The Status of New SUBARU

New SUBARU Project Team

Table. 1 Parameters of the New SUBARU ring.

Storage energy	0.7 ~ 1.5GeV
Goal current	500 mA (multi-bunch)
Circumference	118.716 m
Betatron tunes	6.21/2.17
α_1	−0.0012 ~ +0.0011
RF cavity	1
RF frequency	500 MHz
RF voltage	250 kV
Harmonic number	198
Parameters at 1.5GeV	
Bending field m	1.55 T
Critical photon energy	2.33 keV
Natural energy spread	0.072 %
Damping time τ_L	3.42 ms
τ_H, τ_V	6.56, 6.73 ms
Synchrotron tune	0.0021 ($\alpha_1 = 0.0012$)
Bunch shortening limit	0.1 ps (0.03 mm)
Beam lifetime	10 hrs

New SUBARU, which is a facility for VUV and soft X-rays with a 1.5GeV storage ring, is under construction at the SPring-8 site. The main parameters of the ring are listed in Table 1. The Laboratory of Advanced Science and Technology for Industry (LASTI) at the Himeji Institute of Technology is in charge of the construction, and is collaborating with SPring-8. The overview of the project was presented at IEEE PAC in Vancouber (May 1997), SRI in Himeji (August 1997), and Asian PAC in Tsukuba (March 1998).

Most of the components of the ring, i.e., two beam lines and a part of an electron beam transport line were being manufactured until the end of March 1998. Some tests on these components and rig alignments took place. Work to connect the ring to the 1GeV linac of SPring-8 will be done in July 1998. We are expecting beam commissioning to occure in September 1998 with the maximum beam current of 100mA.

We are in the last stage of building construction, i.e., construction of the switching area of the electron beam just down stream of the linac. The construction of the experimental hall with a ring tunnel and an auxially administrative building havs been completed and the ring elements have been set in place (Fig. 1).

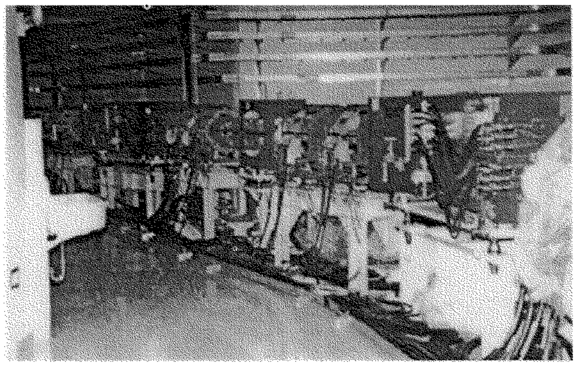

Fig. 1: A unit bending section of New SUBARU. It has three bending magnets, i.e., two normal magnets and one small inverse magnet.

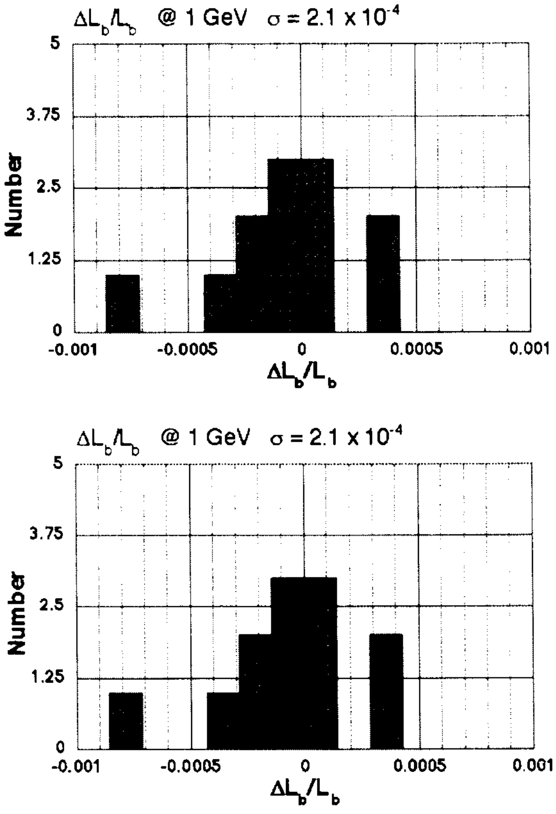

Fig. 2: Distribution of the production errors of bending magnets.

Field measurements on the magnets took place at the manufacturing company. A preliminary result of a production error measurement of 12 dipoles (iron block) is shown in Fig. 2. The deviations of $\Delta(BL)/(BL)$ are 8.8×10^{-4} and 1.37×10^{-3} for 1.0 and 1.5 GeV, respectively. The main source of these deviations is due to the deviation in the magnet gaps, 6.43×10^{-4}. The deviation is larger than that of laminated magnets. The maximum orbit excursion (horizontal C.O.D.) is calculated to be about 2mm.

Precise alignment of the magnets is being done. We are making a network for global alignment of the ring. The network points are the ring center, the center of six inverse bending magnets, and the entrances and exits of 12 bending magnets. A laser tracker which had been used to align the SPring-8 SR, is being in New SUBARU. Figure 3 shows the improvement of the displacement by one set of measurements and adjustments. Later the displacement was reduced to 0.05 mm rms by another set. The precise alignment of the multipole magnets (quadrupole and sextupole), between the dipole magnets started in March 1998 and is continuing.

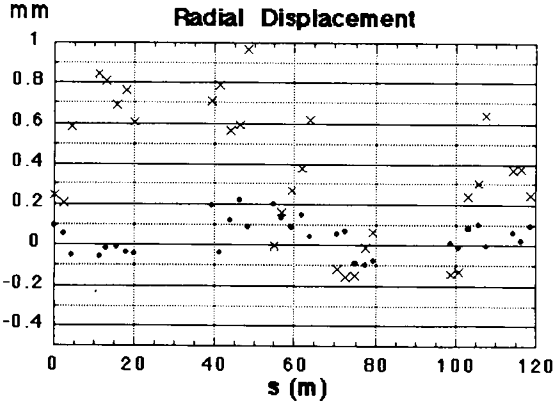

Fig. 3: Radial displacements of inverse bends and normal bends. The crosses and points are positions before and after adjustments, respectively.

All of the 18 BPMs were checked after the manufacture using the test bench at KEK. A BPM frame and a flange are made from one stainless steel block, a high machanical accuracy was expected. A preliminary result shows that their centering errors were less than 0.07 mm and 0.12 mm (rms) for the horizontal direction and vertical direction, respectively. Another calibration of a balance of four button electrodes including cable lines, will be done after installation into the ring.

New SUBARU has one RF cavity for acceleration. It is a HOM damped cavity with a pair of SiC absorber ducts, which was developped at the KEK-PF and SOR-ring. The length of the fixed tuner was determined to avoid instability, based on measurement of the HOM frequency of the cavity. The expected HOM frequency during operation is listed in Table 2.

The control system of the ring, both the software and hardware, was produced following the design for the SPring-8 SR. The main part of this system is a UNIX based VME system.

Table. 2: Expected frequencies of HOM modes normalized with the revolution frequency (f_{rev} = 2.5251MHz).

mode	f/f_{rev}	Q value
longitudinal		
TM010	198	38500
TM020	519.49	73000
TM021	543.46	24000
transverse		
TE111	278.50	18700
TE111	279.46	22400
TM011	314.44	25100
TM110	313.78	
TM110	312.79	41000
TM111	391.75	21000
TM111	392.28	20000

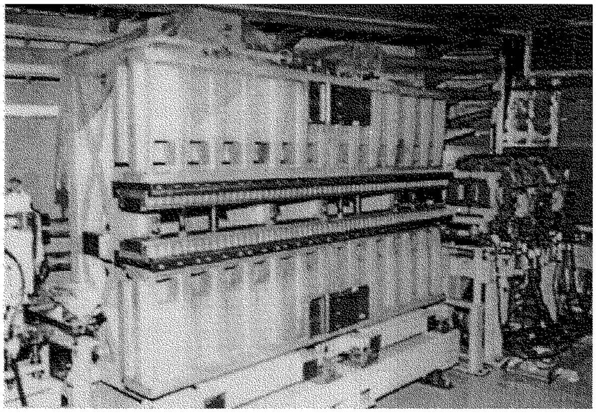

Fig. 4: The short undulator (wiggler) installed in the ring.

Three of the four insertion light sources, i.e., short undulator (Fig. 4), long undulator (Fig. 5) and optical klystron for FEL (Fig. 6) whave been installed. Table 3 shows their parameters. The alignments, field measurements, and trimming will be done in the ring tunnel. The last insertion, i.e., the superconducting wiggler, is now being tested at the manufacturing company.

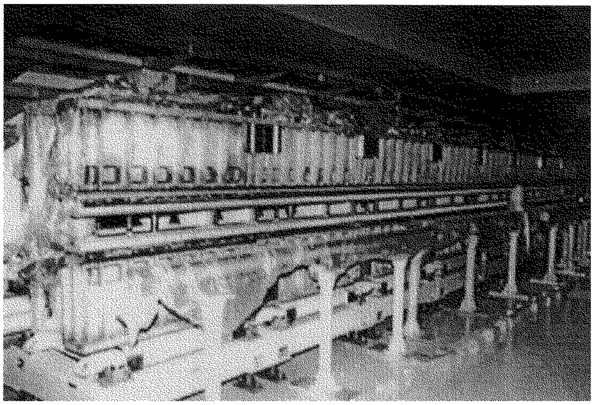

Fig. 5: The 11m long undulator installed into a long straight section of the ring.

Table. 3: Insertion light sources. The wavelength for the superconducting wiggler is that of the critical energy. The number of periods of the optical klystron is changable.

Insertion device	Period (mm)	Gap (mm)	K	No. of periods	Field (T)	Wavelength (nm) 0.5GeV	Wavelength (nm) 1.5GeV
Short undulator	80	23 ~ 59	6.3 ~ 1.6	30	0.85 ~ 0.21	220 ~ 23	97 ~ 10
Long undulator	60	31 ~ 48	2.3 ~ 0.95	200	0.41 ~ 0.17	28 ~ 11	13 ~ 5
S.C. wiggler	350	30	262	1	8	0.23	0.14
Optical Klystron	160	40	2.99	68	0.2	114	51
	320	40	4.48	34	0.15	461	205

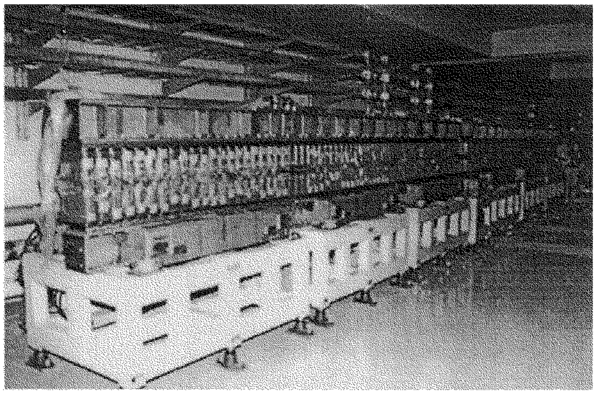

Fig. 6: The elctromagnetic type optical klystron waiting for field measurements.

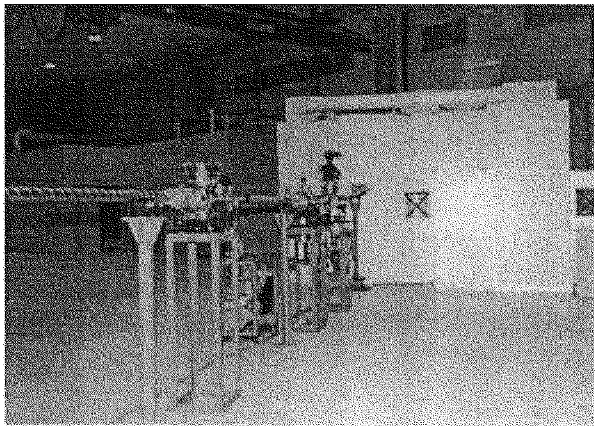

Fig. 7: View of the EUVL beamline from the ring side. The structure in the back is a clean booth.

1. beam lines

Two beam lines from the bending magnets, one for EUVL and the other for LIGA, will be ready in September 1998. Figure 7 shows the set up of the EUVL beam line.

We thank Prof. Izawa and Dr. Haga of KEK Photon Factory for their help of the test measurements.