

A close-up photograph of a person's hand holding a white probe tip over a microchip. The chip is mounted on a dark surface and has several thin wires connected to it. Some wires are blue with gold-colored tips, while others are black with gold-colored tips. The background is dark, and the lighting highlights the intricate details of the chip and the probe.

**Detector Development
for Particle Physics
and medicine**

Erika Garutti

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Experimental particle and astro-particle physics

Particles & detectors:

Prof Gallo,
Prof. Garutti,
Prof. Haller,
Prof. Schleper

The research field:

Basic research of the
fundamental laws of nature
@ CMS experiment (CERN)
@ future ILC experiments

strong collaboration with DESY CMS and FLC groups

Additional groups:

Caren Hagner, Neutrino physics
Dieter Horns, Astro-particle physics

DESY groups on LHC, FLC, ALPS

SFB „Particles, Strings and the Early Universe“

Particle Physics & Detector Development

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My topics:

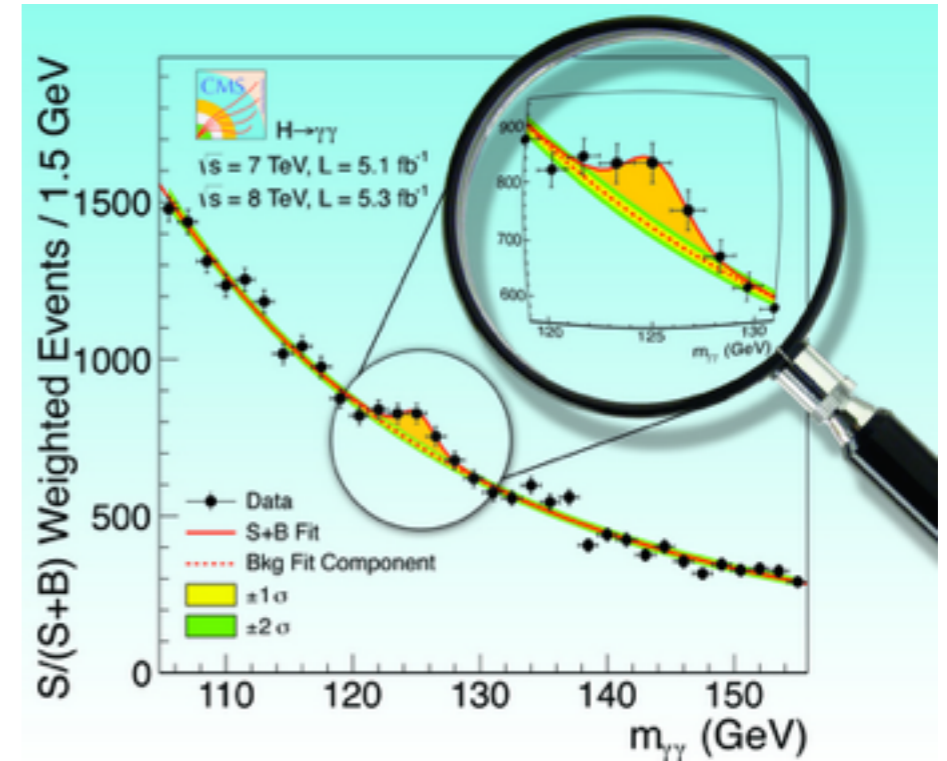
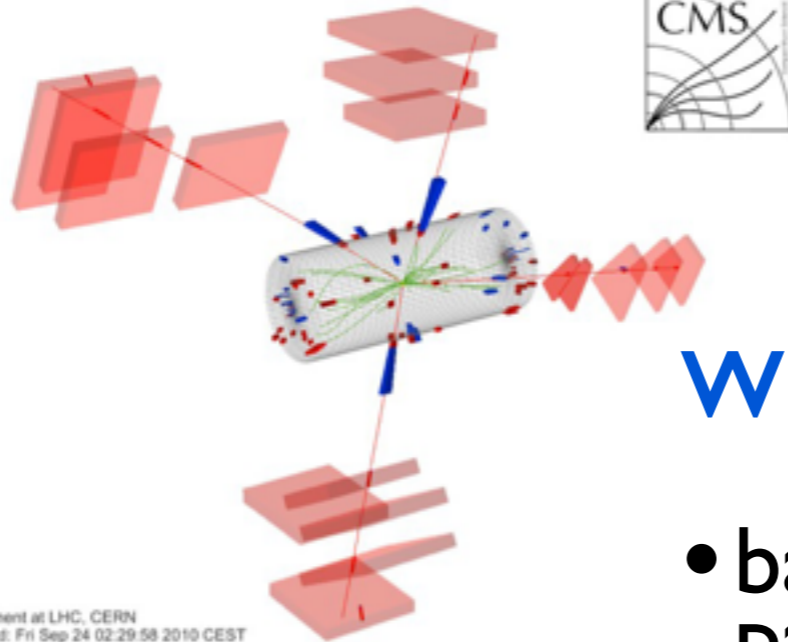
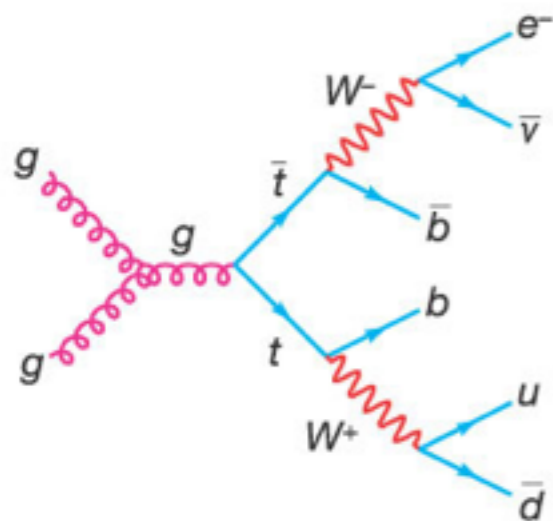
- development of detectors for **high energy physics**
- development of detectors for **medical** applications
- fundamental research on **silicon** detectors

More info: <http://wwiexp.desy.de/groups/pd/>

Higgs, top and SUSY physics with CMS

Prof. Gallo, Prof. Haller, Prof. Schleper

- Study of the top quark & Higgs boson
- Searches for Supersymmetry



The projects:

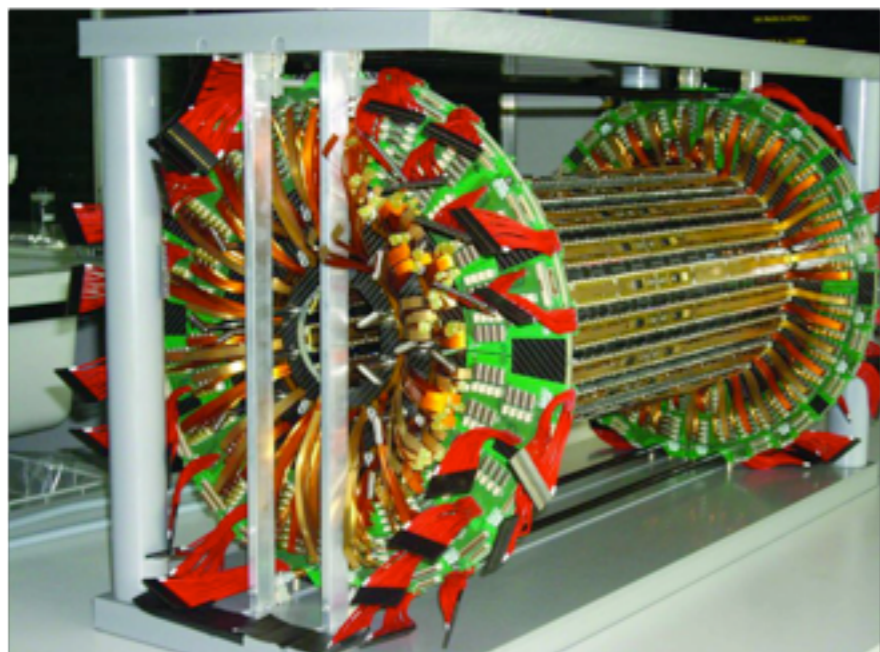
- data analysis in the CMS experiment
- statistical interpretation of the results, comparison to theory

What you learn:

- basic of LHC physics and particle detection
- data analysis techniques
- Object oriented programming
- work in an international team

Detectors for HEP: CMS

Construction and commissioning of CMS upgrade pixel detector



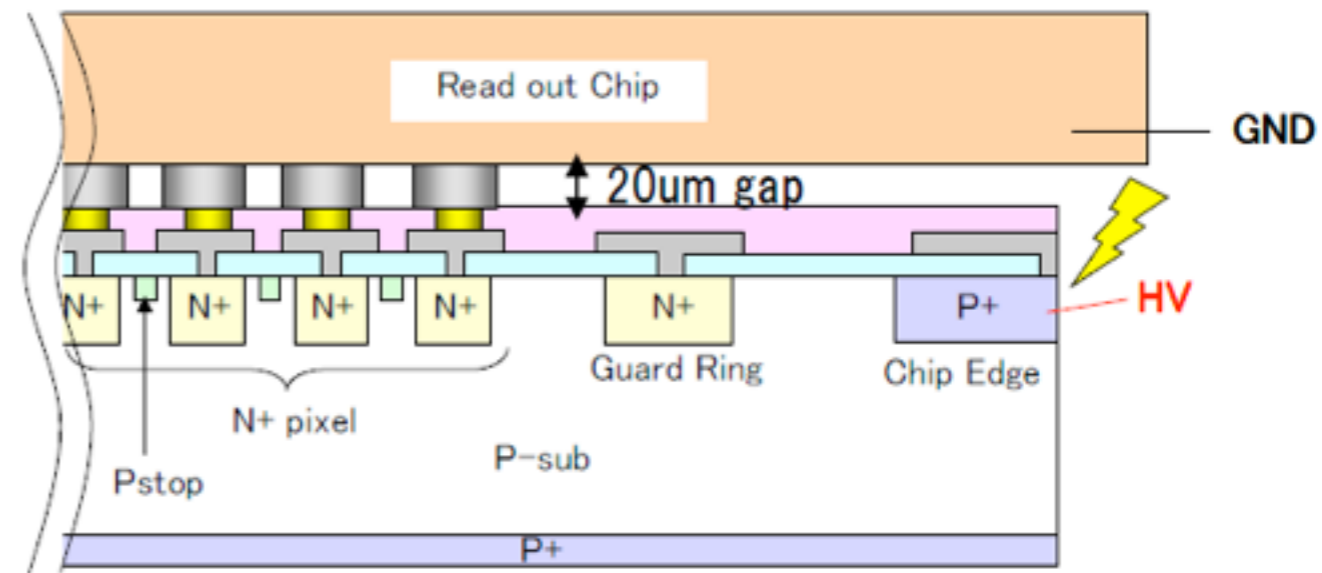
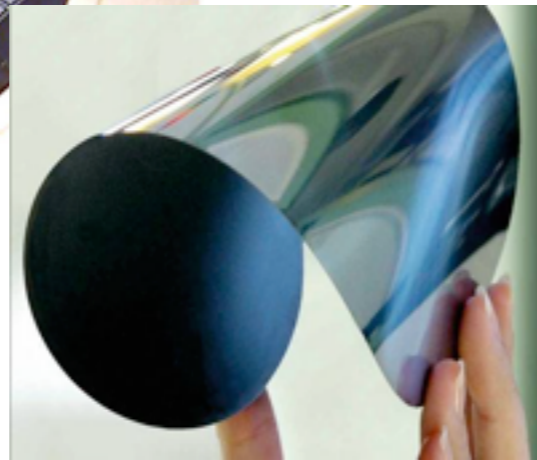
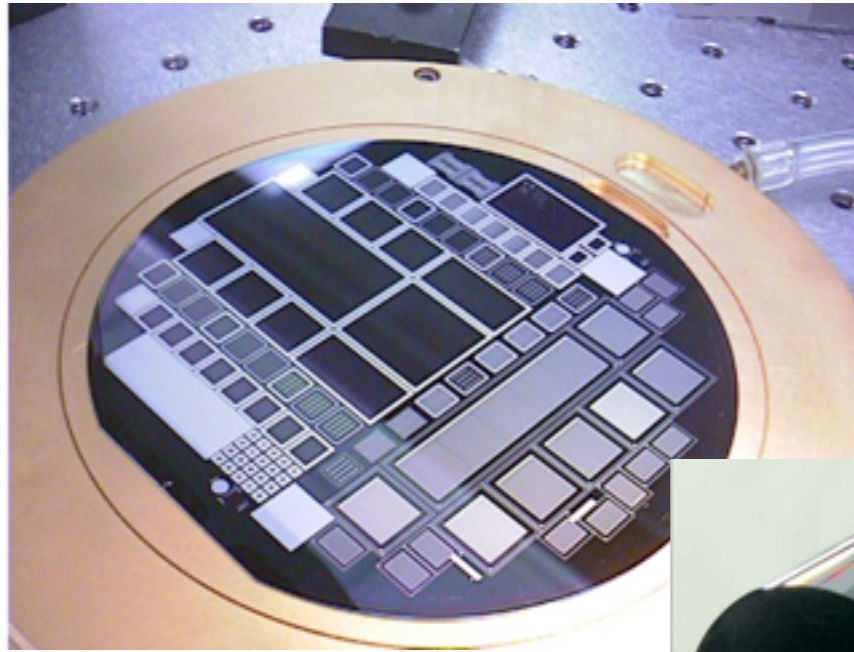
* link to industry application

The projects:

- module calibration with X-rays
- pixel sensor design
- characterization at test beam
- silicon pixel detectors
- Si simulation & meas. techniques
- modern readout electronics
- work in international collab.

Fundamental research on silicon detectors

Frontier technology in detection of charged particles



* link to industry application

The projects:

- pixel sensor design
- radiation hard material / design

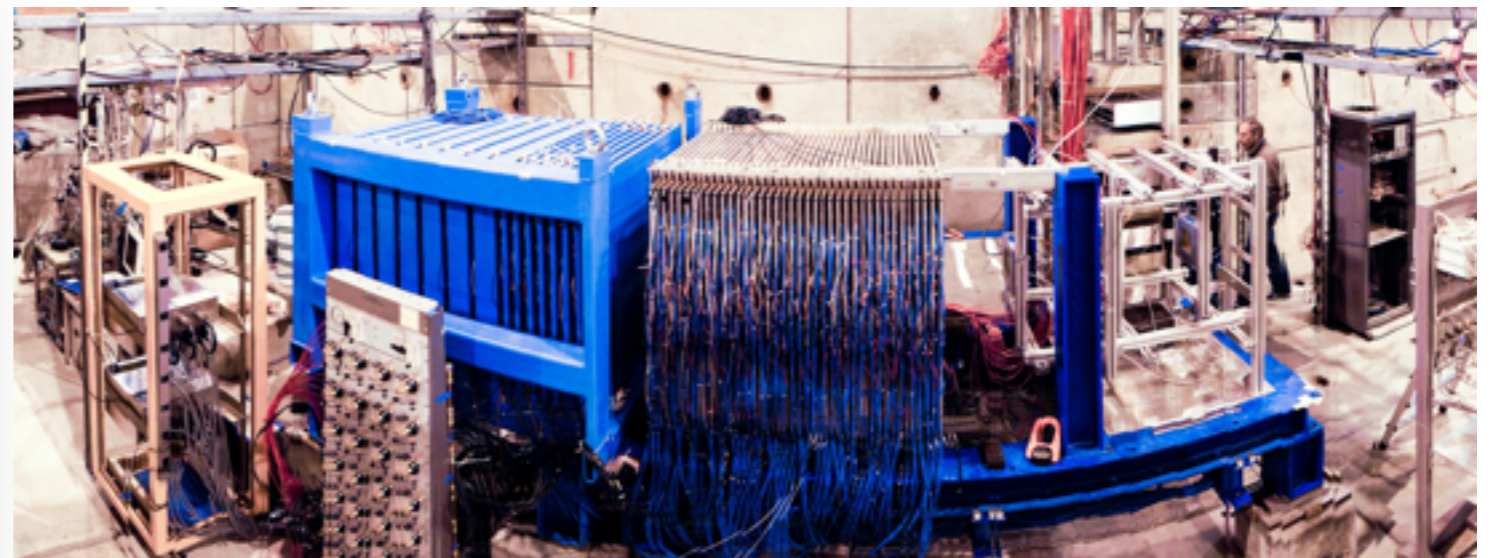
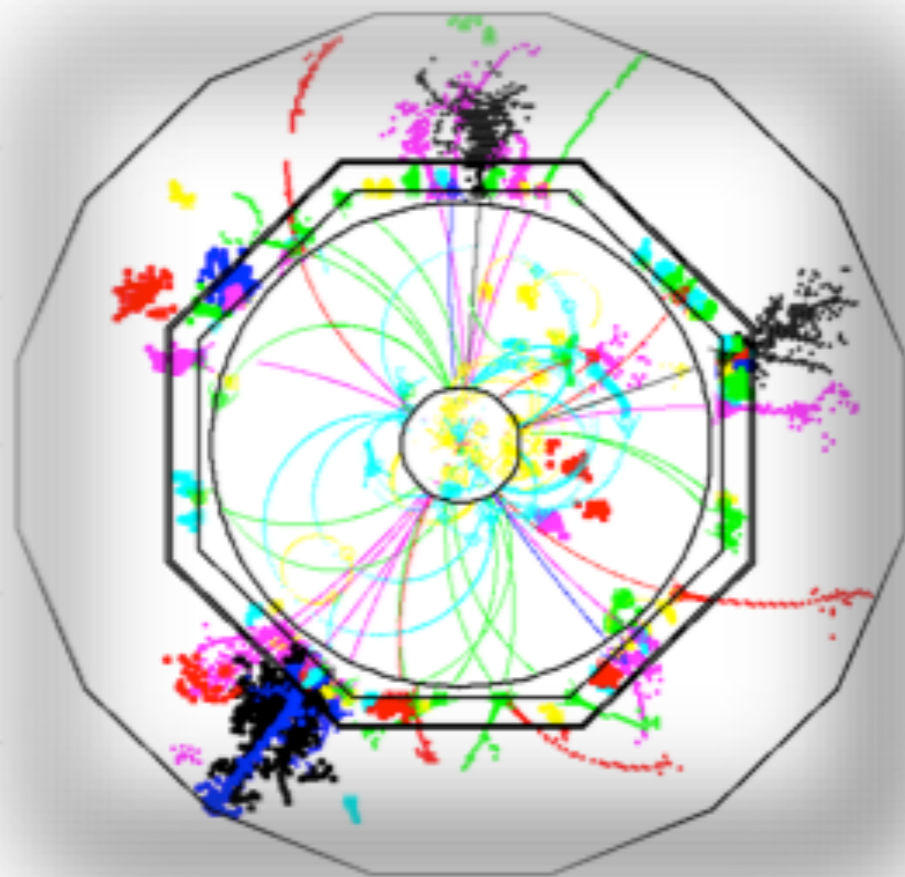
What you learn:

- Si simulation & meas. techniques
- HH: unique competence in rad. hard studies

Detectors for HEP: ILC

Prototype detectors for the ILC

More info: www-flc.desy.de



What you learn:

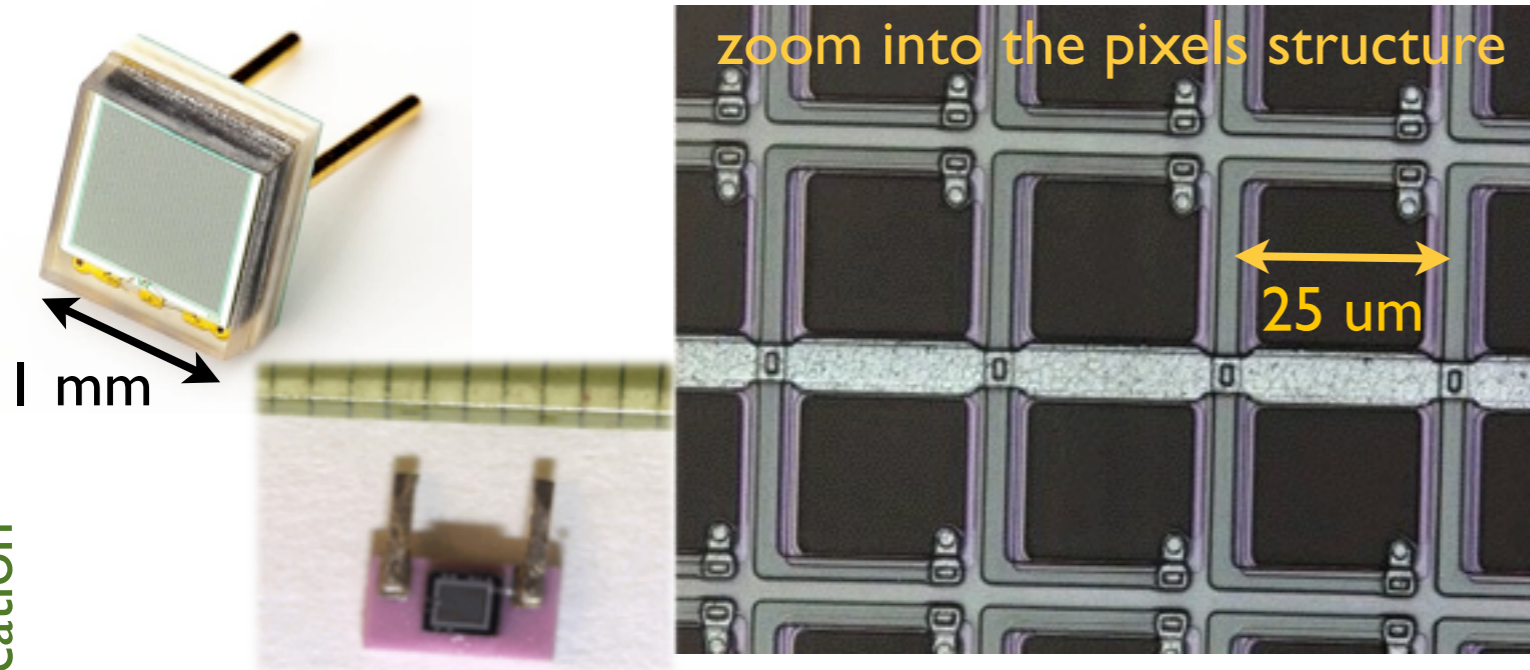
- commission prototype detectors
 - technology frontier in large det. sys.
 - modern readout electronics
 - work in international collab.
- hadronic calorimeter
- time projection chamber

* link to industry application

The projects:

Fundamental research on silicon detectors

Frontier technology in detection of photons



Applications in HEP,
photon science, astro-
particle, medical
detectors, home land
security

Silicon PhotoMultiplier

The projects:

- meas. and simulations
- radiation hard design

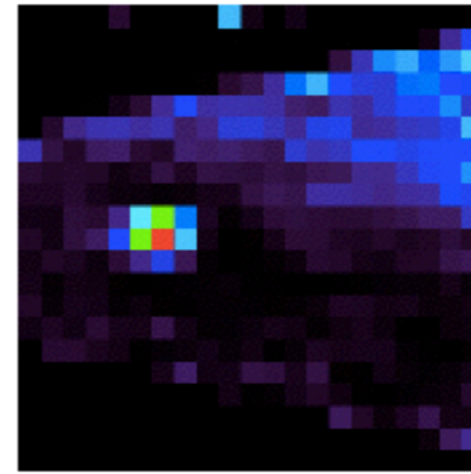
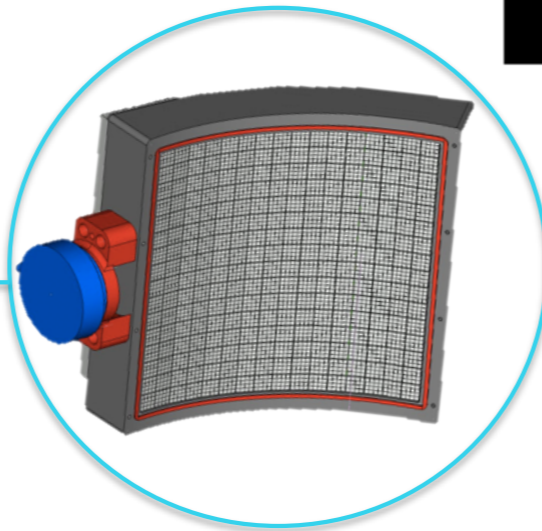
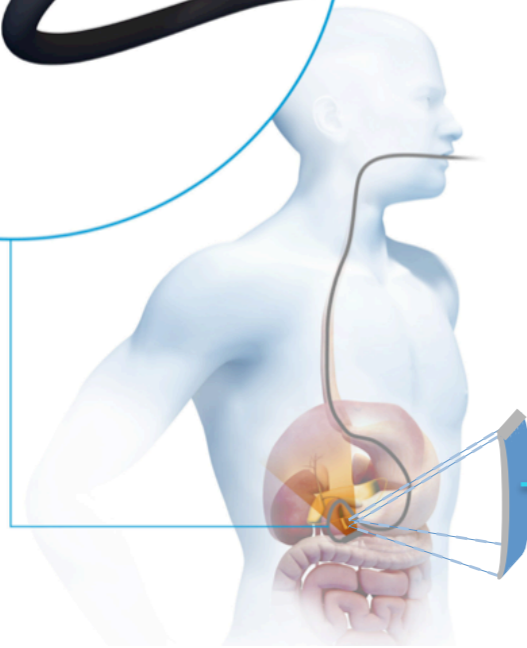
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- Si simulation & meas. techniques
- HH: unique competence in rad. hard studies

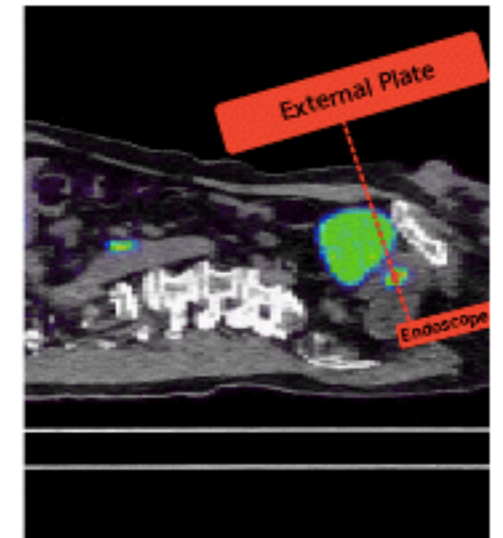
* link to industry application

Detectors for medicine: PET

Endoscopic positron emission tomography



(c) Sagittal



* link to industry application

The projects:

- commissioning of PET det.
- image reconstruction

What you learn:

- Image reconstruction techniques
- work in interdisciplinary environ.

Some interesting numbers

Group statistics:

- 16 bachelors in 4 years
- average note 1.7
- most works end up in publications

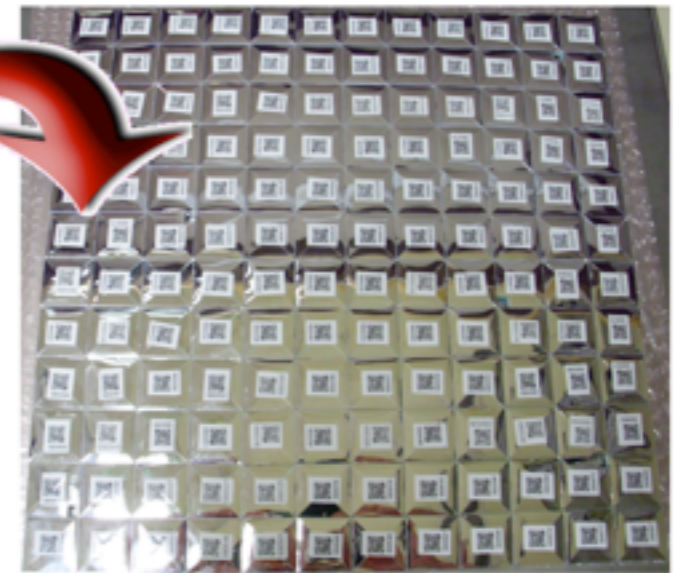
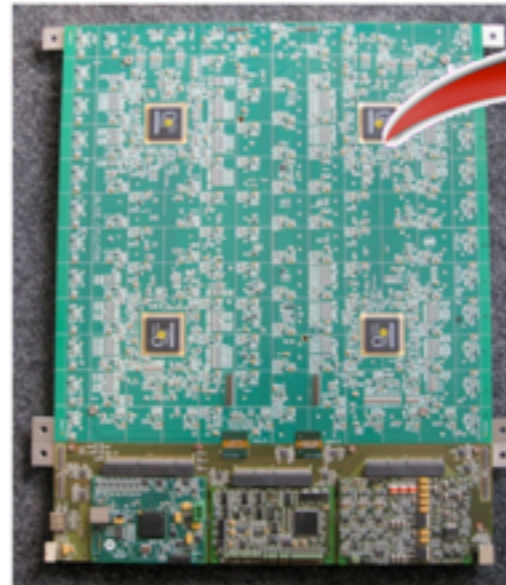
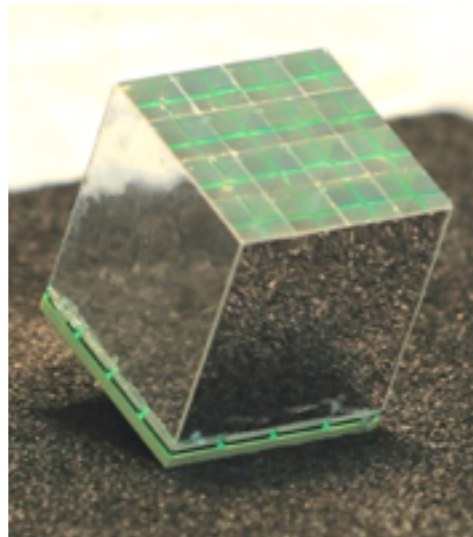
!!! best way to get in contact: HiWi job

Group size:

- 5 seniors, 5 post-docs, 5 PHDs,
2 master students



Conclusion



Building detectors is fun !
Understanding them even more !!!

<http://wwiexp.desy.de/groups/pd/>

<http://www-flc.desy.de>

