Linear Collider at Fermilab

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• Warm Linear Collider R&D

• Linear Collider Directions at Fermilab FY04 and beyond

February 2 2004, All Experimenters Meeting
Warm LC R&D at Fermilab

- **FXB:** 60 cm. Long, high phase advance (150 deg.), traveling wave structures (aka H60VG3, no slots) were produced. (FXB001-006)

- **FXC:** 60 cm. long, 61 mm o.d. cells; 150 degree phase advance; 3% group velocity; slotted cells with .17 a/λ; **fully brazed construction w/o H₂**; Fermilab Waveguide (FWG) I/O couplers and matching cells, no HOM extraction, **4 tuning holes** instead of the 2 in FXB structures. (FXC001-005)

- **FXD:** 60 cm. long, 61 mm o.d. cells; 150 degree phase advance; **4% group velocity; tapered design** with slotted cells and .17 a/λ; fully brazed construction w/o H₂; FWG I/O couplers; **I/O HOM extraction; twofold interleaving** design feature. (FXD001-006)

- **FXE:** Fully Fermilab Designed
Fermilab Structure Facilities

RF quality control clean room (Class 3000)

Structure assembly room (Class 1000)

Frequency measurement setup (above) and part inspection station (below)
Fermilab RF Work

- Low Power RF Testing Development
  - Single Disk Measurement System has been improved
  - Bead Pull Measurement System techniques are continually being refined.

FXB Cell on Single Disk RF Measurement Test Setup
Fermilab RF Work

- RF Design Work
  - Design of Fermilab wave guide couplers
  - Review of FXC and FXD cell tables from SLAC
  - FWG coupler and matching cells for FXC and FXD Structures
  - FXD HOM extraction design and analysis
Strongback Production

- We produced nine structure supporting systems known as “strongbacks” (six for NLCTA use at SLAC, and three for use in girder development at FNAL)
Fermilab Structures in NLCTA

Today there are only four Structures (FXB003,6,7 and FXC001) from Fermilab installed in NLCTA. (FXB2-7 at SLAC)

We are shipping the FXC003 to SLAC this week. FXC004 in mid Feb.
Eight Pack Phase 2: Power Handling Schematic

From SLED II

- 3 dB
- 3 dB
- 3 dB
- 3 dB
- FXC
- FXC
- FXC
- FXC
- FXD-a
- FXD-b
- SLAC/KEK
- SLAC/KEK

Overmoded
300MW, 400 ns

These structures could be located in stations 1&2

Phase IIa

From NLCTA Station 1

- 3 dB
- 3 dB
- 3 dB
- 3 dB

Structure
Structure
Structure
Structure

Phase IIb

From NLCTA Station 2

- 6 dB
- 4.8 dB
- 3 dB
- 3 dB

FXC
FXC
FXC
FXC
FXD-a
FXD-b
SLAC/KEK
SLAC/KEK
H60VG3_FXB6&7 Processing History

Structure Gradient (MV/m) and Trip Rate/5 (#/hr)
(Black = FXB7, Red = FXB6)

Time with RF On (hr)
Structure High Gradient Performance
(Breakdown Rate -vs- Unloaded Gradient with 400 ns Square Pulses)
Warm RF Structure Plans

- **Parts Procurement**
  - Sept. to Oct.
  - FXC-002
  - FXC-003

- **Cell Procurement Period for FXD-001 thru -006**
  - Oct. to Dec.

- **Coupler Procurement Period for FXD-001 thru -006**
  - Nov. to Jan.

- **Cell Procurement Period for FXE-001 and -002**
  - Jan. to Feb.

- **Coupler Procurement for FXE-001 and -002**
  - Feb. to Mar.

- **Technology Decision**
  - Mar. to Apr.

- **HOM Parts Procurement for FXE-001 and -002**
  - Apr. to May

- **Structure Fabrication**
  - May to June

- **FXC-001**
  - June to July

- **FXC-002**
  - July to Aug.

- **FXC-003**
  - Aug. to Sept.

- **End of Furnace Rework Period (Gray Area)**
  - Sept. to Oct.

- **End of Furnace Acceptance Testing and Commissioning**
  - Oct. to Nov.

- **FXC-004**
  - Nov. to Dec.

- **FXC-005**
  - Dec. to Jan.

- **FXD-001**
  - Jan. to Feb.

- **FXD-002**
  - Feb. to Mar.

- **FXD-003**
  - Mar. to Apr.

- **FXE-001**
  - Apr. to May

- **FXE-002**
  - May to June

- **FXD-004**
  - June to July

- **FXD-005**
  - July to Aug.

- **FXD-006**
  - Aug. to Sept.

- **FXD-001 thru -006**
  - Sept. to Oct.

- **FX-001**
  - Oct. to Nov.

- **FX-002**
  - Nov. to Dec.

**Legend:**
- Green: Structures Planned for 8-Pack Phase II
- Yellow: Structures Not Planned for 8-Pack Project (but could be used)
- Blue: Structures Not Planned for Construction
Linear Collider at Fermilab FY04 and Beyond

• FLRPC is expected to endorse the Linear Collider as one of the two future accelerator efforts at Fermilab.

• We are getting ourselves organized to provide technical leadership on the LC Construction.

• We have started engaging in two accelerator physics/technology issues that are central to the Linear Collider and matches our interest and expertise. We are looking at both warm and cold design.

  • Linac

  • Damping Ring

• We are also in discussion with people in LC collaboration to take a leading role in Instrumentations, Feedback systems, Controls, Application programming.
Linear Collider at Fermilab…

• Fermilab has proposed to take a leading role in developing proposals for a Engineering Test Facility (1% system test) for the chosen Linear Collider Technology. Fermilab is willing to serve as a host of such a facility.

• We are in process of defining
  • What should be the scope of such a facility?
  • What are the technology and physics goals for such a facility?
  • How we develop an International Collaboration to build such a facility?
  • Could the ETF be a development facility for the Instrumentation, controls, feedback systems, application program development etc.
  • Could the ETF be a development platform for one of a kind devices?
  • Could the ETF be used for industrialization and QC of major accelerator components.
Linear Collider Group at Fermilab

• A core group of physicists and engineering staff is being assembled in the Technical division to support the planned Linear Collider effort. But a lot more in needed

• We welcome Fermilab staff to join this effort. There is a lot to be done if we want to host the Linear Collider in Illinois.

• We are working with Argonne National Laboratory to develop collaboration of accelerator physics and technologies.

• We are meeting with Universities in Illinois to collaborate with them on the Linear Collider.

• We are also discussing with Universities and other laboratories to collaborate with us on these topics.