

Muon g-2 reconstruction + SUSY: status report

- Try to produce SUSY samples at ILC500 with Whizard2.8.5
 - Theorists prepared “blr1.slha” and SINDARIN files but beam energy spread was not included
 - Worked to include ISR / beam energy spread by implementing CIRCE2
 - Included PYTHIA6 and TAUOLA as well
 - Calculated cross-section (Xsec) for each SUSY process, and generate some events
- Working directory on KEKCC
 - /home/ilc/skawada/SUSYg-2/blr1

	BLR1	BLR2	BLR3	BLR4
M_1	100	100	150	150
$m_L = m_R$	150	150	200	200
$\tan \beta$	5	10	5	10
μ	1323	678	1922	973
$m_{\tilde{\mu}_1}$	154	154	202	202
$m_{\tilde{\mu}_2}$	159	159	207	208
$m_{\tilde{\tau}_1}$	113	113	159	158
$m_{\tilde{\tau}_2}$	190	191	242	243
$m_{\tilde{\nu}_{\mu,\tau}}$	137	136	190	190
$m_{\tilde{\chi}_1^0}$	99	99	150	149
$m_{\tilde{\chi}_2^0}, m_{\tilde{\chi}_3^0}, m_{\tilde{\chi}_1^\pm}$	1323–1324	678–680	1922–1923	973–975
$a_\mu^{\text{SUSY}} \times 10^{10}$	27	27	17	17
$\Omega_{\text{DM}} h^2$	0.120	0.120	0.120	0.120
$\sigma_p^{\text{SI}} \times 10^{47} [\text{cm}^2]$	1.7	3.7	0.8	1.9
$\mu_{\gamma\gamma}$	1.01	1.01	1.01	1.01

Units in GeV

So far, I am only working with BLR1 parametrization.

Xsec

Process $e^+e^- \rightarrow$	Pol (e-, e+)	Xsec (fb)	N = L*Xsec (Assume L = 4 ab ⁻¹)	N = L*Xsec (Assume L = 1.6 ab ⁻¹)
$\widetilde{\mu}_L^+ \widetilde{\mu}_L^-$	-80/+30	99.1388 +- 0.0079	396555	158622
$\widetilde{\mu}_L^+ \widetilde{\mu}_L^-$	+80/-30	25.9426 +- 0.0021	103770	41508
$\widetilde{\mu}_R^+ \widetilde{\mu}_R^-$	-80/+30	26.9622 +- 0.0021	107849	43140
$\widetilde{\mu}_R^+ \widetilde{\mu}_R^-$	+80/-30	92.4999 +- 0.0072	370000	148000
$\widetilde{\tau}_1^+ \widetilde{\tau}_1^-$	-80/+30	92.9890 +- 0.0063	371956	148782
$\widetilde{\tau}_1^+ \widetilde{\tau}_1^-$	+80/-30	86.6444 +- 0.0059	346578	138631
$\widetilde{\tau}_2^+ \widetilde{\tau}_2^-$	-80/+30	29.0410 +- 0.0033	116164	46466
$\widetilde{\tau}_2^+ \widetilde{\tau}_2^-$	+80/-30	26.3214 +- 0.0029	105286	42114
$\widetilde{\tau}_1^+ \widetilde{\tau}_2^-$	-80/+30	8.18989 +- 0.00062	32760	13104
$\widetilde{\tau}_1^+ \widetilde{\tau}_2^-$	+80/-30	6.48573 +- 0.00050	25943	10377
$\widetilde{\tau}_2^+ \widetilde{\tau}_1^-$	-80/+30	8.19128 +- 0.00062	32765	13106
$\widetilde{\tau}_2^+ \widetilde{\tau}_1^-$	+80/-30	6.48553 +- 0.00050	25942	10377

1.6 ab⁻¹ is the integrated luminosity of ILC500 with -80/+30 and +80/-30

Problems / Questions / Next Step (1)

- When I include Pythia, it crashed.
 - Up to Xsec calculation works, but not for event generation.
- I set Tauola is on, **but it keeps PDG +-15 (no decay of tau) in the event.**
- **Solved:** These are solved when I put the sentence “\$ps_PYTHIA_PYGIVE = “MDCY(C1000022,1)=0”” in sindarlin file explicitly (written in Whizard manual).

Problems / Questions / Next Step (2)

- When running TAUOLA, I got the following message.
 - Subroutine fill_pyjets_spin_data: tau helicity information is not set, though polarized tau decay was requested. Most likely, the SINDARIN file does not include polarized for particles and/or not ?polarized_events=true
 - Still no tau decay exist in tau events. Maybe due to this message?
- **Solved:** Put the sentence “?polarized_events=true” in global.

Problems / Questions / Next Step (3)

- Found ~4[7]% events have stable tau (no daughters of tau) in $\text{stau1}+\text{stau2}-[\text{stau1}+\text{stau1}-]$ event.
- The biggest difference with Keita's study is with or without SUSY contribution.
- **Solved**: need to apply patch for PYTHIA6 (many thanks to Mikael Berggren (DESY))
 - This needs: fresh download of Whizard2.8.5, apply patch to PYTHIA6, compile and install. The Whizard2.8.5 which is already installed in KEKCC is not enough to handle stau BSM world.

Problems / Questions / Next Step (4)

- How many events we want to produce and simulate?
 - So far, I have generated $\sim x10$ events (see next page).
 - Samples are stored in KEKCC: /hsm/ilc/users/skawada/SUSYg-2/(LCIO or STDHEP)
- How to do detector simulation?
 - DELPHES? SGV? ILD full simulation?
 - In any case, I need to learn how to run the jobs. Started to learn DELPHES first.
 - Sometimes DELPHES does not work ---> **Solved**: some version difference (many thanks to Daniel), input file was too large. I will split samples every 50K events.

N_generated

Process $e^+e^- \rightarrow$	Pol (e-, e+)	Xsec (fb)	N = L*Xsec (Assume L = 4 ab ⁻¹)	N = L*Xsec (Assume L = 1.6 ab ⁻¹)	N_generated so far
$\widetilde{\mu}_L^+\widetilde{\mu}_L^-$	-80/+30	99.1388 +- 0.0079	396555	158622	1.5M
$\widetilde{\mu}_L^+\widetilde{\mu}_L^-$	+80/-30	25.9426 +- 0.0021	103770	41508	500K
$\widetilde{\mu}_R^+\widetilde{\mu}_R^-$	-80/+30	26.9622 +- 0.0021	107849	43140	500K
$\widetilde{\mu}_R^+\widetilde{\mu}_R^-$	+80/-30	92.4999 +- 0.0072	370000	148000	1.5M
$\widetilde{\tau}_1^+\widetilde{\tau}_1^-$	-80/+30	92.9890 +- 0.0063	371956	148782	1.5M
$\widetilde{\tau}_1^+\widetilde{\tau}_1^-$	+80/-30	86.6444 +- 0.0059	346578	138631	1.5M
$\widetilde{\tau}_2^+\widetilde{\tau}_2^-$	-80/+30	29.0410 +- 0.0033	116164	46466	500K
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$\widetilde{\tau}_1^+\widetilde{\tau}_2^-$	-80/+30	8.18989 +- 0.00062	32760	13104	200K
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