DRD in the European Strategy

Workshop di Sezione per la discussione
della Strategy Europea sulla Fisica delle Particelle

Riccardo Farinelli - Bologna - 07/11/24

Introduction

Outline:

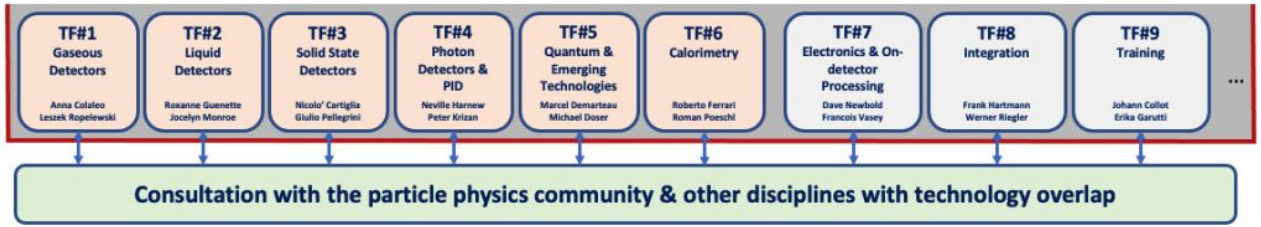
- brief story of the DRDs
- activities, budget,timelines and organization
- integration INFN-DRD
- suggestions

“In this Strategy Update process, we must converge on a preferred option for the next collider at CERN plus alternative options (prioritised)”

The DRDs are structures transversal to all the option mentioned in the Strategy Update.

A short story on the DRD

1) ESPP 2020 → ECFA roadmap → Panel and Task Forces → Themes



2) ECFA → mandate to launch the R&D collaborations

3) R&D community → Survey → DRD Proposal

4) ECFA → DRDC → Approval DRD proposal → 3 year mandate

   Each DRDs has its organization:
   management,scientific and resource; spokesperson, MoU, WG/WP conveeners,

5) Now: waiting for MoU and Annexes (some interactions with CERN and FA are ongoing)

DRD in a nutshell

- Detector R&D community for **strategic** R&D and **blue-sky** R&D with CERN as host laboratory
- Includes detector R&D activities up to the commissioning (excluded) divided in macro-areas (DRDn)
- Implementing the **ECFA** Detector R&D Roadmap and the General **Recommendations** (i.e. long-term strategic funding, design large scale organization, centralized facilities through a network of national hubs, …)
- **International collaborations**: 100-200 institutes and ~M€/year budget each DRD
- DRD are **scientific forum** where R&D activities are shared (i.e. collaboration meeting, common activities, promote common projects, Workshop, Seminars, Notes, regular exchange of expertise)
- Each DRDs has its organization. All of them includes **W**ork **P**ackages to collect strategic activities (ECFA) from different groups involved on similar R&D. WPs have deliverables.
- Some DRDs have also **W**orking **G**roup to share activities on transversal topic (i.e. simulation, electronics, manufacturing, organisation of common test facilities, test-beam)

Working Group and Work Package

WG -> address large-scale organization on common topic (i.e. technological aspect, application, simulation, electronics, production, aging)
WG -> scientific forums, no committed resources

WP -> address long-term funding on strategic **application** (ECFA roadmap)

Synergies with WP and WG.

DRD3

		Working Groups							
	Work Package Projects	WG1- Monolithic silicon technologies	WG2- Hybrid silicon technologies	WG3- Radiation hardening	WG4- Simulation	WG5- Characterization techniques, facilities	WG6- Wide bandgap and innovative sensor materials	WG7- Interconnection technologies	WG8-Outreach and dissemination
Working Packages: WP1 - CMOS sensors	1.1 Spatial resolution	■			■	■			■
	1.2 Timing resolution	■			■	■			■
	1.3 Read-out architectures	■							■
	1.4 Radiation tolerance	■		■	■	■			■
	1.5 Low-cost large-area CMOS sensors	■	■	■	■	■		■	■
WP2- Sensors for 4D-tracking	2.1 3D sensors		■	■	■	■	■	■	■
	2.2 LGAD		■	■	■	■	■	■	■
WP3- Sensors for extreme fluences	3.1 wide band-gap materials (SiC, GaN)		■	■	■	■	■	■	■
	3.2 diamond-based detectors		■	■	■	■	■		■
	3.3 Extreme fluence: silicon detectors		■	■	■	■			■
WP4- 3D-integration and Interconnection	4.1 Integration: fast and maskless interconnect	■	■					■	■
	4.2 3D In house post-processing for hybridization	■	■					■	■
	4.3 Advanced interconnection techniques for detectors	■	■				■	■	■
	4.4 Mechanics and cooling	■	■					■	■

EXAMPLE

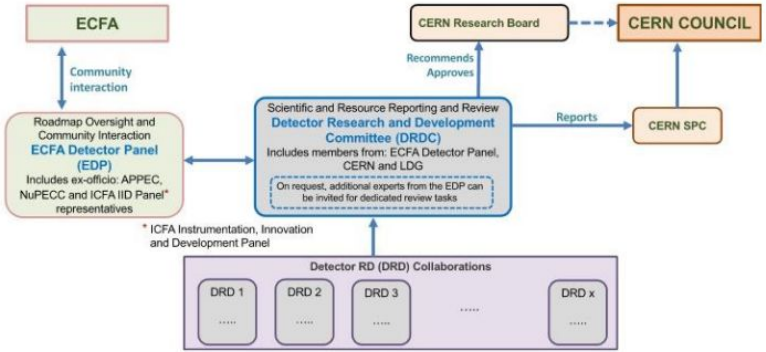
DRD collaboration status

Fully Approved
- Gaseous Detectors (DRD1) [ex RD51]
- Liquid Detectors (DRD2)
- Photodetectors & Particle ID (DRD4)
- Calorimetry (DRD6)

Conditionally approved
- Semiconductor Detectors (DRD3) [ex RD50, RD42,..]

Full proposals submitted
- Quantum Sensors (DRD5)
- Electronics (DRD7)

Letter of Intent submitted
- Integration (DRD8)



Review and budget

The WPs have budget, deliverables, and milestones

FAs manage the **budget** according to their own review scheme
A token payment (?) will be made to support internal DRD activities (awaiting MoU)

The DRD scientific board and WP coordinators monitor ongoing activities and provide **scientific** feedback on how these activities: alignment with the WP deliverables and milestones, ECFA themes

The DRDC provides feedback on DRD **management** and their adherence to ECFA recommendations

Too many reviews? Overlapping or separated committees?

-> It is important to focus on the communication between FAs and DRDC
to improve the outcome of these new collaborations

Timeline

The accepted DRDs currently have a **three-year** lifespan.
If they prove to be successful, this approach will be extended for a long-term period

Within the DRD proposal, the scientific **community** provided **feedbacks** with their proposal for the activities planned for the upcoming years

However, **INFN** operates with a **year-by-year budget** for materials and a mechanism of four years or more for managing personnel

This timescale are not aligned with the DRDs.

It is important to establish a mechanism that offers a long-term perspective on activities taking into account the current INFN budget framework

National hub and centralized facilities

The ECFA recommendations suggest creating national hubs to host and centralize facilities and cost-intensive activities for strategic technology development

The merging of interests can be facilitated through DRDs, and INFN, along with other FAs and/or industries, can support, co-fund, and host these facilities.

How to attentionate and submit proposal for these investment?

i.e. The joint project between INFN and CERN for the DLC machine

Scientific organization

ECFA roadmap suggests a classification of the strategic R&D divided in DRDs and each DRD has its own organization (management, scientific, budget).

INFN has an existing and different structure: the strategic R&D, technologies and projects are managed, funded and refereed by independent CSNs.

The actual DRD structure described in the proposal and accepted by DRDC is complex to be managed by INFN: activities defined in the same DRD are funded and refereed by different INFN projects.

How INFN can handle with those structures without a too complex scheme?

INFN-DRD integration

Large Italian contribution in responsibility roles

INFN provides a large contribution on the resources (FTE and budget)

Given the actual status of the DRDs, how INFN can handle these proposal
and how it can interact with these organizations?

Scientific feedbacks on the DRD proposals are mandatory to manage the INFN priorities with respect to the one suggested by the DRDs.

Effective communication between the two is essential to optimize activities, maximize the benefits of this collaboration, and support new opportunities presented by such a large partnership

INFN-DRD communication

What information is collected:

- R&D activities defined and planned
- institutes/section involved
- budget (FTE and material) existing and required

Why:

- facilitate the knowledge sharing
- connect groups with similar activities in a large international collaboration
- support the common activities from different institutes
- improves the possibility to cluster groups in common task
- avoid double-funding and support co-funding

How:

- survey, community feedback, participation
- MoU ?

INFN-DRD communication

Some personal suggestions

- profit of INFN reference persons to support CSNs in the integration of those two complex structures

- request information to DRD to simplify the process

- DRD should provide useful report on activity, budget, INFN %,
  deliverable in 3/5/10 years timescale for short, medium and long-term priorities

- INFN should monitor the DRDs to define their activity and funding;
  and to identify future strategic R&D (application, investment, key expertise)
  →it is important to define an INFN scheme for referees and activity classification to fit its organization

INFN and DRD funds and referee

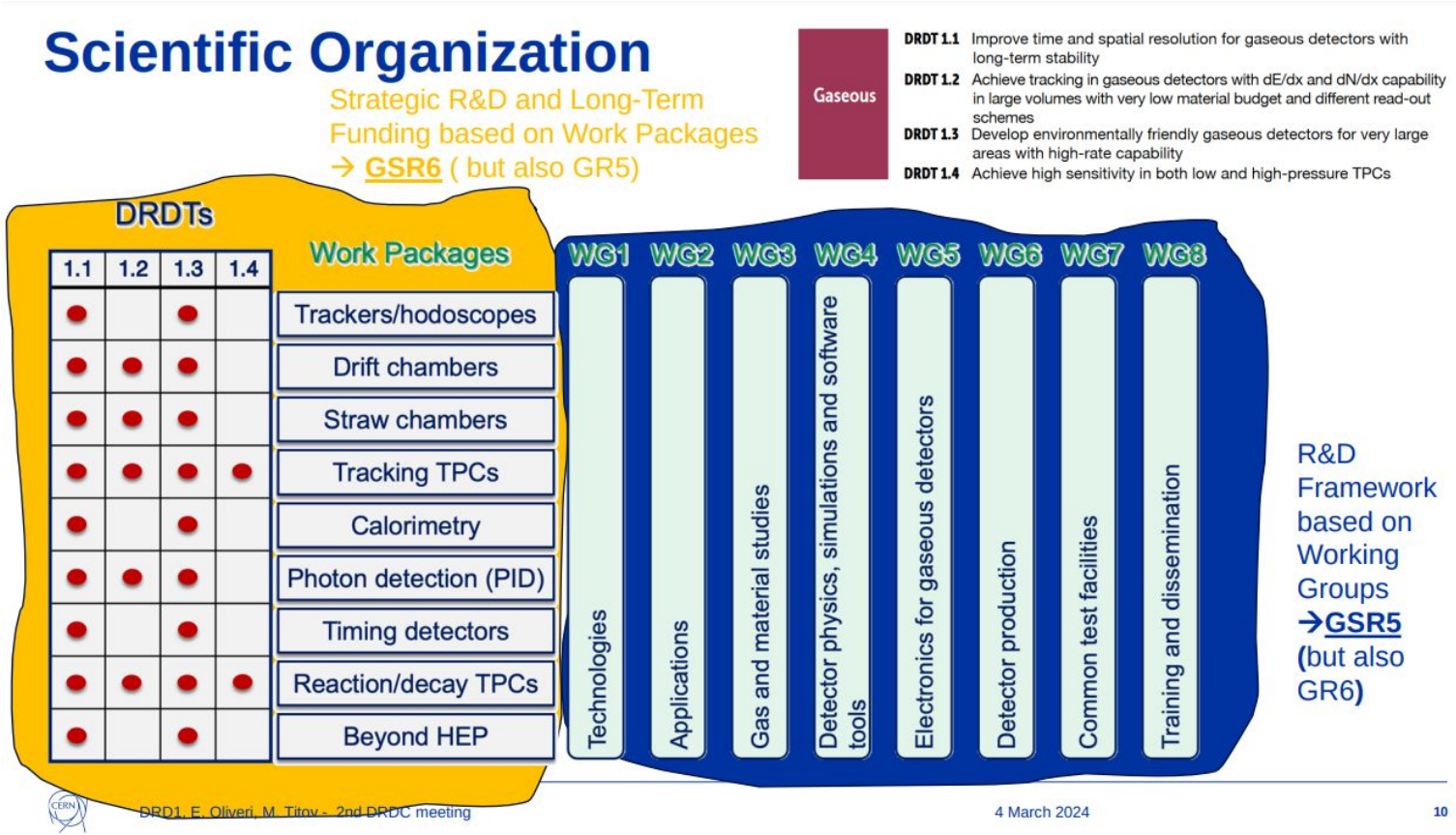
- INFN activities on detectors are divided in different CSN.
  DRD activities are transversal to the CSN.
  How can be managed the fund and referee without increasing too much the complexity?
  i.e. task by task budget request separation within **existing or new projects**
  → define a conversion map from DRD-WP to INFN-projects

- Large synergy can be developed merging activities on the same technology from different CSN to improve the optimization, collaboration and increase the size of the groups.
  A mechanism to support those synergies between CSNs is needed (or work sharing is preferred?)

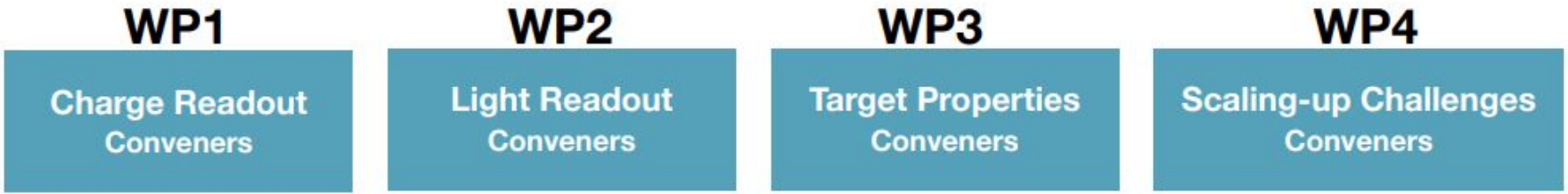
- Define collaboration mechanism with other institutes profiting of the DRD WPs
  Link INFN project to DRD WP deliverable to profit of inter-institute or international collaboration? MoU?

- The DRD management is time-consuming because these structures take care of a large variety of activity with a complex organization. INFN colleagues are involved in the management.
  INFN needs to take full advantage of the opportunities presented by the DRDs
  and the ongoing work provided by the current involved person

DRD1 - Gas detector - WP and WG



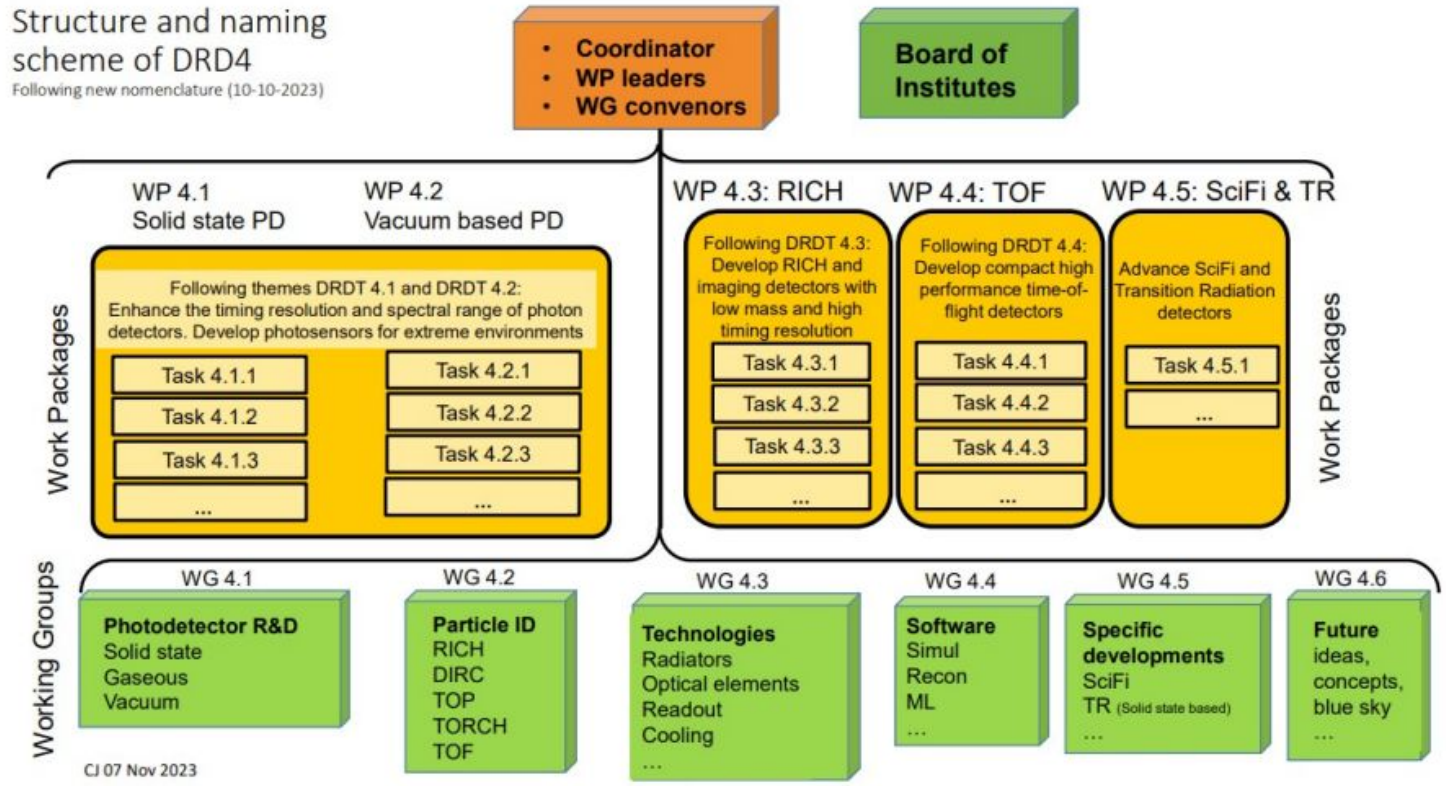
DRD2 - Liquid detector - WP



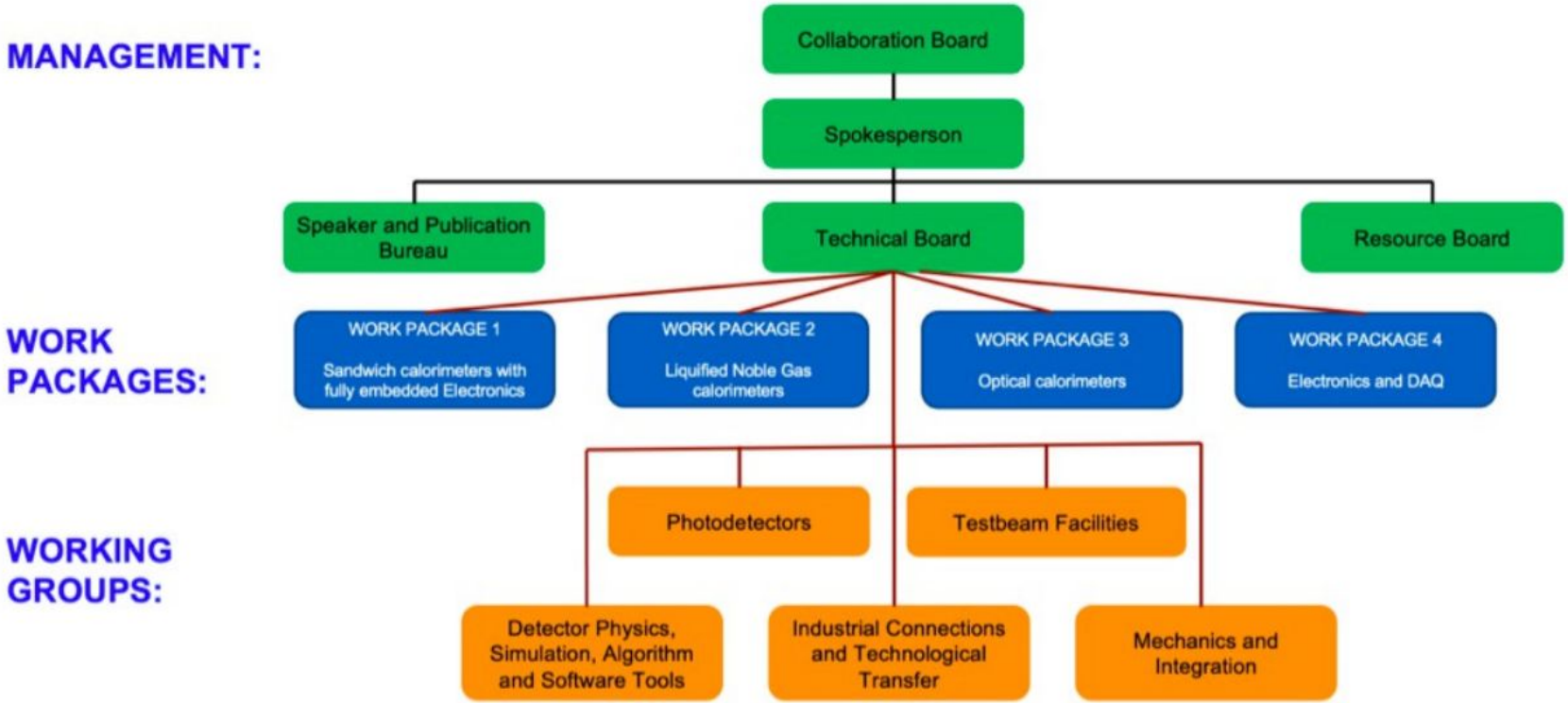
DRD3 - Semiconductor detector - WP and WG

Working Packages	Work Package Projects	WG1- Monolithic silicon technologies	WG2- Hybrid silicon technologies	WG3- Radiation hardening	WG4- Simulation	WG5- Characterization techniques, facilities	WG6- Wide bandgap and innovative sensor materials	WG7- Interconnection technologies	WG8-Outreach and dissemination
		Working Groups							
WP1 - CMOS sensors	1.1 Spatial resolution	■			■	■			■
	1.2 Timing resolution	■			■	■			■
	1.3 Read-out architectures	■							■
	1.4 Radiation tolerance	■		■	■	■			■
	1.5 Low-cost large-area CMOS sensors	■	■	■	■	■		■	■
WP2- Sensors for 4D-tracking	2.1 3D sensors		■	■	■	■	■	■	■
	2.2 LGAD		■	■	■	■	■	■	■
WP3- Sensors for extreme fluences	3.1 wide band-gap materials (SiC, GaN)		■	■	■	■	■	■	■
	3.2 diamond-based detectors		■	■	■	■	■		■
	3.3 Extreme fluence: silicon detectors		■	■	■	■			■
WP4- 3D-integration and Interconnection	4.1 Integration: fast and maskless interconnect	■	■					■	■
	4.2 3D In house post-processing for hybridization	■	■					■	■
	4.3 Advanced interconnection techniques for detectors	■	■				■	■	■
	4.4 Mechanics and cooling	■	■					■	■

DRD4 - Photodetector - WG and WP



DRD6 - Calorimetry - WP and WG



DRD activity in Bologna

DRD1 (Gas) -> P. Giacomelli: μRWELL R&D per muon IDEA @ FCC -> Link

DRD2 (Liquid) -> M. Selvi: Gd-Water Cherenkov as Neutron Veto for Dark Matter experiments @ XENON -> Link

DRD4 (Photon) -> A. Montanari: FEE for SiPM, cooling and cryo characterization technologies @ DUNE -> Link

DRD6 (Calo) -> D. Falchieri: Dual Readout Calorimeter @ FCC -> Link

If corrections are needed to this link, please contact me