

Paris Sphicas CERN & NKUA Plenary ECFA Meeting CERN, November 14, 2024

- Introduction
 - **ECFA membership & RECFA Composition**
- ECFA Panels
 - HET Factory Studies
 - Detector Panel
- ESPP update
- JENA
 - D JENAS 2025
 - Miscellanea
- Other ECFA issues/actions

Membership in ECFA (countries)

- Membership in ECFA: all European CERN Member States and Associate Member States
- **Estonia became the 24th member state of CERN in Sep 2024.**
 - Invitation to Estonia to join ECFA sent.
 - Indicates possibility of country visit to Estonia in 2026.
- Invitations also sent to Latvia and Lithuania
 - They would join Associate Member states already on ECFA: Croatia, Cyprus, Slovenia, Turkey and Ukraine
 - History: invitation to Lithuania sent in 2018 no response
 - **□** Talked to their representatives on Council: they are interested to join.

RECFA membership

- New country representatives on RECFA:
 - Jorgen D'Hondt (NL)
 - Replacing Stan Bentvelsen
 - Zdeněk Hubáček (CZ)
 - Replacing Jana Bielcikova
- Ex-officios:
 - Mike Seidel (LDG Chair, CH)
 - Replacing Dave Newbold (UK)
 - Bruno Alves (LLR, FR)
 - Replacing Lydia Brenner (NL)
- Extensions (three years) received for:
 - Mogens Dam (DK) until end 2025.
 - Heiko Lacker (DE)
 - Justyna Lagoda (PL)
 - Celso Martinez (ES)
 - Marko Mikuz (SI)
 - Erkcan Ozcan (TK)
 - Nick Van Remortel (BE) until end 2025.
 - Gabriel Stoicea (RO)
 - Pavol Strizenec (SK)
 - Lidija Zivkovic (SR)

ECFA Panels

ECFA panels

ECFA HET study

Major event was the HET workshop in Paris (Oct 2024)

• EDP:

- Several discussions and meetings between EDP chairs (Didier Contardo and Felix Sefkow) with Helge Meinhard (CERN) who is organizing the creation of the MoUs
- Discussion on the form and content of EDP contribution to the ESPP in EDP meeting in Paris on 7 October (day before HET Factory Workshop)
- HET workshop in Paris: several detector-related talks (WG3)

• ECR panel:

- There was a parallel meeting of the ECRs at the HET workshop in Paris.
- Engagement is increasing. Could still be stronger.
 - Please advertise current HEP issues and new ESPP process to ECRs in your country.

ECFA HET Factory Study (I)

Third and last in HET Factory workshops

- First ECFA Workshop on e+e- HET Factories:
 2022 @ DESY (GE).
- Second ECFA Workshop on HET Factories: 2023 @ Paestum (IT).
- Third (and last) ECFA Workshop on e+e- HET Factories: <u>2024 @ Paris (FR)</u>.

• Full review of the three working groups:

- WG 1, Physics Potential: Jorge de Blas (Univ. Granada), Patrick Koppenburg (Nikhef), Jenny List (DESY), Fabio Maltoni (UC Louvain/ Bologna).
- WG 2, Physics Analysis Methods: Patrizia Azzi (INFN-Padova / CERN), Fulvio Piccinini (INFN Pavia), Dirk Zerwas (IJCLab/DMLab).
- WG 3: Detector R&D (WG3 web page): Mary Cruz Fouz (CIEMAT Madrid), Giovanni Marchiori (APC Paris), Felix Sefkow (DESY).

3rd ECFA workshop on e⁺e⁻ Higgs, Top & ElectroWeak Factories



WG1 example (I): Higgs-EWK-Top group

- **ZH production and angular studies**
 - Can probe CP-odd in ZH
 - Polarization in LC an advantage; though CC close
- ZZH anomalous couplings
- □ H → ss̄ (BR: 0.024%...)
 - Strange-Yukawa interpretation of BR($H \rightarrow s\overline{s}$)
 - Measurements at 240 and 365 GeV
 - Strong and weak Dalitz decays seem to not be a major problem on the determination of the strange Yukawa coupling
- Higgs mass
 - □ FCC-ee: Want to get $\Delta M_H \sim \Gamma_H = 4 MeV$ for ee $\rightarrow H$
 - □ 240 GeV, ~11ab⁻¹.
- Can one get the electron Yukawa coupling?
 - Energy precision (very important)



Rich, excellent physics program → challenging detectors

Higgs Factory Program

- 2M ZH events at √s=240 GeV
- 75k WW→H events at √s=365 GeV
- Higgs Couplings
- Higgs self-couplings (2-4σ) via loop diagrams
- Unique: $e^+e^- \rightarrow H$ at $\sqrt{s} = 125 \text{ GeV}$

Precision EW and QCD Program

- 6 x 10^{12} Z and 10^8 WW events
- m_Z , Γ_Z , Γ_{inv} , $sin^2\theta_W$, m_W , Γ_W , ...
- 2 x 10⁶ tt events
- $m_{top},\,\Gamma_{top},\,EW$ couplings
- Indirect sensitivity to new physics

Heavy Flavor Program

- 10¹² bb, cc; 1.7 x 10¹¹ тт (all clean): 10x Belle
- CKM matrix, CP measurements,
- rare decays, CLFV searches, lepton universality

Feebly coupled particles Beyond SM

- Opportunity to directly observe new feebly interacting particles with masses below m_z
- Axion-like particles, dark photons, Heavy neutral leptons
- Long-lifetime LLPs



- Momentum Resolution $\sigma(p_T)/p_T \simeq 10^{-3} @ p_T \sim 50 \text{ GeV}$
- Jet $\sigma(E)/E \approx 3-4\%$ in multi-jets for Z/W separation
- Impact parameter resolution for b, c tagging
- Absolute normalisation of luminosity to 10⁻⁴
- Relative normalisation to 10^{-5} (eg Γ_{had}/Γ_{l})
- $\sigma(p)/p$ limited by multiple scattering \rightarrow minimise material.
- Track angular resolution < 0.1 mrad
- Stability of B-field to 10⁻⁶.
- Superior impact parameter resolution
- Precisely identify secondary vertices and measure lifetimes
- ECAL resolution at few %/VE
- Excellent $\pi^{0}\!/\gamma$ separation for tau identification
- PID: K/ π separation over wide p range \rightarrow e.g. timing, ...
- Sensitivity to (significantly) detached vertices
- Tracking: more layers, "continuous" tracking
- Calorimeter: granularity, tracking capability
- Large decay length \rightarrow extended decay volume
- Precise timing
- Hermeticity

P. Sphicas; Report from Chair

F. Sefkow (ECFA HET Wkshp 2024)

ECFA HET Factory Study (II)

Report Planning

A. Robson (ECFA HET Wkshp 2024)

We've seen a huge amount of activity and many beautiful results represented in this workshop! The challenge now is to try to capture this in a useful report

 Concept: a synoptic outline of the physics case and the ECFA study activities, drawing particular attention to the work that has spanned projects, concepts, and WGs, helping to strengthen and build the e⁺e⁻ community.

The report should:

- be self-contained and reasonably comprehensive

(but not ab initio and not extensively repeating material from previous reports)

- and be concise enough that it's a document that people can actually read
- Hope many activities will write individual notes/papers -> we really encourage this
 -> report will largely summarise and reference them
- Physics analysis tools and detector technologies sections will be cross-referenced with physics topics, where they are closely linked

ECFA HET Factory Study (III)

Timeline

| 20/10 | Deadline for physics studies to submit 2-page summary | | |
|-----------------|---|---------------|--|
| ◆ 20/10 – 10/11 | Compilation and editing by WG1 subgroup conveners / nominated editors, and WG2/3 editors (as well as coordinators & chief editors) 10/11 is the deadline for WG1 subgroup conveners finish their part! | | |
| ◆ 10/11 – 27/11 | Editing by WG1 coordinators, WG2/3 editors & coordinators, and chief editors. 27/11 is deadline for complete draft to be handed over to chief editors. | | |
| ◆ 27/11 – 18/12 | Editing by chief editors only | | |
| ◆ 18/12 | Circulation of version 1 to contributors and R-ECFA | Also to PECFA | |
| ◆ 17/1 | Deadline to receive comments on version 1 | | |
| 24/1 | Deadline to receive final results/plots from contributors | | |
| February | Incorporation of comments, final results, and references | | |
| ◆ 21/2 | Final version to R-ECFA | Also to PECFA | |
| ◆ 7-8/3 | R-ECFA approval during country visit followed by submission to arXiv | | |

ECFA HET factory studies

- The primary motivation for the ECFA HET study group was to bring together all the people who were interested, active, working on HET studies
 - It has been largely successful.
 - Despite lack of people, huge pressures from ongoing experiments, and the rest of life.
- We are about to start the last lap towards March 2025.
- With the submission of the ECFA Report and a potential short addendum in time for the Symposium in June 2025, the job will be done.
 - □ Recall: the ESPP drafting session is scheduled to take place on Dec 1-5, 2025.
 - □ And Council is expected (?)/ supposed (?) to approve the new strategy in Jun 2026.
 - That will be the time that we take stock of how ECFA should contribute in the poststrategy era
- Of course, the work of the other ECFA panels, particularly the Detector Panel, will continue throughout, hand-in-hand with the DRDs.

From closeout talk (PS)

ECFA Detector Panel (I)

Panel meeting in Paris (Oct 8) discussed plans for input to ESPP

Preamble to the round table

based on the presentation at the last plenary ECFA (attached to the agenda)

- we have agreed with Thomas as chair of the DRDC that providing an input on the detector R&D roadmap follow-up is not the role of the DRDC
- the planned input aims at providing perspective on how the goals outlined in the roadmap can be achieved by the DRD collaborations
 - The input should remain relatively generic, also allowing to underline DRD specificities
- It is not a review of technical achievements of the DRDs that will be considered in the detector instrumentation working group of the ESPP process
- It is not an update of the roadmap (may be considered as outcome of the ESPP)
- In following slides few considerations on possible content & topics

D. Contardo EDP Meeting

ECFA Detector Panel (II)

EDP ESPP input possible content & topics : DRD collaboration facts

- Preamble referring to the roadmap and the DRD collaboration implementation
 - referring to CERN hosting framework
 - generic work organisation to fulfil the ECFA detector roadmap DRDTs
 - community building
 - establishing areas of collaborative effort / common projects
 - balance achieved in community aspirations and R&D roadmap priorities
 - outreach, training and early career efforts



summed over DRD1, DRD2, DRD3, DRD4, DRD6 and DRD7

still an ongoing process,

also in preparation of MoUs

D Contardo

EDP Meeting

ECFA Detector Panel (III)

EDP ESPP input possible content & topics : DRD programs deployment

- Scientific outcome expected in the 1st phase of the R&D programs (3-4 years)
 - evaluation of technology areas performance potential
 - technical solution for medium term strategic projects; consider transitions to specific engineering (TRL \gtrsim 6)
- Preparation of 2nd R&D phase
 - ex. longer term collider term FCC-ee project; consider opportunities for new technology (TRL \leq 3)
- We expect a consolidated list of deliverables (for MoUs) by the time of the input



Transverse Areas DRD5, DRD7, (DRD8) also cover lower TRLs

> D. Contardo EDP Meeting

P. Sphicas; Report from Chair

EDP (IV): Request sent to DRD Collaborations:

- This input aims at providing a perspective on how the DRD collaborations stand on their way to achieve the goals outlined in the ECFA R&D roadmap and the path forward.
 - It will also consider the progress concerning the execution of other related GSRs of the roadmap.
- We foresee addressing generic topics, not going in details of the specific DRD circumstances and technical details (apart for illustration or where needed). The list of topics could be as follows:

 Main facts and status of implementation of the DRD collaborations (as an introduction)
 Highlights of generic objectives in the first approved phase of 3-4 years, considering the timeline of medium- and longer-term strategic projects.

3) Views of the longer-term goals and technical evolutions proposed, including the approach and prospect to integrate low TRL (blue-sky) R&D in the strategic mainstream
4) General assessment of matching of the resources to the needs with respect to the R&D priorities outlined in the roadmap

5) GSR progress and prospects regarding: availability of facilities for beam test, irradiation and characterisation of prototypes; training, ECR and outreach aspects

Update of the ESPP (European Strategy for Particle Physics)

ESPP (I): Working Groups and Conveners

| Working group | Co-convener | Co-convener |
|--|---------------------------------|--------------------------------------|
| | PPG member | |
| Electroweak physics | Monica Dunford (DE, exp) | Jorge de Blas (ES, theory) |
| Strong interaction | Cristinel Diaconu (FR, exp) | Andrea Dainese (IT, exp, HI) |
| Flavour physics | Gino Isidori (CH, theory) | Marie-Hélène Schune (FR, exp) |
| BSM physics | Fabio Maltoni (BE/IT, theory) | Rebecca Gonzales-Suarez (SE, exp) |
| Neutrino physics and cosmic messengers | Pilar Hernandez (ES, theory) | Sara Bolognesi (FR, exp) |
| Dark matter and dark sector | Jocelyn Monroe (UK, exp) | Matthew McCollough (CERN, theory) |
| Accelerator science and technology | Gianluigi Arduini (CERN, acc) | Phil Burrows (UK, exp, acc) |
| Detector instrumentation | Thomas Bergauer (AT, exp) | Ulrich Husemann (DE, exp) |
| Computing | Tommaso Boccali (IT, exp, comp) | Borut Kersevan (SL, exp, comp) |

Charge to WG conveners: **Selection of Early Career Scientists Definition of sub-topics** and appointment of additional WG members **Definition of Benchmark** processes **Organisation of WG** meetings Writing the Physics **Briefing Book (supported** by Roger Forty, Scientific Secretary of the Strategy update)

10 European countries and CERN represented; 12 men, 6 women; 13 experiment, 5 theory

ESPP (II): responsibilities of PPG/WG and ESG

PPG: Physics + Technology working groups

- Electroweak physics (including Higgs physics)
- Strong interaction
- Flavour physics
- Beyond the Standard Model physics
- Neutrino physics and cosmic messengers
- Dark matter and dark sector
- Accelerator science and technology
- Detector instrumentation
- Computing

→ Physics Briefing Book

ESG: Overarching topics

- National input / roadmaps (→ strategic)
- Projects (FCC, LC, LE-FCC-hh, MC, ..)
 (timeline, costs, (physics → PPG))
- Comparisons across proposed projects
- Relations with other fields of physics
- Implementation of the Strategy (role of CERN and National Labs, coordination of European participation in projects sited outside Europe, ...)
- Knowledge and Technology transfer
- Sustainability, environmental impact
- Public engagement, education, communication

...



ESPP (III): national inputs

- Recall: a major component of the overall community input to the ESPP are the "national inputs", which will be collected individually by each country (and in some cases by regions).
 - To make these national inputs as coherent and as uniform as possible, we have posted the <u>ECFA guidelines here</u>.
 - Reminder: They are suggestions meant to streamline the process across different countries. It is understood that each country will set its own process, schedule and questions to consider in forming a national view and submitting its input(s) to the Strategy.
- National inputs to the ESPP update can be sent at different points in time:
 - Prior to the March 31 2025 deadline for submission of inputs to the ESPP;
 - □ After the March 31 2025 deadline but prior to the Symposium; Deadline: May 26 2025.
 - After the Briefing Book is publicly available, in time for the Strategy drafting session on Dec 1-5 2025. Final deadline for submissions for full consideration by the latter: Nov 14, 2025.
- Google spreadsheet indicating status of plans in different countries (filled in by RECFA representatives):
 - https://docs.google.com/spreadsheets/d/1djVaOC3zTx6CO9b3zidDKxdjWVDeGJr_XmL ys9-Kqcw/edit?gid=0#gid=0

HET factory workshop: a few thoughts on ESPP

- This time, we must, i.e., we absolutely must, converge on a crystal-clear, unambiguous choice for the next collider at CERN – with the widest possible consensus
 - We should analyze in detail; discuss; argue; rediscuss; reanalyze; look at the full picture. Rediscuss....
 - □ And then, we should converge on a clear path to the future.
- □ There is no room for disagreements after we converge on a strategy.
- The fastest way to getting no new collider is non-convergence of the community on one choice that we will all back.
- There is no room for delaying the choice either. The timescales involved are such that we must start now.
 - □ Because it takes a minimum of ~20 years to get a new machine
 - And because our junior colleagues need a vision

From closeout talk

(PS)

JENAA (Joint ECFA, NUPECC, APPEC Activities)

JENAA

- New chair of NuPECC as of Dec 1st 2024:
 - Eberhard Widmann Austrian Academy of Sciences (AT).
- New chair of APPEC as of Jan 1st 2025:
 - **Carlos Peña Garay Canfranc Underground Laboratory (ES).**
- **JENAS (JENA Symposium) 2025: RAL, April 8-11, 2025**
 - This will be the third JENA Symposium; first one was held in Orsay (FR), second one in Madrid (ES)
 - Local Organizing Committee members:
 - Professor Jocelyn Monroe, Dr. Jens Dopke (PP)
 - Professor Rachel Gray, Professor Paula Chadwick (Astro)
 - Professor Rolf-Dietmar Herzberg, Professor David Ireland (Nuclear)
- Issues not covered, compared to last time:
 - Recognition of contributors to large collaborations
 - **•** We have the JENA document. And the ICFA document.
 - **It appears that it is too soon for another iteration. No plans for new contribution.**
 - Thoughts/Opinions?

JENAA: Computing Working Group

First discussed at JENA Symposium in May 2022 (Madrid)

 ECFA-NUPECC-APPEC requirements and plans quite different, but still with significant overlaps.... For all three (HEP, Nuclear, Astroparticle), the challenge for the next decade is scaling. Synergies and commonalities of utmost importance in this scaling.

JENA Computing Workshop on June 12 - 14, 2023, in Bologna.

Five (5) Working groups, with 2/3 conveners each (from different areas)

- HTC and HPC (HPC): WG1 web page.
 - Conveners: Gonzalo Merino (PIC, ES); Concezio Bozzi (Ferrara, IT)
- Software and Heterogeneous Architectures (Software): <u>WG2 web page</u>.
 - Conveners: Graeme Stewart (CERN) ECFA; Adrien Matta (LPC Caen) NUPECC; Paul Laycock (UniGe) – APPEC.
- Federate Data Management, Virtual Research Environments and FAIR/Open Data (Data): WG3 web page.
 - ECFA convener: Ian Bird (CERN)
- Machine Learning and Artificial Intelligence (AI): WG4 web page.
 - ECFA convener: Sascha Caron (NIKHEF); Andreas Ipp (TU, Vienna)
- **Training, Dissemination, Education (TDE): <u>WG5 web page</u>.**
 - ECFA convener: Stefan Roiser (CERN).

Next: draft of executive summary of reports by end 2024; Meeting with WG coordinators on 26 November 2024.

JENAS 2025

- A very important part of the JENAS 2025 event will be the session with representatives with Funding Agencies
 - Dedicated session on Thursday, 10 April 2025.
 - Agenda:
 - Welcome closed session with funding agencies, 3 chairs, WG on computing coordinators and speakers of Thursday's morning session.
 - Open questions in fundamental physics (5-to-10 year perspective)
 - Detector technology challenges to realise our scientific ambitions
 - **Diversity & Inclusion in astroparticle, nuclear and particle physics**
 - ECR (PP & NP input)
 - In the afternoon: Parallel meeting with funding agencies & EC closed.
 Meeting will focus on computing and R&D for detectors

We will be sending out invitations to FA representatives in the next few weeks

2024-2025: RECFA Country visits RECFA/PECFA meetings

RECFA and PECFA meetings in 2024 and 2025

- RECFA synchronization meeting: Jan 30, 2024
- RECFA country visits in 2024:
 - Switzerland (PSI): March 8-9
 - Sweden (Lund): May 15-16
 - uK (London): Sep 13-14
 - Serbia (Belgrade): Nov 29-30
- PECFA meetings in 2024:
 - Frascati: Jul 4-5, 2024.
 - CERN: Nov 14-15, 2024.

- To do: send letters to ministry/FA
 Letters to ministry and FA sent and acknowledged
 - Newsletter done.
- **Reports from HET Workshop; LDG; ESPP update (PPG appointments etc); LHC upgrades**

RECFA country visits in 2025:

- Bulgaria (Sofia): Mar 7-8, 2025
 Letter to ministry sent.
- **u** Finland (Helsinki): May 30-31, 2025 Awaiting ministry/FA details
- Belgium (Brussels): Sep 12-13, 2025
- Turkey (TBC): ~Nov 2025 (TBC)
 To be confirmed
- Description PECFA meetings in 2025:
 - EPS HEP Conference: Jul 7-11, 2025
 - CERN: 20-21 Nov 2025

Plus: ESPP Symposium June 23-27, 2025

Other ECFA issues