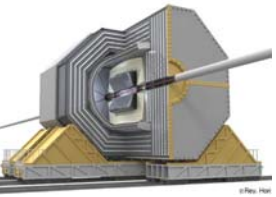


Software tools in Asia

Akiya Miyamoto
KEK

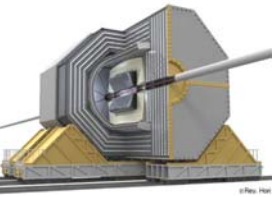
18-March-2005

Simulation and Reconstruction Session
LCWS2005

Representing acfa-sim-j activity

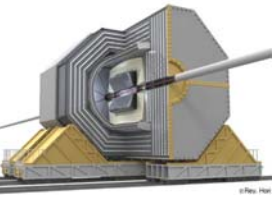
M.C.Chang[1],K.Fujii[2], T.Fujikawa[1], S.Kishimoto[3], A.Miyamoto[2],T.Nagamine[1], H.Ono[4], A.Sanchez[4], T.Takeshita[5],A.Yamaguchi[6], Y.Yamaguchi[6], S.Yamamoto[7]

1:Tohoku Univ., 2:KEK, 3:Kobe Univ., 4:Niigata Univ.
5: Shinshu Univ., 6:Tsukuba Univ., 7: GUAS



Objectives of Softwares

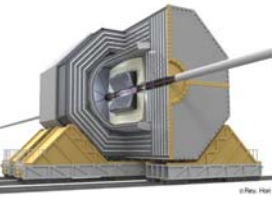
- Physics studies
  - Event generators
  - Fast detector monte carlo
- Detector studies
  - Geant3 ⇨Geant4
  - Reconstruction: clustering, track fitter, vertexing, …
- Beam test studies
  - Data storage and analysis
  - Simulation
- Communication / Information



Goals of in 2004

- By LCWS2004, we had
  - JSF framework and Quick Simulator for physics studies
  - Jupiter with basically CDC, IT, VTX, and IR.
  - basic structures of Satellites/Uranus

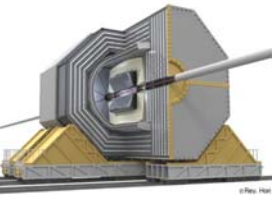
- Goals of studies in 2004 are detector optimization based on Full detector simulation.
  - Implement "GLD" geometry in Jupiter
  - Study PFA performances by an ultimate condition
    - Implement "tower" calorimeter
    - Develop analysis tools
  - Study physics performance vs detector choice.



Overview of our tools

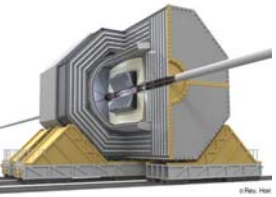
- lcbase : configuration files
- Leda : Analysis tools (Kalman fitter, 4vector and jet findinder utilities)
- jsf : Root-based framework
- lclib : QuickSim and other fortran based utilities
- physsim : Helas-based generator
- Jupiter : Full simulation based on Geant4
- Uranus : Data analysis packages
- Satellites : Data analysis packages for MC data

  - We use only C++, except old fortran tools.
  - Link to various tools at http://acfahep.kek.jp/subg/sim/soft
  - All packages are kept in the CVS. Accessible from http://jlccvs.kek.jp/



Recent updates in Framework, QuickSim, Physsim

- Framework
  - JSF : Root based framework for physics and detector studies
  - Packages in JSF are reorganized to reduce dependences among codes.
  - Interfaces to StdHep and LCIO are implemented.
- Quick Simulator and lclib
  - Detector parameter set for "GLD" configuration is prepared and tuning of the parameters are in progress
- Physisim
  - Collection of event generators based on Helas.
  - Anlib packages (4 vector manipulation and jet clustering, etc.) is moved to Leda package



Jupiter/Satellites Concepts

Tools for simulation Tools

For real data

JUPITER
JLC Unified Particle Interaction and Tracking EmulatoR

Geant4 based Simulator

MC truth generator

Satellites

IO — Input/Output module set

METIS — Monte-Calro Exact hits To Intermediate Simulated output

LEDA
Library Extention for Data Analysis

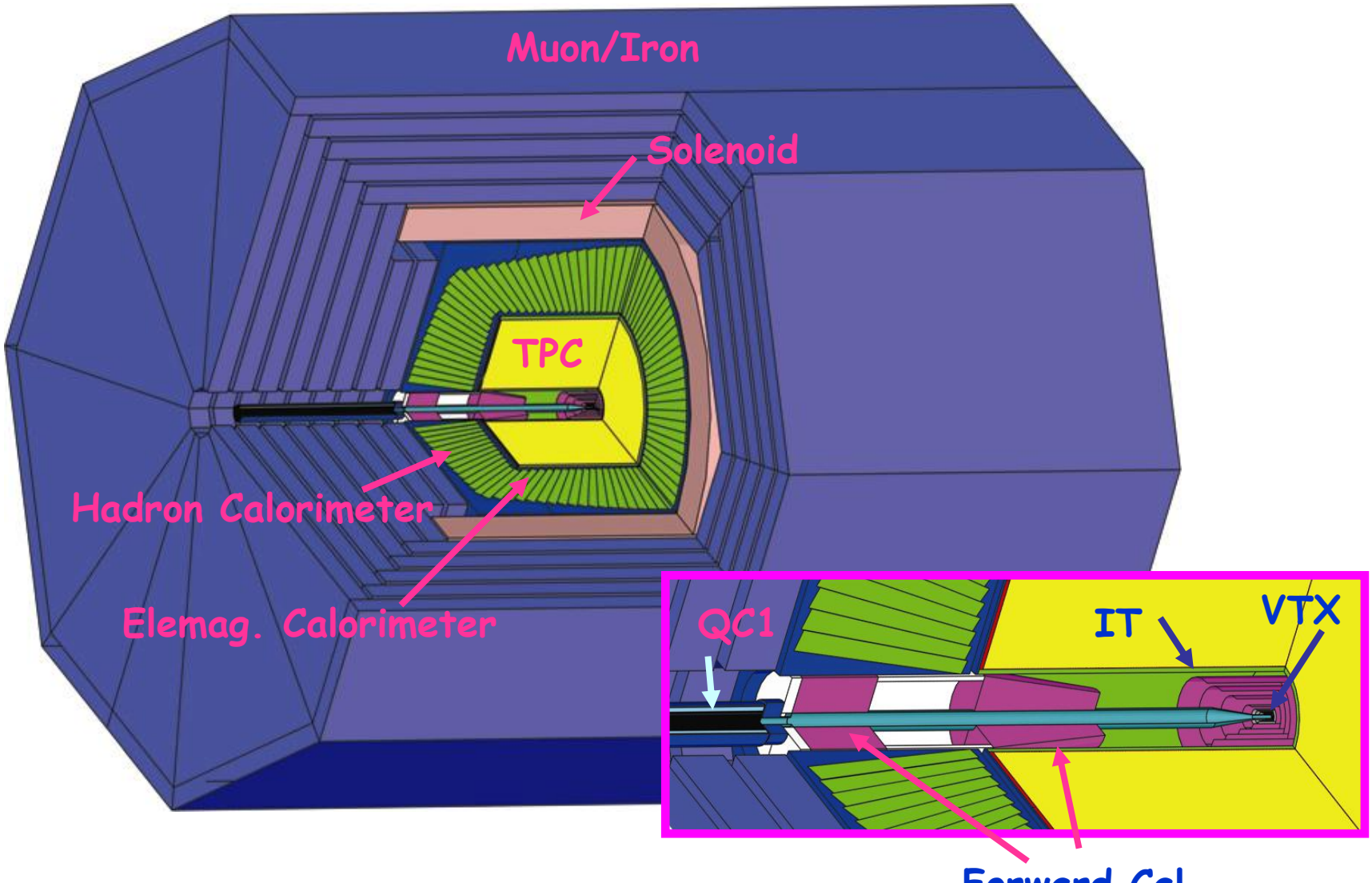
URANUS
Unified Reconstruction and ANalysis Utility Set

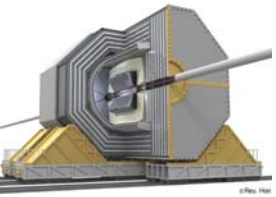
JSF/ROOT based Framework

Event Reconstruction

JSF: the analysis flow controller based on ROOT
The release includes event generators, Quick Simulator, and simple event display

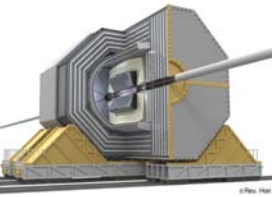
Geometry in Jupiter





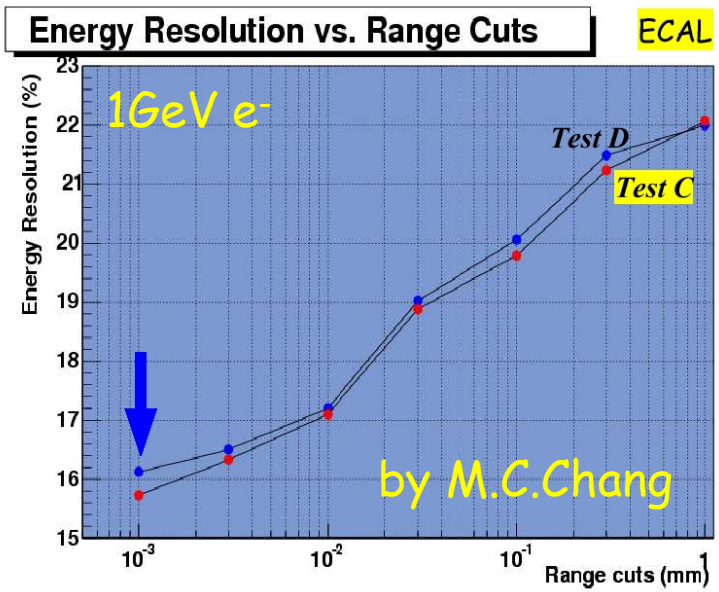
Jupiter status

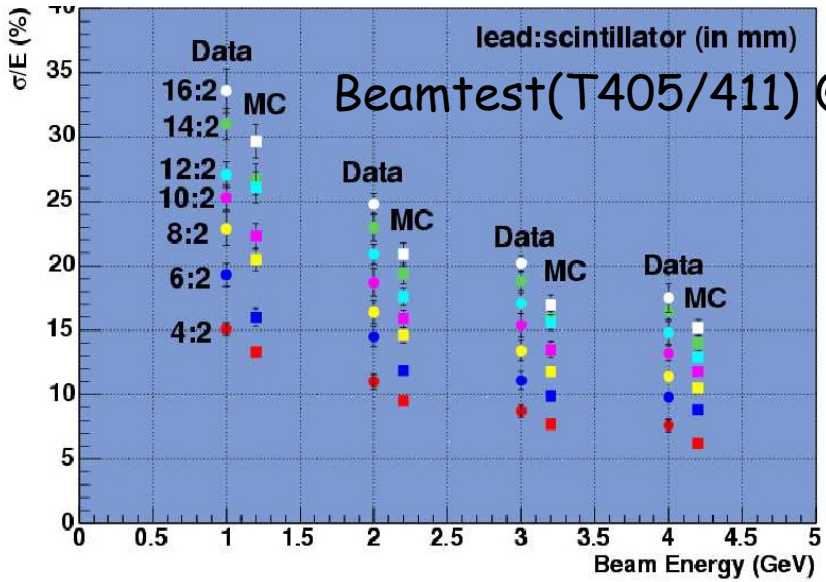
- Geometry definition
  - Hard coded in the source, but addition/deletion of sub-detectors are easily performed through J4XXXParameterList classes.
  - Start to develop XML interface to implement very complicated geometry, but this work does not complete yet.
- StdHep and LCIO
  - Interfaces have been implemented using JSF classes.
  - LCIO output is still experimental. Links to between MCParticle and SimCalorimeterHit/SimTrackerHit are not full compatible.
- Digitization and Hit making
  - Jupiter creates only Monte Calro truth hit points. Smearing/Digitization is performed later in Satellites, since Geant4 simulation is most time consuming part.
  - We want to keep information of tracks which creates signal in Cal. → create a virtual detector to save information as TPC_Post hits.



Range cut for Calorimeter

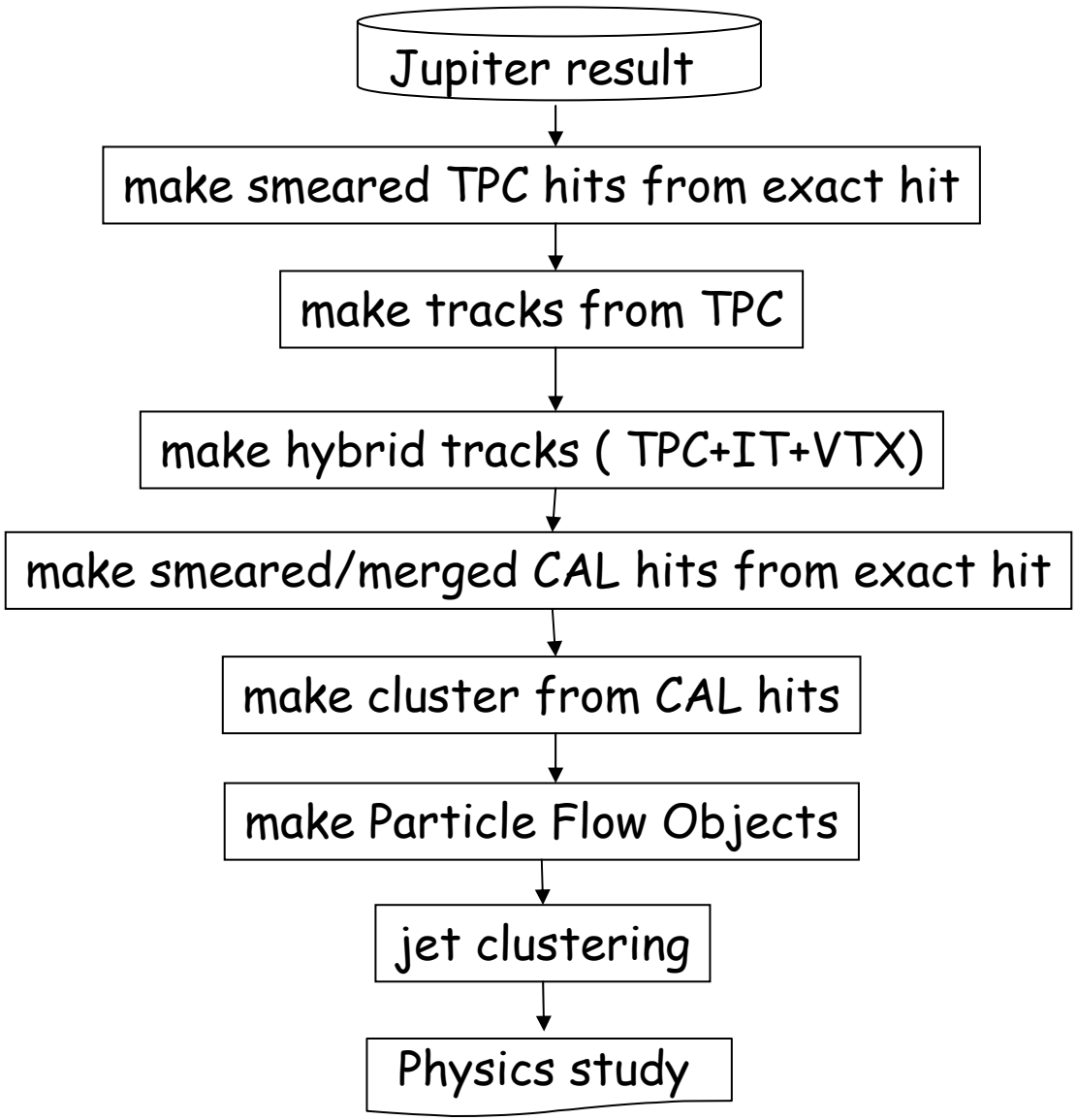
- Geant4's default range cut is 1mm, which is too large for our sampling thickness.
- Energy deposit and resolution depends on the range cut.
- Range cut <0.3μm is good for ΔE
- Simple MC results are always slightly better than beam test.
- Small range cut is memory consuming → using 1~10μm





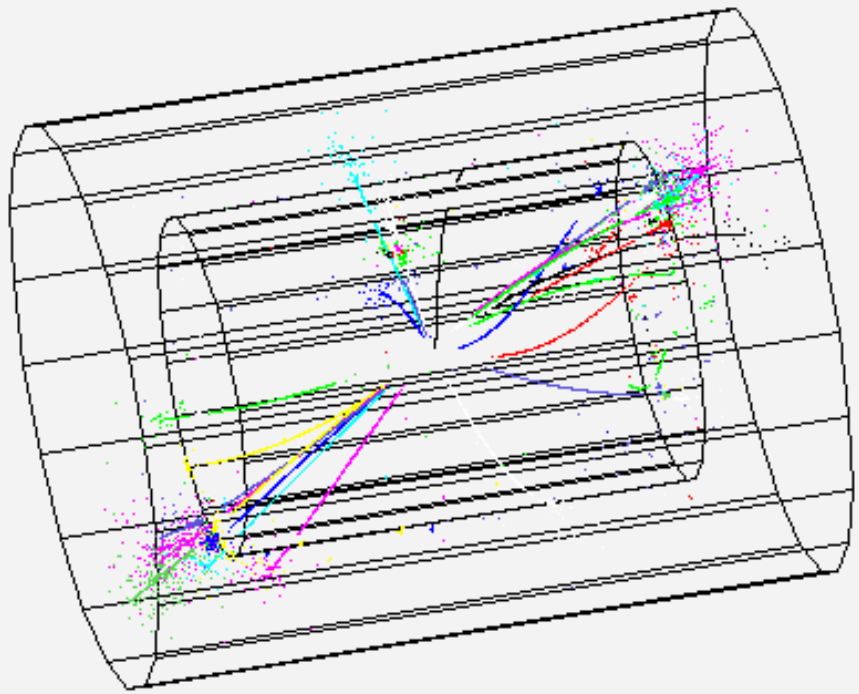
Detail will be presented by Matsunaga san

Metis Analysis Flow



Cheated PFO analysis

ZH event at Ecm=500 GeV

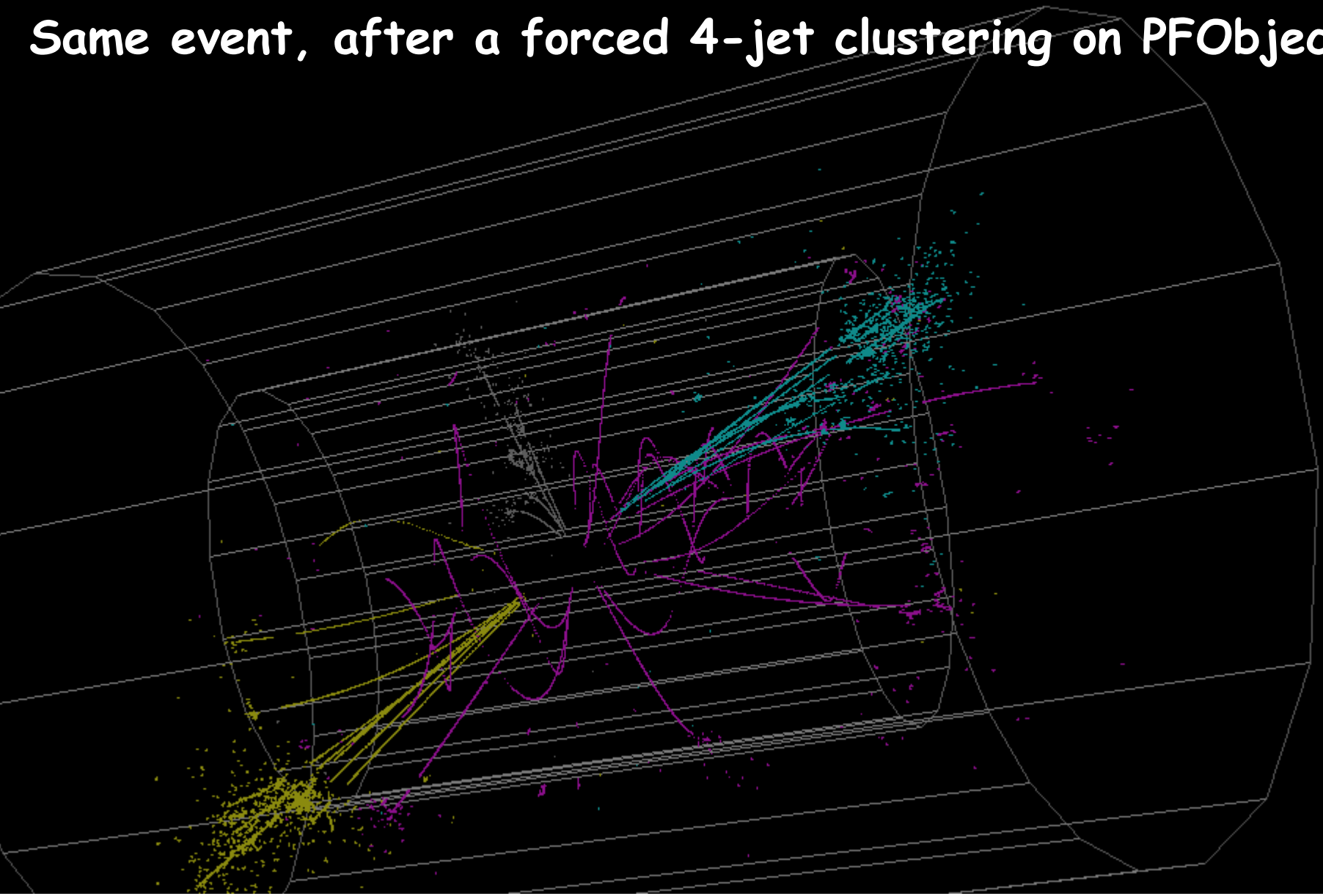


By K.Fujii(KEK), S.Yamamoto(GUAS),
A.Yamaguchi(Tsukuba)

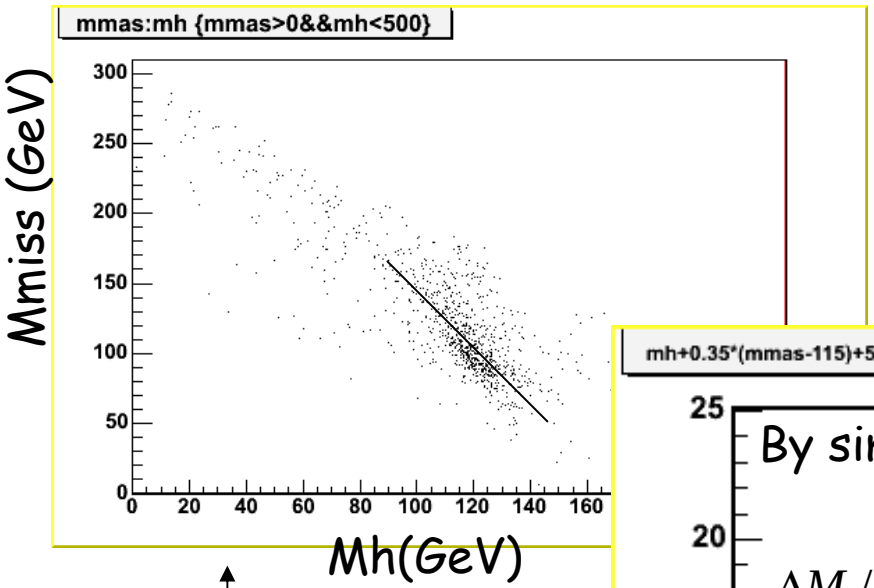
- Exact hit points of TPC and CAL are displayed.
-Hits belong to the same PFO are shown with the same color

-A framework of event display in JSF is used.

Same event, after a forced 4-jet clustering on PFObjects



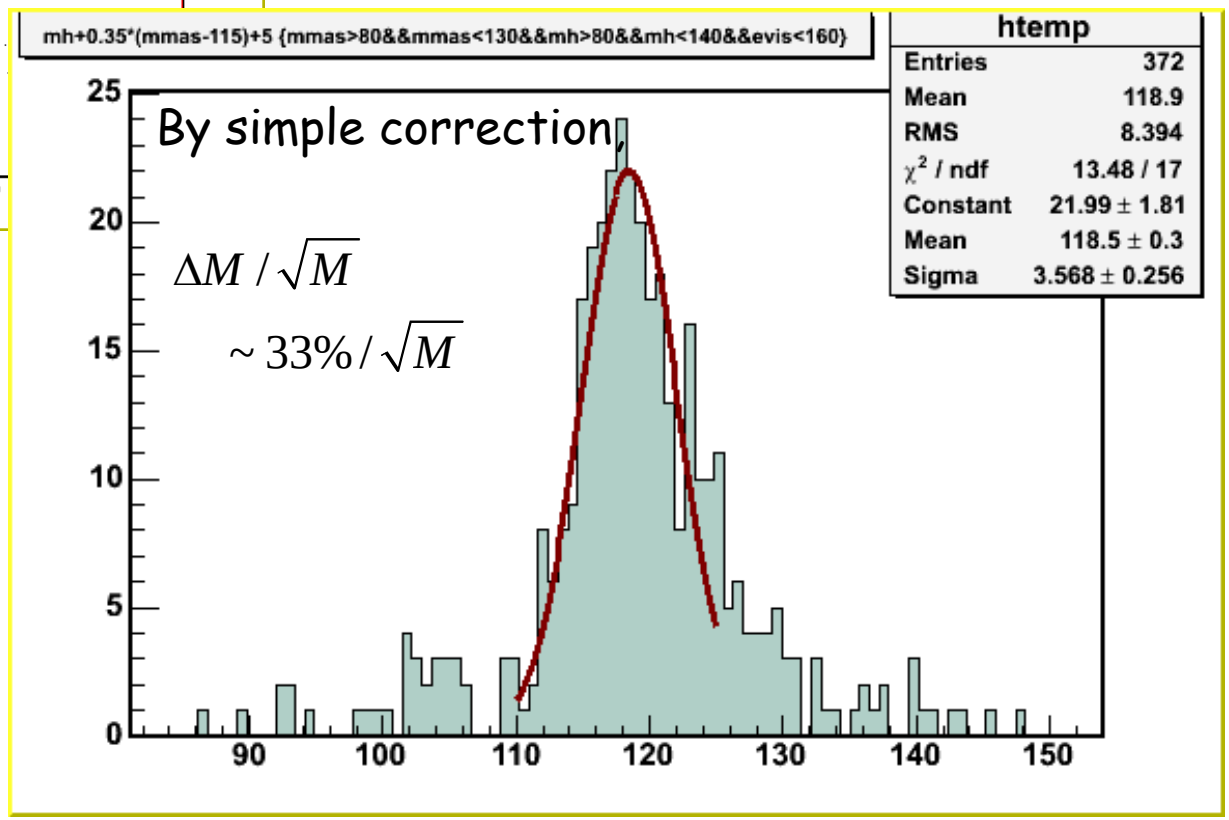
Jet Mass reconstruction



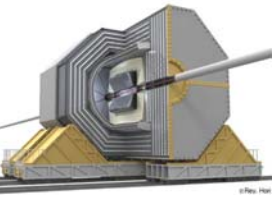
$e^+e^- \to ZH,\ Z \to \nu\bar{\nu}$ at 300GeV

$H \to b\bar{b}, W^+W^-, \tau\bar{\tau}, \ldots.$

Preliminary



Mh depends on Mmiss:
→ Energy correction is not sufficient yet !



Summary

- Full detector simulator, Jupiter, has been updated and many detector geometry are implemented.
- Cheated PFA has been implemented in Satellites and we start to look into jet mass resolution.