SPB/SFX Instrument Parameters for User Experiments (run 2024-01)

26/04/2023

Photon beam parameters		
Photon energy	6 - 12 keV	Up to 15 keV potentially available
Pulse energy	≥2 mJ	Typical at 9.3 keV
Photons per pulse (at source)	~1 x 10^{12}	Derived from previous two fields (@ 9.3 keV)
Pulse duration	25 fs	Estimated
Focal spot size (FWHM)	∽ 3 µm < 200 nm ~1mm	Two KB mirror systems available Direct beam microscopy (higher beam energies potentially available, up to 18 keV)
Photons / µm² (at sample)	> 10^{10}	Derived. Includes abs, expected spot size range.
Train repetition rate	10 Hz	
Intra-train repetition rate	1.1 MHz	(4.5 MHz, 100 kHz, some quasi-arbitrary patterns)
ΔE/E	~0.2%	Estimated
No. of bunches per train	≤352	Some quasi-arbitrary patterns possible.
Sample delivery systems: In vacuum (upstream, 1 Mpx AGIPD), in Helium (downstream, roadrunner, 4M Jungfrau)		
Liquid jet injector rod	½“ nozzle rod with M9x1 mm fine thread nozzle mount compatible with the CXI nozzle rod at LCLS (MPI design), 1200 mm in length. Additionally, 25mm nozzle rod with M23 fine thread.	
Sample injection nozzles (GDVN and DFFN)	3D printed nozzles to produce µm-sized liquid jets. Other nozzle types also possible. Nozzles can be supplied by the SEC group. Please consult with the SEC group prior to proposal submission.	
High viscosity liquid jet	Mounted on nozzle rod. ASU or EuXFEL design	
Aerosol injector	Aerosol produced by electrospray. Other nebulizers also possible	
Fixed target sample holder	Various available. Please consult with instrument scientists prior to proposal submission.	
Pressure systems	HPLC pumps, syringe pumps, gas-pressurised sample reservoirs	
AGIPD 1 Mpx detection properties		
Number of pixels	1024 x 1024	4 quadrants, each 512 x 512 pixels
Pixel size	200 µm x 200 µm	
Minimum sample–detector distance*	~129 mm	Maximum 200 mm stroke
Resolution at edge @ 9.3 keV	< 1.8 Å	At minimum distance from sample
Max sample-detector distance	~ 5.5 m	
Hole size	8 mm. Possibly ~5 mm—large	Quadrant configuration tuneable to suit expected signal

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Optical laser system 1 properties		
Wavelength	800 nm	Tuneable from 750 to 850 nm (pulse duration is longer than 15 fs)
Pulse duration	15, 50 or 300 fs	
Repetition rate	1.1 MHz	Some quasi-arbitrary patterns possible.
Pulse energy	250 µJ	
Wavelength conversion	SHG, THG, OPA	SHG: 375–425 nm, THG: 250–283 nm, OPA: 400–2600 nm
Spot size (FWHM)	≥ 40 µm	
Optical laser system 2 properties		
Wavelength	1030 nm	No wavelength tuneability
Pulse duration	0.85 or 400 ps	
Repetition rate	1.1 MHz	Some quasi-arbitrary patterns possible.
Pulse energy	4 mJ	
Wavelength conversion	SHG, THG, FHG	SHG: 515 nm, THG: 343 nm, FHG: 258 nm
Spot size (FWHM)	≥ 40 µm	
Optical laser system 3 properties (Opolette 355 HE)		
Wavelength	210 – 2400 nm	OPO output
Pulse duration	3 – 7 ns	
Repetition rate	Single shot – 20Hz	
Pulse energy	0.5 – 5 mJ	Dependent on wavelength
Spot size (FWHM)	≥ 100 µm	
	Three of these systems can be operated simultaneously	

Photon Arrival Monitor (PAM) timing tool available for micron beam experiments depending on experimental configuration. TOPAS available with limited pulse energy up to 1.1 MHz.
In these cases, discussion with instrument scientists before proposal submission is essential.

Please discuss your experiment plans with an SPB/SFX instrument scientist before submitting your proposal. They can help you with any details that may have updated, assist with evaluating experiment feasibility, and much more.

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