BCAL and Pair Background

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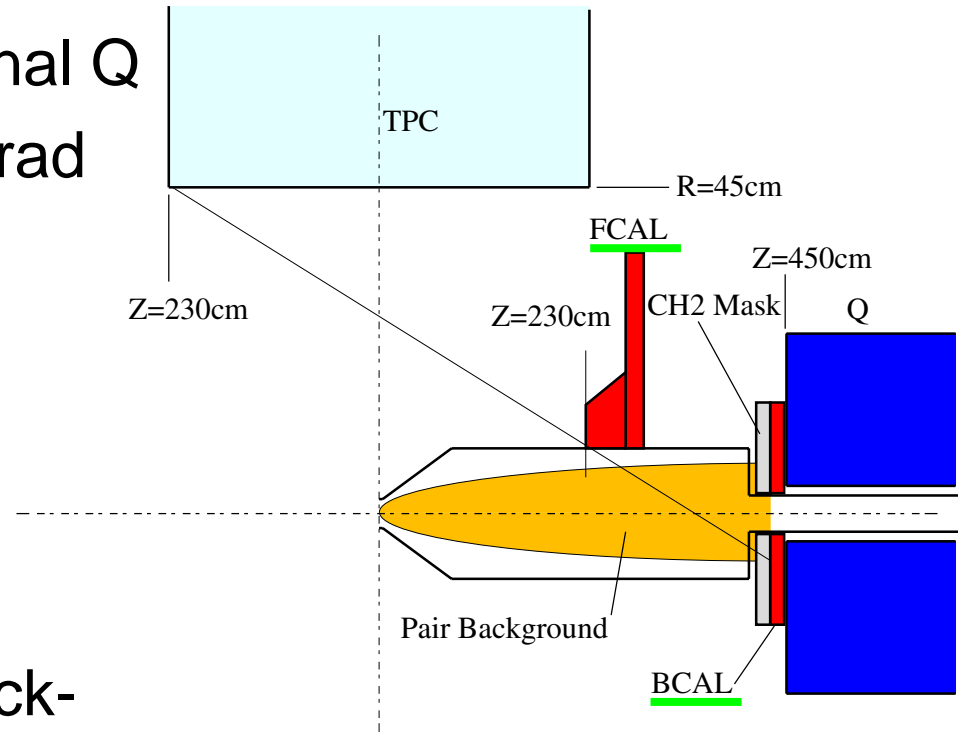KEK
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@Snowmass

FCAL/BCAL

- BCAL
  - Locates just in front of final Q
  - Coverage: down to ~5mrad
  - W/Si or W/Diamond (No detailed design yet)

- FCAL
  - Z~2.3m
  - Also work as a mask protecting TPC from back-scattered photon from BCAL
  - W/Si (No detailed design yet)

TPC

R=45cm

FCAL

Z=450cm

Z=230cm

Z=230cm

CH2 Mask

Q

Pair Background

BCAL

Pair B.G. hit on BCAL

- Generated by CAIN
- High L 20 mrad
- E_{beam}=250 GeV
- 1 BX
- 3T
- Beam exit hole: R=20mm

Energy weighted hit distribution (GeV/mm^2)

E−dep at z=+4.5m
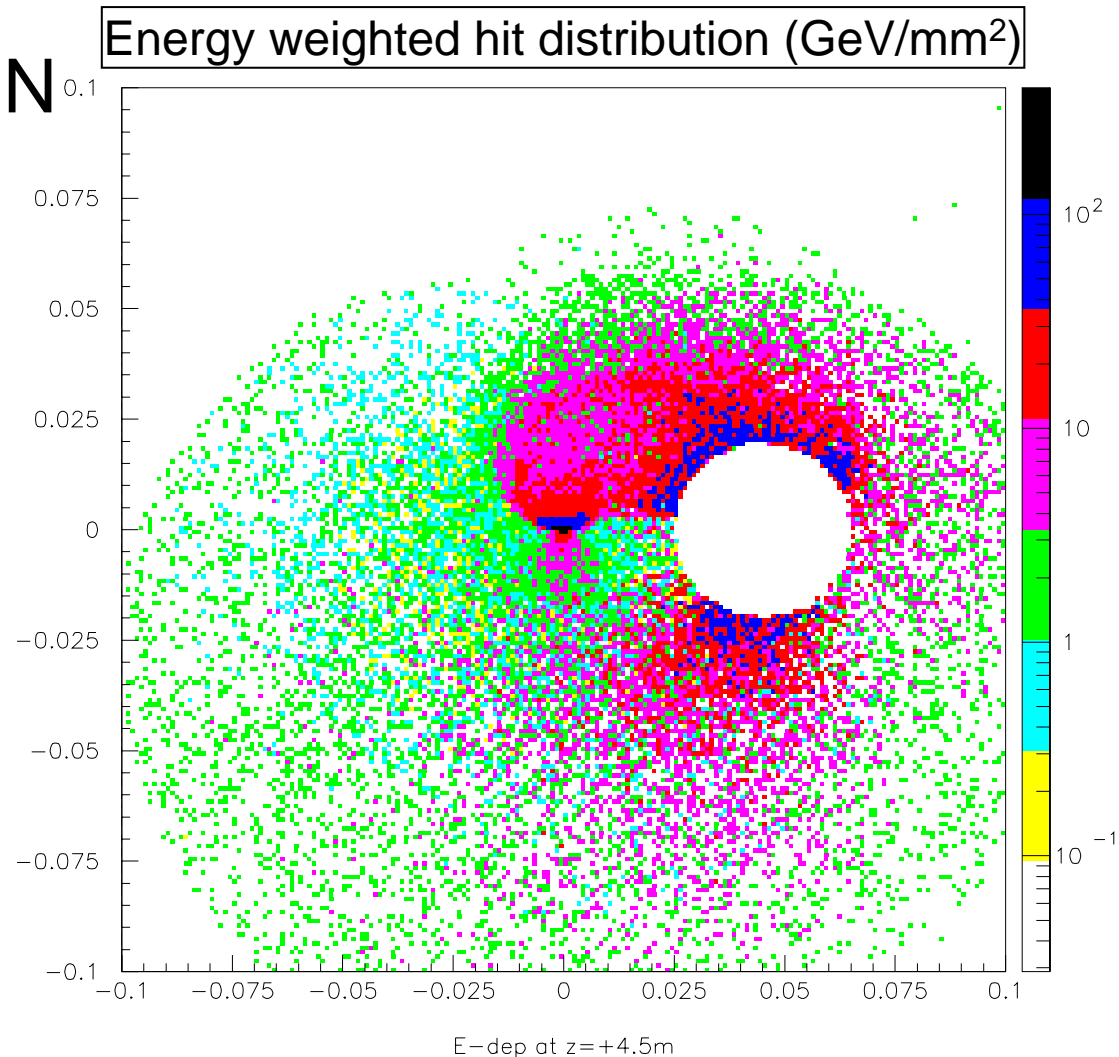
Machine param. dependence

- Sum of both sides

500 GeV

Option	θx (mrad)	Edep (TeV/BX)
Nominal	2	20.8
	20	44.3
High Lum	2	119
	20	184
Low Q	2	6.1
	20	15.7

1 TeV

Option	θx (mrad)	Edep (TeV/BX)
Nominal	2	53.9
	20	98.1
High Lum	2	303
	20	416
Low Q	2	16.3
	20	34.9
High Lum-I	2	141
High Lum-II	2	106

High Lum-I / II are Andrei's new param.

0 mrad crossing

Energy density (GeV/cm**2) Nominal 0mrad

ID	205
Entries	64358
Mean	0.9829E-02
RMS	0.1271E-01
UDFLW	0.000
OVFLW	0.000
ALLCHAN	0.1449E+06

Energy weighted hit density (GeV/cm^2)

E-dep at z=4.5m

R (m)

500 GeV
Sum of both sides
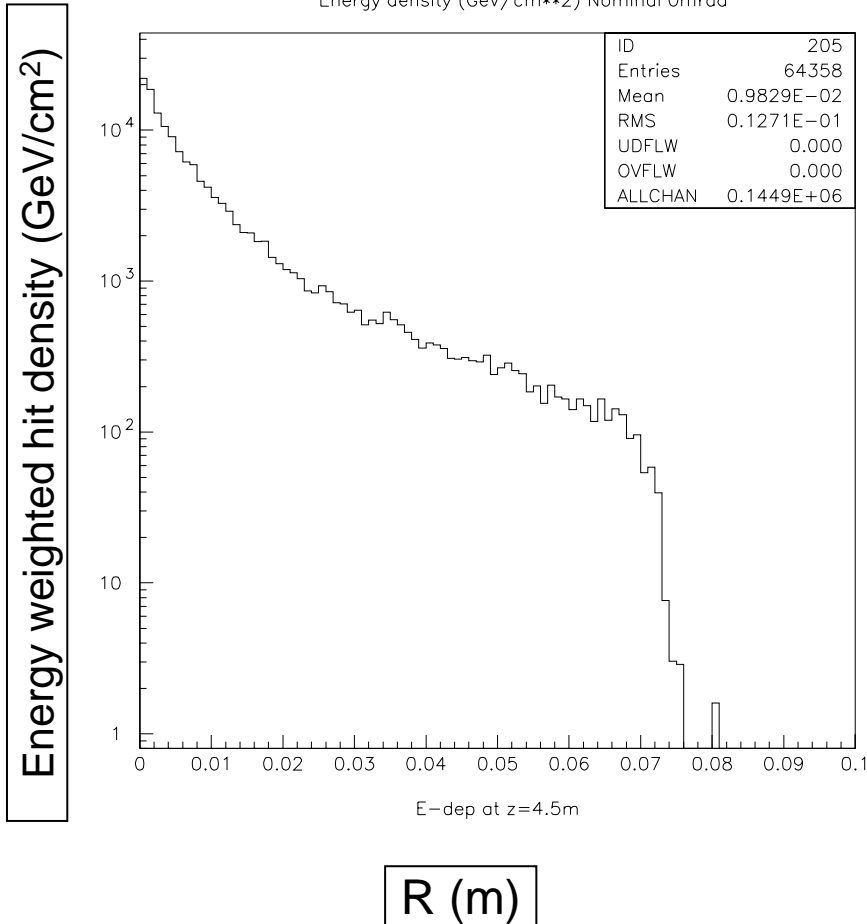
Option	R of exit hole (mm)	Edep (TeV/BX)
Nominal	0	145
	10	43.5
	15	29.3
	20	20.8
High Lum	0	754
	10	242
	15	163
	20	118

Backscattering

- Backscattering e+/e- comes out from beam exit hole (No low-Z mask)
- Hit at $R=L\theta_x/2+-R_{hole}$ w/o DID and $R=L\theta_x+-R_{hole}$ with DID (DID gives $B_x dl$ which cancels out transverse B field for incoming beam) For $\theta_x=20$ mrad,
 - ~4.3+-2 cm w/o DID → VTX
  - ~8.6+-2 cm with DID → IT
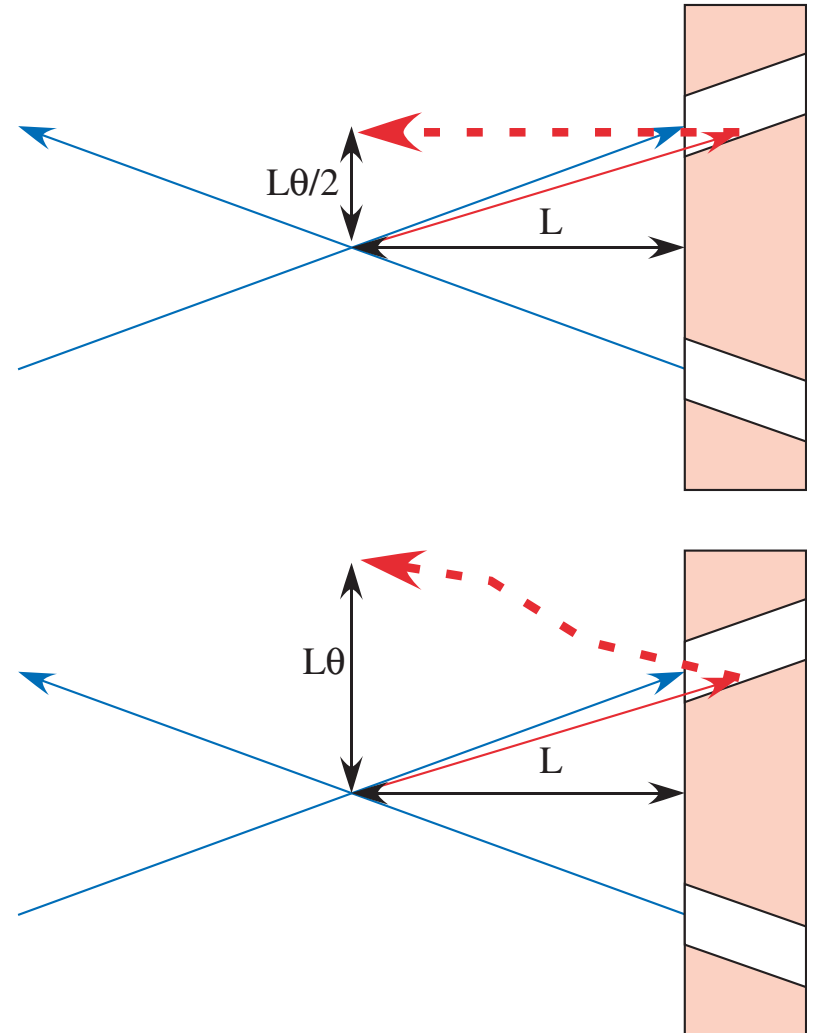
Summary

- Energy deposit in BCAL has large machine-parameter dependence
- It is not trivial BCAL can tag high energy electrons at small R, particularly in "High Luminosity" option
- Andrei's new high luminosity option is favorable for BCAL
- Reduction of beam exit hole radius seems possible with head-on collision from the viewpoint of pair background (determined by synchrotron radiation)
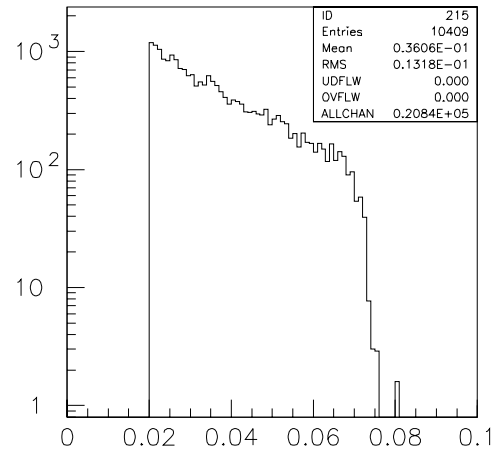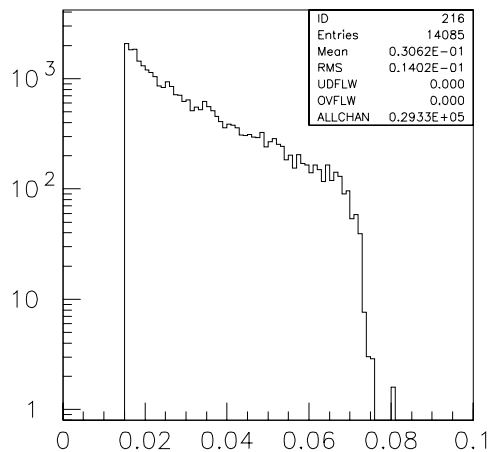- In 20 mrad crossing angle case, backscattering from BCAL can hit VTX or IT

backup

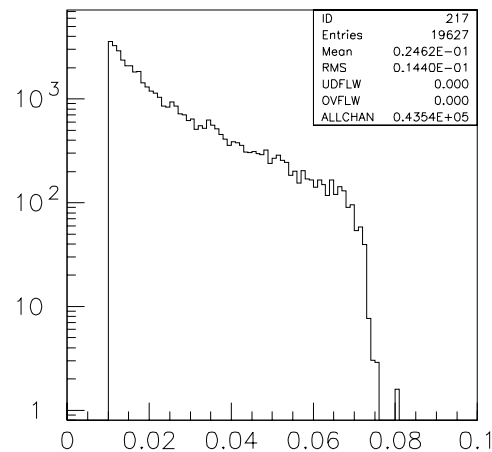# 0 mrad crossing

Energy density (GeV/cm**2) Nominal 0mrad
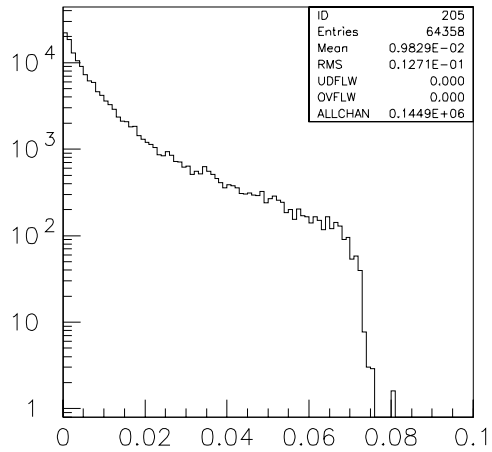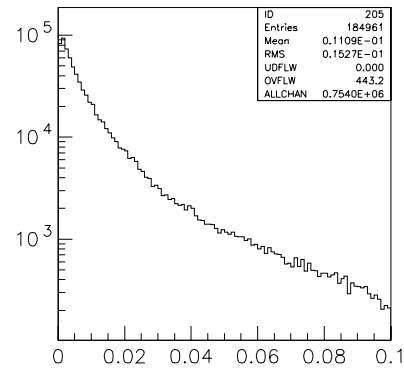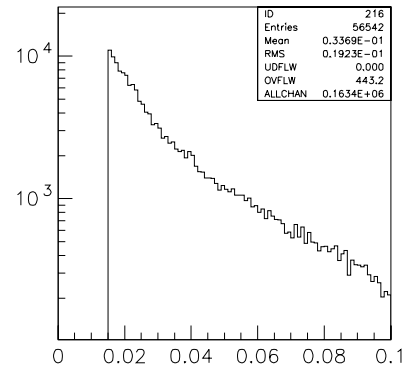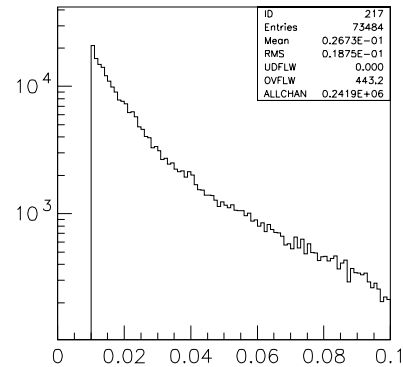

E−dep at z=4.5m

E−dep at z=4.5m

E−dep at z=4.5m

E−dep at z=4.5m

0 mrad HL 500GeV

Energy density (GeV/cm**2) High Lum 0mrad