Nanobeam Interaction Region Issues

Tom Markiewicz/SLAC

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NLC Detector Masking
Plan View w/ 20mrad X-angle

Large Det.- 3 T

Silicon Det.- 5 T

32 mrad

30 mrad

Tom Markiewicz
JLC IR
8 mrad Design

- Iron magnet in a SC Compensating magnet
- 8 mrad crossing angle
- Extract beam through coil pocket
- Vibration suppression through support tube

Tom Markiewicz
TESLA IR
Instrumented W Mask & Pair-LumMon w/ Low Z Mask

laser interferometer

instrumented mask

2K cryostat

quadrupole

83.1 mrad
54.5 MRAD

27.5 MRAD

24mm cylindrical mask with pair L monitor

stripline BPM

cavity BPM

2400 2750

5200 7000

0 1 2 3 m
TESLA SC Final Doublet Quads
Mature LHC based Design

QD0:
- \( L = 2.7 \text{m} \)
- \( G = 250 \text{ T/m} \)
- Aperture = 24 mm

QF1:
- \( L = 1.0 \text{m} \)

[Diagram of TESLA SC Final Doublet Quads]

Tom Markiewicz
Differences w.r.to e+e- IR

- Annular Mirror system
- 10 mrad exit aperture instead of 1 mrad
- 30 mrad $\theta_C$ to accommodate exit aperture
- Larger inner radius of VXD as first 2 layers of LD/SD VXD look in direct line of sight w/dump

Tom Markiewicz
NLC Baseline: Permanent Magnet Quad
Compact, Stiff, Connection Free
Control B by controlling magnet position in Closed-Loop FB

Andy Ringwall

QD
Carbon fiber stiffener
nm-mover
FFTQB style
cam movers

Cantilevered support tube

Knut Skarpaas

<table>
<thead>
<tr>
<th>Magnet</th>
<th>Aperture</th>
<th>Gradient</th>
<th>Rmax</th>
<th>Z_{ip}</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>QD0</td>
<td>1.0 cm</td>
<td>144 T/m</td>
<td>5.6 cm</td>
<td>3.81 m</td>
<td>2.0 m</td>
</tr>
<tr>
<td>QF1</td>
<td>1.0 cm</td>
<td>36.4 T/m</td>
<td>2.2 cm</td>
<td>7.76 m</td>
<td>4.0 m</td>
</tr>
</tbody>
</table>
Cold Bore NLC SC Quadrupole w/ Integrated Sextupole Windings

Quadrupole Coil Layers

Thermal Shield and Cold Mass Support Structure

LHe Flow Space

Coil Support Tubes

Sextupole Coil

Brett Parker, BNL

L.X. Jia, BNL
NLC Extraction Line
150 m long with chicane and common γ and e-dump

X-Angle allows separate beam line to cleanly bring disrupted beam to dump and allows for post-IP Diagnostics

0.2% of beam ~ 4kW lost @ 1 TeV
0-0.002% beam ~ 0-20W lost @ 500 GeV
Electrostatic separators at 20m
Shielded septum at 50m (cτ₀/2)
Dipoles to e-/+ dump at z=240m
Calculated losses OK
Challenging problem
No space for diagnostic equipment

Photons to separate dump at 240m with hole for incoming beam

Tom Markiewicz
Nanobeam IR issues for TESLA:
- Are there any?
Yes

- Crossing angle needed? If yes, how large?
- Realistic design of laser wire/shuntake monitor?
- IP feedback O.K. (already in TTF). But Tesla should also plan for optical/inertial anchors!