Cluster Amplitude

Instructions on how to make cluster amplitude plots and hit time plots.

For a data file, run the following command on an EVIO calibration file. You can configure the following cleanup cuts in the steering file (default is on) - <trackQualityCut> requires tracks to have a Chi2 better than <maxChi2> (default is 10) and 6-hit tracks; <feeCut> requires electrons of momentum between ebeam*<minFee> (default is 0.85) and ebeam*<maxFee> (default is 1.15).

```
java -jar <jar file> hps-java/steering-files/src/main/resources/org/hps/steering/analysis/SvtClusterPlots.lcsim
-i <input recon file> -DoutputFile=<output file>
```

These commands will output a root file with both cluster charge (amplitude) and signal to noise for single hit clusters, multiple hit clusters, and hits on tracks that pass the desired quality cuts. There are also cluster hit times, single hit clusters on track hit times (used in the analysis), and several other plots.

In order to analyze, you need to clone the HPS-CODE repository.

```
git clone https://github.com/JeffersonLab/HPS-CODE
```

Run the following command on the output of the previous java command to produce plots.

Use the -m option to fit the multiple hit cluster plots (default is hits on track plots). Use the -c option to fit cluster amplitude and signal to noise plots with a landau convoluted with a Gaussian (default is just a landau).

```
python HPS-CODE/ANALYSIS/SVT/MakeClusterPlots.py <output file base name> <input root file>
```

Warning: If you try to fit using the landau-Gaussian convolution (which is the correct way), you may have to manually adjust fitting ranges in the code or the fitting may get stuck.

Output:

`<output file base name>_sigtonoise.pdf - fitted signal to noise at each sensor and the most probable value at each sensor`

`<output file base name>_clusteramplitude.pdf - fitted cluster amplitude at each sensor and the most probable value at each sensor`

`<output file base name>_hittime.pdf - fitted hit times (for single hit clusters on track) at each sensor and the fitted sigma of the hit time at each sensor`

`<output file base name>.root - same plots as the three pdf files above but as root histograms`

`Order of "Sensor Number" is as follows (starting at 0):`

0. module_L1b_halfmodule_axial_sensor0
1. module_L1b_halfmodule_stereo_sensor0
2. module_L1t_halfmodule_axial_sensor0
3. module_L1t_halfmodule_stereo_sensor0
4. module_L2b_halfmodule_axial_sensor0
5. module_L2b_halfmodule_stereo_sensor0
6. module_L2t_halfmodule_axial_sensor0
7. module_L2t_halfmodule_stereo_sensor0
8. module_L3b_halfmodule_axial_sensor0
9. module_L3b_halfmodule_stereo_sensor0
10. module_L3t_halfmodule_axial_sensor0
11. module_L3t_halfmodule_stereo_sensor0
12. module_L4b_halfmodule_axial_hole_sensor0
13. module_L4b_halfmodule_axial_slot_sensor0
14. module_L4b_halfmodule_stereo_hole_sensor0

15. module_L4b_halfmodule_stereo_slot_sensor0
16. module_L4t_halfmodule_axial_hole_sensor0
17. module_L4t_halfmodule_axial_slot_sensor0
18. module_L4t_halfmodule_stereo_hole_sensor0
19. module_L4t_halfmodule_stereo_slot_sensor0
20. module_L5b_halfmodule_axial_hole_sensor0
21. module_L5b_halfmodule_axial_slot_sensor0
22. module_L5b_halfmodule_stereo_hole_sensor0
23. module_L5b_halfmodule_stereo_slot_sensor0
24. module_L5t_halfmodule_axial_hole_sensor0
25. module_L5t_halfmodule_axial_slot_sensor0
26. module_L5t_halfmodule_stereo_hole_sensor0
27. module_L5t_halfmodule_stereo_slot_sensor0
28. module_L6b_halfmodule_axial_hole_sensor0
29. module_L6b_halfmodule_axial_slot_sensor0
30. module_L6b_halfmodule_stereo_hole_sensor0
31. module_L6b_halfmodule_stereo_slot_sensor0
32. module_L6t_halfmodule_axial_hole_sensor0
33. module_L6t_halfmodule_axial_slot_sensor0
34. module_L6t_halfmodule_stereo_hole_sensor0
35. module_L6t_halfmodule_stereo_slot_sensor0

For SVT NIM Paper

Files:

Cuts: For hits on track - 6-hit tracks, trackChi2 < 10, 0.85*ebeam < trackP < 1.15*ebeam, and trackOmega > 0

Cluster Amplitude 5772

Signal to Noise 5772

Hit Times 5772

Root File 5772