Results of CROHEP ESPP Update Survey

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Introduction

- A major component of the community input to the ESPP update process is input from national communities. There are several deadlines for providing input but the first one is on March 31
- Survey organized to gather opinions across the CROHEP community and guide the preparation of the Croatian input
- Survey announced on Dec. 12, 2024, closed on Feb. 12, 2025
- Received a total of **20** responses
- For clarity and presentation purposes, some responses uniformized a bit
  - “FCC” vs “FCC-ee and FCC-hh”, “Long-baseline neutrino beam” vs “long-baseline neutrino beam” vs “neutrino beam”, “Neutrino Physics” vs “neutrino physics”, etc.

General questions

Your academic level

Answered: *20*

A. Doctoral student: 3 (15.00%)

B. Postdoc: 2 (10.00%)

C. Junior faculty/staff scientist (doc./znan. suradnik): 6 (30.00%)

D. Senior faculty/staff scientist (izv. prof./viši znan. suradnik and above): 9 (45.00%)

General questions

Your area of research

Answered: *20*

A. Theory: 5 (25.00%)

B. Experiment: 15 (75.00%)

General questions

Do you work on collider phenomenology and/or collider experiment(s)?

Answered: *20*

A. Yes: 12 (60.00%)

B. No: 8 (40.00%)

If no, what is your field of research? (optional)

Answered: *5*

Neutrino Physics

Flavor physics

Neutrino Physics

Neutrino

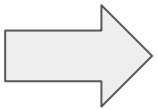
Instrumentation

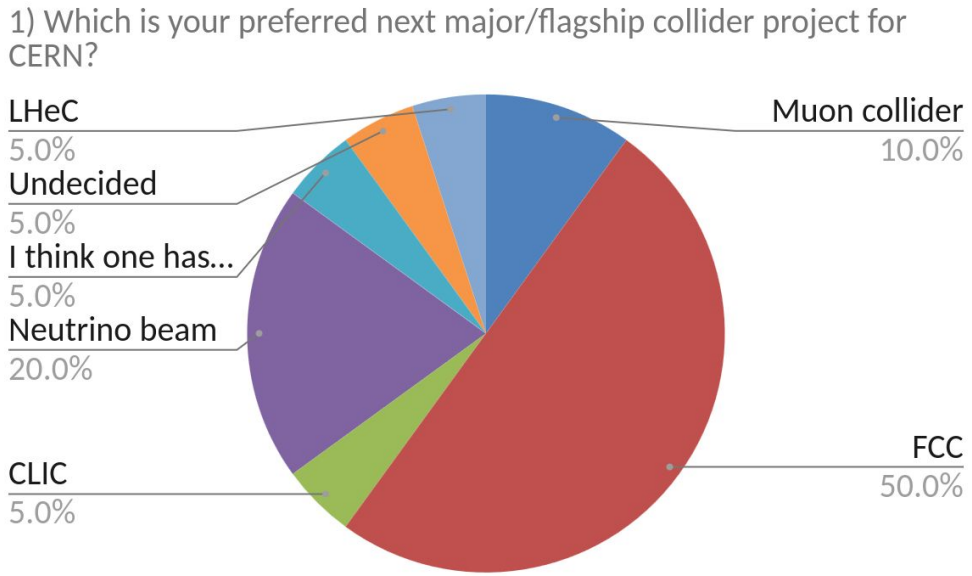
Questions on collider projects

1) Which is your preferred next major/flagship collider project for CERN? *

e.g. FCC (FCC-ee and/or FCC-hh), linear colliders (CLIC, energy recovery linacs, etc.), muon collider, plasma accelerators, long-baseline neutrino beam or some other alternative

1) Which is your preferred next major/flagship collider project for CERN?	Answered: 20
muon collider	
FCC	
FCC	
Long-baseline neutrino beam	
I think one has to carefully weigh all options. FCC, CLIC, ILC w 500 Gev com and upgrade, and muon collider are all viable	
CLIC	
FCC-ee and FCC-hh	
FCC	
FCC-ee	
FCC	
FCC-hh	
undecided	
LHeC	
FCC-ee and FCC-hh	
long-baseline neutrino beam	
long-baseline neutrino beam	
muon collider	
neutrino beam (long and short baseline)	
FCC-ee and FCC-hh	
FCC, neutrino	





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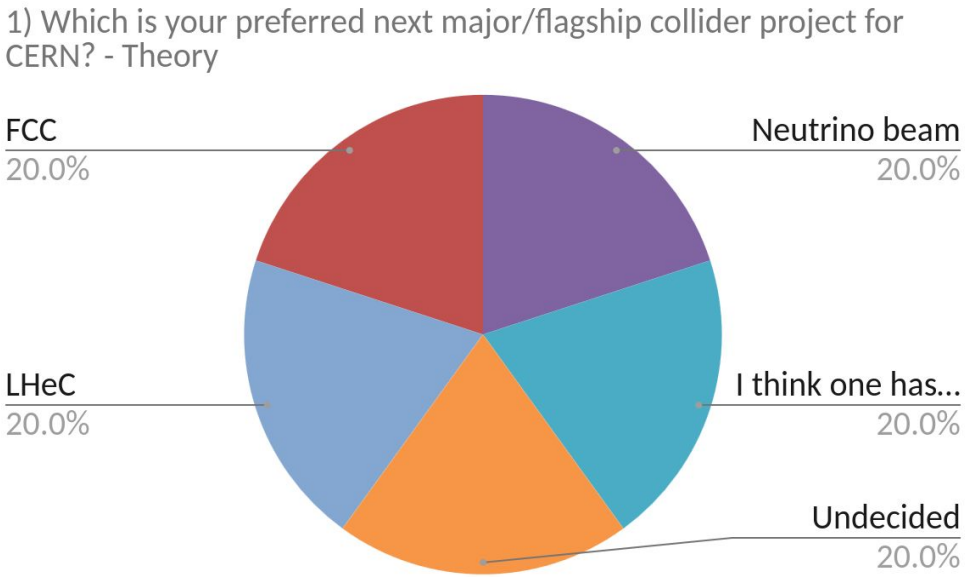
By area of research:
Theory



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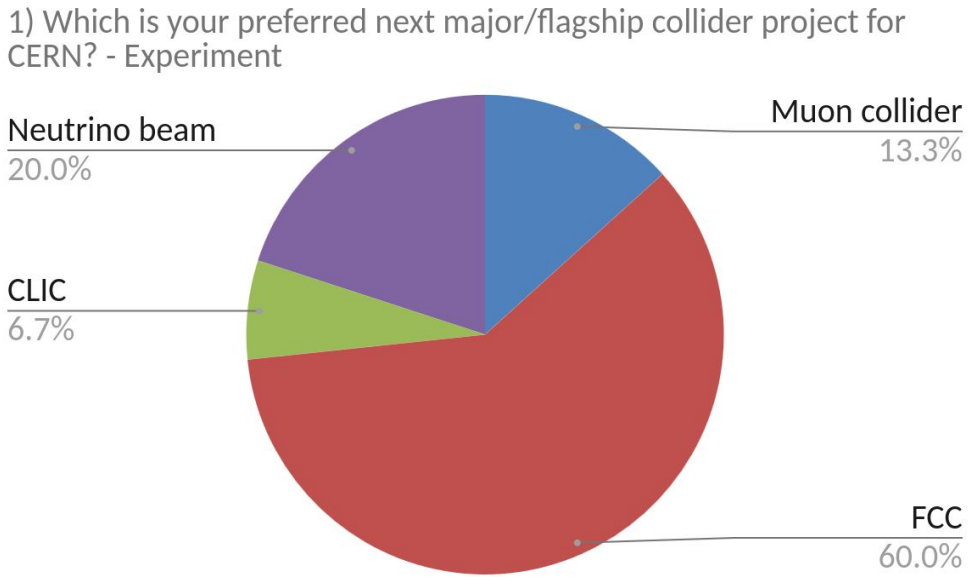
By area of research:
Experiment



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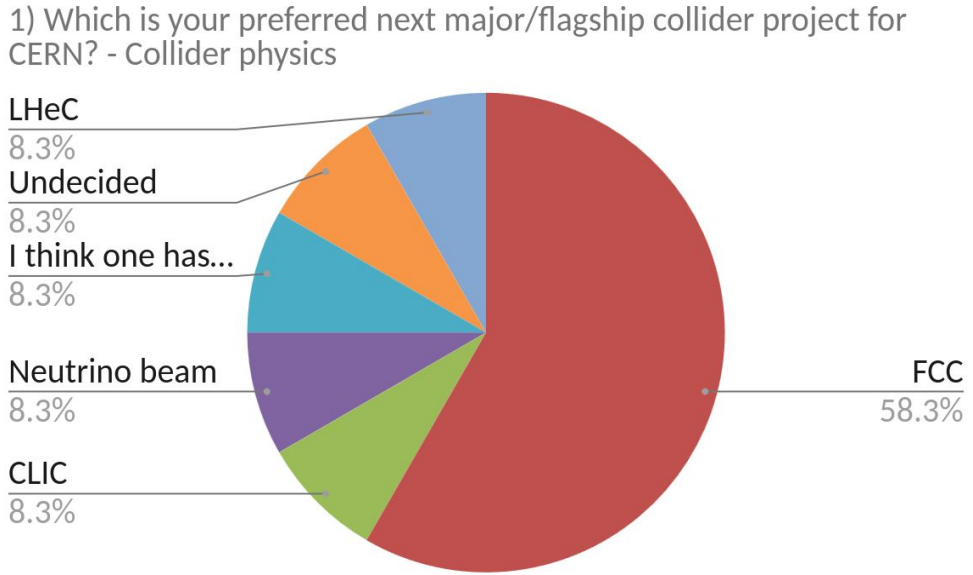
By area of research:
Collider physics



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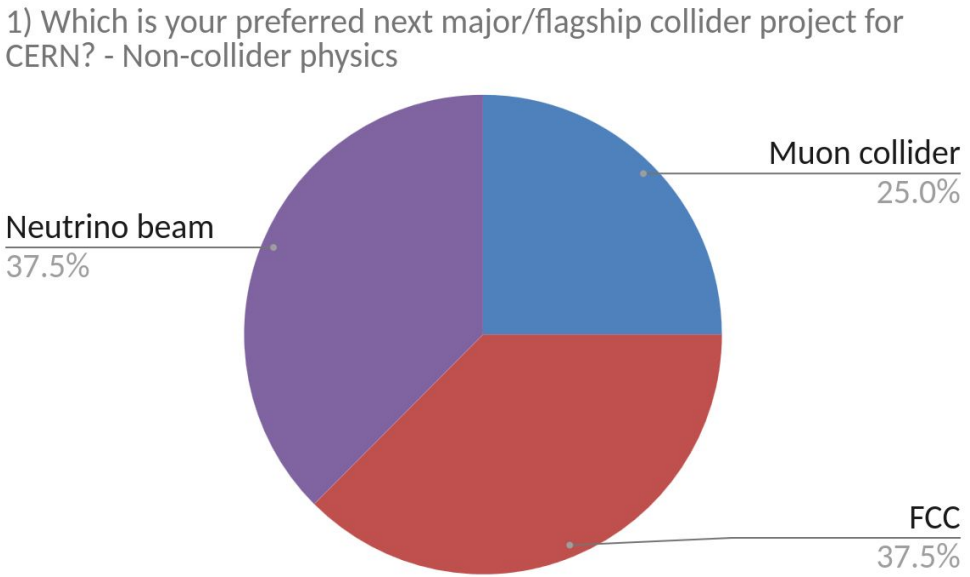
By area of research:
Non-collider physics



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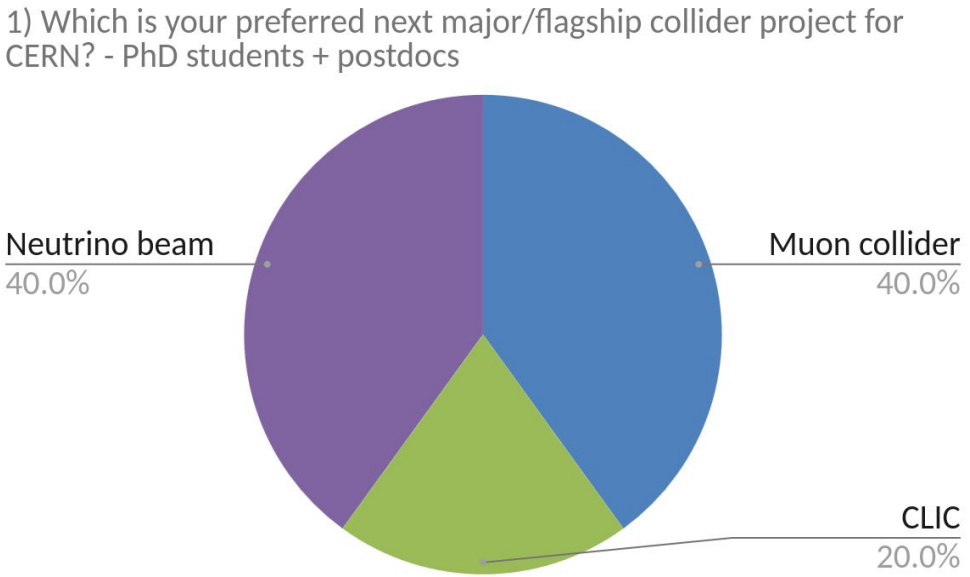
By seniority:
PhD students + postdocs



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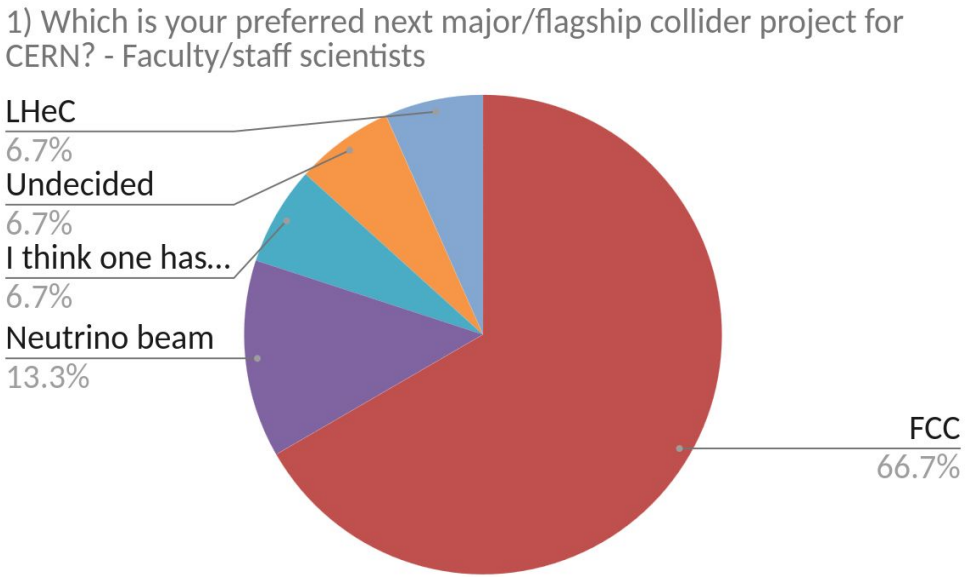
By seniority:
Faculty/staff scientists

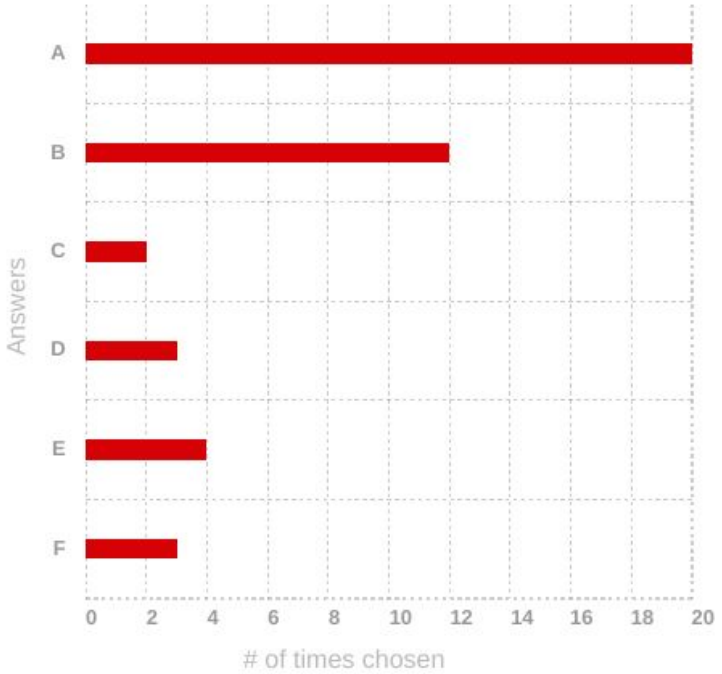


Questions on collider projects

2) What are the main factors driving your choice in 1)?

Answered: *20* Please select up to 3 items

- **A. Physics potential**: 20 (100.00%)
- **B. Long-term perspective** : 12 (60.00%)
- **C. Financial and human resources: requirements and effect on other projects**: 2 (10.00%)
- **D. Timing**: 3 (15.00%)
- **E. Careers and training**: 4 (20.00%)
- **F. Sustainability**: 3 (15.00%)



Questions on collider projects

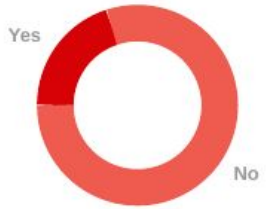
3) Would your chosen flagship project in 1) change if:

a) Japan decides to proceed with the ILC in a timely manner

Answered: *20*

A. Yes: 4 (20.00%)

B. No: 16 (80.00%)



If yes, what would your new choice of flagship project be, and why?

Answered: *2*

FCC-hh, another type of accelerator should allow broader research

FCC-hh

Questions on collider projects

3) Would your chosen flagship project in 1) change if:

b) China decides to proceed with the CEPC on the announced schedule? **Answered:** *20*

A. Yes: 6 (30.00%)

B. No: 14 (70.00%)

If yes, what would your new choice of flagship project be, and why? **Answered:** *4*

Something other than FCC and CLIC as CEPC seems to align with the physics reach of both

FCC-hh

muon collider

This would be a complicated situation because the world does not need two FCC-like colliders and in that case CERN could become a European hub for remote operations and data analysis of CEPC data. Locally, CERN would maintain its existing accelerator infrastructure and use it for test beams, neutrino physics, fixed target experiments, etc.

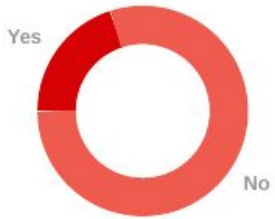
Questions on collider projects

3) Would your chosen flagship project in 1) change if:

c) the US decides to proceed with a muon collider? **Answered:** *20*

A. Yes: 4 (20.00%)

B. No: 16 (80.00%)



If yes, what would your new choice of flagship project be, and why? **Answered:** *1*

FCC-hh

Questions on collider projects

3) Would your chosen flagship project in 1) change if:

d) there are major new (unexpected) results from the HL-LHC and/or other HEP experiments?

Answered: *20*

A. Yes: 8 (40.00%)

B. No: 12 (60.00%)

If yes, what would your new choice of flagship project be, and why?

Answered: *6*

FCC

Probably FCC, but depends on the theory implications of the unexpected result

Possible continuation of HL-LHC

That depends on the new results from HL-LHC

depends on what these results are

It depends on the nature of such unexpected results so it is hard to give a more concrete response.

Questions on collider projects

4) What other accelerator R&D should be pursued in parallel with your preference in 1), and why? (e.g. high-field magnets, RF technology, alternative accelerators/ colliders)

Answered: 9

- *All areas of the R&D should be pursuit. In particular on the magnets and accelerator technologies (including RF)*
- *I cannot decide on this*
- *high-filed magnets, alternative accelerators*
- *High field magnets, useful in wide range of fields and applications*
- *Alternative accelerator technology*
- *newer horn systems to reduce the neutrino flux contamination and compatible with higher beam powers*
- *alternative accelerators/colliders*
- *monitored neutrino beam production beamline*
- *- High-field magnets for possible cost reduction of FCC-hh or potential applications in other areas - Alternative accelerator technologies because the FCC tunnel could be re-used for other types of accelerators in the future*

Questions on collider projects

5) What would be your preferred alternative flagship project(s), in order of preference, if 1) is not feasible due to e.g. cost, timing, international developments, etc.?

Answered: 13

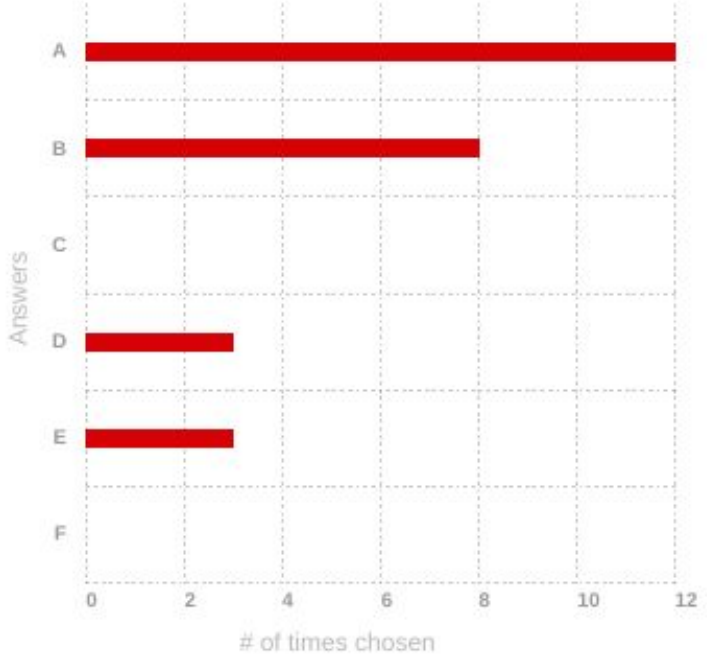
- ILC
- FCC
- I stayed very vague. I have the feeling not all options are compared in a fair manner at the moment.
- FCC, neutrino beam.
- 1.) CLIC, 2.)Muon Colliders, 3.) Plasma accelerators
- we must build new accelerator regardless of cost or international developments
- gravitational wave observatory
- Muon collider
- Linear collider and muon collider
- long-baseline neutrino beam
- muon collider
- None of the collider projects other than FCC seem sufficiently technology-ready to ensure a smooth transition after the HL-LHC. It also greatly depends on the status of CEPC.
- linear collider

Questions on collider projects

6) What are the main factors driving your choice in 5)?

Answered: *20* Please select up to 3 items

- **A. Physics potential**: 12 (60.00%)
- **B. Long-term perspective**: 8 (40.00%)
- **C. Financial and human resources: requirements and effect on other projects** : 0 (0.00%)
- **D. Timing**: 3 (15.00%)
- **E. Careers and training**: 3 (15.00%)
- **F. Sustainability**: 0 (0.00%)



Questions on non-collider projects

7) What other areas of physics should be pursued, and with what relative priority?

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Answered: 13

- Neutrino Physics
- Neutrino physics with high priority.
- neutrino physics
- Neutrino physics. Neutrino physics is the only experimental proof of physics beyond standard model (BSM). The continuous data from neutrino experiments shaping the path for BSM physics including CP violation in leptonic sector and physics beyond standard three flavour scenario. So CERN should pursue neutrino physics with a very high priority.
- Nuclear physics, with the aim of achieving controlled fusion
- Neutrino physics
- Medical physics.
- astroparticle physics, solid state
- Quantum physics, gravitational waves
- Astroparticle physics, neutrinos and other particles from space Gravitational waves
- Neutrino Physics
- Neutrino physics
- Neutrino physics Quantum technologies

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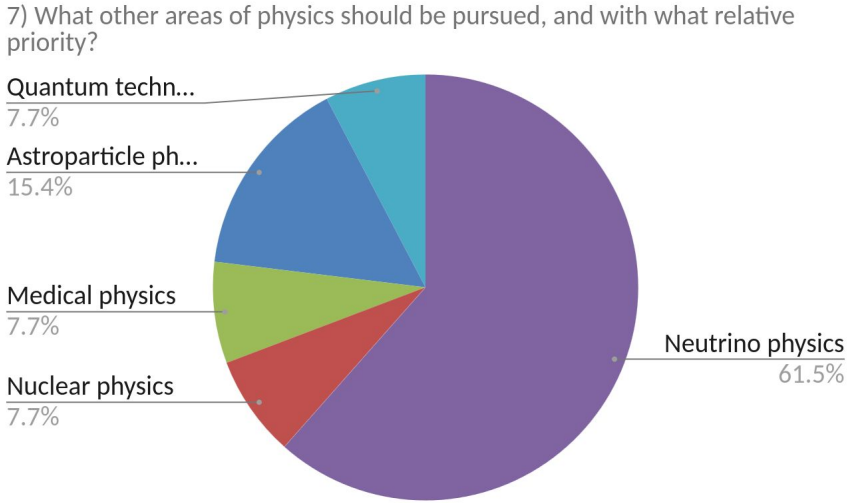
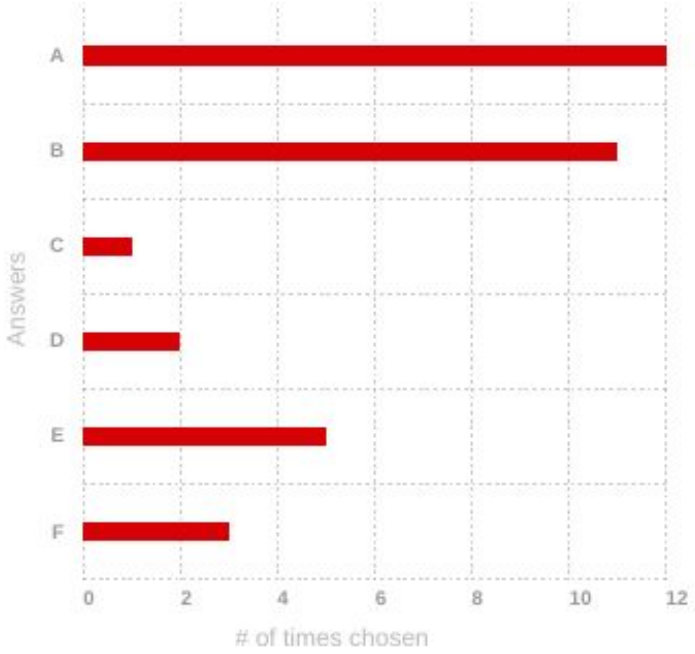


Questions on non-collider projects

8) What are the main factors driving your choice(s) in 7)?

Answered: *20* Please select up to 3 items

- **A. Physics potential**: 12 (60.00%)
- **B. Long-term perspective**: 11 (55.00%)
- **C. Financial and human resources: requirements and effect on other projects**: 1 (5.00%)
- **D. Timing**: 2 (10.00%)
- **E. Careers and training**: 5 (25.00%)
- **F. Sustainability**: 3 (15.00%)



Questions on non-collider projects

9) To what extent should CERN participate in areas of science other than particle physics (e.g. nuclear physics, astroparticle physics, or any other field aligned with the CERN Convention)? Please use the current level and form of activity as a baseline for comparison.

Answered: 9

More or less as on a baseline, current level.

Some complementarity participation in nuclear physics which can help the studies in particle physics will be useful.

I think CERN should focus on particle and collider physics. This is their expertise, and they should not venture away. A closer interaction of the TH department with hadron collider projects would be desirable.

Current level is fine.

Neutrino physics. CERN can do the same, even better than, FNAL for using its accelerator facilities for delivering neutrino beams of quality.

Should be much more involved then what it is now

With at least 20% of its overall effort

I think CERN should be very active in these fields.

This really depends on whether FCC goes forward or not. Either way, a strong focus on development and application of advanced machine learning ("AI") algorithms for data analysis should be pursued such that CERN becomes a global hub and center of excellence for machine learning in collider data analysis.

Summary and conclusions

- The number of responses a bit smaller than expected
  - However, based on private discussions, this level of response is probably as good as it gets
- Not much response (or at least it seems that way) from the astroparticle subcommunity
  - Somewhat understandable based on the format of the survey (biased toward CERN even though the update is of the **E**uropean **S**trategy for ***P**article **P**hysics*, not just collider physics)
- Overall, solid support for FCC as the preferred flagship project at CERN across the whole community and various subcommunities
- Neutrino physics clearly coming out as the second most preferred option
- Wide array of proposals for an alternative flagship project but without a clear winner
- Choices overwhelmingly driven by the physics potential and long-term perspective

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- Wide array of proposals for an alternative flagship project but without a clear winner
- Choices overwhelmingly driven by the physics potential and long-term perspective
- Raw survey results attached to the agenda (PDF and Excel formats)