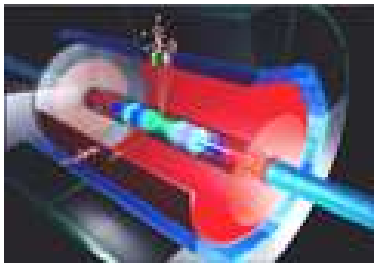
ECFA Study

Physics and Detectors for a Linear Collider



DESY

Systematic effects on luminosity measurement at 2 and 20 mrad beam crossing angle

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Goal

Calculation of luminosity measurement systematics caused by LumiCal displacement

Method described by *Achim Stahl* *(LC-DET-2005-004)*

· event samples generated
· events in LumiCal selected -> N_0
· geometrical displacement
· secondary selection ---------> N_1

$$\frac{dL}{L} = \frac{N_1 - N_0}{N_0}$$

Setups

BHLumi 4.04

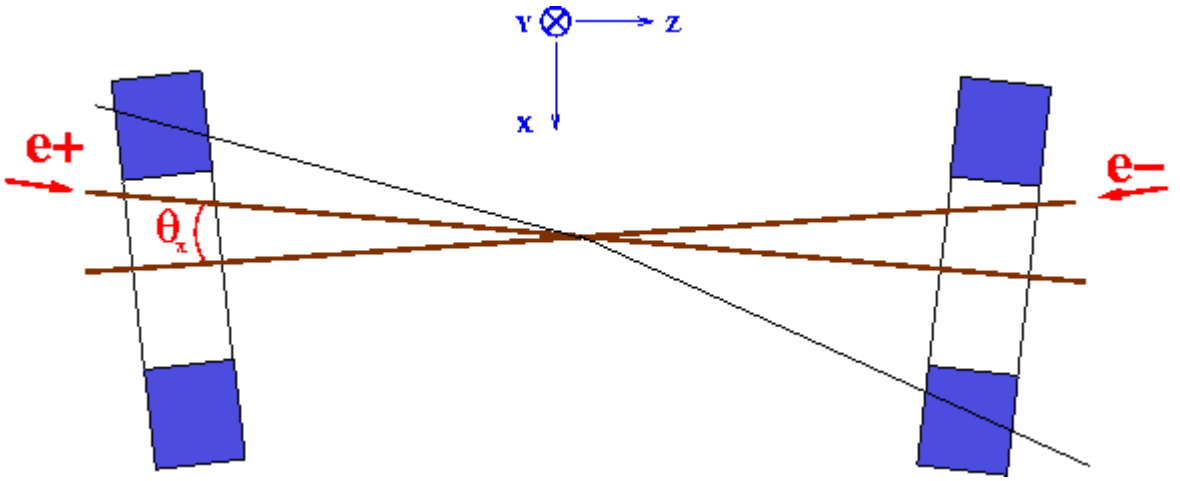
γ off
Z^0 on
RANMAR
$N_{ev} = 5 \cdot 10^6$

LumiCal

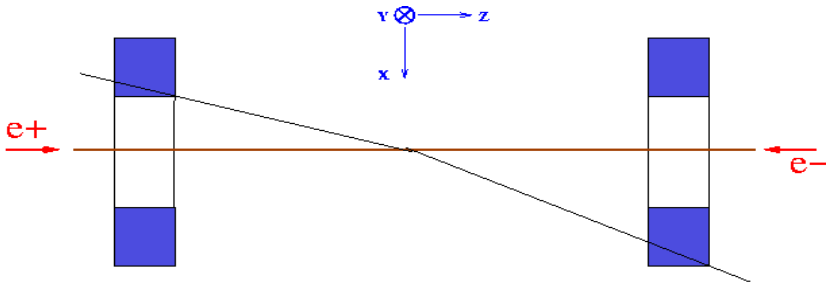
$R_{inner} = 0.08$ m
$R_{outer} = 0.28$ m
$26 < \theta < 92$ (mrad)
$L_{LC\text{-}IP} = 3.05$ m

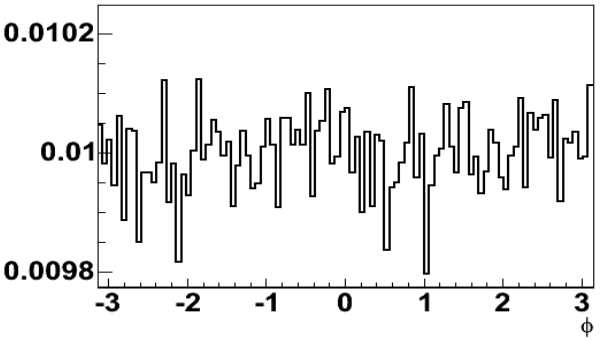
LumiCal positions

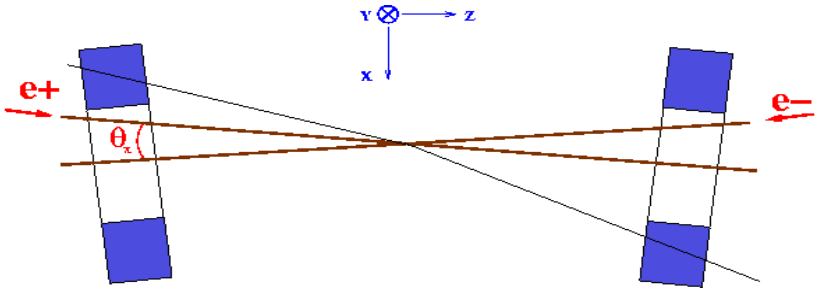
· head-on – 2 mrad
· along outgoing beam – 20 mrad
· along detector axis – 20 mrad

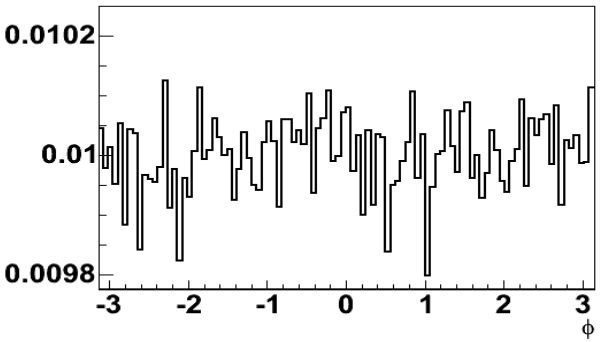


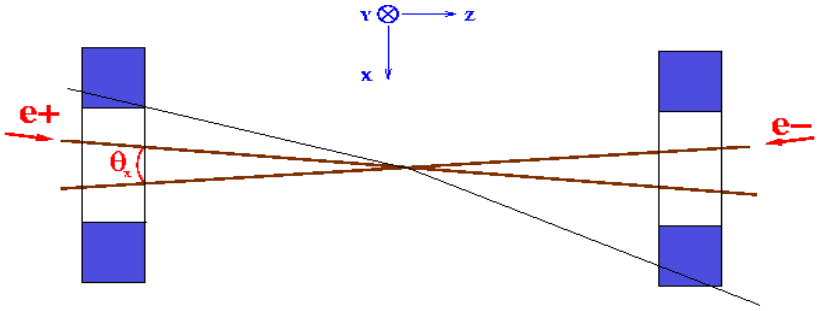
Layouts

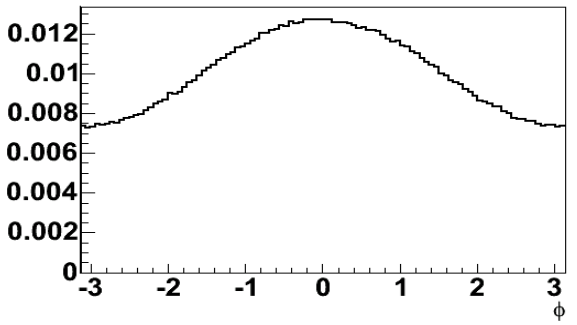

y
z
x
e+
e−


0.0102
0.01
0.0098
-3
-2
-1
0
1
2
3
ϕ

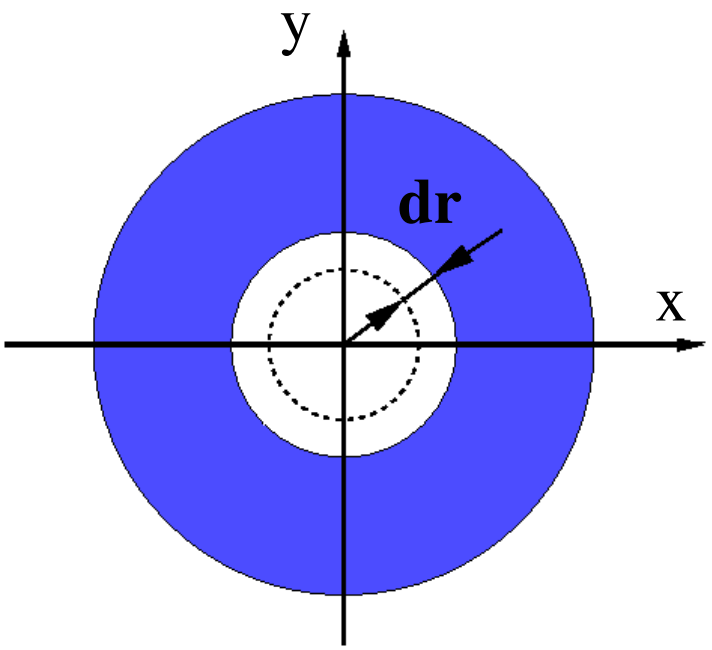

y
z
x
e+
e−
θx


0.0102
0.01
0.0098
-3
-2
-1
0
1
2
3
ϕ

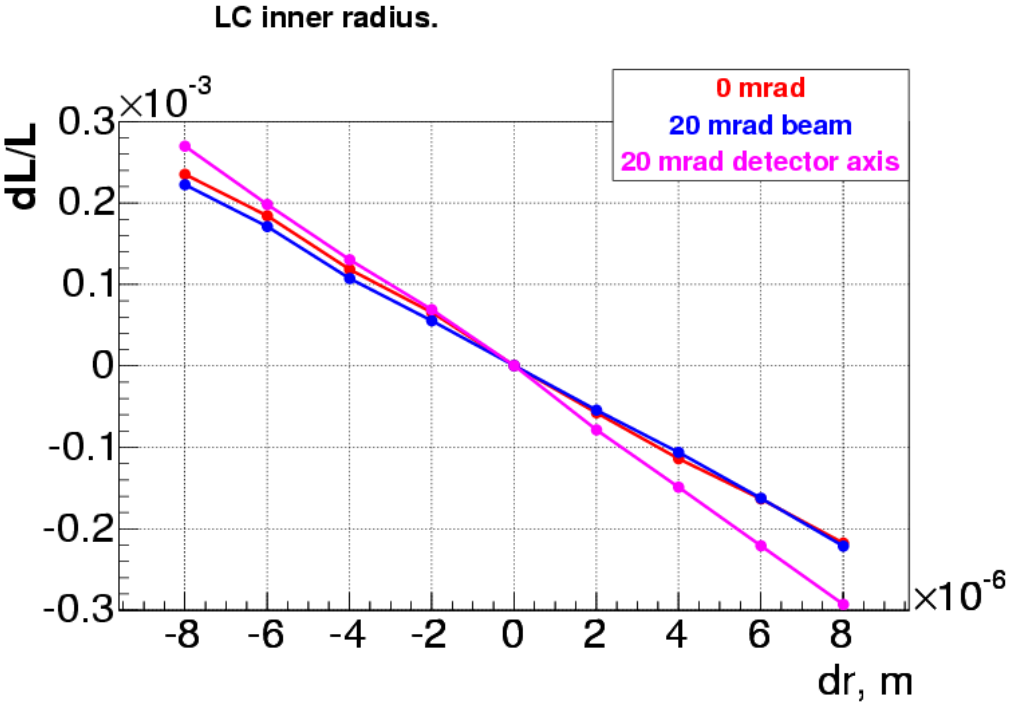

y
z
x
e+
e−
θx


0.012
0.01
0.008
0.006
0.004
0.002
0
-3
-2
-1
0
1
2
3
ϕ

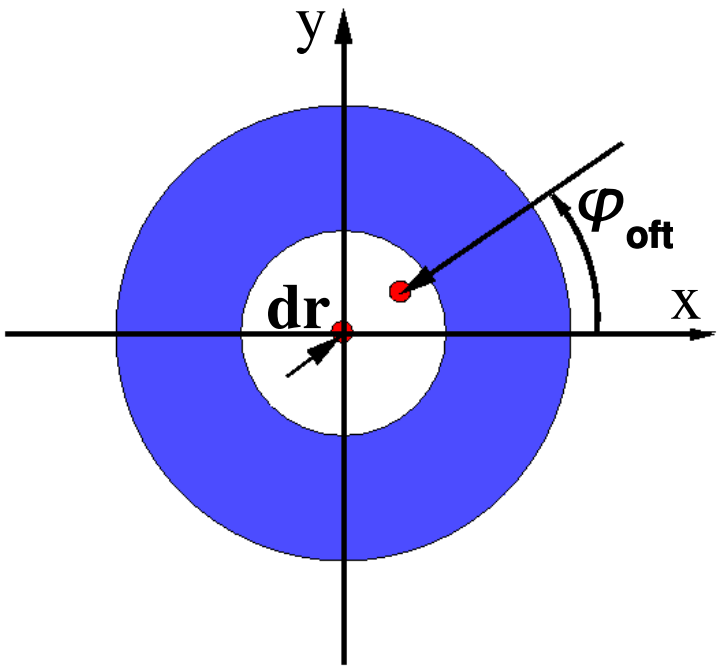
Inner Radius



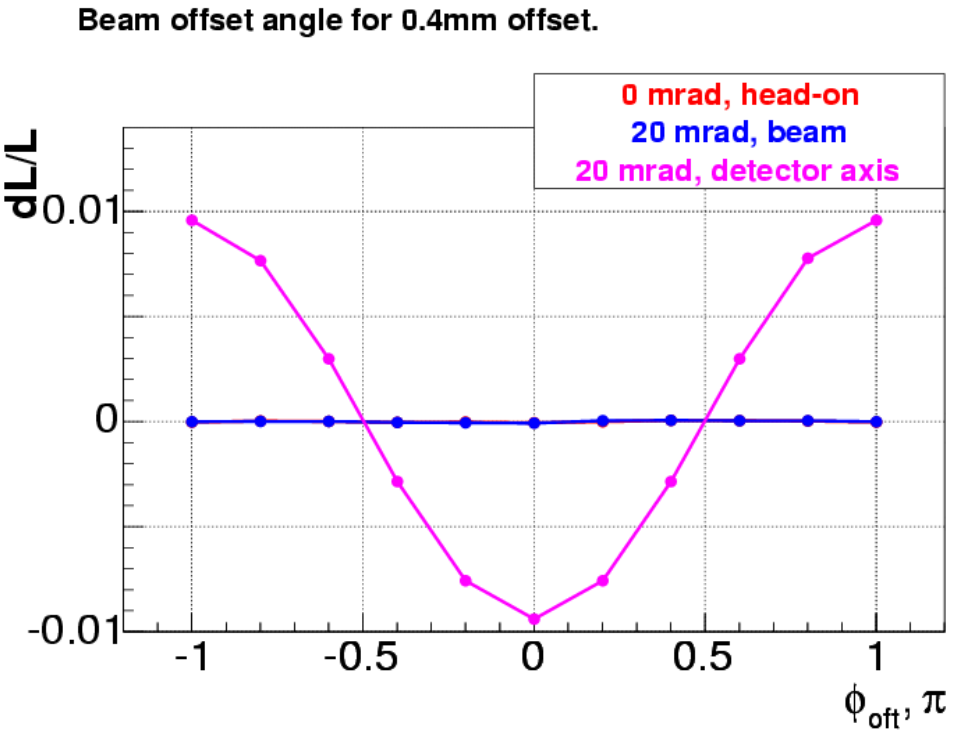
dr = [-8;8] μm



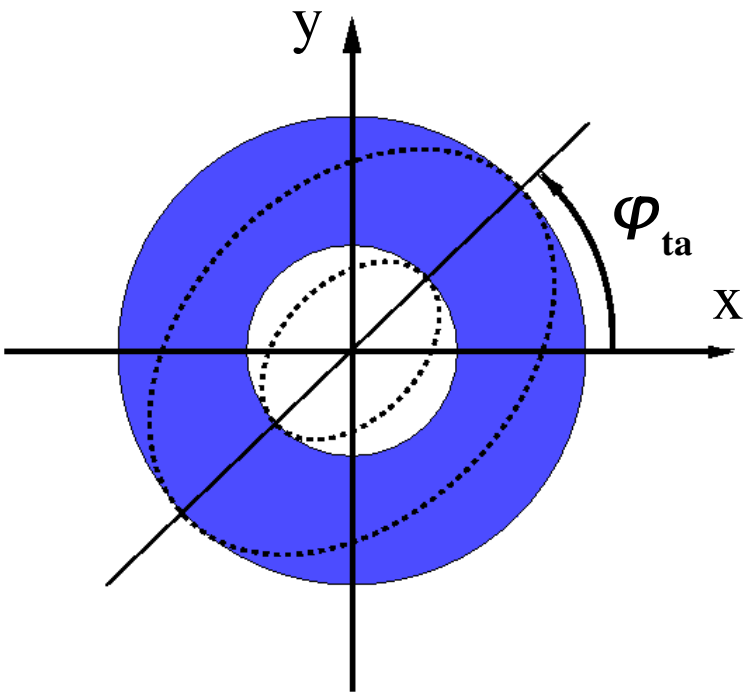
Beam Offset



$$dr = 400\ \mu m$$
$$\varphi_{oft} \in (-\pi;\pi)$$

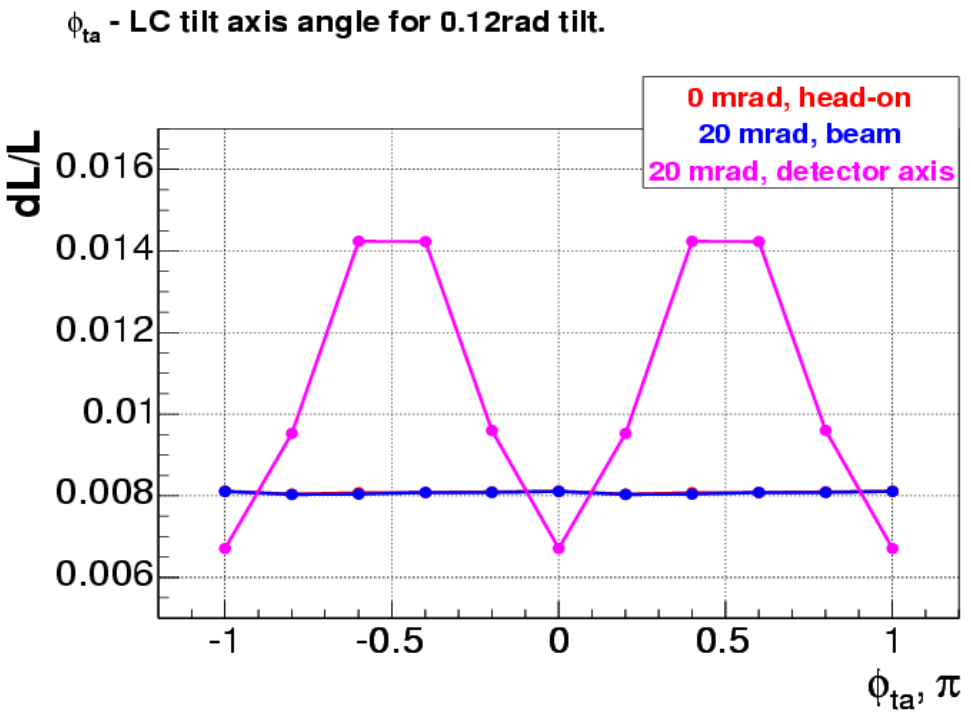


LumiCal Tilt



$$\theta_{tilt} = 0.12\text{rad}$$

$$\varphi_{ta} \in (-\pi/2;\pi/2)$$



Findings

Comparing the systematic effects due to LumiCal inner radius deviation, radial beam offset and LumiCal tilt we see:

- the effects are comparable (or a little bit larger) at 20 mrad with respect to 2 mrad, for the case when LumiCal is centered around the outgoing beam pipe

- the effects are dramatically larger (up to **three orders of magnitude**) if LumiCal is centered around the 'detector axis'.

For the control of the systematics the requirements on the control of the three quantities is almost the same for 2 and 20 mrad, in case the LumiCal is centered around the outgoing beam pipe.