ECFA detector R&D roadmap
&
impact on the RD51 Collaboration

Collection of the slides
Karl Jacobs, Phil Allport, Susanne Kuehn, Eraldo Oliveri,Michael Doser & LR

Implementation proposal - RRB public presentation
ECFA detector R&D roadmap – reference
RD51 Future Day

European Particle Physics Strategy Update

"Organised by ECFA, a roadmap should be developed by the community to balance the detector R&D efforts in Europe, taking into account progress with emerging technologies in adjacent fields."

"The roadmap should identify and describe a diversified detector R&D portfolio that has the largest potential to enhance the performance of the particle physics programme in the near and long term."

"Detector R&D activities require specialised infrastructures, tools and access to test facilities."

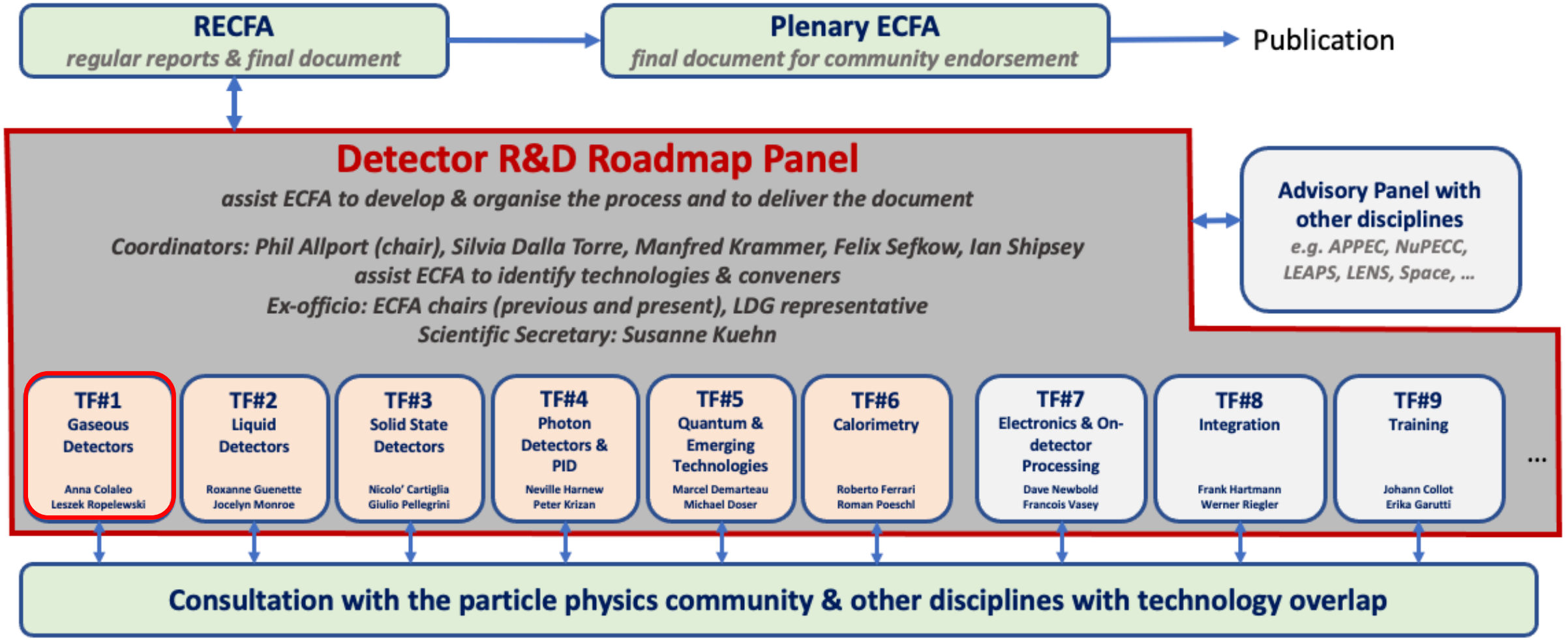
"**The community should define a global detector R&D roadmap that should be used to support proposals at the European and national levels**."

Extracted from the documents of 2020 EPPSU, https://europeanstrategyupdate.web.cern.ch/

For previous presentations on the Detector R&D Roadmap see Plenary ECFA: Jorgen D'Hondt (13/7/20) & Susanne Kuehn (20/11/20) (https://indico.cern.ch/event/933318/ & https://indico.cern.ch/event/966397/)

More roadmap process details at: https://indico.cern.ch/e/ECFADetectorRDRoadmap

Organization for Consultation of Relevant Communities



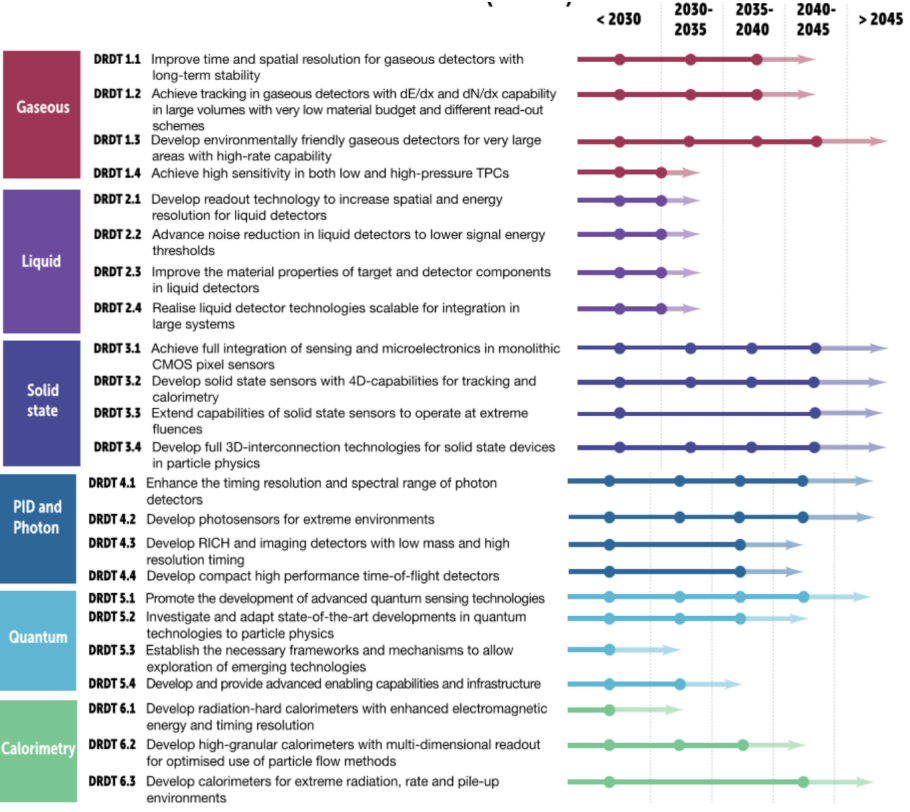
https://indico.cern.ch/e/ECFADetectorRDRoadmap

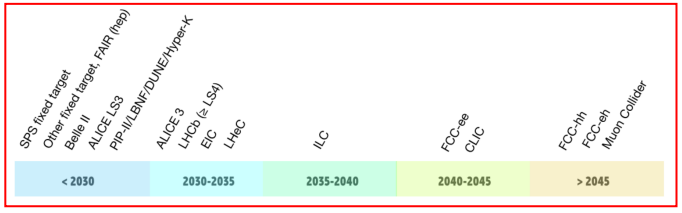
ECFA Detector R&D Roadmap

Main Document published (approval by RECFA at 19/11/21 https://indico.cern.ch/event/1085137/) and 8 page synopsis brochure prepared for less specialists audience

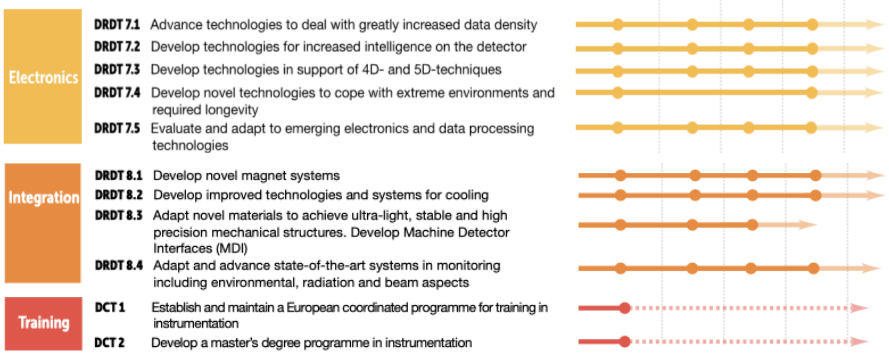

Contents

Detector R&D Roadmap: Detector R&D Themes (DRDTs)





Priorities defined in Roadmap's DRDTs



Technologies: overview, limitations and perspectives.

- MPGD: GEM, Micromegas, THGEM, uRWELL, and other ongoing developments
- RPC, MRPC, and other ongoing developments,
- Drift chambers, straw tubes, TGC, CSC, and other wire chambers
- PID: TPC, TRD, RICH and other large area detectors

Future applications.

- Tracking and muon detection at future colliders
- TPCs at future lepton and lepton-hadron colliders (TPCs, drift chambers, large volume gaseous detectors)
- Nuclear physics applications (tracking, extremely low mass detectors, photon detection, TRD, neutron detection)
- Recoils imaging for DM, neutrino, and BSM physics applications (TPCs variations, optical readout)
- Calorimetry (RPC, MPGD) at future colliders

Challenges and new developments.

- Detector stability (ageing, discharge issues) and rate capability: resistive electrodes
- Novel readout electrodes, optical readout, hybrids with ASICS
- Precise timing detectors
- IBF, photocathode stability and alternatives (including solid converters and nanotech)
- Precision manufacturing techniques (electrical and mechanical properties of detector components), additive manufacturing and new materials (low mass, radio-purity)
- Eco gas mixtures and mitigations procedures for GHG gas (recirculation, recuperation etc.)

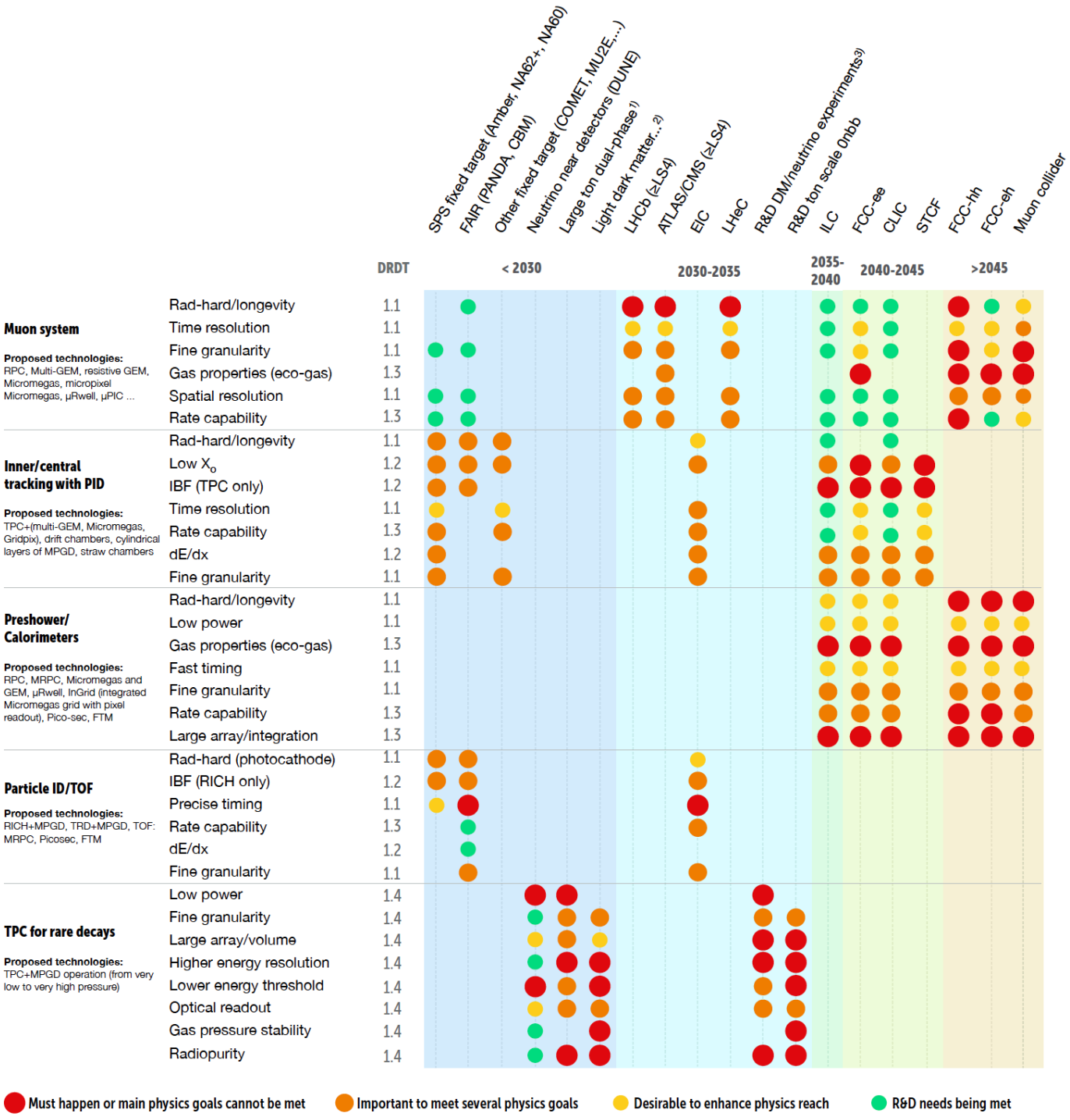
Applications beyond fundamental research.

Development tools and R&D environment.

- Electronics (front-end and DAQ) for gaseous detectors R&D
- Software tools for detector physics simulations
- Infrastructures – development, testing and production facilities
- Relations with industry
- Networking – collaborations, technology dissemination and training

Applications Challenges

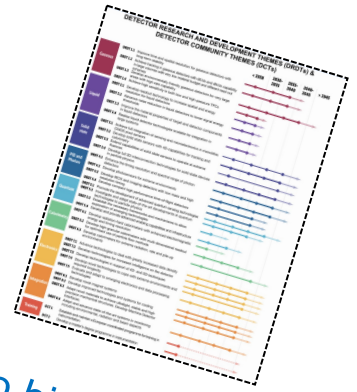
Muon System	Inner and Central tracking	Calorimetry	Photon detection	TOF	Rare decays
• Radiation hardness and stability of large area up to integrated charges of hundreds of C/cm2: - aging issues and discharges; • Operation in a stable and efficient manner with incident particle flows up to ~10 MHz/cm2: - miniaturisation of readout elements needed to keep occupancy low • Manufacturing, on an industrial scale, large detectors at low cost, by means of a process of technological transfer to the industry and identifies processes transferable to industries • Identification of eco-friendly gas mixture and mitigation of the issue related to the operation with high WGP gas mixture: - gas tightness;gas recuperation system;accessibility for repairing • Study of resistive materials (RPC and MPGD): - higher gain in a single multiplication layer, with a remarkable advantage for assembly, mass production and cost - new material and production techniques for resistive layers for increasing the rate capability • Thinner layers and mechanical precision over large area	**Drift chambers** • High rate, unique volume, high granularity, low mass • Hydrocarbon-free mixture for long-term and high-rate operation • Prove the cluster counting principle with the related electronics • Mechanics: new wiring procedure, new wire materials • Integration: accessibility for repairing **TPC** • R&D on detector sensors to suppress the IBF ratio • Optimize IBF together with energy resolution • Gain optimization: IBF, discharge stability • Uniformity of the response of the sensors • Gas mixture: stability, drift velocity, ion mobility, aging • Influence of Magnetic field on IBF • High spatial resolution • Very low material budget (few %) • Mechanics: thickness minimization but robust for precise electrical properties for stable drift velocity • Integration: cooling of electronics **Straw chambers** • Ultra-long and thin film tubes • "Smart" designs: self-stabilized straw module, compensating relaxation • Small diameter for faster timing, less occupancy, high rate capability • Reduced drift time, hit leading times and trailing time resolutions, with dedicated R&D on the electronics • PID by dE/dx with "standard" time readout and time-over-threshold • 4D-measurement: 3D-space and (offline) track time • Over-pressurized tubes in vacuum: control the leakage rate to maintain the shape	• Uniformity of the response of the large area and dynamic energy range • Optimization of weights for different thresholds in digital calorimeters • Rate capability in detectors based on resistive materials: resistivity uniformity, discharge issue at high rate and in large area detector • R&D on sub-ns in active elements: resolution stables over wide range of fluxes • Gas homogeneity and stable over time • Eco-friendly gas mixture for RPC • Stability of the gas gain: fast monitoring of gas mixture and environmental conditions • Mechanics: - large area needed to avoid dead zone: limitation on size and planarity of PCB is an issue - multi-gap with ultra-thin modules: very thin layer of glass and HPL electrodes, gas gap thickness uniformity few micron	• Preserve the photocathode efficiency by IBF and more robust photoconverters • Gas radiator: alternative to CF4 • Gas tightness • Very low noise when coupling large capacitance • Large dynamic range of the FEE • Separate the TR radiation and the ionization process • In TRD use of cluster counting technique and improve it by means of a InGrid	• Uniform rate capability and time resolution over large detector area • New material for high rate (low resistivity, radiation hardness) - uniform gas distribution - thinner structures: mechanical stability and uniformity • Eco-gas mixture • Electronics: Low noise, fast rise time, sensitive to small charge • Possibly optical readout • Precise clock distribution and synchronization over large area	• Radio-purity of the materials • Low background • High granularity • For large volume detectors: transparency over large distance • Pressure stability and control • Electronics with large dynamic range and flexible configuration. • Self-trigger capability • Low noise electronics • Fast electronics • Optical readout



1) Large ton dual-phase (PandaX-4T, LZ, DarkSide -20k, Argo 200k, ARIADNE, ...)
2) Light dark matter, solar axion, 0nbb, rare nuclei&ions and astro-particle reactions, Ba tagging)
3) R&D for 100-ton scale dual-phase DM/neutrino experiments

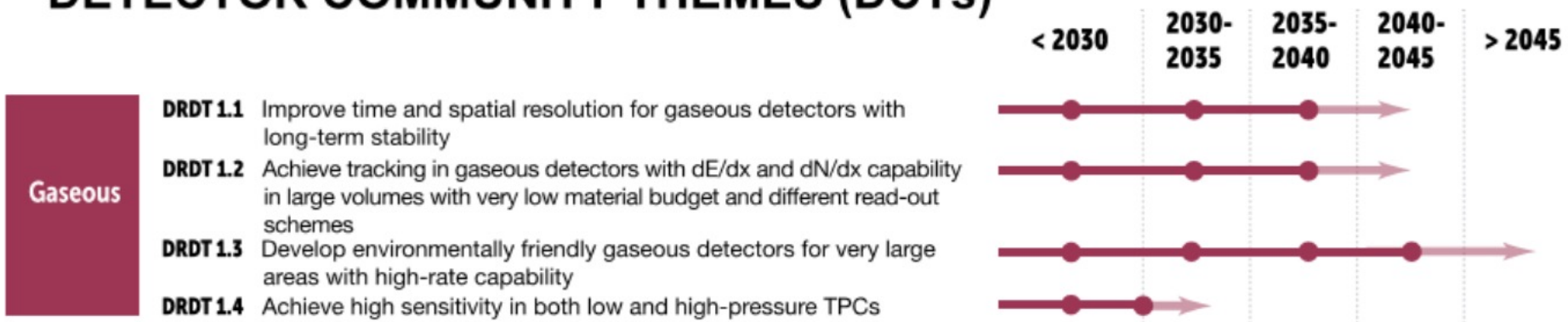
Gaseous detectors

→ **Within each Task Force chapter of the Roadmap document created a time-ordered technology requirements driven R&D roadmap in terms of capabilities not currently achievable**



To highlight the most important drivers for research in each technology area

To not limit a feasible start date of a future facility



- The faded region acknowledges the typical time needed between the completion of the R&D phase and the readiness of an experiment at a given facility.
- Stepping stones are shown to represent the R&D needs of facilities intermediate in time.
- It should be emphasised that the future beyond the end of the arrows is simply not yet defined, not that there is an expectation that R&D for the further future beyond that point will not be needed.

2. Detector R&D Roadmap: General Strategic Recommendations

GSR 1 - Supporting R&D facilities

GSR 2 - Engineering support for detector R&D

GSR 3 - Specific software for instrumentation

GSR 4 - International coordination and organisation of R&D activities

GSR 5 - Distributed R&D activities with centralised facilities

GSR 6 - Establish long-term strategic funding programmes

GSR 7 - 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

First ideas on how to address them have been developed (see backup material);
National Labs should be involved in several aspects, discussions have started as well

Implementation of the Detector R&D Roadmap

- In December 2021, ECFA was invited by CERN Council to elaborate, in close contact with the SPC, funding agencies and relevant research organisations in Europe and beyond, **detailed implementation plans**

- ECFA **Roadmap Coordination Group**
  (Phil Allport, Silvia Dalla Torre, Jorgen D'Hondt, Karl Jakobs, Manfred Krammer, Susanne Kuehn, Felix Sefkow and Ian Shipsey)
  has worked out a proposal;
  Focus was put on defining the general structure first (GSR4 and GSR6)
  → DRD Collaborations

- First proposal was distributed and discussed within Restricted ECFA
  (some RECFA delegates involved the national representatives for detector R&D);
  CERN management was involved as well in these discussions, gave feedback and defined boundary conditions
  (RECFA: Fabiola Gianotti and Joachim Mnich; and Manfred Krammer via Roadmap Coordination Group)

- Presented to SPC and Council in March 2022

  → well received;
  encouragement to discuss with Funding Agencies whether they could support such a plan

Implementation of the Detector R&D Roadmap

- Presentation to the Open LHC-RRB on Monday 25th April:

  https://indico.cern.ch/event/1133070/timetable/

  and a more in-depth discussion with Funding Agency representatives on Thursday, 28th April (as well as one-to-one discussions at CERN)
  (LHC-RRB → reaching out to all Funding Agencies involved in any of the large LHC experiments, reaching also beyond Europe)

- In general: support for the plan, no major objections raised;
  structured, long-term support for detector R&D supported

  - Funding schemes would need to be adapted by several FAs to the new structures;
  - Questions on prioritisation of R&D topics raised;
  - It was also made clear that the new structure (DRD Collaborations) can and should not cover “experiment-specific” R&D activities and “blue-sky” activities
  - Review structure appreciated, however, RRB/MoU found “too heavy” by some FAs
  - Encouragement to cooperate with neighbouring fields

Additional Comments

- As projects develop, **some aspects should be expected to transition into approved experiment-specific R&D** (outside the DRD programme)

- In addition, as stated in the General recommendations (GSR7) funding possibilities for “Blue-sky” R&D” should be foreseen

→ Three areas of Detector R&D:

1. Strategic R&D via DRD Collaborations (long-term strategic R&D lines)
   (address the high-priority items defined in the Roadmap via the DRDTs)

2. Experiment-specific R&D (with very well defined detector specifications)
   (funded outside of DRD programme, via experiments, usually not yet covered within the projected budgets for the final deliverables)

3. ”Blue-sky” R&D
   (competitive, short-term responsive grants, nationally organised)

Recap: Proposed implementation plan

- We propose to organise long-term R&D efforts into **newly established Detector R&D (DRD) Collaborations**

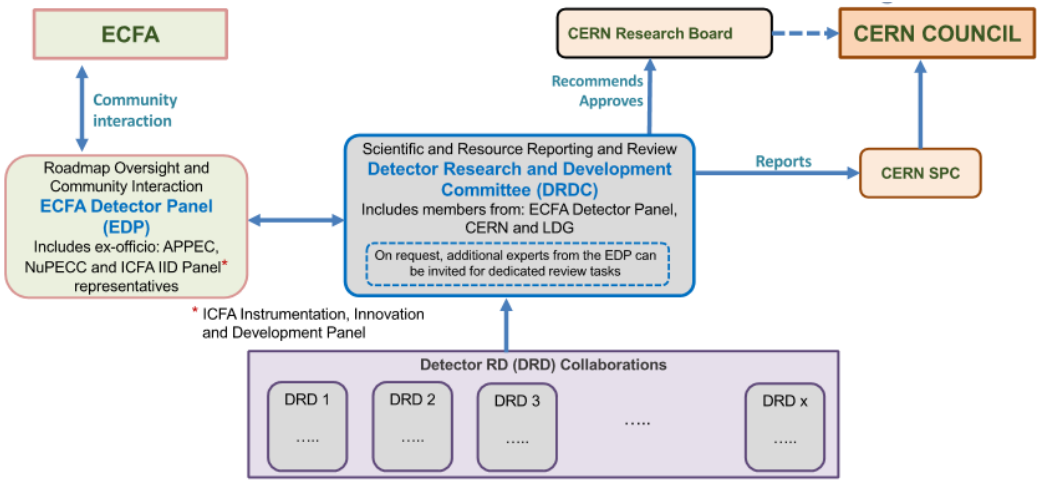
  Detector technology areas: larger DRD collaborations should be considered
  (one for each of the six areas and an additional similar structure for the transversal topics)

- **DRD Collaborations should be anchored at CERN** → CERN recognition, DRD label

- **Taking full account of existing, well-managed and successful ongoing R&D collaborations and other existing activities**
  (CERN EP R&D programme, EU-funded initiatives, collaborations exploring particular technology areas for future colliders)

- The **formation of new DRD collaborations** should adopt a **community-driven approach;**
  Supported by existing ECFA Detector R&D Roadmap Task Forces;
  Aim to have new structure in place in January 2024

Modified Review and Approval Process (for discussion)



1. Scientific and Resource Reporting and Review by a Detector Research and Development Committee (DRDC)

   Includes members from the ECFA Detector Panel (EDP): the scope, R&D goals, and milestones should be vetted against the vision encapsulated in the Roadmap.
   (EDP: http://cds.cern.ch/record/2211641/files/, exists, hosted at DESY, but mandate needs to be updated)

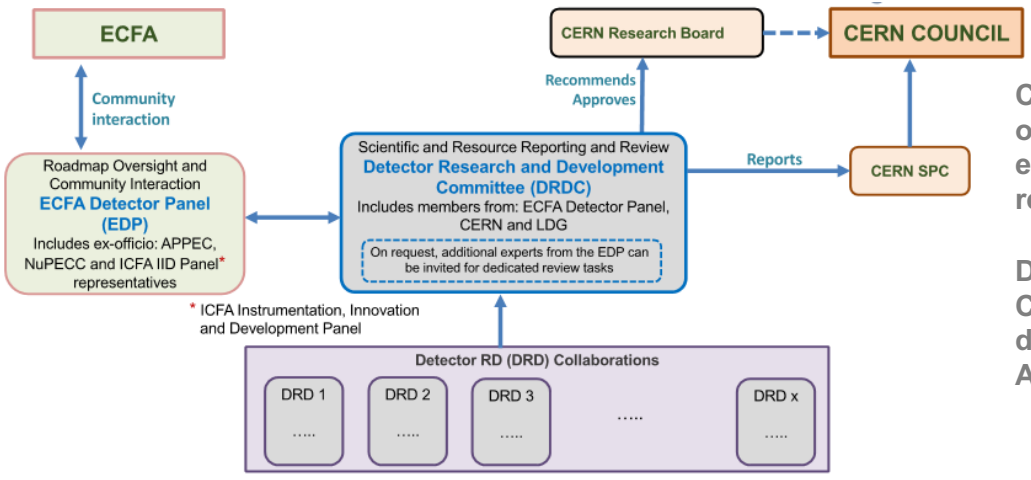
2. Funding Agency involvement via a dedicated Resources Review Board (~once every two years)

3. Yearly follow-up by EDP/DRDC → report to SPC → Council

Suggested Implementation Organisation

ECFA (through RECFA and PECFA) maintains broad links to the wider scientific community.

EDP engages with other scientific disciplines and also communities outside Europe through close links with the ICFA IID Panel.



CERN provides rigorous oversight through well-established and respected reviewing structures.

DRDs able to benefit from CERN recognition in dealings with Funding Agencies and corporations.

EDP:

- provides direct input, through appointed members to the DRDC, on DRD proposals in terms of Roadmap R&D priorities (DRDTs);
- assists, particularly via topic-specific expert members, with annually updated DRDC scientific progress reviews of DRDs;
- monitors overall implementation of ECFA detector roadmap/DRDTs;
- follows targets and achievements in light of evolving specifications from experiment concept groups as well as proto-collaborations for future facilities;
- helps plan for future updates to the Detector R&D Roadmap.

DRDC:

- provides financial, strategic and (with EDP) scientific oversight;
- evaluates initial DRD resources request with focus on required effort matching to pledges by participating institutes (including justification, given existing staff, infrastructures and funding streams);
- decides on recommending approval;
- conducts progress reviews on DRDs and produces a concise annual scientific summary encompassing the full detector R&D programme;
- be the single body that interacts for approvals, reporting etc with the existing CERN committee structure.

Status of implementation:

- Discussions with existing RD50 and RD51 Collaborations (semiconductor and gaseous detectors, respectively) are ongoing, on how the transition can be realised
- Consensus by all that new structure is needed and should be in place when HL-LHC detector construction is completed (HL-LHC deliverables have to be prioritised by many/all institutes)
- A “natural” date for start-up of the new DRD collaborations seems to be **1. January 2024**
- Aim:
  - **Ramp-up of the proposed resources (personnel, money) through 2025**
  - **Steady state by 2026**
- Setting up of new DRD collaborations should be done in a bottom-up approach involving the full community.
  To be coordinated by the ECFA Task Force leaders, with strong involvement existing RD managements (RD50, RD51)
- The proposed review structure with two committees (EDP) and DRDC is felt to be too heavy with too many reporting lines by the RD50 and RD51 managements (→ under discussion, incl. CERN management)

Feedback from Council in June 2022:

b) Detector R&D roadmap implementation plan
(Oral)

The Council took note:

- of the presentation by Professor Newbold, Chair of the Large Particle Physics Laboratory Directors Group (LDG), on the progress towards the development of a prioritised implementation plan for the accelerator R&D roadmap, which would be presented to the Council and the Scientific Policy Committee in September 2022;

- of the presentation by Professor Jakobs, Chair of the European Committee for Future Accelerators (ECFA), on the progress towards a final plan for the implementation of the detector R&D roadmap, which would be presented to the Council and the Scientific Policy Committee in September 2022, including details of the proposed review and approval process and feedback received from funding agencies;

- of the report by the Chair of the Scientific Policy Committee, Professor Rivkin;

and agreed that the proposed organisational structures should be set up immediately to allow concrete R&D plans to be produced and presented later in the year.

Other discussions, role of LDG and next steps

- First discussion round with LGD subgroup (Stan Bentvelsen, Joachim Mnich and Dave Newbold) took place

  Role of major Labs in Detector R&D Roadmap:

  - Major labs can (and should) become members of the new DRD Collaborations

  - Major labs have key roles to play in the implementation of some of the General Strategic Recommendations (for details, see backup slides)

    Examples: testbeam, irradiation facilities, construction facilities for major prototypes, .. engineering and software support, Tier-ed structures for challenging new developments e.g. ASICs (for details, see backup slides)

- Discussions will be continued

Suggested Implementation Timeline

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 Extended 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 in parallel to defining areas of interest per institute.

Suggested Implementation Timeline

- Assuming the new DRDs need to come into existence by the start of 2024, the Detector R&D Roadmap Task Forces will need to start organising open meetings to establish the scope and scale of the communities wishing to participate in the corresponding new DRD activities from Autumn of this year.

  (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.)

- Through 2023, mechanisms will need to be agreed with funding agencies, in parallel to the below, for country specific DRD collaboration funding requests for Strategic R&D and for developing the associated MoUs.
- By Spring 2023, the DRDC mandate would need to be formally defined and agreed with CERN management; Core DRDC membership appointed; and EDP mandate plus membership updated to reflect additional roles.
- To allow sufficient time for reviewing and iteration, DRD proposals will need to be submitted by early Summer 2023.
- Formal approval should be given by the CERN Research Board in Autumn 2023.
- New structures operational and new R&D programmes underway from beginning 2024.
- Through 2024, collection of MoU signatures will need to take place, with defined areas of interest per institute.
- Ramp up of new strategic funding and R&D activities 2024-2026 in parallel to completion of current deliverables.

Suggestion: *DRD Proposal Teams*

(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.)

- **Through TFs identify key players and stakeholders in the wider international community interested in pursuing DRDT topics identified in the Roadmap. Where current relevant detector R&D collaborations exist, their managements need to be involved from the beginning of this process.**

The stakeholders to then be contacted should include:

- **representation of those engaged in near-term programmes where these are clear "stepping stones" towards the longer-term ambitions;**
- **those engaged in establishing detector concepts for the main longer-term experimental programmes advocated in the European Strategy for Particle Physics;**
- **proponents of other facilities beyond the immediate horizon that are also supported in the European Strategy;**
- **were relevant, the primary contacts to other existing funded international detector R&D programmes (including EU and CERN supported activities).**

- **Helped by this wider grouping, one or more community workshops should be organised to gather input on how the relevant communities would best see a strategic R&D programme organised and discuss the proposed structure with the ECFA R&D Roadmap Coordinators.**
- **It is suggested that "DRD Proposal Teams" to lead the preparation of more detailed DRD proposals should be identified as a result of this process.**

Links for Roadmap Process

(**https://indico.cern.ch/e/ECFADetectorRDRoadmap**)

https://indico.cern.ch/event/957057/page/21633-mandate (Panel Mandate document)

https://indico.cern.ch/event/957057/page/21653-relevant-documents

https://home.cern/resources/brochure/cern/european-strategy-particle-physics

https://arxiv.org/abs/1910.11775 (Briefing Book)

https://science.osti.gov/-/media/hep/pdf/Reports/2020/DOE_Basic_Research_Needs_Study_on_High_Energy_Physics.pdf

https://ep-dep.web.cern.ch/rd-experimental-technologies (CERN EP R&D)

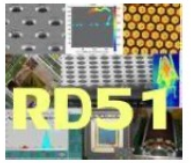
https://aidainnova.web.cern.ch (linking research infrastructures in detector development and testing)

https://attract-eu.com/ (ATTRACT: linking to industry on detection and imaging technologies)

https://ecfa-dp.desy.de/public_documents/ (Some useful documents from the ECFA Detector Panel)

Impact of the ECFA detector R&D roadmap implementation on the RD51 Collaboration future

Implementation proposal - RRB public presentation
ECFA detector R&D roadmap – reference
RD51 Future Day



CERN, 9.6.2022

TO: Joachim Mnich, Karl Jakobs and Phil Allport

FROM: Co-spokespersons RD50 Collaboration: G.Casse (University of Liverpool, UK), M. Moll (CERN, EP-DT), RD50 Collaboration Board chair: G.Kramberger (JSI, Slovenia), Co-spokespersons RD51 Collaboration: L. Ropelewski (CERN EP-DT), S. Dalla Torre (INFN), RD51 MB Scientific Secretary M. Titov (CEA Saclay), RD51 Technical Coordinator E. Oliveri (CERN EP-DT)

Implementation of ECFA detector R&D roadmap: The use of RD50 and RD51 as nucleation structures for DRD3 and DRD1 collaborations.

RD50 (Solid-State Detectors, 66 institutes) and RD51 (Micro-Pattern Gas Detectors, 89 institutes) are very successful CERN R&D world-wide collaborations, which are organically grown, are operating for more than a decade (RD50: 20 years, RD51: 14 years) and have substantially contributed to develop technologies that enabled the HL-LHC upgrades.

RD50 and RD51 welcomed the ECFA Roadmap process and its aim to establish a continuity in detector R&D and detector R&D funding and bridge the community towards the next major particle physics experiments. RD50 and RD51 members gave substantial contributions to this process.

RD50/RD51 letter to the ECFA chair and CERN Research Director

- RD50 and RD51 management proposes a **different timeline and transition strategy** than recommended in the implementation plan by ECFA, in particular insists on transition periods of sufficient length.

- **A community driven approach** should be taken rather than a top-down approach. Therefore, it should be the RD50 and RD51 collaborations who lead the transition towards the DRD collaborations
- implementing the goals of the ECFA Roadmap.

- **Large collaborations**: room for smaller granularity than a full DRDT should be possible. In our opinion this will enhance the effectiveness of the R&D and minimize the organizational overhead for the individual collaborations.

- **Review process**: We propose a hand-over from the LHCC to the new committee in charge of the DRDs with the end of the LHC upgrade constructions in 2026 or 2027. An addendum to the existing RD50 and RD51 MOUs can be used to transfer the reviewing responsibility from LHCC to another CERN approved panel with the end of the LHC upgrade activities.

- **Funding scheme:** The funding of the future R&D activities is not detailed in the roadmap.

Short summary of the Meeting on the

Implementation of the ECFA Detector R&D Roadmap

The meeting took place on Friday, 24 June 2022, 8:00 – 9:20 at CERN

Participants: Phil Allport, Gianluigi Casse, Silvia Dalla Torre, Karl Jakobs, Gregor Kramberger, Manfred Krammer, Michael Moll, Joachim Mnich, Eraldo Oliveri, Leszek Ropelewski and Maxim Titov

Major conclusions:

i. It is acknowledged by all parties that setting up a new structure for detector R&D to establish long-term funding programmes for strategic R&D is vital for carrying out research and development of the multi-decade timescale DRDTs in the ECFA Detector R&D Roadmap.

   There was consensus that a new structure needs to be in place around 2026 when the construction of the large Phase-II upgrade programmes of the LHC general-purpose detectors ATLAS and CMS comes to an end and personnel (engineers, technicians) and financial resources become available for new projects.

RD50/RD51 meeting with the CERN Research Director, the ECFA chair, the CERN EP Department Head, and the chair of the ECFA Detector R&D Roadmap Panel

- **RD51 MoU will terminate in the end of 2023 – there will be no extension,**
- **CERN expects submission of the new proposal and MoU, proposal should ALSO include goals in line with the ECFA detector R&D roadmap themes,**
- **CERN expects one Collaboration covering all gaseous detectors technologies, the progress towards this goal must be smooth and consider the time required for a successful transition,**
- **ECFA/CERN grants bottom-up process for the proposal preparation,**
- **DRDC1 will preserve RD51 organizational structure incorporating activities not covered by ECFA roadmap themes,**
  Tools (electronics, software), infrastructure, non-HEP applications, blue-sky R&D, training and technology dissemination
- **CERN will investigate financial impact of the transition (common fund, running projects, contracts, material ownership, administrative load),**
- **Within DRDC1, the financial assignments for a specific developments will be fully respected,**
- **The financing model already in place for RD51 will be kept within DRDC1,**
- **ECFA/CERN welcomes non-European members in DRDC1,**
- **ECFA/CERN will consider simplified review process with one CERN affiliated committee, which would include also members nominated by ECFA via the ECFA Detector Panel.**

ECFA participants (*Karl&Phil) will prepare the written summary of the meeting*
RD51 will be informed/consulted as soon as the summary is available
follow-up meeting will be scheduled

Callendar:

- First meeting with ECFA chair and ECFA detector R&D roadmap steering panel chair – April 11
- First public presentation of the roadmap implementations plans – RRB April 25
- RD50/RD51 letter to the ECFA chair and CERN Research Director - June 6
- RD51 Future Day - June 16
- SPC/Council presentations - June 13-17
- RD50/RD51 meeting with the ECFA chair and CERN Research Director - June 24
- Communication to the RD51 community – July 15
- RECFA/ECFA presentations - July 21-22
- RD51 MB meeting - August 2
- ECFA Detector R&D Roadmap Panel meeting – August 23
- Last chance RD51 LHCC review and report - September 12-14
- SPC/Council implementation approval - September 26-30 (optionally December 12-16)
- RD51CM/MPGD2022 – December 11-16

Action proposals *(as an alternative to stay passive)* **:**

- Preparation of the **LHCC review session focused on the presentation of the RD51 achievements,** *contributions to the LHC upgrades and construction of the R&D environment (community, infrastructure, and tools),* **future technological developments and possible DRD1 implementation proposal alternatives**,
- **Election** of the new RD51 management team
- **Establishment of contacts with other gaseous detectors technologies communities**: RPC proto-collaboration around GIF++, LCTPC, ...
- **Constitution of a core group for shaping future DRD** Collaboration and preparing the proposal

GD Events:

- RPC2022, September 26-30,
- MPGD2022, December 11-16,
- Gaseous detectors aging workshop, summer 2023, DESY aging workshop 2001
- Gaseous detectors conference (in the spirit of the old Vienna Wire Chamber Conference) - ECFA TF1 Symposium follow-up, spring2023, ECFA TF1 Symposium 2021

RD51 (DRD1) new structure bis

WG1: Technologies, limitations and challenges
Includes detector physics aspects

- MPGDs
- RPCs, MRPCs
- Large Volume Detectors (drift chambers, TPCs)
- Straw tubes
- New amplifying structures

WG2: Applications
full alignment with the ECFA detector R&D roadmap

- Muon systems
- Inner and central tracking with particle identification capability
- Calorimetry
- Photon detection
- Time of Flight systems
- TPCs for rare event searches
- Fundamental research applications beyond HEP
- Medical and industrial applications

WG3: Gas and material studies
Interdisciplinary working group

- Ageing
- Radiation hardness
- Eco-gases searches
- Light emission in gases
- Light (low material budget) materials
- Resistive electrodes
- Precise mechanics
- Photocathodes (novel, ageing, protection)
- Solid converters
- Novel materials (nanomaterials)

WG4: Detector physics, simulations, and software tools

- Detector properties studies (simulations)
- Software tools development and maintenance
- Detector design tools
- Gas cross-section data bases maintenance

RD51 (DRD1) new structure

WG5: Electronics for gaseous detectors

- Readout electronics (SRS, ASICs, fast electronics, pixel, and optical readout)
- HV systems
- Dedicated lab instrumentation

WG6: Detector production

- CERN MPT workshop
- Saclay MPGD workshop
- Novel detector production methods
- Industrialization

WG7: Common test facilities

Incudes development of common detector characterization standards

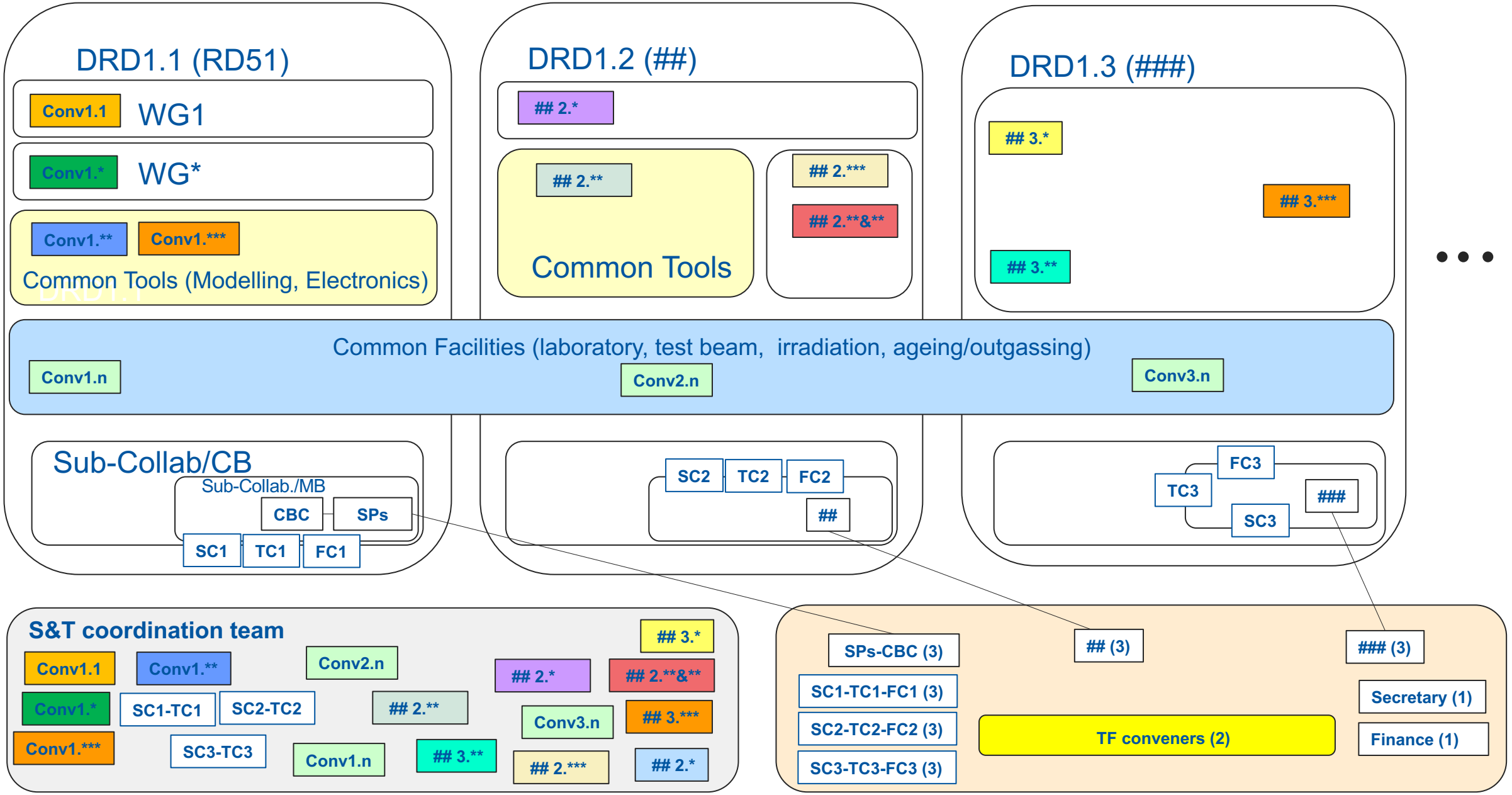
- General purpose detector development labs
- Ageing facilities
- Irradiation facilities
- Gas studies facilities
- Test beam facility

WG8: Training and dissemination

- Schools and trainings
- Topical workshops
- Knowledge transfer

A potential “implementation” based on substructures

Eraldo Oliveri CERN-EP-DD



DRD1 Scientific and Technical coordination (about 50 members)

DRD1 Panel (about 20 members)

RD51 towards DRDC1

WG1: Technologies
Includes experimental detector physics aspects

- MPGDs
- RPCs, MRPCs
- Large Volume Detectors (drift chambers, TPCs)
- Straw tubes
- New amplifying structures

WG2: Applications
full alignment with the ECFA detector R&D roadmap

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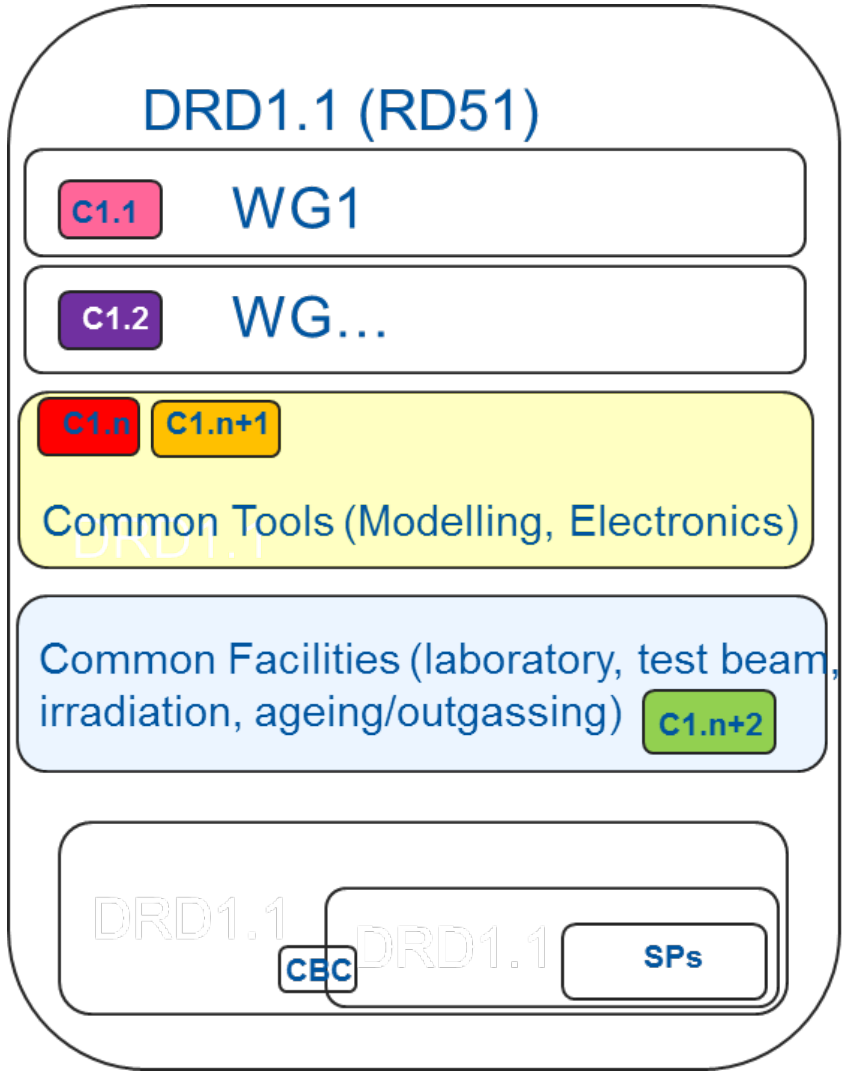
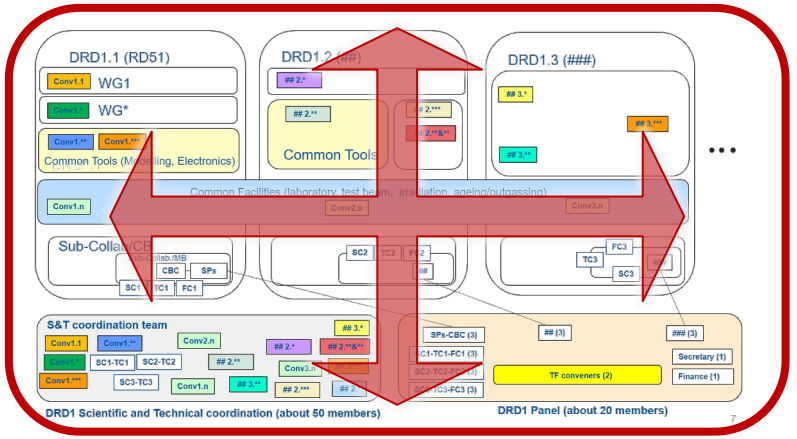


https://indico.cern.ch/event/1138814/contributions/4902073/attachments/2462918/4224970/ECFA%20implementation%20comments%20CB.pdf

Sharing/Meetings

- (I) DRD1 Meeting (full community)
- (II) DRD1.# meeting (substructure collaboration meeting.. RD51, RPC,…)
- (III) Topical Workshop / Working group meeting (transversal between DRD1.#)



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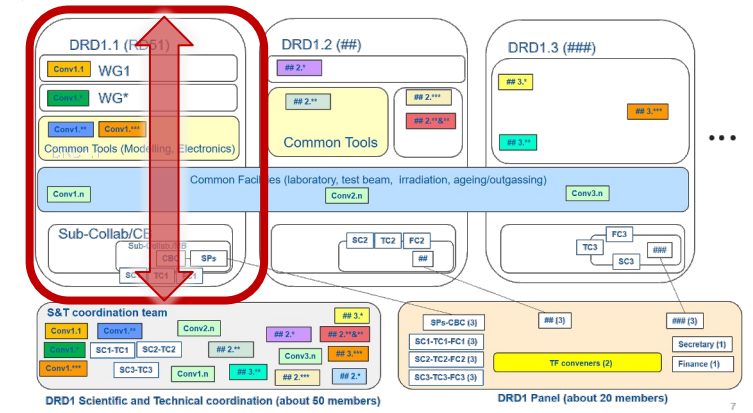
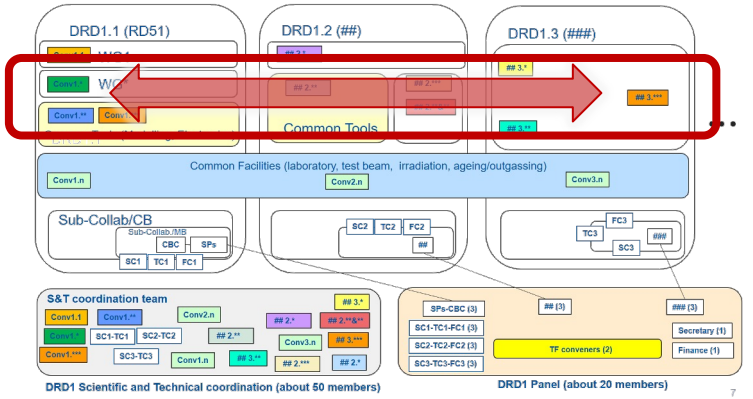
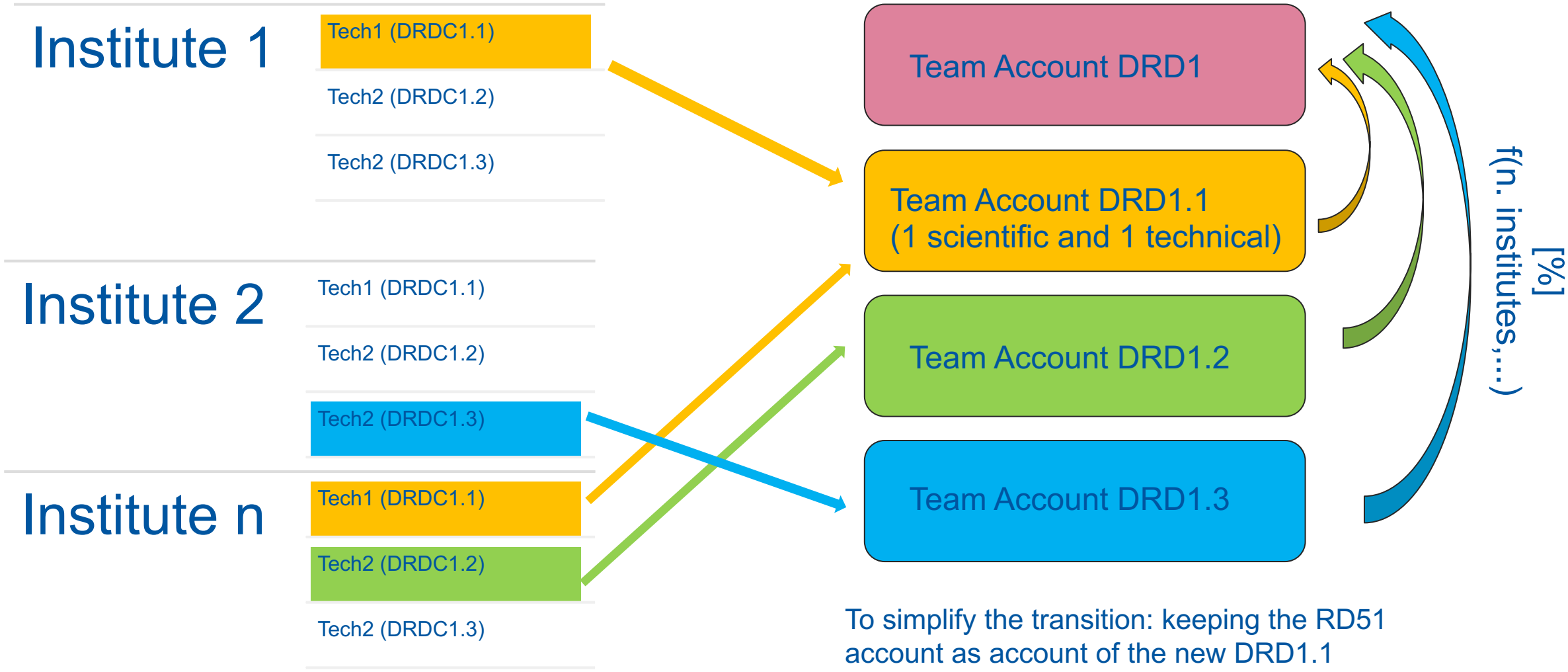


Sub-DRDC



Transversal

Practical Aspect (II): Budgets (to grant flexibility, to limit conflicts)



To simplify the transition: keeping the RD51 account as account of the new DRD1.1

Opening new account for DRD1 and other substructures that are now without account

Take care of the team accounts of institutes

ECFA

bottom up

DRDC

RDq

RD18

RD42

...

clocks, clock networks

kinetic detectors

superconducting, spin-based sensors

optomechanical sensors

atoms, molecules, ions, interferometry

0-, 1-, 2-D materials, metamaterials

1 2 3 4 5 6

superconducting RF coatings

Rydberg TPC's ; ions in traps

perovskytes; calorimetry, timing ; graphene: GEM's

...

6 families defined by ECFA roadmap

Community consists of:

- different countries / entities currently *involved* in different RDq R&D activities relevant to low energy and/or high energy particle physics

- different countries / entities *interested* in pursuing R&D activities in other (new to them) RDq areas relevant to low energy and/or high energy particle physics

UK DE FR IT CERN AT PL LV PT N JP US ...

active

interested

low energy particle physics

high energy particle physics

draft 23/8/22 M. Doser

ECFA

top down

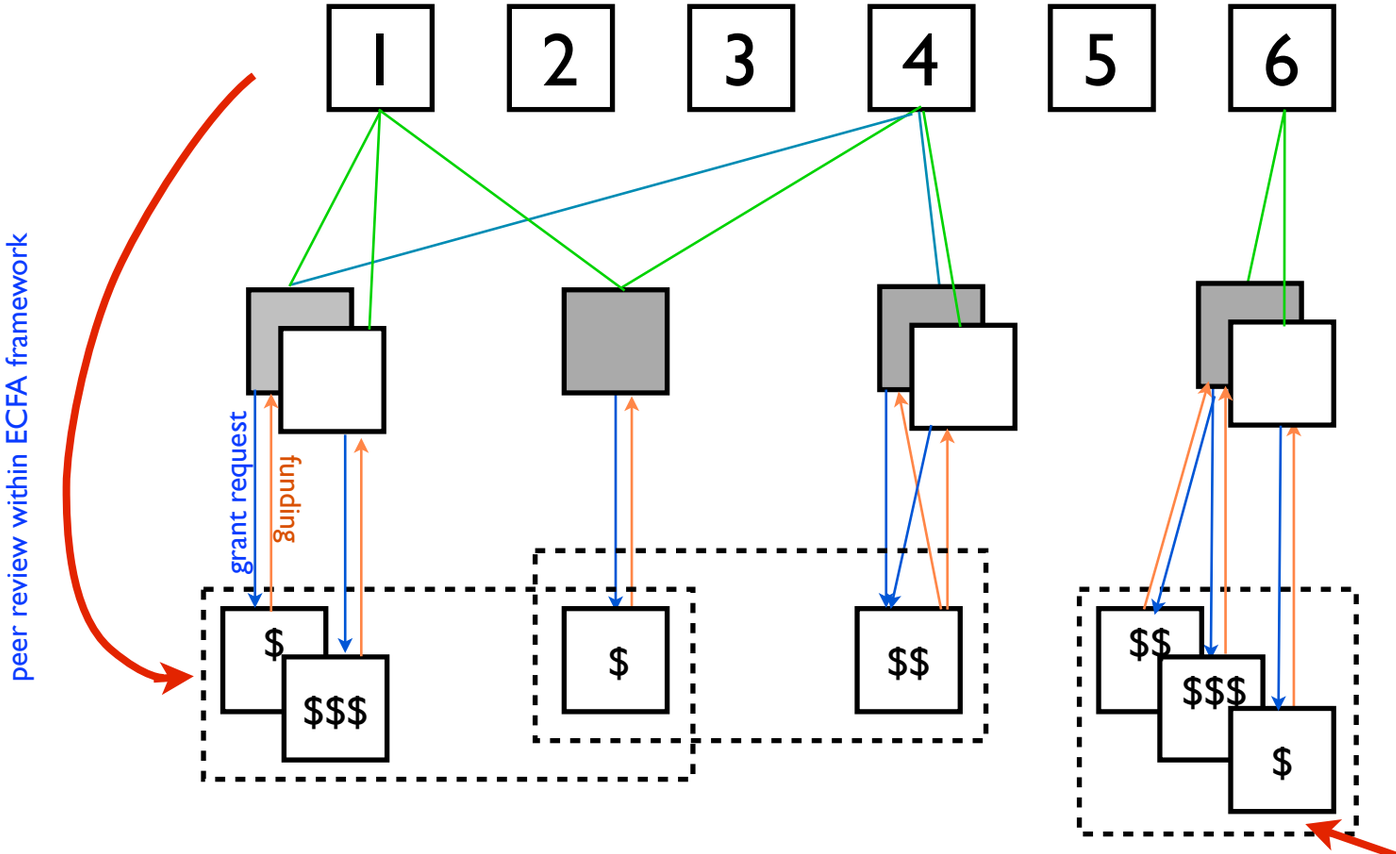
DRDC

follows progress,
verifies that focus
is along lines of roadmap

reports to DRDC
(RDq spokesperson)

RDq

clocks, clock networks
kinetic detectors
superconducting, spin-based sensors
optomechanical sensors
atoms, molecules, ions, interferometry
0-, 1-, 2-D materials, metamaterials



Overall structure patterned on existing RDnn collaborations:

RDq collaboration with
spokesperson, CB;
each sensor family is represented in CB
by each family's spokesperson

6 loose sensor-family specific R&D *collaborations*
(**RDq$_1$** .. **RDq$_6$**, each with their own spokesperson,
CB and family-specific project evaluation board);
no annual fees to allow very lightweight, flexible
and dynamical change of composition

collaborators are any of the following:
institute, national lab, experimental collaborations
(represented by one individual)

it is strongly desirable that TH collaborators are
involved in each sensor family

RDqi can/should be *hosted in different national labs*, to
reflect the strengths and interests of the hosting entity

projects are evaluated based on relevance to
sensor family goals *as part of the ECFA roadmap*;
projects should provide intermediate milestones in
addition to long term physics / functionality goals;
HEP / low energy particle physics / blue sky : 40 / 40 / 20

the outcome of the evaluation will help funding
agencies judge corresponding individual grant requests
and see them in a global context

draft 23/8/22 M. Doser