Status of the UVSOR Facility in 1986

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1. Introduction

UVSOR is a dedicated VUV synchrotron light source used for research in molecular science and related fields. It is a 600 MeV (max. 750 MeV) electron storage ring, which is injected by a 600 MeV synchrotron and a 15 MeV linac. UVSOR first became operational in November, 1983. At present, 10 beam lines are available to users. They cover wavelengths from the far infrared to the soft X-ray region. Plan views of the UVSOR Facility and of the storage ring with its associated beam lines and the intensity distribution of synchrotron radiation from the bending magnets are presented in Figures 1-3. The main parameters of the light source and a description of the beam lines are given in Tables I and II. The organization of the facility is described in the Appendix.

2. Status of UVSOR

The light source operated throughout 1986, except for a shutdown in March. The normal operating schedules remained the same as for the last year: that is with Monday for machine studies and Tuesday to Friday inclusive for users. Beam is available from 9:15 to 13:00 and from 13:15 to 18:00 with two injections per day. A total of 44 weeks operation will be available to users in the fiscal year 1986.

During the March shutdown several important improvements were made to the source. Valves were inserted on both sides of the RF cavity, the damaged inner surfaces of the ceramic perturbator chambers were re-coated with gold and manual valves were installed on all vacant synchrotron radiation ports. A maximum current of 500 mA at 600 MeV was achieved in April and the source has been operated at 750 MeV since June. The normal current after injection is 100 mA with a lifetime at that current level of about 2 hours. Single bunch operation was achieved on several occasions for

time resolved spectroscopy users. The current is normaly around 5 mA in single bunch mode with a pulse width of about 0.4 ns. An undulator, beam pipe and mirror chambers were assembled for a free electron laser (FEL) experiment and also the characteristics of the undulator have been measured.

On BL2A, BL2B2 and BL3B, gas phase experiments have been carried out throughout the year, while BL6A2, BL7A, BL7B, BL8A and BL8B2 have been used primarily for solid state experiments. Especially noteable achievements have been on BL7A, where K edge absorption spectra of light elements were measured with high resolution and also on BL8B2 where angle-resolved photoelectron spectroscopy studies of organic solids had begun. New entirely two beam lines were opened to users: they are BL3A1,which uses undulator radiation without a monochromator and BL6A1 which exploits the infrared part of the synchrotron radiation using a Martin - Puplett interferometer. BL1B, with a 1 m Seya-Namioka monochromator and BL8B1, with a 2.2 m Rowland circle grazing incidence monochromator were set up and preliminary commissioning is now underway. These beam lines are expected to be available to users from April, 1987. It was decided to utilize BL5B as a calibration port for plasma diagnostics devices under the direction of the Institute of Plasma Physics, Nagoya University.

Within the fiscal year 1986, 4 research programmes of "Joint Studies", 15 programmes of "Cooperative Research" and 52 programmes of "Use of Facility" will be undertaken, in addition to the research studies of the staff in Department of Molecular Assemblies at IMS. A Users' Meeting, and a workshop on Beam Dynamics and Free Electron Lasers were held and the 28th Okazaki Conference on "Solid State Chemistry with VUV Synchrotron Radiation "was held from 5-7 February, 1987.

Acknowledgments

The light source and the beam line instrumentation are working very well and the research programme at UVSOR continues to expand in scale and in quality. We would like to express sincere thanks both to in-house staff and to outside users for their excellent support.

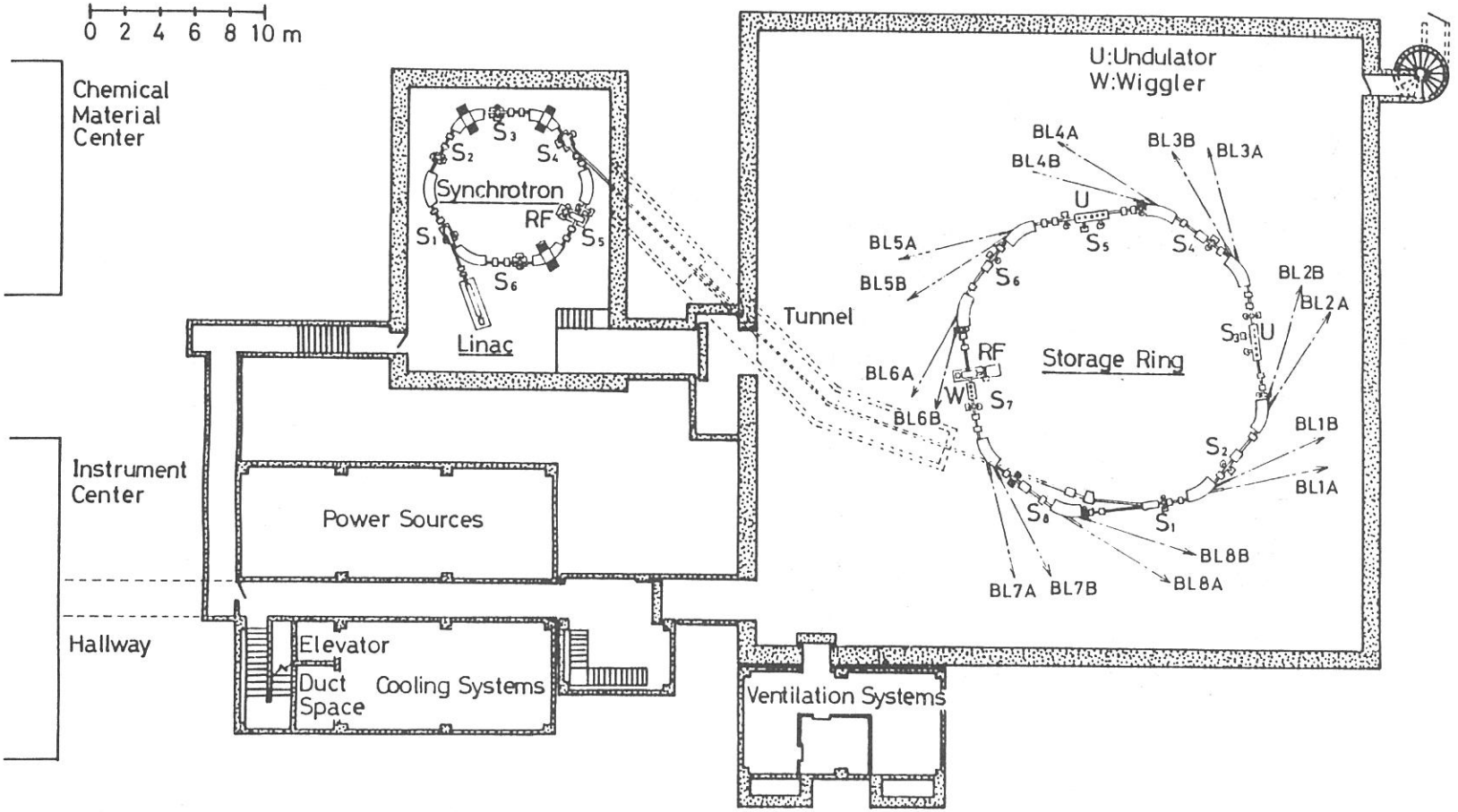

Fig. 1 Plan view of the basement of the UVSOR Facility.

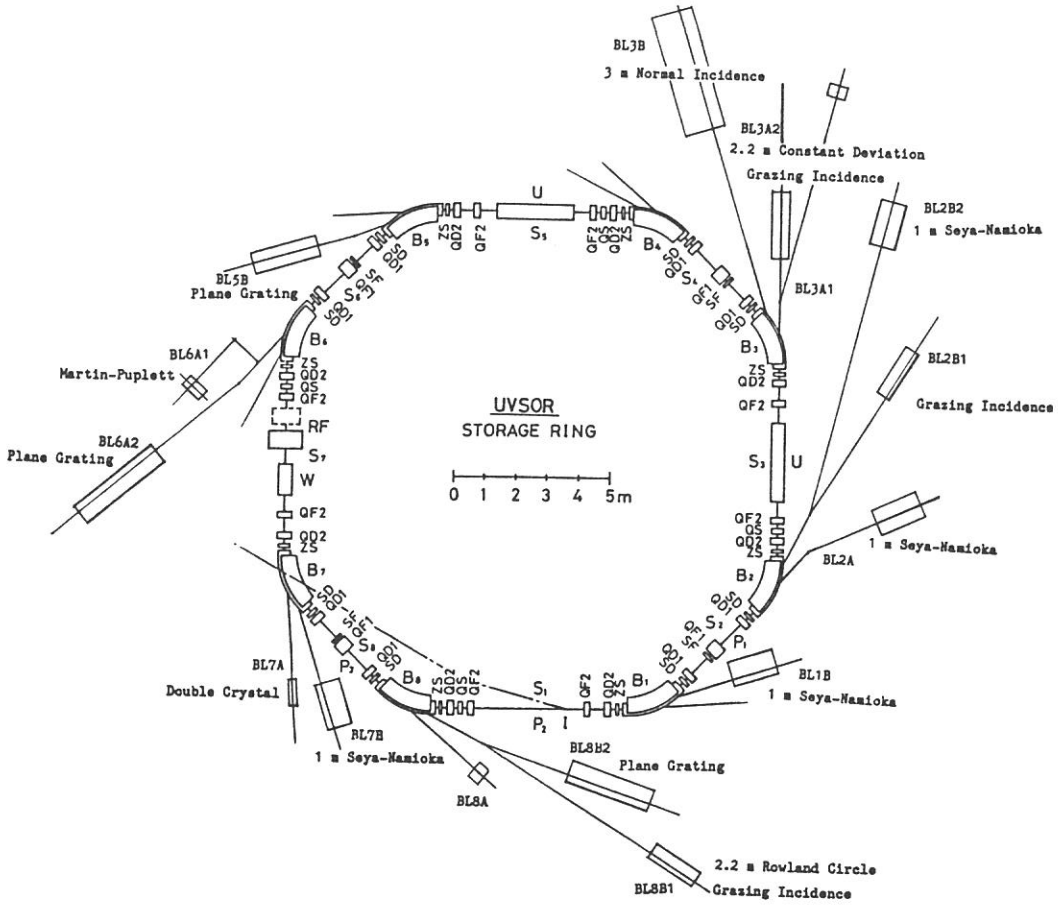

Fig. 2 Plan view of the UVSOR storage ring with associated beam lines.

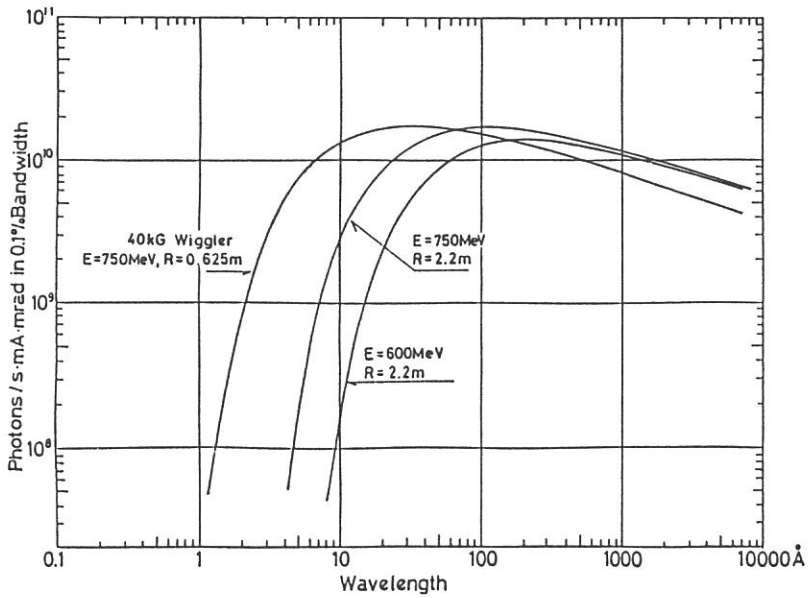

Fig. 3 Intensity distribution of the radiation from the UVSOR.

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 (max. 750 MeV)	MeV	750	MeV
Critical Wavelength	56.9	A		
Current	500	mA	500	mA
Lifetime	1 (500 mA)	hr	2 (100 mA)	hr
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**	Grazing Incidence				Gas
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	1000-100 Å	10	4	Gas & Solid
	Grazing Incidence		(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	15-8 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	440-20 Å	10	2	Solid
	Grazing Incidence				
BL8B2	Plane Grating	6500-80 Å	10	6	Solid

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