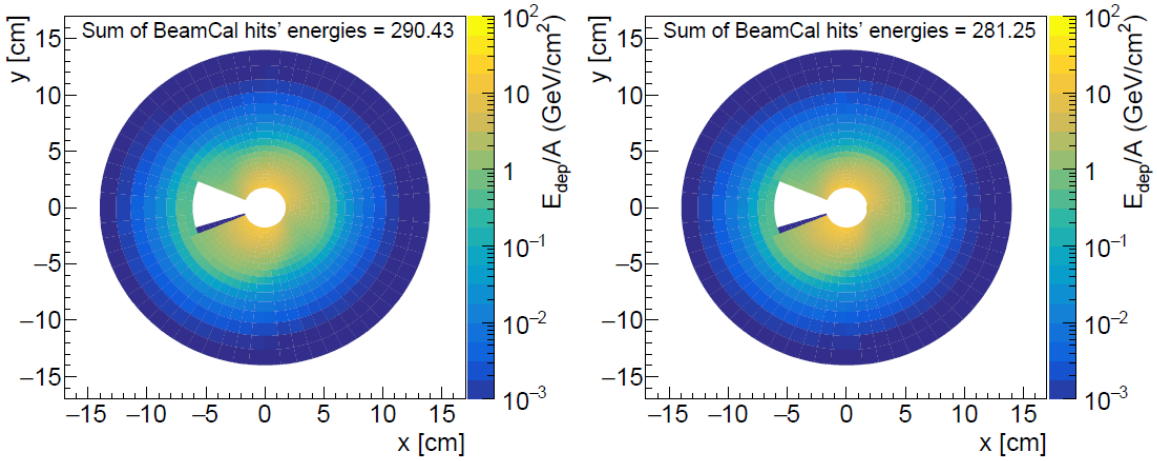
ILD beam related background

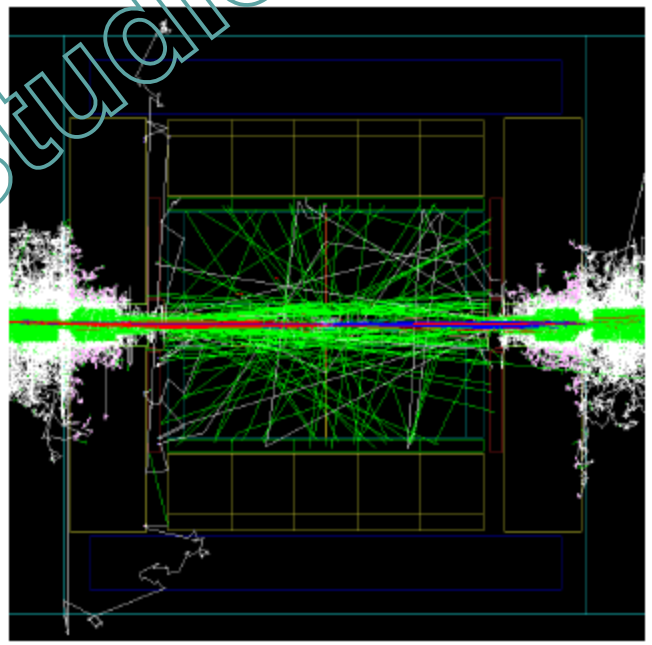
"Backgrounds in ILD" by Daniel Jeans, Akiya Miyamoto
January 18, 2019

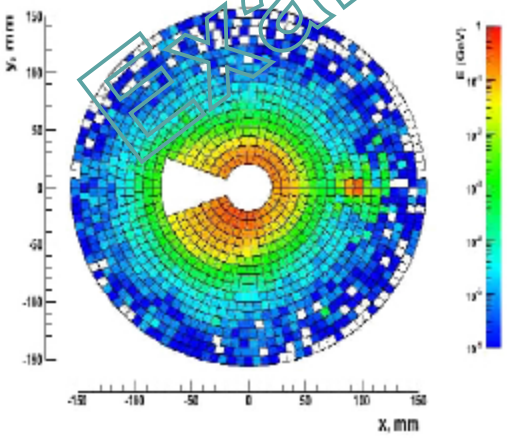
Sergej Schuwalow, DESY Hamburg

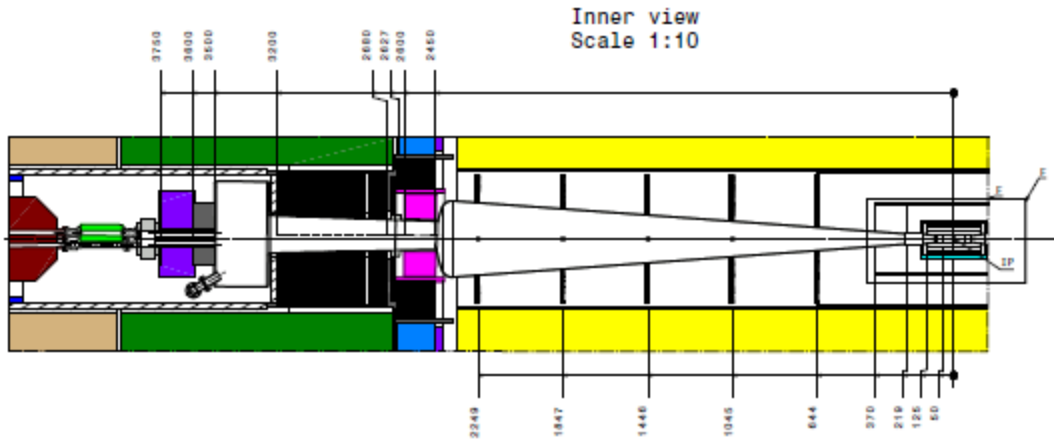


Pair Background Backscattering

- Pairs from Beamstrahlung hit forward region, mostly BeamCal
- Backscattering leads to background in the ILD tracking system
  - charged particles in SI
  - photon conversions in TPC
  - neutrons in calorimeter endcaps
- Need to redo the background simulations if forward region design changes







New background simulations at ILD

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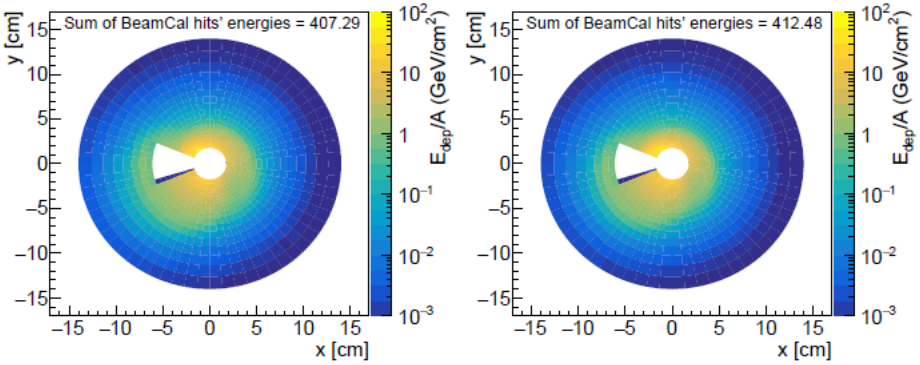
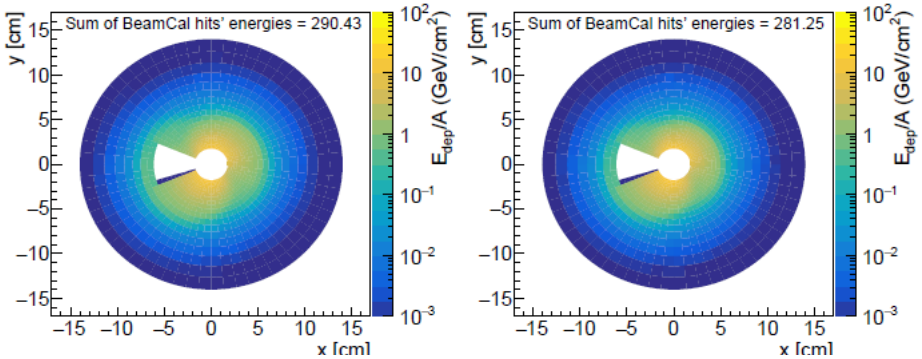
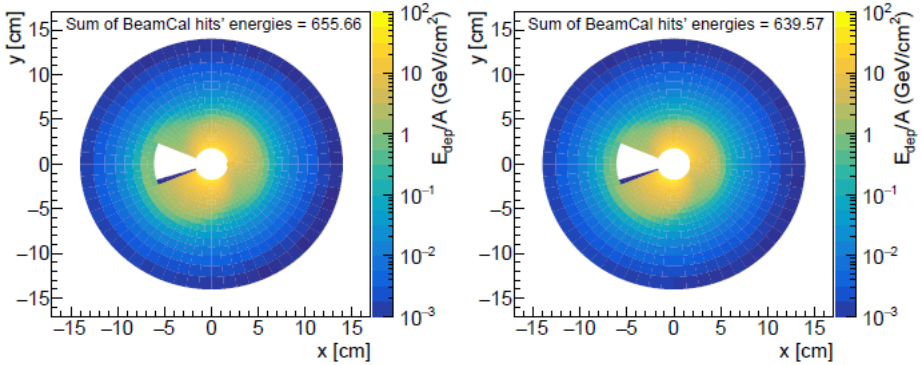
- Detector models ILD [l/s]5 v0[3/5]. [l/s] refers to Large and Small detector models, and [3/5] to models without/with the anti-DID field. The (nominal) strength of the solenoidal field is different in the Large (3.5 T) and Small (4 T) models [note that simulated field maps from U. Schwickerath were used in these studies]. The design of the central and forward detector regions, including the beampipe and inner tracking detectors, and identical in the two models. Differences only occur in the outer radius of the TPC and the barrel detectors beyond.

model	size	energy	anti-DID
ILD_l5_v03	large	250	no
ILD_l5_v05	large	250	yes
ILD_l5_v06	large	500	yes
ILD_s5_v03	small	250	no
ILD_s5_v05	small	250	yes
ILD_s5_v06	small	500	yes

Some results: BeamCal Energy depositions







BeamCal energy density, Large (left) and Small (right) ILD models. Upper row: 250 GeV, no anti-DID; middle row: 250 GeV, with anti-DID; lower row: 500 GeV, with anti-DID.

Some results: hits in tracking detectors
(also separately early and late hits)

	ILD_l5_v03	ILD_l5_v05	ILD_l5_v06	ILD_s5_v03	ILD_s5_v05	ILD_s5_v06
VXD 1	1402 ± 778	914 ± 364	1279 ± 138	1324 ± 824	869 ± 437	1296 ± 764
VXD 2	971 ± 558	545 ± 207	733 ± 107	927 ± 595	494 ± 246	724 ± 413
VXD 3	151 ± 77	129 ± 60	162 ± 50	140 ± 82	111 ± 61	138 ± 73
VXD 4	111 ± 59	107 ± 53	125 ± 43	97 ± 57	88 ± 53	105 ± 59
VXD 5	44 ± 30	40 ± 26	45 ± 24	41 ± 30	32 ± 26	43 ± 28
VXD 6	39 ± 27	34 ± 24	38 ± 20	35 ± 28	27 ± 20	38 ± 26
FTD 1	42 ± 30	38 ± 26	46 ± 10	35 ± 29	30 ± 22	37 ± 29
FTD 2	27 ± 19	24 ± 15	29 ± 7	22 ± 19	19 ± 14	24 ± 19
FTD 3	62 ± 45	40 ± 27	64 ± 13	57 ± 48	36 ± 30	57 ± 51
FTD 4	42 ± 33	25 ± 17	45 ± 9	40 ± 35	25 ± 20	41 ± 38
FTD 5	29 ± 23	18 ± 13	30 ± 7	29 ± 24	17 ± 13	29 ± 27
FTD 6	16 ± 13	9 ± 7	16 ± 5	15 ± 14	9 ± 8	16 ± 14
FTD 7	10 ± 8	6 ± 5	10 ± 4	8 ± 7	5 ± 5	10 ± 9
SIT 1	51 ± 37	24 ± 16	41 ± 9	52 ± 40	24 ± 17	44 ± 35
SIT 2	49 ± 36	21 ± 12	38 ± 9	51 ± 42	22 ± 14	37 ± 30
SIT 3	77 ± 56	34 ± 24	66 ± 11	79 ± 64	36 ± 25	69 ± 60
SIT 4	71 ± 54	31 ± 21	62 ± 12	76 ± 61	33 ± 26	65 ± 57
SET 1	39 ± 28	15 ± 10	29 ± 6	42 ± 35	18 ± 14	35 ± 30
SET 2	46 ± 36	18 ± 12	33 ± 6	52 ± 42	21 ± 16	40 ± 33

Table 3: Estimated number of hits induce by BS pairs, per BX in various tracking detectors. Large/Small, with(out) anti-DID, 250/500 GeV. [100 AKIYA BX.]

Some results: Halo muons

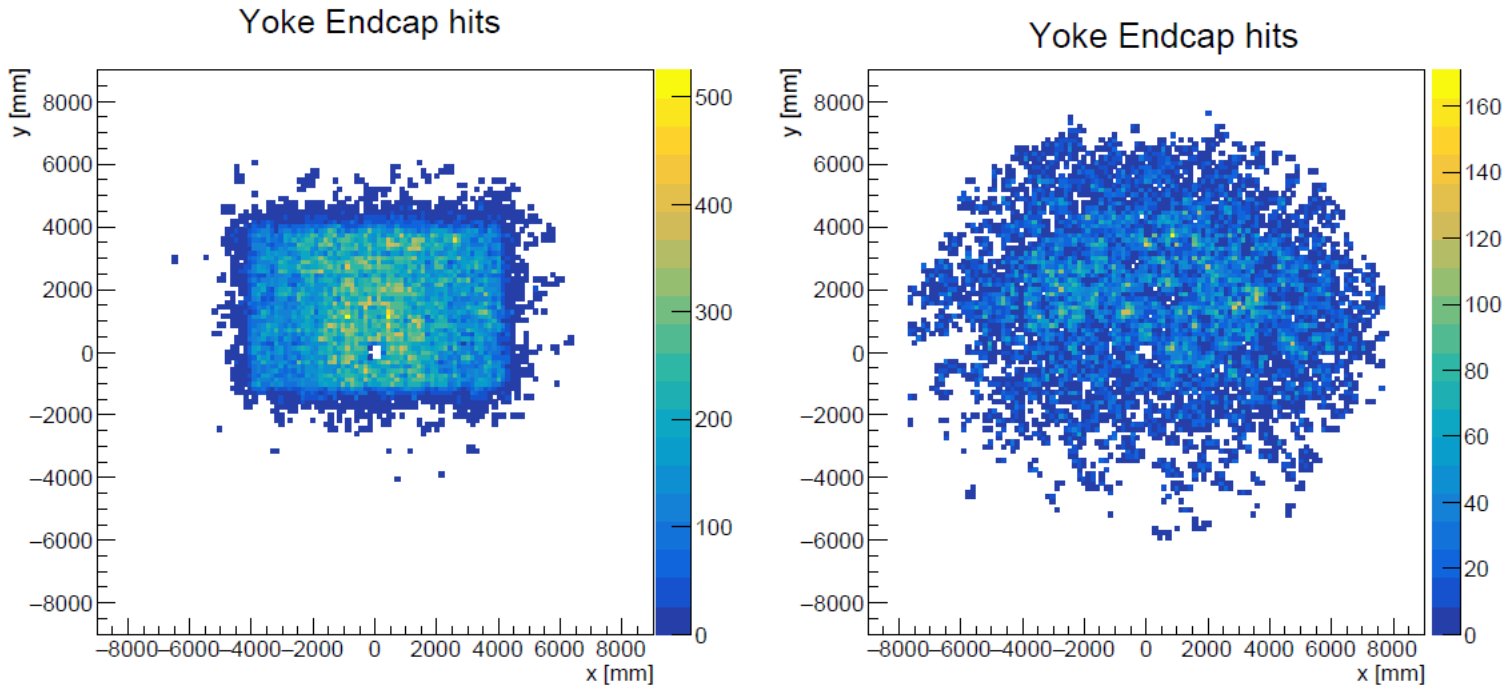
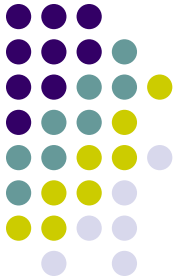


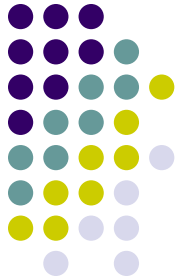
Figure 3: Position of hits induced by beamline muons, without (left) and with (right) the muon wall. Normalised to 2625 bnches at ILC500.

Possible questions to Daniel



- Is there still azimuthal assymetry of central detector background with anti-DID (Lucia simulations)?
- Our understanding was that charge particles flying back from BeamCal were not just backscattered e+ or e-, but mainly electrons kicked out from BeamCal first layers by photons from the em showers. Even if the amount of late hits (table 4) is relatively small, it is interesting if electrons have dominant contribution there.
- What about early hits? Do we have charge asymmetry correlated to +Z / -Z position in the detector?
- Do we have time information for hits caused by halo muons?
- Other questions?

To be done by FCAL



- what I consider to be missing, and that should be done by fcal, is the impact of the pair background on LumiCal and BeamCal performance, and long waited estimate about the potential of the muons for calibration and alignment. I think you would also like to see the possibilities related to fast timing.
- what about asking our friends from Kiev to work on that a bit more in detail??