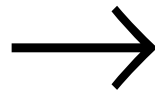

MARLIN and TPC



MarlinTPC

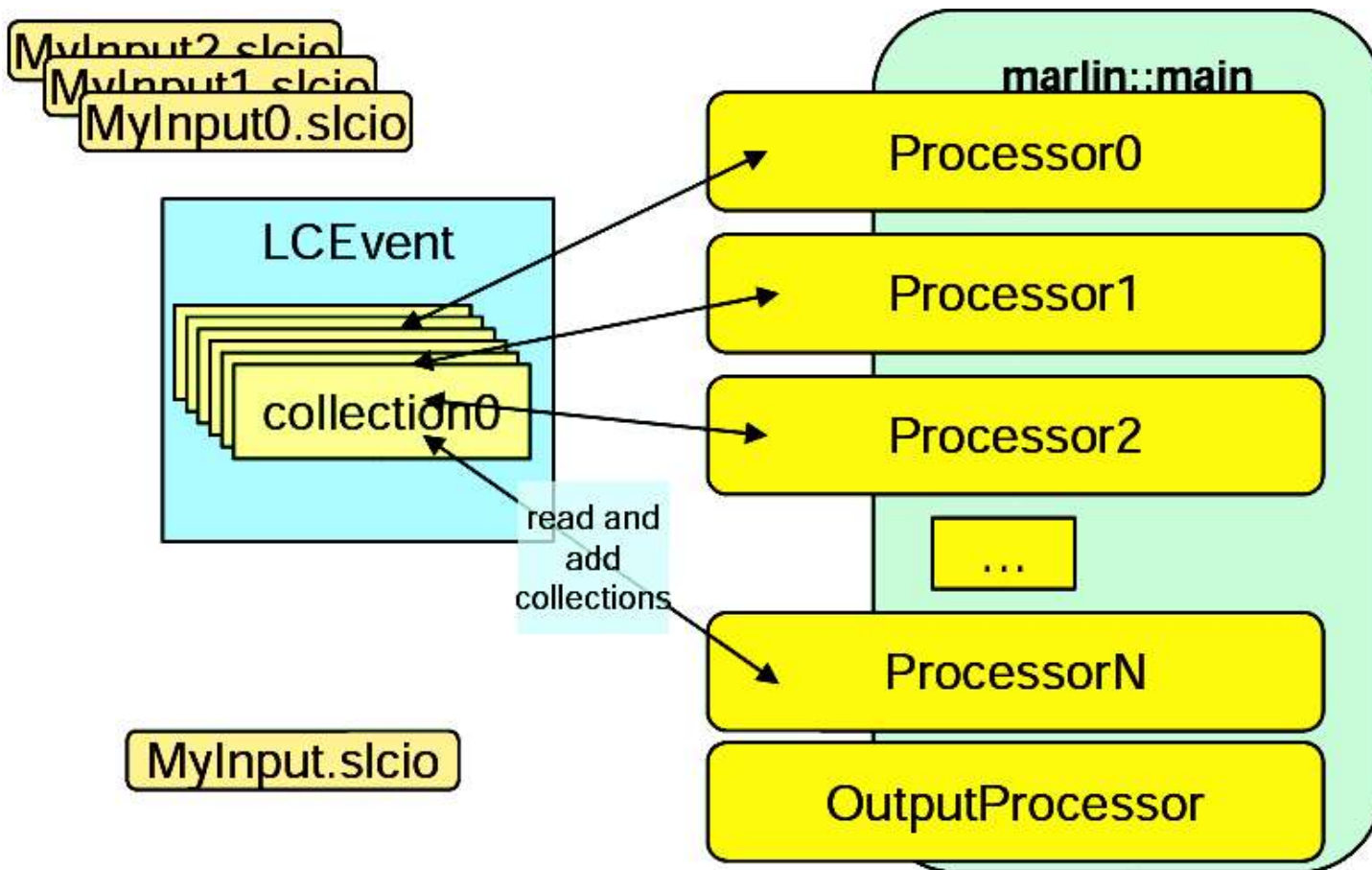
K. Dehmelt, LDC Detector Optimization
Sep 13, 2007

K.Dehmelt, Sep. 13, 2007

MARLIN

- Facilitate the modular development of reconstruction and analysis code based on LCIO
- Have distributed development of modules and combine existing modules as needed in a larger application
- Modules in form of **Processors**
- Steering file mechanism allows to activate the needed processors

MARLIN

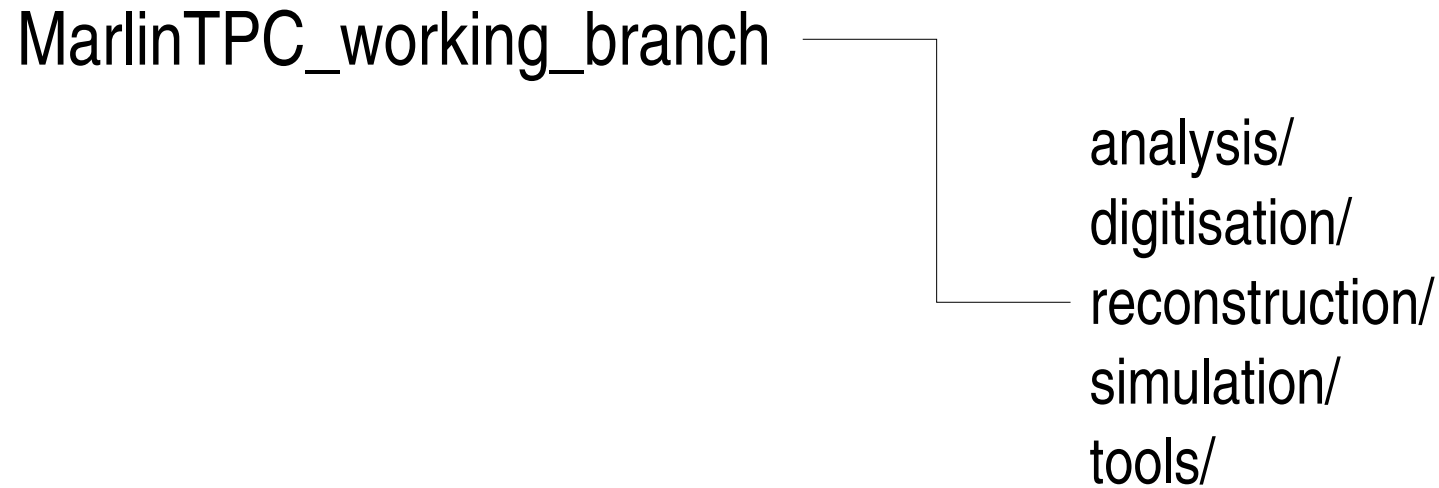


MarlinTPC Design

- MarlinTPC processors
- Linear Collider Conditions Data LCCD: writing and reading conditions data describing detector status as function of time
- Geometry API for Reconstruction GEAR: access geometry information

MarlinTPC Design

SVN structure



OBSOLETE

MarlinTPC Design

tools/

TPCCondData/
TPCGEMSimInput/
examples/

TPCCondData/

ADCChannelMapping.cc
ChannelCorrection.cc
FieldSetting.cc
GasConditions.cc
Pedestal.cc
TPCConditions.cc
WeatherConditions.cc

TPCGEMSimInput/

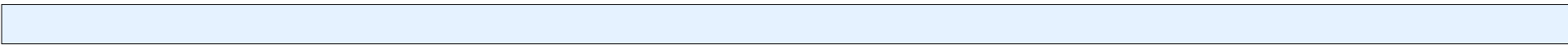
CreateMuonsLCIO.cc

examples/

generateHits/
generatePulses/
generateRawData/

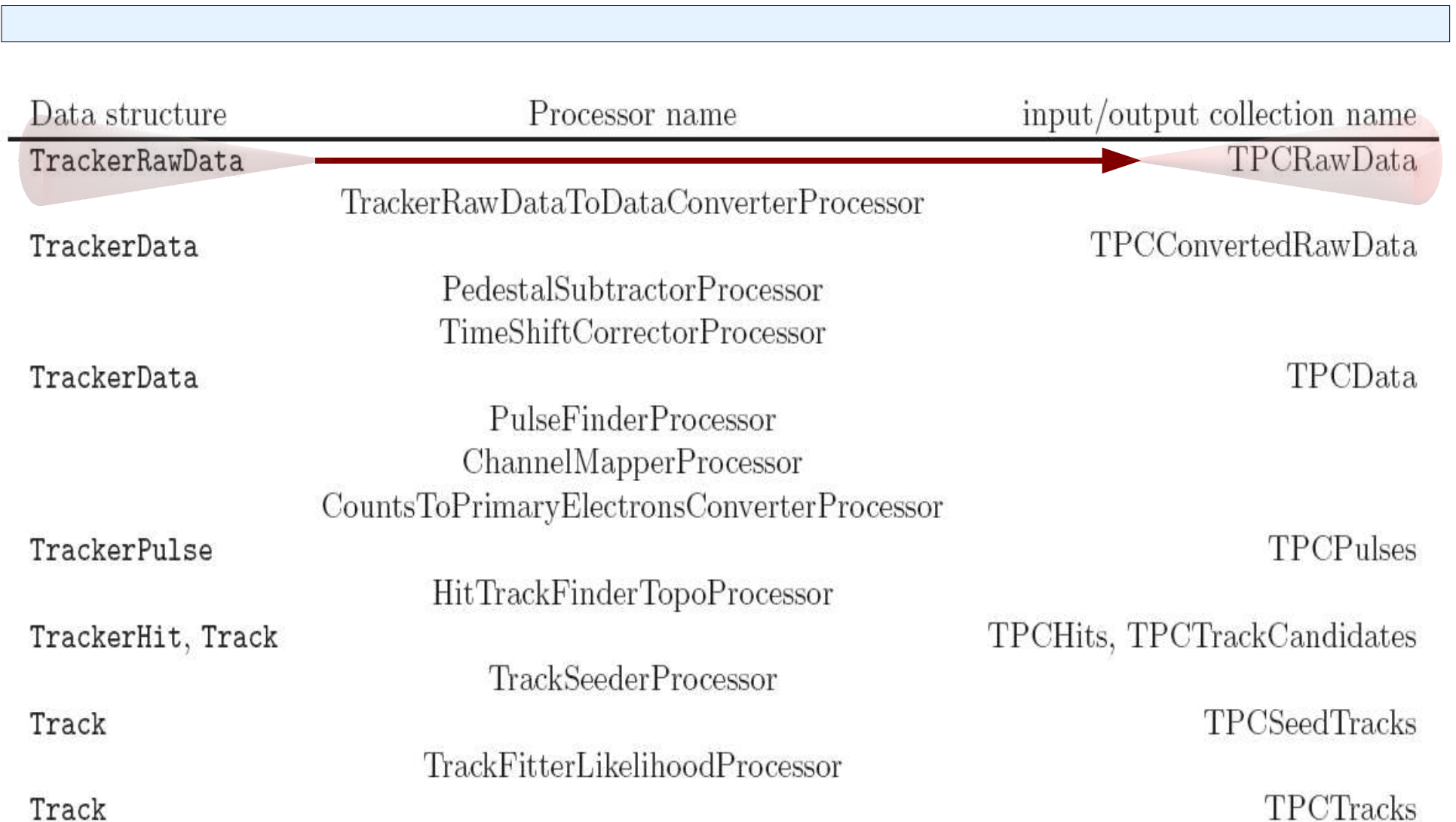
OBSOLETE

MarlinTPC Reconstruction

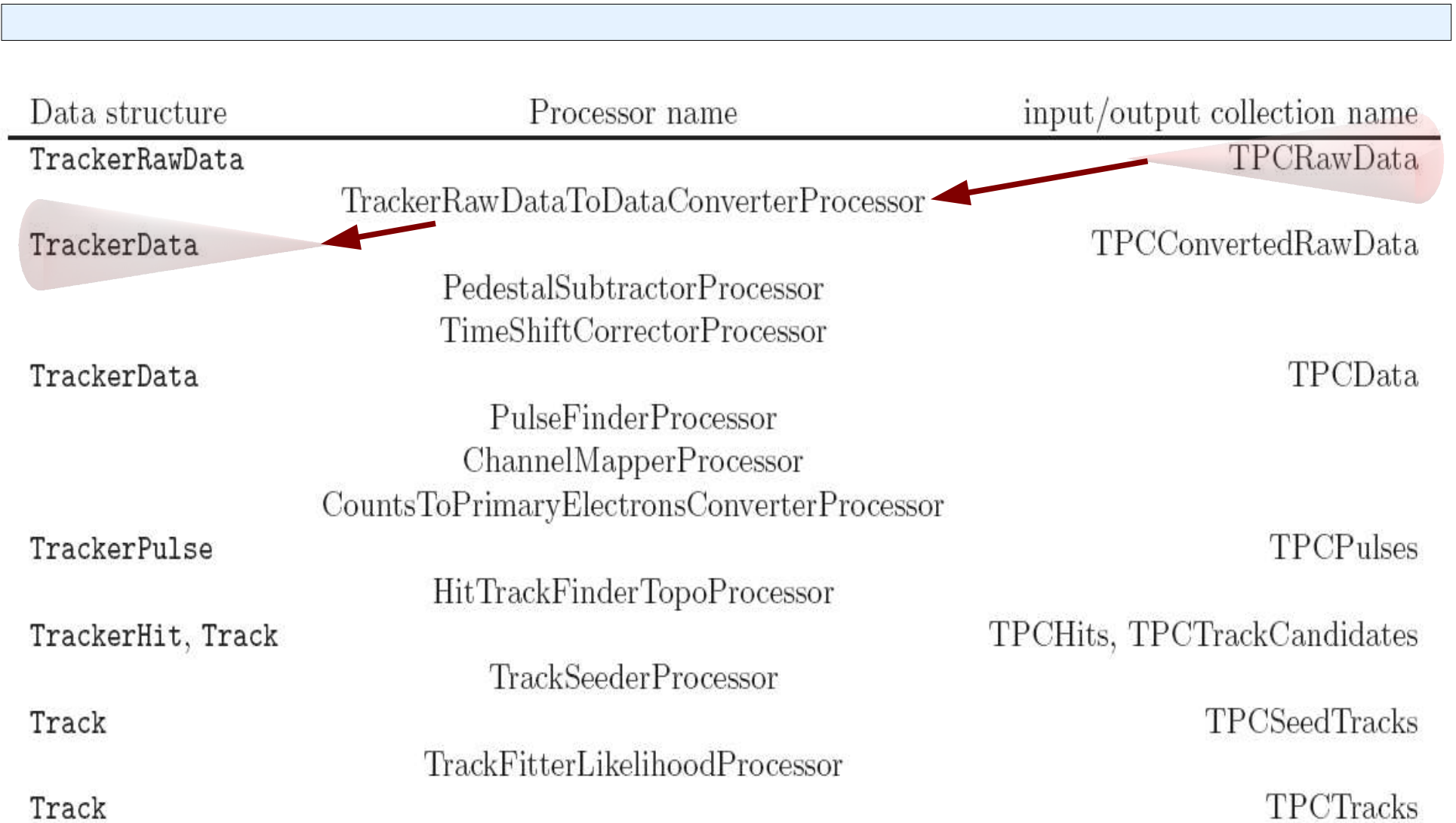


Data structure	Processor name	input/output collection name
TrackerRawData	TrackerRawDataToDataConverterProcessor	TPCRawData
TrackerData	PedestalSubtractorProcessor TimeShiftCorrectorProcessor	TPCConvertedRawData
TrackerData	PulseFinderProcessor ChannelMapperProcessor CountsToPrimaryElectronsConverterProcessor	TPCData
TrackerPulse	HitTrackFinderTopoProcessor	TPCPulses
TrackerHit, Track	TrackSeederProcessor	TPCHits, TPCTrackCandidates
Track	TrackFitterLikelihoodProcessor	TPCSeedTracks
Track		TPCTracks

MarlinTPC Processor Chain



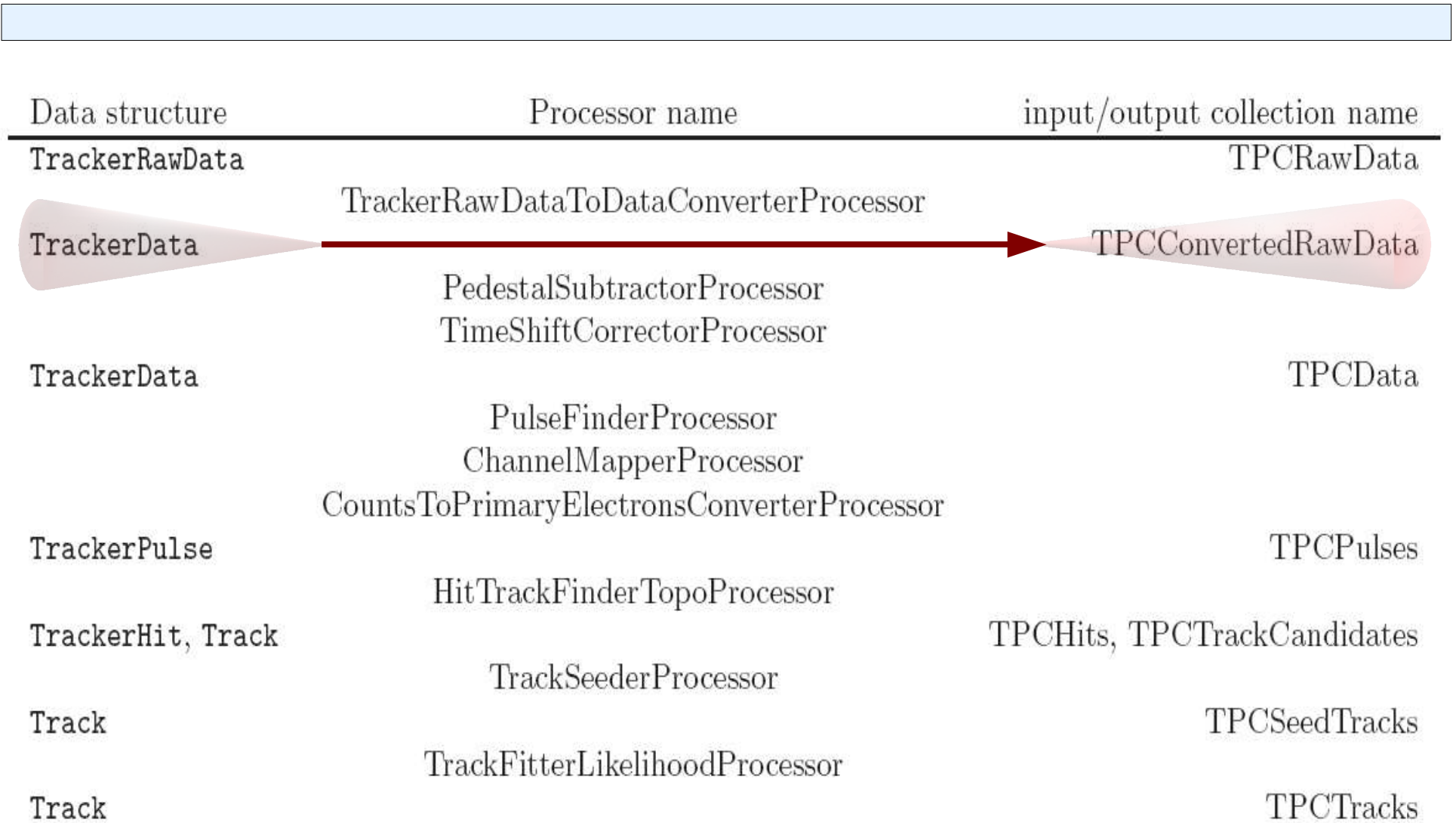
MarlinTPC Processor Chain



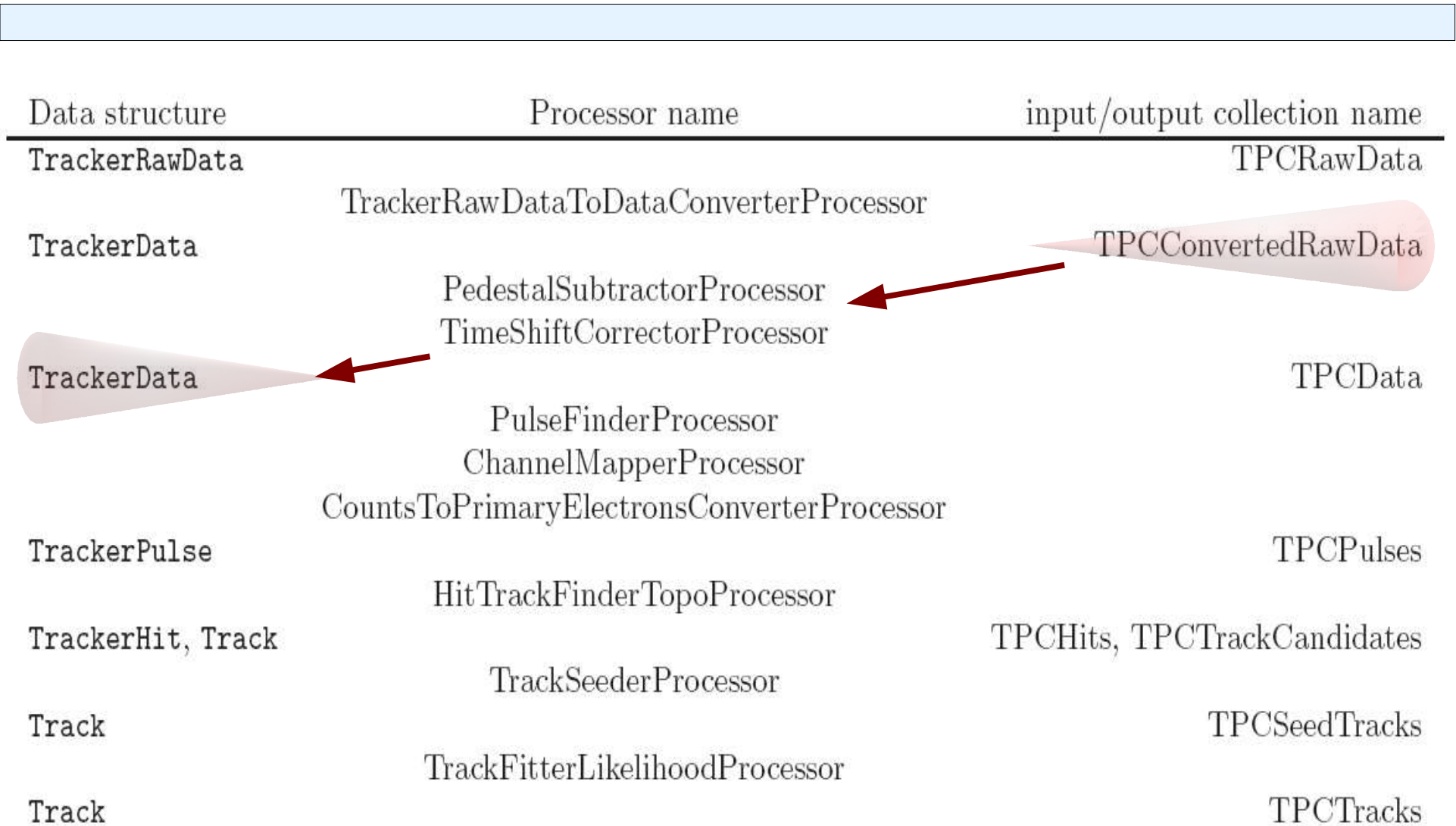
MarlinTPC Processor Chain

➤ ***TrackerRawDataToDataConverterProcessor***: converts ***TrackerRawData*** objects with floating point numbers for channel time spectrum

MarlinTPC Processor Chain



MarlinTPC Processor Chain



MarlinTPC Processor Chain

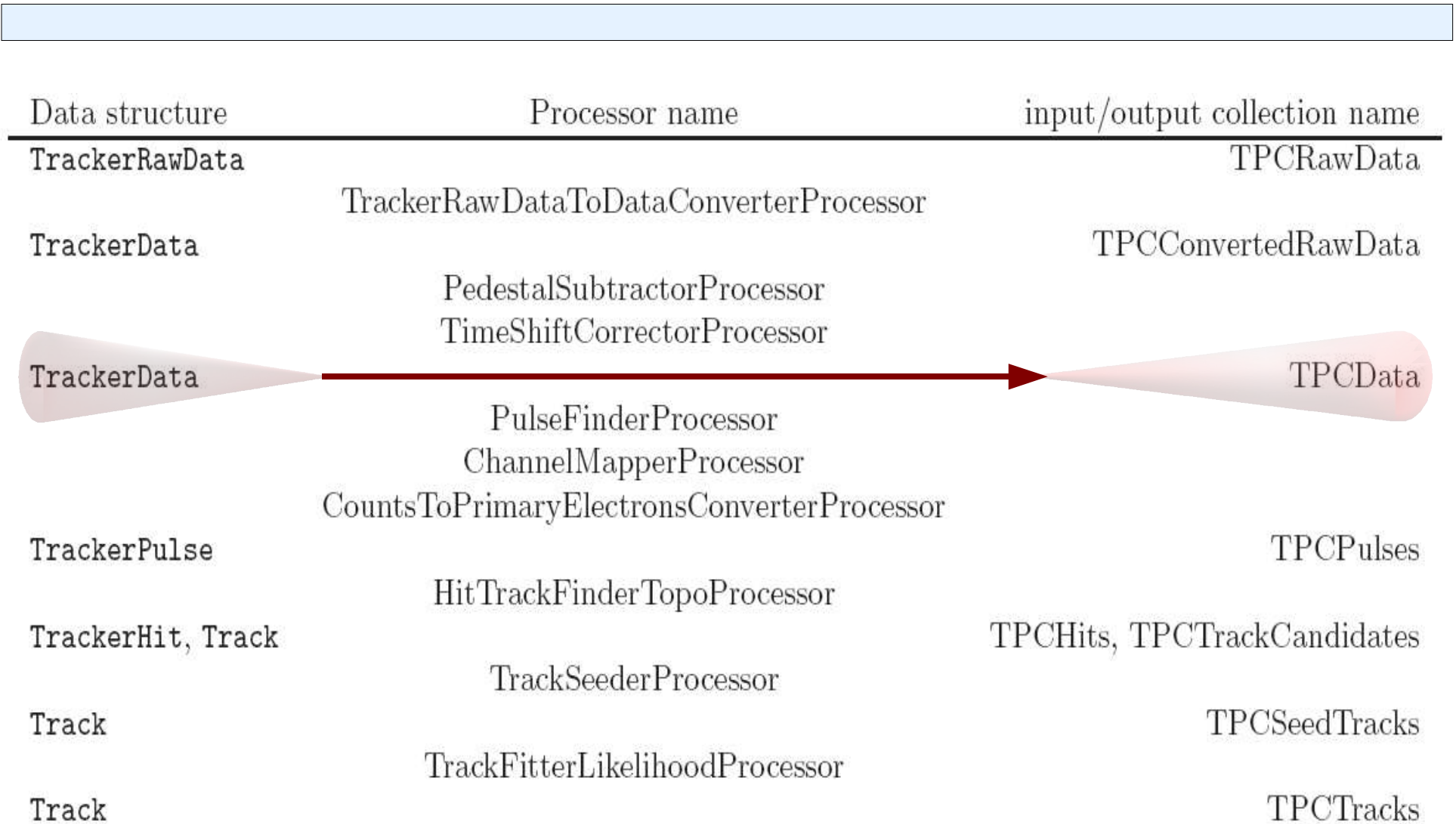
➤ ***PedestalSubtractorProcessor:***

pedestal subtraction via LCCD with ***ConditionsProcessor***

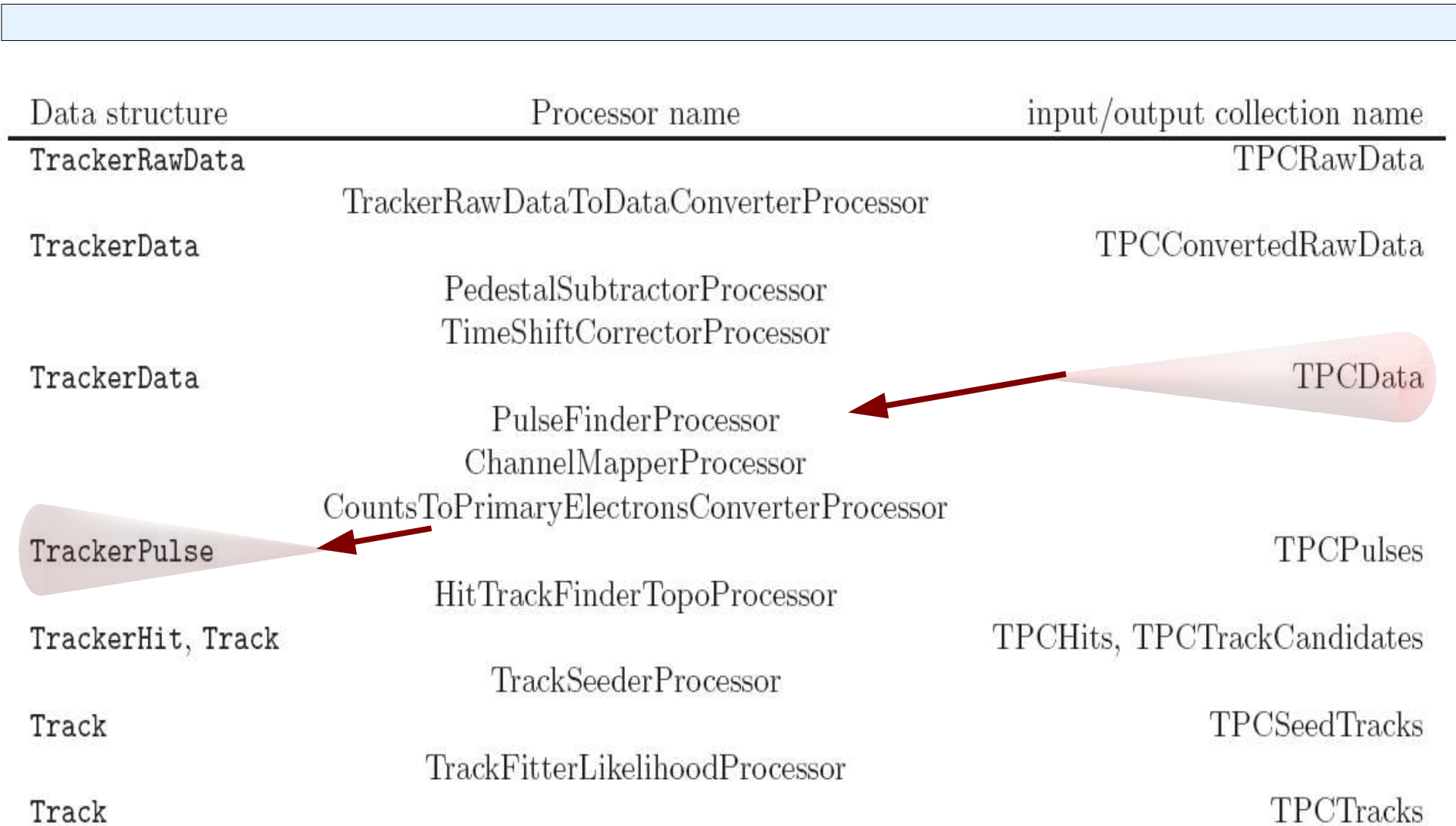
➤ ***TimeShiftCorrectorProcessor:***

applies time offset corrections to individual channels; each channel is read from LCCD

MarlinTPC Processor Chain



MarlinTPC Processor Chain



MarlinTPC Processor Chain

➤ ***PulseFinderProcessor:***

uses threshold based method with individual threshold per channel depending on noise width calculation from pedestal → zero suppression; calculates time and charge information

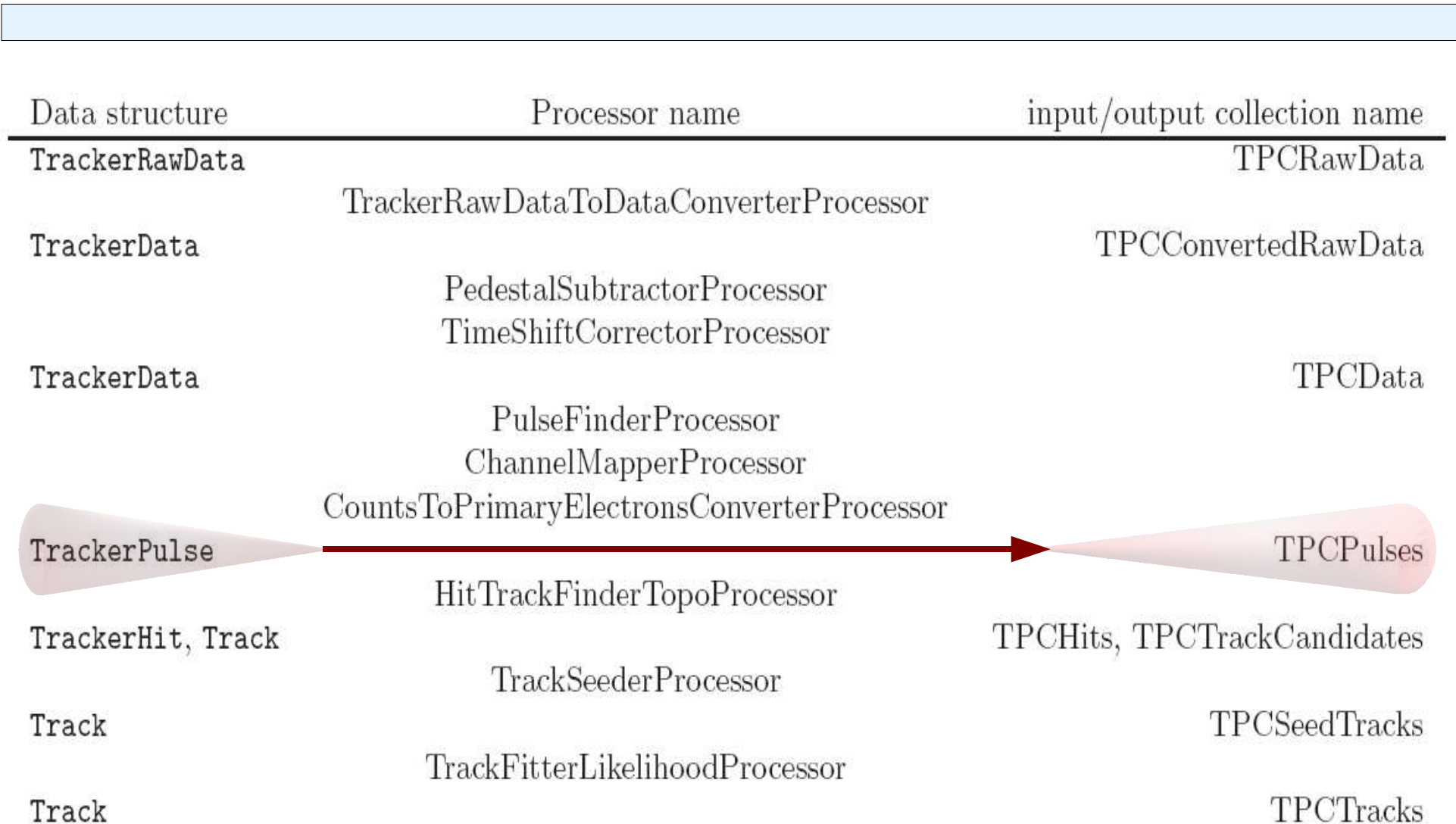
➤ ***ChannelMapperProcessor:***

changes cellID to map from hardware channel numbers to software/logical channel numbers

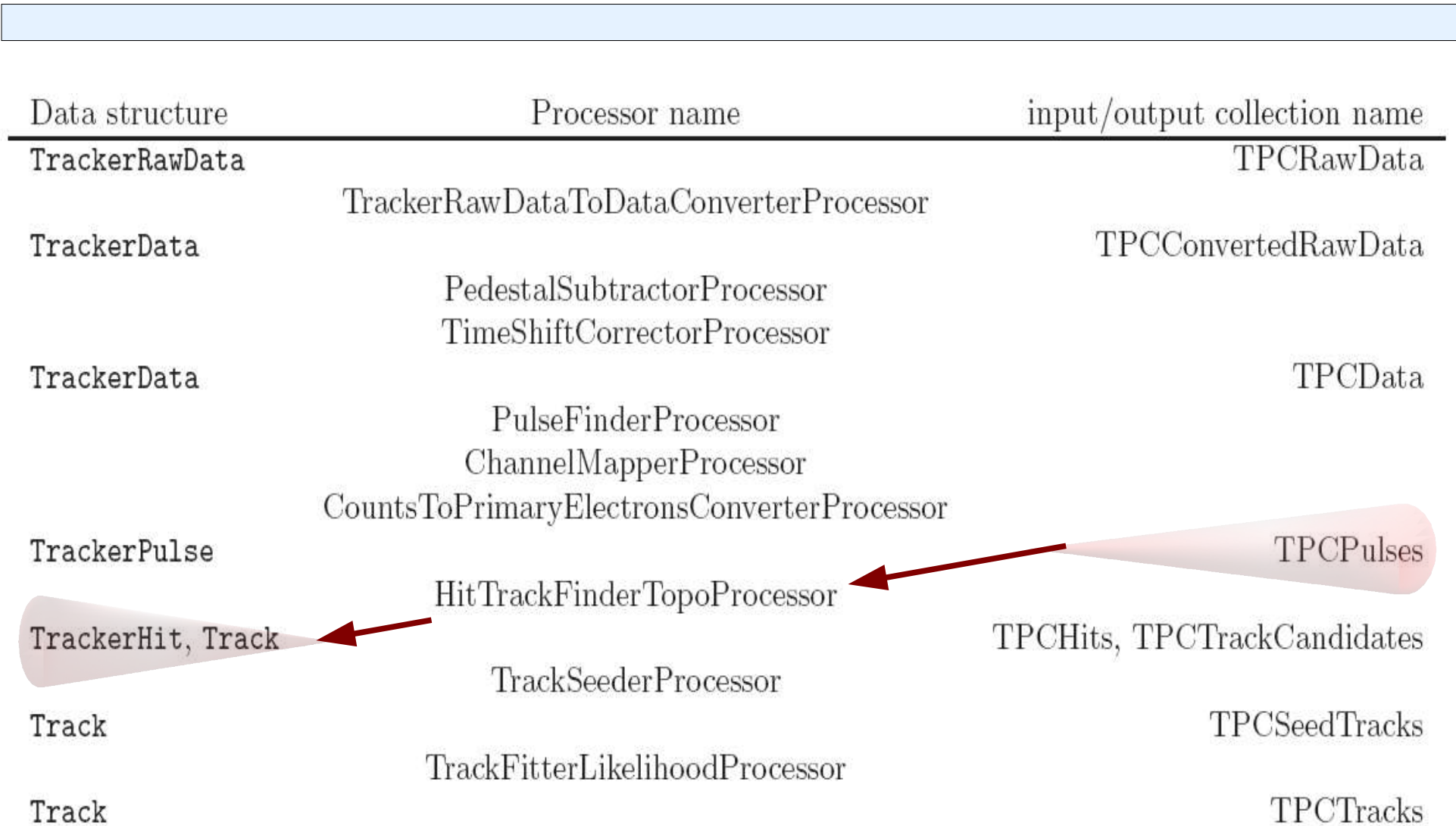
➤ ***CountsToPrimaryElectronsConverterProcessor:***

converts number of ADC counts per pulse into primary electrons

MarlinTPC Processor Chain



MarlinTPC Processor Chain



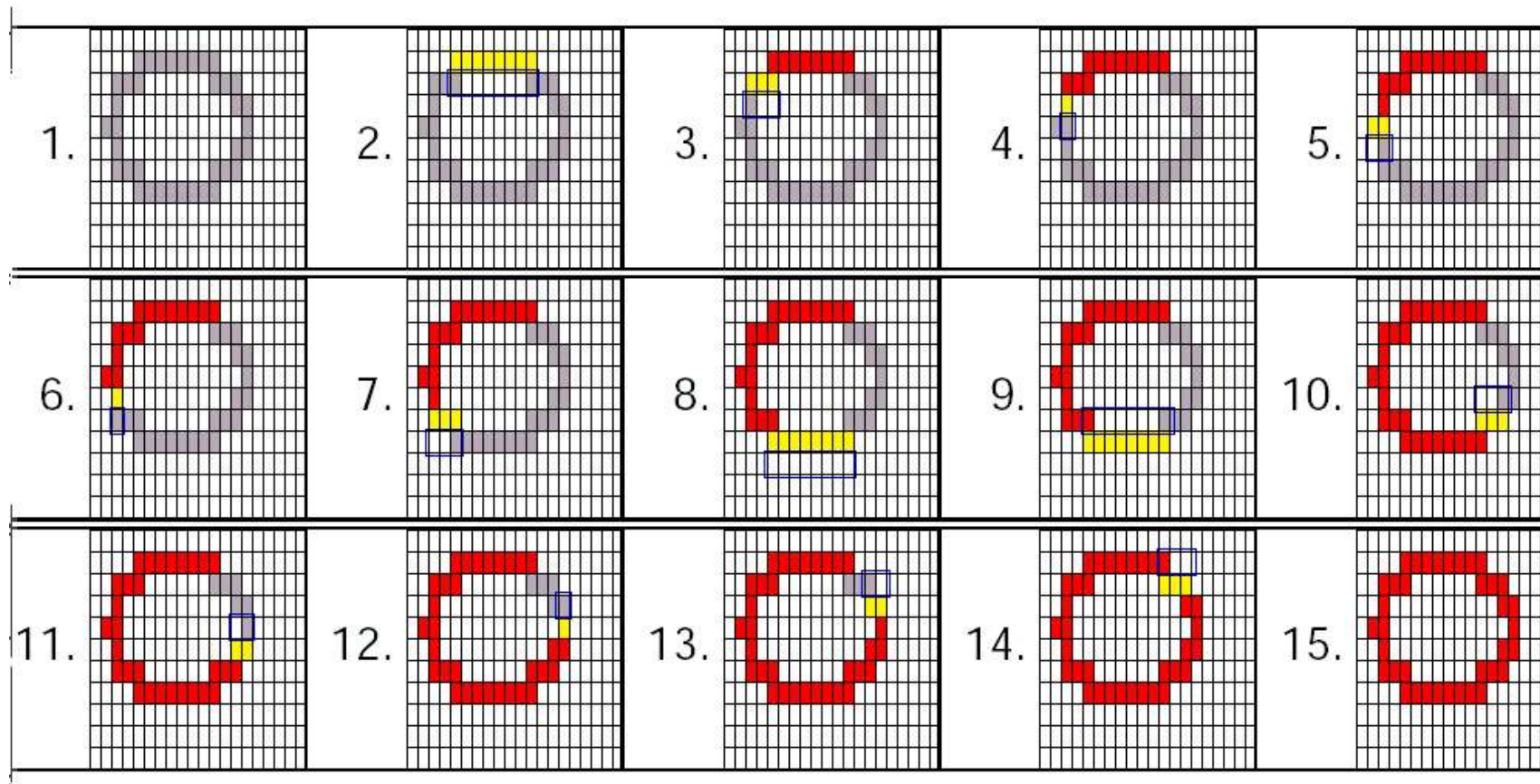
MarlinTPC Processor Chain

➤ ***HitTrackFinderTopoProcessor:***

performs topological search for pulses on neighboring pads.
Works for straight, curved, curled tracks

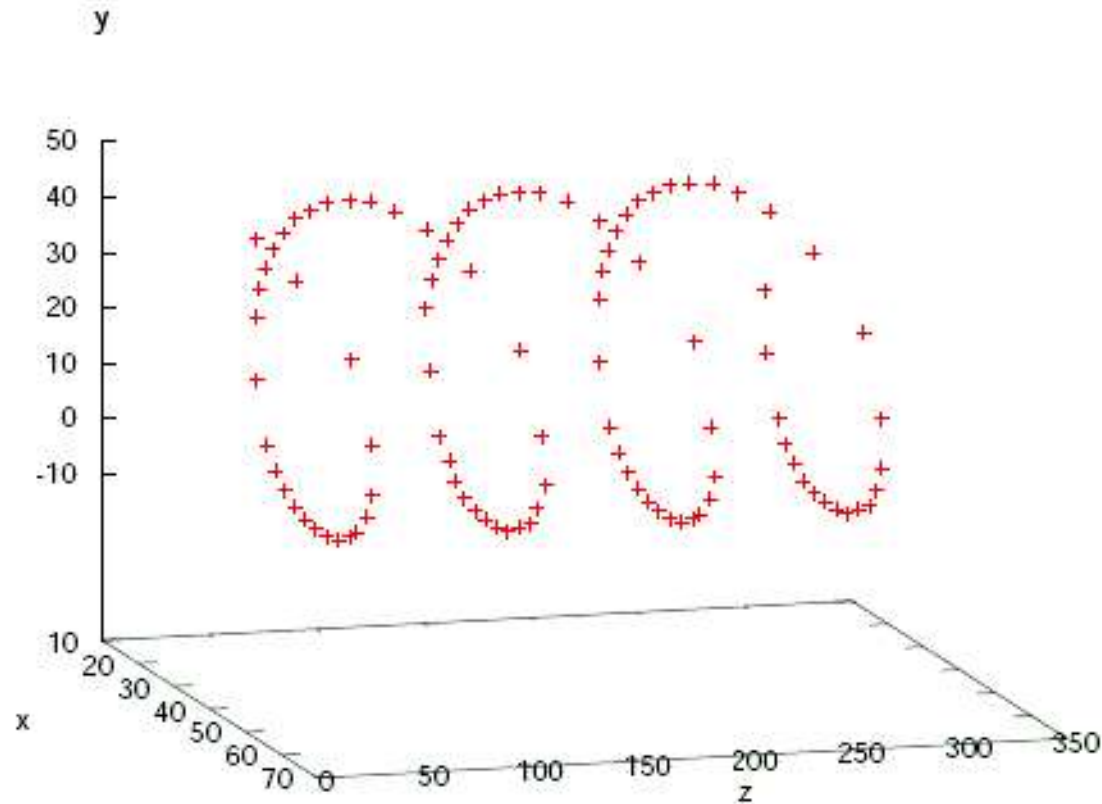
MarlinTPC Processor Chain

- Searches for contiguous hits in different pad rows within adjustable time window



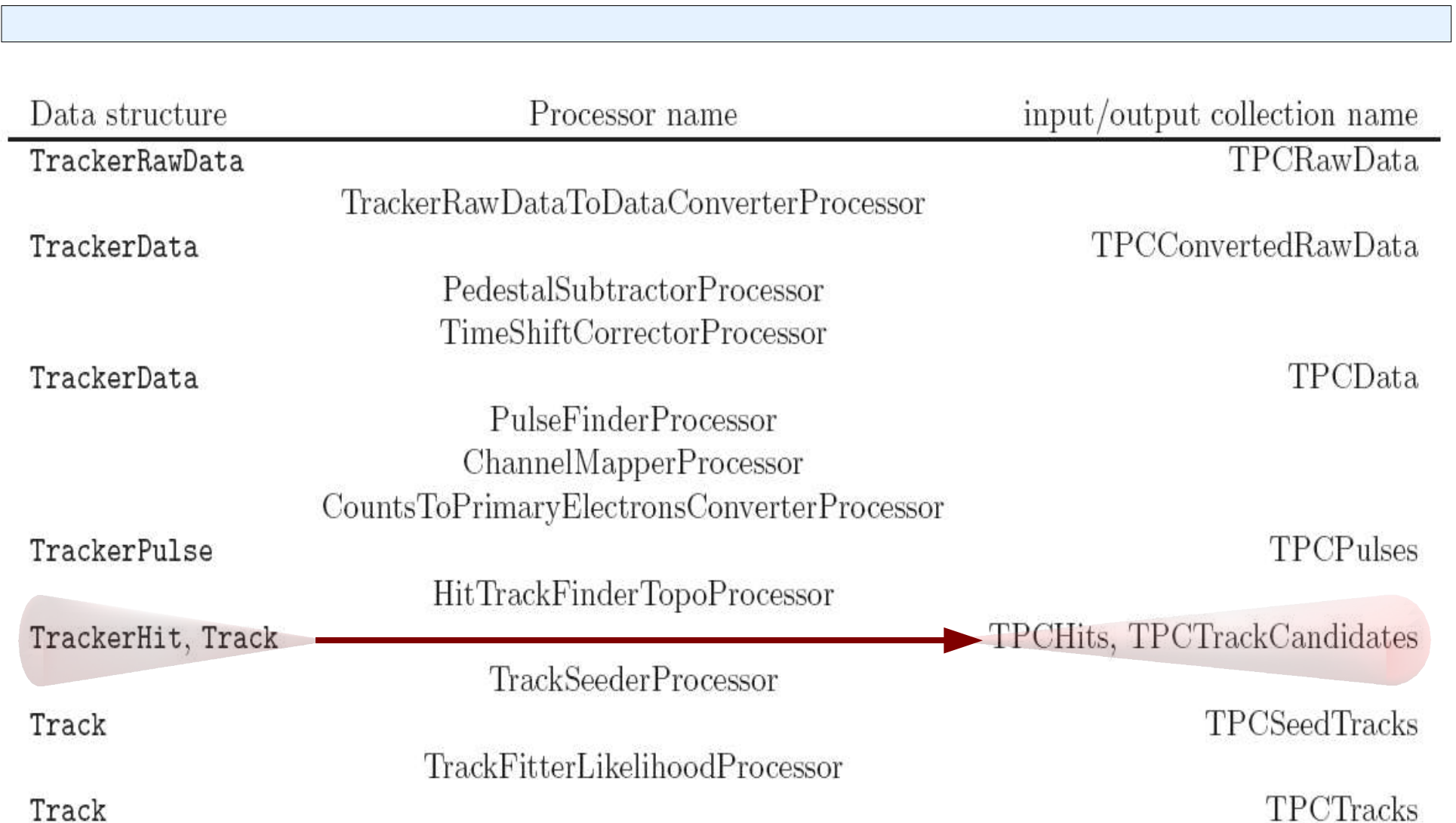
MarlinTPC Processor Chain

➤ Works for straight, curved, curled tracks; works with rectangular and circular pad layout

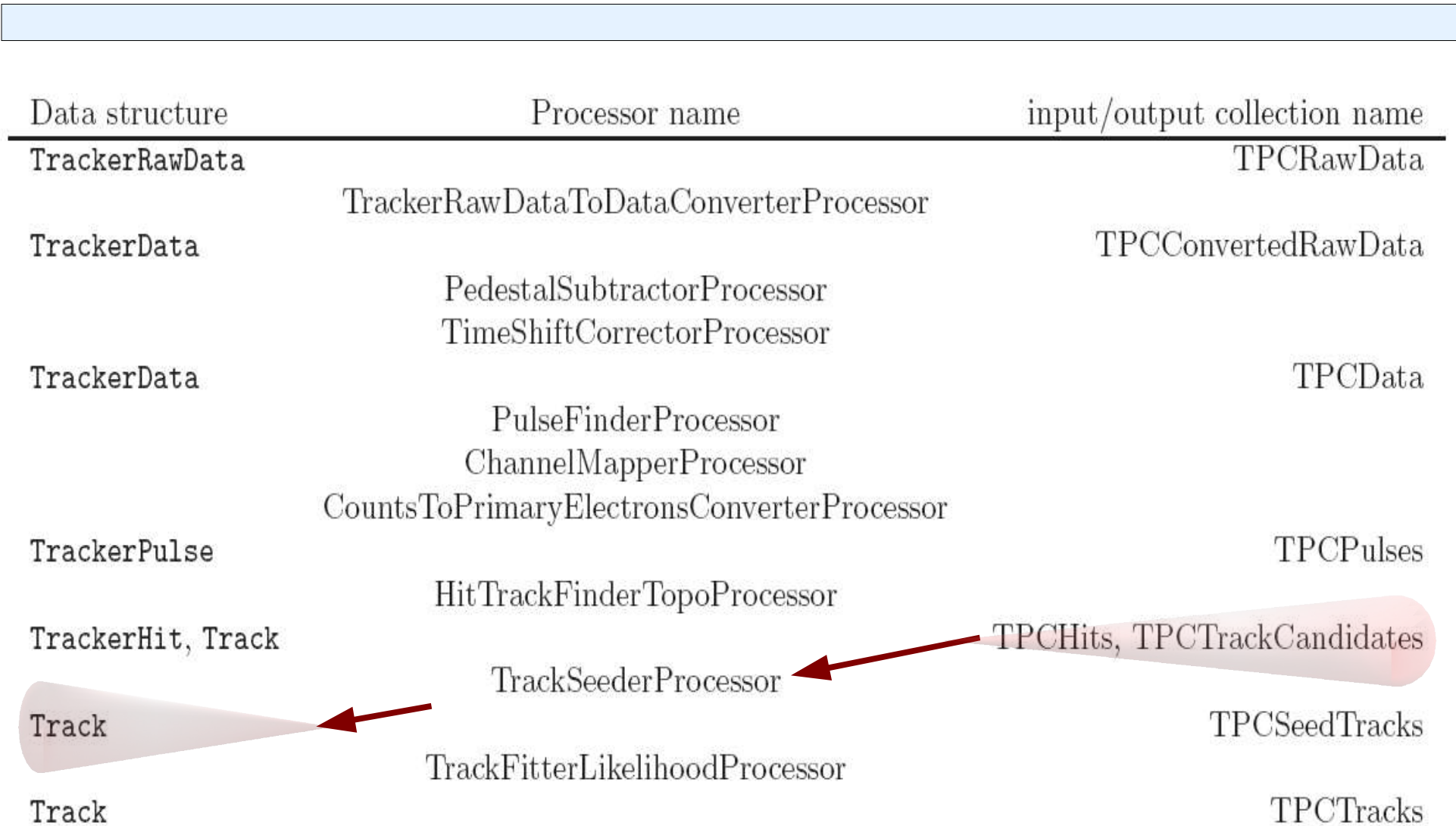


Courtesy of M. Killenberg

MarlinTPC Processor Chain



MarlinTPC Processor Chain

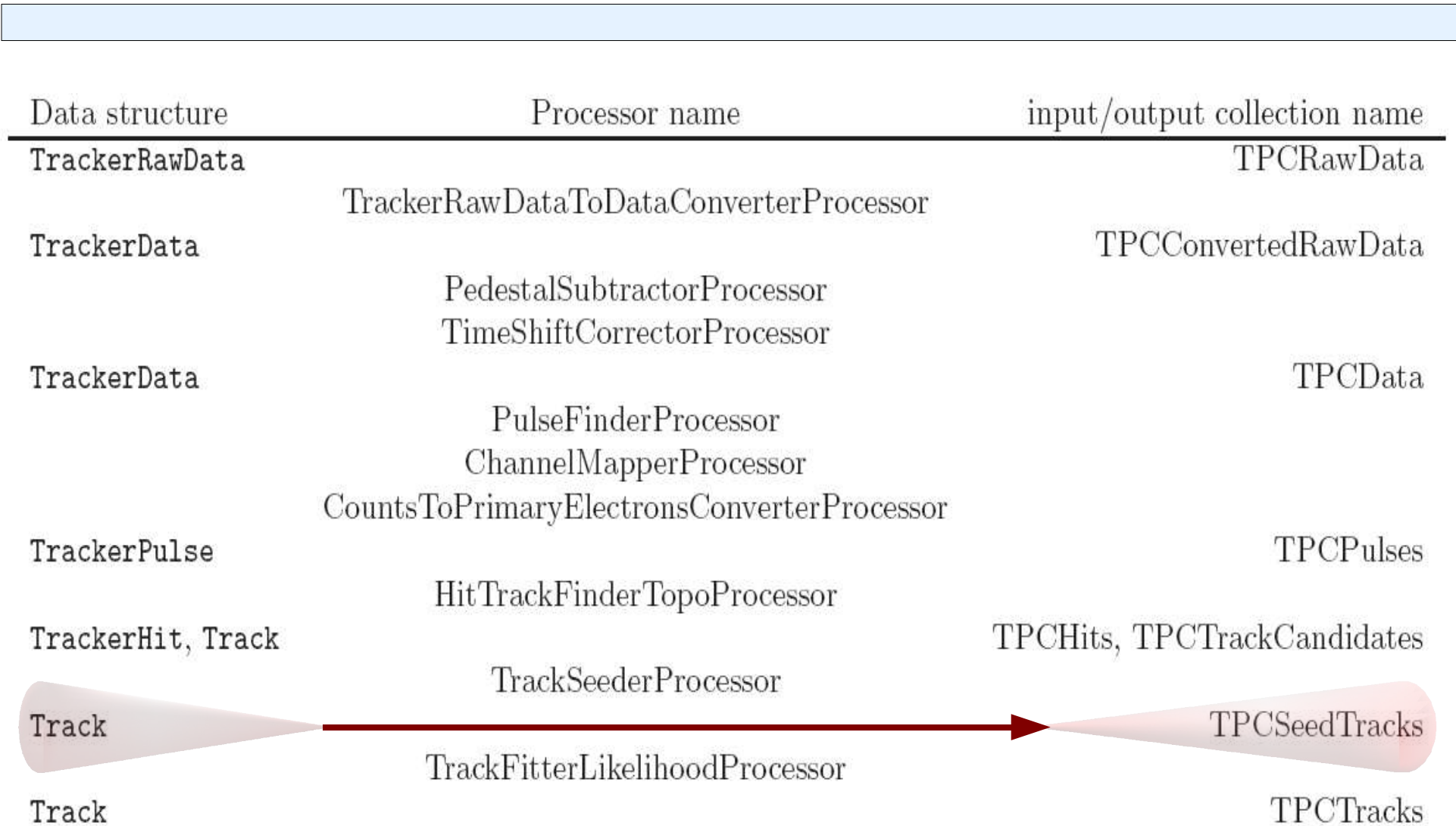


MarlinTPC Processor Chain

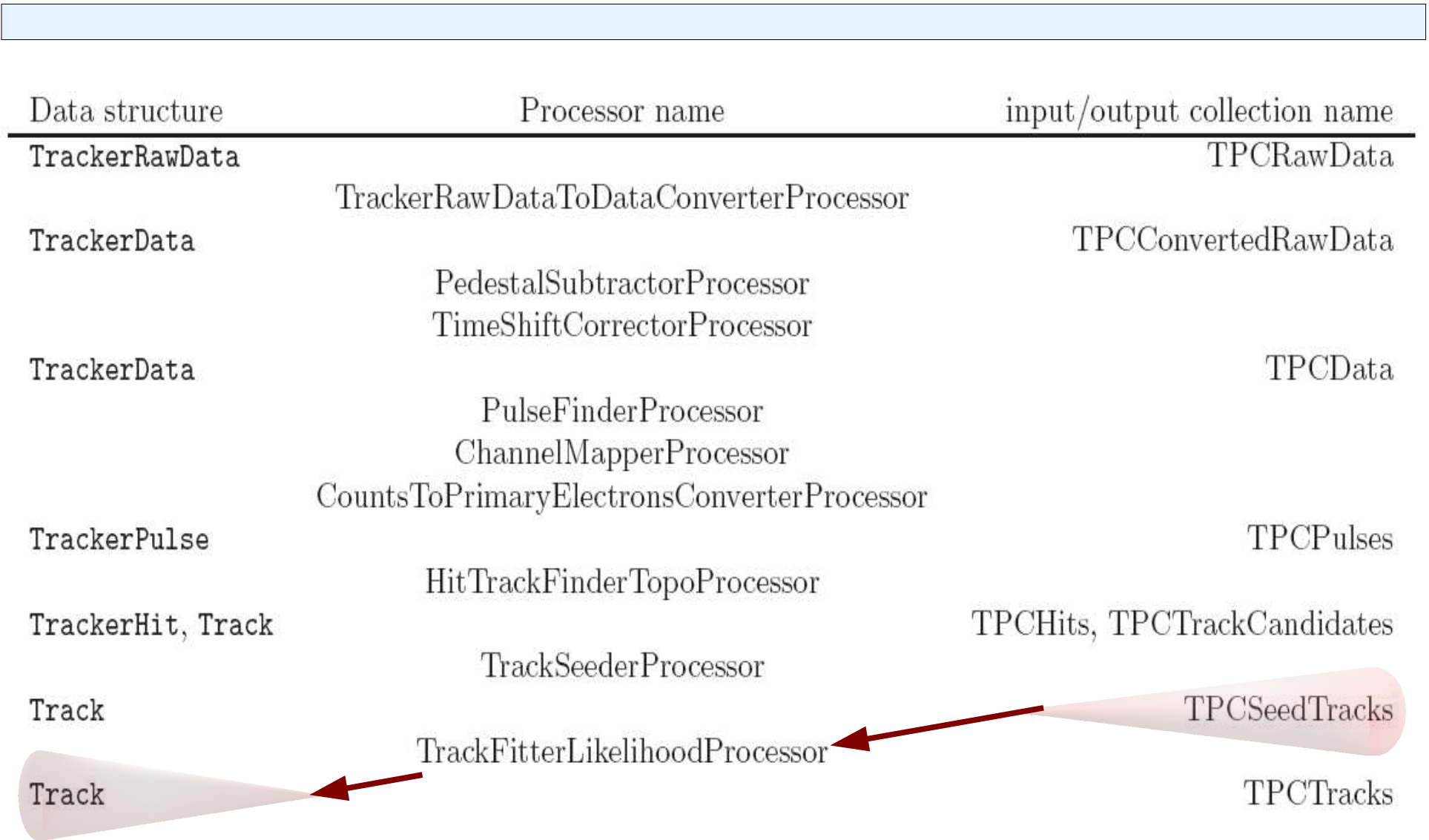
➤ ***TrackSeederProcessor:***

Estimates track parameters with analytical calculations → starting point for track fitter

MarlinTPC Processor Chain



MarlinTPC Processor Chain

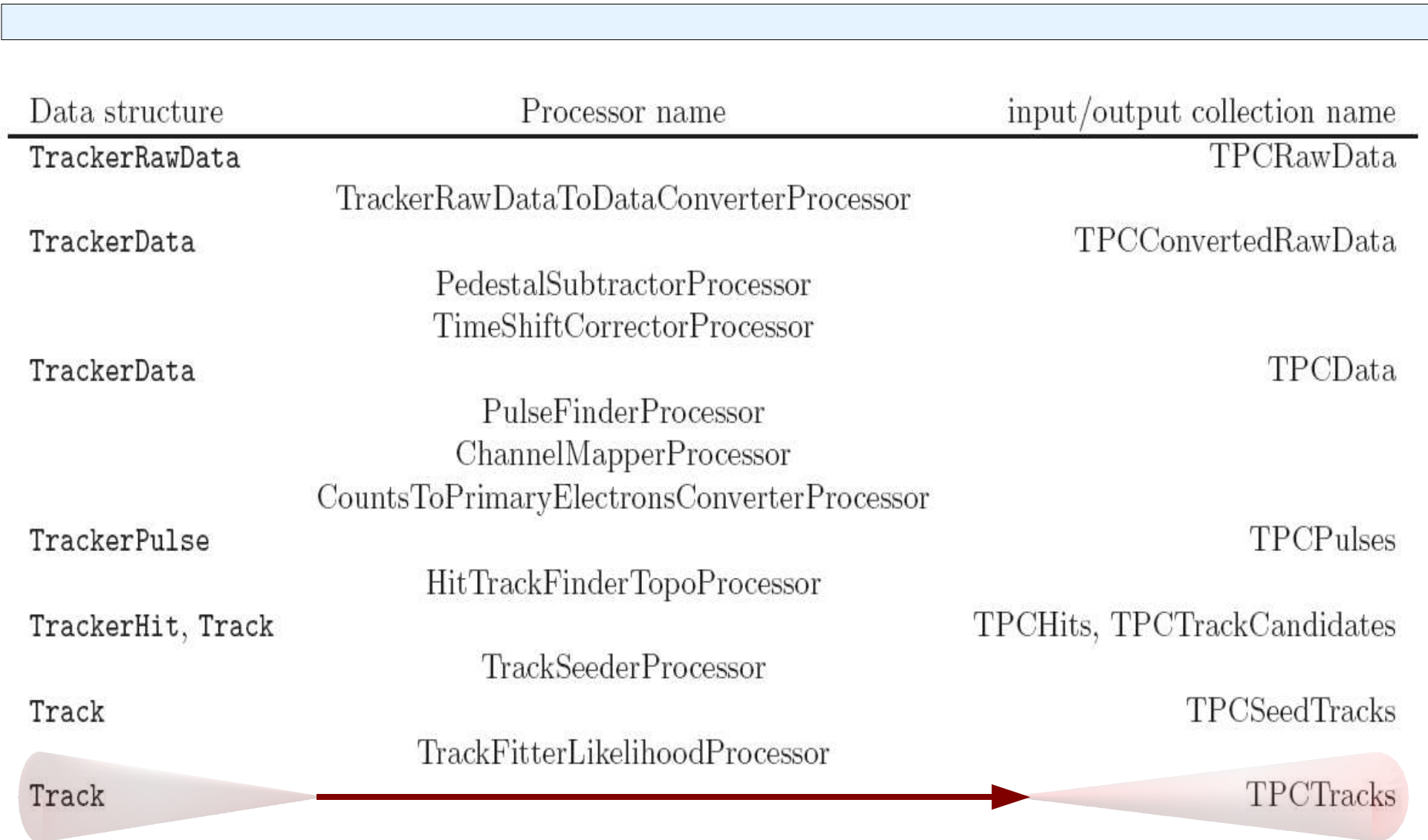


MarlinTPC Processor Chain

➤ ***TrackFitterLikelihoodProcessor:***

determines track parameters → maximization of global likelihood for observing measured charge distribution

MarlinTPC Processor Chain



MarlinTPC Processor Chain

Simulation, Digitization, Analysis

TPCGEMSimulation:

- simulates primary ionization using parametrization of HEED output
- drifting of primary electrons towards endplate
- amplification in 3-GEM system
- electronics shaping
- optionally ion backdrift

MarlinTPC Processor Chain

Simulation, Digitization, Analysis

Work has started for digitization of

- output of detailed gas detector simulations → generation of individual ionization clusters

- output of GEANT4

simulations → generation of rather large energy deposits

- pile-up due to drift time of electrons; due to background

Conclusion & Outlook

- Most important reconstruction processors available
- processors validated with toy data
- extension to algorithms for Medipix2 or Timepix readout chips are under consideration
- extension foreseen for reconstruction, digitization, and analysis processors
- capability checks with LPTPC

Please have a look at

MarlinTPC: A Marlin based common TPC software framework for the LC-TPC collaboration

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Physikzentrum, 52056 Aachen - Germany

Will appear in proceedings of LCWS07. It is also planned to submit it to arXiv, as EUDET report and LC note