# Present Status of Central Japan Synchrotron Radiation Research Facility Project

Synchrotron Radiation Research Center, Nagoya University, Furo-cho, Chikusa-ku, Nagoya 464-8603 Japan
e-mail: office@nusrc.nagoya-u.ac.jp, URL: http://www.nusrc.nagoya-u.ac.jp

Nagoya University had a project to construct “Photo-Science Nanofactory,” with a synchrotron light source as the central facility, to develop a wide range research on basic science, industrial applications, life science, and environmental engineering. The project has now developed to “Knowledge Hub” project of the Aichi Prefecture with “the Central Japan Synchrotron Radiation Research Facility” as the principal facility, to establish a new research center for technological innovations, and to make it as a core for further expansion of research and development of industries and universities at Chubu (Central Japan) Area.

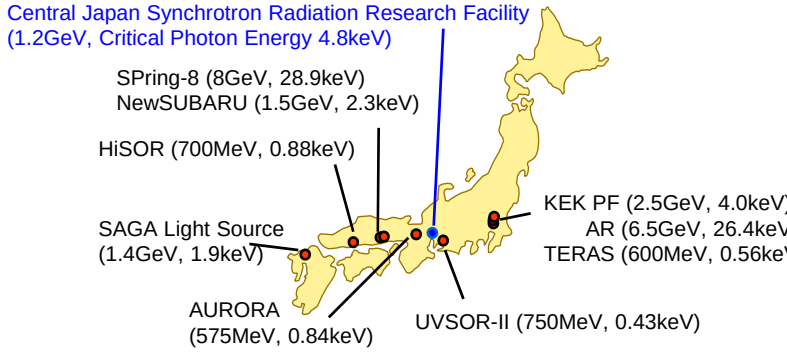


Fig. 1. SR facilities in Japan.

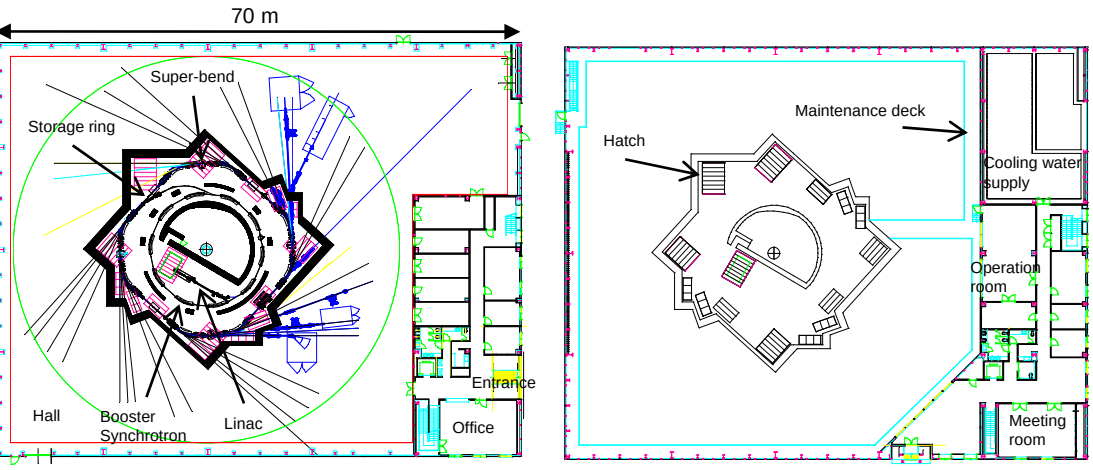


Fig. 2. Floor plan of the facility. 1F (left) and 2F (right).

Table 1. Basic parameters of accelerators

| | |
|---|---|
| **Storage ring** | |
| Beam energy | 1.2 GeV |
| Current | 300 mA |
| Circumference | 72.0 m |
| Normal BM | 1.4 T × 8 |
| Superconducting BM | 5.0 T × 4 |
| RF frequency | 500 MHz |
| Natural emittance | 53 nmrad |
| Magnetic lattice | Triple bend |
| Straight section | 5 m × 1, 4 m × 1 |
| **Booster synchrotron** | |
| Maximum energy | 1.2 GeV |
| Circumference | 48.0 m |
| Bending magnet | 1.0 T |
| RF frequency | 500 MHz |
| **Injector linac** | |
| Beam energy | 50 MeV |
| Current | 60 mA |
| Repetition rate | 1 Hz |
| RF frequency | 2856 MHz |

The key equipment of the facility is a small electron storage ring, which is able to supply hard X-rays. Basic parameters of accelerators are shown in Table 1. The storage ring consists of four triple bend cells. Four of the twelve bending magnets are 5 T superconducting magnets (super-bends). The bending angle of one super-bend is 12 degrees and three hard X-ray beam lines can be extracted from each super-bend. Two insertion devices will be installed in the straight sections. The electron beam is injected from a booster synchrotron with the energy of 1.2 GeV as full energy injection. A 50 MeV linac is used as an injector to the booster synchrotron. The top-up operation is also planned. The booster synchrotron and the linac are placed at the inside of the storage ring.

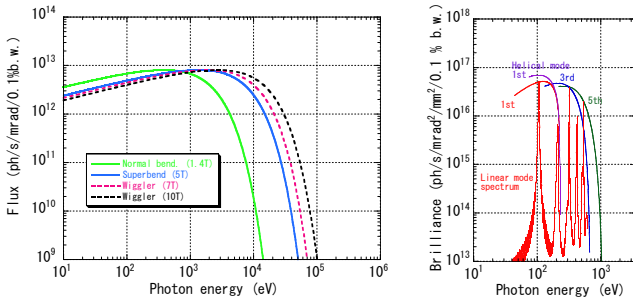


Fig. 3. Flux from bending magnets (left) and brilliance from undulator (right)

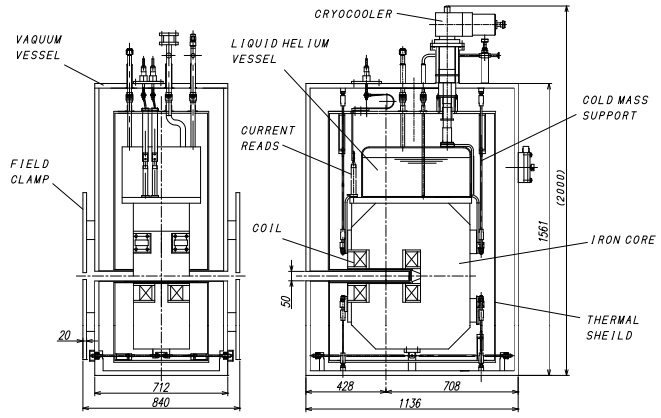


Fig. 4. Superconducting bending magnet (Super-bend)

Table 2. Beamlines to be constructed in the first phase

| | Beamlines | Energy Range | Source | Optics$ |
|---|---|---|---|---|
| 1 | Hard X-ray XAFS | 5 - 20 keV | Super-bend | CM-DXM-RFM |
| 2 | Soft X-ray XAFS | 1 - 6 keV | Normal bend | CM-DXM-RFM |
| 3 | VUV & Photoemission Spectroscopy | 0.03 - 1.5 keV | Undulator | VIAM |
| 4 | Small Angle X-ray Scattering | 5 - 20 keV | Super-bend | TM-DXM |
| 5 | X-ray Diffraction | 5 - 20 keV | Super-bend | VCM-SDXM-VRFM |
| 6 | X-ray Fluorescence & Reflectivity | 5 - 20 keV | Super-bend | VFM-ASXM |

$ CM: collimation mirror, DXM: plane 2 crystal monochromator, RFM: refocusing mirror, TM: toroidal mirror, VIAM: variable-included-angle Monk-Gillieson mounting monochromator, VCM: vertical collimating mirror, SDXM: sagittal focusing 2 crystal monochromator, VRFM: vertical refocusing mirror, VFM: vertical focusing mirror, ASXM: asymmetric 1 crystal monochromator.

Table 3. Basic parameters of super-bend

| | |
|---|---|
| Yoke type | C type |
| Peak field | > 5 T |
| Bending angle | 12° (1.2 GeV) |
| Size | |
| Length | < 950 mm |
| Hight | < 3000 mm |
| Width | < 900 mm |

Compact storage rings usually operate at a low energy, and they cover a wavelength range up to VUV or soft X-ray region. However, a compact source with super-bends is able to deliver hard X-rays. Four super-bends with two or three hard X-ray beamlines mean more than 10 hard X-ray beamlines in our facility. Currently, six beamlines are designed to be constructed in the first phase. Those are beamlines for hard X-ray XAFS, soft X-ray XAFS, soft X-ray to ultraviolet spectroscopy, small angle scattering, X-ray diffraction, and X-ray fluorescence analysis. The Central Japan Synchrotron Radiation Research Center will be in operation in 2011.