



SuperB Collaboration Meeting
Frascatti, March 21, 2012
Sam Dejong



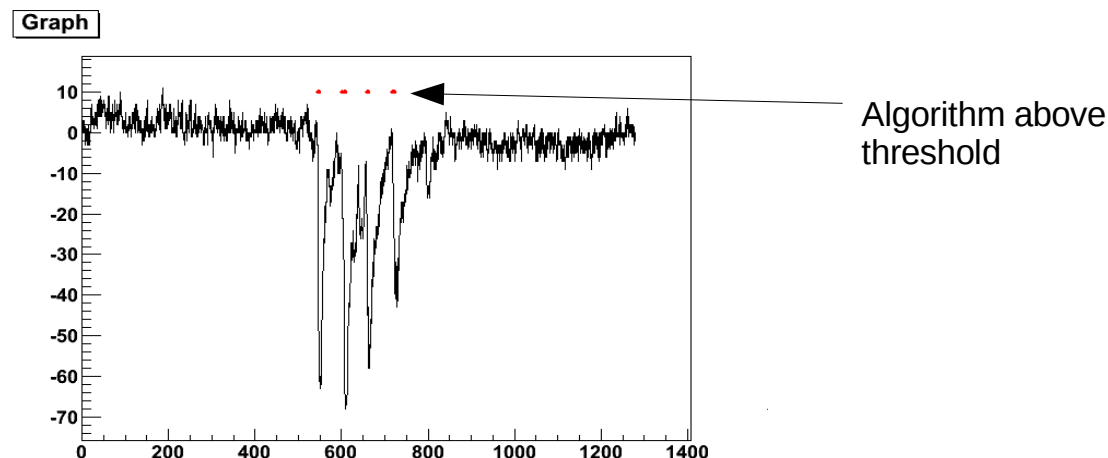
**University
of Victoria**

Cluster counting Algorithm

- Algorithm takes the difference between a bin and the average of previous n bins

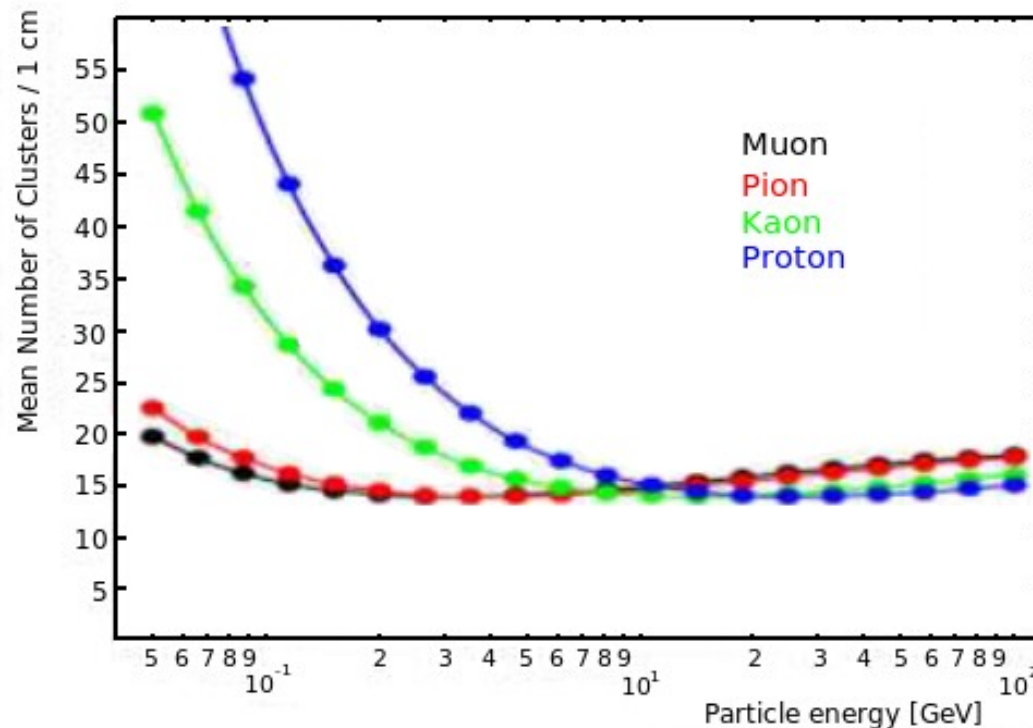
$$a_i = v_i - \frac{\sum_{j=1}^n v_{i-j}}{n}$$

- If a_i is above a certain threshold, a cluster is detected, as long as a_{i-1} is below threshold



TRIUMF testbeam data

- Looking at data in 80/20 and 90/10 for three momenta:
 - 140MeV/c, 180MeV/c, 220MeV/c



80% Helium, 20% Isobutane

Threshold $a=3.7$

$n=5$

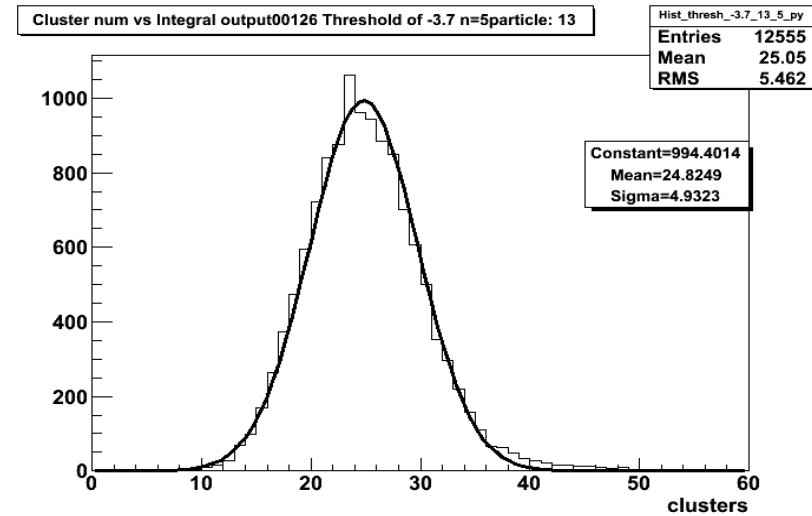
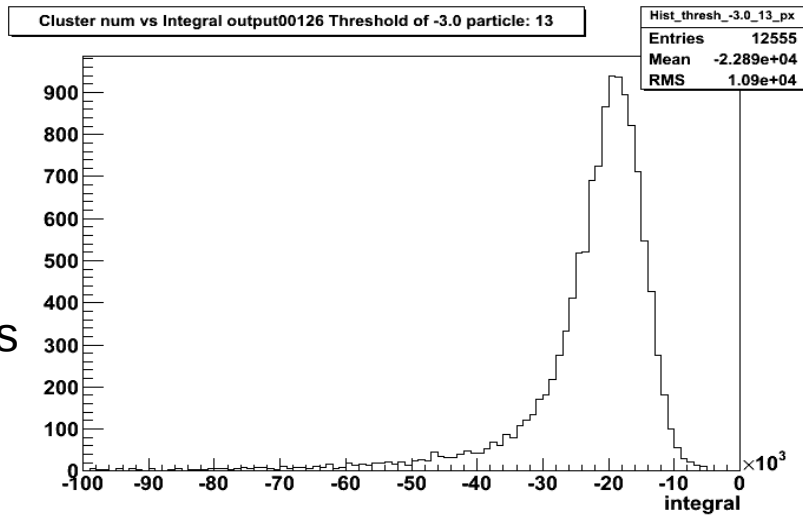
Particle = Muon

Gas: 80/20

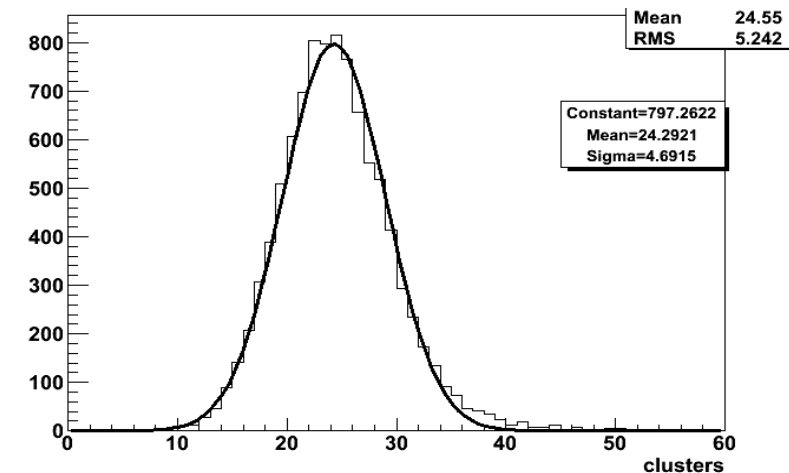
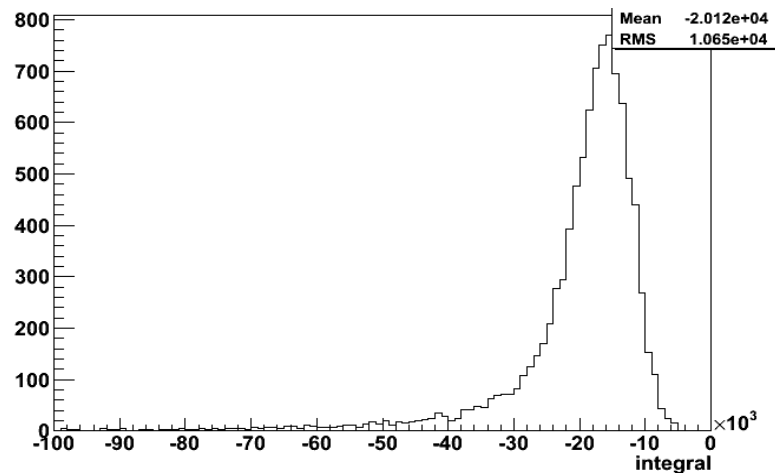
Integral of Signal

Distribution of detected clusters

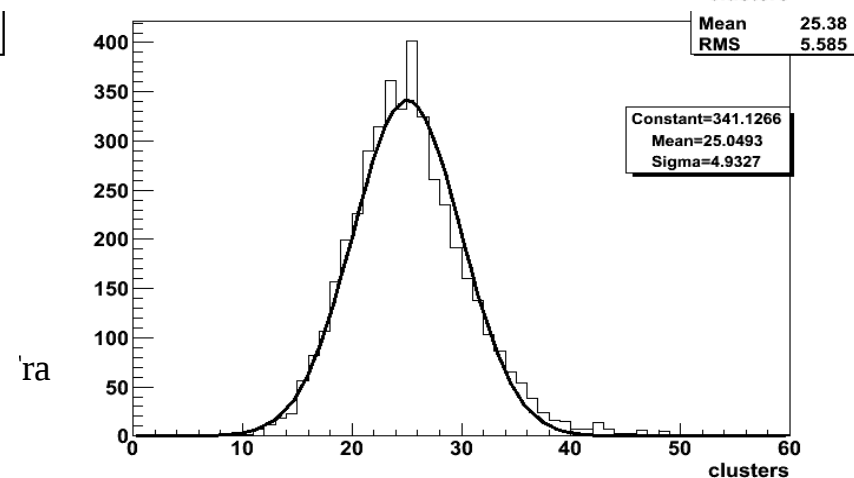
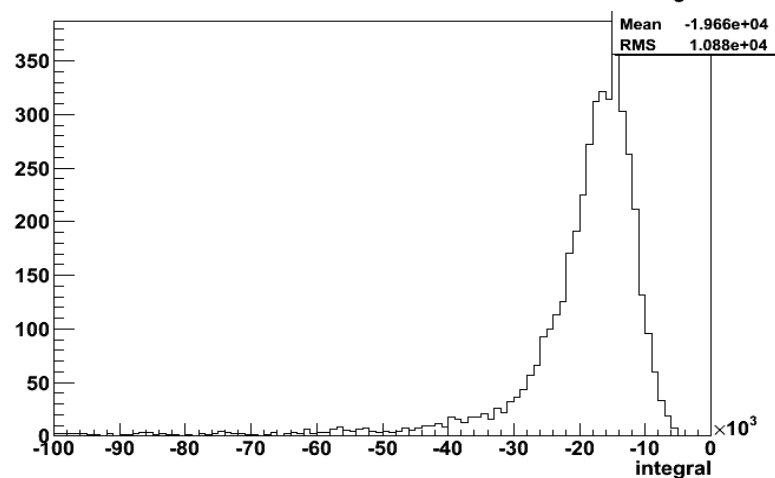
$p=140\text{MeV}/c$
12555 entries



$p=180\text{MeV}/c$
9609 entries



$p=220\text{MeV}/c$
4363 entries



March 21, 2012

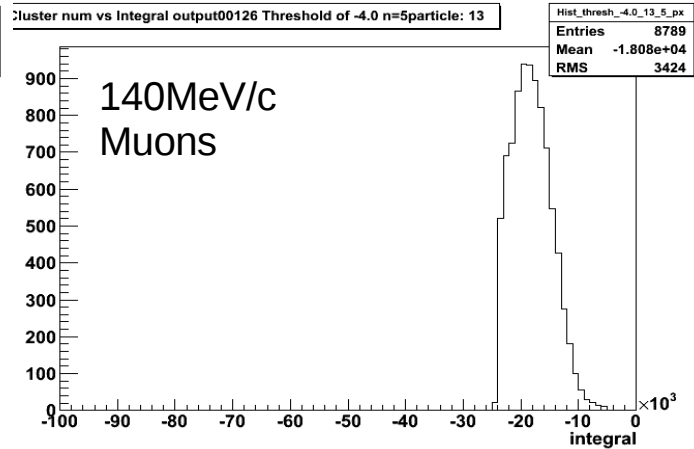
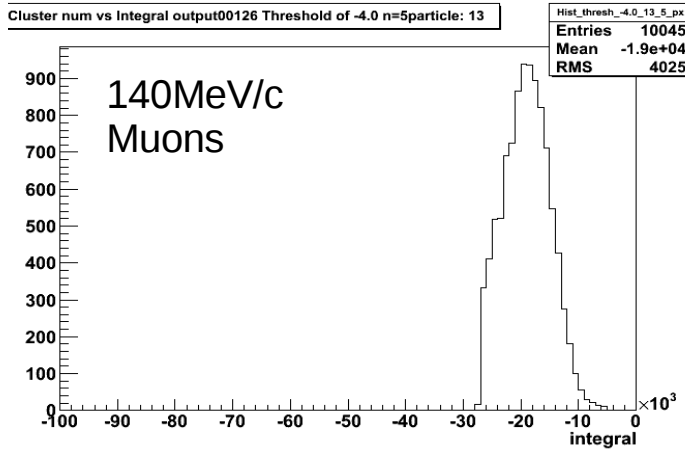
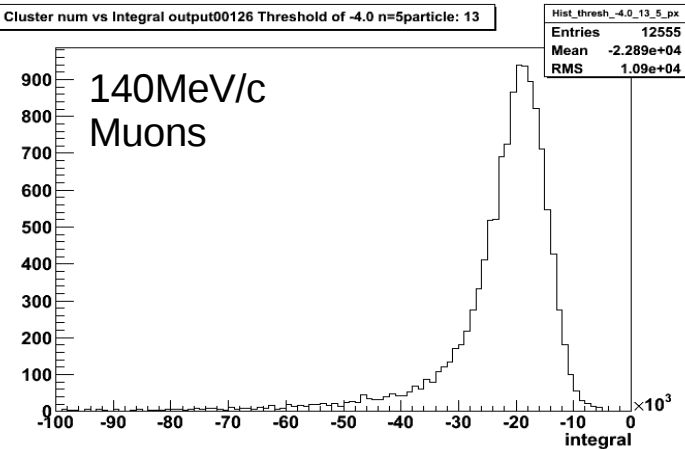
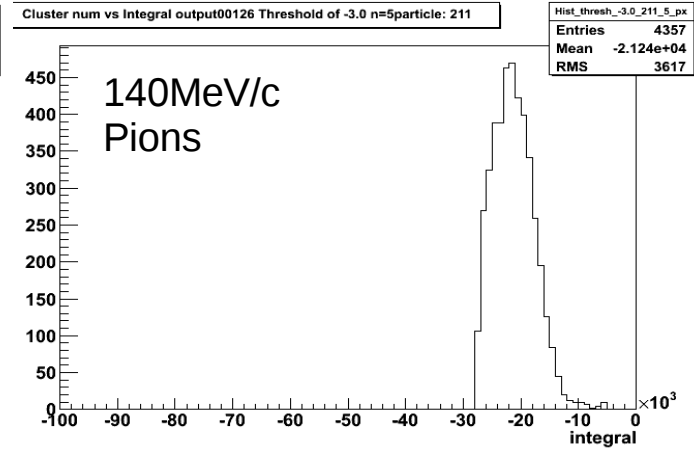
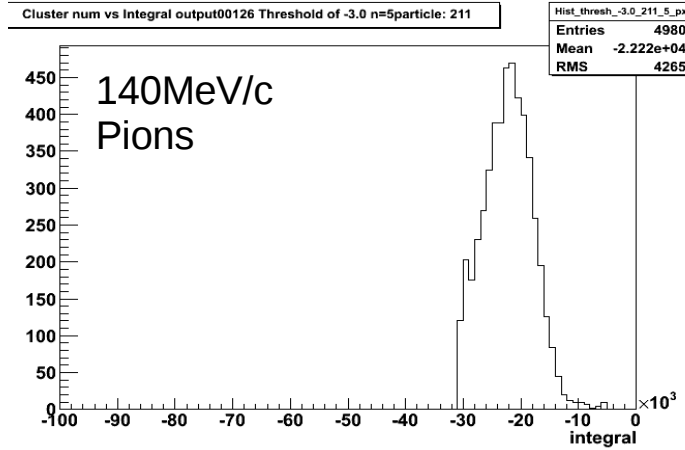
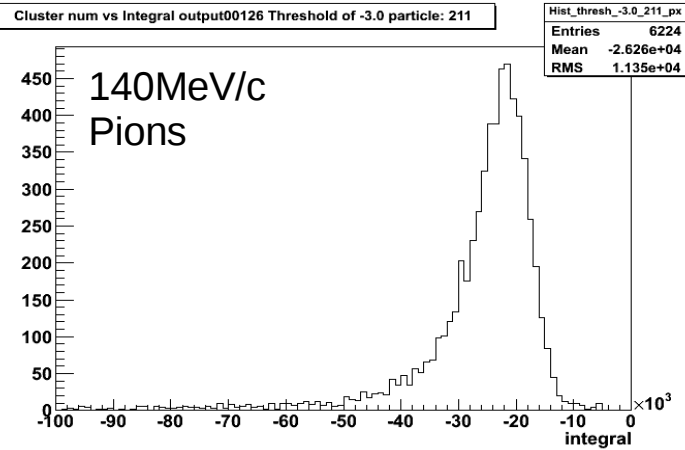
'ra

Truncated Integral 80/20

Full Integral

20% Truncated

30% Truncated



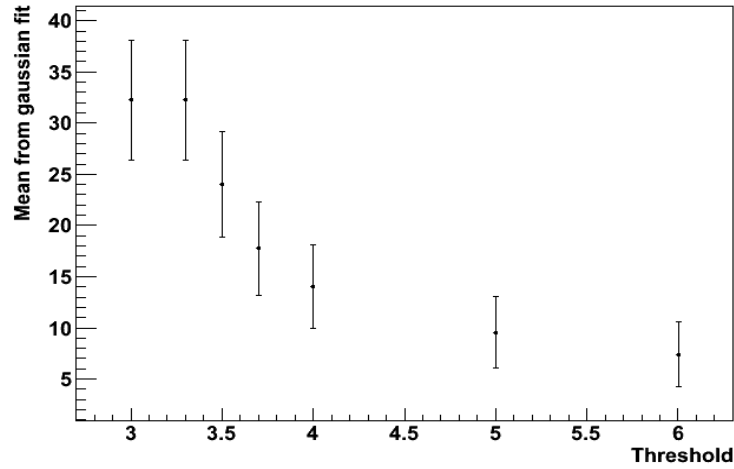
Summary

n=3 (averaged over previous 3 bins in algorithm)

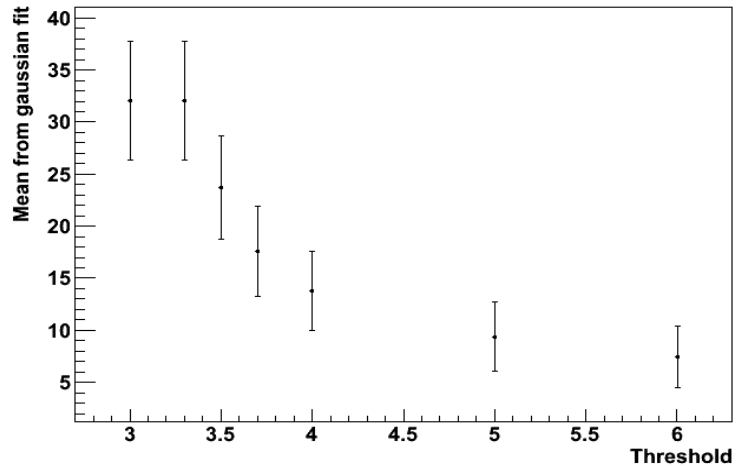
Gas: 80/20

Pions

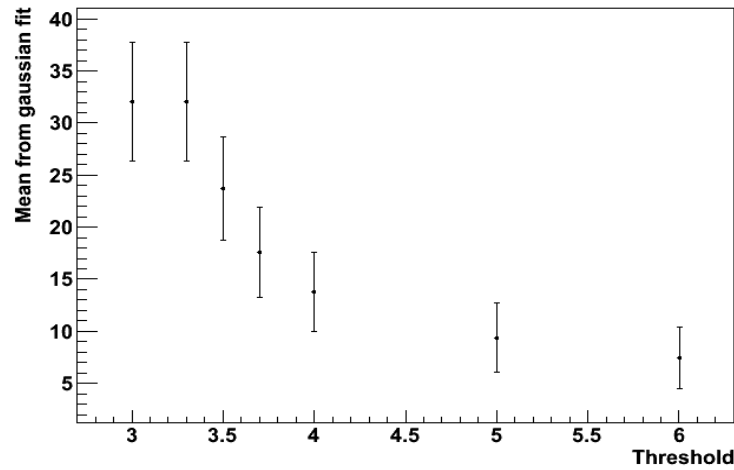
p=140MeV/c



p=180MeV/c

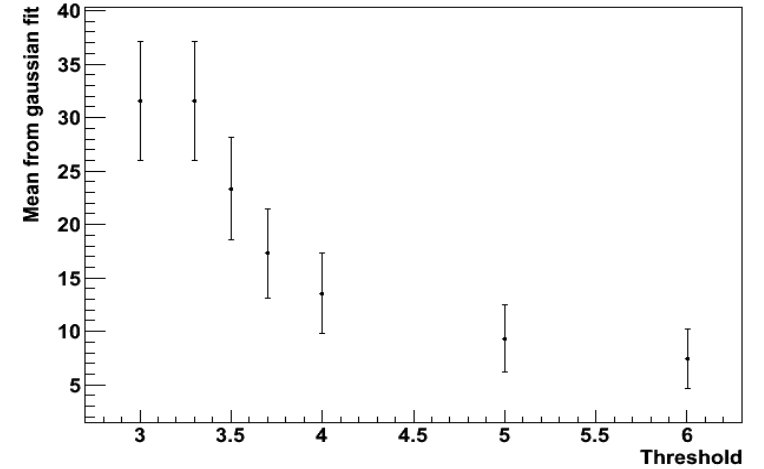
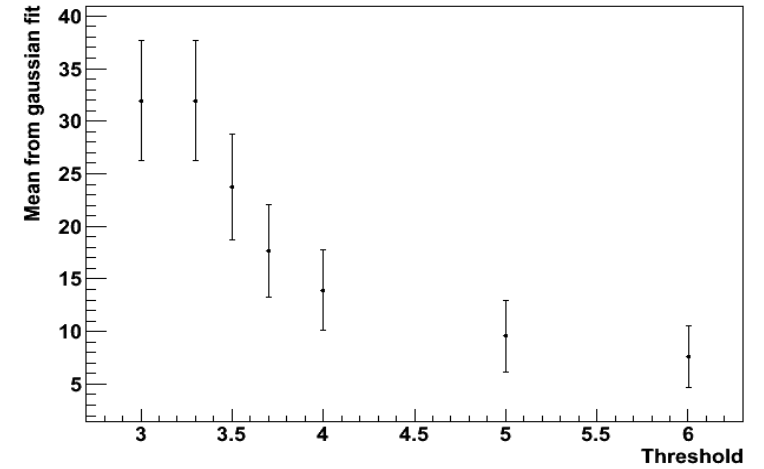


p=220MeV/c

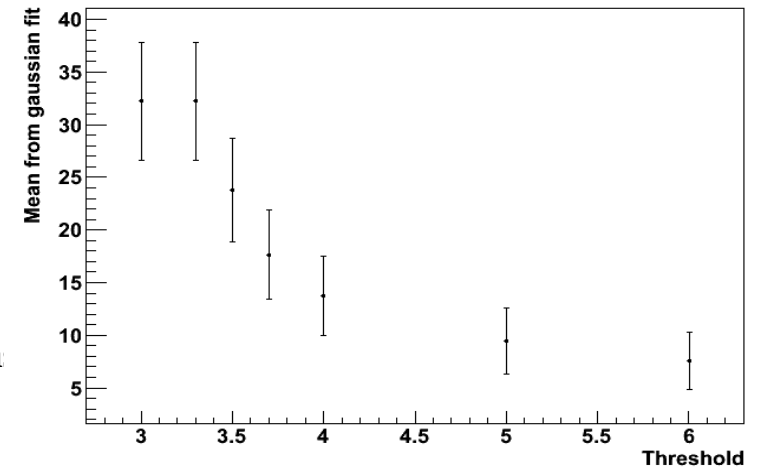


March 21, 2012

Muons



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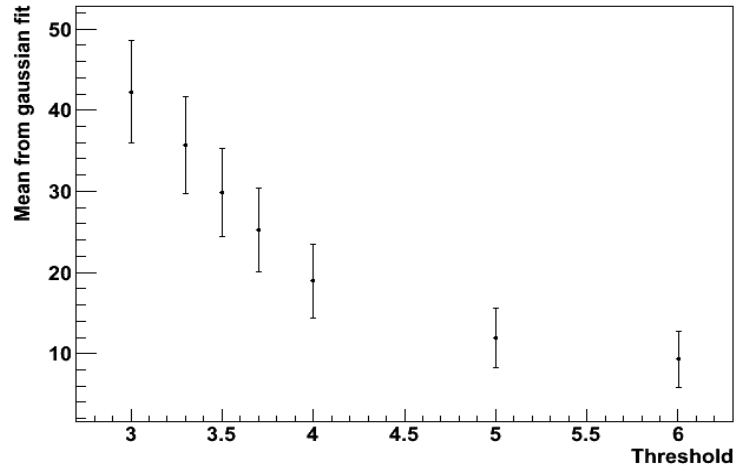


Summary

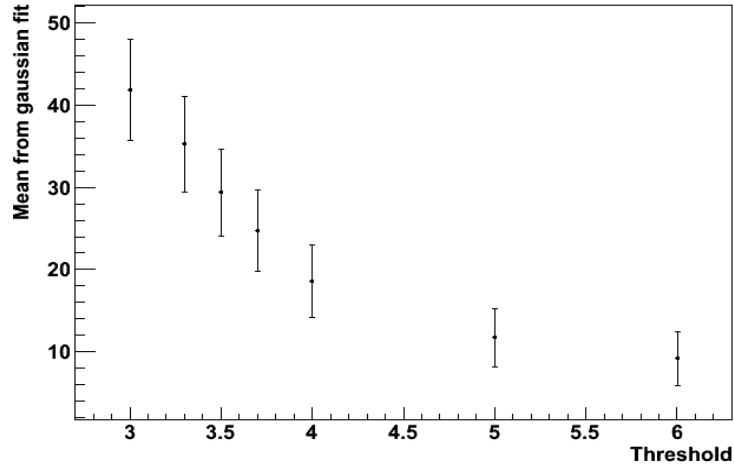
n=5 (averaged over previous 5 Pions
bins in algorithm

Gas: 80/20

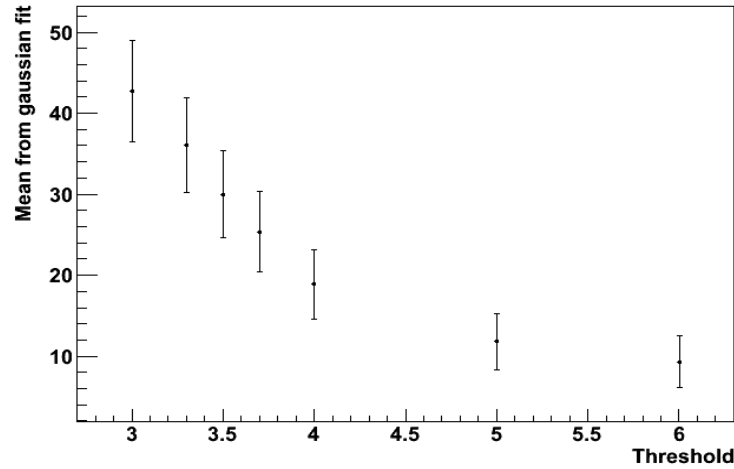
p=140MeV/c



p=180MeV/c

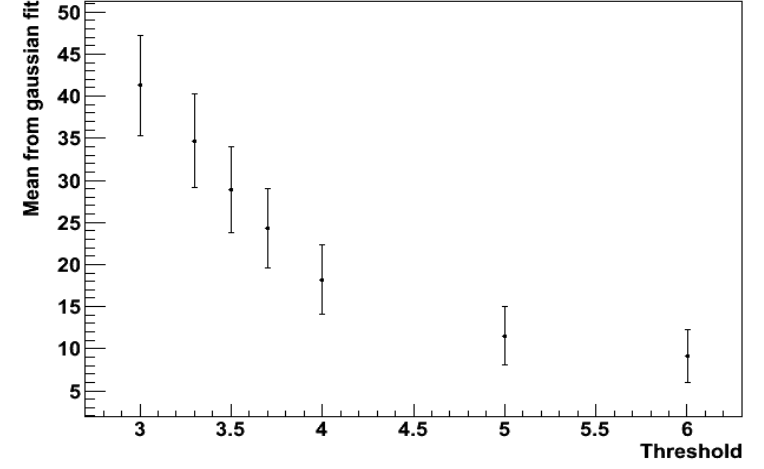
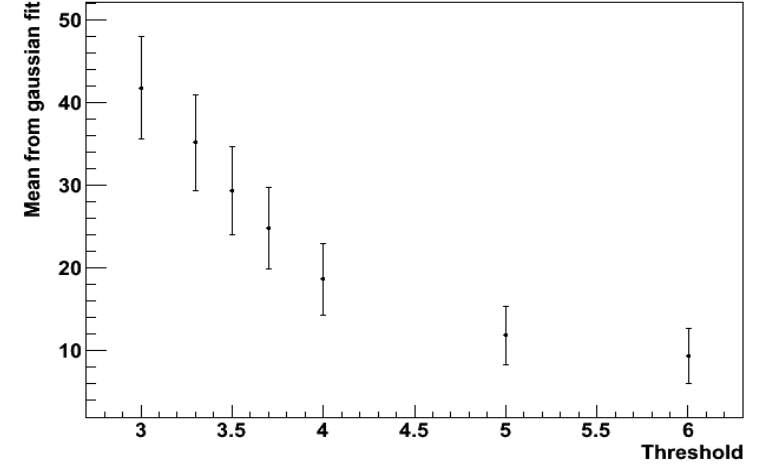


p=220MeV/c

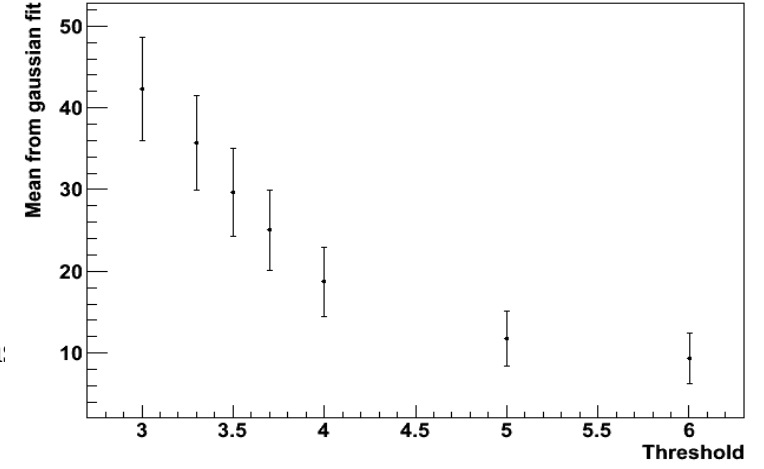


March 21, 2012

Muons



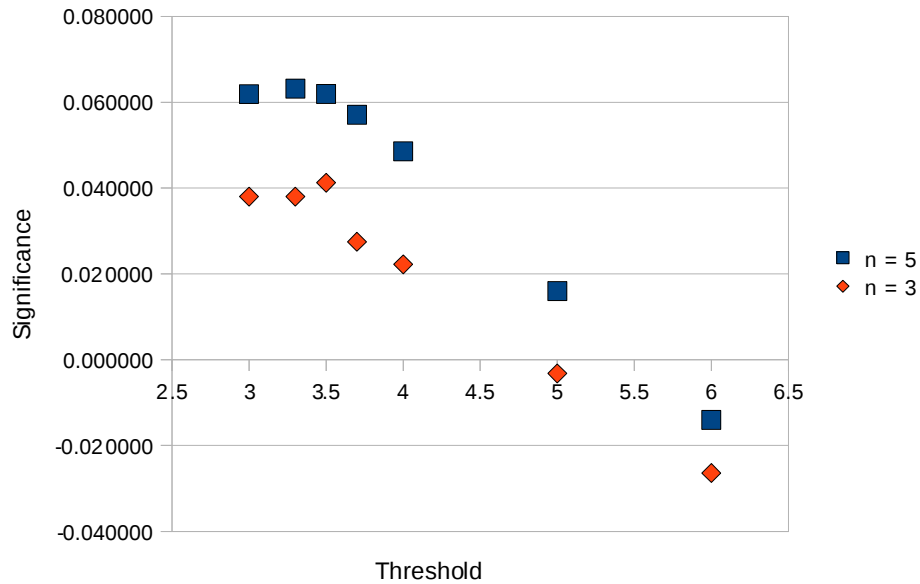
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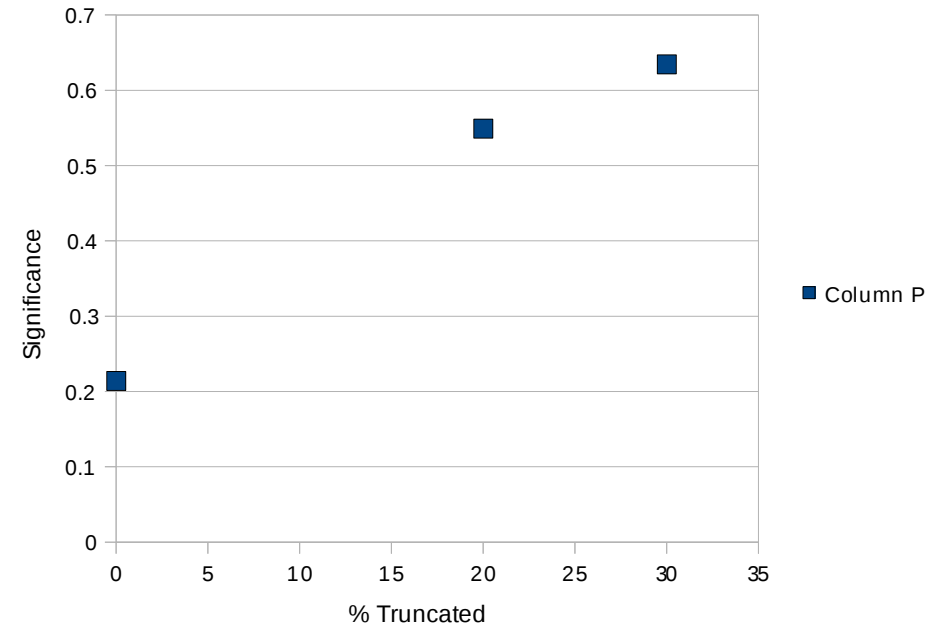
Resolving power (80/20)

140MeV/c

80% Helium 20% Isobutane, Significance of Cluster Counting



80% Helium 20% Isobutane, Significance of Truncated mean



$$Significance = \frac{(\pi_{mean} - \mu_{mean})}{\sqrt{\pi_{RMS}^2 + \mu_{RMS}^2}}$$

90% Helium, 10% Isobutane

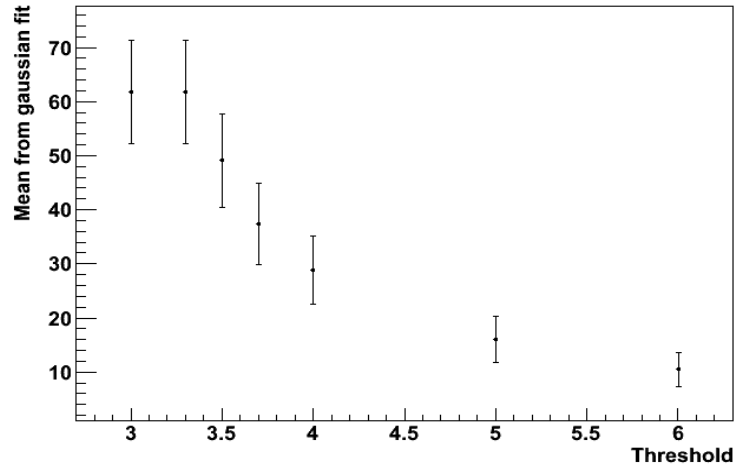
Summary

n=3 (averaged over previous 3 bins in algorithm)

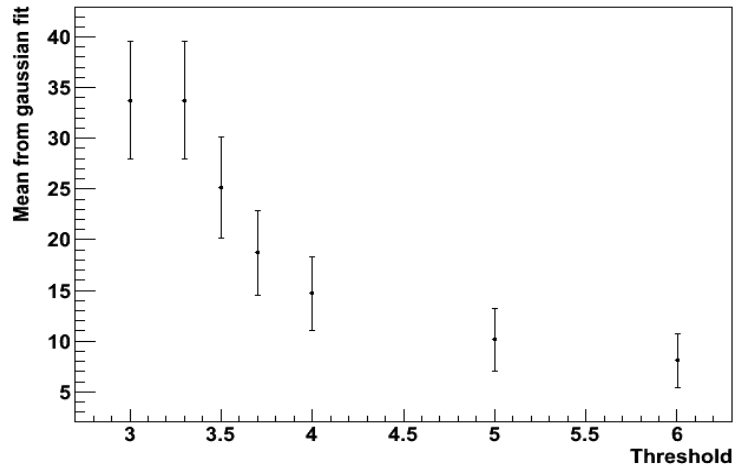
Pions

Gas: 90/10

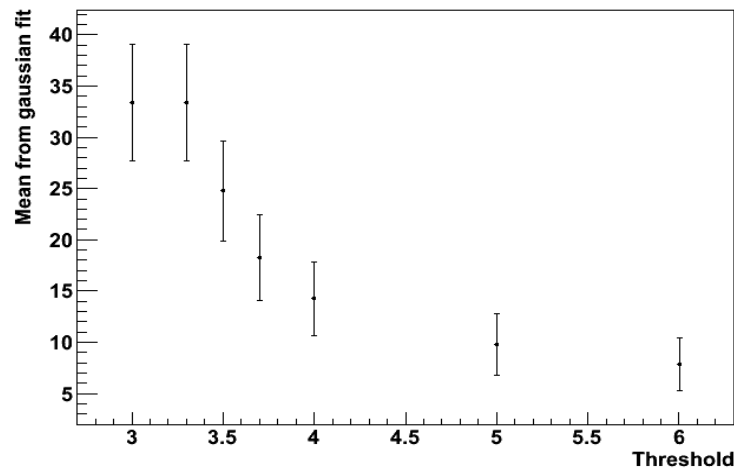
p=140MeV/c



p=180MeV/c

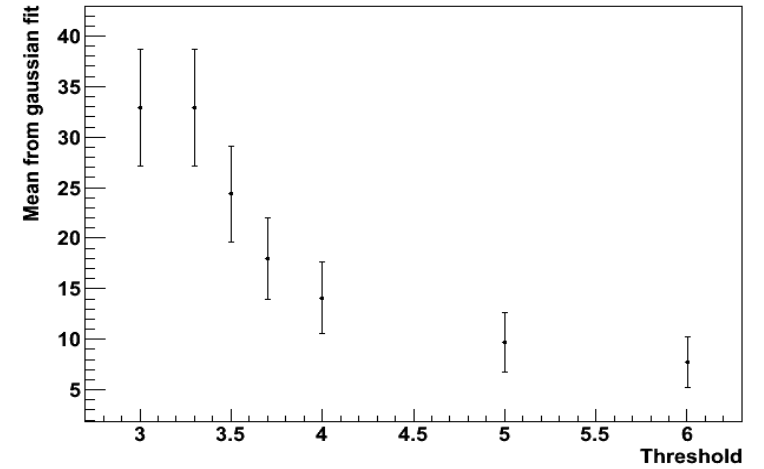
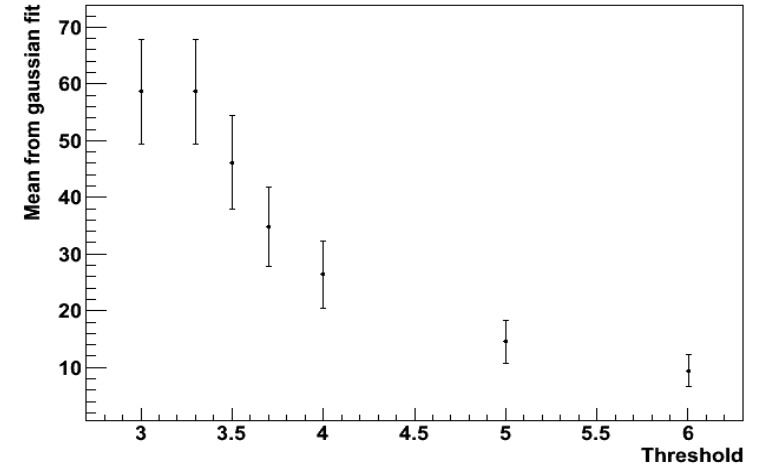


p=220MeV/c

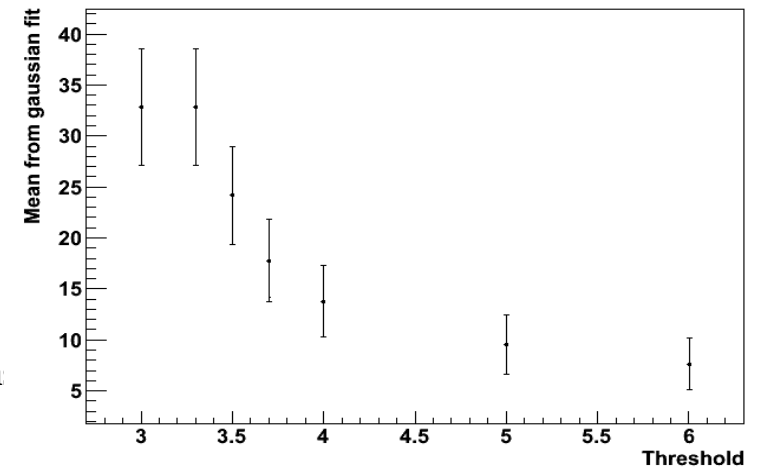


March 21, 2012

Muons



ra



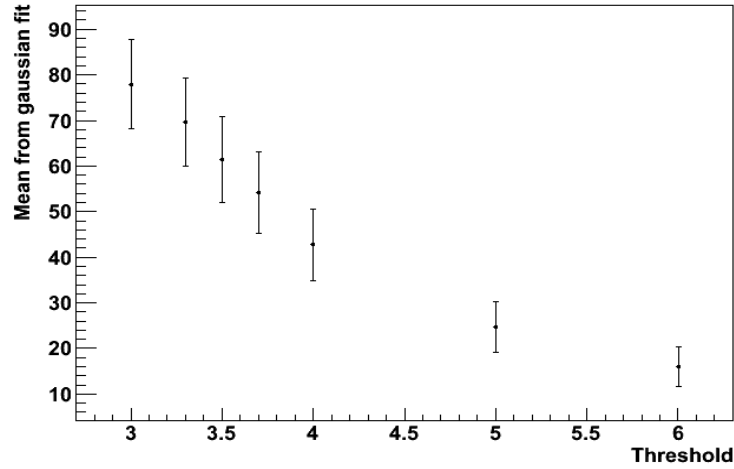
Summary

n=5 (averaged over previous 5 bins in algorithm)

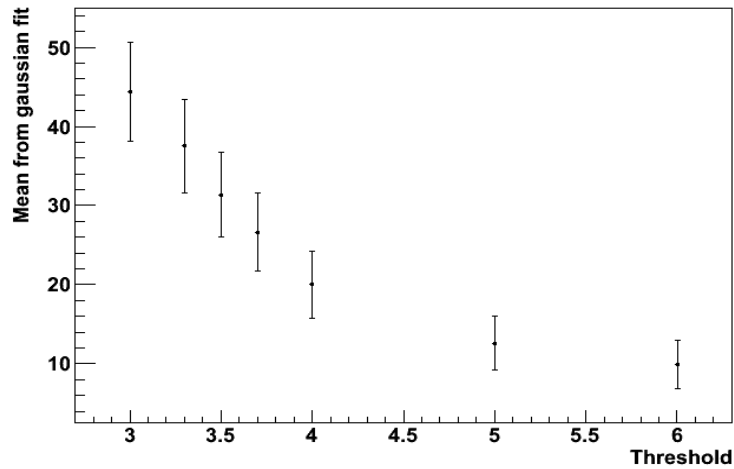
Gas: 90/10

Pions

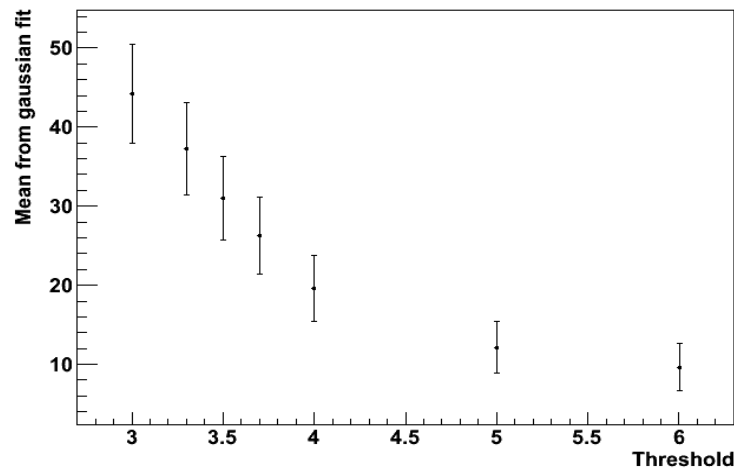
p=140MeV/c



p=180MeV/c



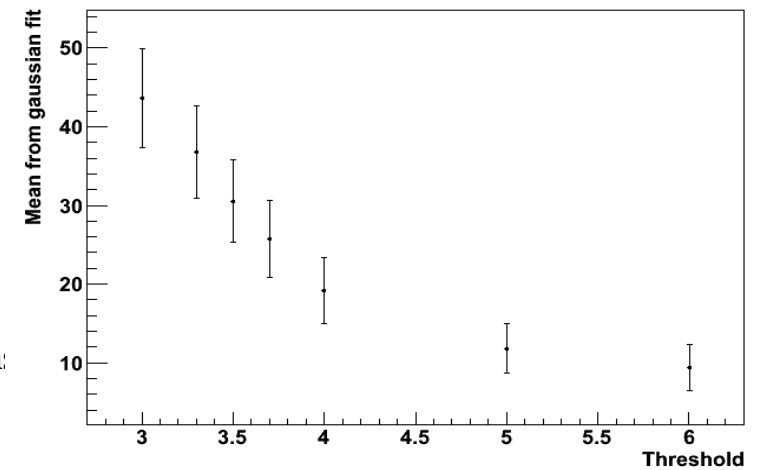
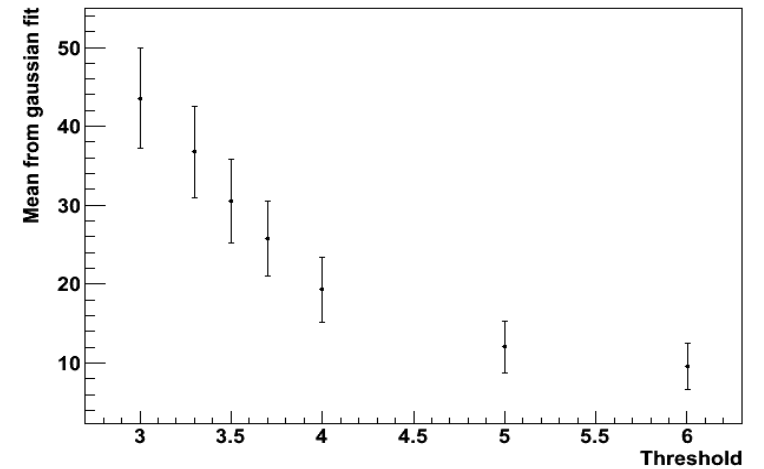
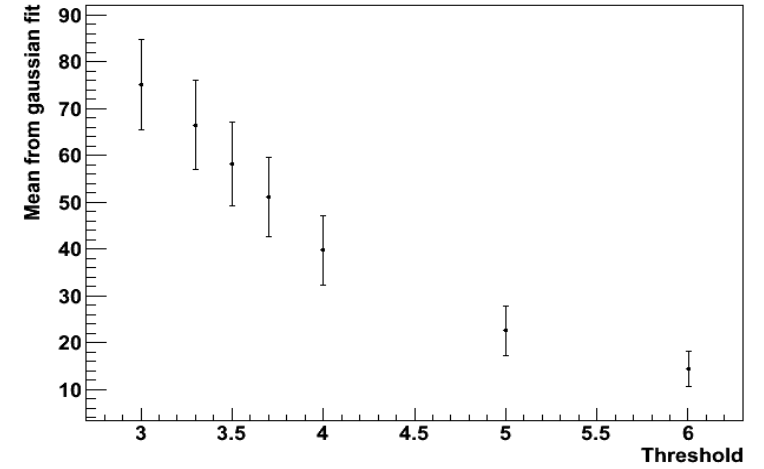
p=220MeV/c



March 21, 2012

Muons

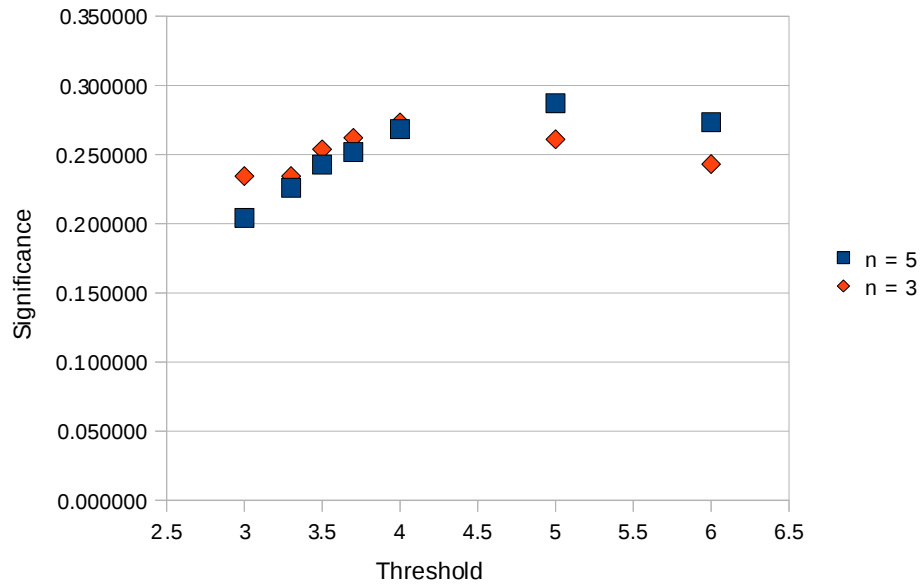
ra:



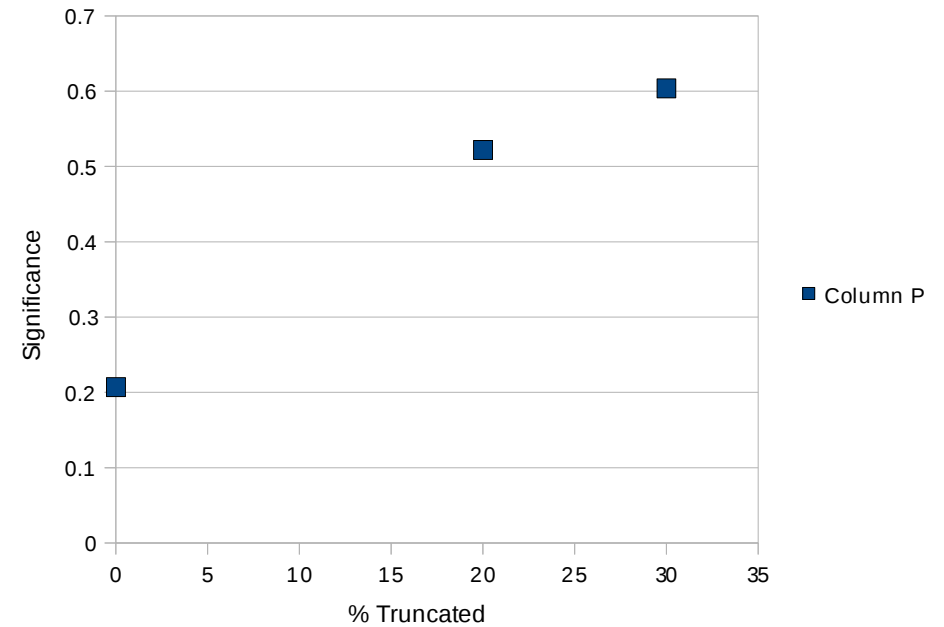
Resolving power (90/10)

140MeV/c

90% Helium 10% Isobutane, Significance of Cluster Counting



90% Helium 10% Isobutane, Significance of Truncated mean



$$Significance = \frac{(\pi_{mean} - \mu_{mean})}{\sqrt{\pi_{RMS}^2 + \mu_{RMS}^2}}$$

Conclusion / Future work

- Work in progress
- Not the best algorithm, so far the truncated mean is better
- More sophisticated approach needed
- 90/10 data has better significance: look at 95/5
- Means of evaluating algorithm is in place

Backup slides

Runs used

- For 80/20:
 - Run 126 for 140MeV/c
 - Run 129 for 180MeV/c
 - Run 127 for 220MeV/c
- For 90/10
 - Run 175 for 140MeV/c
 - Run 138 for 180MeV/c
 - Run 139 for 220MeV/c

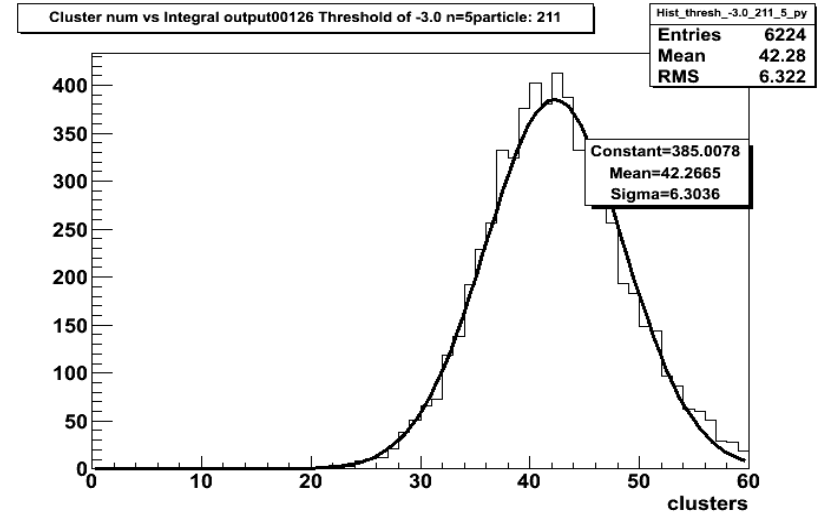
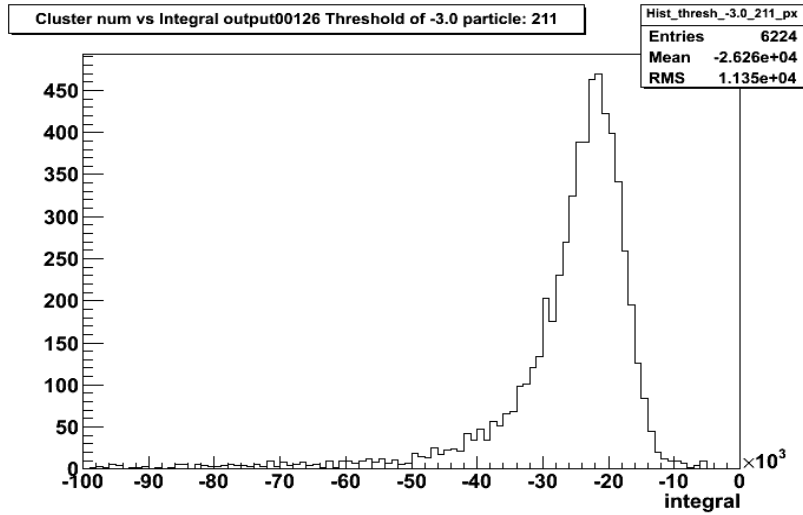
Pions, $n=5$
80/20

Threshold $a=3$
 $n=5$
 Particle = Pion
 Gas: 80/20

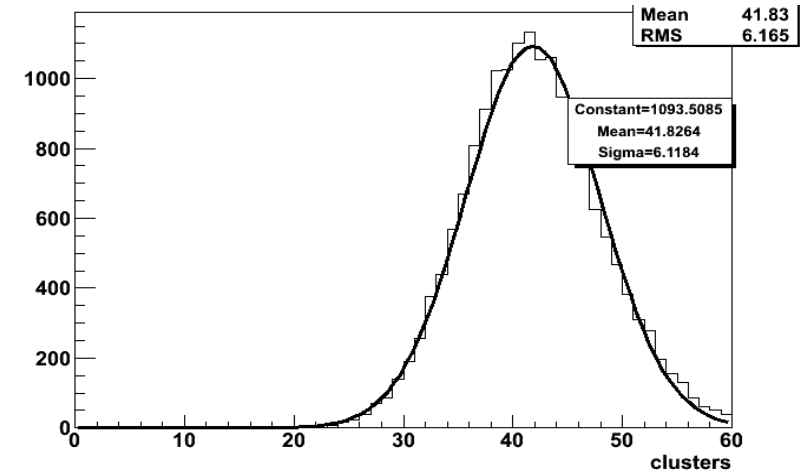
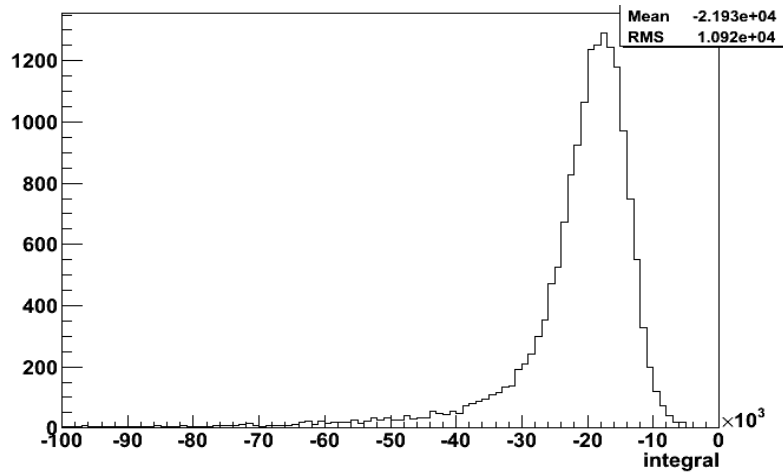
Integral of Signal

Distribution of detected clusters

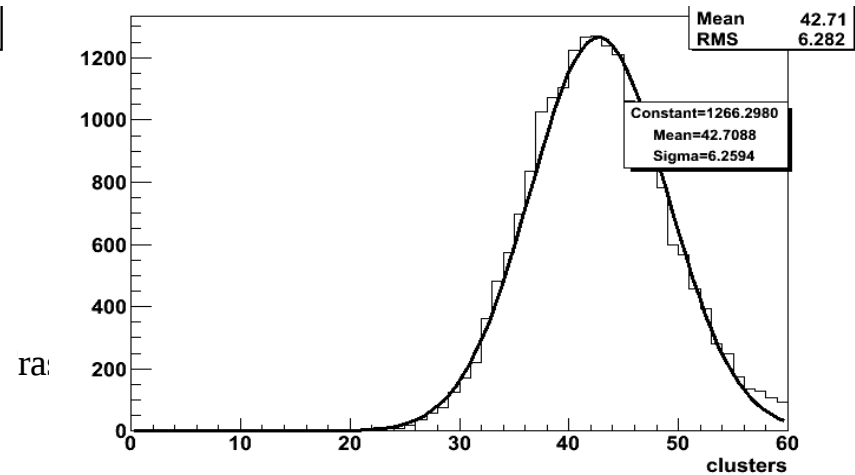
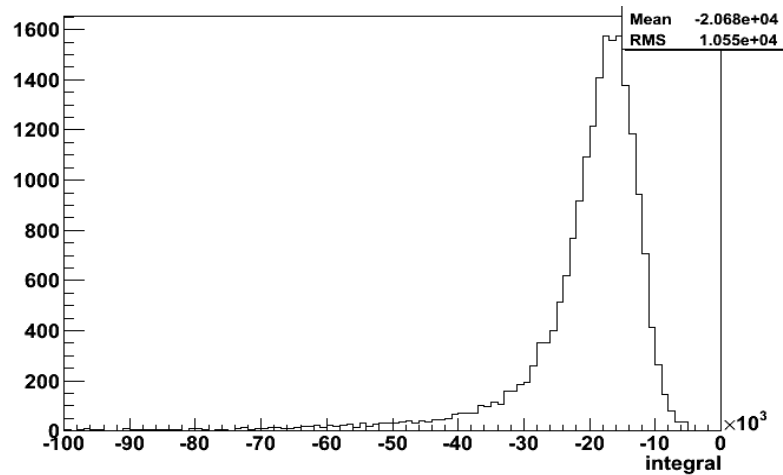
$p=140\text{MeV}/c$
 6224 entries



$p=180\text{MeV}/c$
 17062 entries



$p=220\text{MeV}/c$
 20304 entries



March 21, 2012

Threshold $a=3.3$

$n=5$

Particle = Pion

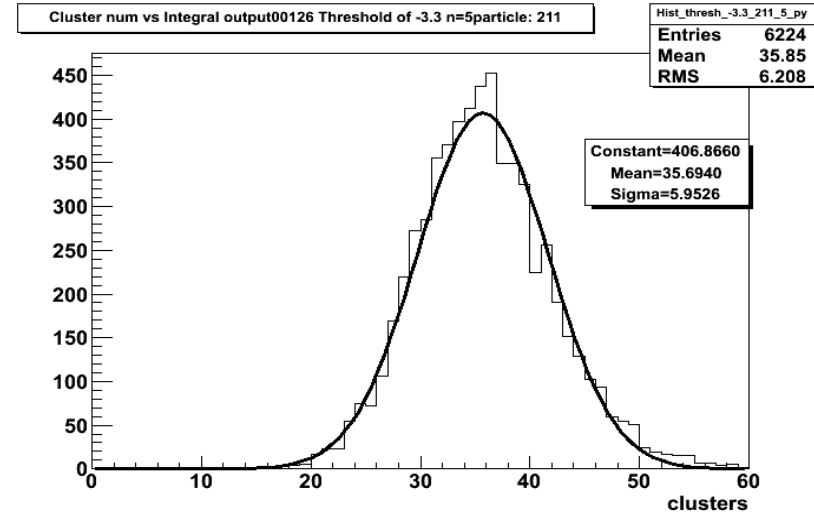
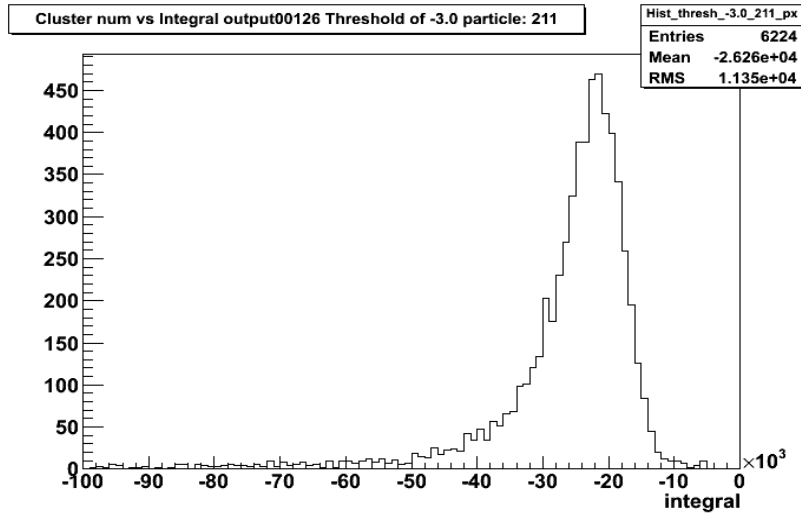
Gas: 80/20

Integral of Signal

Distribution of detected clusters

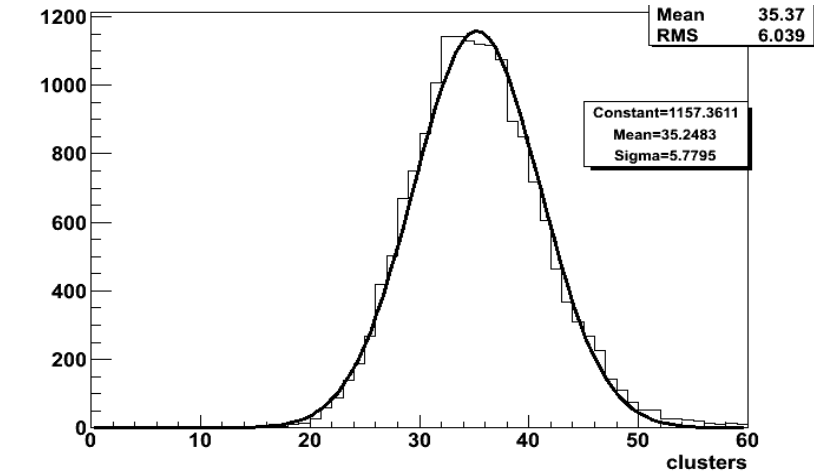
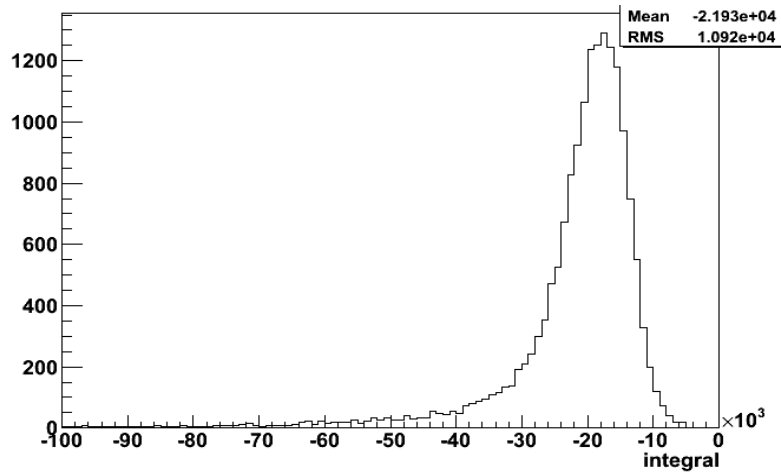
$p=140\text{MeV}/c$

6224 entries



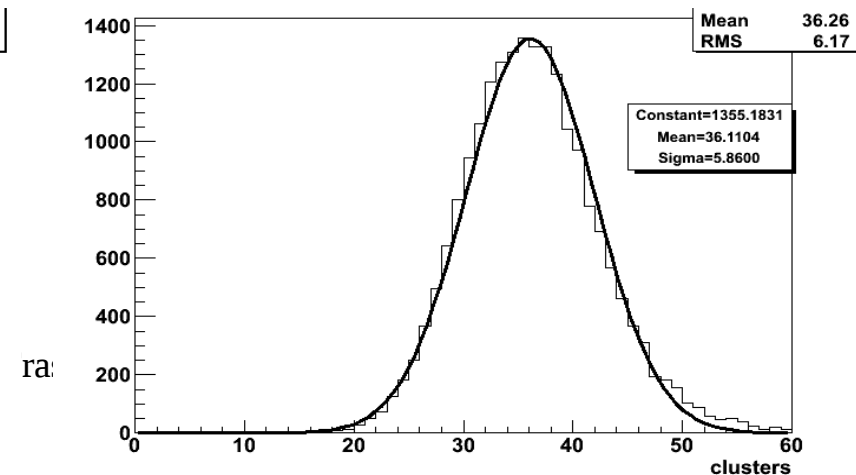
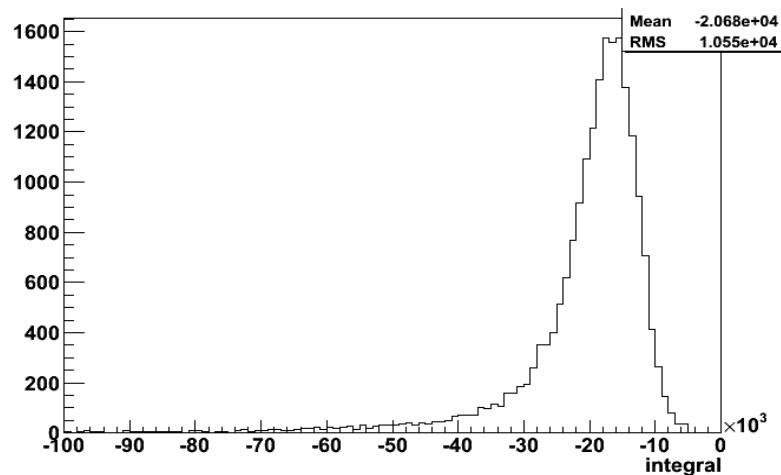
$p=180\text{MeV}/c$

17062 entries



$p=220\text{MeV}/c$

20304 entries



March 21, 2012

Threshold $a=3.5$

$n=5$

Particle = Pion

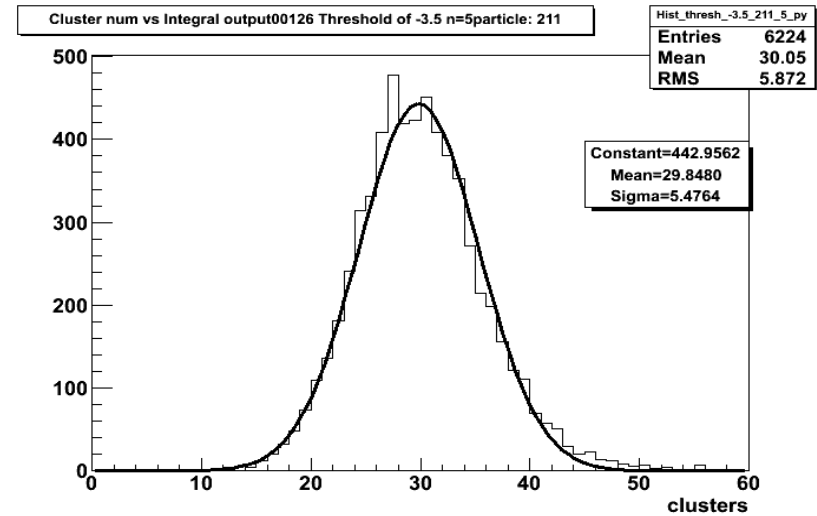
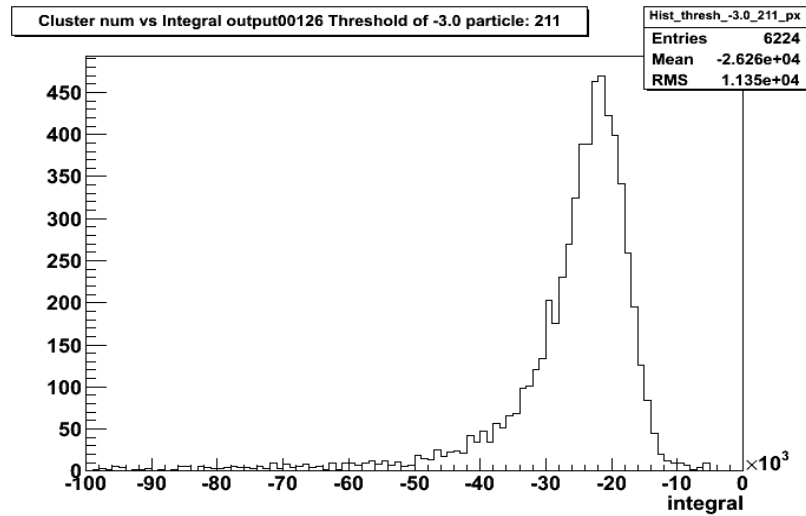
Gas: 80/20

Integral of Signal

Distribution of detected clusters

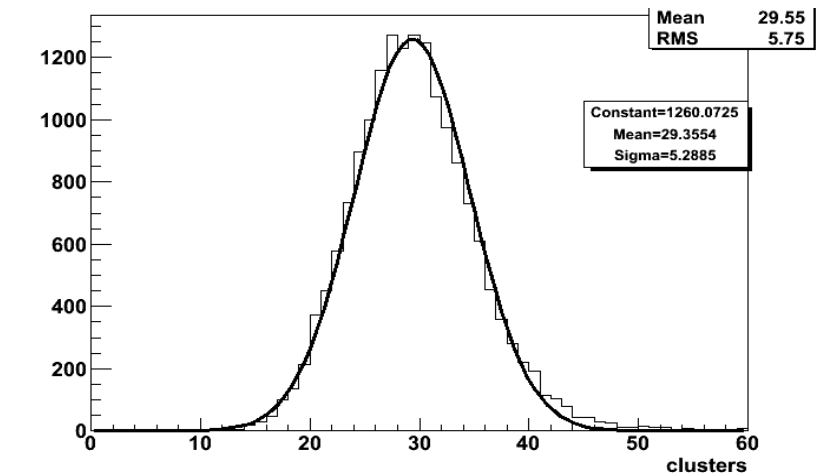
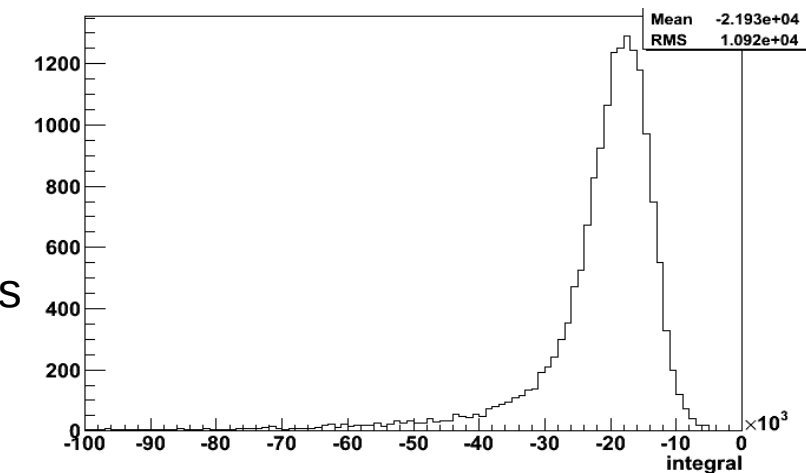
$p=140\text{MeV}/c$

6224 entries



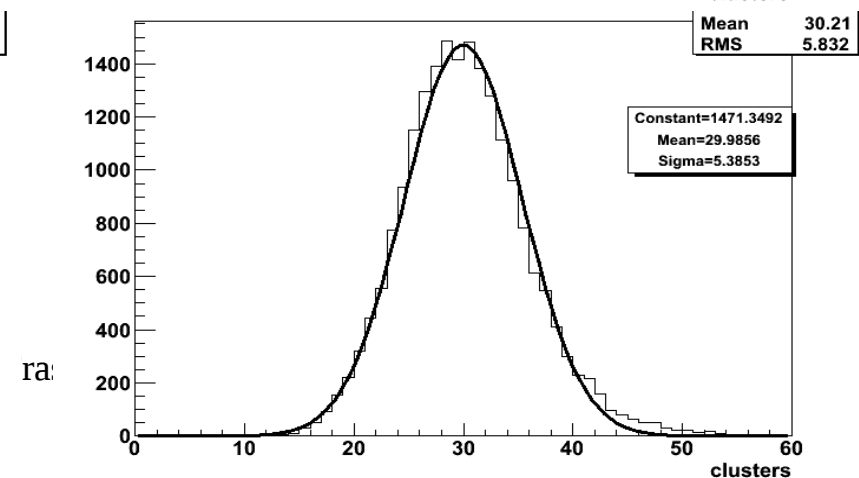
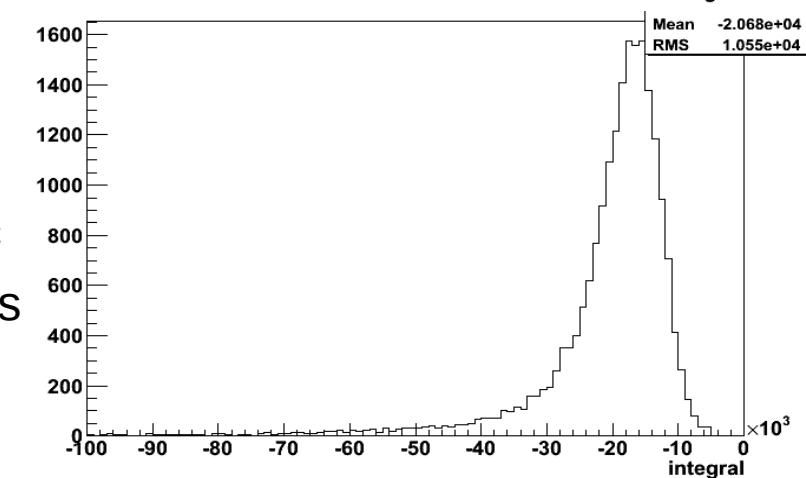
$p=180\text{MeV}/c$

17062 entries



$p=220\text{MeV}/c$

20304 entries



March 21, 2012

Threshold $a=3.7$

$n=5$

Particle = Pion

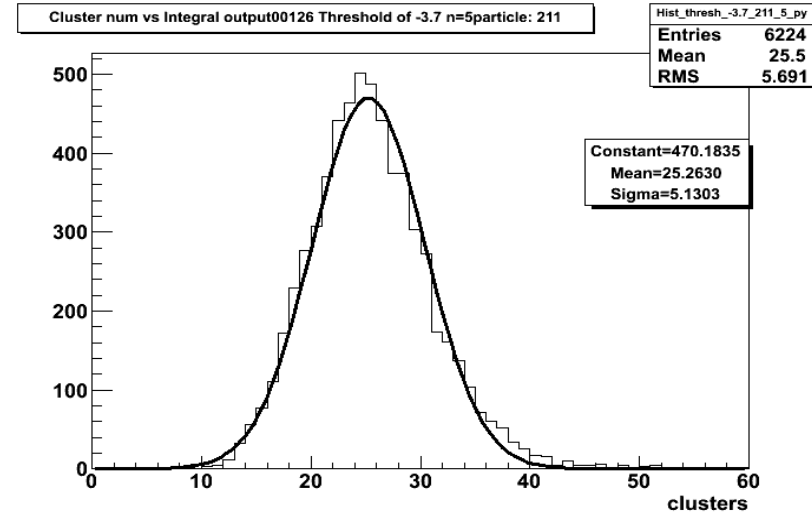
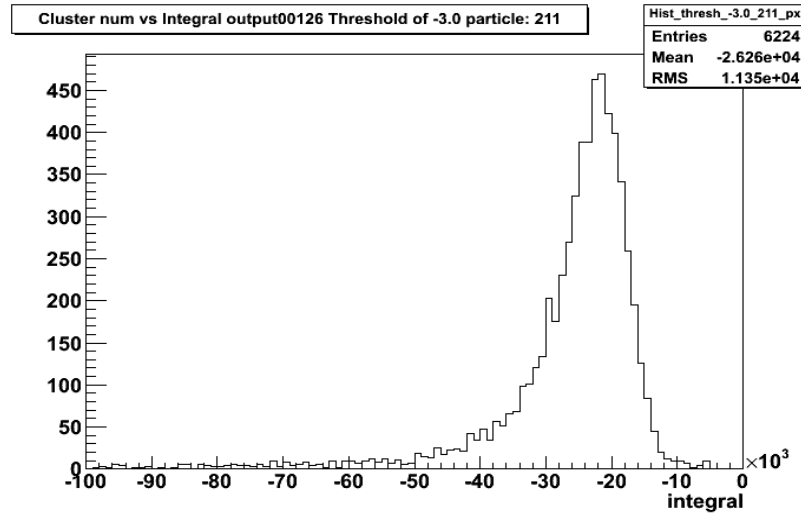
Gas: 80/20

Integral of Signal

Distribution of detected clusters

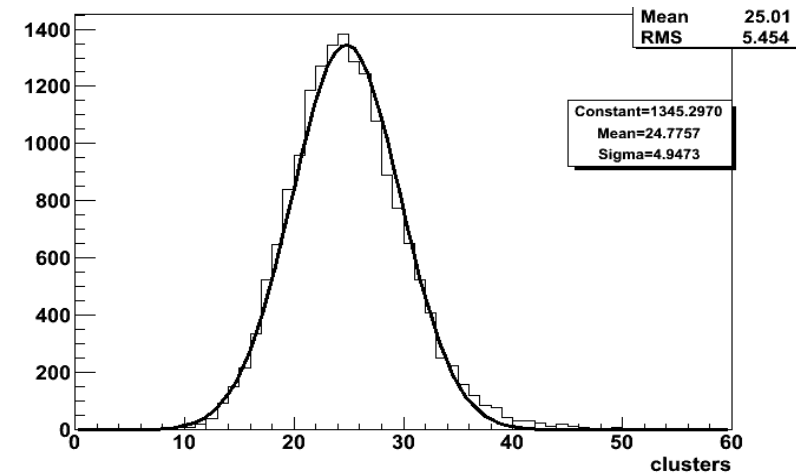
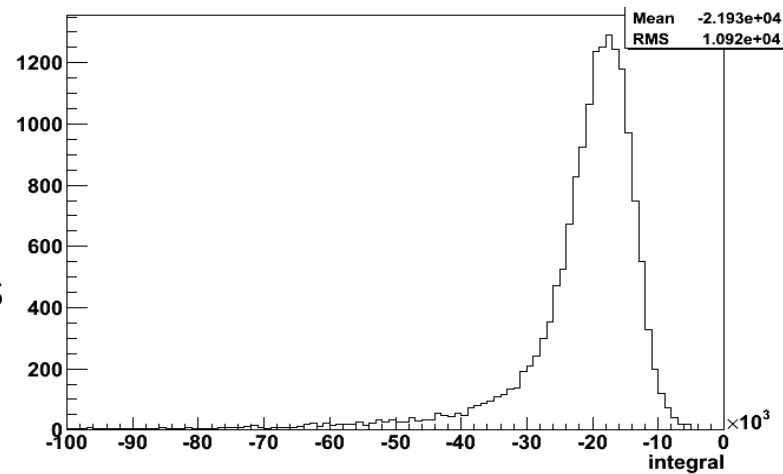
$p=140\text{MeV}/c$

6224 entries



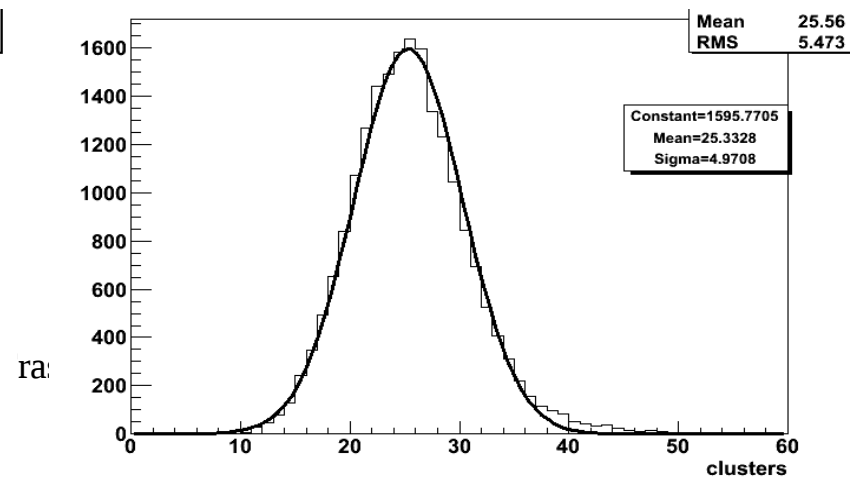
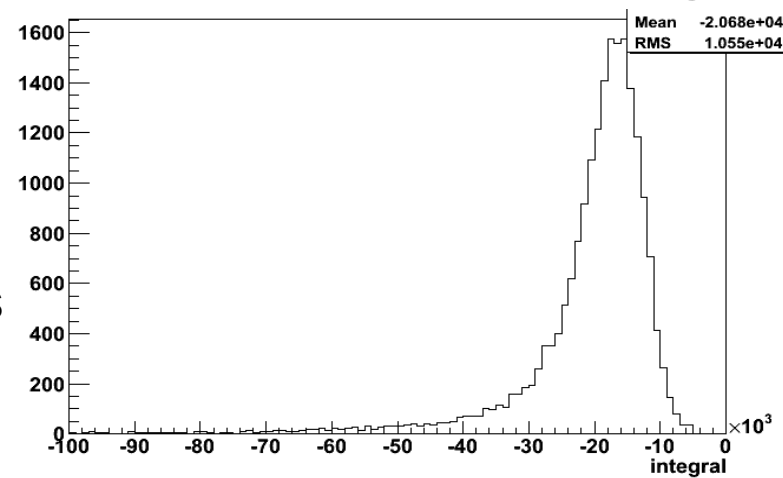
$p=180\text{MeV}/c$

17062 entries



$p=220\text{MeV}/c$

20304 entries



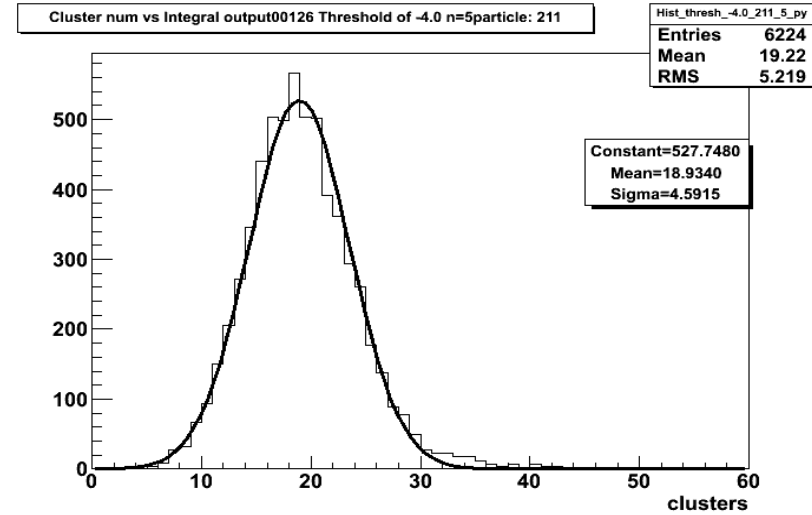
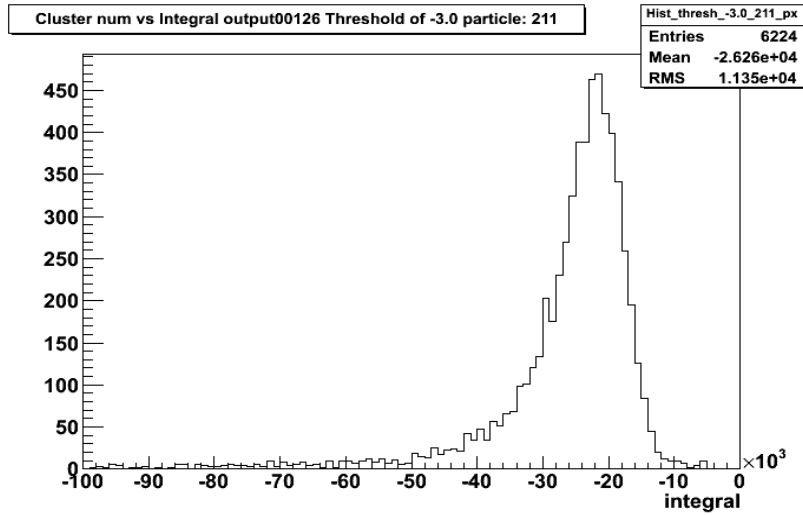
March 21, 2012

Threshold $a=4$
 $n=5$
 Particle = Pion
 Gas: 80/20

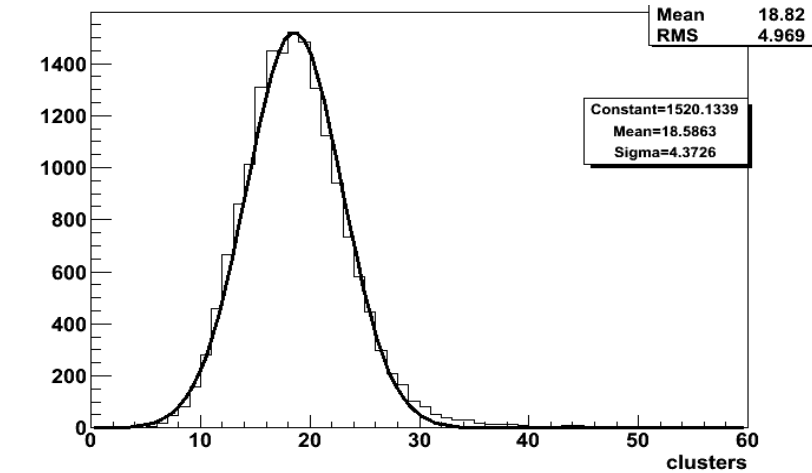
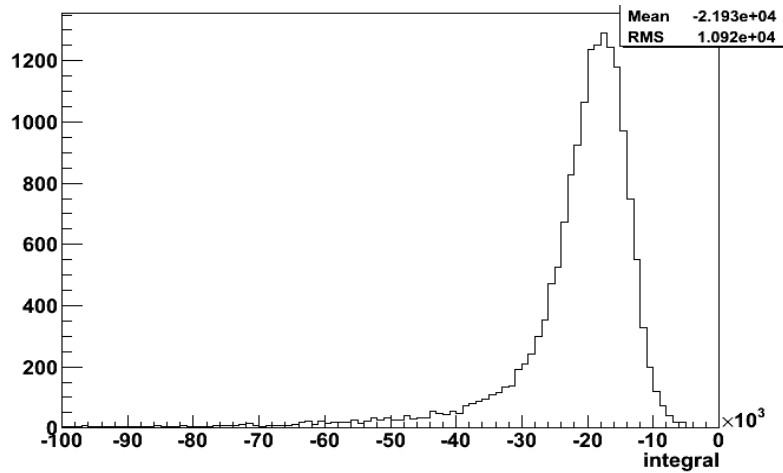
Integral of Signal

Distribution of detected clusters

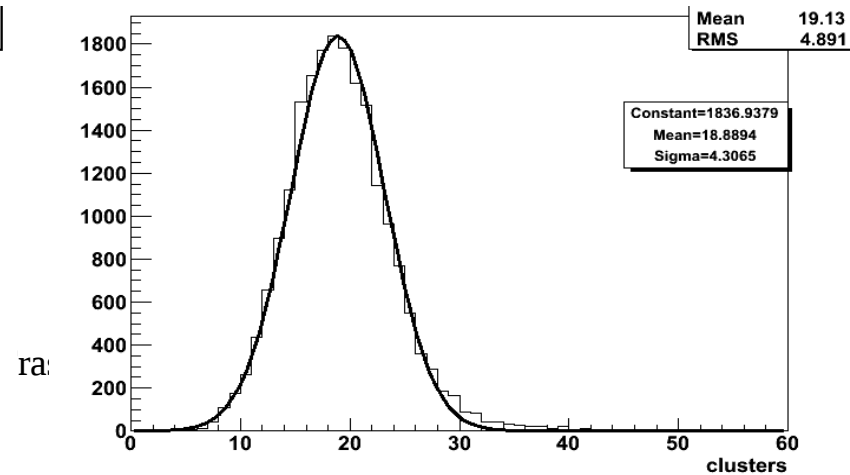
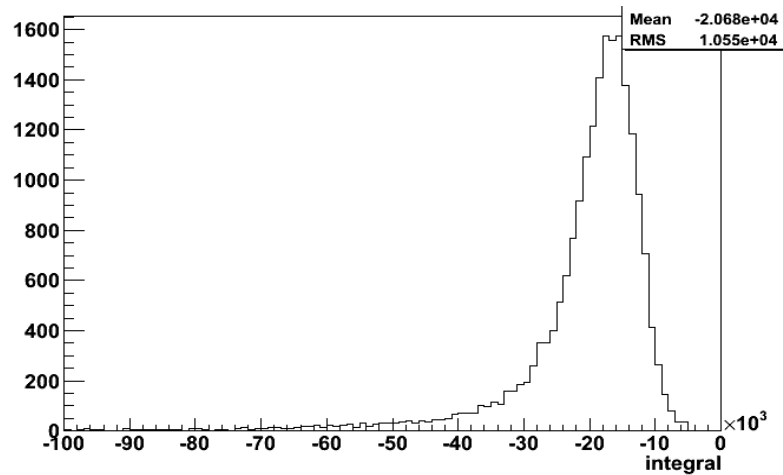
$p=140\text{MeV}/c$
 6224 entries



$p=180\text{MeV}/c$
 17062 entries



$p=220\text{MeV}/c$
 20304 entries



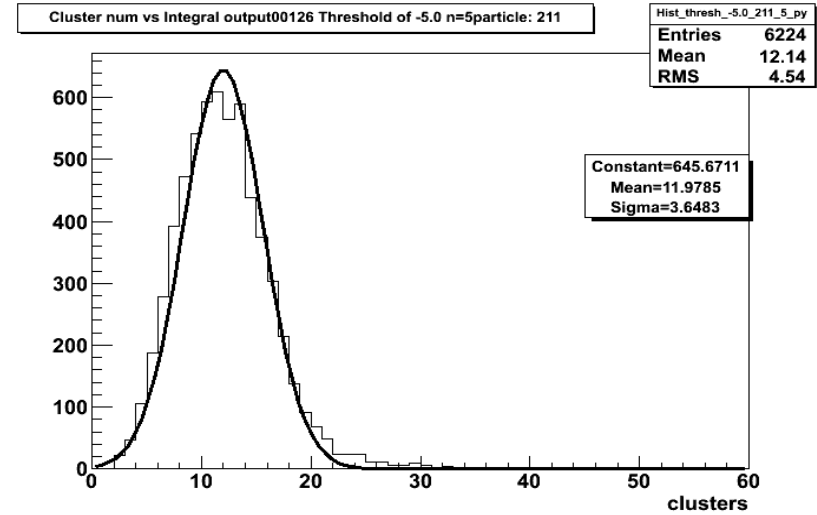
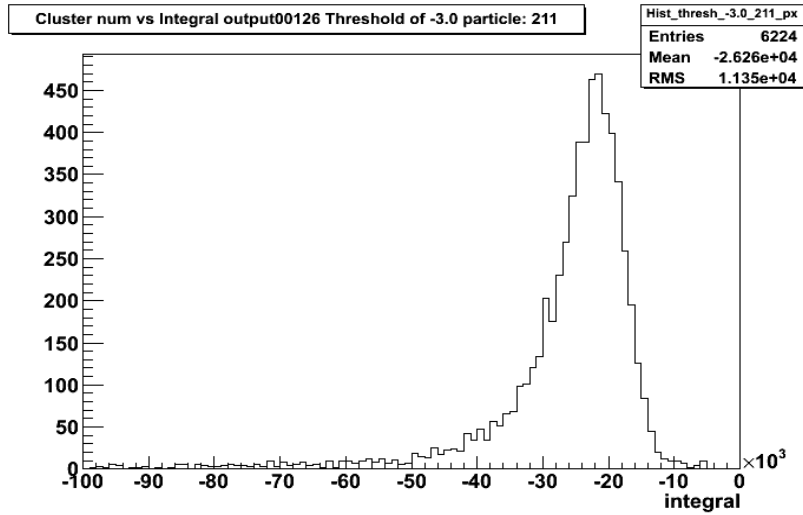
March 21, 2012

Threshold $a=5$
 $n=5$
 Particle = Pion
 Gas: 80/20

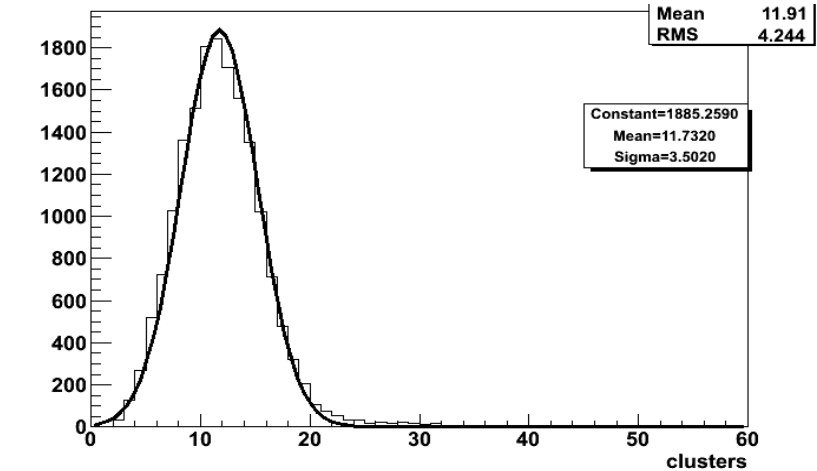
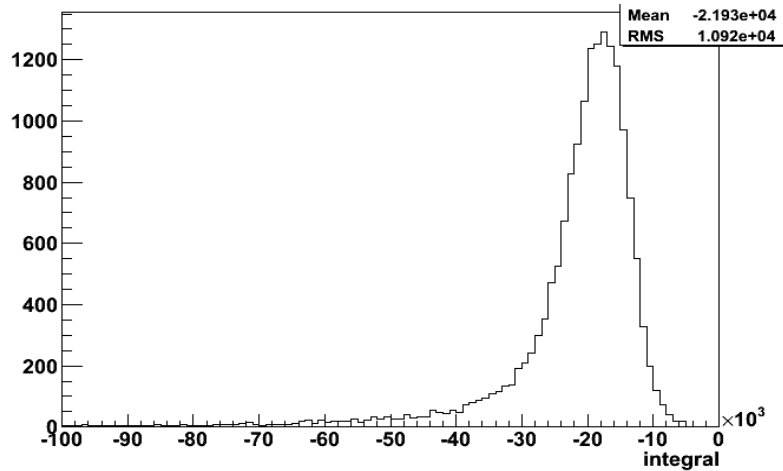
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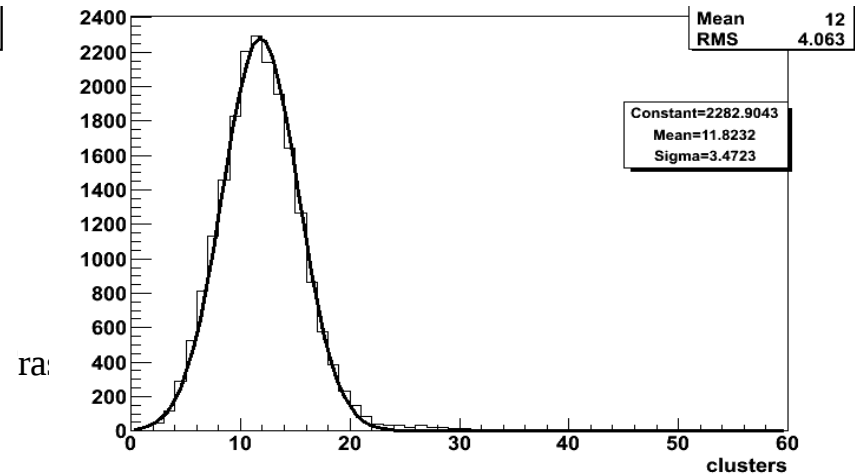
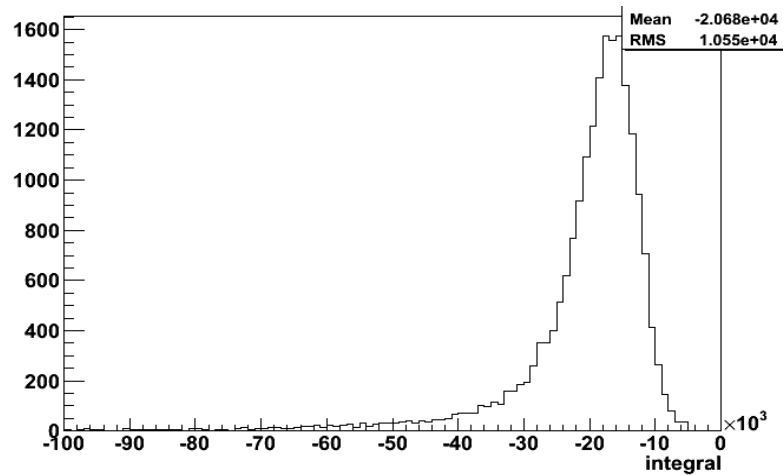
$p=140\text{MeV}/c$
 6224 entries



$p=180\text{MeV}/c$
 17062 entries



$p=220\text{MeV}/c$
 20304 entries



March 21, 2012

Threshold $a=6$

$n=5$

Particle = Pion

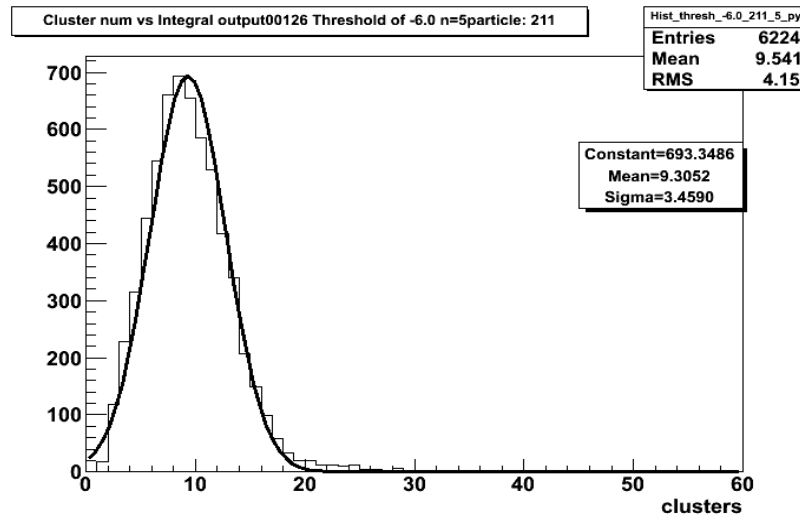
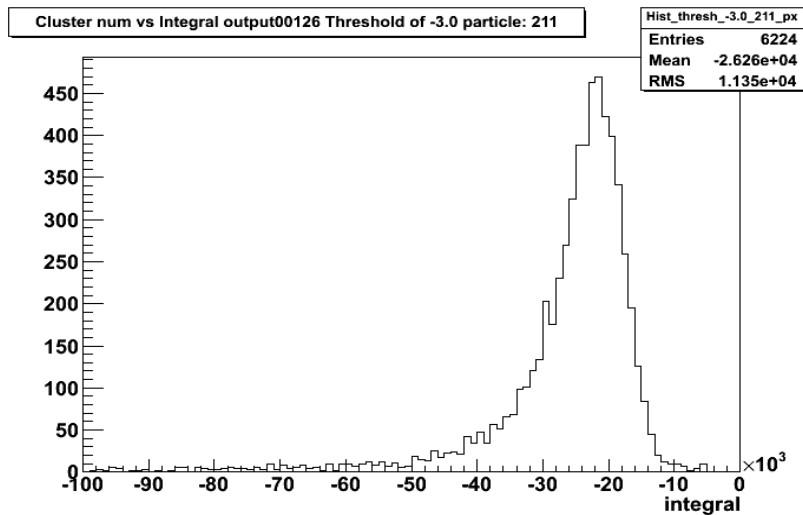
Gas: 80/20

Integral of Signal

Distribution of detected clusters

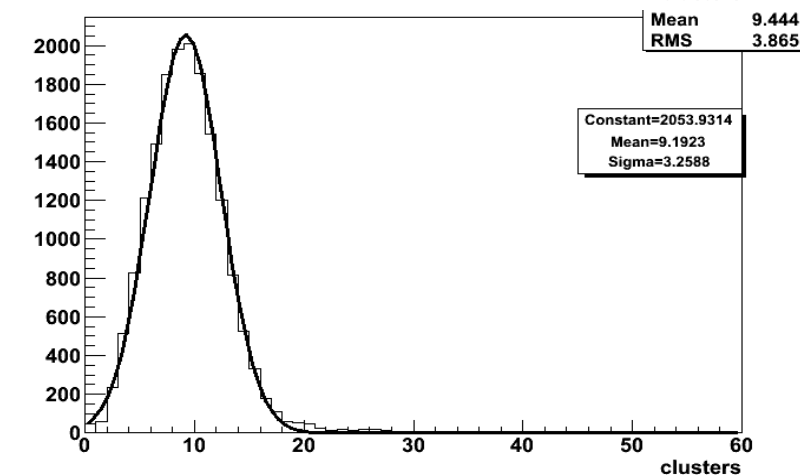
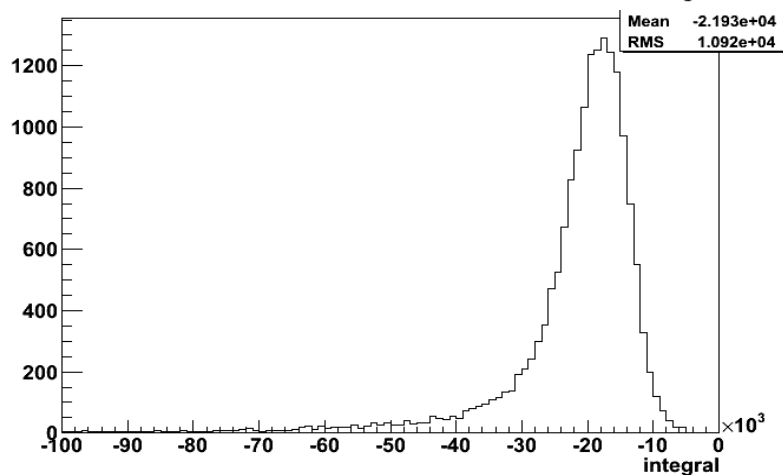
$p=140\text{MeV}/c$

6224 entries



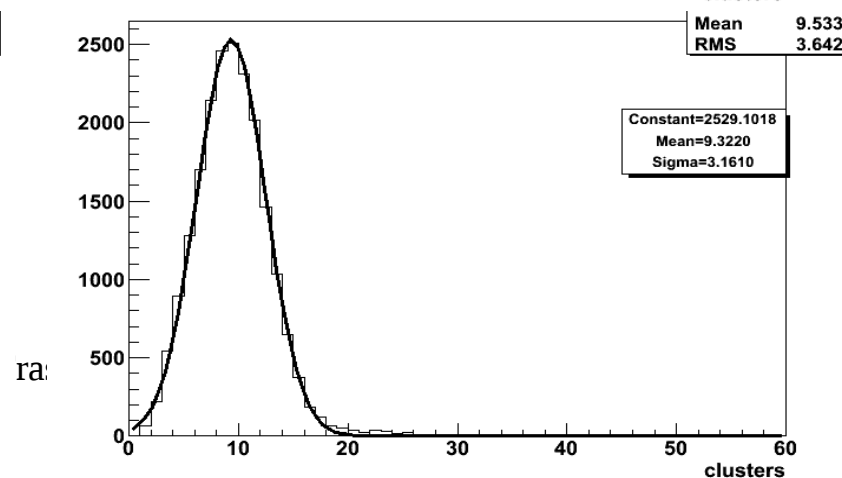
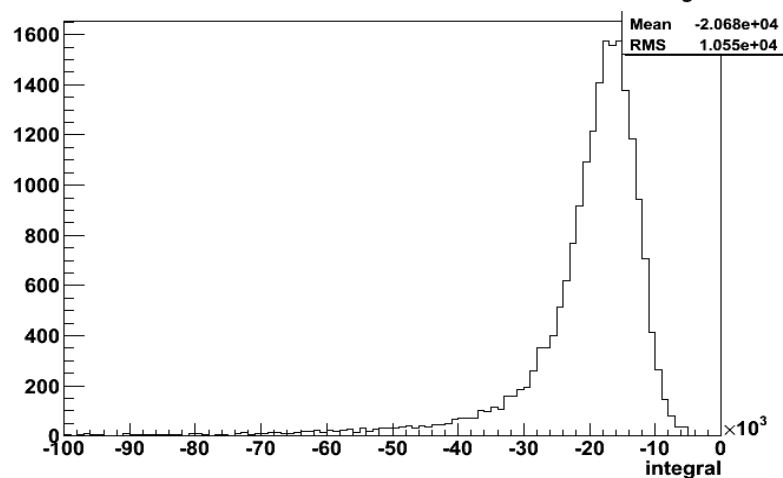
$p=180\text{MeV}/c$

17062 entries



$p=220\text{MeV}/c$

20304 entries



March 21, 2012

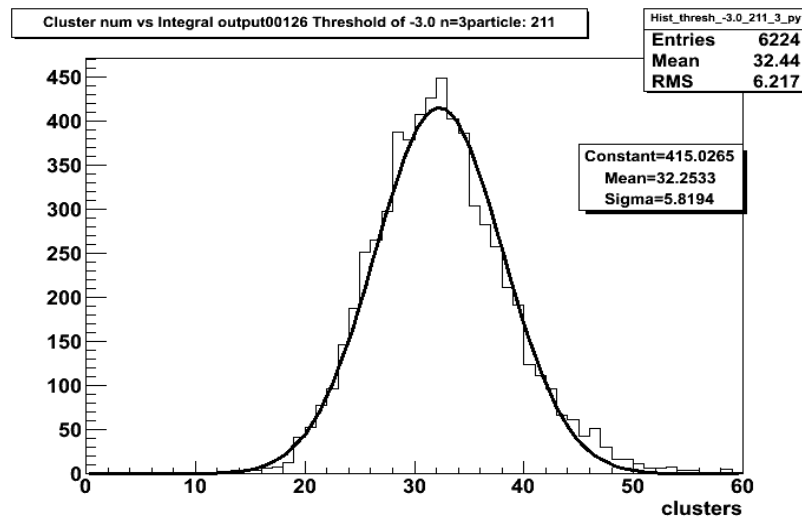
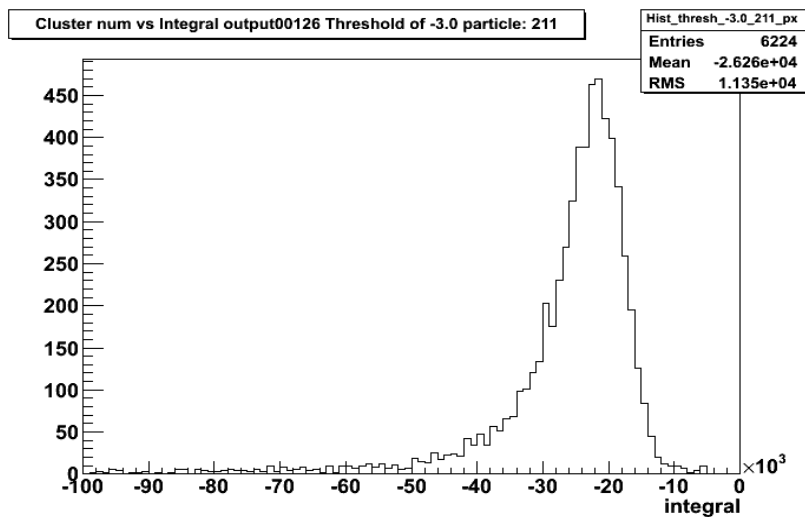
Pions, $n=3$
80/20

Threshold $a=3$
 $n=3$
 Particle = Pion
 Gas: 80/20

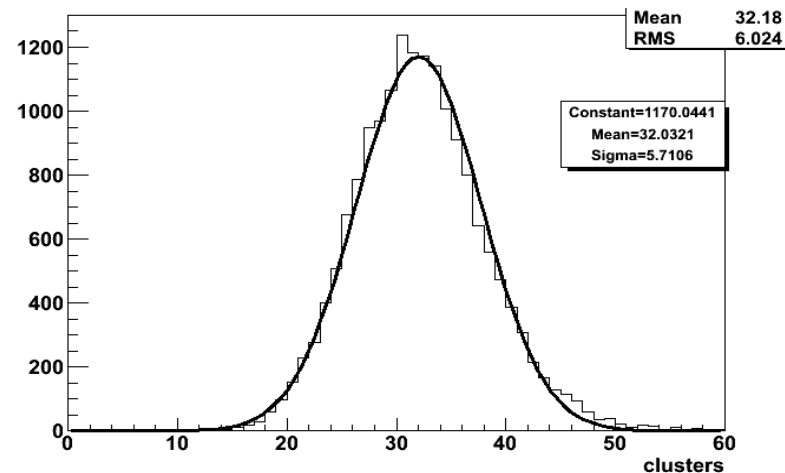
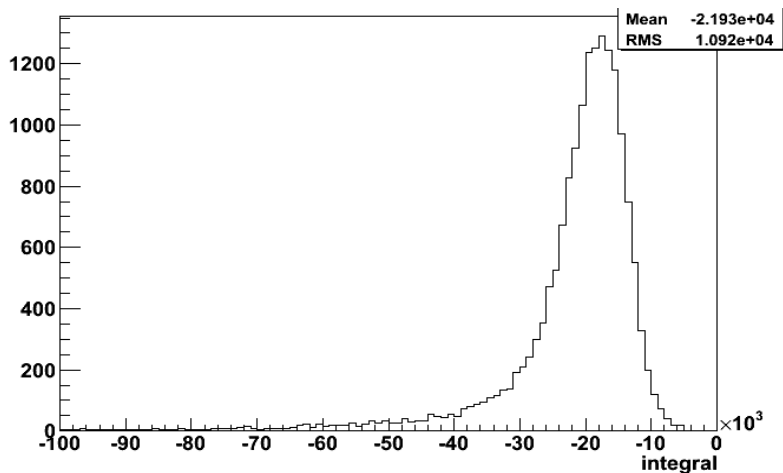
Integral of Signal

Distribution of detected clusters

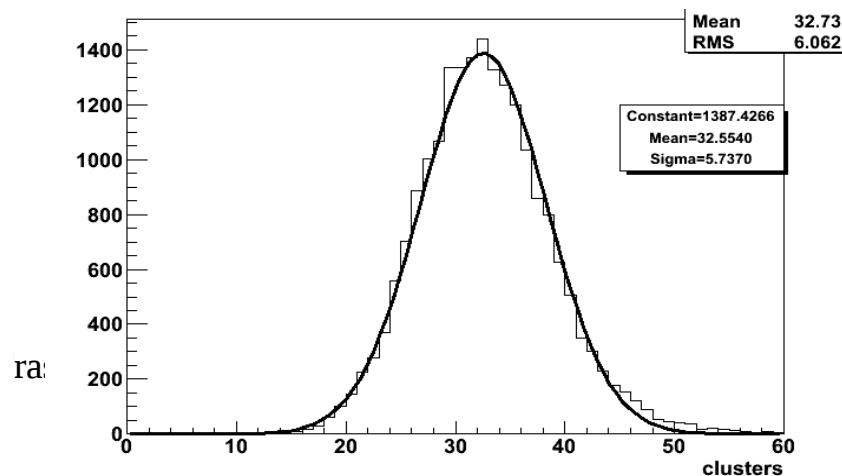
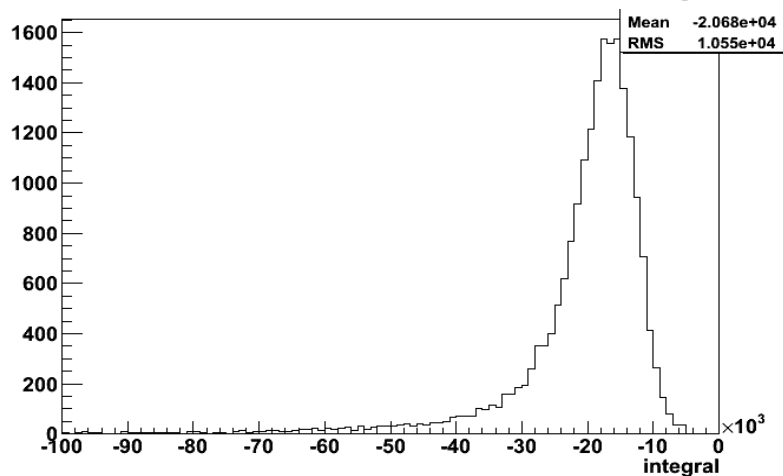
$p=140\text{MeV}/c$
 6224 entries



$p=180\text{MeV}/c$
 17062 entries



$p=220\text{MeV}/c$
 20304 entries



March 21, 2012

Threshold $a=3.3$

$n=3$

Particle = Pion

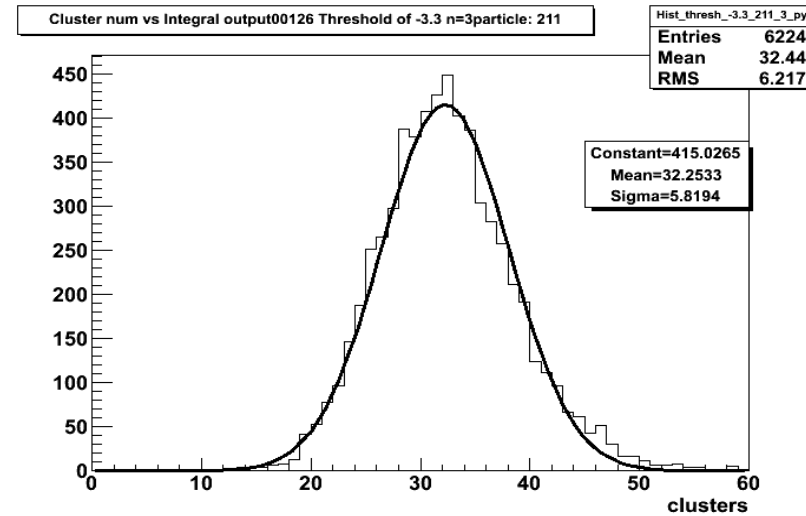
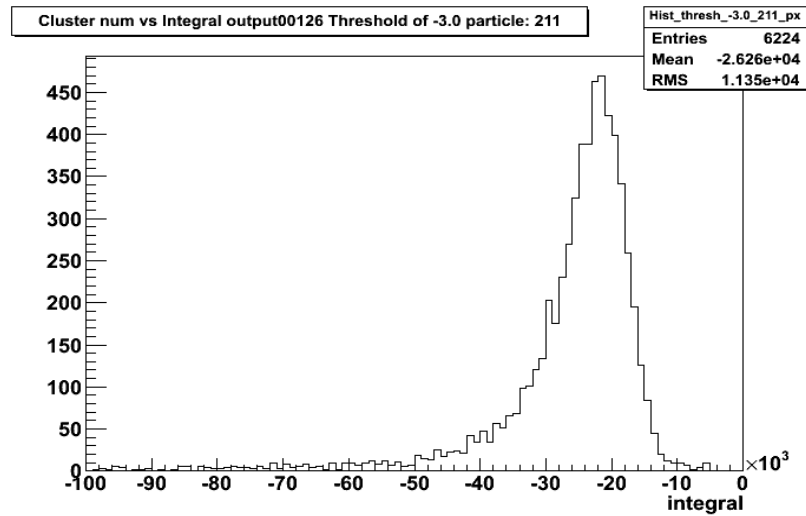
Gas: 80/20

Integral of Signal

Distribution of detected clusters

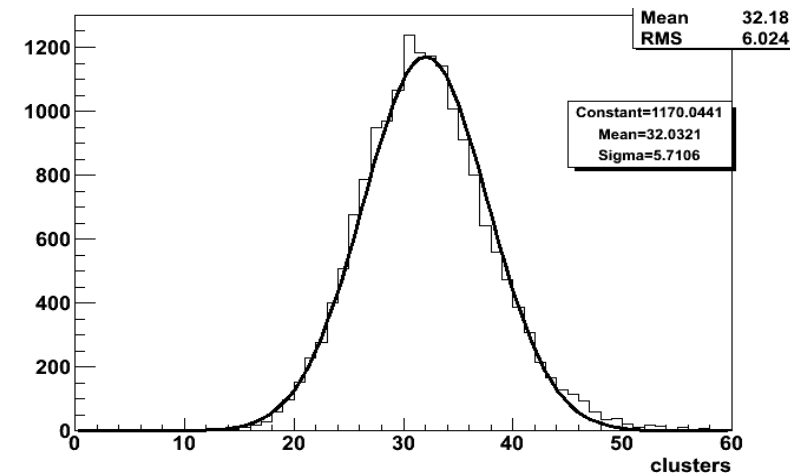
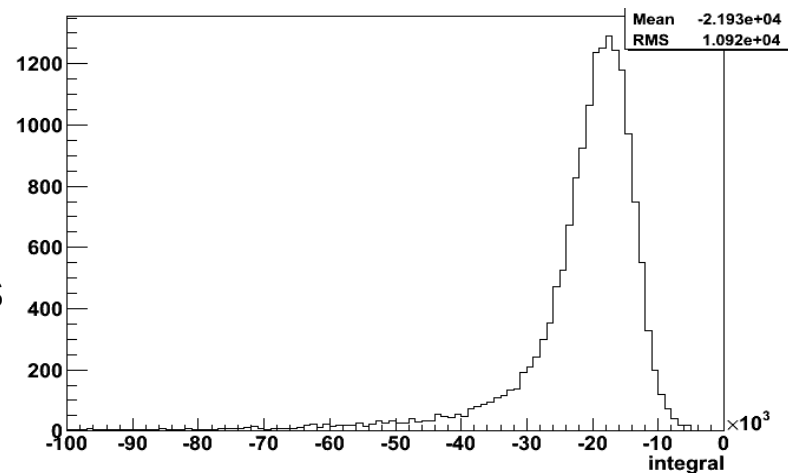
$p=140\text{MeV}/c$

6224 entries



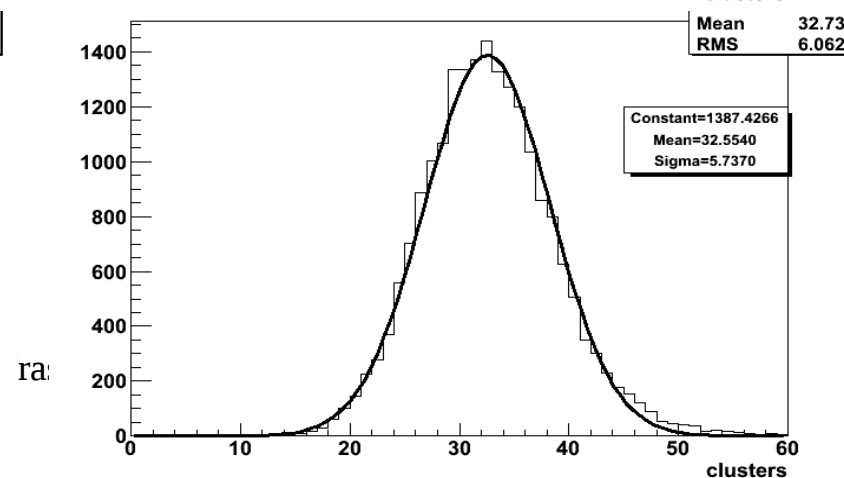
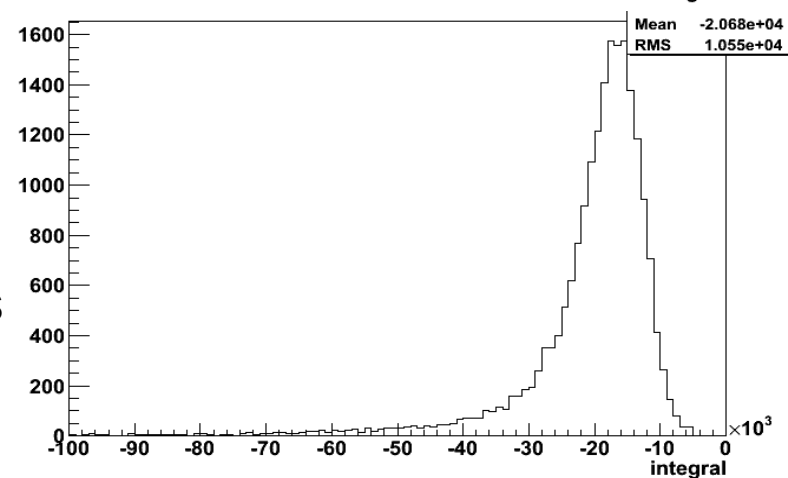
$p=180\text{MeV}/c$

17062 entries



$p=220\text{MeV}/c$

20304 entries



March 21, 2012

Threshold $a=3.5$

$n=3$

Particle = Pion

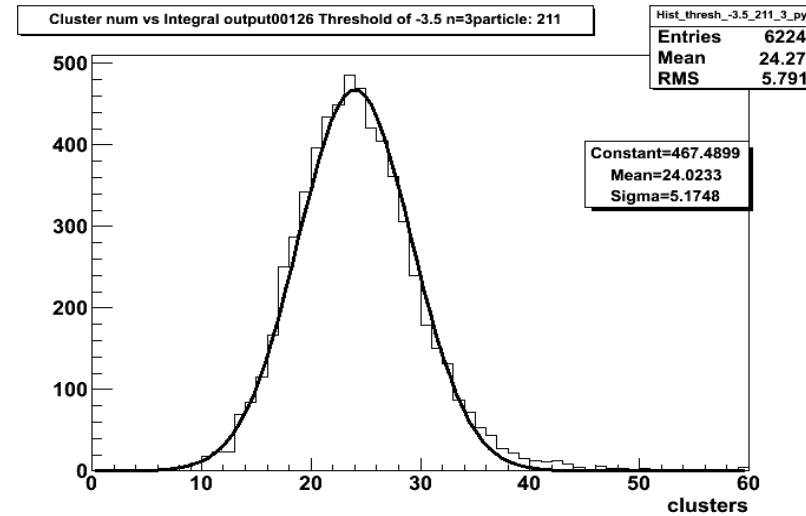
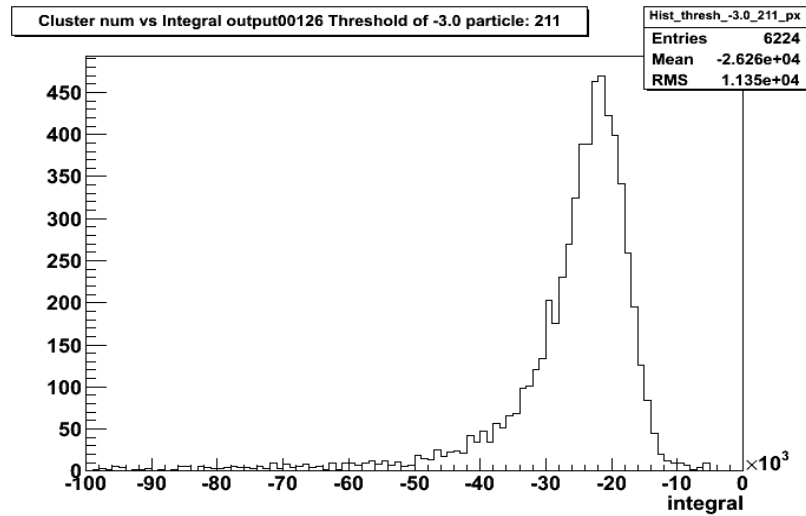
Gas: 80/20

Integral of Signal

Distribution of detected clusters

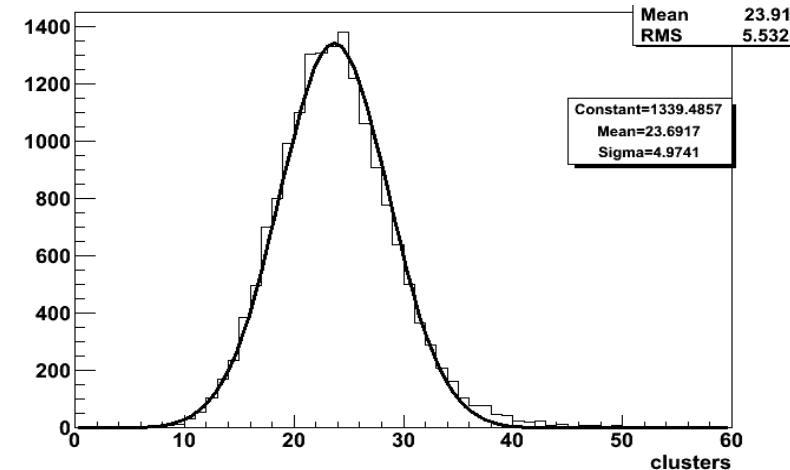
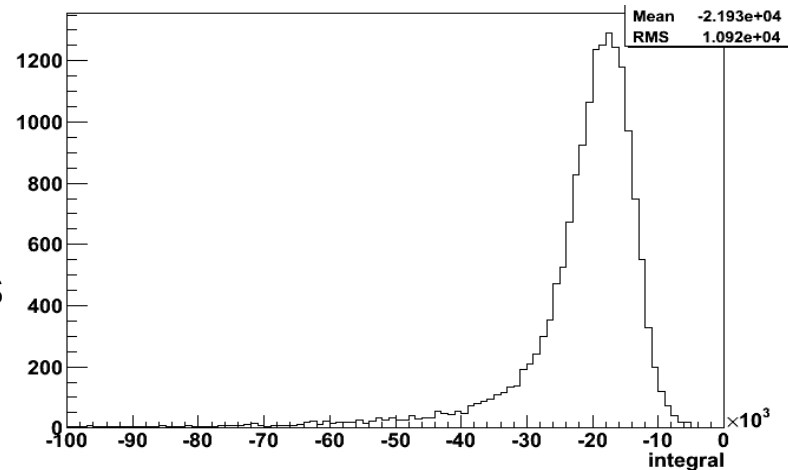
$p=140\text{MeV}/c$

6224 entries



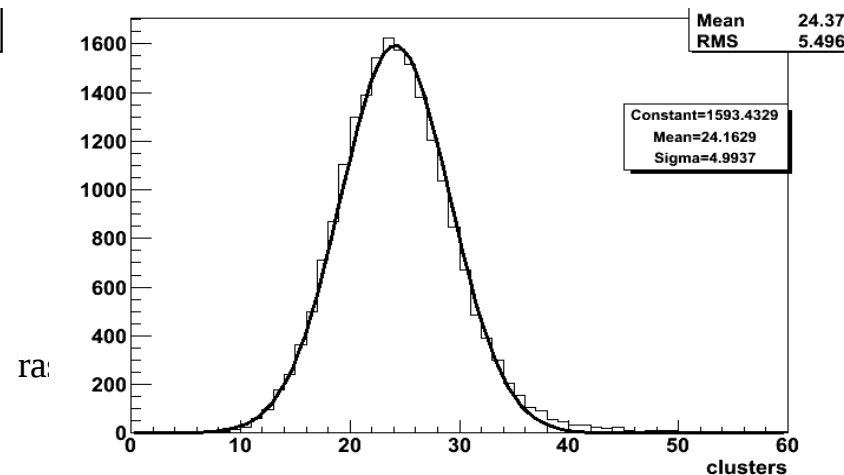
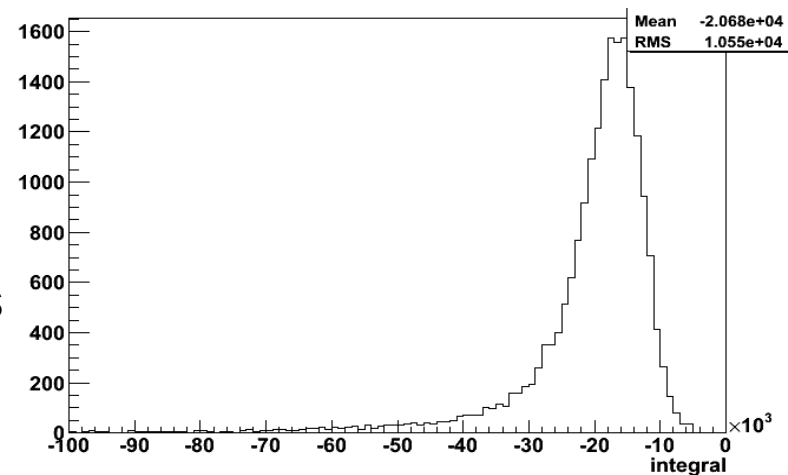
$p=180\text{MeV}/c$

17062 entries



$p=220\text{MeV}/c$

20304 entries



March 21, 2012

Threshold $a=3.7$

$n=3$

Particle = Pion

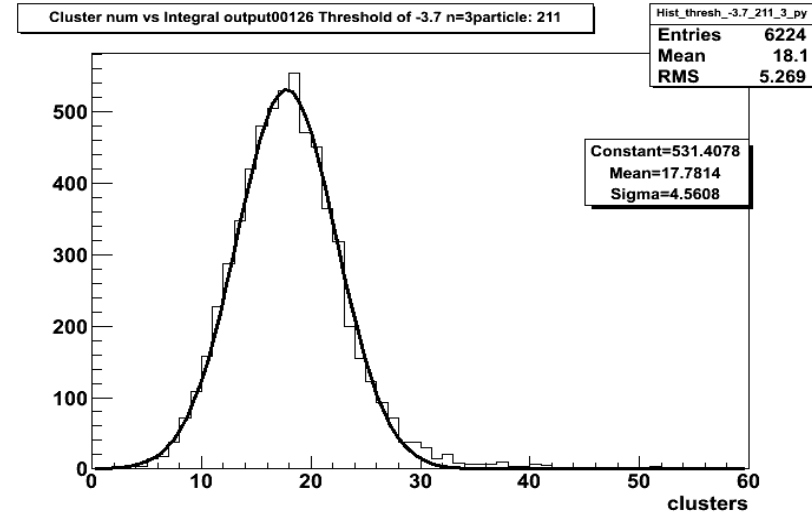
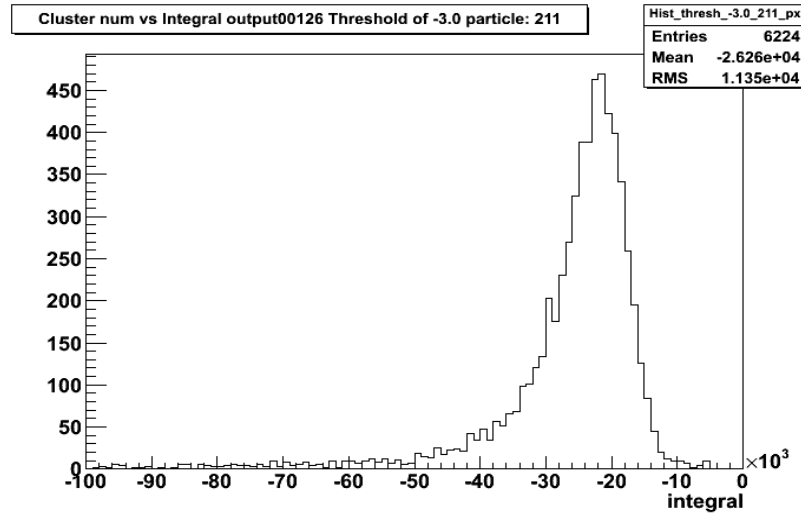
Gas: 80/20

Integral of Signal

Distribution of detected clusters

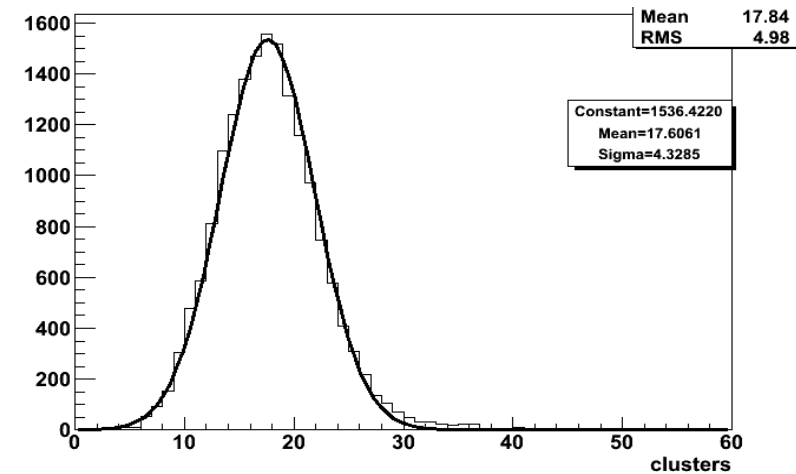
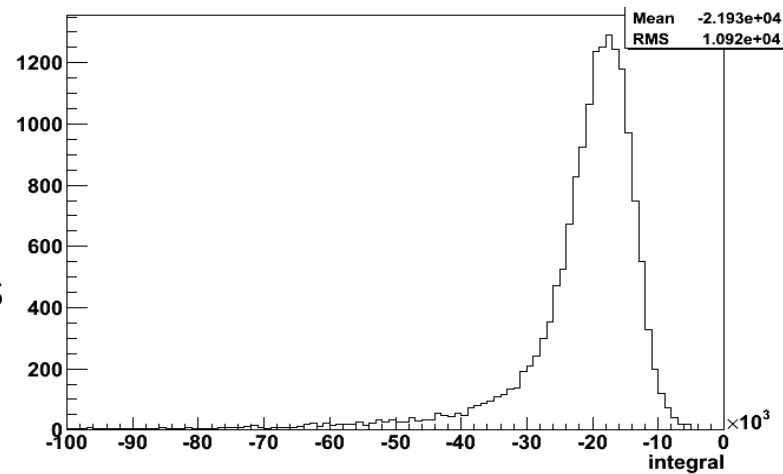
$p=140\text{MeV}/c$

6224 entries



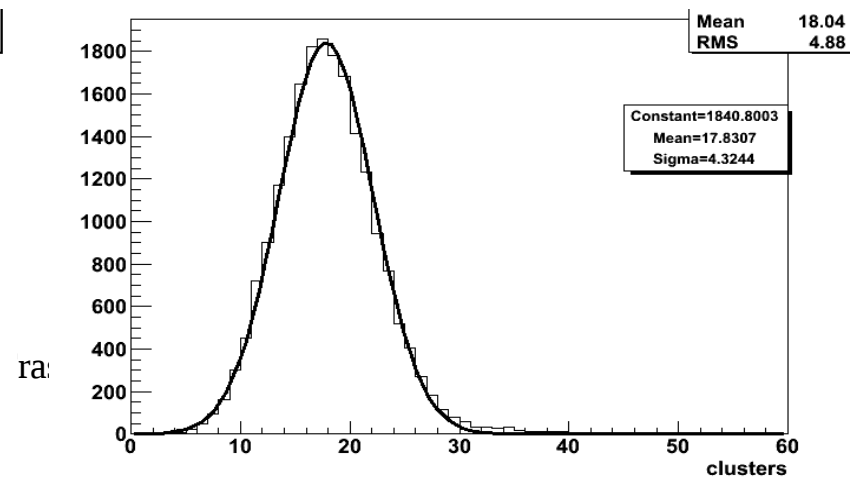
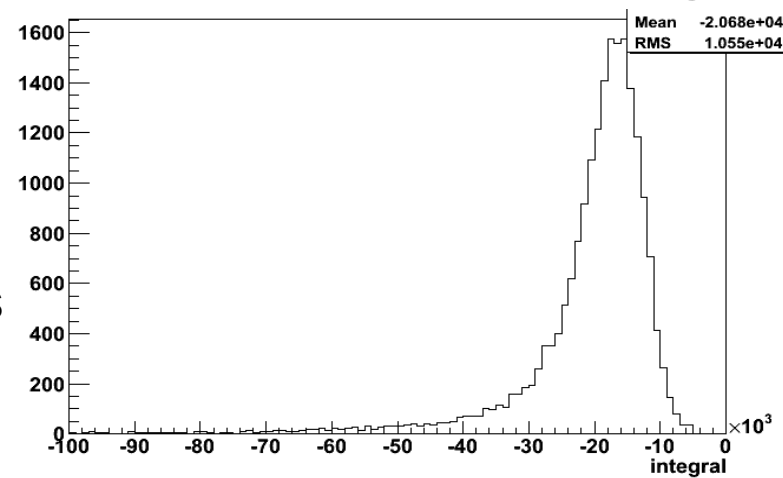
$p=180\text{MeV}/c$

17062 entries



$p=220\text{MeV}/c$

20304 entries



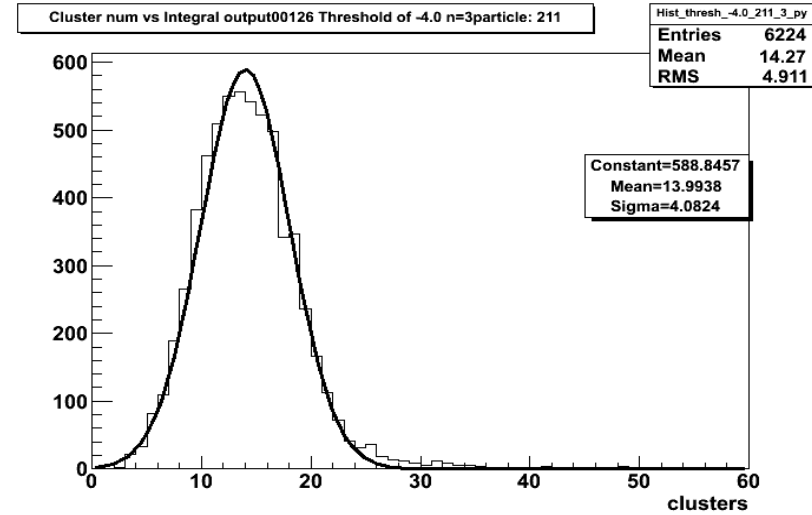
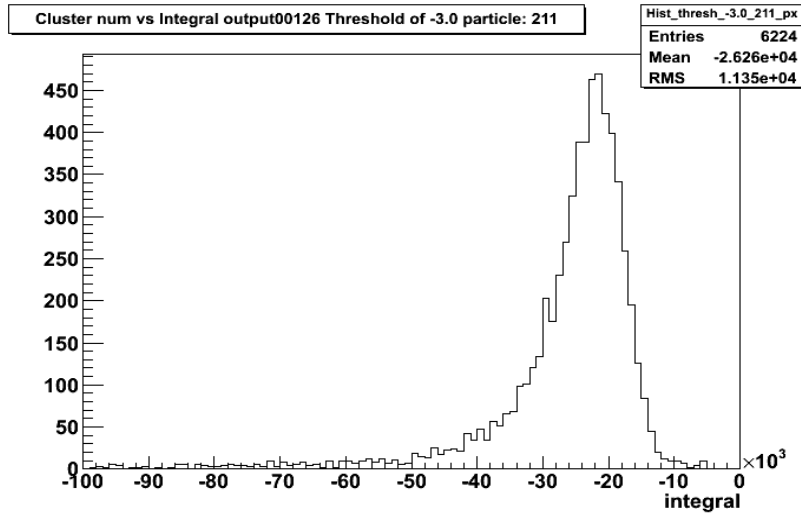
March 21, 2012

Threshold $a=4$
 $n=3$
 Particle = Pion
 Gas: 80/20

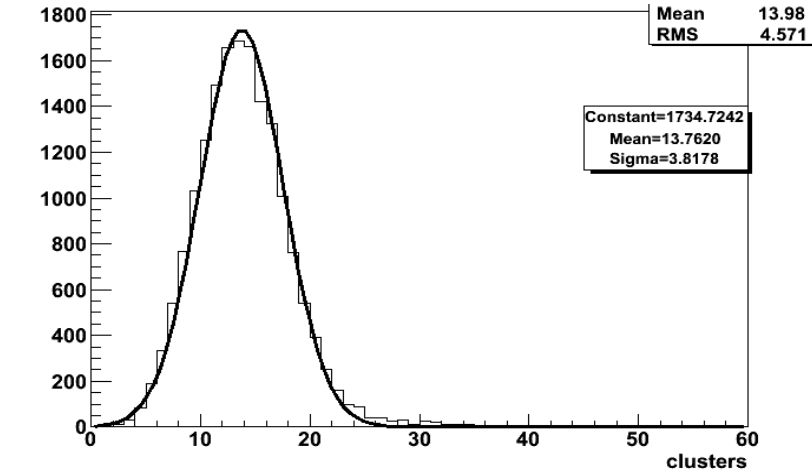
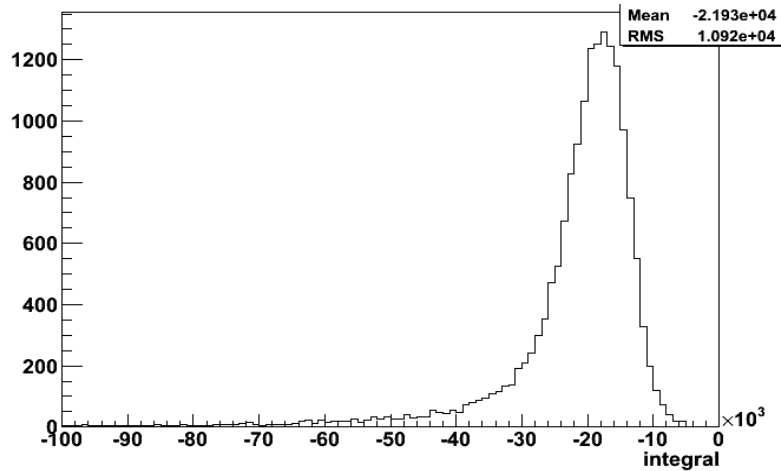
Integral of Signal

Distribution of detected clusters

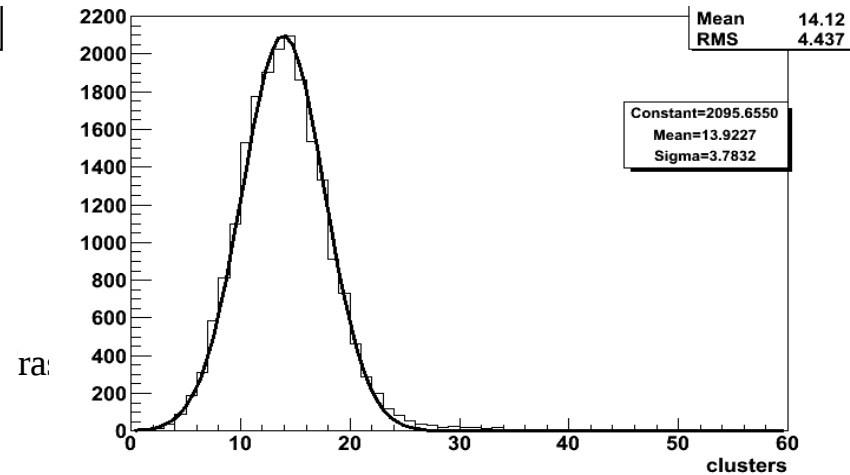
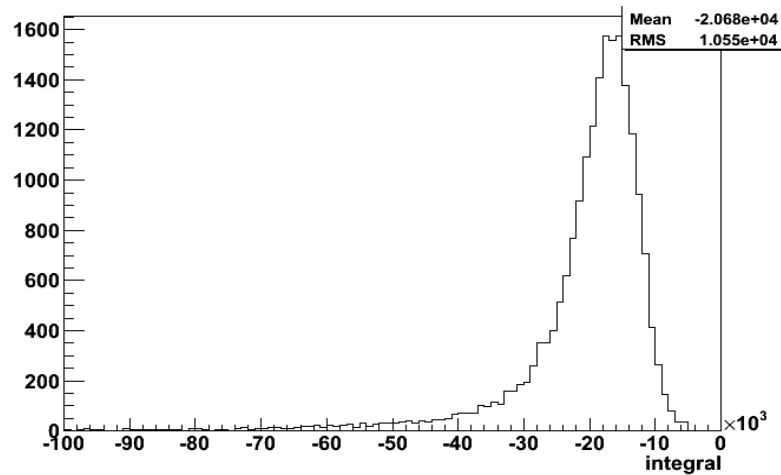
$p=140\text{MeV}/c$
 6224 entries



$p=180\text{MeV}/c$
 17062 entries



$p=220\text{MeV}/c$
 20304 entries



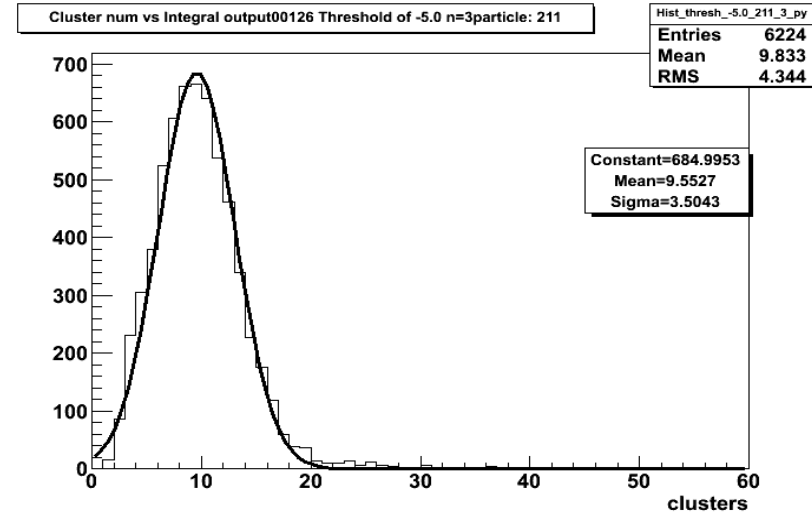
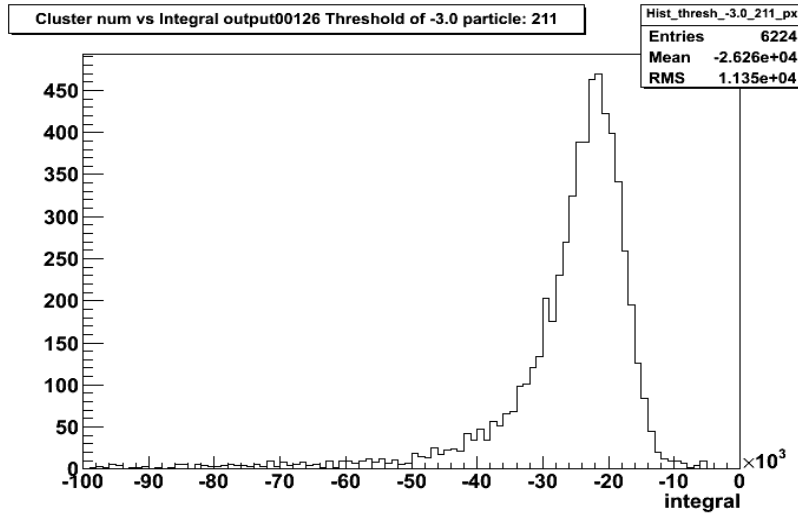
March 21, 2012

Threshold $a=5$
 $n=3$
 Particle = Pion
 Gas: 80/20

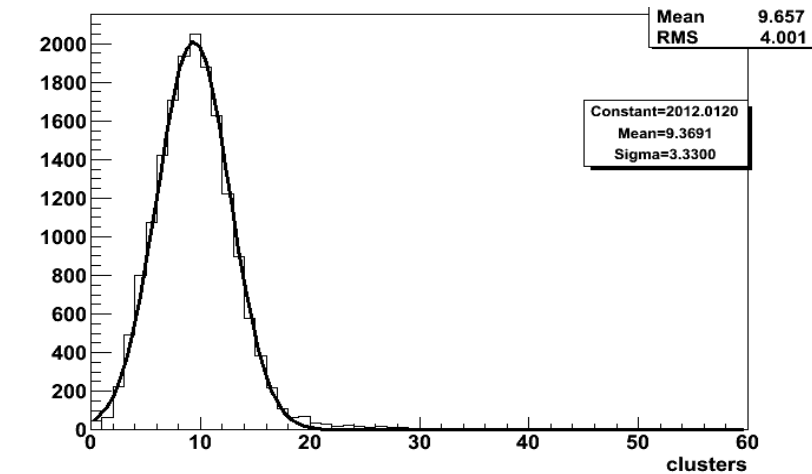
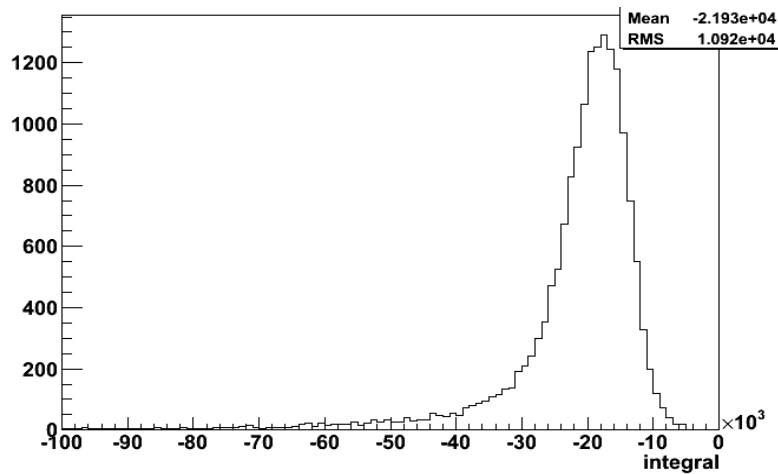
Integral of Signal

Distribution of detected clusters

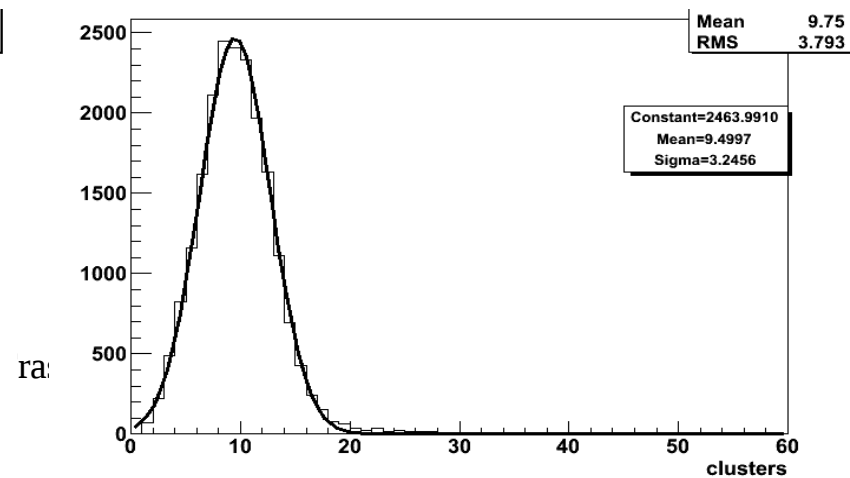
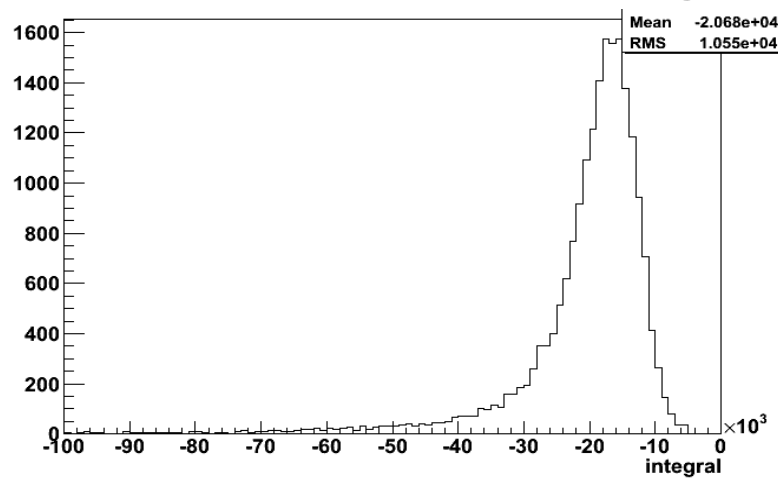
$p=140\text{MeV}/c$
 6224 entries



$p=180\text{MeV}/c$
 17062 entries



$p=220\text{MeV}/c$
 20304 entries



March 21, 2012

Threshold $a=6$

$n=3$

Particle = Pion

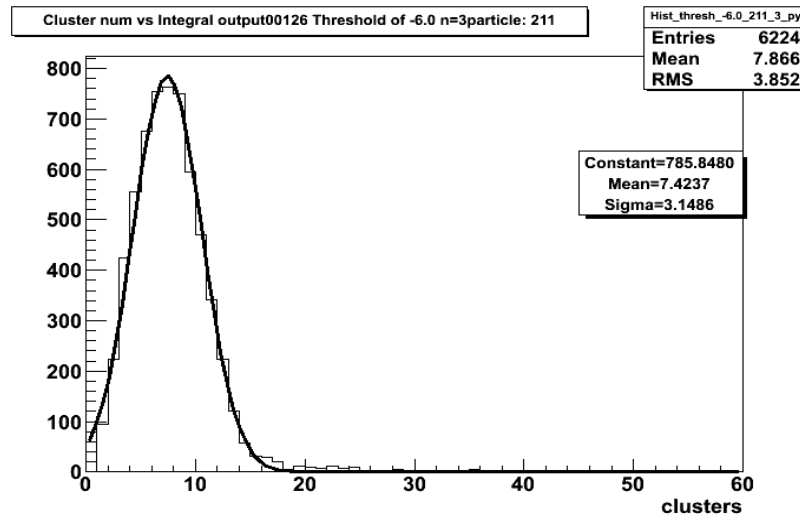
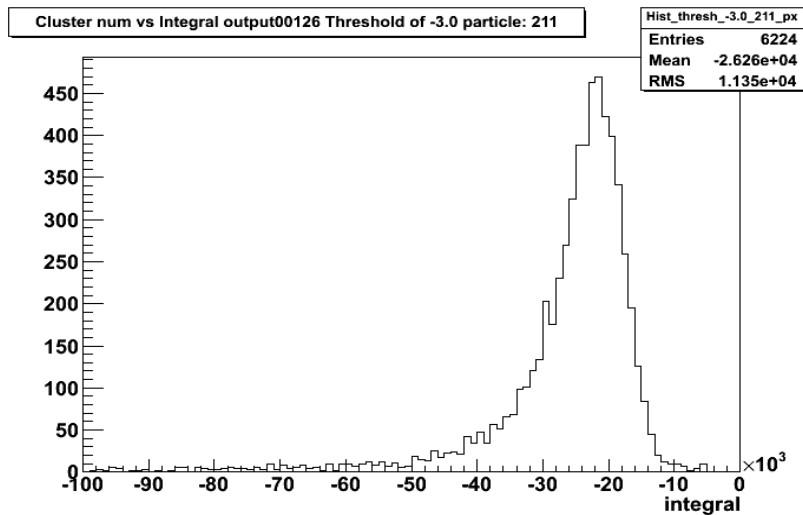
Gas: 80/20

Integral of Signal

Distribution of detected clusters

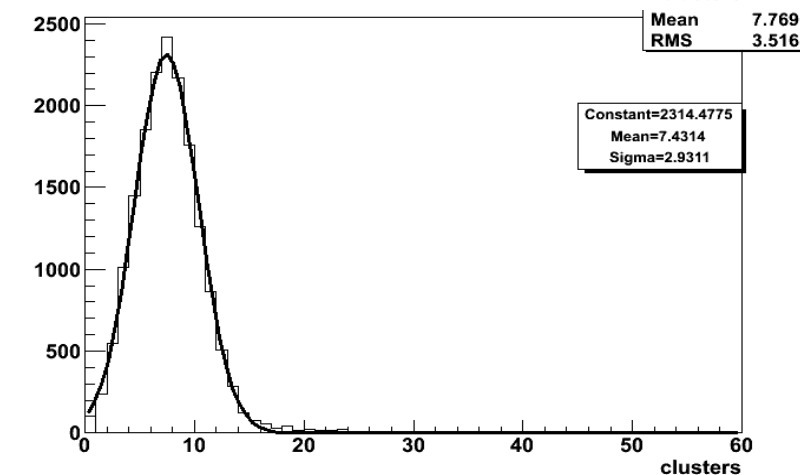
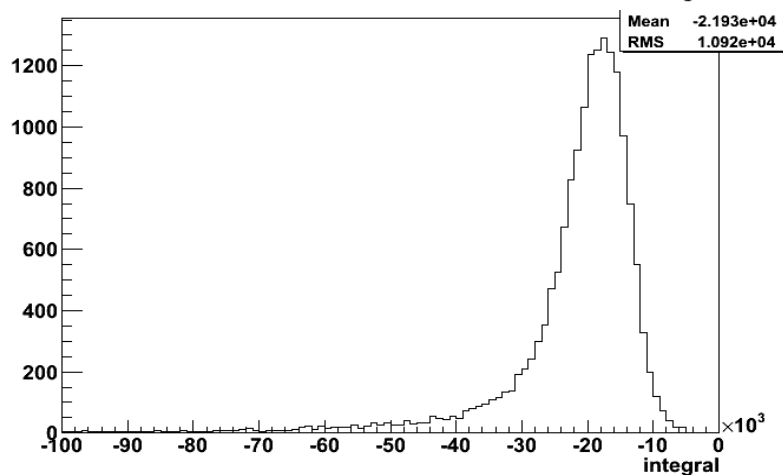
$p=140\text{MeV}/c$

6224 entries



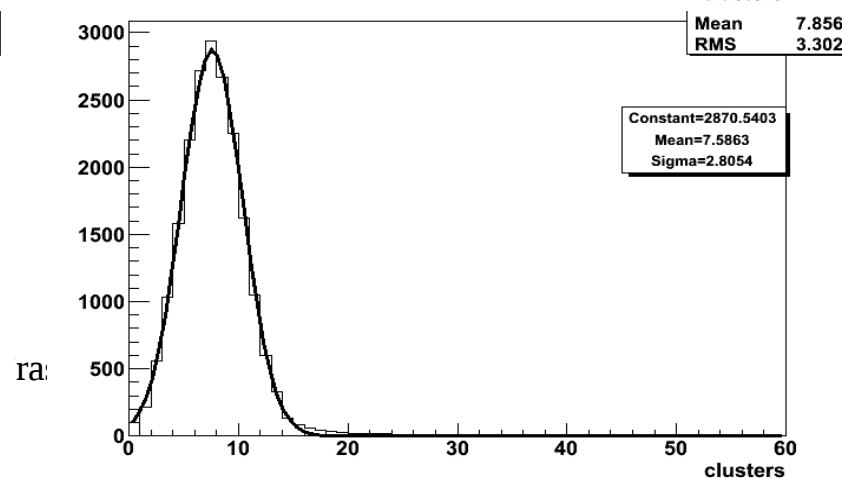
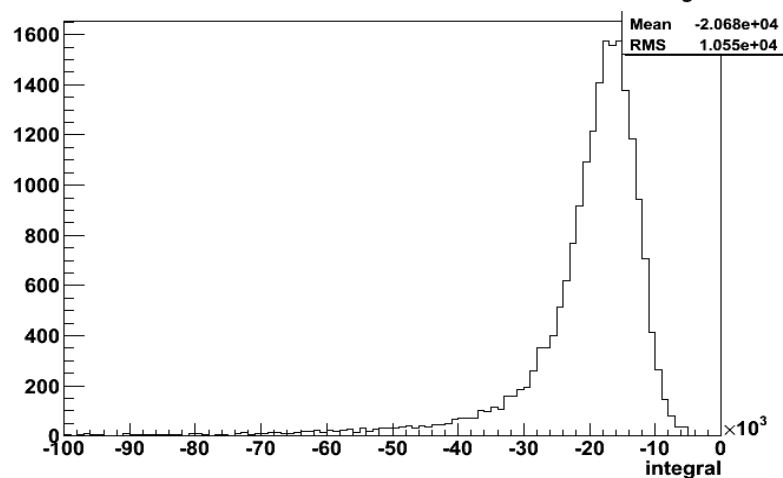
$p=180\text{MeV}/c$

17062 entries



$p=220\text{MeV}/c$

20304 entries



March 21, 2012

Muons, $n=5$
80/20

Threshold $a=3$

$n=5$

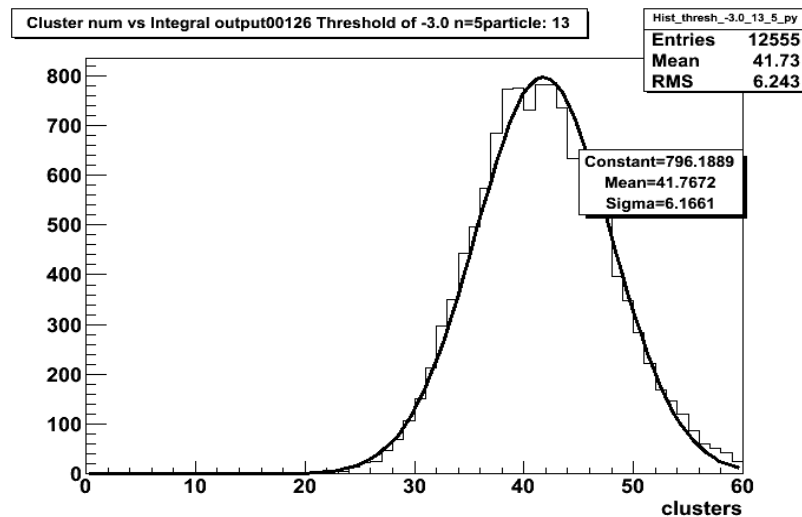
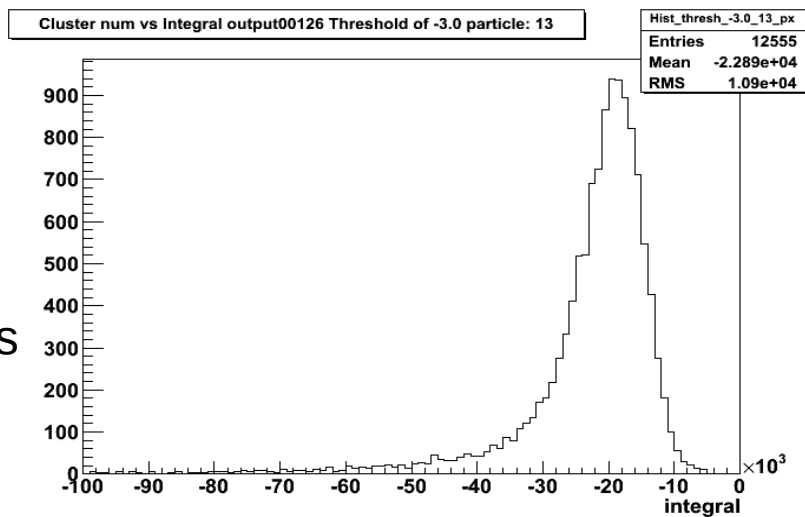
Particle = Muon

Gas: 80/20

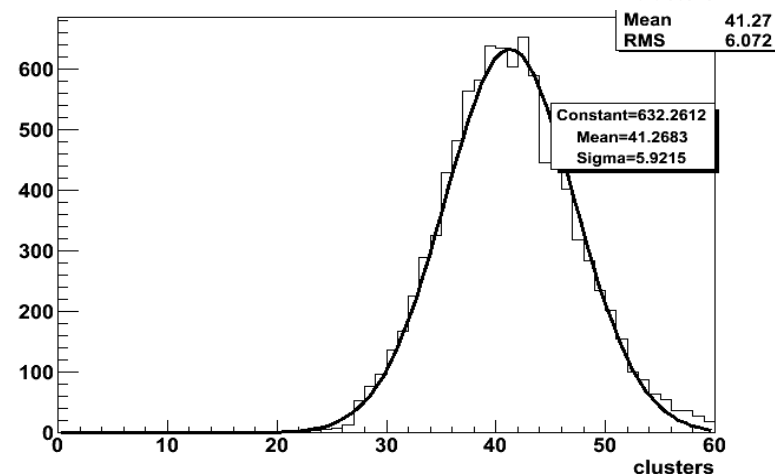
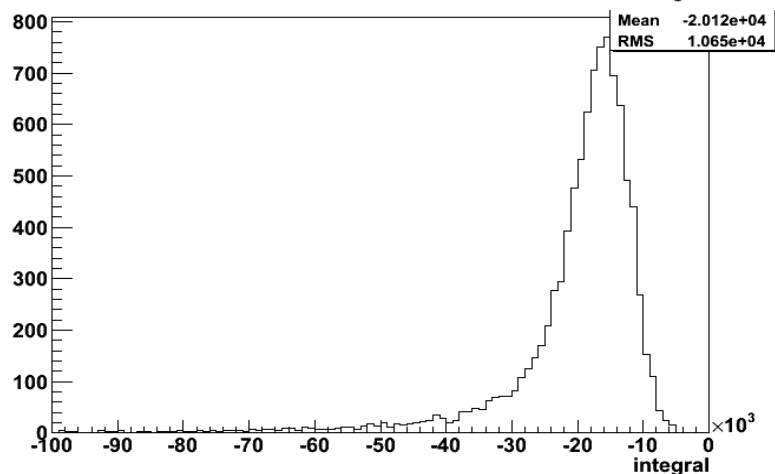
Integral of Signal

Distribution of detected clusters

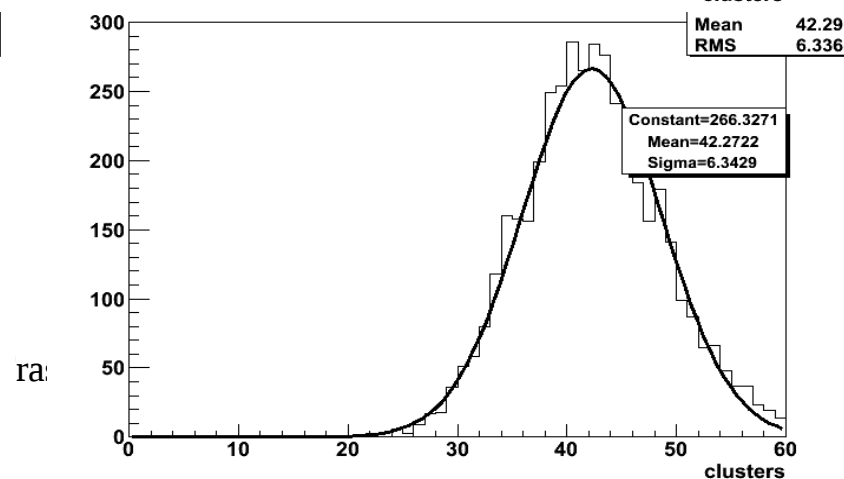
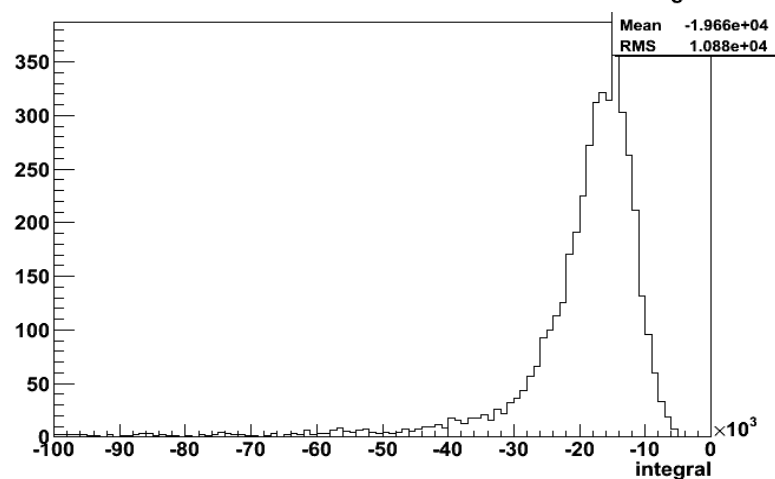
$p=140\text{MeV}/c$
12555 entries



$p=180\text{MeV}/c$
9609 entries



$p=220\text{MeV}/c$
4363 entries



March 21, 2012

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Threshold $a=3.3$

$n=5$

Particle = Muon

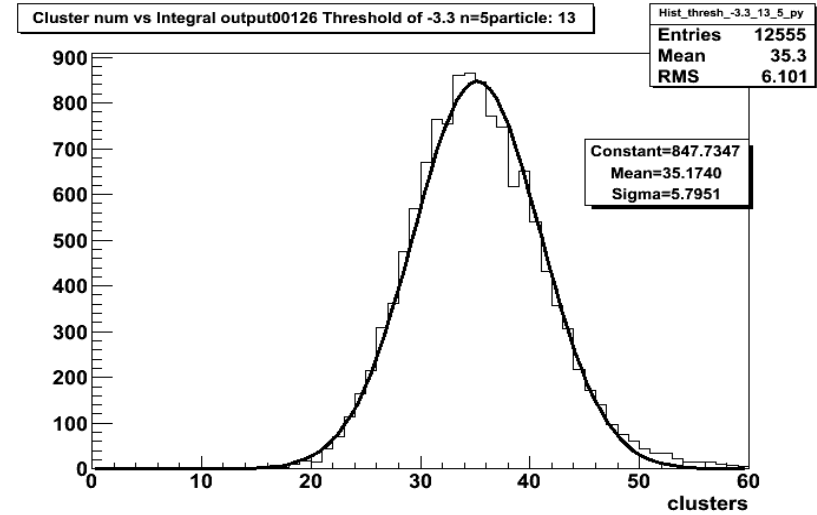
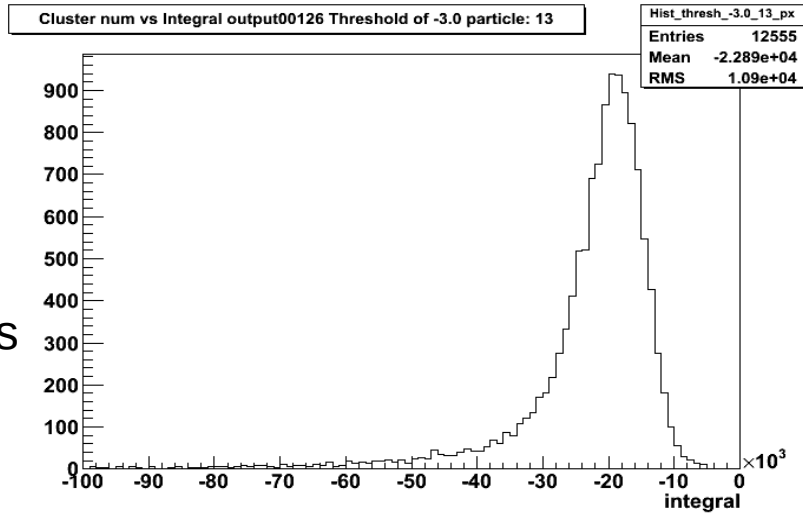
Gas: 80/20

Integral of Signal

Distribution of detected clusters

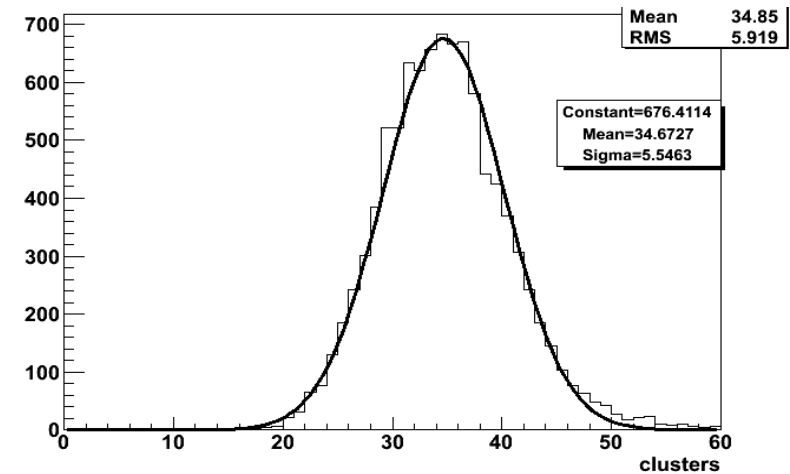
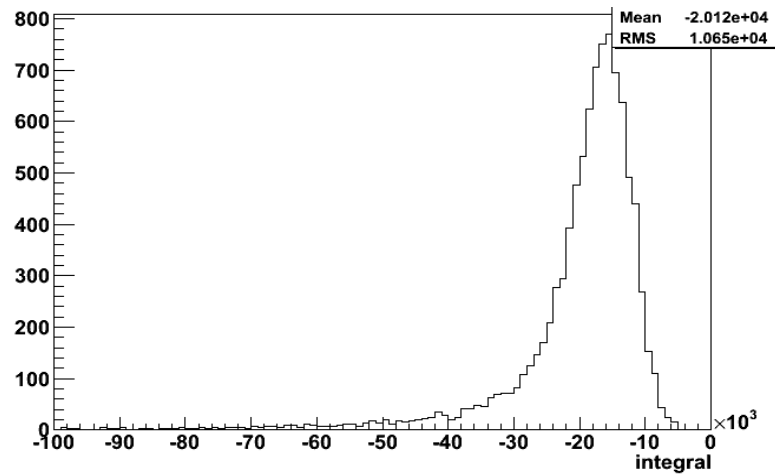
$p=140\text{MeV}/c$

12555 entries



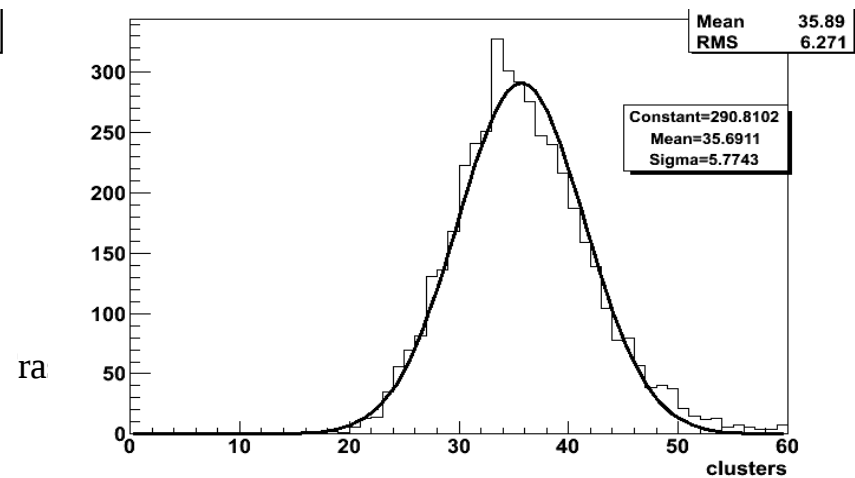
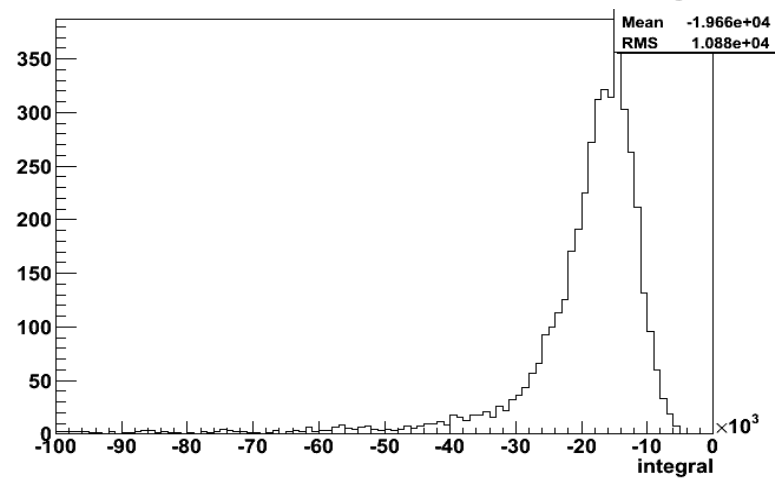
$p=180\text{MeV}/c$

9609 entries



$p=220\text{MeV}/c$

4363 entries



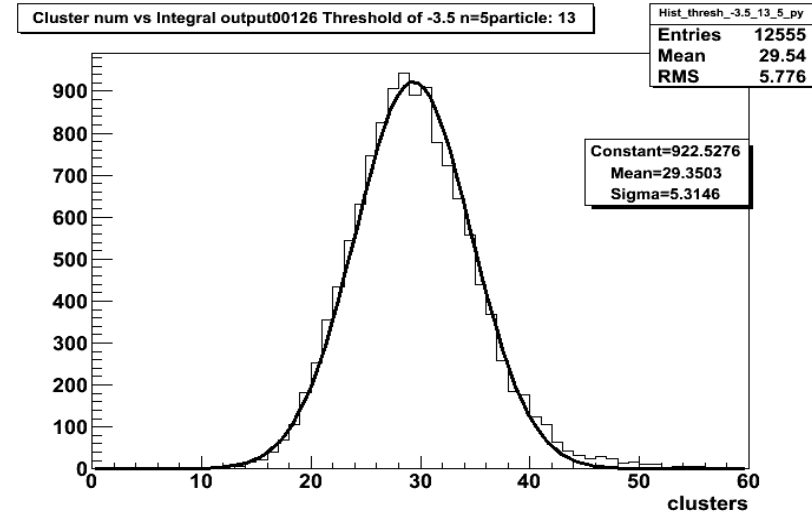
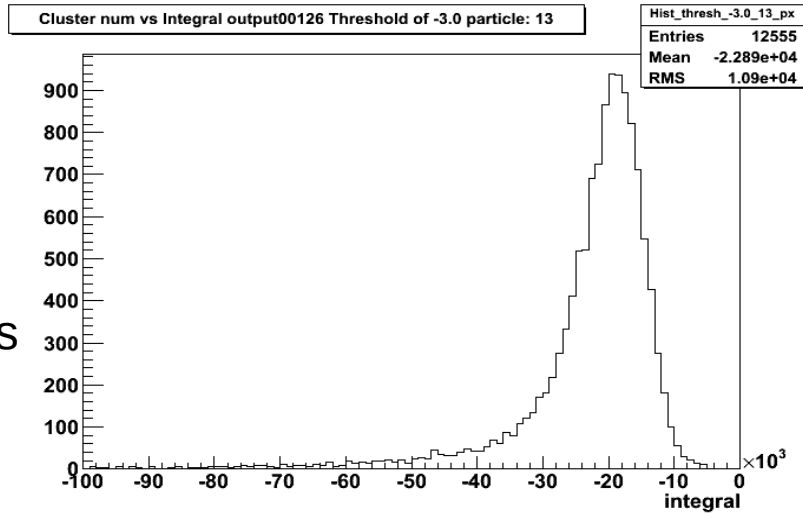
March 21, 2012

Threshold $a=3.5$
 $n=5$
 Particle = Muon
 Gas: 80/20

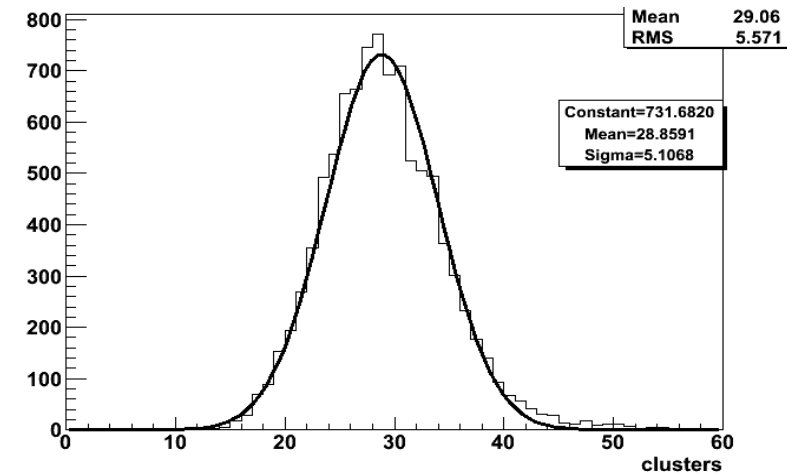
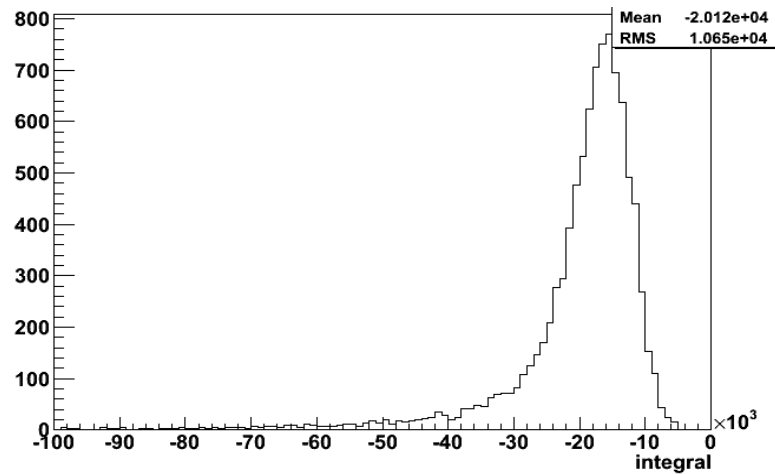
Integral of Signal

Distribution of detected clusters

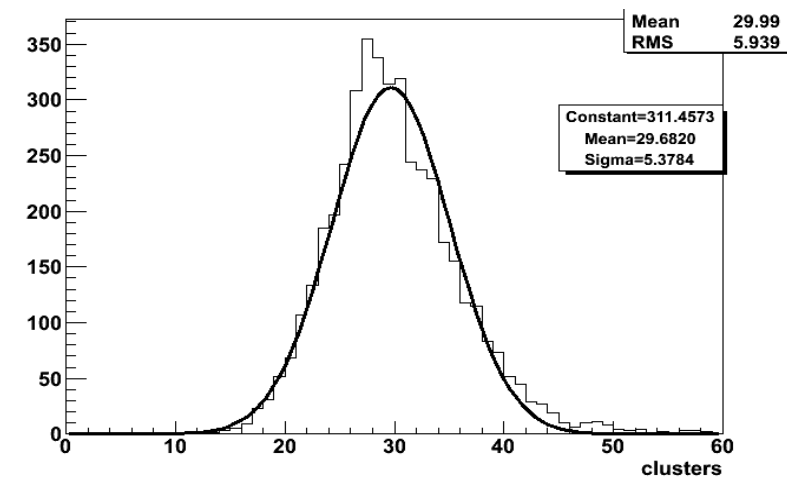
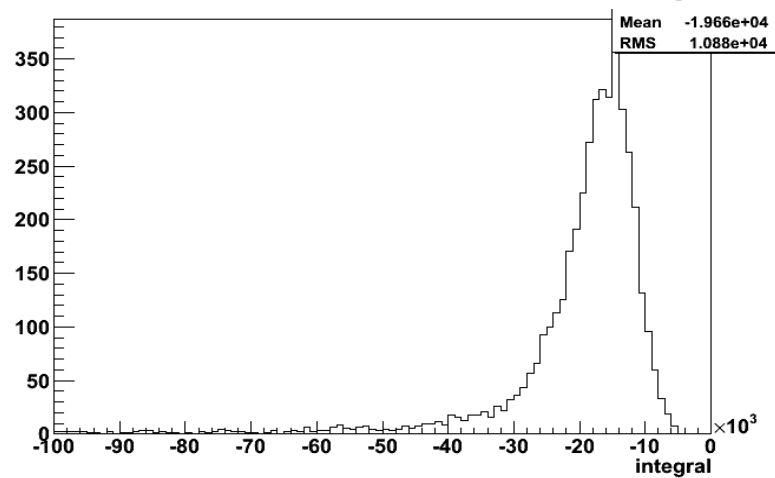
$p=140\text{MeV}/c$
 12555 entries



$p=180\text{MeV}/c$
 9609 entries



$p=220\text{MeV}/c$
 4363 entries



March 21, 2012

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Threshold $a=3.7$

$n=5$

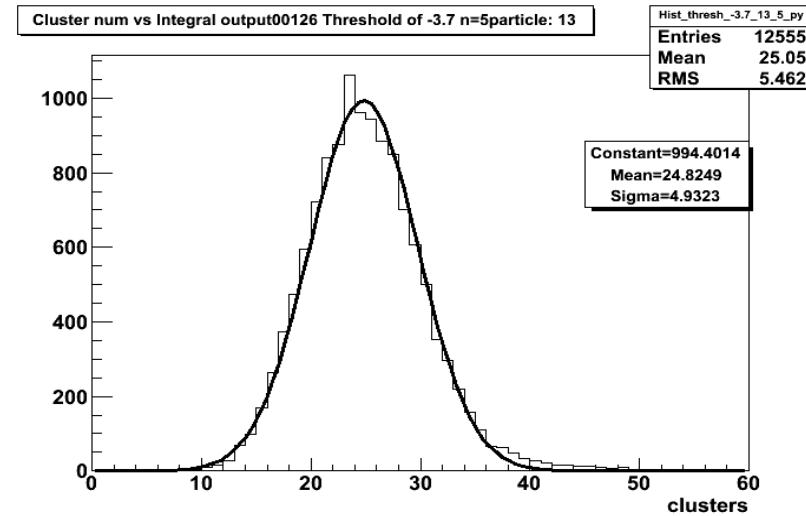
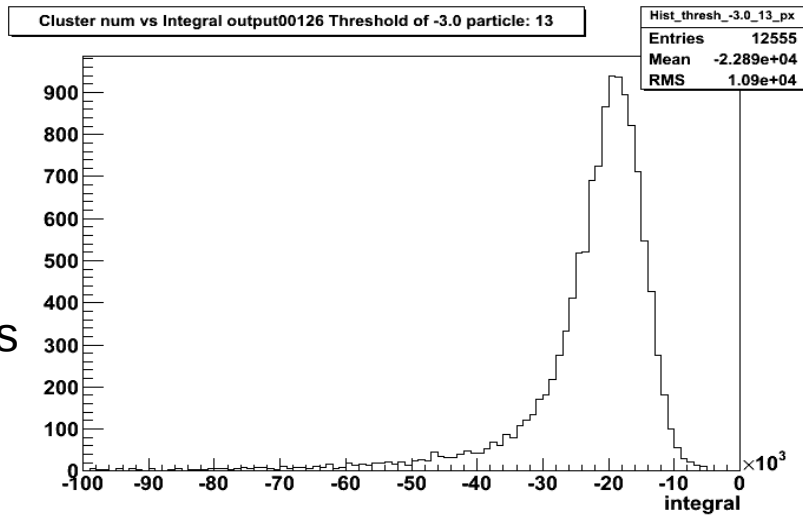
Particle = Muon

Gas: 80/20

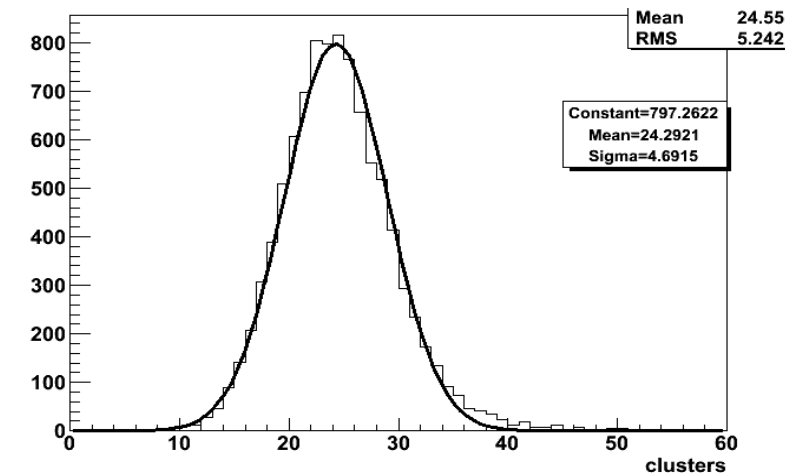
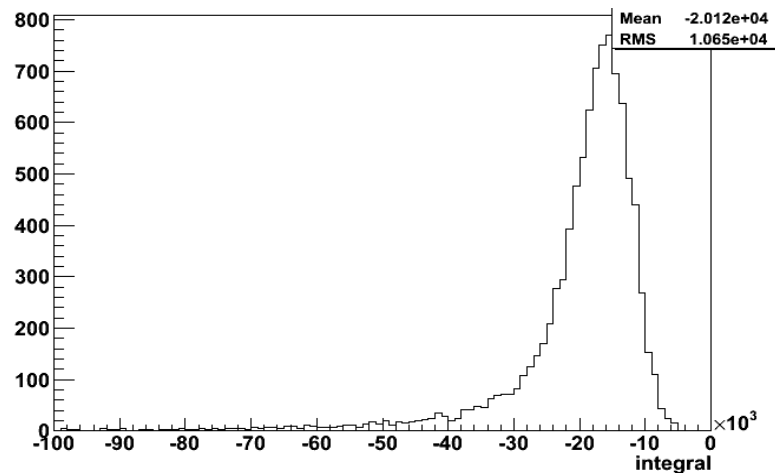
Integral of Signal

Distribution of detected clusters

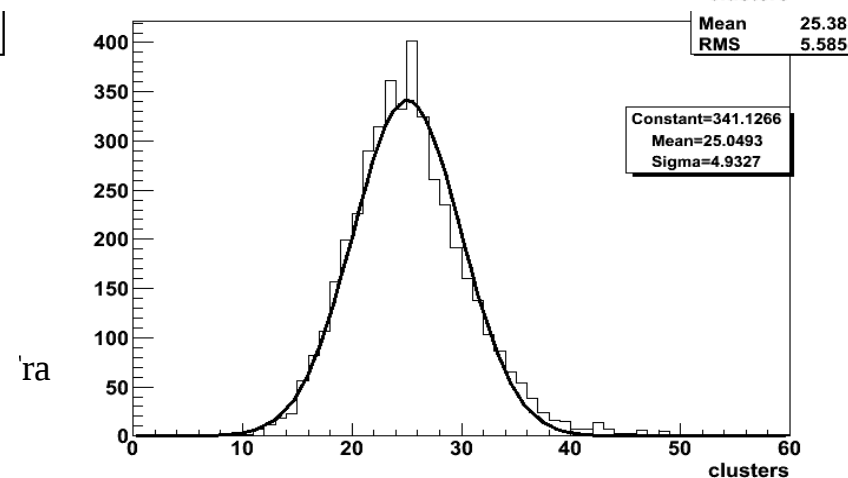
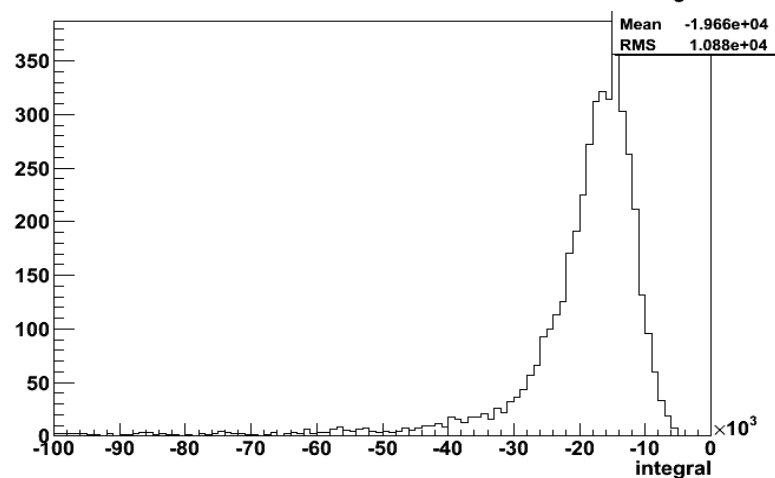
$p=140\text{MeV}/c$
12555 entries



$p=180\text{MeV}/c$
9609 entries



$p=220\text{MeV}/c$
4363 entries



March 21, 2012

Threshold $a=4$

$n=5$

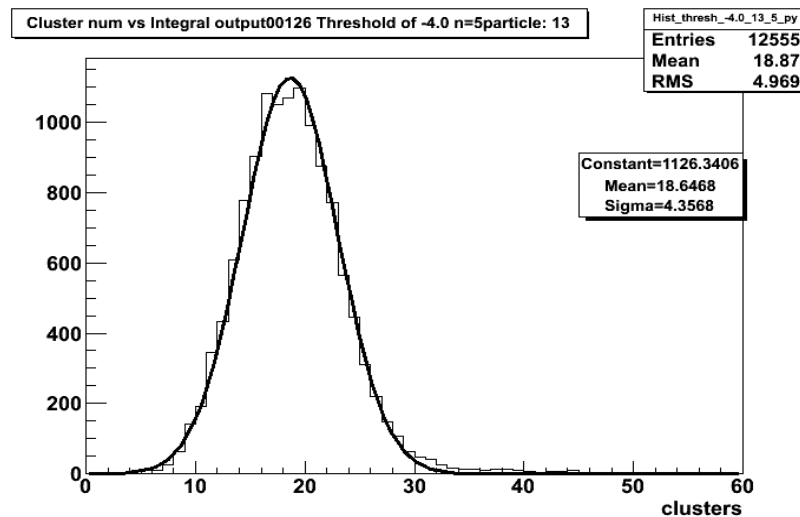
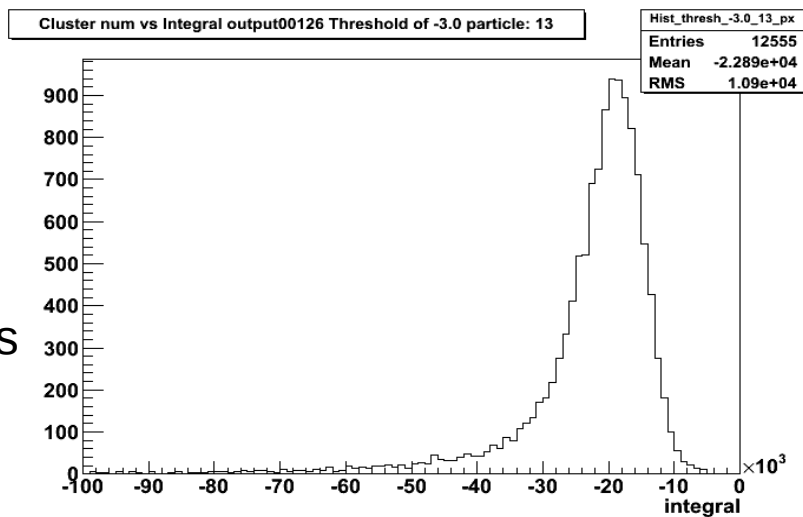
Particle = Muon

Gas: 80/20

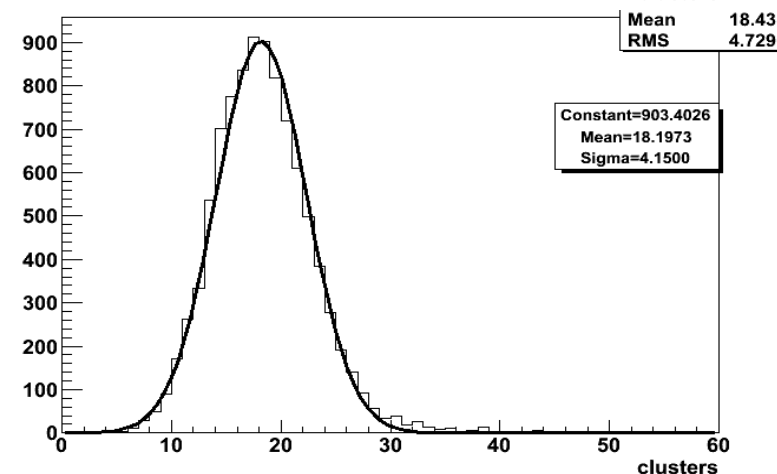
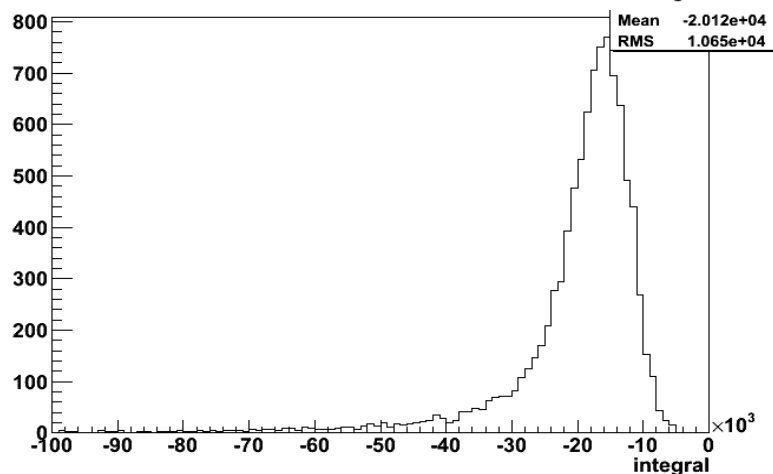
Integral of Signal

Distribution of detected clusters

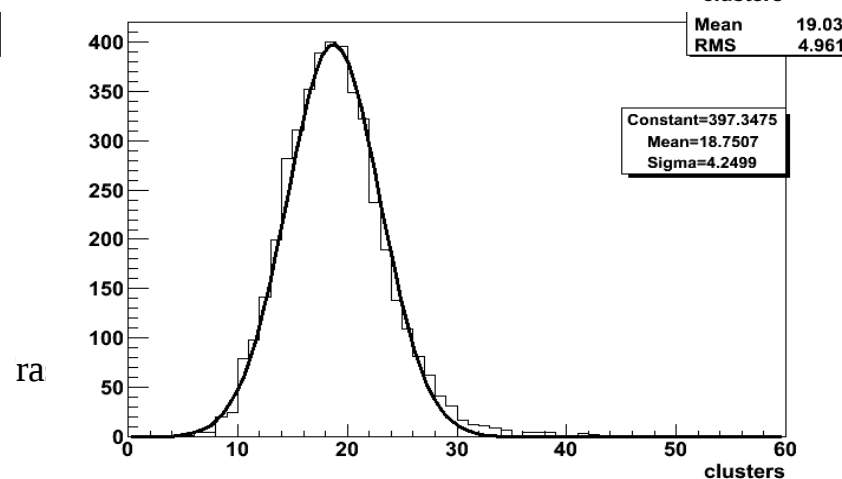
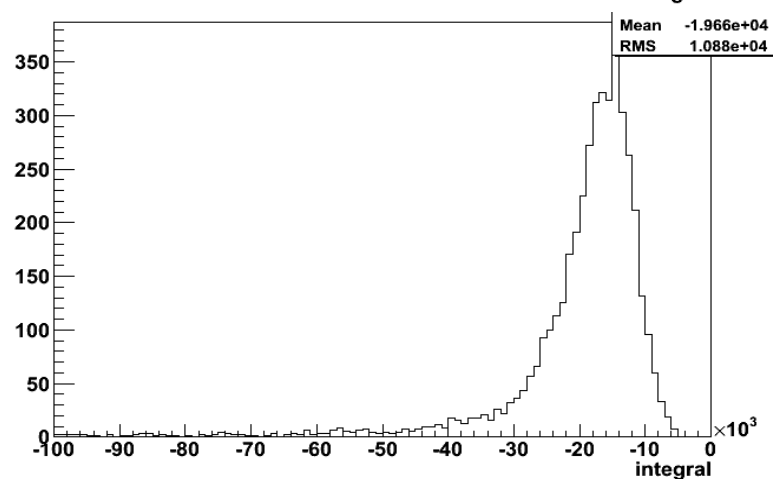
$p=140\text{MeV}/c$
12555 entries



$p=180\text{MeV}/c$
9609 entries



$p=220\text{MeV}/c$
4363 entries



March 21, 2012

Threshold $a=5$

$n=5$

Particle = Muon

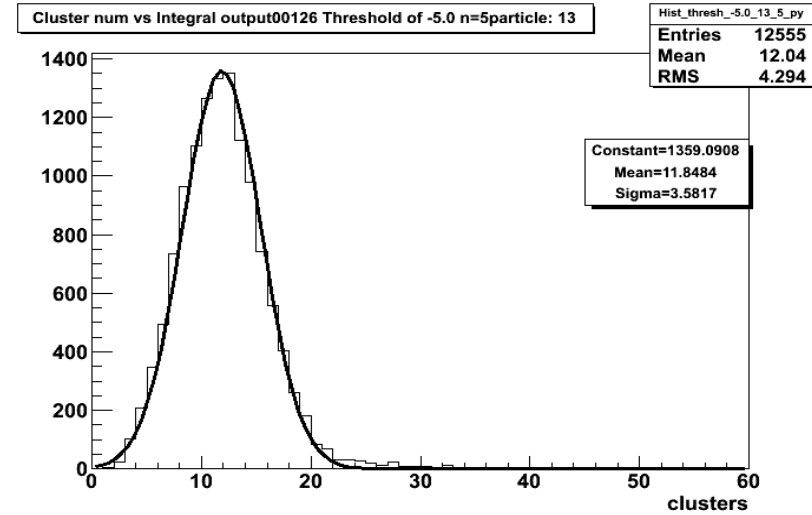
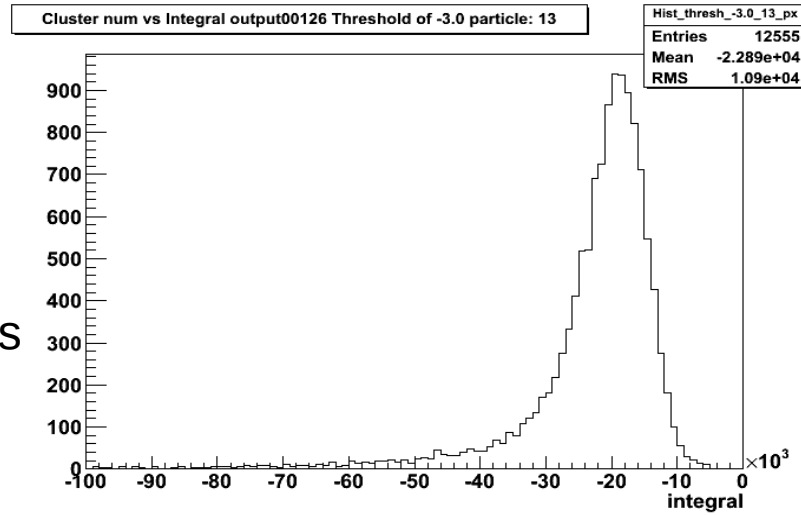
Gas: 80/20

Integral of Signal

Distribution of detected clusters

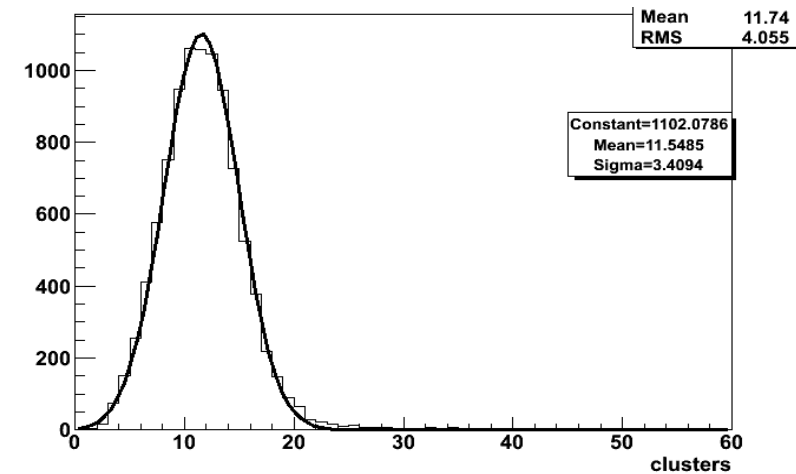
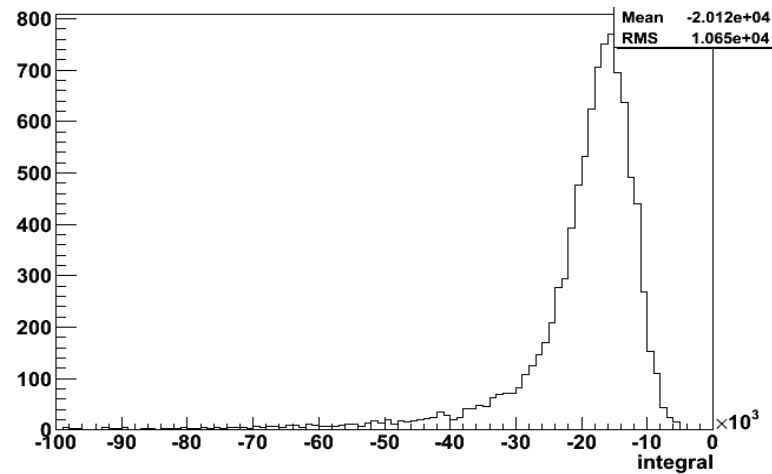
$p=140\text{MeV}/c$

12555 entries



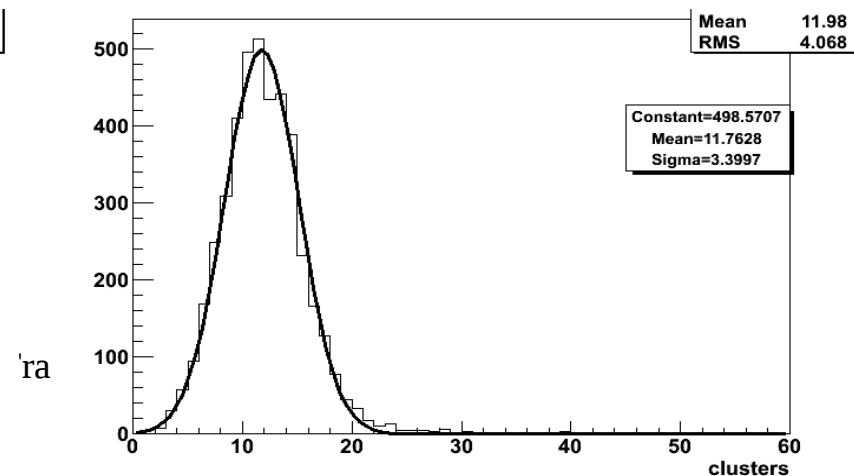
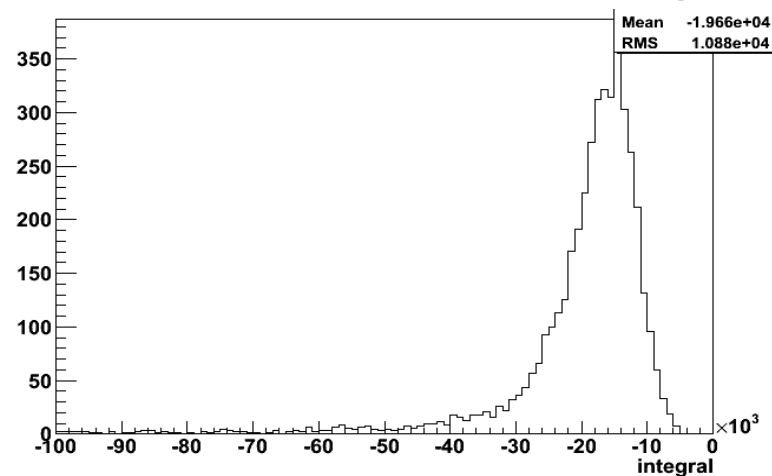
$p=180\text{MeV}/c$

9609 entries



$p=220\text{MeV}/c$

4363 entries

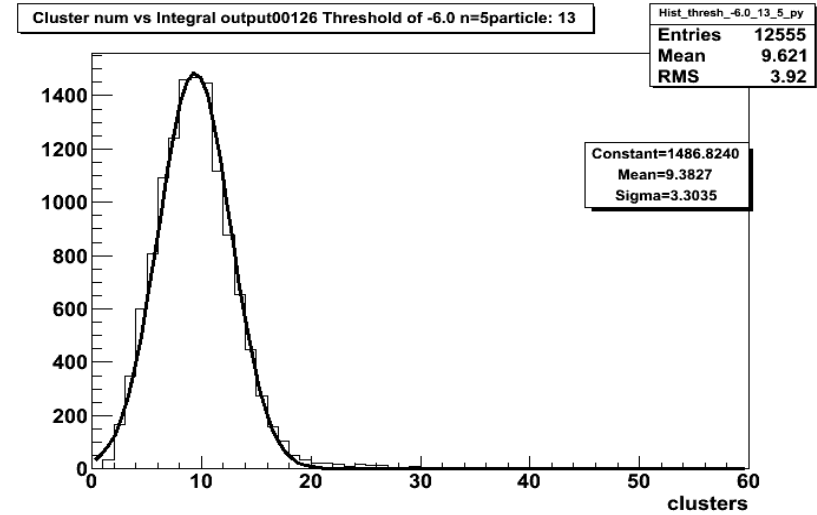
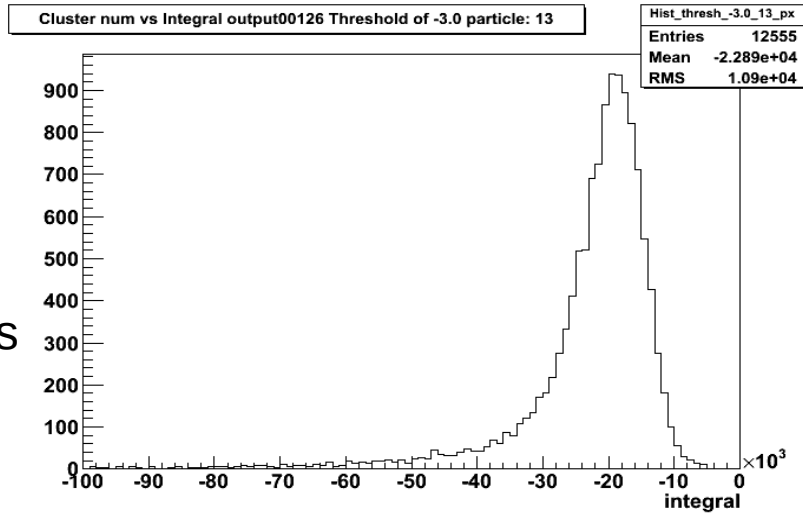


March 21, 2012

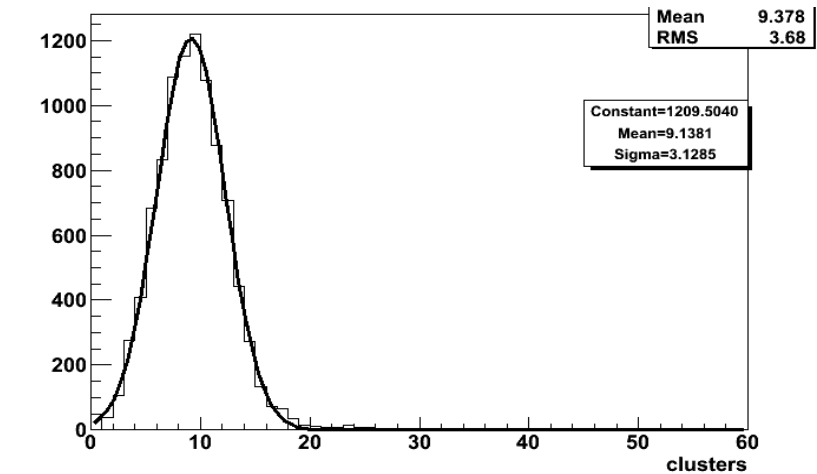
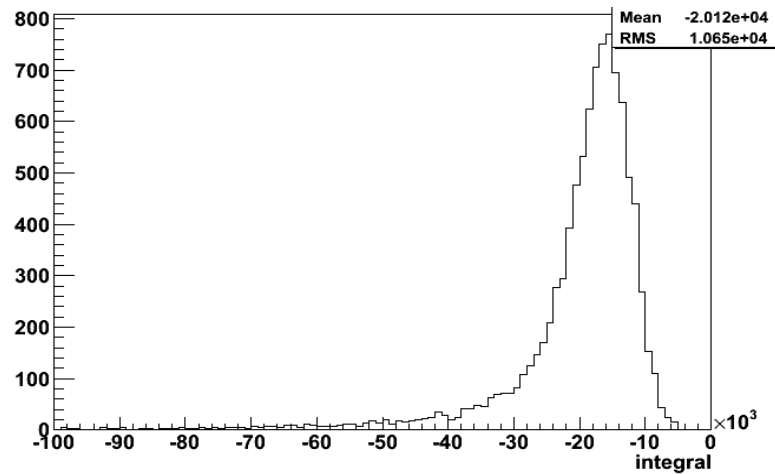
Threshold $a=6$
 $n=5$
 Particle = Muon
 Gas: 80/20

Distribution of detected clusters

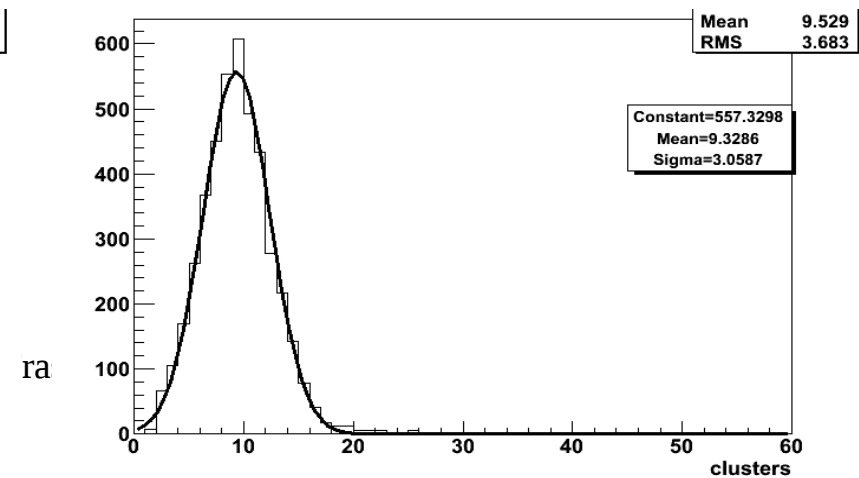
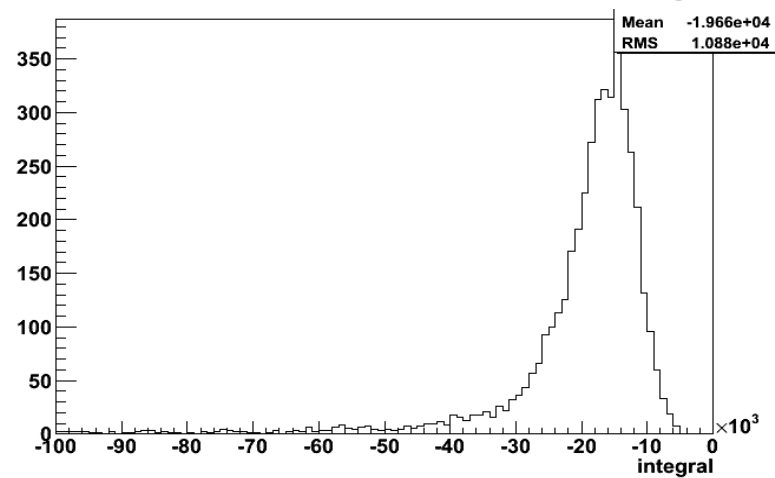
$p=140\text{MeV}/c$
 12555 entries



$p=180\text{MeV}/c$
 9609 entries



$p=220\text{MeV}/c$
 4363 entries



March 21, 2012

Muons, $n=3$
80/20

Threshold $a=3$

$n=3$

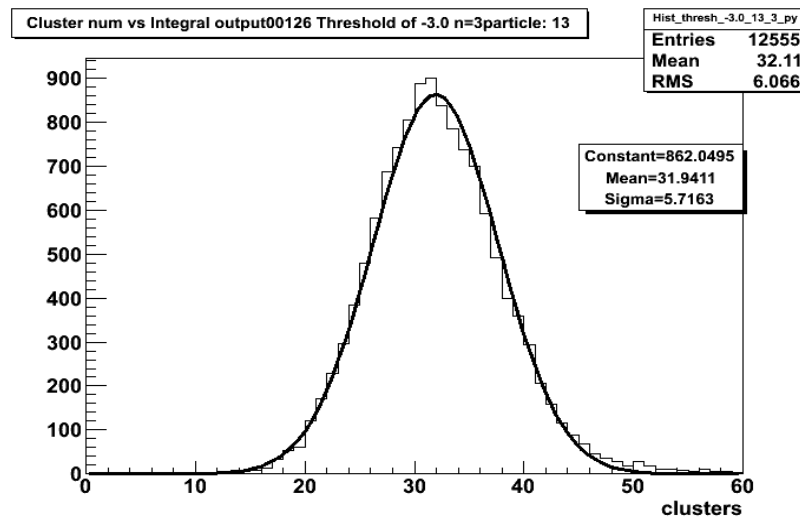
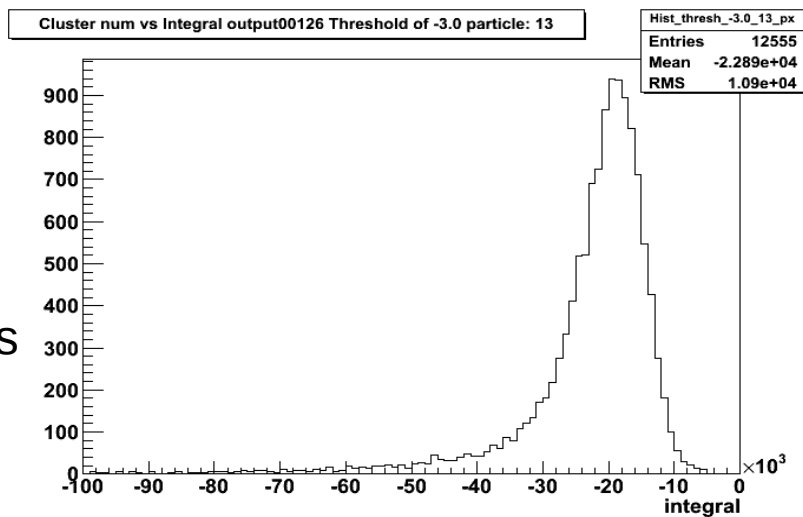
Particle = Muon

Gas: 80/20

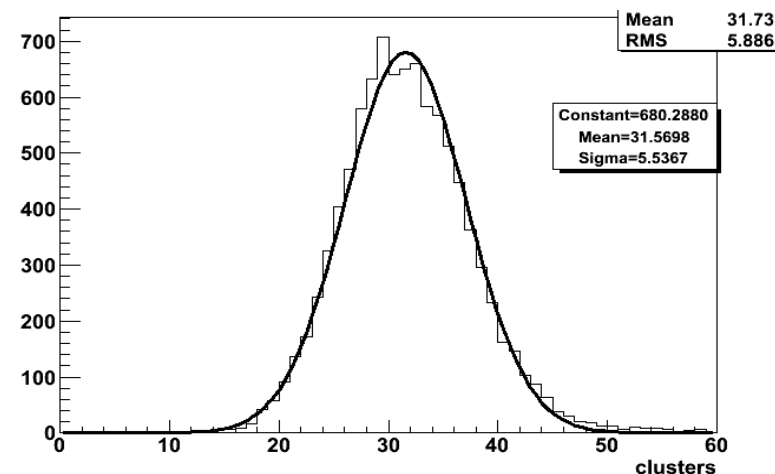
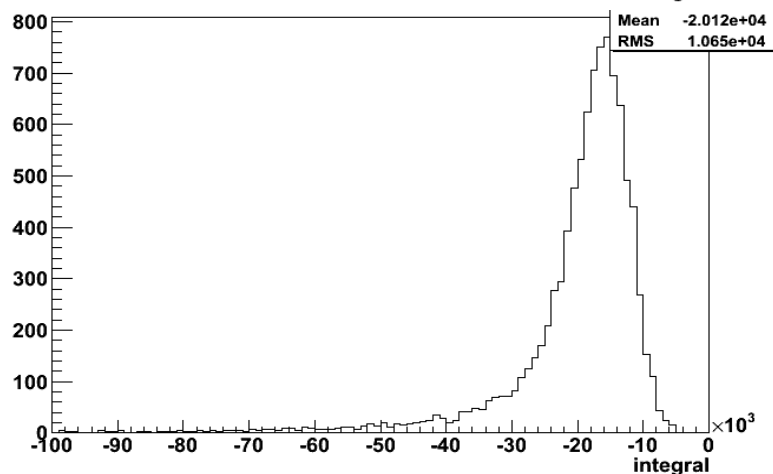
Integral of Signal

Distribution of detected clusters

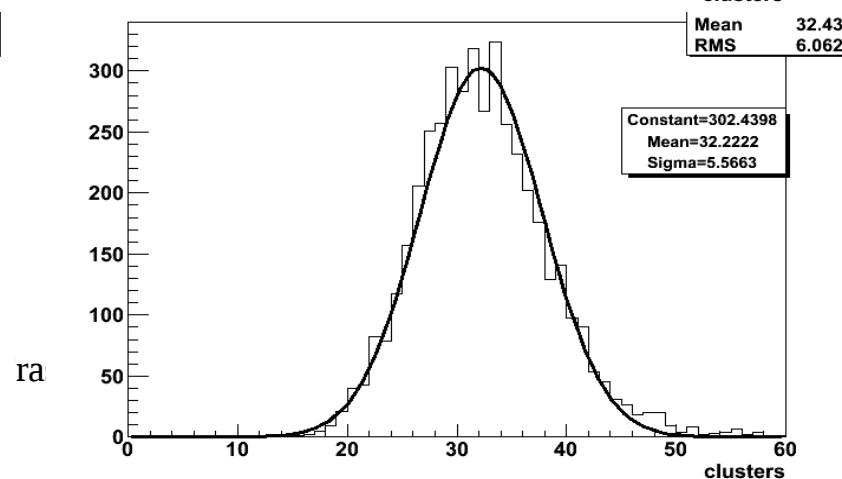
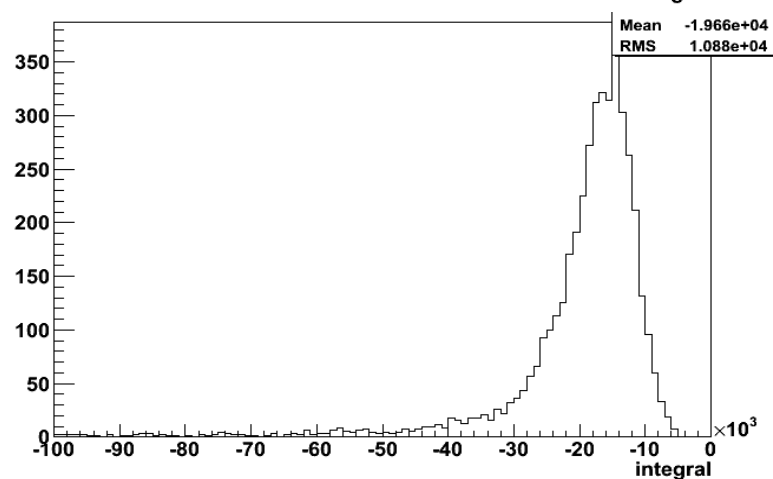
$p=140\text{MeV}/c$
12555 entries



$p=180\text{MeV}/c$
9609 entries



$p=220\text{MeV}/c$
4363 entries



March 21, 2012

Threshold $a=3.3$

$n=3$

Particle = Muon

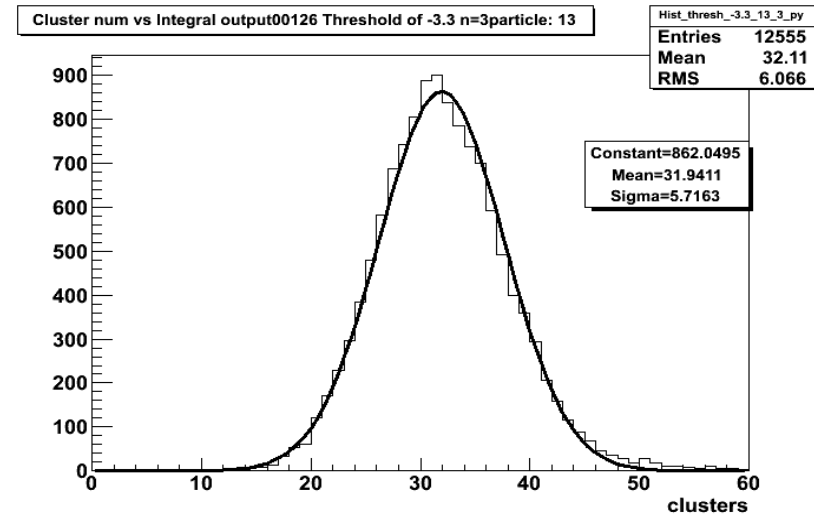
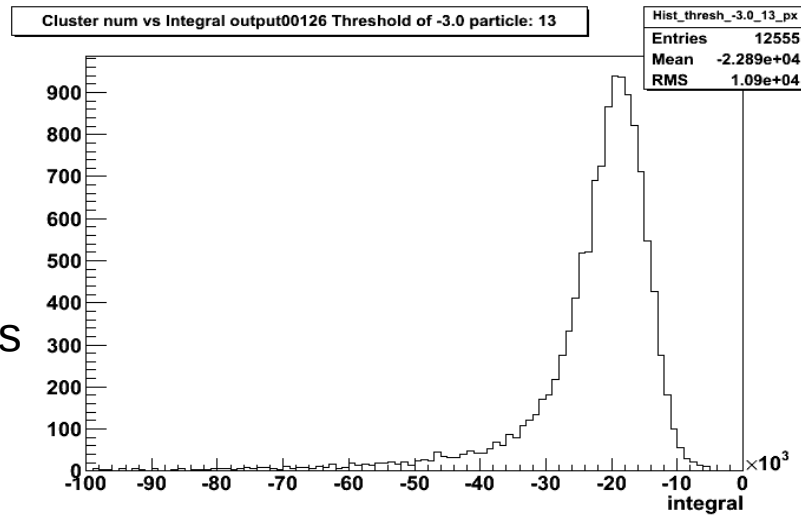
Gas: 80/20

Integral of Signal

Distribution of detected clusters

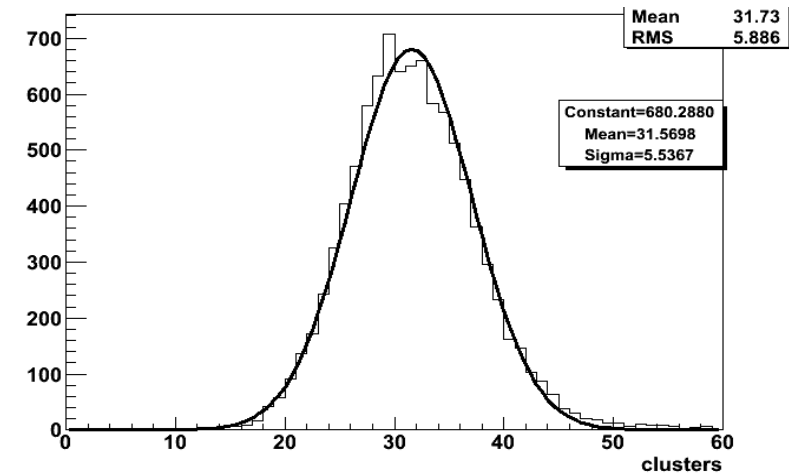
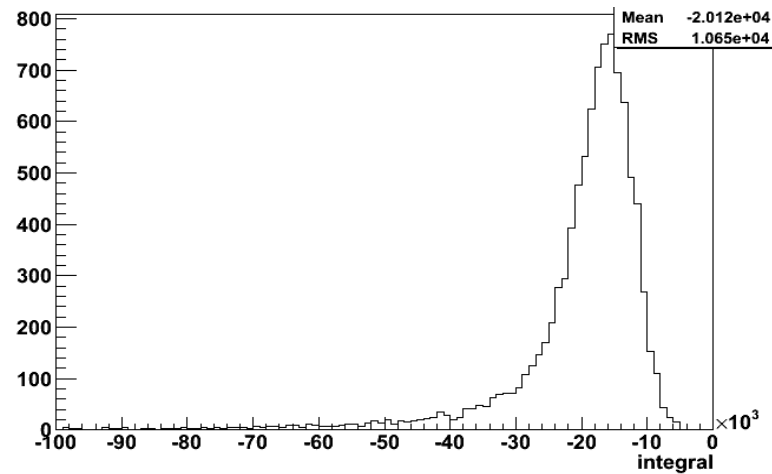
$p=140\text{MeV}/c$

12555 entries



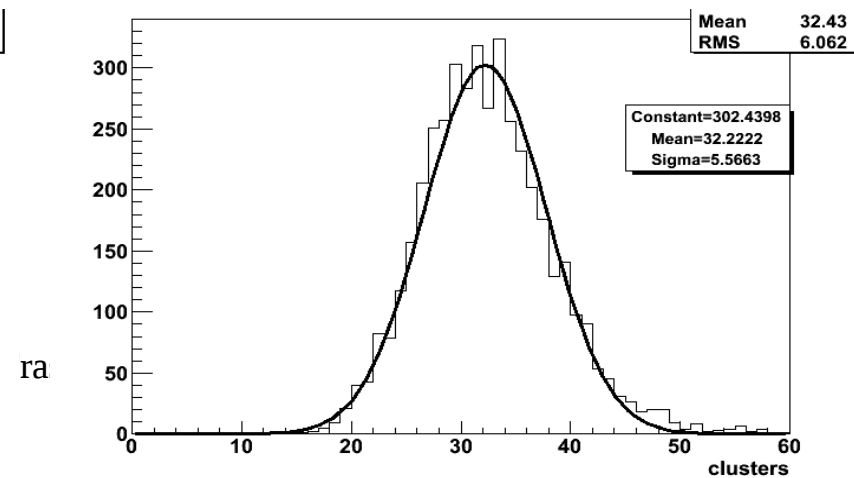
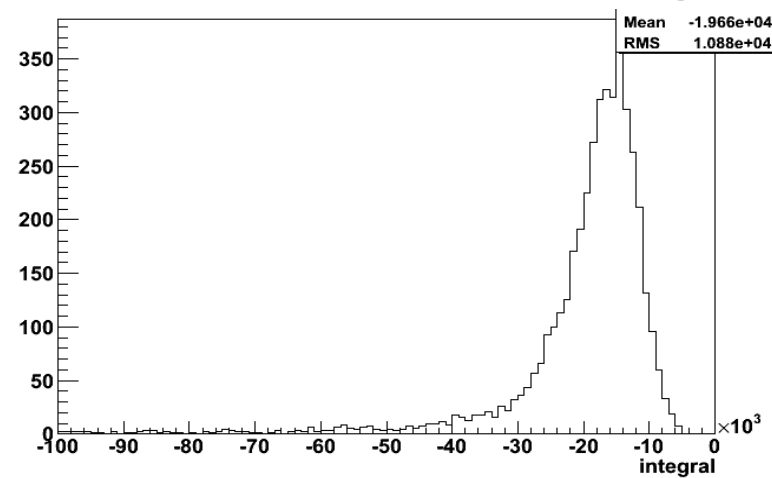
$p=180\text{MeV}/c$

9609 entries



$p=220\text{MeV}/c$

4363 entries



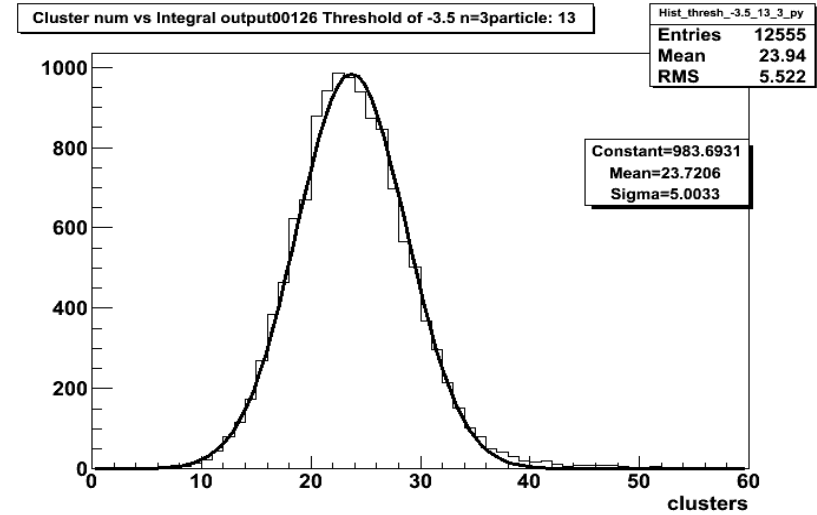
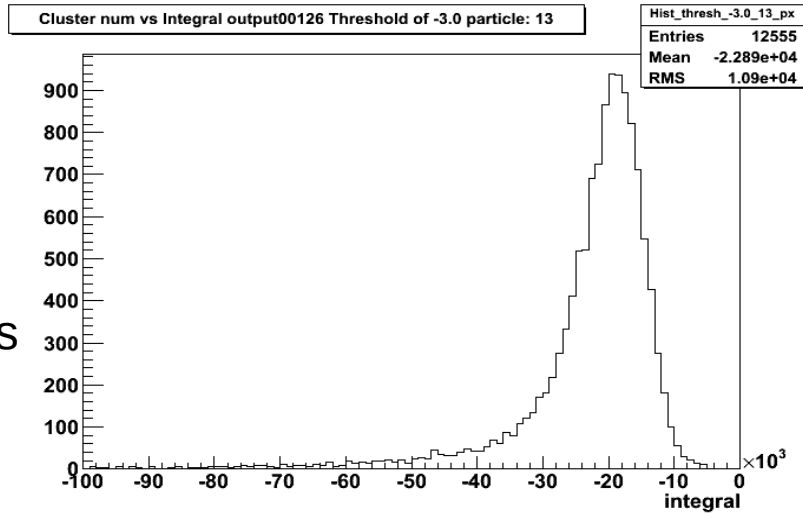
March 21, 2012

Threshold $a=3.5$
 $n=3$
Particle = Muon
Gas: 80/20

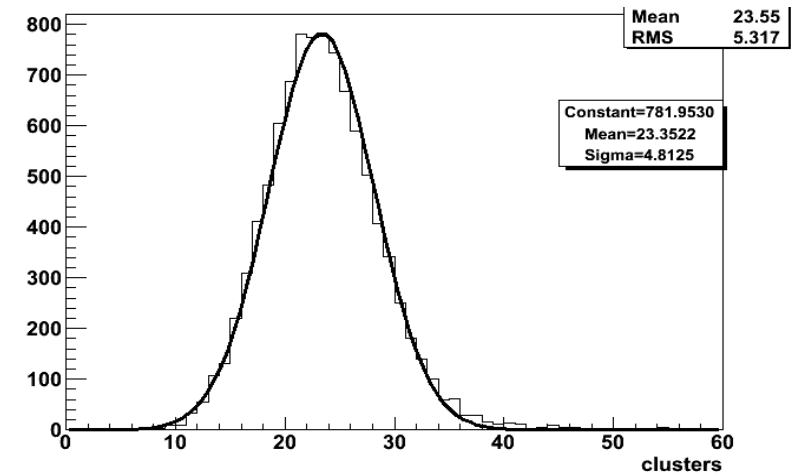
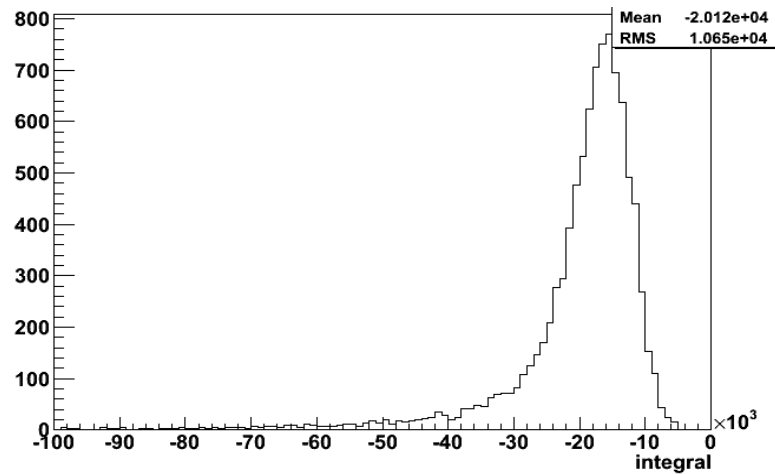
Integral of Signal

Distribution of detected clusters

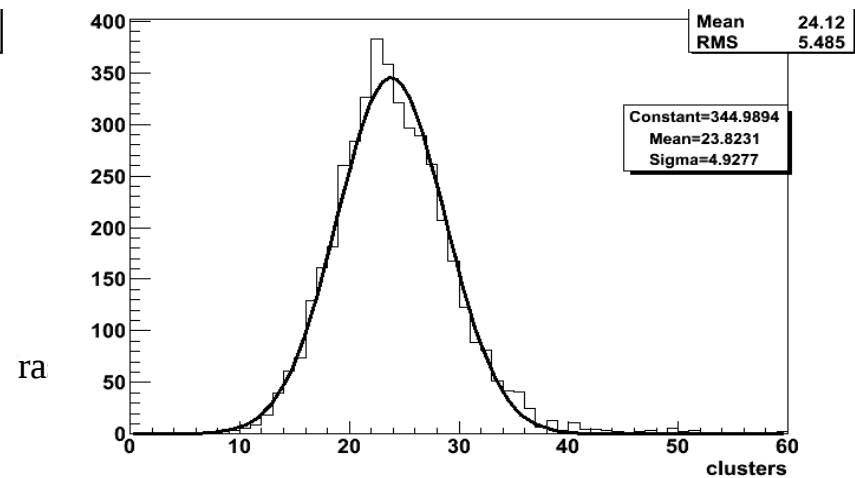
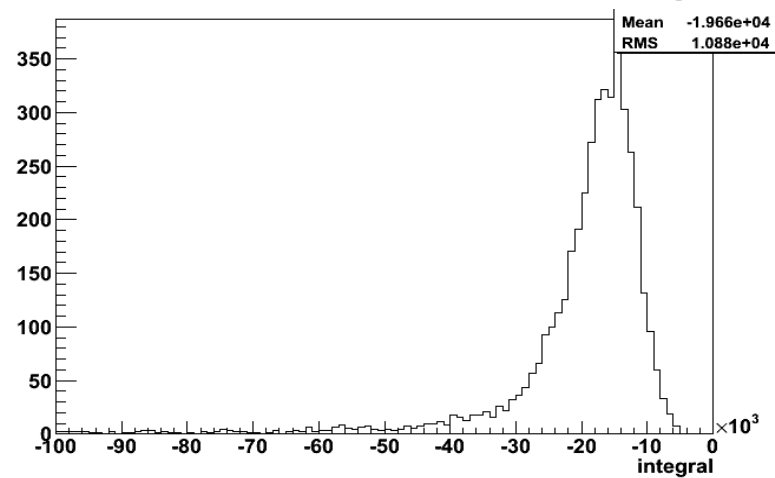
$p=140\text{MeV}/c$
12555 entries



$p=180\text{MeV}/c$
9609 entries



$p=220\text{MeV}/c$
4363 entries



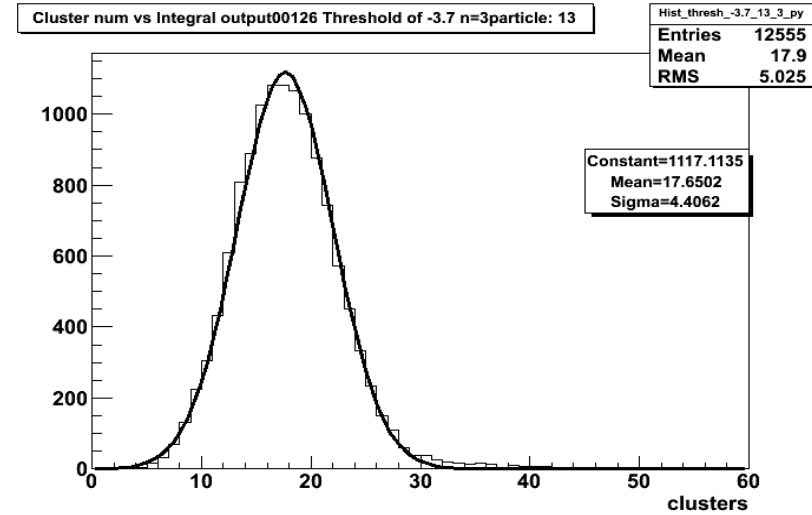
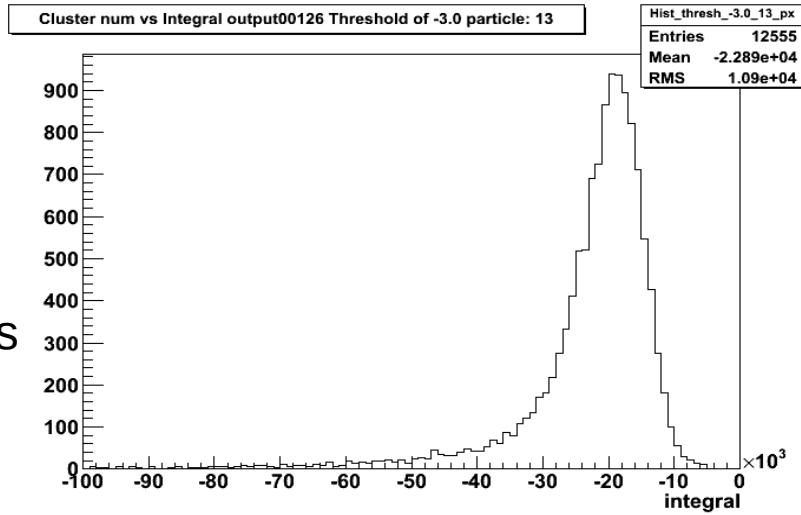
March 21, 2012

Threshold $a=3.7$
 $n=3$
Particle = Muon
Gas: 80/20

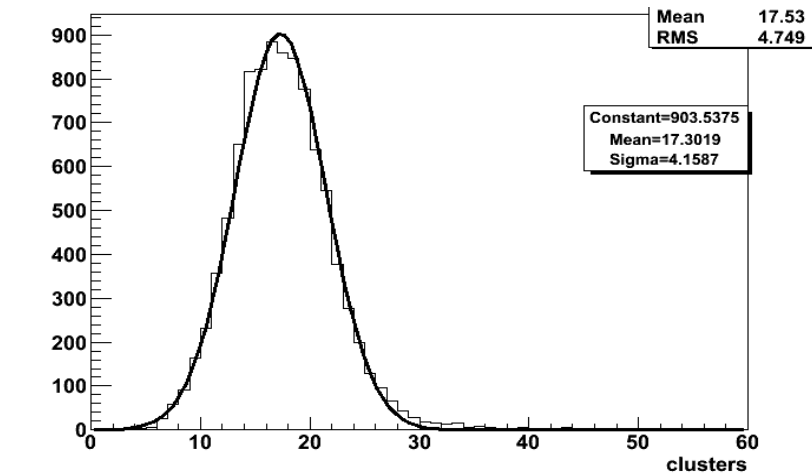
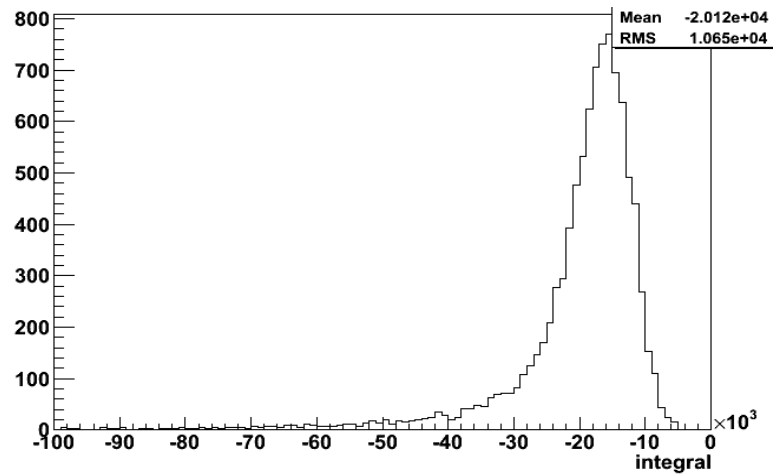
Integral of Signal

Distribution of detected clusters

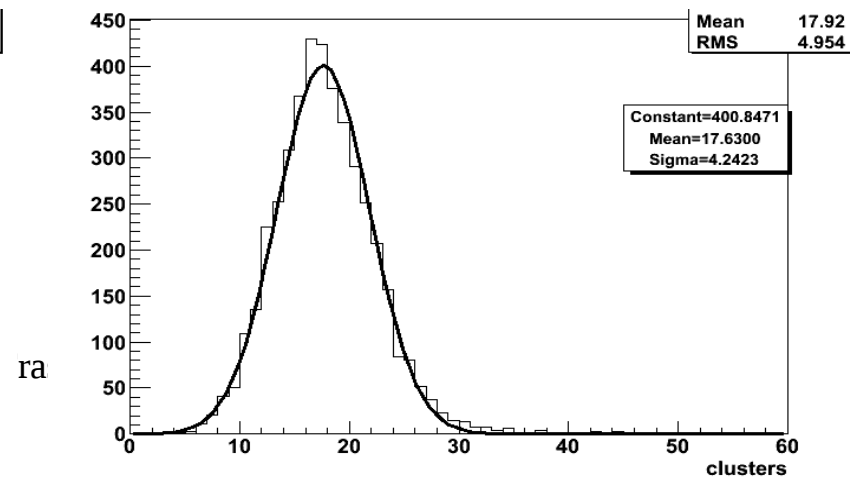
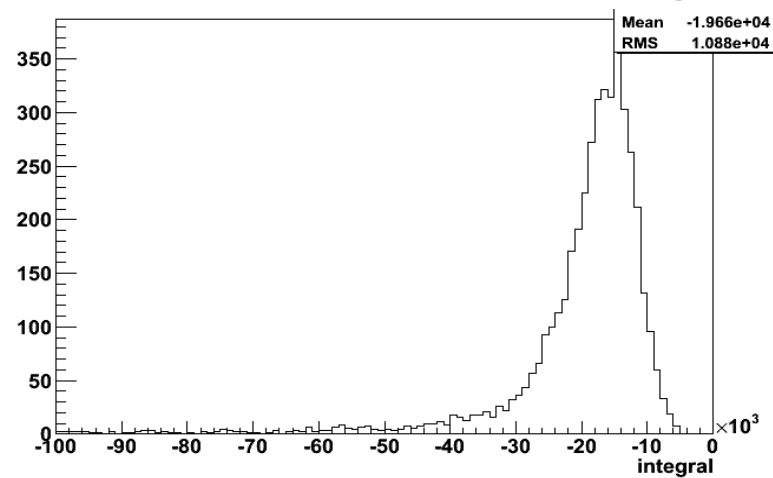
$p=140\text{MeV}/c$
12555 entries



$p=180\text{MeV}/c$
9609 entries



$p=220\text{MeV}/c$
4363 entries



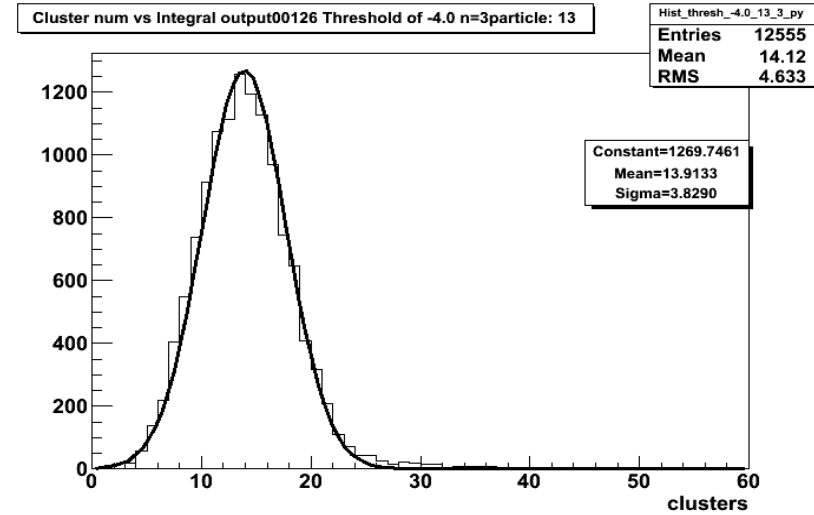
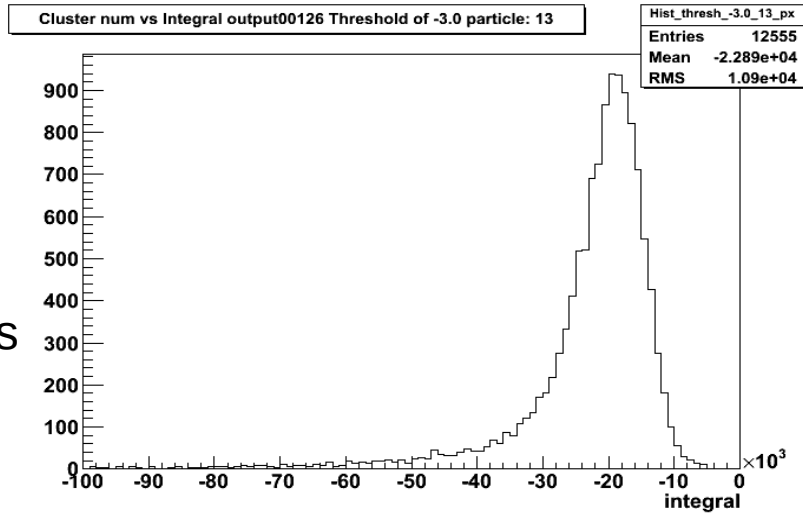
March 21, 2012

Threshold $a=4$
 $n=3$
Particle = Muon
Gas: 80/20

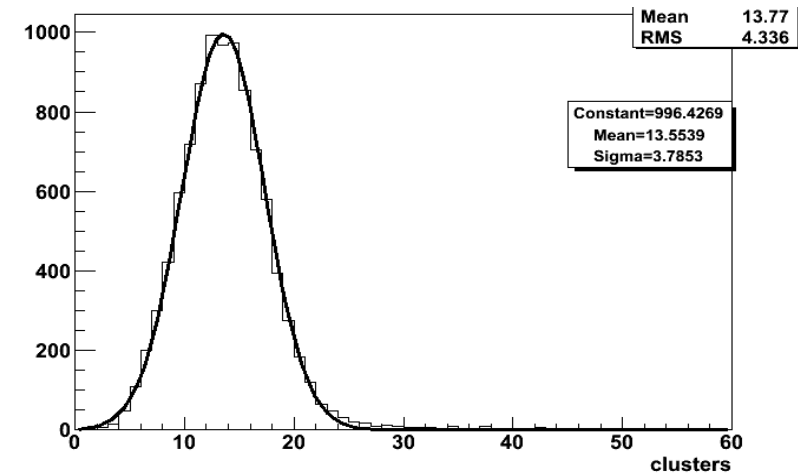
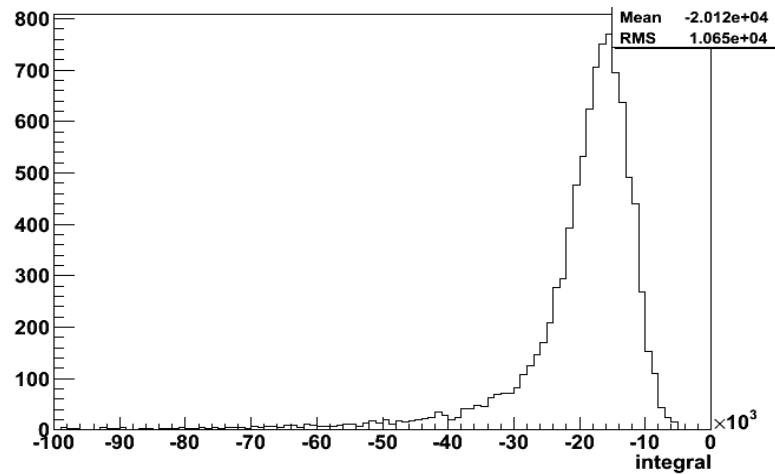
Integral of Signal

Distribution of detected clusters

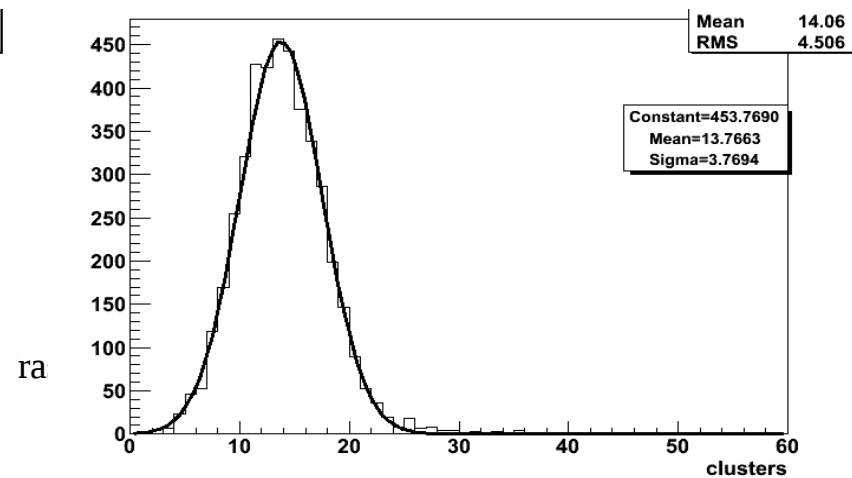
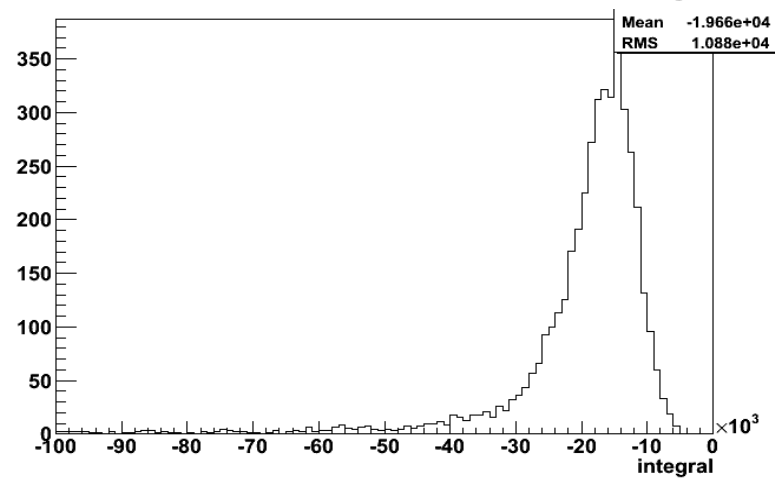
$p=140\text{MeV}/c$
12555 entries



$p=180\text{MeV}/c$
9609 entries



$p=220\text{MeV}/c$
4363 entries



March 21, 2012

Threshold $a=5$

$n=3$

Particle = Muon

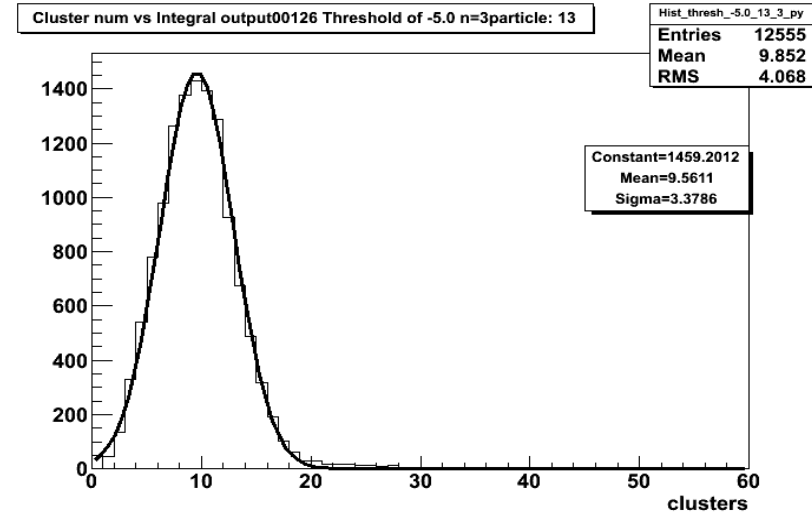
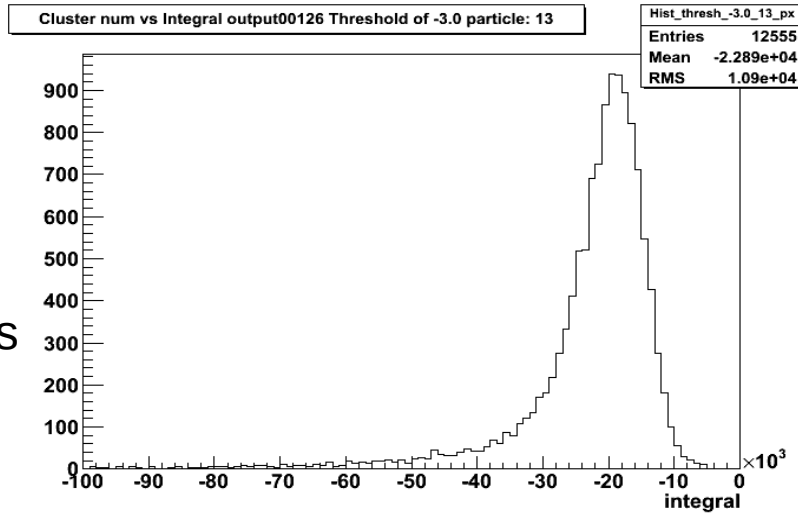
Gas: 80/20

Integral of Signal

Distribution of detected clusters

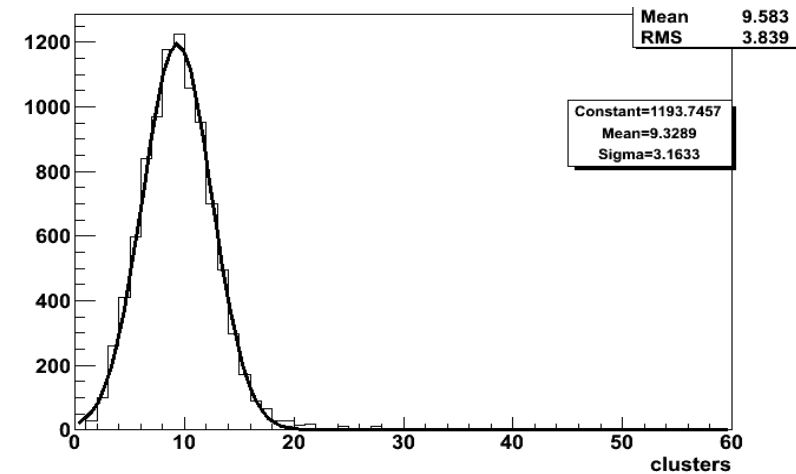
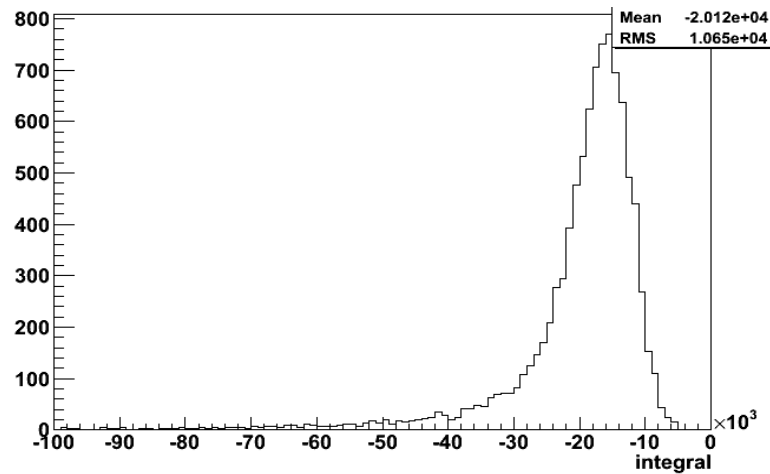
$p=140\text{MeV}/c$

12555 entries



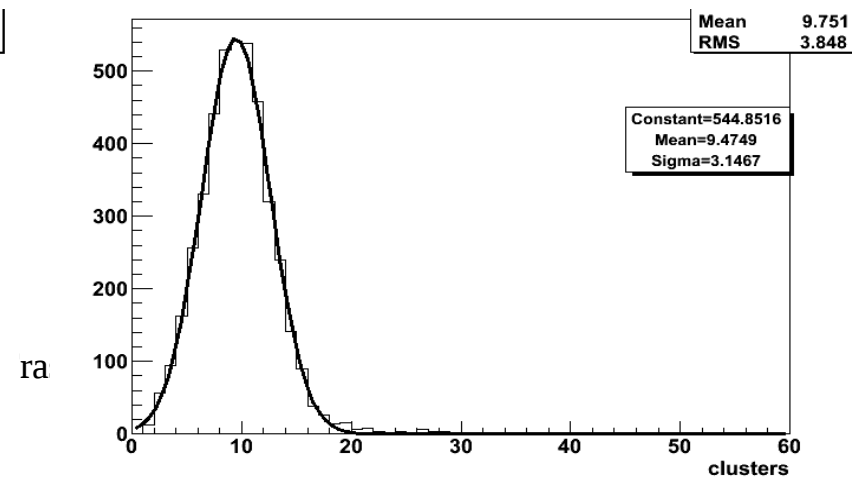
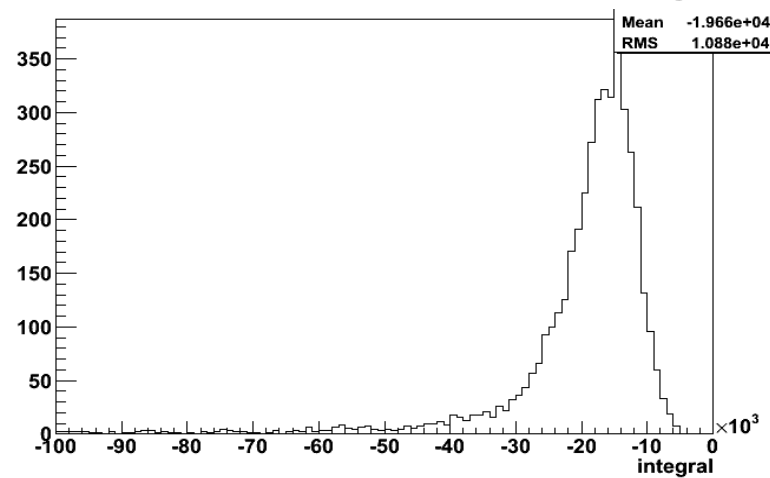
$p=180\text{MeV}/c$

9609 entries



$p=220\text{MeV}/c$

4363 entries



March 21, 2012

Threshold $a=6$

$n=3$

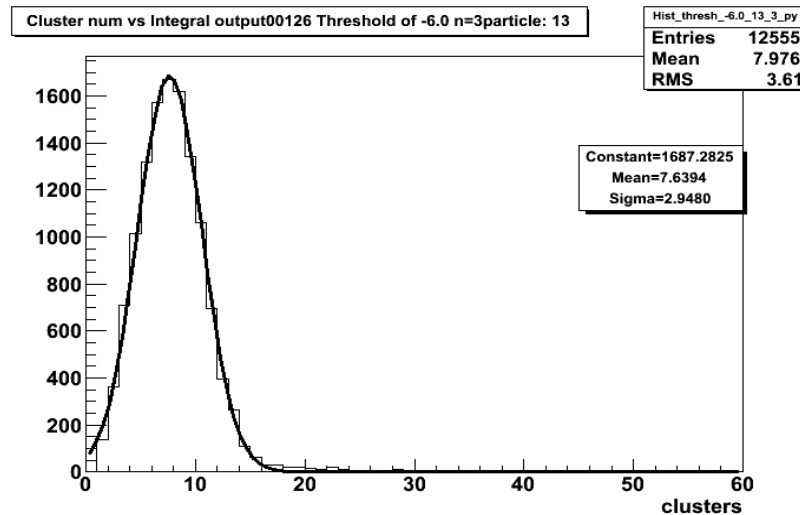
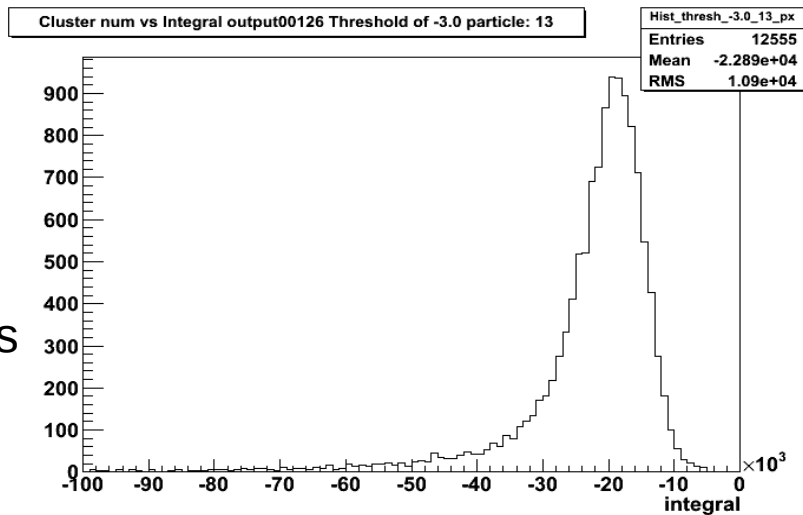
Particle = Muon

Gas: 80/20

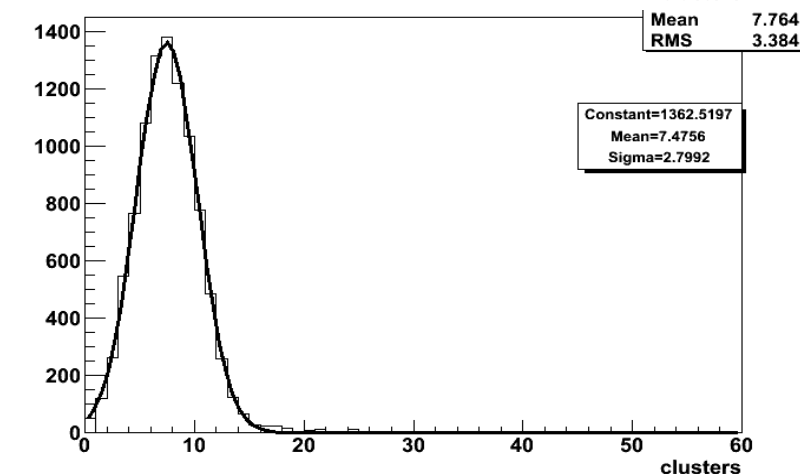
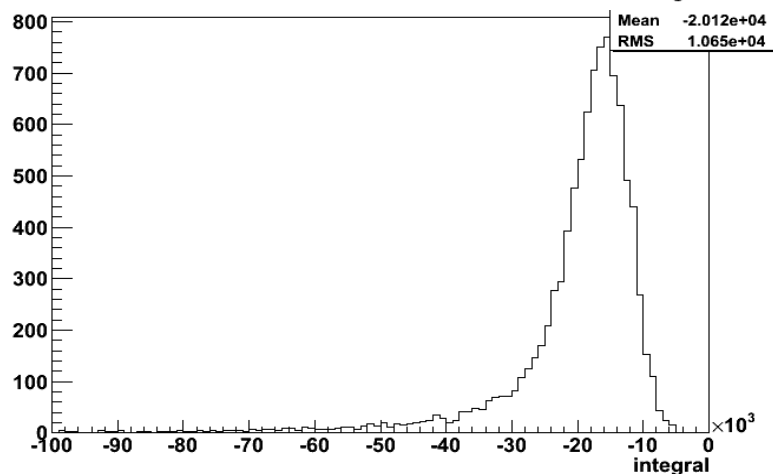
Integral of Signal

Distribution of detected clusters

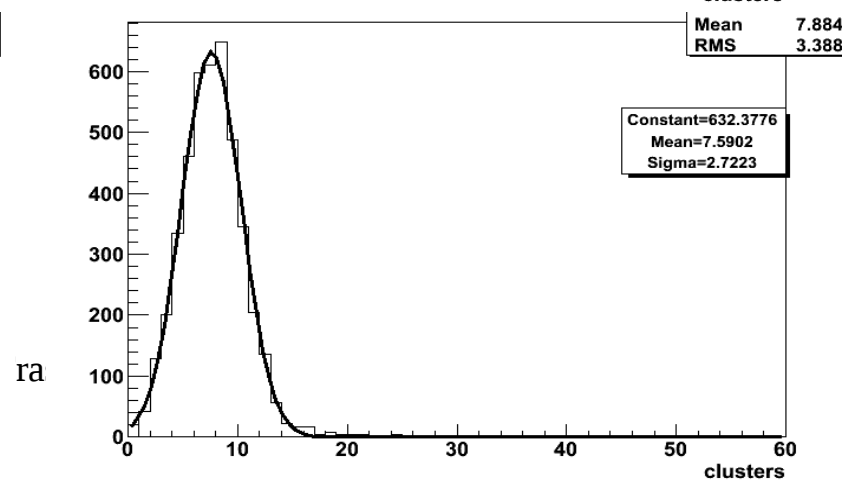
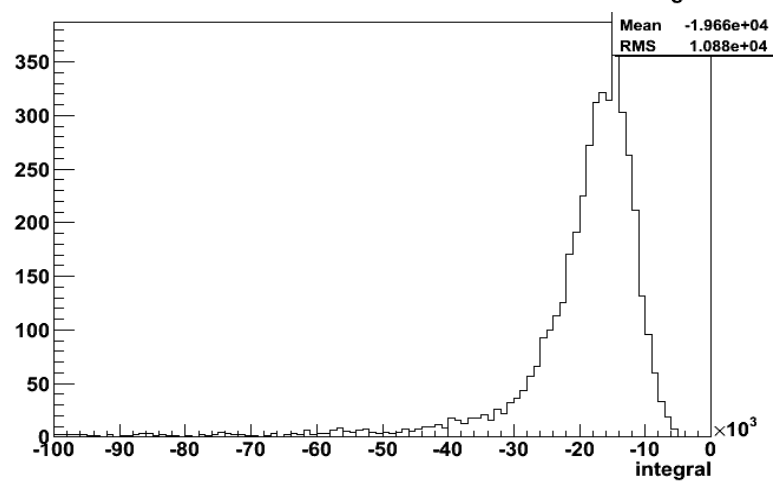
$p=140\text{MeV}/c$
12555 entries



$p=180\text{MeV}/c$
9609 entries



$p=220\text{MeV}/c$
4363 entries



March 21, 2012

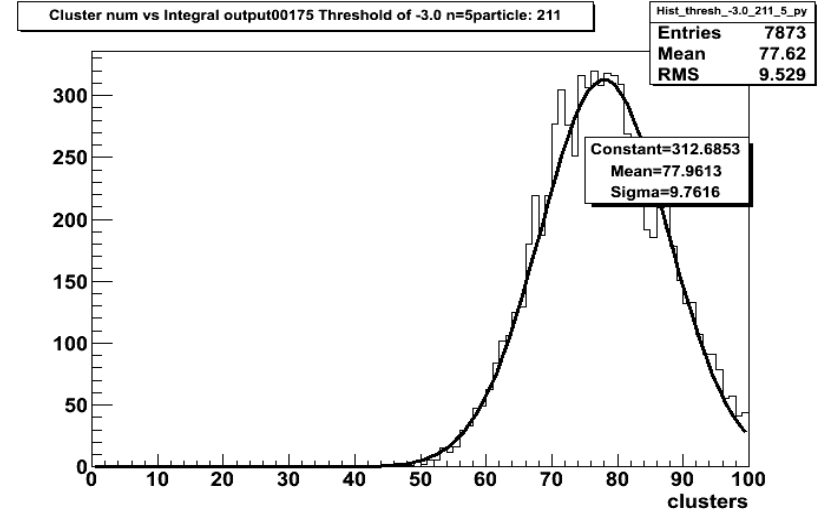
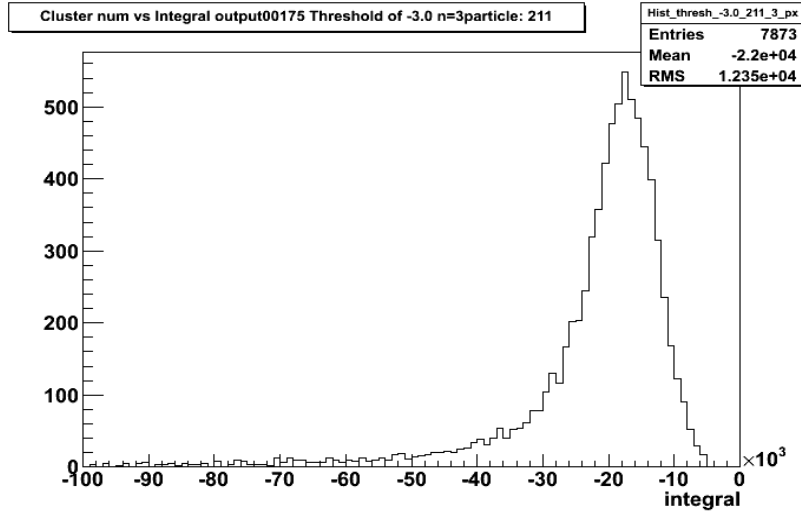
Pions, $n=5$
90/10

Threshold $a=3$
 $n=5$
Particle = Pion
Gas: 90/10

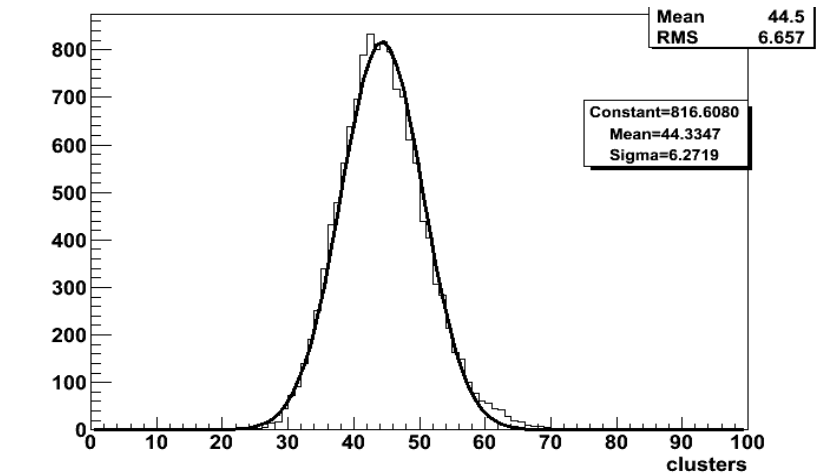
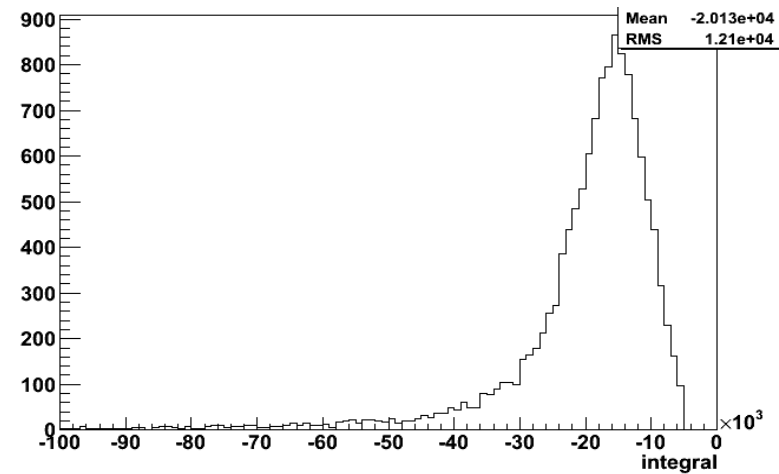
Integral of Signal

Distribution of detected clusters

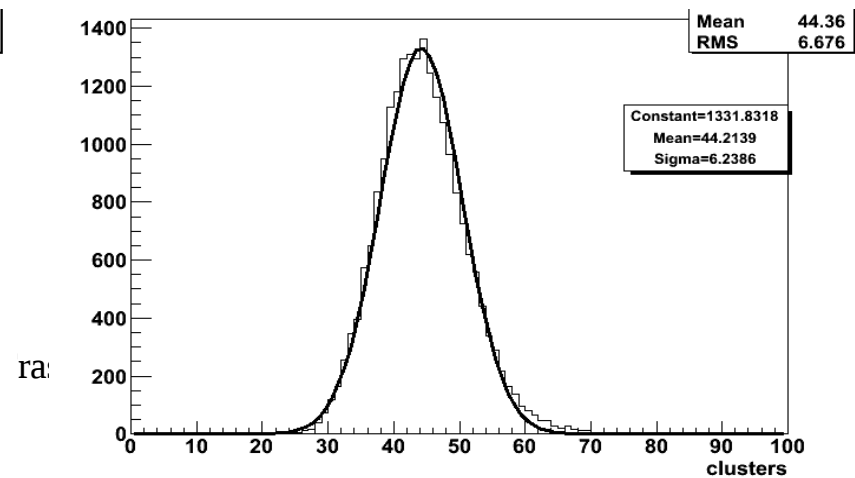
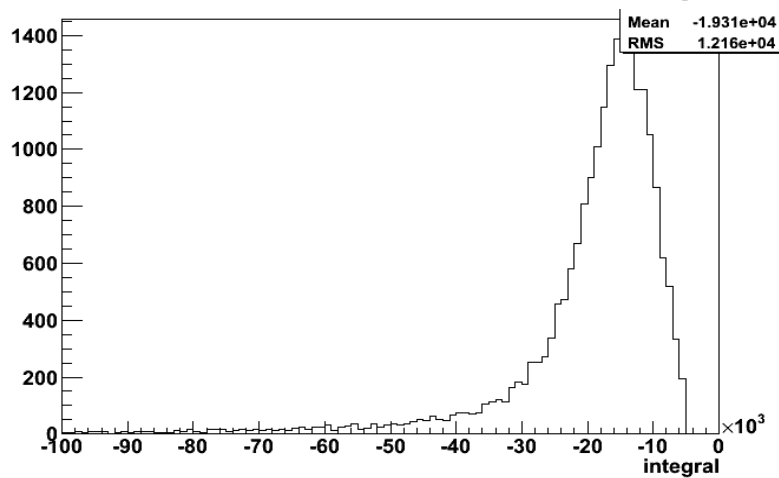
$p=140\text{MeV}/c$
7873 entries



$p=180\text{MeV}/c$
13073 entries



$p=220\text{MeV}/c$
21245 entries



March 21, 2012

Threshold $a=3.3$

$n=5$

Particle = Pion

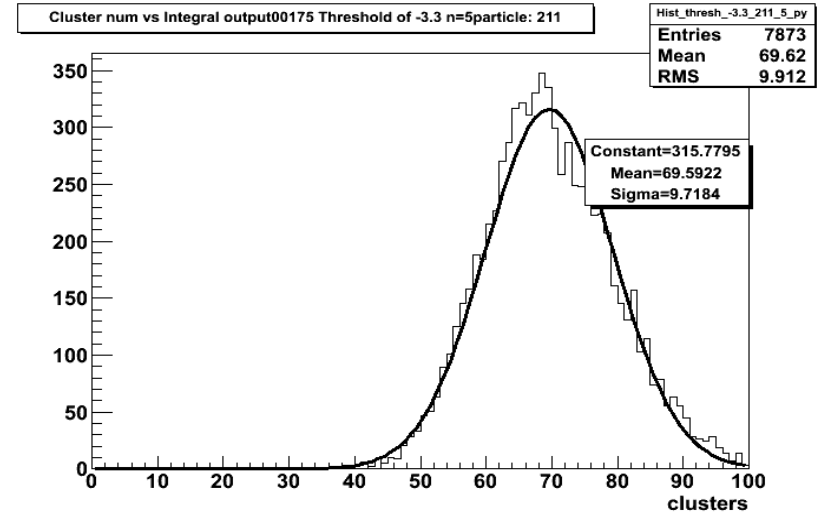
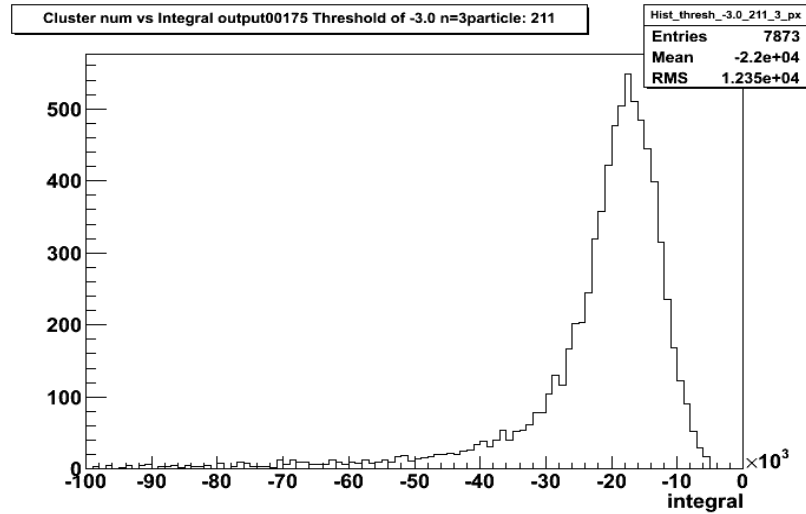
Gas: 90/10

Integral of Signal

Distribution of detected clusters

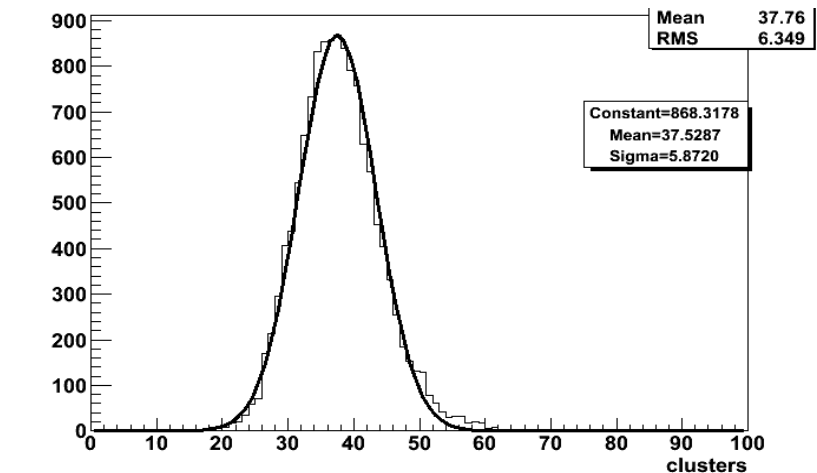
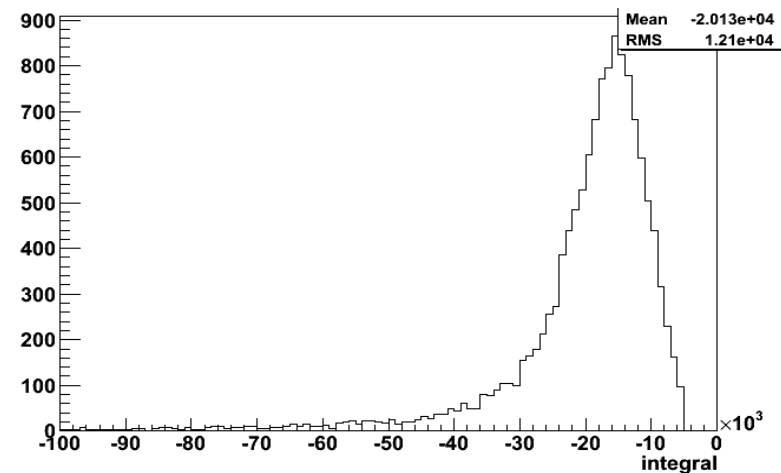
$p=140\text{MeV}/c$

7873 entries



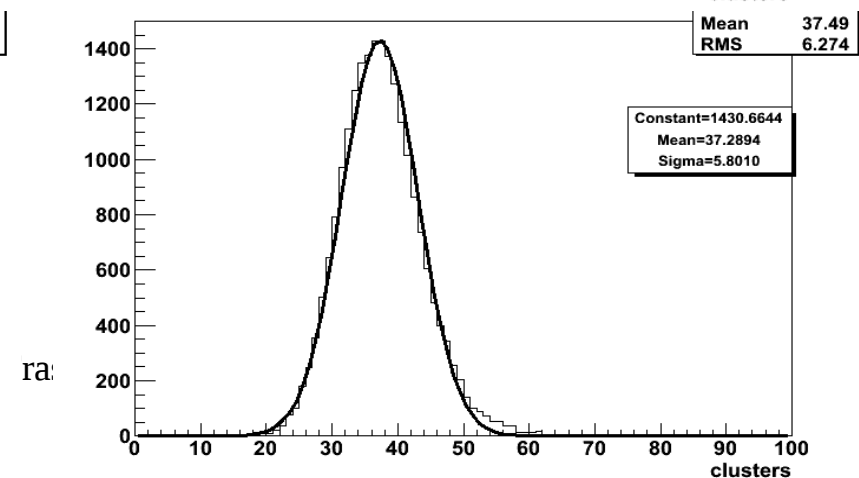
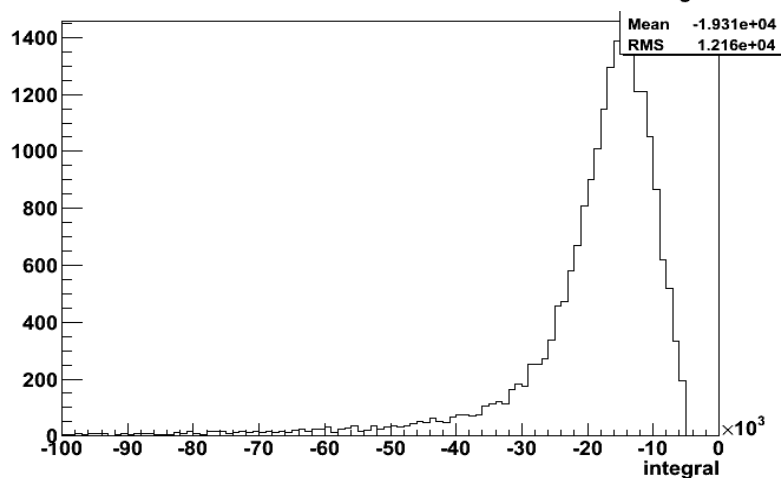
$p=180\text{MeV}/c$

13073 entries



$p=220\text{MeV}/c$

21245 entries



March 21, 2012

ra:

Threshold $a=3.5$

$n=5$

Particle = Pion

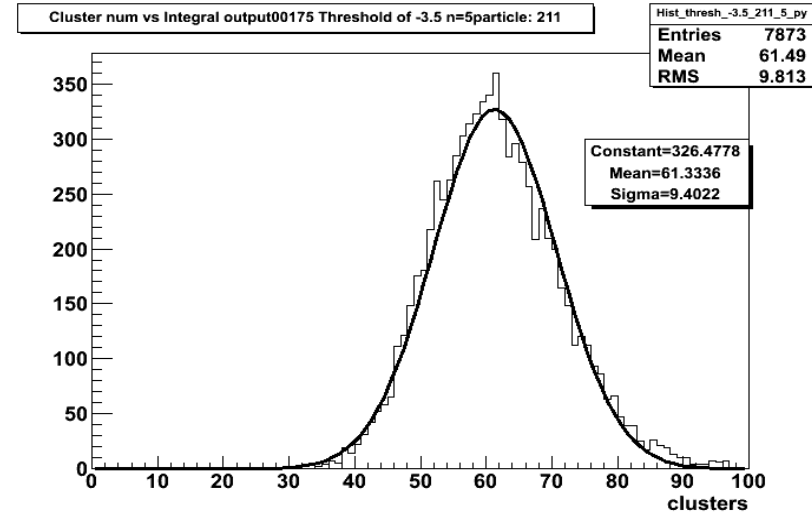
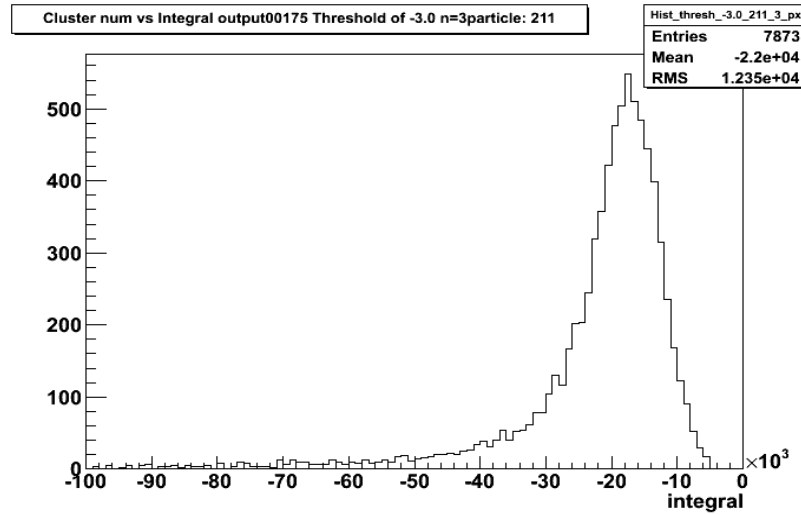
Gas: 90/10

Integral of Signal

Distribution of detected clusters

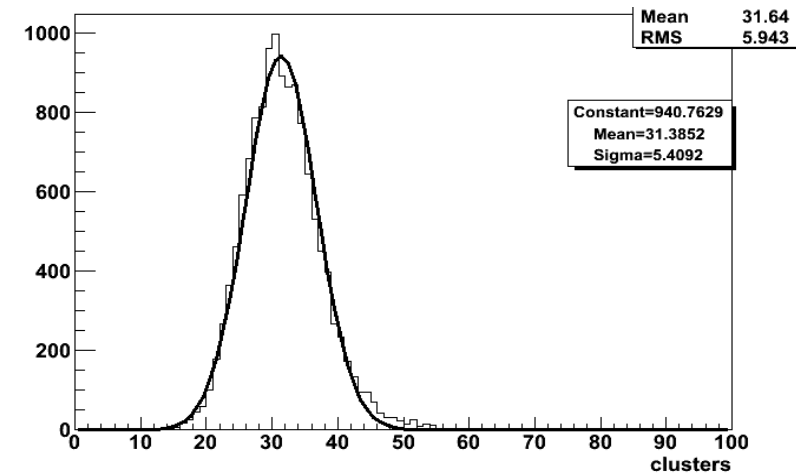
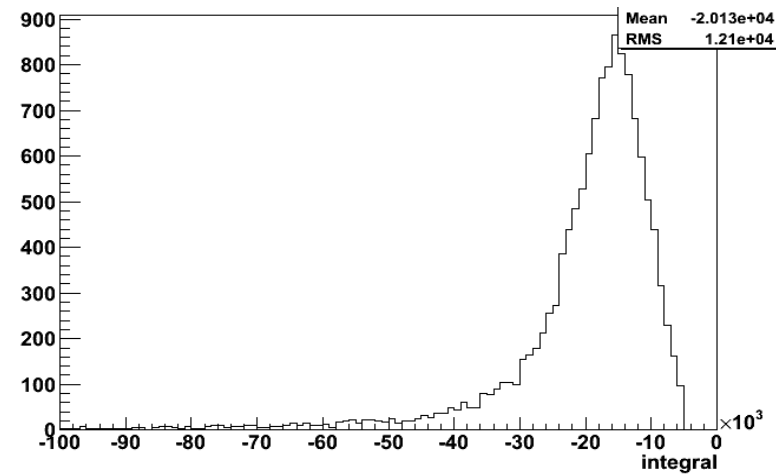
$p=140\text{MeV}/c$

7873 entries



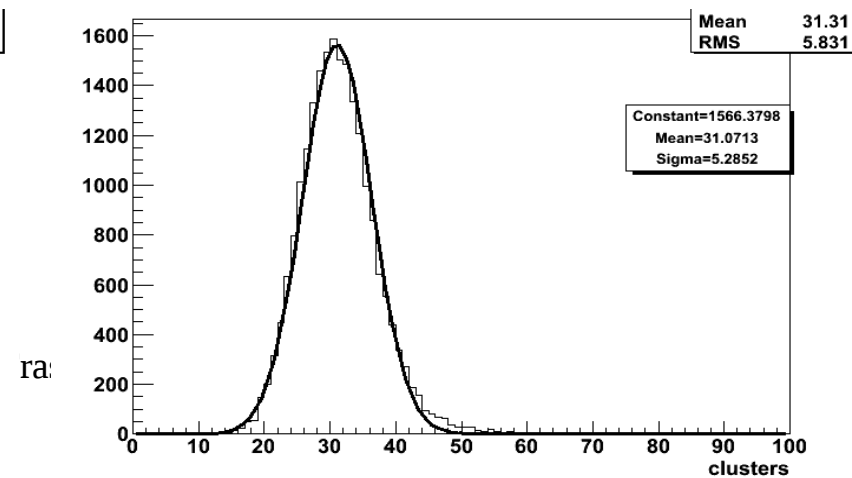
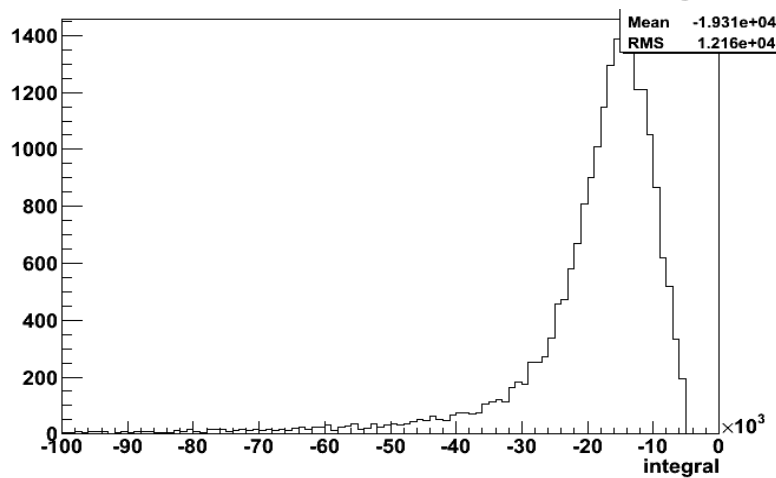
$p=180\text{MeV}/c$

13073 entries



$p=220\text{MeV}/c$

21245 entries



March 21, 2012

Threshold $a=3.7$

$n=5$

Particle = Pion

Gas: 90/10

Integral of Signal

Distribution of detected clusters

$p=140\text{MeV}/c$

7873 entries

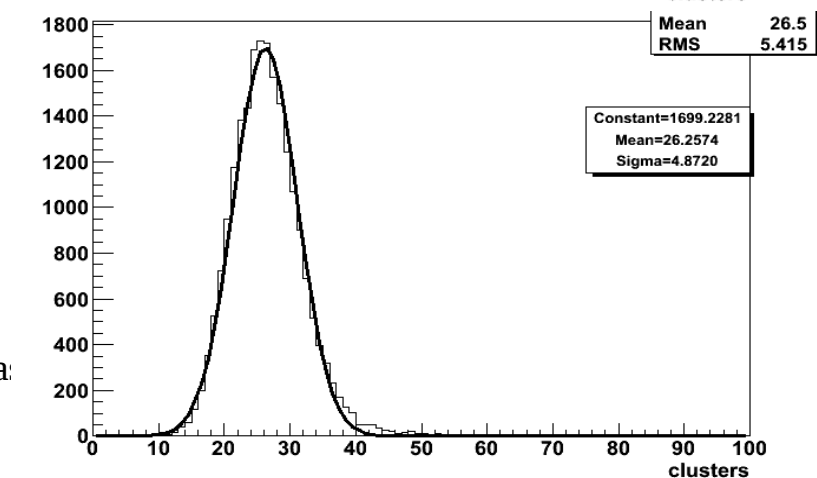
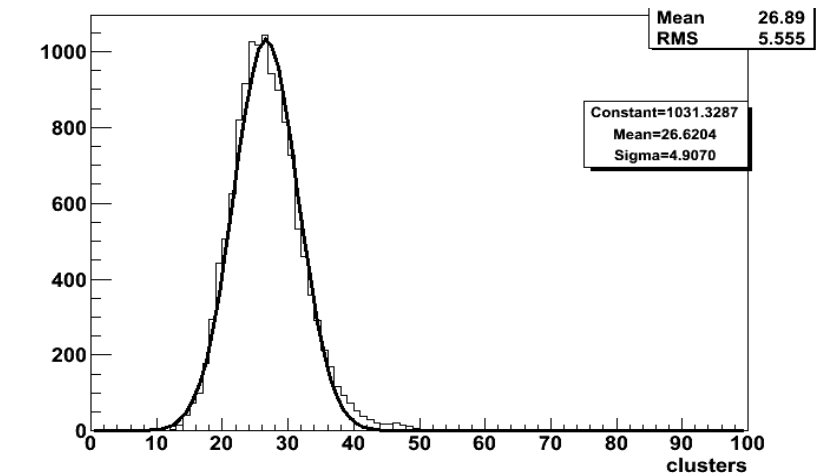
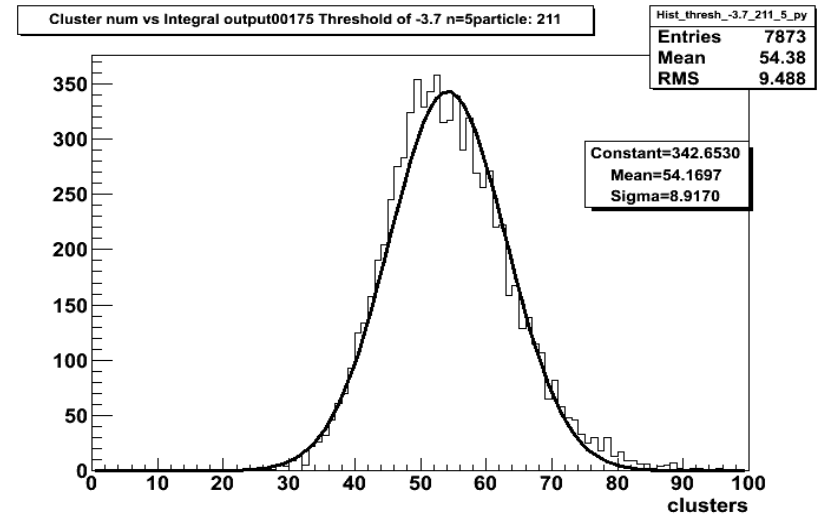
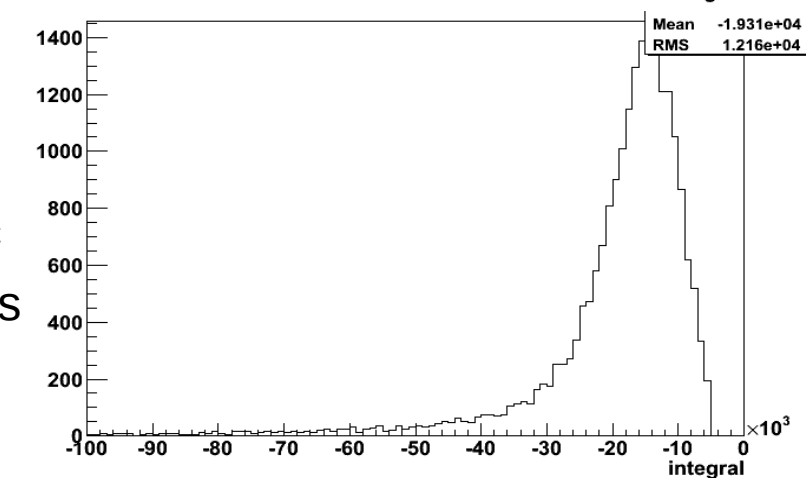
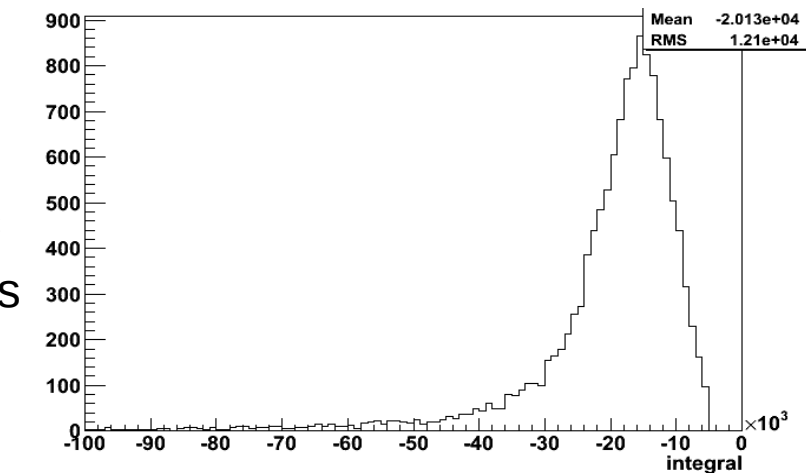
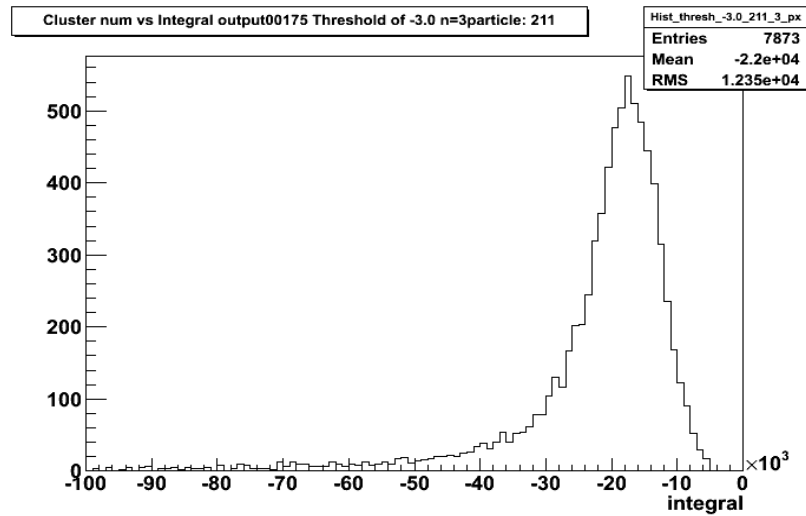
$p=180\text{MeV}/c$

13073 entries

$p=220\text{MeV}/c$

21245 entries

March 21, 2012



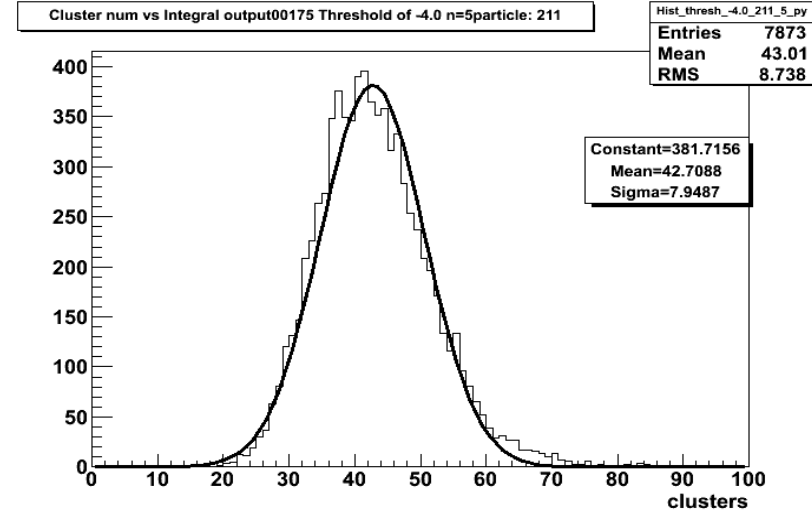
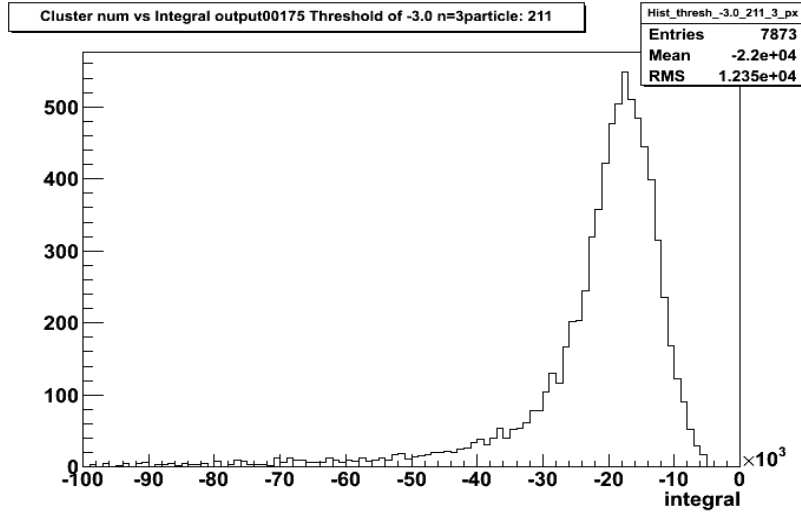
ra:

Threshold $a=4$
 $n=5$
Particle = Pion
Gas: 90/10

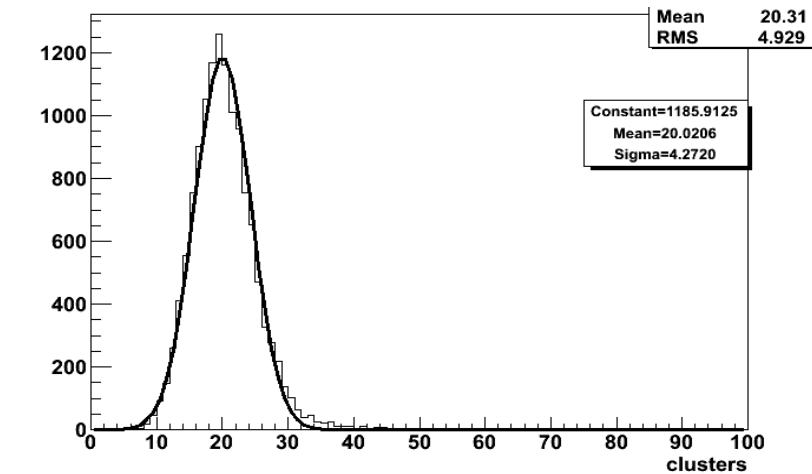
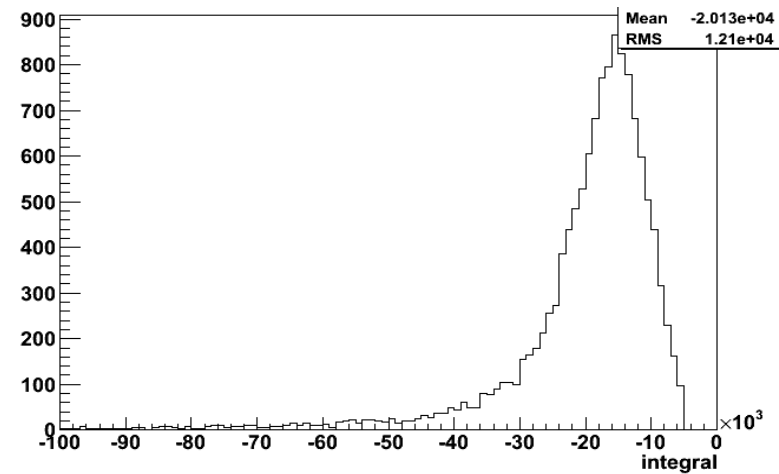
Integral of Signal

Distribution of detected clusters

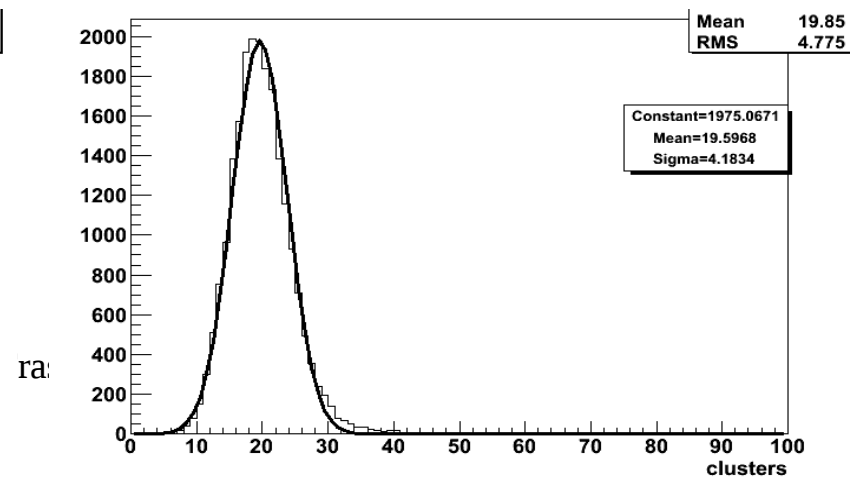
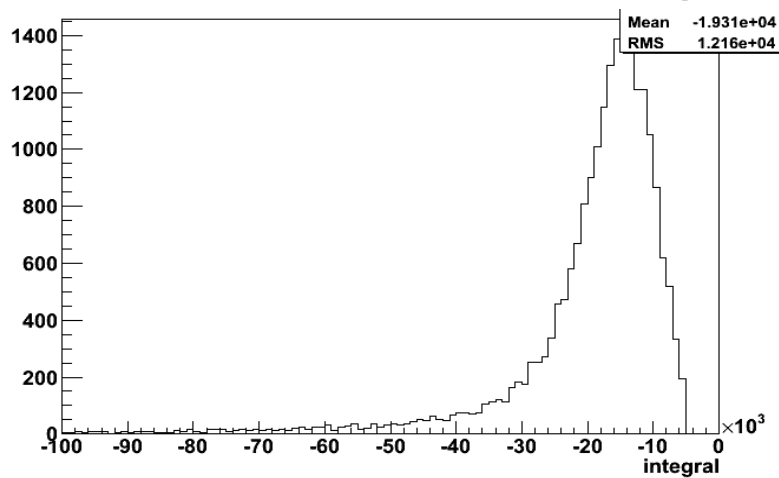
$p=140\text{MeV}/c$
7873 entries



$p=180\text{MeV}/c$
13073 entries



$p=220\text{MeV}/c$
21245 entries



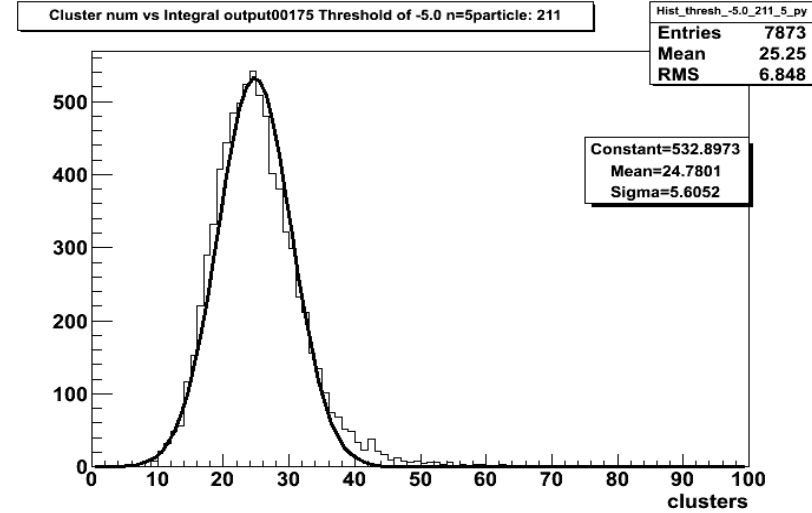
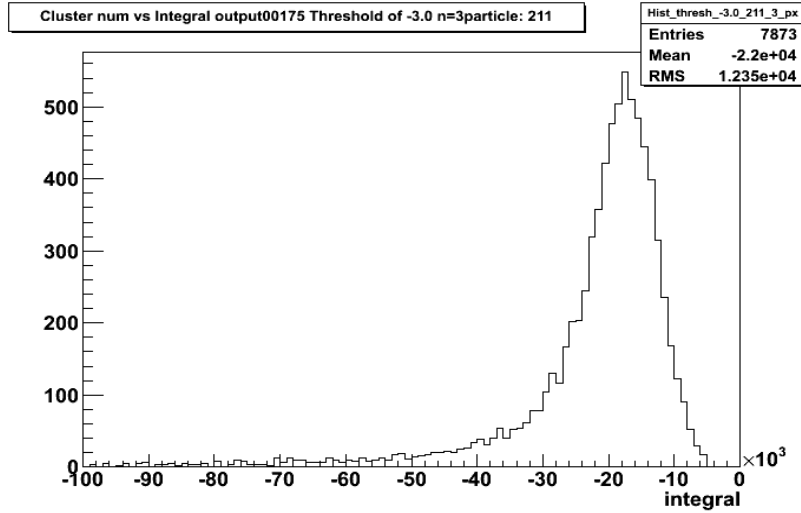
March 21, 2012

Threshold $a=5$
 $n=5$
 Particle = Pion
 Gas: 90/10

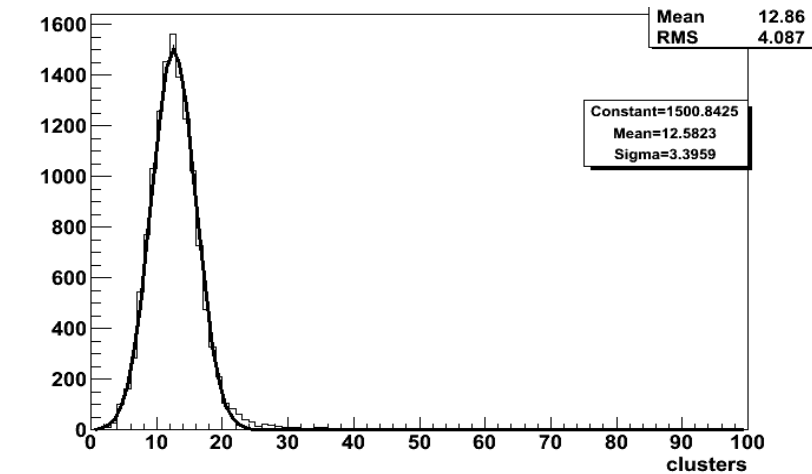
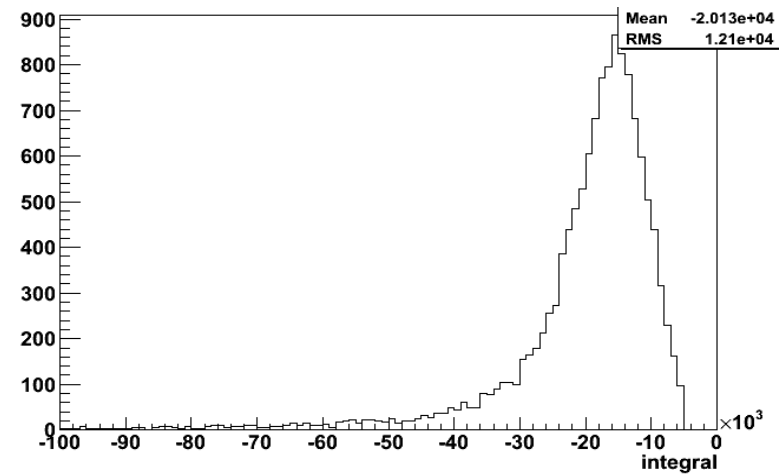
Integral of Signal

Distribution of detected clusters

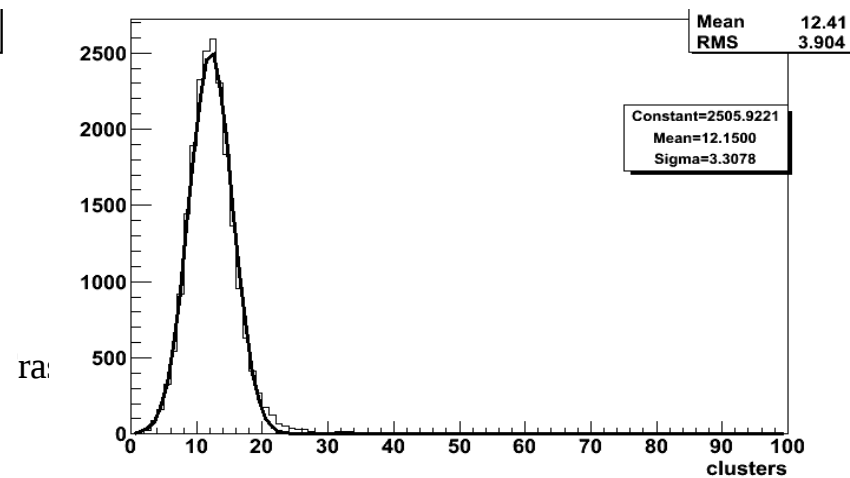
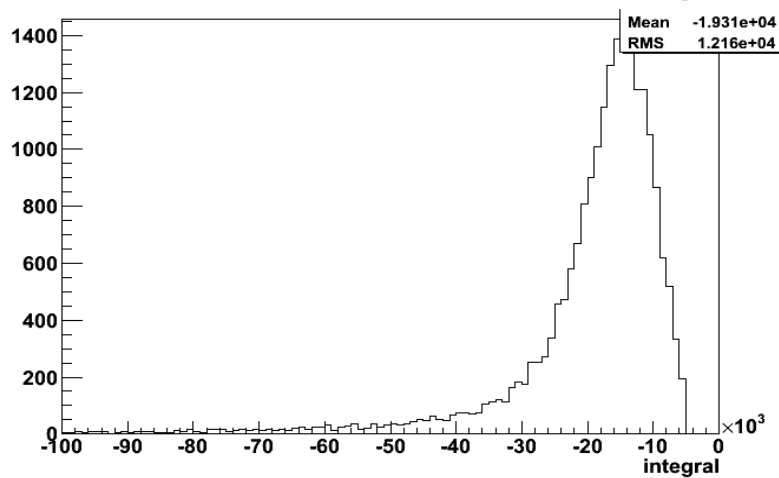
$p=140\text{MeV}/c$
 7873 entries



$p=180\text{MeV}/c$
 13073 entries



$p=220\text{MeV}/c$
 21245 entries



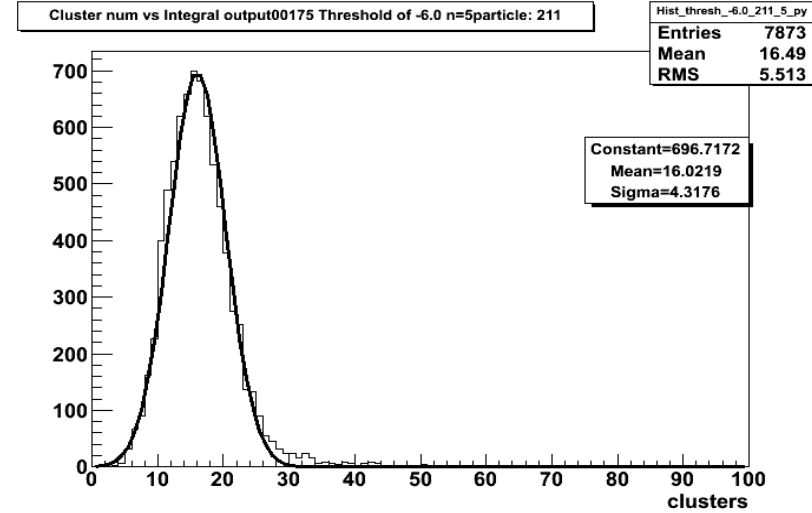
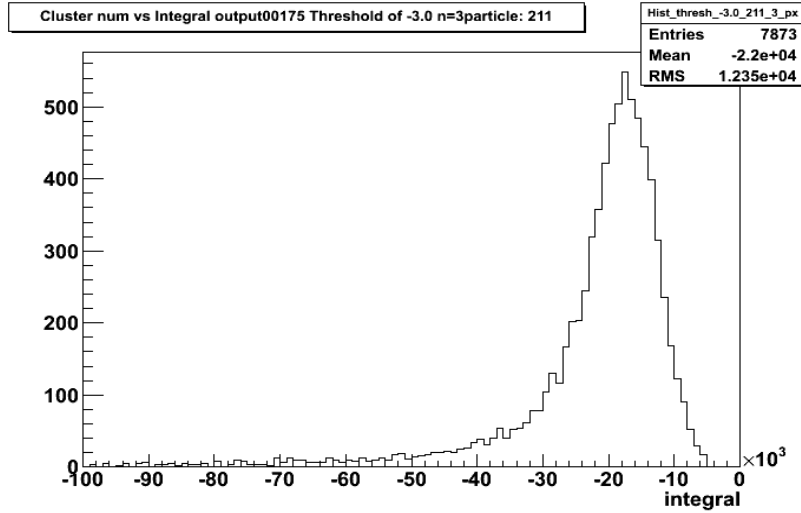
March 21, 2012

Threshold $a=6$
 $n=5$
Particle = Pion
Gas: 90/10

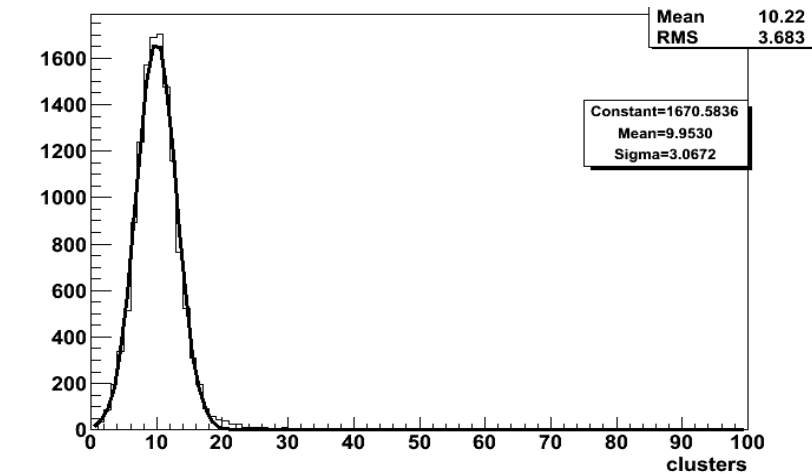
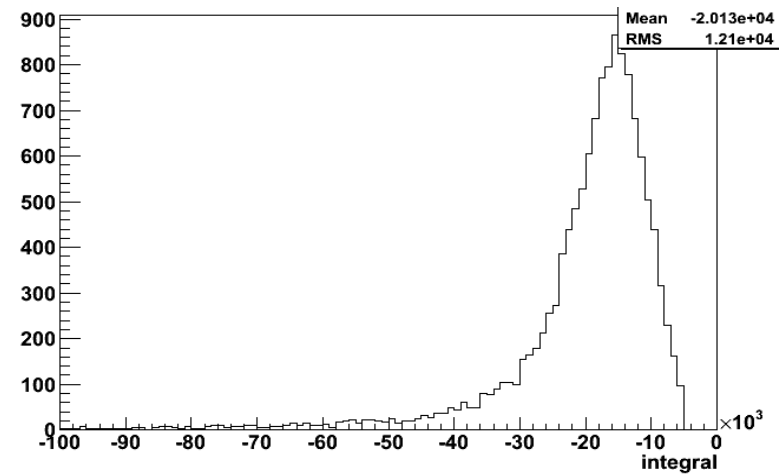
Integral of Signal

Distribution of detected clusters

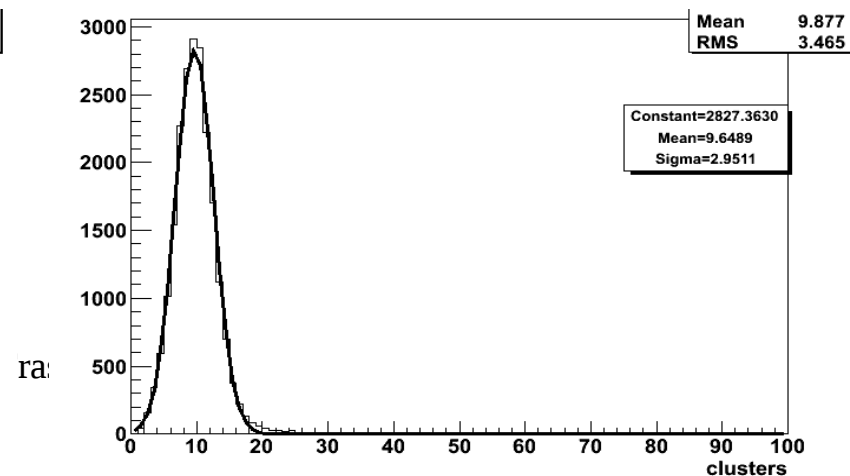
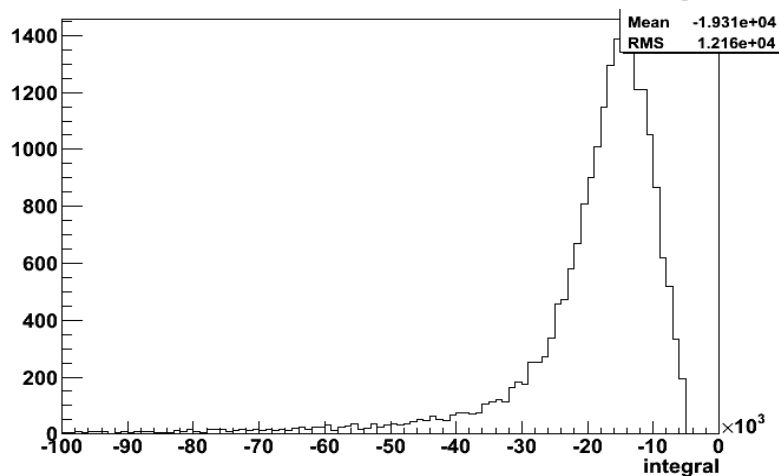
$p=140\text{MeV}/c$
7873 entries



$p=180\text{MeV}/c$
13073 entries



$p=220\text{MeV}/c$
21245 entries



March 21, 2012

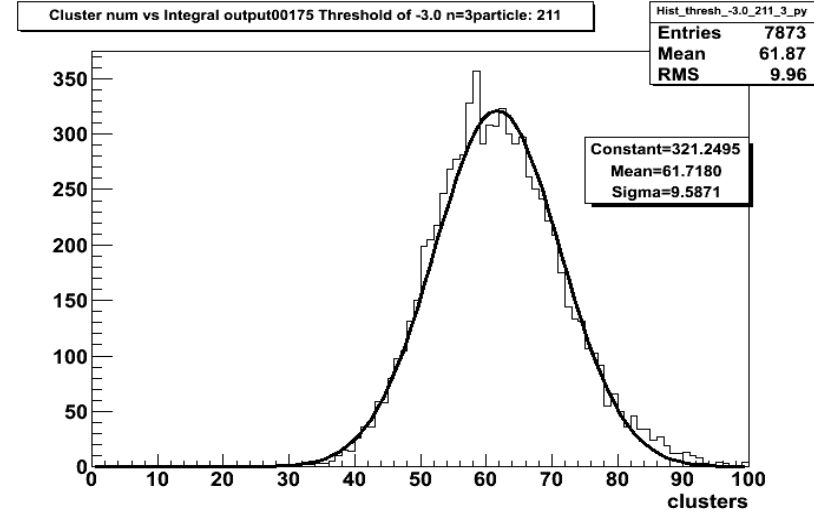
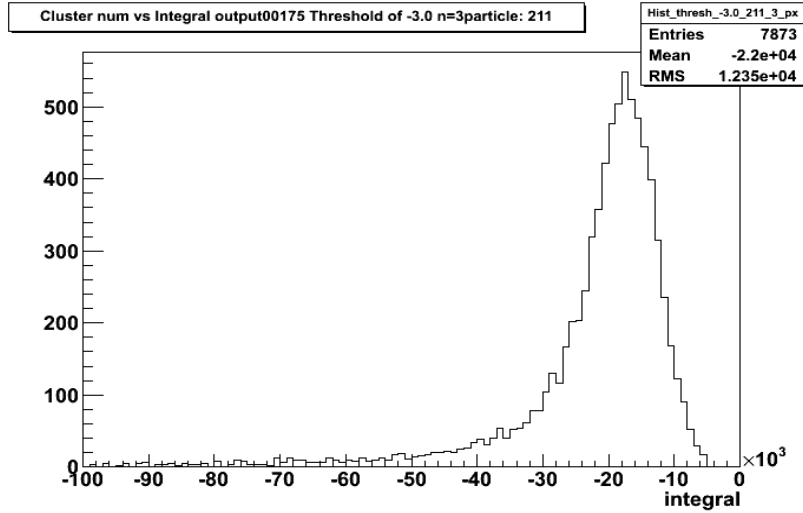
Pions, $n=3$
90/10

Threshold $a=3$
 $n=3$
Particle = Pion
Gas: 90/10

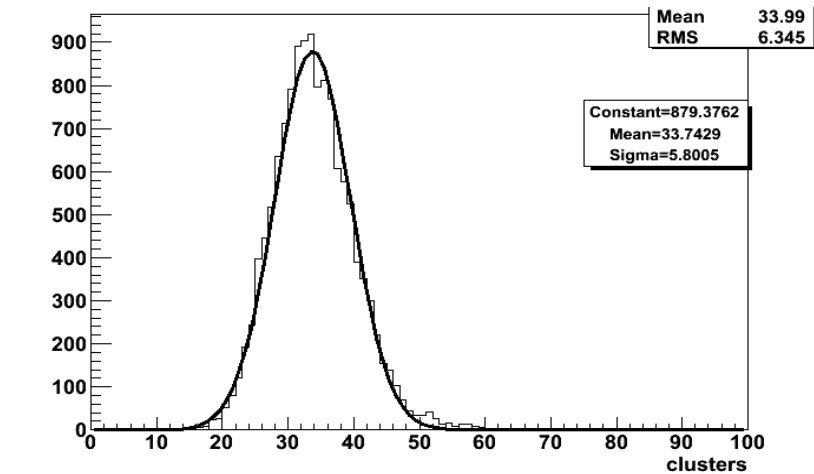
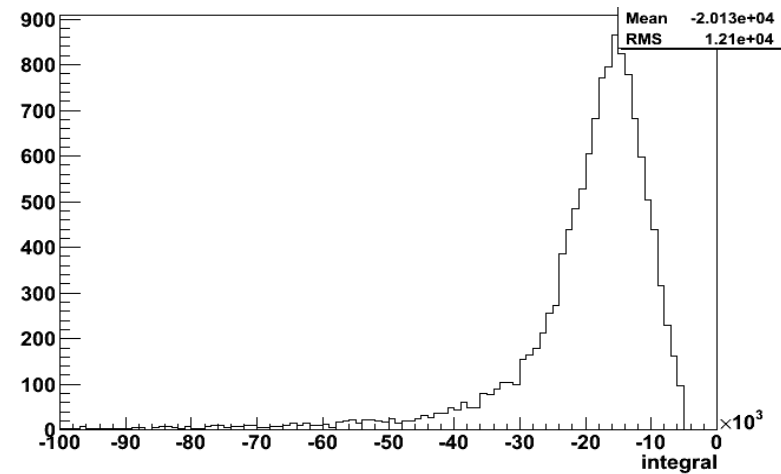
Integral of Signal

Distribution of detected clusters

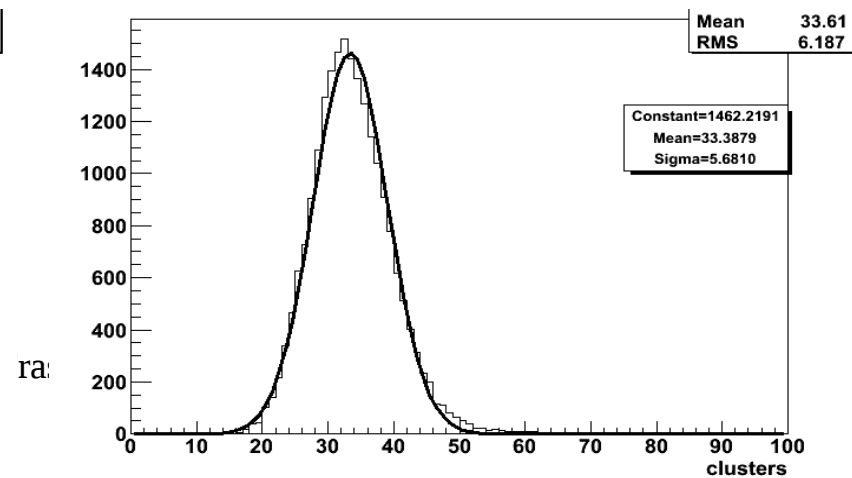
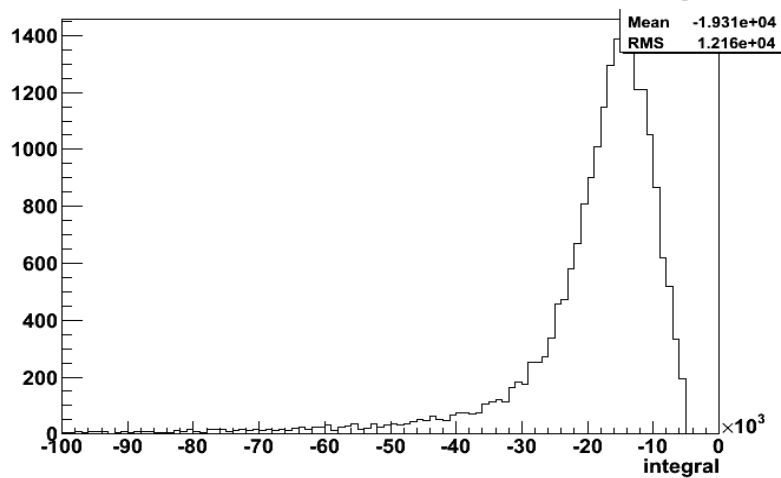
$p=140\text{MeV}/c$
7873 entries



$p=180\text{MeV}/c$
13073 entries



$p=220\text{MeV}/c$
21245 entries



March 21, 2012

Threshold $a=3.3$

$n=3$

Particle = Pion

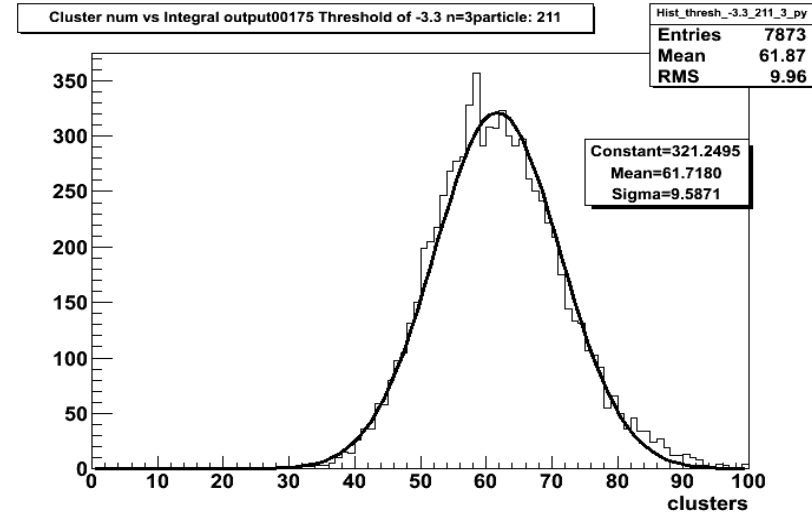
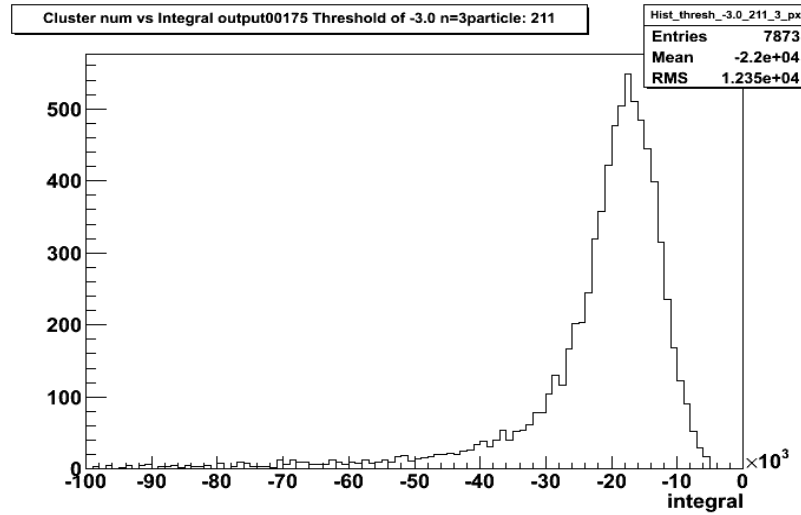
Gas: 90/10

Integral of Signal

Distribution of detected clusters

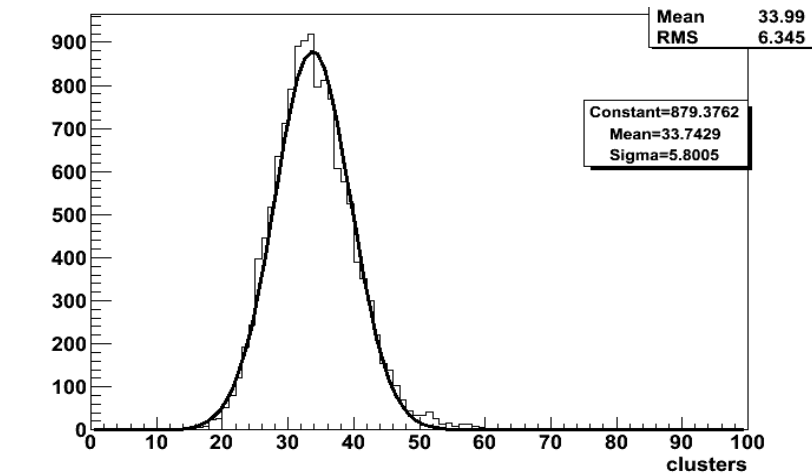
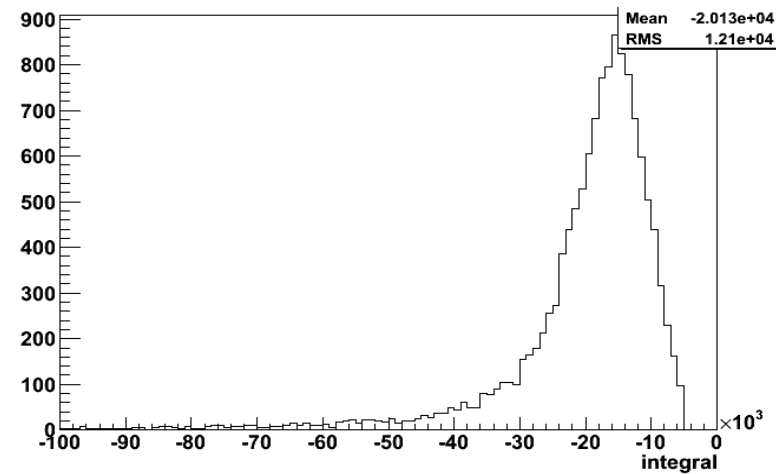
$p=140\text{MeV}/c$

7873 entries



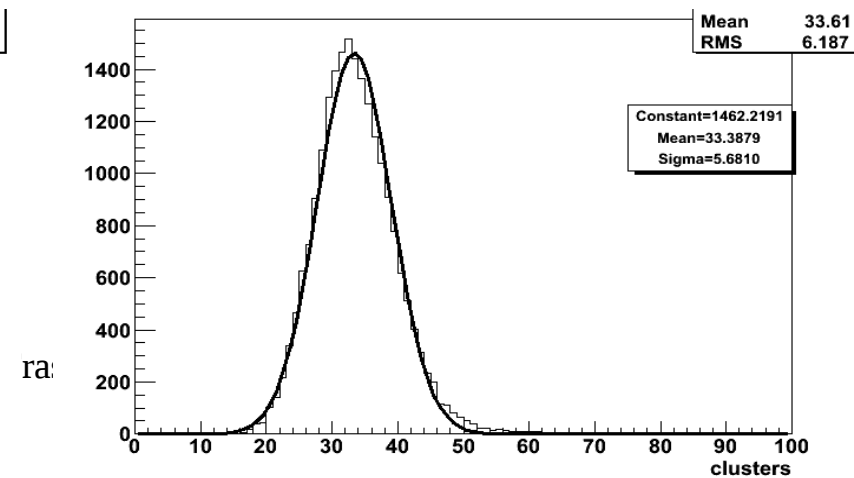
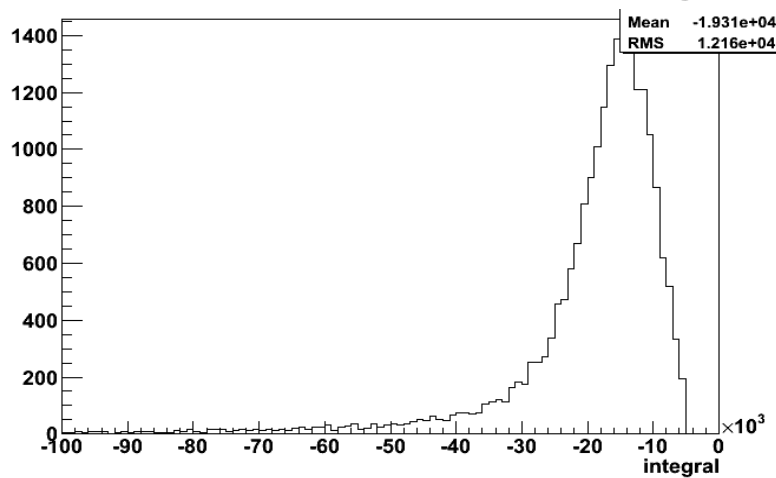
$p=180\text{MeV}/c$

13073 entries



$p=220\text{MeV}/c$

21245 entries



March 21, 2012

ra:

Threshold $a=3.5$

$n=3$

Particle = Pion

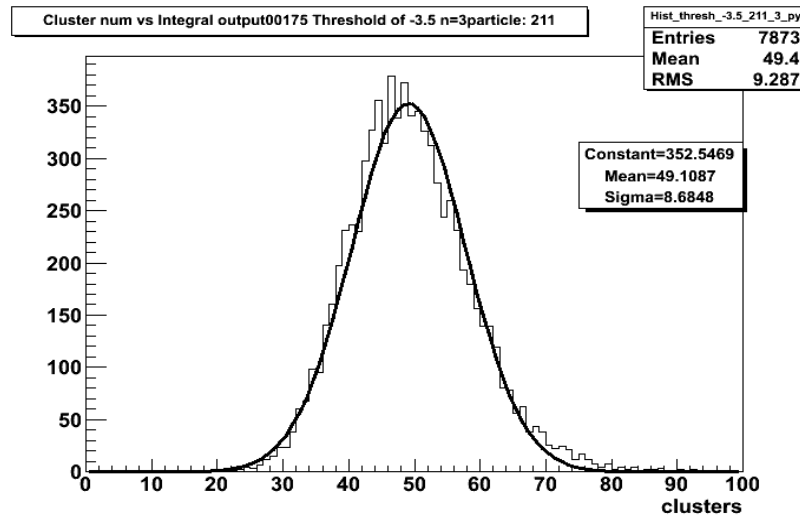
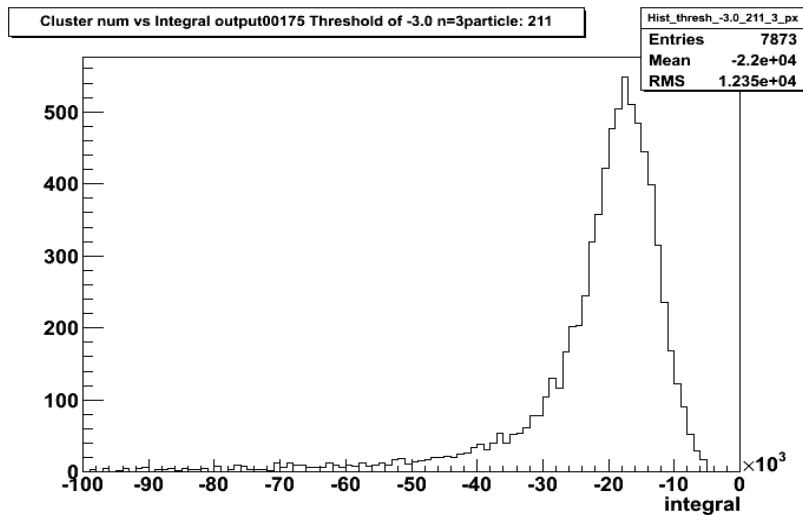
Gas: 90/10

Integral of Signal

Distribution of detected clusters

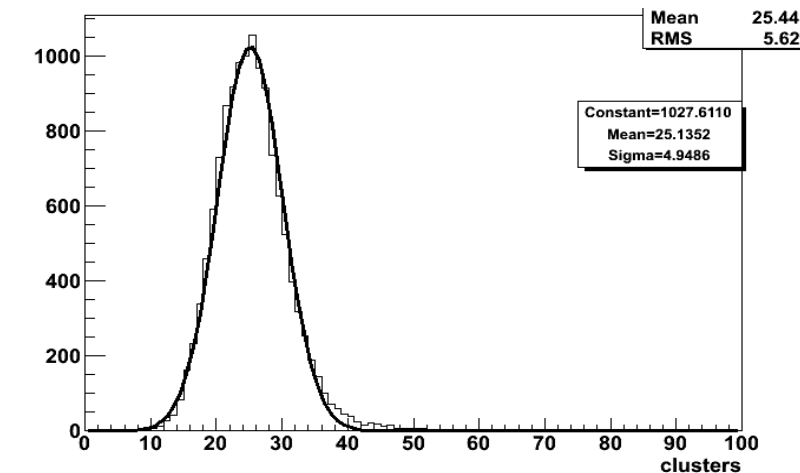
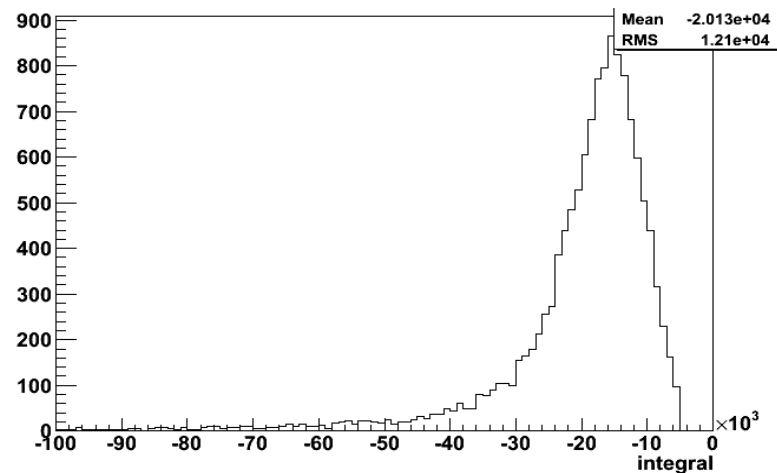
$p=140\text{MeV}/c$

7873 entries



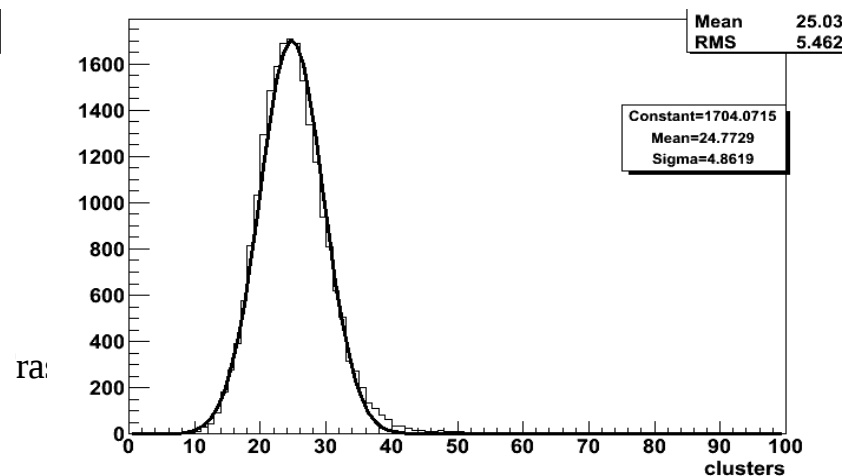
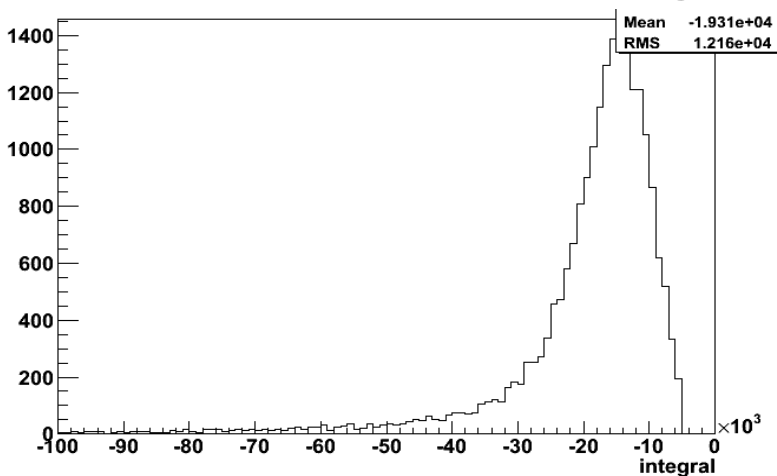
$p=180\text{MeV}/c$

13073 entries



$p=220\text{MeV}/c$

21245 entries



March 21, 2012

Threshold $a=3.7$

$n=3$

Particle = Pion

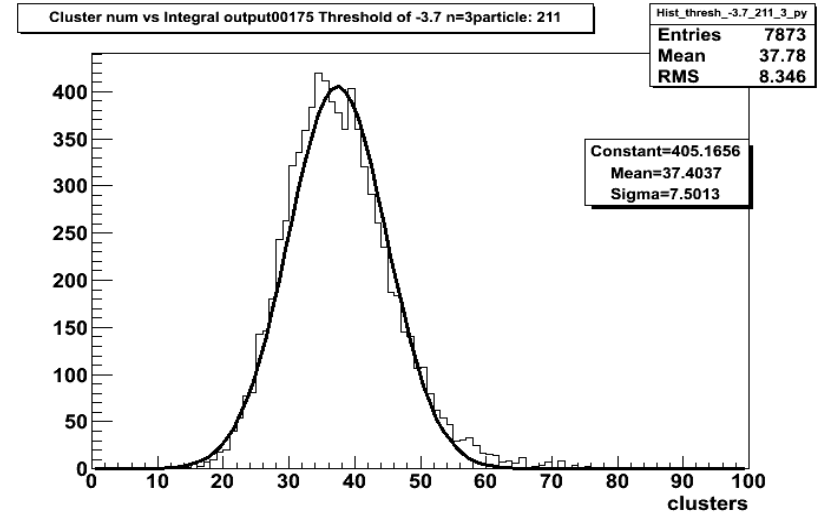
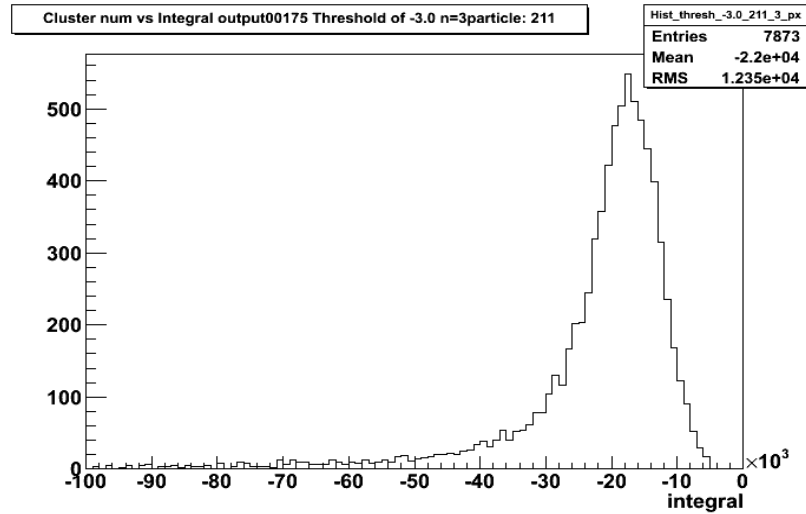
Gas: 90/10

Integral of Signal

Distribution of detected clusters

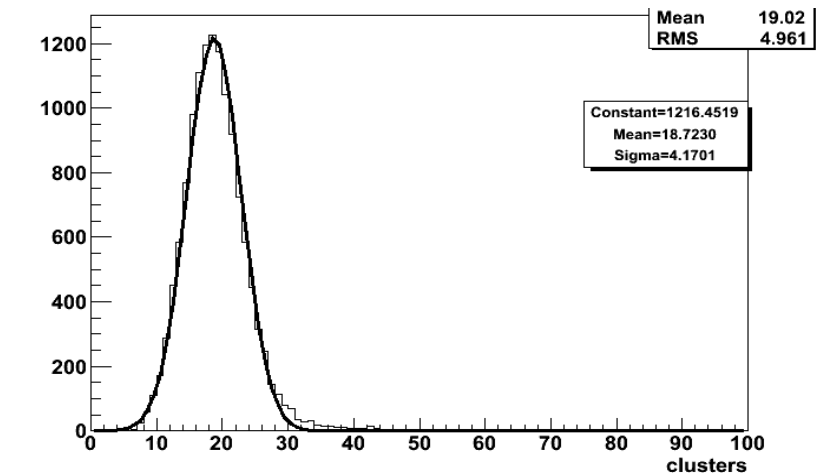
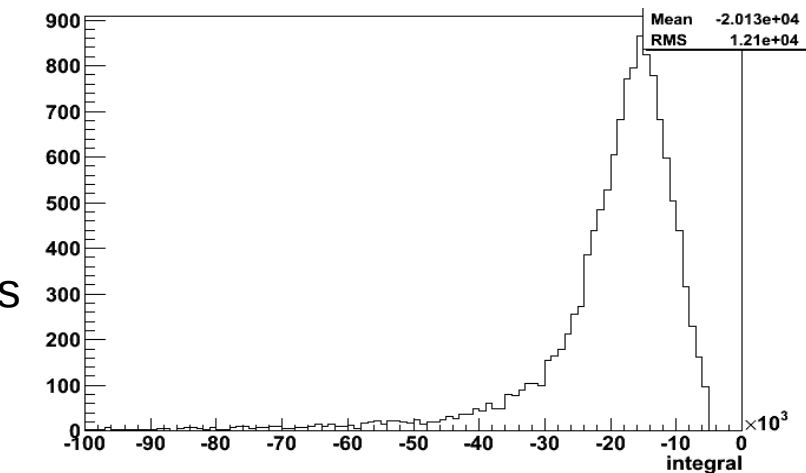
$p=140\text{MeV}/c$

7873 entries



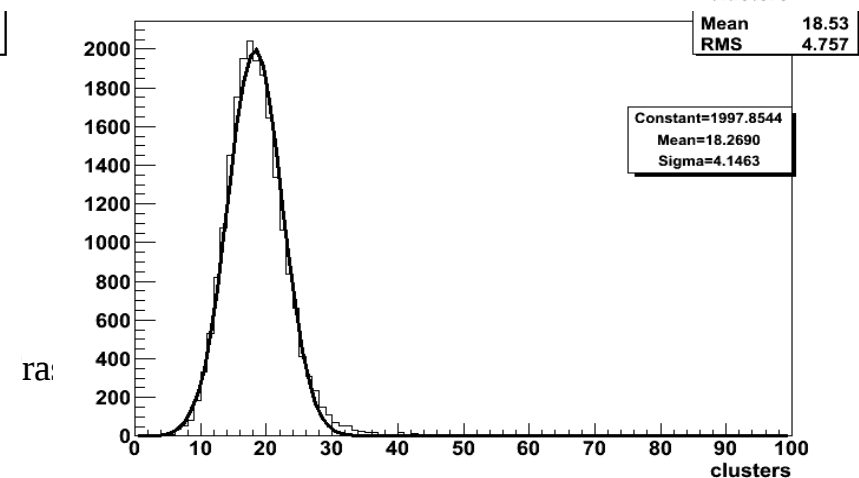
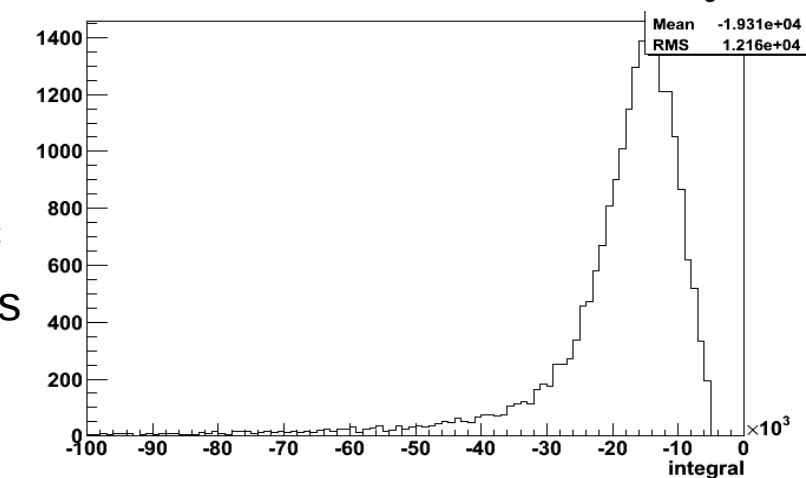
$p=180\text{MeV}/c$

13073 entries



$p=220\text{MeV}/c$

21245 entries



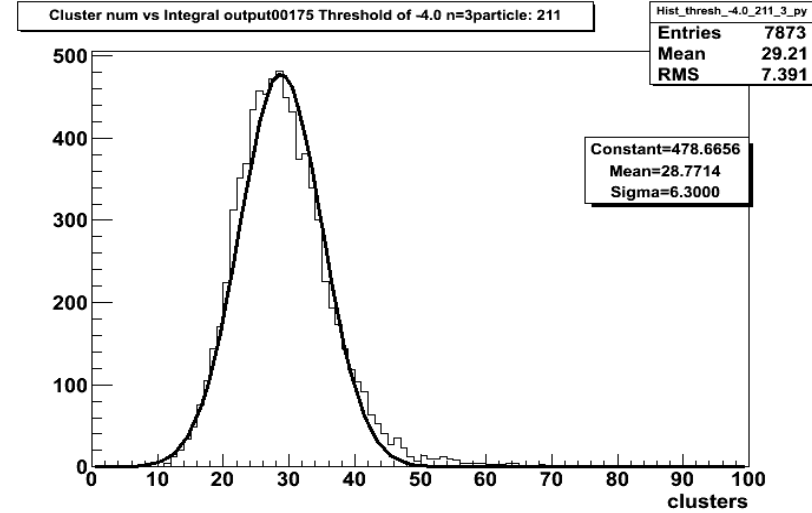
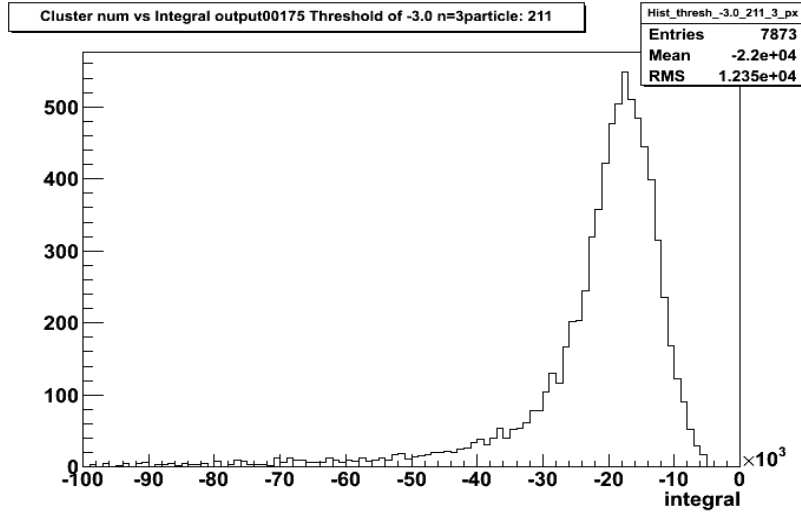
March 21, 2012

Threshold $a=4$
 $n=3$
Particle = Pion
Gas: 90/10

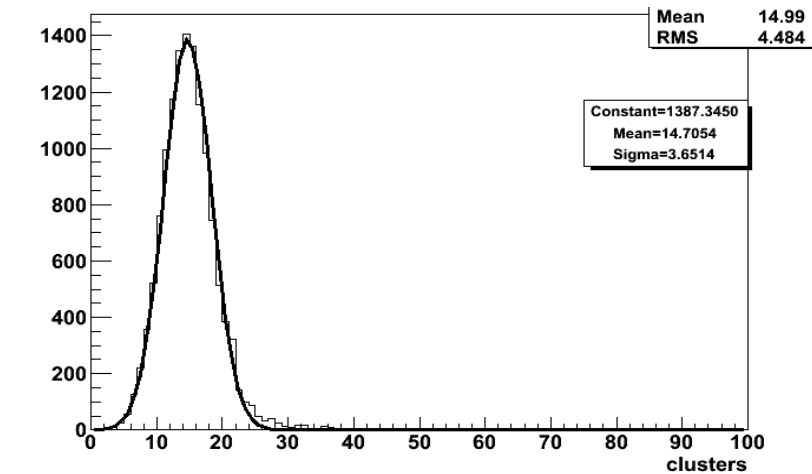
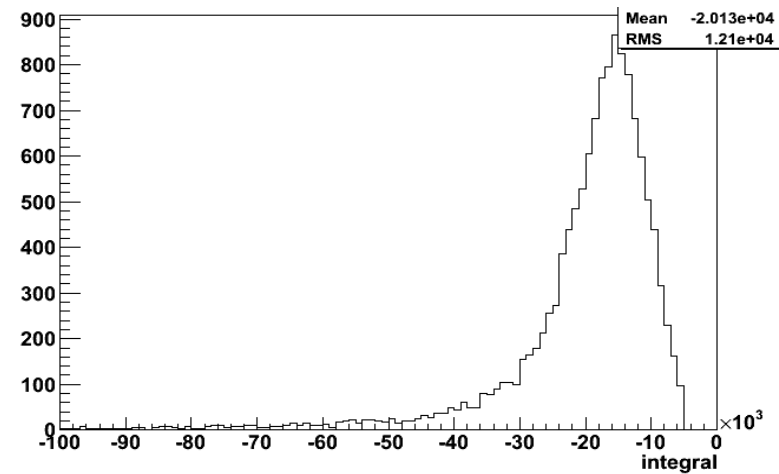
Integral of Signal

Distribution of detected clusters

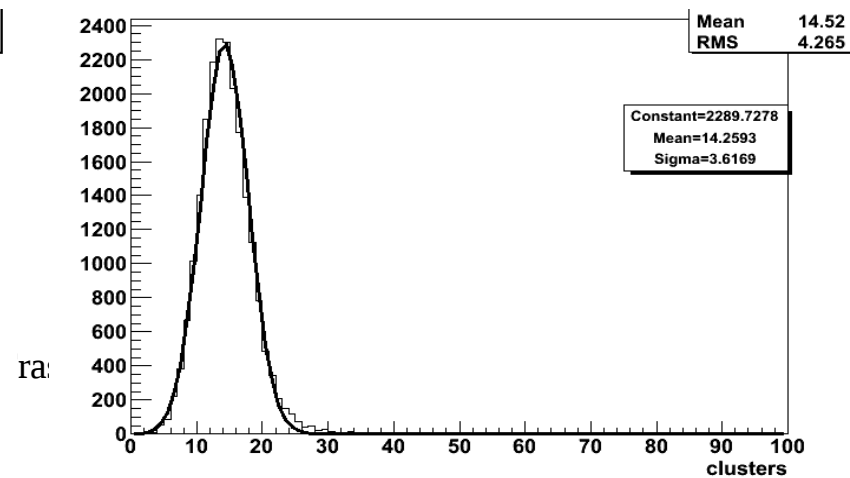
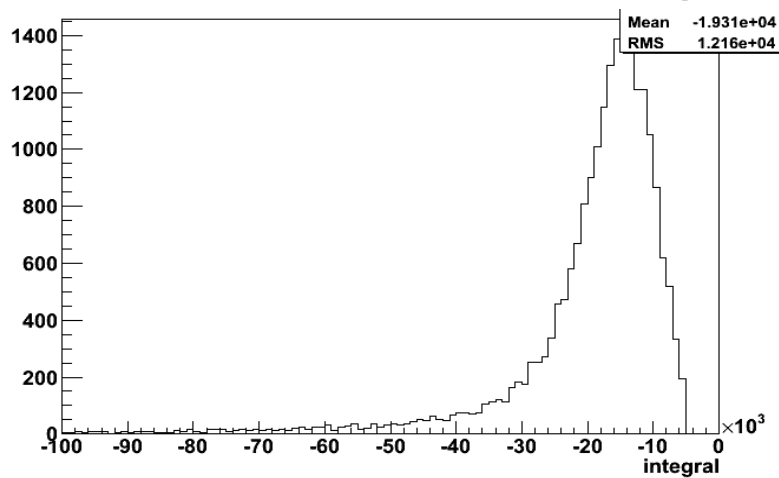
$p=140\text{MeV}/c$
7873 entries



$p=180\text{MeV}/c$
13073 entries



$p=220\text{MeV}/c$
21245 entries



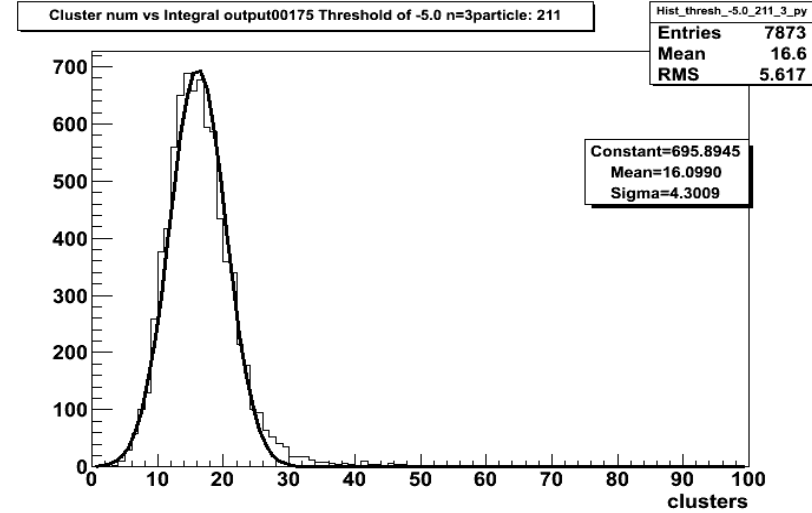
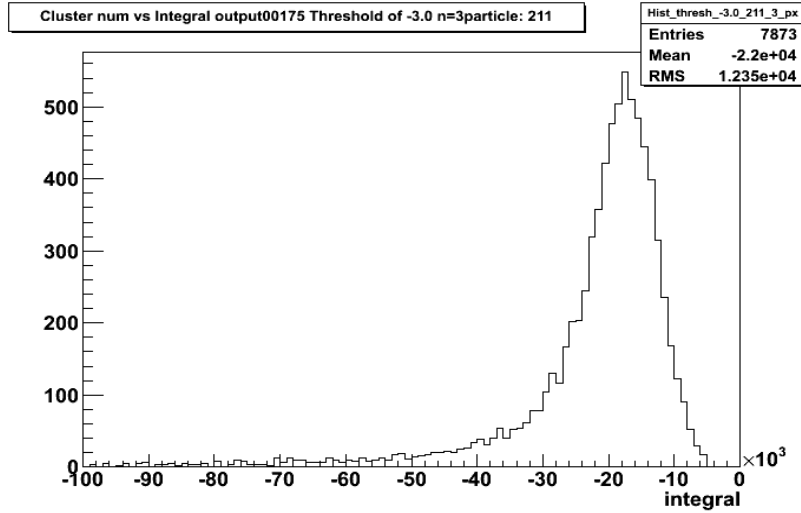
March 21, 2012

Threshold $a=5$
 $n=3$
 Particle = Pion
 Gas: 90/10

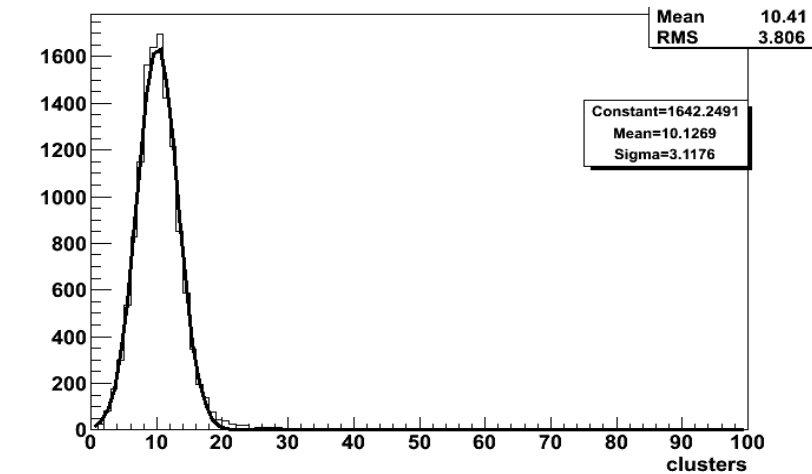
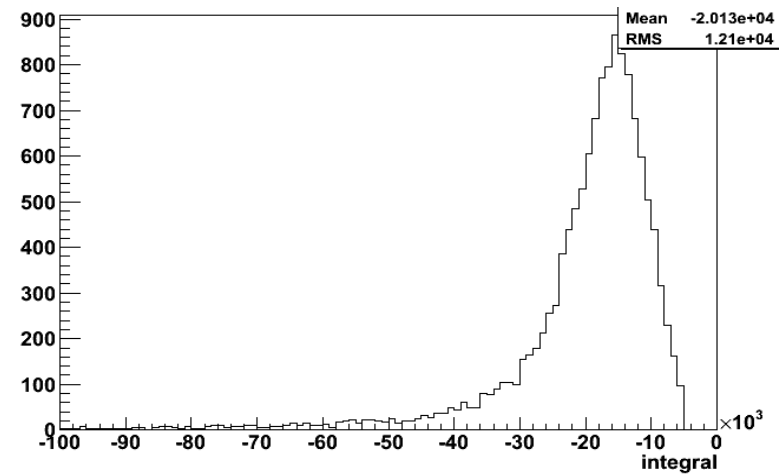
Integral of Signal

Distribution of detected clusters

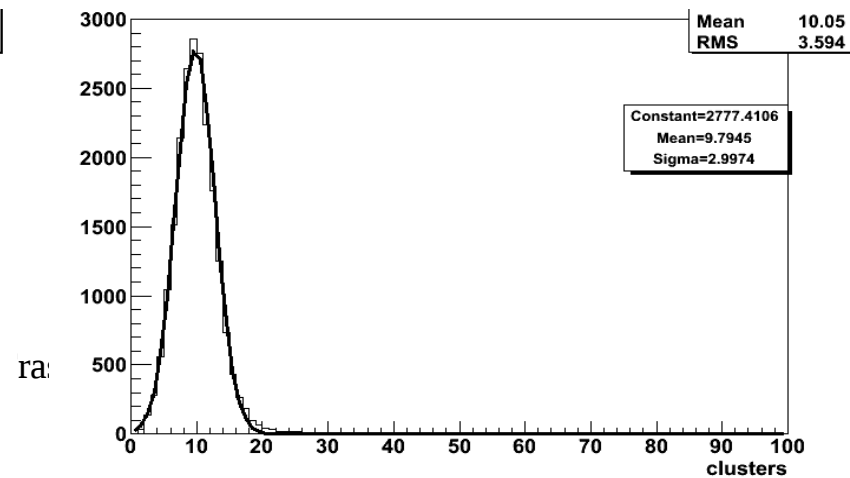
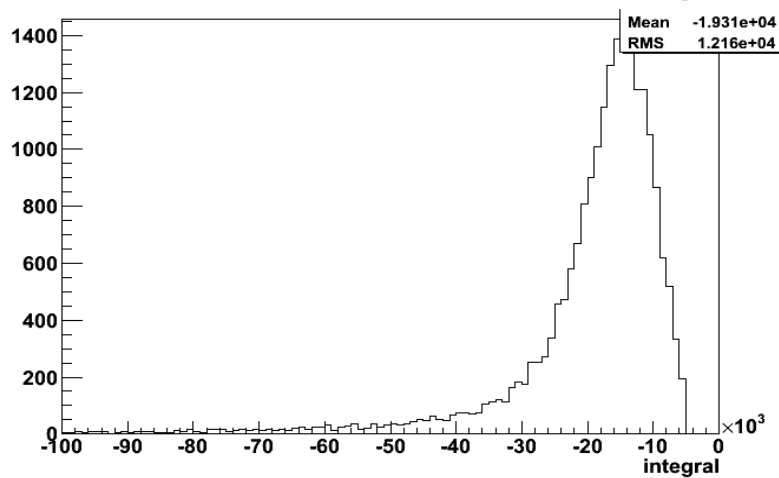
$p=140\text{MeV}/c$
 7873 entries



$p=180\text{MeV}/c$
 13073 entries



$p=220\text{MeV}/c$
 21245 entries



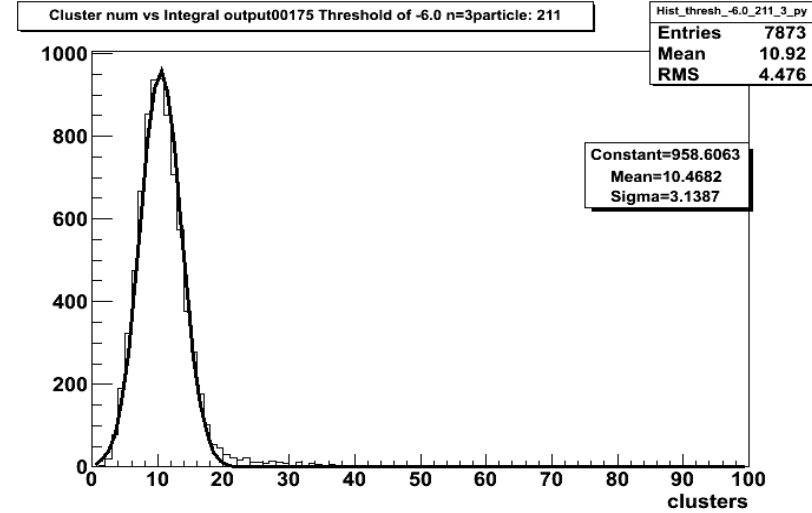
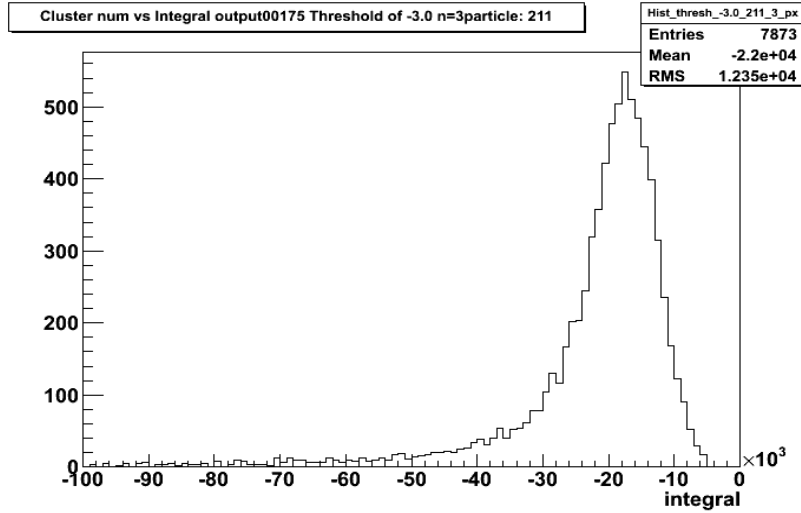
March 21, 2012

Threshold $a=6$
 $n=3$
 Particle = Pion
 Gas: 90/10

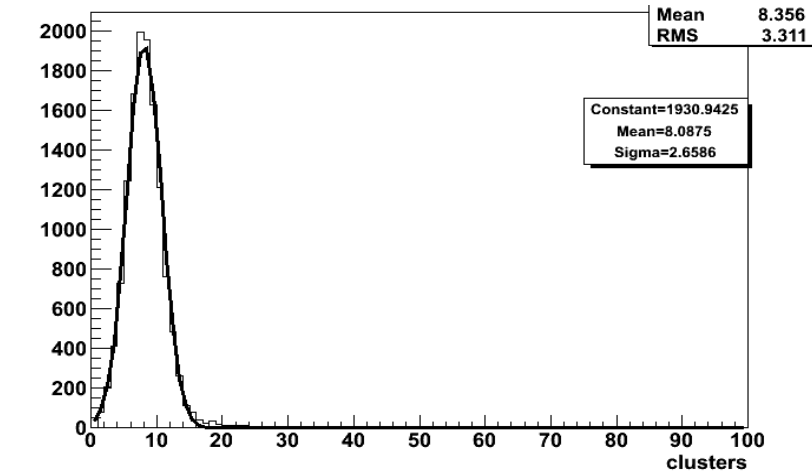
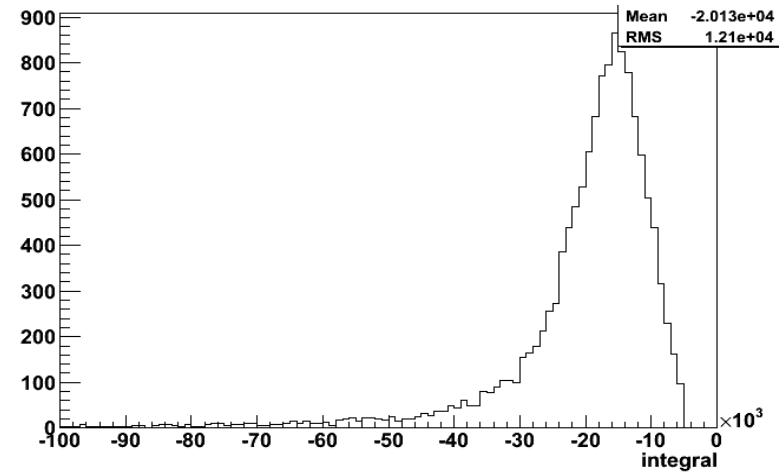
Integral of Signal

Distribution of detected clusters

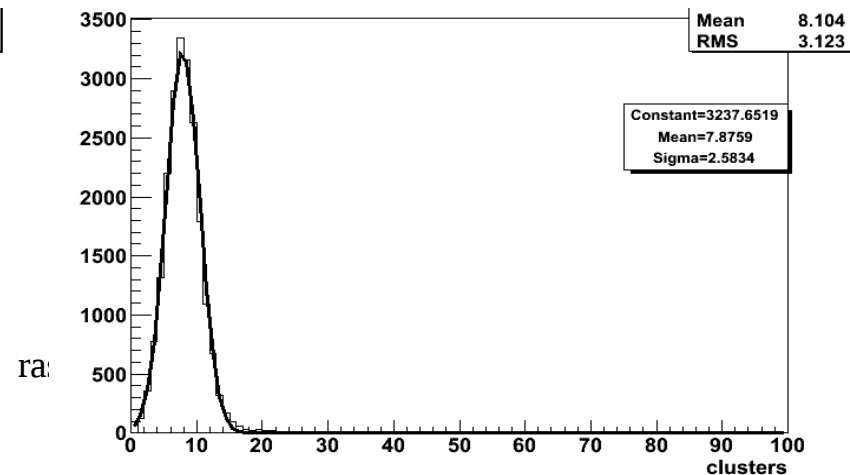
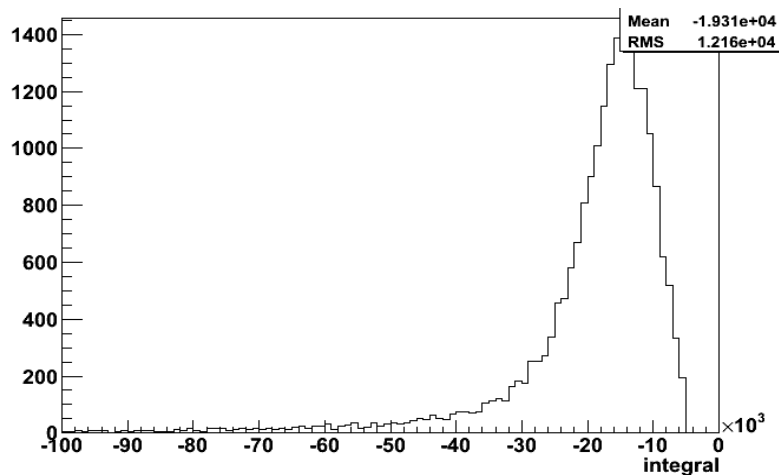
$p=140\text{MeV}/c$
 7873 entries



$p=180\text{MeV}/c$
 13073 entries



$p=220\text{MeV}/c$
 21245 entries



March 21, 2012

Muons, $n=5$
90/10

Threshold $a=3$

$n=5$

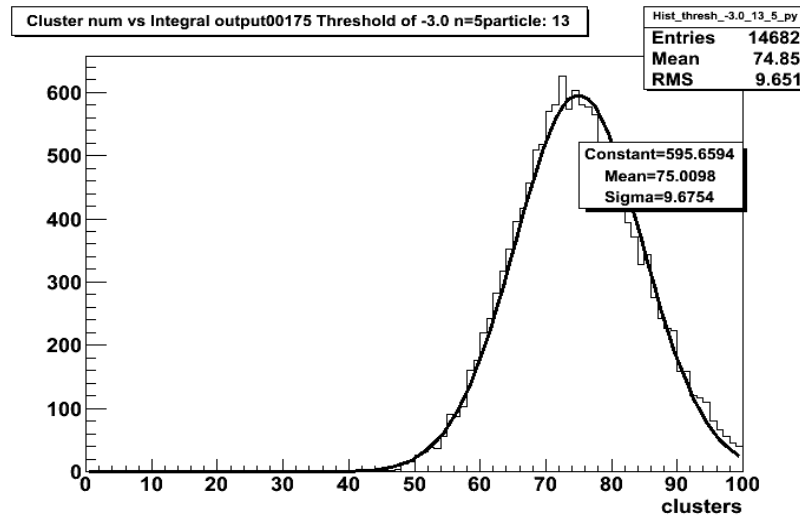
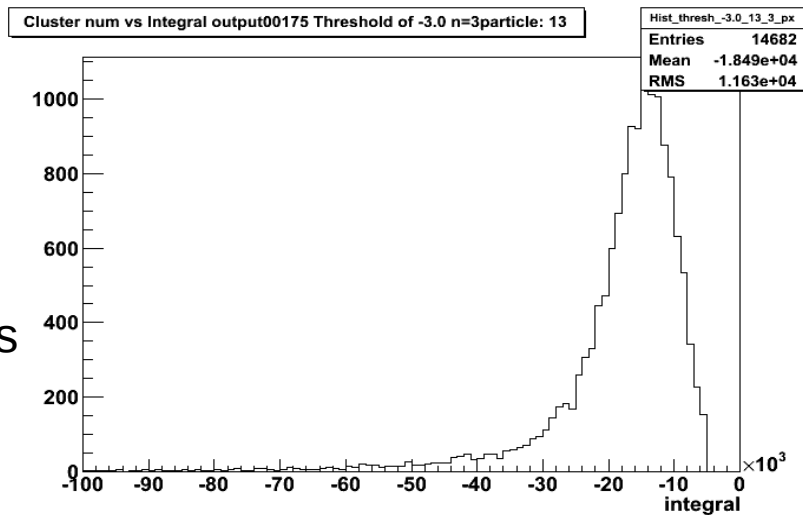
Particle = Muon

Gas: 90/10

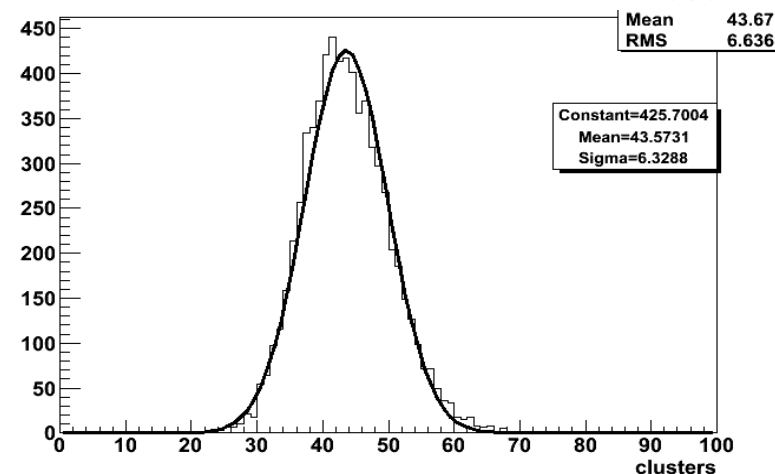
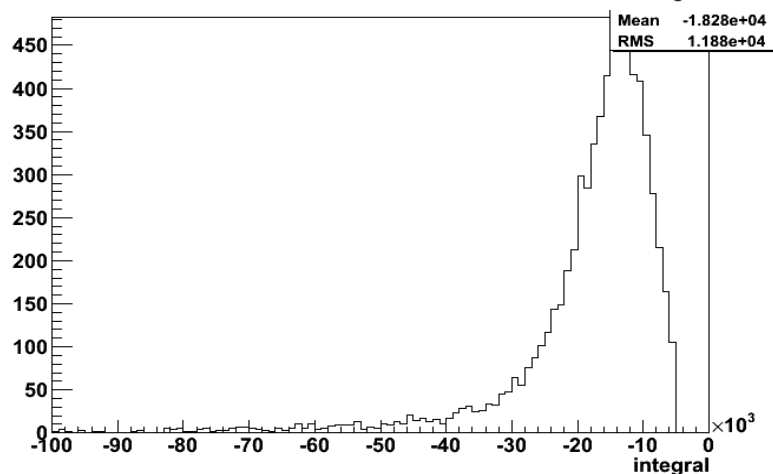
Integral of Signal

Distribution of detected clusters

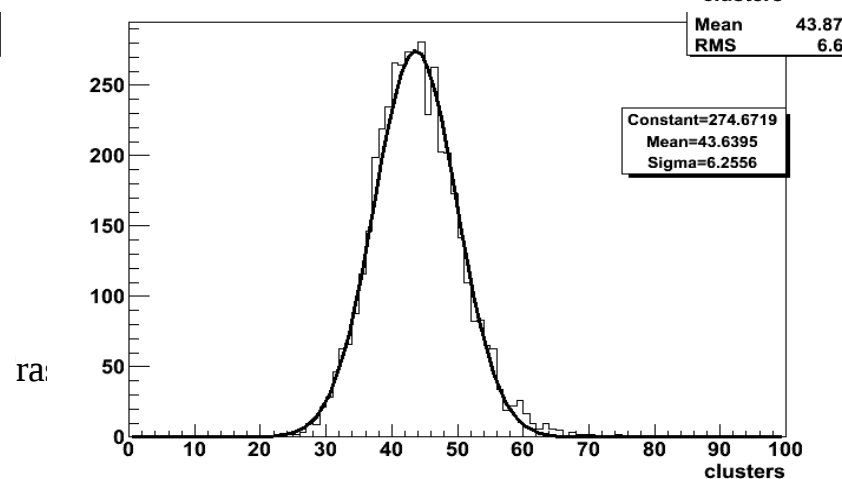
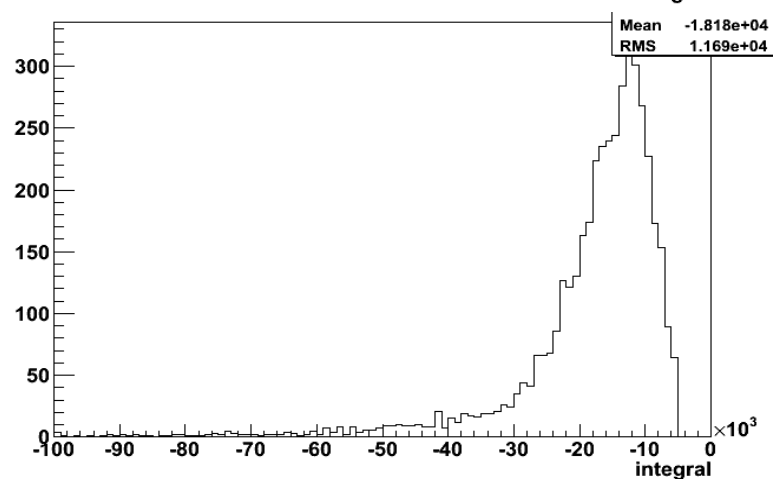
$p=140\text{MeV}/c$
14682 entries



$p=180\text{MeV}/c$
6892 entries



$p=220\text{MeV}/c$
4393 entries



March 21, 2012

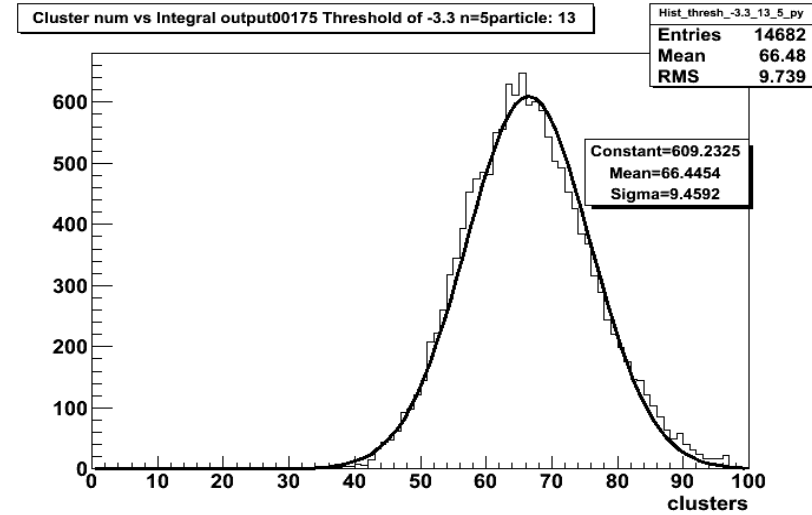
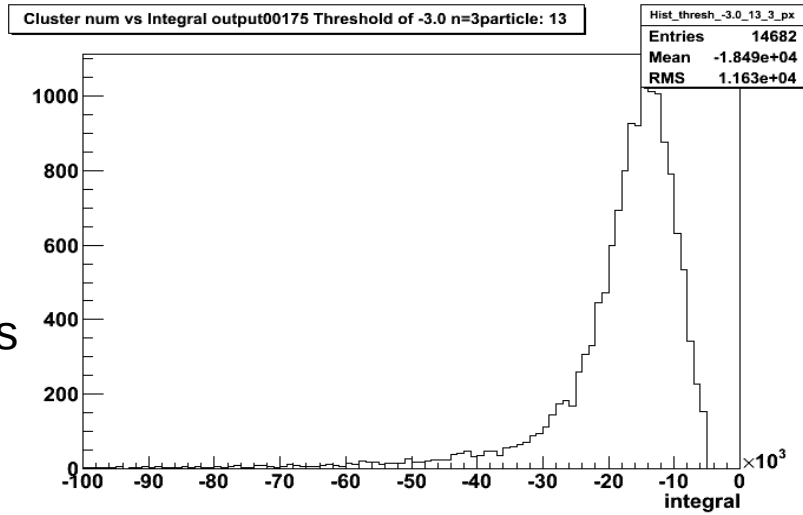
ra

Threshold $a=3.3$
 $n=5$
 Particle = Muon
 Gas: 90/10

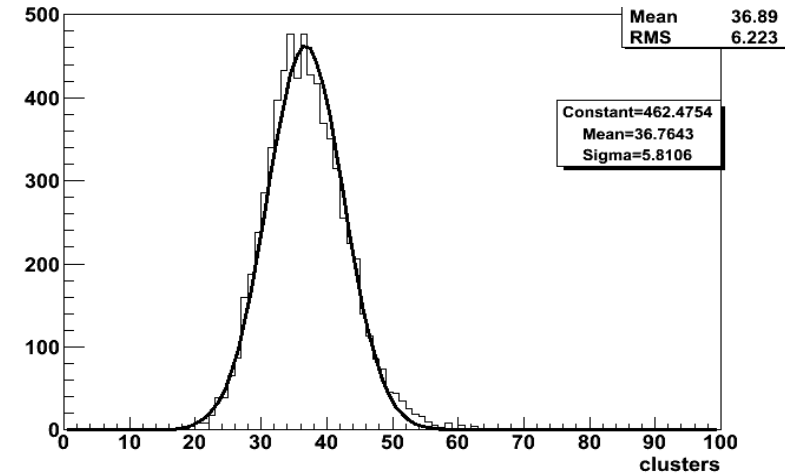
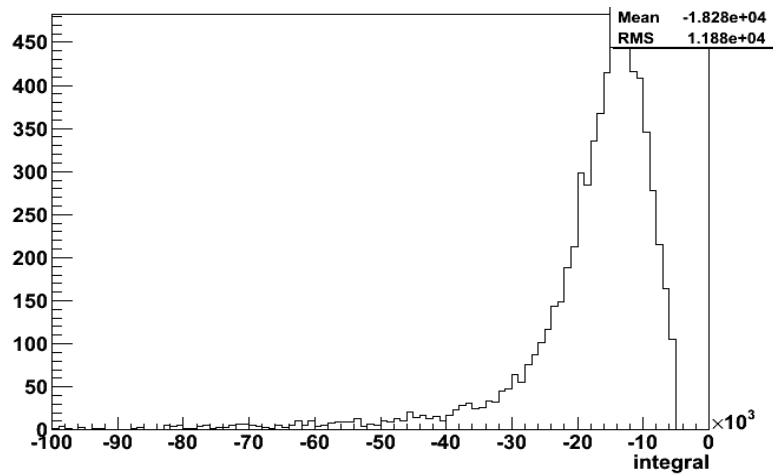
Integral of Signal

Distribution of detected clusters

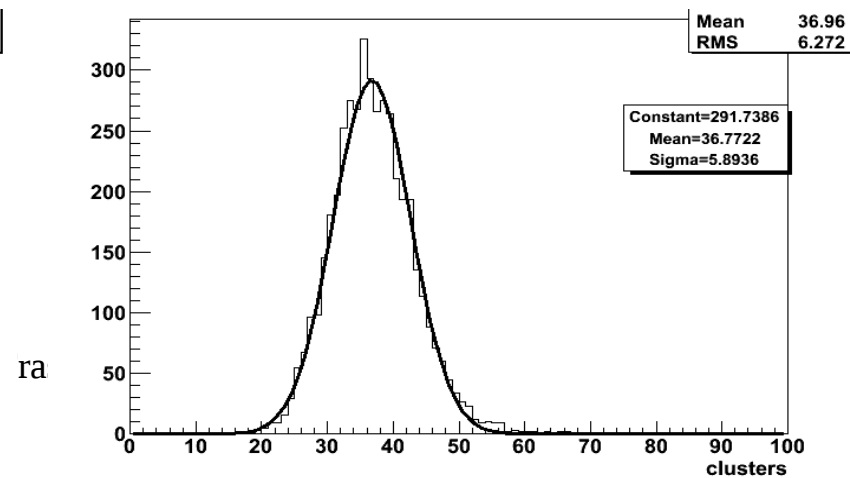
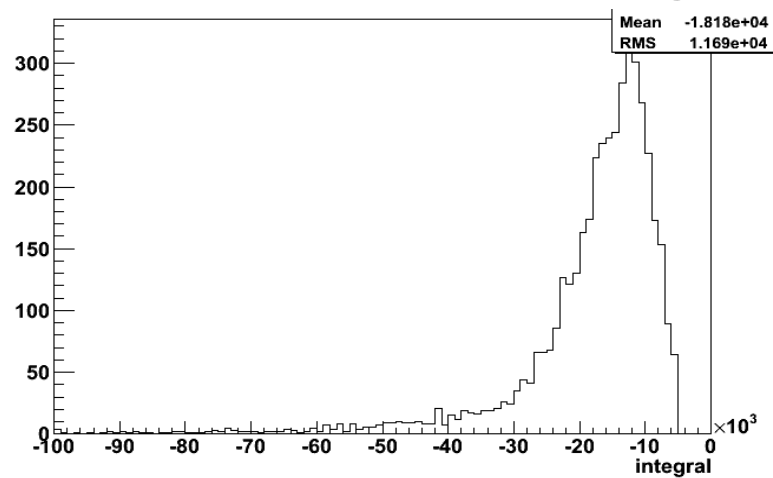
$p=140\text{MeV}/c$
 14682 entries



$p=180\text{MeV}/c$
 6892 entries



$p=220\text{MeV}/c$
 4393 entries



March 21, 2012

ra

Threshold $a=3.5$

$n=5$

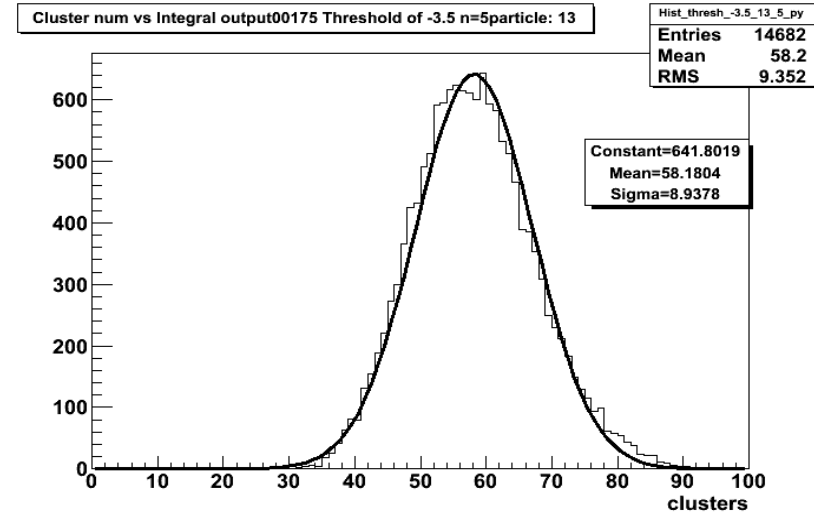
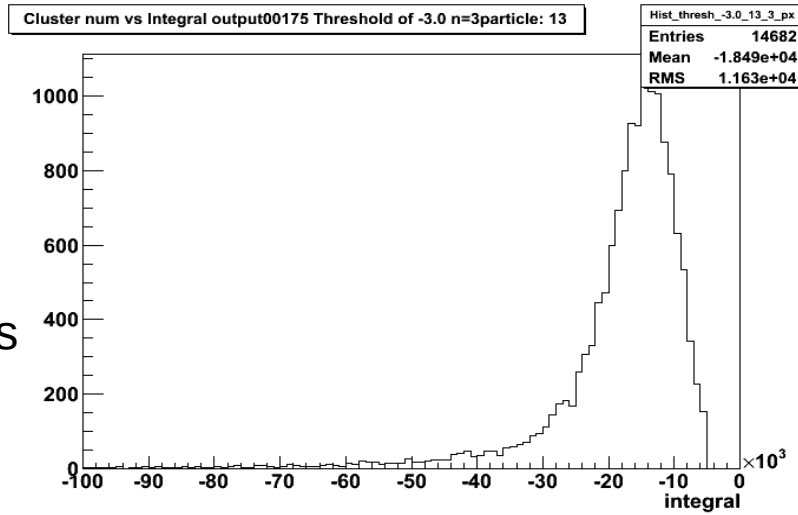
Particle = Muon

Gas: 90/10

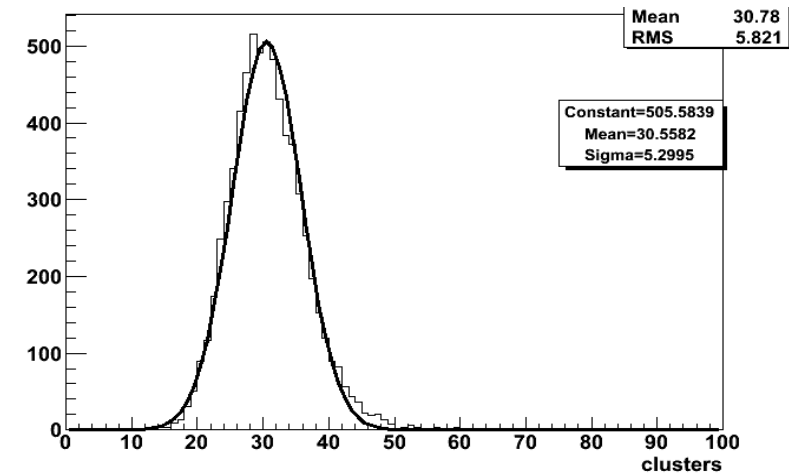
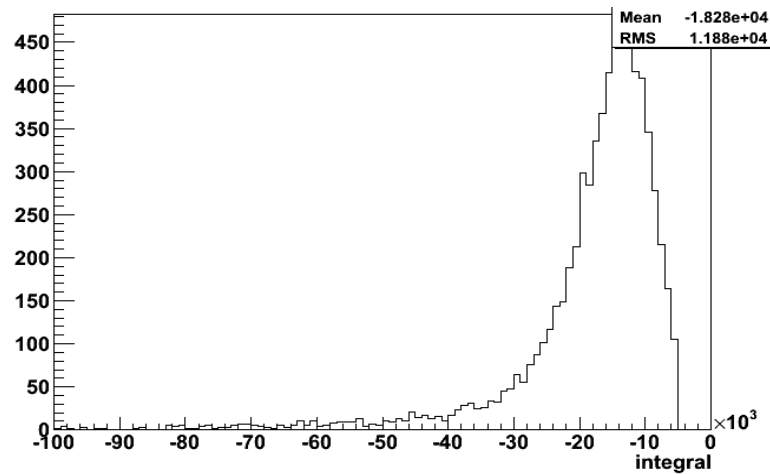
Integral of Signal

Distribution of detected clusters

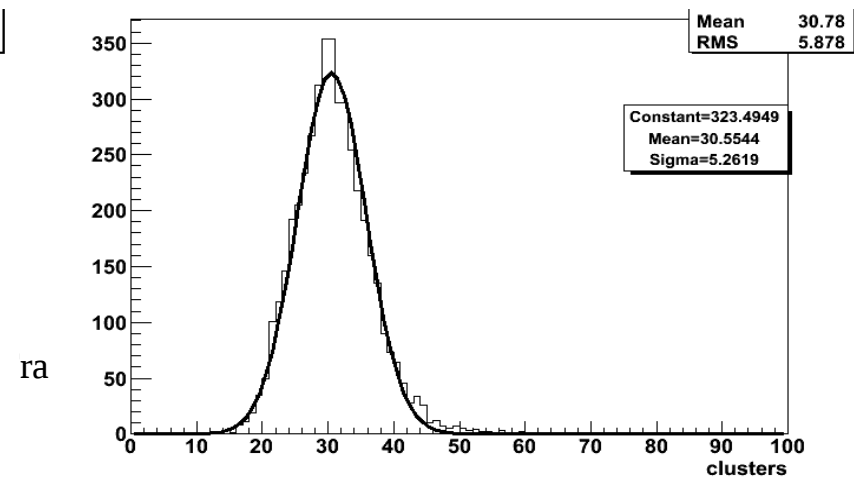
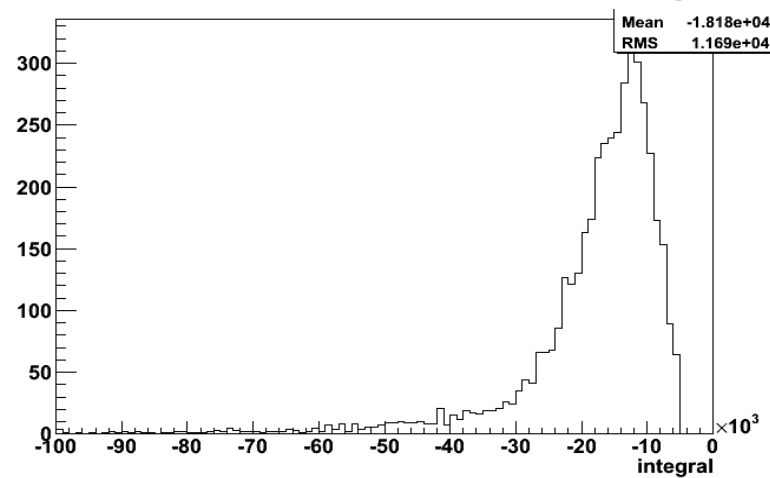
$p=140\text{MeV}/c$
14682 entries



$p=180\text{MeV}/c$
6892 entries



$p=220\text{MeV}/c$
4393 entries



March 21, 2012

ra

Threshold $a=3.7$

$n=5$

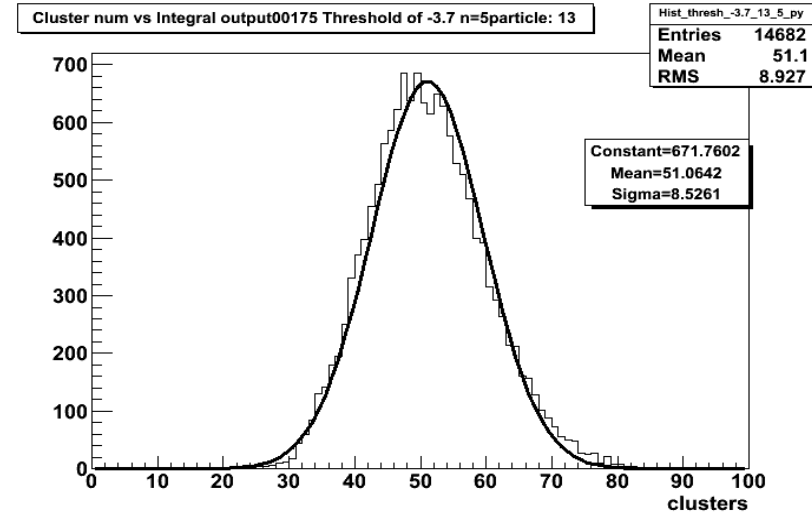
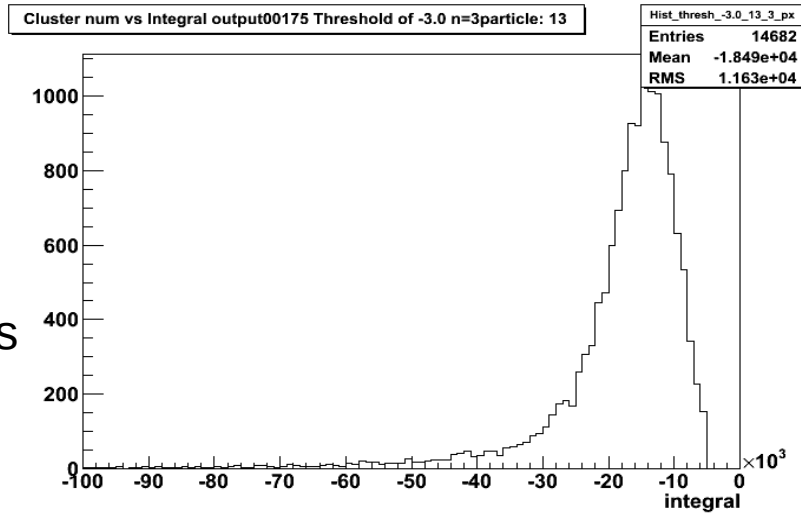
Particle = Muon

Gas: 90/10

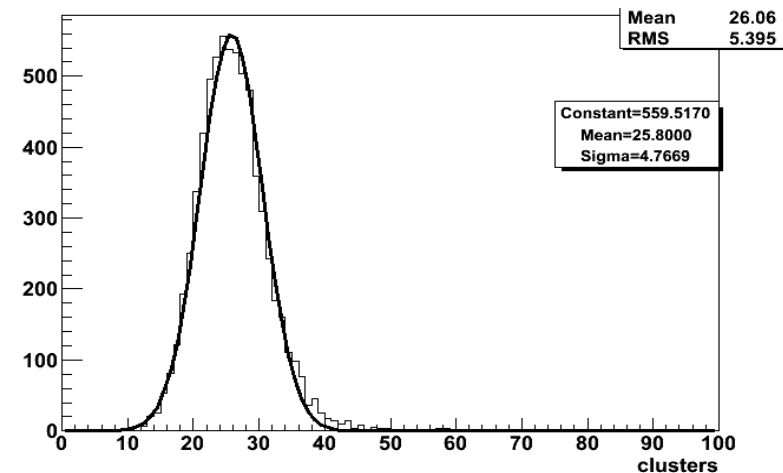
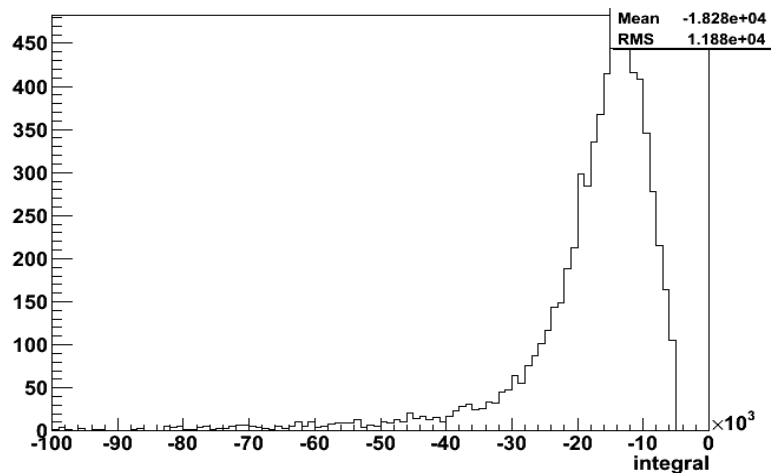
Integral of Signal

Distribution of detected clusters

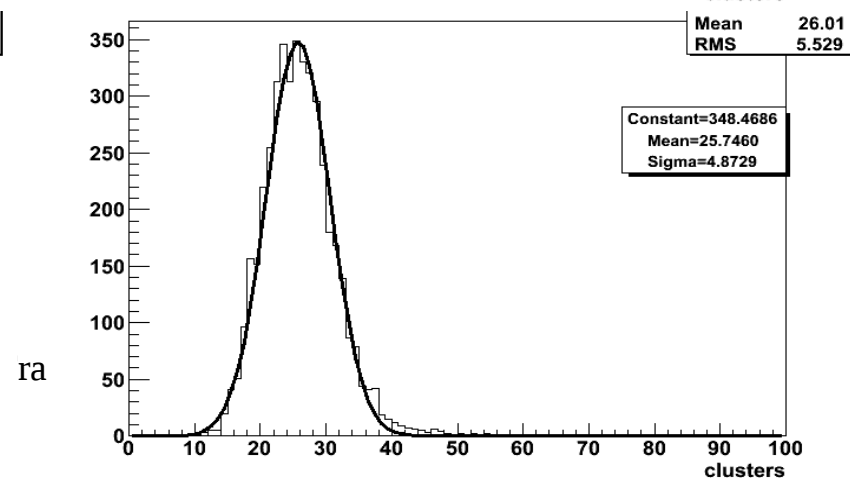
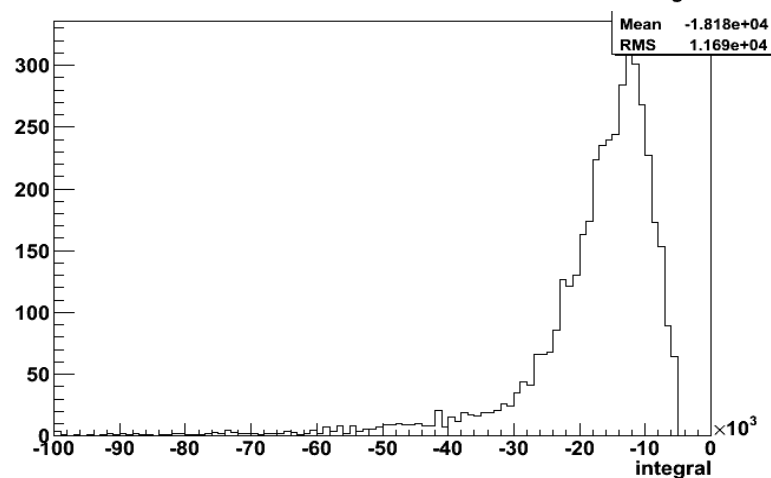
$p=140\text{MeV}/c$
14682 entries



$p=180\text{MeV}/c$
6892 entries



$p=220\text{MeV}/c$
4393 entries



March 21, 2012

ra

Threshold $a=4$

$n=5$

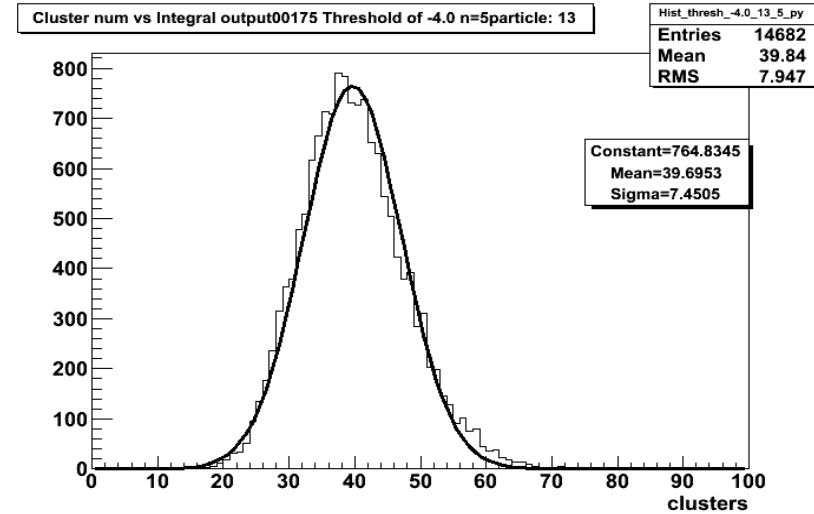
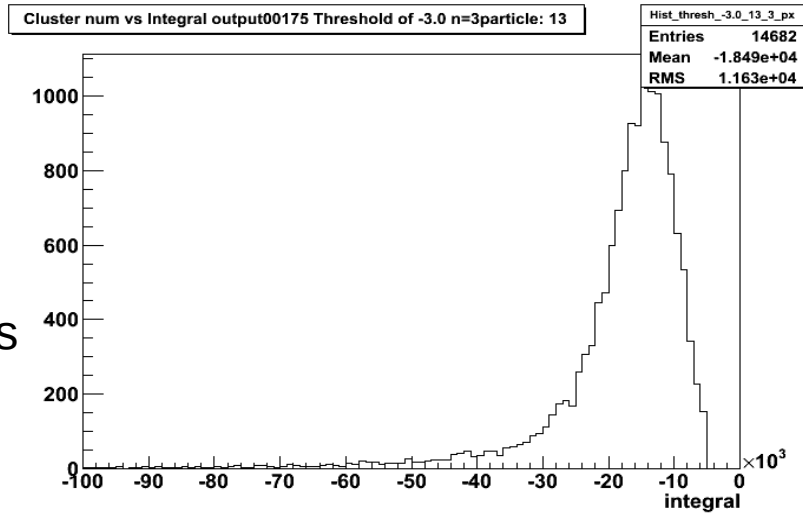
Particle = Muon

Gas: 90/10

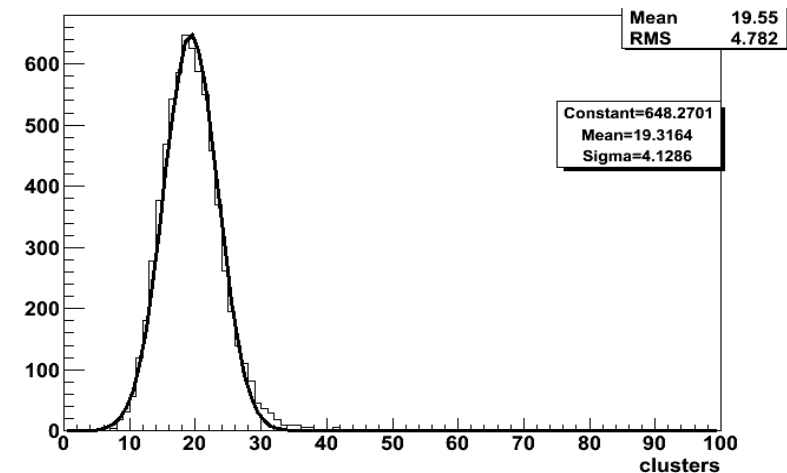
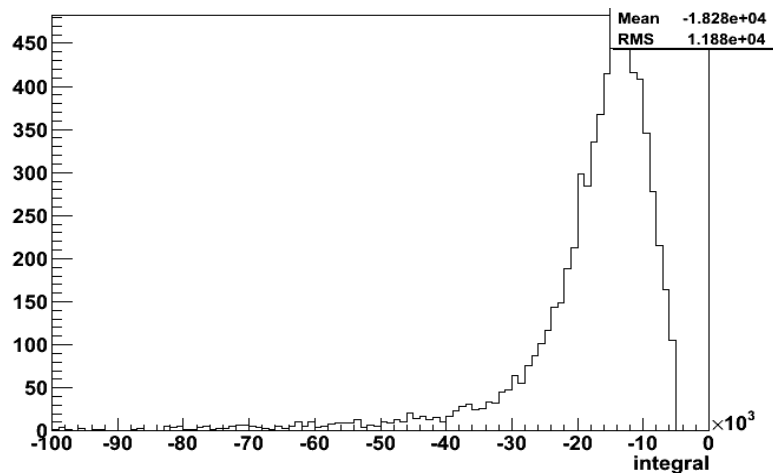
Integral of Signal

Distribution of detected clusters

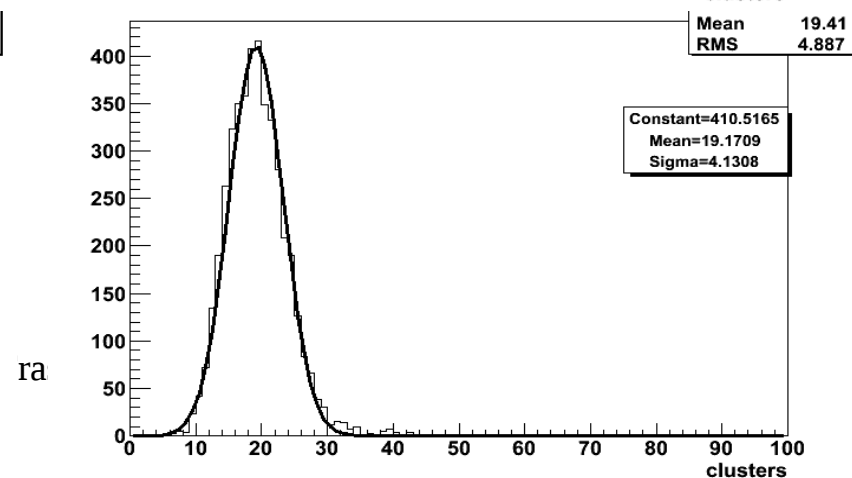
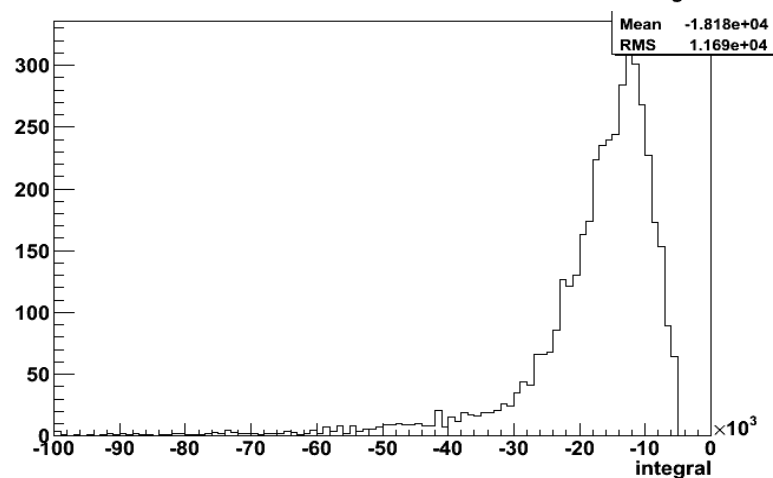
$p=140\text{MeV}/c$
14682 entries



$p=180\text{MeV}/c$
6892 entries



$p=220\text{MeV}/c$
4393 entries



March 21, 2012

ra

Threshold $a=5$

$n=5$

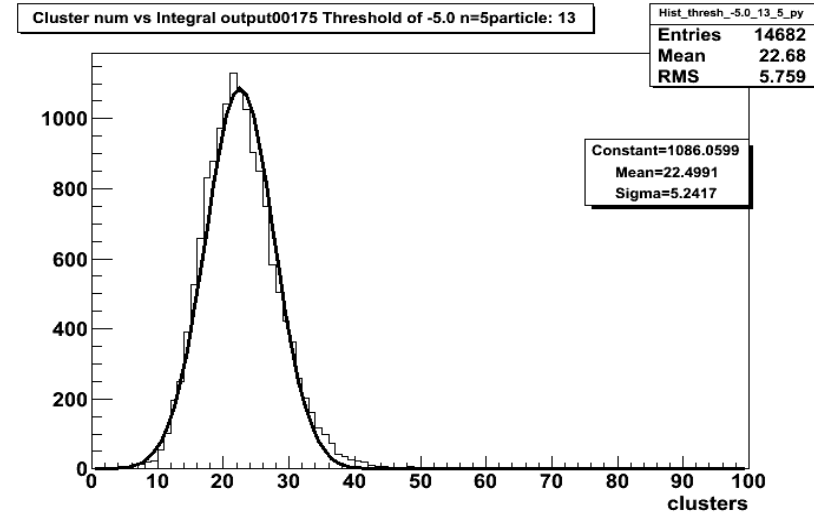
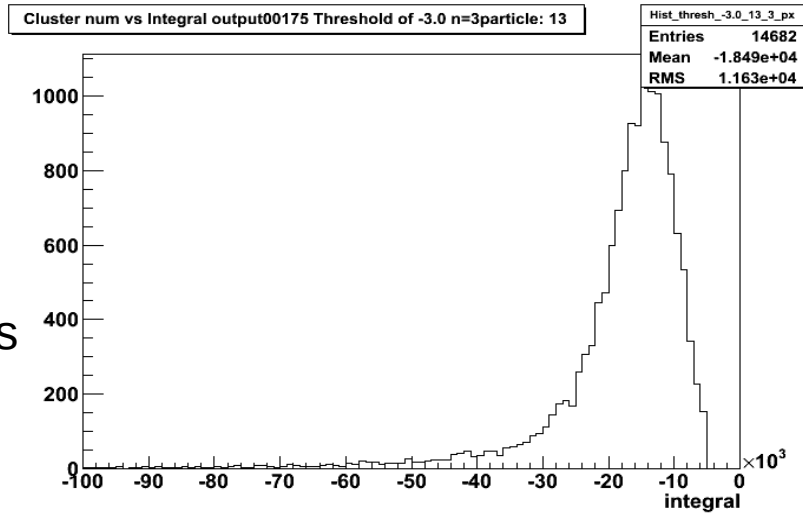
Particle = Muon

Gas: 90/10

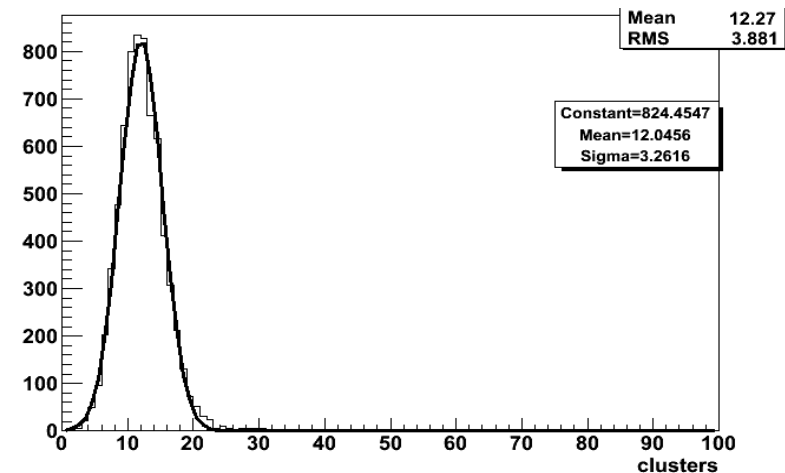
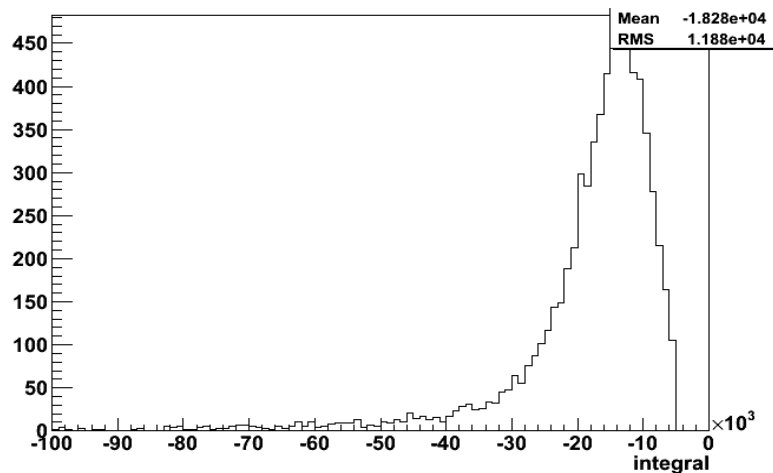
Integral of Signal

Distribution of detected clusters

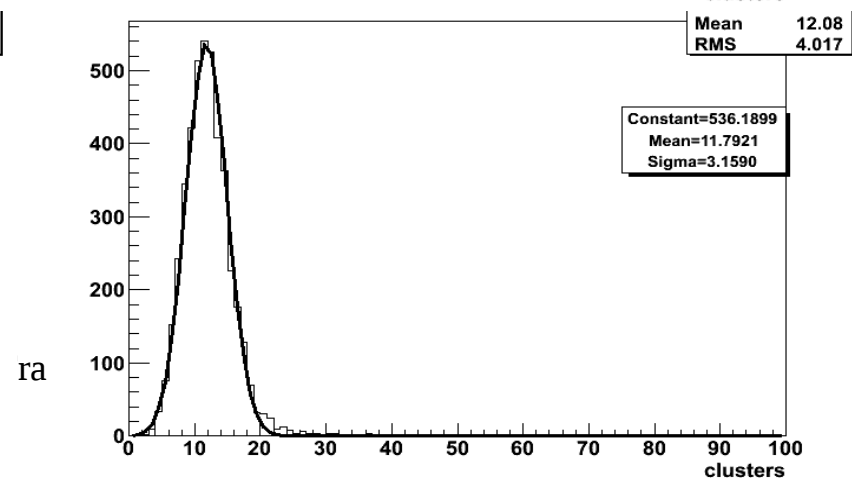
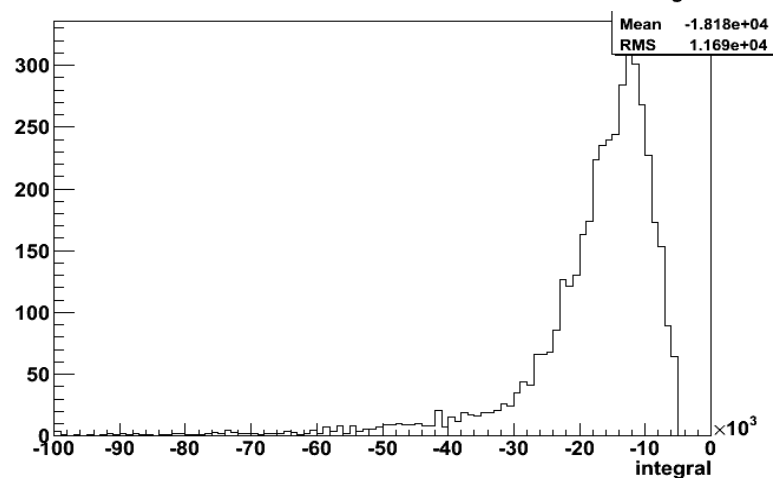
$p=140\text{MeV}/c$
14682 entries



$p=180\text{MeV}/c$
6892 entries



$p=220\text{MeV}/c$
4393 entries



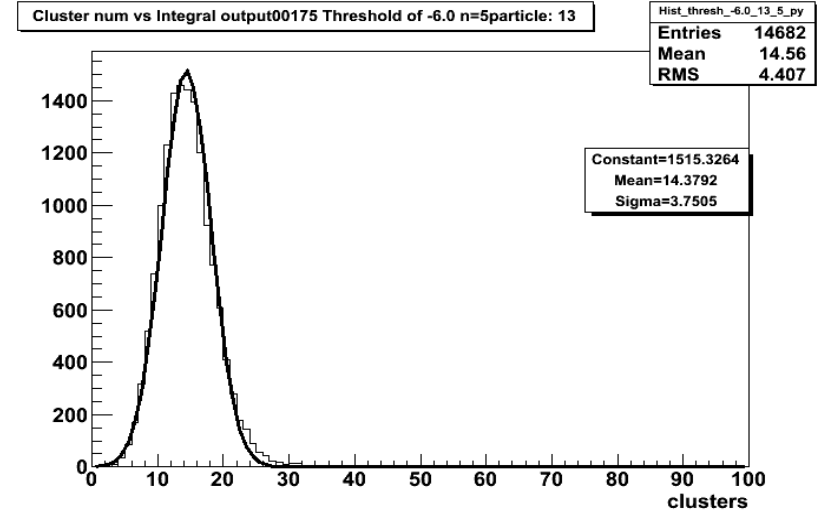
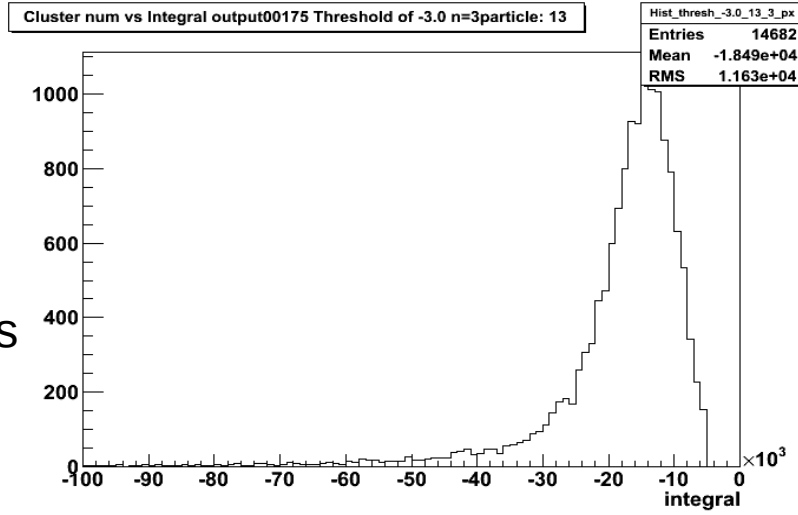
March 21, 2012

ra

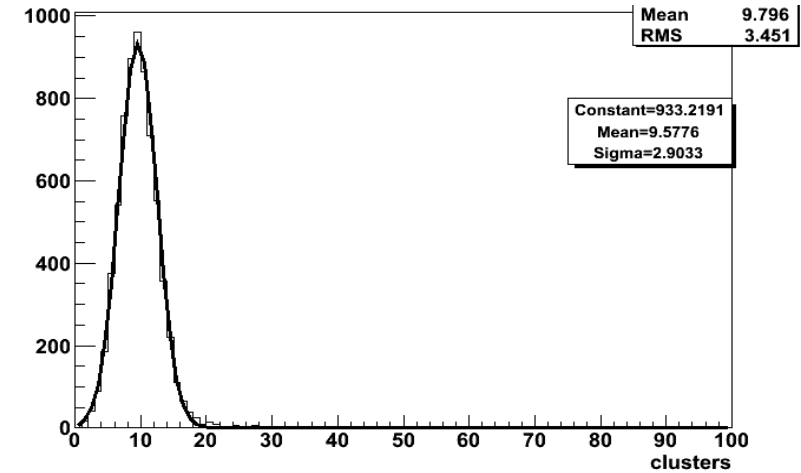
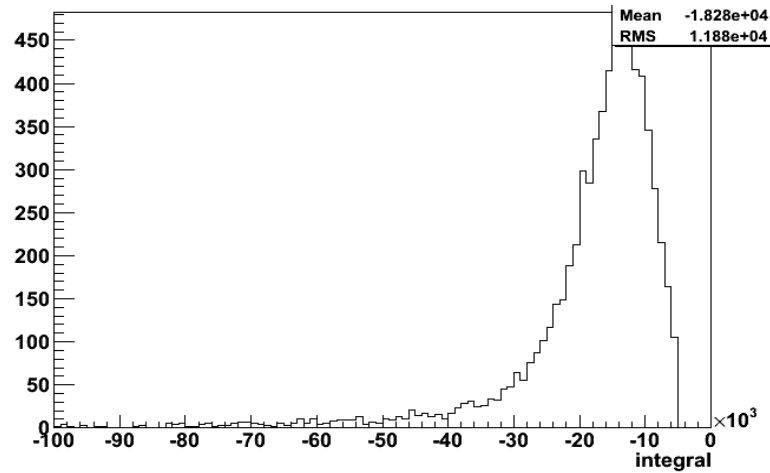
Threshold $a=6$
 $n=5$
 Particle = Muon
 Gas: 90/10

Distribution of detected clusters

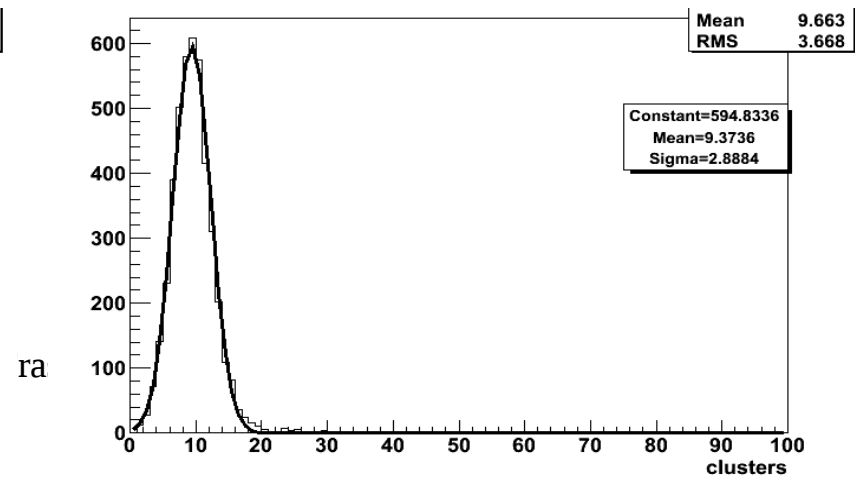
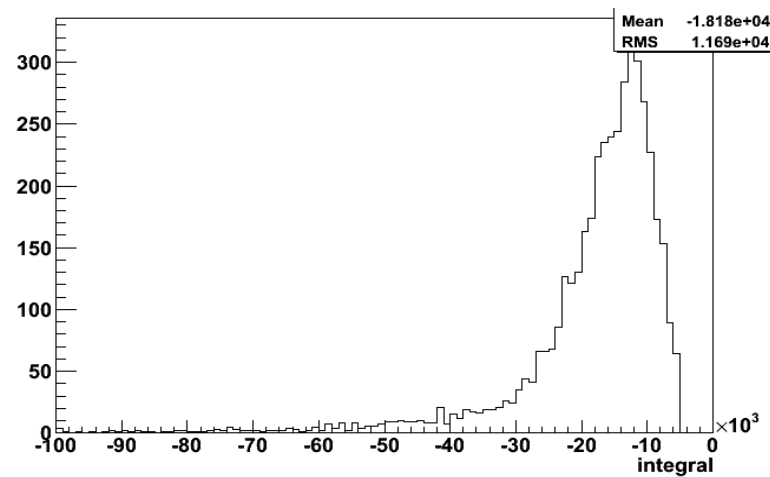
$p=140\text{MeV}/c$
 14682 entries



$p=180\text{MeV}/c$
 6892 entries



$p=220\text{MeV}/c$
 4393 entries



March 21, 2012

ra

Muons, $n=3$
90/10

Threshold $a=3$

$n=3$

Particle = Muon

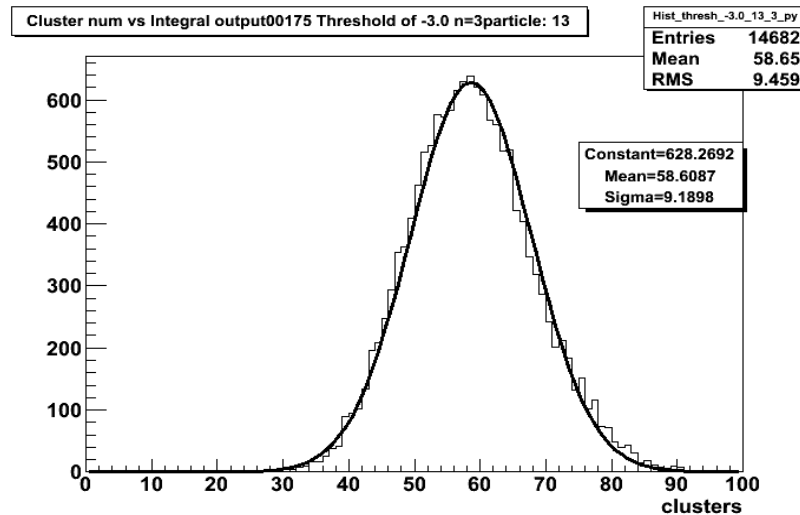
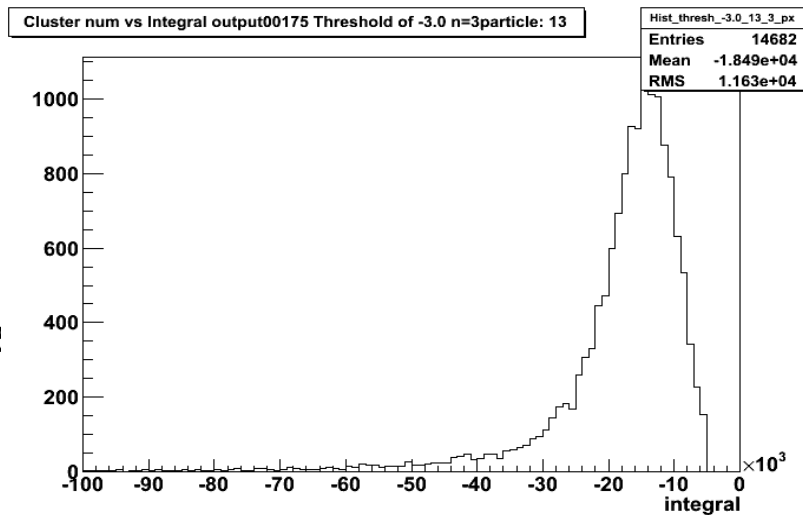
Gas: 90/10

Integral of Signal

Distribution of detected clusters

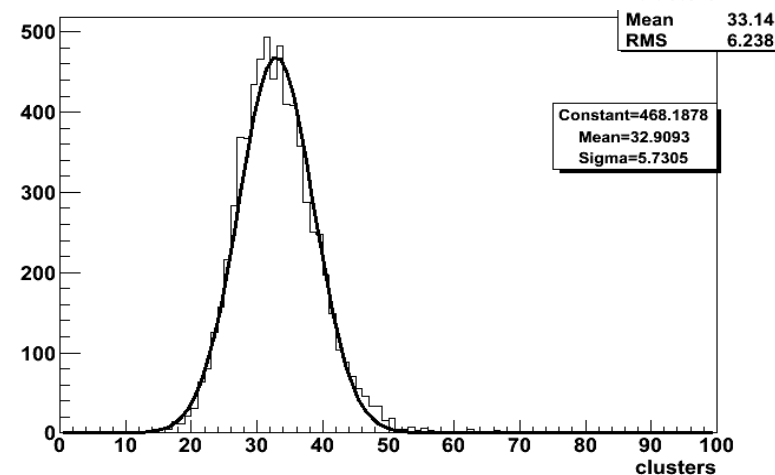
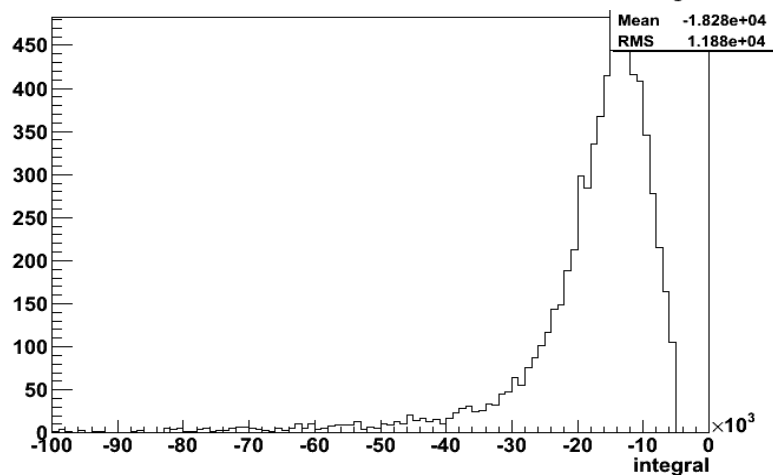
$p=140\text{MeV}/c$

14682 entries



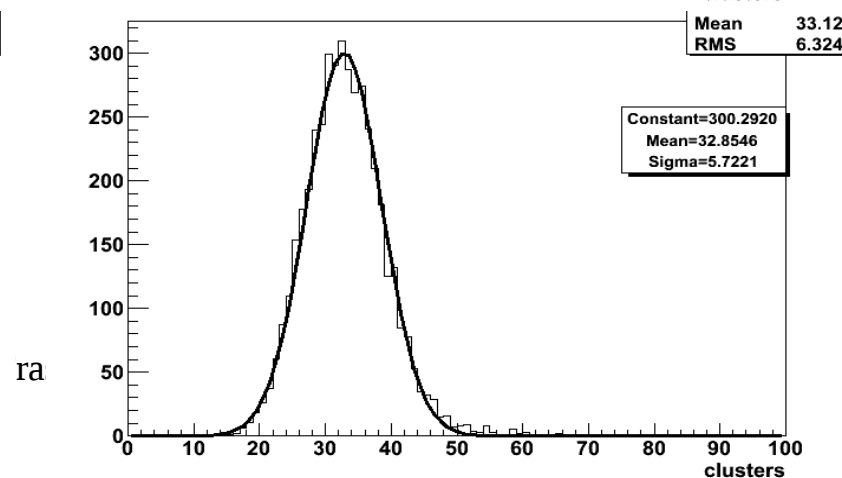
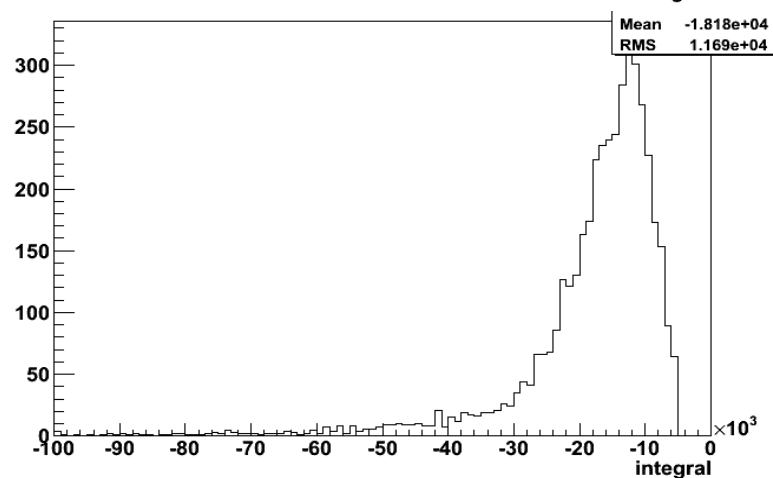
$p=180\text{MeV}/c$

6892 entries



$p=220\text{MeV}/c$

4393 entries



March 21, 2012

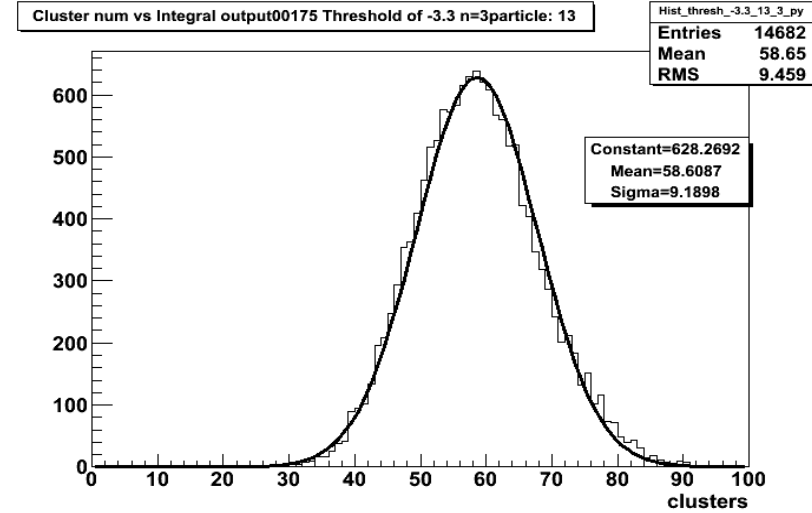
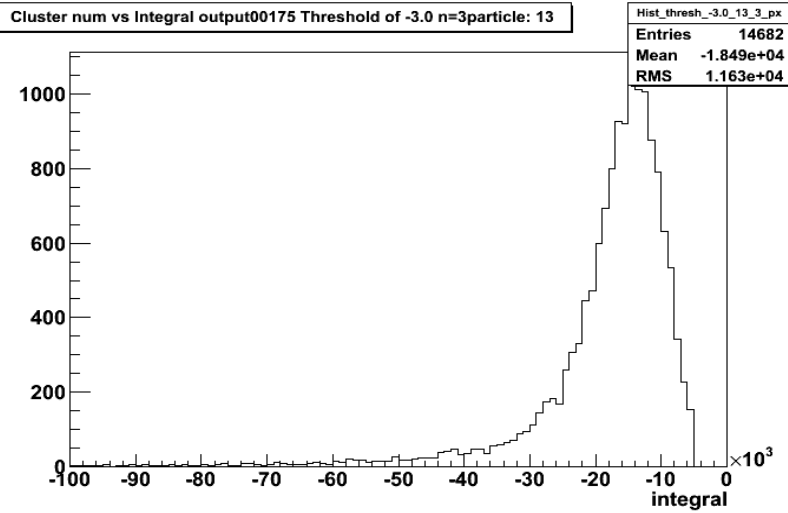
ra

Threshold $a=3.3$
 $n=3$
 Particle = Muon
 Gas: 90/10

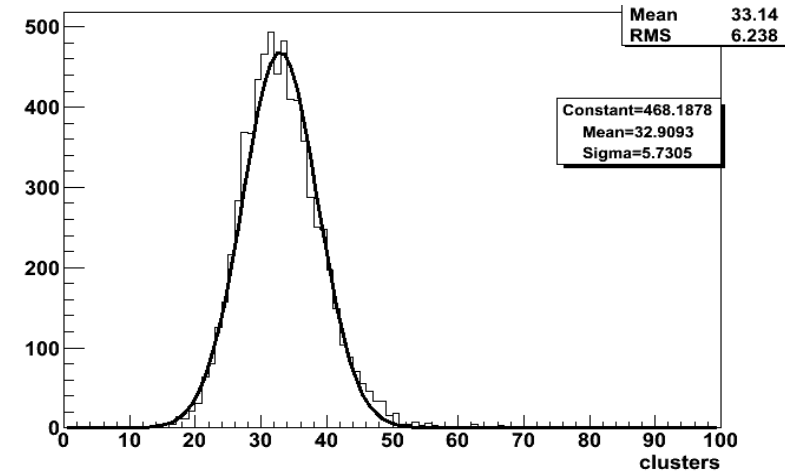
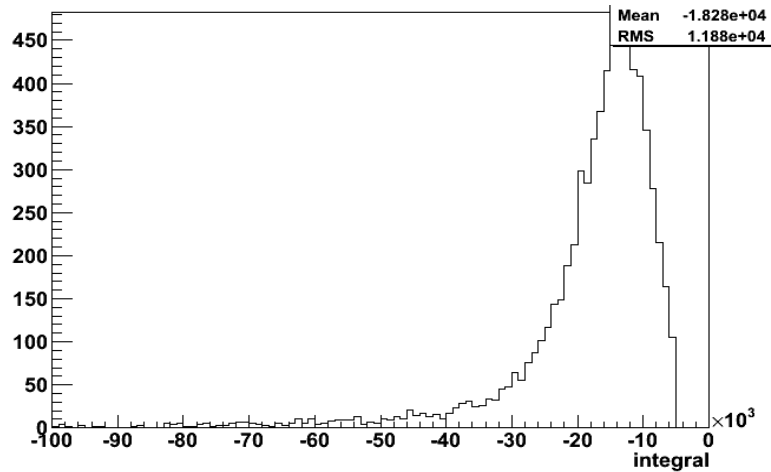
Integral of Signal

Distribution of detected clusters

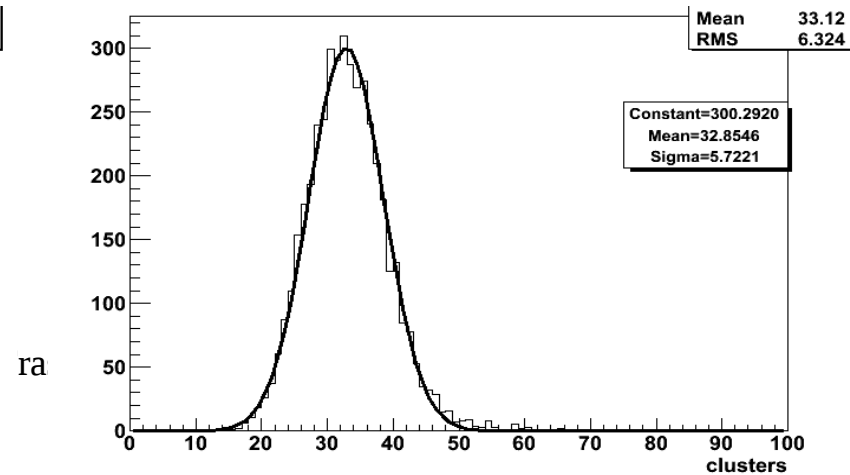
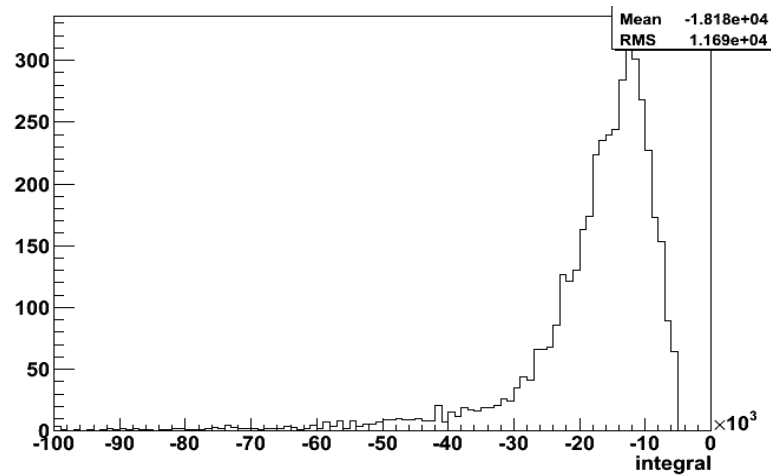
$p=140\text{MeV}/c$
 14682 entries



$p=180\text{MeV}/c$
 6892 entries



$p=220\text{MeV}/c$
 4393 entries



March 21, 2012

ra

Threshold $a=3.5$

$n=3$

Particle = Muon

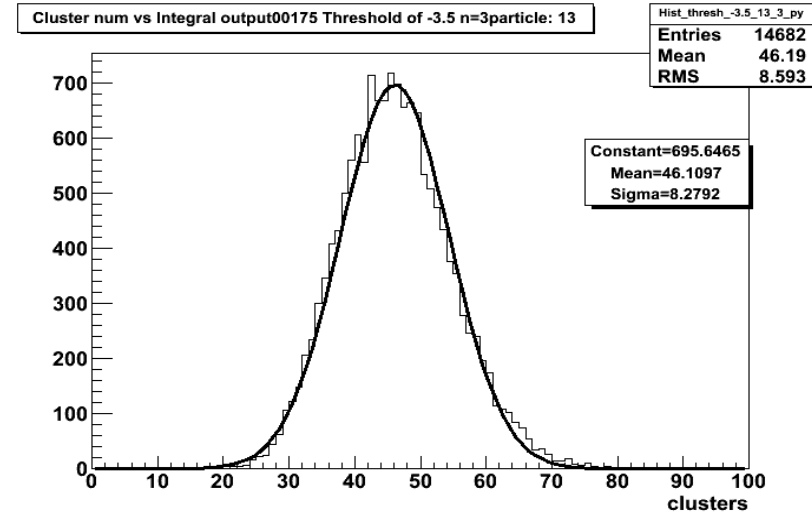
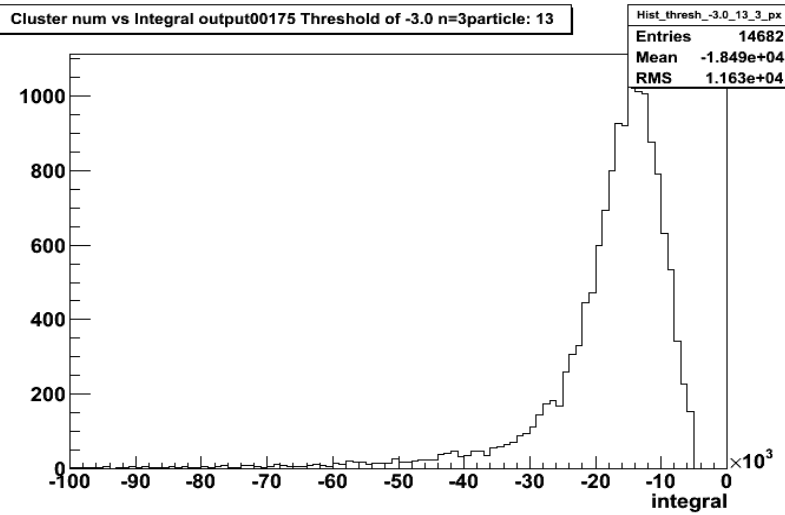
Gas: 90/10

Integral of Signal

Distribution of detected clusters

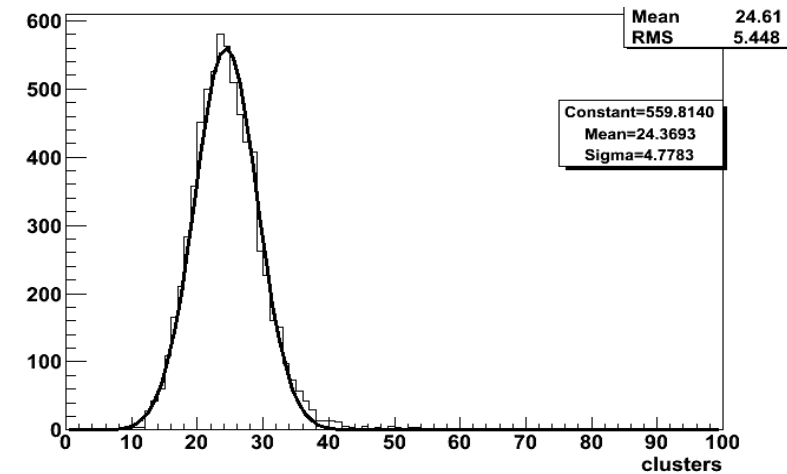
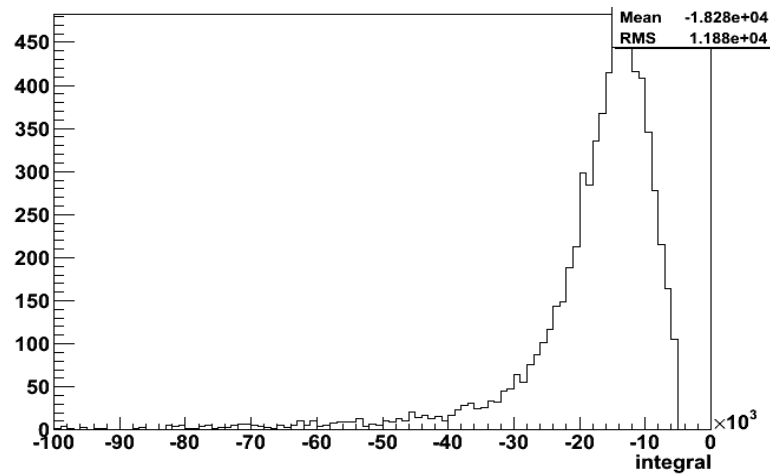
$p=140\text{MeV}/c$

14682 entries



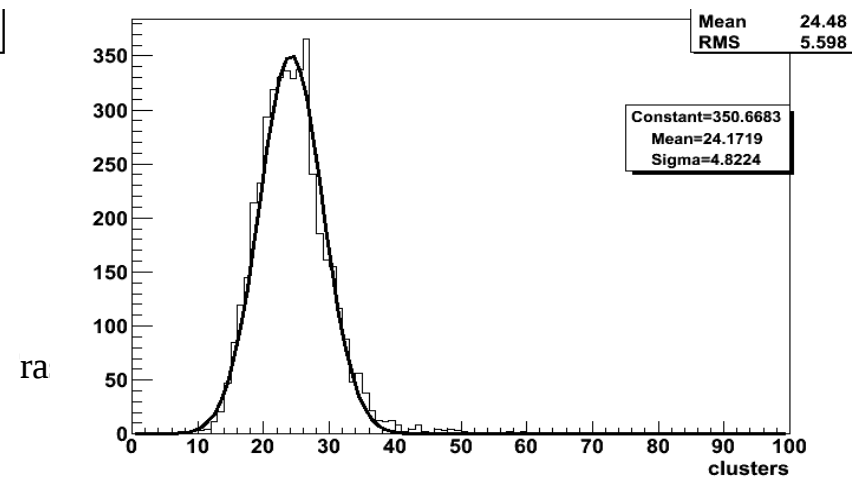
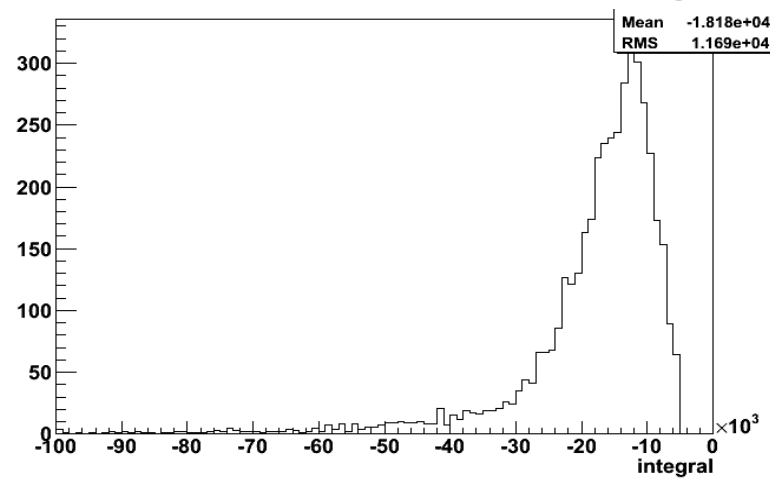
$p=180\text{MeV}/c$

6892 entries



$p=220\text{MeV}/c$

4393 entries



March 21, 2012

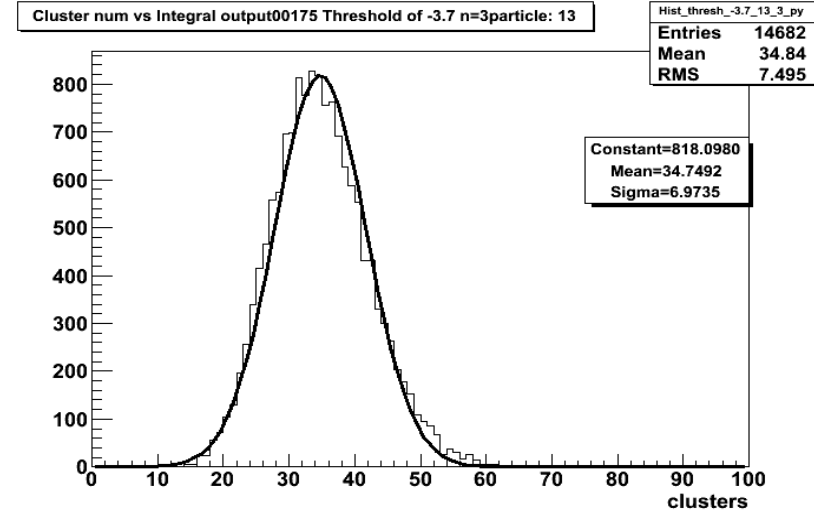
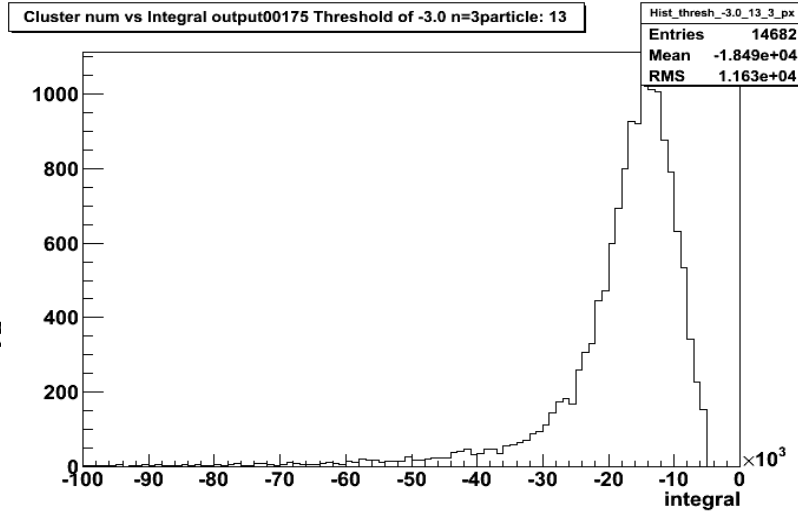
ra

Threshold $a=3.7$
 $n=3$
 Particle = Muon
 Gas: 90/10

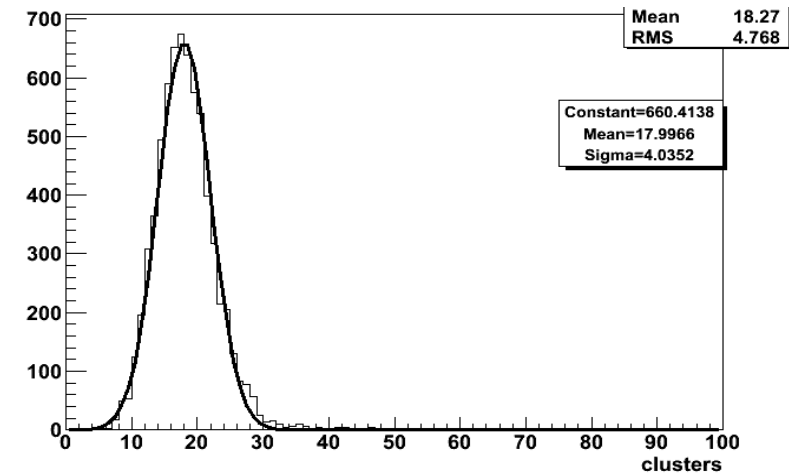
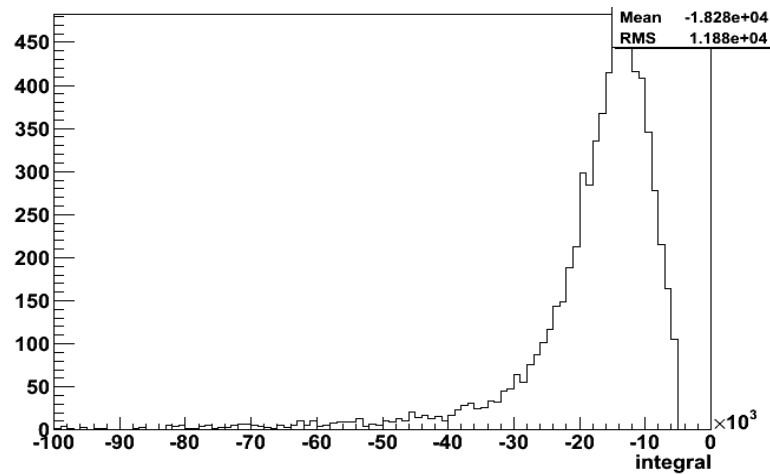
Integral of Signal

Distribution of detected clusters

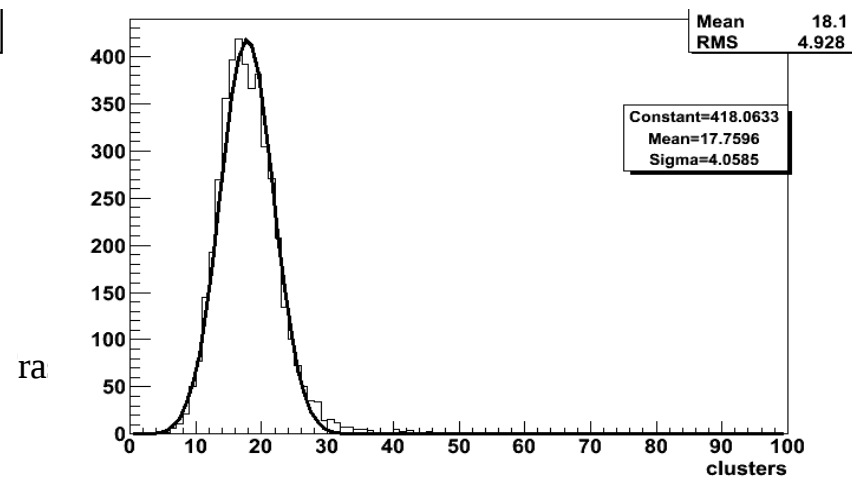
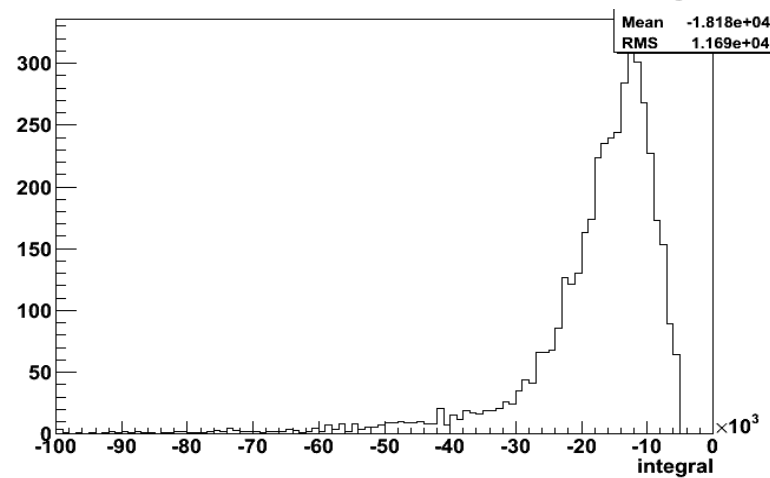
$p=140\text{MeV}/c$
 14682 entries



$p=180\text{MeV}/c$
 6892 entries



$p=220\text{MeV}/c$
 4393 entries



March 21, 2012

Threshold $a=4$

$n=3$

Particle = Muon

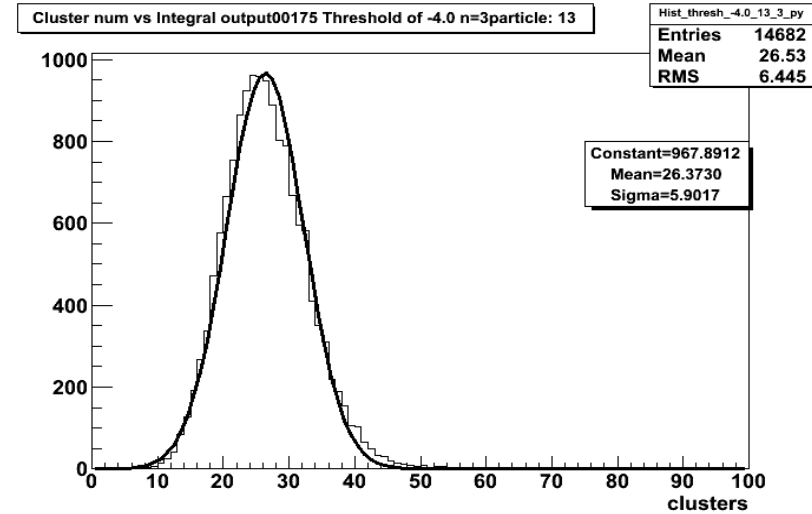
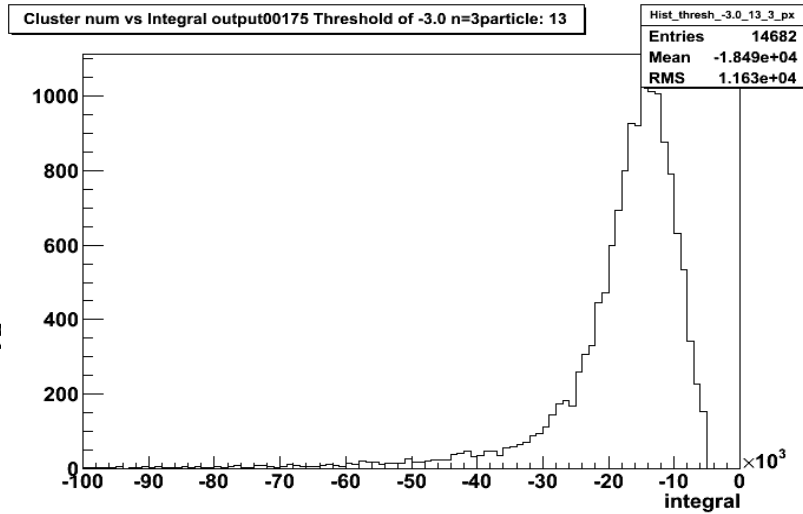
Gas: 90/10

Integral of Signal

Distribution of detected clusters

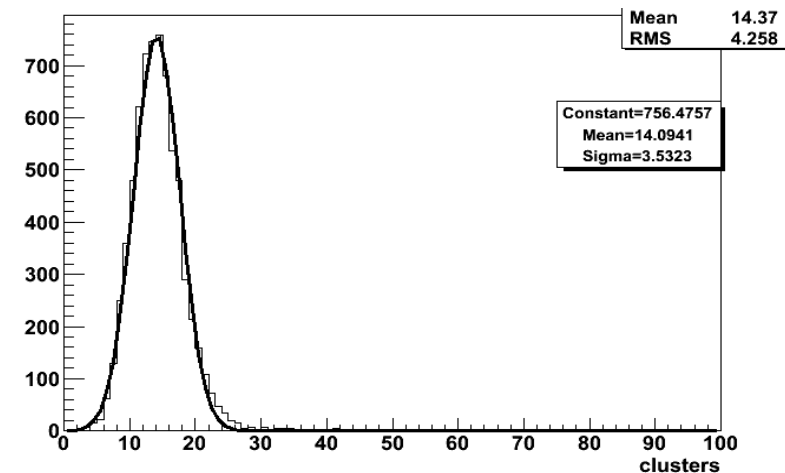
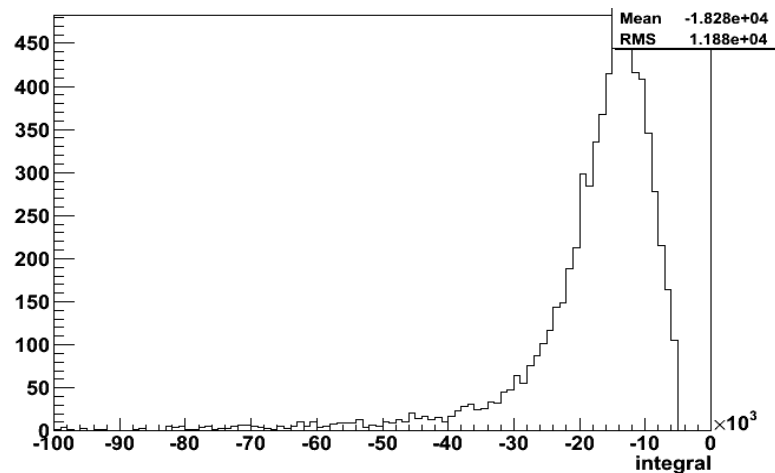
$p=140\text{MeV}/c$

14682 entries



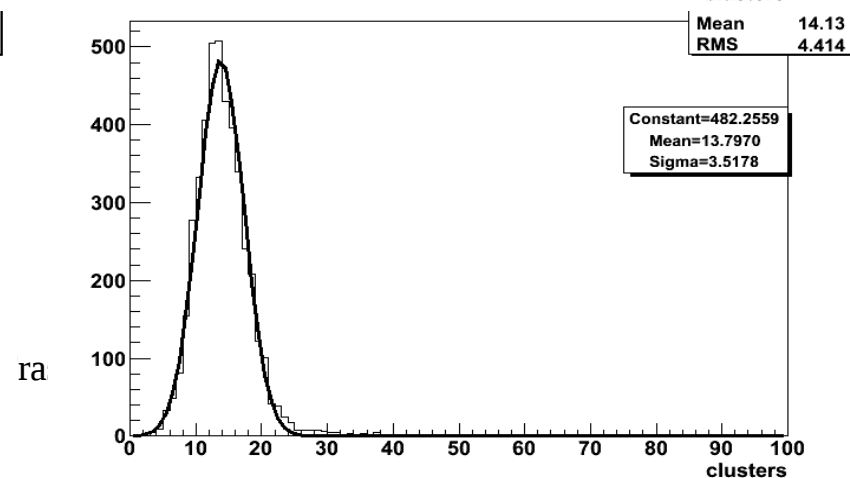
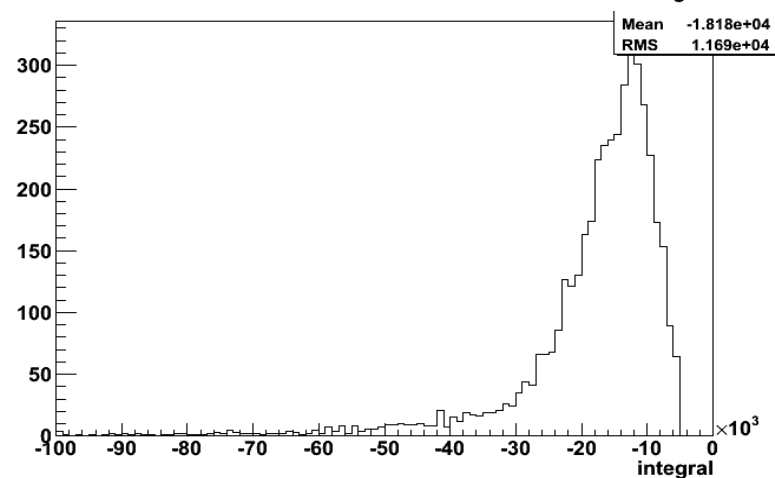
$p=180\text{MeV}/c$

6892 entries



$p=220\text{MeV}/c$

4393 entries



March 21, 2012

Threshold $a=5$

$n=3$

Particle = Muon

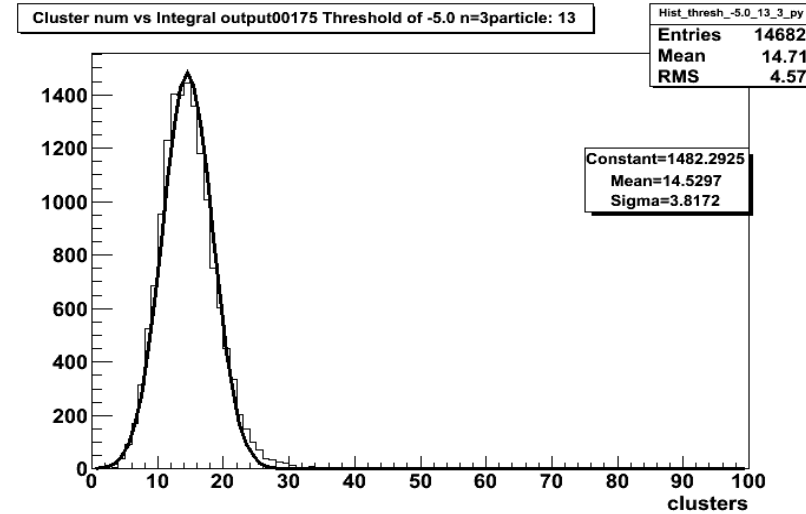
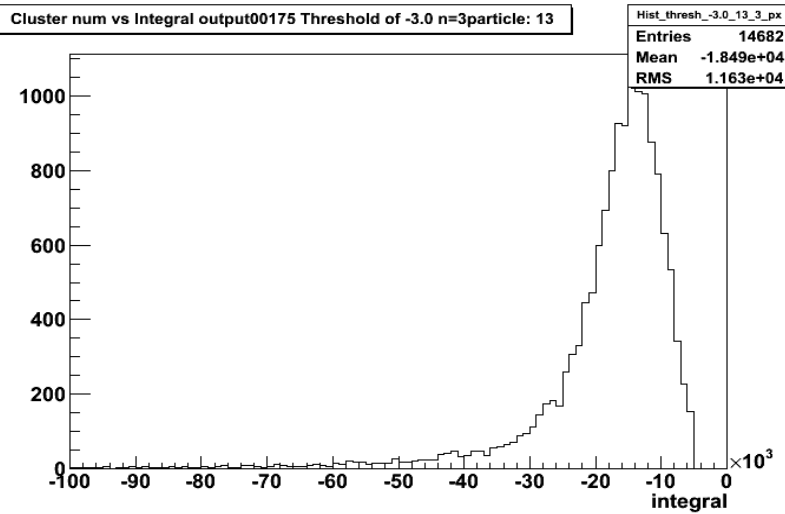
Gas: 90/10

Integral of Signal

Distribution of detected clusters

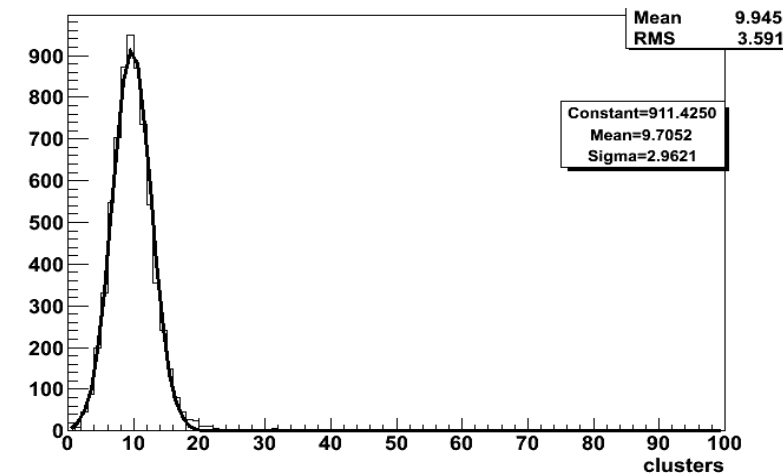
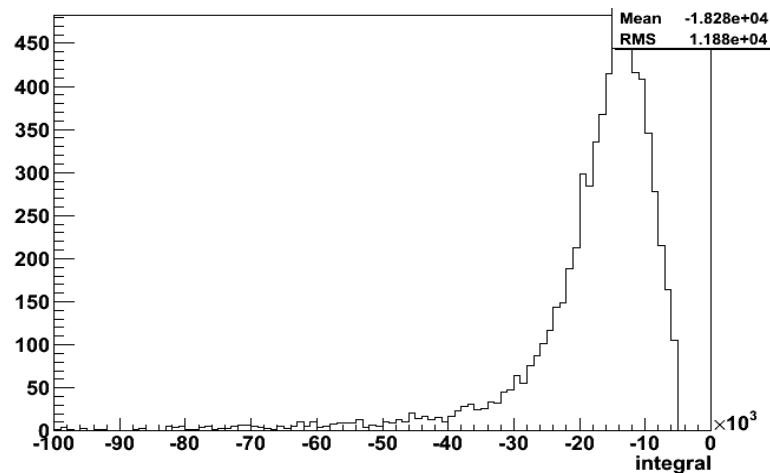
$p=140\text{MeV}/c$

14682 entries



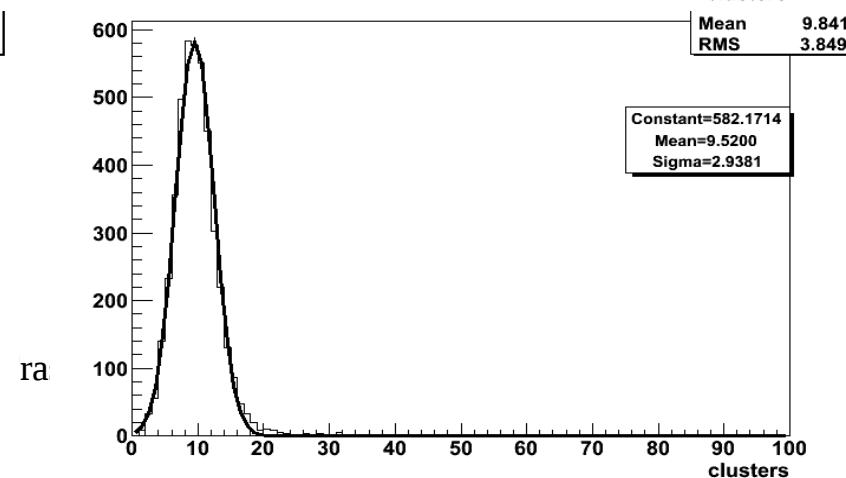
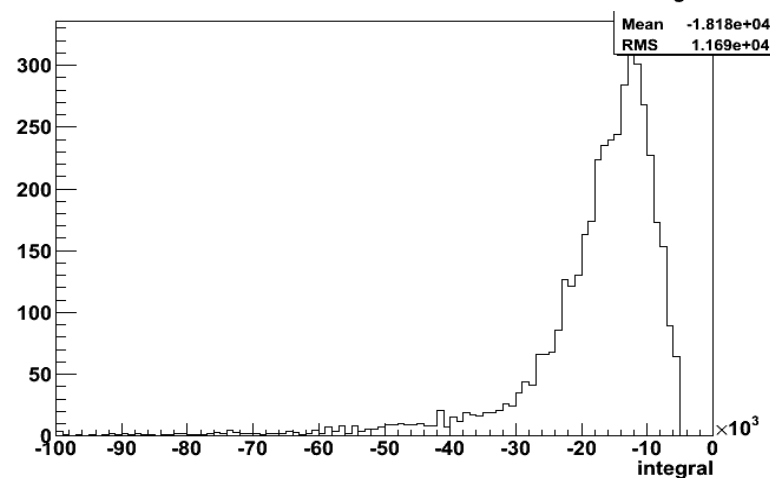
$p=180\text{MeV}/c$

6892 entries



$p=220\text{MeV}/c$

4393 entries



March 21, 2012

ra

Threshold $a=6$

$n=3$

Particle = Muon

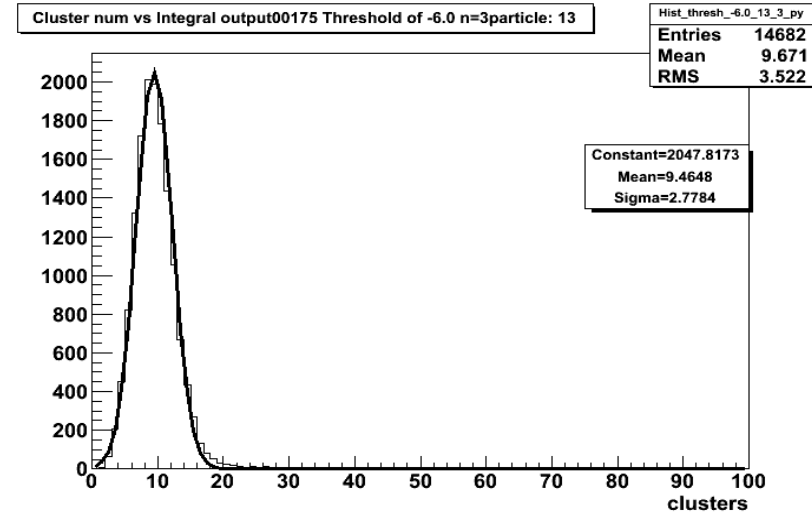
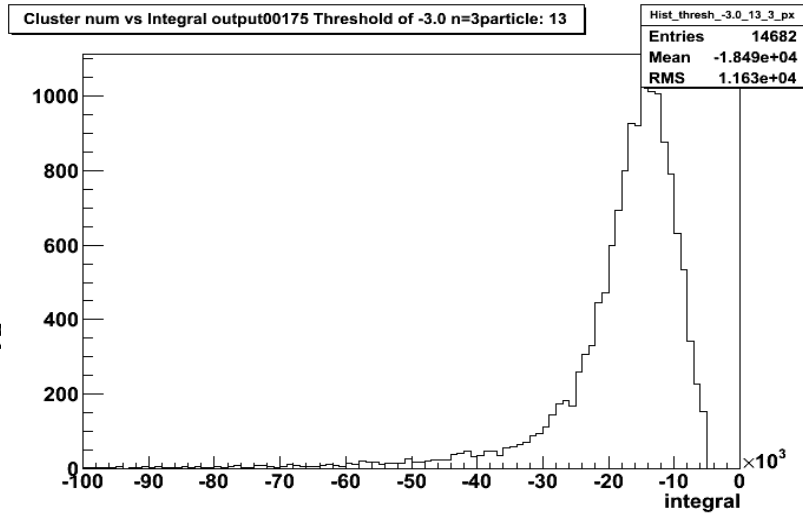
Gas: 90/10

Integral of Signal

Distribution of detected clusters

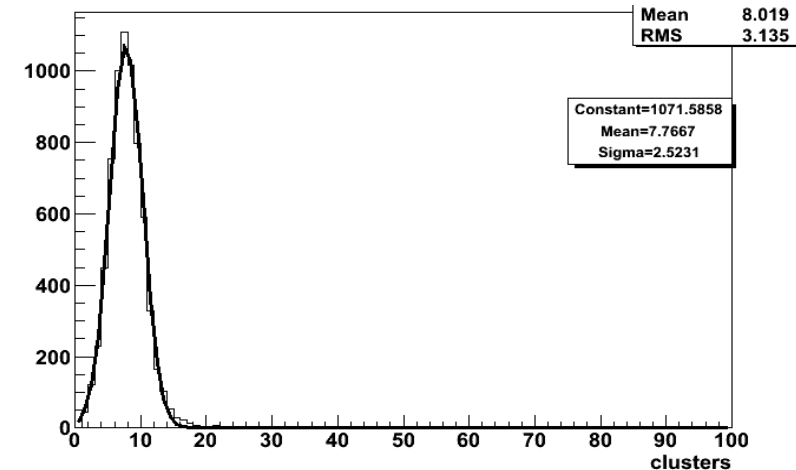
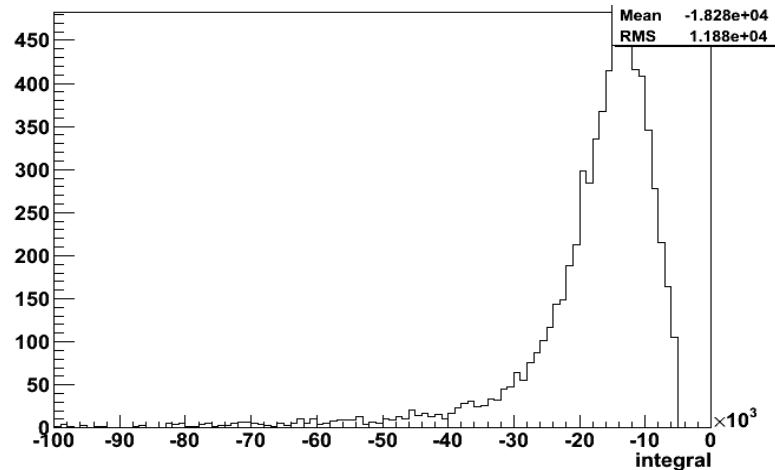
$p=140\text{MeV}/c$

14682 entries



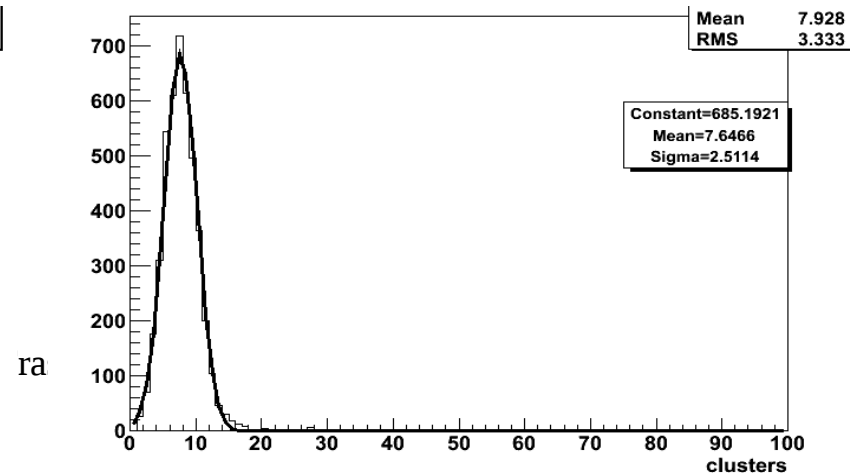
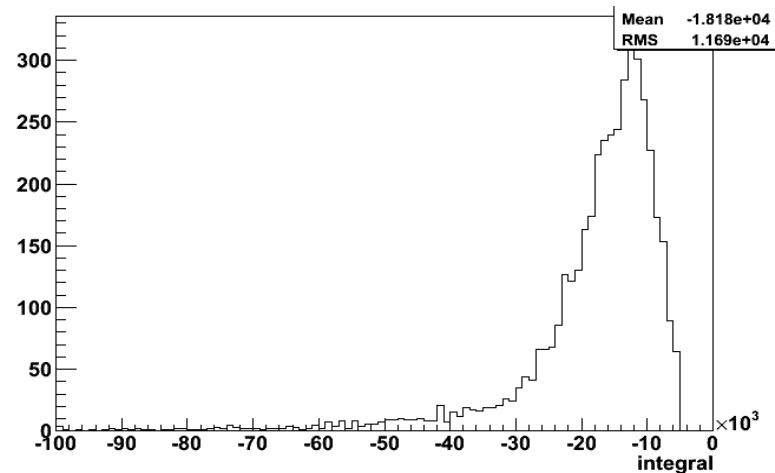
$p=180\text{MeV}/c$

6892 entries



$p=220\text{MeV}/c$

4393 entries



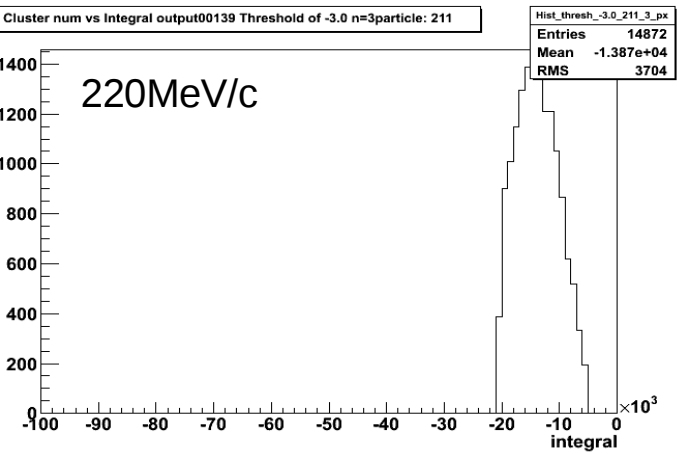
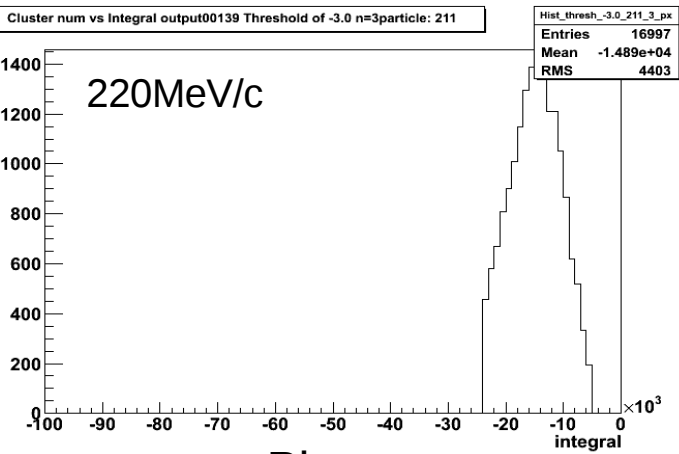
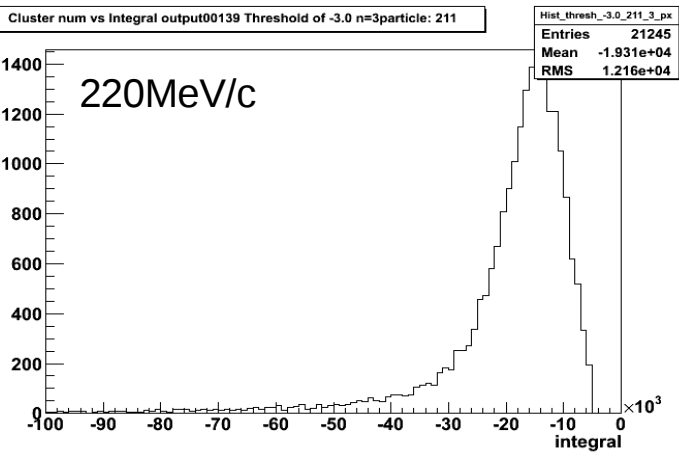
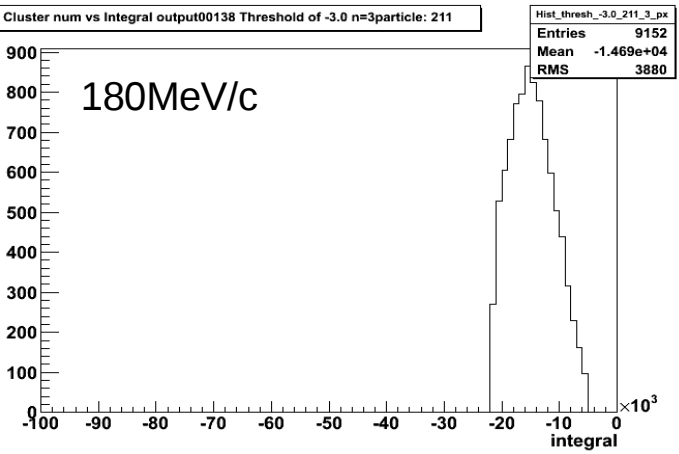
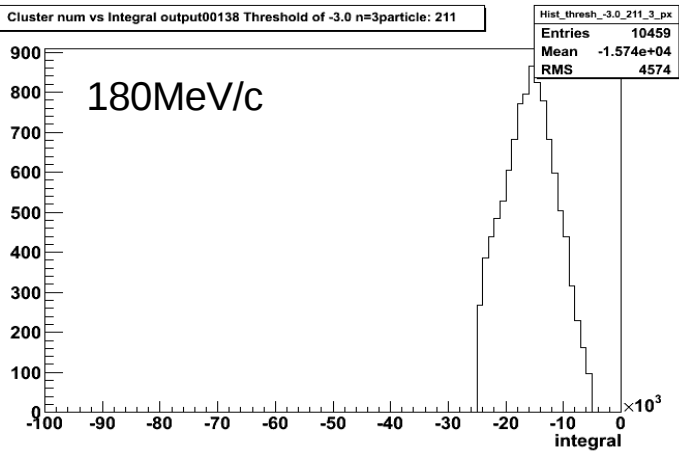
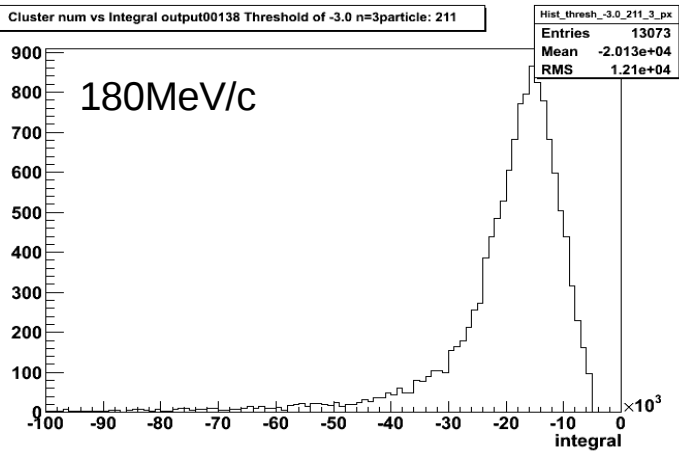
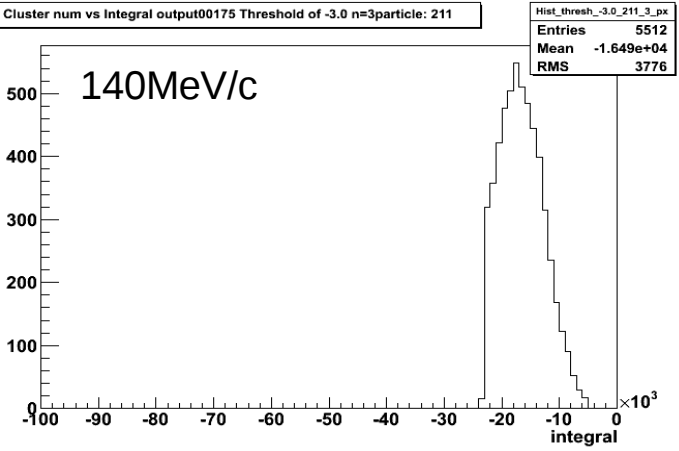
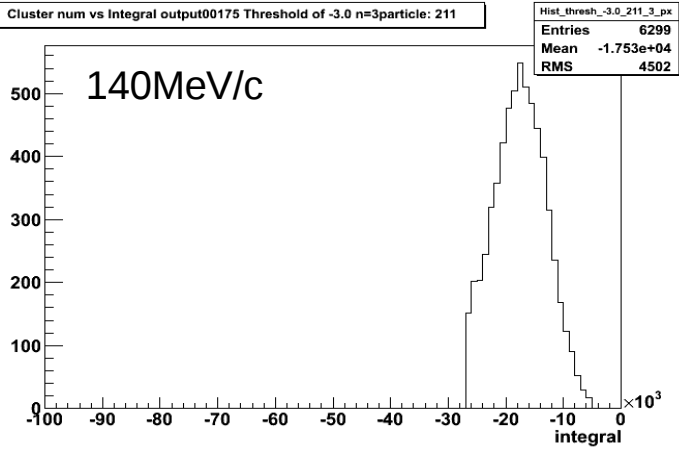
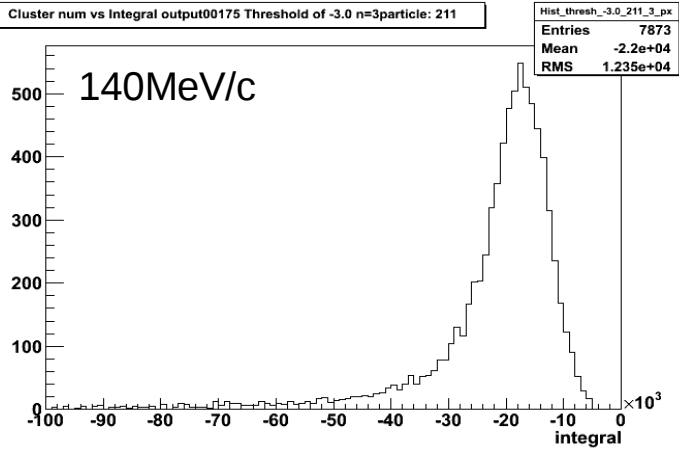
March 21, 2012

Truncated Integral for Pions in 90/10

Full Integral

80% integral

70% integral



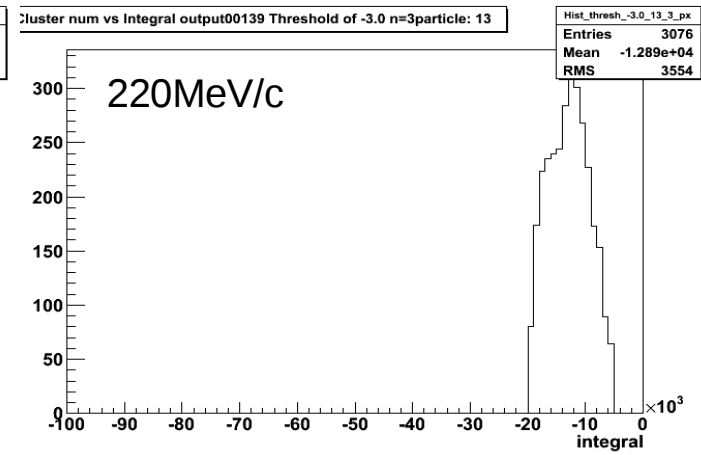
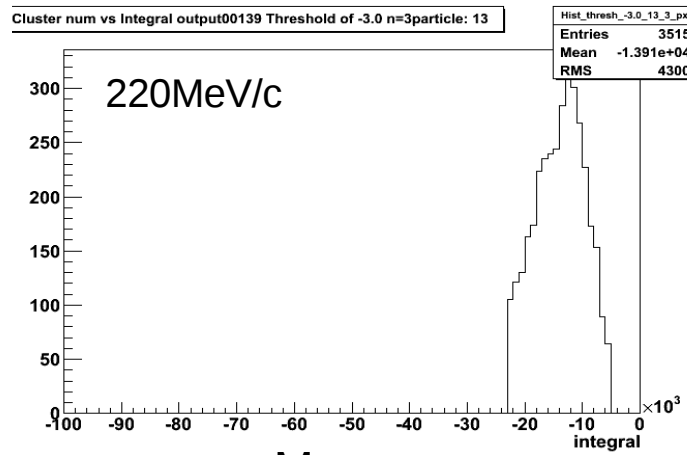
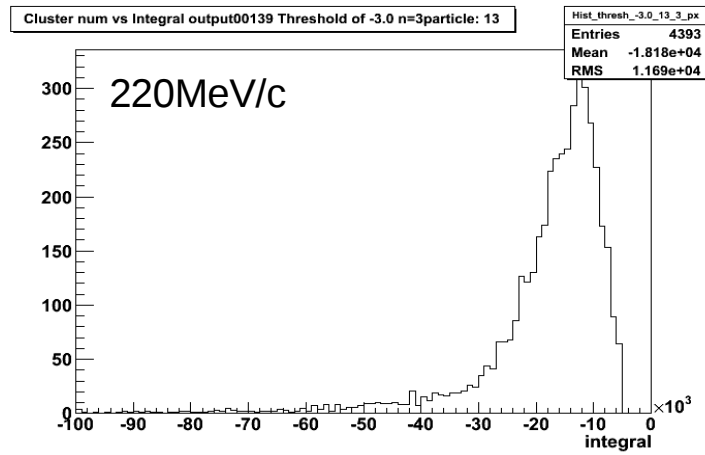
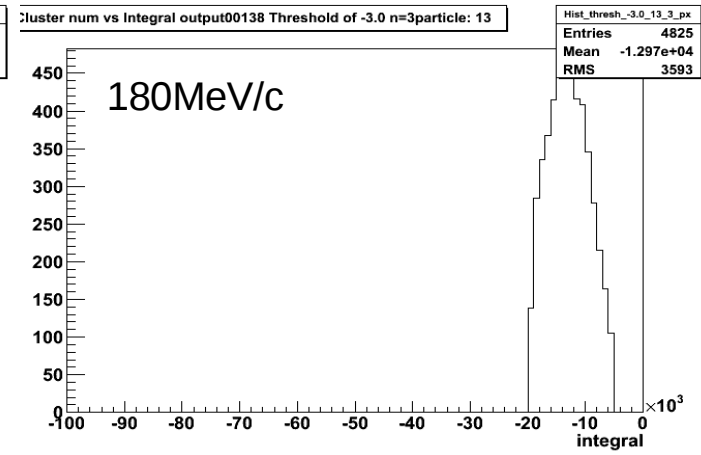
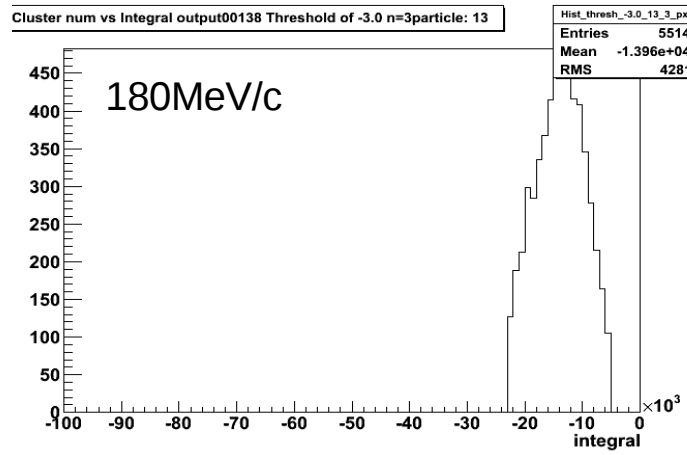
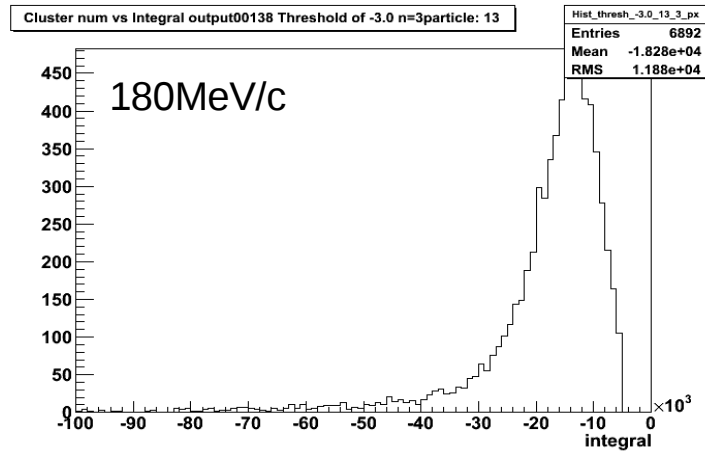
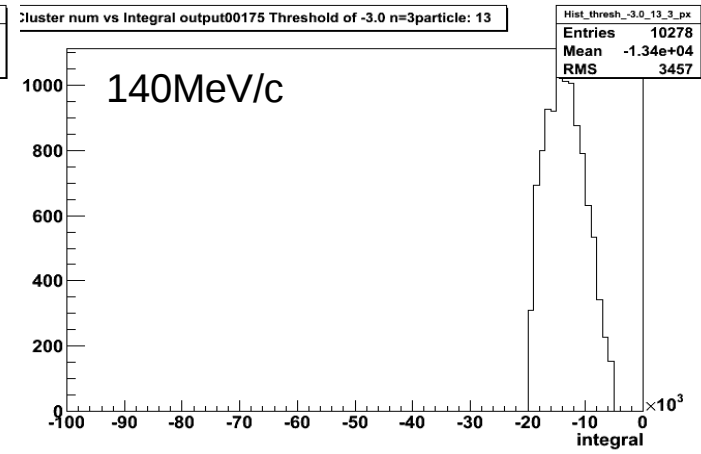
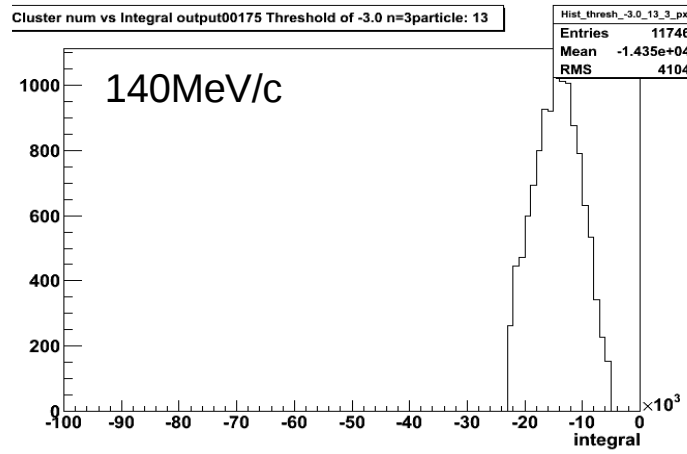
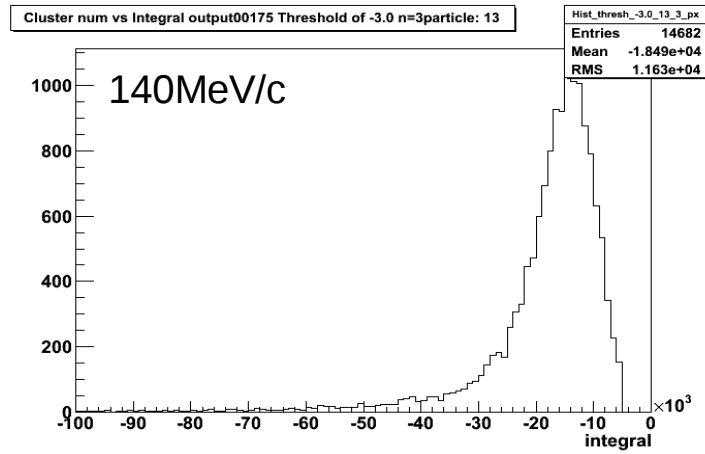
Pions

Truncated Integral for Muons in 90/10

Full Integral

80% integral

70% integral



Muons

Truncated Integral for Pions in 80/20

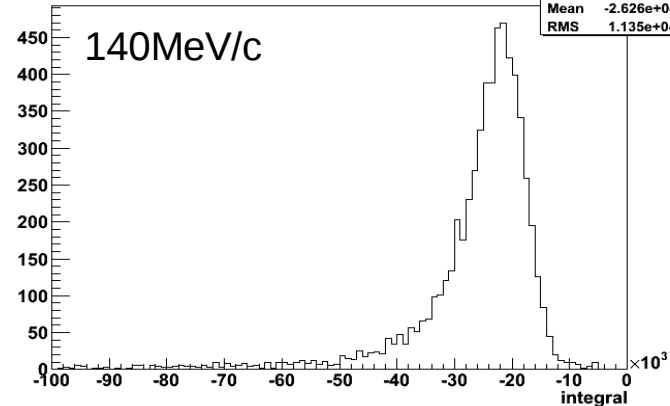
Full Integral

80% integral

70% integral

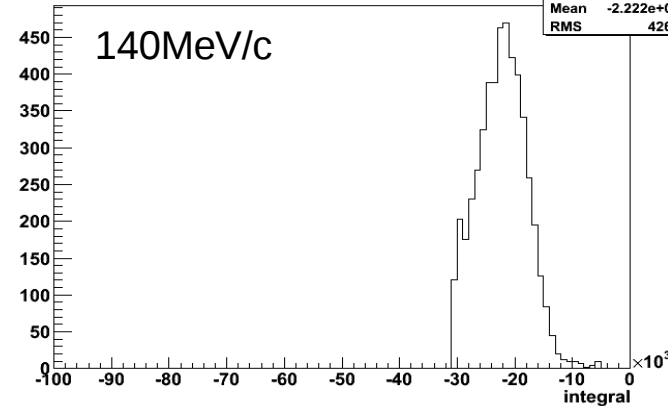
Cluster num vs Integral output00126 Threshold of -3.0 particle: 211

Hist_thresh_-3.0_211_px
Entries 6224
Mean -2.626e+04
RMS 1.135e+04



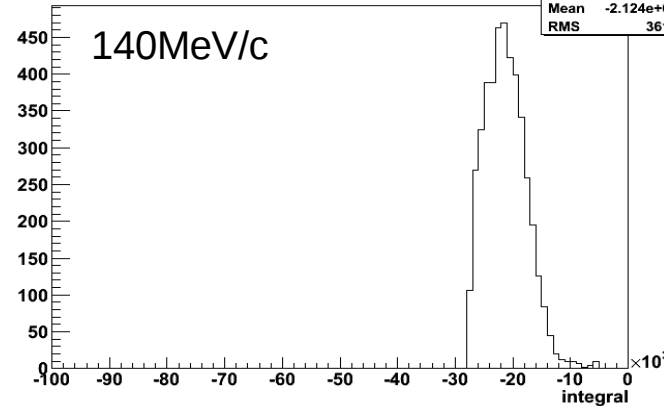
Cluster num vs Integral output00126 Threshold of -3.0 n=5particle: 211

Hist_thresh_-3.0_211_5_px
Entries 4980
Mean -2.222e+04
RMS 4265



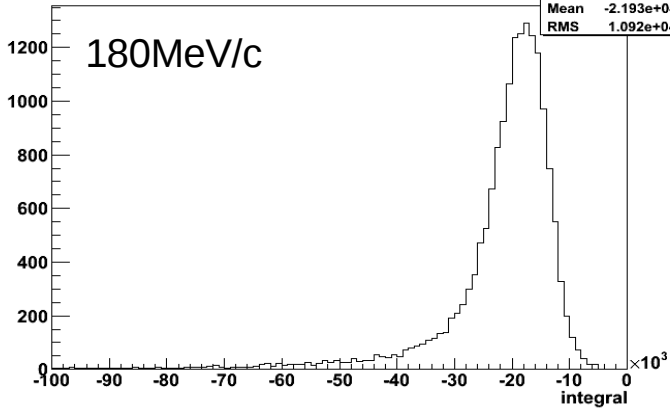
Cluster num vs Integral output00126 Threshold of -3.0 n=5particle: 211

Hist_thresh_-3.0_211_5_px
Entries 4357
Mean -2.124e+04
RMS 3617



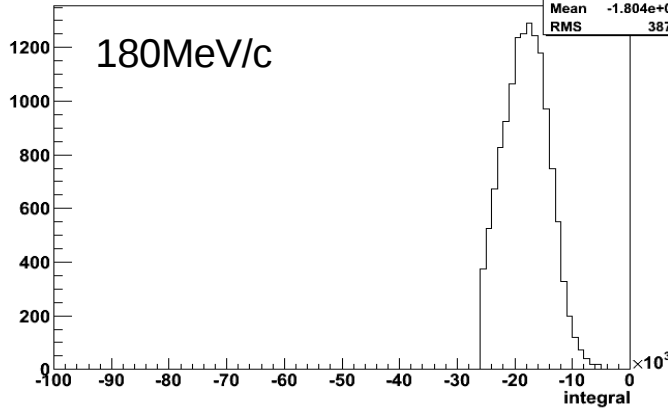
Cluster num vs Integral output00129 Threshold of -6.0 particle: 211

Hist_thresh_-6.0_211_px
Entries 17062
Mean -2.193e+04
RMS 1.092e+04



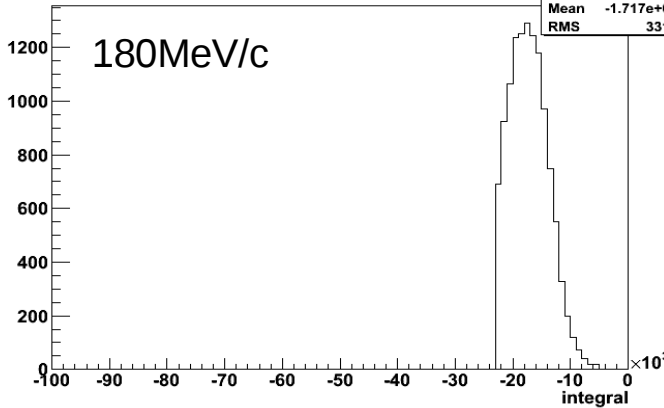
Cluster num vs Integral output00129 Threshold of -4.0 n=5particle: 211

Hist_thresh_-4.0_211_5_px
Entries 13650
Mean -1.804e+04
RMS 3879



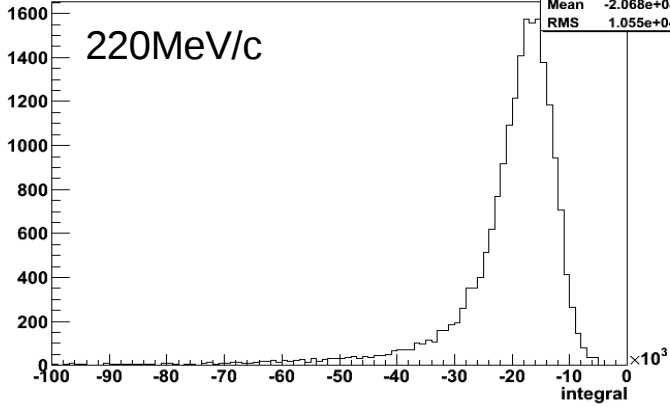
Cluster num vs Integral output00129 Threshold of -4.0 n=5particle: 211

Hist_thresh_-4.0_211_5_px
Entries 11944
Mean -1.717e+04
RMS 3310



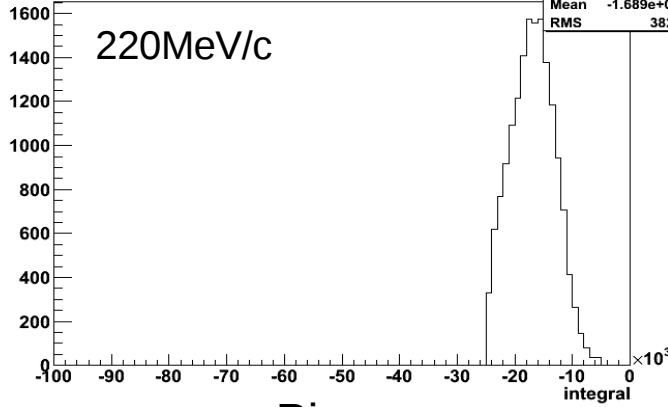
Cluster num vs Integral output00127 Threshold of -4.0 n=5particle: 211

Hist_thresh_-4.0_211_5_px
Entries 20304
Mean -2.068e+04
RMS 1.055e+04



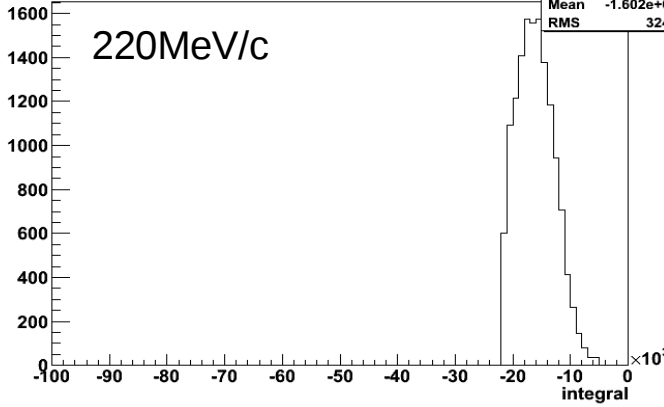
Cluster num vs Integral output00127 Threshold of -3.0 n=5particle: 211

Hist_thresh_-3.0_211_5_px
Entries 16244
Mean -1.689e+04
RMS 3821



Cluster num vs Integral output00127 Threshold of -3.0 n=5particle: 211

Hist_thresh_-3.0_211_5_px
Entries 14213
Mean -1.602e+04
RMS 3244



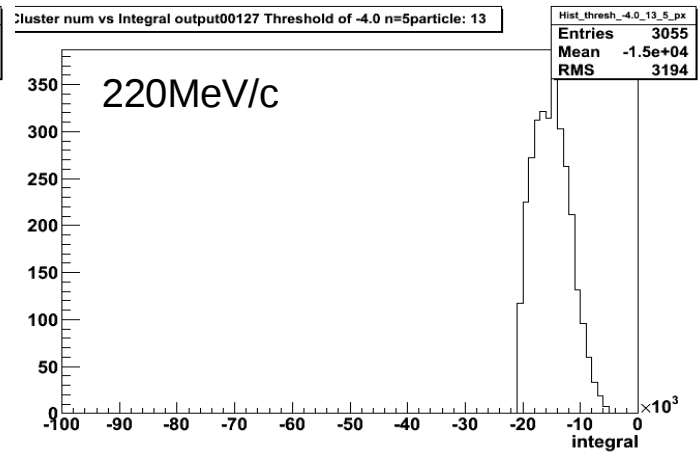
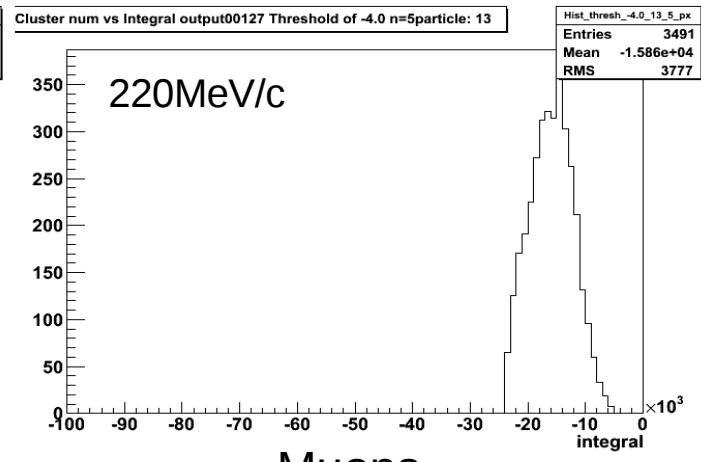
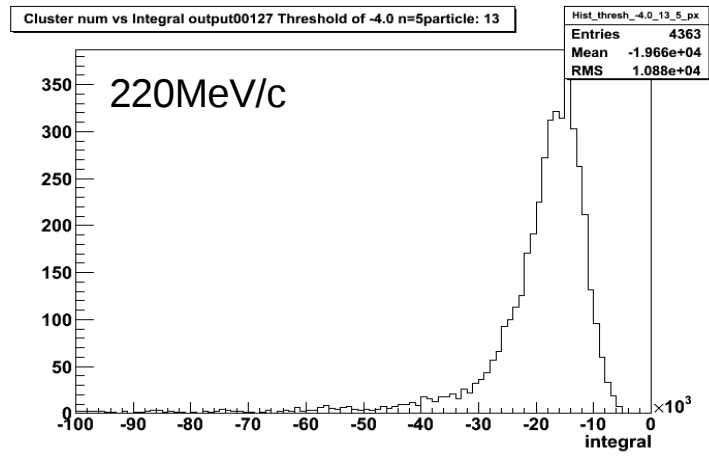
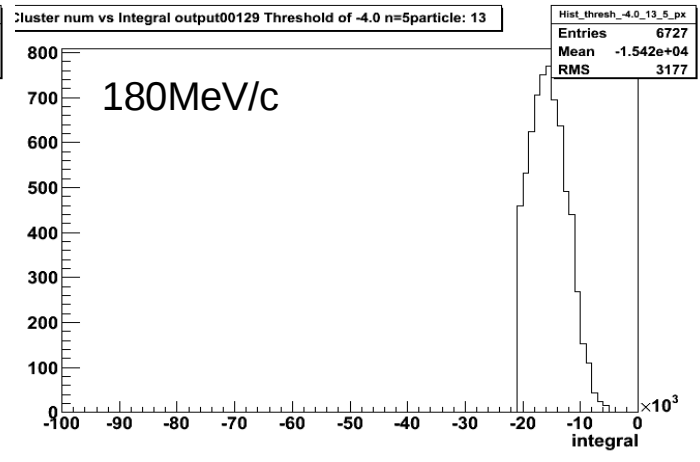
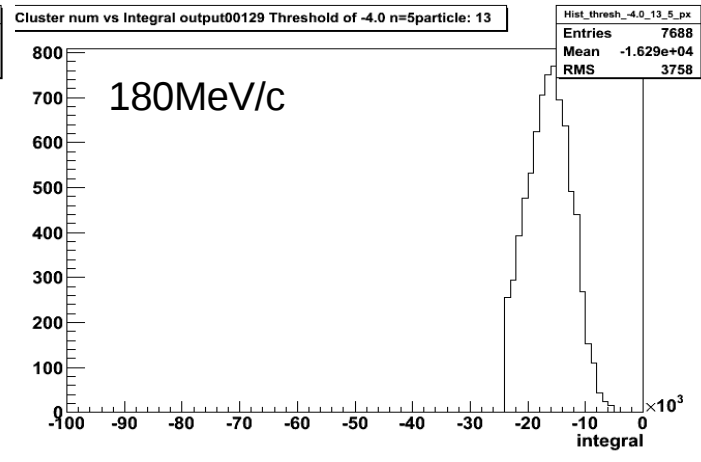
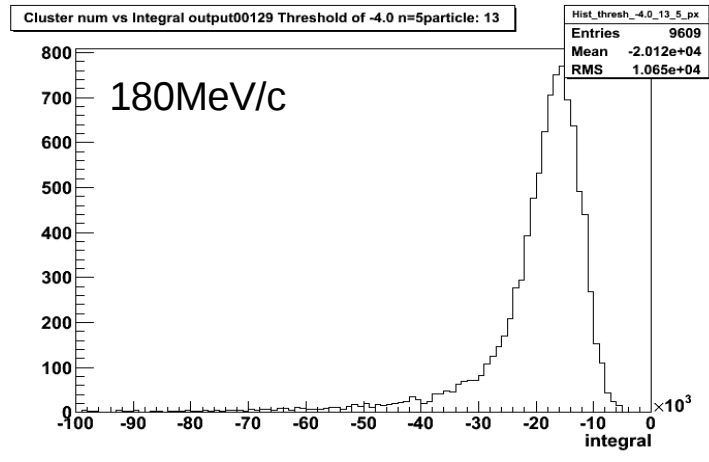
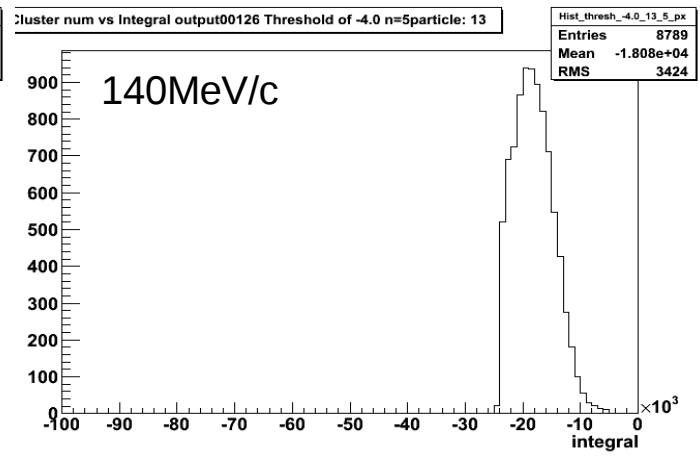
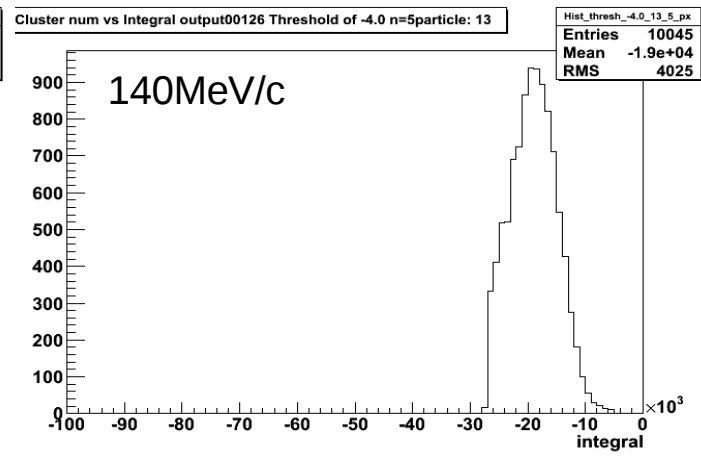
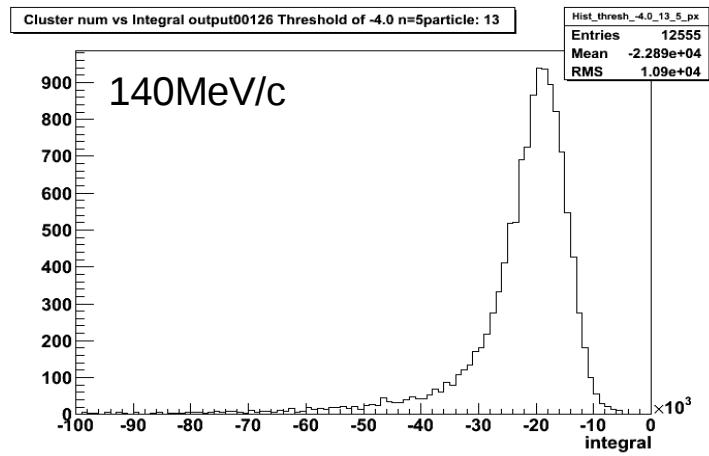
Pions

Truncated Integral for Muons in 80/20

Full Integral

80% integral

70% integral



Muons