Status de la reconstruction pour les détecteurs au Silicium dans SiLC

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Le Tracking dans SiLC

1. CMS : le savoir-faire du LHC
2. SLAC : Simulation et Reconstruction
3. DESY et SLAC @ Boulder
4. Conclusions

CMS

- Un environnement difficile : pile-up, remnants, traces spiralantes.

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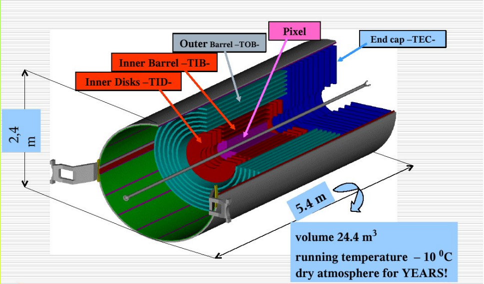
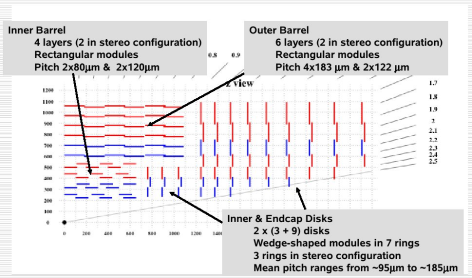
- Demandes de la physique pour la reconstruction : efficacité, bonne résolution à haute impulsion, haute résolution spatiale $\longrightarrow$ vertex primaire et secondaires
- Un détecteur interne tout silicium : haute résolution, granularité et redondance, > 220 m^2 de senseurs.

Schéma classique avec cylindres centraux et disques bouchons

Pixels près de la zone d'interaction, détecteurs simple face, configuration stéréo





Tracking

- 12 à 14 points de mesure par trace, de 10 à 50 μ de résolution, sur 16000 plans

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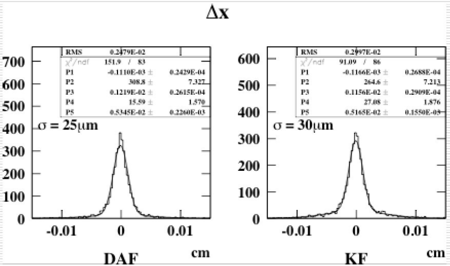
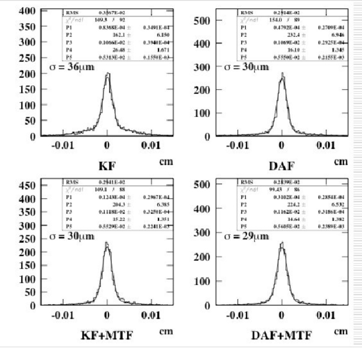
- navigation entre layers et recherche des hits compatibles
- utilisation de Filtre de Kalman
- améliorations :
  Deterministic Annealing Filter (permet la compétition de plusieurs hits/layer pour une trace), Multi-Track Fitter (compétition entre hits et traces),
  Gaussian Sum Filter (surtout pour les électrons)

DAF : paramètre d'impact transverse pour des jets de b

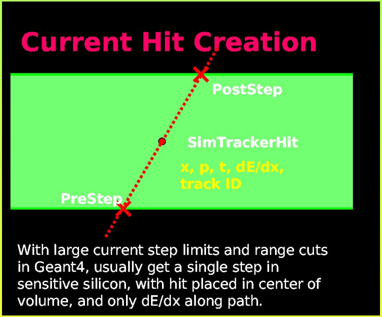


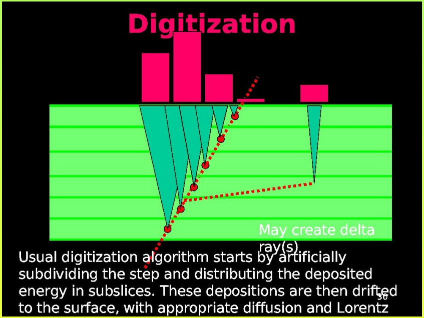
MTF : paramètre d'impact transverse pour des τ



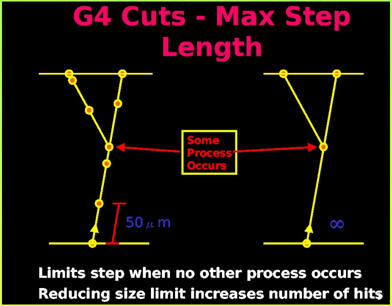
Norman Graf : "Tracking infrastructure"

Lien entre simulation et reconstruction





GEANT4 : pas et seuils



EM energy resolution

- Using default set of range cuts, Geant4 returns a poorer energy resolution than expected for sampling calorimeters with very thin sensitive layers.
  - For SiD, with ~300micron Si, get ~20%, vs ~16% expected.
- This can be remedied by running with smaller range cuts in the absorber material, but one must go to very small values, and program slows by factor of 10-20.

EM energy resolution

- Recently released Geant4 v8 has modifications which address this issue.
  - Essentially reduces range cut as one approaches a volume boundary.
  - Reduces sensitivity of dependence on range cut.
  - Adds slight overhead in runtime to handle additional geometry queries.
  - Beginning systematic studies, but hampered by lack of testbeam data.

Simulation and Reconstruction
Software for the ILC:
from MOKKA to MARLIN
Ties Behnke

ILC Detector Simulation:
The U.S. Framework
Jeremy M^{c} Cormick

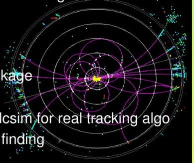
Tracking

- Full track finding and fitting algorithms taken from ALEPH and DELPHI optimised for TPC
    - Track finding is based on out – in search, using Circle Fit to build reference tracks
    - These are then passed to a Kalman Filter in order to take scattering within the material into account for the final fit
    - include hit pickup in inner detectors and full refit
  - Output: LCIO track collection with full covariance matrix
- Track Cheater
    - Uses MC to generate road along which hits are taken, these are then fitted with a helix hypothesis
  - Output: LCIO track collection
- missing: forward tracking
  stand-alone vertex tracking

Ties Behnke:Software in Europe

Reconstruction: Tracking

- Most US reconstruction algorithms still using cheater or MC based tracking
- Cheaters
  - MC Fast
  - Mike Ronan's cheater reco package
  - Or just use MCParticles
- Lots of good tools available in org.lcsim for real tracking algo
  - Norman Graf's track fitting and finding
  - Garfield for TPC
  - Nick Sinev's CCD reconstruction
  - Probably a lot of stuff not in org.lcsim CVS, yet (?)
  - Just need to put together into reconstruction algorithms



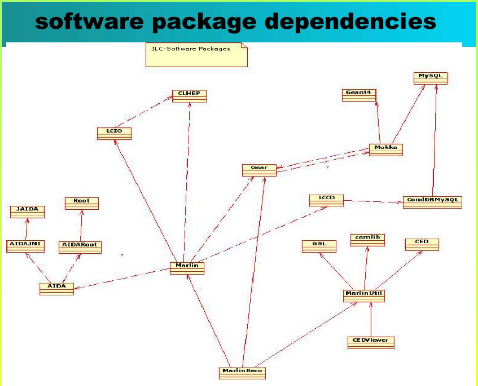
MarlinReco

- Marlin serves as a **framework** for the distributed development of reconstruction algorithms
  - provides a well defined modularity
- MarlinReco is a **toolkit** which aims at providing reconstruction algorithms for detector concept studies
  - (almost) complete set of standard reconstruction (pflow)
  - cheaters for cross checks (and replacements)
  - all processors can seamlessly be combined together with other reconstruction code or plugged into your analysis
    - e.g. different clustering algorithms
    - e.g. different track finding codes

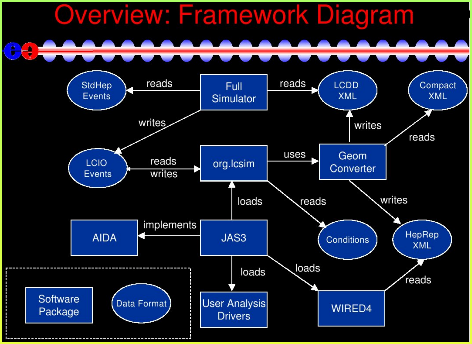
Reconstruction: Complete Algorithms

- Lots of people working on full PFA or portions
  - Steve Magill, Norman Graf, Guilherme Lima, Ron Cassell, Matt Charles, Steve Kuhlman, Lei Xia, …
  - See talk by Steve Magill
- Calorimetry part seems to have working PFA algorithms.
- Real tracking algorithms are not included (yet).
- Many utilities and tools exist.
  - Vertex and track fitting, clustering, jet finding
- Need to work on integration

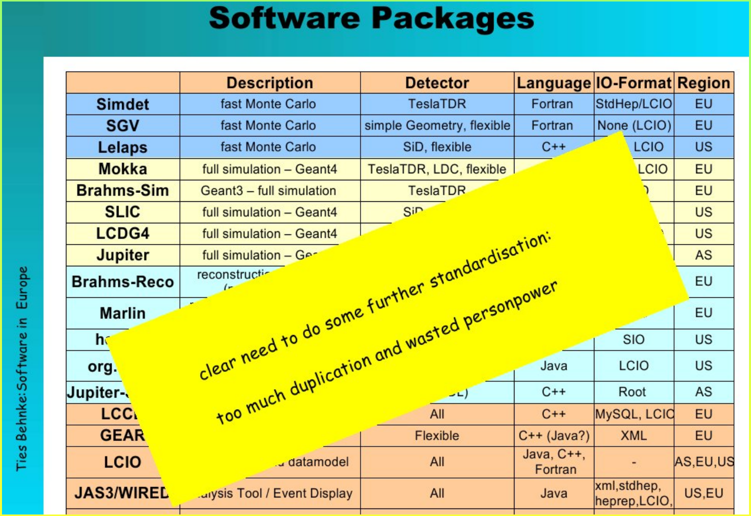
EU


software package dependencies
ILC-Software Packages
MySQL
CLHEP
Geant4
LCIO
Mokka
Gear
LCCD
CondDBMySQL
JAIDA
Root
AIDAJNI
AIDARoot
Marlin
AIDA
GSL
cernlib
CED
MarlinUtil
CEDViewer
MarlinReco

US


Overview: Framework Diagram
StdHep Events
reads
Full Simulator
reads
LCDD XML
Compact XML
writes
writes
reads
LCIO Events
reads
writes
org.lcsim
uses
Geom Converter
loads
reads
writes
AIDA
implements
JAS3
Conditions
HepRep XML
loads
loads
reads
Software Package
Data Format
User Analysis Drivers
WIRED4

Le mot du début à la fin

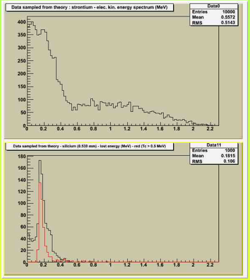


Software Packages

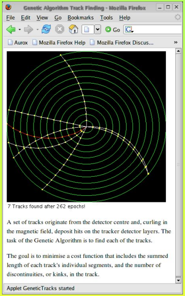
	Description	Detector	Language	IO-Format	Region
Simdet	fast Monte Carlo	TeslaTDR	Fortran	StdHep/LCIO	EU
SGV	fast Monte Carlo	simple Geometry, flexible	Fortran	None (LCIO)	EU
Lelaps	fast Monte Carlo	SiD, flexible	C++	LCIO	US
Mokka	full simulation – Geant4	TeslaTDR, LDC, flexible		LCIO	EU
Brahms-Sim	Geant3 – full simulation	TeslaTDR			EU
SLIC	full simulation – Geant4	SiD			US
LCDG4	full simulation – Geant4				US
Jupiter	full simulation – Ge				AS
Brahms-Reco	reconstructi				EU
Marlin					EU
h				SIO	US
org.			Java	LCIO	US
Jupiter-		L)	C++	Root	AS
LCC		All	C++	MySQL, LCIO	EU
GEAR		Flexible	C++ (Java?)	XML	EU
LCIO	datamodel	All	Java, C++, Fortran	-	AS,EU,US
JAS3/WIRED	alysis Tool / Event Display	All	Java	xml,stdhep, heprep,LCIO,	US,EU

Activités en cours au LPNHE

- Si: simulation pour données avec sources et faisceaux.



- Etudes d'algorithmes pour le tracking : Algorithmes Génétiques, Lignes Brisées de Blobel



- Simulation et reconstruction avec les outils actuels pour les tests en faisceaux.

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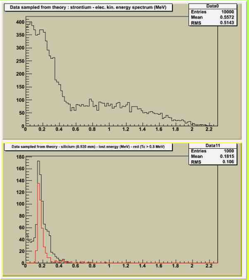

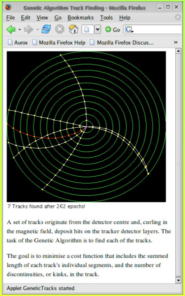

- Simulation et reconstruction avec les outils actuels pour les tests en faisceaux.
- Simulation et tracking avec des processus de référence.