Report from Software Workshop
before TILC09 (16-April)

Akiya Miyamoto, KEK

21-April-2009

ILD Meeting

History to ILD SW workshop

- **Cambridge (Sep.,'08)**
  - ◆ Agreed to postpone the work to merge GLD and LDC tools by the completion of LOI and use LDC tools for the LOI study.
  - ◆ Agreed to organize the software management meeting regularly.

- **At 3rd ILD workshop(Ewha, Feb.), a software group meeting was held. In the meeting, during the discussion towards completion of LOI studies, we agreed to held a workshop to discuss software after LOI issues in detail.**

- **After 3rd ILD workshop, Frank and Steve, visited KEK and**
  - ◆ start to discuss issues for merging GLD and LDC tools
  - ◆ agreed to collect more user's point of view to this discussion

Goal of ILD Software Workshop

- It is time to re-define our strategy.
    - Identify subjects which should be included in LOI but was not.
      Be prepared for requests from IDAG.

    - Identify subjects which should be studied by TDP1/TDP2.
      Make our software tools ready to studies required.

    - Develop strategy to merge LDC and GLD software tools.

[76] **Keynote - Workshop charge**
by Akiya MIYAMOTO (KEK)
(KEK, 4th Building, 1F Seminar Hall: 10:00 - 10:10)

[77] **LDC software tools**
by Frank GAEDE (DESY)
(KEK, 4th Building, 1F Seminar Hall: 10:10 - 10:30)

[78] **GLD software tools**
by Akiya MIYAMOTO (KEK)
(KEK, 4th Building, 1F Seminar Hall: 10:30 - 10:50)

[81] **Comments from Users - Marlin et al**
by Mikael BERGGREN (DESY Hamburg)
(KEK, 4th Building, 1F Seminar Hall: 10:50 - 11:20)

[94] **Comments from MarlinReco users in Asia**
by Dr. Taikan SUEHARA (The University of Tokyo)
(KEK, 4th Building, 1F Seminar Hall: 11:20 - 11:40)

[79] **Comments from JSF Users**
by Dr. Katsumasa IKEMATSU (KEK/IPNS)
(KEK, 4th Building, 1F Seminar Hall: 11:40 - 12:00)

lunch
(12:00 - 12:50)

[82] **Comments from Users - testbeams**
by Dr. Niels MEYER (DESY)
(KEK, 4th Building, 1F Seminar Hall: 13:30 - 14:00)

[85] **tracking code in JSF**
by Keisuke FUJII (IPNS, KEK)
(KEK, 4th Building, 1F Seminar Hall: 14:00 - 14:30)

[88] **tracking code in MarlinReco**
by Dr. Steve APLIN (DESY)
(KEK, 4th Building, 1F Seminar Hall: 14:30 - 15:00)

[92] **discussion: future plans for physics studies**
by Dr. Mark THOMSON (University of Cambridge)
(KEK, 4th Building, 1F Seminar Hall: 15:00 - 16:10)

coffee break
(16:10 - 16:30)

[93] **Expert discussion: future plans**
by Frank GAEDE (DESY); Akiya MIYAMOTO (KEK)
(KEK, 4th Building, 1F Seminar Hall: 16:30 - 18:30)
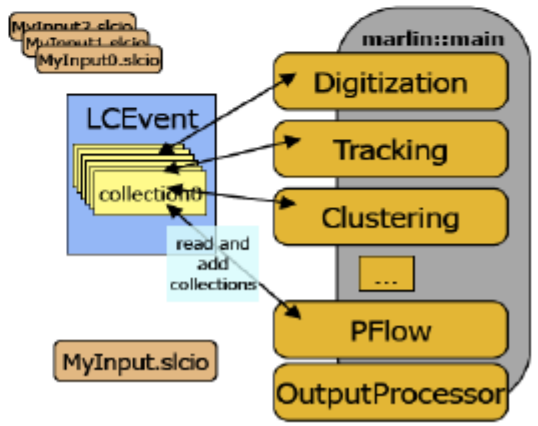
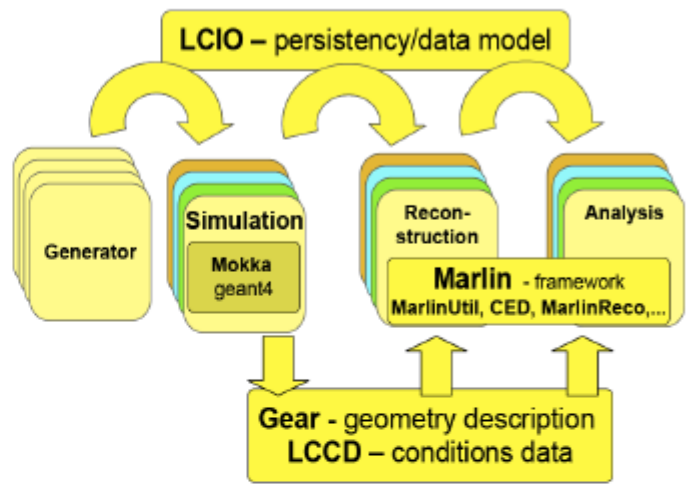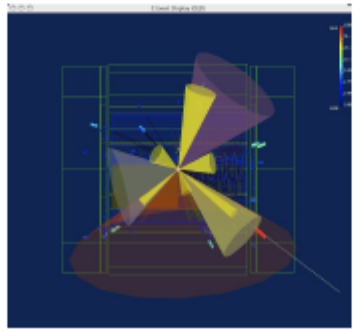Held at KEK, 16 April.   ~ 15 participants

Frank Gaede
DESY
ILD Software Workshop
KEK, Tsukuba, 16.04.2009

The ILD software framework - LDC flavor

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

Frank Gaede, ILD Software Workshop, KEK, 16.04.200

LCIO – persistency/data model

Generator | Simulation | Recon-struction | Analysis

Mokka geant4

Marlin - framework
MarlinUtil, CED, MarlinReco,...

Gear - geometry description
LCCD – conditions data

MyInput2.slcio
MyInput1.slcio
MyInput0.slcio

marlin::main

LCEvent

collection0

Digitization

Tracking

Clustering

...

read and add collections

PFlow

MyInput.slcio

OutputProcessor

Akiya Miyamoto, KEK
16-April-2009
ILD Software Workshop

SimTools: package of GLD tools

- **lcbase** : configuration files

- **Leda** : Analysis tools (Kalman fitter, 4vector and jet findinder utilities)

- **jsf** : Root-based framework
- **lclib** : QuickSim and old fortran based utilities
- **physsim** : Helas-based generator

- **Jupiter** : Full simulation based on Geant4
- **Uranus** : Data analysis packages
- **Satellites** : Data analysis packages for MC data

JUPITER
JLC Unified
Particle Interaction
and
Tracking EmulatoR

➢All packages are kept in the CVS. Accessible from http://jlccvs.kek.jp/
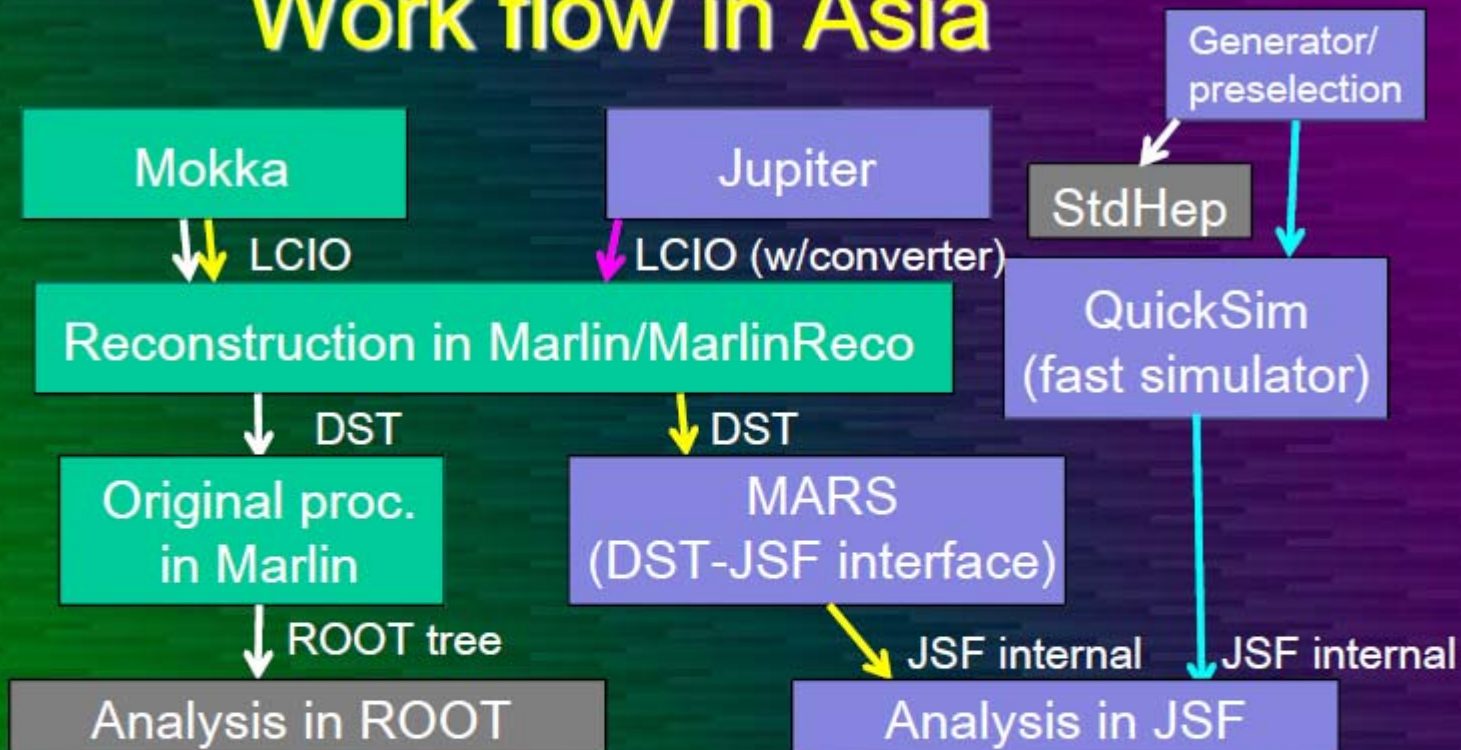
Mikael Berggren[1]

[1]DESY
Hamburg

ILD SW workshop, KEK, March 2009

- **Concrete suggestions** from users
- Short term: What will needed for the next major production (this year) ?

  ✓ Crossing Angle, Simualted IP, Timing Info, Digitization, BCAL with BG
  ✓ Generators for Pythia/BDK/BDKRC for $\gamma\gamma$, BHWIDE for bhabha, Tauola for τ, ISAJET/PYTHIA/SUSY … for SUSY
  ✓ Root tree containing all DST information possible ?

- **Medium term:** What will needed for the TNR?

  ✓ A tool for alignment study ← Geometry Package
  ✓ Fast simulation

- **Long term:** What will needed for Real Data?
  ✓ LCIO-v2

Taikan Suehara
ICEPP, The Univ. of Tokyo

Work flow in Asia

Taikan Suehara, ILD software workshop, KEK, 2009/04/16, page 3

Virtually everyone uses ROOT,
so ROOT-friendliness is very important.

Comments from JSF users

Katsumasa Ikematsu (KEK)

Full Simulator

← benchmarking & Physics

Quick Simulator

← Extensively used for physics studies.

■ JSF/QuickSim ➔ import to Marlin World ?
  ✓ Data model : JSFQuickSim, JSFLTKCLTrack to LCIO
  ✓ LEDA : Root based utilities : TAttLockable,TAttDrawable, ANL4DVector, .. ANLEventShape ..

★ M@RS = Modular Analysis with Root-based Subprograms

■ Features:
  ✓ Interface to LCIO for JSF users.
  ✓ Same approach to Full simulator-Standard reconstruction (MarlinReco/ PandoraPFA/PandoraPFA/LCFIVertex) and Qucik simulator analyses

Experiences from the test-beam pit

Niels Meyer, DESY

- ➢ All three R&D collaborations use the LDC scheme:
  - ➢ Implementations in C++
  - ➢ LCIO as data model and for data storage
  - ➢ Marlin for data processing
  - ➢ LCCD as interface to conditions data
  - ➢ MOKKA as interface to Geant4

Comments on LCIO

- ✓ A feature to process subset information preffered.
- ✓ Integration of user defined class

Comments on Geometry

- ✓ Gear is simulation-driven , not optimal for test beam & full-scale detector
- ✓ Geometry data change with time → LCCD-based handling ?

Tracking Code in Uranus/Satellites

-- Extended Kalman Filter --

Kiesuke Fujii, KEK

Kalman Filter Library Features

- KalLib: general base classes that implement algorithm
  - TVKalSystem, TVKalSite, TVKalState
- KalTrackLib: that implements pure virtuals of KalLib for track fitting purpose
- GeomLib: geometry classes that provide
  - track models (helix, straight line, ...)
  - surfaces (cylinder, hyperboloid, flat plane, ...)

- Minimum number of user-implemented classes
  - MeasLayer : measurement layer
  - KalDetector : an array containing MeasLayers
    - You can put different kinds of MeasLayers
  - Hit : coordinate vector as defined by the MeasLayer
- Track model can change site to site which allows B-field variation along a particle trajectory

Tracking Software in MarlinReco

Steve Aplin

Topics

- Digitisation
- LEPTracking
- SiliconTracking
- FullLDCTracking
- Performance
- Current Issues
- Plans – Ideas

Outstanding Issues

- Barely manageable code base
- Error Description – impact parameters only determined by the Si Tracks due to problems with errors for full tracks
- Material Description
- Background

Plan

- Move to a new Tracking System
- Track Model
- MarlinTPC <=> MarlinReco
- Keisuke's Kalman Filter
- Atlas Inner Tracking Software

ILD Software Workshop: Discussion of Future Plans

Mark Thomson

The Past:
❶ Didn't we do well ?
The Future:
❷ Context
Highest Priority ?
❸ Backgrounds
❹ Simulation
Other issues
❺ Physics needs
❻ Mass production
❼ DST format /root ?
❽ LCFIVertex

4. Simulation
   ➔ Support of various technology options
5. Physics needs
   ➔ Improvement for TDP1 , ZHH
   ➔ Keep people involved, students move on

6. Mass production
   ➔ NOT to pursue a new production in near fear future, unless there is a strong argument

7. DST format / ROOT
   ➔ LCIO deeply embedded in MarlinReco
   ➔ ROOT copy of DST ?

   ➔ Update DST format itself ?
      PID, Isolated lepton, more than 6 jets …

Outcome of Workshop

- "ILD should move towards one software frame :
  LCIO + Marlin + goodies from JSF

- Area of improvements and new features are
  - geometry – w. collaboration with CLIC and other group
  - LCIOv2 – data mode and persistency
  - Investigate usage of ROOT/IO
    - interactive user analysis
    - persistency geometry
  - Goodies from JSF:
    - JSFEnv(Parameter), QuickSim, other Tools

- DST production
  - No major production planed now
  - IDAG requests: ZH $\rightarrow$ ee/$\mu\mu$H + SM background
  - Production by user requests. Some coordination desired

Conclusion

- Workshop was a good opportunity to exchange our idea.

- We got a vague direction of the development direction in coming month. But it is not crystallized as a written form. More e-mail discussion would be necessary.

- At TILC09, we got the homework. This will be our high priority in coming months.