

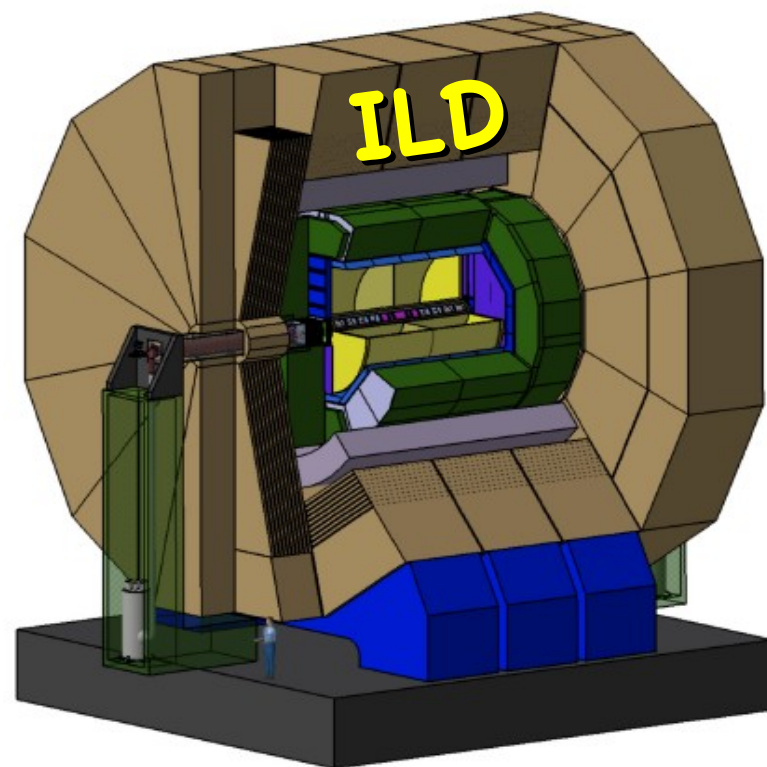
New developments in iLCSoft

Frank Gaede, DESY

International Workshop on Linear Colliders
CERN, Oct. 18-22, 2010

Outline

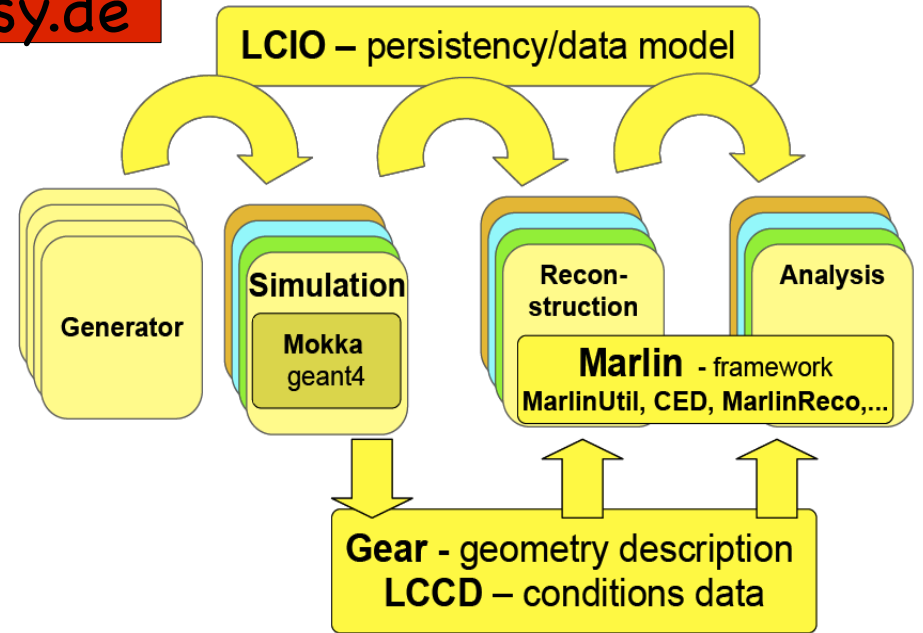
- Introduction & Overview
- new developments since LCWS2010
 - Mokka - towards ILD_01
 - LCIO
 - Marlin
 - CED
 - MarlinReco
 - KalTest
 - (LCCD, Test system -> talk S.Aplin)
- AIDA WP2
- Summary & Outlook



ILD Core Software Tools

<http://ilcsoft.desy.de>

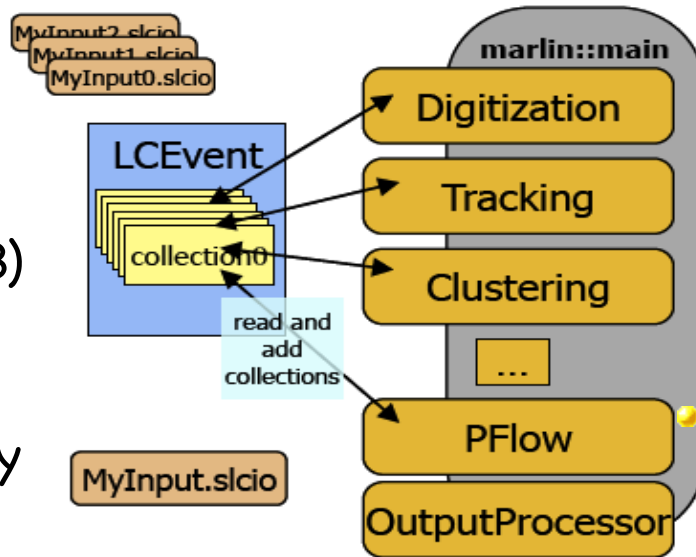
- **Mokka** (LLR)
 - geant4 simulation application
- **LCIO** (DESY/SLAC)
 - international standard for persistency format / event data model



- **Marlin**
 - core application framework for reconstruction & data analysis
- **GEAR** geometry package f. reconstruction

• complete framework used in Monte Carlo & 'real experiments':

- **LCCD**
 - conditions
 - data toolkit (DB)
- **CED**
 - 3d event display

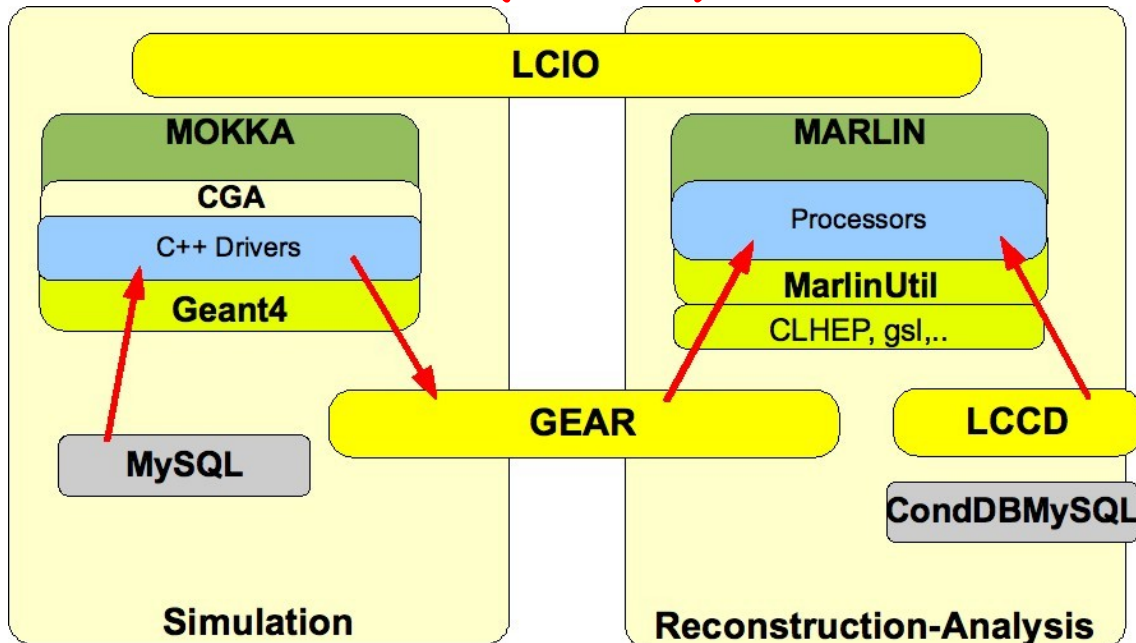
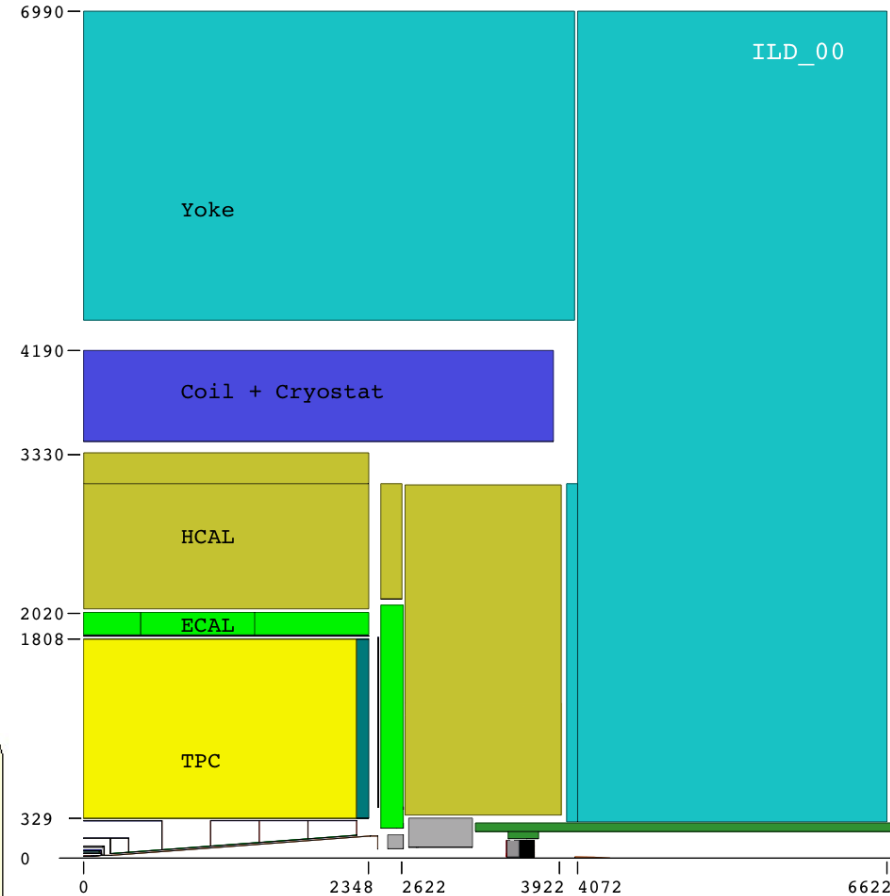


- **ILD detector concept** studies
- **Calice** calo testbeam
- **LC-TPC** testbeam
- EUDET - **Pixel Telescope**

• synergies between testbeam and global detector optimization

Mokka Simulation ILD

- defined 'ILD simulation reference model' for LOI mass production
- engineering level of detail for **most** subdetectors:
 - support structures
 - cracks
- modified to ILD_CLIC detector model to be used for CLIC CDR !
- goal: further improve realism of ILD model for **DBD (ILD_01)**



Mokka writes out GEAR xml files with complete geometry and material parameters that are need for reconstruction and analysis

Digitization & Reconstruction in Marlin

• VXD, SIT, FTD, SET, ETD

- smearing of 3D space points according to detector resolutions as established by R&D groups

• TPC hits

- smearing of 3D space points - taking into account drift distance, polar and azimuthal angle of track
- parameterization from TPC R&D groups

• ECal, HCal, LCal, Bcal, LHCAL, Muon Calo hits

- calibration (single particle resolution)

• Tracking

- standalone tracking in Silicon detectors and TPC - **MarlinReco-FullLDCTracking**
- Kalman filtering: **wrapped f77 code from LEP**
- **new development started ...**

• Particle Flow Algorithm

- **MarlinPandora/PandoraPFANew**

• JetFinder

- Durham jet finder (run for 2-6 jets)

• Flavour Tagging

- **LCFIVertex** package: ZVTop, ZVRes + Neural Network Fl.Tag

• DST Maker

- ReconstructedParticles, Jets, Tracks and Clusters (25k/evt)

ILD software builds and installation

- **ilcinstall** tool: python scripts to download, build and install all ILD and external packages – incl. test beam
 - complete iLCSoft – provided **geant4**, **root** and **mysql** are installed
- used for
 - **iLCSoft releases** (ilcinstall release tag == ilcsoft release)
 - **reference installations** in afs
 - **grid installations** (all WLCG sites supporting VO ILC)
 - **binary tar-balls** (SL4/5)
- started to have more frequent 'developers' releases
 - goal: have defined and agree release schedule, so that groups can contribute their new developments on time
 - started to 'automize' software releases
 - not quite there yet ...

afs reference installations

- so far provided reference installations in afs (SL4/5) at
 - /afs/desy.de/group/it/ilcsoft
 - correct directory resolved through @sys mechanism from afs
 - eg: /afs/desy.de/group/it/.i386_linux26/ilcsoft
 - no longer fully supported – cannot cope with resolving 32bit/64bit, compiler version, CPU, kernel and OS version
- since release v01-09 use

/afs/desy.de/project/ilcsoft/sw/XXX/v01-09-02

XXX:	i386_gcc34_sl4	# i386 CPU, 32 bit, gcc3.4, SL4 and compatible
	i386_gcc41_sl5	# i386 CPU, 32 bit, gcc4.1, SL5 and compatible
	x86_64_gcc41_sl5	# i686 CPU, 64 bit, gcc4.1, SL5 and compatible

- plan to have other OSs in the future (as needed)
 - note: old releases still at old path !

iLCSoft pre-release v01-10-pre02

CED	v01-01
CEDViewer	v01-01-pre
CLHEP	2.0.4.2
CMakeModules	v01-10-pre
CondDBMySQL	ILC-0-9-1-pre
Druid	1.8
Eutelescope	v00-04-04
LCFIVertex	v00-04-pre
LCFI_MokkaBasedNets	v00-01
Marlin	v00-13-pre
MarlinPandora	v00-02
MarlinReco	'v00-19'
MarlinTPC	v00-06
MarlinUtil	v01-01-pre
Mokka	'mokka-07-06'
MokkaDBConfig	v02-01

Overlay	v00-07-04
PandoraPFA	v03-02-02
PandoraPFANew	v00-03
QT	4.2.2
RAIDA	v01-05-pre
SiliconDigi	v00-04-02
StandardConfig	v02-01
cernlib	2006
dcap	1.9.5-5
gear	v00-15-pre
gsl	1.8
lccd	v01-01-pre
lcio	v01-51-01
mysql	5.0.45
root	5.26.00b
KalTest	v01-00
KalDet	v01-00

- many packages changed (wrt v01-09)
- **some new added**

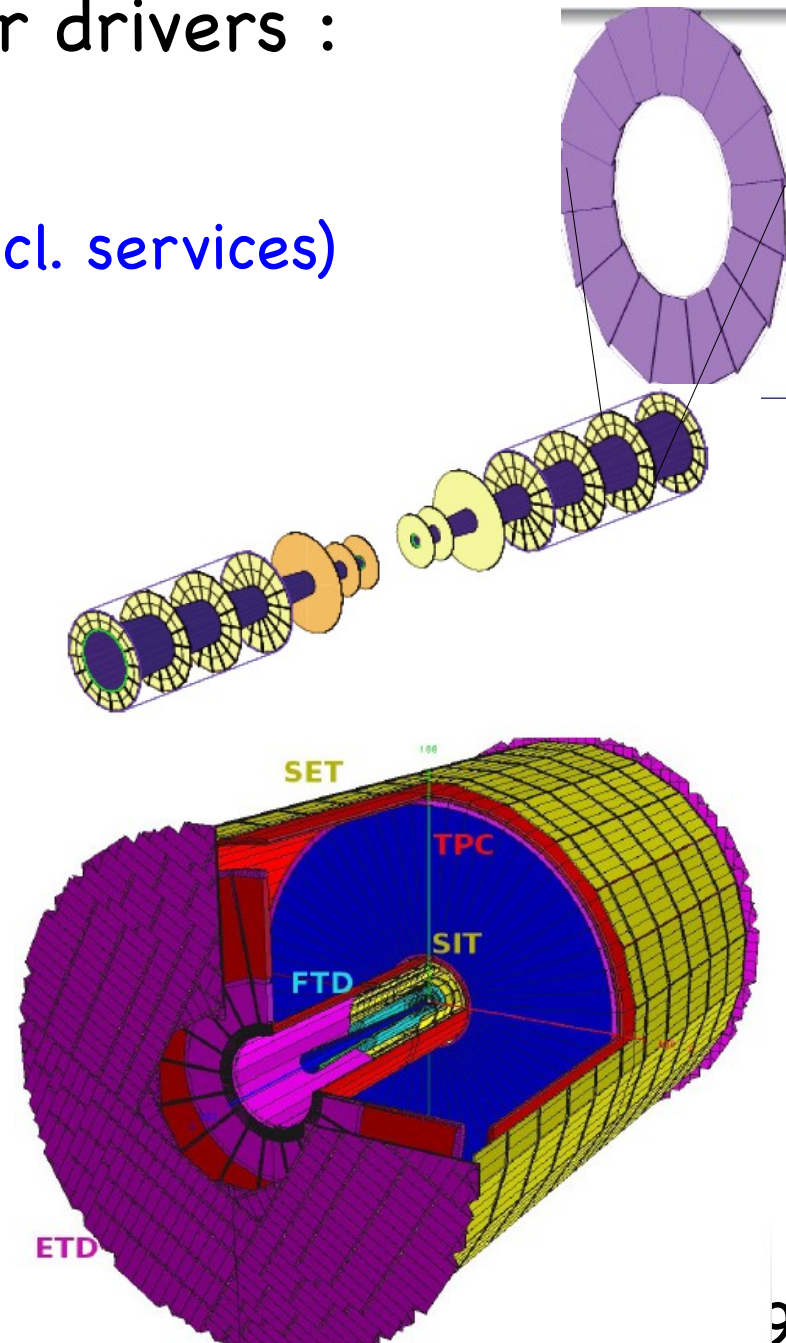
final release planned for next week

new Mokka release – towards ILD_01

- major rewrite of some sub detector drivers :
 - SIT, SET, ETD - FTD - Muon
 - increased level of detail and realism (incl. services)
- TPC
 - added endcap services (cooling)
- new ECal driver:
 - mixing of Scintillator and Si layers
- improved aHcal driver:
 - included electronics & services
- overall services for TPC, Ecal, Hcal

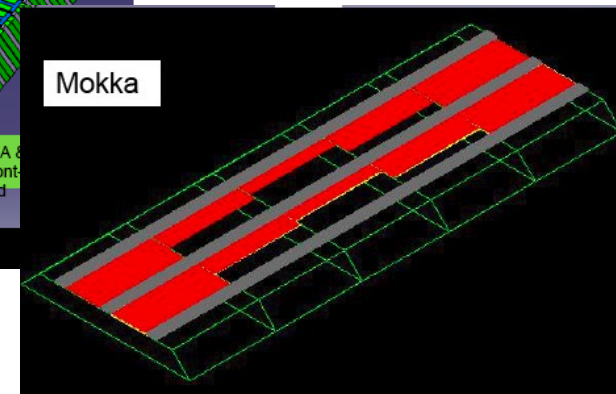
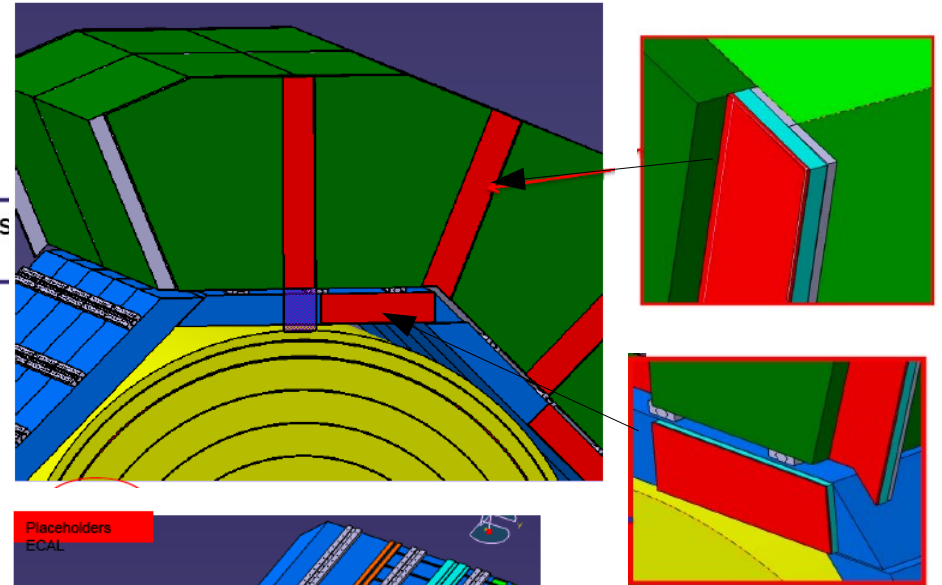
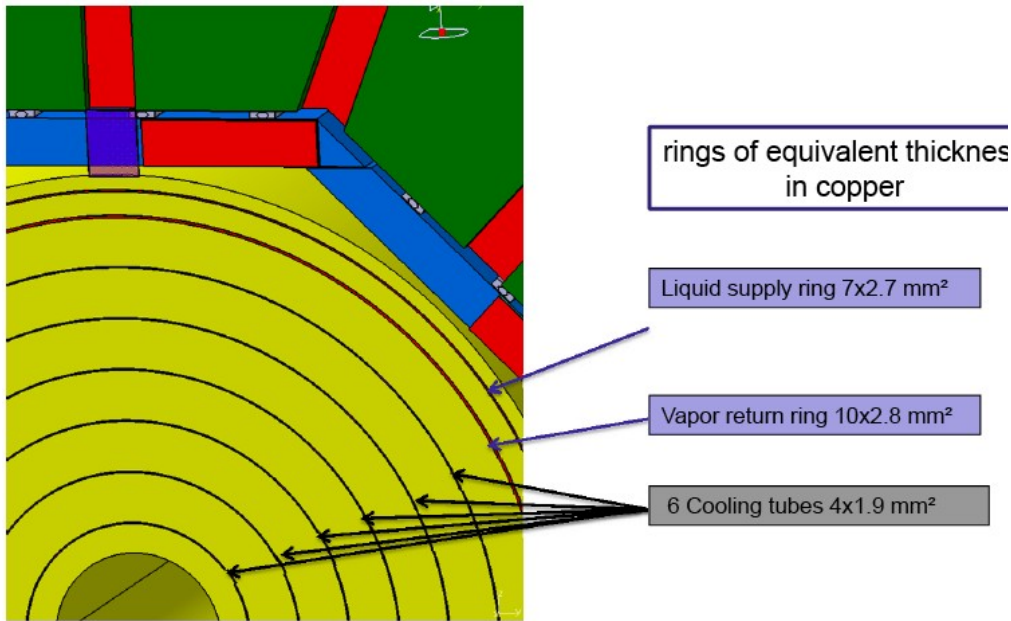
work of many people:

A.Charpy, J.Duarte, A.Saveliev, G.Musat,
A.Lucaci, P.Mora de Freitas,....



new Mokka release – towards ILD_01

- added cabling and services for TPC, ECal & Hcal (C.Clerc, G.Musat)
- still missing: inner detector services (to be defined by R&D groups)

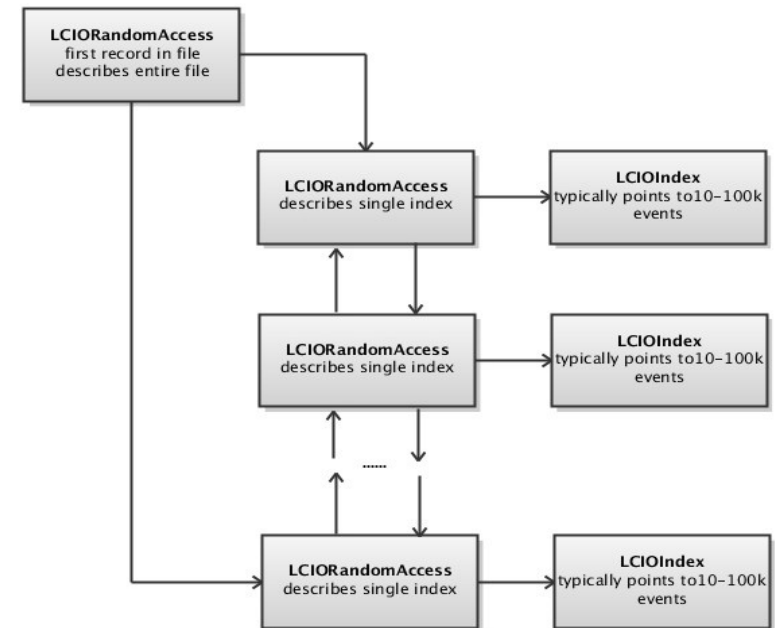


big step forward in increasing realism of ILD detector simulation !

towards LCIOv2 - v01-51-01

- LCIO provides a **rather complete event data model** and has been used successfully in SID and ILD LOI mass production and in various R&D test beam programs
- LCIOv2 needs to be backward compatible and should provide some new features

- **direct access to events -> DONE**
- **partial reading of events**
- **splitting of events over files**
- **(storing of arbitrary user classes)**
- **simplify using LCIO with ROOT -> DONE**
 - (ROOT macros, TTreeView, I/O (?), ...)
- **improving the event data model**
 - (1d,2d hits, tracks/trajectories)



direct Access:

- record written at close()
 - can append to files
 - **can add to existing OLD files**
(if opened in write mode) 11
- new ostream operators <<(...) in C++
 - `cout << ((MCParticle*) c->getElementAt(i)) << endl ;`

a ROOT dictionary for LCIO

- LCIO now comes with a ROOT dictionary for all LCIO classes (optional) - with this one can:
 - use LCIO classes in ROOT macros (already in v01-12-01)
 - write simple ROOT trees, e.g. `std::vector<MCParticleImpl*>`
 - use TTreeDraw for quick interactive analysis of LCObjects:

```
//---gamma conversions:  
TCut isPhoton("MCParticlesSkimmed.getPDG()==22" );  
LCIO->Draw("MCParticlesSkimmed._endpoint[][0]:  
          MCParticlesSkimmed._endpoint[][1]",isPhoton ) ;
```

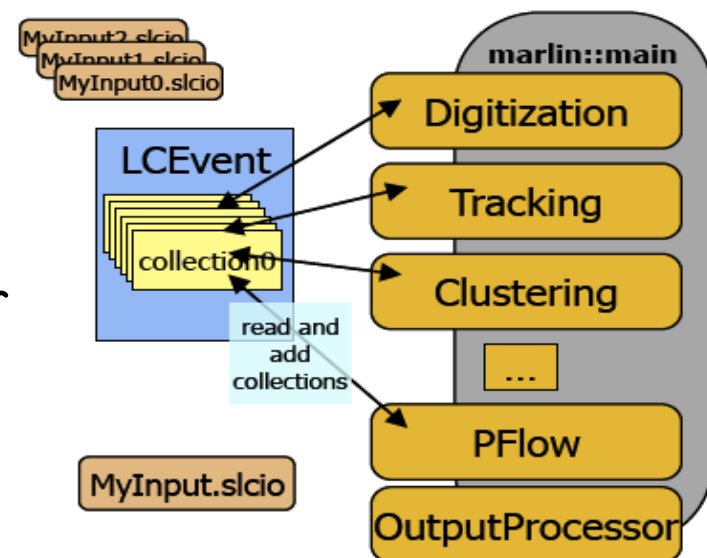
- write complete LCIO events in one ROOT branch
- see: [\\$LCIO/examples/cpp/rootDict/README](#) for details & help
- -> we are interested in feedback from the users if this provides already the requested features

new Marlin release

- new features in v00-(12)13:
 - processors can have **local Verbosity parameter**
 - can turn off messages from other processors for debugging
 - **exit if processor specified in steering file not found**
 - processor return values have to be set if used in logical expression in steering file
 - added macro **streamlog_level(LEVEL)**

```
if( streamlog_level( DEBUG ) && x ) {  
    // do additional computation for debugging ...  
    streamlog_out( DEBUG ) << " ..." << std::endl ;  
}
```

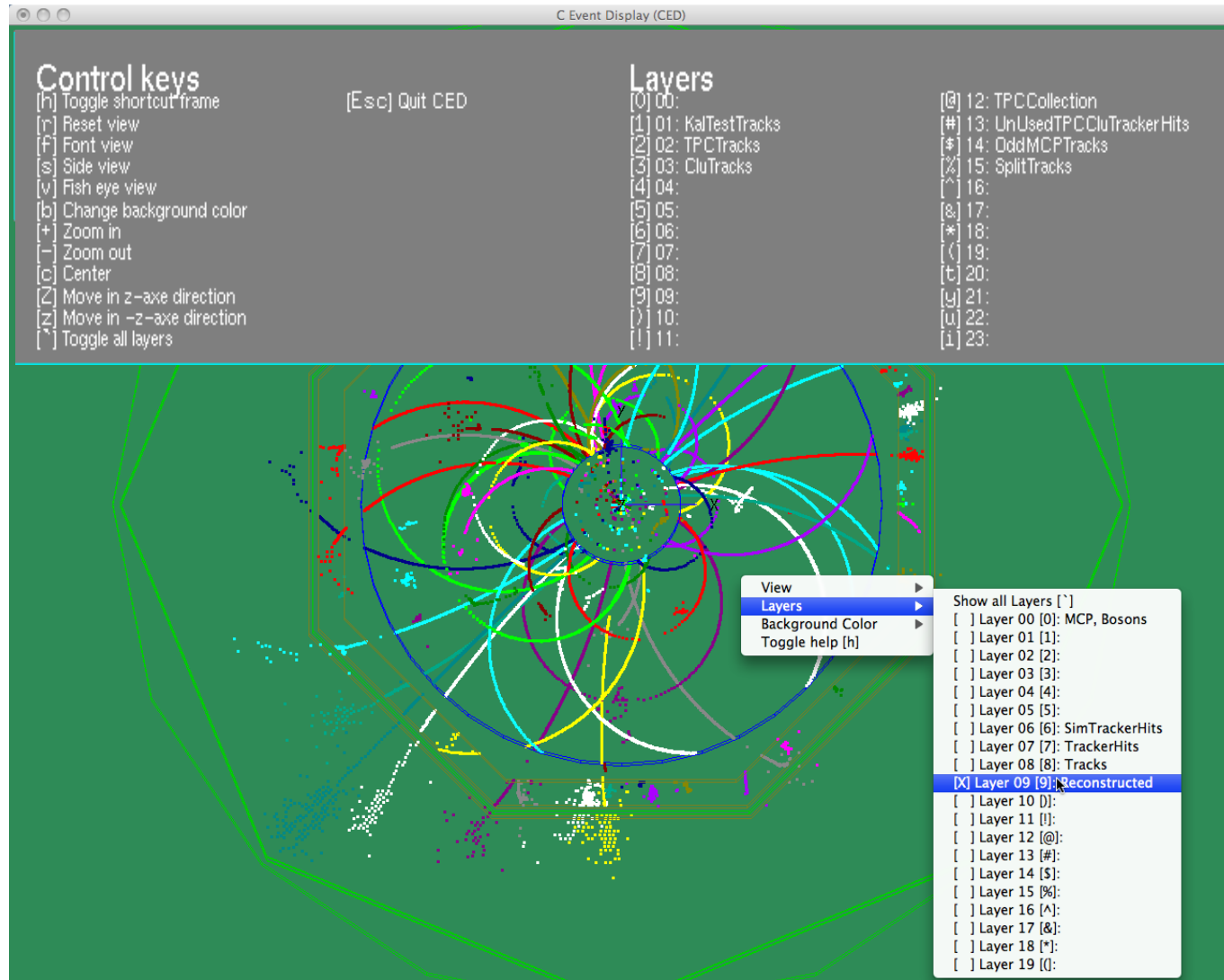
- minor fixes
 - made compliant w. gcc4.1
 - AIDAProcessor: switched default to *.root
 - protect against converting false strings to float



to do for next release:
introduce command line
parameters - **from JSF
framework**

improved CED event display

- added help menu
 - toggled with 'h'
 - shows all keys
 - shows all 'collections'
- added mouse menu
 - toggle single visualization layers
 - choose bg colors
 - views
 - zoom
- commands to add layer description and picking also for user code
- new python script to start CED & CEDViewer in on go: [ced2go.py](#)



(H.Hoelbe)

new packages in iLCSoft - v01-10

- **KalTest**

- Kalman Fitting library (Keisuke Fuji et al)
 - migrated code base to SVN
 - added cmake build scripts

- **KalDet**

- detector description (geometry and material) for KalTest
 - currently writing the geometry build up from GEAR
- both packages will be used by LCTPC (MarlinTPC) and ILD
- ILD: will use (as one option) for new tracking code – started to use for TPC tracking (see talk FG)
- -> try to share as much common code as possible, i.e. is reasonable given the slightly different requirements for testbeam and global detector optimization

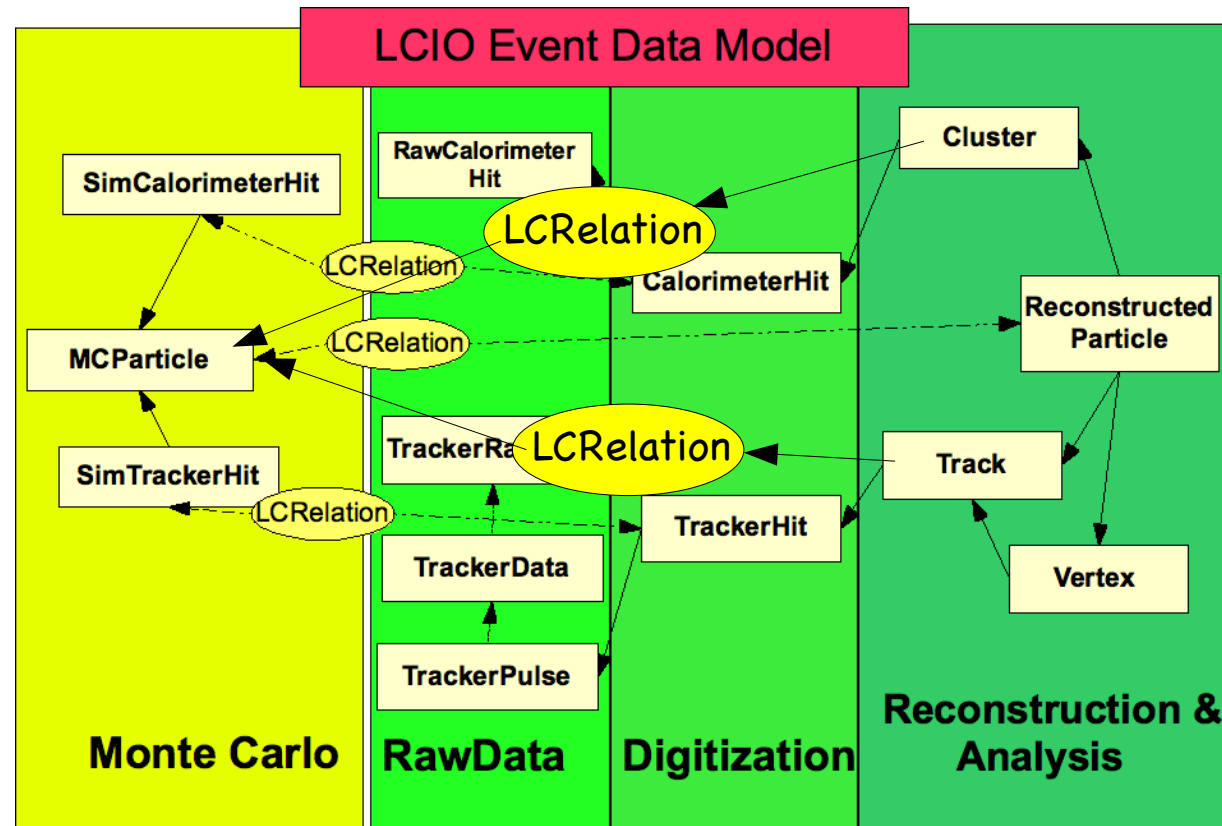
MarlinReco - v00-(18)19

- new package **KinkFinder** (M.Thomson, J.Marshall)
- new package **BCalTagEfficiency** (J.List, M.Berggren)
- new package **FPCDDigi** (D. Kamai)
- Analysis/MarlinKinfIt
 - improved fitting (M.Beckmann)
- TPCDigitizer
 - fixed hit smearing (M.Thomson)
- VXDDigitizer
 - fixed issue w/ smearing off the ladder (S.Aplin)
- SimpleMuonDigi
 - improve calibration of muon hits (M.Thomson)

MarlinReco - v00-19

- VOFinder
 - improved checking to avoid false positives (M.Thomson)
- BCalTagEfficiency
 - fixed memory leak bug (C. Bartels)

- RecoMCTruthLinker
 - added additional relations between MCParticle and Tracks and Clusters - to be used for DST (M.Berggren)

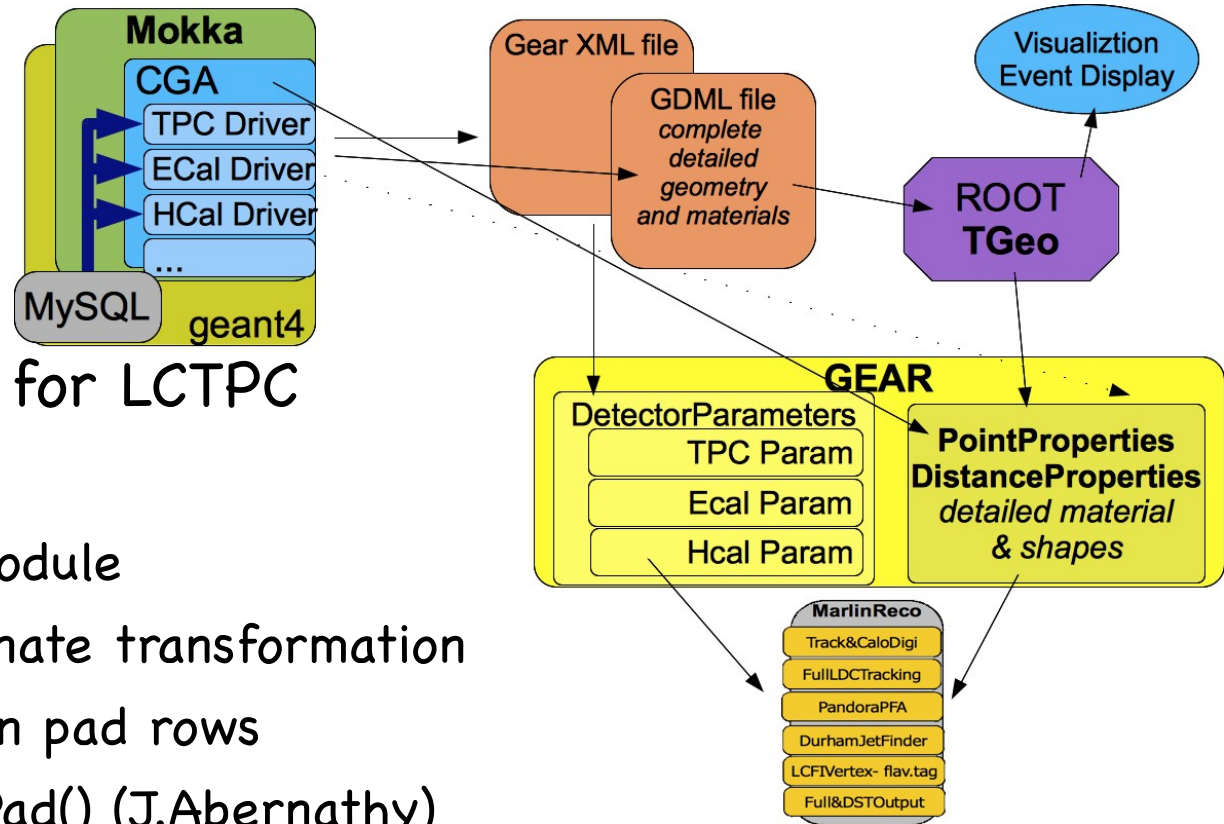


new GEAR release - v00-15

Frank Gaede, IWLC 2010, CERN, Oct 18-22, 2010

new in v00-14(15):

- made pure C++ (no Java)
- improved TPCParameters for LCTPC (M.Killenberg)
 - implemented z-Position of module
 - improved global-local coordinate transformation
 - introduced circle segments in pad rows
 - improved TPCP::`getNearestPad()` (J.Abernathy)
- **Point/DistanceProperties implemented with TGeo** (A.Muennich - see talk by S.Poss)
 - uses GDML interface to geant4
 - introduced material map in memory (performance)
- Mokka-CGA (geant4) implementation of Point/DistanceProperties released in Mokka



AIDA WP2 – Common Software

develop core software tools that are useful for the HEP community at large and in particular for the next big planned projects: sLHC and Linear Collider (ILC/CLIC)

Task 2.2: Geometry toolkit for HEP

- Allow the description of complex geometrical shapes, materials and sensitive detectors
- Provide interfaces to full simulation programs (Geant4), fast simulations, visualization tools and reconstruction algorithms
- Allow for the misalignment of detector components
- Provide an interface to calibration constants and conditions data

- starts Feb 2011
- for 4 years

Task 2.3: Reconstruction toolkit for HEP

- Tracking toolkit based on best practice tracking and pattern recognition algorithms
- Provide alignment tools
- Allow for pile up of hadronic events
- Calorimeter reconstruction toolkit for highly granular calorimeters based on Particle Flow algorithms

general strategy:

- integrate as much as possible with existing software framework(s) and international activities outside of the AIDA project
- collaborate with software activities in other AIDA work packages, e.g. the alignment of silicon sensors

Summary & Outlook

- since LOI we started to work on improving the software for the DBD
- considerable developments in core software tools have been done in 2010
 - first version of ILD_01 model with improved realism on the way
 - improved LCIO (first step towards v2)
 - new GEAR implementation based on TGeo
 - many improvements and fixes in MarlinReco
 - improved LCCD, first version of new test system
 -
- -> to be released soon as **v01-10** (week after IWLC)
- Next Steps:
 - continue to improve software tools - focus on
 - development of **new tracking software**
 - **getting ILD_01 to work (digitization/reconstruction)**