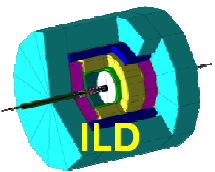


ILD Simulation Status and Plan

Akiya Miyamoto
for ILD Software group
27-March-2010, Beijing
LCWS2010



ILD Software tools

■ Generators

- ◆ Common Stdhep data
- ◆ Whizard/PhysSim package

■ Simulation: Mokka

- ◆ Geant4 application

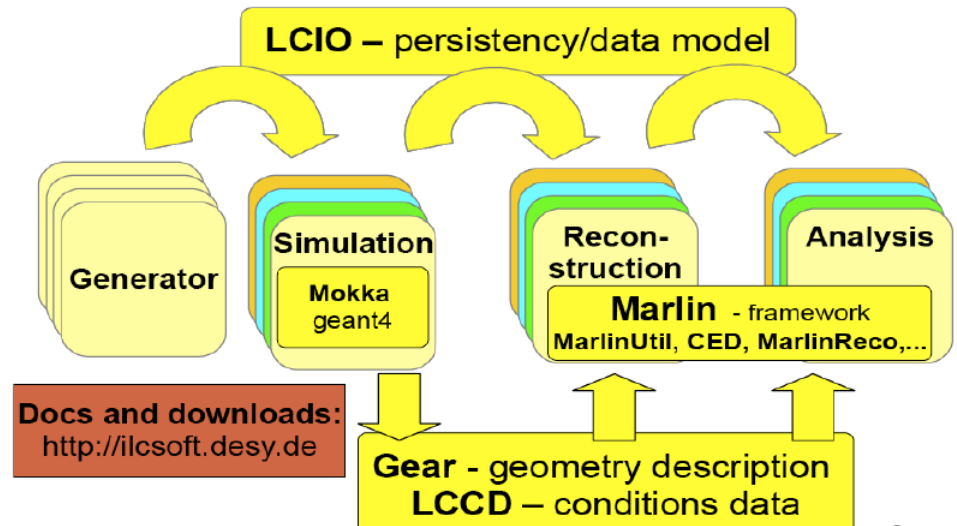
■ Reconstruction

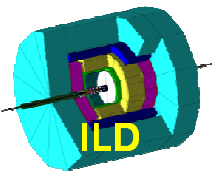
- ◆ Marlin Framework
- ◆ Reconstruction tools as Marlin Processors

- ◆ Digitization

■ Core tools

- ◆ LCIO : standard for persistency format and event data model
- ◆ Gear, LCCD, CED, ...
- ◆ Grid tools and ilcsoft-install



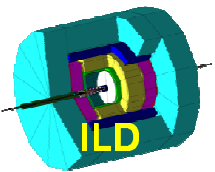


Towards 2012

- ILD software tools has been used successfully in LOI era
 - ◆ About 50M events were produced using a realistic detector model.
 - ◆ Demonstrated physics capability of ILD detector

- For studies by 2012, our tools should be shaped up to meet RD's request,
 - ◆ “Develop a realistic simulation model of the baseline design, including faults and limitation”
 - ◆ To be used for new benchmark studies

- Plan has been discussed soon after LOI approval in various occasions such as
 - ◆ ALCPG 09
 - ◆ ILD WS in Jan. 2010
 - ◆ At bi-weekly ILD Software working group meetings.



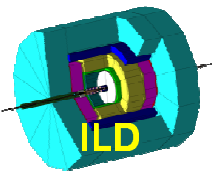
Timeline

■ Global plan : relative weights in each periods

- ◆ 2012: Debug / GRID production / Analysis / Writing
- ◆ 2011: Reconstruction / Optimize / Define baseline
- ◆ 2010: Develop tools / Develop Simulators

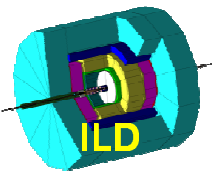
■ Issues being considered

- ◆ LOI studies: detector options – little impact on physics performance
→ some MC production may be started earlier?
- ◆ Reconstruction code developments are significant work.
 - New tracking which can handle non-uniform field, background hits
 - silicon strip tracker
 - PFA for Scintillator strip ECAL, ScSiECAL
 - PFA for HCAL (Analog vs digital) x (8-16 sided vs cylinder)
- ◆ Hardware R&D info will come later.
- ◆ Study for DBD should be based on the best known technologies



Timeline - 2

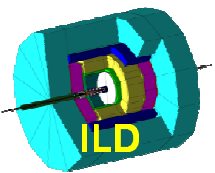
- Conclusion at ILDWS (Jan. 2010) was
 - ◆ to postpone the exact scheduling of mass production for DBD
 - ◆ Request each sub-detector contacts to declare their plans and schedule
 - ◆ Review the progress of code developments in mid. 2010 and re-schedule a plan of mass production.
 - ◆ Limiting factor: man power for code development and running of mass production overlaps.
 - ◆ Priority in this period is in code development, especially on simulation code.
- 17 Mar. '10:
 - ◆ Correct detailed plans from sub-groups
- Mid. 2010:
 - ◆ Software meeting to review status and progress of each plans,
 - ◆ re-consider mass production schedule



Mokka simulation

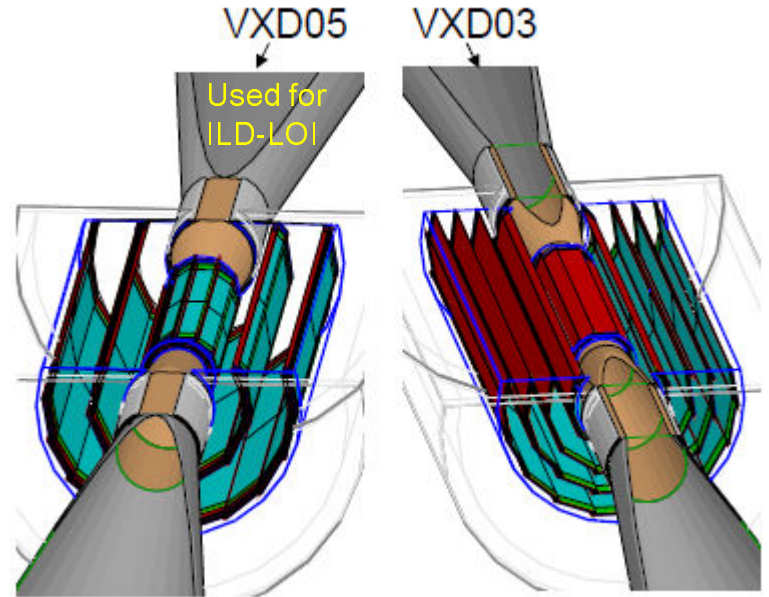
- Successfully used for LOI studies
- Currently uses Geant4 9.2
- No big revolution or reengineering foreseen in DBD study phase
Major activity in Mokka world → develop sub-detector drivers
- PhysicsList
 - ◆ We have been using LCPhys physics list created by Dennis Wright (SLAC) several years ago
 - ◆ Since then many new physicslist are developed and prepared by Geant4 team.
 - ◆ Geant4 team is recommending QGSP_BERT_HP, but it seems to increase computing time significantly.
 - ◆ Other physicslist such as LHEP and Q6SC_CHIP have been used by CALICE people.
 - ◆ ILD wishes to use common physicslist with SiD for DBD studies.

 - ◆ we hope to have an agreement among LC community soon.

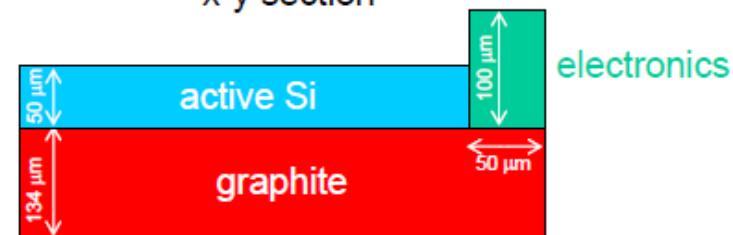


VXD in Mokka

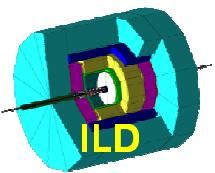
- Two geometries are available in Mokka
 - ◆ Common to DEPFET, FPCCD, CMOS
- ◆ Cryostat is present, but cables and sensors are not addressed.
→ to be improved for DBD
- Technology dependence:
 - ◆ May need to address thickness, pixel size, range cut, etc, for detail performance/background studies
- Digitizer
 - ◆ Smearing 3D hit points
 - ◆ DEPFET-like pixel digitizer exists.
 - ◆ CMOS-like and FPCCD-like digitizer need to be improved/developed.



Sensor structure
x-y section

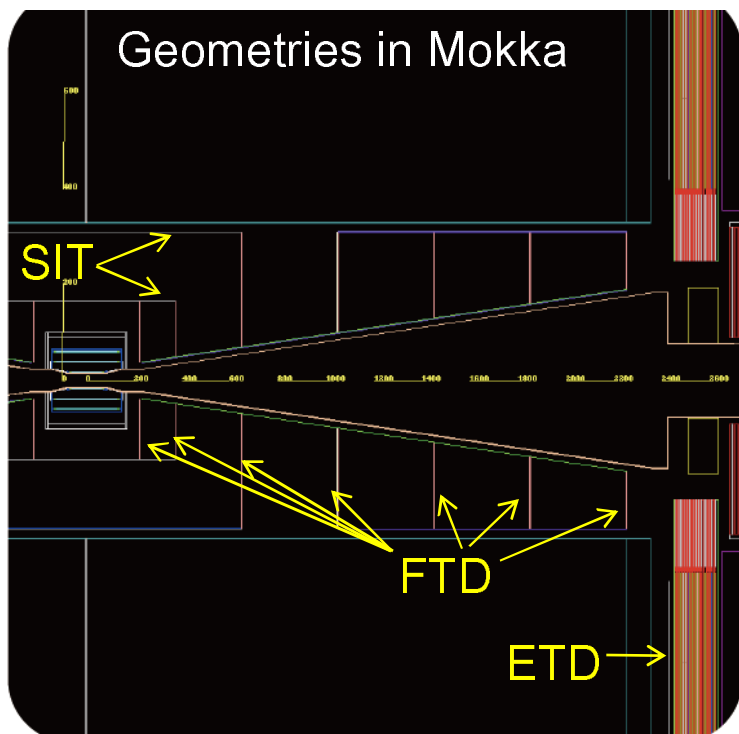


FPCCD: 27(Sat) Afternoon by K.Yoshida

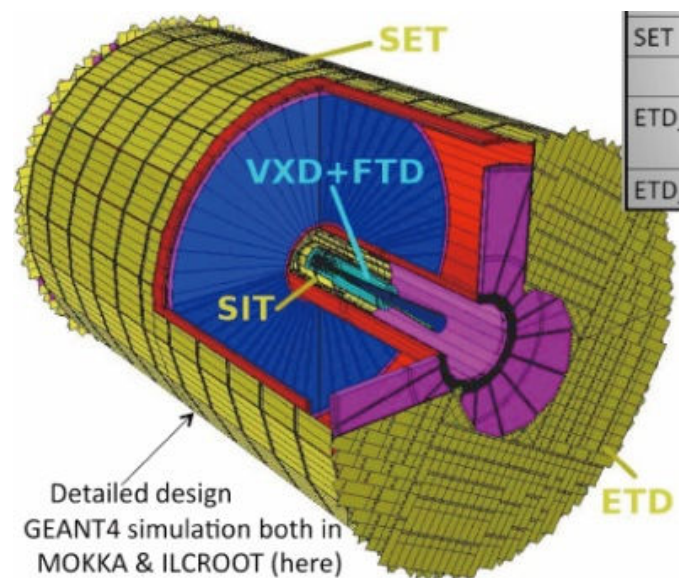


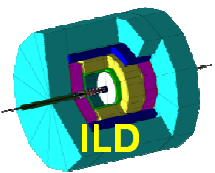
Silicon Trackers

- 4 Silicon trackers in ILD: SIT, FTD, ETD, SET



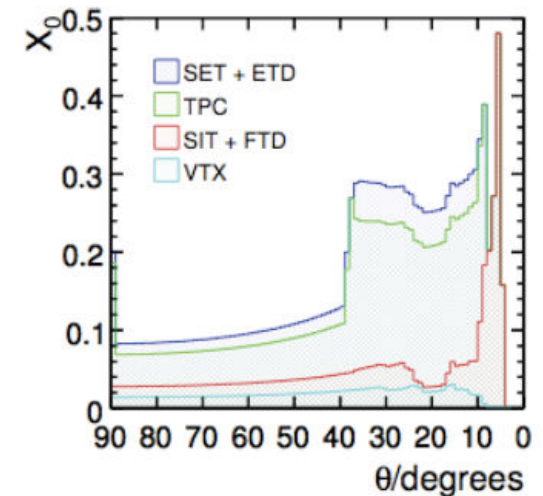
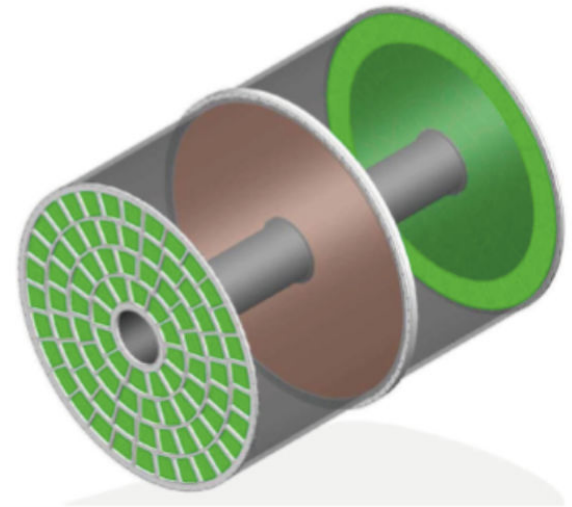
- Cylinder/Disks → strip sensors
- Existing CAD design of them needs to be implemented in Mokka

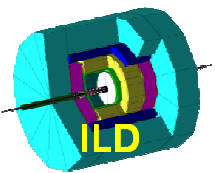




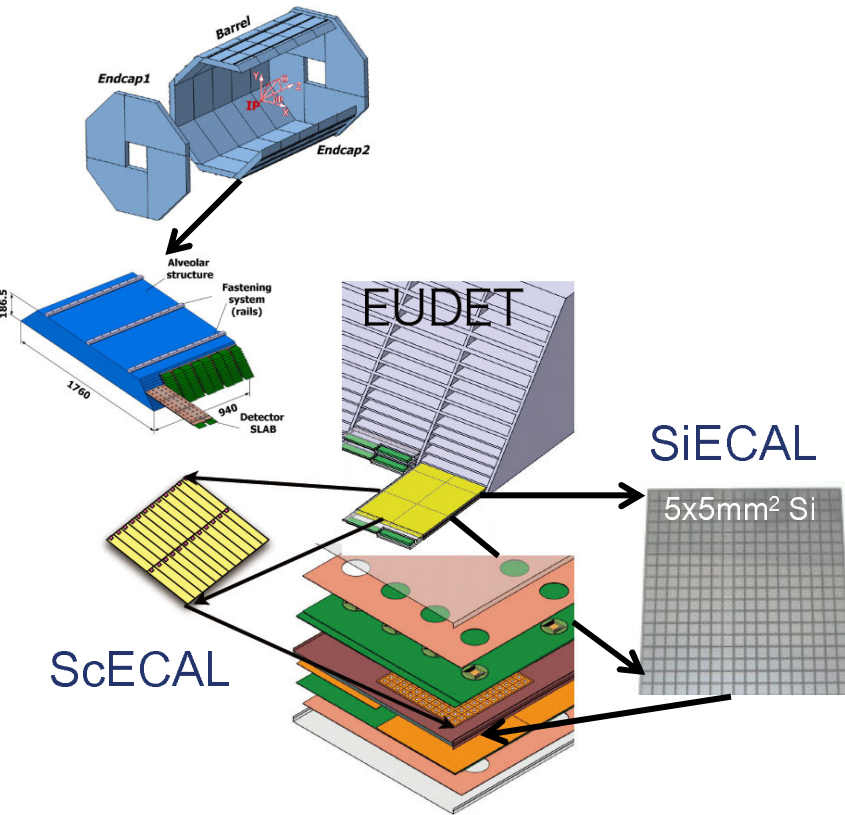
TPC

- Materials:
 - ◆ Gas- Ar/CF₄/C₄H₁₀
 - ◆ Aluminum frame, Cu & mylar cathode
 - ◆ Endplate: sequential discs of G10, Cu, Air, ...
 - cylinders : homogenous in phi
(no gaps between modules)
- Materials in tracking volume is fairly realistic
- Further improved geometries for optimizations
 - ◆ More phi-dependance would be considered
 - ◆ Geometries to optimization
 - end-plate thickness: 15, 30, 45, 60% R.L.
 - TPC-ECAL gap size
- Digitization
 - ◆ Gaussian smeared by θ , ϕ , L_{drift} dependant $\sigma_{\rho\phi}$, σ_z
 - ◆ Improve parameterization by beam tests info.
- Detail simulation of charge correction will not be used mass production



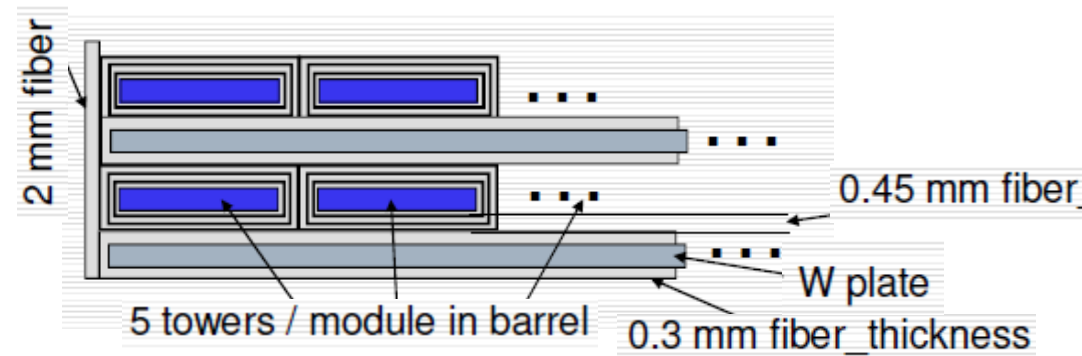


ECAL

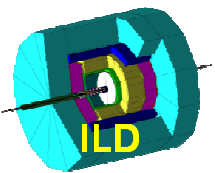


ScECAL and SiECAL share the same structure
 → SiScECAL

ECAL module side view : incl. dead spaces



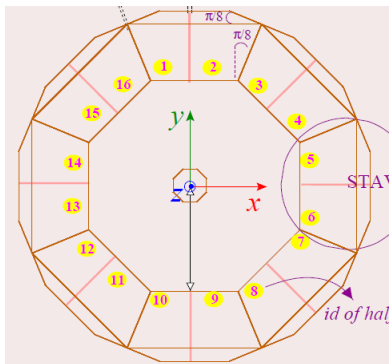
- 3 options: SiEcal, ScECAL, MAPs
 - ◆ SiECAL/MAPs : realistic geom.
 - ◆ ScECAL: Si → Scinti. & Σ tile → strip
 (ScECAL study: Mon. morning, K.Kotera)
- Improvements
 - ◆ SiScECAL : work in progress
- Digitization
 - ◆ Energy deposit x calibration constant



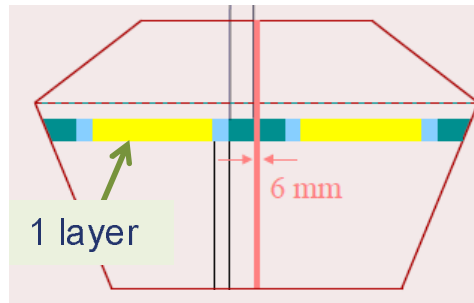
HCAL

- Analog HCAL
Active: Scintillator

8/16-sided



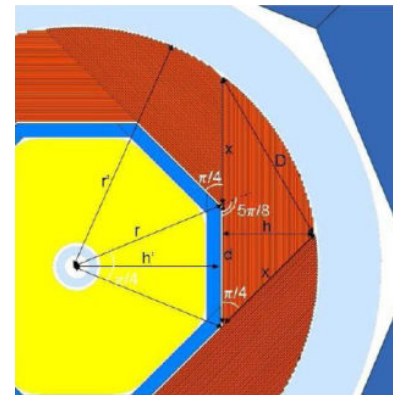
Cross section of 1 module



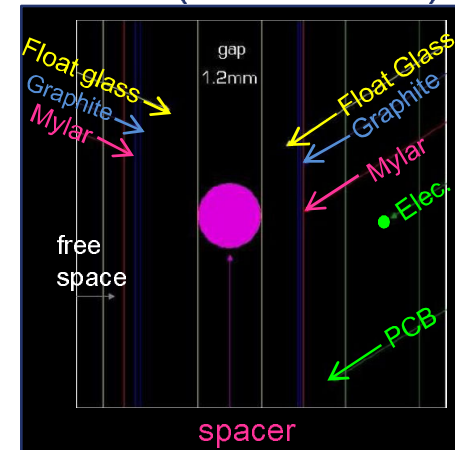
- stainless steel
- aluminium
- air
- scintillator (polystyrene)

- Digital HCAL
Active: RPC

cylindrical

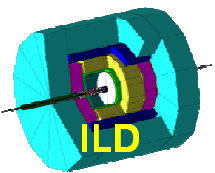


RPC (cross view)

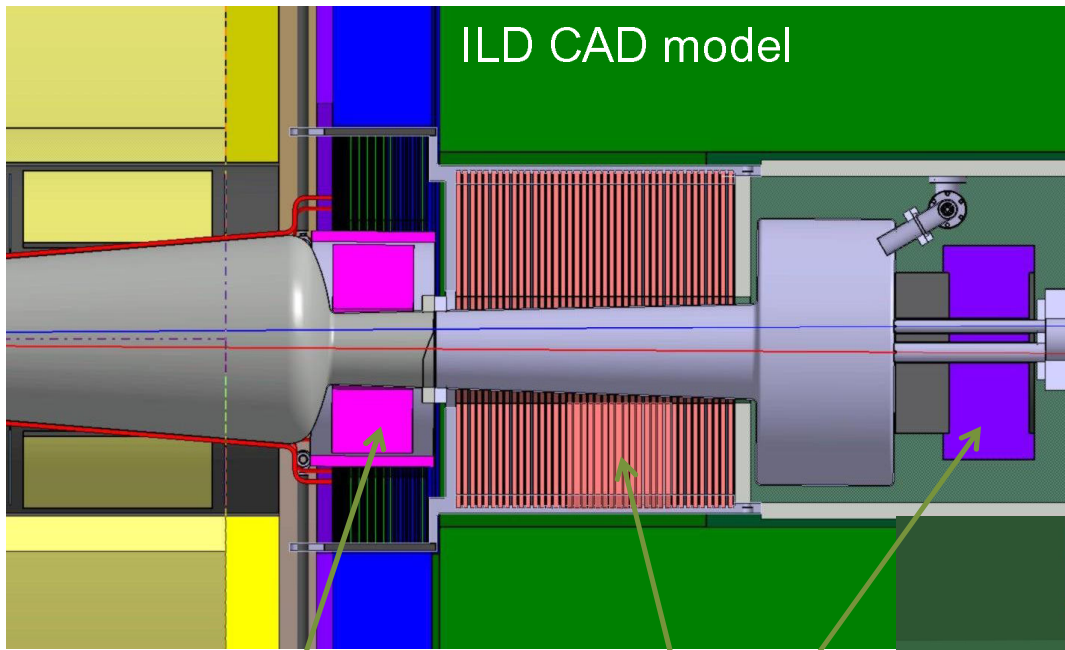


- Realistic geometry already implemented in Mokka
- Optimizations :
 - 8/16-sided vs cylindrical & scintillator vs RPC
 - thickness (# layers), gaps, tail catchers, absorber materials,

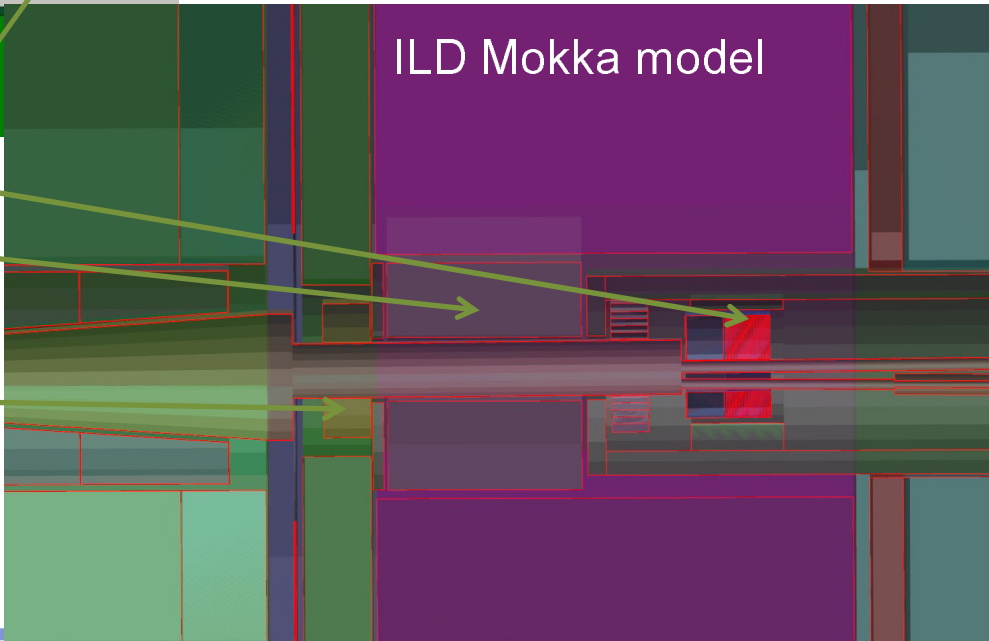
SemiDHCAL study: (Sat) by Manqi, AHCAL study: 29(mon) by Angela



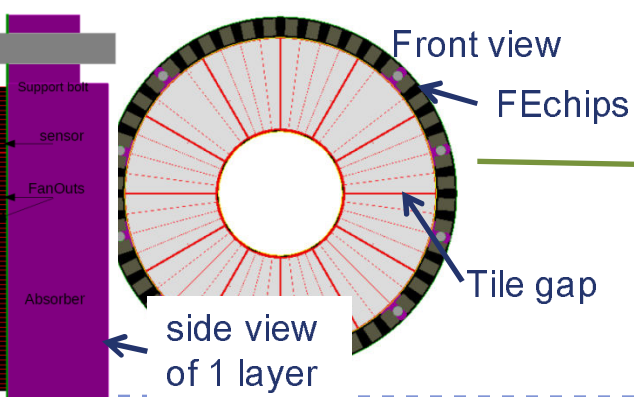
Forward detectors in Mokka



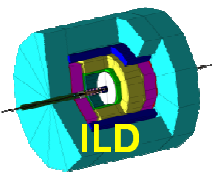
- Consists of LCAL, BCAL, LHCAL, Beam tube and Masks
- Mokka model ~ CAD model, but CAD model will evolve with time and Mokka model needs to follow



New LCAL driver

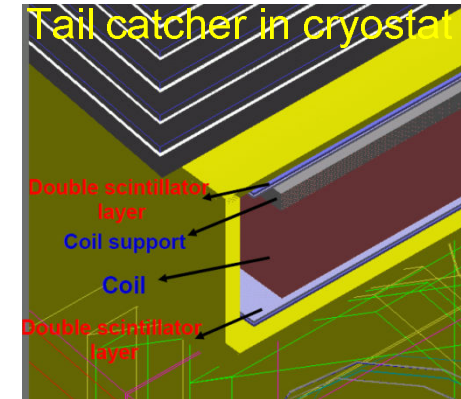
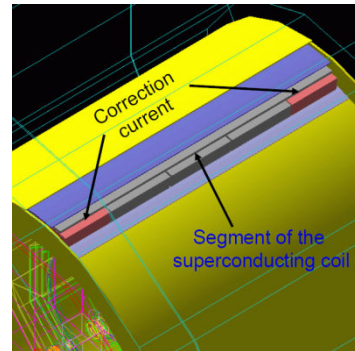
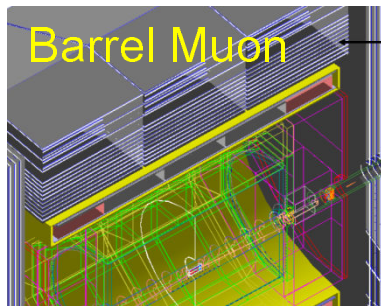


BCAL
LHCAL



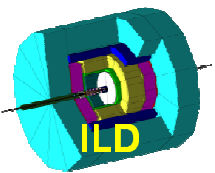
Muon system, Coil and Yoke

- Updated version of the Muon system has been prepared.
Fairly detailed geometry, waiting integration in the central code



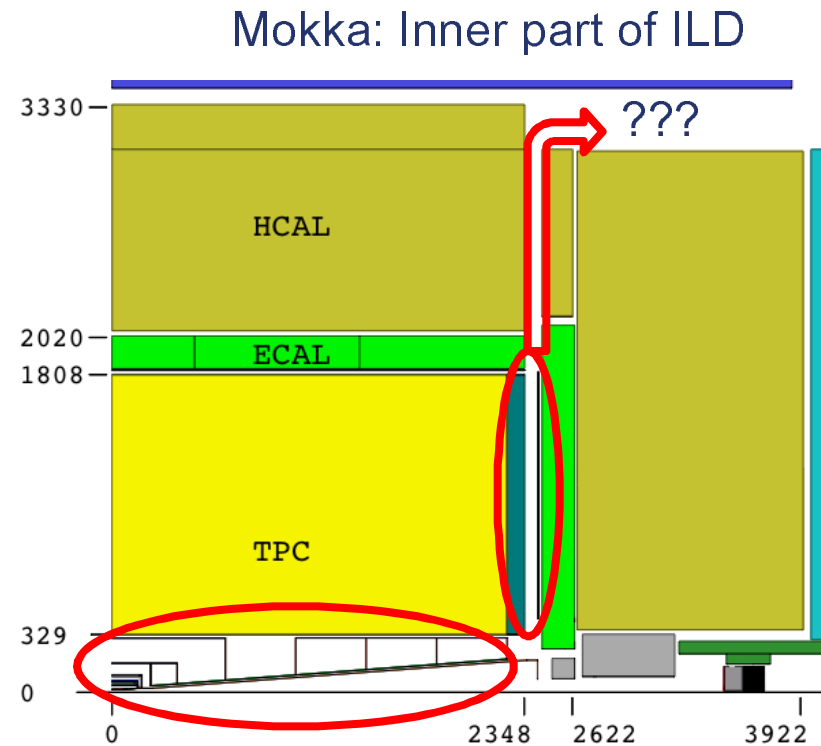
- Magnetic field

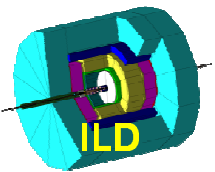
- ◆ For LOI study,
 - uniform Solenoid field for physics study
 - approximated anti-DID field for background study
- ◆ For DBD
 - Better anti-DID field map is necessary for performance study, at least.
 - Uniform field or realistic anti-DID:
 - need to consider balance among code readiness, CPU penalty, improvements in reality,



Cables/Services

- Cables, services, dead materials for data out/power in/cooling/gas flow
- sub-detector drivers implements their own materials.
- To address materials in sub-detector boundaries, small WG has been setup within ILD for
 - ◆ coordination between sub-detectors/optional detectors
 - ◆ defining layout and material budgets
 - ➔ Implementation in Mokka will follow





Summary

- Realistic ILD model was used for ILD LOI study

- Geometry of ILD in Mokka will be improved further
 - ◆ adding new knowledge from hardware studies
 - ◆ implementing realistic cables and services
 - ◆ for optimization of detector parameters

- A plan is
 - ◆ to update Mokka soon in order to provide inputs to reconstructions
 - ◆ progress will be reviewed by mid. 2010, then MC production plan will be re-considered.

BACKUP