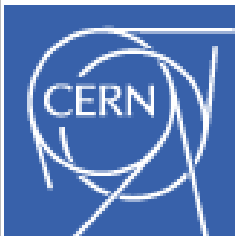


DD4hep Status

HEP detector description

Status,
latest developments
and future plans



On behalf of the 'early-bird-crew':
M.Frank, F.Gaede, N.Graf, C.Grefe, S.Lu, J.Mccormick, A.Sailer

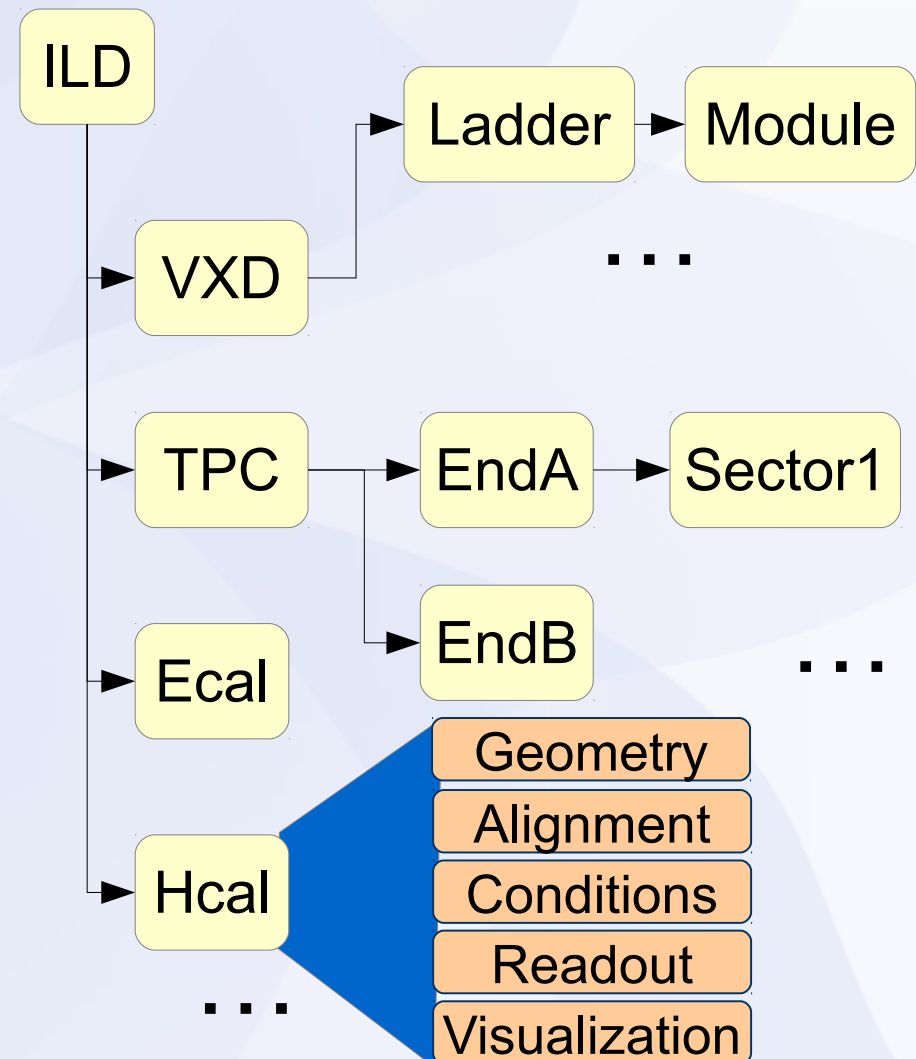
- **Motivation and Goals**
- **Concepts and Design**
- **Status of Ongoing Implementation Work**
- **Future work – next steps**
- **Summary**

Motivation and Goal

- **Develop a detector description**
 - **For the full experiment life cycle**
 - detector concept development, optimization
 - detector construction and operation
 - “Anticipate the unforeseen”
 - **Consistent description, with single source, which supports**
 - simulation, reconstruction, analysis
 - **Full description, including**
 - Geometry, readout, alignment, calibration etc.

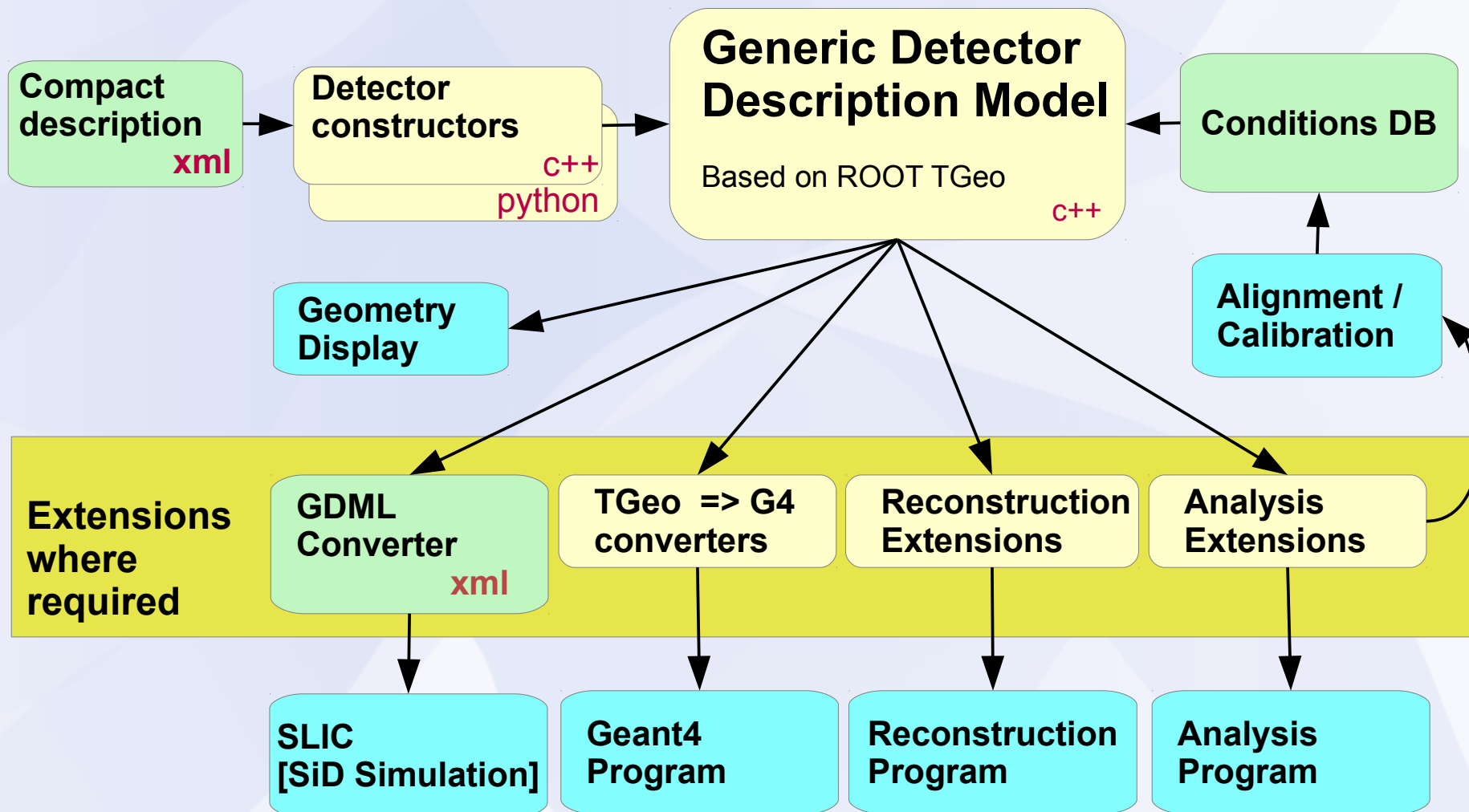
What is Detector Description ?

- **Description of a tree-like hierarchy of “detector elements”**
 - **Subdetectors or parts of subdetectors**
- **Detector Element describes**
 - **Geometry**
 - **Environmental conditons**
 - **Properties required to process event data**

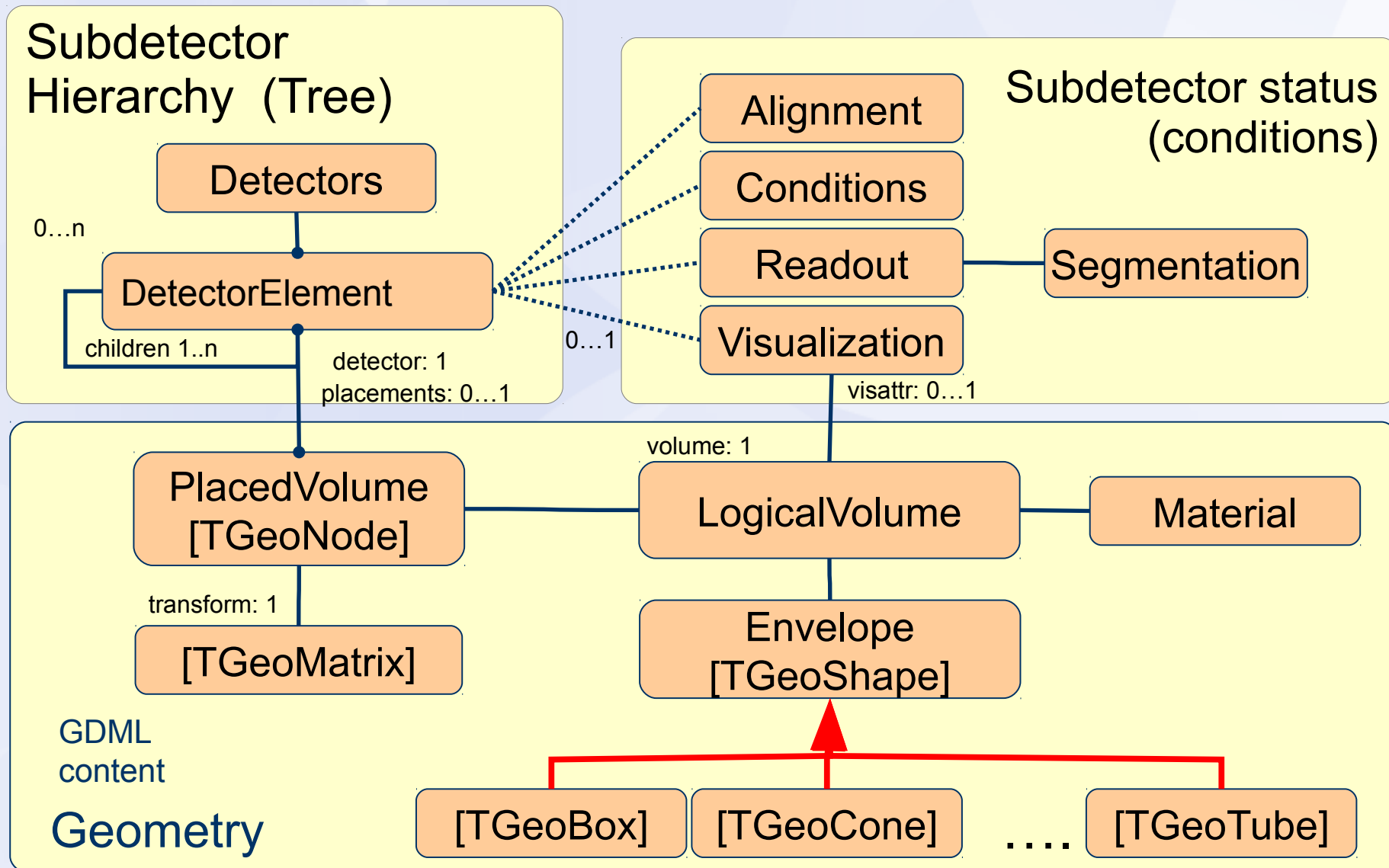


- **Motivation and Goals**
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DD4Hep - The Big Picture



Implementation: Geometry



- Motivation and Goals
- Concepts and Design
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General Design Decisions

- **Things which look of small importance
=> but have significant impact on users**
- **Units: TGeo: GeV/cm/sec Geant4: MeV/mm/nanosec**
 - **Consequently apply units**
`Box(10*tgeo::mm, 10*tgeo::mm, 10*tgeo::mm)`
`G4Box(10*CLHEP::mm, 10*CLHEP::mm, 10*CLHEP::mm)`
 - **To get raw number always divide (both TGeo, Geant4):**
`g4Box->GetXHalfLength()/CLHEP::mm`
- **Transformations**
 - **CLHEP is a dead end (support ?)**
 - **Use ROOT::Math vectors & matrices to build geometries very similar (but not identical!)
started from same code bases, then deviated**

Detector Segmentations

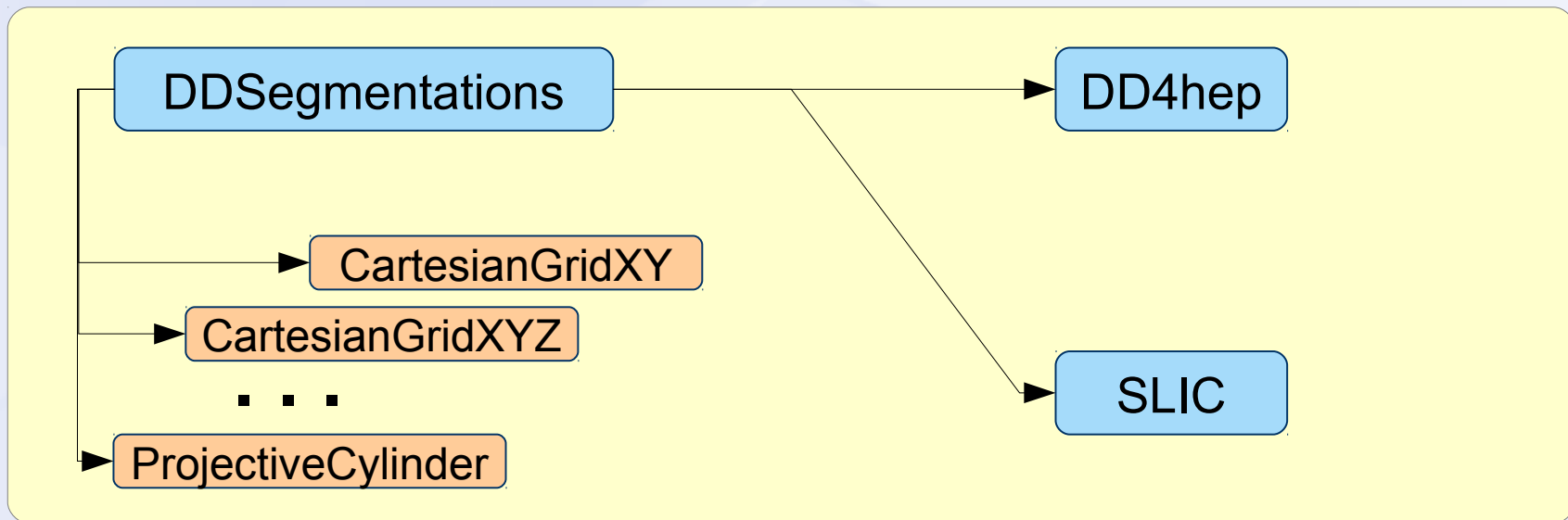
(Christian Grefe)

- **Are the description of the sensitive regions of a subdetector**
- **Define encoding of the location of energy depositions (hits) in a simulation program**
 - **Encoding depends on the sensitive area(s)**
Si Tracker: Side / Layer / Wafer / x-y coordinates
 - **But there are also less obvious segmentations**
mostly projective segmentations (e.g. calo towers)
- **Given an encoded value, it is then possible to define the location of these hits**
 - **Detector / Detector component**
 - **local coordinates**

Detector Segmentations

(Christian Grefe)

- **Essential components to implement**
 - **Simulation programs**
 - **Digitization / Reconstruction applications**
- **Shared, independent package**



Detector Segmentations

(Christian Grefe)

- **Development mostly finished**
 - **Now need to apply the concept**
 - **Integration into the SLIC simulation framework**
 - **Build GEAR like components using DD4hep to support digitization, reconstruction and analysis**

SLIC Simulation

(Norman Graf, Jeremy McCormick)

- **SLIC is the simulation application of SiD**
- **Flexible:**
 - **Generic geometry input from GDML file created by DD4hep => GDML converter**
 - **Uses flexible segmentation and sensitive detectors**
- **SLIC works well with DD4hep if known segmentations are used**
- **The new segmentations developed by Christian are currently being integrated**

Reconstruction Interfaces

(Christian Grefe, Astrid Munich)

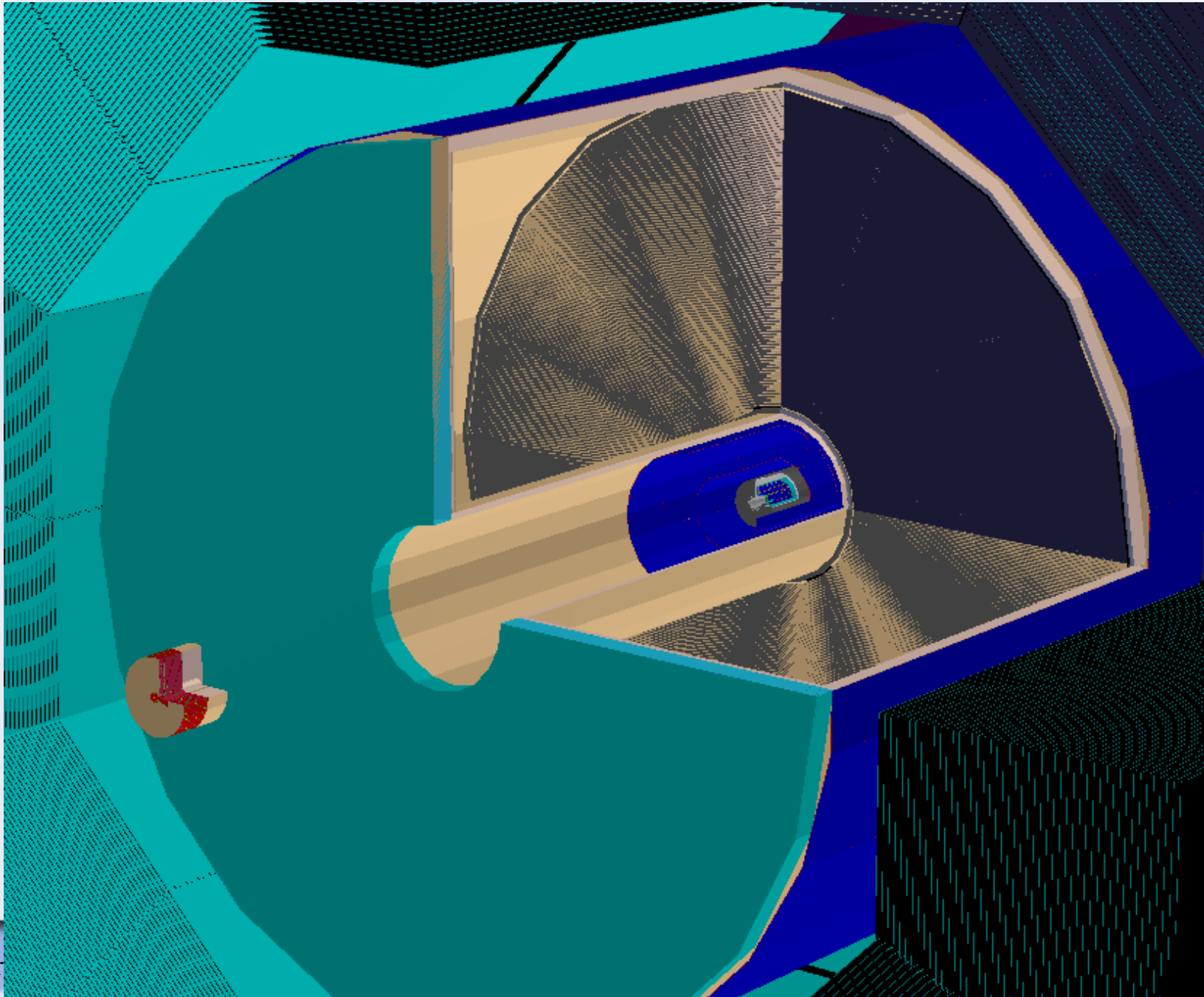
- **In Marlin known as GEAR interfaces**
- **Set of utilities to easy for users the retrieval of specialized geometrical questions**
 - **Chaining transparently reoccurring call sequences to one user call**
 - **Pre-compute and cache information, which is difficult or expensive to obtain but regularly needed**
- **Astrid mimicked the GEAR-TPC model**
 - **Work done ~ year ago**
- **Christian was working on CALO interfaces**
 - **Layered detectors alternating passive and segmented active detectors**

Porting Mokka Drivers

(Frank Gaede, Andre Sailer, Shaojun Lu)

- **Aim is to investigate the translation of Mokka drivers 'with minimal effort' (Model: ILD_o1_v05)**
 - **Create compact xml file from Mokka database**
 - Serves as input to DD4hep driver
 - **Translate G4 in driver calls to DD4hep calls**
 - G4Shape, G4LogicalVolume, ... => Shape, Volume, ...
 - Created 'detector constructor' (~driver)
 - Leave as much unchanged as possible
 - **Experience: VXD, SIT, TPC, SET, beamcal and HCAL barrel**
 - Tracker driver simple, calorimeters much more complicated
 - Parameters change in Mokka at run-time,...
 - Automation without brain is difficult, and will be hard to maintain
 - Will need some policy how to avoid parameter anarchy

Result of Porting Drivers



- **Motivation and Goals**
- **Concepts and Design**
- **Implementation**
- **Future work – next steps**
- **Summary**

Alignment and Detector Conditions

(Markus Frank)

- **Less an issue during the experiment design phase**
 - **Less important for the LC community**
 - **Selling argument for LHC experiments**
- **Important topic to interpret event data from existing ('real') detectors**
 - **Necessity to deal with imperfections**
 - **Geometry => (Mis)Alignment**
 - **Anomalous conditions**
 - **Pressures, temperatures**
=> Gains, refractive indices
=> Contractions, expansions

- **Motivation and Goals**
- **Concepts and Design**
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- **Summary**

Summary

- **The core of DD4hep should be rather stable now**
 - **Part of the next ILCsoft release**
- **Examples of the work to port Mokka drivers to use SLIC as a simulation engine is finished**
 - **Some topics still have to addressed**
- **Ongoing developments**
 - **mimic GEAR for reconstruction / analysis**
 - **support for alignment / detector conditions**

Web: <http://aidasoft.web.cern.ch/DD4hep>
Code view: <http://svnsrv.desy.de/viewvc/aidasoft/DD4hep>
Code access: `svn co https://svnsrv.desy.de/desy/aidasoft/DD4hep/trunk`