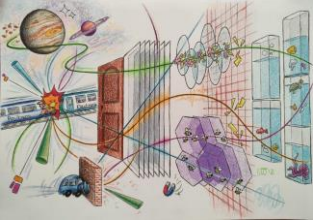


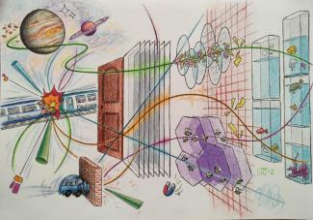
Discussion on CMOS projects

J. Bardot (IPHC – Strasbourg), H. Pernegger (CERN)
and E. Vilella (Uni. Liverpool)



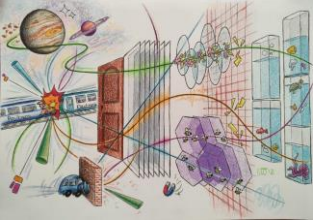
Project proposals

Contact	Group	Project title	Technology	RG	Target application
S. Spannagel	DESY	Octopus - Fine-pitch CMOS pixel sensors with precision timing for vertex detectors at future Lepton-Collider experiments	TPSCo 65 nm	RG1, RG3	FCCEe, vertex
D. Contardo	IP2I	IP2I-TPSCo 65nm CMOS with high precision timing	TPSCo 65 nm	RG2, RG3	FCCEe, tracker, pre-shower
H. Augustin	Heidelberg	Evaluation of new process option(s) for large fill-factor HVCMOS sensors (Xfab) and Internal Gain Layer for HVCMOS sensors	Xfab/IHP SiGe	RG2	PSI, tracker
P. Schwemling	CEA-IRFU	Cactus: Large electrode designs for timing with and without intrinsic amplification	LF 150 nm	RG2	Tracker
H. Pernegger	CERN	CASSIA - CMOS Active SenSor with Internal Amplification	TJ 180 nm	RG2	Generic R&D
A. Apresyan	FermiLab	Development of Ultra Fast-Time Low Mass Tracking Detectors	US vendor	RG2, RG3	Tracker
C Vernieri	SLAC	MAPS developments at SLAC	TPSCo 65 nm	RG3	FCCEe, tracker, calo
Y. Li	IHEP	Development of MAPS using 55nm HVCMOS process for future tracking detectors	SMIC 55 nm	RG3, RG4	HL-LHC, FCCEe, tracker
C. Solans	CERN	Radiation hard read-out architectures	TJ 180 nm	RG3, RG4	HL-LHC, tracker
J. Baudot	IPHC - Strasbourg	Versatile CMOS pixel sensor suited for future trackers	TPSCo 65 nm	RG3 (RG4)	Tracker
A. Dierlamm	KIT	Monolithic sensors, fast electronics, and silicon photonics for future tracking detectors	IHP SiGe	RG3 (RG4)	FCCEe, tracker
E. Vilella	Liverpool	Thin monolithic High Voltage CMOS sensors with excellent radiation tolerance	LF 150 nm	RG4	HL-LHC, tracker
J. Weingarten	Dortmund	Monolithic strip sensors for large area detectors	LF 150 nm	RG5	Tracker
A. Andreazza	Milano	HV-CMOS Multi-chip integration for large area silicon trackers	180 nm/150 nm	RG5	FCCEe, tracker
X. Shi	CAS	CMOS Strip Chip for Future Tracking Detector	CSMC 180 nm	RG5	CEPC, tracker
A. Andreazza	Milano	Arcadia	LF 110 nm		



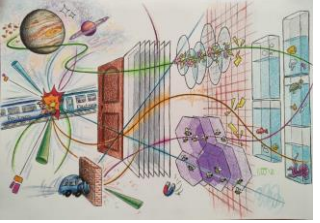
General observations

- Three technologies are well represented (TPSCo65, LF15A, TJ180), there are a few others which sound quite healthy;
 - We expect good synergy between these projects, in particular for TPSCo65, since projects in this techno will share the same submission(s) organised within DRD7;
- Most projects are about trackers (a couple deal about vertex detectors);
- All research goals defined in the roadmap document and in the large table of the proposal are covered;

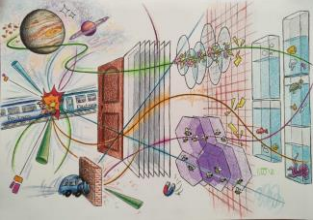


General observations

- We have projects at different levels of maturity, a few can go to the MOU annexes already;
- We have not checked—and will not check, as it is beyond our available time—that any groups who expressed interest in the WG1 activities in the initial DRD3 surveys are not left behind;
 - But we encourage all those who are not yet in a project and would like to, to contact us or the project contact.



Backup slides

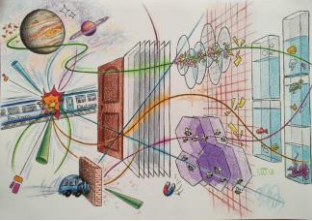


DRD3.1 CMOS – Research goals

Aim is to advance the performance of monolithic CMOS sensors for future tracking applications, tackling the challenges of

- very high spatial resolution;
- high data rate;
- high radiation tolerance;
- low mass;
- covering large areas;
- reducing power;
- keeping an affordable cost;
- and ultimately combining these requirements in one single sensor device.

WG1 research goals <2027	
	Description
RG1	Spatial resolution: $\leq 3 \mu\text{m}$ position resolution
RG2	Timing resolution: towards 20 ps timing precision
RG3	Readout architectures: towards 100 MHz/cm ² , 1 GHz/cm ² with 3D stacked monolithic sensors, and on-chip reconfigurability
RG4	Radiation tolerance: towards $10^{16} \text{ n}_{\text{eq}}/\text{cm}^2$ NIEL and 500 MRad
RG5	Low-cost large-area CMOS sensors



Zoom meetings

DRD3

<https://indico.cern.ch/event/1458026/>

<https://indico.cern.ch/event/1469442/>

<https://indico.cern.ch/event/1476736/>

WG1/WP1 Project proposal discussion - September Session

Friday 27 Sept 2024, 14:00 → 17:10 Europe/Zurich

zoom WG1/WP1 Project proposal discussion

Join

- 14:00** → 14:20 **Introduction** 20m
 - Speakers: Eva Vilella Figueras (University of Liverpool (GB)), Heinz Pernegger (CERN), Jerome Baudot (IPHC - Strasbourg)
 - DRD3-WG1-Septem...
- 14:20** → 17:10 **Proposal updates and presentations**
 - Conveners: Eva Vilella Figueras (University of Liverpool (GB)), Heinz Pernegger (CERN), Jerome Baudot (IPHC - Strasbourg)
 - 14:20** **IP2i-TPSCo 65nm CMOS with high precision timing** 20m
 - Speaker: Didier Claude Contardo (Centre National de la Recherche Scientifique (FR))
 - DRD3-WP1-project_L...
 - DRD3-WP1-project_L...
 - 14:50** **Evaluation of new process option(s) for large-fill factor HVCMOS sensors (Xfab) and Internal Gain Layer for HVCMOS sensors** 20m
 - Speaker: Heiko Christian Augustin (Heidelberg University (DE))
 - DRD3-Proposals_H...
 - 15:20** **CMOS Strip Chip for Future Tracking Detector (postponed to October)** 20m
 - Speaker: Xin Shi (Chinese Academy of Sciences (CN))
 - 15:50** **MAPS developments at SLAC** 20m
 - Speaker: Caterina Vernieri (SLAC National Accelerator Laboratory (US))
 - Maps-DRD3-2024.pdf
 - 16:20** **CASSIA - CMOS Active SenSor with Internal Amplification** 20m
 - Speaker: Heinz Pernegger (CERN)
 - Sensor with Gain-C...

WG1/WP1 Project proposal discussion - October Session

Monday 28 Oct 2024, 09:00 → 12:30 Europe/Zurich

zoom WG1/WP1 Project proposal discussion

Join

- 09:00** → 09:15 **Introduction** 15m
 - Speakers: Eva Vilella Figueras (University of Liverpool (GB)), Heinz Pernegger (CERN), Jerome Baudot (IPHC - Strasbourg)
 - DRD3-WG1-October...
- 09:15** → 11:45 **Project presentations and updates**
 - Conveners: Eva Vilella Figueras (University of Liverpool (GB)), Heinz Pernegger (CERN), Jerome Baudot (IPHC - Strasbourg)
 - 09:15** **Project presentation - CMOS Strip Chip for Future Tracking Detector** 20m
 - Speaker: Xin Shi (Chinese Academy of Sciences (CN))
 - DRD3-WP1-CMOS...
 - 09:45** **Project update - Fine-pitch CMOS pixel sensors with precision timing for vertex detectors at future Lepton-Collider experiments** 10m
 - Speakers: Dominik Dannheim (CERN), Simon Spannagel (Deutsches Elektronen-Synchrotron (DE))
 - LC-Vertex-DRD3-Up...
 - 10:05** **Project update - Development of MAPS using 55nm HVCMOS process for future tracking detectors** 10m
 - Speaker: Yiming Li (Institute of High Energy Physics, Chinese Academy of Sciences (CN))
 - 20241028_HVCMO...
 - DRD3-WP-Project-H...
 - 10:25** **Project update - HV-CMOS Multi-chip integration for large area silicon trackers** 10m
 - Speakers: Prof. Attilio Andreazza (Università degli Studi e INFN Milano (IT)), Yanyan Cao (University of Edinburgh (GB))
 - large_area_tracker...
 - 10:45** **Project update - Cactus: Large electrode designs for timing with and without intrinsic amplification** 10m
 - Speaker: Prof. Philippe Schwemling (Université Paris-Saclay (FR))
 - DRD3_281024.pdf
 - 11:05** **Project update - Thin monolithic High Voltage CMOS sensors with excellent radiation tolerance** 10m
 - Speaker: Eva Vilella Figueras (University of Liverpool (GB))
 - 20241028_DRD3_pr...
 - 11:25** **Project update - Radiation hard read-out architectures** 10m
 - Speakers: Carlos Solans Sanchez (CERN), Carlos Solans Sanchez (CERN)
 - Carlos_Solans_Radi...

WG1/WP1 Project proposal discussion - November Session

Wednesday 20 Nov 2024, 16:00 → 19:00 Europe/Zurich

zoom WG1/WP1 Project proposal discussion

Join

- 16:00** → 16:15 **Introduction** 15m
 - Speakers: Eva Vilella Figueras (University of Liverpool (GB)), Heinz Pernegger (CERN), Jerome Baudot (IPHC - Strasbourg)
 - DRD3.1-intro-Nov20...
- 16:15** → 18:15 **Project presentations and updates**
 - Conveners: Eva Vilella Figueras (University of Liverpool (GB)), Heinz Pernegger (CERN), Jerome Baudot (IPHC - Strasbourg)
 - 16:15** **Project update - Radiation hard read-out architectures** 10m
 - Speakers: Carlos Solans Sanchez (CERN), Carlos Solans Sanchez (CERN)
 - Carlos_DRD3WP1_2...
 - DRD3-WP-Project-M...
 - 16:35** **Project update: Versatile CMOS pixel sensor suited for future trackers** 10m
 - Speaker: Jerome Baudot (IPHC - Strasbourg)
 - project-versatileMat...
 - 16:55** **Project presentation: Monolithic sensors, fast electronics, and silicon photonics for future tracking detectors** 20m
 - Speaker: Alexander Dierlamm (KIT - Karlsruhe Institute of Technology (DE))
 - KIT_2024-11-20_aid...
 - 17:25** **Project presentation: Development of Ultra Fast-Time Low Mass Tracking Detectors** 20m
 - Speaker: Artur Apresyan (Fermi National Accelerator Lab. (US))
 - DRD3-US-Japan.pdf