Summary on Breakout Session 4

Development of Experimental Platform with High Power Lasers

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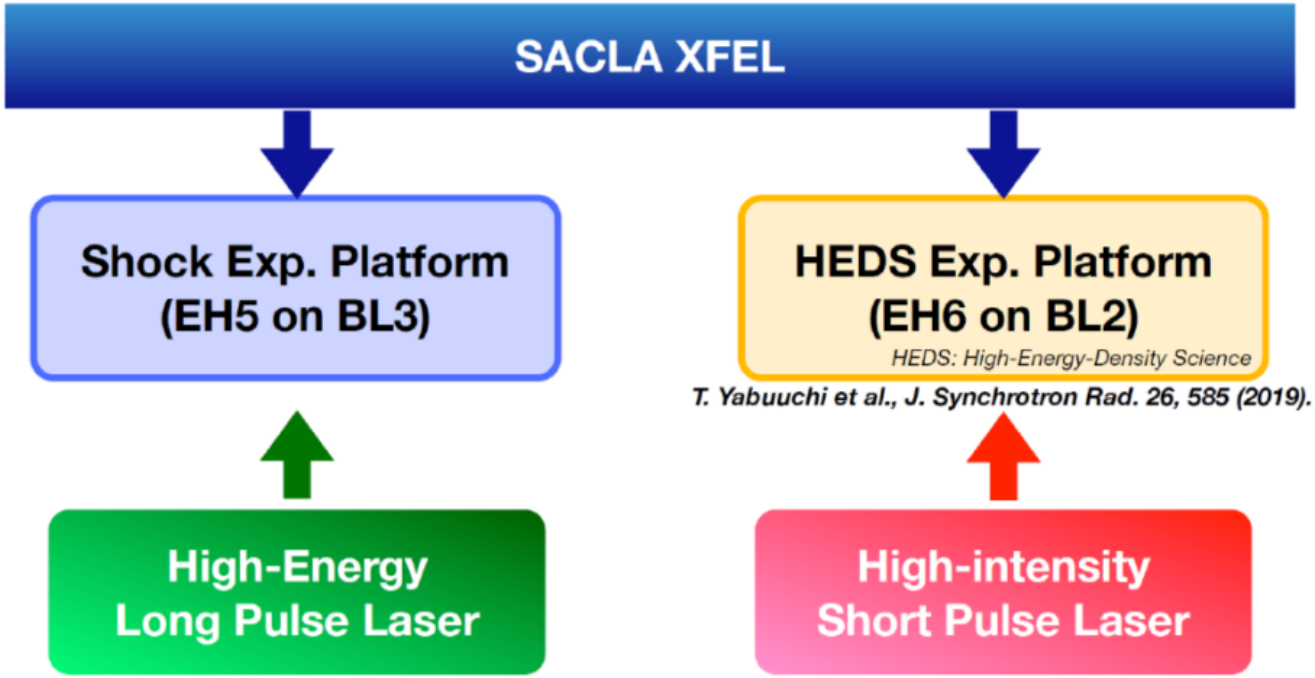
TADASHI TOGASHI (SACLA)

List of presenters

- **K. Sueda, “Overview of high power laser systems at SACLA”**
- **M. Nakatsutsumi, “Characterization of a laser-irradiated dense-plasma surface using a grazing-incidence X-ray scattering”**
- **T. Okuchi, “Laser-shock experiments at SACLA for simulating impact events in the early solar system: current status and perspective”**

K. Sueda

High-power laser systems available for combinative use with hard x-ray FELs at SACLA



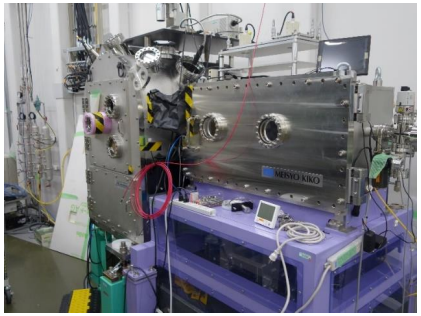
Hamamatsu Photonics

In collaboration with Profs. Kodama and Ozaki,
Institute of Laser Engineering, Osaka University

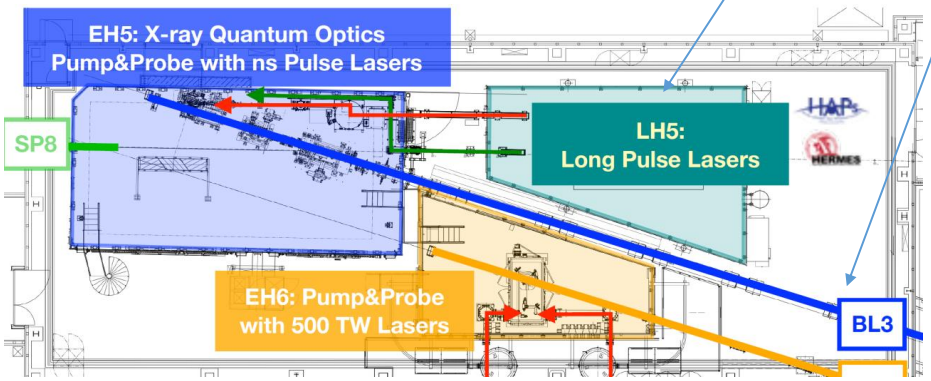
Thales
Menlo Systems
Laser Quantum

K. Sueda

Beam paramters at EH5



SACLA - SPring-8 Experimental Facility



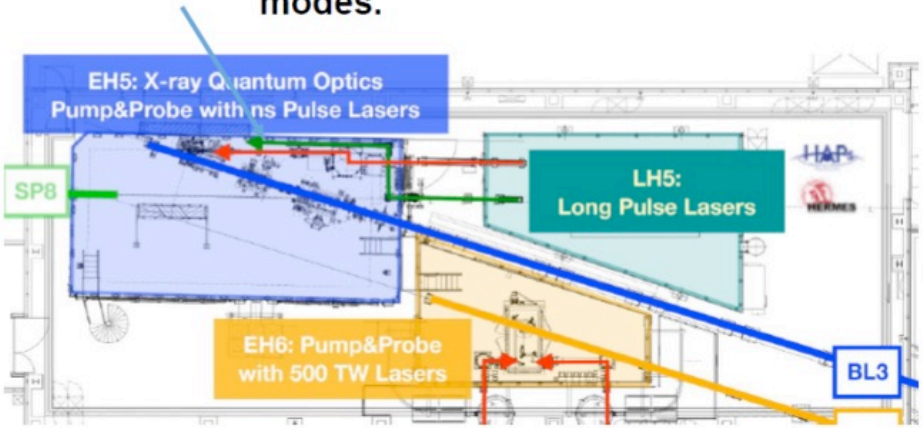
Optical laser	
Pulse energy and duration	30J@5ns, 50J@10ns
Wavelrngth	532 nm
Rep. rate	0.1Hz

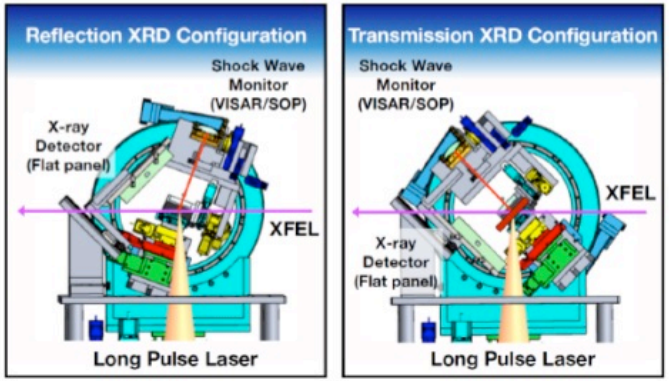
XFEL	
XFEL photon energy	4-20 keV
Band width	~1 x 10^{-4}, < 5 x 10^{-3} (monochrome, pink beam)
Energy	~600μJ/pls@10keV
Pulse duration	< 10 fs
Rep. rate	30 Hz
Focusing optics Advanced operation	KB mirrors for focus (sub-μm, 1D or 2D) Self-seeding Split-and-delay optics Two color

K. Sueda

Experimental platform with a high energy ns laser at EH5

- An experimental chamber for shock experiments with a long-pulse laser was installed in summer 2018.
- Components for laser transport and focusing are compatible for ~100 J pulse in max.
- The chamber is designed specifically for XRD and imaging/SAXS experiments of shocked material using nano-second, high-energy long pulse laser.
- Switchable between 1D-focusing (for diffraction) and 2D-focusing (for imaging, SAXS) modes.





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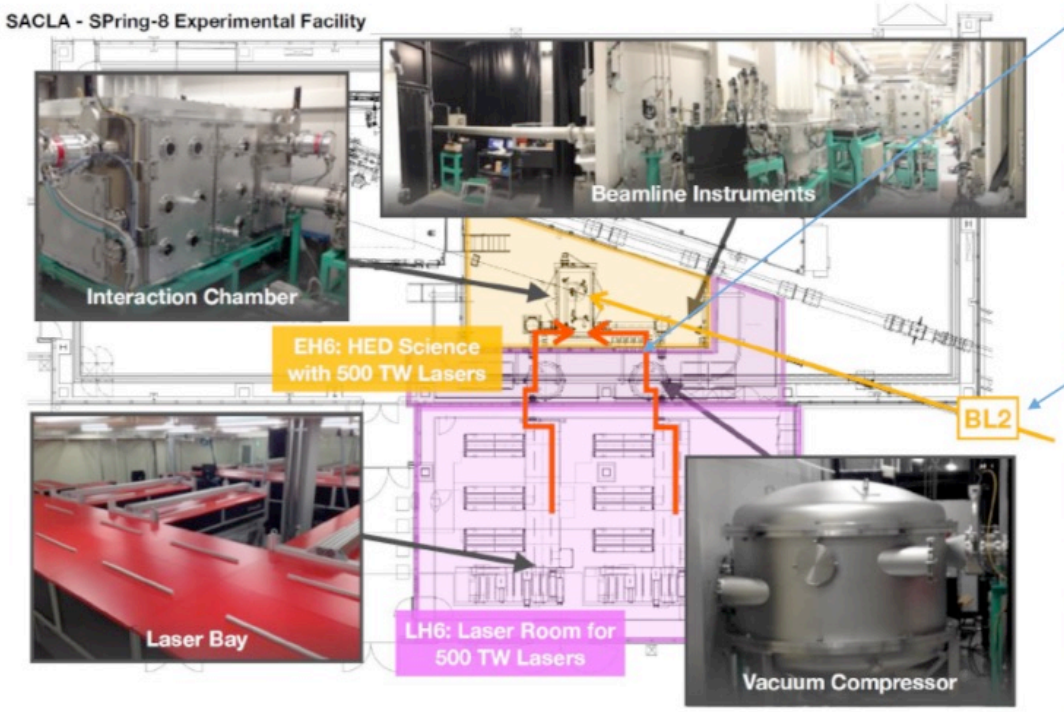
Beam paramters at EH6



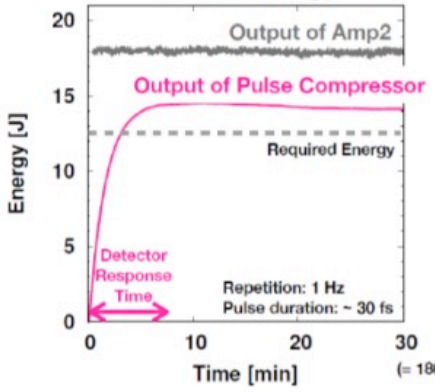
Optical laser	
Pulse energy	~ 8 J
Pulse duration	~ 40 fs
Wavelrngth	800 nm
Rep. rate	1Hz

XFEL	
XFEL photon energy	4-15 keV
Band width	$< 5 \times 10^{-3}$
Peak energy	$\sim 1 \times 10^{-4}$, $< 5 \times 10^{-3}$ (monochrome, pink beam)
Pulse duration	~ 10 fs
Rep. rate	30 Hz
Focusing optics	CRLs for focus (~ a few μm)

K. Sueda

High intensity fs laser performance 1

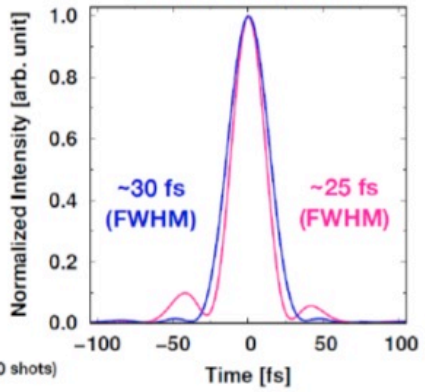
Pulse Energy



Design:
12.5 J after pulse compression

Energy fluc. : 0.14 J or 0.76% in rms (before compressor)

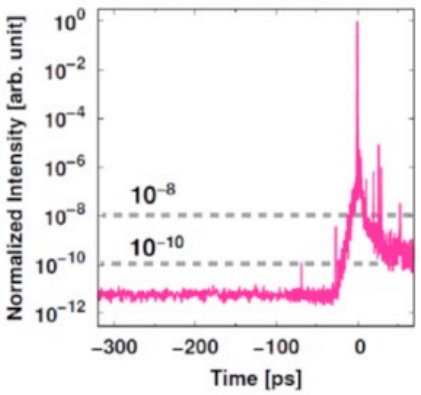
Pulse Duration



Design:
< 25 fs in FWHM

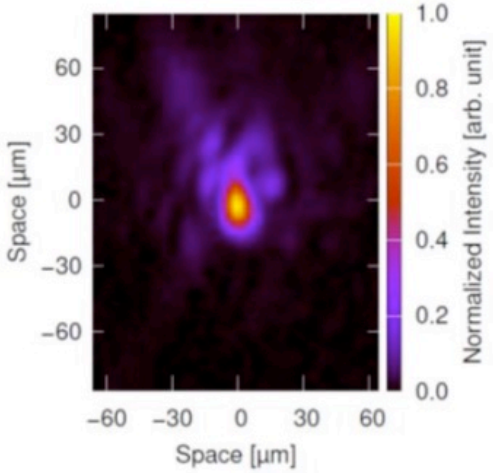
Pulse energy is attenuated after the full amplification before the pulse compression.

Pulse Contrast



Design:
10^{-10}@−100 ps, 10^{-8}@−30 ps

Focused Spot



Focused profile is measured using attenuators (low reflective optics) after the final amplification to 10 J.

Feedback, Suggestion, comments..

For the short pulse laser (HEDS exp't):

- **What is the reason of the damage?**
- **Pre-plasma measurement**
- **Plan for two-beam operation**
- **Second beam activation as a probe laser (small energy operation)**

Feedback, Suggestion, comments..

For the short pulse laser (HEDS exp't):

- **Possibility on installation of gas targets**
- **Improve time of Pumping/venting of the interaction chamber**
- **(Improve target holder for much more samples)**
- **Wider x-ray exit flange size**
- **Mitigate plasma x-ray background on ultrahigh intensity irradiation**
- **Homogeneous intensity profile at large spot size**

Feedback, Suggestion, comments..

For the long pulse laser (Shock exp't):

- **Shock experiments have been improved, improved, and improved**
- **Seeded pulse instead of pink beam**
- **More variety of pulse shape**
- **New detector with small background signal**