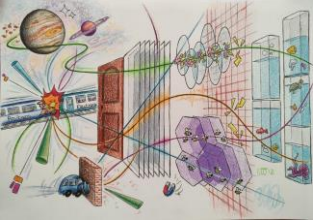


Goal of the DRD3 collaboration

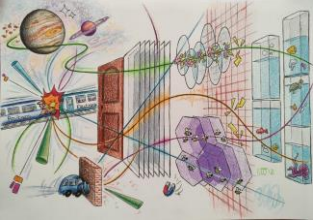
DRD3

The DRD3 collaboration has the dual purpose of pursuing the realization of the strategic developments outlined by the Task Force 3 (TF3) in the ECFA roadmap [1] and promoting blue-sky R&D in the field of solid-state detectors.

Presently, the DRD3 proto-collaboration comprises about 100 groups, 75% from Europe

DRDT 3.1 **CMOS sensors**	**DRDT 3.2** **Sensors for 4D-tracking**
DRDT 3.3 **Sensors for extreme fluences**	**DRDT 3.4** **A demonstrator of 3D-integration**

Table 1: The four strategic DRDTs of DRD3



DRD3 Timeline

DRD3

Q4-2022/Q1-2023

- Formation of the DRD3 proposal team
- Collection of interest from the institutes
- Preparation of the workshop and shaping the direction of RD.

Q2-2023

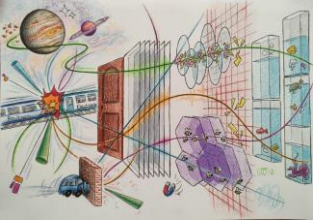
- Writing the scientific proposal (~20 pages) that includes conclusions/feedback from the workshop and questionnaires
- **Second questionnaire to collect the interest of the participant in specific topics**

Q3-2023

- Analysis of the questionnaires
- Submission of the proposal:
- **DRDC review (scientific, milestones, feasibility, financials)**
- **DRDC not yet established, it might lead to delay**

Q4-2023

- Establishing continuation of existing RD50 projects and carrying resources.
- Follow the review revisions and upon green light from DRDC, CERN research board **approves the formation of the collaboration**



Future Steps - snakes and ladders

DRD3

Now

Finish the document

~2 weeks

Send the document along with the second questionnaire

~2 months

Final version of the document

DRDC approval

DRD3 Collaboration Board, CB chair election

Selection of candidate Spokespersons

2024

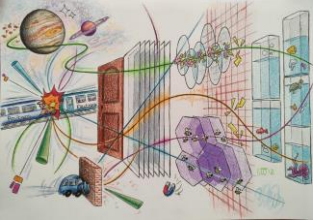
DRD3 first meeting and Spokespersons election

2024

Election of Working Group leaders

2024

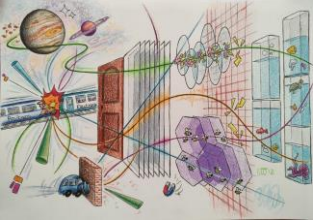
Preparation of the MOU



DRD3 scientific structure: working groups

DRD3

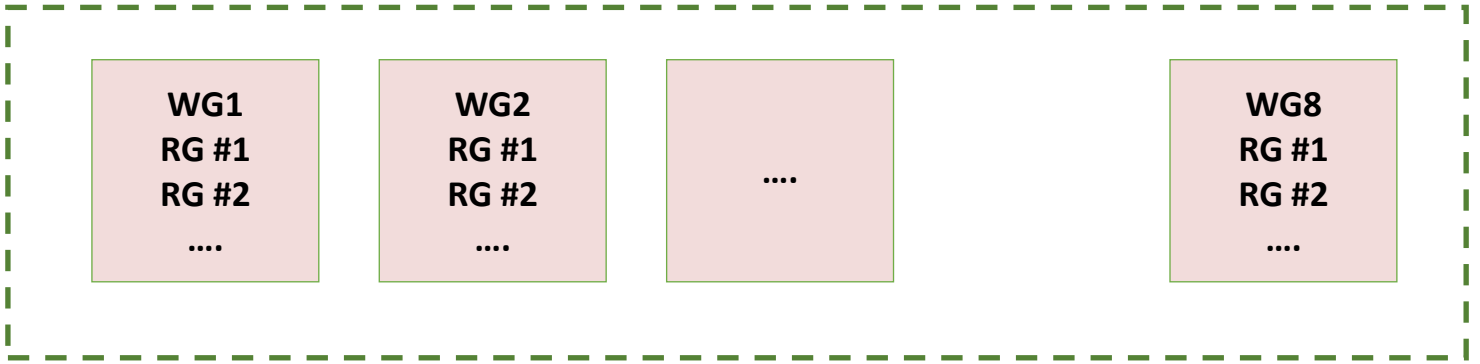
WG 1 Monolithic CMOS sensors	WG 2 Sensors for tracking and Calorimetry with space/time and/or energy resolution	WG 3 Radiation damage and ultra high fluences	WG 4 Simulations	WG 5 New Characterization Methods, Techniques and Infrastructures	WG 6 Non-silicon semiconductor and other material studies	WG 7 Interconnect and device Fabrication technologies	WG 8 Dissemination and outreach
• Investigate Monolithic Active Pixel Sensors (MAPS) than may achieve very high spatial • resolution and very low mass. • Understand radiation hardness limits of MAPS. • Investigate the use of State-of-the-art commercial CMOS in tracking and vertex detectors. • Explore the use of passive CMOS as a complement to standard sensors.	• Develop ultra-fast detectors, enabling 4D tracking to deal with multiple interactions occurring within a bunch crossing (pile-up). • Understand the ultimate limit of precision timing in sensors, with and without internal multiplication. • Investigate new semiconductor and technology processes with faster signal development and low noise readout properties.	• Undestrand microscopic properties of detectors at extreme fluences. • Understand the limit of semiconductors at high fluences. • Study innovative materials • Charachterization of defects in semiconductors	• Verify and prepare the TCAD tools for use in various DRDTs • Improve and develop MC tools • Develop and implement new radiation hardness models and device parametrizations • Design common tools for data processing (digitization, electronics)	• Explore the use of new techniques to characterize detectors • Develop common DAQ tools • Irradiation facilities, including extreme fluences. • Test beams • IBIC studies	• Understand the detailes of the damage of the WBG semicondcuntos • Develop methods for characterization and fabrication of detectors from innovative materials	• Advanced Integration Technologies. • Process capabilities for different wafer sizes and sensor material types. • Alternative bonding technologies for ultra-thin wafers. • Reduction of interconnection pitches	• Participation in congress • Explore other applications (Nuclear physics, Astrophysics, Fusion) • Contact industrial partners. • Participation in EU or similar funding projects • Website

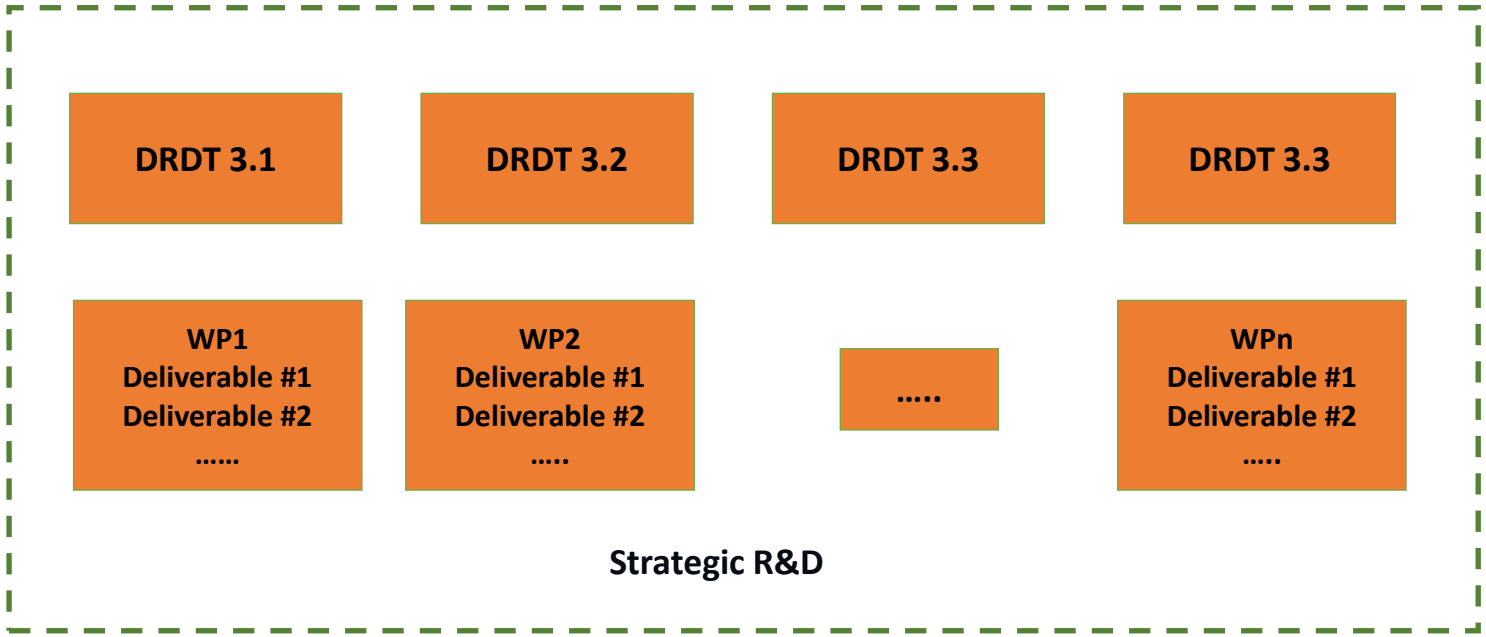


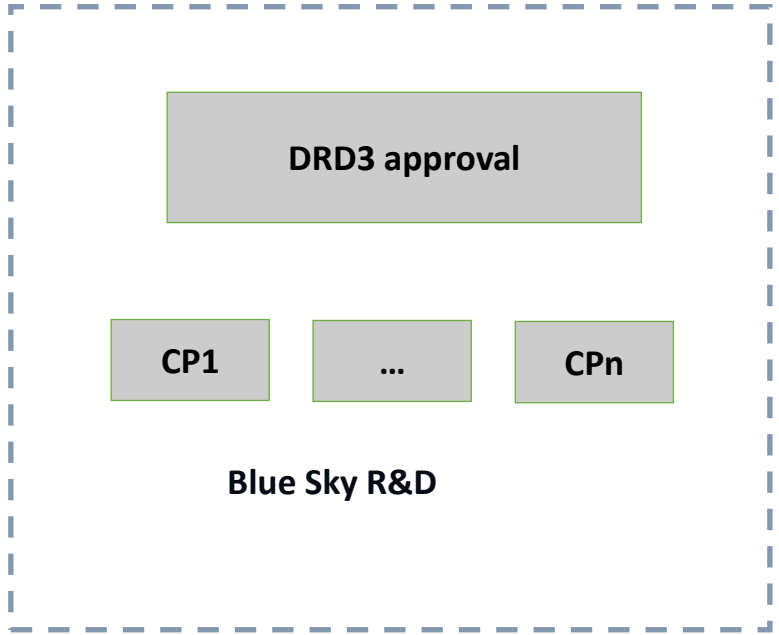
DRD3 general structure

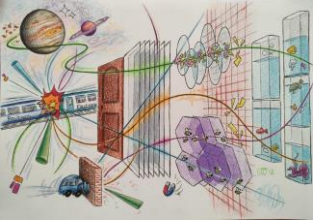
DRD3

WG = working groups
RG = research goals
WP = work package
CP = common project









Document

DRD3 - Solid State Detectors
- Research Proposal -

DRD3 Proposal Team

June 21, 2023

Contents

1 Scope of the DRD3 collaboration **3**
1.1 The DRD3 working group structure . . . 3
1.2 Strategic R&D . . . 3
1.3 Common R&D . . . 4

2 WG1: Monolithic CMOS sensors **6**
2.1 Research themes . . . 6
2.2 Technology processes . . . 7

3 WG2: Sensors for tracking and calorimetry **13**
3.1 Spatial and temporal resolutions at extreme radiation levels . . . 13
3.2 Spatial and temporal resolutions at low radiation levels and low material and power budgets . . . 13

4 WG3: Radiation damage and extreme fluence operation **15**
4.1 Radiation damage and hardening studies at material level . . . 15
4.2 Radiation damage and hardening studies at device and system levels . . . 16

5 WG4: Simulation **18**
5.1 Activities . . . 18
5.2 Milestones and resources . . . 18

6 WG5: Techniques, infrastructures and facilities for sensors characterisation **20**
6.1 Working group implementation . . . 20
6.2 Milestones and resources . . . 21

7 WG6: Wide bandgap and innovative sensor materials **22**
7.1 Diamond . . . 22
7.2 Wide-band semiconductor . . . 23

It exists, but it is not ready for distribution yet