ECalibration with muons: redux

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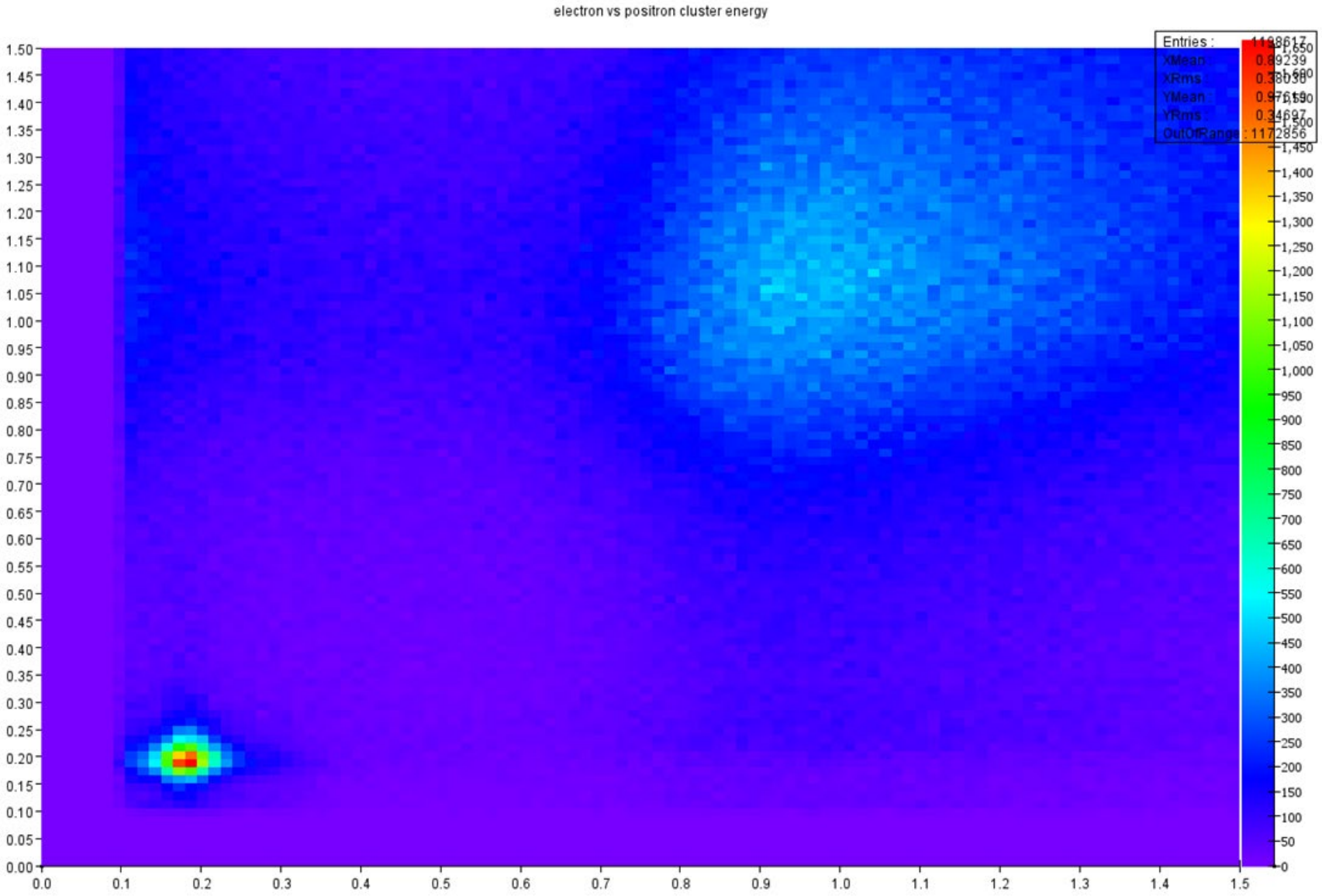
June 30, 2020

Event Samples

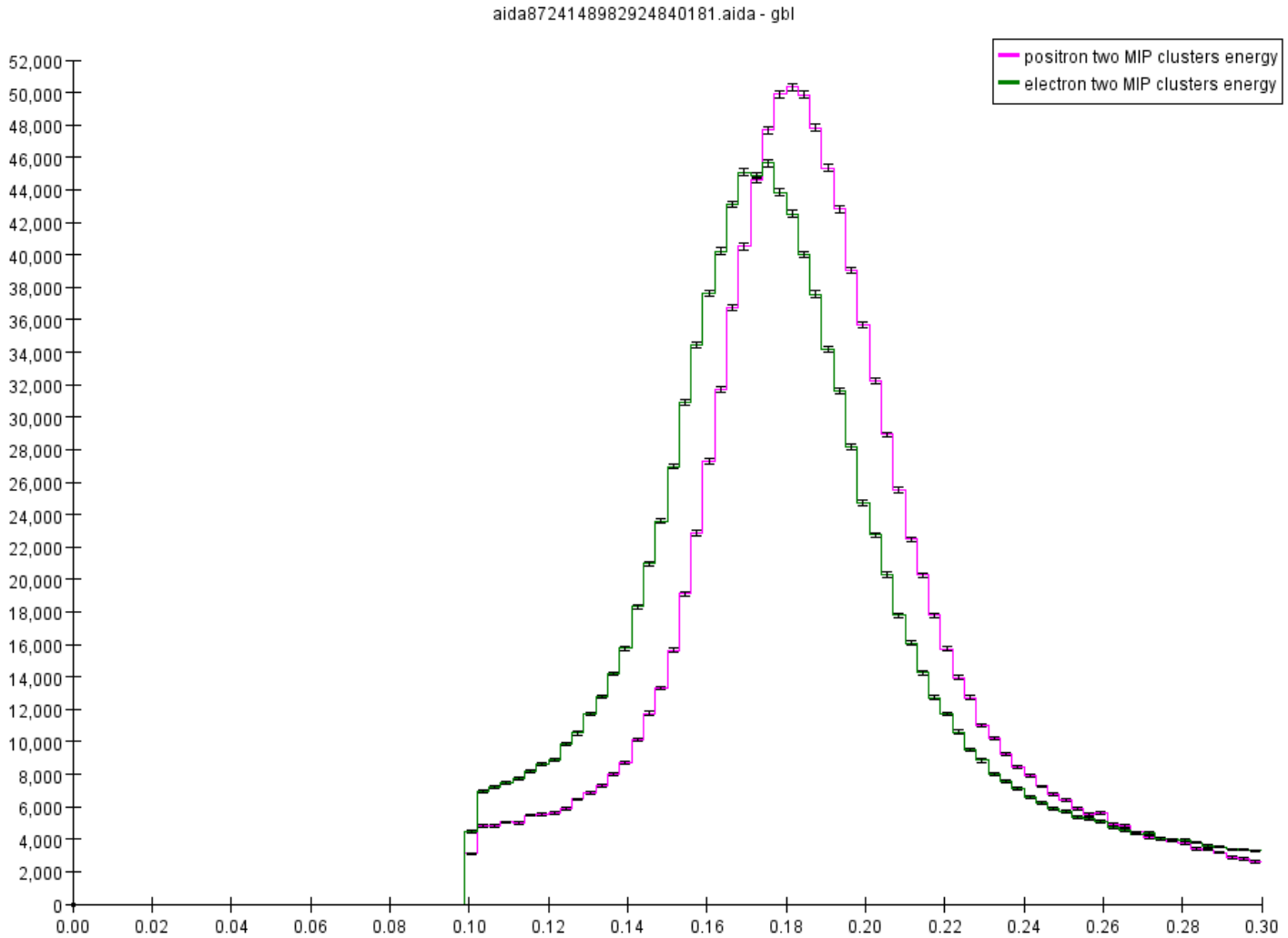
- Nathan has skimmed off events in evio format for events exclusively firing Pairs3 trigger
- Reconstructed a subset of these events using the latest git master snapshot.
- Skimmed events containing a V0 with both particles having an associated ECal cluster with energy below 300 MeV.
- Select single-crystal clusters
  - Cluster energy should be MIP deposit
- Iteratively fit Gaussian to energy peak

Events consistent with $\mu^+\mu^-$ production



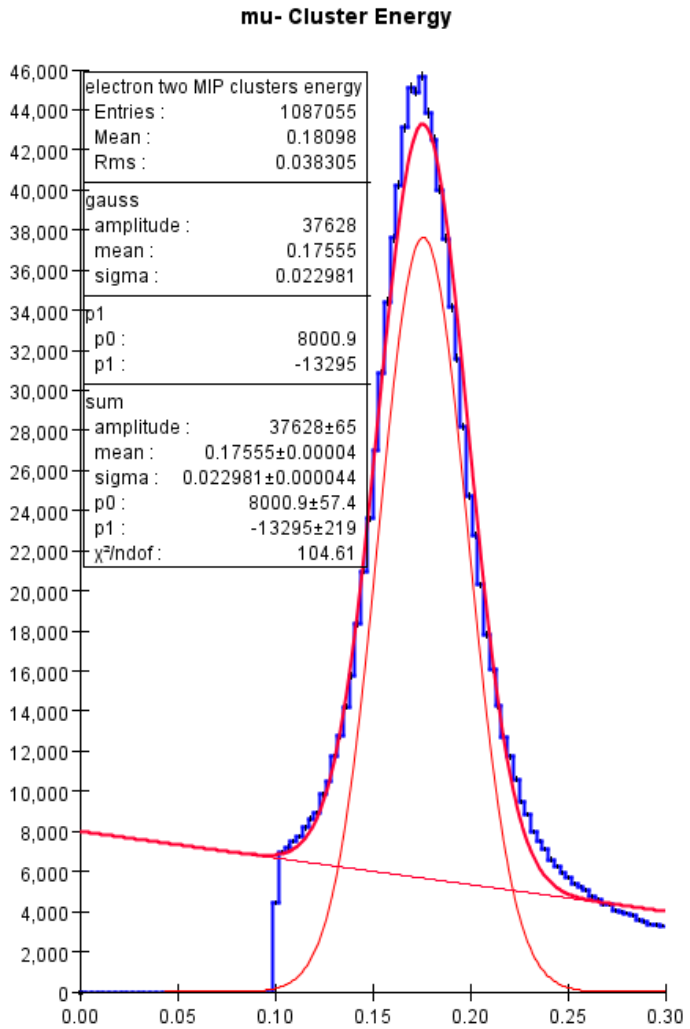
Muon Cluster Energy

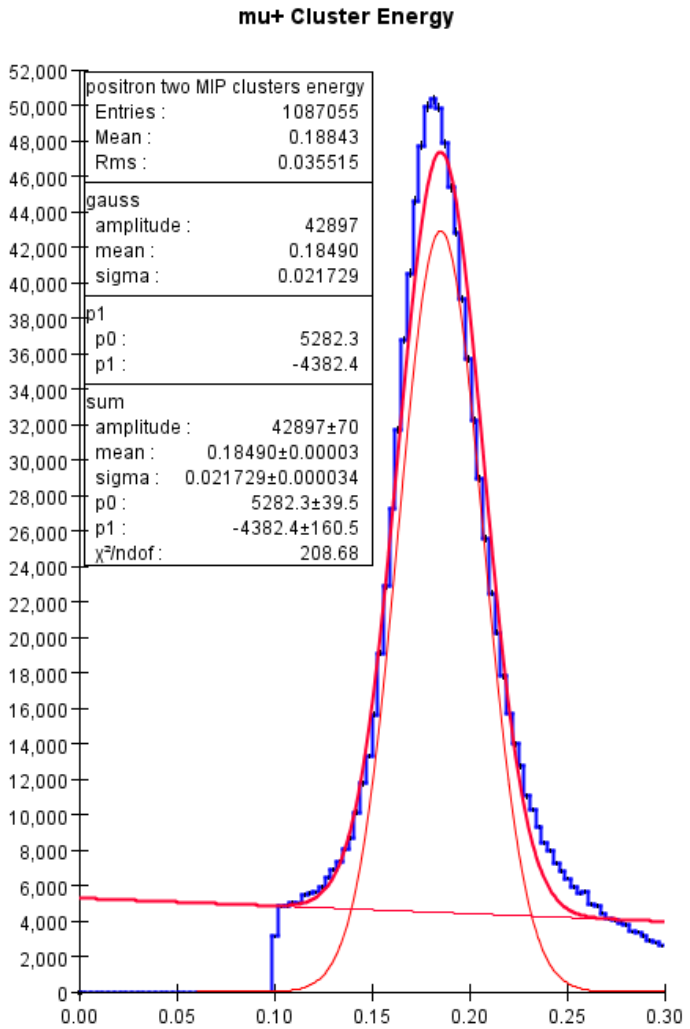
- Systematic offset between μ^+ and μ^-



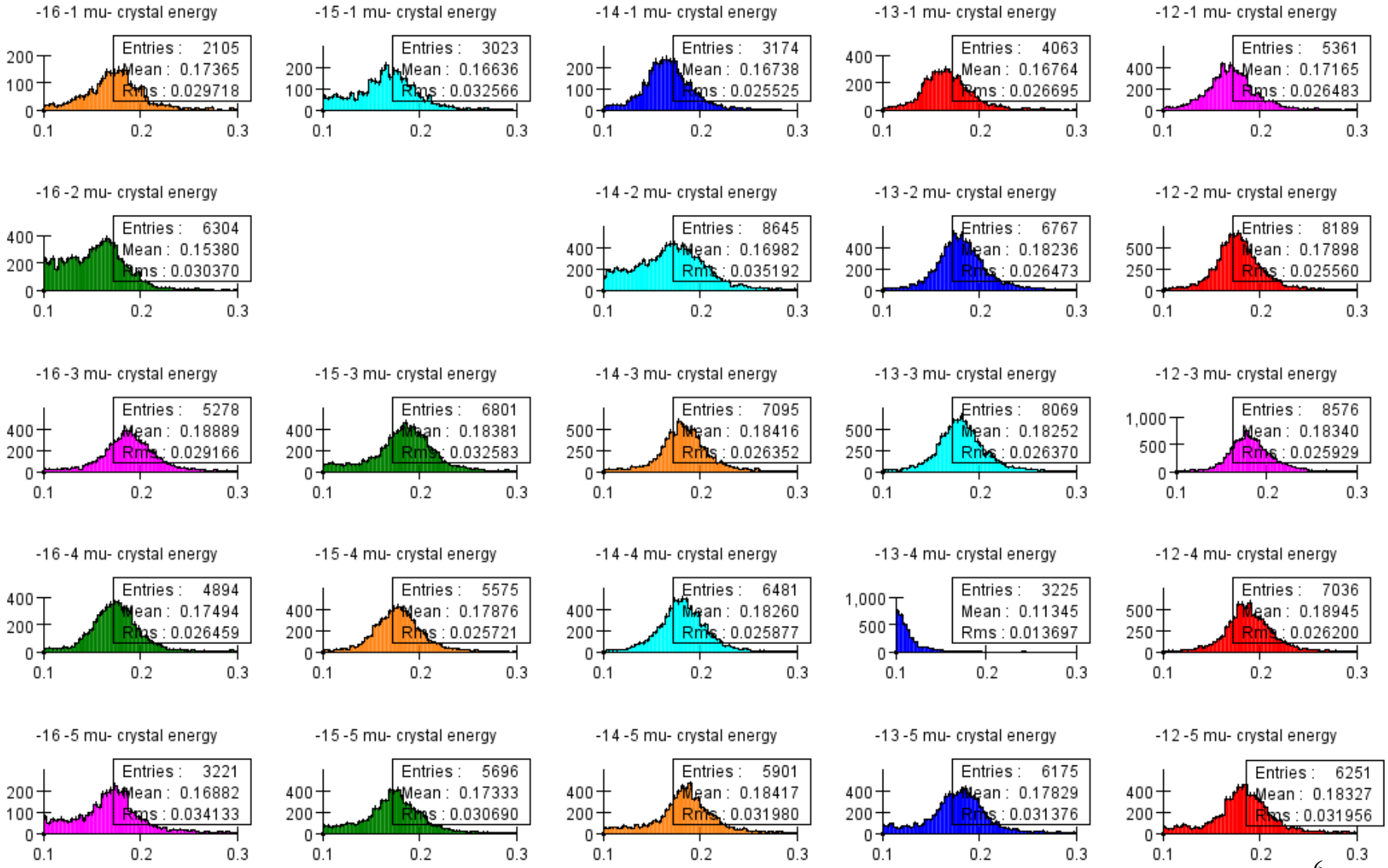
Muon Cluster Energy

Systematic offset between μ^+ and μ^- cluster energy

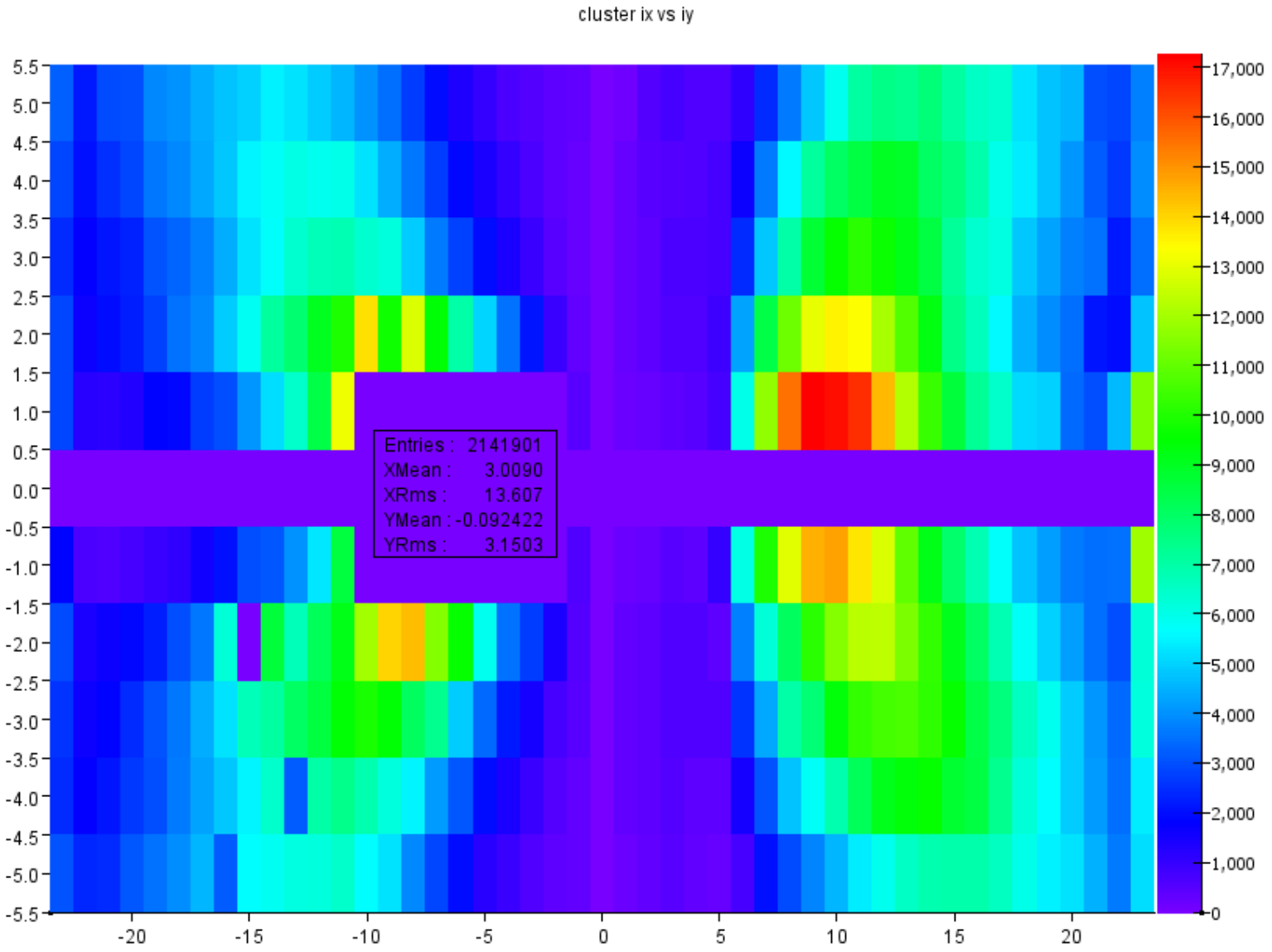




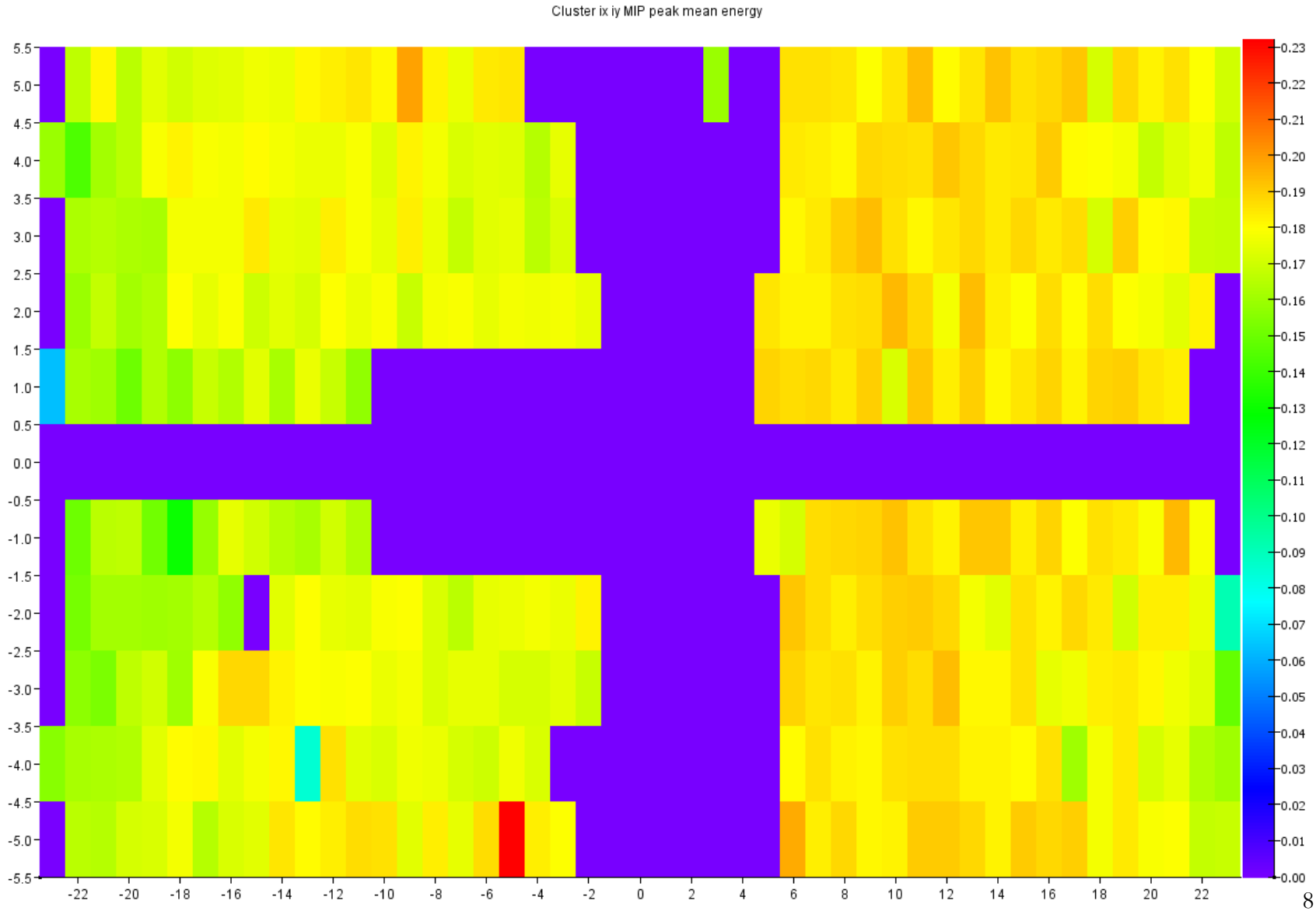
Sample Individual Crystal Cluster Energy



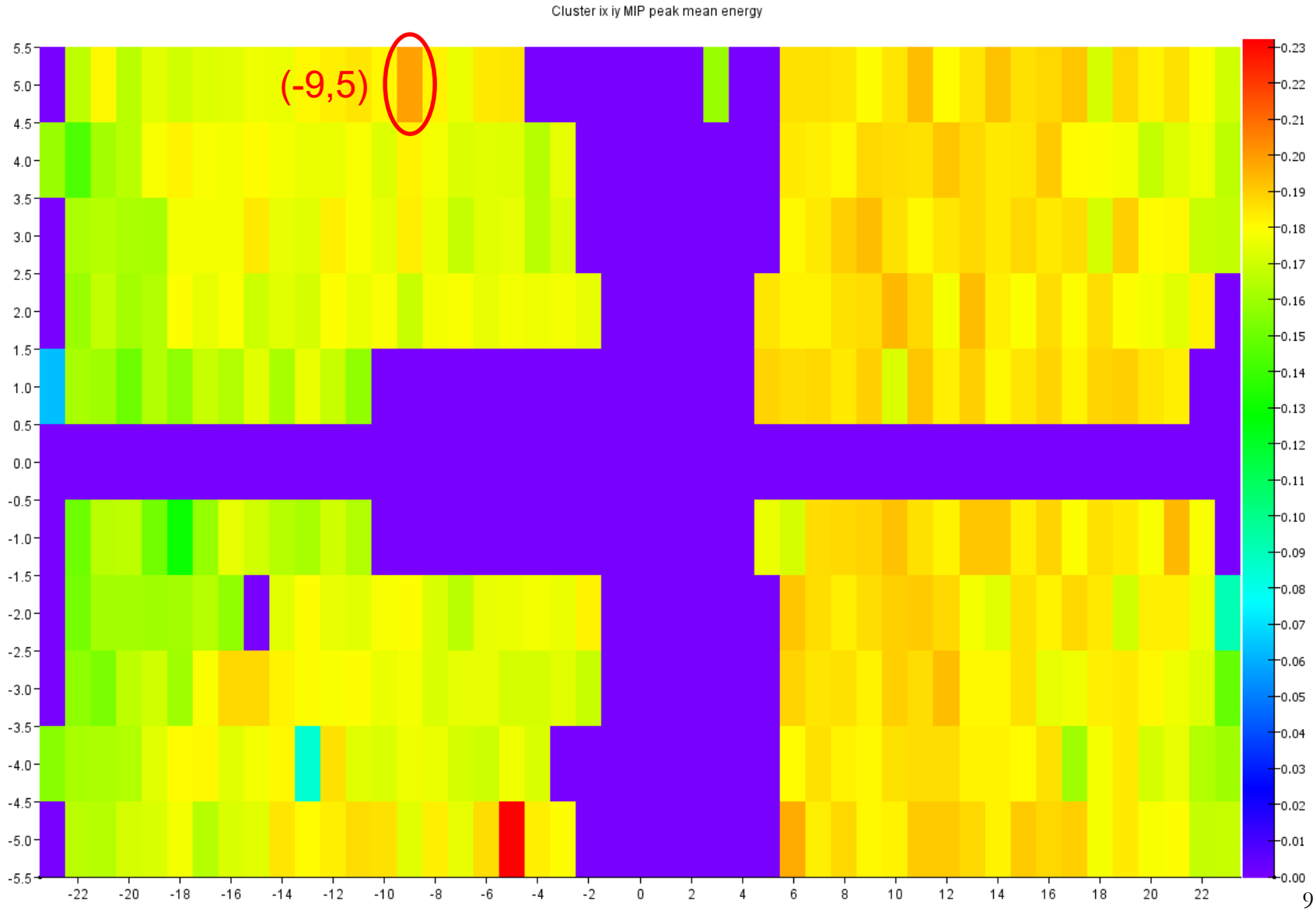
Single-Crystal $\mu^+\mu^-$ Coverage



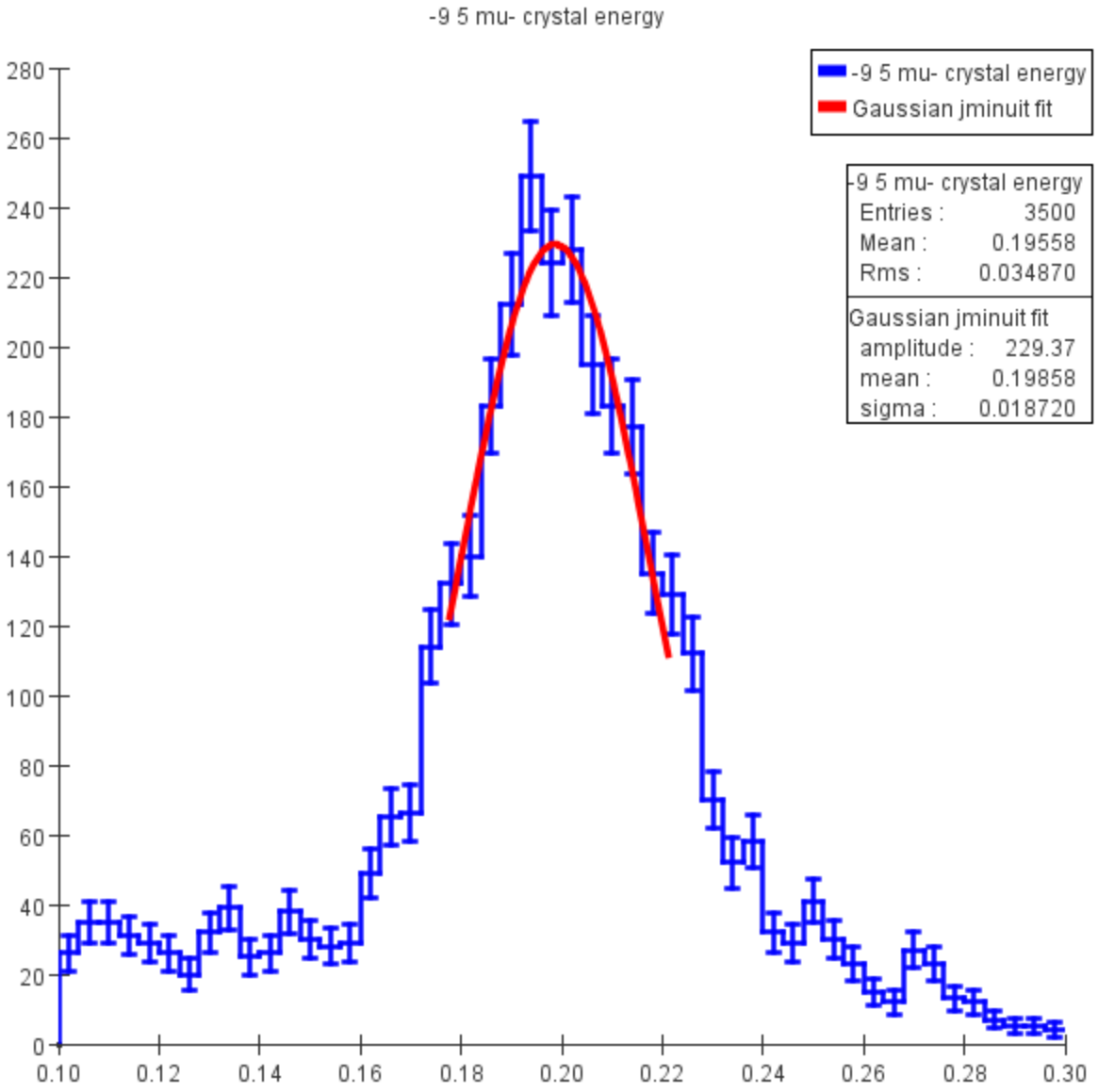
Single-Crystal Cluster Mean Energy



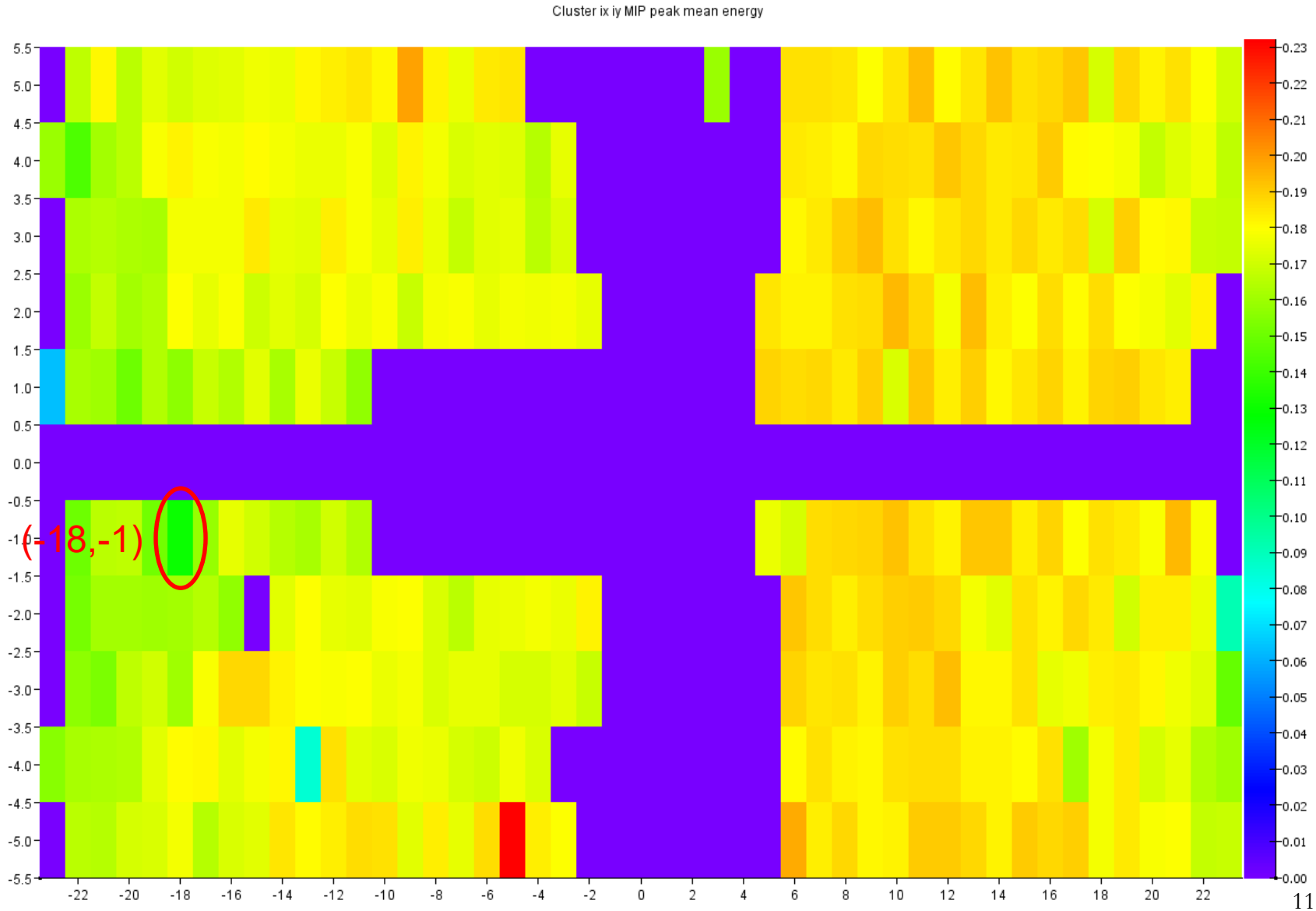
Single-Crystal Cluster Mean Energy



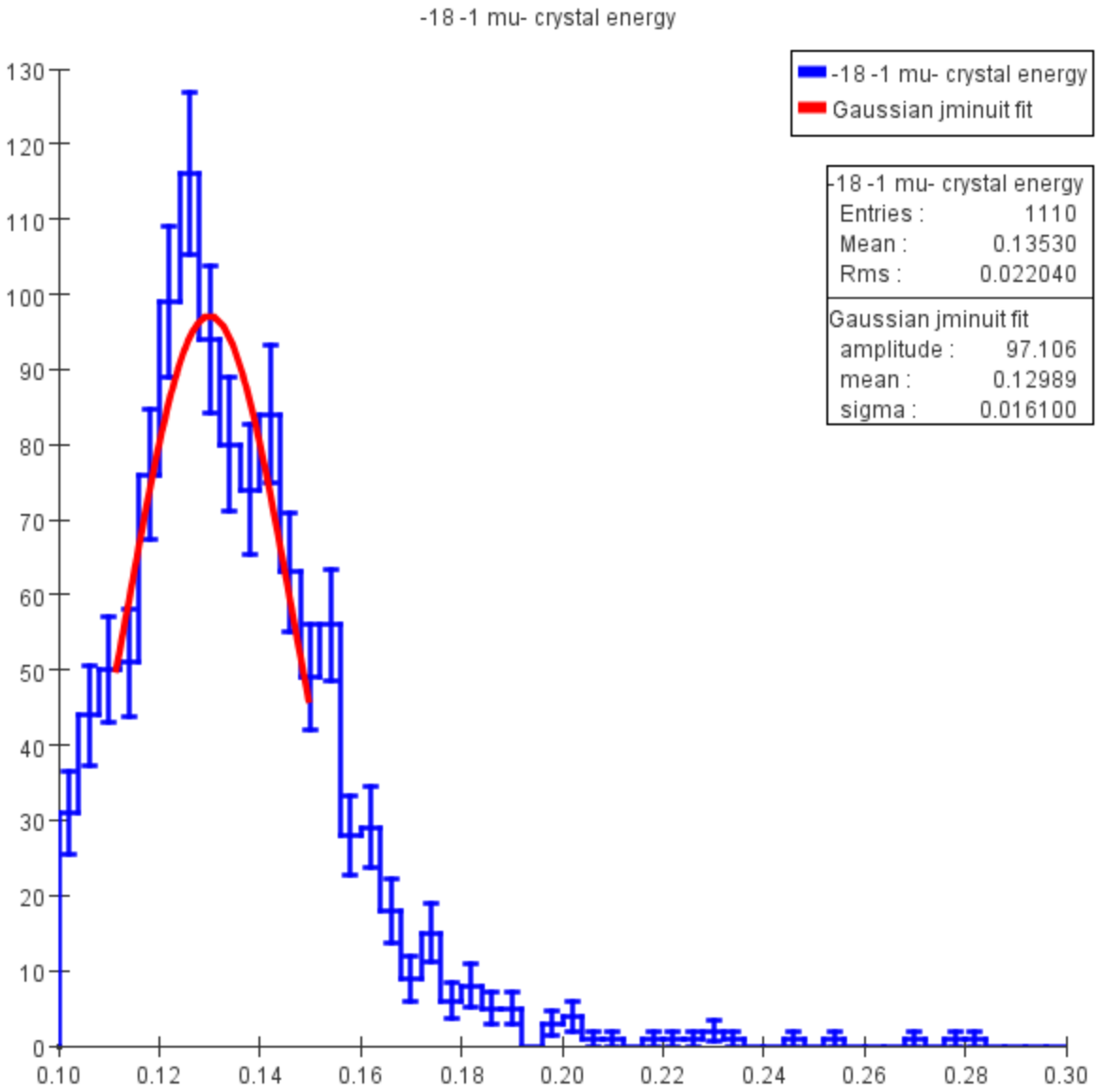
Crystal (-9, 5)


-9 5 mu- crystal energy
-9 5 mu- crystal energy
Gaussian jminuit fit
-9 5 mu- crystal energy
Entries : 3500
Mean : 0.19558
Rms : 0.034870
Gaussian jminuit fit
amplitude : 229.37
mean : 0.19858
sigma : 0.018720
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
0.10
0.12
0.14
0.16
0.18
0.20
0.22
0.24
0.26
0.28
0.30

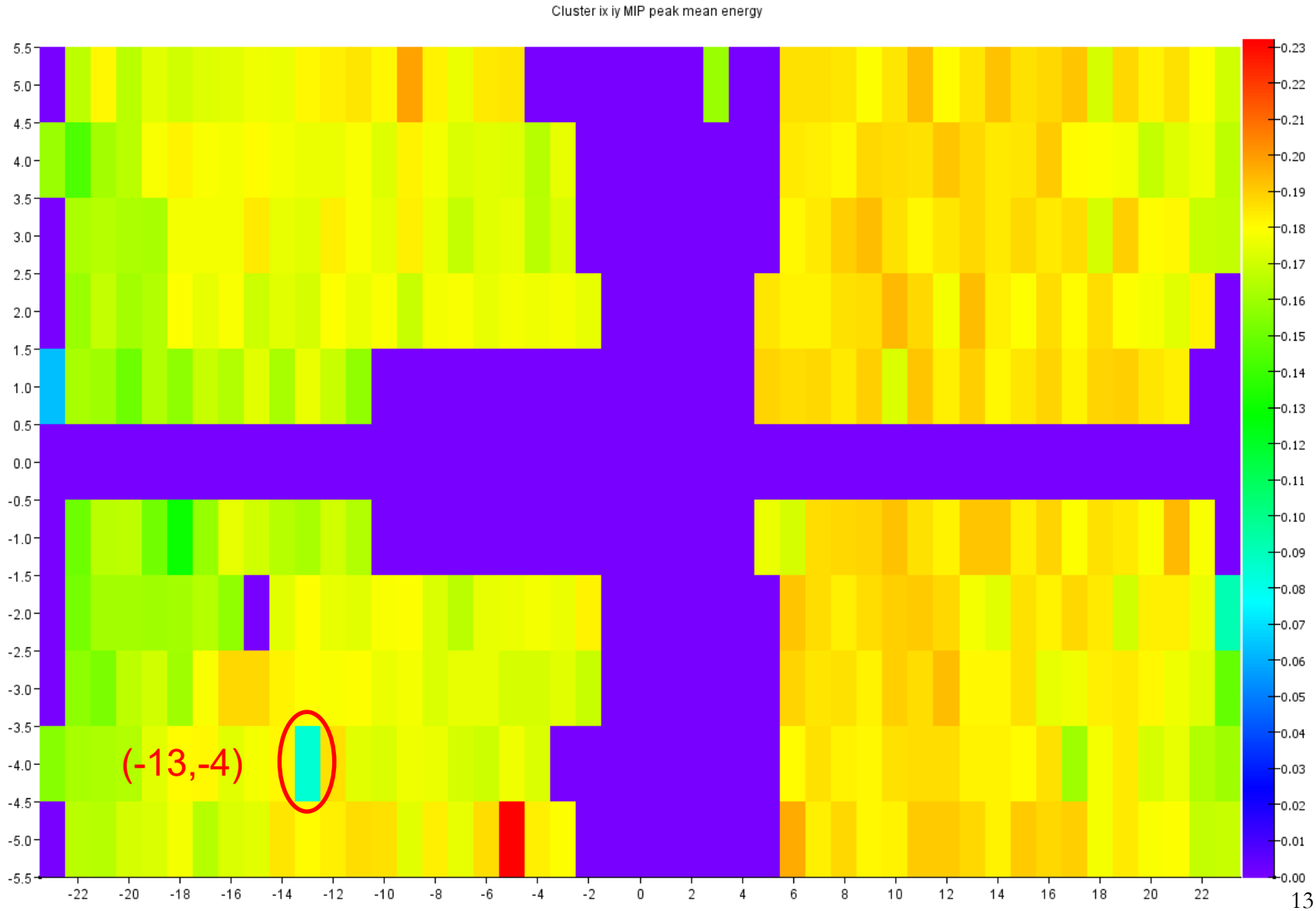
Single-Crystal Cluster Mean Energy



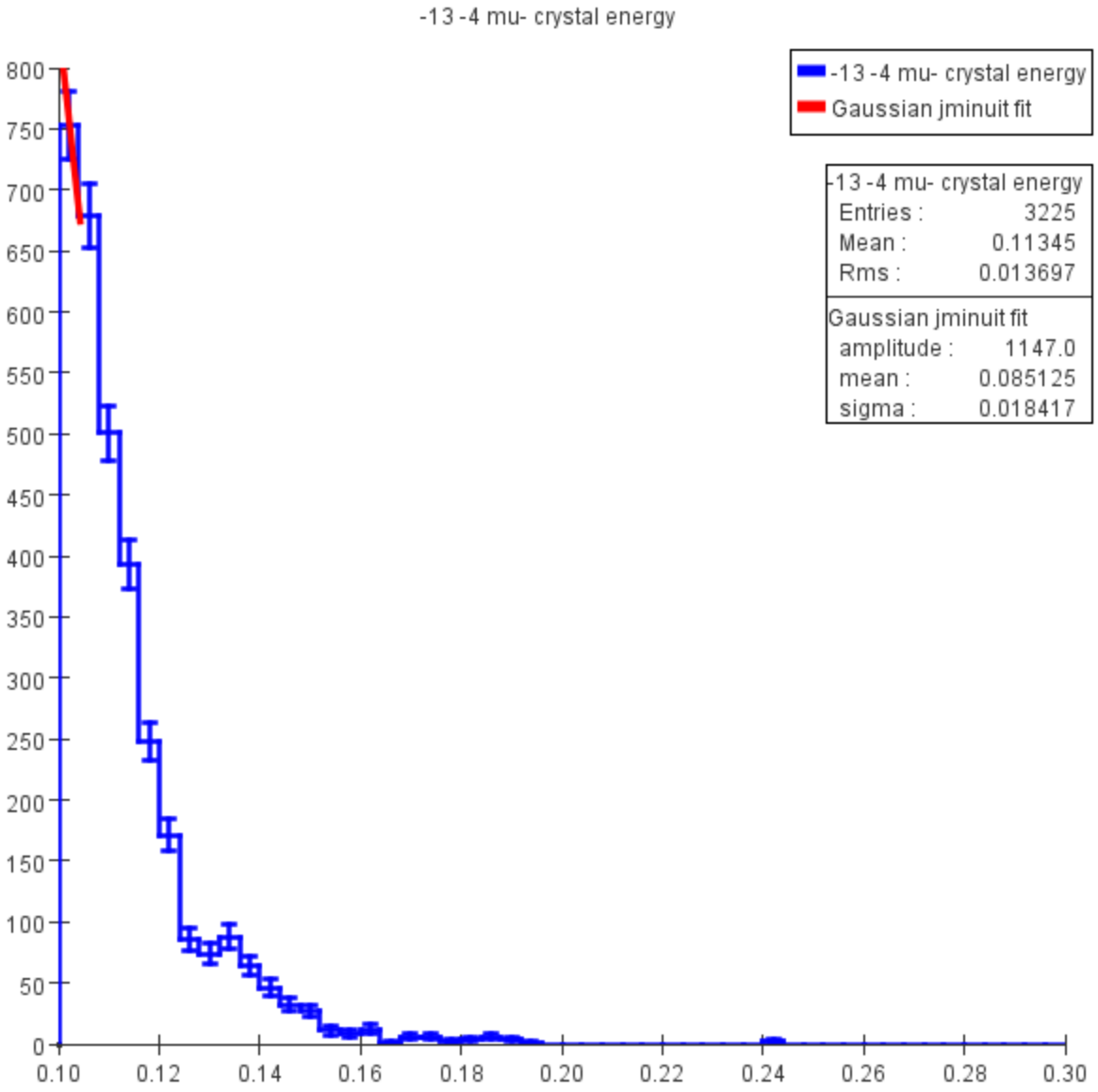
Crystal -18, -1


-18 -1 mu- crystal energy
-18 -1 mu- crystal energy
Gaussian jminuit fit
-18 -1 mu- crystal energy
Entries : 1110
Mean : 0.13530
Rms : 0.022040
Gaussian jminuit fit
amplitude : 97.106
mean : 0.12989
sigma : 0.016100
130
120
110
100
90
80
70
60
50
40
30
20
10
0
0.10
0.12
0.14
0.16
0.18
0.20
0.22
0.24
0.26
0.28
0.30

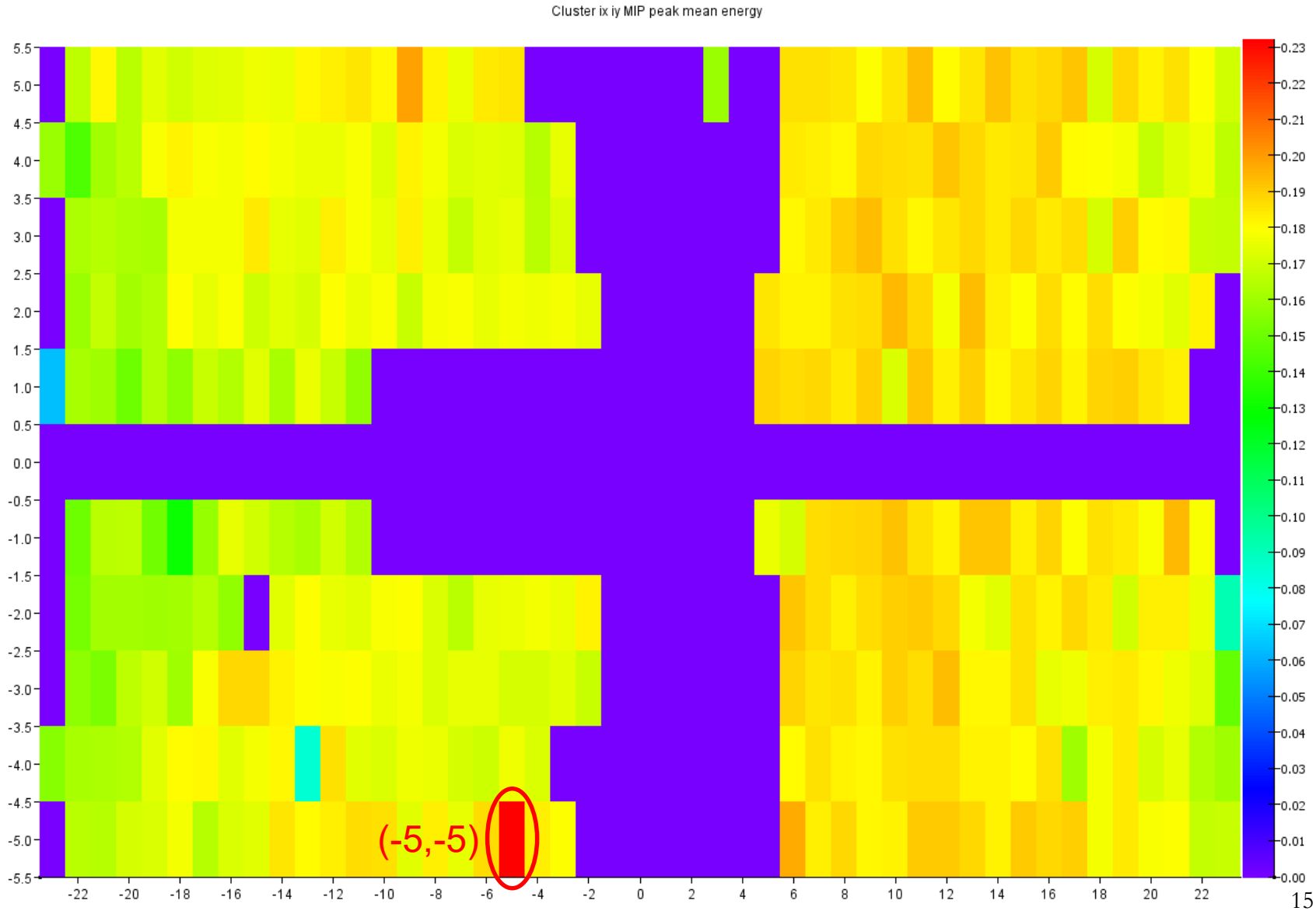
Single-Crystal Cluster Mean Energy



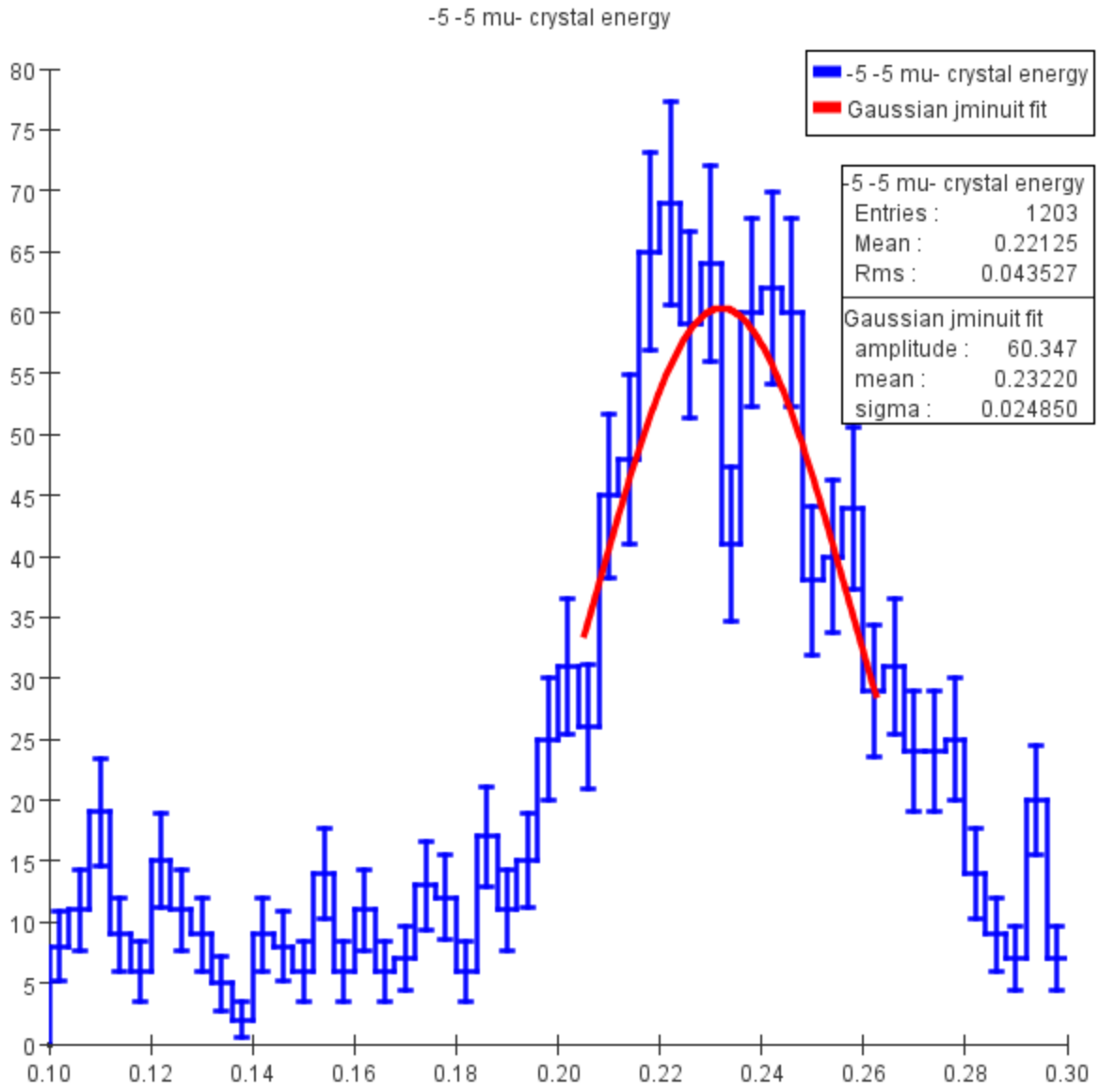
Crystal -13, -4


-13 -4 mu- crystal energy
-13 -4 mu- crystal energy
Gaussian jminuit fit
-13 -4 mu- crystal energy
Entries : 3225
Mean : 0.11345
Rms : 0.013697
Gaussian jminuit fit
amplitude : 1147.0
mean : 0.085125
sigma : 0.018417
800
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
0.10
0.12
0.14
0.16
0.18
0.20
0.22
0.24
0.26
0.28
0.30

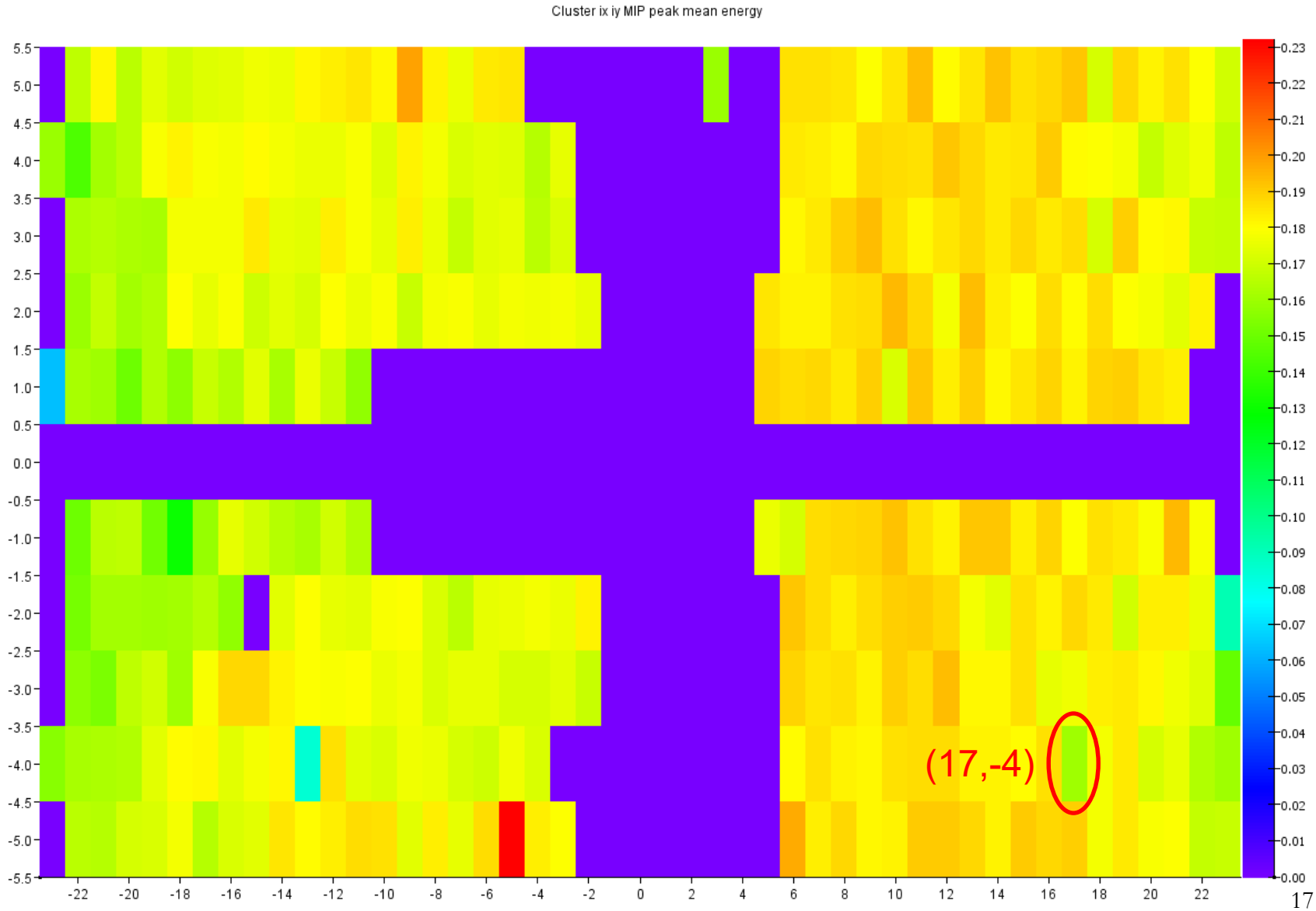
Single-Crystal Cluster Mean Energy



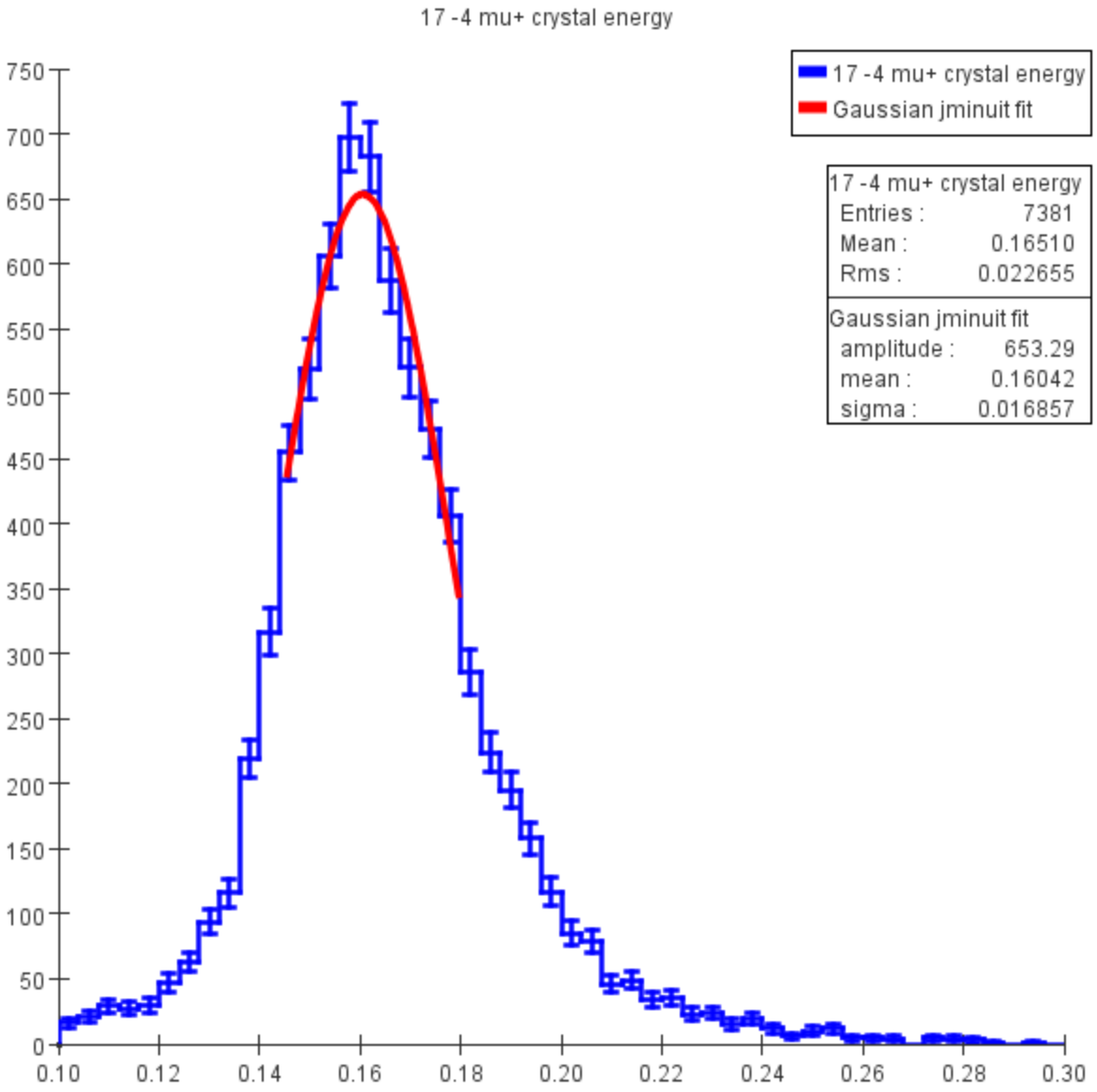
Crystal -5, -5


-5 -5 mu- crystal energy
-5 -5 mu- crystal energy
Gaussian jminuit fit
-5 -5 mu- crystal energy
Entries : 1203
Mean : 0.22125
Rms : 0.043527
Gaussian jminuit fit
amplitude : 60.347
mean : 0.23220
sigma : 0.024850
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
0.10
0.12
0.14
0.16
0.18
0.20
0.22
0.24
0.26
0.28
0.30

Single-Crystal Cluster Mean Energy



Crystal 17, -4


17 -4 mu+ crystal energy
17 -4 mu+ crystal energy
Gaussian jminuit fit
17 -4 mu+ crystal energy
Entries : 7381
Mean : 0.16510
Rms : 0.022655
Gaussian jminuit fit
amplitude : 653.29
mean : 0.16042
sigma : 0.016857
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
0.10
0.12
0.14
0.16
0.18
0.20
0.22
0.24
0.26
0.28
0.30

Summary

- Muons produced in collisions at HPS provide a clean source of MIPs with sufficient statistics to calibrate individual crystals over most of the calorimeter, excepting roughly -2 to +5, and +/-23.
- Electron-side analysis shows a few crystals with abnormally high or low responses:
  - e.g. (-9,5), (-18, -1), (-13, -4), (-5, -5)
  - These should be checked against the gains determined from the FEE analysis.
- Positron-side single-crystal MIP clusters show higher average energy and somewhat more scatter.
- The full set of Pairs3 events should be processed to increase the statistics and fill in some of the gaps.