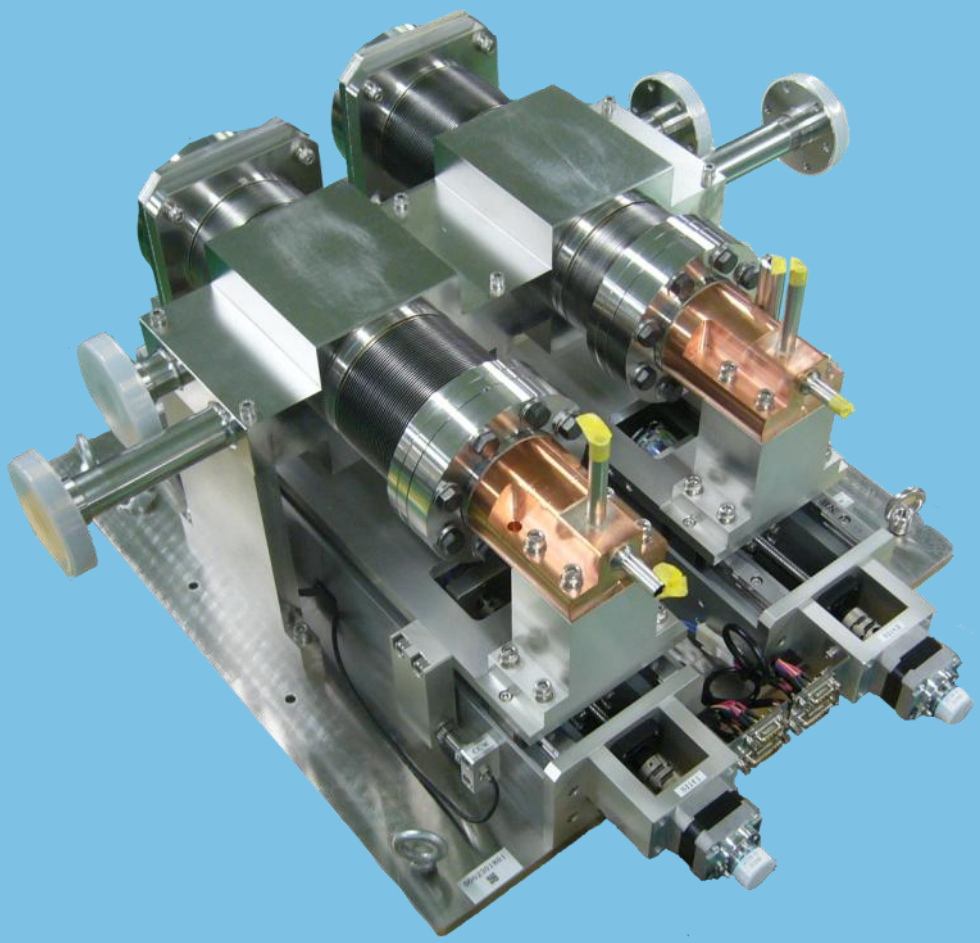
Pioneering New Horizons in Science

TOYAMA

XFEL Beam Monitors



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XFEL Beamline Components

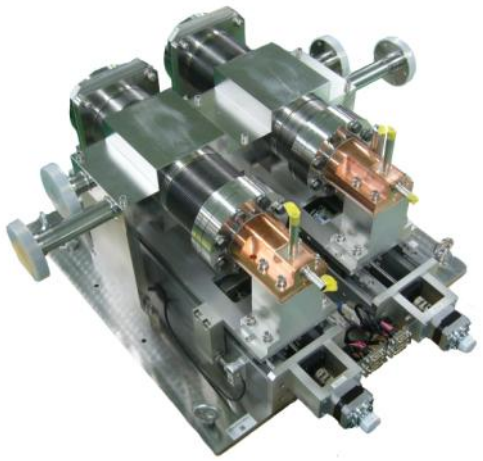
Beamline Components at SACLA

SACLA is a compact 8GeV X-ray Free Electron Laser facility operating at short wavelengths down to 0.6Å. It is located on the SPring-8 site in Japan. Toyama worked with the SACLA project team to develop the beamline components shown here. Toyama has installed these in the accelerator and undulator sections of SACLA as well as in the experimental beamline.

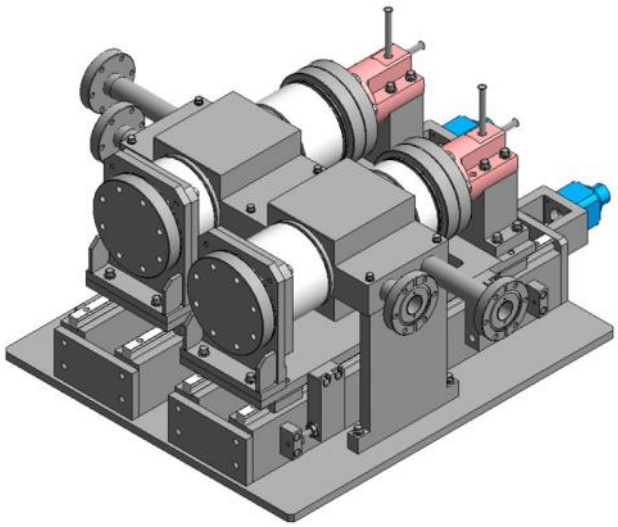
Number of Monitors installed at SACLA	
RF Cavity BPM	56
CT-type Current	30
Beam Profile Monitor	43

Energy Slit for Chicanes

The Energy Slit is installed in the chicanes in the source section of the SACLA XFEL. The slit system acts to cut off the halo element of the electron beam and to remove dark current on the accelerator tubes.



Energy Slit for Chicanes

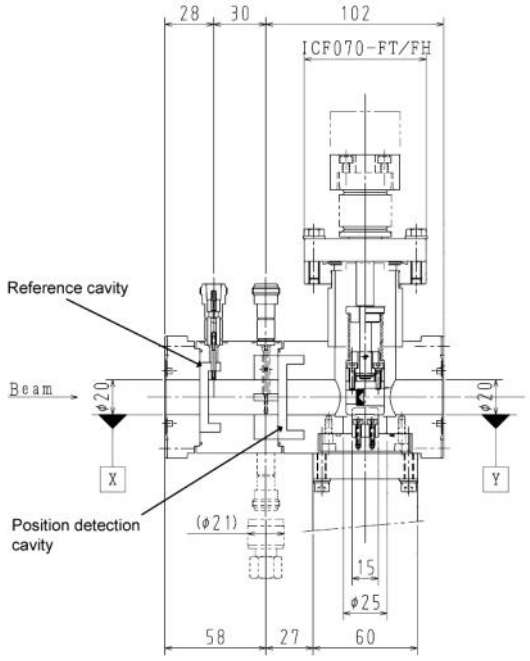


3D Model of the Energy Slit

RF Cavity Beam Position Monitor

The RF cavity monitor was developed as a very high resolution beam position monitor to measure beam position very accurately.

It uses a TM110 dipole resonance field excited in a cylindrical cavity by the electron beam. The position detection cavity and an additional TM010 monopole cavity (the reference cavity) are used to determine the beam charge and phase reference. The two cavities have the same resonant frequency.



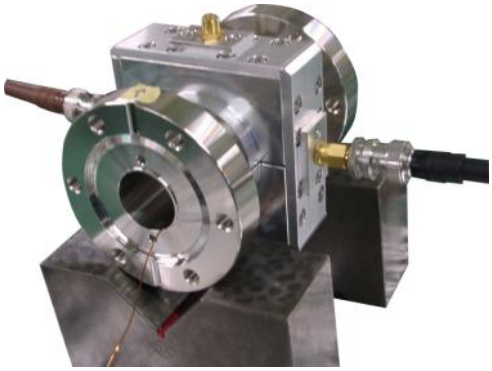
Drawing of the RF cavity Beam Position Monitor showing the two cavities

Position resolution has been measured as less than 0.2μm. The temporal resolution of the beam arrival time was measured as 25fs.

RF Cavity Beam Position Monitor

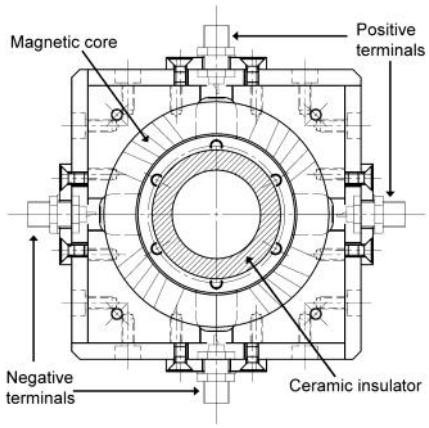
CT-type Beam Current Monitor

The Current Transformer measures the current of the accelerating electron beam and is used to monitor beam transport and beam arrival timing and to confirm bunch lengths. This model has been designed for high speed and to reduce noise.

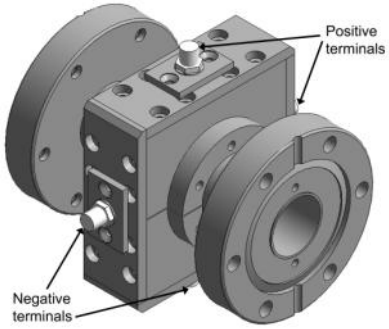


CT-type Current Monitor

The CT-type monitor is a core monitor with four terminal outputs, two positive and two negative, in order to obtain differential signals. Common-mode noise such as from a klystron power source is reduced by subtracting the negative from the positive signal.



Drawing of the CT-type Current Monitor showing the internal structure



3D model of the CT-type Current Monitor showing the pairs of positive and negative terminals

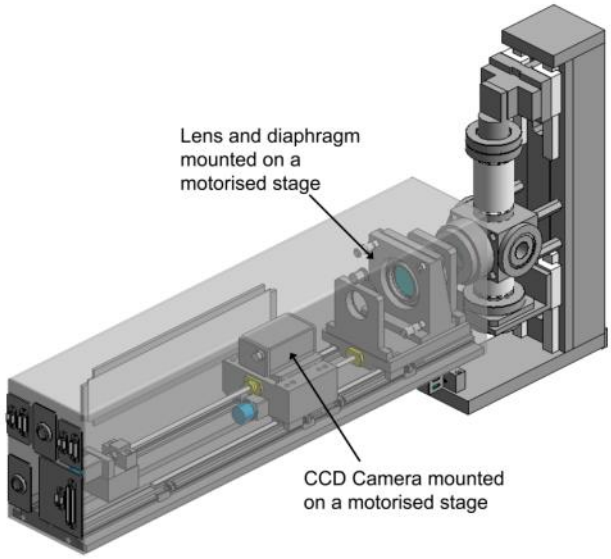
Beam Profile Monitor

The Beam Profile Monitor is a screen monitor used to measure the transverse beam profile. It can use a fluorescent screen for low energy beams or an optical transition radiation (OTR) screen for high energy beams.

Beam Profile Monitor

The imaging system is made up of a custom lens and diaphragm system and a CCD camera both mounted on motorised stages which can be adjusted remotely. These allow for a magnification of up to 4 times.

This beam profile monitor can measure very small beam sizes up to approximately 100μm.



3D model of the Beam Profile Monitor showing the imaging system

Our Company Goal

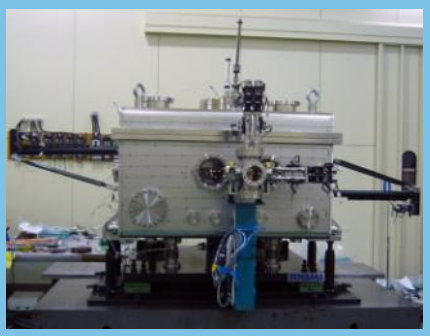
If you have a new concept that needs to be developed, then Toyama is the place to come. We have the technology and experience to turn your ideas into reality. We look forward to working with you.

Other areas of Toyama expertise

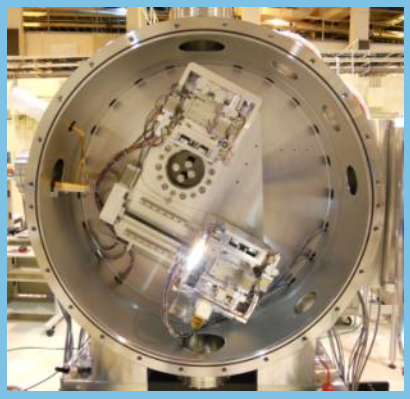
Synchrotron Applications

Toyama has developed an extensive range of components and systems for synchrotron beamlines and front ends including:

- Soft and Hard X-ray Monochromators
- Mirror Systems
- Slits
- High heat load front ends
- End stations such as Ellipsometers, Reflectometers and Diffractometers



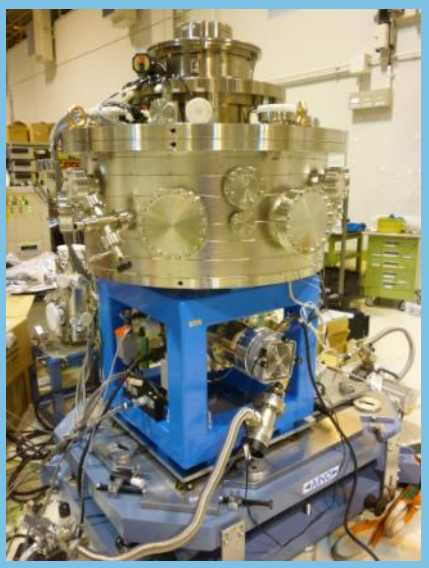
Soft X-ray VLSPGM



Hard X-ray DCM

Liquid nitrogen cooled mirror system

Cooled slit



Diffractometer

FIB-TOF-SIMS

Analytical Instruments

Toyama has developed analysis equipment for measuring low levels of atmospheric contamination and for surface analysis. Instruments include:

- Jet-REMPI—Jet Cooling Resonance Enhanced Multi-Photon Ionisation Mass Spectrometer
- LICA-MS—Laser Ionisation Compact Analyzer Mass Spectrometer
- FIB-TOF-SIMS—The Focused Ion Beam Time-of-Flight Secondary Ion Mass Spectrometer

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