Towards DRD Calorimetry
Introduction – 2nd Community Meeting

Input Proposal Team and TF6+ task force

Martin Aleksa, Etiennette Auffray-Hillemanns, Dave Barney, Jim Brau, Sarah Eno, Roberto Ferrari, Gabriella Gaudio, Adrian Irles, Macro Lucchini, Nicolas Morange, Wataru Ootani, Marc-André Pleier, Roman Pöschl, Philipp Roloff , Tommaso Tabarelli de Fatis, Felix Sefkow, Frank Simon, Hwidong Yoo

- Welcome to the 2nd Community Meeting

- This is another important milestone in the DRD collaboration for Calorimetry

- Many thanks
  - Everyone registered at the meeting either in presence or remotely
  - Everyone (contributed) submitting the proposals
  - The input proposal team members
  - The speakers who accepted to collect and present information today

Roadmap implementation

o ECFA Roadmap Coordination group has worked out a proposal
P. Allport, S. Dalla Torre, J. D'Hondt, K. Jakobs, M. Krammer, S. Kühn, F. Sefkow and I. Shipsey

o Document sent to and **endorsed by CERN Council** in September 2022 (CERN/SPC/1190)

o Main outcomes are
  o the **organization of the Detector R&D** in form of **DRD Collaborations**,
  o the overall Organization of the detector R&D
  o an outline of the way towards the formation of the DRD

o DRD will have a CERN recognition but they **will not be** CERN Collaborations
("anchored at CERN")
o Significant participations by non-European groups is explicitly welcome and needed

o The progress and the R&D will be overseen by a DRDC that is assisted by ECFA

Future Organization of Detector R&D (in Europe)

Identified Key Technologies and R&D Tasks
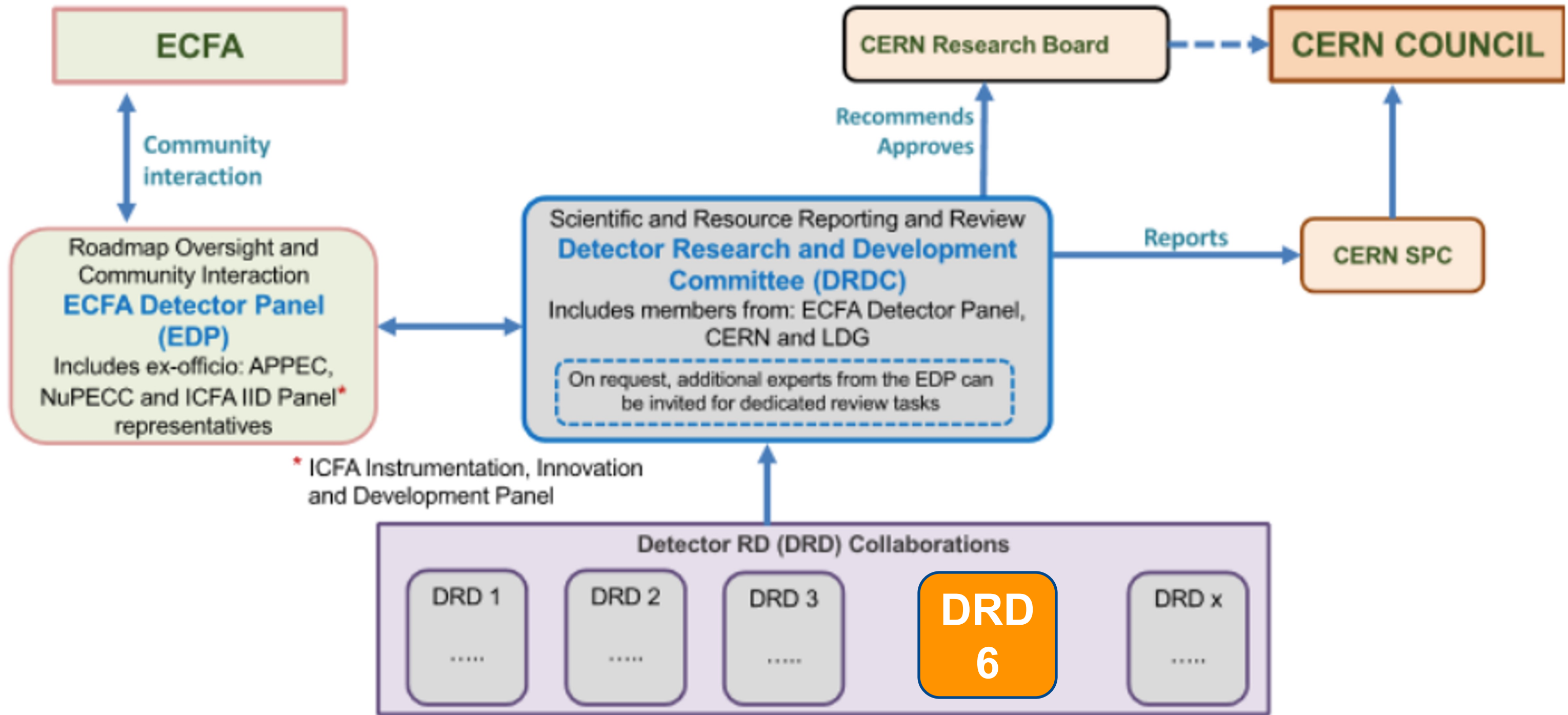
## Key technologies and requirements are identified in Roadmap

- Si based Calorimeters
- Noble Liquid Calorimeters
- Calorimeters based on gas detectors
- Scintillating tiles and strips
- Crystal based high-resolution ECALs
- Fibre based dual readout

R&D should in particular enable

- Precision timing
- Radiation hardness

R&D Tasks are grouped into

- Must happen
- Important
- Desirable
- Already met
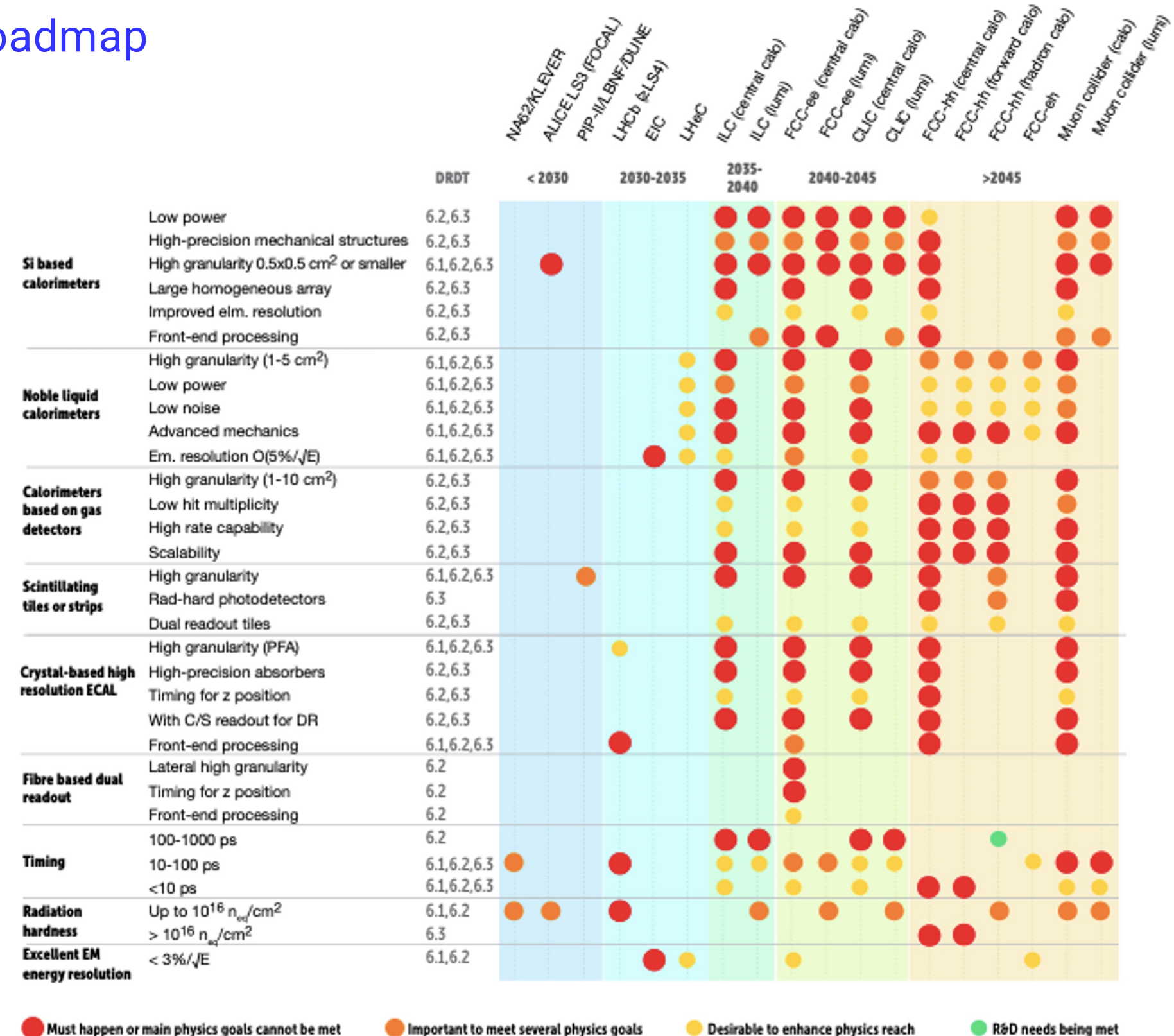
Through 2023, mechanisms will need to be agreed with funding agencies in parallel to the process below for country specific DRD collaboration funding requests for Strategic R&D and for developing the associated MoUs.

Q4 2022	Outline structure and review mechanisms agreed by CERN Council. Detector R&D Roadmap Task Forces organise **community meetings** to establish the scope and scale of community wishing to participate in the corresponding new DRD activity. (Where the broad R&D topic area has one or more DRDTs already covered by existing CERN RDs or other international collaborations these need to be fully involved from the very beginning and may be best placed to help bring the community together around the proposed programmes.)
Q1 2023	**DRDC mandate formally defined** and agreed with CERN management; Core DRDC membership appointed; and EDP mandate plus membership updated to reflect additional roles.
Q1-Q2 2023	**Develop the new DRD proposals** based of the detector roadmap and community interest in participation, including light-weight organisational structures and resource-loaded work plan for R&D programme start in 2024 and ramp up to a steady state in 2026.
Q3 2023	**Review of proposals by DRDC** leading to recommendations for formal establishment of the DRD collaborations.
Q4 2023	DRD Collaborations receive formal **approval from CERN Research Board**.
Q1 2024	New structures operational for ongoing review of DRDs and R&D programmes underway.

Through 2024, collection of MoU signatures

K. Jakobs, ECFA Meeting November 2022

Towards DRD6 - Calorimetry

- 1st Community meeting (12.1.2023)

  https://indico.cern.ch/event/1212696/

- Launch of Input proposal collection

  - mid February – April 1st
  - Scientific proposal of what need to be built and tested in the next 3 (2024-2026) - 6 (2027-2029) years
  - Description and timeline
  - Objectives:
    - Milestones
    - Deliverables
  - List of participating Institutes/Labs with short description
  - Confidential information on resources
    - **they won't be disclosed!**

The Proposal Team

Track 1: Sandwich calorimeters with fully embedded Electronics – Main and forward calorimeters
Track conveners:
Adrian Irles (IFIC), **Frank Simon** (KIT), **Jim Brau** (U. of Oregon), **Wataru Ootani** (U. of Tokyo)

Track 2: Liquified Noble Gas Calorimeters
Track Conveners:
Martin Aleksa (CERN), **Nicolas Morange** (IJCLab), **Marc-André Pleier** (BNL)

Track 3: Optical calorimeters: Scintillating based sampling and homogenous calorimeters
Track Conveners:
Etiennette Auffray (CERN), **Gabriella Gaudio** (INFN-Pavia), **Macro Lucchini** (U. and INFN Milano-Bicocca), **Philipp Roloff** (CERN), **Sarah Eno** (U. of Maryland), **Hwidong Yoo** (Yonsei Univ.)

Track 4: Transversal Activities
Christophe de La Taille (Lab. Omega)

09:00 → 09:20	**Introduction**	20m
	Speakers: Gabriella Gaudio (Dipartimento di Fisica Nucleare e Teorica), Gabriella Gaudio (INFN-Pavia), Roman Poeschl (Université Paris-Saclay (FR))	

09:25 → 09:50	**Summary of proposals submitted to Track 1 - Sandwich calorimeters with fully embedded Electronics – Main and forward calorimeters**	25m
	Speakers: Adrian Irles (IFIC CSIC/UV), Frank Simon (Max-Planck-Institut fuer Physik), Jim Brau (University of Oregon (US)), Wataru Ootani (ICEPP, University of Tokyo), Wataru Ootani (ICEPP, University of Tokyo), Dr Wataru Otani (University of Tokyo (JP))	

10:00 → 10:20	**Summary of proposals submitted to Track 2 - Liquified Noble Gas Calorimeters**	20m
	Speakers: Marc-Andre Pleier (Brookhaven National Laboratory (US)), Marc-Andre Pleier (Brookhaven National Laboratory (US)), Marc-Andre Pleier (BNL), Martin Aleksa (CERN), Nicolas Morange (Université Paris-Saclay (FR))	

10:30 → 10:50	**Coffee Break**	20m

10:50 → 11:10	**Summary of proposals submitted to Track 3 - Optical calorimeters: Scintillating based sampling and homogenous calorimeters, Part 1**	20m
	Speakers: Etiennette Auffray Hillemanns (CERN), Gabriella Gaudio (Dipartimento di Fisica Nucleare e Teorica), Gabriella Gaudio (INFN-Pavia), Hwi Dong Yoo (Yonsei University (KR)), Marco Toliman Lucchini (Università & INFN, Milano-Bicocca (IT)), Philipp Roloff (CERN), Sarah Eno (University of Maryland (US))	

11:20 → 11:40	**Summary of proposals submitted to Track 3 - Optical calorimeters: Scintillating based sampling and homogenous calorimeters, Part 2**	20m
	Speakers: Etiennette Auffray Hillemanns (CERN), Gabriella Gaudio (INFN-Pavia), Gabriella Gaudio (Dipartimento di Fisica Nucleare e Teorica), Hwi Dong Yoo (Yonsei University (KR)), Marco Toliman Lucchini (Università & INFN, Milano-Bicocca (IT)), Philipp Roloff (CERN), Sarah Eno (University of Maryland (US))	

11:40 → 12:00	**Spillover and discussion**	20m

12:00 → 13:15	**Lunch Break**	1h 15m

some general comment on the proposals

Scientific content of the proposals

No confidential information!

Today's meeting

| 12:00 | → 13:15 | **Lunch Break** | 🕐 1h 15m |

13:15 → 13:35 **DRD Calo - Testbeam Infrastructure needs** 🕐 20m

Speaker: Roman Poeschl (Université Paris-Saclay (FR))

13:45 → 14:05 **DRD Calo - Software needs** 🕐 20m

Speakers: Gabriella Gaudio (Dipartimento di Fisica Nucleare e Teorica), Gabriella Gaudio (INFN-Pavia)

14:15 → 14:35 **DRD Calo - Electronics and DAQ Needs** 🕐 20m

Speaker: Dr Christophe De La Taille (OMEGA (FR))

| 14:45 | → 15:00 | **Coffee Break** | 🕐 15m |

15:00 → 16:00 **Discussion on WG organisation and management structure** 🕐 1h

Input will be provided by Proposal Team

Transversal key elements

Proposal Submission Statistics

23 proposals received: track distribution

- track 1:   8 (10) proposals
- track 2:   1 proposal
- track 3: 12 (10) proposals
- track 4:   2 proposals
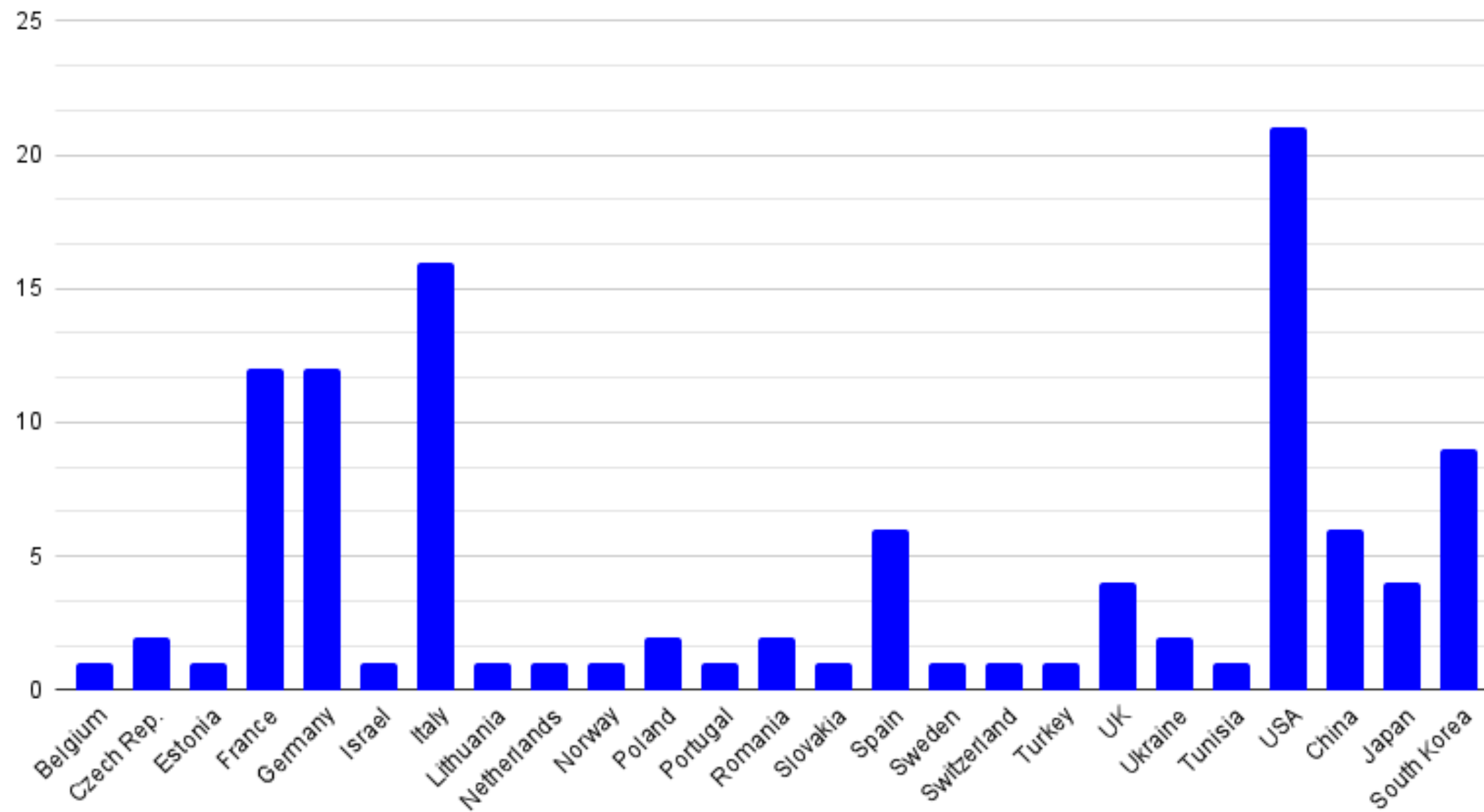
23 proposals received: geographical distribution

- 25 countries
- 4 geographical areas
  - Europe: 19 countries
  - Africa: 1 country
  - America: 1 country
  - Asia: 4 countries

Calo type(*)

- ECAL: 11
- HCAL: 7
- BOTH: 4

Calo type (**)

- Homogeneous: 5
- Sampling: 13
- BOTH: 4

(*) Doesn't apply to Cryogenic DBD proposal
(**) Doesn't apply to Common ASIC proposal

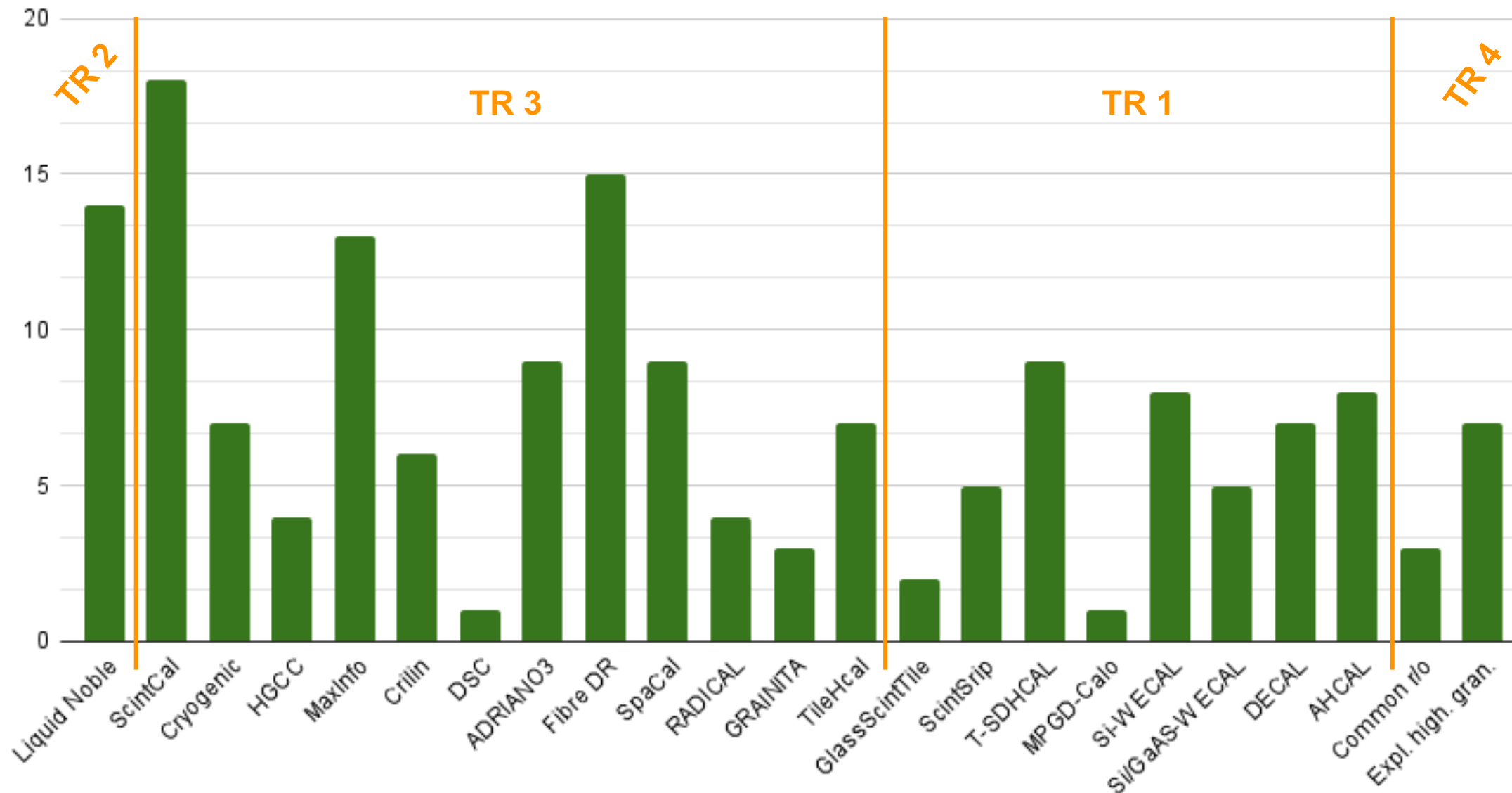# Proposal Submission Statistics

Institutes per Countries
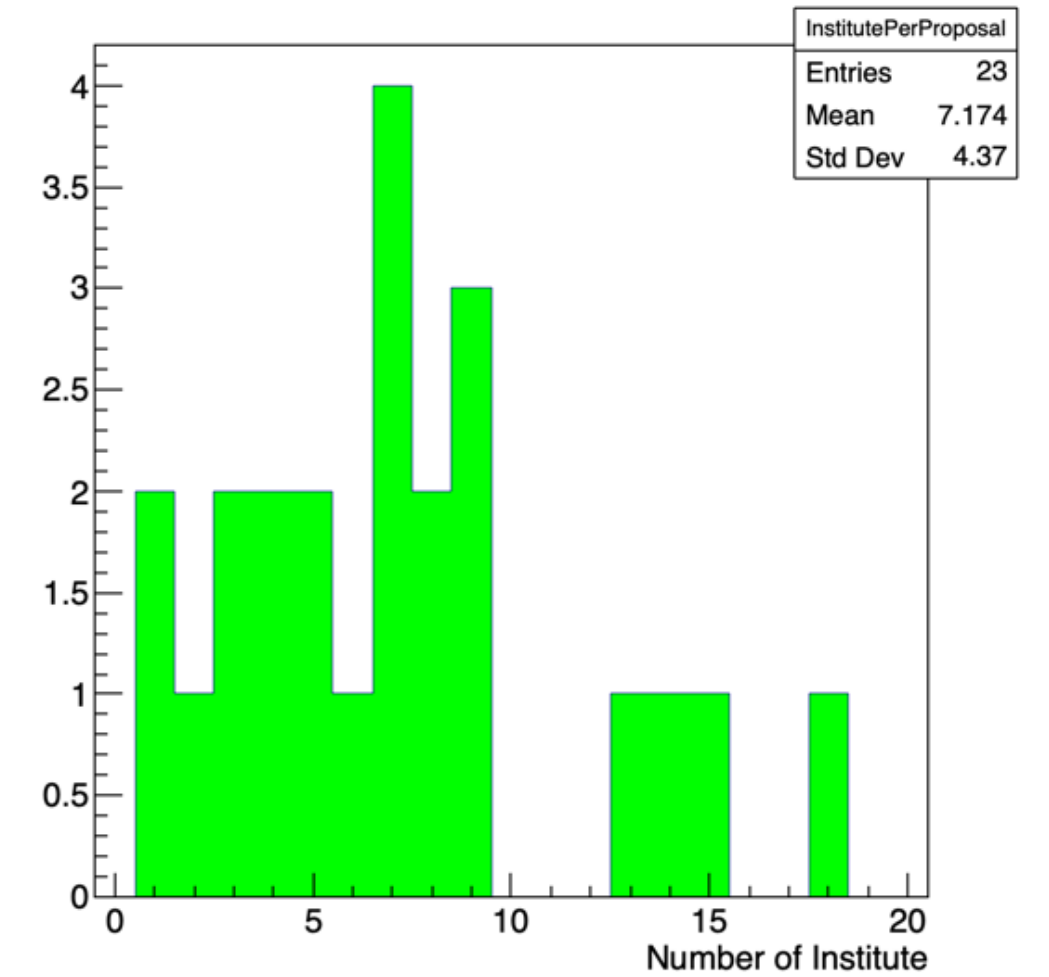
23 proposals received: geographical distribution

- 25 countries

- 110 institutes

  - 2 collaborations: MODE and Glass Scintillator Collaboration

Proposal Submission Statistics

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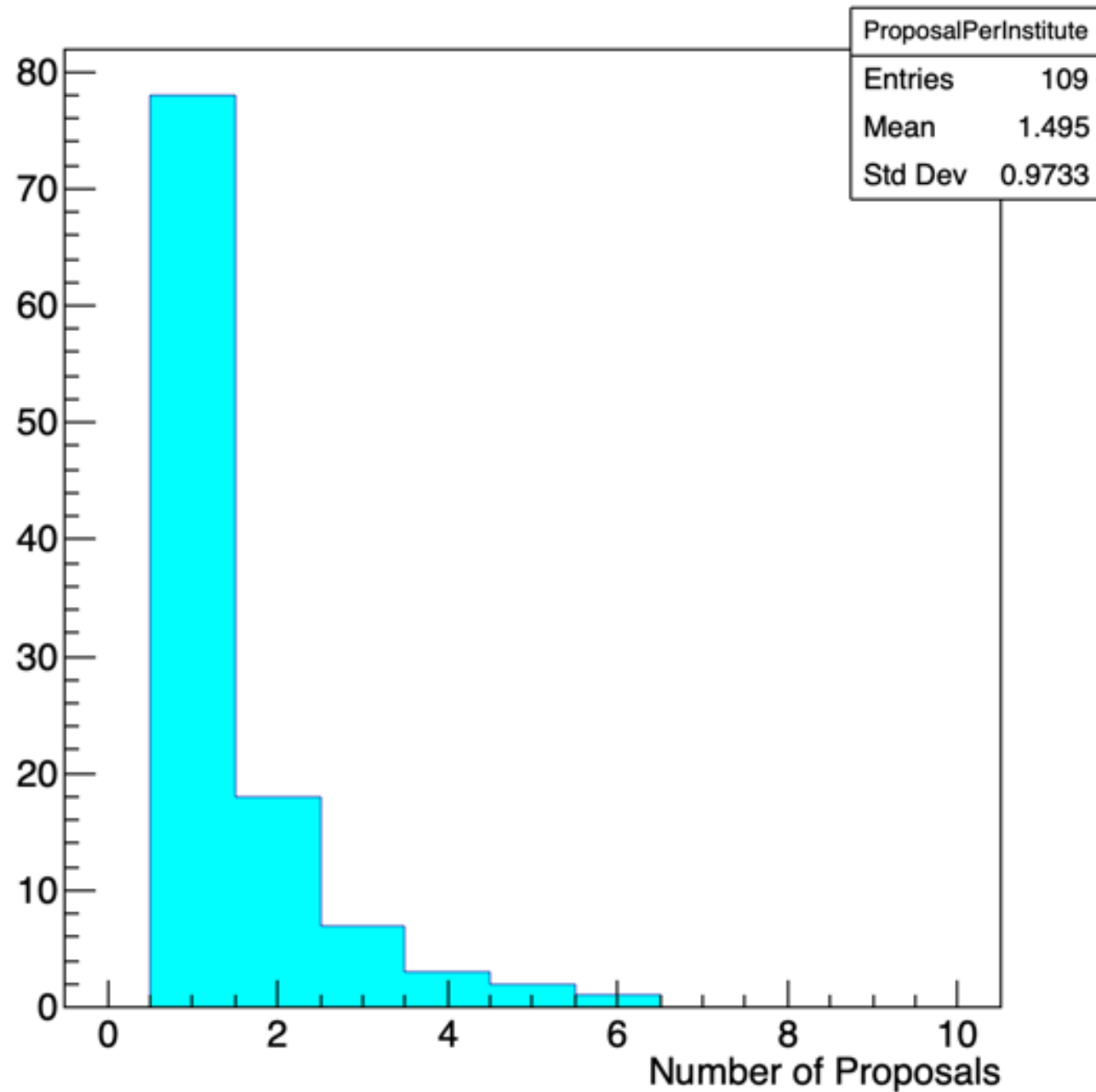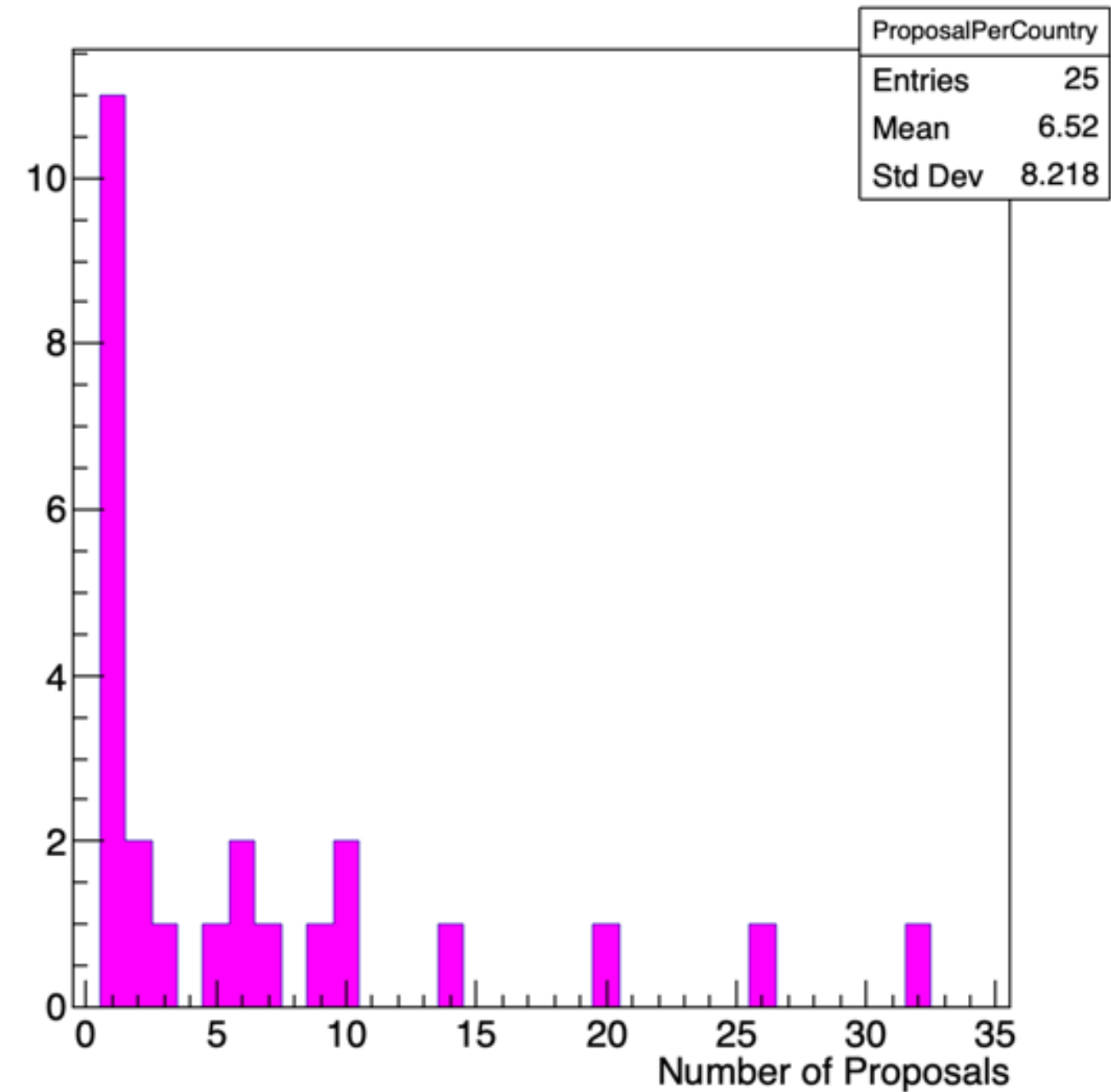
NB. Double counting: In few cases, the same institute/proponent is in more than a proposal

MUCOLL
CALICE
CERN FCC-ee
ALICE-FOCAL
Korea NRF GRANT
CrystalClear
CalVision LHC FCC-hh
LUXE
AIDAinnova MODE
GlassScint
EUROLABS
Radical

- Proposals comes from pre-existing collaborations or working framework

- Consolidated modus-operandi and experience

- Need to pick up all the best and put into the DRD6 collaboration

General Observation on group commitment

- <u>Confidential information won't be disclosed</u>.

- Few general comments:

  - Many institutes were not able to provide person-power, funds or material available or to be required

    - Interactions with funding agencies is needed to clarify this step

  - Person-power: in some cases, it's not clear if the indicated person-power is FTE or Physical person. **To be clarified**

  - Input proposal team will come back to you to understand these issues to be able to prepare the DRD6 proposal

- Calorimeters in no longer a detector to measure only Energy (1D)

- High granularity is recurrent topic in all the proposals (+ 3D)

  - 2D-segmentation

  - 3rd dimensions achieved either by physical segmentation or by timing information

- Timing is also additional "dimension" of the calorimeter (+1D)

  - pile-up rejection (μ-collider, FCC-hh, …)

  - better track/particle matching

  - **tens of ps** is the current paradigm for timing application

- Timescale for prototype construction and test is not always clear in the proposals

  - we'll iterate on this as well

- Where indicated it spans between 2024 to later than 2026

  - due to different level of maturity/innovation of the proposals

  - either small or large prototypes (or both) proposed

- Despite different technologies proposed, @testbeam all we need is ...

  - a good beam line

  - PID information

  - position information

See Roman's talk

- Particle Flow Algorithms:

  - mentioned in 17/23 proposals (also in non-native PF-calorimeters)

  - High-granularity $\Leftrightarrow$ PFA

- Geant4 Simulation:

  - needed to optimise detector design and interpret data

- Machine (Deep) Learning

  - widely used to reconstruct complicated final states

  - though to have on-board intelligence in FE elx

  - used to optimize detectors?

- Common test beam software?

  - what about a "plug-n-play" SW for data acquisition? Eudaq?

See GG's talk

SiPM & ASIC: must-have electronics

- SiPM's appear in almost all the proposal for Optical and scintillating based calorimeters

  - consequence of the high-granularity requirement

  - PMTs and MCP

- For all the proposal ASIC based readout is required

  - fast TDC (~ps)

  - large dynamic range ADC

  - low power consumption (especially for LAr and fully integrated calorimeters)

See Christophe's talk

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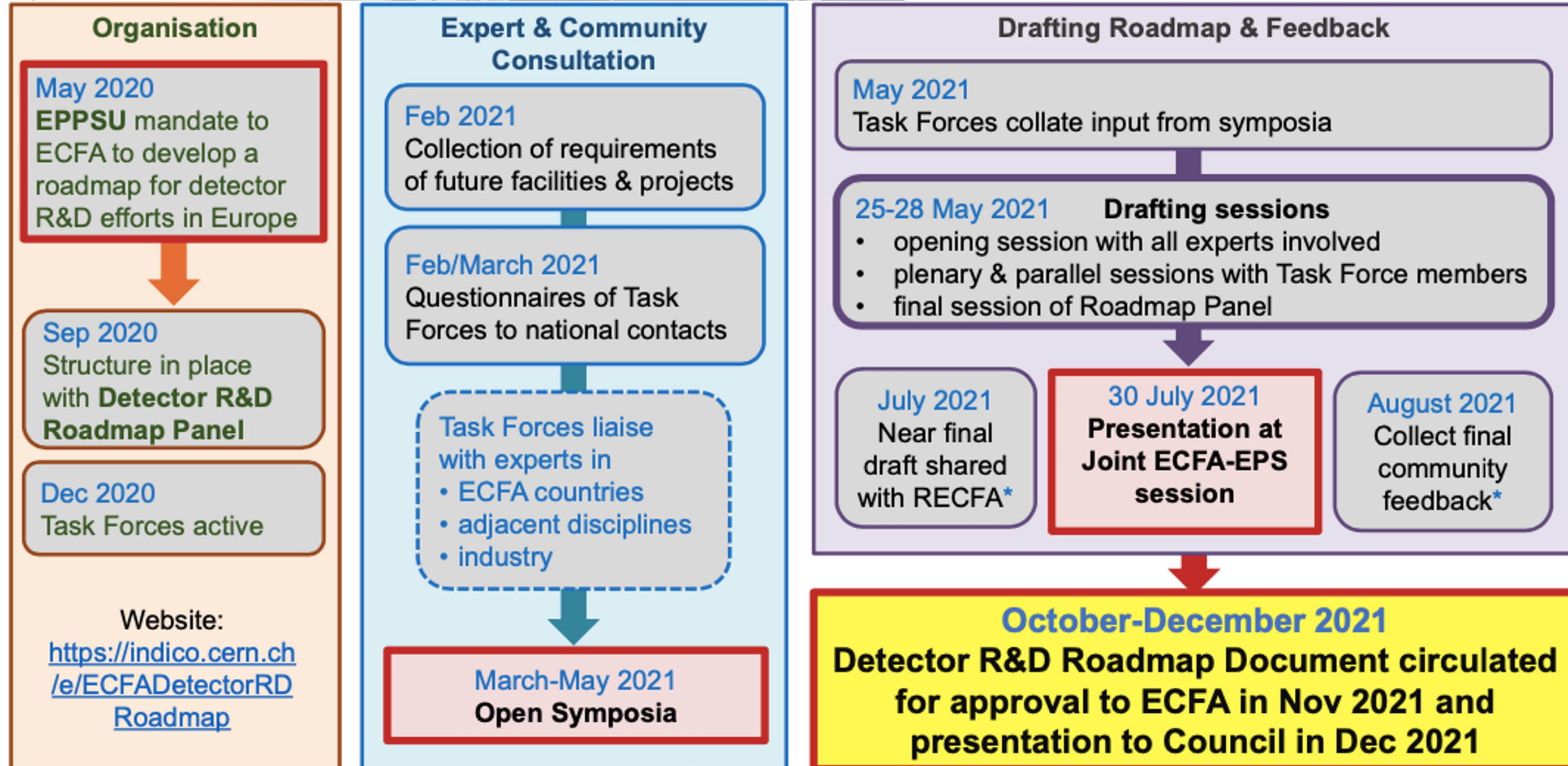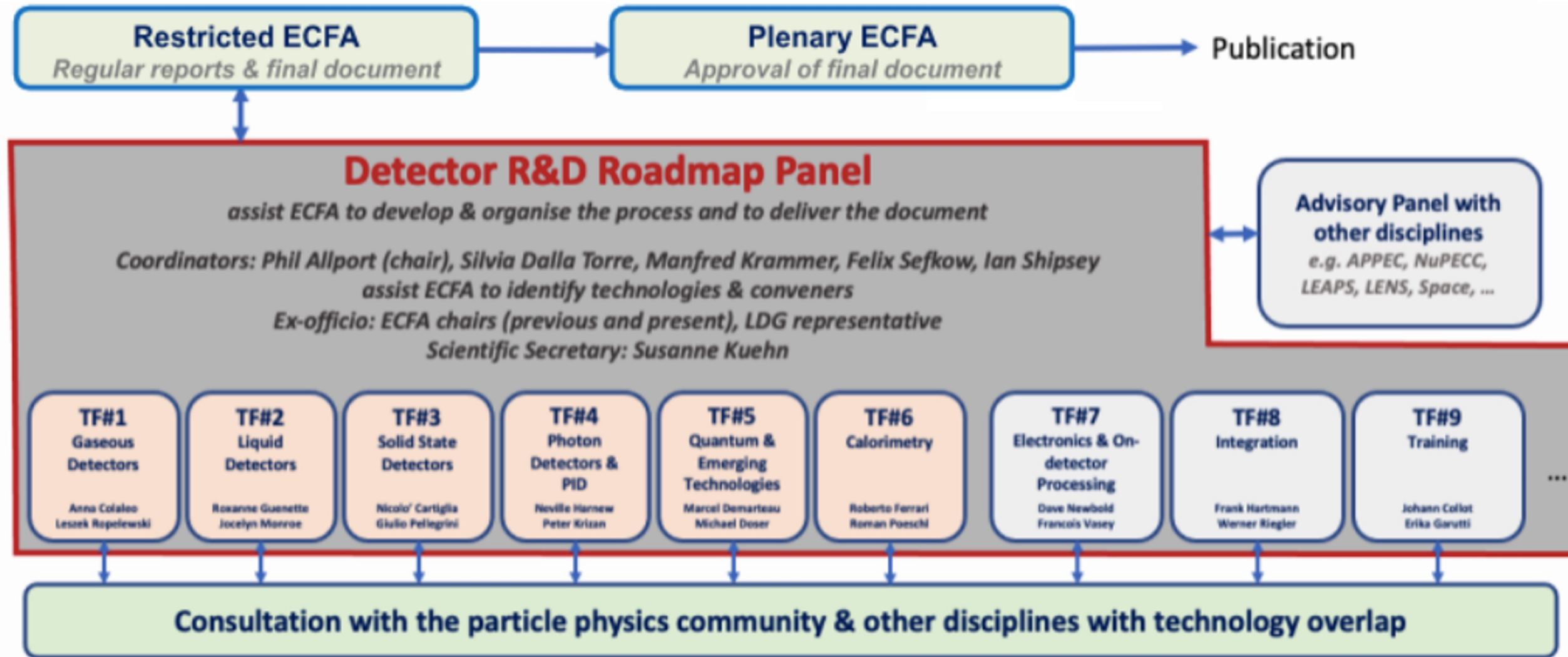
Let's have a profitable workshop!

20

Backup

Roadmap Implementation Process

ECFA
European Committee for Future Accelerators

Process and Timeline

Organisation

May 2020
EPPSU mandate to ECFA to develop a roadmap for detector R&D efforts in Europe

Sep 2020
Structure in place with **Detector R&D Roadmap Panel**

Dec 2020
Task Forces active

Website:
https://indico.cern.ch/e/ECFADetectorRDRoadmap

Expert & Community Consultation

Feb 2021
Collection of requirements of future facilities & projects

Feb/March 2021
Questionnaires of Task Forces to national contacts

Task Forces liaise with experts in
• ECFA countries
• adjacent disciplines
• industry

March-May 2021
Open Symposia

Drafting Roadmap & Feedback

May 2021
Task Forces collate input from symposia

25-28 May 2021 **Drafting sessions**
• opening session with all experts involved
• plenary & parallel sessions with Task Force members
• final session of Roadmap Panel

July 2021
Near final draft shared with RECFA*

30 July 2021
Presentation at Joint ECFA-EPS session

August 2021
Collect final community feedback*

October-December 2021
Detector R&D Roadmap Document circulated for approval to ECFA in Nov 2021 and presentation to Council in Dec 2021

Roadmap Organization

9 Taskforces including TF6 on Calorimetry
Central events: Symposia
TF6 Symposium https://indico.cern.ch/event/999820/
More on roadmap process https://indico.cern.ch/event/957057/

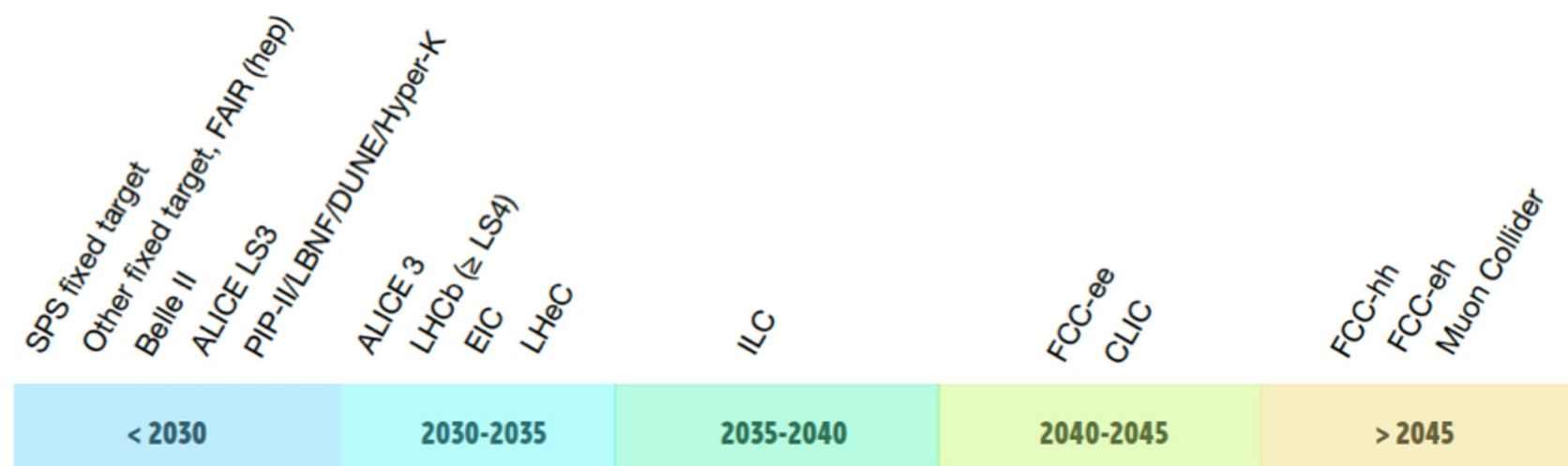# The Roadmap document and process

ECFA R&D Roadmap
- CERN-ESU-017 https://cds.cern.ch/record/2784893
- 248 pages full text and 8 page synopsis

Endorsed by ECFA and presented to CERN Council in December 2021

- The Roadmap has identified
- General Strategic Recommendations (GSR)
- Detector R&D Themes (DRDT) for each of the taskforce topics
- Concrete R&D Tasks

Timescale of projects as approved by European Lab Director Group (LDG)

Guiding principle: Project realisation must not be delayed by detectors

THE 2021 ECFA DETECTOR
RESEARCH AND DEVELOPMENT ROADMAP

The European Committee for Future Accelerators
Detector R&D Roadmap Process Group

European Strategy Update | ECFA European Committee for Future Accelerators

General Strategic Recommendations

GSR1- Supporting R&D facilities

GSR2- Engineering support for detector R&D

GSR3- Specific software for instrumentation

GSR4- International coordination and organisation of R&D activities

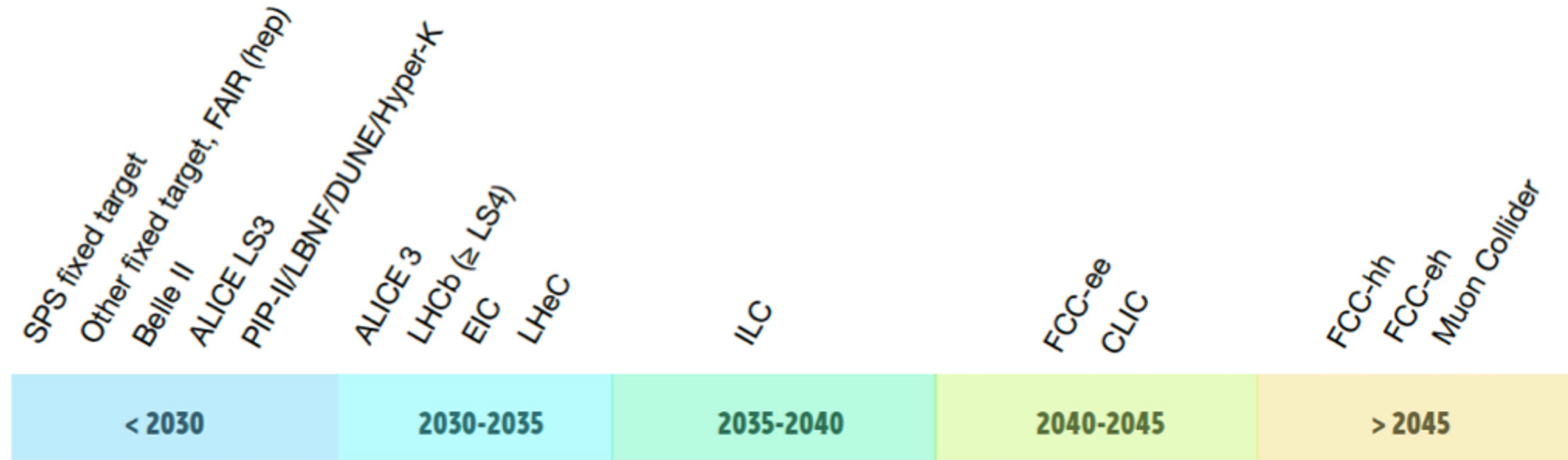GSR5- Distributed R&D activities with centralised facilities

GSR6- Establish long-term strategic funding programmes

GSR7- Blue-sky R&D

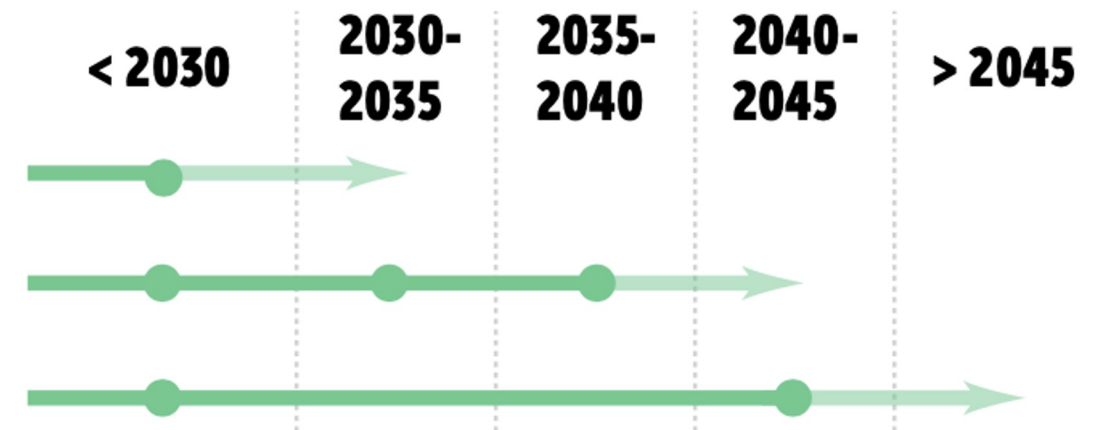GSR 8 - Attract, nurture, recognise and sustain the careers of R&D experts

GSR 9 - Industrial partnerships

GSR 10 - Open Science

Future Facilities and DRDT for Calorimetry

- The DRDT and the provisional time scale of facilities set high-level boundary conditions
- Both as well as the GSR should be taken into account when formulating the R&D proposal(s)