Time Dependence of the XFT Performance

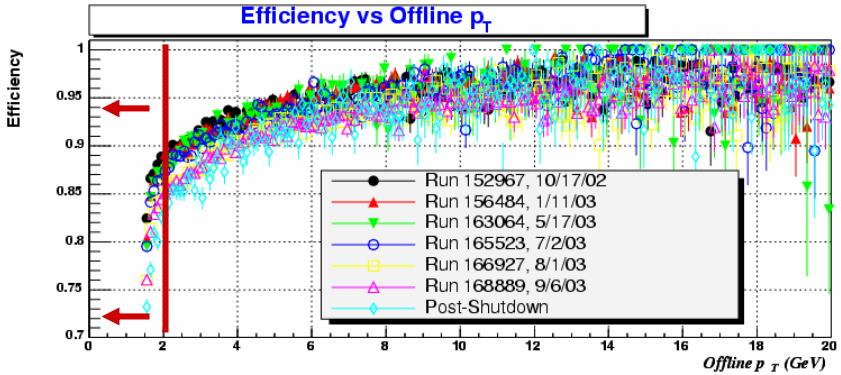
Kevin Lannon
Richard Hughes, Ben Kilminster,
Evelyn Thomson, Brian Winer
The Ohio State University

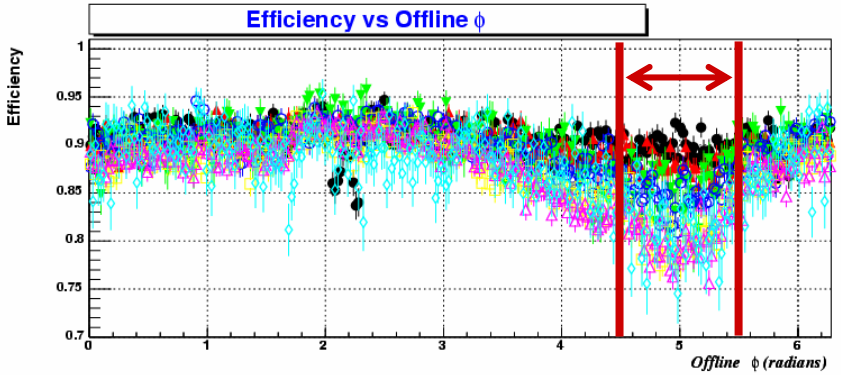
Time Dependence

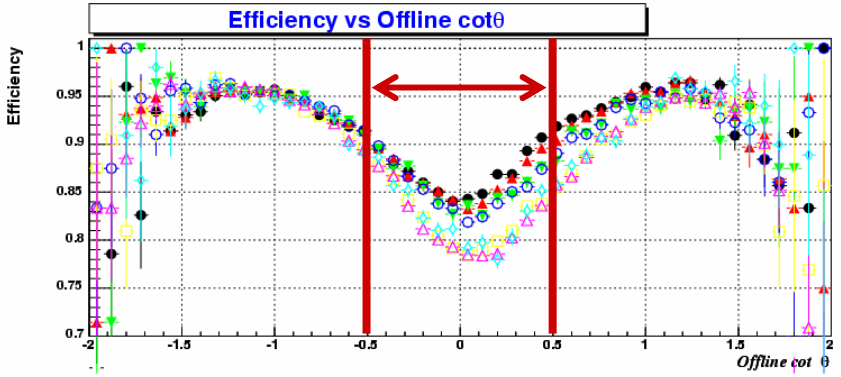
- From Oct 2002 to Sept 2003
  - XFT efficiency decreased: Gradual or sudden?
  - XFT efficiency worse in particular parts of phase space
    - Low p_T
    - Low $\cot\theta$
    - Near ϕ_0 = 5 radians
  - Is the time dependence of the changing efficiency in these areas the same or different?
- In November thresholds on COT axial layers lowered
  - Essentially recovered lost efficiency since Oct 2002
  - How long before efficiency starts to drop again?

XFT Performance Benchmarks

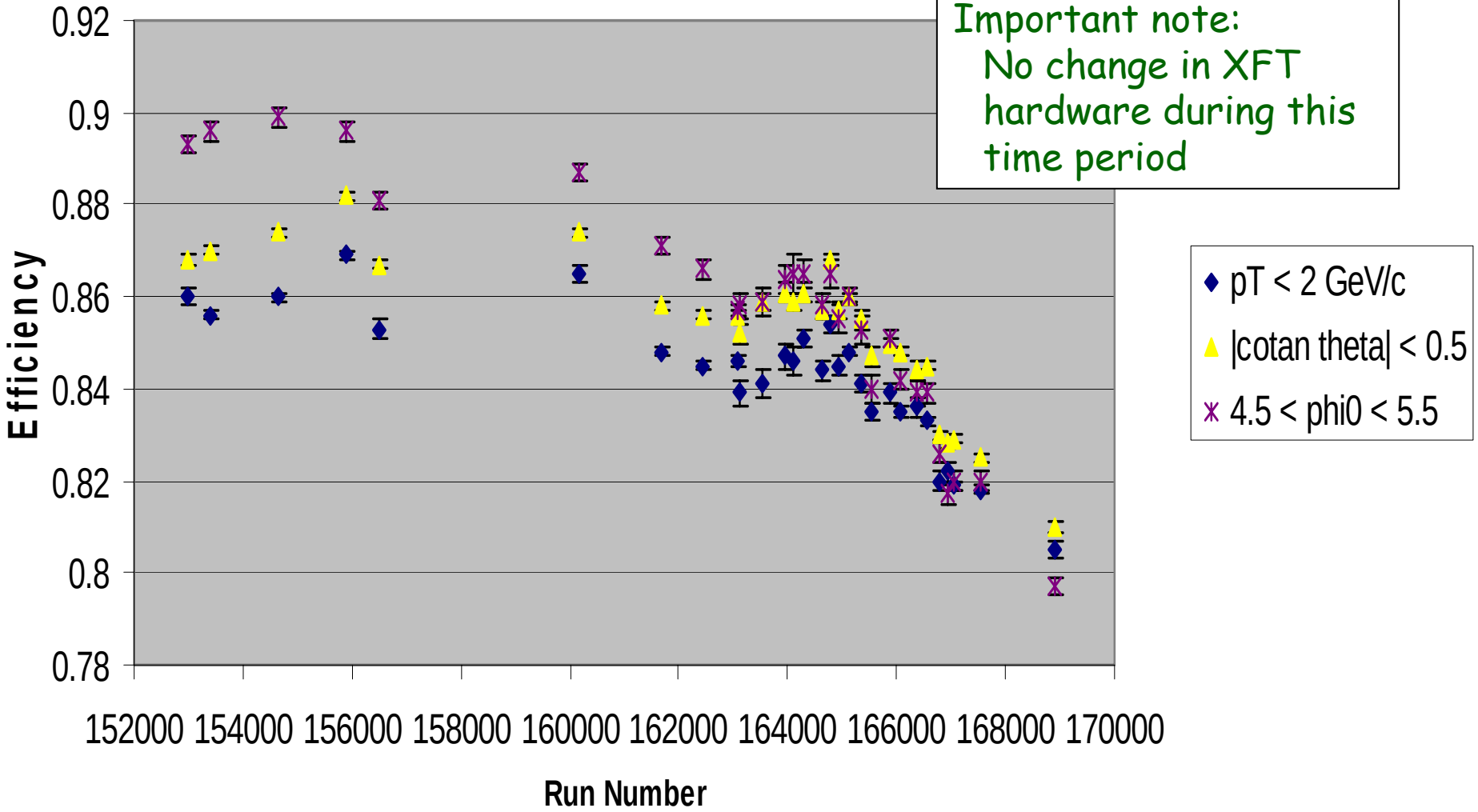
- Consider XFT efficiency in three regions:
  - Offline tracks with $p_T < 2$ GeV/c
  - Offline tracks with 4.5 radians < ϕ_0 < 5.5 radians
  - Offline tracks with $|\cot\theta| < 0.5$
- Track how the efficiency of the XFT in these three cases changes with time
- Spot check a sample of good runs from Oct 2002–Sept 2003



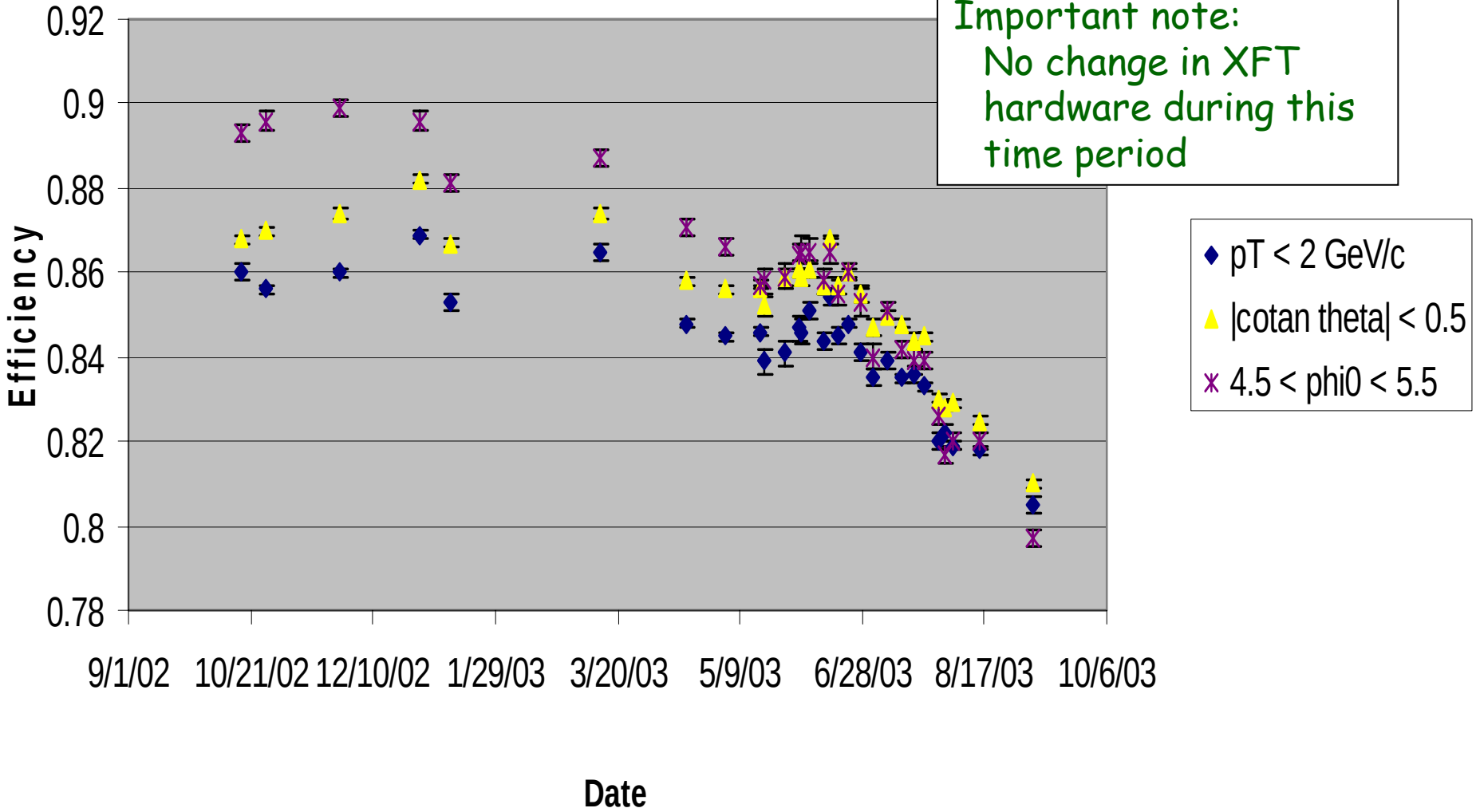




Time Dependence



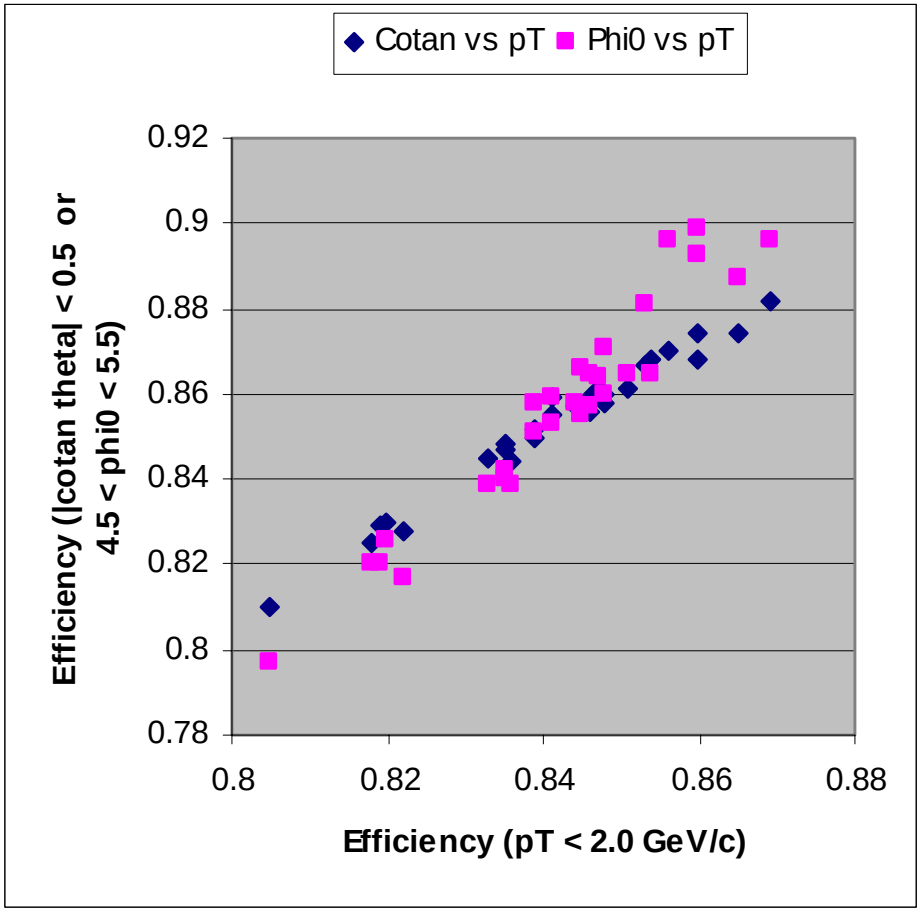
Time Dependence

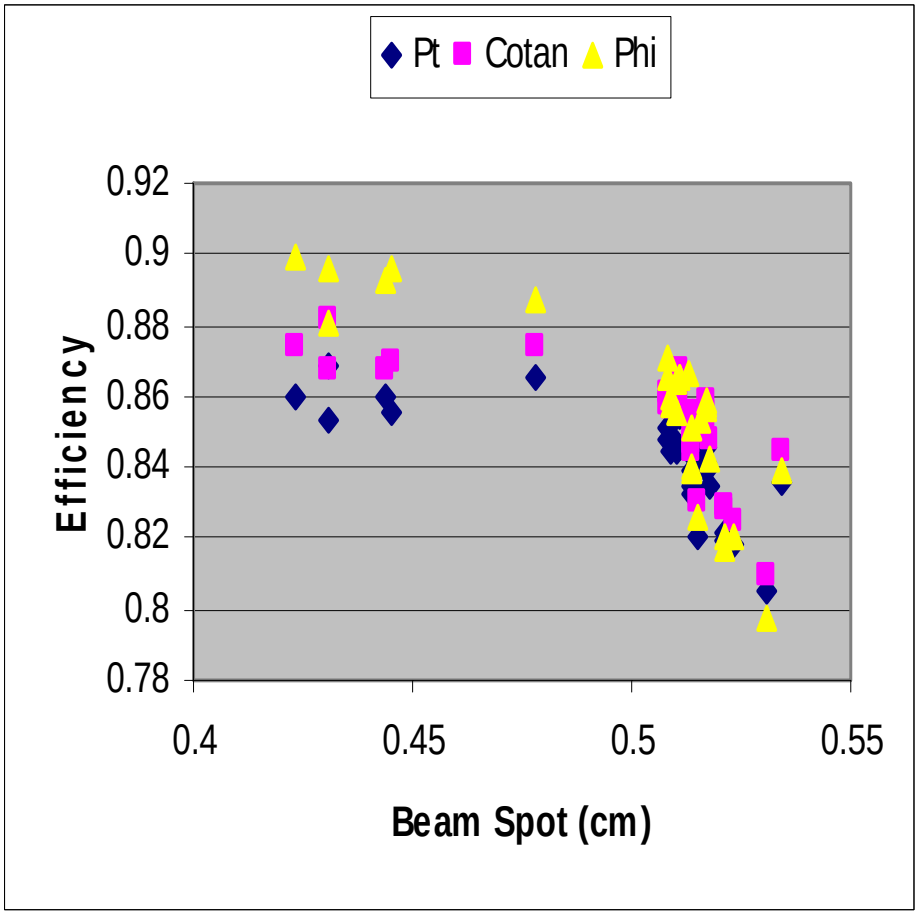


Correlations

- Efficiencies well correlated with each other
- Common cause?

- Efficiencies not well correlated with beam spot

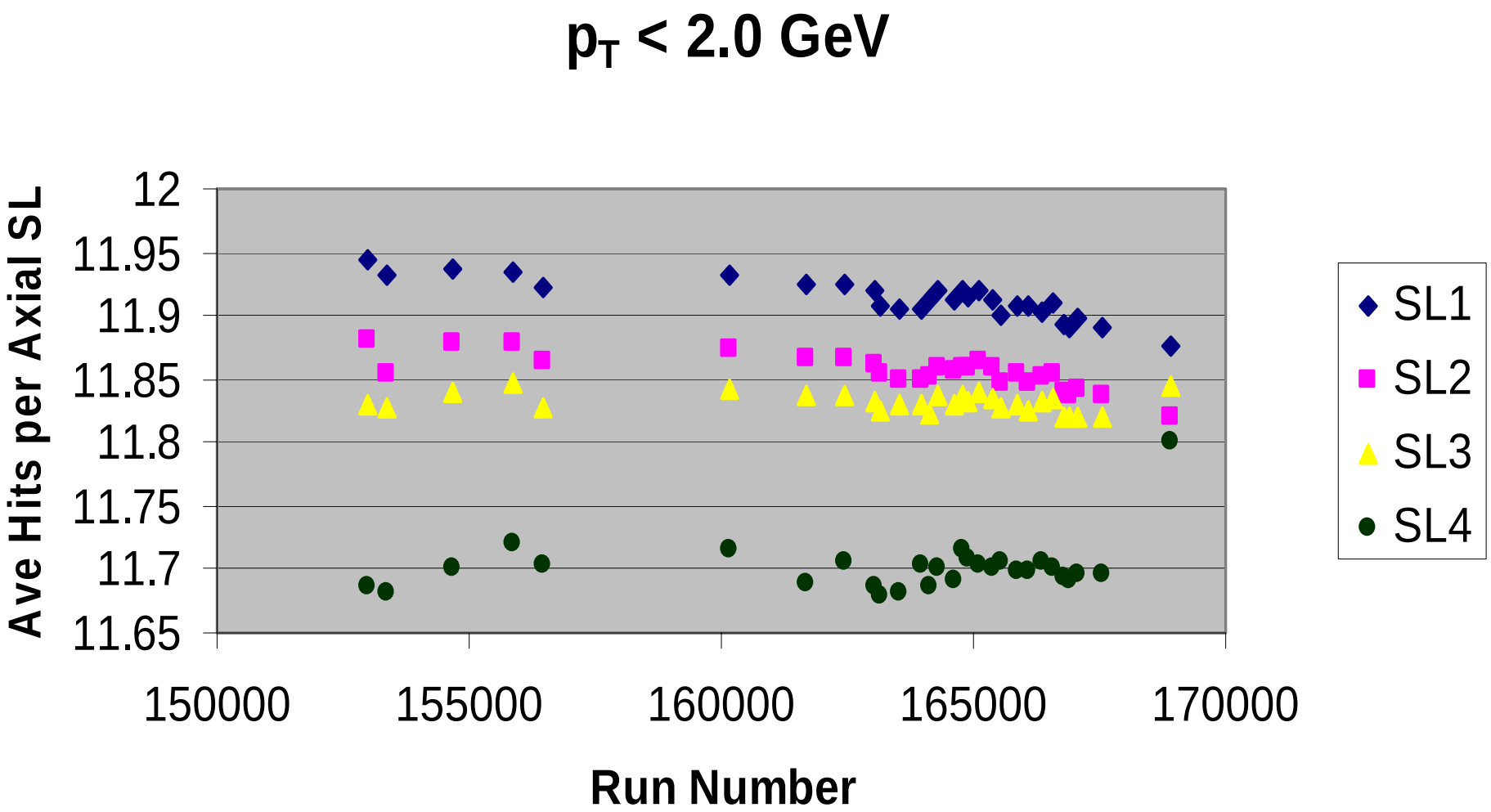




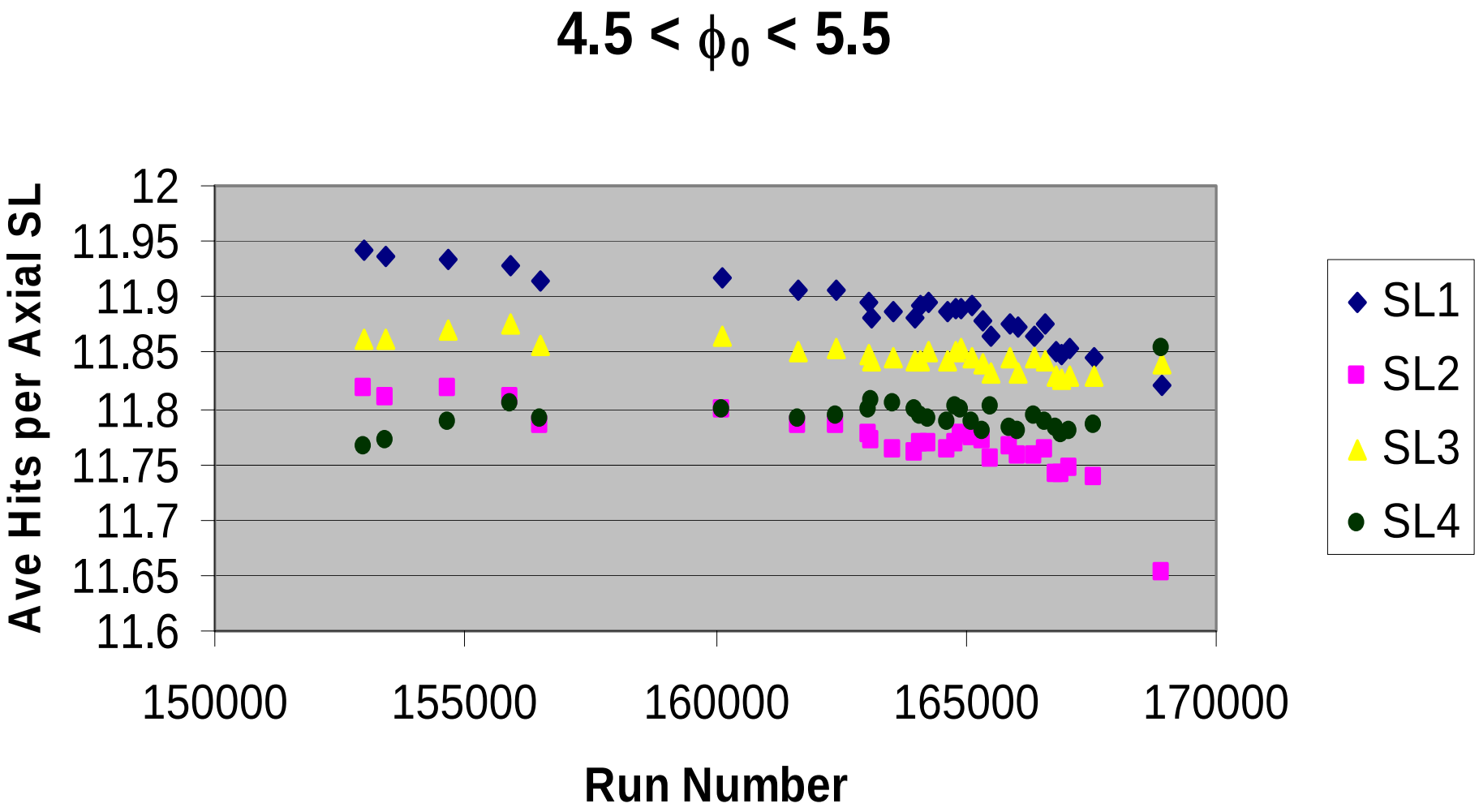
COT Hits

- Check the number of COT hits "attached" to a track (very simple approach):
  - Extrapolate offline track to each axial SL in the COT
  - Determine the Cell the track passes through
  - Check to see whether there is at least one hit on each wire that should have a hit (based on this extrapolation)
  - Independent of XFT information
- Check the average number of hits per SL for each of the cases plotted previously:
  - Offline track $p_T < 2$ GeV/c
  - Offline track with 4.5 radians < ϕ_0 < 5.5 radians
  - Offline tracks with $|\cot\theta| < 0.5$
- Important to note: These plots are independent of XFT

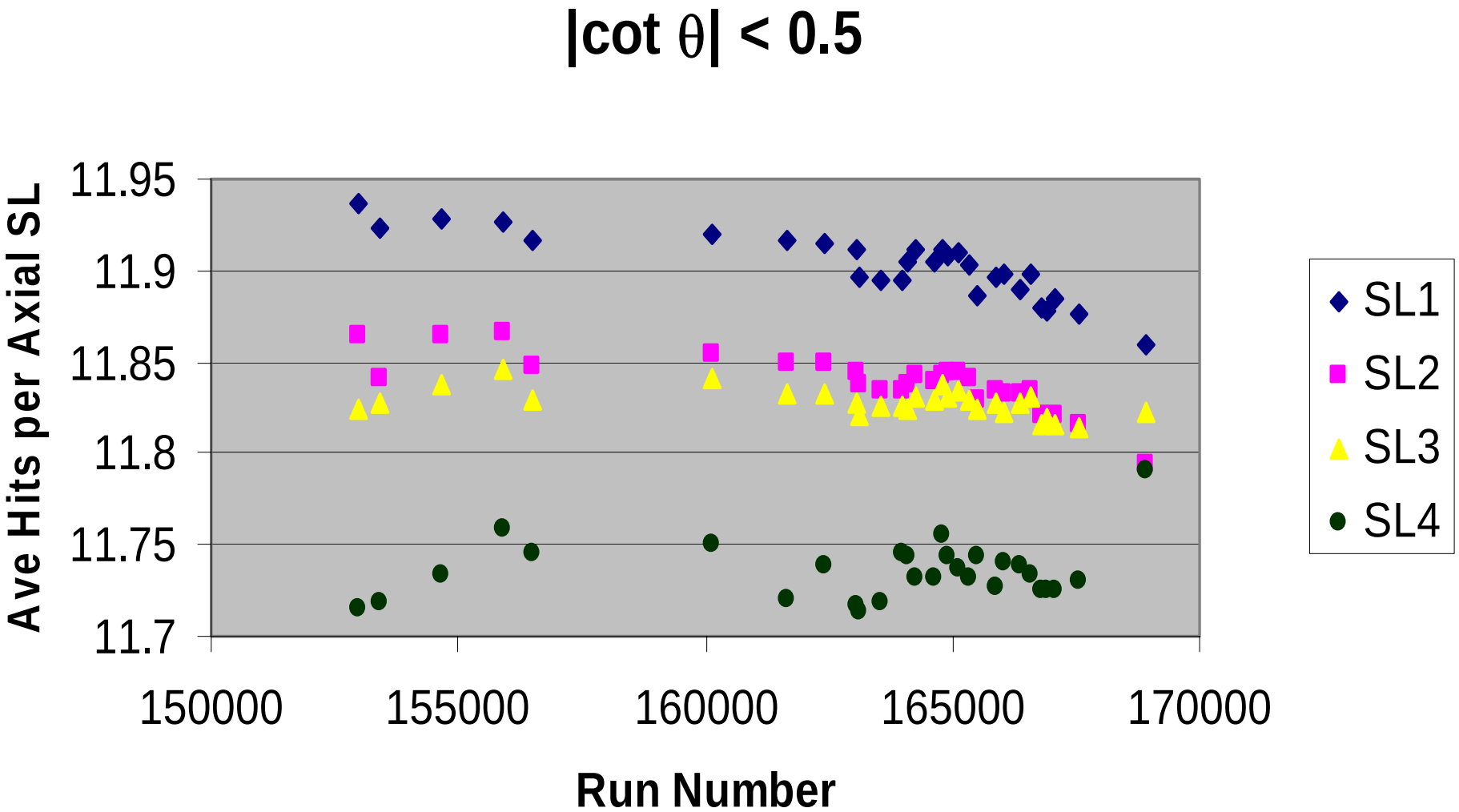
Average # COT Hits



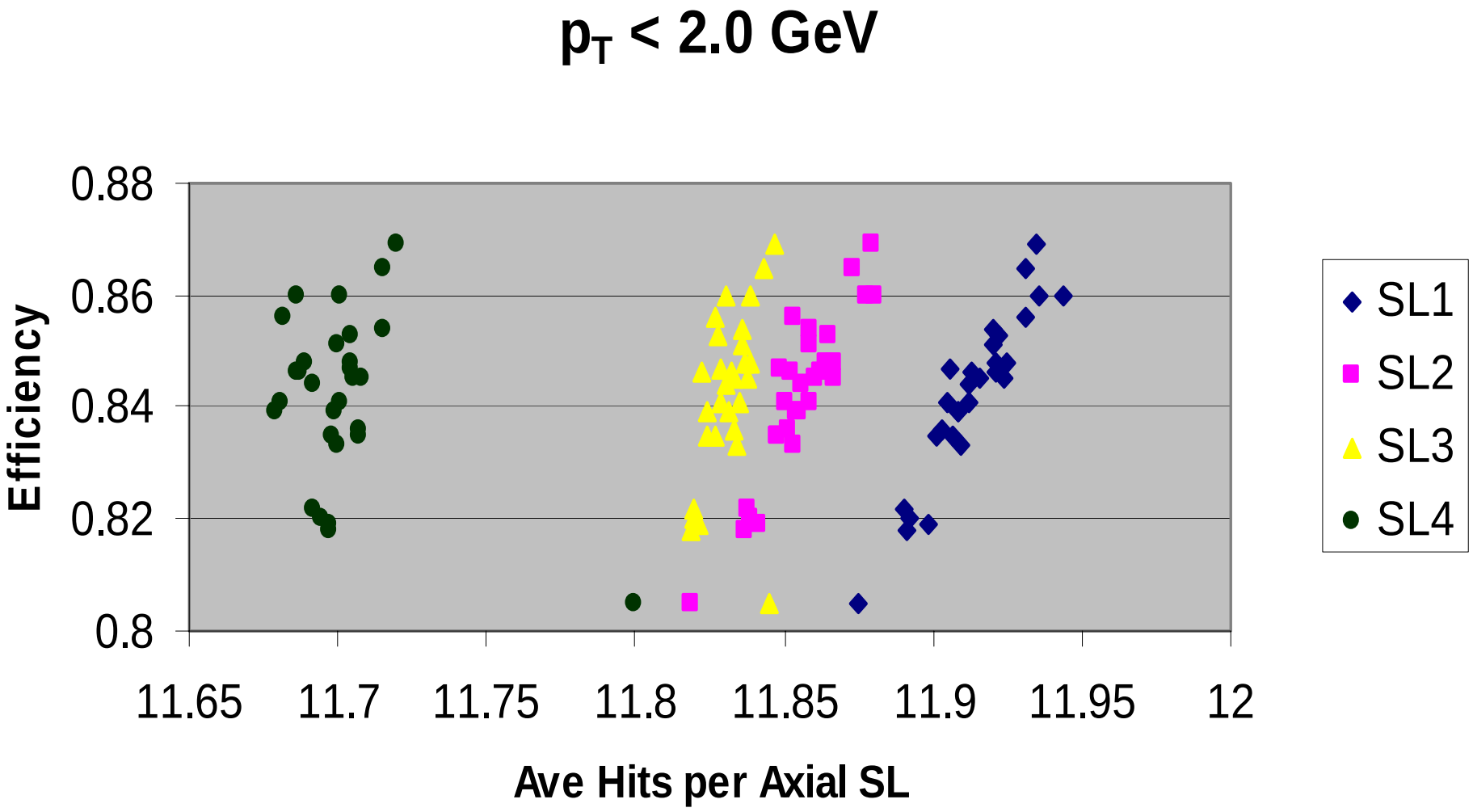
Average # COT Hits



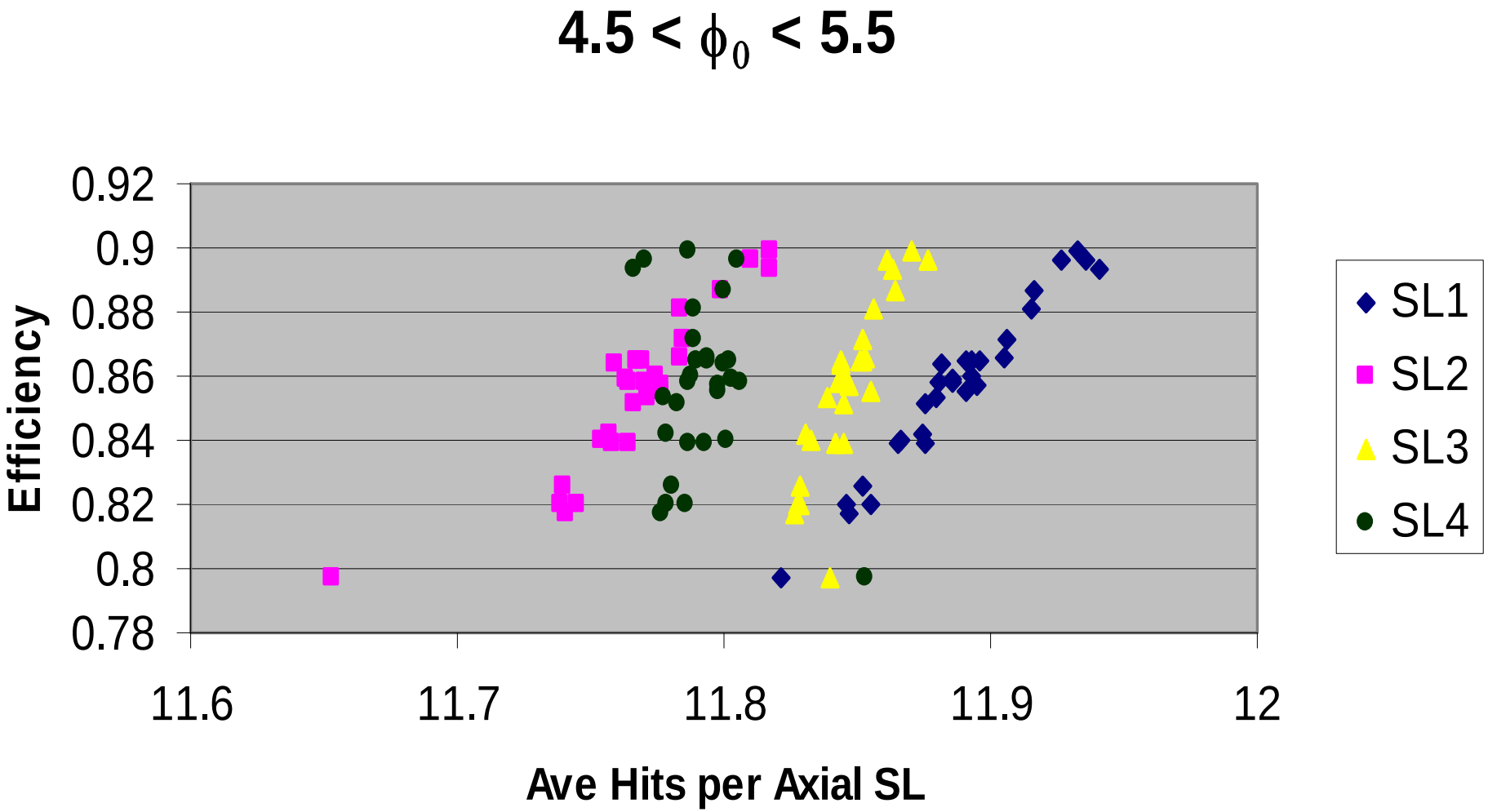
Average # COT Hits



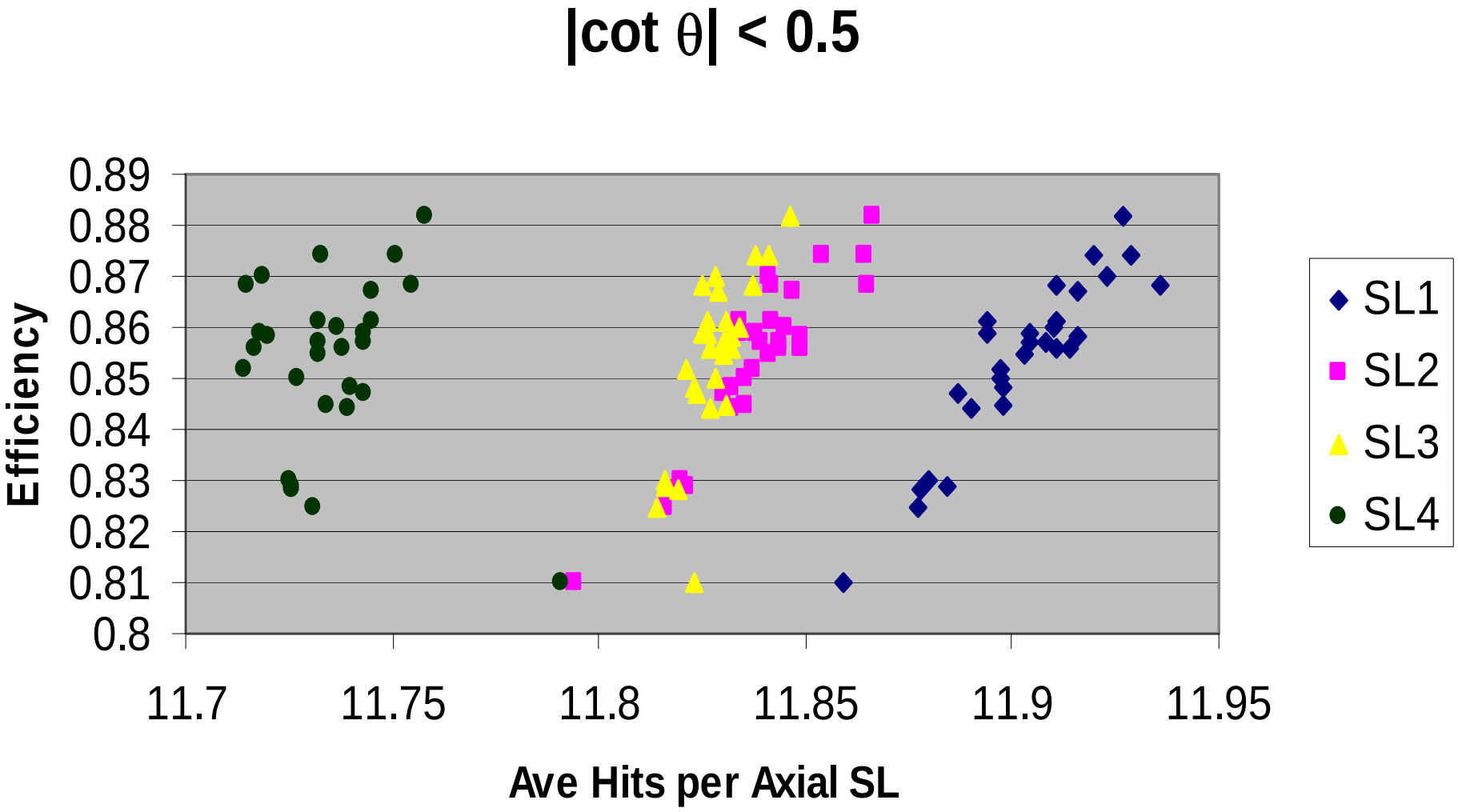
XFT-COT Hit Correlation



XFT-COT Hit Correlation

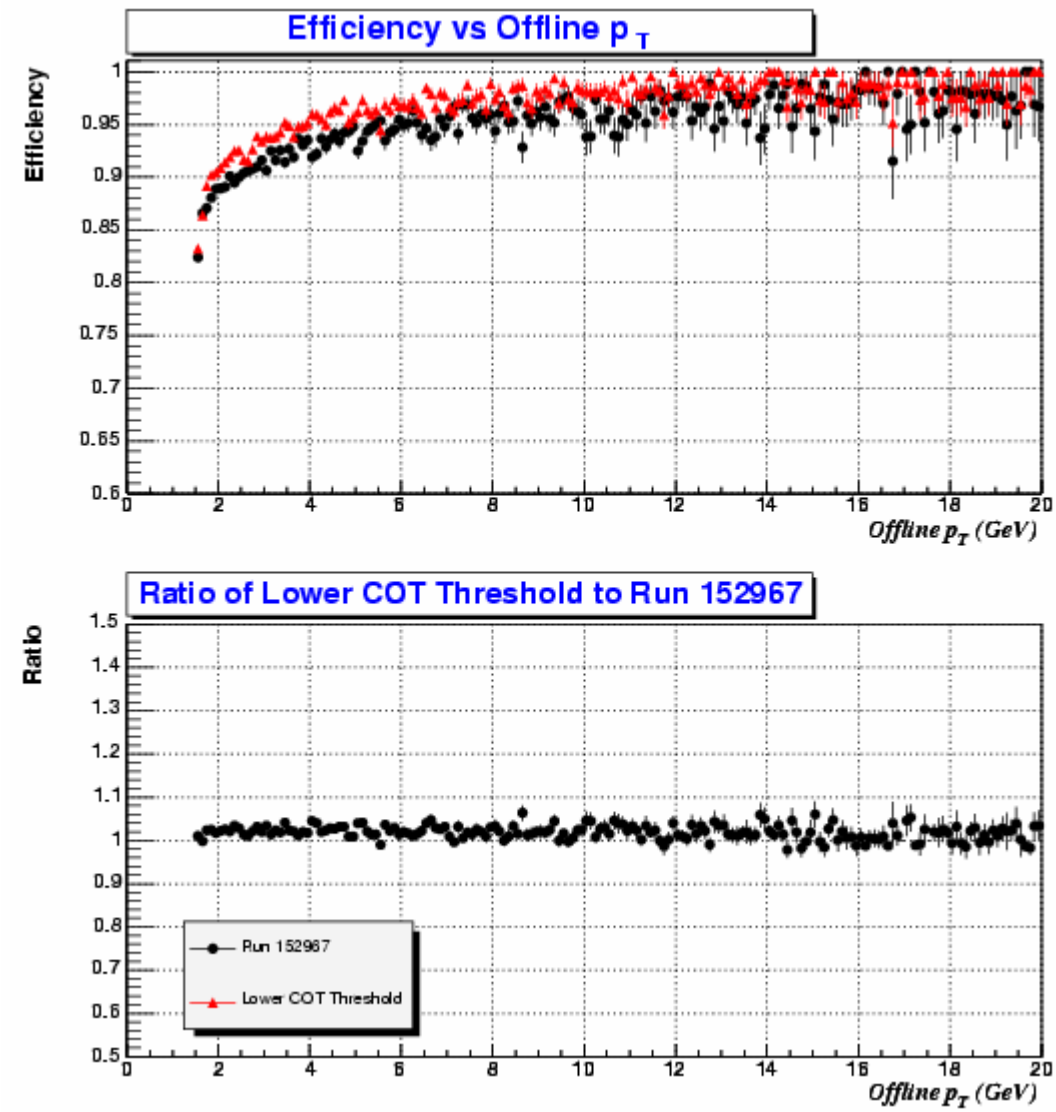


XFT-COT Hit Correlation



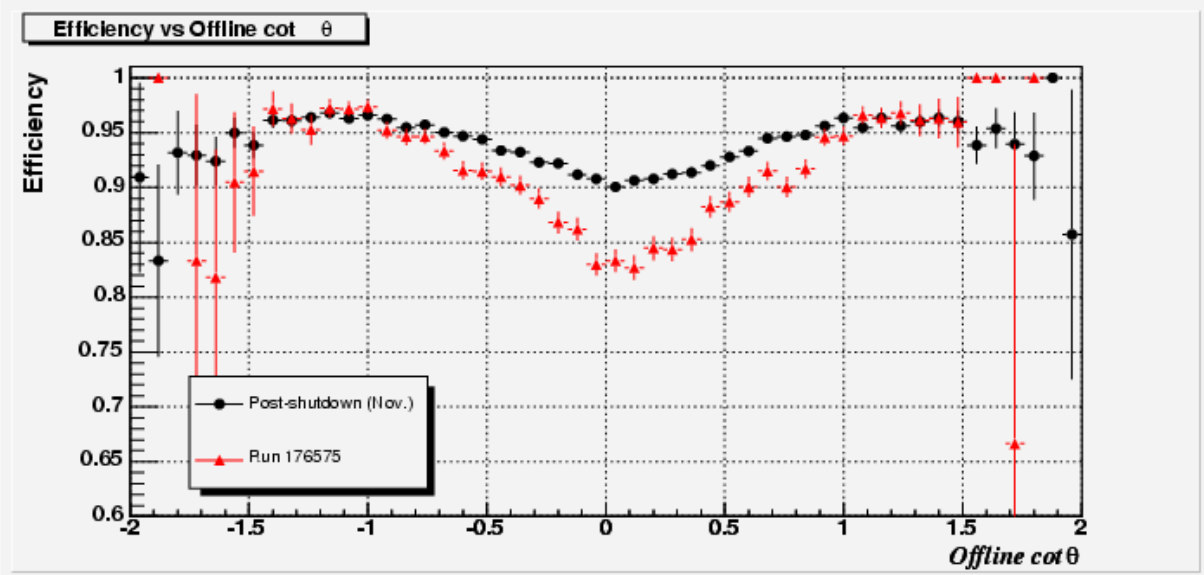
Recent Performance

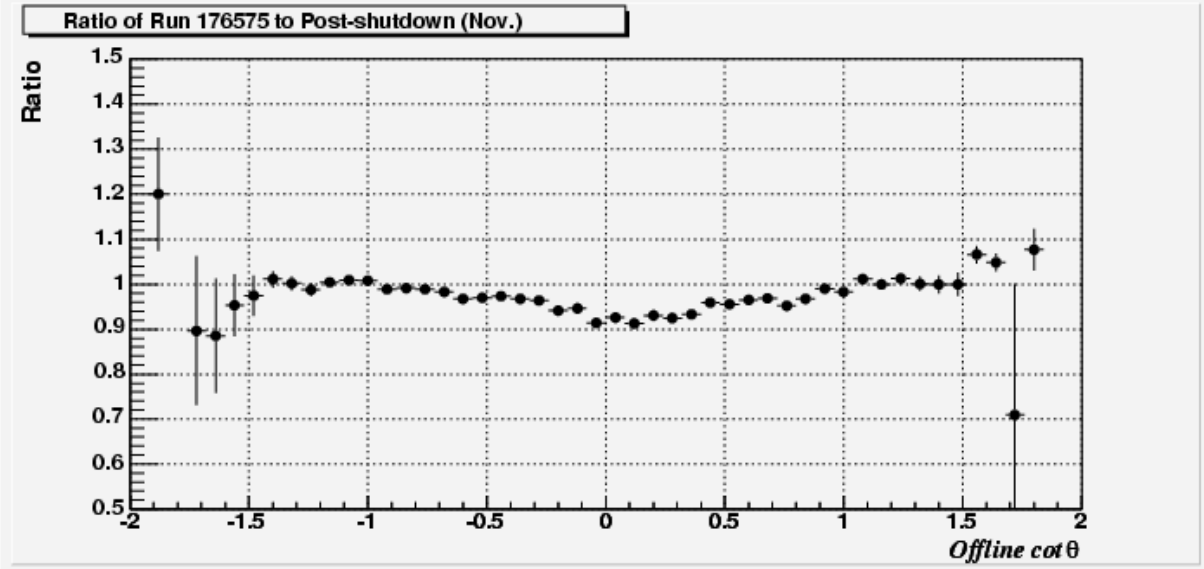
- After the COT threshold change, XFT performance restored to near Oct 2002 level
  - Black = Oct 2002
  - Red = Nov 2003 (after COT threshold change)



Run 176757

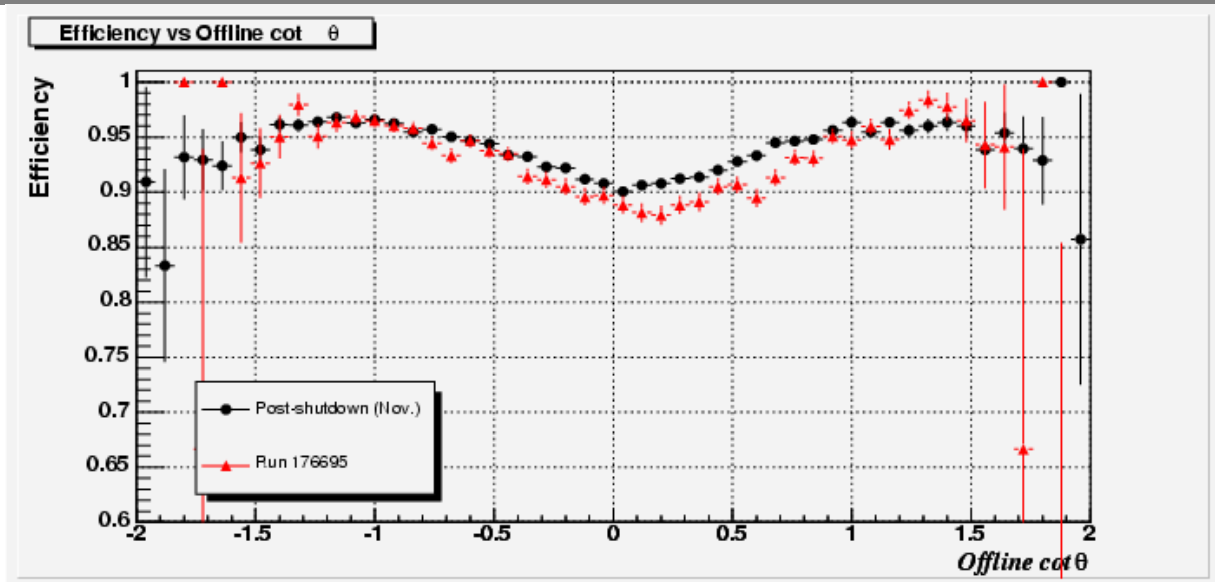
- Run 176757
  - CCAL test run right after beam spot change
  - 12/17/2003
  - Efficiency vs p_T and ϕ_0 show similar features
- Cause? (Hypothesis from Dave Ambrose)
  - Chamber purged with N_2 over weekend (less than 1 week before)
  - Often need more than one week before chamber widths plateau after a purge

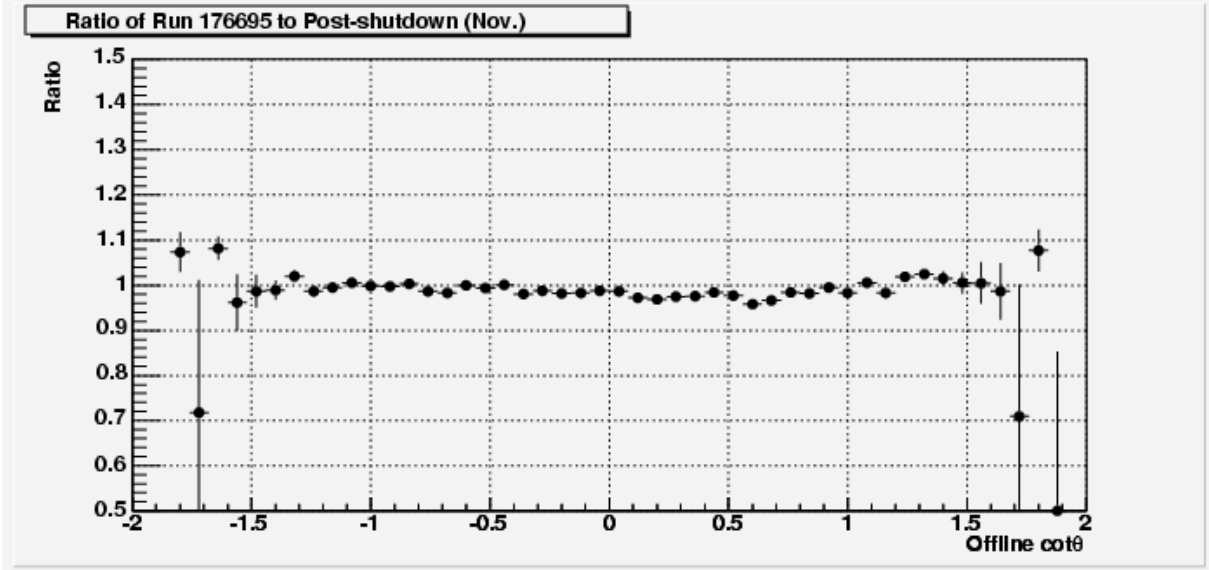




Run 176695

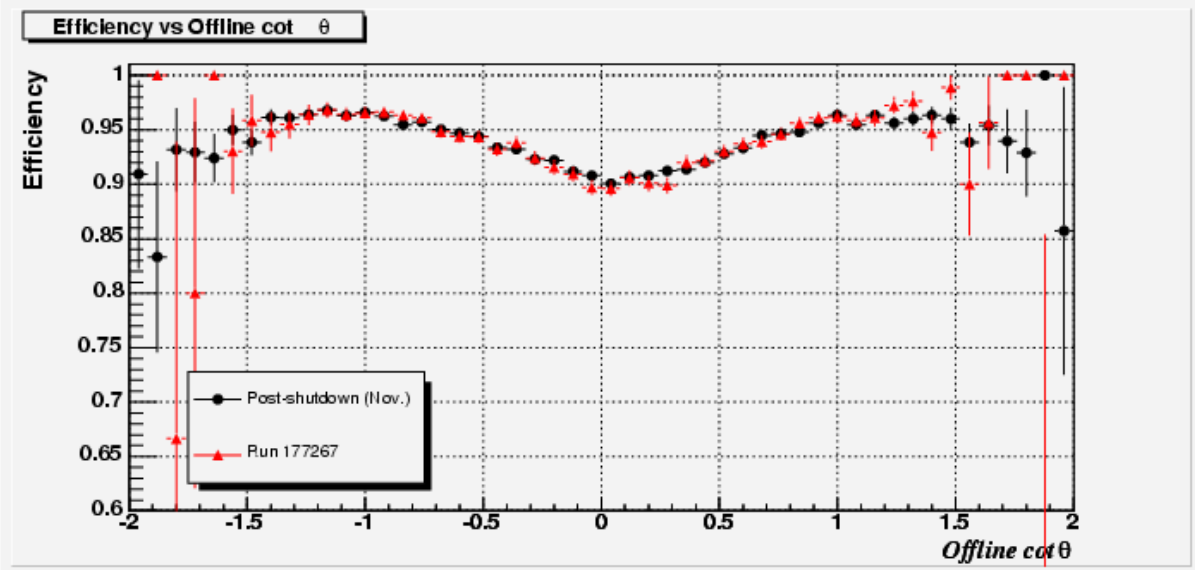
- Run 176695
  - Stream G data
  - 12/20/03
  - Chamber performance seems mostly recovered from N_2 purging?

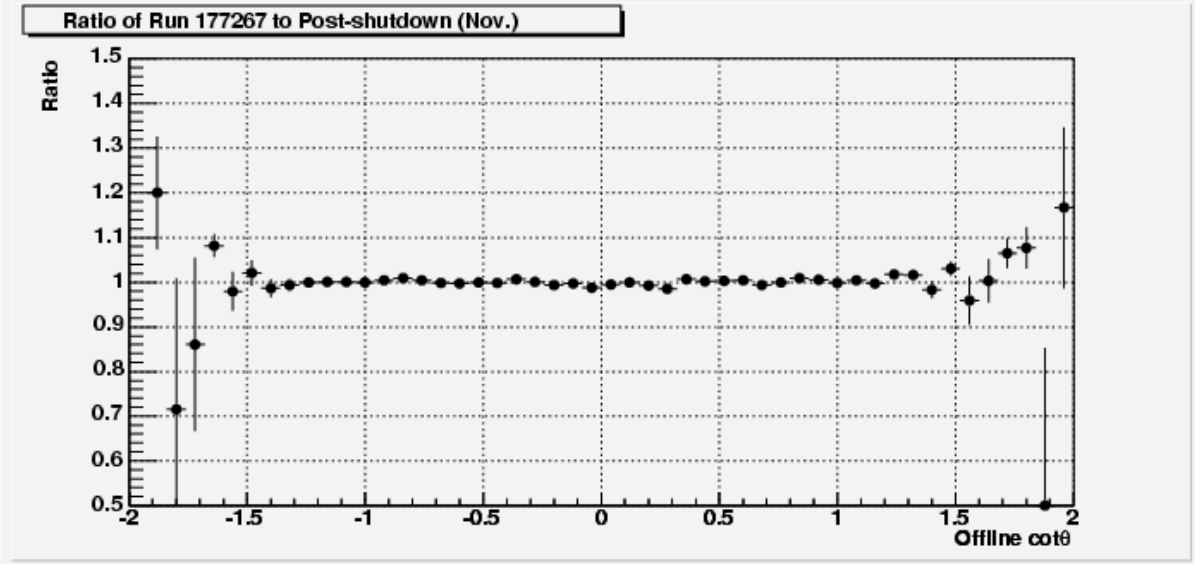




Run 177267

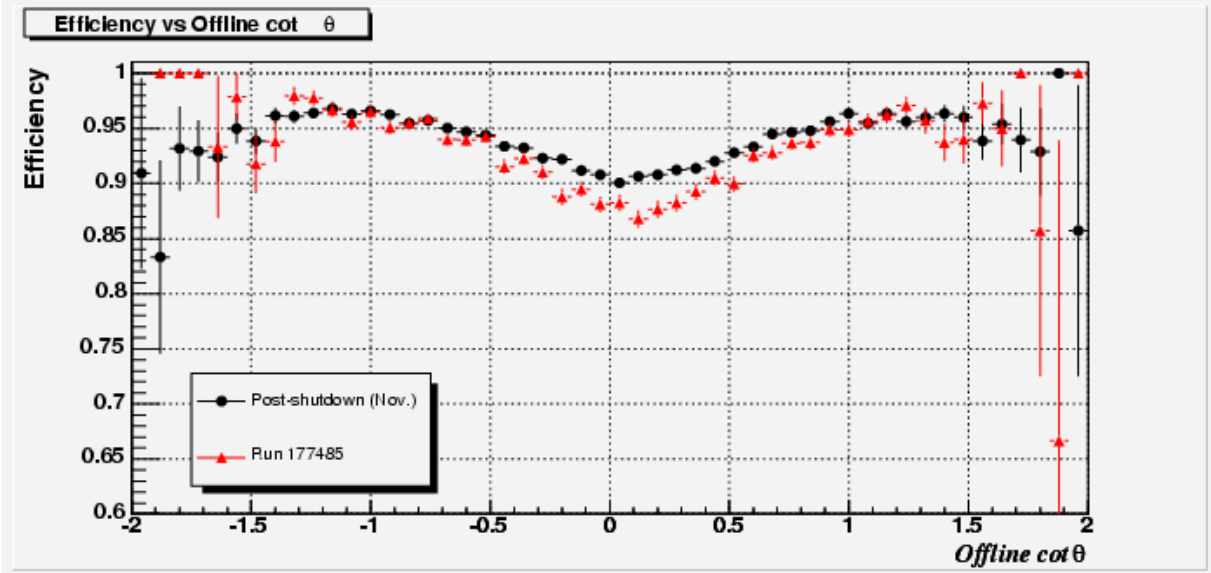
- Run 177267
  - Stream G data
  - 1/1/04
  - Happy New Year!
  - Start with a clean slate?

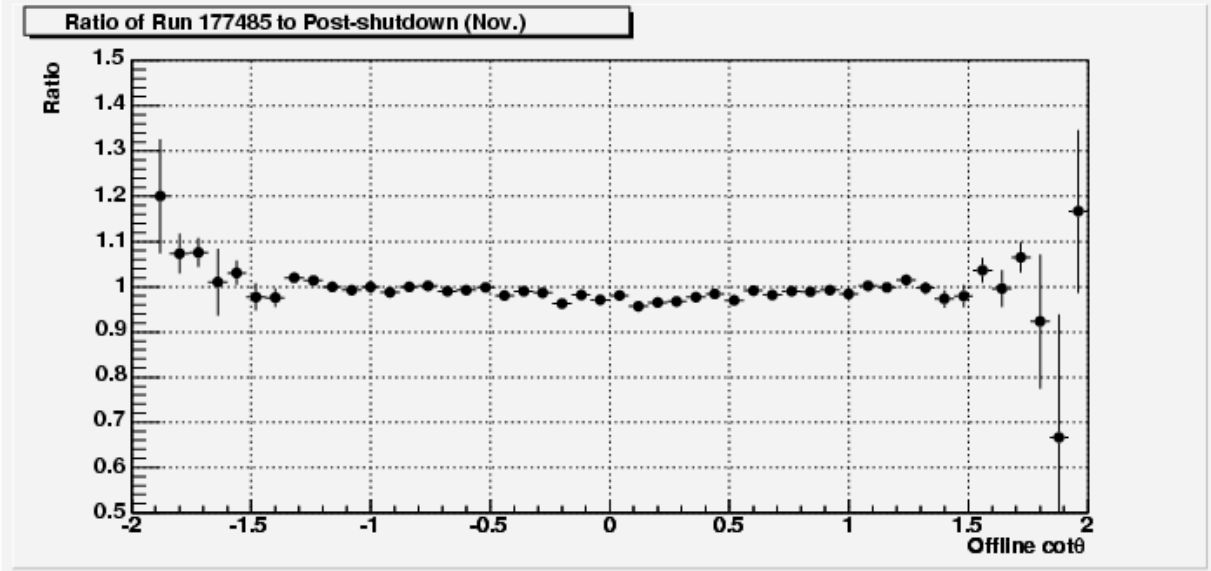




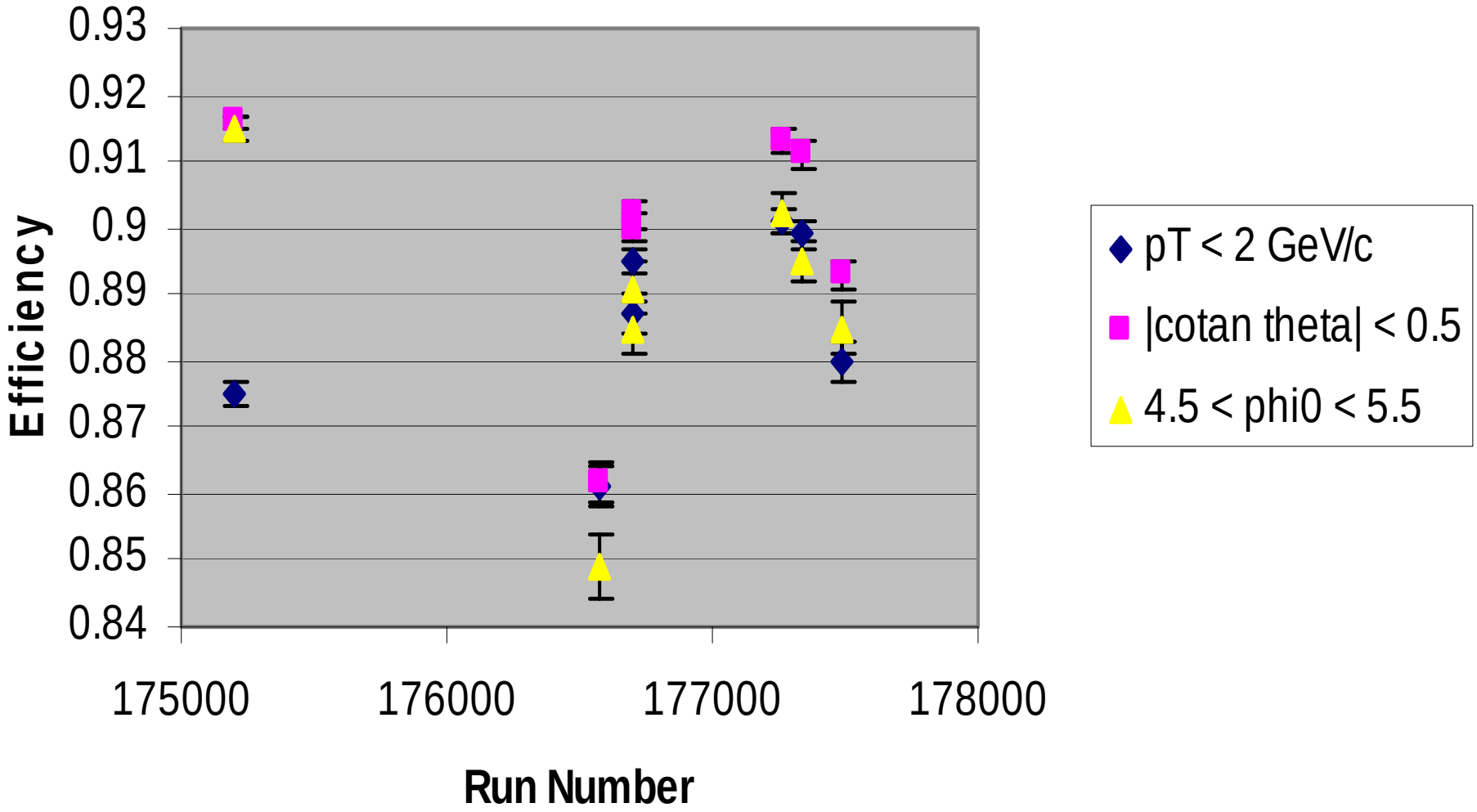
Run 177485

- Run 177485
  - Stream G data
  - 1/8/04
  - Starting to decline again?

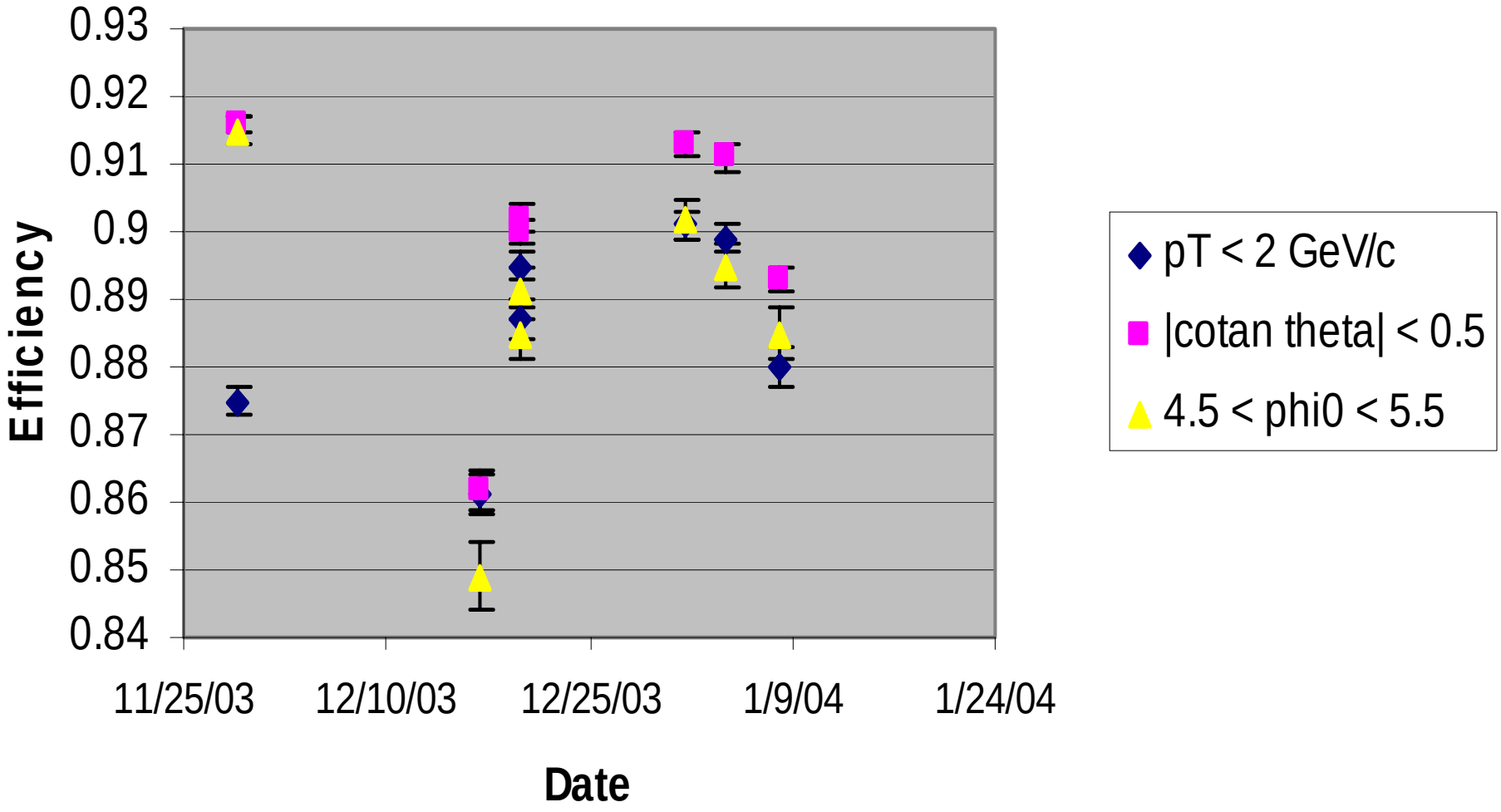




Time Dependence



Time Dependence



Conclusions

- Time Dependence of the XFT performance
  - The increasing inefficiency for tracks with low p_T, low $\cot\theta$, and 4.5 radians < ϕ_0 < 5.5 radians seems to have the same time dependence
  - The change in efficiency for all three does not seem correlated with movement of the beam spot
  - The change for all three does seem correlated with change in average number of COT hits "attached" to track
  - Common cause?
    - Ionization/charge dependent COT hit inefficiency?
    - Other ideas?
- Since the shutdown
  - Performance improved with lowered thresholds
  - Chamber takes some time to recover after N_2 flushing
  - Performance may be starting to degrade again (too soon to tell for sure)
  - Will monitor the situation closely