

ILD and its contributions to the ECFA Higgs factory study

Aleksander Filip Źarnecki



ILD @ LCWS'2024

July 12, 2024

ECFA study final report timeline

after ESU schedule announced in April

- June 2024: draft list of topics expected to be included in the final report
focus topics, but there is also space for additional topics
- October 2024: deadline for report results
new results should be presented, together with draft write-ups at the Paris workshop
- December 2024: finalized text of the report
released for the comments from the community
- March 31, 2025: submission as input to the European Strategy Update
- November 14, 2025: further input from the community (after Briefing Book)
updated (new?) results could also be presented at Open Symposium in June

Concept based on my private notes from ECFA WG1 conveners meeting at CERN

- Self-contained and reasonably comprehensive
not extensively repeating old studies, concise enough that people actually want to read it
- Starting point are the focus topics, but supplemented by other relevant topics available
extent of 'other topics' very area/WG1-group specific...
- Focus on the recent progress but give an overall context and overview
full coverage for results obtained after Snowmass reports

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- Focus on the recent progress but give an overall context and overview
full coverage for results obtained after Snowmass reports
- Encourage individual studies (or topics) having dedicated notes/papers with more details
report is likely to be quite large anyway, only few pages per topic
- tools like flavour tagging should be presented in a broader context

Concept (2)

- October workshop is considered as a deadline for new results to be included
1–2 page written summary, with 1–2 plots, per analysis should be available (draft)
also 1-2 slides for summary presentation, if not presented in a dedicated contribution
- I would not assume all results for the report need to be presented at the workshop !
If already presented before, OK to prepare a summary and 1-2 slides for conveners (?)

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Latest! We should try to start drafting as early as possible...

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- Final ECFA report (on arXiv) can most likely be updated after few months, but only once!
before the community meeting (?) or in the second submission round just announced (?)

Schedule

- Primary interest in the progress in the focus topic studies
selected focus topics presented in the plenary session
- Submitted abstracts to be presented in parallel sessions
recent results, but also reviews/summaries of results being prepared for the report (?)
- Summary plenary talks to review other contributions to the report (from each session)
hard to guess how many abstracts will be submitted, what the acceptance rate will be...

I do hope we will have many submissions, including many ILD (related) submissions.
Even if not accepted for the oral presentation, should be considered for the report...

Document [arXiv:2401.07564](https://arxiv.org/abs/2401.07564) **Note that 500 GeV is relevant for all but one topic!!!**

Table 1: Overview of focus topics and relevant centre-of-mass energies. Energies applicable to the considered topic are indicated with '✓'.

Topic	Lead group	Relevant \sqrt{s} [GeV]				
		91	161	240–250	350–380	≥ 500
1 HtoSS	HTE			✓	✓	✓
2 ZHang	HTE (GLOB)			✓	✓	✓
3 Hself	GLOB			✓	✓	✓
4 Wmass	PREC		✓	✓	✓	✓
5 WWdiff	GLOB			✓	✓	✓
6 TTthres	GLOB (HTE)				✓	✓
7 LUMI	PREC	✓	✓	✓	✓	✓
8 EXscalar	SRCH			✓	✓	✓
9 LLPs	SRCH	✓	✓	✓	✓	✓
10 EXtt	SRCH				✓	✓
11 CKMWW	FLAV		✓	✓	✓	✓
12 BKtautau	FLAV	✓				
13 TwoF	HTE (PREC)	✓	✓	✓	✓	✓
14 BCfrag and Gsplit	PREC (FLAV)	✓	✓	✓	✓	✓

and ILD contact persons (members of the topical expert teams)

#	topic	lead group	ILD group	ILD contact person
1	HtoSS	HTE	Higgs/EW	Taikan Suehara
2	ZHAng	HTE (GLOB)	Higgs/EW	Ivanka Bozovic, Natasa Vukasinovic
3	Hself	GLOB	Higgs/EW	Junping Tian
4	Wmass	PREC	Higgs/EW	Graham Wilson
5	WWdiff	GLOB	Higgs/EW	Jenny List
6	TTthres	GLOB (HTE)	Top/HF/QCD	Marcel Vos
7	LUMI	PREC	Higgs/EW	Ivanka Bozovic
8	EXscalar	SRCH	BSM	Mikael Berggren
9	LLPs	SRCH	BSM	Filip Zarnecki
10	EXtt	SRCH	BSM	Teresa Nunez
11	CKMWW	FLAV	Top/HF/QCD	Uli Einhaus
12	BKtautau	FLAV	Top/HF/QCD	—
13	TwoF	HTE	Top/HF/QCD	Adrian Irles and Roman Pöschl
14	BCfrag and Gsplit	PREC (FLAV)	Top/HF/QCD	Adrian Irles



with links to results presented at LCWS'2024 and people suggested for abstract submission

HtoSS Taikan Suehara

- Application of Particle Transformer to quark flavor tagging..., Risako Tagami
- Fast Timing for Particle ID, Jenny List

⇒ Results on application to $H \rightarrow s\bar{s}$ expected for ECFA workshop

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ZHang Ivanka Bozovic-Jelisavcic

Old study on CPV in $H \rightarrow \tau\tau$ (not realistic to update)

⇒ New results: recent paper on CPV in VBF at 1 TeV ILC

[arXiv:2405.05820](https://arxiv.org/abs/2405.05820)

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Hself Junping Tian (?)

- Towards an update of the ILD ZHH analysis, Bryan Bliewert

⇒ Updated results, should be presented at the workshop



LUMI Ivanka Bozovic-Jelisavcic

- Metrology in the integrated luminosity measurement at ILC, Ivan Smiljanic
- + Reimagining Linear Collider Luminosity Measurement, Graham Wilson

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EXscalar Teresa Nunez, AFZ

- Prospects for light exotic scalar measurements at the e^+e^- Higgs factory, Aleksander Filip Zarnecki

⇒ New results expected for $S \rightarrow b\bar{b}$ (ongoing study) and decay-mode independent search

Teresa Nunez: Decay-mode independent searches for new light scalars at future Higgs factories

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CKMWW Jenny List (?)

- Searching for new physics in WW and single-W events, Jenny List

⇒ Updated results, should be submitted



LLPs Jan Klamka, Daniel Jeans (?)

- Long-lived particle searches with the ILD experiment, Jan Klamka
- Finding kink signatures of LLPs in TPC at ILC, Jurina Nakajima

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TwoF Adrian Irlles, Krzysztof Mekala

- Probing GHU models at the ILC with di-quark AFB..., Adrian Irlles
- Prospects for constraining light-quark electroweak couplings..., Krzysztof Mekala

GHU paper results presented in Paestum. Any updates?

⇒ Study of quark couplings in radiative events (fast simulation) - new, to be submitted

- 1 **HtoSS** – $e^+e^- \rightarrow Zh: h \rightarrow ss$ ($\sqrt{s} = 240/250$ GeV)
- 2 **ZHang** – Zh angular distributions and CP studies
- 3 **Hself** – Determination of the Higgs self-coupling
- 4 **Wmass** – Mass and width of the W boson ...
- 5 **WWdiff** – Full studies of WW and $e\nu W$
- 6 **TTthres** – Top threshold: Detector-level simulation study of $e^+e^- \rightarrow t\bar{t}$...
- 7 **LUMI** – Precision of the luminosity measurement
- 8 **EXscalar** – New exotic scalars
- 9 **LLPs** – Long-lived particles
- 10 **EXtt** – Exotic top decays
- 11 **CKMWW** – CKM matrix elements from W decays
- 12 **BKtautau** – $B^0 \rightarrow K^{0*} \tau^+ \tau^-$
- 13 **TwoF** – EW precision: 2-fermion final states ($\sqrt{s} = M_Z$ and beyond)
- 14 **BCfrag** and **Gsplit** – Heavy quark fragmentation and hadronisation, gluon splitting...



SUSY Mikael Berggren, Teresa Nunez

- Stau searches at future e^+e^- colliders, Mikael Berggren
- + "Here be SUSY" - Prospects for SUSY searches at future colliders, Mikael Berggren

Teresa Nunez: "Impact of detector and accelerator conditions
on the stau-pair production sensitivity at future Higgs Factories"

Review type contribution from Mikael? (as intended for report)

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Heavy Neutral Leptons

- Study of Majorana Right Handed Neutrino (RHN) production..., Jurina Nakajima
- HNL at e^+e^- colliders, Krzysztof Mekala
- ? Searching for heavy neutral leptons through exotic Higgs decays at the ILC, Simon Thor

Clearly suitable for the report (HNL section). Workshop abstracts ?



Higgs/EW

- A New Method for Measuring the Higgs Mass at ILC, Thomas Berger

Details presented at the last SA meeting. What are the plans?



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Software

- Particle-flow reconstruction with Transformer (poster), Paul Wahlen

One of many possible software contributions. Not clear what WG2 plans for the workshop are...



Dark Matter searches

- WIMP dark matter paper (full simulation) [arXiv:2001.03011](#)
- Mono-photon searches for DM production (fast simulation) [arXiv:2107.11194](#)

Dark photons (?)

- presented at EPS-HEP'2023 [PoS\(EPS-HEP2023\)047](#)

Non-standard searches

- Exploring hidden sectors with two-particle angular correlations... [arXiv:2312.06526](#)

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Even more contributions expected for the ECFA report

We should start preparing summaries of our studies (1-2 page write-ups + 1-2 slides) and contact corresponding conveners to get access to the report overleaf (!)

Look at the LaTeX style proposed for the report before starting to write...