γγ/eγ/e-e- Physics and Technology

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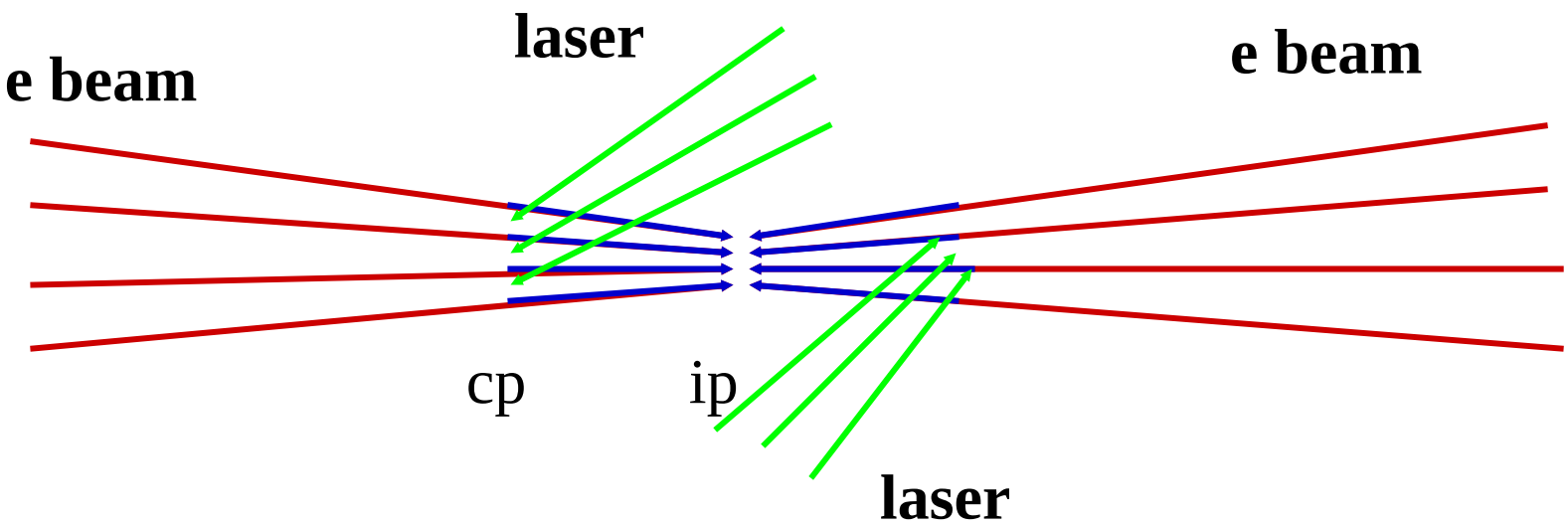
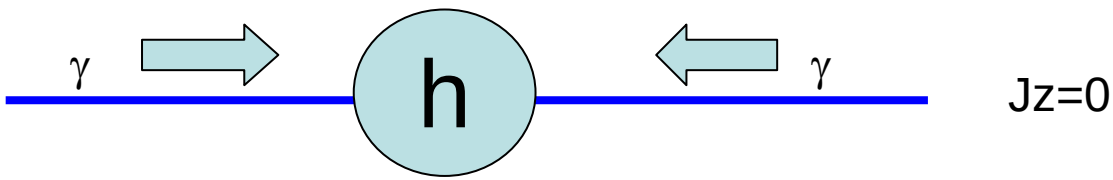
Principle of γγ, eγ , e-e-Collider



Spectrum, polarization, depends on electron/laser polarization



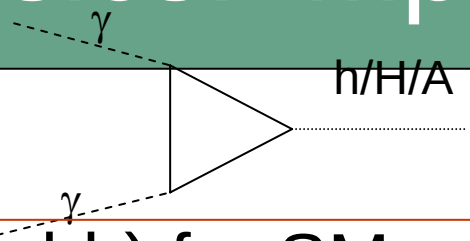
electron polarization is essential

this workshop

- 4 sessions
  - 3 for physics
  - 1 for technology
- Physics
  - 8 talks on $\gamma\gamma$, 2 fo
    - 6 for Higgs related
    - WW,$\mu\mu$+ν,
- Technology
  - How to accommodate options
  - impact of the “COLD” on the $\gamma\gamma$/eγ technology

Hot topic in this WS

Physics: Improvement



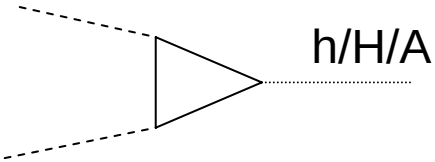
- Γ(h->γγ)Br(h->bb) for SM ,,,,,Niezuraski
- γγ->H->bb in MSSM,,,,,,,,,,,,,Niezurawski

γγ collider would work as advertised

  - QCD bg, OE, x-angle, ww bg, tuning of cuts
- Γ(h->γγ)Br(h->bb) for SM ,,,,,,,,,Rosca
  - Shapa,,, event generator for qqg
- Precise calculation for γγ->WW->4f,,,,Dittamier
  - including radiative correction

important as γγ collider is a W factory
dκ,λ measurement,BG

Physics: New Ideas



s-channel production of Higgs

- CP phase in cMSSM via $\Gamma(h->\gamma\gamma)Br(h->bb)$
  - sensi
- $\gamma\gamma$->H
  - Utili
- $\gamma\gamma$->A
- Charg urg
  - signal for new physics
- Charge asymmetry in eγ-> eWW,,,,Ginzburg
  - a probe for strong interacting sector

polarization:
$\gamma\gamma$ collider provides
Jz=0/2 or
CP odd/even
$\gamma\gamma$ Initial states

Technology

- What are specific for $\gamma\gamma$/$e\gamma$

J.Gronberg

- e-e- beam (polarization) K.Moenig
- Beam optics
- Beam Crossing angle V.Telnov
- Beam dump
- Lasers
- Laser Optics Y.Honda

gnet

Beam parameters

		ILC optimistic	ILC w/ e+e-	NLC $\gamma\gamma$	e+e-
f_{rep}	Hz	5	5	120	5
n_b		2820	2820	95	2820
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}	$cm^{-2}s^{-1}$	$11.8x10^{33}$	$5.9x10^{34}$	$4.0x10^{34}$	$1.6x10^{34}$

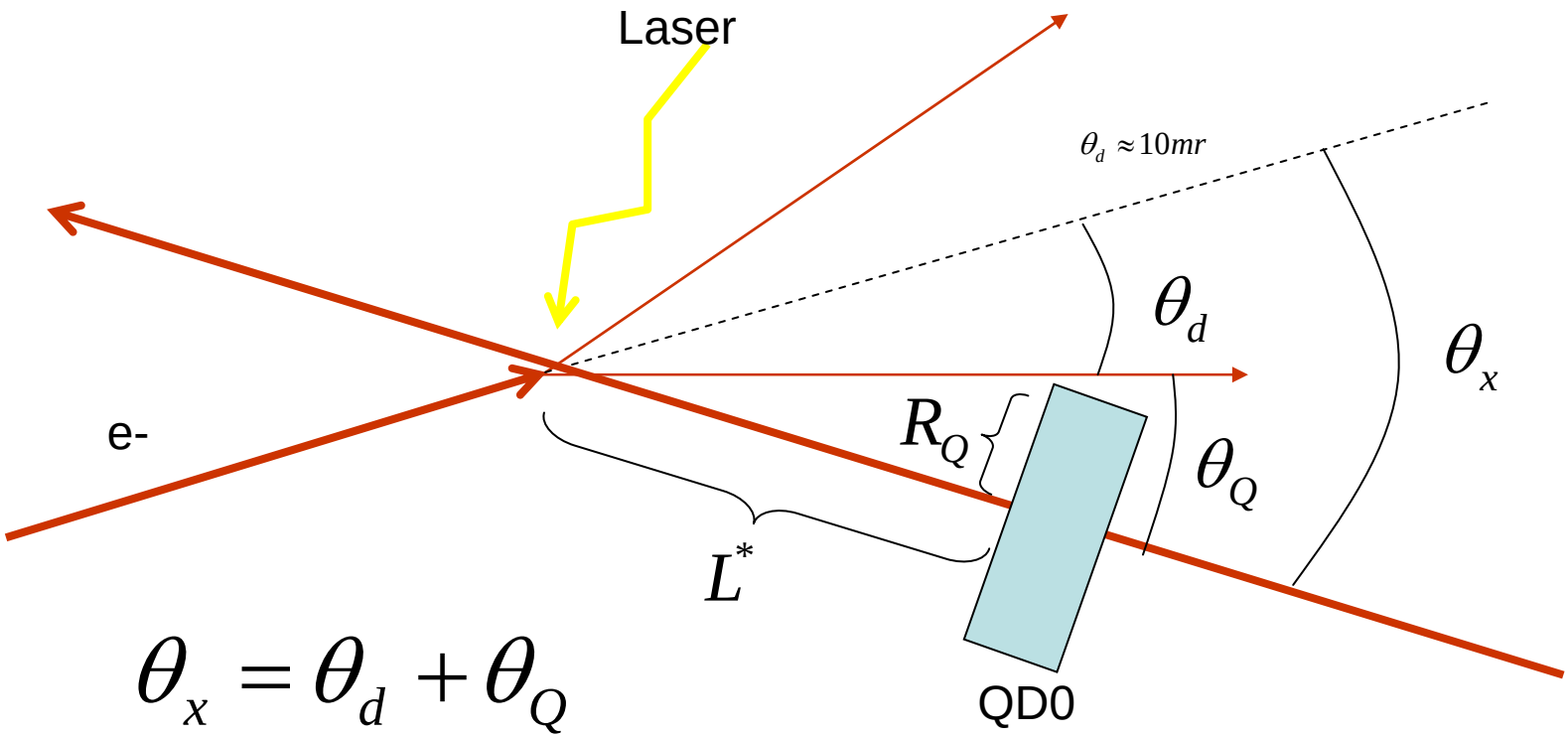
same emittance(dumping ring) ,
tune final focus to achieve small spot size

- very important that the baseline use standard ILC parameters

Gronberg

Crossing angle consideration for $\gamma\gamma$

- Bottom line



$$\theta_x = \theta_d + \theta_Q$$

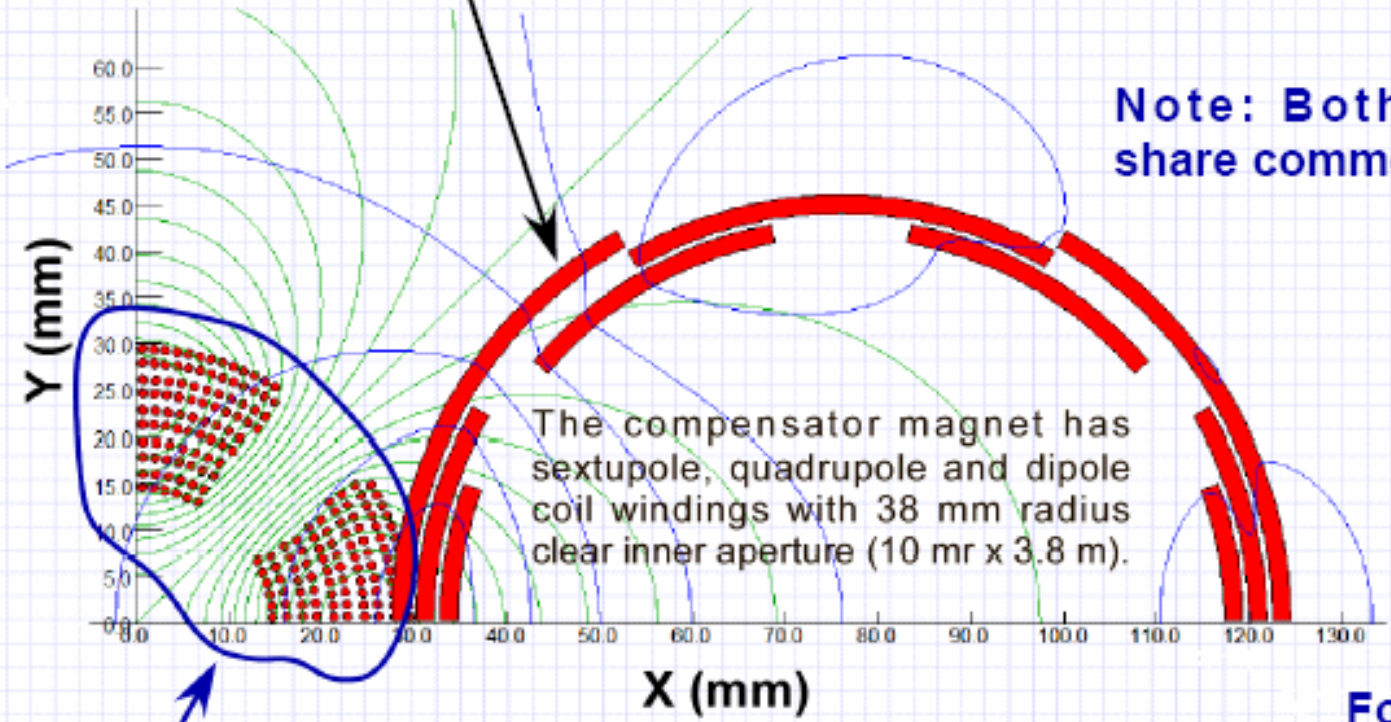
$\theta_d \approx 10mr$ beam simulation

$\theta_Q = \frac{R_Q}{L^*}$ θ_Q depend on QD and FF optics

Compensation Coils

Brett Parker

This is the first of two coil geometries proposed for a gamma-gamma IR.

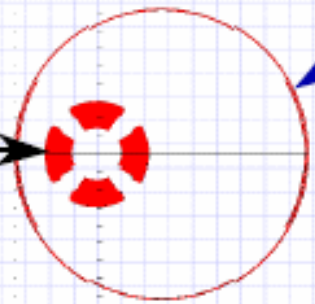


Note: Both magnets share common cryostat.

The compensator magnet has sextupole, quadrupole and dipole coil windings with 38 mm radius clear inner aperture (10 mr x 3.8 m).

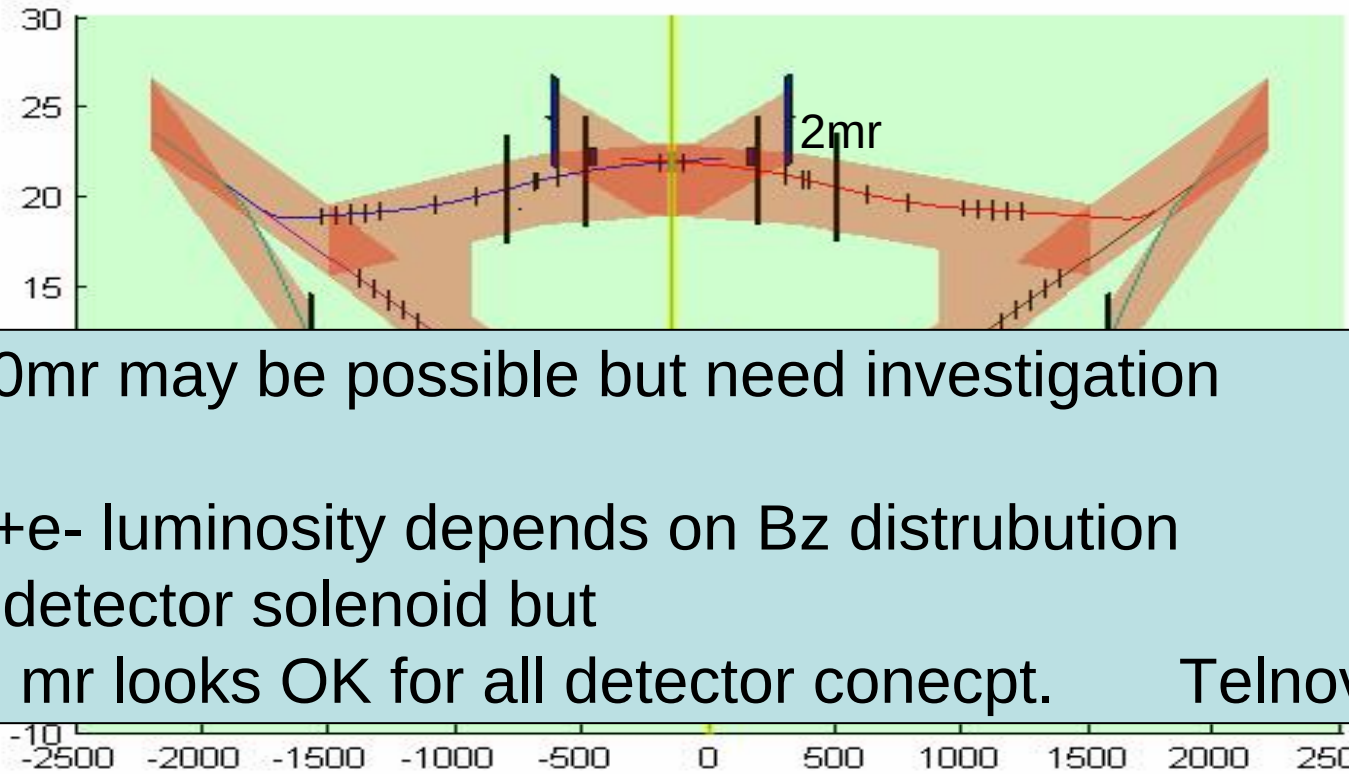
QD0 is now more compact and made only from cable with inner coil gone (outer layers have moved inward).

Second solution with QD0 inside compensator.



For normal IR outer magnet has a much smaller radius.

Crossing angle



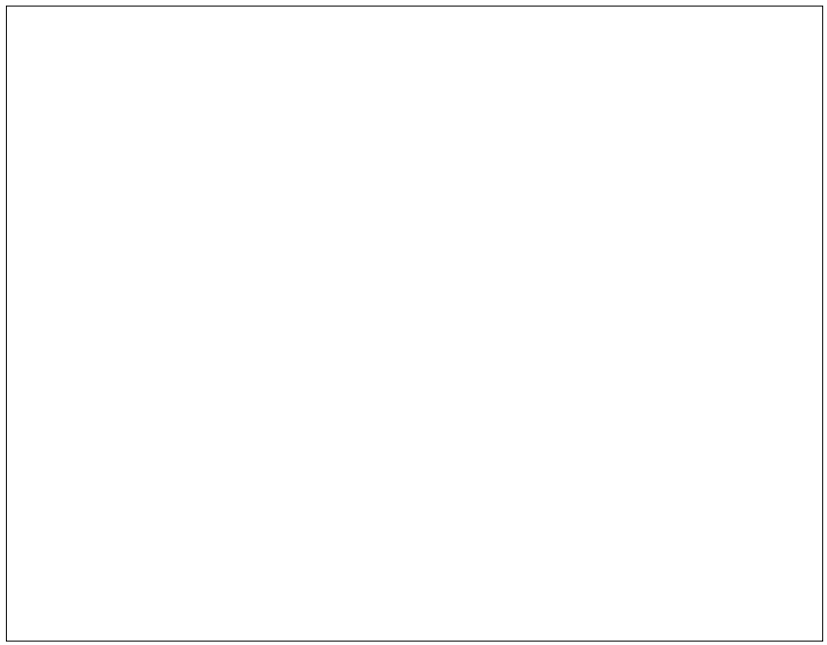
- 20mr may be possible but need investigation

- e+e- luminosity depends on Bz distrubution of detector solenoid but 25 mr looks OK for all detector conecpt. Telnov

note: e-e- mode is not operative at 2 mr as can not let the outgoing beam through final doublet.

Lasers

~3000 bunches/1 ms

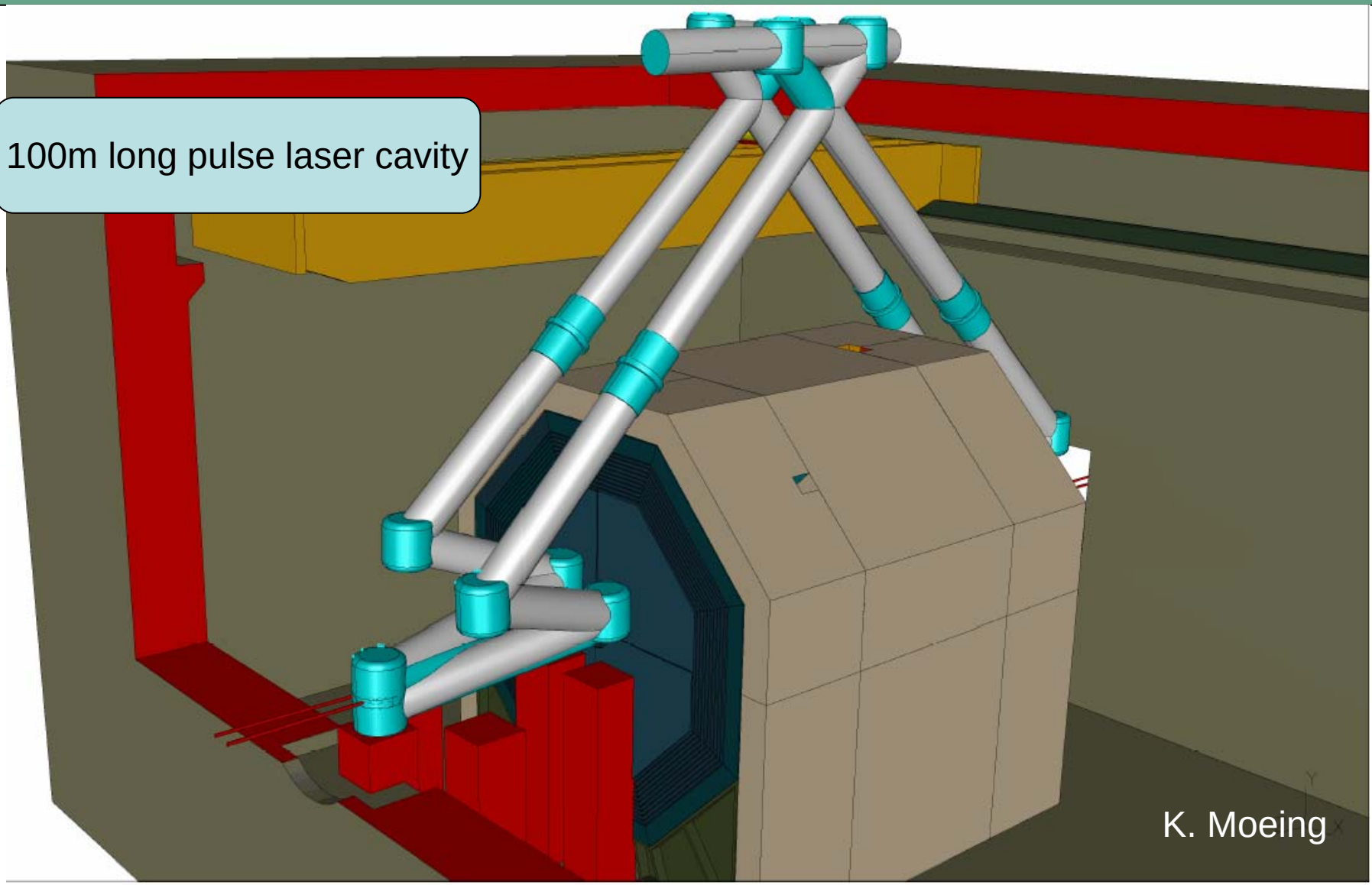


need to amplify (feed energy to) 3000 pulses in 1ms

electrons <- SCRF
Solid state Laser <- none

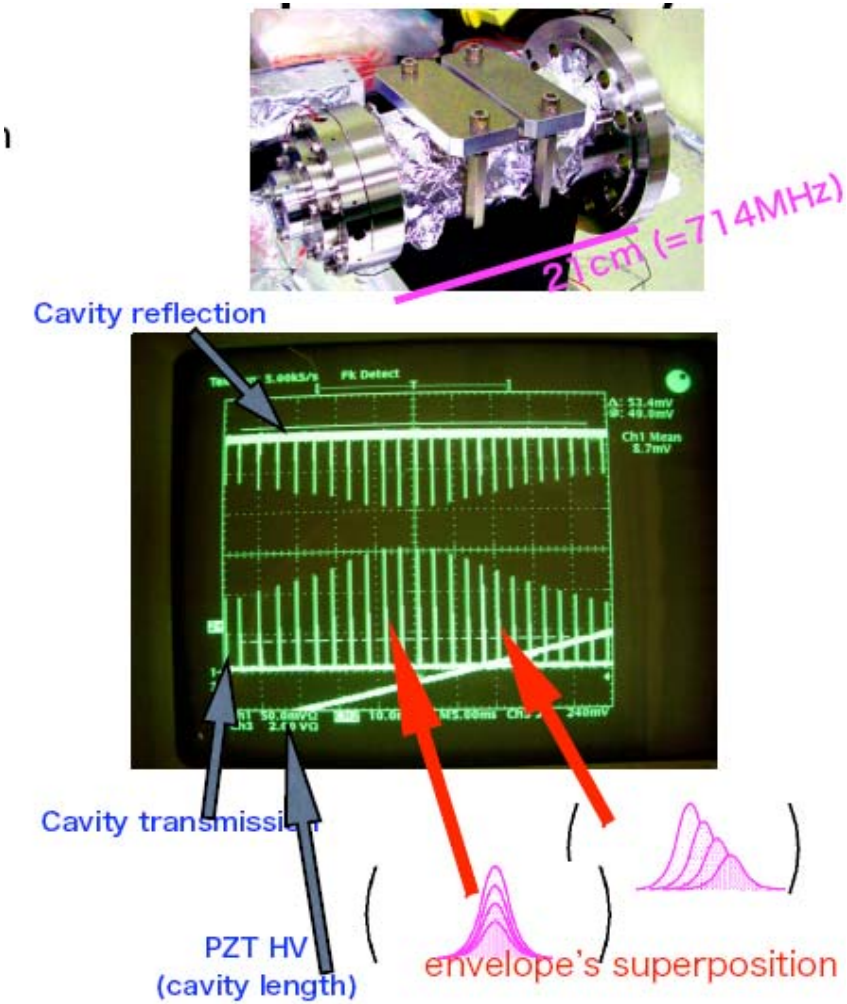
way out ,,,,,,, construct Hi Q (pulse stacking) cavity out side the laser

A Detector with Cavity



Short pulse stacking cavities are under development

- Y. Honda et al. KEK
  - 7 ps pulses
  - Developed for laser wire application
- A good start, but…
  - Nowhere near $\gamma\gamma$ power levels
  - Nowhere near $\gamma\gamma$ small laser focus
  - Nowhere near $\gamma\gamma$ cavity size ~20m



Y. Honda

Issues for Snowmass

- IR layout , final focus for θ_x =20mr (25mr):
  - minimize horizontal beta function
- beam dump design for disrupted beam and collimated photons.
  - full beam tracking FF to beam dump
  - detector background and masks
  - compatibility with e+e- detector
- Design pulse cavity ,,,,, need laser optics person
    - feed back
    - stability
    - damage
    - nonlinear index
- compatibility with e+e- detector

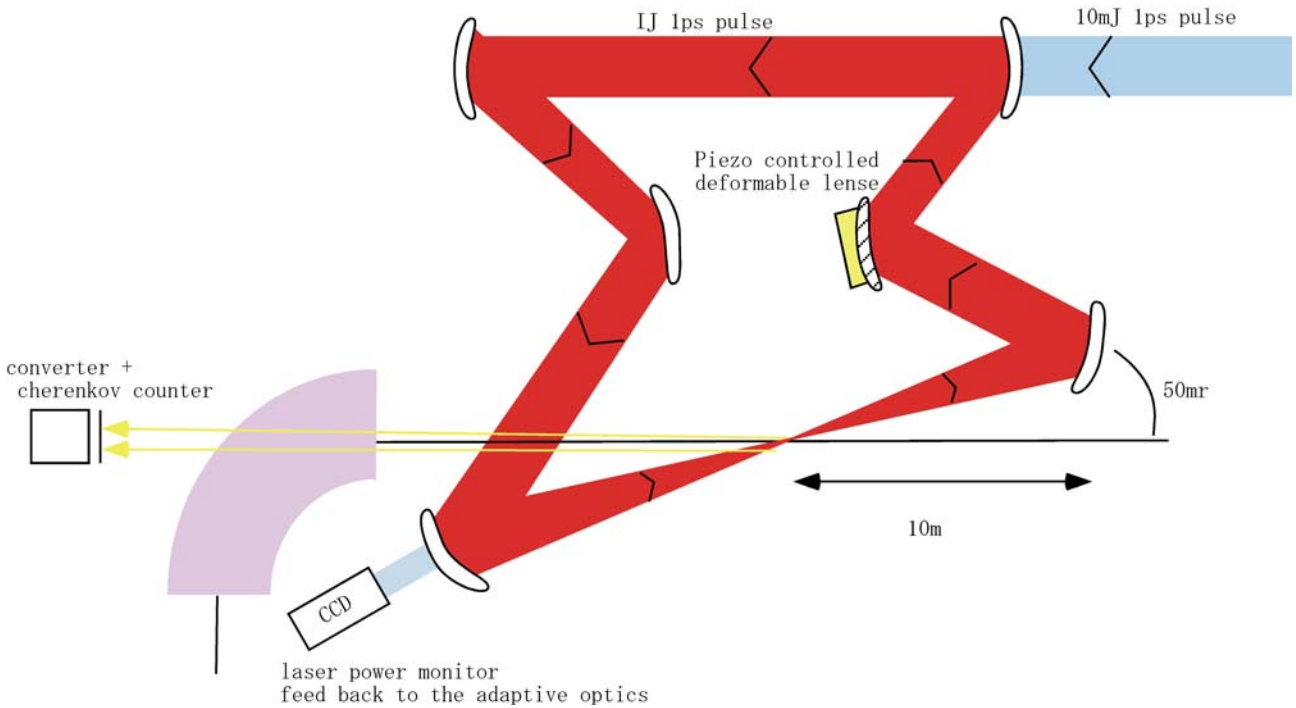
Get ILC community(BDS, detector) agreed with the design

Summary

- Why
  - Optional operation is desired for all physics case.
- When/How long should we run options?
  - Physics will tell us,,, not a current issue.
- How ,,,,,,, issue to be discussed now
  - to share accelerator w/ e+e-
  - to share detectors
  - to develop laser sytem
- who will work on
  - synergetic w/ base ILC program
  - BDS, detectors, polarimeters, laser wire, pol. e+,,,

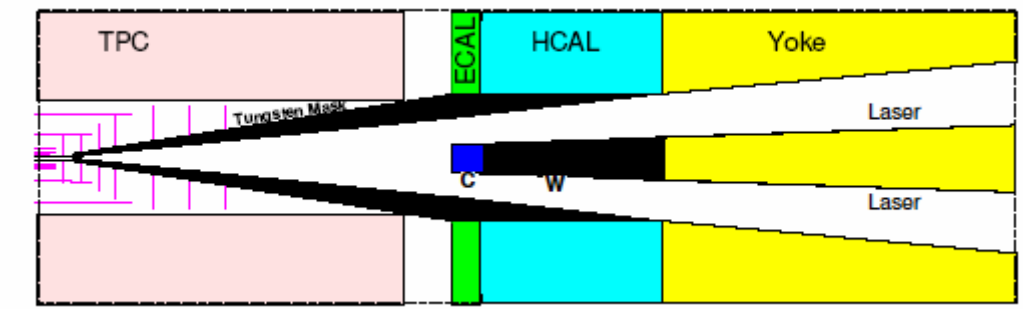
Laser facilities at ATF2

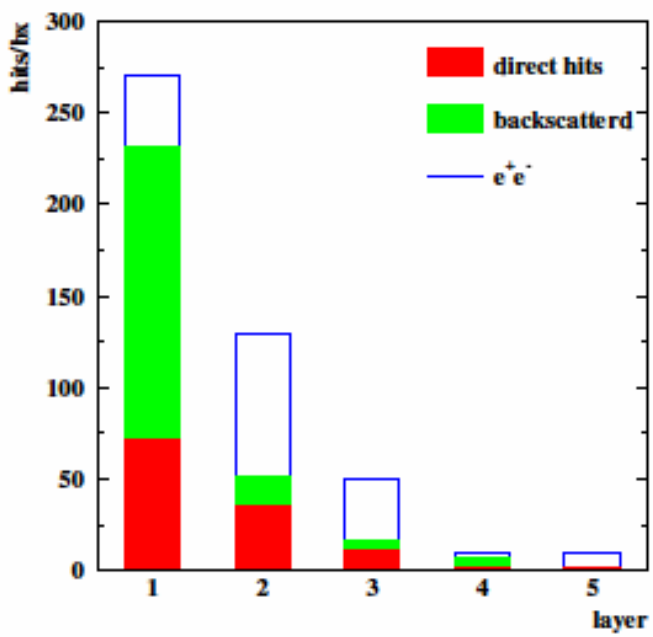
- Proposals being prepared
  - not just for $\gamma\gamma$,
  - polarimeters, polarized e+ test facilities



Other issues

- Background
  - large disruption angle
  - angle between beam



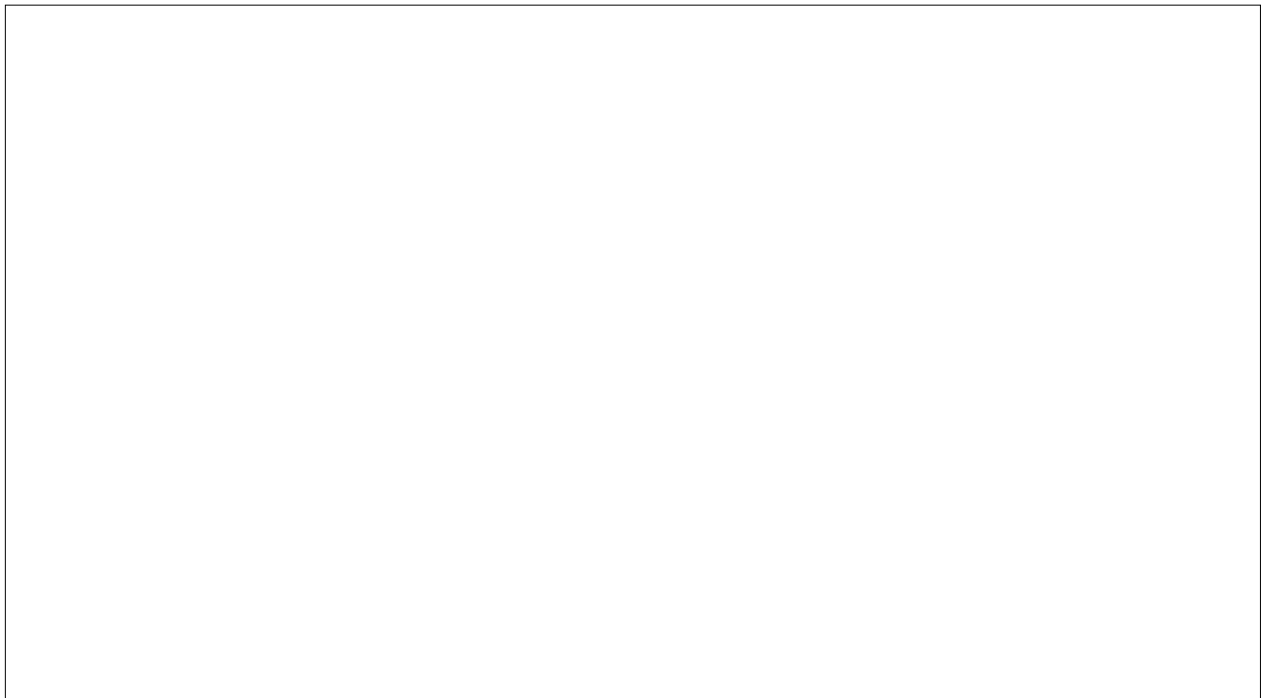


background are similar to e+e- but <7.5deg dead

K.Moenig

Beam dump

- Electrons
  - +- 10mr beam pipe
  - large momentum spread,,, no sophisticate optics
- Photons
  - collimated (10μr) ,,, concentration of heat at beam dump
- probably incompatible with e+e-

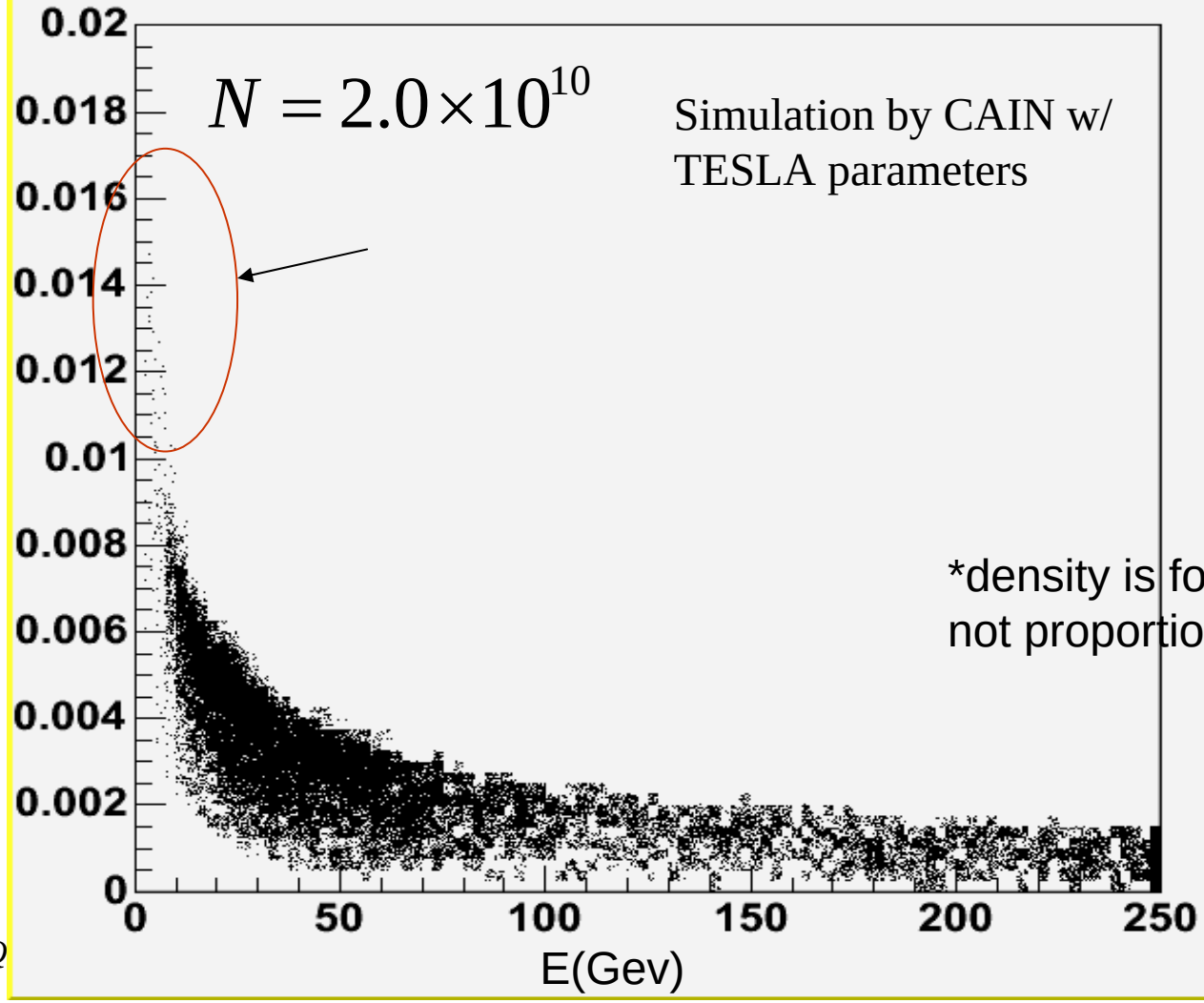


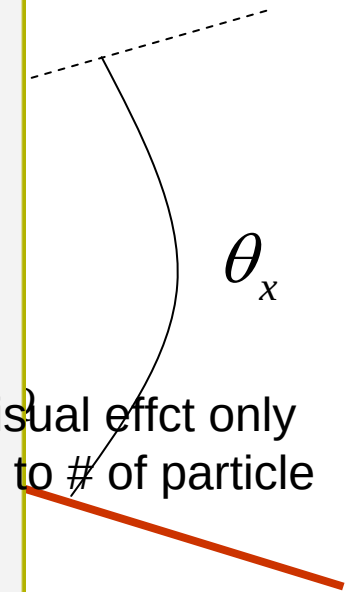
Contributions

- Review by Jeff Gronberg
- Spin transport ,,,,,,,,,, Klaus Moenig
  - how to deliver desired helicity states to two IR
- e+e- beam vs e-e- ,,,,, Telnov
- e+e- luminosity for 20mr and 25 mr,,,,, Telnov
  - in MDI session but important information
  - no big difference between 20mr and 25 mr
- Pulse stacking cavity at KEK-ATF,,, Honda
  - working example of the laser cavity

Crossing angle consideration for $\gamma\gamma$

- disruption angle





*density is for visual effct only
not proportional to # of particle