

Development of a multialkali photocathode DC gun for high current operation

Tohoku Univ.
QST

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Outline

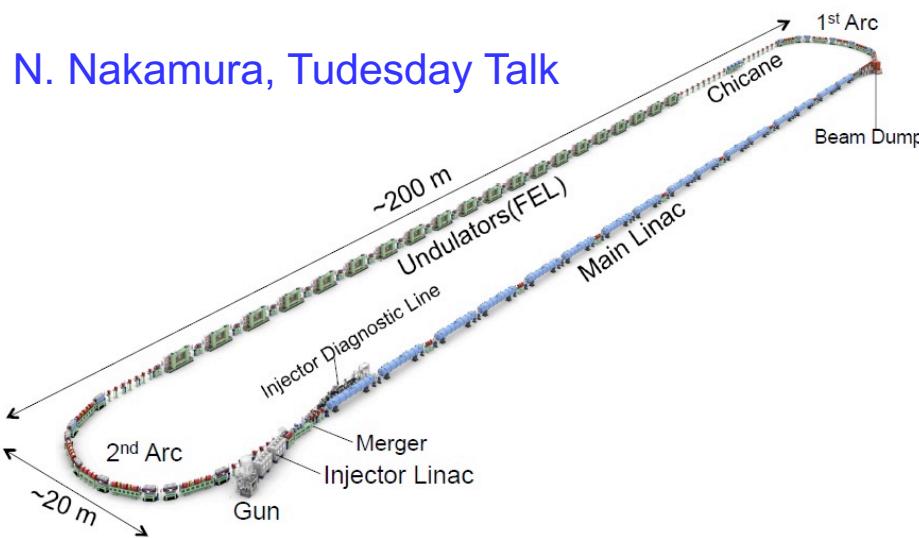
- Development of a photoemission DC gun at QST
- Fabrication of Cs_3Sb photocathode with QE of 5%
- mA beam generation from the gun
- Summary

Application of high current DC gun

800MeV ERL-FEL

- 10kW EUV light sources

N. Nakamura, Tudesday Talk



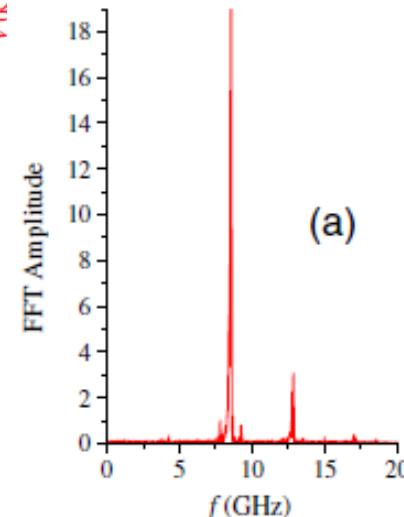
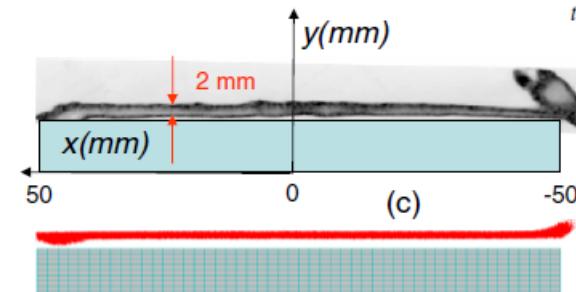
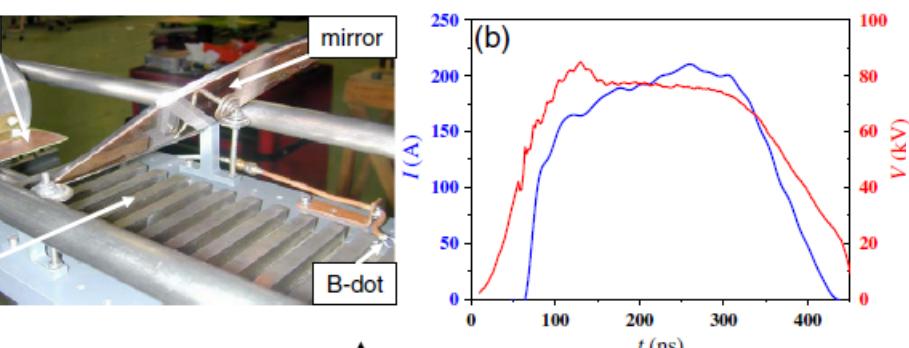
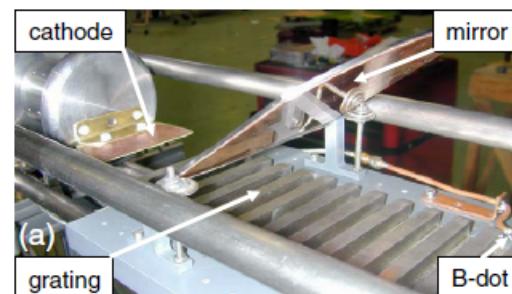
Injector specifications after merger

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

Smith-Purcell FEL

- Compact THz light source

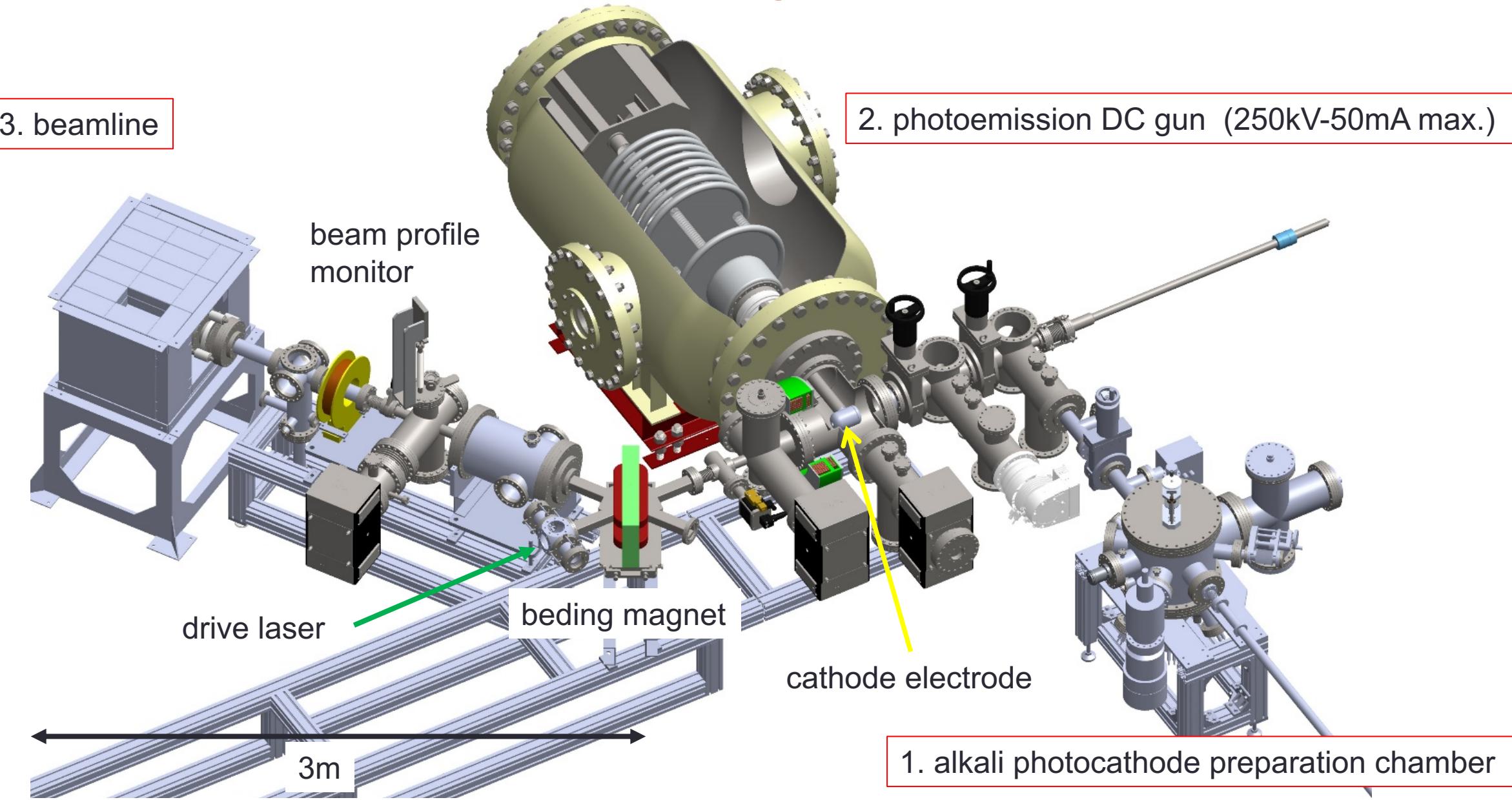
CEA-CESTA, France



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

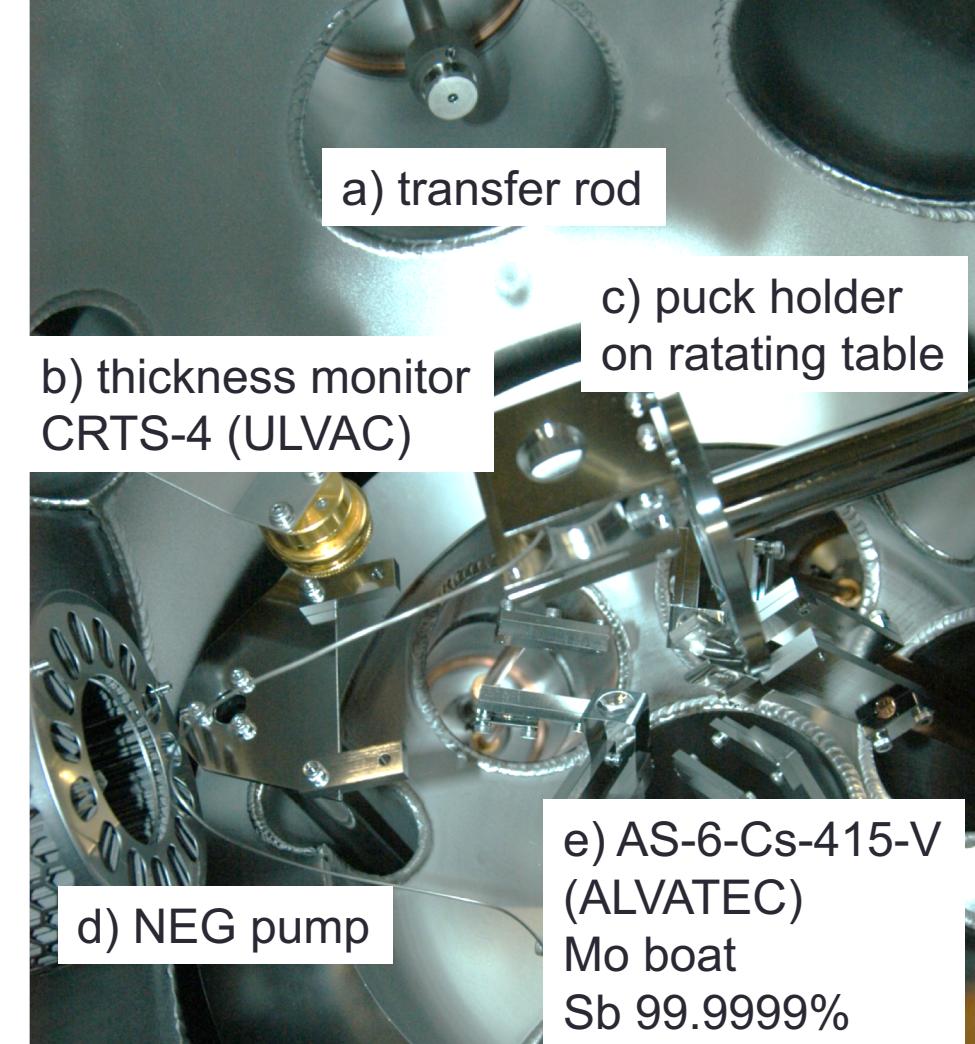
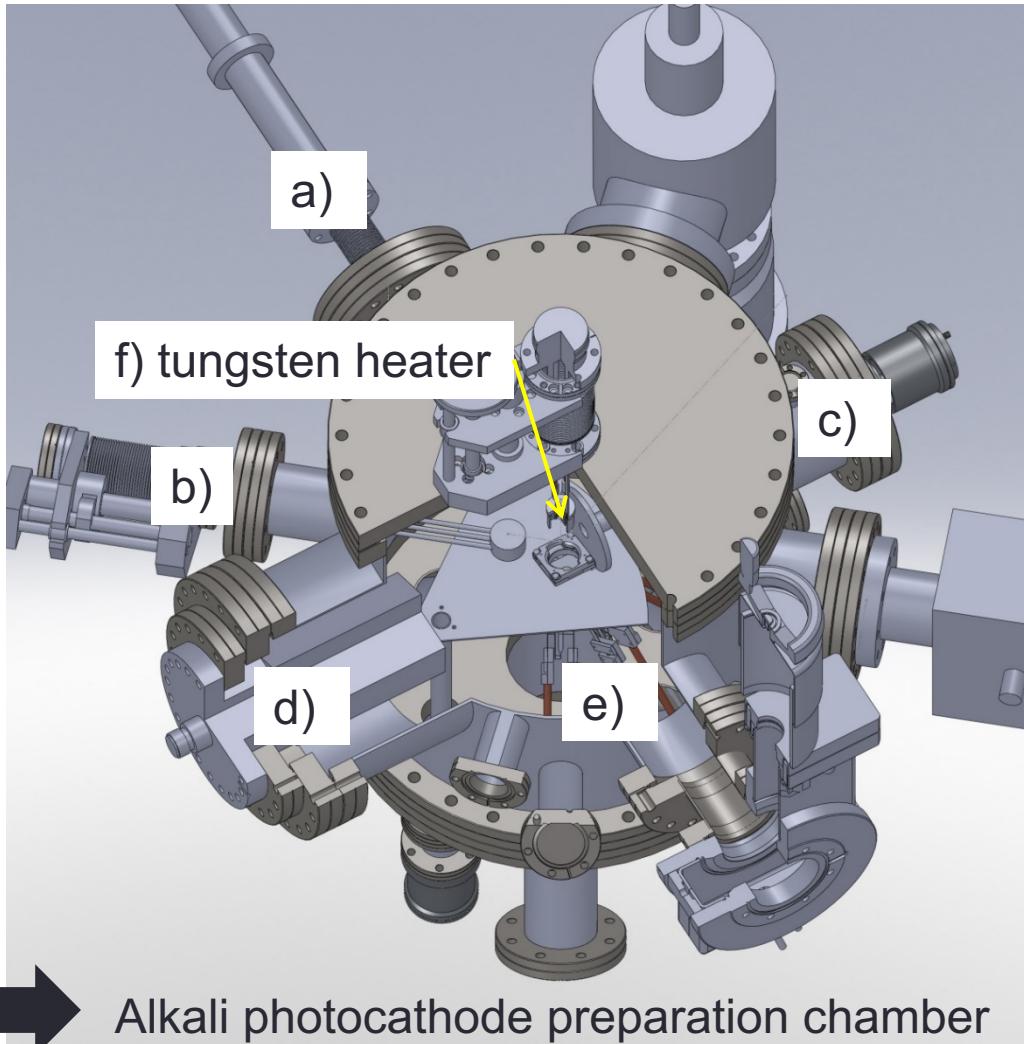
Development of a photoemission DC gun at QST



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

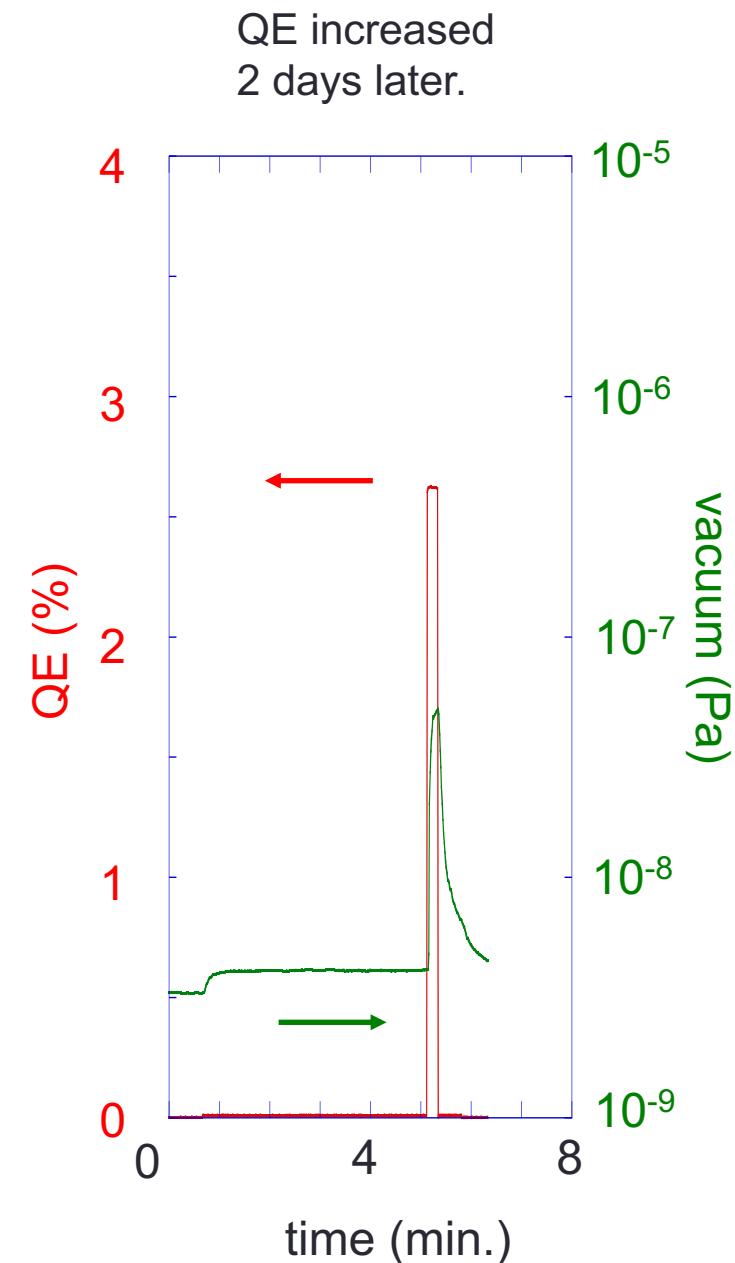
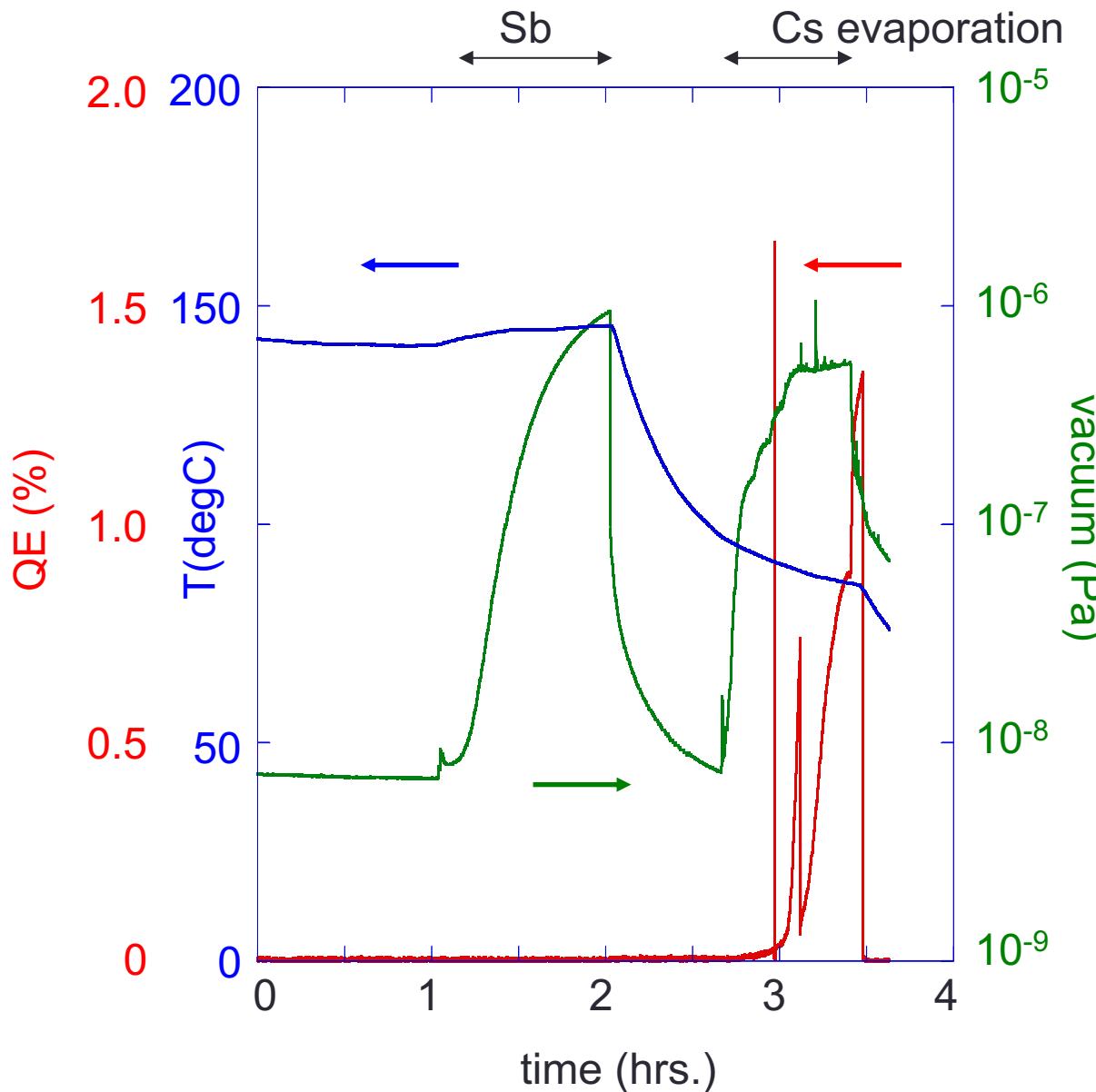
Follow Cornell's system,

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



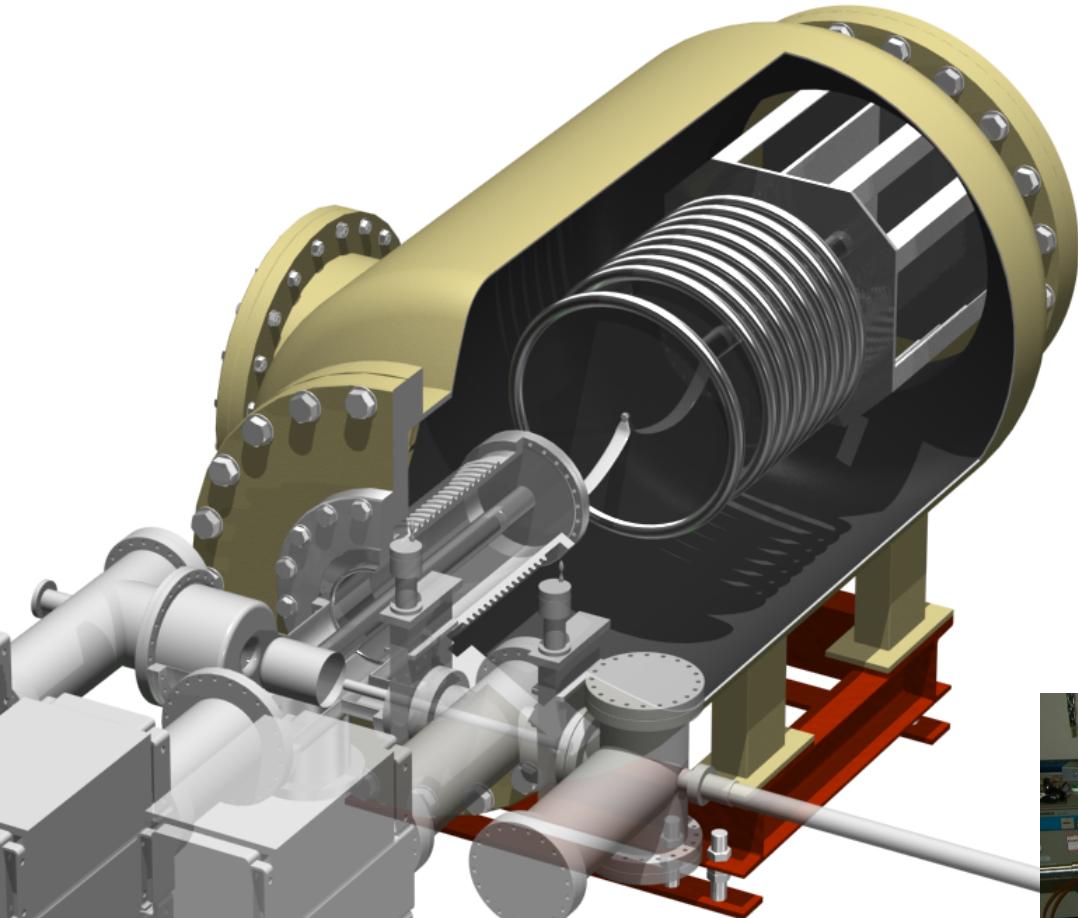
2. Development of a photoemission DC gun

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

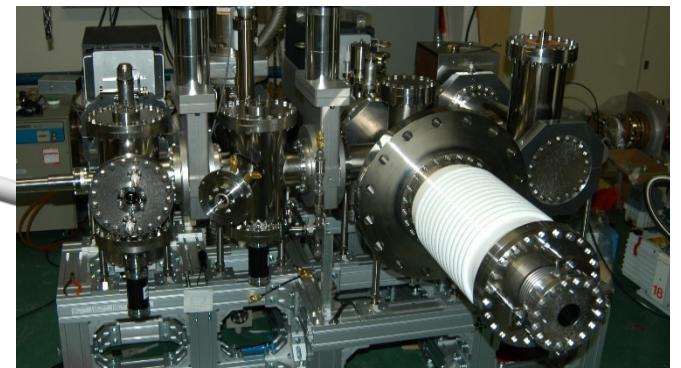
SF6 insulator gas tank



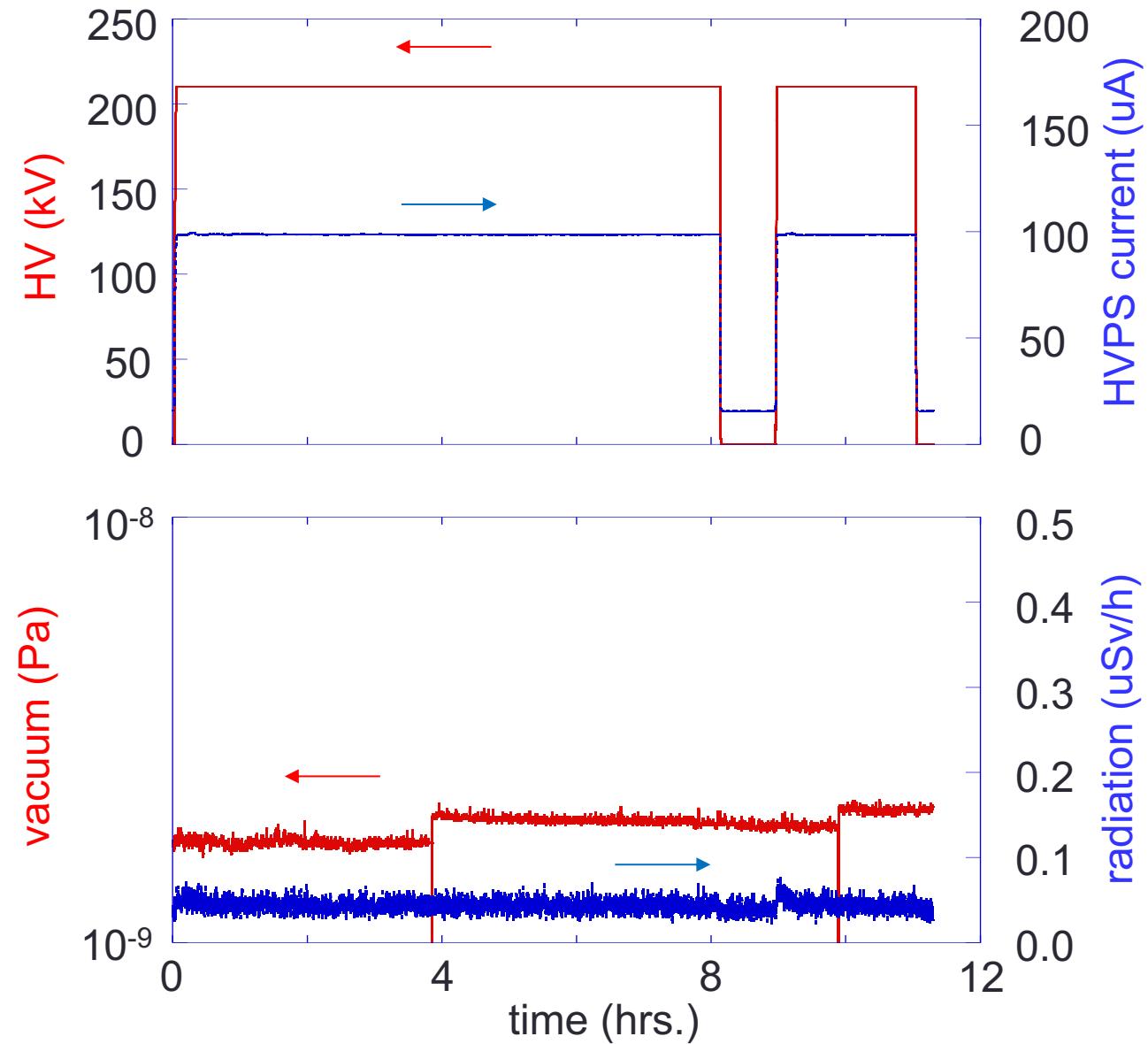
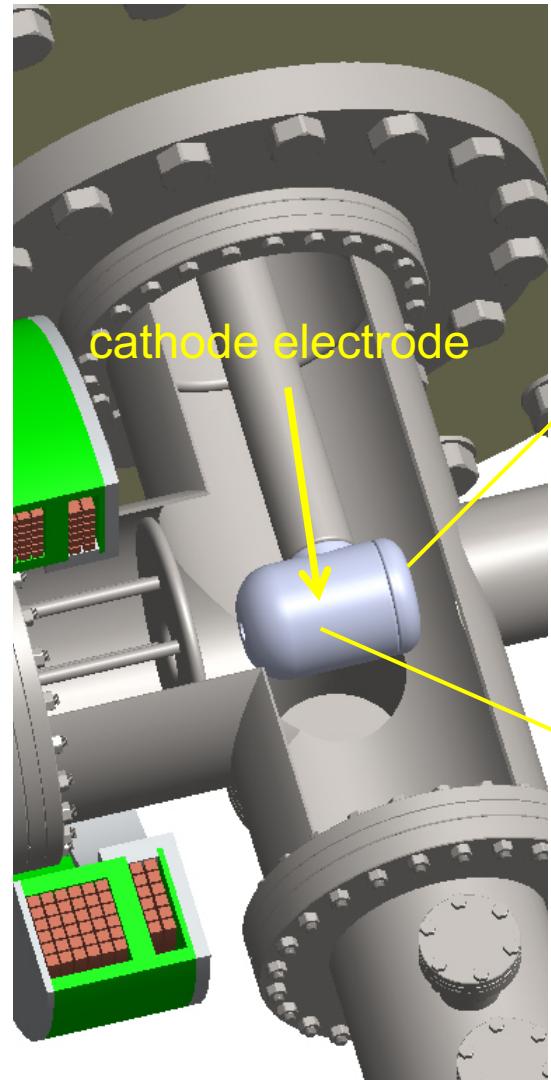
250kV-50 mA HV power supply



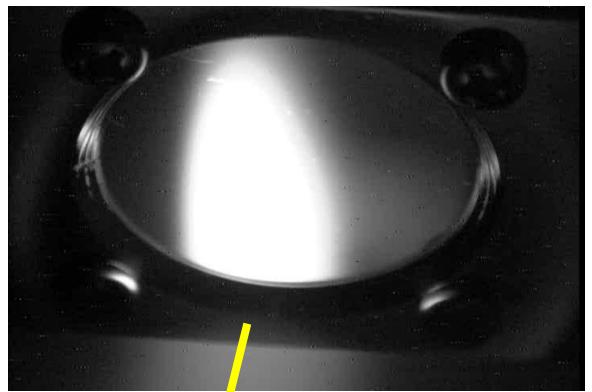
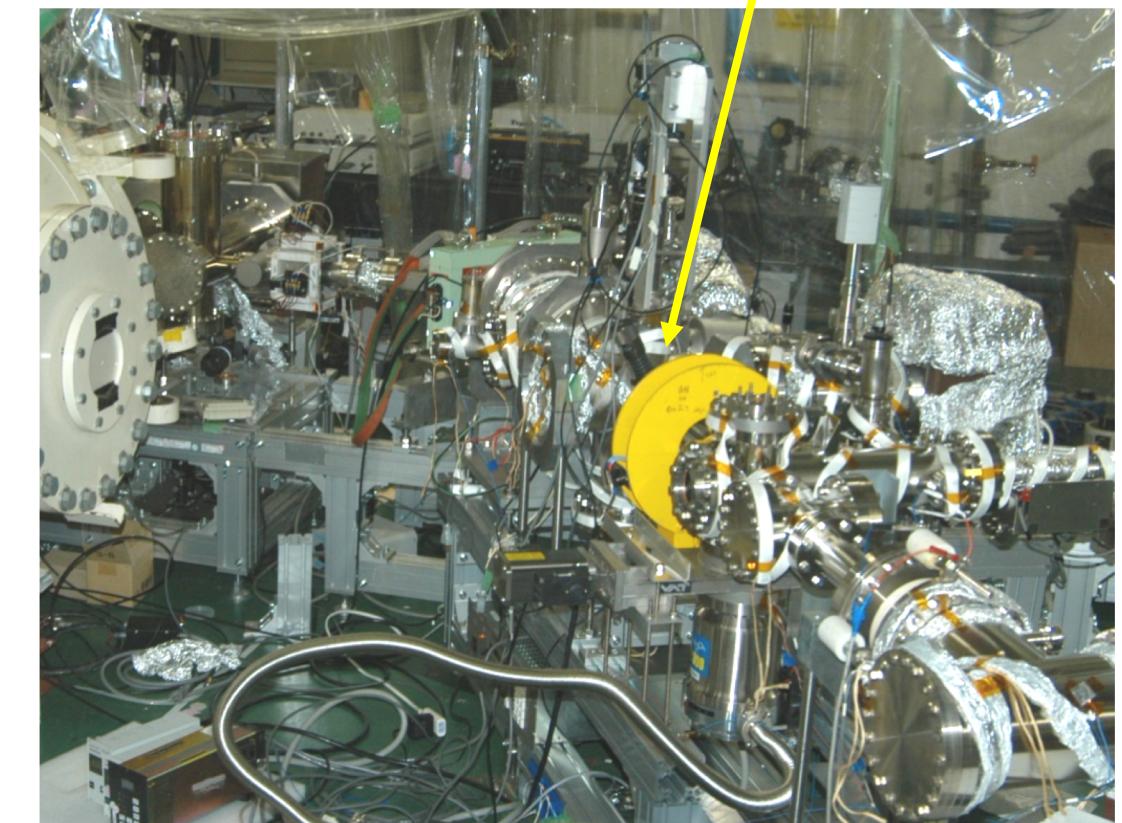
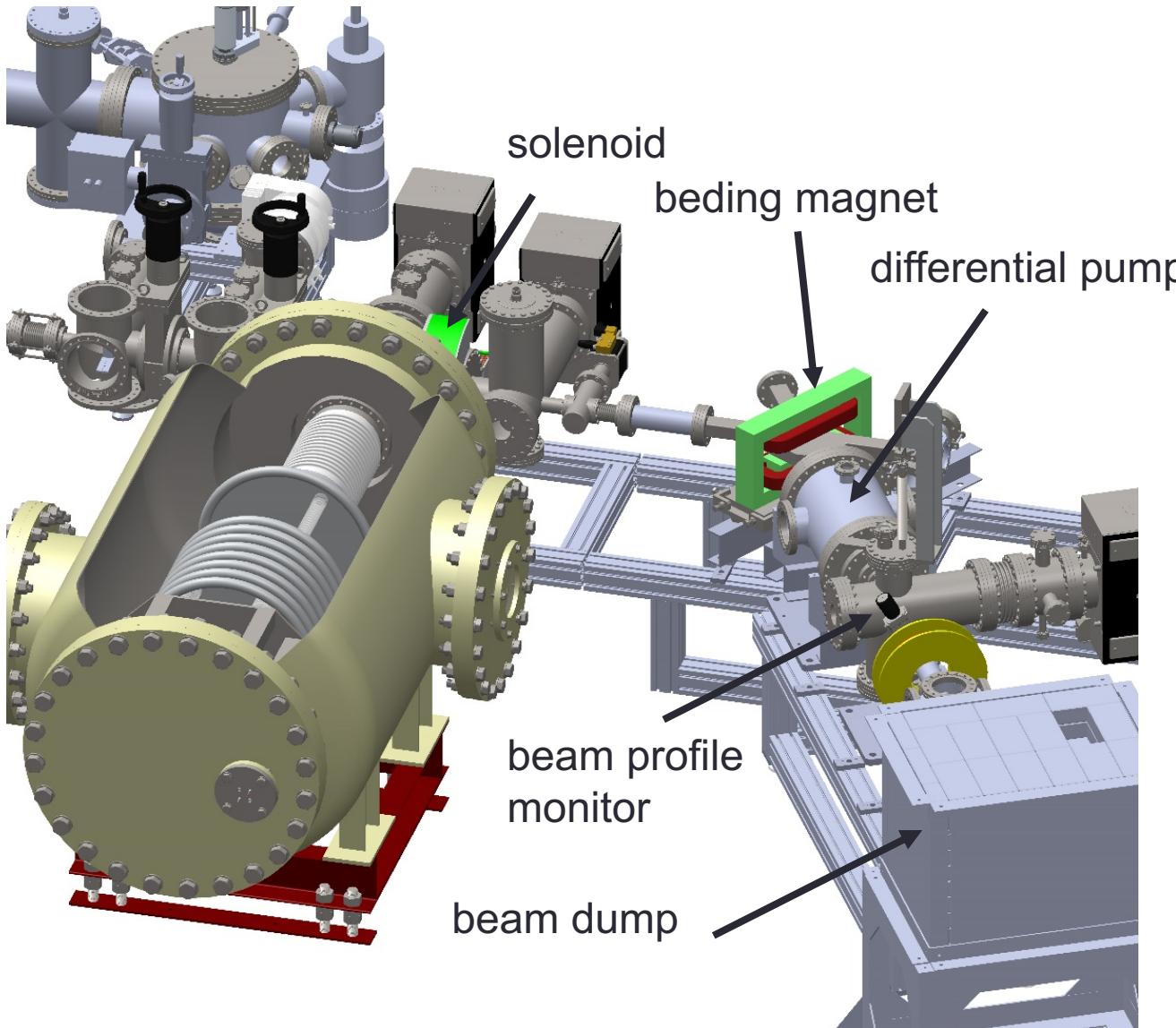
GaAs preparation system



HV test with cathode electrode in place

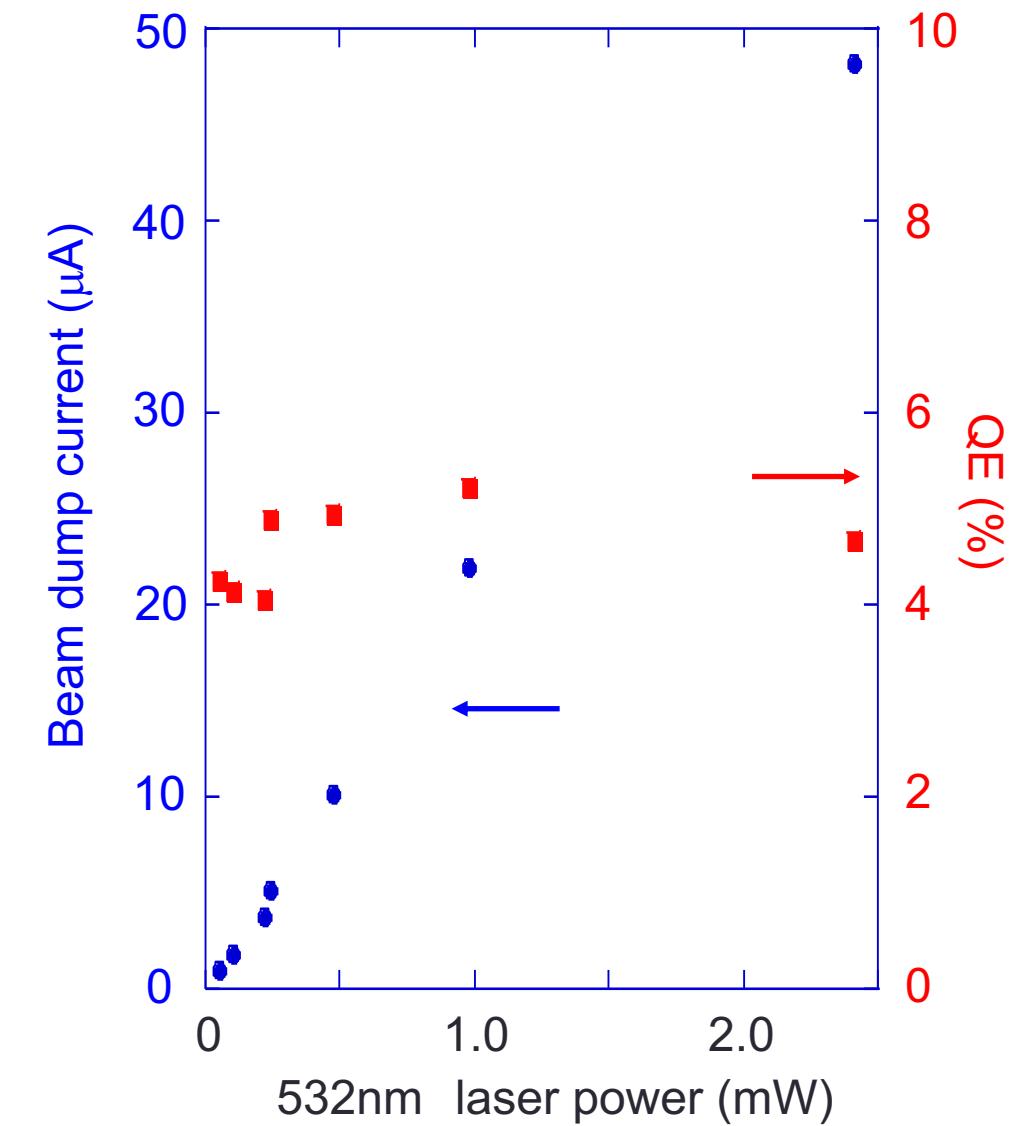
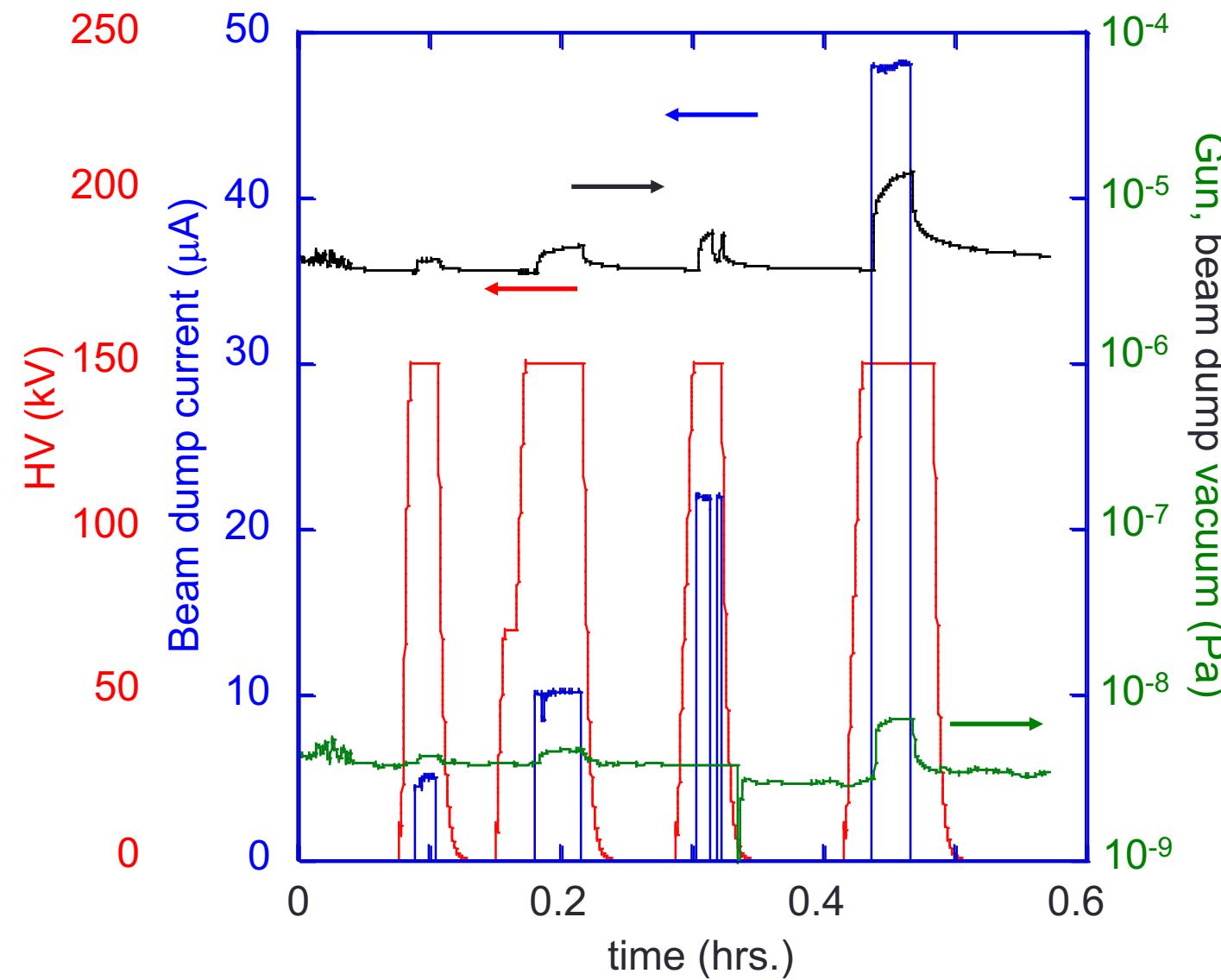


3. Beamline

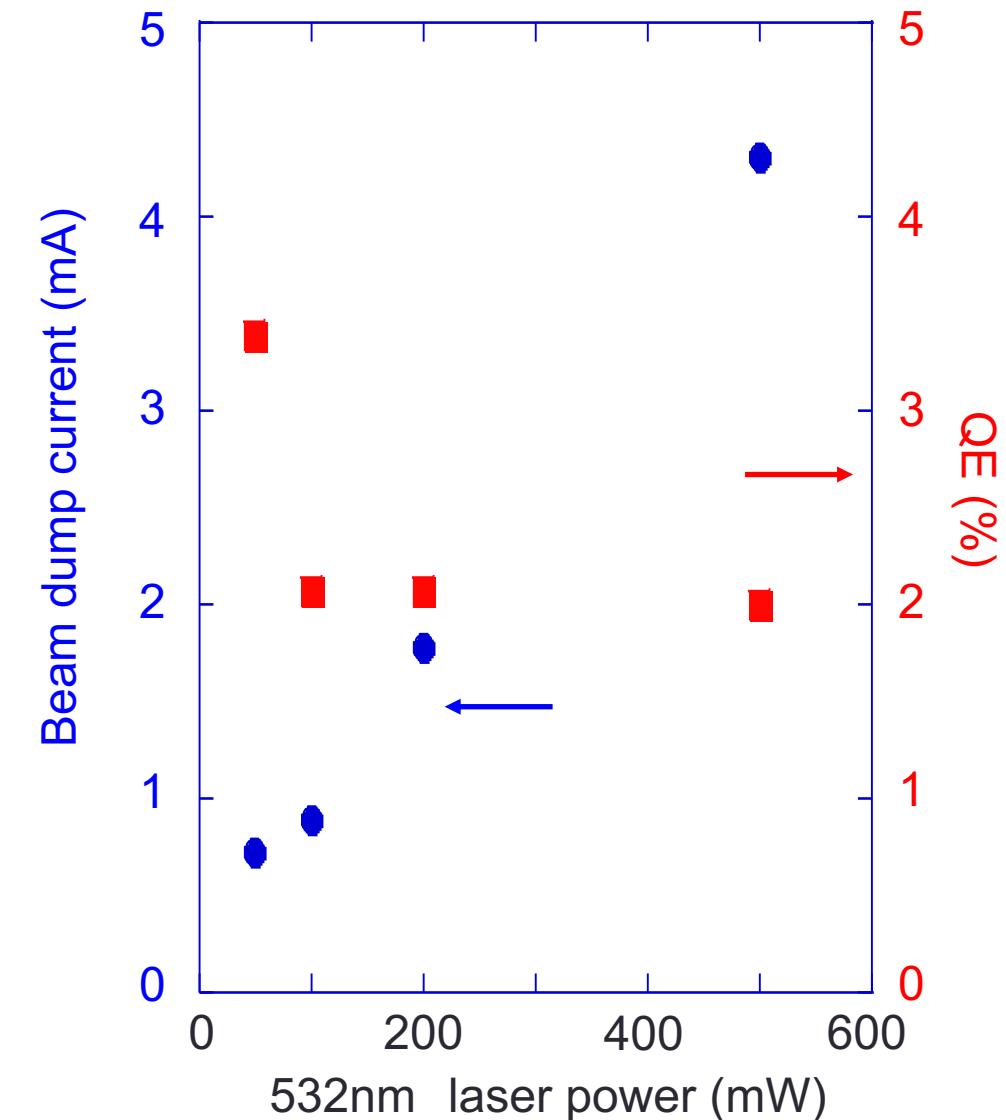
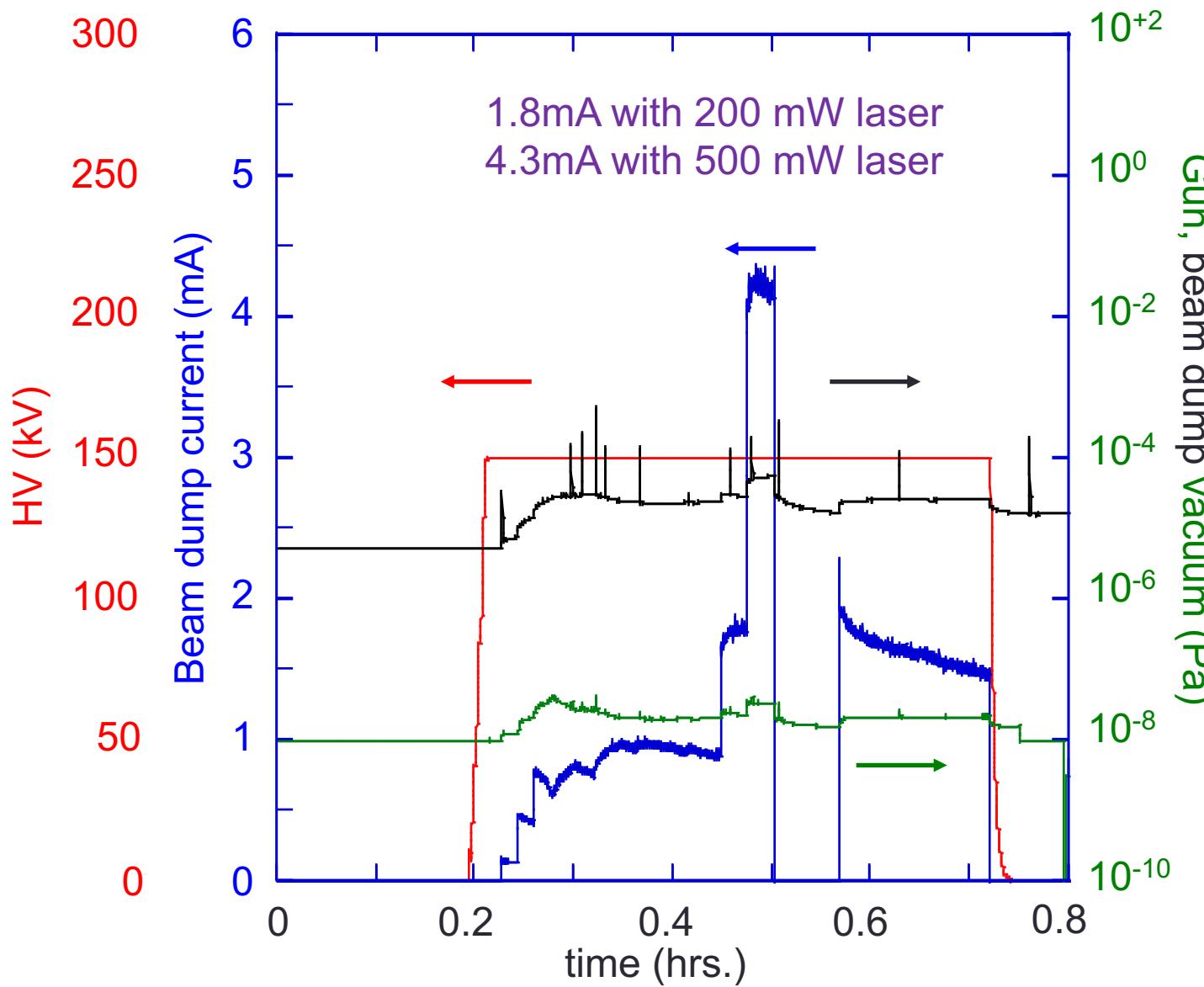


beam profile

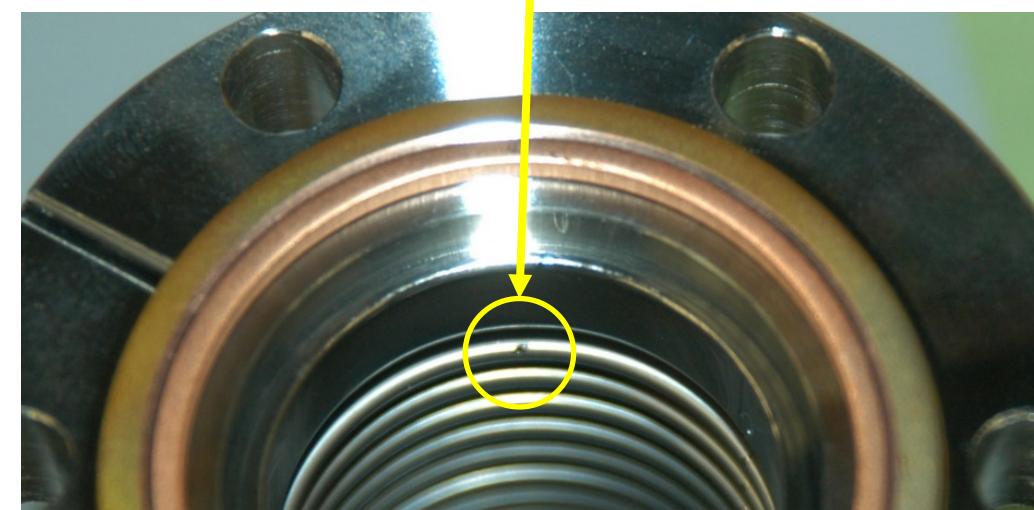
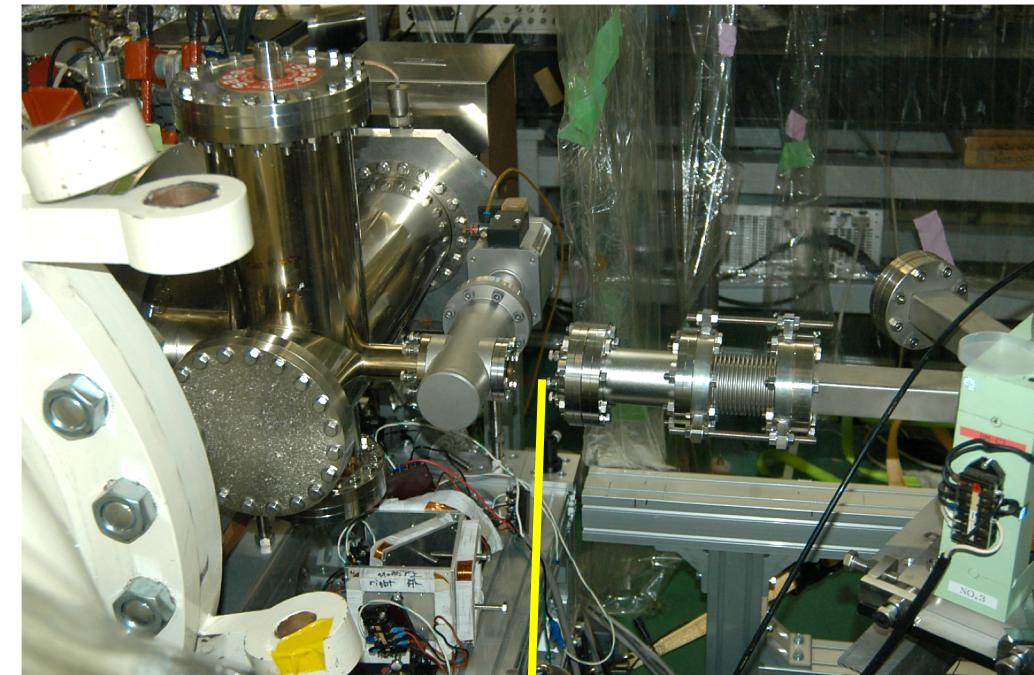
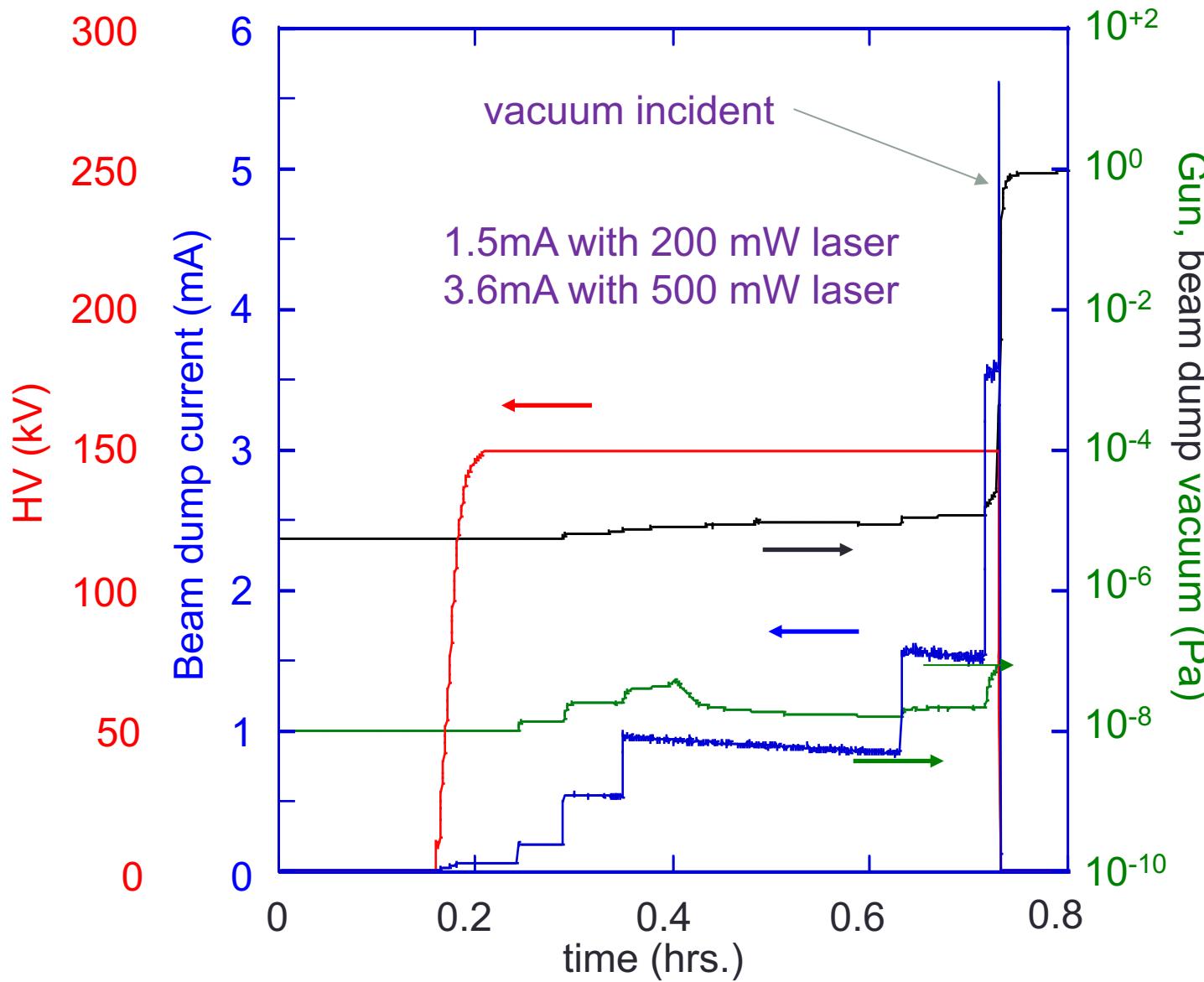
μA beam generation



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

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