Migrate SiliconTracking into Key4hep using EDM4hep

Chengdong FU

Introduction

- Key4hep framework ready at LCG97.0.2 environment
- …

Source

- 97.0.2 and CEPCSW
- Based on the version using plcio
  - KalDet
  - KalTest
  - PlanarDigiAlg
  - SiliconTracking
- GeoSvc for geometry apllied

Modification

- plcio->edm4hep, very few
  - Removed
  - etc. (refer to message from Jianeng&Tao)

```
/// operator to allow pointer like calling of members a la LCIO
TrackerHit *operator->() { return (TrackerHit *)this; }
```

- GaudiAlgorithm
  - //friend class AlgFactory<SiliconTracking> #declare removed
- Copy TrackerHit objects into TrackerHitExtended, and then transmit their pointers to classes/functions of next step

```
TrackerHitExtended * hitExt = new TrackerHitExtended(trkhit);
```

  - edm4hep::TrackerHit* TrackerHitExtended::getTrackerHit();

```
/** Convert LCIO Tracker Hit to an ILDPLanarTrackHit  */
virtual ILDVTrackHit* ConvertLCIOTrkHit(edm4hep::TrackerHit* trkhit) const = 0 ;
```

Progress

- Compile&link ok
- Run ok
- Check ok
- Test environment
  - from Gaudi.Configuration import *
  - from Configurables import K4DataSvc (K4LCIOReader)
  - from Configurables import LCIOInput
  - from Configurables import MarlinEvtSeeder
  - from Configurables import GeoSvc
  - from Configurables import GearSvc ←expect VXD, GeoSvc not compeleted
  - from Configurables import TrackSystemSvc
  - from Configurables import PlanarDigiAlg
  - from Configurables import SiliconTracking
  - from Configurables import PodioOutput
  - from Configurables import ApplicationMgr

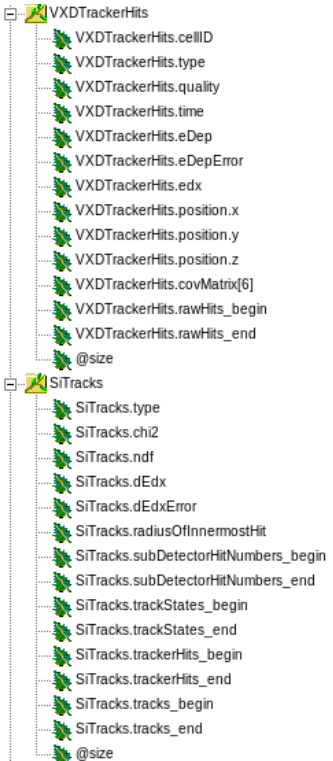
Check

- Tracking and fit
  - Exactly same, if keep same input (random, geometry, option, event hits)

```
SiliconTracking     DEBUG Total 4-momentum of Si Tracks : E = 18.51696 Px = -0.02617096 Py = -11.30624 Pz = -14.66445
[ DEBUG4 "MySiliconTracking_MarlinTrk"] Total 4-momentum of Si tracks : E = 1.851696e+01 Px = -2.617095e-02 Py = -1.130624e+01 Pz = -1.466445e+01
```

    - Confirm both event data model (EDM4hep) and LCIO→EDM4hep convertor work rightly
  - More validation to do
- Output
  - TrackerHit:
    - same as saved, confirm podio work rightly
  - Track: different format in ROOT
- Memory and CPU
  - To do

```
root [6] events->Scan("VXDTrackerHits.positi
************************************
*    Row   * Instance * VXDTracke *
************************************
*        0 *        0 * -0.013130 *
*        0 *        1 * -0.009254 *
*        0 *        2 * 0.0253850 *
*        0 *        3 * 0.0407702 *
*        0 *        4 * 0.1434272 *
*        0 *        5 * 0.1522918 *
*        1 *        0 * 12.297722 *
```



Found Issues/States

- Different material property between DD4hep and MokkaC
  - A_C=12.0107 in DD4hep
  - A_C=12.01073638 in MokkaC
  - $\sum$fiAi, Ai=N (DD4hep)
  - Tiny difference does not cause serious error, but tiny difference, because A$\rightarrow$radiation length

```
</element>
<isotope N="12" Z="6" name="C12">
  <atom unit="g/mole" value="12"/>
</isotope>
<isotope N="13" Z="6" name="C13">
  <atom unit="g/mole" value="13.0034"/>
</isotope>
<element name="C">
  <fraction n="0.9893" ref="C12"/>
  <fraction n="0.0107" ref="C13"/>
</element>
```

To do

- CMakeLists.txt of KalDet&KalTest
  - INCLUDE($ILCUTIL/cmakemodules/ilcsoft_default_settings.cmake)
- Apply MCRecoTrackerAssociation
  - SimTrackerHit↔TrackerHit
- Test strip-silicon (SIT)