

ILD Software for CLIC detector R&D

André Sailer

CERN-PH-LCD

LCD*



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*Not our Logo

Introduction

- Short term goal: CLIC Conceptual Design Report, April 2011
- Feasibility study for Detector at 3 TeV CLIC machine
- Using both validated concepts, ILD and SiD, to study physics reach of CLIC
- Study machine backgrounds and accelerator constraints on detectors
- Make use of available software tools from both concepts
- Contribute to development of software tools
- Start MC production of SM backgrounds and signal in September

Contents

- 1 Ongoing Work on Core Tools
- 2 Simulations with Mokka
- 3 Reconstruction with MarlinReco
- 4 Summary

Section 1:

1 Ongoing Work on Core Tools

- ILCDirac
- TGeoGEAR
- TPC

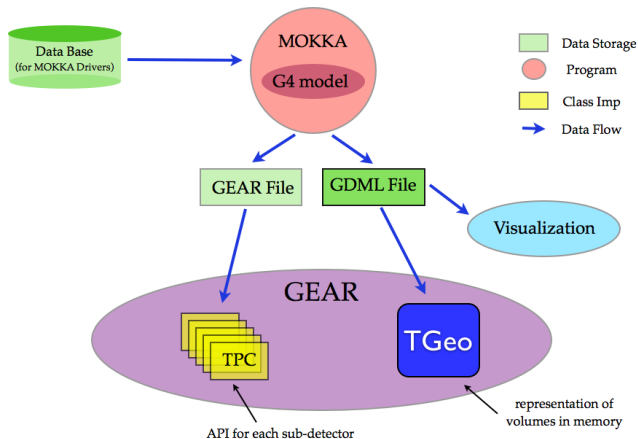
ILCDirac

- See Talk(s) by S. Poss:→Link
- Interface to Grid resources
- Wrapper around all LC (ILD and SiD) software
- Easy to use for the end-user and production
- Example MOKKA job

```
from ILCDIRAC.Interfaces.API.DiracILC import DiracILC
from ILCDIRAC.Interfaces.API.ILCJob import ILCJob
dirac = DiracILC();job = ILCJob()
job.setMokka("v07-02",steeringFile="my.steer",
            inputGenfile="my.stdhep",nbOfEvents=100)
dirac.submit(job)
```

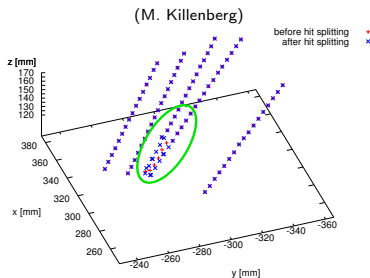
TGeoGEAR

- Long Term: Persistent geometry format for simulation, reconstruction and analysis
- See Talk by A. Münnich: →Link



TPC

- Simulation of hits in TPC for full bunch train and overlay with backgrounds
- Track separation for high occupancy and dense jets, e.g. $t\bar{t}$
- Developing hit splitter to estimate potential of TPC for CLIC
- TPC stand alone digitisation and reconstruction in MarlinTPC
 - ▶ Use Mokka output as input for detailed digitization
 - ▶ Planned: Reco up to hit level in MarlinTPC, tracking using LEPTracking from MarlinReco



Pattern recognition identifies overlapping hits as single track → Separate hits

Section 2:

- 2 Simulations with Mokka
 - CLIC_ILD
 - CLIC_ILD Forward Region
 - Vertexing and Forward Tracking
 - Other Uses

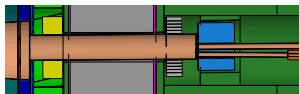
CLIC_ILD

- CLIC01_ILD: Based on ILD_00 with a few changes
- Deeper HCal ($7-9 \lambda_i$)
 - ▶ Tungsten in barrel
 - ▶ Either iron or tungsten in end-cap
- Increased radii for Vertex Detector
- Solenoid: 4 T
- Part of central Mokka database
- Will use this or similar model to simulate SM background and some signal for CDR



CLIC_ILD with
longer iron HCal
end-cap

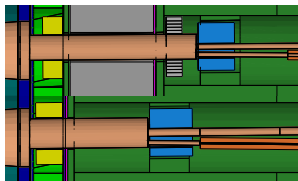
Detector with more detailed Forward Region



- Based on ILD_00fw forward region
- CLIC specific design for forward region
 - ▶ 20 mrad crossing angle
 - ▶ QD0 position and design
 - ▶ Beam-beam backgrounds
- Estimate background, overlay backgrounds with signal events
- Several iterations already
- New BeamCal Driver

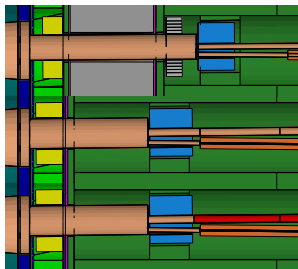
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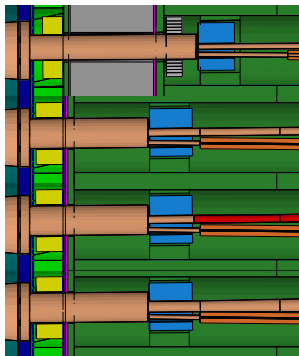
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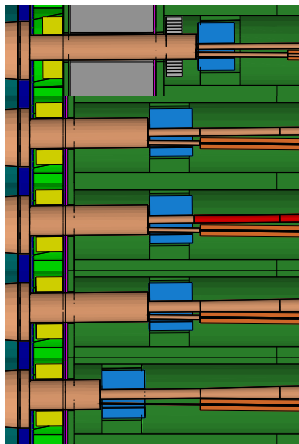
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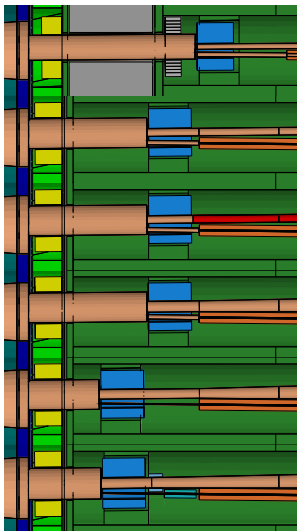
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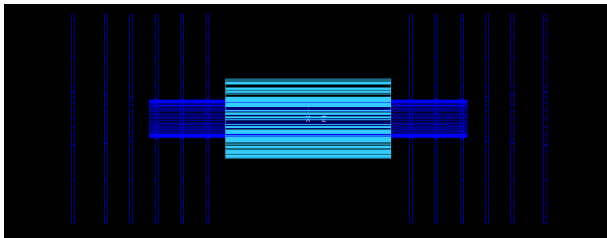
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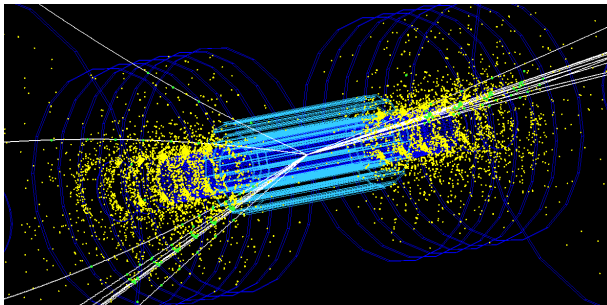
Vertexing and Forward Tracking

- Optimize vertex and forward tracking with full simulation and backgrounds (M. Battaglia, Marcel Vos, WG 3)
- Using different straw-man designs



Vertexing and Forward Tracking

- Optimize vertex and forward tracking with full simulation and backgrounds (M. Battaglia, Marcel Vos, WG 3)
- Using different straw-man designs
- And include backgrounds



Other Uses

- Simulations for the Tungsten HCal stack for the testbeam in November (C. Grefe)
- Muon system studies (E. van der Kraaij, P. Majewski, B. Schmidt)

Section 3:

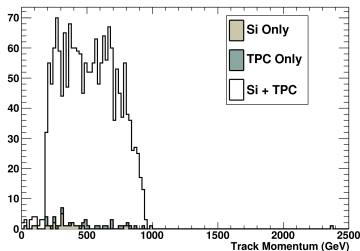
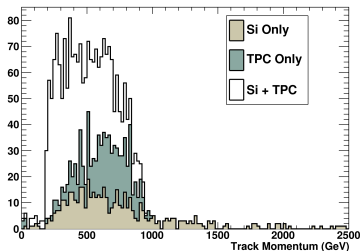
3 Reconstruction with MarlinReco

- Tracking
- PandoraNewPFA
- Overlay
- Jet Clustering
- TauFinder

Tracking

- Initially had some problems with split tracks
- Tracks in Si and TPC not connected
- Fixed by M. Battaglia & S. Aplin, coming to MarlinReco soon...
- On the right: Tracks with hits in Si, TPC or both. With old and new FullLDCTracking
- With new track merging number of tracks only in one tracker reduced

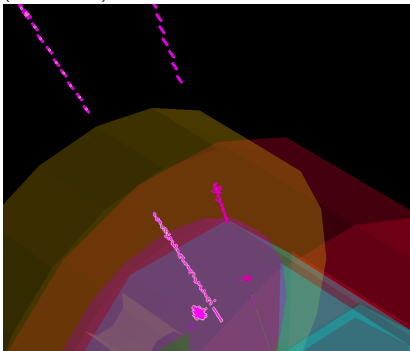
(M. Battaglia)



PandoraNewPFA

- PandoraNewPFA by J. Marshall, M. Thomson, P. Speckmayer
- Currently testing with simple topologies
- CLIC CDR WG2: M. Thomson, J.J. Blaising
- Right: Hits in muon system from two tracks are attributed to same PFO, under investigation
- Starting with $Z \rightarrow uds$ at higher energies ($\sqrt{s} > 1$ TeV) to check jet energy resolution
-

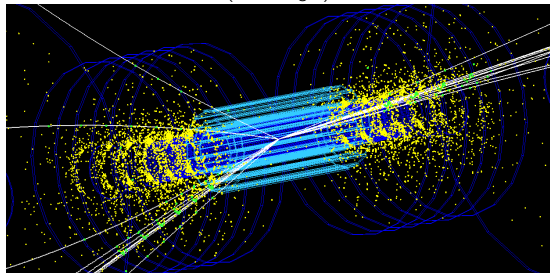
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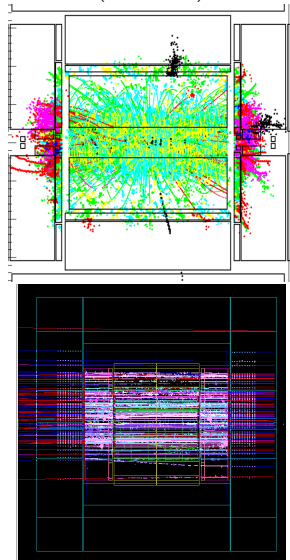
Overlay

- Overlay signal with some of the backgrounds at CLIC
- Apply different time-stamping intervals in all sub-detectors
- Implement in Marlin Overlay

(M. Battaglia)



(M. Thomson)



Jet Clustering

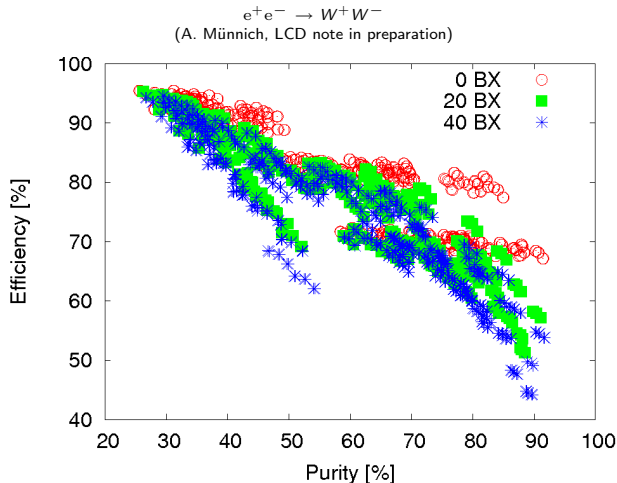
- Marlin processor implementing an interface to the FastJet library
- Several different Jet clustering algorithms
- Coming soon to MarlinReco(?)
- Keep $\gamma\gamma \rightarrow$ Hadrons from merging with jets from physics events

M. Battaglia and P. Ferrari, LCD-Note-2010-006, studying $HA \rightarrow bbbb$

| BX of overlaid $\gamma\gamma \rightarrow$ Hadrons | RMS ₉₀ /E _{jet} | |
|--|-------------------------------------|------------------------|
| | 4-jet Durham | semi-inclusive anti-kt |
| 0 | 0.113±0.002 | 0.112±0.002 |
| 20 | 0.149±0.003 | 0.129±0.002 |
| 40 | 0.170±0.003 | 0.133±0.002 |
| 60 | 0.183±0.003 | 0.140±0.002 |

TauFinder

- Marlin processor
- Runs on ReconstructedParticles



Summary

- Deadline for CDR April 2011
- Start simulation in September 2010
- Progress with CLIC_ILD simulation
- Progress with reconstruction
- Continue working on all aspects of software tools
- I hope both sides have benefitted and will continue to benefit

Thank You!