

1st Pixel Platform Workshop

Welcome and introduction

Silvia Masciocchi

March 23, 2026

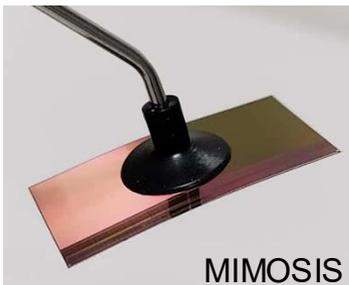


CMOS Monolithic Active Pixel Sensors

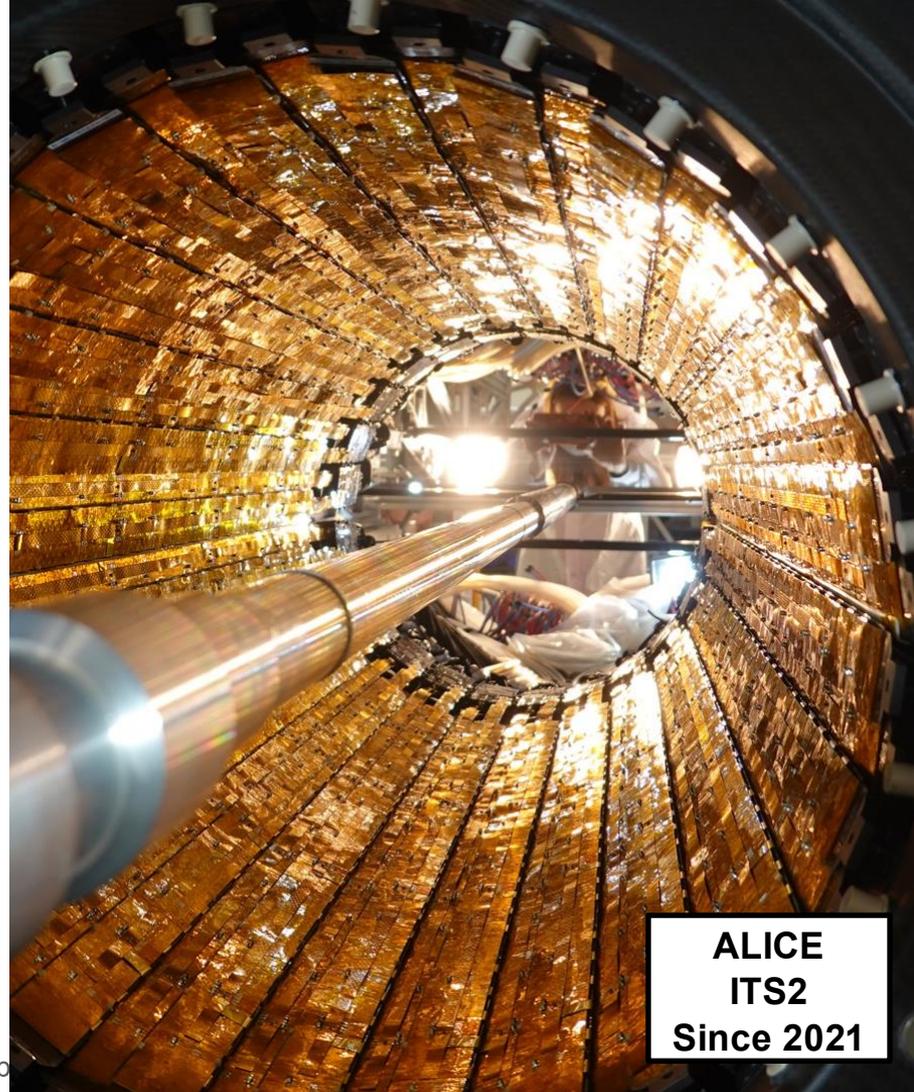
5-10 μm point resolution

Sensor size: $\sim 2 \times 3 \text{ cm}^2 \rightarrow$ wafer scale

So far up to $\sim 10 \text{ m}^2$ total area

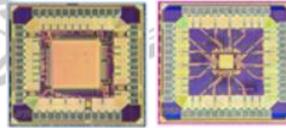
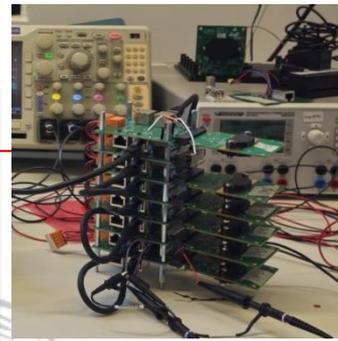
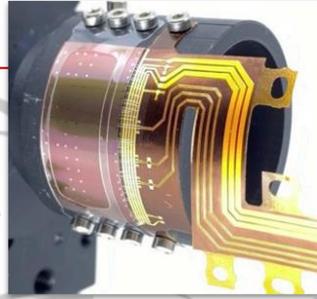
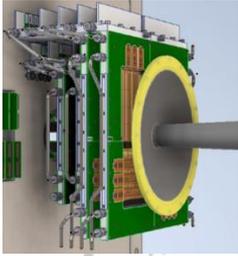


MIMOSIS



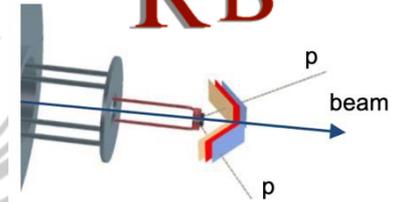
**ALICE
ITS2
Since 2021**

Many pixel activities at GSI

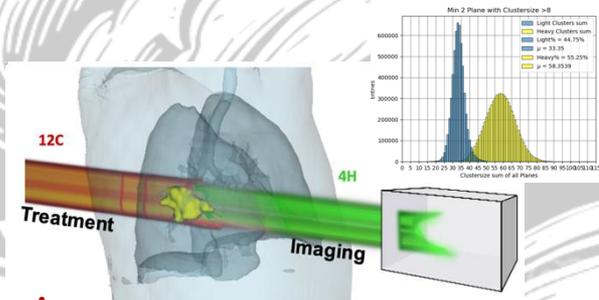


ALICE

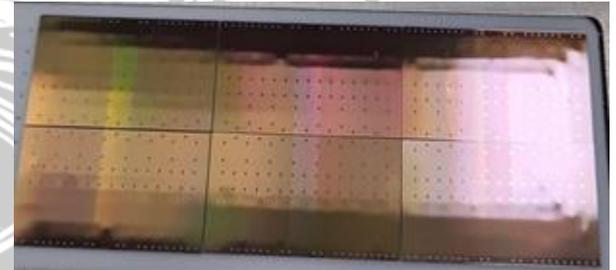
R³B



CBM



Biophysics



Pixel Platform at GSI/FAIR

Competence center on pixel sensors and their integrated detector system:
Built on five strong GSI/FAIR pillars, with broad and unique expertise.

GSI Detector Laboratory

Interconnections
Assembly,
packaging
Readout
Production
Test and more

GSI EEL Experiment Electronics

ASIC design
A&D electronics
System design
Manufacture
Control systems



MAPS
180 nm
MIMOSIS
CBM MVD



ALICE
MAPS
180nm ALPIDE
65 nm MOSAIX
ALMIRA



MAPS
180 nm
ALPIDE

Technical coord. team



Module design
Coord. of
interfaces
Light-weight mech.
Logistics, prod.

Pixel Platform at GSI/FAIR

Competence center on pixel sensors and their integrated detector system:
Built on five strong GSI/FAIR pillars, with broad and unique expertise.

Will share competences and offer support to users

ASIC design

Sensor
characterization

System
integration

Powering and
data transmission

Software



**GSI Detector
Laboratory**

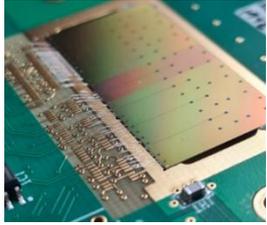
**GSI EEL
Experiment
Electronics**



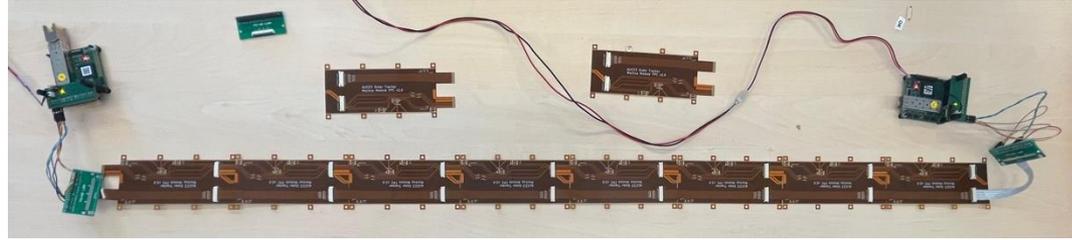
**Technical
coord. team**



From sensor to full system (just **SOME** aspects mentioned here)

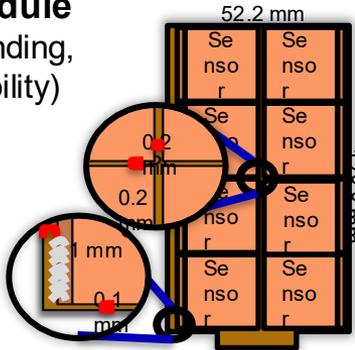


Sensor
(ASIC design, characterization)

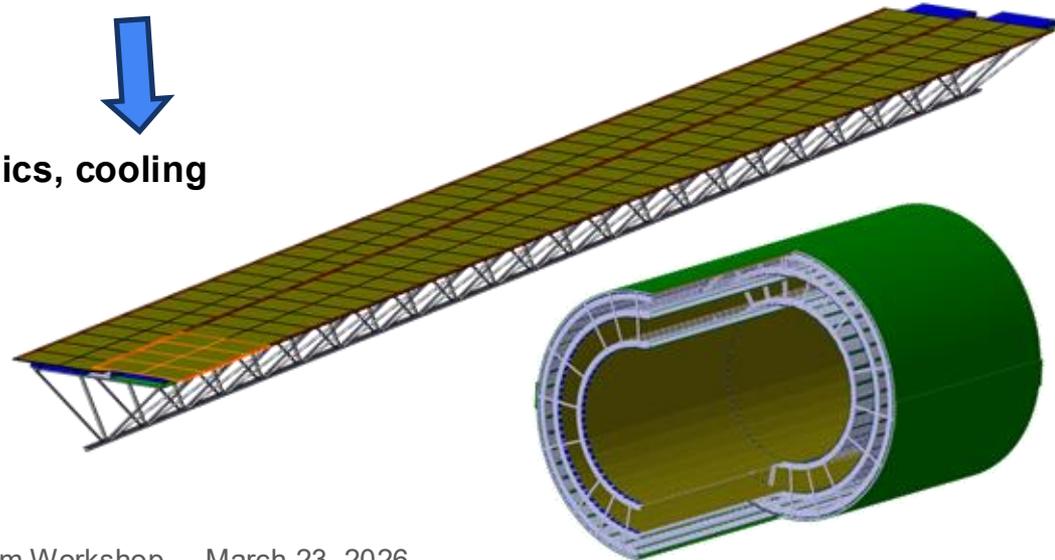
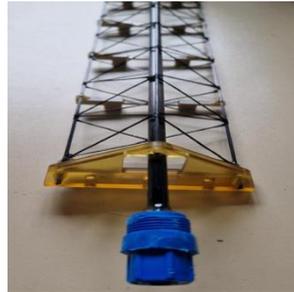


Powering, control, data transmission

Module
(bonding, stability)

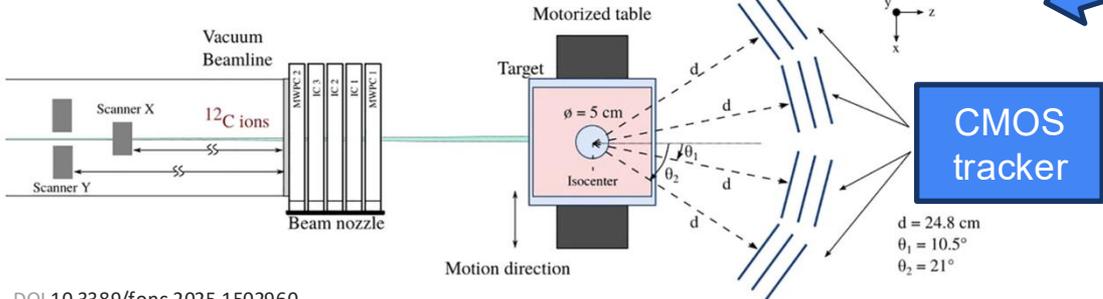
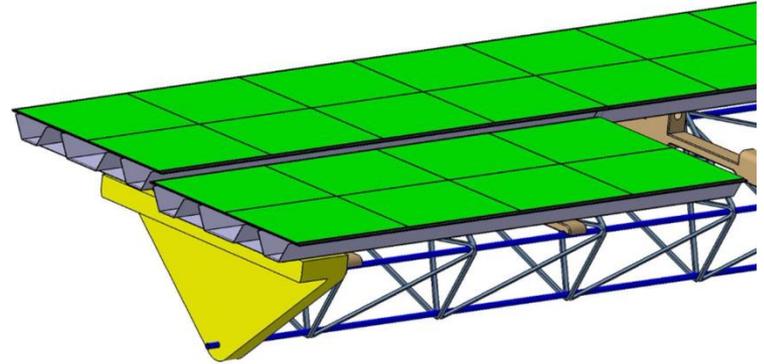
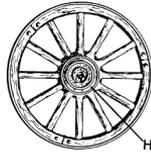


Mechanics, cooling



The Pixel Platform can offer support as:

- Stronger connection among the groups
→ monthly meetings
- Work together on common challenges
- Use resources at best ...



In future: offer advanced or ready solutions for other applications

GSI Detector Laboratory



Christian Schmidt



Detector Laboratory: 600 m² Clean-Room (ISO7 to ISO3)



Developments for:

- CBM/HADES at GSI/FAIR
- Accelerator diagnostics at FAIR
- NUSTAR/SFRS at GSI/FAIR
- APPA at GSI/FAIR and elsewhere (therapy)
- ALICE at CERN
- Cooperation with ESA (JUICE)



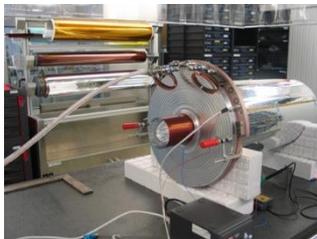
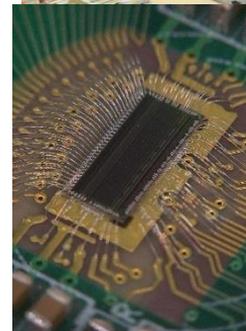
Competences:

- Micro-Patterned Gaseous Detector Technology
- Silicon-Strip Detector Integration
- ASIC Handling and Integration
- Diamond Detectors



Machinery:

- Laser Lithography
- PVD
- Bonding Automates
- Probestation and Chip Handling
- Automatic Wafer-Scale Probing
- Automated Wire and Fibre Winding
- Digital Microscopes
- Thin Foils Handling and Processing
- Detector Ageing Teststands
- Large Prototyping CNC Milling Machine

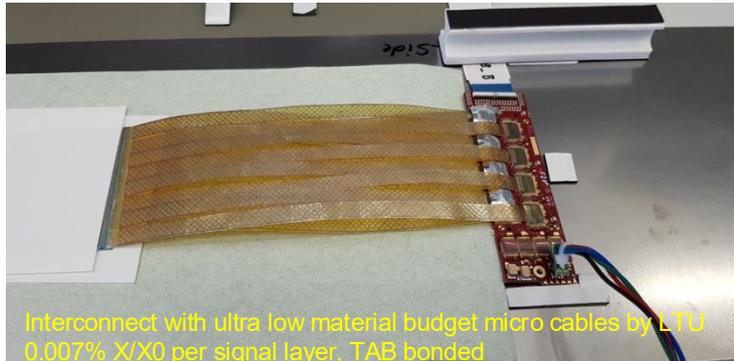


Silicon Competence and Micro-Bonding Technologies

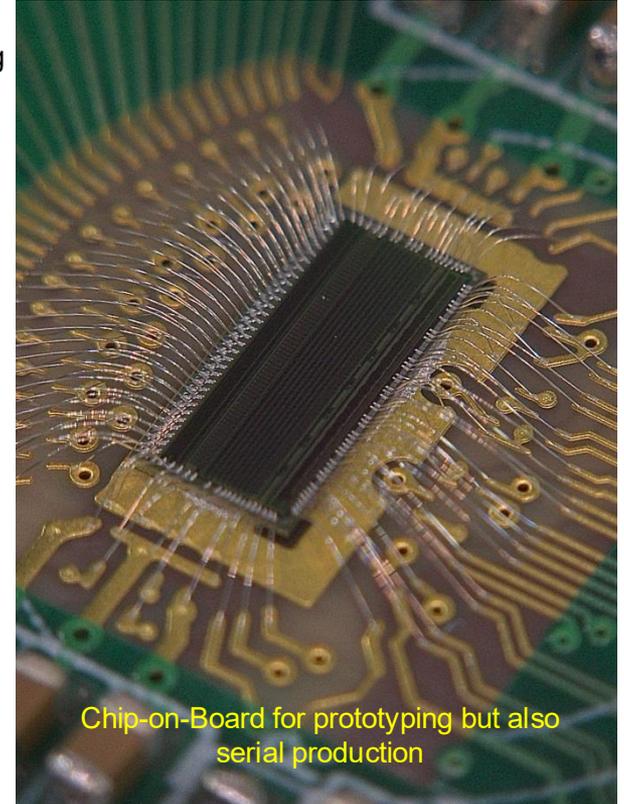


Bonding Specialties:

- Al wedge wedge micro bonding
- Au ball-wedge, bump bonding
- Al TAB-bonding (LTU Al-micro cables)
- 5 automatic bonding machines
- 140 mm free working height underneath large Delvotec bonding automate
- Expanding equipment into flip-chip technologies

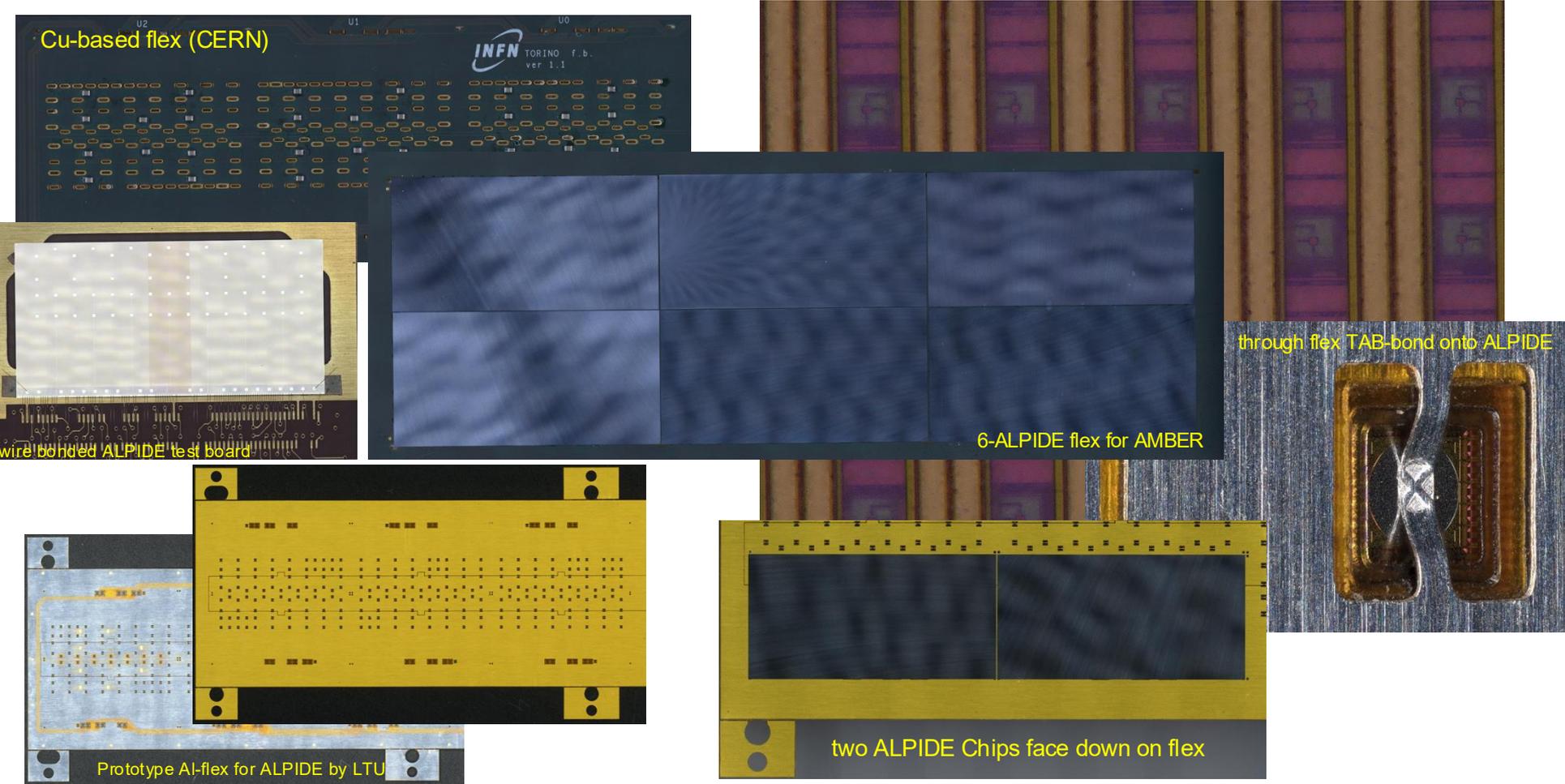


Interconnect with ultra low material budget micro cables by LTU
0.007% XIX0 per signal layer, TAB bonded



Chip-on-Board for prototyping but also serial production

Quite some experience with integrating multi ALPIDEs onto flex at GSI-DetLab



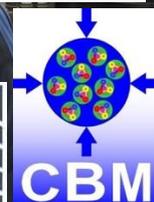
Cleanroom-Team and Cooperation Partners

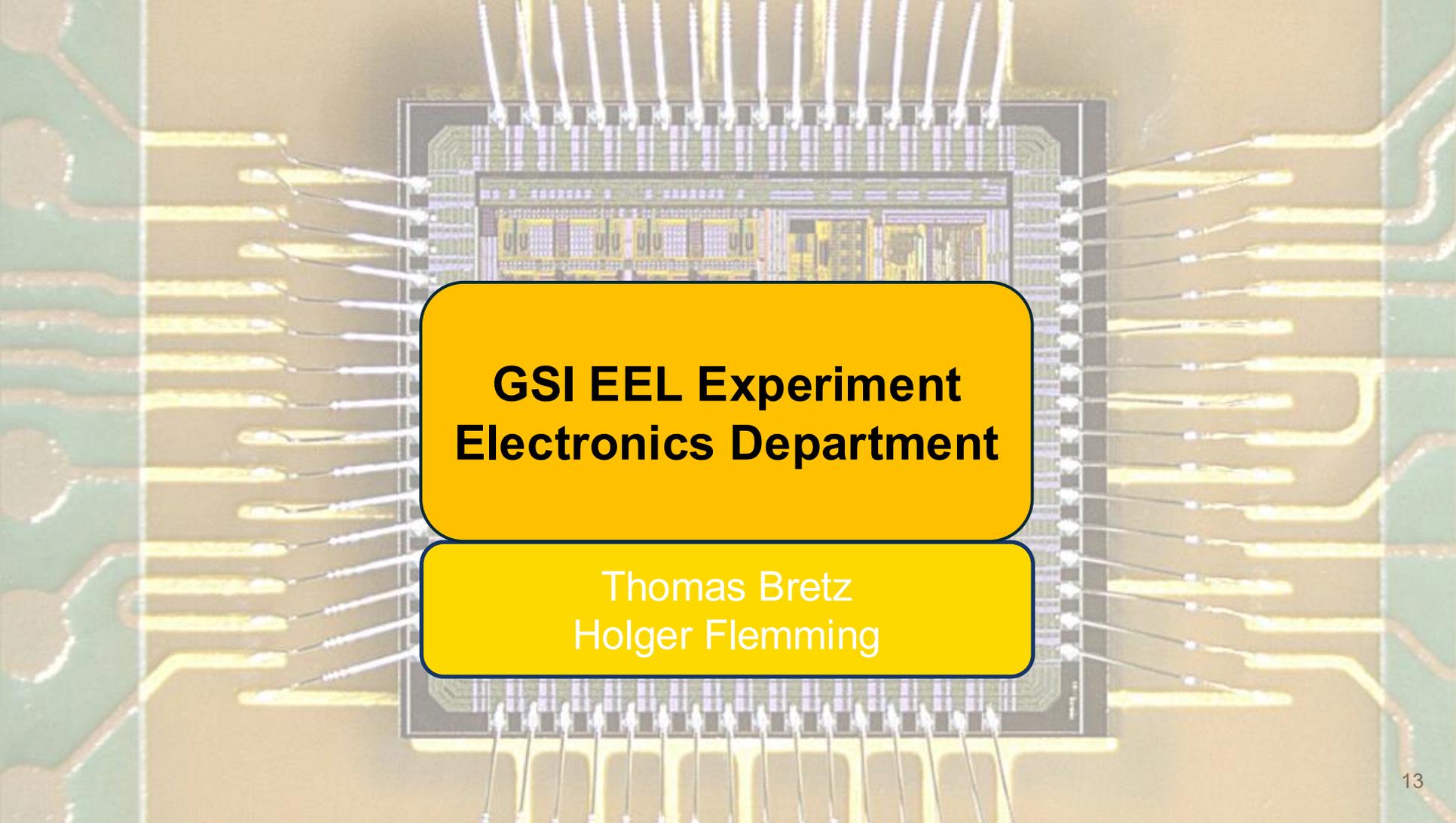


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HEIDELBERG
ZUKUNFT
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Leibniz



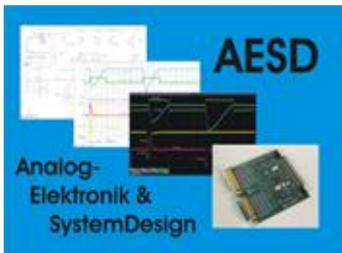
A detailed photograph of a microchip, likely a CCD or CMOS sensor, mounted on a green printed circuit board (PCB). The chip is square with a complex internal circuit pattern. Numerous gold wire bonds are attached to the chip's perimeter, extending outwards to connect it to the PCB. The background is a soft, out-of-focus green, matching the PCB color.

**GSI EEL Experiment
Electronics Department**

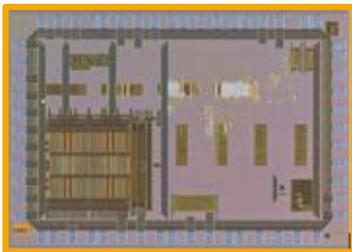
Thomas Bretz
Holger Flemming

Research - Experiment Electronics (EEL)

Analog
design:
pre-amp,
shaper



**ASIC
design**



Digital
design:
data
acquisition



*Data acquisition systems
and support*



Layout



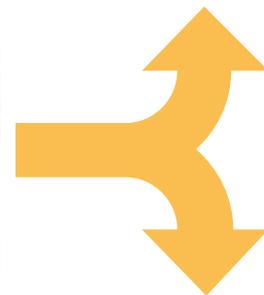
Assembly

6 groups / ~30 people

Control
systems
e.g. EPICS

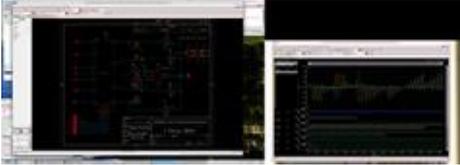


Embedded and
DAQ Software
e.g. MBS, Go4



Research - ASIC-Design (EEL / ASIC)

CAD-Env. (Design)



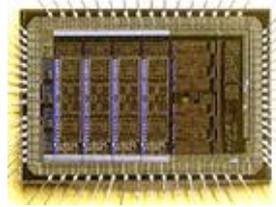
Cleanroom



3 people +
1 vacancy

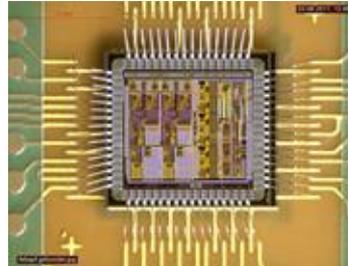
(Prototyping)

EEL-Lab
(Testing)



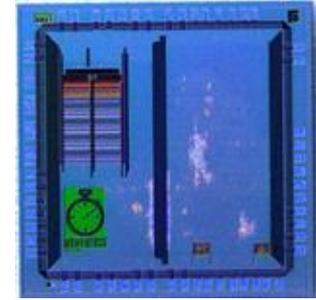
QFW2 –

Beam diagnostics
charge-freq. converter



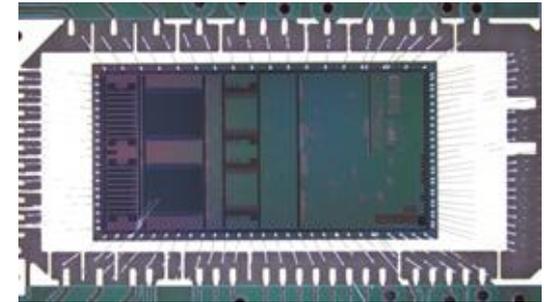
APFEL CSA –
Spectroscopy

300kHz, dyn. 10k



GET4++ – TDC

$\sigma < 10ps$



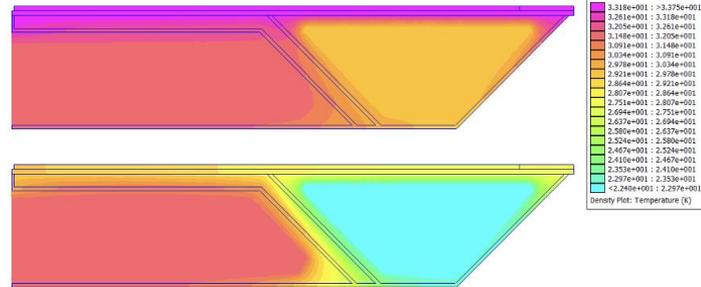
CTR16 - Transientrecorder

16ch, 100MHz, 12bit ADC

Technical Coordination Team PANDA

- Looking for a modernized PANDA experiment in the future
- Pixel detectors are a key technology in modern experiments
- Making good use of long-standing competences
 - Development of tailored mechanics with light materials
→ Rapid prototyping with 3D printers
 - Integration of services and optimization
 - Finite element methods and calculations
 - Project management and technical designs

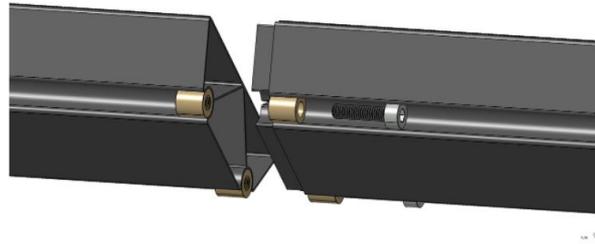
The team: [S. Koch](#), [U. Kurilla](#), [J. Lühning](#),
[A. Belias](#), [L. Schmitt](#)



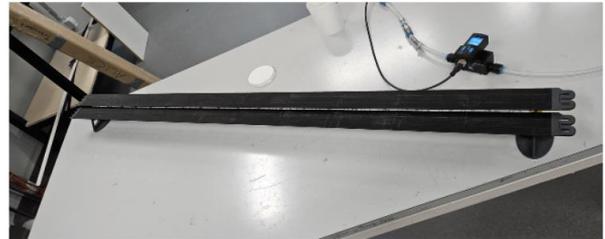
2D FEM calculation of channel



Pressurized cooling channel



Self-supporting channel with screws



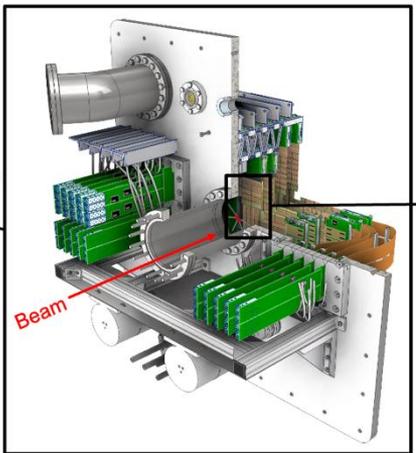
Two cooling channels on CF ladder

Compressed Baryonic Matter @ FAIR

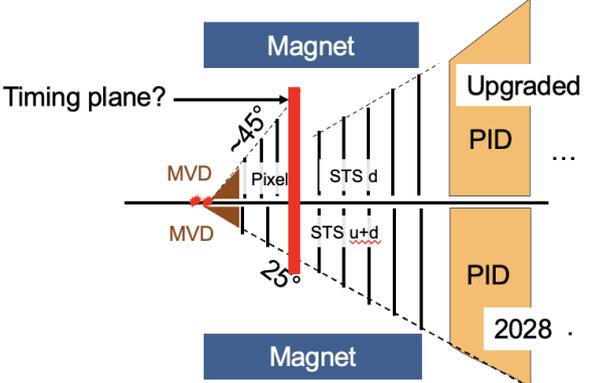


Finalizing MIMOSIS sensor

Construction of CBM Micro Vertex Detector (MVD)

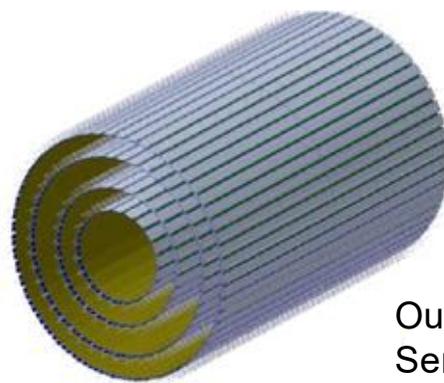
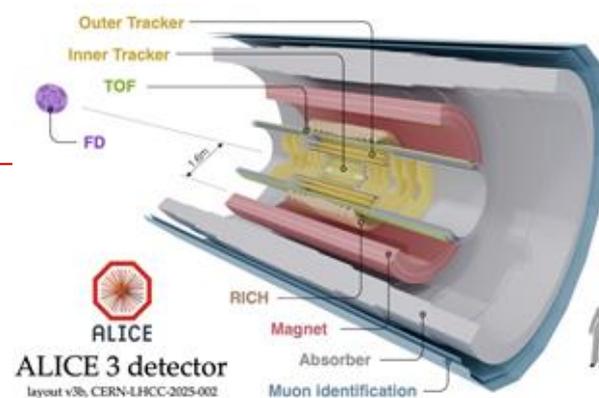
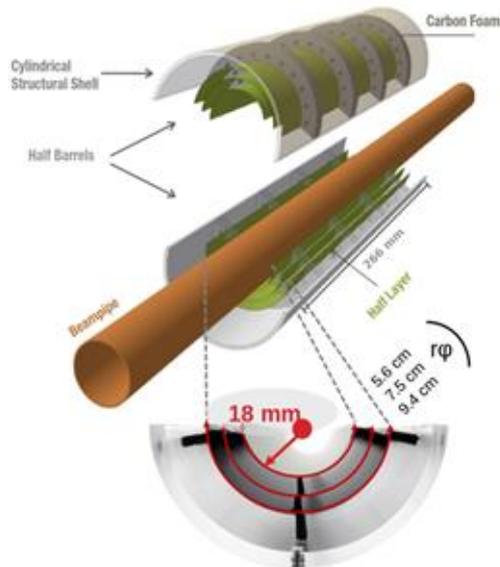


Upgrade (MVD + STS) in 2030's

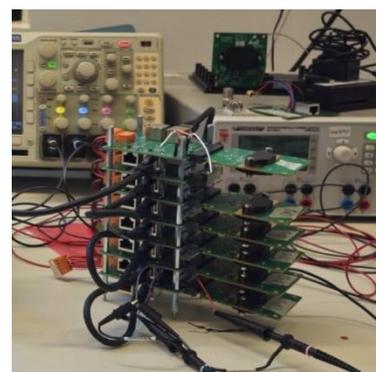


Michael Deveaux
Talk: Franz Matejcek

ALICE and ALICE 3 @ LHC



Outer Tracker
Serial powering



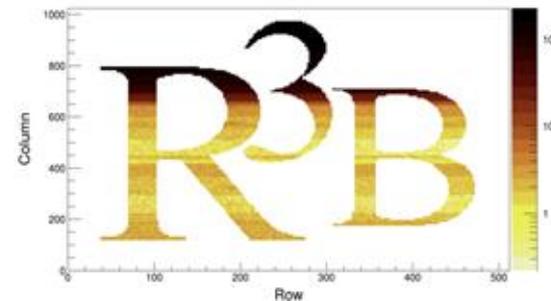
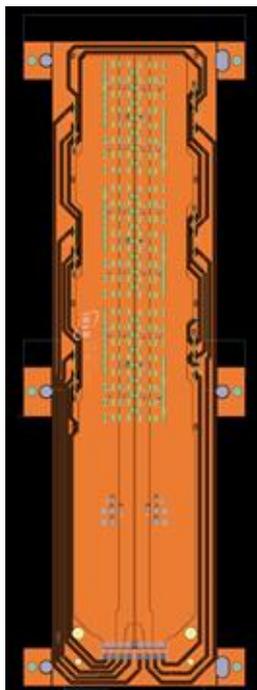
**Inner Tracking System 3
Magnus Mager (CERN)**

Talk: Bogdan Blidaru

NUSTAR, R3B @ FAIR



Large area recoil station, ALPIDE sensors



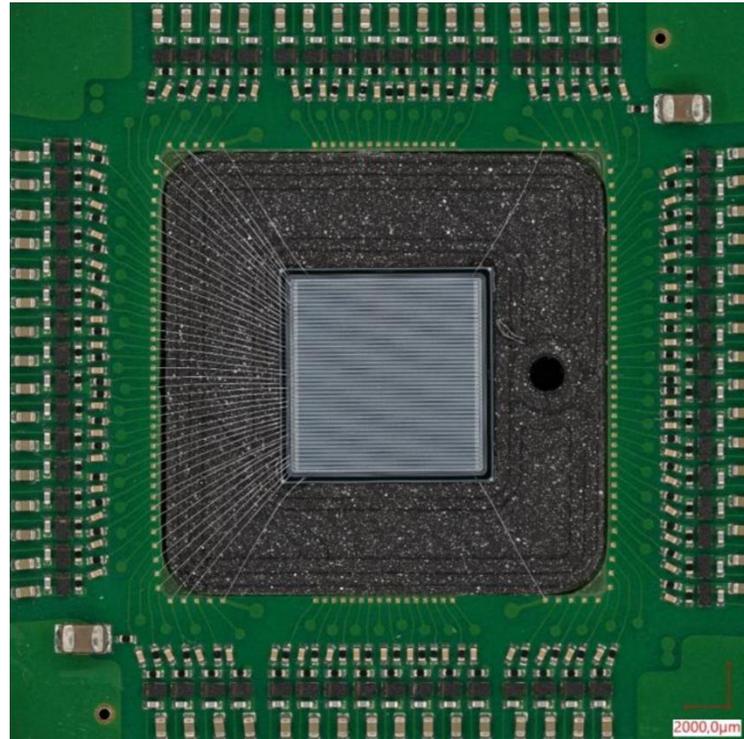
Oleg Kiselev

Talk: Luke Rose (York)

Low Gain Avalanche Diode

Developed in the
contest of the
HADES experiment

Jerzy Pietraszko



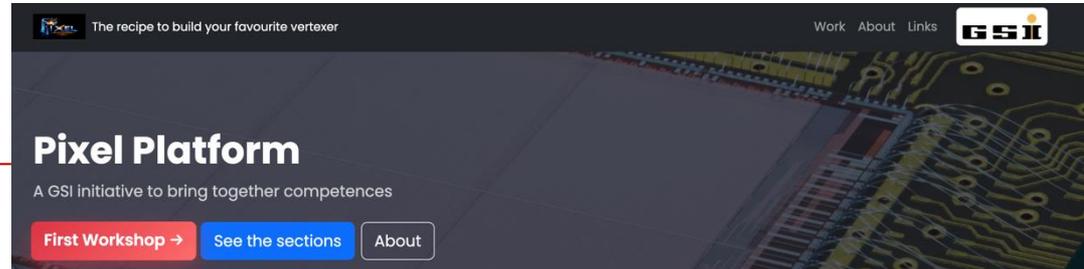
Web page, events, contacts

<https://pixel-platform.gsi.de/>

- Mailing list
→ sign up!
- Regular meetings
- Further workshops and lectures
E.g. radiation damage
serial powering
material budget, mechanics

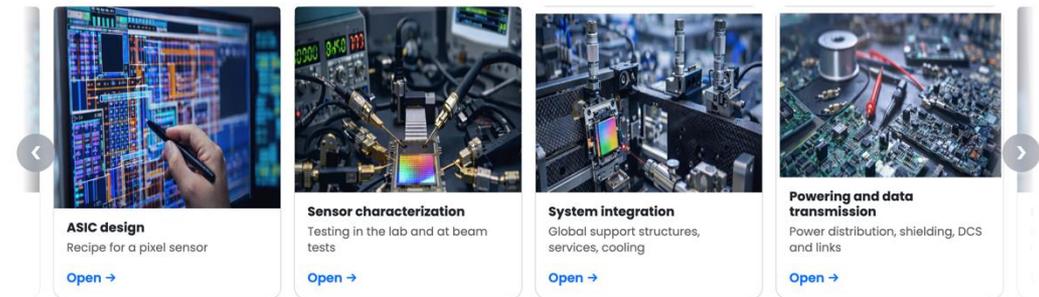


Let us know your wishes !



Featured sections

Browse the platform topics.



About

Pixel sensors are the eyes of modern nuclear and particle physics experiments: the first to witness the aftermath of a collision and the last arbiter of vertexing precision, the layer after which theory meets reality.

The billions of pixels surrounding the collision point measure the ionization traces left behind the charged particles crossing their sensitive volume enabling precise tracking and allowing scientists to distinguish primary interaction vertices from secondary decay vertices displaced by mere fractions of a millimeter. Their ultra-thin, low-material design ensures they have minimal impact on the very tracks they record, while their speed and radiation tolerance allow them to tackle the most extreme environments of today's colliders. They bring the extreme collision environments into sharp focus.

On the GSI campus, plenty of expertise in this field is available across several experimental collaborations, the Detector Laboratory, and the Experimental Electronics department. The Pixel Platform is conceived as a competence center that brings together this distributed expertise, fostering efficient collaboration between all involved teams. It aims to support both current and new users interested in exploring new measurement opportunities based on CMOS pixel technologies.

Organizers

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Dr. Lars Schmitt

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Mailing list

Stay informed about developments and activities.

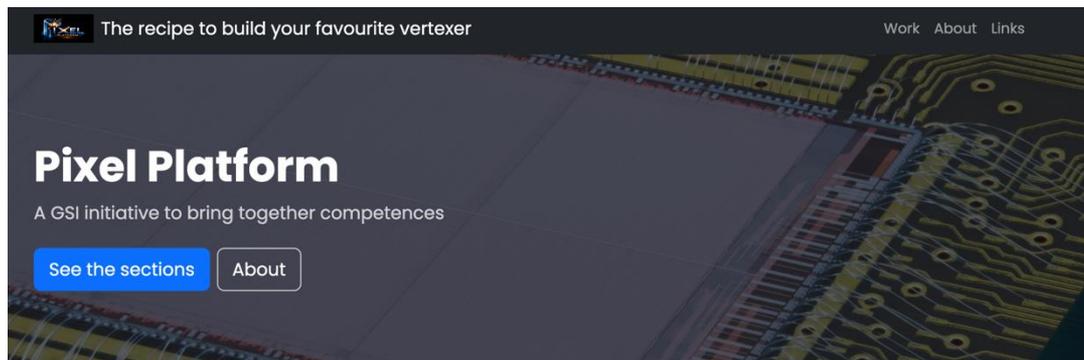
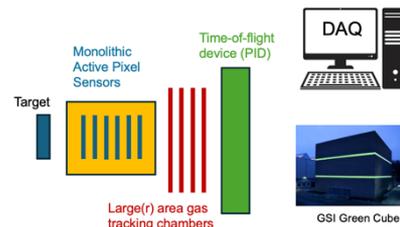
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And more ...

- ASIC design: collaboration with CERN and IPHC
Dedicated manpower
- Hightech Agenda Germany
Competence Center Chip Design
- GSI beam for students
- ...



Bogdan Blidaru, Thomas Bretz, Michael Deveaux, Holger Flemming, Piotr Gasik, Udo Kurilla, Silvia Masciocchi, Christian Schmidt, Lars Schmitt, Maksym Teklishyn