

Status of MarlinTPC

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Introduction to MarlinTPC

- Common simulation, reconstruction, digitisation and analysis framework for LC-TPC
- 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 GEM, Micromegas and wire amplification
 - 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



Overview

- Simulation
- Digitisation
- Reconstruction
- Analysis
- Calibration
- TPCCondData
- Tools
- Validation

At present in repository:

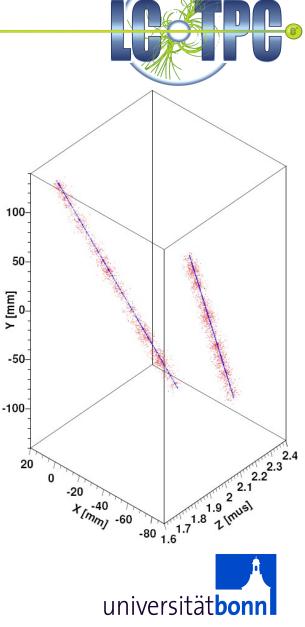
- 33 processors from all categories in trunk
- > 800 commits in < 1 year
- 13 different authors





Simulation

- Creates primary ionisation from a parametrisation of HEED simulation
- Parametrisation available for Ar-CO₂-CH₄ (93-2-5), Ar-CH₄ (90-10), Ar-CH₄ (95-5)
- Faster than full HEED simulation
- Correct treatment of delta electrons in magnetic fields



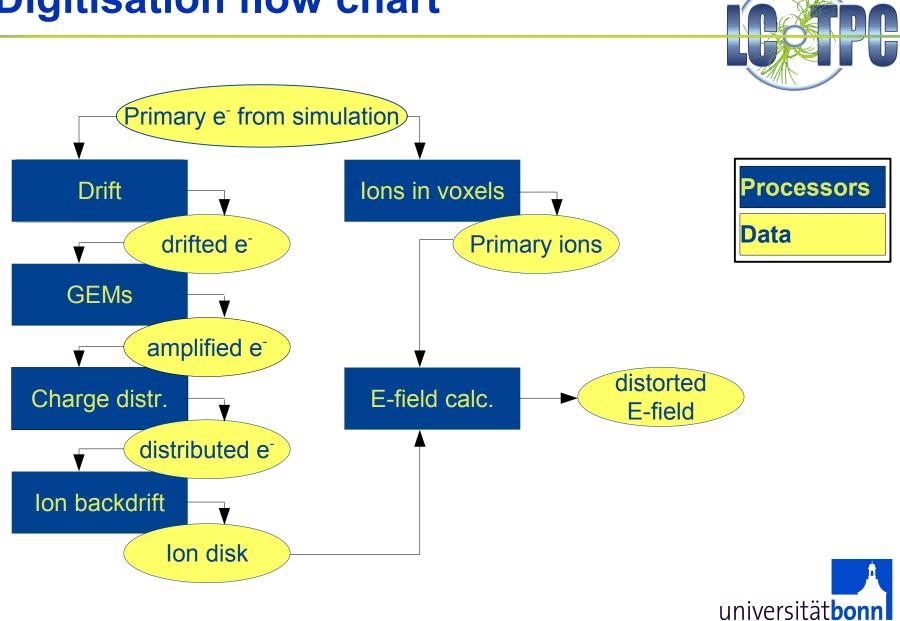
Digitisation



- Simulates detector response to primary ionisation
- 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 digitisation



Digitisation flow chart



Reconstruction

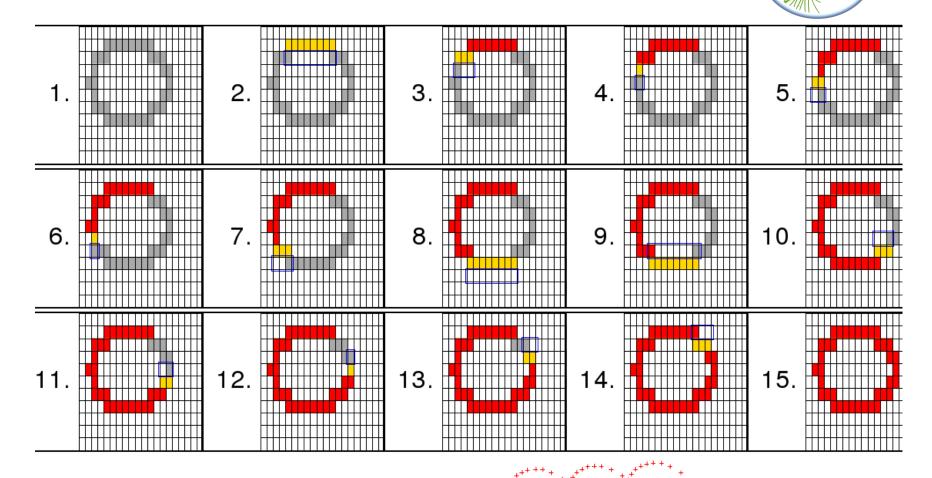


Data Structure	Processor Name	Collection Name
TrackerRawData		TPCRawData
	TrackerRawDataToDataConverter	
TrackerData		TPCConvertedRawData
	PedestalSubtractor	
TrackerData		TPCData
	PulseFinder	
	ChannelMapper	
	CountsToPrimaryElectronsProcessor	
TrackerPulse		TPCPulses
	HitTrackFinderTopoProcessor	
TrackerHit		TPCHits
Track		TPCTrackCandidates
	TrackSeeder	
Track		TPCSeedTracks
	TrackFitterLikelihood	
Track		TPCTracks



+ several correction processors

Topological track finder

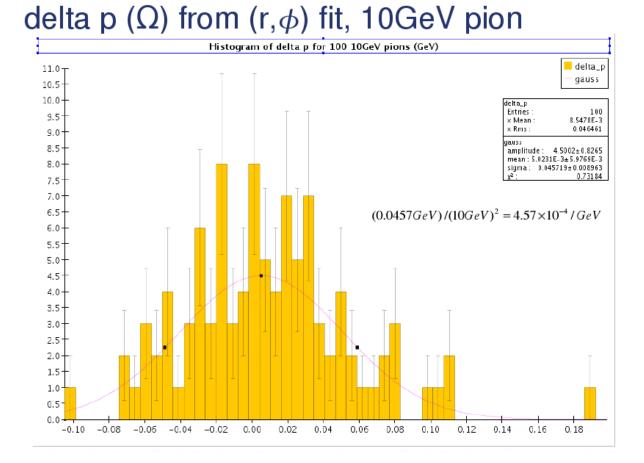


 Works in 3D without specific track hypothesis



Track fitter

- Likelihood method implemented, performance not yet as expected
- χ² based fitter almost done



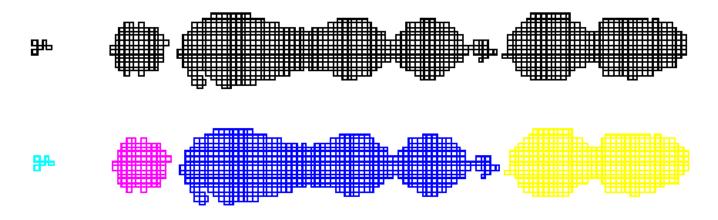


Reconstruction of TimePix data

Zero-suppression



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



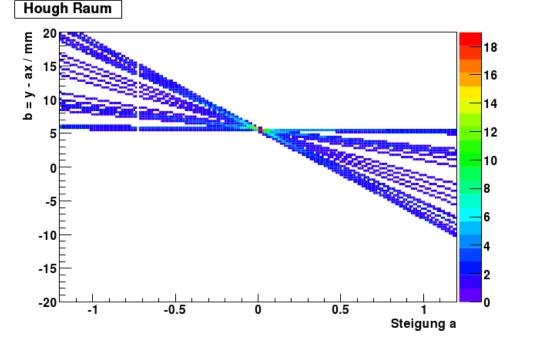
 Cluster separator: separates obviously distrinct cluster by projecting all pixels onto a straight line fit and cut at minima (only for GEM setups)





Reconstruction of TimePix data

- Hit calculation: calculates centre-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



Track fitting is shared with "normal" reconstruction

Analysis

- First processor available producing residual plots
- Will extend list of processors producing figures of merit agreed on 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 to check for biases

- ...



Installation procedure



- 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 the impatients: Just type svn co svn://pi.physik.uni-bonn.de/MarlinTPC/trunk and have a look



Wiki workbooks

• User workbook

Developer workbook

MarlinTPCUserWor	kbook < ILCTPC < TWiki - Mozilla Firefox	_ 6
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 ▲ ILCTPC Web ▲ Create New Topic ■ Index ▲ Search 	MarlinTPC User Workbook	
F Changes	Introduction	
ia Notifications Statistics	The LCIO Persistency Framework The Marlin Analysis and Reconstruction Framework MarlinTPC	
CERN Webs		
ABATBEA	Getting Started	
ACPP ADCgroup AfricaMap ALICE AliceTOF	<u>Getting MariinTPC</u> <u>Compiling MariinTPC</u> <u>Example Steering Files</u>	
ALPHA AliceSPD ArdaGrid	Running MarlinTPC	
AthenaFCaITBAna Atlas AXIALPET	Available Processors	
CAE CALICE	Digitisation:	
CERNSearch CDS CMS	ChargeDistributionProcessor.h DriftProcessor.h GEMProcessor.h	
Cloud Controls	• uchrrocessor.n • InhEFieldCalculationProcessor.h	
DefaultWeb	• IonsInVoxelsProcessor.h	
DESgroup EGEE ELFms	TPCELectronicsProcessor.h	
ETICS	Reconstruction:	
EgeePtf	ChannelMapperProcessor.h	
FlOgroup Gaudi	CountsToPrimaryElectronsProcessor.h	
GeneratorServices	GainCorrectorProcessor.h	
GuidesInfo	HitTrackFinderTopoProcessor.h	
HCC Inspire	LinearRegressionProcessor.h	
ILCBDSColl	Pedestal SubtractorProcessor. h	
Done	PulseFinderProcessor.h	twiki.cern.ch



Summary



- Rapid MarlinTPC development during last year thanks to increasing number of developers
- Simulation, digitisation and reconstruction already in good shape for LP work
- MarlinTPC has become "working horse" for first small prototype analyses and for machine background study to study impact of ion disc on incoming tracks
- So far no work on implementation of calibration and alignment algorithms
- MarlinTPC on right track for LP

