

# *Status of EU Telescope*

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on behalf of JRA1 software/analysis group*

EUDET Annual Meeting – Paris – 8/10 October 2007

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# ***Introduction***



# *Main goals of the tracking software*

- Providing the users a set of relevant high level objects (like tracks or space points) to characterize the DUT along with histograms of important figures of merit.
  - Complementing the hardware part in improving the test beam infrastructure.
  - Collaborating in the development of a common software framework in view of the future International Linear Collider experiment.
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# *Very solid starting point...*

*... trying not to reinvent the wheel!*

- Gain as much as possible from past experience and already available and tested software tools:
    - **Single sensor analysis** → sucimaPix (INFN)
    - **Eta function correction** → MAF (IPHC - there are several other things we can and should borrow)
    - **Track fitting** → Analytical track fitting (A. F. Zarnecki taking care of MS) and straight line fitting (T. Klimkovich)
    - **Simple alignment** → Minuit based (copied and improved from other codes)
    - **Framework** → ILC Core software = Marlin + LCIO + GEAR + (R)AIDA + CED (+ LCCD).
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# *A collaborative approach...*

*... a virtuous circle!*

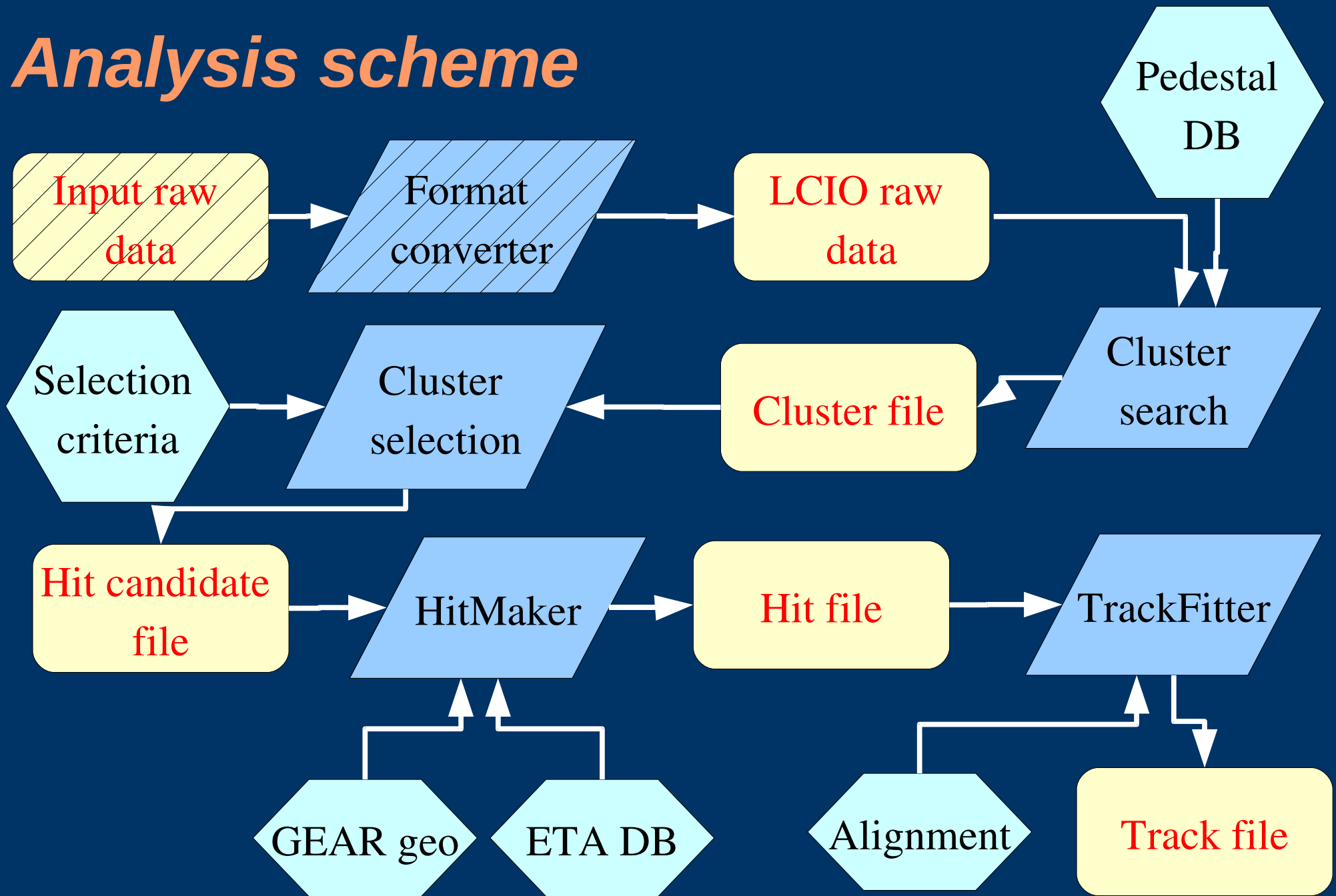
- In the last months, the ILC software framework has been adapted to our needs:
    - Added the capability to re-loop over the input events
    - Added the possibility to re-implement the output processor
    - Added a new logging mechanism
  - At the same time, our team was helping the main developers to implement missing features:
    - Telescope-like GEAR description (T. Klimkovich)
    - Telescope-like graphical event display (A. B.)
    - Alignment using Millepede (work in progress by P. Roloff)
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# *The analysis strategy*

*... going step by step*

- Each analysis module is implemented into a Marlin processor and consequently we can execute all of them together, or stop after every single step to verify the output.
  - This is offering several advantages
    - Once the telescope behavior will be well understood, several steps can be merged together but for the time being it is allowing the debug of both hardware and software
    - Some analysis (like efficiency and purity) requires to replay the same analysis step with different selection criteria. Storing intermediate results can reduce long reprocessing time.
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# Analysis scheme



# ***Achievements***





## *It's WORKING*

- EUTelescope has been successfully used during the last three test beam periods.
- One major bug was discovered in the data conversion soon after the end of the first data taking period and immediately fixed.
- All the results of the beam tests have been obtained using EUTelescope!

## *It's on the GRID*

- Nearly all the analysis steps are performed on the GRID reducing the processing time by at least one order of magnitude
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# *EUTelescope in ILCSoft*

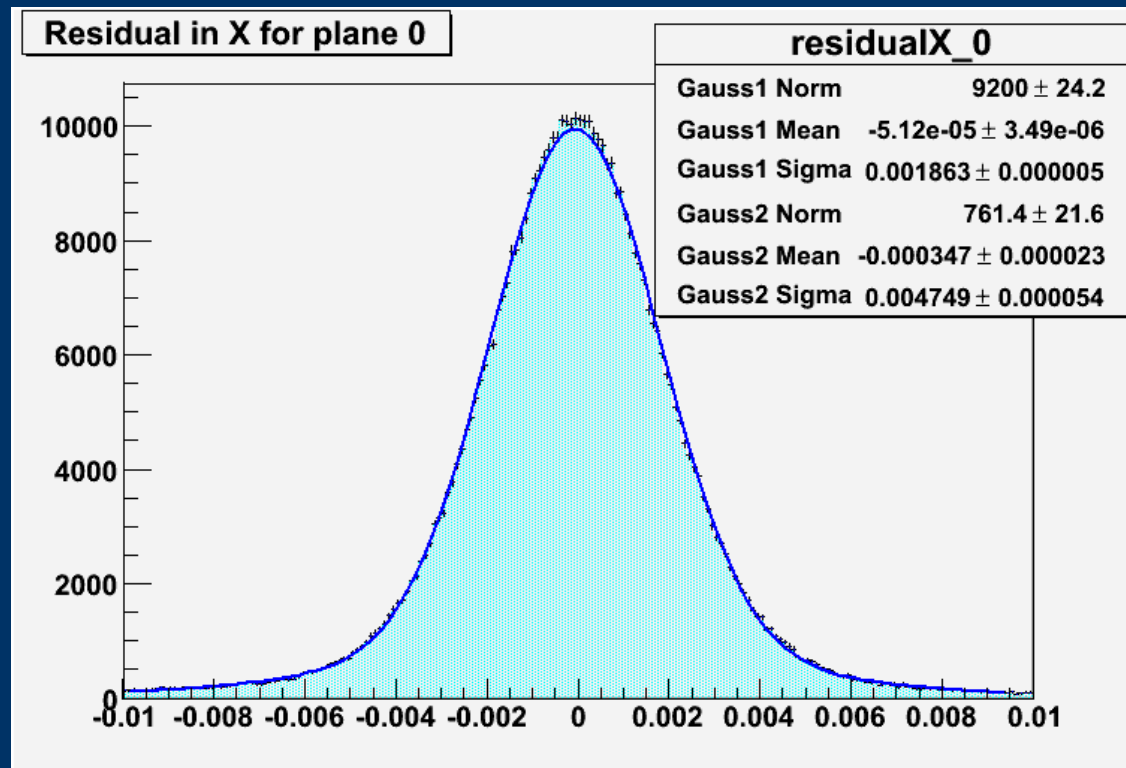
- EUTelescope is available to the ILC community as a Marlin package
  - This is making the installation of EUTelescope very easy using ilcinstall.
  - The integration with all the other software tool is trivial

```
# Marlin Packages
ilcsoft.install( MarlinUtil( "v00-04" ) )
ilcsoft.install( CEDViewer( "v00-03" ) )
ilcsoft.install( Eutelescope( "v00-00-05" ) )

# Eutelescope specific
ilcsoft.module("Eutelescope").download.type="ccvssh"
ilcsoft.module("Eutelescope").download.username="bulgheroni"
ilcsoft.module("Eutelescope").buildWith([ "GEAR", "RAIDA",
                                           "MarlinUtil", "GSL", "LCCD", "EUDAQ", "ROOT" ])
ilcsoft.module("Eutelescope").env["EUDAQ"]="/home/toto/ilc/eudaq"
ilcsoft.module("Eutelescope").env["ROOT_HOME"]="/cern/root"
```

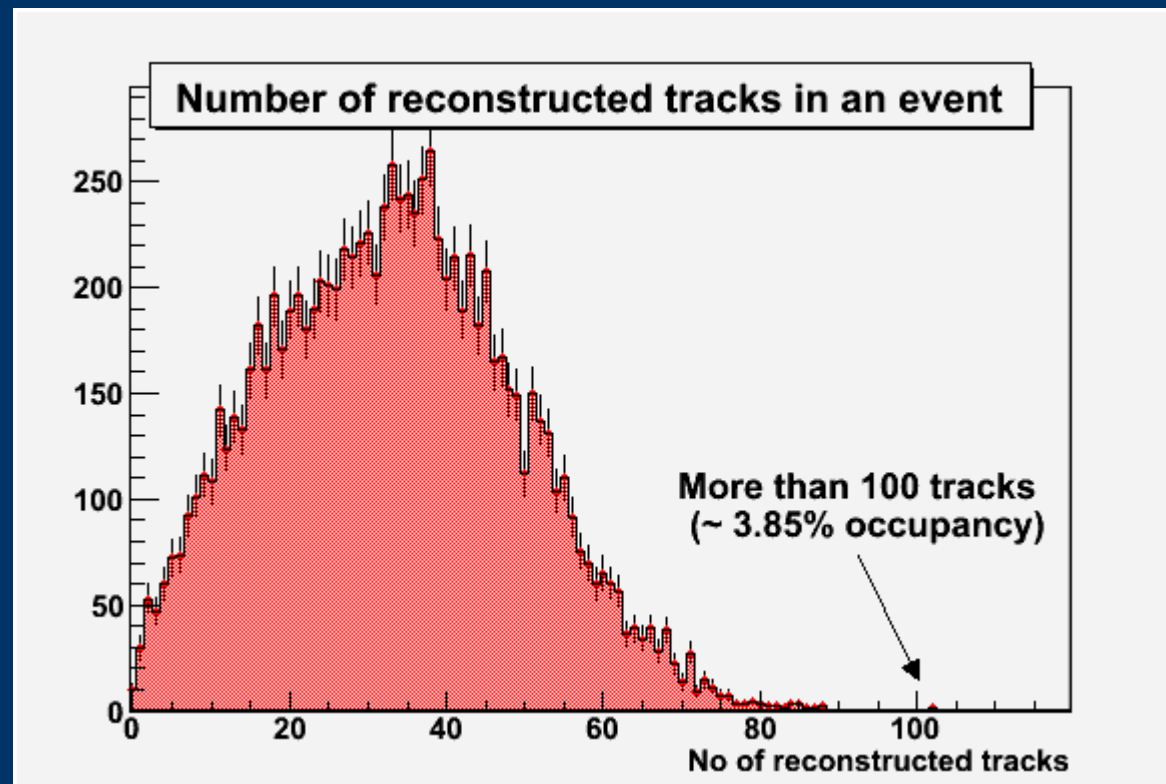
# Results...

- Two talks during this annual meeting (1 in JRA1 parallel session and 1 in the plenary)
- Test beam results will be presented also at IEEE – NSS (Hawaii) in less than one month.



# Performances...

- This impressive plot is showing the pretty mature development stage of the tracking software.



CERN large multiplicity data taken two weeks ago

# *Future plans*



# Getting closer to the DAQ / 1

- Remove the format conversion step... getting LCIO files directly from the DAQ
    - So far used the native data format only for debug. Now time has come to test the LCIO output.
    - The native format will be used among the DAQ components and the LCIO file will be produced by the DataCollector to minimize the changes.
    - In principle not too difficult, but requires lots of tests because we cannot lose information at this stage.
    - Requires some changes to the LCIO library because compression (zlib) can be too heavy during data taking.
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# *Getting closer to the DAQ / 2*

- Improve the interaction between the DAQ and EUTelescope.
  - EUDAQ and EUTelescope should log to the same conditions DB
  - EUTelescope should immediately process pedestal run and upload the new thresholds to the DAQ system when working in ZS mode.



# *Improve the alignment procedure*

- Currently using a simple alignment processor
    - Minimizing the residual on one plane with respect to one or to several other planes.
    - It requires some iterations to align the full telescope.
    - Based on Minuit and currently requiring to link against ROOT.
  - Include Millepede in MarlinUtil package and use it within EU Telescope (P. Roloff)
    - The full telescope is aligned in one single iteration.
    - It has been tested already in the simulation but without rotations (T. Klimkovich)
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# *Improve the event display*

- Taking part on the development of a common event display for EUDET.
  - So far using CED to display hits.
  - Still not able to display tracks because the current available parametrization is for helix only.
  - Along with 3D visualization also 2D projections can be useful.
  - Possibility to display histograms for online DQM.
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# *Better integration with DUT data*

- So far only one test beam with DUT.
  - Telescope and DUT data streams were saved into two different files using the TLU to tag the event number.
  - Now we need to overlay the two streams.
    - The overlay processor available in Marlin is not suitable because it doesn't take care of the event number.
    - Several adhoc processors can be developed but a general solution would be better.
    - Parallel input files instead of serial (?)
  - What to do when the DUT data stream is inside the telescope one?
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# *Montecarlo input*

- We are considering the possibility to develop some Montecarlo processors in order to feed the analysis chain with simulated data.
  - Continuing and improving the work of T. Klimkovich in Mokka
  - Include in a Marlin processor the studies done by Lukasz Maczewski on charge sharing in MAPS sensor.
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# Conclusion

- EUTelescope is working.
- The results obtained from the three data taking periods are proving that it is well behaving...
- A lot of work has been done and the milestone foreseen for the end of 2008 will be easily achieved.
- Other possible improvements are envisaged.
  
- **CVS Server:**  
<http://www-zeuthen.desy.de/lc-cgi-bin/cvsweb.cgi/Eutelescope/?cvsroot=eutelescope>
- **DOC Server:**  
<http://www.roma3.infn.it/~bulgheroni/Eutelescope/head/index.html>

**Thanks!**

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