Short summary of PESP2008

F. Zhou (SLAC)

Note: I ‘borrowed’ most slides from Matt Poelker, who prepared them for SPIN08

Programs of PESP2008

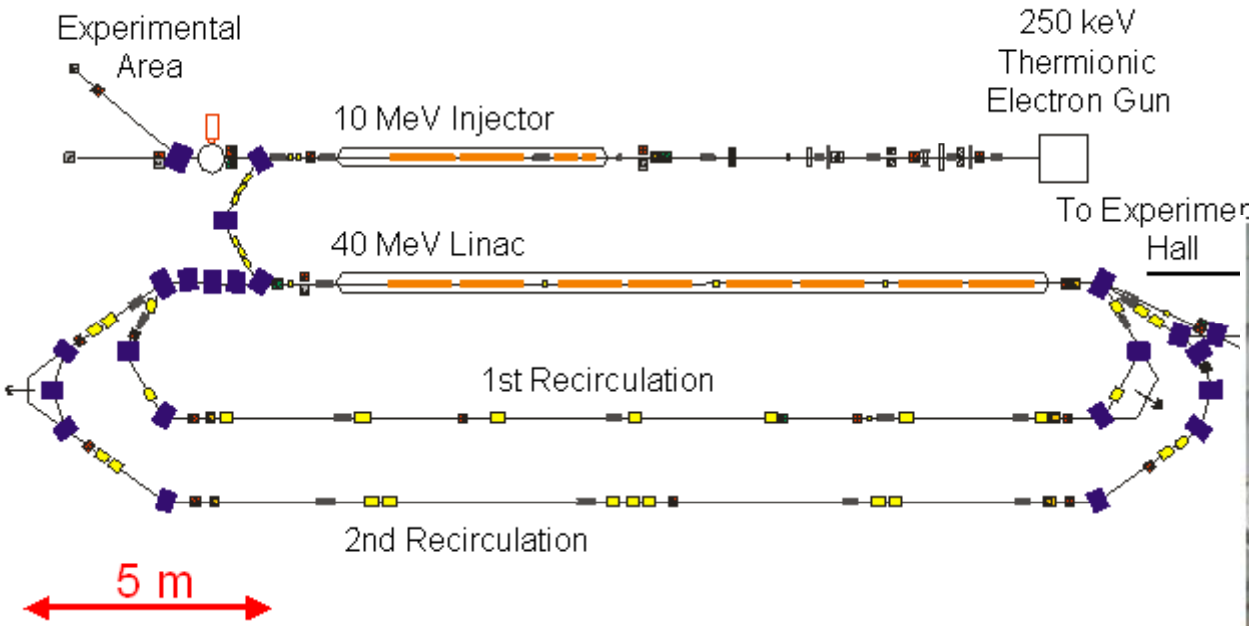
- Polarized e-Beam Programs – with focus on NEW and proposed machines
- Photocathodes: High Polarization, novel structure, obtaining longer lifetime
- Very High Voltage DC Guns (voltage >>100kV)
- RF and SRF guns – with focus on polarized and CW
- Drive lasers
- Vacuum
- Polarimetry

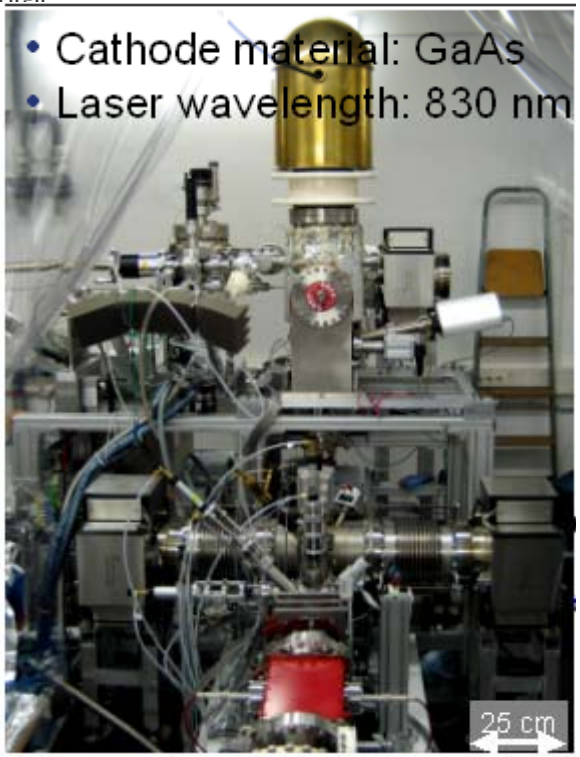
~80 registered attendees, 37 talks.

NEW Polarized e-Beam Facility

S-DALINAC Polarized Injector („SPIN“)

TECHNISCHE UNIVERSITÄT DARMSTADT



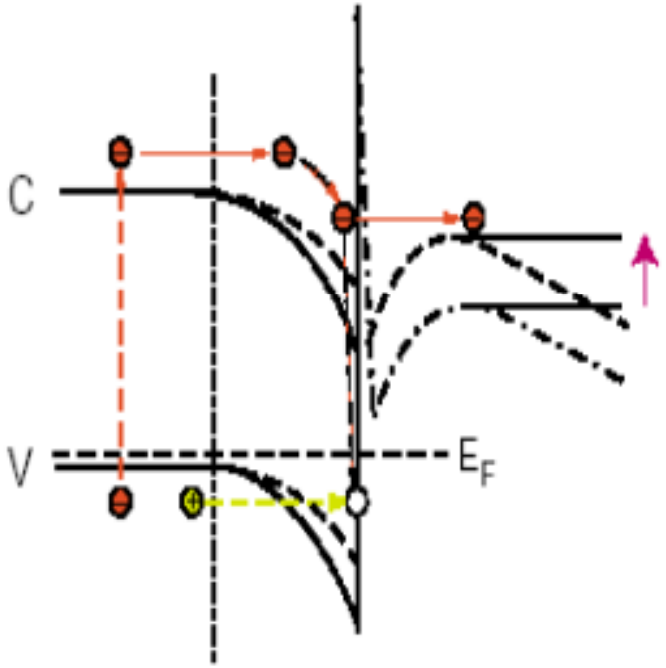


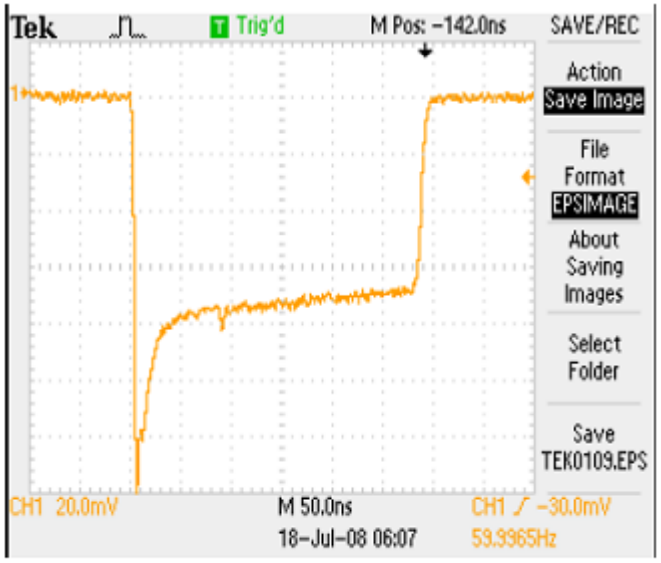
With help from Mainz….

From Y. Poltoratska, Darmstadt Univ.

Proposed polarized facilities: ILC and CLIC

ILC and CLIC: High Bunch Charge, High Peak Current and "new" time structure compared to SLC. R&D Issues: Space Charge and Surface Charge Limit.





$2.5x10^{10}$ e- @ 8x laser energy
10 mm full size

From F. Zhou, SLAC

Proposed polarized facilities: Electron Ion Collider

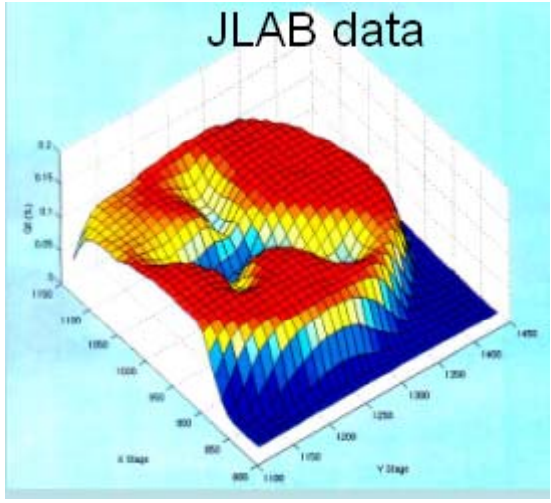
eRHIC (Linac-ring version)

Requires a polarized electron source with an extremely high current

Luminosity ~ $2.6 \cdot 10^{33} \mathrm{cm}^{-2}\mathrm{s}^{-1}$ $\Rightarrow$ I(average) ~ 250 mA

Residual Gas leads to Ion Back-Bombardment and QE decay and short lifetime:

- Improve Vacuum
- Large laser spot
- Higher gun voltage
- More rugged photocathodes
- Better beam management



Slide from E. Tsentalovich, MIT-Bates

Polarized photocathodes

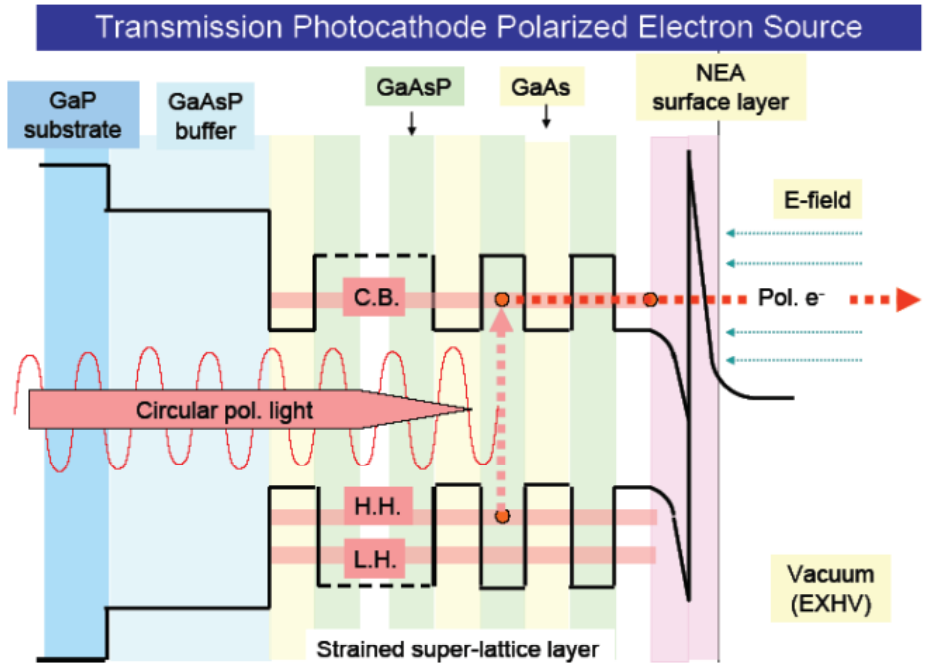
Best photocathodes

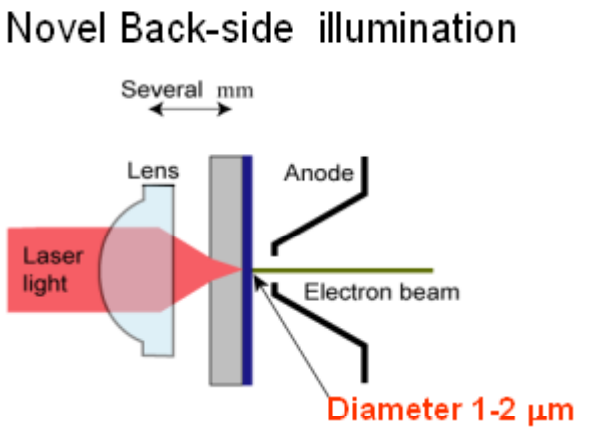
Sample	Composition	P_{max}	$QE(\omega_{max})$	Team
SLSP16	GaAs(3.2nm)/ $GaAs_{0.68}P_{0.34}$ (3.2nm)	92%	0.5%	Nagoya University, 2005
SL5-777	GaAs(1.5nm)/ $In_{0.2}Al_{0.23}Ga_{0.57}As$(3.6nm)	91%	0.14%	SPbSPU, 2005
SL7-307	$Al_{0.4}Ga_{0.6}As$(2.1nm)/ $In_{0.19}Al_{0.2}Ga_{0.57}As$(5.4nm)	92%	0.85%	SPbSPU, 2007

- Exceptional modeling helps identify depolarization mechanisms
- Working on reflective back surface to boost QE

From L. Gerchikov. State Polytechnic Univ. St. Petersburg
Samples grown at Ioffe Technical Institute, St.Petersburg

Polarized photocathodes



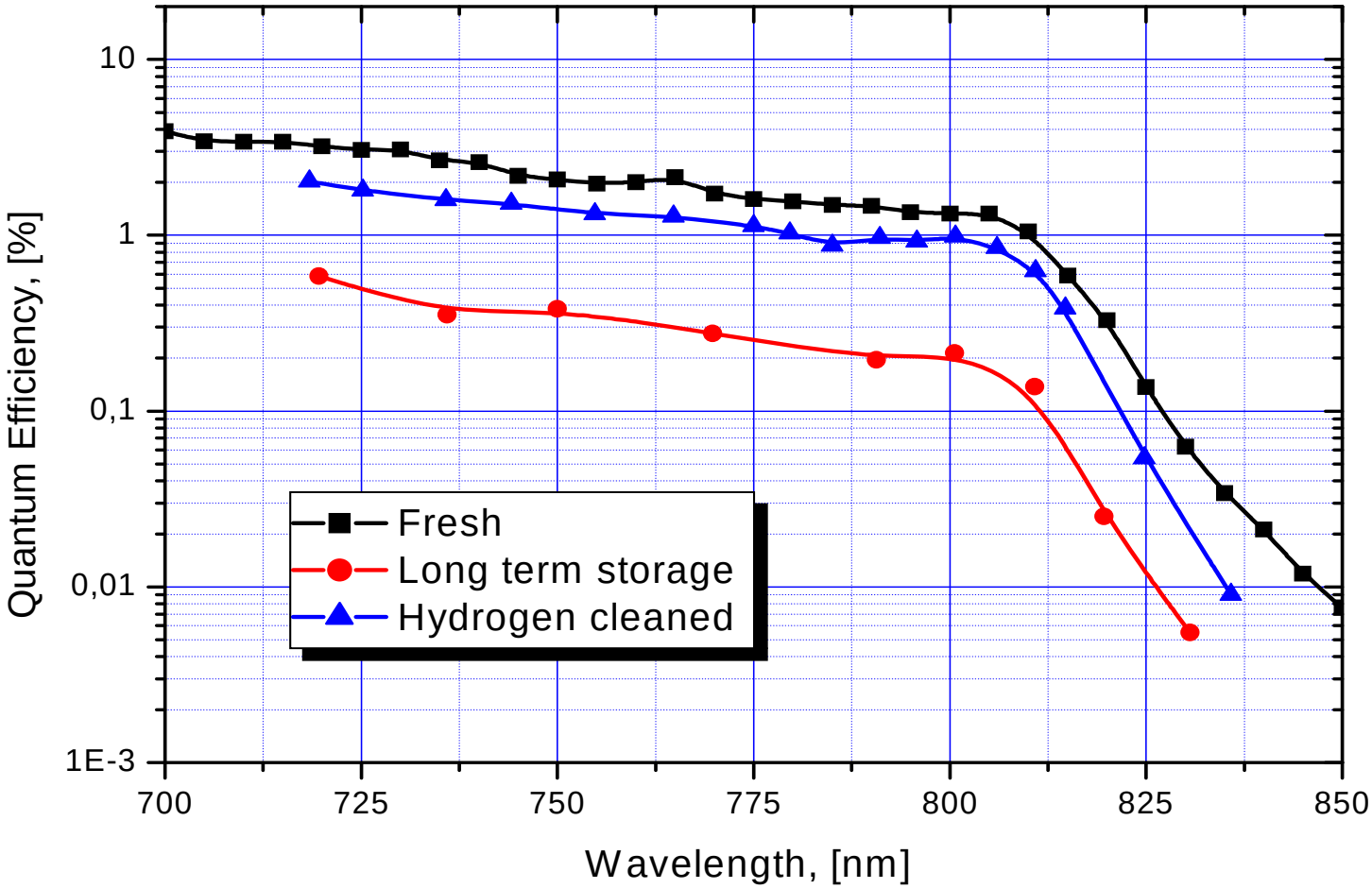


Highly focusing lens can be used.

Back-illuminated High Polarization (~ 90%) and High Brightness Photocathode, built for materials science, but could be used for accelerator applications with extremely low emittance requirement

Excellent work reported by T. Ujihara, X. Jin, N. Yamamoto, T. Nakanishi, Nagoya University

Polarized photocathode: Atomic hydrogen cleaning

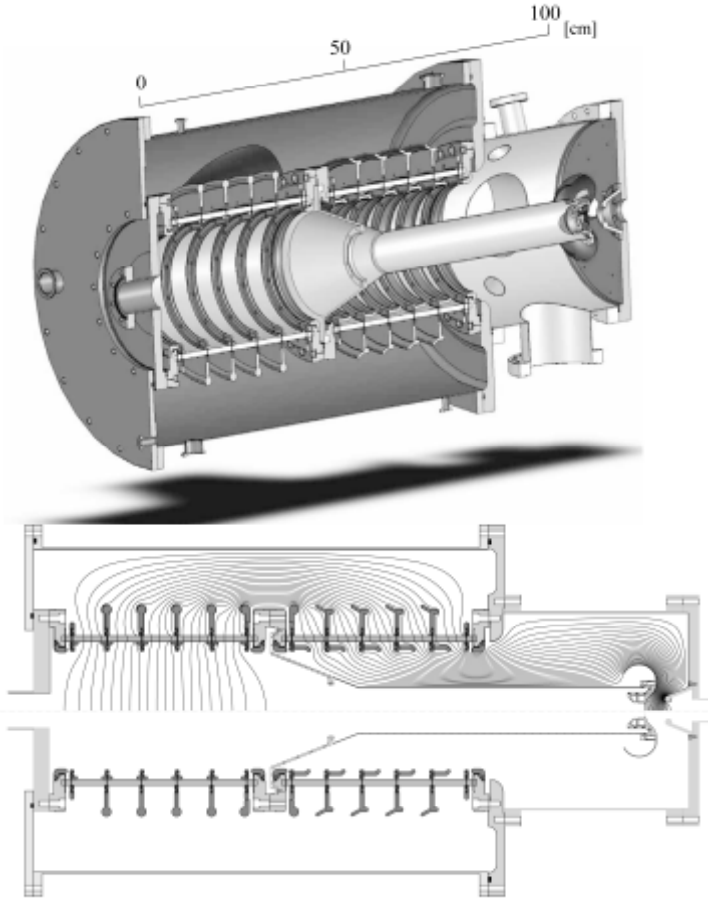


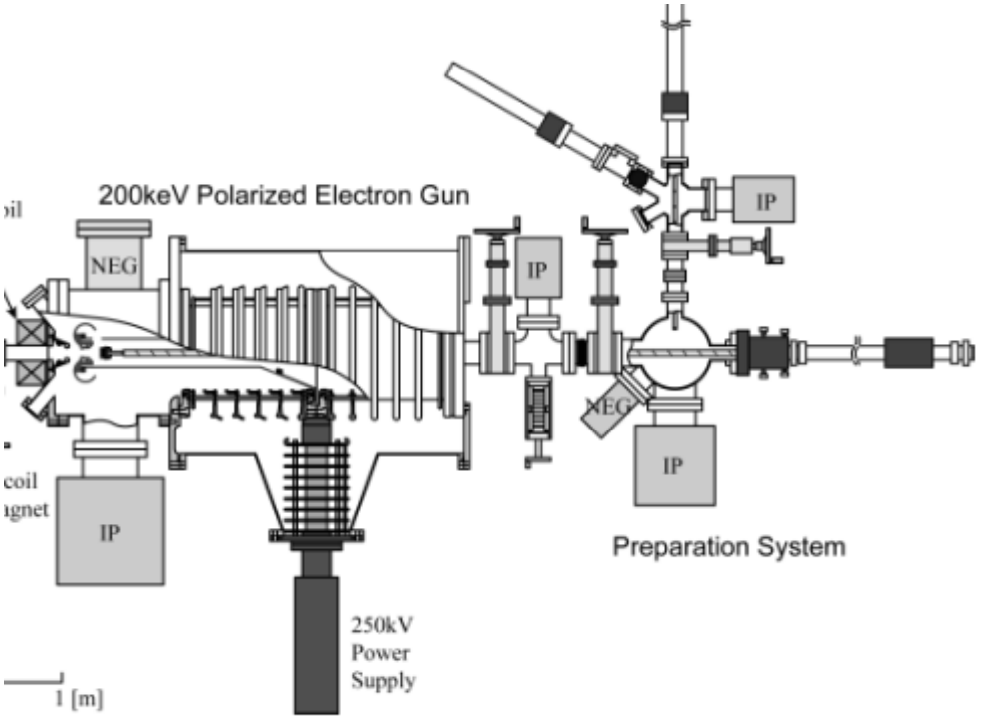
Improves *5 at low intensities+absence of saturation!
(*50 improvement for high intensities at MAMI)

V. Tioukine, MAMI, Germany

Very High Voltage DC Guns (polarized)

200kV Gun, load lock gun with segmented insulator and high polarization GaAs photocathode





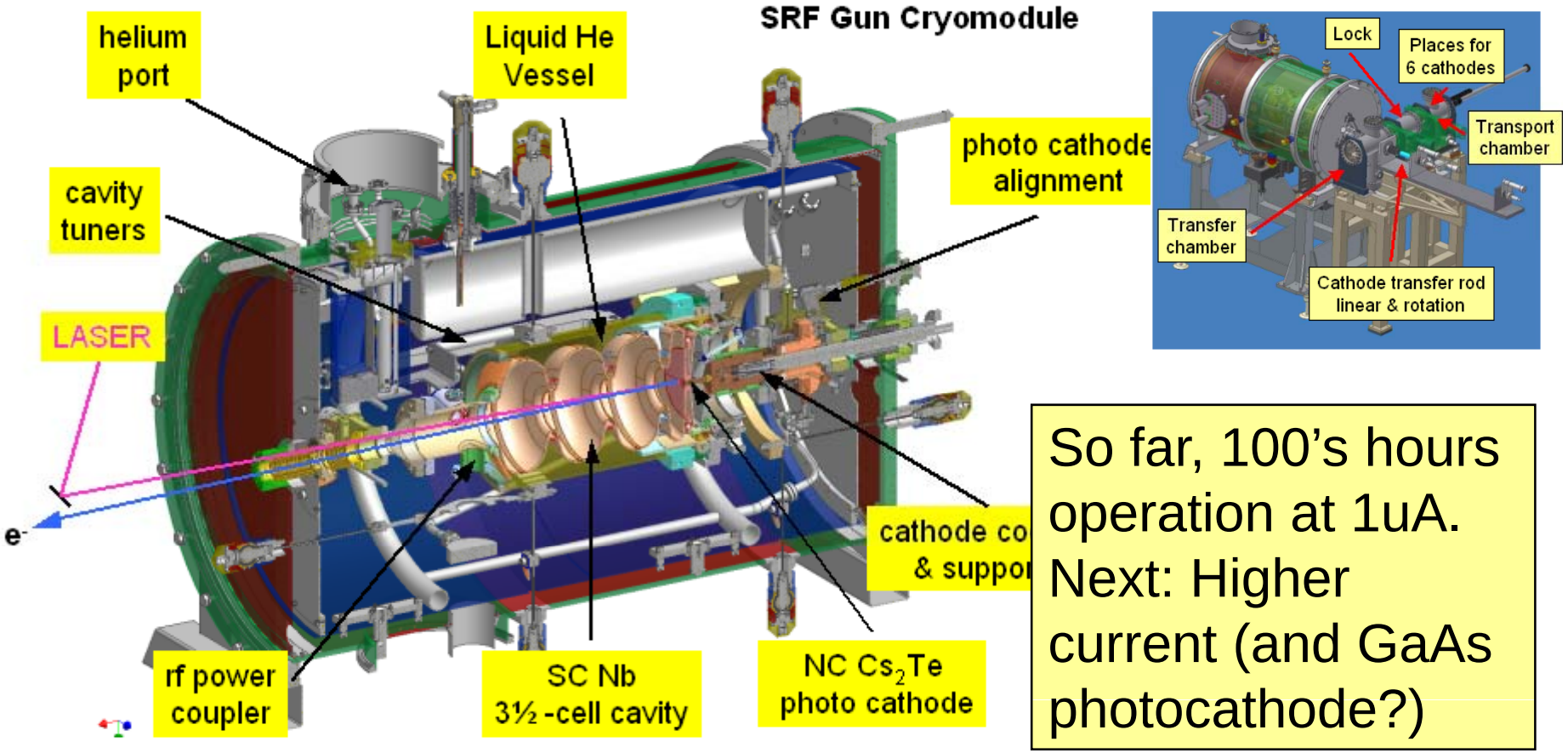
From M. Yamamoto, Nagoya Univ.

Very high voltage DC gun (unpolarized)

- JLAB-FEL project: design 500kV but typical operation at 330kV; field emission can lead to catastrophic insulator “punch-through (C. Hernandez-Garcia).
- ASTeC-Daresbury: 350 kV; field emission not problematic but repeated mechanical failures at ceramic-to-flange joint…(L. Jones)
- Cornell: design 750 kV but Field emission and “punch through” limits voltage to ~ 300kV (K. Slomenski).
- JAEA: 250 kV; working on 500kV version with segmented insulator (N. Nishimori).

SRF Gun (unpolarized)

Holy Grail of e-guns: Perfect vacuum, High Average Current, High Brightness, Low RF Power

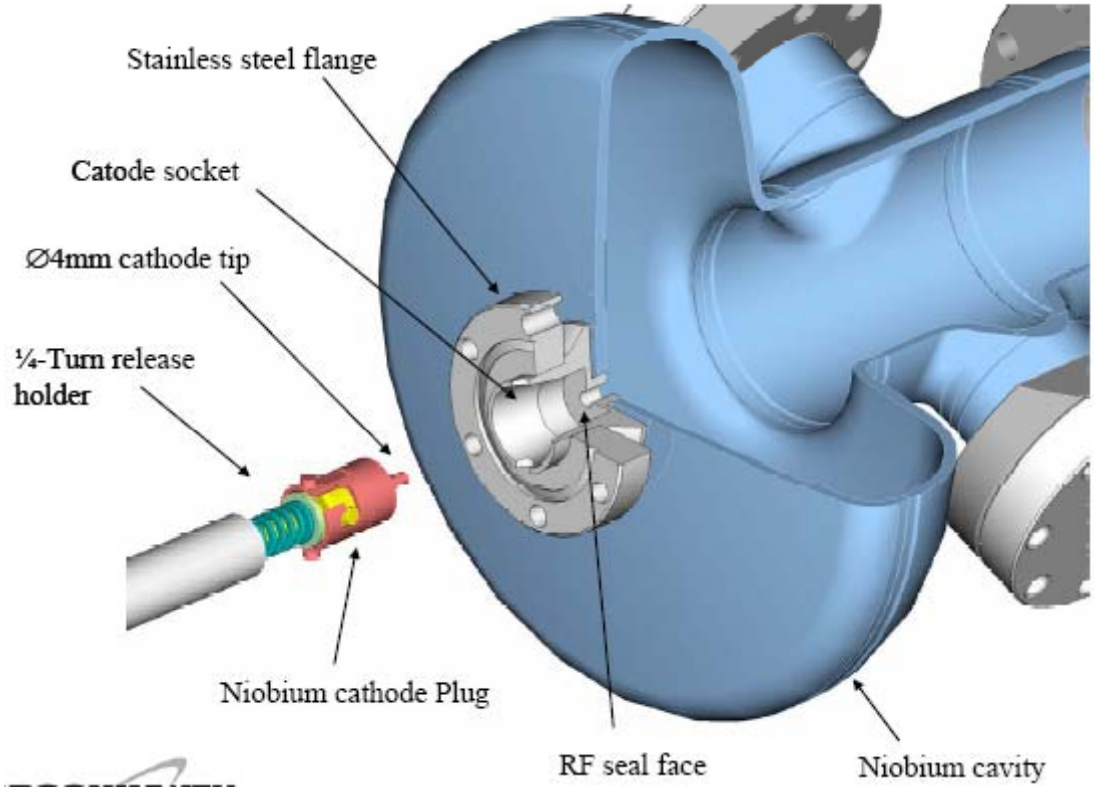


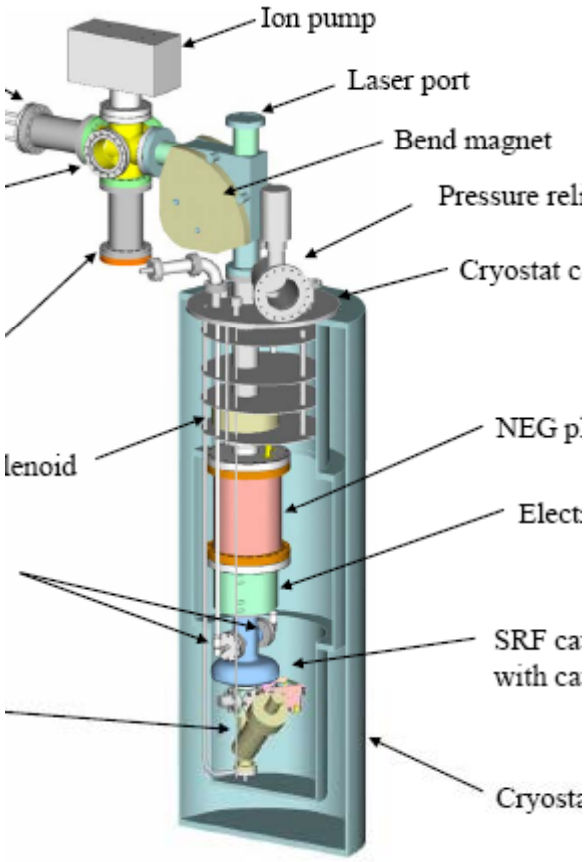
So far, 100's hours operation at 1uA. Next: Higher current (and GaAs photocathode?)

From J. Teichert, A. Arnold, FZD Dresden-Rossendorf

SRF Gun under development (polarized)

Polarized SRF Gun at BNL: for ILC, eRHIC and ERLs



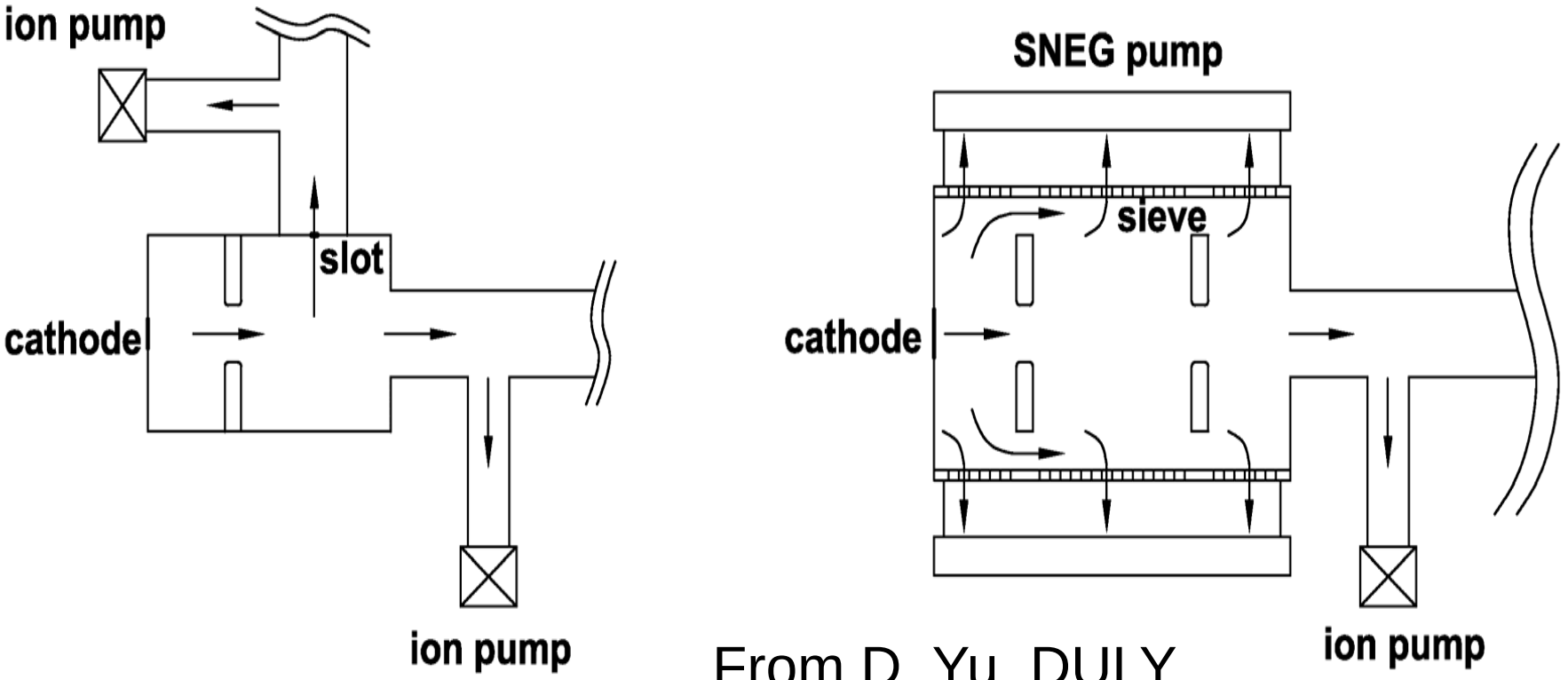


From D. Holmes, AES and J. Kewisch, BNL

PWT N.C. RF gun under development (polarized)

Vacuum Pumping Paths

1.6-cell Gun (left) and PWT Gun (right)



From D. Yu, DULY

Summary of R&D Projects

- Reliable trouble-free DC high voltage gun operation beyond 300kV (eliminate field emission, improved insulator design)
- Understanding (and eliminating) Surface Charge Limit (the phenomenon of reduced QE at high laser power)
- Develop rugged photocathodes with improved lifetime
- Back-illuminated, transmission-style photocathodes
- Achieve better vacuum, 10^{-12} Torr and below
- SRF gun technology – BNL (and Rossendorf?) to demonstrate operation with GaAs…