Tracking Efficiency Studies for the SD Option

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Outlook:

✓ *SD* and *LD* tracker's geometries and simulation framework.

✓ Fiducial volume cuts.

✓ Simulation results.

✓ Conclusion.

Detectors and simulation framework

- *Detectors:* <u>SD</u> and <u>LD</u> geometries as of March 2001.
- *Resolutions:* <u>SD</u> – $\sigma_{r\varphi}$ = 7 μ, σ_z = 10 μ; <u>LD</u> - $\sigma_{r\varphi}$ = 100 μ, σ_z = 1400 μ.
- *Input data:* $t\bar{t}$ -events at $\sqrt{S} = 500\,GeV$, *"panpy-tt-500-010301-*D-sim-**.sio"* files.
- *Tracking:* *(Deliberately)* <u>"blind"</u> use of codes from the *"hep.lcd.recon"* package.
- *Analysis:* Modified *"TrackEfficiencyDriver"* code *(W. Walkowiak)* from "Snowmass-2001" CD tutorial.
- *Acceptance:* Only barrel trackers (+VXD) with forward disk *(Endcaps)* hits *removed* (smeared to "a parsec" = 100 m away).
- *Framework:* Local <u>JAS</u> analysis at the (close to) "pocket-size" Sony Vaio laptop.
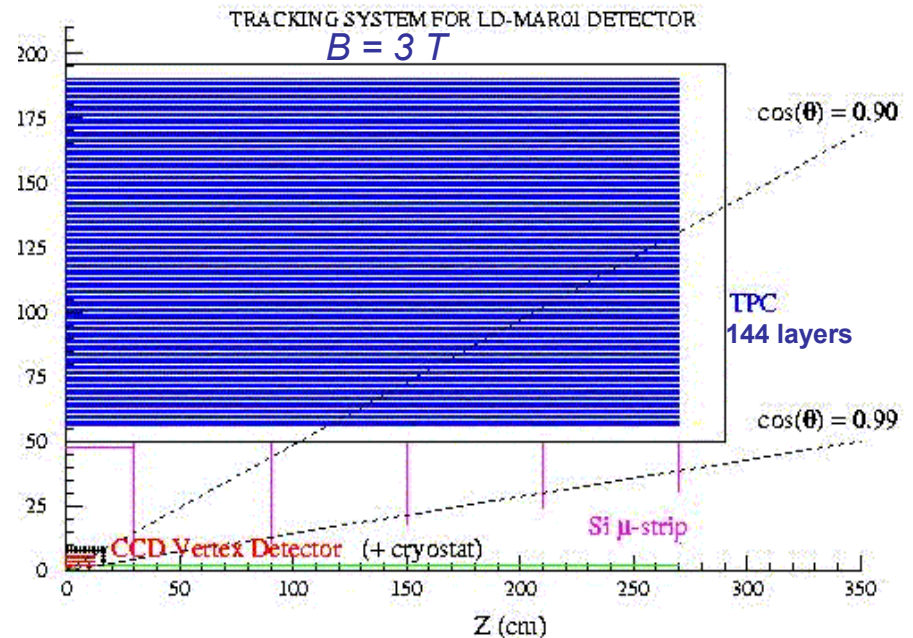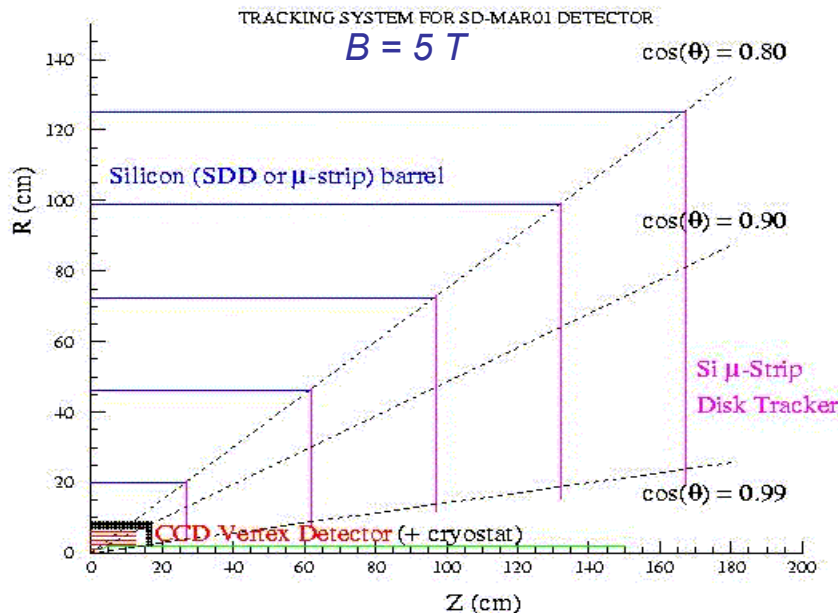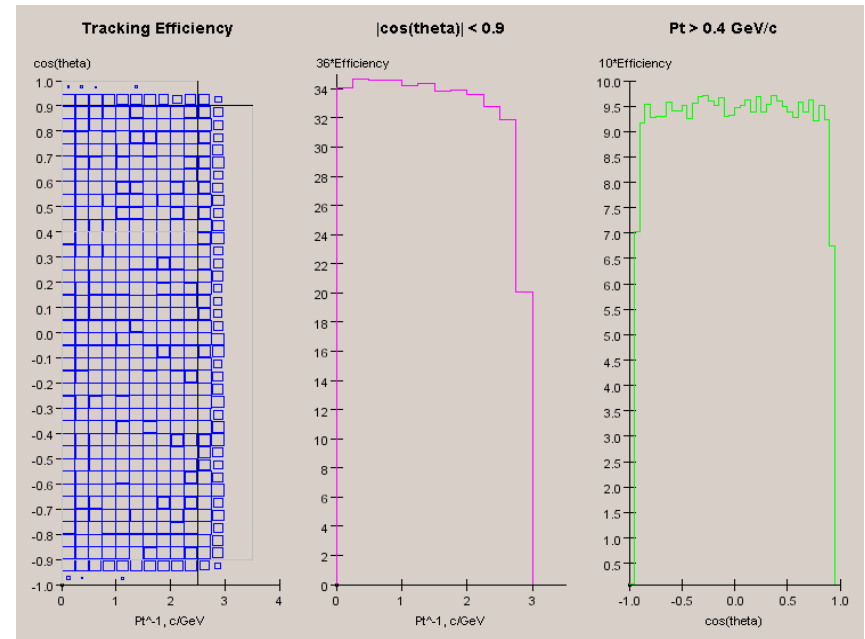
Acceptances

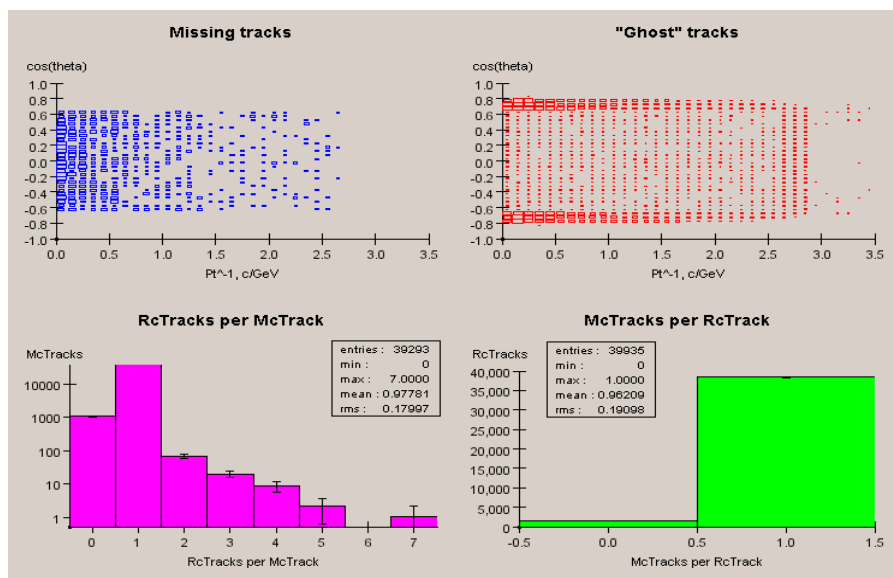*Track Association:* Standard "*hit vote*" of the "*hep.lcd.reco*" package.
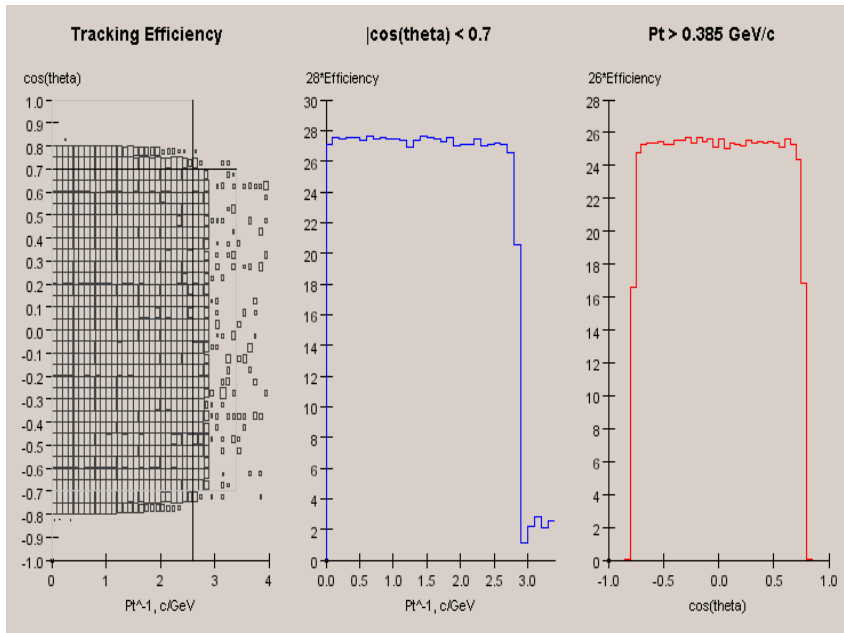
Fiducial volume: $|cos(\theta)| < 0.65$
$P_T > 0.55$ GeV/c

↑ **LD** ↓

↑ **SD** ↓

Fiducial volume: $|cos(\theta)| < 0.65$
$P_T > 0.38$ GeV/c

Fiducial volumes for:
- ❖*Efficiency (counting McTracks):*
  $|cos(\theta)| < 0.65$, $P_T > 0.55$ GeV/c
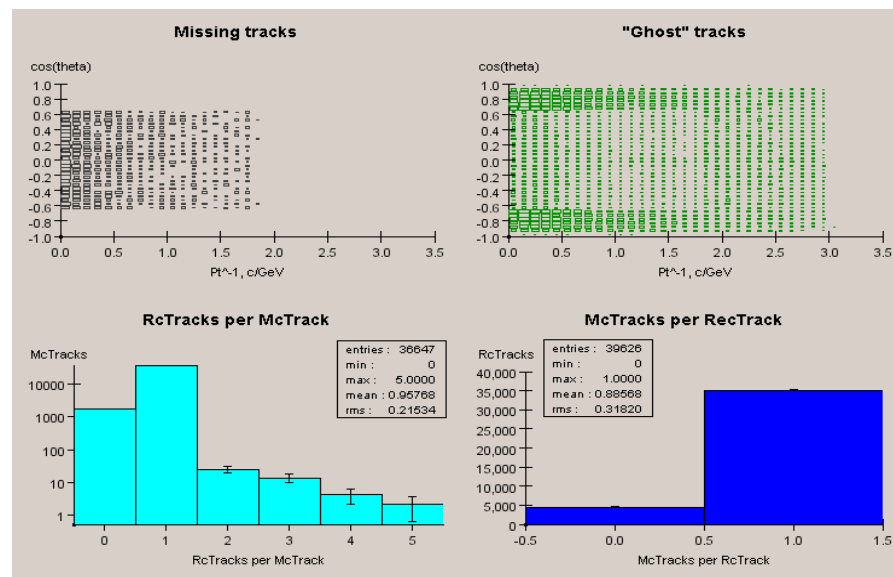 Rc/Mc(>1) = (0.11±0.02)%
- ❖*Ghost tracks (counting RcTracks):*
  $|cos(\theta)| < 0.6$, $P_T > 0.6$ GeV/c
  Mc/Rc(=0) = (11.4±0.2)%

↑ **LD** ↓

↑ **SD** ↓

Fiducial volumes for:
- ❖*Efficiency (counting McTracks):*
  $|cos(\theta)| < 0.65$, $P_T > 0.38$ GeV/c
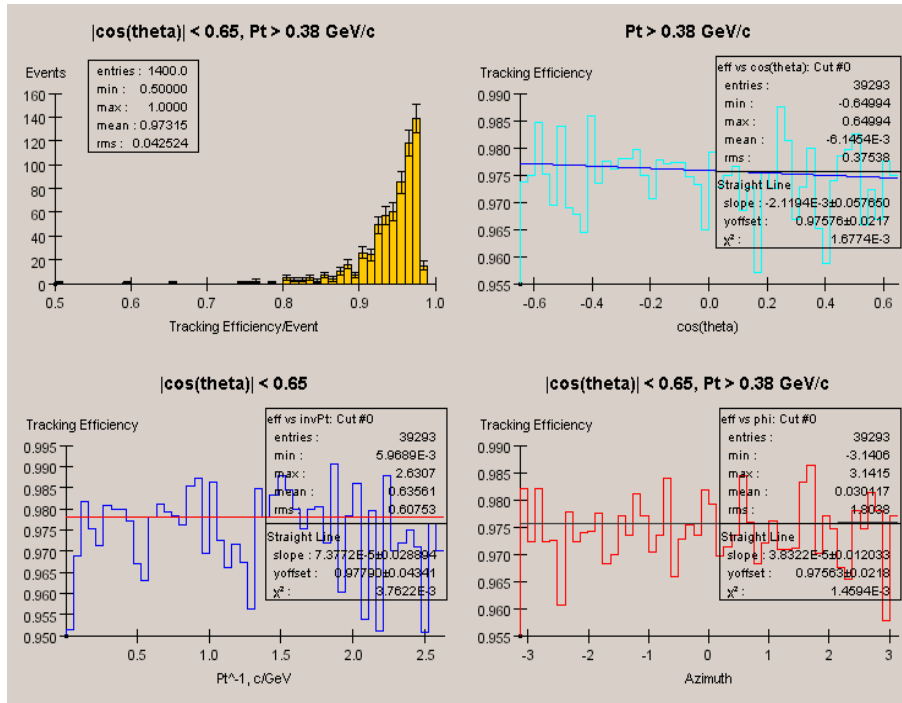 Rc/Mc(>1) = (0.25±0.03)%
- ❖*Ghost tracks (counting RcTracks):*
  $|cos(\theta)| < 0.6$, $P_T > 0.43$ GeV/c
  Mc/Rc(=0) = (3.75±0.1)%

Tracking efficiencies within fiducial volumes

Tracking efficiencies:
- ❖ For *100%* hit efficiency: (95.3±0.13)%
- ❖ For *98%* hit efficiency: (94.5±0.14)%
- ❖ For *90%* hit efficiency: (89.5±0.20)%

↑ **LD** ↓

↑ **SD** ↓

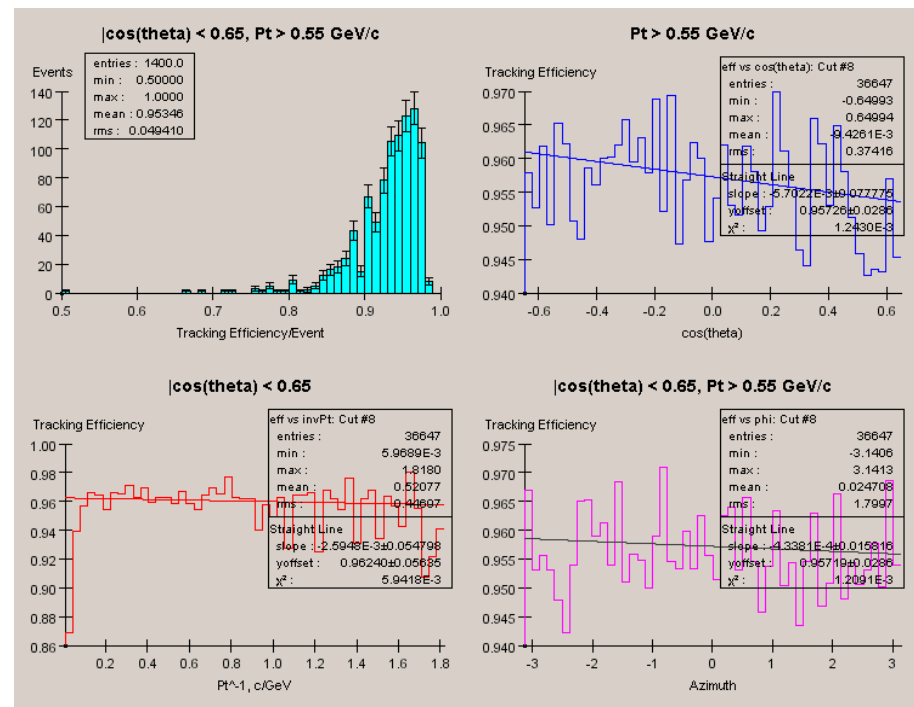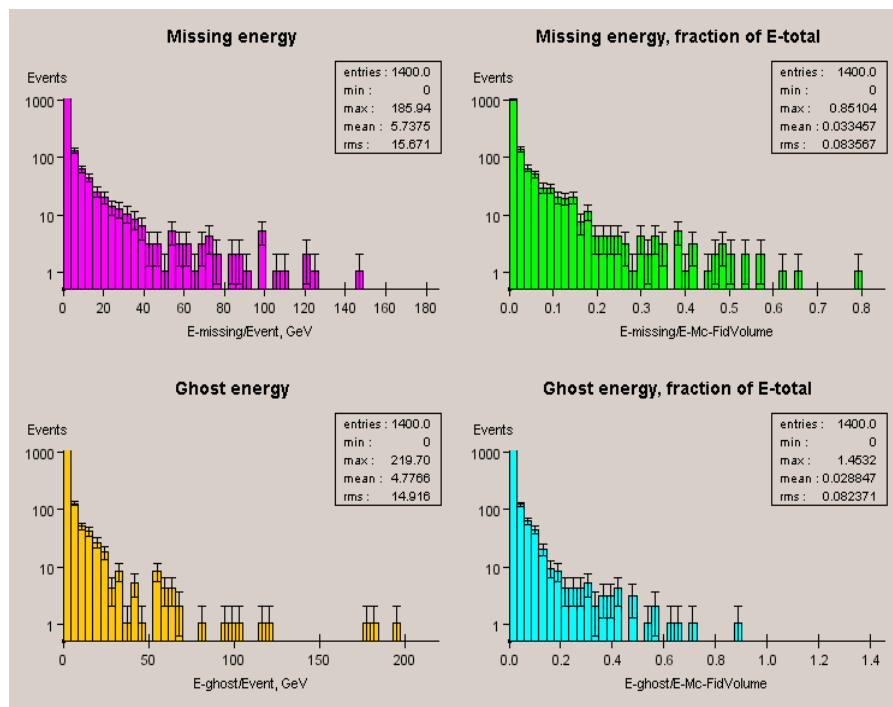*Tracking efficiencies:*
- ❖ For *100%* hit efficiency: (97.3±0.10)%
- ❖ For *98%* hit efficiency: (96.6±0.12)%
- ❖ For *90%* hit efficiency: (92.7±0.16)%

Missing and ghost energies

For hit efficiency *100%:*
- ❖ *Missing energy* = (11.7±0.6) GeV
  = (7.1±0.3)%
- ❖ *Ghost energy* = (19.6±0.8) GeV
  = (13.1±0.6)%

↑ ***LD*** ↓

↑ ***SD*** ↓

For hit efficiency 100%:
- ❖ *Missing energy* = (5.7±0.4) GeV
  = (3.3±0.2)%
- ❖ *Ghost energy* = (4.8±0.4) GeV
  = (2.9±0.2)%

Santa Cruz Linear Collider Retreat
June 27th - 29th 2002
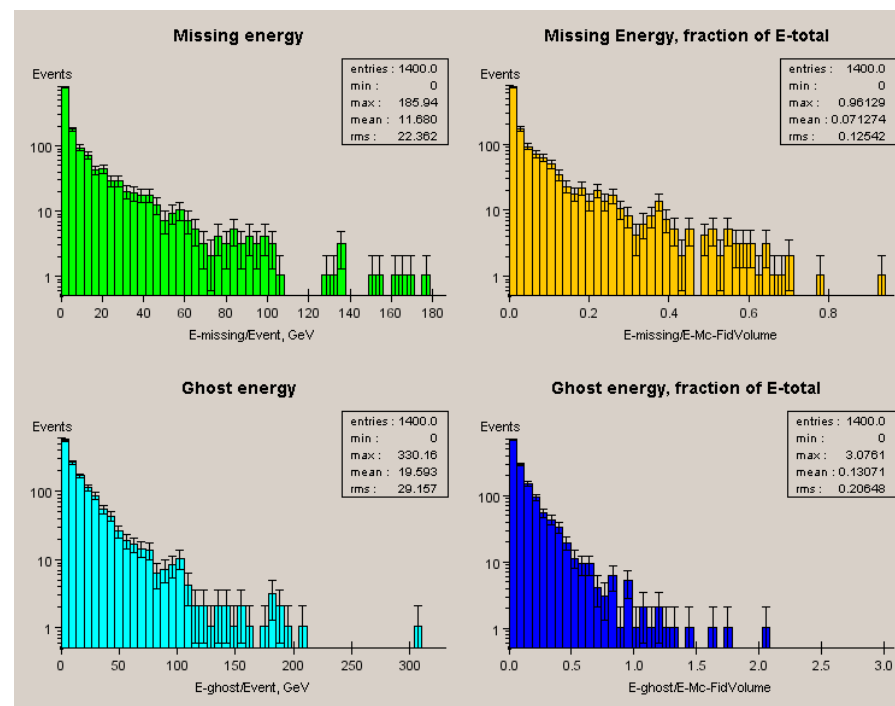
Conclusion

➢ The existing tracking codes of *"hep.lcd.reco"* package yield *good* pattern recognition characteristics for the *5-layer Si barrel tracker* of the *SD* option which are, at minimum, *no worse* than for the *144-layer TPC* of the *LD* option.

➢ For a conclusive judgment on the *SD* option tracking capabilities, *more realistic simulations* with *beamstrahlung, event pile up, noise, etc. are needed*, and, of course, including forward disks (*Endcaps*).

➢ There are indications, that the existing tracking codes require a somewhat *better tuning*. However, …

➢ It is hard to imagine that any further code tune up and improvement *could make worse* the presented here *good pattern recognition characteristics in the SD* … unless there is some "crude cheating" in the current codes (like using prior info about Monte Carlo tracks for track finding, which I do not believe is the case).