Determining μ at LCC4 on Full Simulation

Marco Battaglia
Marat Freytsis

UC Berkeley and LBNL

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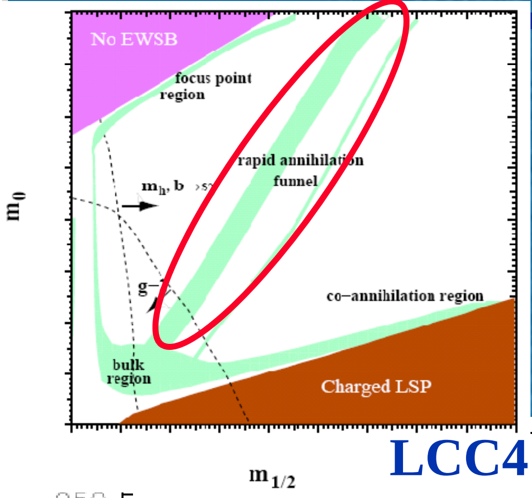
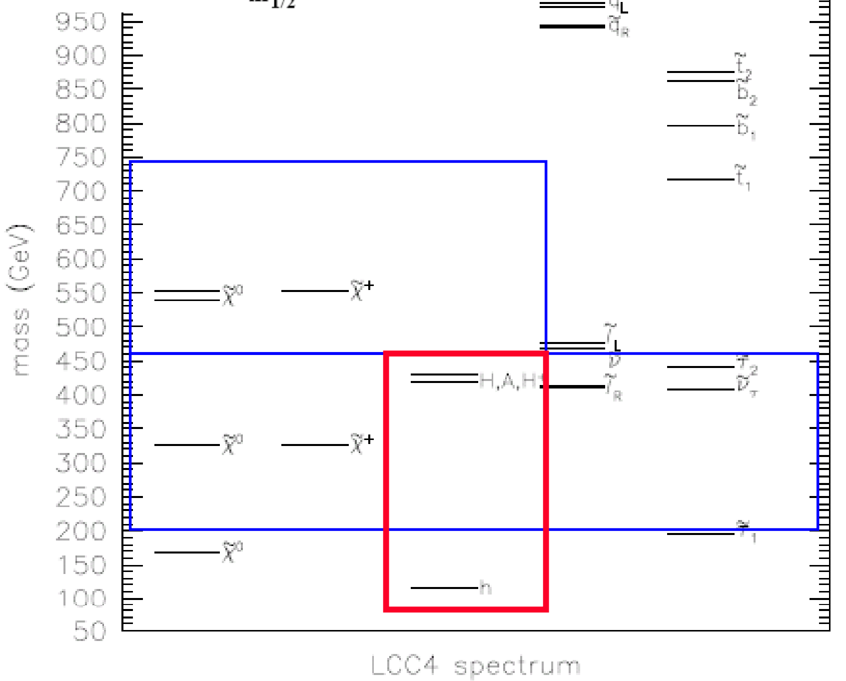
The SUSY Sector of the LCC4 Point

LCC4 point in A^0 Funnel region
Benchmark point defined in cMSSM



LCC4 Benchmark



$\tilde{\chi}^0_1$: 169.13 GeV

$\tilde{\chi}^0_2$: 327.15 GeV

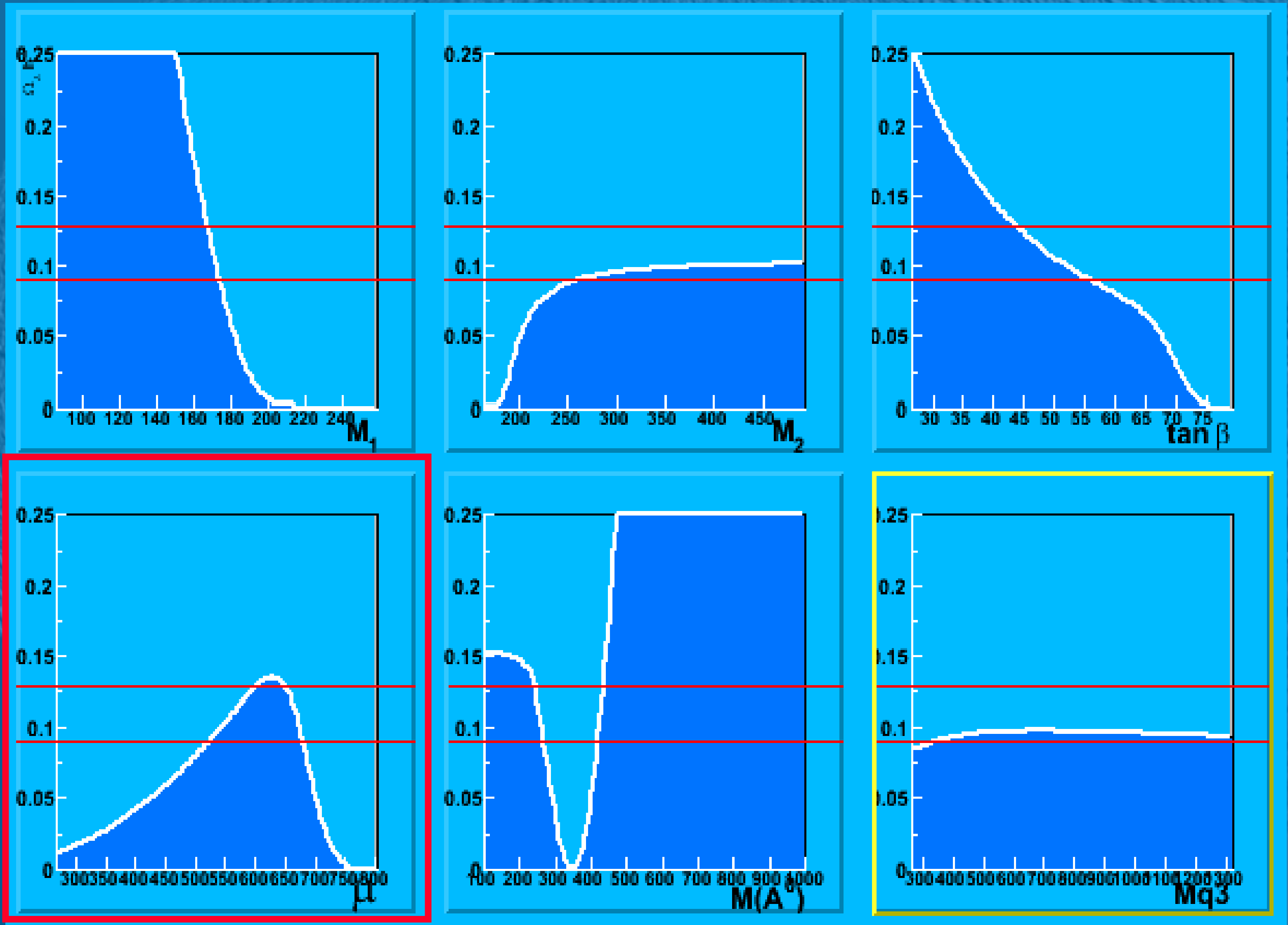
$\tilde{\chi}^0_3$: 553.10 GeV

$\tilde{\chi}^0_4$: 539.77 GeV

$\tilde{\chi}^{\pm}_1$: 327.47 GeV

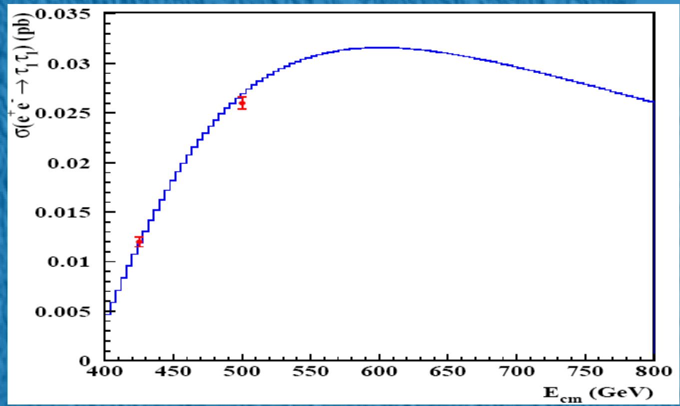
$\tilde{\chi}^{\pm}_2$: 553.30 GeV

$\Omega_\chi h^2$ and SUSY Parameters at LCC4



LCC4 at ILC at 0.5 and 1 TeV

LCC4 studied in details using `SIMDET` parametric simulation;
Results presented at LCWS04, ALCPG Victoria and ILC-Cosmo study
`hep-ph/0410123`



Determine $M(\tau_1)$ and $M(\tau_1)$ - $M(\chi_1^0)$ from stau threshold scan and decays at 0.5 TeV;

Estimate $\Gamma(A^0)$ from precise $BR(h^0 \to bb)$ at 0.35/0.5 TeV;

$$\Gamma(A^0) = \frac{\mathrm{BR}(h^0 \to b\bar{b})}{\mathrm{BR}(A^0 \to b\bar{b})} \times \Gamma(h^0) \times \tan^2\beta$$

Precisely determine $M(A^0)$, $\Gamma(A^0)$ in HA production at 1 TeV.

Determine μ from $M(\chi_{2,3})$-$M(\chi_1)$ at 1 TeV

Neutralino Analysis with Full G4 + Marlin Reconstruction

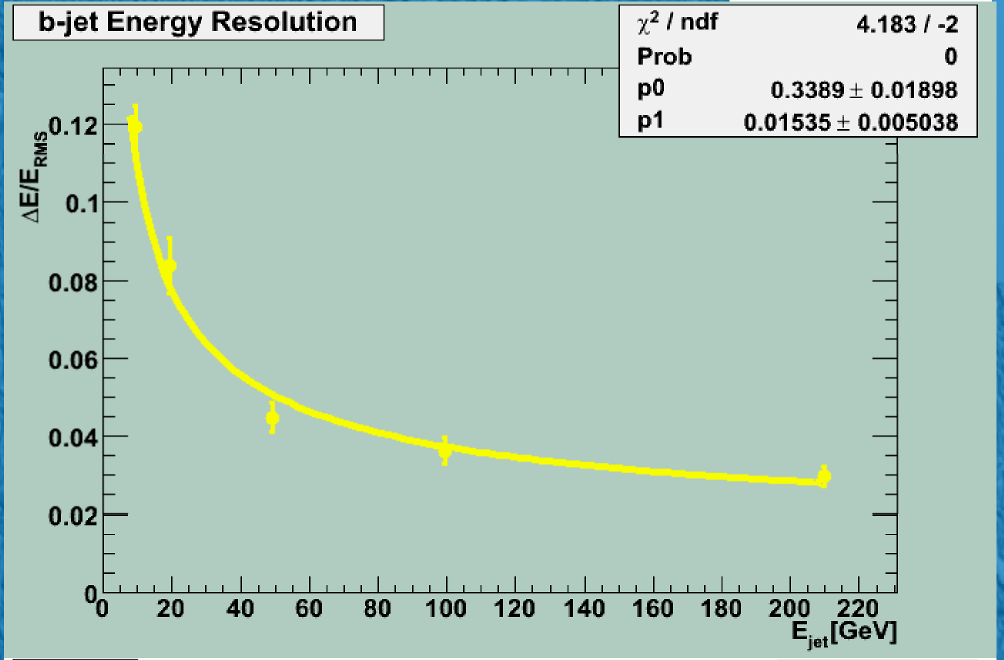
- Generate events with PYTHIA 6.58 + ISASUGRA 7.69
- Full G4 Simulation with Mokka for LDC00Sc
- Reconstruction using Marlin + MarlinReco

Selection Cuts:
- 4 hadronic jets, isolated lepton veto
- Emissing > 300 GeV , pT > 50 GeV
- |cos q ptot | < 0.9
- |Mjj – MZ| < 10 GeV

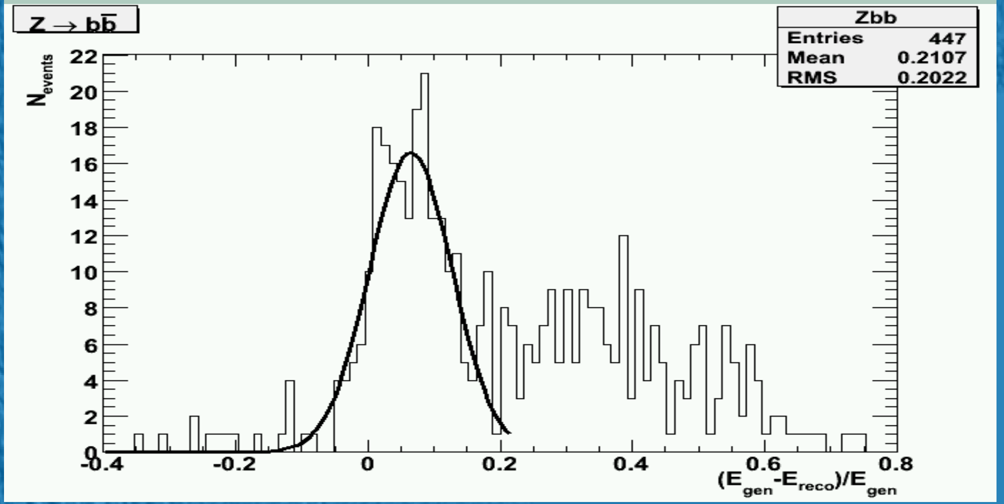
Signal efficiency 52%
SM gauge boson bkg virtually removed

Reconstruction

Energy resolution from Particle flow in `MarlinReco` (use cheating for clustering)



Need to remove jet energy distortion due to s.l. B and D hadron decays;



Neutralino Pair Production at ILC 1 TeV

Production Cross Sections at 1 TeV

$\tilde{\chi}^0_1\tilde{\chi}^0_1$: 56.7 *fb*

$\tilde{\chi}^0_2\tilde{\chi}^0_2$: 16.0 *fb*

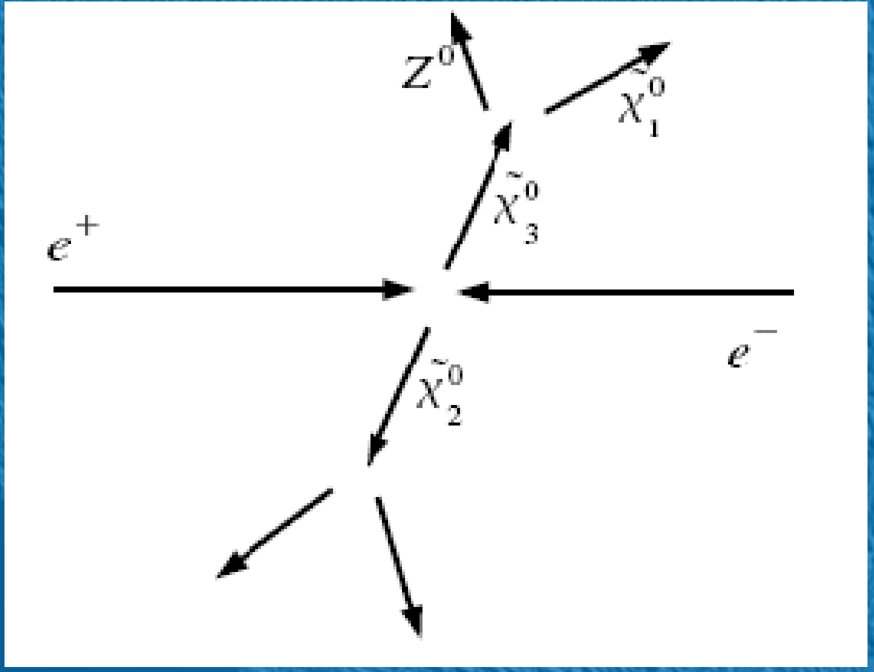
$\tilde{\chi}^0_1\tilde{\chi}^0_2$: 15.1 *fb*

$\tilde{\chi}^0_1\tilde{\chi}^0_3$: 0.7 *fb*

$\tilde{\chi}^0_1\tilde{\chi}^0_4$: 0.7 *fb*

$\tilde{\chi}^0_2\tilde{\chi}^0_3$: 1.9 *fb*

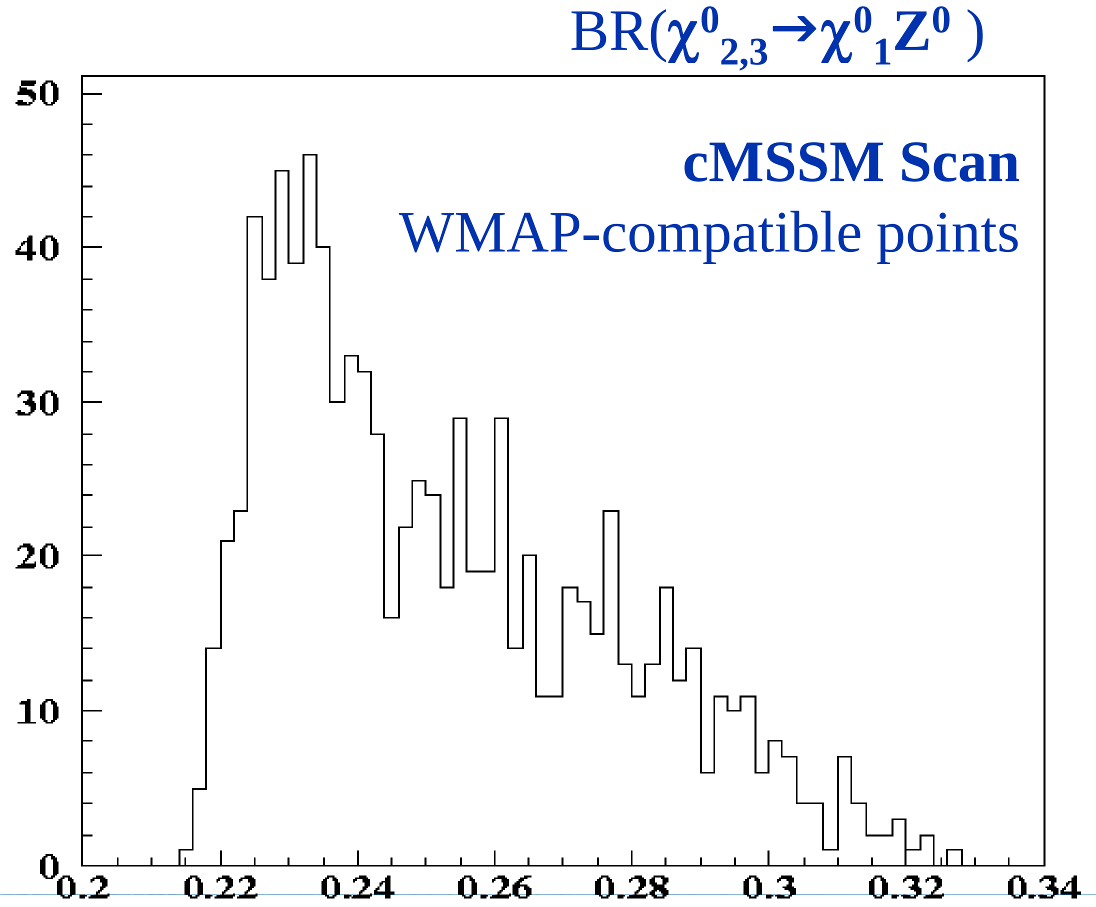
$\tilde{\chi}^0_2\tilde{\chi}^0_4$: 0.4 *fb*



The $\chi^0_{2,3} \rightarrow \chi^0_1 Z^0$ Process

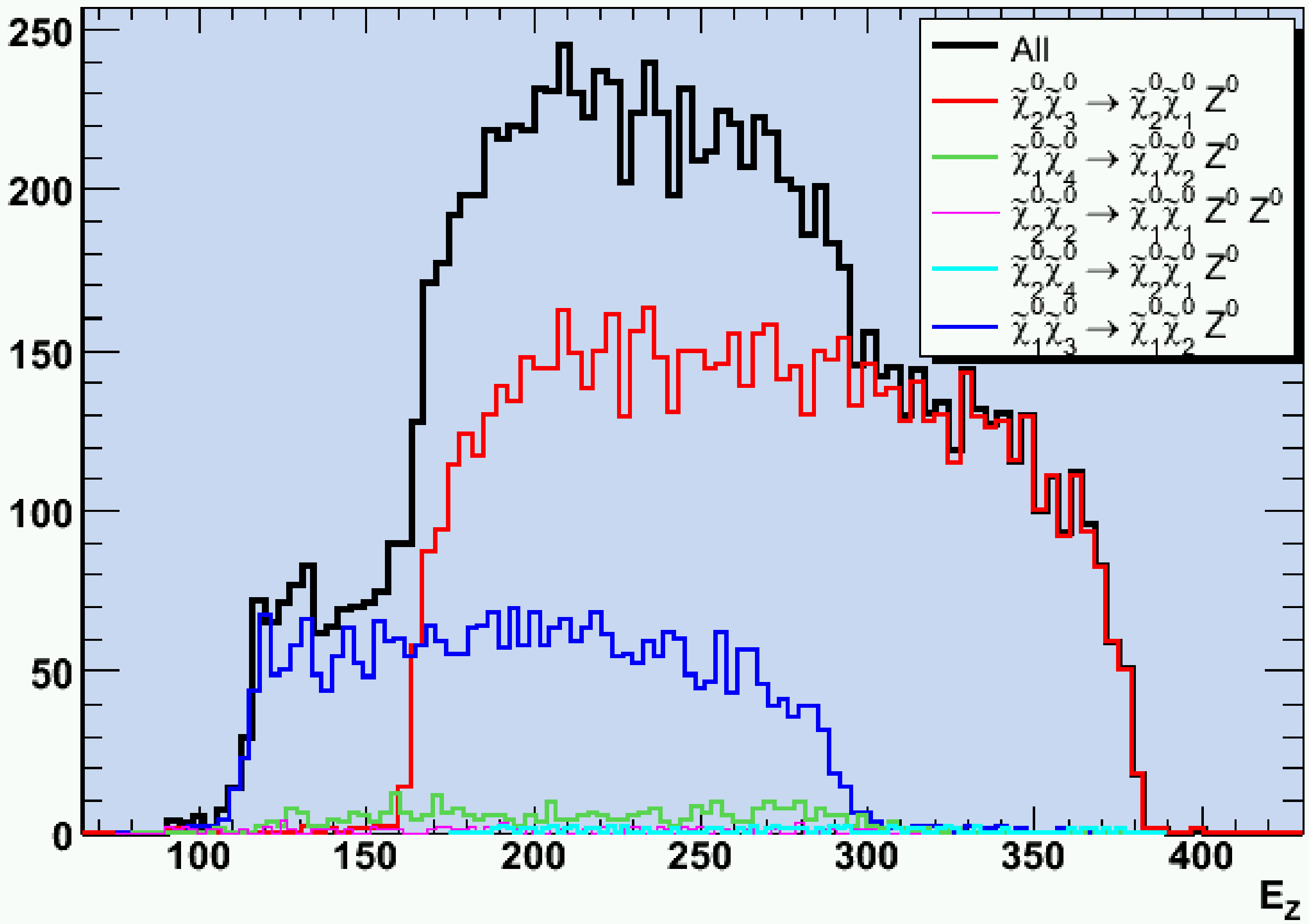
Heavy Neutralino decays to real Z bosons sizeable in DM-motivated regions of parameters

cMSSM Scan
$30 < \tan\beta < 50$
$200 < M_0 < 500$
$200 < M_{1/2} < 500$
$-200 < A_0 < 200$



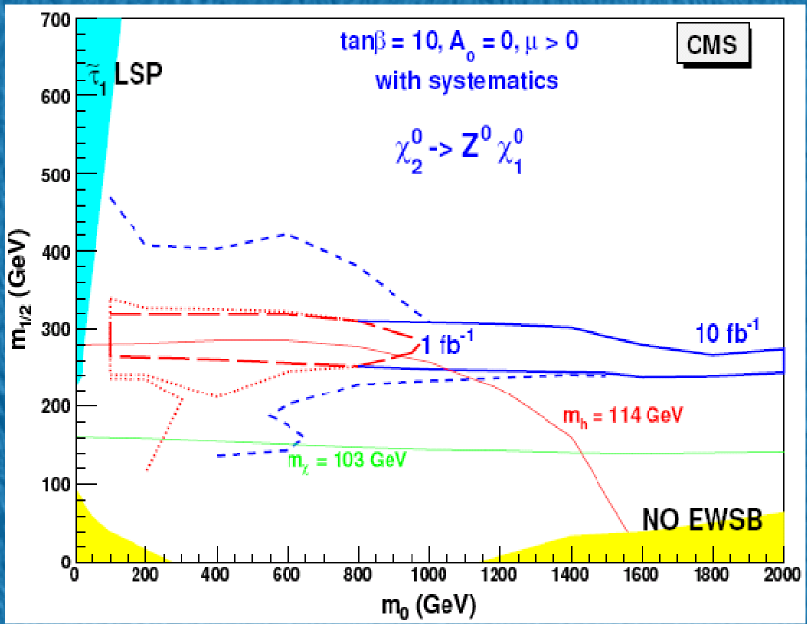
The $\chi^0_{2,3} \rightarrow \chi^0_1 Z^0$ Process

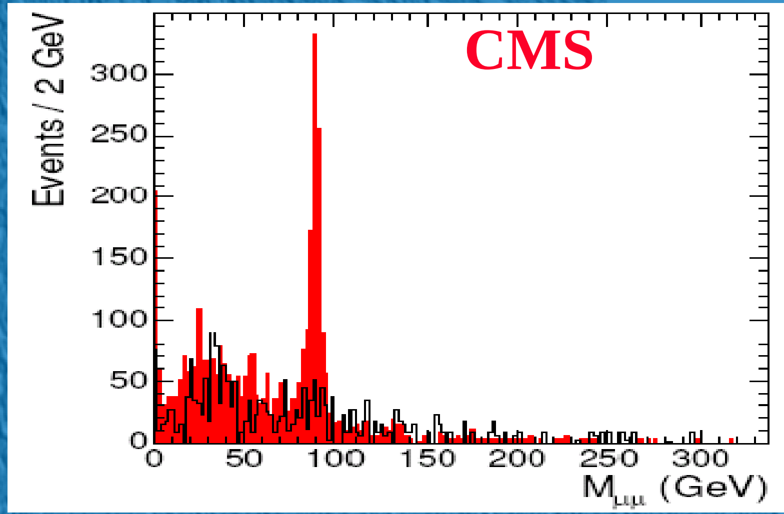
E(Z0) from Heavy Neutralino decays at LCC4

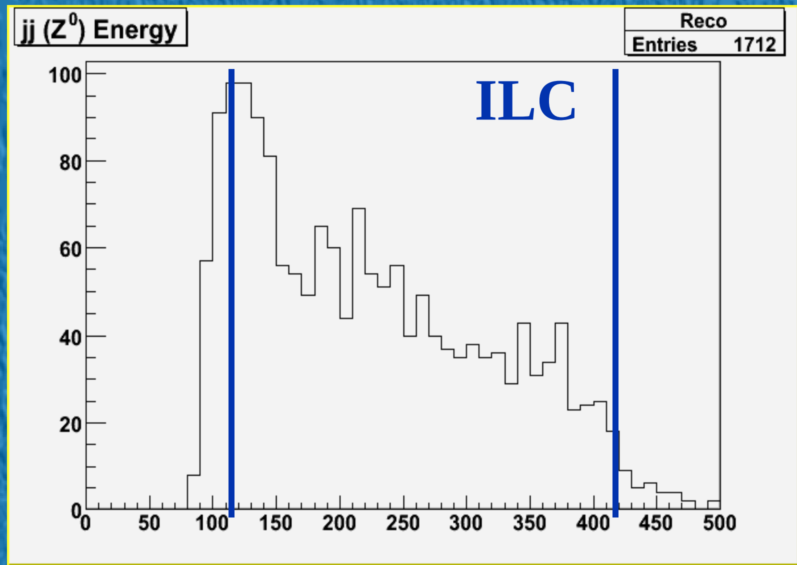


Other Scenarios with real Z^0 bosons

Production of real Z^0 bosons in the decay of heavier neutralinos (i.e. $\chi^0_3 \rightarrow \chi^0_1 Z^0$) serves as useful signature a LHC through $Z^0 \rightarrow l^+ l^-$;



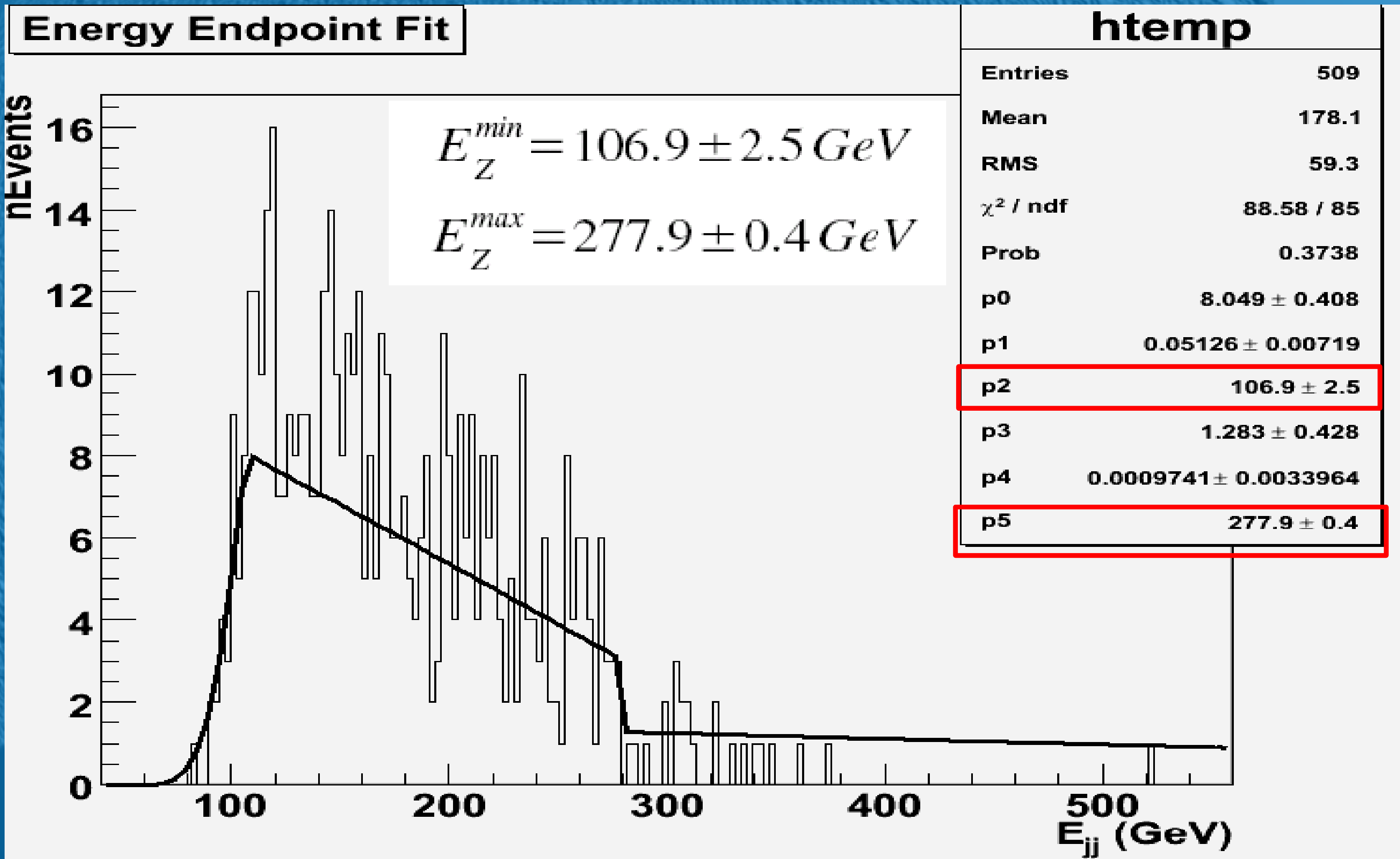




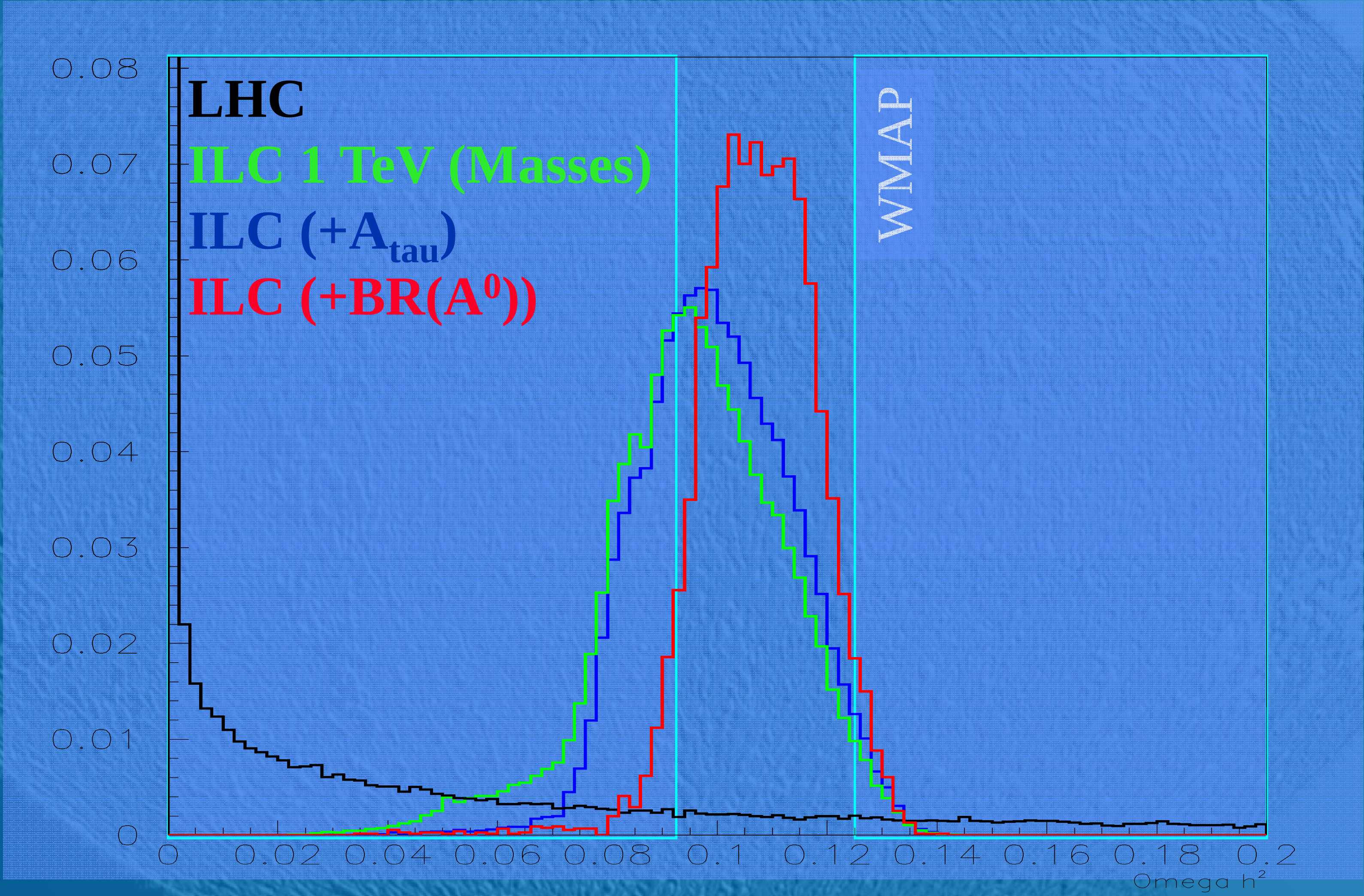
Similar features appear in baryogenesis motivated scenarios where DM density is controlled by stop-coannihilation

Carena, Freytas, hep-ph/0608255

The Fit to the $\chi^0_3 \rightarrow \chi^0_1 Z^0$ Process



DM Density Accuracy for LCC4 at ILC



Plans

• SUSY scenarios with real Z from heavy neutralinos important for benchmarking di-jet energy reconstruction in unconstrained environment;

• Need to apply corrections for s.l. heavy flavour decays;

• Plan to extend analysis to full set of decays and perform global fit to E(Z) edges to extract μ ;

• Perform broad scan of MSSM to scale result to other regions.