# The status of and plans for MarlinTPC

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# Introduction

Status up to now

- Many different TPC simulation and reconstruction packages

- Most packages are monolithic programs

- Many different data formats, coordinate systems etc.

Goal of MarlinTPC

- Collect the available algorithms in a common framework

- Avoid work being done twice: Modularity allows high reusability

- Provide a complete reconstruction and analysis framework for simulation and real data using LCIO and Marlin

- Provide detailed TPC simulation which produces TPC raw data

# Proposal for an ILC TPC data stream

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**Abstract**

This document proposes a TPC data flow model for use during ILC detector R&D
studies. It is based on LCIO data structures and Marlin as analysis and reconstruction
framework.

# Overview

- Simulation

- Reconstruction

- Analysis

- Examples for getting started

- Library for TPC conditions data based on LCCD

# TPCGEMSimulation

Simulation package for detailed studies of a GEM based TPC

- Parameterized deposition of primary electrons

- Drift of electrons incl. diffusion

- Detailed simulation of amplification and charge transfer in a GEM stack

- Digitization incl. pulse shaping of the electronics

→ Provides `lcio::TrackerRawData`

- Additional processor calculates ion backdrift

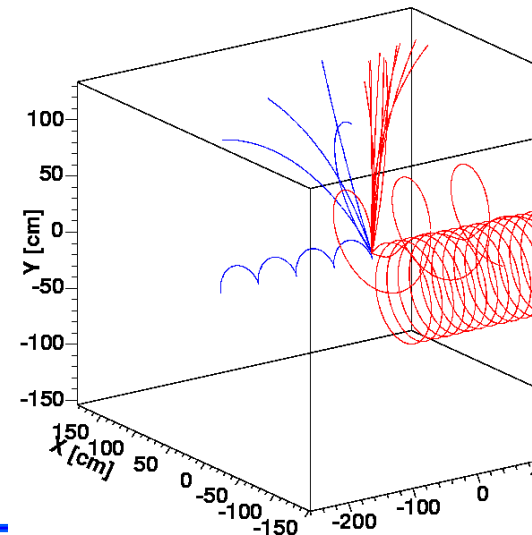Established and well debugged and documented.

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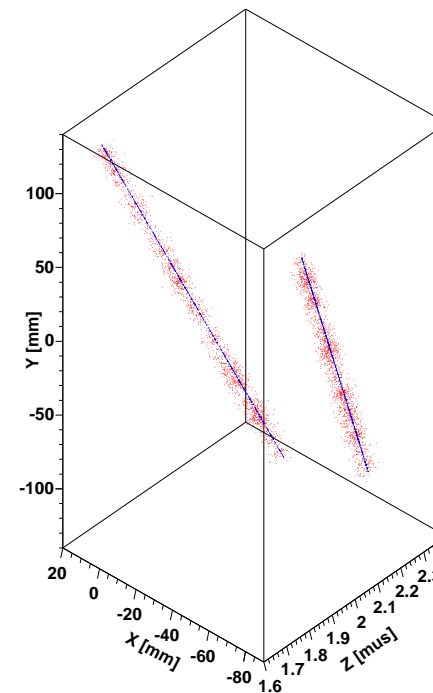Established and well debugged and documented.

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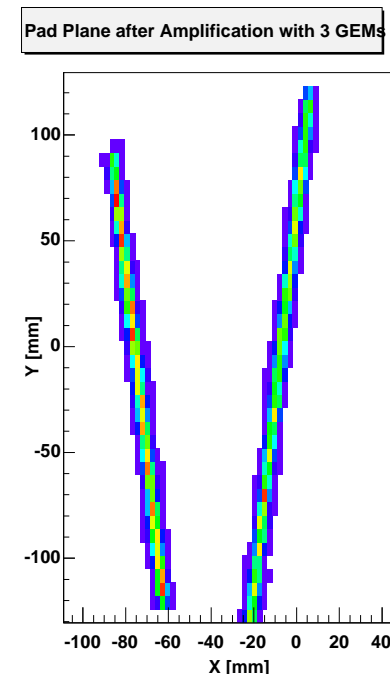
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Pad Plane after Amplification with 3 GEMs

# Reconstruction

| Data Structure | Processor Name | Collection Name |
|---|---|---|
| `TrackerRawData` | | TPCRawData |
| | TrackerRawDataToDataConverter | |
| `TrackerData` | | TPCConvertedRawData |
| | PedestalSubtractor | |
| `TrackerData` | | TPCData |
| | PulseFinder | |
| | ChannelMapper | |
| `TrackerPulse` | | TPCPulses |
| | HitFinder | |
| `TrackerHit` | | TPCHits |
| | TrackFinder[Method] | |
| `Track` | | TPCSeedTracks |
| | TrackFitter[Method] | |
| `Track` | | TPCTracks |

Correction processors (gain, pad response, linearity, time shift) still missing

# Analysis

Planned:

Provide a set of processors implementing the default analyses agreed on at first TPC Analysis Jamboree 2006 in Hamburg.

- Resolution using geometric mean of fits with and without the test row

- Resolution using external reference track (hodoscope or MC truth)

- Resolution in dependence on the drift distance

- Distribution showing number of 1-pad, 2-pad, 3-pad hits

- Bias plots (residuals vs. position on the pad)

- ...

# Plans

- Define interface of other readout techniques: TDCs, TimePix

  - How to store data in LCIO?

  - Where to join the common reconstruction chain?

- Test the reconstruction with real data

- Look for skillful pattern recognition and track reconstruction algorithms

# What Else Is Missing?

- **Event Display** showing charge distribution on pads and/or in voxels
  - ⟶ Extend CED

- **Data Browser** for LCIO data classes
  - ⟶ LCIO plug-in for JAS3 is being updated

- **GEAR Extention** to simultaneously handle multiple layouts for different modules

# Conclusions

- Detailed simulation provides realistic data, ready for further studies

- Reconstruction chain is now complete, provides basic functionality

- No analysis yet

Goals:

- Provide TPC simulation, reconstruction and analysis for prototypes and ILC detectors

- Combine with / become part of the detector reconstruction packages

http://www-flc.desy.de/ilcsoft/ilcsoftware/marlintpc