



Focus topics for the ECFA study on Higgs / Top / EW factories

Report from the Focus Groups: ZHang and LUMI experts' groups

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Outline

1. The paper on focus topics for the ECFA study on Higgs / Top / EW factories has been released (https://cernbox.cern.ch/pdf-viewer/public/D68ojcg6OjMx2K4/ECFA_Focus_Topics.pdf)
2. 3rd ECFA WS approaching, as well as the deadline for the required input from the Focus Groups for the European Strategy
3. I'll summarize here the input associated with the focus topics ***Zh angular distributions and CP studies (ZHANG)*** and the ***Precision luminosity measurement (LUMI)***
4. And also highlight existing and expected results by the ILD

Zh angular distributions and CP studies (ZHang)

Expert Team: Cheng Li, Chris Hays, Gudrid Moortgat-Pick, Ivanka Bozovic, Ken Mimasu, Markus Klute, Sandra Kortner

A CP-odd interactions

- a. Models predicting CP-odd couplings – Gudi Moortgat-Pick (theory)
<https://indico.cern.ch/event/1415724/>
- b. CP at LHC -- Sandra Kortner
https://indico.cern.ch/event/1393738/contributions/5858478/attachments/2821768/4927913/ECFA_LHC_CP.pdf
- c. HZZ CP at FCC -- Andrei Gritsan & Nicholas Pinto
<https://indico.cern.ch/event/1393738/contributions/5858480/>
- d. CP at CEPC
<https://indico.cern.ch/event/1415724/>
- e. **HVV CP at 1 TeV ILC -- Ivanka Bozovic-Jelisavcic**
ILD-PHYS-PUB-2024-002, arXiv <https://arxiv.org/abs/2405.05820>
- f. CP at e+e- with transverse polarization -- Cheng Li
https://indico.desy.de/event/33640/contributions/128808/attachments/77537/100295/chengli_ecfa.pdf
- g. CP in H->tau-tau -- Kazuki Sakurai (theory)
<https://indico.cern.ch/event/1311033/contributions/5594844/>

Zh angular distributions and CP studies (ZHang)

Expert Team: Cheng Li, Chris Hays, Gudrid Moortgat-Pick, Ivanka Bozovic, Ken Mimasu, Markus Klute, Sandra Kortner

B CP-even interactions

- a. H \rightarrow Z γ in the 3HDM -- Emine Yildirim <https://indico.cern.ch/event/1132480/timetable/#20220420.detailed>
- b. Additional Higgs bosons -- Sven Heinemeyer <https://indico.desy.de/event/33640/contributions/127616/attachments/77597/100376/sven-Higgs.pdf>
- c. HZZ coupling at CLIC @ 350 and 1400 GeV -- Natasa Vukasinovic <https://indico.desy.de/event/33640/contributions/128809/>
- d. HZZ coupling sensitivity to angular observables -- Jiayin Gu <https://indico.cern.ch/event/1355212/contributions/5706081/attachments/2770210/4826548/hzz-x1.pdf>
- e. Coupling measurements at the LHC -- Nick Wardle <https://indico.cern.ch/event/1132480/contributions/4798453/>
- f. Update of the ILD ZHH analysis - Jenny List et al. (?)

Zhang – potential ILC/ILD studies

Further studies can determine whether there is scope to improve the sensitivity, or to extend it to additional interactions. (ILD meeting in January)

PHYSICS ANALYSES (CP-odd)

- Other channels in HZ: (inclusive Z decays), H to WW to hadrons (decay)
- *Other energies: H to $\tau\tau$ at higher ILC energies, not realistic to make it for October (I.B, Daniel Jeans et al.)*
- Analyses refinement: use optimal observable(s) to enhance sensitivity to the Higgs CP structure

ALGORITHMS

- Tracking and ID: τ and jet reconstruction
- Jet charge measurement (quark-antiquark separation in H to VV hadronic decays)

Precision luminosity measurement (LUMI)

Expert Team: Ivanka Bozovic, Mogens Dam, Fulvio Piccinini, Wiesław Płaczek, André Sailer, Maciej Skrzypek, Graham Wilson; Paolo Azzuri, Ayres Freitas, Adrián Irlés, Andreas B. Meyer

- **Low-angle Bhabha scattering (LABS):**
 - In the Focus topic document released beginning of the year, it has been concluded that **ILC/ILD systematics from metrology needs an update** (since A. Stahl, Luminosity measurement via Bhabha scattering: Precision requirements for the luminosity calorimeter, LC-DET-2005-004, Apr 2005) \Rightarrow done; to be presented at SWANA in July, LCWS24 - Ivan Smiljanic, I.B., G. Kacarevic, Metrology in the integrated luminosity measurement at ILC (and hopefully published in JHEP or similar);
 - Challenging systematics calls for (complementary) alternatives;

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- **Di-photon production (avoids EM deflections issues in addition to avoiding severe metrology and significant hadronic vacuum polarization):**
 - Graham Wilson, working to try to understand precision of low angle gamma-gamma events using a mini-tracker in front of the low-angle calo. Extension of measurement to lower polar angles ($|\cos\theta| < 0.9$): Presented at the ILC WS in January <https://agenda.linearcollider.org/event/10211/contributions/53837/>

LUMI – potential ILC/ILD studies

LABS is preferred for the point-to-point luminosity control, novel (central) processes to be investigated in addition to detailed understanding of metrology. (ILD meeting in January)

SIMULATION STUDIES

- **ILD needs detailed metrology study for LABS at all ILC energies (I.B)**
- **Di-photon production (G.W)** - A detailed study of the luminosity calibration using this process is still lacking and would be very important; Feasibility of angular acceptance precision (50 μm) for centrally reconstructed photons
- **Other processes (i.e. di-muon production at the Z-pole) Not realistic to make it for October (I.B. et al.);** Angular acceptance and position resolution of the central tracker, no BSM contributions