

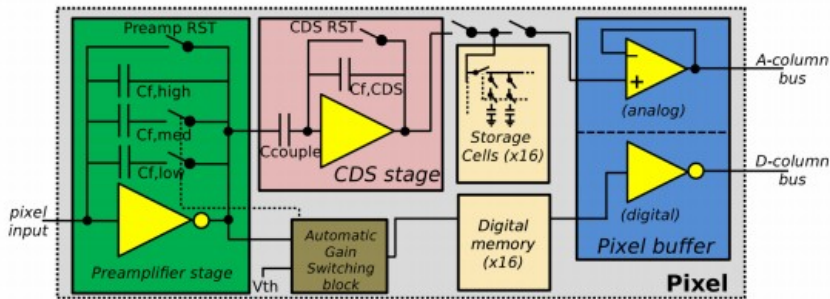
The JUNGFRAU and GOTTHARD-II detectors at European XFEL: status and plans



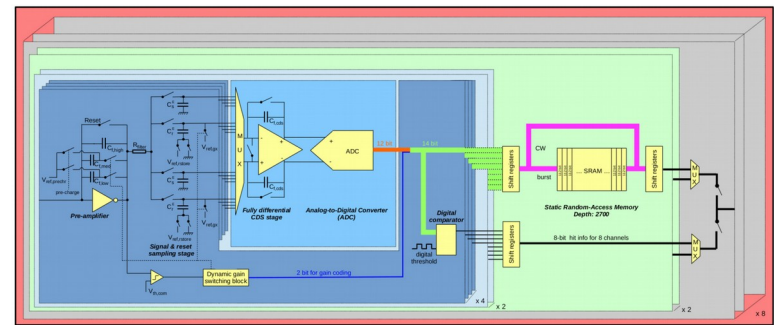
M. Ramilli on behalf of the Detector Operation group,
A. Mozzanica, J. Zhang, B. Schmitt

IFDEPS Virtual Thursdays, 01.04.2021

JUNGFRAU



GOTTHARD-II



JUNGFRAU 'single cell' operation

Total of 17 modules

in Air

SPB/SFX

4M system

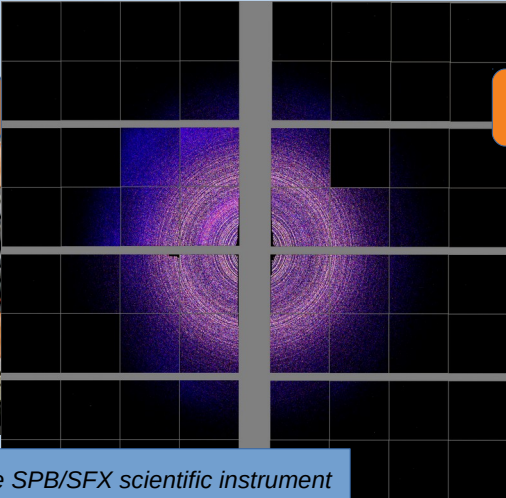
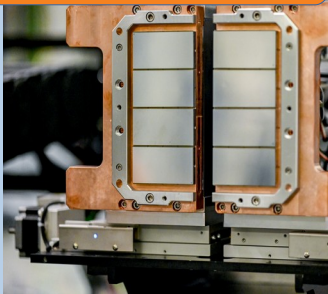
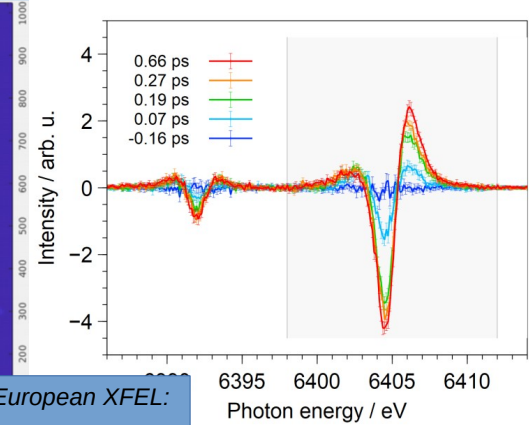


Image courtesy of the SPB/SFX scientific instrument

1M + 500K



FXE

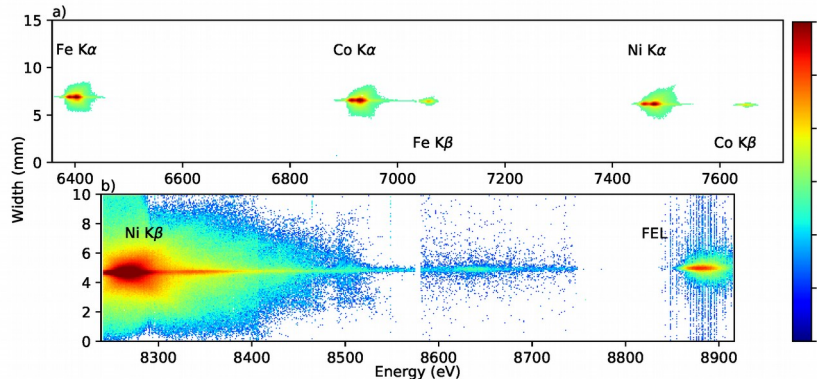


"Ultrafast X-Ray Photochemistry at European XFEL: capabilities of FXE instrument"
D. Khakhulin et al., Appl. Sci., **10**(3), 995 (2020)

in Vacuum

HED

x4 500K



"Design and performance characterisation of the HAPG Hámos Spectrometer at the High Energy Density instrument of European XFEL"
T. Preston et al., 2020 JINST, **15** P11033

MID

x2 500K

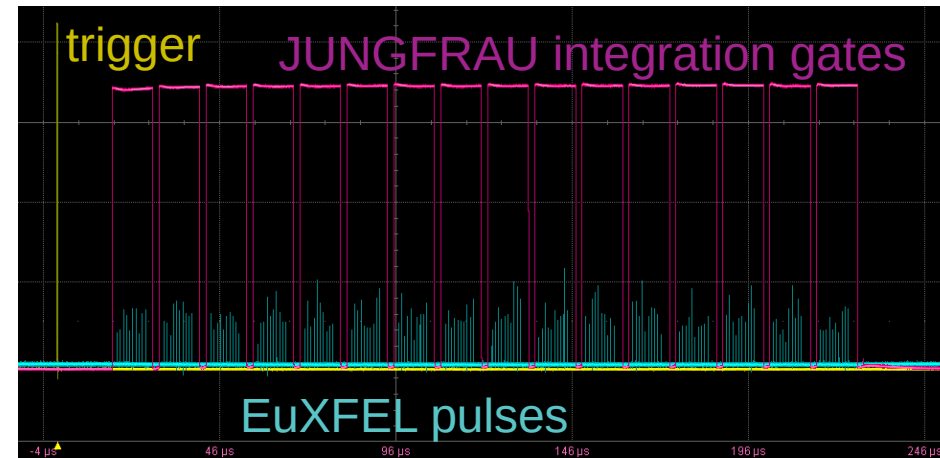
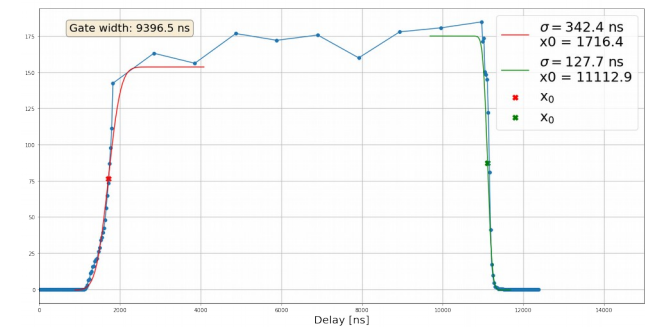


JUNGFRAU 'burst' mode

- Exploit the 16 storage cell array
 - 'burst mode'
 - ▶ Increase images per train
 - ▶ 'pulse-by-pulse' correlation (as much as possible)
- PSI delivered FW beginning 2019
- Test the maximum frame rate possible
- Validate the calibration
 - Establish a correction algorithm

- Raw data correction:
 - Validate constants evaluation:
 - ▶ Pedestal value
 - ▶ Gain conversion factors
- Main issue with lower gain stages
- Beam tests at the scientific instruments
- Latest on 13.-14.03. at SPB/SFX
 - Intensity scans to test the correction
 - ▶ Flux dependency
 - ▶ Frame rate dependency
 - Analysis ongoing

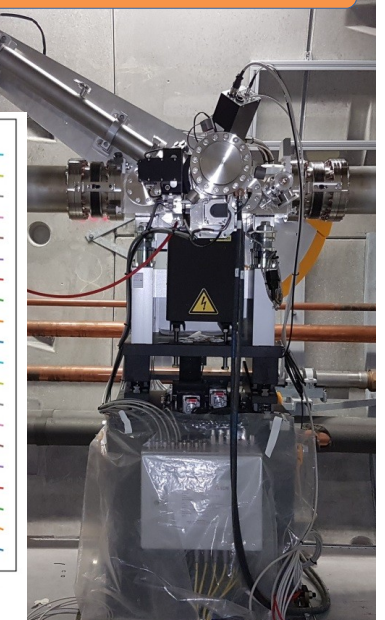
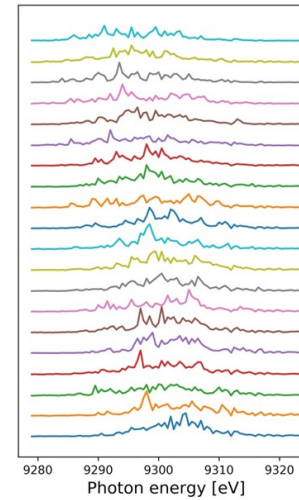
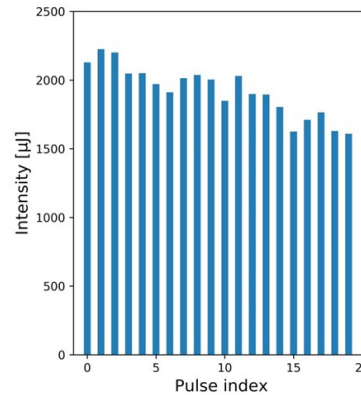
Integration gate delay scan



GOTTHARD-II future installations

- Developed at PSI for EuXFEL (→ J. Zhang's talk)
- 29 GOTTHARD-II modules ordered
 - Pitch: 50 μm or 25 μm
 - Sensitivity: X-ray or visible light
- Widely installed:
 - All six scientific instruments
 - X-ray Photon Diagnostic (XPD)
- Mostly used for spectroscopy
 - Started with GOTTHARD-I

HIREX spectrometers for SASE1 & 2



N. Kujala, et al., Review of Scientific Instruments 91(10), 2020

Pulse Arrival Monitors (PAMs)

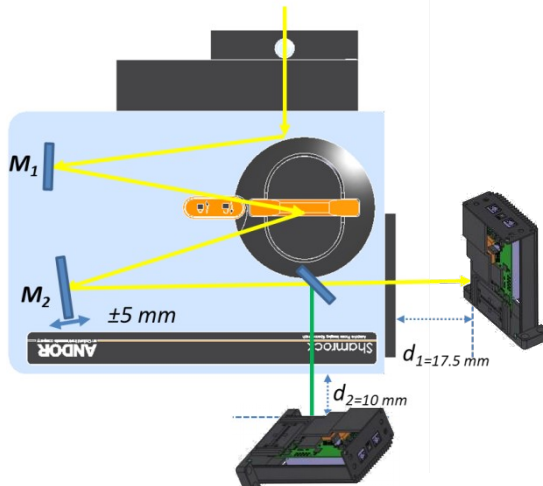
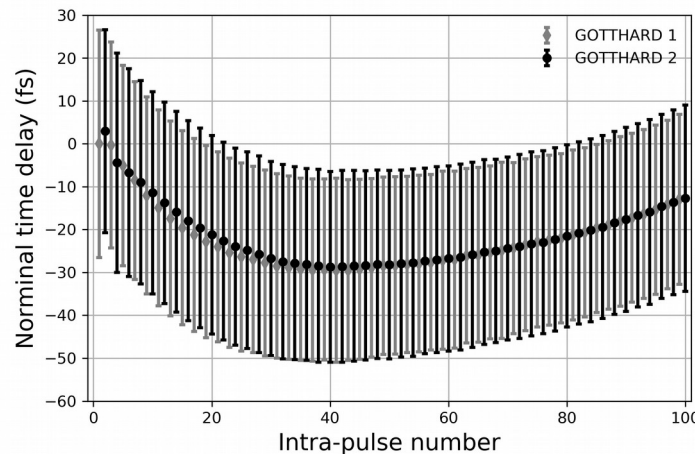


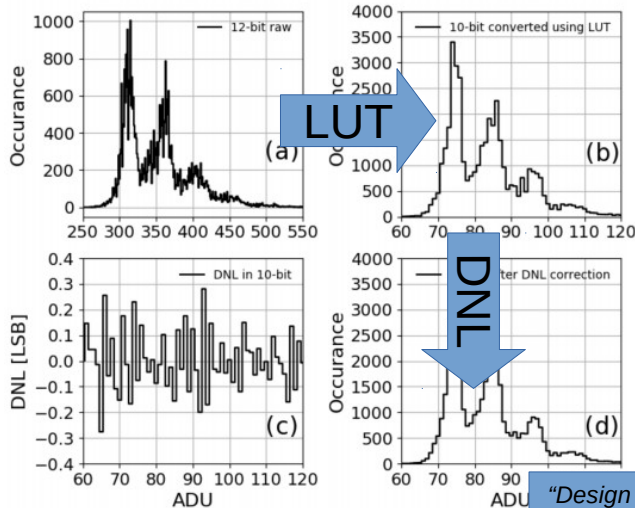
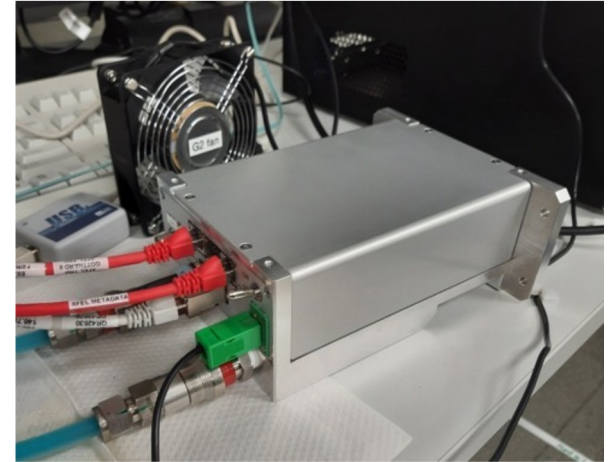
Image courtesy of J. Liu



T. Sato, et al., Optica 7, 716 (2020)

GOTTHARD-II path towards integration

- First two prototypes at EuXFEL from PSI
 - First used for firmware and software test (passed)
 - Second for first beam test (t.b.d.) (fully calibrated by PSI)
- Steps towards integration:
 - Integrate the SW in EuXFEL control SW
 - Integrate in the Correction pipeline
 - ▶ Online correction (preview)
 - ▶ Offline correction
 - Beam tests
- Already existing infrastructure
 - Already (partially) integrated GOTTHARD-I
 - Correction pipeline



- ADC linearization
 - 12 bit \rightarrow 10 bit:
 - ▶ Procedure developed by PSI
 - ▶ PSI provides LUT for linearization
- Data analysis is at 10 bit
 - Apply LUT on-the-fly to preview
 - Apply DNL at histogramming
 - Re-calibration setup