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Magnet Note

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Title: Compact small aperture quadrupoles for NLC IR

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Compact small aperture quadrupoles for NLC IR

Ramesh Gupta

Next Linear Collider (NLC) [1] needs very small aperture quadrupoles in its interaction region. At SNOWMASS 2001, the permanent magnet solution was presented to fulfill these requirements [2]. A need for small aperture (hence, low pole tip field in quadrupole) and restrictions of environment made permanent magnet as the natural choice. However, an examination of the overall IR design parameters revealed that these requirements can be met with superconducting technology as well as long as a compact cryostat can be designed. An alternate option was proposed [3] on the spot following the spirit of SNOWMASS, pointing out that in particular, BNL experience and technology (compact cryostat and wire winding technology) can be adopted for this application. A quick follow-up magnetic design work and zeroth order study of cryogenic and mechanical requirements indicated that these parameters could indeed be met [4]. The enclosed e-mail exchange documents the initial proposal. B. Parker, who has carried out magnetic designs of similar magnets earlier [5], is presently pursuing this work.

References:

1. 2001 Report on the Next Linear Collider. A report submitted to SNOWMASS 2001.
2. Fermilab presentations on permanent magnets by W. Foster, V. Kashikan, et al..
3. R. Gupta @ SNOWMASS 2001.
4. M. Anerella, et al., private communication.
5. B. Parker, et al., "Test of a Model Superconducting Magnet for the HERA ep Interaction Regions" at MT-16, Sept 26-Oct 2, 1999.

From: Gupta, Ramesh C Sent: Wed 7/18/2001 10:09 AM
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Subject: NLC IR Quads

Compact small aperture quadrupoles for NLC IR

As promised on my last day at Snowmass, I looked into the possibility of adapting HERA superconducting luminosity upgrade magnet designs for NLC interaction region quadrupoles. The HERA magnets were built at BNL. One of the major requirements was coming up with a compact design where the magnets (including the cryostat) fit within the HERA detectors (< 40 mm in horizontal direction). I see a similarity in design considerations between these magnets and the magnets required for the NLC IR. The coil inner radius in the magnets for HERA upgrade is ~56 mm and the cryostat outer radius is ~ 84 mm. The beam tube inner radius is 45 mm. The design is shown schematically in the attached word document. The magnets actually operate in a solenoidal field of ~1.5 T.

I checked with various people about extending the present technology to meet NLC IR quadrupole design requirements in their entirety (namely a coil inner radius of 1 cm, a cryostat outer radius of ~6 cm and a gradient of 200 +/- 50 T/m, etc.). These are within the realm of present technology; however, some R&D would still be required. I am attaching a paper presented by Parker et al. at ASC 2000 on this subject. Please also see, "Test of a Model Superconducting Magnet for the HERA ep Interaction Regions" at MT-16, Sept 26-Oct 2, 1999, by Parker, et al.

nlc-quad.doc

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---Ramesh

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