Hcal geometry and implementation in software

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ILD Task Force Meeting, 7-8.11.16

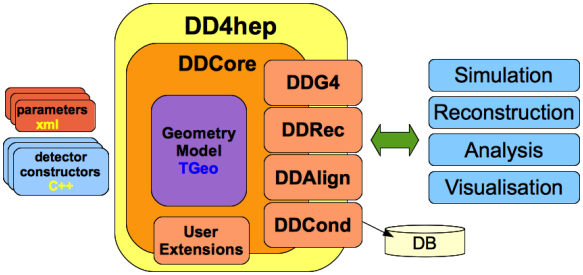
Outline

- Introduction
- ILD geometry models in lcgeo
- Tesla geometry
- Videau geometry
- validation process
- simulating multiple technologies
- Summary and Outlook

Introduction

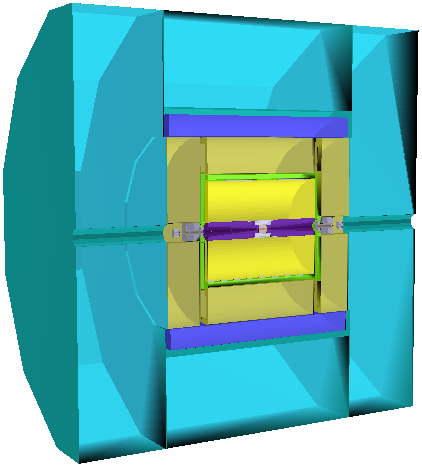
- recently have introduced DD4hep in ilcsoft
- common detector geometry description
- interfaces to:
  - DDG4: Geant full simulation
  - DDRec: reconstruction code
  - DDAlgin: alignment tools
  - DDcond: condition data bases

will use DD4hep based simulation and reconstruction for large scale Monte Carlo production for next round of ILD detector optimization



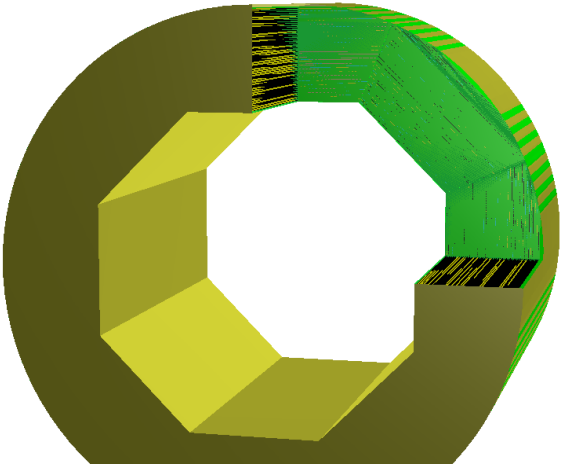
ILD simulation models in lcgeo

- ported ILD models used in DBD from Mokka
  - **ILD_o1_v05** (AHcal-SiW Ecal)
  - **ILD_o2_v01** (SDHcal-SiW Ecal)
  - **ILD_o3_v05** (AHcal-SciW Ecal)
- introduced mandatory envelope volumes
  - simplify geometry validation
  - speed up simulaiton
  - allow for **easy exchange** of sub-detectors



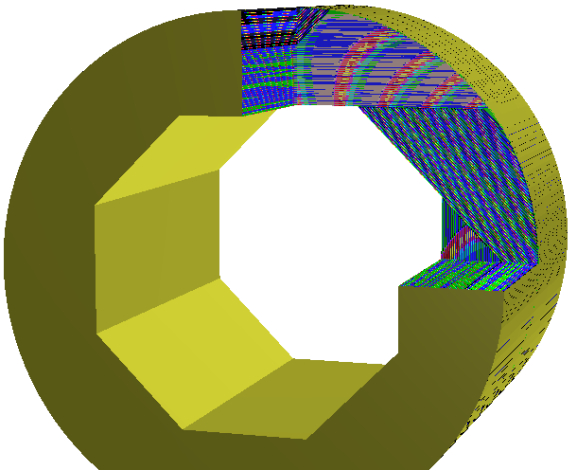
the AHcal in the ILD simulation (S.Lu et al.)

- model ported from Mokka model used for the DBD
- updated to recent engineering design
  - rounded edges
- scaling to smaller radius implemented
- sensitive technology: **scintillator**
- **ideally we need also need RPC readout in the Tesla geometry**



the SDHcal in the ILD simulation (T.Kurca)

- model ported from Mokka model used for the DBD
  - currently DBD radius only
  - need to create scaled down version
- sensitive technology: **RPCs**
- **ideally we need also need scintillator readout in the Videau geometry**



new ILD simulation models

large DBD like	new smaller model	Hcal	Ecal	Hcal geometry
ILD_l1_v01	**ILD_s1_v01**	analog	SiW	Tesla
ILD_l2_v01	ILD_s2_v01	semi-digitial	SiW	Videau
ILD_l3_v01	ILD_s3_v01	analog	SciW	Tesla

- eventually will create the complete set of models
- can be used for dedicated studies/analyses

- will use only **two models (large and small)** for large MC production
- **will have to decide on geometry and technology** to use

validation of ILD simulation model(s)

group	name	detectors/systems
Calo	**Daniel Jeans**	**Ecal, Hcal**
Si-Tracker	Marcel Vos	VXD, SIT, SET, FTD
VFS	Bogdan Pawlik	beamCal, LCal, LHCal
Yoke	Nicola d'Ascenzo	Muon, Coil
MDI	Karsten Buesser	beam pipe, cables, services
TPC	Dimitra Tsionou	TPC

validation of subdetector simulation models

- nominated software contact people
- validate the software in close contact with technical groups
- should synchronize as much as possible with new **ICD** document

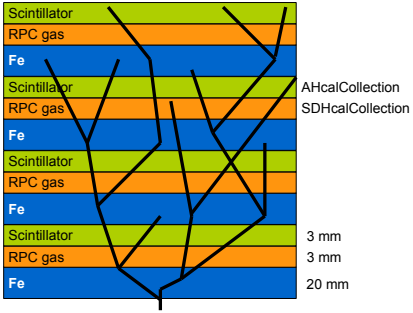
validation of the Hcal (and others)

- validation of the simulation model includes:
  - checking of dimensions
  - material properties: densities, interaction and radiation lengths, ...
  - gaps and imperfections
  - cables, services, cooling,...
  - digitization effects: cross talk, calibration, ...

- can only use technology in the large MC production that has been fully validated
- including **comparison to real data** from test beam
- expect people to report on validation process in ILD Software and Analysis Meetings

simulating multiple technologies

- calorimeter shower development largely defined by absorber structure
- idea to create HCal (Ecal) model with two sensitive materials
- could use in large scale MC production with little overhead in disk space
- would provide possibility to compare technologies on full physics analysis using the **same** events
- issues:
  - need to demonstrate that simulated showers are equivalent to individual technology simulation
  - slightly different cross section e.g. for neutrons in scintillator ...



Summary and Outlook

- both HCal geometries implemented in new DD4hep based simulation
  - AHcal with Tesla geometry
  - SDHCal with Videau geometry
  - need implementation of both technologies in other geometry
- will create large (DBD-like) and small ILd simulation models with these options

large scale Monte Carlo production

- will have to choose **one** geometry for the HCal
- will have to choose **one** technology for the HCal (and ECal) to use
  - **fully validated** with test beam
- alternatively can use **multi-technology-simulation**