Discussion Detector Multiplicities & Timing Requirements Warm vs. Cold

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Backgrounds and IR Layouts

	TESLA-500	JLC/NLC-500
N	2.0×10^{10}	0.75×10^{10}
σ_x	550 nm	243 nm
σ_y	5 nm	3 nm
σ_z	300 μm	110 μm

Incoherent production of e+e- pairs.

- # pairs scales with luminosity and is ~equal for both designs.
- Detector occupancies depend on machine bunch structure and relevant readout time
- IR Designs are similar in the use of tungsten shielding, instrumented masks, and low Z material
- GEANT and FLUKA based simulations indicated that in both cases occupancies are acceptable

NLC/TESLA Beam-Beam Comparison

	NLC500	TESLA500
D_y	14	25
Y	0.11	0.06
n_γ	1.17	1.6
δ_b	4.6%	3.2%
H_D	1.4	2.1
# pairs/bunch	49,000	130,000
<E>_pair e	4.1 GeV	2.8 GeV
#pairs/ sec	1.1E9	1.8E9
#pairs/ Lum	5.5 fm^2	5.3 fm^2

$$\Upsilon = \frac{5\gamma r_e^2 N_e}{6\alpha\sigma_Z(\sigma_X+\sigma_Y)} = \gamma\frac{B_{bunch}}{B_c}$$

$$D_Y = \frac{2r_e N_e \sigma_Z}{\gamma\sigma_Y(\sigma_X+\sigma_Y)}$$

Larger σ_z for TESLA

More time for disruption

larger luminosity enhancement

more sensitivity to jitter

Lower charge density

lower energy photons

Detector Occupancies

from e+e- Pairs @ 500 GeV

fcn(bunch structure, integration time)

	Detector	Per bunch	R. O.	Eff #B	Occupancy	Comment
TESLA	VXD-L1	36E-3/mm^2	50 μs	148	5.3/ mm^2	1.5cm, 4T
	VXD-L2	3.1E-3/mm^2	250 μs	742	2.3/ mm^2	2.6cm, 4T
	TPC	1336γ, 5trks	55 μs	160	Few per mil	
	Barrel ECAL	1176γ, 0.63GeV	150 ns	1	0.63 GeV	101γ>3MeV
	Endcap ECAL	1176γ, 1.29GeV	150 ns	1	1.29 GeV	91γ>3MeV
NLC	VXD-L1	38E-3/mm^2	8 ms	192	7.2/ mm^2	1.2cm, 3T
	VXD-L2	3.1E-3/mm^2	8 ms	192	0.6/ mm^2	2.4cm, 3T
	TPC	1377γ, ?trks	8 ms	192	"Few per mil"	Needs Study
	Barrel ECAL	547γ , 0.73 GeV	8 ms	192	139 GeV	Needs Study
	Endcap ECAL	597γ, 0.9 GeV	8 ms	192	171 GeV	Needs Study

TESLA=TDR; NLC=Snowmass 2001