

Activity report from Higgs/EW group

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ILD Analysis/Software Meeting, Sept. 14

outline

- summary of 1st Higgs / EW group meeting
- news about documentation
- dedicated talk on anomalous HVV coupling (next talk by T.Ogawa)

Higgs/EW group meeting on Aug. 31st, 2016

- This is the first dedicated meeting of the ILD Higgs/Electroweak Physics Group.
- The expectation is that we foster more of a “working” meeting environment where we can discuss plans and ideas. Less emphasis on formal presentations. Hopefully easier for participants to actively participate especially in discussions.
- Frequency of these dedicated meetings to be finalized. Will be in “off-weeks” - out of phase with the bi-weekly general Software/Analysis meeting. Likely every 6 weeks. Next one TBD.

Higgs/EW group meeting on Aug. 31st, 2016

~14 participants, status of major ongoing studies

Specific short contributions

- 1 Shin-ichi Kawada: $H \rightarrow \mu^+ \mu^-$ update.
- 2 Mila Pandurovic: Higgs to WW in Higgstrahlung
- 3 Katsu Kotera: W Mass with Single W
- 4 Yu Kato: H to invisible
- 5 Junping Tian: Higgs Mass and Higgs self-coupling
- 6 GWW: Analysis plans related to Higgs/EW
- 7 Tomohisa Ogawa: Anomalous HVV Couplings
- 8 Masakazu Kurata: Higgs self-coupling using HH to bbWW*
- 9 Roundtable opportunity for others to briefly explain their plans and/or interests

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

very brief summary of the group meeting

o Electroweak

- ▶ **W mass (K.Kotera):** direct recon. from $W \rightarrow qq$; ILD benchmark; take over study by K.Tsuchimoto; aiming to apply newly developed recon. tools such as π^0 finder, PID, dE/dx ; systematics from hadronisation
- ▶ **W mass (G.Wilson):** polarised threshold scan; constrained reconstruction; direct recon. (exploiting per event JER, with B.Doren mass constrained $\pi^0 \rightarrow \gamma\gamma$, with J.Anguiano on $\pi^0 \rightarrow e^+e^-\gamma$ and $\eta \rightarrow \pi^+\pi^-\gamma$, can extend to more decay chains with vertex constraints)

very brief summary of the group meeting

o Electroweak

- ▶ **Z measurement (G.Wilson):** physics case for “Giga-Z”; detector case for “z-pole running”; detector performance and systematics
- ▶ **absolute \sqrt{s} determination (G.Wilson):** further work on $\mu\mu(\gamma)$; momentum scale calibration using $J/\Psi \rightarrow \mu\mu$, targeting 10ppm, $K^+ \rightarrow \pi^+\pi^-\pi^+$, $K^+ \rightarrow \mu^+\nu$?

very brief summary of the group meeting

o Higgs branching ratios

- ▶ $H \rightarrow \mu\mu$ (S.Kawada): ILD benchmark; preliminary cut based results obtained, $\delta\text{BR} \sim 60\%$ for H20 (40% by extrapolation); event-by-event weighting using $\Delta M(\mu\mu)$ ongoing; MVA & optimisation ongoing
- ▶ $H \rightarrow WW^*$ (M.Pandurovic): $Z \rightarrow qq$, $WW^* \rightarrow 4q$; MVA based results obtained, $\delta\text{BR} \sim 6\%$ with 500 fb^{-1} ; significantly better than extrapolation (9.2%), help improve Γ_H measurement; observed some inconsistency between two different signal samples

very brief summary of the group meeting

○ Higgs Properties

- ▶ **Higgs Mass (A.Ebrahimi)**: apply full kinematic fitting using $H \rightarrow bb$; preparing thesis; detail coming soon
- ▶ **Higgs Mass (G.Wilson)**: using direct recon. using $\nu\nu b\bar{b}$ channel (exploiting per event JER); improve leptonic recoil by vertex and beam-spot constraints & better electron momentum reconstruction
- ▶ **Higgs Mass (J.Tian)**: simplified new method (using just jet directions & Pt balance); for $Z \rightarrow \mu\mu/ee$, a factor ~ 3 better than recoil method; $Z \rightarrow qq$ ongoing

very brief summary of the group meeting

o Higgs Properties

- ▶ **Higgs CP (D.Jeans)**: full analysis using $H \rightarrow \tau\tau$ based new τ reconstruction method completed \rightarrow draft done, ILD internal review ongoing
- ▶ **Higgs CP (A.Drutskov)**: interested in some new method/channel to measure Higgs CP

very brief summary of the group meeting

- Higgs self-coupling
 - ▶ $HH \rightarrow bbWW^*$ (M.Kurata): focusing on new jet clustering; full results based on classical analysis completed \rightarrow publish together with $HH \rightarrow bbbb$ (C.Duerig), need check double counting
 - ▶ systematics based on EFT (J.Tian): qualitative analysis done; systematics from SM-like interactions done; ongoing systematic from BSM-like interactions

very brief summary of the group meeting

- BSM Higgs studies

- ▶ **H \rightarrow Invisible (Y.Kato)**: ILD benchmark; just get started; some exercise by reproducing leptonic recoil completed
- ▶ **anomalous HVV coupling (T.Ogawa)**: full results based on classical shape analysis completed \rightarrow paper in preparation; new progress on applying matrix element method (details in next talk)

news about documentation

- $\nu\nu H$, $H \rightarrow bb / cc / gg$ (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 $H \rightarrow \tau\tau$ @ 250 GeV: draft being reviewed in ILD, by D.Jeans