Impact of Tracker Design on Higgs Mass Resolution & Cross Section

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MC Generator: PANDORA V2.2, PYTHIA V3.1
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)

\[ e^+ e^- \rightarrow Z H \rightarrow \mu^+ \mu^- X(\gamma) \]
\[ \sqrt{S} = 350, 500 \text{ GeV} \]
\[ M_H = 120, 140, 160 \text{ GeV} \]
\[ \mathcal{L} = 500 fb^{-1} \]
- UDSCB Full and Fast MC at 500 GeV

⇒ Thanks to Bruce A. Schumm for expected momentum resolution.
Track Momentum Resolution

UDSCB at 500 GeV

- Expectation (cos Θ = 0)
- Fast MC (udscb)
- Full MC (udscb)
- Full MC (|cos Θ| < 0.5)
- Fast MC (|cos Θ| < 0.5)

● UDSCB Full and Fast MC at 500 GeV

⇒ Thanks to Bruce A. Schumm for expected momentum resolution.
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 $\text{fac}(0.25, 0.5, 1.0, 2.0, 4.0)$. 
Higgs Mass Distributions

**LD−350−140−50000**

- **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).
- Raw recoil mass is fitted by single gaussian.

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

⇒ SDMAR01 is better than LDMAR01

⇒ NLC 350 GeV is better than NLC 500 GeV
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 $ZH \rightarrow \mu^+ \mu^- X(\gamma)$ is ***insensitive*** to track momentum resolution.

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

**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.