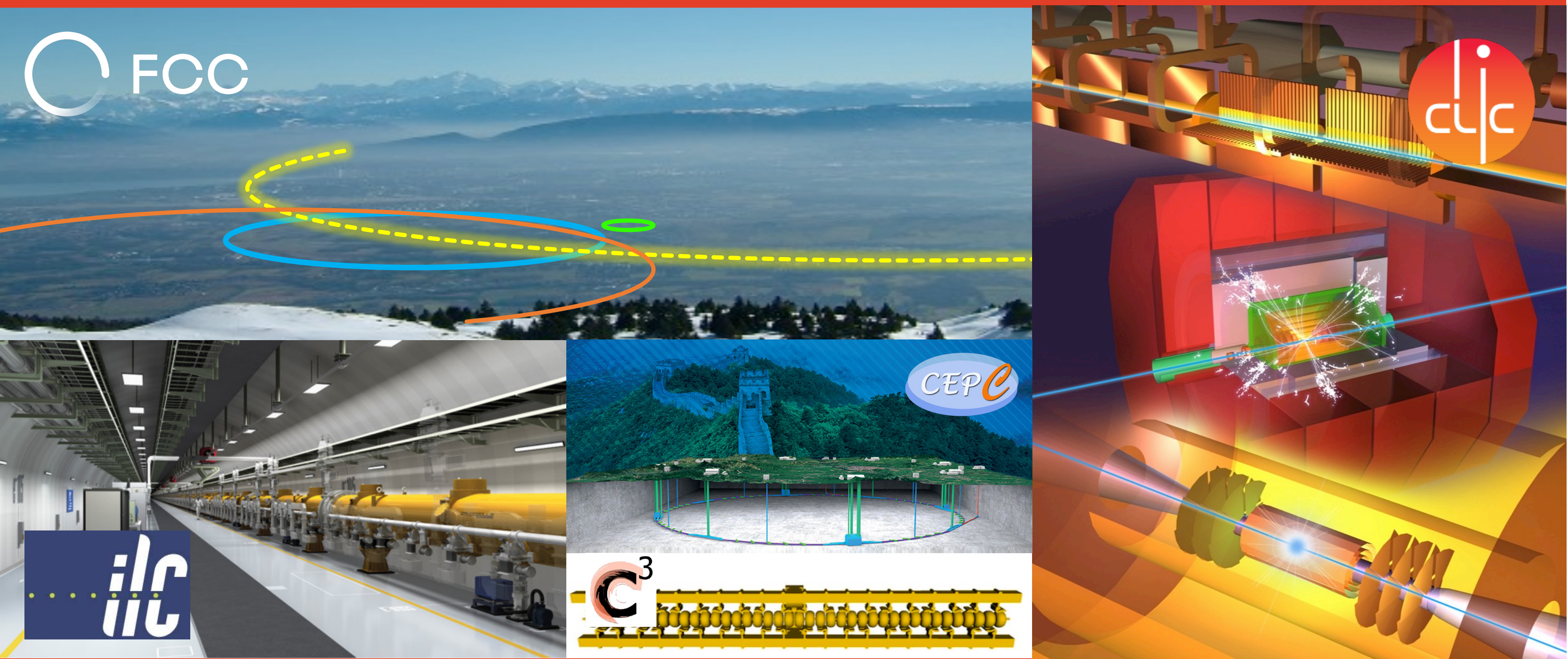
# ECFA studies towards an $e^+e^-$ Higgs/EWK/top factory




P-ECFA, 5 July 2024

Aidan Robson

# ECFA studies towards an $e^+e^-$ Higgs/EWK/top factory

## *Outline*

- Ongoing activities
- Planning towards report
- 3rd ECFA Workshop

P-ECFA, 5 July 2024

Aidan Robson

# Ongoing activities

- Organised in three WGs
  WG1: Physics Programme
  WG2: Physics Analysis Methods
  WG3: Detector Technologies
- Highly active topical groups

Working meetings so far in 2024:

***WG1 SRCH***
15 Mar 2024 EXscalar - focus topic planning meeting
29 Apr 2024 ECFA Focus topic: LLPs - round table
29 May 2024 EXscalar - focus topic working meeting

***WG1-PREC***
22 Mar 2024 MiniWorkshop : Two-fermion physics
07 May 2024 W MASS expert team: discussion and kick-off of report
08 May 2024 LUMI expert team: discussion and kick-off of report
15 May 2024 BCFRAG expert team: discussion and kick-off of report
13 Jun 2024 TwoF expert team: discussion and kick-off of report

***WG1-HTE***
18 Mar 2024 e+e- to ZH angular measurements
18 Jun 2024 e+e- to ZH angular measurements

***WG1-FLAV***
17-18 Apr 2024 Flavour mini-workshop

***WG1-GLOB***
09 Feb 2024 Focus topic meeting - ttbar threshold
28 Feb 2024 Focus topic meeting - ttbar threshold
17 Apr 2024 Focus topic meeting - ttbar threshold
15 May 2024 Mini-workshop on Higgs self-coupling focus topic
25 Jun 2024 Mini-workshop on WWdiff focus topic

Indico category:
https://indico.cern.ch/category/14055/

***WG2***
02 Jul 2024 Focus Meeting: Technical Benchmarks

# Focus Topics

- **Much of the current activity is centred around 14 focus topics**

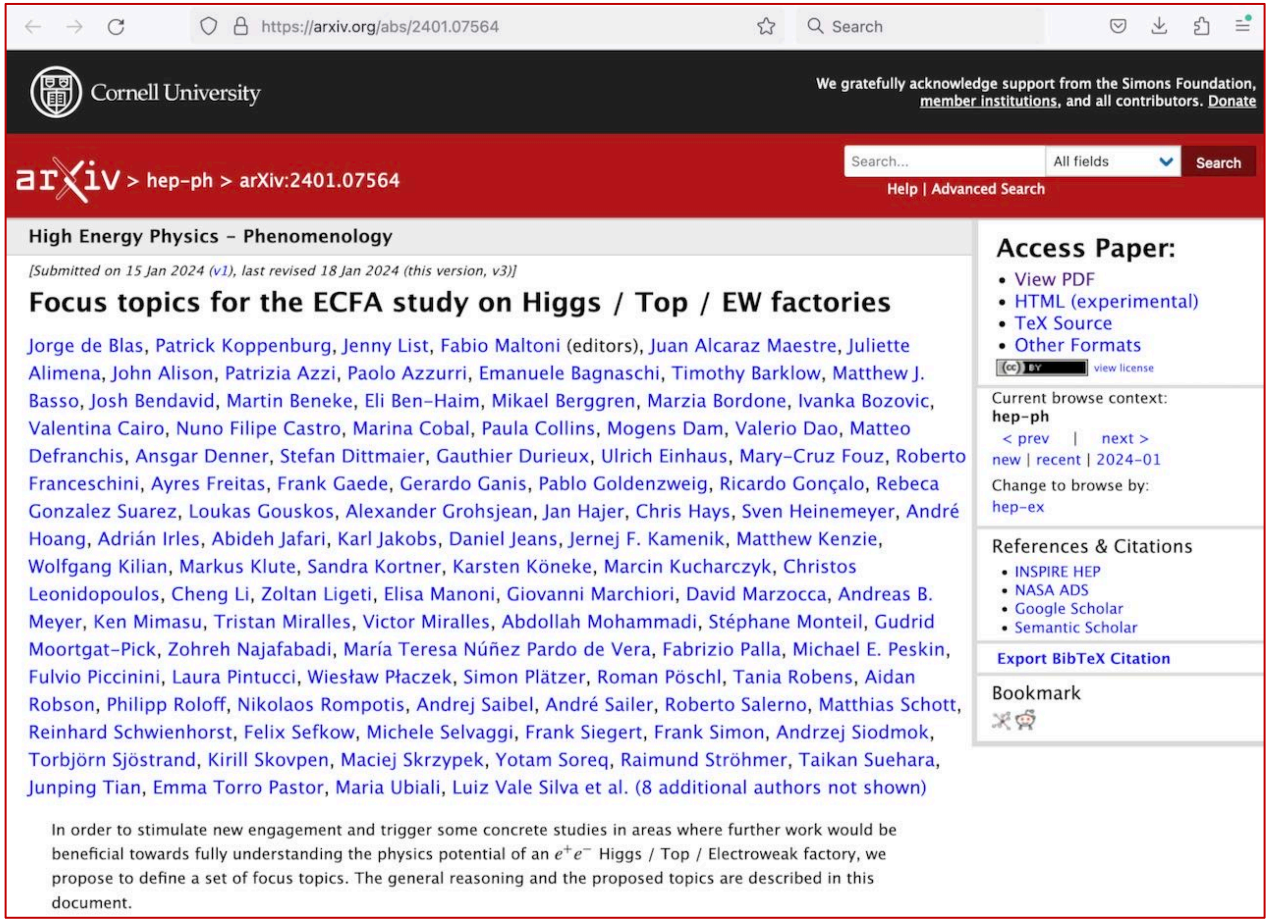
Reminder:

- The focus topics are intended:
  - (1) to bring people across projects to work *together* (i.e. even more than "coherently")
  - (2) to bring attention to areas where analyses and analysis tools can be developed cooperatively for the mutual benefit of all projects
  - (3) to provide a clear entry point and concrete studies to attract people to join the e+e– effort

Focus Topics description/definition document appeared on arXiv in January: https://arxiv.org/abs/2401.07564

Huge effort from expert teams & conveners [listed in backup]

- 50 pages + references
- 108 authors



https://arxiv.org/abs/2401.07564

Cornell University

We gratefully acknowledge support from the Simons Foundation, member institutions, and all contributors. Donate

arXiv > hep-ph > arXiv:2401.07564

High Energy Physics – Phenomenology

[Submitted on 15 Jan 2024 (v1), last revised 18 Jan 2024 (this version, v3)]

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

Jorge de Blas, Patrick Koppenburg, Jenny List, Fabio Maltoni (editors), Juan Alcaraz Maestre, Juliette Alimena, John Alison, Patrizia Azzi, Paolo Azzurri, Emanuele Bagnaschi, Timothy Barklow, Matthew J. Basso, Josh Bendavid, Martin Beneke, Eli Ben-Haim, Mikael Berggren, Marzia Bordone, Ivanka Bozovic, Valentina Cairo, Nuno Filipe Castro, Marina Cobal, Paula Collins, Mogens Dam, Valerio Dao, Matteo Defranchis, Ansgar Denner, Stefan Dittmaier, Gauthier Durieux, Ulrich Einhaus, Mary-Cruz Fouz, Roberto Franceschini, Ayres Freitas, Frank Gaede, Gerardo Ganis, Pablo Goldenzweig, Ricardo Gonçalo, Rebeca Gonzalez Suarez, Loukas Gouskos, Alexander Grohsjean, Jan Hajer, Chris Hays, Sven Heinemeyer, André Hoang, Adrián Irles, Abideh Jafari, Karl Jakobs, Daniel Jeans, Jernej F. Kamenik, Matthew Kenzie, Wolfgang Kilian, Markus Klute, Sandra Kortner, Karsten Köneke, Marcin Kucharczyk, Christos Leonidopoulos, Cheng Li, Zoltan Ligeti, Elisa Manoni, Giovanni Marchiori, David Marzocca, Andreas B. Meyer, Ken Mimasu, Tristan Miralles, Victor Miralles, Abdollah Mohammadi, Stéphane Monteil, Gudrid Moortgat-Pick, Zohreh Najafabadi, María Teresa Núñez Pardo de Vera, Fabrizio Palla, Michael E. Peskin, Fulvio Piccinini, Laura Pintucci, Wiesław Płaczek, Simon Plätzer, Roman Pöschl, Tania Robens, Aidan Robson, Philipp Roloff, Nikolaos Rompotis, Andrej Saibel, André Sailer, Roberto Salerno, Matthias Schott, Reinhard Schwienhorst, Felix Sefkow, Michele Selvaggi, Frank Siegert, Frank Simon, Andrzej Siodmok, Torbjörn Sjöstrand, Kirill Skovpen, Maciej Skrzypek, Yotam Soreq, Raimund Ströhmer, Taikan Suehara, Junping Tian, Emma Torro Pastor, Maria Ubiali, Luiz Vale Silva et al. (8 additional authors not shown)

In order to stimulate new engagement and trigger some concrete studies in areas where further work would be beneficial towards fully understanding the physics potential of an $e^+e^-$ Higgs / Top / Electroweak factory, we propose to define a set of focus topics. The general reasoning and the proposed topics are described in this document.

Access Paper:

- View PDF
- HTML (experimental)
- TeX Source
- Other Formats

Current browse context: hep-ph

References & Citations

- INSPIRE HEP
- NASA ADS
- Google Scholar
- Semantic Scholar

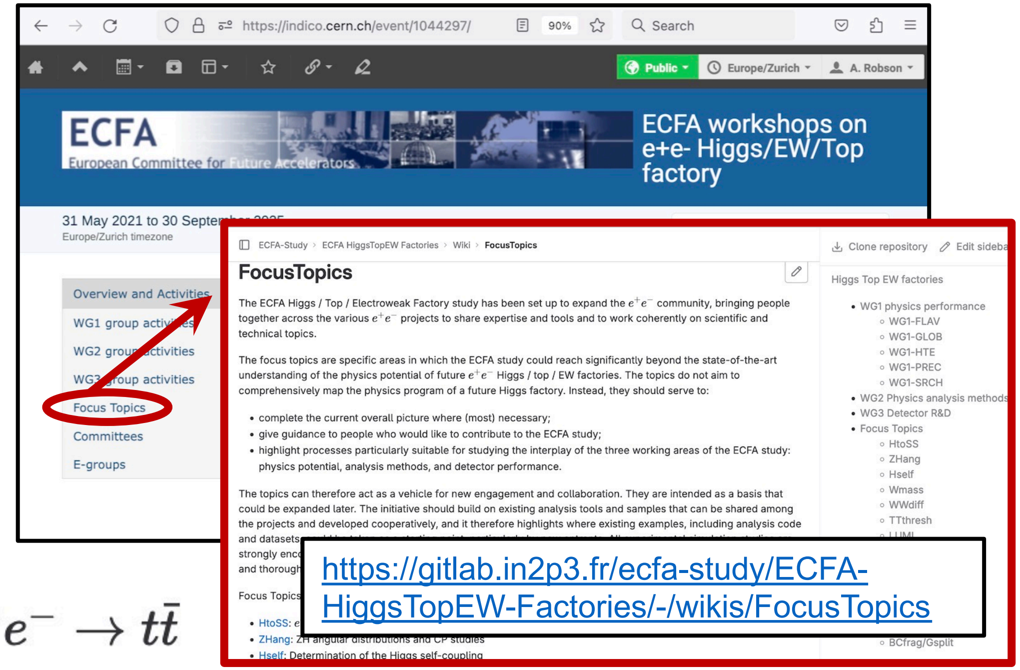
Export BibTeX Citation

Bookmark

# Focus Topics

◆ Topics sample the physics landscape (not exhaustively!)

- HtoSS: $e^+e^- \to Zh$: $h \to ss$
- ZHang: ZH angular distributions and CP studies
- Hself: Determination of the Higgs self-coupling
- Wmass: Mass and width of the W boson
- WWdiff: Full studies of WW and evW
- TTthresh: Top threshold - detector-level studies of $e^+e^- \to t\bar{t}$
- LUMI: Precision luminosity measurement
- EXscalar: New exotic scalars
- LLPs: Long-lived particles
- EXtt: Exotic top decays
- CKMWW: CKM matrix elements with on-shell and boosted W decays
- BKtautau: $B^0 \to K^{0*}\tau^+\tau^-$
- TwoF: EW precision - 2-fermion final states
- BCfrag/Gsplit: Measurement of $b$- and $c$-fragmentation functions and hadronisation rates and measurement of gluon splitting to $bb$ / $cc$

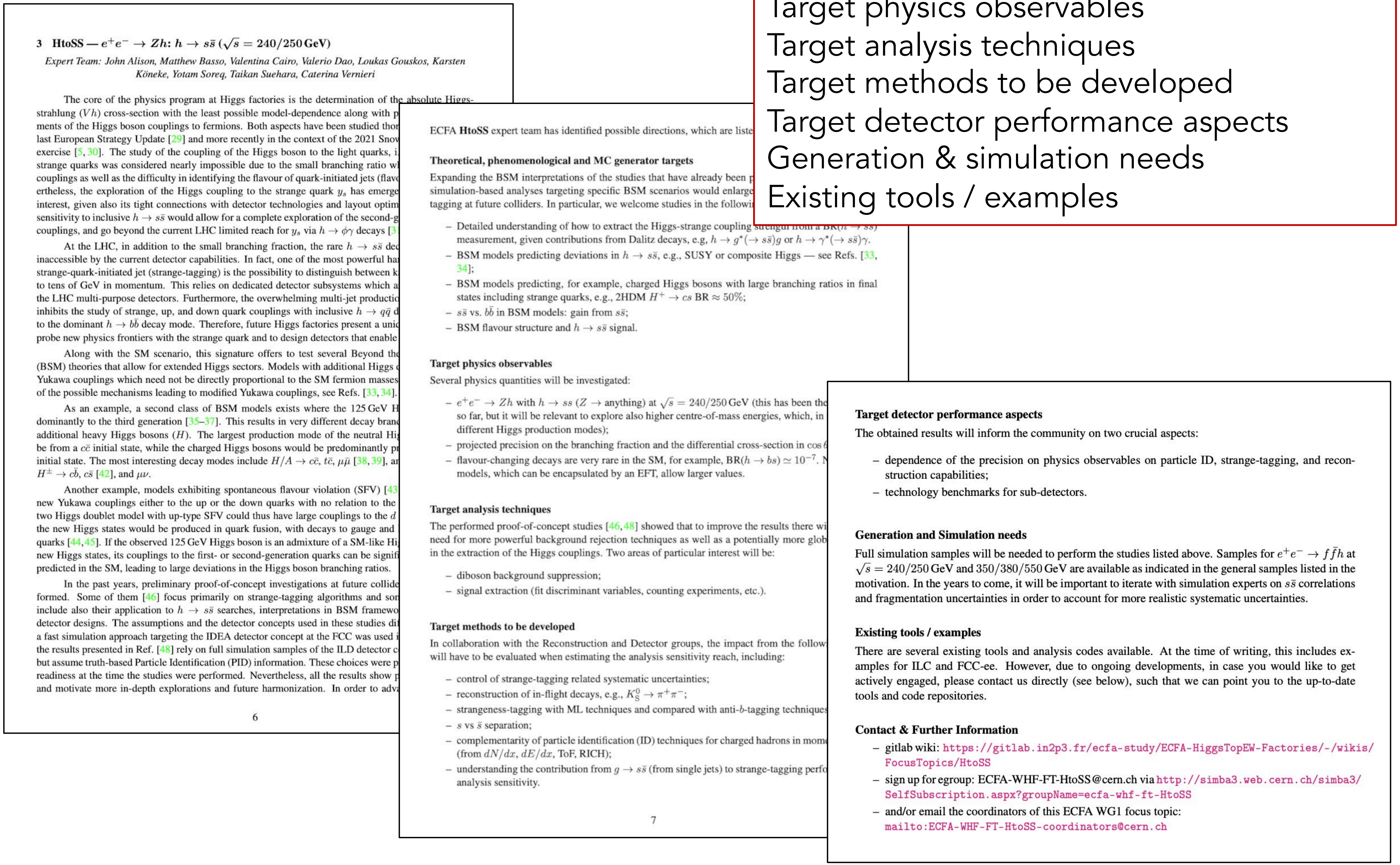



https://gitlab.in2p3.fr/ecfa-study/ECFA-HiggsTopEW-Factories/-/wikis/FocusTopics

in2p3 gitlab chosen for straightforward access via eduGain (can use institutional login; does not require full CERN account)

# Example focus topic description:

Theoretical, pheno & MC generator targets
Target physics observables
Target analysis techniques
Target methods to be developed
Target detector performance aspects
Generation & simulation needs
Existing tools / examples



**3 HtoSS — $e^+e^- \to Zh$: $h \to s\bar{s}$ ($\sqrt{s} = 240/250$ GeV)**

*Expert Team: John Alison, Matthew Basso, Valentina Cairo, Valerio Dao, Loukas Gouskos, Karsten Köneke, Yotam Soreq, Taikan Suehara, Caterina Vernieri*

The core of the physics program at Higgs factories is the determination of the absolute Higgs-strahlung ($Vh$) cross-section with the least possible model-dependence along with p… ments of the Higgs boson couplings to fermions. Both aspects have been studied thor… last European Strategy Update [29] and more recently in the context of the 2021 Snow… exercise [5, 30]. The study of the coupling of the Higgs boson to the light quarks, i… strange quarks was considered nearly impossible due to the small branching ratio w… couplings as well as the difficulty in identifying the flavour of quark-initiated jets (flav… ertheless, the exploration of the Higgs coupling to the strange quark $y_s$ has emerge… interest, given also its tight connections with detector technologies and layout optim… sensitivity to inclusive $h \to s\bar{s}$ would allow for a complete exploration of the second-g… couplings, and go beyond the current LHC limited reach for $y_s$ via $h \to \phi\gamma$ decays [3…

At the LHC, in addition to the small branching fraction, the rare $h \to s\bar{s}$ dec… inaccessible by the current detector capabilities. In fact, one of the most powerful ha… strange-quark-initiated jet (strange-tagging) is the possibility to distinguish between k… to tens of GeV in momentum. This relies on dedicated detector subsystems which a… the LHC multi-purpose detectors. Furthermore, the overwhelming multi-jet productio… inhibits the study of strange, up, and down quark couplings with inclusive $h \to q\bar{q}$ d… to the dominant $h \to b\bar{b}$ decay mode. Therefore, future Higgs factories present a uni… probe new physics frontiers with the strange quark and to design detectors that enable…

Along with the SM scenario, this signature offers to test several Beyond the… (BSM) theories that allow for extended Higgs sectors. Models with additional Higgs d… Yukawa couplings which need not be directly proportional to the SM fermion masses… of the possible mechanisms leading to modified Yukawa couplings, see Refs. [33, 34].

As an example, a second class of BSM models exists where the 125 GeV H… dominantly to the third generation [35–37]. This results in very different decay bran… additional heavy Higgs bosons ($H$). The largest production mode of the neutral Hi… be from a $c\bar{c}$ initial state, while the charged Higgs bosons would be predominantly pr… initial state. The most interesting decay modes include $H/A \to c\bar{c}$, $t\bar{c}$, $\mu\bar{\mu}$ [38, 39], a… $H^\pm \to c\bar{b}$, $c\bar{s}$ [42], and $\mu\nu$.

Another example, models exhibiting spontaneous flavour violation (SFV) [43… new Yukawa couplings either to the up or the down quarks with no relation to the… two Higgs doublet model with up-type SFV could thus have large couplings to the $d$… the new Higgs states would be produced in quark fusion, with decays to gauge and… quarks [44, 45]. If the observed 125 GeV Higgs boson is an admixture of a SM-like Hi… new Higgs states, its couplings to the first- or second-generation quarks can be signifi… predicted in the SM, leading to large deviations in the Higgs boson branching ratios.

In the past years, preliminary proof-of-concept investigations at future collide… formed. Some of them [46] focus primarily on strange-tagging algorithms and so… include also their application to $h \to s\bar{s}$ searches, interpretations in BSM framewo… detector designs. The assumptions and the detector concepts used in these studies di… a fast simulation approach targeting the IDEA detector concept at the FCC was used i… the results presented in Ref. [48] rely on full simulation samples of the ILD detector c… but assume truth-based Particle Identification (PID) information. These choices were p… readiness at the time the studies were performed. Nevertheless, all the results show p… and motivate more in-depth explorations and future harmonization. In order to adv…

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ECFA **HtoSS** expert team has identified possible directions, which are liste…

**Theoretical, phenomenological and MC generator targets**

Expanding the BSM interpretations of the studies that have already been p… simulation-based analyses targeting specific BSM scenarios would enlarge… tagging at future colliders. In particular, we welcome studies in the followi…

- Detailed understanding of how to extract the Higgs-strange coupling strength from a BR($h \to s\bar{s}$) measurement, given contributions from Dalitz decays, e.g. $h \to g^*(\to s\bar{s})g$ or $h \to \gamma^*(\to s\bar{s})\gamma$.
- BSM models predicting deviations in $h \to s\bar{s}$, e.g., SUSY or composite Higgs — see Refs. [33, 34];
- BSM models predicting, for example, charged Higgs bosons with large branching ratios in final states including strange quarks, e.g., 2HDM $H^+ \to cs$ BR $\approx 50\%$;
- $s\bar{s}$ vs. $b\bar{b}$ in BSM models: gain from $s\bar{s}$;
- BSM flavour structure and $h \to s\bar{s}$ signal.

**Target physics observables**

Several physics quantities will be investigated:

- $e^+e^- \to Zh$ with $h \to ss$ ($Z \to$ anything) at $\sqrt{s} = 240/250$ GeV (this has been the… so far, but it will be relevant to explore also higher centre-of-mass energies, which, in… different Higgs production modes);
- projected precision on the branching fraction and the differential cross-section in $\cos\theta$…
- flavour-changing decays are very rare in the SM, for example, BR($h \to bs$) $\simeq 10^{-7}$. N… models, which can be encapsulated by an EFT, allow larger values.

**Target analysis techniques**

The performed proof-of-concept studies [46, 48] showed that to improve the results there wi… need for more powerful background rejection techniques as well as a potentially more glob… in the extraction of the Higgs couplings. Two areas of particular interest will be:

- diboson background suppression;
- signal extraction (fit discriminant variables, counting experiments, etc.).

**Target methods to be developed**

In collaboration with the Reconstruction and Detector groups, the impact from the follow… will have to be evaluated when estimating the analysis sensitivity reach, including:

- control of strange-tagging related systematic uncertainties;
- reconstruction of in-flight decays, e.g., $K^0_S \to \pi^+\pi^-$;
- strangeness-tagging with ML techniques and compared with anti-$b$-tagging techniques…
- $s$ vs $\bar{s}$ separation;
- complementarity of particle identification (ID) techniques for charged hadrons in mome… (from $dN/dx$, $dE/dx$, ToF, RICH);
- understanding the contribution from $g \to s\bar{s}$ (from single jets) to strange-tagging perfo… analysis sensitivity.

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**Target detector performance aspects**

The obtained results will inform the community on two crucial aspects:

- dependence of the precision on physics observables on particle ID, strange-tagging, and reconstruction capabilities;
- technology benchmarks for sub-detectors.

**Generation and Simulation needs**

Full simulation samples will be needed to perform the studies listed above. Samples for $e^+e^- \to f\bar{f}h$ at $\sqrt{s} = 240/250$ GeV and 350/380/550 GeV are available as indicated in the general samples listed in the motivation. In the years to come, it will be important to iterate with simulation experts on $s\bar{s}$ correlations and fragmentation uncertainties in order to account for more realistic systematic uncertainties.

**Existing tools / examples**

There are several existing tools and analysis codes available. At the time of writing, this includes examples for ILC and FCC-ee. However, due to ongoing developments, in case you would like to get actively engaged, please contact us directly (see below), such that we can point you to the up-to-date tools and code repositories.

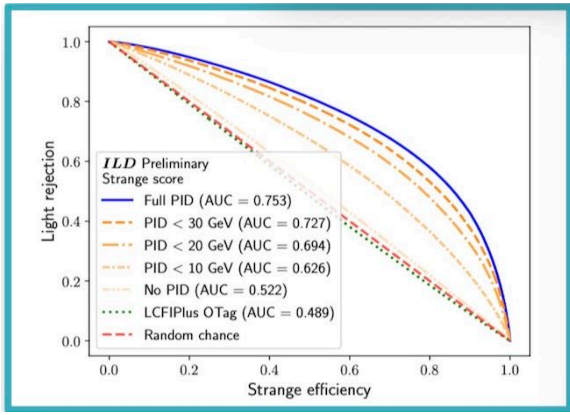
**Contact & Further Information**

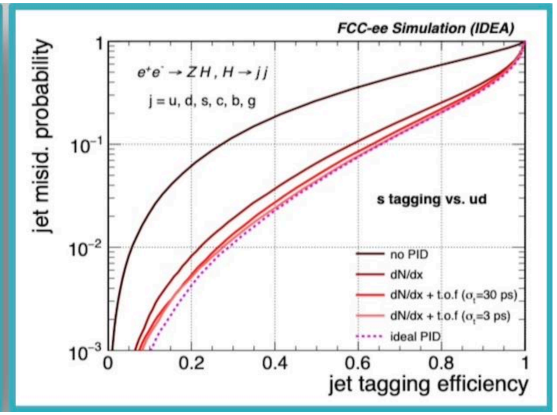
- gitlab wiki: https://gitlab.in2p3.fr/ecfa-study/ECFA-HiggsTopEW-Factories/-/wikis/FocusTopics/HtoSS
- sign up for egroup: ECFA-WHF-FT-HtoSS@cern.ch via http://simba3.web.cern.ch/simba3/SelfSubscription.aspx?groupName=ecfa-whf-ft-HtoSS
- and/or email the coordinators of this ECFA WG1 focus topic: mailto:ECFA-WHF-FT-HtoSS-coordinators@cern.ch

# Example status: H->ss

◆ Topic has been gathering increasing interest and crosses all 3 WGs: physics sensitivity, algorithm development, & detector design optimisation

For Snowmass, ~only ILD-based studies were complete from RICH to PID to analysis; now studies at FCC and CEPC evolved from tagger-only to include analysis and RICH




Example active points:

❖ fragmentation models – changing at generation level in Pythia 8 to assess sensitivity

❖ PID reco: adding d*N*/dx plot to the combination (PID vs *p*) so that a comparison can be made with the RICH performance –> update ILD studies with reconstructed PID

❖ RICH: detector designs are evolving into full Geant 4 simulation now, and first H->ss events are being run through –> analyse how this impacts Particle Flow performance

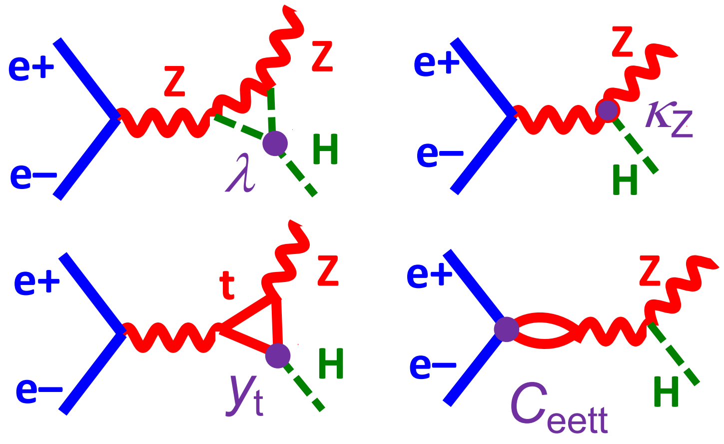
– for detector design options considering tradeoff of cooling and material
–> important study as it motivates addition of new detector systems

**Clear strong benefit from cross-project collaboration.**
**Not all studies will be complete by ESPPU, but some important updates for report**

Just a few examples to illustrate joined work – for the full picture come to the workshop!

# Example status: Higgs self-coupling

- Critical parameter; progress in single- and double-Higgs approaches




Single-Higgs; issue is separating $\lambda$ from other new physics; advances on:

❖ Potential on using differential cross-sections or splitting data-taking in different $\sqrt{s}$ around 240GeV to separate from other contributions to $\kappa_Z$

❖ Fully accounting for LHC input on top-Yukawa $y_t$

❖ New theoretical calcns. on 4-fermion couplings e.g. $C_{eett}$

Double-Higgs; main question is how to improve experimental analysis; ongoing efforts on

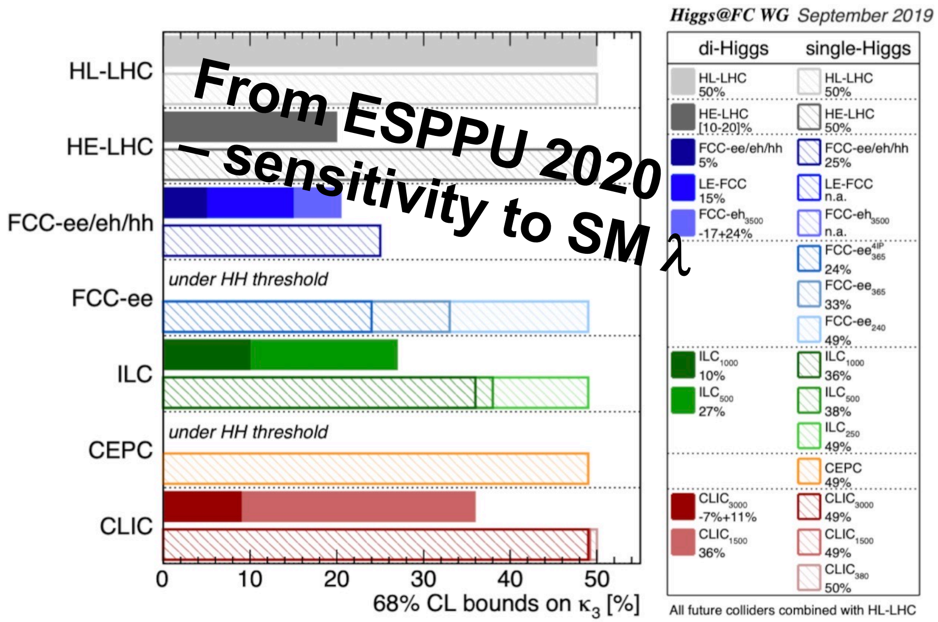
❖ jet clustering

❖ flavour tagging

❖ advanced analysis

as well as sensitivity under non-SM scenarios

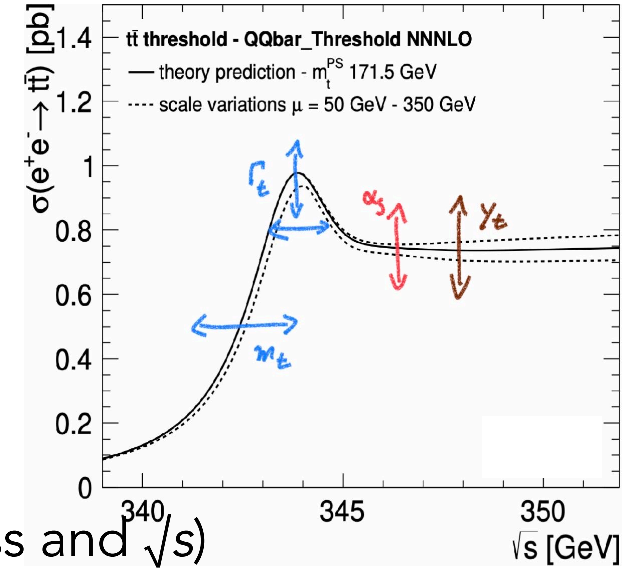
**ECFA study brings all contributors together**
**Projections from ESPPU 2020 will be updated**



Just a few examples to illustrate joined work – for the full picture come to the workshop!

# Example status: Top physics

## ◆ Threshold scan for top properties




Example active points:

❖ Recent studies to optimize scan parameters

❖ Discussion of machine aspects and luminosity spectra (inputs from FCCee/CEPC/ILC/CLIC/$C^3$ spectra)

❖ Assessment of dominant theory uncertainties (Qqthreshold)

❖ New study of experimental uncertainties (demonstrate efficient and clean selection independent of mass and $\sqrt{s}$)

## ◆ Top couplings

Specific studies underway by several groups:

❖ Update collider operation scenarios

❖ Study interplay with the Higgs/EW sector

❖ Re-evaluate anomalous top coupling sensitivities at circular colliders

❖ Provide inputs on top operators to Higgs self-coupling study

❖ Connect with interesting new work on entangled top quark pairs & role in SMEFT ?

**New FCC-ee simulated samples strongly benefited from collaborative work**
**Should have significant new elements on properties and couplings for report**

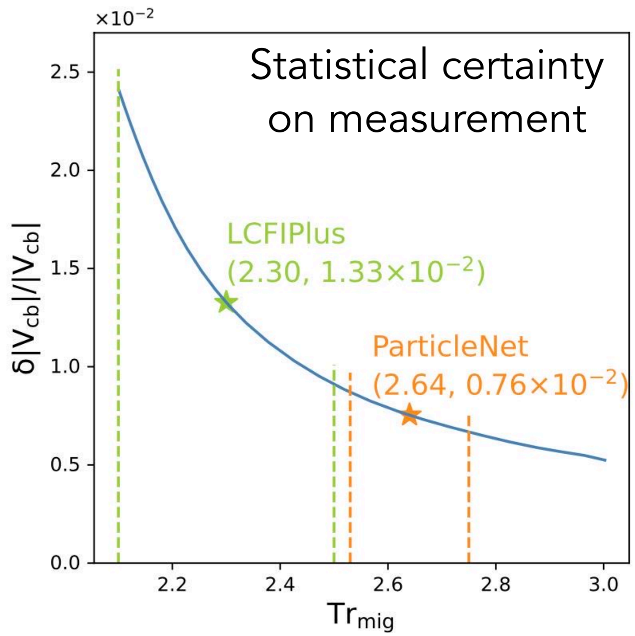
Just a few examples to illustrate joined work – for the full picture come to the workshop!

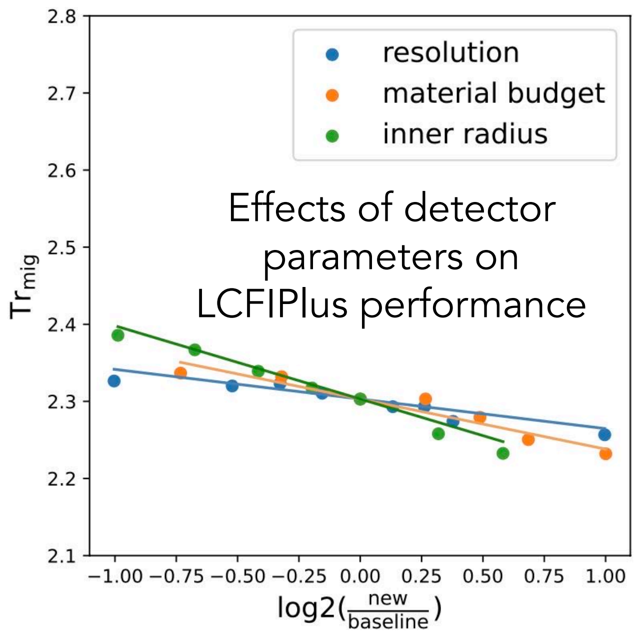
# Tools development – Flavour Tagging

## ◆ Flavour tagging

## Expertise shared and developed in common tools/framework

Just one example:
CEPC study [ https://arxiv.org/pdf/2309.13231 ] comparing:
(1) LCFIplus [extensively used for ILC and CLIC, and now also for FCC-ee] and ParticleNet [more recent, GNN-based]
(2) effect of vertex detector optimisations




**Collaboration facilitated by ECFA common study, and results inform other proto-collaborations' detector optimisations and ongoing flavour tagging improvements**

# Tools development – Technical Benchmarks

## ◆ Technical Benchmarking Project

led by Alan Price (Jagiellonian University, Krakow)

e+e– studies have long lifetime; MCs go through many changes

–> need benchmarks / standard candles for comparison/validation

Goal: provide a framework to perform technical tests of MC generators for all possible future Higgs factories

❖ Identify possible deviations between generators

–> lead to discussions with WG1 and generator authors

Included so far:

❖ Babayaga (Latest)
❖ KKMC (v5 cpp release)
❖ Madgraph (3.5.4)
❖ Sherpa (2.2.15)
❖ Whizard (3.1.4)

Dedicated python package developed, using common tools Key4hep and EDM4hep, considering:

*various processes:*

2-fermion, ZH, WW, tt, gg

*various setups:*

ISR / no ISR; simple fiducial cuts; several √s

*various kinematic distributions*

Example cross-sections

| Process | $\sqrt{s}$ (GeV) | Generator | Cross Section (pb) |
|---|---|---|---|
| $\mu^+\mu^-$ | 240 | MadGraph5_aMC@NLO | $3.8332 \pm 0.0112228$ |
| | | Whizard | $4.4799 \pm 0.0677174$ |
| $\mu^+\mu^-$ | 350 | SHERPA-MC | $1.7548 \pm 0.00297814$ |
| | | MadGraph5_aMC@NLO | $1.72647 \pm 0.00184034$ |
| | | Whizard | $1.78481 \pm 0.00846396$ |
| $\gamma\gamma$ | 91.2 | MadGraph5_aMC@NLO | $51.941 \pm 0.027225$ |
| | | Babayaga | $49.1597 \pm 1.10742$ |
| | | SHERPA | $52.1944 \pm 0.00260813$ |
| $t\bar{t}$ | 350 | MadGraph5_aMC@NLO | $0.186168 \pm 0.000132046$ |
| | | Whizard | $0.186629 \pm 0.000826694$ |
| | | SHERPA | $0.184721 \pm 0.000179541$ |
| ZH | 241.123 | MadGraph5_aMC@NLO | $0.19851 \pm 0.00054668$ |
| | | Whizard | $0.198518 \pm 0.00069897$ |
| | | SHERPA | $0.197514 \pm 0.00230028$ |

**Very valuable new tool for community, with strong engagement from MC generator authors**

# Report Planning

- *Synoptic outline of the physics case and the ECFA study activities, drawing particular attention to the joined work, cross-concept and cross-WG*
  – self-contained and reasonably comprehensive
  – but not ab initio and not extensively repeating material from previous reports
  – and concise enough that it's a document that people actually want to read
- Hope many activities will have individual notes/papers –> really encourage this
  -> plan is largely to summarise and reference them
- Physics analysis tools and detector technologies sections will sit alongside physics topics, cross-referencing where closely linked

# Timeline

- The Strategy acceleration has removed significant real working time from the study
  – ***this is a problem***: hard to attract new people; some studies will not be complete
- October ECFA workshop is deadline to present new material that should receive full consideration for inclusion (and authors will be asked for 1-2 page summary & plots)
- Intensive writing straight after October workshop
- Draft complete mid-December 2024
- Circulate to community, R-ECFA & IAC until ~end January 2025
- Finalize by early March 2025

# Proposed Structure

## Contents





- **Sections:**
  - Introduction
  - Common Developments
  - Developments in Higgs Physics
  - Developments in Electroweak Physics & QCD
  - Developments in Top Physics
  - Global Interpretations
  - Direct Searches for New Particles
  - Flavour
  - New Detector Technologies

# Proposed Structure

- Will concentrate on recent material, given in context of longer-term studies
- Scope of physics content of report goes well beyond Focus Topics; depends on area

  Example: Searches →



- Detailed structure of each chapter currently lies with topical conveners; next stage is to assign coordinating names to subsections

# 3rd ECFA Workshop on Higgs/Top/EWK factories

https://indico.in2p3.fr/event/32629/overview


- **Overview**
- Committees
- Timetable
- Registration
- Participant List
- Payment of Registration

Dear Colleagues,

The third 3rd ECFA work…
place in the center of Pa…

The Workshop will last f…
**11th, 16:00.**

Aim for real 'working workshop' as with previous editions

Registration & abstract submission OPEN

- abstract submission deadline for talks, 15th July
- abstract submission deadline for posters, September

Early registration deadline end July

ECRs who submit poster get reduced registration fee

(Students also get reduced registration fee)

# Backup

# Focus Topics Expert Teams

- Focus topic definitions have been developed by 'expert teams' from across projects, driven by the WG1 coordinators & conveners (next slide)
- Note: expert team members participating as 'consultants' – not necessarily active in topics at the moment!

Expert Teams

| **EXscalar (SRCH)** | **LLPs (SRCH)** | **EXtt (SRCH)** | **HtoSS (HTE)** | **ZHang (HTE(GLOB))** | **TwoF (HTE)** |
|---|---|---|---|---|---|
| Filip Zarnecki | Rebeca Gonzalez Suarez | Nuño Castro | Valentina Cairo | Ivanka Bozovic | Adrian Irles |
| Mikael Berggren | Juliette Alimena | Marina Cobal | Taikan Suehara | Markus Klute | Daniel Jeans |
| Sven Heinemeyer | Jan Hajer | Gauthier Durieux | Loukas Gouskos | Sandra Kortner | Freya Blekman |
| Abdollah Mohammadi | Marcin Kucharczyk | Roberto Franceschini | Matt Basso | Cheng Li | Mogens Dam |
| Tania Robens | Emma Torro Pastor | María Teresa Núñez Pardo de Vera | Caterina Vernieri | Gudrid Moortgat-Pick | Jorge de Blas |
| Nikolaos Rompotis | Sarah Louise Williams | Kirill Skovpen | Valerio Dao | Ken Mimasu | Eram Rizvi (tbc) |
| | Filip Zarnecki | Marcel Vos | John Alison | | Emanuele Bagnaschi |
| | | | Yotam Soreq | | |
| **Hself (Glob)** | **WWdiff (Glob)** | **TTthres (Glob(HTE))** | | | |
| Junping Tian | Patrizia Azzi | Marcel Vos | **BCFrag/Gsplit (FLAV/PREC)** | **Wmass (PREC)** | **LUMI (PREC)** |
| Gauthier Durieux | Timothy Barklow | Patrizia Azzi | Eli Ben-Haim | Paolo Azurri | Ayres Freitas |
| Jose Goncalo | Jorge de Blas | Martin Beneke | Maria Ubiali | Josh Bendavid | Ivanka Bozovic |
| Sven Heinemeyer | Ansgar Denner | Jorge de Blas | Andrzej Siodmok | Martin Beneke | Mogens Dam |
| Michael Peskin | Alexander Grohsjean | Matteo Defranchis | Simon Plaetzer | Stefan Dittmaier | Fulvio Piccinini |
| Philipp Roloff | Wolfgang Kilian | Gauthier Durieux | Loukas Gouskos | Simon Plätzer | Wiesław Płaczek |
| Roberto Salerno | Frank Siegert | Roberto Franceschini | Torbjörn Sjöstrand | Matthias Schott | André Sailer |
| | | Andre Hoang | | Raimund Ströhmer | Maciej Skrzypek |
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- WG2: **Physics analysis methods** conveners Patrizia Azzi, Fulvio Piccinini, Dirk Zerwas
- WG3: **Detector technologies** conveners Felix Sefkow, Mary Cruz Fouz, Giovanni Marchiori
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