HFT Simulation Update

- Low p_T cut optimization
- Physics plots update

Soft Hadron Meeting, 07 Dec, 2009

3D scan

1) 6 p_T bins: 0-0.5, 0.5-1.0, 1.0-1.5, 1.5-2.0, 2.0-2.5, 2.5-3.0

2) cos(θ) cut: scan range 0.2 – 0.9 (step=0.05), 0.9-1.0 (step=0.01).

3) DCA to primary vertex cut: scan range 30 – 300μm (step=10μm).

4) DCA to V0 cut: scan range 30 - 100μm (step=10μm).

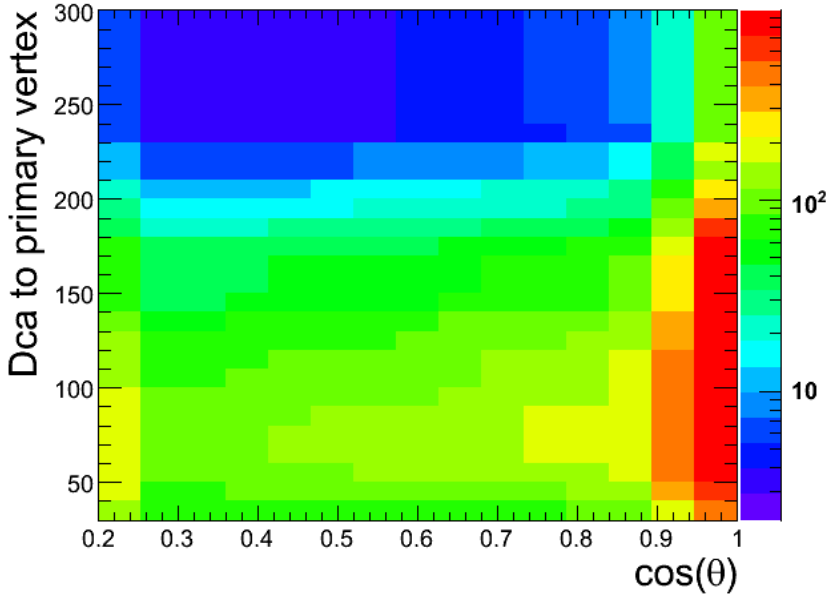
Signal and Background are scaled to real numbers.

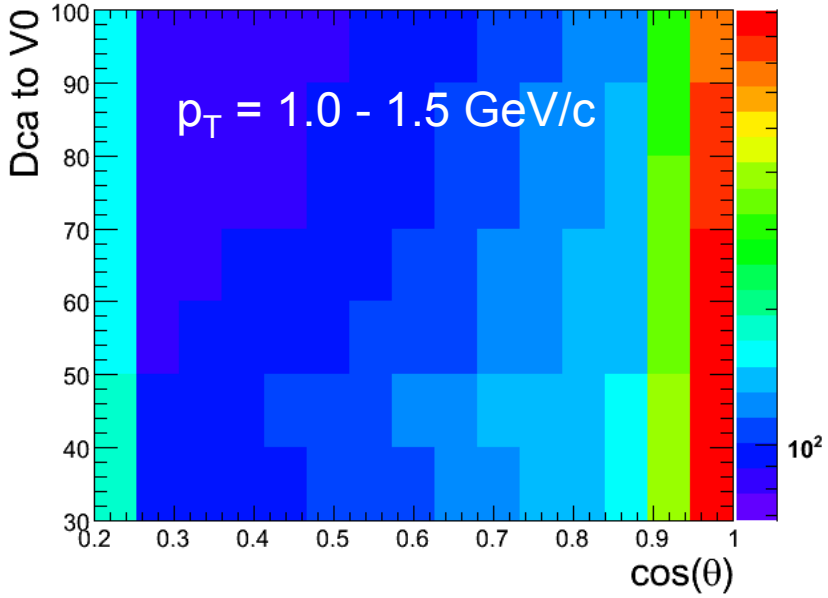
Significance is defined as S/sqrt(S+B).

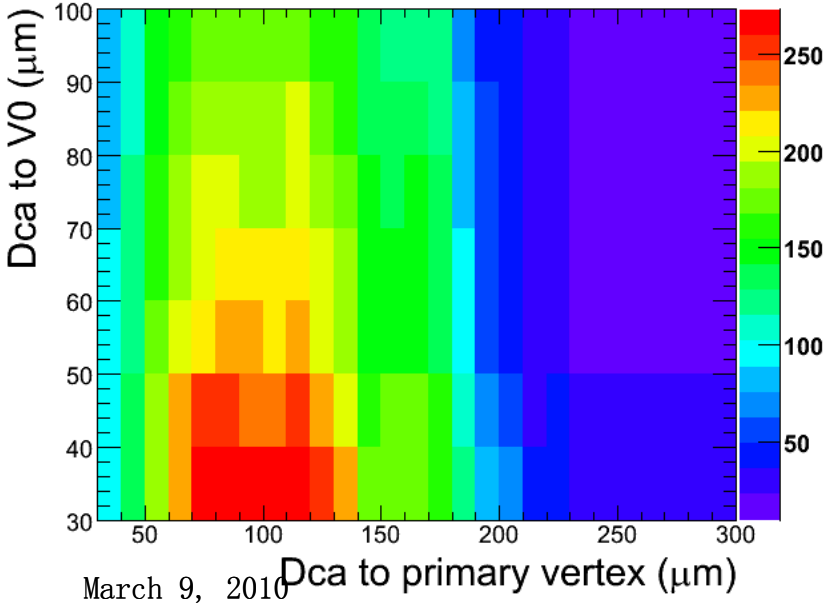
3D scan code is done for study significance vs cuts. The running process is also very fast (compare to fastsimu), but the number of jobs are huge (each set of cuts goes to one computing job).

Focus on low p_T, but still have space to improve at high p_T.

2D plots vs significance with thin PXL



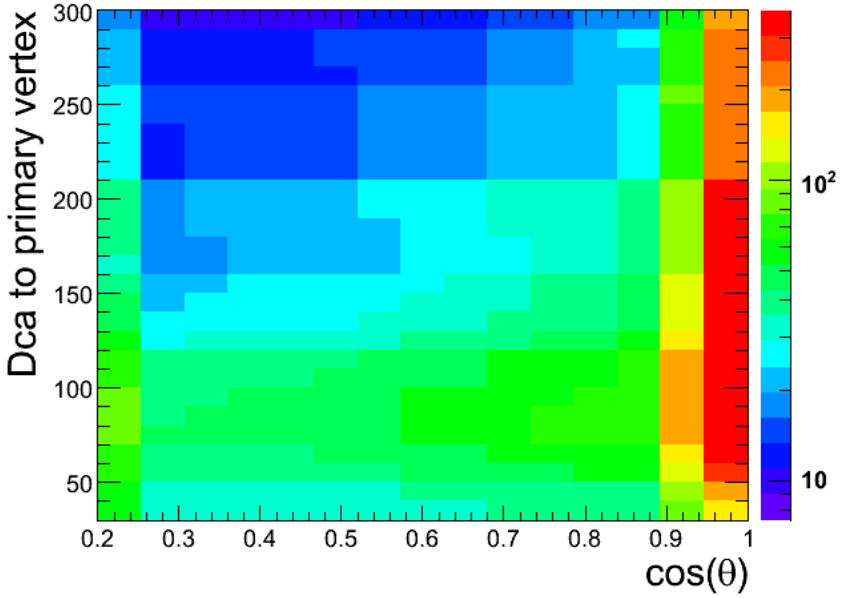


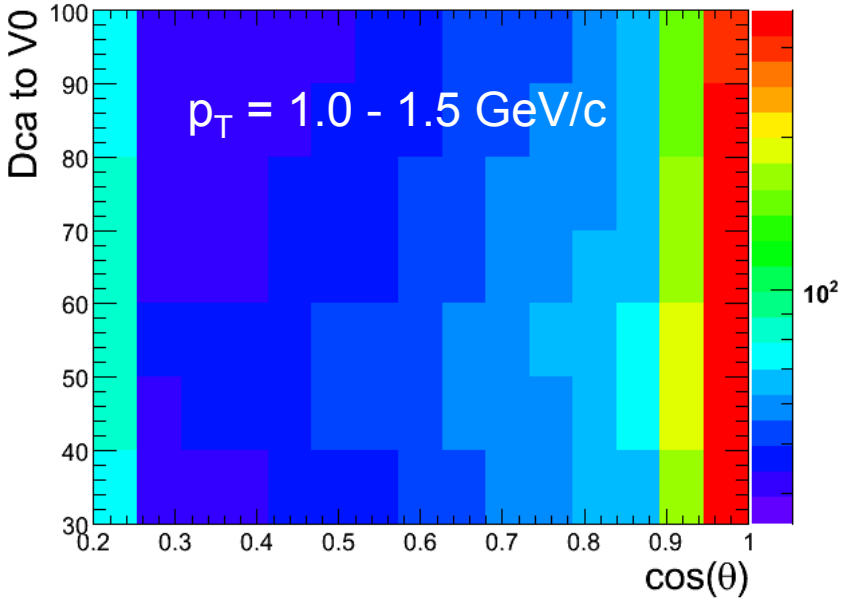


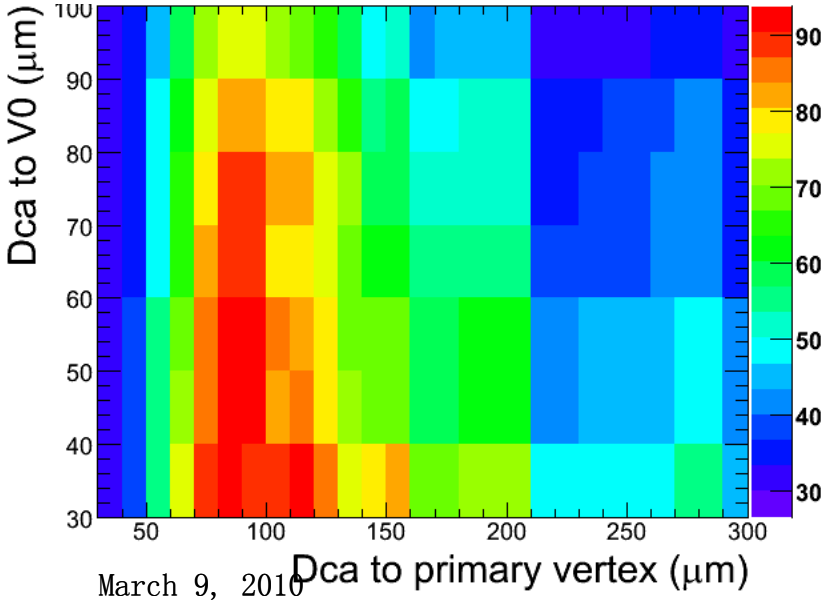
Best cuts (maximum significance):

p_T (GeV/c)	0.25	0.75	1.25	1.75	2.25	2.75
cos(θ)	0.98	0.99	0.99	0.98	0.99	0.99
DcatoVp	100	100	110	80	90	90
DcatoV0	30	40	30	40	30	40

2D plots vs significance with thick PXL



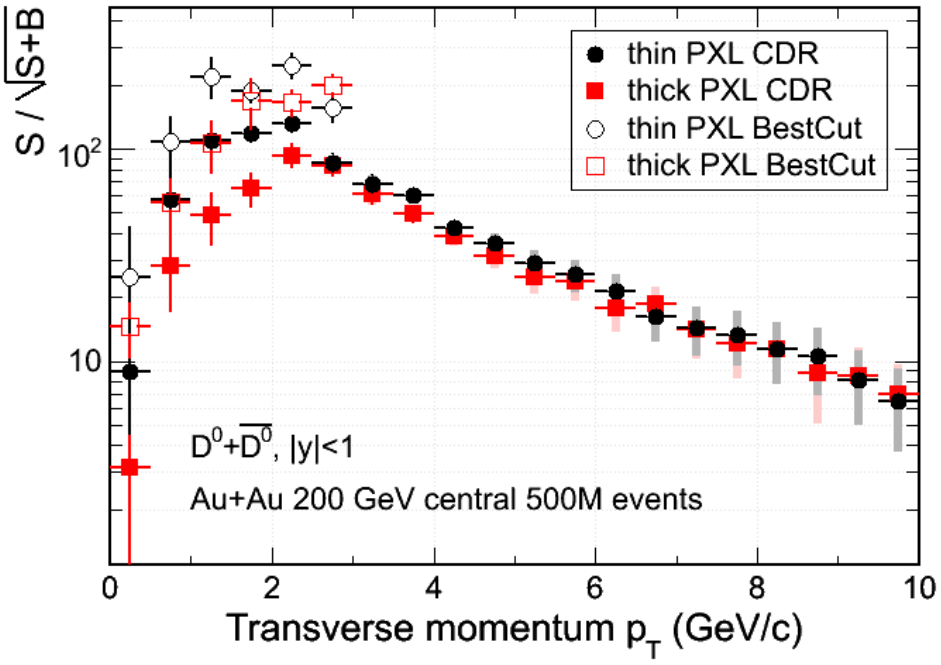


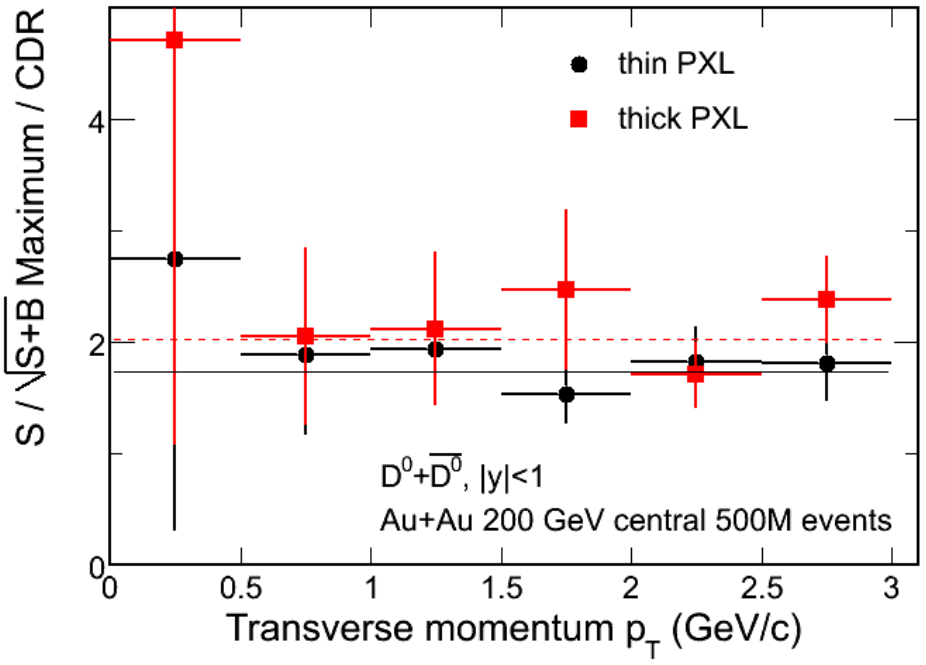


Best cuts (maximum significance):

p_T (GeV/c)	0.25	0.75	1.25	1.75	2.25	2.75
cos(θ)	0.65	0.97	0.99	0.99	0.99	0.99
DcatoVp	80	100	110	140	80	90
DcatoV0	40	40	30	30	30	30

Significance vs p_T



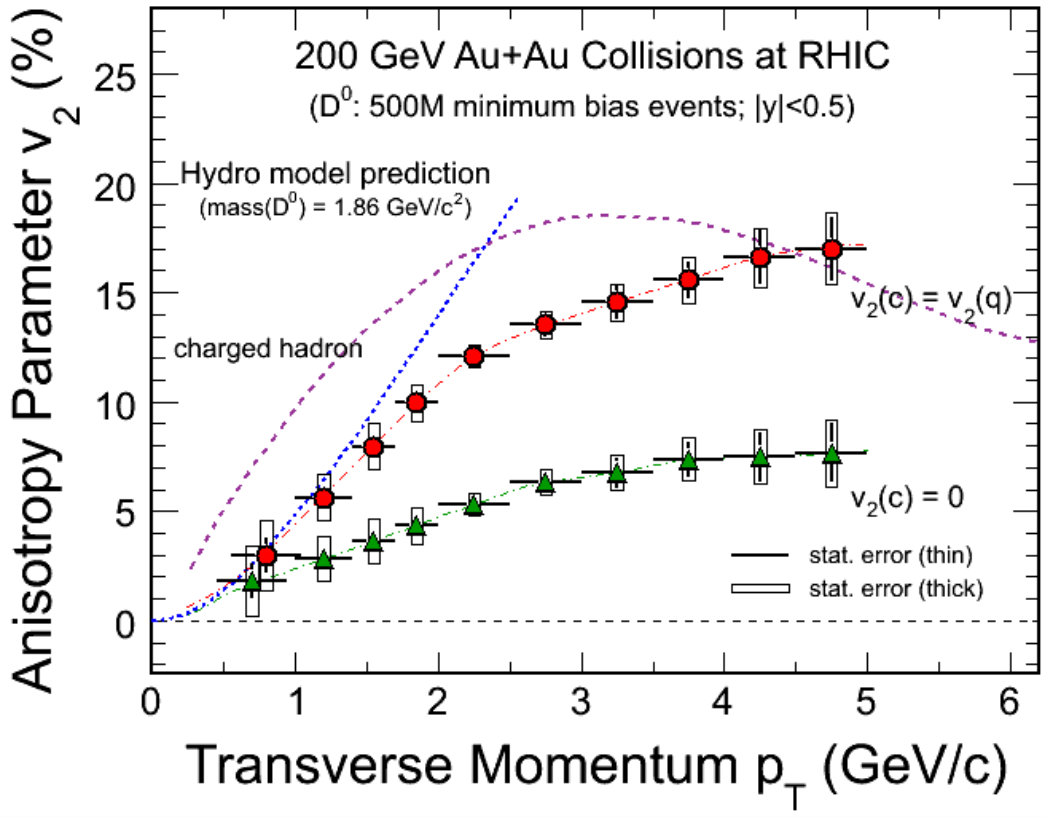


Gain a factor of 2 by applying best cuts for both thin and thick PXL compared to CDR.

The maximum significance with thick PXL is about a factor of 2 smaller than with thin PXL at low p_T.

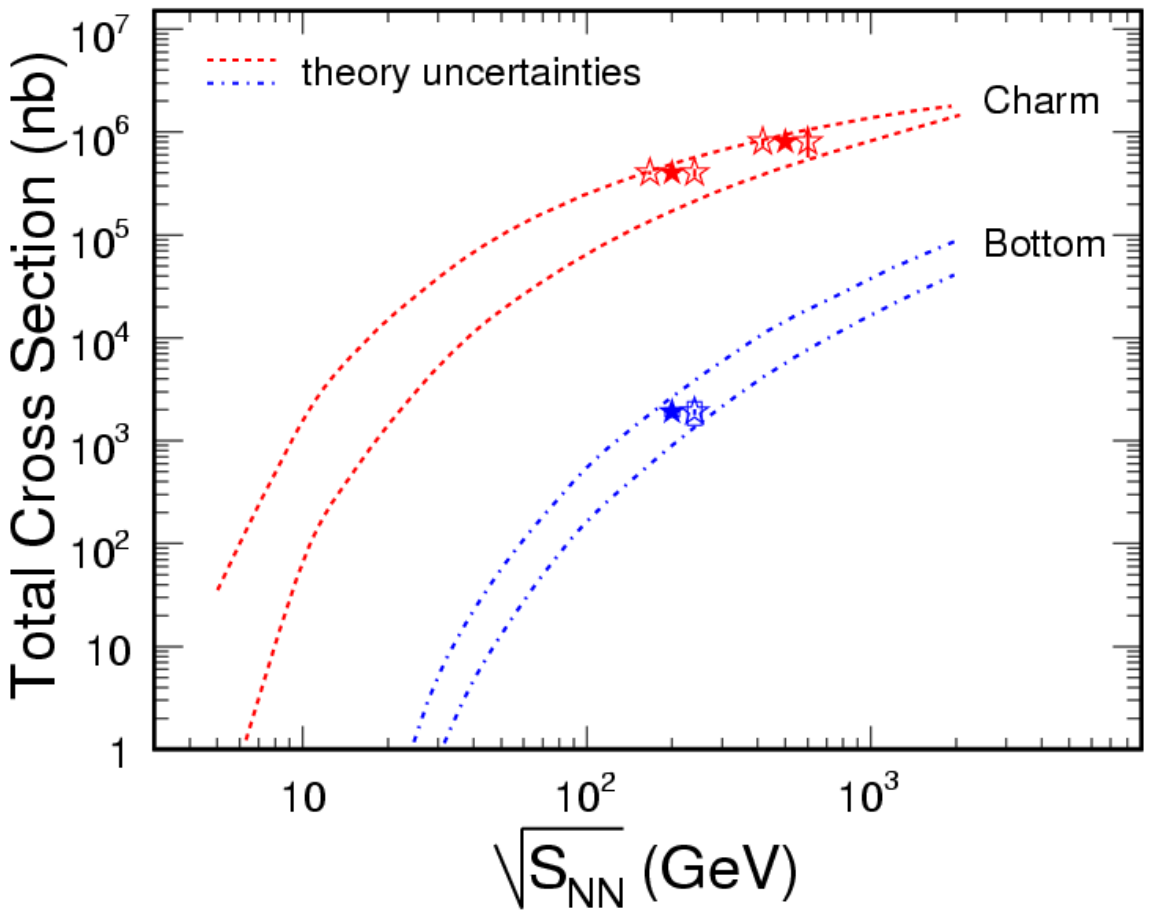
D^0 v_2

Charged hadron v_2, *Phys. Rev. C* ***77*** *(2008) 54901*



With best cuts, significance enhanced a factor of 2 => reduce v_2 errors.
Compare to charged hadron v_2, suppose to be decreasing at high p_T.
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.

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.

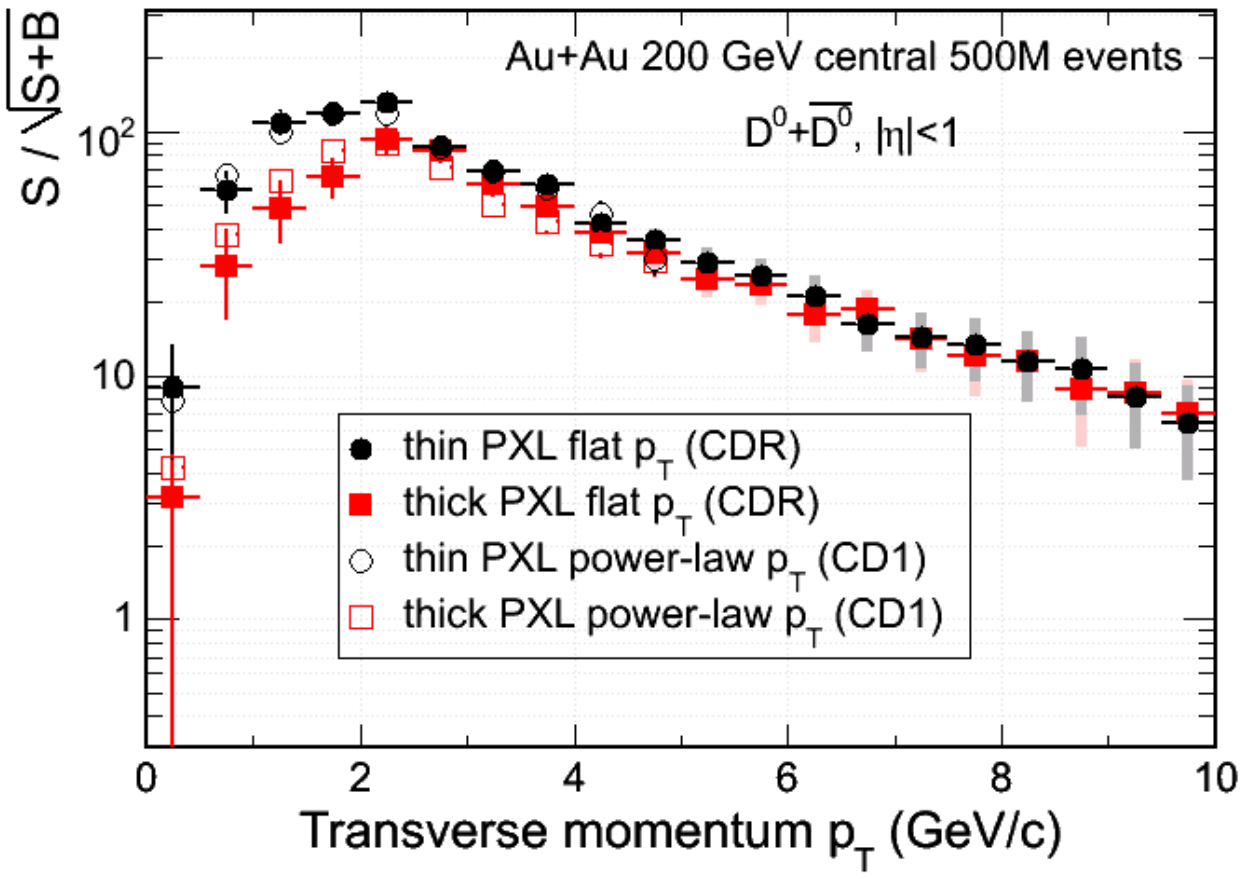
Statistics estimated for bottom cross section in Au+Au mb and central at 200 GeV. Systematic errors are estimated from $D^0 \rightarrow e$ p_T shape uncertainties.

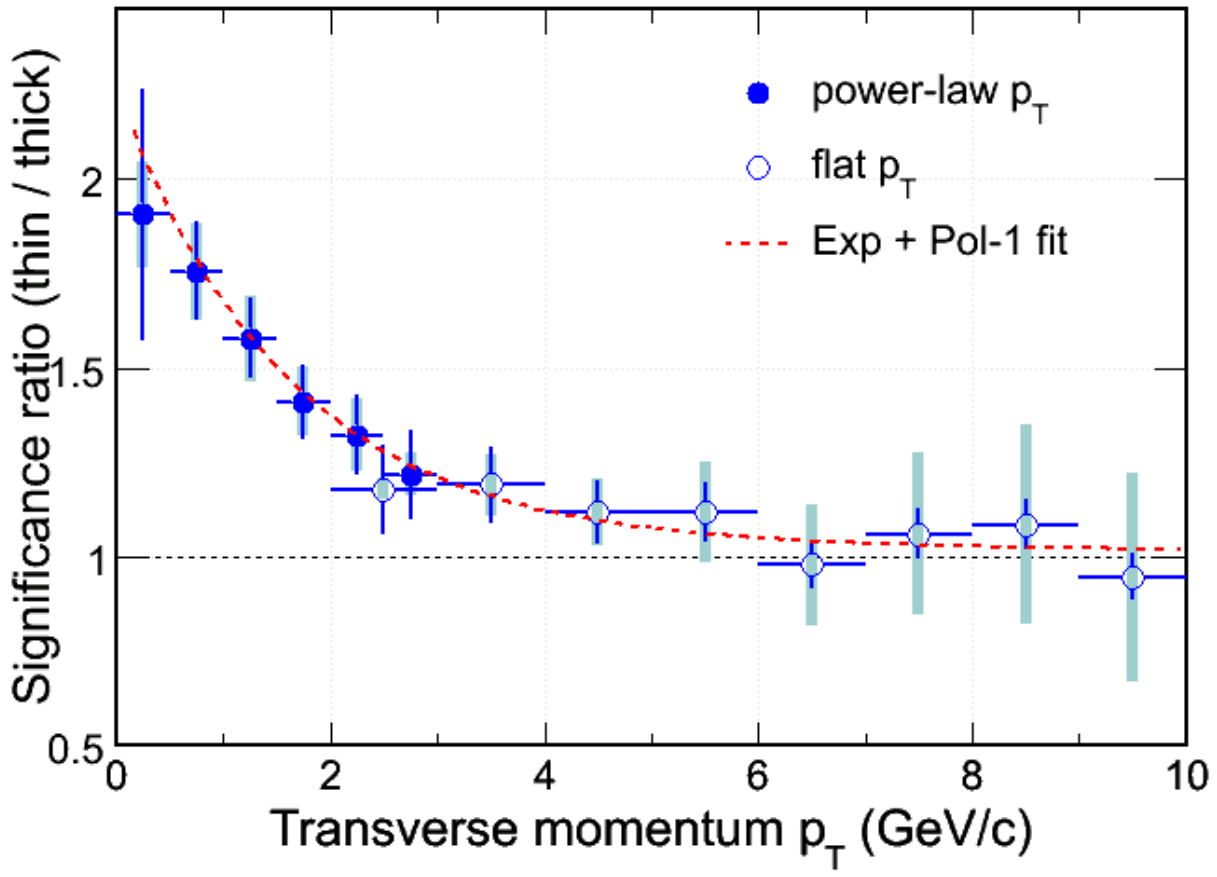
Errors should be smaller when high p_T cut optimization is also done (effect should be small).

Summary

- Optimized low p_T cuts (versus p_T). The significance was found to be a factor of 2 higher than CDR for both thin and thick PXL.

- Greatly reduced errors for physics plots.


Au+Au 200 GeV central 500M events
$D^0+\overline{D^0}$, |η|<1
$S/\sqrt{S+B}$
10^2
10
1
0
2
4
6
8
10
Transverse momentum p_T (GeV/c)
thin PXL flat p_T (CDR)
thick PXL flat p_T (CDR)
thin PXL power-law p_T (CD1)
thick PXL power-law p_T (CD1)


power-law p_T
flat p_T
Exp + Pol-1 fit
Significance ratio (thin / thick)
Transverse momentum p_T (GeV/c)
0.5
1
1.5
2
0
2
4
6
8
10