Cluster counting studies from July testbeam

For

SuperB collaboration meeting

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By

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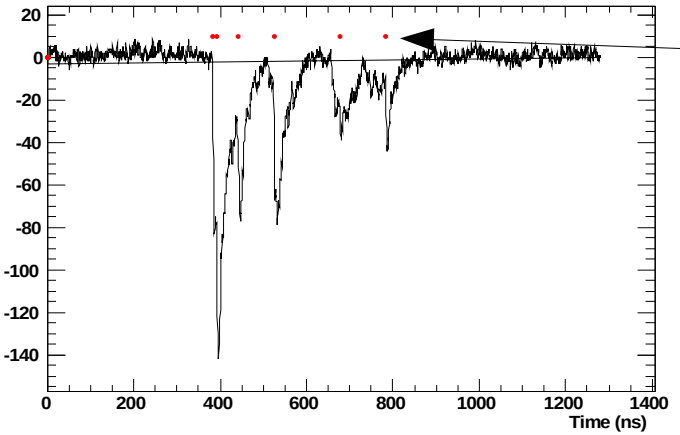
Cluster counting Algorithm

- 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



Cluster counting

- The algorithm contains two parameters:
  - a, the threshold above which a cluster is detected
  - n, the number of previous bins averaged over
- Use separation power of muons and pions to optimize these parameters

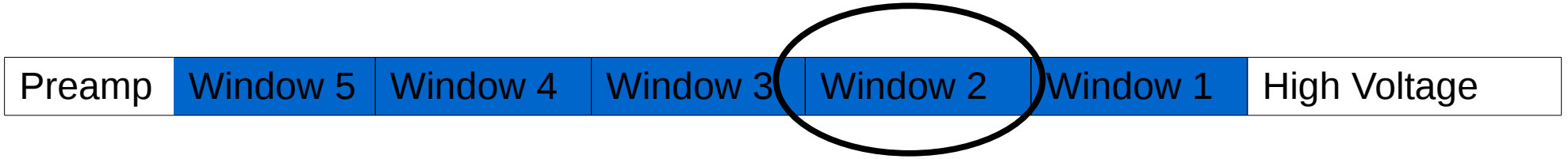
$$\text{Resolving power} = \frac{\bar{\pi} - \bar{\mu}}{\sqrt{\sigma_{\pi}^2 + \sigma_{\mu}^2}}$$

Here is presented results of analysis on chamber with 20μm sense wire

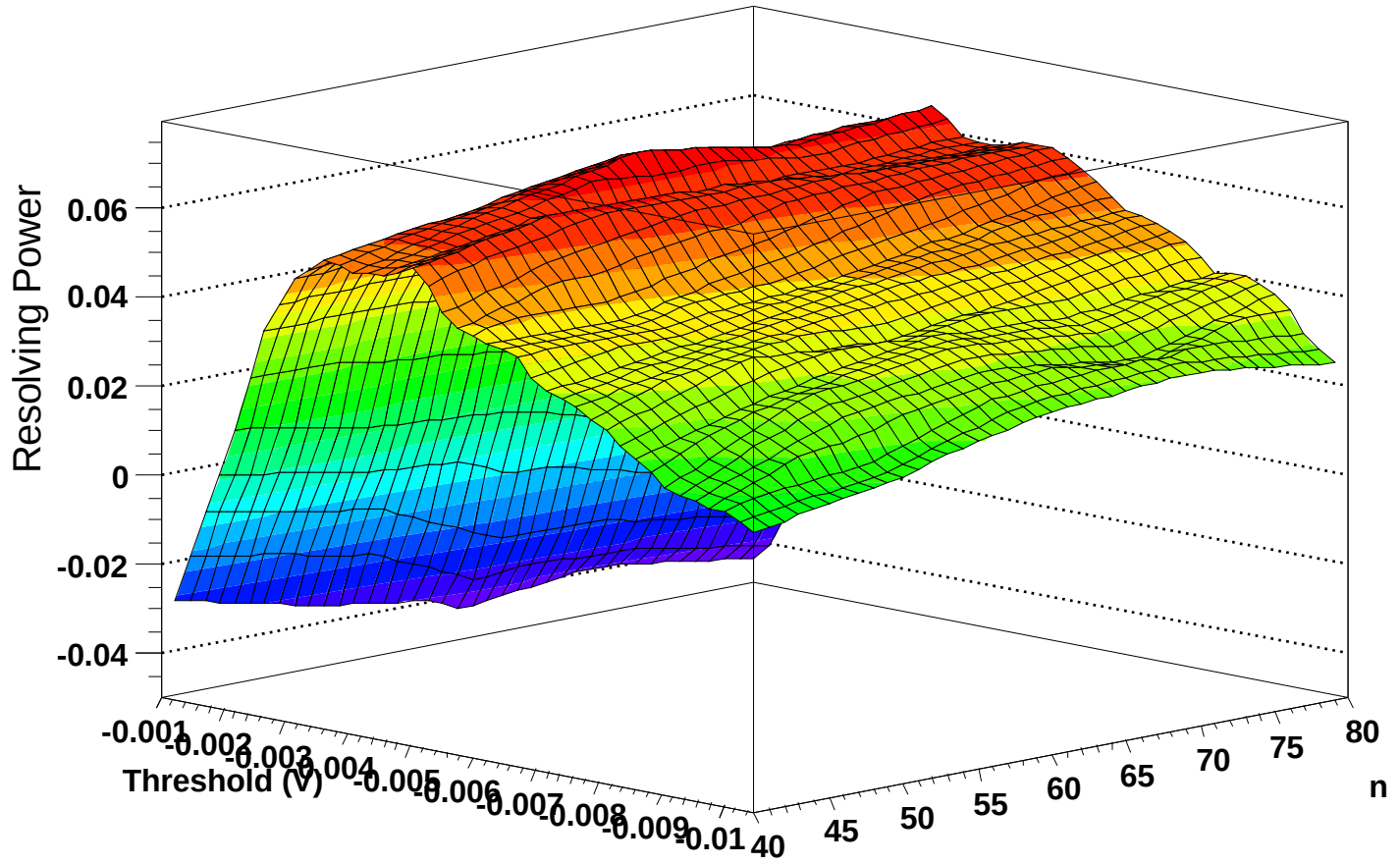
Studied gas gain variation.

All data was taken at 210MeV/c, with a dip angle of 10°, and the 1855 cable, taken at window 2

Two preamps studied: A1-3 (with 50Ω impedance), and cc194-1 (with 370Ω impedance)

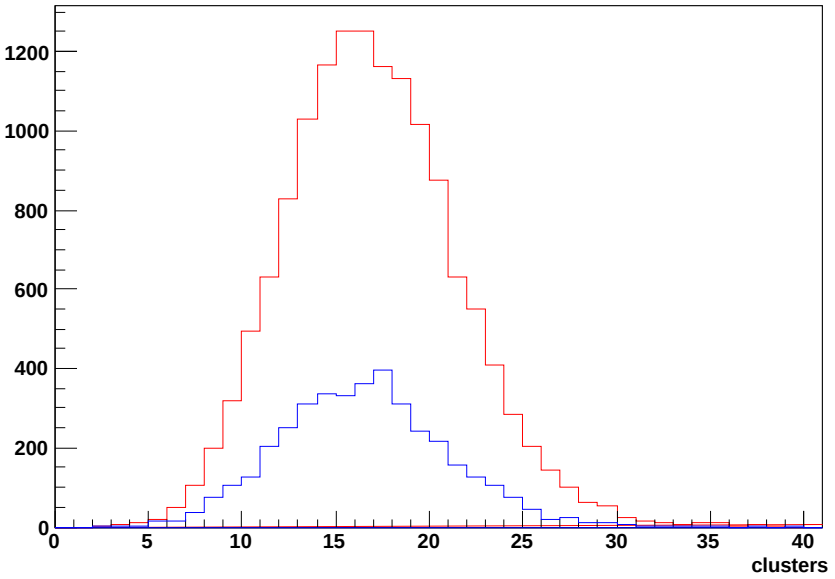


Optimization: 50Ω preamp



- Optimization of run 450:
  - Sense wire voltage at 1820V
  - 50Ω preamp (A1-3)
  - 210MeV/c
  - Peak resolving power of 0.068 for n=60, threshold of -4mV

Cluster Distribution for run 450



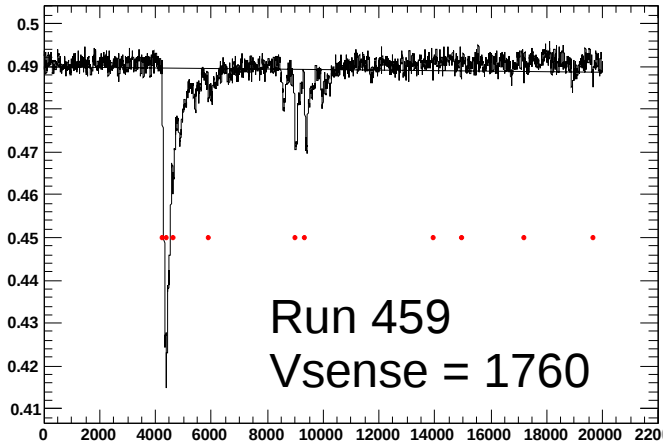
- Muon mean/rms = 16.12/4.68, n_{μ} = 3943
- Pion mean/rms = 16.58/4.81, n_{π} = 14103
- Blue is Muons, Red is Pions.

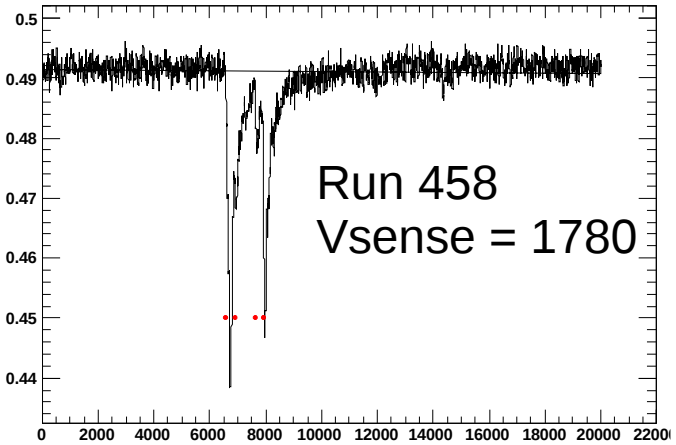
Gain scan summary

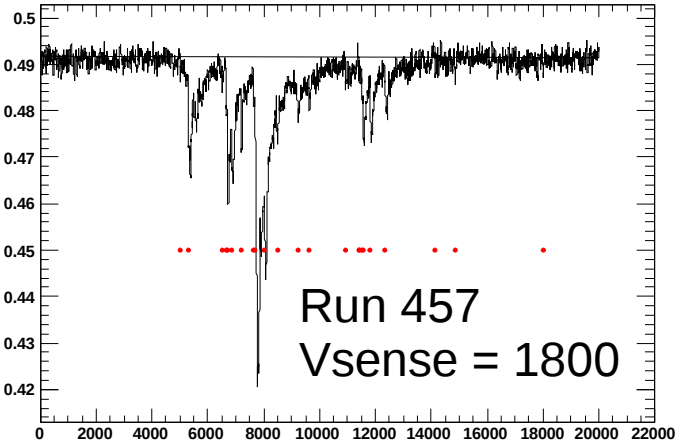
Run	V_{sense}	Pressure/ Temperature	Truncated mean (muons)	Resolving Power (Truncated Mean of 40 events)	Resolving Power (CC)	Threshold (mV)	n
459	1760	3.37	26.00	0.9745	0.6464	-4.5	60
458	1780	3.37	34.67	0.8565	0.7014	-4.5	80
457	1800	3.35	56.77	0.8381	0.7621	-4	80
450	1820	3.35	84.05	0.5177	0.4326	-4	60
456	1840	3.35	109.84	0.5670	0.5623	-3.5	50

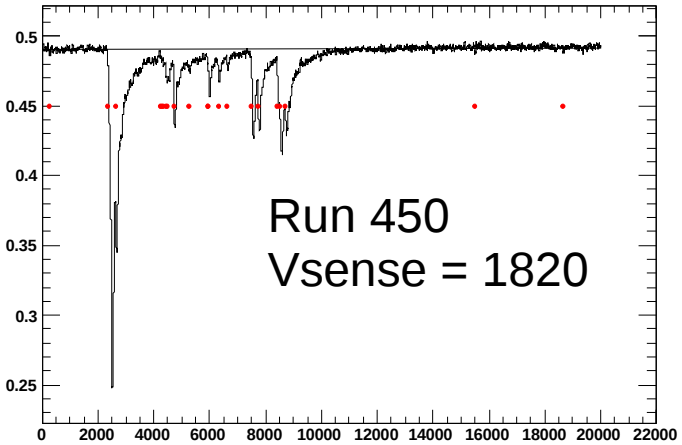
- For A1-3 preamp (50Ω impedance)
- Chamber at 10°
- Window 2
- Space charge effects at higher gain?

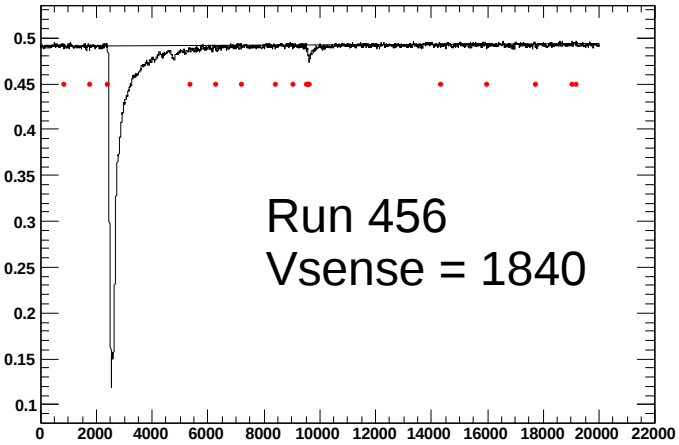
Sample Traces





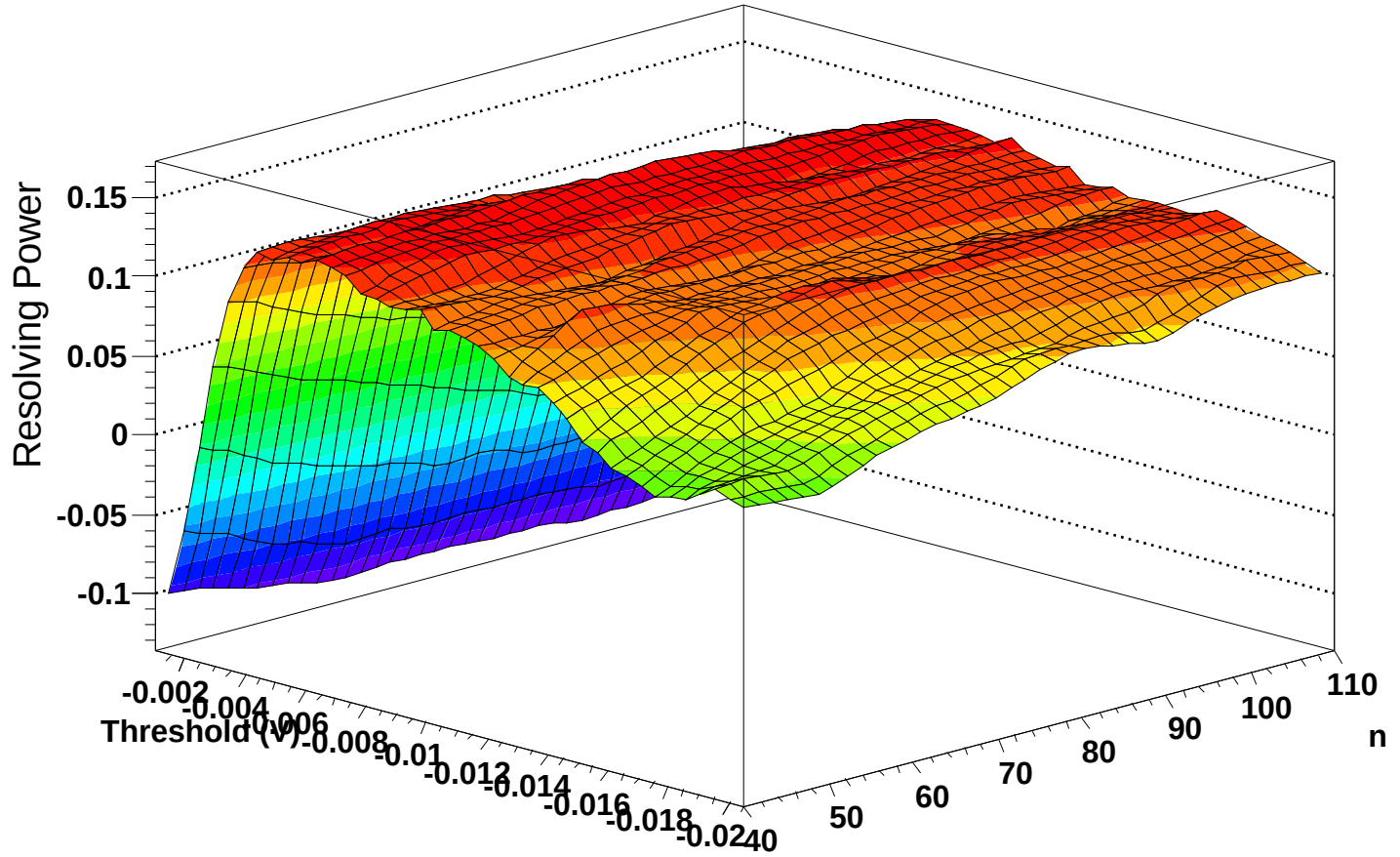






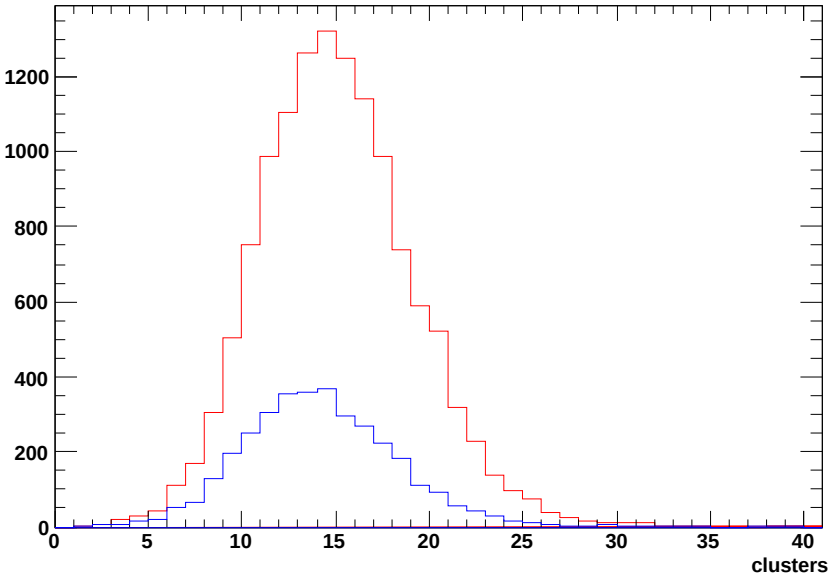
Red dots represent locations of clusters

Optimization: 370Ω preamp



- Optimization of run 535:
  - Sense wire voltage at 1700V
  - 370Ω preamp (cc194-1)
  - 210MeV/c
  - Peak resolving power of 0.1460 for n=80, threshold of -6.5mV

Cluster Distribution for run 535



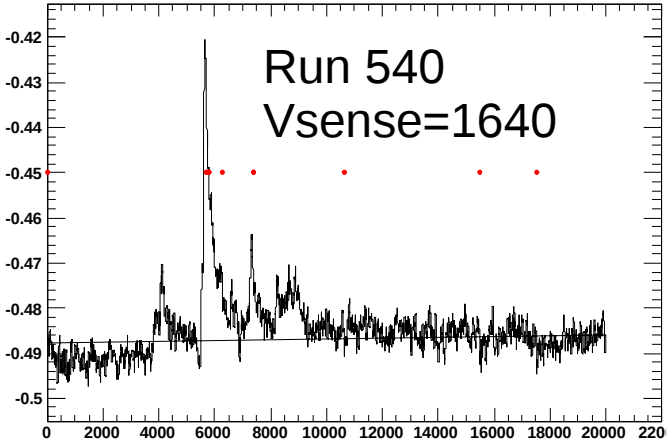
- Muon mean/rms = 13.73/4.20, n_{μ} = 3492
- Pion mean/rms = 15.08/4.12, n_{π} = 12848
- Blue is Muons, Red is Pions.

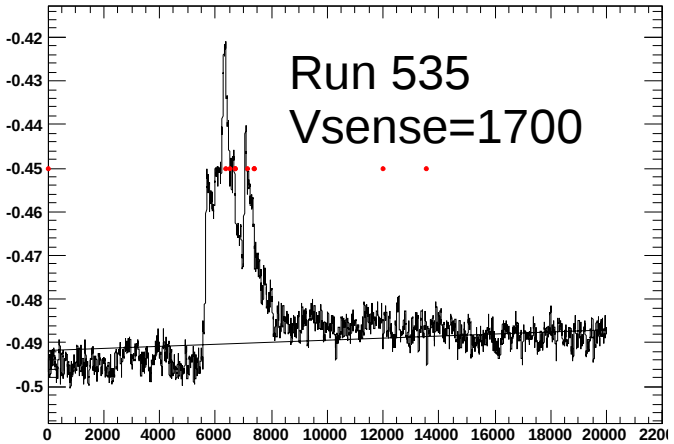
Gain scan summary

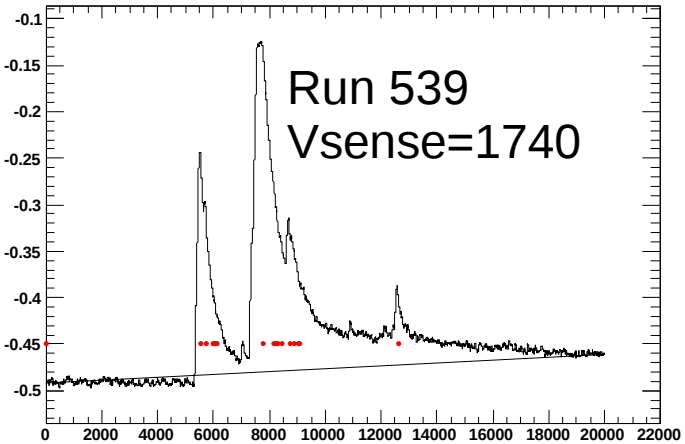
Run	V_{sense}	Pressure/ Temperature	Truncated mean (muons)	Resolving Power (Truncated Mean of 40 events)	Resolving Power (CC)	Threshold (mV)	n
540	1640	3.36	80.89	0.9497	1.060	-6.5	80
535	1700	3.38	167.42	0.9298	0.9253	-6.5	80
539	1760	3.36	429.34	0.7887	0.9626	-9	80

- For cc194-1 inverting preamp (370Ω Impedance)
- Chamber at 10°
- Window 2
- Space charge?

Sample Traces







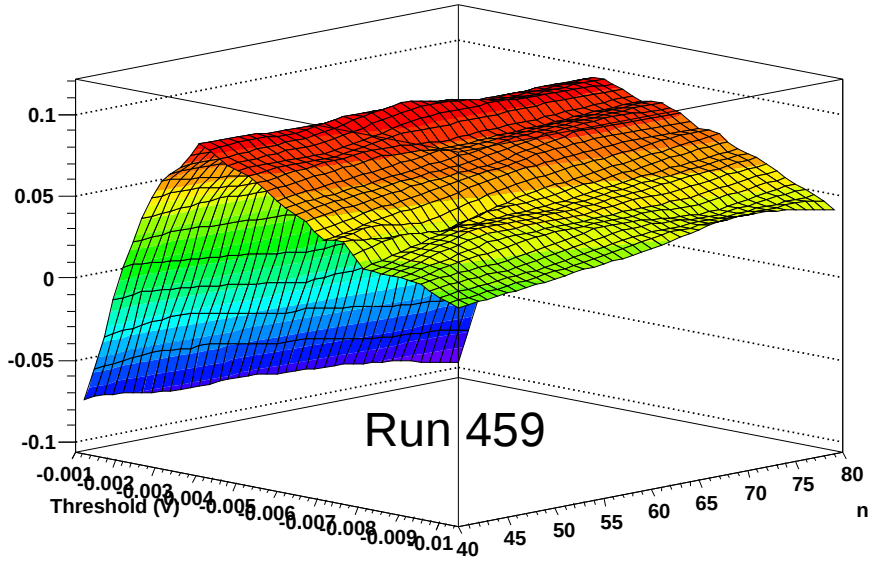
Red dots represent locations of clusters

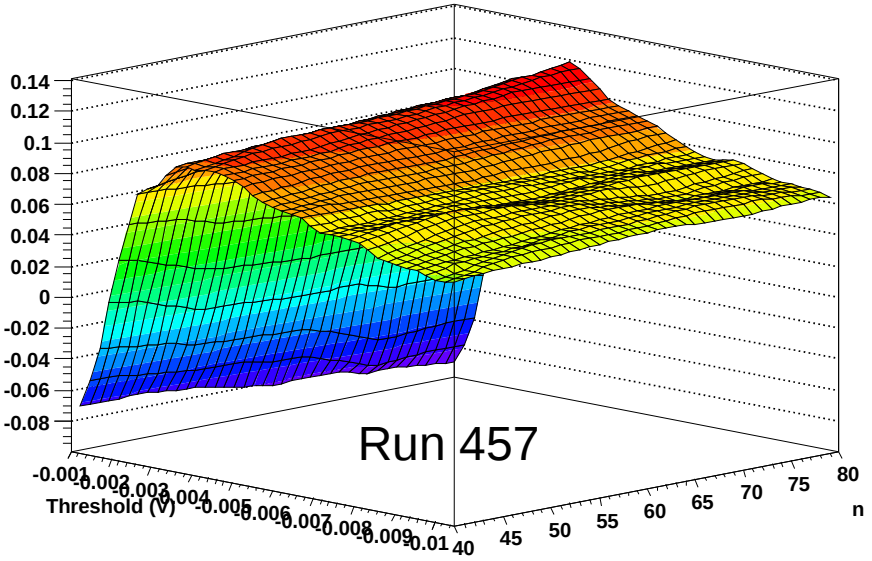
Future Work

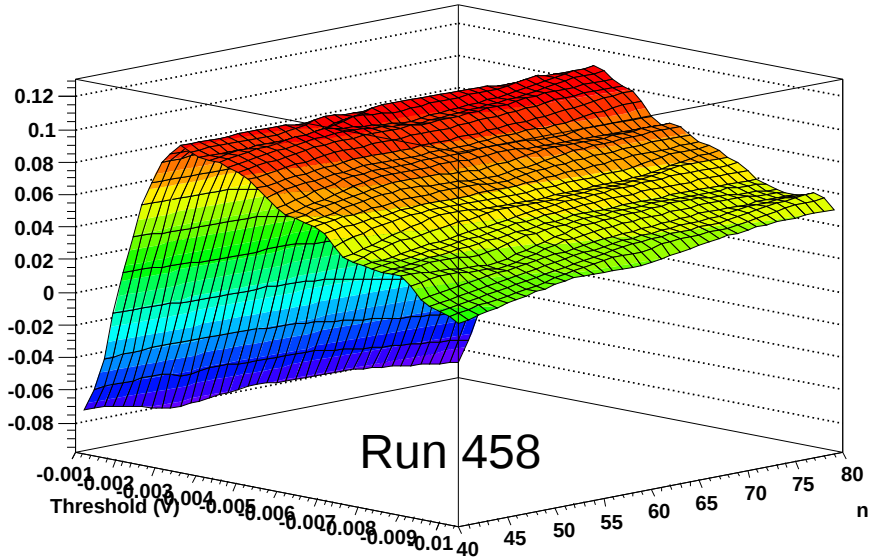
- Efficiency of muons vs. efficiency of pions tagged as muons
  - For cluster counting, truncated mean, and combined
- Study other momenta
- Study other angles
  - Explore space charge hypothesis
- November: Data with different gas gain at other angles

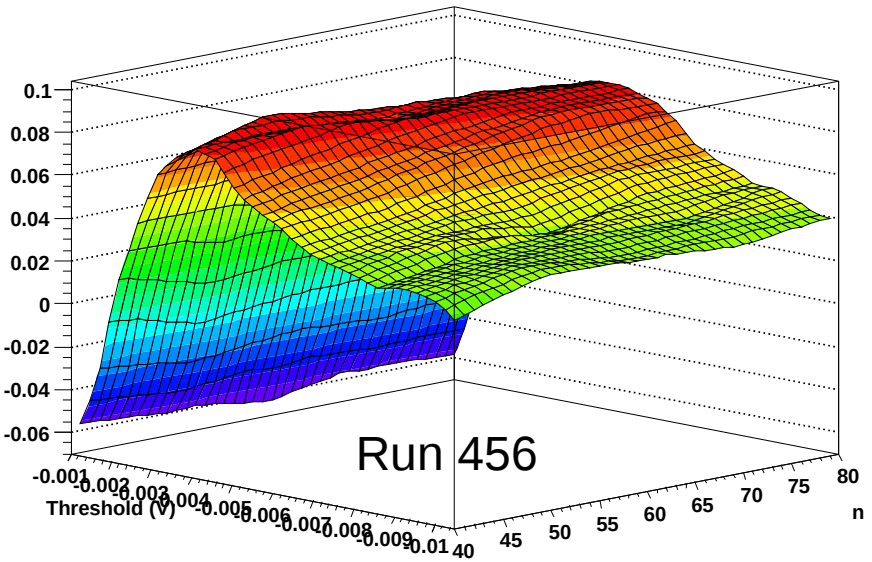
Backup Slides

Optimization of 50Ω preamp runs









Optimization of 370Ω runs