

Updated mandate LHeC and FCC-eh studies

from CERN Director-General & CERN Director for Research and Computing
(received on October 23, 2022)

Following the publication of the updated CDR, CERN continues to support studies for the LHeC and the FCC-eh as potential options for the future and to provide input to the next Update of the European Strategy for Particle Physics.

The study is to further develop the scientific potential and possible technical realization of an ep/eA collider and the associated detectors at CERN, with emphasis on FCC.

Mandate of the LHeC/FCC-eh Coordinator (Jorgen D'Hondt)

The coordinator convenes the Coordination Panel.

The coordinator provides visible leadership, organization, and advocacy for the work towards an ep/eA collider programme at CERN.

The coordinator acts as the Spokesperson of the study to the international community and represents the FCC-eh towards the FCC feasibility study.

The coordinator can assign a deputy.

Mandate of the LHeC/FCC-eh Coordination Panel (members: TBC)

The panel has the task to assist the coordinator (and deputy).

The panel organizes, coordinates, oversees, and steers an appropriate long-term organizational structure and programme plan.

The panel will report to CERN's Director for Research and Computing through the Coordinator and will receive advice from the International Advisory Committee.

It includes an international representation and acts as a decision-making and prioritization body for the study.

Mandate of the International Advisory Committee (members: TBC)

The IAC advises the Coordination Panel and the CERN Directorate by following the development of options of an ep/eA collider at the LHC and at the FCC.

Advice may relate to the scientific and technical direction for the physics potential of the ep/eA collider, with emphasis on the FCC, depending on the machine parameters and a realistic detector design.

The IAC assists the Coordination Panel build the international case for the accelerator and detector developments, and advises on the resource, infrastructure and science policy aspects of the ep/eA collider.

Mandate of the Convener Group

Conveners will lead thematic working groups in the ep/eA collider programme and establish collaboration among its participants.

They will plan and lead the research developments required to enhance the potential of the programme while embedding innovations in both experimental and theoretical research.

In their role as experts, they will animate the working groups with regular meetings, engage and guide new researchers, seek opportunities to disseminate and promote results, and establish transversal collaboration across working groups.

Initially, the following working groups are active: Higgs physics (NN), Beyond the Standard Model (NN), top quark and EW physics (NN), PDFs (NN), low-x physics (NN), eA physics (NN), detector designs (NN), collider designs (NN).

Conveners are nominated by the Coordination Panel and appointed by CERN's Director for Research and Computing.

ERL mandate within the Accelerator R&D Roadmap

from Lab Directors Group (LDG)
(received in July 2022)

Advancing Accelerator Technologies

High-energy & high-intensity beams are required for nuclear and particle physics

European Accelerator R&D Roadmap (2021)

<https://arxiv.org/pdf/2201.07895.pdf>

- High-field magnets
- RF accelerating structures
- Plasma acceleration
- Muon colliders
- Energy Recovery Linacs (ERL)

Continuous innovations are required in accelerating structures to achieve more bright, energetic and powerful beams for nuclear and particle physics

A high-energy muon collider is as well on the mind (at CERN... towards a $\mu p/\mu A$ DIS program at high energies)

An overarching theme is the development of
Sustainable Accelerating Structures

less energy, less cooling, less power loss, recover beam energy

Efficiently recovering the energy from the accelerated particle beam

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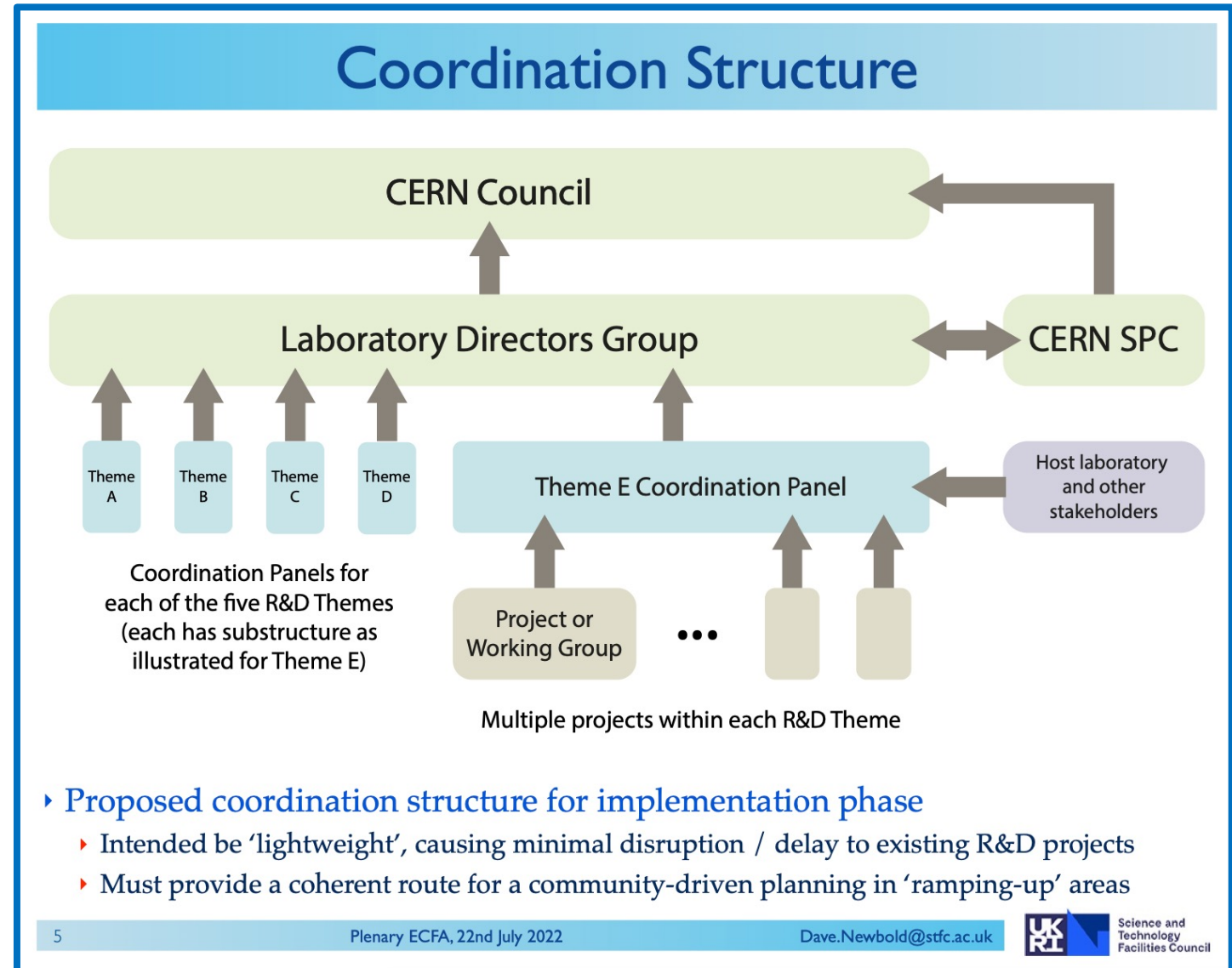
Organising the European R&D for Energy Recovery in HEP

connecting the R&D community with the HEP steering and funding bodies

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From Dave Newbold (chair of the Lab Directors Group, LDG), slides shown during Plenary ECFA meeting July 2022, <https://indico.cern.ch/event/1172215/>

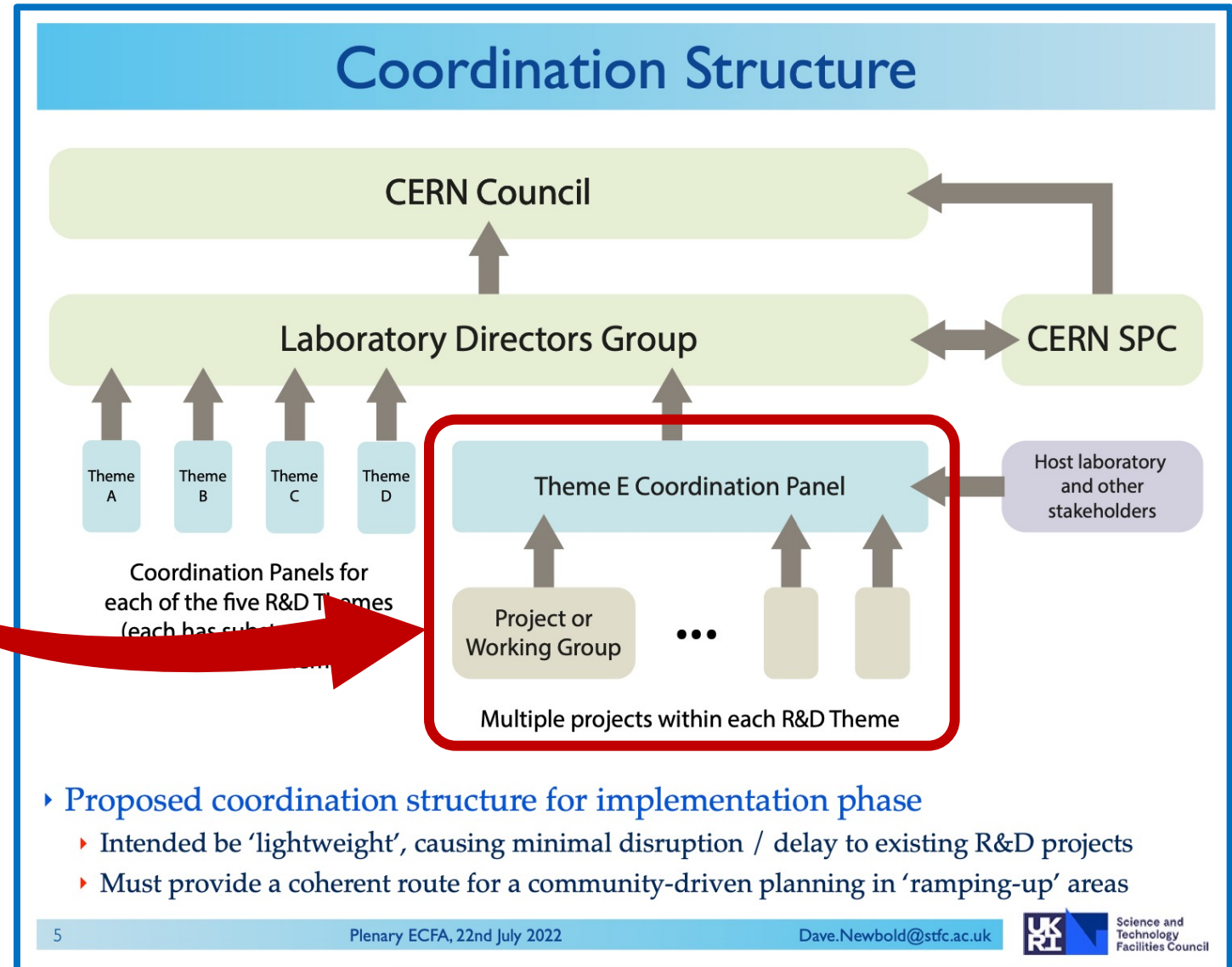


Organising the European R&D for Energy Recovery in HEP

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Energy Recovery Accelerators



Organising the European R&D for Energy Recovery in HEP

- ① *connecting the ERL R&D community with the HEP steering and funding bodies*
- ② *leverage on ongoing ERL R&D towards implementations in HEP applications*
- ③ *strengthen collaboration across the field to reach the HEP-related R&D objectives*

Coordination Panel

Jorgen D'Hondt (chair), Max Klein (deputy)

Jens Knobloch (bERLinPro), Achille Stocchi (PERLE), Andrew Hutton (R&D oversight)

Working Groups

1. Beam Diagnostics & Instrumentation
2. Simulations (incl. education)
3. Designs of e^+e^- colliders with Energy Recovery (incl. Dual Axis R&D)
4. Sustainable SRF (incl. HOM damping, FRT, >4K operation)

Additional

- Electron Source *work integrated in the bERLinPro & PERLE programs*
- Design of ep collider *ongoing in the realm of the LHeC and FCC-eh programs*

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Working Groups

1. Beam Diagnostics & Instrumentation
2. Simulations (incl. education)

to be explored

3. Designs of e^+e^- colliders with Energy Recovery (incl. Dual Axis R&D) – joint with RF Coordination Panel
4. Sustainable SRF (incl. HOM damping, FRT, >4K operation) – joint with RF Coordination Panel

Joint WG as a stepping stone for generic R&D towards potential integration in the PERLE and bERLinPro programs

Additional

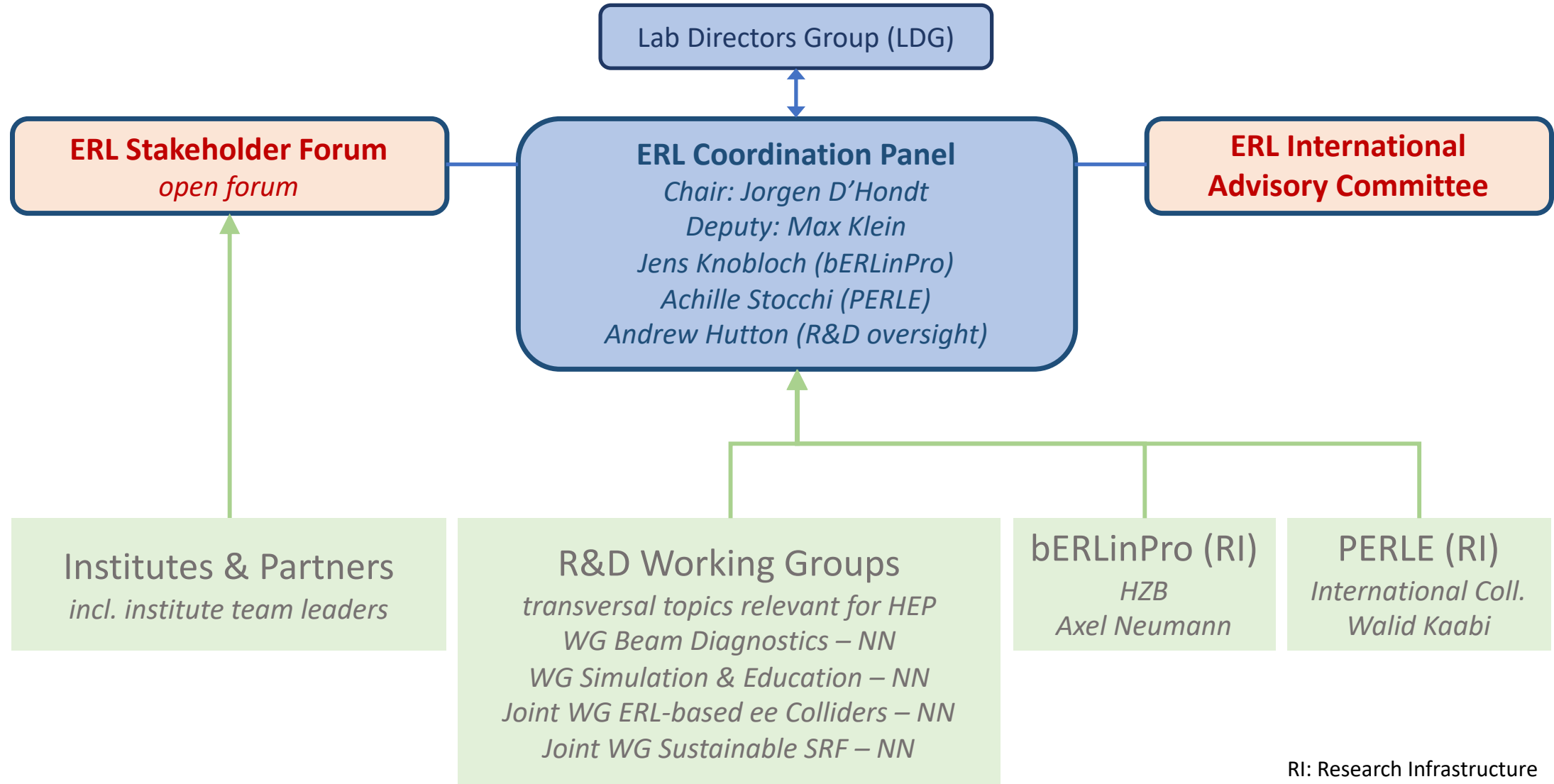
- Electron Source
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Organising the European R&D for Energy Recovery in HEP

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ERL Coordination Panel – *mandate from LDG with frequent meetings*

- *organise, coordinate, oversee and steer the implementation of the ERL R&D Roadmap with a view to allow the implementation of Energy Recovery in HEP applications*
- *within the scope of the ERL R&D Roadmap act as a decision-making and prioritisation body*
- *contact with stakeholders and funding agencies*

ERL Stakeholder Forum – *meets at least 1x per year, open meeting*

- *inform the community on ERL R&D strategy, progress and challenges in the realm of HEP*
- *review the sharing of resources among participating institutions*

ERL International Advisory Board – *meets at least 1x per year*

- *connect with partners in other regions relevant for ERL R&D, Energy Savings and applications*
- *provide international oversight and advises to the ERL Coordination Panel*

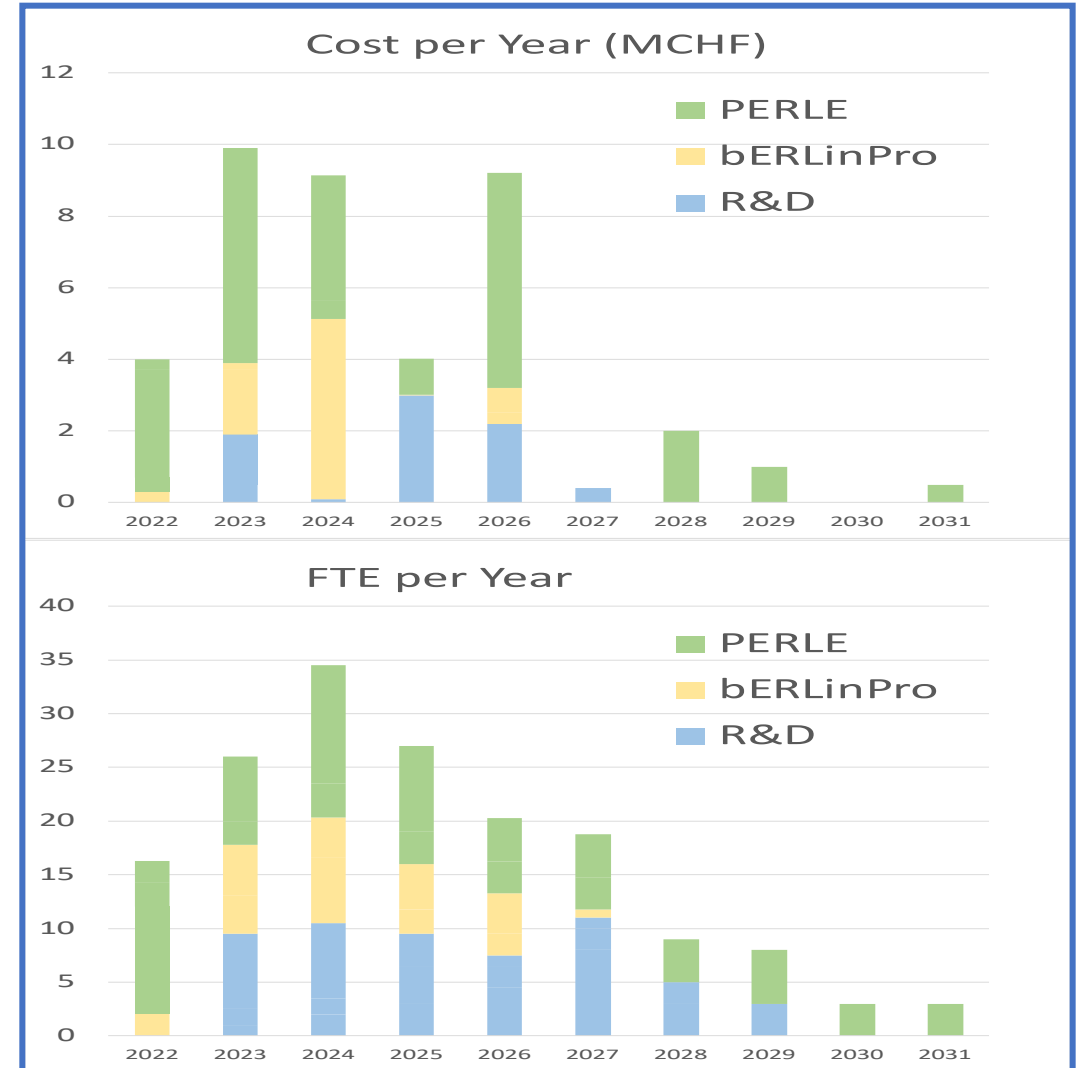
ERL WG Conveners – *frequent WG meetings*

- *establish collaboration across the field on the WG topic (focus on R&D topics for HEP applications)*

Required resources for the R&D program for Energy Recovery

demonstrate a ready-to-go-path for high-energy colliders by the next Strategy Update

	R&D Working Groups						bERLinPro		PERLE			
	Beam Diagnostics	Simulations & Education	Sustainable SRF (HOM Damping part)	ERL-based ee Colliders	Electron Source	ERL-based ep-collider	Phase-1 100mA beam	Phase-2 Recirculation	Phase-1 250 MeV	Phase-2 500 MeV		
2022												
2023												
2024												
2025												
2026												
2027												
2028												
2029												
2030												
2031												
Cost (MCHF 2021)	1,4			2,7	3,5			2,4	5,9	14,6	9,6	40,1
FTEy	19			24,5	12,5			16	17	64	23	176



Expression of Interest to join this R&D program for Energy Recovery

with a view to demonstrate its applicability in high-energy particle physics colliders

Institute	R&D Working Groups				Electron Source		bERLinPro	PERLE
	Beam Diagnostics	Simulations & Education	Sustainable SRF	ERL-based ee Colliders	ERL-based ep-collider			
Univ. NN (names individuals)	x					x	x	x

ERL R&D is at the crossroad between different disciplines.

The successful and timely realisation of the ERL R&D plan for particle physics depends on the interest and involvement of leading experts and their institutions.

In addition, and as a prerequisite, it requires the particle physics funding bodies to timely resource load the plan in order to cover the material costs and activate the concrete implementation plan.