# Tracking Update

Simon Taylor/JLab

- Changes to track candidate code
- New parameters related to hit selection
- Changes to Kalman filter code

Recent changes to tracking code

- Patched ALT1 hit selector to remove chance that a track at 90° can be matched to FDC hits
- Paul fixed "wrong mass" bug in usage of DReferenceTrajectory
- Improved algorithms for matching CDC and FDC candidates in forward direction
  - Added routine to guess charge for matched FDC-CDC candidates that do not agree on the charge
  - Also match FDC candidates with CDC hits not associated with any track candidates
- Added flag USE_HITS_FROM_CANDIDATE to enable bypassing hit selection at the wire-based stage
- Added flag USE_HITS_FROM_WIREBASED_FIT to enable bypassing hit selection at the time-based stage

Charge from fit

- Generated 250,000 single track events, 0.1-4.1 GeV/c, 1-131°
    - Secondaries, hadronic interactions, decays, delta rays on
    - Extended target: 50-80 cm
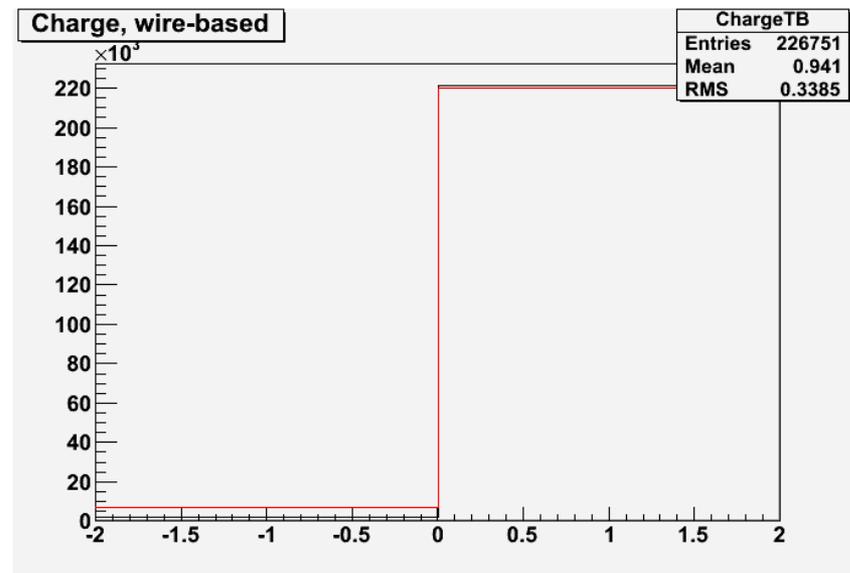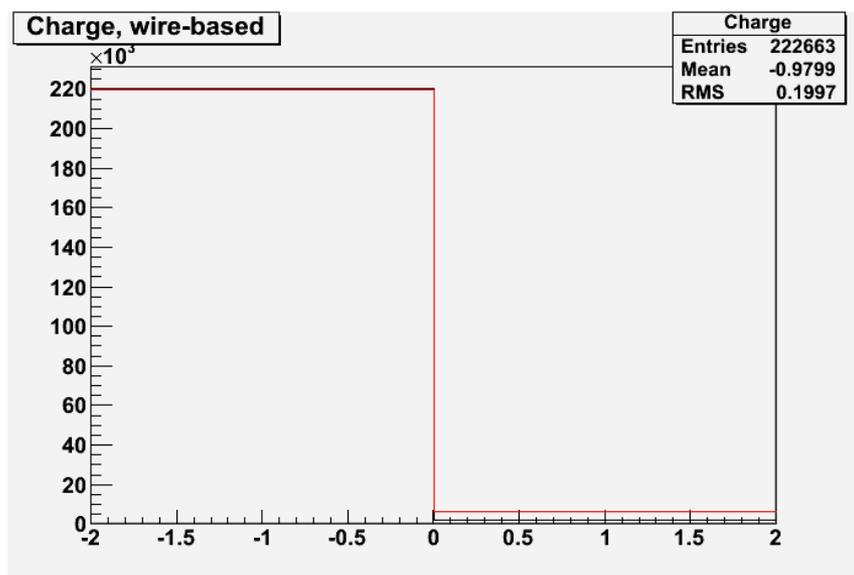
Wire-based: wrong charge ~1% of the time
Time-based: wrong charge ~3% of the time

One reconstructed track, pion mass hypothesis only

Recent changes to Kalman filter

- Limit extent of reference trajectory in CDC to 1 cm radial distance beyond the outermost hit (used to extend to inner radius of BCAL)
- Added command-line parameters to control which hits are included in the fit based on how far hit is from projected position
  - Use number of sigmas away
  - Defaults: NUM_FDC_SIGMA_CUT=20.0, NUM_CDC_SIGMA_CUT=10.0

Results for pion events:

Cuts		Overall efficiencies	
$N\sigma(FDC)$	$N\sigma(CDC)$	ε	$\varepsilon(P(\chi^2,\nu)>0.001)$
1200	1200	0.96	0.63
20	10	0.96	0.74
10	5	0.95	0.79

Note: used default (ALT1) hit selector...
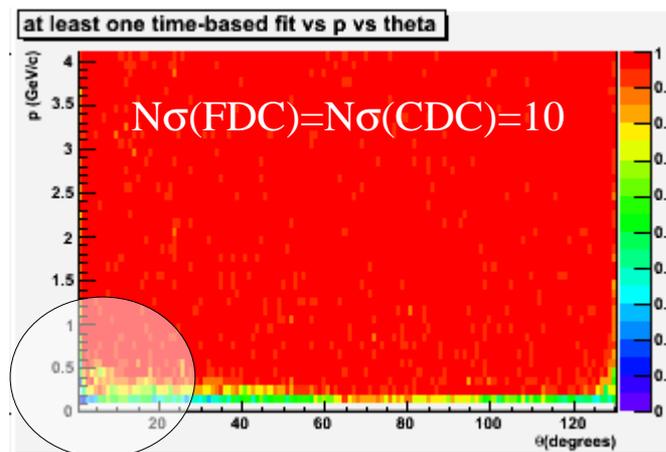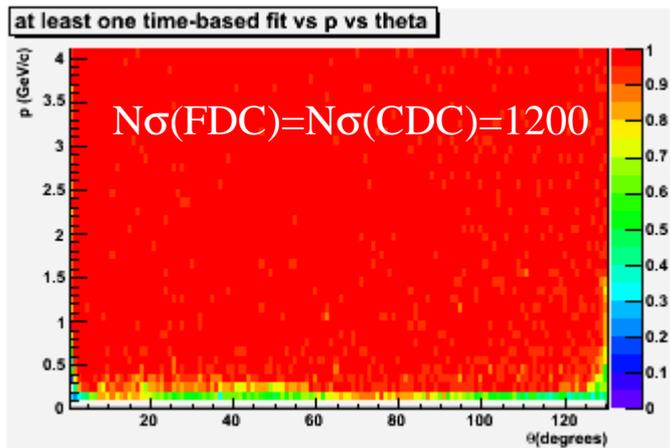
JSA

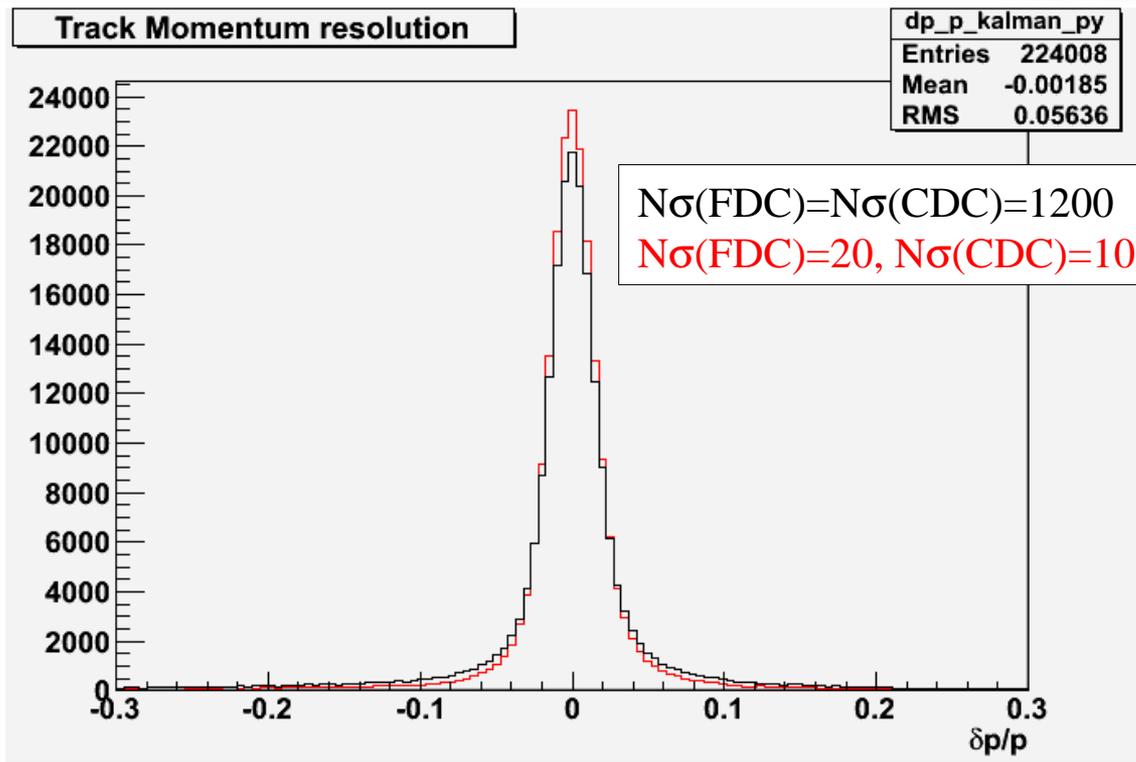Jefferson Lab

Effects of hit pruning in filter
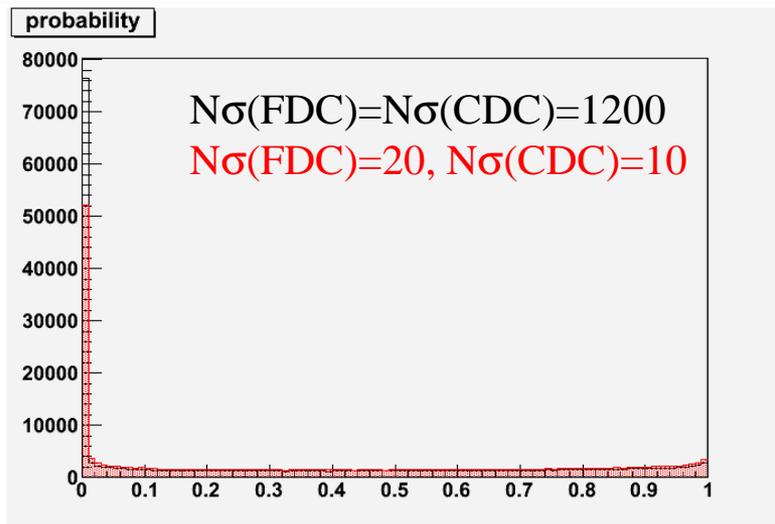
- Hit pruning can greatly reduce number of bad χ^2 fits

(results for pion events)

- ... but cutting too aggressively introduces efficiency holes

Effects of pruning hits in filter II

Track Momentum resolution

dp_p_kalman_py	
Entries	224008
Mean	-0.00185
RMS	0.05636

Nσ(FDC)=Nσ(CDC)=1200
Nσ(FDC)=20, Nσ(CDC)=10

δp/p

(for pion events)

- Pruning appears to reduce tails and improve average resolution
  - May need to optimize for efficiency

Note: used default (ALT1) hit selector...