

## 10<sup>th</sup> Call for Proposals for User Experiments: Regular Proposals (including Cross-Instrument Use) and Sample and Protein Crystal Screening Proposals



The 10<sup>th</sup> call for regular proposals at the European X-Ray Free-Electron Laser Facility (European XFEL) is open until **Friday, 09 December 2022, at 16:00 (local Hamburg/Schenefeld time / Central European Time – CET)** for the seven scientific instruments planned to be in operation the second semester of 2023. Please refer to the important information below and apply via the [User Portal to the European XFEL \(UPEX\)](#).

- In the framework of this call, **standard configurations for the HED and the MID, instruments** can be specified in the UPEX proposal form.
- The SCS instrument **only** accepts proposals for the solid-state sample environment of the XRD experiment station and RIXS spectrometer using back-scattering geometries
- A specific call for **Sample and Protein Crystal Screening (PCS) proposals is also open at SPB/SFX** with the same deadline as the regular call.
- The **SXP** instrument joins the call for proposals for the first time. Following the approach used at the baseline instruments, **Community Proposals** will be organized and be given **priority** over regular proposals. Access to this instrument in this run is only possible in the standard configuration described in section 1.3 below.

A **virtual information meeting** will be held on **Thursday, 10 November 2022 at 17:00 (local Hamburg/Schenefeld time / Central European Time – CET)**. Details about the videoconference link and agenda will be posted on [our website](#) soon.

Beamtime will be allocated from July to November 2023 at these scientific instruments:

- [Femtosecond X-Ray Experiments \(FXE\)](#) at Beamline SASE1
- [Single Particles, Clusters, and Biomolecules and Serial Femtosecond Crystallography \(SPB/SFX\)](#) at Beamline SASE1
- [High Energy Density Science \(HED\)](#) at Beamline SASE2
- [Materials Imaging and Dynamics \(MID\)](#) at Beamline SASE2
- [Spectroscopy and Coherent Scattering \(SCS\)](#) at Beamline SASE3
- [Small Quantum Systems \(SQS\)](#) at Beamline SASE3
- [Soft X-Ray Port \(SXP\)](#) at Beamline SASE3

Instrument overview: <https://www.xfel.eu/facility/instruments>

**Please check with the relevant instrument group about specific feasibility conditions for this call before submitting a proposal.** Please also inquire with the instrument groups for more information about planned user community projects.

- **FXE:** [christopher.milne@xfel.eu](mailto:christopher.milne@xfel.eu)
- **SPB/SFX:** [spb.sfx@xfel.eu](mailto:spb.sfx@xfel.eu)
- **HED:** [ulf.zastra@xfel.eu](mailto:ulf.zastra@xfel.eu)
- **MID:** [mid-info@xfel.eu](mailto:mid-info@xfel.eu)
- **SCS:** [scs@xfel.eu](mailto:scs@xfel.eu)
- **SQS:** [michael.meyer@xfel.eu](mailto:michael.meyer@xfel.eu)
- **SXP :** [sxp@xfel.eu](mailto:sxp@xfel.eu)

All proposals submitted in this call will be reviewed for their scientific quality by panels of international experts and checked for safety and feasibility conditions.

## 1. Standard instrument configurations in this call

An efficiency advantage can be established on some instruments with the development of “standard configurations”. The goal is to allow user experiments to be grouped together back-to-back without involving a major change in setup every time. In addition, these standard configurations will help provide a pathway to broaden the user community by reducing the need for user teams to include the expertise needed to design/construct and install specific end station components. A range of standard configurations may be offered by an instrument, alternating throughout a period that covers several calls, to limit the range of required setups on a temporary basis. A number of instruments will make available standard configurations in this call. Access to the SXP instrument in this run is only possible in the standard configuration described in section 1.3 below.

### 1.1 HED standard configurations

#### 1.1.1 *Diamond Anvil Cell (DAC) standard configuration*

- IC2 standard DAC setup, symmetric DAC cell support for users who need cells, user-supplied BX90 with adapters
- Optical observation microscope, streaked pyrometry for X-ray heating
- 18 keV SASE, max. rep. rate of 4.5 MHz, >0.5 mJ pulse energy from the undulators (not accounting for beamline transmission)
- 5–15 micrometer focal spot size (fixed at 5  $\mu\text{m}$ , but effectively larger, depending on beam pointing stability)
- Detectors: AGIPD mini-half detector and VAREX flatpanel
- Required: Contact the [HED instrument group](#) for a feasibility check

#### 1.1.2 *ReLaX-SAXS-PCI standard configuration*

- IC1 chamber, 100 TW ReLaX laser incident on target at 45° w. r. t. XFEL (no normal incidence of laser on target)
- SAXS+PCI @ 8.15 keV SASE (tunable within reasonable range), ca. 1 mJ per pulse, 2.25 MHz maximum rep. rate
- +5–50  $\mu\text{m}$  spot size (both X-ray and ReLaX), no nanofocus possibility
- +PCI resolution of about 1  $\mu\text{m}$
- Backward HAPG X-ray spectrometer, forward spectrometer can be added only if SAXS diagnostics is not used
- Laser diagnostics (upon request): EMP, electron, bremsstrahlung, and proton diagnostics
- Further details: Contact the [HED instrument group](#)

#### 1.1.3 *DiPOLE 100-X standard configuration*

- Experiments in IC2 chamber with shock setup
- Geometry: the quasi-collinear geometry will be commissioned, however 90° between laser and x-rays may be proposed, but requires a setup change and commissioning time (please account for it in your proposal).
- DiPOLE laser at 2w, focus on target with 250  $\mu\text{m}$  or 500  $\mu\text{m}$  phase plate
- 2w laser energy: temporal square pulse scales as currently expected: ca. 50 J in 10 ns, ca. 15 J in 2 ns.
- pulse shaping (other than flattop) on best-effort basis, contained energy has to be evaluated and will be lower than in a square pulse.
- X-ray diagnostics: XRD with VAREX at 18 keV x-ray photon energy, SASE
- Optical diagnostics: VISAR (1 arm 1064nm and 2 arms 532nm) plus 1 SOP arm.

- Further details: Contact the [HED instrument group](#)

### 1.2 MID – Small-angle MHz XPCS standard configuration

- AGIPD MHz area detector, 1 Mpx, 200  $\mu\text{m}$  pixel size
- Photon energy: 7–12 keV, up to 2 mJ/pulse, up to 200 pulses/train, 10 trains/sec
- Min. correlation function lag time 440 ns, max. lag time 88  $\mu\text{s}$
- q-range (8 m sample–detector distance):  $\sim 7\text{e-}3 - 0.1 \text{ \AA}^{-1}$  (small angle scattering)
- Beam size on sample: 1–10  $\mu\text{m}$  with local optics, >30  $\mu\text{m}$  with tunnel optics
- Standard mounts for sample in capillaries and scanning
- Mounting of user-supplied sample environments possible (contact [MID instrument group](#) before proposal submission)
- Further details: Contact the [MID instrument group](#)

### 1.3 SXP – Time-resolved photoelectron spectroscopy standard configuration

- Spatial and momentum resolved k-microscope photoelectron spectrometer equipped with a delay-line detector.
- Photon energy: > 1 keV, up to 200 pulses/train, 10 trains/sec
- Beam size on sample: 3 - 500  $\mu\text{m}$ , default  $\sim 30 \mu\text{m}$
- Omicron type mount for solid samples
- Load lock for fast sample insertion and preparation chamber
- Further details: Contact the [SXP instrument group](#)

## 2. Sample and Protein Crystal Screening at SPB/SFX

A specific call for Sample and Protein Crystal screening (PCS) is open at the SPB/SFX instrument that combines sample characterization and injection tests in the laboratories, followed by screening beamtime at the SPB/SFX instrument.

This call predominantly aims for protein crystals; however, can also include non-protein crystals or other diffracting protein samples if in accordance with the PCS standard parameters (see table below).

Nozzles and injection support will be provided by the Sample Environment and Characterization (SEC) group. This call exclusively addresses injection by gas dynamic virtual nozzles (GDVNs) and double-flow focusing nozzles (DFFNs).

For further information, please contact [Katerina Dörner \(katerina.doerner@xfel.eu\)](mailto:katerina.doerner@xfel.eu) prior to submission.

#### **Standard Parameters for PCS\***

Photon energy	9.3 keV
Detector distance	125 mm (approx. 1.7 $\text{\AA}$ edge resolution)
FWHM focus size**	0.3 $\mu\text{m}$ or < 200 nm
Sample delivery	Low viscosity liquid jet (GDVN, DFFN)

\* Minor changes to some of these parameters may occur due to logistics during the user run

\*\* Micro or nano focus will be determined based on the standard configuration for the user run

PCS proposals, which are to be submitted to a specific call in the user portal UPEX, will be selected after peer review (including feasibility and safety checks).

More details are available on the [SPB/SFX web page](#).

### 3. Cross-instrument proposals

Highly targeted experiment proposals for a specific instrument have better chances of success. If, on the advice of our scientists, specific parts of your project should be conducted by using different European XFEL instruments, the selection of two instruments is possible in the proposal form. Make sure that the proposal addresses the experiment sessions on both instruments exhaustively. For schedule reasons, the proposal will receive individual IDs on submission and will be reviewed by both instrument proposal review panels concerned. ***This option should not be used to submit the same experiment to two different instruments in order to increase the chances for beamtime allocation.***

### 4. X-ray beam conditions for the allocation period

The conditions expected for this allocation period are listed below. **Nevertheless, case-by-case verification of specific feasibility conditions with the instrument groups is required.**

	Photon energy range	Expected pulse energy**
SA1	5–9.3 keV	2 mJ
	>9.3–14 keV	1 mJ
	>14–24 keV	0.5 mJ
SA2	5.8–9.3 keV	2 mJ
	>9.3–12 keV	1 mJ
	>12–24 keV	0.5 mJ
SA3	0.5–1.5 keV	5 mJ
	>1.5–2.5 keV	2 mJ
	>2.5 keV	0.5 mJ

Bunch distribution: 350 X-ray pulses per instrument assume equal distribution at 2.25 MHz operation. Higher or smaller numbers for higher/smaller intra-train frequency. Max. 2250 electron bunches within 500  $\mu$ s are available for distribution to the instruments (4.5 MHz)

\*\* Pulse energy depends on bunch charge, electron energy, and photon energy.

Explanations:

1. The above parameters correspond to the *standard* SASE operation mode.
2. The following *special* modes are available but may require more tuning and are maybe less reliable:
  - a. Hard X-ray self-seeding (SA2; 7 - 14 keV)
  - b. Hard X-ray two-colour w. variable delay (SA2; 6–10 keV; 0–0.5 ps)
  - c. Soft X-ray two-colour w. variable delay (SA3; 500–3000 eV; 0–1 ps)

- d. Short bunches (< 10 fs FWHM); requires coordinated scheduling as other instruments and available number of bunches might be affected; time-diagnostics is only partially available
- e. Full trains at instruments with  $\ll$  10 Hz rep. rates (~ 2250 pulses)

Experiments requesting these *special* modes should address the development of new techniques and fields and are expected to involve large communities and facility staff. If included in the final schedule, continuous (24 hr) beam delivery would be planned in this case. Since there is a vast range of detailed specifications for these special modes, proposers are requested to contact the corresponding instrument staff in order to clarify requirements.

Figure 1 shows the general relation between photon energy and electron energy. There are two curves for SASE 1/2 (red) and two curves for SASE3 (blue), respectively. For any given electron energy, the accessible photon energies for any SASE lie between the respective curves. EuXFEL currently employs 3 standard electron energy working points, that are: 11.5 GeV, 14 GeV, and 16.3 GeV. Additional restrictions for accessible photon energies may apply with different scientific instruments, please check with instrument staff.

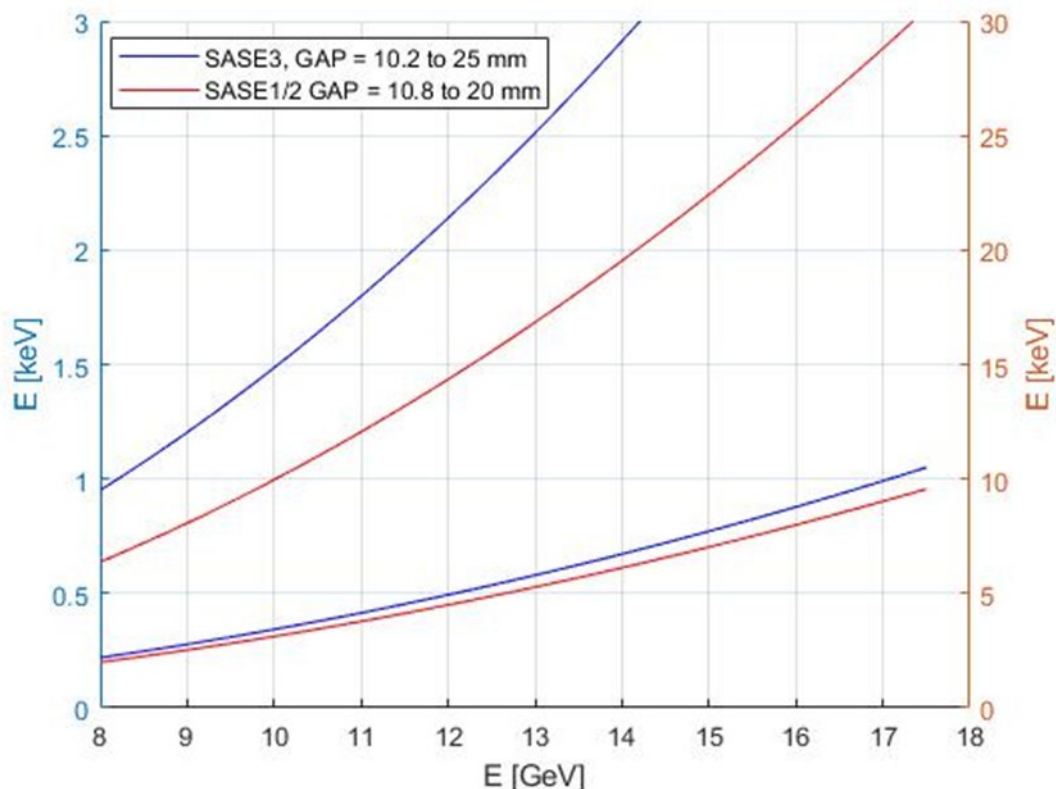


Figure 1. Photon Energy vs Electron Energy for the SASE1/2 (red) and SASE3 (blue)

## 5. Experiment reports about previous beamtime

Experiment reports are mandatory and must be submitted 3 to 6 months after the end of each experiment. However, Main Proposers and/or Principal Investigators who have received beamtime in the past and who submit new proposals or continuation proposals **must provide the experiment reports related to previous proposal(s) via the User Portal to the European XFEL (UPEX) by Monday 12 December 2022.**

Missing experiment reports may result in withdrawal of new proposals from the review

process. Please refer to further [instructions on our homepage](#).

## 6. Operation during COVID-19 pandemic

At present, it cannot be excluded that the access restrictions that affected previous user runs and the [specific hygiene measures applying to user operation at our facility](#) this year will also influence operational aspects in 2023. In the proposal form, you are requested to detail to what degree your proposal would be affected by the persistence of pandemic conditions and what measures could be taken in order to mitigate these consequences, still preserving good chances of success. In case of doubt, please contact the instrument groups for advice.

## 7. User pages and funding options

More practical information for users can be found here:

<https://www.xfel.eu/users>

**Travel funding** and living subsistence are available for a number of users affiliated with organizations based in the member countries of European XFEL.

Further details are available here:

[https://www.xfel.eu/users/user\\_guide/funded\\_user\\_travel](https://www.xfel.eu/users/user_guide/funded_user_travel)

Specific **shipping funding options** for organizations based in the member countries of European XFEL are available in order to mitigate the impact of COVID-19 travel restrictions.

European XFEL User Office

Email: [useroffice@xfel.eu](mailto:useroffice@xfel.eu)

Phone: +49 (0)40 8998-6937 or -6767

**Please always check with the relevant instrument group about specific feasibility conditions before submitting a proposal.**

- **FXE** : [christopher.milne@xfel.eu](mailto:christopher.milne@xfel.eu)
- **SPB/SFX**: [spb.sfx@xfel.eu](mailto:spb.sfx@xfel.eu)
- **HED** : [ulf.zastra@xfel.eu](mailto:ulf.zastra@xfel.eu)
- **MID** : [mid-info@xfel.eu](mailto:mid-info@xfel.eu)
- **SCS** : [scs@xfel.eu](mailto:scs@xfel.eu)
- **SQS** : [michael.meyer@xfel.eu](mailto:michael.meyer@xfel.eu)
- **SXP** : [sxp@xfel.eu](mailto:sxp@xfel.eu)