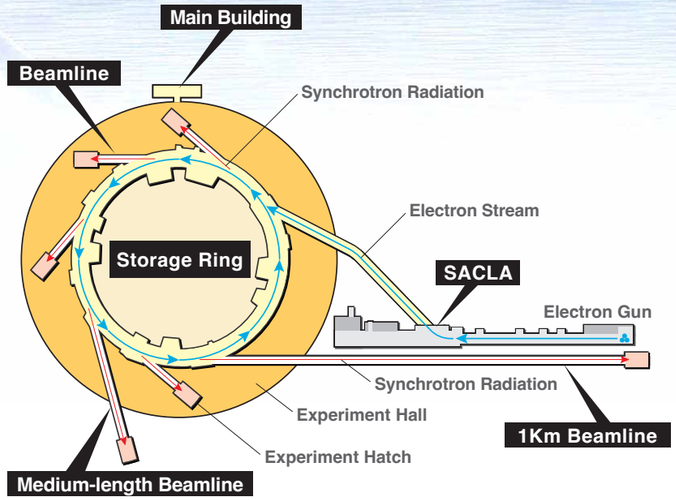
Main Facilities of SPring-8

Generation of Synchrotron Radiation

The electrons emitted by the SACLA electron gun are accelerated to 8 GeV (8 billion electron volts) by the SACLA accelerator, injected into a storage ring with a circumference of about 1,500 m, and circulated while maintaining the energy of 8 GeV. Synchrotron radiation is generated by the bending magnets or insertion devices. The generated synchrotron radiation (X-rays) is guided through the beamline to the experimental hatches provided inside and outside of the storage ring building, and is used for various experiments.



Experimental Stations

Experimental Station in Experimental Hall
Synchrotron radiation from a bending magnet or an insertion device is modified with optics and led to the experimental station. A sample is studied by measuring X-ray scattering / diffraction, X-ray absorption, fluorescence X-rays, secondary electrons, and so on.

Research Methods Used in the SR Science

X-ray Diffraction and Scattering

Research Method	Typical Examples of Research Subjects
Macromolecular crystallography	Atomic structure and function of proteins.
X-ray diffraction under extreme conditions	Structural phase transition at high pressure / high or low temperature.
X-ray powder diffraction	Precise electron distribution in inorganic crystals.
Surface diffraction	Atomic structure of surfaces and interfaces.
Small angle scattering	Structure of protein molecules and polymers.
Residual stress analysis	Three-dimensional strain mapping in bulk materials. Depth strain profiling.
X-ray Optics	X-ray interferometry. Coherent X-ray optics. X-ray quantum optics.

Spectroscopy and Spectrochemical Analysis

Photoelectron spectroscopy	Electronic structure of advanced materials.
Atomic and molecular spectroscopy	Photoionization, photoabsorption and photoelectron spectra of neutral atoms and simple molecules.
Compton scattering	Momentum distribution of electrons in materials and magnetic electrons.
X-ray inelastic scattering	Electronic excitation. Electron correlations in the ground state. Phonon excitation.
Nuclear resonant scattering	Time-domain Mössbauer spectroscopy. Nuclear inelastic scattering.
X-ray fluorescence spectroscopy	Ultra-trace element analysis. Chemical states of trace elements. Archeological and geological studies.
XAFS (X-ray absorption fine structure)	Atomic structure and electronic state around a specific atom.
X-ray magnetic circular dichroism	Magnetic properties of solids, thin films and surfaces. Orbital and spin magnetic moments.
Photon correlation spectroscopy	Speckle from disordered systems. Dynamics of atomic-scale disorder.
Infrared spectroscopy	Infrared microspectroscopy. Infrared reflection and absorption spectroscopy.

X-ray Imaging

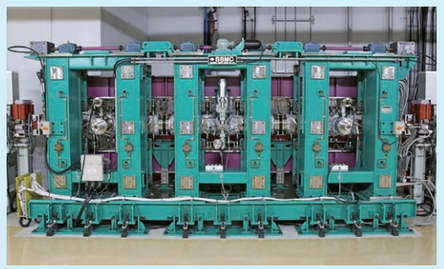
Refraction-contrast imaging	Imaging of low absorbing specimens.
Phase-contrast imaging	Imaging of biological samples with an X-ray interferometer or gratings.
X-ray microtomography	Three-dimensional imaging.
X-ray fluorescence microscopy	Imaging of trace elemental distribution with a scanning X-ray microprobe.
X-ray microscopy	Imaging of materials by magnifying with microfocusing elements.
X-ray topography	Static and dynamic processes of crystal growth, phase transition and plastic deformation in crystals.
Photoelectron emission microscopy (PEEM)	Element-specific surface morphology. Chemical reaction at surface. Magnetic domains.

Radiation Effect

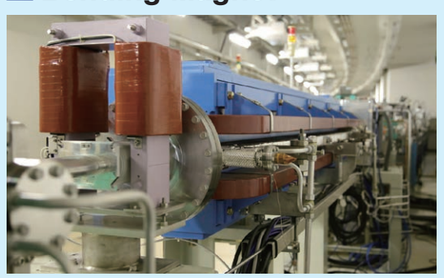
Material processing	Solid phase crystallization. Soft X-ray CVD. Microfabrication.
Radiation biology	Radiation damage of biological substances.

Synchrotron Radiation Source and Beamlines

Undulator



Bending Magnet



There are two types of light sources in SPring-8. Those are insertion device source and bending magnet one. Insertion devices are classified into an undulator and a wiggler.

SPring-8 Beam Ports
- Insertion Device Beamlines
  (Straight Section 4.5m) max.34
- Long Insertion Device Beamlines
  (Long Straight Section 25m) max.4
- Bending Magnet Beamlines max.24

An undulator and a wiggler are composed of magnet arrays and produce periodic magnetic fields that wiggle electron beam and emit synchrotron radiation. In-vacuum type undulators developed at SPring-8 seal magnet arrays in a vacuum chamber. This arrangement results in a smaller gap between arrays. Therefore, synchrotron radiation with shorter wavelength and higher power can be generated.
Other than standard in-vacuum type, in-vacuum revolver undulator, invacuum figure-8 undulator, twin helical undulator, tandem vertical undulator, elliptical wiggler, and others are installed in SPring-8. These insertion devices generate various polarized radiation.

A bending magnet is a part of the storage ring that bends the electron orbit and emits white X-rays with the characteristic photon energy of 28.9 keV.