DRD3 WG2
Proposed Projects

Anna Macchiolo (UZH)
Alessandro Tricoli (BNL)
Martin van Beuzekom (Nikhef)

DRD3 Week - Working Group 2 (WG2) Session

List of Proposed Projects

1. **Development of TI-LGADs for 4D Tracking**
   a. Contact: Anna Macchiolo (Anna.Macchiolo@cern.ch)
2. **Novel silicon 3D-trench pixel detectors based on 8-inch CMOS process**
   a. Contact: Manwen Liu (liumanwen@ime.ac.cn)
3. **4DRSD: 4D-tracking with Resistive Silicon Sensors**
   a. Contact: Roberta Arcidiacono (roberta.arcidiacono@cern.ch)
4. **Development of Ultra Fast-Time Low Mass Tracking Detectors**
   a. Contacts: Artur Apresyan (Artur.Apresyan@cern.ch), Koji Nakamura, (Koji.Nakamura@cern.ch), Alessandro Tricoli (Alessandro.Tricoli@cern.ch)
5. **Advancing the Pixelated Resistive Silicon Readout and Charge Collection Techniques**
   a. Contact: Gaetano Barone (Gaetano.Barone@cern.ch)
6. **Characterizing the Environmental Operational Envelope of Timing and Resistive Silicon Sensors**
   a. Contact: Gaetano Barone (Gaetano.Barone@cern.ch)
7. **Development of very small pitch, ultrarad-hard 3D sensors for tracking + timing applications @ FBK**
   a. Contact: Maurizio Boscardin (boscardi@fbk.eu)
8. **ASIC Development for Timing Measurements using LGAD Sensors for CMS Tracker phase III**
   a. Contact: Abderrahmane Ghimouz (abderrahmane.ghimouz@cern.ch)
9. **NEUROPIX: A neuromorphic computing framework for pixelated detector data processing**
   a. Contact: Mathieu Benoit (benoitm@ornl.gov)
10. **OPTIMA, a board dedicated to Optimized Precision Timing for Multichannel Acquisition**
    a. Contact: Federico de Benedetti (federico.de.benedetti@cern.ch)
11. **LGAD and 3D technology at the IMB-CNM**
    a. Contact: Neil Moffat (neil.moffat@cern.ch)
12. **Fast 3D Sensors**
    a. Contact: Ulrich Parzefall (Ulrich.Parzefall@cern.ch)
13. **Research of AC-LGAD strip detector for 4D tracking**
    a. Contact: Weiyi Sun (weiyi.sun@cern.ch)

- **RD50 Common Fund Project - RD50-2023-03: Deep Junction LGAD**
  - Contact: Simone Mazza (simazza@ucsc.edu)
- **RD50 Common Fund Project - RD50-2023-09: State-of-the-art Radiation Resistant AC- coupled Resistive LGAD - RadHard AC-LGAD**
  - Contact: Roberta Archidiacono (roberta.arcidiacono@cern.ch)

…Proposed Projects

Development of TI-LGADs for 4D Tracking

Contact: Anna Macchiolo (Anna.Macchiolo@cern.ch)

https://indico.cern.ch/event/1463712/contributions/6208997/attachments/2960172/5206149/WG2_TI_LGAD_presentation_November4.pdf

This project concerns the development of TI-LGAD sensors toward 4D Tracking, combining in a single device an accurate position resolution with the precise timing determination for Minimum Ionizing Particles (MIPs). In the TI-LGAD technology, the pixelated LGAD pads are separated by physical trenches etched in the silicon. This technology can reduce the interpixel dead area, mitigating the fill factor problem. Two production runs are foreseen in this project, to optimize the process and design parameters towards a higher radiation hardness and maximal fill-factor and to produce within 2028 large area sensors compatible with the timing chips that are being developed in 28 nm CMOS technology.

Country	Collaborating Institution	Town	Institution Code	Contact
France	Irene Joliot-Curie Lab	Orsay	IJCLAB	A. Torrento
France	Laboratoire de Physique Nucléaire et des Hautes Energies, Paris	Paris	LPNHE	G. Calderini
Germany	GSI Helmholtzzentrum für Schwerionenforschung GmbH	Darmstadt	GSI	J. Pietraszko
Germany	IPE KIT	Eggenstein-Leopoldshafen	IPE	M. Caselle
Germany	University of Hamburg	Hamburg	UHH	J. Schwandt
Italy	Fondazione Bruno Kessler	Trento	FBK	M. Boscardin
Italy	INFN-Torino	Torino	INFN-TO	V. Sola
Montenegro	University of Montenegro	Podgorica	UoM	G. Medin
Slovenia	Jozef Stefan Institute	Ljubljana	JSI	G. Kramberger
Spain	Centro Nacional de Aceleradores, CNA	Seville	CNA	M. C. Jiménez Ramos
Spain	Instituto de Física de Cantabria (CSIC-UC)	Santander	CISC-UC	I. Vila
Switzerland	CERN	Geneva	CERN	D. Dannheim
Switzerland	University of Zurich	Zurich	UZH	A. Macchiolo
USA	Oak Ridge National Laboratory	Oak Ridge	ORNL	M. Benoit

Novel silicon 3D-trench pixel detectors based on 8-inch CMOS process

Contact: Manwen Liu (liumanwen@ime.ac.cn)

https://indico.cern.ch/event/1434481/contributions/6128367/attachments/2927672/5139977/DRD3%20proposal.pdf

The purpose of this Work Package is to build and test a prototype of Novel silicon 3D-trench pixel
detectors based on 8-inch CMOS process.

(1) Work Package 1: (Design and Simulation) Ludong University, IHEP and IMECAS
  (a) Deliverable 1.1: Device design: Calculation and Geometry optimization
  (b) Deliverable 1.2: Simulation of Electrical characteristics
(2) Work Package 2: (Processing) IMECAS
  (a) Deliverable 2.1: Processing flow, SEM images
  (b) Deliverable 2.2: 3D detector prototype
(3) Work Package 3: (ASIC) collaboration with DRD7
  (a) Deliverable 3.1: Read-out system
  (b) Deliverable 3.2: PCB boards
(4) Work Package 4: (Characterization) IMECAS,University of Sheffield and Nikhef
  (a) Deliverable 4.1: IV and CV test results on wafer level
  (b) Deliverable 4.2: TCT measurement results: Time resolution and CCE
(5) Work Package 5: (Irradiations) JSI and collaboration with DRD3-WG3

Country	Collaborating Institution	Town	Institution Code	Contact
China	Institute of Microelectronics, Chinese Academy of Sciences (IMECAS)	Beijiing		Manwen Liu
China	Ludong University	Yantai		Li Zheng
China	Institute of High Energy Physics, CAS, IHEP	Beijiing		Xin Shi
United Kingdom	University of Sheffield	Sheffield		Dengfeng Zhang
the Netherlands	Nikhef	Amsterdam		Kazu Akiba
Slovenia	Jožef Stefan Institute (JSI)	Ljubljana		Gregor Kramberger

…Proposed Projects

4DRSD: 4D-tracking with Resistive Silicon Sensors

Contact: Roberta Arcidiacono (roberta.arcidiacono@cern.ch)

https://indico.cern.ch/event/1439336/contributions/6242237/attachments/2978078/5243054/Status4DShare.pdf

Abstract:
Develop a sensor able to concurrently achieve 30 ps and 10 um resolutions while maintaining a low read-out channel density (about 1000-2000 ch/cm^2)

Project Description: (including motivation and strategic goals aligning with DRDT)
This project is in line with the goals of DRDT2, WP2, task 2.2, and wants to fulfill MS2.4. The project exploits the properties of resistive silicon detectors (RSD) to obtain a design of a 4D tracker that has a power consumption similar to the present 3D trackers.

The RDS design is currently evolving in two directions: the optimization of the AC-coupled design and the development of the DC-coupled version. The AC version is well-developed and is currently undergoing a radiation hardening campaign, while the DC version is in the prototyping phase.

This work package starts *after* the completion of these studies and aims to improve the understanding of the different RSD implementations.

The goal is to have the sensor detector-ready as a candidate to be used for the possible HL-LHC run 6 which includes:

- Radiation hardness in line with experimental requirements
- Proven ability to maintain high position and temporal resolution at high occupancy
- Large sensor and large volume production

Participants:
INFN Torino, INFN Perugia, INFN Firenze, FBK - Fondazione Bruno Kessler, KIT- Karlsruhe Institute of Technology
… possibly others

Development of Ultra Fast-Time Low Mass Tracking Detectors

Contacts: Artur Apresyan (Artur.Apresyan@cern.ch), Koji Nakamura, (Koji.Nakamura@cern.ch), Alessandro Tricoli (Alessandro.Tricoli@cern.ch)

https://indico.cern.ch/event/1434481/contributions/6128369/attachments/2927569/5139779/DRD3-US-Japan.pdf

Future Higgs factories and multi-TeV collider experiments will benefit from low-mass trackers that provide fast-timing at the 10 ps level or better. For hadron colliders the additional requirement of radiation tolerance is critical. We will design a monolithic 4D (with fine time and space resolution) detector based on the AC-LGAD technology. Such a device will be low-mass, as the sensing and readout elements will be manufactured on the same silicon wafer, and has the potential to meet the stringent specifications in time and space resolution for future HEP collider experiments. To this end, we will benefit from a parallel set of activities that aims at improving the performance of AC-LGAD sensors and readout electronics for hybrid detectors, i.e. with sensing and readout circuits fabricated on different silicon wafers and bonded together via bumps or wire bonds. We will develop a collaboration with an electronic chip foundry for the design and fabrication of a monolithic AC-LGAD. The characterisation of the prototype detectors will be carried out in the consortium laboratories and in test-beams. Irradiation campaigns to test the radiation hardness of such devices are also planned.

Country	Collaborating Institution	Town	Institution Code	Contact
USA	Fermilab	Batavia	FNAL	Artur Apresyan
Japan	KEK	Tsukuba	KEK	Koji Nakamura
USA	Brookhaven Nat/.Lab.	Upton	BNL	Alessandro Tricoli
USA	Berkley Nat. Lab.		LBNL	Zhenyu Ye
USA	Univ. of California at Santa Cruz	Santa Cruz	UCSC	Simone Mazza
Japan	Univ. of Tsukuba	Tsukuba	TSUK	Yuji Takeuchi

More Collaborators are welcome!

…Proposed Projects

Characterizing the Environmental Operational Envelope of Timing and Resistive Silicon Sensors

Contact: Gaetano Barone (Gaetano.Barone@cern.ch)

This proposal aims to understand the impact of environmental conditions on silicon devices with internal gain at their fundamental level through stress testing. The primary output will be a performance-to-environmental-conditions model that will extend the reach of this technology to space-based spectroscopy beyond its intended use in collider physics. This project is timely, as extensive R&D on this technology is blooming, given their integration in large-scale HEP experiments. Through its execution, this program will foster a new line of collaboration between sensor fabrication and application.

Diallo Boye	Brookhaven National Laboratory, Nuclear and Particle Physics, USA,
Gabriele D'Amen	Brookhaven National Laboratory, Nuclear and Particle Physics, USA,
Gabriele Giacomini	Brookhaven National Laboratory, Instrumentation Department, USA,
Alessandro Tricoli	Brookhaven National Laboratory, Nuclear and Particle Physics, USA,
Ulirich Heintz	Brown University, USA,
Jingyu Luo	Brown University, USA,
Jennifer Roloff	Brown University, USA.
Hijas Farook	University of New Mexico, USA,
Sally Seidel	University of New Mexico, USA,

More Collaborators are welcome!

Advancing the Pixelated Resistive Silicon Readout and Charge Collection Techniques

Contact: Gaetano Barone (Gaetano.Barone@cern.ch)

https://indico.cern.ch/event/1402825/contributions/6000561/attachments/2879874/5045548/NN_RSD_readout_barone.pdf

A signal compression architecture based on cutting-edge methods will be developed, and it will be able to harness the information of the output of FEE technologies currently employed in RSDs. **The ML-assisted analog-to-digital map will aid in waveform compression of the information and, in turn, reduce the noise.** We will eliminate the need to solve the analytical laws governing complex geometry-induced behaviors, **unlocking the fine-tuning of the sensor design to optimal geometries** with reduced readout elements and reducing the electronics' data throughput, material budget, and complexity. This unique approach **will significantly reduce the data throughput while optimizing the sensor geometry to maximize the spatial resolution.** The developed algorithm will be ported on FPGAs by developing a readout firmware, opening the path to future applications to a full readout chain and trigger-time-control command chain from the ASIC to/from the off-detector electronics. This research is timely, as this technology is being investigated for application at Phase-3 High Luminosity LHC upgrade, extending the capabilities for the forward region with 4D tracking characteristics of the CMS detector, the LHCb velo upgrade and collaborations for future circular colliders beyond HL-LHC. The successful development of an ML-based readout chain of RSDs and AC-LGADs will improve the spatial resolution of the current reconstruction algorithms, and it will lead to optimized sensor design aiming for a 10 ps and $\approx$10 μm timing and spatial resolutions, respectively. The optimized pad arrangement will minimize the number of readout channels, yielding lower power consumption and costs. The deliverables will play a significant role in the track reconstruction of future HEP experiments that require high-precision timing and space resolution. In this entirety, **this project intends to spearhead the application of RSD devices in collider-based HEP experiments and beyond by returning an ML-assisted processing unit in the readout chain**.

Alessandro Tricoli	Brookhaven National Laboratory, Nuclear and Particle Physics, USA,
Gabriele Giacomini	Brookhaven National Laboratory, Instrumentation Department, USA,
Anna Macchiolo	University of Zurich, Switzerland,
Matias Senger	University of Zurich, Switzerland,
Ben Kilminster	University of Zurich, Switzerland,
Ulirich Heintz	Brown University, USA,
Daniel Li	Brown University, USA,
Jingyu Luo	Brown University, USA.

More Collaborators are welcome!

…Proposed Projects

Development of very small pitch, ultrarad-hard 3D sensors for tracking + timing applications @ FBK

Contact: Maurizio Boscardin (boscardi@fbk.eu)

https://indico.cern.ch/event/1463712/contributions/6213216/attachments/2960241/5206411/FBK_Si3D_DRD3_01112024.pdf

2024-2025

- Extensive characterization of AIDA Innova batch (well matches scope of RG 2.2)
  - Includes both test structures and small-medium (up to 128x128) pixel arrays
- New batch of small-pitch 3D column sensors, funded by INFN (well matches scope of RG 2.1 and RG 2.2), fabrication to start in 09/24
  - Design optimized for timing, several layout options
  - Cell size down to 45x45 mm^2 for pixels and below for test structures (also very small cell samples – 25x25 mm^2 , for charge multiplication studies)

2026-2028

- Si-3D batch: Implement the best layout solutions to large size arrays (funding not yet available)

- FBK (Maurizio Boscardin) : device fabrication
- TIFPA – INFN (Gian-Franco Dalla Betta): design, simulation and characterization
- INFN Cagliari (Adriano Lai): simulation and characterization (+ readout design)
- INFN Firenze (Giacomo Sguazzoni): characterization
- INFN Genova (Claudia Gemme): characterization
- NIKHEF (Martin van Beuzekom): characterization
- Univ. New Mexico (Sally Seidel): characterization

More Collaborators are welcome!

ASIC Development for Timing Measurements using LGAD Sensors for CMS Tracker phase III

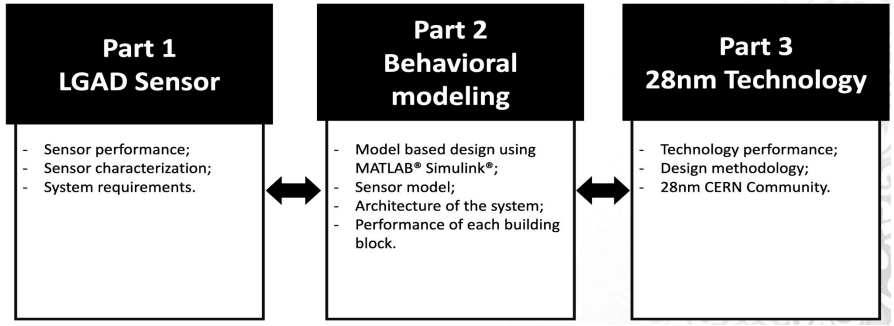
Contact: Abderrahmane Ghimouz (abderrahmane.ghimouz@cern.ch)

https://indico.cern.ch/event/1439336/contributions/6242235/attachments/2977799/5242496/DRD3_week2024_PSI.pdf

The CMS experiment will enhance its capabilities with precision timing detectors covering $|\eta| \leq 3$ to manage high rates and reduce pile-up in the HL-LHC era starting in 2030. Future upgrades may extend timing across the full tracker acceptance ($|\eta| \leq 4$), with LGADs as a potential option for pixel detector end-cap replacements. This project focuses on the development of an ASIC in 28 nm CMOS technology, optimized for TI-LGAD sensors, capable of achieving sub-30 ps timing resolution. Key features include a low-jitter preamplifier, a discriminator stage, and a Time-to-Digital Converter (TDC), with radiation tolerance up to 1-5 × 10^{15} neq/cm^2.

The ASIC design will balance performance, power efficiency, and integration while addressing HL-LHC challenges. Initial prototypes will feature a limited number of channels for systematic testing of timing resolution and radiation hardness. Successful designs will scale to full-channel ASICs compatible with various LGAD types, ensuring flexibility for future sensor developments.

Fabrication will occur via MPW/mini@sic runs, with testing in realistic radiation environments. Results will support the CMS Tracker upgrade, contribute to advancements in 4D tracking technologies, and enable future high-energy physics experiments.



The project carried out in collaboration with PSI, UZH, CERN 28nm Community and CERN DRD3/7.

…Proposed Projects

NEUROPIX: A neuromorphic computing framework for pixelated detector data processing

Contact: Mathieu Benoit (benoitm@ornl.gov)

https://indico.cern.ch/event/1439336/contributions/6242186/attachments/2977810/5242483/DRD3_SNN_Mathieu%20Benoit.pptx

We propose the NEUROmorphic computing framework for PIXelated detector data processing (NEUROPIX) framework, which will create a path for hardware development, enabling the development of integrated circuit (IC)-based neuromorphic platforms that can perform powerful classification, interpolation, and anomaly-detection tasks with low latency and power. We base this framework on spiking neural networks (SNNs), a type of network closely related to biological examples of neural networks, which can perform complex tasks with fewer parameters and connections—and, therefore, lower power—than other types of networks. Our goal is to provide the software infrastructure for the simulation, training, and deployment to field-programmable gate arrays (FPGAs) and advanced systems on integrated circuits (ASICs) of SNN algorithms for edge processing of pixel detector data and extraction with low latency of complex quantities, such as beam luminosity and position, that are relevant for experiments at particle colliders. Our work will demonstrate the need for this type of solution in modern detector systems; justify investment in a large-scale, neuromorphic hardware platform with increased polyvalence and processing capabilities; and motivate the integration of such systems in future HEP detectors.

Oak Ridge National Laboratory

University of Tennessee

University of Kansas

OPTIMA, a board dedicated to Optimized Precision Timing for Multichannel Acquisition

Contact: Federico de Benedetti (federico.de.benedetti@cern.ch)

https://indico.cern.ch/event/1439336/contributions/6242234/attachments/2978028/5242888/OPTIMA_DRD3_fdebened.pdf

We will present the development of an electronics board that will make the rapid characterization of multipixel silicon sensor arrays for fast timing possible. OPTIMA is optimized for multichannel readout, such that full information relative to the timing performance of shared charge between pixels is acquired. Each channel comprises a dual-stage amplifier design with a uniform response up to a frequency range of 8 GHz. A trans-impedance amplifier configuration using a SiGe transistor is used for both stages. The design features a passive daughterboard for versatile sensor replacement. Full characterization has been done in the lab achieving a total gain of more than 100. LGAD and 3D sensors have been tested in the test beam, and time resolutions of less than 50 ps have been obtained. Moreover, the board has been synchronized with the Timepix4 telescope. These preliminary results will be presented.

Project Goals

- Develop a common platform for non-hybridized silicon sensor characterization
- **Precision timing** and **multichannel** application
- Targeting lab and test beams characterization environments
- Cooling support for irradiated sensor campaigns
- Hot-swappable carrier boards:
  - Fast sample turnaround
  - Irradiating sensor board only
  - Different flavours for sensor wire bonding
- Integration with Timepix4 telescope
- Environmental monitoring on board

USC UNIVERSIDADE DE SANTIAGO DE COMPOSTELA EP R&D

…Proposed Projects

LGAD and 3D technology at the IMB-CNM

Contact: Neil Moffat (neil.moffat@cern.ch)

https://indico.cern.ch/event/1439336/contributions/6242236/attachments/2978221/5243265/CNM-Projects-2024-DRD3.pdf

Project 1: Trench Isolated iLGAD for fill factor optimization
Project 2: AC-LGAD for HEP and Synchrotron Applications.
Project 3: Deep Junction LGAD, stabilisation of the technology at the IMB-CNM.
Project 4: Doubled sided 3D detectors for ultra-radiation hard timing applications.

Project 1

Spain IMB-CNM CNM Pablo Fernandez
Spain IFCA IFCA Ivan Vila Alvarez
Spain CNA Sevilla CNA Maria del Carmen Jimenez Ramos
UK University of Glasgow Glasgow Richard Bates
Czech Republic Czech Technical University , Czech Technical University Peter Svirha

Project 2

Spain IMB-CNM CNM Neil Moffat
Spain IFAE IFAE Stefano Terzo

Project 3

Spain IMB-CNM CNM Pablo Fernandez
Spain IFCA IFCA Ivan Vila
Spain IFAE IFAE Stefano Terzo
Spain CNA, Sevilla CNA Maria del Carmen Jimenez Ramos

Project 4

Spain IMB-CNM CNM Neil Moffat
UK University of Glasgow Glasgow Richard Bates
Poland AGH University of Krakow UGH Tomasz Szumlak
Netherlands Nikhef Nikhef Martin van Beuzekom
Germany Freiburg University Freiburg
Switzerland LHCb Cern CERN Victor Coco
Slovenia Jožef Stefan Institute JSI Gregor Kramberger

Fast 3D Sensors

Contact: Ulrich Parzefall (Ulrich.Parzefall@cern.ch)

https://indico.cern.ch/event/1434481/contributions/6130832/attachments/2927374/5139377/FastTiming3Ds_DRD3WG2_v6.pdf

- Before irradiation, both 3D sensors reach time resolutions of 30-35 ps comparable to LGADs
- 3D pixel sensors improve resolution after irradiation while the bias voltage range stays almost the same
- 3D pixels withstand $5\times10^{16} n_{eq}/cm^2$ while keeping their timing performance
- **Limitations**: Measurement setup (now dismantled) was improvised . We measured timing, but make no statement on efficiency! New „fast timing“ set-up is under construction. New dedicated fast timing PCB (inspired by SCIPP board, designed by Dennis) available
- RD50 project - Dedicated timing sensors:
  - Hexagonal geometry, IV measurements completed, CV measurements ongoing and timing measurements to be started when new setup is comissioned
- Irradiation campaign to high fluences also planned

- Fast 3D project funded by BMBF (German funding agency)
  - July 2024 – June 2027 at several places
- DRD3 project on 2nd generation of fast 3Ds is a natural evolution of this work, but not yet. Probably starting end of 2025
- Before that: Need to evaluate existing 3Ds for timing performance!
  - also post-irradiation
  - also measure efficiency

…Proposed Projects

Research of AC-LGAD strip detector for 4D tracking

Contact: Mei Zhao (zhaomei@ihep.ac.cn)

https://indico.cern.ch/event/1439336/contributions/6242215/attachments/2977964/5242778/4d_aclgad_swy_v6.pdf

With the development of collider experiments, the demand for detectors with high time and spatial resolution has become increasingly stringent. AC-LGAD has sparked wide research due to its exceptional time and spatial resolution and can achieve lower readout electronics density under a fixed effective area and enable position resolution with directional sensitivity. The project aims to develop an AC-LGAD strip for future colliders such as CEPC, FCC-ee, ILC, CLIC, etc.

IHEP associated with IME has developed an AC-LGAD strip sensor prototype with 150-250μm pitch and 5.6 mm length and achieved time resolution up to 30 ps scale and spatial resolution to 10 μm scale. AC-LGAD strip will contribute to the technical design reports for future lepton collider projects, and even other experiments demanding 4D tracking ability beyond collider experiments.

Participants for now

- Institute of high energy physics, Chinese Academy of Sciences(IHEP)
- Institute of Microelectronics, Chinese Academy of Sciences(IME)
- Jozef Stefan Institute, Ljubljana (JSI)
- University of Montenegro (UCG)
- Shanghai Jiao Tong University(SJTU)
- Shandong University (SDU)
- Nankai University (NKU)
- Zhengzhou University (ZZU)

- AC-LGAD has the potential to fulfill the requirements of DRD-3 4D tracker in terms of spatial and time resolution, sensitive area fill factor, etc.
- R&D of AC-LGAD has yielded promising results but still has a long way to go……

You Are Warmly Invited to Join Us

Contact person:
Prof. Mei Zhao (IHEP-CAS), zhaomei@ihep.ac.cn

Project plan: https://cds.cern.ch/record/2918306

--DRD3–Working Group2 *Hybrid Silicon Technologies*
--DRD3–Working Package2 *Sensors for 4D Tracking*

…RD50 Projects

RD50 Common Fund Project - RD50-2023-03: Deep Junction LGAD

Contact: Simone Mazza (simazza@ucsc.edu)

https://indico.cern.ch/event/1439336/contributions/6242202/attachments/2977844/5242540/281124_DRD3_DJ_LGAD_update.pdf

- Fabrication within RD50 of DJ-LGAD at FBK (providing in-kind contribution)
  - Project cost ~100k
  - 12 participating institutions

Contact Person	Dr. Simone Michele Mazza, Santa Cruz Institute for Particle Physics University of California, Santa Cruz 1156 High St., Santa Cruz, CA, 95064, U.S. simazza@ucsc.edu
Institutes	1. University of California Santa Cruz (S.M. Mazza, B. Schumm) 2. FBK (M. Boscardin, M. Centis Vignali, G. Paternoster) 3. CERN (M. Moll, V. Kraus, M. Wiehe, M. Fernandez Garcia, N. Sorgenfrei) 4. UNM (S. Seidel, J. Si, R. Novotny, J. Sorenson, H. Farook, A. Gentry) 5. KIT (M. Caselle, A. Dierlamm) 6. PSI (J. Zhang, A. Bergamaschi, M. Carulla) 7. HEPHY (T. Bergauer, A. Hirtl, M/ Dragicevic) 8. UCG (G. Lastovicka-Medin, V. Backovic, I. Bozovic, J. Doknic) 9. Nikhef (M. van Beuzekom, F. Filthaut, M. Wu, H. Snoek) 10. UZH (B. Kilminster, A. Macchiolo, M. Senger) 11. IHEP Beiking (Z. Liang, M. Zhao, Y. Fan) 12. Manchester (O.A. De Aguiar Francisco, E. Ejopu, M. Gersabeck, A. Oh)
Total project	101.600 €
RD50 request	50.000 €

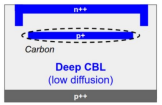
RD50 Common Fund Project - RD50-2023-09: State-of-the-art Radiation Resistant AC- coupled Resistive LGAD - RadHard AC-LGAD

Contact: Roberta Archidiacono (roberta.arcidiacono@cern.ch)

https://indico.cern.ch/event/1402825/contributions/6002837/attachments/2879613/5045883/RD50-RadHard-ACLGAD.pdf

Objectives:

- **One** RadHard AC-LGAD **prototype run** (**10 wafers** batch@ FBK)
  - ***Split table will include:***
    1. *shallow carbonated boron implant with the CBL activation scheme*
    2. *deep carbonated boron implant with the CBL activation scheme*



- **Irradiation with neutrons and protons** *(up to 3E15 1MeV-n_{eq}/cm^2)*
- Study **effect on** all sensor components (**gain, oxide and n+ resistive layer**), on **signal sharing** and **time/space resolutions**.

INFN Torino	Roberta Arcidiacono
FBK	G. Paternoster
Karlsruhe Institute of Technology	Alexander Dierlamm
University of Montenegro	Gordana Medin
HEPHY	Thomas Bergauer
INFN Perugia	Francesco Moscatelli
Santa Cruz Institute for Particle Physics	Simone Mazza
University of Science and Technology of China	Yanwen Liu
Brown University	Jennifer Roloff
Fermilab	Artur Apresyan
Vilnius University	Thomas Ceponis