The FH detector R&D platform

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HELMHOLTZ

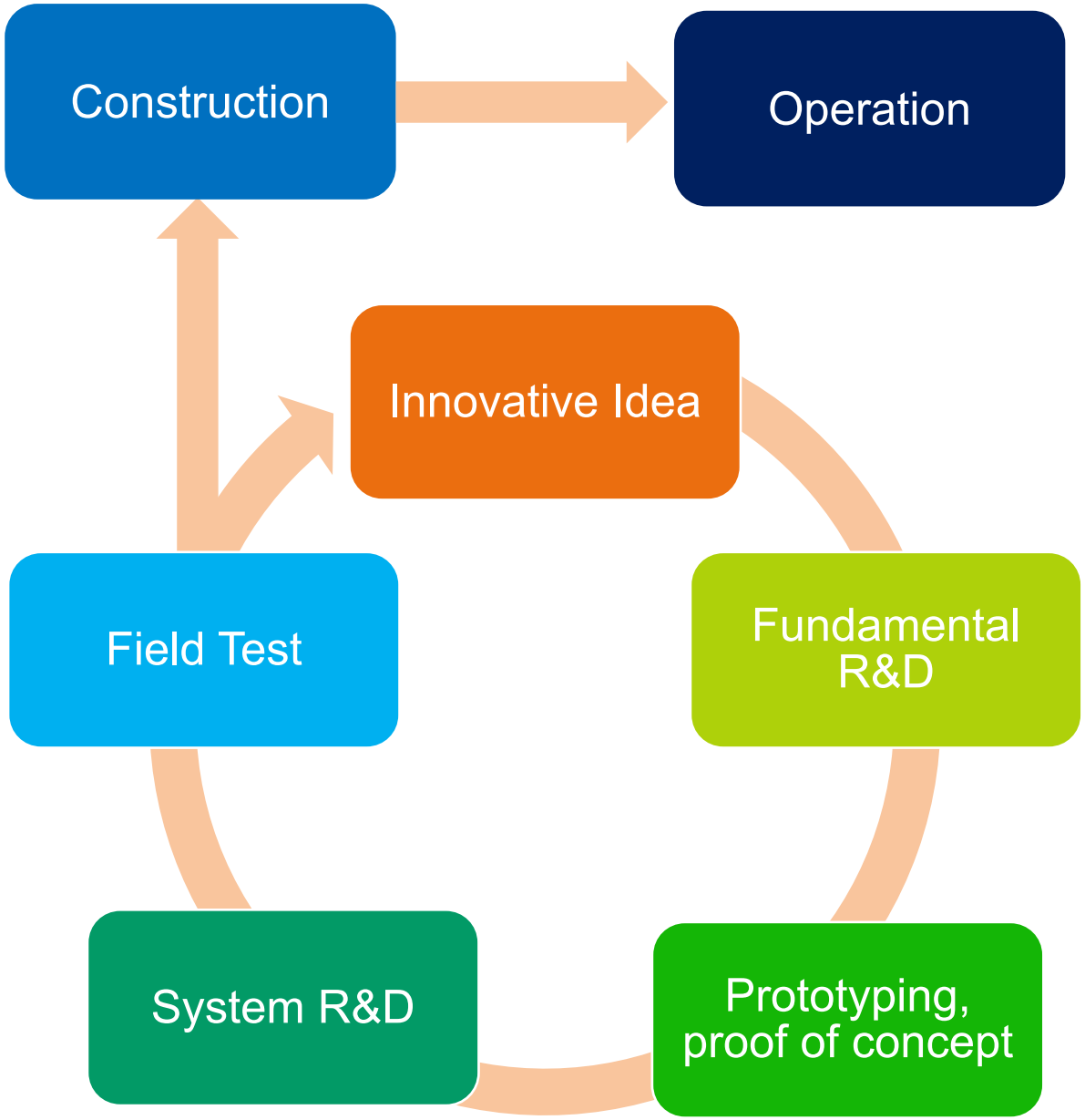
DESY.

Detector competences

Detector Lifecycle

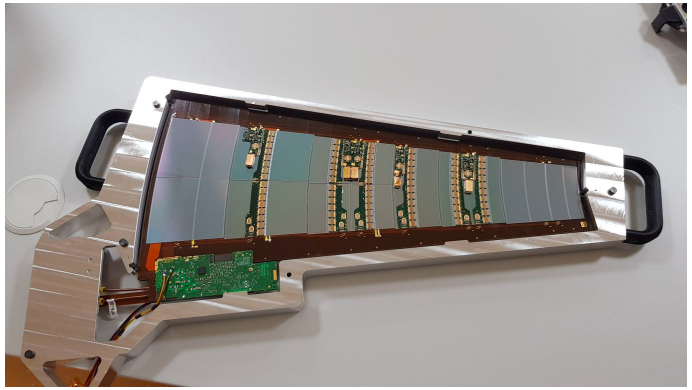
DESY has competences for the full detector lifecycle

- Innovative Idea: low-level and high-level simulations
- Fundamental R&D: sensor development
- Prototyping, proof of concept
- System R&D: readout system, mechanics, cooling, …
- Field test: testbeams
- Construction: e.g. Detector Assembly Facility
- Commissioning and operation



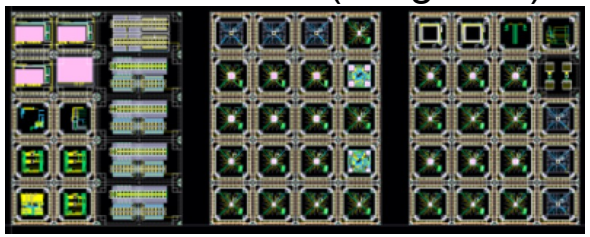
Detector Projects in DESY FH

Examples

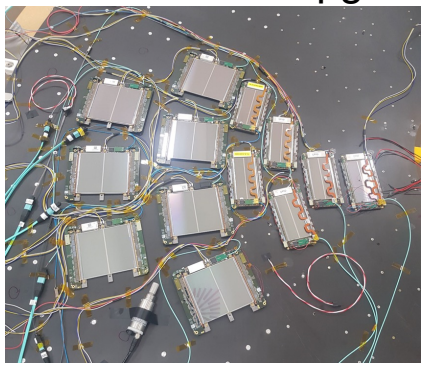


ATLAS ITk

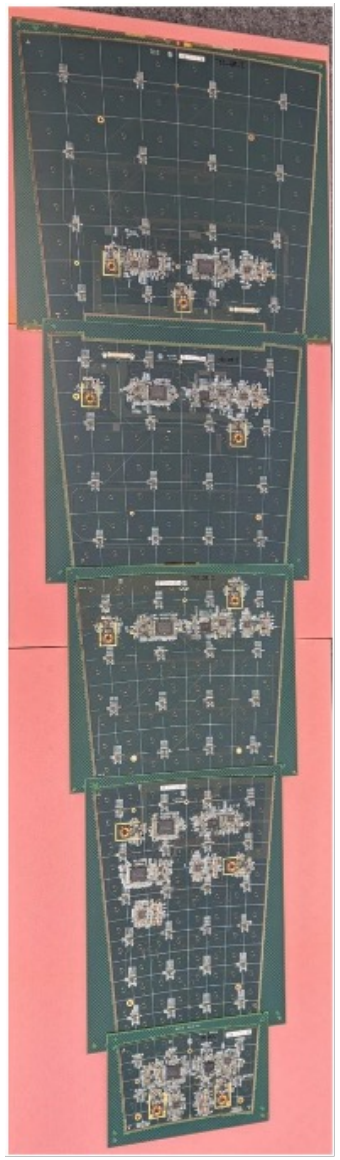
CMOS MAPS (Tangerine)



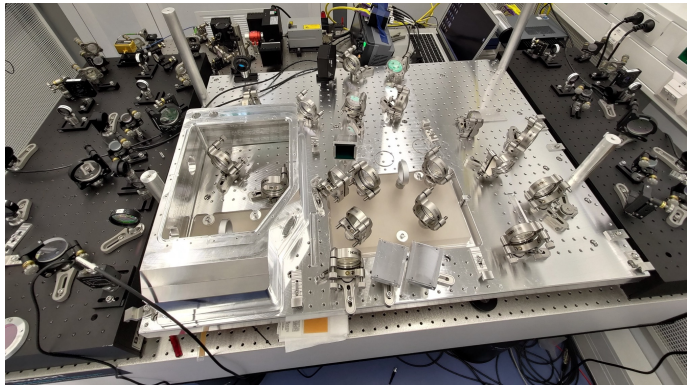
CMS Tracker Upgrade



CMS HGCAL



Belle II PXD

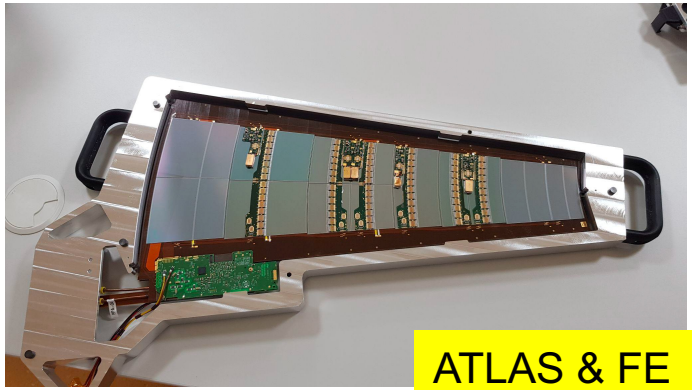


Detectors for ALPS searches

Testbeam telescope

Detector Projects in DESY FH

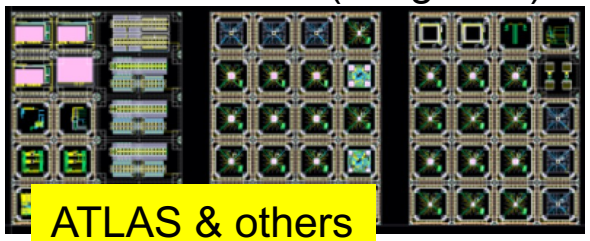
Examples



ATLAS & FE

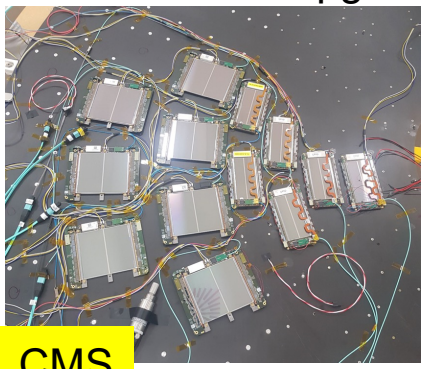
ATLAS ITk

CMOS MAPS (Tangerine)



ATLAS & others

CMS Tracker Upgrade



CMS

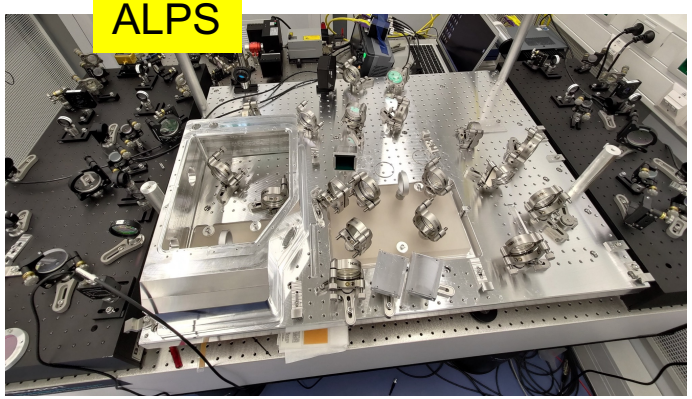
CMS HGCAL

CMS & FTX & FE

Expertise distributed over many groups in FH

Belle

Belle II PXD



ALPS

Detectors for ALPS searches

FTX & ATLAS

Testbeam telescope

Detector Projects in DESY FH

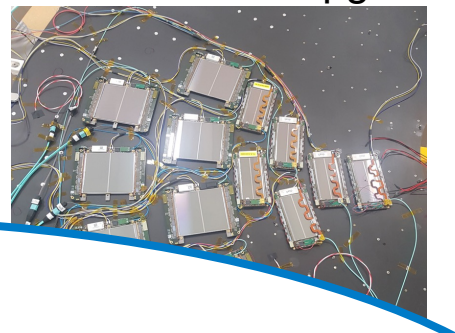
Examples

ATLAS ITk

CMOS MAPS (Tangerine)

ATLAS & others

CMS Tracker Upgrade

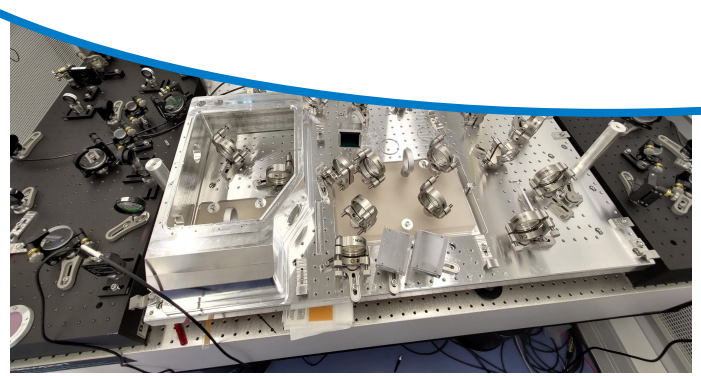


CMS HGCAL

& FTX & FE

Detector R&D Platform

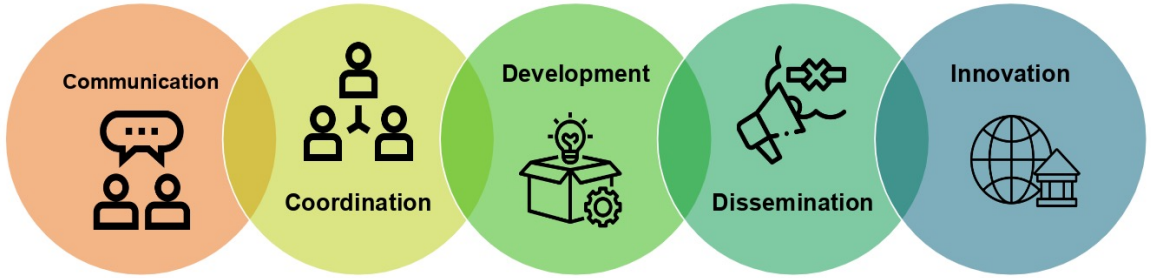
Belle II PXD



Detectors for ALPS searches

Testbeam telescope

Detector R&D Platform Overview



- Goal is to establish a common Detector R&D effort
  - Define common strategy
    - Within FH, but also with others (FS/AP, Helmholtz/MT, Unis)
  - Improve communication
  - Increase visibility
- Organise common FH activities in detector R&D
  - Organise common invest projects
  - Control over person power stays within the groups
- 2 coordinators with 3 years renewable mandate (staggered by 1.5 years)
- A steering group (2 years mandate) has been formed with representatives for each R&D topics and relevant contact persons.

Steering Group

Coordinators

Katja Krüger
Calorimeter

Friederike Januschek
Cryogenic Detectors

Simon Spannagel
Silicon detectors

Christian Reckleben
ASICs & Si-photonics

Moritz Guthoff
Integration

Andreas Nürnberg
DAF

Ties Behnke
MT contact

Lennart Huth
ITT contact

Marcel Stanitzki
Test Beam contact

Dario Ariza
Engineering contact

Topics of Interest & Connections to DRDs

Silicon detector development is a strong focus of our interest

- Monolithic CMOS
- Novel sensors (ELAD, digital SiPM, …)
- Software tool developments
- Involvement in DRD3

Calorimeter developments

- Highly granular SiPM on tile calorimeter
- Involvement in DRD6

Data transfer

- Silicon photonics
- Advanced interconnects
- Involvement in DRD7

Integration

- Detector integration center
- R&D on light weight mechanics, local cooling and cooling systems
- Involvement in DRD8

Cryogenic detectors

- Transition Edge Sensors
- Developments for axion/dark matter experiments

Infrastructure

- Detector Assembly Facility
- Test beam

Involvement in DRD1 (gaseous detectors) & DRD5 (quantum sensors) on observer level.

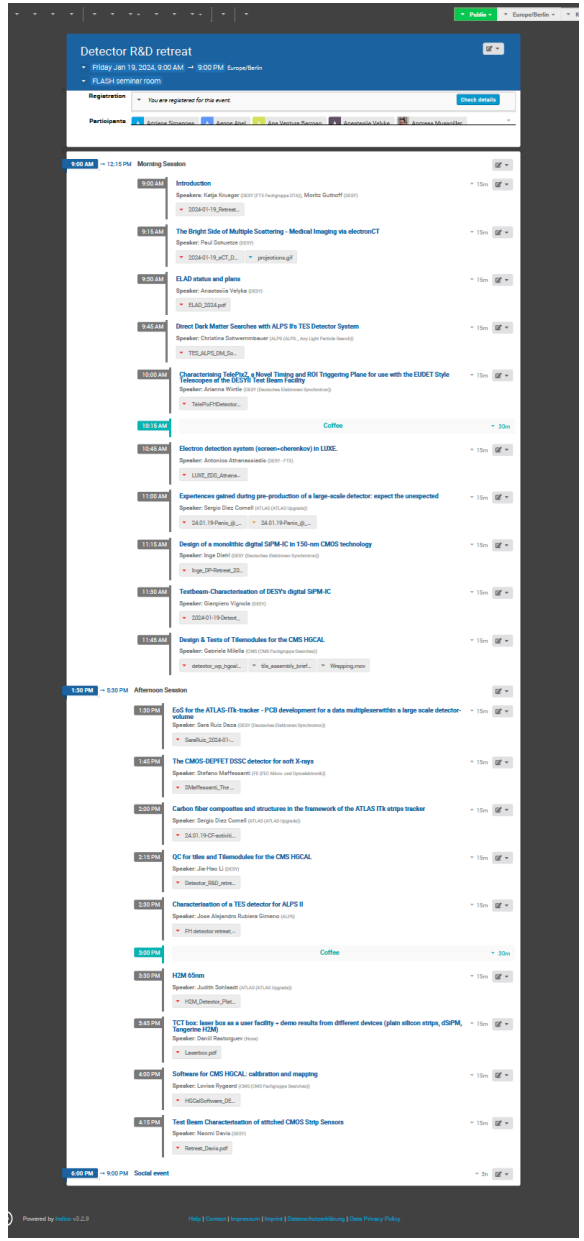
Communication & Visibility

Improve communication within FH and beyond

- Two detector R&D retreats per year
  - First one at DESY in January 2024, FH internal
  - Second one on 9 July 2024 at the Youth Hostel Horner Rennbahn
    - Invited talks on infrastructure, posters & ample time for discussions
    - Please register: https://indico.desy.de/event/44744/
- Joint Instrumentation Seminar: include more DESY speakers
- Journal Club: already existing for silicon R&D: https://confluence.desy.de/display/SDR/Silicon+Detector+Journal+Club
- Planned: Lab tours

Career Development

- Plan a central place to collect Bachelor, Master and PhD projects
  - Full time or part time
- Post-doc projects?



Summary

- The detector R&D platform has started its work
  - Define common strategy
  - Improve communication
  - Increase visibility

- Relies on enthusiasm of the detector R&D community at DESY!

- Platform mail list: fh-detector@desy.de

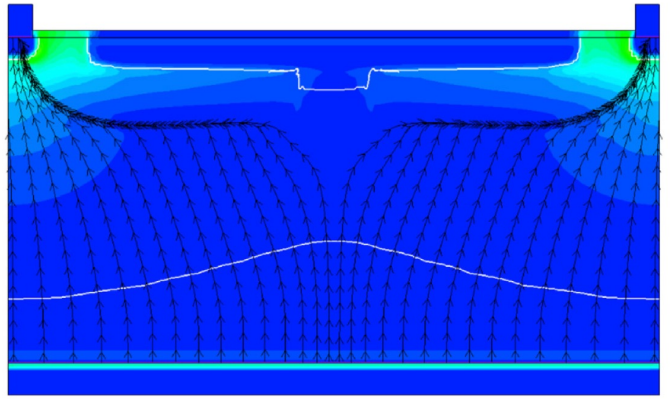
Thank you

Backup

Infrastructure for Detector R&D

Fulfilling DESY's role as hub

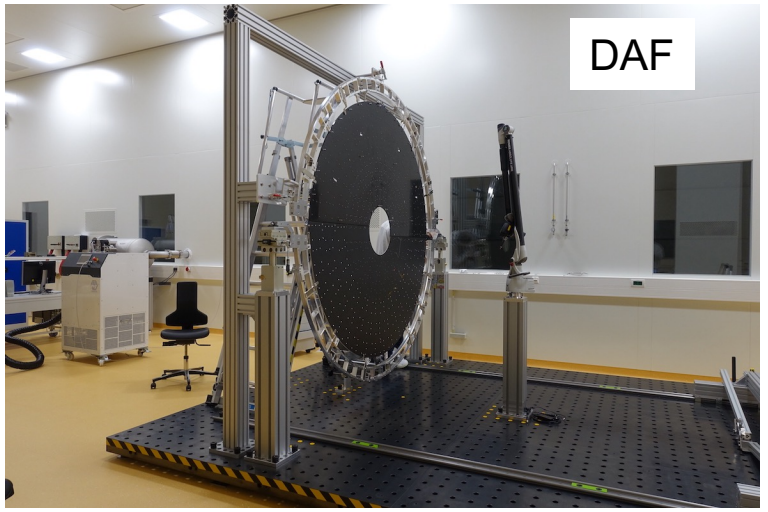
- **Software tools** for detector development
  - DESY is maintaining & developing several software tools & frameworks for the detector R&D community (e.g. Simulations: Allpix Squared, Testbeam reconstruction: Corryvreckan, Data acquisition: EUDAQ2)
  - User communities: particle and nuclear physics, photon science, space applications, …
- **Test beam:** Essential work horse for detector development in particle and nuclear physics. National and international.
  - Currently available test beams: 1-6 GeV electrons. 3 beam lines
  - With PETRA IV, a new test beam facility is needed, concepts are being developed
  - New beam telescopes: synergy with detector technology development
- **Detector Assembly facility (DAF)**
  - Currently fully in use for LHC upgrades (expected until 2027)
  - Large clean rooms with equipment for detector assembly, testing, mechanical integration, cooling tests, metrology etc.

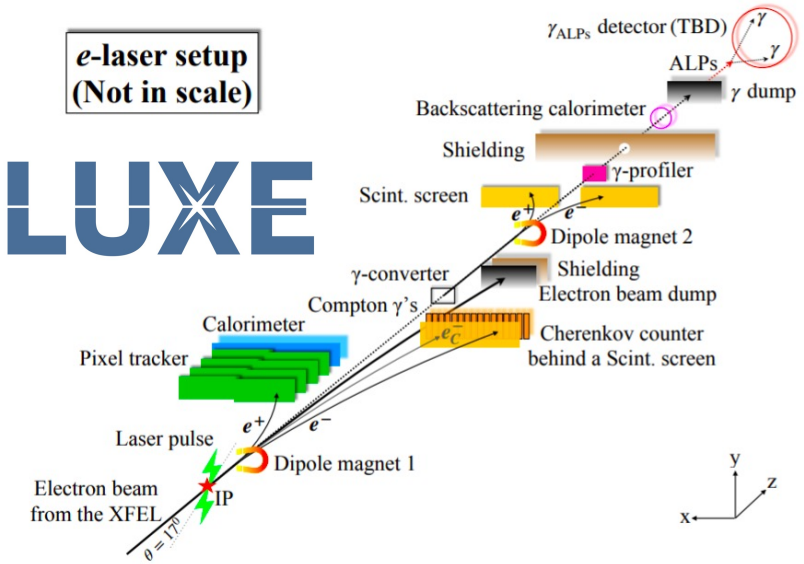


FH - Detector R&D strategy

Paving the way for the future

- DESY's base funding is provided through the Helmholtz association by the mechanism of "Programmorientierte Förderung" (PoF)
  - Current period is PoF IV, will end in 2027
  - The next (PoF V) with be 2028 to 2035. The application process for PoF V is in already ongoing
- With the start of PoF V, construction of HL-LHC detector upgrades will be largely completed
- In PoF V switch focus to R&D for future experiments:
  - e+e- Higgs factory pending European Particle Physics Strategy Update (EPPSU) in 2026
  - Smaller on-site experiments: Axion search experiments, LUXE,...





FH - Detector R&D strategy

Paving the way for the future

- R&D activities and interests to meet the needs of future experiments
  - Strong focus on monolithic silicon pixel sensors & systems
  - Highly granular calorimetry using SiPM-on-tile technology
  - Silicon photonics to address future data transfer needs
  - Cryogenic Sensors for Axion/Dark Matter detection

- Build on DESY's system design expertise

- Address challenges for future experiments ranging from mechanics & cooling to system integration

- Strong involvement in the international R&D effort (DRDs)

Innovation & Technology Transfer

Innovation & Technology Transfer

Science for Society

INNOVATION & TECHNOLOGY TRANSFER

> **Anja Karliczek**

Former Federal Minister of Germany for Education and Research

“DESY shows us which impact basic research also has for the economy in general and start-ups in particular. This is why the German government invests around 250 million euros annually in DESY.“

“Transfer from science to practical application is an essential part of the Helmholtz mission.”

https://www.helmholtz.de/en/transfer/

We promote innovation and share our know-how.

DESY expands technology transfer. DESY is going to be the starting point for further start-ups in the Hamburg and Brandenburg regions.

Key part of the DESY 2030 strategy

DESY Generator Program

Funding for your invention(s)

- Providing seed funding for DESY technologies with high innovation potential for industrial application
- Designated for activities beyond basic research
- Funding depends on the evaluation of potential market value

dgp.desy.de

Four key fields of activity

Ecosystem for innovation

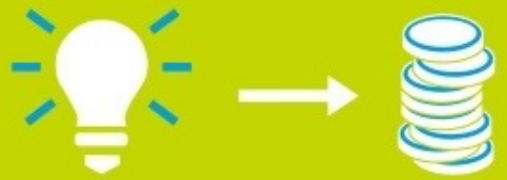
#networks

Industry Services

#Innovationservice

Technology Transfer

#ideastomarket



Start-up Services

#Startups