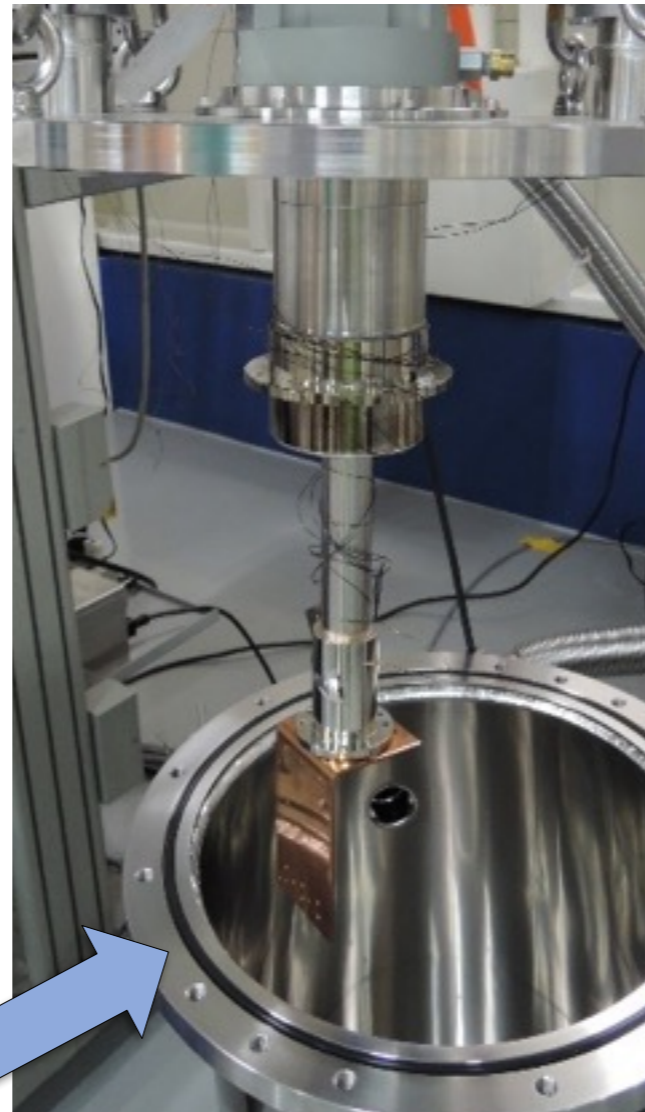
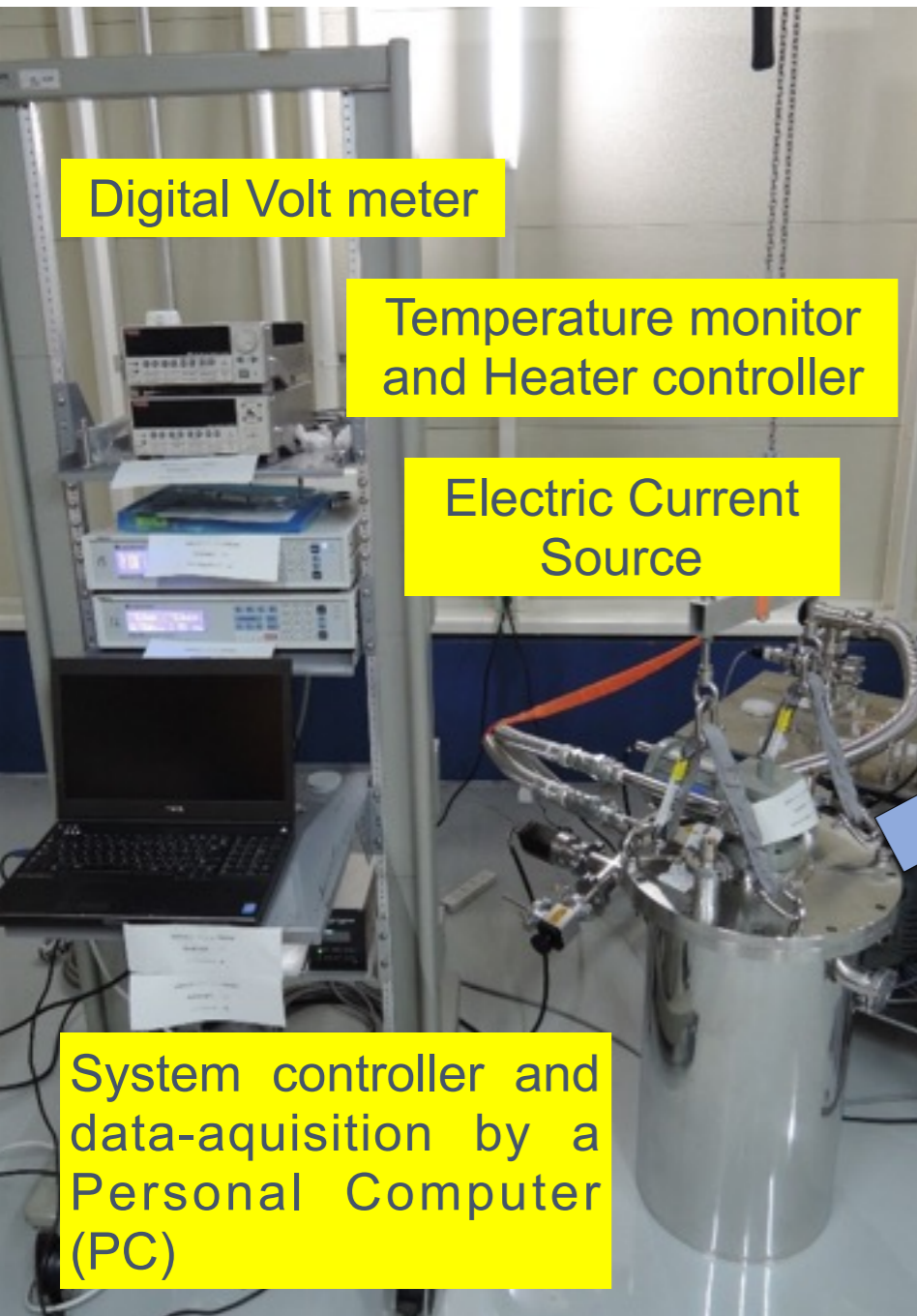


**Activities on
SRF Thin Film Study
at KEK & Kyoto U.**

**Y. Iwashita, T. Saeki, T. Kubo, S. Kato,
H. Hayano and H. Oikawa**

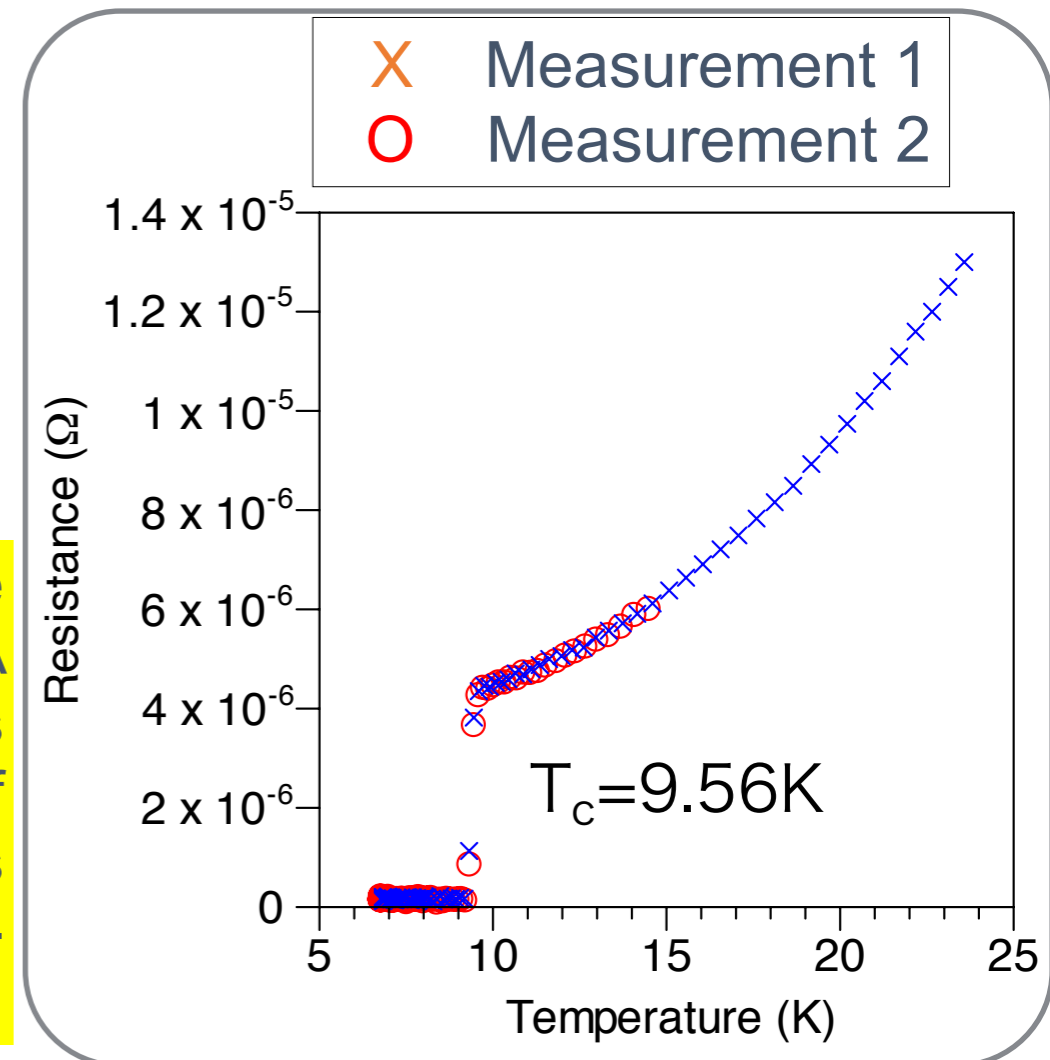
Small-sized Cryostat with a Compact

Refrigerator for Measurements of SC Samples



Refrigerator is fixed in the center of top-flange. A copper L-angle stage is attached on the top of refrigerator head. Samples are fixed on the copper L-angle stage.

Nb sample:
 $2.8 \times 5 \times 150$ (mm³)
Resistance measurement with electric current :
50 mA

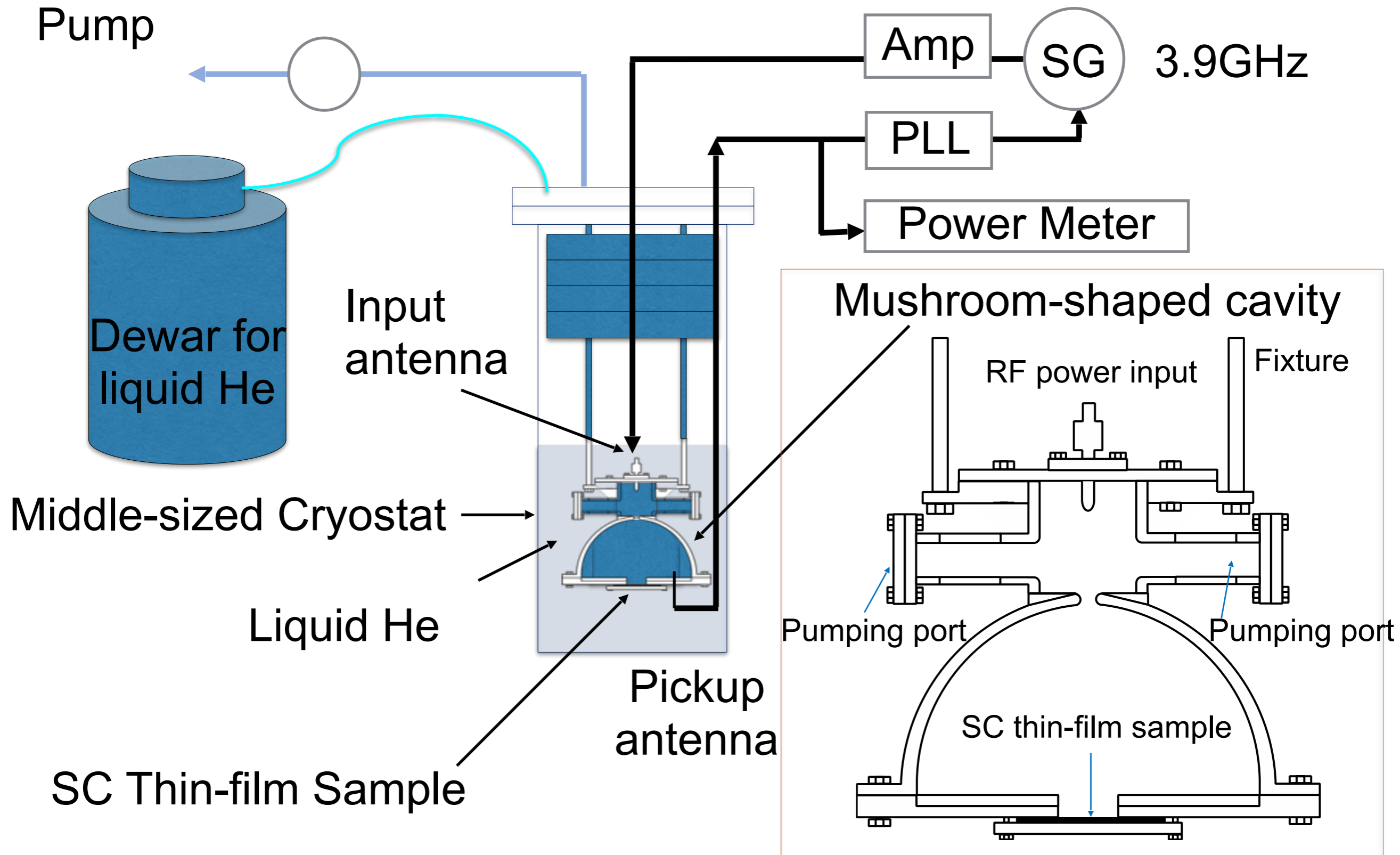


Small-sized Cryostat with a Compact

Refrigerator for Measurements of SC Samples

- Compact system to measure the SC characteristics of thin-film samples.
- Handling of the system is easy because no need of complicated liquid-He operation. The refrigerator starts cooling just by switching-on. (After measurements, warming up is done without complicated He-gas operation.)
- The history log of 8 temperature-sensors (CERNOX) are recorded.
- The temperature of samples can be controlled by a heater and a controller.
- Data acquisition and the temperature controlling can be done by a Personal Computer (PC).

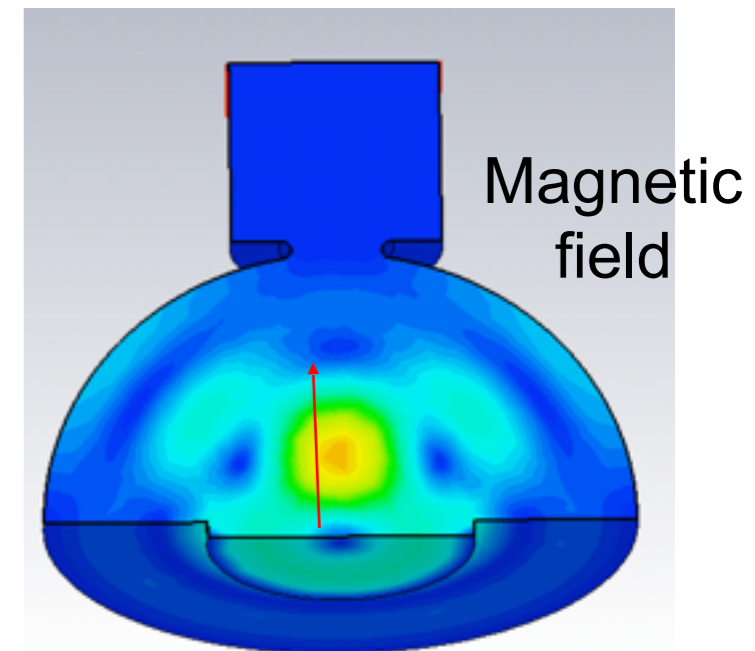
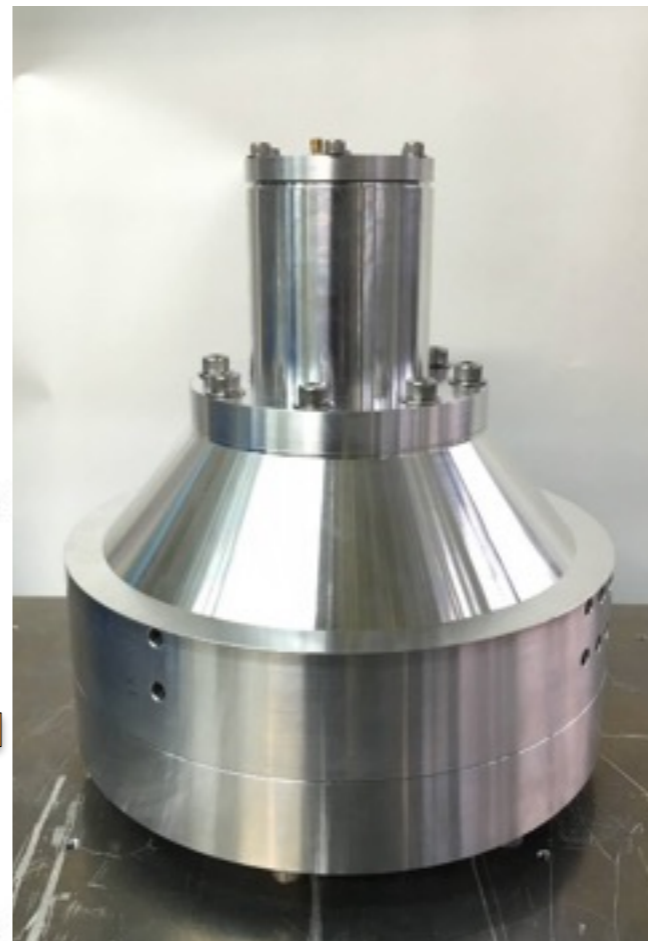
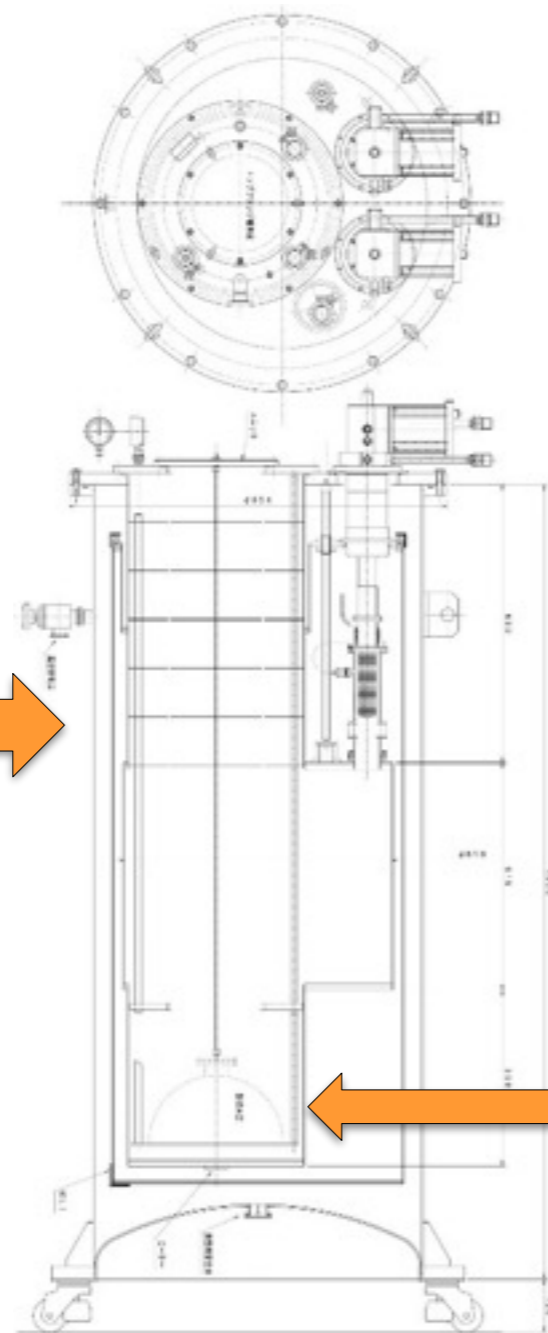
Setup to measure the RF critical magnetic field (B_{c1})



Middle-sized Cryostat for Bc1 RF Measurement

Al-model of mushroom-shaped cavity for RF test at Room Temperature (RT).

Mushroom-shaped cavity for RF measurements of a thin-film sample



Magnetic field
on thin-film
sample

Bc1 measurement for RF field

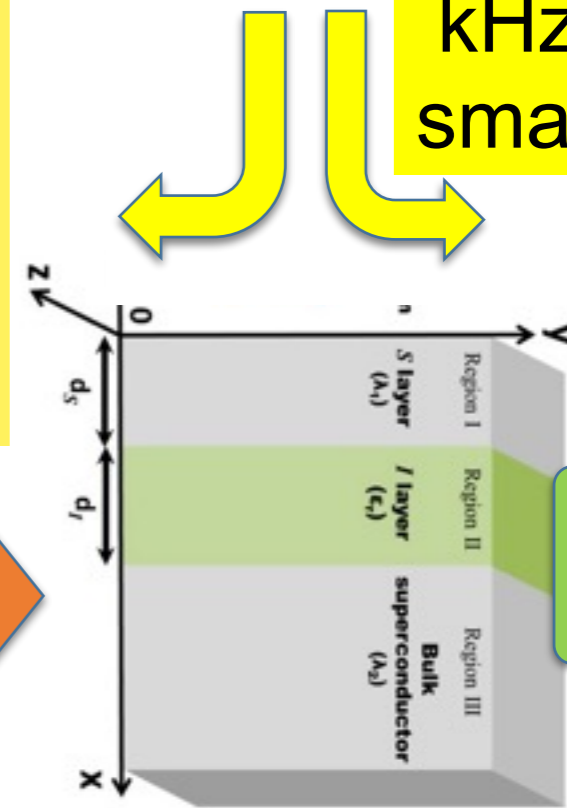
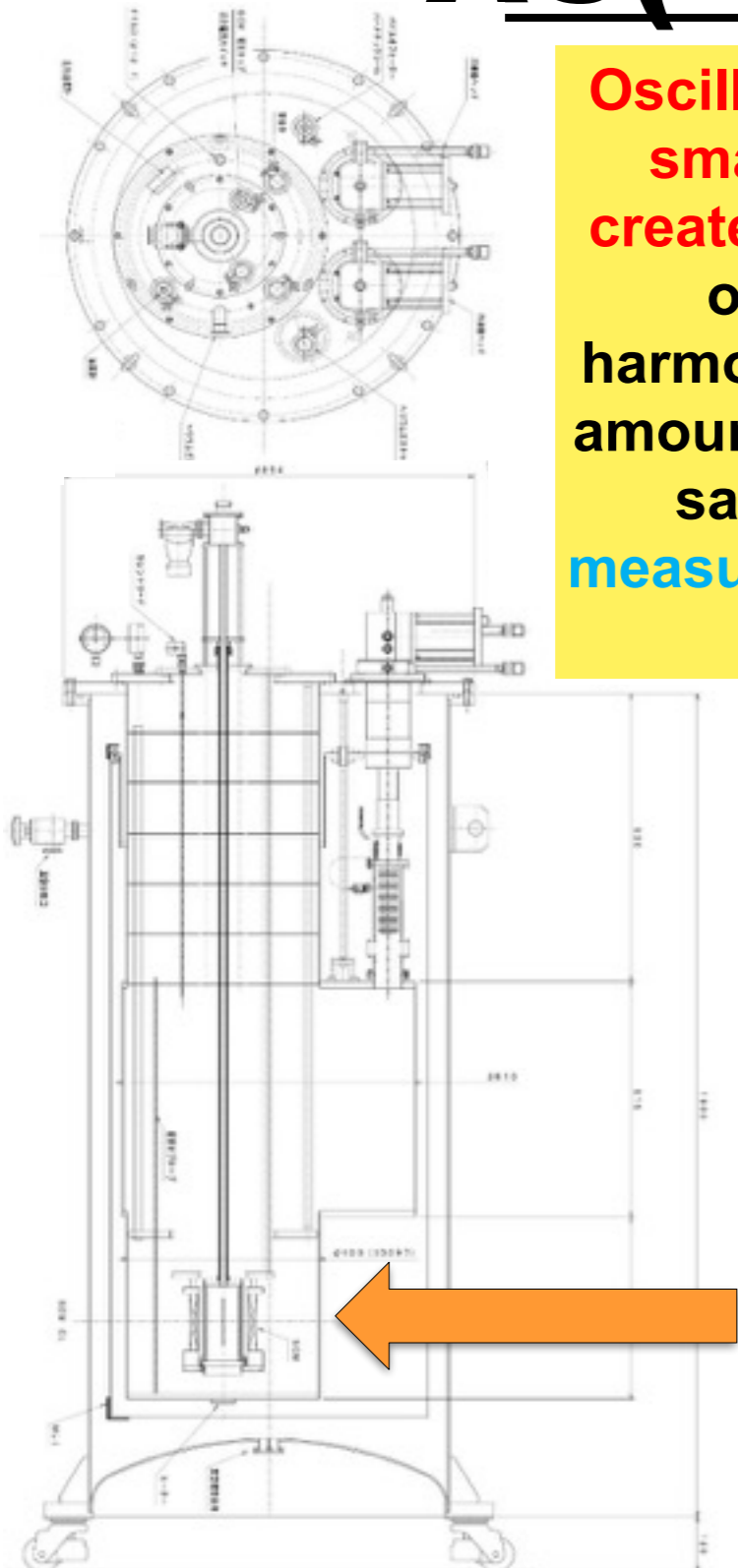


Middle-sized Cryostat for Bc1

AC(\sim kHz) Measurement

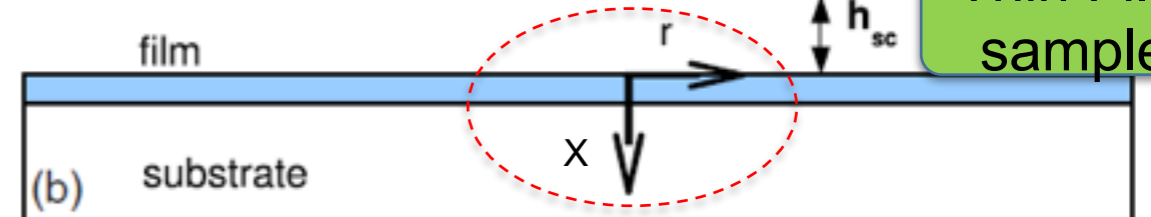
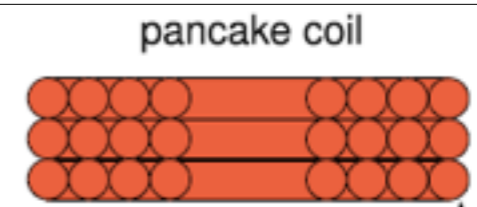
Oscillating voltage at \sim kHz is applied to the small coil and magnetic field at \sim kHz is created on the thin film sample. The voltage of the small coil is measured. Third harmonics of the voltage corresponds to the amount of penetrating magnetic field into the sample and the Bc1 is measured. The measurement of Bc1 is repeated by changing the temperature T.

Magnetic field at \sim kHz by a small coil.



Thin Film sample

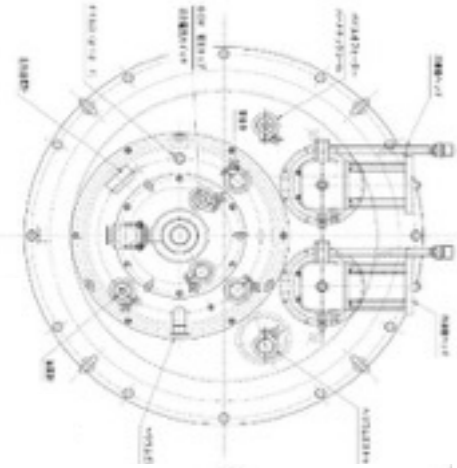
Small coil



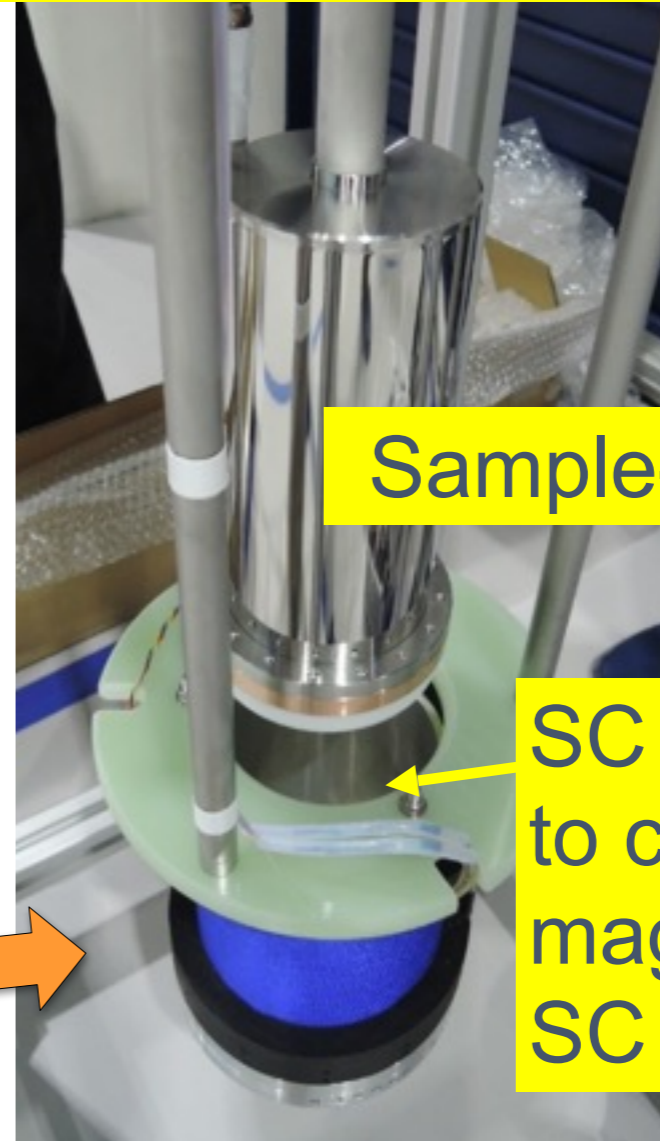
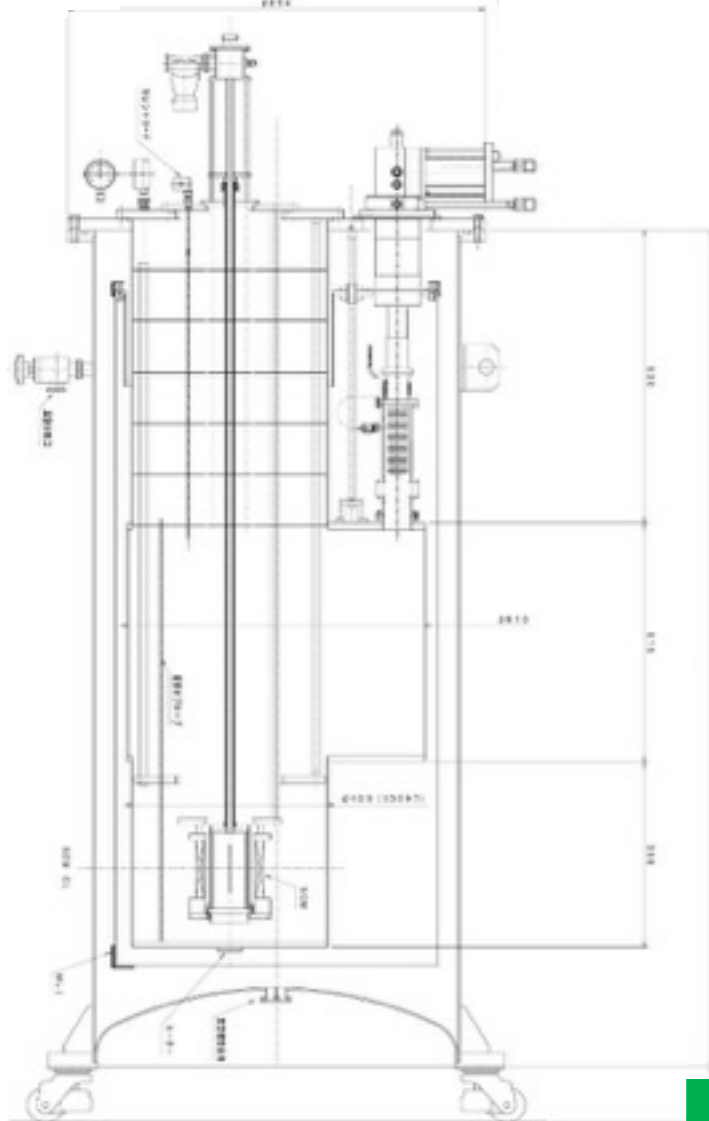
Thin Film sample

Middle-sized Cryostat for Bc1

DC Measurement



Top-flange is flexible and compatible for various setups.



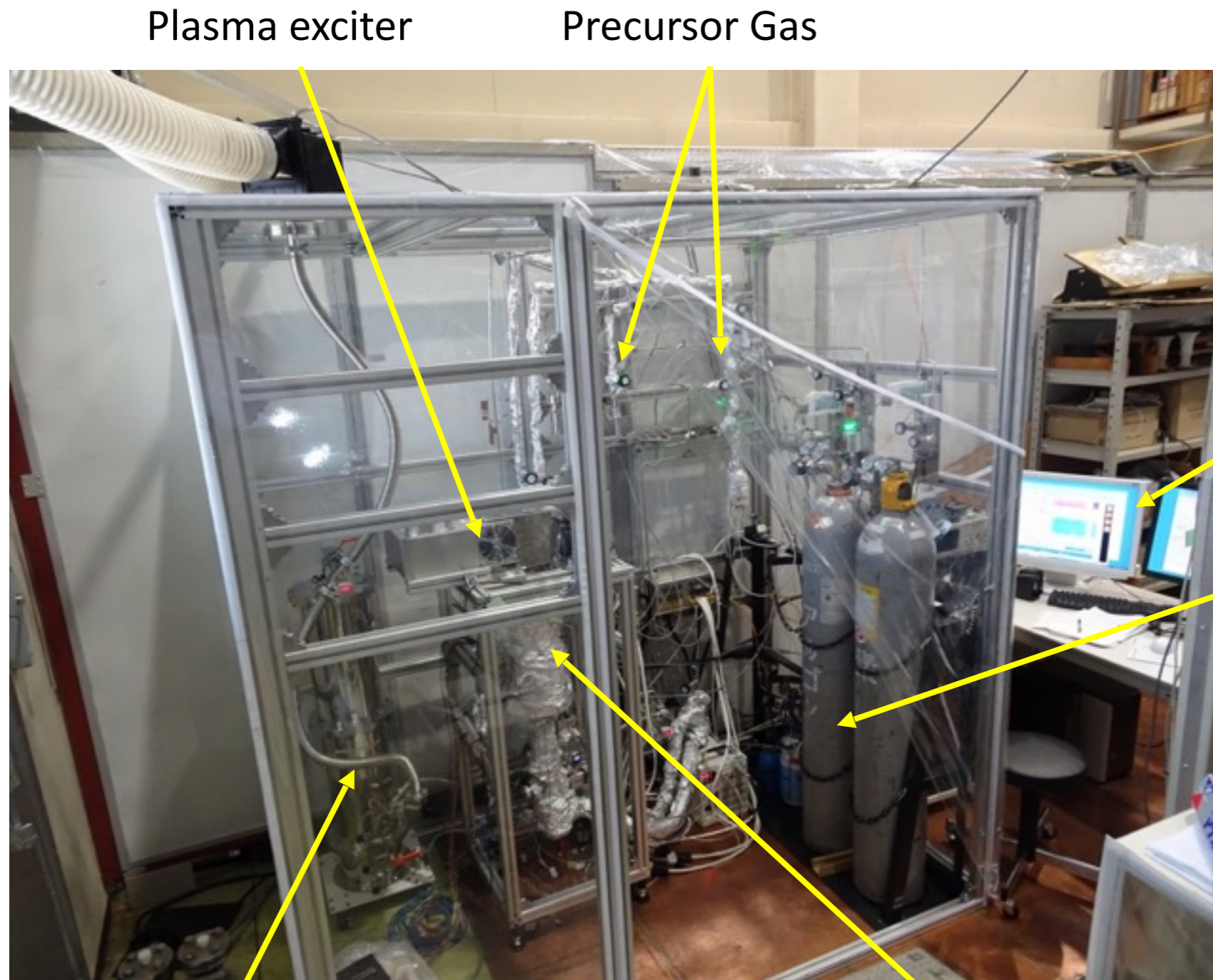
Sample-chamber

SC solenoid (5T) to create external magnetic field for SC samples.

Bc1 for DC field or Bc1 for AC field by small coil.

Thin-film R&D by Atomic Layer Deposition

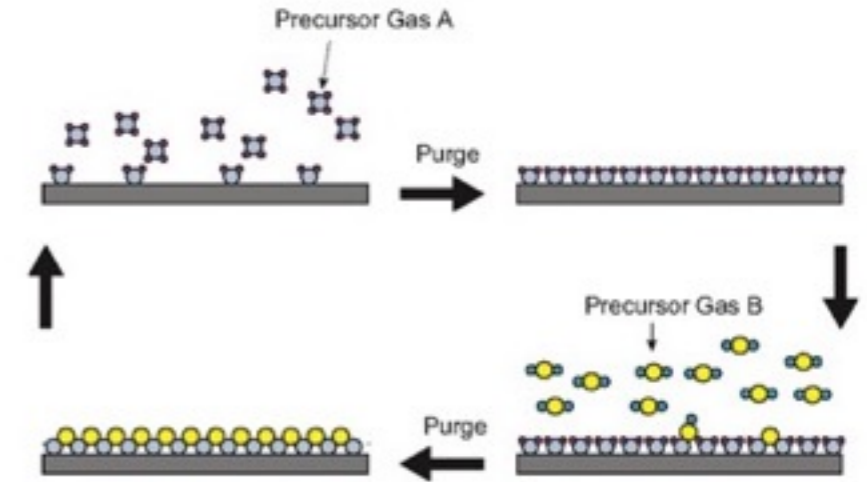
KEK ALD device is now under development



Plasma exciter

Precursor Gas

Thin-film by Atomic Layer Deposition



Control PC

Purge Gas: Ar, N

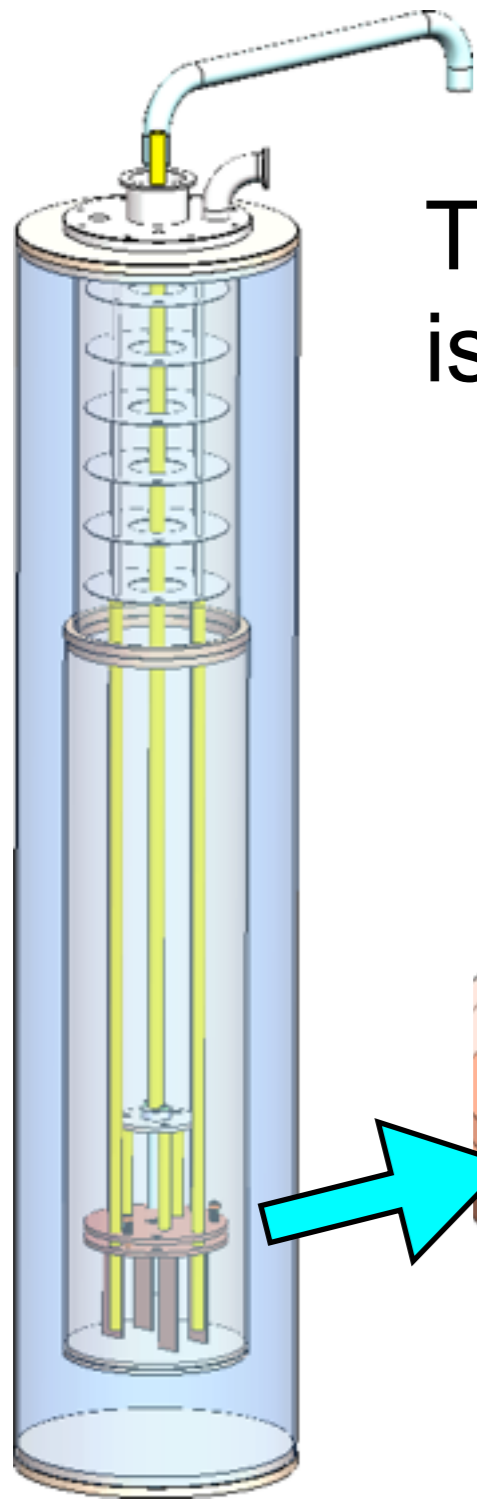
Almost ready to make film.

NbN ALD on Si-wafer,
at first.

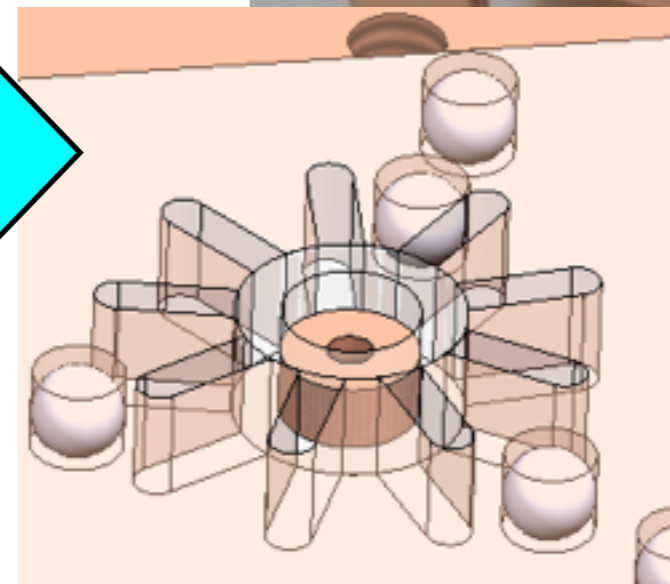
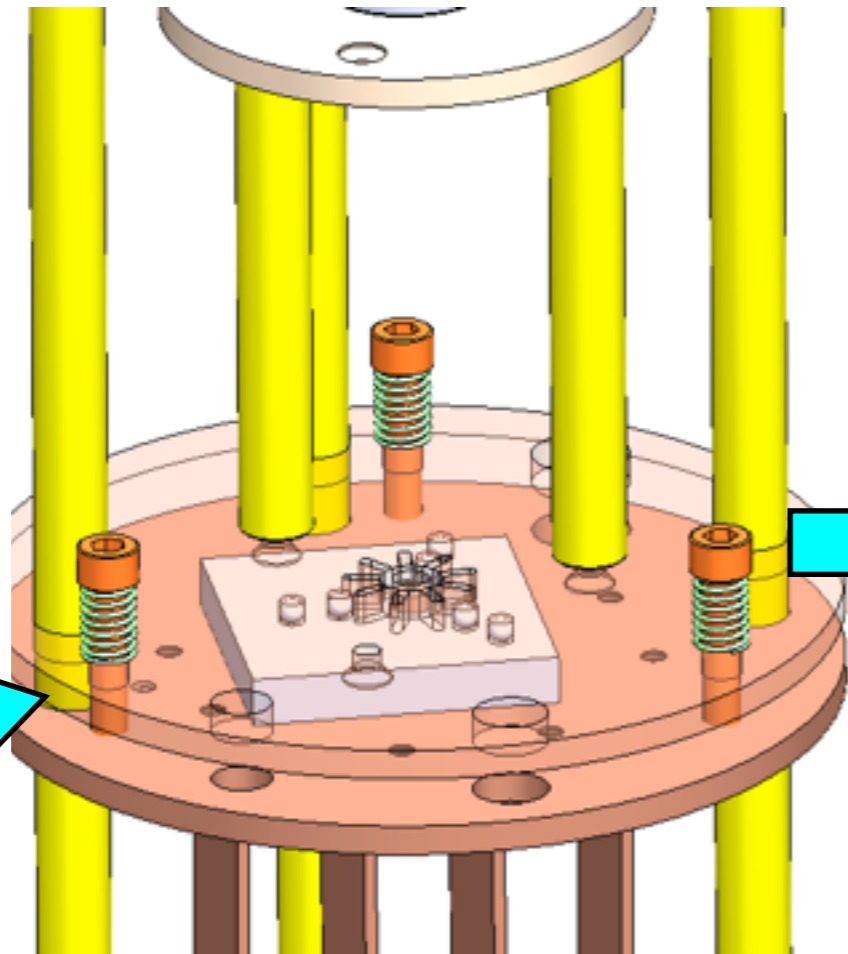
Detoxifying apparatus

Sample deposition chamber
with heater

Third Harmonic Test at Kyoto U.



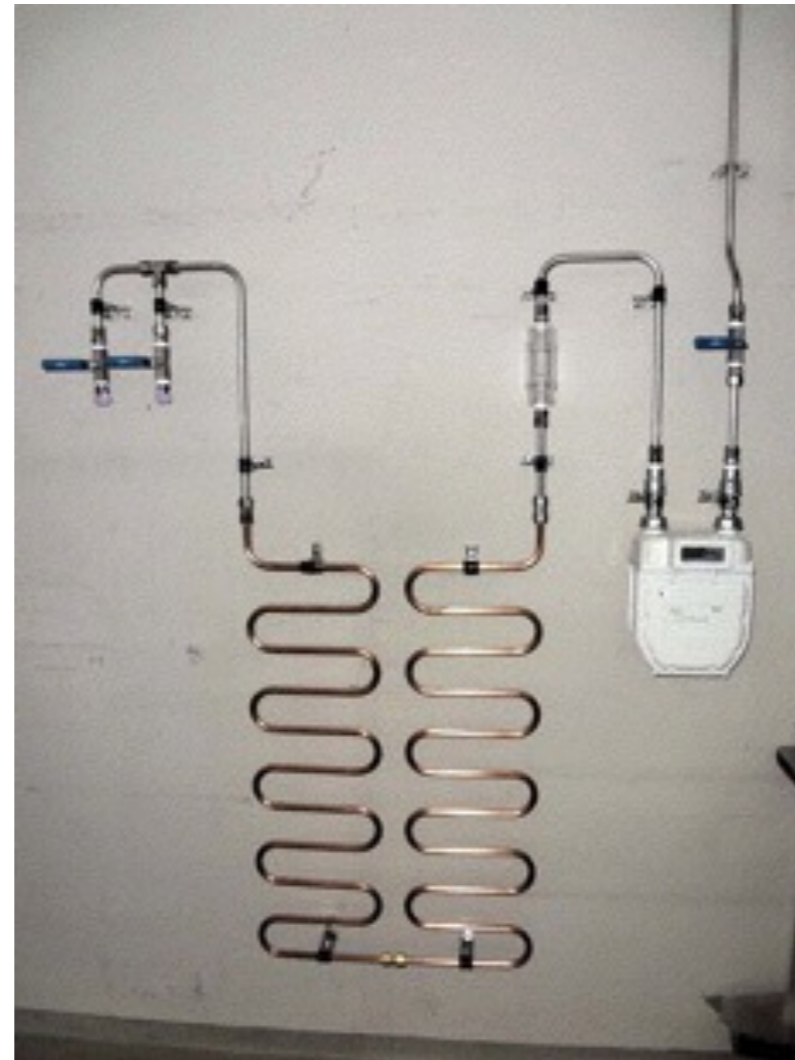
Third harmonic test system is under construction.



Coil Holder with flux return slots

Waiting for arrivals of some parts.

Third Harmonic Test at Kyoto U.



He gas warming
heat exchanger.

He gas return system is prepared.



Summary

A small-sized cryostat with a compact refrigerator is successfully installed at KEK.

The system with a small cryostat is cooled down without complicated liquid-He operation and is used for the measurements of critical temperature T_c and RRR of SC samples.

A middle-sized cryostat is designed and fabricated. The system is cooled down by liquid He.

The middle-sized cryostat is used for the measurements of B_{c1} for SC samples by DC, AC, and RF fields. DC field is created by SC solenoid magnet (5T). AC field is created by a small coil. And RF field is created by Mushroom-shaped cavity.

The Al-model of mushroom-shaped cavity for 3.9 GHz RF field is fabricated for RF test at Room Temperature (RT).

Atomic Layer Deposition system is under development at KEK

Preparation for the third harmonic test
— Test bed & Gas return system