The Early Career Researchers' Input to the 2026 Update of the European Strategy for Particle Physics

Abdelhamid Haddad (LPCA, CNRS/IN2P3)
Alexander Burgman (Stockholm Univ.)
on behalf of the ECR White Paper team
and the European ECR community
eppsu-ecr-organisers@cern.ch

ECRs: (non-perm or < 10 a after PhD)

Context / 2020 ESPPU

B. Particle physics, with its fundamental questions and technological innovations, attracts bright young minds. Their education and training are crucial for the needs of the field and of society at large. ***For early-career researchers to thrive, the particle physics community should place strong emphasis on their supervision and training. Additional measures should be taken in large collaborations to increase the recognition of individuals developing and maintaining experiments, computing and software. The particle physics community commits to placing the principles of equality, diversity and inclusion at the heart of all its activities.***

Ref: CERN-ESU-015-2020

A group of Early-Career Researchers (ECRs) has been given a mandate from the European Committee for Future Accelerators (ECFA) to debate the topics of the current European Strategy Update (ESU) for Particle Physics and to summarise the outcome in a brief document [1]. A full-day debate with 180

This report aims to provide input from the ECR community on the ESU scheduled to be approved by the CERN Council in 2020.

This initiative was started towards the end of the consultation period for the ESU, which has taken place throughout 2019. A total of 180 ECRs from institutes across Europe were invited to a plenary debate on 15th November 2019. The broad range of possible topics was subdivided into several areas with common physics or themes to streamline the discussion:

Ref: CERN-OPEN-2020-006

The Early-Career Researchers (ECR) panel of the European Committee for Future Accelerators (ECFA) [1] formed in January 2021, following the recommendations of an initial ECR debate in November 2019 [2], which aimed to provide ECR input to the 2020 update to the European Strategy for Particle Physics [3]. Following this, the panel aims to continue to provide ECR input to ECFA, and to the 2026 update to the European Strategy for Particle Physics.

Ref: ArXiv: 2407.12761 [acc-ph]

Context / 2026 ESPPU

⏳ This time, the ECR community is aiming to do better:

- ❏ Initiated by the ECFA ECR panel, as an open, community-driven effort
- ❏ A concrete and unified input to the ongoing ESPPU

💡 What's for ?

- ❏ Filling the gap, address topics not (necessarily) covered in other inputs, but of **critical importance to ECRs** & to **the future of the field** !

Timeline

10 October 2024

ECR session @ 3rd ECFA Workshop in Paris

First working groups (WGs) established

Discussions among WGs, first draft statements

ECR Workshop on EPPSU @ CERN

14 November 2024

20th February 2025

Open ECR Symposium @ CERN

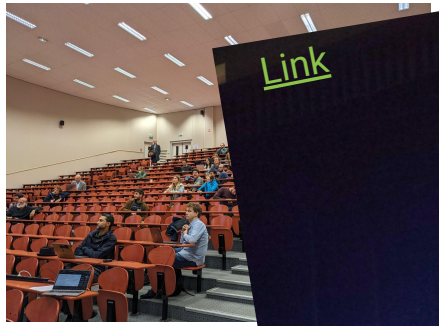
Discussion of survey results and first full White Paper draft

Presentation of final results (open to all)

Open Seminar on the White Paper @ CERN

27 May 2025

Timeline



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first full White Paper draft

The White Paper and ESPPU Input

Early Career Researcher Input to the
European Strategy for Particle Physics Update:
White Paper

Fifty-five recommendations for the future of our field

Editors

Jan-Hendrik Arling[1,*], Alexander Burgman[2,*], Christina Dimitriadi[3], Ulrich Einhaus[4], Axel Gallén[5], Abdelhamid Haddad[6], Laura Huhta[7], Armin Ilg[8,§], Jan Klamka[9], Elizabeth Long[10], Thomas Madlener[1], Arnau Morancho Tarda[11], Emanuela Musumeci[12,‡], Krzysztof Mękała[1,9,†], Elena Pompa Pacchi[13], Marvin Pfaff[14], Daniel Reichelt[15], Leonhard Reichenbach[15,16], Birgit Stapf[15], Francesco P. Ucci[17,18], Erik Wallin[19] and Harriet Watson[20,+]

Contact: epsu-ecr-organisers@cern.ch,
[*]jan-hendrik.arling@cern.ch, [*]alexander.burgman@fysik.su.se, [§]armin.ilg@cern.ch,
[†]k.mekala@uw.edu.pl, [‡]emanuela.musumeci@cern.ch, [+]harriet.watson@cern.ch

Authors

Sagar Vidya Addepalli[21], Bruno Alves[22], Robert Mihai Amarinei[23], Ricardo Barrué[24], Lydia Brenner[25], Giacomo Da Molin[24], Arturo de Giorgi[26], Bohdan Dudar[27], Francesco Giuli[28,29], Andrea Gurgone[30,31], César Jesús-Valls[32], Antoine Laudrain[3], Martin J. Losekamm[33], Rafal Maselek[34], Wrishik Naskar[35], Miquel Nebot-Guinot[20], Marko Pesut[8], Thomas Pöschl[15], Efrain P. Segarra[36], Rebecca Taylor[14,15], Pavel Vana[10], Hannah Wakeling[37] and Aidan R. Wiederhold[38]

Endorsed by the ECFA ECR Panel
27th of March, 2025

Abstract

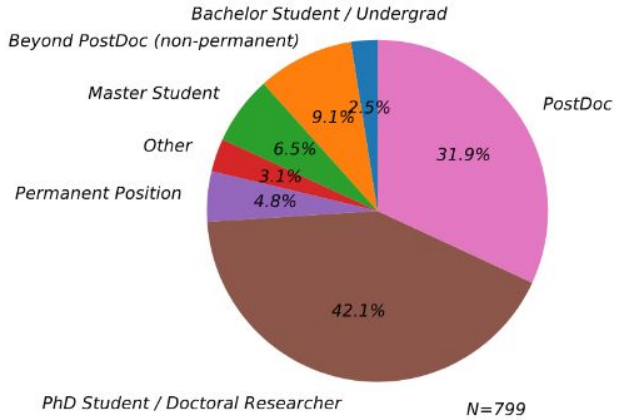
This document, written by early career researchers (ECRs) in particle physics, aims to represent the perspectives of the European ECR community and serves as input for the 2025–2026 update of the European Strategy for Particle Physics. With input from a community-wide survey, it highlights key challenges faced by ECRs — career stability, funding access and long-term research opportunities — while proposing policy recommendations and targeted initiatives. It underscores the importance of practices fostering diverse, equitable, inclusive and healthy workplaces, as well as of stronger ECR communities, and highlights how effective communication and interdisciplinary collaborations reinforce the societal relevance of particle physics and promote continued support for large-scale and long-term projects. Finally, the future of both collider and beyond-collider experiments is addressed, emphasising the critical role of ECRs in shaping future projects.

The ECR contribution is formed of two parts: the ten-page executive summary submitted as input to the European Strategy for Particle Physics Update and, as backup document, this extended white paper providing additional context.

[1] Deutsches Elektronen-Synchrotron DESY, Hamburg, Germany
[2] Stockholm University, Stockholm, Sweden
[3] KTH Royal Institute of Technology, Stockholm, Sweden
[4] Karlsruhe Institute for Technology, Karlsruhe, Germany
[5] Uppsala University, Uppsala, Sweden
[6] Laboratoire de Physique de Clermont Auvergne, CNRS/IN2P3, Université Clermont Auvergne, France
[7] University of Jyväskylä, Jyväskylä, Finland
[8] University of Zürich, Zürich, Switzerland
[9] University of Warsaw, Warsaw, Poland
[10] Charles University, Prague, Czech Republic
[11] Niels Bohr Institute, Copenhagen, Denmark
[12] Instituto de Física Corpuscular (IFIC), CSIC – Universitat de València, Paterna (València), Spain
[13] The University of Oklahoma, Norman, Oklahoma, USA
[14] Imperial College London, London, United Kingdom
[15] CERN, Geneva, Switzerland
[16] University of Bonn, Bonn, Germany
[17] University of Pavia, Pavia, Italy
[18] INFN - Sezione di Pavia, Pavia, Italy
[19] Lund University, Lund, Sweden
[20] The University of Edinburgh, Edinburgh, United Kingdom
[21] SLAC National Accelerator Laboratory, Menlo Park, USA
[22] Laboratoire Leprince-Ringuet, CNRS/IN2P3, Ecole Polytechnique, Institut Polytechnique de Paris, Palaiseau, France
[23] University of Geneva, Geneva, Switzerland
[24] Laboratório de Instrumentação e Física Experimental de Partículas (LIP), Lisbon, Portugal
[25] National Institute for Subatomic Physics (NIKHEF), Amsterdam, Netherlands
[26] Institute for Particle Physics Phenomenology, Durham University, Durham, United Kingdom
[27] University of Mainz, Mainz, Germany
[28] Dipartimento di Fisica, Università degli Studi di Roma Tor Vergata, Rome, Italy
[29] INFN - Sezione di Roma 2, Rome, Italy
[30] Università di Pisa, Pisa, Italy
[31] INFN - Sezione di Pisa, Pisa, Italy
[32] Kavli IPMU (WPI), UTIAS, The University of Tokyo, Kashiwa, Japan
[33] Technical University of Munich, Munich, Germany
[34] Laboratoire de physique subatomique et de cosmologie de Grenoble, Grenoble, France
[35] University of Glasgow, Glasgow, United Kingdom
[36] Paul Scherrer Institute, Villigen, Switzerland
[37] John Adams Institute for Accelerator Science, University of Oxford, Oxford, United Kingdom
[38] University of Manchester, Manchester, United Kingdom

Input to ESPPU / ArXiv:2503.19862

- 10 pages summary input + 100 pages backup
- 55 recommendations*, i.e. suggestions for Improvement + statements and examples
- 800 survey replies from European ECRs
  - & 2022 ECFA ECR Panel survey on career and diversity ArXiv:2404.02074
- 150 supporters so far (in addition to authors)



* Many recommendations were skipped for this talk.

Outline

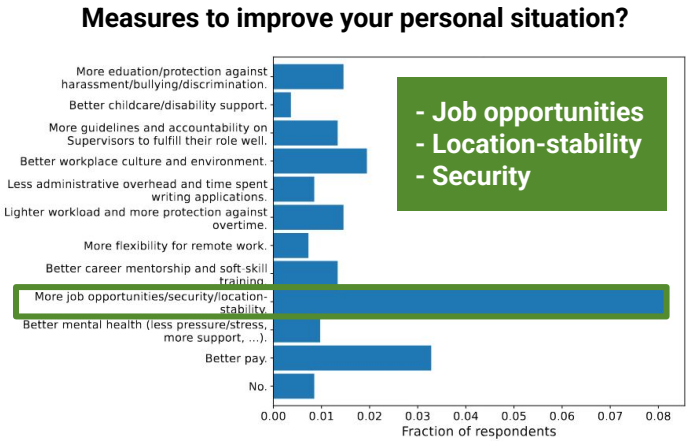
Part I:

1. Careers, wellbeing & DEI
2. Community building & leadership
3. Communication and outreach

Part II:

4. Future colliders
5. Beyond-collider projects

Career Prospects and wellbeing



- Provide information and career paths guidance to early-ECRs
- Skills training relevant to academia and industry (mentorship)
- Promote at least 3 years postdoc contracts, and more structured path to permanent positions (whenever possible)
- Recognise 2nd & non-research contributions in evaluations and institutional benchmarks.
- Mandatory supervision training to help staff align expectations and understand supervisee needs
  - ***80%** support mandatory supervision training*
  - ***59%** report that no such training exist locally*

Great science only happens with great scientists—and careers that retain them

Diversity, Equity & Inclusion (DEI)

Related input: DEI [259]

Talent knows no gender, background, or identity—our policies shouldn't either.

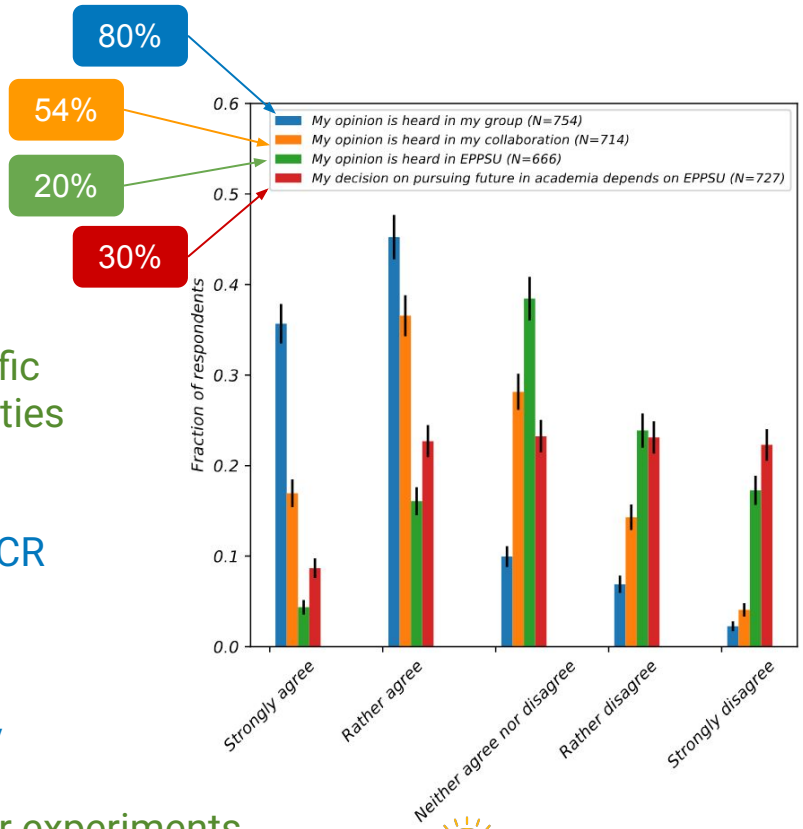
- ❏ ***57%** struggled at a certain degree with their **mental health***
  - ❏ ***80%** of them suffered **discrimination** or **harassment***

- ❏ Fund institutional mental health services, specially ECRs
- ❏ Establish DEI offices in all institutions, labs and research centers
- ❏ Have a publicly accessible Code of Conduct (e.g. CERN)
- ❏ Provide mandatory DEI training and safe spaces
- ❏ Ensure diversity in hiring panels and leadership roles
- ❏ Guarantee anonymity and discretion in complaint

Enforce Zero-tolerance for harassment and discrimination

Leadership, recognition & ECRs community building

- Include ECRs in executive boards, topical WGs and conferences organization & ECR sessions
- Ensure transparency in the selection of PPG scientific secretaries, clearly define their role and responsibilities toward the community
- Democratic ECFA ECR selection & Mandate ECFA ECR panel to send an ECR delegation to the ESG
- Dedicated funding to organise events (e.g. national forums) and activities to strengthen the community
- Inclusivity: dedicated ECFA panel on beyond-collider experiments



ECRs need a stronger voice in strategic roles and leadership

Communicating the importance of PP

Several of our recommendations align with input from
IPPOG [60], EPPCN [144] and INFN Communication Office [66]
& a collaboration is foreseen (in the near future) !

Effective Science communication and Outreach

- **Inspire the next gen of physicists**
- **Secure support and funding**
- **Give back to society**

~~Disinformation~~
~~Excessive simplification~~

~60%

Of ECRs already active in outreach

Outreach culture
Promote outreach as an integral part of science, sustaining motivation amongst ECRs

40%

Do not feel adequately valued for their outreach work

Recognition
Recognise and reward outreach and communication efforts, and integrate them into institutional benchmarks

40%

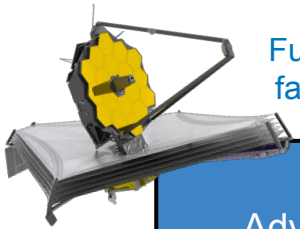
Of ECRs do not feel adequately trained to do science communication

Training & Resources
The community should develop standardised training and provide a centralised outreach platform

A lot of material already available!
(IPPOG is working on a centralised platform)

85%

Are motivated to engage with the public on topics of future projects in particle physics



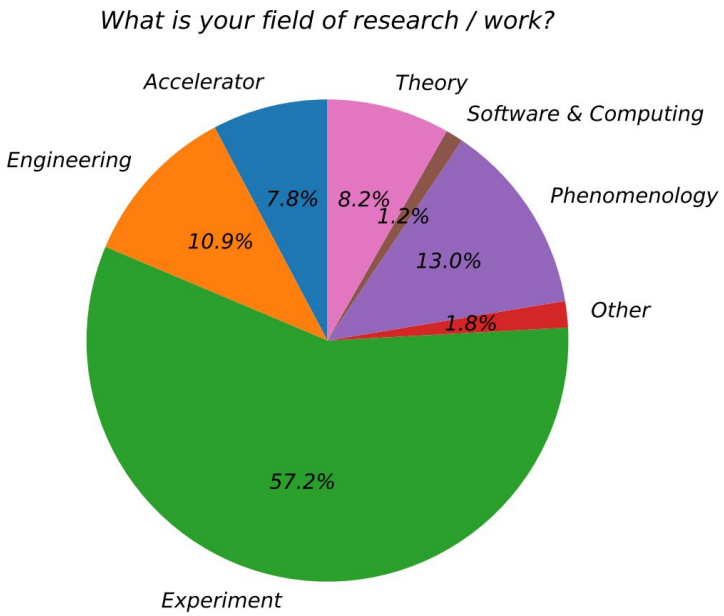
Future *discoveries* can be limited by several factors. The Community should change the storytelling

Storytelling
Advertize the role of future experiments as observatories, rather than discovery machines

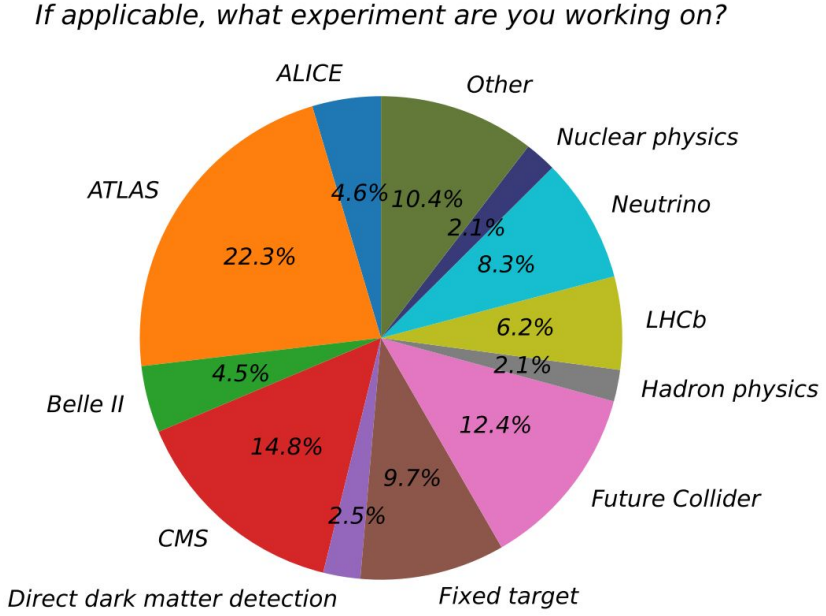
Future Experiments

Colliders and Beyond

Diverse Engagement with Survey



N=803 (191 multi responses)



N=658 (122 multi responses)

Criteria for a future collider

80 % of respondents **want a future flagship** collider

Deciding criteria for which future flagship collider (point-based prioritisation in survey)

– Driving factors	– Medium	– Less
• **Technological innovation** • **Physics baseline program** • **Collaboration**	• **Sustainability** • **Smaller project support**	• **Upgrade path** • **Timeline** • **Social acceptance** • **Location**

- **74 %** say the flagship collider should be built in the **most sustainable way**
- **Social acceptance important** for any flagship option

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ECRs prioritize an ambitious project – technologically and scientifically

Sustainability and **social acceptance** are necessary conditions – should not drive the collider decision

Which future collider?

– Driving factors

- **Technological innovation**
- **Physics baseline program**
- **Collaboration**

Which collider?

28% *circular e^+e^-*
15% *muon collider*
14% *hadron collider*
8% *linear e^+e^-*
23% *no strong opinion/don't know*
9% *any collider ASAP*

- FC-active ECRs: **~ 60 %** voted for "their" project, second most common is *any collider ASAP*

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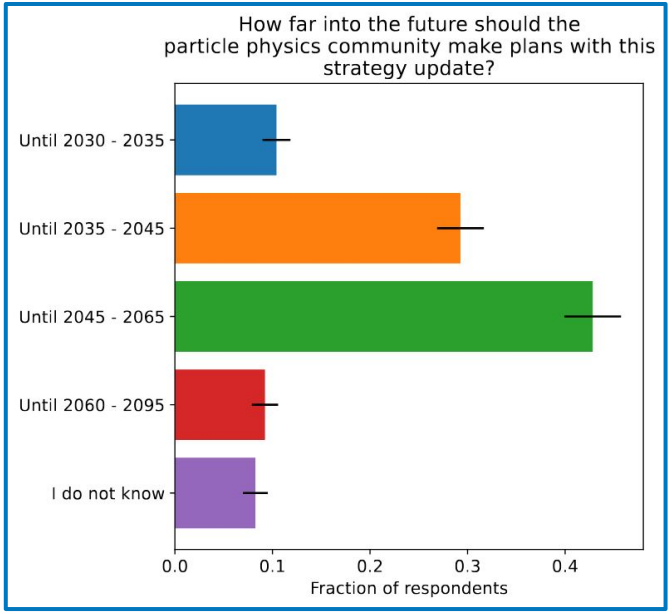
Significant effort needed to unify community behind selected project

84 % of ECRs are willing to **support the ESPPU outcome**, even if their preferred collider option is not prioritised.

ESPPU Time Coverage

- Upgrade path **not** prioritized as **driving factor**
- **ESPPU** should make plans **< 2065**



Call for a **timely decision** — avoids uncertainty

- **Career planning**, motivation for **funding bodies**
- Not fastest project, but **fast decision**

A **clear recommendation** on the next flagship collider for Europe should be given in this ESPPU process.

The ESPPU should **urge the CERN Council** to make a **timely decision** on the next flagship.

The decision process

ESPPU **community driven process**

- *some communications represent one project as “the default option”*
- *some communications exert pressure to conform, rather than convincing to agree*

We advocate for a **fair and open process**

The process towards defining the European strategy for particle physics must be **more transparent and democratic**. After the decision has been made, a **structured explanation of the criteria** which led to a certain result is **necessary**.

A **fair and inclusive decision process** is essential to create acceptance for the decision among proponents of the future collider alternatives and is vital for trust in the procedure. **Proponents of the leading project must work to gather support for their project**.

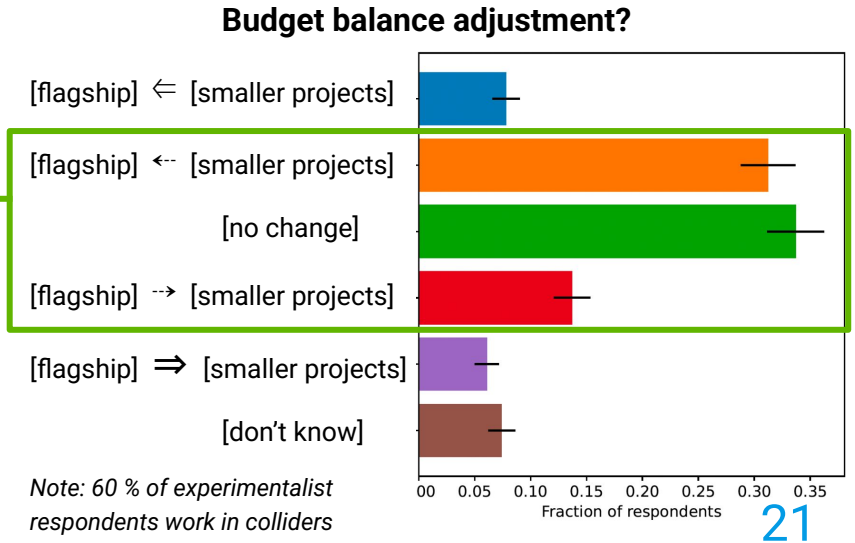
- Selection of collider is **not trivial**
- Show **clear and transparent** reasoning of the outcome of the ESPPU

Future colliders and beyond

Beyond-collider experiments and activities should maintain a prominent role in the European particle physics landscape, both as **groundbreaking activities in their own right** and as **pathfinders** for collider searches. Their **diversity** in scale, infrastructure and duration **should be valued and sustained** in order to maintain a thriving beyond-collider landscape.

Budget balance between flagship collider and smaller projects should **remain roughly steady**

Strong ECR support for the beyond-collider fields



Note: 60 % of experimentalist respondents work in colliders

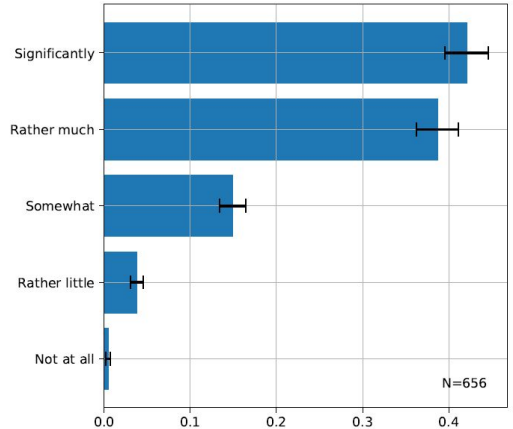
Beyond colliders

Forum for beyond-collider researchers: collaboration & coherence

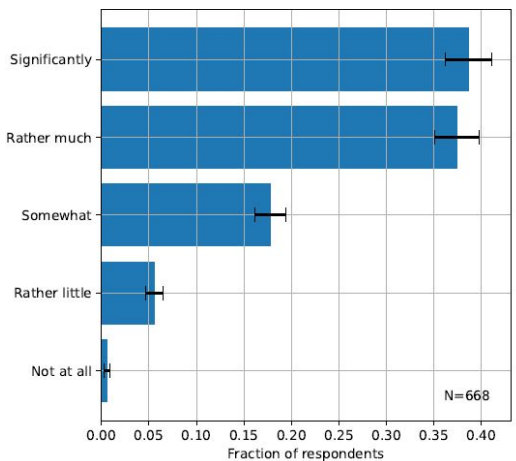
- **Easier transition** between collider and beyond-collider fields
- Dedicated beyond-collider **funding**
- Beyond-collider **ECFA panel**

Actions to benefit beyond-collider fields

Dedicated funding scheme



Easier transition C/BC experiments



Beyond colliders

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- Dedicated beyond-collider **funding**
- Beyond-collider **ECFA panel**

ESPPU should include **concrete recommendations for beyond-collider** particle physics

- pressing measurements, theoretical progress, required instrumentation and research infrastructure
- **career guidance**, motivation to **funding bodies**

Strengthen beyond-collider fields with **forum** and **concrete ESPPU recommendations**

Conclusions

Conclusions

- Investing in ECRs is to invest in the future of particle physics
- Great science only happens with great scientists—and careers that retain them
- Inclusion needs structure:
  — DEI offices — mentorship
- Value all contributions: analysis, software, R&D, outreach and comm.
- ECRs need a stronger voice in strategy and leadership

Flagship collider:

- Ambitious flagship
  — technologically — scientifically
  — collaborative — sustainable
- No majority for single project: openness to harmonization
- Timely decision
- Fair and transparent process

Beyond colliders:

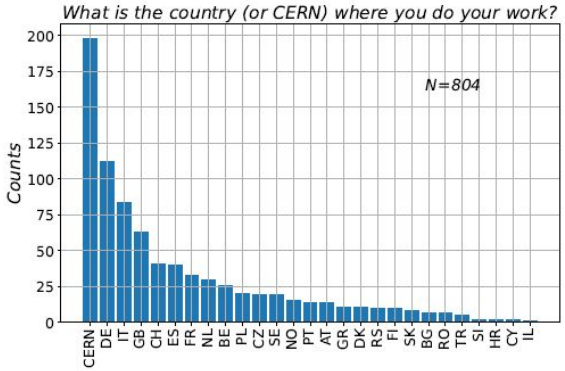
- Retain budget balance
- Dedicated forum
- Concrete ESPPU recommendations

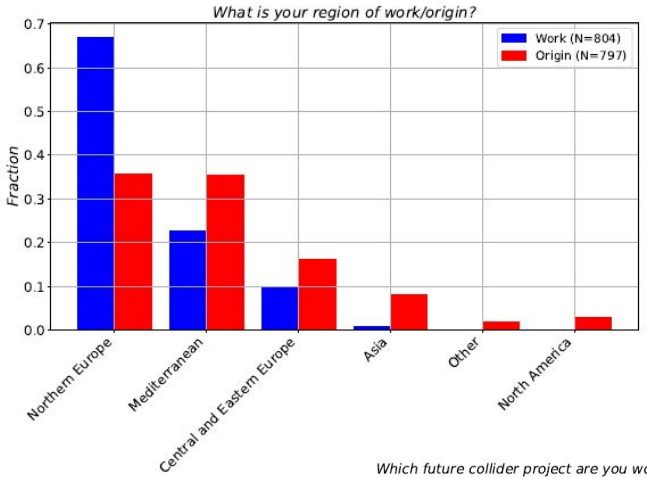
Thank you

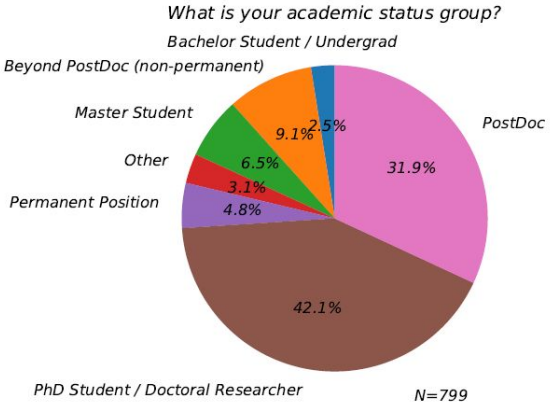
on behalf of the ECR White Paper team

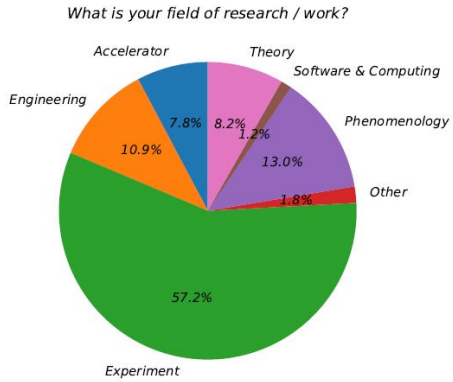
BACKUP

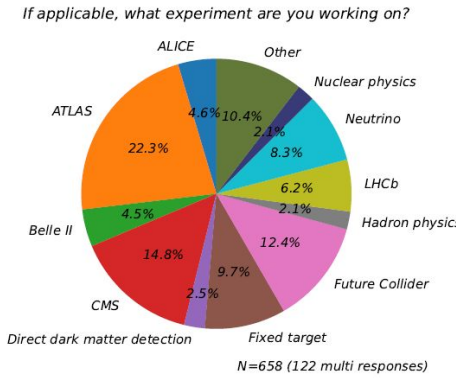
Survey demographics

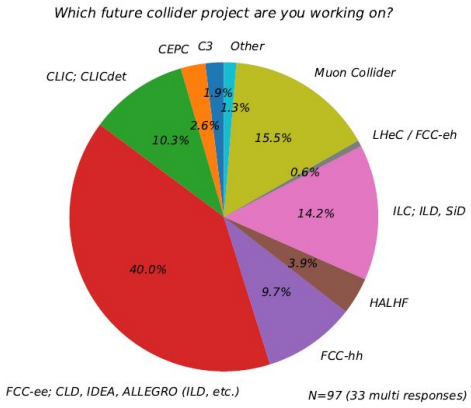


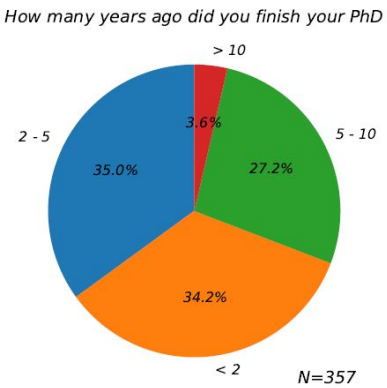




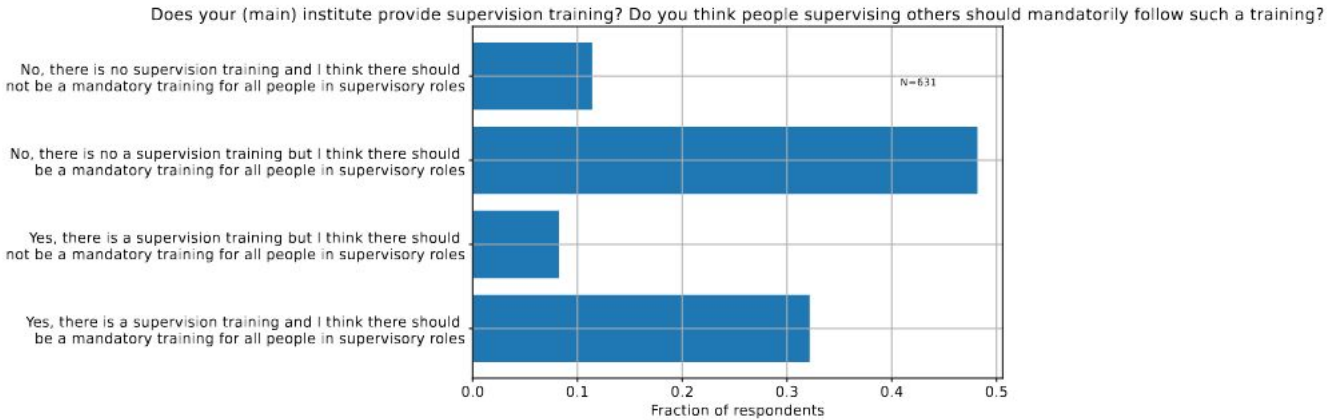




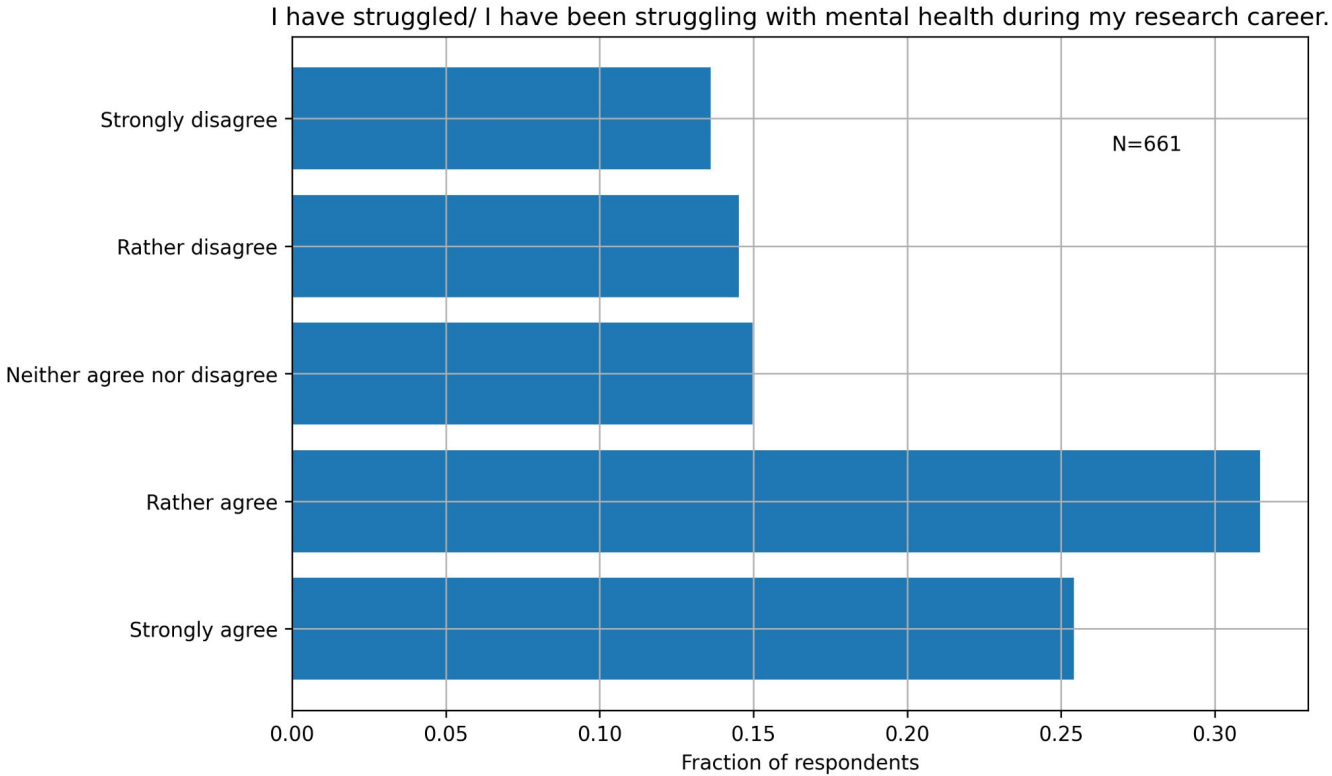




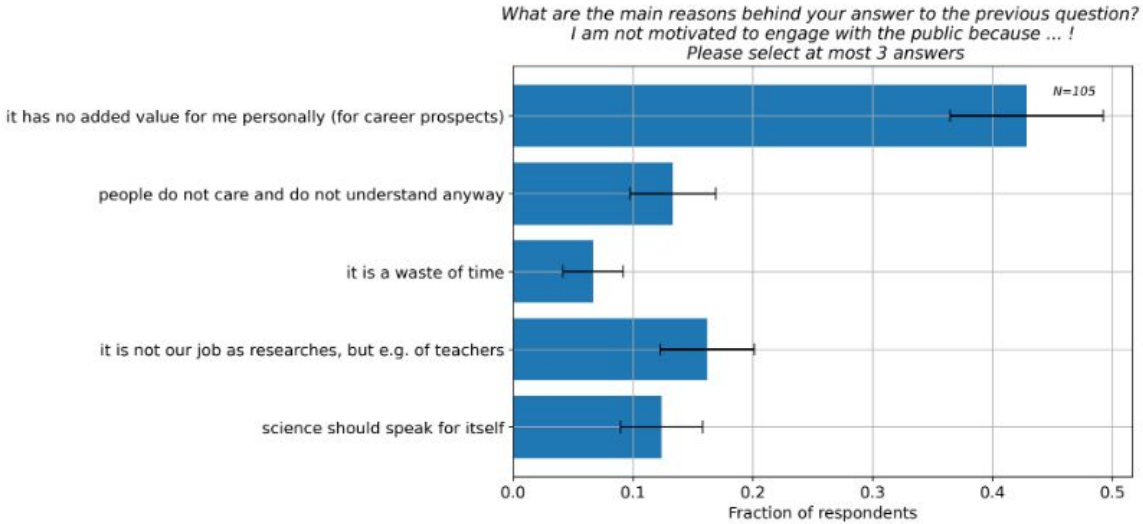
Career


Does your (main) institute provide supervision training? Do you think people supervising others should mandatorily follow such a training?
No, there is no supervision training and I think there should not be a mandatory training for all people in supervisory roles
No, there is no a supervision training but I think there should be a mandatory training for all people in supervisory roles
Yes, there is a supervision training but I think there should not be a mandatory training for all people in supervisory roles
Yes, there is a supervision training and I think there should be a mandatory training for all people in supervisory roles
N=631
0.0
0.1
0.2
0.3
0.4
0.5
Fraction of respondents

Wellbeing

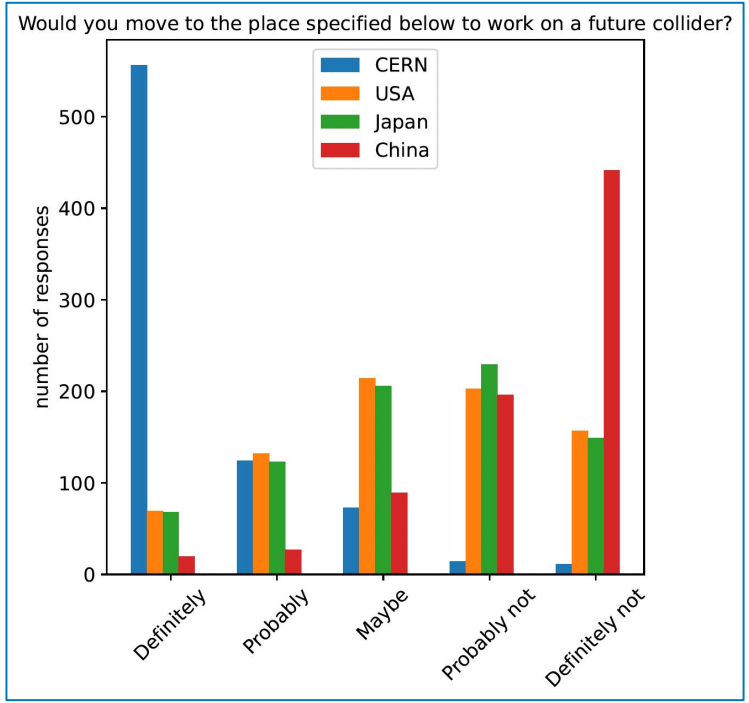

I have struggled/ I have been struggling with mental health during my research career.
Strongly disagree
Rather disagree
Neither agree nor disagree
Rather agree
Strongly agree
N=661
0.00
0.05
0.10
0.15
0.20
0.25
0.30
Fraction of respondents

Communication



But where?

- **CERN-based** flagship appreciated, but **not a justification** for selecting a collider
- Openness to **global collaboration** crucial for the next flagship, regardless of location
- Europe should build **complementary project** if a major collider is approved **elsewhere**



European ECRs hesitant to relocate to the US, Japan or China for alternative flagship colliders.
Note: Survey closed before current U.S. president taking office