NLC collimation meeting notes, FZ, 05/22/98

The present NLC collimation system has a length of about 3 km (on either side of the IP). The length is determined by the requirement that spoilers and absorbers should survive the impact of one entire bunch train. This sets a limit on the minimum spot size, and thus on the minimum beta functions. The large beta functions in turn result in a large system length. The problem is compounded by the additional requirement that each betatron phase and each plane is collimated twice.

The collimation system in fact serves two different functions: it should protect all downstream systems against bunch trains which enter with large betatron excursions or large energy errors, and it should continually remove the beam halo, which otherwise would cause unwanted background in the NLD.

Tor outlined his ideas about what this group should be investigating. The idea of the NLC collimation group is to pursue new, alternative, perhaps radically different approaches, which can shorten and/or simplify the collimation section.

Examples of such alternative approaches were sketched: nonlinear collimation with sextupoles or with higher order multipoles, nonlinear magnetic fields, bending magnets with small gaps, sacrificial collimators which are moved inwards or rotated after beam impact, etc.

Tor also discussed the main areas where beam tails are generated: (1) damping rings, (2) scattering on gas and on thermal photons, and (3) wakefield driven tails in the linac. The last is probably the dominant one.

We arrived at the following lists:

1) *baseline parameters*:

- collimate $\sim 1\%$ of the beam at $50\sigma_y$ and $7\sigma_x$
- beam energy 500 GeV
- largest emittances: $\gamma\epsilon_x = 6 \times 10^{-6}$ m, $\gamma\epsilon_y = 14 \times 10^{-8}$ m
- smallest emittances: $\gamma\epsilon_x = 4 \times 10^{-6}$ m, $\gamma\epsilon_y = 4 \times 10^{-8}$ m
- $N = 10^{12}$ particles per train
- the transverse and longitudinal beam parameter window that is not intercepted by the linac MPS corresponds to $300\sigma_y$, 30–40σ_x, and 4% relative energy deviation.

2) A critical question is the need for *passive protection.*

3) *Other issues* include:

- survivability/material
- optics
- wakefields
- edge scattering
- repetition, phases

4) *Methods* to explore:

- novel materials
- conventional system
- alternative methods of passive protection (e.g., sacrificial elements proposed by D. Helm)
- magnetic spoilers
- nonlinear focusing to remove the tails (K. Thompson)
- rf methods, rf octupoles etc.