SACLA Users' Meeting 2024

Capabilities of intense X-ray sciences

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on behalf of SACLA
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Focusing capabilities

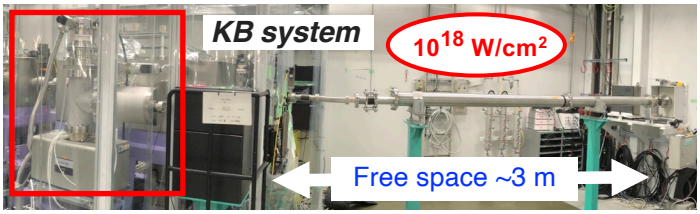
BL3 EH2 Be CRLs

T. Katayama *et al., JSR* 26 (2019)

Tuning time: **~2 h**
Lifetime of focus: **> 72 h**
Photon energy: **5~15 keV**
Throughput of optics: **25~60%**
Typical focus size: **1~2 μm fwhm**

BL3 EH4c 1-μm KB

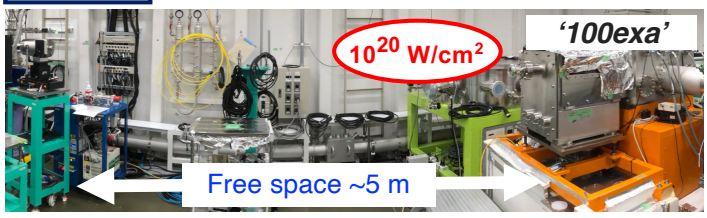
K. Tono *et al., Proc. SPIE 10237* (2017)



Tuning time: **~2 h**
Lifetime of focus: **> 72 h**
Photon energy: **4~20 keV**
Reflectivity: **>90%**
Typical focus size: **1 μm fwhm**

BL3 EH5 '100exa'

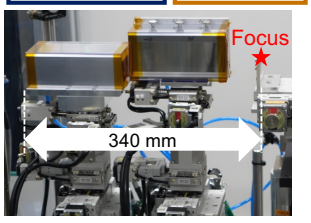
H. Yumoto *et al., Appl. Sci,* 10 (2020)



Tuning time: Initial tuning **~4 h**, retuning **~1 h**
Lifetime of focus: **> 12 h**
Photon energy: **< 12 keV**
Reflectivity: **~80%**
Typical focus size: **100x200 nm fwhm**

UPDATES

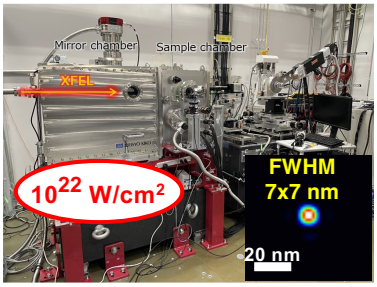
BL3 EH2/4c BL2 EH3 'portable KB' 10^{19} W/cm^2



Tuning time: Initial **~6 h**
Retuning **<10 min**
Lifetime of focus: **>12 h**
Photon energy: **>11.5 keV**
Typical focus size: **150x200 nm fwhm**
⚠ *Designed for atmospheric use*

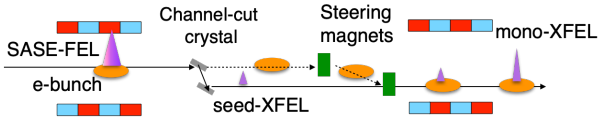
BL3 EH4c 'sub-10 nm'

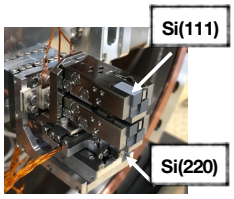
J. Yamada *et al., Nat. Photon. (in press)*



Tuning time: Initial **<12 h**
Retuning **<10 min**
Lifetime of focus: **6~10 h**
Photon energy: **9.1 keV**
Reflectivity: **~40%**
Typical focus size: **7x7 nm fwhm**

Self-seeded XFEL (only available at BL3)

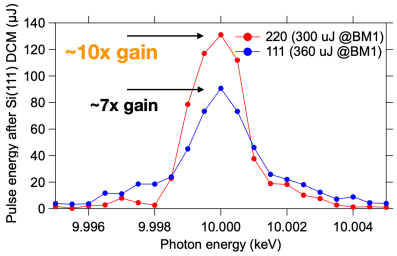




Applicable photon energy:
- < 8 keV (in principle)
- 8-12 keV(confirmed)

Inoue *et al., Nat. Photon.* 13 (2019).
Osaka *et al., JSR* 28 (2019).
Matsumura *et al., Opt. Exp.* (2020).

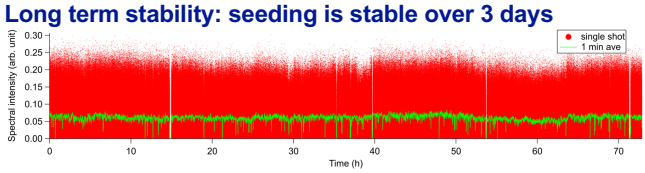
Gain of spectral brightness (compared with normal SASE XFEL)



- Typical gain is ~6, irrelevant of reflection plane of channel-cut crystal

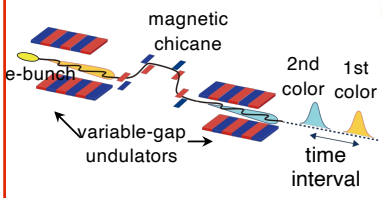
cf. best record (left figure):
~10 (220 reflection),
~7 (111 reflection)

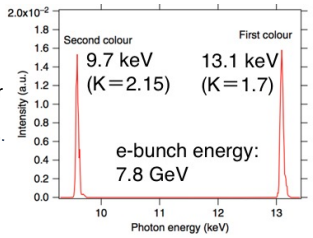
Long term stability: seeding is stable over 3 days



XFEL intensity after Si (111)DCM @User experiment(Dec. 2018)

Two-color XFEL (BL3)



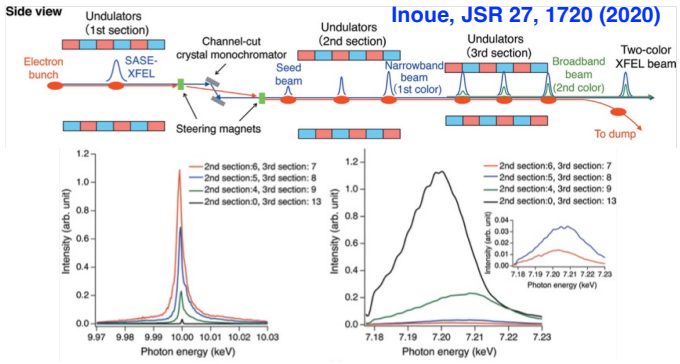


Hara *et al., Nat. Commun.* 4 (2013).
Inoue *et al., PNAS* 113 (2016).

Total pulse energy (1st color + 2nd color): ~200 μJ
Maximum photon energy separation: ~6 keV
Maximum time interval between twin pulses: ~300 fs

Advanced two-color mode (SASE beam+seeded beam)

Inoue, JSR 27, 1720 (2020)



UPDATE: Two-color mode at BL2
Total pulse energy (1st color + 2nd color): ~100 μJ
⚠ *No chicane → Twin pulses have no time separation*