



EUDET

Detector R&D towards the International Linear Collider



Status of MarlinTPC

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TILC08 Sendai

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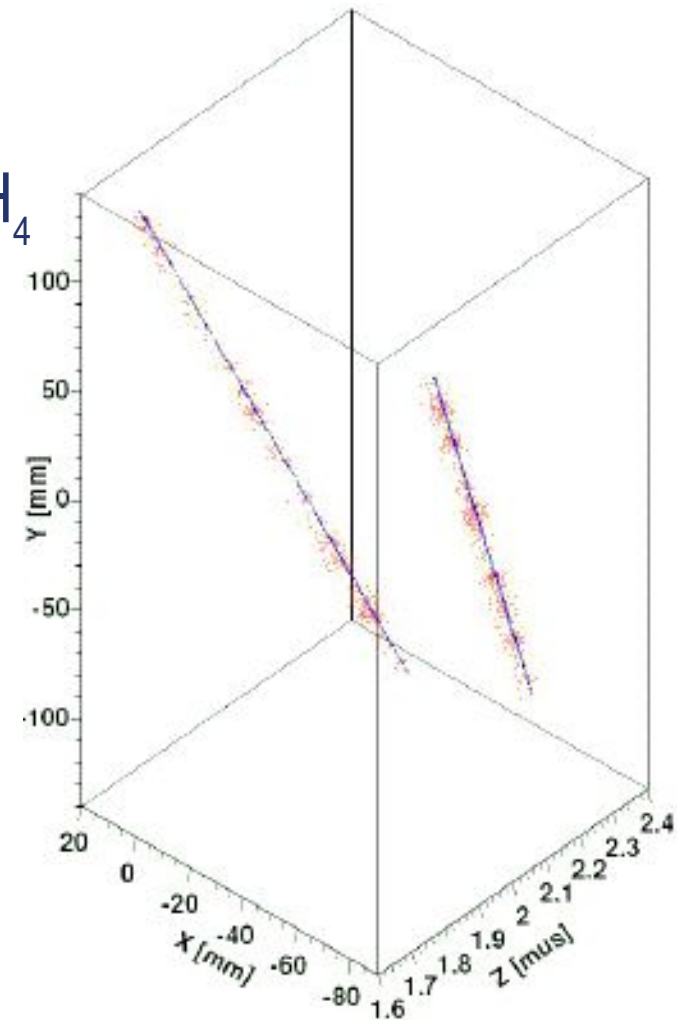
- Common framework for LCTPC: simulation, reconstruction, digitization, and analysis
- Builds on top of LCIO, Marlin and other *ilcsoft* tools
- Versatility:
 - works for all TPCs that can be described by GEAR:
prototypes, collider detectors, ...
 - works for pad and pixel readout
 - works for FADC and TDC based electronics
- Advantages:
 - easy comparability (algorithms, technologies, geometries, ...)
 - easier transferability from prototypes to full size detector in collider environment
 - high re-usability of code

- Simulation
- Digitization
- Reconstruction
- Analysis
- Calibration
- Conditions Data TPCCondData
- Tools
- Validation

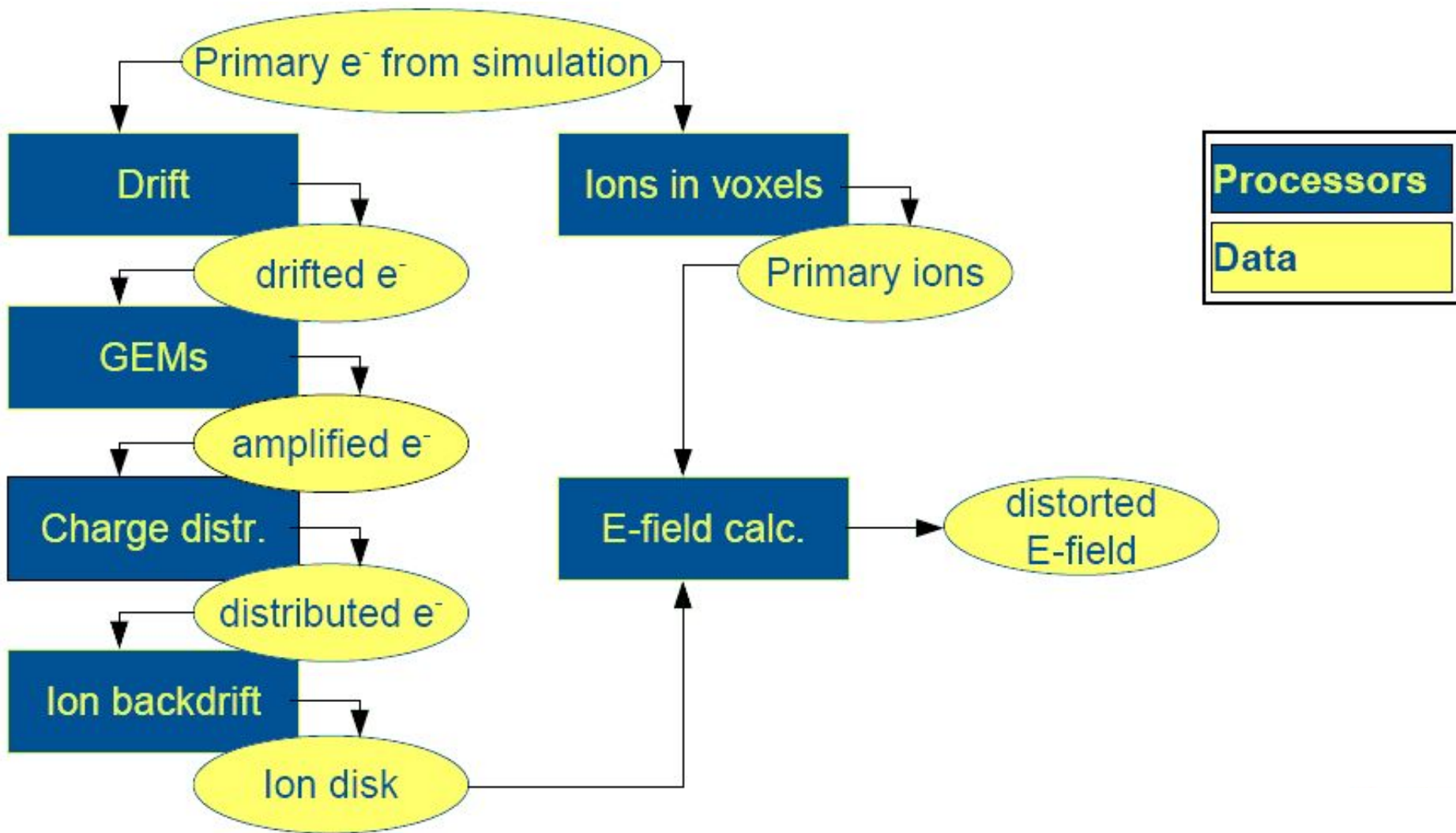
Presently in repository:

- 33 processors from all categories in trunk
- more than 800 commits in less than one year
- 13 different authors

- Creates primary ionization from a parametrization of HEED simulation
- Parametrization available for Ar-CO₂-CH₄ (93-2-5), Ar-CH₄ (90-10), Ar-CH₄ (95-5)
- Faster than a full HEED simulation
- Correct treatment of δ -electrons in magnetic fields



- Simulates detector response to primary ionization
- Reads primary charge, provides TPC raw data
- Takes ILC bunch structure properly into account
- So far only available for GEM amplification with FADC readout
- Rather detailed simulation which tracks individual electrons up to amplification process, includes many details (E-field distortions from ions, ...)
- A faster version working on MOKKA hits is planned once important disturbing effects are known from detailed digitization



Data Structure

Processor Name

Collection Name

TrackerRawData

TPCRawData

TrackerRawDataToDataConverter

TrackerData

TPCConvertedRawData

PedestalSubtractor

TrackerData

TPCData

PulseFinder

ChannelMapper

CountsToPrimaryElectronsProcessor

TrackerPulse

TPCPulses

HitTrackFinderTopoProcessor

TrackerHit

TPCHits

Track

TPCTrackCandidates

TrackSeeder

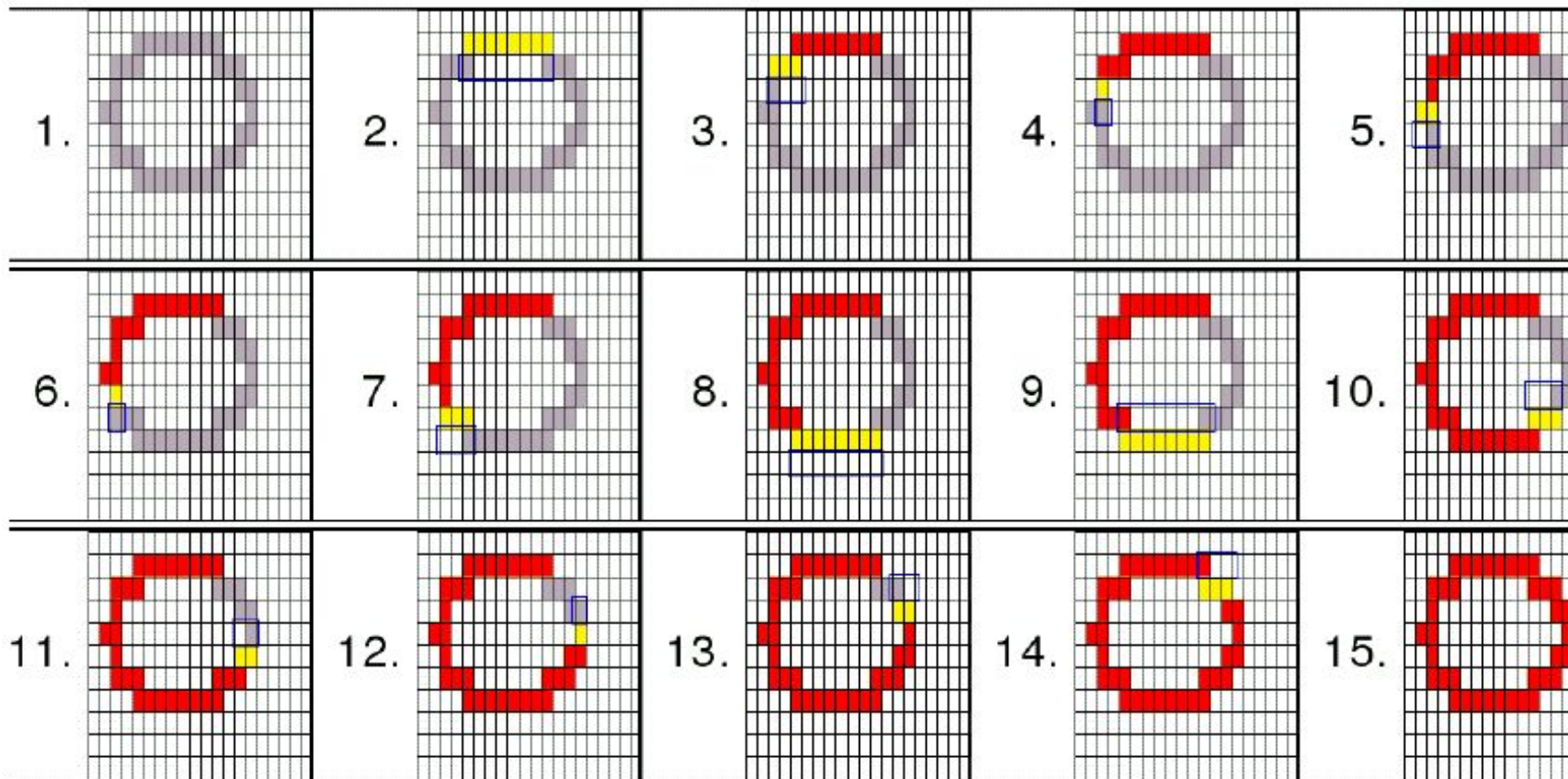
Track

TPCSeedTracks

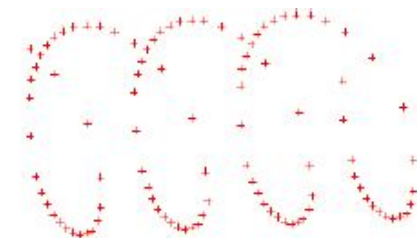
TrackFitterLikelihood

Track

TPCTracks

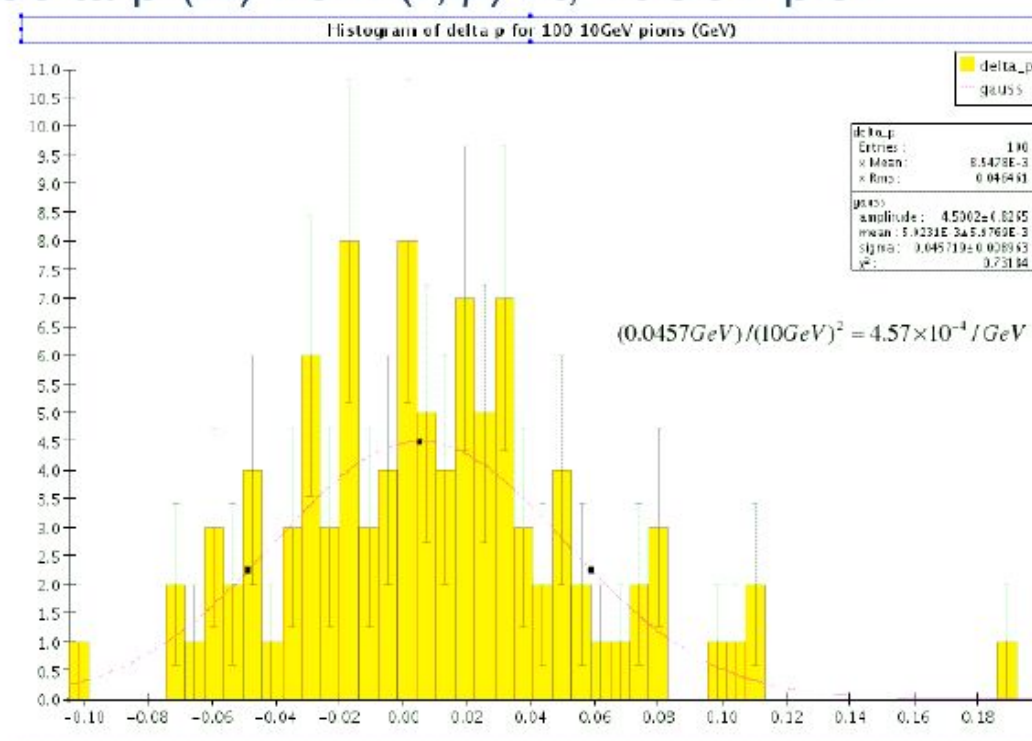


- Works in 3D without specific track hypothesis

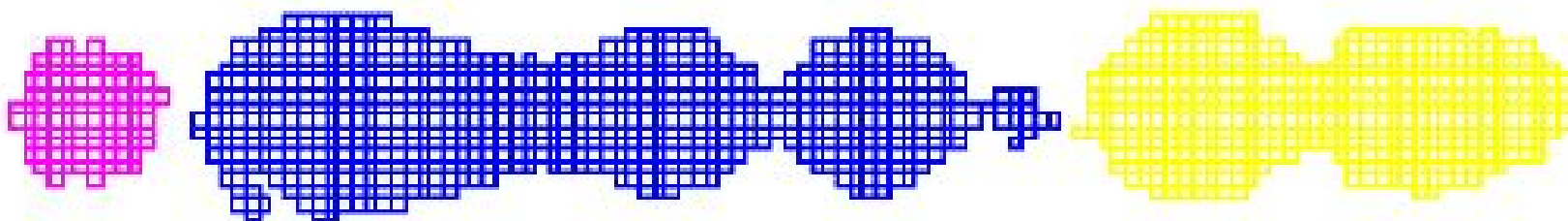
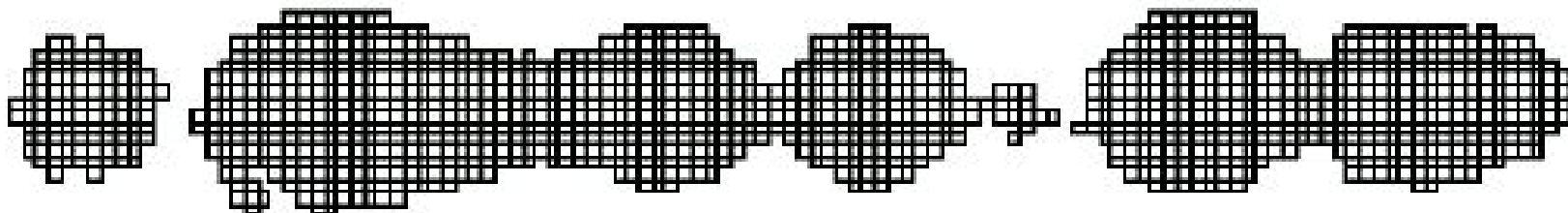


- Likelihood method implemented, performance not yet as expected
- χ^2 based fitter almost done

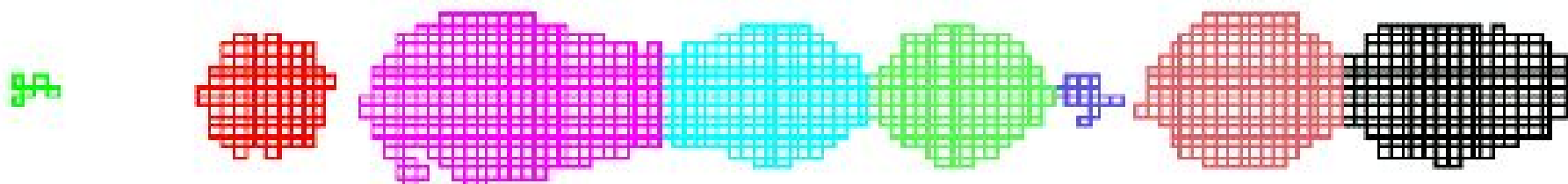
delta p (Ω) from (r, ϕ) fit, 10GeV pion



- Zero-suppression
- Cluster finder: group all topologically connected pixels to clusters (works only for setup with GEMs)

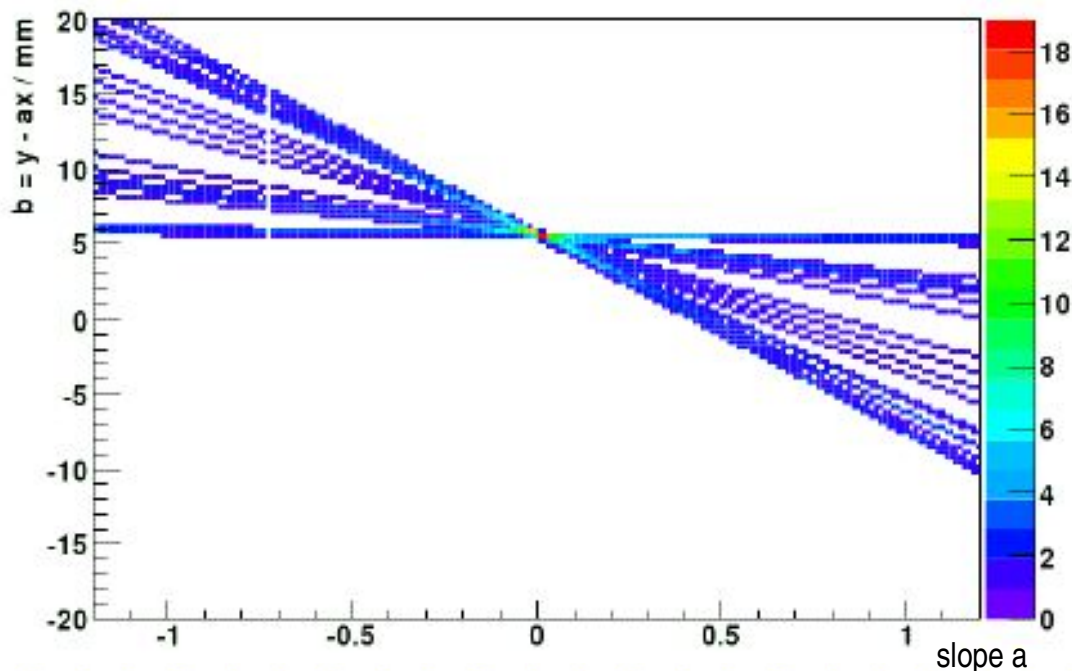


- Cluster separator: separates obviously distinct clusters by projecting all pixels onto a straight line fit and cut at minima (only for GEM setups)



- Hit calculation: calculates the center-of-gravity of clusters (using charge info, if available)
- Track finding: uses linear *Hough* transformation (every hit is a straight line in *Hough* space), intersection of tracks is estimate for track parameters

Hough space

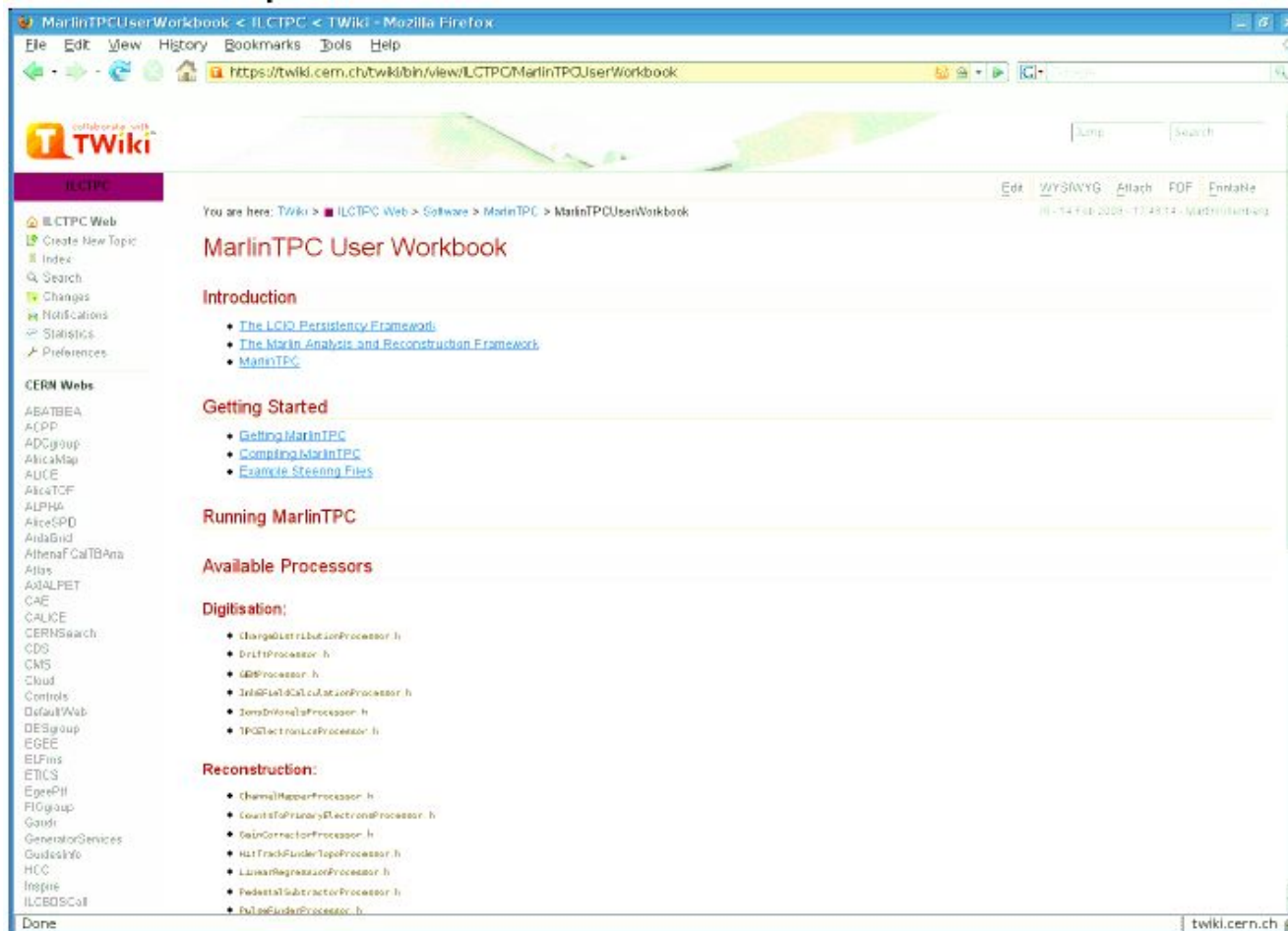


- First processor available producing residual plots
- List of processors will be extended for producing figures of merit (agreed upon at first ILC TPC Analysis Jamboree)
 - resolution from geometric mean of fits with and without test row
 - resolution using external reference track (hodoscope or MC truth)
 - resolution vs drift distance
 - residuals vs position on pad ot check on biases
 - ...

- Since December 2007, MarlinTPC is integrated in `ilcinstall` (see <http://ilcsoft.desy.de>)
- Allows easy installation of MarlinTPC together with required other *ilcsoft* software
- For having a quick check, type:

```
svn co svn://pi.physik.uni-bonn.de/MarlinTPC/trunk
```

- User workbook
- Developer workbook



- MarlinTPC is rapidly developing during last year \Rightarrow thanks to increasing number of developers
- Simulation, digitization, and reconstruction already in good shape for Large Prototype work
- MarlinTPC has become “working horse” for first small prototype analyses and for machine background studies, to study the impact of ion discs on incoming tracks
- So far no work on implementation of calibration and alignment algorithms
- MarlinTPC on right track for LP

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