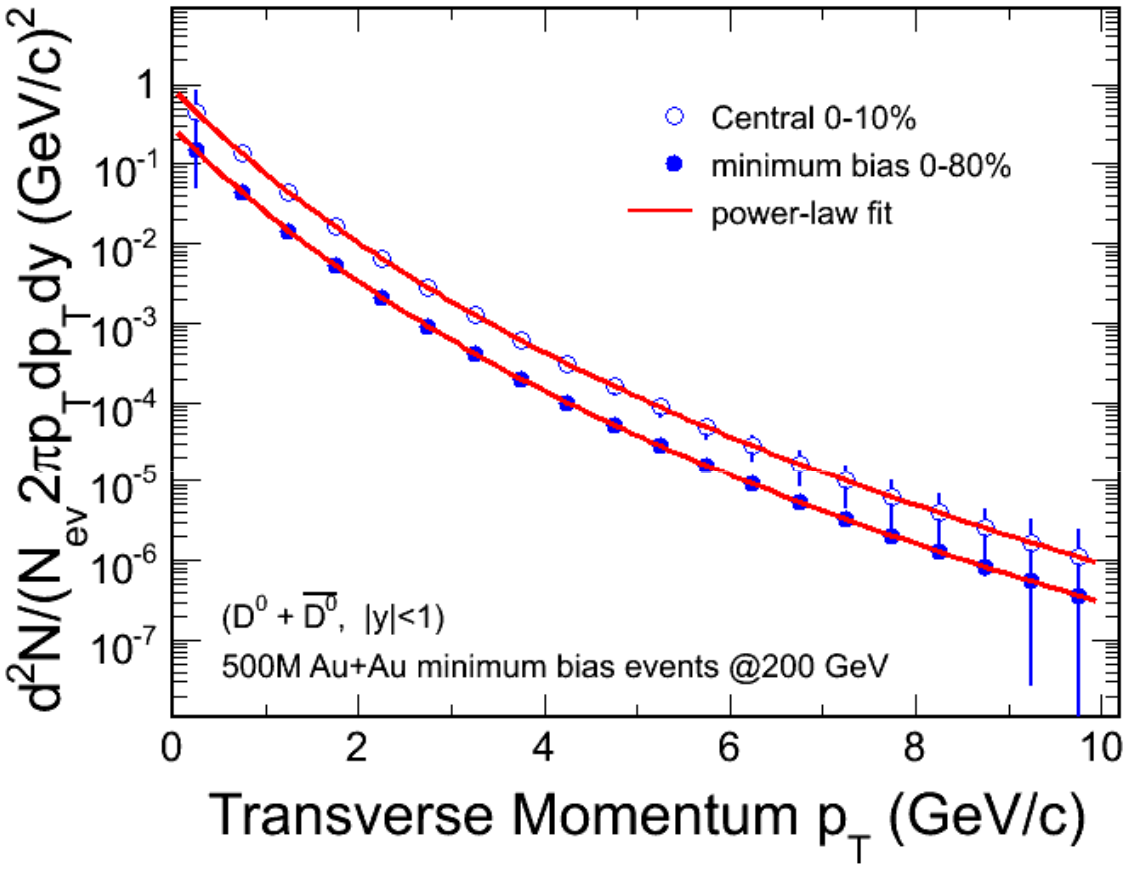
HFT Simulation

– Answers to CD-1 review questions

- Charm and bottom cross section with HFT
- How does HFT thickness affect physics observables?

D^0 p_T spectrum and charm cross section



Statistic errors estimated for 500M Au+Au minbias events

Cross section error was obtained from power-law fit.

The D^0 p_T shape uncertainty => $D^0 \rightarrow$ e pt shape uncertainty.

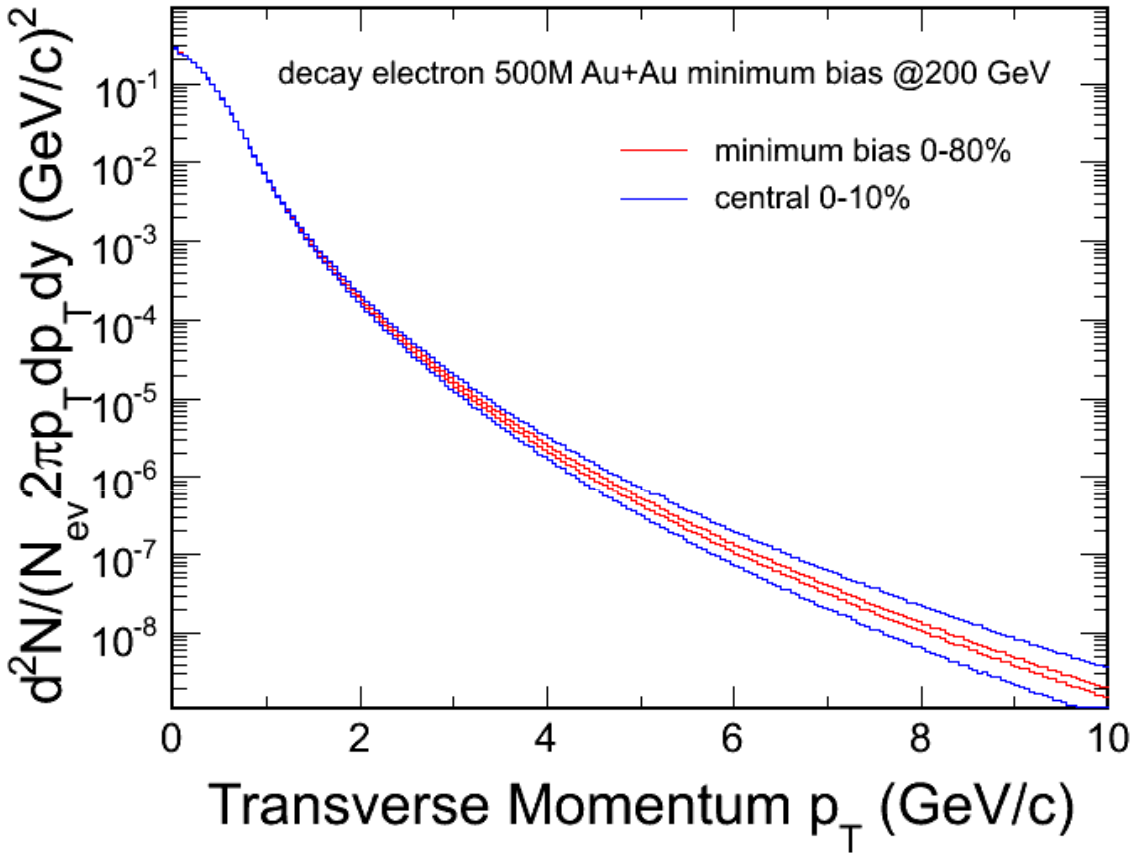
1) 500M 200 GeV Au+Au minbias
   minbias 0-80% 400 $\pm$ 7 ub
   central 0-10% 400 $\pm$ 34 ub

2) 300M 200 GeV p+p: 400 $\pm$ 15 ub

3) 100M 500 GeV Au+Au minbias
   minbias 0-80% 800 $\pm$ 46 ub
   central 0-10% 800 $\pm$ 238 ub

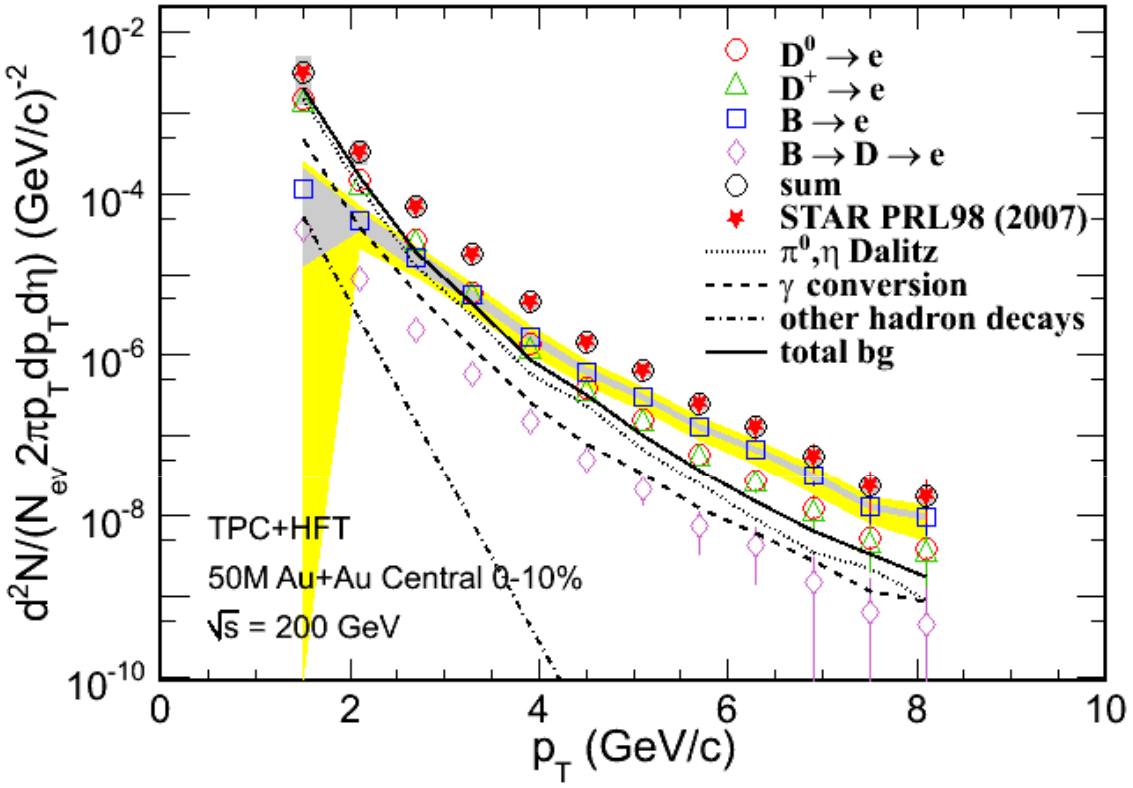
4) 100M 500 GeV p+p: 800 $\pm$ 65 ub

$D^0 \rightarrow e$ spectrum uncertainty



Form factor decay:
D^0 p_T distributions with 1-σ uncertainty (Previous slide).
$D^0 \rightarrow e$ p_T shape uncertainty estimated for 500M Au+Au minbias events.

B → e spectrum uncertainty

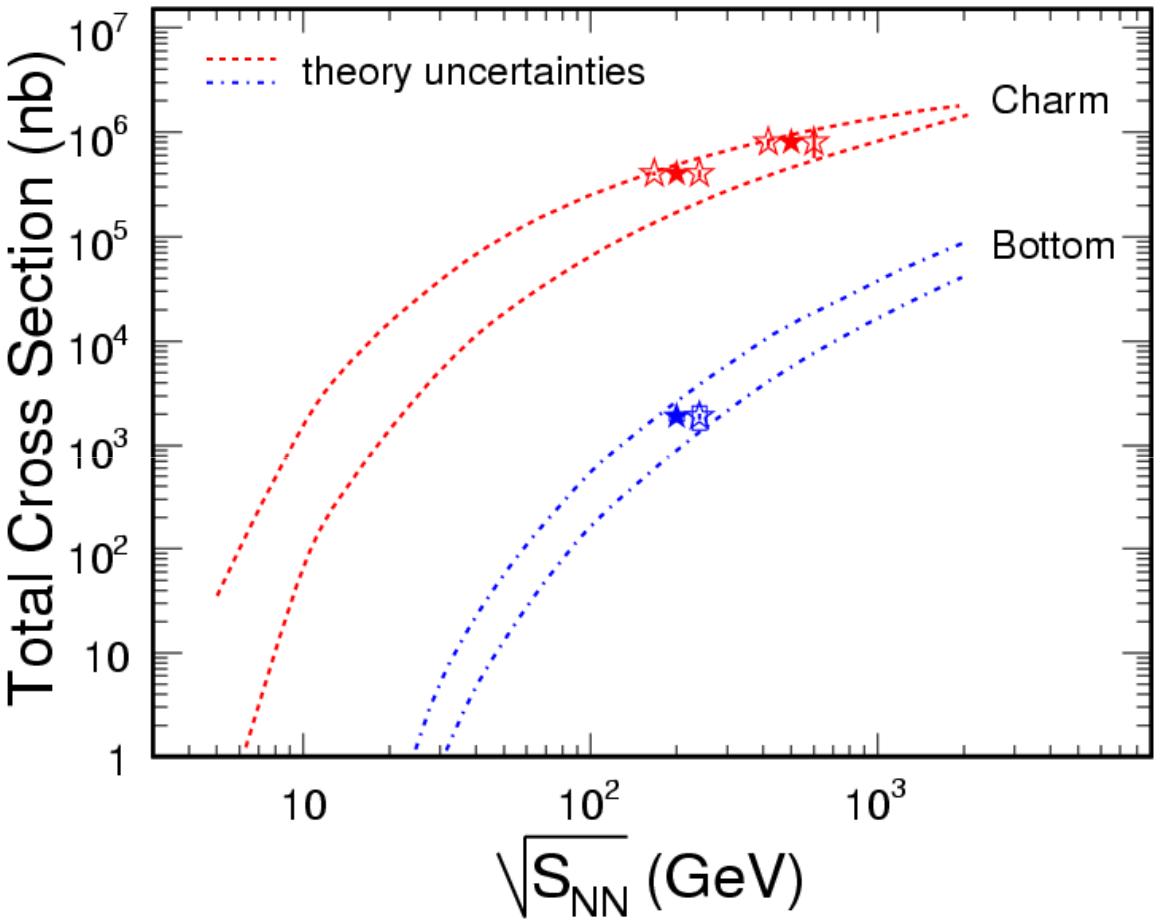


Estimated b-bbar cross section for 500M 200 GeV Au+Au minbias:

minbias 0-80%
$1.90 \pm 0.08 \pm 0.18$ ub
central 0-10%
$1.90 \pm 0.12 \pm 0.49$ ub

Bottom cross section obtained from FONLL fit to B→e:
Sys. errors from D meson p_T shape are propagate to the B→e spectrum.
Grey band is the sys. error for 500M 200 GeV Au+Au minbias.
Yellow band is the sys. error for 50M 200 GeV Au+Au central 0-10%.

Charm and bottom cross section

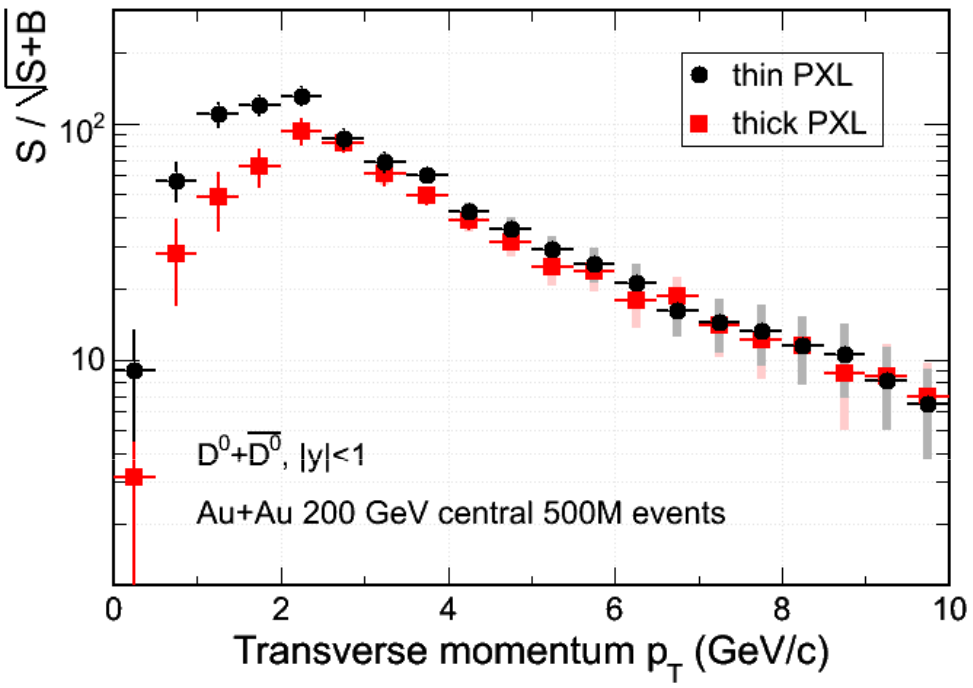


NLO pQCD predictions of charm and bottom total cross sections per nuclear nuclear collisions.

Statistics estimated for charm cross section in p+p, Au+Au mb, Au+Au central at 200 and 500 GeV.

Statistics estimated for bottom cross section in Au+Au mb and central at 200 GeV. Systematic errors are estimated from $D^0 \rightarrow e$ p_T shape uncertainties.

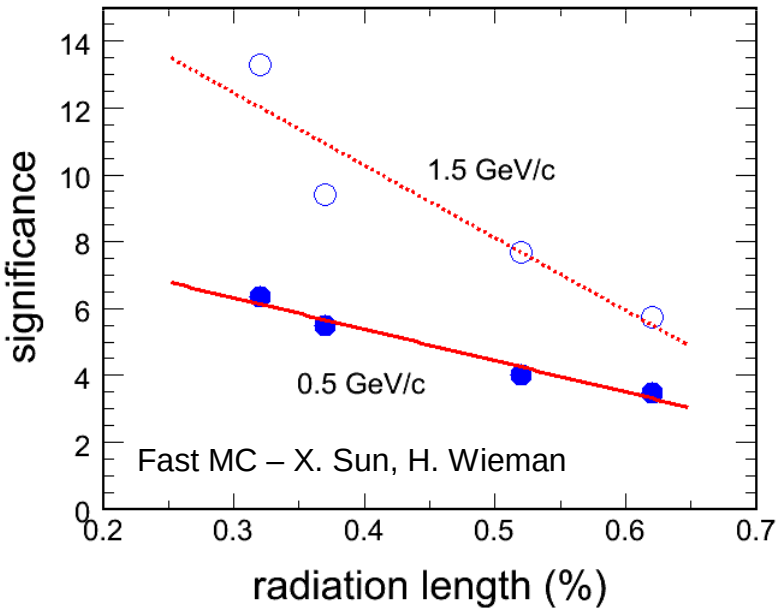
D^0 significance vs PXL thickness



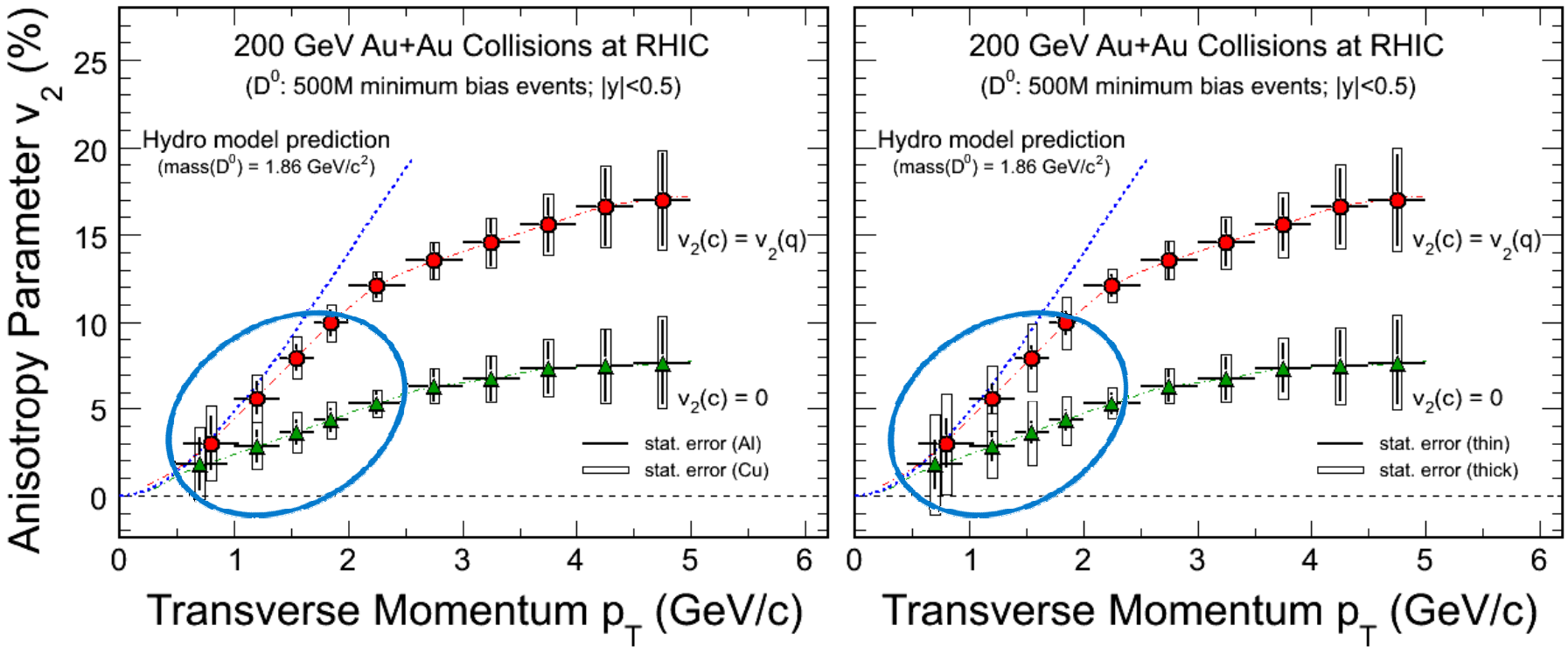
Thin PXL 0.32%X_0
Thick PXL 0.62%X_0

Aluminum cables: 0.37%X_0
Copper cables: 0.52%X0

A linear extrapolation was used for the Cu vs Al cables.



D^0 v_2 vs PXL thickness



The effect of thickness change is dominant at low p_T.
Low p_T hydro region, larger errors with Cu cables or double thicker PXL.
No effect on R_{CP} , R_{AA} (high p_T)

Summary

- Errors for charm and bottom cross section are estimated. The D^0 p_T shape uncertainties are propagated to B $\rightarrow$ e and the systematic errors of bottom cross section.

- The effect of PXL thickness change is dominant at low p_T, which affects the statistic errors for D^0 v_2 in the hydro region. The thicker (copper) configuration may not suitable to quantitatively study models.

- To do:
  Optimize low p_T cuts (versus p_T). Redo all the physics plots and error estimates with a set of best cuts.