Requirements for Smuon searches at CLIC (part 2)

Outline

- Signal and Background cross sections, update
- Selection efficiency and S/B
- Background subtraction
- Final fits
- Table of results
- Summary

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Signal and Background Cross Sections

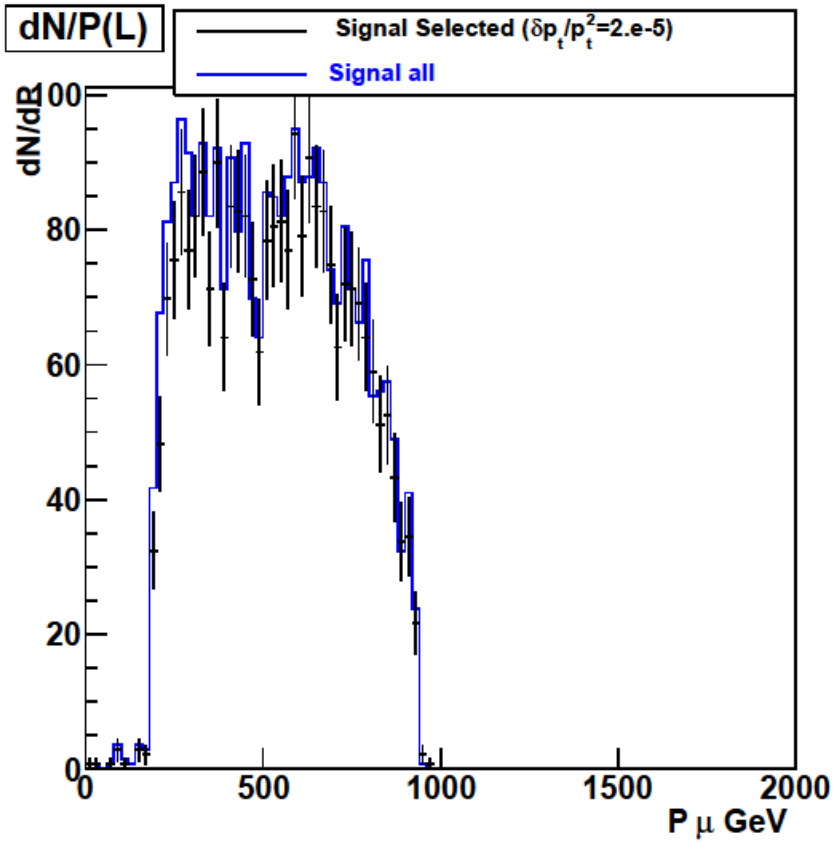
Signal: $e^+ + e^- \rightarrow \tilde{\mu}^+ + \tilde{\mu}^- \rightarrow \chi^0, \mu^+ + \chi^0, \mu^-$

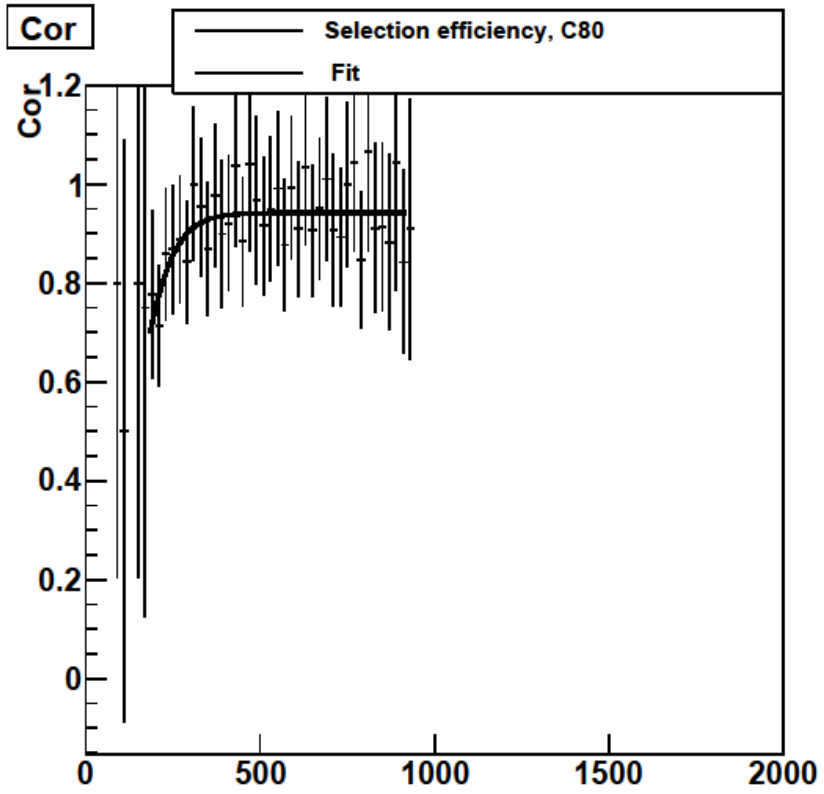
M $\tilde{\mu}$ = 1109 GeV, M χ^0 = 554 GeV, σ =0.7 fb

Background:

- $e^+e^- \rightarrow W^+W^- \rightarrow \mu^+\mu^-\nu_\mu\nu_\mu$; σ=10.5 fb
- $e^+e^- \rightarrow Z^0Z^0 \rightarrow \mu^+\mu^-\nu_X\nu_X$; σ=0.5 fb
- $e^+e^- \rightarrow$ susy $\rightarrow \mu^+\mu^-$; σ=0.4 fb
- $e^+e^- \rightarrow \mu\nu_e\mu\nu_e$ (inclusive); σ=135 fb

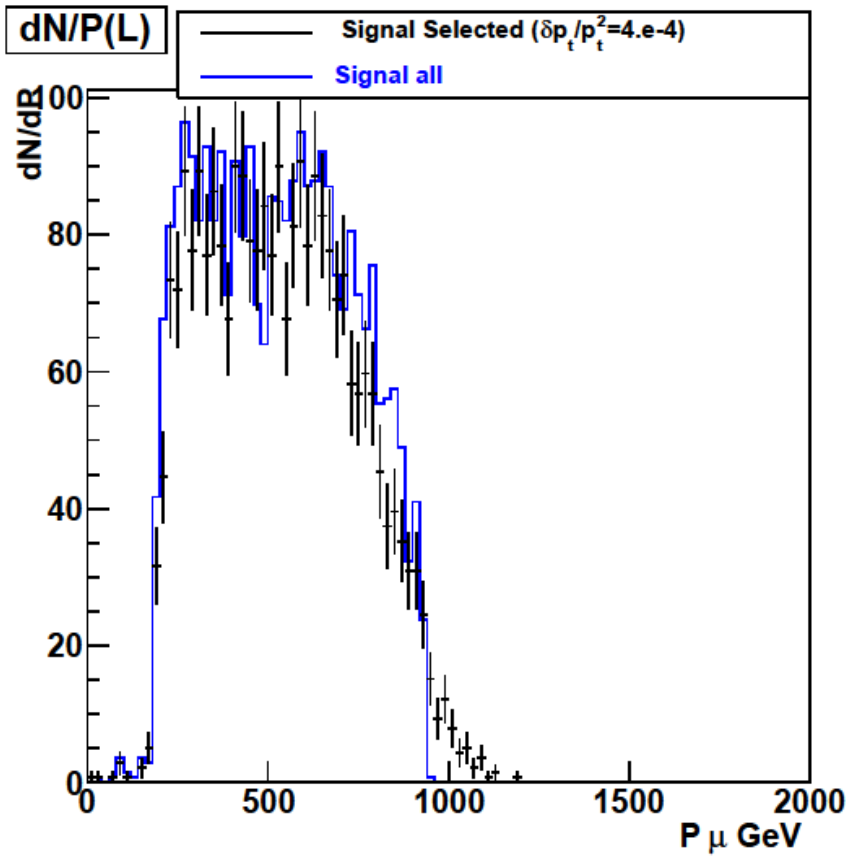
Selection efficiency 1

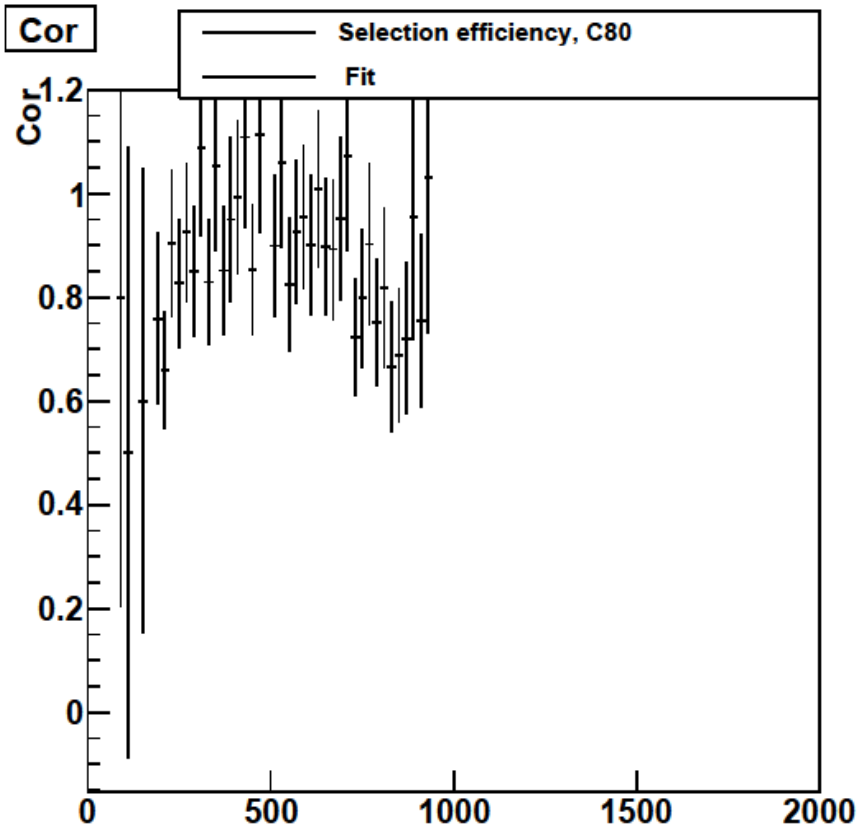




Muon momentum distribution (left) and selection efficiency (right) for Prob > 0.8 and $\delta Pt/Pt^2=2.10^{-5}$. E ~ 93 % and S/B ~ 40%;

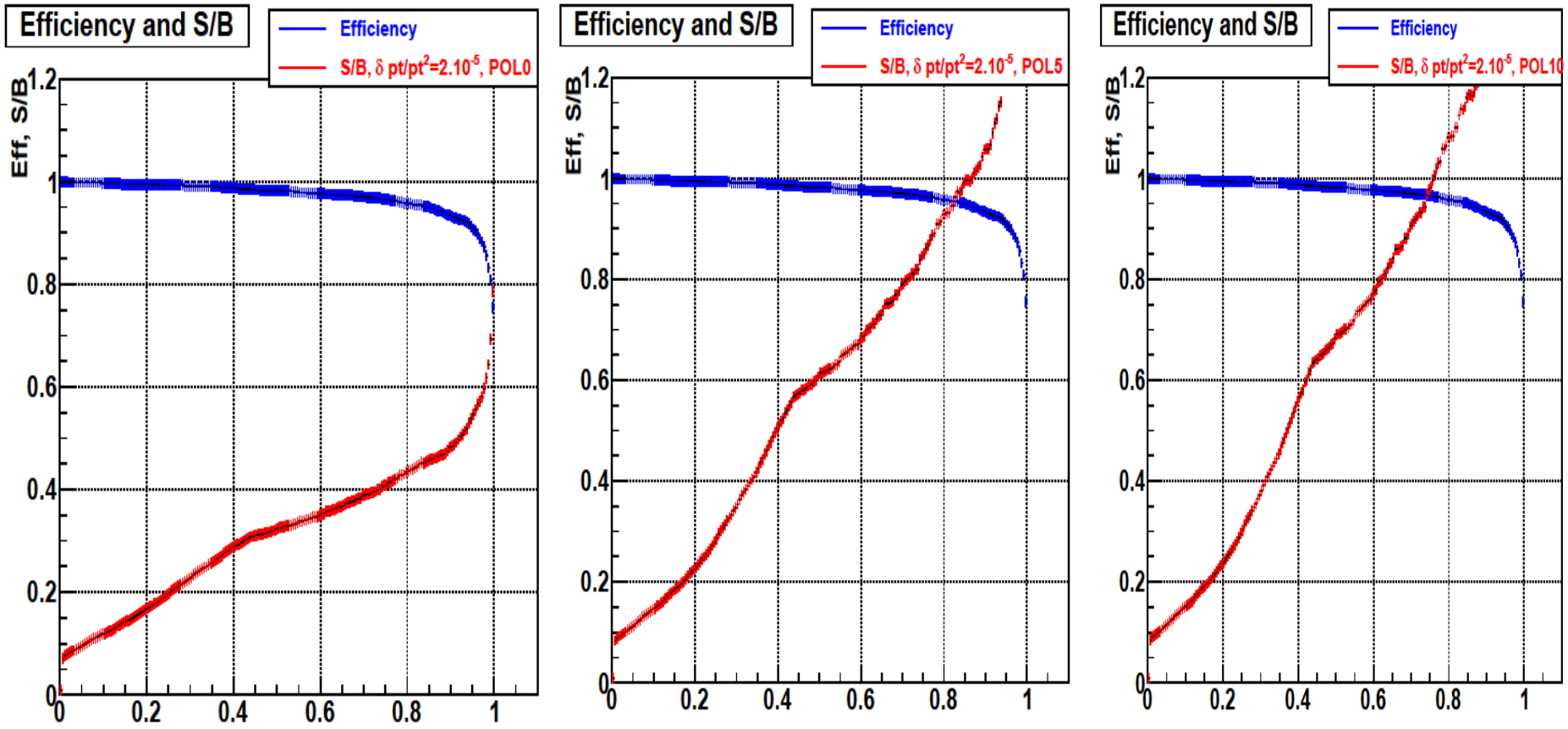
Selection efficiency 2





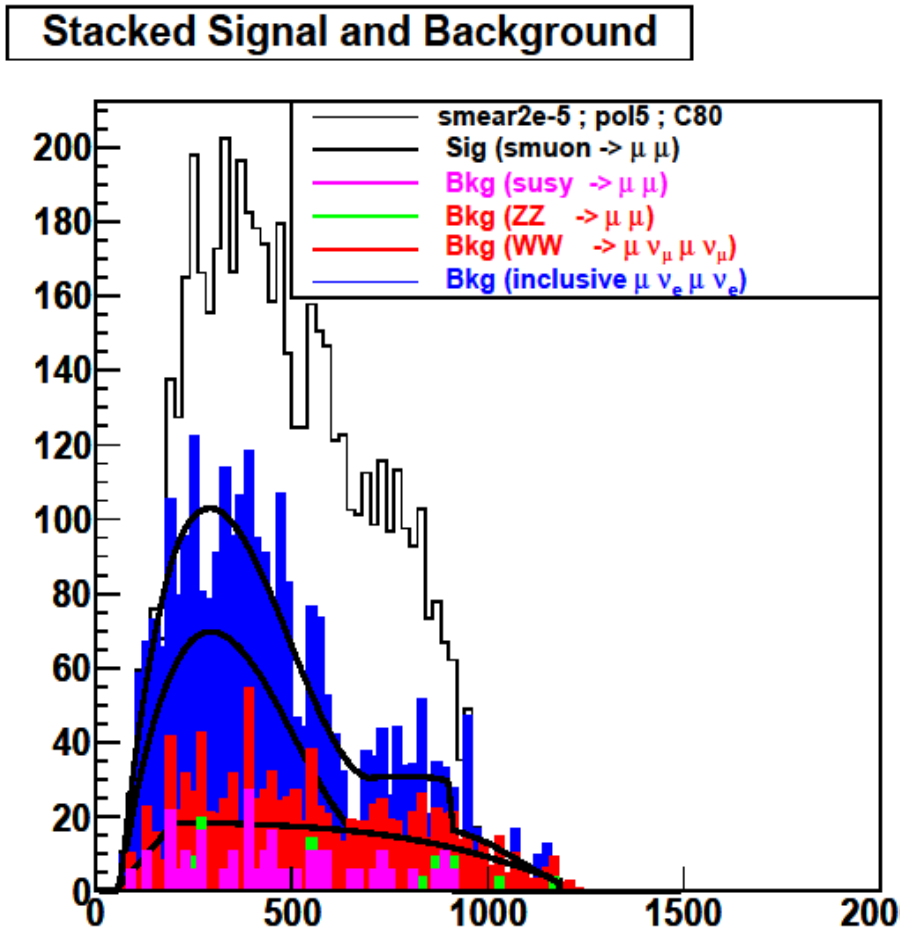
Muon momentum distribution (left) and selection efficiency (right) for Prob > 0.8 and $\delta Pt/Pt^2=2.10^{-4}$. E ~ 93 % S/B decreases to 33%; the upper edge is biased

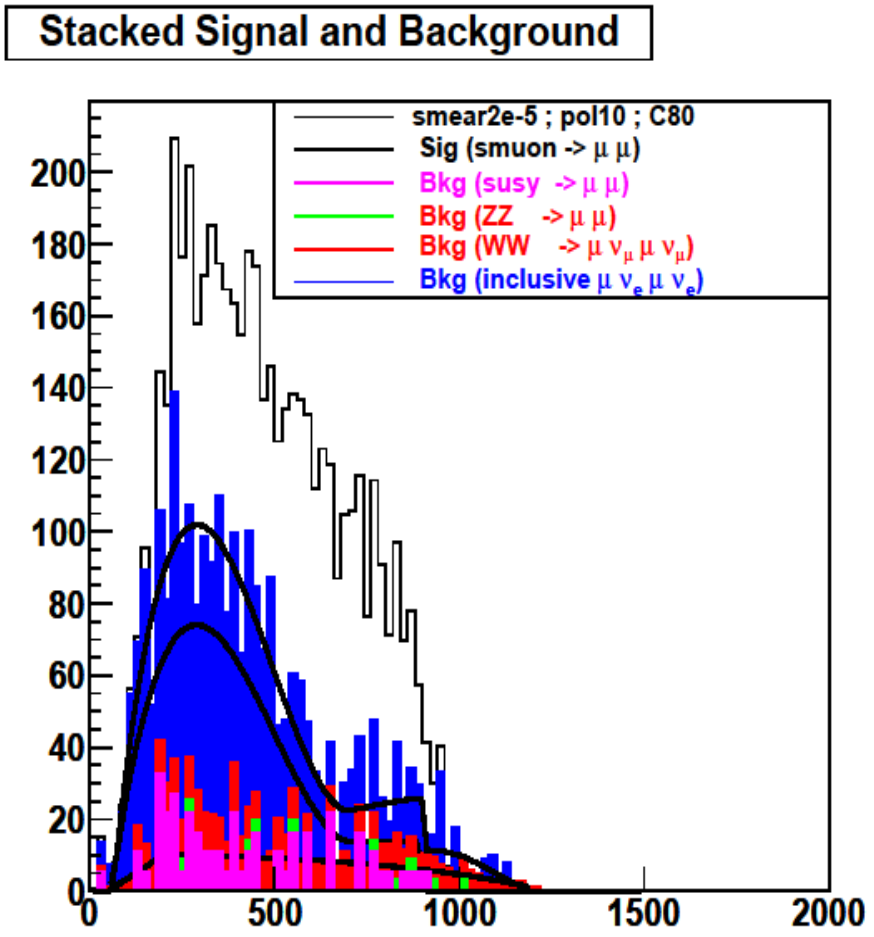
Selection efficiency and S/B



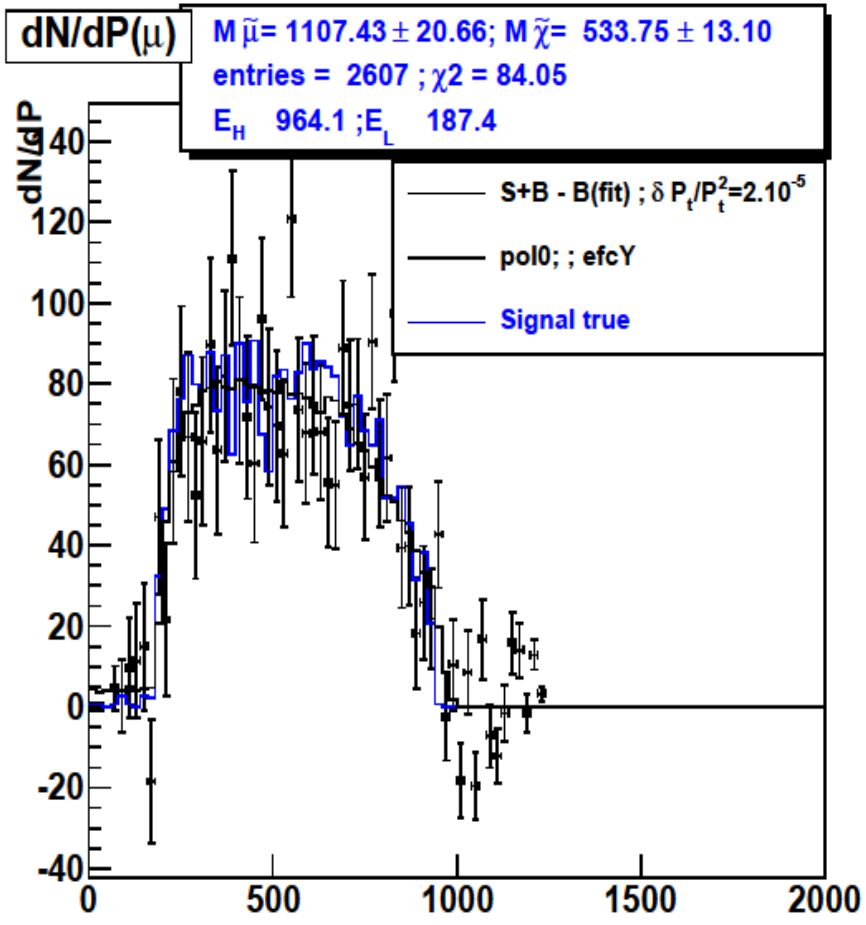
selection efficiency and S/B; $\delta Pt/Pt^2$; pol (e^-/e^+) (0/0); (80/0); (80/60)

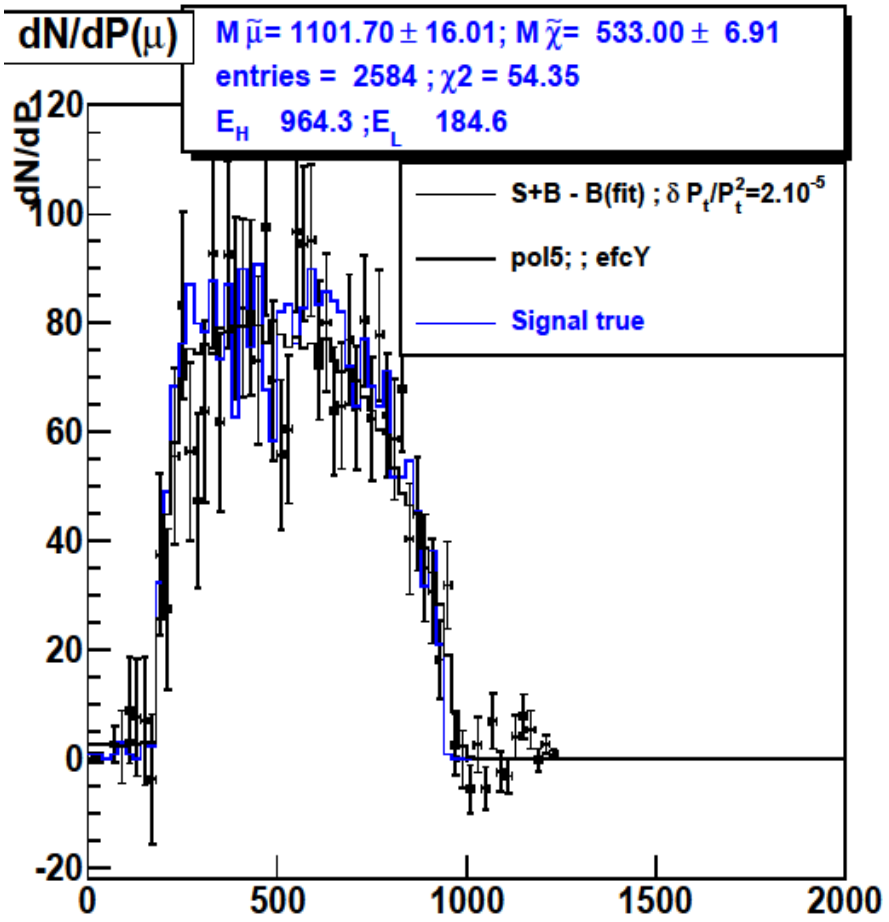
Background modeling





S-B Fits





Smuon : δm/m ~ 2.0 % without polarization and 1.5 % with 80% e^- polarisation

Neutralino: δm/m ~ 2.4 % without polarization and 1.2 % with 80% e^- polarisation

Results

$\delta p_\perp/p_\perp^2$ ($\times 10^{-5}$ GeV^{-1})	$\sqrt{s}>$ (GeV)	Data Set	Pol (e^-/e^+)	BX	(M$\pm\sigma_M$) (GeV) $\tilde{\mu}_R^\pm$	$\tilde{\chi}_1^0$
0.	2950	S	0/ 0	0	1106.3± 2.9	558.8 ± 1.3
0.	2500	S	0/ 0	0	1098.8± 2.6	555.4 ± 1.2
0.	2500 (ISR only)	S	0/ 0	0	1109.2± 3.2	555.4 ± 1.2
0.	2500	S (No FSR Cor)	0/ 0	0	1095.3± 3.2	557.7 ± 1.3
2.	2500	S	0/ 0	0	1104.6± 2.9	560.0 ± 1.7
2.	2500	S (G4+Reco)	0/ 0	0	1107.1± 2.8	560.1 ± 1.5
4.	2500	S	0/ 0	0	1102.8± 2.9	557.2 ± 2.8
6.	2500	S	0/ 0	0	1098.8± 3.1	559.1 ± 3.6
8.	2500	S	0/ 0	0	1101.0± 3.4	564.2 ± 4.0
20.	2500	S	0/ 0	0	1107.5± 4.2	575.7 ± 5.3
2.	2500	S+B	0/ 0	0	1107.4±20.7	533.8 ± 13.1
2.	2500	S+B	80/ 0	0	1101.7±16.2	533.1 ± 6.9
2.	2500	S+B	80/60	0	1101.7±13.5	536.7 ± 5.5
2.	2500	S+B	80/60	5	1102.4±12.9	548.9 ± 7.2
2.	2500	S+B	80/60	20	1104.6±12.8	551.1 ± 7.1
2.	2500	S+B C90	0/0	0	1107.5±19.0	533.7 ± 13.4

For 10 ns time stamping, there is no significant degradation

Applying a tighter selection cut (0.9) doesn't improve the mass resolution.

Summary

The smuon and neutralino masses can be extracted from a fit to the muon momentum distribution. At 3 TeV, the main sources to the errors on the smuon and neutralino masses are:

- The background estimation and subtraction.
- The luminosity spectrum modeling.
- The muon momentum resolution.

To reach a statistical accuracy of ~ 1 % , on the masses requires:

- 2 ab^{-1} of integrated luminosity
- Electron beam polarization ~ 80% to increase the S/B ratio.
- Good control of the luminosity spectrum, ISR and beamstrahlung.
- Good muon ID and $\delta pt/pt^2 < 5.10^{-5}$ to minimize muon momentum efficiency correction