

UPC-electrons in PIXEL

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- Full GEANT simulation with *Starlight*
 - Generation of UPC pairs using Starlight
 - Generation of full rapidity/eta (-6 to +6)
 - Full diamond coverage ($\sigma_z=20\text{cm}$ here)
 - UGR15 geometry - CDR
 - Hit densities due to spirals included
 - Impact on D0 efficiency estimated

Directory with codes/kumacs/plots/scripts/history here:
[/star/institutions/ksu/margetis/hft/starlight/run](#)

	HFT
Inner radius:	1.3 cm
Outer radius:	5.0 cm
Magnetic field:	0.5 T
p_T - cut-off:	1.0 MeV/c
UPC X-section*:	34 k barn
Visible X-section:	3.460 k barn
Luminosity:	$10^{27} \text{ cm}^{-2}\text{s}^{-1}$
Rate:	3.46×10^6

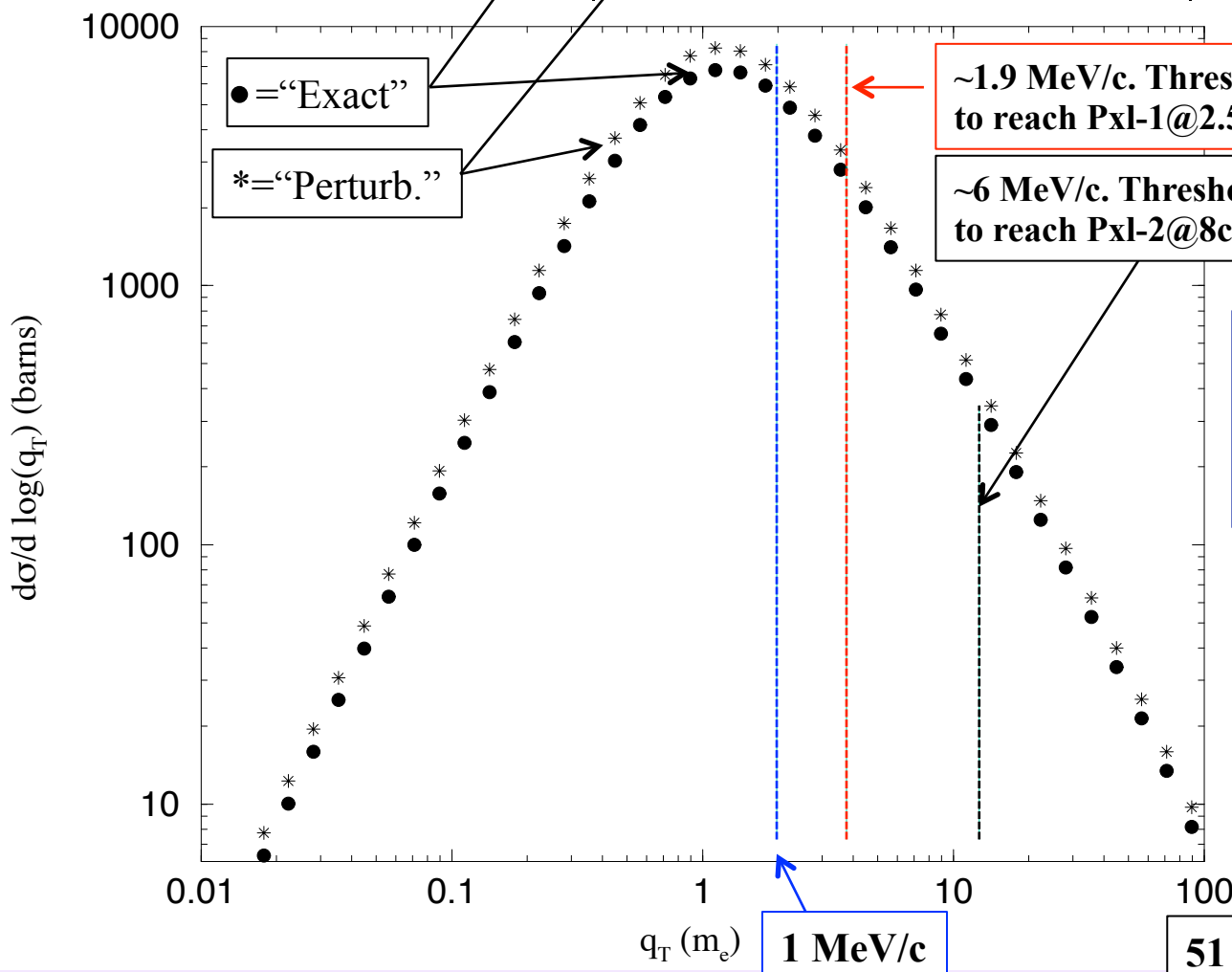
	UPC	Hadronic Au + Au
Integration time:	4 ms	4 ms
Hit density, inner layer:	57 cm^{-2}	58 cm^{-2}
Hit density, outer layer:	6 cm^{-2}	14 cm^{-2}

*QED calculations: A.J. Baltz, nucl-th/0409044.

***QED calculations: A.J. Baltz, nucl-th/0409044v3**

Au + Au	Computer Evaluation	28,600	34,600	-6,000 (+220)
$\gamma = 100$	Racah Formula		34,200	
	Hencken, Trautmann, Baur		34,000	
	Lee-Milstein	34,100	42,500	-8,400 (+290)

Perturb=Exact*1.21



~1.9 MeV/c. Threshold to reach Pxl-1@2.5cm

~6 MeV/c. Threshold to reach Pxl-2@8cm

Pxl-1 x-section ~4(5)Kbarn
 Kai ~3.5Kbarn
 Pxl-2 x-section ~350 (420) barn
 1MeV cut $\sigma \sim 8 (9.7)$ Kbarn

Using 4Kbarn, Event rate is (for $L=80 \cdot 10^{26}$) Rate=32MHz and (for 0.2ms integr. time) gives PileUp= $6.4 \cdot 10^3$ Events

1 MeV/c

51 MeV/c

- For 4Kbarn (and $L=80 \cdot 10^{26}$) Rate=32MHz and (for 0.2ms) gives PileUp= $6.4 \cdot 10^3$ Events
- **For Starsim (~ 1 MeV E_{cm}^γ cut) and 10.6 Kbarn x-section PileUp= 17 Kevnts**

detp geom upgr15

```

BEAM_1_Z 79      # Z of projectile
BEAM_1_A 197     # A of projectile
BEAM_2_Z 79      # Z of target
BEAM_2_A 197     # A of target
BEAM_GAMMA 108.4 # Gamma of the colliding ions
W_MAX 1.0        # Max value of w
W_MIN 0.001      # Min value of w,  $\gamma+\gamma$  cm energy
RAP_MAX 6.        # max y
CUT_PT 0         # Cut in pT? (0 no, 1 yes)
CUT_ETA 1        # Cut in pseudorapidity? (0 no, 1 yes)
ETA_MIN -6.      # Minimum pseudorapidity
ETA_MAX 6.        # Maximum pseudorapidity
PROD_MODE 1      # gg or gP switch (1 2-photon )
PROD_PID 11     # Channel of interest e+ + e- pairs
BREAKUP_MODE 4  # Nuclear breakup 4=leave intact
INTERFERENCE 0  # Interference (0 off, 1 on)

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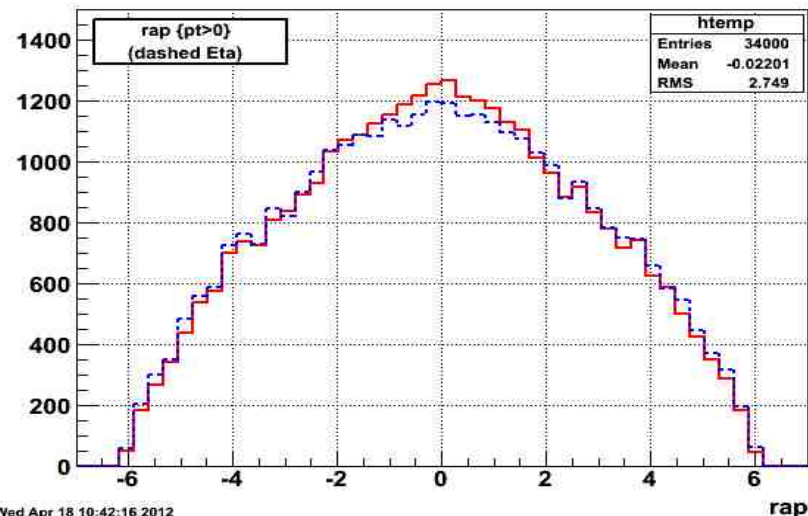
gkine -9 0
gfile o [outfile]

```

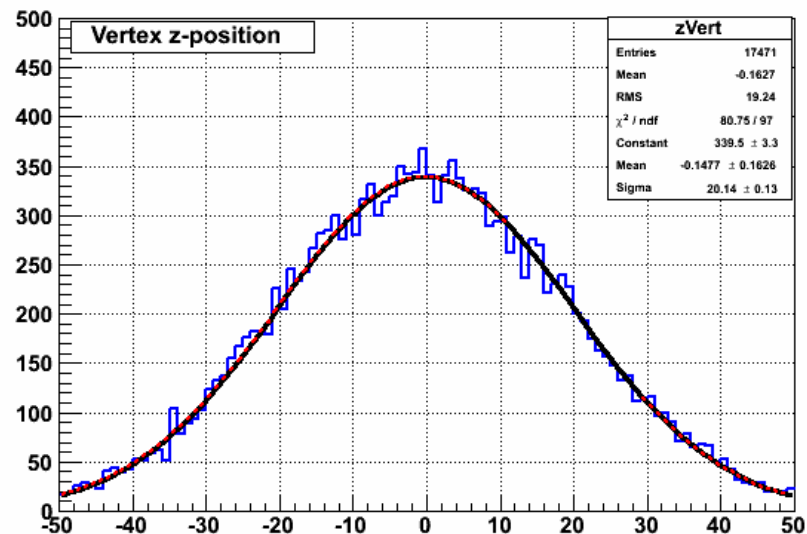
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gvertex 0.32 0.09 -0.1
gspread 0.055 0.02 20.0

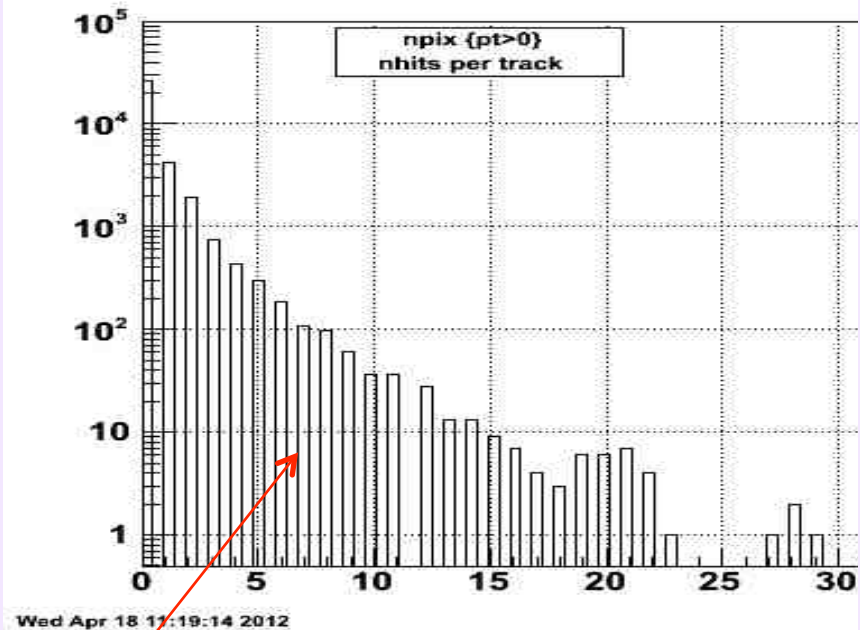
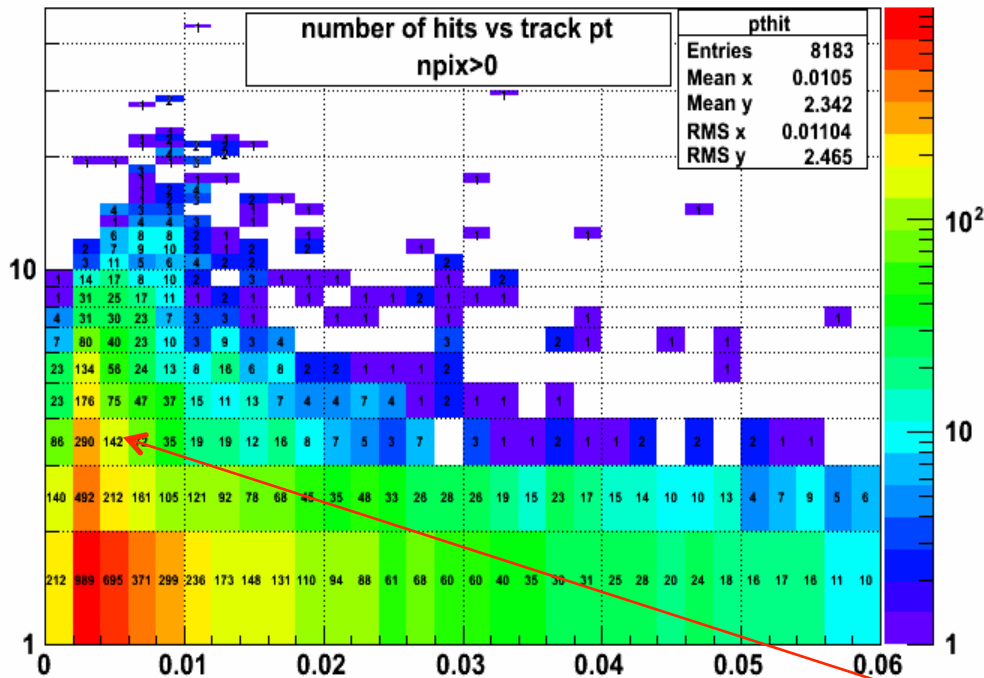
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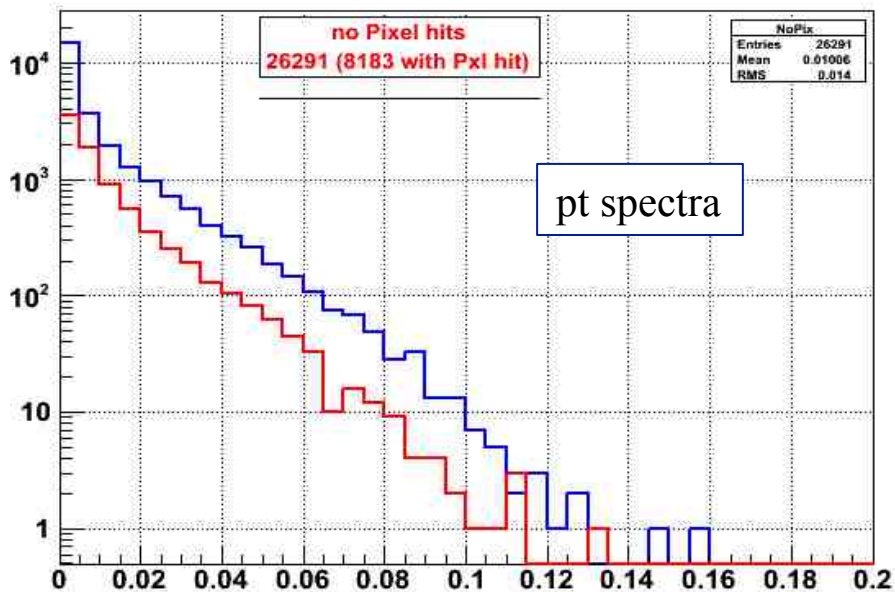
Wed Apr 18 10:42:16 2012



Wed Apr 18 15:28:48 2012

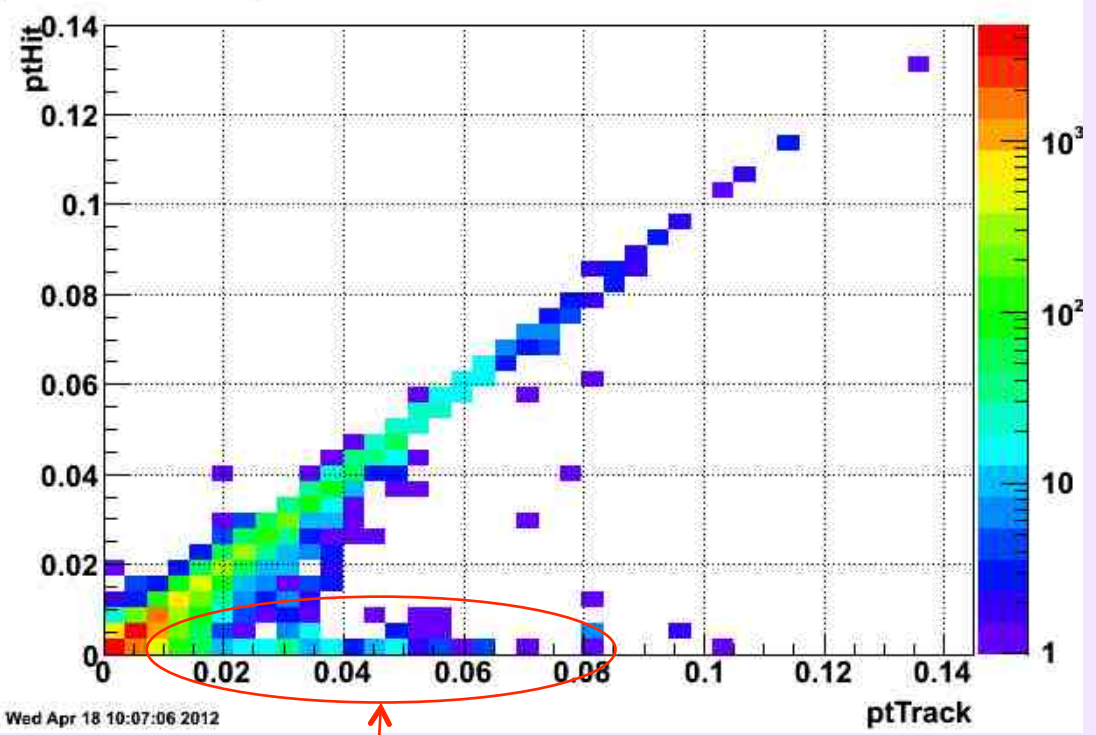


SPIRALS @ low pt



Tracks with:
 Zero Hits = 26 K
 One Hit = 4 K
 Two Hits = 2 K
 >2 Hits = 2 K

ptHit:ptTrack



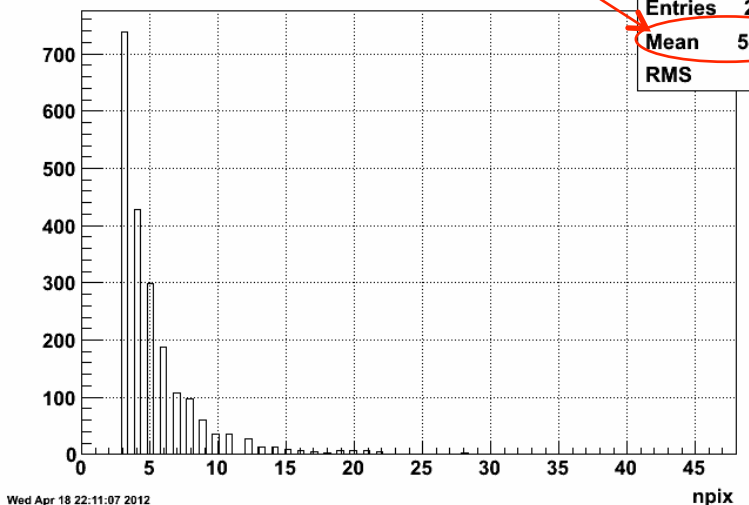
Wed Apr 18 10:07:06 2012

Track Pt as recorded at Hit Position vs the parent track Pt

Important
Average number of Hits per Spiraling Track = 5.3

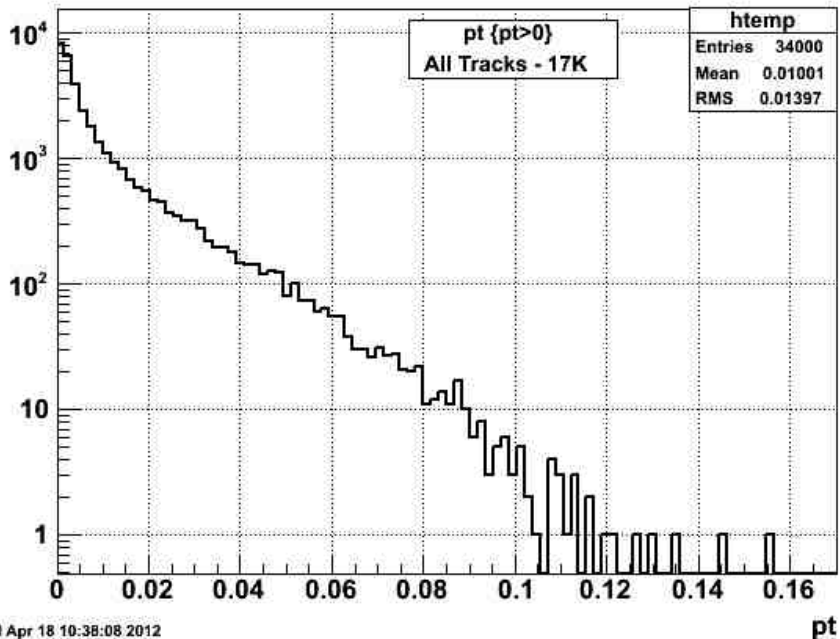
SPIRALS tend to have much lower pt than original track

npix {pt>0&&npix>2}

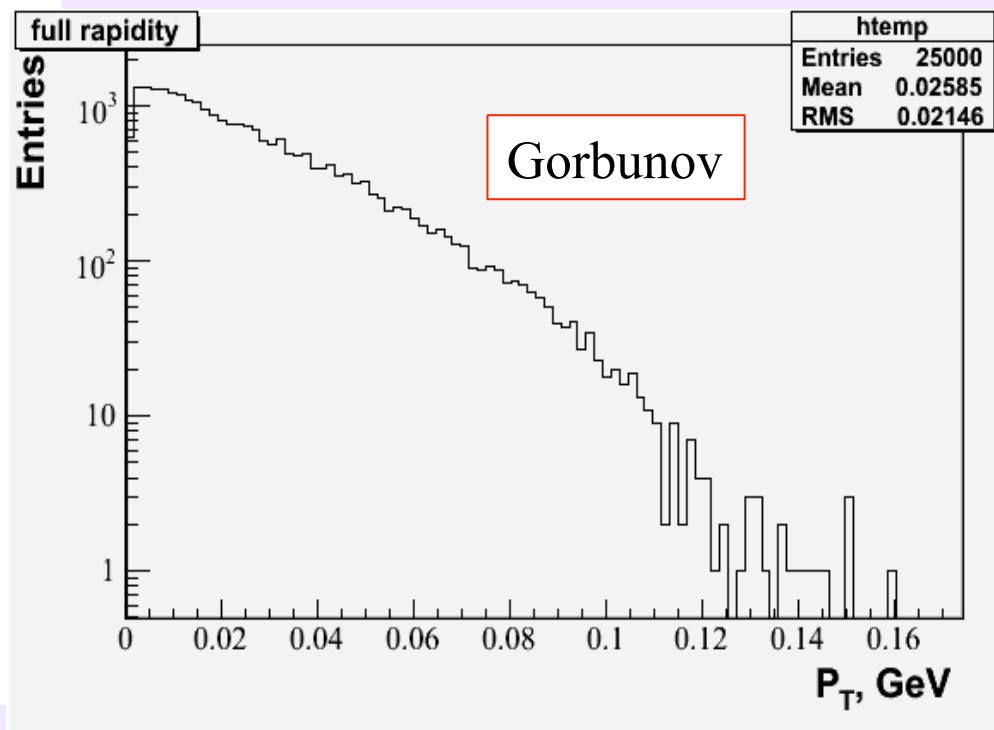


htemp	
Entries	2097
Mean	5.286
RMS	3.34

Wed Apr 18 22:11:07 2012

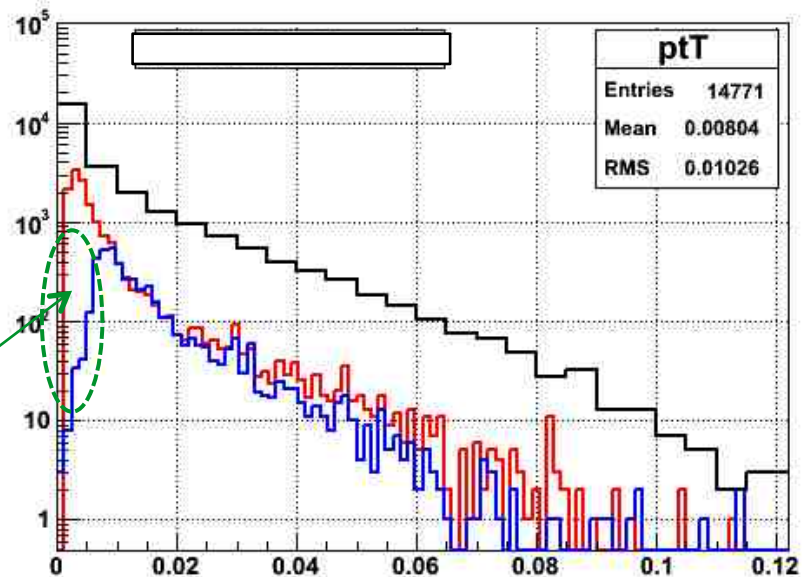


Wed Apr 18 10:38:08 2012



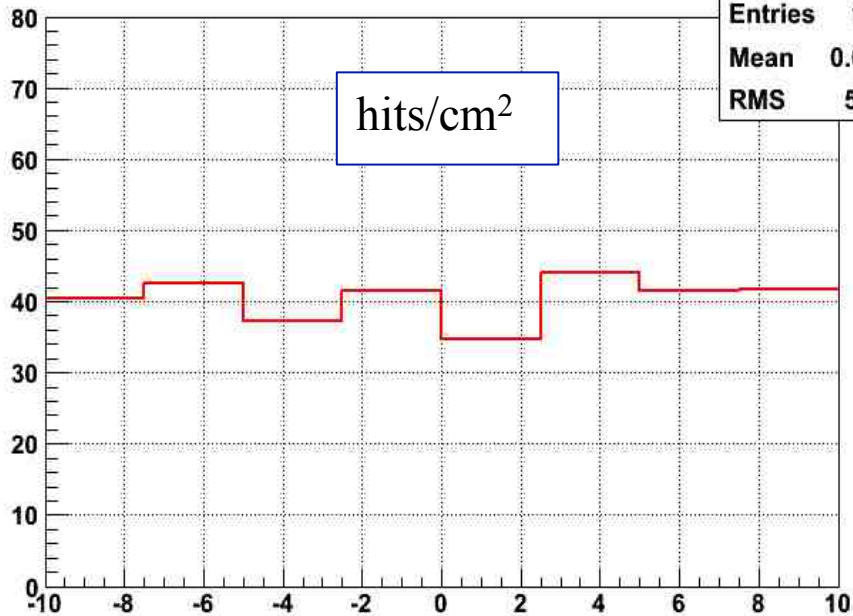
- This spectrum is compatible with others (full rapidity). Very low pt region depends on cuts used.
- It also agrees with Theory one (a few slides up)

Layer-2 harder to reach than Layer-1



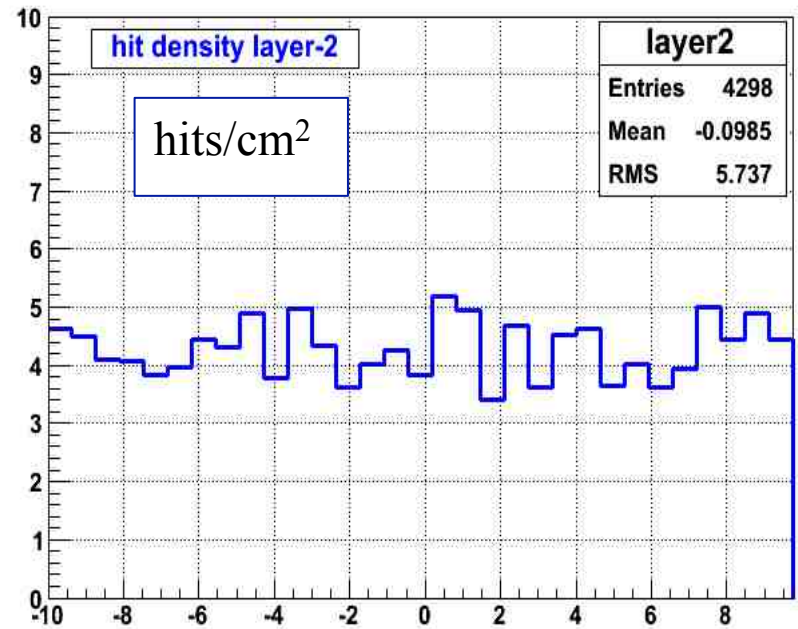
Tue Apr 17 17:33:03 2012

hit density layer-1



lay1	
Entries	1295
Mean	0.0719
RMS	5.817

Z(cm)



layer2	
Entries	4298
Mean	-0.0985
RMS	5.737

Z(cm)

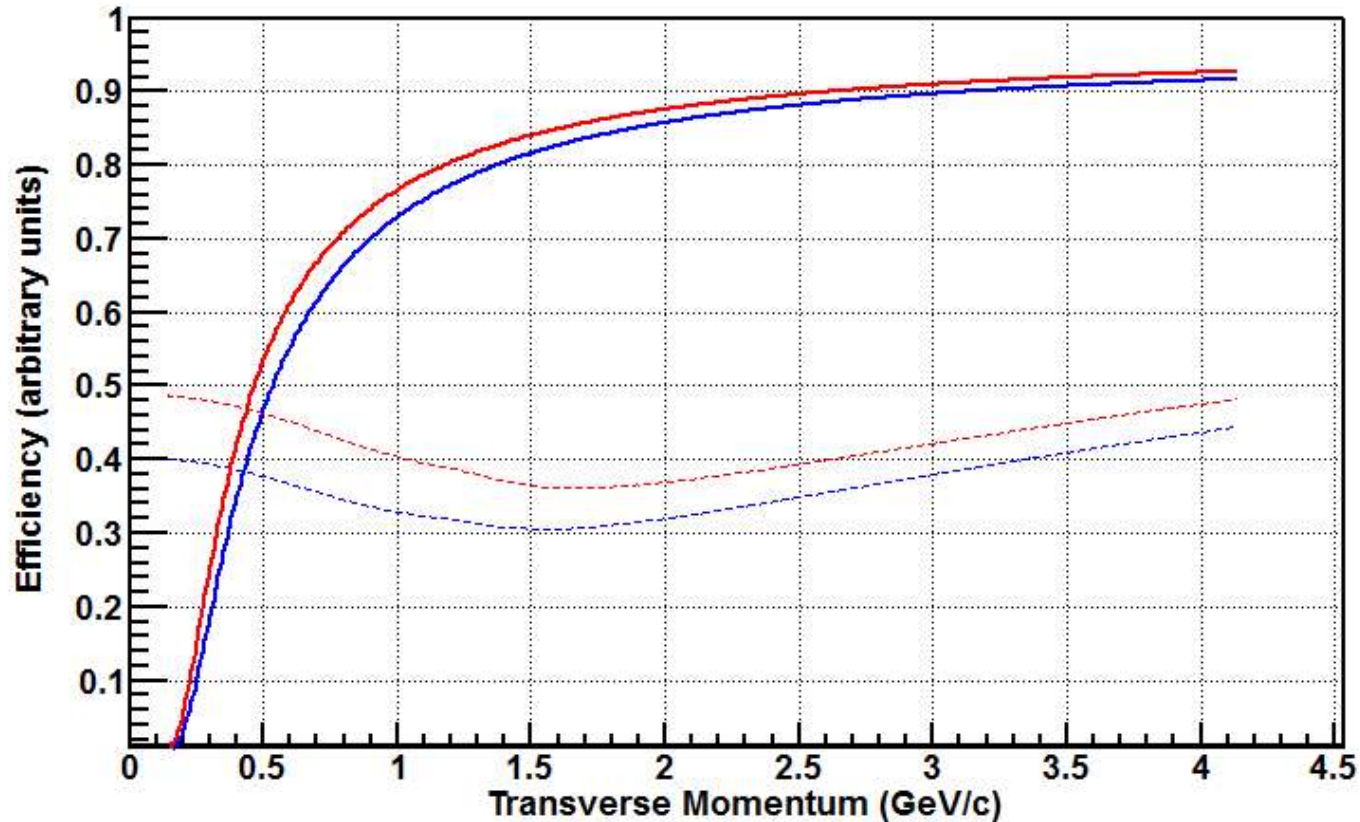
Au+Au Luminosity (RHIC-II)	$80 \times 10^{26} \text{ cm}^{-2} \text{ s}^{-1}$
dn/dη (Central)	700
dn/dη (MinBias)	170
MinBias cross section	10 barns
MinBias collision rate (RHIC-II)	80 kHz
Interaction diamond size, σ	15 cm
Integration time for Pixel Chips	200 μsec

	PIXEL-1 Inner Layer	PIXEL-2 Outer Layer
Radius	2.5 cm	7.0 cm
Central collision hit density	17.8 cm^{-2}	2.3 cm^{-2}
Integrated MinBias collisions (pileup)	23.5 cm^{-2}	5.2 cm^{-2}
UPC electrons	19.9 cm^{-2}	0.8 cm^{-2}
Totals	61.2 cm^{-2}	8.3 cm^{-2}

**Full simulations show a factor of 2 more hits in layer-1 and 5 in layer-2
If I use the same sigma=15 they will go up**

Bottom line: Effect on D0 efficiency

Single Track Efficiency for the HFT (D0 Efficiency dashed) .vs. Pt



Red= Using HFT-proposal numbers
Blue= Using this results

Summary

- We get ~60% extra hits from spiraling
 - Out of 19.1 Khits (total), $2097 \text{ Tr} * 5.3 \langle \text{hits/Tr} \rangle = 11.1 \text{ Khits}$
 - hard to estimate exactly or which layer but doable
- We get contributions from tracks with large z_{vertex} if y is right
- We estimate a higher UPC -electron background in both layers
 - factors 2 [5] higher than CDO in layer-1[2]
 - simulation shows a different radial dependence than CDO
- Impact on D0 efficiency visible

