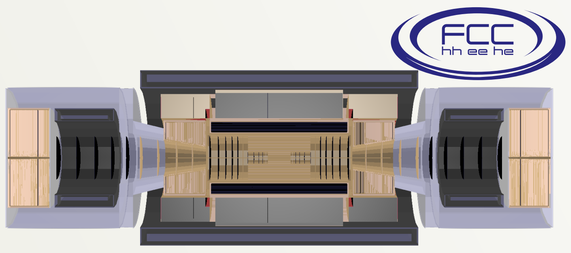
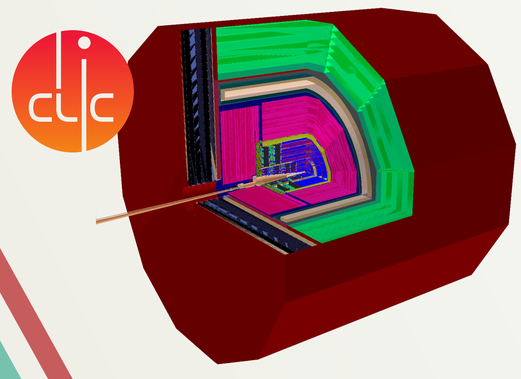
A SINGLE SOLUTION TO DETECTOR DESCRIPTION IN HEP

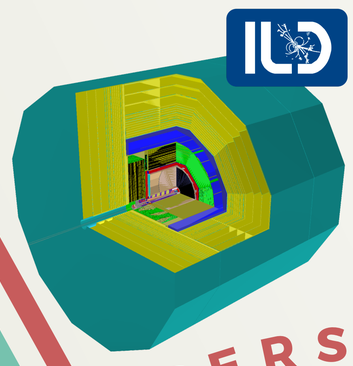
DD4hep

Detector Description Toolkit for High Energy Physics

http://dd4hep.cern.ch







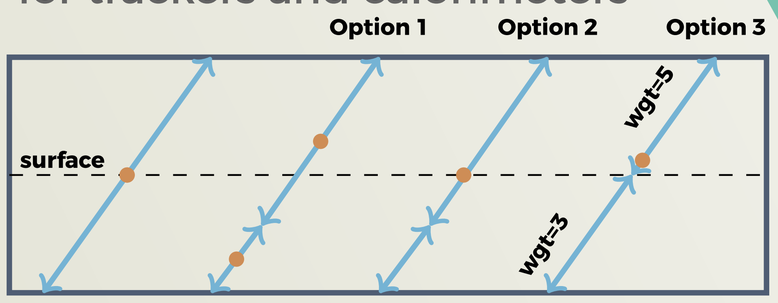
USERS

Introduction

- Complete Detector Description
  Providing geometry, materials, visualization, readout, alignment, calibration...
- Supports full experiment life cycle
  Concept development, optimization, operation – easy transition stages
- Single source of information
  → consistent description
  Use in reconstruction, simulation and analysis, etc.
- Licensed under:
  LGPL Free Software
  Free as in Freedom

Plugins

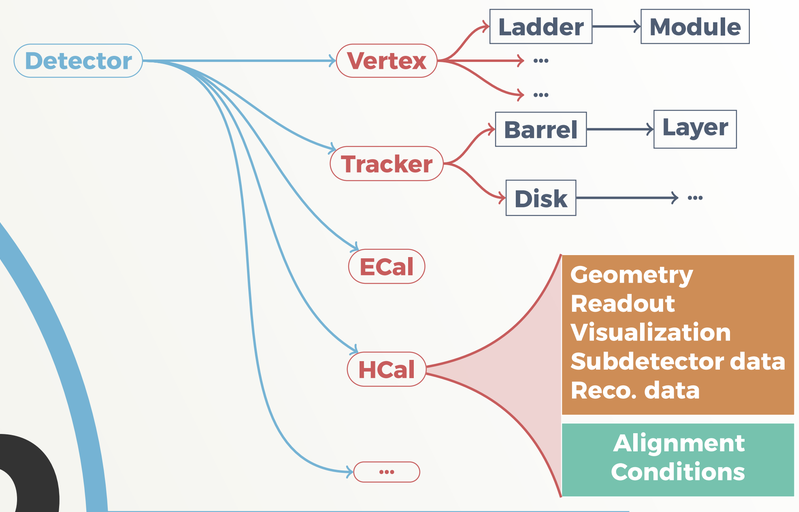
- Providing input handlers, sensitive detectors for most cases...
  Providing palette of most 'common' sensitive components for trackers and calorimeters



- Several IO handlers: LCIO, ROOT StdHep, HepEvt, HepMC

Detector Description

- Description of a tree-like hierarchy of detector elements
- Detector Element describes:
  Geometry, environmental conditions... and **extensions**



Conditions Alignment

- Provides access to consistent set of values to a given time and accompanying data
- Supports for hosting alignment results and application to geometry
  Global and Local (mis-)alignment
- Supports multi-threading

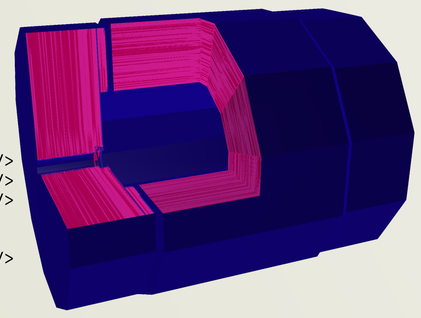
DDG4

- In-memory translation of geometry TGeo → Geant4
  Materials, solids, limit sets, regions, logical volumes, placed volumes and physical volumes
- External configuration via plugin mechanism
  Supports configuration via XML, Python or ROOT-AClick Property mechanism to configure plugin instances
- Use plugin mechanism to configure: Generation, Event Action, Tracking Action, SensDetector, PhysicsList...
- Provides out of the box MC truth handling w/o record reduction

Detector Palette

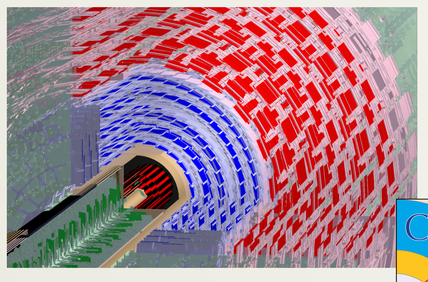
- Scalable and flexible generic drivers available
  Parameters are provided in compact XML files

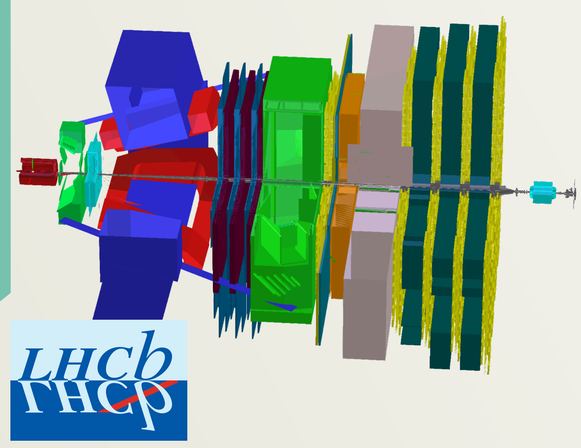
```
<detector id="15" name="HCal" type="GenericCalBarrel_o1_v01" readout="HCalCollection">
  <envelope vis="HCALVis">
    <shape type="PolyhedraRegular" numsides="HCal_sym" rmin="HCal_rmin" rmax="HCal_rmax"
           dz="HCal_dz" material="Air"/>
    <rotation x="0*deg" y="0*deg" z="90*deg-180*deg/HCal_symmetry"/>
  </envelope>
  <dimensions numsides="HCal_sym" rmin="HCal_rmin" z="HCal_dz*2"/>
  <layer repeat="(int) HCal_layers" vis="HCalLayerVis">
    <slice material="Steel235"    thickness="0.5*mm" vis="HCalAbsorberVis" radiator="yes"/>
    <slice material="Steel235"    thickness="19*mm"  vis="HCalAbsorberVis" radiator="yes"/>
    <slice material="Polystyrene" thickness="3*mm"   sensitive="yes"  limits="cal_limits"/>
    <slice material="Copper"      thickness="0.1*mm" vis="HCalCopperVis"/>
    <slice material="PCB"         thickness="0.7*mm" vis="HCalPCBVis"/>
    <slice material="Steel235"    thickness="0.5*mm" vis="HCalAbsorberVis" radiator="yes"/>
    <slice material="Air"         thickness="2.7*mm" vis="InvisibleNoDaughters"/>
  </layer>
</detector>
```



- Scale, change layers, radii, composition visualization attributes...
- Users can easily write their own detector drivers

EVALUATION





FOR SIM RECO ANALYSIS AND VISUALIZATION

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