

SCS Instrument Parameters for User Experiments – 2025-I / 13th CfP

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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)* Attosecond pulse delivery at SASE3 (e.g. ≥200 as, few 100 μJ @ 1 keV)**	*) short bunches requires coordinated scheduling as other instruments and available number of bunches might be affected; time-diagnostics only partially available **) inquire for details
Mono resolving power	LR grating 1 st order: 3,000 (3 permille transmission) HR grating 1 st 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 st 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	variable polarization linear and left/right circular polarizations*	*) APPLE-X tested so far the energy range of 700 – 900 eV. Inquire for details
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.

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FFT experiment station - solid sample environment, Forward-scattering geometries		
Fixed target sample holder	Frame with 50 mm x 50 mm active area. limited fast “single-shot” scanning, room temperature, forward scattering geometry	
Sample Frame	Standard frames are provided by the instrument. A drawing of the frame to produce own sample frames is available on request	
DC electromagnet	≤ 0.35 T, along the X-ray propagation direction	
Cryostat sample holder	15 – 300K, top-inserted LHe flow cryostat, inquire for details	
DSSC detector SAXS, CDI, BOZ-XAS, XPCS		
Number of pixels	1024 x 1024	
Pixel coordinates	Hexagonal	Detector quadrants in windmill configuration
Pixel size	204 μm x 236 μm	
Max frame rate	4.5 MHz	
Beam hole size	Default: 4.75 mm (windmill)	The diameter of the central dead area is 8mm.
Standard detector-to-sample distance	Min: 1.02 m Max: 5.40 m Travel range: 1.5 m (under vacuum)	
Femto-XAS XAS, BOZ-XAS		
Transmission Monitor (cw diamond / MCP)	Pulse resolved detection, parallel operation to DSSC	operates up to 4.5 MHz, sensitivity: ten nJ
Beam-splitting off-axis zone plate (BOZ) for MHz transient XAS	BOZ exist for various photon energy ranges, for photon energies above 1.5keV inquire	BOZ X-ray Absorption Spectroscopy is recorded with DSSC. Inquire for details of the method
PI-MTE3 Detector		
Number Pixels / Size	2048 x 2048, 15μm x15μm	Cartesian coordinates, 30.7 x 30.7 mm imaging area
Frame rate	up to 1Hz*	*4 port readout, inquire for details
detector-sample distance	55 - 820 mm	

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CHEM / Liquid sample environment		
Sample delivery	Liquid Jets: single cylinder, 20 – 50µm Flat jet, thickness 1 – 4µm	
RIXS scattering angle	145 deg, 125 deg, 90 deg	Standard configuration: 125 deg
Solvents	Water, Ethanol*	*) Inquire for alternative solvents
hRIXS Spectrometer for CHEM / Liquid sample environment		
Photon energy range	0.4 – 1.4 keV	nominal working range
Combined resolving power (Monochromator & hRIXS)	Up to 10,000 (High resolution) Up to 3,000 (Low resolution)	Commissioned in the range of O K edge and Cu L edge Inquire for details of spectrometer transmission.
Detection scheme	single photon sensitivity, centroiding, train resolved detection at 10Hz	
Transient XAS for CHEM (Liquid sample environment, in transmission geometry)		
Sample delivery	Flat jet, thickness 1 – 4µm	
Beam-splitting off-axis zone plate (BOZ) for MHz transient XAS	BOZ exist for various photon energy ranges, for photon energies above 1.5keV inquire	BOZ X-ray Absorption Spectroscopy is recorded with DSSC. Inquire for details of the method and its possibilities.
Optical laser system SASE3 PP laser		
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. Inquire for details
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	

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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

- 1) experiments using the forward-scattering geometries and solid sample environment of FFT, i.e. transient XAS/XMCD, SAXS, CDI, and XPCS
- 2) experiments using the liquid sample environment of the CHEM station for time-resolved PFY/RIXS in back-scattering geometries and for transient XAS in transmission geometry.

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