IPAC2012
電子銃関連報告

広島大学　栗木雅夫

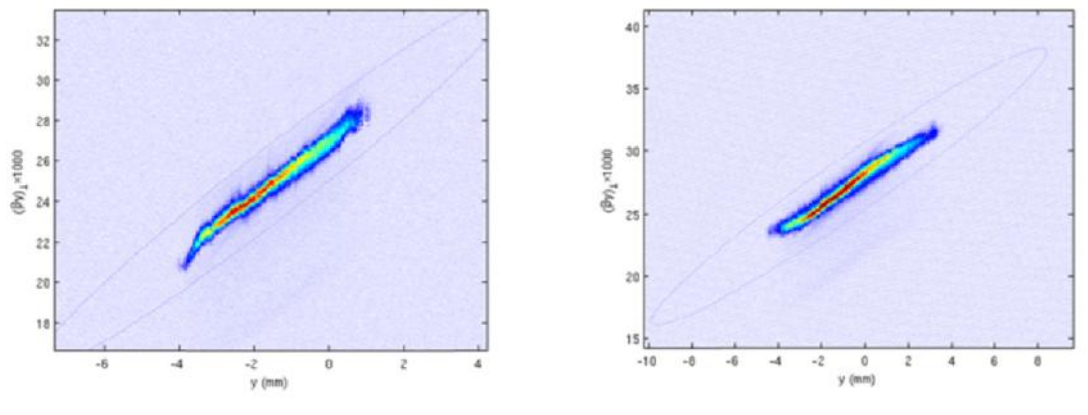
IPAC2012

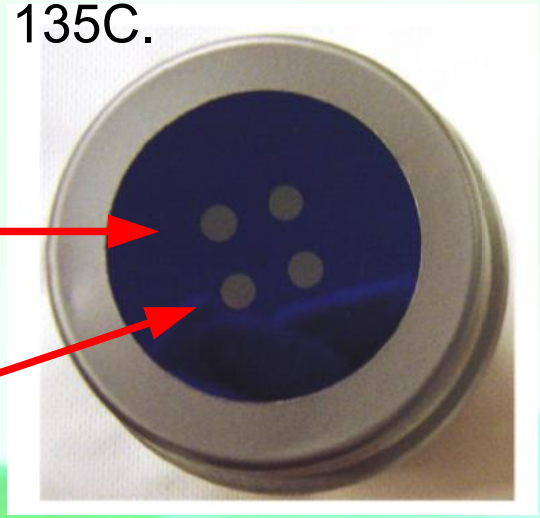
- IPAC2012 : 5/21-25(main session) in Ernest N. Morial Convention Center, New Orleans, Louisiana.
- Number of abstract submission ~ 1500.
- Many on FELs (78) and LHC(129).
- Followed by ERL(39), THz (39), Laser Compton (29).
- SRF Gun activity is much increased.
- Only articles provided by pre-press version are covered.

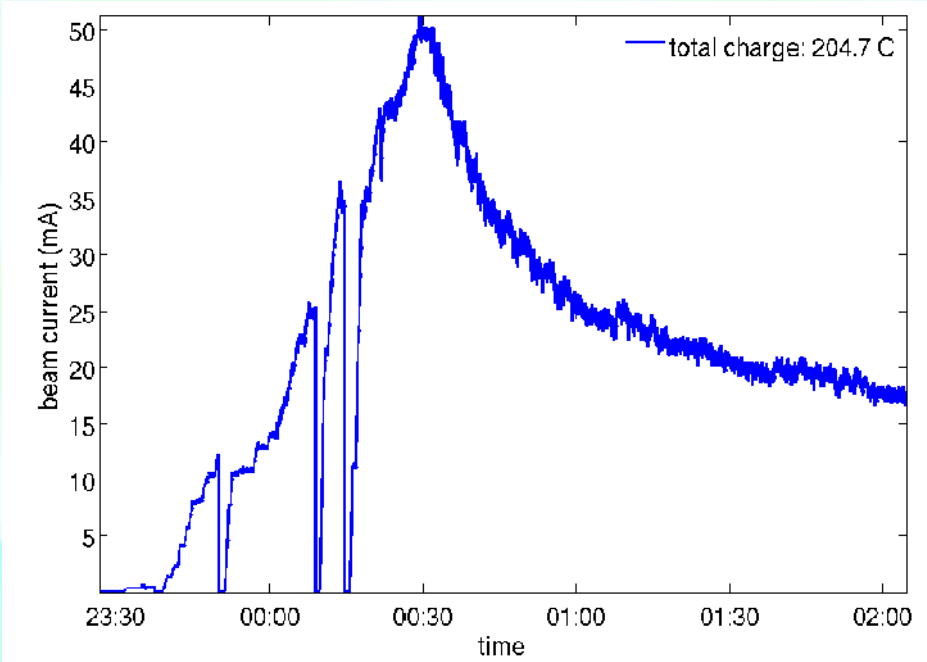
PERFORMANCE OF THE CORNELL HIGH-BRIGHTNESS, HIGH-POWER ELECTRON INJECTOR

B. Dunham, A. Bartnik, I. Bazarov, L. Cultrera, J. Dobbins, C. Gulliford, G. Hoffstaetter, R. Kaplan, S. Karkare, V. Kostroun, H. Li, Y. Li, M. Liepe, X. Liu, F. Loehl, J. Maxson, P. Quigley, D. Rice, E. Smith, K. Smolenski, M. Tigner, V. Veshcherevich and Z. Zhao,
CLASSE, Cornell University, Ithaca, NY 14853, USA

- Cornell demonstrates both high brightness and high power beam generation as titled.
  - 0.4μm @20pC
  - 50mA operation was achieved (still few minutes, but a record).
  - 1/e life ~1.5h / 135C.

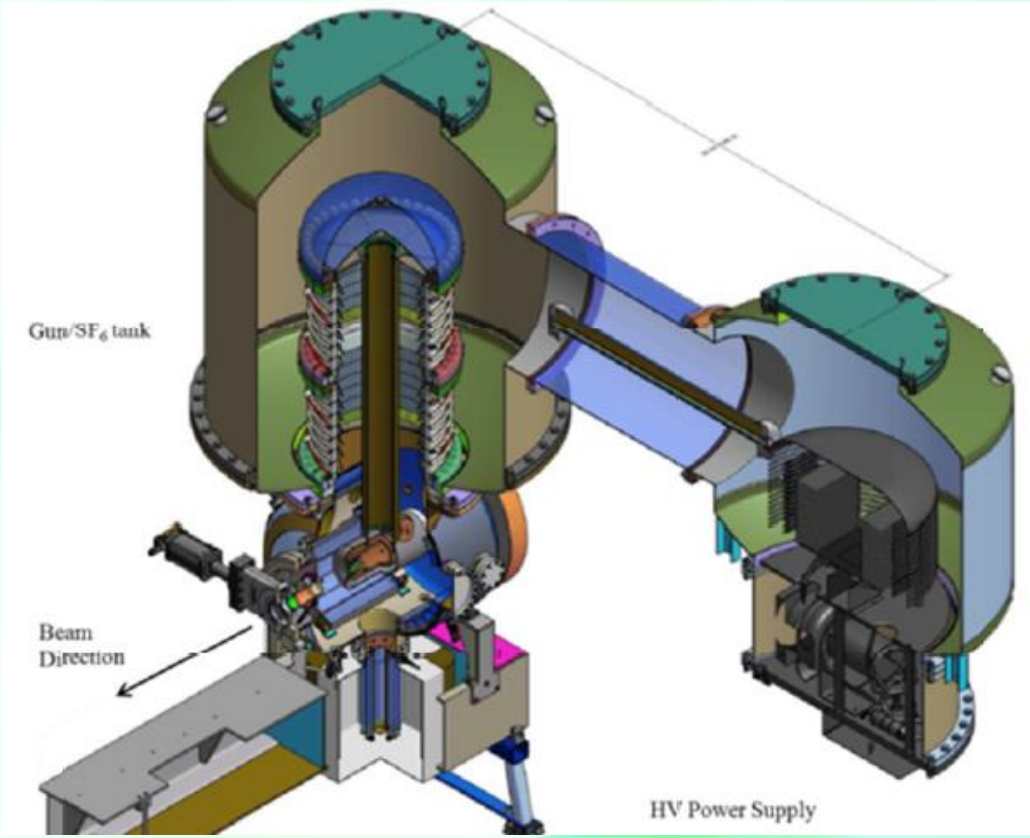






- Still behind on HV, but catching up with us.
- The monolithic insulator will be replaced with a segmented type ceramic with guard rings.
- Is this our dead-copy? Absolutely NO.
  - The diameter is increased in order to reduce the maximum field in the gun to 10MV/m at 750kV, 6.7MV/m at 500kV.
  - They might overtake us soon.

Future shape

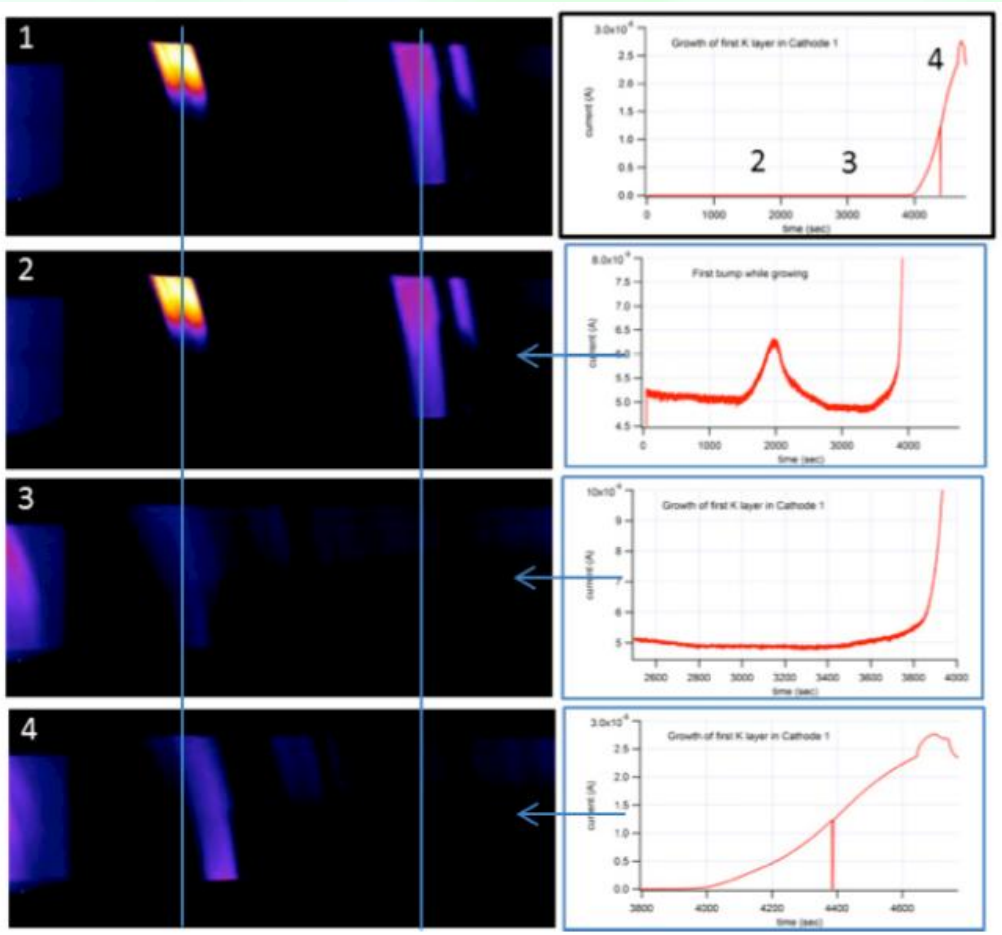


MOPPP049

DEPOSITION AND *IN-SITU* CHARACTERIZATION OF ALKALI ANTIMONIDE PHOTOCATHODES

X. Liang, M. Ruiz-Osés, I. Ben-Zvi, Stony Brook University, Stony Brook, NY, USA
J. Smedley, K. Attenkofer, Brookhaven National Laboratory, Upton, NY, USA
T. Vecchione, H. Padmore, Lawrence Berkeley National Laboratory, Berkley, CA, USA
S. Schubert, Helmholtz-Zentrum Berlin, Berlin, Germany

- Multi-alkali cathode development by observing structure and chemical composition during growth by XRR, XRD, XPS, XRF.
- Growth on Si(100) sequentially by Sb (100C), K(140C), and Cs(130C) .
- 2.7-3.7% QE at 532nm.
- Sb crystal structure is once disappeared and replaced by alkali structure.
- QE is increased when Sb diffraction is blurred.

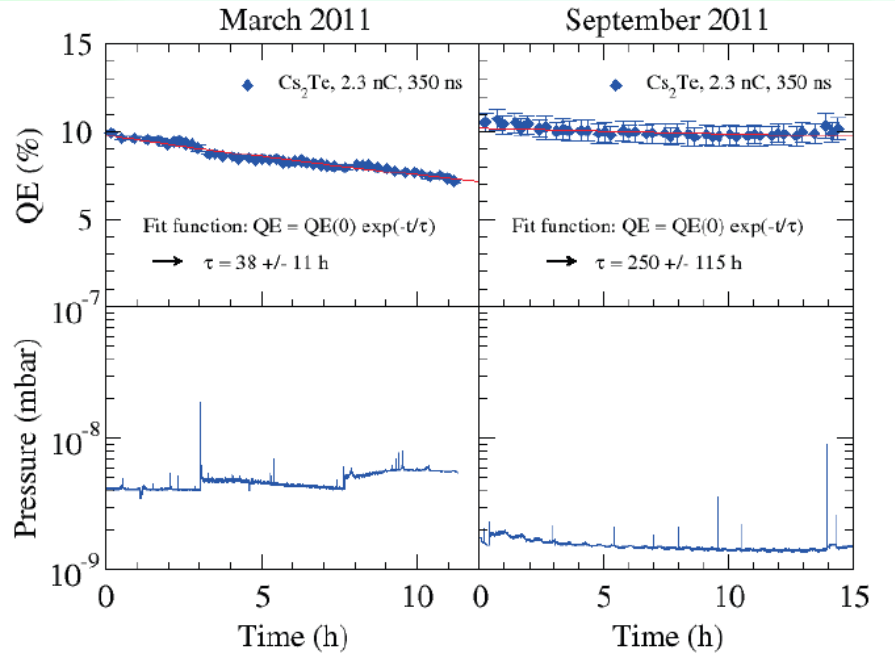


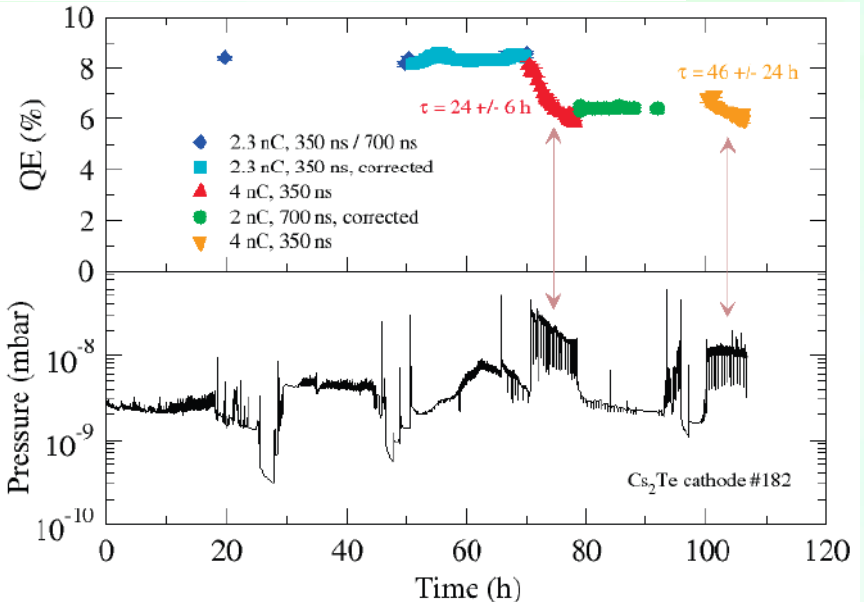
TUPPD066

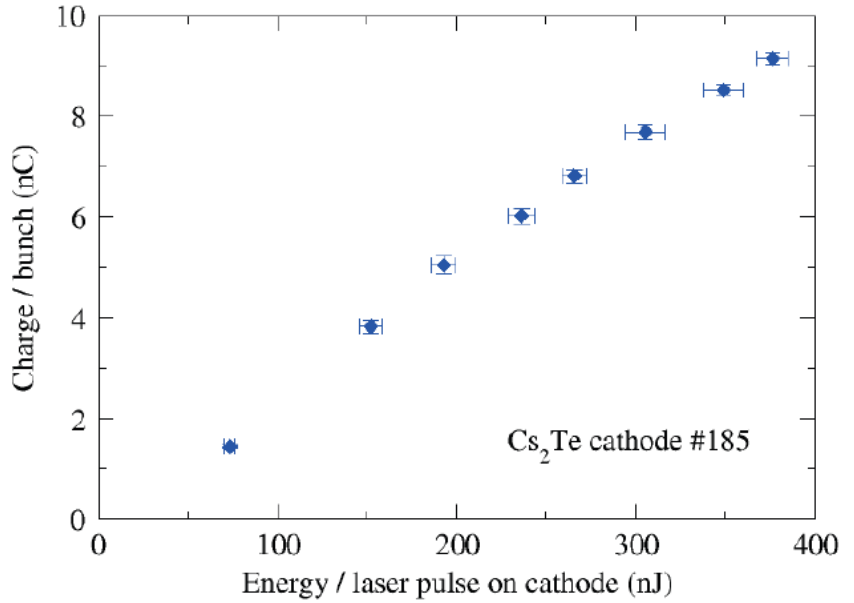
LIFETIME STUDIES OF Cs_2Te CATHODES AT THE PHIN RF PHOTOINJECTOR AT CERN

C. Hessler, E. Chevallay, M. Divall Csatari, S. Doebert, V. Fedosseev,
CERN, Geneva, Switzerland

- Cs_2Te cathode lifetime study for CLIC drive beam.
- It strongly depends on pressure.



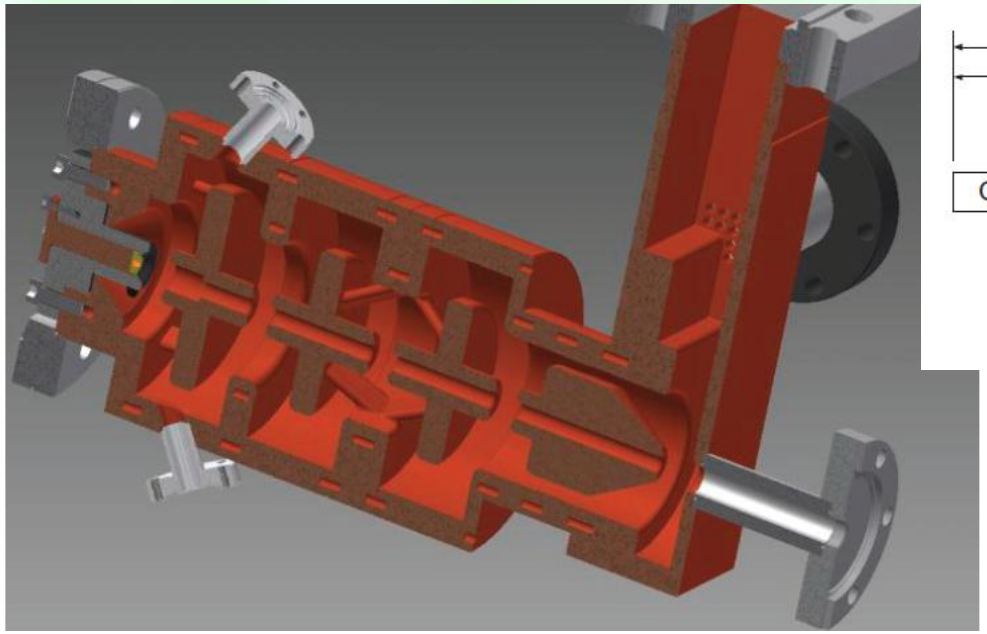


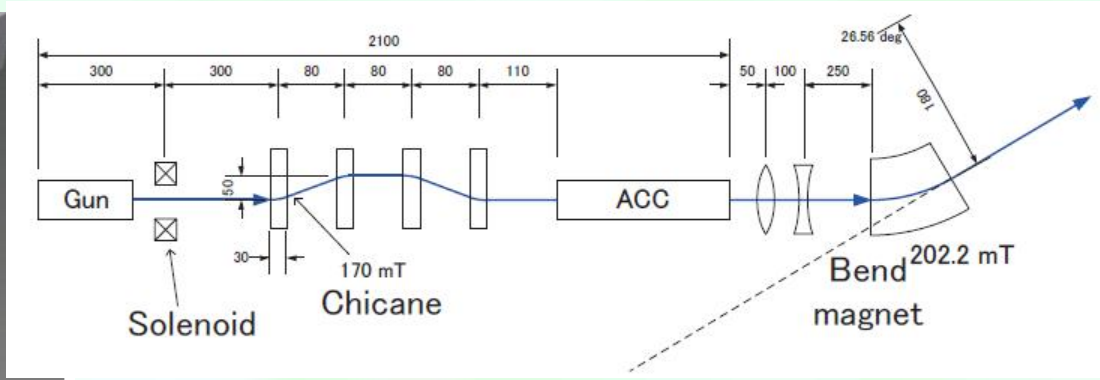


TUPPD057

HIGH CHARGE LOW EMITTANCE RF GUN FOR SUPERKEKB

Takuya Natsui #, Mitsuhiro Yoshida, Xiangyu Zhou, Yujiro Ogawa
High Energy Accelerator Research Organization (KEK)
1-1 Oho, Tsukuba, Ibaraki 305-0801 Japan





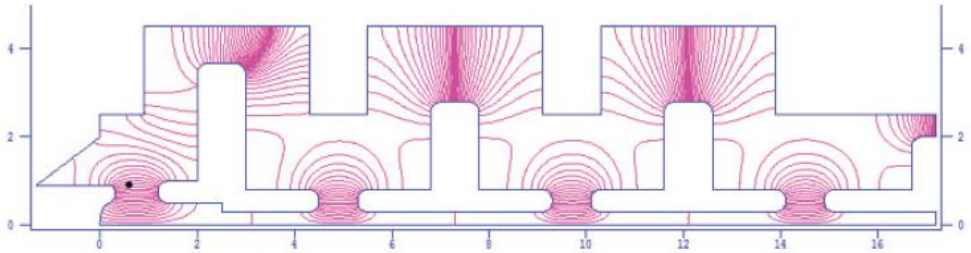


Figure 3: 2D resonant mode calculation (E-field).

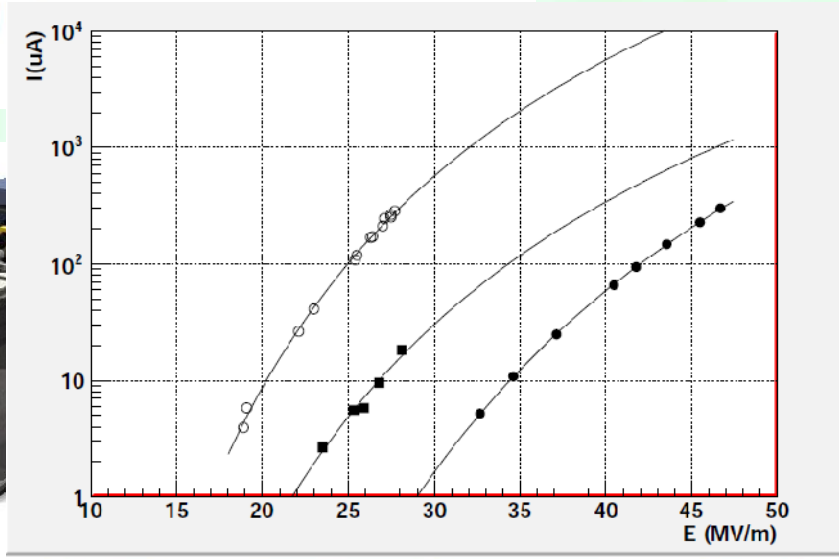
3.0nC beam was generated
With Ir_5Ce cathode.

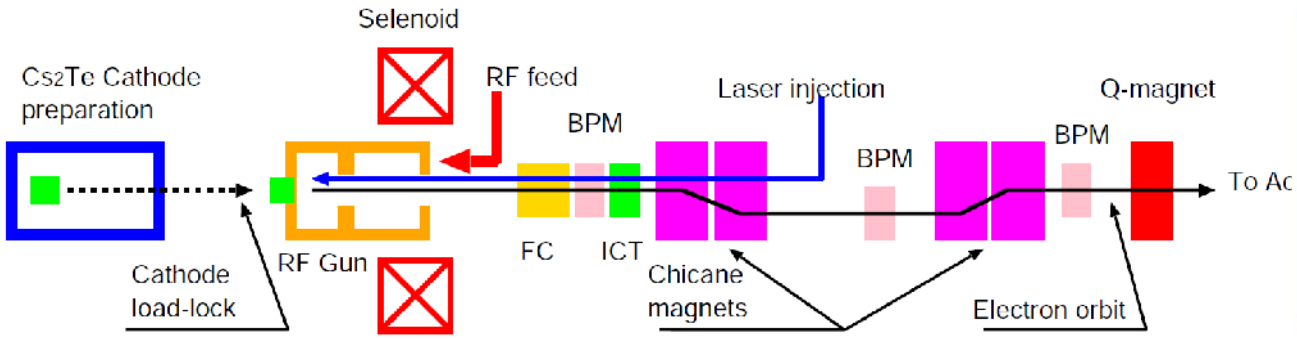
TUPPD034

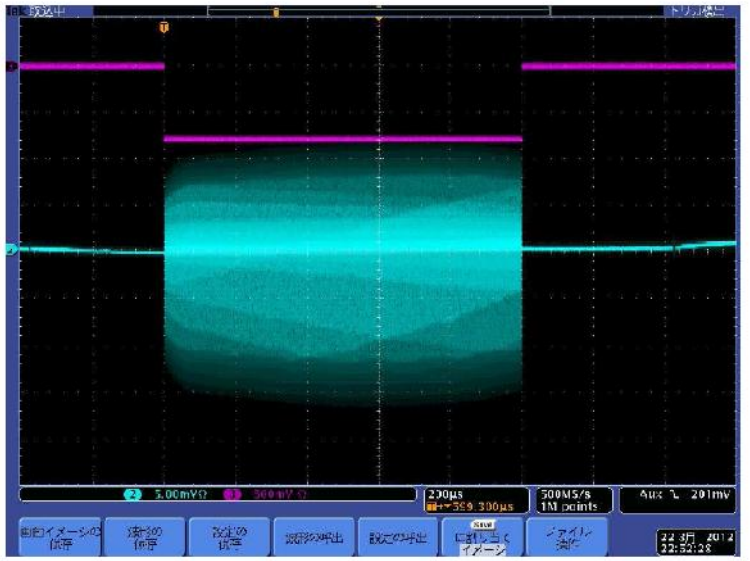
Multi-bunch Beam Generation by Photo-cathode RF Gun for KEK-STF*

M. Kuriki†, H. Iijima, S. Hosoda, HU/AdSM, Higashihiroshima
K. Kawase, G. Isoyama, R. Kato, ISIR, Osaka
K.Watanabe, H.Hayano, H. Sugiyama, J. Urakawa,KEK, Tsukuba
A. Kuramoto, Y. Takahashi, Sokendai, Hayama
S. Kashiwagi, Tohoku U., Sendai
K. Sakaue,RISE, Tokyo

1ms, 10mA beam was generated
By the L-band RF Gun.



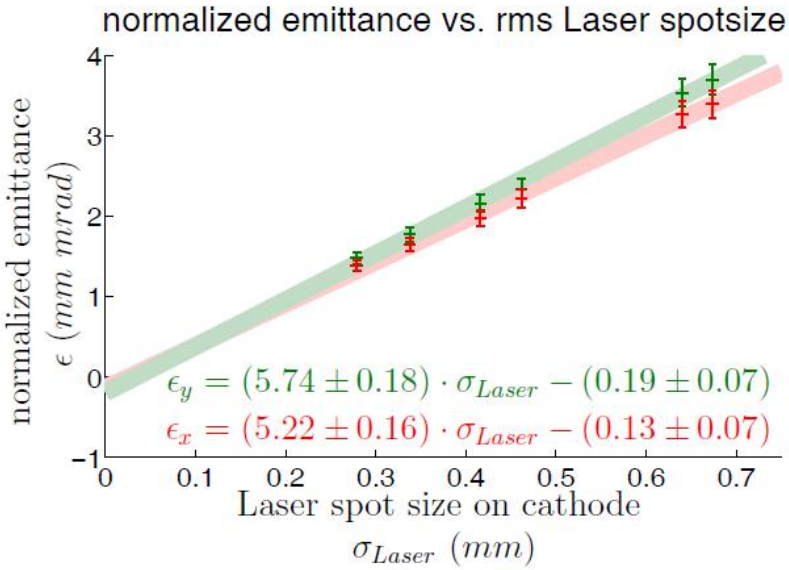




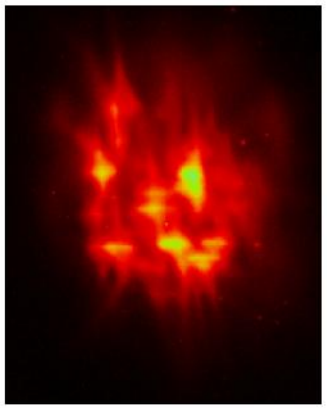
TUPPD051

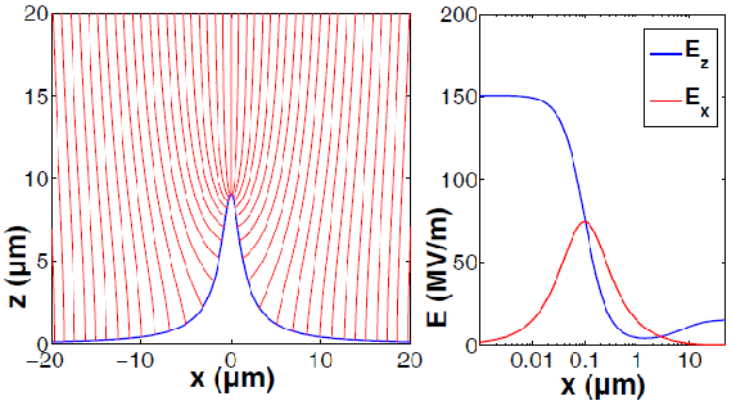
OPERATIONAL EXPERIENCE WITH THE Nb/Pb SRF PHOTOELECTRON GUN*

J. Völker†, T. Kamps, W. Anders, R. Barday, A. Jankowiak, J. Knobloch, O. Kugeler, A. N. Matveenko, A. Neumann, T. Quast, J. Rudolph, S. Schubert, HZB, Germany
V. Volkov, BINP SB RAS, Russia; J. Smedley, BNL, USA
J. Sekutowicz, DESY, Germany; J. Teichert, HZDR, Germany
P. Kneisel, JLab, USA; R. Nietubyc, NCBJ, Poland; I. Will, MBI, Germany



Parameter	Value
Cathode material	Pb (SC)
Cathode QE_{max}	$1 \cdot 10^{-4}$ at 258 nm
Drive laser wavelength	258 nm
Drive laser pulse length	2.5 ps fwhm
Repetition rate	8 kHz
Electric peak field in cavity	20 MV/m
Operation launch field on cathode	5 MV/m
Electron exit energy	1.8 MeV
Bunch charge	6 pC
Electron pulse length	2. . .4 ps
Average current	50 nA
Normalized emittance	2 mm mrad





MOPPP045

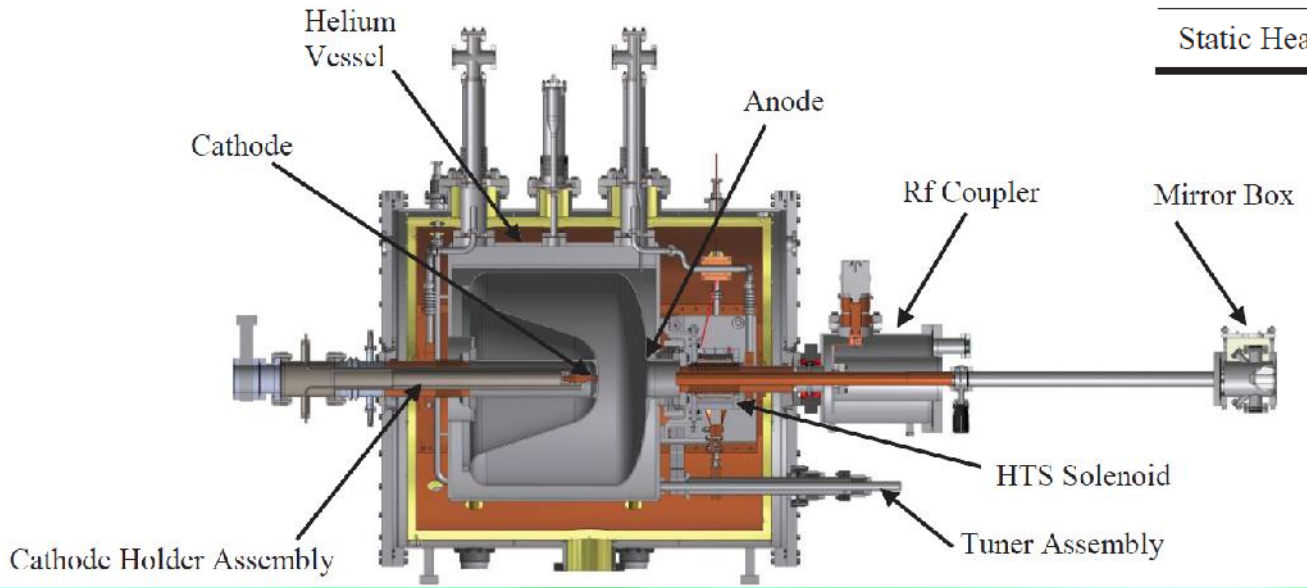
STATUS OF THE WISCONSIN SRF GUN*

R. Legg, J.J. Bisognano, M. Bissen, R. Bosch, D. Eisert, M. Fisher, M. Green, K. Jacobs,
K. Kleman, J. Kulpin, G. Rogers, M. Severson, D. Yavuz
University of Wisconsin, Stoughton, WI, 53589, USA

- Start operation in 2012 fall with Cu cathode.
- 20pC x 80 MHz is planned.

Table 1: Cavity Parameters

Parameter	Calc Value	Units
Temperature	4.2	K
Cavity Frequency	199.6	MIIz
Unloaded Q (Q0), Nominal	3 x 10^9	
Surface electric field, Pk	53	MV/m
Integrated Electric Field	3.96	MeV
Dynamic heat loss at E_{PK}	39.2	Watts
Static Heat Loss at 4.2K	7.5	Watts



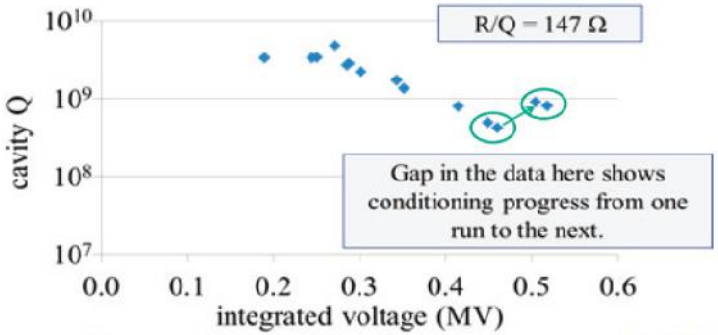


Figure 2: Day One Q0 vs Integrated E Field.

TUPPD062

THE SOURCE OF EMITTANCE DILUTION AND PHOTOEMISSION TUNNELING EFFECT IN PHOTOCATHODE RF GUNS*

V. Volkov, BINP SB RAS, Novosibirsk, Russia
R. Barday, T. Kamps, J. Knobloch, A. Matveenko, S. Schubert, J. Voelker, HZB, Berlin, Germany,
J. Sekutowicz, DESY, Hamburg, Germany

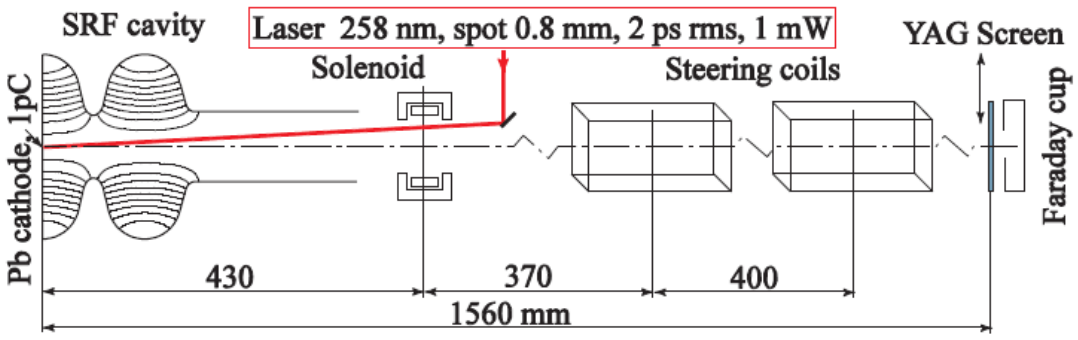


Figure 1: A sketch of the experimental setup.

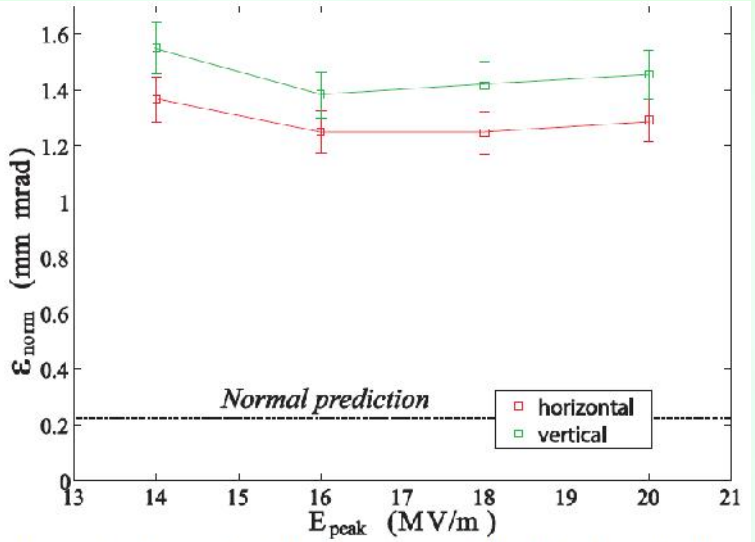


Figure 2: Normalized Emittans vs cathode field with the launch phase of 25°.

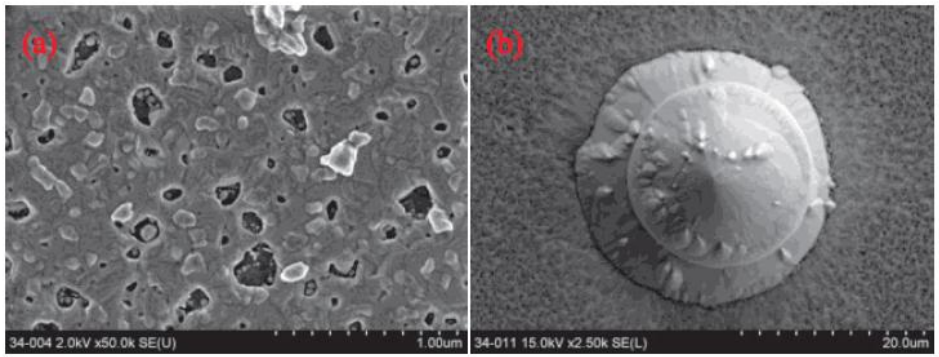
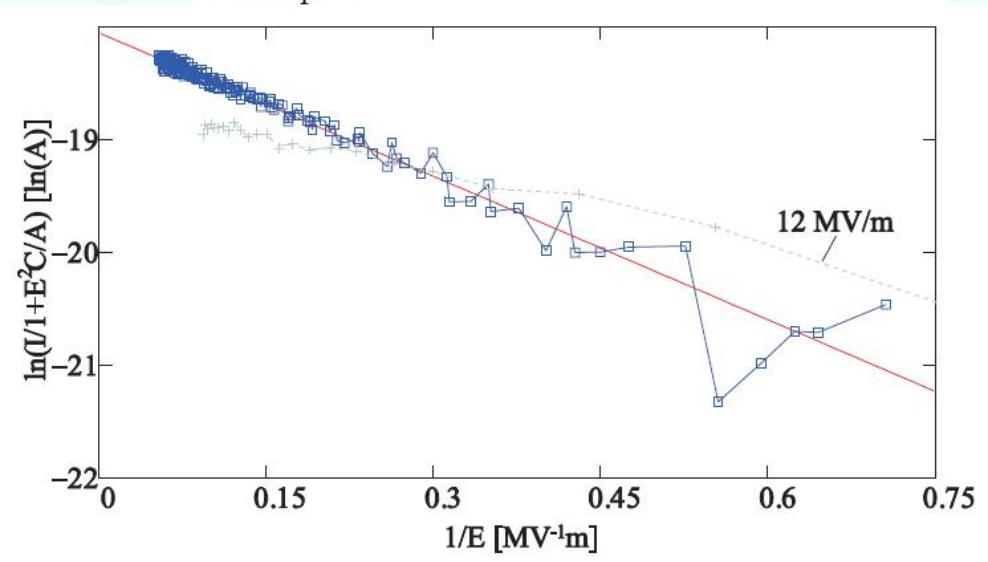


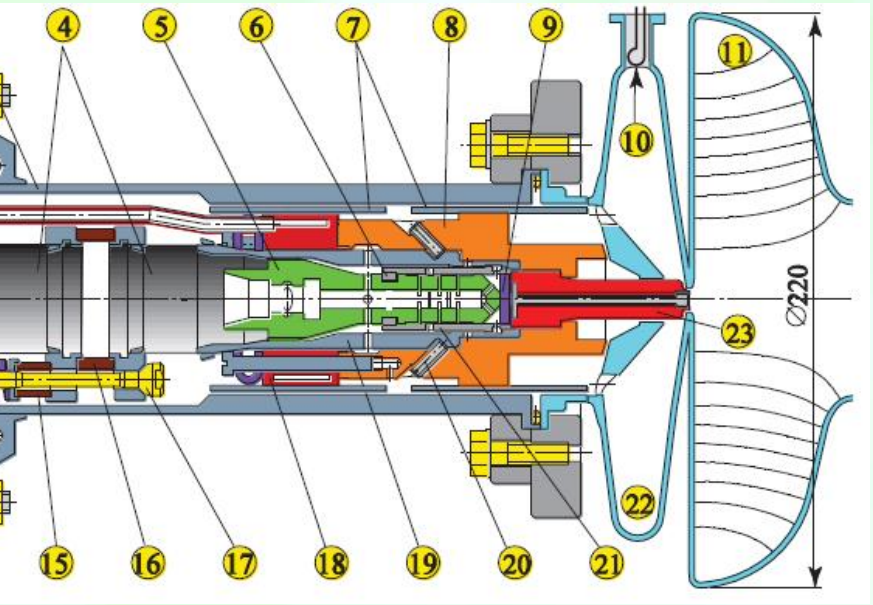
Figure 3: SEM picture of Lead deposited on niobium substrate. (a) 1 μm scale ("Knobs"), (b) 20 μm scale ("Blob").



TUPPD064

CATHODE INSERT DESIGN FOR SC RF GUNS*

V. Volkov, BINP SB RAS, Novosibirsk, Russia
R. Barday, T. Kamps, J. Knobloch, A. Matveenko, HZB, Berlin, Germany



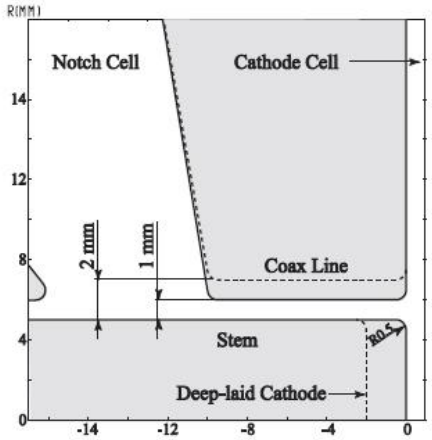


Figure 2: Initial cathode insert geometry [3, 4, 5].

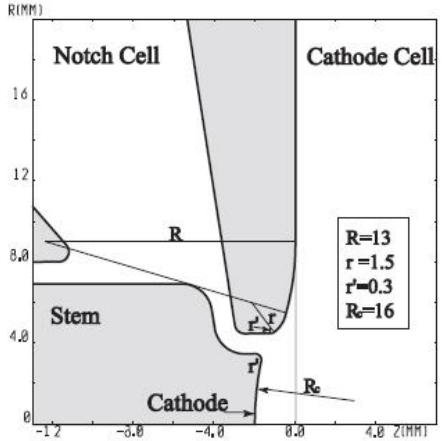


Fig. 3: Upgraded geometry of the cathode insert.

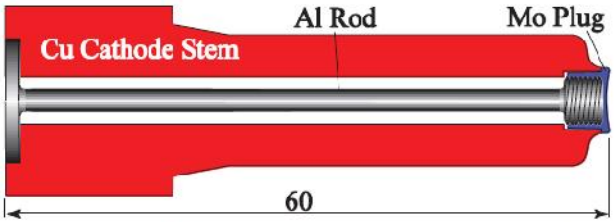
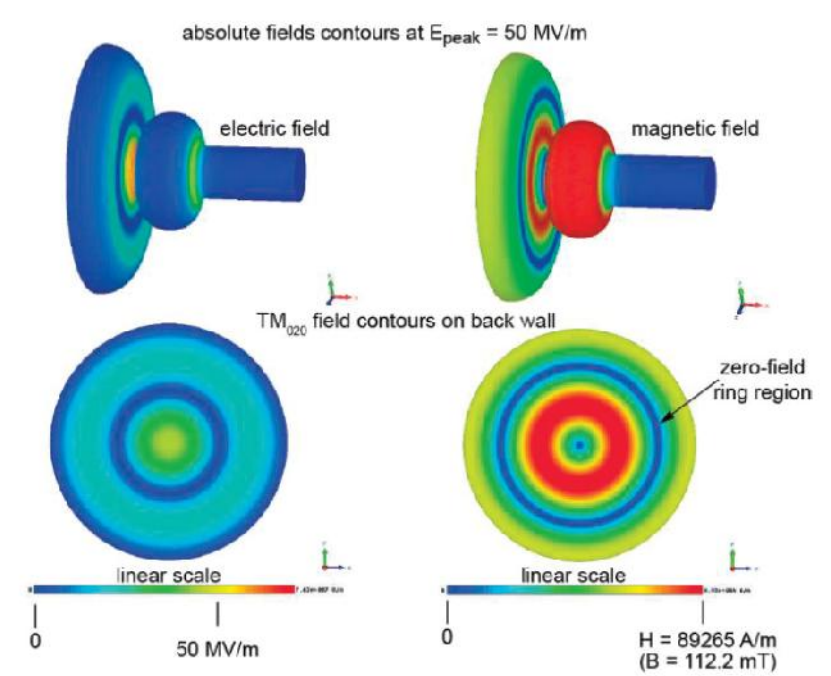


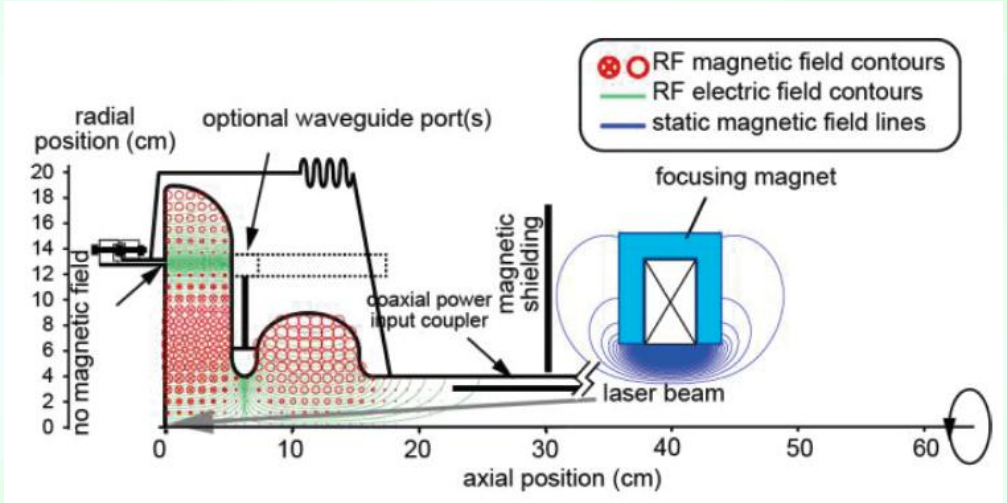
Figure 4: The cathode stem (mm scale).

The variant: gap/depth[mm]	1/0	1/2	2/0
Dissipated RF power, [W]	48	8.2	61
Cathode field, [MV/m]	40	25.2	39.3
Av. gap E field, [MV/m]	8.8	4.38	8.5
Edge E_{peak}, [MV/m]	59.5	72.2	65
Multipactor zone, [MV/m]	≤7	≤7	≤12

A NOVEL DESIGN OF A HIGH BRIGHTNESS SUPERCONDUCTING RF PHOTOINJECTOR GUN CAVITY*

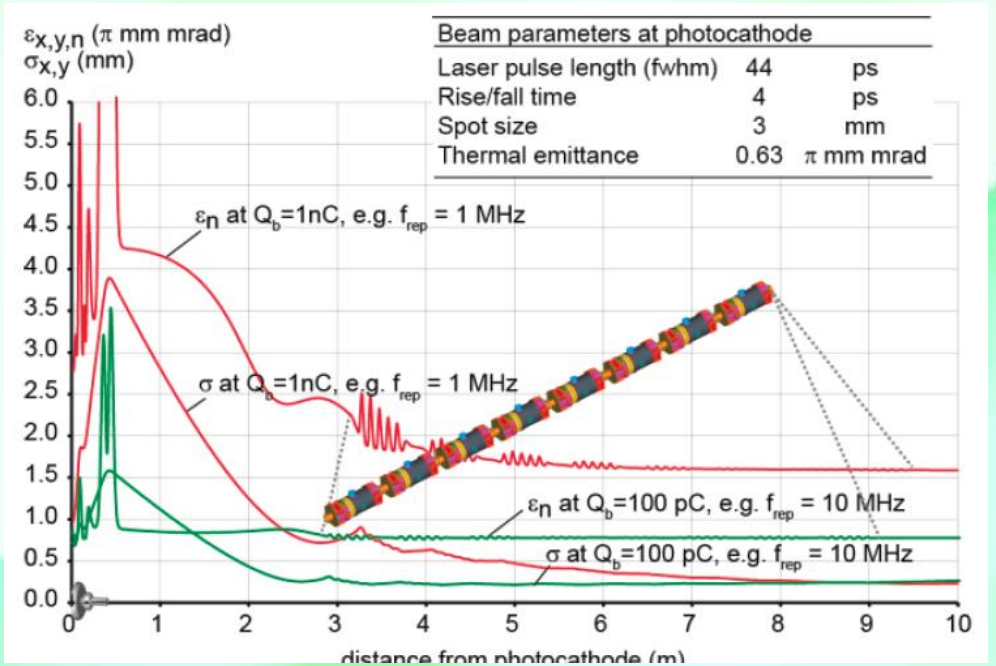
F. Marhauser#, J. Rodriguez, MuPlus, Inc., Newport News, VA
Z. Li, SLAC, Menlo Park, CA





Parameter	Symbol	Units	Value
active length	L_{act}	cm	16.3
on axis peak field	E_{peak}	MV/m	50
beam energy after exit	E_b	MeV	4.8
accelerating field (E_b/L_{act})	E_{acc}	MV/m	29.3
surface resistance*	R_s	nΩ	21
unloaded quality factor*	Q_0		1.2e10
dynamic load	P_{diss}	W	12.1
char. shunt impedance**	R/Q_0	Ω	152
transit time factor**	TTF		0.83
stored energy	U	J	15.9
peak surface flux density	B_{peak}	mT	112

* assumed for Nb at 2 K, ** tracked particles from cathode to gun exit



Summary

- Gun related activities reported at IPAC12 are summarized.
- Good progress on high brightness beam generation in Cornell, and careful studies on multi-alkali cathode in BNL are impressive.
- The technology of NC photo-cathode RF gun is surely in an operational phase.
- Many activities related SRF gun and novel concepts were found.