

A First Look at Track Reconstruction with High Random Backgrounds

Haijun Yang Keith Riles

University of Michigan, Ann Arbor



American Linear Collider Workshop

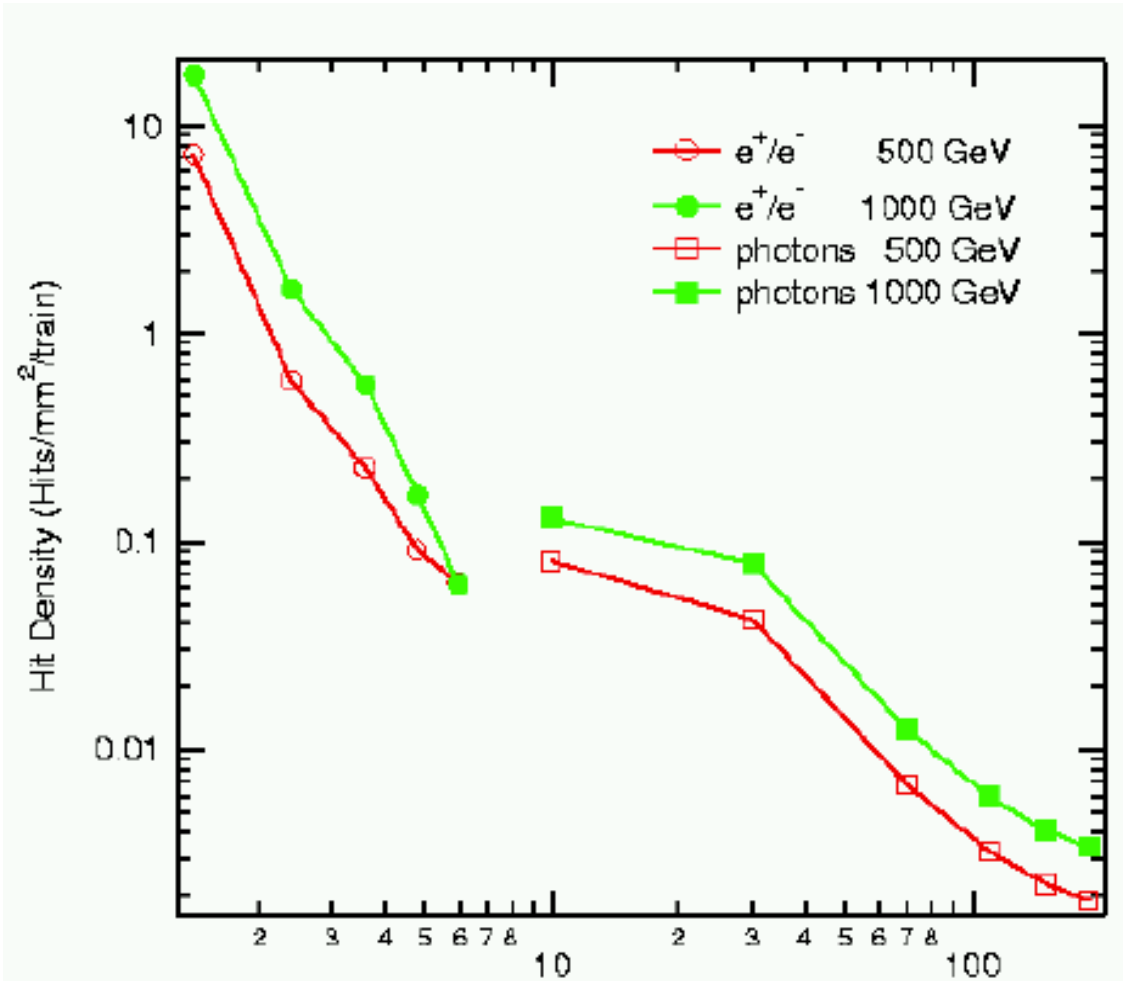
University of Chicago, USA

January 7-9, 2002

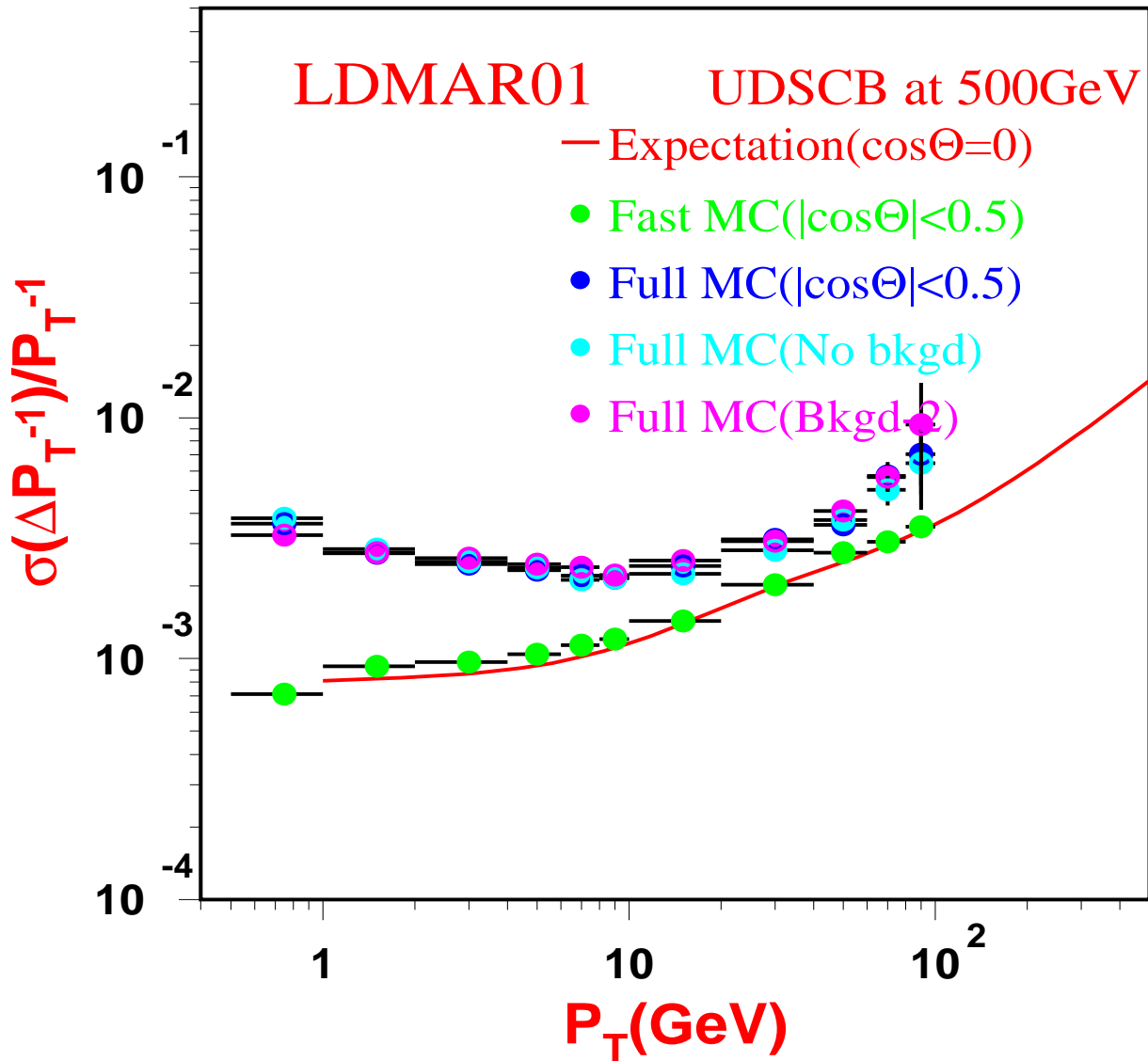
- Full MC comes from SLAC lccdata01 server
 - `panpy-udscb-500-010301-LD-sim`
 - `panpy-udscb-500-010301-SD-sim`
- Detectors: LDMAR01(LD), SDMAR01(SD)
- Analysis Platform: JAVA Analysis Studio V2.2.4
 - ⇒ Thanks to Tony, Wolfgang, Mike.
- Machine Backgrounds
 - Synchrotron Radiation.
 - Neutron back shine.
 - Muon production at collimators.
 - Beam-Gas collision.
 - ⇒ Thanks to Tom and Stan.

BUT, no full MC with 'real' machine background is available now, so random backgrounds hits are used in this study.

- Acceptance Cuts on true MC particles
 - $P_T > 0.5 \text{ GeV}$, $|\cos\theta| < 0.9$
 - $R_{origin} < 130 \text{ cm}$, $Z_{origin} < 150 \text{ cm}$, $R_{end} > 3.6 \text{ cm}$.



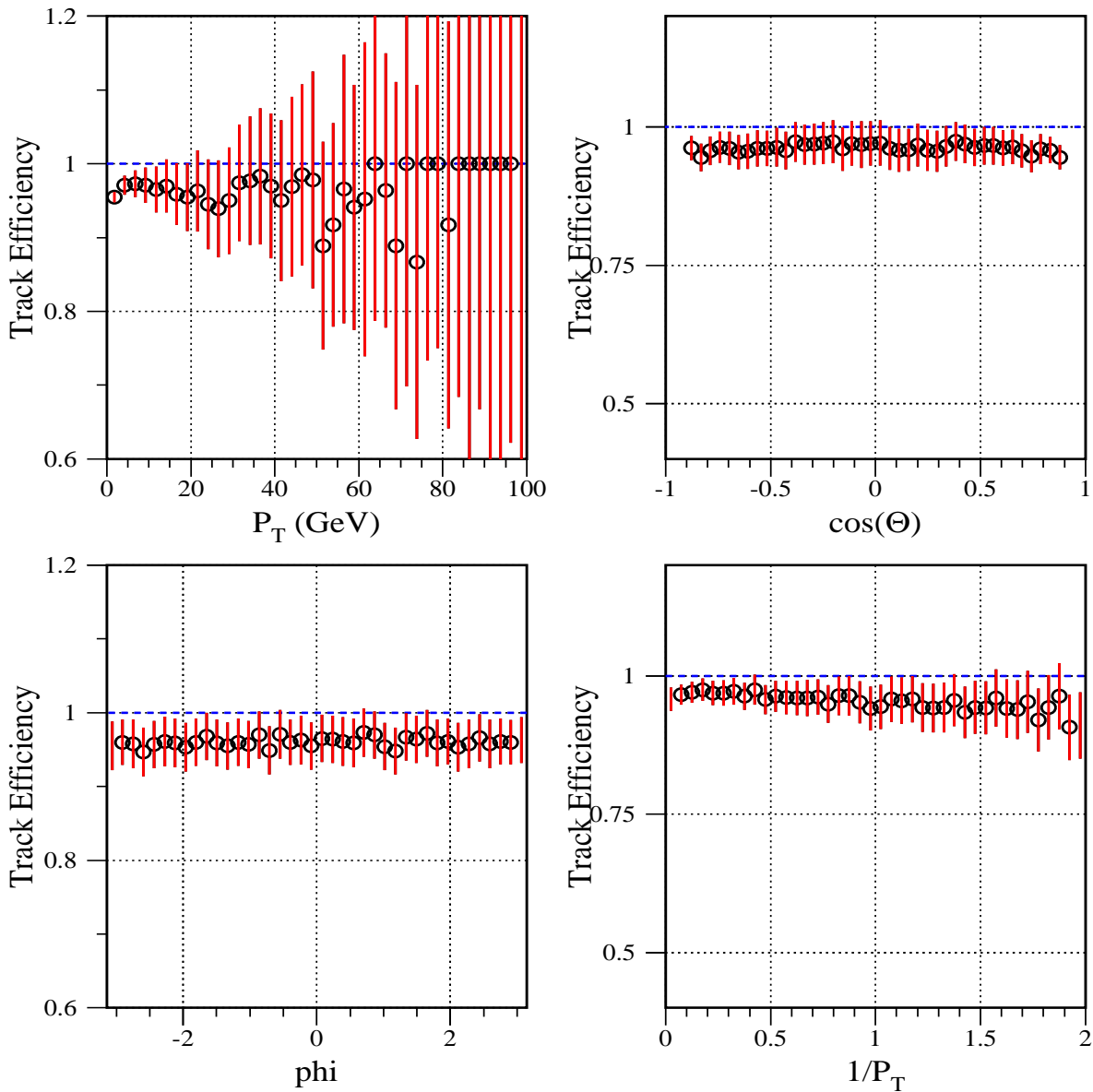
- Hit Densities for the NLC LD Detector.
- In this talk, random background hits in CCD are added according to the criteria, factor 2 means 2% of above hit density. But for the TPC, 0.001 hits/cm² are produced at each layer uniformly. If we assume compton scattering rate is 1% in TPC, factor 2 means 20% of the normal hit density.



- UDSCB Full and Fast MC at 500 GeV

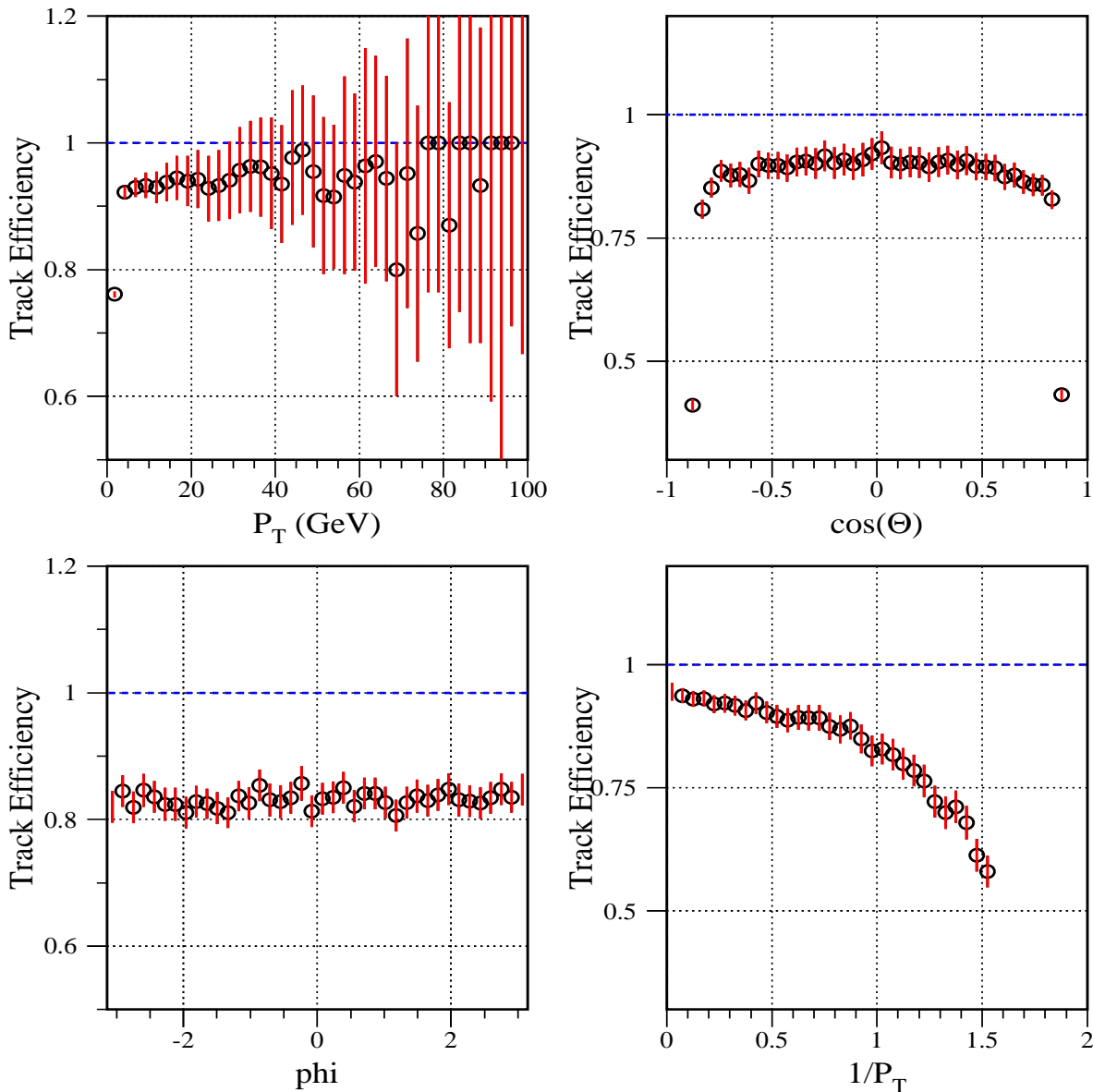
⇒ Thanks to Bruce A. Schumm for expected momentum resolution.

LDMAR01

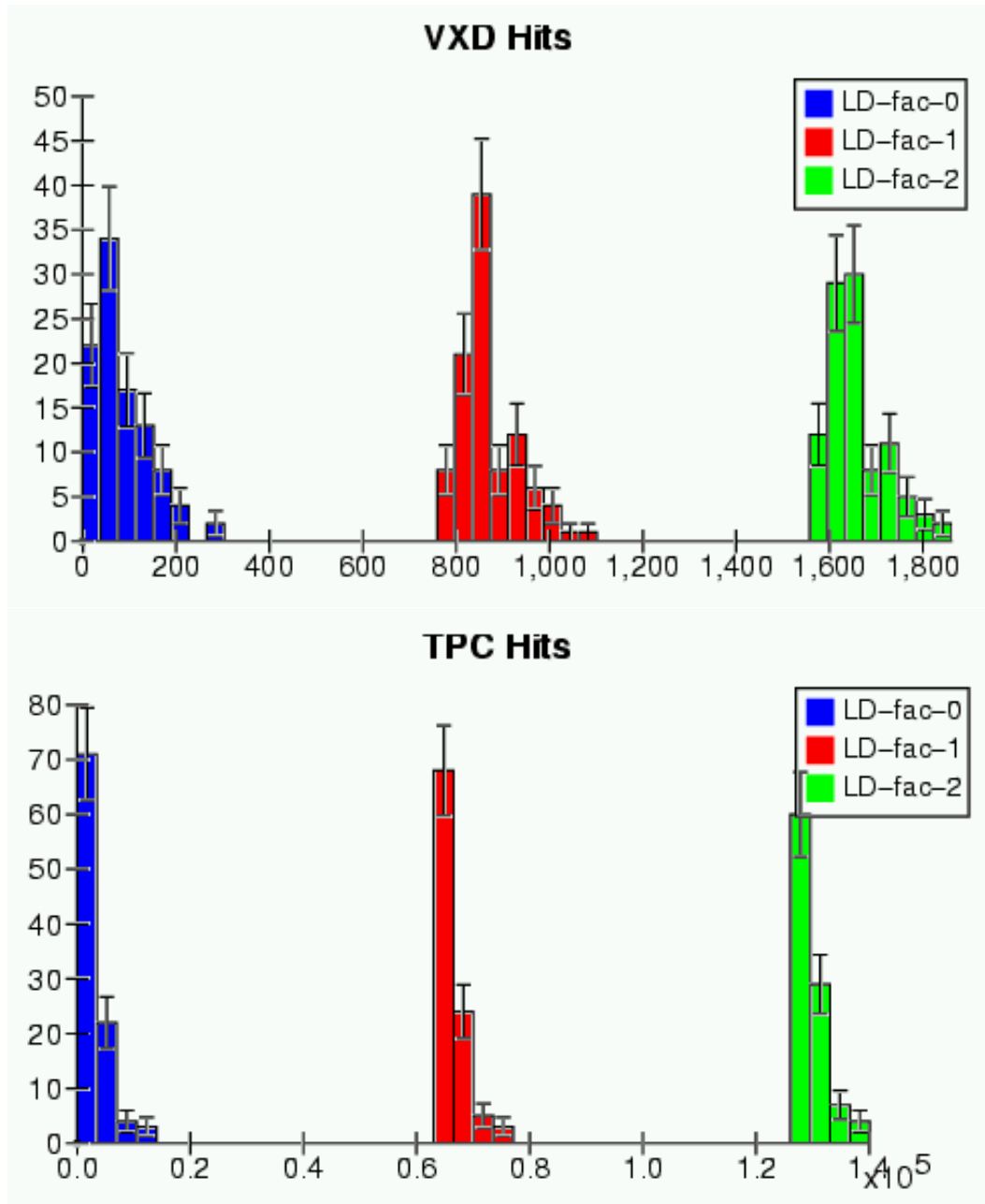


- $|\cos \theta| < 0.9$, no random backgrounds.
- Track Reconstruction Efficiency is 96.1%.

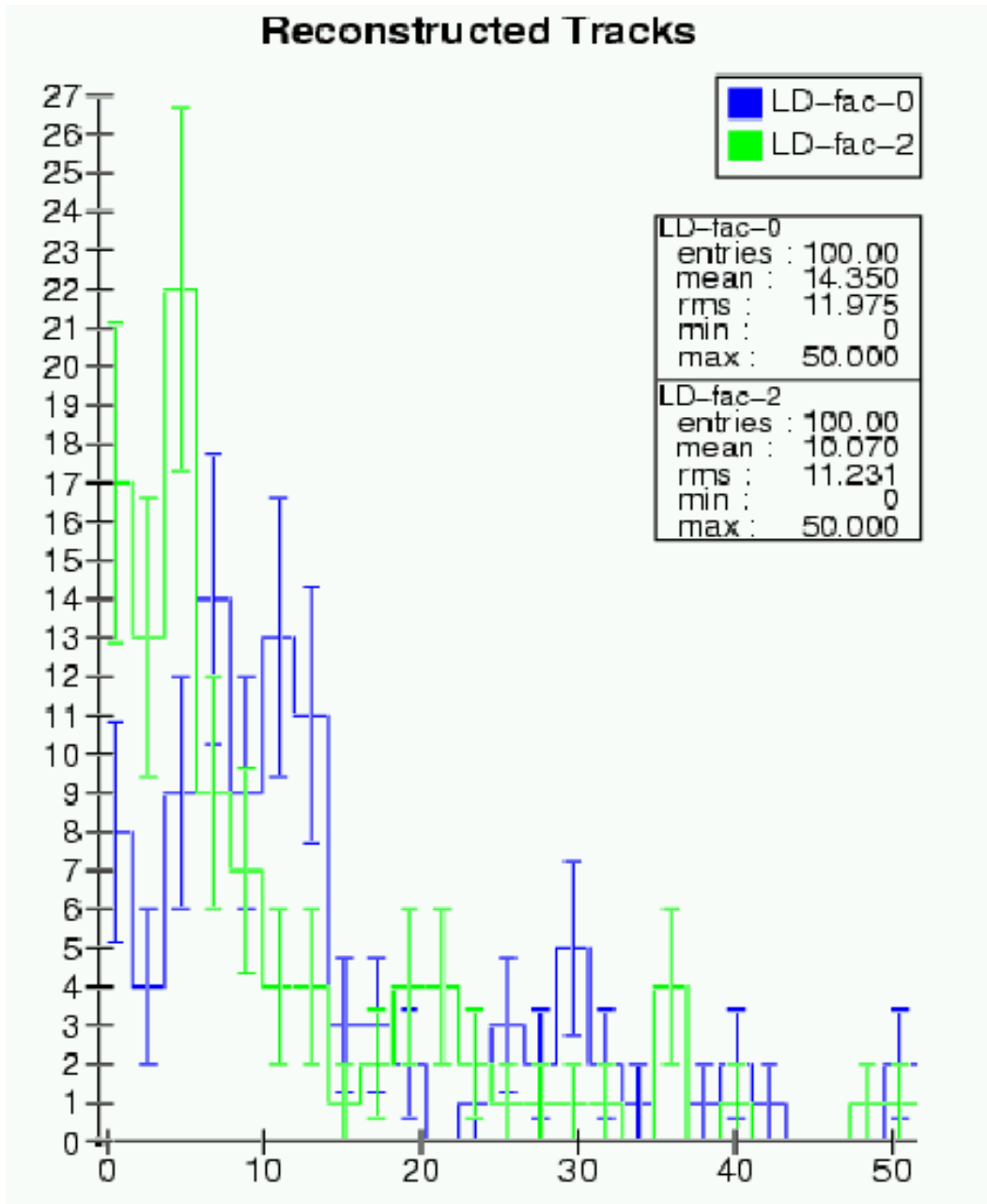
LDMAR01



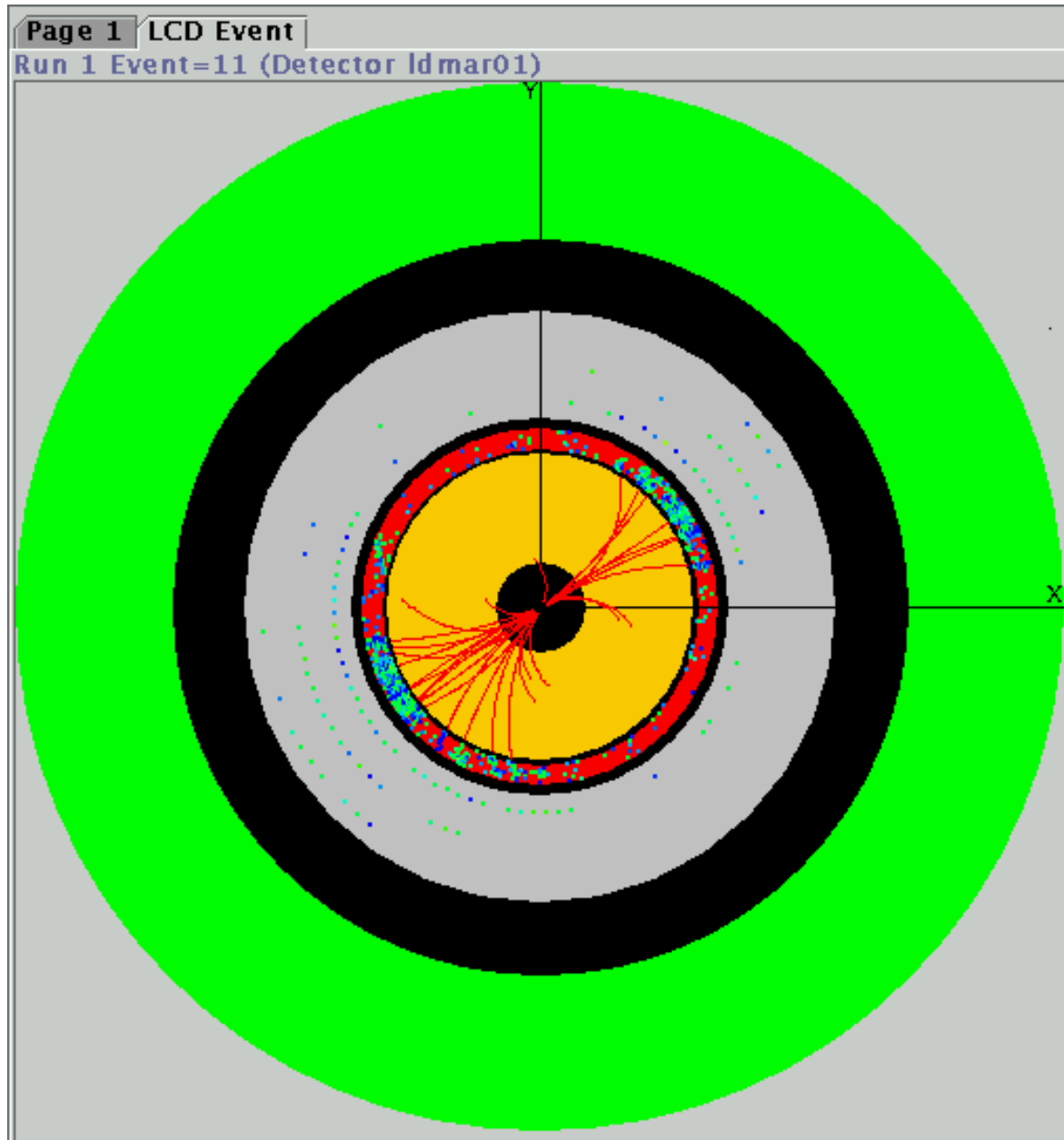
- $|\cos \theta| < 0.9$, random backgrounds(factor=2).
 - Track Reconstruction Efficiency is 83.2%.
- \Rightarrow Low Track Efficiency at Low P_T and Low θ .



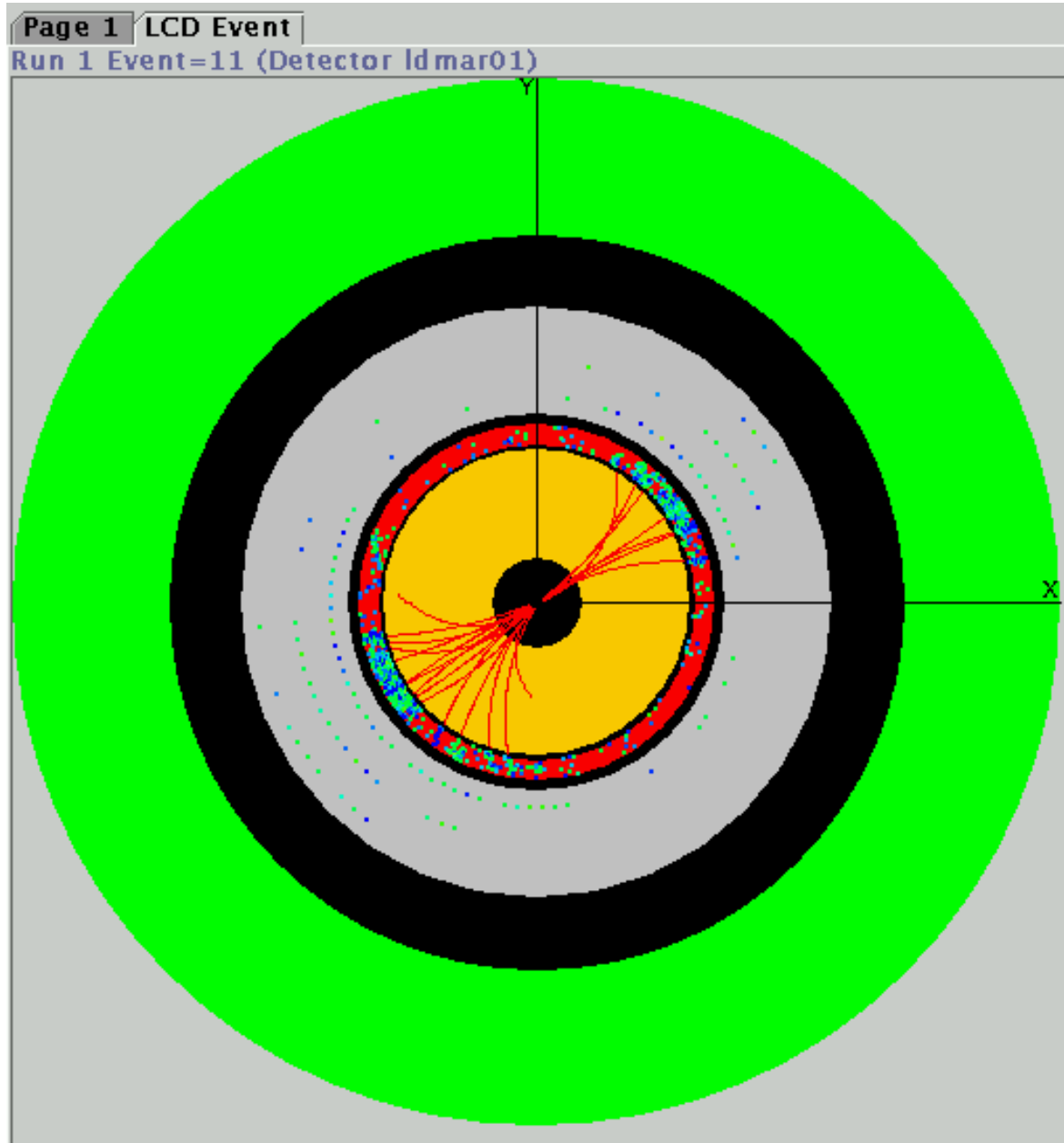
- random backgrounds(factor=0, 1, 2).
- CCD Hits 1 : 10 : 20, TPC Hits 1 : 20 : 40 .



⇒ Tracks are not well reconstructed when the number of hits combination exceed 2×10^7 .

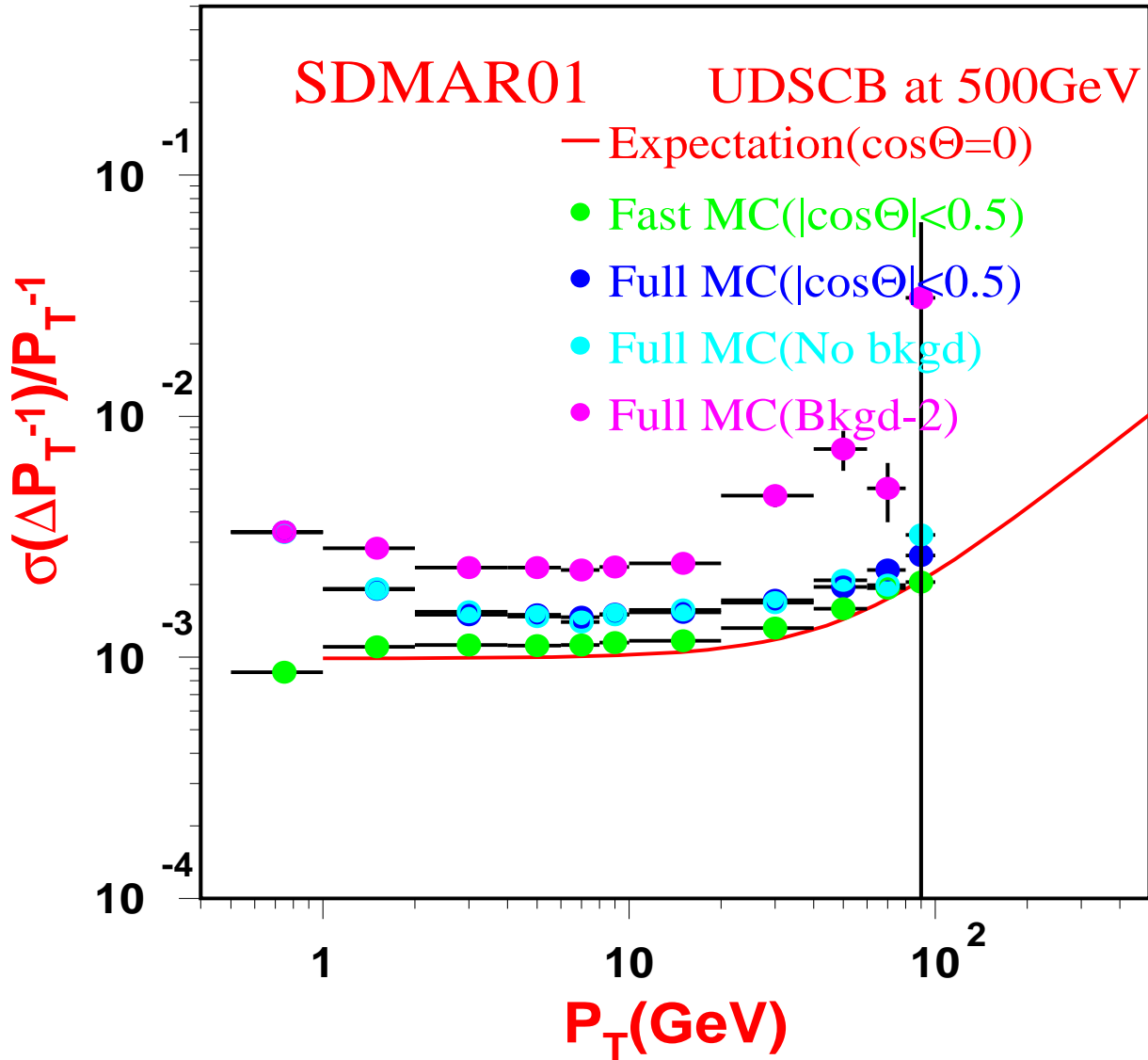


- no random backgrounds.
- Number of reconstructed tracks is 29.



- random backgrounds(factor=2).

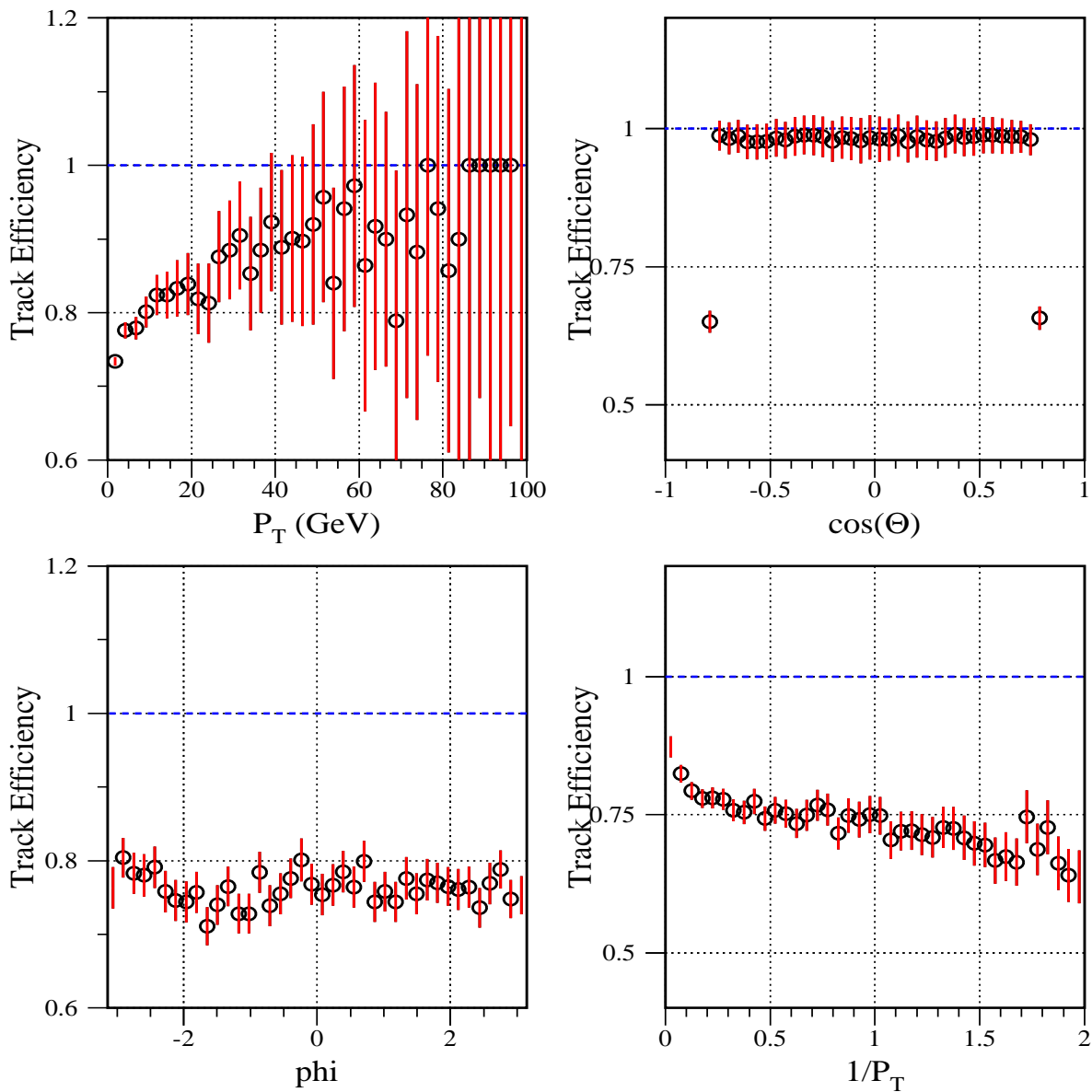
⇒ Only 21 tracks are reconstructed, some low P_T tracks are not reconstructed.



- UDSCB Full and Fast MC at 500 GeV

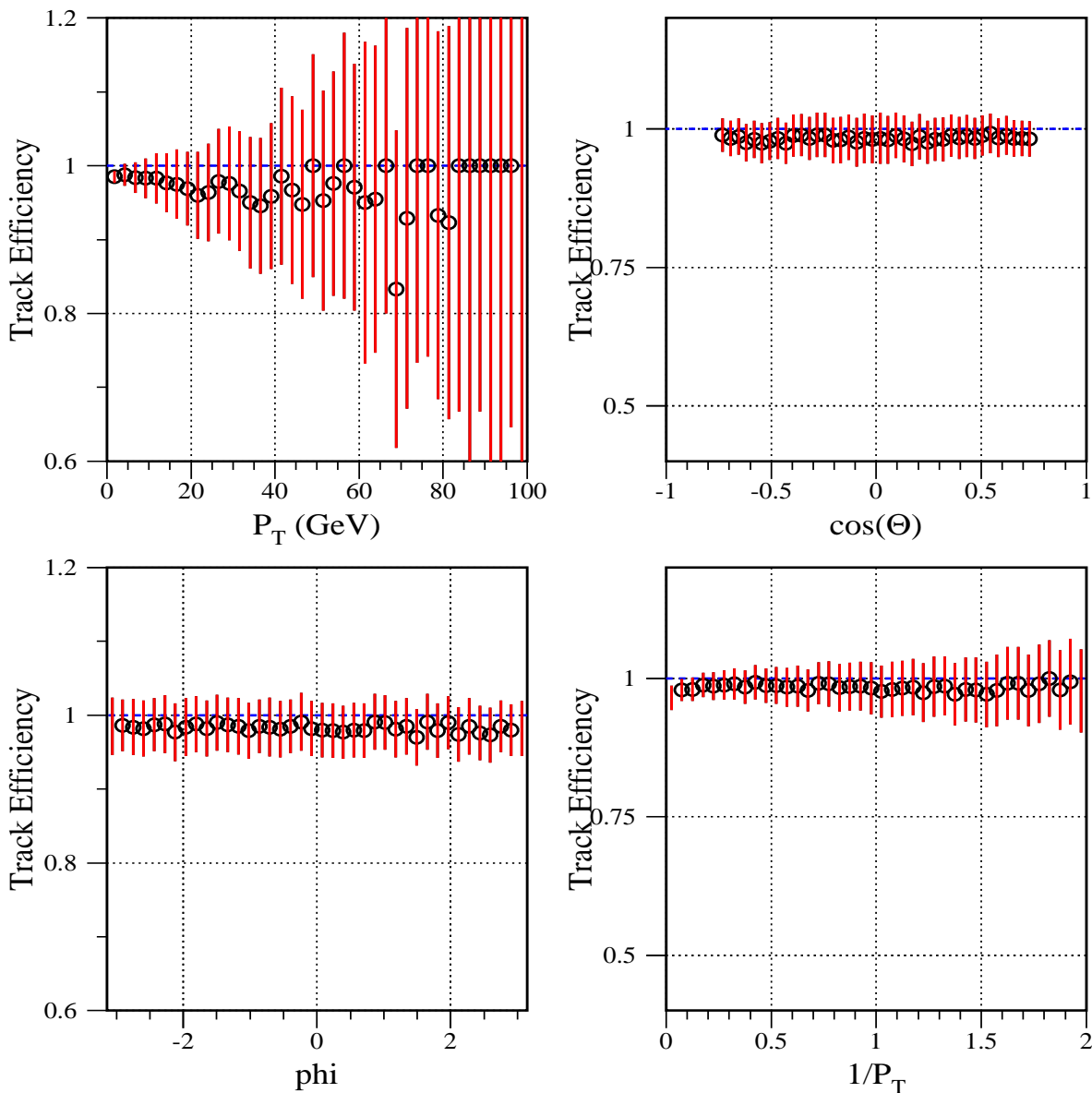
⇒ Thanks to Bruce A. Schumm for expected momentum resolution.

SDMAR01



- $|\cos \theta| < 0.9$, no random background.

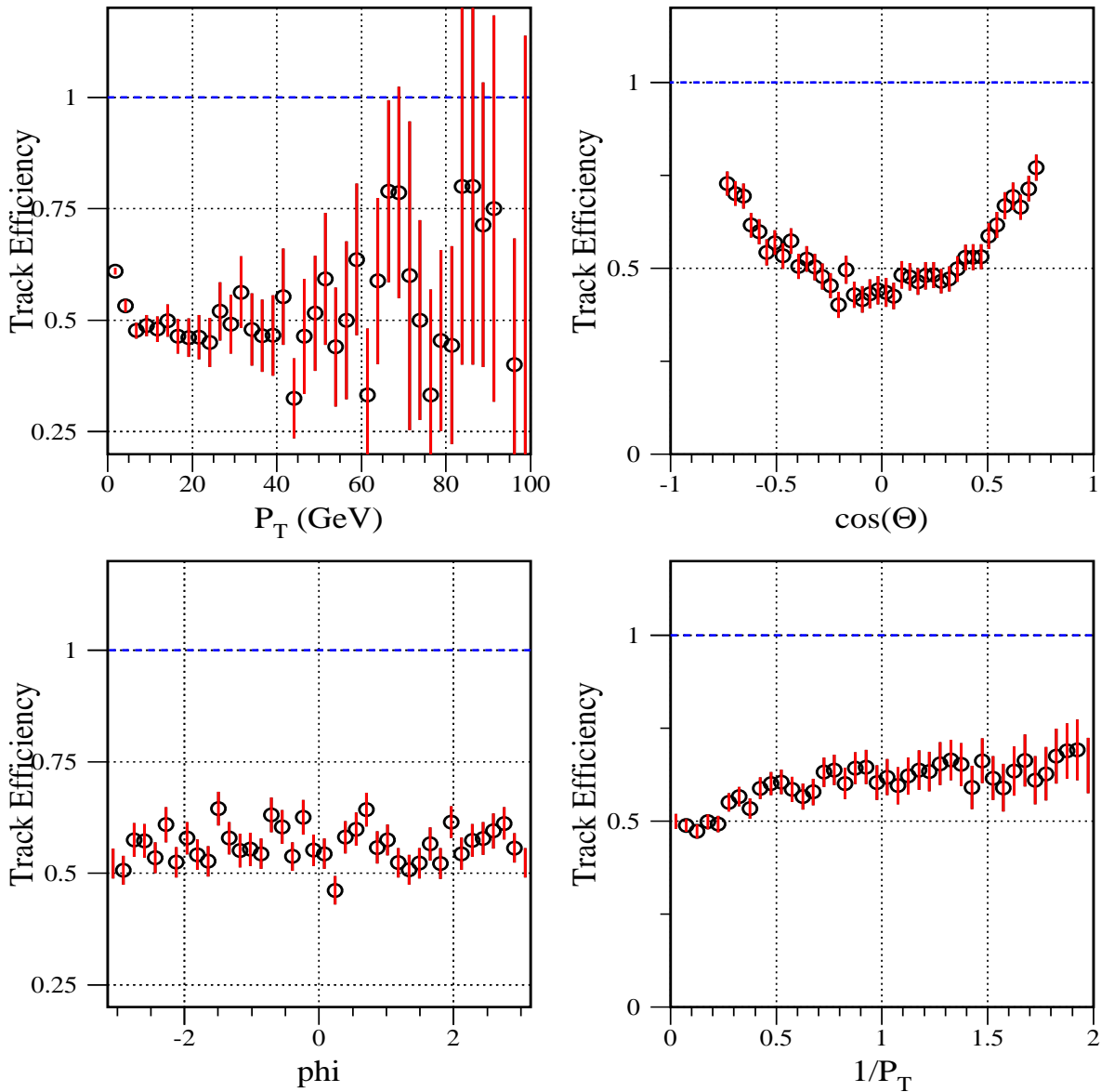
SDMAR01



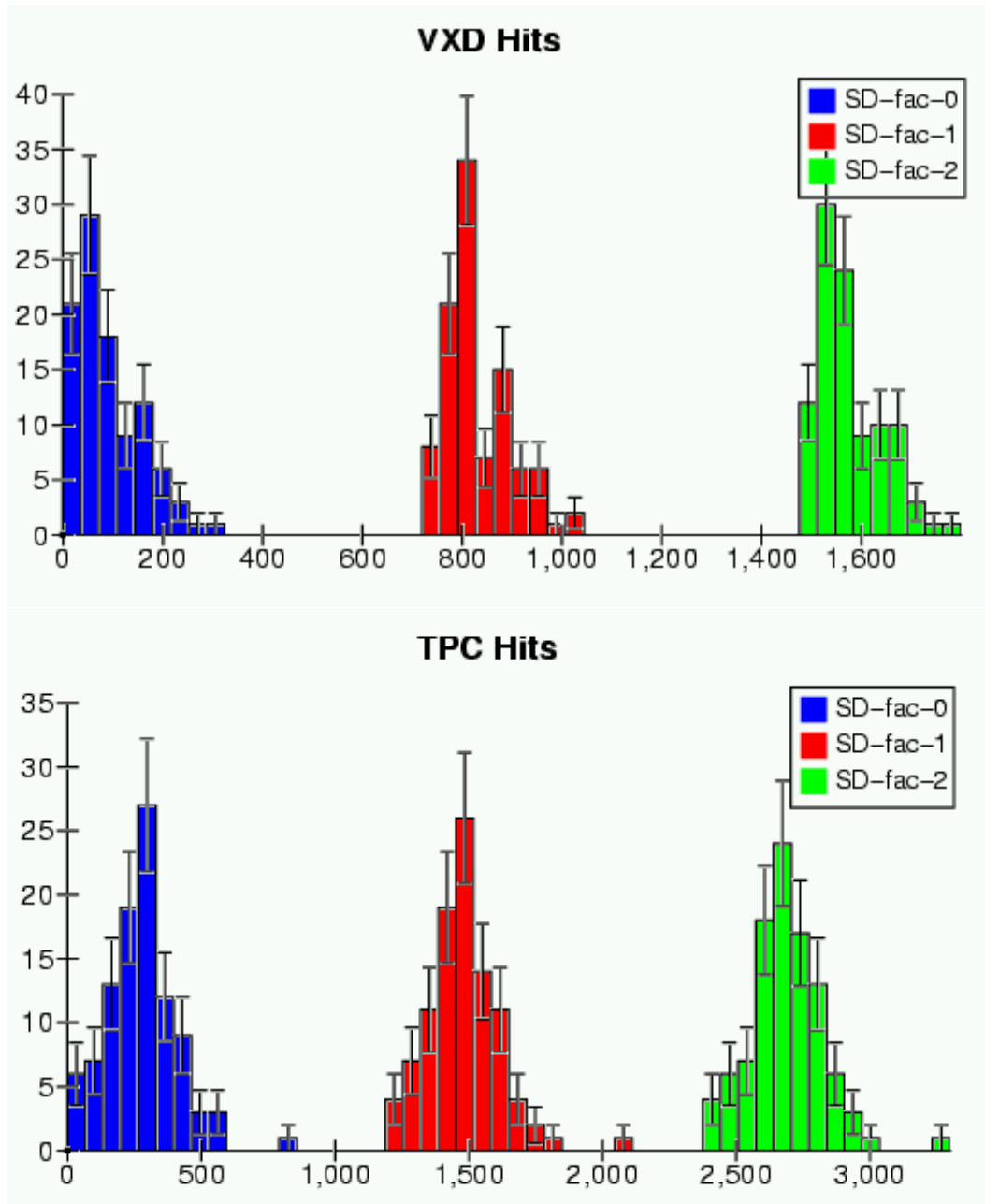
• $|\cos \theta| < 0.75$, no background (eff=98.3%).

⇒ Low track efficiency at $|\cos \theta| > 0.75$, need to improve track efficiency in forward region.

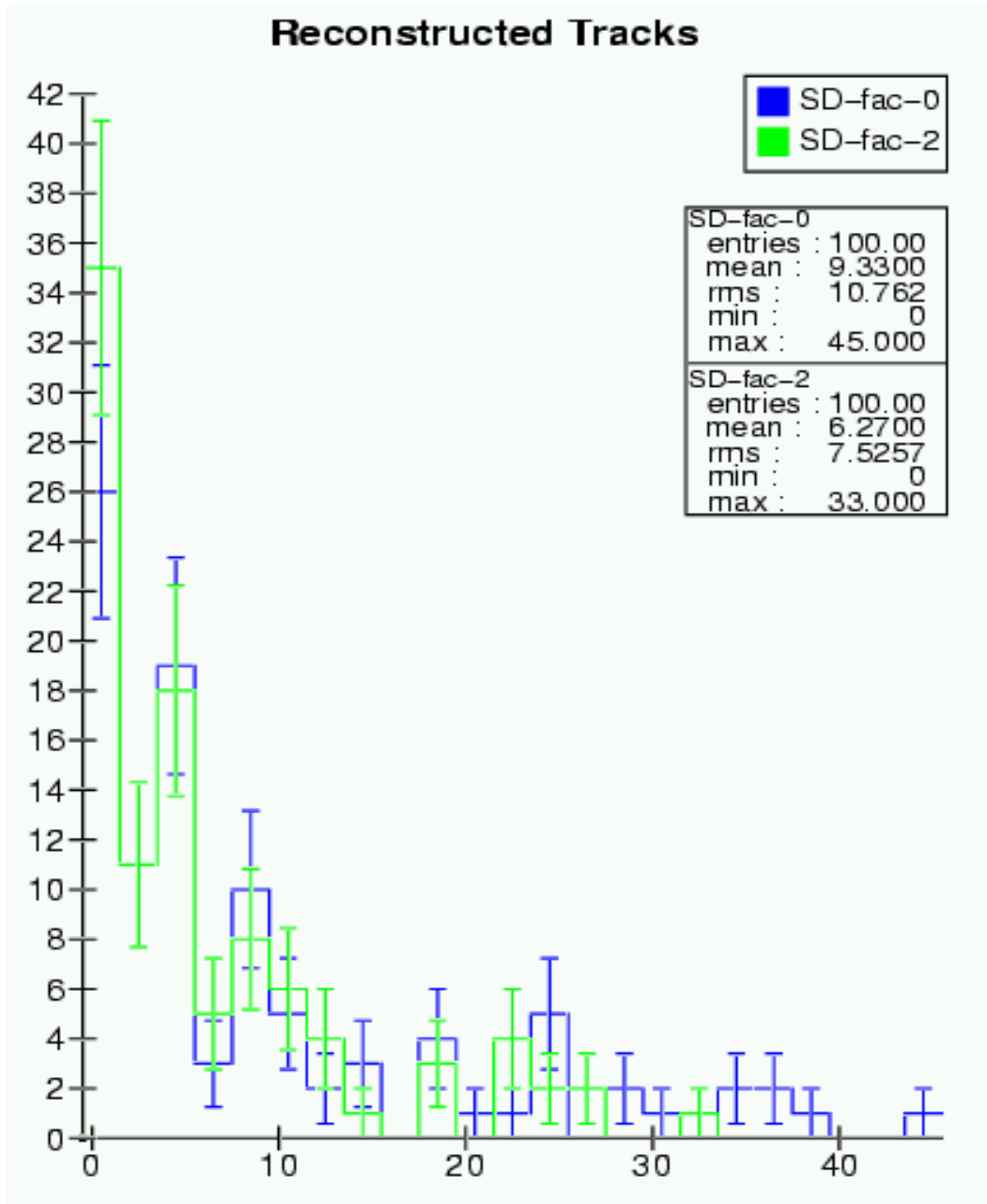
SDMAR01



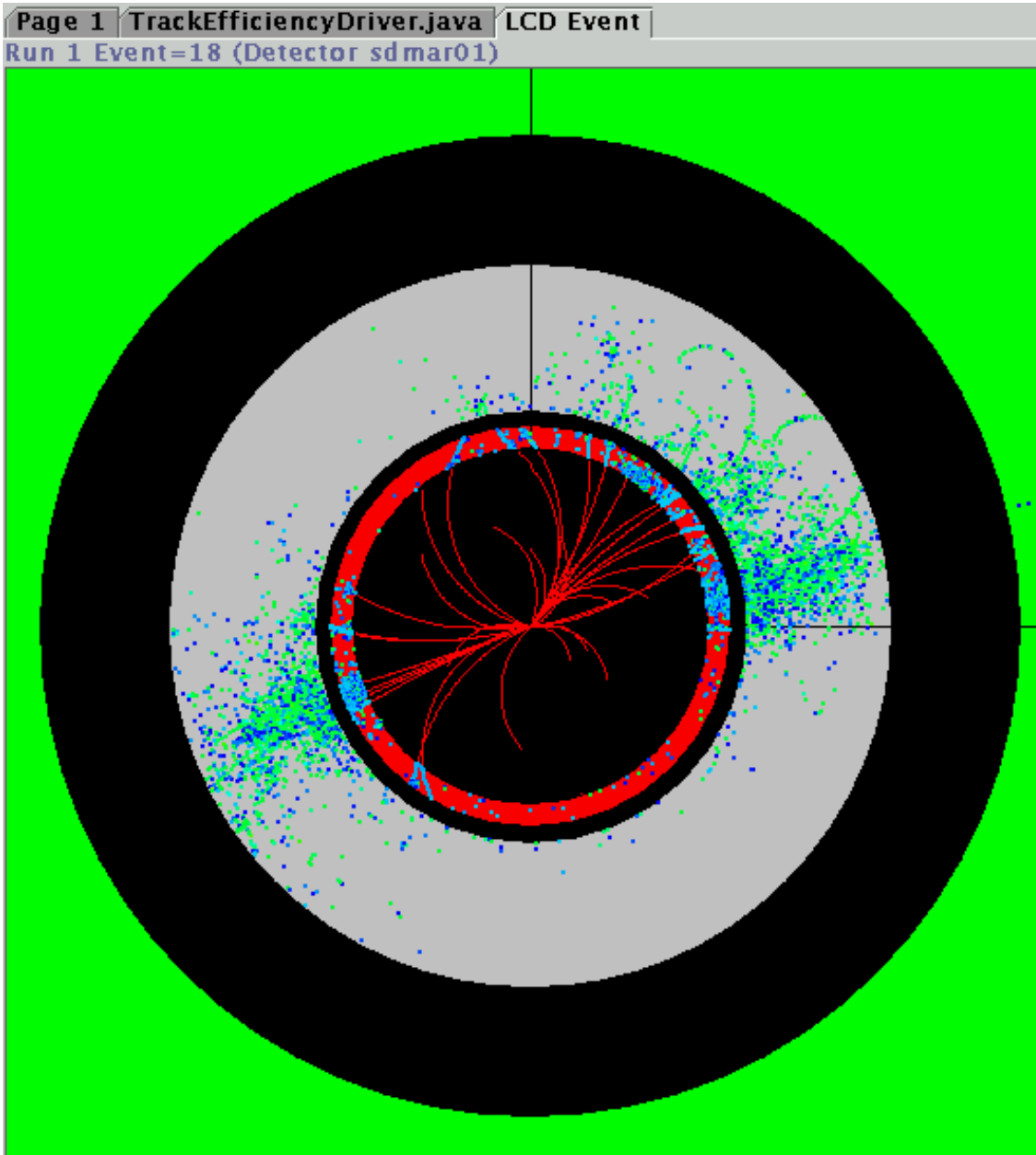
- $|\cos \theta| < 0.75$, random backgrounds(factor=2).
- Track Reconstruction Efficiency is 56.7%.



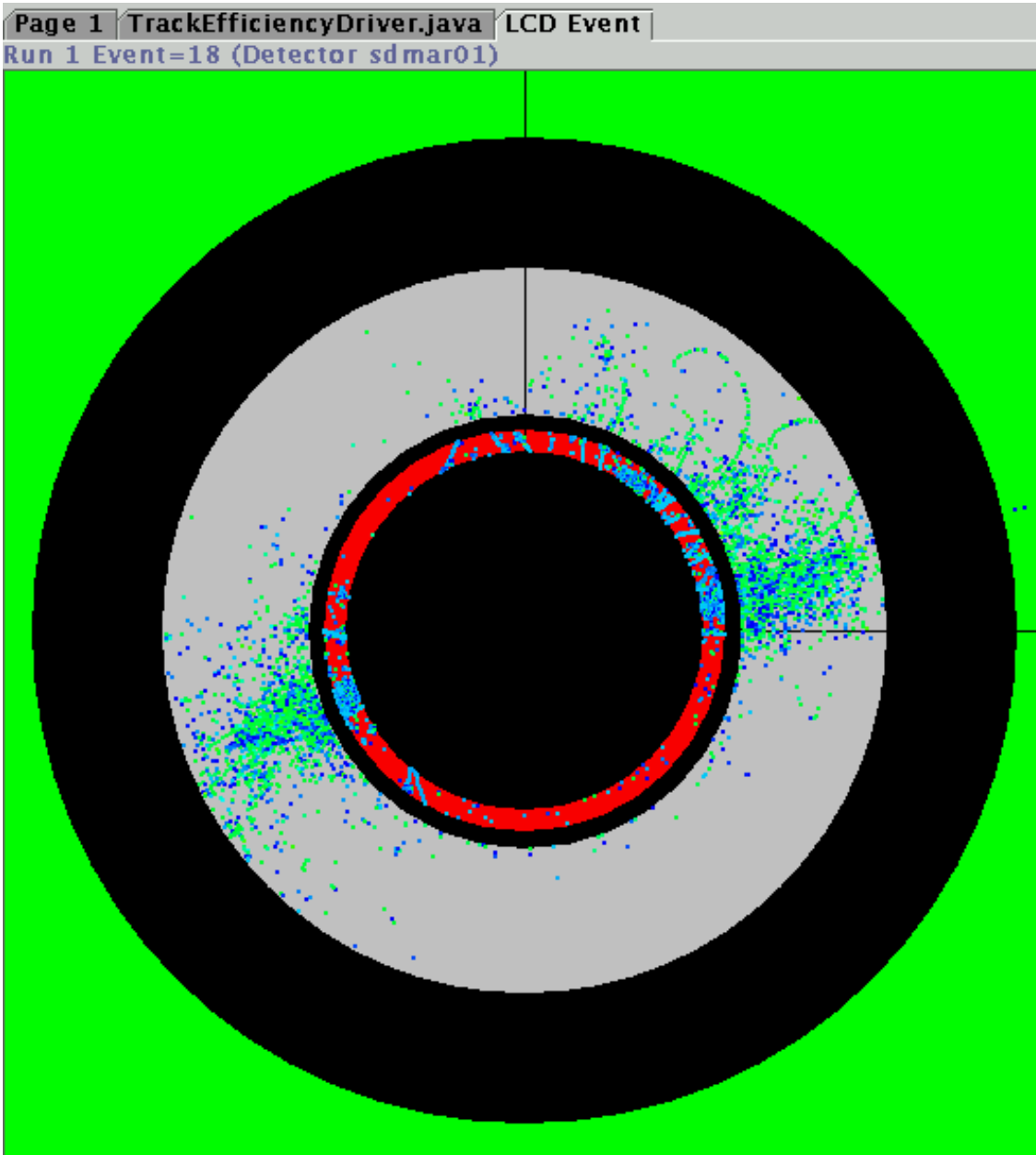
- random backgrounds(factor=0, 1, 2).
- CCD Hits 1 : 9 : 18, TPC Hits 1 : 5 : 10.



⇒ Tracks are not well reconstructed when the number of hits combination exceed 2×10^7 .



- no random backgrounds.
- Number of reconstructed tracks is 34.



- random backgrounds(factor=2).
⇒ No tracks are reconstructed.

⇒ SDMAR01: need to improve track reconstruction efficiency in the forward region.

⇒ Track momentum resolution and reconstruction efficiency is stable if random backgrounds hits factor(<1), that is,

LD - CCD Hits < 10 Times, TPC Hits < 20 Times.

SD - CCD Hits < 10 Times, TPC Hits < 5 Times.

⇒ Track reconstruction efficiency goes down when hits combination exceeds 2×10^7 . If we expand the maximum hits combination number to 2×10^8 , the track efficiency keeps stable for random background hits factor($=2$),

LD: Eff = 83.2% → Eff = 95.8%

SD: Eff = 56.7% → Eff = 97.8%