Single Photon Counting X-ray Detectors

Dr. Ch. Brönnimann, CEO
Swiss Photonics, 11.9.2013

DECTRIS Ltd.
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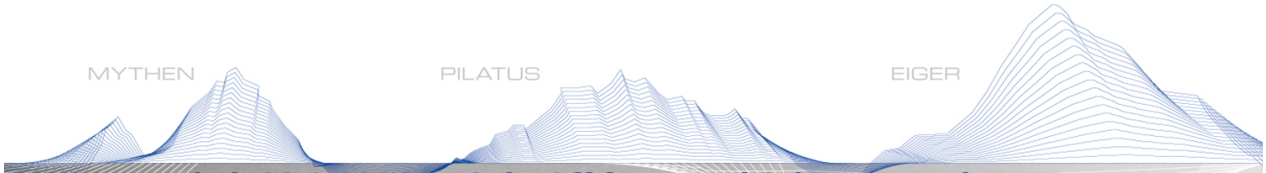
Switzerland
www.dectris.com

About Dectris



Founded: 28.9.2006 as Spin-Off from Paul Scherrer Institute

Location: Baden, Switzerland, 1200 m² production facilities, labs and office space. PSI cleanroom (300m²) for frontend processing.

Products: Digital X-ray cameras based on single photon counting technology for scientific & industrial applications

Team: 50 employees, about 30 physicists & engineers

2010 Winner of Swiss Economic Award, Category Hightech/Biotech

2011 Winner of Aargauer Unternehmerpreis, Category Industry

Mission

MYTHEN PILATUS EIGER

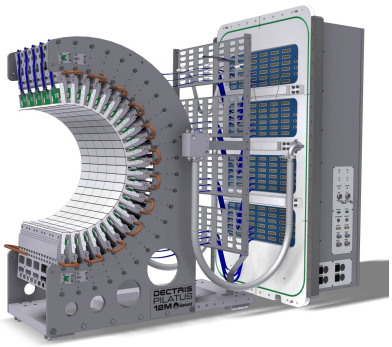
DECTRIS develops, produces and delivers outstanding X-ray detectors to industrial and scientific customers all over the world.

Our products enable you to focus on measurements and science. We deliver best possible detectors.

Our technology is based on the CERN detectors which detected the Higgs-Boson. Detecting the future!

Business-Segments

synchrotron	laboratory & industry	specific solutions



PILATUS3

Key Advantages

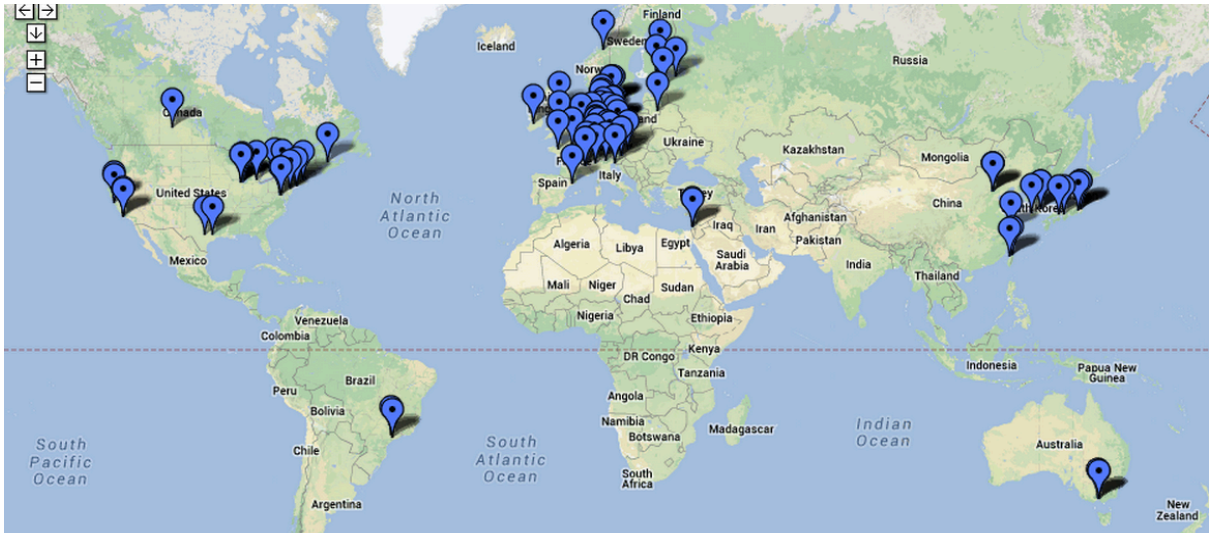
- count rates up to 10^7 cts/pixel/sec
- frame rates up to 500 Hz
- readout time of 0.95 ms
- overflow-free 20 bit counter
- 320, 450 and 1000 µm sensors

Applications

- Macromolecular crystallography
- Small-molecule crystallography
- Surface diffraction and reflectometry
- Scanning beam imaging (sSAXS, ptychography)
- Time-resolved experiments
- SAXS, WAXS and GISAXS

PILATUS laboratory series

Systems installed



DECTRIS® detecting the future

Technology

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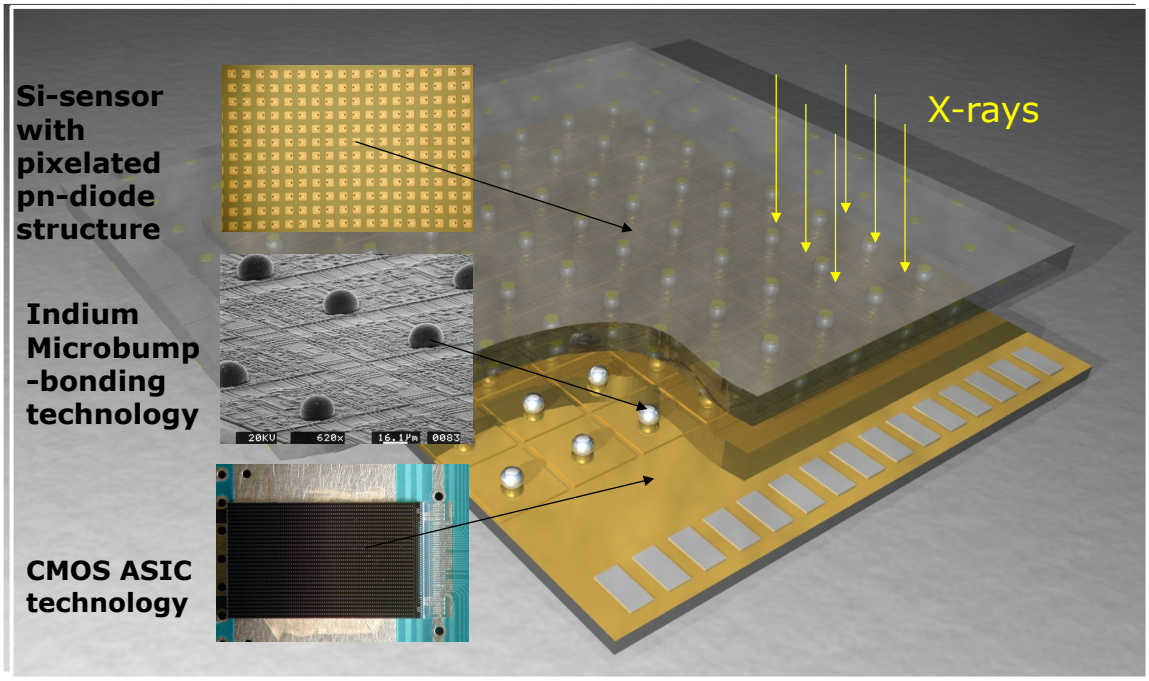
Hybrid Pixel Detector - Overview



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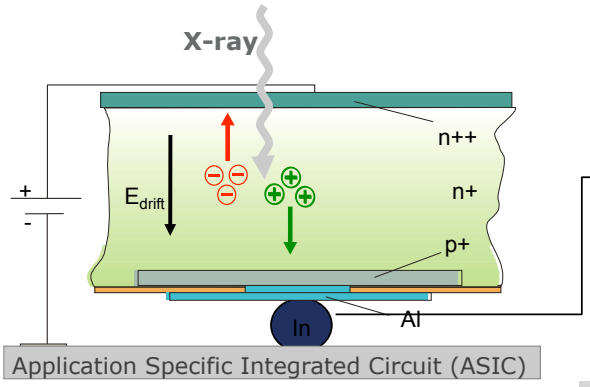
Hybrid Pixel Detector - Technology

Sensor pixel

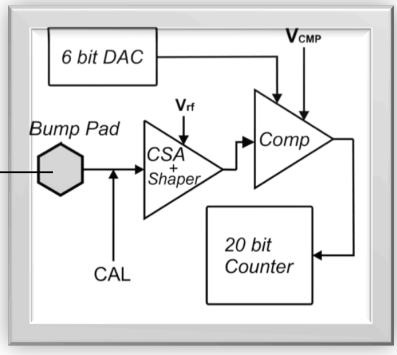


Direct Detection of X-rays in solid state sensor

→ Point Spread Function: = 1 pixel

3.6 eV to create 1 eh-pair @12keV: 3300 eh-pairs

Readout pixel



Single Photon-counting in CMOS

→ no readout noise & dark current

→ adjustable energy threshold

→ high dynamic range (20 bit)

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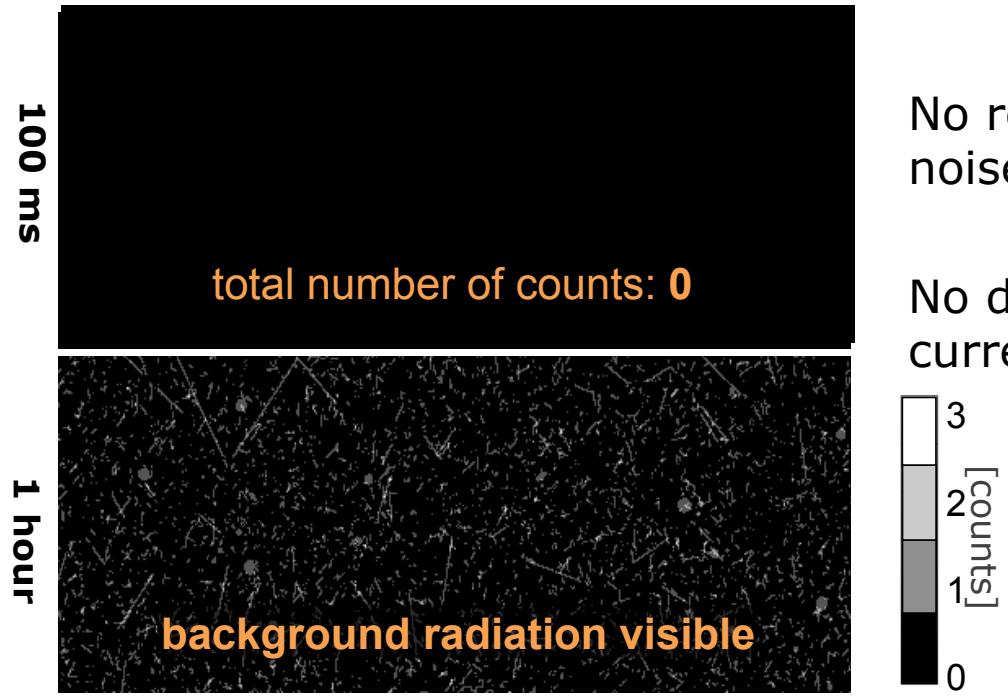
Hybrid pixel: noise free detection



100K detector

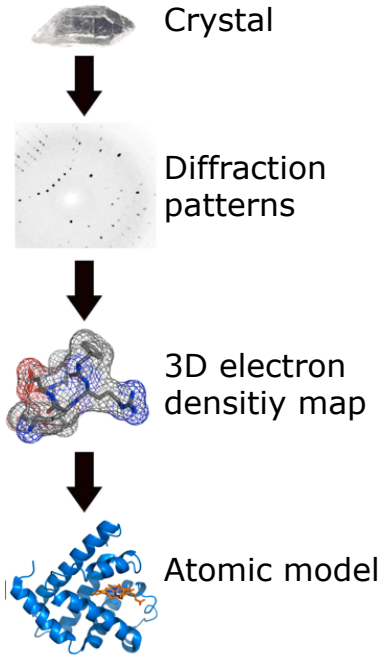
Protein structure determination

Proteins fulfill very important functions:

- ***Transportation***: *O_2-transport by Hämoglobin*
- ***Signal transmission***: *Hormons binding to protein receptors*
- ***Catalysis:*** *chemical reactions in metabolism*
- *"**Protein machines**":*
  - *Replication of Proteins through **Polymerase***
  - *Synthesis of Proteins through **Ribosomes***

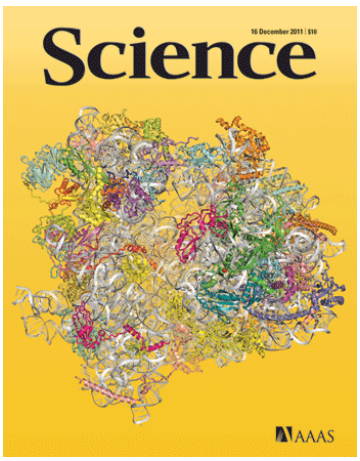
Protein Crystallography enables determination of atomic structure and precise understanding of the function

- ***Fundamental Research***
- *Development of **pharmaceuticals***



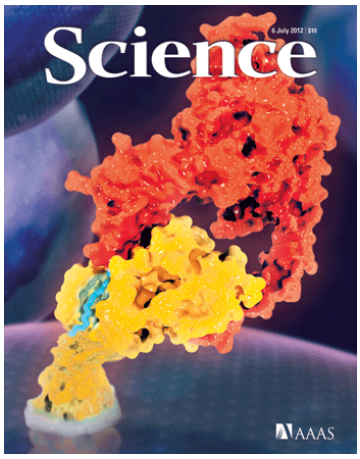
PX – Fundamental Research

High profile publications of data from PILATUS Detectors:



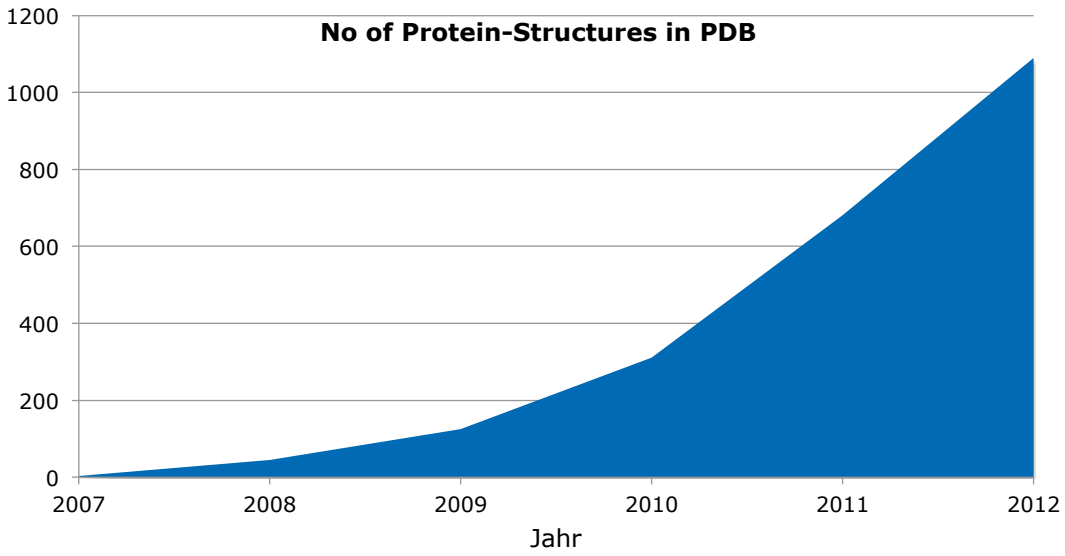
80S-Ribosom from *S. cerevisiae* (Yeast)

IGBMC Strasbourg and Swiss Light Source



Structure of the Wnt signaling molecule (red) in complex with the Frizzled ligand-binding domain (yellow)
Stanford University and Stanford Synchrotron Radiation Laboratory

PX – structure determination



Number of Proteins Structures determined with PILATUS-Detectors in the Protein Data Bank

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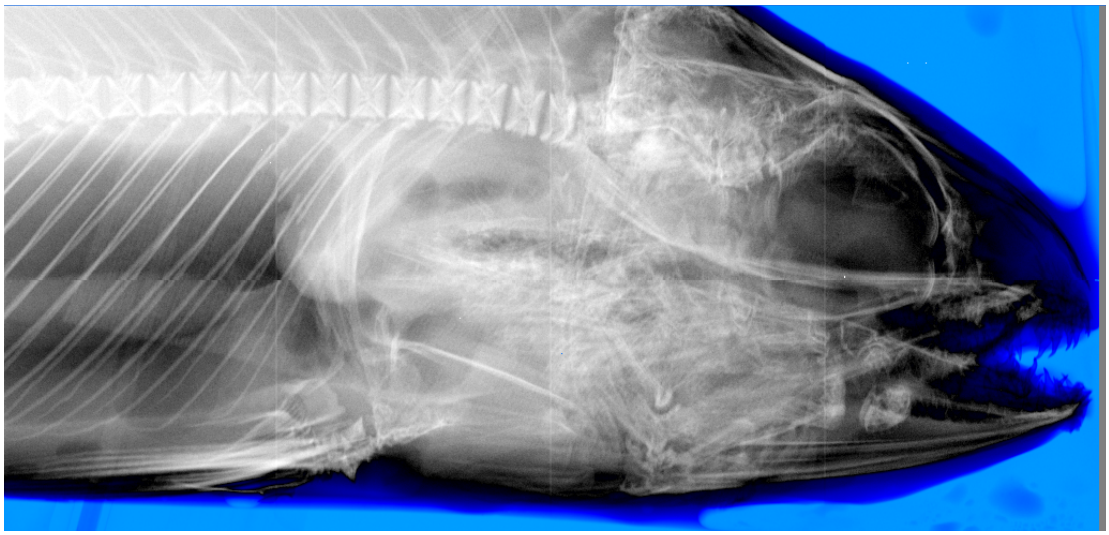
DECTRIS® detecting the future

EIGER 1M

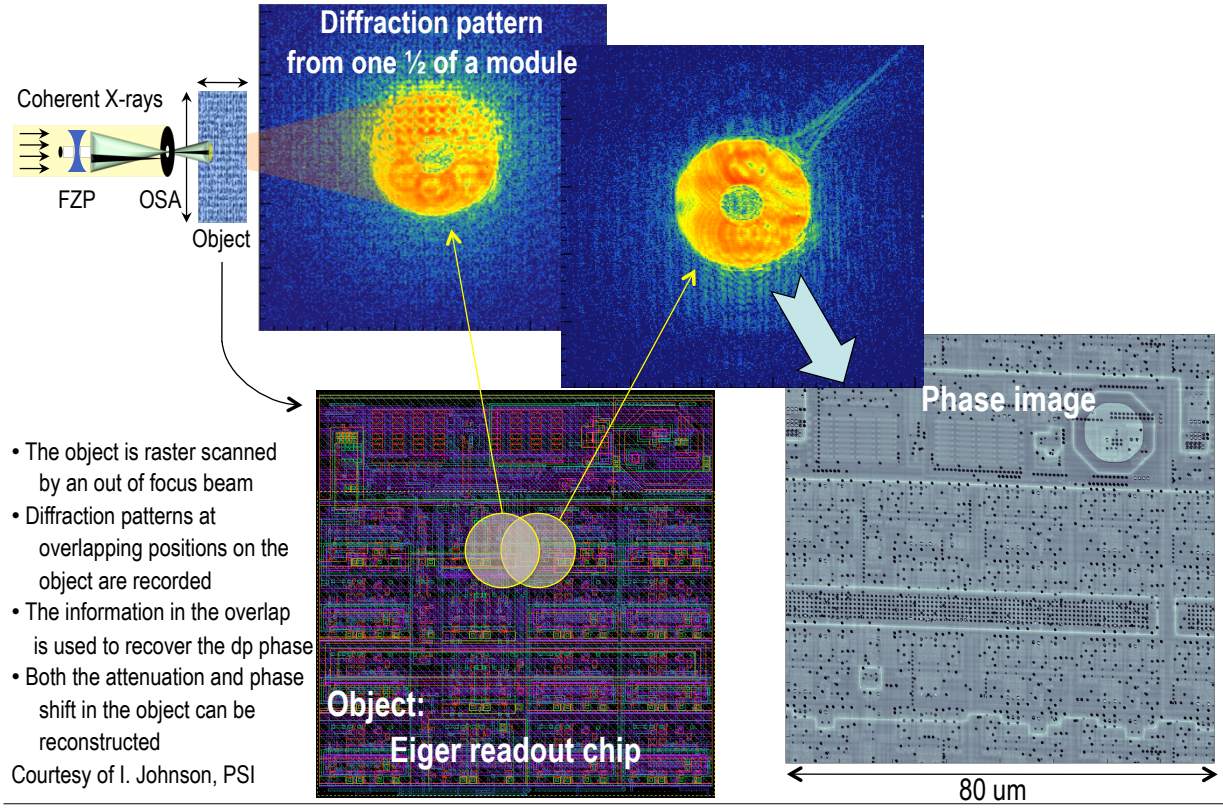
- ***Extremely high resolution***
  75 x 75 um²
- ***Extremely high frame-rate***
  3 kHz
- ***No dead time***
- ***Format***
  1030 x 1065 pixels
- ***Compact Housing***
  11 x 14 x 21 cm³

Available from Jan 2014

EIGER - Image of a Trout



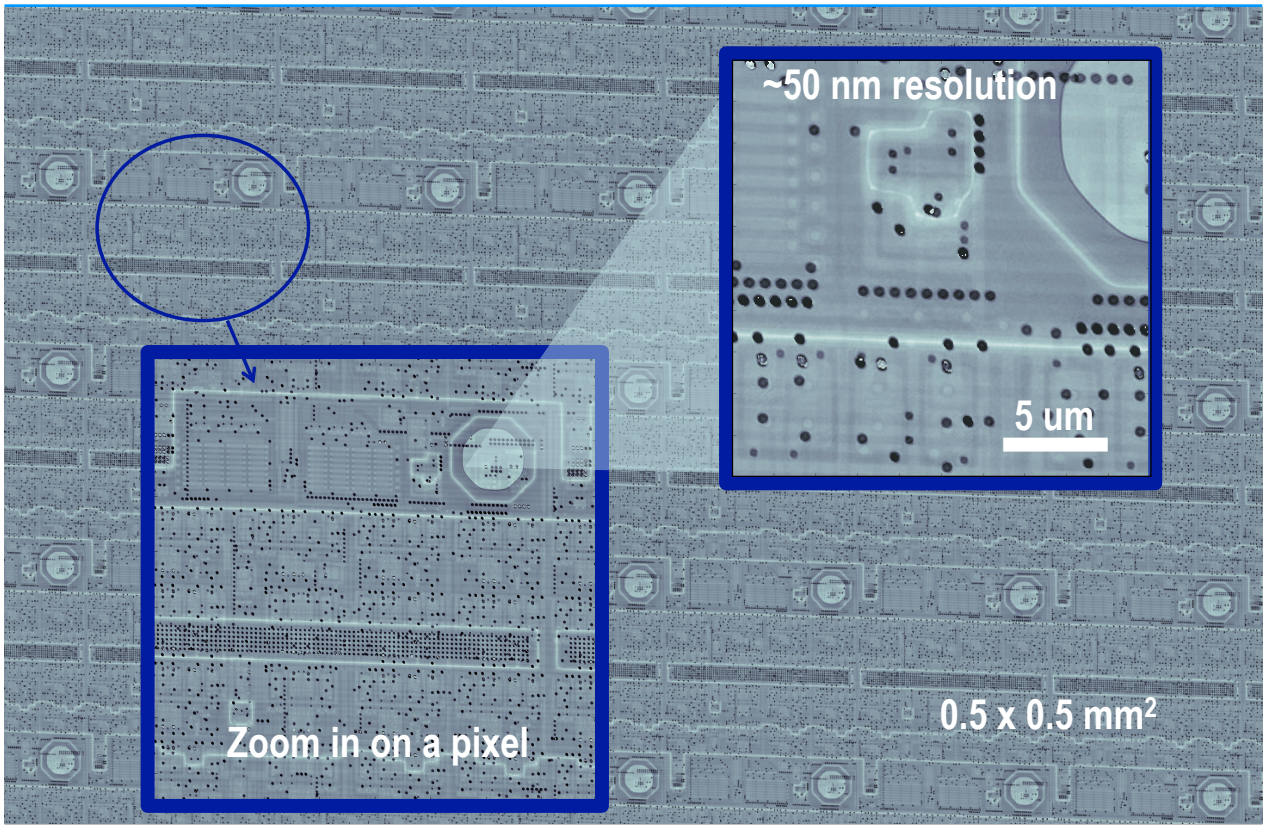
An Eiger self portrait (Ptychography)



- The object is raster scanned by an out of focus beam
- Diffraction patterns at overlapping positions on the object are recorded
- The information in the overlap is used to recover the dp phase
- Both the attenuation and phase shift in the object can be reconstructed

Courtesy of I. Johnson, PSI

Large area, high resolution Ptychography



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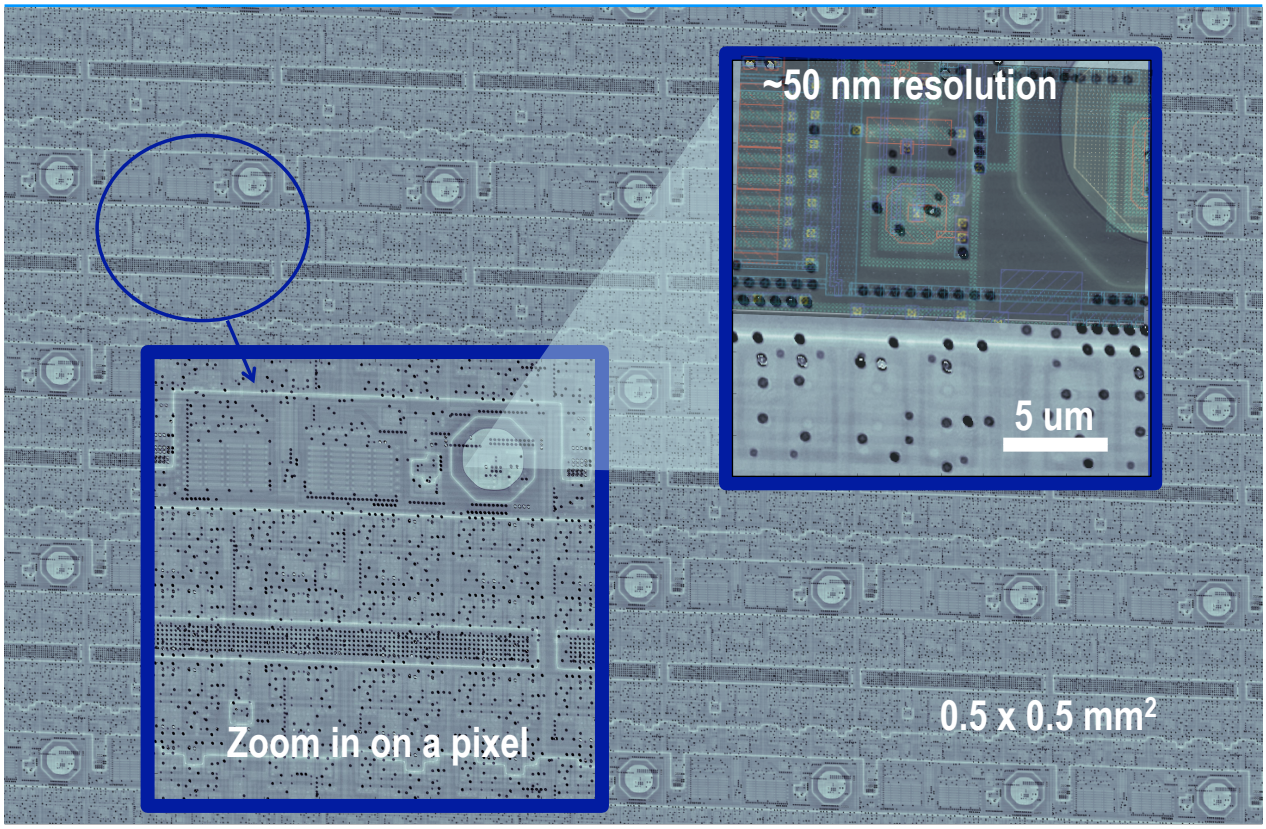


Summary & Outlook

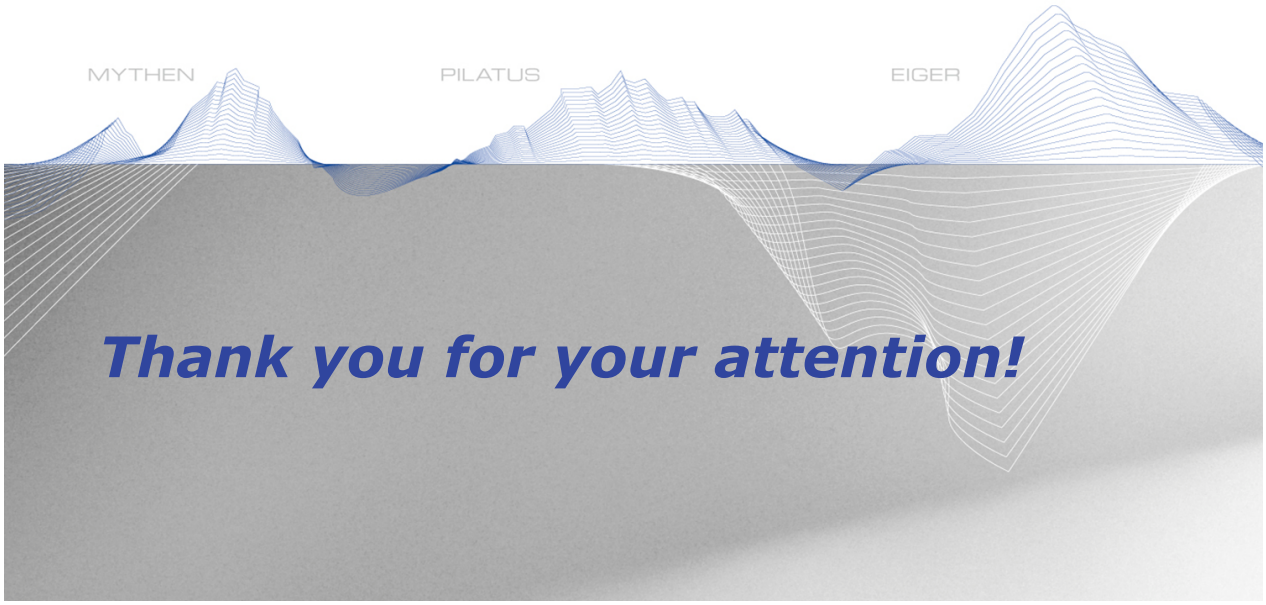
MYTHEN PILATUS EIGER

Dectris is leading in the field of Single Photon Counting Detectors

Hybrid Pixel Detectors are setting the standard for x-ray diffraction

Eiger: newest product for high speed high resolution x-ray diffraction and imaging

Industry and medical apps are the growth markets



Thank you for your attention!