

# Breakout session A2: New perspectives using the coupling between high- power nanosecond laser and XFEL at SACLA

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Organizers: B. Albertazzi (LULI) and K. Miyanishi (SACLA)

## Facility report

“Capability, updates, and development plans of the experimental platform with high-power nanosecond laser at SACLA”

K. Miyanishi (SACLA)

## Propositions from representative users

“X-ray scattering spectroscopy of shock compressed matter at XFEL-SACLA”

N. Ozaki (Osaka Univ.)

“Toward x-ray absorption spectroscopy of planetary materials during shock compression”

T. Okuchi (Kyoto Univ.)

“Platform development: Adding a 20 T external B-field in EH5”

B. Albertazzi (LULI)

## Round table discussion

# Progress in 2021 on provided suggestions in the last Users' Meeting

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## Diagnostics for X rays (XFELs)

- Transmission, other geometry for XRD >> Almost ready to use (Miyanishi's talk)
- Scan x-ray photon energy for wide q-range XRD >> Low-q: additional FPD, High-Q: 15 keV X-ray?
- XFEL beam pattern: The beam pattern is problematic for X-ray imaging analysis. Debris shielding for Be windows to have a better pattern of XFEL. Be window replacing is planned.

## Diagnostics for laser-matter interactions

- Absolute calibration of SOP

>> Some Be windows have been replaced to improve the beam pattern (2021).  
>> The calibration will be performed in 2022. A standard light source and its mounts are already in hands.

## Others

- Pump laser direction relative to the XFEL
- Gas filling (environment) in the sample chamber
- Applying magnetic field
- Cryogenic/RT liquid sample delivery system
- Sample heating system for solid sample (<1000 K)
  - SACLA Basic development program

>> At the moment, the facility has not started any work on this. This is really heavy work. More opinions are needed.

As presented in the SACLA Users Meeting 2022 by some users, SACLA/SP8 Basic Development Program may cover these developments. Please consider applying to the program. These developments cannot be done only by the facility and need close collaborations between users and the facility.

# Feedback, requests, and comments

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## Facility plan

- Additional Flat Panel Detectors (FPD) for X-ray diffraction
  - Adding FPD is scheduled in FY2022 (sometime in 2022)
  - Azimuth angle coverage over 90 deg is preferable to investigate anisotropic compression behavior

## Users' propositions

- Prof. N. Ozaki (Osaka U): X-ray scattering spectroscopy (inelastic scattering)
  - Is the seeded XFEL necessary? Yes, but depending on the required energy resolution, SASE beam might be also ok.
  - Observation direction:
    - Back scattering configuration may give enough photon. Not have to be at 90 degrees.
  - Performing scattering measurements and XRD simultaneously
    - Typical spot size of XFEL for XRD is 10-30 um.
    - Tiny x-ray spot could be a disadvantage for the scattering measurements.
- Prof. T. Okuchi (Kyoto U): X-ray absorption spectroscopy
  - Requirement: 1eV (or at least a few eV) resolution at 11 keV. -> A few eV resolution is possible.
  - Precision of absorption coefficient is less important relative to the energy resolution in the first phase of research.
  - 50 eV bandwidth (spectral range) is acceptable for the measurement.
- Dr. B. Albertazzi (LULI): B-field (20T)
  - B-field time scale is in micro-sec scale, thus one can assume a "static" B-field.
  - Discharge issues may occur in gas filled experiments.
  - For typical experiments under a high vacuum ( $10^{-4}$  mbar), the insulation should be ok.
  - Future: 50-60 T capability without destruction?
    - With this B-field, magnetic pressure will be 1.5 GPa. But there are many things need to be developed.
- Others
  - DAC with XFEL heating

## Long term plan of lasers?

Significant involvement and leadership of user community is essential to consider the future upgrade of the laser system.