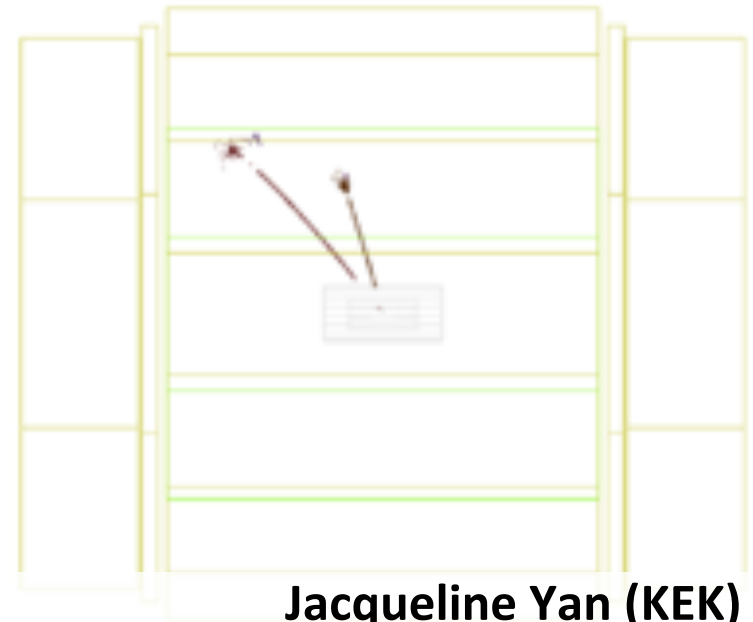
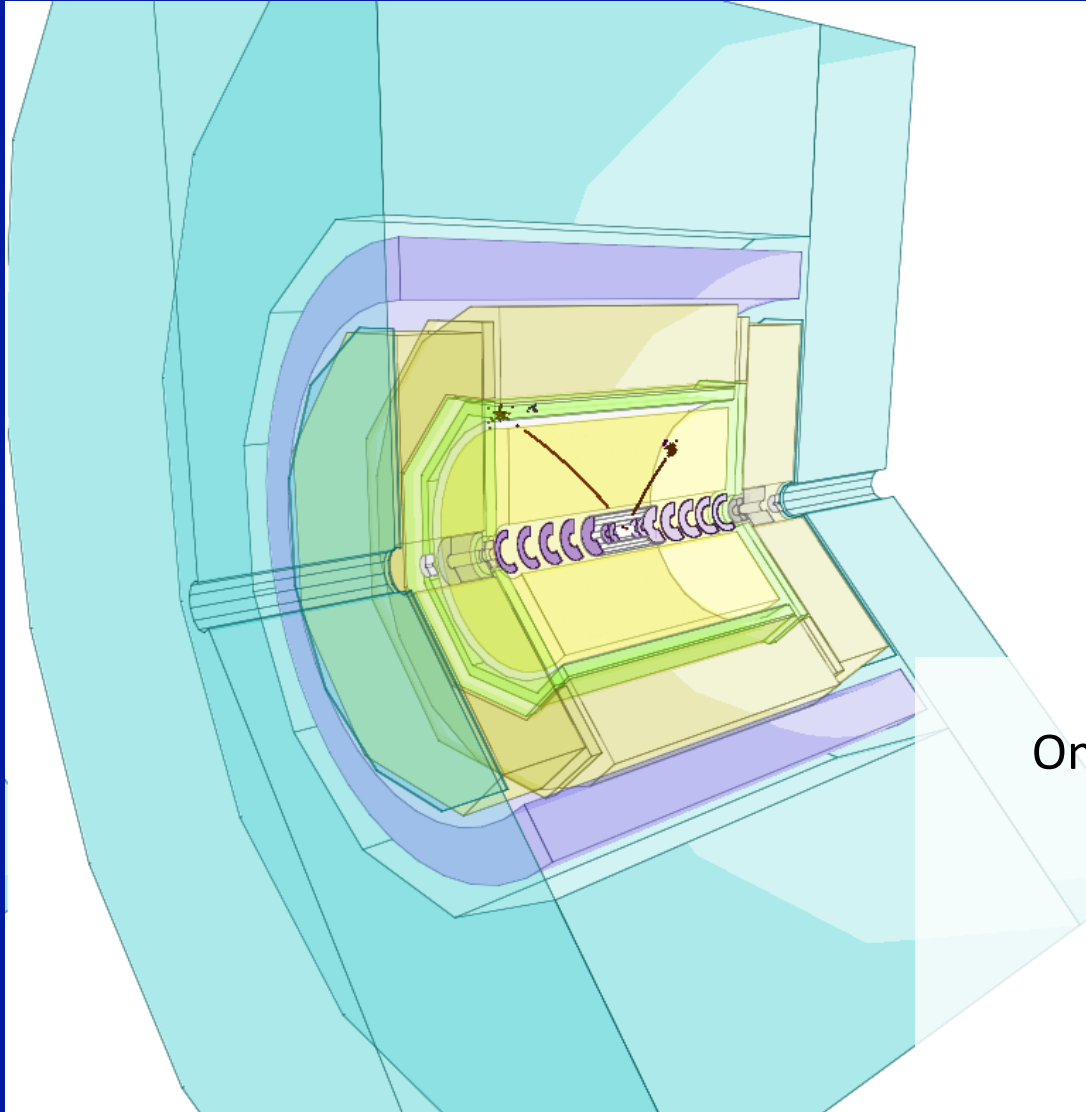


Report of BSM Study Group (Talks at ICHEP 2016)



Jacqueline Yan (KEK)
On behalf of the ILD BSM study group

**ILD Software
and Analysis Meeting**

Aug 10, 2016

ILD-related BSM Talks at ICHEP

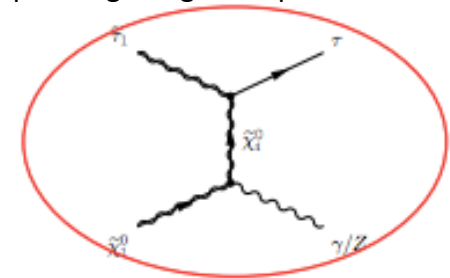
<	Thu 04/08	Fri 05/08	Sat 06/08	All days	>
Print PDF Full screen Detailed view Filter					
09:00	BSM physics at CLIC (15' + 5')			<i>Rosa Simoniello</i>	📁
	<i>Chicago 7</i>			09:00 - 09:20	
	SUSY model and dark matter determination in the compressed-spectrum region at the ILC. (15' + 5')			<i>Mikael Berggren</i>	
	<i>Chicago 7</i>			09:20 - 09:40	
	WIMP Searches at the International Linear Collider (15' + 5')			<i>Moritz Habermehl</i>	📁
	<i>Chicago 7</i>			09:40 - 10:00	
10:00	Naturalness and light higgsinos: a powerful reason to build ILC (15' + 5')			<i>Dr. Jenny List et al.</i>	📁
	<i>Chicago 7</i>			10:00 - 10:20	

SUSY model and dark matter determination in the compressed-spectrum region at the ILC

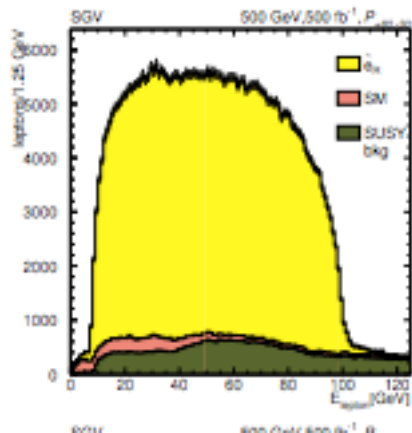
Mikael Berggren, on behalf of the ILC Physics and Detector Study

<http://indico.cern.ch/event/432527/contributions/1072434/attachments/1321206/1981376/berggren-ictp-chicago-aug-2016.pdf>

- SUSY explains well the observed dark matter density
- favored by stau co-annihilation and small $\Delta M(\text{NLSP} - \text{LSP})$
 → Not excluded by LHC, only detectable at lepton collider



- **Show prospects for observation / precision characterization of SUSY with small ΔM @ ILC**
- SUSY masses can be determined at O(0.1)%-level, mixings at %-level (?)
 → enables ILC to measure DM relic density with precision close to Planck's CMB results
- synergies of ILC and HL-LHC results.



s from edges ($E_{CMS}=500, 500 \text{ fb}^{-1} @ [+0.8,-0.3]$)

selectrons:

$$M_{\tilde{e}_R} = 126.20 \pm 0.21 \text{ GeV}/c^2$$

$$M_{\tilde{\chi}_1^0} = 95.47 \pm 0.16 \text{ GeV}/c^2$$

snuons:

$$M_{\tilde{\mu}_R} = 126.01 \pm 0.51 \text{ GeV}/c^2$$

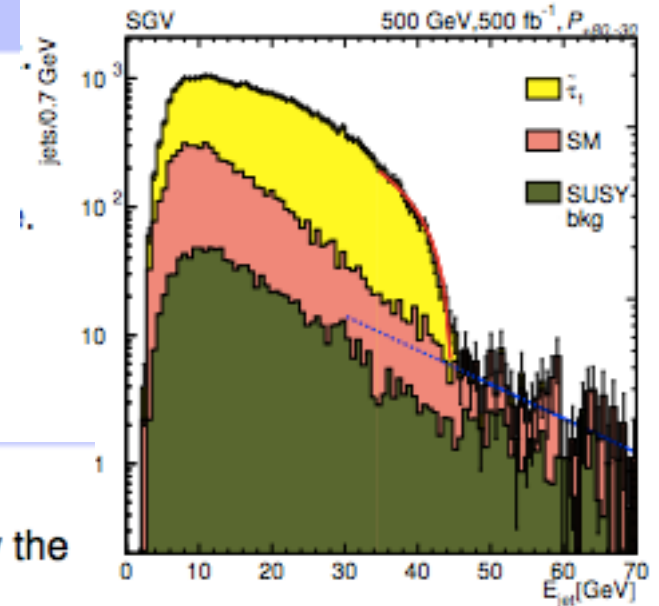
$$M_{\tilde{\chi}_1^0} = 95.47 \pm 0.38 \text{ GeV}/c^2$$

combined:

$$\sigma_{M_{\tilde{\chi}_1^0}} = 147 \text{ MeV}/c^2 \quad \sigma_{M_{\tilde{\ell}_R}} = 194 \text{ MeV}/c^2$$

$$E_{max,\tilde{\tau}_1} = 44.49^{+0.11}_{-0.09} \text{ GeV}$$

Translates to an error on the mass of 0.27 GeV/c², dominated by the error from $M_{\tilde{\chi}_1^0}$.



Naturalness and light Higgsinos: a powerful reason to build ILC

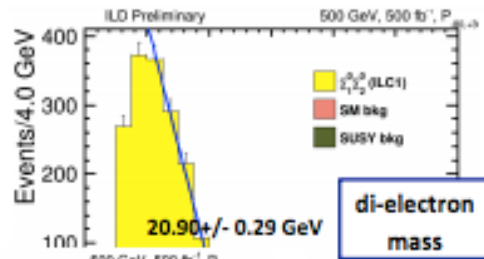
Howard Baer (U. of Oklahoma), Jenny List (DESY)

with J. Yan (KEK), S.L. Lehtinen (DESY), M. Berggren (DESY), K. Fujii (KEK) and T. Tanabe (Tokyo)

http://indico.cern.ch/event/432527/contributions/1071436/attachments/1321032/1981067/ichep_Baer-List.pdf

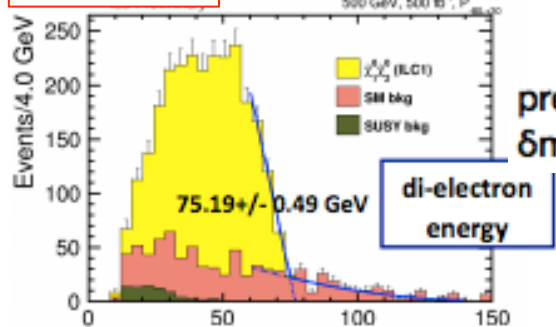
- if there is natural SUSY, ILC is a light Higgsino factory
- Pair production of four light Higgsinos not too far above Z boson mass
- small mass splittings : 5-20 GeV

Kinetic edge fit to extract mass



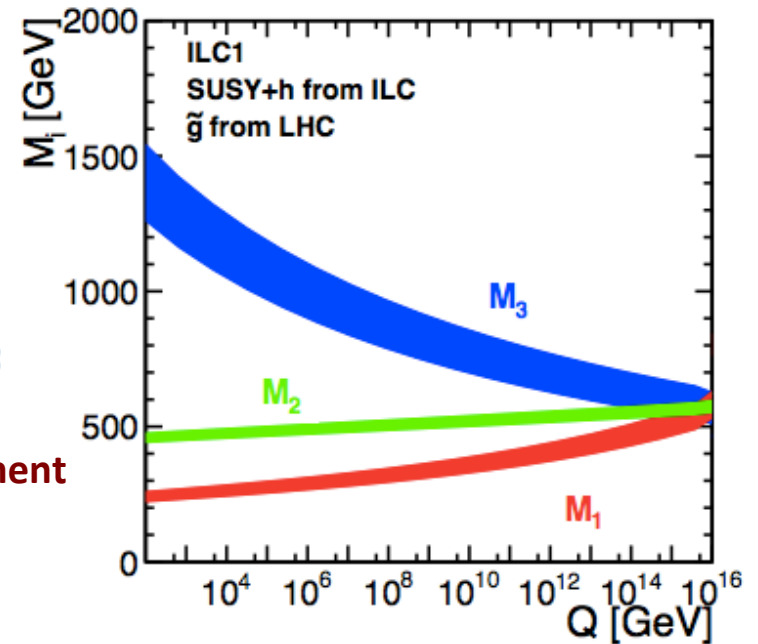
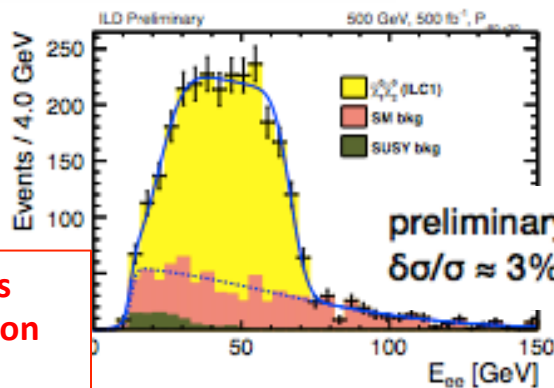
preliminary precision for 500/fb @ GeV:
 $\delta m/m \approx 1\%$

Demonstrate measurement precision of Higgsino properties at %-level



preliminary precision for 500/fb @ GeV:
 $\delta\sigma/\sigma \approx 3\%$ (for $P(e^-,e^+)=(\pm 80\%, \mp 30\%)$)

Cross section fit



together with Higgs couplings, allow for extraction of SUSY parameters and allows to test for unification and to probe the GUT scale

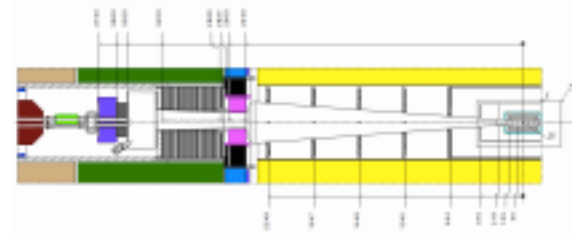
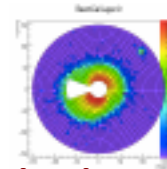
WIMP Searches at the International Linear Collider

Moritz Habermehl, with Keisuke Fujii, Jenny List, Shigeki Matsumoto, and Tomohiko Tanabe
http://indico.cern.ch/event/432527/contributions/1072339/attachments/1320087/1979345/MHabermehl_WIMPs_ILC_ICHEP2016.pdf

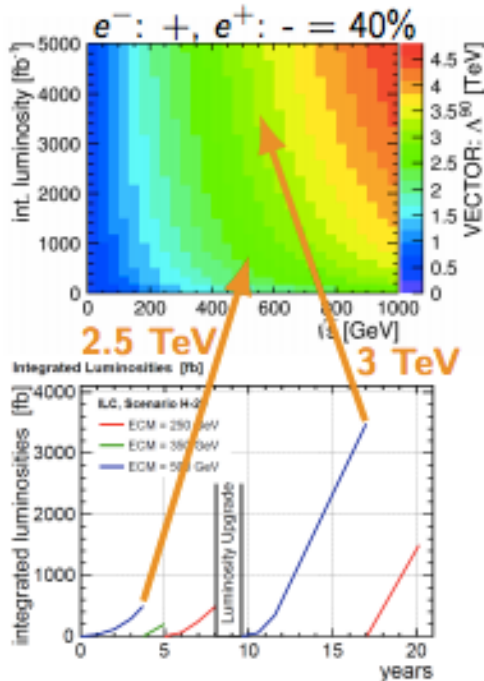
- evaluation of future prospects for WIMP searches and characterization
- WIMPs are among favorite candidates for dark matter
- ILC covers unique parameter space, complementary to LHC searches and direct detection
- Polarized beams are essential to reduce SM backgrounds and to determine WIMP model

- Use ISR photon tag
- WIMP pair production can be probed for masses up to $\sim \sqrt{s}/2$
- But sensitive up to $\Lambda = 3-4$ TeV

BeamCal has to be moved closer to interaction point by 40 cm



Evaluate dependency on \sqrt{s} , luminosity, beam polarization



- extrapolation of sensitivity from full simulation
 - for small M_χ (< 100 GeV)
 - reachable Λ at different \sqrt{s} and integrated luminosities
- allows to give estimates for sensitivity
 - for different time scales
 - for different running scenarios
- for $\sqrt{s} = 500$ GeV
 - after first four years: $\Lambda \approx 2.5$ TeV
 - after full ILC programme: $\Lambda \approx 3$ TeV
- for upgrade to $\sqrt{s} = 1$ TeV: $\Lambda \approx 4.5$ TeV

detector design has crucial impact
 \Rightarrow maintain hermeticity in forward region down to few mrad

