Update on Pair Background Studies

Outline:

- **Cross-check status (Akiya, Eduard)**
  - **BCal energy depositions**
  - **VXD hit study**
- **Timing studies**
  - **Origin of background hits**
  - **Possible methods of background reduction**

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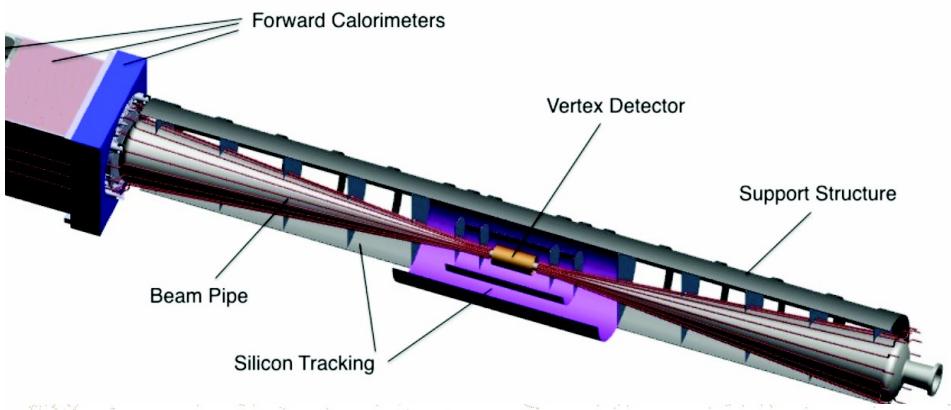
Update on Pair Background Studies
DESY, 17 October 2012

HELMHOLTZ ASSOCIATION

DESY

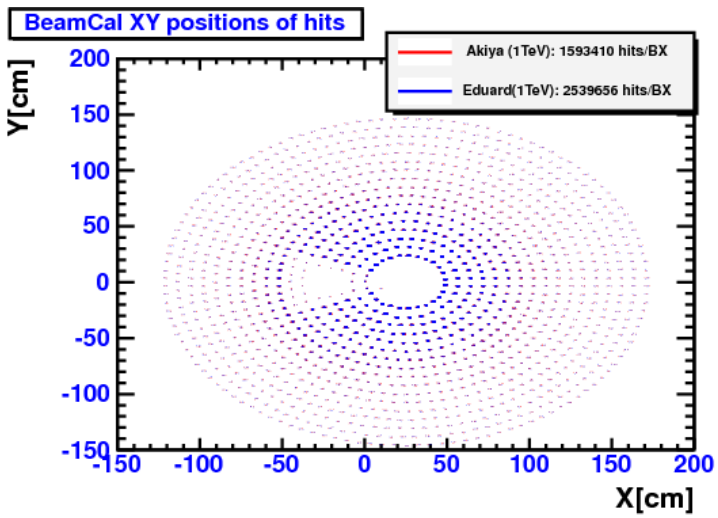
Pair Backgrounds

- Intense EM fields in the beam-crossing region produce huge amounts (200-400k per BX) of e^+e^- pairs
- Mostly in forward direction, some create hits/noise in the detectors
- The hit occupancy and energy contributions in certain (forward/vertex) detectors can be crucial
- Earlier studies for RDR-500 documented in LOI
- TDR-1000 being studied



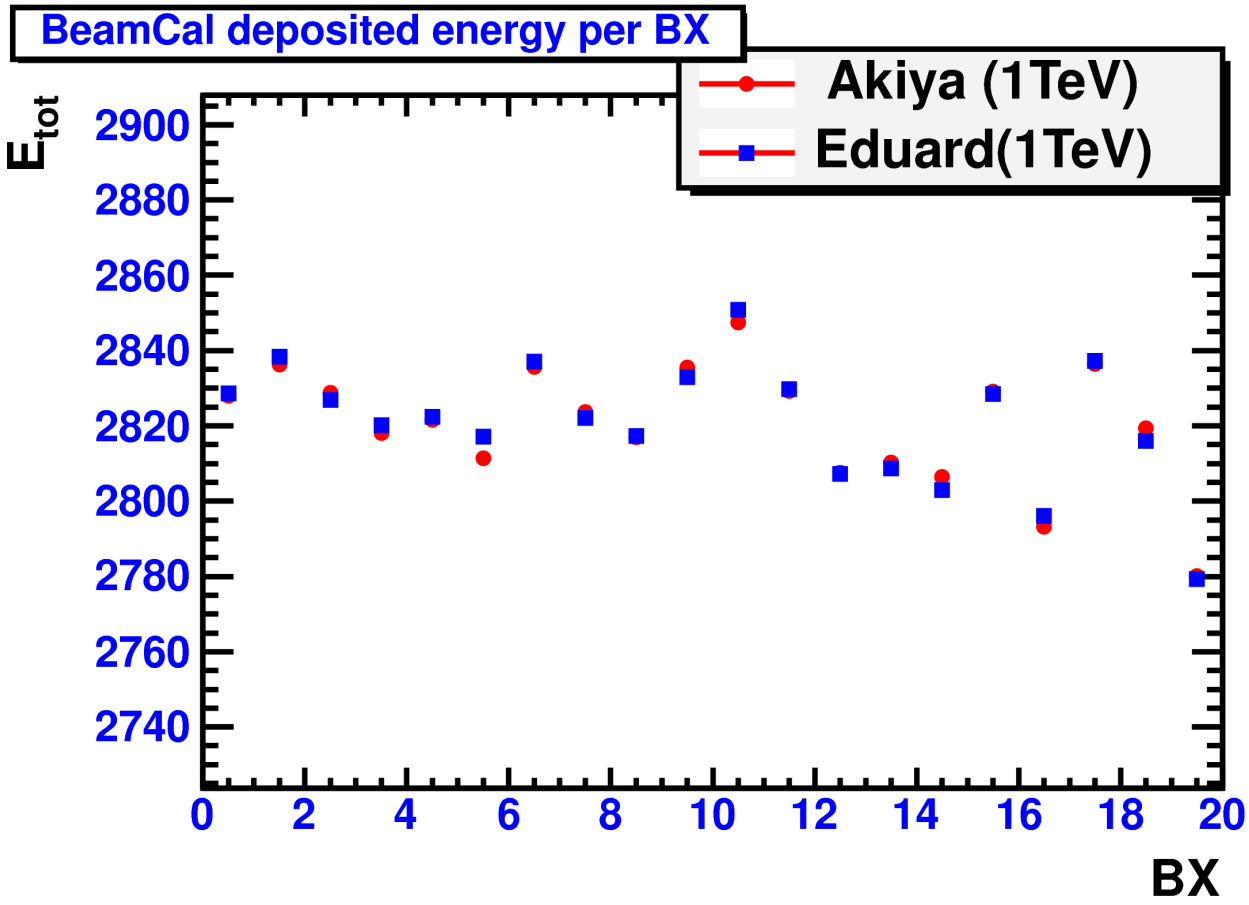
Cross-check Status

- /Mokka/init/detectorModel **ILD_o1_v05**
- **40BX** GuineaPig pairs (1TeV) analyzed, full bunch train in the queue
- Mokka setup differences:
  - Akiya: 1000 pairs/event, 200 events/run, 1 joined slcio output/BX
  - Eduard: 100 pairs/event, 400 events/run, 11 slcio files per BX
- Agreement in **VXD** hit counts and distributions
- Mismatch in raw hit counts in **Bcal**
  - normal due to saturation
    - Full agreement in total energy deposition per BX



BCal comparison

- Full agreement in total energy deposition per BX
- Mean energy per hit ~0.5 – 1GeV

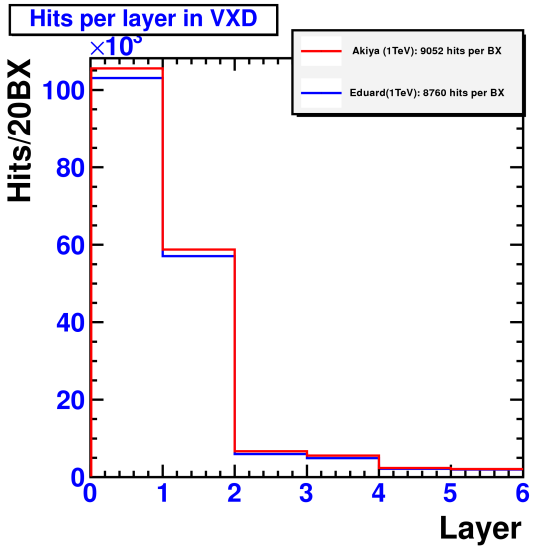


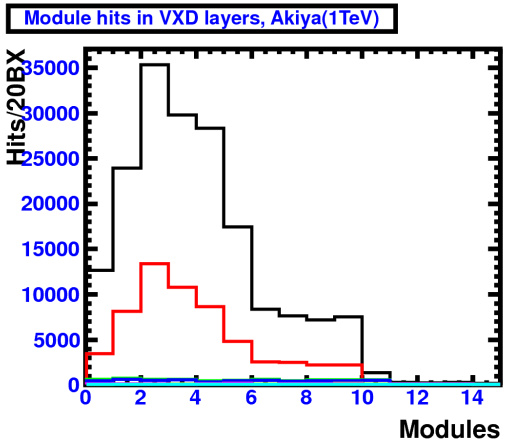
VXD Comparison

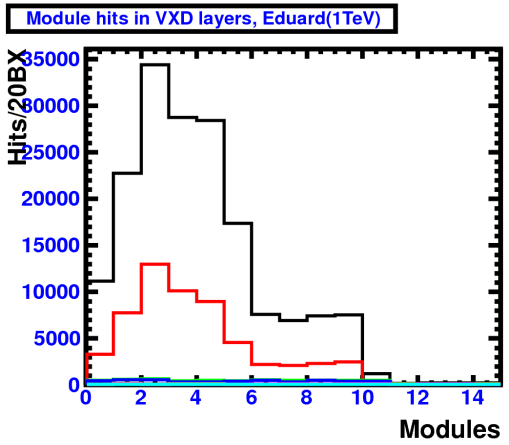
- Good (~3%) agreement in raw hit counts
- Layer/module hit counts ok

#Layer	Akiya (1TeV)		Eduard (1TeV)	
	Hits/BX	Hits/BX/cm^2	Hits/BX	Hits/BX/cm^2
1	5277	3070	5152	2998
2	2938	1709	2854	1660
3	335	48	299	43
4	280	41	248	36
5	117	17	108	16
6	105	15	99	14

Table 3.6.1 (DBD)

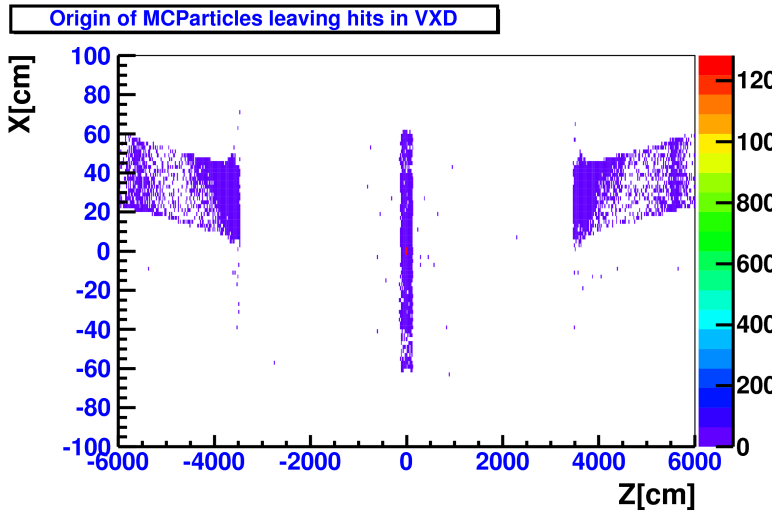


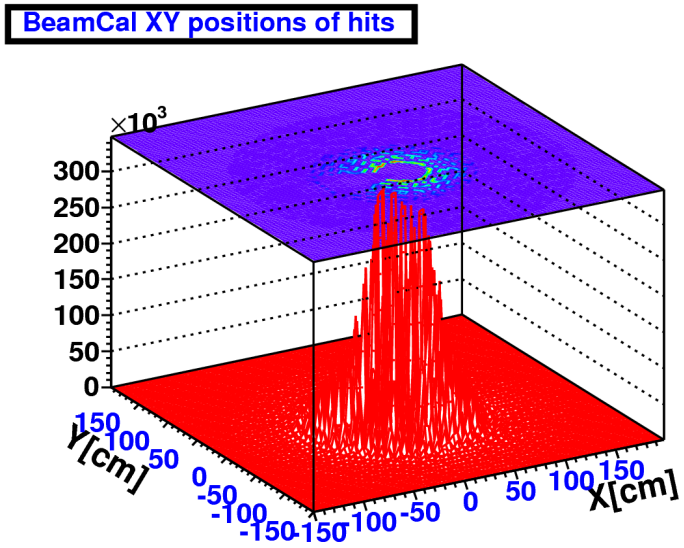


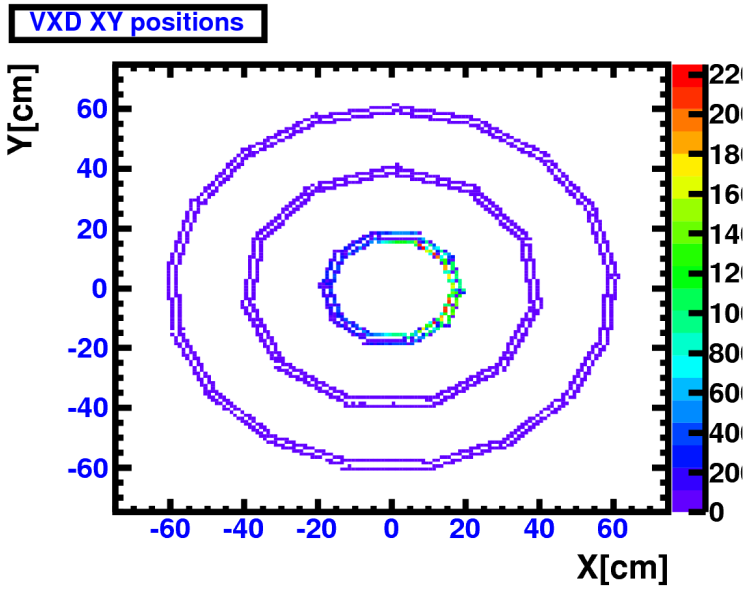


VXD Hit Positions

- Many hits come from backscattered particles from BCal and beam pipe
- Most of the VXD hits are located in the first 2 layers
- Opposite to the keyhole in BCal
- Backscattered hits – check with timing

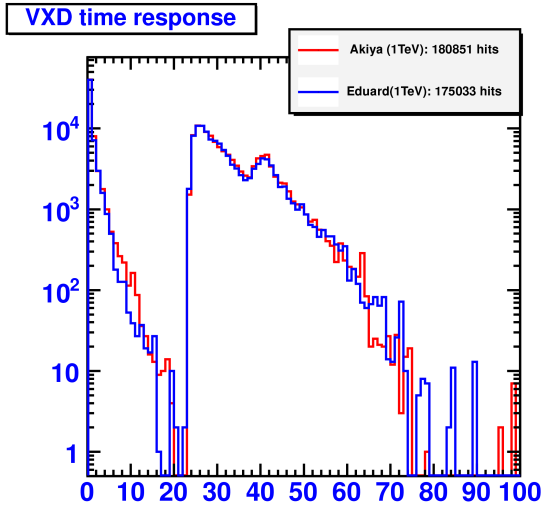




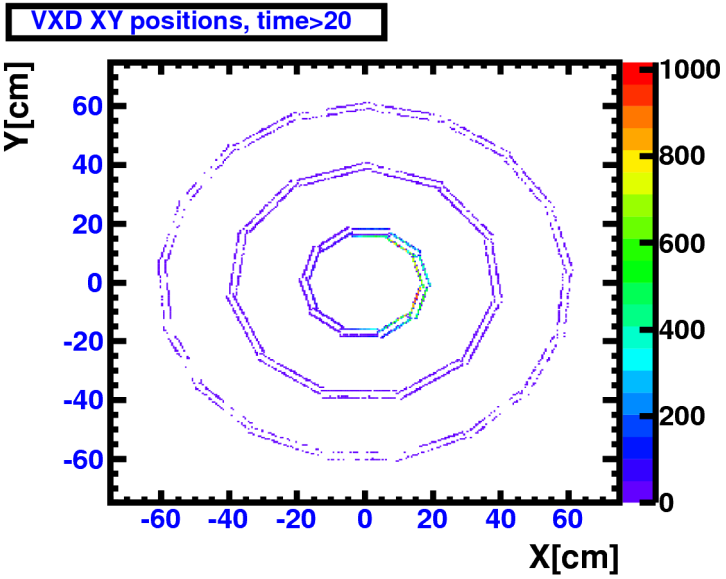


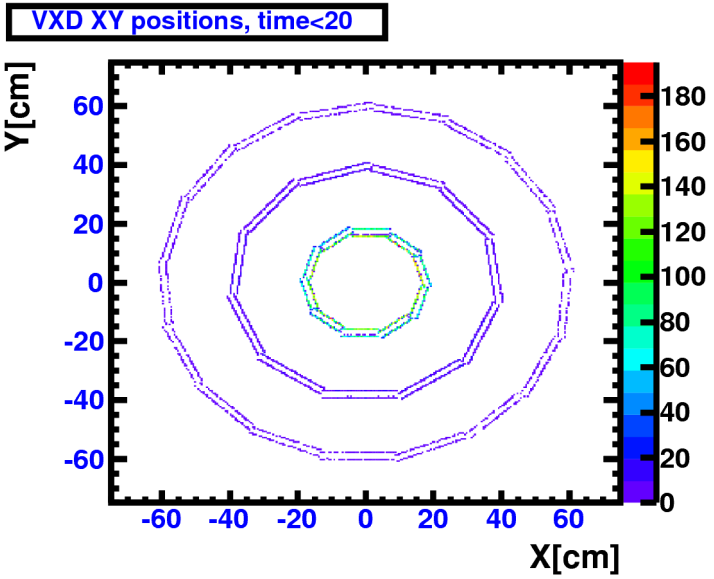
VXD Hit Timing

- 24ns ~ 7m (BCal is ~3.5m far)



- Background strongly suppressed if time<20





Summary

- Pair backgrounds studied with updated software versions:
  - Mokka 8-00-03
  - ILCSoft v01-16
  - ILD o1-v05
- Good agreement Akiya/Eduard
- Updated hit counts for DBD
- Timing structure possibly useful for pair background rejection
  - Real physics overlays needed – in progress
- SIT/SET/FTD etc to be added soon.