ILC polarized Electron Source EDR Work Packages

ALCPG/GDE Meeting
Fermilab, October 25, 2007

Axel Brachmann

Agenda

- ‘Kick-off’ meeting
- Work Packages
- Expression of Interest Form
- EDR R&D

EDR 'Kick Off Meeting'

- Review of RDR design
- Identify gaps and refinement possibilities crucial to cost optimization
  - Examples
    - Magnet apertures
    - CF&S cost breakdown
    - Dump/ Dump service enclosures
    - Do we need separate cryoplant ?
- Include groups into work planning on international level
- EDR Plans and Expectations
  - Development and implementation of policies and procedures
  - Responsibilities
  - Work Packages
  - Definition of high priority R&D needs

GDE EDR Electron Source Work Packages

High Level Work Packages

Source Drive Laser System	Magnet System
Polarized DC Gun	Power Supplies
Polarized Photo Cathodes	HLRF
Bunching System and NC RF structures	LLRF/Controls
Dumps and Collimators	Instrumentation
Polarization issues	Vacuum System
Accelerator Physics	Cryogenics
CF&S and Installation	Cryomodules
System Design – Optimization	Advanced R&D

EOI Solicitations

- Based on defined Work Packages.
- Some responses so far.
  - Resource availability only partially adequate
- Expect more responses after this meeting.

Example of ‘Sub – Work Packages’

Instrumentation

- Button/Stripline BPM’s
- Wirescanners
- Laser Wires
- OTR’s
- DMC’s (LOLA)
- WMC’s
- Toroids
- Faraday cups
- Macine Protection devices
- Polarimetry
- Feedbacks

Suggested e- or e+ WP Major Milestones (Magnet systems; preliminary version)

1. Magnet and PS requirements and specifications	February 1, 2008
2. Conventional (room temp) magnets and DC PS conceptual designs	October 1, 2008
3. Superconducting solenoid conceptual design	December 1, 2009
4. Magnets – PS- cables optimization	October 1, 2009
5. All magnets' integration details & beamline layout drawings	February 1, 2009
6. Detailed costs of all magnet styles	July 1, 2009
7. Overall fabrication, measurement, installation & repair plans	February 1, 2010
8. Finish writing e- & e+ magnets and PS chapters of EDR	May 1, 2010

How to evolve a Magnet System Group : Spencer's idea

- Institutions are proposing to do work on certain magnet & power supply tasks for particular areas
- They will have funds to do these work packages and so they'll have paid-for magnet or PS experts
- Policy would be: if you are doing a magnet or PS work package you must provide a fraction (TBD) of your magnet expert's time to work on magnet system group ILC-wide tasks
- I reckon we would have at least 8 people generated by such a policy; equivalent to at least 2 FTEs
- Group would also help review proposals for work packages and enforce design & material standards

Technical Systems Work Package Description

Excerpt from Magnet Power Systems Work Package Description:

Work Package Details (Continued)		
Deliverables from Work Package	1.Magnet / power supply list 2.Power supply/controls designs, specifications 3.Power system layout drawings 4.Electrical interconnect (EI) diagrams 5.Reliability / FMEA analyses 6.Identification of industry partners 7.Acquisition, build plan and schedule 8.Input for EDR report	
Major Milestones (including key decision points)	1.Interfaces, relationships, collaborations established or strengthened 2.Power system design 3.Reliability / FEMA analyses 4.Equipment profiles, power system and raceway layouts 5.Equipment specifications 6.Cost estimate, acquisition plan, schedule and EDR input	2008 2009 - 2010 2009 - 2010 2009 - 2010 2009 - 2010 2010
Resources required (eg expertise, facilities, leader, …)	1.Power Electronics Engineer, (Lead) 2.Pulsed Power Engineer 3.Controls Engineer 4.Electronic Designer/Coordinator 5.Raceway Designer/Coordinator	

R&D Work Packages during EDR Phase

→ High Priority

→ Support EDR Baseline Design

- Source Laser System
- DC Gun
- Photo Cathodes

} Integrated System

Laser System

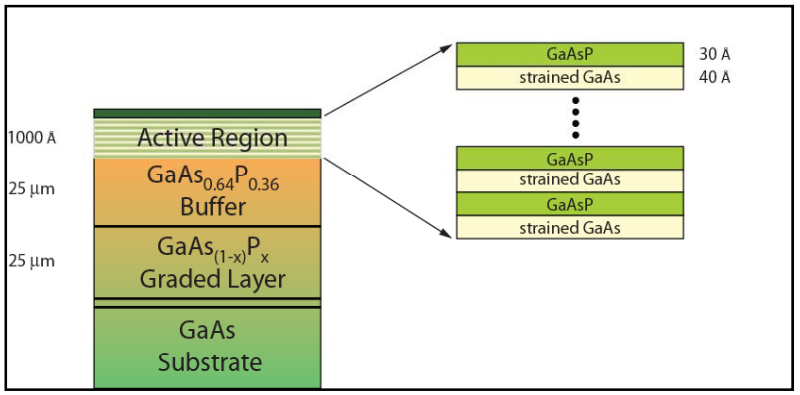
- Development of source laser system addresses two issues:
  - Laser Technology that needs to be developed for the ILC
  - Needed to understand performance of photo cathodes under ILC conditions

Challenge:
16 W average power laser system with ILC bunch train format

→Work in progress
→Proof of principle system by 2010

Photo Cathodes for the ILC Source

- Baseline: strained GaAs/GaAsP
  - Must deliver ~ 90 uA beam (SLC 2uA)



- Current PC's are optimized for SLC conditions, not ILC.
- Issues are not primarily QE or polarization but:
  - Surface charge limit (SCL) under ILC conditions
  - Indication from cw machines indicate that SCL may play a role
  - We do not know impact of SCL on ms timescale
- Effect SCL can only be determined using appropriate laser system.

DC Gun Development Program

- Baseline is 140 – 160 (200) kV DC gun
- Challenge is to minimize Ion back-bombardment of the Photocathode (destruction of NEA surface)

→ Optimize HV design

- Address space charge limit,
- minimize dark current, push breakdown limit

→ Vacuum system (10^{-12} Torr)

- minimize destructive species near photocathodes

- Currently R&D program is taking place at Jlab and University of Nagoya
- We also anticipate further contributions from KEK and University of Hiroshima

SBIR's

- Support of R&D program through 'non-ILC' funding but very important contributions for source development
- Baseline design and advanced R&D towards future design options
  - Laser system development
  - Photocathode development
  - Advanced R&D such as RF guns for polarized electrons