

DRD3 Proposal: Solid State Detectors

DRD3

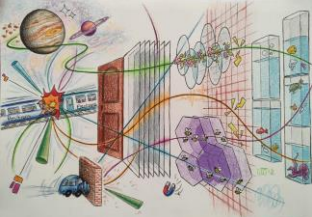
From TF3.....



..... to DRD3

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⁷ Centro Nacional de Microelectronica IMB-CNM-CSIC (Barcelona), ⁸ Instituto de Fisica de Cantabria (Santander)



For the RD50

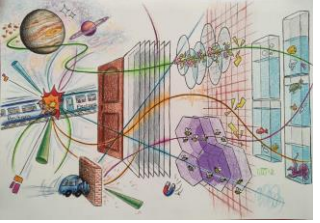
DRD3

Status of the document

- **The first version** was distributed to the whole community.
- **The second version includes the suggestions from the DRDC**; it has not been distributed due to time constraints. The changes were mostly organizational, with the restructuring of the workpackages and milestones. No major scientific changes.
- **The final version will be circulated** after DRDC approval,
- **DRDC meeting on Monday 4th/12/2023**

- Q4 2022
 - Identify **key players and stakeholders** from the wider international community.
 - Where current relevant detector R&D collaborations exist, their **managements** need to be fully involved from the beginning of this process.
 - **DRD proposal teams**, to lead the preparation of the more detailed DRD proposals in each area, should be identified as a result of this process.
 - Q1 2023:
 - Outcomes of **community workshops** are collated and each DRD proposal team calls for expressions of interest from institutes.
 - DRDC **mandate formally defined and agreed with the CERN Management**; DRDC membership appointments begin; EDP mandate plus membership updated to reflect additional roles .
 - Q2 2023:
 - **Develop the new DRD proposals** based of the detector roadmap and community interest in participation, and ramp up to a steady state in 2026.
 - "Strategic R&D" proposals (**materials and total FTE**). The primary aim is to create a dedicated funding line for Strategic R&D.
 - Mechanisms **agreed with funding agencies** for structuring country-specific DRD collaboration funding requests.
 - Q3 2023
 - **The DRD proposal teams submit full DRD proposals** , indicating estimates of the resources needed (including both those requested and those that are already available, as well as details of who covers what, i.e. pledges by institutes/ funding agencies).
 - Q4 2023:
 - Following the review and revision (if required) of proposals, the DRDC recommends the formal establishment of the DRD collaborations.
 - Formal **approval** is given by the CERN Research Board
 - 2024
 - **Collection of MoU signatures.** The areas of interest per institute and the expected support for the long-term commitments involved should be specified in the MoUs.
- Formal start of the DRD collaborations (01/01/2024).**
(-> End of actual RD's)

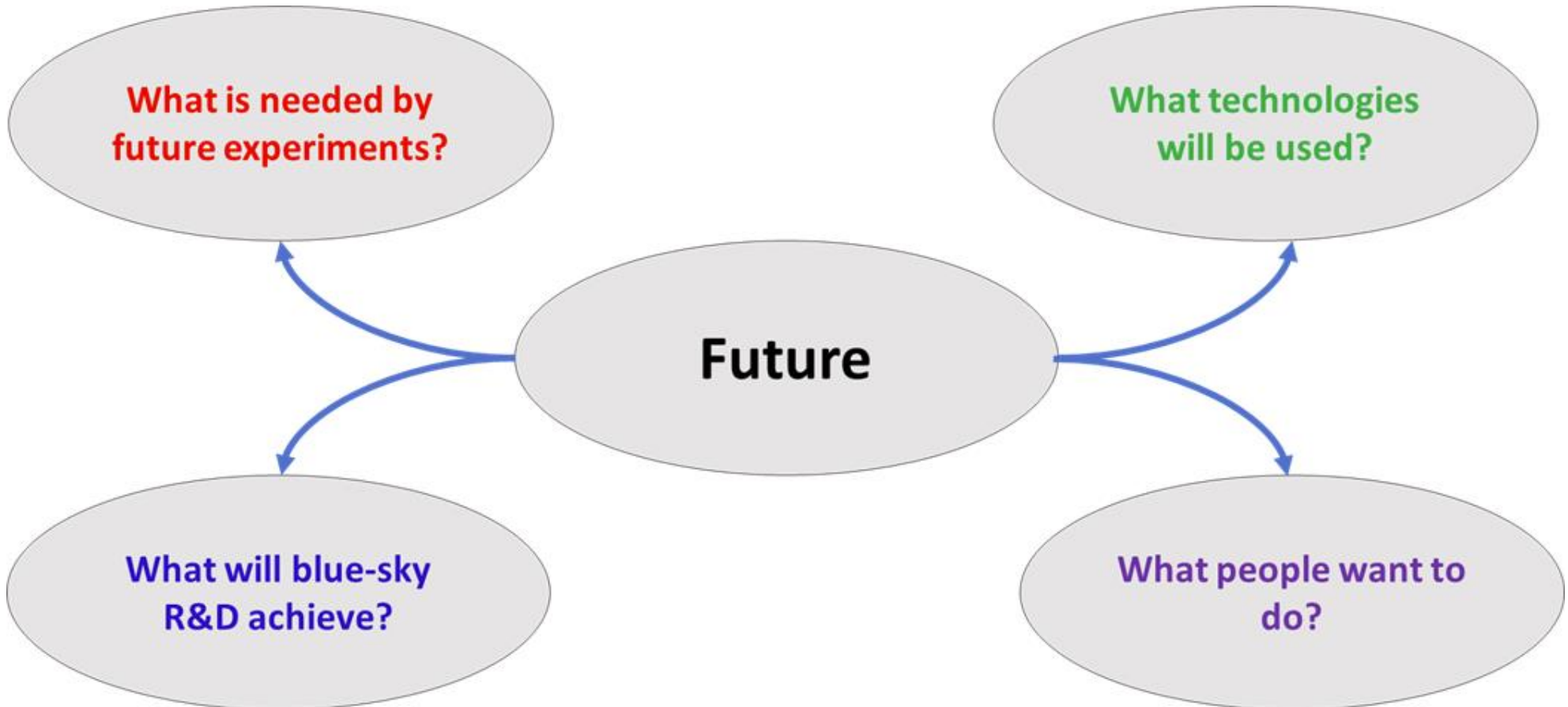
Detector R&D Committee (DRDC):<https://committees.web.cern.ch/drdc>

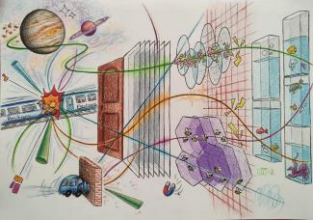


Objectives of the collaboration

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 road map and **promoting blue-sky R&D** in the field of solid-state detectors.

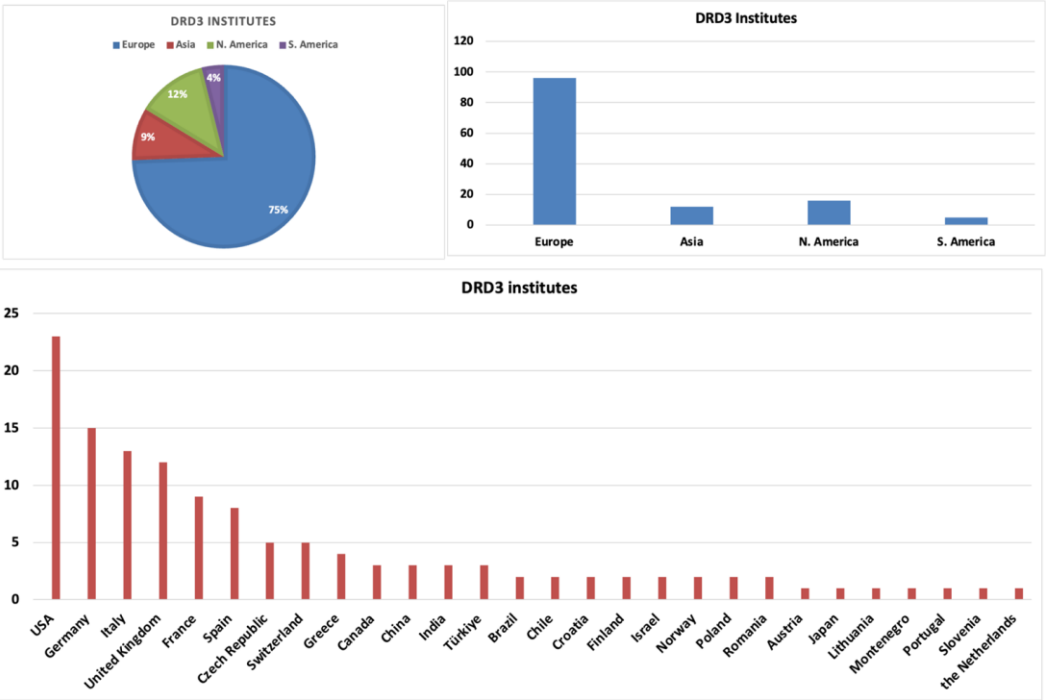
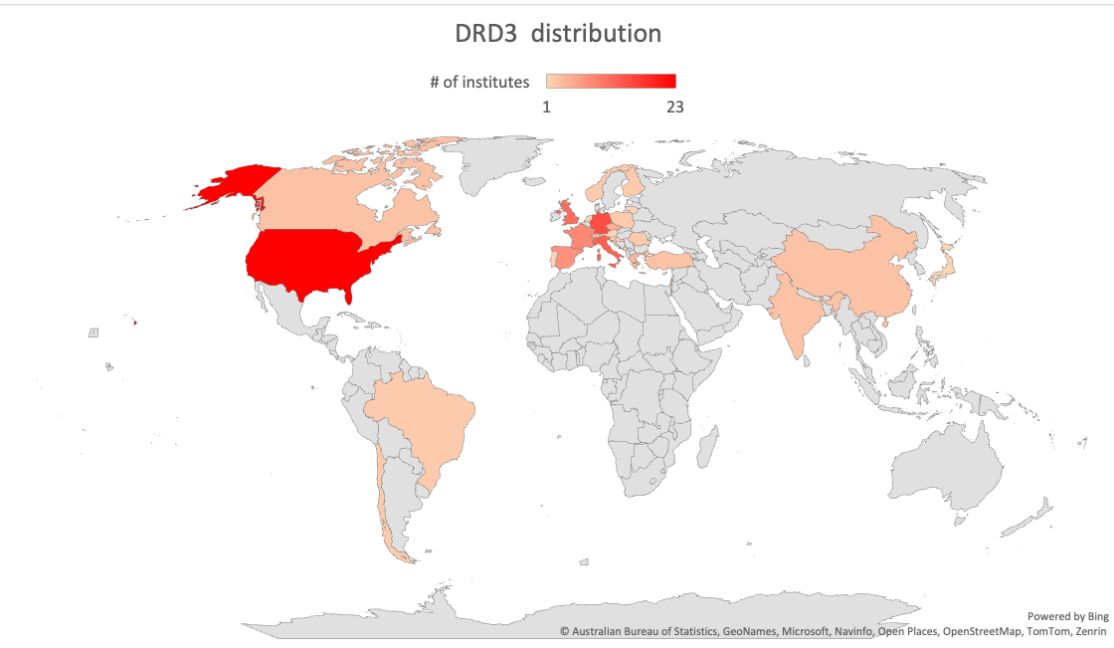




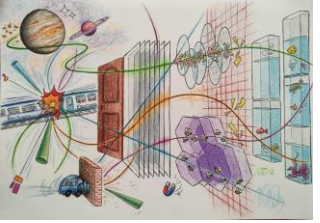
The DRD3 geographical distribution

DRD3

number of institutes = 129 (x2 RD50)



*9 institutes from USA did not send the questionnaire but are included in the list



Workforce

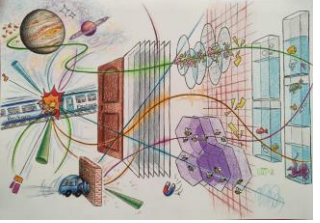
Number of researchers = 900 (x2 Rd50)

Number of FTE= 170 (permanent researchers), 156 (non-permanent)

Strategic non permanent= 171 (non-permanent)

Workpackages	FTE/y		
	Permanent	Non-permanent	Strategic non-permanent
WP1	65	62.6	69.4
WP2	42.2	41.5	39.2
WP3	42.6	37	42.5
WP4*	20.5	15.2	19.9
Total	170	156	171

*Mechanics and cooling were added at a late stage and no included in the questionnaire

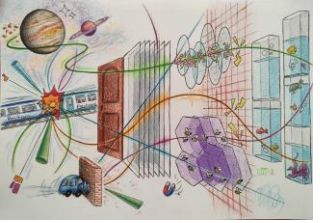


Total budget: existing and requested

DRD3

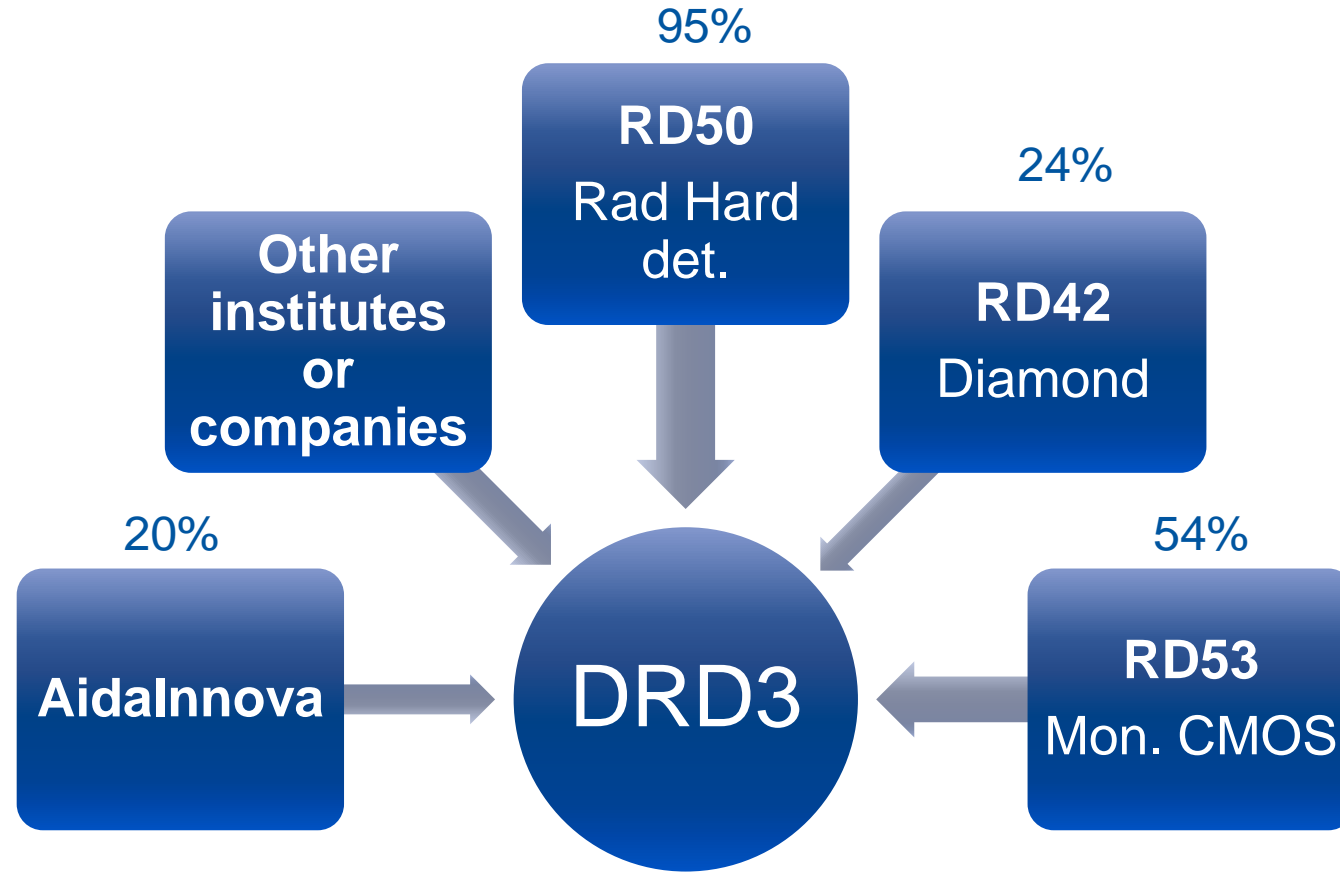
Workpackages	Budget [kCHF/y]	
	Existing	Requested
WP1	2013	3427.4
WP2	1196.5	1542.5
WP3	1193.6	1921.8
WP4	667.1	1006.9
Total	5070.2	7898.6
Total/institute*	47.5	65.8

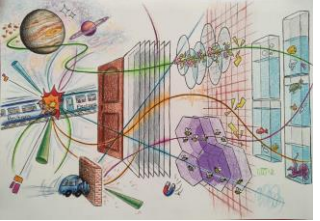
*Only considered 120 institutes that send the questionnaire



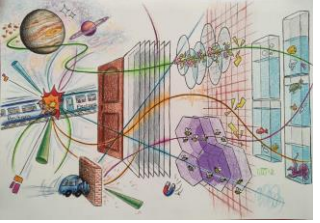
Who is composing DRD3?

DRD3



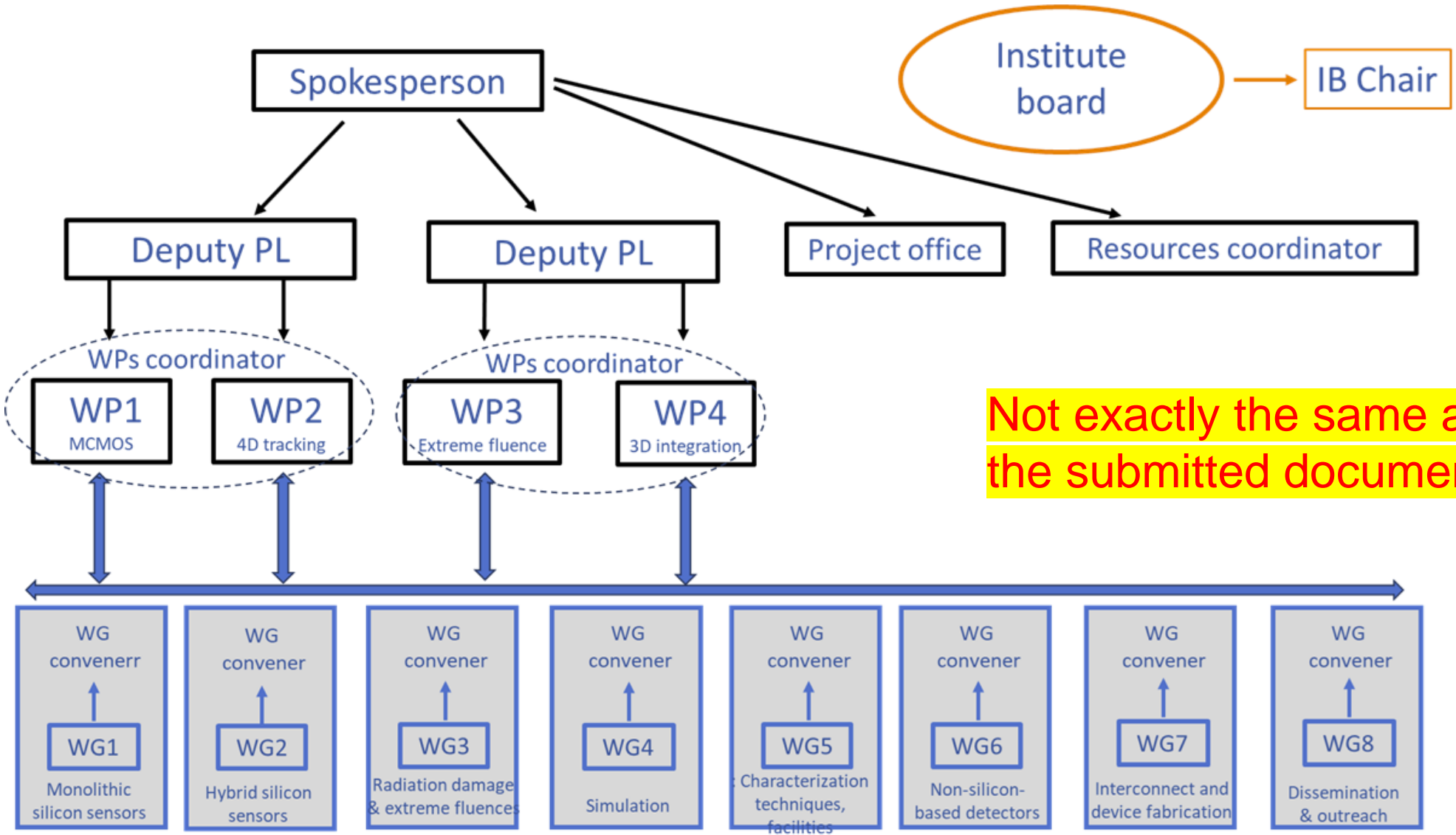


- **DRD3 proposal team will call for nominations for the CB chair**, select ~5 candidates, and organize for a collaboration vote by **6.1.2024**. Vote by multiple round majority system, using one of the standard ones, by the end of January at the first organizational kickoff workshop.
- **The main body deciding on all DRD3 matters is the CB**, presided by **CB chair**, who will nominate the deputy chair.
- **The CB chair will form a search committee for spokesperson**. The candidates should present the program (including WP/WG leaders) at first full/scientific DRD3 workshop in June 2024.
- **The CB elects the spokesperson and heads of all committees** (speakers, DRD sync....). The CB chair is responsible to form search committees for all elected positions. The CB is responsible for endorsement of all appointed positions.
- **The spokesperson should nominate WG conveners** which will be endorsed by CB.
- The DRD3 proposal team suggests for the spokesperson to have **two deputies**, coordinating two WPs each.

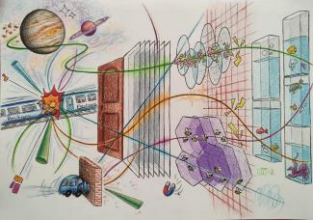


The organigramme

DRD3



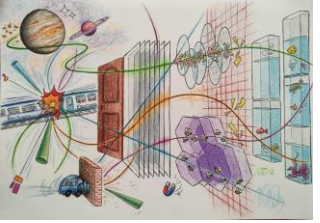
Not exactly the same as in the submitted document!



Timeline

DRD3

Request of nomination for the CB chair	31/12/23						
Select 4-5 candidates for the CB chair		06/01/24					
First online workshop, only for the CB			22/01/24				
Election of the CB chair			22/01/24				
CB chair select comitee for Spokesperson				15/02/24			
Call for Spokesperson					Mar-24		
Deadline for Spokesperson nomination						May-2024	
First in person workshop at CERN							Mid-june-2024
Election of the Spokesperson							Mid-june-2024

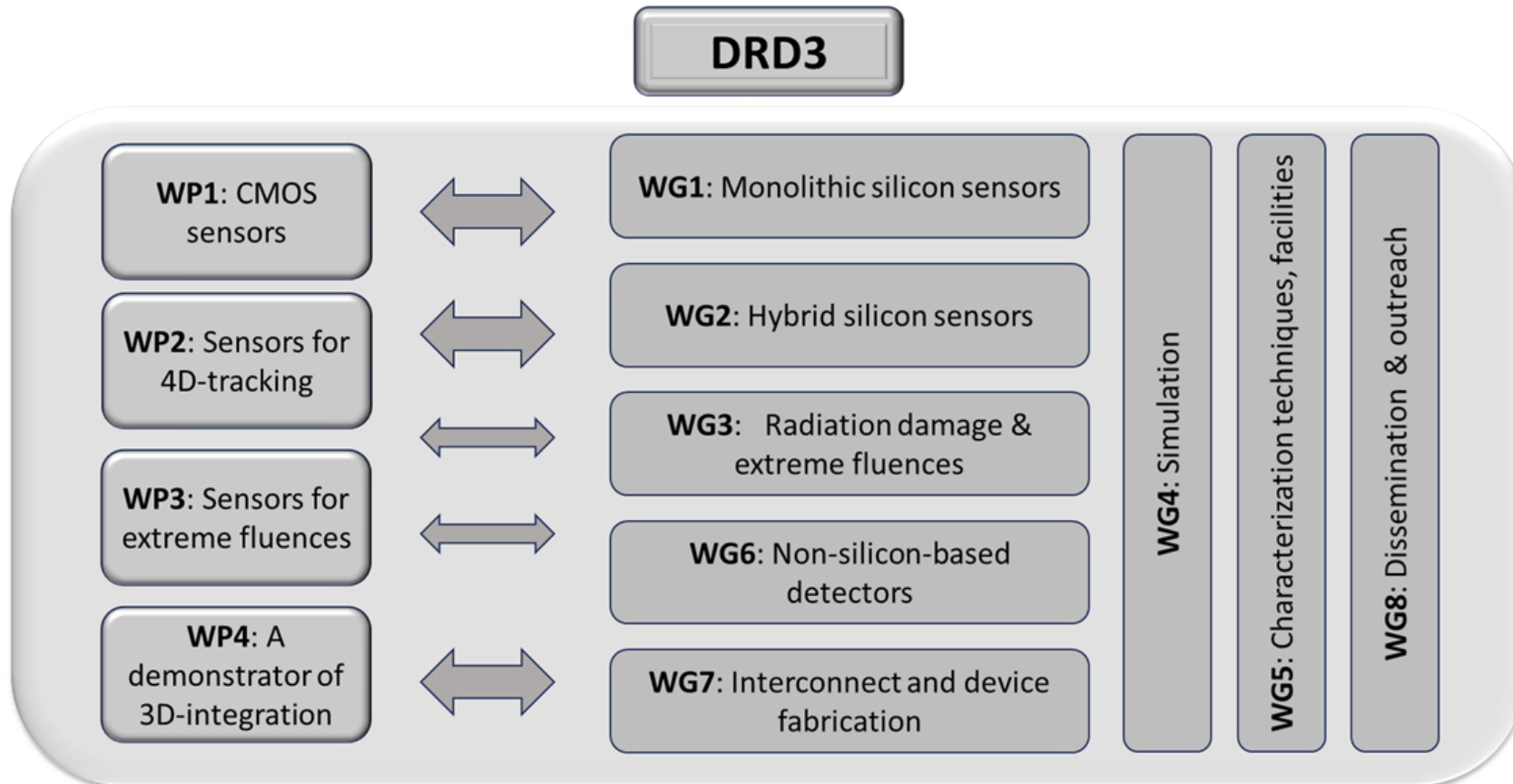


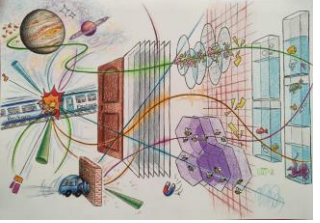
DRD3 Scientific Organization

DRD3

The **Work Packages (from the Detector R&D Themes (DRDT))** address the need of the strategic R&D objectives.

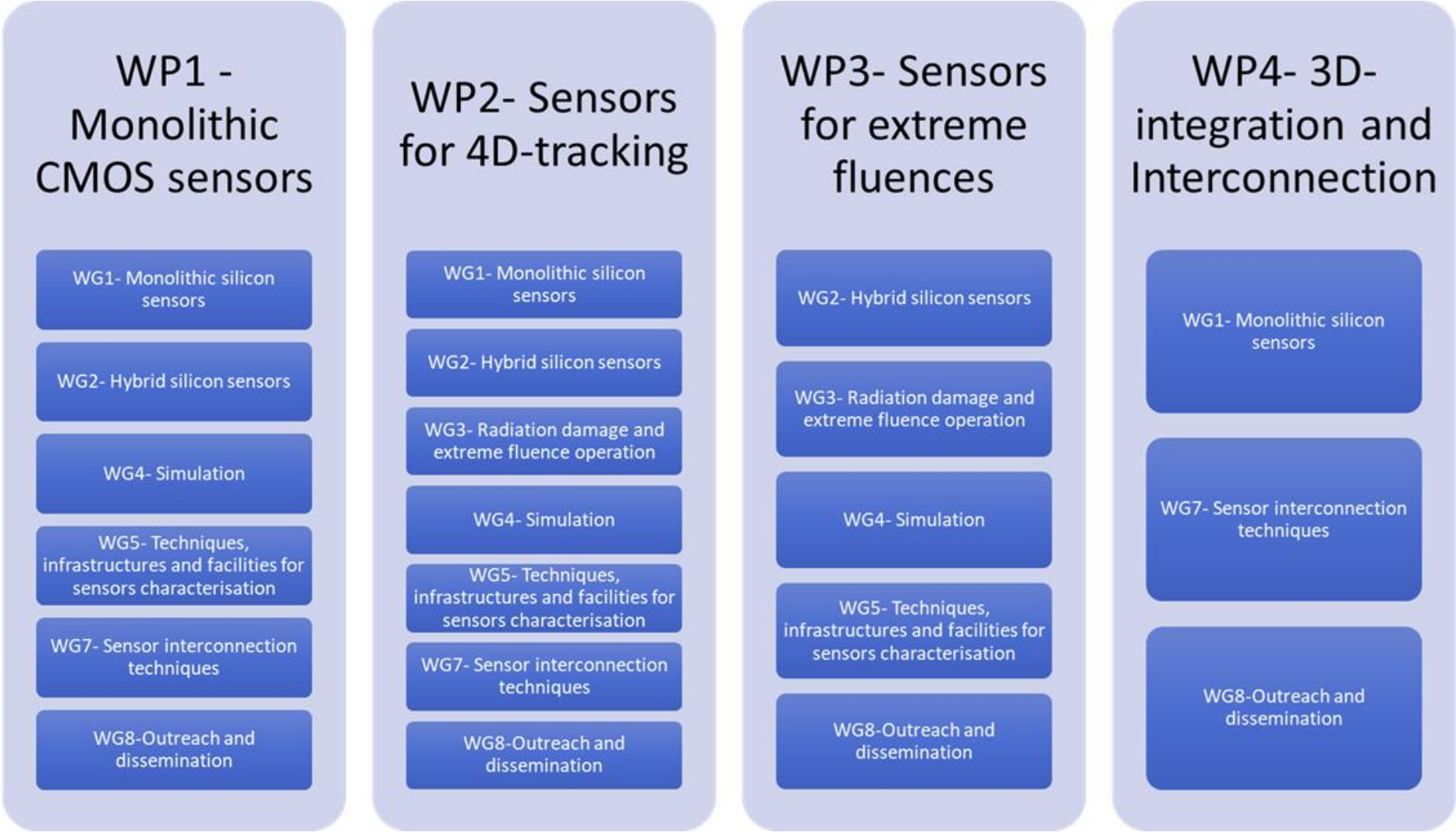
The **Working Groups** link together activities broadly focused on the same scientific goals

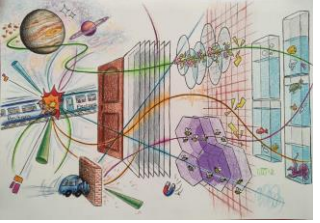




Relation among WPs and WGs

DRD3





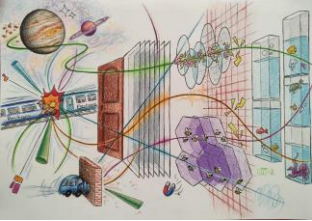
For each WP, tasks are defined

WP3: sensors for extreme fluences

Example: the first tasks of WP3

Full list in the document

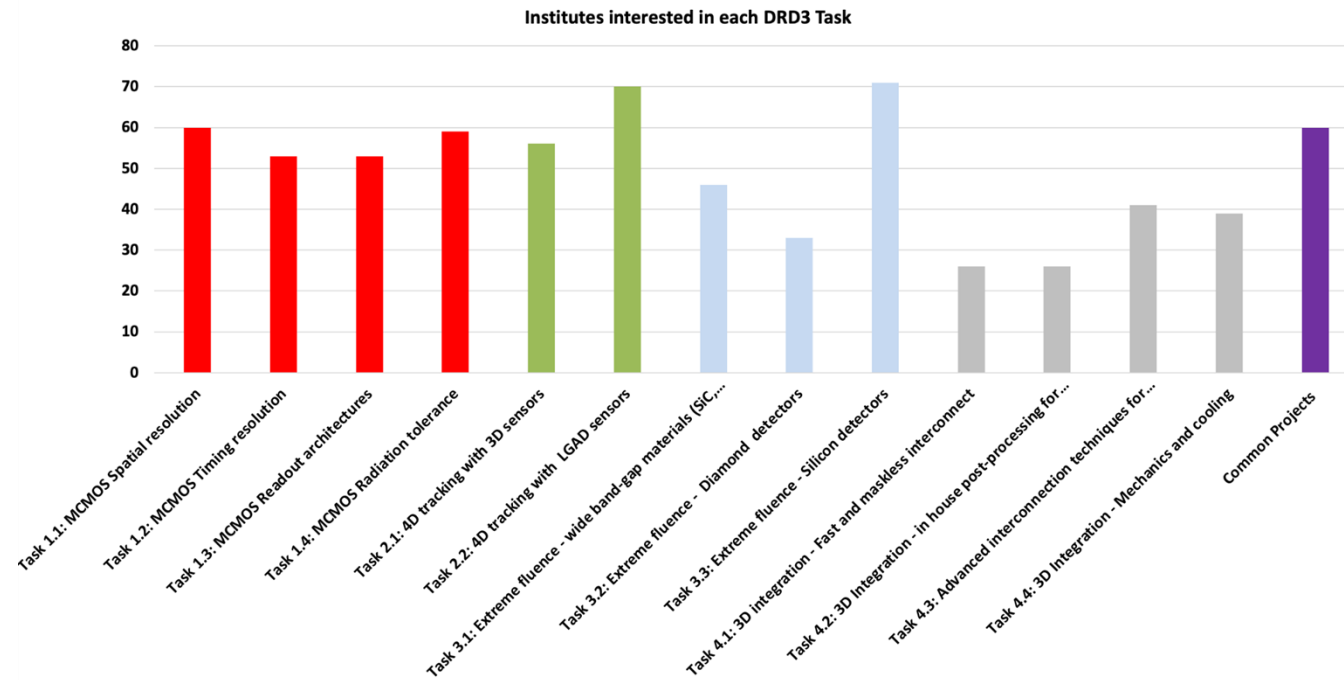
WP	Task	MS or D	Description	2024	2025	2026	2027-2029	> 2030
3	3.2.	MS3.1	Evaluate the possibility of achieving CVD diamond wafers with CCD > 500 μm and variation < 2%				x	
3	3.2.	MS3.2	Study radiation hardness and fast timing (< 30 ps) of diamond detectors at $1 \cdot 10^{16} \text{ n}_{\text{eq}}/\text{cm}^2$ (2026), $0.5 \cdot 10^{17} \text{ n}_{\text{eq}}/\text{cm}^2$ (2029), $1 \cdot 10^{17} \text{ n}_{\text{eq}}/\text{cm}^2$ (>2030) in planar and 3D geometries			x	x	x
3	3.1.	MS3.3	Fabrication of SiC sensors with different geometries and epitaxial thicknesses (50 μm in 2024 and >100 μm in 2030).	x				x
3	3.1	MS3.4	Understanding timing performance and validate simulation models of SiC detectors, before irradiation (2024) and at $1 \cdot 10^{15} \text{ n}_{\text{eq}}/\text{cm}^2$ (2030).			x		x
3	2.2, 3.1	MS3.5	SiC-LGAD (gain layer) proof of principle, simulation and first fabrication of devices with small areas (< 1 cm^2 in 2026) and in large areas (5 cm^2 after 2030).			x		x
3	3.1	MS3.6	Assess GaN devices as high-rate, high timing precision devices			x		

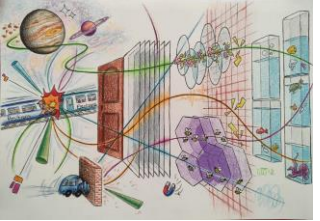


Interest of institutes

992 **15 Annex - III: Involvement of each institution in the work**
 993 **packages**

Workpackage	3.1 Monolithic CMOS sensors				3.2 4D Tracking		3.3 Extreme Fluence			3.4 Intercon.			
	Spatial resolution	Temporal resolution	Read-out architecture	Radiation Tolerance	3D sensors	LGAD	Wide band-gap materials	Diamond	Silicon	maskless interconnect	in house post-processing	advanced interconnect	mechanics and cooling
Institute													
Aerospace Science and Technology Department, National and Kapodistrian University of Athens	X	X	X	X						X			
AGH University of Krakow, Faculty of Physics and Applied Computer Science						X		X					
Aix-Marseille University			X			X	X				X		X
Ankara University													
Argonne National Laboratory		X	X			X					X	X	
Bolu Abant Izzet Baysal University													
Brookhaven National Laboratory	X	X	X	X	X	X		X			X		X
Brown University						X	X	X					
Brunel University London	X			X			X	X					
Caltech													
Carleton University - National Research Council	X		X	X			X	X					
Cavendish Laboratory, University of Cambridge	X	X	X	X				X					
CEA-Irfu	X	X	X	X				X					





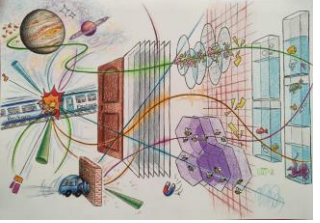
The first organizational kick-off meeting formalizing the collaboration will take place in **January** and it will be on-line only.

The first full scientific meeting will take place in **June**, it will be in person at CERN.

Regular DRD3 workshops will take place twice a year (spring/autumn) for a full week with plenary contributions only. One will be at CERN and the other outside.

The DRD3 activities will be published in a webpage (following agreed upon security concerns and personal data protection)

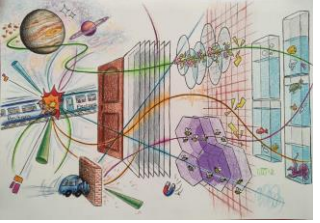
The scientific output of DRD3 shall be published open access.



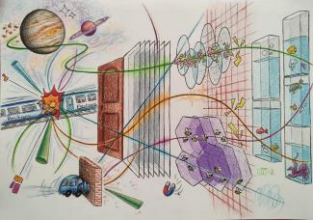
How the WGs & WPs are funded

DRD3

- **The DRD3 collaboration will be regulated by a light-MoU (not resource-loaded).**
- **Institutes not signing the light MoU that contribute to the common fund are allowed to take part in DRD3 collaboration.**
- **Each institute, regardless of the light-MoU signature, should follow the rules of collaboration.**
- **Each WP will be regulated by a resource-loaded MoU annex.** The resources committed to the WP can be labour/material/service; this will be regulated by the agreement between the WP participants.
- **The WPs can accept the participation of institutions that do not sign the corresponding MoU annex,** provided that the non-signing institutions make a clear contribution to the WP.
- **Participation to the WGs does not require the signature of a resource-loaded MoU**
- **The only funding regulated by the WGs are those of the common projects.** The goals of the common project might directly support the realization of the WPs goals.



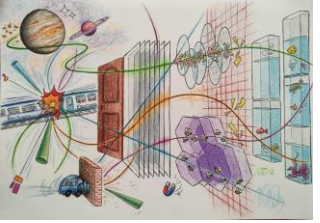
- **Each institution should contribute to the DRD3 R&D common funds.**
- **The common projects funding rules are:**
 - At least **3** participation institutions
 - Funding is limited to material & service cost
 - The DRD3 participation is limited to **50%** of the total cost
 - The common projects are **reviewed, approved and followed** by a nominated committee (normally the WG conveners)
- In addition to finance the common projects, **the R&D common funds can be used for activities such as:**
 - Support to young students with **travel scholarships** and accommodation for internship in other laboratories
 - Support participation to **conferences**
 - Support interchange with **other fields** of applications
- The R&D common funds **cannot cover administrative cost** (secretariat, services, etc)



To be approved by the RD50 CB

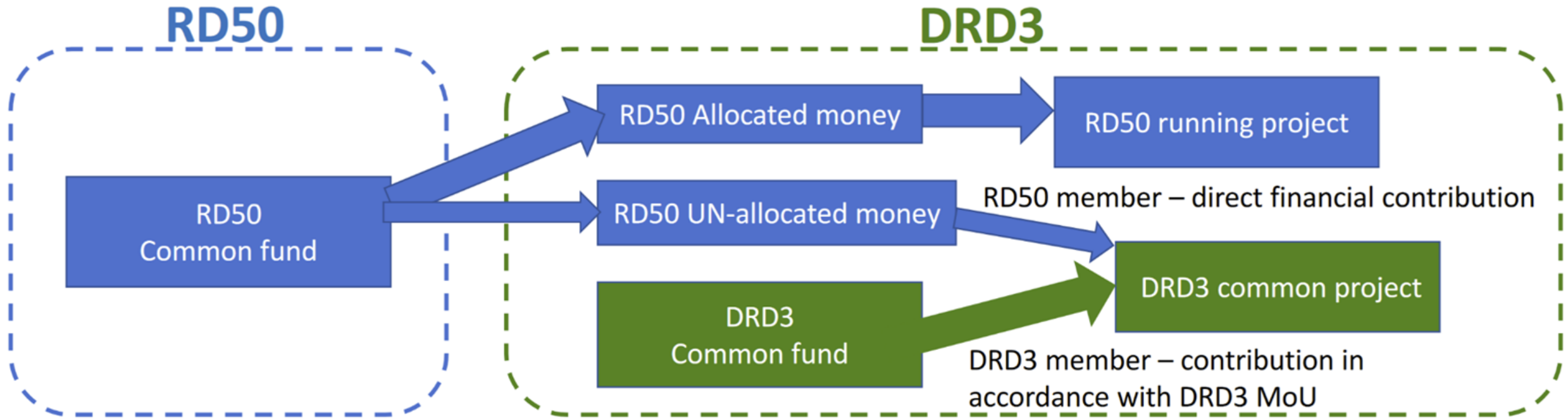
RD50 funds within DRD3

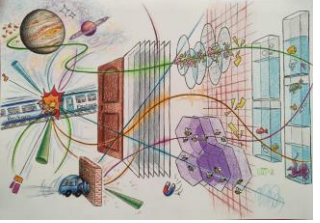
- **RD50 running projects will continue** to get funded from the funds transferred to DRD3 and will stay under control of RD50 CB (as the large part of the RD50 is in the DRD3 this will form a subset). The running RD50 projects can spend the resources in **three years** after the foreseen duration of the project. This period can be prolonged by RD50 CB when activities related to the project are still ongoing. Any unspent money from the project will be treated as unallocated in the RD50 common fund.
- The **unallocated** resources in the RD50 common fund will be transferred to the DRD3 common fund. These RD50 resources will be available to the future DRD3 projects for those groups within the DRD3 project which were also members of RD50.
- **DRD3 projects with participation of the RD50 groups** will be allowed to **include** RD50 fund in the financial scheme of the DRD3 project in accordance to RD50 agreed scheme. Those resources will count as a direct financial contribution from the participating institute.



RD50 legacy common funds (2)

DRD3



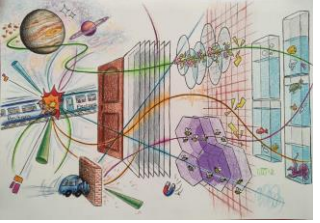


- **DRD4:** SiPM, possible collaboration may arise from understanding mechanism to mitigate the radiation damage mechanism in the gain layer.
- **DRD5:** 2D materials, very early stage. Future interaction may be possible.
- **DRD6:** interconnecting technologies used for calorimeters with silicon sensitive layers for the readout, such as silicon pixel high granularity calorimeter.
- **DRD7:** the development and characterization of devices are aimed to the sensors part will go to DRD3, while all developments more electronics oriented such as tier-to-tier interconnections for example are clearly more suitable to belong to DRD7. Regular meeting will be organized inside and outside the workshop.

First meeting with the Executive board of the Solid State and Radiation Damage of the **CPAD**

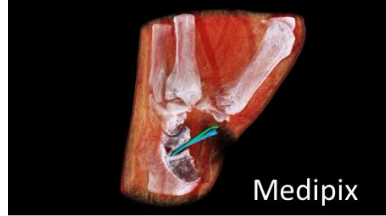
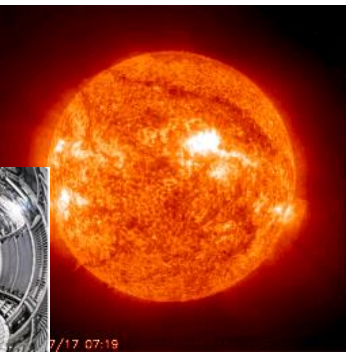
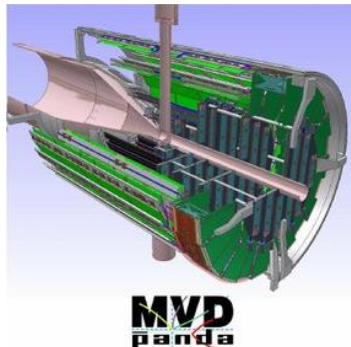
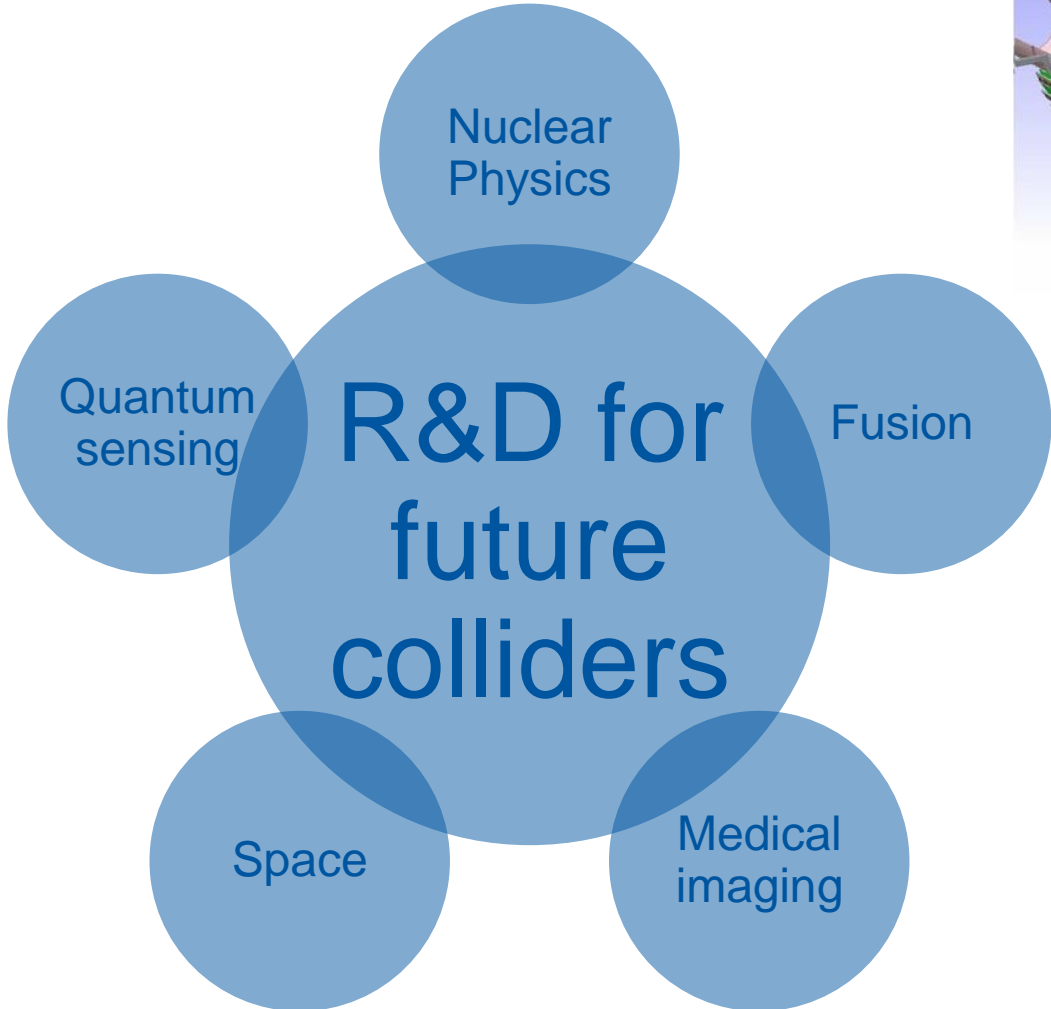
For each DRD a contact person will be nominated by the collaboration:

at the moment is ***Eva Villena*** is the contact for DRD7 and ***Giovanni Calderini*** for DRD6.



Synergies with other fields (WG8)

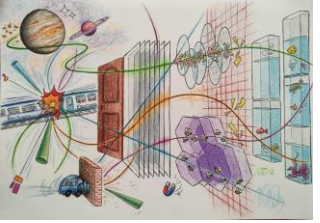
DRD3



Radiotherapy

Thank you for your attention

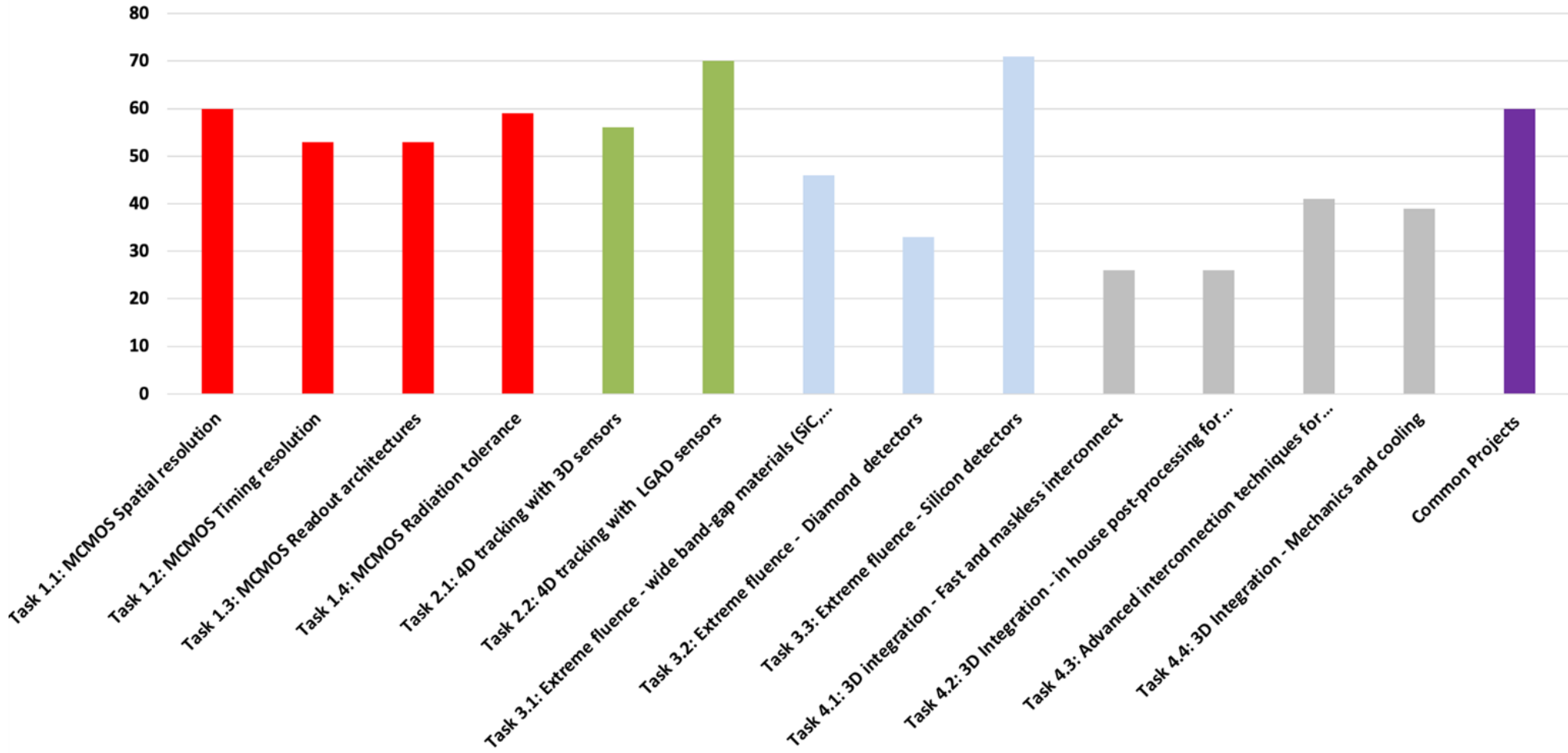


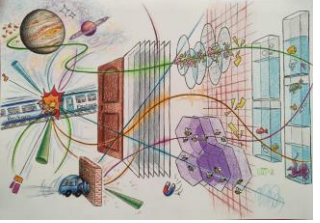


Work package

DRD3

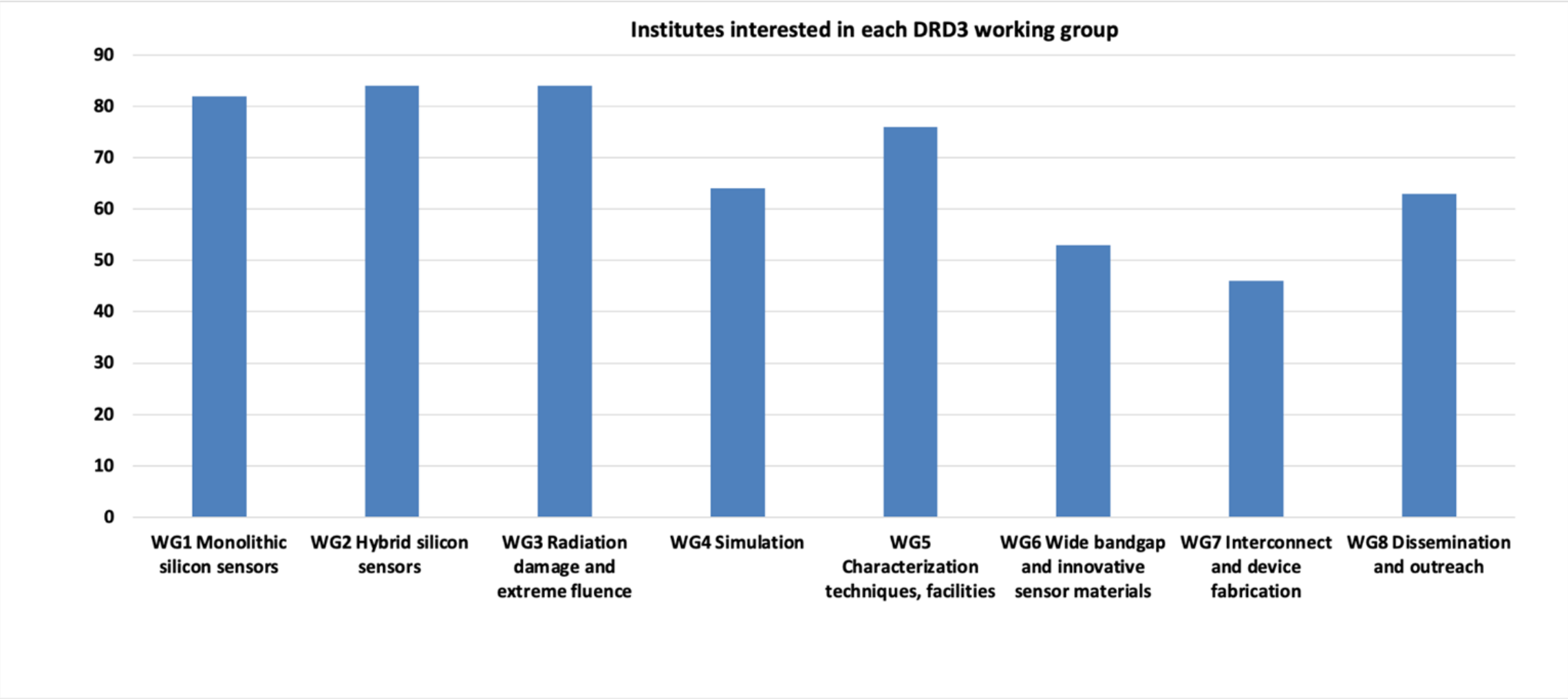
Institutes interested in each DRD3 Task

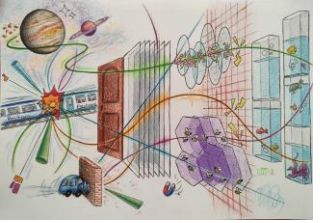




Working groups

DRD3





WG, WP and Tasks

DRD3

		Working Groups								
		Tasks	WG1- Monolithic silicon sensors	WG2- Hybrid silicon sensors	WG3- Radiation damage and extreme fluence operation	WG4- Simulation	WG5- Techniques, infrastructures and facilities for sensors characterisation	WG6- Wide bandgap and innovative sensor materials	WG7- Sensor interconnection techniques	WG8-Outreach and dissemination
Working Packages	WP1 - CMOS sensors	T1.1 DMAPS: spatial resolution								
		T1.2 DMAPS timing resolution								
		T1.3 DMAPS: read-out								
		T1.4 DMAPS: radiation tolerance								
	WP2- Sensors for 4D-tracking	T2.1 3D sensors								
		T2.2 LGAD								
	WP3- Sensors for extreme fluences	T3.1 wide band-gap materials (SiC, GaN)								
		T3.2 diamond based detectors								
		T3.3 Extreme fluence: silicon detectors								
	WP4- 3D-integration and Interconnection	T4.1 Integration: fast and maskless inter connect								
		T4.2 3D In house post-processing for hybridization								
		T4.3 Advanced interconnection techniques for detectors								
		T4.4 Mechanics and cooling								