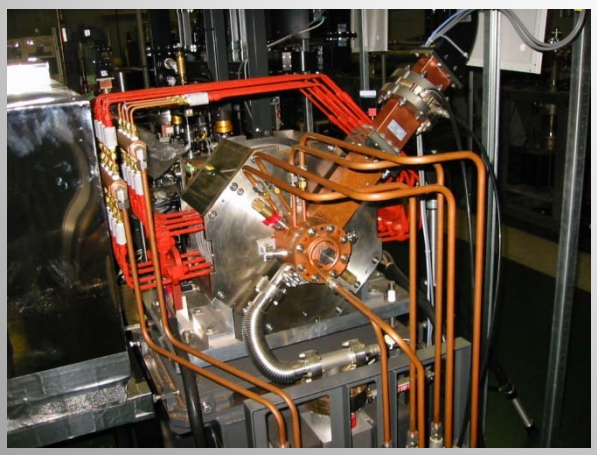
L-band Linac

$^{60}$Co γ-ray irradiation facility

# Research Laboratory for Quantum Beam Science

http://www.sanken.osaka-u.ac.jp/labs/rl/



S-band Laser Photocathode RF Linac

150 MeV S-band Linac

**ISIR, Osaka University**

# Research Laboratory for Quantum Beam Science

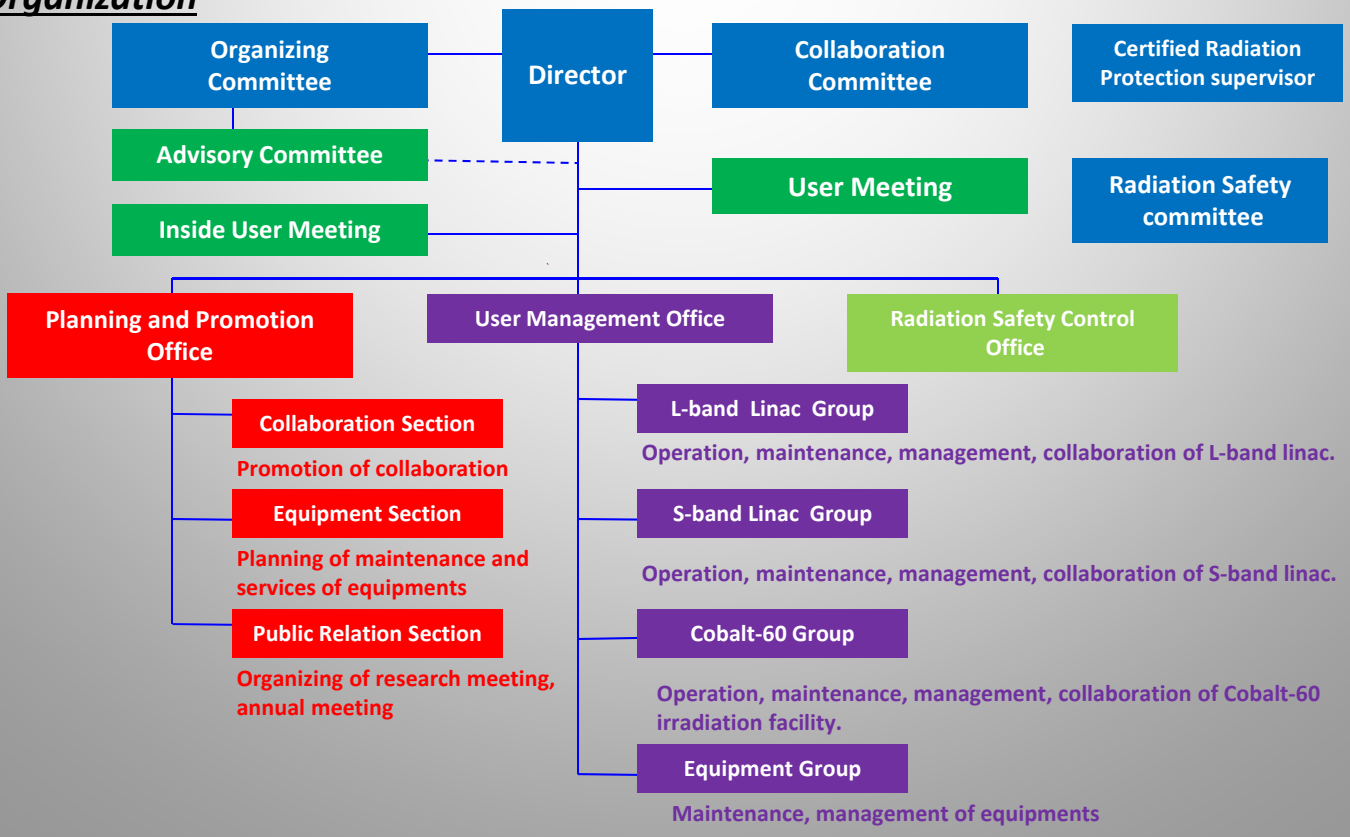
## *Outline*

The Research Laboratory for Quantum Beam Science (RLQBS) was newly established in the fiscal year of 2009 as a successor of the Radiation Laboratory in the Nanoscience and Nanotechnology Center of ISIR. All the facilities in the Radiation Laboratory were taken over; the 40MeV L-band electron linear accelerator (linac), the 150 MeV S-band electron linac, the 40 MeV RF-gun electron linac, and the $^{60}$Co γ-ray irradiation facility. These are opened to users in Osaka University. The staff of RLQBS is composed of the full-time members, who are two researchers, one technician from the Technical Division and a secretary, and concurrent members. In RLQBS, based on quantum beam science, frontier beam science relating to environmental material science, new energy sources and advanced medical technology as well as fundamental beam science are promoted with concurrent members. The management including operation, maintenance and the safety control of radiation related facilities such as electron linear accelerators, cobalt-60 irradiation facility are also conducted with the aid of concurrent members.

Current research topics are listed below.

- Application of quantum beam science to the fields of environmental science, new energy technology and advanced medical technology.
- Management, operation, maintenance and safety control of the facilities.
- Research and development of analyzing methods of materials using quantum beams.
- Radiation induced reactions in organic molecules and photocatalytic semiconductors.

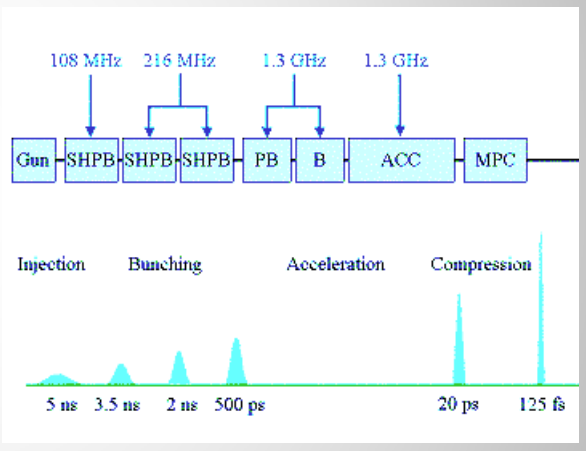
## *Organization*



## ***Facilities***

### L-band electron Linac

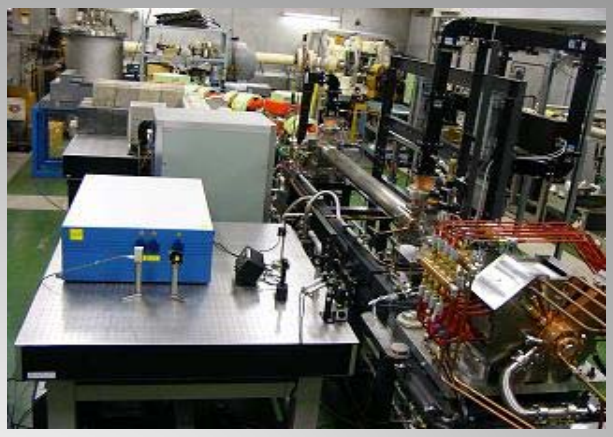
The L-band linac was constructed in 1978 for generating intense electron beam singly bunched in picosecond width. After the improvement of sub-harmonic pre-buncher (SHPB) system and the gun cathode, the charge of electrons in the single bunch beam was increased up to 91 nC. The high-brightness electron beam has been mainly used for researches on the transient phenomena in the range from nanoseconds to sub-picoseconds by means of pulse radiolysis, and developing a far-infrared free electron laser (FEL) as well as basic research on Self-Amplified Spontaneous Emission (SASE) in the far-infrared region. The linac was renewed in 2003 for the purpose of realizing high stability and reproducibility as well as easy operation. The linac is composed of a thermionic electron gun, three SHPBs, a pre-buncher(PB), a buncher (B) and 3m long accelerating tube, and is operated with four modes; transient, steady, single-bunch and multi bunch modes. Electrons injected from the gun and passing through the SHPB system are bunched to 20-30 ps with PB and B and accelerated up to 40 MeV through the acceleration tube driven with a klystron with the peak power of 30 MW at the RF frequency of 1.3 GHz.

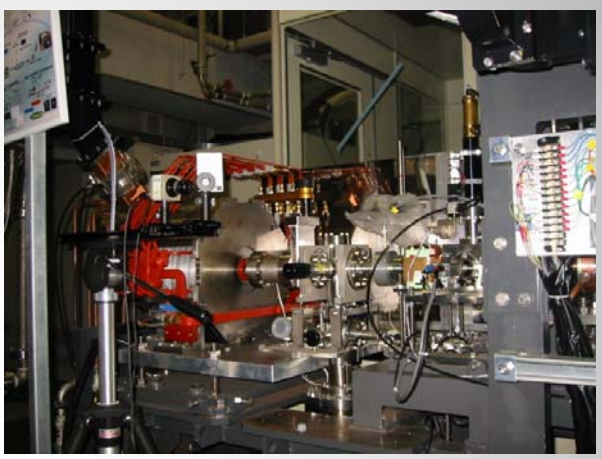



### 150 MeV S-band electron Linac

The 150 MeV S-band linac was developed in 1990. This linac consisting of tree acceleration tubes and a thermionic gun, can accelerate electron bunch up to 100 MeV with the current of 0.25 A in a representative operation. The bunch length is two microseconds and its repetition is less than 30 Hz. This linac has been dominantly used to produce positron beam.

## Laser Photocathode RF-gun S-band Linac





The laser-photocathode RF electron linear accelerator is a new low-emittance and ultra short-bunch electron accelerator which is constructed with a 1.6-cell S-band laser photocathode RF electron gun, TW linear accelerator and a magnetic pulse compressor. The picoseconds electron beam is generated in the RF gun driven by an all solid-state Nd:YLF picoseconds laser. A copper cathode is used to generate a low-emittance electron beam. The electron beam generated from the RF gun is accelerated by the linac downstream of the RF gun with energy modulation, and compressed into femtosecond by rotating the longitudinal bunch phase space in magnetic field. The linac was constructed in 2003. A 98-fomtosecond single bunch electron beam was generated successfully in 2004. The normalized emittance was 3.8 mm-mrad.

## $^{60}$Co γ-ray irradiation facility

The $^{60}$Co γ-ray irradiation facility has been equipped with 4 $^{60}$Co γ-ray sources with their activity ranging from 0.614 TBq to 106 TBq at Oct.1$^{st}$ in 2009. Two radiation shielded irradiation caves are available for the use of scientific researches. To date, the present facility is used in the fields such as irradiation effects on materials and tissues, radiation induced polymerization, radiation damages on materials, radiation hazard on biological system and so on.

## Related Laboratories

Department of Advanced Nanofabrication
http://www.sanken.osaka-u.ac.jp/jp/organization/nnc/nnc_index.html

Department of Accelerator Science
http://www.sanken.osaka-u.ac.jp/jp/organization/sec/sec_index.html

Department of Molecular Excitation Chemistry
http://www.sanken.osaka-u.ac.jp/jp/organization/thi/thi_index.html

Department of Beam Materials Science
http://www.sanken.osaka-u.ac.jp/en/organization/sec/sec_07.html

Beam Application Frontier Research Laboratory
http://www.sanken.osaka-u.ac.jp/jp/organization/srp/srp_03_01.html

# Suita Campus

**Research Laboratory for Quantum Beam Science**




**Research Laboratory for Quantum Beam Science**
**ISIR,Osaka University**
**http://www.sanken.osaka-u.ac.jp/labs/rl/**

**8-1 Mihogaoka, Ibaraki, Osaka Zip Code 567-0047**
**TEL 06-6879-8511 FAX 06-6875-4346**