ERL 2011: WG1 Injectors

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17 Oct 2011

Working Group Charge

"Explore the progress in high average current, extremely bright sources for use in ERLs. The working group will explore the results and new technologies available in injectors since the previous ERL workshop."

We define ‘Injection’ as the part of the ERL up to, and including, the merge with the returning high-energy beam.

A Diversity of Objects

We started at:

1. Gun technologies; DC, NCRF, SRF
2. Beam dynamics
3. Technological challenges
4. Photocathodes and lasers
5. Injector designs and codes
6. Beam diagnostics

But these emphasized the differences between the groups; e.g. DC vs. NCRF vs.SRF.

What we are trying to accomplish make us the same.

1. How do we operate the injector?

a. Controls needed
b. Feedback
c. Signal monitoring
d. Integrated systems
e. 'operational' diagnostics and monitoring

2. How do we make it more reliable?

a. more robust materials
b. parts with more headroom (60 W drive laser)
c. Faster changeout of parts
d. Tracking of parts/ systems
e. more mature technologies (gun design, etc)
f. improved requirements and flowdown to subsystems
g. subsystem testing
h. laser synchronization
i. stability of RF, magnets, gun HV
j. vacuum system improvements?

3. How do we know it's working properly or not?

a. Diagnostics (what kind? How?)
b. Rf signals (sync, phase, amp) (need for fast buffers to look at transients)
c. End Users
d. Stability
e. Modeling, online comparisons btwn data and modeling

4. How do we minimize / meet the phase space requirements?

a. Emittance compensation
b. Cathode material
c. Drive laser wavelength
d. Scraping
e. Electrode shaping
f. Booster /buncher design and operation
g. Modelling
h. magnet stray fields, magnet alignment specs, remote magnet movement
i. centering of the beam through all elements
j. microphonics, HOM's and beamloading, coupler kicks

5. How do we mate the injector with the rest of the machine?

a. Injector Energy
b. Merge geometry
c. match particle codes and matrix codes
d. How do we know it's matched? See 3. above.

And the 800 lb. gorillas...

6. Budget

7. Schedule

While talking about your system or status try to address the goals that directed your choices.

Session Plan

1. DC guns
2. NCRF Guns
3. Cathodes
4. Drive Lasers
5. Joint session with WG2(Optics and beam transport)
6. SRF guns
7. Operational Experiences
8. Writing WG report

Agenda Day 1 - SRF Guns

1. Status of SRF guns at Brookhaven National Lab – Sergey Belomestnykh (15:30)
2. The SRF photoinjector at ELBE – Andre Arnold (15:50)
3. SRF gun development for BerlinPro at HZB – Torsten Quast (16:10)
4. Discussion session (16:30)

Agenda Day 2 – Lasers & Injectors

Morning

1. Brookhaven Nat'l Lab Laser Work – Triveni Rao (11:00)
2. A 1.3 GHz Fiber Laser System for an ERL – Bruce Dunham (11:15)
3. Operational experience with an ERL driver for the Jlab UV/VUV FEL – Bob Legg (1130)
4. Discussion session (11:45)

Afternoon

1. Status of the 500-kV gun at JAEA – Nobuyuki Nishimori (13:30)
2. Progress on the Cornell ERL prototype injector (13:50)
3. Operational experience with DC photoemission guns at Jlab – Carlos Hernandez Garcia (1410)
4. High-brightness thermionic electron gun performance – Alan Todd (14:30)
5. Performance of the ALICE ERL photoinjector – Boris Militsyn (14:50)

Agenda Day 3 – More Guns & Injectors

1. Development of high average current RF injectors – Dinh Nguyen (11:00)
2. Status of the Wisconsin SRF Gun – Bob Legg (11:20)
3. Microtron –based RF gun for a low emittance electron source – Hironari Yamada (11:40)
4. Compact CW NC RF photoinjector for the CW XFEL or ERL Facilities – Yujong Kim (12:00)

Agenda Day 4 – Cathodes and Simulations/Theory

1. Development of efficient, robust photocathodes for high average current operation at BNL – Triveni Rao (11:00)
2. Photocathodes for the high average current ERL photoinjector at Daresbury – Boris Militsyn (11:20)
3. The Jlab 200 kV inverted gun: lifetime measurements using strained GaAs and CsK_2Sb – Riad Suleiman (11:40)
4. Development of photocathodes for the Cornell ERL – Bruce Dunham (12:00)

Discussion Session 13:30 to 15:30 – writing assignments

1. Emittance partitioning through controlling eigen-emittances – Bruce Carlsten (16:00)
2. Envelop matching from the injector to the main linac for an ERL – Tsukasa Miyajima (16:20)
3. Longitudinal dynamics in the ALICE injection line – Julian W. McKenzie (16:40)
4. Optics design of the Injector for BerlinPro – Alexander Matveenko (17:00)
5. Investigation of the effect of space charge in the compact ERL – Ji-Gwang Hwang (17:20)

Joint session with WG2

Discussion Session 17:40 to 18:30 – discussion or short talks

Agenda – Day 5

Report for WG1 at 0900 - 0930

Summary Papers

At ERL2009, we wrote two summary papers, one covering DC gun technology and one covering RF and SRF guns.

We will plan on one or two similar summary papers for ERL2011

For the WG1 report

To summarize each talk and discussion,
all the speakers and discussion leaders are kindly requested to prepare

- 1-page slide (PowerPoint file)
- half-page memo (Word file)

and send them to the conveners

We have several people missing, so some talks can be extended by 5-10 minutes to fill the extra time.