PRESENT STATUS OF CONTROL SYSTEM OF UVSOR-II

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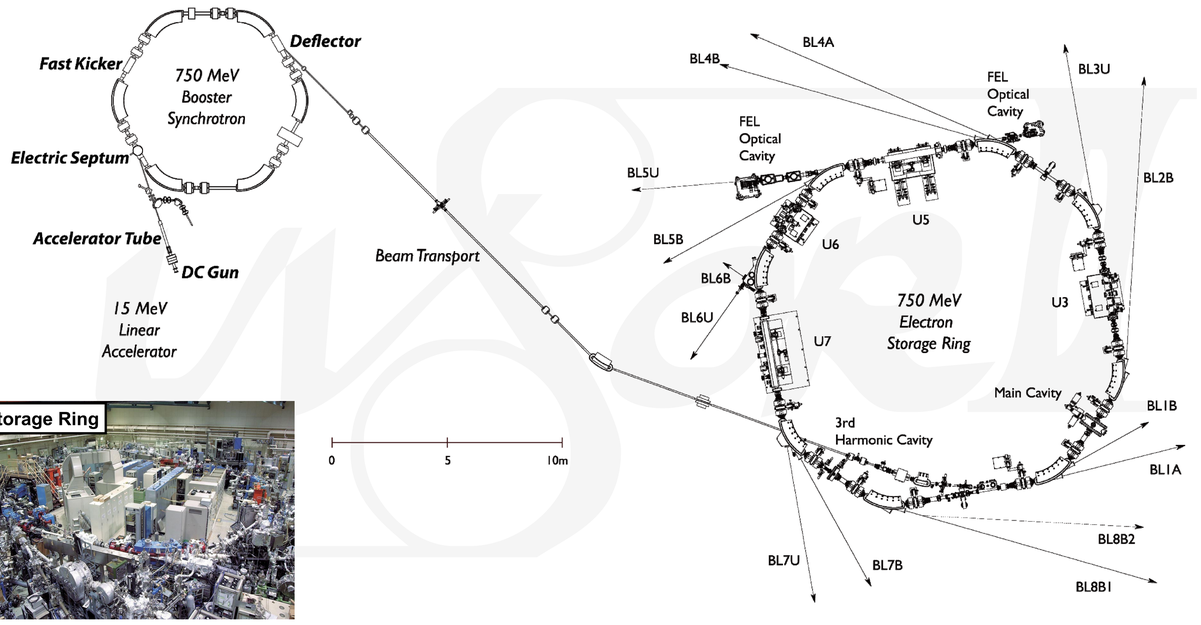
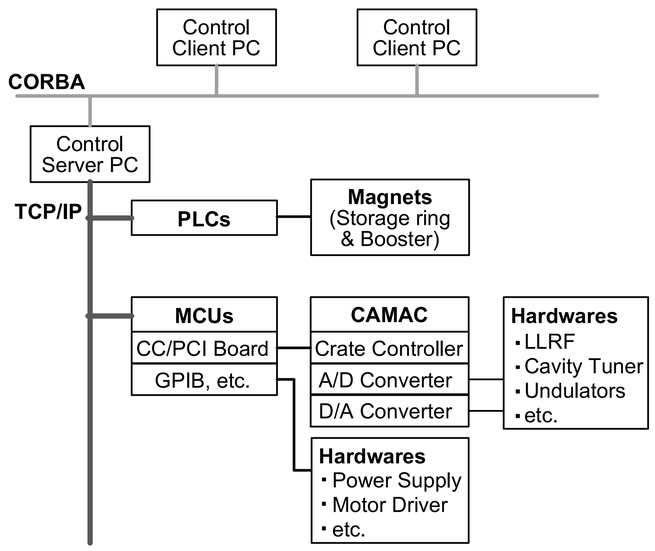
About UVSOR-II

UVSOR-II is a synchrotron light source based on a low emittance 750 MeV electron storage ring, which have been operated for more than 20 years and had been upgraded several times. The UVSOR-II accelerator consists of the 750 MeV storage ring, a 750 MeV booster synchrotron and a 15 MeV linear accelerator. Now eight bending magnets and four insertion devices are available and the total number of operating beamlines is thirteen (9 is opened to outside users, and 4 is dedicated to users of our institute). From 2008, test run of top-up operation of the storage ring was started. User operation with top-up injection will be started from this October. For the operation, stable operation of the injector (the linear accelerator and booster synchrotron) is strongly required for keeping the stored current in the storage ring constant.



Overview of Control System



Components
- Windows-PCs
- PLCs for magnets control
- MCU/CAMAC system for various purpose
- CORBA used for client-server connection

Software
- JAVA Abeans for MCU/CAMAC control
- “Mitarou” for PLC control

What are controlled
- Storage ring and booster synchrotron magnets
- Tuner position of RF cavities
- LLRF of main and 3rd harmonic RF cavity
- Undulator gaps and correction magnets
- etc.

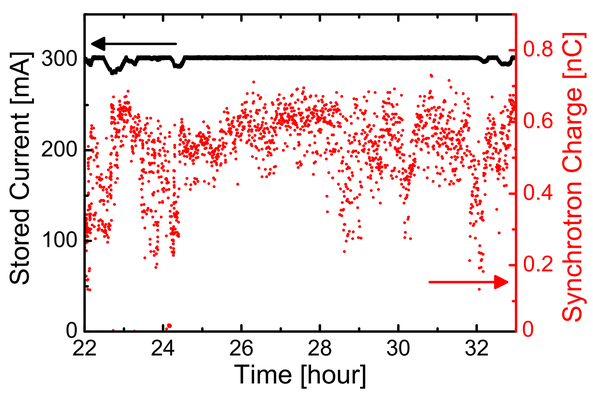
Typical Operational Parameters of Accelerators

15-MeV Linear Accelerator	
RF frequency	2856 MHz
Beam Energy	15 MeV
Energy Spread	1.6 %
Beam Current	～100 mA
Macro-pulse Duration	1.5 ms
Booster Synchrotron	
Maximum Beam Energy	750 MeV
Injection Energy	15 MeV
Beam Current	～32 mA
Circumference	26.6 m
RF Frequency	90.1 MHz
Harmonic Number	8
Bending Radius	1.8 m
Lattice	FODO x 8
Horizontal Betatron Tune	2.25 (designed)
Vertical Betatron Tune	1.25 (designed)
Momentum Compaction	0.138
Repetition Rate	1 Hz (750 MeV)

Storage Ring	
Energy	750 MeV
Injection Energy	750 MeV
Maximum Stored Current	500 mA (mult.) 100 mA (single)
Natural Emittance	27.4 nm-rad
Circumference	53.2 m
RF Frequency	90.1 MHz
Harmonic Number	16
Bending Radius	2.2 m
Lattice	Extended DBA x 4
Straight Section	(4 m x 4) + (1.5 m x 4)
RF Voltage	100 kV
Horizontal Betatron Tube	3.75
Horizontal Betatron Tube	3.20
Momentum Compaction	0.028
Natural Chromaticity Horizontal Vertical	 -8.1 -7.3
Energy Spread	4.2×10^{-4}
Natural Bunch Length	108 ps

Development of Slow Feedback System for Injector Stabilization

Result of Top-up test run



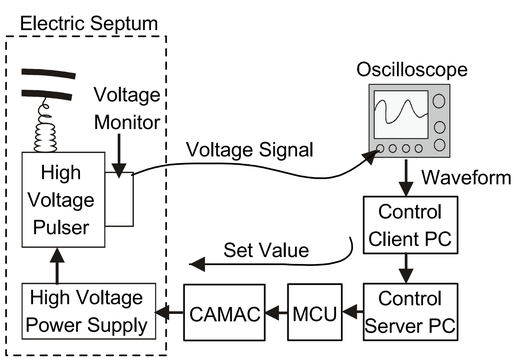
Sometimes the stored beam current gets smaller than 300 mA.
It depends on the amount of accelerated charge in the booster synchrotron.

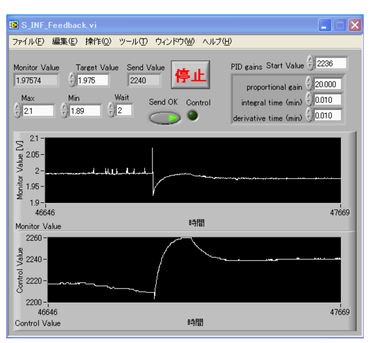
Stabilization of the injector operation is required

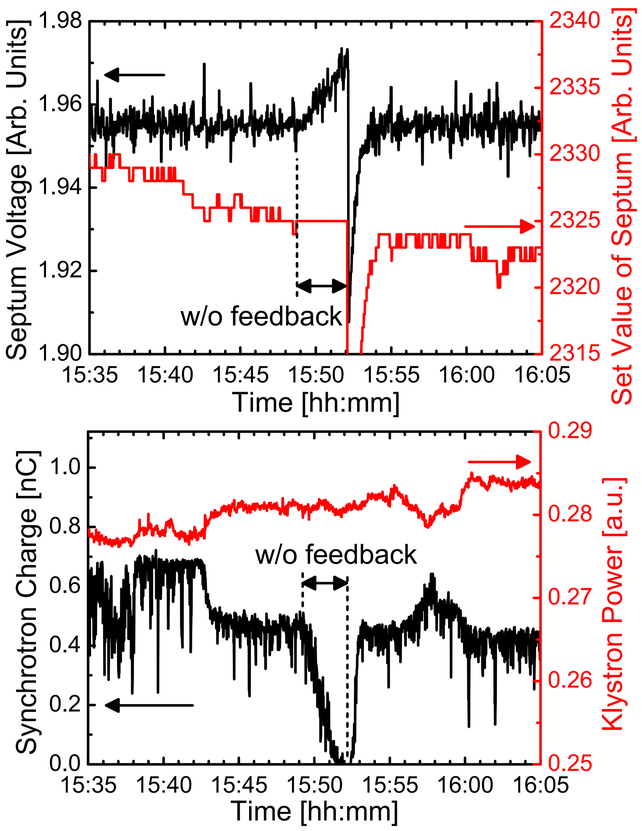
Feedback system for the electric septum

We found that the long term drift of electric septum voltage was the most significant source of the fluctuation.

A slow feedback system for voltage stabilization was developed.







Summary of Results
- Voltage drift of electric septum was suppressed by the feedback control.
- The voltage fluctuation was less than 1% with the feedback.
- Another source of fluctuation was found. It is output power fluctuation of a klystron which is used to drive a 15-MeV linear accelerator.