

Linear Collider R&D at Fermilab

David Finley

NLC MAC

May 9, 2002

- Organization Evolution
- Upcoming (Fermilab) Speakers
- Large Furnace (one slide update)
- XBand Powerstation @ MS5



Organization Evolution

Crucial People/Posts

- David Finley
 - LC R&D at Fermilab 2/1/02
 - Reports to Steve Holmes
- Steve Holmes => Run II etc.
 - Associate Director for Accelerators
- Bob Kephart
 - Head of Technical Division
 - Gave “Finley’s talk” to HEPAP on April 26, 2002
 - CDF / HEP background => Collaboration, Consortium etc

Watch These Develop

- RF Technology Development Group
 - David Finley = Group Leader (see later slides for teams)
 - Reports to Bob Kephart
 - In the Technical Division
 - Includes XBand, srf and RF
- Run II
 - Most of Beams Division plus
 - Finley, Solyak part time
 - Lebrun, Dombeck full time



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Organization Evolution

RF Technology Development Group in Technical Division

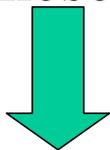
- Present Activities
 - XBand and NLC Main Linac Beam Line Units*
 - * includes adjustable permanent magnets
 - Superconducting RF
- Group has four teams
 - XBand, SRF, Physics, RF Engineering
 - Finley: Carter, Terechkine, Solyak, Romanov
- Physics and RF Engineering support XBand and SRF



Organization Evolution

RFTD in Technical Division: People and Teams

These support these



- D. Finley / Group Leader
- N. Solyak / Physics
- G. Romanov / RF Engineering
 - T. Khabiboulline
 - I. Gonin

- H. Carter / XBand
 - T. Arkan
 - C. Boffo
 - E. Borrisov
 - Brian Smith
 - ~~Future Technician~~
M. Batistoni
- I. Terechkine / SRF
 - Connections to others*

* Most XBand members support SRF

* Others = BD and outside Fermilab



SRF R&D at Fermilab

- Superconducting RF
 - Mostly led by BD at this time, but TD is rising
 - FNPL = photoinjector lab (nee A0 Photoinjector lab)
 - this is much of the srf money in FY02 (\$0.9M Fermilab + NICADD)
 - 3.9 GHz beam separator cavities for fixed target experiment (CKM)
 - Transverse kick, not accelerating
 - This is most of the rest of the srf money in FY02
 - TESLA TDR study (with Argonne, Cornell, JLab, SLAC)
 - Design of 3.9 GHz accelerating cavity appropriate for both TTFII and HBPI (see next bullet)
 - EOI for High Brightness Photoinjector (HBPI aka Pi3)
 - When this gets rolling, it could become most of the money
 - Gerry Blazey of NIU is the spokesperson



Other RF R&D and Other LC R&D at Fermilab

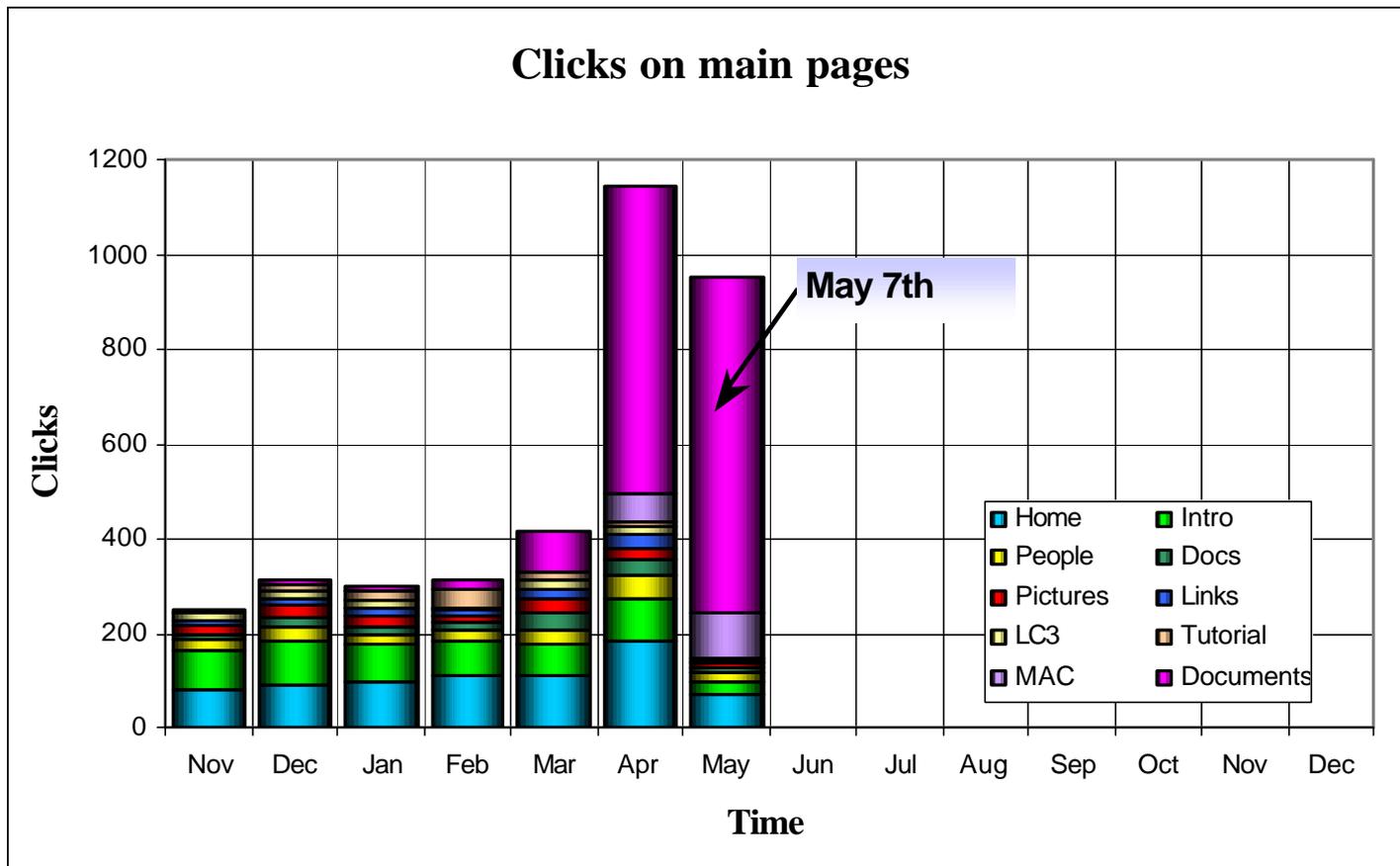
- RF R&D
 - “Minimal funding” status
 - A single 805 MHz cavity in a solenoid at Lab G
 - Steve Geer gave talk at NLC Collaboration meeting on Tuesday
 - Initiated by ionization cooling for muon beams
- Connecting Universities and LC R&D
 - “Pre-funding” status
 - “We want an e^+e^- linear collider, how can we help?” ... or ...
 - The linear collider “is too important to be left in the hands of the experts”
 - April 5, 2002 Meeting at Fermilab: Midwest consortium
 - “The List” (see Tom Himel’s talk)
 - May 10, 2002 (Friday)
 - Cornell, Fermilab, SLAC ... Checking signals

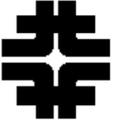


Connecting Universities and LC R&D ... April 5, 2002

Hits on <http://www-td.fnal.gov/lc/lc.html>

Cristian Boffo

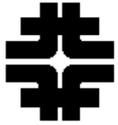




Linear Collider at Fermilab !

(from Bob Kephart's HEPAP Talk April 26, 2002)

- FNAL Director, Mike Witherell, stated in his June 12, 2001 presentation to the DOE/NSF HEPAP subpanel:
 - “We propose to the U.S. and to the international HEP community that we work together to build a linear collider at or near the Fermilab site.”
- FNAL activity in the U.S. LC R&D program is increasing.
- Goals : Develop the technology to support construction of a linear collider.
 - initial CM energy of 500 GeV
 - luminosity of at least 10^{34} cm⁻² sec⁻¹
 - upgradable to an energy in excess of 1 TeV.



Linear Collider R&D at Fermilab

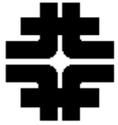
(from Bob Kephart's Talk to HEPAP April 26, 2002)

- Fermilab is the only US institution that is both an NLC and TESLA collaborator
- On NLC Fermilab is:
 - Making RF structures for the 8 pack test at SLAC
 - Working on industrialization of RF structures
 - Working on support girder design for the main linac
 - Investigating adjustable permanent magnet quadrupoles
- On TESLA/SCRF
 - FNPL (Fermilab NICADD Photo-injector Lab)
 - EOI for High Brightness Photo-injector (HBPI), with many universities and labs
 - CKM cavities (SC cavities for separated K beam experiment at FNAL ~TESLA)
 - Design of 3rd harmonic cavities appropriate for both TTFII and HBPI
 - Study of the TESLA TDR: Goal = understand costs in US terms and to familiarize FNAL staff with the engineering aspects of the proposal
- For Both : Studies of possible US sites (including FNAL) for a Linear Collider



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Upcoming (Fermilab) Speakers (NLC R&D at Fermilab)

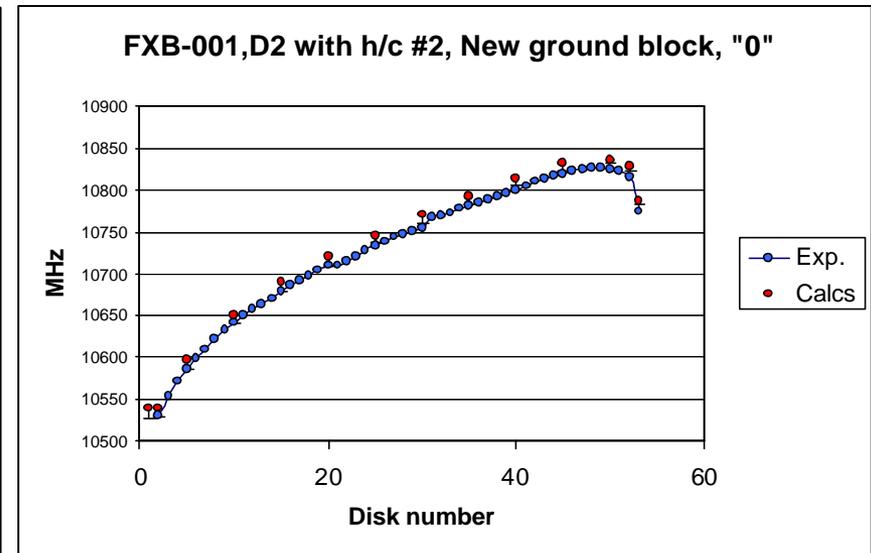
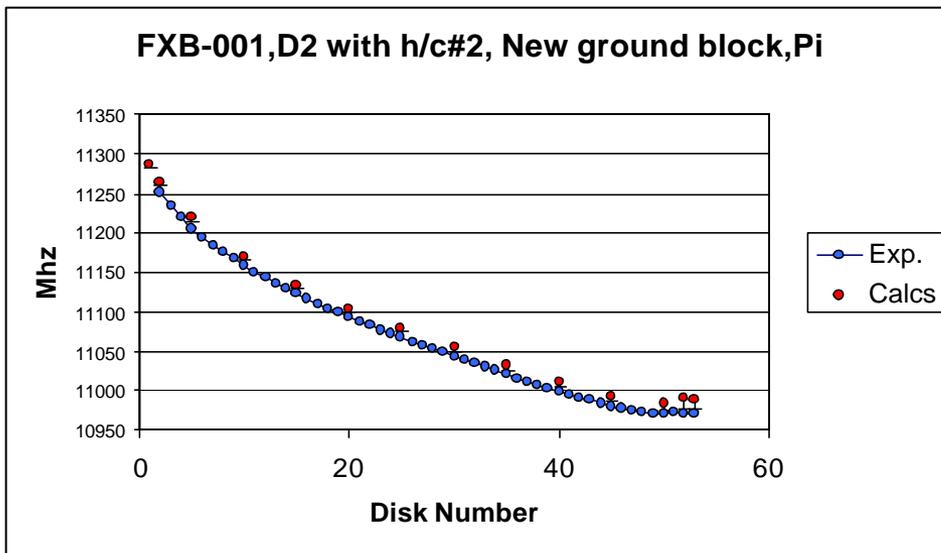
- XBand powerstation
 - More later in this talk
 - Modulator being built
 - Induction brazing of DLDS pipes being attempted
 - What's the point?
- Beam Physics (no more today)
 - On hold until Run II works
- Civil Engineering
 - See Vic Kuchler's talk
 - Minimal NLC funds in FY02
- Permanent Magnets*
 - See Jim Volk's talk
 - Radiation damage
- Main Linac girder*
 - See Harry Carter's talk
- XBand structures*
 - See Nikolay Solyak's talk

* These are all pursuing the “production of Main Linac beam line units” which is (my interpretation of) Fermilab's original intention upon joining the NLC Collaboration ... along with an Illinois site, of course.



Microwave measurements of FXB-001 disks

- Two sets of FXB-style* disks have been made by industry and measured at Fermilab. (See N. Solyak's talk.)
 - These are high precision conventional machined parts.
 - These are within the drawing tolerance of (-10 micron, +zero micron); we chose to tune to higher frequencies only. (10 MHz = ~10 microns for 2b.)

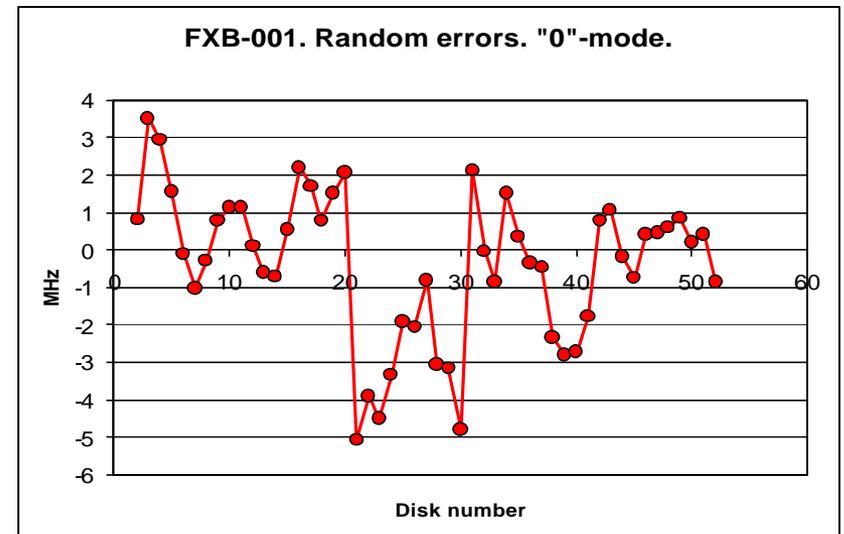
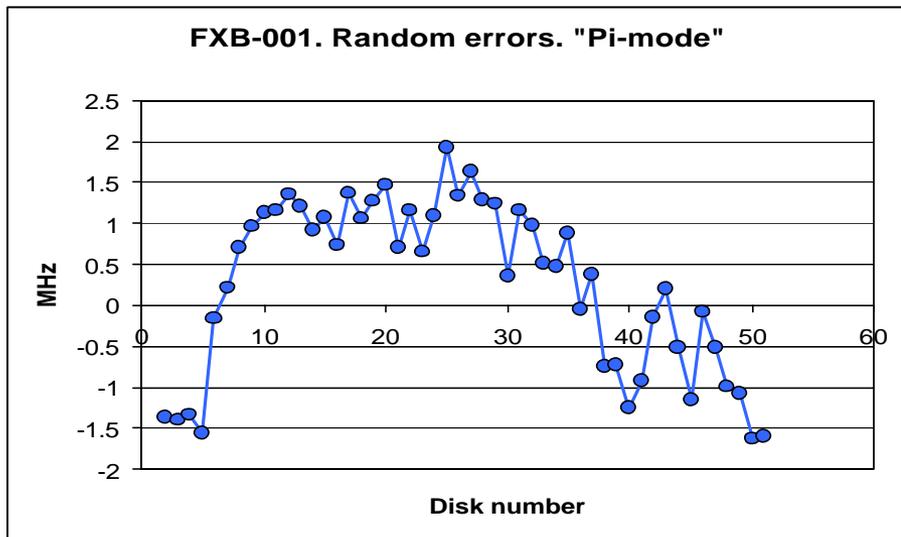


- FXB = 60 cm high gradient test structure; ~~six~~^{nine} structures to be delivered to 8 Pack Test
- FXC = Full feature Main Linac style accelerating structures (e.g. RDDS-like)



Microwave measurements of FXB-001 disks

- Precision / random errors: (see N. Solyak's talk)
- The plots below show the result of subtracting the average value (accuracy).
- These are high precision conventional machined parts.





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Large Furnace

- The Bad News

- It sprung an air leak when under vacuum at high temperature at the company
- Thus, it inhaled oxygen deeply and fried its guts
- It was two months late when this happened
- ~ \$320K of \$400K already paid to company.
- We were not amused.

See D. Atkinson's talk

- The Good News

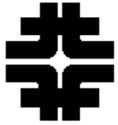
- The company and Fermilab and NIU are working together on a cure
- Impact on delivering FXB-001 to SLAC for high gradient testing??
 - None or \$\$\$
 - None if it shows up according to the cure notice (end of May)
 - If not, \$\$\$ for Travel and AlphaBraze
- The impact on the two “5.4m” objects for the 8 pack test (aka “girders”)
 - None ... we hope.
 - Jul - Aug 03 for Girder A
 - May - Jun 04 for Girder B

Finley's top down estimate and Carter's more detailed estimate



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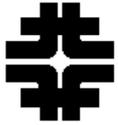
XBand Powerstation at Fermilab

- Present Status
 - Location identified (MS-5) and waiting for \$ to be cleaned out
 - Modulator being built to handle one klystron at this time, but is configured to handle two klystrons; to be finished by September – December 2002
 - Induction brazing of DLDS pipes being attempted
 - Counting on one klystron (50 MWatt) & load from SLAC by September 2002



XBand Powerstation at Fermilab

- Then, with flat \$ in FY03 (to XBand powerstation)
 - Full power for a photocathode rf gun from AES if they get their Phase II SBIR
 - Full (?) power to standing wave structures
 - Partial power to high gradient structures
 - Partial power to Main Linac 60/90 cm structures (either one)



XBand Powerstation at Fermilab

- Then with even more \$ in FY03, and a second klystron, load and power redistribution system
 - Full power for high gradient structures
 - Full power for Main Linac 60/90 cm
 - R&D test of tungsten iris material test for CLIC (requires a different power redistribution system -> need about a month to reconfigure)
- But ... why should Fermilab have an XBand powerstation now, soon or ever?



Why should Fermilab have an XBand powerstation now?

- 1) Short Term:
 - To continue the completion of the RF Factory concept locally (see next slide ... again). This would stimulate more RF creativity and expertise locally.
- 2) Long Term: (my opinion ... shared by some not all)
 - XBand expertise will be needed at Fermilab if/when the NLC is located/operated at Fermilab. And you can't start too early.



RF Factory Elements

(Norbert Holtkamp, David Finley)

From David Finley's Presentation at the May 31, 2000
NLC Collaboration Meeting at Fermilab

- Seven Elements of the RF Factory

- RF Design

- Produce Copper / Machine Copper

- RF Measurements & Development / Low Power

- Structure and Vacuum

- Mechanical Measurements of Straightness

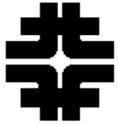
- Brazing / Bonding Facility

- High Power Processing



What the MAC should consider ...

- It would be good if the MAC were to consider whether an “XBand powerstation at Fermilab” has the appropriate priority within the NLC Collaboration.
- But: Wait until Tor’s talk tomorrow in which he puts R&D in context.



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