Discussion of gamma-gamma parameters

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Beam parameters

		ILC optimistic	ILC w/ e+e-	NLC γγ	e+e-
f_{rep}	Hz	5	5	120	5
n_b		2820	2820	95	2820
σ_x^*/σ_y^*	nm	88/4.3	175/4.3	166/3.0	553/5
β_x^*/β_y^*	mm	1.5/0.3	1.5/0.3	4/0.08	11/0.4
$\varepsilon_{xn}/\varepsilon_{yn}$	μm rad	2.5/0.03	10/0.03	3.6/0.071	10/0.03
L_{geom}^{ee}	$cm^{-2}s^{-1}$	$11.8x10^{34}$	$5.9x10^{34}$	$4.0x10^{34}$	$1.6x10^{34}$

•very important that the baseline use standard ILC parameters

Gronberg

- Slide from LCWS05 gamma-gamma summary talk

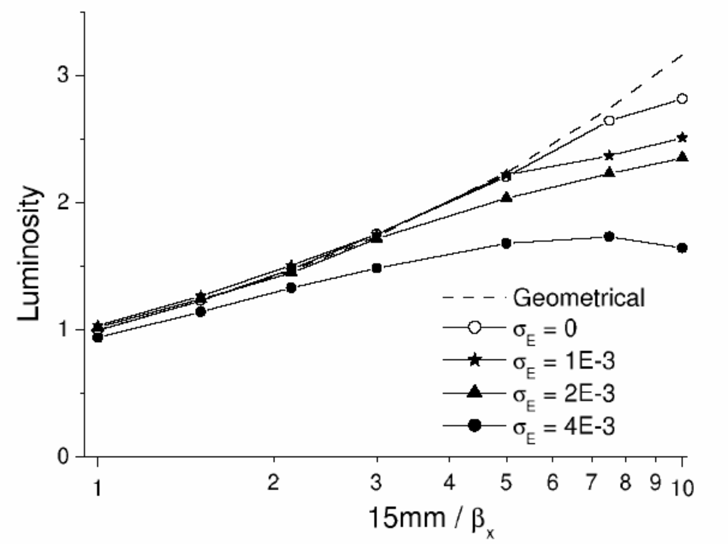
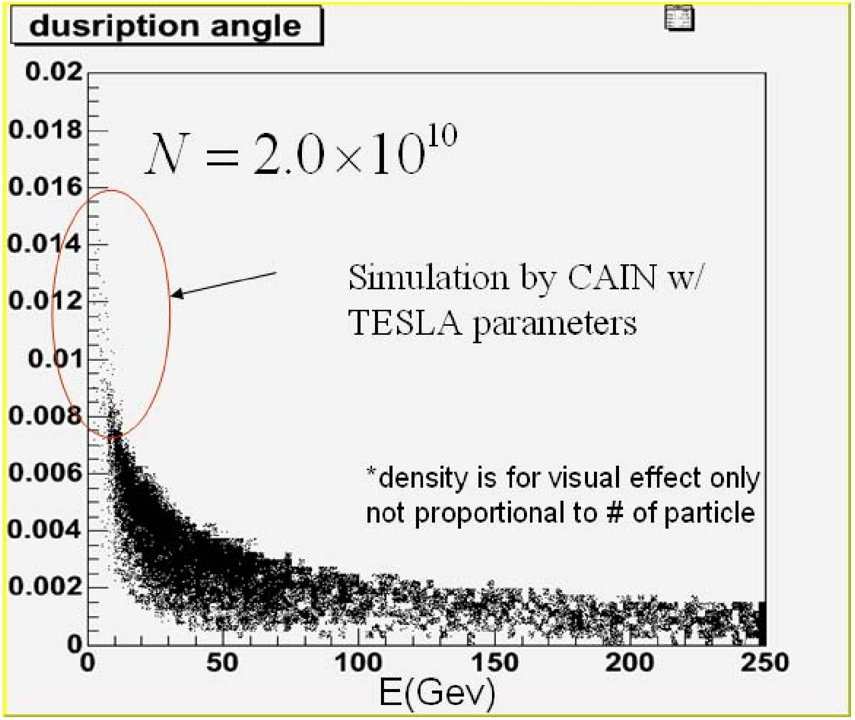


Figure 1.4.4: *Dependence of the geometric e^-e^- luminosity on the horizontal β–functi(SLAC design). For TESLA the relative energy spread (σ_E in the figure) is 10^{-3}.*



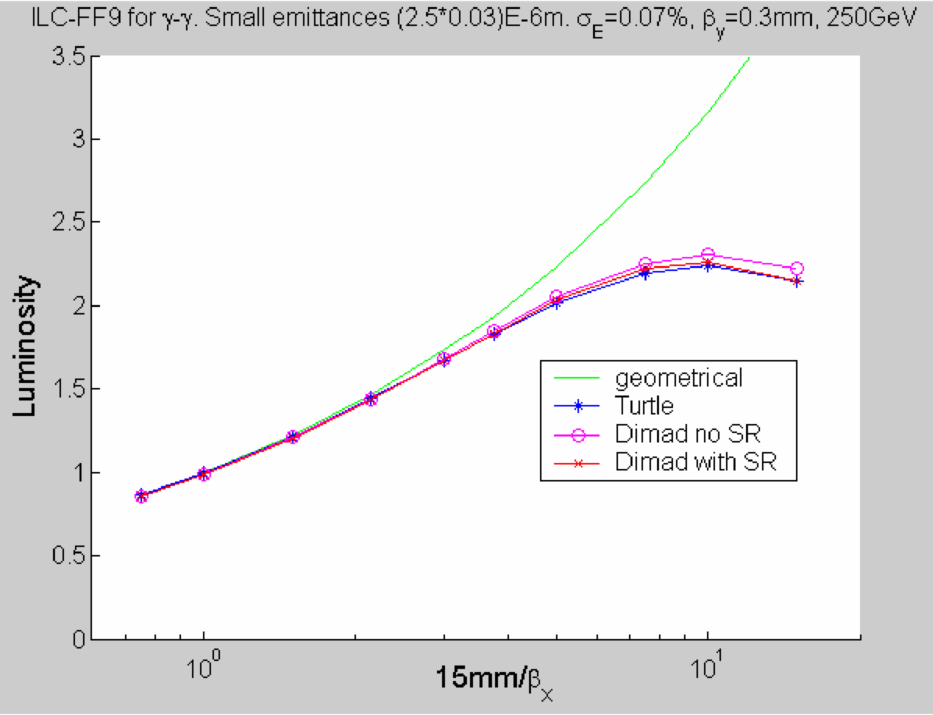
T. Takahashi

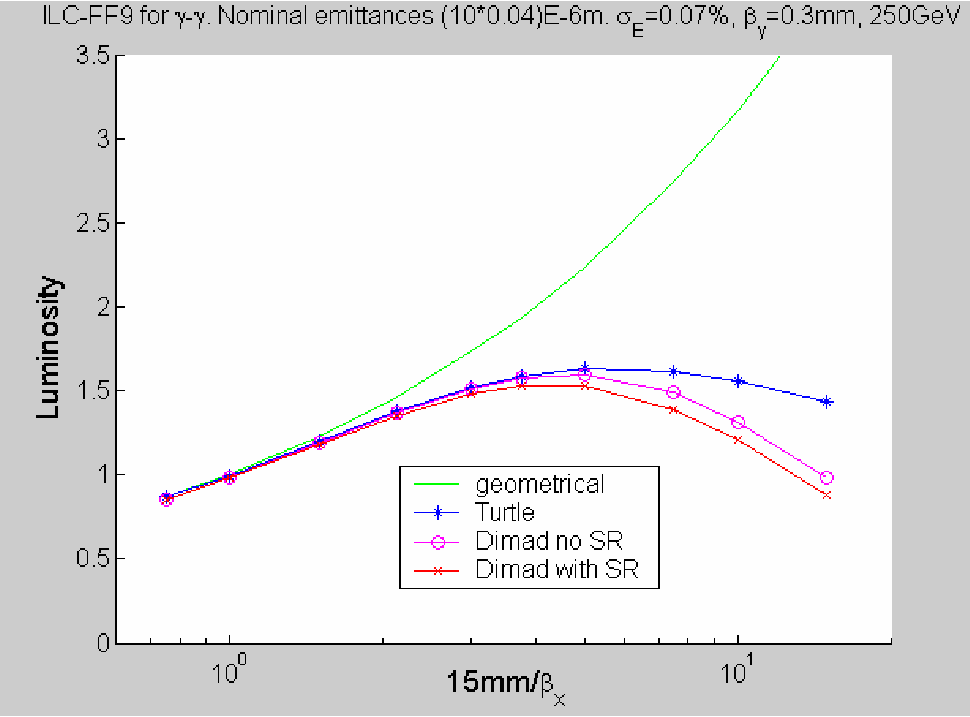
Left: FF (2001) performance with smaller β_X. Picture from gamma-gamma TESLA TDR. Aggressively small emittance was used: 250GeV/beam, $\gamma\varepsilon_{x/y}$ = 2.5/0.03E-6m, β_y=0.3mm

Right: disruption angles of the beams after conversion and beam-beam interactions. Parameters? Possibly, also high lumi aggressively case.

- => estimate ILC-FF9 performance with lower β_X and nominal emittances
- => estimate disruption angles for achievable beams

ILC-FF9 with smaller β_x (without rematching, change incoming betas)





Left: aggressive emittance.
(similar performance as in 2001)

Right: nominal emittance.

- For nominal emittances, the optimal beta-x is 3mm
- Tracked beam sizes are 323*5.21nm (geom. 247.6*4.95nm)
- For emittances 10*0.04 the effective betas are 5.1*0.33mm

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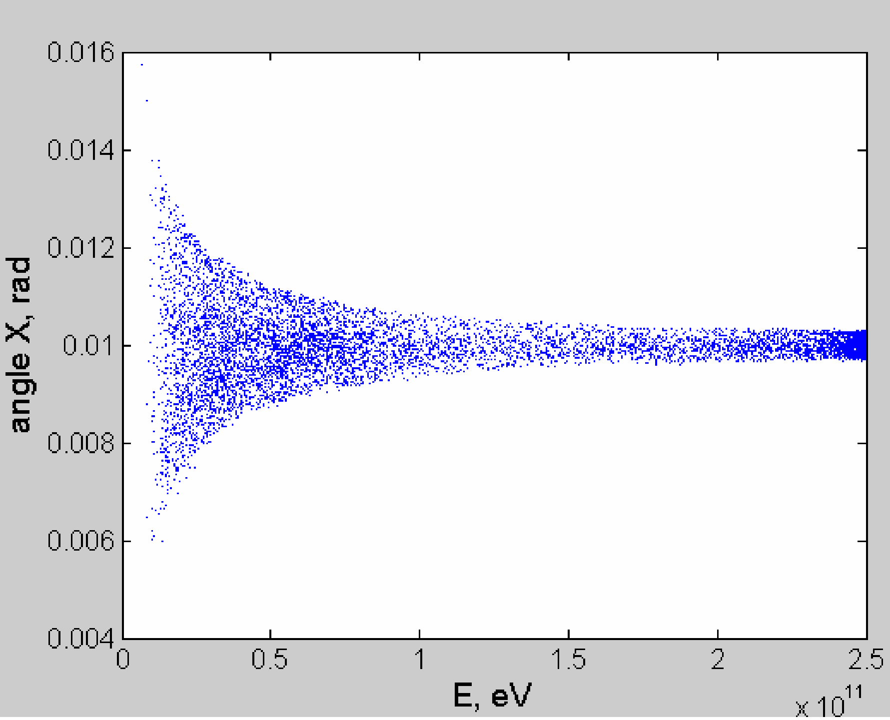
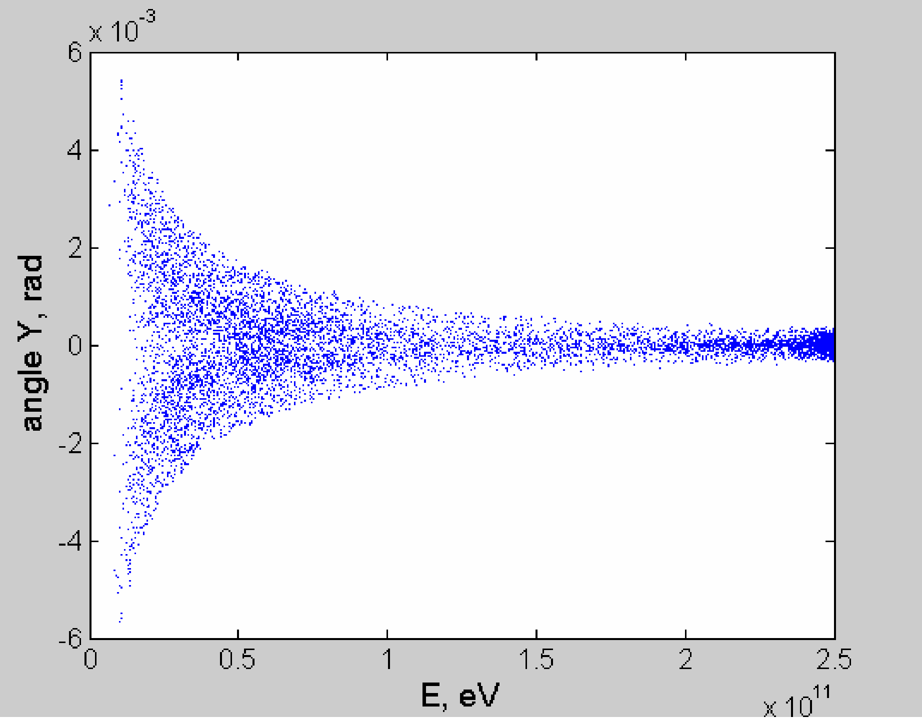
Gronberg

- Compare the beam sizes with the values obtained by tracking :
- ILC optimistic: tracked = 121nm * 4.37 nm (geometrical is 87.6nm * 4.29nm)
- ILC w/e+e- (at beta 3mm/0.3mm): tracked = 323nm * 5.21nm (geometrical is 247.6nm * 4.95nm)
- Correspondingly, the luminosity with tracked beams are:
- ILC optimistic: 8.48e+34 instead of 11.8e34 in the table, i.e. 72%
- ILC w/e+e- : 2.67e+34 instead of 5.9e34 in the table, i.e. 45%





- Disrupted angles for beam with nominal emittances and tracked beam sizes, CAIN simulation. The divergence is much smaller.
- Parameters (especially laser) need to be verified

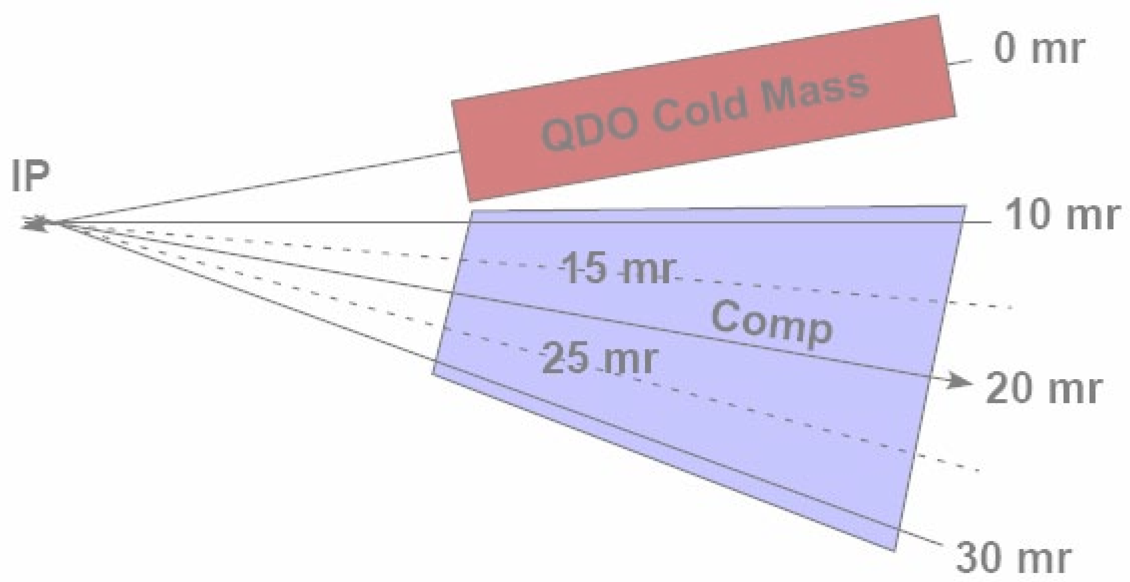
Parameters used in CAIN (need to be verified, especially laser parameters):

SET ee=250D9, gamma=ee/Emass, an=2.0D10, sigz=0.3*mm,
betax=5.1*mm, betay=0.33*mm, emitx=10.0D-6/gamma, emity=4.0D-8/gamma,
sigx=Sqrt(emitx*betax), sigy=Sqrt(emity*betay),
ntcut=2.5, xangle=0.01, frep=2820*5, off=0.0;
SET laserwl=1.05*micron, pulseE=1.57, lambar=laserwl/(2*Pi),
omegal=Hbarc/lambar, rlx=0.1*mm, rly=0.1*mm,

! gaussian pulse shape
sigt=0.23*mm, powerd=pulseE*Cvel/[Pi*lambar*sigt*Sqrt(2*Pi*rlx*rly)],
! square pulse shape
! tott=0.23*mm, powerd=pulseE*Cvel/[Pi*lambar*ttot*Sqrt(2*Pi*rlx*rly)],
xisq=powerd*mu0*Cvel*(lambar/Emass)^2, xi=Sqrt(xisq),
eta=omegal*ee/Emass^2, lambda=4*eta,
angle=0.0, dcp=5*mm ; ! dcp=CP-to-IP distance

Brett's sketch of QD0 and compensator for γγ

Assumed Gamma-Gamma IR Geometry Schematic



Note: X-ing angle is 20 mr and gg opening is ±10 mr so in magnet frame γγ ranges from 10 to 30 mr. But in the detector frame γγ goes from 0 to 20 mr.

Discussion

- The nominal parameters would yield about 2.7E34 luminosity, not including reduction due to conversion coefficient
- Disruption angles significantly smaller than +-10mrad, and more like +-5mrad (to be confirmed)
- Next: develop QD0-Compensator idea in more details, to have +-10mrad for disrupted beam, thus with factor of two safety, with 20mrad crossing angle
- Many other issues to study: e.g. feedback for collision centering, extraction and beam dump, etc.

- It is important to continue this discussion with gamma-gamma community to settle on a realistic parameters