Overview of Simulation and Reconstruction Tools in Europe

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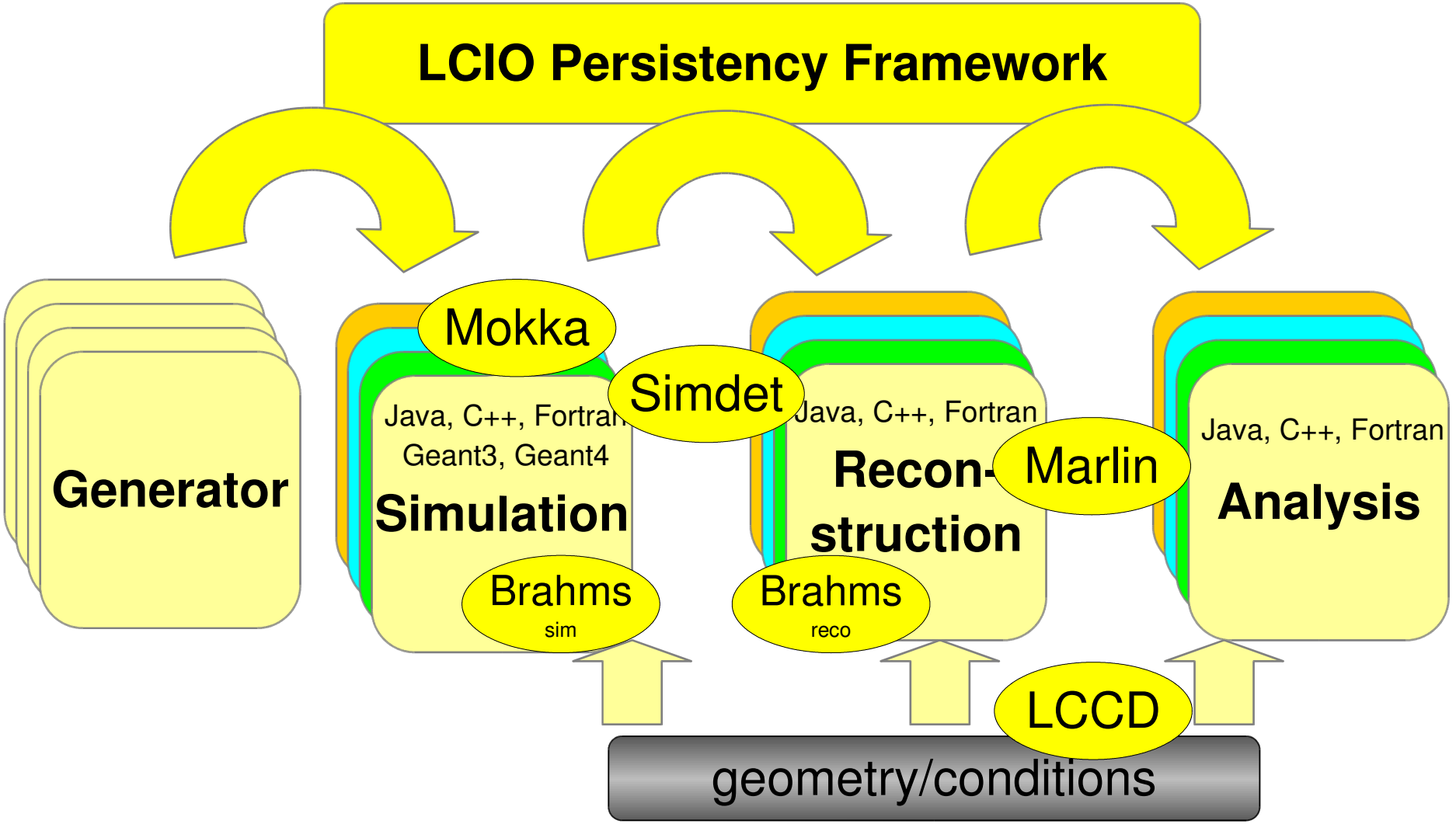
Outline

- Introduction
- LCIO – data model & persistency
- Simulation
  - SIMDET – fast simulation
  - Mokka – geant4
  - BRAHMS – geant3 & reconstruction
- MARLIN – C++ reconstruction framework
- LCCD - conditions data toolkit
- Summary

Overview of software tools



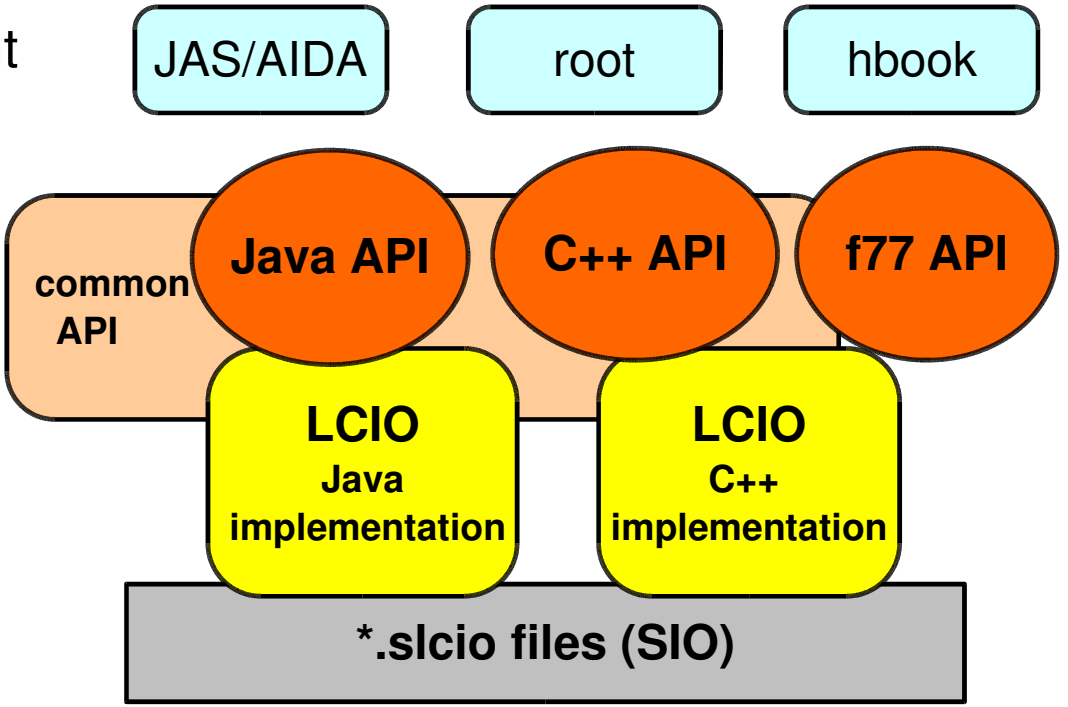
LCIO overview

- DESY and SLAC joined project:
  - provide common basis for ILC software
- Features:
  - Java, C++ and f77 (!) API
  - extensible data model for current and future simulation and testbeam studies
  - user code separated from concrete data format
  - no dependency on other frameworks

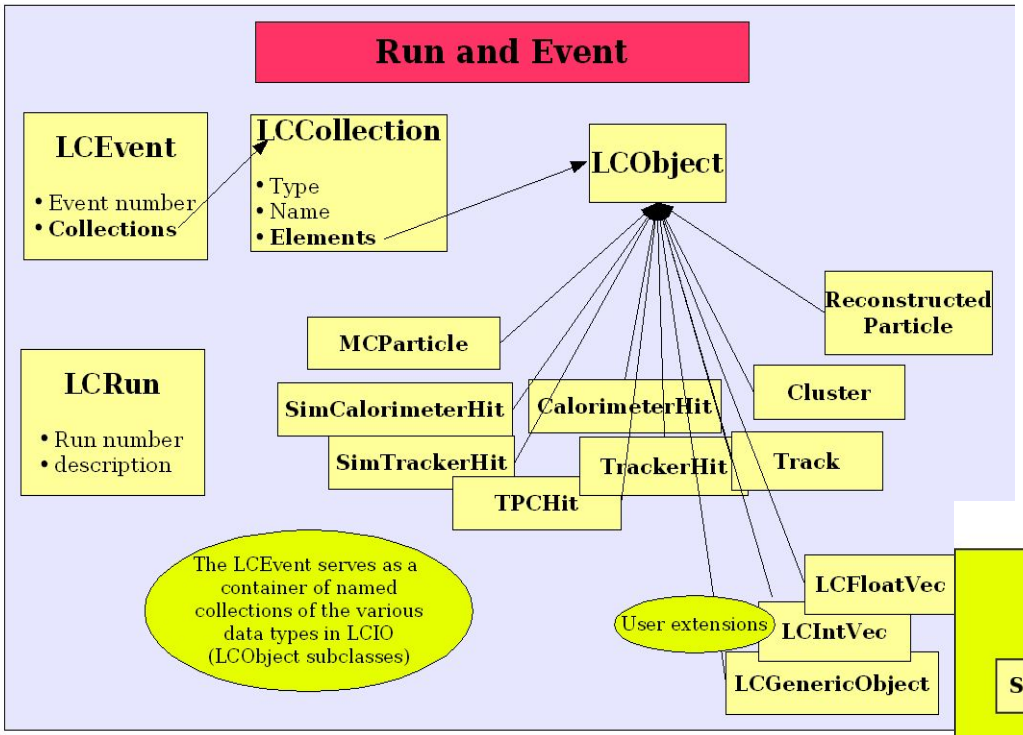
simple & lightweight

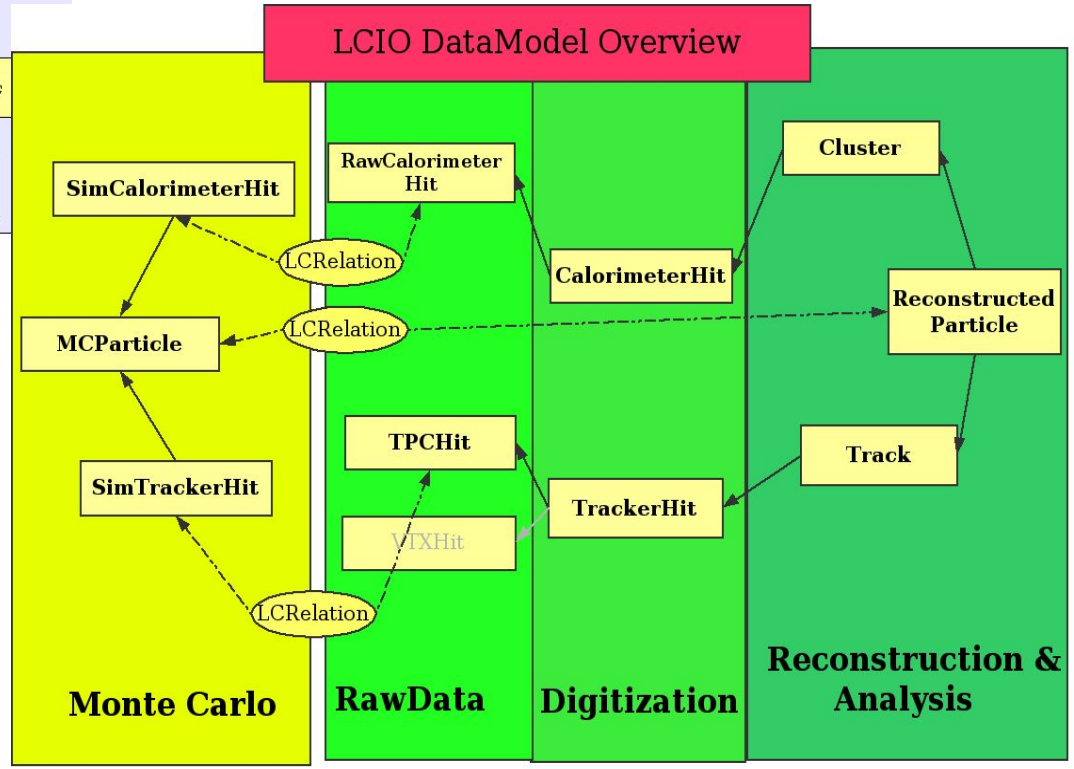
now de facto standard for ILC software

SW-Architecture



LCIO data model

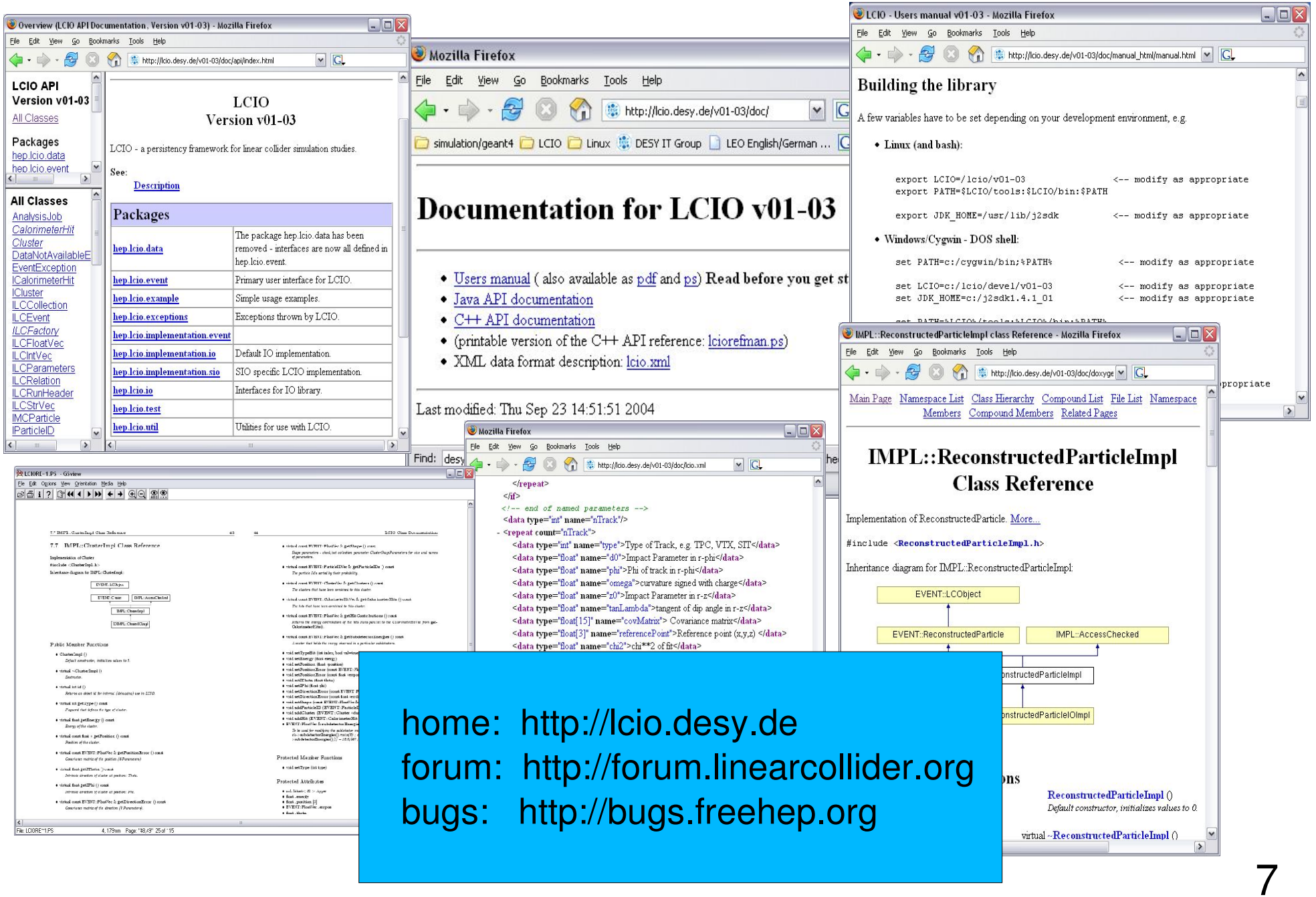




LCIO status-new features

- new release v01-04 (March 2005)
- features:
  - support and definition of 64bit time stamps
    - **ns since 1/1/1970 (UTC)**
  - multiple I/O streams in C++
  - LCGenericObjects in Java (user defined data objects)
  - subset collections
    - hold pointers/references to objects already existent in the event, e.g. LeptonCandidates from ReconstructedParticles
    - transient and persistent
      - if persistent, only pointers/references are stored in the file
      - files are downward compatible, LCIO 1.3 can read new files
  - bug fixes
  - improved documentation

LCIO on the web



Simulation tools

- **SIMDET**
  - parameterized fast Monte Carlo (f77)
  - hard coded geometry: TESLA TDR Detector

writes LCIO

- **Brahms**
  - geant3 simulation (f77)
  - hard coded geometry: TESLA TDR Detector
  - full standalone reconstruction part (pflow)

writes LCIO

for download (cvs web interface)
and more information:
http://www-zeuthen.desy.de/linear_collider

reads + writes LCIO

- **Mokka** (see talk by H.Videau)
  - geant4 simulation (C++)
  - uses MySQL database for geometry definition
  - flexible geometry setup on subdetector basis using C++ drivers, e.g.
    - Tesla TDR Detector with new masks
    - CALICE testbeam prototypes

writes LCIO

full simulation and reconstruction with Mokka & Brahms for Tesla/LDC !

LCCD

Linear **C**ollider **C**onditions **D**ata Toolkit

- handles access to conditions data transparently from
  - conditions database (CondDBMySQL)
  - LCIO files

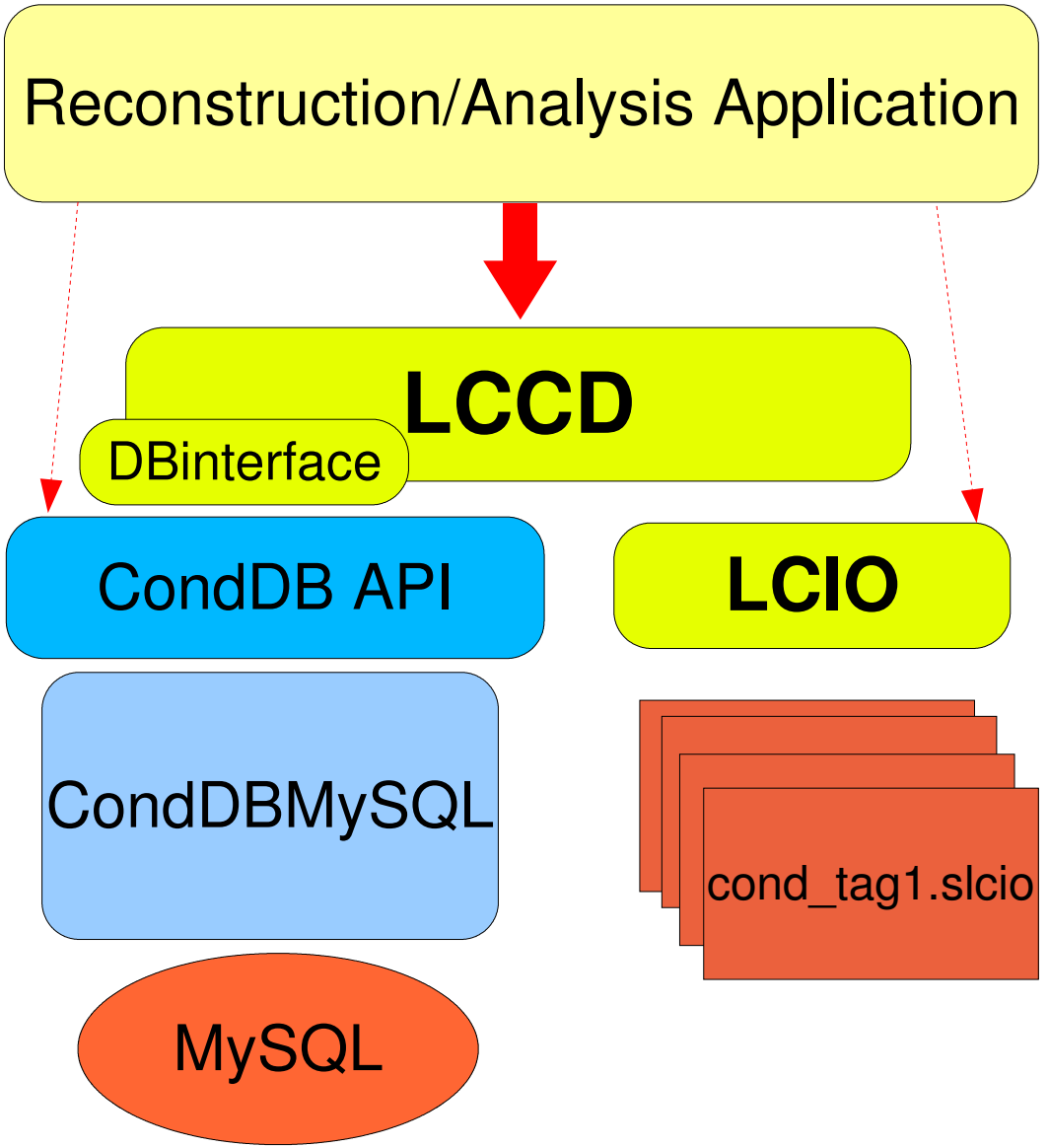
- Conditions Data:
  - all data that is needed for analysis/reconstruction besides the actual event data
    - typically has lifetime/validity range longer than one event
      - can change on various timescales, e.g. seconds to years
    - need for versioning (tagging) (changing calibration constants)
    - also 'static' geometry description (channel mapping, positions,...)

ConditionsDBMySQL

- open source implementation of CondDB API
  - conditions data interface for LHC (Cern IT)
- developed by Lisbon Atlas group
- features
  - C++ interface to conditions database in MySQL
  - data organized in folder/foldersets
  - objects stored as BLOBs (binary large objects)
  - tagging mechanism similar to CVS
  - outperforms implementation based on Oracle
- status
  - no active development - but bug fixes
- remark: first tests suggest that software runs stable
  - need extended tests before used in production environment

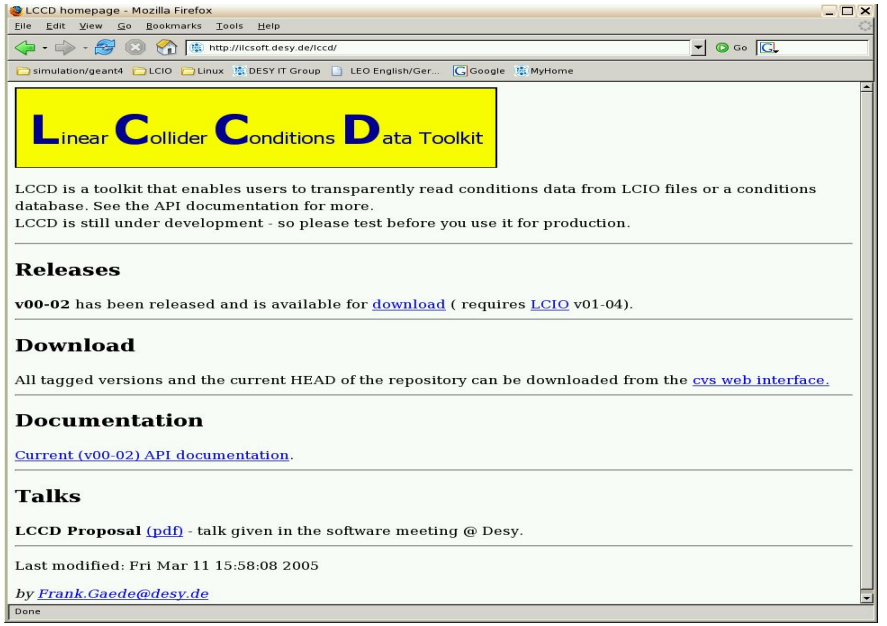
LCCD features

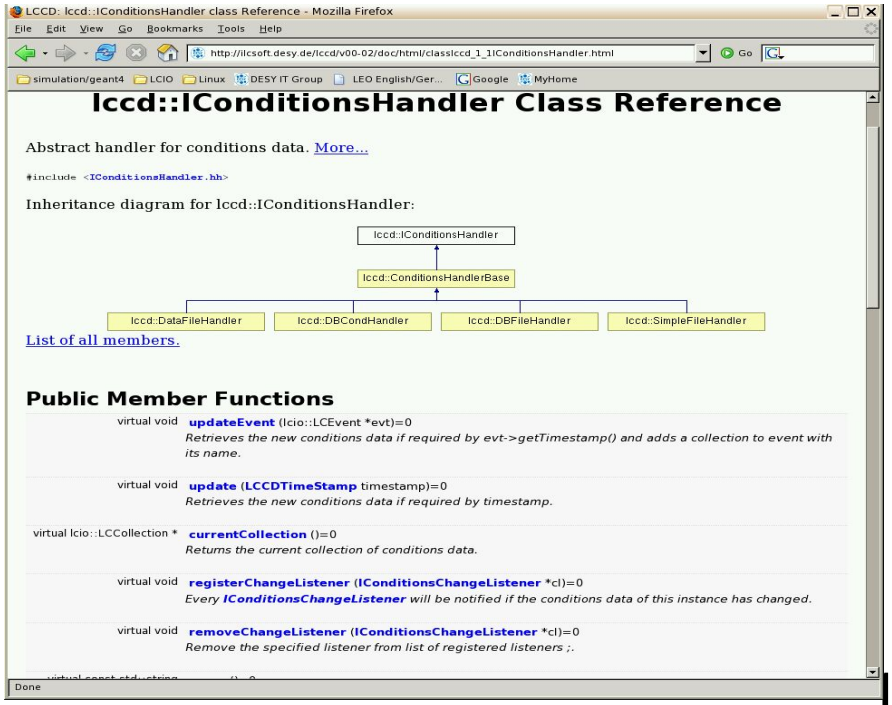
- Reading conditions data
  - from conditions database
    - for given tag
  - from simple LCIO file
    - (one set of constants)
  - from LCIO data stream
    - e.g. slow control data
  - from dedicated LCIO-DB file
    - has all constants for given tag
- Writing conditions data
  - as LCGenericObject collection
  - in folder (directory) structure
  - tagging
- Browsing the conditions database
  - through creation of LCIO files
    - vertically (all versions for timestamp)
    - horizontally (all versions for tag)



LCCD Status

- v00-02 released
- fairly complete functionality
- passes simple tests
- example/test code
- complete API documentation
- availiable via cvs web:
  - ***http://ilcsoft.desy.de/lccd***
- feedback welcome
- CALICE will use LCCD for testbeams

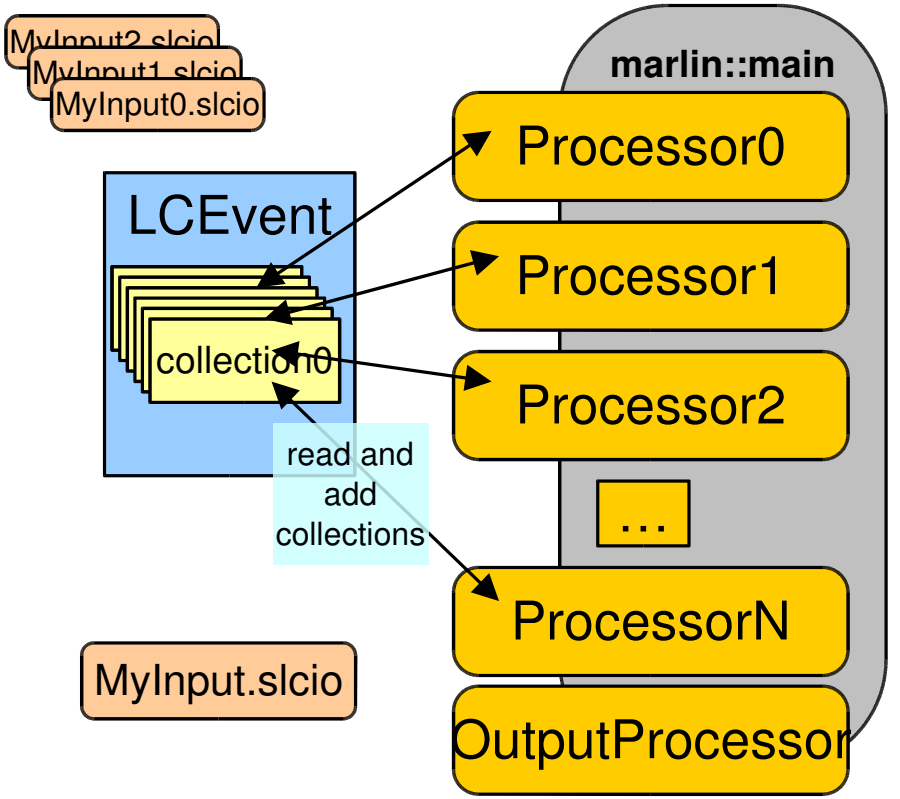




Marlin

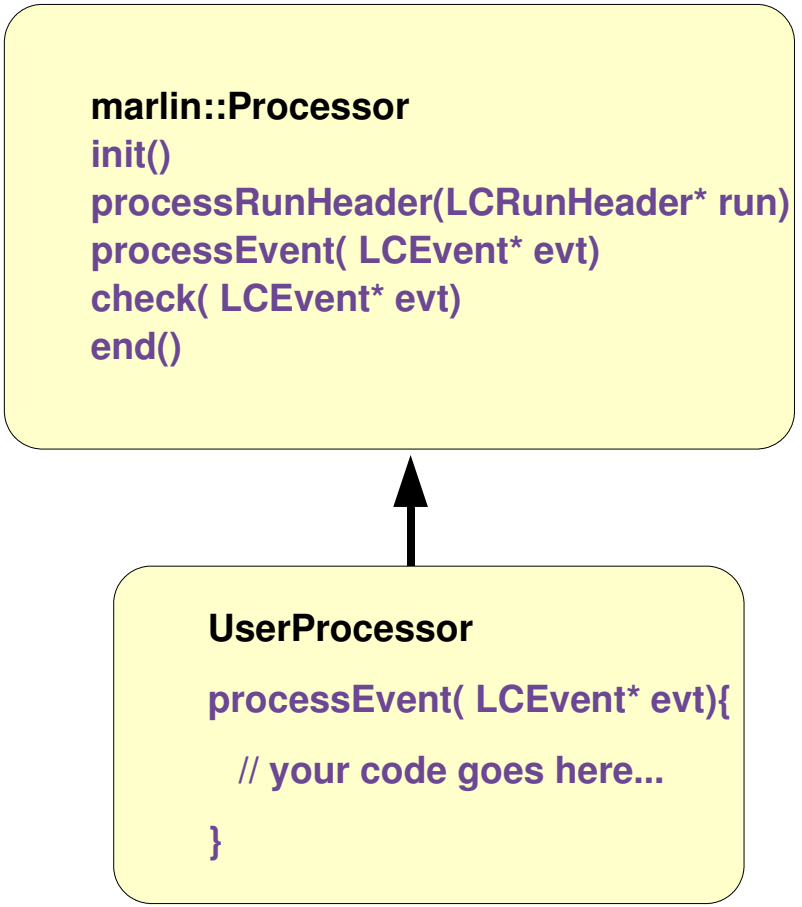
Modular**A**nalysis & **R**econstruction for the **L I N**ear Collider

- modular C++ **application framework** for the analysis and reconstruction of LCIO data
- uses LCIO as transient data model
- software modules called Processors
- provides main program !
- provides simple user steering:
  - program flow (active processors)
  - user defined variables
    - per processor and global
  - input/output files



Marlin overview

- core functionality
  - AIDAProcessor
    - for easy creation of histograms, clouds, ntuples
  - OutputProcessor
  - ConditionsProcessor
    - read conditions transparently with LCCD
  - OverlayProcessor
    - event mixing (under development)
  - MyProcessor
    - simple example – serves as template for user code



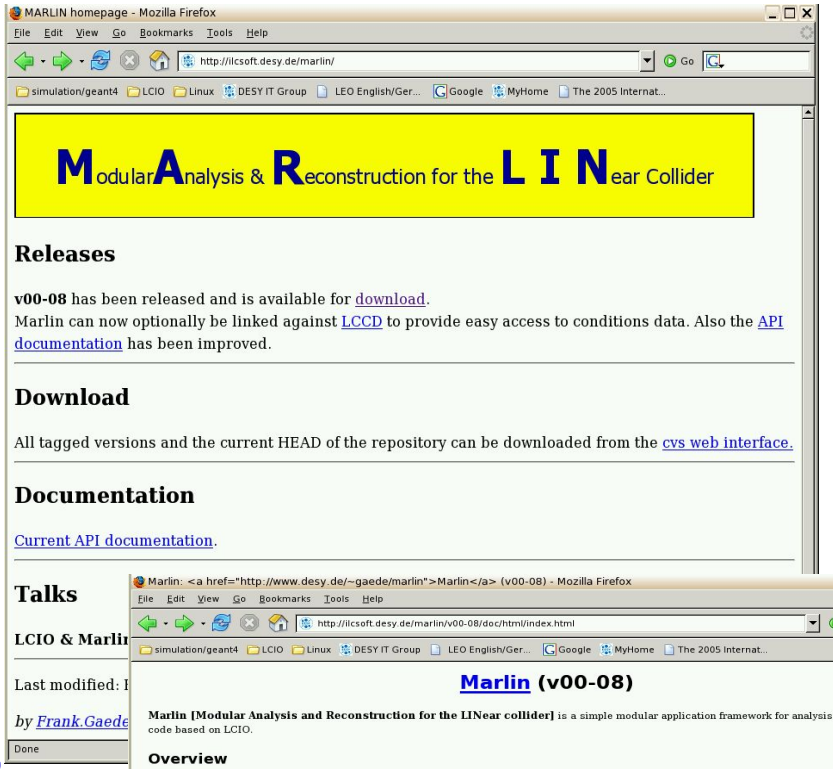
Marlin serves as a framework for the distributed development of a full suite of reconstruction algorithms !
It can also be used for small standalone analysis jobs.

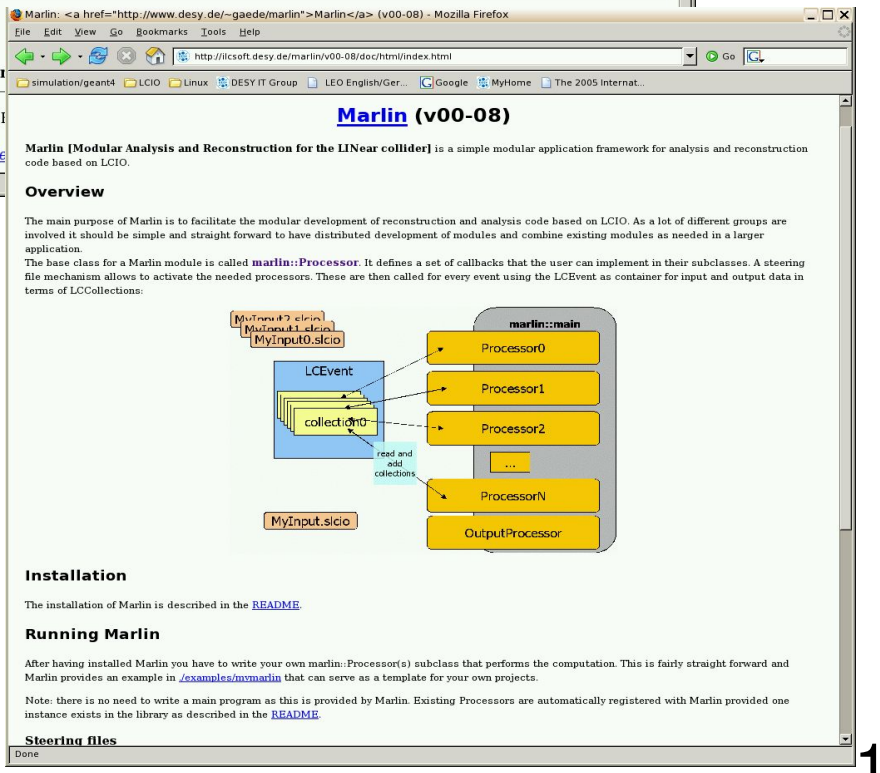
Marlin users

- CALICE testbeam software
  - DigiSim (G.Lima)
  - Ganging and Calibration (R.Poeschl)
- Analysis software
  - LCLeptonFinder (J.Samson)
  - JetFinder (Th.Kuhl)
  - ThrustFinder (Th. Kraemer)
- Reconstruction software
  - wrapper for Brahms-Tracking code (S.Aplin)
  - clustering and pflow – SNARK in C++ (A.Raspereza)
  - clustering algorithms (Ch. Ainsley, G. Mavromanolakis)
- probably others ...
- **aim: have (at least one) complete set for standard reconstruction in C++ soon !**
- need common repository or web portal to provide entry point for users to download and configure their marlin application !

Marlin status

- v00-08 released
  - ConditionsProcessor
  - improved Makefiles
  - improved processor parameters
  - available via cvs web @
- new homepage: ***http://ilcsoft.desy.de/marlin***
  - (old download page obsolete!)
- improved documentation
- overview & API doc





Summary & Outlook

- fairly complete software chain exists for Tesla/LDC studies:
  - fast simulation - SIMDET
  - full simulation geant4/geant3 - Mokka/Brahms
  - reconstruction workhorse (Brahms) still f77
  - new C++ reconstruction framework (Marlin) under distributed development
  - conditions data toolkit – LCCD
  - Calice testbeam will exercise the software chain
- all tools use LCIO !
- still a lot of work to do:
  - have complete Marlin based reconstruction
  - geometry description for reconstruction
  - make tools more flexible (other detector concept studies)
  - investigate options for interoperability with other frameworks
    - geometry description /Java-C++ interfacing / conditions ...