OVERVIEW

STATUS OF THE UVSOR FACILITY IN 1987

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The UVSOR light source with an electron energy of 750 MeV in the Institute for Molecular Science, Okazaki, has been regularly operated without serious trouble, and so far twelve beam lines have been used for synchrotron radiation experiments under over 80 programs of molecular science. The whole UVSOR Facility and its storage ring with the beam lines are schematically shown in Figures 1 and 2, respectively. The main parameters of the synchrotron light source and the characteristics of the beam lines are summarized in Tables I and II, respectively. The intensity distribution of the synchrotron radiation from the UVSOR bending magnets is shown in Figure 3.

1. Light Source

The light source has been in regular operation during 1987: the rate of the fault (the shut-down time/the prescribed time) is less than 3%. The normal operating schedule in 1987 was essentially the same as in 1986; namely, in every week, machine studies were carried out on Monday, while user's studies were from Tuesday through Friday. Electron injections were performed twice a day; the machine time was available in the periods 9:15 - 13:00 and 13:15 - 18:00. A total of 43 weeks were allotted to users in the 1987 fiscal year. The initial current was normally 100 mA with a lifetime of about 3 hours. The single bunch operation was performed at a rate of 1 week in 2 months. The initial current at the single bunch operation was usually 10 mA, the maximum current attained being 50 mA.

The electron beam dynamics associated with the excitation of the superconducting wiggler as well as with the insertion of the permanent magnet undulator have been studied by the machine physics group. Some new devices to minimize the effects of the wiggler and the undulator have been developed.

A total machine time of 3 weeks was allocated to the wiggler users. The undulator at the S_3 straight section has often been inserted during the normal operating conditions.

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The multi-bunch instability has been suppressed successfully with a newly developed longitudinal active damper. Concerning the free electron laser, some basic studies including gain measurements have been continuing.

2. Beam Lines

Gas-phase experiments have been carried out on Beam Lines 2A, 2B2 and 3B; and solid-state experiments have been primarily on Beam Lines 3A1, 6A1, 6A2, 7A, 7B, 8A and 8B2. Some other experiments with liquids have been performed on Beam Lines 6A1 and 7B. Furthermore, some irradiation experiments with solid surfaces under gas atmosphere have been made on Beam Line 8A.

On the Beam Line 7A, it has been found that the wiggler produces a flux of 10^8 - 10^9 photons/s (a band width of 10^{-3}) in the wavelength region down to 2 Angstrom (6 keV). In 1987 two new beam lines have been completed; one is BL1B with a 1-m Seya-Namioka monochromator, and the other is BL8B1 with a monochromator of 2.2-m Rowland circle grazing incidence.

In October 1988 two more beam lines will be available to users; one is BL2B1 with a 2-m Grasshopper monochromator, and the other is BL3A2 with a 2.2-m constant-deviation grazing incidence monochromator. Beam Line 5B is now under construction, which is the calibration port for plasma diagnostics devices, belonging to the Institute of Plasma Physics, Nagoya University.

Focused beams at the entrance slits on Beam Lines 1B and 7 were found to move by the temperature change of mirrors during measurements. In order to fix the focused beams, the pre-mirror holders have been improved so as to keep the temperature of the mirrors constant. At present, the pre-mirrors are cooled only by air, the position of the focused beam being essentially unchanged. Two-photon preliminary experiments on solids have been carried out with a combination of mode-locked laser and a visible part of synchrotron radiation.

3. Joint Studies

In the 1987 fiscal year, various synchrotron radiation studies were scheduled under the following; 5 programs of "Special Project", 12 programs of "Cooperative Research", and 76 programs of "Use of Facility". Furthermore, the four groups of the Department of Molecular Assemblies had their own programs. Two kinds of meetings have been held; one was a users' meeting,

and the other was a workshop on beam dynamics and the free electron laser. The scientists who visited the UVSOR Facility for long term in 1987 are listed in the Appendix.

I would like to thank all other UVSOR staff members for their great efforts and contributions to the recent development of the Facility. I would also like to express my thanks to many in-house staff and outside users for their excellent cooperation.

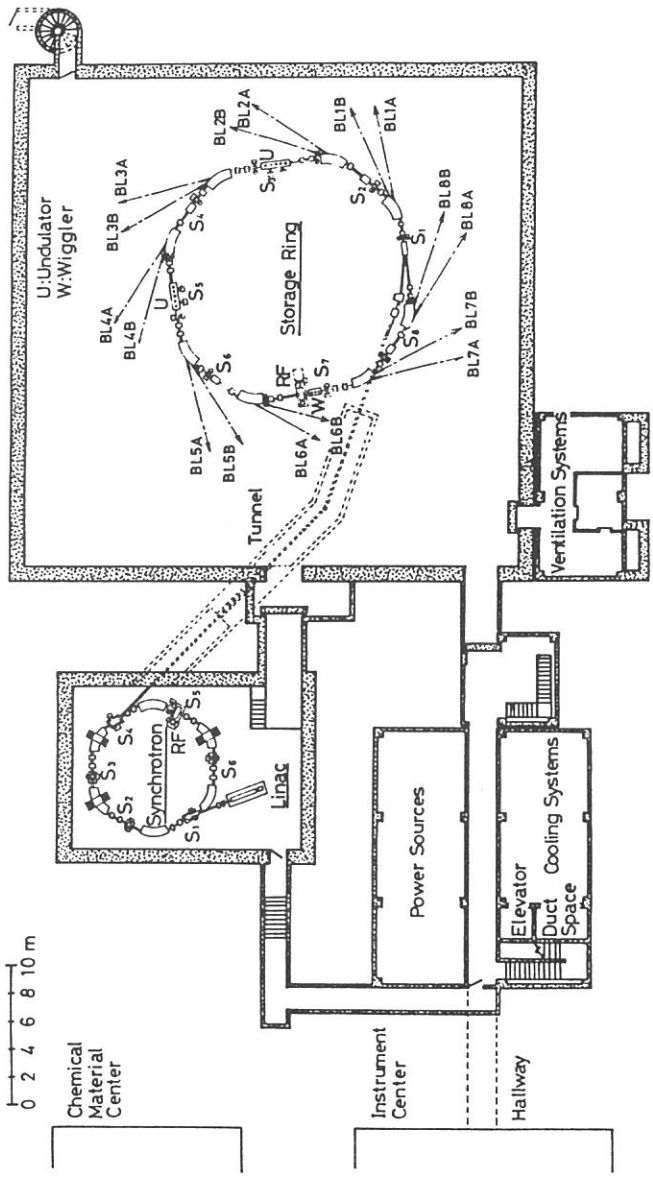

Figure 1. Plan view of the basement of the UVSOR Facility.

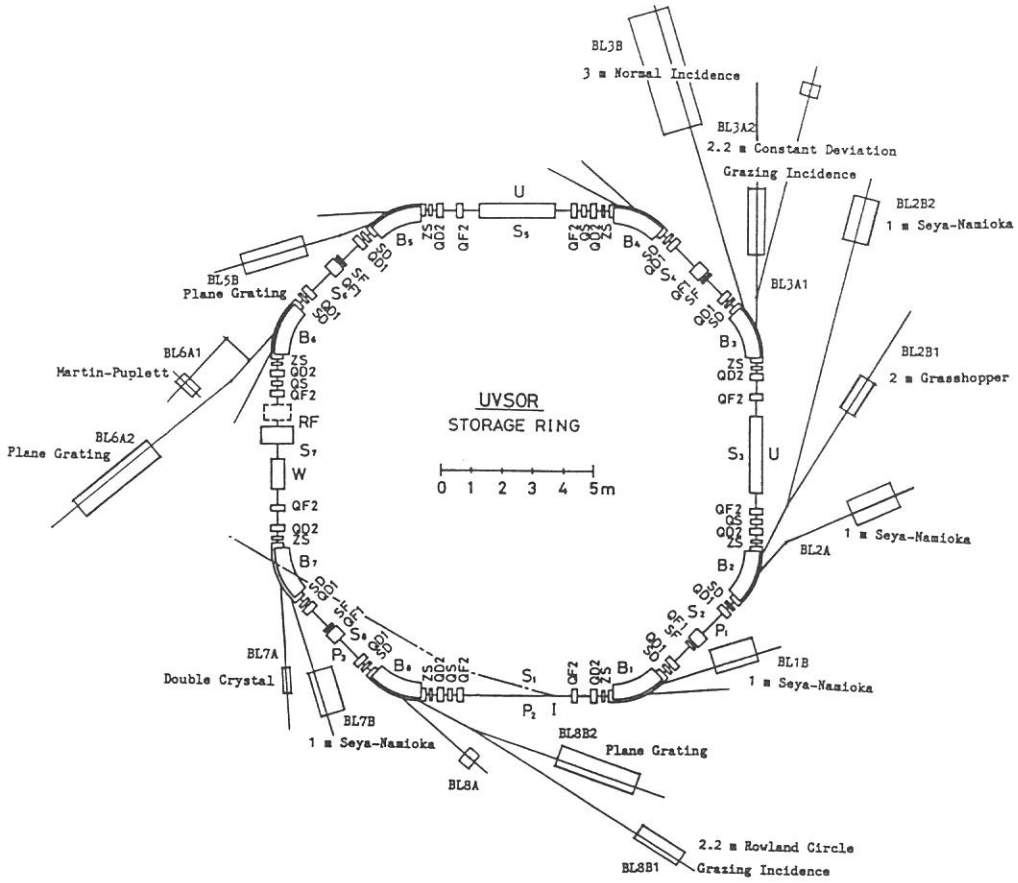

Figure 2. The UVSOR storage ring and the beam lines.

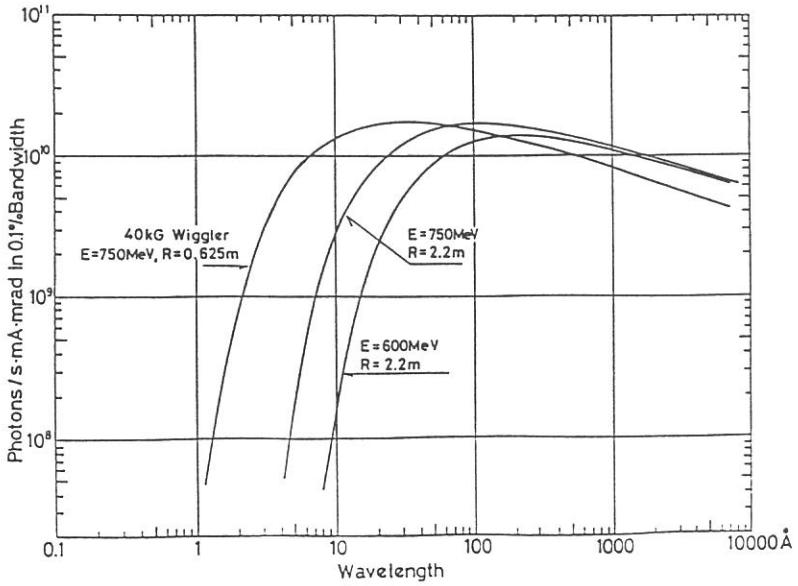

Figure 3. Intensity distribution of the UVSOR radiation.

Table I. Main Parameters of UVSOR

	Designed		Achieved	
Linac				
Energy	15	MeV	20	MeV
Frequency	2.856	GHz		
Synchrotron				
Energy	600	MeV	600	MeV
Current	50	mA	20	mA
Circumference	26.6	m		
Periodicity	6			
Bending Radius	1.8	m		
Tune (Q_H, Q_V)	(2.25,	1.25)		
Harmonic Number	8			
Radio Frequency	90.1	MHz		
Repetition Rate	1-3	Hz	2.5	Hz
Storage Ring				
Energy	600	MeV	750	MeV
	(max.	750 MeV)		
Critical Wavelength	56.9	A		
Current	500	mA	500	mA
Lifetime	1	hr	3	hr
	(500	mA)	(100	mA)
Circumference	53.2	m		
Periodicity	4			
Bending Radius	2.2	m		
Bending Field	0.91	T		
Tune (Q_H, Q_V)	(3.25,	2.75)		
Harmonic Number	16			
Radio Frequency	90.1	MHz		
RF Voltage	75	kV		
Radiation Damping Time				
Horizontal	45.4	ms		
Vertical	40.9	ms		
Longitudinal	19.5	ms		
Emittance				
Horizontal	$8\pi\times10^{-8}$	m.rad	$<16\pi\times10^{-8}$	m.rad
Vertical	$8\pi\times10^{-9}$	m.rad*		
Beam Size (at the Center of Bending Section)				
Horizontal ($2\sigma_H$)	0.64	mm		
Vertical ($2\sigma_V$)	0.46	mm*		
Bunch Length ($2\sigma_\tau$)	0.17	ns	0.4	ns

*10% coupling is assumed.

Table II. Beam Lines at UVSOR

Beam Line	Monochromator, Spectrometer	Wavelength Region	Acceptance Angle(mrad) Horiz.	Vert.	Experiment
BL1B	1 m Seya-Namioka	6500-300 Å	60	6	Gas & Solid
BL2A	1 m Seya-Namioka	4000-300 Å	40	6	Gas
BL2B1*	2 m Grasshopper	600-15 Å	10	1.7	Gas & Solid
BL2B2	1 m Seya-Namioka	2000-300 Å	20	6	Gas
BL3A1	None (Filter, Mirror)		(U) 0.3	0.3	Gas & Solid
BL3A2*	2.2 m Constant Deviation Grazing Incidence	1000-100 Å	10	4	Gas & Solid
			(U) 0.3	0.3	
BL3B	3 m Normal Incidence	4000-300 Å	20	6	Gas
BL5B*	Plane Grating	2000- 20 Å	10	2.2	Calibration#
BL6A1	Martin-Pupplet	5 mm-50 μm	80	60	Solid
BL6A2	Plane Grating	6500-80 Å	10	6	Solid
BL7A	Double Crystal	15-4 Å	2	0.3	Solid
		15-2 Å	(W) 1	0.15	
BL7B	1 m Seya-Namioka	6500-300 Å	40	8	Solid
BL8A	None (Filter)		25	8	Irradiation, User's Instr.
BL8B1	2.2 m Rowland Circle Grazing Incidence	440-20 Å	10	2	Solid
BL8B2	Plane Grating	6500-80 Å	10	6	Solid

* : under construction. # : Institute of Plasma Physics, Nagoya University.
U : with an undulator. W : with a wiggler.