



# XFT Post Shutdown Performance

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# Post Shutdown Changes



- Use XFT linker roads appropriate for beam spot (0.55 cm)
  - Should improve  $p_T$  and  $\phi_0$  resolution
  - Should decrease dependence of resolutions on  $\phi$
- Decrease COT threshold on axial superlayers from 225 mV to 205 mV.
  - Should improve overall XFT efficiency
  - Should alleviate strong  $p_T$  and  $\cot\theta$  dependence of XFT efficiency



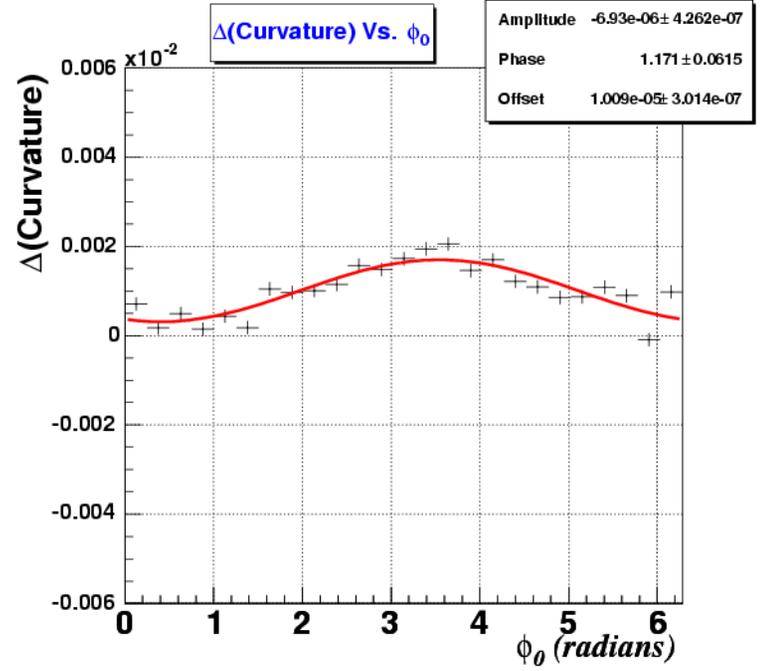
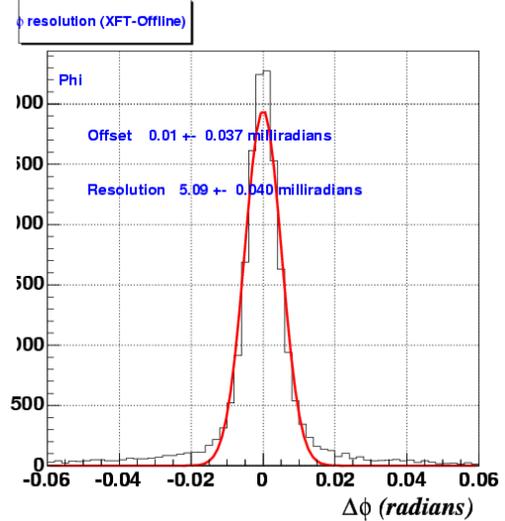
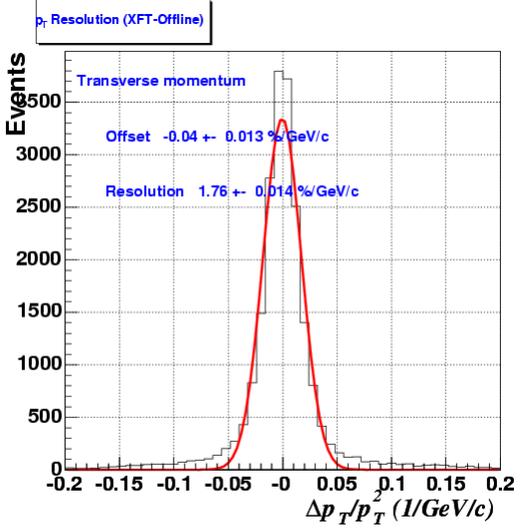
# Beam Spot



- Evaluate changes based on some early data available after shutdown:
  - Run 174773 (Before COT thresholds lowered)
    - ❑ Simple calorimeter based trigger table
    - ❑ Some problems with XFT and COT hardware
  - Run 175282 (After COT thresholds lowered)
    - ❑ Stream A/Express production
    - ❑ Limited study to non-track triggers: DIPHOTON, JET100, ULTRA\_PHOTON, W\_NOTRACK
- For comparison, consider one run from before the shutdown
  - Run 168889
    - ❑ GJET dataset (mixture of jet triggers)



# Beam Spot



Run Number	True Beam Spot	XFT Beam Spot	$p_T$ Resolution	$\phi$ Resolution	$\Delta$ Curvature Amplitude
168889	0.53	0.4	1.99%/GeV	5.9 mRad	$20 \times 10^{-6} \text{ GeV}^{-1}$
174773	0.55	0.55	1.60%/Gev	4.1 mRad	$3 \times 10^{-6} \text{ GeV}^{-1}$
175288	0.60	0.55	1.76%/GeV	5.1 mRad	$7 \times 10^{-6} \text{ GeV}^{-1}$

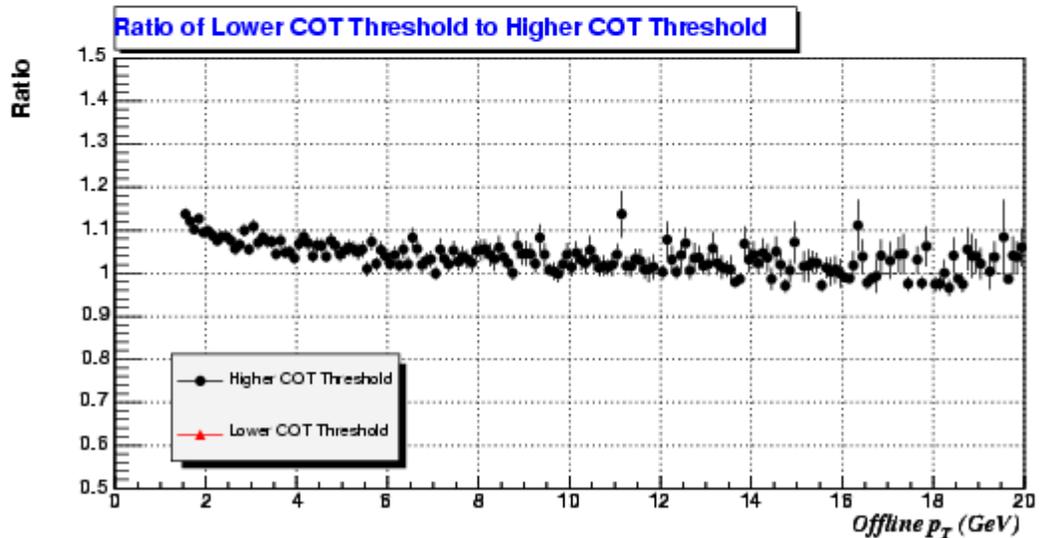
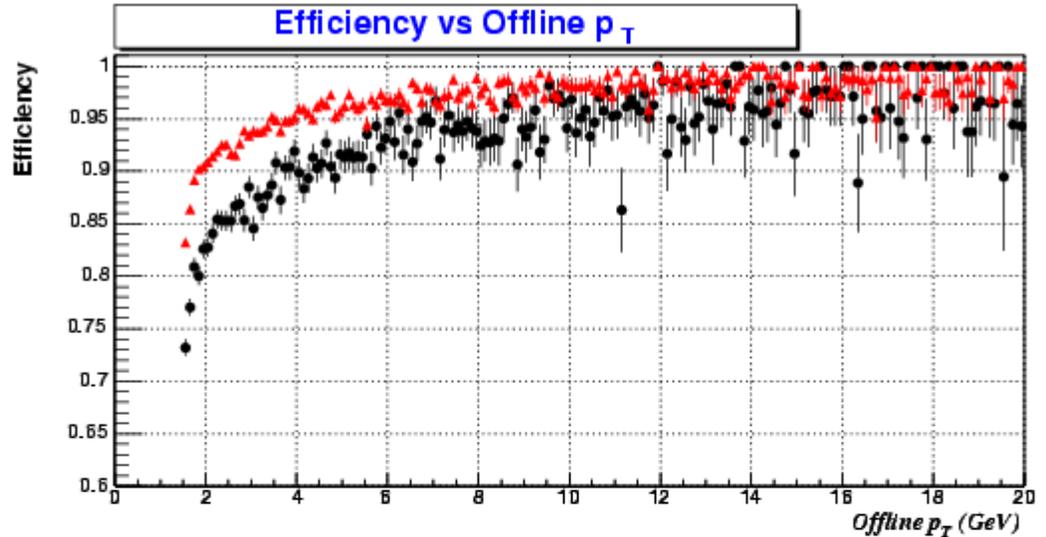


# Lowered COT Thresholds

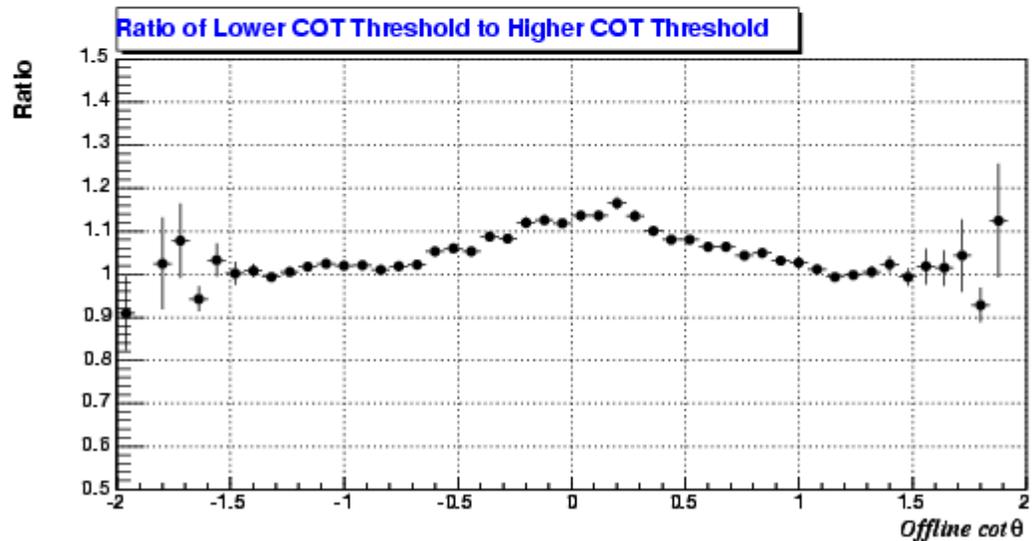
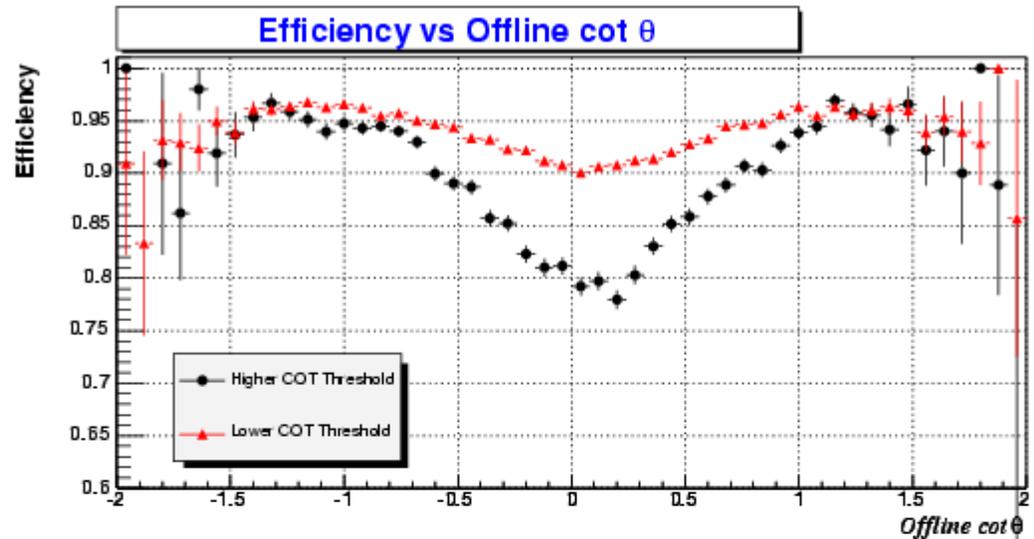


- After change to 1-miss designs, XFT efficiencies show strong dependence on  $p_T$  and  $\cot\theta$ 
  - Ionization dependent hit efficiency?
  - Lowering COT thresholds should improve
- Before Run 175075, COT thresholds set to 225 mV in all layers
- After Run 175075, COT thresholds reduced to 205 mV in axial superlayers (the ones used by XFT).
- Compare post-shutdown data taken before and after COT threshold reduction
  - COT Threshold = 225 mV: Runs 174996-7, 175002, 175008, and 175066
  - COT Threshold = 205 mV: Runs 175075, 175078-9, 175087-8, 175143, 175146-8, 175150, 175155, and 175195
  - Stream A—limited to non-track triggers

- Some overall improvement
  - $p_T > 1.5 \text{ GeV}$ 
    - 225 mV: 87.5%
    - 205 mV: 93.5%
  - $p_T > 10 \text{ GeV}$ 
    - 225 mV: 96.3%
    - 205 mV: 98.4%
- Improvement at low  $p_T$  end
- Turn-on still not as sharp as 2-miss design → perhaps we'll need to go to more misses in some or all layers



- cot  $\theta$  related to amount of ionization
  - High cot  $\theta$  tracks traverse cell at high angle  $\rightarrow$  more ionization
  - Low cot  $\theta$  tracks traverse cell at small angles  $\rightarrow$  less ionization
- Significant improvement with lowered thresholds in low cot  $\theta$  region
- Efficiencies nearly match in the high cot  $\theta$  region
- Residual cot  $\theta$  dependence still more than desired

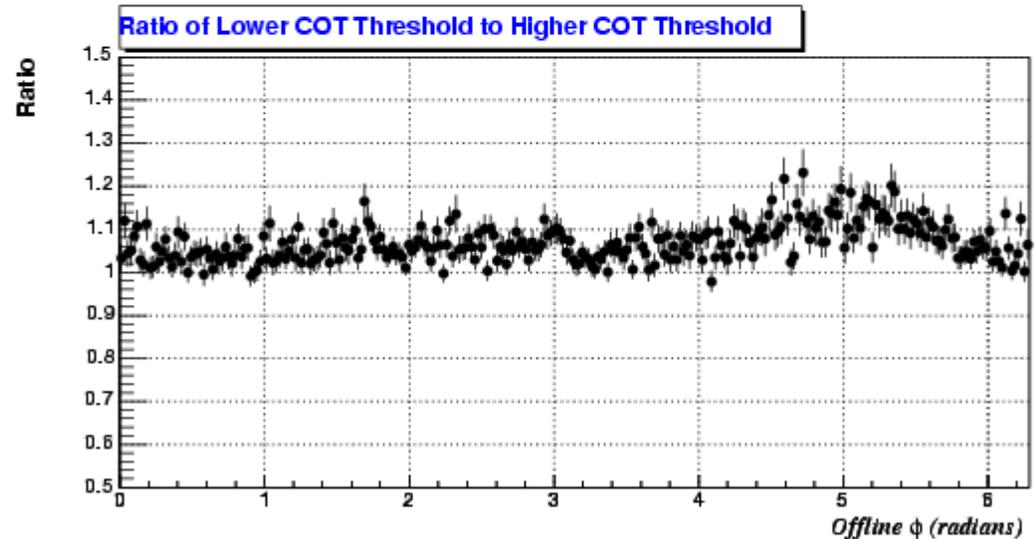
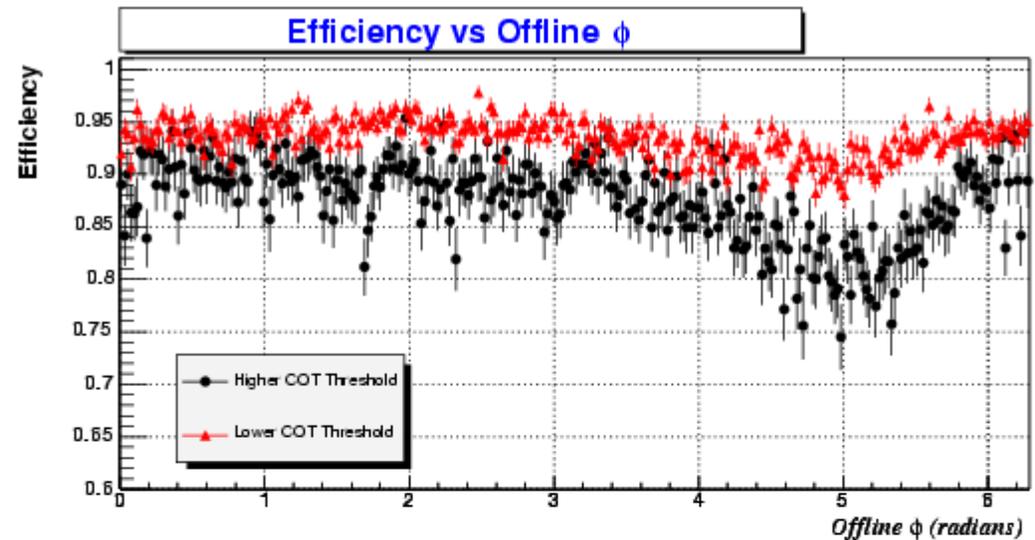




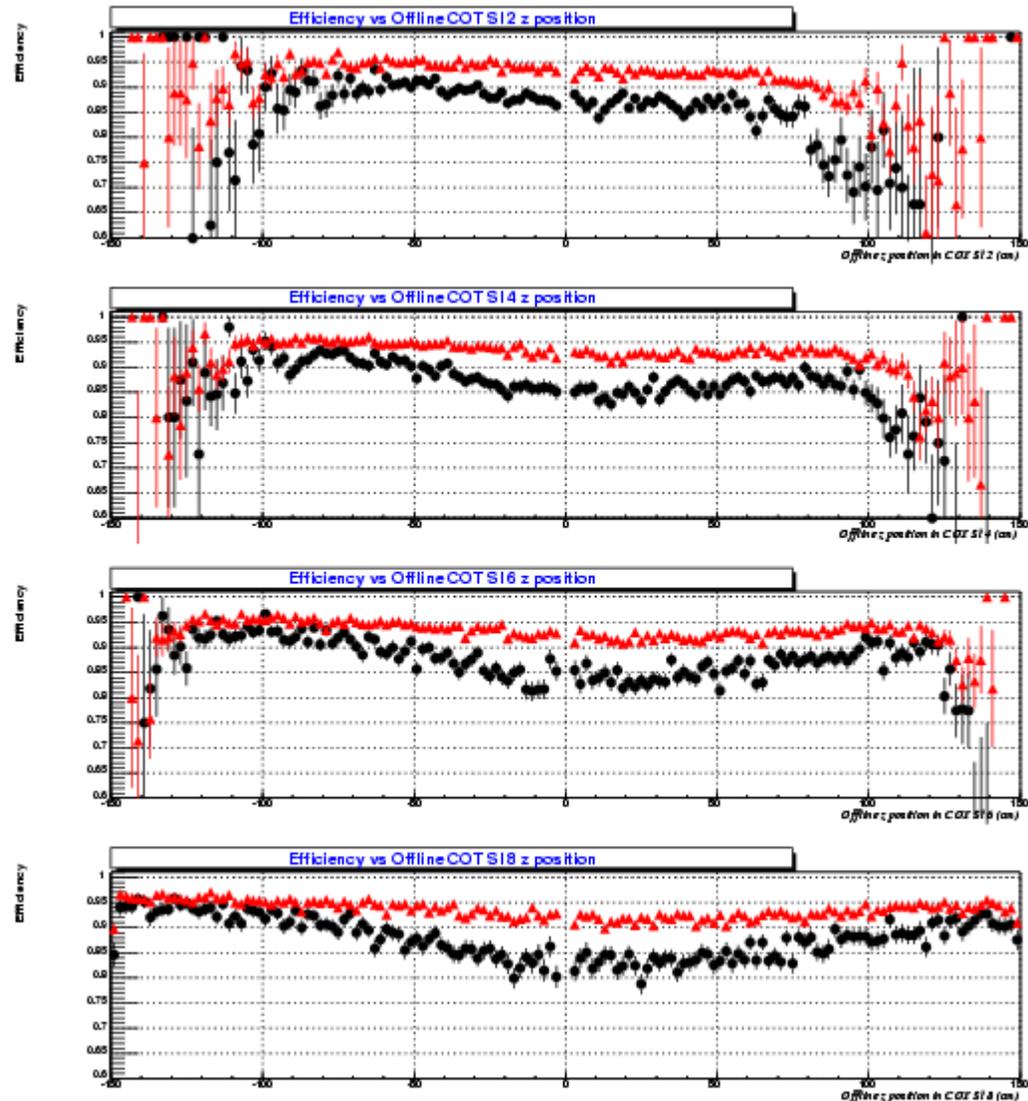
# $\phi_0$ Dependence



- Improved efficiency over most of  $\phi_0$  range
- Strange dip in efficiency near  $\phi_0 = 5$  not as pronounced with lower COT thresholds



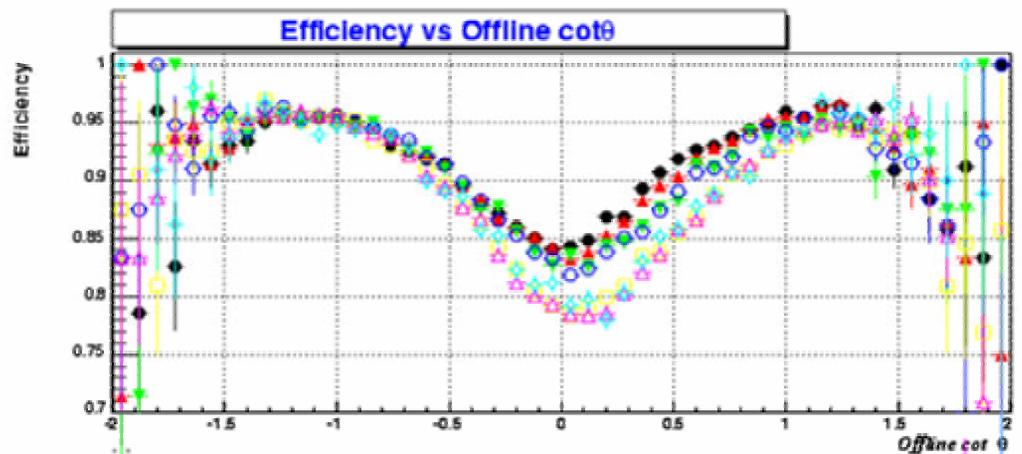
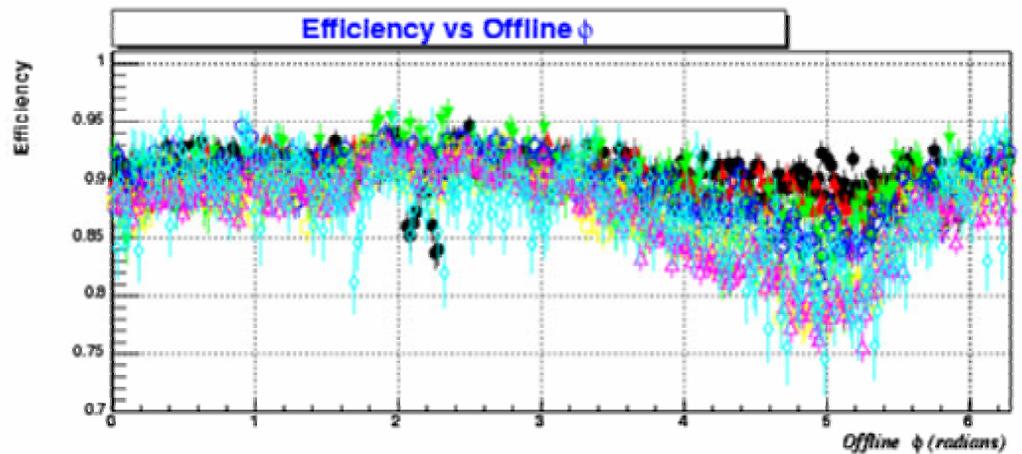
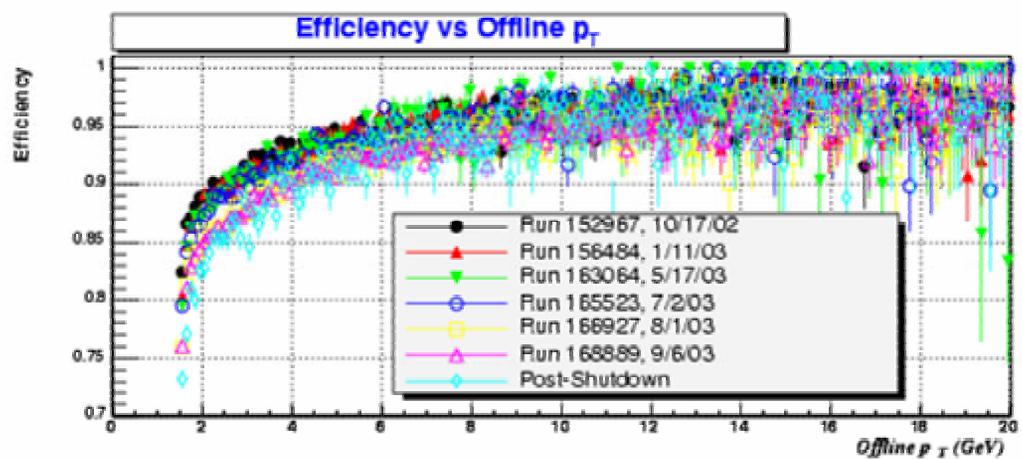
- XFT tracking efficiency as a function of the  $z$  at which the track crosses each axial superlayer
- Asymmetry in  $z$  not understood
- Effects not as pronounced with lowered thresholds



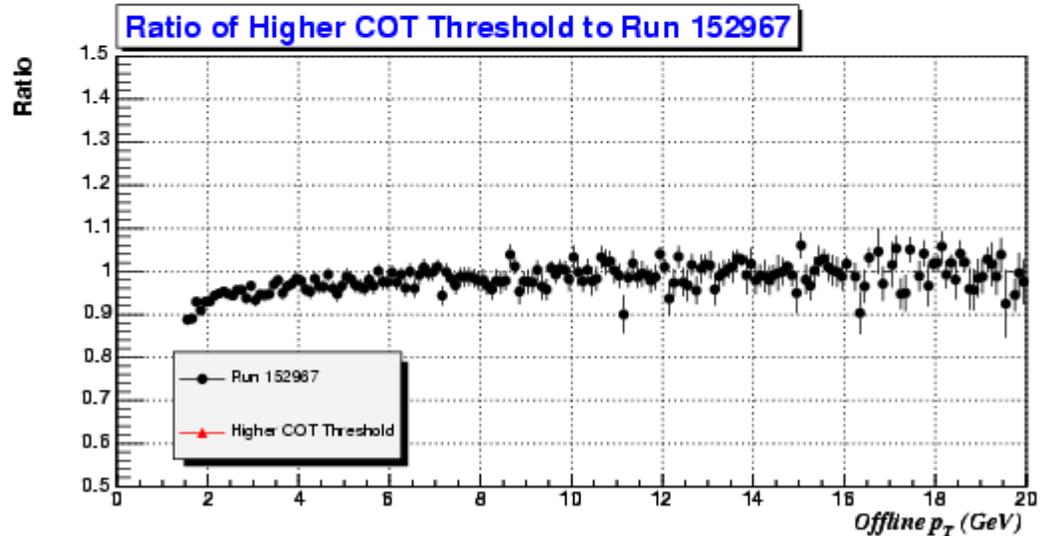
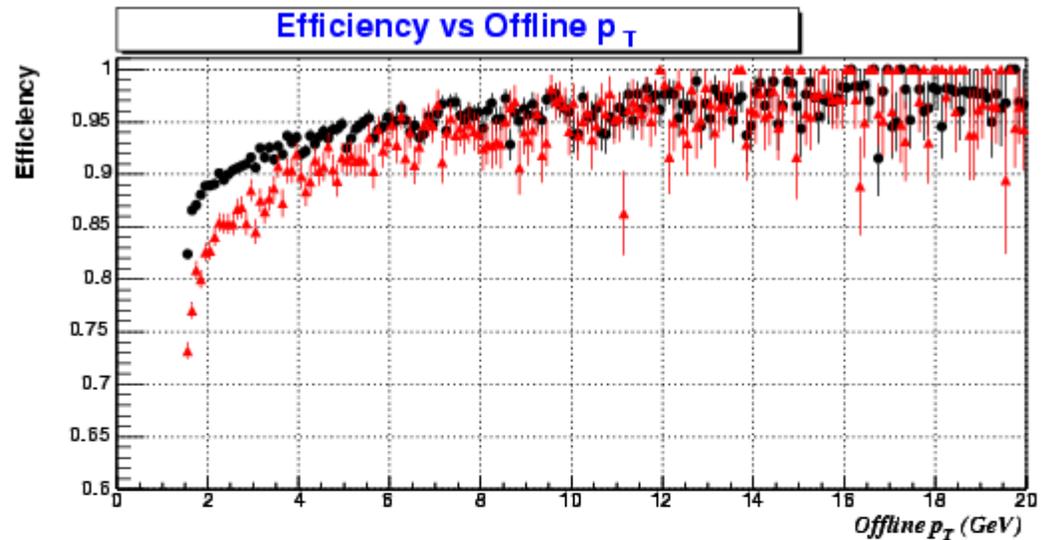


# Time Dependence

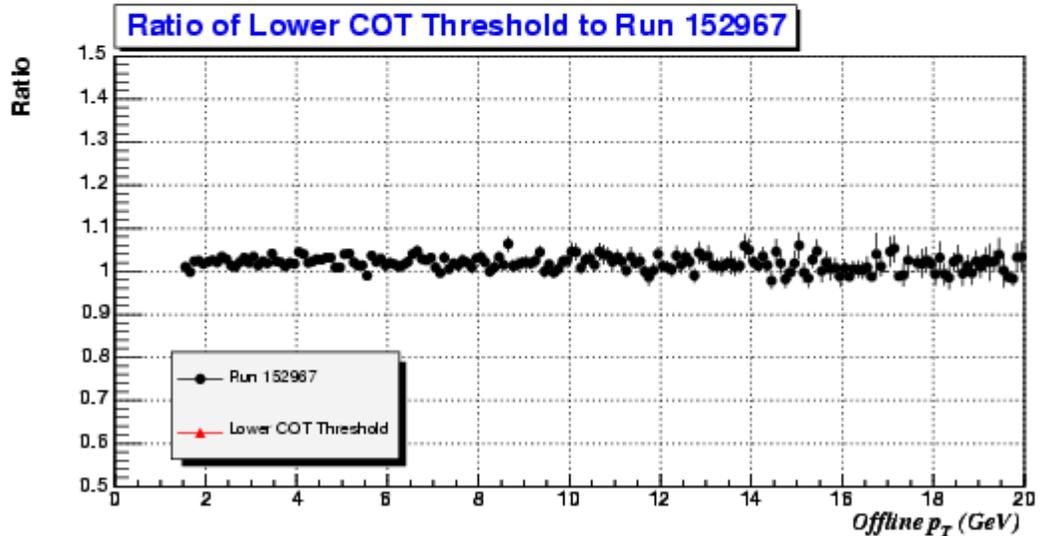
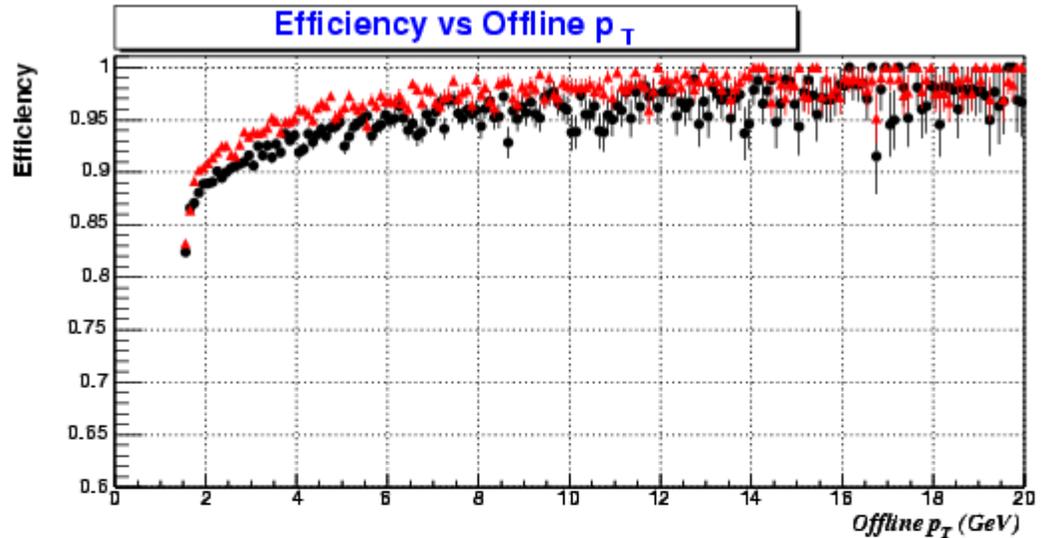
- Progression from change to 1-miss design until after the shutdown (but before COT threshold change).
- Gradual decline or abrupt change at discrete point?
  - $p_T$  and  $\cot\theta$  plots suggest maybe between June (165523) and August (166927)
  - $\phi_0$  not clear
- Relevant parameter:
  - Time?
  - Integrated luminosity?



- Comparison of run from right after we changed from 2-miss to 1-miss to the post-shutdown data with 225 mV COT threshold
- Losing efficiency at low  $p_T$  (also small  $\cot\theta$ )



- Lowering the threshold gets us back to roughly where we started
- Will the deterioration continue?





# Conclusions



- New XFT linker roads
  - Bring resolutions back to expected levels
  - Probably already need to change from 0.55 cm to 0.6 cm
  - Residual  $\phi_0$  dependence may be linked to angular discrepancy between XFT beam spot and true beam spot
- Lowered COT thresholds
  - Improves overall efficiency
  - Improves ionization dependent efficiency drops
- Concerns over time-dependence of these effects
  - XFT 1-miss performance at higher COT threshold seems to have gradually worsened
  - Lowered threshold restores some of performance, but problem may resurface with time
- Will continue studies with simulation to be reported on later (changing miss designs, road files, etc.)