

**ECFA**

European Committee for Future Accelerators

# ECFA WG3: Topical Workshop on tracking and vertex

*Mary-Cruz Fouz, Giovanni Marchiori, Felix Sefkow*

CERN. May 30-31 2023

<https://ecfa.web.cern.ch/ecfa-study-higgs-ew-top-factories>

Based on the recommendations of the European Strategy for Particle Physics Update, the European Committee for Future Accelerators (ECFA) has launched a series of workshops on physics studies, experiment design, and detector technologies towards a future electron-positron Higgs/EW/Top factory. **The aim is to bring together the efforts of various  $e^+e^-$  projects, to share challenges and expertise, to explore synergies, and to respond coherently to this high-priority strategy item.**

**WG 1: Physics Potential.**

Conveners: Jenny List (DESY), Fabio Maltoni (UC Louvain / Bologna) and Jorge de Blas (Univ. Granada)

**WG 2: Physics Analysis Methods**

Conveners: Patrizia Azzi (INFN-Padova/CERN), Fulvio Piccinini (INFN Pavia) , Dirk Zerwas (IJCLab/DMLab)

**WG 3: Detector R&D**

Conveners: Mary Cruz Fouz (CIEMAT Madrid), Giovanni Marchiori (APC Paris), Felix Sefkow (DESY)

**The working group 3** is organising a series of **workshops around detectors**. Their goal is to bring representatives of future collider studies and associated detector concept groups together with the R&D community, in order to support the ongoing process of forming Detector R&D (DRD) Collaborations for strategic developments towards future facilities. Higgs factories are highly prioritised by the European Strategy, after the HL-LHC, and important parts of detector R&D will be targeted towards experiments at future  $e^+e^-$  colliders.

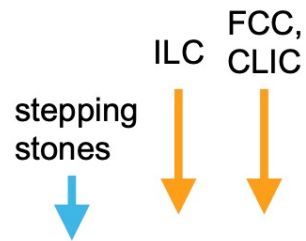
# ECFA Detector Roadmap Summary

## Relating Technology R&D to Major Drivers from Facilities

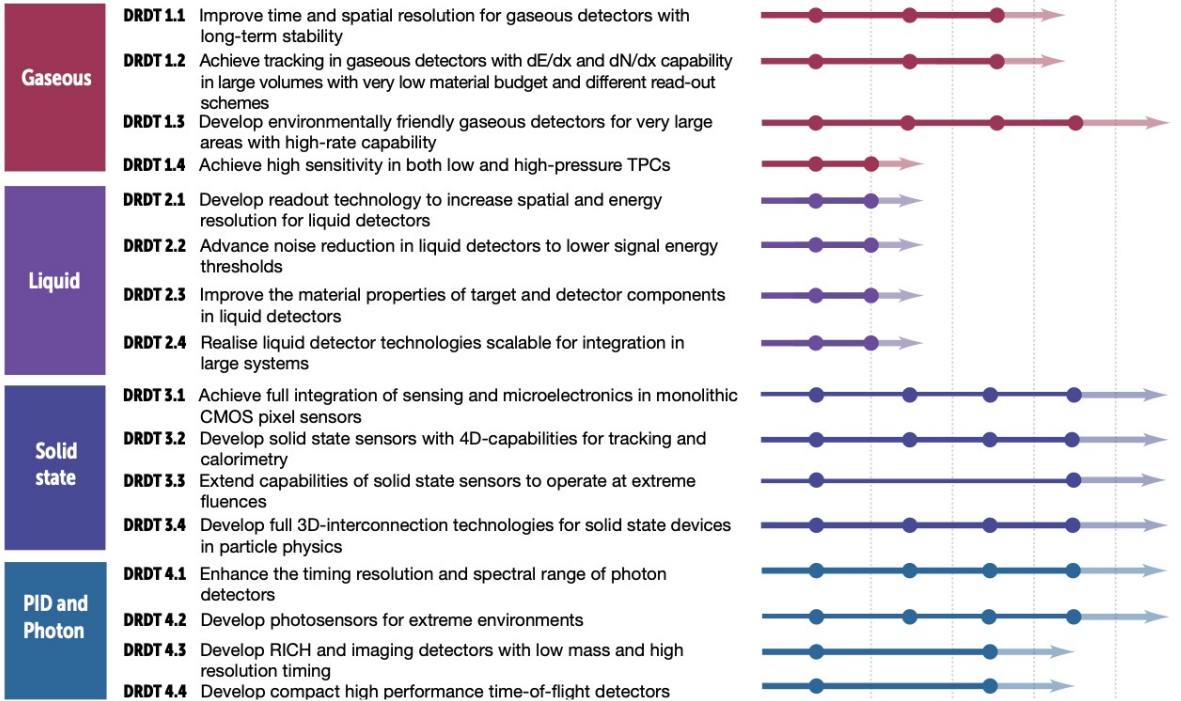
<https://cds.cern.ch/record/2784893>

~ 200 pages  
~ 1 year young

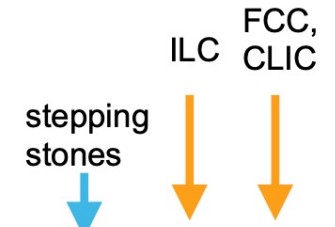
### DETECTOR RESEARCH AND DEVELOPMENT THEMES (DRDTs) & DETECTOR COMMUNITY THEMES (DCTs)



< 2030    2030-2035    2035-2040    2040-2045    > 2045



Dates when R&D finished and real engineering & construction can start



Detector R&D Themes (DRDTs) and Detector Community Themes (DCTs). Here, except in the DCT case, the final dot position represents the target date for completion of the R&D required by the latest known future facility/experiment for which an R&D programme would still be needed in that area. The time from that dot to the end of the arrow represents the further time to be anticipated for experiment-specific prototyping, procurement, construction, installation and commissioning. Earlier dots represent the time-frame of intermediate "stepping stone"

projects where dates for the corresponding facilities/experiments are known. (Note that R&D for Liquid Detectors will be needed far into the future, however the DRDT lines for these end in the period 2030-35 because developments in that field are rapid and it is not possible today to reasonably estimate the dates for projects requiring longer-term R&D. Similarly, dotted lines for the DCT case indicate that beyond the initial programmes, the activities will need to be sustained going forward in support of the instrumentation R&D activities).

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## Detector R&D Roadmap implementation

[https://indico.cern.ch/event/1197445/contributions/5034860/attachments/2517863/4329123/spc-e-1190-c-e-3679-Implementation Detector Roadmap.pdf](https://indico.cern.ch/event/1197445/contributions/5034860/attachments/2517863/4329123/spc-e-1190-c-e-3679-Implementation%20Detector%20Roadmap.pdf)

- It is proposed that the long-term R&D efforts be organised into newly established **Detector R&D (DRD) collaborations**
- That collaborations will be established to address each of the **detector technology areas identified in the Roadmap**

*We are here*

DRD collaborations should start work in January 2024, with a ramp-up of resources through 2024/2025, reaching a steady state by 2026.

## 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 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

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Plenary ECFA meeting, CERN, 17<sup>th</sup> November 2022

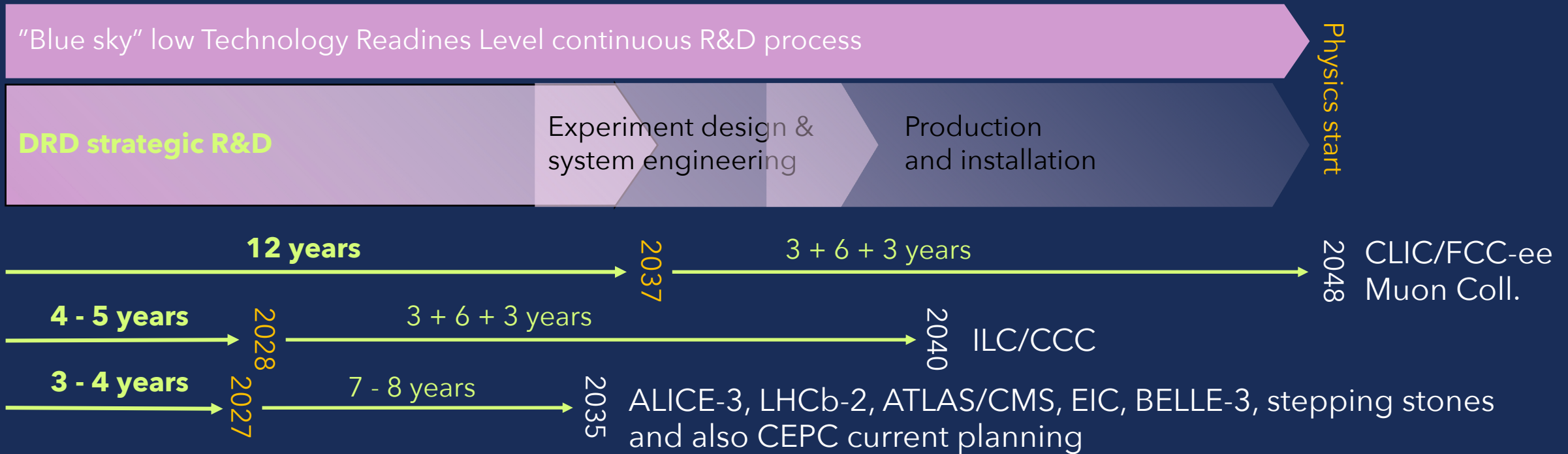
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Through 2024, collection of MoU signatures

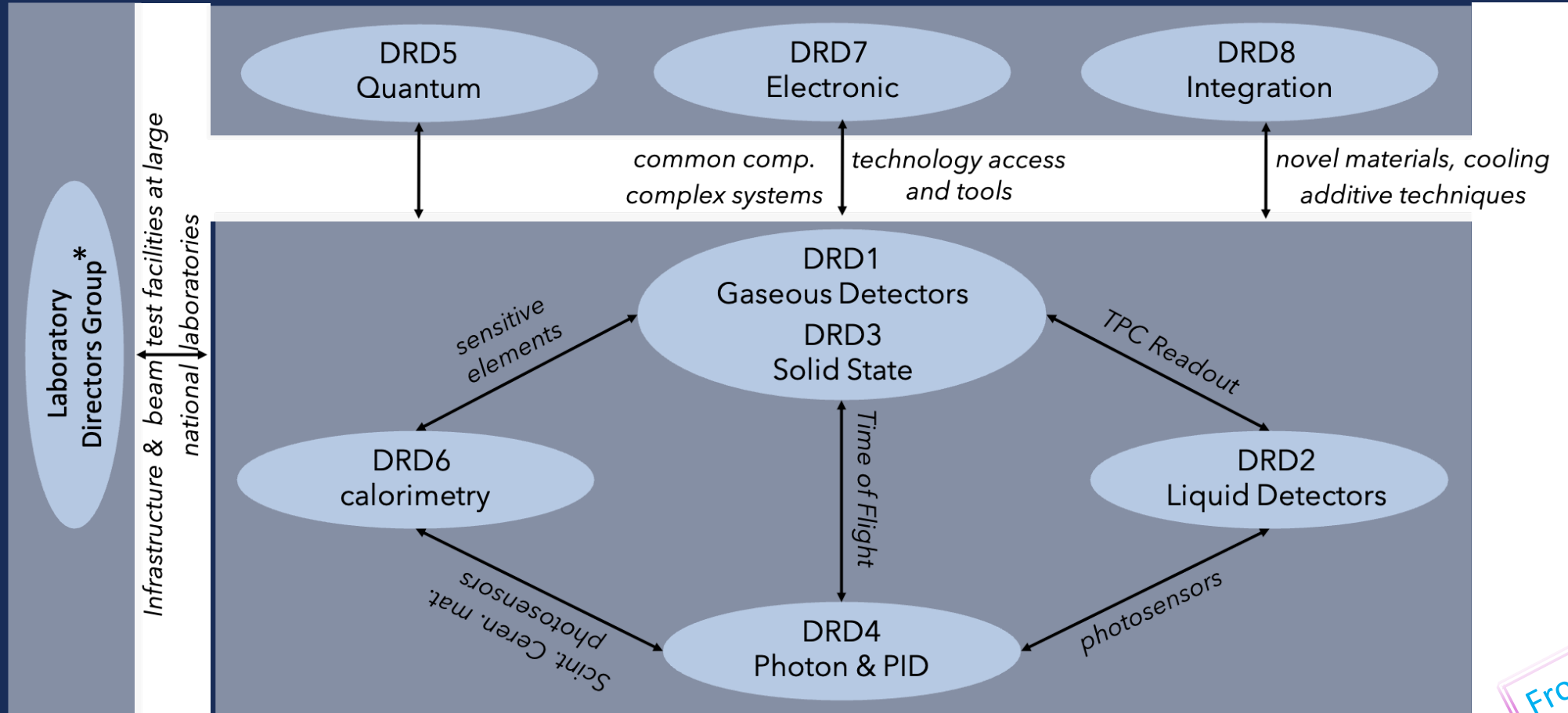
*From K. Jakobs*

# From DRD to new/update collider experiments

DRD collaborations active Jan. 2024



# Interplay between DRDs



From

From D.Contardo

direct the community contributions to Work Packages and resources in proper DRD(s)

\* LNF - Italy, STFC/Daresbury - UK, CIEMAT - DESY, Germany, STFC/RAL - UK, LNGS - Italy, F.CEA/Irfu - France, IJCLab - France, Nikhef - Netherlands, PSI - Switzerland

# DRDs in a Nutshell

Draft - June

## DRD1 - Gaseous Detectors

- **WG1** : technologies MPGDs, RPC, Wires, TPC, DCH
- **WG2** : applications (Muon systems, Inner & Central Tracking with PID, Calorimetry, Photo-detectors, Timing, TPC for rare event searches)
- **WG3** : gas and material studies
- **WG4** : modelling and simulation
- **WG5** : electronic
- **WG6** : production & technology transfer
- **WG7** : common test facilities
- **WG8** : knowledge transfer

Draft - June

## DRD2 - Liquid Detectors

- **WG1** : charge readout
- **WG2** : light readout
- **WG3** : target properties

Draft - June

## DRD3 - Solid State Detectors

- **WG1** : Monolithic CMOS sensors
- **WG2** : sensors for tracking and calorimetry (Hybrid, LGADs)
- **WG3** : radiation damage and ultrahigh fluence
- **WG4** : simulation
- **WG5** : characterization techniques, facilities
- **WG6** : non silicon based detectors
- **WG7** : Interconnect and device fabrication
- **WG8** : dissemination and outreach

## DRD5 - Quantum and Emerging Technologies

- **WG1** : clocks, clock networks
- **WG2** : kinetic detector
- **WG3** : superconducting spin based sensors
- **WG4** : optomechanical sensors
- **WG5** : atoms, molecules, ions, interferometry
- **WG6** : meta materials 0-1-2D materials

September 1<sup>st</sup> community workshop  
Final proposal January 2024

## DRD4 - Photon Detectors & PID

- **WG1** : photodetector (SiPM, SPADs, PMT/MCP-PMT, Gas)
- **WG2** : particle ID (RICH/DIRC/TOP/TORCH/ToF)
- **WG3** : technologies (radiators, optical elements, readout, cooling, software)
- **WG4** : emerging technologies (novel materials and concepts...)

Draft - June

## DRD6 - Calorimeters

- **WG1** : full integrated sampling calorimeters
- **WG2** : liquified Noble Gas calorimeters
- **WG3** : optical calorimeters
- **WG4** : transversal activities

Draft - June

## DRD7 - Electronics

- **WG1** : data density and power efficiency
- **WG2** : intelligence on the detector
- **WG3** : 4D and 5D techniques
- **WG4** : extreme environments
- **WG5** : backend systems and cots
- **WG6** : complex imaging ASICs and technologies

Now collecting expressions of interest  
September 2<sup>nd</sup> community workshop  
Final proposal - December

# 2<sup>nd</sup> ECFA Workshop on $e^+e^-$ H/EW/Top Factories

8

11 – 13 Oct 2023, Paestum (Salerno – Italy) <https://agenda.infn.it/event/34841/>

Expecting –pre-meetings and software tutorial on 10 Oct

Registration already open

Detector talks @ Parallel & Plenary sessions  
Submission of abstracts for parallel talks will open soon



Venue: Hotel Ariston

## SECOND • ECFA • WORKSHOP on $e^+e^-$ Higgs / Electroweak / Top Factories

11-13 October 2023  
Paestum / Salerno / Italy

### Topics:

- Physics potential of future Higgs and electroweak/top factories
- Required precision (experimental and theoretical)
- EFT (global) interpretation of Higgs factory measurements
- Reconstruction and simulation
- Software
- Detector R&D

Hosted by INFN Napoli, Università degli Studi di Napoli Federico II  
& Università degli Studi di Napoli Parthenope



# Workshop Program

13:30 → 15:00

TUESDAY, 30 MAY

## Introduction and requirements by future facilities

13:30

### Introduction

Speakers: Felix Sefkow (Deutsches Elektronen-Synchrotron (DE)), Giovanni Marchiori (APC, CNRS/IN2P3 and Université de Paris), Iglesias (CIEMAT - Centro de Investigaciones Energéticas Medioambientales y Tec. (ES))

13:45

### Requirements from future facilities : Experimental conditions

Speaker: Giovanni Marchiori (APC, CNRS/IN2P3 and Université de Paris)

14:15

### Requirements from future facilities: Physics drivers on vertexing and tracking (inner + muon)

Speaker: Manqi Ruan (Chinese Academy of Sciences (CN))

15:00 → 15:30

Coffee break

15:30 → 18:10

## Conceptual designs and related R&D challenges

15:30

### Conceptual designs and R&D challenges for vertex detectors and silicon trackers

Speaker: Dr Auguste Guillaume Besson (Centre National de la Recherche Scientifique (FR))

16:25

### Conceptual designs and R&D challenges for drift chambers

Speakers: Francesco Grancagnolo (INFN - Lecce), Dr Francesco Grancagnolo (Universita & INFN Lecce (IT))

17:05

### Conceptual designs and R&D challenges for TPCs

Speaker: Paul Colas (Université Paris-Saclay (FR))

09:00 → 11:00

WEDNESDAY, 31 MAY

## Conceptual designs and related R&D challenges, DRD status/plans

09:00

### Conceptual designs and R&D challenges for muon detectors

Speaker: Giulio Aielli (INFN e Universita Roma Tor Vergata (IT))

09:40

### DRD1 (gaseous detectors) status and plans

Speaker: Anna Colaleo (Universita e INFN, Bari (IT))

10:20

### DRD3 (solid state detectors) status and plans

Speaker: Eva Vilella Figueras (University of Liverpool (GB))

11:00 → 11:30

Coffee break

11:30 → 12:45

## DRD status/plans

11:30

### DRD7 (electronics) status and plans

Speaker: Jerome Baudot (IPHC - Strasbourg)

12:00

### DRD8 (mechanics) status and plans

12:30

### Closeout

# And... don't forget the dinner!!!

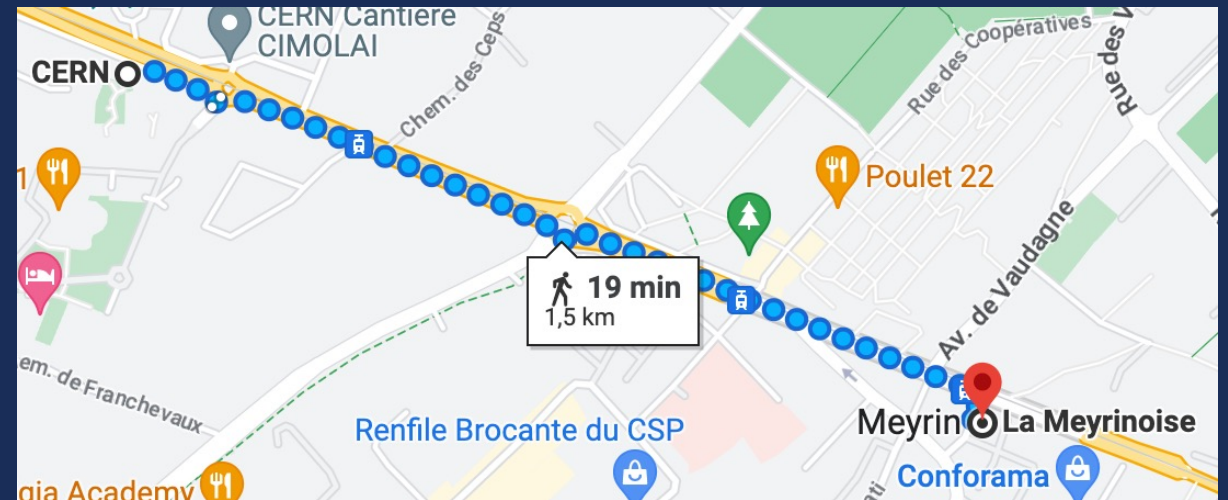
Today at 19:30

## Restaurant La Meyrinoise

Chemin Antoine Verchère, 1 Meyrin, Switzerland 1217



Walking



By Tram

18  
LINE



Schedule around 19:30h

19 02 11 16 26 37 55