Software Status for GLD Concepts

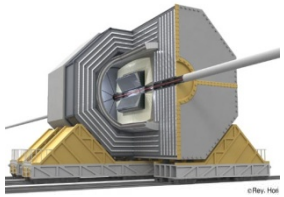
Akiya Miyamoto

31-October-2007

ILD Optimization Meeting

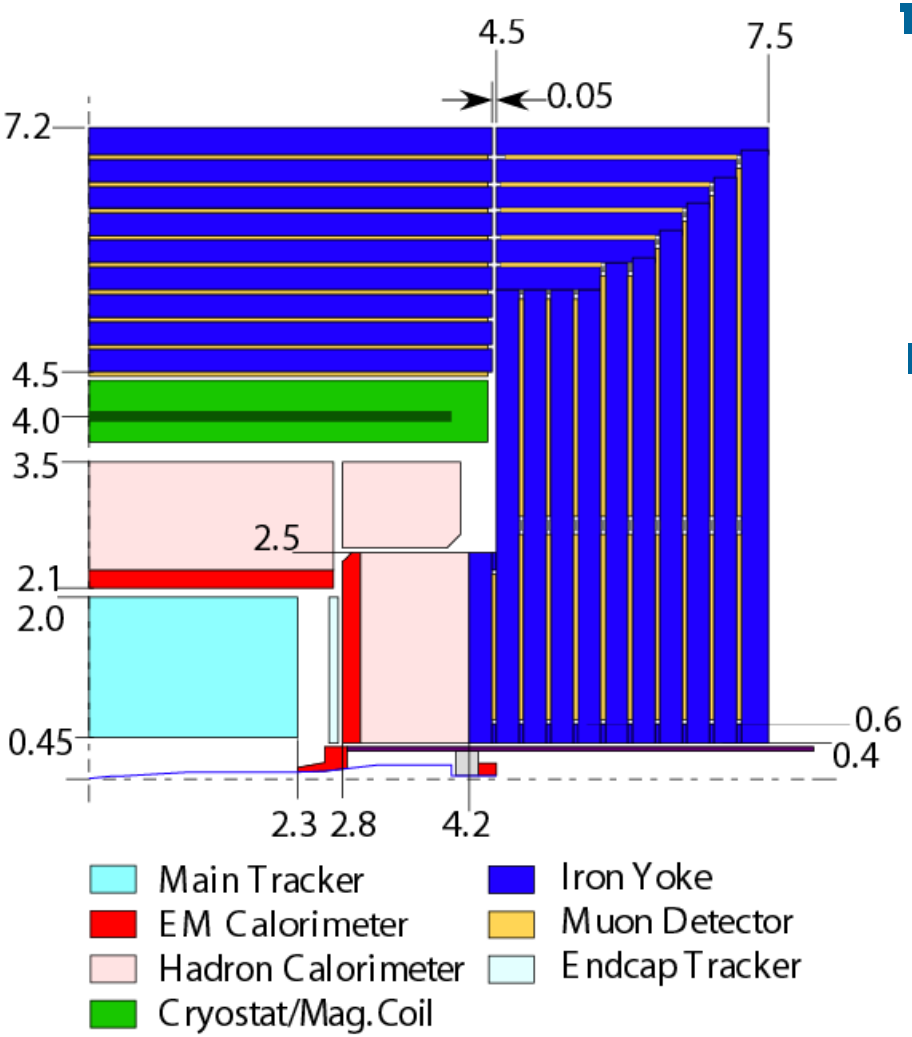
References:

- Y.Sugimoto, "GLD and GLDc", talk at ALCPG07, ILD meeting
- T.Yoshioka, "LCIO interface and study by PandoraPFA", talk at ALCPG07, Simulation session



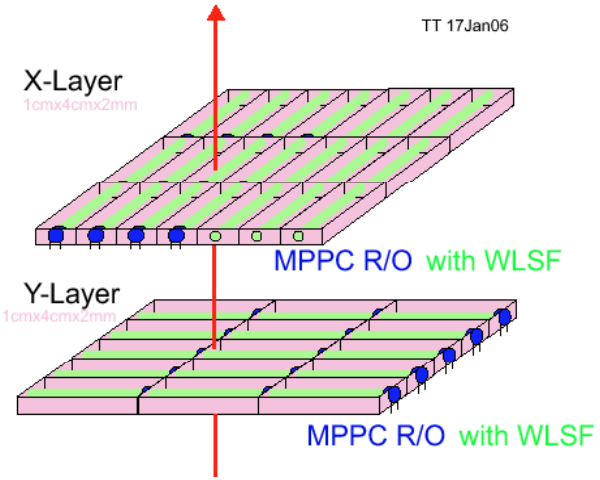
GLD Configuration

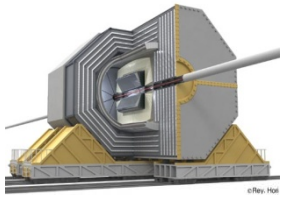
GLD Side view



- Moderate B Field : 3T
- R(ECAL) ~ 2.1m
  - ECAL: 33 layers of
    3mm^t W/2mm^t Scint./1mm^t Gap
  - HCAL: 46 layers of
    20mm^t Fe/5mm^t Scint./1mm^t Gap
- Photon sensor: MPPC ~O(10M) ch.

Configuration of sensor is one of the R&D items





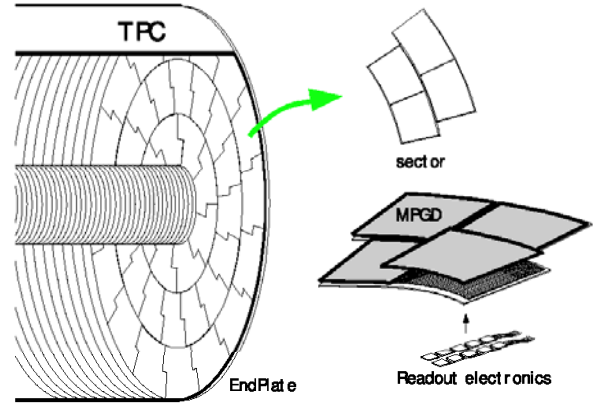
GLD Configuration - 2

TPC:

R: 0.45→2.0m, ~200 radial sample

Half Z: 2.3m

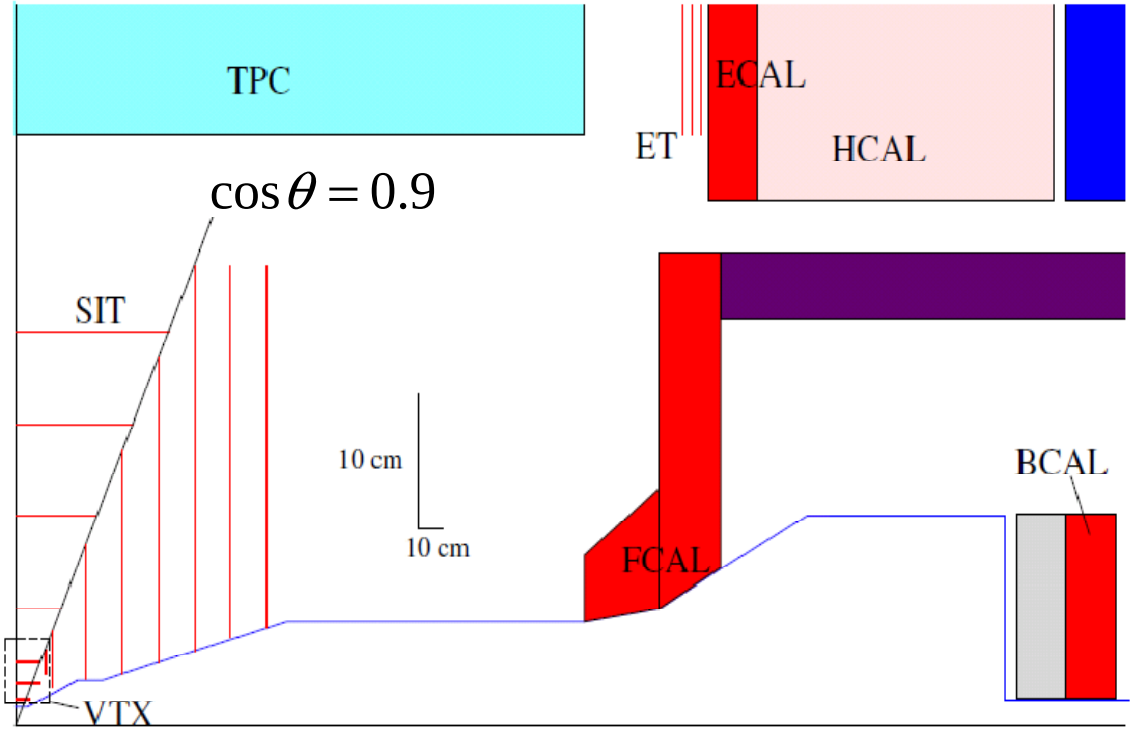
MPGD readout: $\sigma_{r\phi}$<150μm



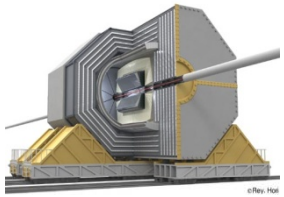
VTX:

Fine Pixel CCD: ~5x5mm^2

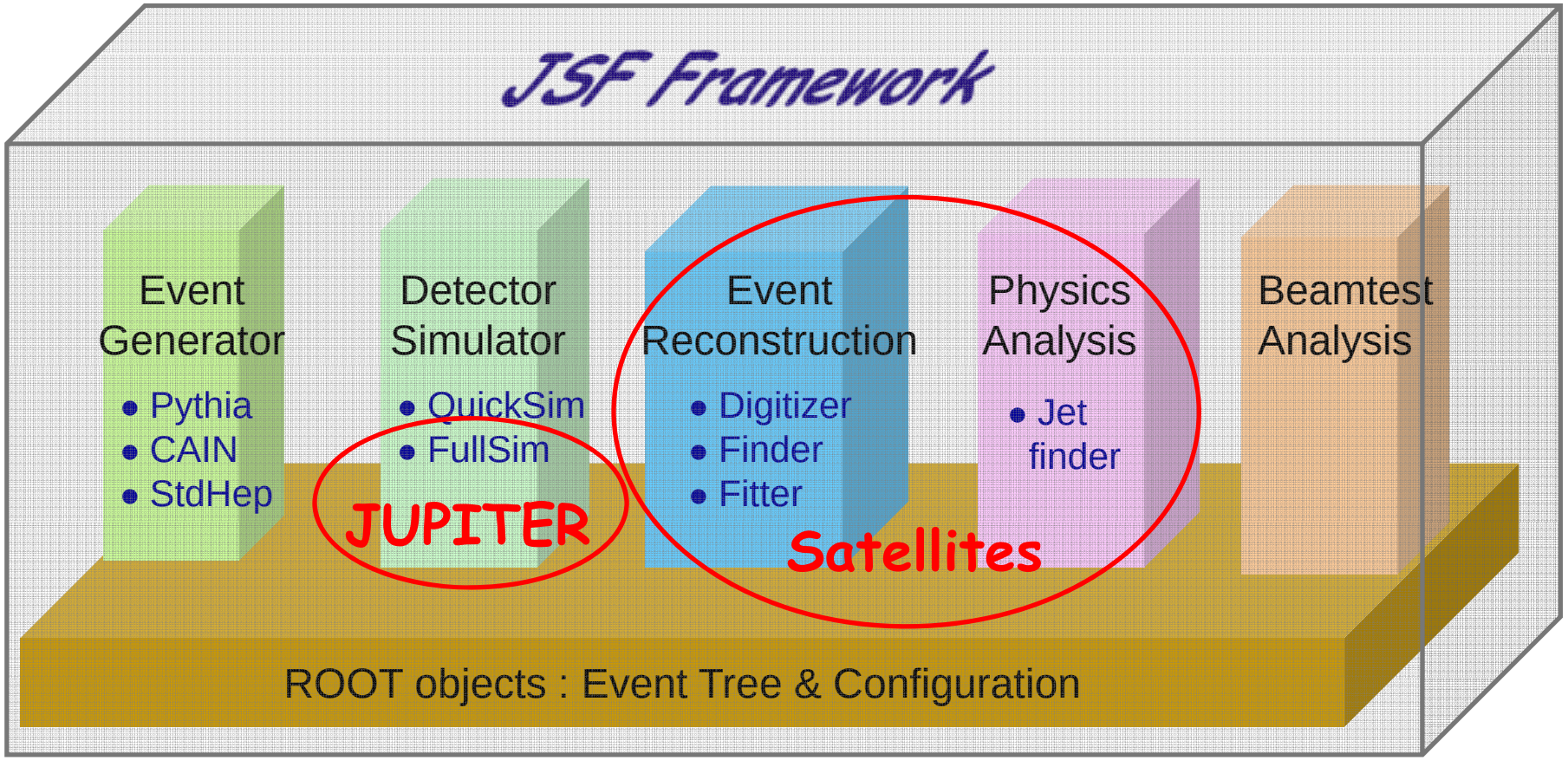
2 layers x 3 Super Layers



- SIT: Silicon Strip Barrel/Endcap



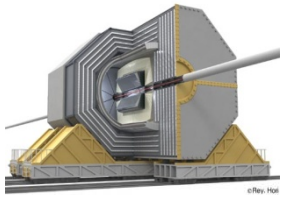
Our software tools



- Link to various tools at http://acfahep.kek.jp/subg/sim/soft
- GLD Software at http://ilcphys.kek.jp/soft
- All packages are kept in the CVS. Accessible from http://jlccvs.kek.jp/

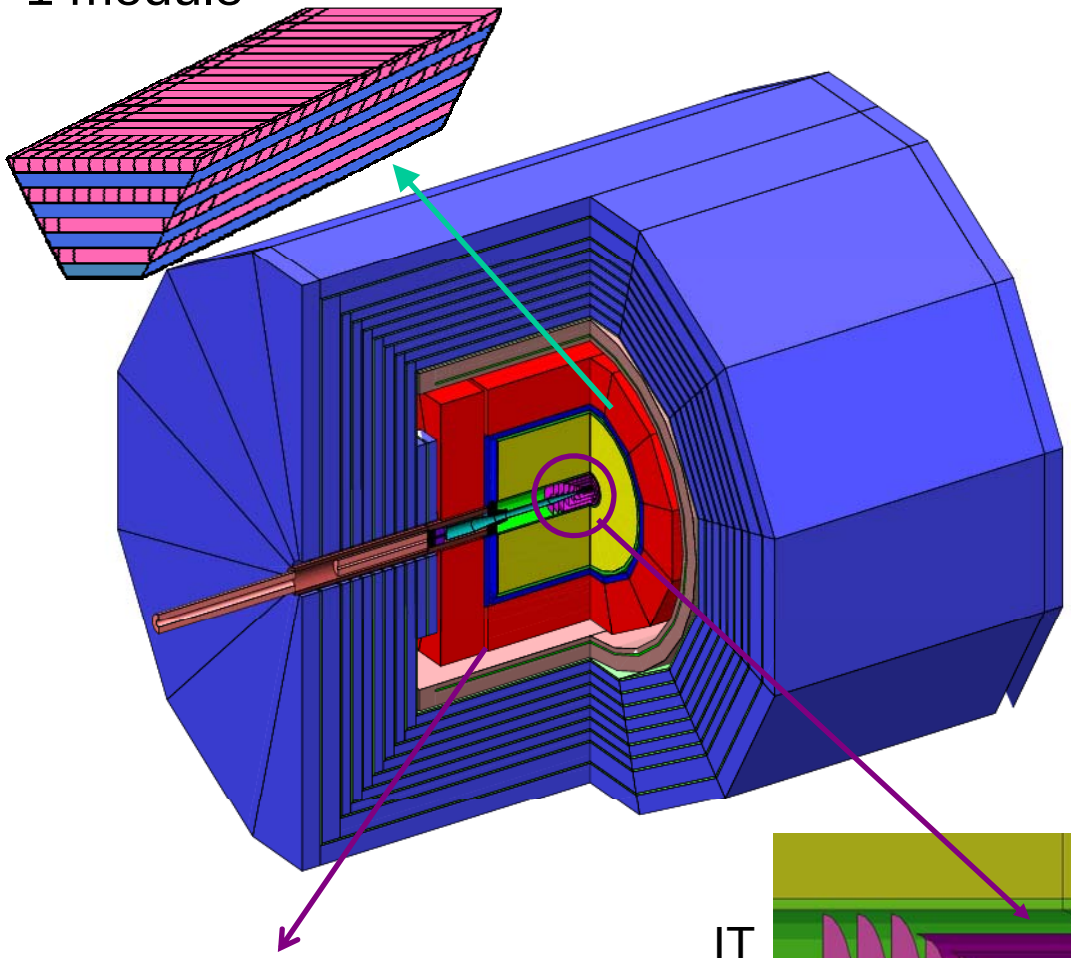
Jupiter

- Geant4.8.2p01 has been used. Updating to Geant4.9.0p01 in progress. (hard to remove infinitely small step length in tracking)
- Generator inputs:
  - ROOT (JSF) format is a default. Can read CAIN background data.
  - StdHep file: Single particle and qqbar events OK. But ttbar events was not good.
- Physics List:
  - J4PhysicsList (taken from genat4 examples)
  - LCPhysicsList tried. But has not been seriously tested.
- Geometry:
  - Parameters in ASCII file are read in at run time.
  - Different B Field, Rin(ECAL), etc. had been tried.
    So, change detector parameters are easy if detector topologies are same.



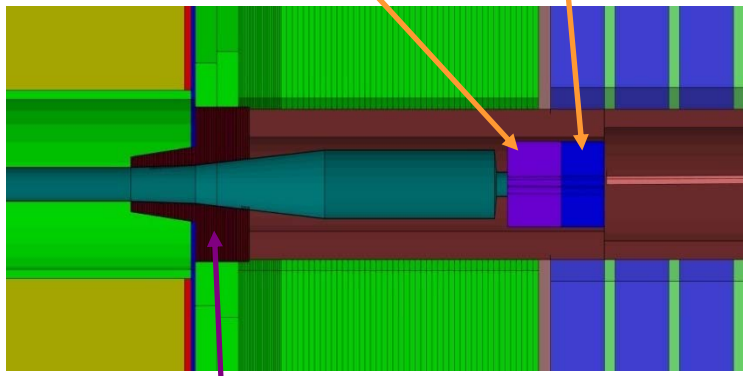
GLD Geometry in Jupiter

1 module



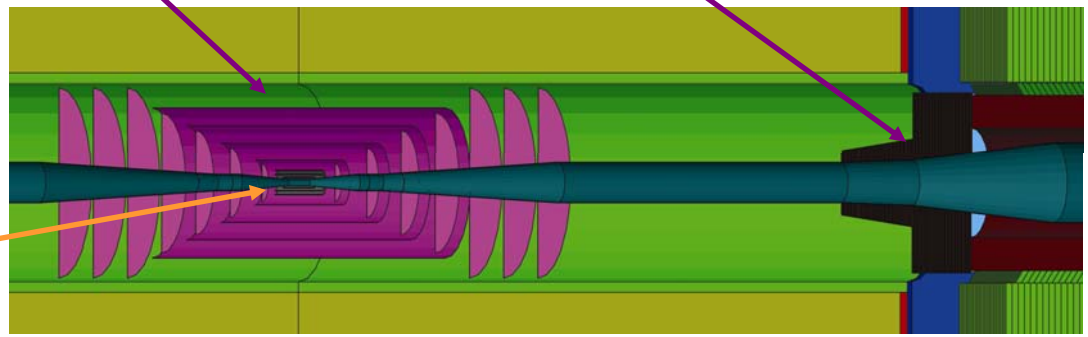
CH2mask

BCAL



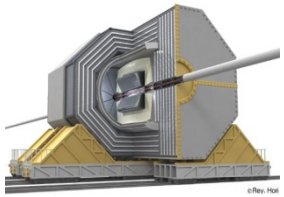
FCAL

IT



VTX

Include 10cm air gap
as a readout space



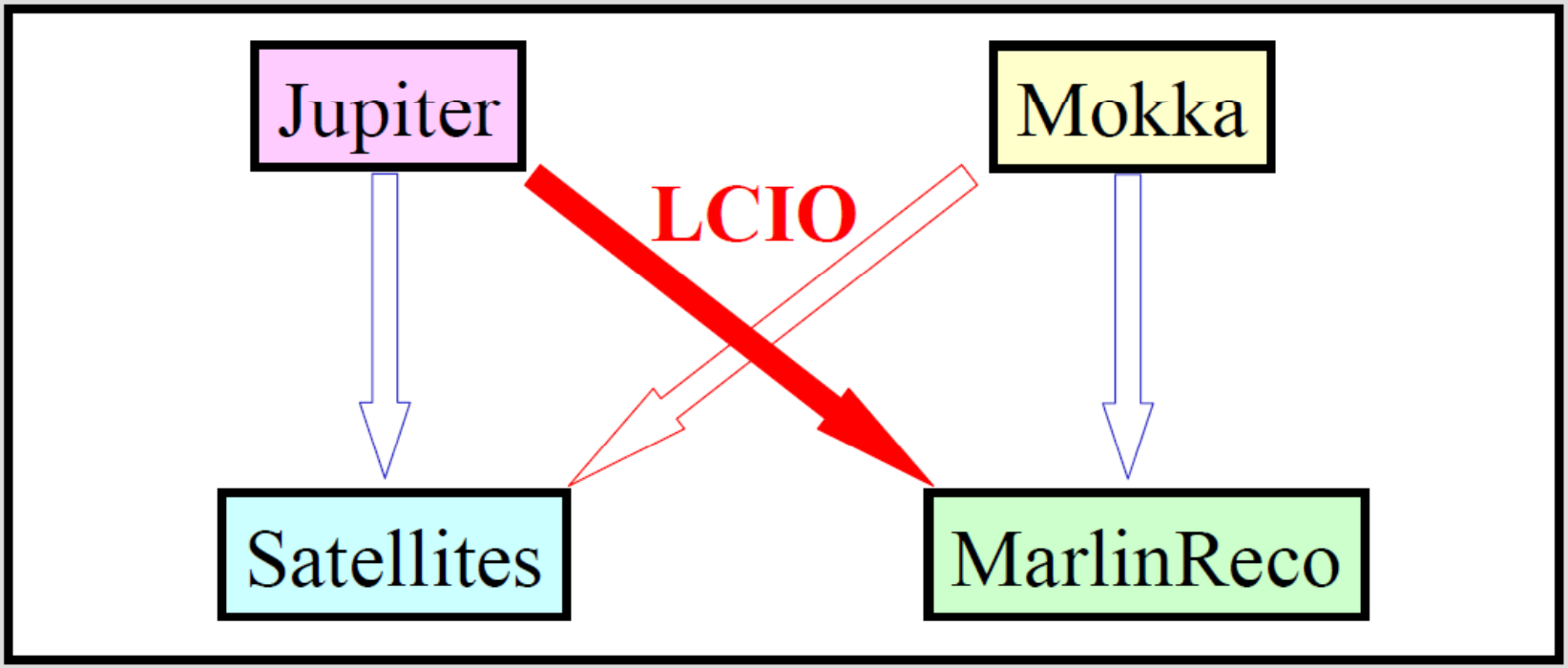
Satellites package

- Satellites is a collection of reconstruction tools for Jupiter data.
- Run as a JSF module, i.e,
  - Jupiter data and reconstructed results are saved in a ROOT tree.
  - Each module is relatively independent, thus easy to implement different reconstruction algorithm according to user interests
- Package includes
  - IO: Geant4 objetcs to ROOT objects/ Interface to LCIO
  - Hit digitizer: Mostly simple smearing of exact hits

    CAL hit maker : include a cell signal merger for strip configuration
    Run Jupiter with 1cmx1cm tile size and merge cell signals in Satellites
  - Cheated track finder and Kalman fitter for TPC, IT, and Vertex
  - Cheated PFA
  - Realist PFA (GLD-PFA)
  - Jet clustering

LCIO Interface

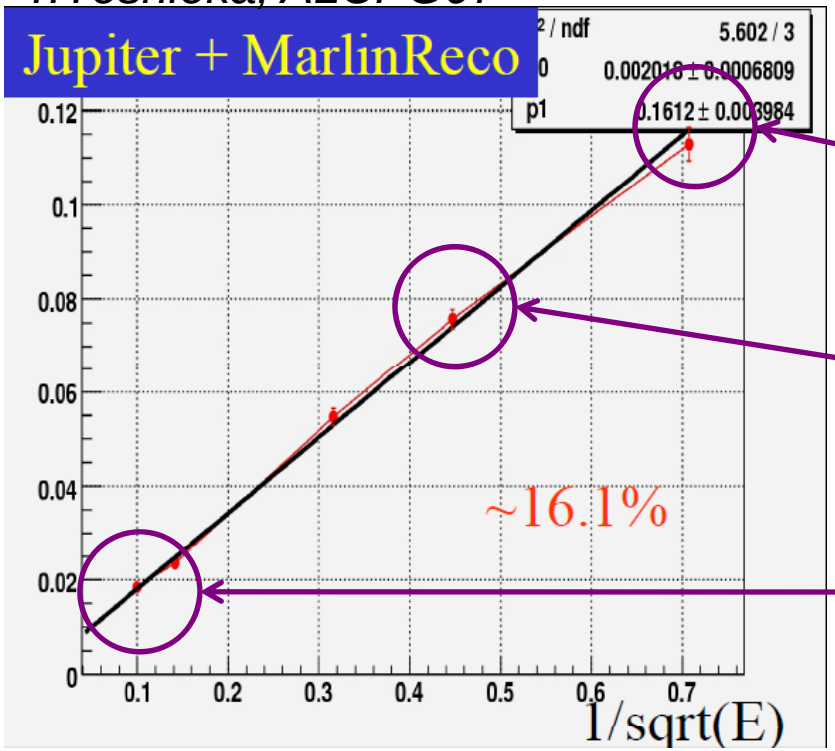
- An interface which converts Jupiter output to LCIO format has been successfully implemented.



Performance of single particles, Z→qqbar and Zh events were checked by using the MarlinReco and PandoraPFA.

Analyze same γ Jupiter events by MarlinReco and Satellites

T.Yoshioka, ALCPG07



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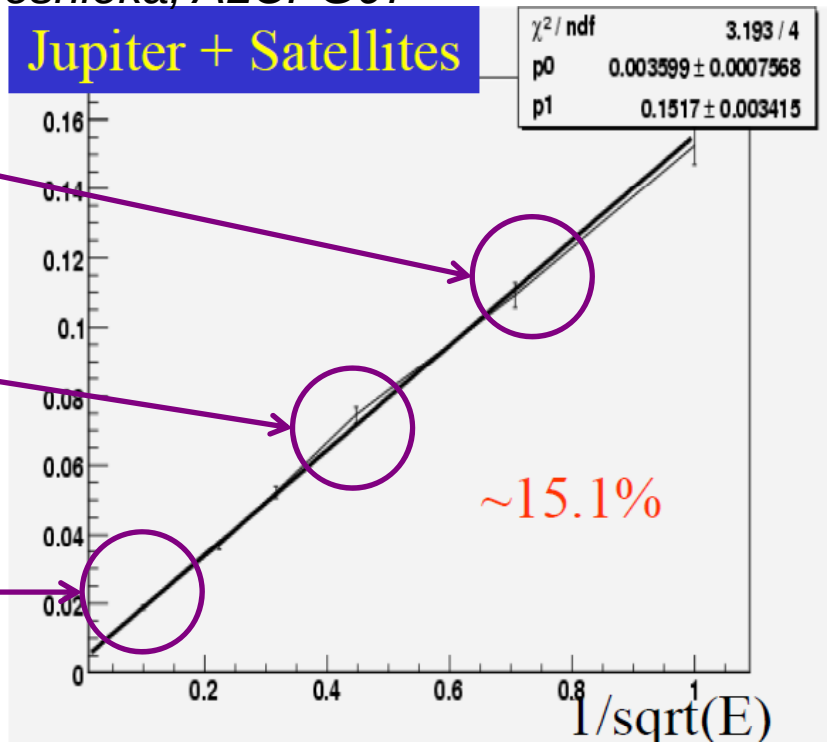
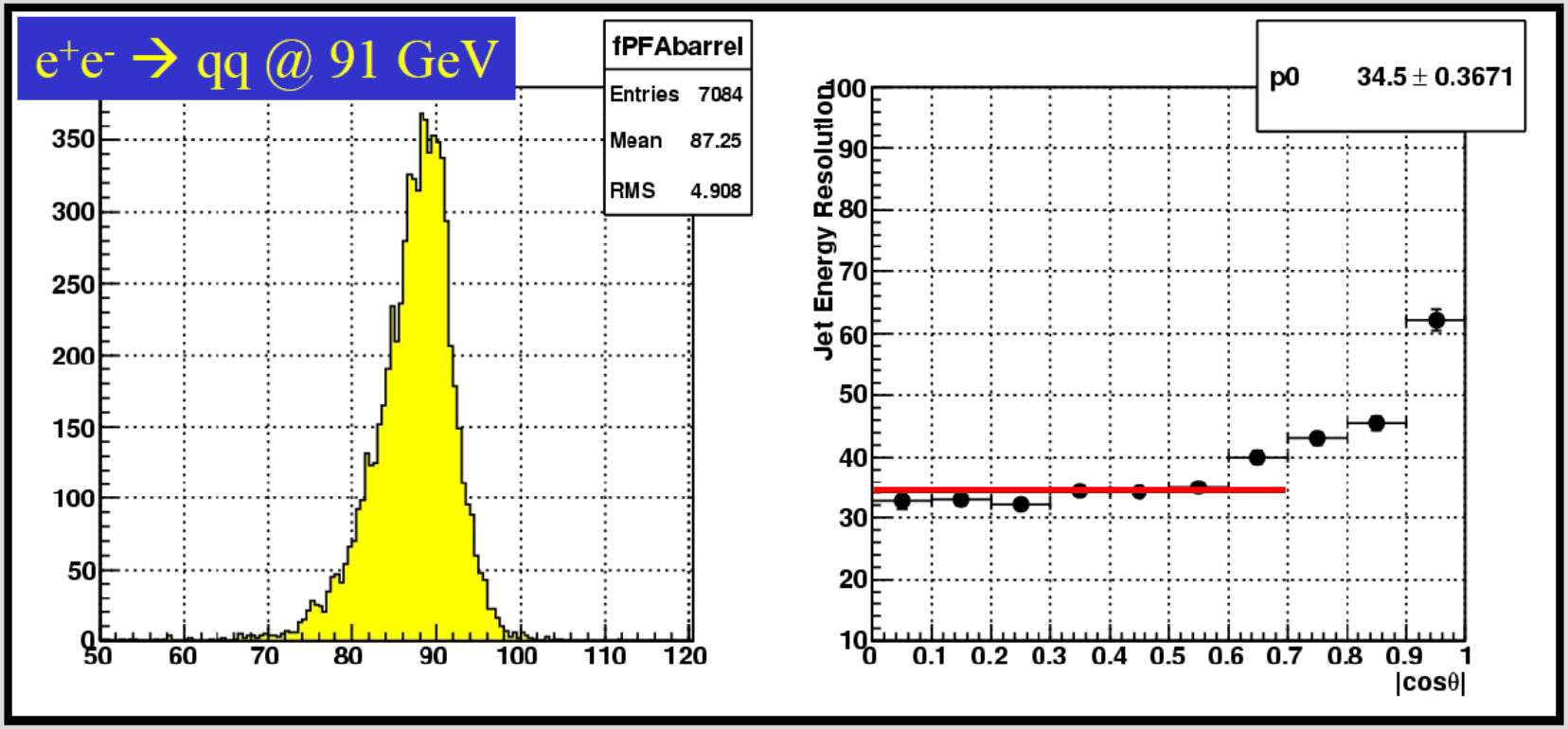


- Plots of calorimeter energy sum
- Resolutions obtained by Satellites and MarlinReco are consistent
- Consistency check of event-by-event basis is yet to be studied

Pandora Performance (1)



- Jet energy resolution is obtained to be ~34%/$\sqrt{E}$ in barrel region.
- Worse resolution in the EndCap region.

For Z0 events, Satellites and GLD-PFA resolution is ~30%/Sqrt(E)
For Higher energies (350 GeV), Jupiter-PandoraPFA performs better than GLD-PFA
Need more studies to understand consistencies and differences.

GRID in Japan

- GRID for ILC in Japan has been operational since late 2006.

- KEK, Tohoku Univ. and Kobe Univ. are members of ILC-VO.
  Kobe Univ. is a member of CALICE-VO
  KEK-CC supports both IILC-VO and CALICE-VO

- KEK is operating WLCG production sites.
  Resources we have are very limited, but 955 jobs/570 CPU hours have been used in ILC-VO at KEK.

- File transfer:
  - Tape access and security setting had been problems
  - After resolving these problems
    DESY→KEK transfer speed (for replica) is several MB/sec
  - Sample Jupiter data are put on /grid/ilc/users/miyamoto/….)

- JSF/Jupiter/Satellites on GRID are under preparation.
  - Tests Jupiter jobs for SLC3 systems are now running at KEK-Grid

Summary

- Jupiter-LCIO interface is ready
  for studies based on GLD'/LDC'.

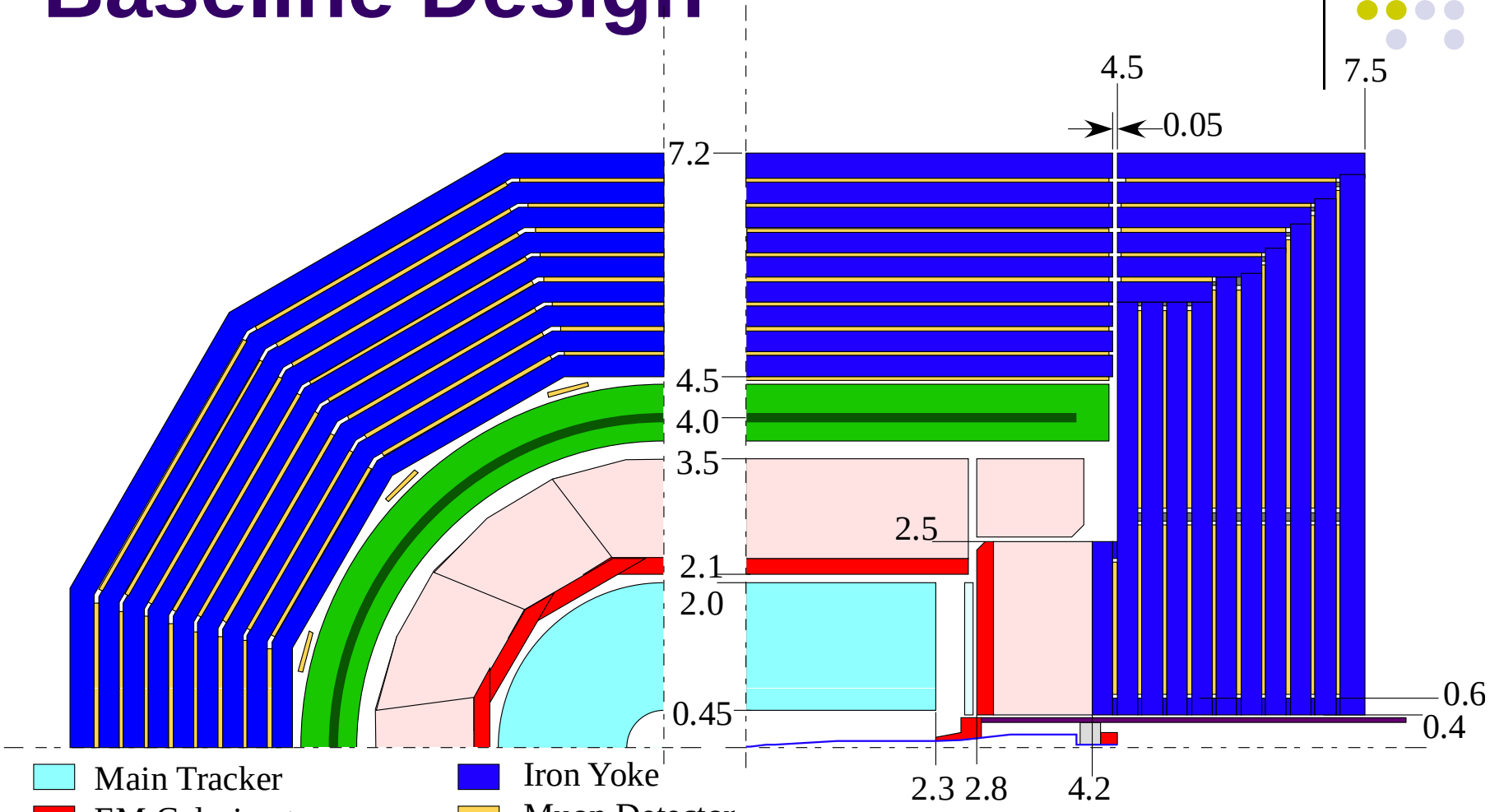
- We are developing tools for ILC studies on GRID

Backup Slides

GLD

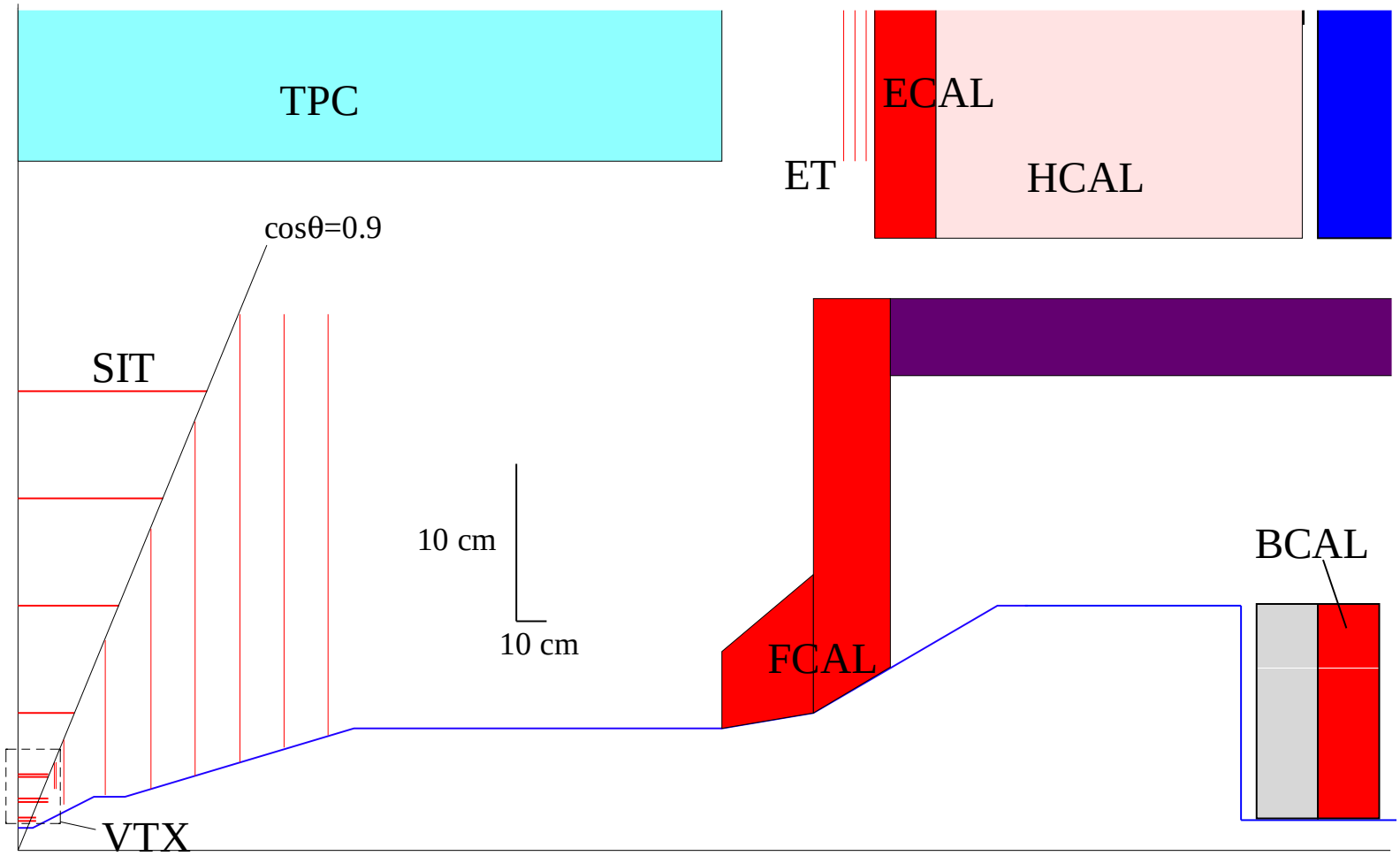
Baseline Design

Y.Sugimoto, ALCPG07



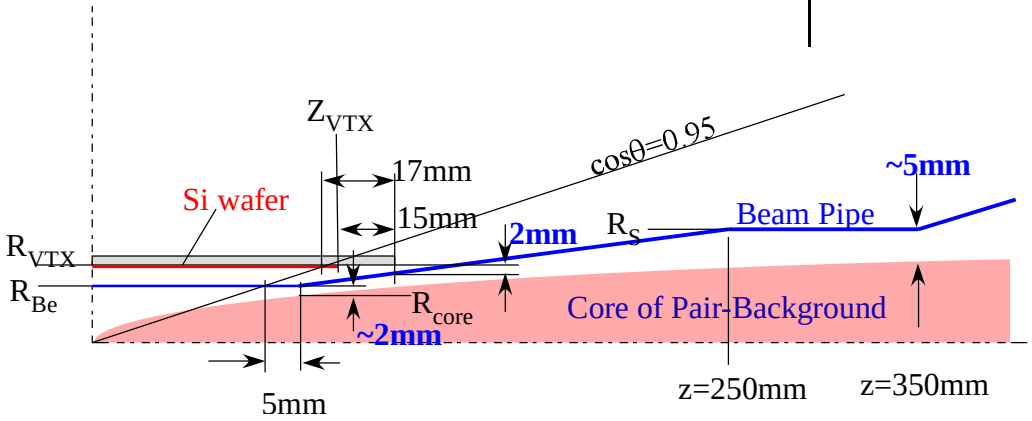
Return yoke design modified from DOD to reduce the total size of the detector and exp-hall size

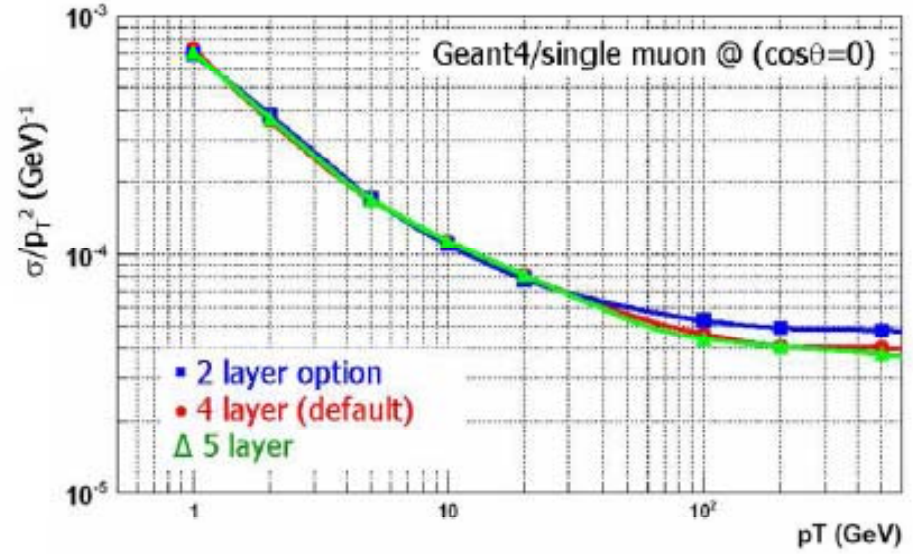
Baseline Design

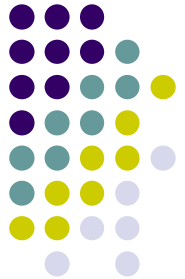


Detector Parameters

- VTX
  - 6 layers (3 doublets)
  - R=20(18) mm – 50 mm (Strongly depends on machine parameters)
  - Fine pixel CCD as the baseline design
- SIT
  - DSSD, 4 layers, R=9 - 30 cm
  - 7 discs in forward region, Z=15.5 - 101.5cm
  - Bunch ID capability
- TPC
  - R=45 cm – 200 cm
  - Z=230 cm

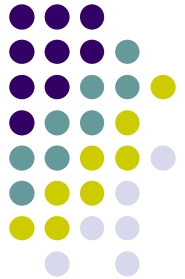






Detector Parameters

- ECAL
  - W/Scintillator/Gap = 3/2/1 mm
  - 33 layers
  - 1cmx4cm scintillator strips, w.l.s. fiber+MPPC (SiPM) readout
  - 2cmx2cm scintillator tile as an option
  - 26 X_0, 1 λ
- HCAL
  - Pb(Fe)/Scinti./Gap = 20/5/1 mm
  - 46 layers
  - 1cmx20cm scintillator strips + 4cmx4cm scintillator tile, w.l.s. fiber+MPPC readout
  - 5.7 λ
- Muon detector
  - 8/10 layers in 4-cm gaps between 25-30 cm thick iron slabs of return yoke
  - X-Y scintillator strips with w.l.s.fiber+MPPC readout



Detector Parameters

- PFA

	GLD	LDC	SiD
B (T)	3	4	5
R_{CAL} (m)	2.1	1.6	1.27
p_t^{min} in CAL (GeV/c)	0.95	0.96	0.95
B R^2_{CAL} (Tm^2)	13.2	10.2	8.1
t_{HCAL} (λ)	5.7	4.6	4
E_{store} (GJ)	1.6	1.7	1.4
R_{Fe} (m)	7.2	6.0	6.45