Impact of Tracker Design on Higgs Mass Resolution & Cross Section

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Monte Carlo Generator & Simulation

- MC Generator: PANDORA V2.2, PYTHIAV3.1
  Using NLC Beam Energy Spread (1%)
  ⇒ Thanks to Michael E. Peskin, Masako Iwasaki.

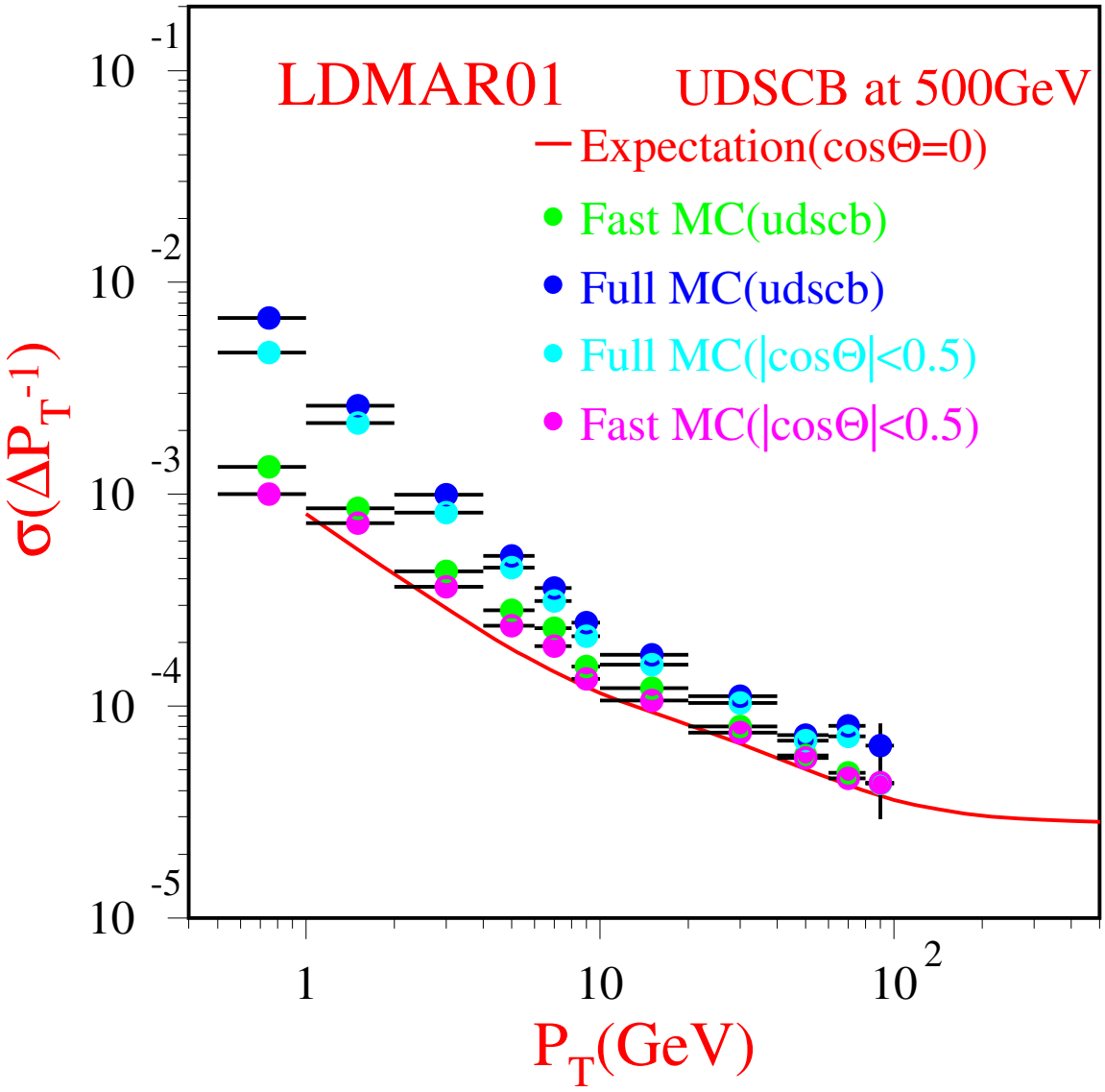
- Analysis Platform: JAVA Analysis Studio V2.2.5
  ⇒ Thanks to Tony Johnson, Mike Ronan,
  Wolfgang Walkowiak.

- Full MC comes from SLAC lcddata server
  ⇒ Thanks to Gary Bower, Norman Graf.

- Detectors: LDMAR01(LD), SDMAR01(SD)

- $e^+e^- \to ZH \to \mu^+\mu^- X(\gamma)$
  $\sqrt{S} = 350,\ 500$ GeV
  $M_H = 120,\ 140,\ 160$ GeV
  $\mathcal{L} = 500 fb^{-1}$

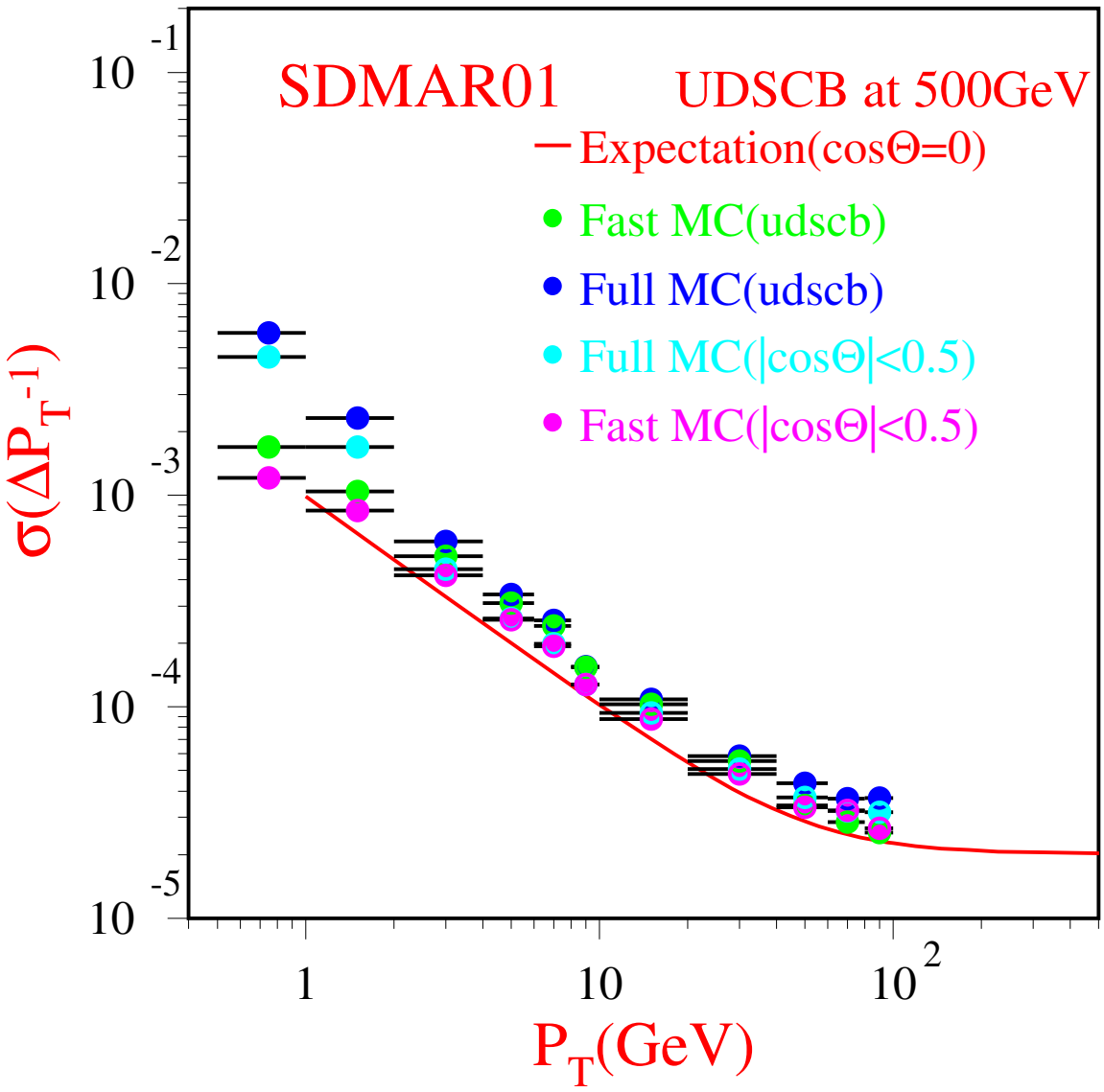
Track Momentum Resolution



- UDSCB Full and Fast MC at 500 GeV

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

Track Momentum Resolution



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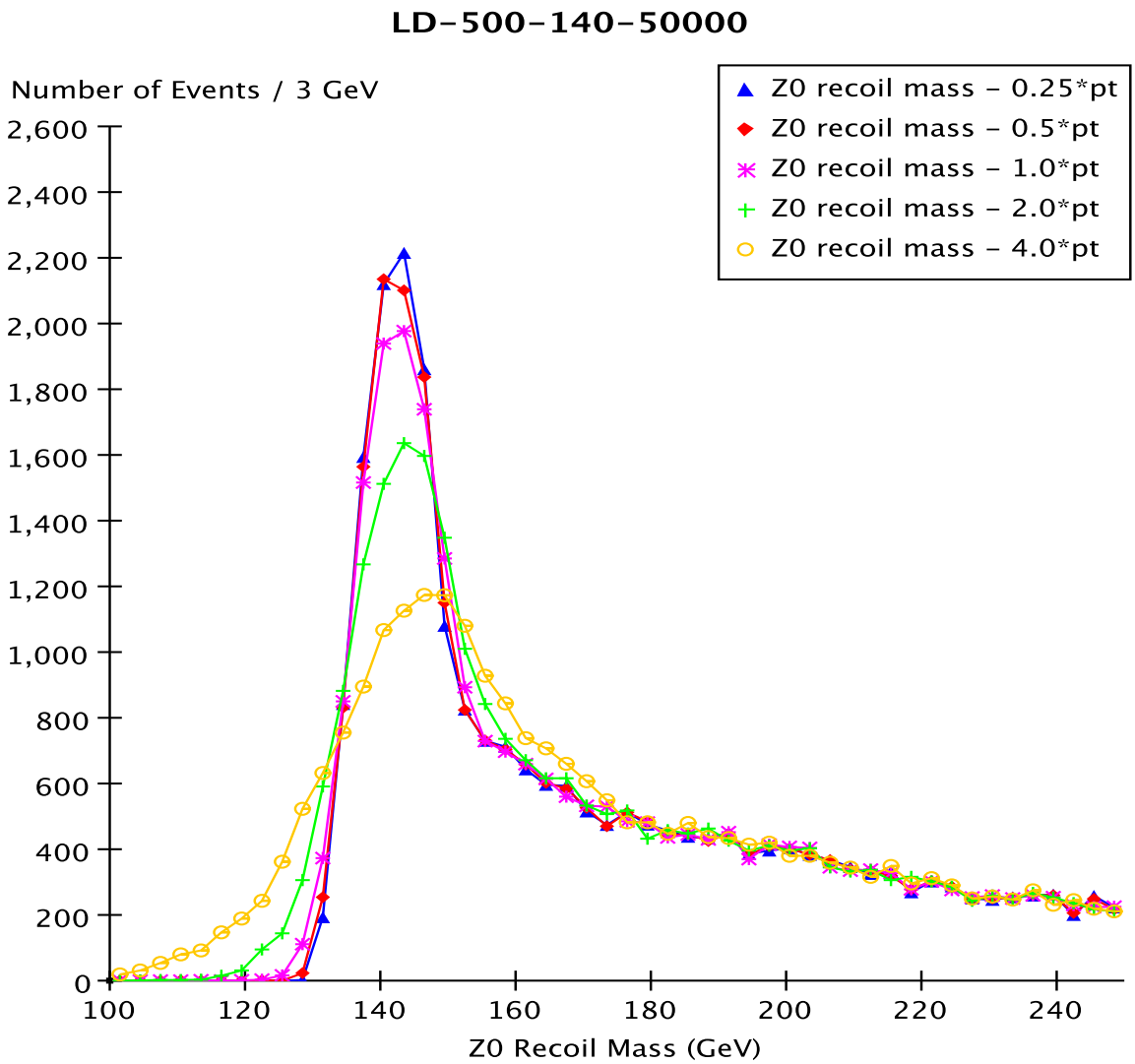
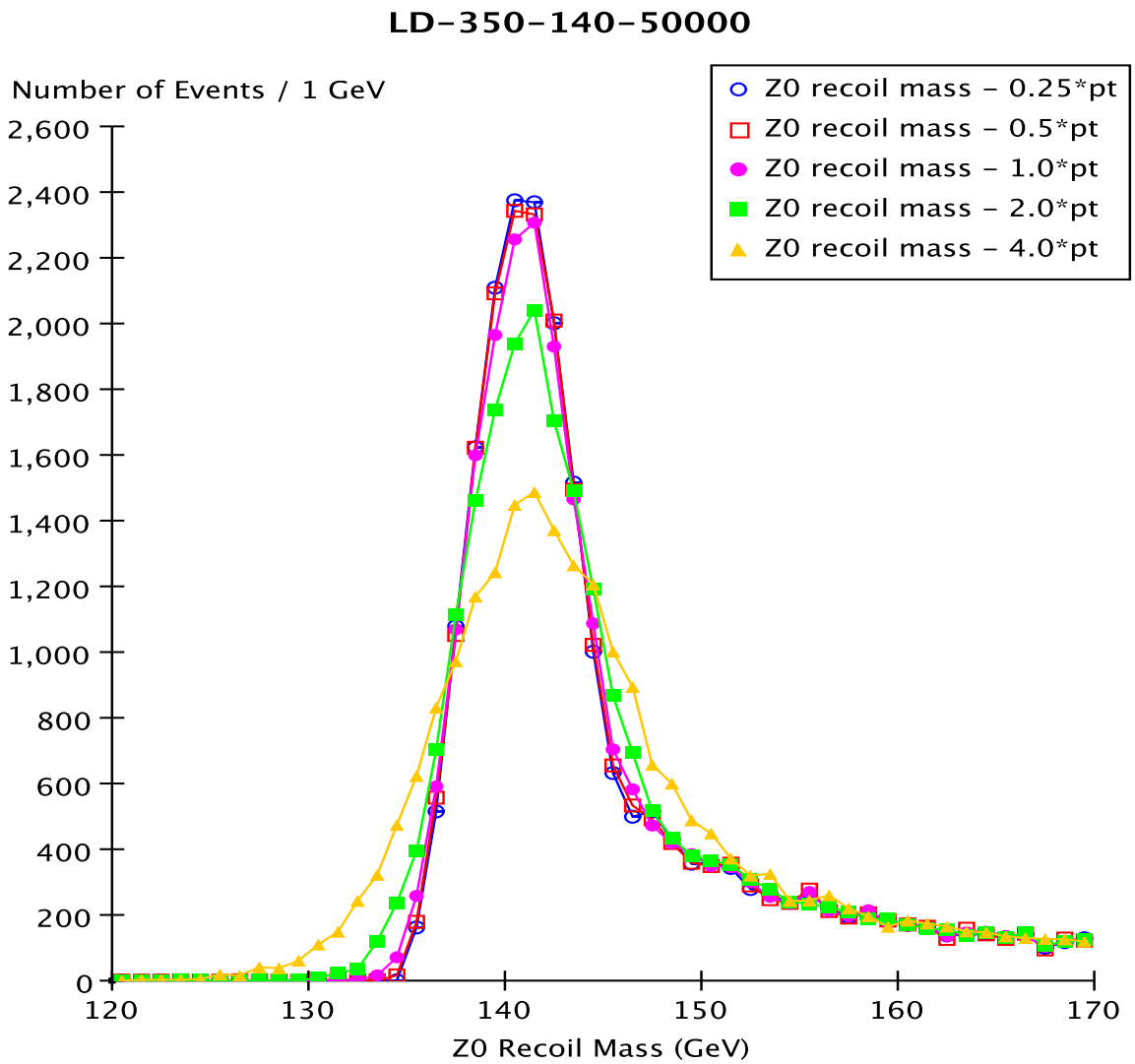
Higgs Mass Distributions



- FAST MC: $ZH \rightarrow \mu^+\mu^- X(\gamma)$, $M_H = 140$ GeV, LDMAR01
- Higgs mass distributions. Track momentum resolutions $\Delta(\frac{1}{P_t})$ are re-scaled by factor fac(0.25, 0.5, 1.0, 2.0, 4.0).

Higgs Mass Distributions



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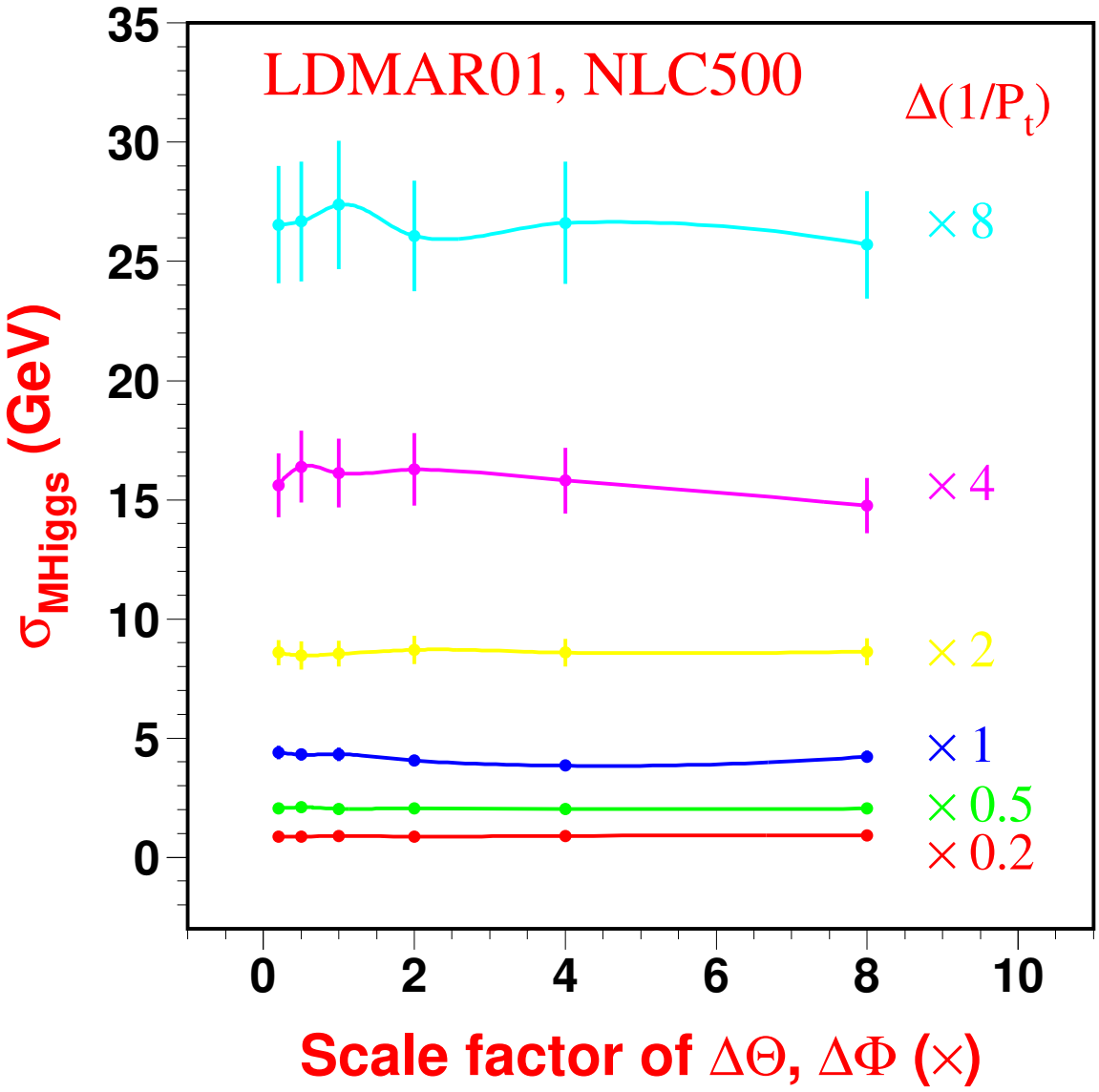
Higgs Mass Resolutions (Pandora V2.1)



- Raw recoil mass is fitted by single gaussian.

⇒ Higgs mass resolution is **insensitive** to track angular resolution.

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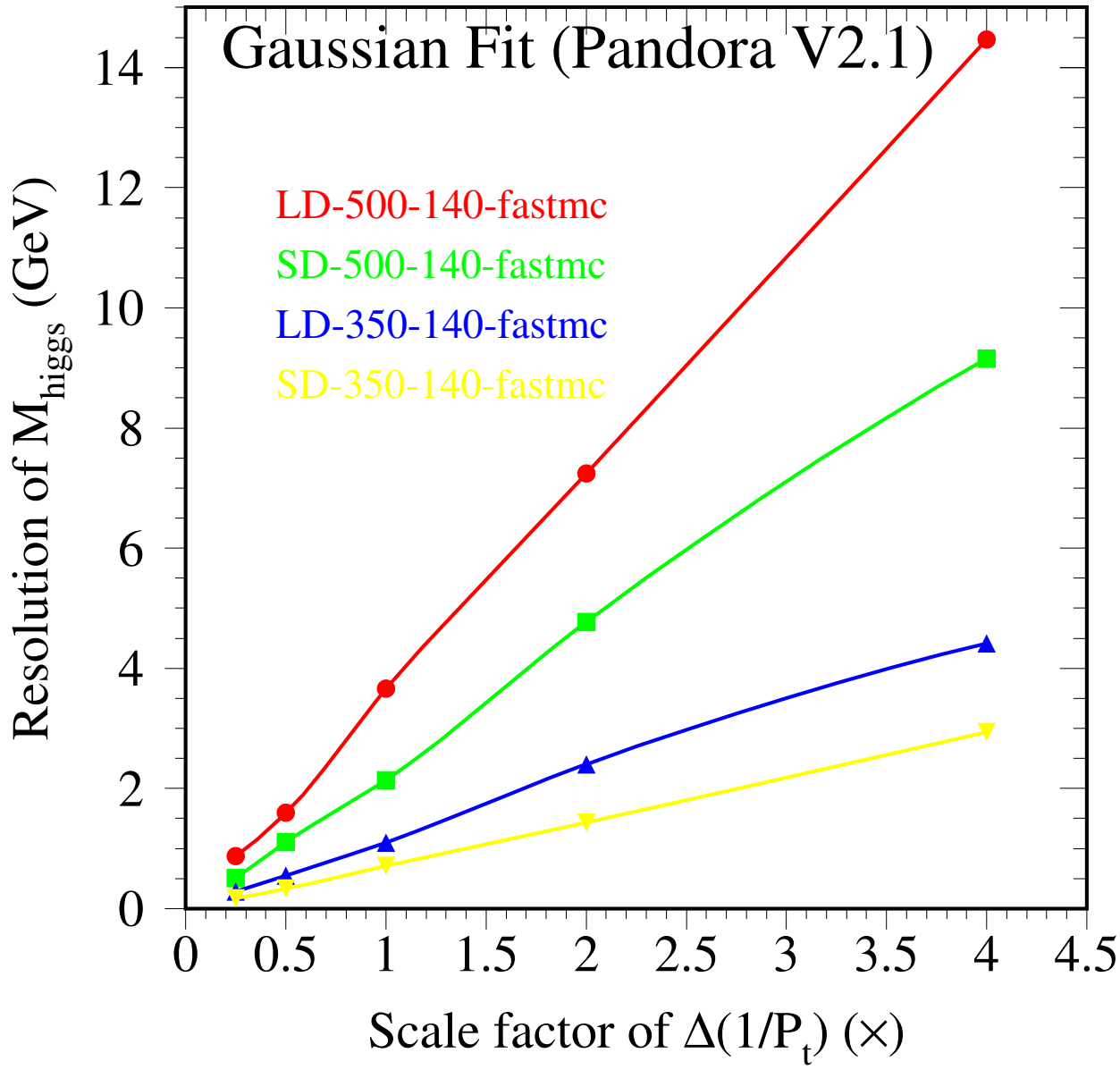
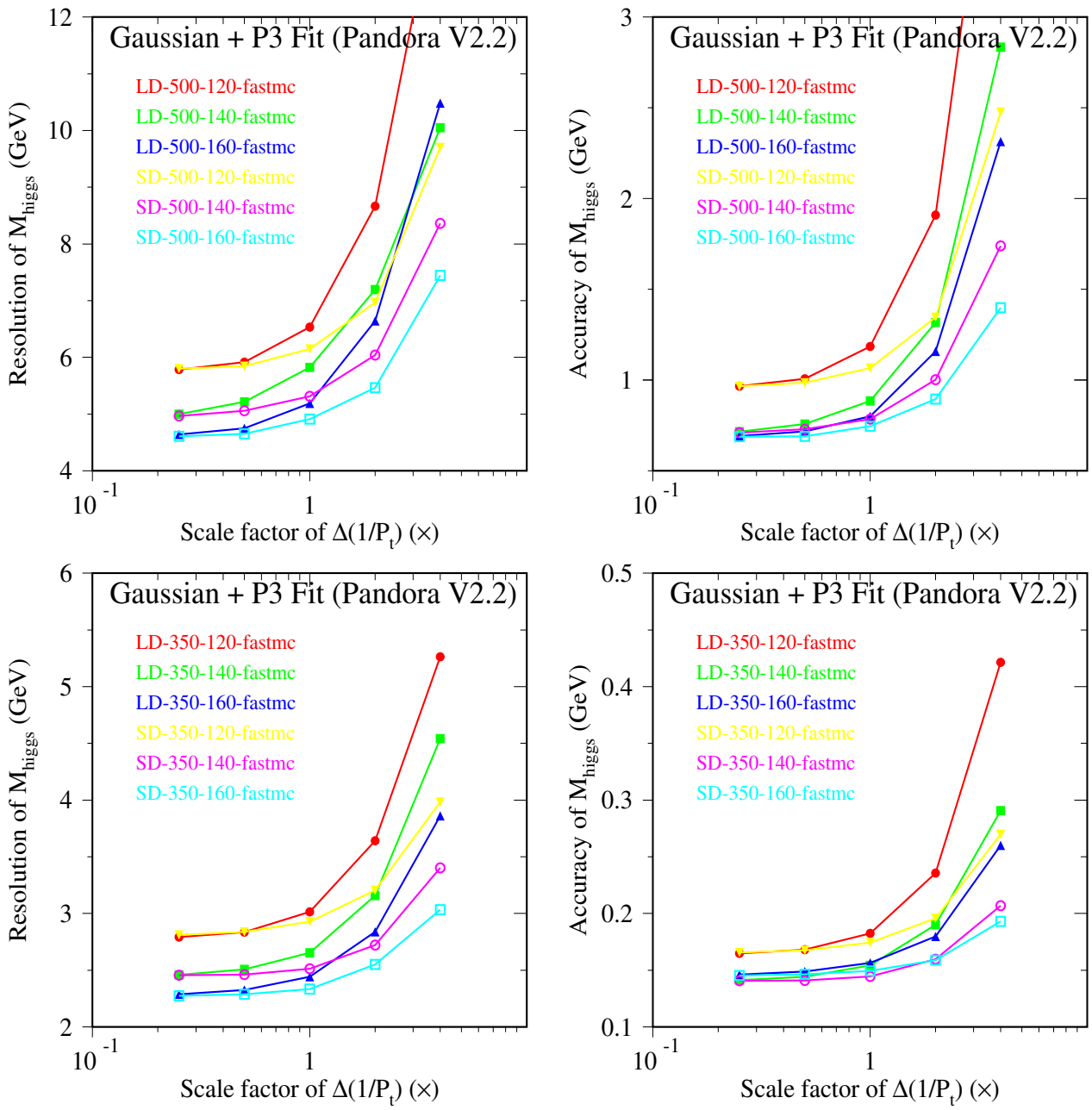


⇒ Higgs mass resolution is **sensitive** to track momentum resolution.

⇒ SDMAR01 is better than LDMAR01

⇒ NLC 350 GeV is better than NLC 500 GeV

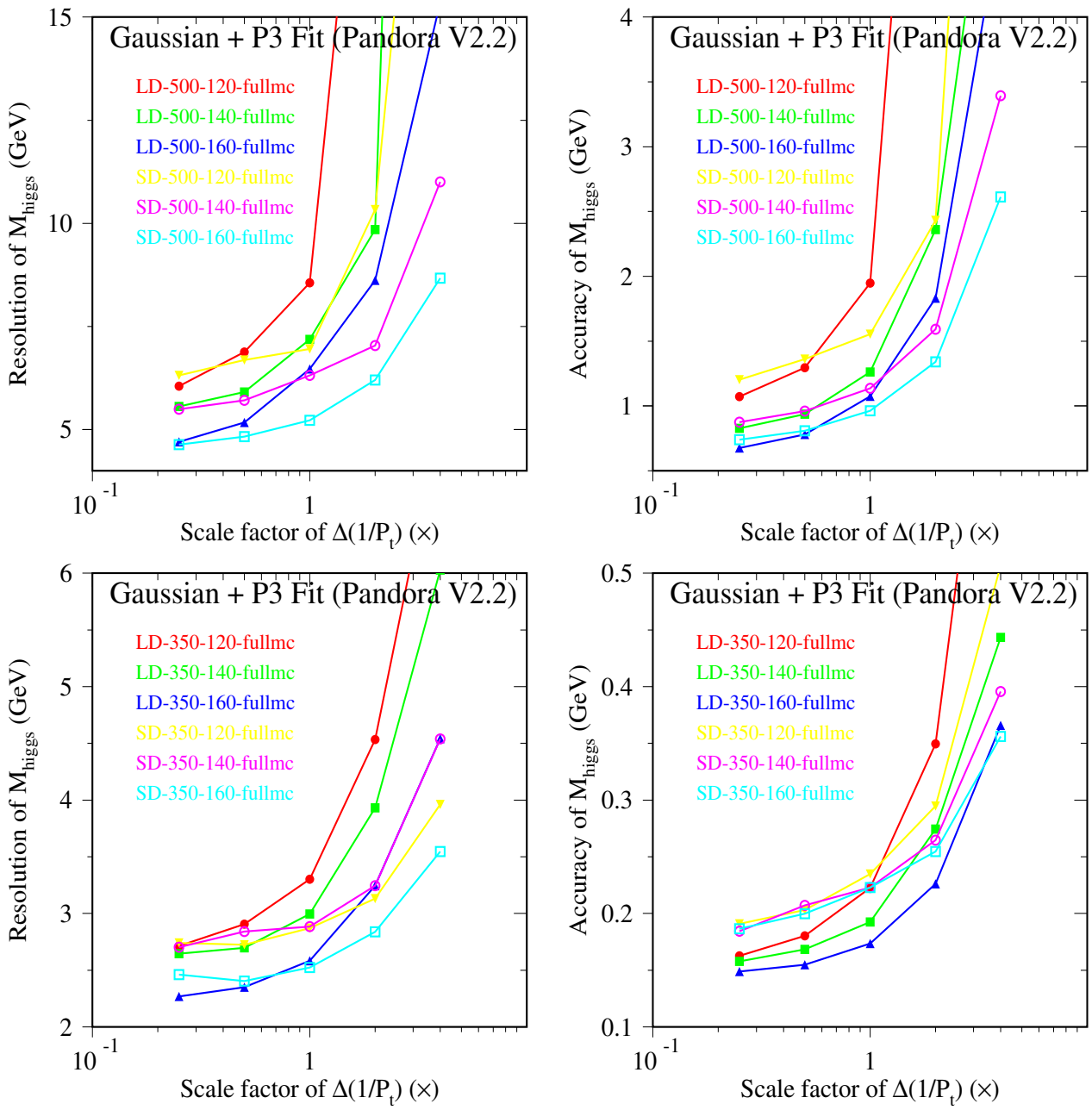
Higgs Mass Resolutions - Fast MC



- Backgrounds from ZZ & WW are considered.

⇒ Higgs mass resolution is **sensitive** to track momentum resolution, BUT ...

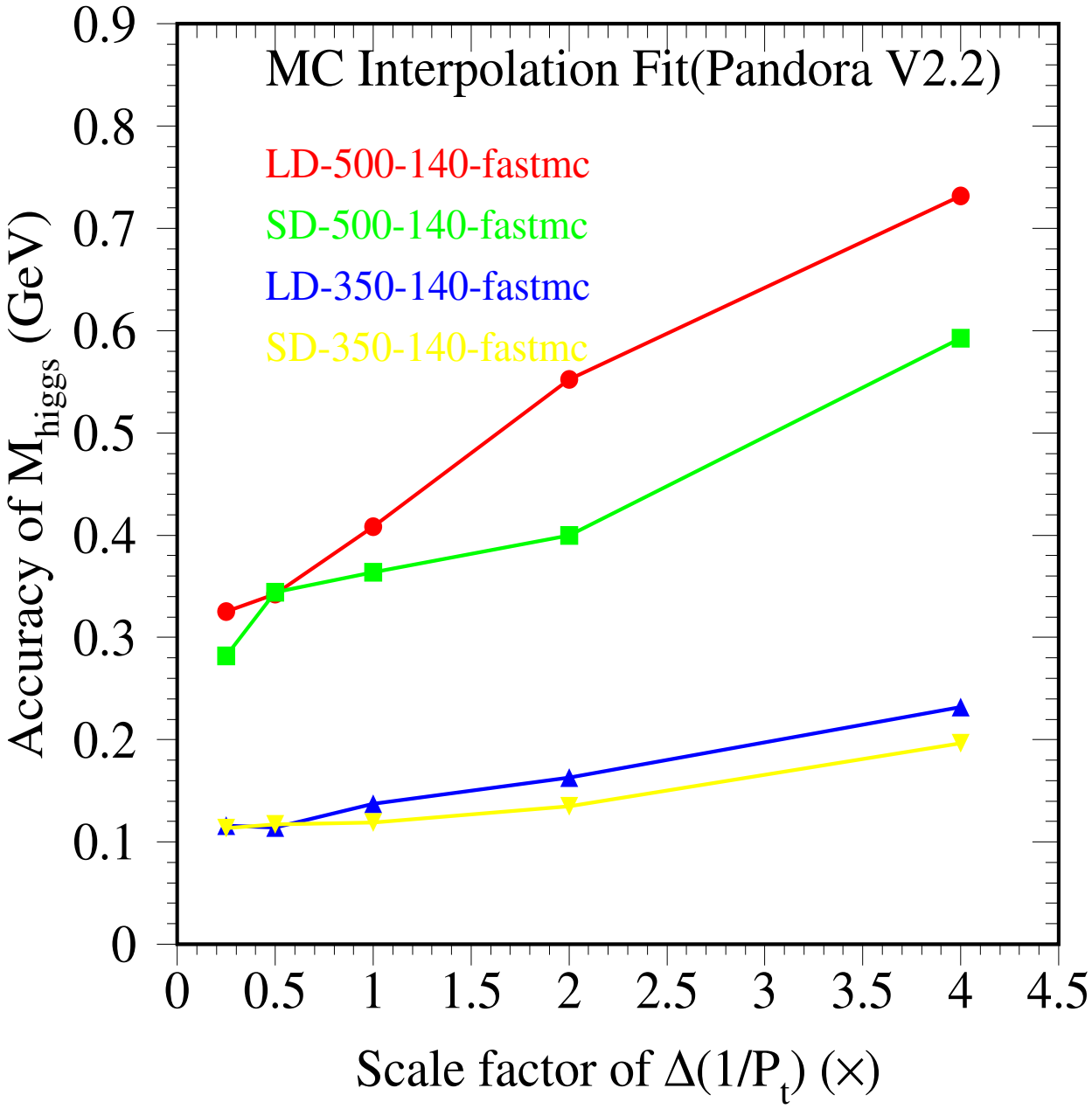
Higgs Mass Resolutions - Full MC



- Backgrounds from ZZ & WW are considered.

⇒ Higgs mass resolution and accuracy from full MC is worse than that from fast MC.

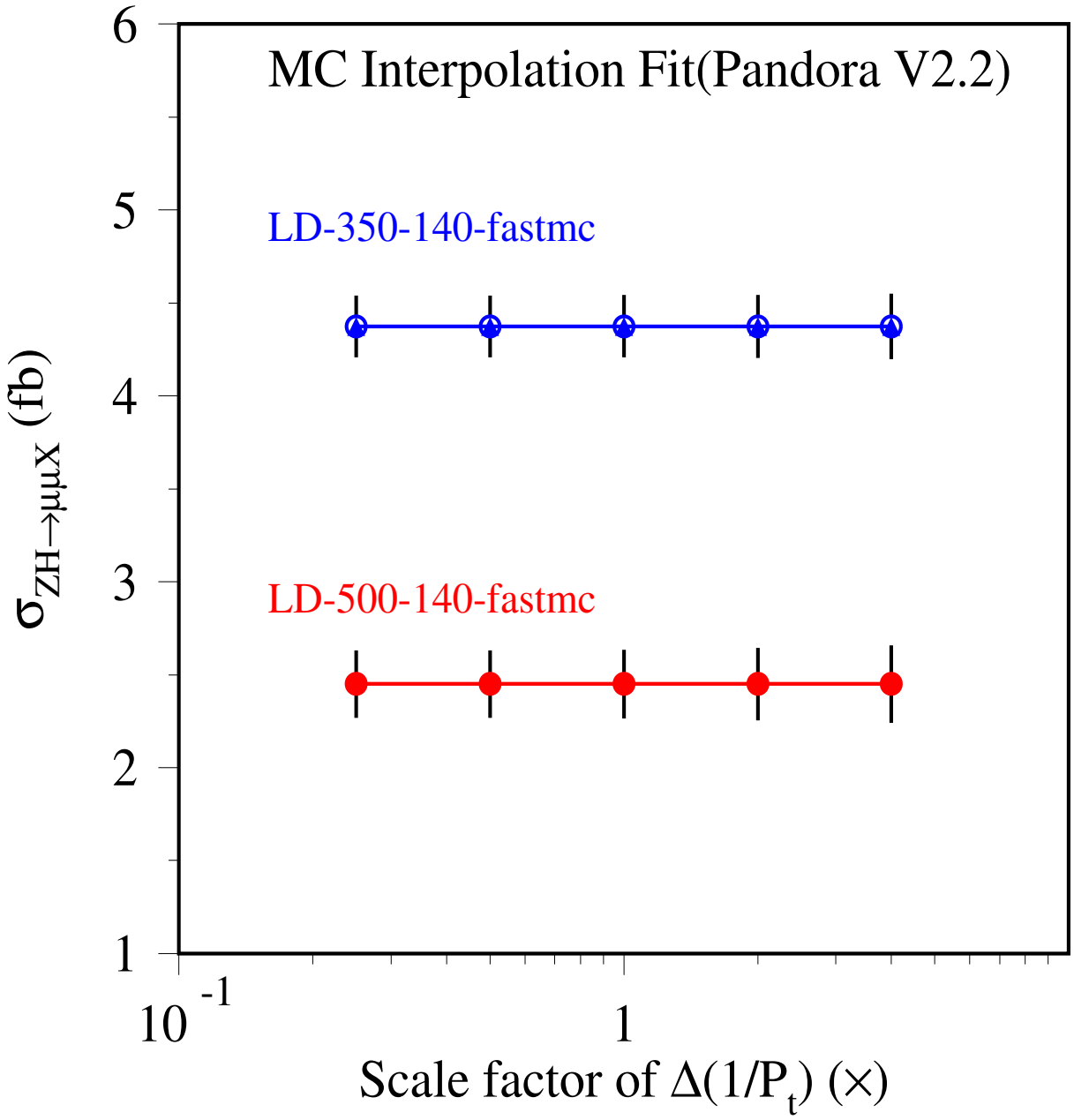
Higgs Mass Accuracy



- Backgrounds from ZZ and WW are considered.

⇒ Higgs mass accuracy from MC interpolation fit looks better.

Cross Section of $ZH \to \mu^+\mu^- X(\gamma)$



⇒ Cross section of $ZH \to \mu^+\mu^- X(\gamma)$ is **insensitive** to track momentum resolution.

Preliminary Conclusions

⇒ Track momentum resolution:

Full MC is worse than Fast MC

⇒ Norman Graf, Mike Ronan and Nick Sinev will talk about recent progress of Full MC reconstruction issues.

⇒ Higgs mass resolution and accuracy:

insensitive to track angular resolutions

sensitive to degraded momentum resolution

SDMAR01 is better than LDMAR01

NLC 350 GeV is better than NLC 500 GeV

⇒ Cross section of $ZH \to \mu^+\mu^- X(\gamma)$:

insensitive to track momentum resolution

⇒ Central tracking $\delta(\frac{1}{p_t}) \sim 3 \times 10^{-5}(GeV/c)^{-1}$ is around optimal in current beam setup.

⇒ Physics potential may gain by:

decreasing beam energy spread.