Control system design for Central Japan Synchrotron Radiation Research Facility

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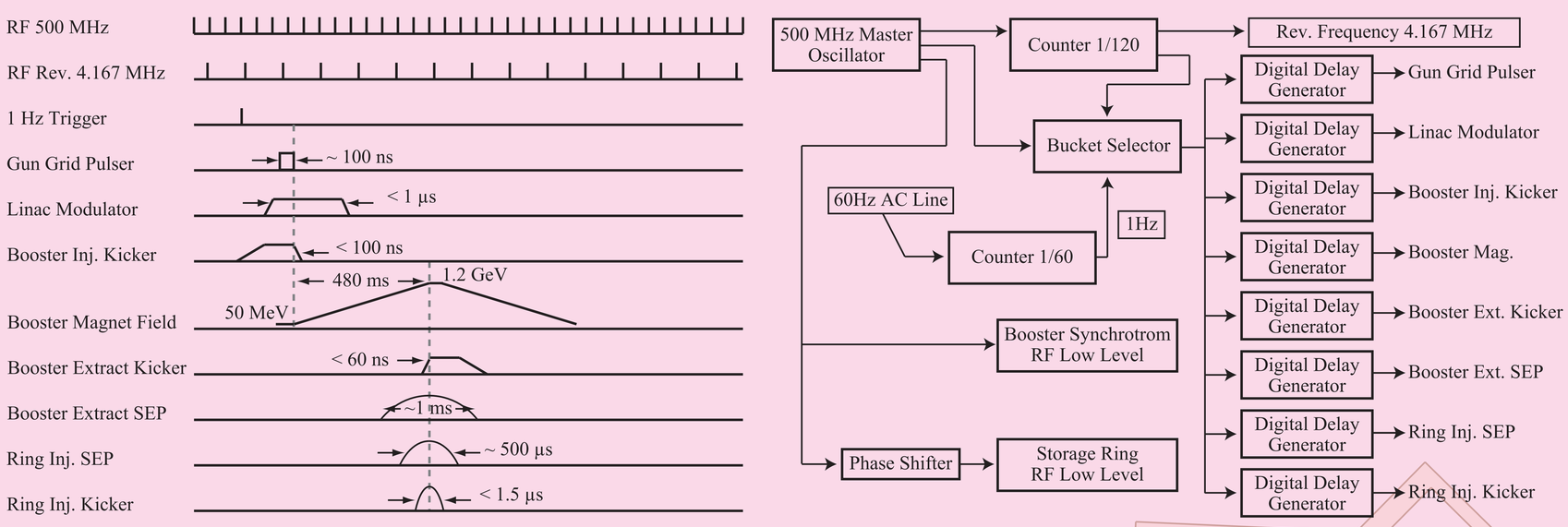
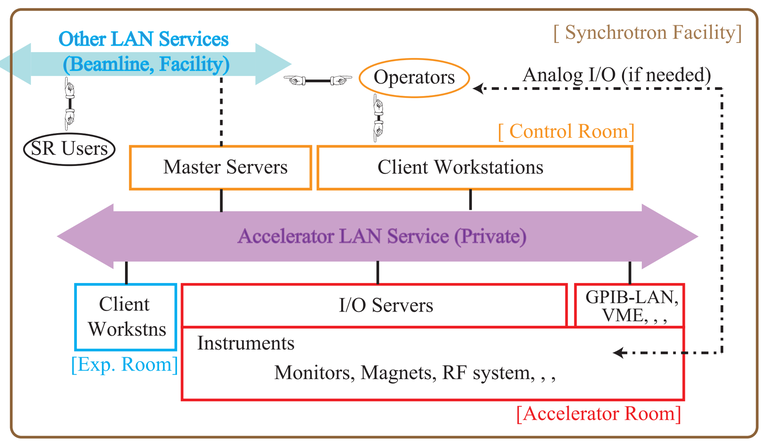
Introductoin

A control system for Central Japan Synchrotron Radiation Research Facility has been designed. Central Japan Synchrotron Radiation Research Facility is a synchrotron light source planed by a local prefectural government, industries, universities, and research institute in the Aichi area of Japan. The synchrotron radiation (SR) facility has been expected as an adaptable facility not only for basic research, but also for engineering and industral research and development. The facility, consisting of accelerators, beamlines, peripheral equipments and housing, has been designed at the Nagoya University Synchrotron Radiation Research Center. The accelerators consists of a linac, a full energy booster synchrotron and a compact storage ring, which is able to supply hard X-rays from superconducting bending magnets. An important issue on this facility is its tightly restricted budget and the top-up operation is required as soon as possible. Thus, the control system should be simple, robust and inexpensive. To reply these needs, we have considered to use Ethernet-based data communication systems and a database management system.

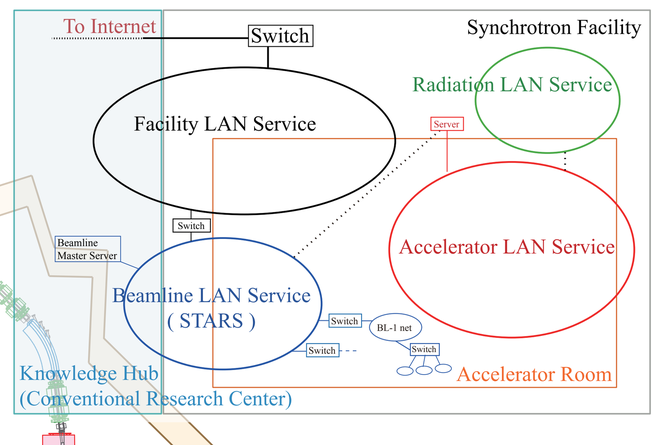
Timing system



Control system



Network diagram



Accelerators & Beamlines

Table1. Parameters of Accelerators

Storage Ring	
Beam energy	1.2 GeV
Circumference	72 m
Current	>300 mA
Natural emittance	53 nmrad
Betatron tune	(4.72, 3.23)
RF frequency	500 MHz
RF Voltage	500 kV
RF bucket height	> 0.990 %
Harmonics number	120
Energy spread	8.41 x 10^{-4}
Magnetic lattice	Triple Bend Cell x 4
Normal bend	1.4 T, 39° x 8
Superbend	

Booster synchrotron	
Max. beam energy	1.2 GeV
Circumference	48 m
Current	> 10 mA
RF frequency	500 MHz
Injector linac	
Beam energy	50 MeV
Current	5 ~ 50 mA
Pulse length	5 ~ 100 ns
RF frequency	2,856 MHz

Table 2. Parameters of the Superbend

York type	C type	Length	< 950 mm
Peak field	> 5 T	Hight	< 3000 mm
Bending angle	12° (1.2 GeV)	Width	< 900 mm

For the top-up operation, the electron beam will be injected from a booster synchrotron with the full energy.

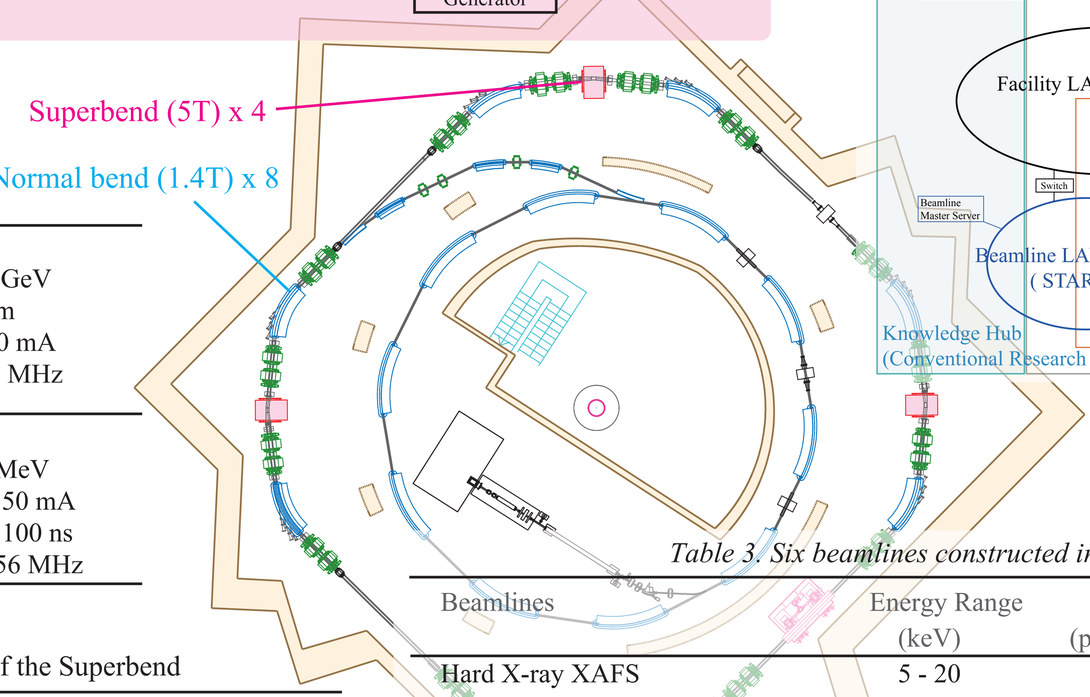


Table 3. Six beamlines constructed in the first phase

Beamlines	Energy Range (keV)	Flux (photons/sec)	Energy Resolution (E/ΔE)
Hard X-ray XAFS	5 - 20	1×10^{11}	7,000
Soft X-ray XAFS	0.85 - 6	7×10^{10}	2,000
VUV & Photoemission Spectroscopy	0.03 - 0.85	1×10^{13}	10,000
Small angle X-ray Scattering	8.2	7×10^{10}	2,000
X-ray Diffraction	5 - 20	1×10^{11}	7,000
X-ray Fluorescence & Reflectivity	5 - 20	1×10^{11}	2,000

Construction Schedule

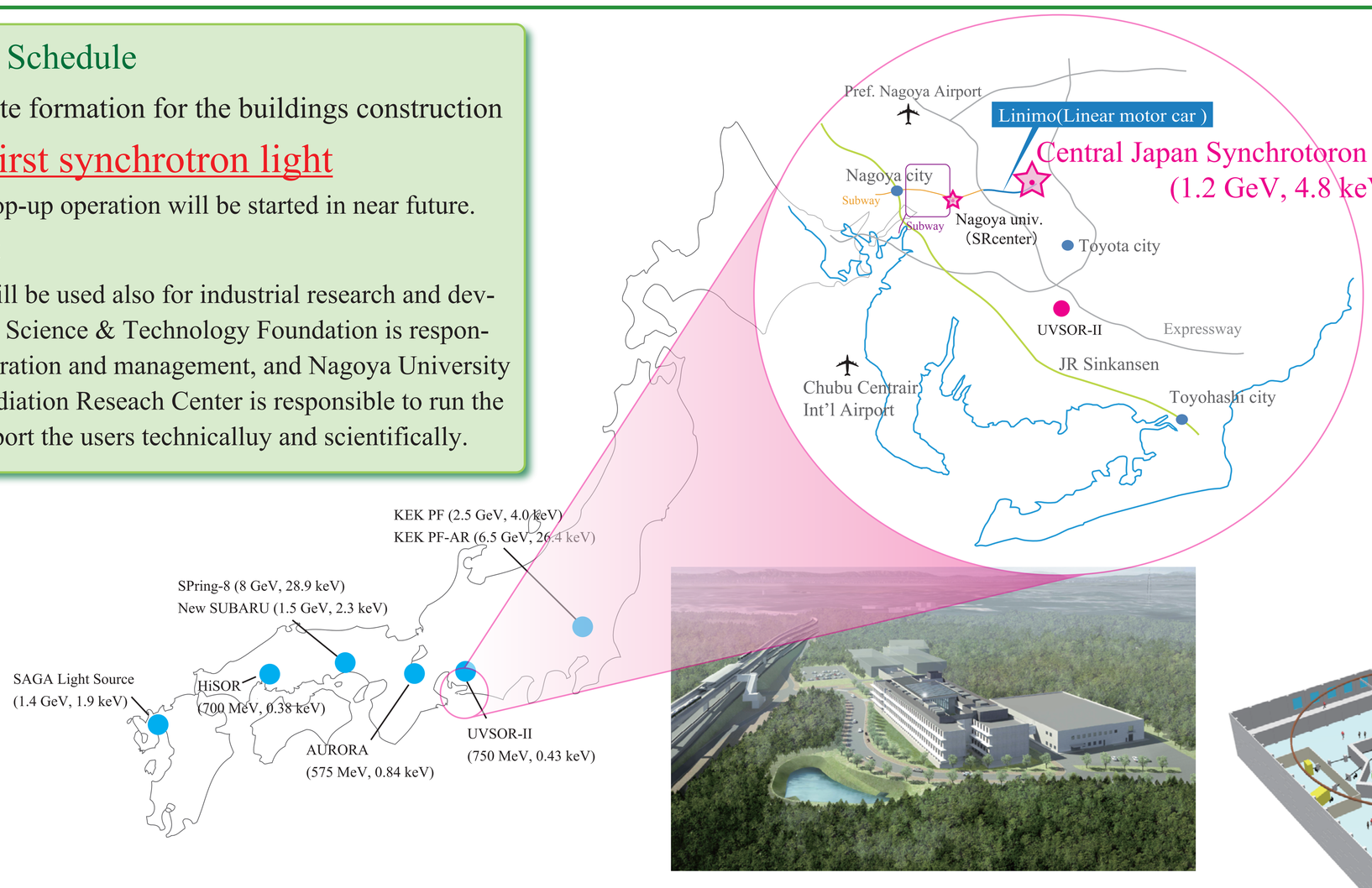
2009. Site formation for the buildings construction

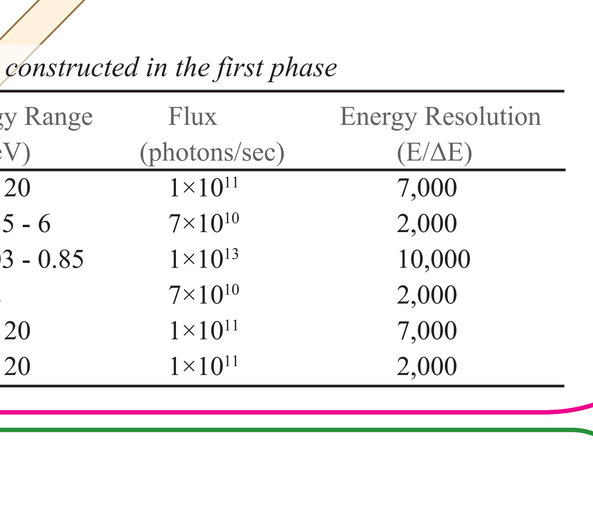
2012. First synchrotron light

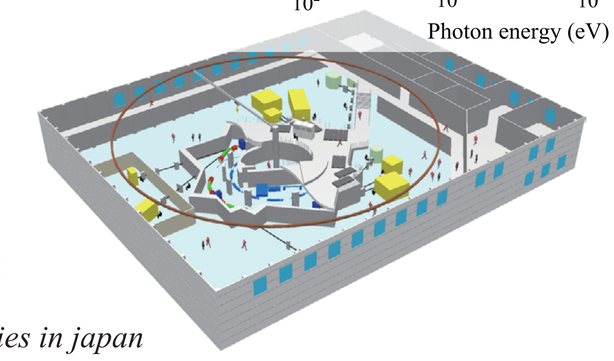
Top-up operation will be started in near future.

Management

This facility will be used also for industrial research and development. Aichi Science & Technology Foundation is responsible for the operation and management, and Nagoya University Synchrotron Radiation Reseach Center is responsible to run the facility and support the users technicalluy and scientifically.







Central Japan Synchrotron Radiation Facility and SR facilities in japan