

# SCS Instrument Parameters for User Experiments – 2024-II / 12<sup>th</sup> CfP

Page 1/3, 29 Sep 2023



Photon beam parameters		
Photon energy SASE3	0.40 – 3.0 keV	11.5GeV – 16.3GeV, Soft X-ray two color mode with variable delay is possible: 0.40 – 3.0 keV; 0 – 1 ps
X-ray pulse energy	5 mJ (0.5 – 1.5 keV) 2 mJ (1.5 – 2.5 keV) 0.5 mJ (> 2.5 keV)	Expected performance. Pulse energy depends on bunch charge, electron energy and photon energy
X-ray pulse duration	10-25 fs (fwhm), short bunches (<10fs)*	*) short bunches requires coordinated scheduling as other instruments and available number of bunches might be affected; time-diagnostics only partially available.
Mono resolving power	LR grating 1 <sup>st</sup> order: 3,000 (3 permille transmission) HR grating 1 <sup>st</sup> order: 10,000	High resolution compromises short pulse durations, see pulse stretching
X-ray pulse stretching	30 – 50 fs (mono LR) 80 – 150 fs (mono HR)	Expected durations based on monochromator
X-ray pulse energy after mono	1 – 30μJ	Mono 1 <sup>st</sup> order
Number of pulses per train	350  2250	X-ray pulses per instrument assuming equal distribution at 2.25 MHz (higher/smaller pulse numbers for higher/smaller intra-train frequencies or interleaved mode). Maximum 2250 electron bunches within 500 μs are available for distribution to the instruments (4.5 MHz). Exact bunch distribution is based on needs of experiments and the capabilities of the photon delivery systems  Full trains at instruments with << 10 Hz rep. rates (~ 2250 pulses)
Repetition rate in pulse train	Up to 4.5 MHz	For time-resolved studies using the PP laser, see available repetition rates and pulse energies on page 2
Train repetition rate	10 Hz SCS train picker	SCS train picker to convert e.g. 5Hz, or single train
Polarization	*Linear horizontal ( $\pi$ -polarization)	*APPLE-X afterburner commissioning expected 2024-I: linear vertical and circular polarizations may become available during 2024-II without assurance
Focal spot size at sample, tunable	1 μm (hor & ver) tunable up to 500μm	Independent tuning of horizontal and vertical focus. line focus is used for RIXS.

# SCS Instrument Parameters for User Experiments – 2024-II / 12<sup>th</sup> CfP

Page 2/3, 29 Sep 2023



XRD station with solid sample environment in back-scattering and reflection geometry		
Sample environment	Solid samples	Samples have to be UHV compatible
Pressure	10 <sup>-8</sup> / 10 <sup>-9</sup> mbar	
Temperature	16 K – room temperature	
Sample stage	Translation x, y, z: +/- 5 mm Theta: > 180 deg, Chi: +/- 30 deg Azimuth: +/- 90 deg	Six-degrees of motion.
RIXS scattering angle	65 – 145 deg Default: 125 deg	Changing the scattering angle may cost a few hours of beamtime per point. Inquire for details
Detectors in-vacuum	MCP, Photodiodes, APDs	Inquire for details
hRIXS Spectrometer		
Photon energy range	0.4 – 1.4 keV*	commissioned up to 1.0 keV, nominal up to 1.4 keV (inquire for details)
Combined resolving power (Monochromator & hRIXS)	Up to 10,000 (High resolution) Up to 3,000 (Low resolution)	
Detectors	Commercial CCD1 at ~0.2Hz (currently in operation) *Commercial CCD2 at 10Hz (expected in operation in 2024-I)	*we expect to have train-resolved detection of spectra at 10Hz starting from 2024-I.
Optical laser system		
Center wavelength	800 nm	
Pulse duration	15 or 50 fs	
Repetition rate and Pulse energy	2 mJ @ 113 kHz, 800 nm 0.2 mJ @ 1.13 MHz, 800 nm	Other working points exist (564kHz mode)
Wavelength tunability	Conversions from 800 nm / 50 fs: SHG (400 nm) , THG (266 nm), OPA: wavelength between 350 nm and 2.5 microns Please inquire for details on pulse energies	
Spot size	~100 µm	
Polarization	Linear and circular	
Operation	Burst mode synchronized to FEL with jitter <50 fs	

# SCS Instrument Parameters for User Experiments – 2024-II / 12<sup>th</sup> CfP

Page 3/3, 29 Sep 2023



Please discuss your experiment plans with the SCS team as soon as possible and **before** submitting your proposal. We can help you with any details that may have updated, assist with evaluating experiment feasibility, and much more.

This call is open for experiments using the solid sample environment of the XRD experiment station in back-scattering geometries (RIXS, XRD, Reflection)

contacts:

[scs@xfel.eu](mailto:scs@xfel.eu)

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