Presentation at the ALCPG-SLAC Meeting

SUSY Analysis of Sleptons
Problems, Solutions, Improvements

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THE GROUP

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ACTIVITIES

- Simulation of Supersymmetry. New method to overcome the negative effects of beamstrahlung and bremmstrahlung.

- The Benefits of Positron Polarization.

- Resolution on $M_0$, $M_{1/2}$ from mass measurement
Simulation of Selectron Production

Case Study

• Consider Case SPS3, $M_{1/2} = 400$ GeV, $M_0 = 90$ GeV.

• Mass of $e_R = 178.3$ GeV, Mass of $e_L = 287.1$ GeV, Mass of $\chi^0_1 = 160.6$ GeV.

• Compare Fits with Beam and Bremsstrahlung and without.

• We use the $e^+ - e^-$ Energy Spectra Subtraction Technique to remove Standard Model Background.
Selectron Production

$$e^+ - e^- \text{ Energy Spectra}$$
Resultant Fits to Energy Edges

No Bremsstrahlung

Bremsstrahlung

Chi2 / ndf = 2.158 / 1
Mass eR = 178.7 ± 0.1589
Mass eL = 287.1 ± 0.1863
Mass X10 = 160.8 ± 0.1414
New Method to Determine Masses

Compare Energy Spectrum to those Generated with different parameters encompassing the correct one.

Do a Chi Square Fit to the Spectra Comparison.

Choose the minimum and determine the masses.
$M_{1/2} = 400$, $M_0 = 90$ expected value.

$M_{1/2} = -1.5\%$ from 400, $M_0 = 90$
Chi Square Fit Distribution

\[ M_{1/2}(\text{expec.}) = 400 \text{ GeV} \]

\[ M_{1/2}(\text{fit}) = 400.22^{+0.19}_{-0.54} \text{ GeV} \]

\[ M_0 \text{ fixed at 90 GeV} \]
$M_{1/2}$ vs $M_0$ curves for $M_{sel}^L$ values  

$M_{1/2}$ vs $M_0$ curves for $M_{sel}^R$ values

Not physical  
Not physical
$M_{1/2}$ vs $M_0$ curves for $M(\tilde{\chi}_1^0)$

No dependence on $\tan(\beta)$

Not physical
Effect of Positron Polarization

What do we observe if we have positron polarization. We studied 80% e^-, 80% e^+.

Applied to Selectrons and Smuons.
Electron, Positron Energy Spectrum from $e^+e^-$ → all $\bar{e}\bar{e}$

$e^- \text{Spect.}$ $e^- 80\% R$  $e^+ \text{Spect.}$ $e^- \text{Spect.}$ $e^- 80\% R$  $e^+ \text{Spect.}$

$e^+ 80\% L$

$e^+ 80\% R$

$e^+ 0\text{ pol.}$

$e^+ 0\text{ pol.}$
Muon Energy Spectrum from $e^+ e^- \rightarrow \mu^+ \mu^-$

$e^- 80\% R$ $e^+ 80\% L$ $e^- 80\% L$ $e^+ 80\% R$