Experimental Facilities
- General -

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1. Introduction

The activities of the Experimental Facilities Group are primarily on the beamline construction and associated R & D on various components, as well as the public relations to the SR scientists including Users Society, the international collaboration and workshops.

Beamlines of the SPring-8 are categorised into four;public beamlines, contract beamlines, JAERI/RIKEN beamlines and in-house beamlines for machine study and R & D program. These will be described below in more detail. The R & D are briefly as follows. There have been various types of insertion devices designed that are optimized for sciences, in addition to the standard in vacuum type undulators. In the front end channel, R & D are mainly on X-beam position monitor, absorber and X-Y slits. There have been much progress in the crystal cooling engineering. A technical problem of pin-post cooling has nearly been solved for silicon monochromator and will be subjected to test at ESRF. The diamond crystals, up to 7 mm^2, has been grown with narrower rocking curve. Two-dimensional detector have been developed, gas proportional detectors and CCD detector with phosphor. The details of these R & D program will be described in following sections.

2. Beamlines

The SPring-8 Project Team categorizes 61 synchrotron radiation sources into public, contract, JAERI/RIKEN and machine study-R & D beamlines. The Project Team decided to construct two "pilot beamlines" for bio-crystallography and Compton scattering in FY1992. The Beamline Committee, chaired by Professor S. Suga of the Osaka University, submitted a report to the Project Steering Committee on the construction of public beamlines. The Project Team decided two beamlines to construct in addition to the two pilot beamlines in FY1993. At the beginning of FY1995, the Committee informed six additional beamlines to be constructed to the Steering Committee. The FY1995 was the year of fair wind, i.e., six additional public beamlines were budgeted to be constructed by the middle of FY 1997 by the supplementary budget. As a result, ten public beamlines are to be completed by the middle of FY1997 in the first stage of the SPring-8 construction.

3. Ten Public Beamlines

The original schedule of the beamline construction was to complete ten public beamlines by the end of FY1998. However, the supplemental budget from the Government in FY1995 made the program to finish one year earlier than the schedule, i.e, to serve the beamlines for public use in the middle of FY1997. The ten public beamlines are listed in Table 1, with the names of beamlines, scientific program, sources(energy range). Of these, the two pilot and preceding beamlines are in the sciences associated with protein crystallography, Compton scattering, nuclear resonant scattering and soft X-ray spectroscopy of solids, and all these beamlines are from the insertion device X-ray sources. Those which are assigned a multiple number of research subjects are the beamlines that carries either more than one experimental hutches or are with more than one equipments for time sharing use. This is to serve beamlines for as many scientists as possible at the initial stage of the public use starting October, 1997 since there have been 23 beamline proposals. The operation in the list is the official figure. However, the construction of many experimental hutches or equipments may delay the completion in some public beamlines.

4. Contract Beamlines

There have been call for letter of intent to

construct contact beamlines. The contract beamlines are constructed based on the proposal by universities, national laboratories or industries with their expenses. The beamlines will be, in principle, solely used for their purposes. The proposed beamlines are listed in Table 2. The Project Team will start discussion on their construction, especially the SR source since the number of straight sections with normal length for insertion devices are limited to 34 in total. Secondly, the details of the beamline design, in conjunction with the standardization of beamline components, have to be discussed among the persons concerned. Then, the schedule of beamline construction and utilization of beamtime, space and others will be fixed.

5. JAERI/RIKEN Beamlines

In FY1996, we can count six beamline constructions for exclusive use by JAERI/RIKEN scientists. They are listed in Table 3, though the operation schedule for some are not fixed yet. Out of these, the RIKEN structural biology beamlines, 1 and 2, will be partly subjected for public use by the scientists in the fields of small-angle X-ray scattering and time-resolved bio-crystallography(Laue method). The experimental stations of these fields are not found in the first phase of the Project.

6. Beamline Allocation

The experimental hall of the storage ring building are roughly divided into four zones, i.e., the general purpose beamline zone(northern section), the biomedical science beamline zone(Eastern section), diffraction physics and material science beamline zone(western section), and zone for beamlines with RI, reactive gases and so on(southern section). This is because of the probable use of common utilities and instruments, especially in biomedical field, by a number of participating users in the hall. The location beamlines, public, JAERI/RIKEN and R&D beamlines are seen in Figure 1 (allocation of the contract beamlines is not seen since they have been in the process of detailed design).

The Project Team has a strong will to continuous construction of public beamlines in the second phase of the Project. This will hopefully start from 1998, constructing 4 public beamlines a year to end up 30 public beamline construction by FY2003. Incidentally, the chairperson of the Beamline Committee is Professor O. Shimomura of the Photon Factory, KEK this year.

As for the contract beamline, following the detailed design, some part of the beamline construction has to be started this year. The overseas contract beamline is also very much welcome.

Table 1. Public Beamlines in the First Phase of the Project

beamline scientist in charge	research subjects	source E-range(keV)	BL no. operation
XAFS S. Emura(Osaka U.)	XAFS	BM	BL01B1 1997.10
Crystal Structure Analysis Y. Noda(Chiba U.)	structural phase transition powder diffraction chemical crystallography critical diffuse scattering	BM	BL02B1 1997.10
High Temperature Research K. Tsuji(Keio U.)	high temperature research geophysics	BM	BL04B1 1997.10
High Energy Inerastic Scattering N. Sakai(HIT)	Compton scattering	EMPW 60-300	BL08W 1997.10
Nuclear Resonant Scattering Y. Yoda(U. Tokyo)	time domain mossbauer spectroscopy surface structure research	U 5-75	BL09XU 1997.10
Extremely Dense State N. Hamaya(Ochanomizu U.)	high pressure research high brilliance XAFS	U 5-75	BL10XU 1997.10
Soft X-ray Spectroscopy of Solid S. Suga(Osaka U.)	spin polarized photoemission circular dichroism	U 0.5-3.0	BL25SU 1997.10
Soft X-ray Photochemistry K. Koyano(HIT)	molecular spectroscopy dynamics of inner-shell excitation X-ray CVD	U 0.5-5.0	BL27SU 1997.10
Physicochemical Analysis H. Maruyama(Okayama U.)	X-ray microanalysis magnetic absorption and scattering	U 4-20	BL39XU 1997.10
Bio-crystallography N. Kamiya(RIKEN)	protein crystallography	U 9-54	BL41XU 1997.10

Table 2. SPring-8 Contract Beamlines (proposed)

1. Advanced Light Beamline (Kyoto University)
   vertical wiggler, polarized (E= 4 - 115 keV)
   spectroscopy and diffraction

2. High-precision Material Science Beamline 1 (National Research Institute for Metals)
   undulator (E= 5 - 15 keV)
   chemical analysis, surface/interface science, micro analysis

3. High-precision Material Science Beamline 2 (National Institute for Research in Inorganic Materials)
   tandem undulator (E= 0.5 - 60 keV)
   photoelectron microscopy, high pressure diffracto-spectrometry
   material science under X-irradiation

4. Supramolecular crystallography (Osaka University)
   undulator (E= 5 - 25 keV)
   supramolecular crystallography, solution X-ray scattering

5. Hyogo Beamline (Hyogo prefecture)
   undulator (E= 0.5 - 10 keV, E= 10 - 100 keV)
   microbeam material characterization, micro diffraction
   SR CVD, canser research

6. Sunbeam BM (JASRI-industry)
   Bending magnet source (E= 5 - 60 keV)
   XAFS, topography

7. Sunbeam ID (JASRI-industry)
   vertically polarized, in vacuum undulator (E= 5 - 60 keV)
   microbeam application in material science
   fluorescent X-ray analysis

Table 3. JAERI/RIKEN Beamlines

JAERI

Beamline 1 tunable, polarized undulator (E=0.5 - 3 keV)
actinides — photoelectron spectroscopy
surface science
radiation biology
at BL22SU and expected operation from 1998.1

Beamline 2 bending magnet source (E= 5 - 60 keV)
X-ray(γ-ray) sciemce — crystal diffraction
XAFS
at BL14B1 and expected operation from 1998.4

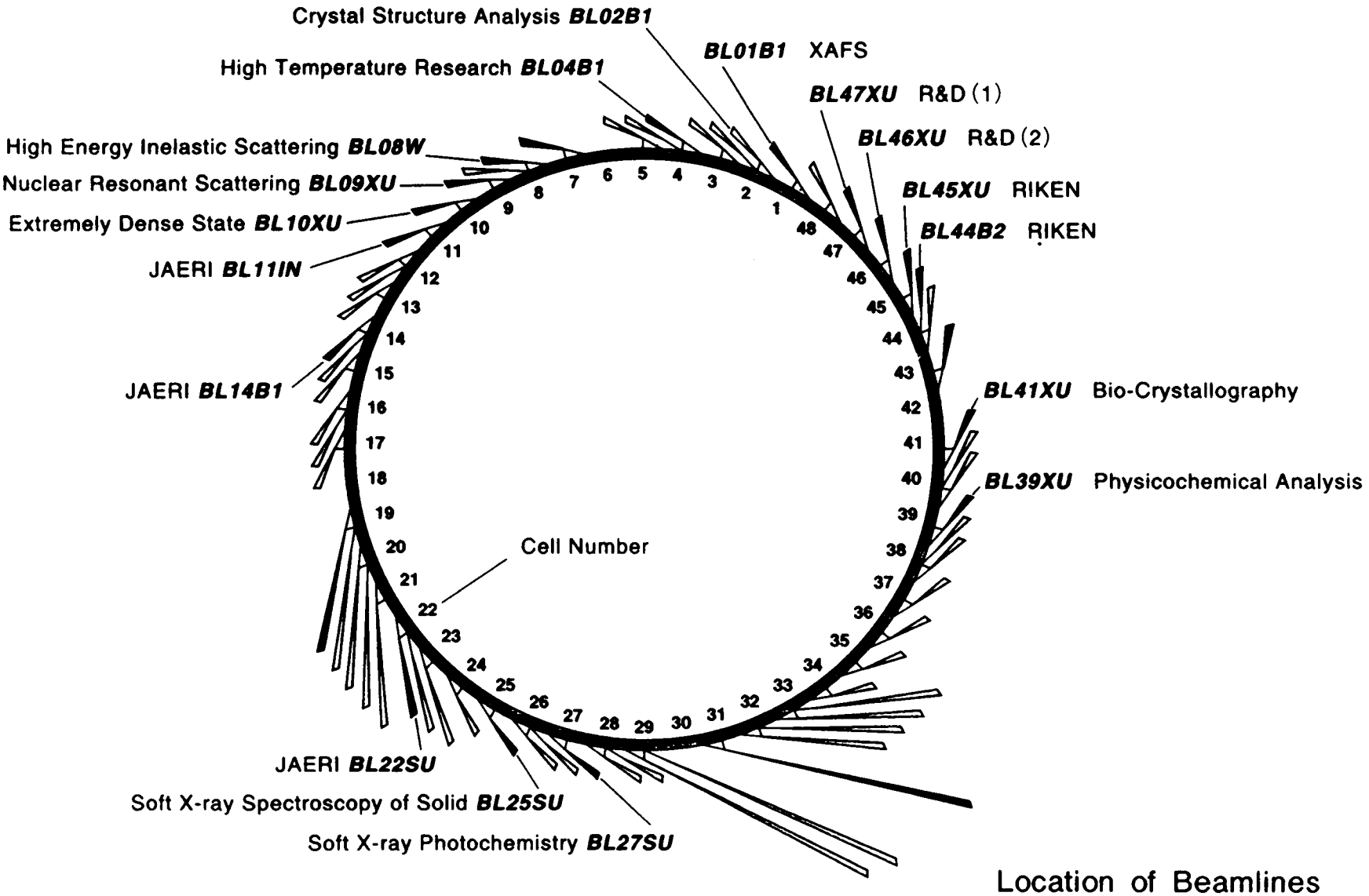
Beamline 3 in vacuum undulator (E= 3 - 60 keV)
material science — surface science
fluorescent X-ray
at BL11XU and expected operation from 1998.10

RIKEN

Beamline 1 vertically polarized, in vacuum undulator (E= 6 - 14 keV)
structural biology — macromolecular crystallography
small-angle X-ray scattering
at BL45XU and expected operation from 1997.10

Beamline 2 bending magnet source (E= 5 - 60 keV)
structural biology — time-resolved biocrystallography
time-resolved XAFS
at BL44B2 and expected operation from 1998.1

Beamline 3 invacuum undulator, figure-8 undulator (E= 1 - 60 keV)
coherent X-rays — X-ray interferometry, imaging
soft X-ray spectroscopy
high energy scattering/diffraction
at BL44XU and expected operation from 1998.4



Location of Beamlines