EUROTeV-Memo-2007-001

Improved final doublet parameters for the ILC 2mrad crossing angle interaction region

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April 16, 2007

Abstract

In this memo we present new final doublet parameters for the small crossing angle layout of the International Linear Collider. We use NbTi technology for the 500 GeV layout and Nb_3Sn technology for the 1 TeV machine. The charged beam and radiative Bhabha power losses for the new High Luminosity parameter set are also presented.

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1 INTRODUCTION

In this brief memo we present new final doublet parameters for the small crossing layout [1] for the International Linear Collider. The intention is to provide a basis for cross-checking and evaluation, in view of finalising the optimisation taking into account the magnet design in a realistic way. The final doublets are based on superconducting technologies for QD0 and SD0, and warm conducting technologies for QF1 and SF1. For the design with a centre of mass energy of 500 GeV, we use NbTi for QD0 with a pole-tip field limit of 6.3T, and for the 1 TeV centre of mass energy design we use Nb_3Sn with a pole-tip field limit of 8.8T. The maximum pole tip field limit for the large-bore superconducting sextupole SD0 was taken to be 4.4T, following the Snowmass layout. For the warm magnets, we use pole tip field limits of 1.4 and 0.75 T for the quadrupole and sextupole, respectively. Note the outgoing beam will pass through the pocket region of QF1 and SF1. The optimisation method is based on the one presented in [2], where a discussion can be found on the 1 W maximum power loss tolerance appropriate to use in the super-conductive magnets in this design.

2 IMPROVED FINAL DOUBLET PARAMETERS

The optimised parameters are shown in Table 1 for the 500 GeV machine and in Table 4 for the 1 TeV machine. The beam energy losses shown in Tables 2. The inter-magnet spacings are shown in Table 3. In this work the new machine parameters are used [3], with particle phase space distributions taken from [4].

Acknowledgement

This work is supported by the Commission of the European Communities under the 6^{th} Framework Programme "Structuring the European Research Area", contract number RIDS-011899.

References

[1] Appleby *et al*, EuroTeV report 2006-001-01, http://alcpg2005.colorado.edu:8080/alcpg2005/program/accelerator/WG4/aug17_nosochkov_extraction2mrad.pdf

[2] R. Appleby and P. Bambade, JINST 1 P10005 (2006), EuroTeV report-2006-022, physics/0606022

[3] RDR, http://media.linearcollider.org/report-apr03-part1.pdf and 'New beam parameters' circulated by T.Raubenheimer to the RDR leaders

[4] http://flc-mdi.lal.in2p3.fr/spip.php?rubrique17

Table 1: The 500 GeV final doublet parameters.

Parameter	QD0	SD0	QF1	SF1
Length [m]	1.059	1.469	1.596	0.75
Strength	-0.270 m^{-2}	2.969 m^{-3}	0.0786 m^{-2}	-2.044 m^{-3}
radial aperture [mm]	28	60	20	30
gradient [T/m]	225	-	65	-

Table 2: The power losses losses for the 500 GeV and 1 TeV final doublets. Note that QF1 and SF1 are warm magnets with no significant power losses.

Parameter set	QD0	SD0
High Luminosity CB [W] 500 GeV	<1	<1
High Luminosity RB [W] 500 GeV	0.46	0.2
High Luminosity CB [W] 1 TeV	<1	<1
High Luminosity RB [W] 1 TeV	0.82	0.04

Table 3: The inter-magnet drift spaces used in the final doublet. On all layouts, the total QD0-QF1 distance is always 5.3m.

	500 GeV	1 TeV
l* [m]	4.5	4.5
QD0-SD0 [m]	0.8	0.8
SD0-QF1 [m]	3.03	2.05
QF1-SF1 [m]	0.5	0.5

Table 4: The 1 TeV final doublet parameters.

Parameter	QD0	SD0	QF1	SF1
Length [m]	1.352	2.5	3.192	1.5
Strength	-0.210 m^{-2}	1.502 m^{-3}	0.0394 m^{-2}	-0.943 m^{-3}
radial aperture [mm]	25	59	20	30
gradient [T/m]	350	-	66	-