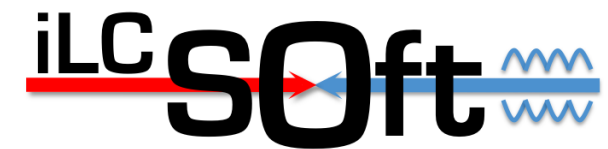


Summary of the Software Meeting

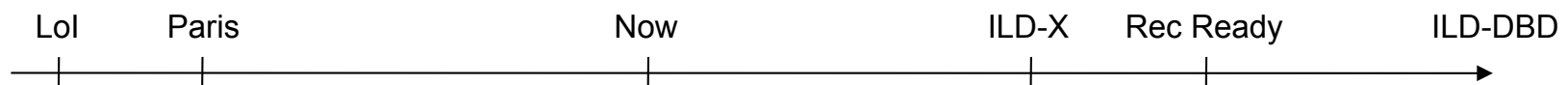
Steve Aplin

ILD Software and Integration Workshop 2010 – DESY
8th July 2010



Overview

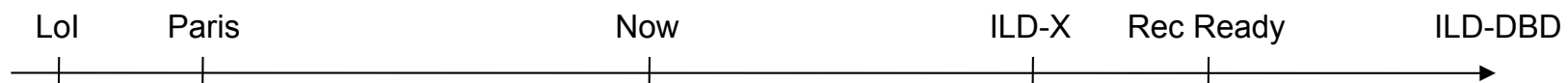
- 2009 LoI – Tools Ready – MC done – Job done ...
- 2012 DBD – More realistic – Background
- “2010 is the year for software development”
 - This Software Workshop – a direct outcome of Paris ILD Meeting



Outcomes of Paris Software Meeting

- Time-Line
- Discussions on how to converge on ILD detectors models
- Discussions on Monte-Carlo Production

5 month	Analysis and Writing	13 month
t0 - 5m	Monte Carlo production finished	
5 month	Grid Production	
t0 -10m	start Monte Carlo production	
3 month	Test, Debug and release ILDsoft	
t0-13m	freeze ILDsoft development	~20 month
>1 month	implement baseline in simulation	
t0-x	ILD baseline defined	
	evaluate technology options develop tracking package develop geometry LCIOv2	
	improve simulation realism improve reconstruction study machine backgrounds	



Goal of this Workshop

■ Simulation

◆ Increase realism of sub-detector drivers and add alternatives/options

- according to reports from sub-group contacts in mid. March, most of them are aiming to deliver improvements by this summer(Now)
- New ILD integration WG has been formed to address issues related to services/cables.

→ Review status of improved drivers and options/alternatives. Readiness and scheduling for the next step.

■ Reconstruction/Analysis/Core tools

◆ Improved drivers needs improved reconstruction tools

→ Review status of tools and news/updates of tools

■ MC Production

→ Review status of tools and news/updates of tools



Workshop Break Down

- Status of software tools
 - ◆ core
 - ◆ reconstruction
 - ◆ analysis and optimization
- Status of detector simulation
 - ◆ increased level of realism
 - ◆ services in simulation
- Integration issues
 - ◆ real estates and no-go holes
 - ◆ services
 - ◆ push-pull
- Monte Carlo production
 - ◆ Benchmark reactions
 - ◆ SB2009
 - ◆ ILD roadmap for DBD

6-July

7-July Morning

7-July Afternoon

8-July

*Very busy program, but please leave enough time for discussion
Let's have a fruitful workshop*

6 July 2010

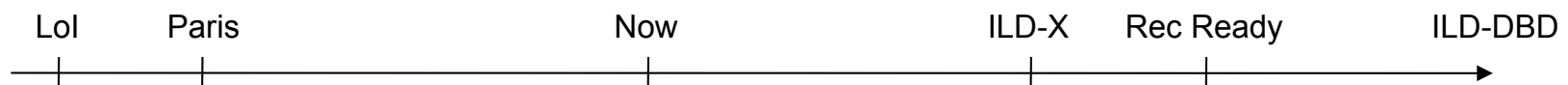
Akiya Miyamoto, ILD Software and Integration WS

5



Core Activities

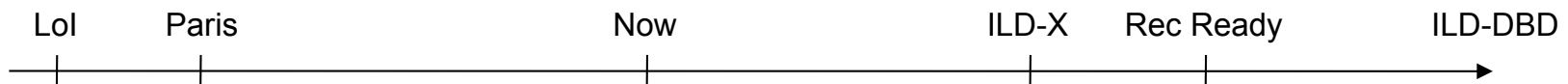
- Core Tools
 - LCIO and GEAR
 - Testing
 - Production Tools
 - Releases



Core Activities

- Core Tools
 - LCIO and GEAR
 - Testing
 - Production Tools
 - Releases

LCIO v1-51, Direct Access, Root Dictionaries
Extensions to GEAR – TGeo and CGA



Core Activities

- Core Tools
 - LCIO and GEAR
 - Testing
 - Production Tools
 - Releases

Frank Gaede, ILD Software WS, DESY, July 6-8, 2010

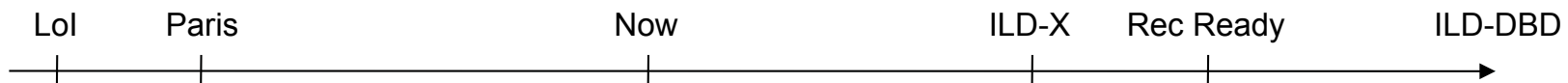
iLCSoft release v01-09	
CED	v01-00 *
CEDViewer	v01-00 *
CLHEP	2.0.4.2
CMakeModules	v01-09
CondDBMySQL	ILC-0-8-1
Druid	1.5 *
Eutelescope	v00-02-02
LCFIVertex	v00-03-01
LCFI_MokkaBasedNets	v00-01
Marlin	v00-12
MarlinPandora	v00-01 *
MarlinReco	v00-18
MarlinTPC	v00-05-02
MarlinUtil	v01-00
Mokka	mokka-07-04
MokkaDBConfig	v02-01
Overlay	v00-07-03
PandoraPFA	v03-02-01
PandoraPFANew	v00-02 *
QT	4.2.2
RAIDA	v01-04-03
SiliconDigi	v00-04-02
StandardConfig	v02-01
cernlib	2006
dcap	1.9.5-5
gear	v00-14-01
gsl	1.8
java	1.6.0
lccd	v01-00
lcio	v01-51
mysql	5.0.45
root	5.26.00b

• many packages changed (wrt v01-08)

• **some new added**

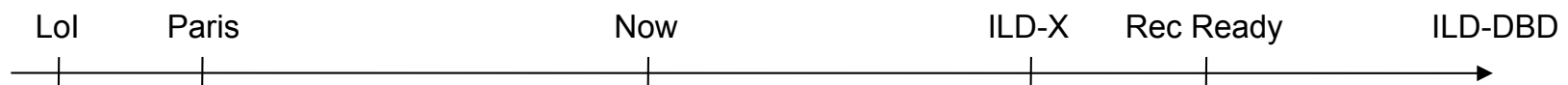
*see dedicated talks

7



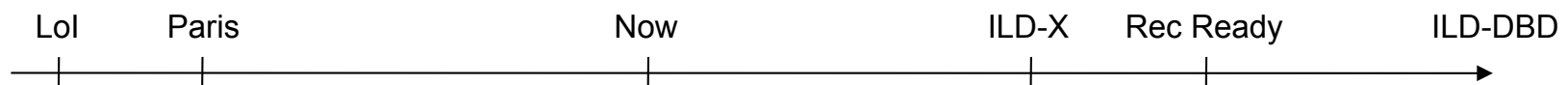
Core Activities

- Core Tools
 - LCIO and GEAR
 - Testing
 - Production Tools
 - Releases
- Establishment of New Working Groups
 - Intergration Group
 - Background Working Group
 - ILD – CLIC



ILD Simulation Model

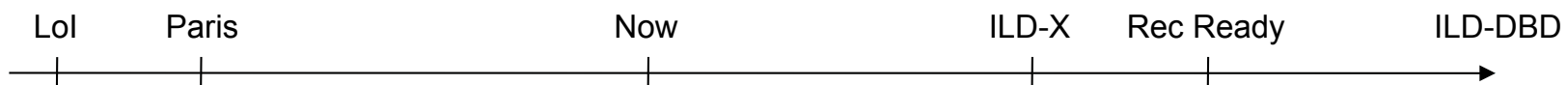
- Good coverage for the sub detector drivers
- Clear dialogue with R&D groups
- Integration of services and support outstanding
- Mokka – EDMS



ILD Simulation Model

sub detector	technology	contact persons
VXD	three double layers	Rita DeMasi /Takubo Yosuke
	five layers	Rita DeMasi
FTD	pixels/strips	Jordi Duarte
SIT	silicon strips	Alexandre Charpy, Valery Saveliev
SET	strips	Alexandre Charpy, Valery Saveliev
ETD	strips	Alexandre Charpy, Valery Saveliev
TPC		Steve Aplin
ECal	SiW	Paulo Mora deFreitas, Gabriel Musat
	ScintW	Katsushige Kotera
	Maps	Nigel Watson
HCal	SciFe	Angela Lucacci
	RPC-Fe – digital	Gerald Grenier
Muon (Coil)		Nicola D'Ascenzo, Valery Saveliev
BeamCal		Olga Novgorodova, André Sailer
LumiCal		Bogdan Pawlik
LHCal		?
beampipe/masks		Paulo Mora deFreitas
B-Field (Map)		?
Physic List		CSWTG (Akiya, Frank)

Contribution List	Time Table
Wednesday, 07 July 2010	
09:00	<p>[23] Mokka Status and Plans slides by Mr. Paulo MORA DE FREITAS (LLR) (Seminar Room 2: 09:00 - 09:15)</p> <p>[24] VXD slides by Georgios Gerasimos VOUTSINAS (Institut Pluridisciplinaire Hubert Curien (IPHC)) (Seminar Room 2: 09:15 - 09:30)</p> <p>[25] FTD slides by Jordi DUARTE CAMPDERROS (IFCA - Instituto de Fisica de Cantabria-Consejo Sup. de Investig) (Seminar Room 2: 09:30 - 09:45)</p> <p>[26] SIT, SET, ETD slides by Mr. Alexandre CHARPY (CNRS - IN2P3 - LPNHE) (Seminar Room 2: 09:45 - 10:00)</p>
10:00	<p>[27] TPC slides by Dr. Steve APLIN (DESY) (Seminar Room 2: 10:00 - 10:15)</p> <p>[28] SiW & Sci Ecal slides by Mr. Gabriel MUSAT (CNRS) (Seminar Room 2: 10:15 - 10:30)</p> <p>[29] SciHcal & dHCal slides by Dr. Angela LUCACI-TIMOCE (FLC, CALICE, DESY) (Seminar Room 2: 10:30 - 10:45)</p>
11:00	<p>[30] Muon slides by Dr. Nicola D'ASCENZO (Obrninsk State University) (Seminar Room 2: 11:15 - 11:30)</p> <p>[31] BeamCal slides by Andre SAILER (CERN, HU Berlin) (Seminar Room 2: 11:30 - 11:45)</p> <p>[32] LumiCal slides by Dr. Bogdan PAWLIK (Institute of Nuclear Physics PAN) (Seminar Room 2: 11:45 - 12:00)</p>
12:00	<p>[33] Discussion - Plans and Timeline slides (Seminar Room 2: 12:00 - 12:30)</p>



ILD Simulation Model

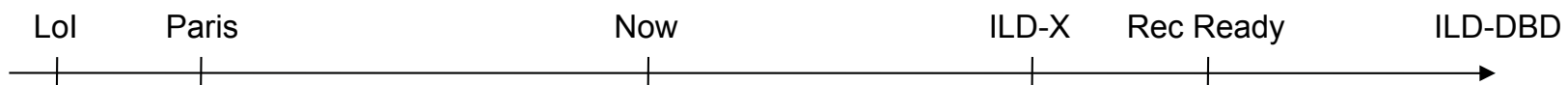
ILD simulation status today I

Frank Gaede, ILD Software WS, DESY, July 6-8, 2010

- beam pipe:
 - no final engineering design -> MDI/Integration group
- B-field
 - realistic field map for bg studies
 - simple field for mass production
- Physics List
 - use QGSP_BERT (re. by geant4)
 - issues in tungsten @CLIC !?
- VXD
 - realistic models for 3 double and five single layers
 - cabling missing
- FTD
 - currently simplified model - realistic design to be implemented
 - just started
- SIT, SET, ETD
 - realistic and detailed sim. exists
 - currently implemented in Mokka
- TPC
 - rather realistic simulation
 - need cabling and support

blue: ongoing work or to be addressed

3



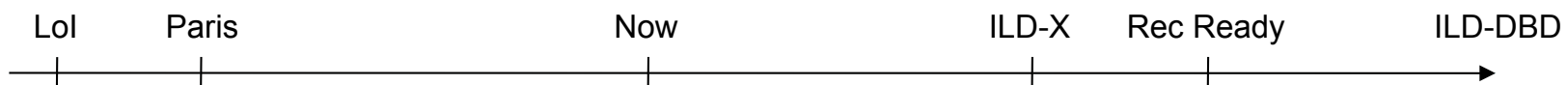
ILD Simulation Model

ILD simulation status today II

Frank Gaede, ILD Software WS, DESY, July 6-8, 2010

- Sci- and Si/W ECal
 - realistic driver exists
 - can vary mix of Scint./Silicon
 - -> can study options !
- dHcal – Sci Hcal
 - realistic simulation drivers exists
 - two geometries for dHCAL
 - need cabling and services
- Muon
 - new more realistic model exists
 - needs to be verified
 - strips vs. tiles ?
- BeamCal
 - new engineering design exists
 - implemented in Mokka
- LCal
 - new realistic driver exists
 - including support, cooling
- LHCAI
 - no real design exists

4



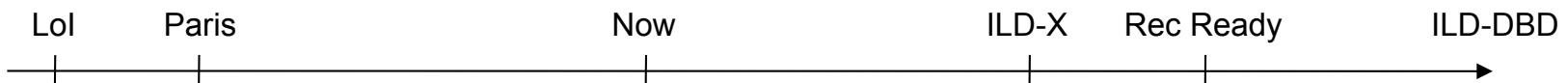
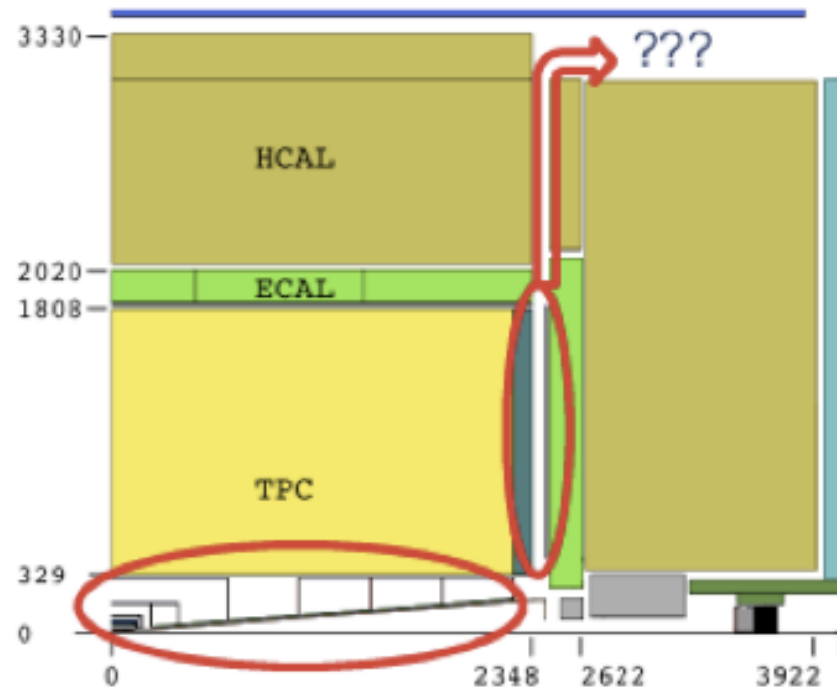
ILD Simulation Model

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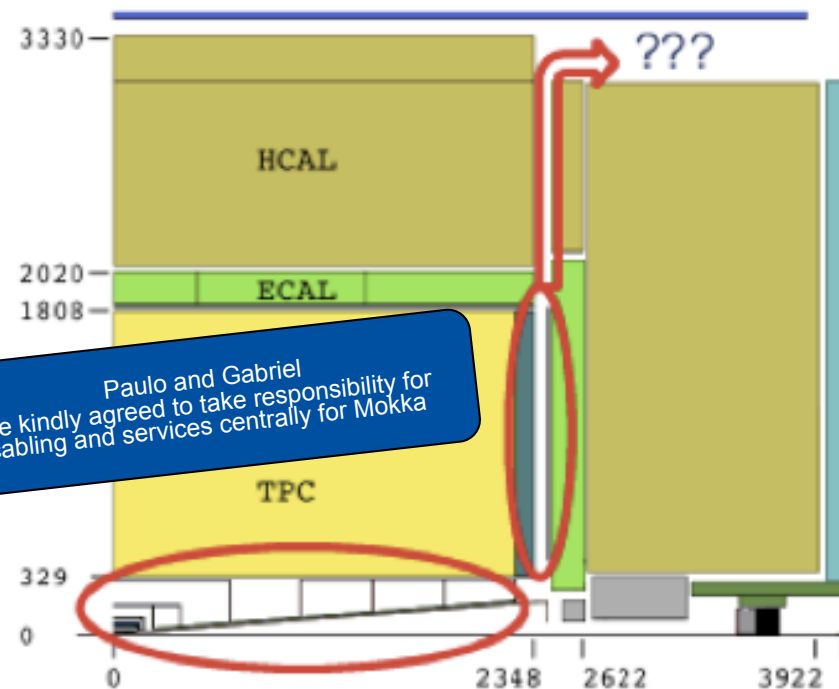
ILD Simulation Model

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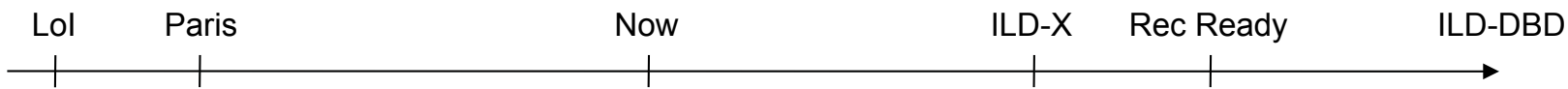
Frank Gaede, ILD Software WS, DESY, July 6-8, 2010

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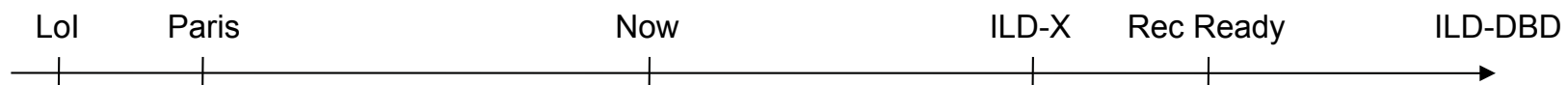


Paulo and Gabriel have kindly agreed to take responsibility for cabling and services centrally for Mokka



ILD Simulation Model

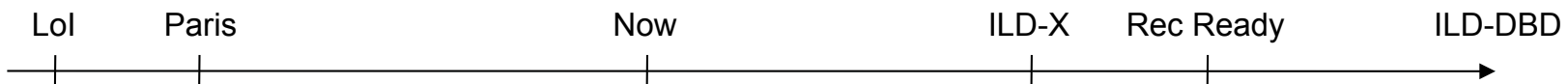
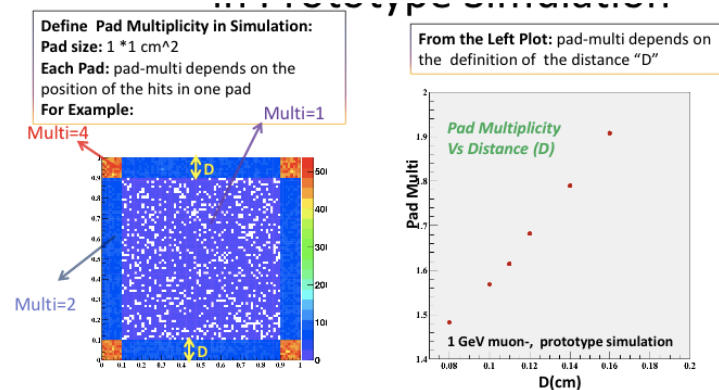
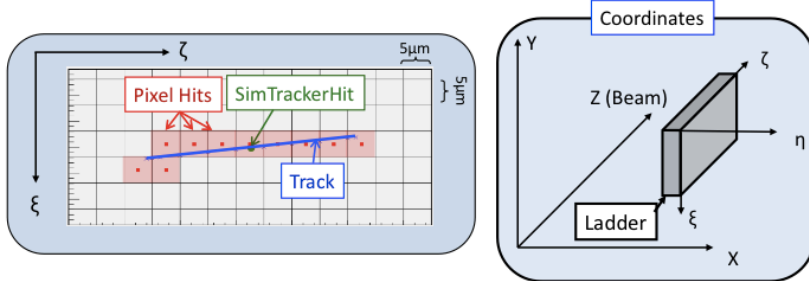
- ILD baseline includes options: we need a sufficient, yet limited number of ILD models – preferably with optioned studied in the “same” geometry
- Using the new drivers a New Development Model ILD-01 should be created ASAP
- Need to keep our eye on the issue of digitisation



ILD Simulation Model

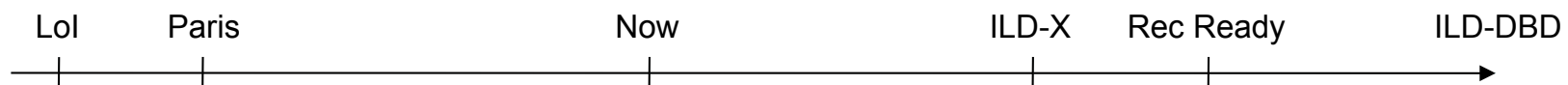
- ILD baseline includes options: we need a sufficient, yet limited number of ILD models – preferably with optioned studied in the “same” geometry

- The track is calculated by the local point and local momentum.
 - Large momentum \rightarrow Approximated by a linear track.
 - Low momentum \rightarrow Calculated as a helical track.

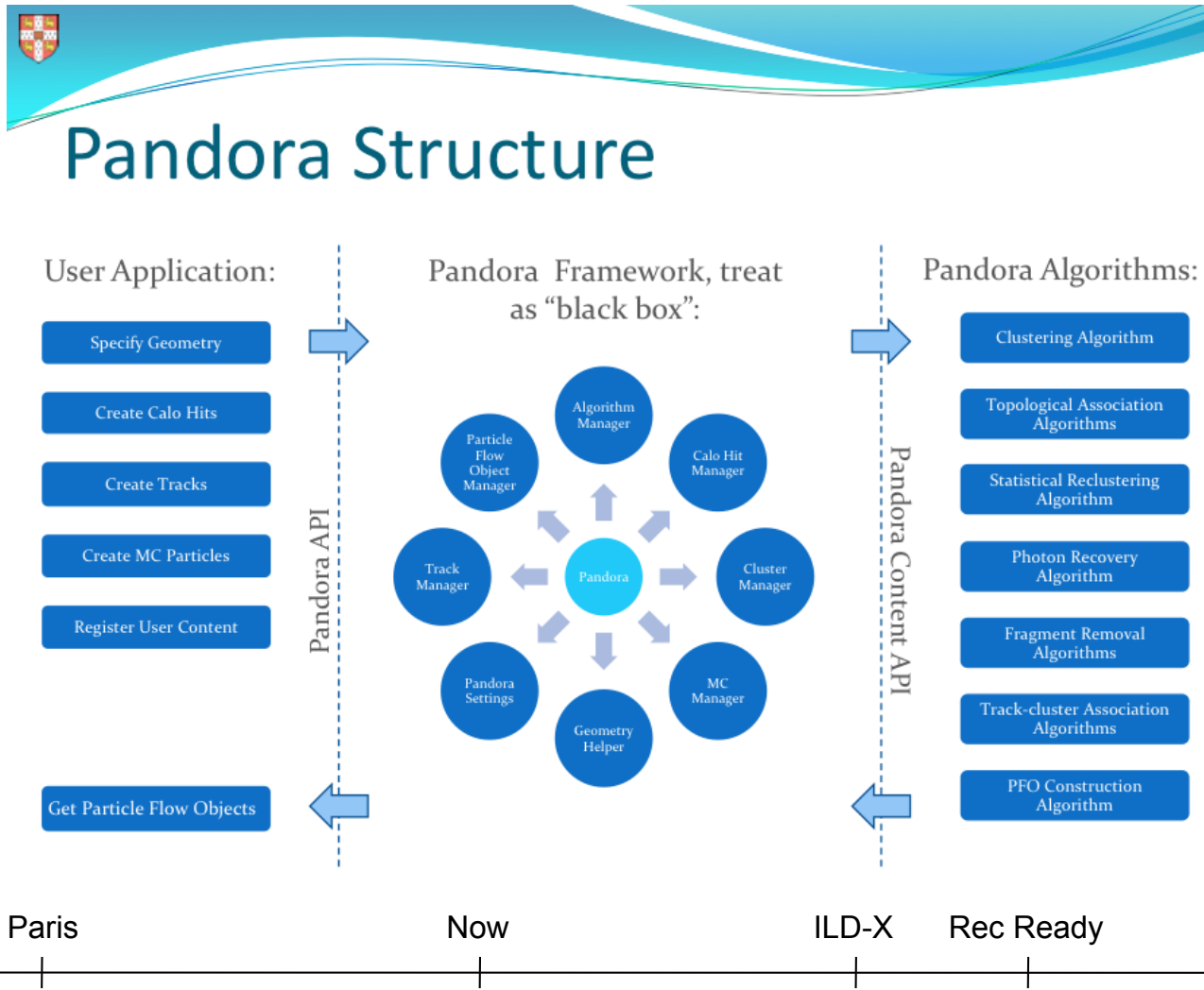


Reconstruction

- Generally people doing reconstruction are making use of this relatively quiet time after what has been a quite intense period focused on performance
- Pleased to see that there has been an early uptake of New Pandora PFA, and that those still using the original are committed to moving over



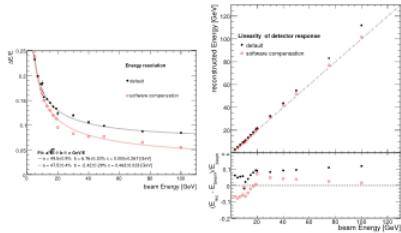
Reconstruction



Reconstruction

K_L^0 events with physics list QGSP_BERT at low energies

Dip at 10 GeV. Most likely due to physics list composition



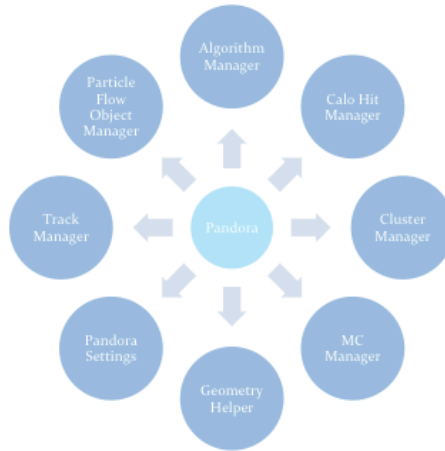
Pandora Structure

User Application:

- Specify Geometry
- Create Calo Hits
- Create Tracks
- Create MC Particles
- Register User Content
- Get Particle Flow Objects

Pandora API

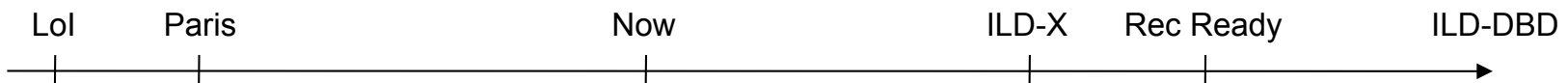
Pandora Framework, treat as "black box":



Pandora Algorithms:

- Clustering Algorithm
- Topological Association Algorithms
- Statistical Reclustering Algorithm
- Photon Recovery Algorithm
- Fragment Removal Algorithms
- Track-cluster Association Algorithms
- PFO Construction Algorithm

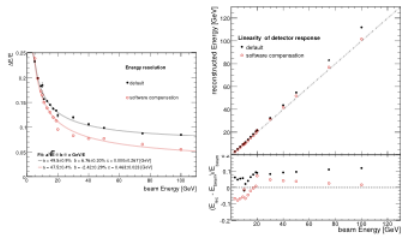
Pandora Content API



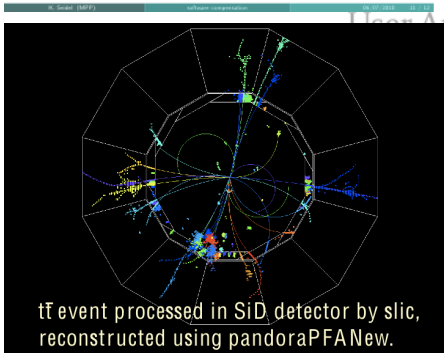
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Pandora Structure

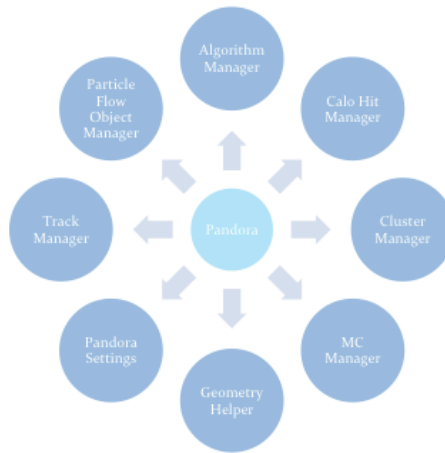


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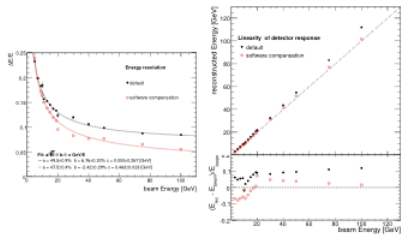
Pandora Content API



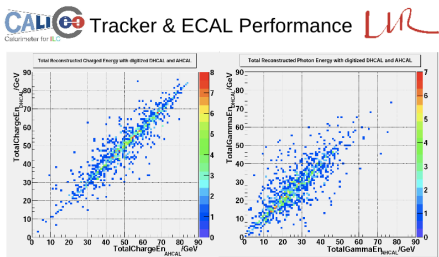
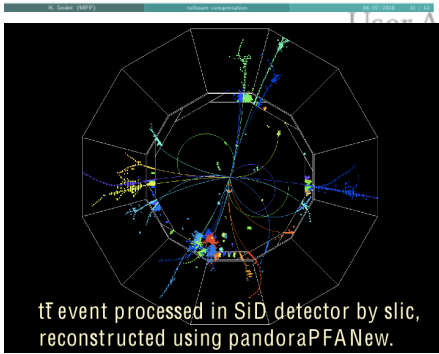
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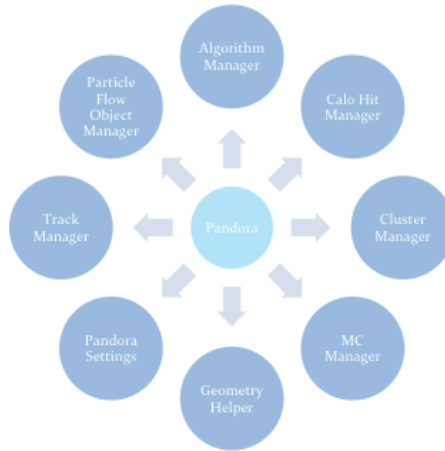


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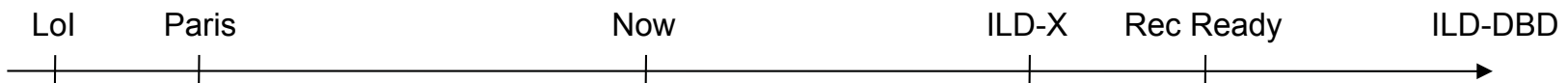
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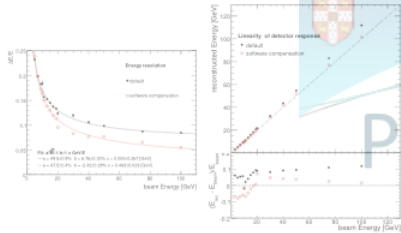
Pandora Content API



Reconstruction

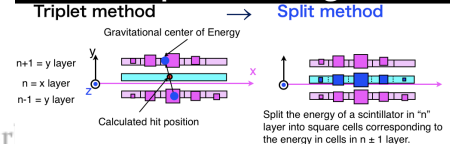
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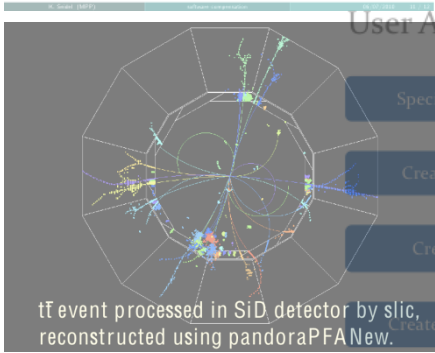


Pandora Structure

New approach for the Strip Clustering

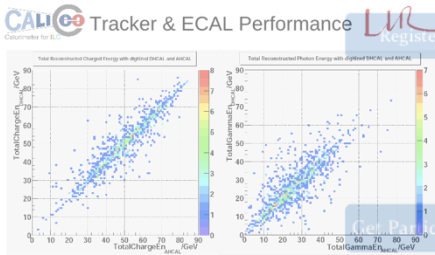


- Split method**
- Note that we do not need to give strip shape information to the PFA processor.
 - Energy in split cells are calculated as a fraction of total energy in a scintillator.
 - This is suitable for the PandoraPFA which requires $5 \times 5 \text{ mm}^2$ segmentation
 - Simple way

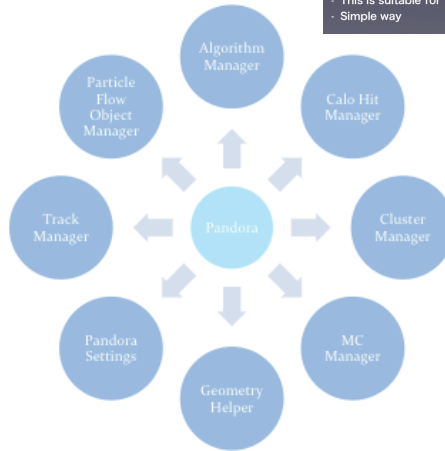


User Application:

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Pandora Framework as "black box"

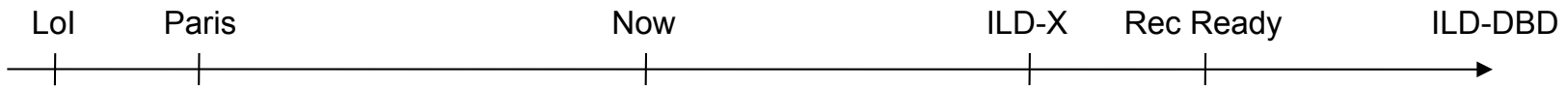


Algorithms:

- Topological Association Algorithms
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Pandora API

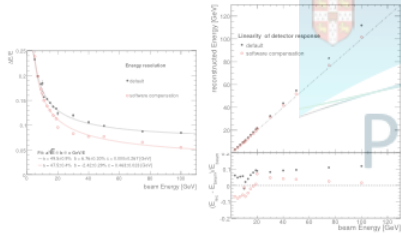
Pandora Content API



Reconstruction

K^0 events with physics list QGSP_BERT at low energies

Dip at 10 GeV. Most likely due to physics list composition



Pandora Structure

New approach for the Strip Clustering

Triplet method → **Split method**

Gravitational center of Energy

Calculated hit position

Split the energy of a scintillator in "n" layer into square cells corresponding to the energy in cells in $n \pm 1$ layer.

Split method

- Note that we do not need to give strip shape information to the PFA processor.
- Energy in split cells are calculated as a fraction of total energy in a scintillator.
- This is suitable for the PandoraPFA which requires $5 \times 5 \text{ mm}^2$ segmentation
- Simple way

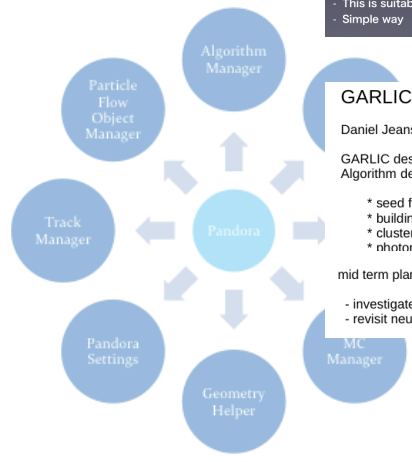
User Application:

- Specify Geometry
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tt event processed in SiD detector by slic, reconstructed using pandoraPFA New.

Pandora API

Pandora Framework as "black box"



Algorithms:

- Topological Association Algorithms
- Clustering Algorithms
- Discovery Algorithms
- Removal Algorithms
- Track-cluster Association Algorithms
- PFO Construction Algorithm

GARLIC photon identification : code status

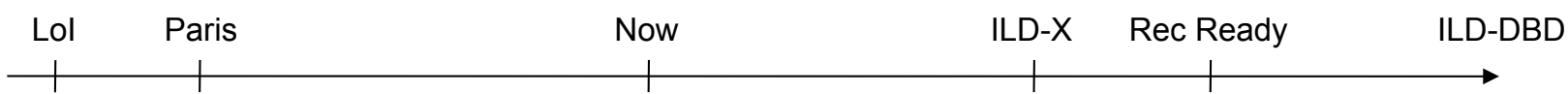
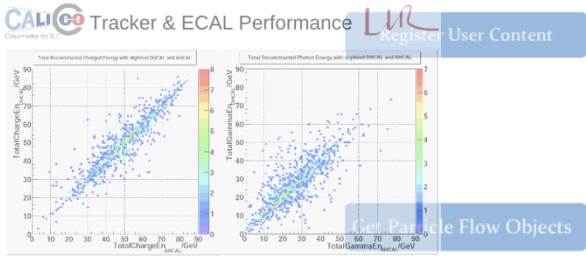
Daniel Jeans, LLR Ecole polytechnique

GARLIC designed to identify pointing photons
Algorithm developed from ALEPH -> TESLA studies -> ILD/CALICE

- * seed finding in first section of ECAL
- * building up of cluster core
- * clustering around core
- * photon identification by Neural Network

mid term plans:

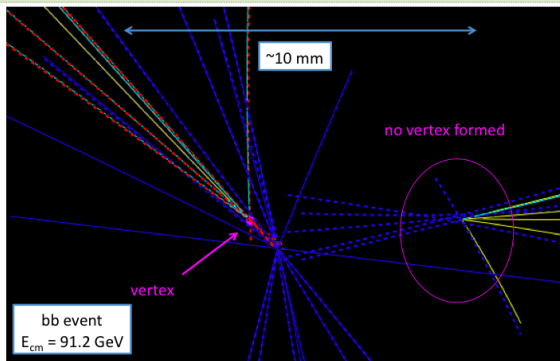
- investigate integrating algorithm into Pandora framework
- revisit neural network trainings (reduce # variables)



Reconstruction

- LCFI Vertex
 - Good to see that the group which have taken over maintaining LCFI Vertex have established themselves well

event display



- Checking vertex reconstruction with the event display (dedicated to track + vertex)
- One often finds a cluster of tracks which seem like a perfectly good vertex candidate but the vertexing fails (such as the one shown on the right)



T. Tanabe

10

summary and plans

- from basic checks to algorithm tuning
 - ✓ vertex hits
 - ✓ track reconstruction
 - ✓ track residual & track errors
 - ➔ track quality & track selection
 - vertex reconstruction
 - combination of input variables
 - optimization for multi-jet environment

April – June 2010 ✓

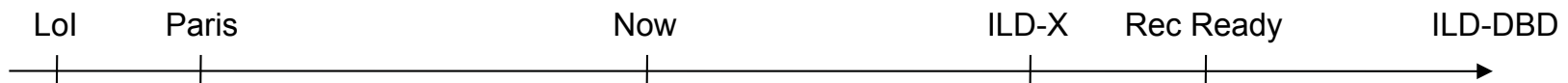
July – September 2010

to be completed by ECFA



T. Tanabe

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Reconstruction

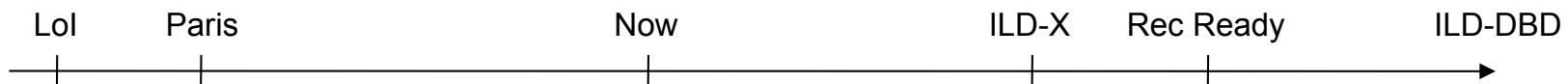
- LCFI Vertex
 - Good to see that the group which have taken over maintaining LCFI Vertex have established themselves well

- Analysis tools
 - Need to ensure that tools don't get lost
 - SW development and ILD as a whole would greatly benefit from an increase in the number of people looking at analysis

Summary

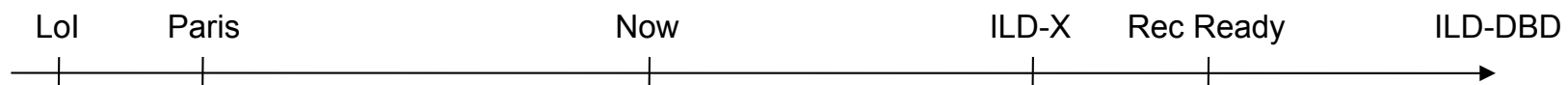
- The specific needs for physics analysis tools were presented.
- A survey of existing tools was given.
- Some examples of missing tools was also given.
- A few points were raised:
 - The lack of "User's Guide"-type documentation was pointed out.
 - Why are so few of the tools developed for various analyses in ILCSoft ?
 - Are the needs in physics analysis to balance significance and power, or to choose null and alternative hypotheses met, in particular wrt. LCFI and Pandora ?

Wolfgang Bergauer (DESY/HH) Status of physics, Tools in Merlin ILD see also, DESY 18 / 18



Tracking

- Biggest single software project for ILD
- DBD \leftrightarrow AIDA differences in time frame
- To move forward with ILCSoft, we need to make a Kalman Filter easily accessible and familiar to everybody using Marlin
 - use Kaltest for this purpose
- Establish a tracking framework based on abstract interfaces, thus ensuring freedom of implementation whilst protecting against the inherent problems of software dependency – this work has already started
- Establish a Working Group to coordinate the effort within the AIDA WPA: although as not of all of the people working on tracking will be working directly on the AIDA project, we must maintain an efficient work flow exchange between the detector groups and avoid duplication of effort



Tracking

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Manpower & funding aspects

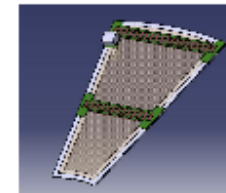
- **HEPHY Vienna:**
 - Commitment of the Vienna ILD Group to take full responsibility of the [new Forward Track Reconstruction](#) processor;
 - Expect a first [diploma student](#) to start work this autumn;
 - Later do a [study of background radiation in the forward region](#).
- **AIDA Proposal:**
 - Submitted to EU's fp7 for period 2011-14, decision mid 2010 ?
 - WP 2 of 9 "[Common Software Tools](#)" (*F. Gaede, P. Mato*);
 - Task 2 of 2: "[Reconstruction Toolkits for HEP](#)", Sub-task 1 of 4: "[Tracking Toolkit](#)" – DESY: coordination and "Barrel Tracking" (*St. Aplin*), HEPHY: "Forward Tracking" (*R.F., W.M.*);
 - Expect 1/3 refunding for 4 student-years, and travelling costs.

6 - 8 June 2010 ILD Software and Integration Workshop 9

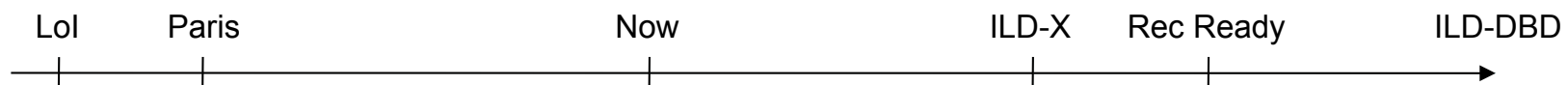
Digitization of FTD

Current Status

- Not defined yet the technology, so digitization is done via gaussian smearing of the simulated hits
- Smearing in XY local coordinates in all Disks
 - Disks 1-3: pixel Si detector
 - Disks 4-7: micro-strip Si detector
- For strip detectors smearing must be done in the direction of the strips: $R\Phi$ coordinate



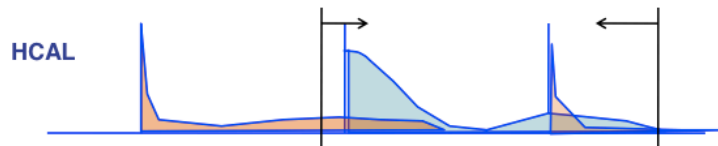
Jordi Duarte Campesinos (IFCA) Forward tracking II ILD Workshop 2 / 8



Background

Proposal

- ★ All overlay performed in Overlay processor
 - i.e. not in the digitisers which would require passing LCIO background hits to digitisers (most would be thrown away)
- ★ Overlay processor(s)
 - Handle multiple background files .slcio (pair, muon, ...)
 - Configurable at global level
 - e.g. specify BX separation in time
 - Include functions for overlay of different sub-detectors
 - some will be simple, others won't ...
 - configuration to specify BX window required and timing cuts



- Need to include hits from a range of BXs and then impose cuts

ILD Meeting, 7th July 2010, DESY

Mark Thomson

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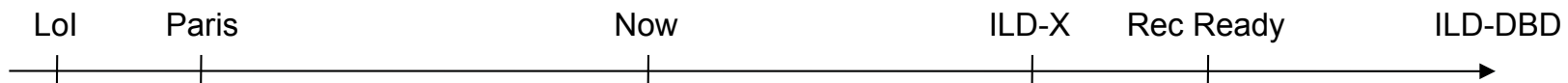
Software Tasks

- ★ OverlayProcessor
 - Validate running multiple processors (one for each background type) works
 - Integrate missing sub-detectors, e.g. Calorimeters
 - Benchmark software performance, CPU, memory
- ★ Unify configuration of sub-detectors in overlay processor
 - Specify range of BXs for overlay, e.g. -50, +10 BXs
 - Specify assumed two hit separation in time, e.g. 10 ns
 - This is hardware dependent but in first instance make reasonable guess at pulse shape (probably not critical)
 - Specify timing cuts for hits to be passed to digitiser, e.g. -5 ns, +100 ns
- ★ Digitisers
 - Timing cuts
- ★ Prepare background samples
 - We have pairs
 - Need: gamma gamma → hadrons
 - Need: beam halo muons
 - Coordinate with CLIC on this

ILD Meeting, 7th July 2010, DESY

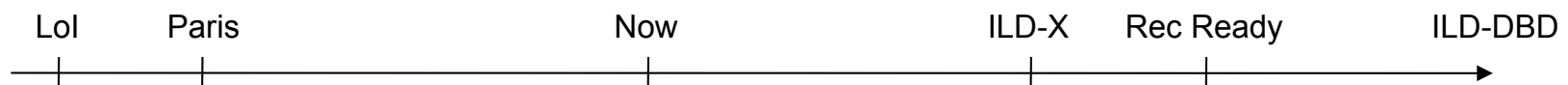
Mark Thomson

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LC Software Meeting

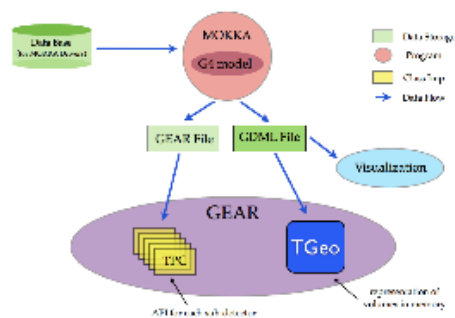
- Representatives working on software from:
 - ILD
 - SID
 - CLIC
 - CALICE
 - LC-TPC



LC Software Meeting

- Discussions on Core Tools and MC Production
 - Geometry
 - Use and Sharing of Grid Resources

Geometry Information Flow



A. Muerlieth TGeo and GEAR 5

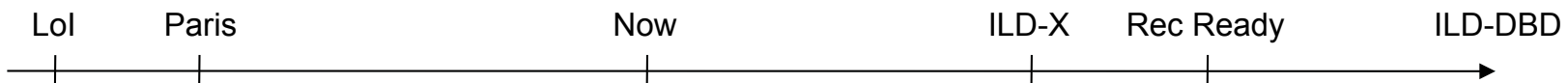
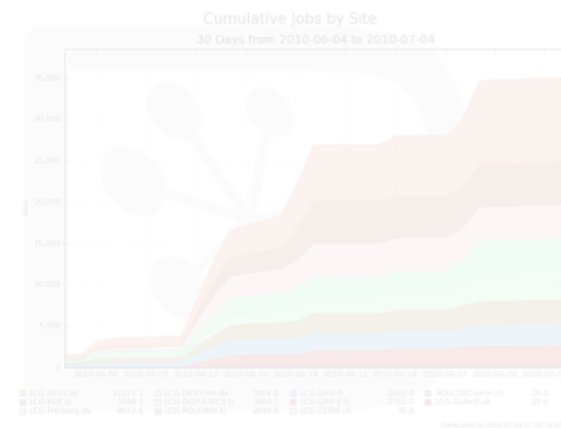
The GearMgr object

- Has all the information until now contained in the GEAR file
- Also provides the information on the Point and Distance Properties
 - `const GearDistanceProperties& distProp= gearMgr->getDistanceProperties();`

Paulo Mora de Freitas - L.L.R. - Ecole polytechnique

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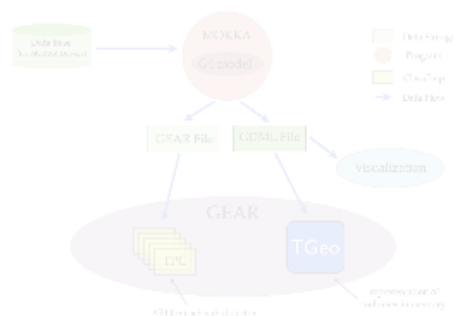
Number of jobs in the system



LC Software Meeting

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 - Geometry
 - Use and Sharing of Grid Resources

Geometry Information Flow

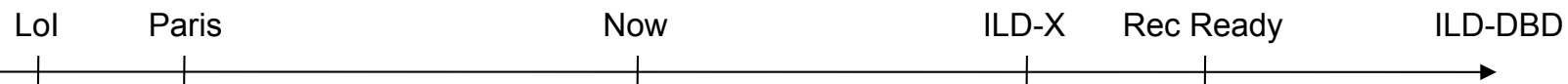
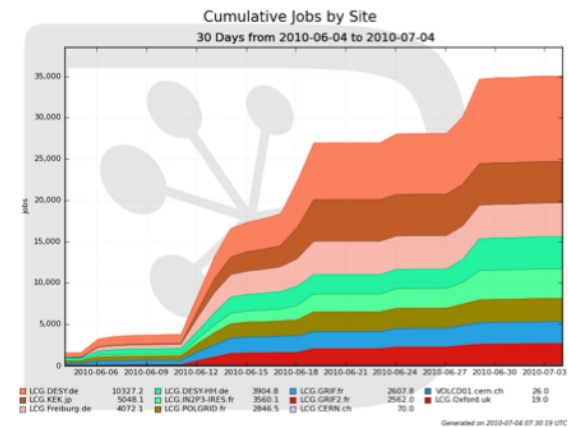


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Number of jobs in the system



Summary

- Participation very encouraging
- Need to produce next ILD Simulation Model ASAP
- As ever Workshops help to produce more work ;)

Summary

from T.Behnke, LCWS2010

Main Milestones

