Beam-induced background effects in the ILD

Master student Zhanna Khuranova, Gleb Lakhno

Taras Shevchenko National University of Kyiv

Supervisor Aushev V, Onischuk Y, S.Schuwalove

Beam-induced background in ILD

In order to reach a luminosity
we want small bunch

$$\mathcal{L} = \frac{n_b N^2 f_{\text{rep}}}{4\pi\sigma_x\sigma_y} H_D,$$

Size of bunch

1) Beam need to be focused to an extremely small spot;

2) Smaller beam size implies higher charge density

3) Some particles accelerated towards to centre of bunch

} **"pinch effect"**

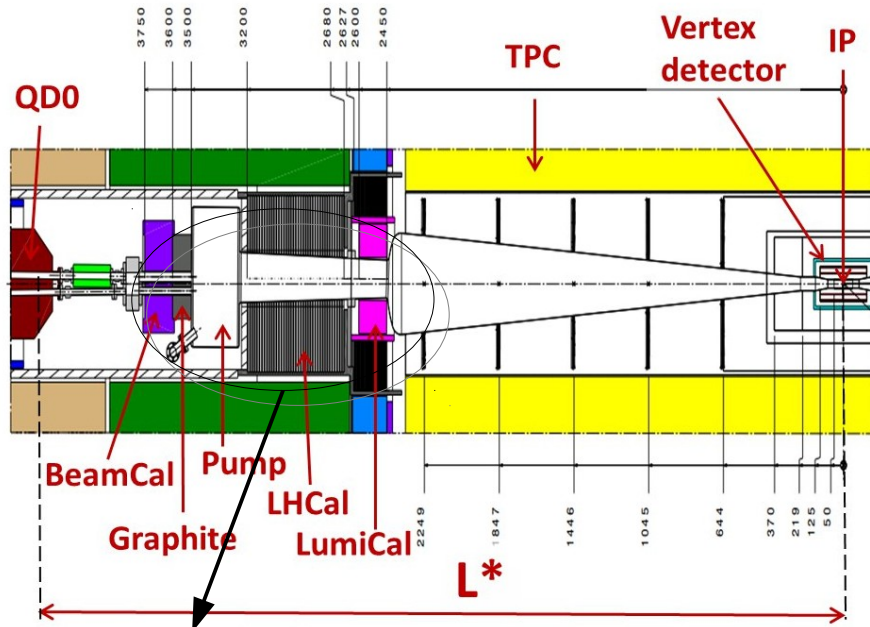$e^+ e^-$ Pairs

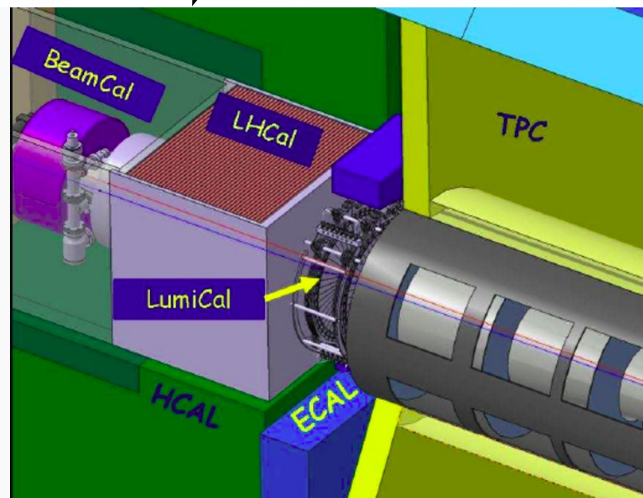beamstrahlung

photons

IP

Beamstrahlung
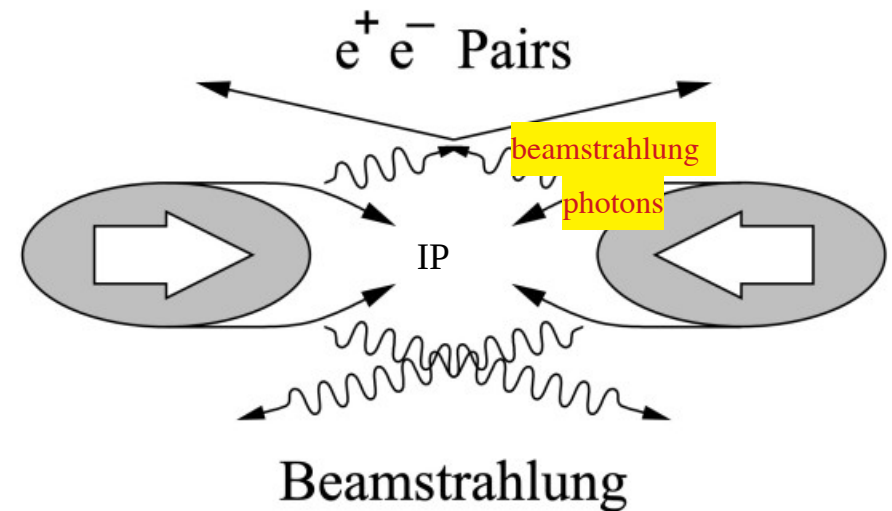
Average energy loss:

$$\delta \propto \frac{\gamma}{E\sigma_z^*}\left(\frac{N}{\sigma_x^* + \sigma_y^*}\right)^2$$

e+e− pairs focused in the forward direction and hitting the detector material
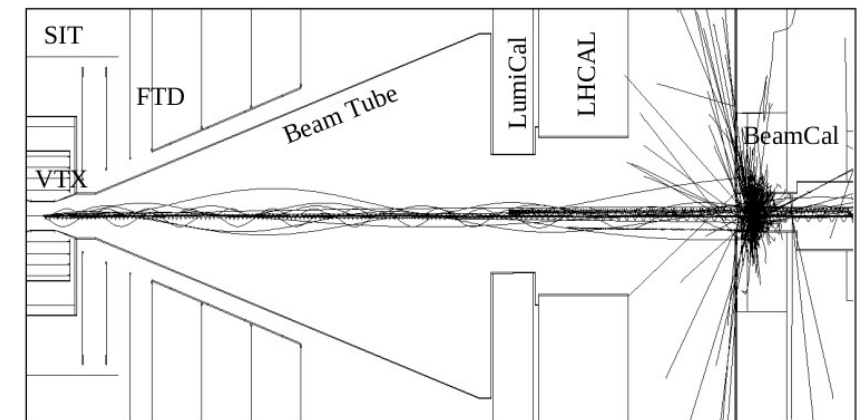
ILD detector

The beam-induced pairs are also mainly focused in the forward direction here

Hitting material between incoming and outgoing beampipes and inducing intense electromagnetic showers

Many of the particles with slightly larger polar angles or transverse momenta will hit the forward calorimeters of the detector, where they will deposit a large amount of energy

Forward calorimeters system

The goal of Anti-DiD field

The anti-DID field designed to guide particles into the outgoing beampipe →
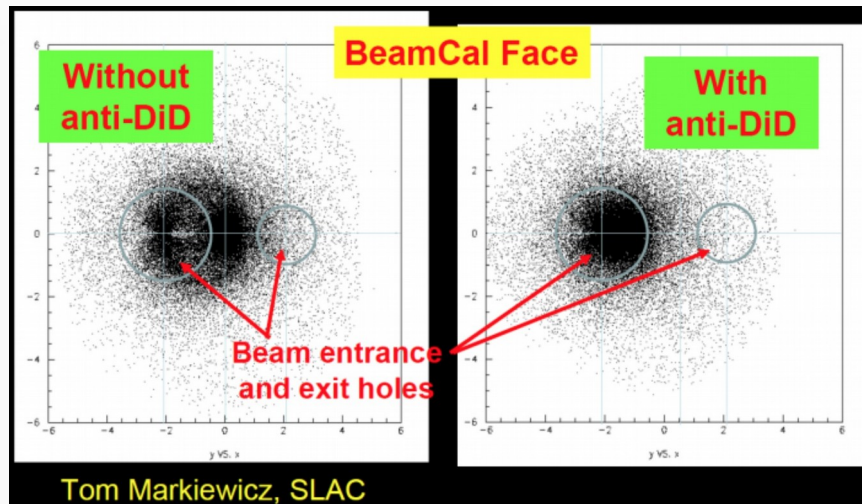
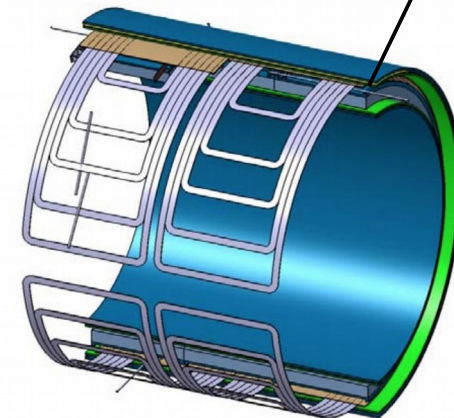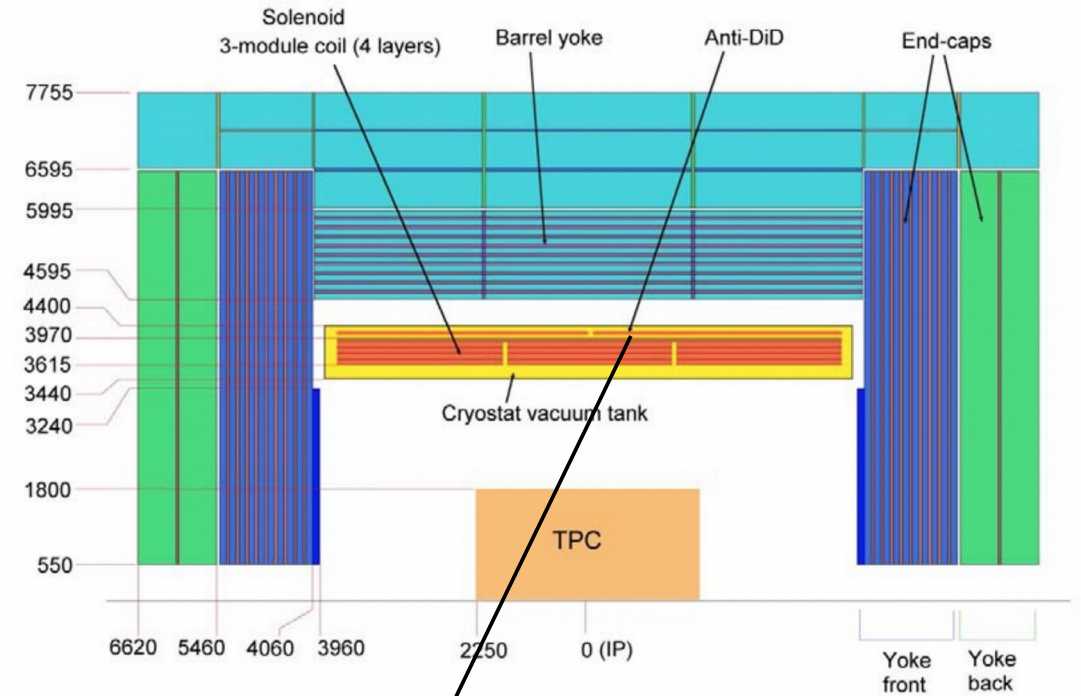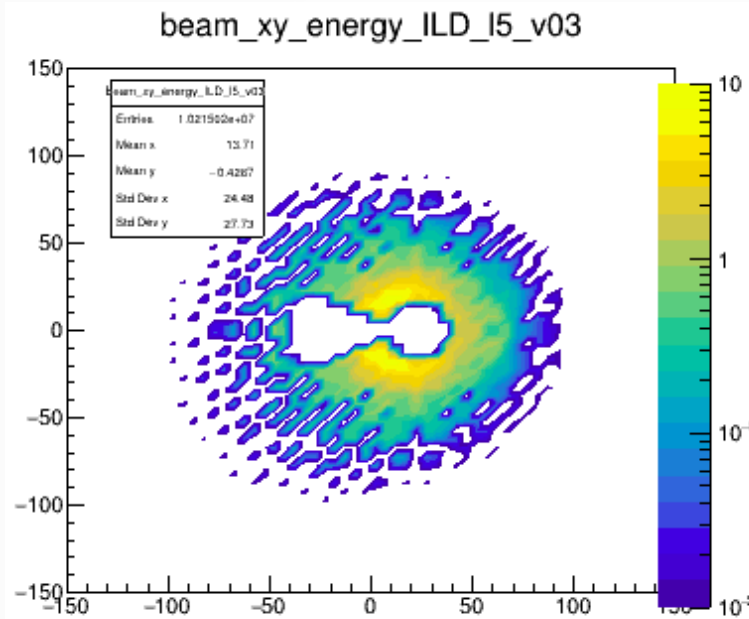reducing the number of particles backscattered into the central detector region.

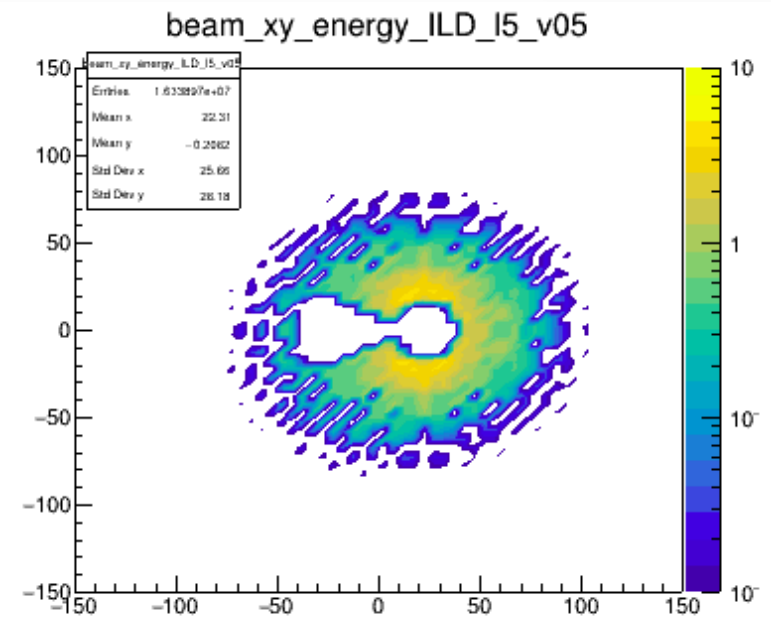Fig 2. Position and designed of AntiDID dipole

Tasks

- Get familiar with LCIO soft

- Reproduce analysis done by Daniel and Akiya

- Get similar plots for energy distribution for LumiCal and LHCal

BeamCal _enegry_distribution

beam_xy_energy_ILD_l5_v03
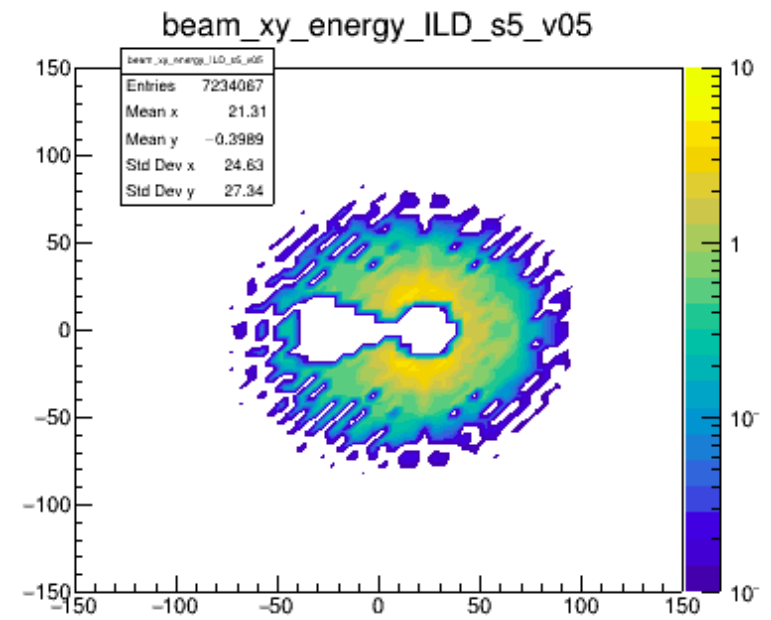
beam_xy_energy_ILD_l5_v05

Large_without AntiDiD_normolized ~9000

Large_with AntiDiD_normolized ~19000

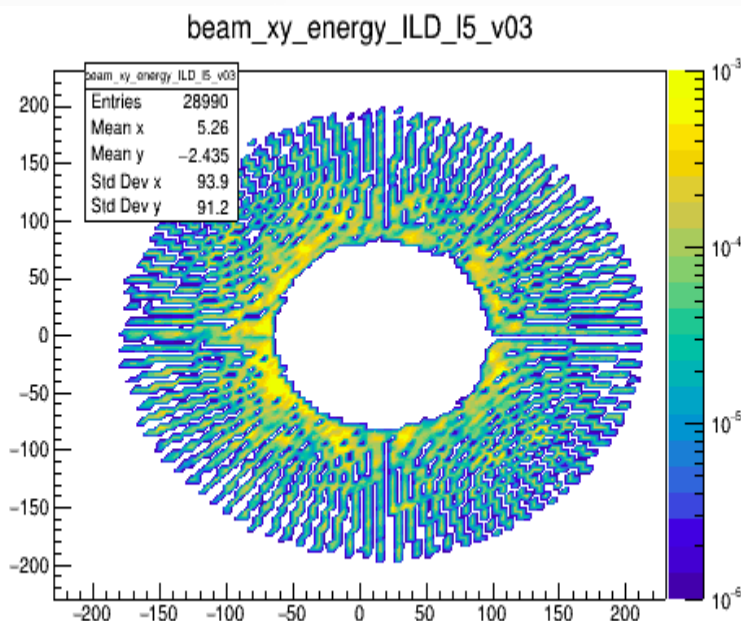beam_xy_energy_ILD_s5_v03

beam_xy_energy_ILD_s5_v05
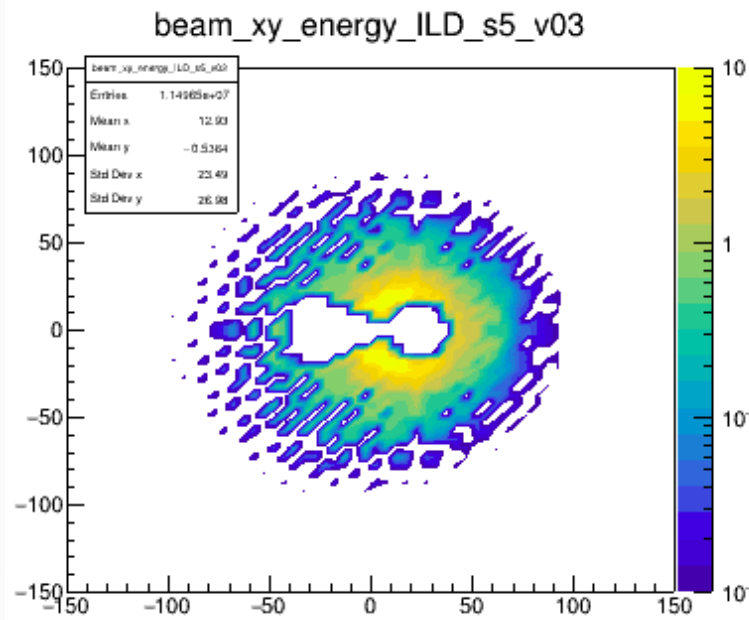
Small_without AntiDiD_normolized ~9000

Small_with AntiDiD_normolized ~9000

LumiCal _enegry_distribution

beam_xy_energy_ILD_l5_v03

beam_xy_energy_ILD_l5_v03	
Entries	28990
Mean x	5.26
Mean y	−2.435
Std Dev x	93.9
Std Dev y	91.2

Large_without AntiDiD_normolized ~9000

beam_xy_energy_ILD_l5_v05

beam_xy_energy_ILD_l5_v05	
Entries	35904
Mean x	3.654
Mean y	−1.399
Std Dev x	89.11
Std Dev y	95.81

Large_with AntiDiD_normolized ~19000

beam_xy_energy_ILD_s5_v03

beam_xy_energy_ILD_s5_v03	
Entries	29277
Mean x	12.49
Mean y	1.872
Std Dev x	95.47
Std Dev y	95.77

Small_without AntiDiD_normolized ~9000

beam_xy_energy_ILD_s5_v05

beam_xy_energy_ILD_s5_v05	
Entries	20453
Mean x	11.41
Mean y	−0.2089
Std Dev x	89.74
Std Dev y	94.68

Small_with AntiDiD_normolized ~9000

Thanks for attention !