Linac Girder Studies and Plans

C. Boffo – E. Borissov – H. Carter
Fermilab, Technical Division
RF Technology and Development Group
OUTLINE

- Strongbacks for NLCTA
  - First delivery (FXB001/2)
  - Near future plans (FXB003-12)

- NLC Girders development
  - Stability Measurements
  - Vibrations – HLS – Movers – FEM/FEA

- Schedule & Budget
Strongbacks For FXB002/3

- SLAC Style
- Fit up to 2 structures or 1 structure + instrumentation
- Maintain the same beam line length as SLAC strongbacks in NLCTA
Strongbacks For FXB002/3

Mockup

Shipping supports

Instrumentation from SLAC

Linac Girder Studies and Plans
Strongbacks -> NEXT STEP

- Extend the strongback to accommodate 3 structures with the minimum impact on the NLCTA setup
- Reduce the length of the drift pipes; add bellows to compensate for thermal deformations (3 mm)

Available space 89″

FXB004  FXB005  FXB006

eyelet

~94″
NLC Girder Development

- Stability measurements
- Vibration measurements
- Motors and gears
- HLS
- FEM / FEA Simulations
Stability measurements (SM)

- Study the effect of thermal cycles on the girder assembly.
  (started in 1998 C. Adolphsen)

GOALS

Investigate about the sensitivity of the girder + structures complex to thermal variations due to the water cooling and heat generation.
Reproduce SLAC measurements and improve the setup by substituting:
- actual tubes -> dummy structures with disks with the same Inertia as C type
- actual 4.5 m support -> 6 m long girder

In the process to:
- Calibrate and align the sensors.
- Connect the water system.
- Test the electronics and DAQ.
**Long term plan:**
Upgrade this mockup by steps in order to create a real girder “NLC style” fully instrumented to perform all needed tests.
Collaborate with SLAC (Seryi, Le Pimpec) to:

- Perform vibration measurements on the Girder complex.
- Determine effect on stability due to water cooling system on FNAL structures.
- Transmission of vibrations to quads

Hardware:
- Geophones
- DAQ system

Software:
- SLAC Labview applications
Motors and movers

Build a complex of 2 cams system to:
• Understand the limits of the application
• Perform tests on hardware
• Perform tests and familiarize with controls

Actual quote:
• 2 stepper motors $ 5000 x 2
• 2 gear boxes $ 2500 x 2
• control system $ 1000

$ 16,000
Hydrostatic Level System

- Contacts with groups at FNAL and SLAC that use HLS to monitor ground motion in tunnels.
- Need to build know-how in adapting the devices to work on girders

COSTS:
- Sensors (4) $2,500 / each
- Software $10,000

$20,000
SIMULATIONS

PLANS

• Create solid model of structure on strong back using TD resources
• Involve FNAL PPD group for finite element analysis
• Perform thermal and mechanical stress analysis
• Perform vibration modes analysis

• As soon as we converge on a design for Girders extend simulations on the full complex
• Verify FEA results with experimental data where possible

STATUS

No work as been pursued in this direction yet. Need to generate a solid model first in order to begin the process.
<table>
<thead>
<tr>
<th>ACTIVITIES AND BUDGET</th>
</tr>
</thead>
<tbody>
<tr>
<td>FY03 Budget for girders and strongbacks</td>
</tr>
<tr>
<td>Stability measurements</td>
</tr>
<tr>
<td>Movers</td>
</tr>
<tr>
<td>HLS</td>
</tr>
<tr>
<td>Strongbacks production</td>
</tr>
<tr>
<td>Simulations</td>
</tr>
</tbody>
</table>
### SCHEDULE

#### NLCTA STRONGBACKS:
- Build and deliver strongback for FXB003 01/03
- Design and build strongback for FXB004/5/6 04/03
- Build and deliver strongback for FXB007/8/9 07/03
- Build and deliver strongback for FXB010/11/12 10/03

#### SLABILITY MEASUREMENTS:
- Complete calibration and start routine measur. 01/03
- Implement FXB dummy structures 04/03
- Implement 6m long “static” girder 07/03

#### VIBRATION MEASUREMENTS:
- Start measurements on dummy structures 01/03

#### MOVERS – HLS – SIMULATIONS:
- Depending on FUNDING and TIME availability
SUMMARY

Work on girder development has begun at FNAL.

Just as everyone else we are experiencing funding limitations. Time and engineering resources are limited due to the involvement in other projects. Future work on NLCTA strongbacks for the 8 pack test will not require significant engineering resources.