Summary of Fermilab/SLAC Accelerator Physics Discussions  
Mike Syphers & Tor Raubenheimer

This is a summary of discussions regarding the Fermilab/SLAC collaborative effort on NLC accelerator physics which were held during the afternoon of August 16th and the morning of August 17th at SLAC. The attendees were John Marriner, Nan Phinney, Tor Raubenheimer, and Mike Syphers.

Since Fermilab is interested in assuming responsibility for the main linac beam lines, we concentrated on issues relevant to this portion of the NLC design. Our discussion covered three main topics. First, we discussed the present state of the linac accelerator physics design and specific topics that need to be addressed. We discussed who at Fermilab might work on these tasks and possible contacts at SLAC. A preliminary list of some linac topics, as well as some other items that might be studied, follows in an appendix at the end of this document. The topics are subdivided to be roughly independent tasks, however, in many cases, significant ground work has already been performed by people at SLAC; Tor will ensure that the relevant initial studies are documented as LCC Notes (see below).

Second, we discussed modes of communication for the collaborative work. We considered visits to Fermilab and SLAC by various people as part of the education process to help get the work started and plan to organize those visits once the appropriate people have been identified. We also plan to use the web to transfer information and Mike and Tor spent some time exploring the NLC web site. Mike will consider the possible methods of setting up a common or shared web site. Tor noted that much of the work thus far performed has been documented scanned transparencies from the various meetings. Although this information is available through the web, it is difficult to follow. Mike and Tor will discuss a more general format for documenting the meeting discussions. There is more formal documentation in the form of LCC Notes (also available from the NLC web site) but these have not been utilized extensively.

In addition, we will use the video conference facilities for more frequent discussions of the ongoing work. The first few video meetings will be overview presentations of the linac design with some in depth discussion of the various tasks described above. At this time, we have reserved two slots: a weekly meeting at 9 am PDT on Wednesdays and a bi-weekly meeting at 11 am PDT on Wednesdays. The schedule for the month of September is listed below – the speakers are still tentative:

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<th>Date</th>
<th>Time</th>
<th>Topic</th>
<th>Speaker</th>
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<tr>
<td>9/8</td>
<td>9am</td>
<td>Review of linac layout and DLDS scheme</td>
<td>Adolphsen</td>
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<td>9/8</td>
<td>11am</td>
<td>Discussion of tasks and general comments</td>
<td>Tor Raubenheimer</td>
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<td>9/15</td>
<td>9am</td>
<td>Sources of transverse phase space dilution</td>
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Finally, we discussed talks aimed toward a more general audience at Fermilab. The talks would be used to convey the broader spectrum of issues and constraints on the present NLC design. We first came up with a list of roughly 20 talks that would be of interest and then narrowed the list to roughly five seminars that should be presented in the near-term. Chris Adolphsen has agreed to give the first seminar during his visit to Fermilab in early October. The other talks that were given high priority were: Peter Tenenbaum on steering and beam-based alignment and the final focus design, Paul Emma to discuss the damping ring lattices and the bunch compression system, Roger Jones on the RDDS structure electrical design and modeling, and Jon Ives to discuss Conventional Systems for the NLC.

Appendix A

Tasks for linac and other studies

Codes / simulation routines

- Study extended standard input format (XSIF) – suggest improvements
- Install MAD with acceleration – compare with TRANSPORT
- Install LIAR for linac emittance simulations

Main linac optics

- Re-match to increase bandwidth / decrease magnet/power supply variation
- Study minimum booster supplies needed for matching with strings – can the booster supplies by installed in the tunnel?
- Compare optics and alignment measurements with strings versus individual power supplies
- Verify matching requirements for different klystron populations
- Study re-matching with failed booster supplies
- Verify power supply tolerances and magnetic harmonic requirements
- Can PM hybrid magnets be used for part of the linac? What range is necessary? Are these air-cooled?
- Consider different linac quadrupole layouts, i.e. 1 quadrupole after every accelerator girder

Linac transverse phase space

- Verify alignment algorithms including long-range wakefields and girder deformations
- Study effectiveness of alignment algorithms versus quadrupole variation
- Study effectiveness of alignment as a function of BPM and mover failure
Study effectiveness of beam bumps with realistic energy and betatron phase errors — can these be used to ease mover/diagnostic requirements
Specify maximum mover step-size (limited by beam oscillations that could increase backgrounds in the detector)
Verify BPM requirements
Evaluate ‘worst’ bunch train distribution for BBU
Study ‘BNS’ damping of long-range wakefield — does it work?
Measure component vibration and jitter at Fermilab and model this in simulation
Consider long-term component motion and requirements on alignment routines and alignment components
Evaluate magnet/mover failure scenarios that could put beam into structures

**Linac longitudinal phase space**

Verify BNS damping overheads and repair margins
Layout and simulate longitudinal energy feedback — use results in beam bump simulations (above)
Study jitter effects — bunch length, charge distribution, rf phase, etc.
Consider bunch shaping — is there an approach that would work without degrading the bunch compressor performance
Evaluate rf failure scenarios that could put beam into structures

**Accelerator structure design and tolerances**

Verify baseline construction tolerances
Study different transverse mode distributions — evaluate frequency and alignment tolerances
Study wakefields due to higher dipole and longitudinal bands
Translate performance requirements into final construction tolerances
Model manufacturing process and QC to estimate effect of construction errors

**Other topics of interest**

Design of specialized nonlinear magnets for energy collimation system
Study of collective effects in the IR region
Study of backgrounds from the collimation system (muons, degraded e+/e-, etc.)