Mono crystal selection

U.S. DEPARTMENT OF ENERGY | Stanford University

SLAC NATIONAL ACCELERATOR LABORATORY

While the IXS end stations will perform over the whole energy range if needed, there will be a selection of photon energies where we will expect “ultimate” performance. We will optimize the monochromators accordingly.

Considering the fact that we will have good SASE performance up until 12-13 keV until the low-emittance injector is deployed, there is no real reason to optimize the monos and the spectrometers for higher photon energies. Note, the instrument can quickly be configured for higher photon energies. This switch is not an “upgrade”, but rather a configuration change. Between day-1 of LCLS-II-HE and the new injector operation, we also expect self-seeded beam to be available up to ~9.5 keV.

Here are the three “day-1” modes we will optimize for:

1. SASE 9 keV (non-resonant IXS around 9 keV and Cu K-edge)
2. SASE 11.5 keV (non-resonant IXS around 11 keV and Ir L-edge)
3. Self-seeding 9 keV

Mode-1: 9keV SASE

Assuming 50 W SASE beam with 1e-3 BW
E: 9000 eV

HHLM

Crystal	Reflection	Bragg	asymmetry	footprint	Power
1	Si (111)	12.69	-9	38	30
2	Si (111)	12.69	9	38	1.5
3	Si (440)*	45.86	-38.3	19	12
4	Si (440)*	45.86	38.3	19	0.25

*Si (440) with 38.3 asymmetry is the same crystal as the Si (111) with 3 deg asym

Mode-2: 11keV SASE

Assuming 50 W SASE beam with 1e-3 BW
E: 11215 eV

HHLM

Crystal	Reflection	Bragg	asymmetry	footprint	Power
1	Si (111)	10.15	-6	34	33
2	Si (111)	10.15	6	34	1.15
3	Si (440)*	35.16	-32	44	9
4	Si (440)*	35.16	32	44	0.4

*Si (440) is different from the Mode-1 Si (440)

Mode-3: 9keV Self-seeded

Assuming 50 W Self-seeded beam with 1.9e-5 BW
(SS beam power will more likely to be ~20W
E: 9000 eV

Crystal	Reflection	Bragg	asymmetry	footprint	Power
1	Si (440)*	45.86	-41.3	30	2.25
2	Si (440)*	45.86	41.3	30	2.14
3	Si (553)	77.02	-74	45	22.17
4	Si (553)	77.02	74	45	5.66

*Si (440) with 41.3 asymmetry is the same crystal as the Si (111) with 6 asym