Fast Kalman Track Fit in HLT1 & validation of Lite Clusters

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Content:

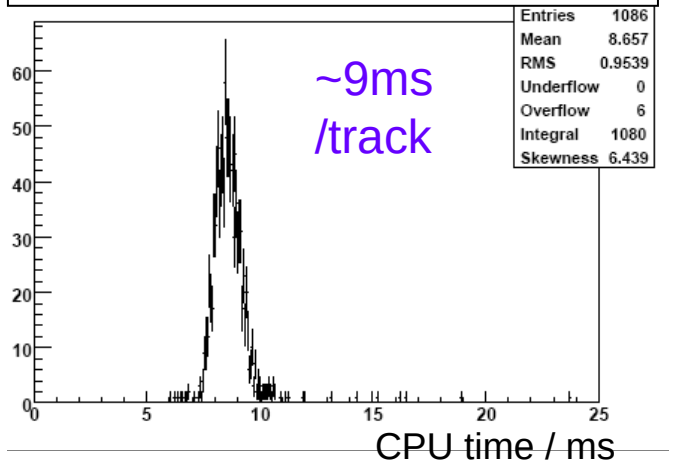
- fast track fit
- validation of lite clusters
- use of fit in HLT1

Reminder: Fast Track Fit

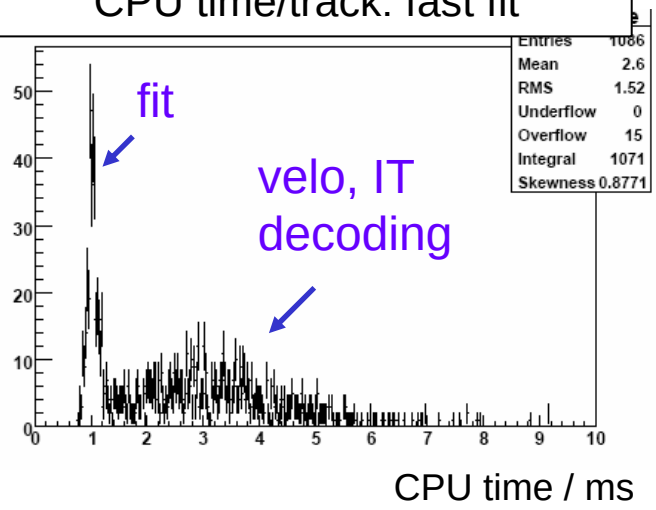
- Use kalman fit with fast options:
  - simplified geometry
  - Only 1 iteration, one direction
  - no outlier rejection, smoother
- Fast fit has shown to be very useful in HLT1
  - muon alley: J.A. TRec Oct.6
  - hadron alley: X.C.Vidal, Dec.15
- Problem: decoding for full Velo, IT/TT clusters

Thanks to Wouter for help in the implementation

CPU time/track: full offline fit



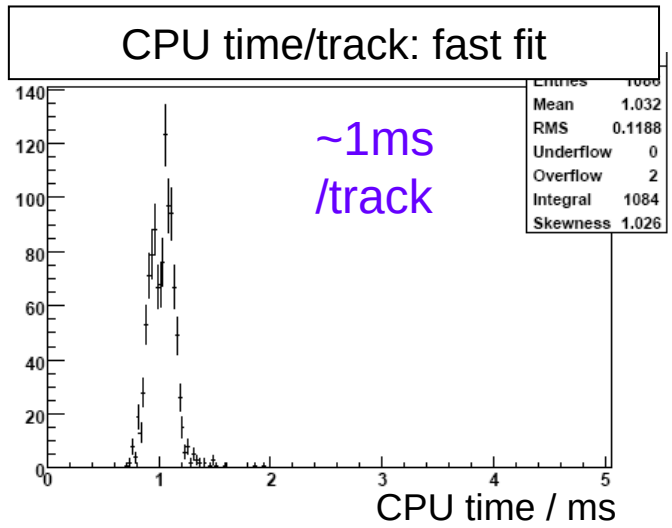
CPU time/track: fast fit



time measured on 1.95 * 2.8 GHz Xeon

Reminder: Fast Track Fit

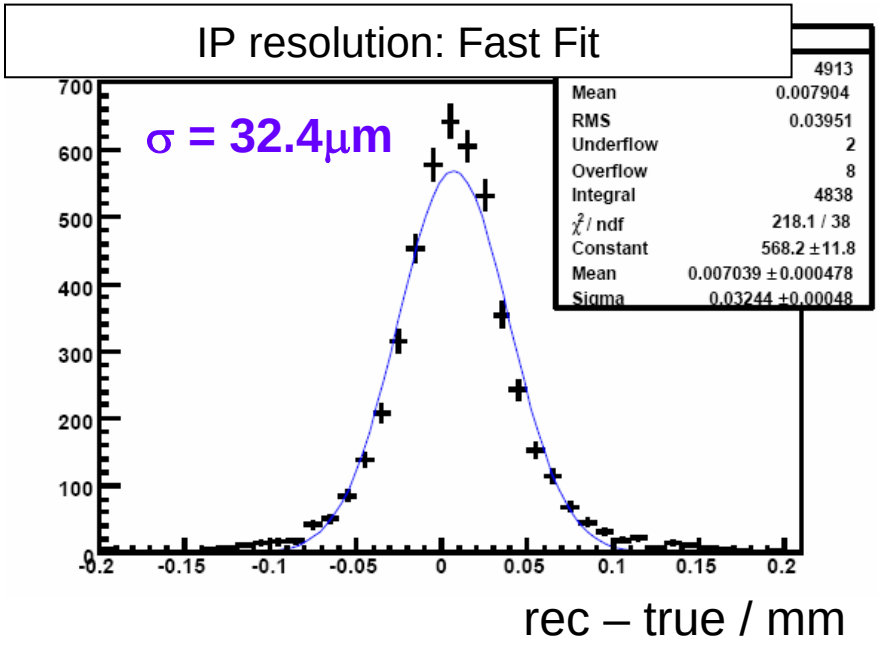
- D. Hutchcroft (Velo), M. Needham (IT,TT) prepared the fit to use lite clusters
- With slight modifications, the MeasurementProvider can now handle them
- Fit now runs on Velo&IT Lite clusters
  - ~1ms/track
  - validate results with lite clusters

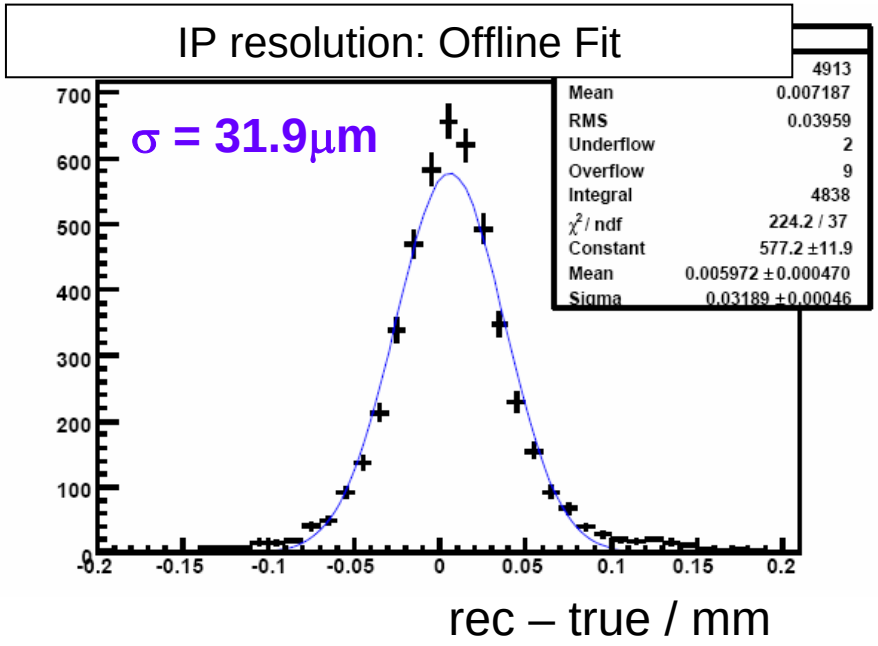


Software versions:
- DaVinci v22r0 plus head of:
  - Event/TrackEvent
  - Kernel/LHCbKernel
  - Tr/TrackFitEvent
  - Tr/TrackFitter
  - Tr/TrackInterfaces
  - Tr/TrackMonitors
  - Tr/TrackProjectors
  - Tr/TrackTools
  - Velo/VeloDAQ
  - Velo/VeloTools

Validation of Lite Clusters: IP

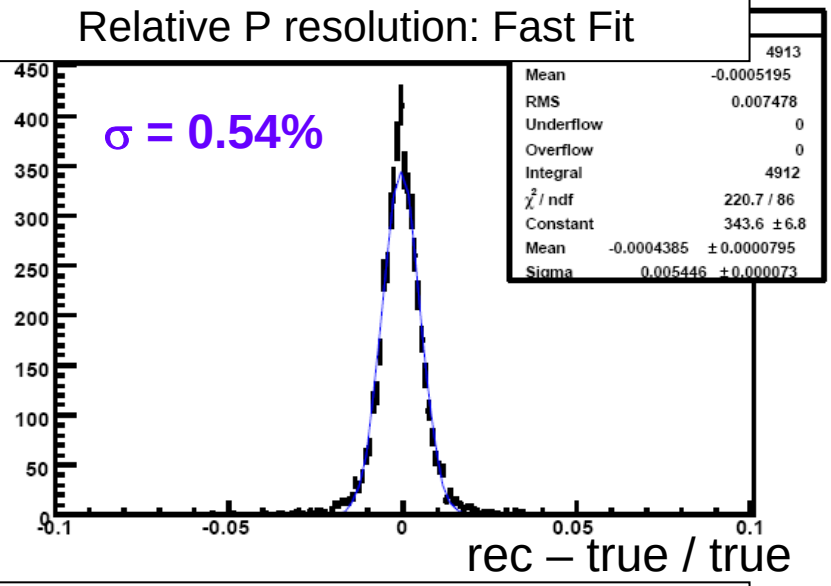
- Use offline selected Bs→J/ψ(μμ)φ events
- Tracks in HLT1 after single muon decision
- Compare IP, p, pt, χ2 of fast fit w/ lite clusters and offline



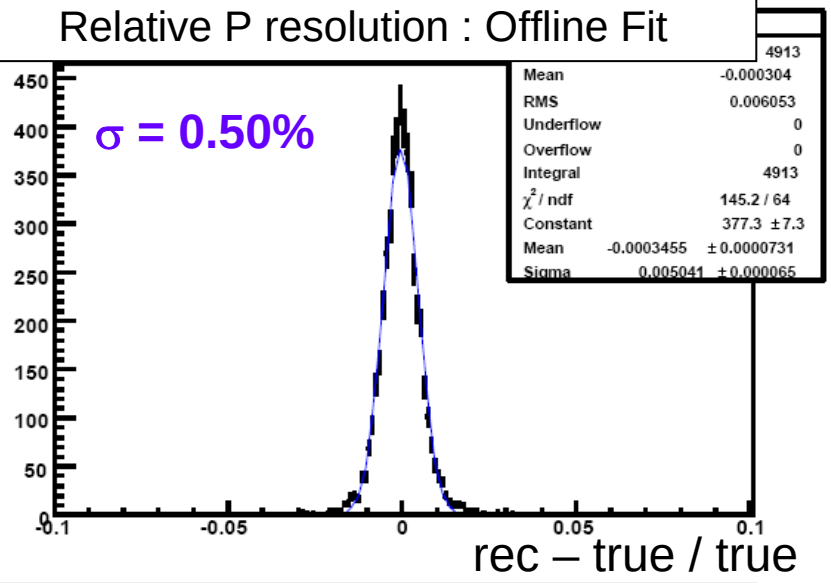


Validation of Lite Clusters: P, PT

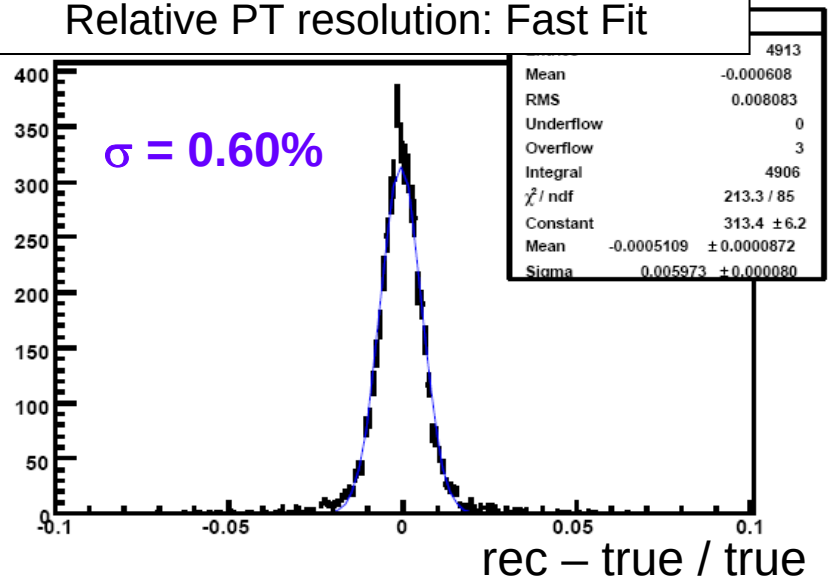
Relative P resolution: Fast Fit



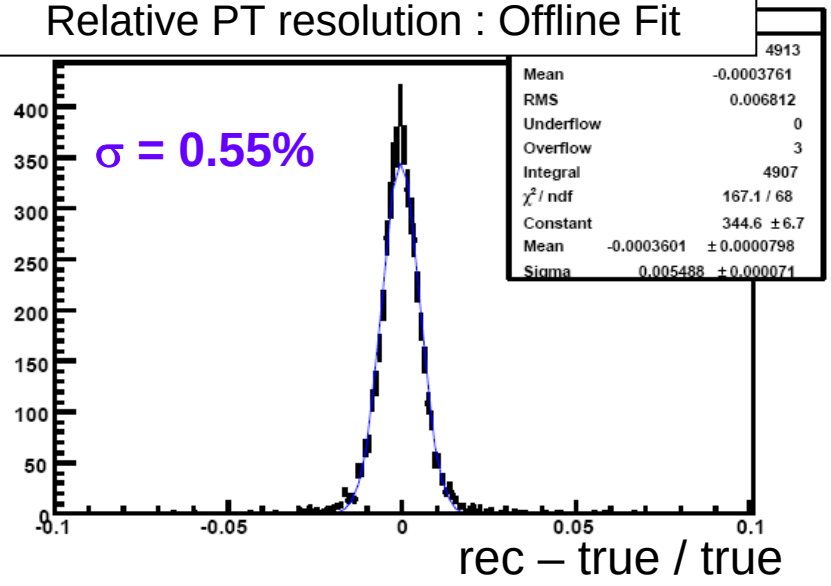
Relative P resolution : Offline Fit



Relative PT resolution: Fast Fit

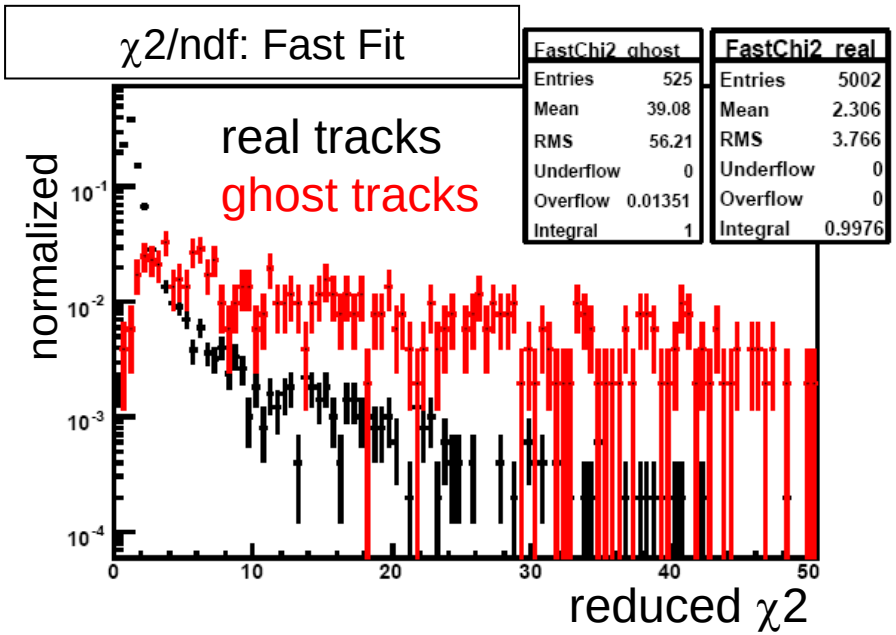


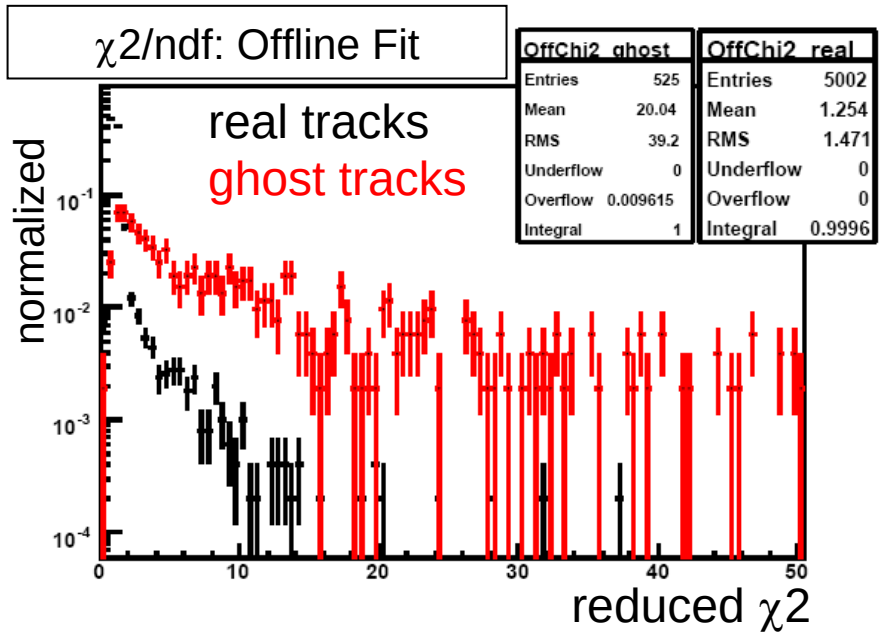
Relative PT resolution : Offline Fit



Ghost Identification

- Use track fit $\chi 2$ to separate real tracks (more than 70% of hits from same MCParticle) from ghosts

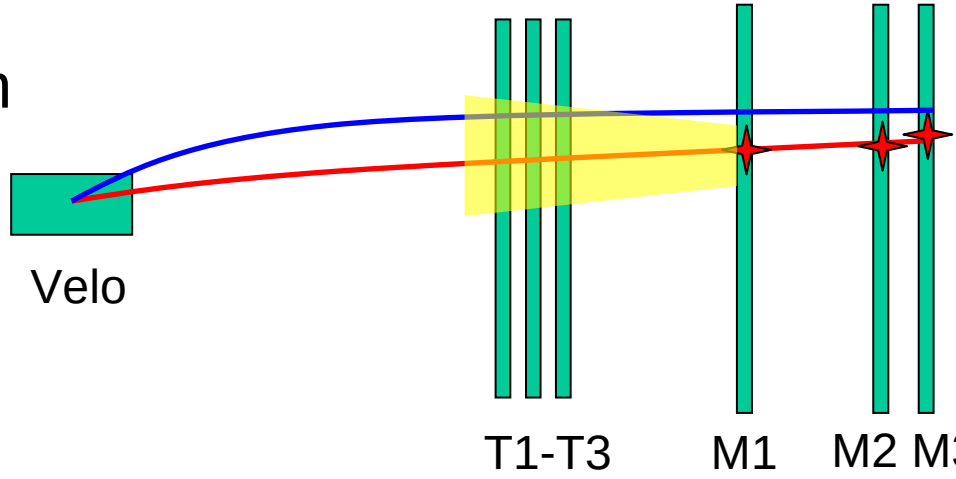




- Good separation between ghosts and real tracks
  → However, some outliers in fast fit

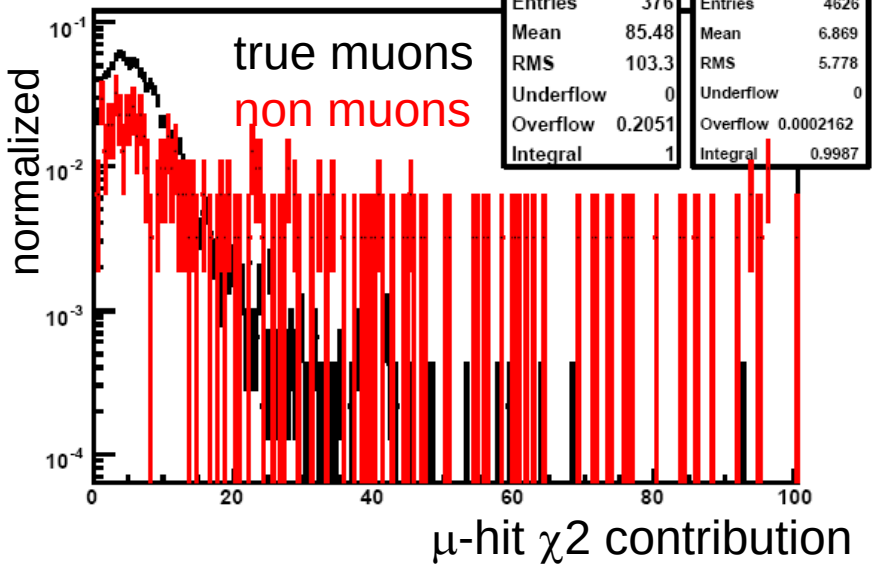
Muon Identification

- Use muon hit contribution to $\chi 2$ for muon ID
- The fit performs an excellent muon ID!



Muon hit $\chi 2$: Fast Fit

Muon hit $\chi 2$: Offline Fit



Summary

- **Velo, IT and TT Lite clusters are ready to be used in the simplified track fit**
- Tracks (in HLT1) can be fitted within ~1ms/track
- IP, p and pt resolutions hardly degraded with fast fit
  - however, $\chi 2$ distributions have bigger tails