

Development of a multialkali photocathode DC gun for high current operation

Tohoku Univ.
QST

N. Nishimori
R. Nagai, M. Sawamura, R. Hajima

Outline

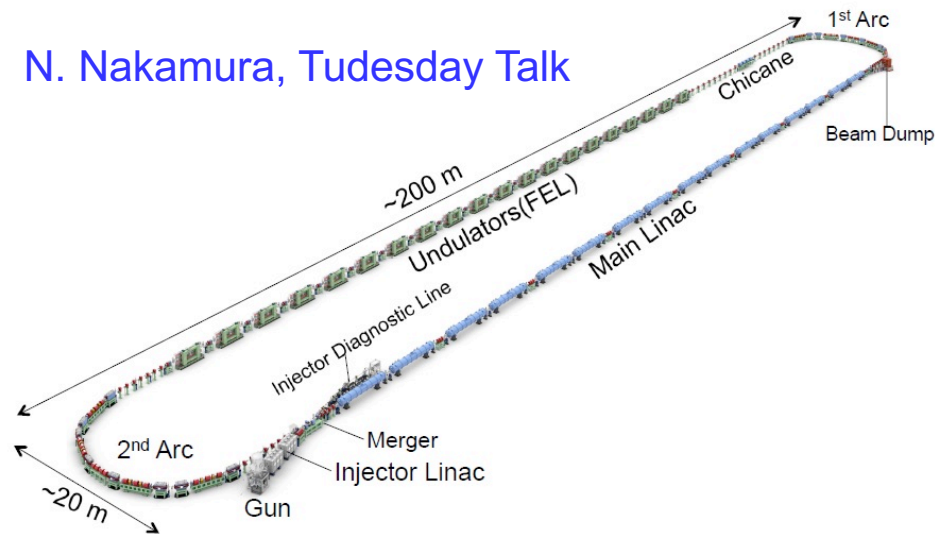
- Development of a photoemission DC gun at QST
- Fabrication of Cs_3Sb photocathode with QE of 5%
- mA beam generation from the gun
- Summary

Application of high current DC gun

800MeV ERL-FEL

- 10kW EUV light sources

N. Nakamura, Tuesday Talk



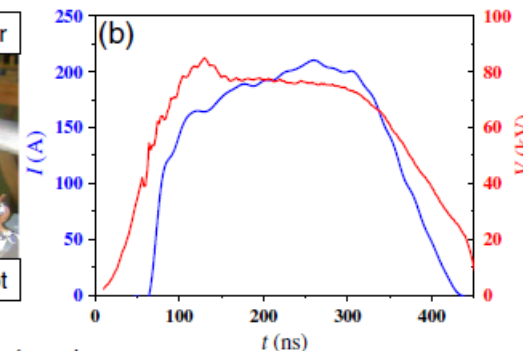
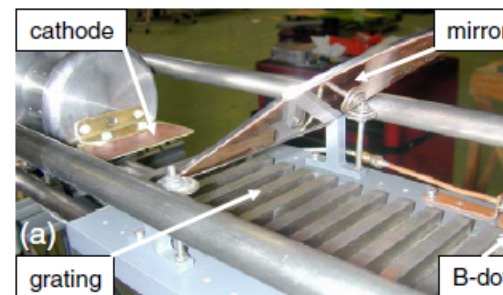
Smith-Purcell FEL

- Compact THz light source

CEA-CESTA, France

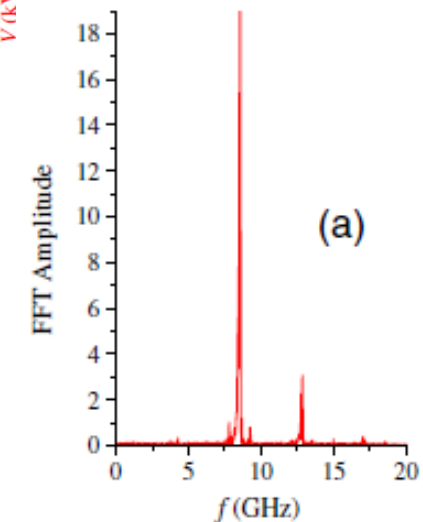
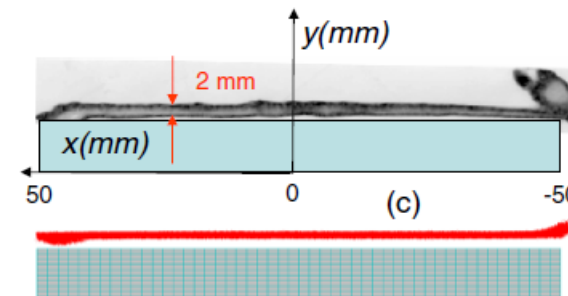
J. Gardelle et al., PRSTAB12, 110701 (2012)

Parameters	Value
Applied voltage	(85 ± 5) kV
Current	(180 ± 30) A
Current pulse duration (FWHM)	300 ns
Beam thickness	2 mm
Beam-grating distance	2 mm
Beam width	10 cm
Grating period	2 cm
Grating groove depth	1 cm
Grating groove width	1 cm
Grating width	10 cm
Number of periods	20
External magnetic field	Variable from 0 to 1 T

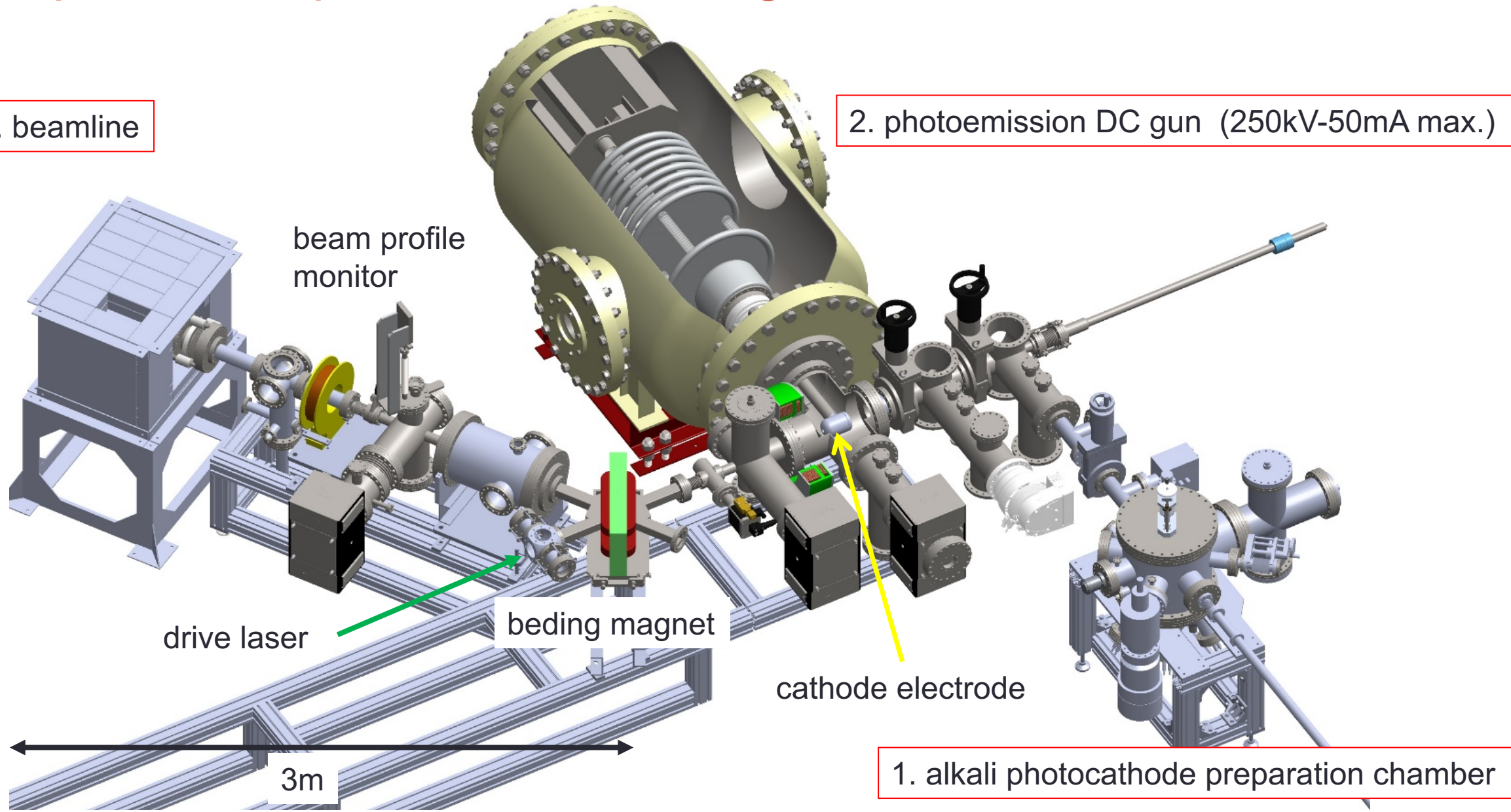


Injector specifications after merger

Charge	ϵ_n (μm)	I_{peak} (A)	$I_{\text{ave.}}$ (mA)
60 pC	0.60	30	10



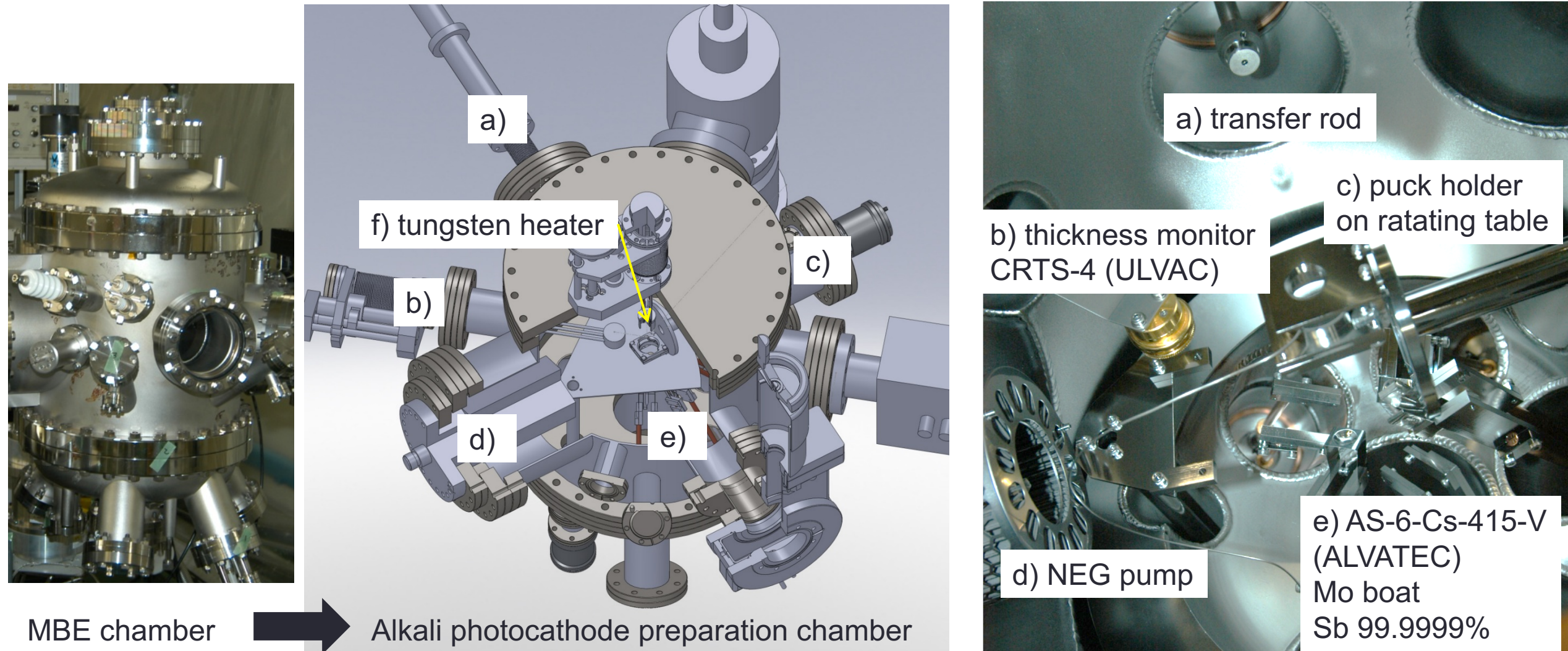
Development of a photoemission DC gun at QST



1. Development of an alkali photocathode preparation chamber (2013~)

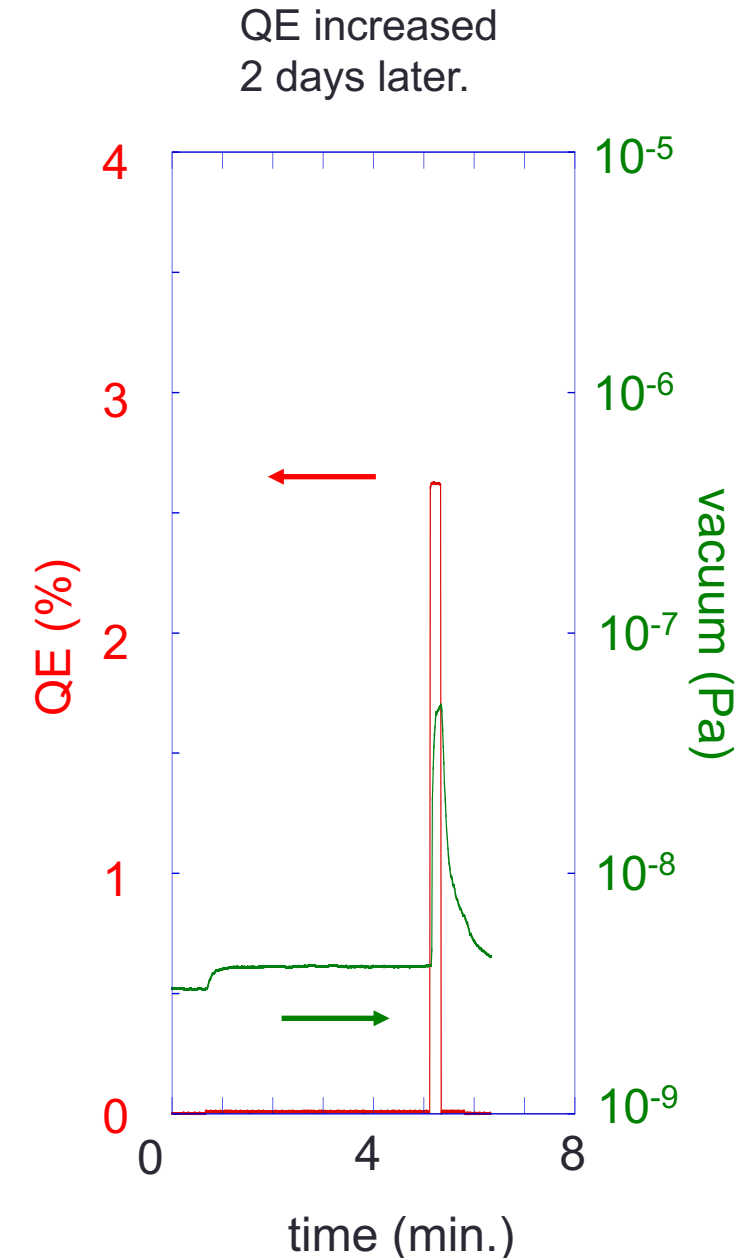
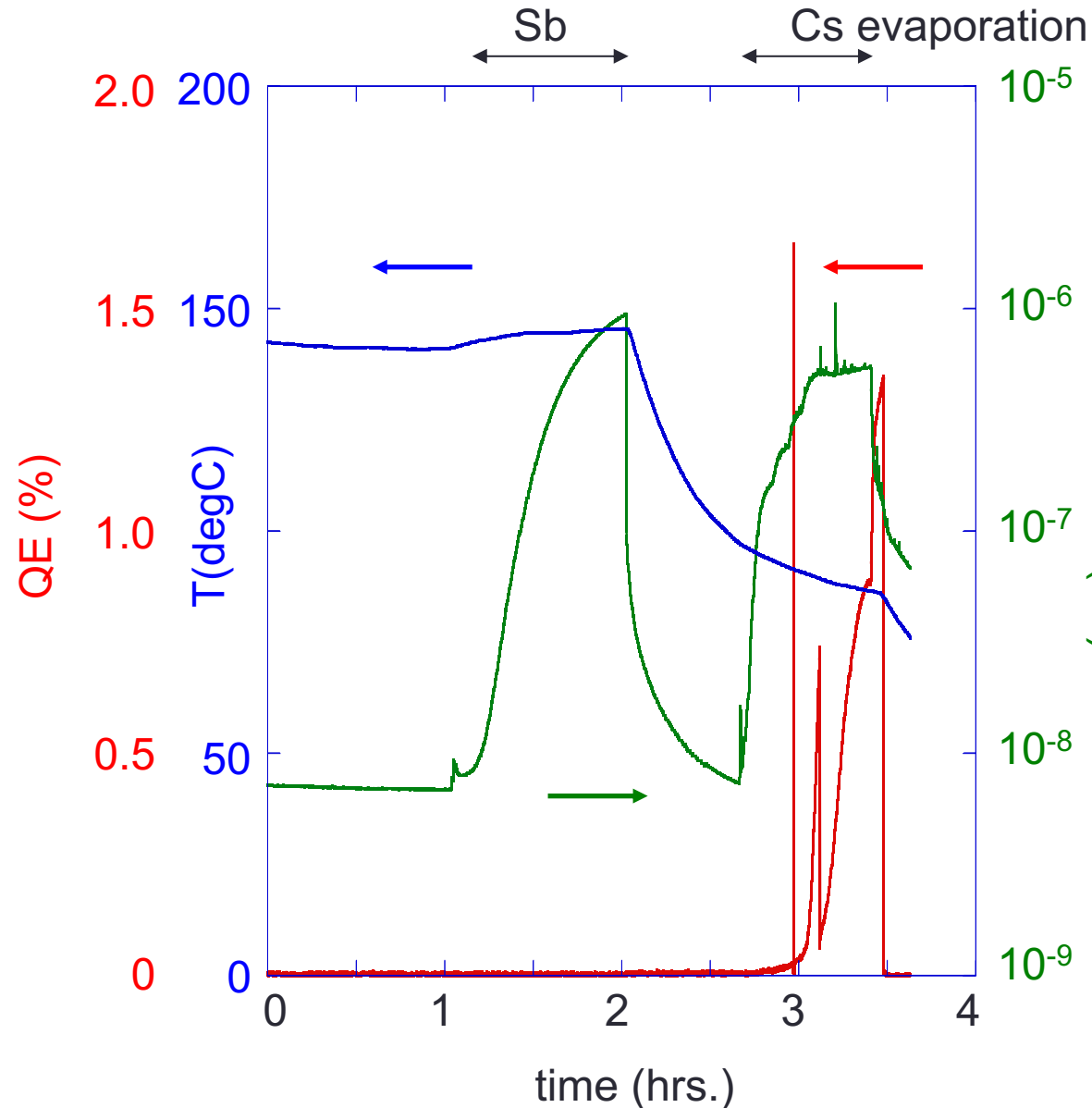
Follow Cornell's system,

L. Cultera, "Fabrication, characterization and use of alkali antimonides in a dc gun", P3 Workshop 2012.



Fabrication of Cs_3Sb photocathode

Mo puck
(cERL compatible)
Si(100) substrate



2. Development of a photoemission DC gun

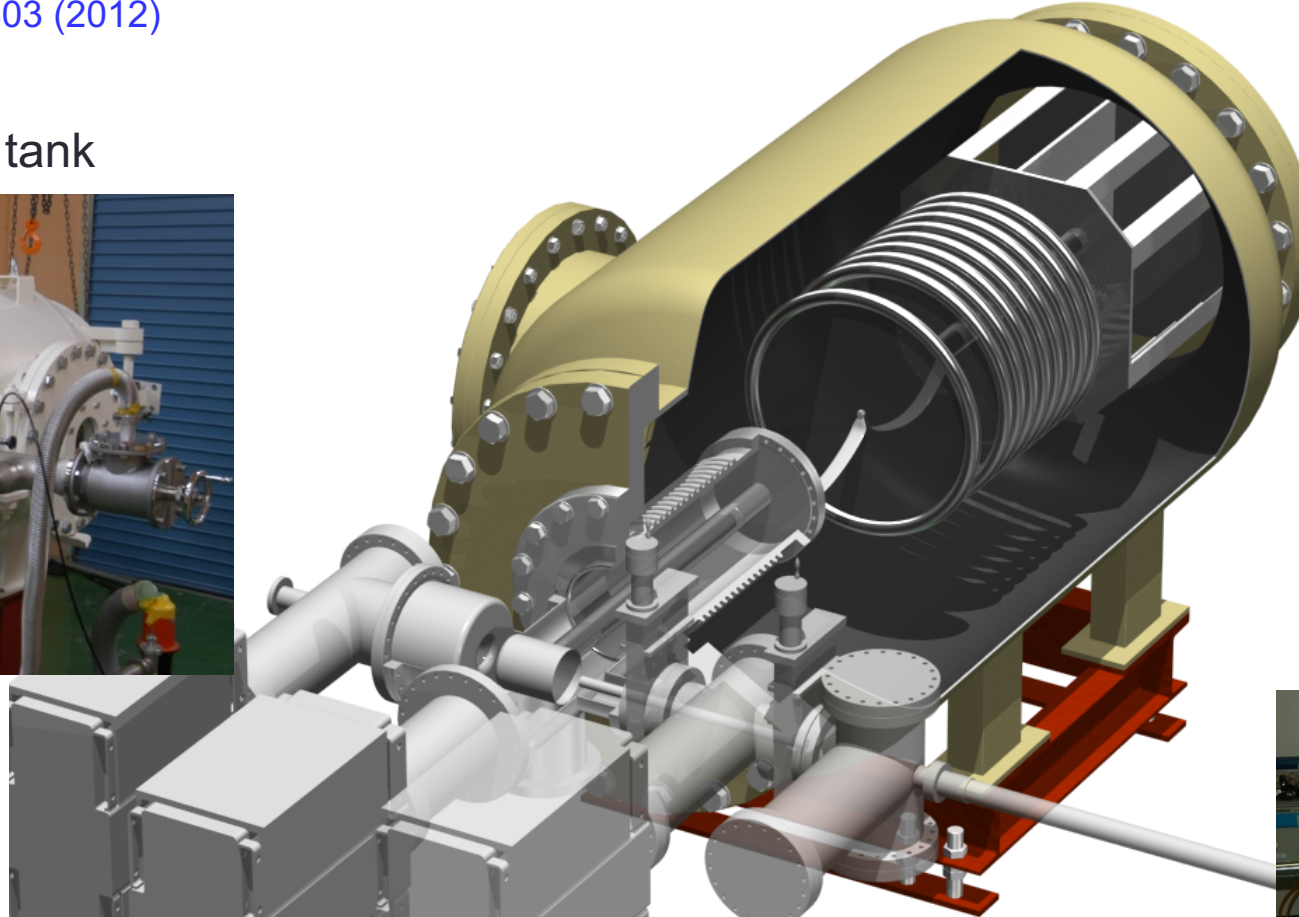
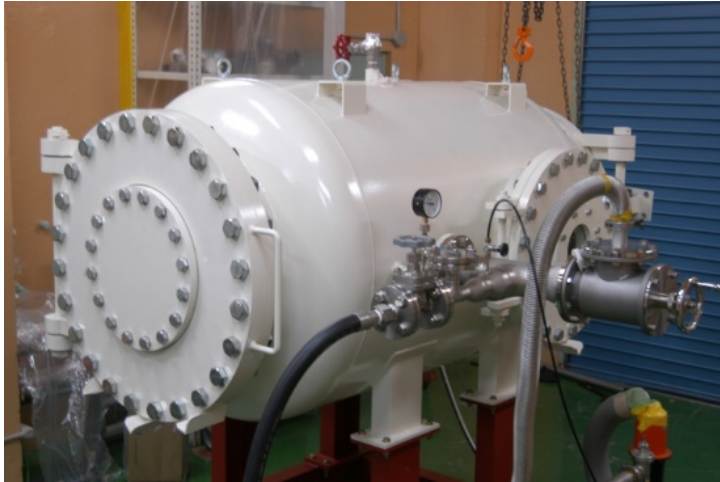
Gun development started in 2006.

R. Nagai et al., Proc. Of PAC09, 545 (2009)

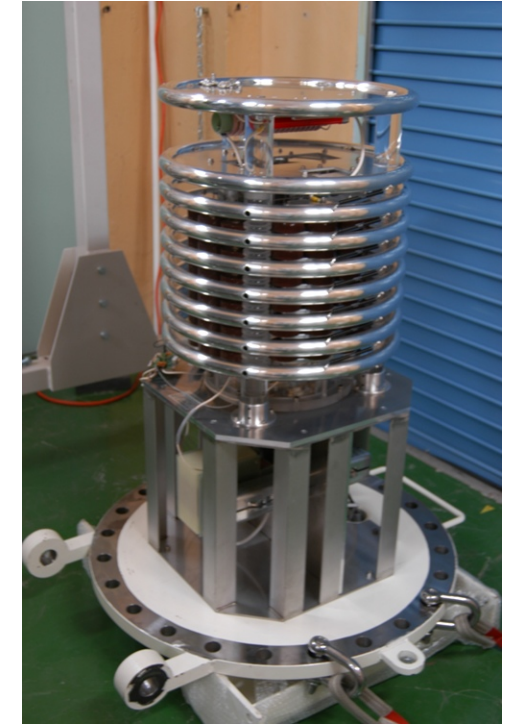
R. Nagai et al., RSI 83, 123303 (2012)

- ✓ 180kV-1 μ A beam generation with GaAs photocathode

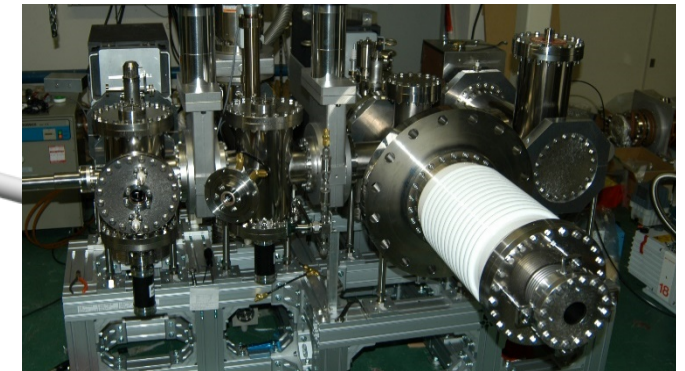
SF6 insulator gas tank



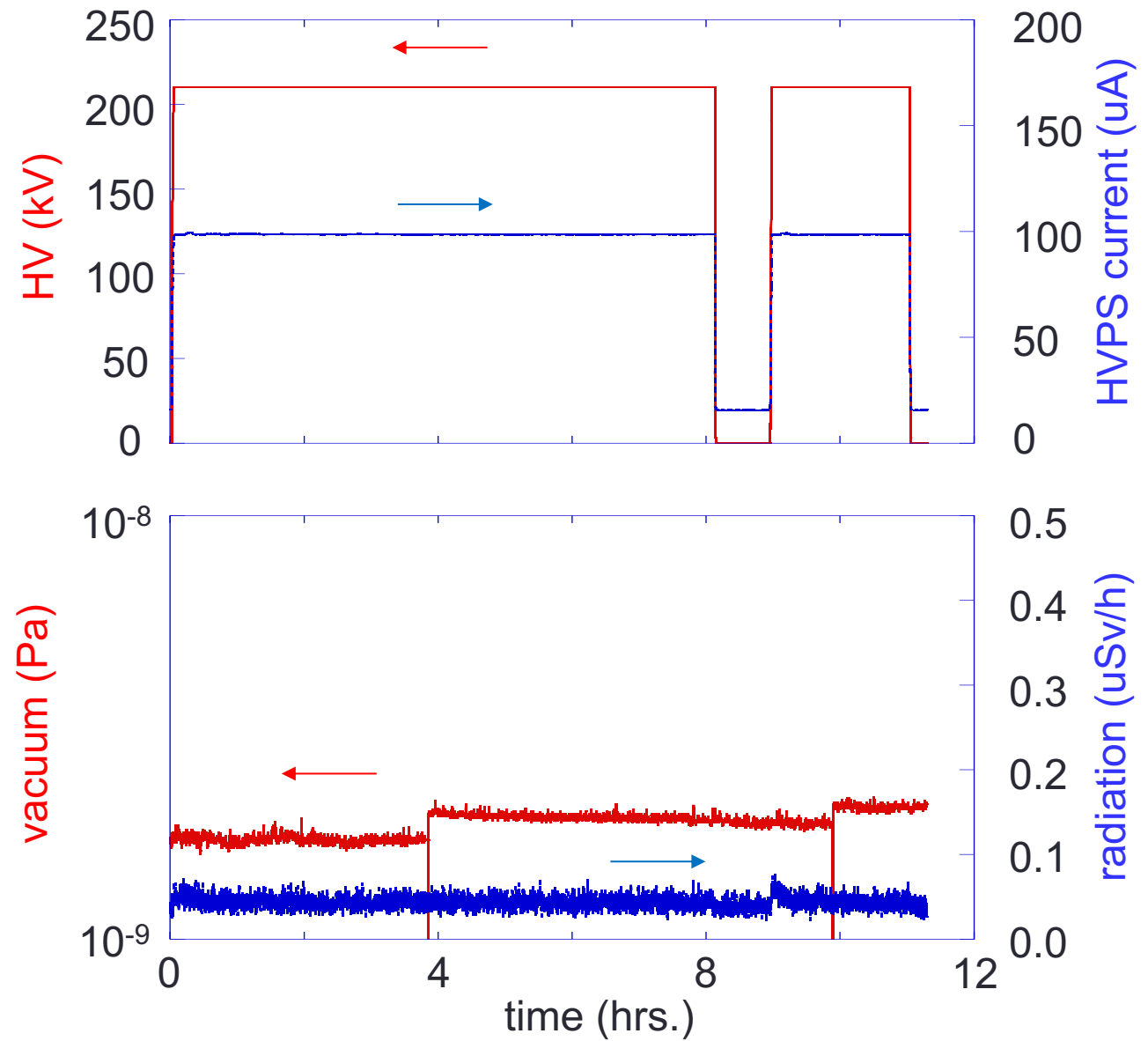
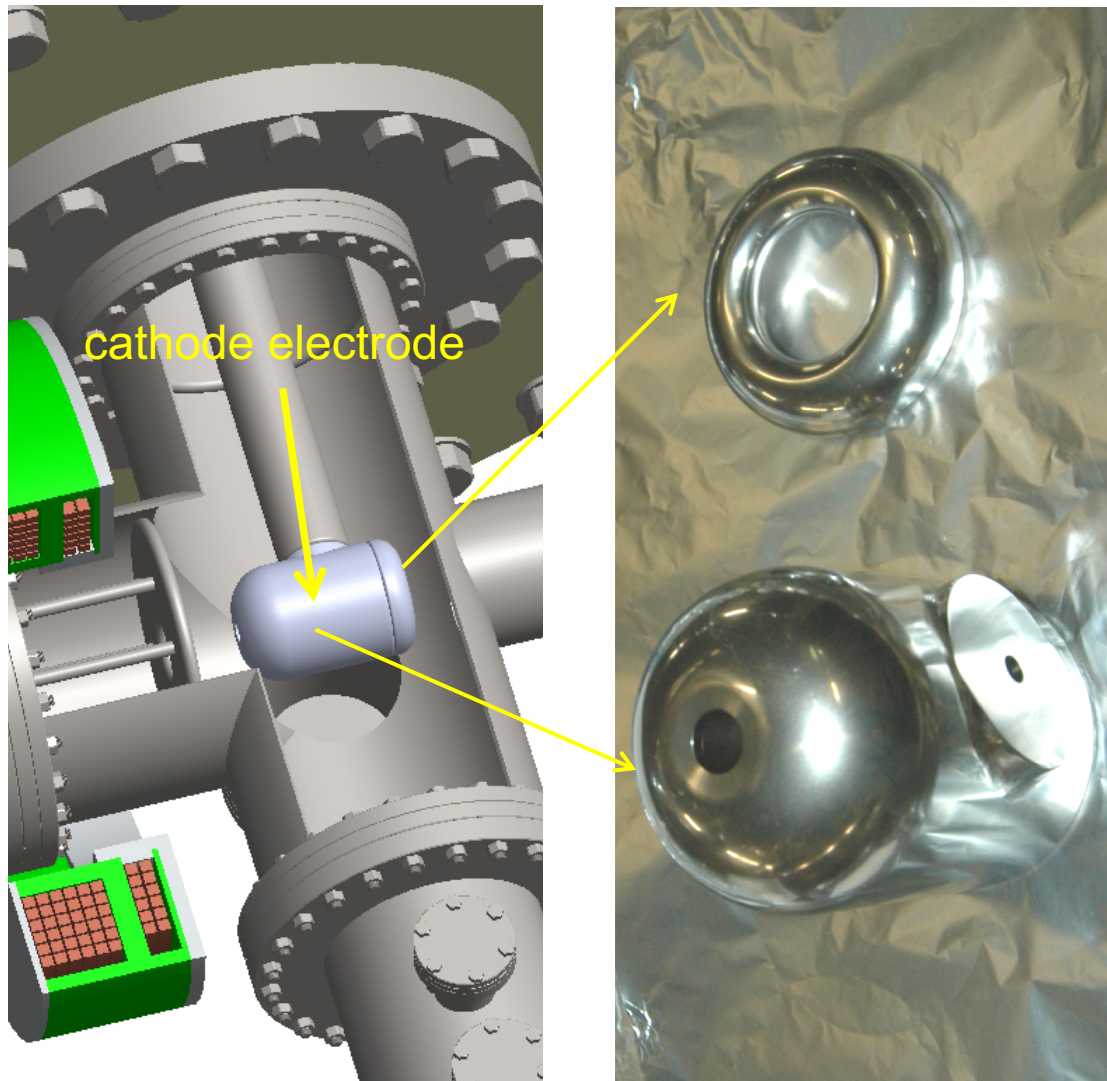
250kV-50 mA HV power supply



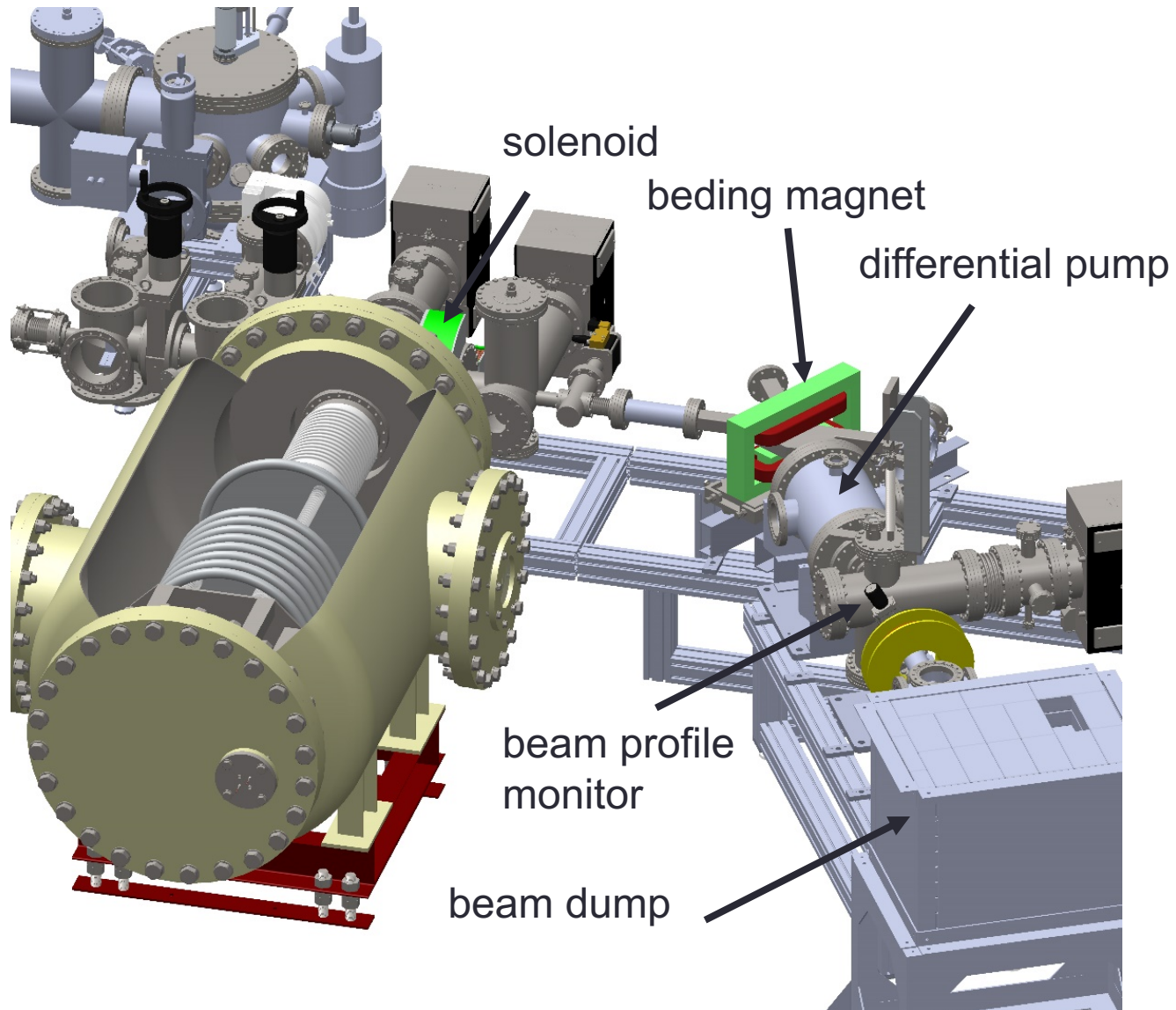
GaAs preparation system



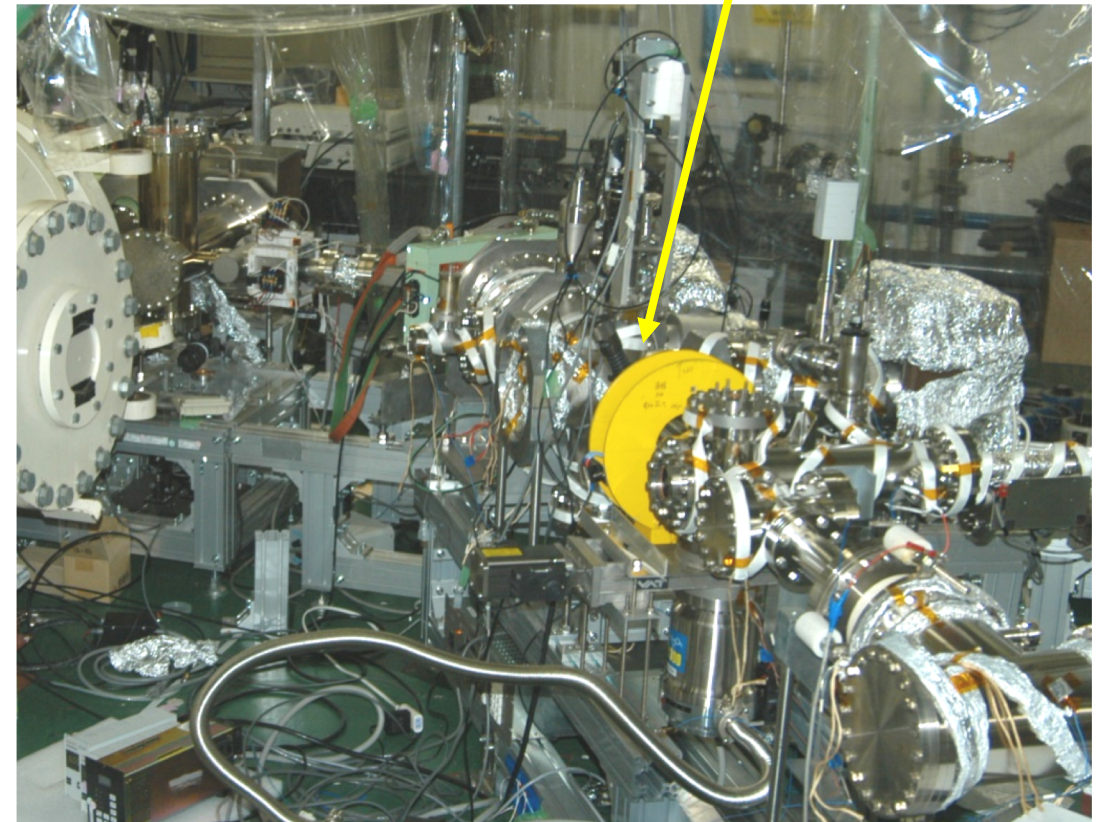
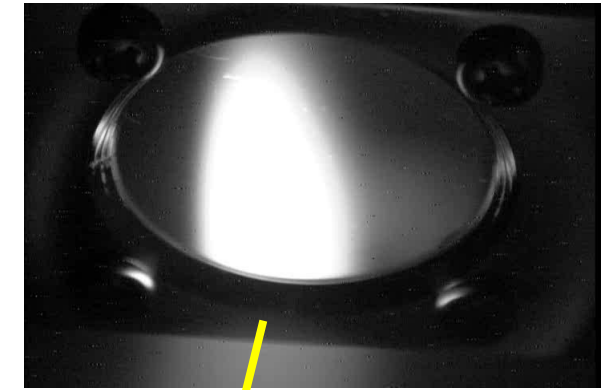
HV test with cathode electrode in place



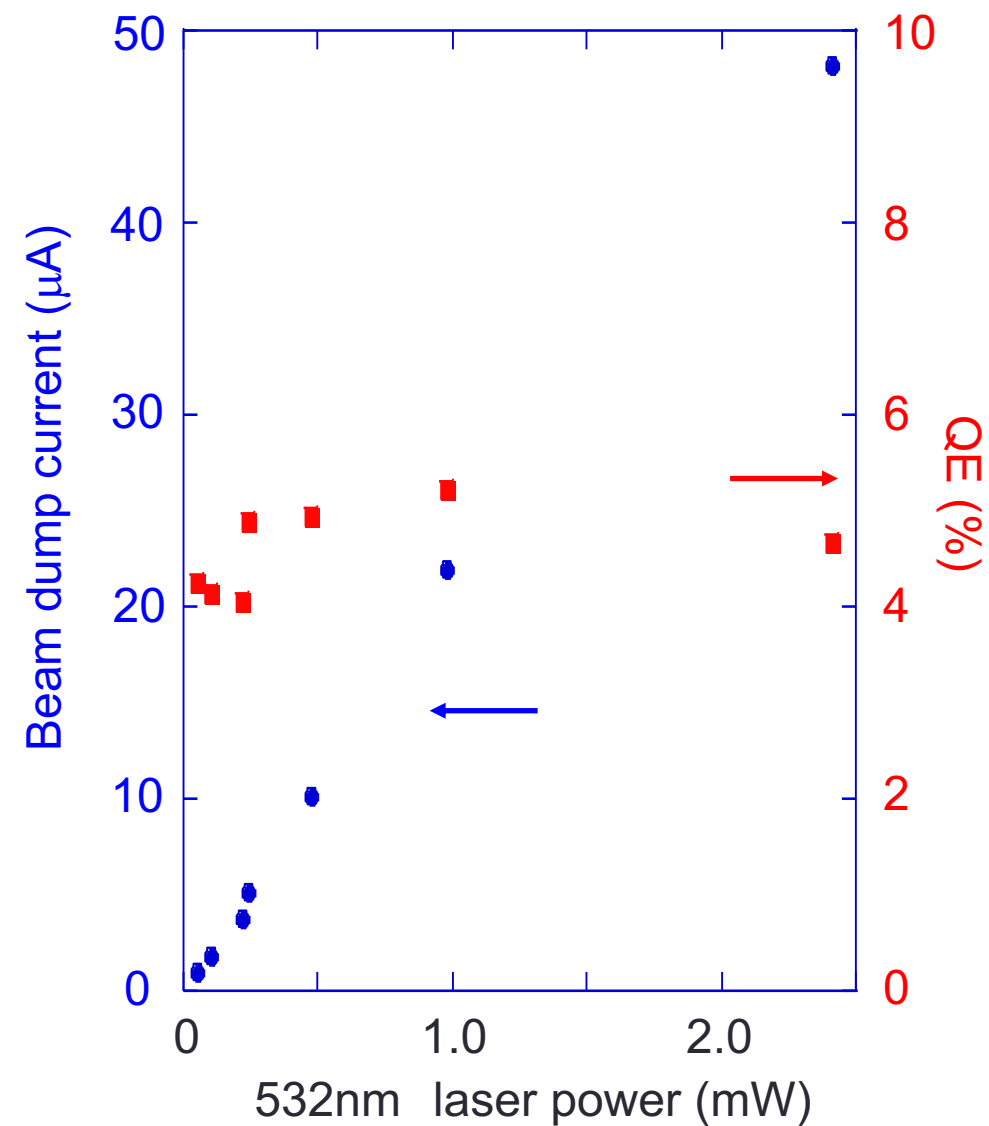
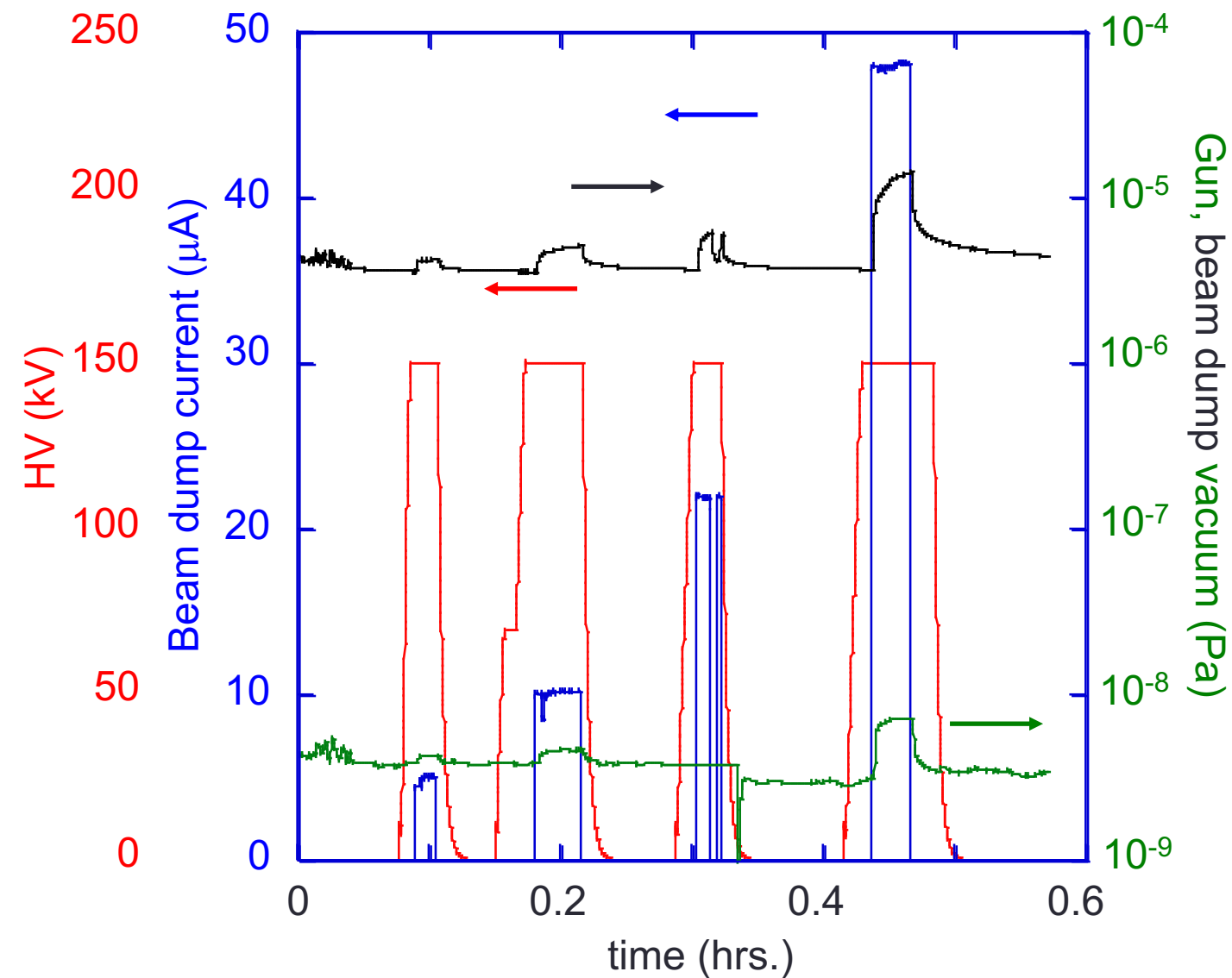
3. Beamline



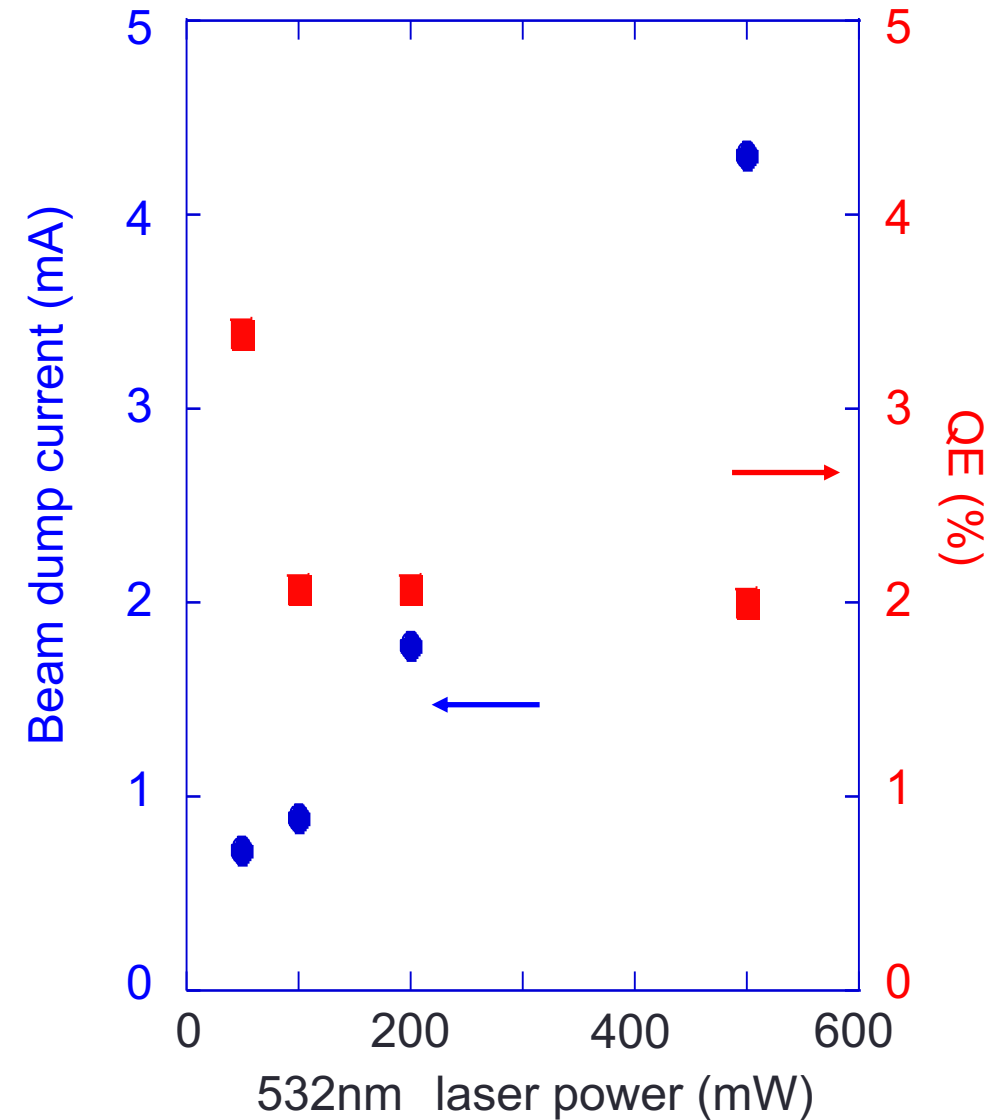
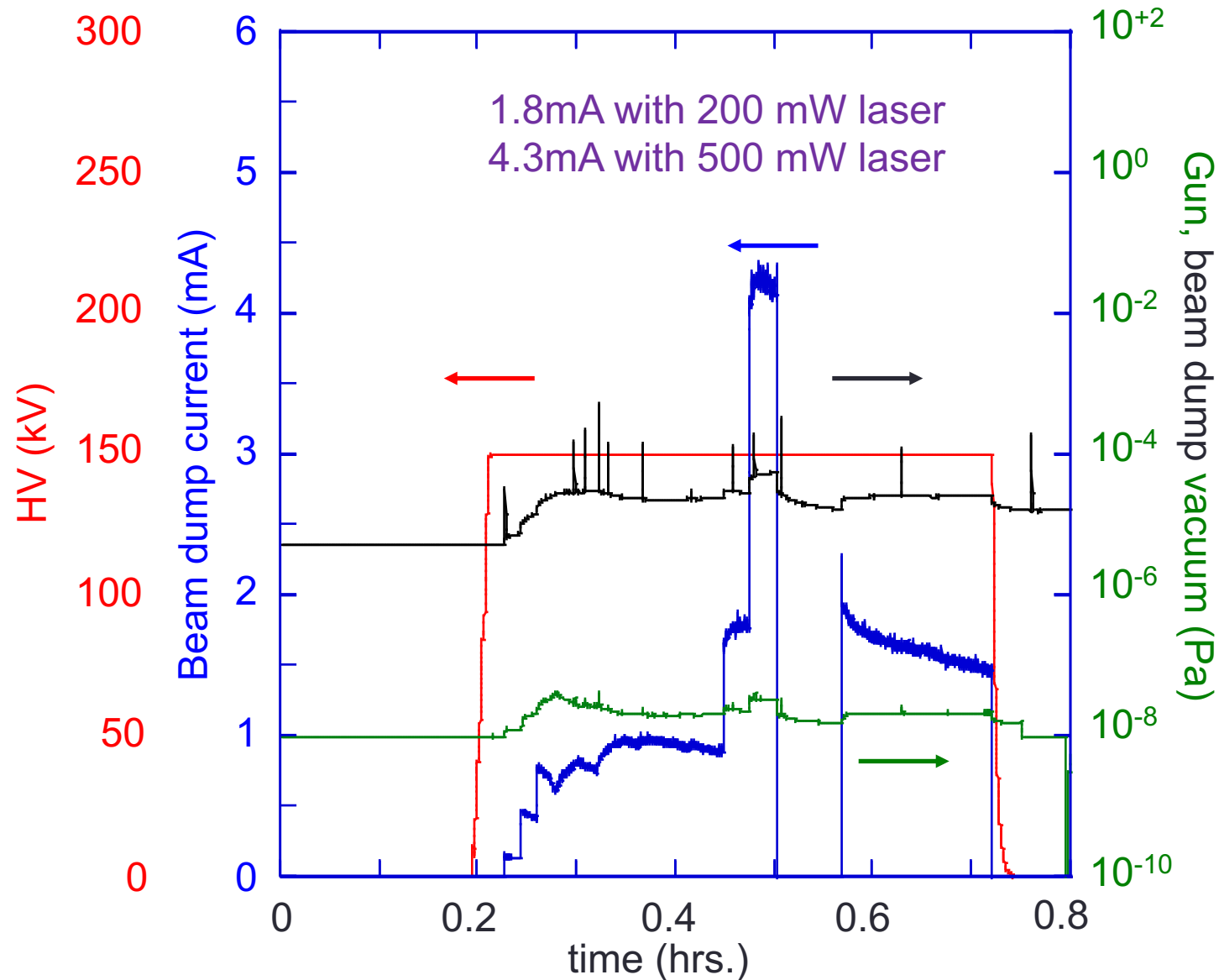
beam profile



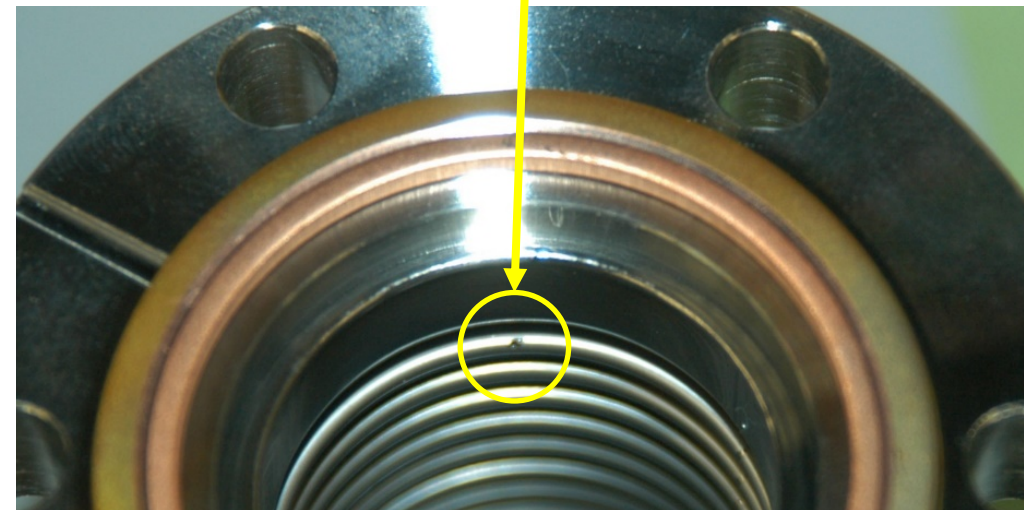
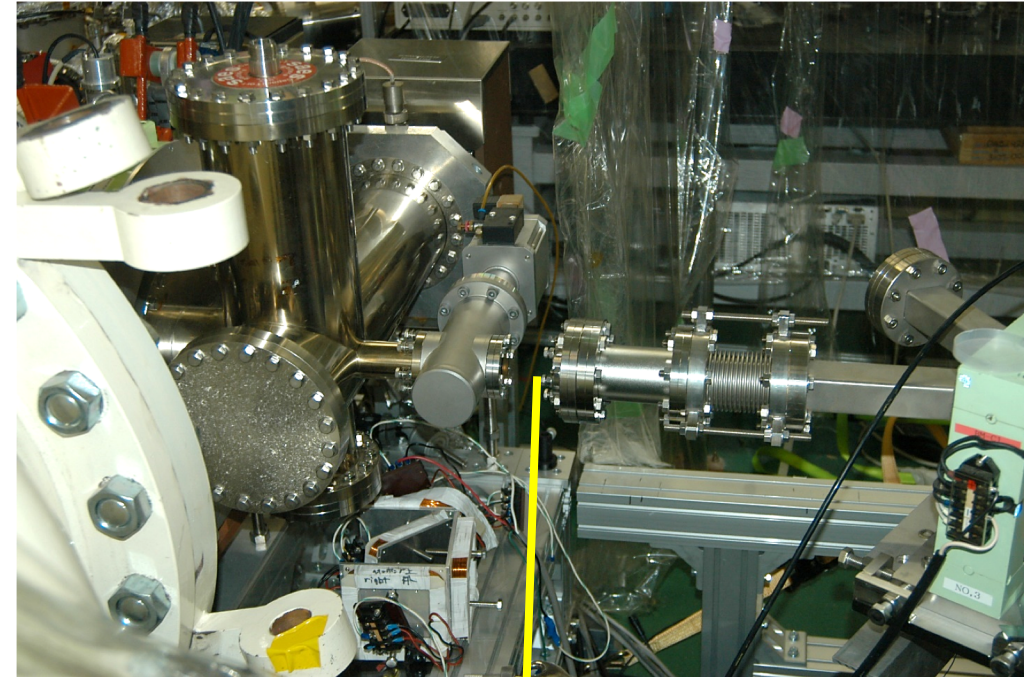
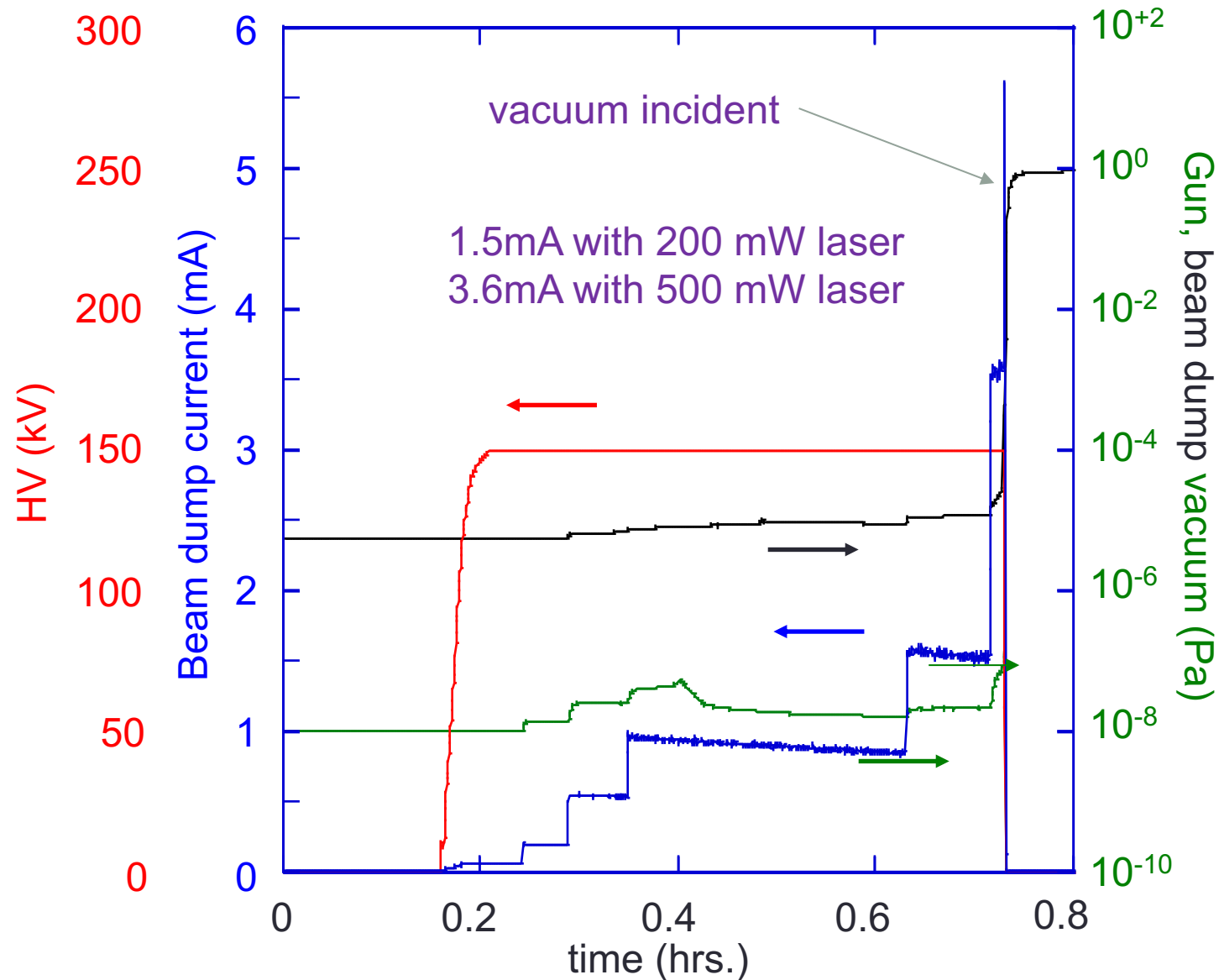
μA beam generation



mA beam generation



Vacuum incident during beam transport



Summary

- ✓ Fabricated Cs_3Sb photocathode with QE of 5 %.
- ✓ Generated 150kV - 4.3 mA beam from the photocathode.

Future work

- ❑ Fix the vacuum issue and perform baking, HV conditioning, photocathode fabrication to restart the gun development.

Acknowledgement

This work is partially supported by
JSPS Grants-in-Aid for Scientific Research in Japan (15K13412).