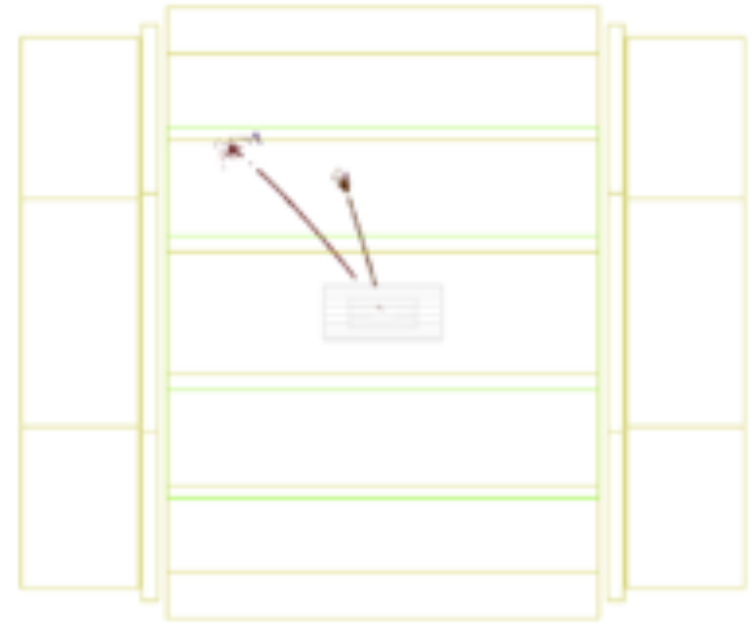
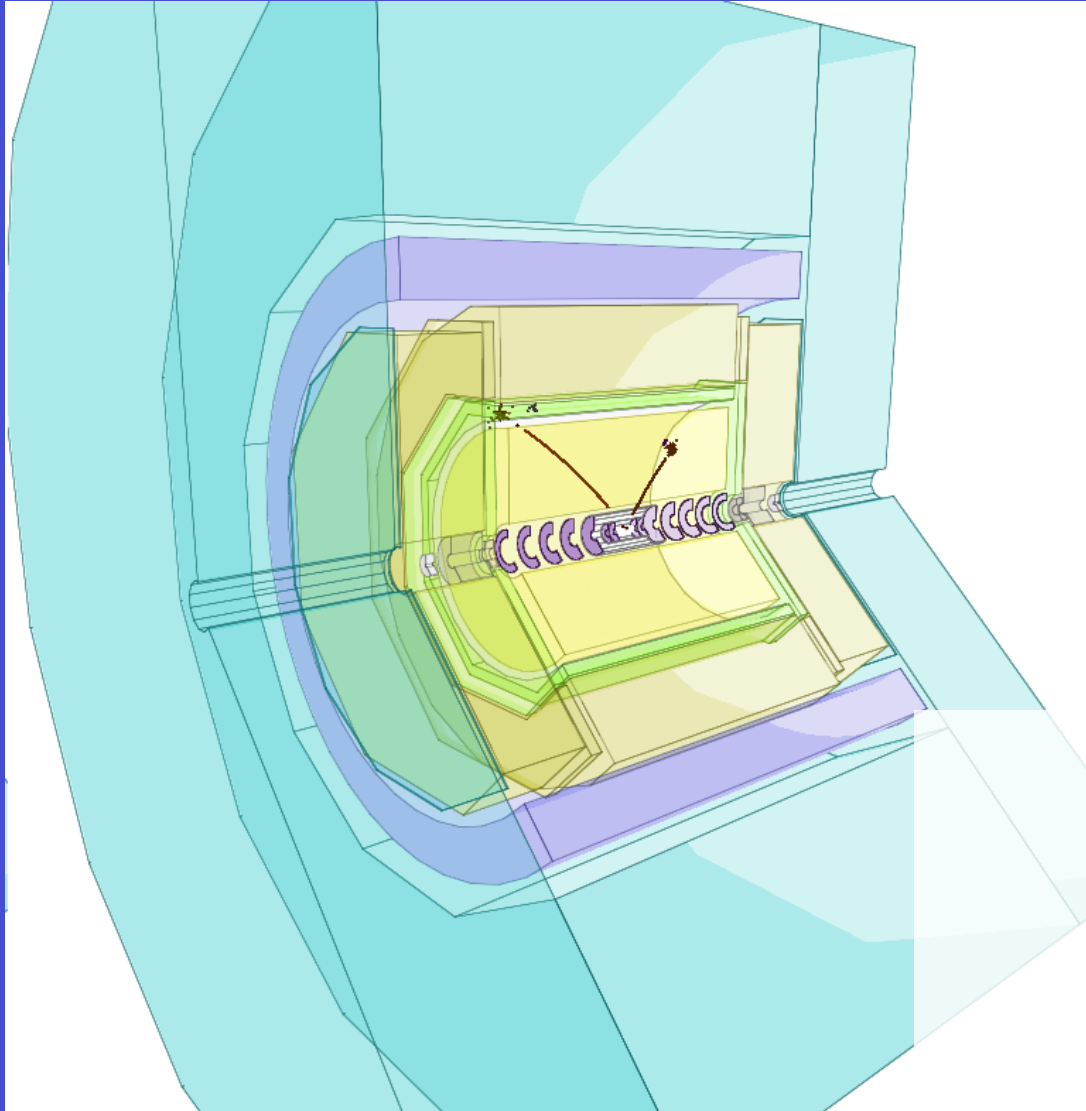


Characterizing Light Higgsinos from Natural SUSY at ILC $\sqrt{s} = 500$ GeV



Jacqueline Yan (KEK)

Friday Physics Meeting

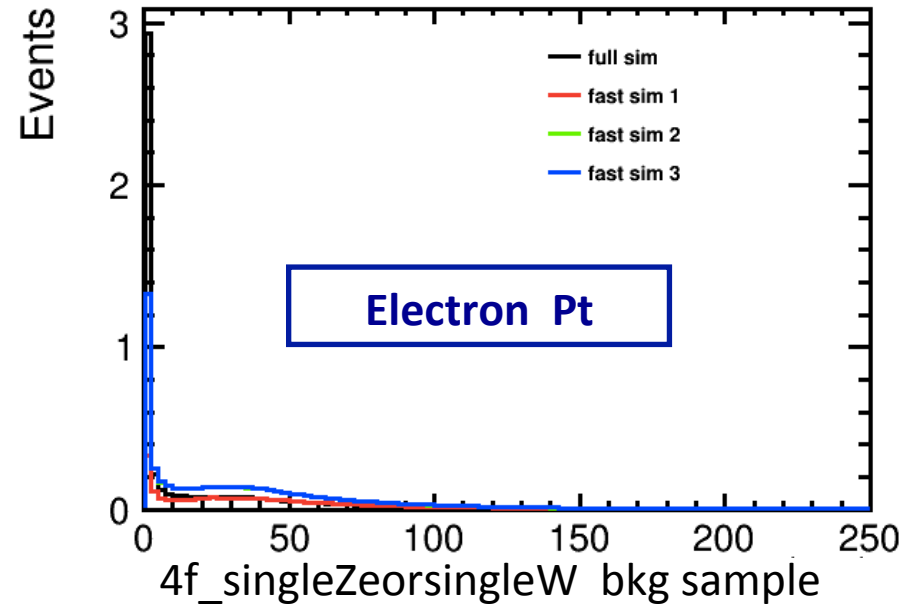
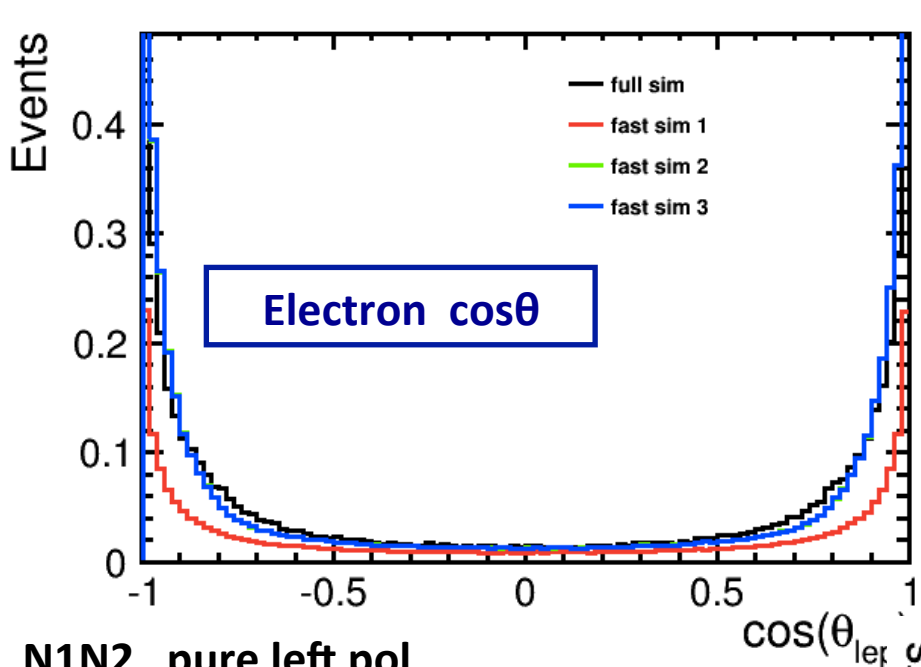
July 1, 2016

Outline

- ◆ Resolved inconsistency between different SGV samples
- ◆ Investigate strange peak at 40 GeV of di-muon energy
- ◆ Continue extraction of mass and cross section (fitting)
- ◆ prepare materials for SUSY 2016 presentation

- Comparison of reconstructed info between full sim and fast sim (Before isolated lepton finder)

No more inconsistency between **SGV2** and **SGV3** (there was a bug)



N1N2 pure left pol

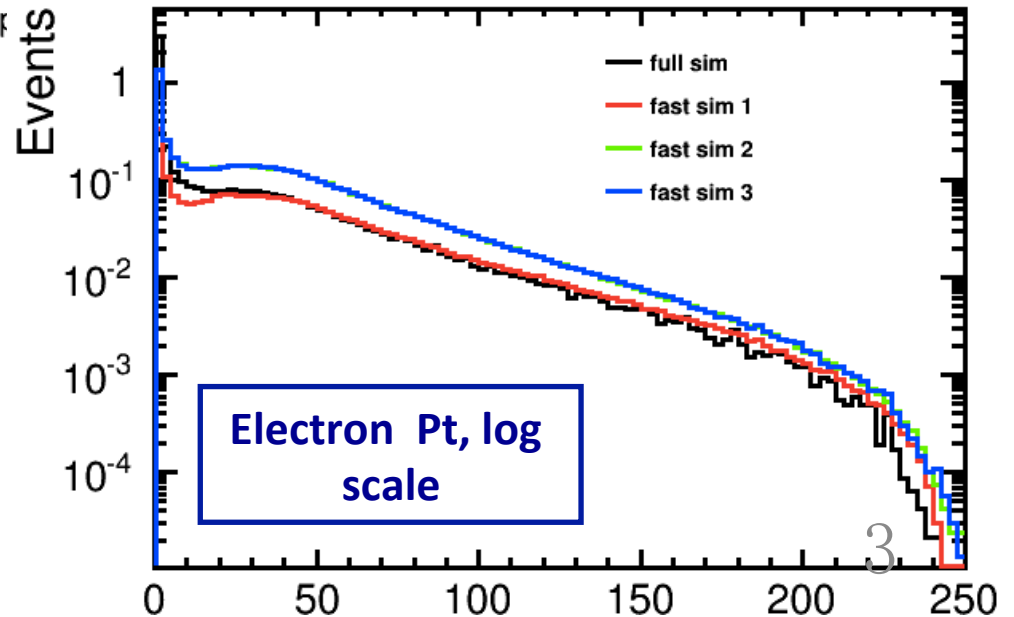
SGV1, SGV2, SGV3

(in order of date) vs full sim

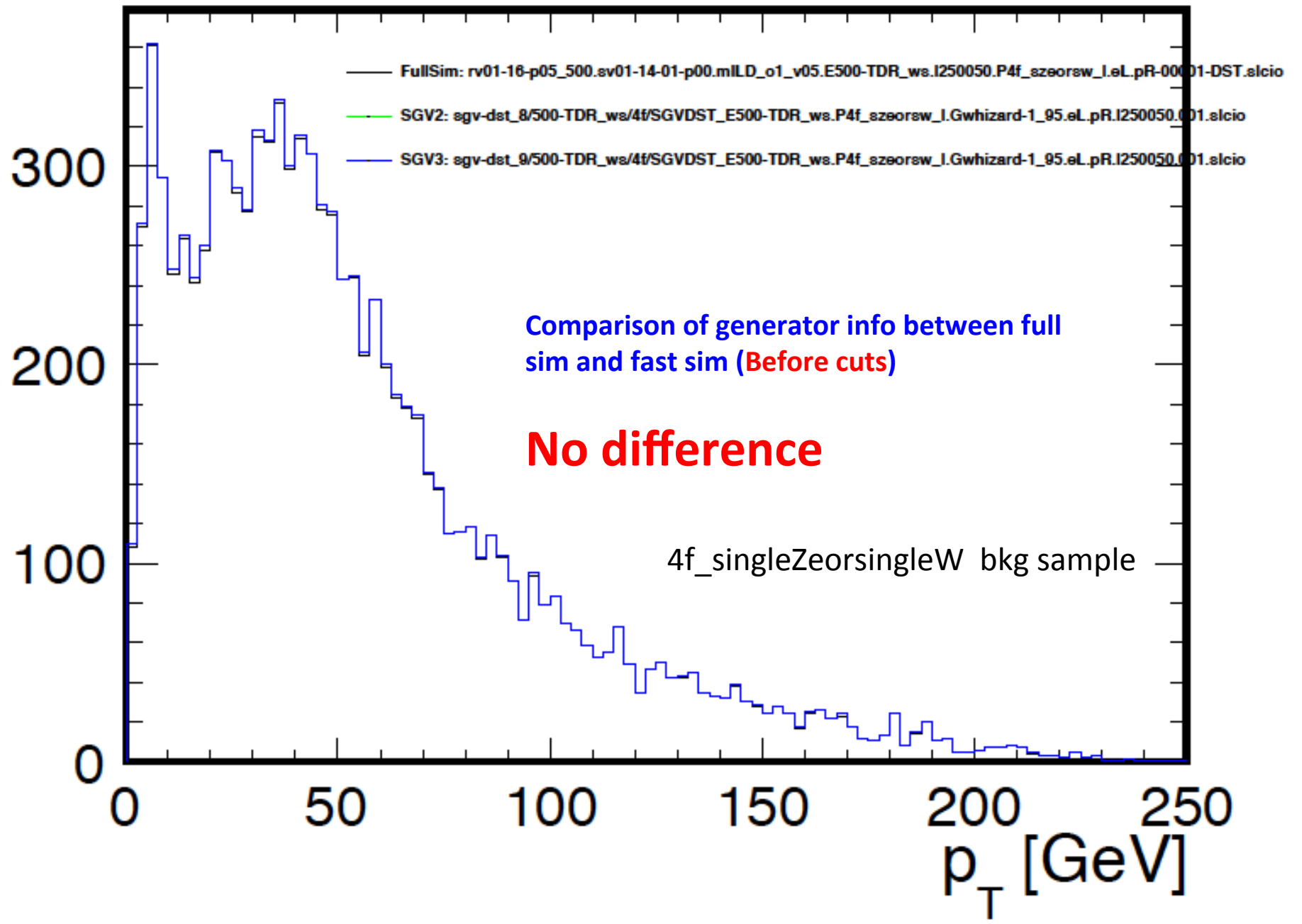
some inconsistency in Pt and $\cos\theta$
between full sim and fast sim samples

We are using SGV3 now

Normalized to # of generated events



Comparison of generator-level final-state electron (PDG==11), first 10k events (szeorsw)

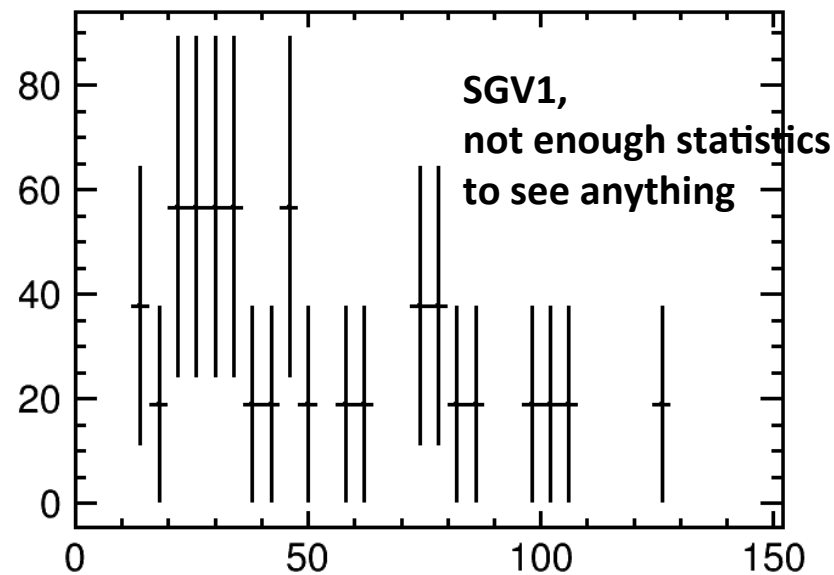
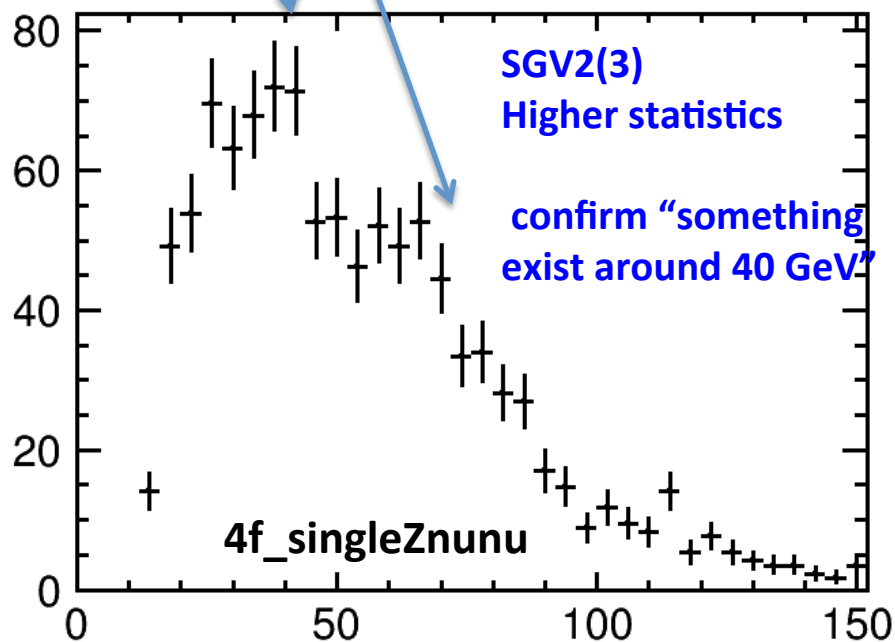
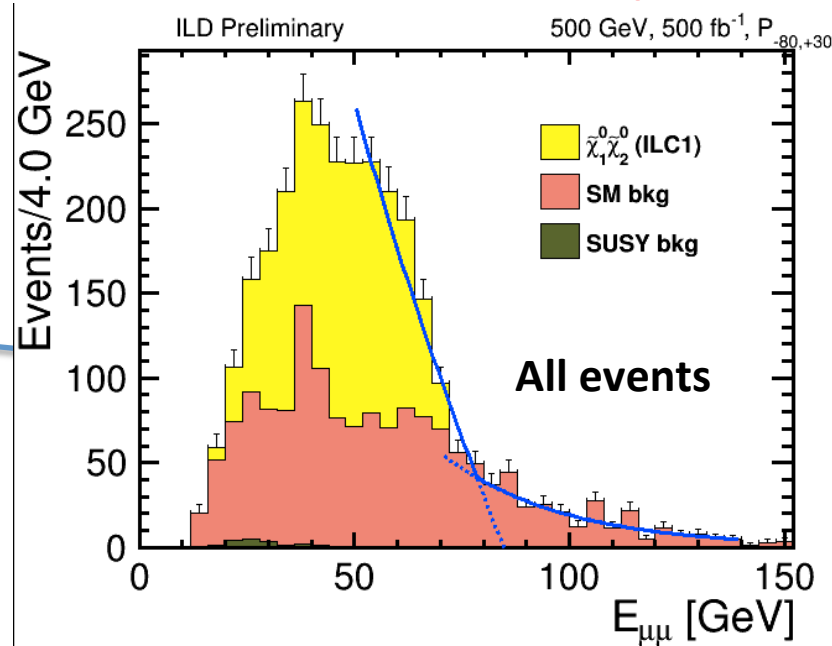


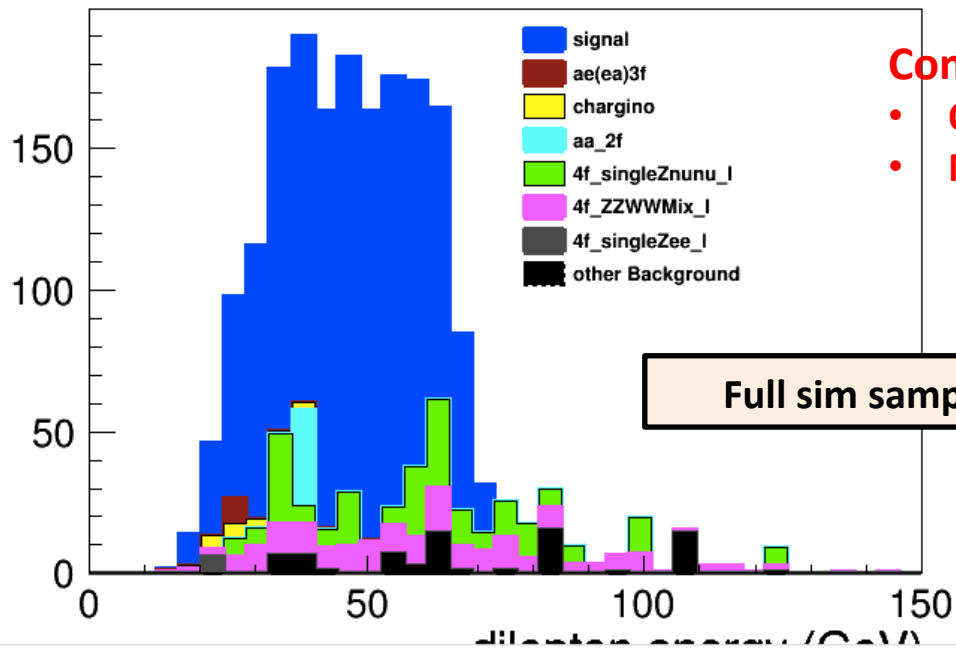
**E_mumu,
after all cuts applied**

What is the strange excess around 40 GeV (+ other places ?)

reconstructed info

Some structure around these places



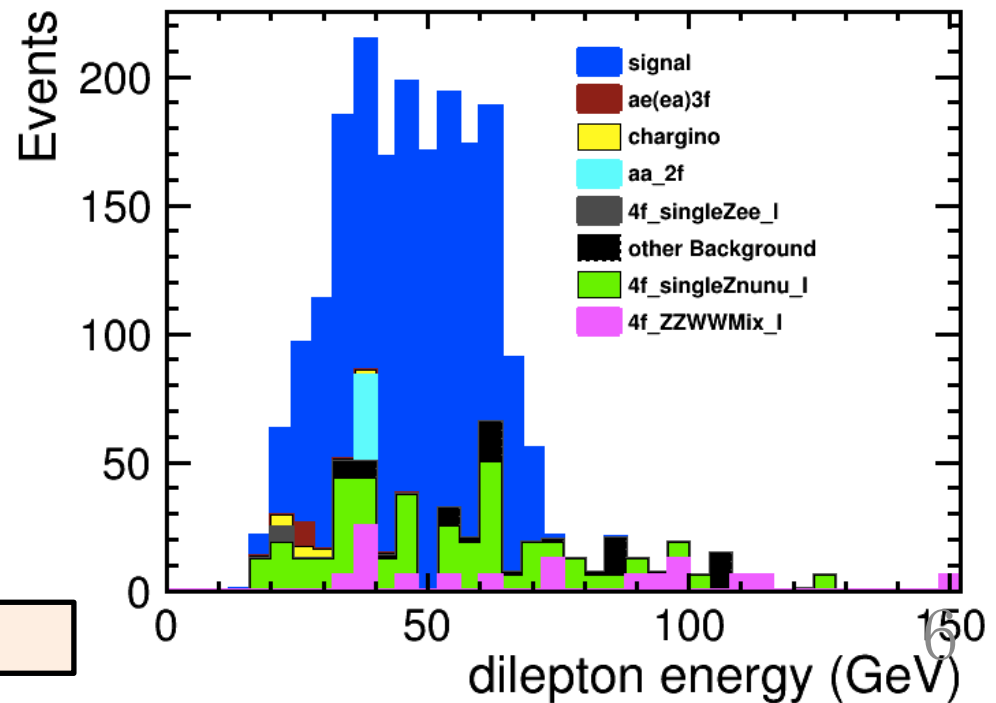


Compare effect of lepton finding methods

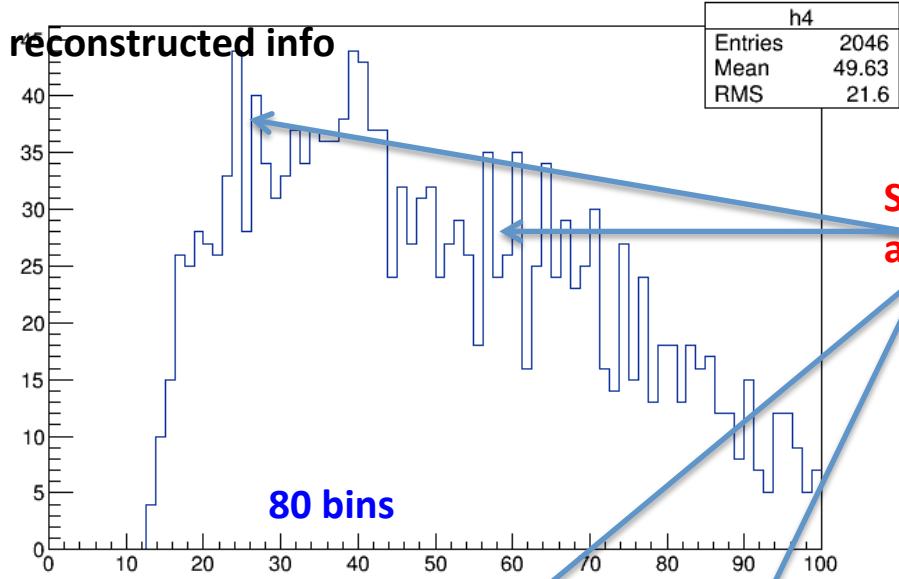
- Old : MVA based
- New: simple cone energy and impact parameter

$E_{\mu\mu}$, left pol

Not huge difference (?)

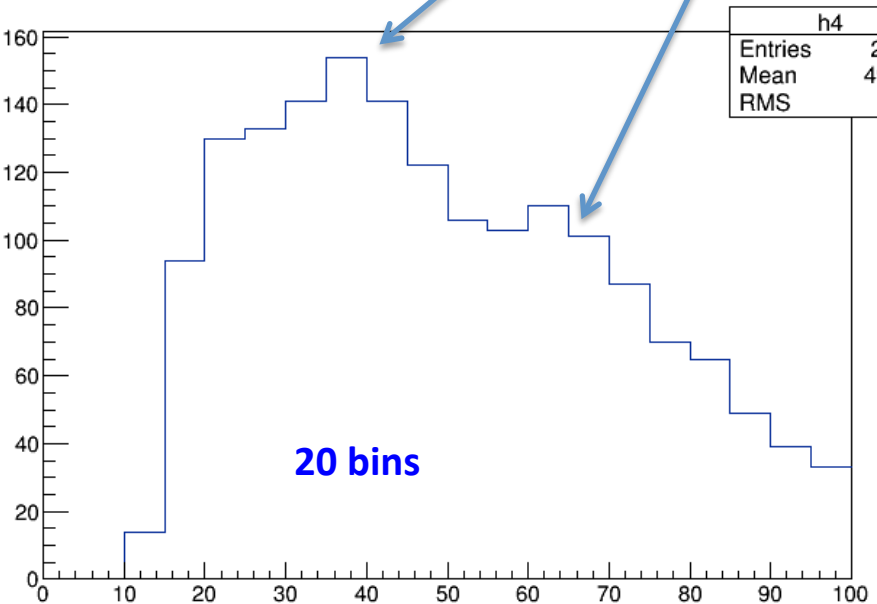
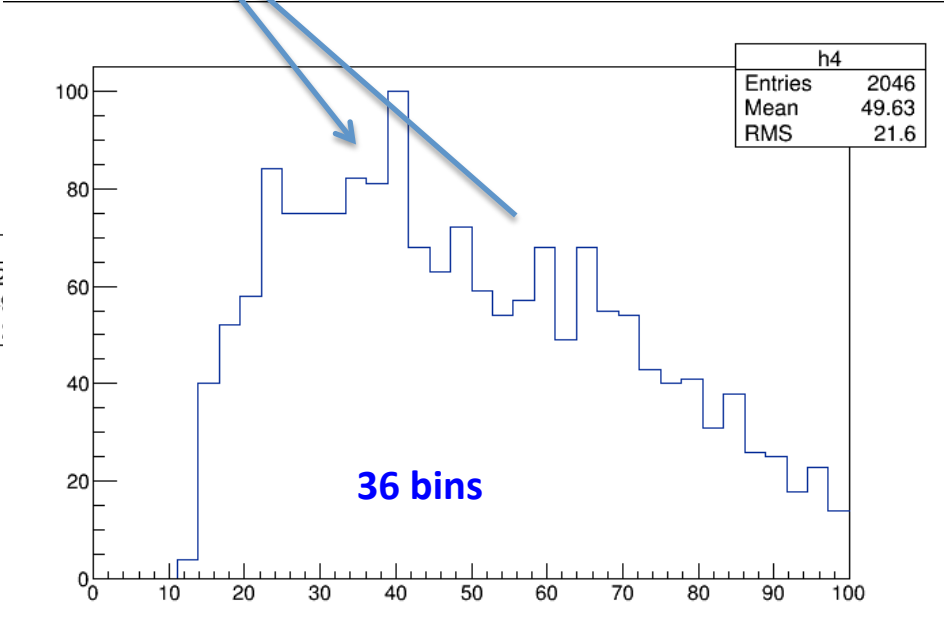


**E_mumu,
after all cuts applied**



Some structure
around these places

reconstructed info
of 4f_singleZnunu

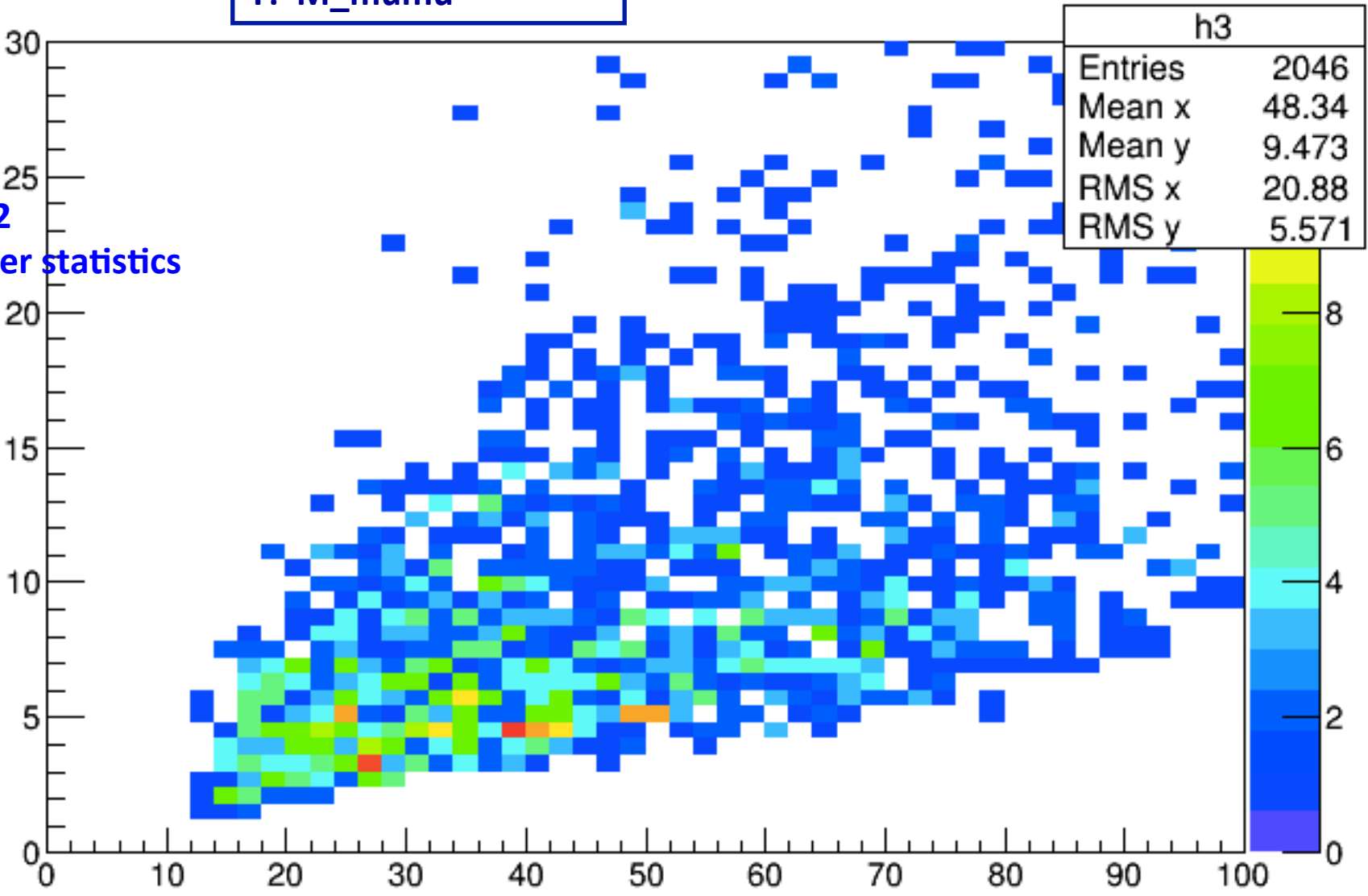


SGV2

Scatter plot of
X: E_mumu
Y: M_mumu

reconstructed info
of 4f_singleZnunu

SGV2
Higher statistics

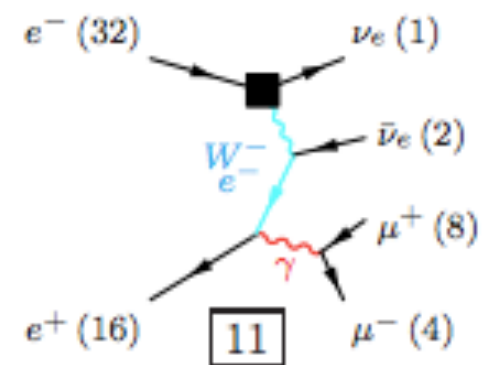
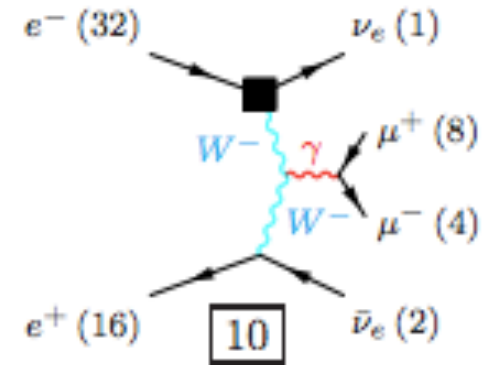
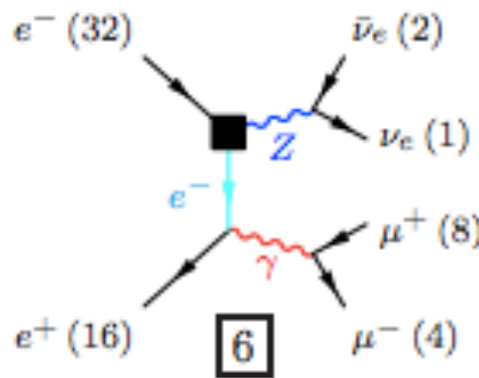
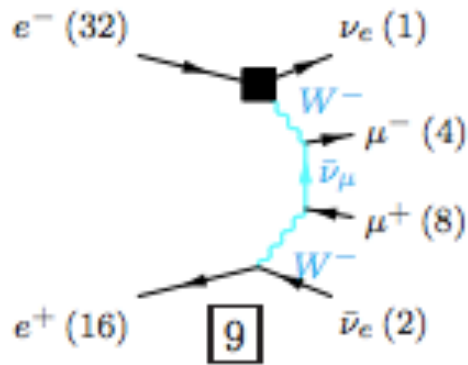


Major Residual bkg

in region of higher kinematic edge of M_{inv} and E_{dl}
 4f_leptonic processes involving missing energy

$\mu\mu$: 4f_singleZnunu_l

Dimuons not coming from Z



These are not all the diagrams

Extraction of Higgsino Mass

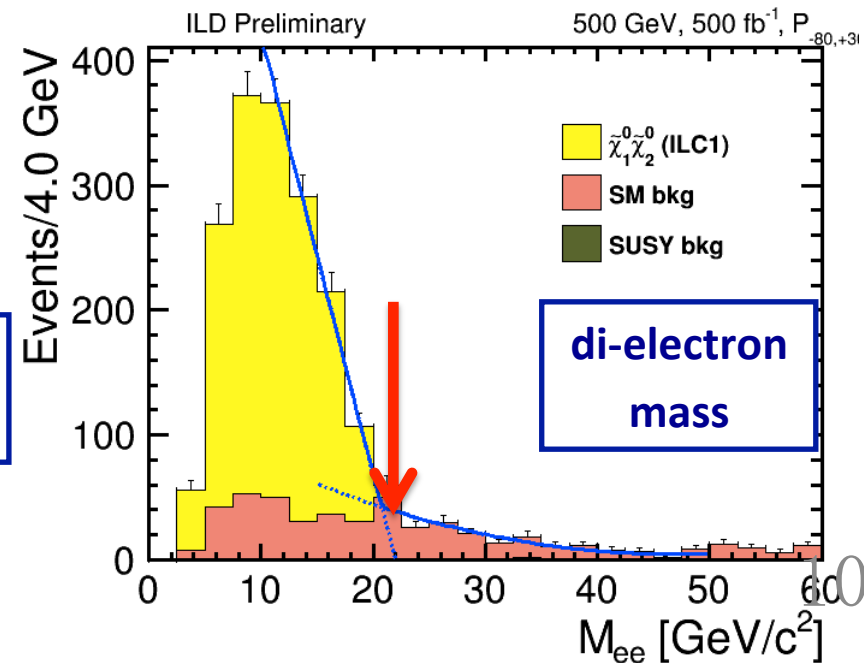
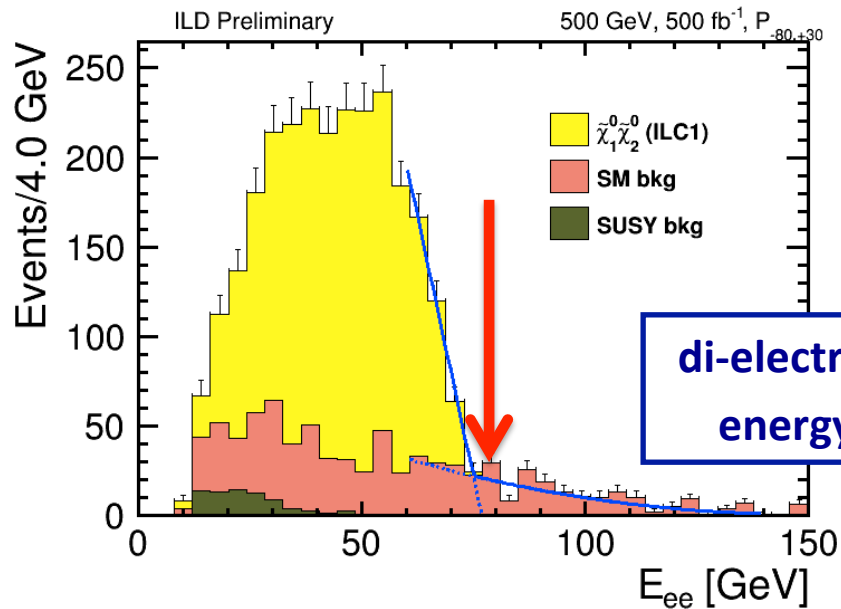
[work in progress]

Neutralino mixed production with leptonic decay

$$e^+e^- \rightarrow \tilde{\chi}_1^0 \tilde{\chi}_2^0 \rightarrow \tilde{\chi}_1^0 \tilde{\chi}_1^0 \ell^+ \ell^-$$

- The position of the kinematic edges of the dilepton energy (E_{ll}) and invariant mass (M_{ll}) are functions of CM energy and the two neutralino masses.
- The maximum values $E_{ll,max}$ and $M_{ll,max}$ are extracted by a fit to obtain the neutralino masses after correcting for detector/reconstruction effects`

Similar for case of chargino pair production ($ll \rightarrow jj$)



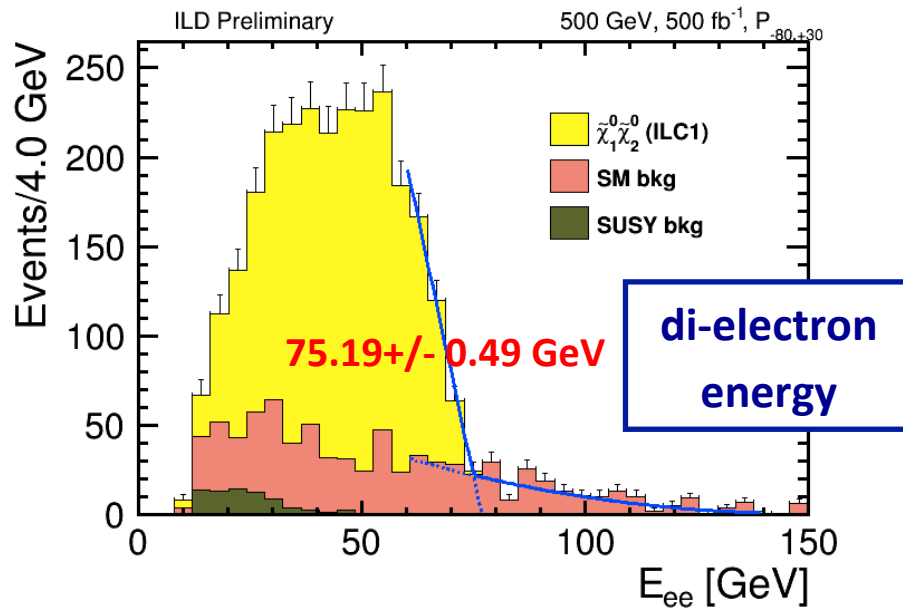
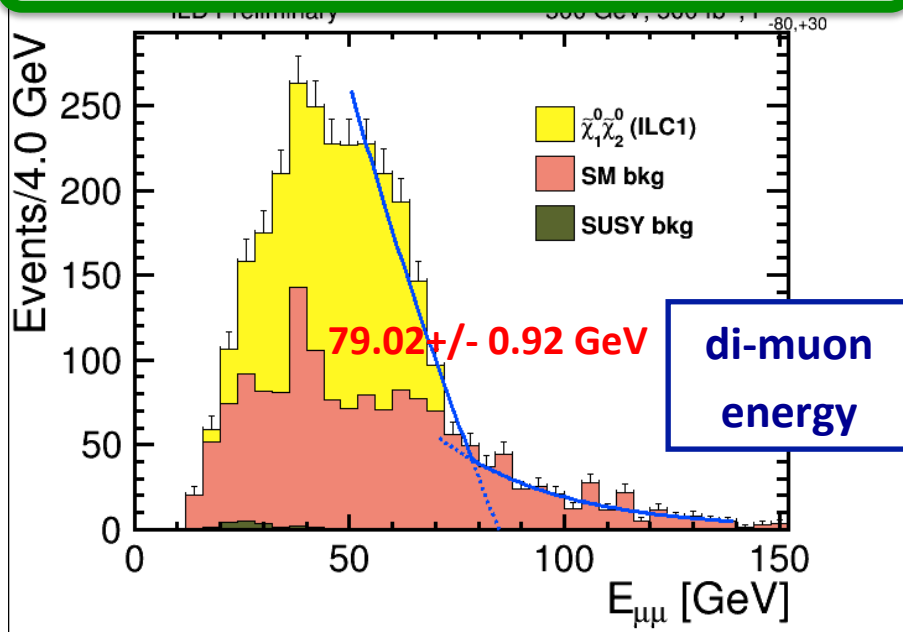
Cuts have been designed so as not to destroy upper edge

- Use toy MC (generated from MC data fit) to evaluate statistical uncertainty

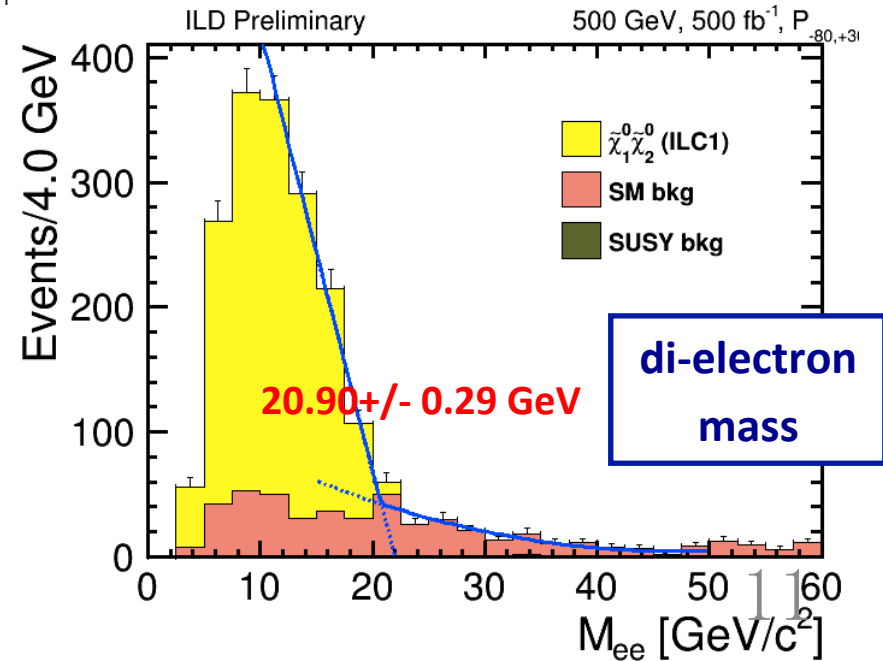
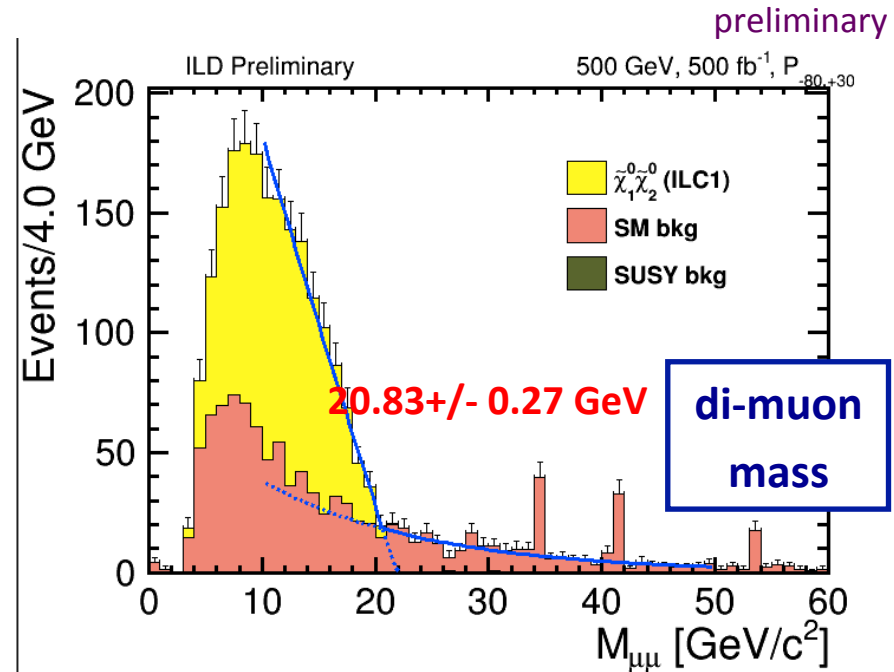
Edge extraction precision $\sim 1\%$

Neutralino mixed production with leptonic decay

$$e^+e^- \rightarrow \tilde{\chi}_1^0 \tilde{\chi}_2^0 \rightarrow \tilde{\chi}_1^0 \tilde{\chi}_1^0 \ell^+ \ell^-$$

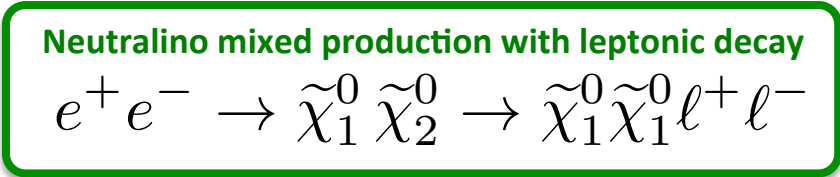


Polarization (P_{e-}, P_{e+}) = (-0.8, +0.3)

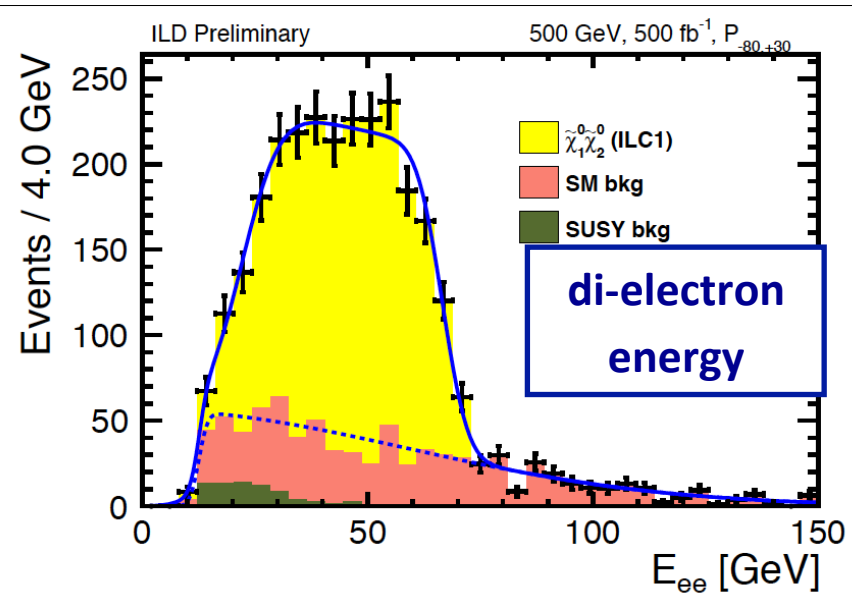
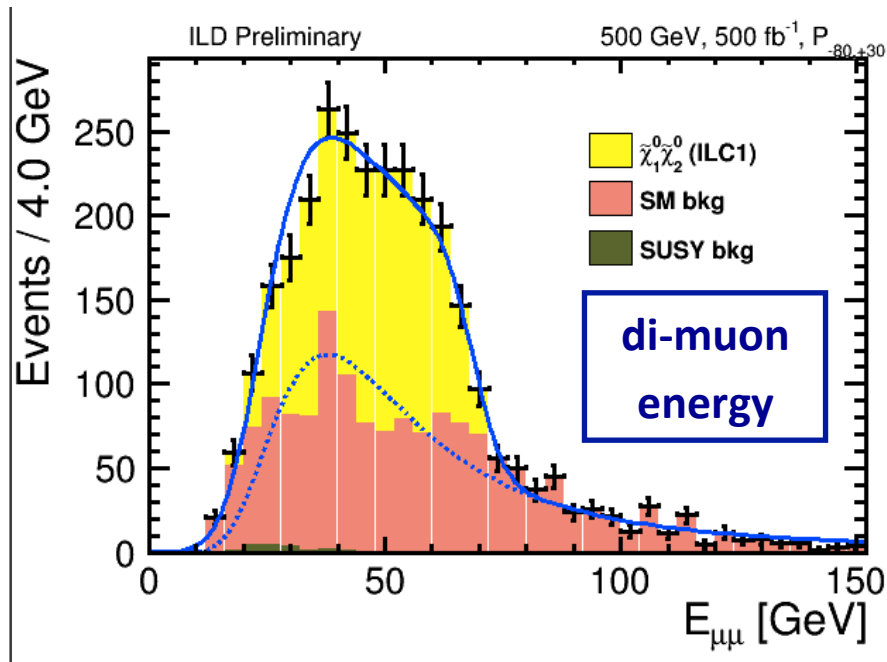


Extraction of Cross Section [work in progress]

Strategy: Fit overall shape to estimate total number of signal events



preliminary



The results of Higgsino mass and cross section become input to the parameter fit to extract SUSY parameters (e.g. Wino and Bino masses, $\tan\beta$, etc.)

Additional Material