

# ***Physics, Experiment & Detector Studies towards a Higgs/EW/Top Factory***

Informational Kickoff Meeting  
18<sup>th</sup> June 2021

*Karl Jakobs, ECFA Chair*

**ECFA**

European Committee for Future Accelerators





## 3. High-priority future initiatives

An **electron-positron Higgs factory is the highest-priority next collider**. For the longer term, the European particle physics community has the ambition to operate a proton-proton collider at the highest achievable energy. Accomplishing these compelling goals will require innovation and cutting-edge technology:

- *the particle physics community should ramp up its R&D effort focused on advanced accelerator technologies, in particular that for high-field superconducting magnets, including high-temperature superconductors;*
- *Europe, together with its international partners, should investigate the technical and financial feasibility of a future hadron collider at CERN with a centre-of-mass energy of at least 100 TeV and with an electron-positron Higgs and electroweak factory as a possible first stage. Such a feasibility study of the colliders and related infrastructure should be established as a global endeavour and be completed on the timescale of the next Strategy update.*

*The timely realisation of the electron-positron International Linear Collider (ILC) in Japan would be compatible with this strategy and, in that case, the European particle physics community would wish to collaborate.*

## ECFA statement (endorsed at the Plenary ECFA meeting on 13 July 2020)

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- *ECFA recognizes the need for the experimental and theoretical communities involved in physics studies, experiment designs and detector technologies at future Higgs factories to gather. **ECFA supports a series of workshops** with the aim to **share challenges and expertise, to explore synergies in their efforts** and to respond coherently to this priority in the European Strategy for Particle Physics (ESPP).*

*Goal: bring the entire  $e^+e^-$  Higgs factory effort together, foster cooperation across various projects, collaborative research programmes are to emerge*

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- Setting up an **International Advisory Committee (IAC)** was agreed to be the next step with involvement of some RECFA members and European leaders of possible future Higgs factories. In addition the (HL)-LHC community should be represented.
  - ECFA-chair would act as chair: Karl Jakobs
  - From RECFA: Jean-Claude Brient, Tadeusz Lesiak, Chiara Meroni
  - With (HL)-LHC experience: Jorgen D'Hondt, Max Klein, Aleandro Nisati, Roberto Tenchini
  - For theory: Christophe Grojean, Andrea Wulzer
  - For Linear Colliders: Steinar Stapnes, Juan Fuster, Frank Simon, Aidan Robson
  - For Circular Colliders: Alain Blondel, Mogens Dam, Patrick Janot, Guy Wilkinson
  - For CERN: Joachim Mnich

# IAC Recommendations

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- Extension to include **electroweak** and **top** factory
- Extend physics studies, where relevant (not all completed at time of EPPSU), however, focus on  $e^+e^-$  potential (no discussion of pros and cons of various machines or alternatives to  $e^+e^-$  Higgs factories)
- Understand better the interplay between (HL)-LHC and an  $e^+e^-$  Higgs/EW/Top factory
- Development of common tools (software, simulation, fast simulation, ...) important
- Development of common analysis methods of high interest
- Exploit synergies, discuss challenges, do not restrict to common items
- Need for theoretical accuracy and MC generator improvements ...
- ...
  
- Overall goal: make sure community works coherently together
- Open for collaboration with other ongoing activities, e.g. Snowmass, ...
- Process is open for all interested physicists

There was unanimous agreement within the IAC that these objectives can only be reached if **Working Groups** would be set up  
Conveners (theory and experiment), regular meetings, working towards ECFA workshops, ...

## WG 1: Physics Potential

- Collect, compare and harmonise the work of the different project-specific efforts
- Interplay between (HL)-LHC and a future Higgs factory, e.g. include LHC potential on high- $p_T$  measurements and EFT interpretations
- Identify specific topics where concrete work should be organised
- Requirements on accuracy in theoretical calculations and parametric uncertainties, ..
- ...

## WG 2: Physics Analysis Methods

- Monte Carlo generators for  $e^+e^-$  precision EW/top Higgs factory
- Software framework
- Fast simulation (and its limitations)
- Particle flow
- Luminosity measurement ...
- ...

## WG 3: Detector R&D

(start activities once the [ECFA Detector R&D Roadmap](#) is defined; Roadmap process currently ongoing)  
First public presentation (close-to-final report) by Phil Allport (Univ. Birmingham, Chair of the Roadmap Panel)  
at the ECFA-EPS session on 30<sup>th</sup> July at the [EPS Conference](#)

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- More detailed **mandates** for Working Groups 1 and 2 have been prepared  
→ more in the final discussion today, talk by Jenny List
- **Conveners** for both working groups have been appointed:

## WG 1: Physics Potential

Juan Alcaraz (CIEMAT - Madrid)  
Jenny List (DESY)  
Fabio Maltoni (UC Louvain / Bologna)  
James Wells (Univ. Michigan)

## WG 2: Physics Analysis Methods

Patrizia Azzi (INFN-Padova / CERN)  
Fulvio Piccinini (INFN Pavia)  
Dirk Zerwas (IJCLab)

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- The working groups will carry out work over the forthcoming years in preparation of community-wide plenary ECFA workshops

Kickoff meeting today: inform the community, take stock, organise the next steps in the work programme...

- Major milestones: **ECFA workshops** are planned to be held in 2022 and 2023

In 2021: presentation at the **Open Plenary ECFA meeting** on 19<sup>th</sup> November at CERN

- Final report: “ECFA report”  
(à la Aachen for LHC, or Aix-Les-Bains for LHC Phase-II upgrade)
- Major entry portal to collect information on the ongoing activities:  
<https://indico.cern.ch/event/1044297/>
- e-group will be set up;  
Your consent to be put on such a list was asked during the registration step  
→ if you have not yet registered, please do it now!