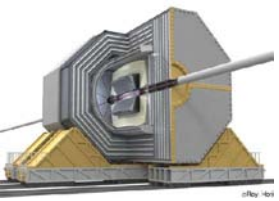# Jupiter/Satellites

Akiya Miyamoto

KEK

Snowmass 2005

23 August 2005

Short summary of work done by

K.Fujii(KEK), T.Fujikawa(Tohoku), K.Kawagoe(Kobe), T.Takeshita(Shinshu), H.Matsunaga(Tsukuba), A.Yamaguchi(Tsukuba), Y.Yamaguchi(Tsukuba), T.Nagamine(Tohoku), S.Yamamoto(GUAS), H.Ono(Niigata), T.Yoshioka(Tokyo), A.L.C.Sanchez(MISIIT), …
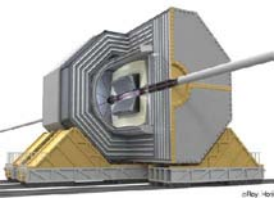
Topics

1. Jupiter
   - interface to geometry data
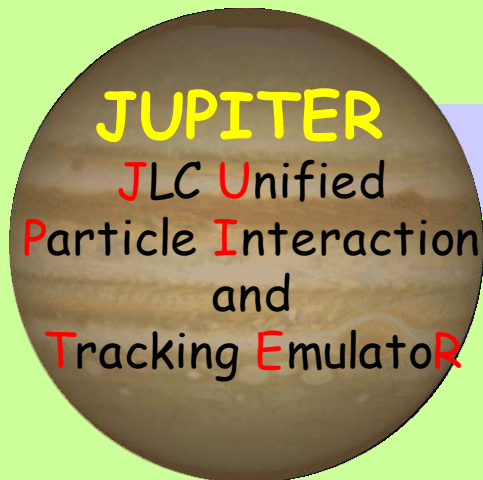   - for background studies

2. Satellites (reconstruction package)
   - PFA : Cheated / Realistic
   - Kalman track fitter

Jupiter/Satellites Concepts

Tools for simulation Tools

For real data

JUPITER
JLC Unified
Particle Interaction
and
Tracking EmulatoR

Geant4 based Simulator

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

MC truth generator
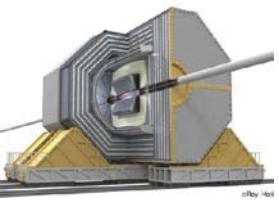
Event Reconstruction

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

Jupiter feature - 1

- Based on Geant4 7.0p1
- Modular organization of source codes for easy installation of sub-detectors
- Geometry
    - parameters (size, material, etc) can be modified by input ASCII file.

- Input:
    - StdHep file(ASCII, Binary), HepEvt, CAIN, or any generators implemented in JSF.

A problem found in reading StdHep binary files

containing secondary vertices

Jupiter feature - 2

- Run mode:
  - A standalone Geant4 application
  - JSF application to output a ROOT file.
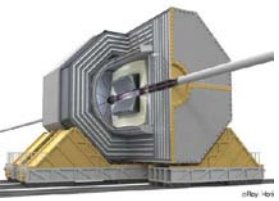- Output:
  - Exact Hits of each detectors (Smearing in Satellites)
  - Pre- and Post- Hits at before/after Calorimeter
    - Used to record true track information which enter CAL.
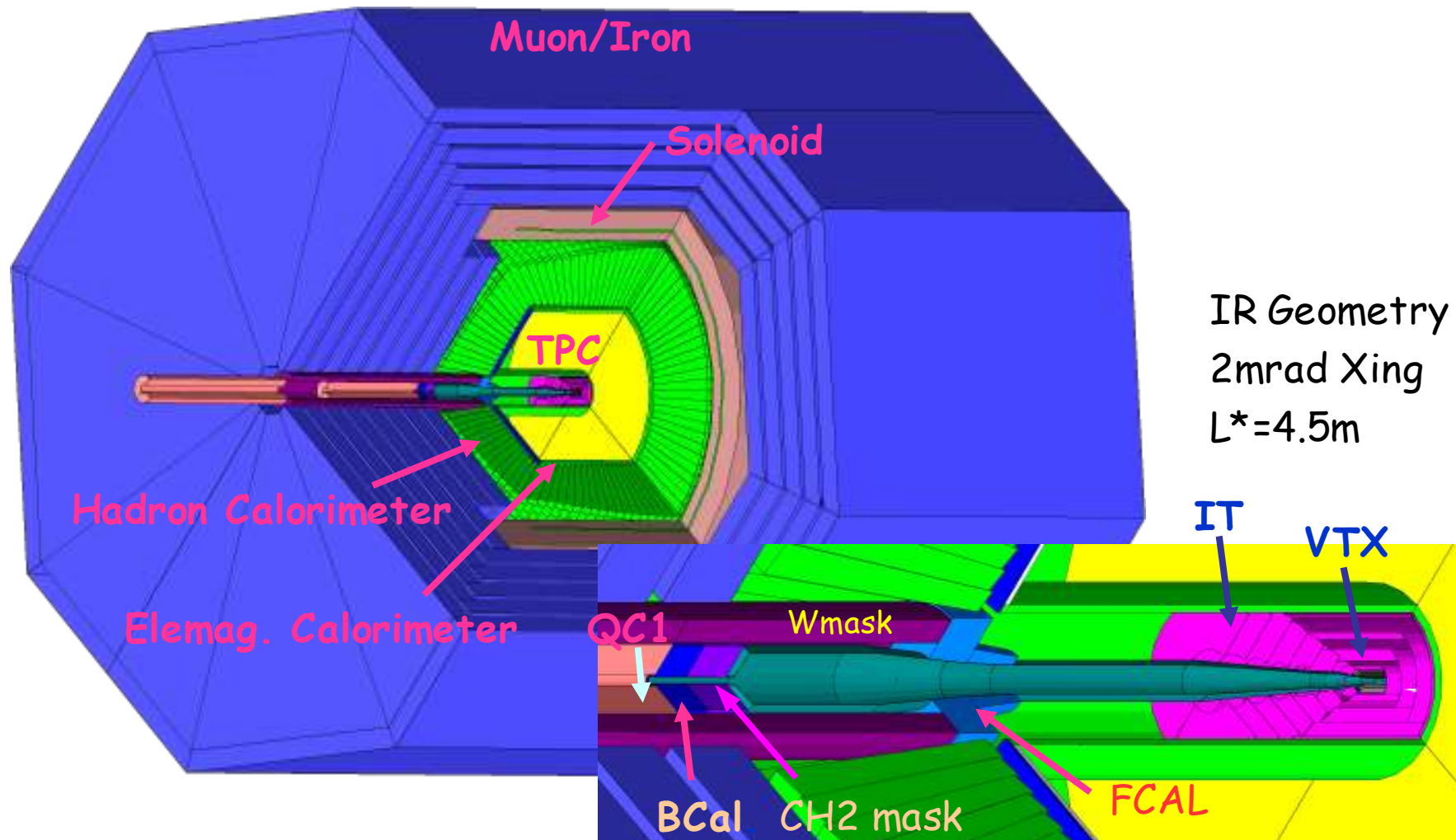 - Format: ROOT (standard), ASCII(debug), LCIO
- Physics List
  - LCPhysicsList
  - QGSP, LHEP, …

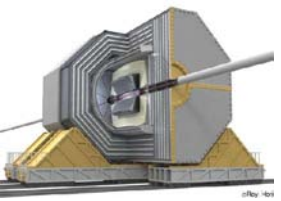 → Calorimeter resolution : Depends on physics list, and not as good as we expected for single particle
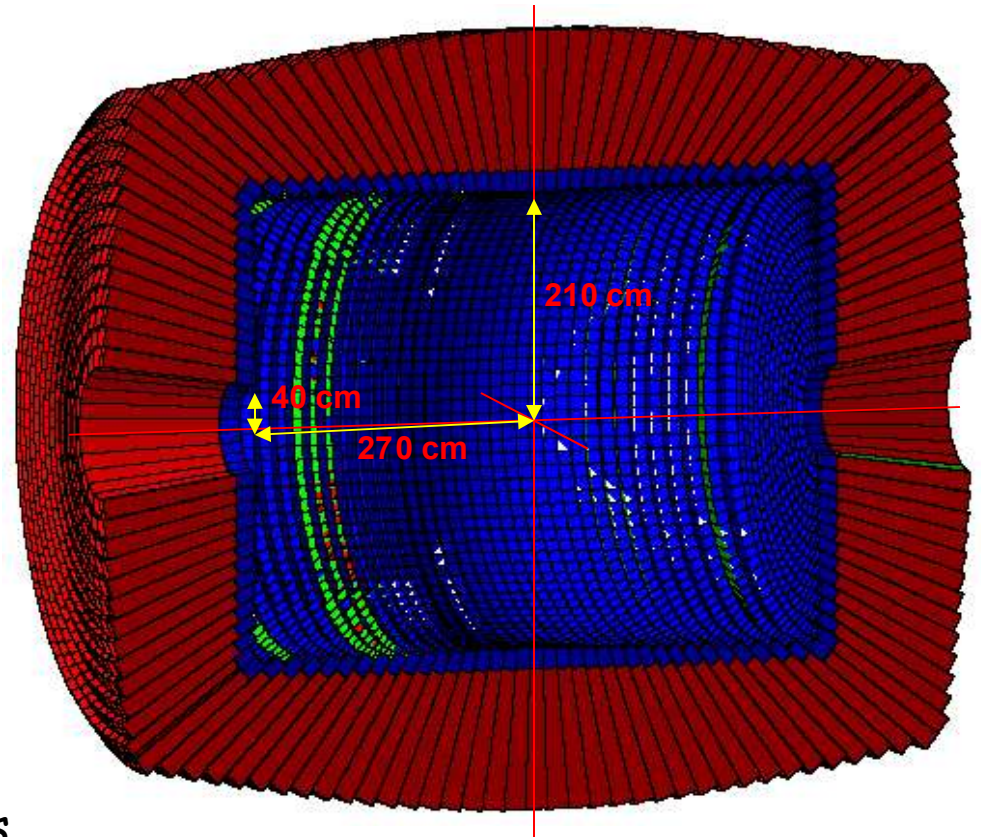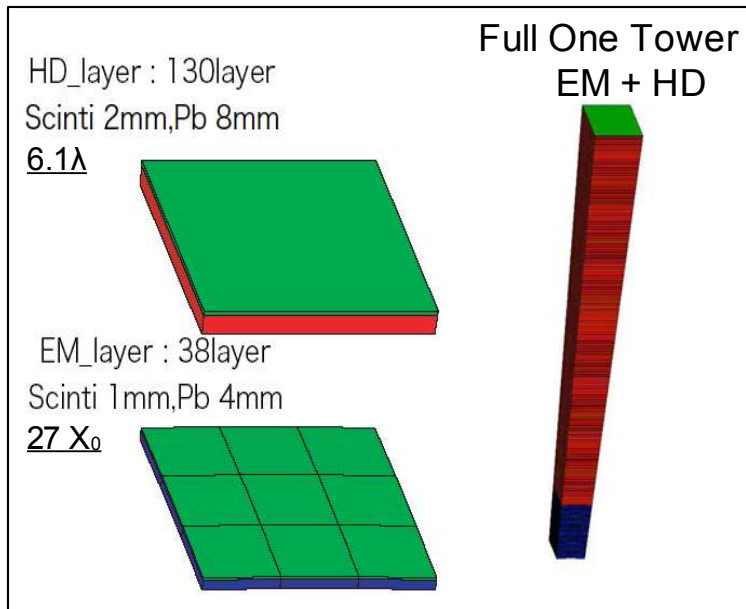
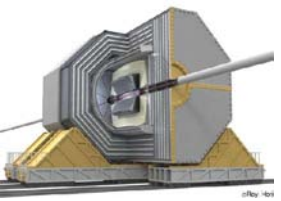# Geometry in Jupiter

Snowmass05 geometry

Muon/Iron

Solenoid

TPC

IR Geometry
2mrad Xing
L*=4.5m

Hadron Calorimeter

Elemag. Calorimeter

IT

VTX

QC1

Wmask

BCal   CH2 mask

FCAL

Calorimeter Geometry

HD_layer : 130layer
Scinti 2mm, Pb 8mm
6.1λ

EM_layer : 38layer
Scinti 1mm, Pb 4mm
27 X_0

Full One Tower
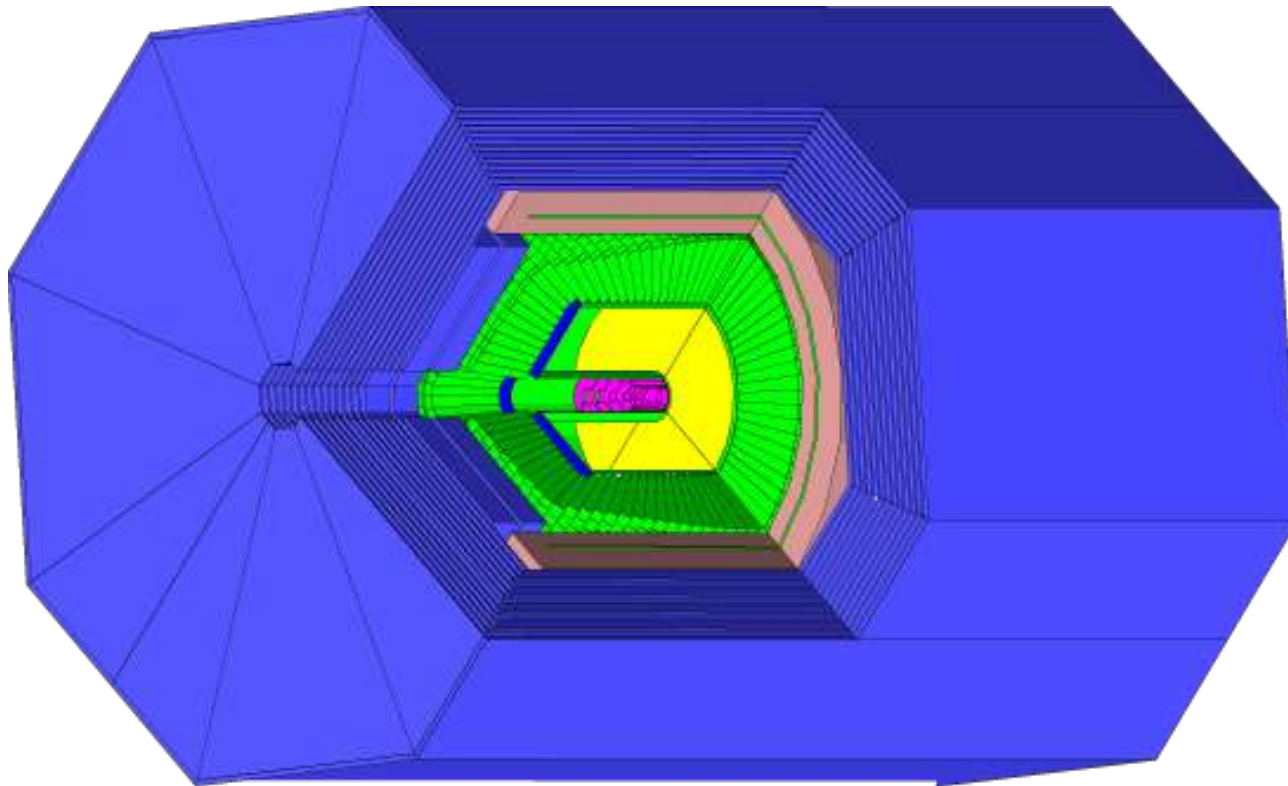EM + HD

210 cm

40 cm

270 cm

- ■ Default sensor size:
  - ➢ EM: 4cmx4cmx1mm, 38 layers
  - ➢ HD:12cmx12cmx2mm, 130 layers
- ■ Replica
  - ➢ Phi direction : Tower and mini-tower
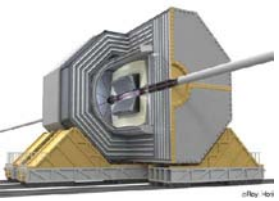- ■ Sandwich structure of X/Y scinti structure can be defined.

"LDC" like geometry in Jupiter

Based on Tesla TDR

Tower geometry for calorimeter

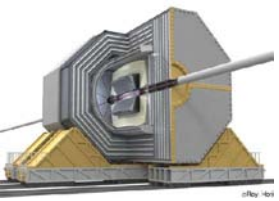"SiD" like geometry is in preparation.

Jupiter for background studies

- **LCBDS**
  - ◆ Developed at U. of Tokyo;Tanabe san, Abe san, and their colleagues.
  - ◆ Geant4 based simulator for the beam delivery and the dump line of ILC (from the exit of main linac to the beam dump)
  - ◆ Inputs to LCBDS :
    - • SAD data file are used to define geometry
      → easy to follow changes of ILC parameters.
    - • Accelerator components are approximated by cubic and/or cylindical shape
  - ◆ Output from LCBDS:
    - • Synchrotron γ's, muons, off-momentum electrons, etc are created
    - • Particles information near the interaction point are saved in StdHep ASCII format → Inputs to Jupiter
  - ◆ Status
   - • First version to write StdHep data were prepared. Waiting for the confirmation by Jupiter.

Jupiter for background studies - 2

- **CAIN**
  - ◆ Simulator for beamstrahlung effects
  - ◆ Generates low energy e+/e-, g, and off-momentum electrons
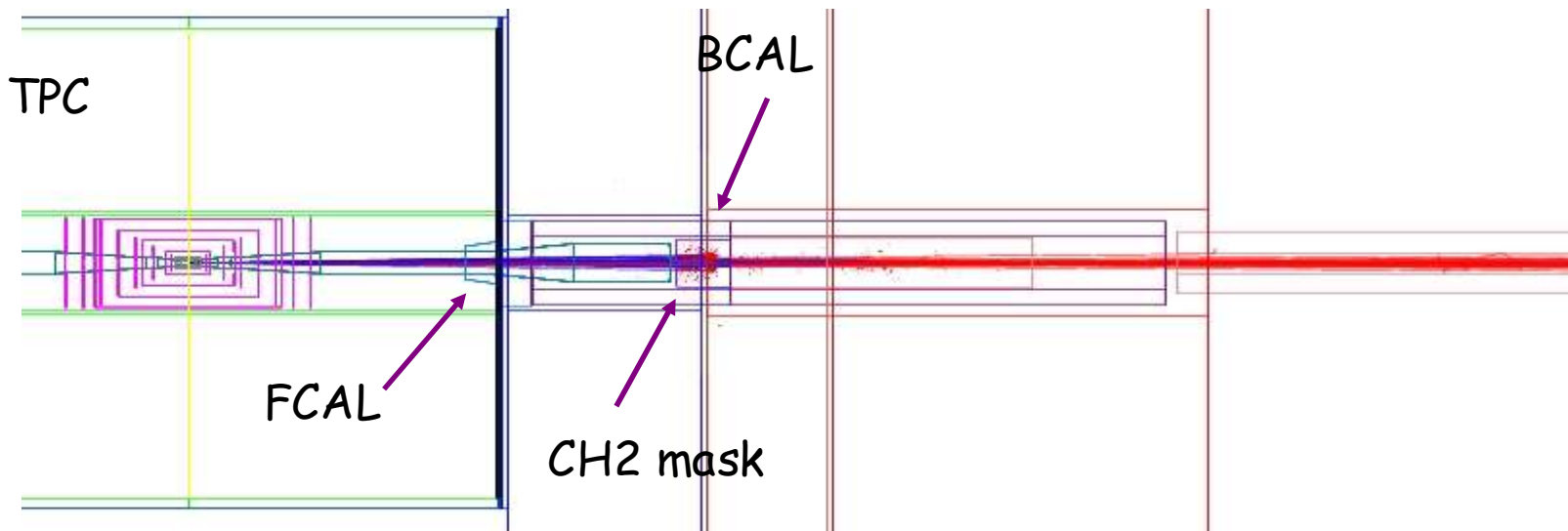 - ◆ Interface to CAIN data exists in Jupiter

- **IR geometry**
  - ◆ Several files depending on options
    - • Crossing angle: 2mrad/20mrad
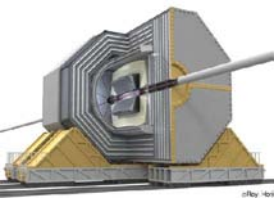   - • Beam pipe radius etc: lumosity option – nominal, high lum.
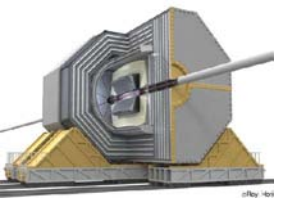
100 e+/e- CAIN events
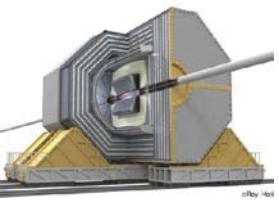1 bunch contains ~ 66k events
ILC 500 GeV nominal parameter
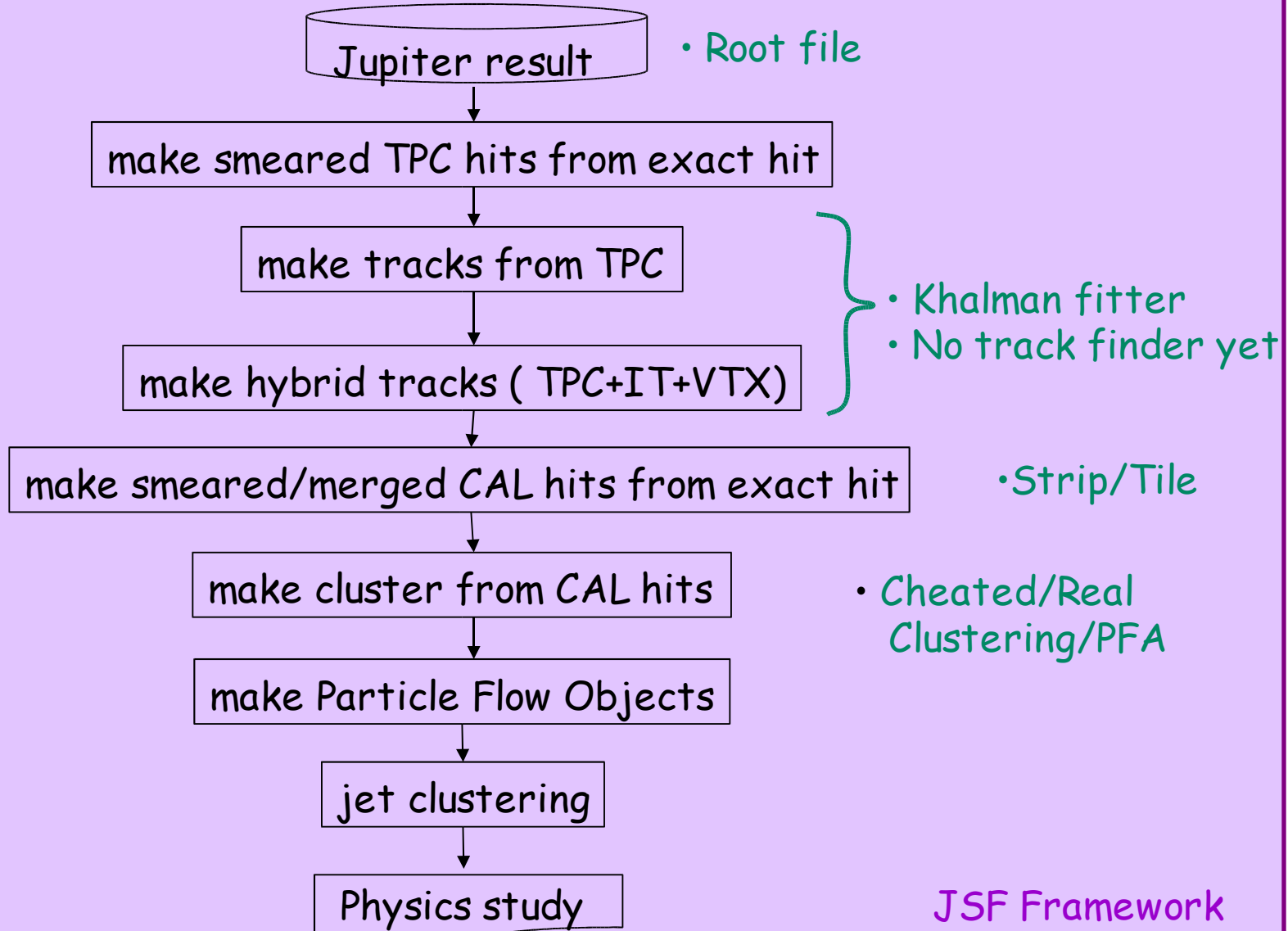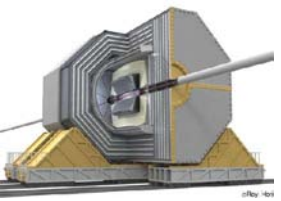

background study in progress!

Metis package

- Metis is a collection of reconstruction tools for Jupiter data.
- Initial aim was to prepare a minimum set of Metis modules for studies of Particle Flow Algorithm.
- Novice users will be able to do physics analysis using information of PFO classes.
- As a first step, a cheated track finder and a cluster maker, etc are in preparation in order to know ultimate performance.

- Each module is independent, thus it is easy to implement different reconstruction algorithms
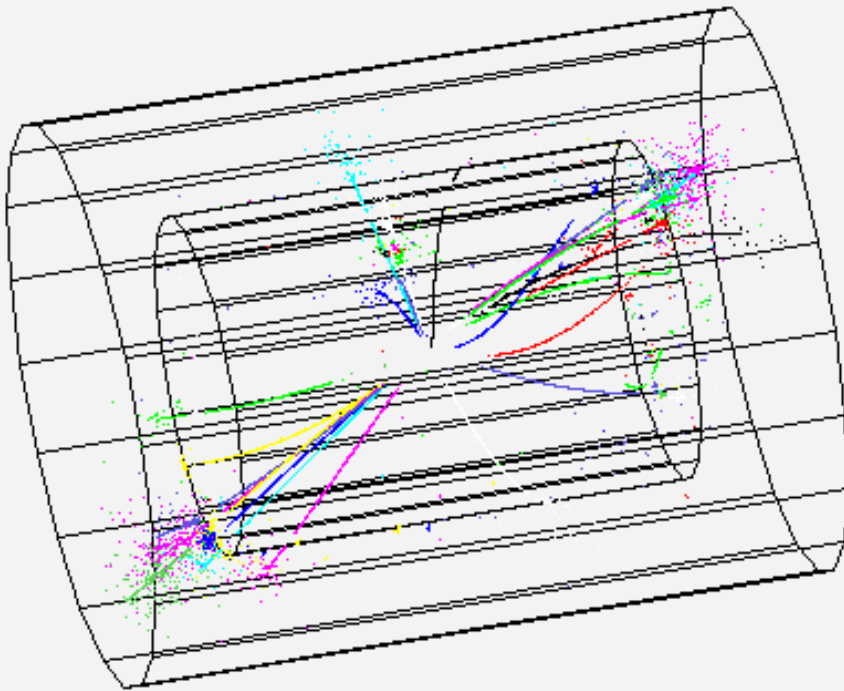 - → Real clustering codes are prepared using this framework

Metis Analysis

Jupiter result — • Root file

↓

make smeared TPC hits from exact hit

↓

make tracks from TPC ⎫
                      ⎬ • Khalman fitter
make hybrid tracks (TPC+IT+VTX) ⎭ • No track finder yet

↓

make smeared/merged CAL hits from exact hit — •Strip/Tile

↓

make cluster from CAL hits — • Cheated/Real Clustering/PFA

↓

make Particle Flow Objects

↓

jet clustering

↓

Physics study

JSF Framework

Cheated PFO analysis

ZH event at Ecm=500 GeV

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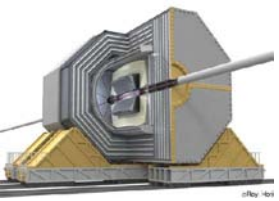 are shown with the same color

-A framework of event display
 in JSF is used.

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

Web information

- Our software tools are maintained in CVS server,jlccvs.kek.jp.
- At http://jlccvs.kek.jp/,
  - Description about how to download latest version.
  - Web interface to the CVS repository,
    - http://jlccvs.kek.jp/cgi-bin/cvsweb.cgi/
  - Snap shot of source codes.
    - http://jlccvs.kek.jp/snapshots/

- SimTools: binary codes of our tools
  - Web page: http://acfahep.kek.jp/subg/sim/simtools/index.html
  - Examples and documents are also prepared.
  - The latest version: SimTools-1-02 (Aug, 2005).
- GLD Software page:
  - http://ilcphys.kek.jp/soft/index.html

Summary

- Studies of detector performances based on Jupiter/Satellites have been performed by many people, which are covered by other parallel session talks.

- Implementation of new geometry in Jupiter has started for studies of background and IR design.