Mokka & DD4hep
Development for CEPC

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Outline

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  • Status: new copy and development
  • A simple calorimeter module
  • A simple silicon-tracker module

• DD4hep
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  • Status of CEPC model

• Next to do
Motivation

• CEPC-SPPC

• Mokka has been used for ILC, DD4hep is being developed for SiD.

• Mokka can work well for CEPC physical simulation at CDR.
  • Enough? New geometry should be added in future.

• For sub-detectors CDR, more modification of geometry will be needed. Therefore, the simulation tool should be more flexible. Comparing with Mokka, DD4hep is more flexible, and has more function, such as reconstruction, geometry display, etc.
Status of Mokka

• Using for physical simulation based on CEPC-v1

• New geometries are being built.

• Development based on a new copy, available at /workfs/bes/fucd/Mokka/mokka-08-03

  • /Mokka/init/EditGeometry/rmSubDetector remove sub-detectors from database option

  • /Mokka/init/EditGeometry/newSubDetector add the calorimeter not existing in database

  • Unpack the parameters of structure of sub-detector from globalModelParameter.

• New field constructor: MyField, build fields at different regions.

• New generators support: HepMC, slcio

• Resize world size (world_box_hx, world_box_hy, world_box_hz) by globalModelParameter.
A simple calorimeter module

- **SiCal**: cylinder, barrel & endcap, Ecal & Hcal
- Input parameters by `globalModelParameter`, easy to modify the structure of the calorimeter, any size, any layer placement, and any type(?)-predefined.
- First support silicon-based calorimeter, now including:
  - Si, BGO, LGO, Scintillator, THGEM1, THGEM2, RPC1, RPC2
- Output:
  - `SimCalorimeterHit` in slcio file, reconstructed by `Marlin` possibly.
A simple silicon-tracker module

- **SiTracker**: cylinder, barrel & endcap
- Input parameters by `globalModelParameter`:
  - Layer position and layer number
  - Layer structure is fixed as SiD’s silicon-tracker
- Output:
  - **SimTrackerHit** in slcio file, reconstructed by **Marlin** possibly.
Introduction of DD4hep

• A Detector description Toolkit for High Energy Physics Experiments, is being developed.

• DDAlign, DDCond, **DDCore, DDDdetectors, DDEve, DDG4**, DDRec, etc.

• Successful to install at lxslc6 based on **Root5.34.07**, `/workfs/bes/fucd/DD4hep`
Test on SiD model

• Found problem
  • Hcal cannot give out hits
  • Overlap found by check tool

<table>
<thead>
<tr>
<th>content</th>
<th>test</th>
</tr>
</thead>
<tbody>
<tr>
<td>elements xml file defined</td>
<td>√</td>
</tr>
<tr>
<td>materials xml file defined, don’t need pre-define in code</td>
<td>√</td>
</tr>
</tbody>
</table>
| sub-detector constructor  
  display readout | √ X           |
| limits possible special limit for each sensitive detector | √             |
| physics list predefined Geant4 physics lists  
  user-defined | √ -           |
| fields GlobalSolenoid | -             |
| constants expression supported | √             |
| generator ParticleGun  
  file input | √ -           |
| output slcio ROOT | √ -           |
Standard DD4hep supplied detector palette

DD4hep_SiTrackerBarrel  DD4hep_SiTrackerEndcap2  DD4hep_MultiLayerTracker  DD4hep_DiskTracker

DD4hep_CylindricalBarrelCalorimeter  DD4hep_CylindricalEndcapCalorimeter

DD4hep_ForwardDetector  DD4hep_EcalBarrel  DD4hep_PolyhedraBarrelCalorimeter2  DD4hep_PolyhedraEndcapCalorimeter2

2016/3/27
Compact Design for CEPC model

- Ignore support first

- EM calorimeter
  - DD4hep_PolyhedraBarrelCalorimeter2 + DD4hep_PolyhedraEndcapCalorimeter2

- Hadron calorimeter
  - DD4hep_PolyhedraBarrelCalorimeter2 + DD4hep_PolyhedraEndcapCalorimeter2
  - Before bug being found, regarded as EM calorimeter, tagged by layer number

- Muon
  - DD4hep_PolyhedraBarrelCalorimeter2 + DD4hep_PolyhedraEndcapCalorimeter2

- Tracker
  - Silicon: DD4hep_SiTrackerBarrel + DD4hep_SiTrackerEndcap2
  - TPC:
    - simplified as tube, DD4hep_SiTrackerBarrel + DD4hep_SiTrackerEndcap2
    - New type of sub-detector

- The CEPC detector can be simplified and built by existing standard DD4hep type of sub-detector.
Next to do

• Simulate with new geometries by DD4hep

• 2 types of tracker and 4+ types of calorimeters → at least 8 options
  • Silicon-tracker + silicon-calorimeter is coming soon

• The designs of sub-detectors are welcome to build the whole CEPC detector model now!
Thanks a lot!