LArSoft Meeting

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Reminder of what we've shown before

- GausHitFinder reconstructs >99% of the same hits as FFTHitFinder
- GausHitFinder agrees with FFTHitFinder on the hit parameters (Start Position, Peak Position, Hit Width, “Charge” etc...)
- GausHitFinder correctly reports back a χ^2 / NDF for the Gaussian fit of the hit pulse that was found to be broken in the FFTHitFinder
- GausHitFinder identifies the hit multiplicity (number of peaks in a single hit) and reports back this number ***(previously hard coded to = 1 in FFTHitFinder)***

See backup slides for more details

What's new?

- Update on the time performance difference between GausHitFinder and FFTHitFinder.
- Comparison study with “MC Truth” using HitCheater
- Tunable χ^2 / NDF cut added to the GausHitFinder .fcl file

Results of the GausHitFinder Algorithm

Single Particle μ [2.0 GeV] and Genie Events

What is the time performance of the two algorithms?

FFTHitFinder
(Running over 10 single muon events)

Avg. Time
~ 14 seconds per event

GausHitFinder
(Running over 10 single muon events)

Avg. Time
~ 14 seconds per event

FFTHitFinder
(Running over 10 Genie events)

Avg. Time
~ 13 seconds per event

GausHitFinder
(Running over 10 Genie events)

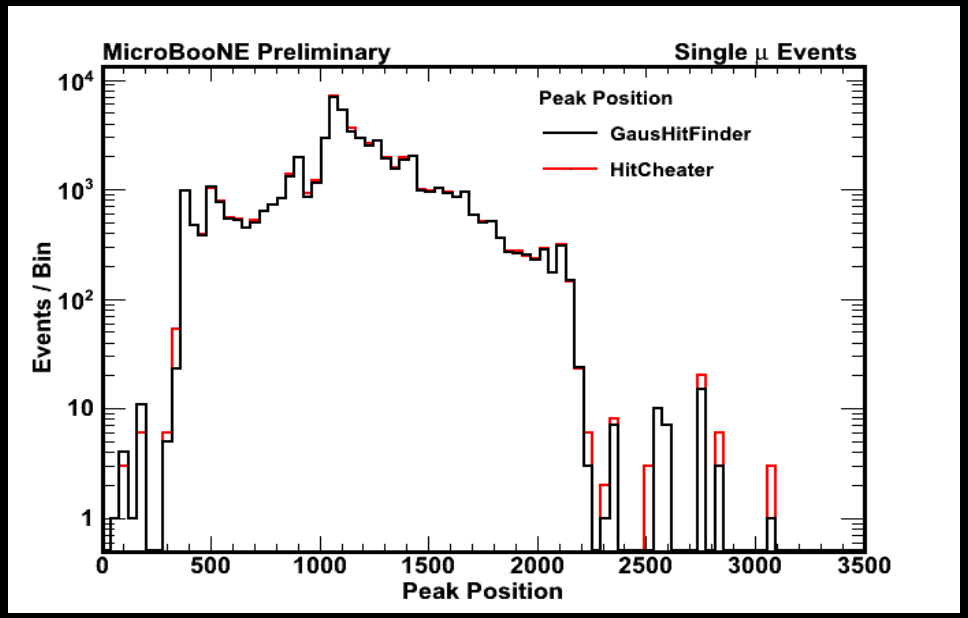
Avg. Time
~ 13 seconds per event

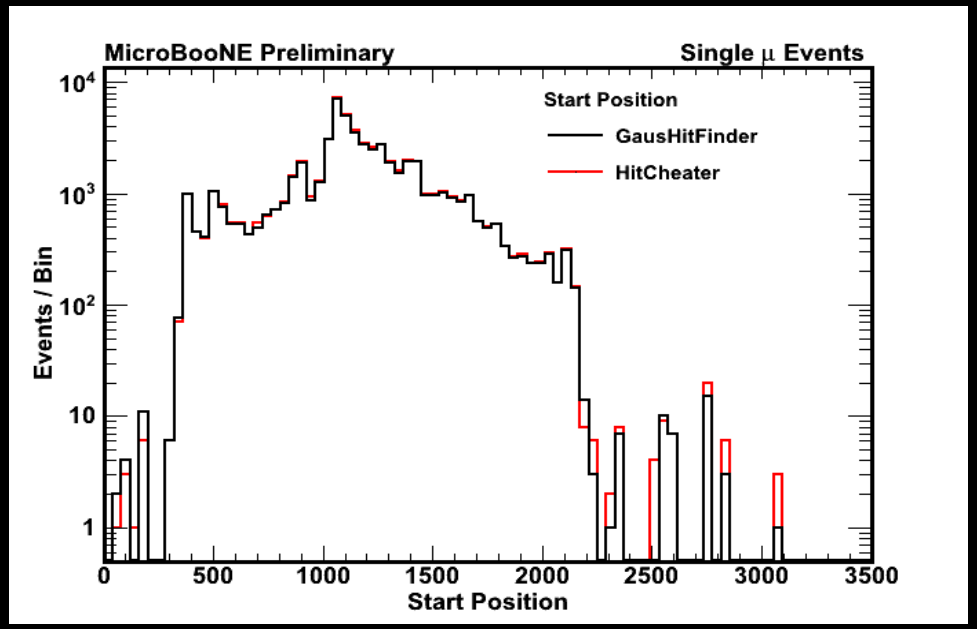
No Time Performance Difference!

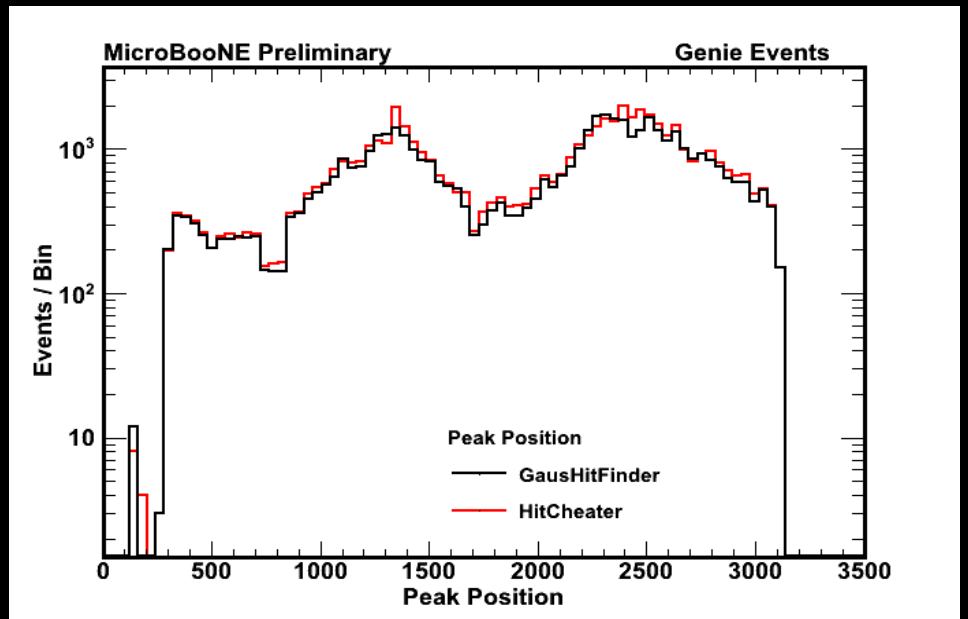
Previous performance difference came from ROOT fitting options (now using a more time efficient choice)

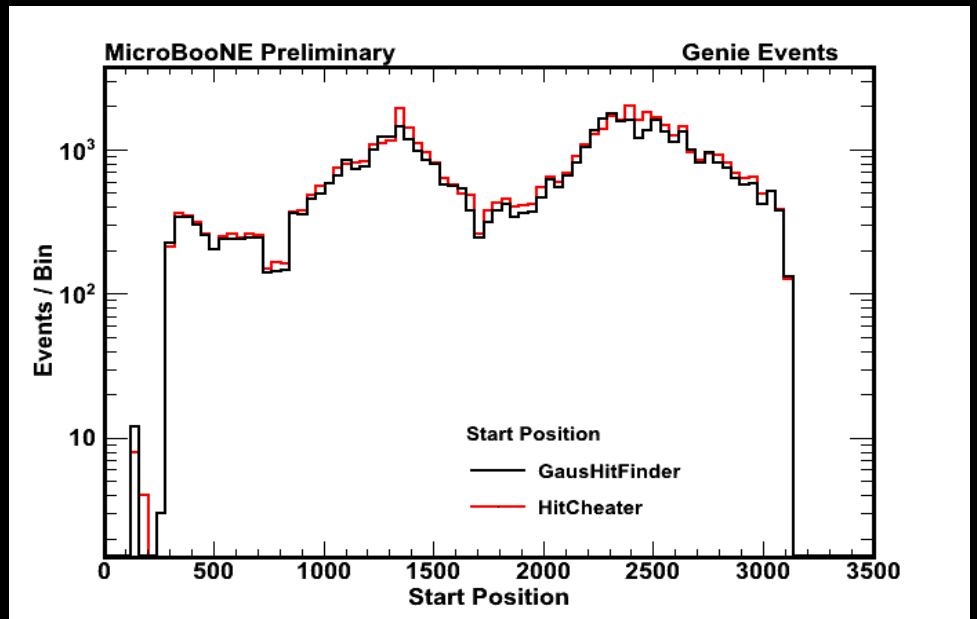
GausHitFinder vs HitCheater

Single Particle μ [2.0 GeV] and Genie Events









GausHitFinder vs HitCheater

Single Particle μ [2.0 GeV] and Genie Events

Single Particle μ [2.0 GeV]

HitCheater
(Running over 10 single muon events)

Number of Hits Found = 58,047

GausHitFinder
(Running over 10 single muon events)

Number of Hits Found = 56,891

"Efficiency" = 98%
(Not sure how far I would trust the HitCheater to represent TRUTH information)

Genie Events

HitCheater
(Running over 10 Genie events)

Number of Hits Found = 53,195

GausHitFinder
(Running over 10 Genie events)

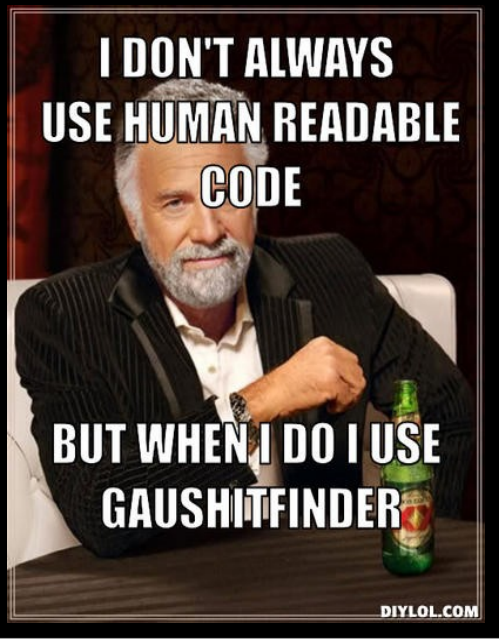
Number of Hits Found = 49,339

"Efficiency" = 93%
(Not sure how far I would trust the HitCheater to represent TRUTH information)

N.B. My statement about HitCheater representing TRUTH is a statement about how we define a truth level hit and not a statement about the performance of HitCheater

Conclusions

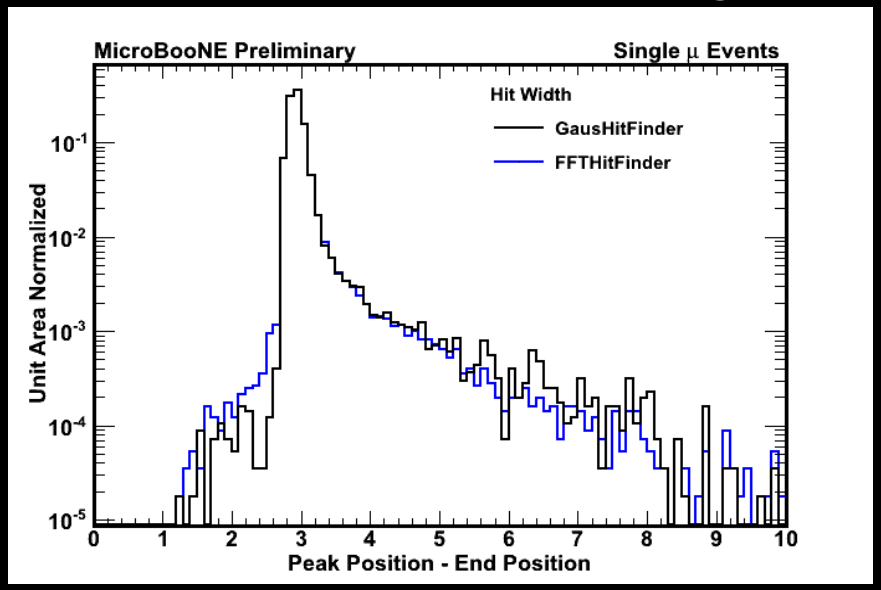
- Checked in “new” hit finder algorithm (GausHitFinder)
- Shown GausHitFinder > 93 % efficient compared to MC truth and finds 99% of the same hits as FFTHitFinder
- Code is made more readable for user
- Reports back χ^2/NDF that can be used to reject poorly fit hits
  - This parameter is stored in the hit and will have a cut that is tunable in the .fcl file
- This algorithm is ready to be used as the default HitFinder in LarSoft (Remember to change your HitModuleLabel to “gaushit”)

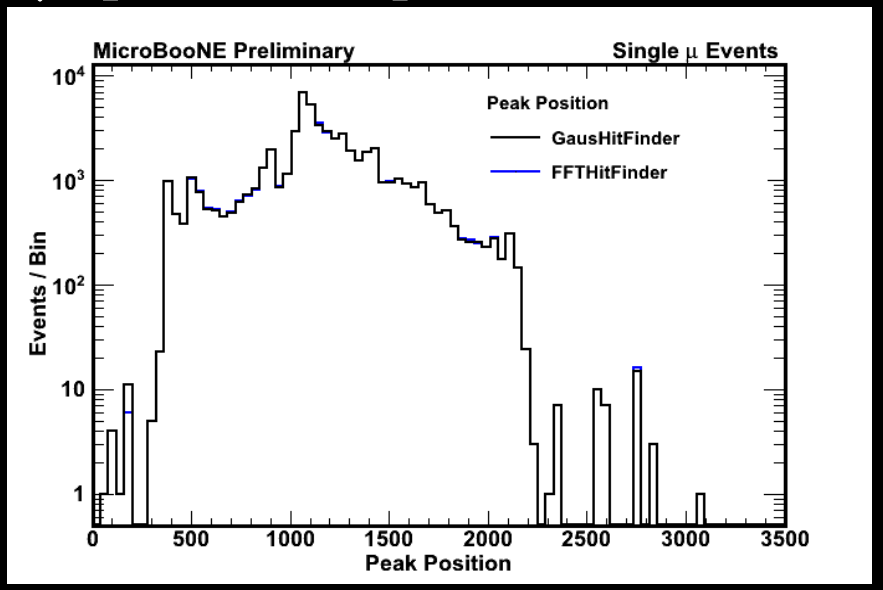


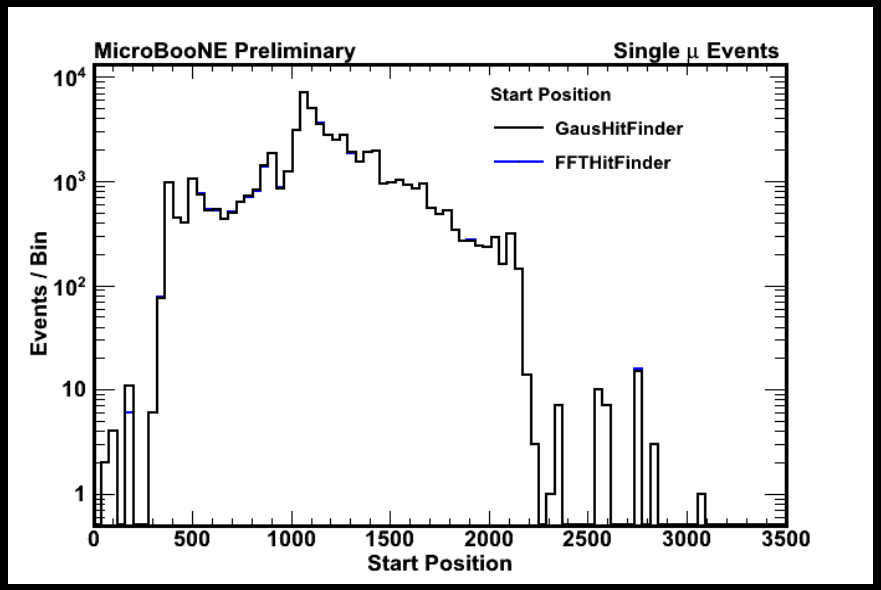
Back-up Slides

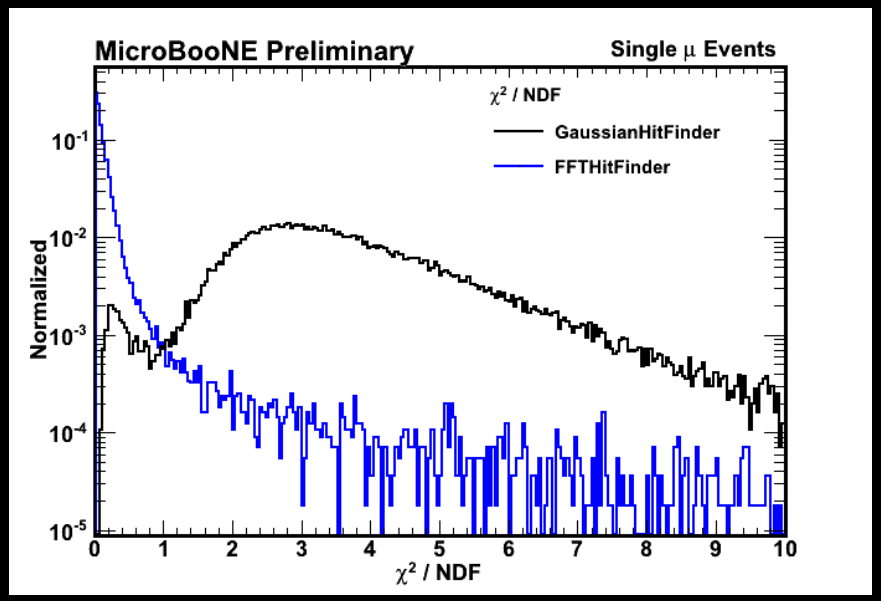
GausHitFinder vs FFTHitFinder

Single Particle μ [2.0 GeV]





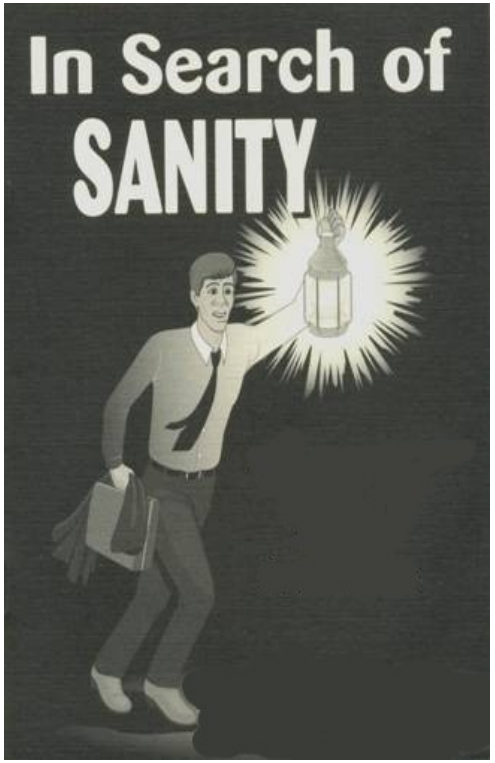




Results of the GausHitFinder Algorithm

Single Particle μ [2.0 GeV]

Event #	# of Hits Found (GausHitFinder)	# of Hits Found (FFTHitFinder)
1	5521	5528
2	5812	5824
3	5835	5838
4	5552	5556
5	5499	5550
6	5762	5771
7	5713	5717
8	5740	5746
9	5668	5672
10	5794	5805
Totals	**56891**	**57007**



GausHitFinder finds 99.8 % of the same hits as FFTHitFinder

→ *This 0.2 % difference comes entirely in the multi-peaked pulses*

Results of the GausHitFinder Algorithm

Genie Events

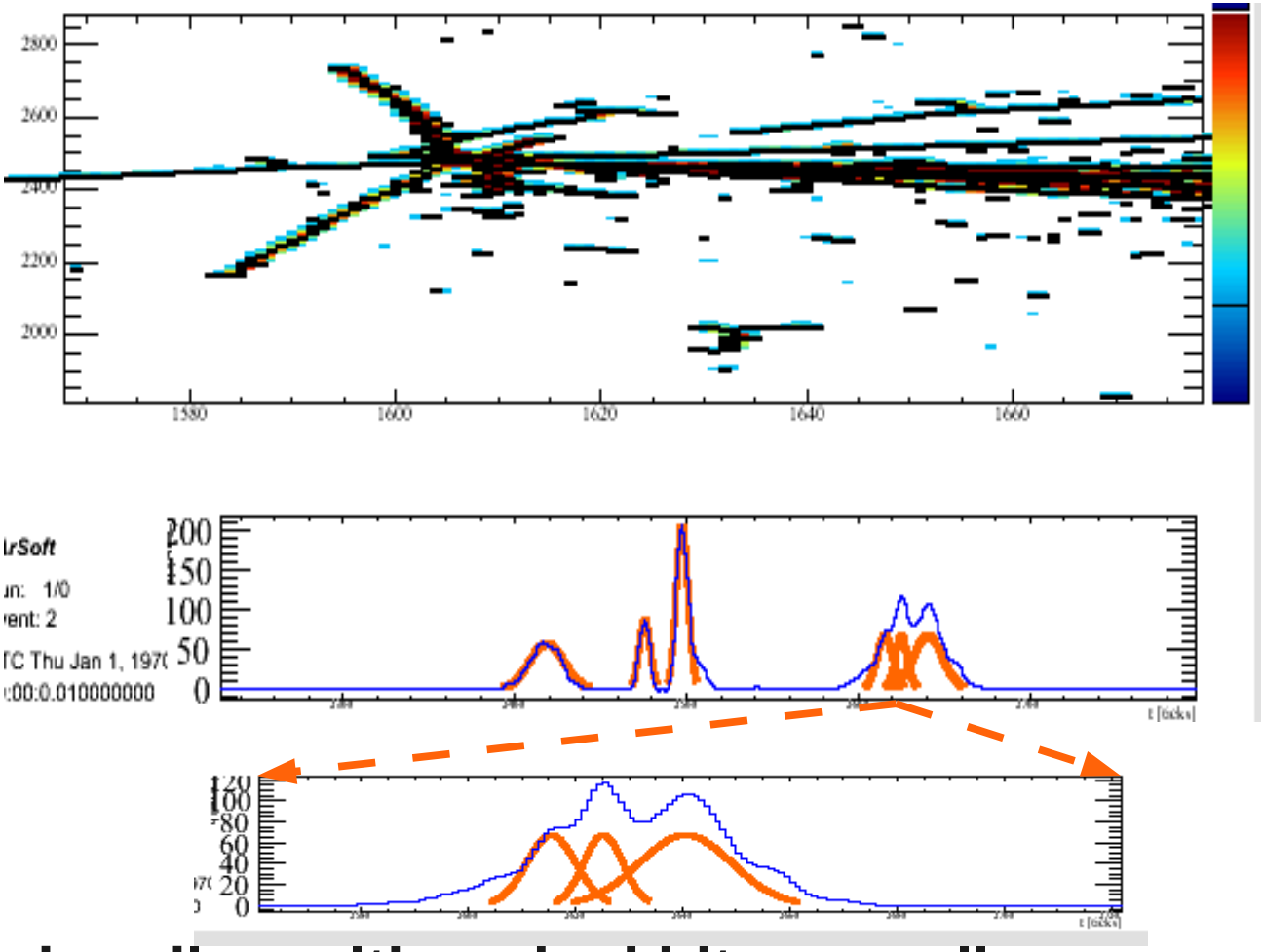
Event #	# of Hits Found (GausHitFinder)	# of Hits Found (FFTHitFinder)
1	3864	3869
2	14811	14904
3	3829	3845
4	0	0
5	8287	8295
6	2761	2767
7	2771	2777
8	0	0
9	8582	8640
10	4462	4479
Totals	**49339**	**49576**

GausHitFinder finds 99.6% of the same hits as FFTHitFinder

→ *This 0.4 % difference comes from multi-peaked hits*

Results of the GausHitFinder Algorithm

Genie Events



GausHitFinder now can handle multi-peaked hits as well as correctly identify the multiplicity of the hit

→ Can allow us to identify how to handle “Goodness of fit” for high multiplicity hits