

Negative Parity in Tracking Code

or

*Things I fixed that I didn't know were
broken (and didn't want to know)*

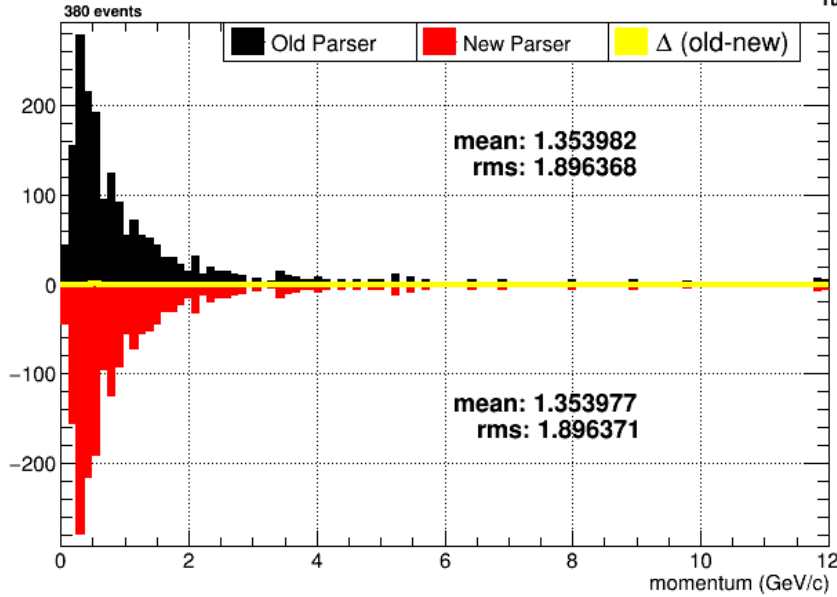
David Lawrence - JLab

May 25, 2016

Reconstructed parameters for old and new parsers

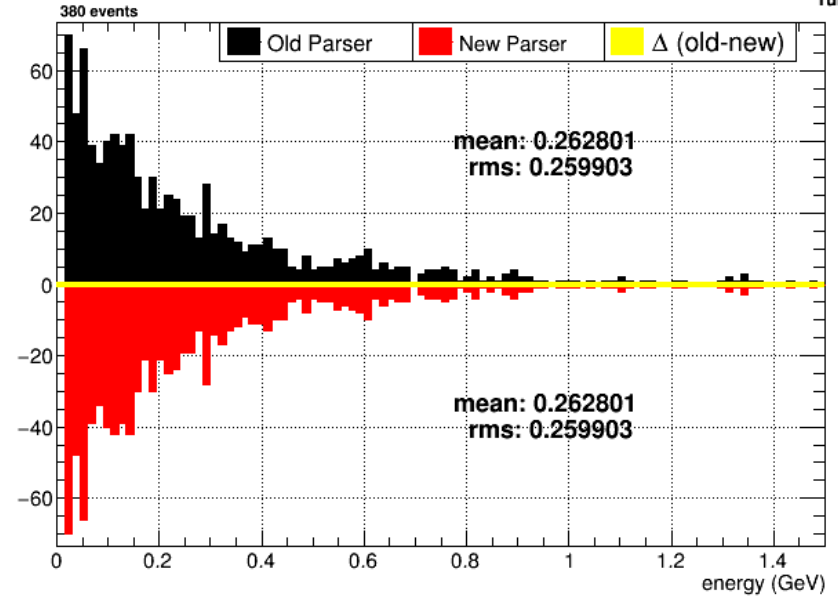
Momentum of Time-based tracks

May 8, 2016 DL
git revision 8347b7
run 11667



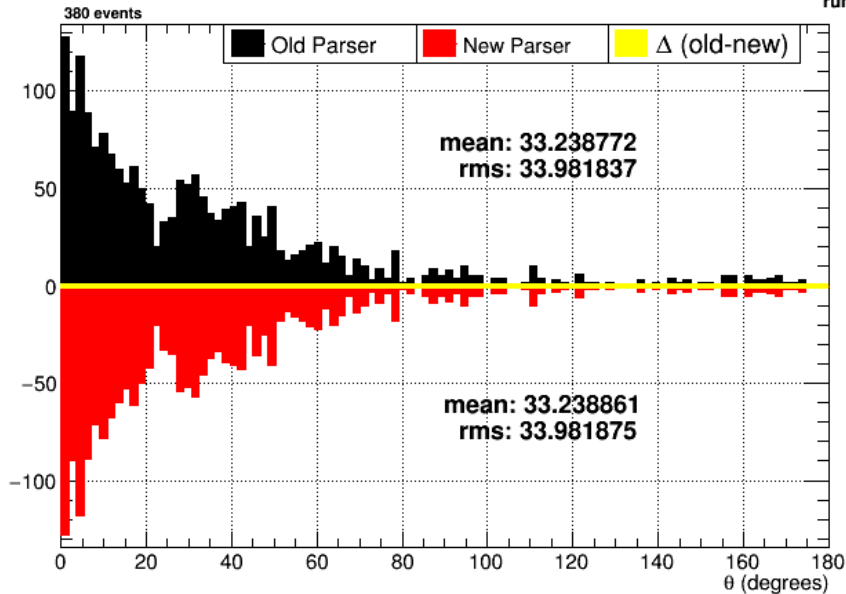
Reconstructed BCAL Showers

May 8, 2016 DL
git revision 8347b7
run 11667



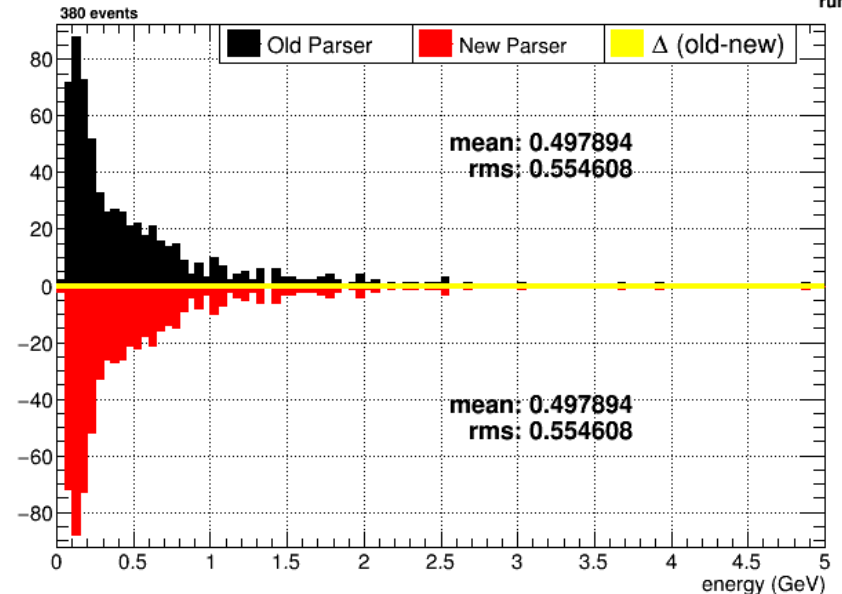
θ angle of Time-based tracks

May 8, 2016 DL
git revision 8347b7
run 11667



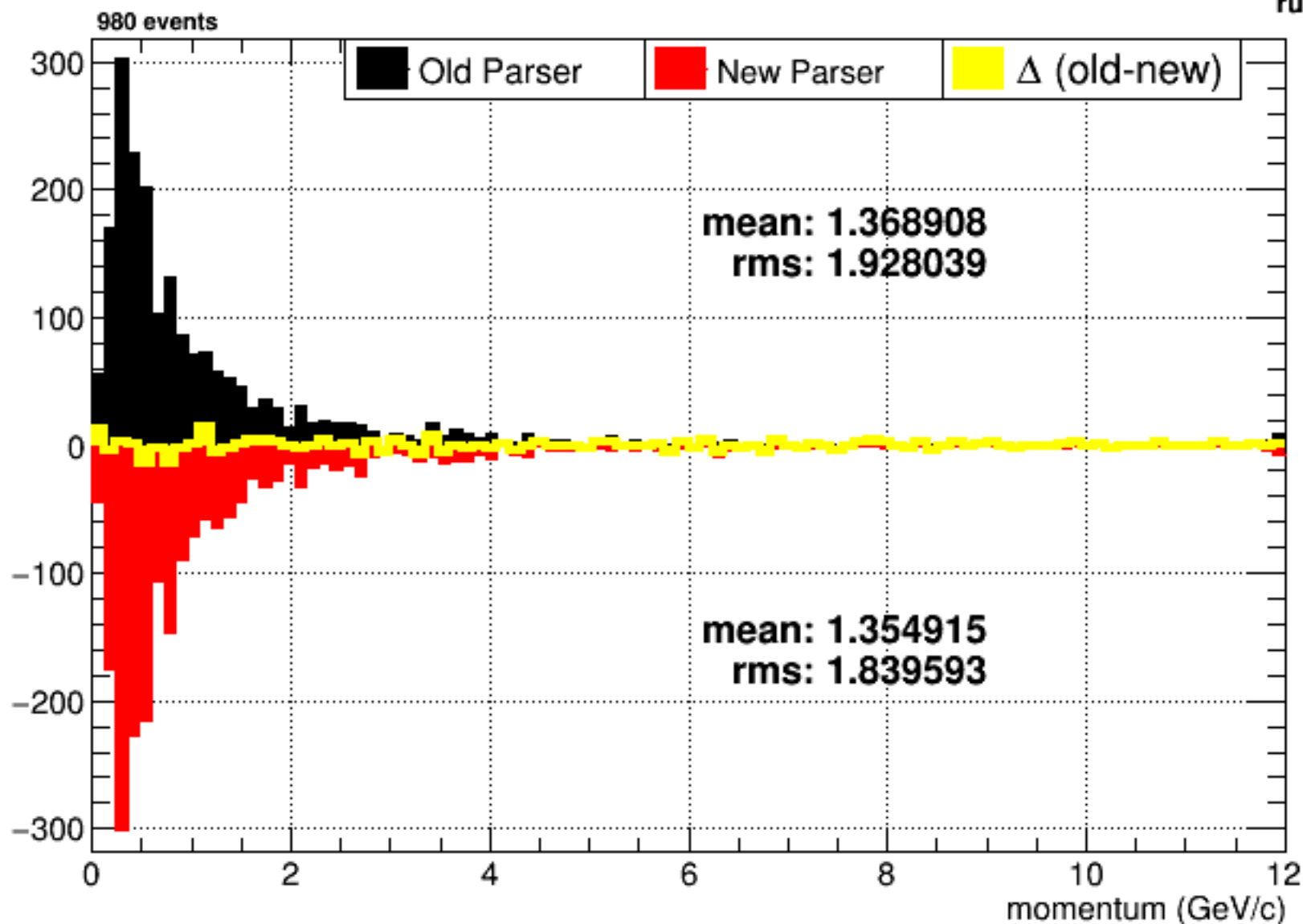
Reconstructed FCAL Showers

May 8, 2016 DL
git revision 8347b7
run 11667



Momentum of Time-based tracks

May 24, 2016 DL
git revision #1d6d050
run 11667



sim-recon hit objects have negative parity?

(How can the order of hit objects affect the tracking results?)

DTrackHitSelectorALT2.cc

Assume hits are ordered from innermost to outermost ring

```
191 // Loop over hits
192 bool outermost_hit=true;
193 vector<const DCDCTrackHit*>::const_reverse_iterator iter;
194 for(iter=cdchits_in_sorted.rbegin(); iter!=cdchits_in_sorted.rend(); iter++){
195     const DCDCTrackHit *hit = *iter;

235     if (outermost_hit){
236         // Fractional variance in the curvature k due to resolution and multiple scattering
237         double s_sq=s*s;
238         double var_k_over_k_sq_res=var*p_over_a*p_over_a*0.0720/double(N+4)/(s_sq*s_sq*sinl2)/cosl2;
239         double var_k_over_k_sq_ms=var_pt_factor*var_pt_factor*last_step->invX0/s;
240         // Fractional variance in pt
241         var_pt_over_pt_sq=var_k_over_k_sq_ms+var_k_over_k_sq_res;
242
243         // Variance in dip angle due to measurement error
244         var_lambda_res=12.0*var*double(N-1)/double(N*(N+1))*cosl2*cosl2/s_sq;
245
246         outermost_hit=false;
247     }
```

variances are used to determine which hits are selected to be on the track

** Order of objects determines which hits are selected for track*

sim-recon hit objects have negative parity?

(How can the order of hit objects affect the tracking results?)

DFDCPseudo_factory.cc:makePseudo()

387

388

389

```
if (old_wire_num==(xIt)->element) continue;  
old_wire_num=(xIt)->element;
```

*If multiple hits on one FDC
wire, only first in list is used.
Subsequent ones are discarded*

** Order of objects determines which hit on FDC wire is used*

DFDCCathodeCluster

The screenshot displays two side-by-side windows from a software application, comparing data from two different parser versions. The left window, titled "DFDCCathodeClusterNew.txt", shows a list of data points with columns for event ID (328), count (0-57), a primary value (144869405), and several other numerical values. The right window, titled "DFDCCathodeClusterOld.txt", shows the same data points but in a different order. A vertical double-headed arrow is positioned between the two windows, highlighting the differences in the sequence of data points. The interface includes a menu bar (File, Edit, View, Help) and a toolbar with icons for New, Save, Undo, Redo, Down, Up, and Stop. The status bar at the bottom right indicates "INS : Ln 20, Col 1".

Old Parser Ordering

New Parser Ordering

DFDCCathodeCluster

DFDCCathodeClusterNew.txt : DFDCCathodeClusterOld.txt - Meld (on gluon49.jlab.org)

Row	Col 1	Col 2	Col 3	Col 4
19	2 *	1 *	3 *	179.60000 *
20	2 *	1 *	3 *	40.799999 *
21	5 *	1 *	3 *	349.79998 *

Total charge of cluster differs!

Old Parser Ordering

New Parser Ordering

DFDCCathodeCluster

Format: *strip/q*

Old Parser Ordering

```
gPlane=3 q_tot=216.2 105/216.2, 106/133.8,  
gPlane=3 q_tot=40.8 104/40.8, 105/120,  
gPlane=3 q_tot=349.8 100/42.2, 101/138.4, 102/114.8, 103/54.4, 104/179.6,  
gPlane=3 q_tot=1143.2 78/55, 79/257, 80/241.2, 81/134.4, 82/305.6, 83/150, 84/27,  
gPlane=4 q_tot=810.6 117/10.4, 118/116.8, 119/422.2, 120/201.4, 121/50.8, 122/11.4
```

New Parser Ordering

```
gPlane=3 q_tot=216.2 105/216.2, 106/133.8,  
←gPlane=3 q_tot=179.6 104/179.6, 105/120,  
gPlane=3 q_tot=349.8 100/42.2, 101/138.4, 102/114.8, 103/54.4, 104/40.8,  
gPlane=3 q_tot=1143.2 78/55, 79/257, 80/241.2, 81/134.4, 82/305.6, 83/150, 84/27,  
gPlane=4 q_tot=810.6 117/10.4, 118/116.8, 119/422.2, 120/201.4, 121/50.8, 122/11.4
```

- Strip number 104 has 2 hits with different charges
- Code splits cluster into 2 when strip number does not increment
- Order of two hits changes total charge of each resulting cluster

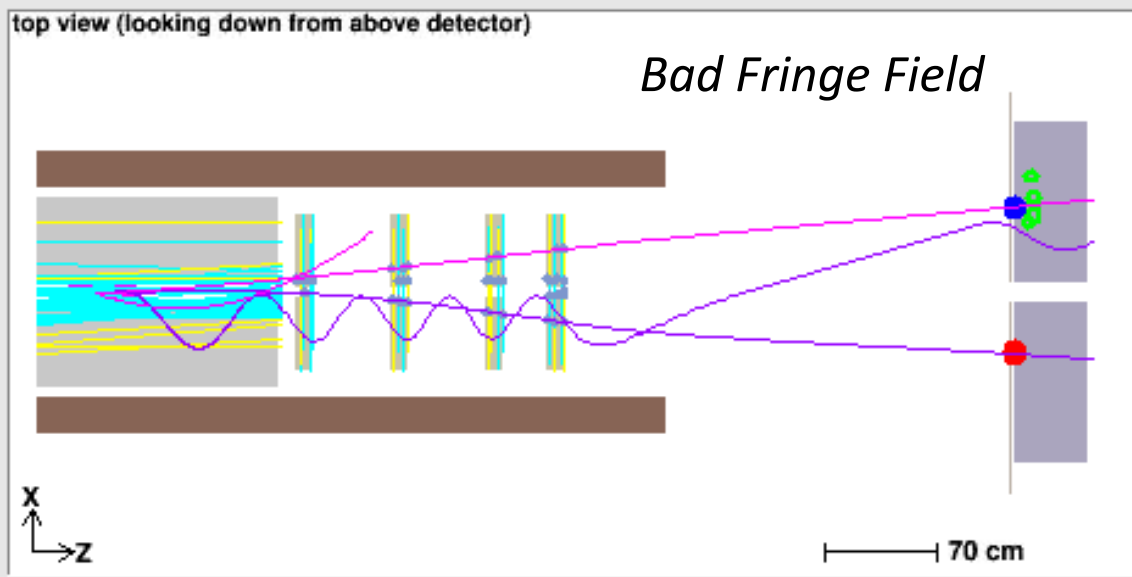
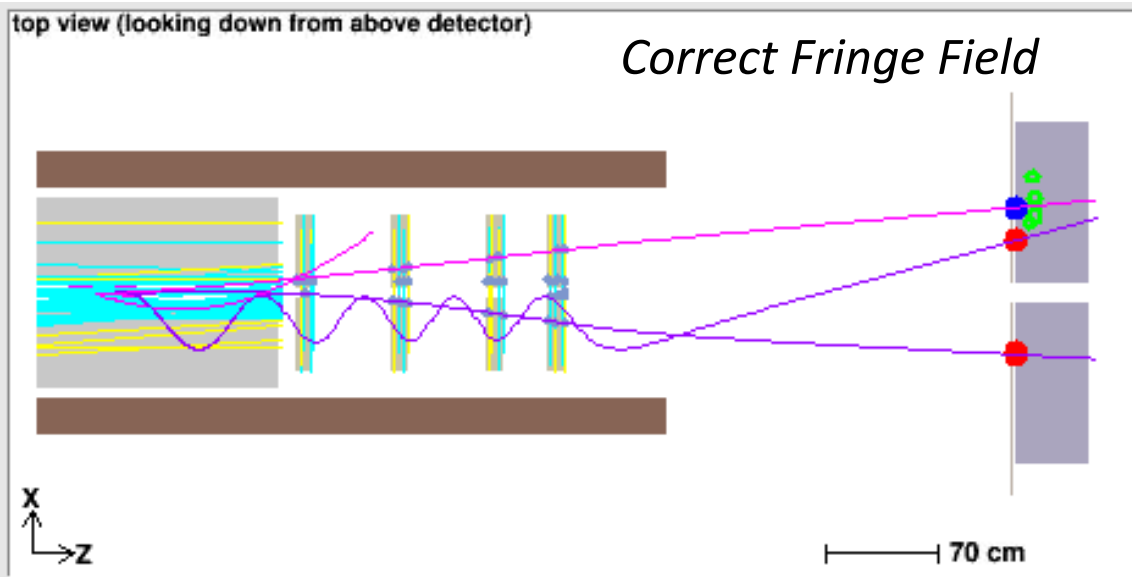
Off to the races!

- Initially thought this was due to object order, but turned out to be a race condition
- Each TBT forms a list of potential start times by matching to other detectors
- Start time with smallest uncertainty is used
- For this event, the Start Counter hit was sometimes matched and sometimes not
- Matching changed even when using old parser repeatedly (i.e. sometimes it was matched, and sometimes it was not)

```
cdchits.size()=11
fdchits.size()=0
cdchits[0] ring=2 straw=10 tdrift=401.291 dist=0.567962
cdchits[1] ring=3 straw=14 tdrift=520.491 dist=0.641531
cdchits[2] ring=11 straw=28 tdrift=133.291 dist=0.336235
cdchits[3] ring=8 straw=27 tdrift=414.891 dist=0.576917
cdchits[4] ring=4 straw=13 tdrift=183.691 dist=0.392132
cdchits[5] ring=1 straw=11 tdrift=190.891 dist=0.399418
cdchits[6] ring=6 straw=26 tdrift=-17.909 dist=-1.64768
cdchits[7] ring=1 straw=10 tdrift=345.291 dist=0.529179
cdchits[8] ring=8 straw=31 tdrift=500.491 dist=0.629911
cdchits[9] ring=10 straw=24 tdrift=3.691 dist=0.0577623
cdchits[10] ring=7 straw=30 tdrift=29.291 dist=0.161012
TBT vertex: x=0.103686 y=0.0422123 z=62.6352
TBT start_time[0] t0=-15.0081 t0_sigma=0.3 system=ST
TBT start_time[1] t0=-25.8997 t0_sigma=5 system=CDC
263.0 events processed (273.0 events read) 6.0Hz (avg.: 5.4Hz)
```

- Effect only seen when using multiple threads

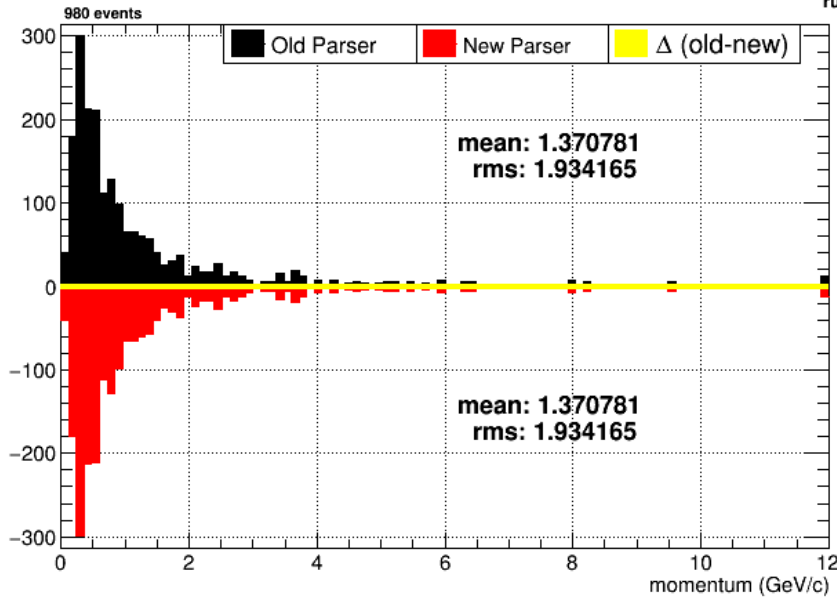
(Not) Matching track to Start Counter Hit



- Start Counter matching begins with finding intersection of WBT trajectory with plane
- Search for closest intersection step starts from end of trajectory closest to plane
- Some trajectories cross plane multiple times so a different intersection is found if searching from beginning or end
- Start counter is only matched when search started from front of trajectory
- *GetField* method returns early if $z > 600$, leaving values for B-field uninitialized

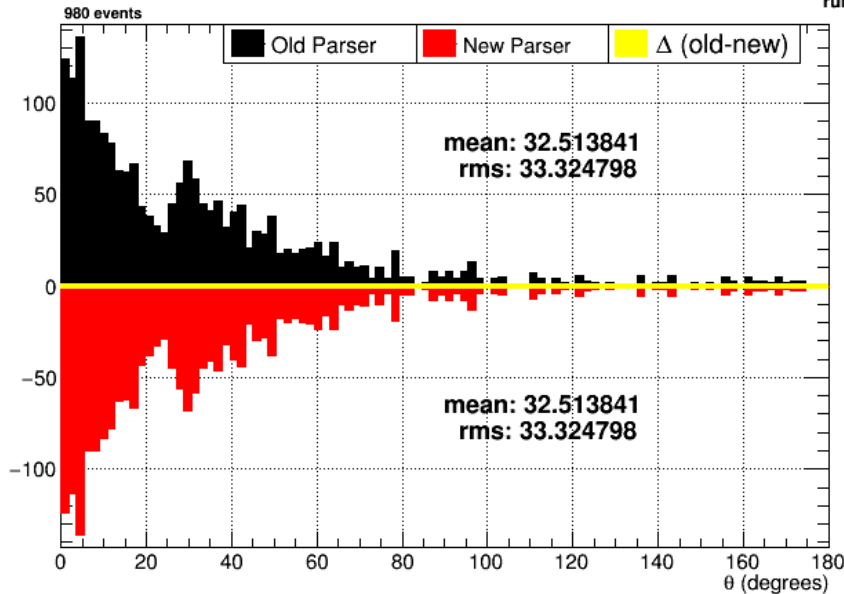
Momentum of Time-based tracks

May 25, 2016 DL
git revision #023c0f6
run 11667



θ angle of Time-based tracks

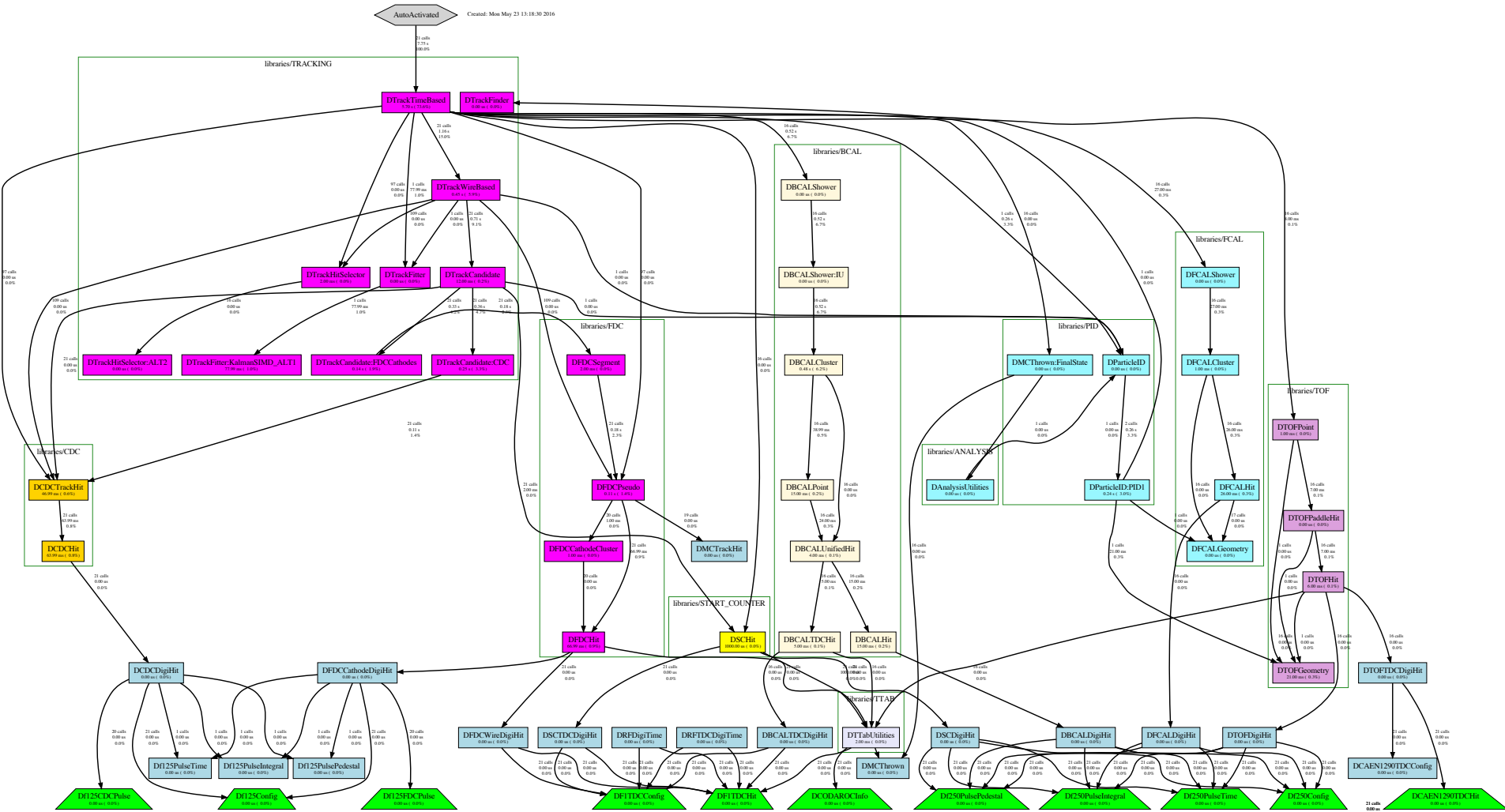
May 25, 2016 DL
git revision #023c0f6
run 11667



Fixed:

- ✓ Outermost hit in Hit selector used for variance
- ✓ Drop second FDC wire hit
- ✓ Allow multiple hits from same strip in cathode cluster
- ✓ Add last strip to q_{tot} in cathode cluster
- ✓ Default to zero field when outside of map

janadot



ianadot

Created: Mon May 23 13

AutoActivated

libraries/TRACKING

21 calls
7.75 s
100.0%

DTrackTimeBased
5.70 s (73.6%)

DTrackFinder
0.00 us (0.0%)

21 calls
1.16 s
15.0%

97 calls
0.00 us
0.0%

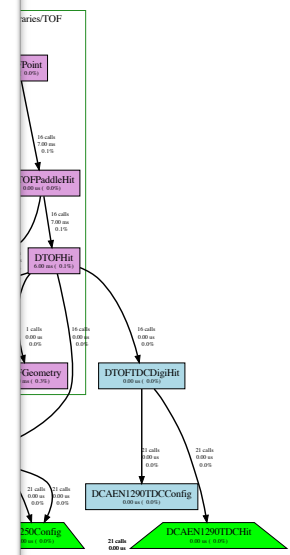
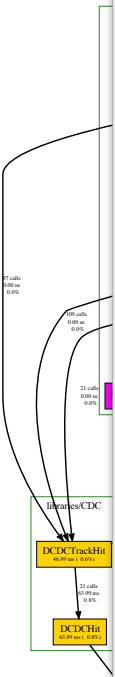
1 calls
77.99 ms
1.0%

DTrackWireBased
0.45 s (5.9%)

109 calls
0.00 us
0.0%

1 calls
0.00 us
0.0%

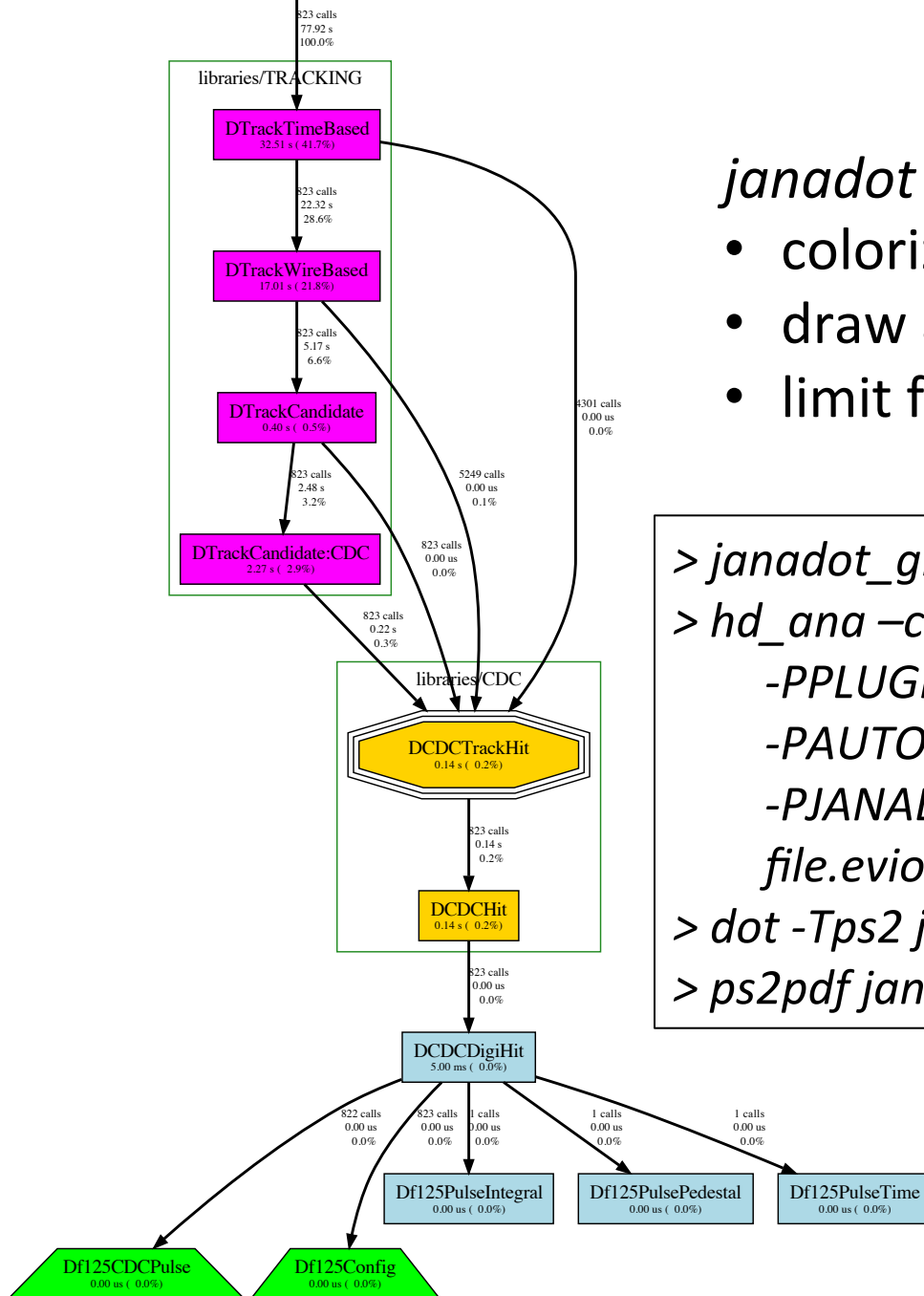
21 calls
0.71 s
9.1%



janadot

janadot can ...

- colorize classes based on library
- draw a border and label
- limit focus to specific factory



```
> janadot_groups.py $HALLD_HOME/src/libraries
> hd_ana -config=janadot_groups.conf \
        -PPLUGINS=janadot \
        -PAUTOACTIVATE=DTrackTimeBased \
        -PJANADOT:FOCUS=DCDCTrackHit \
        file.evio
> dot -Tps2 jana.dot -o jana.ps
> ps2pdf jana.ps
```