High-flux CdZnTe sensors for high-speed and high-energy experiments at PETRA and EuXFEL.

D. Magalhaes[1,2,3], M. Ruat[4], A. Rothkirch[1], O. Gutowski[1], T. Laurus[1,3], J. Schwandt[2], S. Martens[2], H. Hirsemann[1,3], S. Lange[1,3], M. Niemann[1,3], M. Hajheidari[1,3], A. Klujev[1,3], M. Veale[5], N. Schell[6], E. Garutti[2], H. Graafsma[1,3]

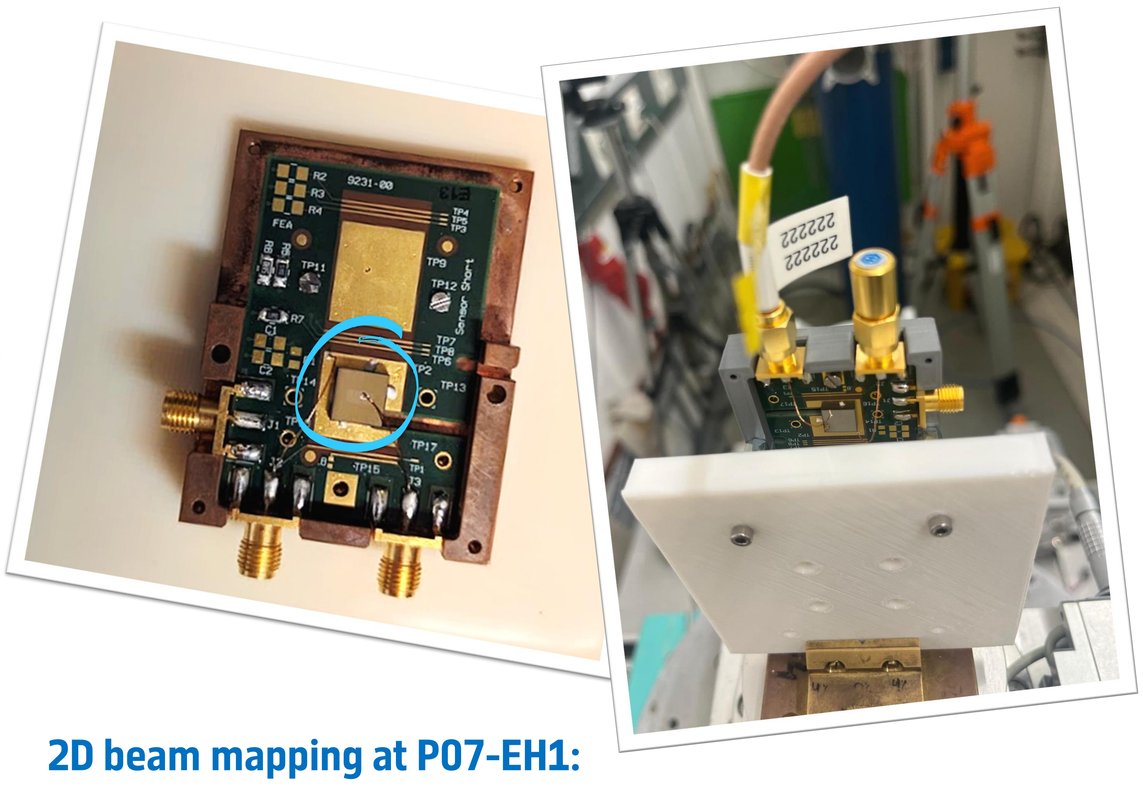
1. Deutsches Elektronen-Synchrotron (DESY)
2. University of Hamburg (UHH)
3. Center for Free-Electron Laser (CFEL)
4. European Synchrotron Radiation Facility (ESRF)
5. Science and Technology Facilities Council (STFC-RAL, UKRI)
6. Helmholtz-Zentrum Hereon

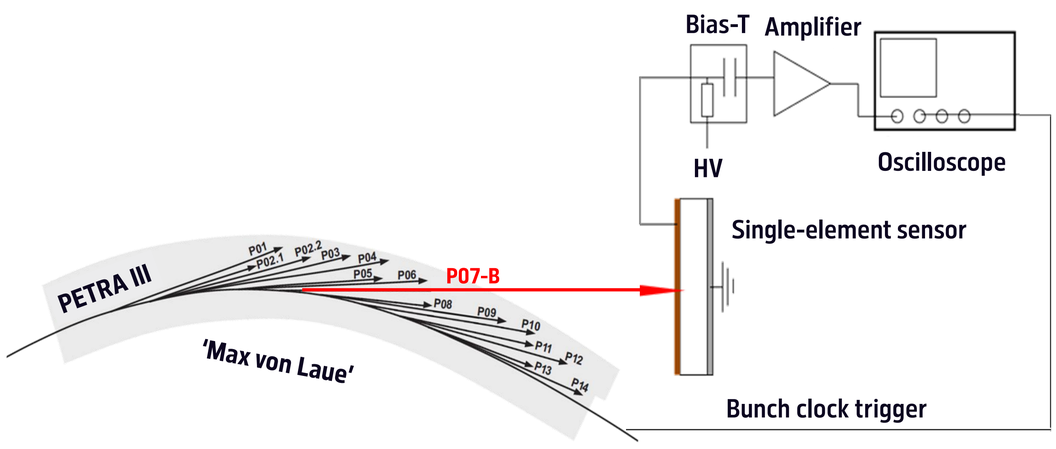
Motivation:

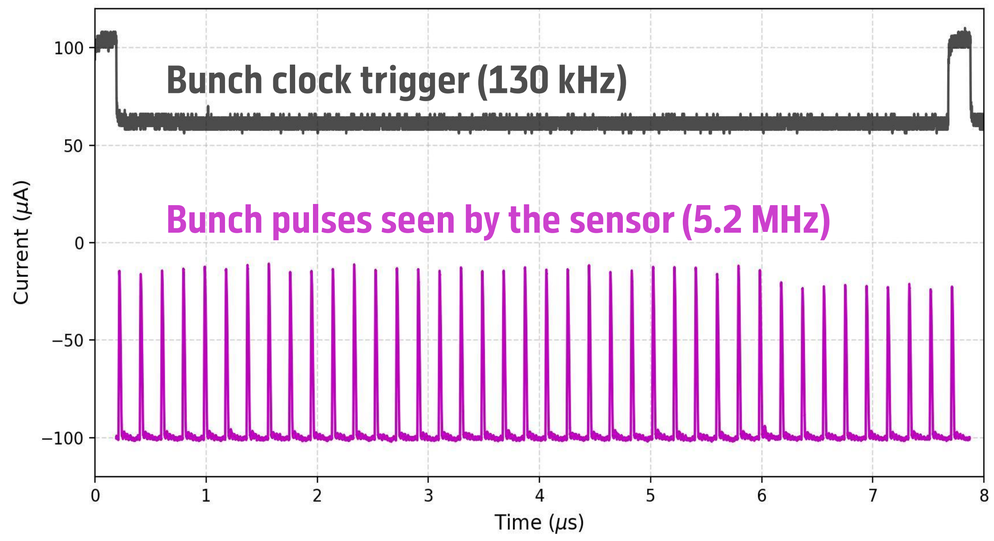
Characterization of sensors to be used in hybrid pixel detectors for X-ray applications > 18 keV in EuXFEL and PETRA

Redlen high-flux CdZnTe sensors:

- S1: Pt/CZT/Pt, 1.5 mm thick, 7.6x7.6 mm^2, 6666 V/cm
- S2: Pt/CZT/Ti/Au, 2 mm thick, 7.6x7.6 mm^2, 6666 V/cm

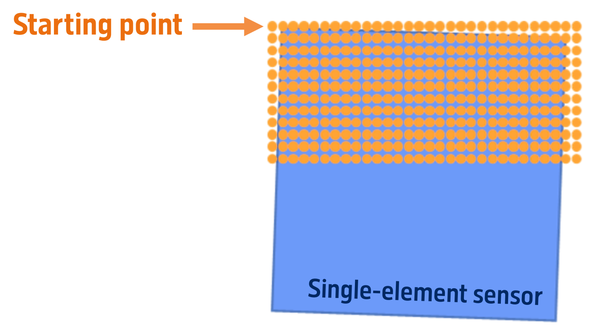






2D beam mapping at P07-EH1:

- Beam size: 100x100 μm^2, defined with slits
- Triggering at each full revolution of the electrons (130 kHz)
- Beam energy: 87 keV (att. length = 680 μm in CdZnTe)
- 40 bunch mode, 192 ns period



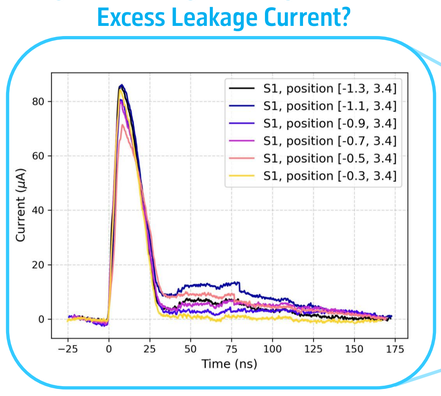
- 41x20 positions
- 200 μm steps

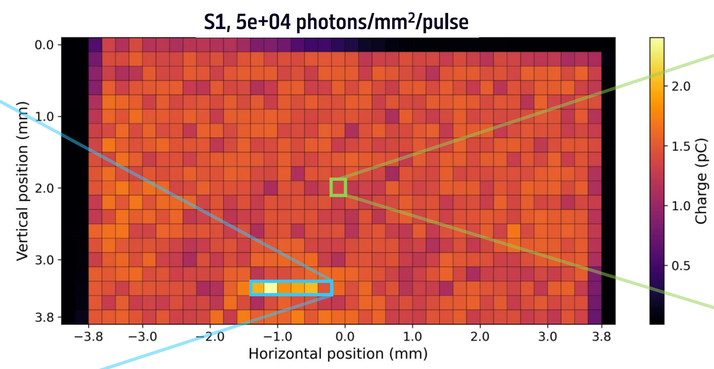
Transient Current Technique (TCT) setup from UHH:

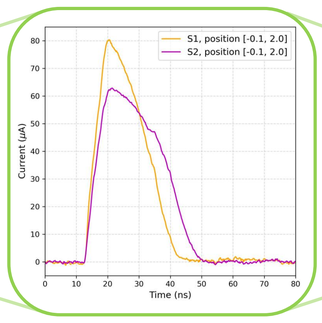
- Bias-T, Amplifier: Femto 40 dB, 2 GHz
- Oscilloscope: Tektronix MSO 4104, 5G Samples/s
- Bias voltage supply: ISEG SHR 20 60r

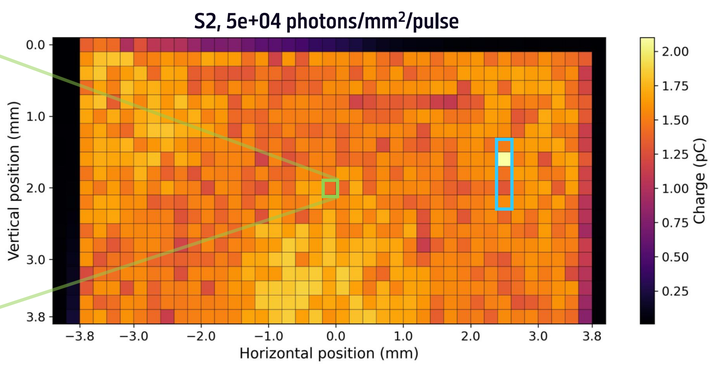
Comparative Results:

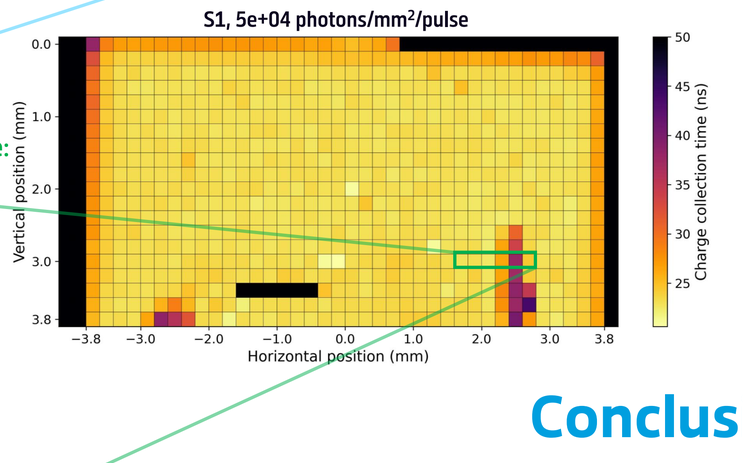
Regions with higher charge collection: Excess Leakage Current?

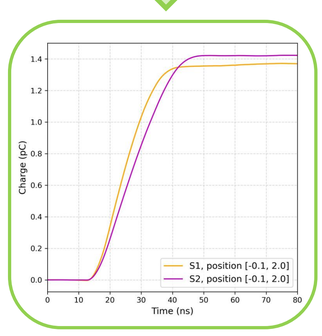


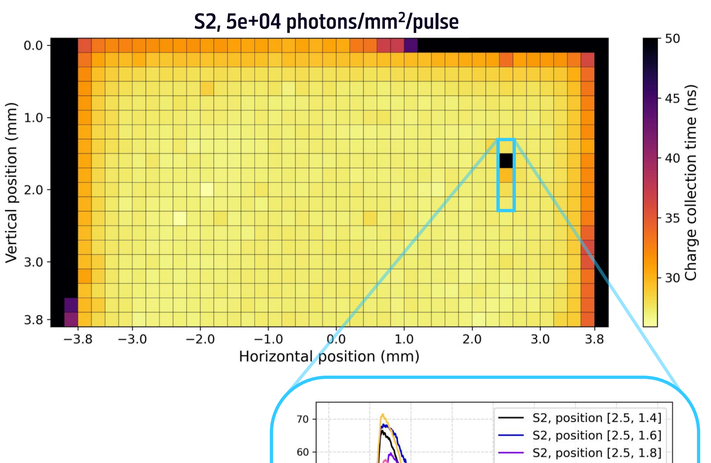




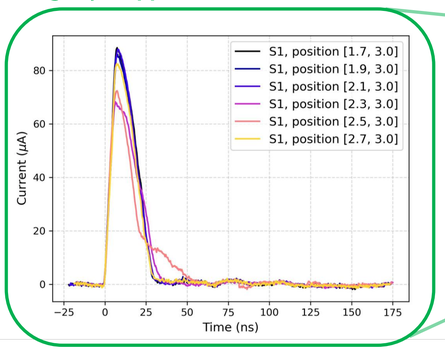


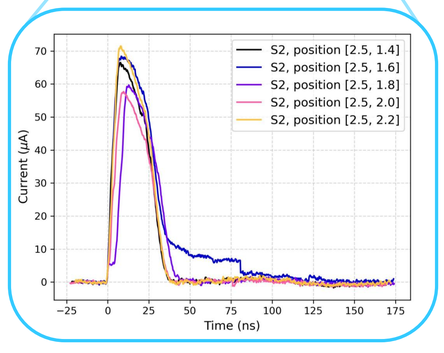






Good collection efficiency, longer drift time: lightly trapped electrons arrive later





Conclusions:

- **The sensors are suitable for use in high-rate pulsed sources** (collection time < 120 ns);
- Homogeneous response to high photon energy (87 keV) and high flux (1e11 ph/mm^2/s);
- The sensor response changes in the vicinity of defects and on the sensor edges;
- Possible ELC effect → less than 8.7% and 5.4% of the peak after 120 ns for S1 and S2