EJČF zítra

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What is it?

- It is a document that will set the road of European particle physics in the future, in coordination with projects from around the world, such that particle physics benefits the most
- The Physics Preparatory Group prepares the scientific contribution from the community to the European Strategy Group, which drafts a proposal of the European Strategy for Particle Physics to the CERN Council to make a final decision

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The story of the strategy

CERN Council

According to the Convention for the Establishment of a European Organization for Nuclear Research, established by the twelve founding members of CERN, the Council is the supreme decision-making authority of the Organization, composed by delegates of all its twenty-three Member States.

Through the Council's adoption of the first European Strategy for Particle Physics in July 2006 and the subsequent Update of this Strategy in May 2013, CERN has assumed its mandate of organising and sponsoring international cooperation in particle physics and related fields not only inside, but also outside the Laboratory. Launched in 2018, the current Strategy update process will deliver its conclusions in spring 2020. This will be an important step in defining the future priorities of European particle physics and for the infrastructures which should follow the LHC.

The story of the strategy

European Strategy Group (ESG)

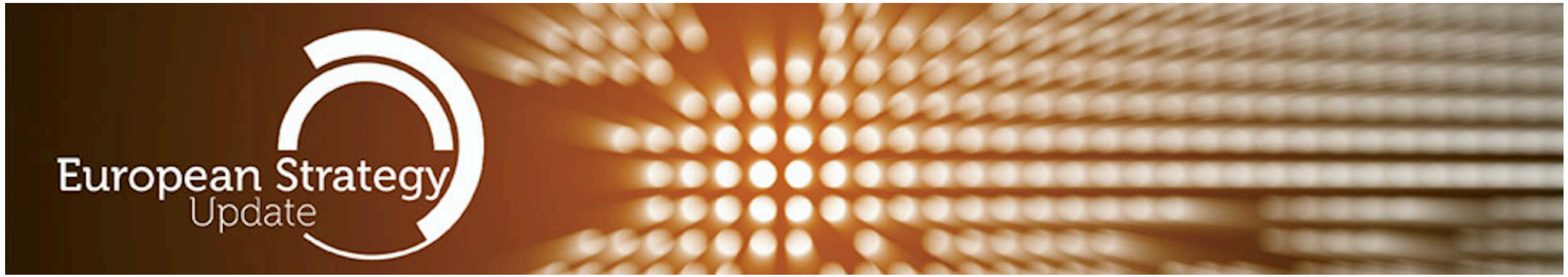
European Strategy Update

The European Strategy Group (ESG) is a special body set up by the CERN Council approximately every five years, with the remit to establish a proposal for the periodic update of the medium-and long-term European Strategy for Particle Physics which it submits to the CERN Council for approval. The ESG is assisted in this task by a Physics Preparatory Group (PPG) and drafts its update proposal taking into account, inter alia, the scientific input submitted by the PPG.

Physics Preparatory Group (PPG)

The remit of the Physics Preparatory Group (PPG) is to prepare the scientific contribution to the work of the ESG (the “Briefing Book”), based on the input it gathers from the community.

The story of the strategy



The European Strategy for Particle Physics provides a clear prioritisation of European ambitions in advancing the particle physics science. The Strategy is due to be updated by May 2020 to guide the direction of the field to the mid-2020s and beyond.

To optimally inform all participants in the process, the Secretariat of the European Strategy Group (ESG) called upon the particle physics community across universities, laboratories and national institutes to submit written input by 18 December 2018 to prepare the discussions on the Strategy Update which will take place in 2019.

Global Perspective

The European Strategy takes into account the worldwide particle physics landscape and developments in related fields, and was initiated by the CERN Council to coordinate activities across a large, international and fast-moving community with the aim to maximise scientific returns.

What is ECFA

website

- Long-range planning of European high-energy facilities
- ECFA is advisory to CERN Council and others
- Physicists from Member States of CERN participate in ECFA

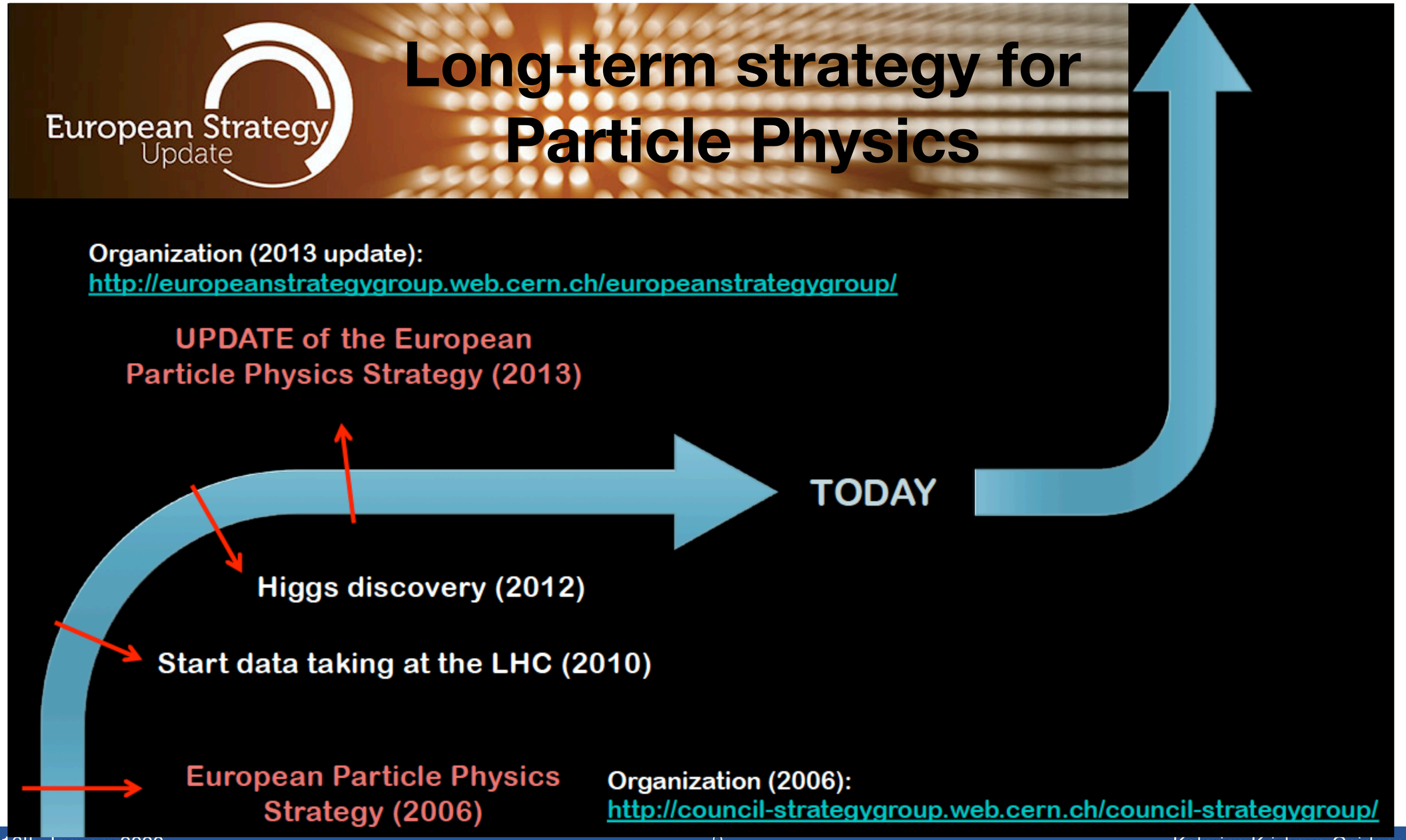
- For Czech Republic: Jana Bielcikova, Marek Tasevsky, Tomas Davidek

What is ApPEC and NuPPEC

- Astroparticle European Physics Consortium responsible for coordinating and funding national research efforts in astroparticle physics
- Also releases European Astroparticle Physics Strategy

- Nuclear Physics European Collaboration Committee develops the strategy in nuclear science by supporting collaborative ventures between research groups in Europe
- Releases a “Long range plan” document
- For Czech republic: Vladimir Wagner

The road of strategies



Strategy in 2006

website

- **The main focus is the LHC**
  - The highest priority is to fully exploit the physics potential of the LHC, resources for completion of the initial programme have to be secured such that machine and experiments can operate optimally at their design performance; R&D for machine and detectors has to be vigorously pursued now and centrally organised towards a luminosity upgrade by around 2015

- **Coordinate the European activity with the ILC project**
  - It is fundamental to complement the results of the LHC with measurements at a linear collider. There should be a strong well-coordinated European activity, including CERN, for the ILC design and technical preparation …

- **Coordinate with ApPEC and NuPECC**

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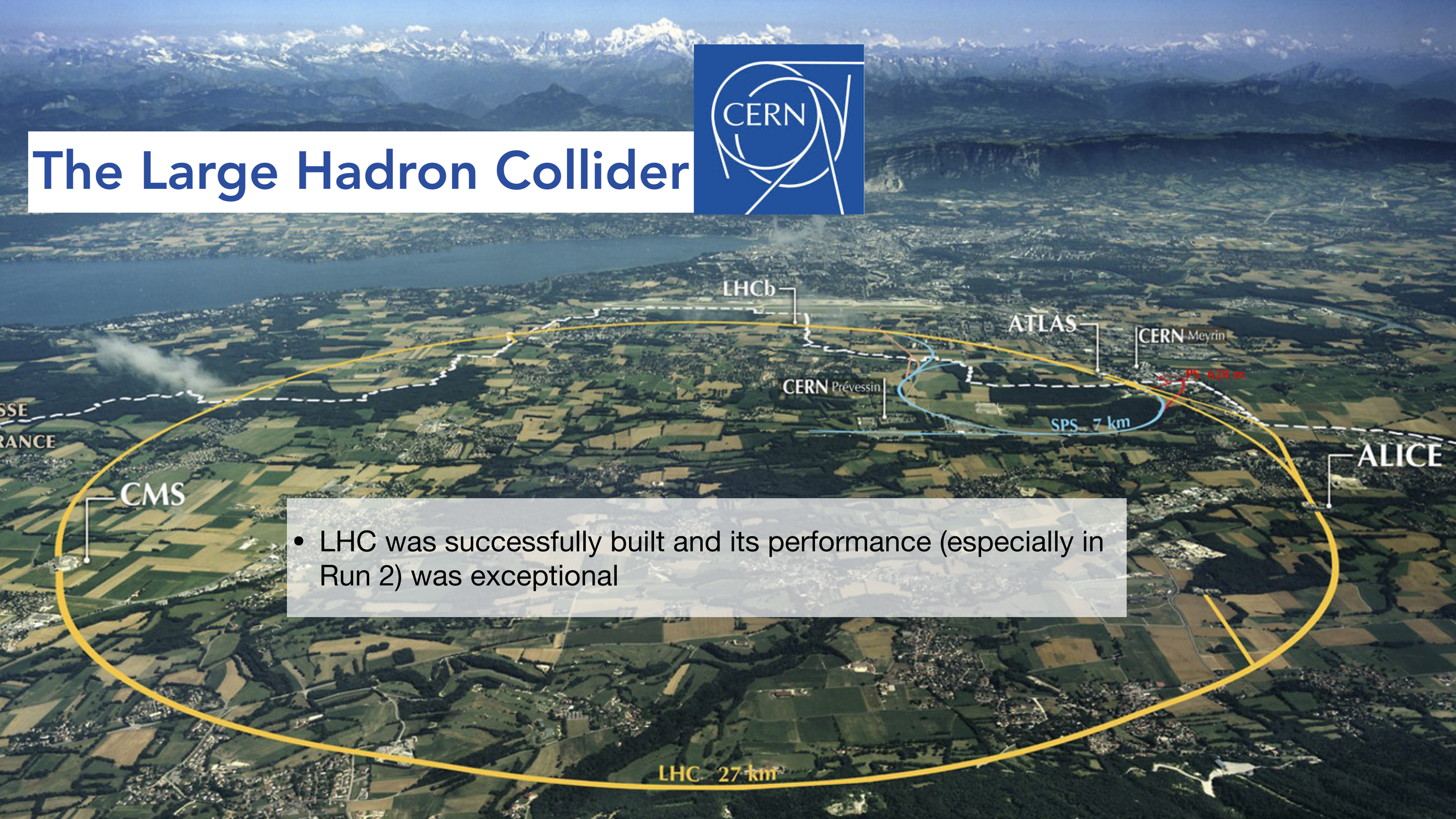
The Large Hadron Collider



- LHC was successfully built and its performance (especially in Run 2) was exceptional

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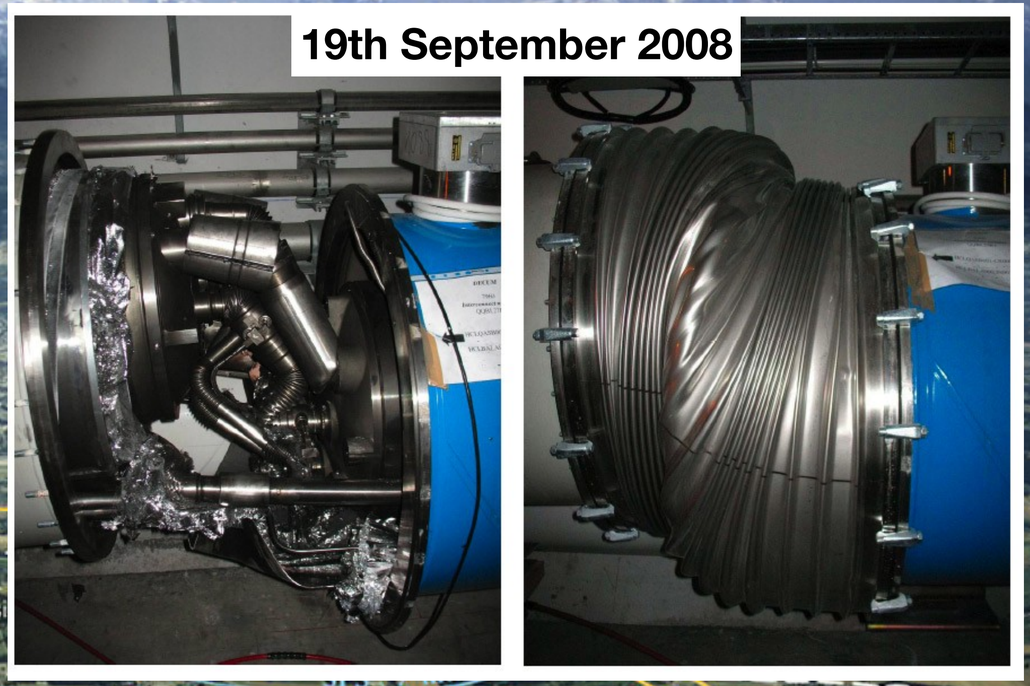

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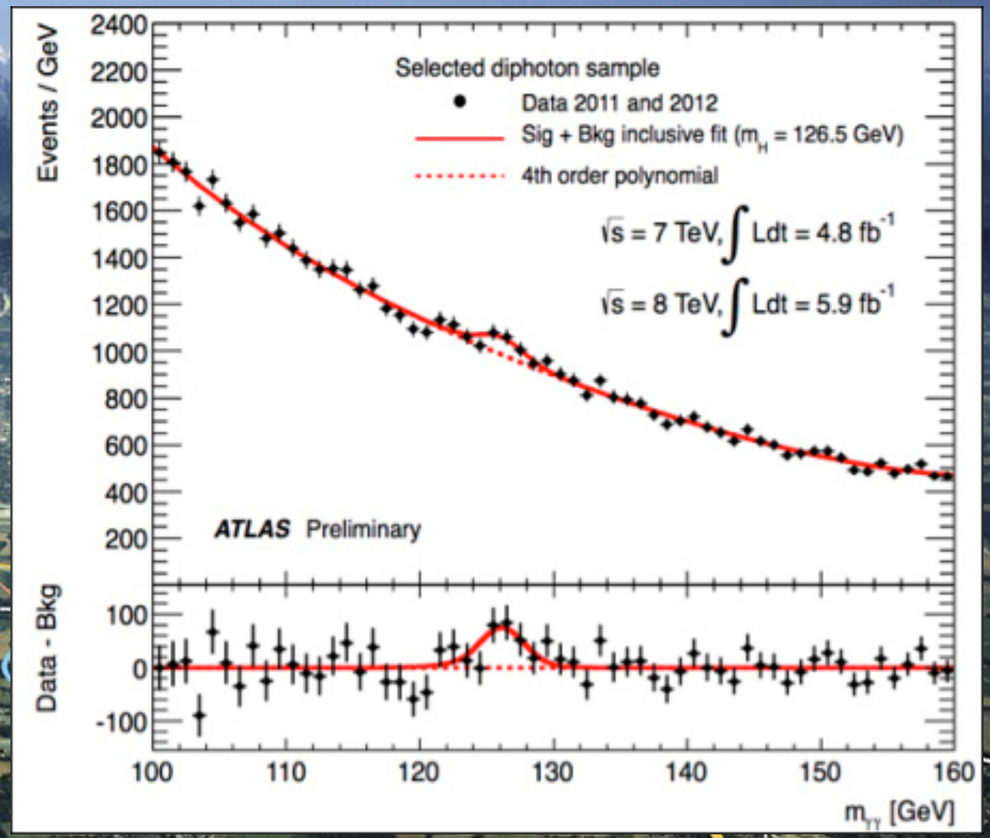
The Large Hadron Collider

Higss boson discovery announcement, 4th July 2012



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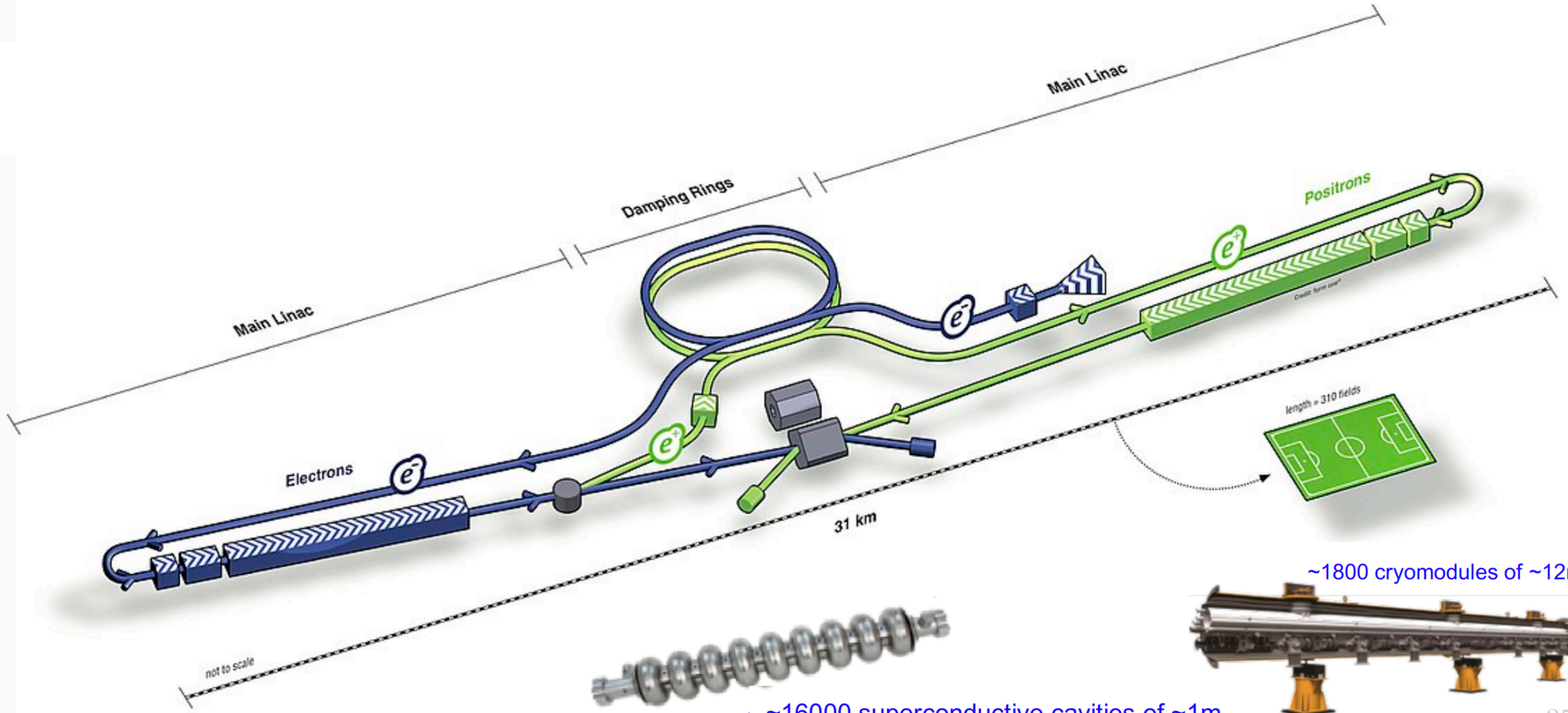
- …

International Linear Collider (ILC)

- e^+e^- collider with $\sqrt{s}$ = 0.5 TeV (upgradeable to 1 TeV)
- precision Higgs and top programme and beyond
- 20 km long tunnel with 2 all-purpose detectors at the interaction point

- International project, supposed to be built in Japan
- The decision process is still in progress
- Project now downgraded to $\sqrt{s}$ = 250 GeV
  - Just above the production threshold of HH pair

website



~16000 superconductive cavities of ~1m

~1800 cryomodules of ~12m

Strategy in 2006

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- First meeting in October 2019

Update to the Strategy in 2013

website

- **Exploit the full potential of the LHC**
  - The discovery of the Higgs boson is the start of a major programme of work to measure this particle's properties. Europe's top priority should be the exploitation of the full potential of the LHC, including the high-luminosity upgrade and detectors with a view to collecting ten times more data than in the initial design, by around 2030.

- **Undertake design studies to be able to propose a post-LHC accelerator at the next Strategy update**
  - To stay at the forefront of particle physics, Europe needs to be in a position to propose an ambitious post-LHC accelerator project at CERN by the time of the next Strategy update, when physics results from the LHC running at 14 TeV will be available. CERN should undertake design studies in a global context, with emphasis on pp and ep high-energy frontier machines, coupled to R&D of high-field magnets, high-gradient accelerating structures, …

- **Europe looks forward to a proposal from Japan to discuss a possible participation**
  - There is a strong scientific case for an ep collider complementary to the LHC. The TDR has been completed, with large European participation. The initiative from the Japanese particle physics community to host the ILC in Japan is most welcome, and European groups are eager to participate.

- **Europe should explore the possibility of major participation in leading long-baseline neutrino projects in the US and Japan.**

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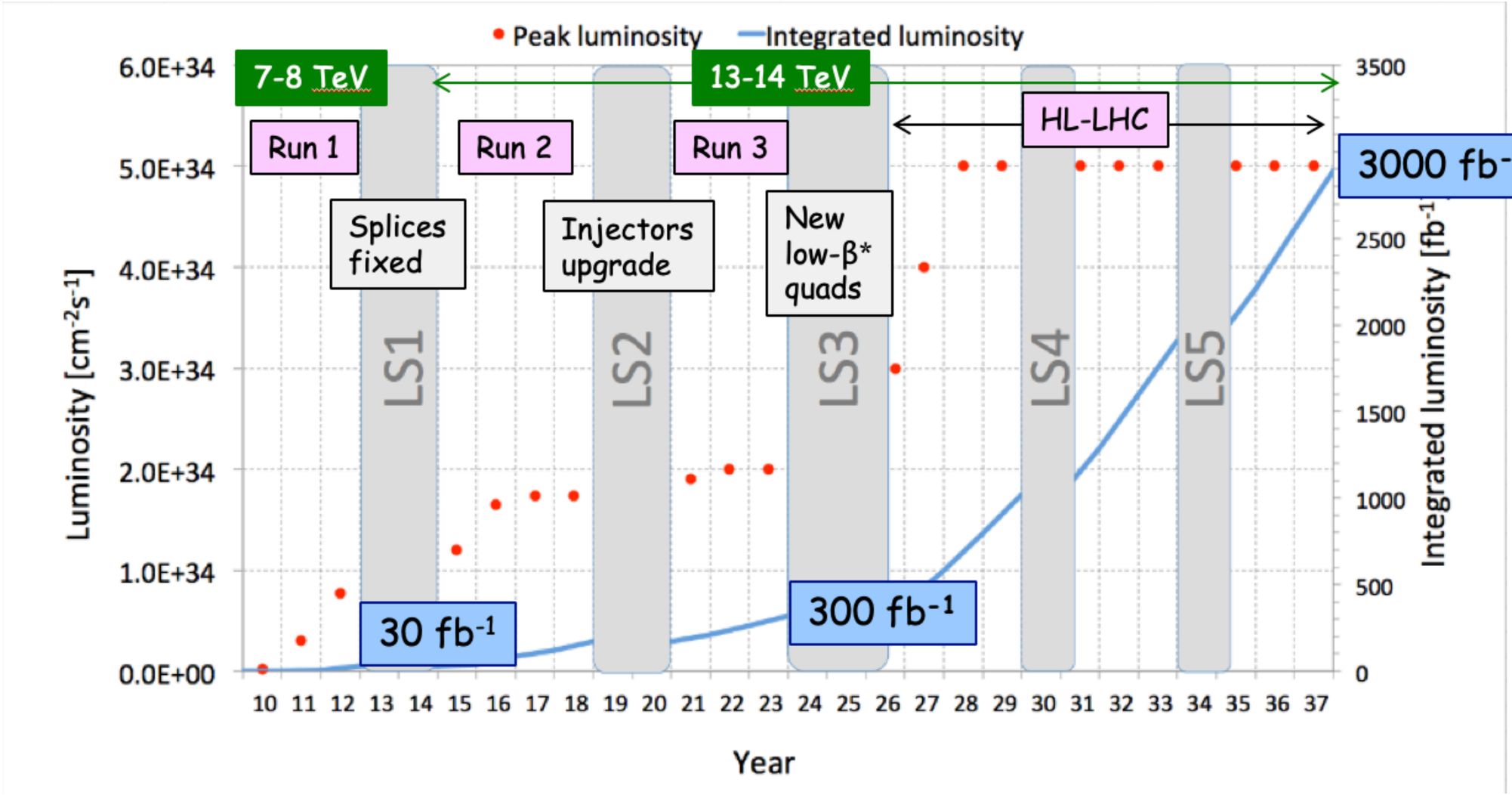
Exhaustive program at the LHC



- Successfull Run1 and even better Run2 behind us
- Now preparing for Run3 (most important for heavy-ion experiments)

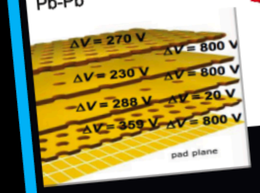
Upgrades

ALICE – Upgrade LS2 – *study Quark-Gluon Plasma formed in nuclear collisions*

Monolythic-pixel Inner Tracking System
→ x3-5 better tracking precision

Pixel Muon Forward Tracker
→ non-prompt muons from B decays

GEM-based TPC readout
→ x100 readout rate in Pb-Pb



- Low-p_T heavy-flavour mesons/baryons:
- Low-p_T charmonia: c-cbar melting and
- Low-mass di-electrons: QGP thermal r

LHCb – Upgrade LS2

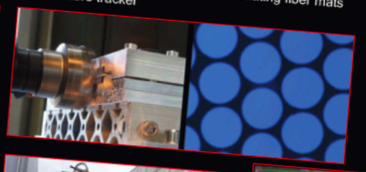
Construction well advanced

- Will collect 50 fb^{-1} at instantaneous lumi of 2x10^{33}cm^{-2}s^{-1}
- Full software trigger
- New tracking detectors
- New RICH photon detectors
- New electronics read out at 40 MHz

Prototypes of DAQ board (PCIe40)

VELO RF-foil (250 um thick machined aluminum foil)

Machining and light scan of the scintillating fiber mats for the fibre tracker



Cherenkov ring from a full RICH MaPMT module

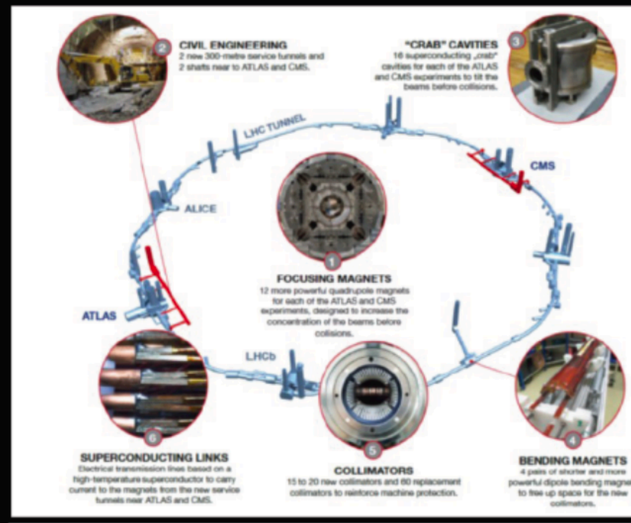
eam Tracker silicon or module under test

First scintillating fibre modules arriving at CERN

Calorimeter front-end board

Muon system readout ASIC

High-Luminosity LHC: 300/fb (by 2023) → 3000/fb (by 2037)



HiLumi HL-LHC PROJECT

New IR-quads Nb_3Sn (inner triplets)
New 11 T Nb_3Sn (short) dipoles
Collimation upgrade
Cryogenics upgrade
Crab Cavities
Cold powering
Machine protection
Civil engineering

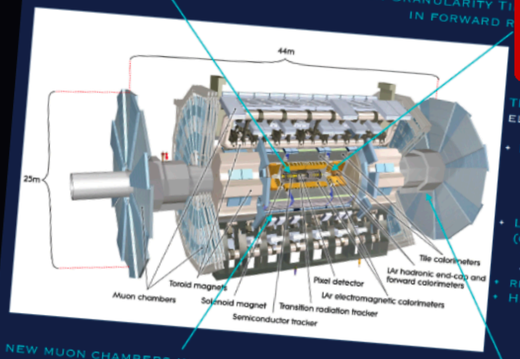
Formal approval by CERN Council (June 2016)
Cost to Completion : 950 MCHF (material)

Detector
plann

ATLAS – Upgrade Phase II (LS3)

NEW ALL-SILICON INNER TRACKER (ITK) WITH ETA COVERAGE UP TO 4

HIGH GRANULARITY TI… IN FORWARD R…



TDAQ OFF-DETECTOR ELECTRONICS:

- L0 HARDWARE TRIGGER:
  - L0 CALORIMETER
  - L0 TOPOLOGICAL
  - L0 MUON
  - L0 GLOBAL
- L1 HARDWARE TRIGGER (OPTION):
  - L1 GLOBAL
  - L1 TRACK TRIGGER
- READOUT SYSTEM
- HLT

NEW MUON CHAMBERS IN THE INNER BARREL REGION

FORWARD MUON TAGGER (OPTION)

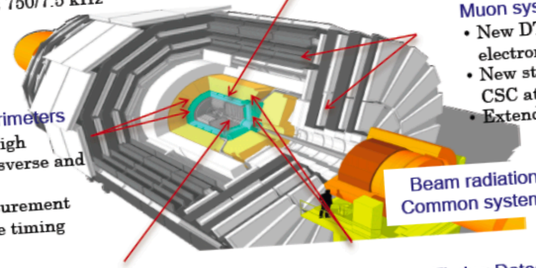
64

CMS – Upgrade Phase II (LS3)

Trigger/HLT/DAQ (interim TDR submitted)
- Track information in trigger at 40 MHz
- 12.5 μs latency
- HLT input/output 750/7.5 kHz

Barrel EM calorimeter
- New FE/BE electronics for full granularity readout at 40 MHz - with improved time resolution
- Lower operating temperature (8∘)

Muon systems
- New DT & CSC FE/BE electronics
- New station to complete CSC at $1.6 < \eta < 2.4$
- Extended coverage to $\eta \simeq 3$



New Endcap Calorimeters
- Rad. tolerant - High granularity transverse and longitudinal
- 4D shower measurement including precise timing capability

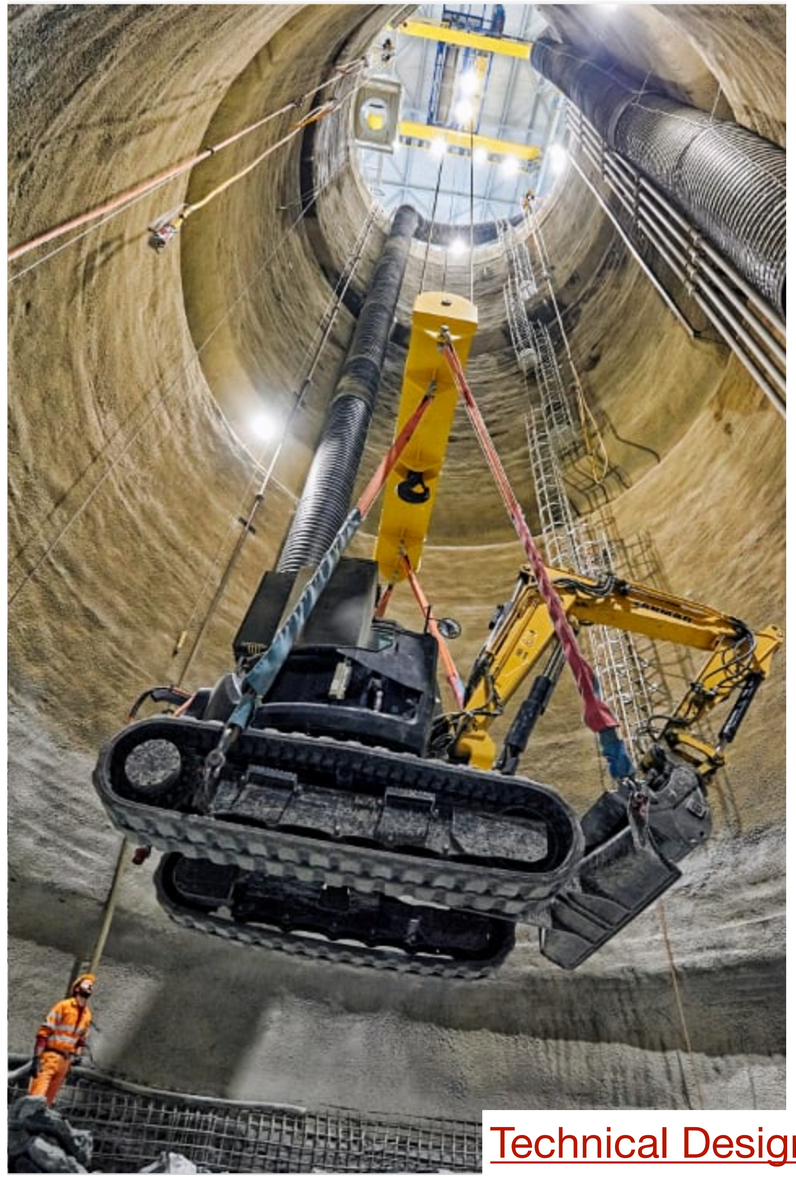
Beam radiation and luminosity
Common systems and infrastructure

New Tracker
- Rad. tolerant - increased granularity - lighter
- 40 MHz selective readout (strips) for Trigger
- Extended coverage to $\eta \simeq 3.8$

MIP precision Timing Detector
- Barrel layer: Crystal + SiPM
- Endcap layer: Low Gain Avalanche Diodes

HL-LHC

- Objective is to increase the luminosity by 10 times the LHC design value
  - E.g., it will produce 15M Higgs bosons/year (now it is only 3M)
  - Top priority of the strategy 2013
- The whole LHC will undergo major upgrades
  - “Crab cavities” for tilting the beams at interaction points
  - More compact and powerful bending magnets (11 T compared to 8 T)
  - Two new shafts at Points 1&5 (CMS and ATLAS sites)
  - …



Technical Design Report

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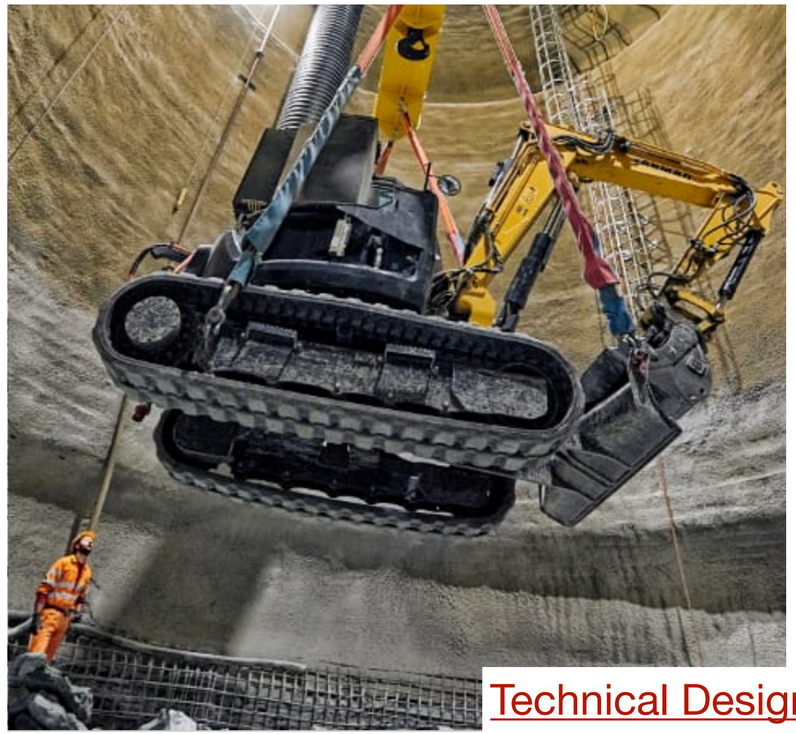

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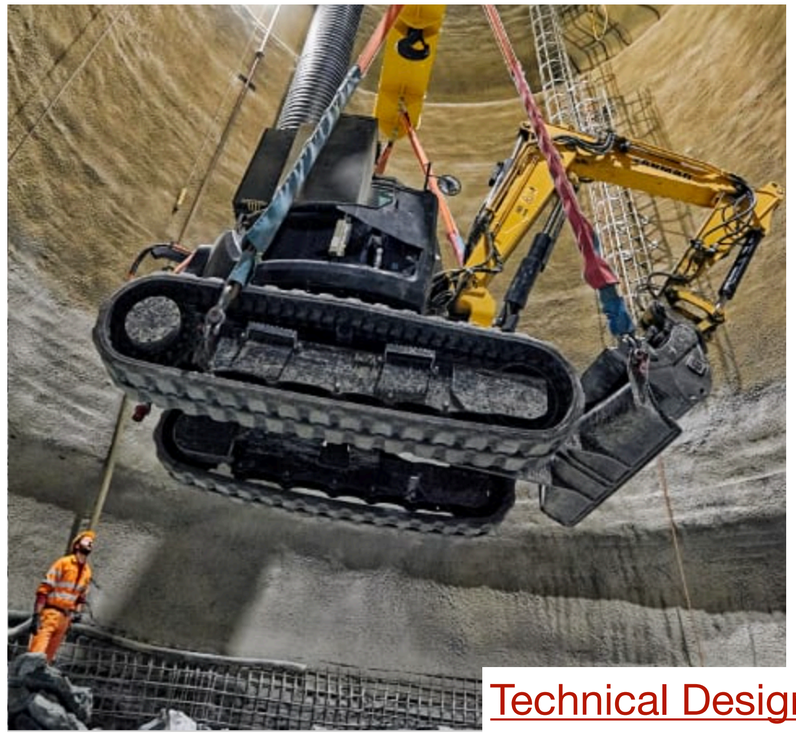
- Also Pb-Pb collisions are under consideration
  - But the ALICE experiment will probably not be able to cope with this



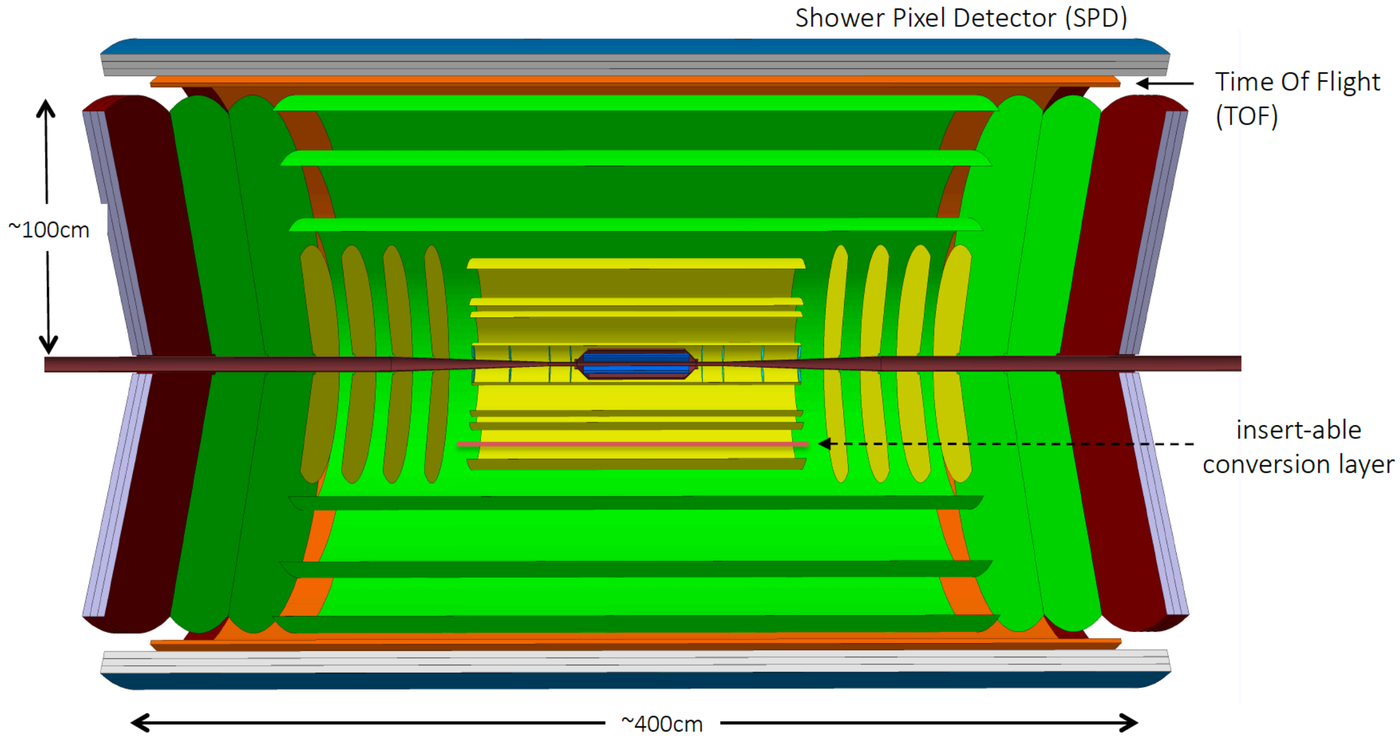
Technical Design Report

New experiment at Point 2

- When the luminosity is too high for ALICE, there are two options discussed about how to use the interaction Point 2

Option 1)

- All silicon light detector to study ultra-soft QCD (a “better” ALICE)
  - Parts of the detector inside the beam pipe !
- Installed during LS4
- arXiv: 1902.01211



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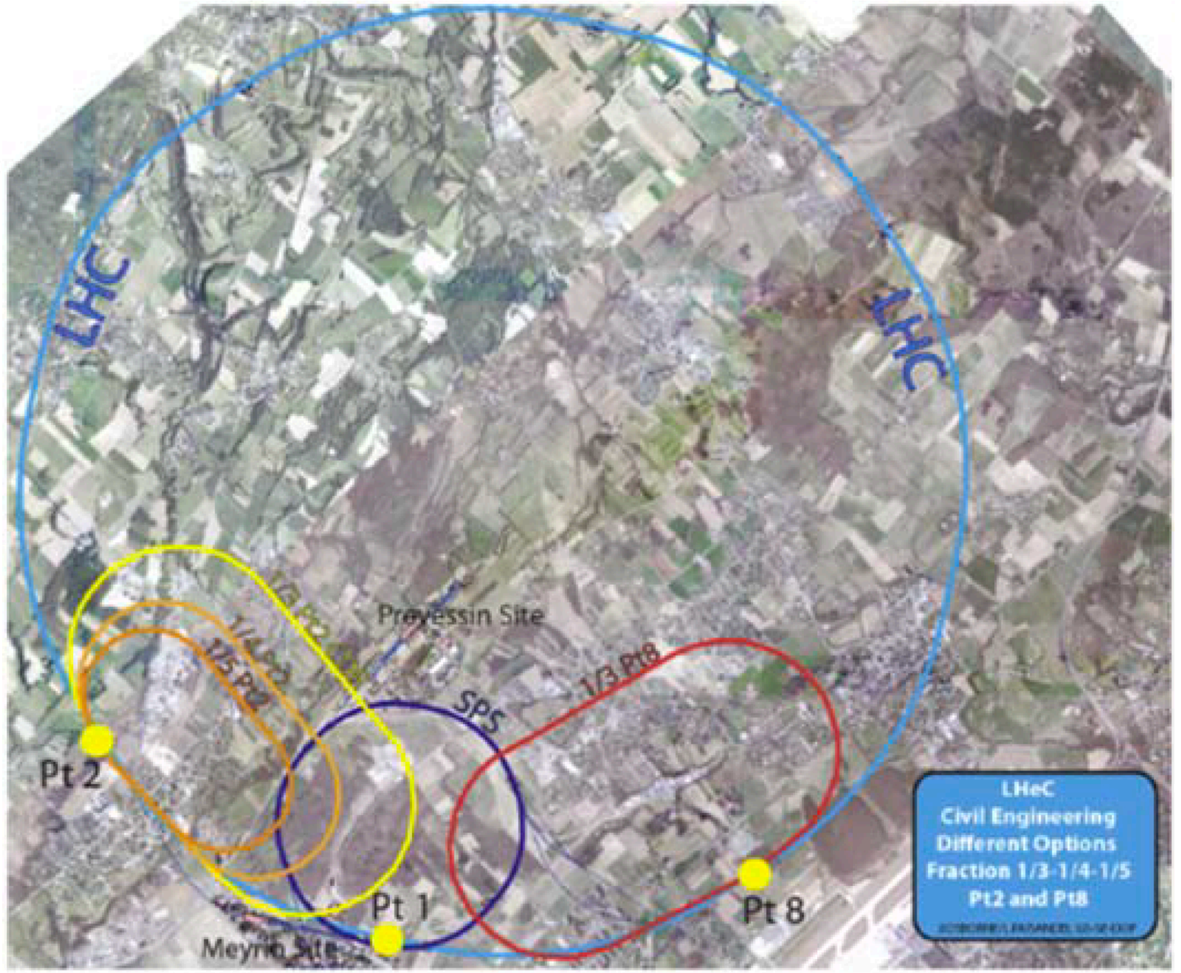
Option 2)

- LHeC project, which can run in parallel to HL-LHC
  - ep or eA collisions with up to $\sqrt{s_{eh}}$ ~ 1.3 TeV
- J.Phys.G.: Nucl.Part.Phys. 46 (2019) 123001



Update to the Strategy in 2013

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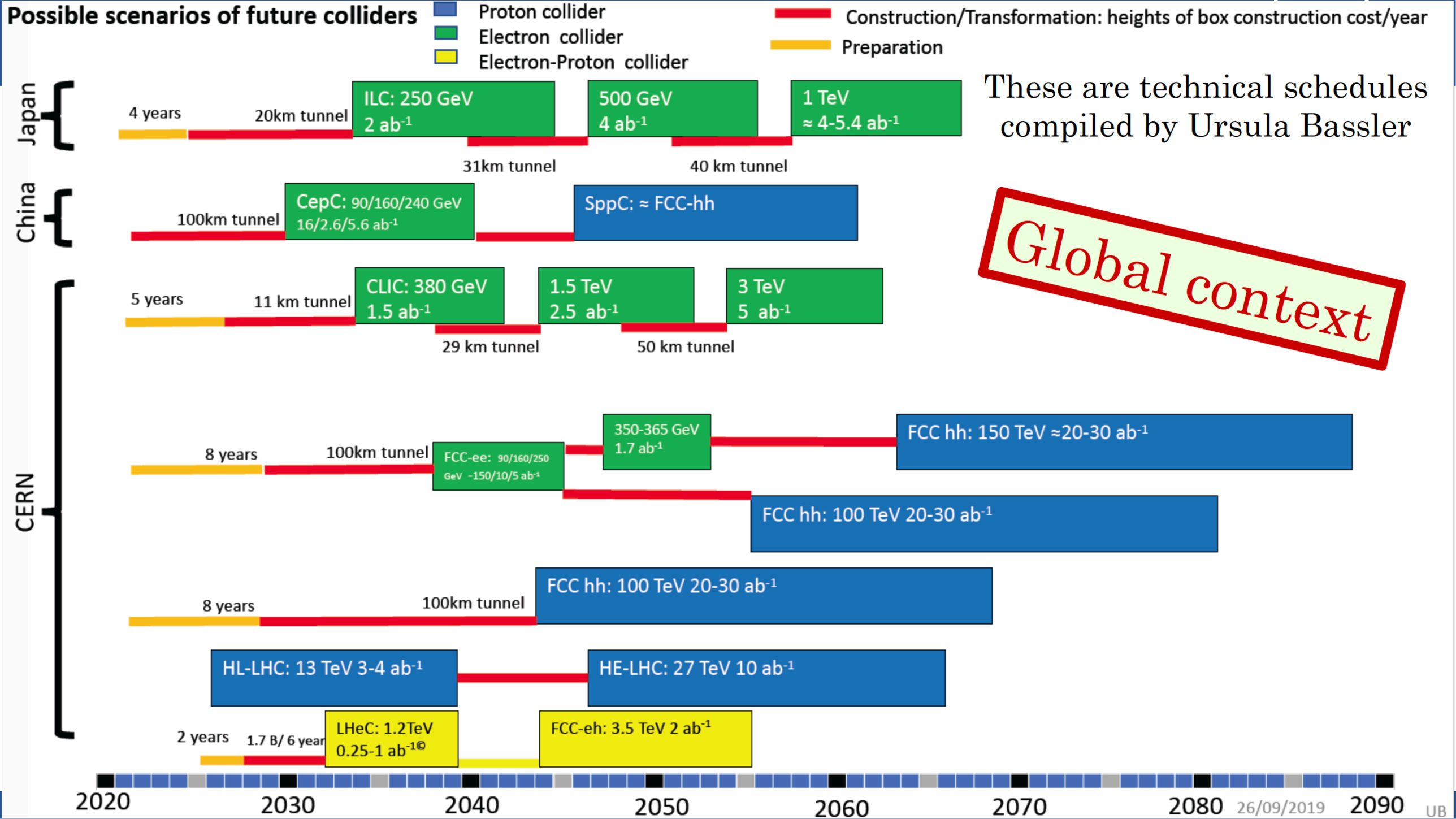
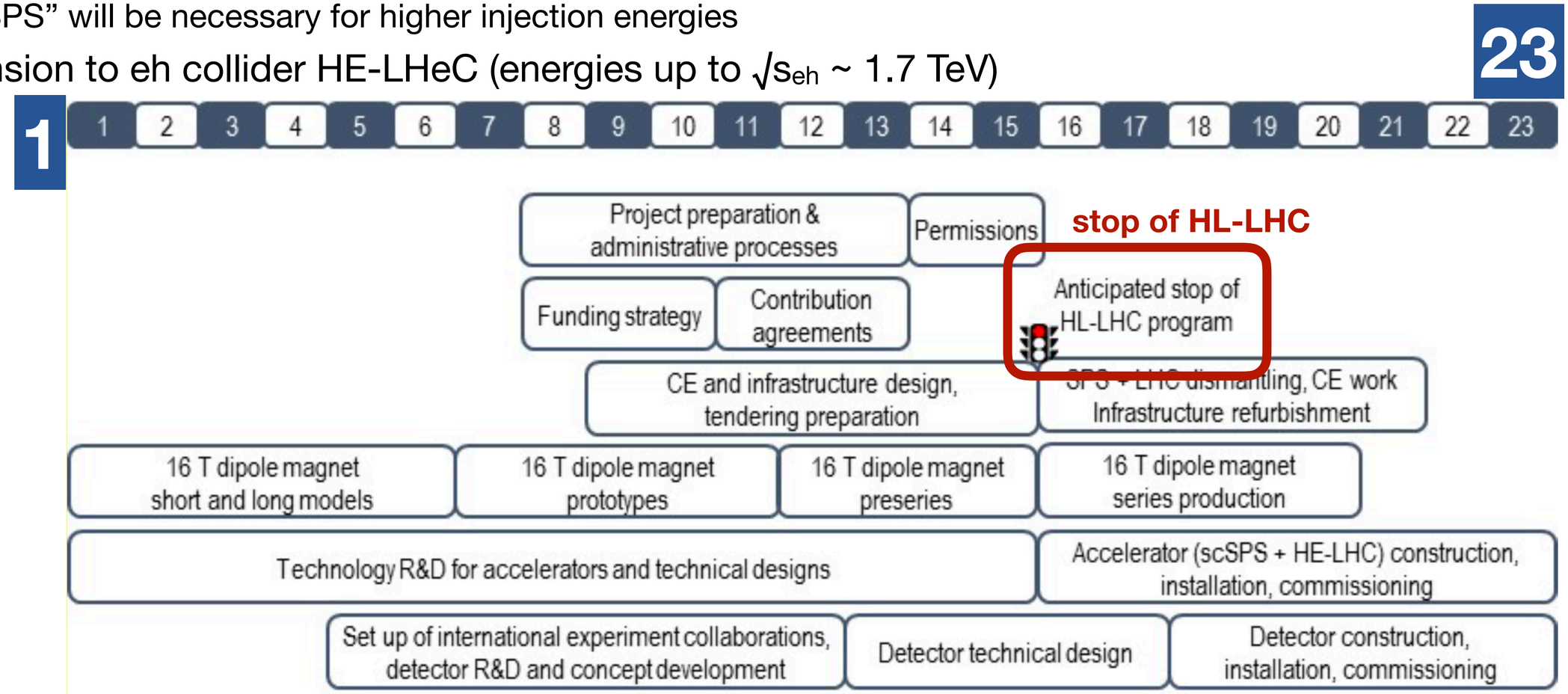

Possible scenarios of future colliders
Proton collider
Electron collider
Electron-Proton collider
Construction/Transformation: heights of box construction cost/year
Preparation
These are technical schedules compiled by Ursula Bassler
Global context
Japan
4 years
20km tunnel
ILC: 250 GeV
2 ab-1
31km tunnel
500 GeV
4 ab-1
40 km tunnel
1 TeV
≈ 4-5.4 ab-1
China
100km tunnel
CepC: 90/160/240 GeV
16/2.6/5.6 ab-1
SppC: ≈ FCC-hh
CERN
5 years
11 km tunnel
CLIC: 380 GeV
1.5 ab-1
29 km tunnel
1.5 TeV
2.5 ab-1
50 km tunnel
3 TeV
5 ab-1
8 years
100km tunnel
FCC-ee: 90/160/250 GeV -150/10/5 ab-1
350-365 GeV
1.7 ab-1
FCC hh: 150 TeV ≈20-30 ab-1
FCC hh: 100 TeV 20-30 ab-1
8 years
100km tunnel
FCC hh: 100 TeV 20-30 ab-1
HL-LHC: 13 TeV 3-4 ab-1
HE-LHC: 27 TeV 10 ab-1
2 years
1.7 B/ 6 year
LHeC: 1.2TeV
0.25-1 ab-1©
FCC-eh: 3.5 TeV 2 ab-1
2020
2030
2040
2050
2060
2070
2080
2090
26/09/2019
UB

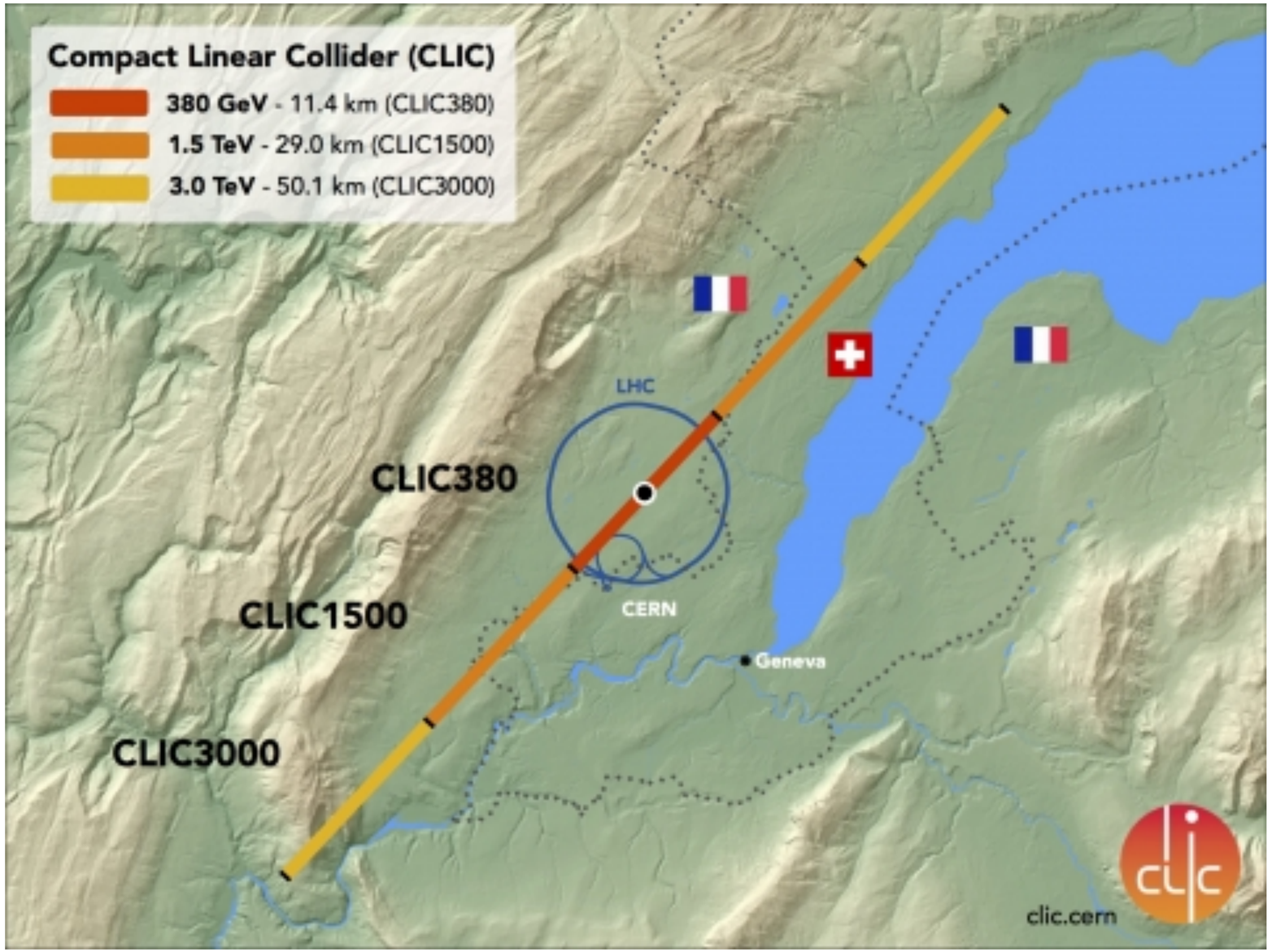
High Energy LHC (HE-LHC)

- Upgrade of the LHC to achieve 2 times higher energies than its original nominal value
  - With 16 T magnets being developed for the purpose of the FCC
  - pp collisions with $\sqrt{s}$ ~ 27 TeV
- It will be a new collider, the old LHC would have to be decommissioned and dismantled
  - Also a “new SPS” will be necessary for higher injection energies
- Possible extension to eh collider HE-LHeC (energies up to $\sqrt{s_{eh}}$ ~ 1.7 TeV)



Compact Linear Collider (CLIC)

- e^+e^- collider
- Designed to study HH, tt production and more



website

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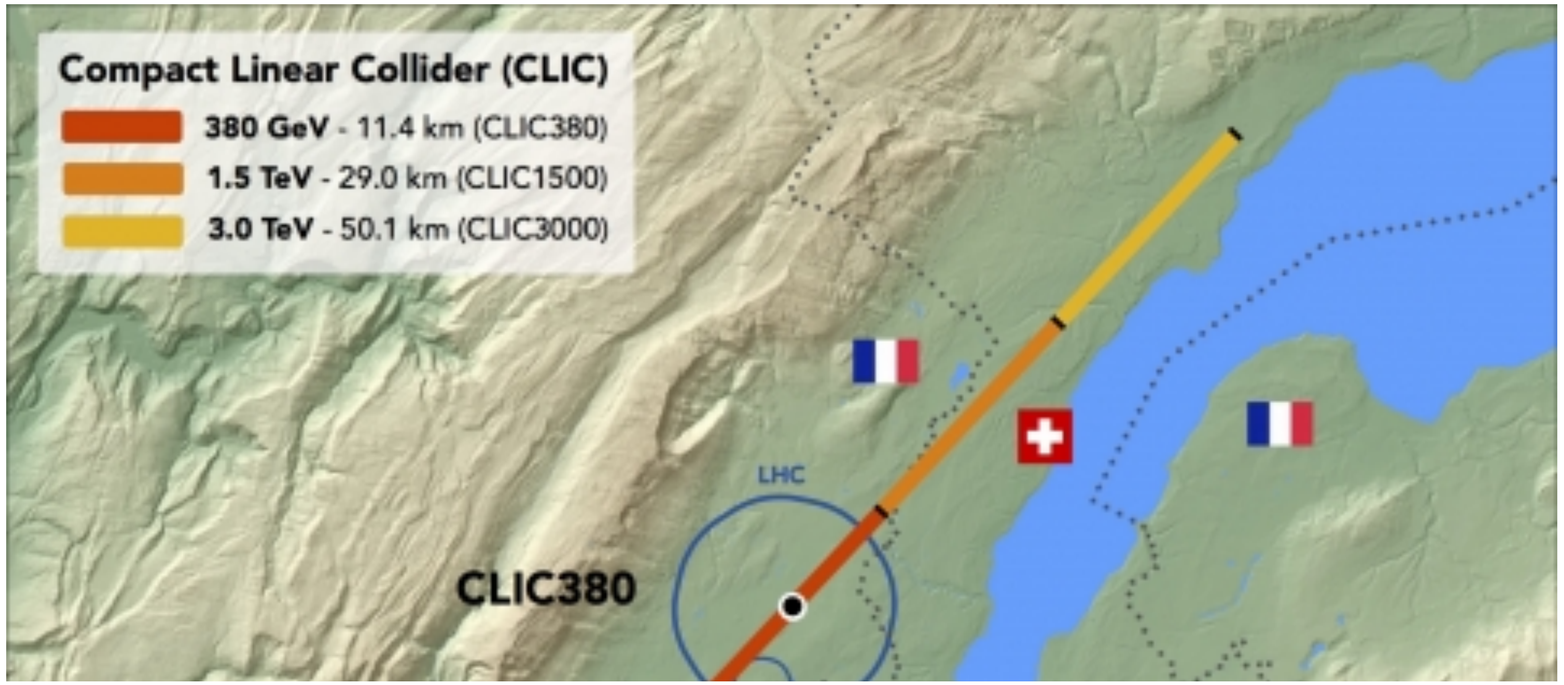
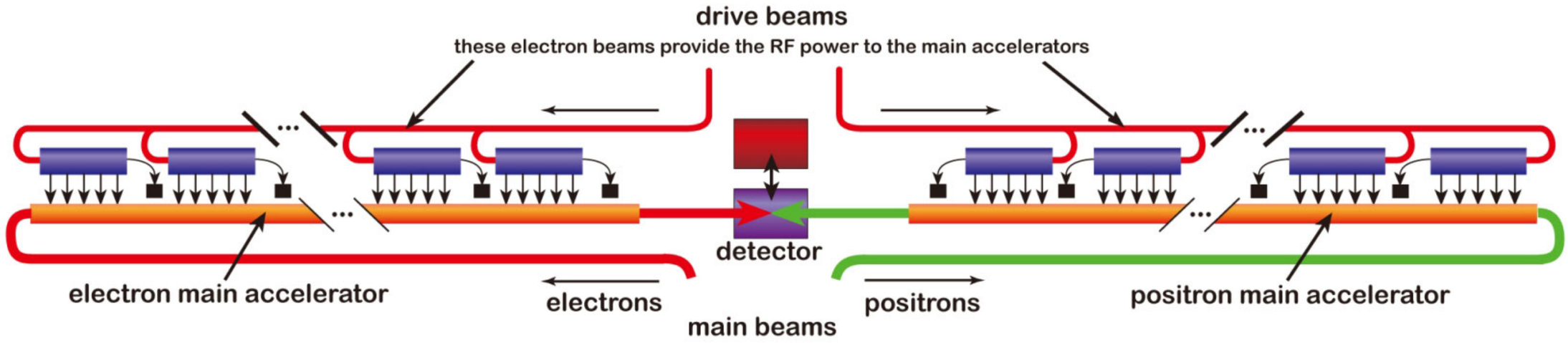
- Acceleration via a drive beam

website





Compact Linear Collider (CLIC)

website

2013-2019
Development Phase

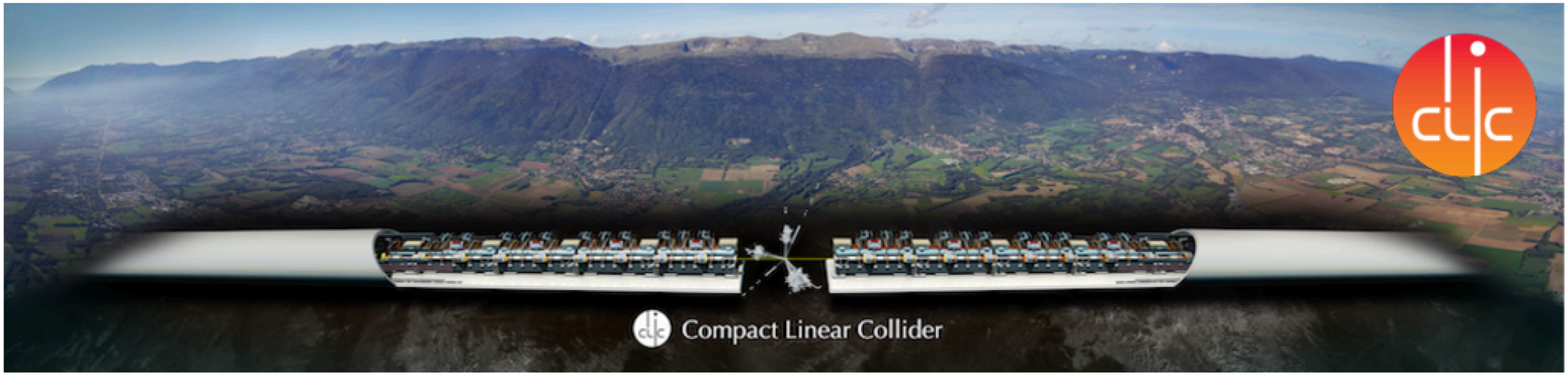
2020-2025
Preparation Phase

2026-2034
Construction Phase

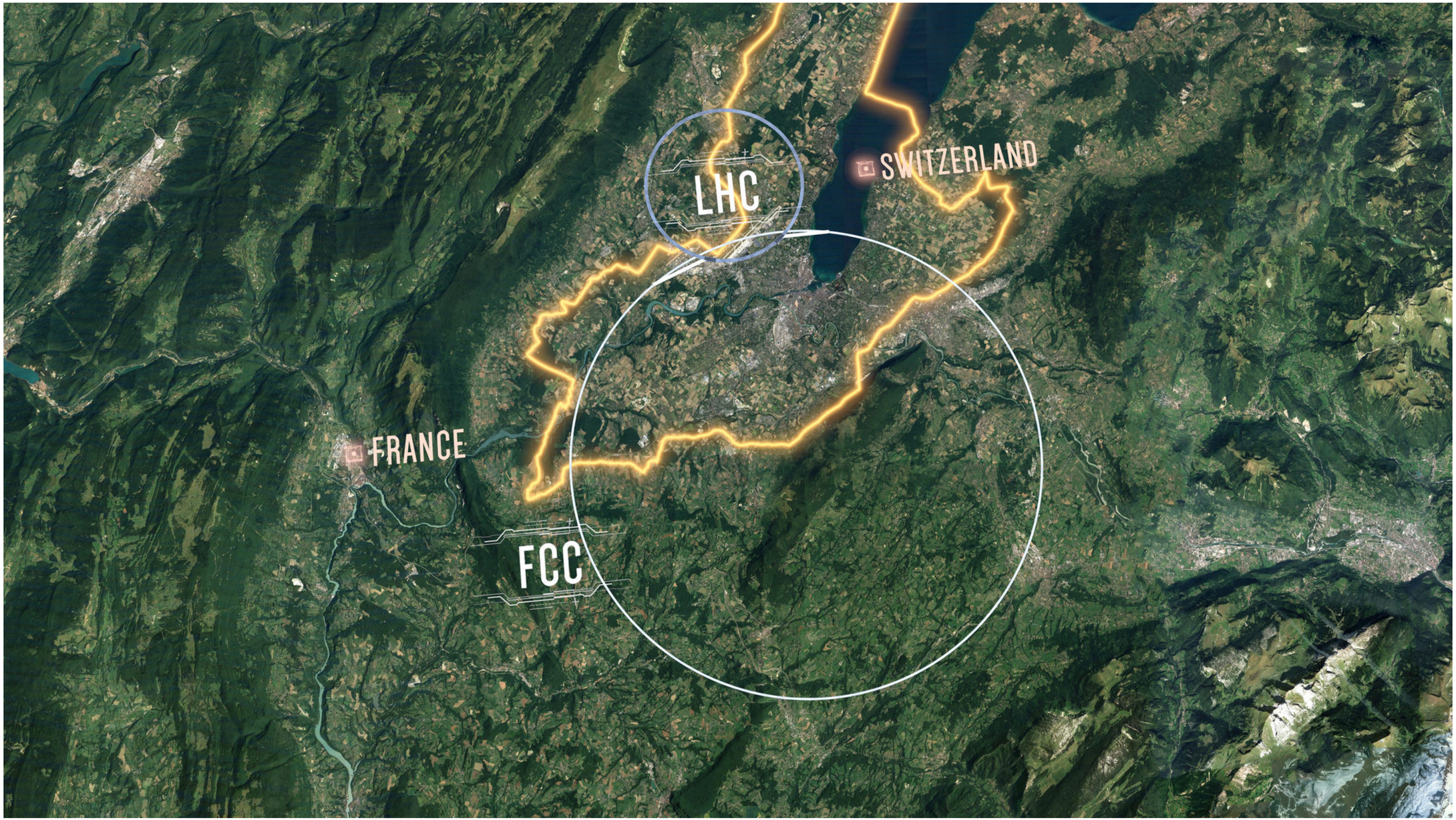
2019-2020
Decisions (Strategy)

2025
Construction Start

2035
First Beams



Future Circular Collider (FCC)

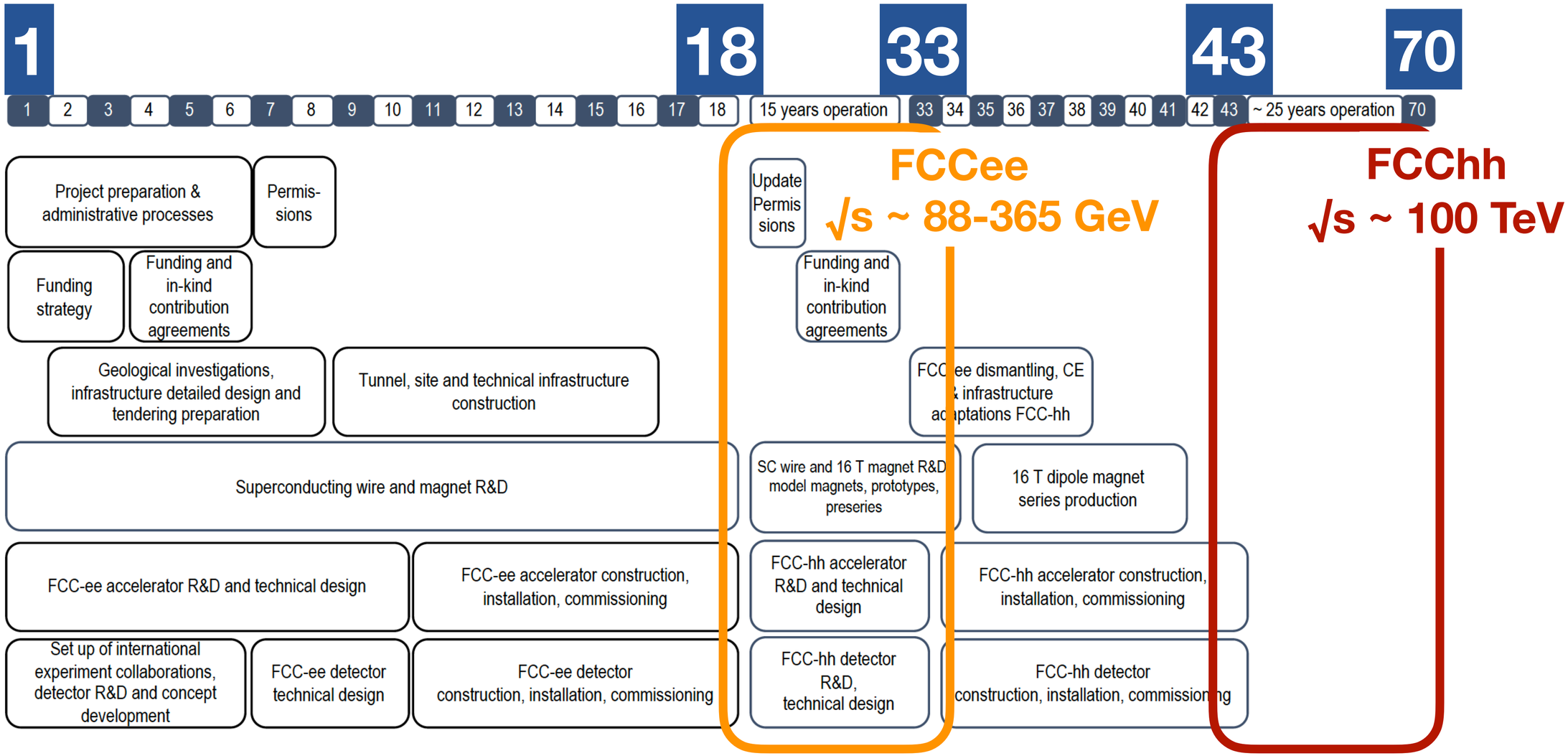


website

website

FCCee + FCChh

- Similarly as LEP (precision machine), LHC (discovery machine) and HL-LHC upgrade



FCCee + FCChh

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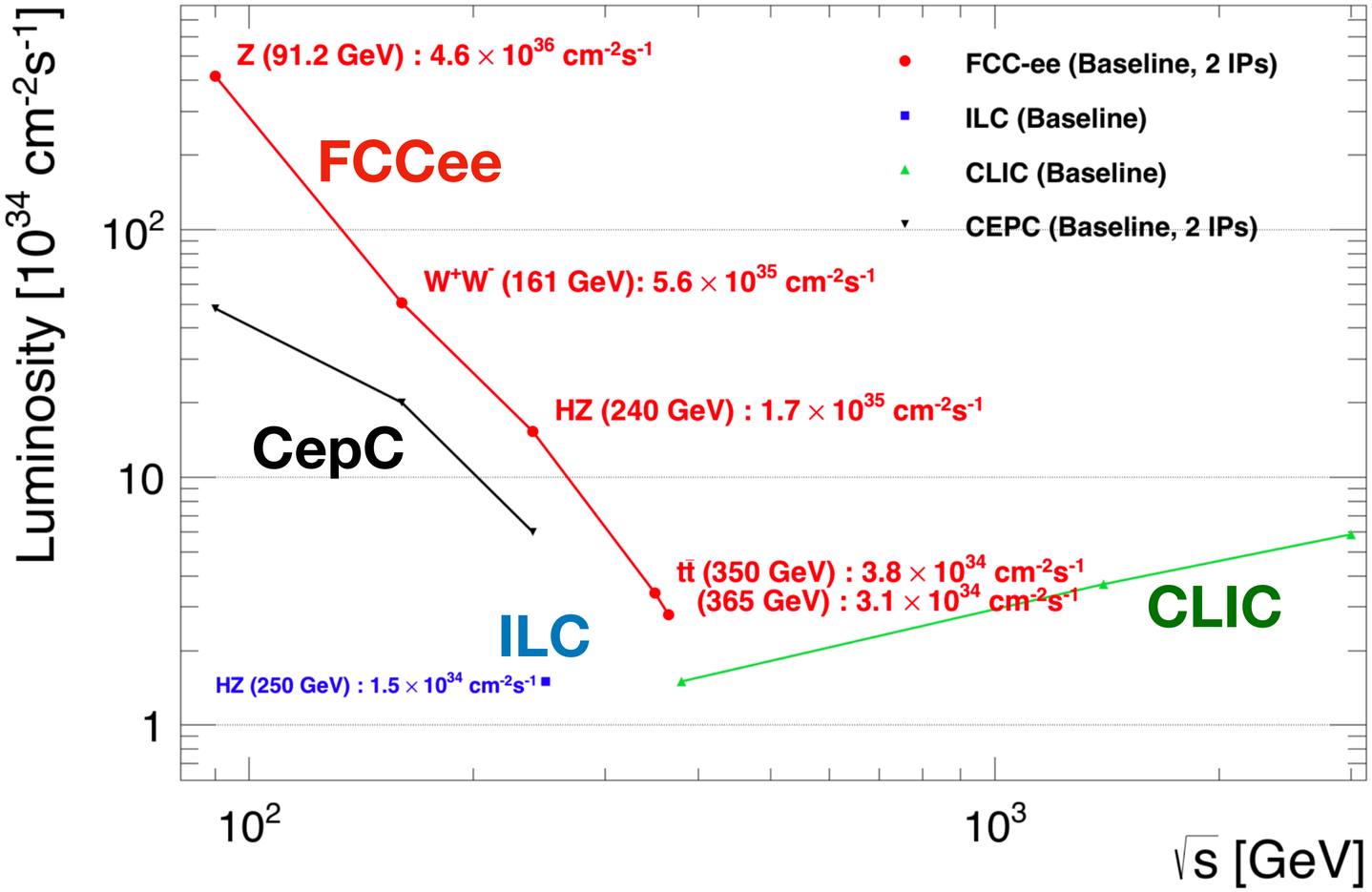
Domain	**Cost in MCHF**
Stage 1 - Civil Engineering	5,400
Stage 1 - Technical Infrastructure	2,200
Stage 1 - FCC-ee Machine and Injector Complex	4,000
Stage 2 - Civil Engineering complement	600
Stage 2 - Technical Infrastructure adaptation	2,800
Stage 2 - FCC-hh Machine and Injector complex	13,600
TOTAL construction cost for integral FCC project	**28,600**

FCCee

- Disadvantage over CLIC: cannot reach such high energies
  - Although it is enough for all SM related processes
- Advantage over CLIC: achieved luminosity

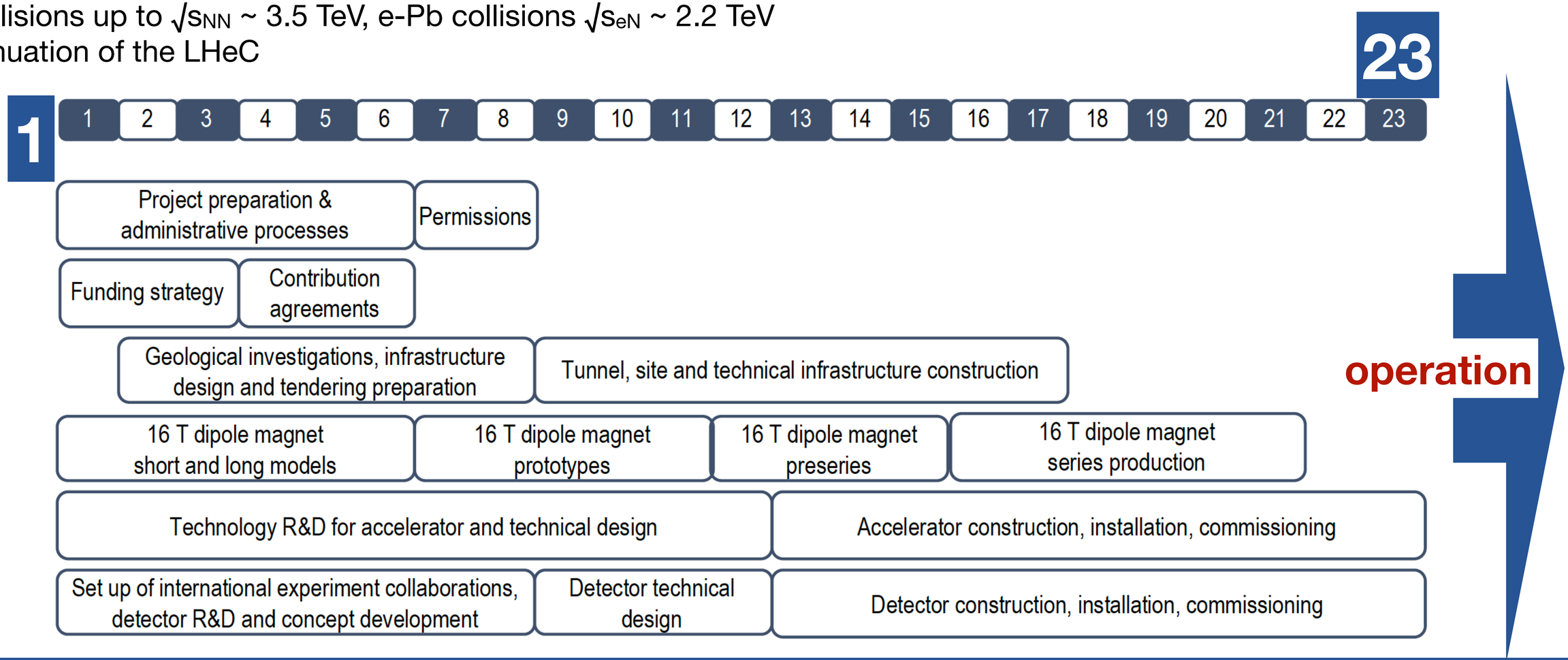
CERN-ACC-2019-0003



FCChh

- A possibility of a heavy-ion program
  - Pb-Pb collisions with $\sqrt{s_{NN}}$ ~ 39 TeV
  - p-Pb collisions with $\sqrt{s_{NN}}$ ~ 63 TeV
- Possibility to be extended to an electron-hadron collider
  - ep collisions up to $\sqrt{s_{NN}}$ ~ 3.5 TeV, e-Pb collisions $\sqrt{s_{eN}}$ ~ 2.2 TeV
  - Continuation of the LHeC

Timeline without prior FCCee



Update to the Strategy in 2013

- **Exploit the full potential of the LHC**
  - The discovery of the Higgs boson is the start of a major programme of work to measure this particle's properties. Europe's top priority should be the exploitation of the full potential of the LHC, including the high-luminosity upgrade and detectors with a view to collecting ten times more data than in the initial design, by around 2030.

- **Undertake design studies to be able to propose a post-LHC accelerator at the next Strategy update**
  - To stay at the forefront of particle physics, Europe needs to be in a position to propose an ambitious post-LHC accelerator project at CERN by the time of the next Strategy update, when physics results from the LHC running at 14 TeV will be available. CERN should undertake design studies in a global context, with emphasis on pp and ep high-energy frontier machines, coupled to R&D of high-field magnets, high-gradient accelerating structures, …

- **Europe looks forward to a proposal from Japan to discuss a possible participation**
  - There is a strong scientific case for an ep collider complementary to the LHC. The TDR has been completed, with large European participation. The initiative from the Japanese particle physics community to host the ILC in Japan is most welcome, and European groups are eager to participate.

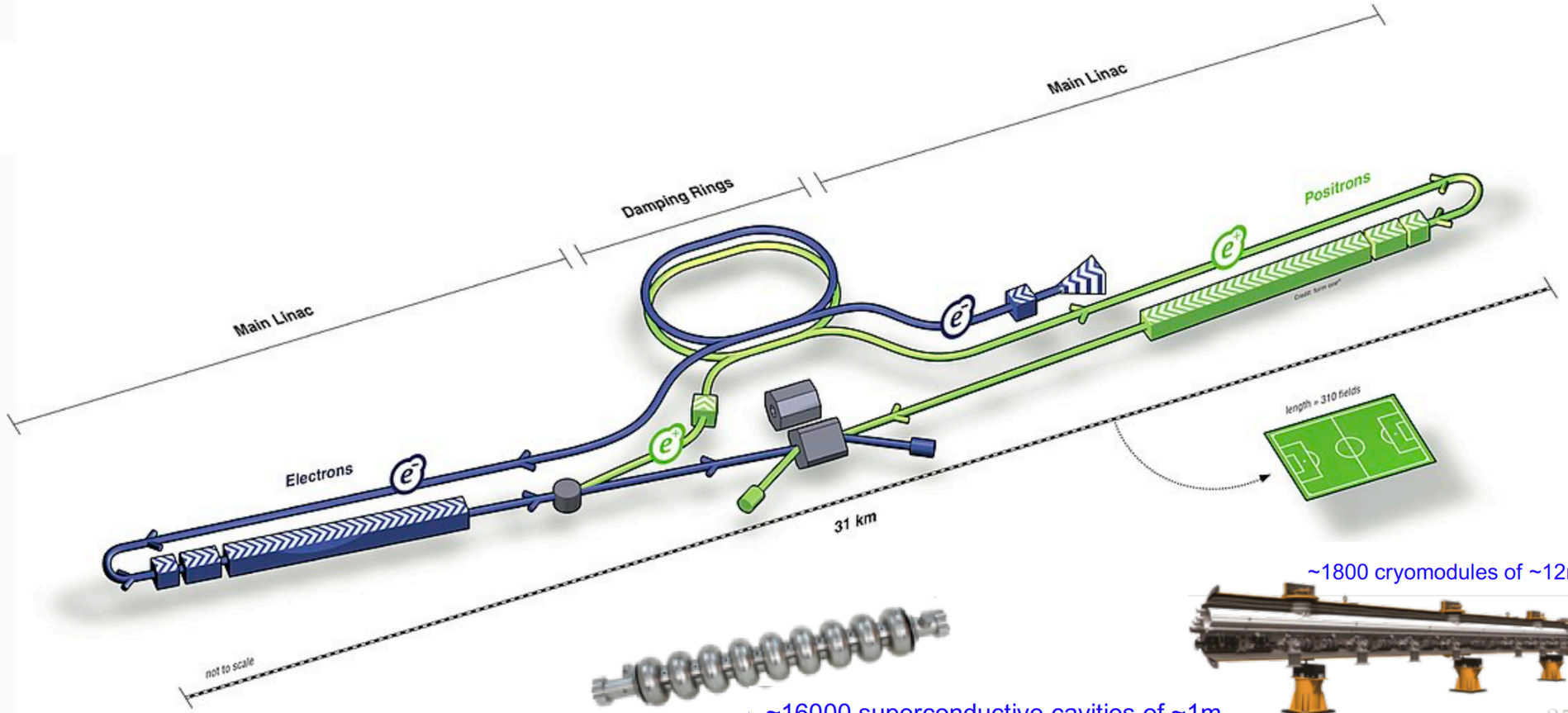
- **Europe should explore the possibility of major participation in leading long-baseline neutrino projects in the US and Japan.**

International Linear Collider (ILC)

- e^+e^- collider with $\sqrt{s}$ = 0.5 TeV (upgradeable to 1 TeV)
- precision Higgs and top programme and beyond
- 20 km long tunnel with 2 all-purpose detectors at the interaction point

- International project, supposed to be built in Japan
- The decision process is still in progress
- Project now downgraded to $\sqrt{s}$ = 250 GeV
  - Just above the production threshold of HH pair

website



~16000 superconductive cavities of ~1m

~1800 cryomodules of ~12m

Update to the Strategy in 2013

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Neutrino projects

CERN Neutrino Platform

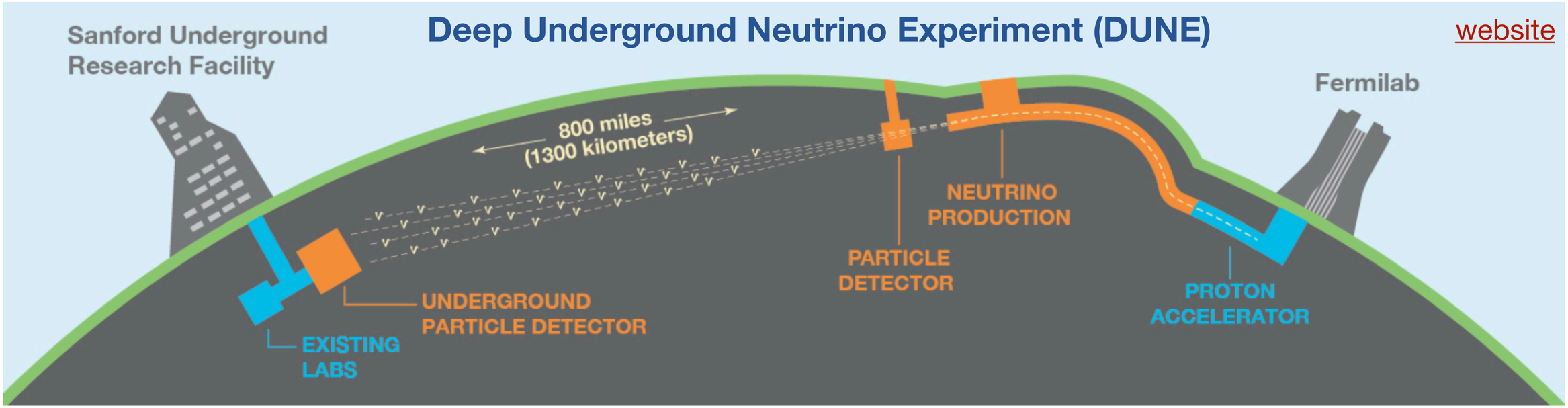
The Neutrino Platform is CERN's undertaking to foster and contribute to fundamental research in neutrino physics at particle accelerators worldwide

The CERN Neutrino Platform is CERN's undertaking to foster and contribute to fundamental research in neutrino physics at particle accelerators worldwide, as recommended by the 2013 European Strategy for Particle Physics. It includes the provision of a facility at CERN to allow the global community of neutrino experts to develop and prototype the next generation of neutrino detectors. The CERN Neutrino Platform is CERN's main contribution to a globally coordinated programme of neutrino research.

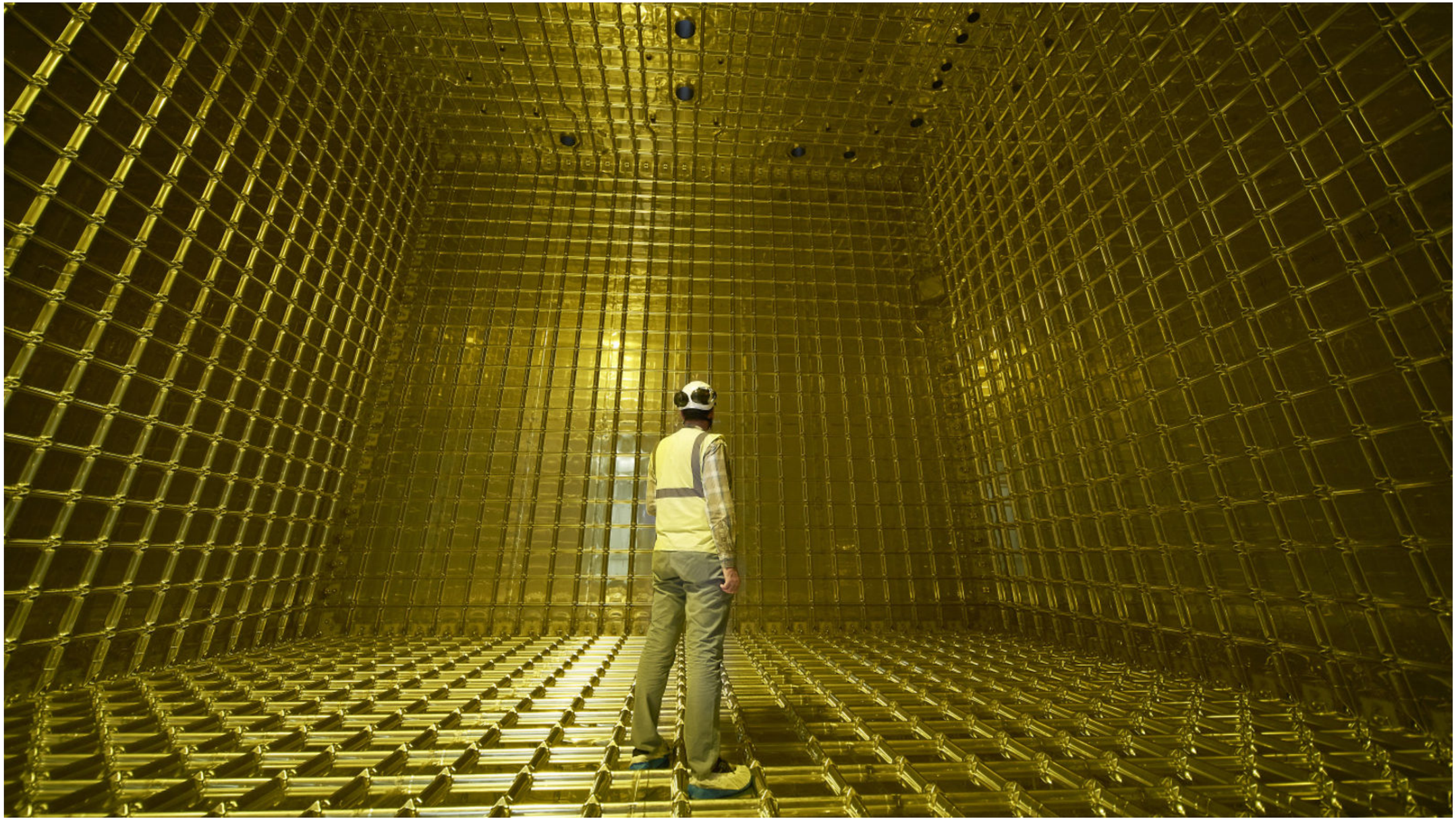
One of the experiment where CERN is participating:

Deep Underground Neutrino Experiment (DUNE)

website

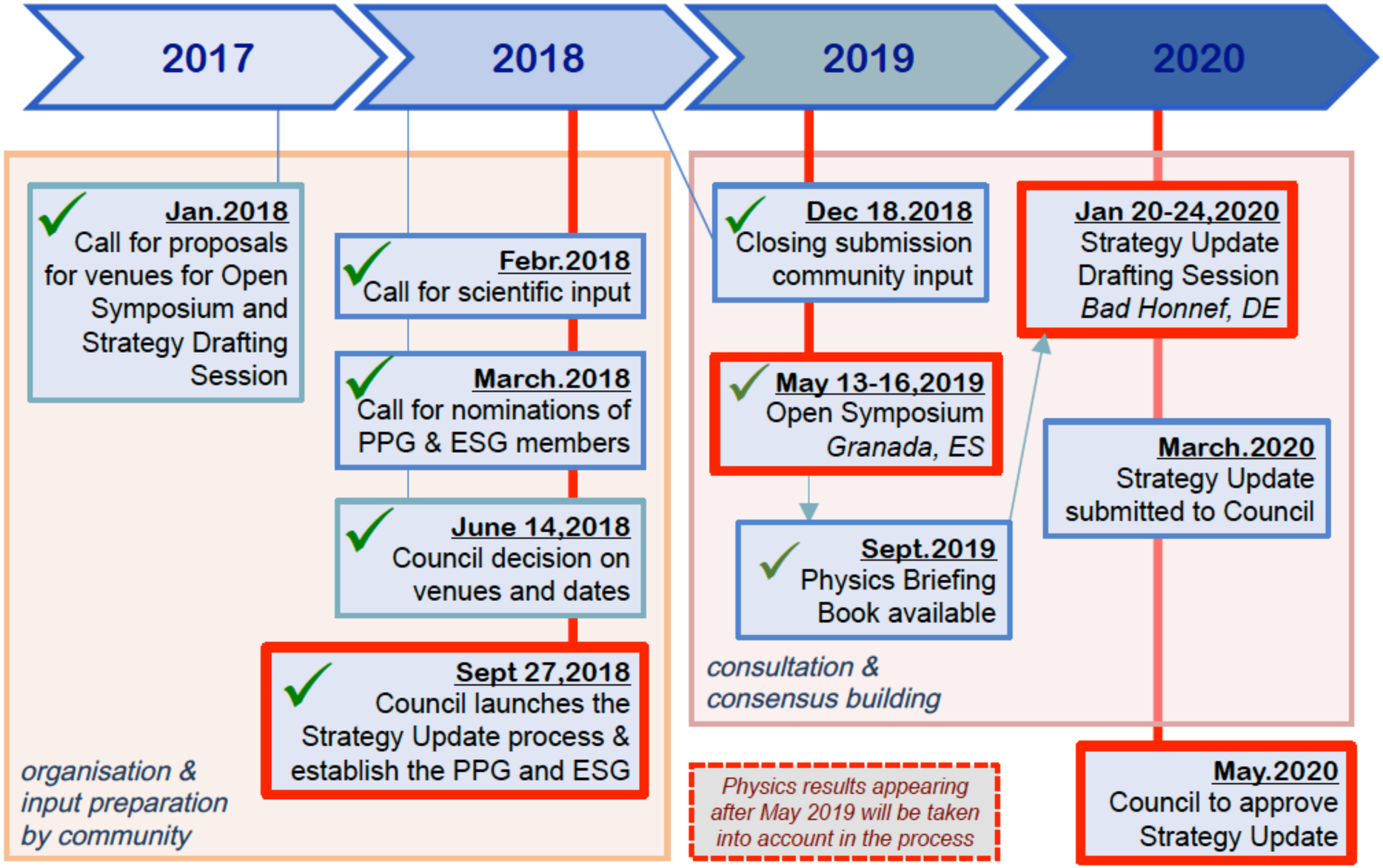


ProtoDUNE @ CERN



- The goals of the Strategy Upgrade 2013 seem to be advancing well
- There is time for a new Strategy Update 2020
  - This one will have big impact on the far future: we should decide on which future accelerator will be the main focus of European particle physics community

The Long-term Strategy in 2020



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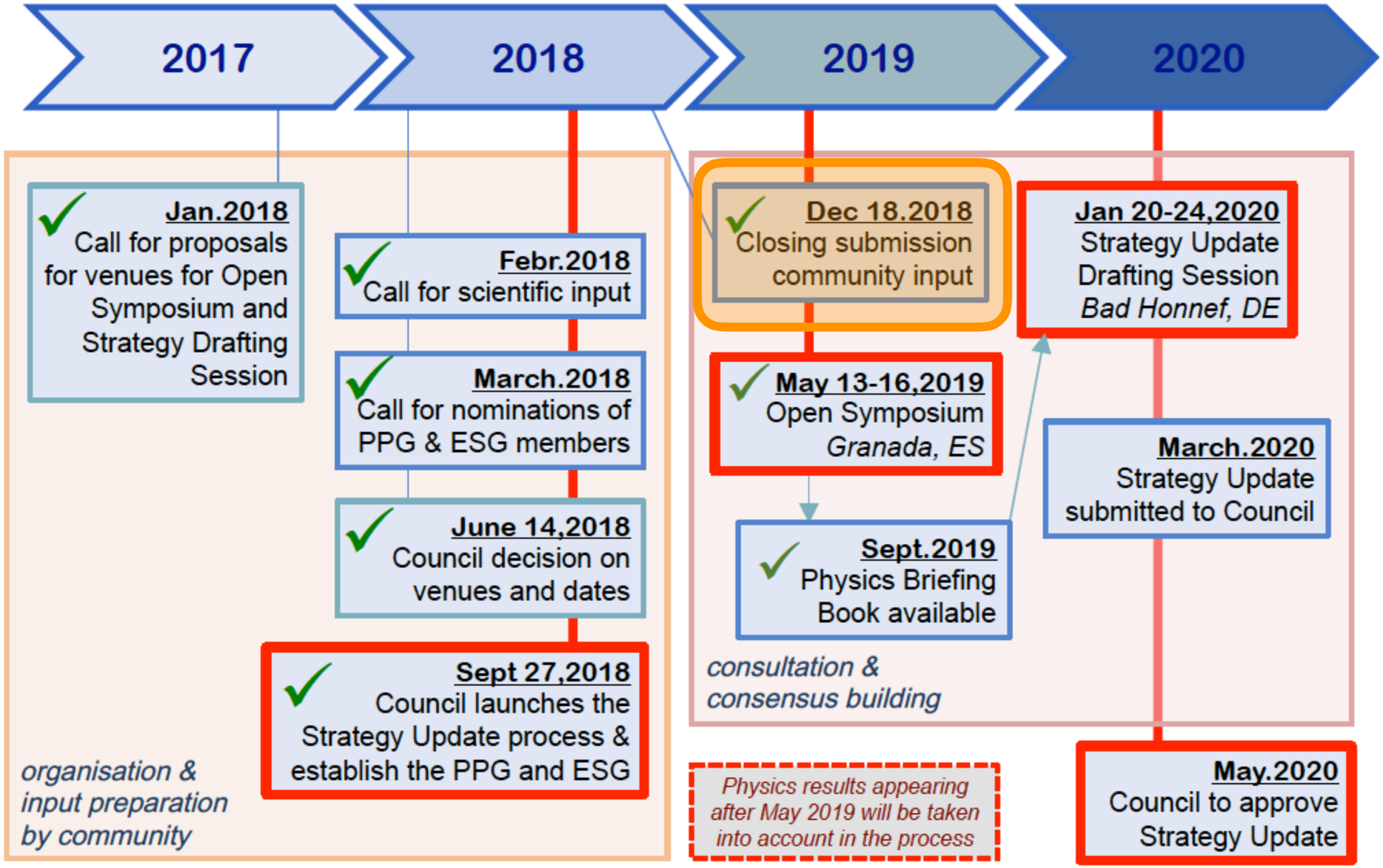


Czech input to the Strategy

Inputs to European Strategy Update 2018-2020 by the Czech particle physics community

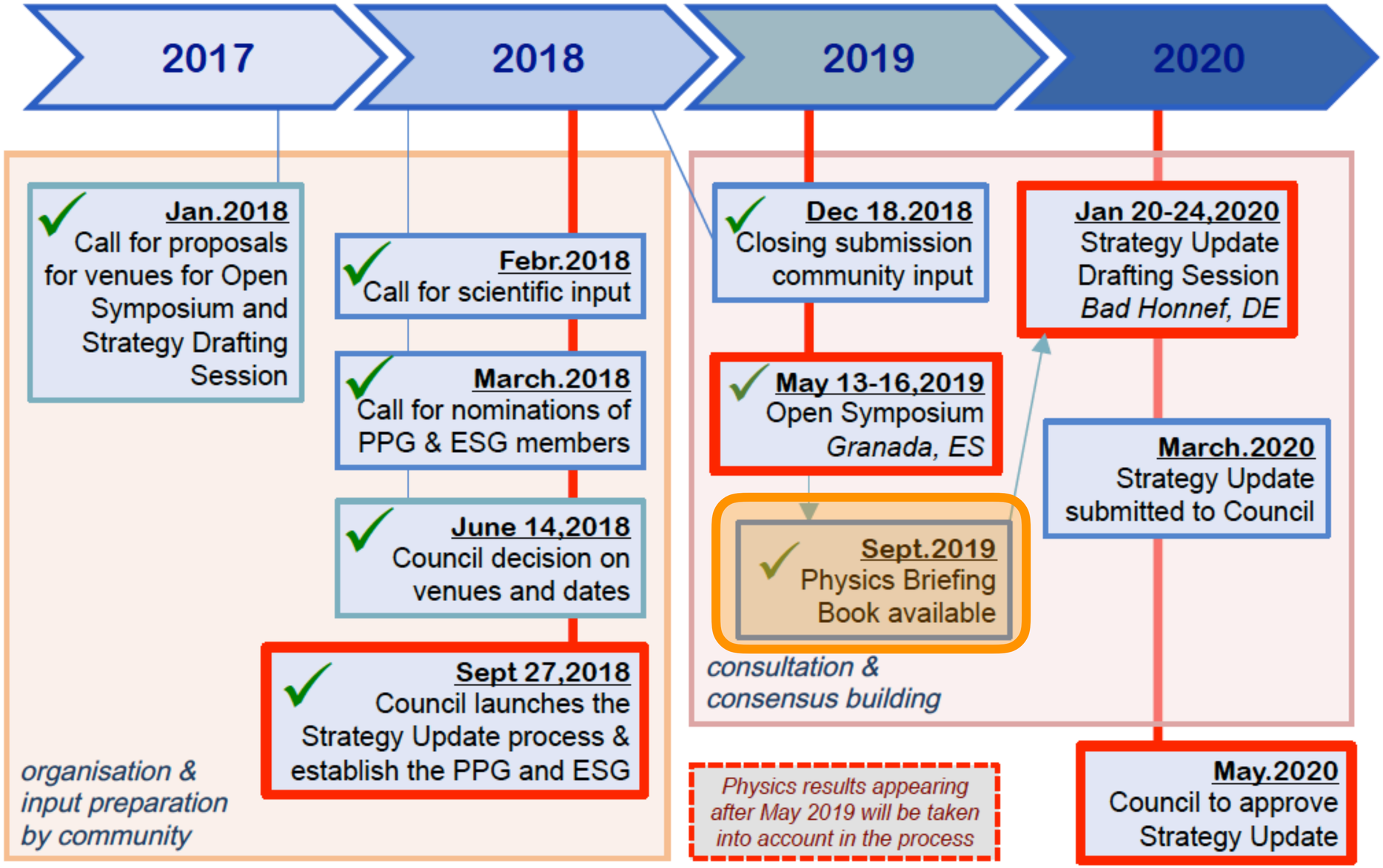
Abstract

Although the Standard Model has been very successful in predicting and interpreting current measurements in particle physics, it has become clear that it cannot answer all the outstanding questions. To resolve the remaining issues new theories have been developed and further measurements are needed. The experience shows that diverse and complementary scientific program is the right approach to tackle the questions. To maintain this, the Czech high-energy physics community agreed upon a strong support of the activities listed below.

Czech input to the Strategy

- **Full exploitation of the physics potential of the CERN LHC**
  - Continuation in a strong participation in both ATLAS and ALICE experiments
  - Strong endorsement of a new successor project of ALICE at the LHC
- **R&D of detector and new accelerator technologies**
  - … in order to secure CERN its know-how and ability to build new experiments and accelerators in the future
- **Support the ILC project in Japan**
- **Support the EIC project in USA**
- **Lower energy experiments** (e.g. ISOLDE, …)
- **Neutrino experiments** (DUNE, JUNO, consider participation in Hyper-Kamiokande)
- **Computing development**
- **Theoretical physics program** (collaboration between theorists and experimentalists)
- **Cooperation with astroparticle and nuclear physics communities**
  - Cooperation with ApPEC: Pierre Auger Observatory
  - Cooperation with NuPECC: FAIR at GSI, as well as smaller experiments
- **Outreach**

The Long-term Strategy in 2020



CERN-ESU-004
1 October 2019

Physics Briefing Book

Input for the European Strategy for Particle Physics Update 2020

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Anton Andronic[16], Ferenc Siklér[17] *(Scientific Secretaries)*
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Editors: Halina Abramowicz[71], Roger Forty[20], and the Conveners

- > 200 pages
- > 700 references

arXiv: 1910.11775

Main topics discussed in the BF

- Electroweak Physics (W,Z,H,t,QED)
- Flavour Physics and CP violation (quarks, charged leptons, rare processes)
- Dark Matter and Dark Sector
- Accelerators Science and Technology
- Beyond Standard Model at colliders
- Strong Interactions (QCD, DIS, heavy-ions)
- Neutrino Physics
- Instrumentation and Computing

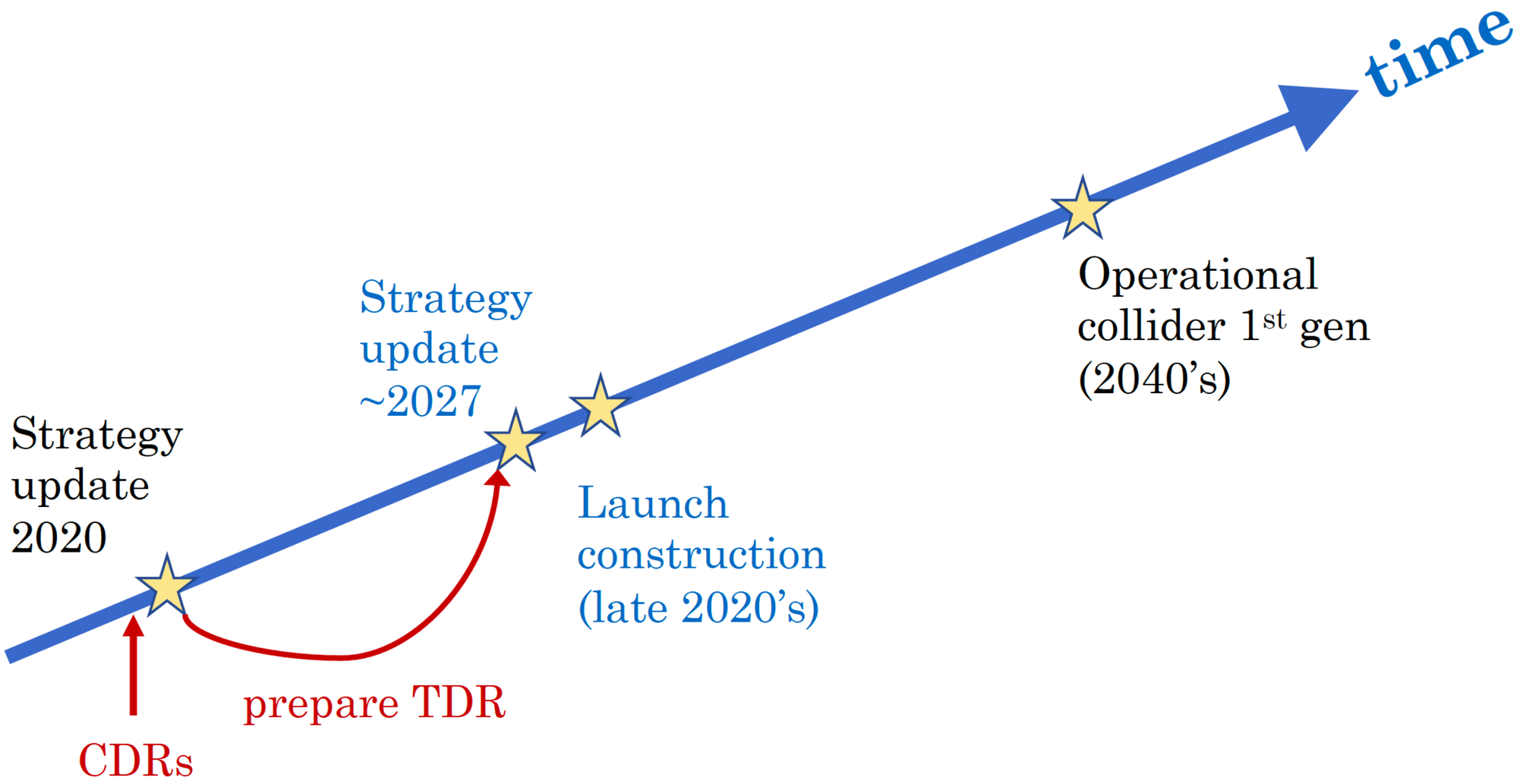
Main strawman scenarios

	2020-2040	2040-2060	2060-2080
		1st gen technology	2nd gen technology
CLIC-all	HL-LHC	**CLIC380-1500**	CLIC3000 / other tech
CLIC-FCC	HL-LHC	**CLIC380**	FCC-h/e/A (Adv HF magnets) / other tech
FCC-all	HL-LHC	**FCC-ee (90-365)**	FCC-h/e/A (Adv HF magnets) / other tech
LE-to-HE-FCC-h/e/A	HL-LHC	**LE-FCC-h/e/A (low-field magnets)**	FCC-h/e/A (Adv HF magnets) / other tech
LHeC-FCC-h/e/A	HL-LHC **+ LHeC**	**LHeC**	FCC-h/e/A (Adv HF magnets) / other tech

- Some scenarios may depend on decisions outside of Europe (i.e. to be verified at the next Strategy update in about 7 years, when HL-LHC will start)
- An advanced acceleration technologies may come in for the second generation colliders, thus it can be updated/changed
- LHeC can potentially be added to all scenarios

Main strawman scenarios

Typical path: select a scenario and plan for success



The juniors enter the game

After all, a decision is being made, which will affect us.

	2020-2040	2040-2060	2060-2080
		1st gen technology	2nd gen technology
CLIC-all	HL-LHC	CLIC380-1500	CLIC3000 / other tech
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LHeC-FCC-h/e/A	HL-LHC + LHeC	LHeC	FCC-h/e/A (Adv HF magnets) / other tech

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- Early-Career Researchers (ECR) were invited by ECFA to debate and express their opinions to the current European Strategy Update

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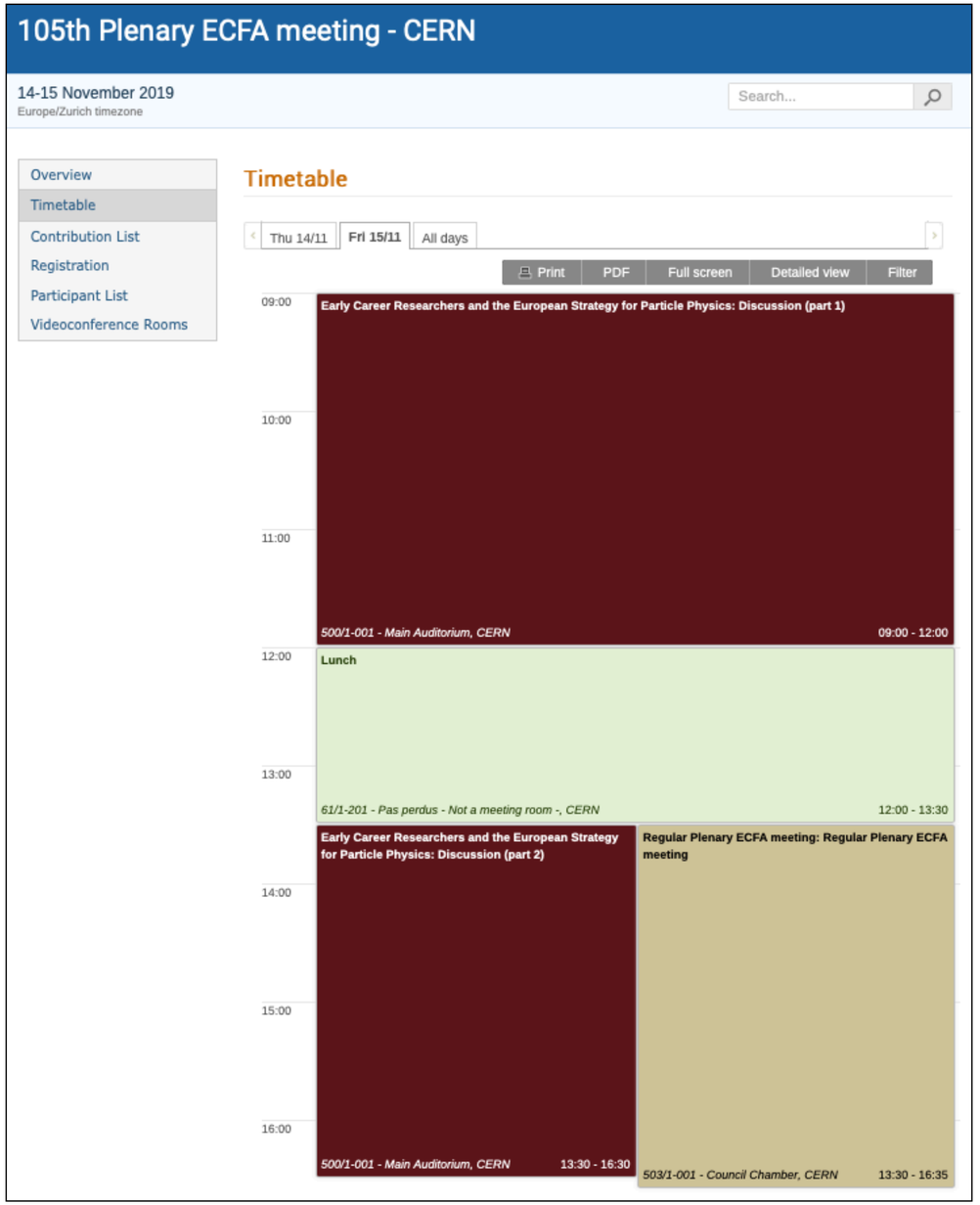
- We all met at CERN on 15th November 2019 for a whole-day discussion, which was followed by a survey collecting quantitative input (180 delegates)



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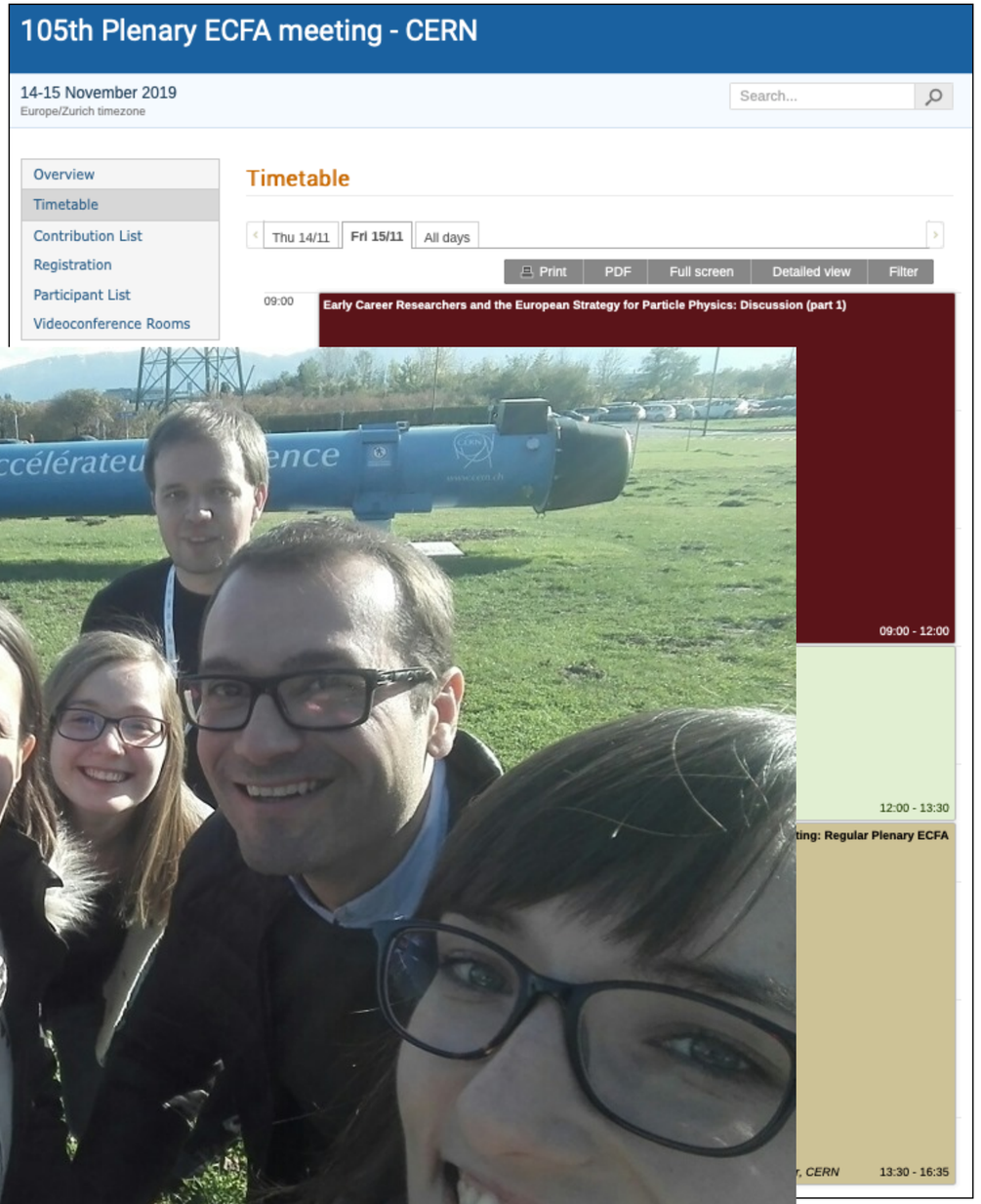

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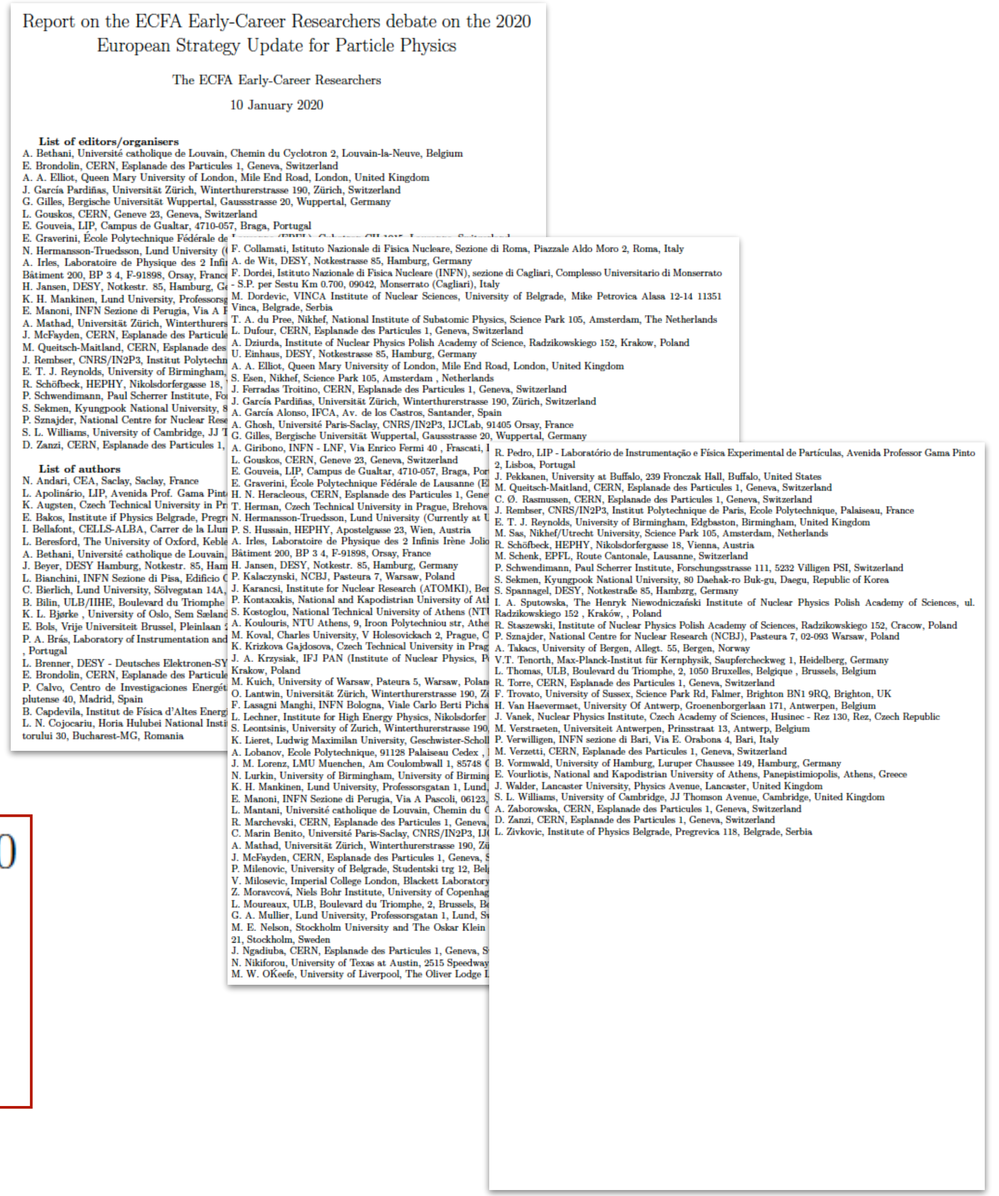
- We all met at CERN on 15th November 2019 for a whole-day discussion, which was followed by a survey collecting quantitative input (180 delegates)
- A report document from the ECR debate was put together and handed to the chair of ECFA on 10th January 2020
  - The chair of ECFA promised that they will consider our document during the Drafting Session of the Strategy Update on 20-24th January 2020
- Eventually, the document will be put on arXiv


Report on the ECFA Early-Career Researchers debate on the 2020 European Strategy Update for Particle Physics

The ECFA Early-Career Researchers

10 January 2020

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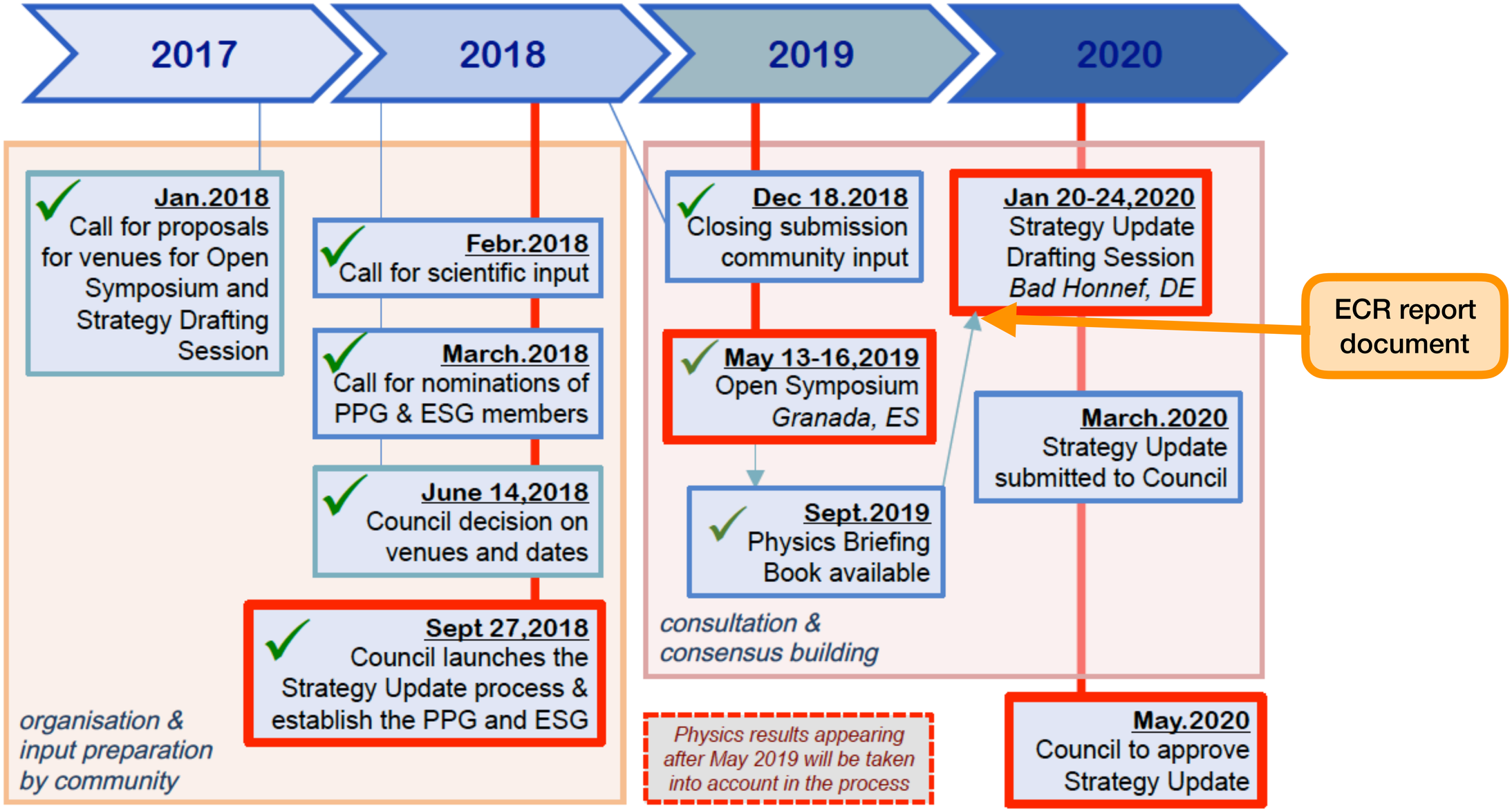
Report on the ECFA Early-Career Researchers debate on the 2020 European Strategy Update for Particle Physics

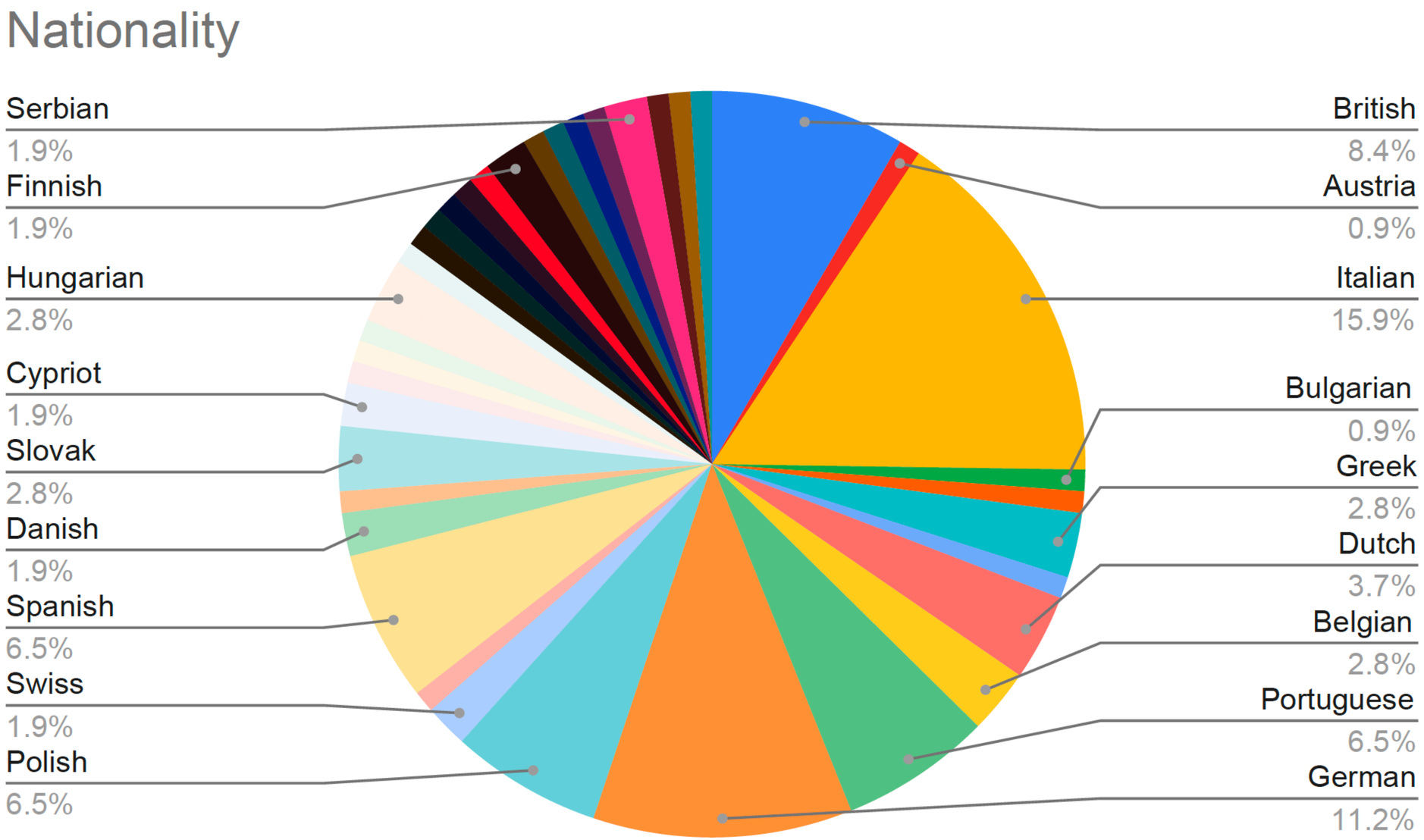
The ECFA Early-Career Researchers

10 January 2020

The Long-term Strategy in 2020



Results of the survey



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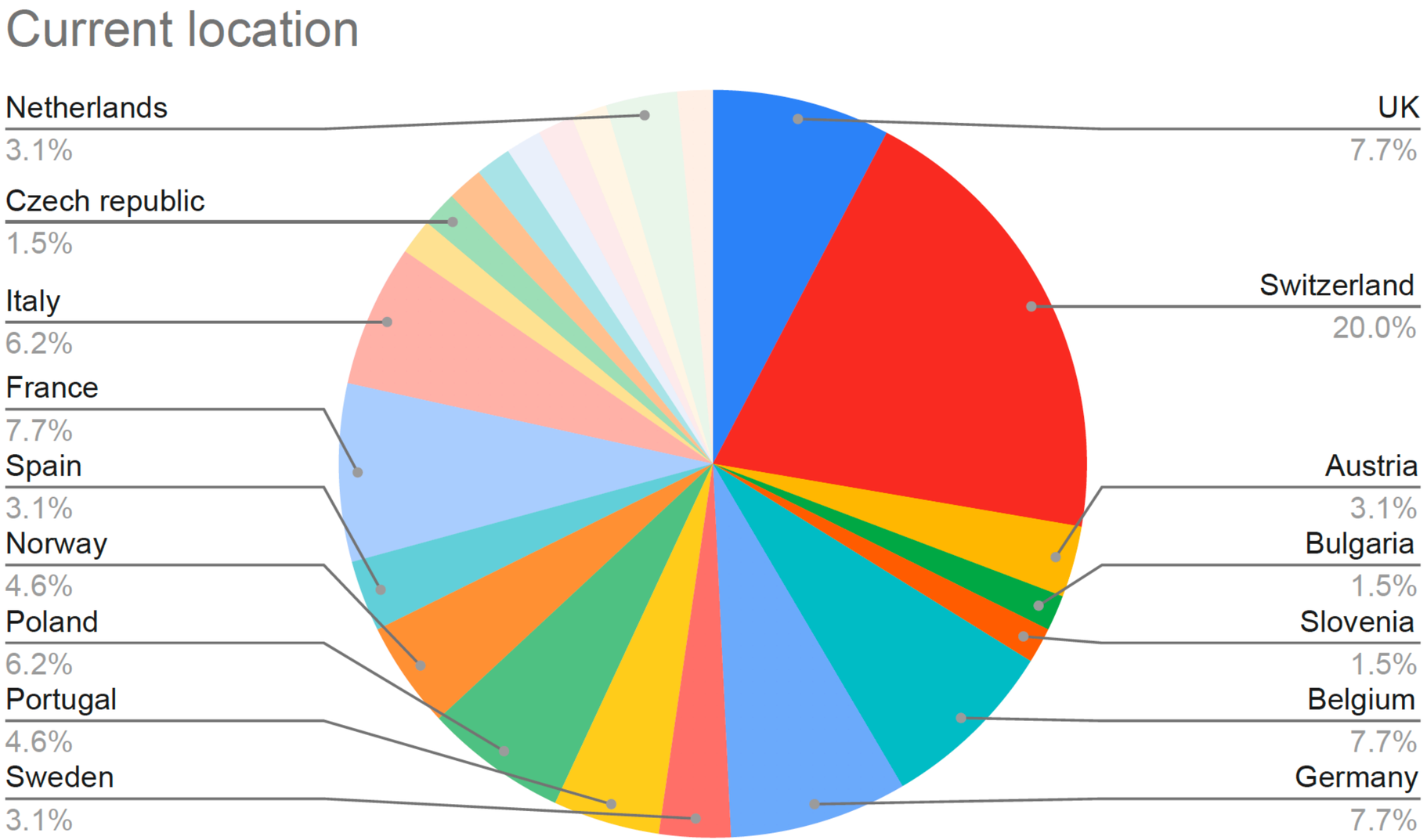

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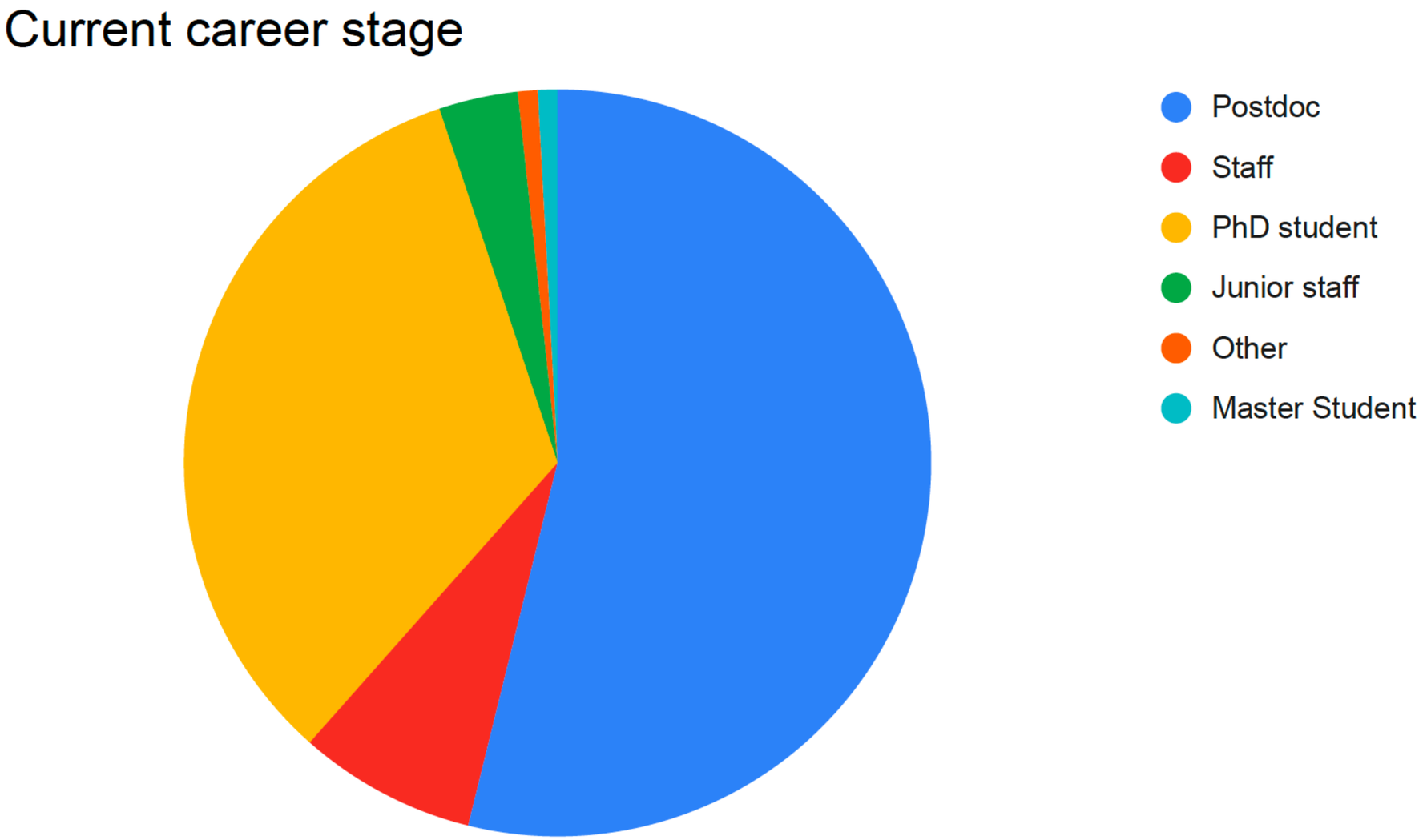


Views of ECR to the Strategy Update

- Originally, the discussion was split into sections:
  - Environment and Sustainability
  - Electroweak and Strong Physics
  - BSM, Dark Matter and Dark Sector
  - Neutrino, Flavour and Cosmic Messenger Physics
  - Accelerator and Detector R&D
  - Computing and Software

- After the meeting in November, the sections were extended with
  - Human and sociological factors

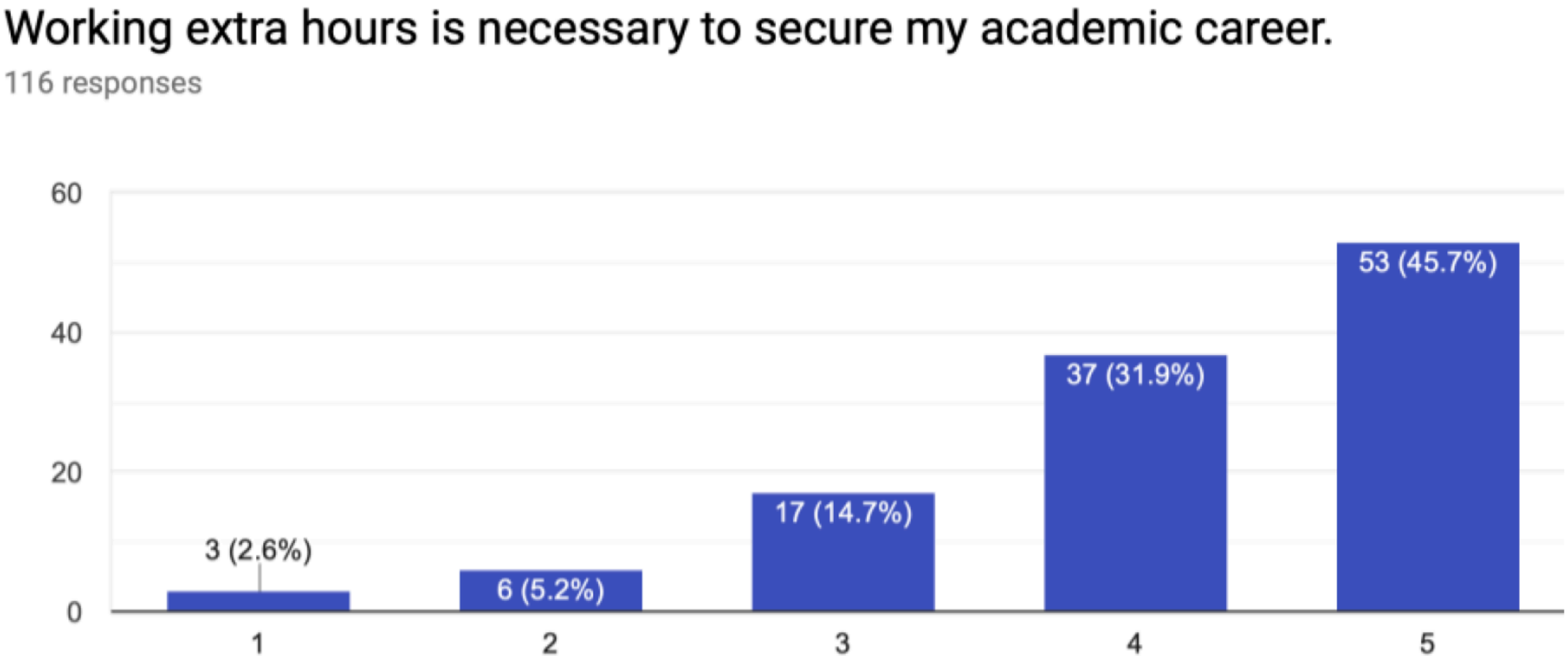
Views of ECR to the Strategy Update

GENERAL

- “ECRs feel that the attractiveness of our field is at risk and that dedicated actions need to be taken to save its future” …. “The European Strategy Update must therefore include sociological and sustainability aspects in addition to technical ones …”
  - “funding for non-permanent positions is converted to funding for permanent positions, i.e. fewer post-docs in exchange for more staff”
  - “establish a permanent ECR committee as part of ECFA”

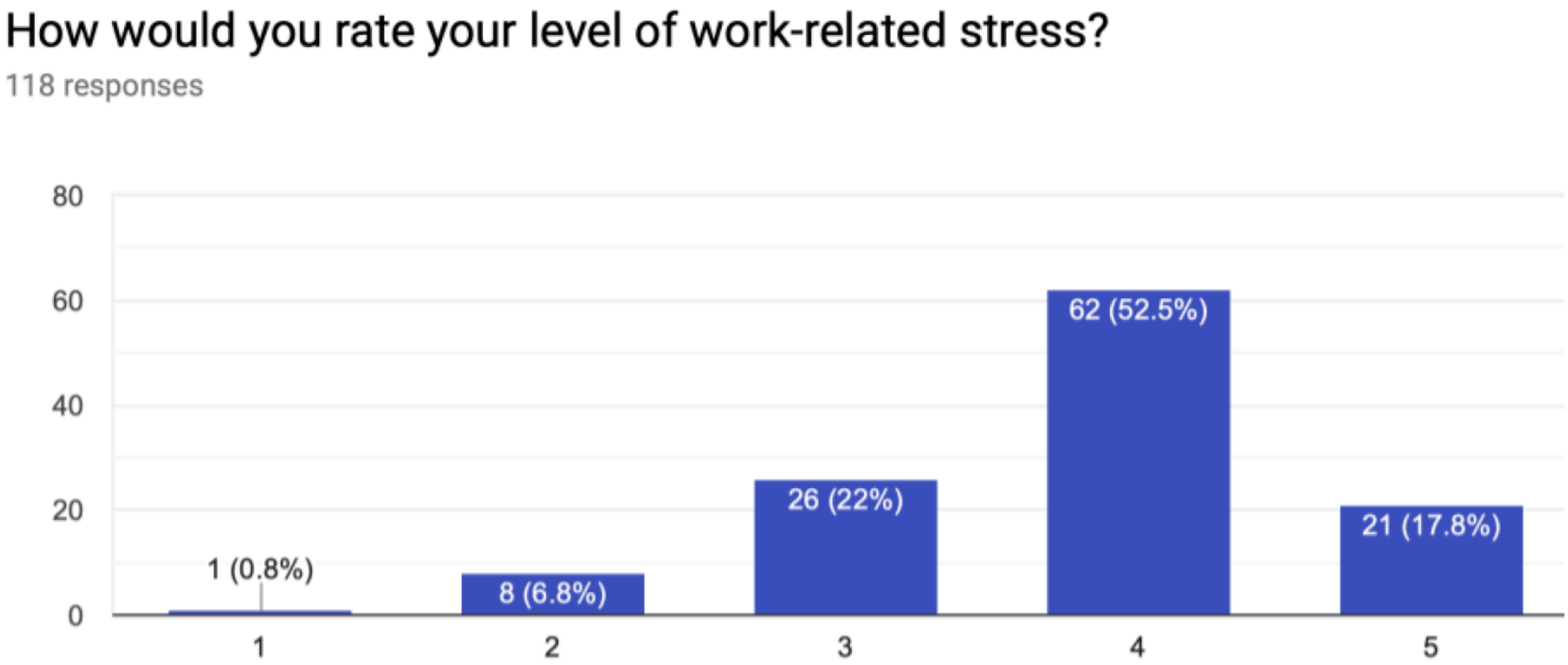
Views of ECR to the Strategy Update

HUMAN AND SOCIOLOGICAL FACTORS



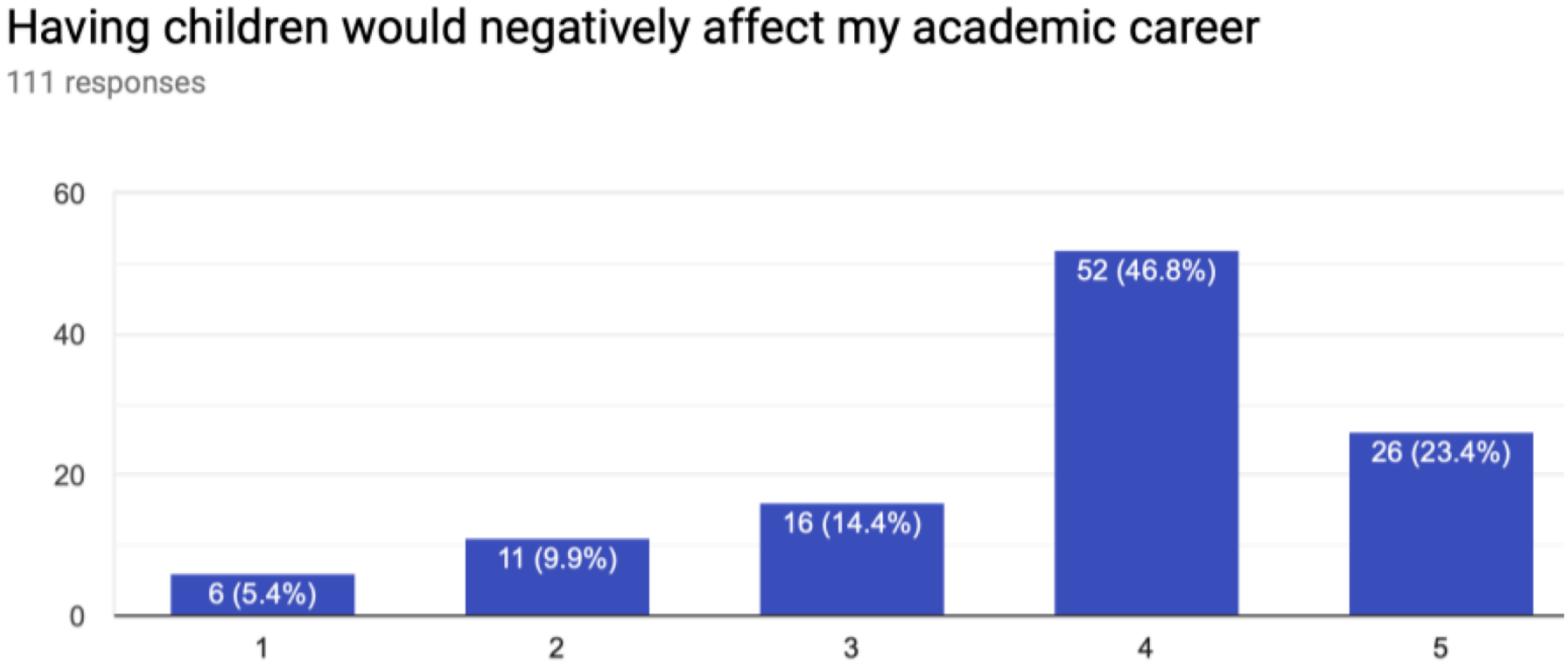
Views of ECR to the Strategy Update

HUMAN AND SOCIOLOGICAL FACTORS



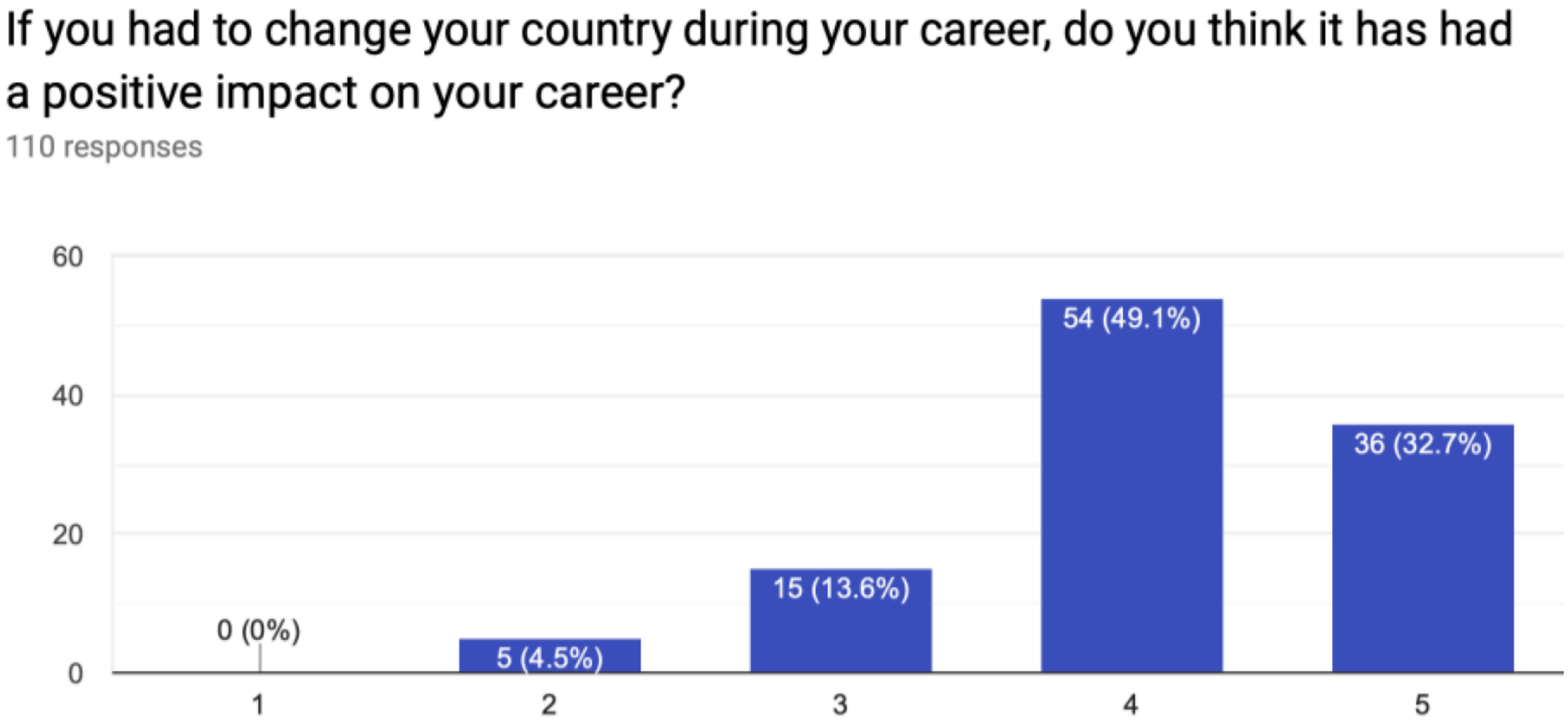
Views of ECR to the Strategy Update

HUMAN AND SOCIOLOGICAL FACTORS



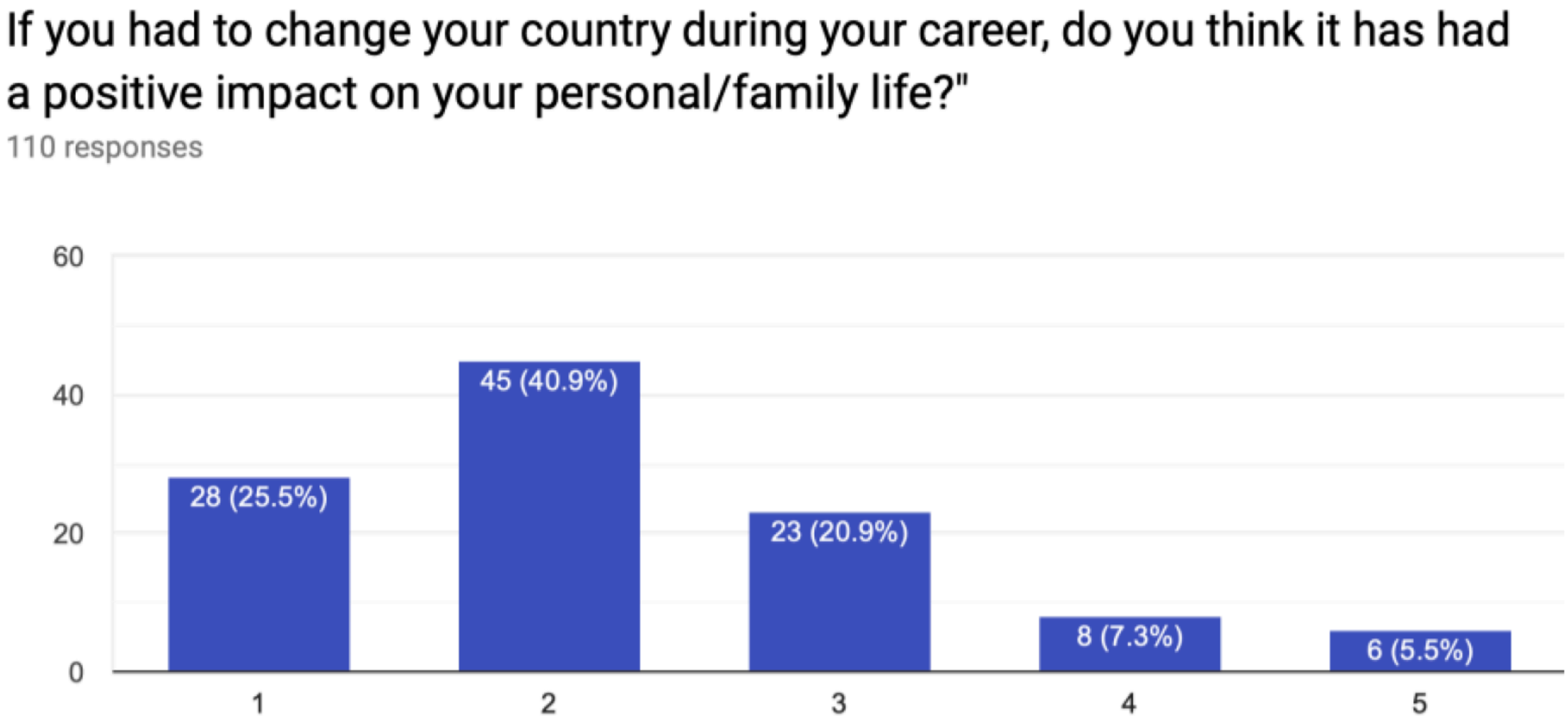
Views of ECR to the Strategy Update

HUMAN AND SOCIOLOGICAL FACTORS



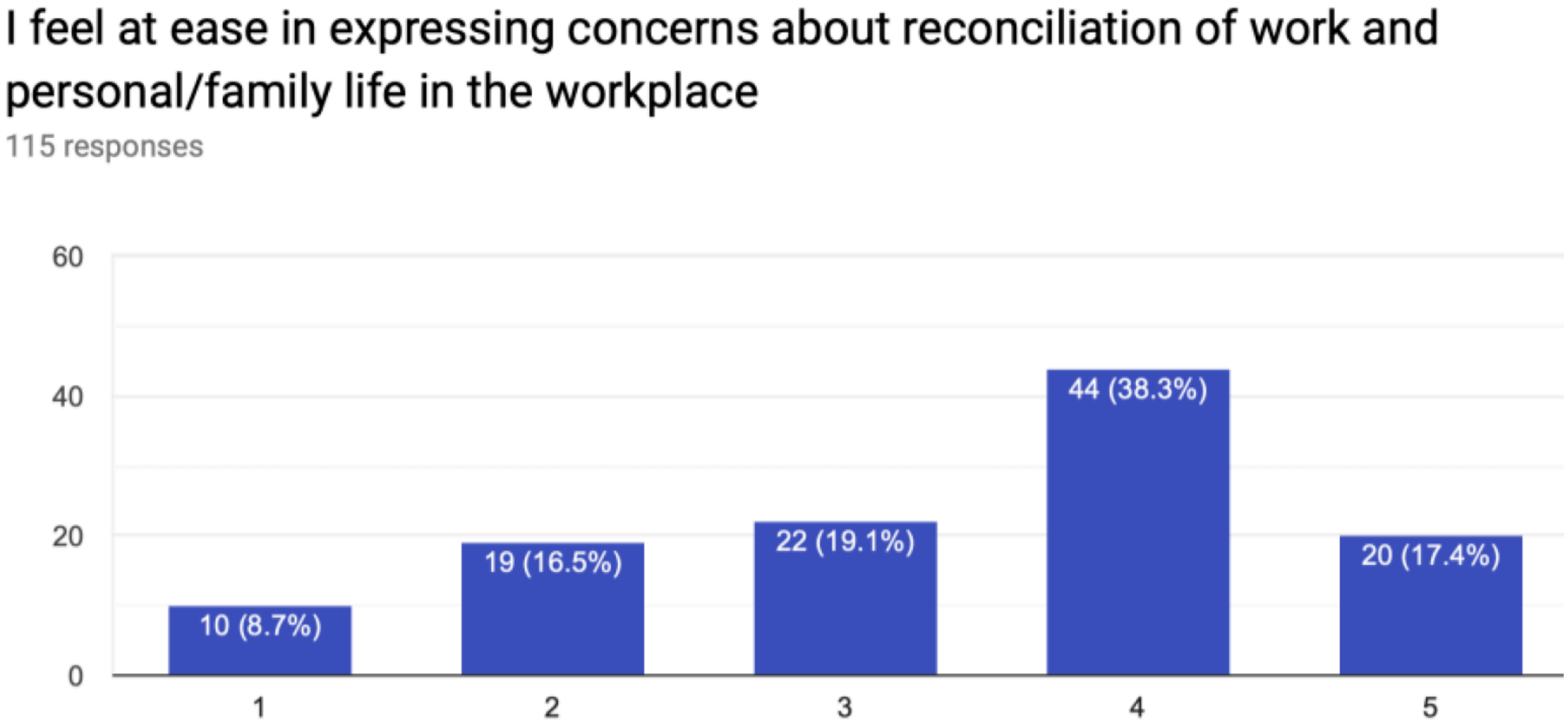
Views of ECR to the Strategy Update

HUMAN AND SOCIOLOGICAL FACTORS



Views of ECR to the Strategy Update

HUMAN AND SOCIOLOGICAL FACTORS



Views of ECR to the Strategy Update

HUMAN AND SOCIOLOGICAL FACTORS

- “possibility for a healthy work-life-balance and the reconciliation of family and a scientific career is a must” …
  - Such topics were only partially discussed in the Briefing Book and ECRs want to emphasise their importance in the report
  - Future project evaluations and strategy updates should include the social impact in their implementation
  - Project-oriented short-term funding -> base-funding, enabling the institutions to realise a healthier and more family-friendly environment with a larger fraction of permanent positions
  - Reasonable work-life balance should not come into effect only after a successful permanent job application
  - Having children often translates to less mobility -> less possibilities to take part in conferences and workshops

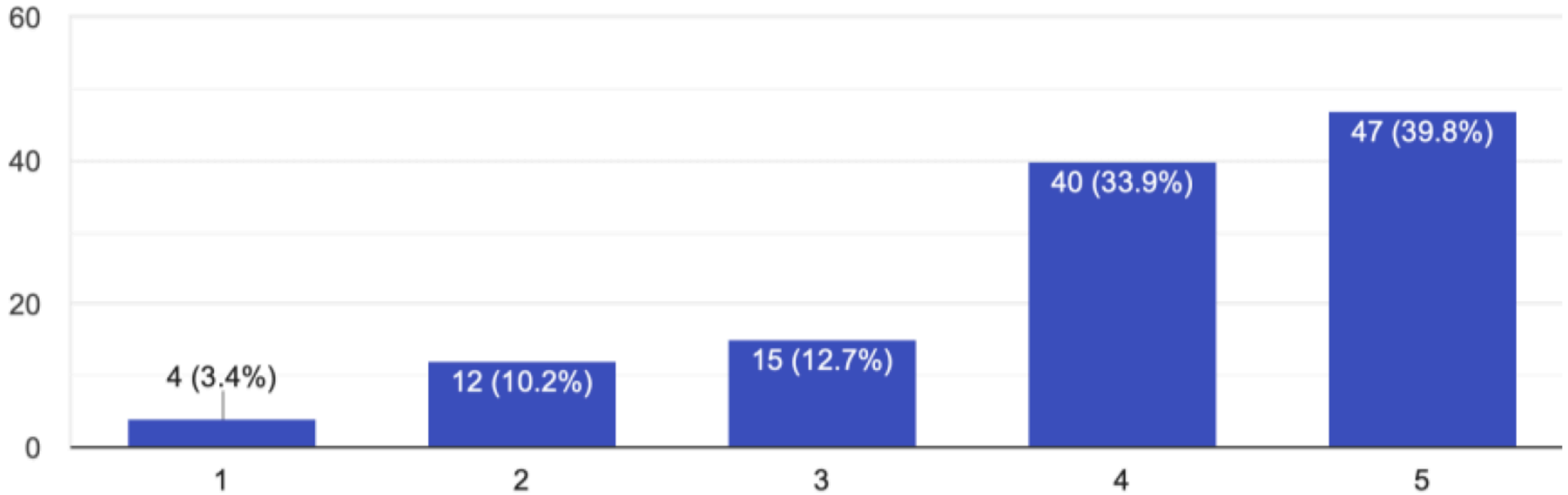
- “equal recognition and career paths for the various domains of our field have to be established to maintain expertise in the field”
  - Equal recognition: areas such as detector R&D does not receive such recognition as physics analysis, although they play an essential role for progress in experimental particle physics
  - Strengthening the networks with the “outside world” of industry could be beneficial to the field

Views of ECR to the Strategy Update

ENVIRONMENT AND SUSTAINABILITY

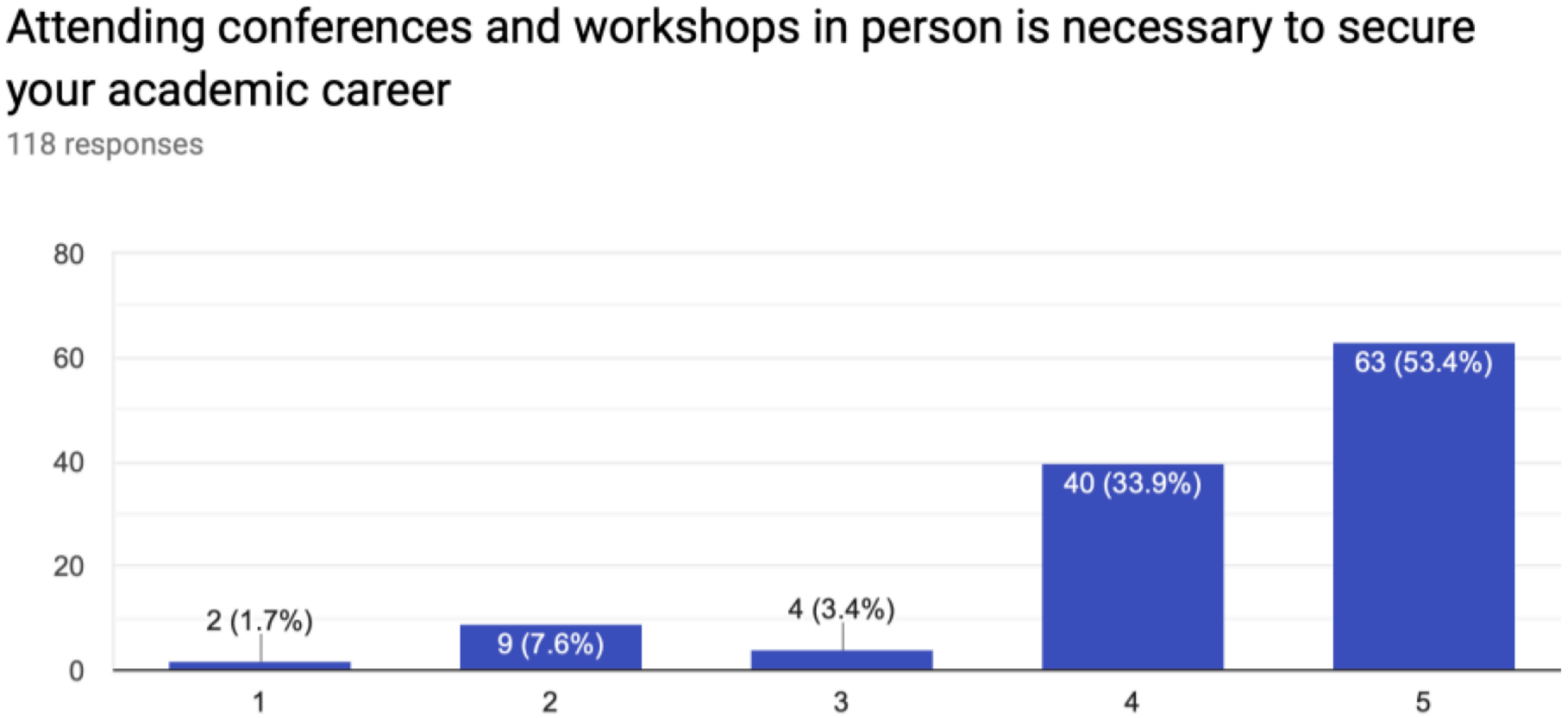
How important it is for you that the environmental impact is taken into account when taking decisions on future projects?

118 responses



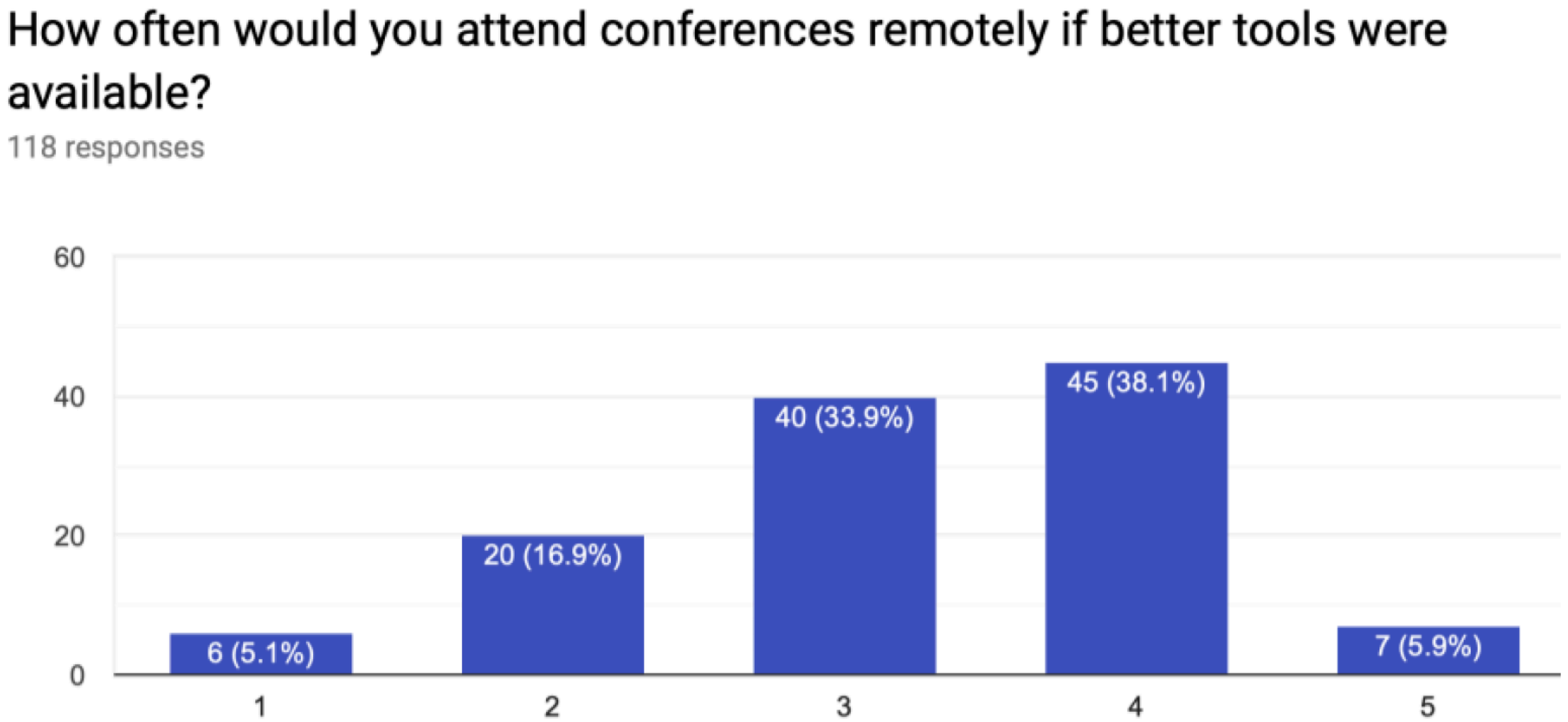
Views of ECR to the Strategy Update

ENVIRONMENT AND SUSTAINABILITY



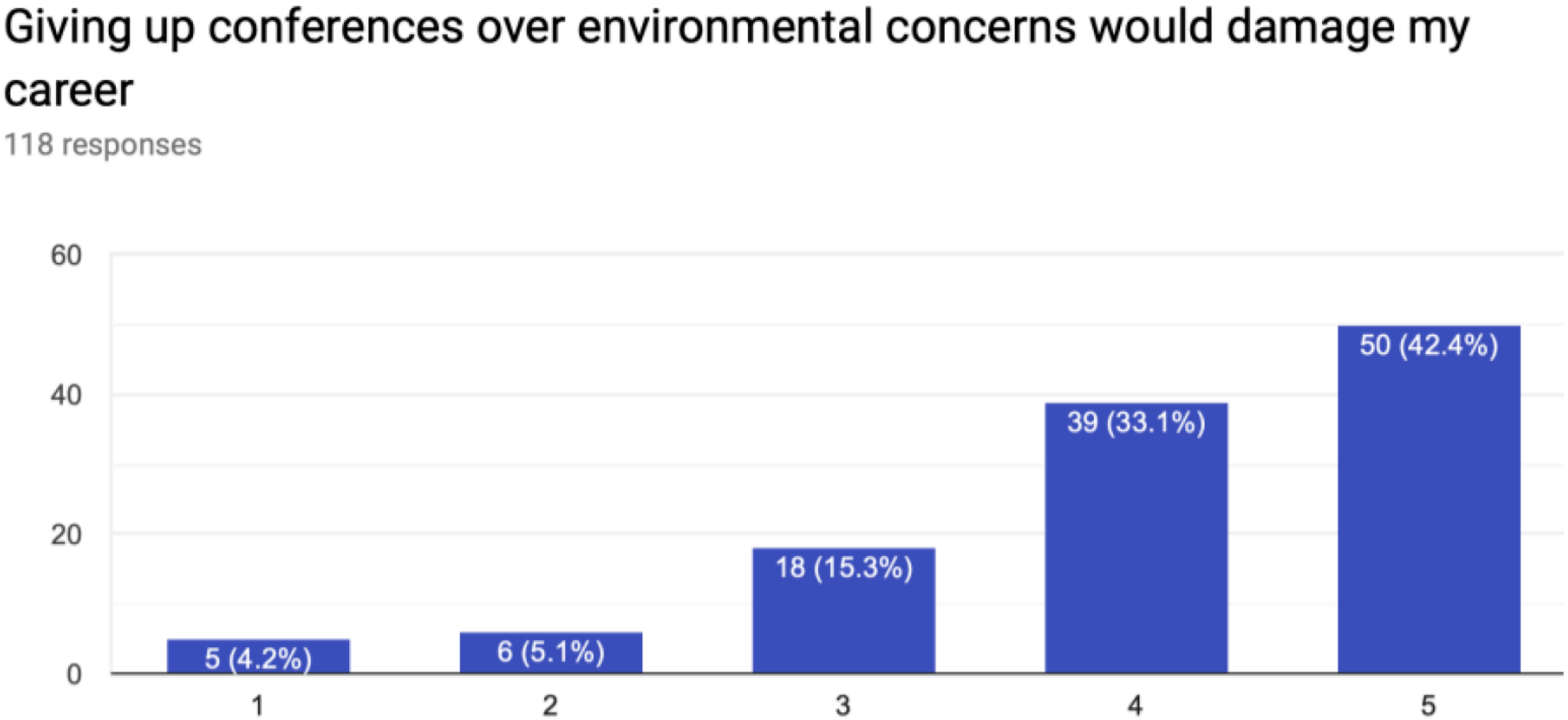
Views of ECR to the Strategy Update

ENVIRONMENT AND SUSTAINABILITY



Views of ECR to the Strategy Update

ENVIRONMENT AND SUSTAINABILITY



Views of ECR to the Strategy Update

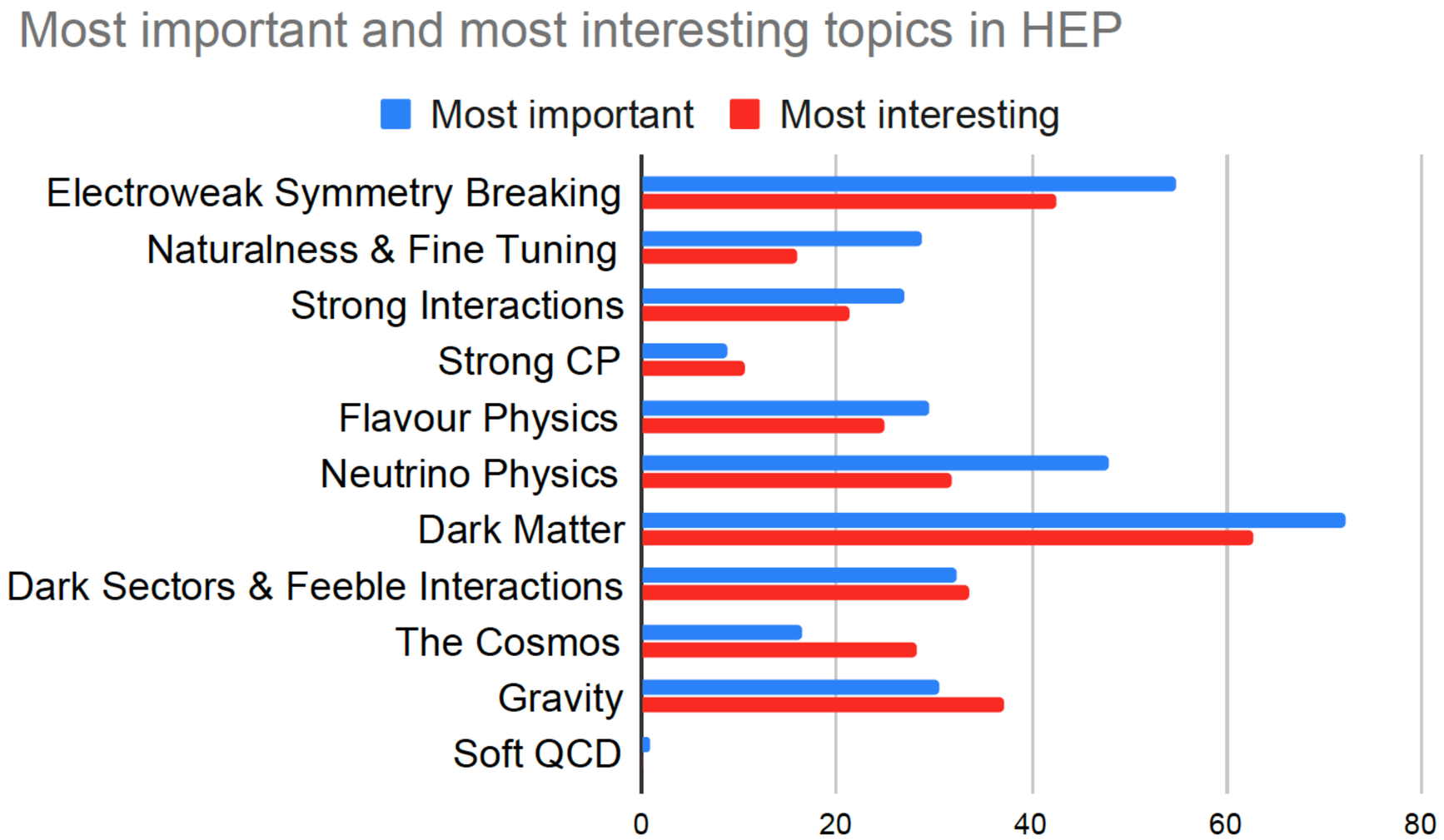
ENVIRONMENT AND SUSTAINABILITY

- “Laboratories such as CERN have a unique position and responsibility in society. A strong statement from CERN putting the environment and sustainability at the forefront of decision-making would have a significant impact.“
  - More considerations should be put to the environmental impact of future collider scenarios (construction and disposal of large infrastructure)

- In order to increase researcher’s visibility, an unnecessary amount of journeys to conferences and workshops is done
  - Job market in academia is highly competitive, leading to ECRs to prioritise career concerns over environmental considerations
  - Travel and conference schedules should be seriously assessed to reduce the amount of travel and the associated carbon footprint

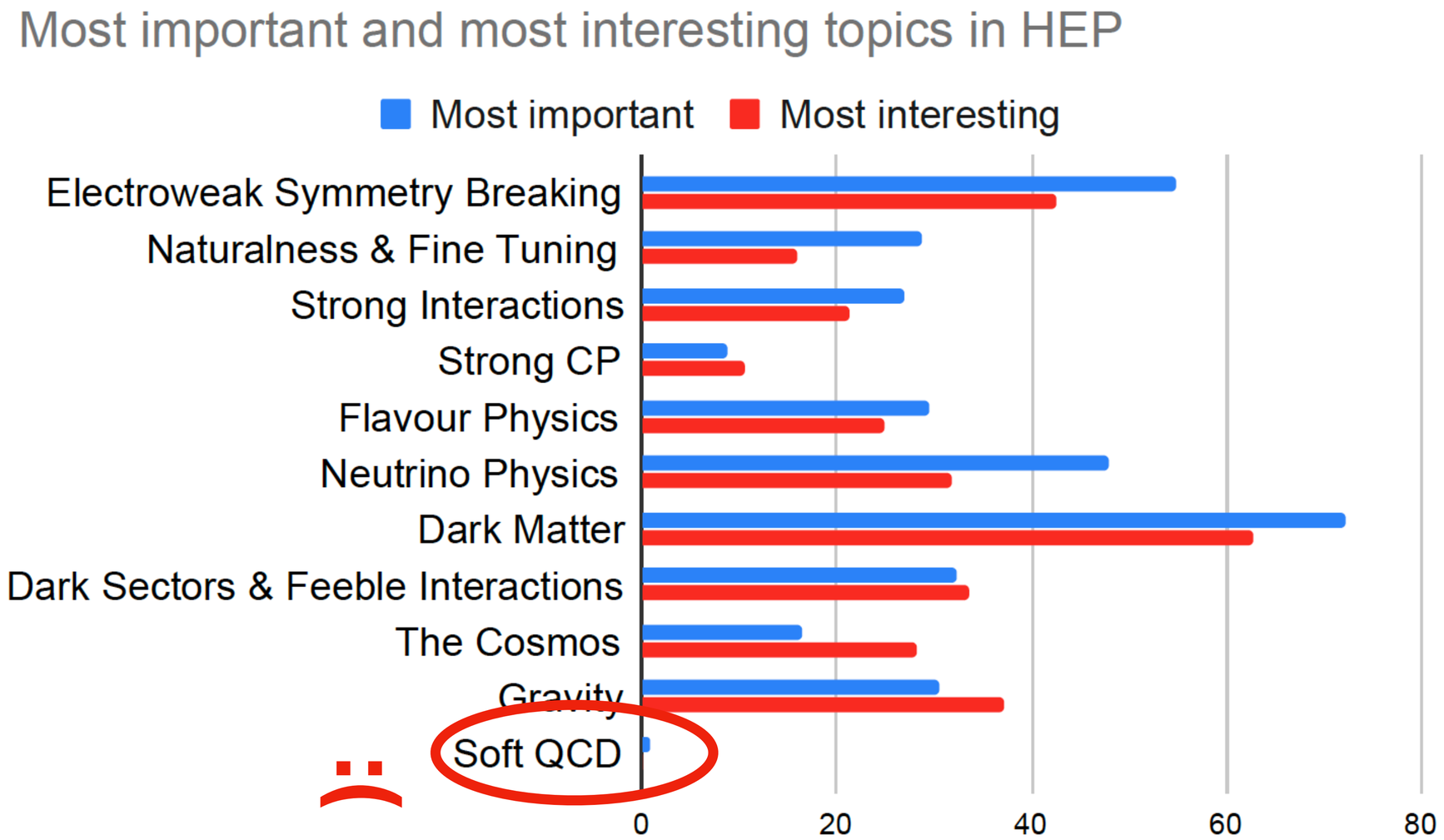
Views of ECR to the Strategy Update

PHYSICS



Views of ECR to the Strategy Update

PHYSICS



Views of ECR to the Strategy Update

PHYSICS

- No clear consensus on which future collider should be pursued due to clear advantages being offered by different areas
  - e^+e^- machine: Precision couplings of Higgs, factory of W,Z,H,t
  - hh machine: BSM searches, PDFs, hot and dense QCD
  - Better collaboration between theory and experiment, and between different observatories (neutrino + gravitational waves + gamma ray telescopes, …)

Views of ECR to the Strategy Update

ACCELERATOR AND DETECTOR R&D

- Concerns have been raised about whether the key numbers stated in the Briefing Book allow for a fair comparison of the various projects

COMPUTING AND SOFTWARE

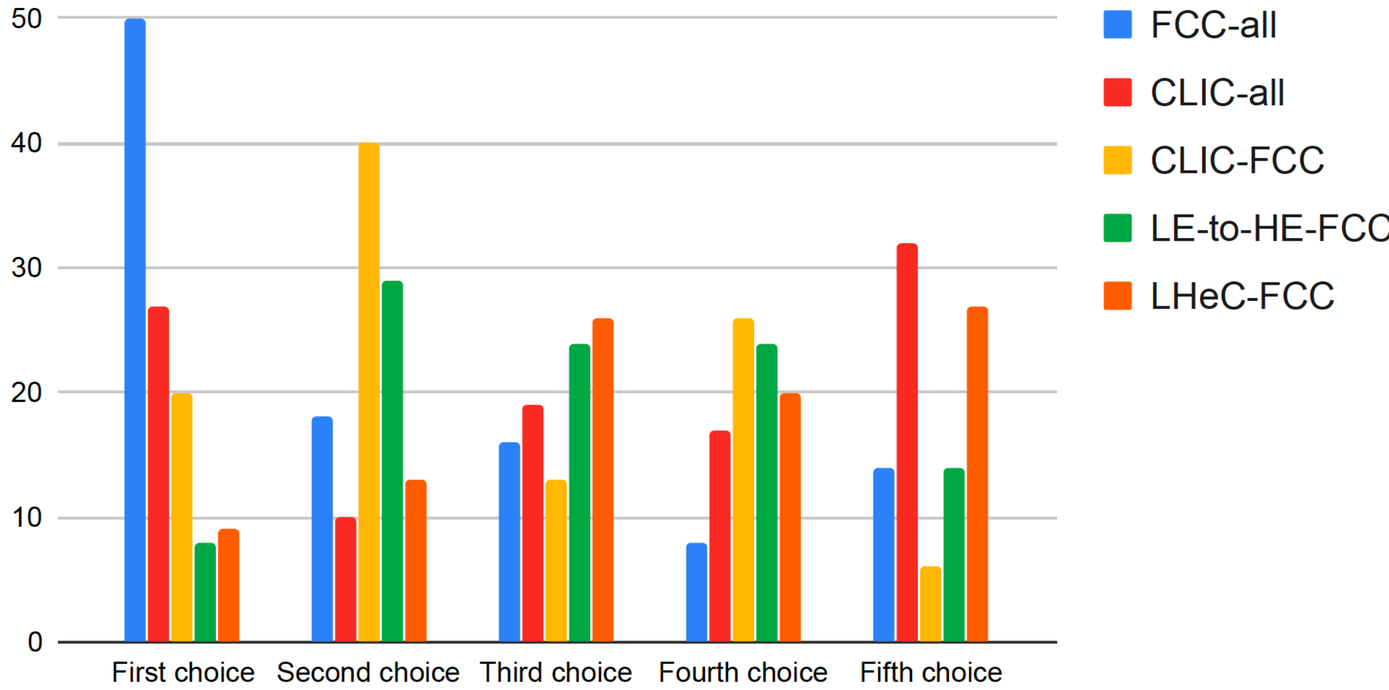
- Software and computing must be recognised not only as means to do physics analyses, but as research that requires a high level of skill
  - Innovation in physics analysis [code] should minimise the time to produce physics results allowing more person-power to be allocated to areas where innovation and development is truly needed

Preferred future collider scenario

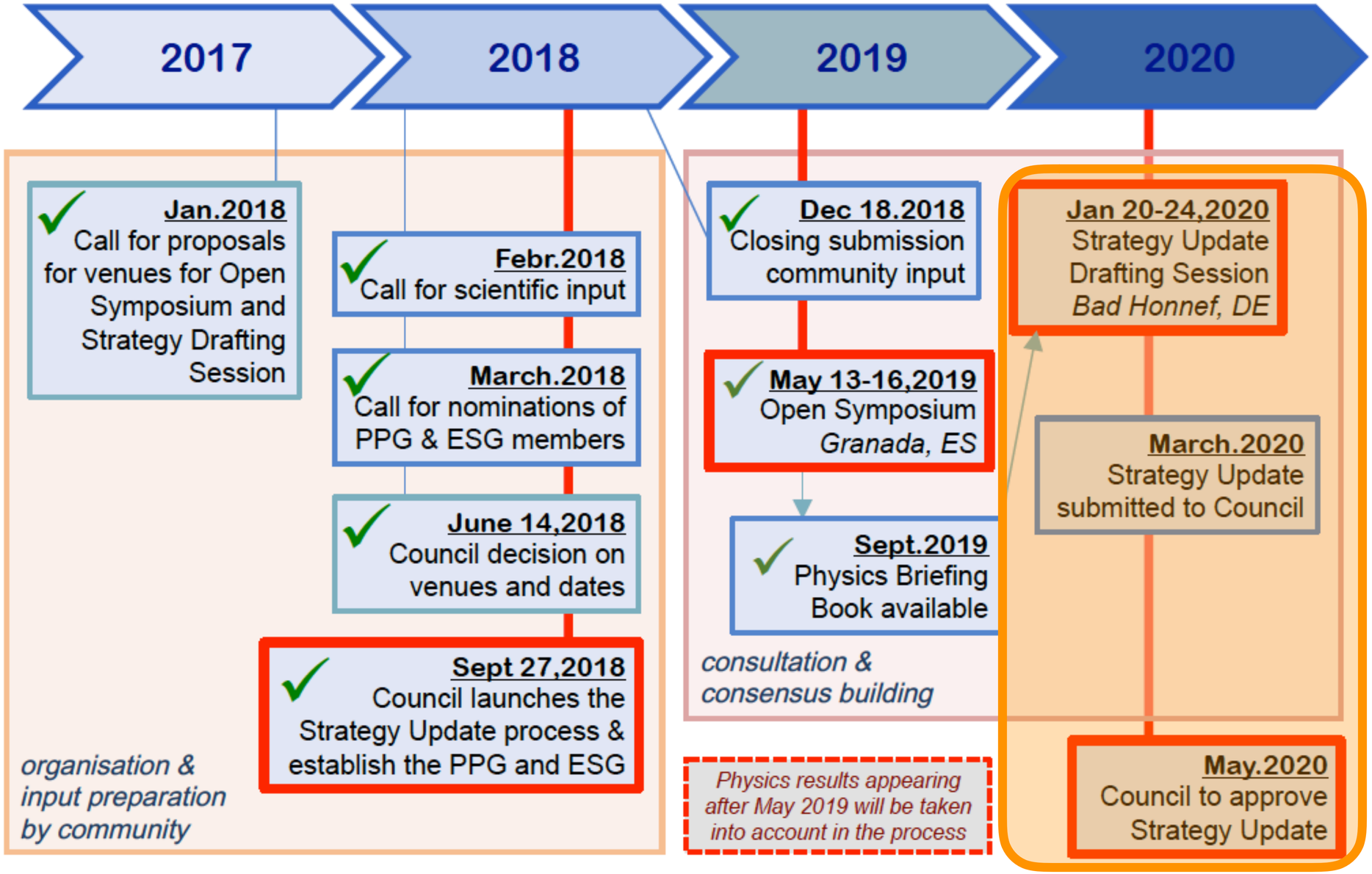
	2020-2040	2040-2060	2060-2080
		1st gen technology	2nd gen technology
CLIC-all	HL-LHC	CLIC380-1500	CLIC3000 / other tech
CLIC-FCC	HL-LHC	CLIC380	FCC-h/e/A (Adv HF magnets) / other tech
FCC-all	HL-LHC	FCC-ee (90-365)	FCC-h/e/A (Adv HF magnets) / other tech
LE-to-HE-FCC-h/e/A	HL-LHC	LE-FCC-h/e/A (low-field magnets)	FCC-h/e/A (Adv HF magnets) / other tech
LHeC-FCC-h/e/A	HL-LHC + LHeC	LHeC	FCC-h/e/A (Adv HF magnets) / other tech

FUTURE OF THE FIELD

- "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"



The Long-term Strategy in 2020



The road of strategies