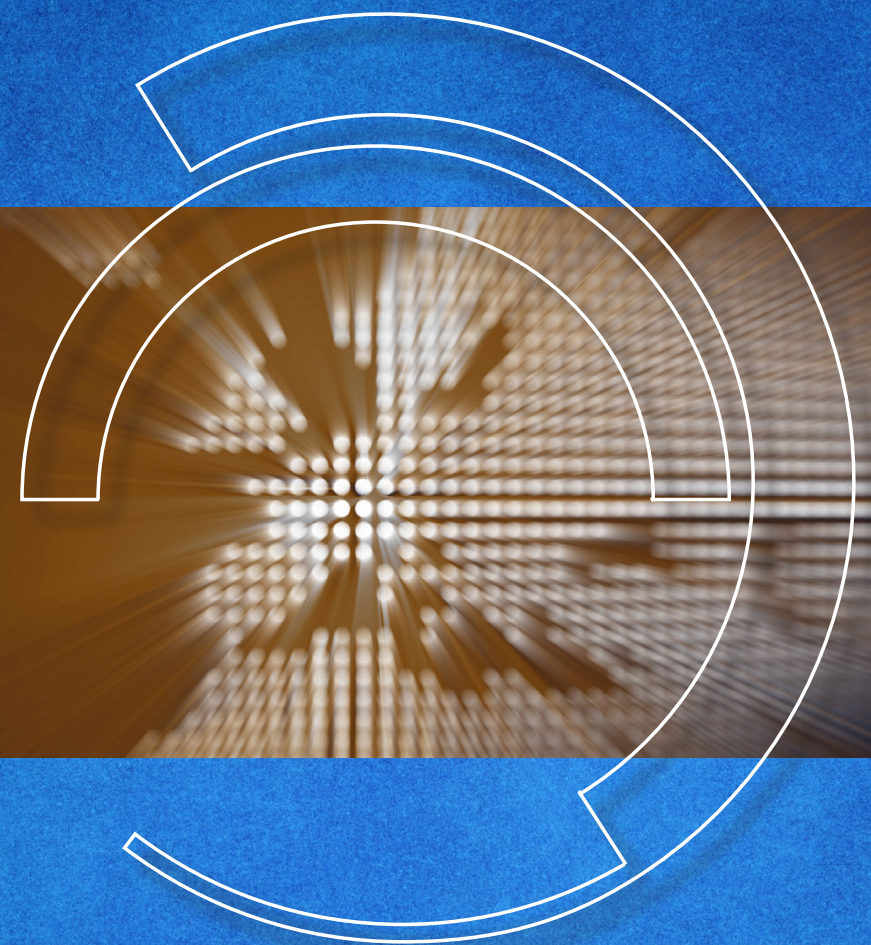


UPDATE ON THE UPDATE: EUROPEAN STRATEGY FOR PARTICLE PHYSICS

Eric Laenen

2020 UPDATE



2020 UPDATE OF THE EUROPEAN STRATEGY
FOR PARTICLE PHYSICS

by the European Strategy Group



DELIBERATION DOCUMENT



DELIBERATION DOCUMENT
ON THE 2020 UPDATE OF THE EUROPEAN STRATEGY
FOR PARTICLE PHYSICS

The European Strategy Group



EPSSU 2020

- 20 Strategy statements:
 - 2 statements on Major developments from the 2013 Strategy
 - 3 statements on General considerations for the 2020 update
 - 2 statements on High-priority future initiatives
 - 4 statements on Other essential scientific activities for particle physics
 - 2 statements on Synergies with neighbouring fields
 - 3 statements on Organisational issues
 - 4 statements on Environmental and societal impact

MAJOR DEVELOPMENTS SINCE 2013 UPDATE

- a) Continue HL upgrade of LHC and detectors
 - ▶ For full physics potential, including flavour and heavy ions
- b) Continue Neutrino Platform with US and Japan
- c) R&D for CLIC and FCC
 - ▶ CDR's written
- d) Look forward to ILC proposal from Japan
 - ▶ Not (yet) received

GENERAL CONSIDERATIONS

- a) Continue Europe's leadership in particle physics and its technology
 - ▶ By implementing this strategy
- b) Strengthen ecosystem of CERN and national labs/research centres
- c) Collaborate with global partners and other fields to implement this strategy

HIGH-PRIORITY FUTURE INITIATIVES

- a) Higgs factory highest priority, FCC-hh as long term goal,
 - ▶ Start feasibility study (tunnel, finance, technology)
 - ▶ ILC proposal would be compatible with this, Europe would collaborate if built
- b) More accelerator R&D (incl. high-field magnets/HTS), make roadmap for CERN and national labs

OTHER ESSENTIAL ACTIVITIES

- a) Support dark matter and flavour, smaller experiments, at other labs, including outside Europe
 - ▶ No room in budget for starting Beam Dump Facility/LHeC
- b) Support theory, from abstract to phenomenology. Provide career options for those who develop and maintain MCs, calculations etc
- c) Enhance detector R&D at CERN and in member states, develop roadmap (with ECFA)
- d) Support computing and software R&D

SYNERGIES WITH NEIGHBOURING FIELDS

- a) Support experiments at boundary with nuclear Physics via NuPECC
- b) Strengthen synergies with astroparticle physics, via APPEC
 - ▶ Establish new procedure for CERN technical support, but cost-neutral for CERN

FRIDAY JUNE 19 2020: UPDATE APPROVED

- Unanimously decided in Open Session of CERN Council
- Culmination of two years of compilation, discussion, deliberation...



NEXT STEPS

- a) Continue full exploitation of (HL)-LHC
- b) Include strategy in CERN's Medium Term Plan (now+5 years)
- c) R&D roadmaps have to be made (1-2 years)
 - ▶ Accelerator Technology
 - ▶ Detector R&D
- d) Make links with national labs more concrete
- e) Start the feasibility studies, to be completed by 2026
- f) Monitor and support developments in Japan and China

DEVELOPMENTS SINCE THE JUNE 2020 ADOPTION

- a) Medium Term Plan 2021-2025 approved (September Council)
 - ▶ MTP's goal is always to realise the strategy
- b) R&D roadmaps underway
 - ▶ Links with national labs more concrete in roadmaps
- c) Feasibility studies started
- d) Computing R&D: Quantum Technology Initiative, with Member States, 3MCHF seed money
- e) Japan - ILC moved forward on the physicist side
 - ▶ ICFA -> ILC international development team to prepare IL Pre-Lab in Japan
 - Pre-Lab does not require government approval
 - ▶ To be completed late next year

ACCELERATOR R&D INITIATIVES IN MTP: MAGNETS

a) Superconducting high-field magnets

- ▶ for future hadron/muon colliders, neutrino beams etc.

b) Budget increase: 10 (now) -> 16-18 (2021-2024) -> 20 MCHF/y after

c) All magnet R&D in CERN now under one roof and in one budget line

d) Activities

- ▶ Low temperature (Nb₃Sn, for 16T) and High-T_c for at least 20T
- ▶ Prototyping, infrastructure, etc
- ▶ Foster connection to industry (Bruker-EAS in Germany, only HTS wire supplier in Europe)

e) Goals for 2026:

- ▶ Nb₃Sn: demonstrate technology for large scale application in accelerators
- ▶ HTS: demonstrate suitability for accelerators

ACCELERATOR R&D INITIATIVES IN MTP: FUTURE COLLIDERS

- a) Start CLEAR facility (*CERN Linear Electron Accelerator for Research*): cont'n of CLIC R&D
 - ▶ Including plasma wakefield
 - ▶ Maintain Europe's linac expertise (also for medical applications)
 - ▶ No more funds for CLIC physics studies
- b) Muon colliders: 2MCHF/y to jump start community efforts
- c) ERL research foreseen not at CERN, but in Member States (esp. France)

ACCELERATOR R&D INITIATIVES IN MTP: FUTURE COLLIDERS

a) FCC: 20 MCHY/y for feasibility study of infrastructure and colliders

▶ Financial feasibility

- First priority is tunnel: 5.5 BCHF. “need innovative funding mechanisms”

▶ Governance model to be developed (discussions with DOE started)

▶ Technical feasibility

- Two countries and their legal systems, land expropriation, environmental aspects. Any show-stopper?

▶ Technology

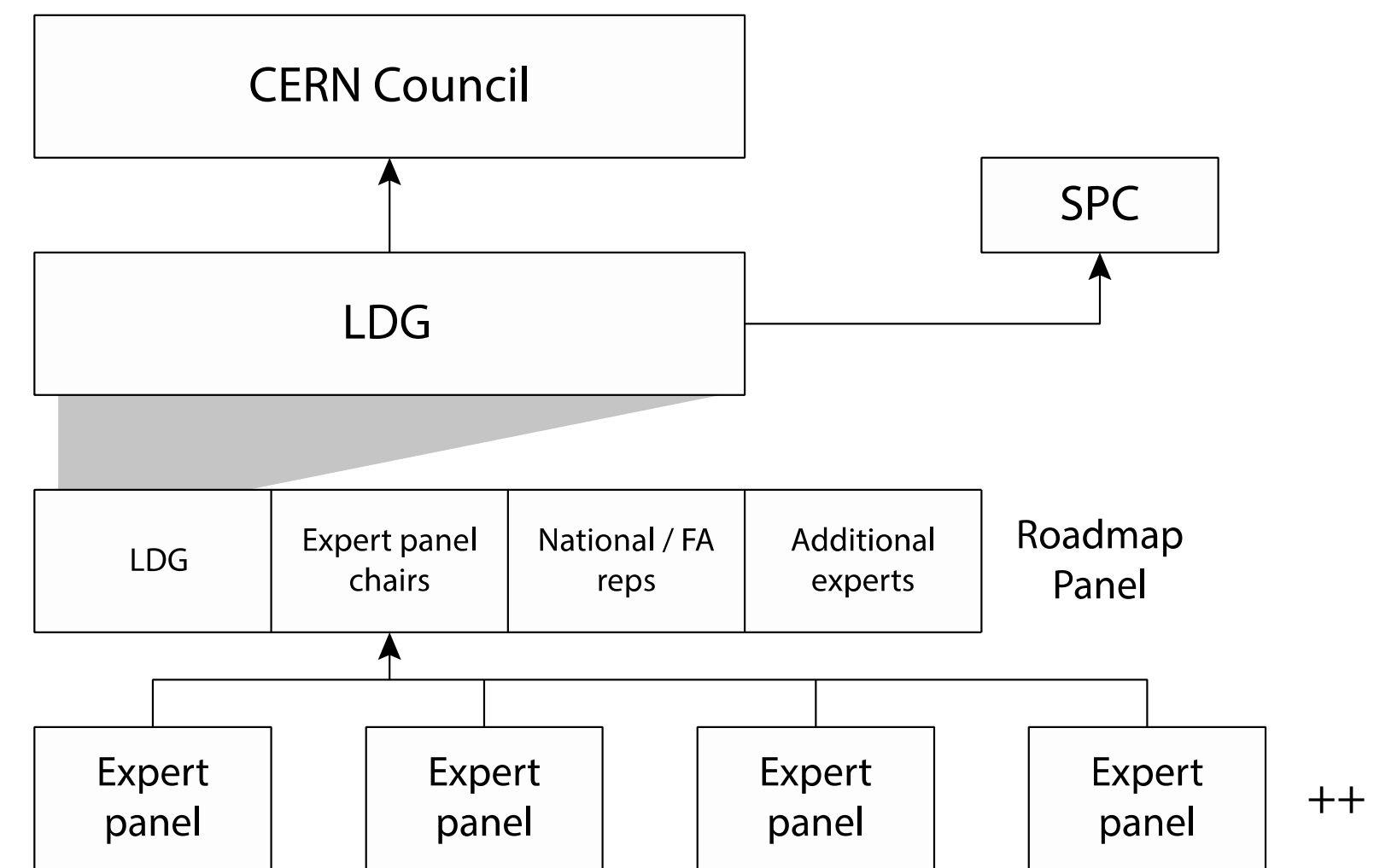
- Magnets, “green collider”

▶ Political and societal feasibility

- Consensus building with govts, scientists from other fields, public (Science Gateway)

ACCELERATOR R&D ROADMAP

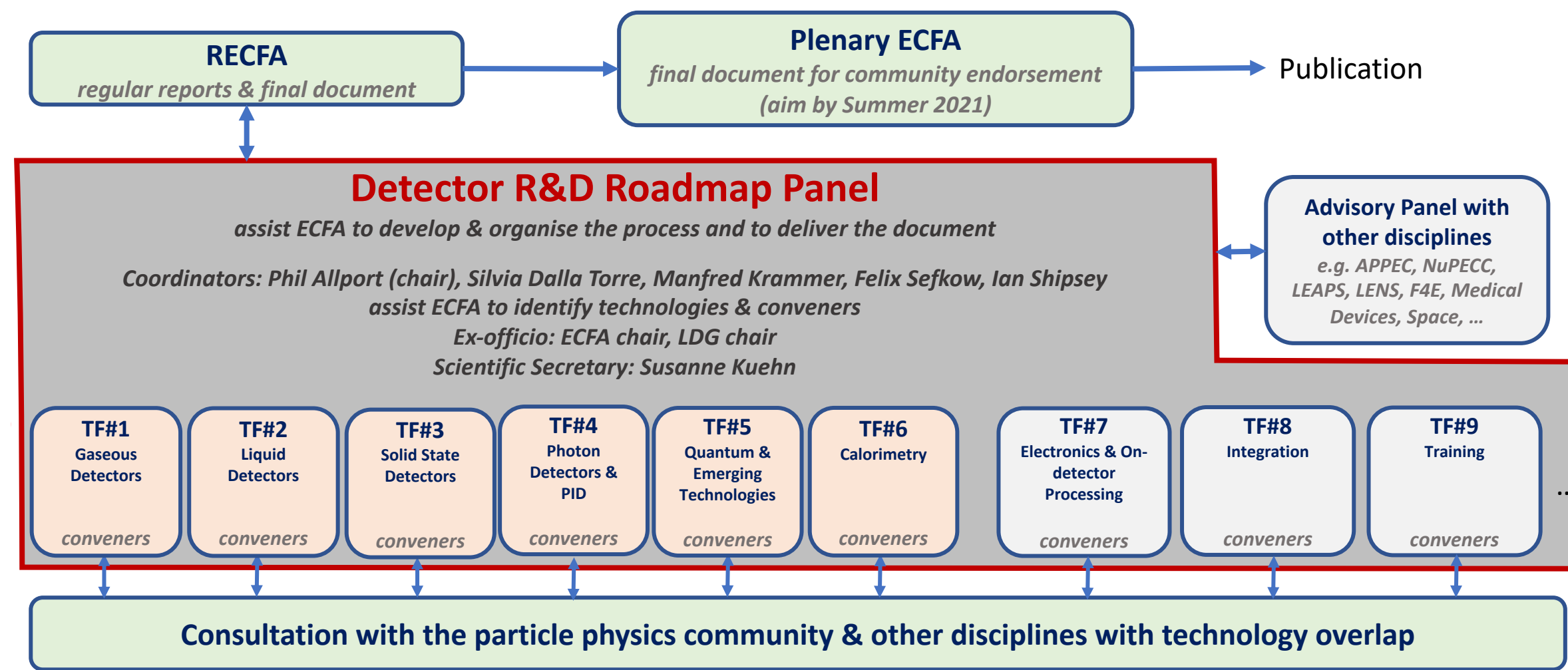
- a) Should give route towards implement ESPPU goals
 - ▶ CERN + national labs
 - ▶ Under auspices of Laboratories Directors Group (chair: Lenny Rivkin)
- b) Expert and Roadmap panels are being formed
- c) Timeline:
 - ▶ Dec. 2020: panel composition, scope
 - ▶ March 2021: intermediate report
 - ▶ June 2021: final report



Horizontal expansion is possible if necessary

DETECTOR R&D ROADMAP

- a) Should also give route to implement ESPPU goals
 - ▶ Under auspices of ECFA
- b) Panels and Task Forces are being formed
- c) Timeline:
 - ▶ Intermediate reports to RECFA
 - ▶ Final document to PECFA by summer 2021



SCIENTIFIC DIVERSITY

a) Neutrino Platform

- ▶ Strengthening (more MCHF in MTP, for 1st DUNE cryostat) very important to USA and success of DUNE

b) Physics Beyond Colliders

- ▶ Smaller experiments already underway
- ▶ Platform for more collaboration of CERN and European National Labs
- ▶ Small budget increase (1->3 MCHF/y), includes continuation of R&D and design studies of beam dump facility, for 2026 decision

SUMMARY

- a) CERN is well underway in following-up on ESPPU.
- b) Feasibility studies key to next collider. FCC by no means a guarantee
- c) Not yet a strong signal of efforts to better align CERN and National Labs, but it is still very early days. And of course, Covid.
- d) Not touched upon:
 - ▶ Other statements in Strategy on Diversity, Early-Career Researchers (Panel!), Public Engagement, Open Science, are also being followed-up