

Track3DKalmanHit Improvements

Larsoft Coordination Meeting
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Overview

- Request merge feature branch `greenlee_line_surface` into `develop` prior to this week's integration release (`lardata` and `larreco`).
- In `lardata`, changes are confined to `lardata/RecoObjects` and `lardata/test/RecoObjects`.
 - Kalman filter toolkit used by `Track3DKalmanHit`.
- In `larreco` changes are in `larreco/RecoAlg` and `larreco/TrackFinder`.
 - `RecoAlg/KalmanFilterAlg.*`
 - `TrackFinder/Track3DKalmanHit_module.cc`
 - `TrackFinder/TrackKalmanCheater_module.cc`
 - `TrackFinder/trackfindermodules.fcl`

Lardata Changes

- Add support for “line surfaces” in Kalman filter toolkit.
 - Line surfaces.
 - Propagators for line surfaces.
 - Interactors for line surfaces.
 - Measurements for line surfaces.
 - Measurement containers for line surfaces.
- Existing measurement class for larsoft Hits on plane surfaces has an interface change such that such that these types of measurements are constructed from wireid's instead of channels.
 - Better for wrapped wire detectors.

Larreco Changes

- Add ability to use new “line surface infrastructure” (off by default currently).
- Make better use of PFParticle input.
 - Remove the need for external seeds when reconstructing PFParticles. Effectively convert entire PFParticle into one 3D seed.
 - This is the change that I mainly want to get released, as it improves track-finding efficiency.

New and Changed FCL Parameters

<code>physics.producers.trackkalmanhit.UsePFParticleHits:</code>	<code>true</code>
<code>physics.producers.trackkalmanhit.UsePFParticleSeeds:</code>	<code>false</code>
<code>physics.producers.trackkalmanhit.UseClusterHits:</code>	<code>false</code>
<code>physics.producers.trackkalmanhit.SelfSeed:</code>	<code>true</code>
<code>physics.producers.trackkalmanhit.LineSurface:</code>	<code>false</code>
<code>physics.producers.trackkalmanhit.InitialMomentum:</code>	<code>0.5</code>

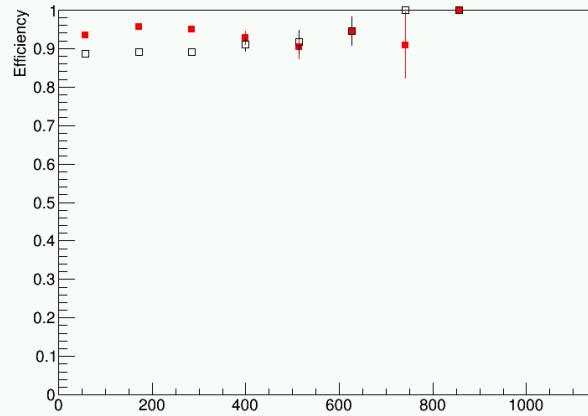
Performance

- TrackAna cuts.
 - Colinearity > 0.98
 - Impact parameter < 2 cm.
 - Reconstructed length $> 0.8 * \text{true length}$.
- Performance plots on following slides.
 - MCC 6.1 vs. head version (isotropic single muons).
 - Using pandora MCC 6.1 PFParticles.

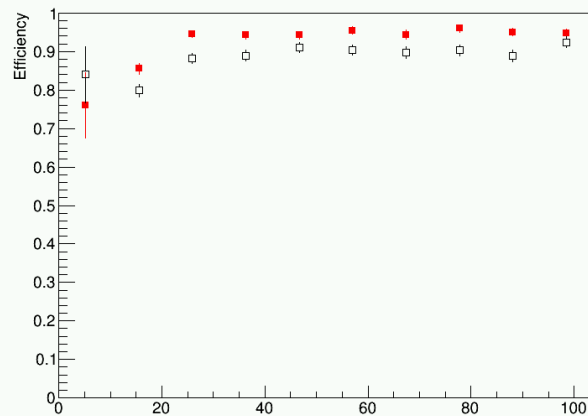
	MC Tracks	Reco Tracks	Efficiency
Branch Head	9391	8862	94.4%
MCC 6.1	9391	8351	88.9%

Performance

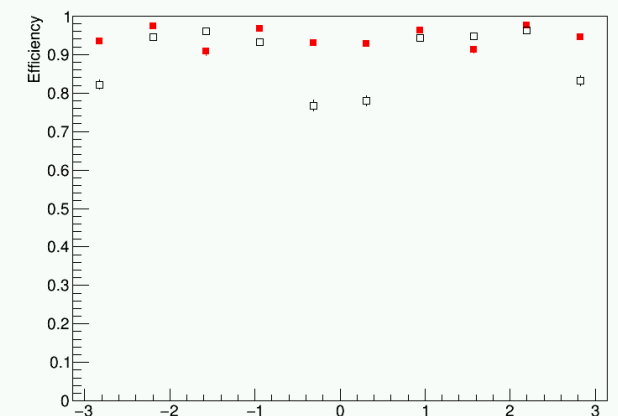
Efficiency vs. Particle Length



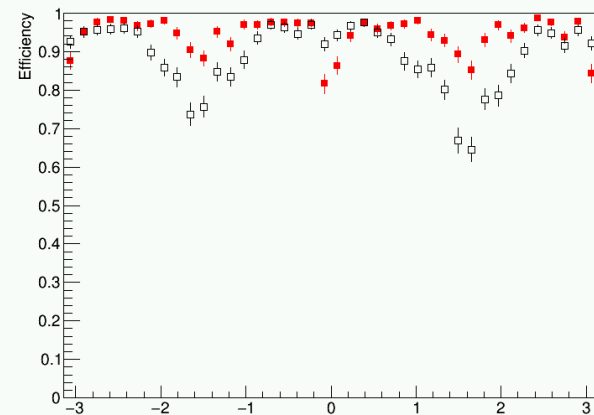
Efficiency vs. Particle Length



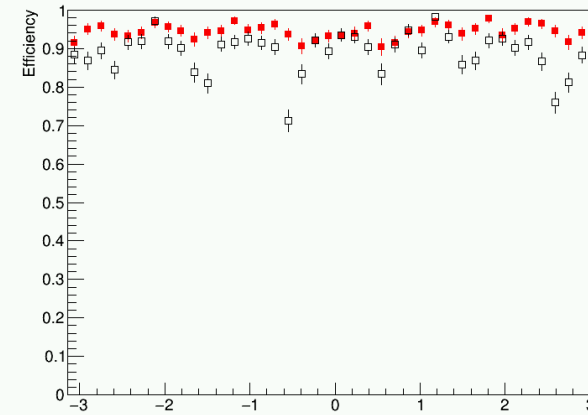
Efficiency vs. Phi



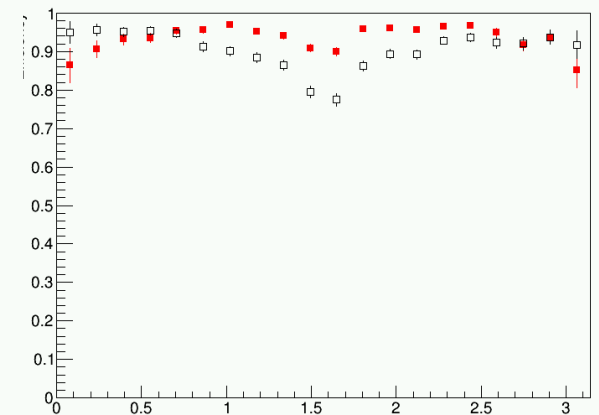
Efficiency vs. Theta_xz



Efficiency vs. Theta_yz



Efficiency vs. Theta



Summary

- Updates to Track3DKalmanHit to rely more on PFParticle pattern recognition.
 - Reduced inefficiency by almost half.
- Updates currently on feature branch greenlee_line_surface.
 - Lardata.
 - Larreco.
 - Ubooncode (fcl parameters and tests).