Simulation Performance Reconstruction

Frank Gaede, DESY

LCWS 2012

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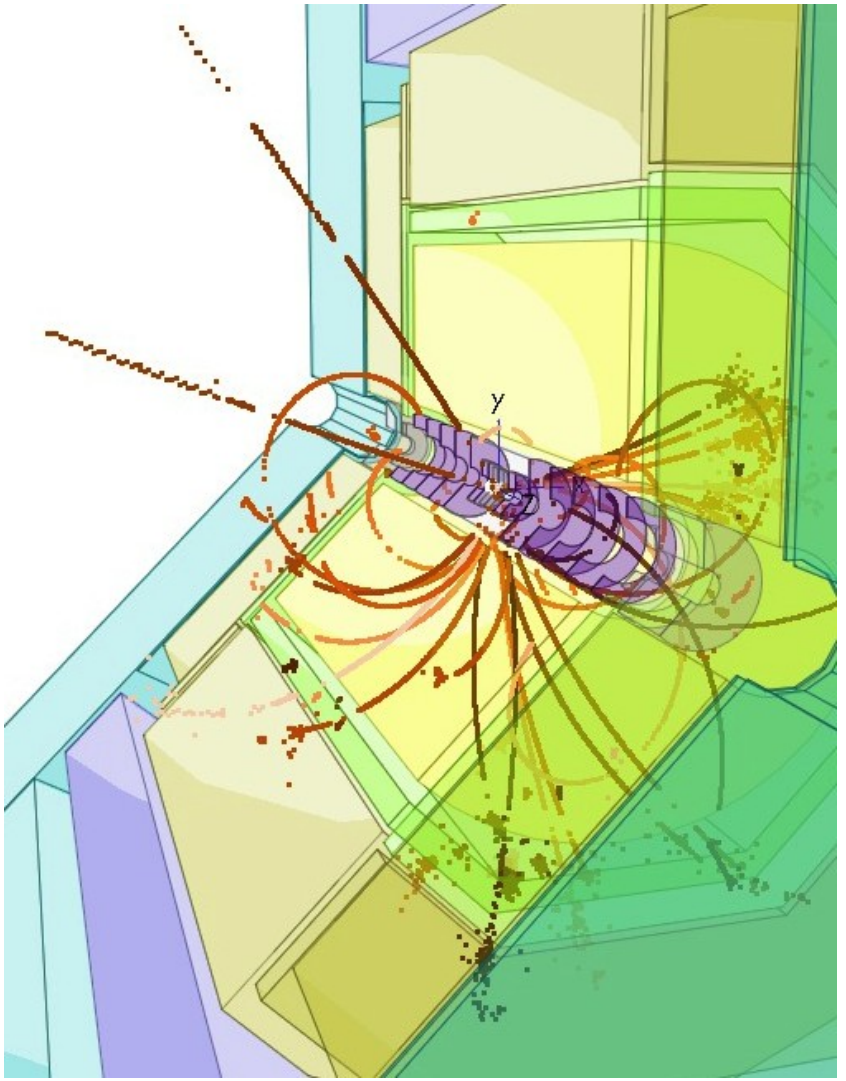
Talks in 4 Sim/Perf/Rec sessions

title	presenters
iLCSoft - Status and Plans	GAEDE, Frank
slic and lcsim	MCCORMICK, Jeremy
ALCPG software: status and future plans	GRAF, Norman
New developments in SGV - a fast detector simulation	BERGGREN, Mikael
SiD DBD production (DIRAC)	STRUBE, Jan Fridolf
Reconstruction of Granular Scintillator Strip Electromagnetic Calorimeter in ILD	Prof. TAKESHITA, Tohru KOTERA, Katsushige
Simultaion Study of the Hybrid ECAL for ILD	UENO, Hiraku
Simulation of RPC avalanche signal for a Digital Hadron Calorimeter	Dr. XIA, Lei
Electron Tagging with the BeamCal at 3 TeV CLIC	SAILER, Andre
Measurement of the Differential Luminosity at 3 TeV CLIC	SAILER, Andre
Correction methods for counting losses induced by the beam-beam effects in luminosity measurement at ILC	SMILJANIC, Ivan
Combined detector performance in the SiD DBD	STRUBE, Jan Fridolf
Occupancies from beam-related backgrounds in SiD at ILC and CLIC	Mr. GREFE, Christian
SiD DBD Tracking Performance	Mr. GREFE, Christian
The New C++ Tracking Code in iLCSoft	GAEDE, Frank Dr. APLIN, Steve GLATTAUER, Robin
Status of LCFIPlus	Dr. SUEHARA, Taikan

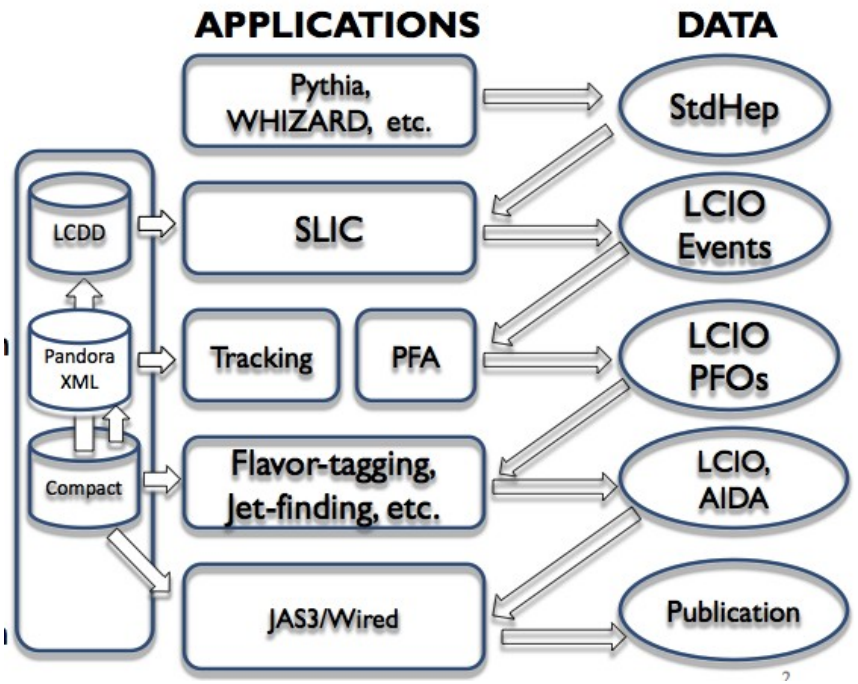
Apologies for no further reference to individual talks

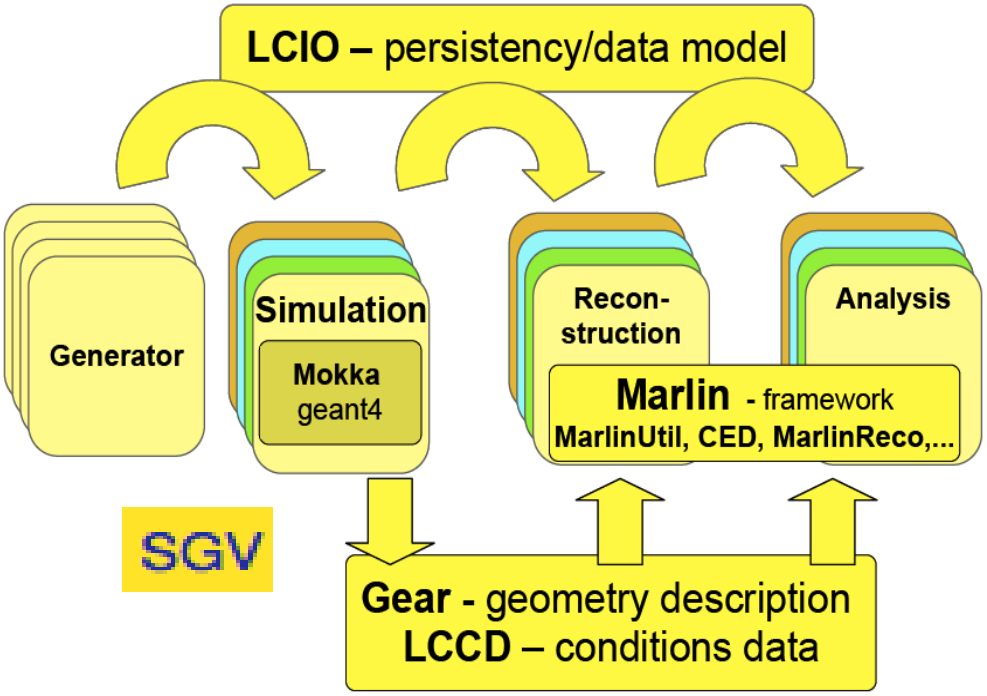
Outline

- Software Frameworks
- Simulation
- Reconstruction
- MC production for the DBD
- Detector Performance
- Future Plans



Two core software Frameworks





- **lcsim** - SLIC: geant4 , org.lcsim (Java): reco/ana
- used by SID, CLIC and recently by HPS (JLab), muon collider
- **iLCSoft** - Mokka: geant4 , Marlin (C++): reco/ana, SGV fastsim
- used by ILD, CLIC and testbeam: Calice, LCTPC, EUTelescope
- both use **LCIO** as common Event Data Model and persistency

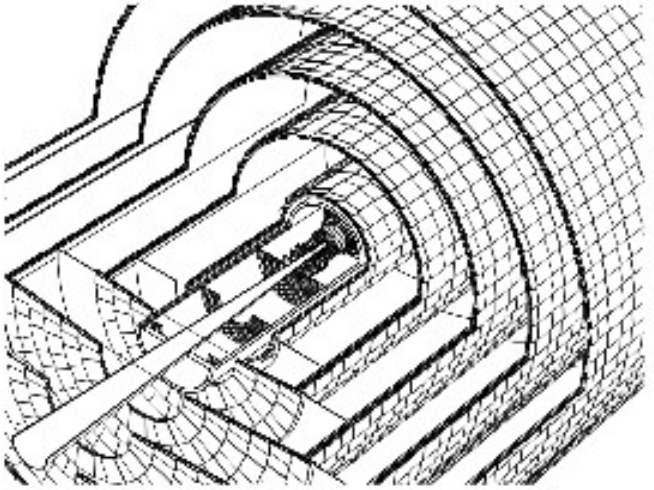
Towards common software tools

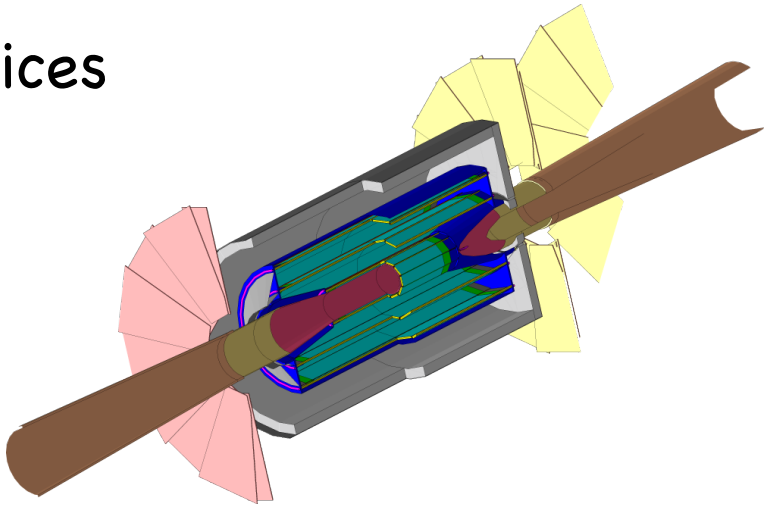
- maintaining, supporting - and using - two complete software frameworks becomes increasingly difficult
  - due to tight manpower situation
- process towards common tools has started (SCTG) and already for the DBD we all used:
  geant4, LCIO, PandoraPFA, LCFIPlus, Marlin, Root
- LC-SW Meeting in Feb. at CERN had brought consensus to:
  - move towards common simulation application
  - move towards common tracking toolkit
    - based on tools developed in AIDA WP2
- plan to pick up this process after DBD

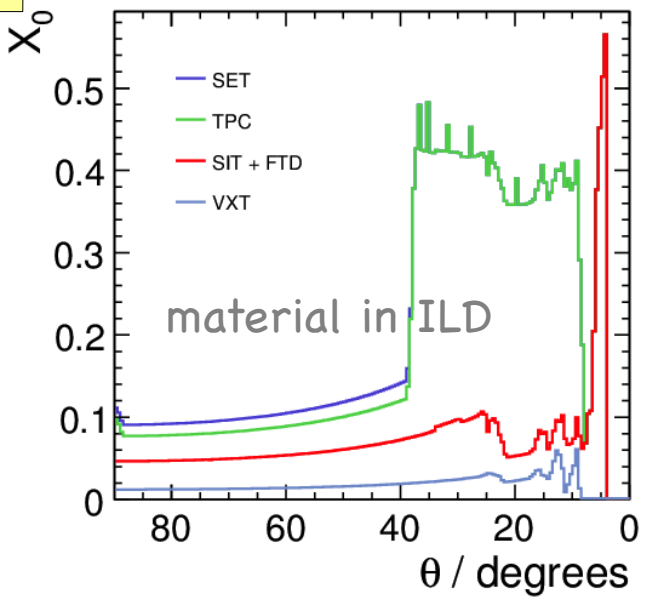
  => start with another LC-SW Meeting early 2013
- important that (big) labs allocate sufficient resources for the continuous support of LC software

Simulation for the DBD

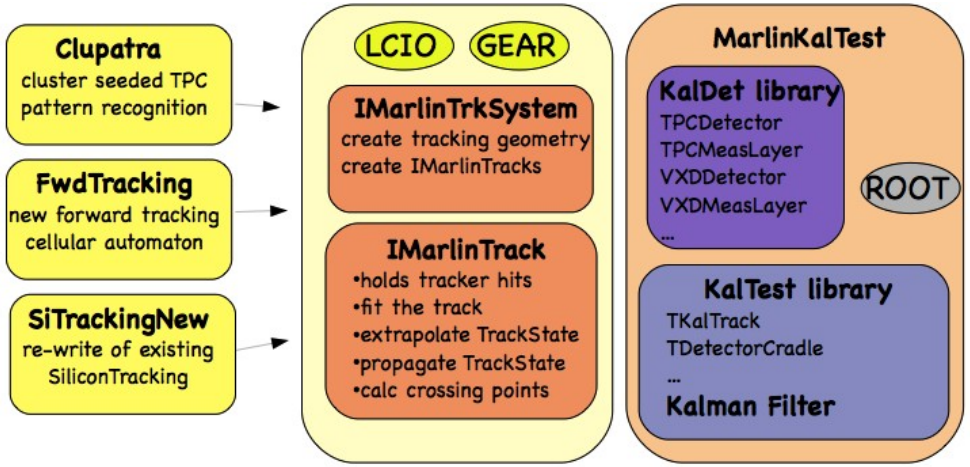
- both detector concepts have made an enormous effort to improve the realism of their simulation models for the DBD
  - **synchronize with engineering model**
  - have correct description of materials
  - include imperfections and gaps
- proper treatment of Si-Trackers
  - individual sensors - rectangular and petal wafers
  - 1D strip hits including ghost hits
  - proper support structures - space frames
- dead material for electronics, cables and services





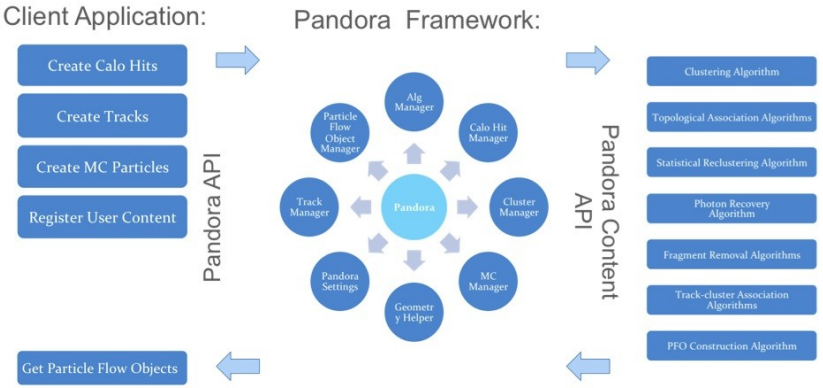


reconstruction tools for the DBD

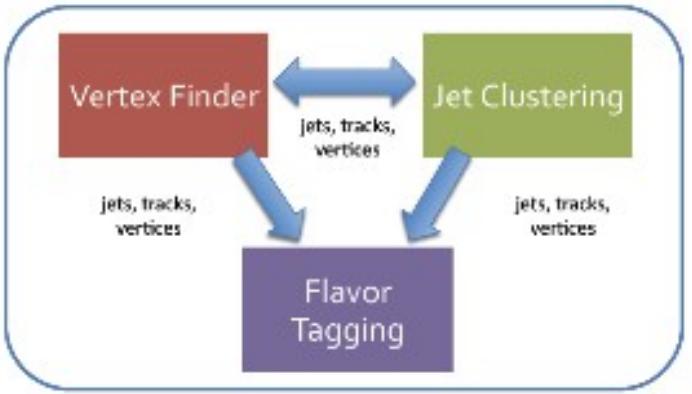


- ILD: new tracking: **MarlinTrk**
  - TPC patrec - Clupatra
  - fwd patrec - ForwardTracking
  - re-write of SiTracking and FullLDC
- to replace old LEP f77 tracking

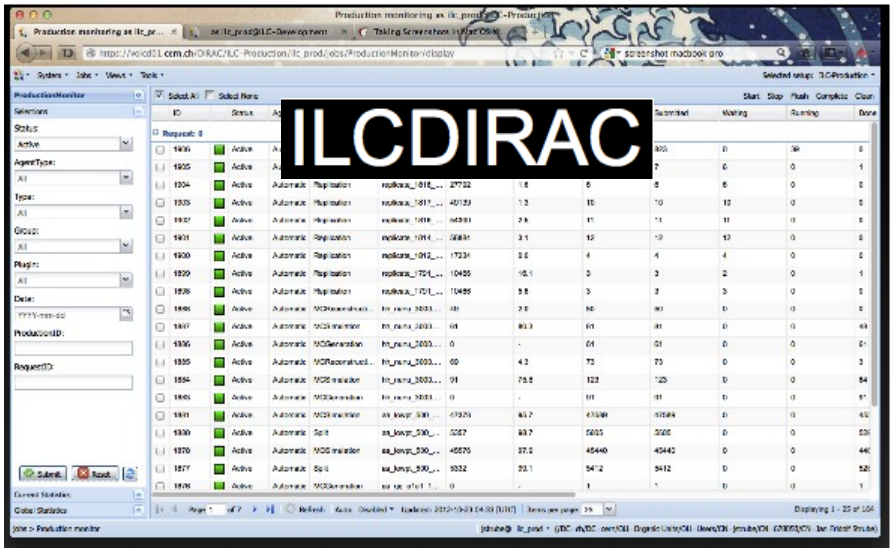
- **PandoraPFA**
  - already re-designed and massively improved for CLIC CDR
  - used by ILD and SID with small adaptations

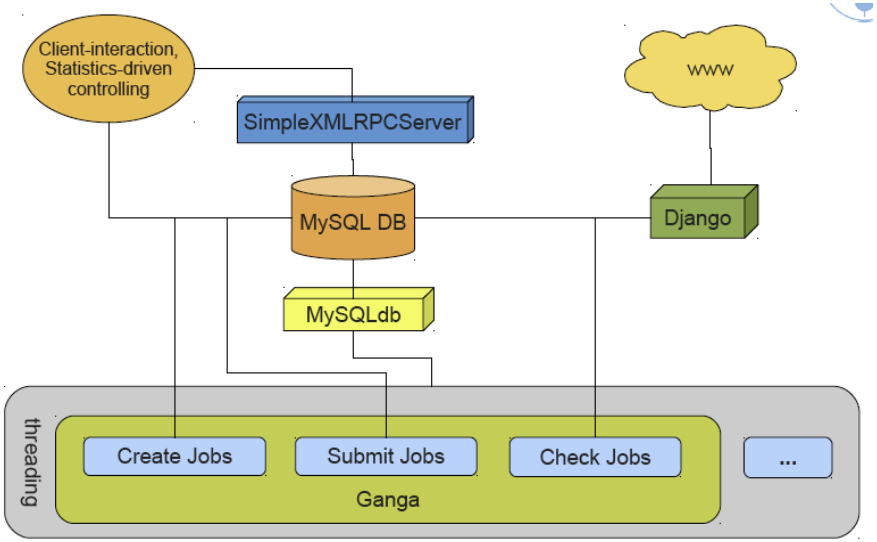


- **LCFIPlus**
  - new improved algorithms for vertexing and flavor tag (based on LCFIVertex)
  - also used for both SID and ILD



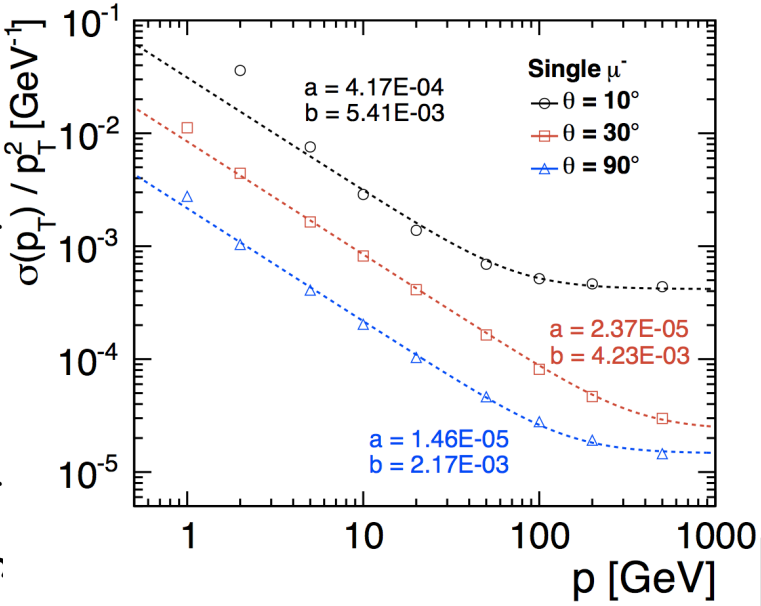
DBD Grid production



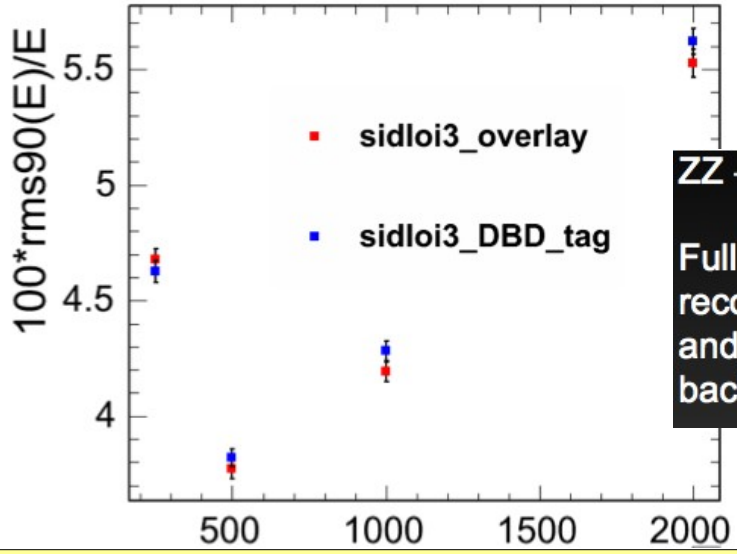


- both SID and ILD used the Grid for the DBD MC production
- independent production systems ILCDIRAC and GridProd
- use VO ILC - now common in LCG and OSG (EU/Asia/Americas)
- generator files provided by Common Generator WorkingGroup
- fully simulated and reconstructed 60/10M events for DBD benchmarks and SM background including overlaid background
  - for ILD also large set of DST samples with SGV fast simulation

DBD Reconstruction Performance



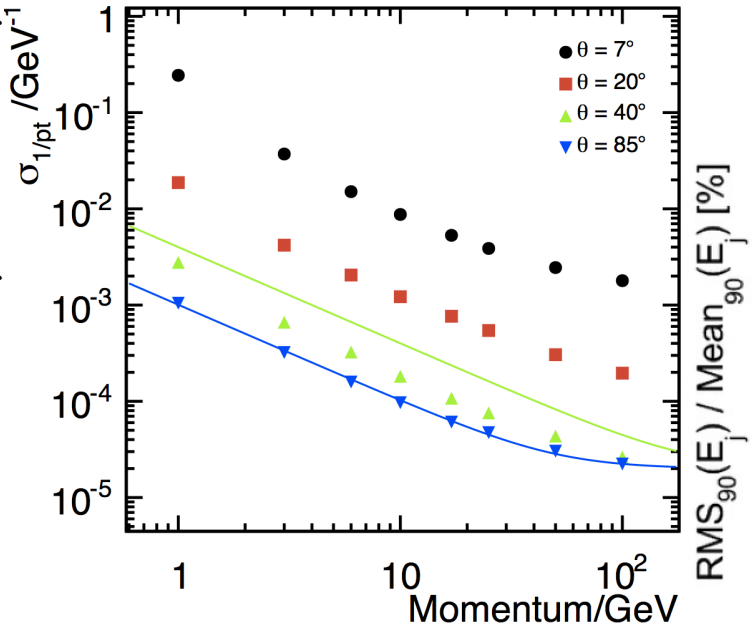
SID

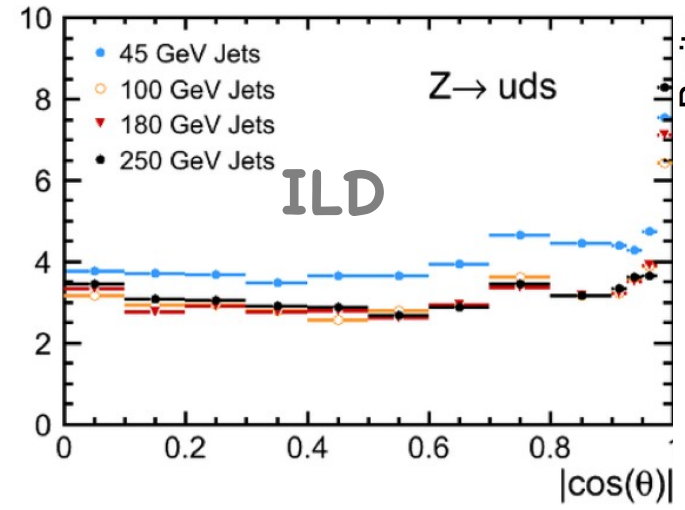


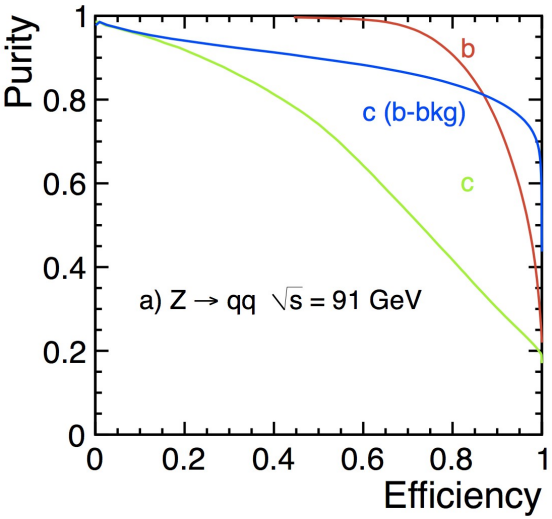
ZZ → 2 jets + invisible

Full simulation and reconstruction with and without background

- for both concepts the tracking, PFA and flavor tag performance meets the requirements
- compatible performance compared to LOI despite increased realism in simulation models







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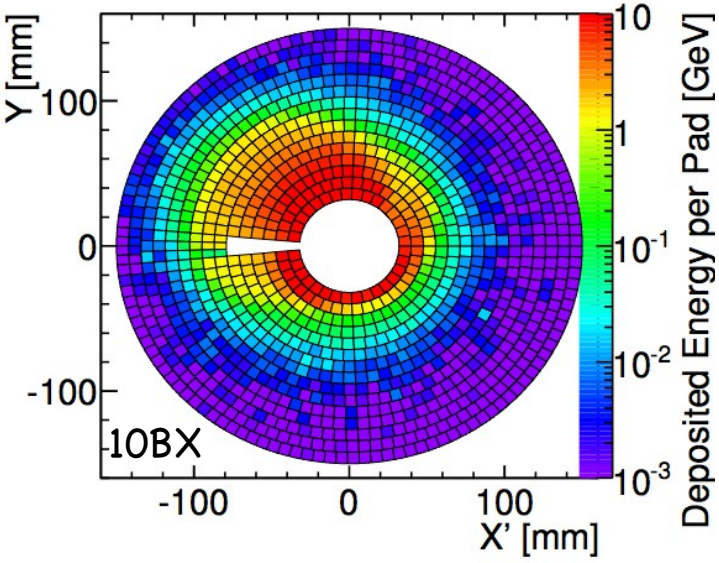
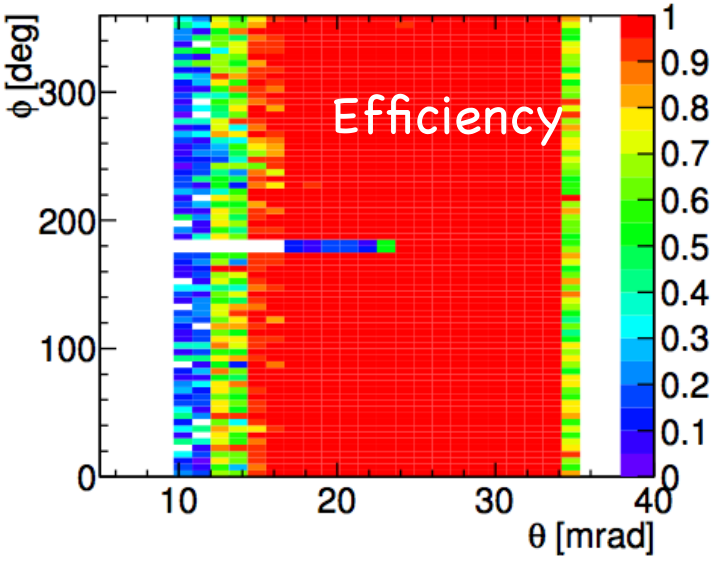
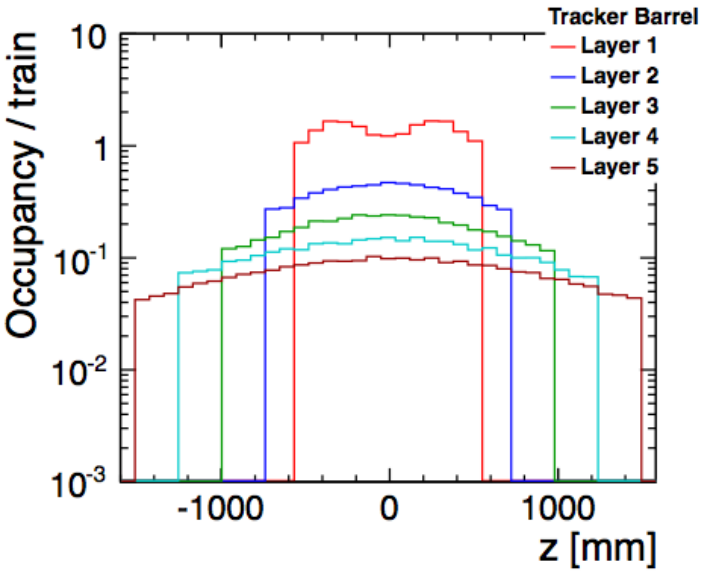
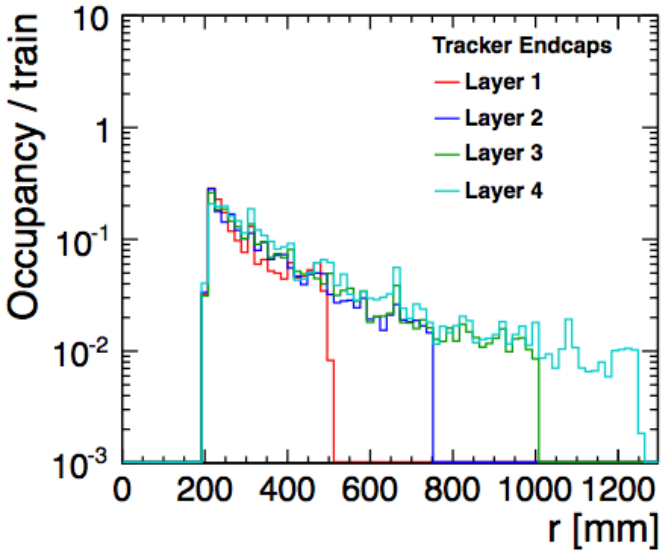
CLIC Performance Studies





- electron tagging in BeamCal at CLIC 3TeV
- 33TeV/BX from pair background

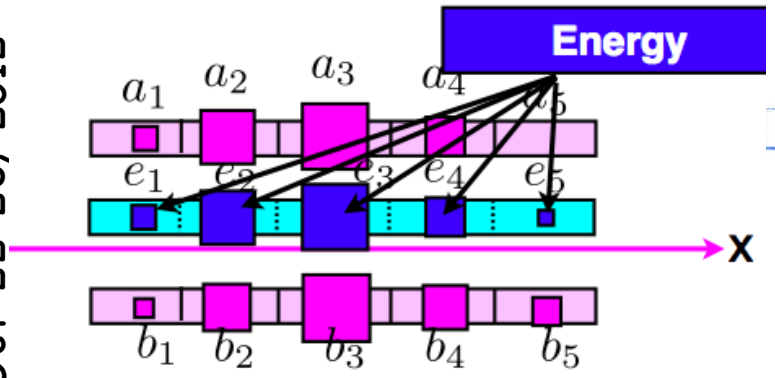




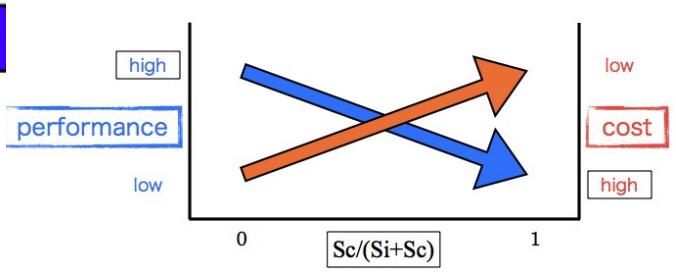
- incoherent pairs result in 200% (barrel) and 30% (endcap) occupancies from 1 train !
- need multi-hit capabilities

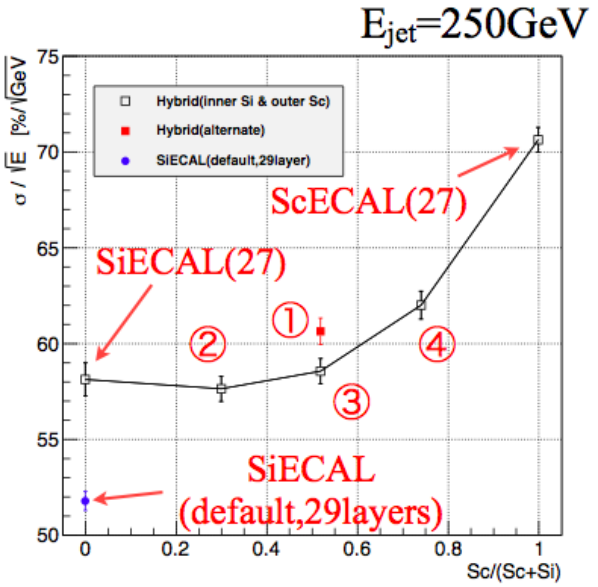
CLIC_SID Tracker

Calorimeter Reconstruction/Digitization

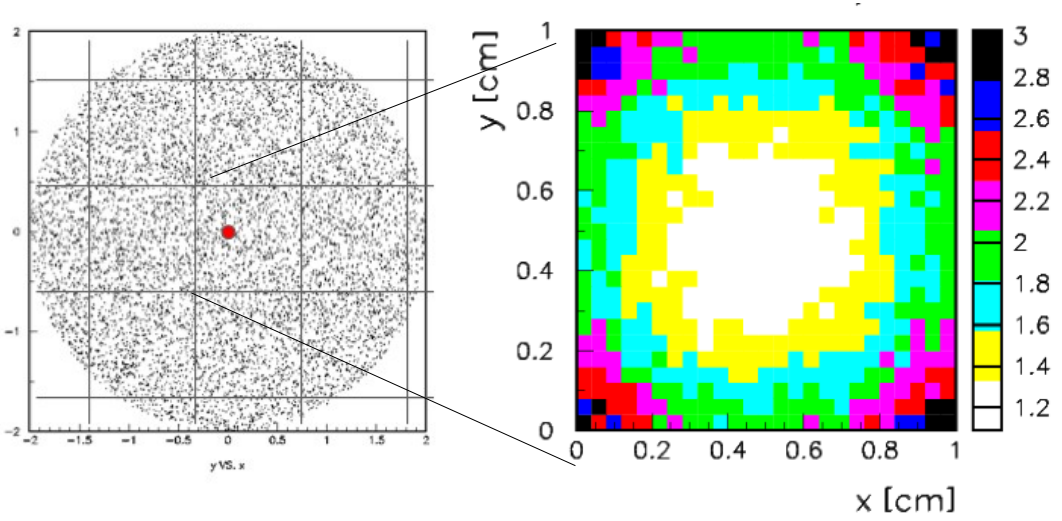


$$e_i = E_{\mathrm{n}} \cdot \frac{a_i + b_i}{\sum a_i + \sum b_i}$$





- reconstruction in a scintillator strip Ecal
- study of hybrid option Si<->Sci W for ILD



- digitzation for a DHcal
- simulation of charge sharing in org.lcsim
- very similar activities in Marlin

Summary & Outlook

- software activities since the LOI were mainly driven by preparation for the CLIC CDR and the ILC DBD
  - improved/adapted the core tools
  - made the simulation much more realistic
  - new development, major improvements and/or re-structuring of all reconstruction algorithms
  - development of Grid production systems
- reached performance which is compatible with that of LOI

Outlook

- we have a window of opportunity now to continue the process of moving to more common software tools
- **resource limit: need to understand what the manpower situation will permit**
- start with LC-SW-Meeting early 2013