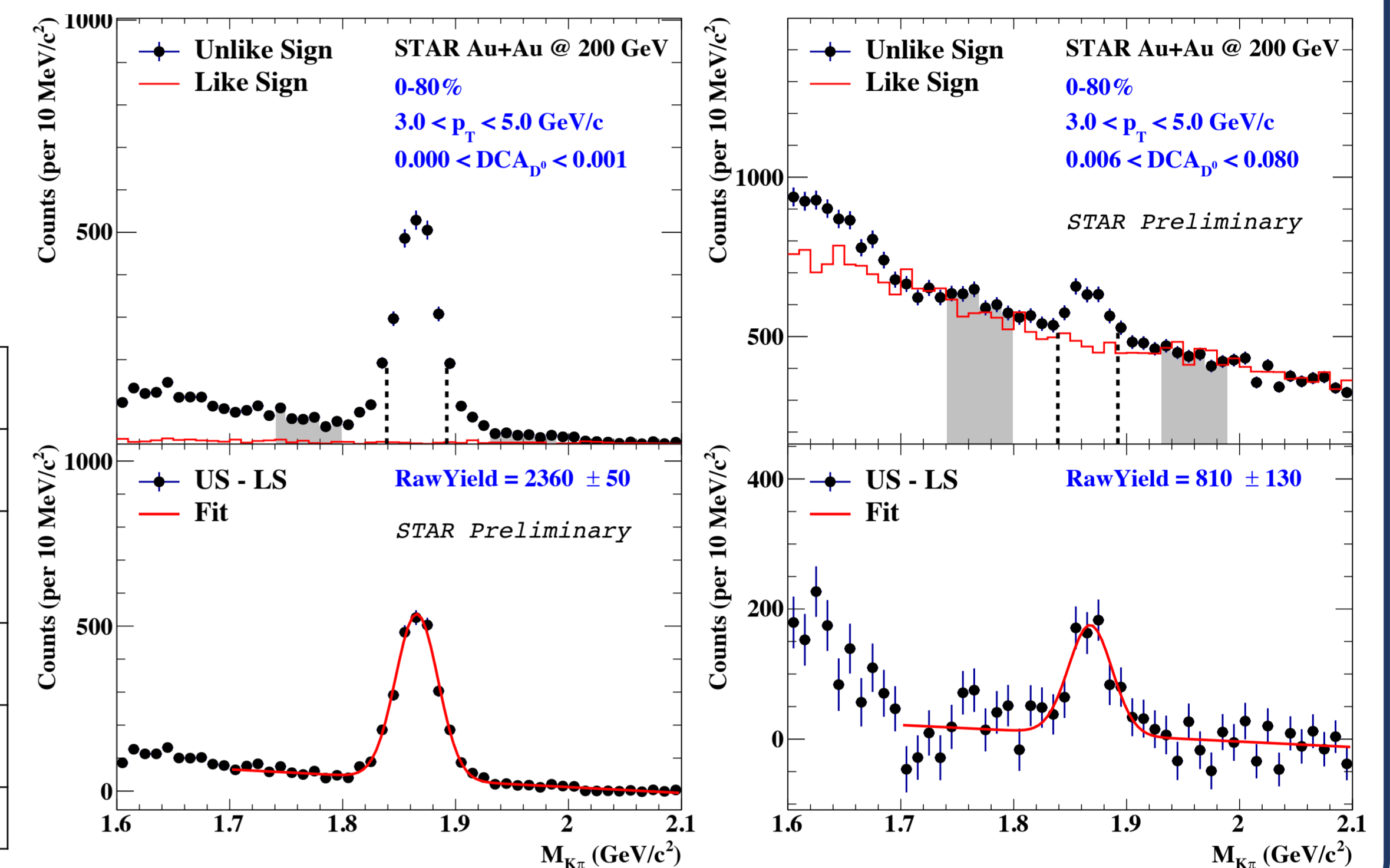
Total Events: $\sim 900\text{M}$

Inclusive D^0 :

- 1) Prompt D^0
- 2) D^0 from B decay

Topological cuts

p_T (GeV/c)	3-5	5-8
DecayL (μm)	>247	>259
$\cos\theta$	>0.95	>0.95
$DCA_{K\pi}$ (μm)	<50	<60
DCA_K (μm)	>79	>58
DCA_{π} (μm)	>81	>62

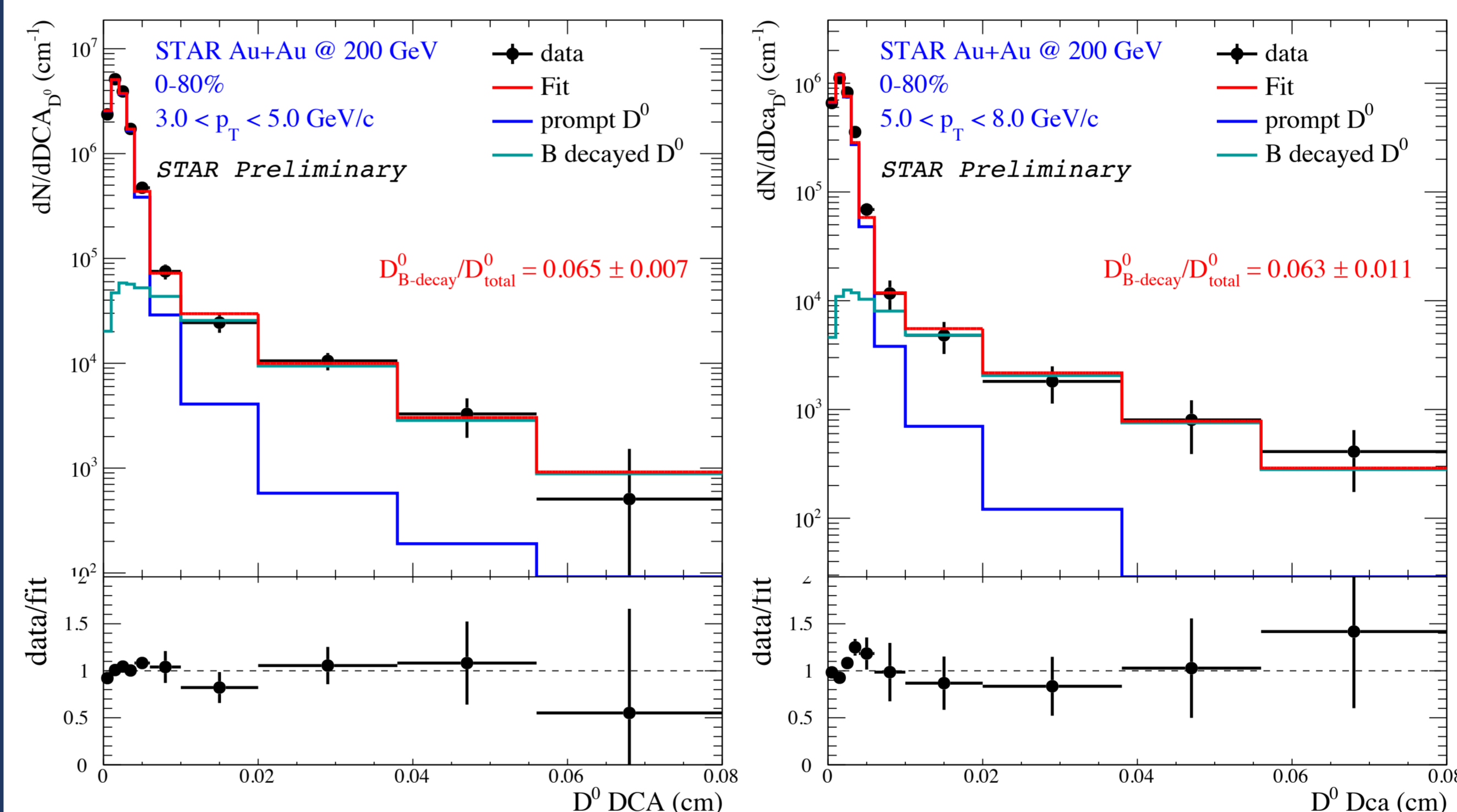


Templates for prompt and non-prompt D^0 mesons

- B-meson and D^0 -meson p_T spectra are from FONLL [2].
- All decay channels to D^0 for B^0 and B^{\pm} are included (PYTHIA version 6.416).
- Relative Contributions of B^+ , B^0 to non-prompt D^0 are fixed using fragmentation and branch ratio listed in the following table.
- Include detector effects: tracking efficiency, HFT matching ratio, DCA resolution, momentum resolution, etc.

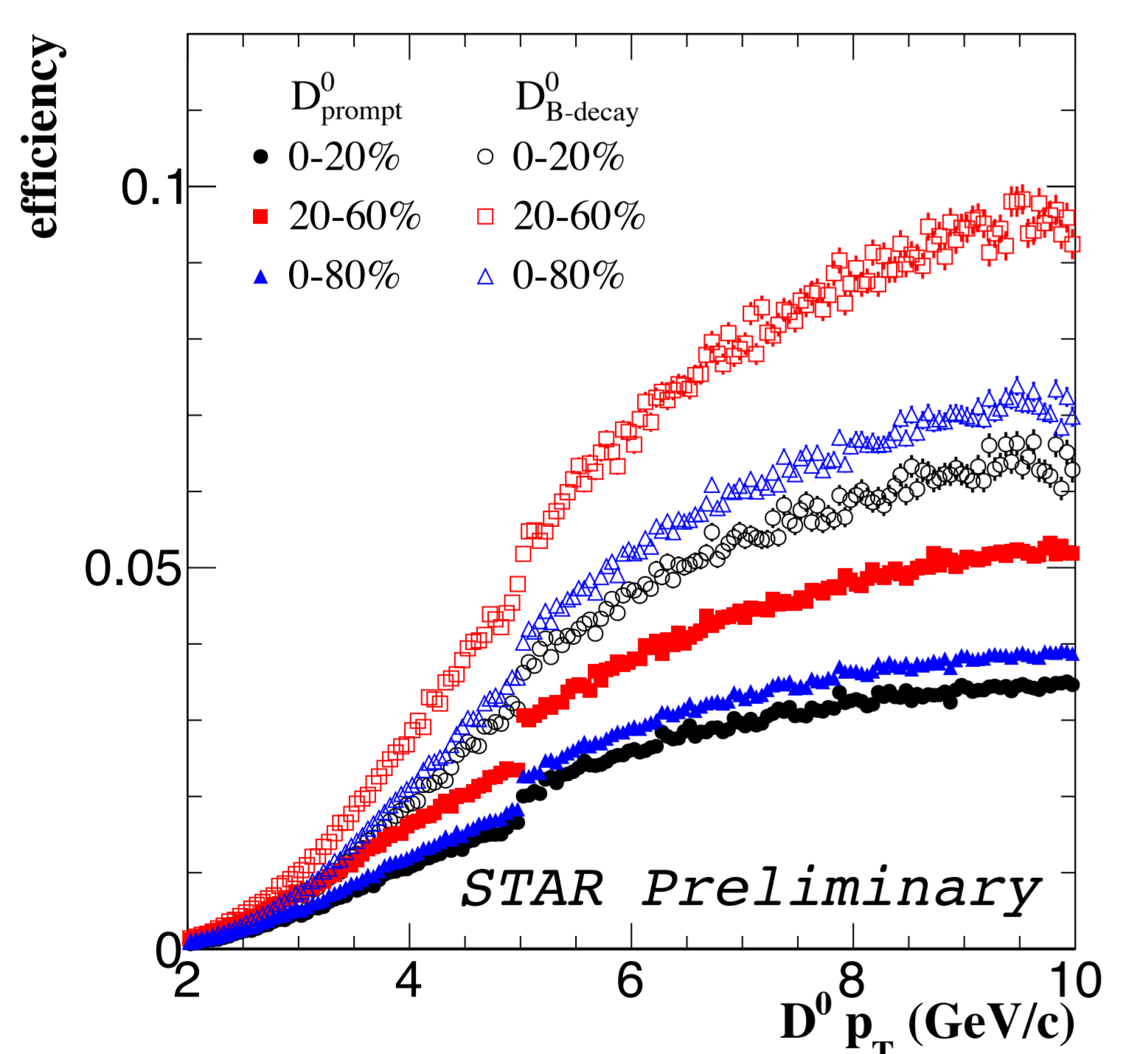
Particle	$c\tau$ (μm)	Mass (GeV/c^2)	$q(c, b) \rightarrow X(FR)$	$X \rightarrow D^0(\bar{D}^0)$ (BR)
D^0	123	1.865	0.565	-
B^0	459	5.279	0.40	0.081(0.474)
B^+	491	5.279	0.40	0.086(0.790)

Template fitting



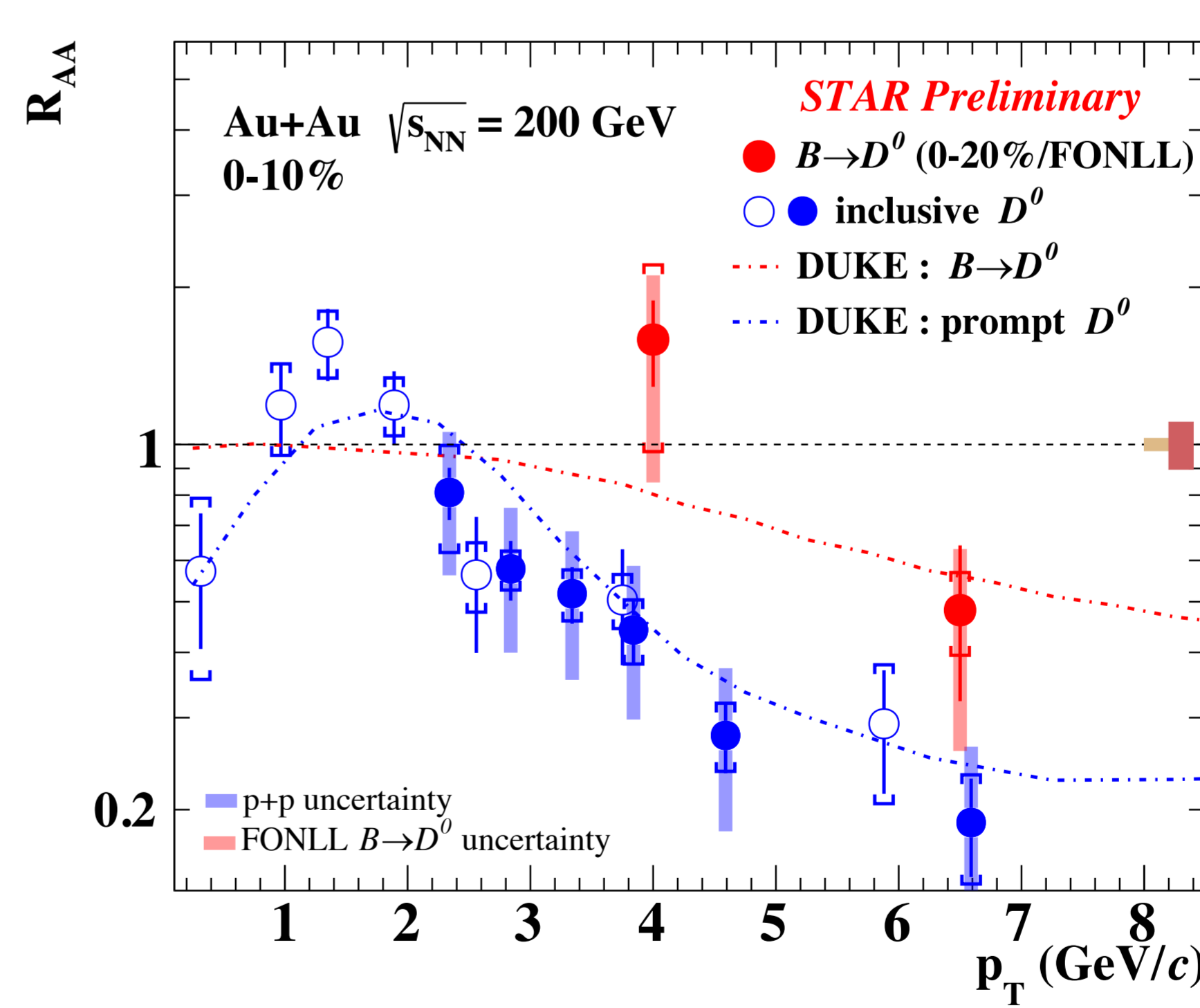
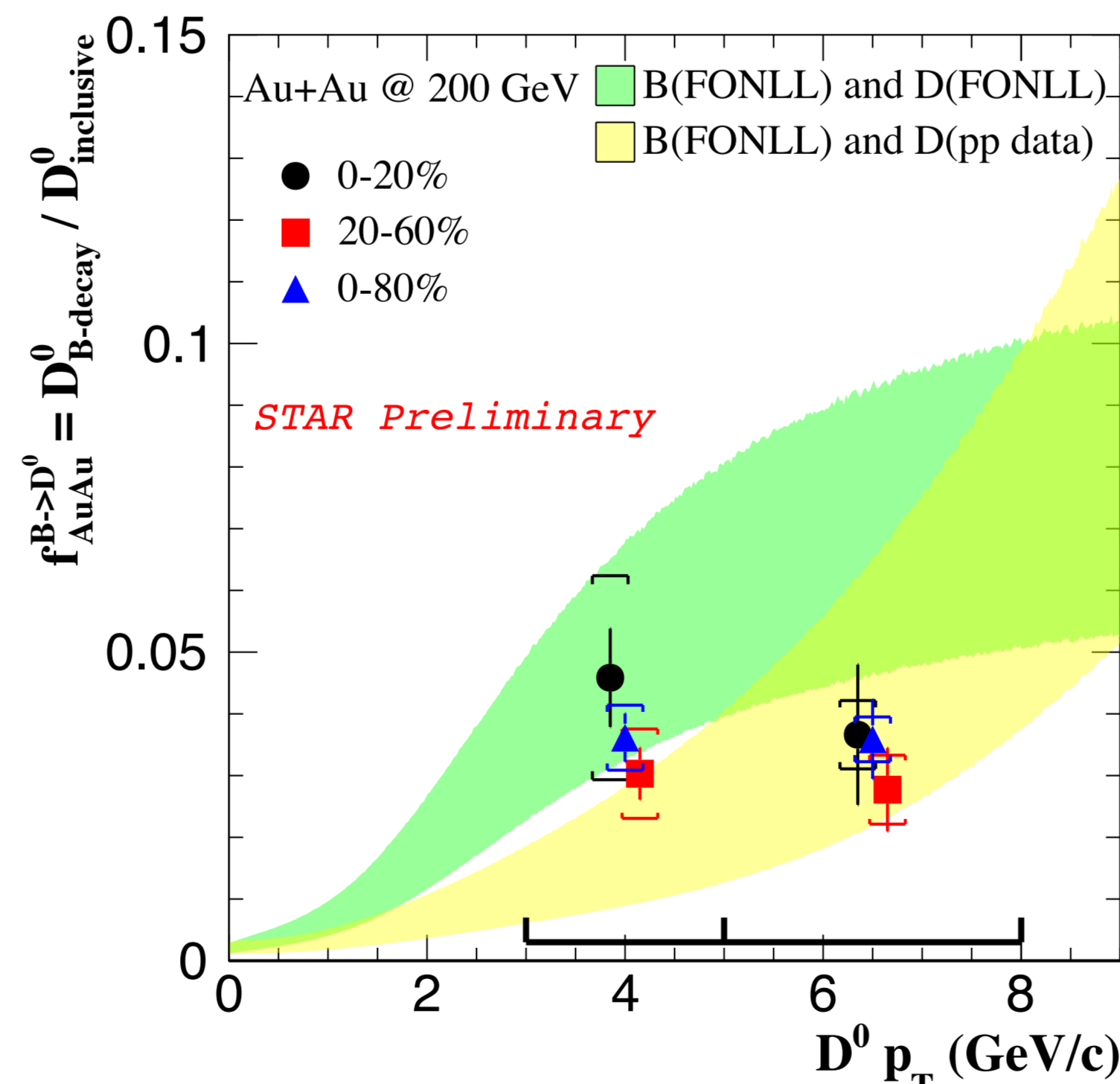
- Data point:
- (1) $DCA < 0.006$ cm: raw yield from mass fitting
 - (2) $DCA 0.006-0.08$ cm: background estimated using unlike-sign distribution in the side band regions.

Efficiency



Jump at 5 GeV/c due to change in topological cuts

Non-prompt D^0 fraction and R_{AA}



- Non-prompt $D^0 R_{AA}$: FONLL calculation of non-prompt D^0 is used as the pp baseline.
- Theory curves: S.Cao *et al.*, Phys.Rev.C92,024907 (2015)
- Inclusive $D^0 R_{AA}$: STAR PRL 113(2014) 142301
STAR Nucl. Phys. A 956, 473-476 (2016)
- pp data: STAR Nucl. Phys. A 931, 520-524 (2014)

Summary

- 1) First measurement of the non-prompt D^0 -meson production in Au+Au collisions at $\sqrt{s_{NN}} = 200$ GeV with the STAR HFT.
- 2) In 0-80% centrality, the non-prompt D^0 fraction is $0.036 \pm 0.004(\text{stat.}) \pm 0.005(\text{sys.})$ for 3-5 GeV/c, and $0.036 \pm 0.006(\text{stat.}) \pm 0.004(\text{sys.})$ for 5-8 GeV/c.
- 3) Using FONLL calculation for B-meson production as the p+p baseline, the non-prompt D^0 production at $5 < p_T < 8$ GeV/c in Au+Au collisions is suppressed.

Outlook

Expect a factor of 3 increase in statistics by combining data taken by STAR in 2014 and 2016.

Reference

- [1] L. Adamczyk *et al.* [STAR Collaboration], Phys. Rev. Lett. 113, 022301 (2014).
- [2] M. Cacciari, P. Nason, and R. Vogt, Phys. Rev. Lett. 95, 122001 (2005).