

DUT analysis with EU Telescope: overview and some improvements

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EUDET Annual Meeting 2010
Parallel Session JRA1
29 September 2010

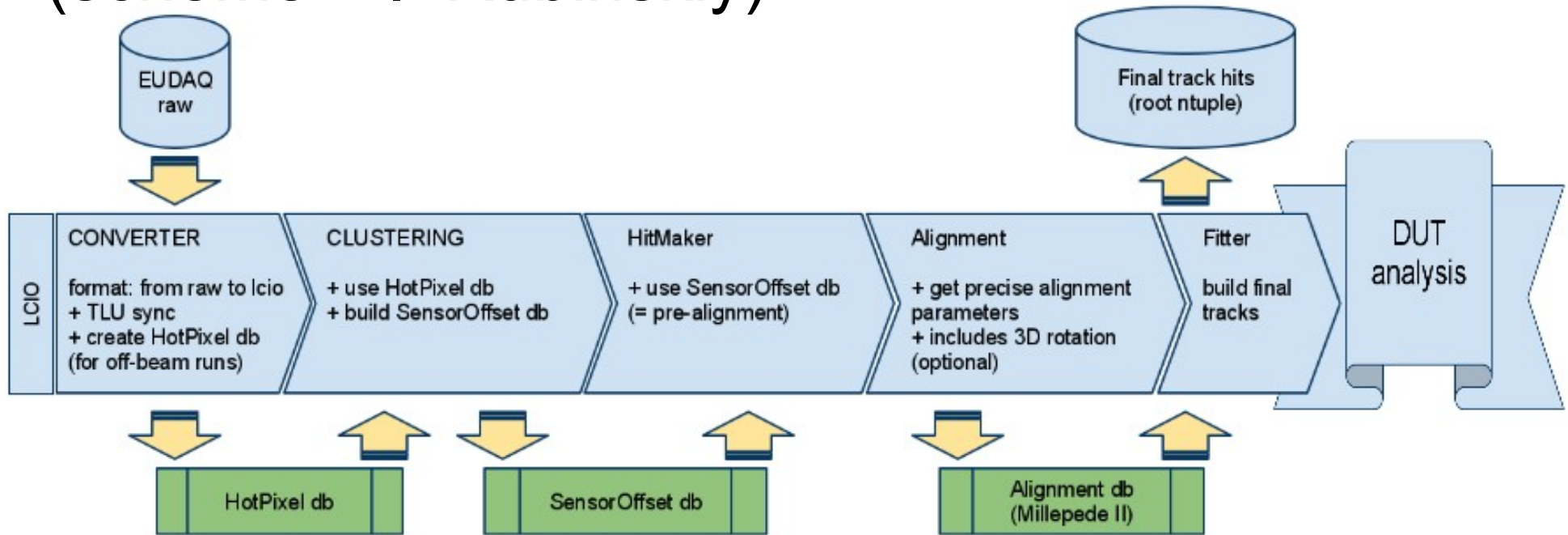
Outline

- General overview
- Modifications for ATLAS Pixel integration
- Correlation band usage
- DUT-specific plots
- Summary & Outlook

Results: see talk V.L. @ JRA1 Users Session today

Reminder

- Data analysis within EUTelescope includes (scheme – I. Rubinskiy)



- LCIO package is used as data persistency model
<http://lcio.desy.de/>
- Basic objects (hits, clusters, tracks) are stored in collections which form events

DUT analysis with EU Telescope

- In principle DUT analysis is implemented “explicitly”, but only for one device
- Approach we follow instead: add more DUTs as if they were additional Telescope layers
- Technically – done by *merging* Telescope and DUT *collections* (in my case – already at clustering level)

Modifications to EU Telescope for APIX integration

- EUTelAPIXSparsePixel – pixel class to include timing information
- EUTelAPIXSparseClusterIMPL – to treat long pixels properly
- Some changes inside the code to incorporate new type of pixel

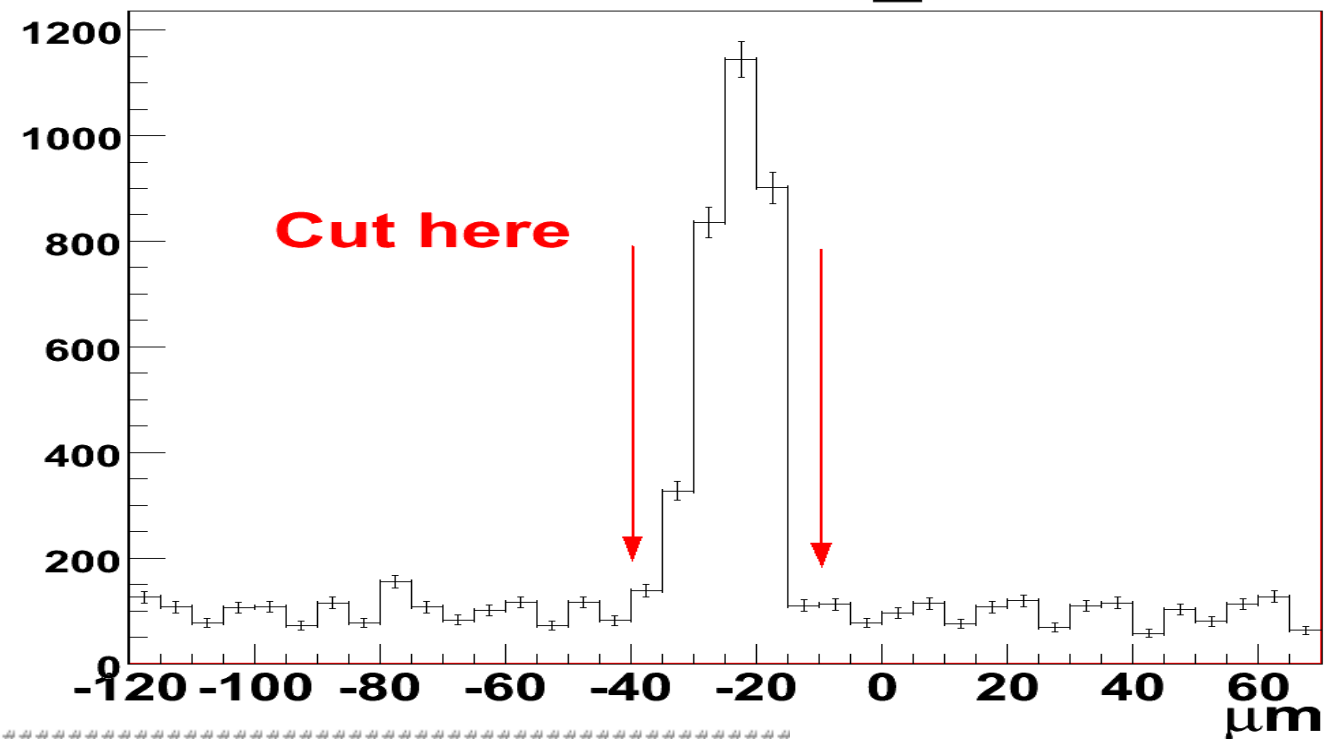
More details:

http://www-zeus.desy.de/~libov/apix/APIX_inclusion/index.htm

Reminder: standard alignment with residual cuts

- To align sensors, good tracks have to be selected
- Play with DistanceMax parameter so that clear peaks are visible
- Define residual cuts by observing peaks and write them to your config file

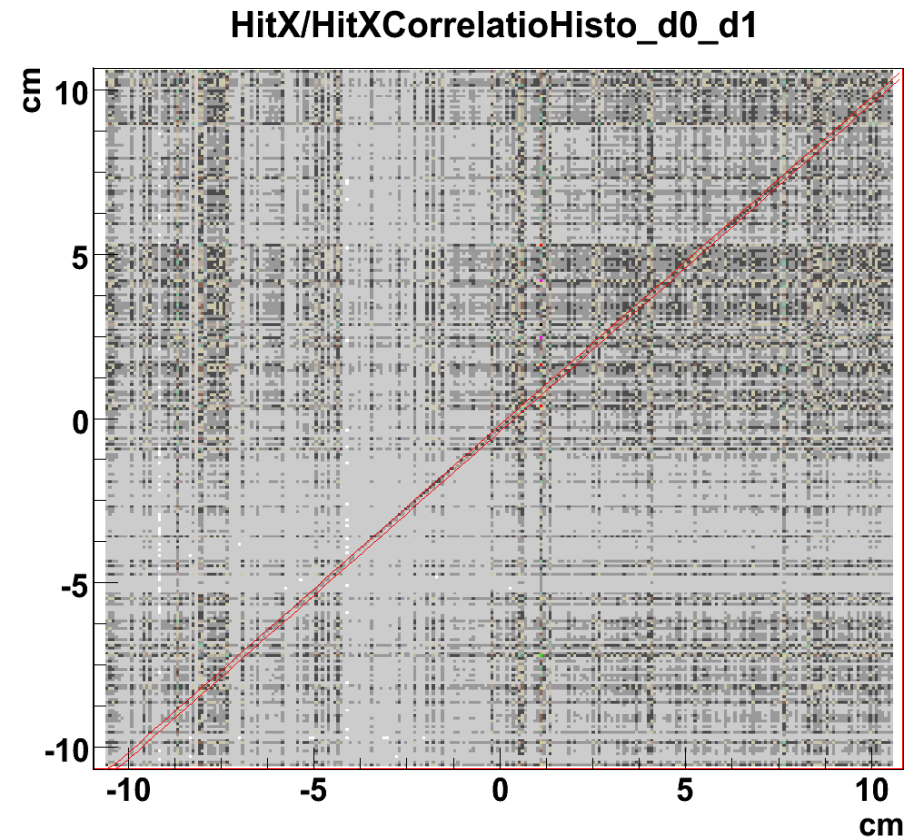
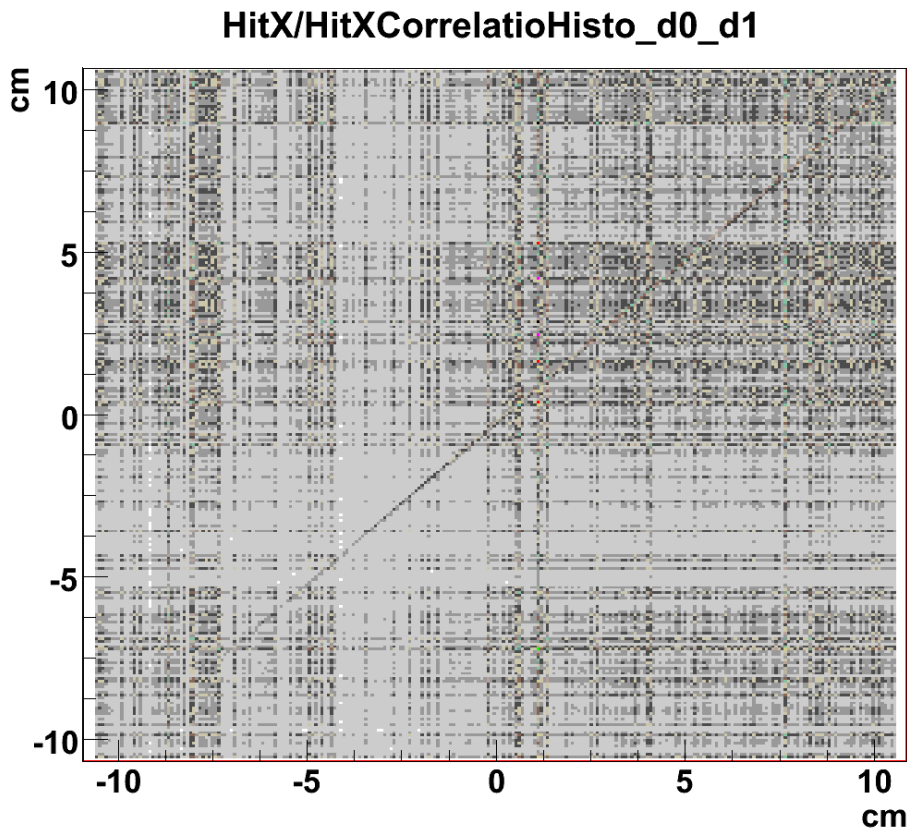
XResidual_d0



```
#####  
# run 8090, 3 planes (0 1 2) with distmax=5000; tight cuts  
ResidualXMin      = -40, 25, -40, -5000 -5000 -5000  
ResidualXMax      = -10, 65, -10, 5000 5000 5000  
ResidualYMin      = -70, 60, -70, -5000 -5000 -5000  
ResidualYMax      = -25, 130, -25, 5000 5000 5000
```

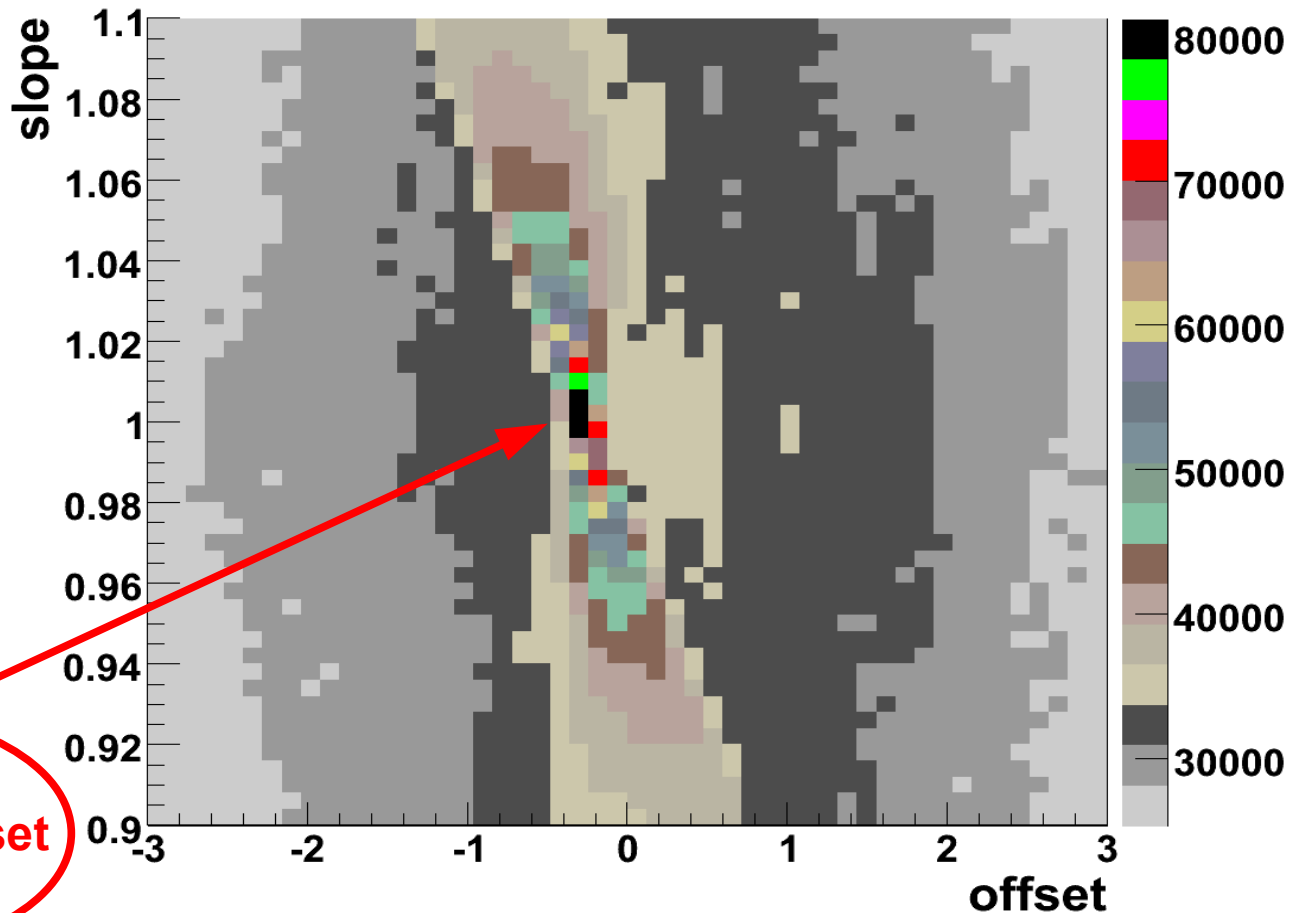
Correlation bands usage

- **Disadvantages of the standard way:** requires a lot of manual work; with higher multiplicities gets hard (if not impossible)
- **Alternative:** use only hits from correlation bands to form track candidates



Correlation bands usage

- How: scan offset/slope space and determine parameters which give highest number of entries (*simplest way*)

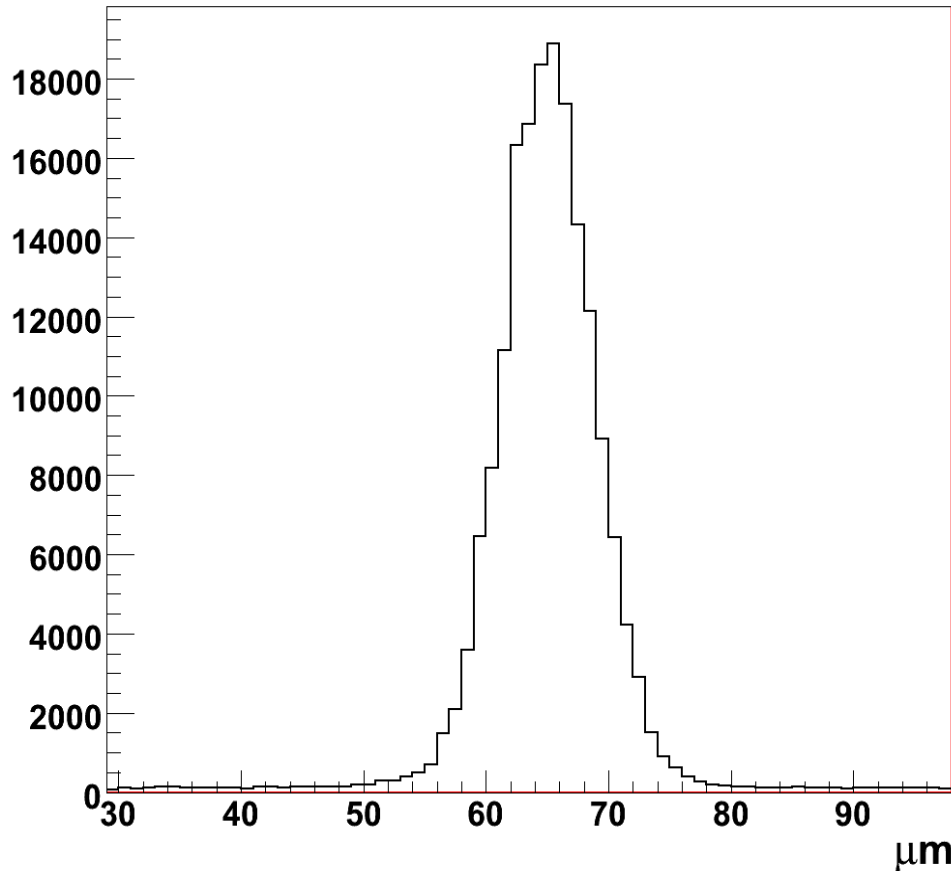


- Can be done for all sensor combinations and both directions
- Root script was implemented for this task

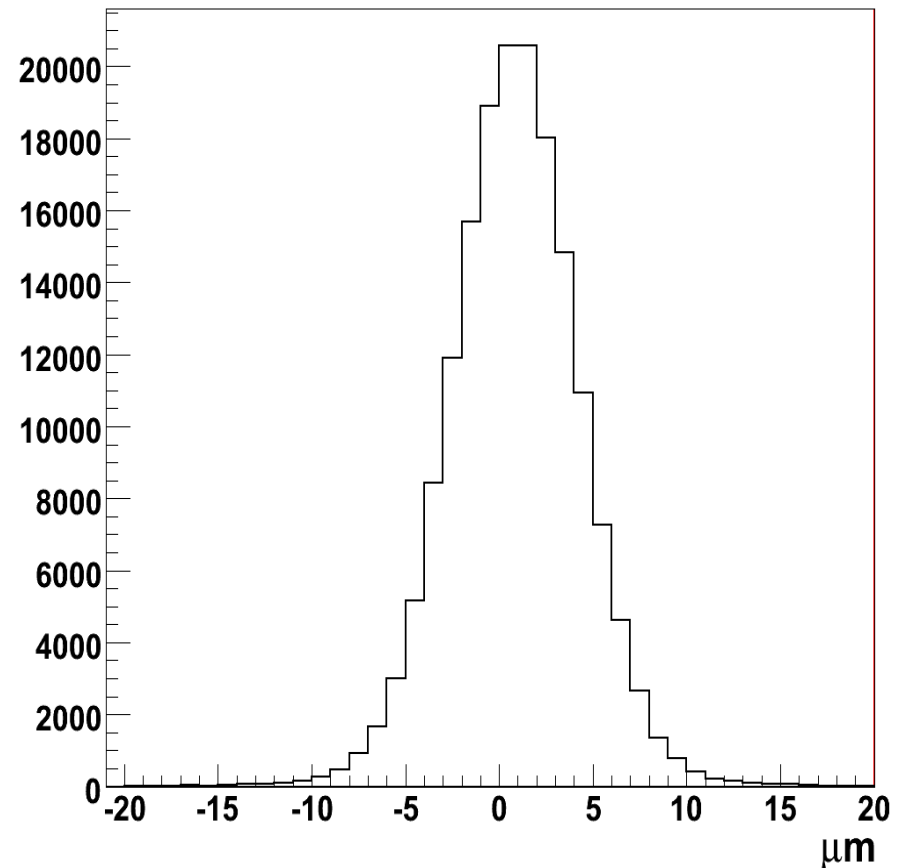
Correlation bands usage

- After selecting tracks using hits from correlation bands no further cuts on residuals are needed!
 - Nice gaussian, background free

Residual in X before alignment



Residual in X After alignment



- One can further improve results adding 2nd iteration using standard way – with tight symmetric cuts

DUT specific plots

- In fact, each type of detector has it's own specific measurements of interest
- ATLAS specific plots were implemented to *EUTeIDUTHistoProcessor* but some of them are generic to all pixel DUTs
 - Cluster size, X,Y, # of pixels, Cluster signal
 - DUT efficiency in local FoR
 - ToT (related to charge) distribution
 - Lv1 distribution (timing information)
 - Charge Collection vs impact point of a track inside a pixel
 - Charge Sharing probability
 - Matching to other DUT

Summary & Outlook

- EU Telescope framework is sufficient for DUT analysis
- Some minor modifications might be needed to include DUTs of different types
- ATLAS Pixel devices were integrated in the framework
- Correlation band approach – proof-of-principle, first implementation, extensive tests with APIX data
 - ✓ Makes analysis automatic
 - ✓ Improves performance

Further developments

- Correlation band usage is being implemented as a “pre-alignment” step (see talk I. Rubinsky) which will make analysis even easier
- Include other plots to DUT specific part (*EUTelDUTHistoProcessor*)
- Merge with final EU Telescope version
- We are opened for Your suggestions on how to improve DUT analysis

Thanks a lot for Your attention!