Status and plans of reconstruction and core software tools

summary from software pre-meeting

Frank Gaede
DESY

ILD Meeting
Paris, Jan 28-30, 2009

detector R&D plan for DBD 2012

Guideline for the Plan of the detector groups

1. **Continue R&Ds on critical components to demonstrate proof of principle**
2. **Define a feasible baseline design**
   (Options may also be considered. But one of them should be proven to be feasible.)
3. **Complete basic mechanical integration of the baseline design accounting for insensitive zone**
   (such as support structure, pipes, power lines etc.)
4. **Develop a realistic simulation model of the baseline design, including faults and limitations**

- in getting the software ready for the DBD 2012 we need to address pts. 4. and 7./8. of RDs roadmap !
- ILD software groups also has made plans for software !

Guideline (cont'ed)

5. **Develop a push-pull mechanism working with relevant groups**
6. **Develop a realistic concept of integration with the accelerator including the IR design**
   5&6: with GDE's BDS group through the MDI group
7. **Simulate and analyze benchmark reactions, which can be updated**
8. **Simulate and analyze some reactions at 1 TeV, including realistic higher energy backgrounds demonstrating the detector performance.**
   8&9: Based on the work of the Physics Group and Software group.
   The reaction will be chosen to show the strength of ILC compared to other facilities.

slide with plans shown at last ILD meeting in Albuquerque 09/2009:

Plans for ILD software

- at Cambridge decided to move towards common ILD software framework - developed plans in
- (bi)weekly ild-sw-mgmt meetings
- dedicated ILD software workshop in Tsukuba 2009
- bi-weekly software WG meetings:
  - merge goodies from JSF into framework
  - develop a test system
  - develop new GRID production system
  - improve the geometry description
  - improve the reconstruction (tracking & PFA)
  - develop LCIOv2
  - improve the simulation

Frank Gaede, DESY, ILD Meeting 2009, Albuquerque 1.10.2009

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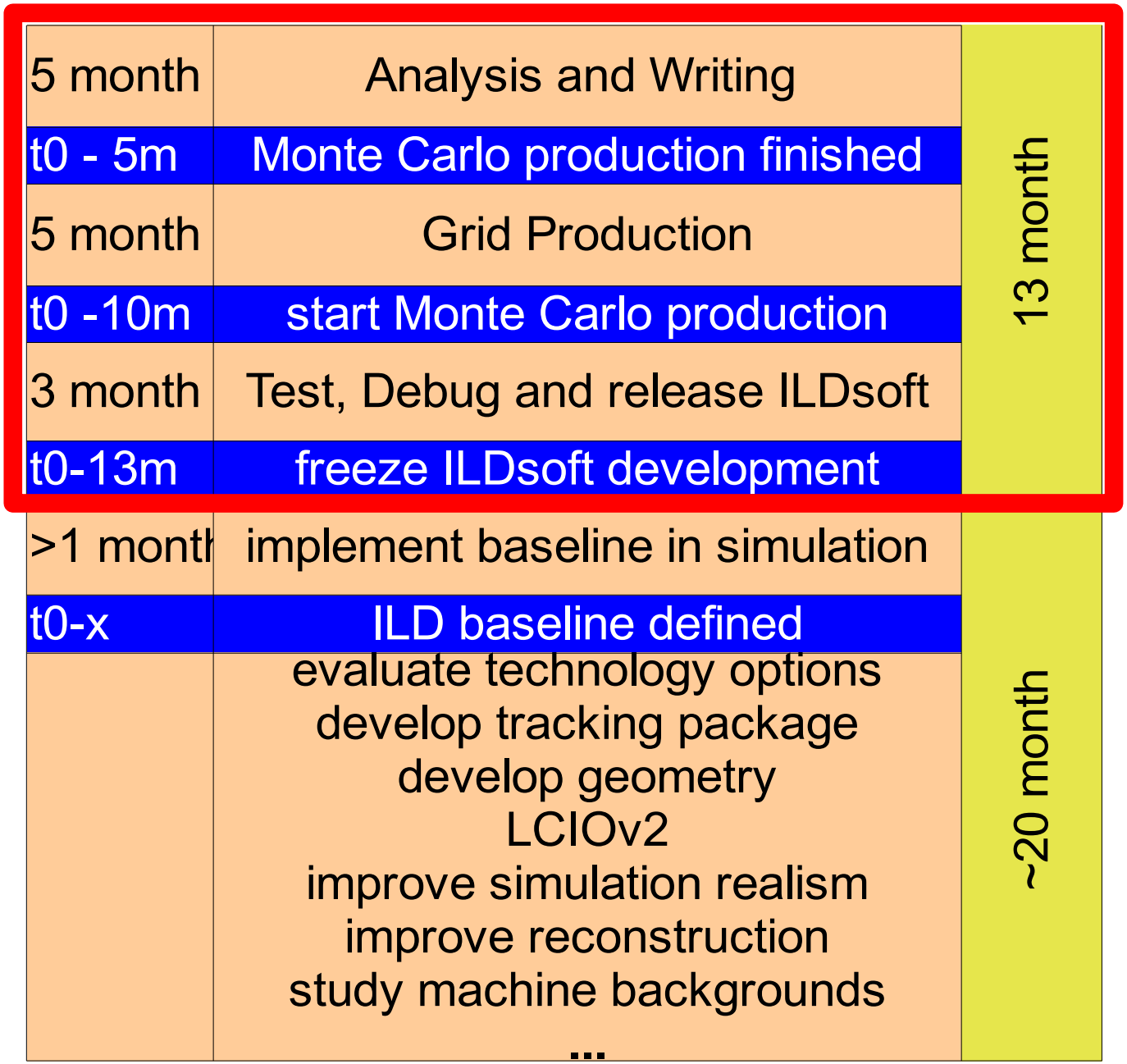
- almost all planned topics are addressed already
- (test system to follow soon)
- man power is critical

timeline for ILD software development



13 months prior to hand in of DBD are **fixed**

t0 will be end of 2012 -> have 20 month for software development

-> this is less than it looks, given the large number of topics to be addressed
-> need to define timeline and milestones

ILD software pre-meeting - agenda

14:30->*16:00* Status of ILD Reconstruction Tools (Convener: Akiya Miyamoto (*KEK*))

14:30	LCFIVertex status and plans (15') (Slides)	Tomohiko Tanabe (*University of Tokyo*)
14:45	PandoraPFA status and plans (15') (Slides)	John Marshall (*UCam*)
15:00	Photon shower reconstruction with Garlic (15') (Slides)	Jean-Claude Brient (*LLR*)
15:15	Tracking status and plans (15') (Slides)	Steve Aplin (*DESY*)
15:30	test beam software - Calice (15') (Slides)	Angela Lucaci-Timoce (*FLC, CALICE, DESY*)
15:45	testbeam software - TPC (15') (Slides)	Katsumasa IKEMATSU (*KEK/IPNS*)

16:20->*18:15* Core Software Tools and Plans for TDR2012 (Convener: Frank Gaede (*DESY*))

16:20	LCIOv2 (20') (Slides)	Frank Gaede (*DESY*)
16:40	Towards a new Geometry System (20') (Slides)	Astrid Muennich (*CERN*) , Astrid Munnich
17:00	New Grid production system (10') (Slides)	Jan Engels (*DESY*)
17:10	Computing resources on the GRID for ILC (15') (Slides)	Roman Poeschl (*LAL Orsay*)
17:25	DRUID - Displaying Root module Used for ILD (10') (Slides)	Manqi Ruan (*CNRS*)
17:35	CED event display (10') (Slides)	Jan Engels (*DESY*)
17:45	discussion and wrap-up (30') (Slides)	Frank Gaede (*DESY*)

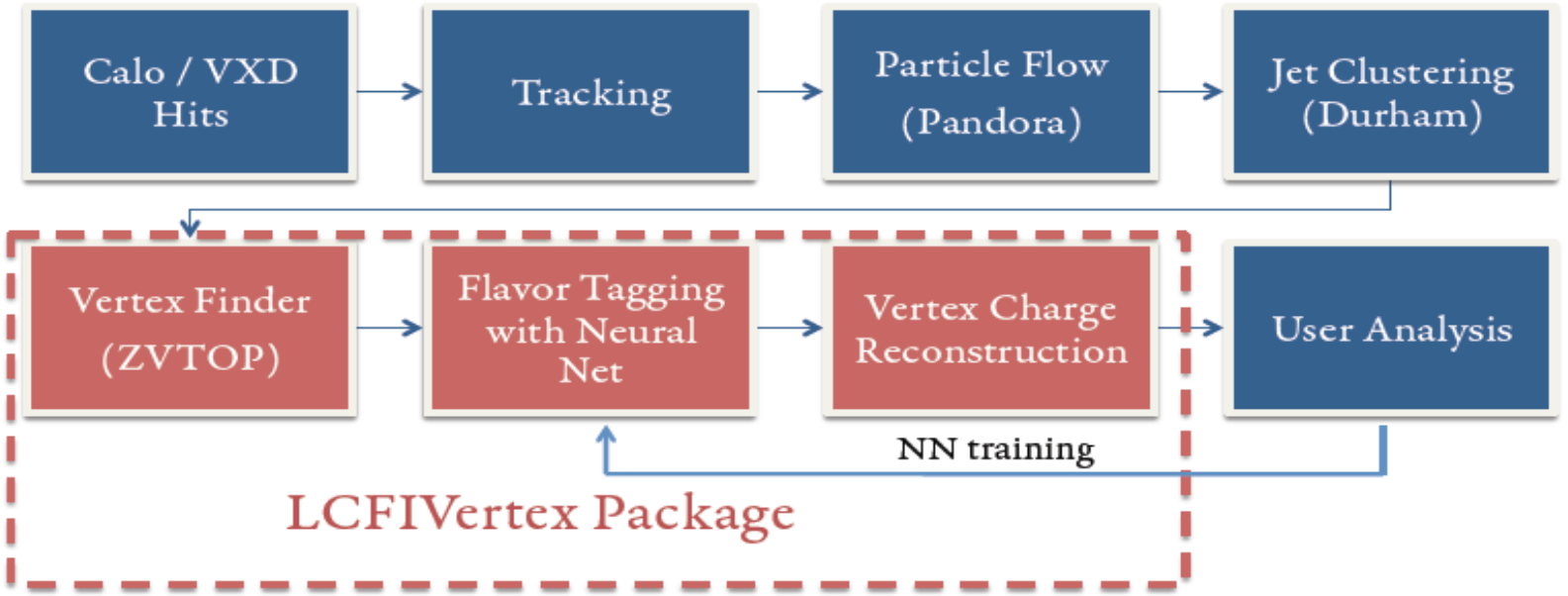
LCFIVertex I

T.Tanabe

Task	Assignment
Jet Clustering / Flavor Tagging	T. Suehara, T. Tanabe
Parton Charge Identification	(TBD)
LCFIVertex Validation	Y. Takubo
Coordination	H. Ono, A. Miyamoto
FPCCD Digitizer	K. Yoshida, Y. Takubo

LCFIVertex Tasks

- fundamental improvements
  - jet-clustering, flavor-tagging
- impact on detector optimization
  - parton charge identification
  - (performance check using beam background)
- maintenance work
  - validation of LCFIVertex results when other code changes



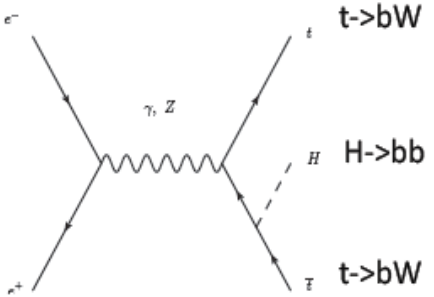
- strong japanese group took over responsibility for LCFIVertex from original authors (LCFI,UK)

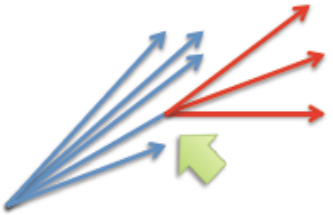
LCFIVertex II

T.Tanabe

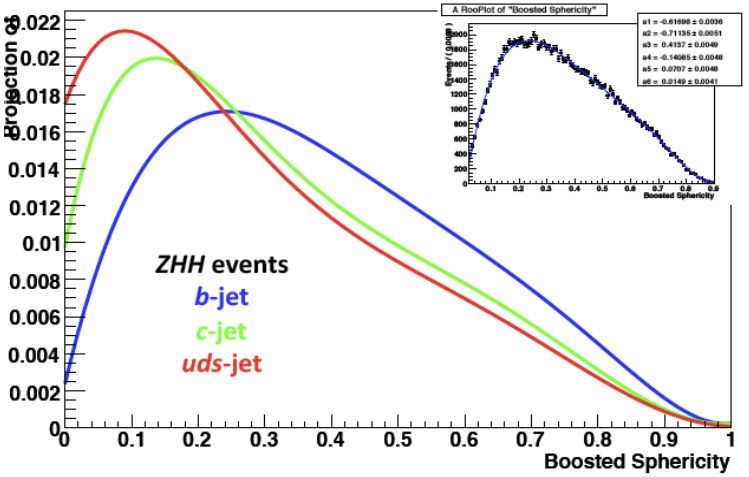
Jet Clustering & Flavor Tagging

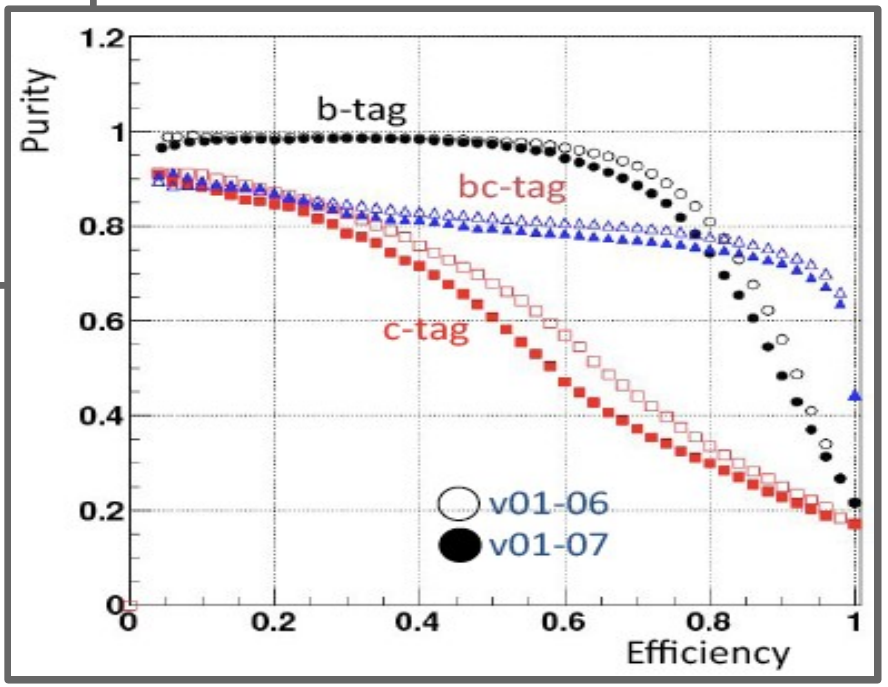
- many important analyses use ≥6 jets (e.g. ZHH, ttH)
  - improvement in jet-clustering/flavor-tagging is essential in order to achieve the target precision
- jet-clustering could be improved by:
  - use of vertex information
  - physics-motivated jet finding (mass-like constraint)
- flavor-tagging could be improved by:
  - using jet substructure information (sub-jets, multiplicity)
  - using kinematic variables (which are not currently included)





Boosted Sphericity

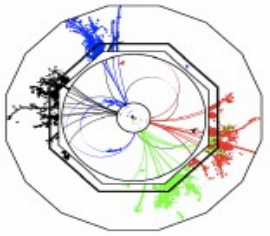




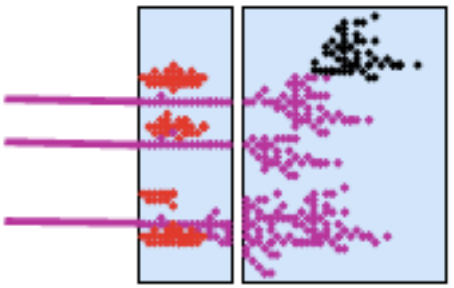
- started to improve the flavour tagging
- started comparison of ildsoft releases

PandoraPFA

J.Marshall

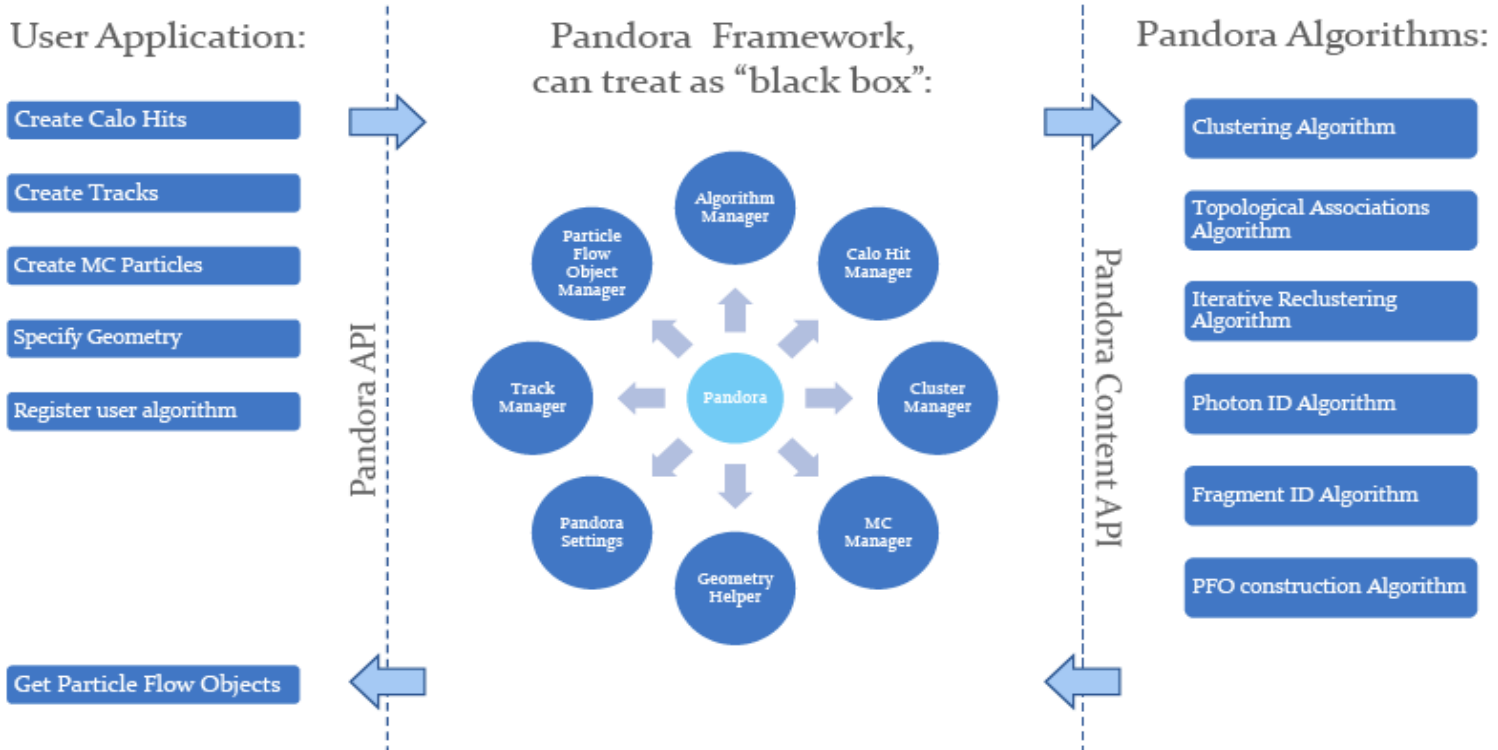


Redesign of Pandora PFA



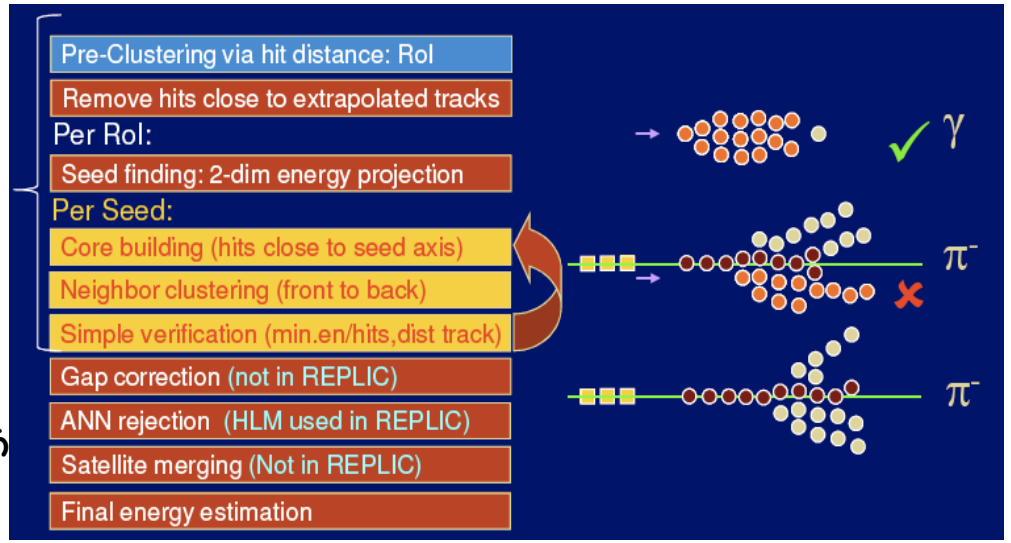
E_{JET}	σ_E/E (rms_{90})
45 GeV	3.7 %
100 GeV	2.9 %
180 GeV	3.0 %
250 GeV	3.1 %

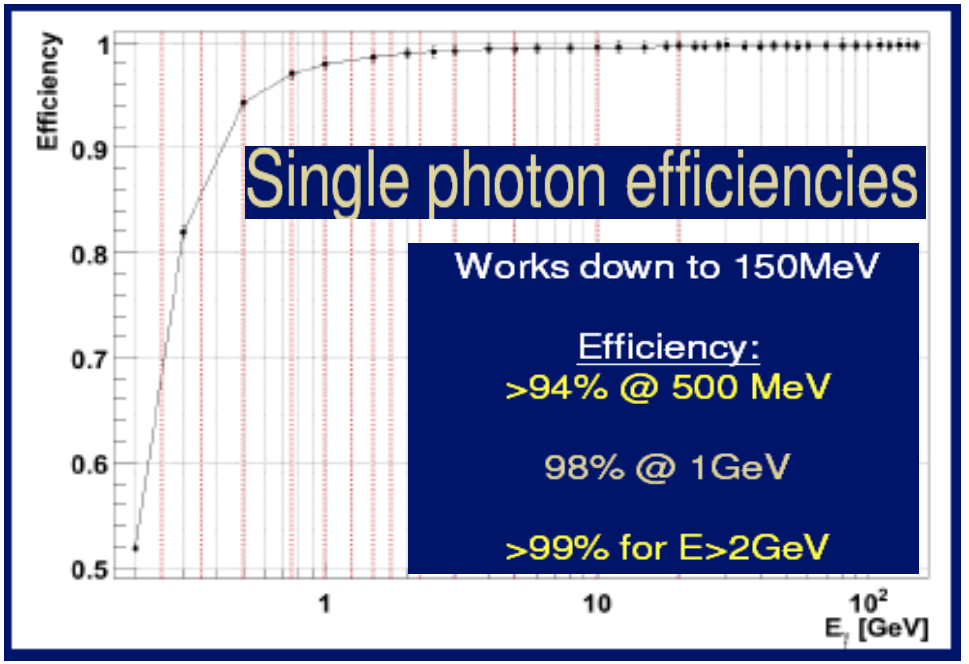
- Pandora most mature PFA todate
- PandoraPFA re-written in detector independent way
- re-implementation of PandorPFO marlin processor underway
- various improvements under development



Garlic photon reconstruction

JC.Brient





tau reconstruction

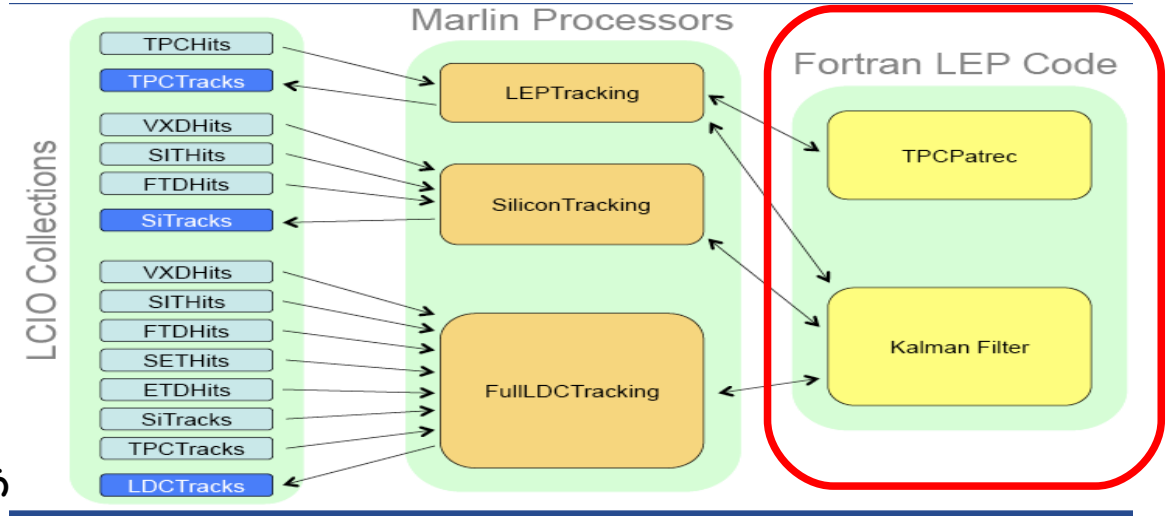
[%]	π^{sim}	ρ^{sim}	a_1^{sim}
π^{rec}	95.9	2.8	0.6
ρ^{rec}	3.9	90.8	11.2
a_1^{rec}	0.1	6.1	86.8
not identified	0.1	0.3	1.4

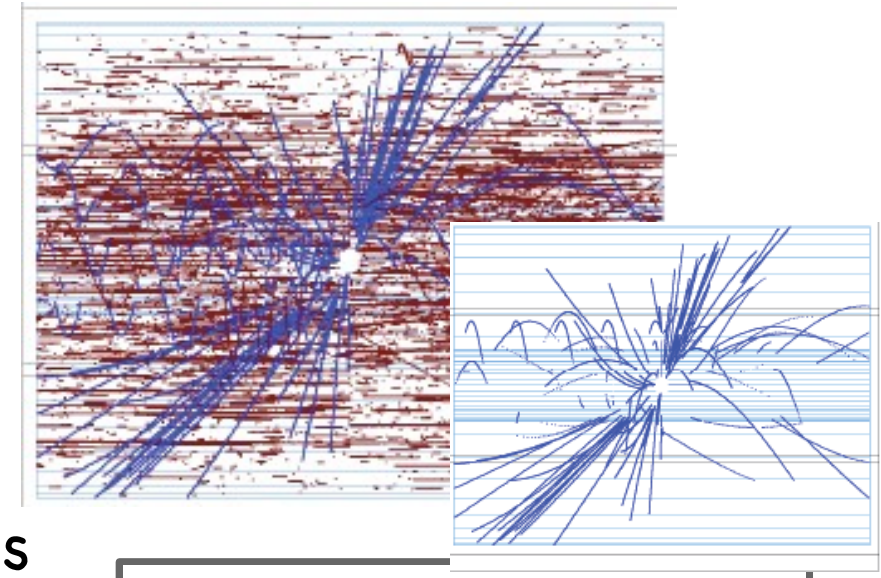
It was about
70 – 75 % in ALEPH

- Garlic: standalone photon reconstruction
- available as MarlinProcessor
  - to be released soon
- could be included in PandoraPFA (how?)
- to be used for Ecal optimization

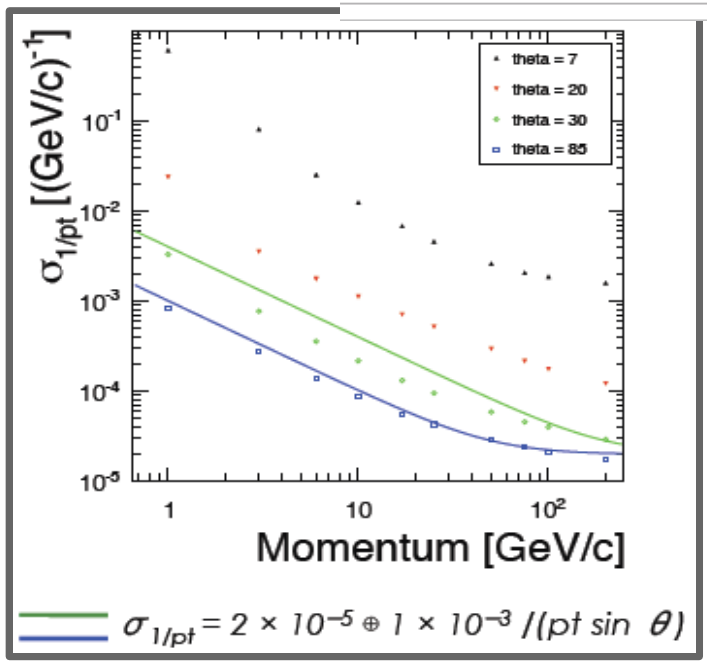
Tracking/PatRec

S.Aplin





- current tracking used for LOI process
  - required p_t resolution reached
  - also in present of backgrounds (even bg*3)
- issues:
  - ff7: maintenance 'nightmare' !
  - homogeneous B-field only !
  - difficult to use witch backgrounds
  - only single BX reconstruction
  - issues at 1-3 TeV
  - no strip tracking (ghost hits)



- -> need for a new tracking package

new Tracking/PatRec

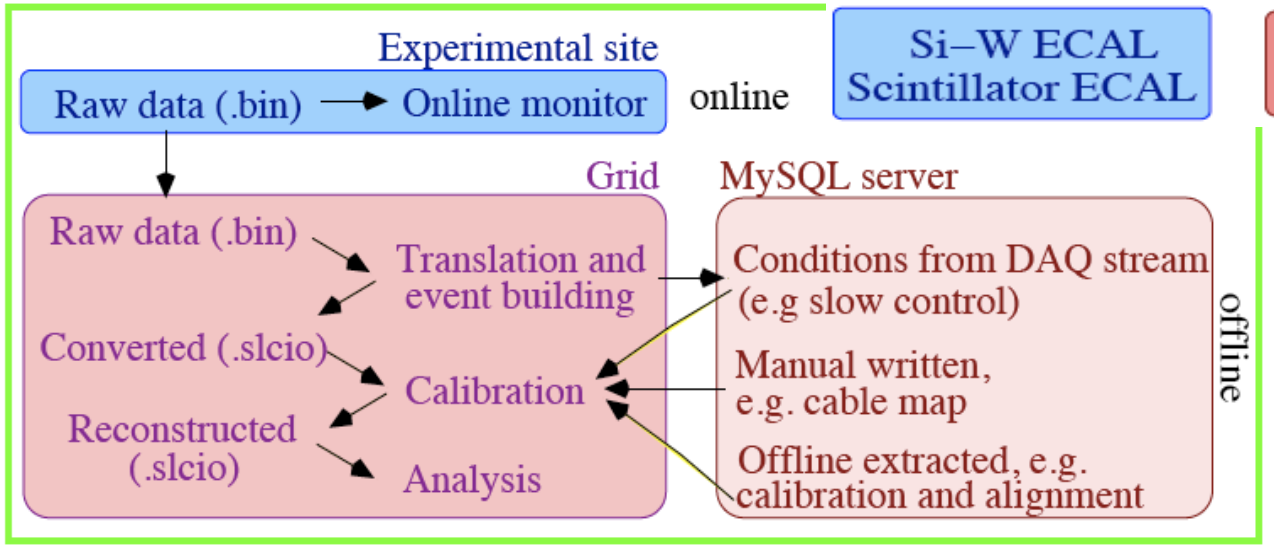
- started to look into ATLAS tracking code – full featured modern PatRec:
  - (combinatorical) Kalman Filter
  - Gaussian Sum Filter, DAF,...
  - modular design
- hoped for simple integration into Marlin – however
  - rather tight coupling to GAUDI and Athena frameworks
    - algtools, DataVec, logging,...
- further evaluation needed
  - some support from CERN/LHC
- conclude by march 2010...

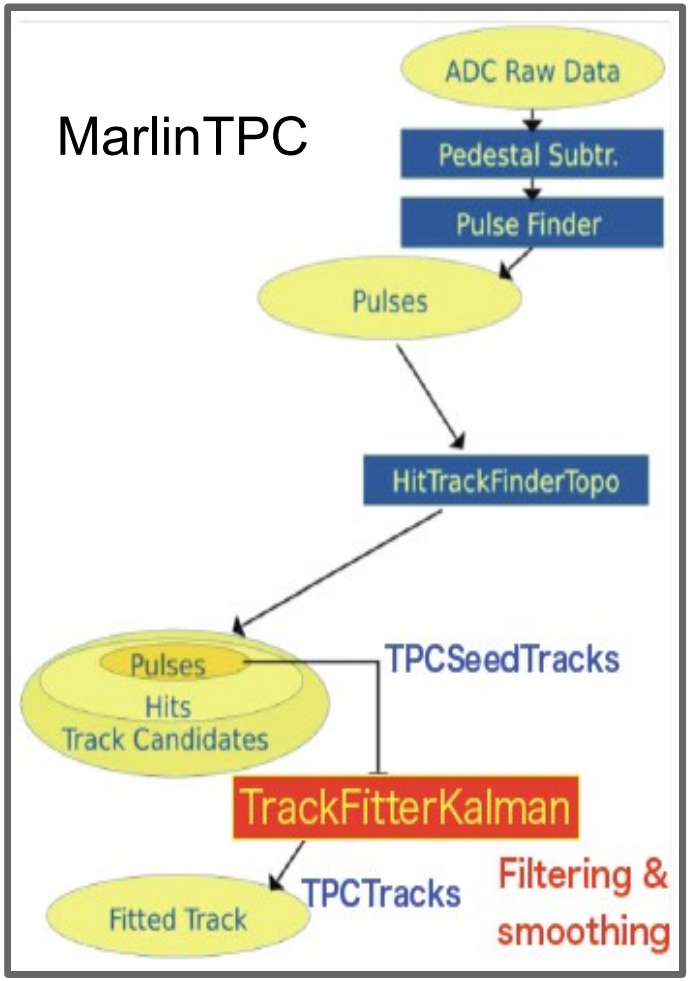
- developing a new tracking system is (one of)the biggest project(s) in ildsoft for the DBD phase !
- what can be achieved on this timescale depends on
  - the available effort
  - the priorities/timeline of ILD wrt. the software tools
- 'Plan B' : continue with LepTracking through DBD phase and develop new tracking at lower priority

testbeam software (calice, TPC)

A.Lucaci, K.Ikematsu

Calice Data Flow

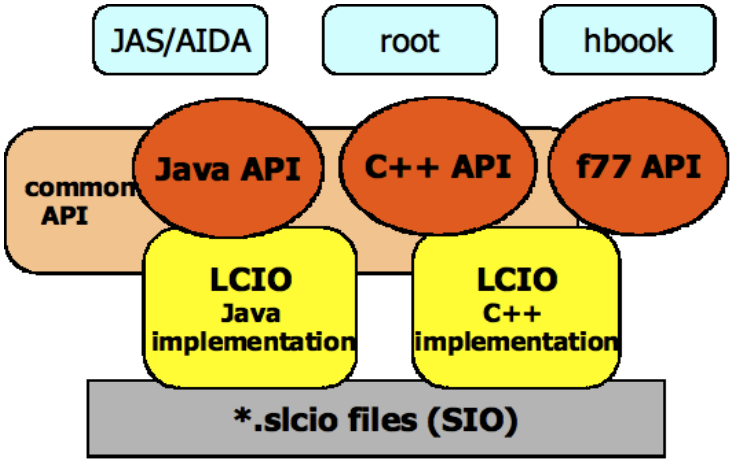


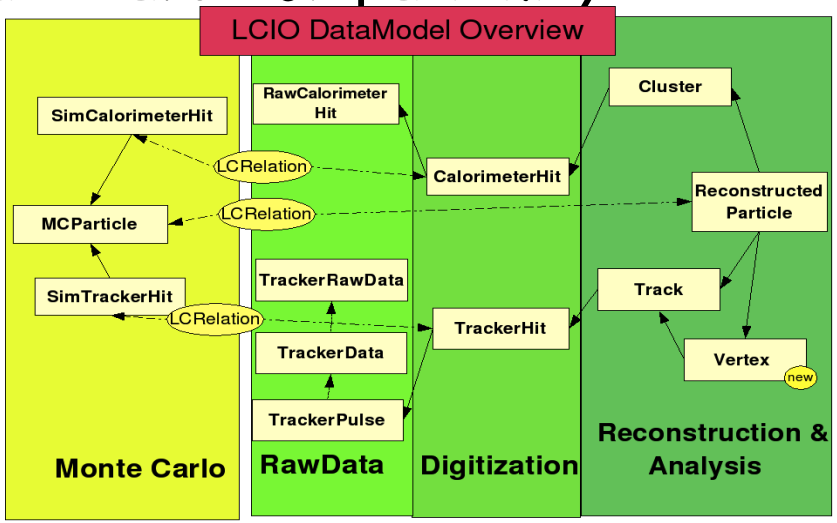


- the complete ildsoft framework is also used by most testbeam programs
- provides synergies:
  - can collaborate, e.g. on Kalman Filter
  - users can switch between ILD & prototypes
- also need some effort for testbeam specific developments, e.g. LCCD

LCIO v2

- LCIO provides a hierarchical **event data model** and a **persistency solution (I/O)** for LC software
- used in ILD and SID (and LCD) software frameworks and in most ILC **testbeam** experiments
- >150 TB of real and simulated data exist
- need to evolve keeping backward compatibility





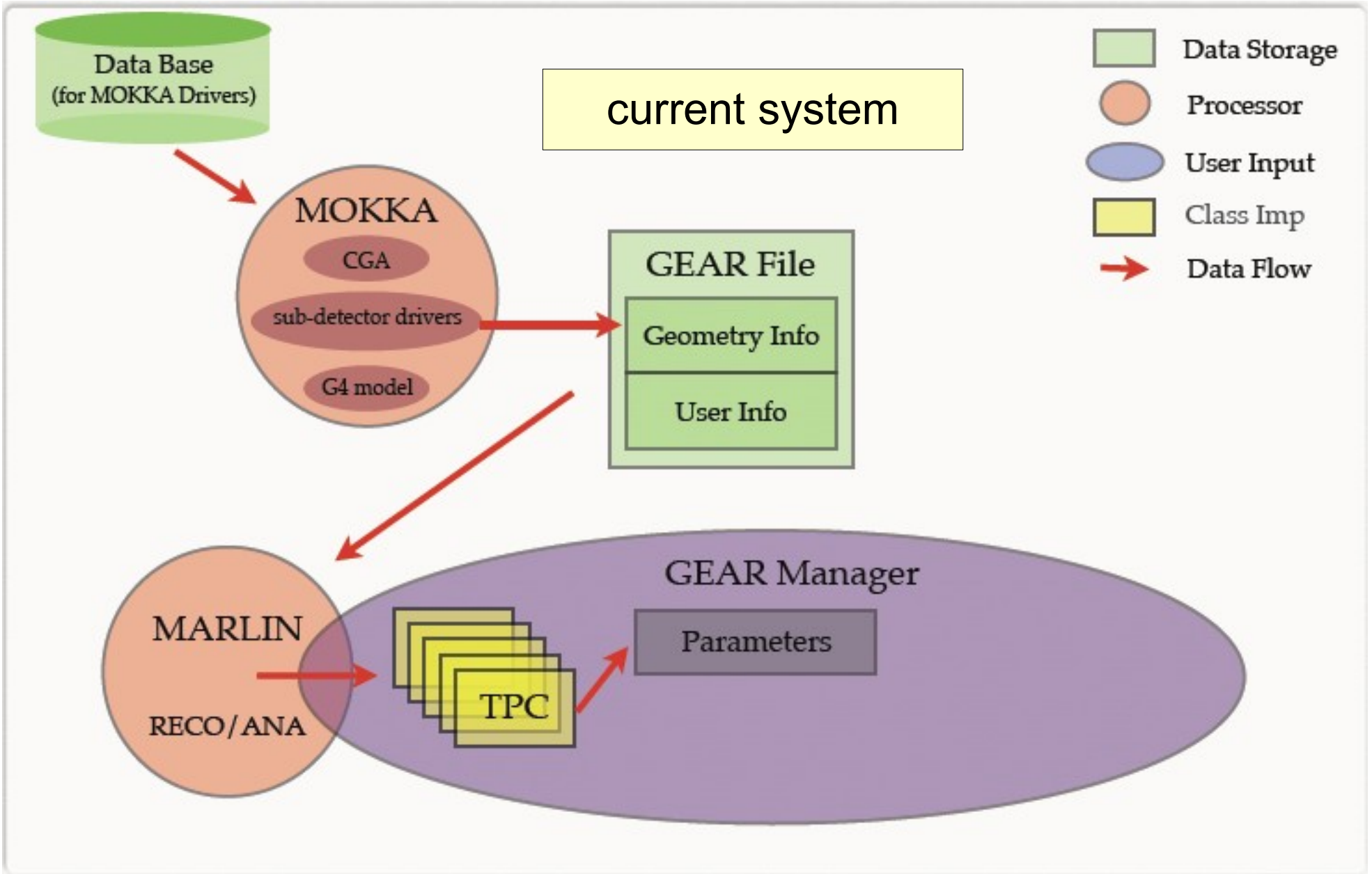
- features under development:
  - direct access to events
  - partial reading of events
  - splitting of events over files
  - storing of (arbitrary) user classes
  - use LCIO with ROOT (ROOT macros, TTreeViewer, I/O,....)
  - improving the event data model (1d,2d hits, tracks/trajectories)

LCIOv2 development

- investigate LCIO & ROOT
  - experimental code branch with ROOT I/O exist
    - could use ROOT I/O as option to SIO (*.slcio)
    - some changes to existing classes
    - need further development
  - need to solve I/O for JAVA
  - released LCIO v01-12-01 with optional ROOT dictionary:
    - can use LCIO classes in ROOT macros
    - can write simple LCIO-ROOT trees and use TTree::Draw()
- implement new features in current SIO version of LCIO:
  - direct access
    - prototype in Java exists
  - partial reading and event splitting over files
    - have C++ index based pointers
  - SLAC working on 1d, 2d tracker hits and improved Track class
- continue successful collaboration with SID colleagues !

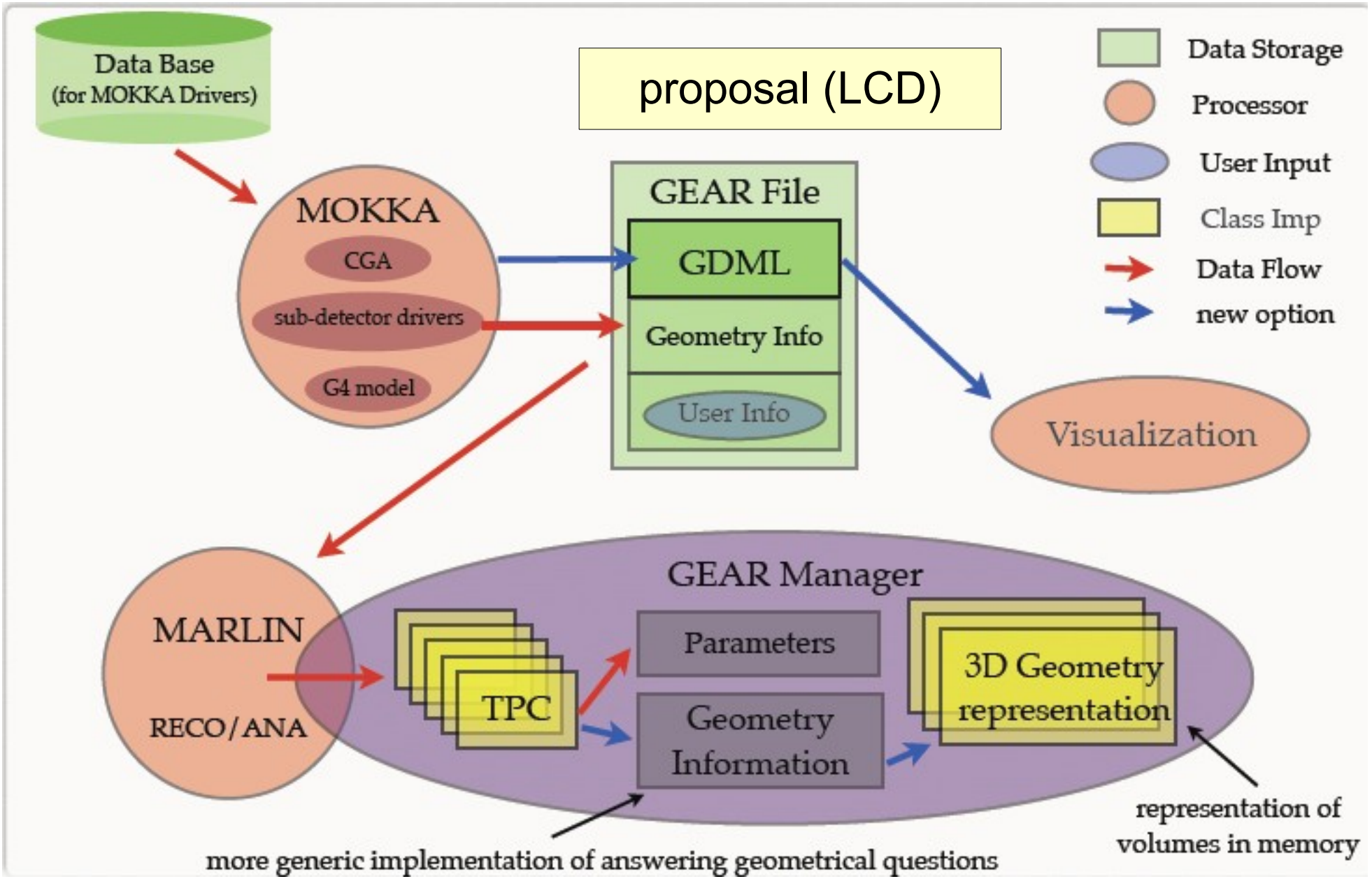
current geometry system

A.Muennich



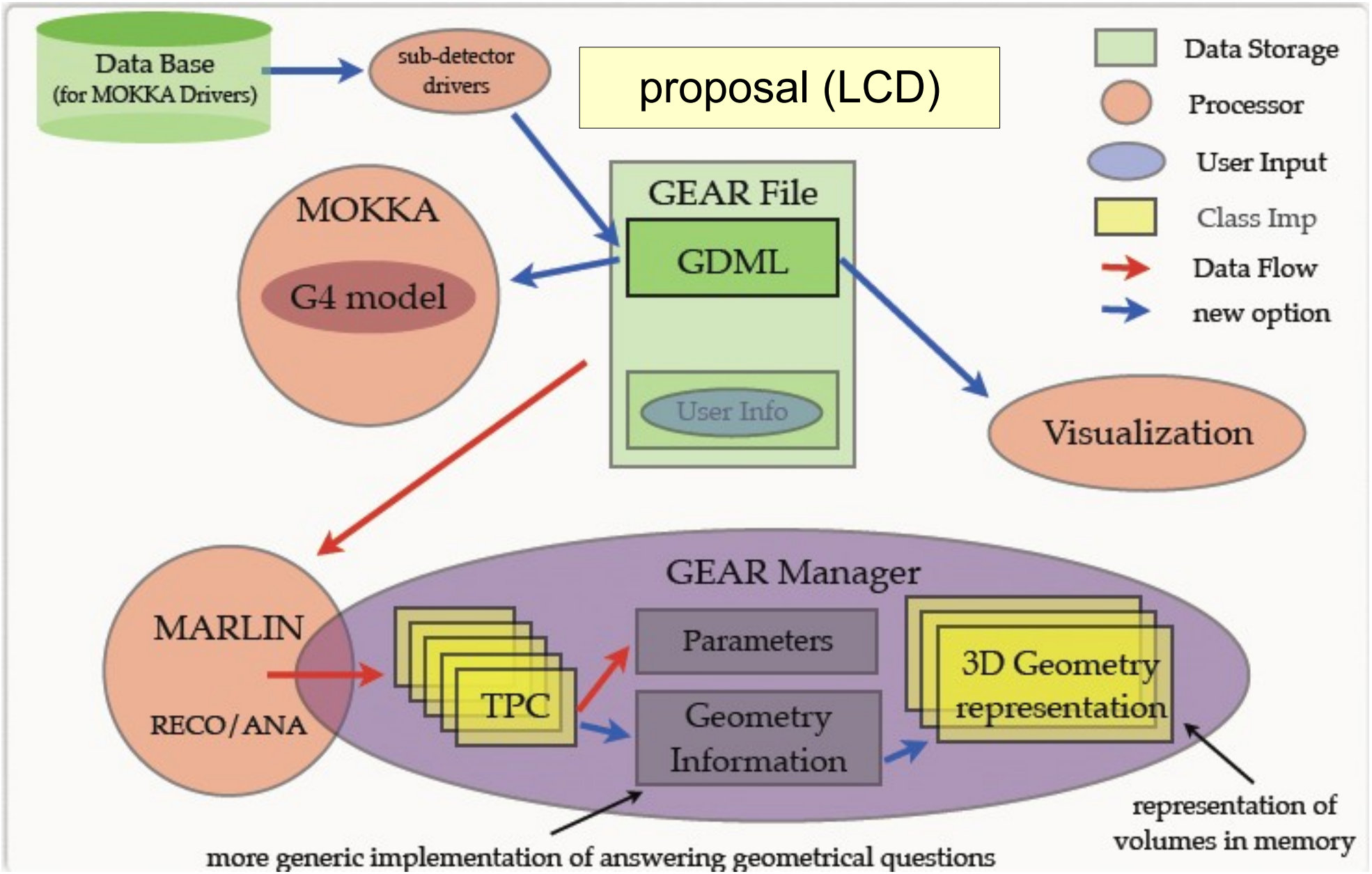
new geometry – step 1

A.Muennich



new geometry – step 2

A.Muennich

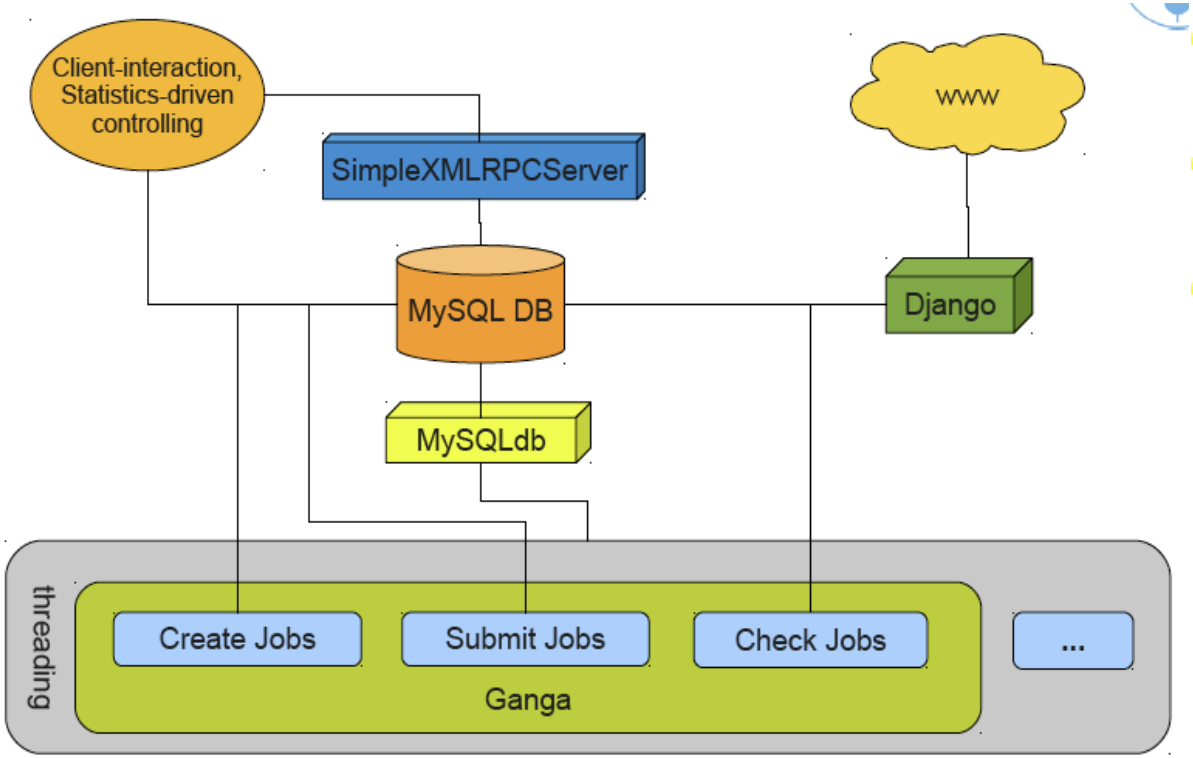


developing a new geometry system

- the current geometry system needs to be improved
- a new system should be easier to use, more flexible and less error prone (user defined parameters, multiple sources,...)
- ideally have one source of geometry that feeds into full simulation, reconstruction, analysis and event display at the various levels of detail and should:
  - describe the detailed realistic geometry of the detector
  - sensitive and dead material
  - allow for miss-alignment
  - convert local-to-global coordinates (cellID <-> position)
- as all software tools are affected, we need to have further discussions and iterations on the topic between ILD/LCD/SFT
- process has started
- note: in AIDA Workpackage 2 this would be addressed

new Grid production system

J.Engels



- job submission
- job monitoring
- data catalogue
  - python scripts
  - Ganga
  - MySQL w/ transactions
  - XMLRPC

- realized in LOI mass production that current system did not scale to O(10k) jobs (expert only system)
- new system will be easier to use (share production) and more efficient
- need a test production soon
- also look into using DIRAC with LCD group

Grid resources for ILC

R.Poeschl

Frank Gaede, DESY, ILD Meeting, Paris 27-30.01.10

Ressources in Germany

National Contact: Frank Gaede (?)

Two major sites: DESY-HH and DESY-Zeuthen

DESY-HH is the center of ILC computing

all ilc simulation files and calice data are residing there!!!

For storage (DESY-HH) :

ilc-tape:
88Tb

ilc-disk-pools:
70Tb (12Tb - disk-only, generated)

calice-tape:
45Tb

calice-disk-pools:
50Tb (15Tb - disk-only, generated)

CPU: 5kHEPSPECS

For storage (DESY-Zeuthen)

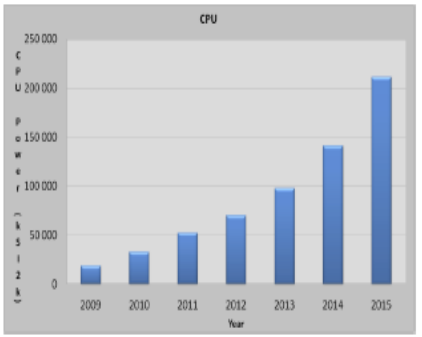
ilc/calice-tape:
No tape

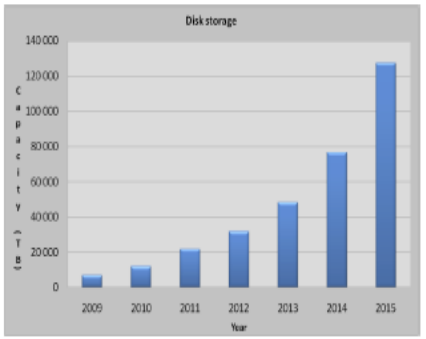
ilc/calice-disk-pools:
25Tb (ou of 50 Tb)

CPU: 0.8kHEPSPECS

Development of cc in2p3 until 2015

- ~40 groups with standard requirements (among which ilc)
  Typical in2p3 policy is that non LHC groups get 20% of ressources
- Takes LHC commitment into account
- LHC upgrade
- Significant increase of needs from astroparticle community

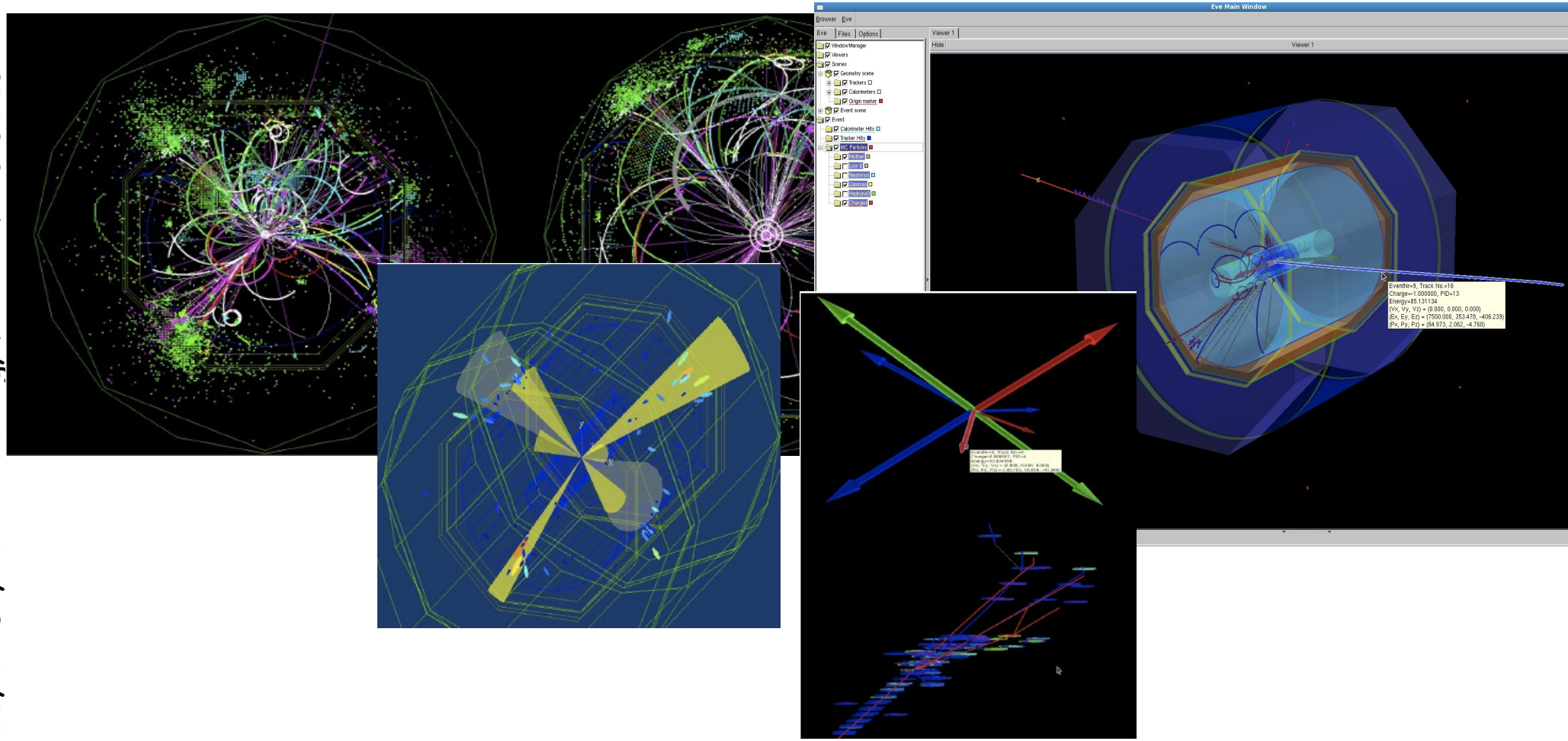




- significant Grid computing resources (CPU&storage) provided by DESY and CC/in2p3 and Grid sites in UK
- typically growths will follow that of LHC-Grid
- probably enough resources available for 2010/2011
  - need to arrange for 2012

event displays

M.Ruan, J.Engels



- (at least) two event displays available for ILD:
  - CED (GLUT/OpenGL, very fast, client server, no GUI,...)
  - DRUID (ROOT based, GUI, picking,...)
- can we 'downsize' to one ILD event display ?

towards a timeline for software

- the ILD Software Working group - and friends - is addressing quite a number of topics in order to improve the software tools
  - task list identified and discussed in software working group
- manpower is limited and we need to prioritize and understand the requirements in order to define a timeline and milestones
  - biggest single task: new tracking system
- need input from and discussion with ILD and R&D groups
  - -> some questions to be answered

Questions

- what level of realism is needed in subdetector simulation/digitization ?
  - to be defined by R&D groups and ILD
  - very realistic frozen model vs. flexible scaling model
  - effects on reconstruction to be clarified (Si-strips/ghosts) ?
- how to deal with technology options in simulation ?
  - physics benchmarks vs. detector performance
    - do we have the reconstruction/digitization (dHcal, FPCCD) ?
- when do we need more sophisticated tracking ?
  - already for DBD ? - at what level ? - ('plan B')
- which physics/optimization studies in 2010/11 ?
  - need a running version of the full ILD software at all times !?
- need answers to define timeline