anti-DID simulation options

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Outline

- role of B-field in simulation
- anti-DID in previous simulation codes
- B-field in new simulation
- effect on tracking performance
- background simulation

B-field in simulation and reconstruction

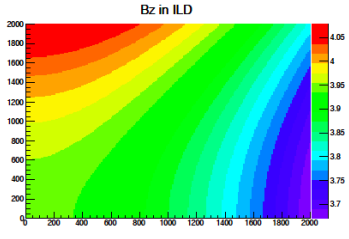
- having a correct and detailed knowledge of the B-field is crucial for the simulation
  - independent of whether we have an anti-DID or not

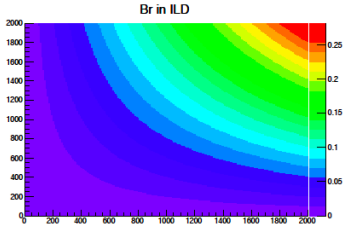
most important effects:

- background in beamcal from direct pairs
- background in inner tracking detectors
  - mostly from backscatter from forward region
- potential effects of inhomogeneous B-field on track finding and fitting
  - can be corrected for in Kalman filter

the solenoid field in ILD

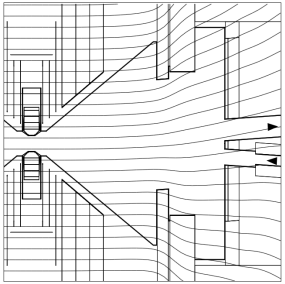
- in LOI and DBD simulation models we had a rather homogeneous solenoid field
  - based on desgin with correction coils (droped in DBD)
- more recent coil design results in inhomogeneties of $>10\%$
- will affect the track finding anf fitting performance
  - KalTest Kalman filter version that can deal with this exists
- **need detailed tracking studies with correct field map to study tracking performance**

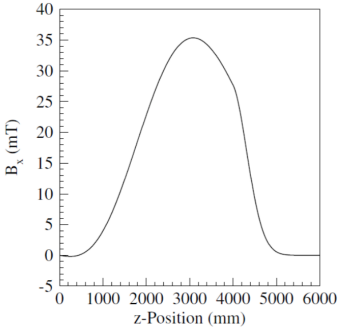




anti-DID in the Mokka simulation - LOI

- implementation of B-field incl. anti-DID in Mokka
  - done by A.Vogel pre-LOI for LDC
  - adopted for ILD for the LOI
- used for first detailed investigation of pair-bg in ILD (LDC)
- some issues w/ this implementation
  - actual shape of anti-DID unrealistic (as we know today)
  - parameterization of solenoid field was unphysical at larger R

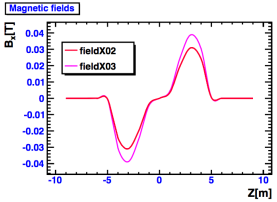


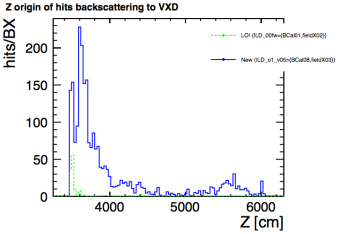


anti-DID in the Mokka simulation - DBD

- replaced the solenoid field w/ a correct field map (FG)
- adjusted the anti-DID field somewhat free-handedly

- dramatic effect on occupancies in inner tracking detectors
  - due to backscatter from inside of holes in the beamcal
- **fine tuning the anti-DID is crucial for the control of the background**





a complete field description for ILD

- a complete field descrioption for ILD that can be meaningfully used for detailed background studies needs to have B-fields for:
  - the main solenoid
  - the anti-DID
  - the QD0 quadrupole
  - the anti-solenoid
  - potentially including finge fields

tuning of relative field strengths

if we have the anti-DID included in the setup, its relative strength must be **carefully tuned** using **iterative** pair background simulations in order to minimize occupancies in inner tracking detectors (and the beam cal)

plans for next Monte Carlo production

- plan to use simplified (homogeneous) field in MC mass production
  - considerable faster simulation times (factor >2 !?)
- this only works, if
  - the tracking efficiency is compatible to that w/ bg and realistic B-field
  - the momentum and impact parameter resolutions are compatible to those w/ bg and realistic B-field
  - we understand the expected bg in the beamcal as this will have to be parameterized before the reconstruction

prerequesites for MC mass production:

- detailed B-field maps
- full pair-background simulations
- tracking studies w/ background and inhomogeneous B-field

implementation of B-fields in ddsim (lcgeo)

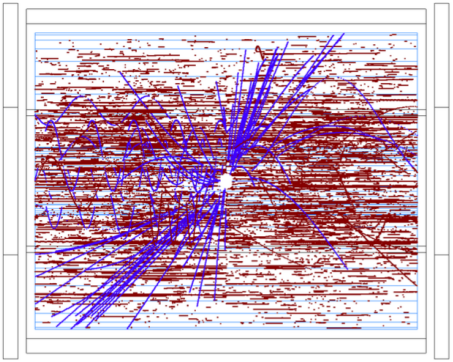
- ddsim uses the functionality of DDG4 to overlay several electromagentic fields
- users (or experts) need to implement the details of the field map lookup
  - currently only $\vec{B}(\rho, \phi)$ implemented
  - other can be added as needed
  - can copy some existing code from Mokka

smart implementations of B-field map lookups save CPU and memory requirements

- should try and identify manpower to implement this
- potentially the same person that is going to study the background for ILD

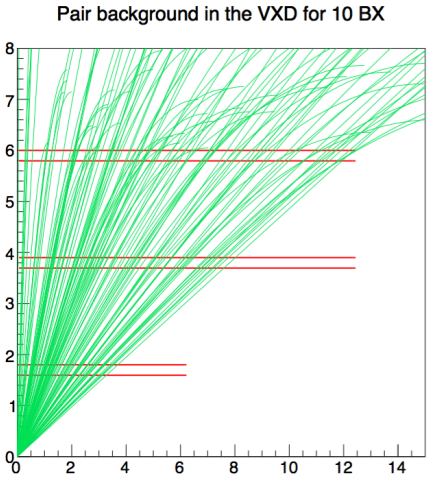
Pair background simulation for ILD

- need detailed study of pair bg in ILC with and without anti-DID
- study occupancies in Si-tracking detectors and TPC and beamCal
- some subtle issues:
  - no detailed Si-digitizers exist
  - actual occupancies have to be estimated based on assumptions of #pixels per hit (dependent on incident angle)
  - hits in TPC simulation suppressed by E_{cut}
- non trivial task - but has been done before, so know how exists
- need new numbers in particular with **changed** L^*



background for large physics sample

- overlaying pair-bg for large scale MC production prohibitive due to large CPU and memory consumption
- however important background for low-multiplicity low-p_t studies (low mass difference Higgsinos scenarios)
- plan to overlay e^+e^- pairs that actually are reconstructable in VXD and FTD



Summary and Outlook

- anti-DID in simulation and reconstruction affects:
  - bemCal background energy depositions
  - background occupancy in inner tracking detectors
- need detailed field map(s) for ILD detector model(s)
  - study the background
  - effect of non-homogeneous B-field on tracking performance
  - plan to use only for dedicated studies, but **not the large MC production**
- some coding needed for implementing (smart) field maps in ILD simulation models
  - potentially to be done by person identified for background studies