

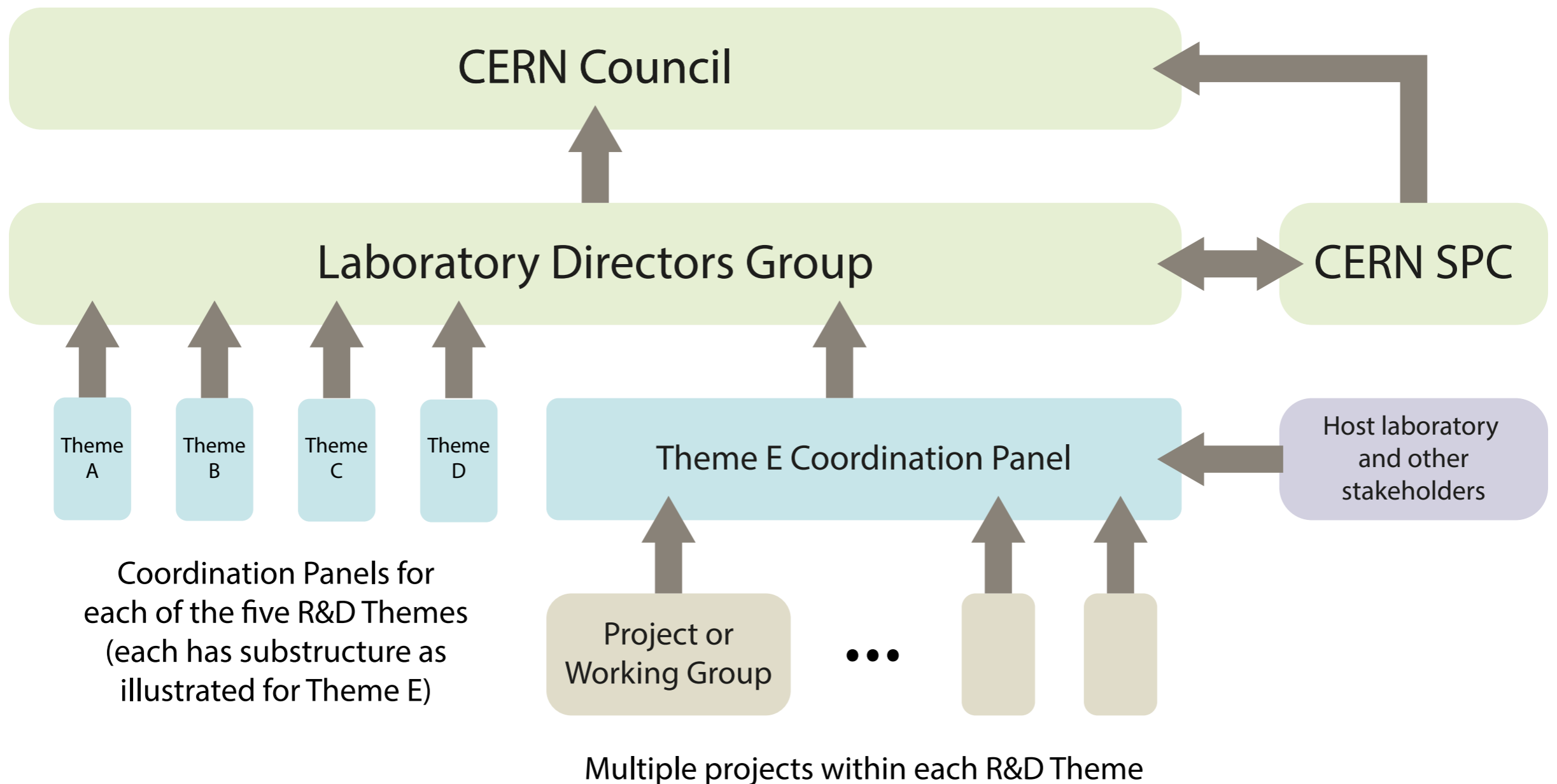
Accelerator R&D Roadmap

- ▶ LDG working via mandate conferred by Council, March 2022
- ▶ Where are we?
 - ▶ Roadmap defined, received by Council, published at start of 2022
 - ▶ Definition and population of coordination structure for the coming years
 - ▶ Discussions with supporting funding agencies and labs
 - ▶ First formal review of progress / status in December 2022
- ▶ LDG view of the goals for the coming years
 - ▶ Provide evidenced inputs to the next update of the European Strategy, supporting decision-making around future collider projects
 - ▶ Performance expectations, technical options, cost analysis, plausible schedule, site options
 - ▶ What intermediate demonstrators should be built, and what science can they deliver?
 - ▶ Build and sustain coherent R&D community, working with particle physics community
 - ▶ Ensure focus on the goals of the European Strategy, while profiting from links to the wider 'accelerator development' world
 - ▶ Make the case for adequate support and engagement by European funding agencies
 - ▶ **New: develop and document the 'sustainability case' for new machines**
- ▶ We note that the IMCC is dealing with more than just the machine

General Roadmap Recommendations

1. The Roadmap is the consensus view of the community (but many detailed planning decisions are yet to come)
2. Governance structures should be put in place, spanning the R&D programmes; CERN Council is the ultimate arbiter
3. Maintain a broad front: at least the minimal programmes in each area
4. Retain the capability for blue skies R&D
5. Continuity of funding is more important than maximal funding; investments must be supported in the long term
6. Sustainability is now a driving factor; plan in light of this
7. Early science output (and impact) from the R&D is desirable; plan in light of this
8. We need to work with industry closely, and in ways that they can accommodate
9. Close and organised cooperation between major labs internationally is needed to facilitate the programme
10. Trained people are the lifeblood and future of the field – ensure the supply

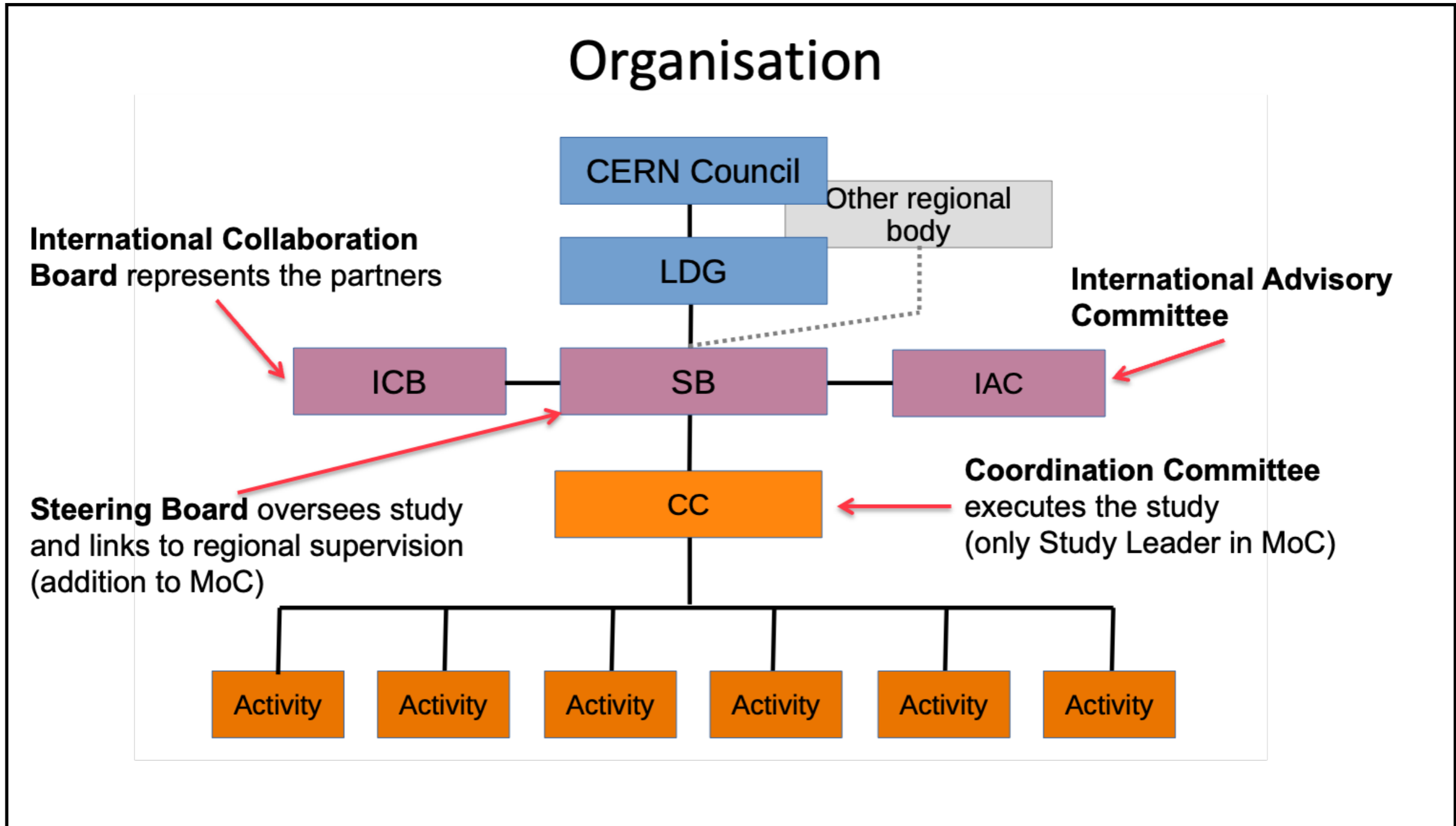
Coordination Structure



▶ Proposed coordination structure for implementation phase

- ▶ Intended be 'lightweight' and cause minimal disruption / delay to existing R&D projects
- ▶ Also needs provide a coherent route for a community-driven planning in 'ramping-up' areas

Muons Area Coordination



- ▶ Coordination panel maps directly onto IMCC Steering Board

Coordination Panel Terms of Reference

- ▶ Oversee the development of a detailed execution **plan** for each R&D Theme, and **coordinate** the necessary work
- ▶ Have representation from all **stakeholders**, including (as appropriate) participating laboratories, institutes, and national communities
- ▶ Include representation from **international partners**, ensuring that a uniform picture for both European and international oversight bodies
- ▶ Act as a **decision-making and prioritisation** body within the approved scope of each R&D Theme, based on a consensus of stakeholders
- ▶ Where changes of objectives or scope, or prioritisation between objectives, are needed, submit **recommendations and requests** for comment to the LDG
- ▶ Ensure that decisions are made on a **sound technical basis**, drawing on the expertise of the collaborating projects and institutions, and setting up any subsidiary technical working groups that may be needed

Panel Leadership Tasks

- ▶ Make **initial contact** with all projects, laboratories, institutes, and funding agencies with an interest in contributing to or supporting the R&D Theme
- ▶ Convene the Panel, where necessary, by calling for representatives from stakeholders, and hold **regular meetings** thereafter
- ▶ Organise, by consensus, an appropriate **long-term structure** for work within the R&D Theme
- ▶ Maintain ongoing contact with all stakeholders, including those with a future interest in the programme, working to **define and negotiate technical and financial contributions**
- ▶ Develop a **detailed plan** for the R&D programme, commensurate with the top-level priorities expressed in the R&D Roadmap and the available **resource profile**, drawing upon the expertise and capabilities of all participants
- ▶ Monitor progress against a clearly specified set of **milestones**, and track the usage of resources
- ▶ Act as **link persons to LDG** for reporting on plans and progress, including provision of progress reports at intervals agreed with LDG, and including a final report as input to the next European Strategy update
- ▶ Provide visible **leadership, organisation and advocacy** for the ongoing work of the Panel

Coordination Panel Leadership

▶ HFM

- ▶ Mike Lamont (CERN)
- ▶ Pierre Vedrine (IRFU)

▶ RF

- ▶ Giovanni Bisoffi (INFN Padova)
- ▶ Deputy TBD

▶ LPA

- ▶ Wim Leemans (DESY)
- ▶ Rajeev Pattahill (RAL)

▶ Nominations received from laboratories and funding agencies

- ▶ Important to identify strong organisational and technical representation, with national balance
- ▶ In the cases where a formal collaboration exists, the names are drawn from the elected leadership

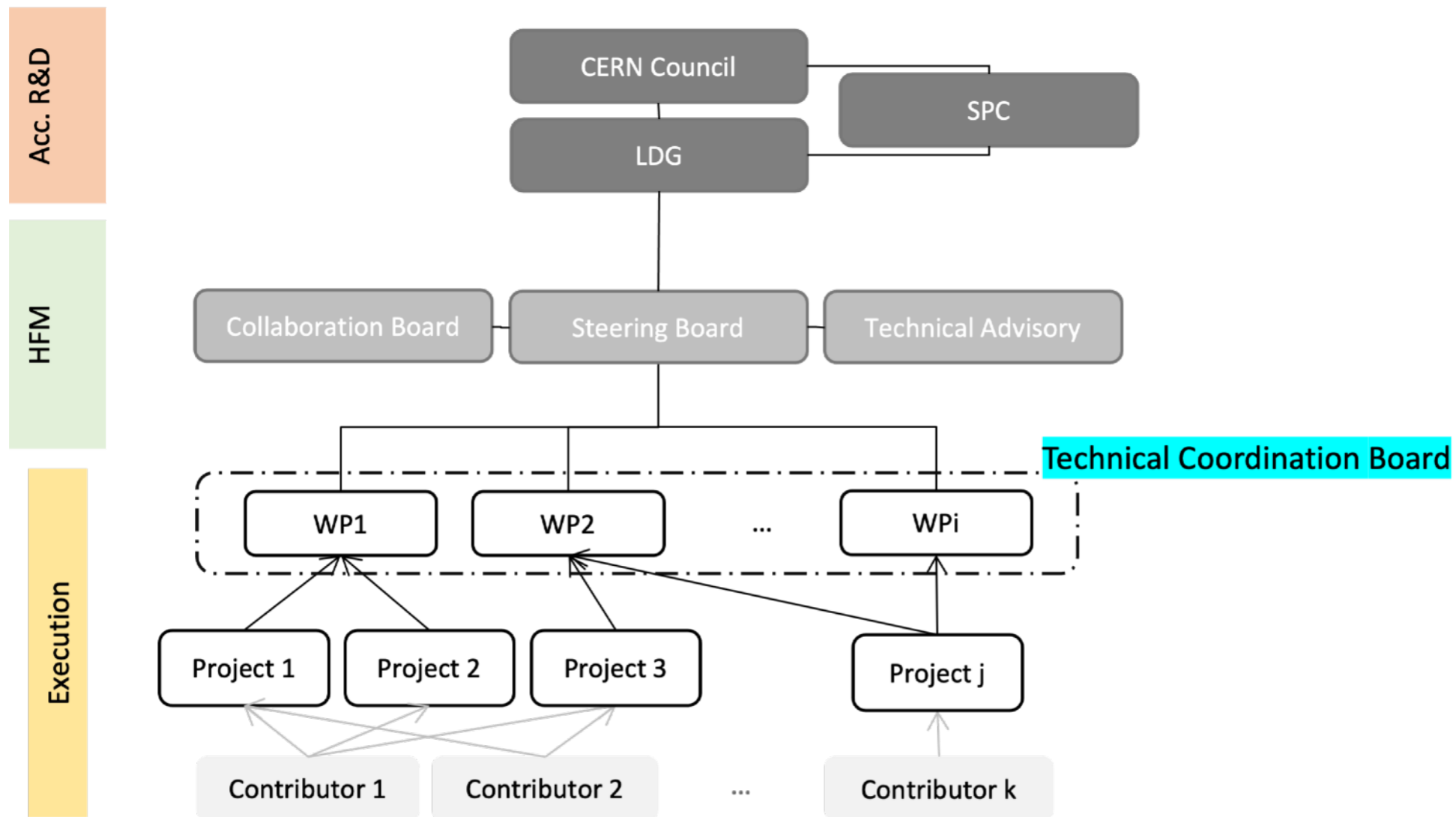
▶ Muons

- ▶ Steinar Stapnes (CERN)
- ▶ Daniel Schulte (CERN)

▶ ERL

- ▶ Jorgen D'Hondt (VUB)
- ▶ Max Klein (Liverpool)

HFM



▶ Aims

- ▶ Common understanding of the key technical challenges outlined in the HFM part of the Roadmap, wherein the requisite measures to address them are organized into work packages.
- ▶ Vibrant communities tackling these challenges in collaborative and competitive ways, producing timely, pragmatic, and innovative solutions.
- ▶ Technical coordination that ensures that developments find their way into demonstrator magnets.

RF

Task	Begin	End	Description	MCHF	FTE.y														
RF.SRF.BKNb	2022	2026	Superconducting RF: bulk Nb	4	75	0.25	5	0.75	17.5	2	32.5		5		5	0.5	5	0.5	5
RF.SRF.FE	2022	2026	Superconducting RF: field emission	4	40	0.5	5	1	5	1.5	20			0.5	5	0.5	5		
RF.SRF.ThF	2022	2026	Superconducting RF: thin film	15	100??	11	35	2	15	1	15						5	1	10
RF.SRF.INF	2022	2026	Superconducting RF: infrastructure	5	15	2	7.5	1	2	2	1.5	0.5	1				1.5	0.5	1.5
RF.SRF.FPC	2022	2026	Superconducting RF: power couplers	4	16	1.5	5	1	5	1	5					0.5	1		
RF.NC.GEN	2022	2026	Normal conducting RF: general NC studies	0	27		17								6.5		2.5		1
RF.NC.MAN	2022	2026	Normal conducting RF: NC manufacturing techniques	2.5	30	2	20							0.5	8		1		1
RF.NC.HF	2022	2026	Normal conducting RF: mm wave & high frequency	0	5						1								4
RF.HP.HE	2022	2026	High-power RF: high-efficiency klystron & solid state	5.5	20	3.5	12.5		3					2	0.5				2
RF.HP.HF	2022	2026	High-power RF: mm-wave & gyro devices	0	5														5
RF.HPTUN	2022	2026	High-power RF: reduced RF power needs tuners	0.4	6	0.4	2.8												3.2
RF.HP.AI	2022	2026	AI and machine learning	0.6	26					0.3	7.5						2.5	0.1	16
RF.TS.NCRF	2022	2026	NC RF test stands	5.3	40	2	15							2.5	15		5	0.75	5
RF.TS.MAT	2022	2026	Test stand: new materials	0.7	16	0.25	10					0.045	4						2
RF.TS.BEAM	2022	2026	Test stand: cavities in strong magnetic fields (aspirational)	3	20			3	10									0.3	8
RF.TS.SRF	2022	2026	Test stand: SRF Horizontal cryostat	0.9	10														

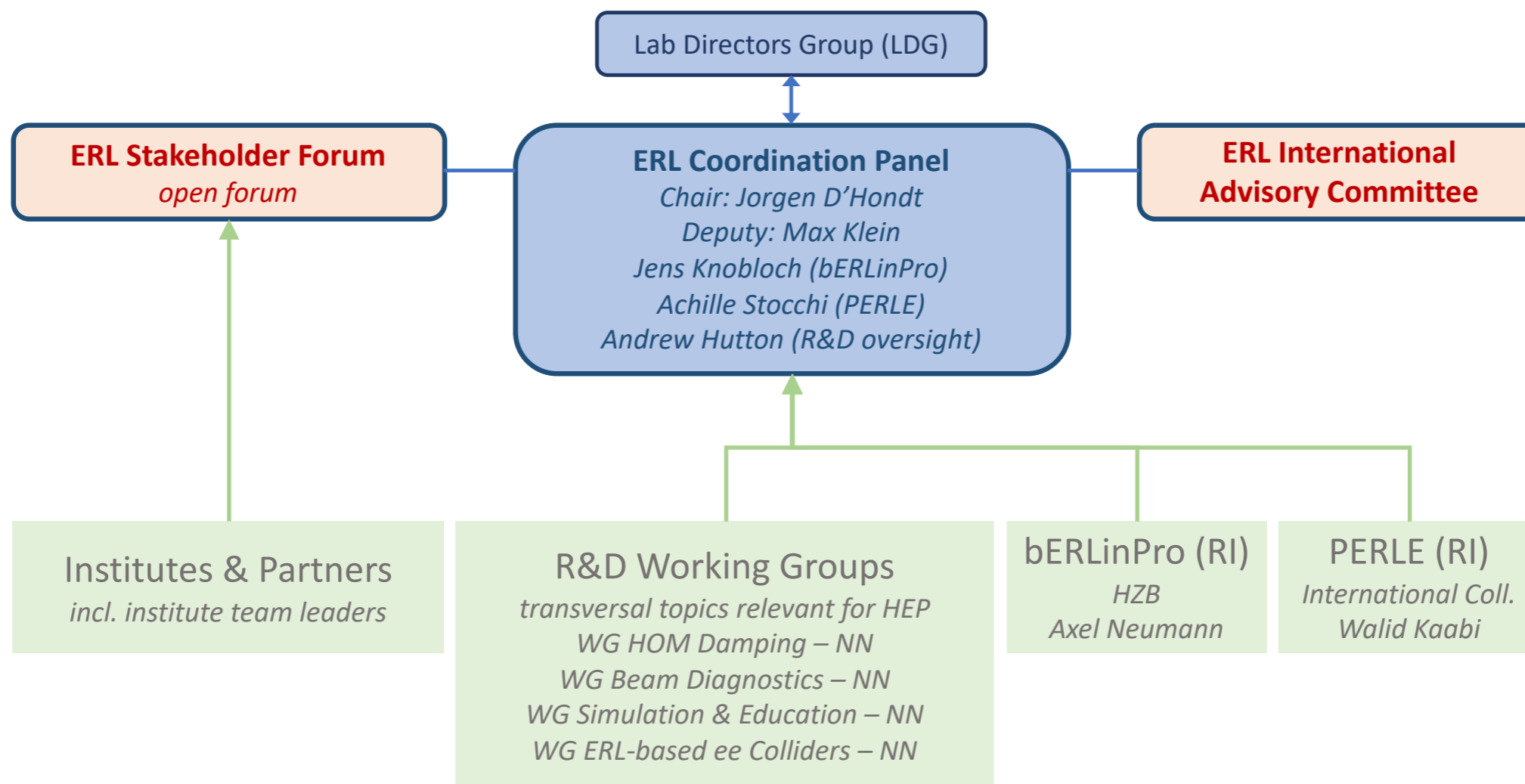
► Specific challenges in RF

- Community is large and well-funded, but dispersed and not coordinated
- Technology is cross-cutting and applies to very wide range of future projects
 - First applications of 'new technologies' not likely to be in particle physics
 - Strong overlap with ERL and muons areas
- Many (expensive) parallel developments in different labs
- Roadmap well less specific and 'planning oriented' than other areas

► Discussions now regaining momentum quickly

- Concrete discussions on resources and cooperation beginning
- 'Dual role' panel being put in place, combining technical leadership and national representation

ERL



▶ Clear shortfall in funding compared to roadmap ambition

- ▶ Coordination panel is active in discussions with FAs
- ▶ The prominent and importance of this area can only grow with time due to energy costs
- ▶ However, first applications may be on boundary of particle / nuclear physics
 - ▶ Discussions needed on how to interact with the NuPECC long-range planning process

LPA

- ▶ Clear that a ‘from scratch’ organisation is required
 - ▶ A lot of activity ongoing in this area (and well funded)
 - ▶ Meaning: relevant labs and experts are already working on both ‘fundamentals’ but increasingly towards short-term applications in other fields
 - ▶ Key topics relevant to future colliders are not covered
 - ▶ Positron acceleration; staging; energy efficiency; machine simulation and design
- ▶ Panel now exists, including key people not previously engaged
 - ▶ The task is to turn the bold ambition expressed in the roadmap into a realistic plan
 - ▶ For some sub-areas no obvious funding lines exist – but FAs ready to discuss
- ▶ Goals for the coming months
 - ▶ Meeting of work package leaders – November 2022
 - ▶ Prioritisation of activities and deliverables – November 2022
 - ▶ Discussions with funding bodies – December 2022
 - ▶ Progress report and funding discussions at LDG – December 2022
 - ▶ Forming the collaboration board – February 2023
 - ▶ Community coordination meeting and progress update at ALEGRO meeting – March 2023

Funding Agency View

- ▶ Informal discussions with seven funding agencies so far
 - ▶ Gain a first impression of interests, commitments, plans
 - ▶ Understand requirements for governance structure and reporting
- ▶ Common themes
 - ▶ Pressure on budgets from existing projects – R&D may need to ramp up slowly
 - ▶ Clear need to tie Roadmap R&D into broader programme of applied accelerator development (and e.g. fusion)
 - ▶ Full recognition of careers pipeline / training issues
 - ▶ Concern as to the feasibility of beyond-next-generation machines
 - ▶ Including: energy costs and sustainability
 - ▶ In some cases: lack of transparency on funding, motivation and outcomes of R&D
- ▶ Arguments for proceeding with a large-scale R&D programme
 - ▶ Cost and sustainability concerns must be addressed via study / new ideas
 - ▶ Pressure on resources increases need for explicit coordination / cooperation
 - ▶ Robust and visible organisational structure will provide transparency, offer opportunities for collaboration outside our field

Next Steps

▶ Coordination panel tasks

- ▶ Identify all possible (current and future) stakeholders, discuss resources ✓
- ▶ Inaugurate suitable coordination structures ✓
- ▶ Define the concrete research plan for the coming years ✓
 - ▶ Establishing realistic goals and expectations for next strategy update
- ▶ Progress discussions between panels on overlaps / common interests

▶ First iteration of 'annual review cycle'

- ▶ LDG will review planning / execution in early December
- ▶ Report to SPC and Council at the open session on strategy, December

▶ Issues still to be resolved

- ▶ The composition and inaugural meeting of the RRB
 - ▶ Ideally in common with the Detector R&D to present a coherent view of activities
- ▶ How to ensure long-term balance of funding with priorities and ambition

▶ LDG observes that rapid progress is being made in the IMCC

- ▶ Seems to be on track to deliver against the roadmap goals, though resources and engagement will need continue to ramp up
- ▶ Watching with interest the discussions and actions in the US and elsewhere
- ▶ Looking forward to presentation of a firm and realistic R&D plan in December