

CKF & VXD Hit Recovery for Belle 2

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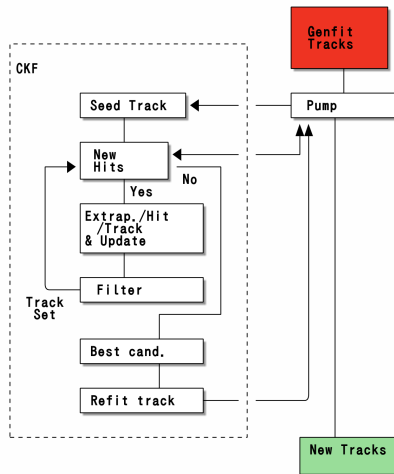
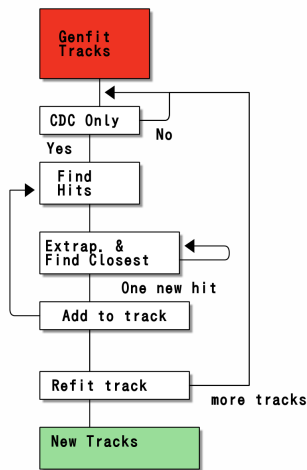
B2 Tracking Meeting
November 6, 2015

Overview

Looking to recover VXD hits in tracks reconstructed in the CDC only.

VXD Extrapolator

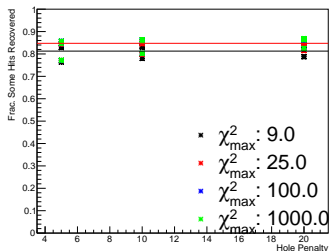
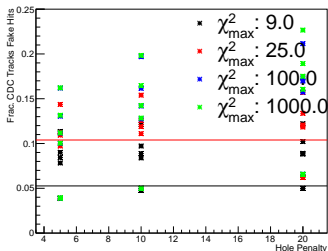
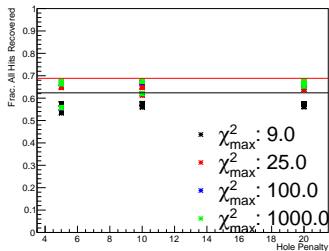
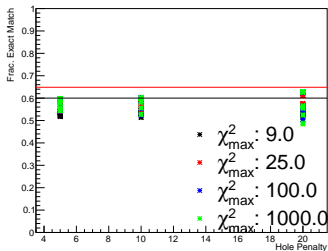
CKF



- Tracks are selected by maximizing Q
- $Q = M_{hit} * N_{hits} - N_{holes} - \frac{1}{P_{hole}} * \sum \chi_{hit}^2$
 - M_{hit} a hit multiplier
 - P_{hole} hole penalty (bad hits get downweighted cf. holes as this grows)
 - N_{holes} the number of "true" holes (layers with missing hits *between* added hits)
 - N_{hits} number of hits added to the track (the χ_{hit}^2 sum runs over *all* hits)
- Requiring
 - $\chi_{hit}^2 < \chi_{max}^2$
 - $N_{holes} < N_{holes}^{max}$
 - I propagate N_{max} tracks, by at each step taking only the N_{max} best quality tracks
- Sample is a 5000 event $B \rightarrow [K_S \pi \pi]_D K$ with background. Ran 2 weeks ago with trasan and with the MC matcher
- Look at **efficiency** to recover hits from CDC tracks with VXD hits assoc. to truth track and **fake rate**, fraction of CDC-only tracks *with no VXD hits in truth* that have VXD hits added by codes

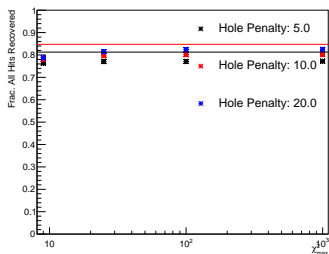
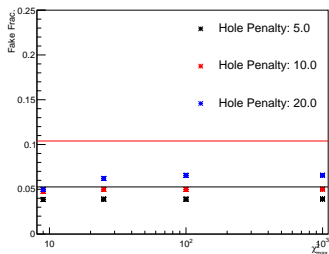
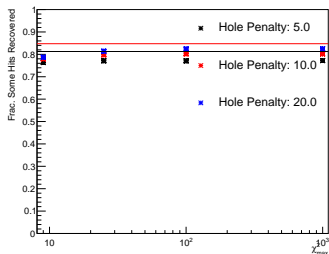
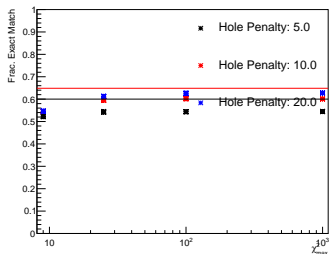
CKF Efficiency and Fake Rates

Fraction of tracks that CKF fitter (dots) / VXD extrapolator (lines) found: all and only the true hits (top-left), all the true hits (top-right), some of the hits (bottom-right), hits on tracks w/o true hits (bottom-left).



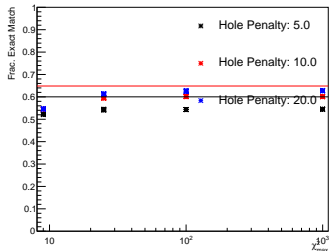
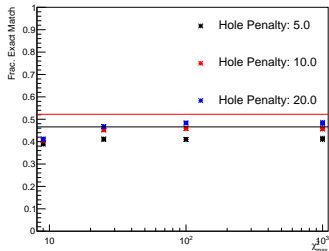
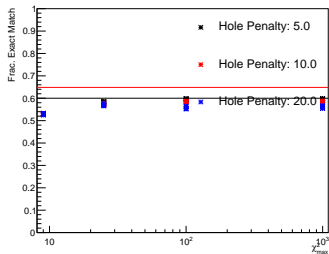
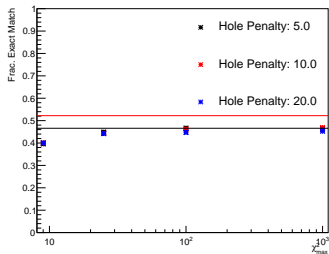
CKF, $H_{\text{mult}}=1$

Hit multiplier increases the "some hits" (top-right) efficiency, but drastically increases the fake rate (bottom-left) and decreases the "exact hits" (top-left) fraction



- \exists CKF working point that gives roughly an equivalent recovery and much lower fake rate than VXD extrapolator
- Don't have a configuration that gets as high an exact match rate as possible w/VXD
 - Though, this VXD point has a huge fake rate
 - Anyway, there may be some path that the VXD allows that is unfairly penalized by CKF
- Have only investigated with Legendre tracking as of state nearly immediately after the change over
 - Saw large eff. rate loss at that point cf. Trasan
- Haven't yet run with the data-only VXD/CDC combiner

Legendre vs Trasan (Exact)



Legendre vs Trasan (Fakes)

