Status of TOF reconstruction

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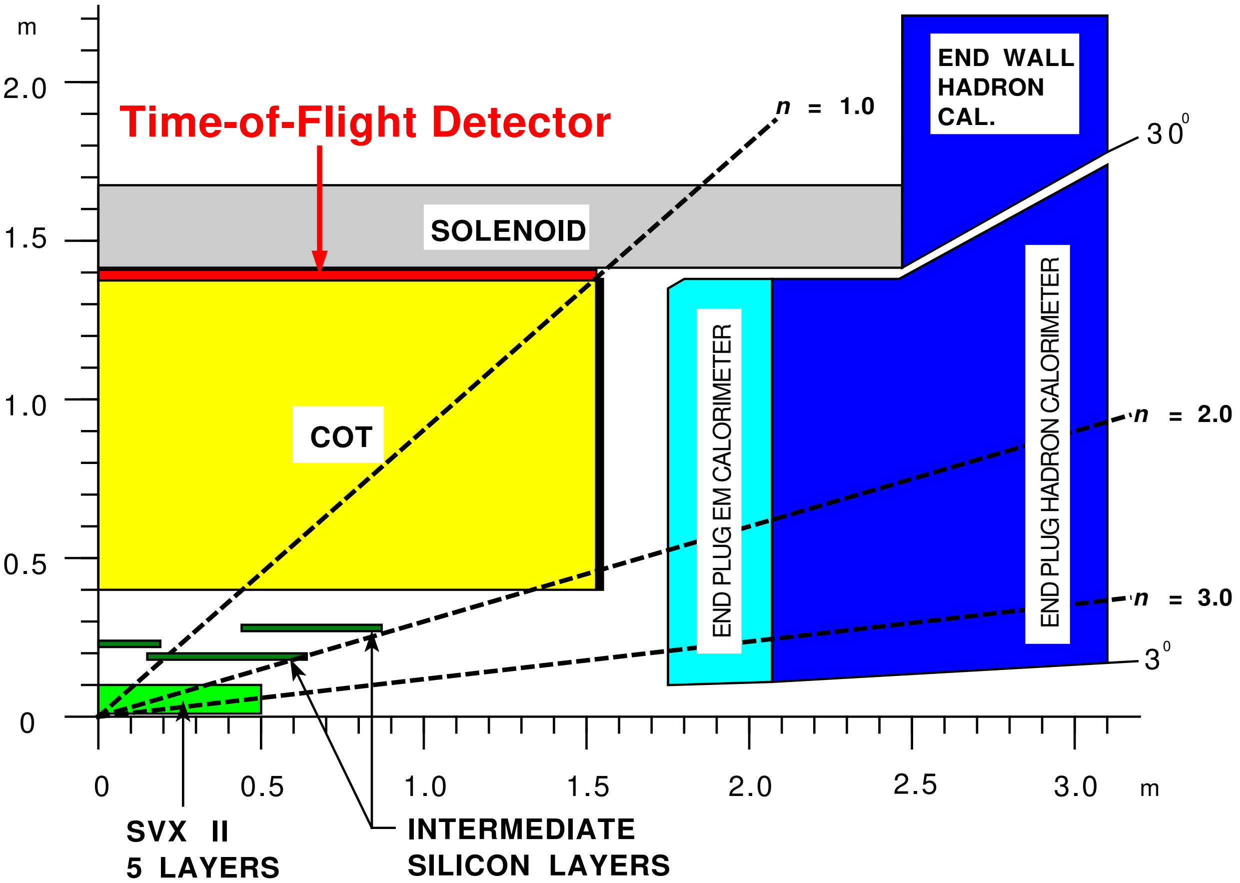
M I T

- Tof general issues
- Reconstruction components
- Status, recent development
- Future plans

Main developers: Cantabria, Korea, LBL, MIT, Pittsburgh, Penn, Roma

May 31, 2001

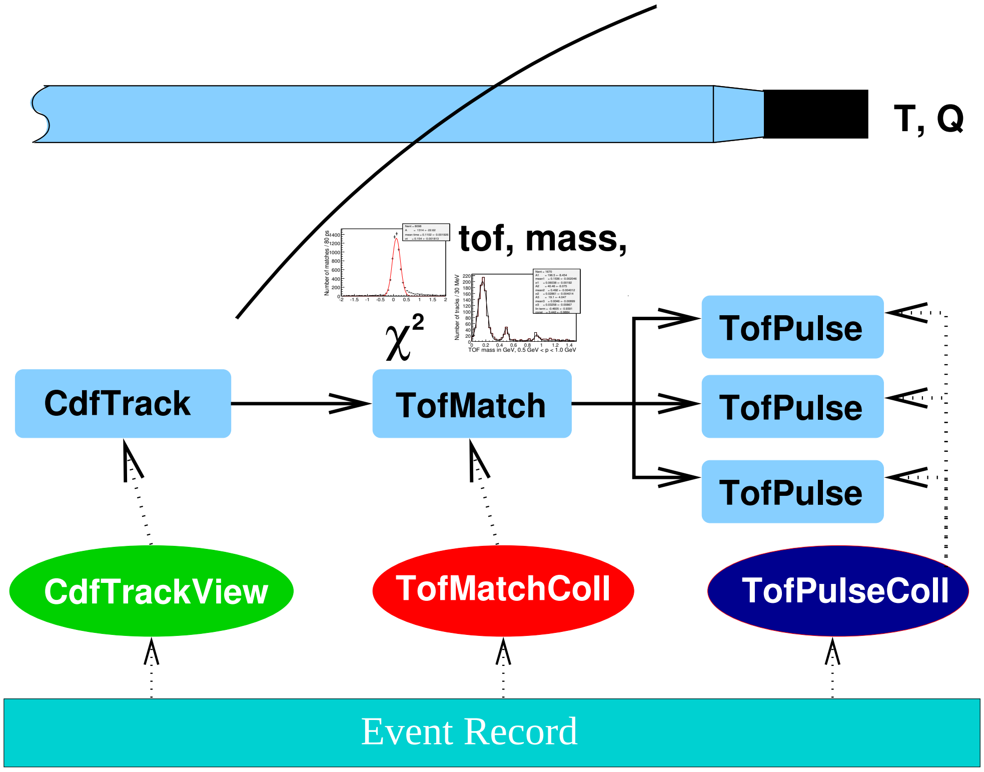
TOF, briefly:



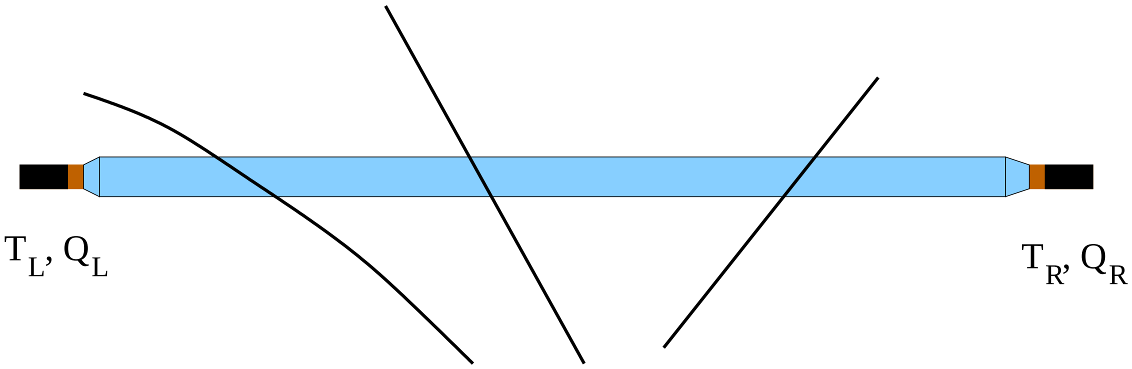
- 216 scintillator bars, between COT and solenoid
- single bar bar covers $\delta\phi = 5/3^{\mathrm{o}}$, $|\eta| < 1$
- each bar read out by two PMT's, one at each end
- nominal timing resolution ≈ 100 ps
- physics: B flavor tagging, CHAMPS, monopoles

TOF reconstruction goals:

- interpret TOF data, match TOF hits to tracks
- provide a user interface to physics quantities
- apply corrections to get best possible timing resolution



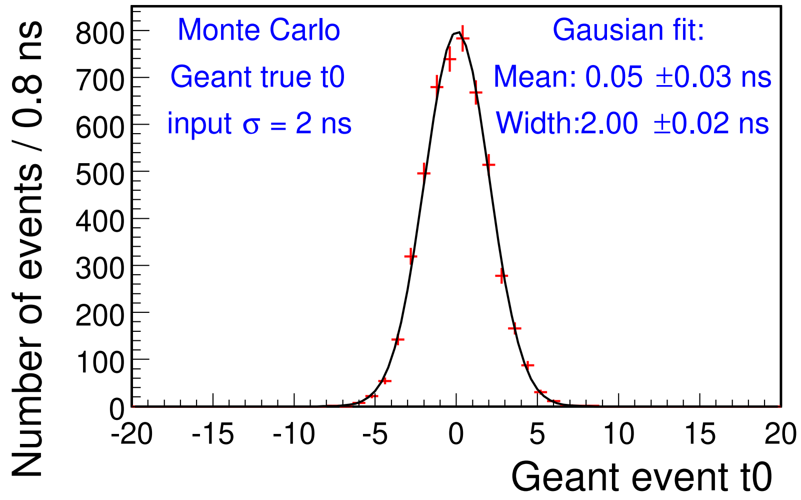
Track - Pulse Matching Algorithms:



- $\mathrm{T_L - T_R}$ (TofSimpleAssoc)
- $\mathrm{T_L - T_R = 2 \cdot z / c_s}$
- looks for tracks within 2σ of calculated z
- Closest Z (TofAssoc)
- associates pulse with track closest to the bar end
- Hybrid (TofHybridAssoc)
- changes between algorithms depending on track and hit topology

Event t_0 calculation:

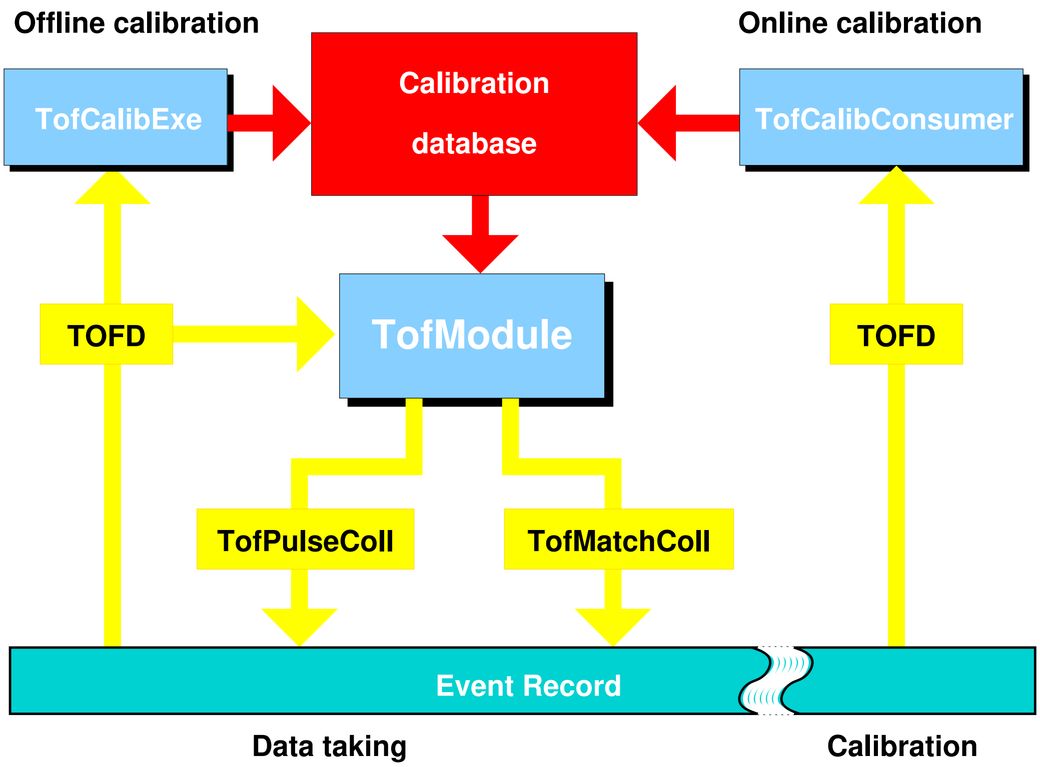
- bunch length $\sim$ 30 cm $\rightarrow \mathrm{t}_0 \sim 1\mathrm{ns}$
- event t_0 calculation enters every tof calculation
- need good resolution $(<< 100\mathrm{ps})$



- TofAbstT0Calculator - base class for calculators
- CheatT0Calculator - GEANT truth information
- iterative averaging algorithm $(\sigma \sim 40\mathrm{ps})$
- log likelihood fit

TofModule - the reconstruction module

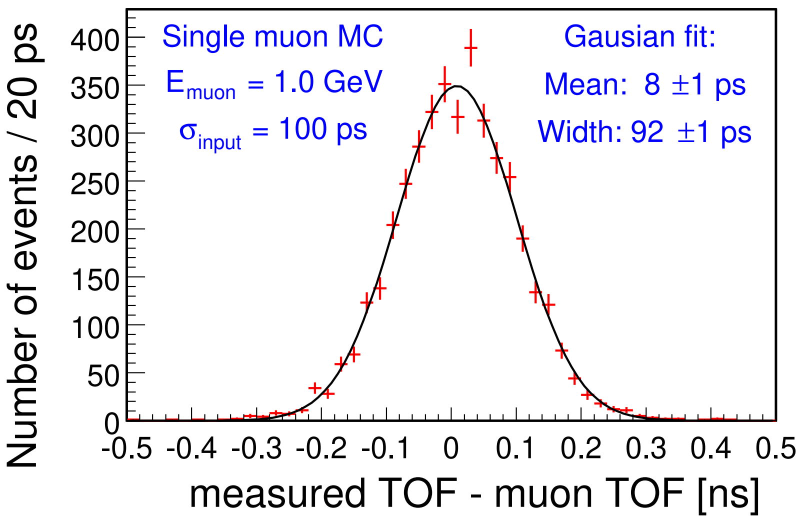
- unpacks TOFD banks, does $\mathrm{D} \rightarrow \mathrm{E}$ conversion
- track - pulse association (default: closest Z)
- t0 determination (default: GEANT)
- tof calculation for all matched tracks
- stores all persistent objects into the event record



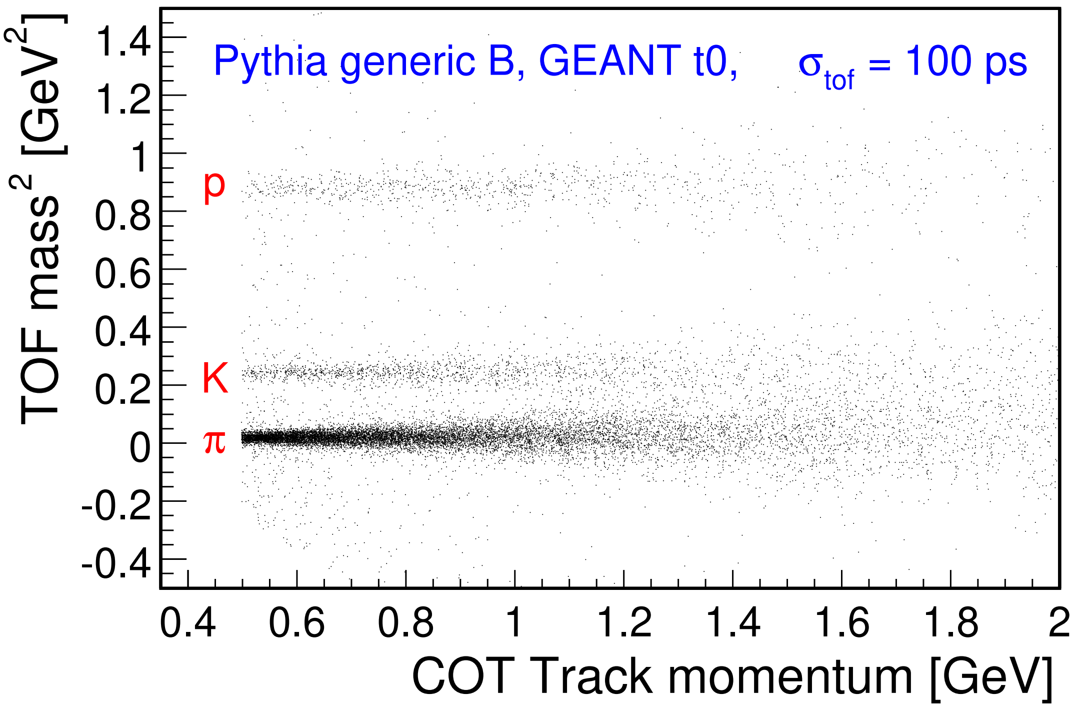
Validation of TOF data:

- Data validation (TofValidationModule)
- monitor minimal set of reconstructed quantities
- provide information for good run flagging

- Monte Carlo validation:
- monitor a set of MC and data quantities
- produce root tuple for experts
- modify module for use on data (reco. tuning)
- weekly Sim/Reco consistency check on single muons:



Excercise on simulated data:

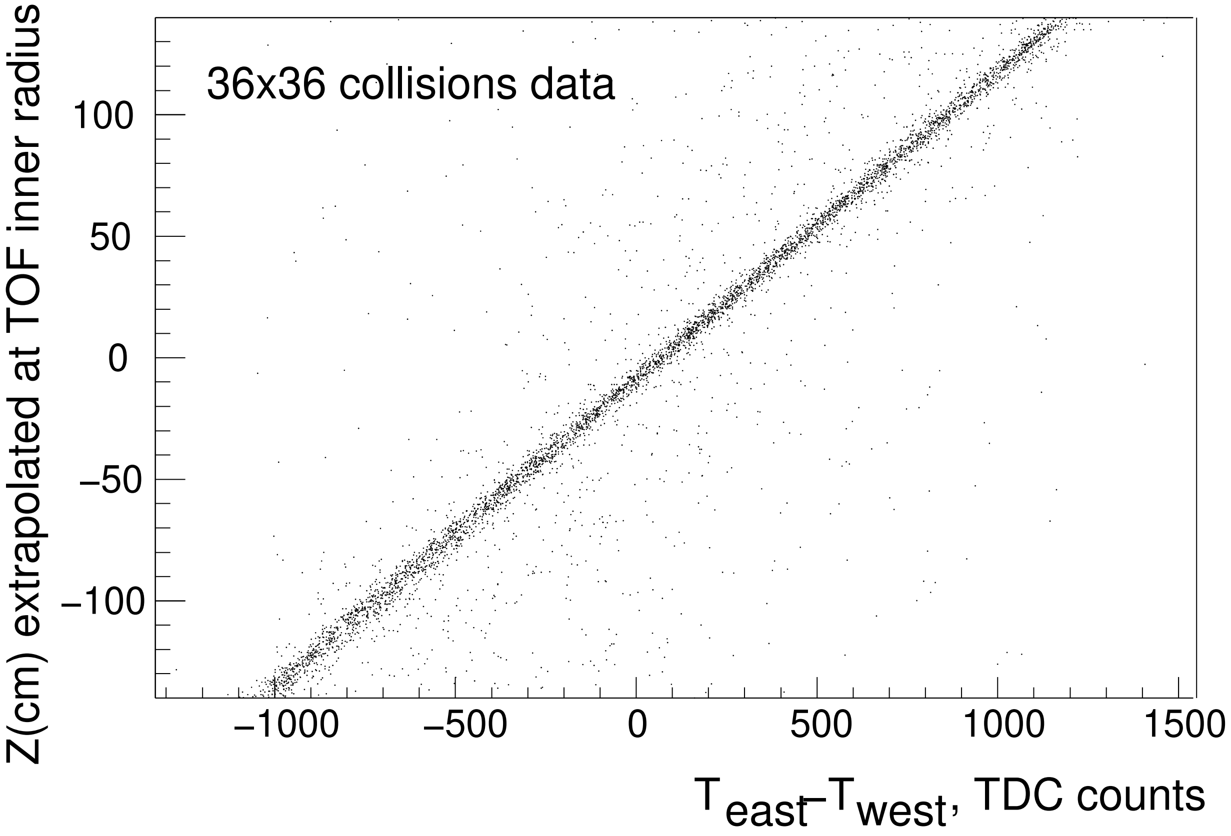


- full track-pulse matching, tof calculation
- GEANT t0
- good K/π separation

Recent developments:

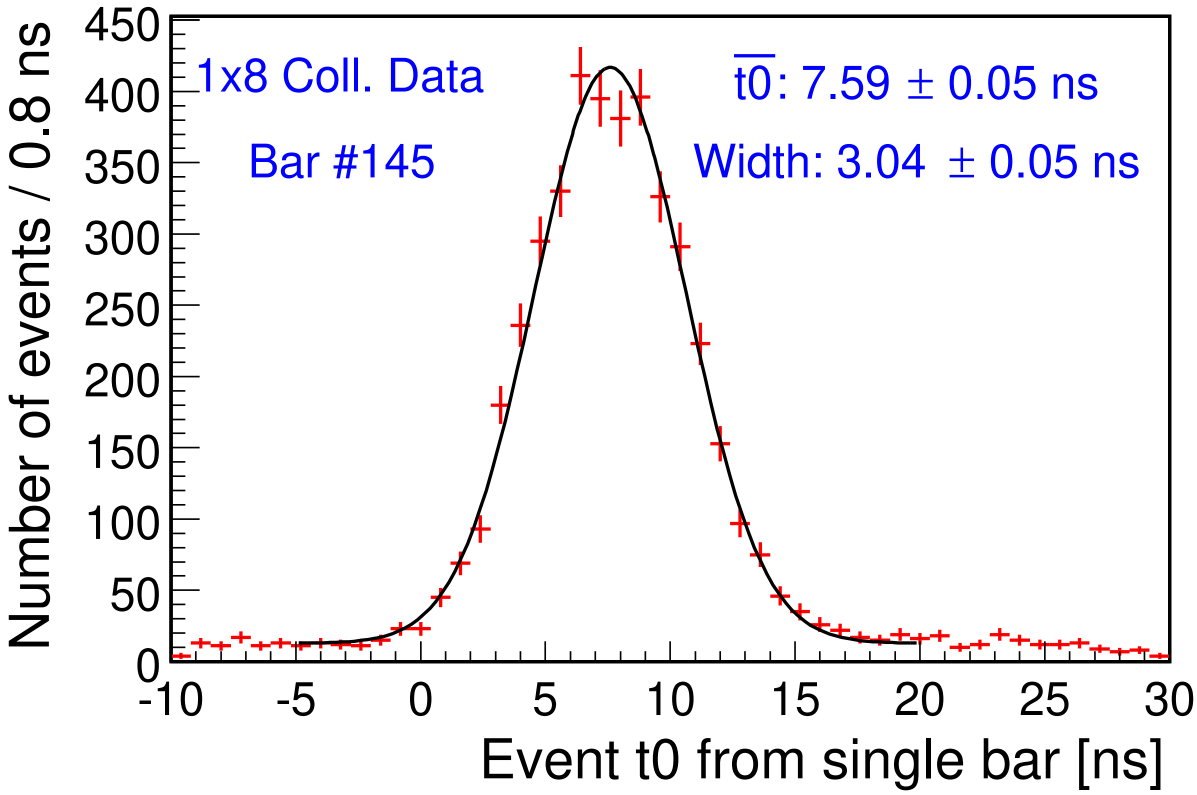
- commissioning run, 1x8 and 36x36 collision data analyzed
- tuning of track matching algorithms
- data validation modules and tools
- linking TofModule to calibration database
  - offline calibrations: light speed
  - online calibrations: TAC calibration
- channel filter, pedestal suppression
- comparisons of data and Monte Carlo
- t0 calculation framework development

Results from recent data: (light speed)



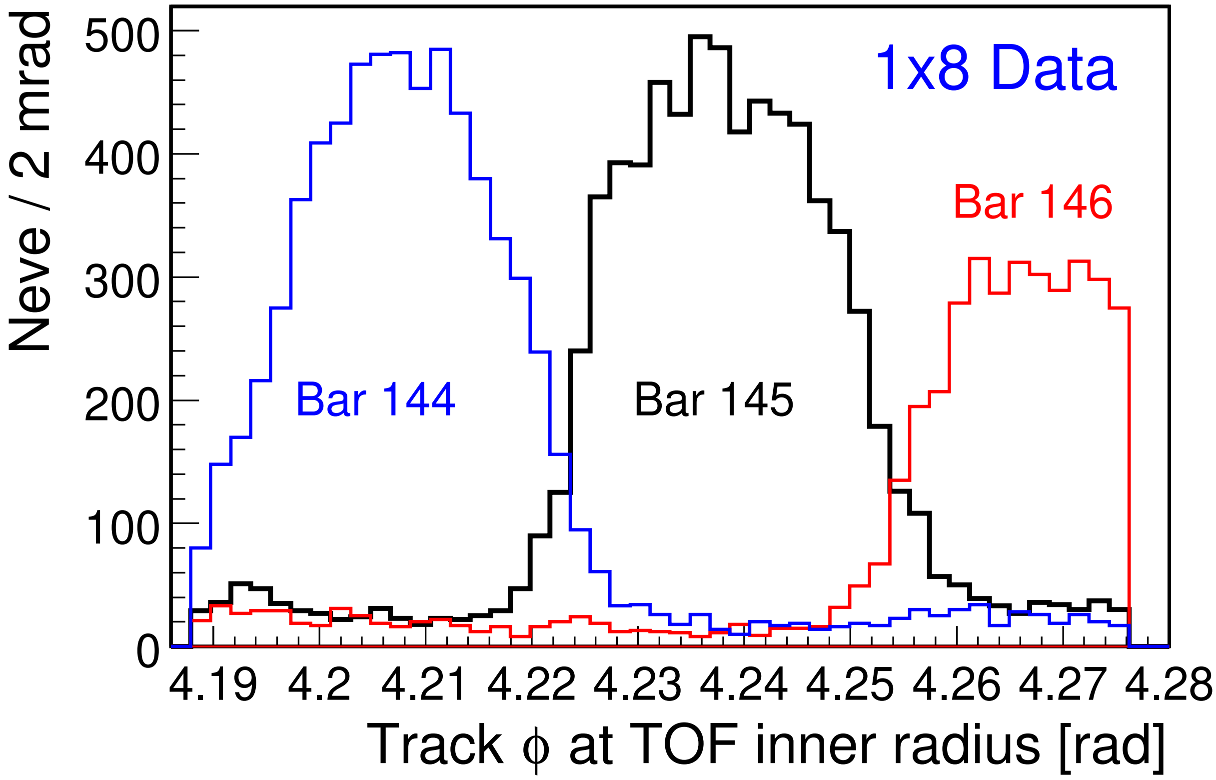
- $\mathrm{T_L - T_R = 2 \cdot z/c_s}$
- needed for time calculation and matching
- offline calibration → calibration database

Results from recent data: (event t0)



- single bar, single track used
- measured width $\sim 3\mathrm{ns}$
- distribution wider than expected?
- channel time offsets

Results from recent data (geometry):



- mapping of TOF bars using COT tracks
- bars shifted wrt nominal position
- corrections to survey data?
- comparison with MC for fine tuning

Future plans:

- Short term missing functionality:
  - t0 calculator implementation
  - geometric corrections
  - channel time offset corrections
- aim to implement all this by mid-july
- validate, test on 1x8 and 36x36 data
- this would complete the framework
- more corrections: time walk correction, ...
- verify error propagation
- calibration on data samples: $\mathrm{D} \to \mathrm{K}\pi$, $\Lambda \to \mathrm{p}\pi$
- automatization of offline calibration

Conclusions:

- framework for offline TOF operations is in place
- is already running in production
- complete wish list for mid-july runs
- implement further corrections afterwards