
Early-Career Researchers White Paper input to European Particle Physics Strategy Update 3rd ECFA workshop on e^+e^- Higgs, Electroweak and Top Factories Paris, 10.10.2024

Armin Ilg, on behalf of the ECFA ECR panel
and the ECR session organisers:

Jan-Hendrik Arling, Lydia Brenner, Christina Dimitriadi, Armin Ilg, Emanuela
Musumeci, Marko Pesut, Leonhard Reichenbach, Magdalena Vande Voorde

ECFA

European Committee for Future Accelerators



How do WE envision the future of HEP?

ECFA

European Committee for Future Accelerators



ECFA ECR Panel

[...] to discuss **all aspects** that contribute in a broad sense to the **future of the research field of particle physics** [...]

Aiming to represent the European early-career particle physics community

- From PhD students to young assistant professors
- Theoreticians, phenomenologists, experimentalists, ...
- 3 members per country (+1 if LDG lab in country)
- Organization Committee (Marko Pesut, Jan-Hendrik Arling, Arnau Morancho Tarda)
- 5 delegates in Plenary ECFA, 1 delegate in Restricted ECFA

Our panel actually was created as a follow-up to the [ECFA Early-Career Researchers response to the 2020 Update of the European Strategy for Particle Physics](#) (rather ad-hoc, not a panel)

- The ECFA ECR panel is tightly linked with the Update of the European Strategy
- Make sure that this time ECRs are in the loop from the beginning!

European Particle Physics Strategy Update: Scope

... develop a visionary and concrete plan that greatly advances knowledge in fundamental physics **through the realisation of the next flagship project at CERN**. This plan should attract and value international collaboration and allow Europe to continue to play a leading role in the field.

Regarding a future collider project, the Strategy update should include the **preferred option for the next collider at CERN** and **prioritised alternative options** to be pursued if the preferred plan turns out not to be feasible or competitive.

EPPSU timeline and structure



9 topical WGs:

- EW/Higgs Physics
- Strong Interaction
- Flavor Physics
- BSM
- Neutrino Physics and Cosmic Messengers
- DM and Dark Sector
- Accelerator Science and Technology
- Instrumentation
- Computing

1 ECR scientific secretary for each WG

- Anyone can submit input to the strategy (31st of March)
 - Future collider communities
 - E.g. ECFA countries, collaborations, ... → use this chance!
 - And us! → ECR White Paper
 - Focus on topics relevant to ECRs, not covered in topical WGs

Process towards ECR White Paper input to EPPSU

Initiated by ECFA ECR panel, but open to all European* ECRs†

- Preparatory meetings within ECFA ECR panel and with other ECR representatives
 - Discuss process, first ideas on possible topics to address
- **3rd ECFA Workshop:**
 - Bring ECR community together, rally people to contribute to ECR White Paper
 - Define topics to address in ECR White Paper → Form WGs to address most important topics
- Online WG meetings
- Thu. 14th of November, adjacent to (Open) Plenary ECFA meeting at CERN
 - Discuss in plenum first rough WG statement proposals
 - Missing topics/WGs?
- Online WG meetings, draft of White Paper by WG organisers
- Meeting to agree on White Paper draft contents (location/format TBD)
- Endorsement by ECFA ECR panel

*: Focus on ECRs employed/hired in European institutes, but input beyond Europe appreciated

†: Non-permanent position or <10 years after PhD

Food for thought



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ECFA Early-Career Researchers response to the 2020 Update of the European Strategy for Particle Physics (report)

General

- [...] must therefore include **sociological and sustainability aspects** [...]
- [...] funding for non-permanent positions is converted to funding for **permanent positions** [...]
- [...] **different states of maturity** of the projects were not taken into account sufficiently.
- [...] impact of collider projects outside Europe [...] has not been laid out sufficiently.

Future of the Field

- While being **open** for future international projects, the ECRs emphasise the **importance of a European collider project soon after HL-LHC**. **Postponing** the choice of the next collider project at CERN to the 2030s has the potential to **negatively impact** the future of the field.

Human and Sociological Factors

- [...] holistically **include social and human factors** when planning the future of the field.
- [...] **equal recognition and career paths for the various domains** of our field have to be established to maintain expertise in the field.
- The possibility for a **healthy work-life balance** and the reconciliation of family and a scientific career is a must.

Environment and Sustainability

- A strong statement from CERN putting the **environment and sustainability** at the forefront of decision-making, aiming at becoming a carbon-neutral laboratory in the short term future, would have a **significant impact**.
- [...] higher **renewable energy** fraction.
- **Travel and conference schedules** [...] to reduce the amount of travel and the associated CO2 footprint.

Computing and Software

- [...] recognised not only as means to do physics analyses, but **as research that requires a high level of skill**.
- [...] **minimise the time to produce physics results** allowing more person-power to be allocated to areas where innovation and development is truly needed.
- [to reduce CO2 footprint] our community can drive the development of new software for **remote meetings**
- [...] **open data** and [...] the need for **sharing knowledge and resources** with other computing communities.

EW and Strong Interaction Physics

- Priority should be put on **precision measurements and global fits rather than model-driven searches**.
- Tighter **collaboration between theory and experiment** would enhance the precision of measurements.

Beyond Standard Model, Dark Matter and Dark Sector Physics

- [...] **diversification of experiments**, building on projects such as Physics Beyond Colliders, [...] vital for the future of the field [...]

Flavour, Neutrino and Cosmic Messenger Physics

- [...] **specialised smaller experiments** in the light sector are needed [...]
- Real-time observations between connected observatories [...] will be crucial in the future

Future Colliders for ECRs, Sep. 2023 @ CERN ([indico](#), [report](#))



- There **are guaranteed discoveries** out there (e.g. Higgs self coupling and many more)
- Learn how to communicate importance of precision
- Future colliders are **worth** it
 - For science and society
- See **sustainability not as a concern but as a challenge**
 - To develop **technologies relevant for society** (e.g. high-temperature superconductors)
- Future collider R&D highly transferable between collider proposals (and beyond)
 - **Good ideas will survive a collider proposal or two...**
- It's a long time until any future collider is operational
 - Take **future collider decision as early as possible**, give ECRs a goal and timeline, ease grant application
 - **Long-term R&D** projects and support for **careers in instrumentation/engineering/accelerator physics/...**
 - Mind the **gap!**
- Huge **enthusiasm** for future colliders! (>100 participants in person and >100 on Zoom)
- Many aspects relevant for ECRs are country-dependent!
 - Created [national ECR event blueprint](#) and organised/organising national follow-up events
 - [Nordic countries](#), [Austria](#), [Czech Republic](#), [Czech Republic+Slovakia](#), [France \(Tuesday\)](#), [Germany](#), [Italy](#), [Belgium+Netherlands](#), [United Kingdom](#), and more planned!

ECFA ECR letter to March 2024 CERN Council (see [report](#))

Dear CERN Council,

In the 70 years since its founding, CERN has not only established itself as the global centre of particle physics research but as a powerful symbol of international collaboration and scientific excellence. This would never have been possible without the unfaltering support offered by the CERN member states.

As a community, we feel immense pride and gratitude that we are part of this journey of scientific exploration and opportunity which CERN has pioneered. While the High-Luminosity LHC constitutes a much-anticipated and necessary advance in the LHC program, a clear path beyond it for our future in the field must be cemented with as little delay as possible. For the field to sustain the population, expertise, and enthusiasm required to overcome the challenges of what CERN's next major project/accelerator will present, the ECR community needs certainty without delay that High Energy Physics has an immediate future beyond HL-LHC, and that funding and positions required to realise our future will grow rapidly.

We, the ECFA Early-Career Researchers Panel, on behalf of the ECR community, would like to strongly urge the Council to make every effort to ensure that the process of evaluating, selecting and implementing potential future projects, which will define this century of High Energy Physics for Europe and the World, proceed with as quick a pace as possible, accelerating its time frame to start the European strategy process as early as possible and conclude by early 2026. This will go some way in helping further secure CERN's unique position in science, technology and international cooperation for the next 70 years and beyond.

Kind regards,

The ECFA Early-Career Researchers panel

EPPSU started earlier than originally anticipated! ECR input has impact

Conditions for Future Project Excitement

Physics:

- Must fully explore Higgs and electroweak physics
- Should probe beyond the Standard Model scenarios

Technology:

- Must be **feasible in funding and technology**, allowing for innovative **upgrades**
- Should include **interesting and challenging hardware**

Feasibility/Sustainability:

- Should ensure environmental sustainability and minimize ecological impact
- Must demonstrate **stable funding support and construction timelines** to attract early-career participation

Time Scale:

- The project should be launched in a **timely manner to ensure sustainable career opportunities for ECRs**

Other Considerations

- **Scientific work should be free from political influence and support a diverse, tolerant environment**

ECR Aspirations for Collaboration:

Leadership and Participation:

- Desire for **empathic leadership** with **well-trained management skills**
- Call for **transparent decision-making** and **impactful participation from ECRs**

Sustainability and Inclusivity:

- Emphasis on integrating environmental sustainability from the beginning
- Advocacy for **inclusivity and adoption of work ethics that promote a supportive environment**

Communication and Quality:

- Focus on **good communication and documentation**, valuing quality of work over quantity

Career Concerns of ECRs:

Long-Term Viability:

- Uncertainty about career stability due to a **lack of permanent positions and funding challenges**

Transitioning Projects:

- **Difficulty in moving from large-scale projects to future initiatives while maintaining career prospects**

Funding Feasibility:

- Concerns about funding large colliders due to current economic challenges create uncertainty for ECRs

FCC Week 2024 ECR session (session, summary)



By the time a future collider is built, **today's ECRs will be the ones leading it**

- Are future collider **organisational structures** designed to give influence and decision making power to ECRs?
 - **Open nominations for convenor positions!**
- Appoint ECRs to convenorship roles within future collider related efforts (e.g. DRDs)

Uncertainties...

- How to **maintain current ECRs** (and their expertise) working in **engineering/auxiliary fields** for the LHC over long timescales?
 - Prevent gap after HL-LHC upgrades are finished!

Need better communication of how **precision measurements** translate to mass reach for new physics

Early Career Researchers & Muon Colliders event (indico)

Early Career Researchers
& Muon Colliders

Wed 28th August 2024 - Via Zoom
14:00-18:00 (CEST) & 08:00-12:00 (EST)

Q&A
Discussions
Design Overview
Call for External Speakers

Open to:

- Undergraduates
- Masters
- PhDs
- Postdocs
- Students etc.

Interested in:

- Physics
- Engineering
- Computing
- Mathematics
- Communication etc.

International Muon Collider Collaboration

MuCol

Funded by the European Union

Significant interest of community in muon colliders

- **Sustainable** approach
 - Including people!
- Importance of **synergies to other (sub)-fields**
 - High-field magnets, nuclear fusion, ...
 - **New technologies**
- “No **showstoppers** identified” for muon colliders, “time is now”
- Recent **wave of excitement** about muon colliders due to access of **10 TeV partonic centre of mass** regime
 - Precision Higgs program **complimentary to Higgs factory**
 - Highly motivated physics targets that might be too heavy for the LHC, but only one order of magnitude above in energy

Menu for today...

Subscribe to esppu-ecr@cern.ch e-group!

Join our [Mattermost channel](#) (ECRs for EPPSU 2024) !

13:00

The European Particle Physics Strategy Update and the role of Early-Career Researchers (talk) *Armin Ilg*

Amphi Farabeuf, Campus des Cordeliers, Paris, Metro Odeon

13:15 - 13:30

Who are we? (interactive)

Emanuela Musumeci et al.

Amphi Farabeuf, Campus des Cordeliers, Paris, Metro Odeon

13:30 - 13:45

What is important to us for the future of particle physics in Europe? (discussion)

Emanuela Musumeci et al.

Amphi Farabeuf, Campus des Cordeliers, Paris, Metro Odeon

13:45 - 14:10

14:00

Further topics for ECR White Paper input? (discussion)

Leonhard Reichenbach

Amphi Farabeuf, Campus des Cordeliers, Paris, Metro Odeon

18:30 - 18:40

Ranking of topics (interactive)

Emanuela Musumeci et al.

Amphi Farabeuf, Campus des Cordeliers, Paris, Metro Odeon

18:40 - 18:55

Potential statements (discussion, if time allows)

Armin Ilg

Amphi Farabeuf, Campus des Cordeliers, Paris, Metro Odeon

18:55 - 19:05

Formation of Working Groups

Armin Ilg

Amphi Farabeuf, Campus des Cordeliers, Paris, Metro Odeon

19:05 - 19:15

Summary and next steps towards ECR White Paper input to EPPSU (talk)

Amphi Farabeuf, Campus des Cordeliers, Paris, Metro Odeon

19:15 - 19:30

19:00

To help discussion...

- Raise your hand
- Speak only with microphone
- Shortly introduce yourself

Focus on what should be covered in the White Paper – don't need to agree on statements yet



<https://www.menti.com/al2j1ofonx7z>



Thanks!

ECFA ECR panel

Keep in touch with us

- [Our webpage](#) to find your country ECR representative
- ecfa-ecr-organisers@cern.ch
- [Subscribe](#) to ecfa-ecr-announcements e-group to get notified about our activities!