Report from Physics WG

Keisuke Fujii
on behalf of the Physics WG
Sep. 21, 2016

Subgroup Activities

1. Higgs/EW WG (Junping Tian, Graham Wilson)

held 1st Higgs/EW subgroup meeting on Aug. 31, got ~14 participants, reviewed status of major ongoing studies, and discussed plans and ideas:

1. H→μ+μ- (Shin-ichi Kawada)
2. H→WW in Higgsstrahlung (Mila Pandurovic)
3. mW with single W production (Katsu Kotera)
4. H→invisible (Yu Kato)
5. mH reconstruction & HHH coupling (Junping Tian)
6. Higgs/EW analysis plans (Graham Wilson)
7. Anomalous HVV couplings (Tomohisa Ogawa)
8. HHH coupling using HH→bbWW* (Masakazu Kurata)
9. discussions on plans and/or interests (others)

https://agenda.linearcollider.org/event/7334/

Beam energy/luminosity spectrum calibration: a common issue for precision mass measurements (mW, mH, mt)

News about documentation

- vvH, H→bb/cc/gg (separating ZH and WW-fusion) @ 350 GeV: PhD thesis by F.Mueller

- Higgs self-coupling, state-of-the-art ZHH analysis @ 500 GeV: PhD thesis by C.Duerig

- Leptonic recoil analysis @ 250, 350, 500 GeV: paper submitted, being reviewed, arXiv:1604.07524, by J.Yan

- Higgs CP measurement using H→ττ @ 250 GeV: *draft being reviewed in ILD*, by D.Jeans

The next dedicated Higgs/EW subgroup meeting:

Sep. 28, 2016

Subgroup Activities (continued)

3. BSM WG (Mikael Berggren, Jacqueline Yan)

Higgsino Analysis (Jacqueline Yan)

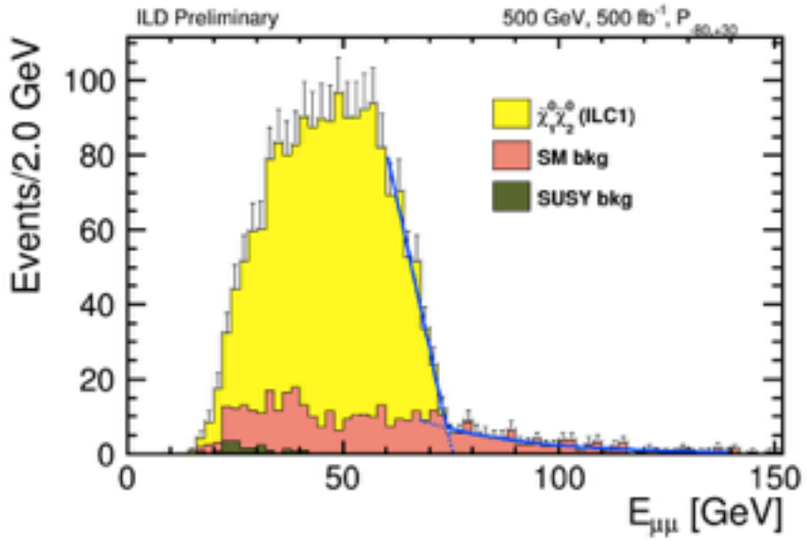
Current analysis@500 GeV for ILC1 benchmark
almost finished

- Δ M ~ 21(15) GeV for neutralinos (chargino)
- mC1=117 GeV, mN2=124 GeV, mN1=103 GeV

m0=7.03TeV, m1/2=568.3GeV, tanβ=10, mu=115, MA=1000, A0=-1.04e4

N1N2: $e^+e^- \to \tilde{\chi}_1^0\tilde{\chi}_2^0 \to \tilde{\chi}_1^0\tilde{\chi}_1^0\ell^+\ell^-$

C1C1: $e^+e^- \to \tilde{\chi}_1^+\tilde{\chi}_1^- \to \tilde{\chi}_1^0\tilde{\chi}_1^0 qq'\ell\nu$



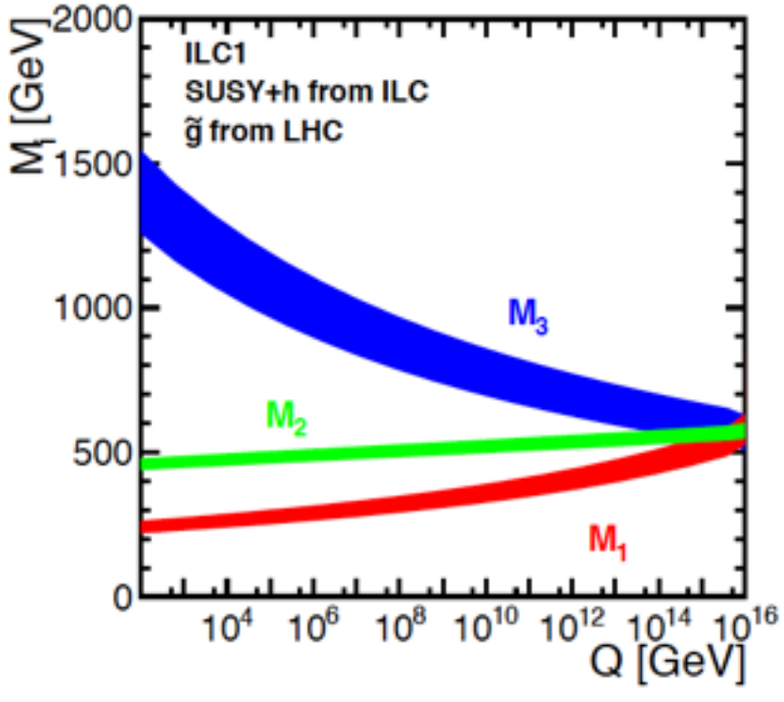
Mass precision ~ 0.2% (H20)

Cross section precision ~ 1-1.5% for N1N2 (H20)

~ 0.5% for C1C2

Global Fit (incl. precision Higgs measurements)
(Suvi-leena Lehtinen)

Test of gaugino mass unification



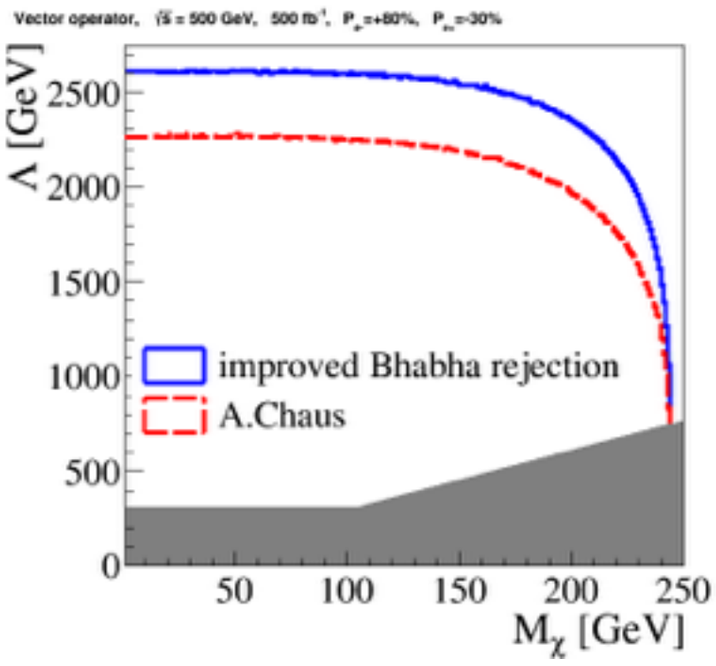
Generic WIMP Analysis

Talk given at ICHEP

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

Lower Bhabha background than in previous ILD analysis
by A.Chaus → sensitivity improved by 15%.
(forward hermetically crucial for Bhabha rejection)

after 1st 4 years → Λ~2.5TeV
H20 → Λ~3TeV



Integration of full simulation study and phenomenology

1. Full simulation study done by M.Habermehl (DESY)
2. New phenomenology study (fast simulation) in progress by T.Katayose and S.Matsumoto (IPMU)
3. Next step: integration of the two studies

(--> Can we expect results for LCWS?)

Subgroup Activities (continued)

3. Top/QCD WG (Roman Peoschl, Hitoshi Yamamoto)

Report from Roman

- At LAL we have started/continued to look into **ee→bb** since
  a) it is an important process to understand to complement the top results and
  b) it is a challenging channel for the detector concerning the b-charge measurement.
- *Yo Sato is working at LAL* on **the matrix element method** with Francois Le Diberder and Emi Kou. Yo performed *the full kinematical reconstruction (including neutrinos) after b-bbar hadronization, before and after detector level*, for ee→ttbar→mu+mu-(γ) b bbar nu nubar. For b-reconstruction he used both b-jet algorithm and Thrust axis method in search of optimum way to reconstruct b-quark directions.
  As of now, some relevant effects (gluon emission by tops, ISR, beamstrahlung) have been switched off to simplify the work. He is currently writing down a short report on his work. Next step before he returns to Japan is to apply his reconstruction to a one-parameter fit (CP violation).
- Marcel Vos has circulated **a draft for a paper on CPV couplings** (based on the DBD study). Around this draft *an intensive discussion* is going on between Richard, Bernreuther and Vos (with Roman rather as a spectator) *around the scope of the theory part but in particular what is needed for the ILC to make a real impact* in these measurements. It seems that here for example one indeed needs the full luminosity to arrive at necessary precisions.

Report from Marcel

Concerning the ongoing activities at IFIC:

- work is ongoing by Martin Perello and the theorists behind the SM-EFT@NLO project - Cen Zhang and Gauthier Durieux - to perform **a global fit to the coefficients of effective D6 operators** on representative LC data sets. This builds *on the IFIC/LAL study of the constraints of top EW couplings, but adds several observables and generalizes to a wide range of sqrt(s).*
- - Nacho Garcia and Martin Perello work with Philipp Roloff and Rickard Strom at CERN to understand the performance of **top reconstruction at sqrt(s) beyond 1 TeV**. Preliminary results are presented in the CLICdp meeting today: https://indico.cern.ch/event/563319/
- - Março Boronat and Pablo Gomis - supervised by Juan Fuster - are working on the **extraction of the top quark mass in the continuum**. This analysis takes advantage of the *"return-to-the-threshold" effect by measuring the energy of ISR photons*. Most attention is going into a realistic estimate of the uncertainty due to the luminosity spectrum.

LCWS preparation

Roman and Marcel (and the other conveners) are starting to compile the agenda for the top session at LCWS16

Support Document that follows up the ICFA letter

First authors' meeting held on Sep. 9

Discussed the structure and basic ideas about contents together with how to share the writing

The ILC's Potential for Discovering New Particles

Document Supporting the ICFA Response Letter to the ILC Advisory Panel

The purpose of this document is to provide in-depths material supporting statements on the ILC's discovery potential for new particles sketched out in the answer of ICFA to the ILC Advisory Panel of MEXT, taking into account LHC Run II development.

Target: Particle physicists (a version for the MEXT ILC Advisory Panel will be prepared based on this)

Length: 25 - 30 pages

Deadline: originally the end of summer 2016, but since X750 is gone and no immediate action seems to be expected, we could postpone it a little bit: **1st rough draft by Sep. 30.** and a **1st presentable draft by the Morioka WS**.

Guideline:

1. Minimize overlap with the ILC physics case update document from last year. → focus should be on the ILC's new particle discovery potential and the relation to LHC (and others like direct/indirect detection, flavor, neutrinos, ... where appropriate). Nevertheless, we recapitulates the major points of precision Higgs and top studies from the BSM points of view.
2. We will hand this document to ICFA who will decide how to use it best in the political process.
3. Assign two main authors responsible for each subsection, who will then be in charge of organizing smaller contributions (e.g. subsubsections) etc.
4. Of course every author, as well as the whole LCC Physics Group will have the opportunity to comment on and give input to the whole document.

Physics focus schedule

Sep 28: Dedicated Higgs/EW subgroup meeting

Oct 5: S&A meeting with physics focus on BSM

Oct 19: S&A meeting with physics focus on Top/QCD