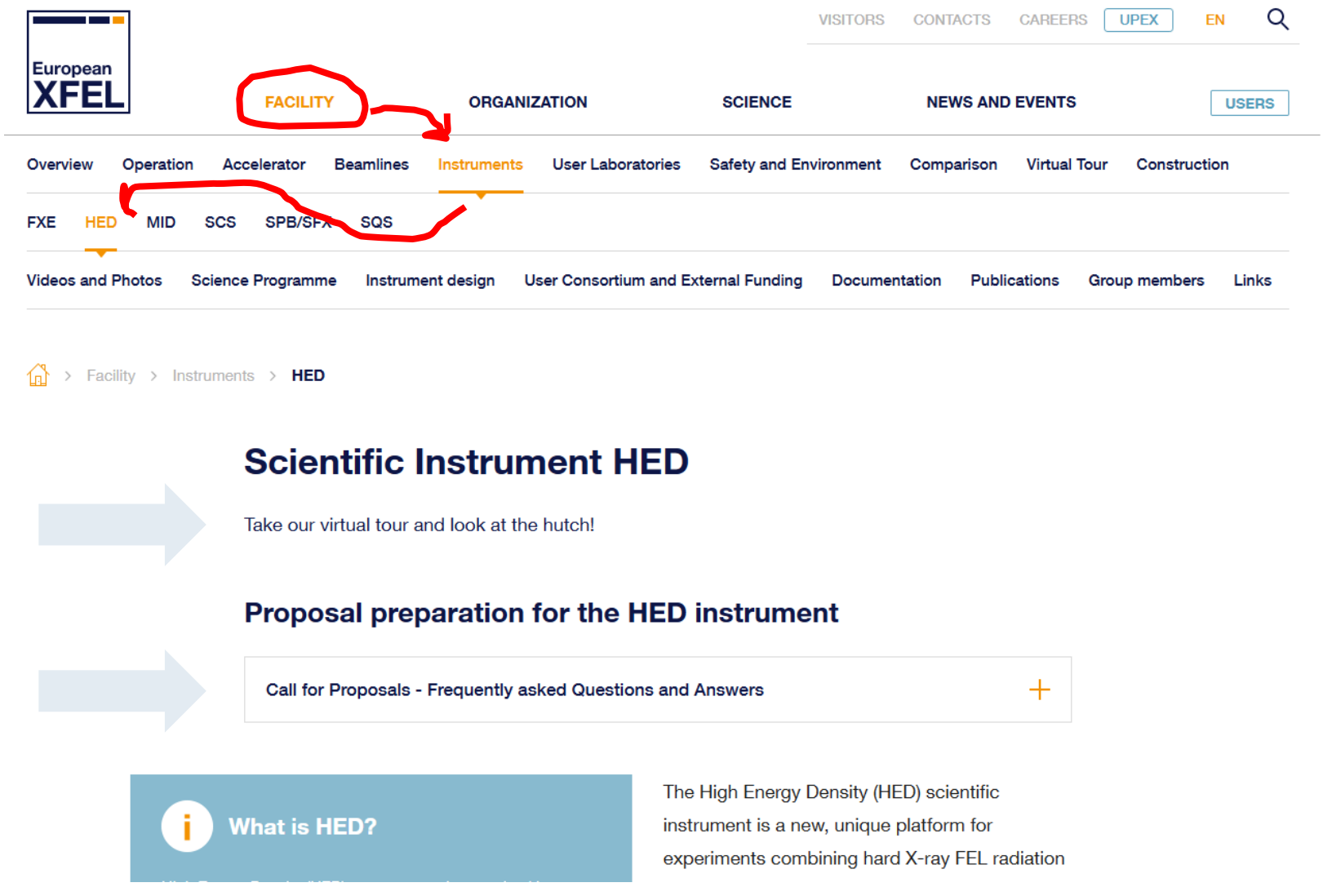
https://www.xfel.eu/facility/instruments/hed/



7th call for proposals (opens Nov 5, closes Dec 16, 2020)

- **We offer on a regular basis – X-RAY parameters:**
  - 5-24 keV x-ray photon energy SASE spectrum (about 0.2% bandwidth), usually about 1-2 mJ Pulse energy in ~20-40 eV
  - Seeded x-rays between 8-14 keV (~0.8 eV spectral width), few 100 µJ

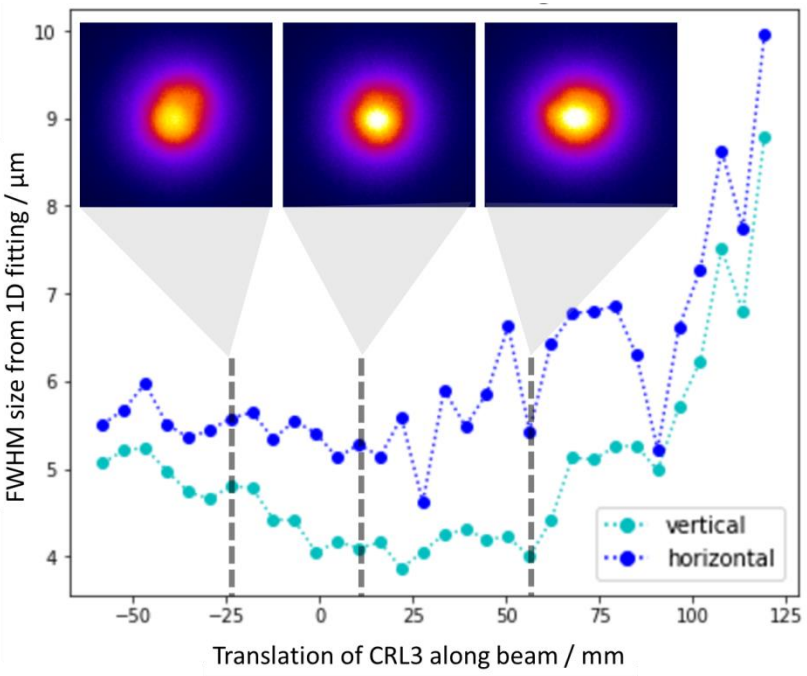
  - Single pulses/trains on demand, or 10 Hz continuous
  - pulse trains of 2.25 MHz (440 ns) or up with 4.5 MHz rep. rate (220 ns) and max. 200 µs window

  - 4-bounce monochromator (1 eV bandwidth) at 10 Hz between 5-18 keV
  - High res-mono@7.49 keV (about 40 meV bandwidth) at 10 Hz

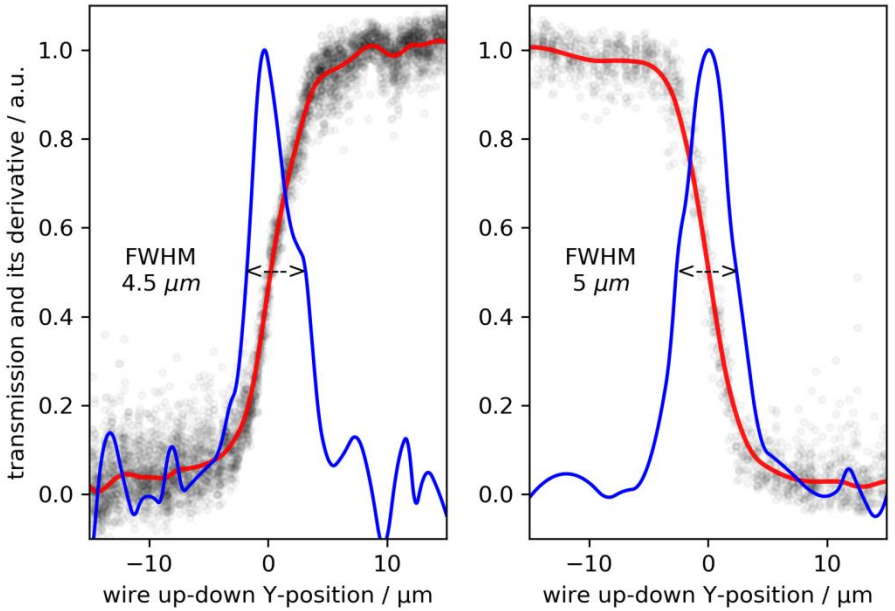
  - full focusing capability CRL 1,2,3,4
    any focus from parallel beam (few µrad divergence) down to sub-µm foci, however with partly strong absorption in the Be lenses.

  - “HIREX2” spectrometer in the SASE2 branch (before the separation into MID and HED) for monitoring the incident SASE / seeded spectrum

5x5 µm focus characterized



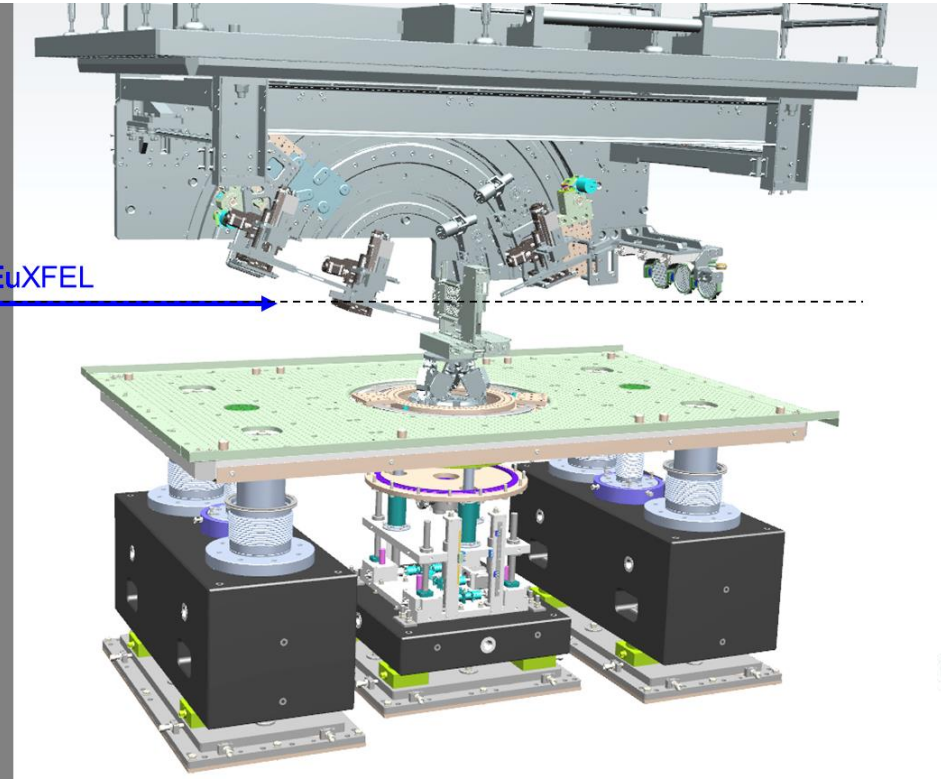
Focus in IC1 at 6.0 keV photon energy by LiF imprints and post analysis

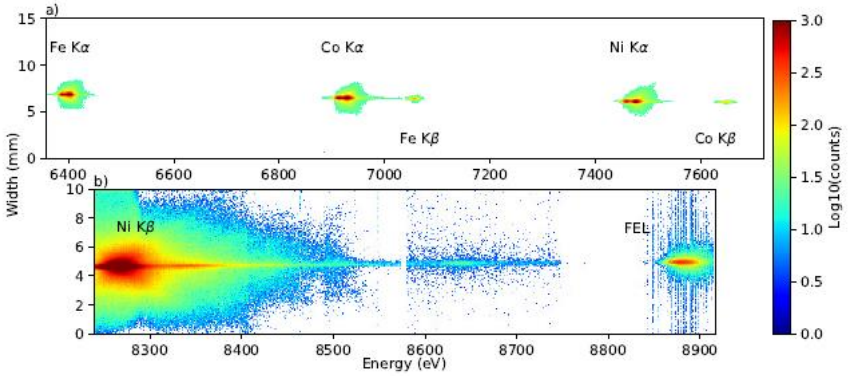


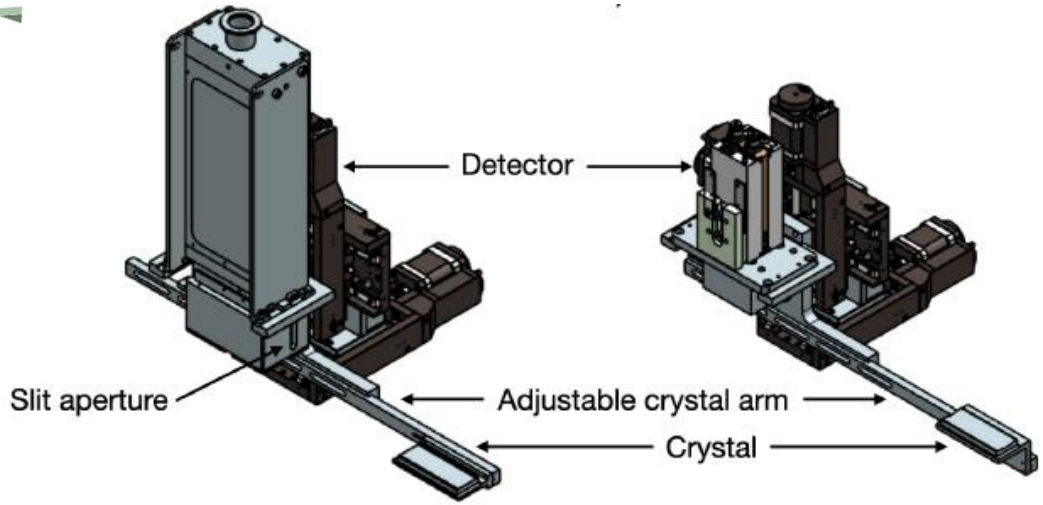
Focus in IC2 at 17.8 keV photon energy by scannign with a 1 mm diam. W rod

Mosaic graphite von-Hamos spectrometer

- Inside IC1, we offer von-Hamos HAPG spectrometers for emission or scattering experiments. Please contact us for further details. A JINST publication is available: https://doi.org/10.1088/1748-0221/15/11/P11033 .
  Contact Thomas Preston or Ulf Zastrau for details.



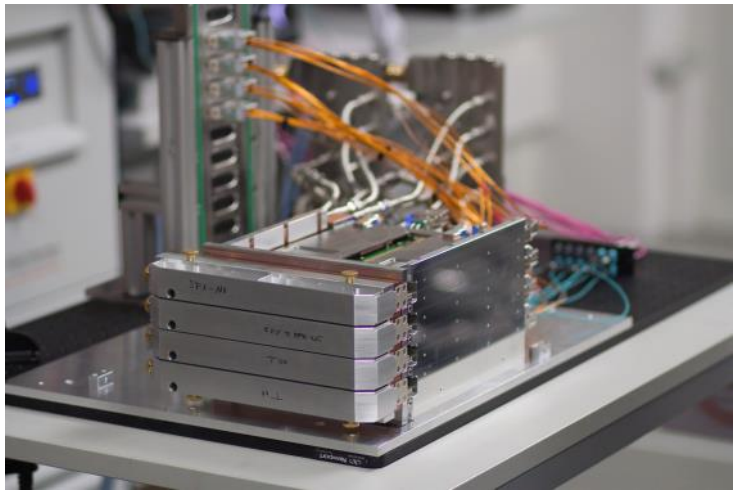




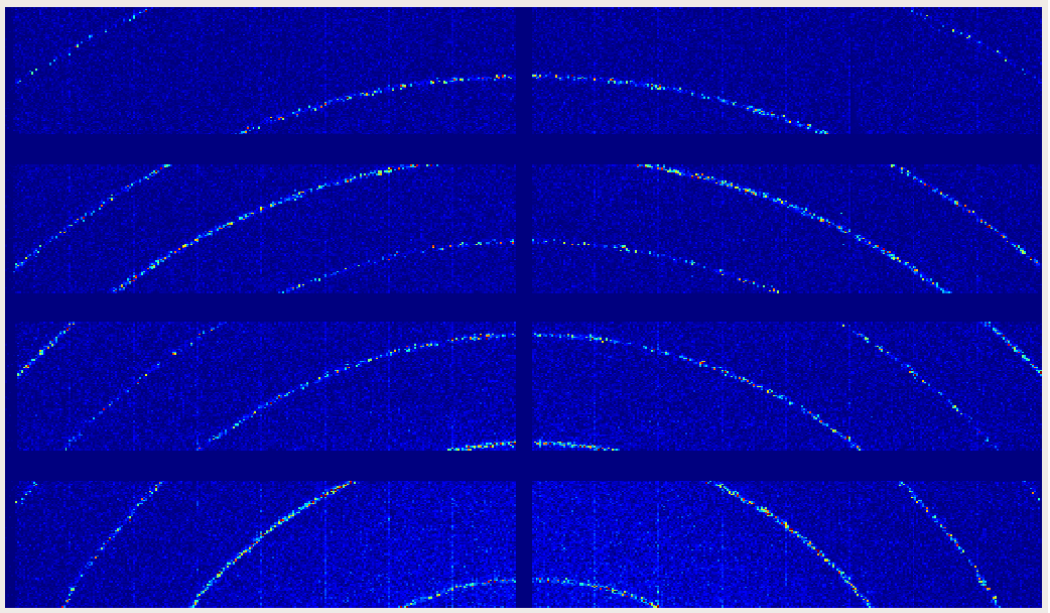
Optional devices which require R&D and heavy support

- bent diamond crystal spectrum analyzer downstream of the interaction.
  Contact Karen Appel or Mikako Makita for details.
- AGIPD Mini-half detector (352 images at 3 gain stages with 4.5 MHz).
  Contact Cornelius Strohm for details.

AGIPD mini-half

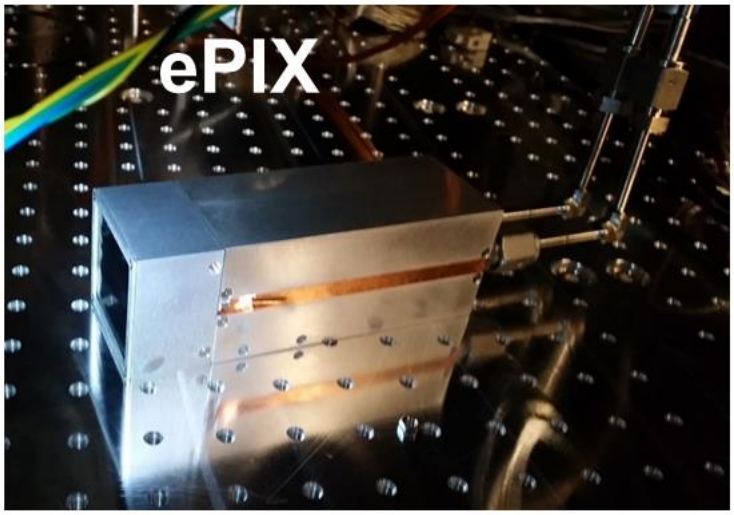


First light on the AGIPD mini-half at HED – LaB6 at 17.8 keV – fresh data from Nov 2020



ePIX and JUNGFRAU

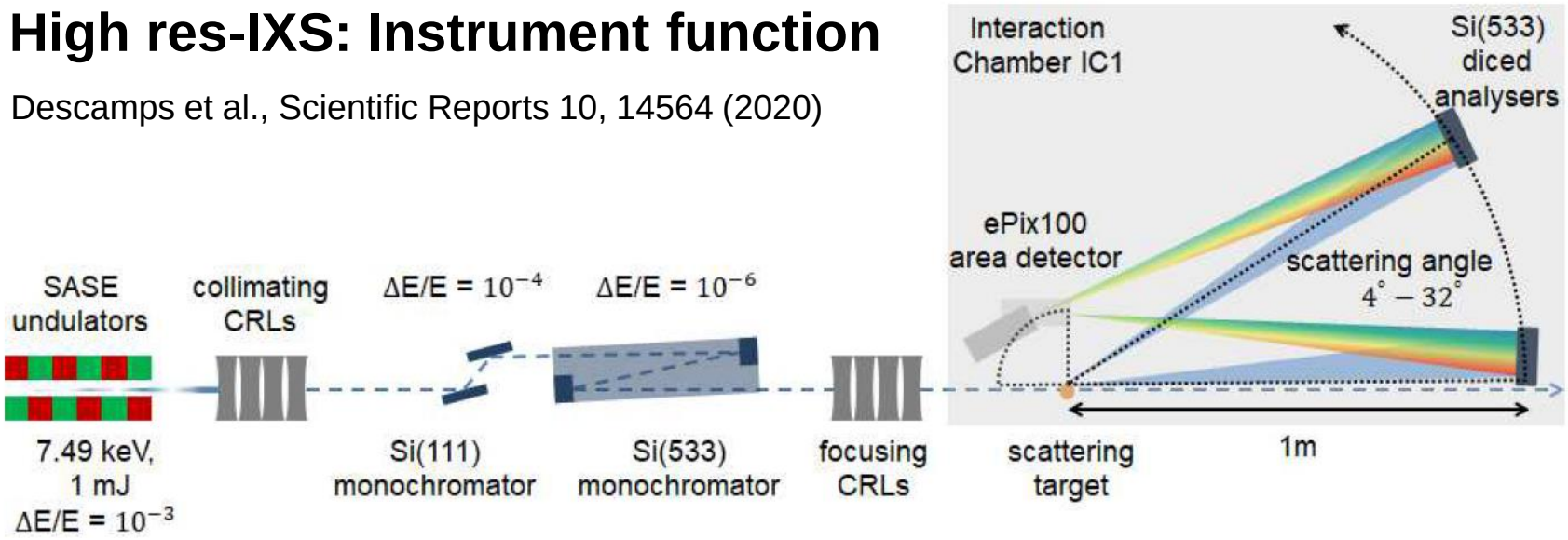
For details on detectors,
please contact Sebastian Göde or Valerio Cerantola from the HED team.



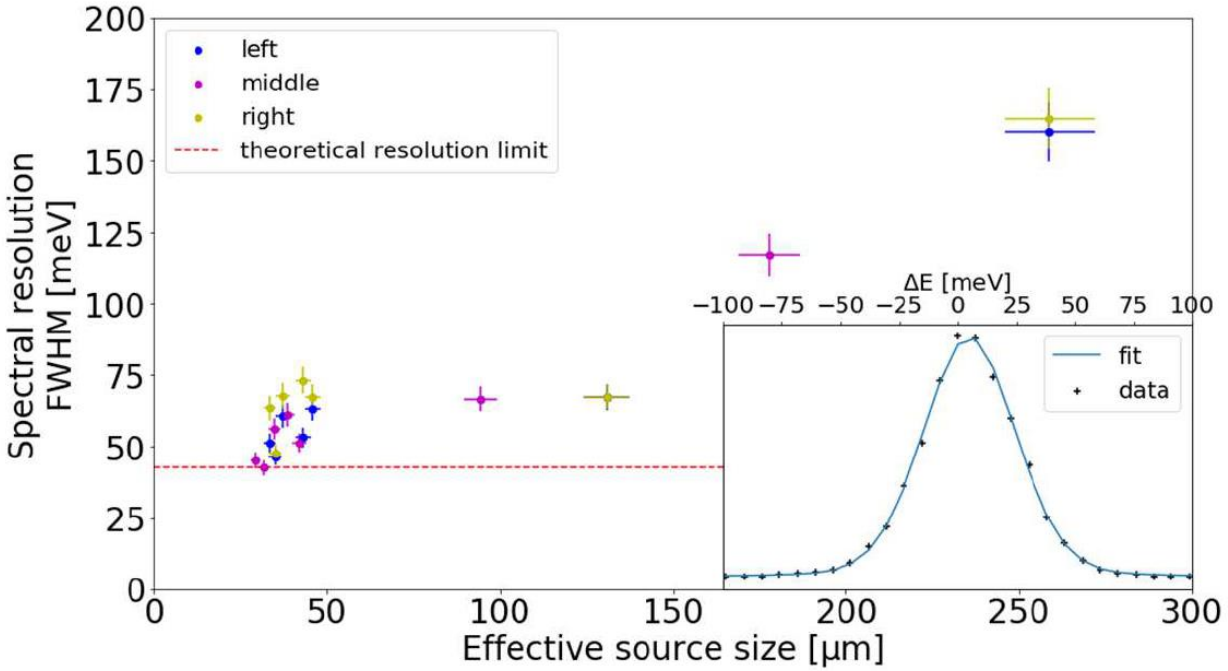
Name	Pixel size (μm)	No. of pixels (adim.)	Detection area (mm^2)	Noise (eV)	Frame rate (Hz)	Dynamic Range (photons per pixel)
ePix 100	50	704 × 768	35 × 38	< 280	120	10^2 8 keV
Jungfrau	75	512 × 1024	38.55 × 77.25	< 450	2400	10^4 12 keV

High res-IXS: Instrument function

Descamps et al., Scientific Reports 10, 14564 (2020)

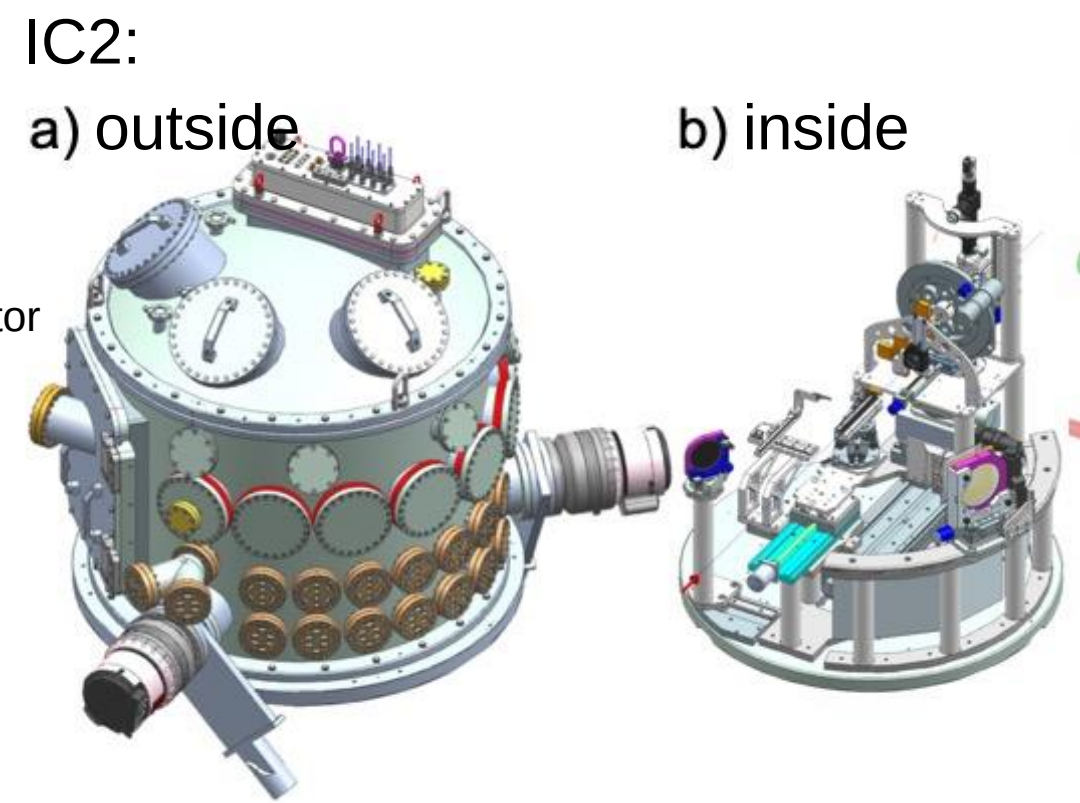


Thin samples yield close-to design spectral resolution



Platforms – Interaction Chamber 2, pp-laser

- **IC2**
  - Diamond Anvil Cell (DAC) setup for precision XRD
  - 2 VAREX flatpanel detectors in IC2 (10 Hz)
  - AGIPD mini-half 4.5 MHz detector
  - Pulsed laser heating for DAC research
  - Dynamic DAC (dDAC)

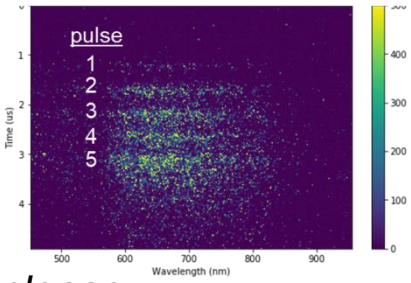


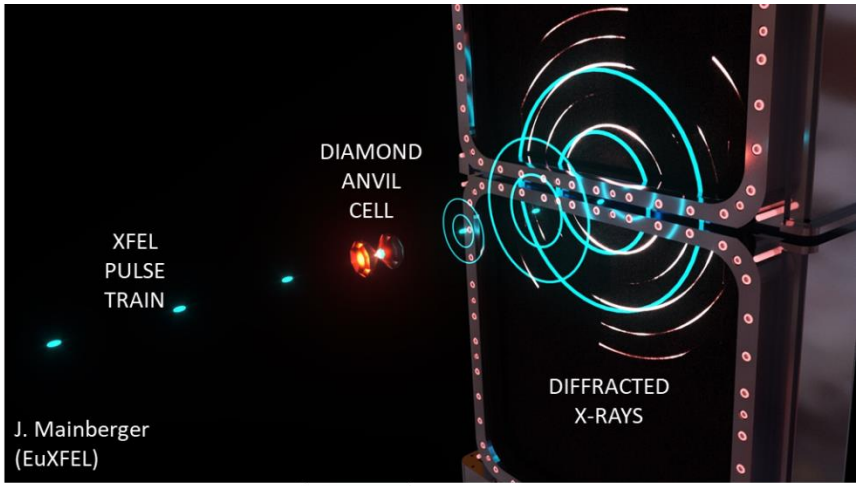
contact HED instrument scientists: *Zuzana Konopkova, Valerio Cerantola*
or HiBEF UC members: *Cornelius Strohm, Hanns-Peter Liermann*
for details of this platform

Pulsed Laser heating for DAC research

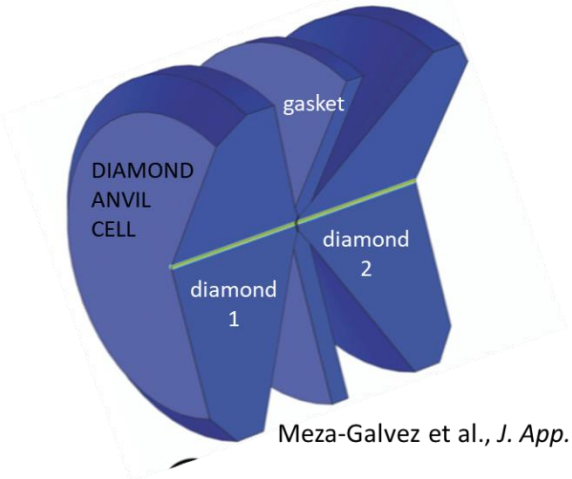
- double side laser heating in DACs
- 2x 100 W NIR lasers in pulse mode or cw mode. Pulse duration 10-500 ns, and >1 µs possible
- temperature determination: time resolved spectral radiometry (SOP) using streak camera system
- Streaked optical pyrometry (SOP)

Streaked spectrogram





For further information, please contact Zuzana Konopkova from the HED team: zuzana.konopkova@xfel.eu



Meza-Galvez et al., *J. App. Phys.*, 2020

Pump-probe (PP) laser

- Anticipated parameters
  - **PP laser at 800 nm wavelength**
    - ► 15 fs duration, Fourier-limited bandwidth (going for narrower bandwidth with longer pulse duration is an option)
    - ► 100 kHz, max ~2 mJ (10Hz or shot-on-demand is possible. Higher repetition than 100 kHz with lower pulse energy is an option)
    - ► Second harmonic (400 nm) is potentially available
  - **PP laser at 1030 nm wavelength**
    - ► ~ 1 ps duration
    - ► 100 kHz, max ~35 mJ (10Hz or shot-on-demand is possible. Higher repetition than 100 kHz with lower pulse energy is an option)
    - ► Second/third harmonic (515/343 nm) are potentially available

For more details contact Motoaki Nakatsutsumi and/or Jan-Patrick Schwinkendorf from the HED team: motoaki.nakatsutsumi@xfel.eu, jan-patrick.schwinkendorf@xfel.eu

A23 HIBEF laser bay

HI-OL: HiBEF ReLaX TW laser

For the run 7 the UHI laser is offered to the user community with a limited parameter set in terms of laser properties, allowed irradiation geometries and offered x-ray and non x-ray diagnostics.

Questions about the laser can be directed to Toma Toncian, t.toncian@hzdr.de

HI-OL Laser parameters:

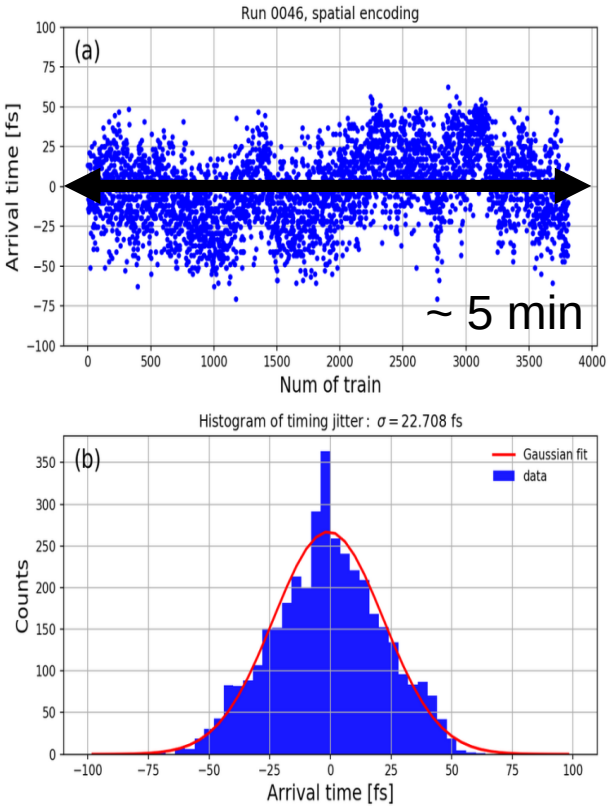
- up to 100 TW laser beam available at IC1 target chamber.
- Laser pulse duration <30 fs (nominal).
- Energy up to 3 J on target.
- Irradiation geometry: 45 deg to XRAY axis and target normal.
- F/2 focusing optic.
- Laser wavelength 750-850 nm.
- Arrival jitter compared to x-rays at IC1 <300 fs RMS.
- a synchronized optical probe beam with mJ energy can be made available upon request.
- on shot diagnostic package with NF, FF, WF, pulse duration, arrival time at PAM.
- latest laser contrast trace can be measured upon request.
- Shot-on-demand experiments only (no automated high repetition rate).

Shot rate will be limited by alignment time, debris issues, and probationary radiological limits.

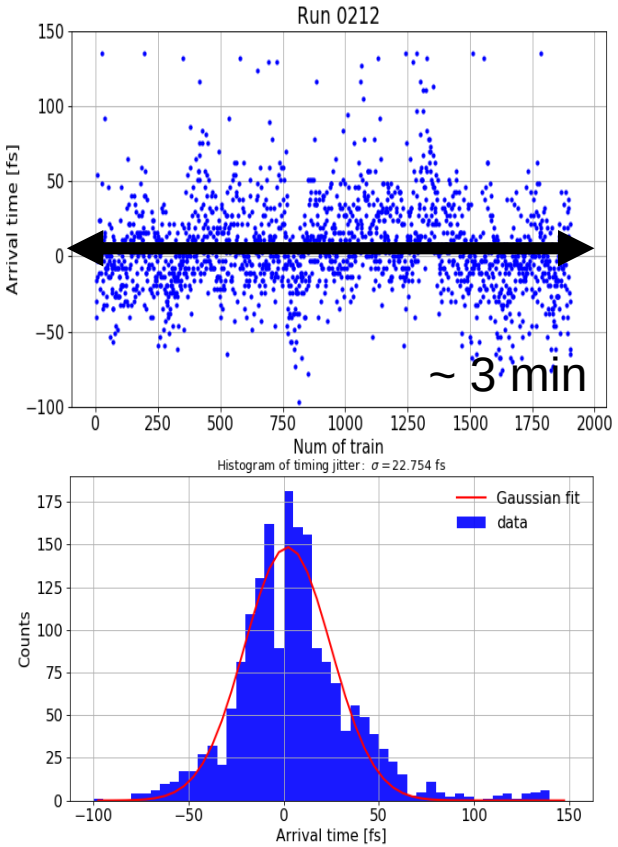
For x-ray and optical diagnostics, see HED website.

Pulse-to-pulse arrival jitter betweeen x-ray and optical lasers is 20-30 fs

Pump-probe laser



ReLaX TW laser



HE-OL: HiBEF opens the DiPOLE 100-X laser for a single, centrally coordinated community proposal

For the run 7 the DIPOLE laser is offered for a single community user assisted commissioning proposal with a limited parameter set in terms of laser properties, allowed irradiation geometries and offered x-ray and non x-ray diagnostics. **Other proposals for this laser are technically not feasible in this run.**

Prospective applicants are encourage join the community by contacting the PI/MP of the community proposal**:** *Malcolm McMahon (U Edinburgh) and Karen Appel (EuXFEL). For technical details, contact Erik Brambrink.*

HI-OL Laser parameters:

- Up to 50 J at 515 nm (frequency doubled)
- Laser pulse profiling capability for pulse length from 1 to 15 ns.
- Laser focal spot size 100, 250 and 500 mum (top head profile)
- Irradiation geometry: Experiment in IC2 with co-linear geometry (see drawing)
- Diffraction diagnostics with VAREX detector
- Shot-on-demand experiments. Shot rate will be limited by alignment time. 10 Hz laser operation possible, target delivery has to be provided by users

What do we still have to exclude for users?

- Split-Delay-Line (installation planned for winter shutdown 2019/2020, commissioning planned for spring 2020)
- Pulsed magnetic fields
- 1M AGIPD (this “full scale” AGIPD detector is delayed to unknown time due to necessary redesign of the cooling system)

Typical experiments

Scientific drivers to create HED states:

- Isochoric heating, aka x-ray fs heating (focused x-rays)
- Diamond anvil cells, pulsed laser heating, SOP
- Pump-probe laser (PP)
- TW laser “ReLaX”
- ns-laser “DiPOLE” (only in a single community proposal)

→ Contact the HED instrument scientists for detailed information.

→ https://www.xfel.eu/facility/instruments/hed