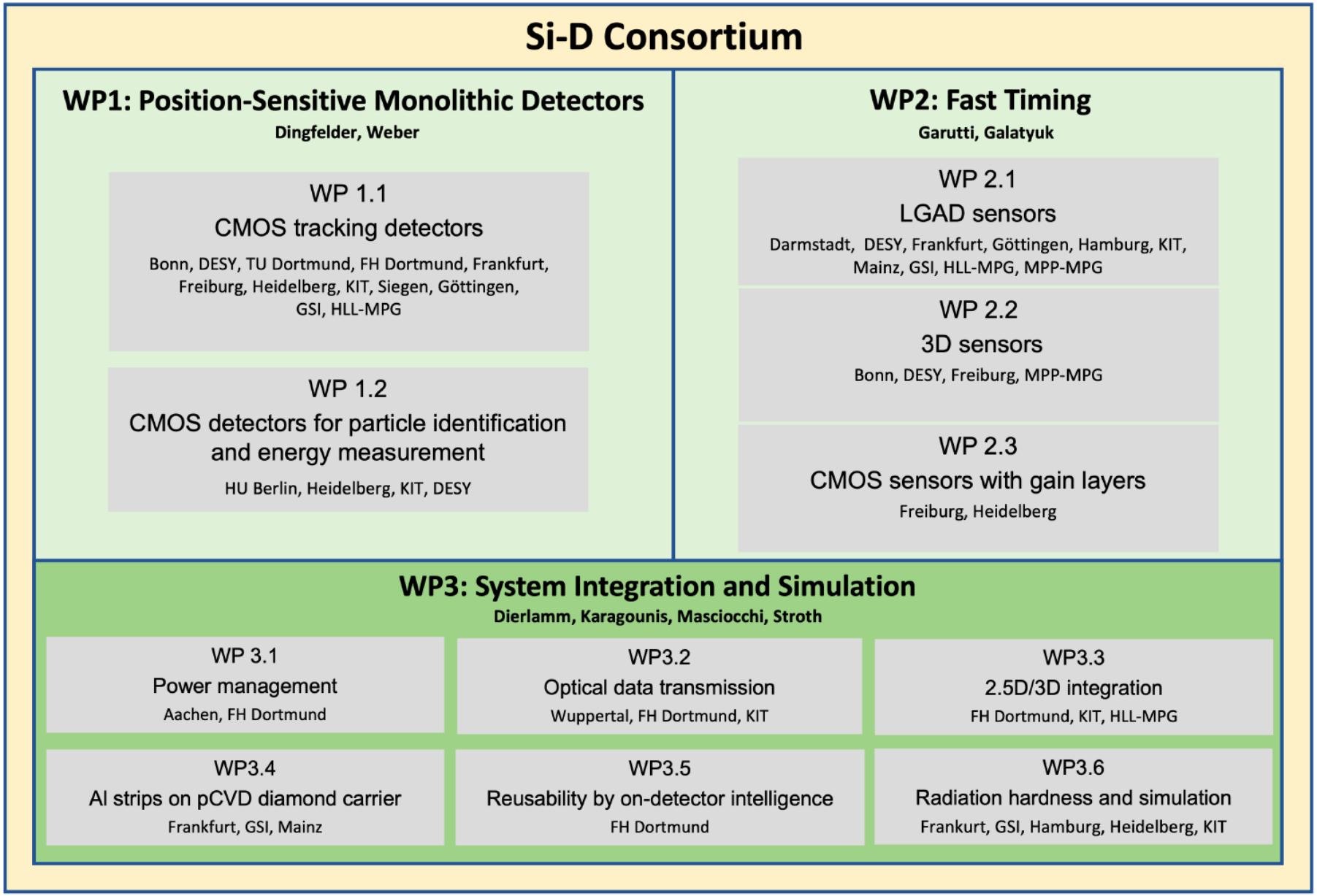
Si-D Consortium Meeting

28.01.2025

Jochen Dingfelder (U. Bonn), Erika Garutti (U. Hamburg)

Si-D Consortium



Cooperation partners

Funded:

Aachen
Bonn
Frankfurt
Freiburg
Göttingen
Hamburg
Heidelberg
KIT

Not funded:

HU Berlin
TU Darmstadt
FH Dortmund
TU Dortmund
Siegen
Wuppertal

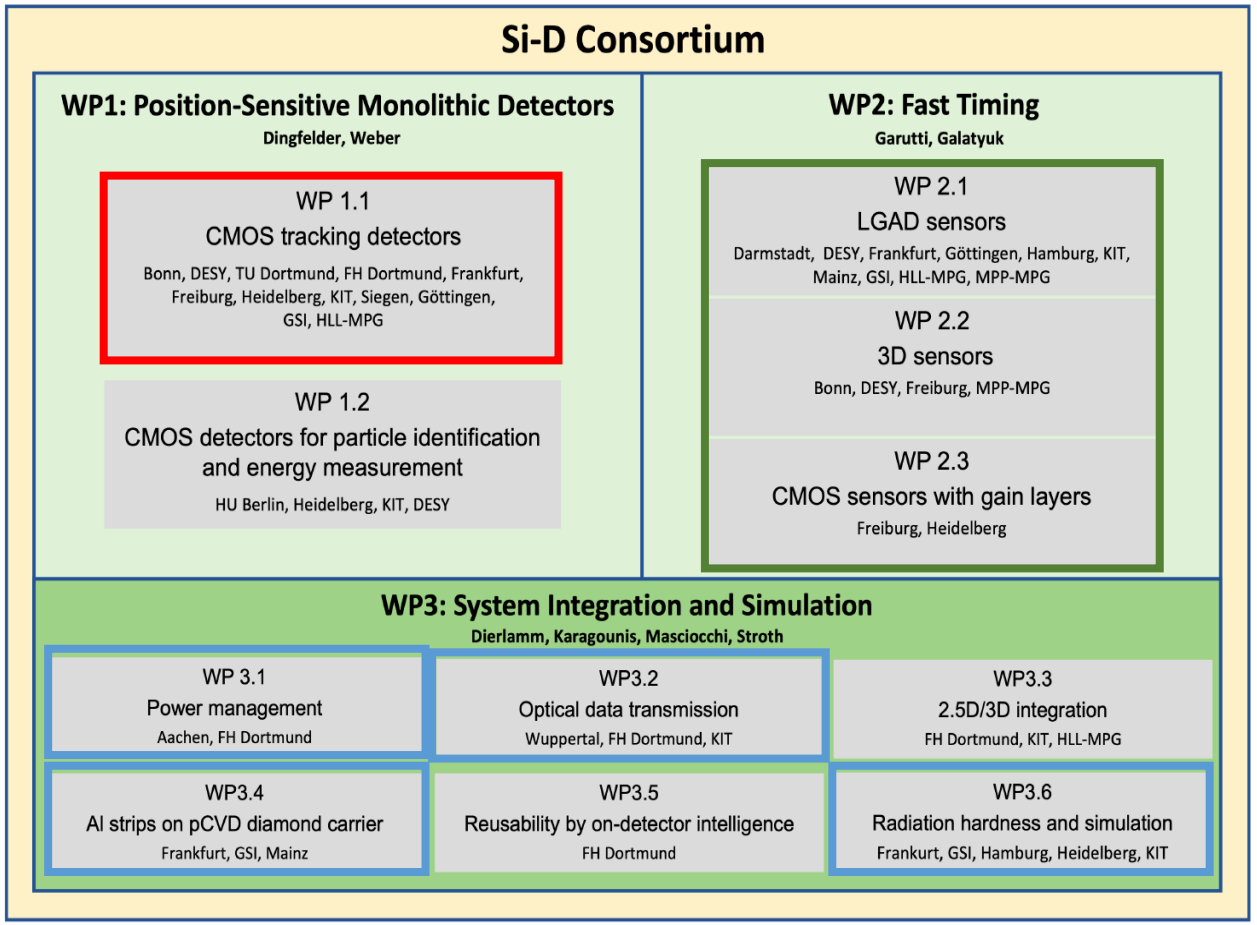
Not on cooperation agreement:

HU Berlin
TU Darmstadt
Wuppertal

Associated partners

Mainz
DESY
GSI
HLL-MPG
MPP-MPG

(Partially) funded projects



WP1.1.1 Low-cost, large-area CMOS sensors with short strips
(**Freiburg**, FH & TU Dortmund, Bonn, DESY)

WP 1.1.2 Monolithic sensors for vertex layers
(**Heidelberg**, **KIT**)

WP 1.1.3 All-silicon modules
(**Bonn**, TU Dortmund, **Göttingen**, Siegen, HLL)

WP2.1.1 Fast timing layer
(DESY, **Hamburg**, Mainz, **Göttingen**)

WP2.1.2 A German LGAD for 4D tracking
(**Hamburg**, HLL, MPP, KIT)

WP2.2 3D sensors for fast timing (sensor & R/O Chip)
(**Freiburg**, **Bonn**, MPP, DESY)

WP2.3 CMOS sensor with gain layer
(**Freiburg**, **Heidelberg**)

WP3.1 Power management
(**Aachen**, FH Dortmund)

WP3.2 Optical data transmission
(**KIT**, Wuppertal, FH Dortmund)

WP3.6 Radiation hardness/simulation
(**Frankfurt**, Hamburg, Heidelberg, KIT, GSI)

WP Al strips on pCVD carriers
(**Frankfurt**, Mainz, GSI)

Groups with R&D BMBF funding for 2024-27shown in **bold face**

Cooperation agreement

Cooperation agreement almost finished

One last disagreement related to requests from U. Frankfurt and KIT (§10 “Einbindung von Dritten”) still to be solved

Deadline for getting all signatures: **Feb. 15, 2025**

Kooperationsvereinbarung – Projekt: R&D Detektoren: Siliziumdetektoren („Silicon-D“)

Kooperationsvereinbarung

zwischen der

Rheinischen Friedrich-Wilhelms-Universität Bonn
vertreten durch den Rektor, dieser vertreten durch den Kanzler,
Regina-Pacis-Weg 3, 53113 Bonn
Ausführende Stelle: Ausführende Stelle: Physikalisches Institut (Prof. Dr. Jochen Dingfelder)
- im Folgenden „Universität Bonn“ oder „Koordinator“ genannt –

und
RWTH Aachen University KdöR
vertreten durch den Rektor, Templergraben 55, 52062 Aachen
Ausführende Stelle: Lehrstuhl für Experimentalphysik I B und I. Physikalisches Institut (Prof. Dr. Lutz Feld)
– im Folgenden „RWTH“ genannt –

und
Johann Wolfgang Goethe-Universität Frankfurt am Main
vertreten durch den Präsidenten, Theodor-W.-Adorno-Platz 1, 60323 Frankfurt am Main
Ausführende Stelle: Institut für Kernphysik (Prof. Dr. Joachim Stroth)
– im Folgenden „UFRA“ genannt –

und
Albert-Ludwigs-Universität Freiburg
vertreten durch die Rektorin, Prof. Dr. Kerstin Kieglstein
Friedrichstr. 39, 79098 Freiburg im Breisgau
Ausführende Stelle: Physikalisches Institut (Prof. Dr. Karl Jakobs)
– im Folgenden „UFR“ genannt –

und
Georg-August-Universität Göttingen/ Georg-August-Universität Göttingen Stiftung Öffentlichen Rechts (Stiftungsuniversität Göttingen)
vertreten durch den Präsidenten, Wilhelmsplatz 1, 37073 Göttingen
Ausführende Stelle: II. Physikalisches Institut, Prof. Dr. Arnulf Quadt
– im Folgenden „UGÖ“ genannt –

und
Universität Hamburg
vertreten durch den Präsidenten
Ausführende Stelle: Institut für Experimentalphysik (Prof. Dr. Erika Garutti)
– im Folgenden „UHH“ genannt –

und
Universität Heidelberg

VID 30383

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Expressions of Interest for detector concepts for FCC

Next Steps: Submit EOIs

The Calls

Deadline Jan 31 for submission of EOIs to **PED** (us)

- for editorial feedback and iteration
- and inclusion in combined FCC submission summary
  - we will write an executive summary or cover letter
    - to be circulated with all submitters
  - attach EoIs in pdf format to common FCC submission
    - no template
- EOI submitters are free to chose
  - independent submission to ESU (we'd appreciate to remain posted)
  - being attached to FCC common submission (default, let us know otherwise)
  - both (let us know)

Deadline Mar 31 for submission to **ESU**

- submission of executive summary and attached EoIs (optional)
- submission of EOIs (independent or in parallel)

Content, on 2-4 pages (3-6 for concepts):

- The scope of planned activties for the next 3-5 years
- The Partners (Institutes) and their expertise
- The names of one or two contact persons
- The connection with technological activities in the DRD framework
- The engineering and simulation connections with concept groups
- References to relevant more detailed documentation of the technologies

DESY. Detector Concepts | Felix Sefkow | January 2025

From Presentation by F. Sefkow at 8th FCC workshop at CERN (Jan. 18, 2025)
https://indico.cern.ch/event/1439509/

- From discussions with colleagues, the plan (so far) is to submit two EOIs

  Vertex detector → TPSCo 65 nm (OCTOPUS)

  Main tracker → Large-area CMOS sensors

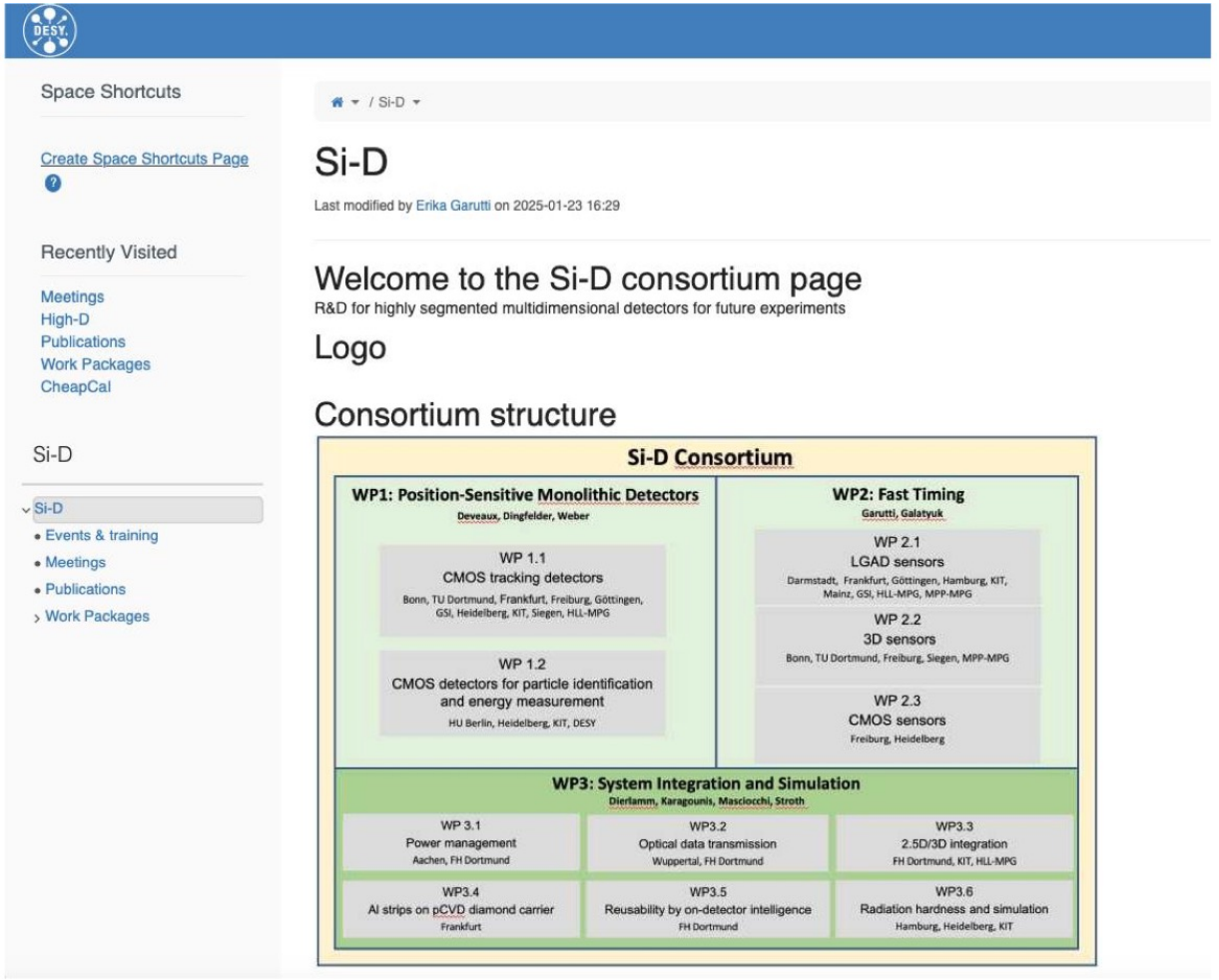
- Deadline for EOIs (~ 2 pages) very soon: **January 31st**
- If someone plans to submit an EOI or would like to join the EOIs above, please let us know

Organizational issues

- **Si-D web page (xWiki)**

  → see presentation from Erika

- Si-D **logo**?

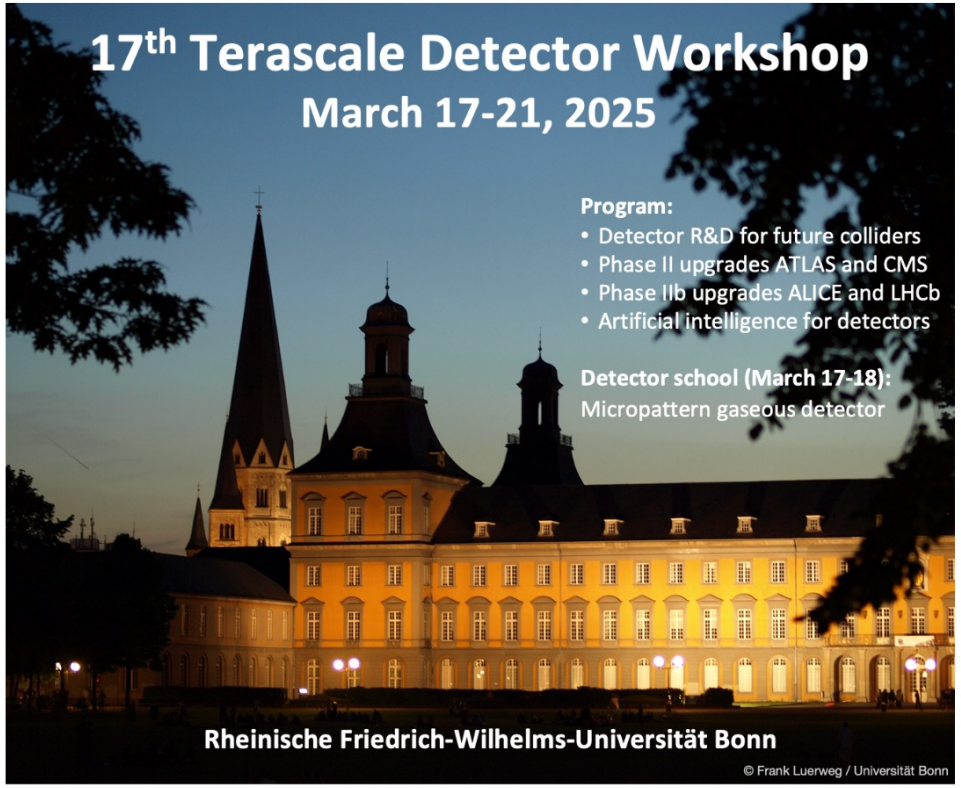


Si-D Meeting at Terascale Detector Workshop 2025

Helmholtz Alliance

PHYSICS AT THE TERASCALE

Deutsches Elektronen-Synchrotron DESY + + + Karlsruher Institut für Technologie + + + Max-Planck-Institut für Physik München + + + Rheinisch-Westfälische Technische Hochschule Aachen + + + Humboldt-Universität zu Berlin + + + Rheinische Friedrich-Wilhelms-Universität Bonn + + + Technische Universität Dortmund + + + Technische Universität Dresden + + + Albert-Ludwigs-Universität Freiburg + + + Justus-Liebig-Universität Gießen + + + Georg-August-Universität Göttingen + + + Universität Hamburg + + + Ruprecht-Karls-Universität Heidelberg + + + Johannes Gutenberg-Universität Mainz + + + Ludwig-Maximilians-Universität München + + + Universität Regensburg + + + Universität Rostock + + + Universität Siegen + + + Julius-Maximilians-Universität Würzburg + + + Bergische Universität Wuppertal + + +



Organizing Committee

Jochen Dingfelder, Doris Eckstein, Lutz Feld, Tobias Flick, Ulrich Husemann, Oliver Kortner, Lucia Masetti, Andreas Mussgiller, Ulrich Parzefall, Hans-Christian Schultz-Coulon, Felix Sefkow, Frank Simon, Arno Strässner

Local Organizers

Markus Ball, Florian Bernlochner, Klaus Desch, Yannick Dieter, Jochen Dingfelder, Matthias Hamer, Philip Hauer, Fabian Hügging, Jochen Kaminski, Bernhard Ketzer, Sebastian Neubert, Matthias Schott, Slavomira Stefkova, Marco Vogt

Website:

https://indico.desy.de/event/47789/

Please register by March 3, 2025

Timetable

Mon 17/03 | Tue 18/03 | **Wed 19/03** | Thu 20/03 | Fri 21/03 | All days

Print | PDF | Full screen | Detailed view | Filter

Session legend

Detector R&D for Future Colliders

German Detector Consortia Meetings

09:00 **German Detector Consortia Meetings**

Si-D meeting

Please take this into account when making travel arrangements for the detector workshop

09:00 - 12:30

10:00

11:00

12:00

Lunch Break

12:30 - 14:00

13:00

14:00

Welcome

14:00 - 14:15

Highlights from the BMBF Detector R&D Consortia *Erika Garutti et al.*

14:15 - 15:15

15:00

Backup

WP1: Position-sensitive monolithic detectors

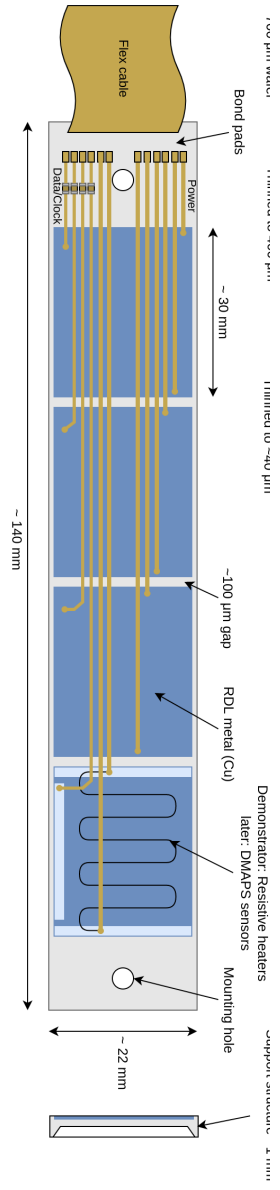
WP 1.1 CMOS tracking detectors

- **CMOS strip detectors in 150 nm LFoundry technology** (Freiburg, FH & TU Dortmund, Bonn, DESY)
  - Cost-effective large-area CMOS sensors (reticle stitching)
  - Design active strixel sensors: short strips, integrated FE electronics

- **Monolithic sensor in 130 nm SiGe BiCMOS technology** (Heidelberg, KIT)
  - High rate capability (HBT → fast amplifiers/transmitters up to 10 Gbps)

- **MAPS in 65nm TPSCo technology** (Heidelberg, Frankfurt, GSI)
  - Sensor characterization & qualification of stitched sensors
    → towards large-area & bent sensors
  - Simulations for optimization of pixel design and radiation hardness

- **All-silicon modules for DMAPS** (Bonn, TU Dortmund, Göttingen, Siegen, HLL)
  - Ultra-light module design
  - Integration of power and readout lines directly on wafer (RDL)



WP1: Position-sensitive monolithic detectors

WP 1.2 CMOS detectors for “non-tracking” applications

- **Monolithic sensors with high dynamic range for PID** (KIT, Heidelberg)
  - PID through dE/dx measurement in HVMAPS (large depleted region)
  - High-dynamic-range ADC in every pixel
  - Further design optimization to improved dynamic range

- **DMAPS for digital calorimeters** (HU Berlin, DESY)
  - DMAPS provide high granularity for counting tracks in shower
  - Investigation of new data reduction techniques (hit/cluster counting)
  - New sensor design with on-chip digital processing capabilities suitable for digital calorimeter readout

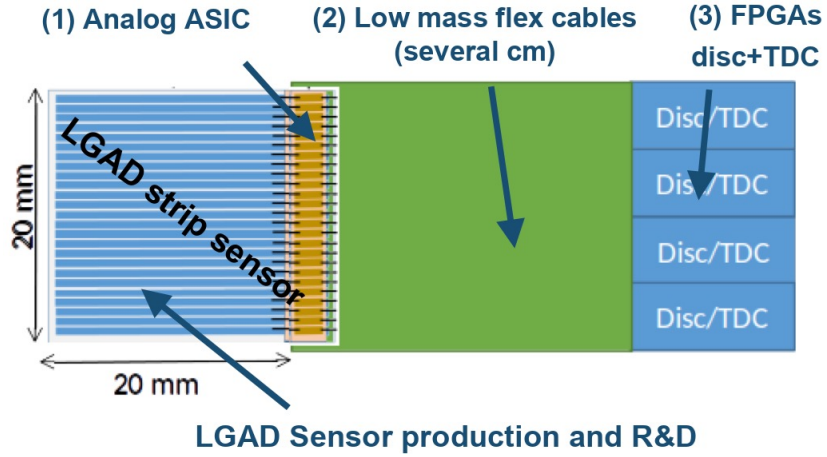
WP2: Fast timing

WP 2.1 LGADs

- **Fast timing layer** (DESY, Hamburg, Mainz, Göttingen)
  - Timepix4-based timing layer in EUDET telescope
  - Available to all groups for test-beam measurements of various LGAD layers

- **German LGAD for 4D tracking** (Hamburg, HLL, MPP, KIT)
  - Novel LGAD design by HLL (MARTHA)
  - Characterization of first prototypes developed for photon science
  - Goal: New optimized design for particle physics expts (timing, rad. hardness) + new readout ASIC (IHP 130nm BiCMOS)

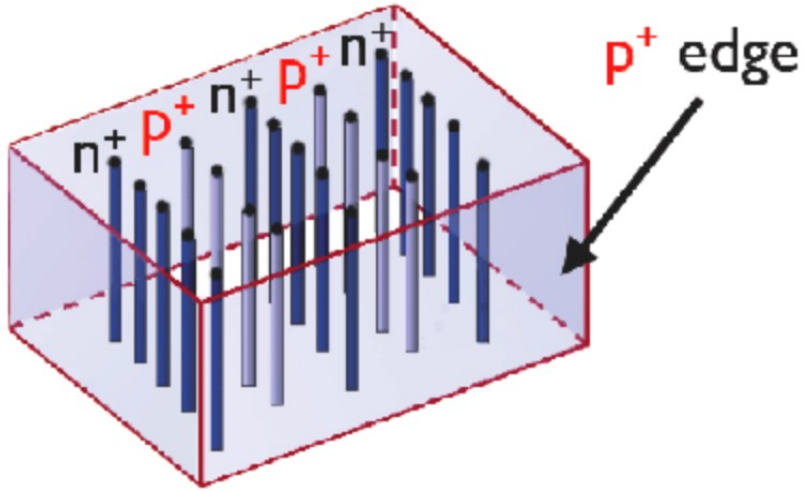
- **Large-area, low-mass 4D tracking demonstrator** (TU Darmstadt, GSI, KIT)
  - Novel 4D tracking concept based on separation of FE electronics and sensor
  - Goal: Combine single modules to large-area system (100 cm^2)



WP2: Fast timing

WP 2.2 3D sensors (Freiburg, Bonn, MPP, DESY)

- Novel radiation-hard 3D sensors dedicated to fast timing
  (based on cooperation within RD50 – CNM Barcelona, Ljubljana)
- Design of dedicated readout ASIC with high-bandwidth analog FE
  adapted to large sensor capacitance



WP 2.3 CMOS sensors with gain layers (Freiburg, Heidelberg)

- Improve time resolution of CMOS sensors with gain layers (→ higher S/N)
- “Implementing LGADs in CMOS technology”

WP3: System integration, radiation tolerance, and simulation

WP 3.1 Power management (Aachen, FH Dortmund)

- DC-DC converters with larger conversion factors, new circuit designs to reduce power dissipation

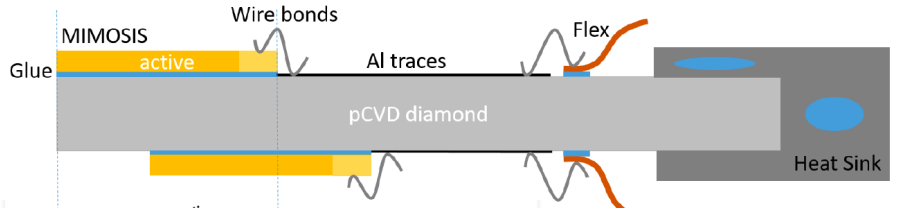
WP 3.2 Optical data transmission (KIT, Wuppertal, FH Dortmund)

- Optical transmission based on chips integrating silicon-photonics components

WP 3.3 2.5/3D integration (KIT, FH Dortmund, HLL-MPG)

- Integration of chips with active interposers (2.5D) or vertical stacking with TSVs (3D)
- Advanced wafer bonding techniques

WP 3.4 Aluminium strip lines on pCVD diamond carriers (Frankfurt, Mainz, GSI)



- Combine mechanical support, cooling, electrical connectivity in one (low-material) component

WP 3.5 Reusability by on-detector intelligence (FH Dortmund)

- Programmability/reconfigurability through radiation-hard, SEU-tolerant RISC-V CPUs & FPGAs
- On-detector chip intelligence, e.g. hardware accelerators for AI and ML

WP 3.6 Radiation hardness and simulations (Frankfurt, Hamburg, Heidelberg, KIT, GSI)