

# GE Silicone Sealants $^{222}\text{Rn}$ Emanation Measurement

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# Sample Photos



**Figure 1:** photo not yet available

# Overview of Emanation

Two samples were emanated throughout the latter half of 2023

- GE All-Purpose Silicone Sealant was emanated four times with a total of 465 hours of usable assay data.
- GE Advandced Silicone Sealant was emanated three times with a total of N hours of usable assay data.



# Overview of GE All-Purpose Silicone Sealant Emanation

A sample of GE All-Purpose Silicone Sealant was emanated six times throughout Summer 2023.

- However, only four of those runs contained useful assay data, resulting in 465 hours of data available to analyze.
- The sample emanated had a surface area of approximately  $200 \text{ cm}^2$
- Overall, the sample was determined to emanate at a rate of  $0.00^{+0.02}_{-0.00} \text{ mBq}$ 
  - The uncertainties in this figure were calculated separately for top and bottom errors in order to provide a more conservative estimate.

Overall, this sample has an emanation rate sufficiently low for use in SuperCDMS



# Run 717 Analysis

Run 717 occurred in June 2023.

- Emanation Rate was determined to be  $0.00^{+0.03}_{-0.00}$  mBq.
- This determination was based on the observed emanation rate of  $^{214}\text{Po}$ .
- The  $^{218}\text{Po}$  rate wasn't used as poor resolution between the peaks of  $^{218}\text{Po}$  and  $^{210}\text{Po}$  likely caused  $^{210}\text{Po}$  events to spill over into the  $^{218}\text{Po}$  ROI

The Rate vs. Time plot for Run 717 follows.

See backup slides for Run 717



# Rate vs. Time, Run 717

Rate vs Time Run 717, with Model Background

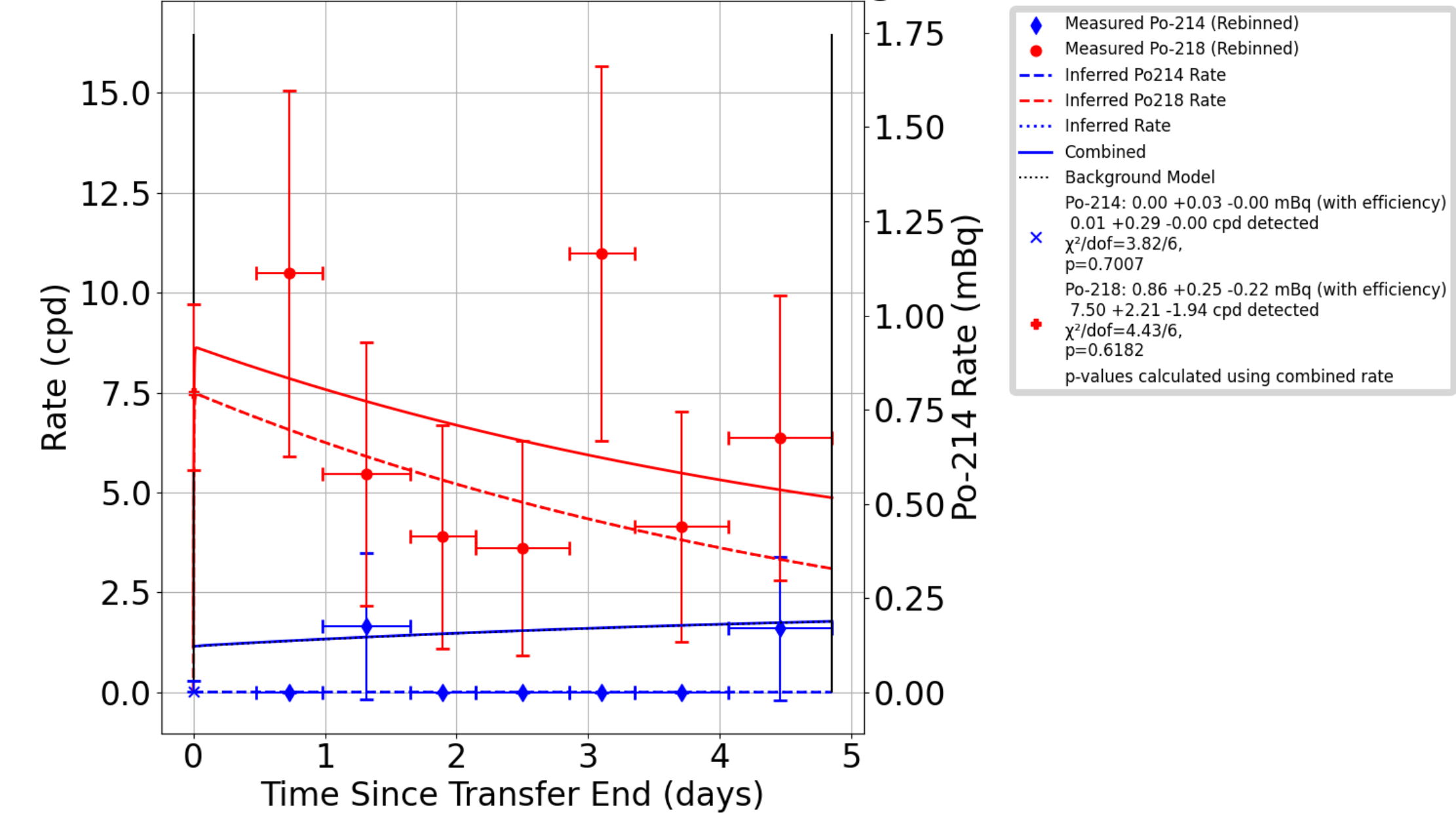


Figure 2:  $^{222}\text{Rn}$  Emanation Rate:  $0.00^{+0.03}_{-0.00}$  mBq (from  $^{214}\text{Po}$  Rate)



# Run 720 Analysis

Run 720 occurred in June and July 2023.

- Emanation Rate was determined to be  $0.00^{+0.54}_{-0.00}$  **mBq**.
- This determination was based on the observed emanation rate of  $^{214}\text{Po}$ .
- The  $^{218}\text{Po}$  rate wasn't used as poor resolution between the peaks of  $^{218}\text{Po}$  and  $^{210}\text{Po}$  likely caused  $^{210}\text{Po}$  events to spill over into the  $^{218}\text{Po}$  ROI

See Backup Slides for Run 720



# Rate vs. Time, Run 720

Rate vs Time Run 721, with Model Background

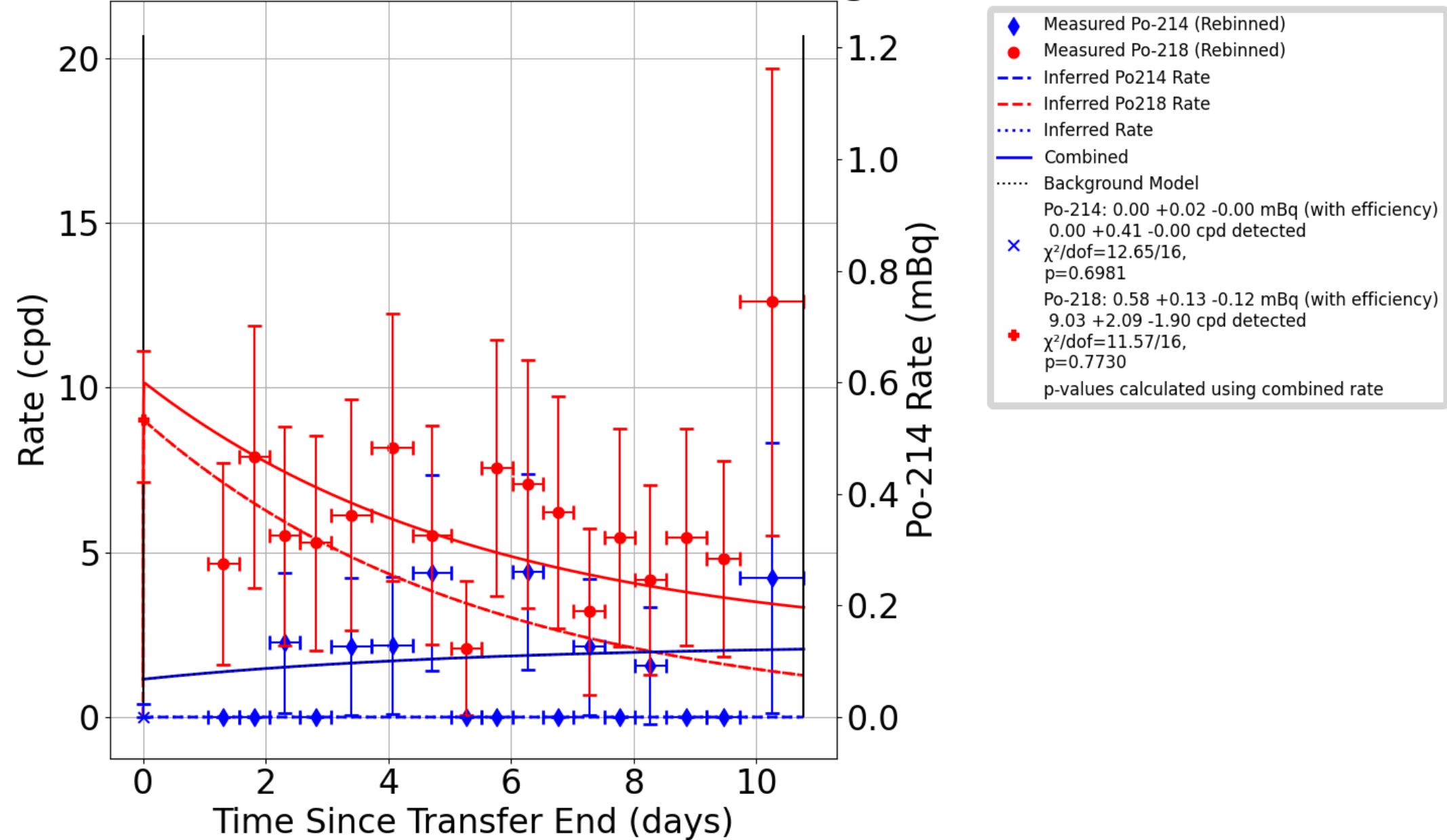


Figure 3:  $^{222}\text{Rn}$  Emanation Rate:  $0.00^{+0.54}_{-0.00}$  mBq (from  $^{214}\text{Po}$  rate)





# Run 721 Analysis

- Emanation Rate was determined to be  $0.00^{+0.02}_{-0.00}$  **mBq**.
- This determination was based on the observed emanation rate of  $^{214}\text{Po}$ .
- The  $^{218}\text{Po}$  rate wasn't used as poor resolution between the peaks of  $^{218}\text{Po}$  and  $^{210}\text{Po}$  likely caused  $^{210}\text{Po}$  events to spill over into the  $^{218}\text{Po}$  ROI

See Backup Slides for Run 721



# Rate vs. Time, Run 721

Rate vs Time Run 721, with Model Background

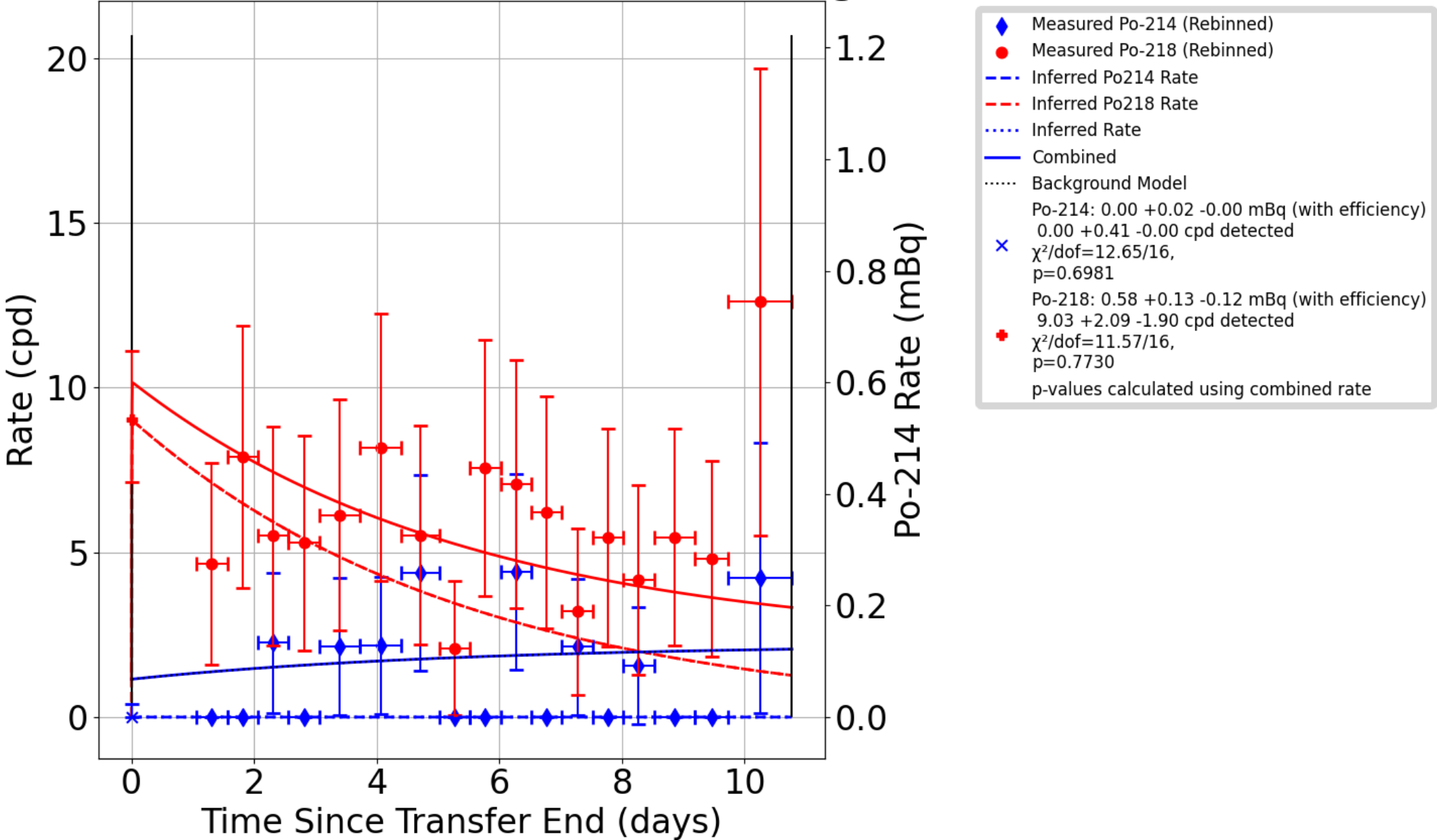


Figure 4:  $^{222}\text{Rn}$  Emanation Rate:  $0.00^{+0.02}_{-0.00}$  mBq (from  $^{214}\text{Po}$  rate)



# Run 722 Analysis

- Emanation Rate was determined to be  **$0.177^{+0.096}_{-0.081}$  mBq.**
- This determination was based on the combined rates  $^{214}\text{Po}$  and  $^{218}\text{Po}$ .

See Backup Slides for Run 722



# Rate vs. Time, Run 722

Rate vs Time Run 722, with Model Background

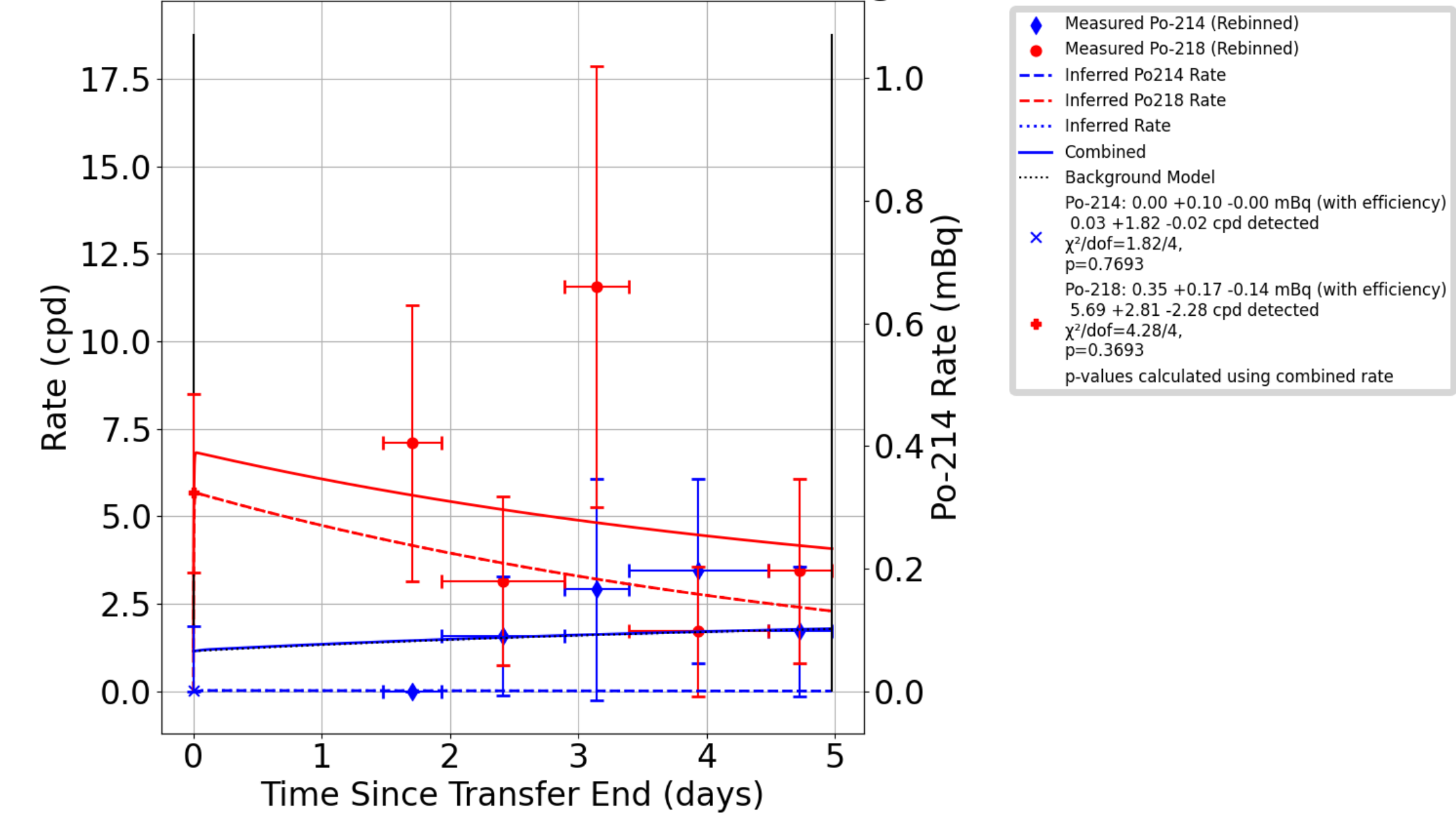


Figure 5:  $^{222}\text{Rn}$  Emanation Rate:  $0.177^{+0.096}_{-0.081}$  mBq (from combined rate)



Backup Slides contain additional data and information that may be helpful to provide context if questions come up.

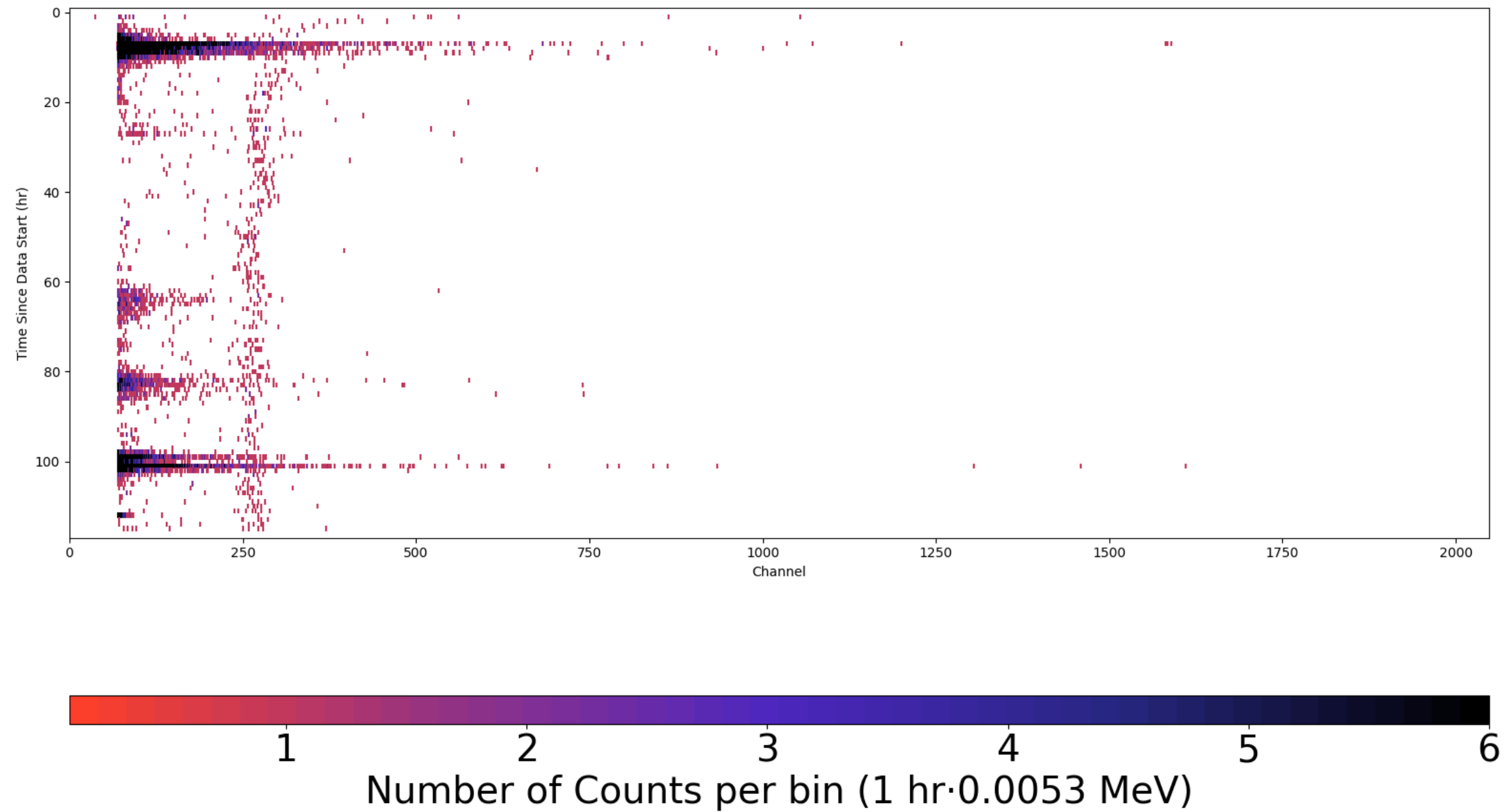


# Run 717 Backup Slides

The following slides contain additional data and information regarding Run 717.

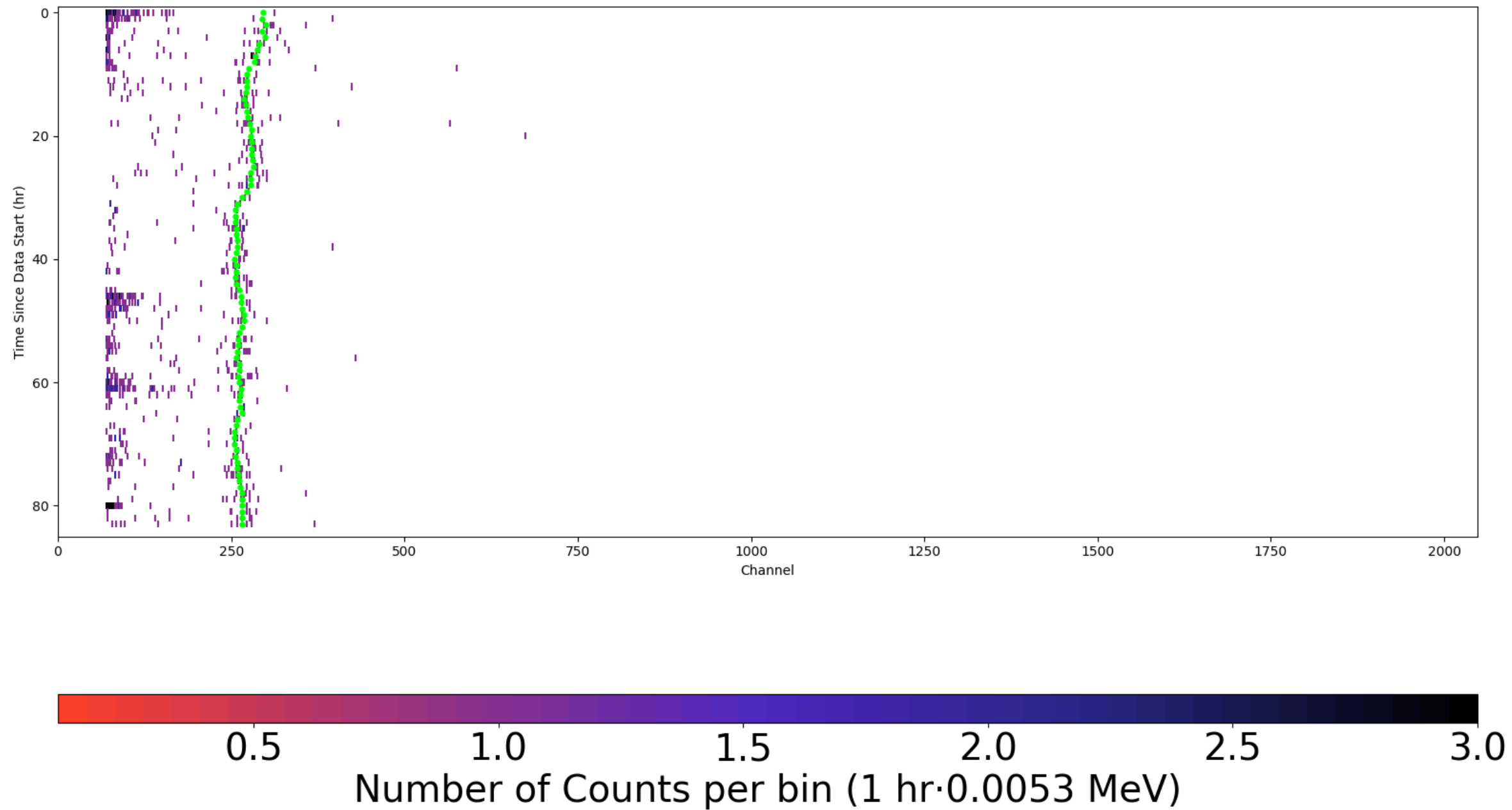


# Raw Data, Run 717



**Figure 6:** Large regions of noisy data had to be removed

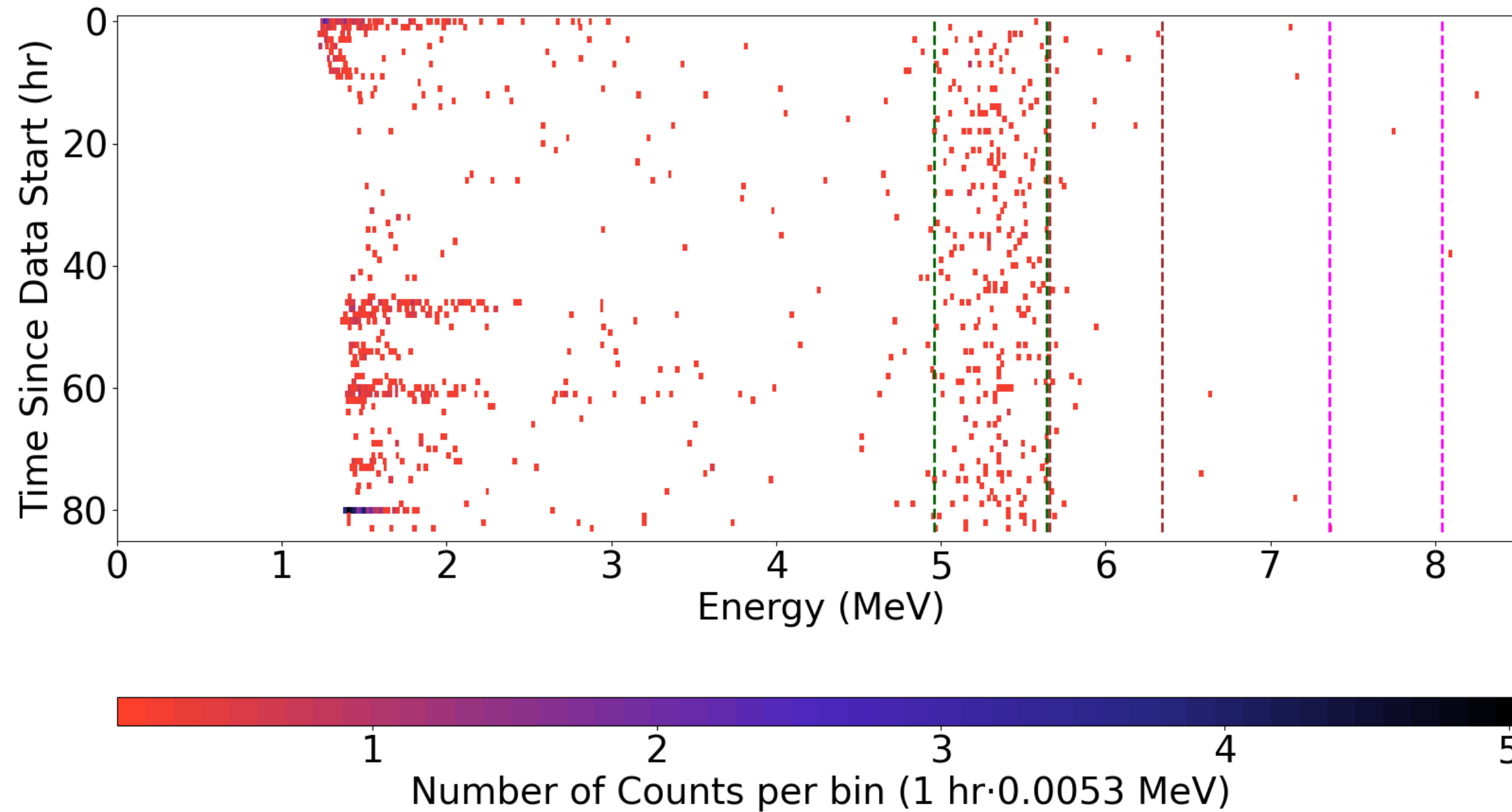
# Raw Data after Removing Bad Intervals, Run 717



**Figure 7:** Gain is extremely low, resulting in poor data resolution

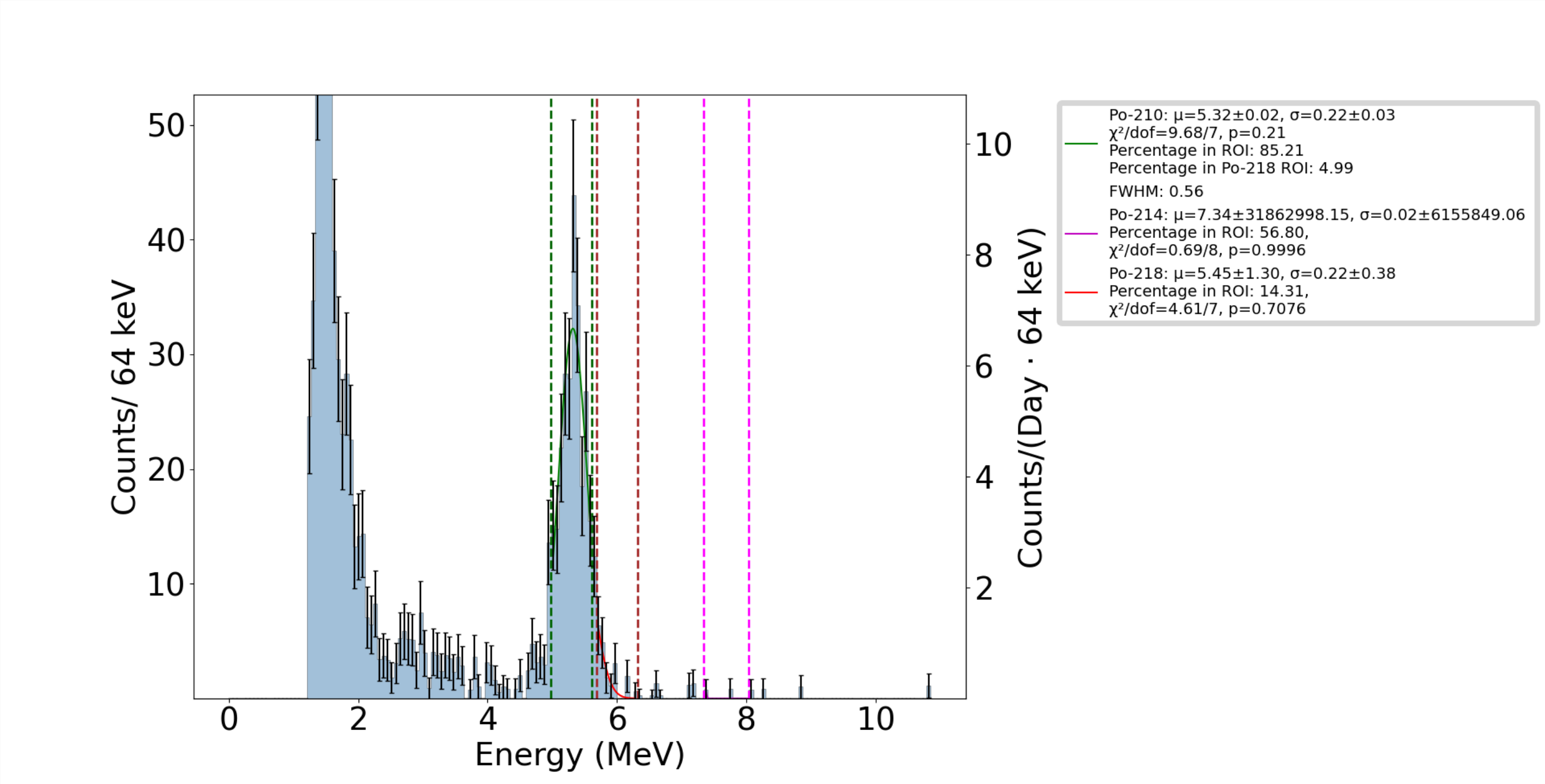


# Gain-Corrected Data, Run 717



**Figure 8:** Data has been corrected to center the 5.3 MeV  $^{210}\text{Po}$  peak at MCA channel 1000

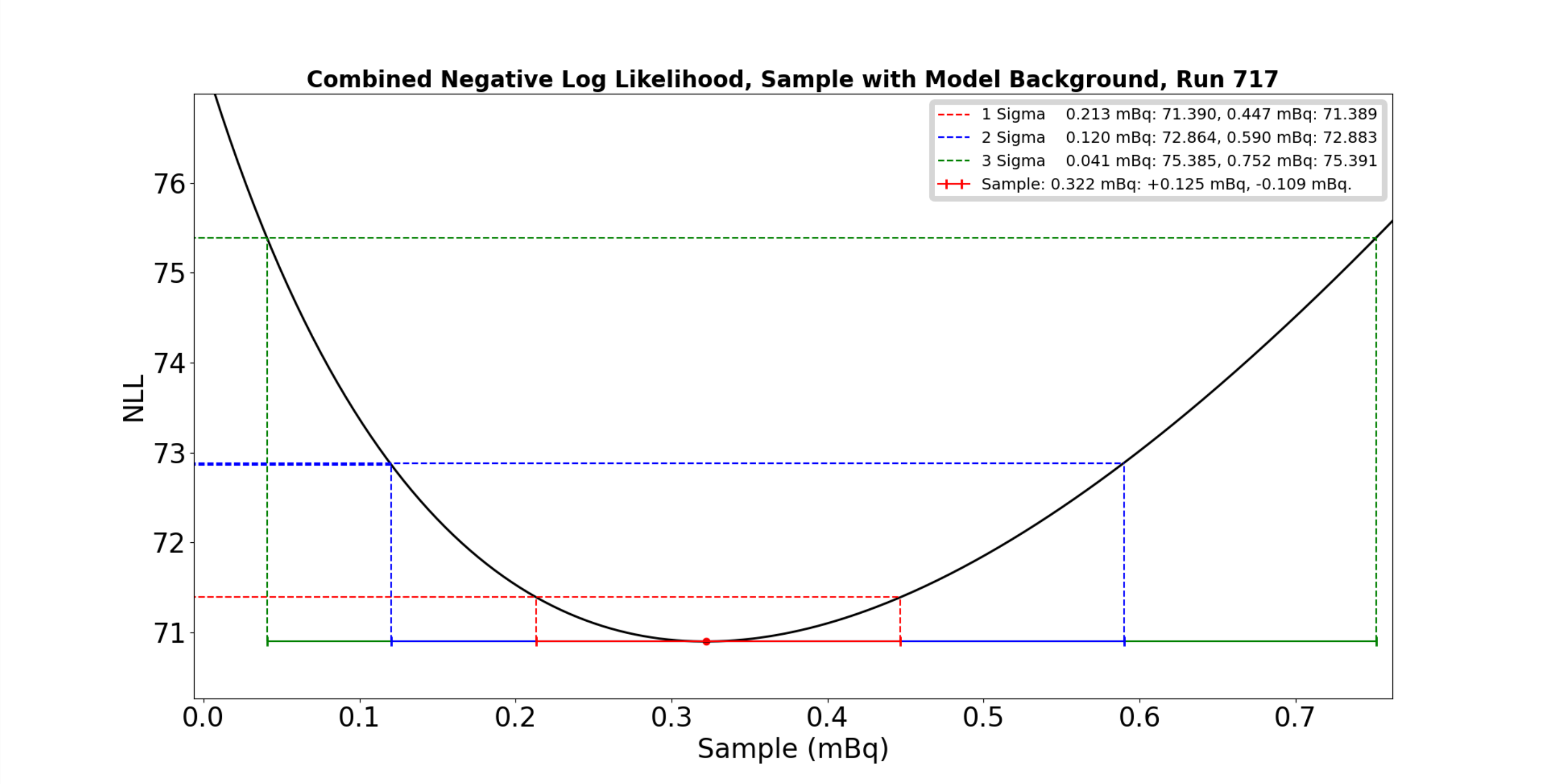
# Counts vs. Energy, Run 717



**Figure 9:**  $^{210}\text{Po}$  peak has poor resolution and bleeds into  $^{218}\text{Po}$  ROI

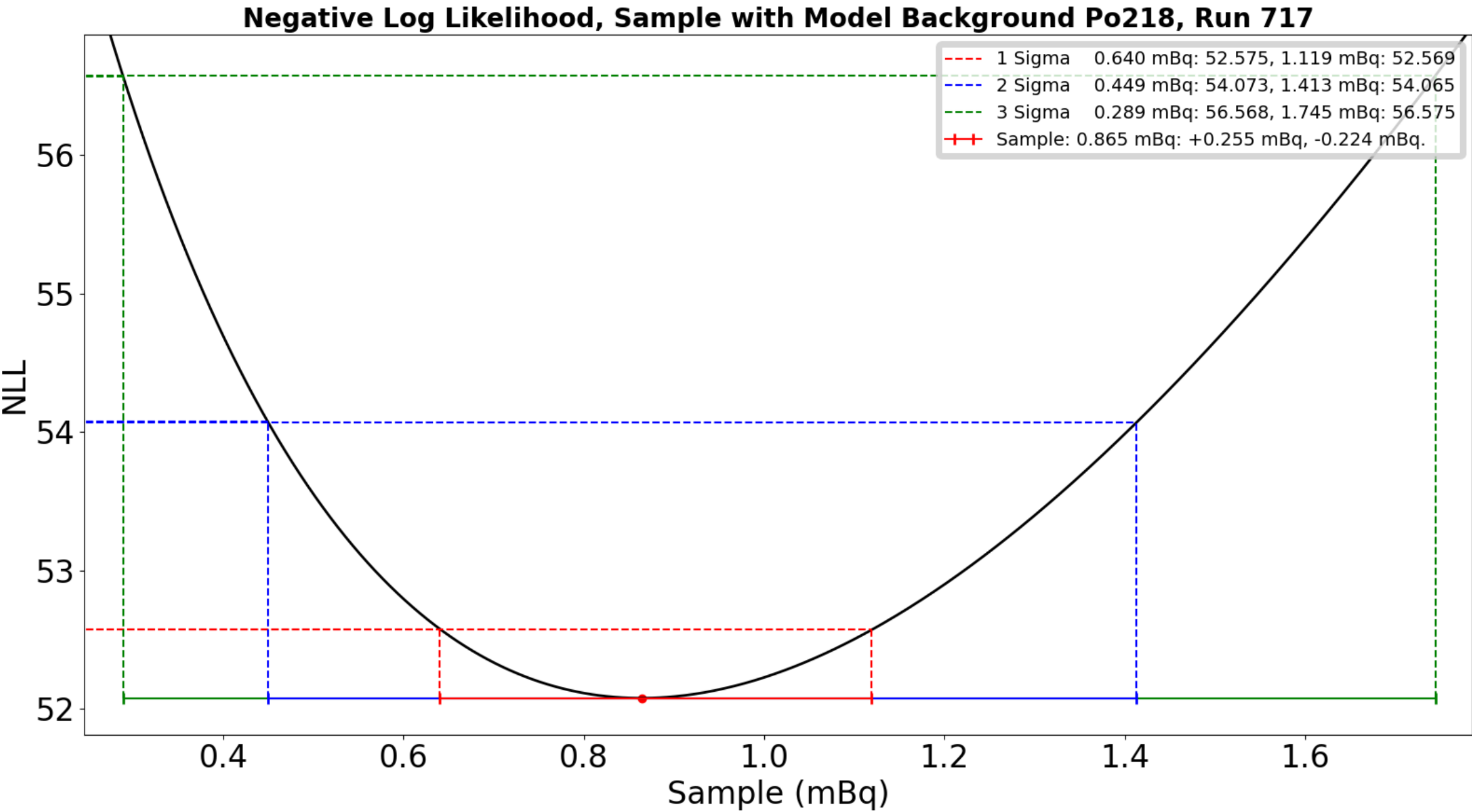


# Combined NLL, Run 717



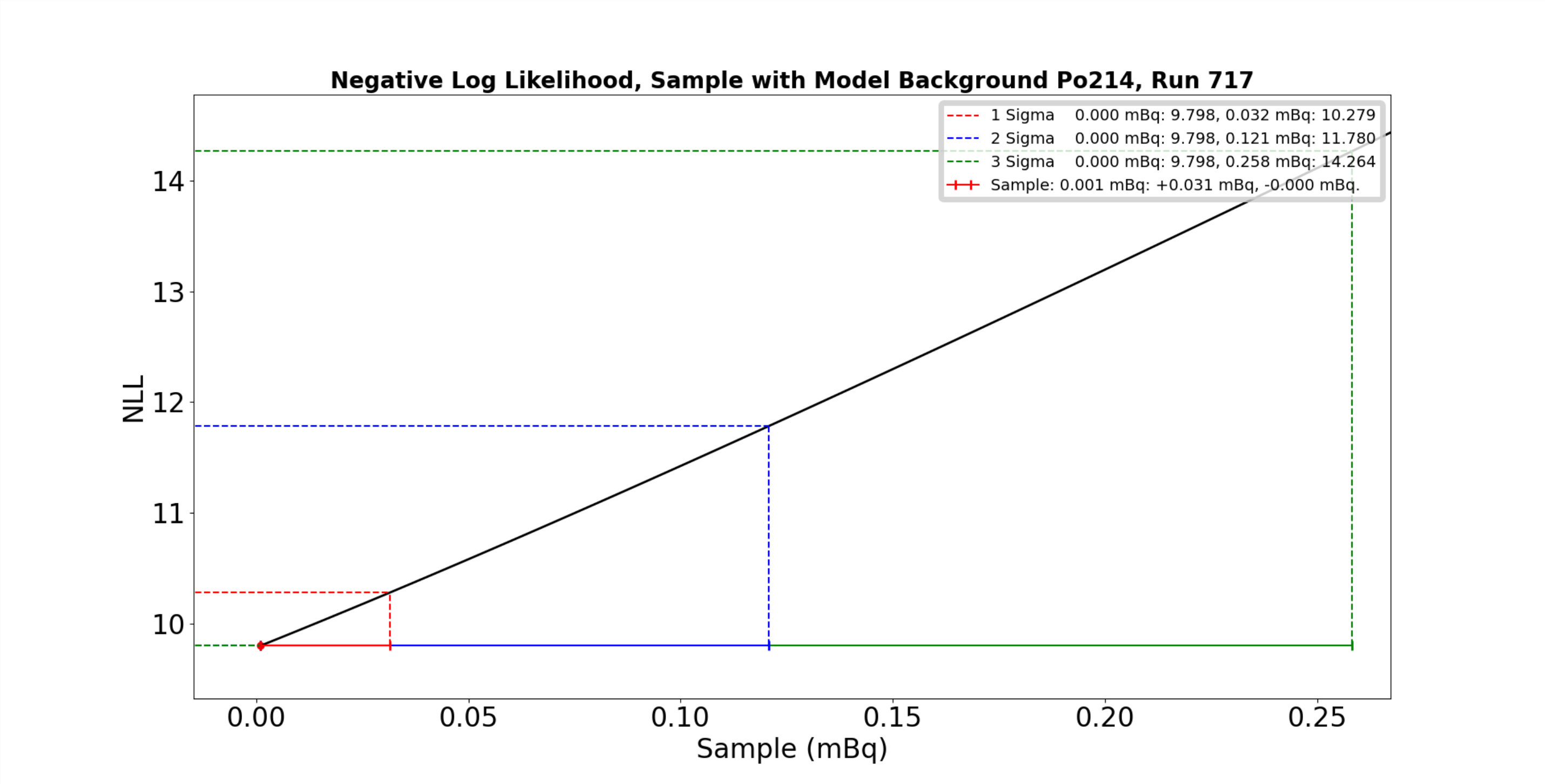
**Figure 10:** This rate is not used because of the resolution problems discussed earlier





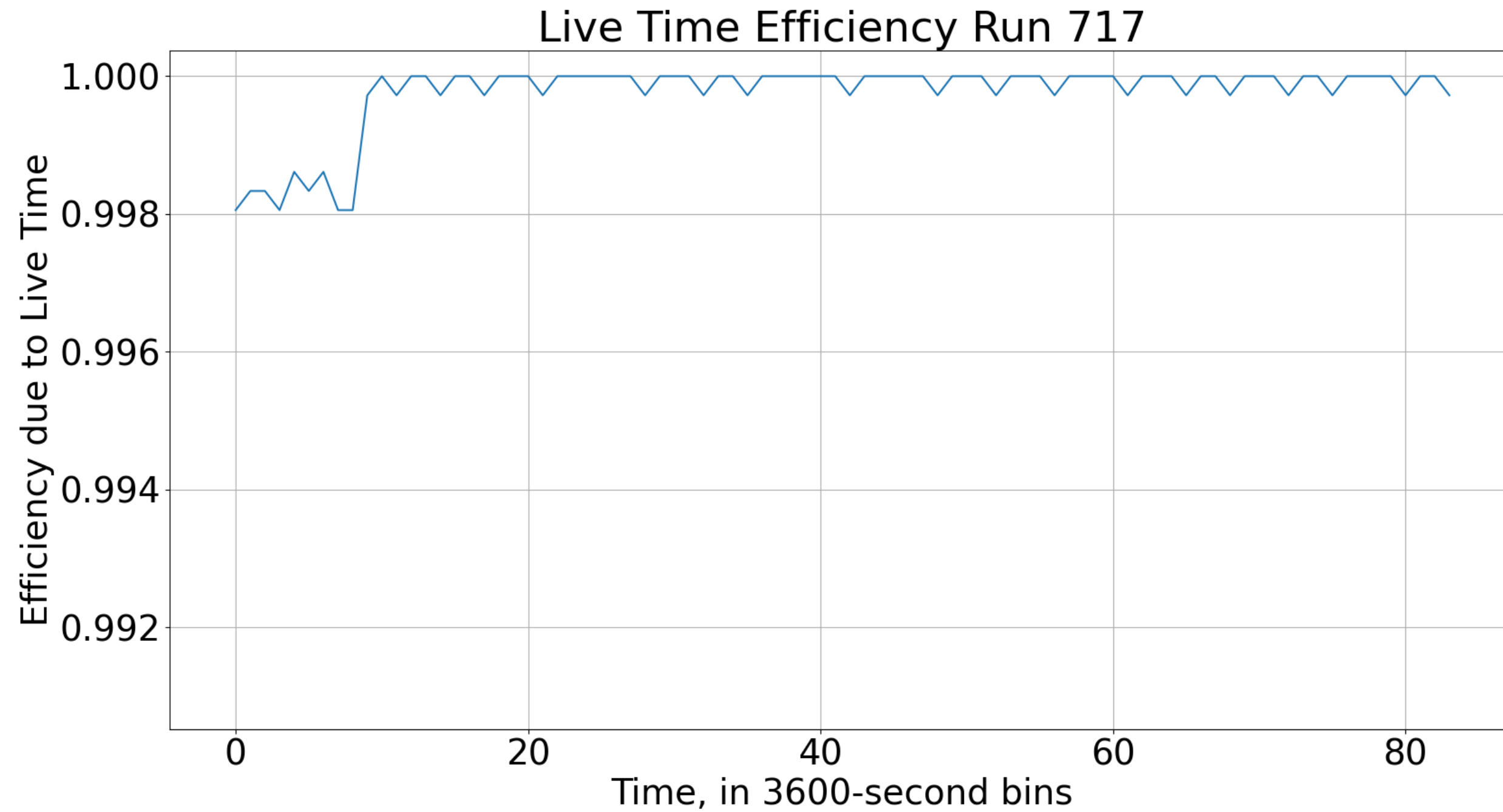
**Figure 11:** This rate is artificially high because of spillage from the  $^{210}\text{Po}$  ROI





**Figure 12:** This is the rate that was used to determine the emanation rate of Run 717

# Live Time Efficiency



**Figure 13:** Detector had relatively little dead time

# Notes on Run 717 Analysis

A large portion of the data had to be discarded due to high levels of noise that interfered with gain correction and rate finding. The run also exhibited low gain, with the  $^{210}\text{Po}$  peak resting somewhere around MCA channel 250, rather than the standard 1000. The low gain caused further issues with data resolution, which caused the  $^{218}\text{Po}$  rate calculated to include spill-over from  $^{210}\text{Po}$  events. Because of this, the  $^{214}\text{Po}$  rate was exclusively used to determine the emanation rate for this run.

[Back to Rate vs Time Run 717](#)



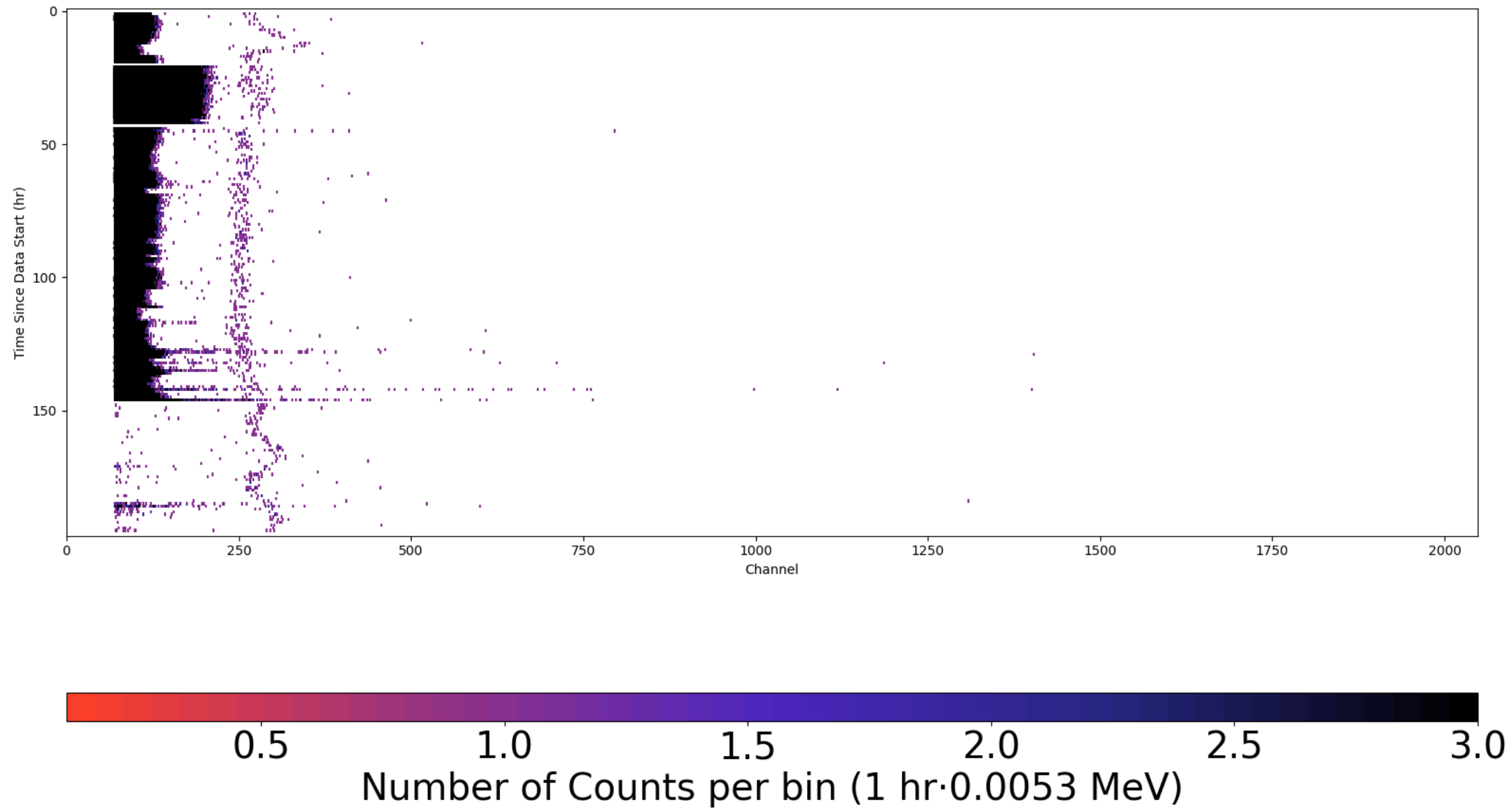
# Run 720 Backup Slides

The following slides contain additional data and information regarding Run 720.



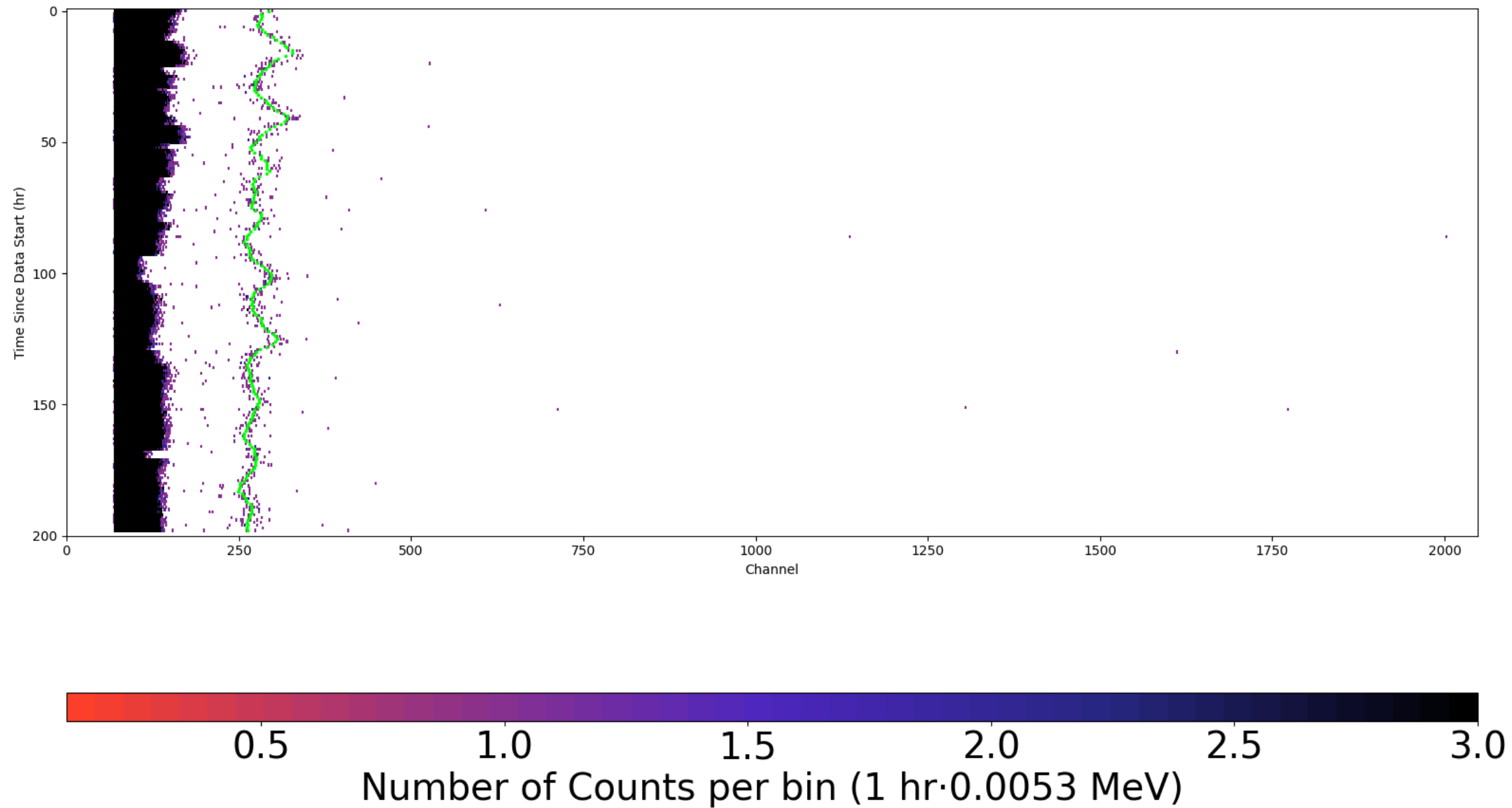


# Raw Data, Run 720



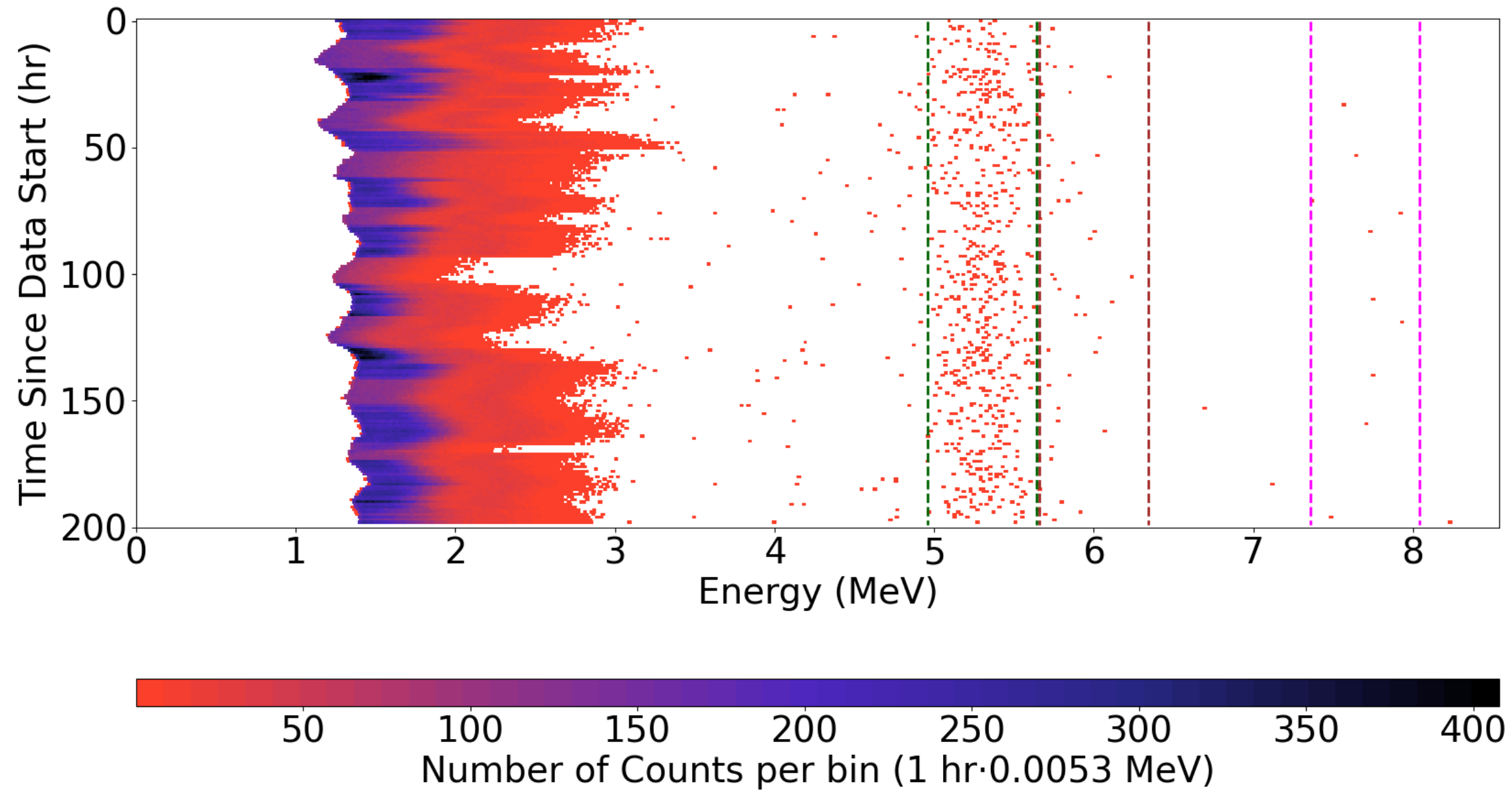
**Figure 14:** Run 720 exhibited both gain shift and areas of problematic noise

# Raw Data after Removing Bad Intervals, Run 720



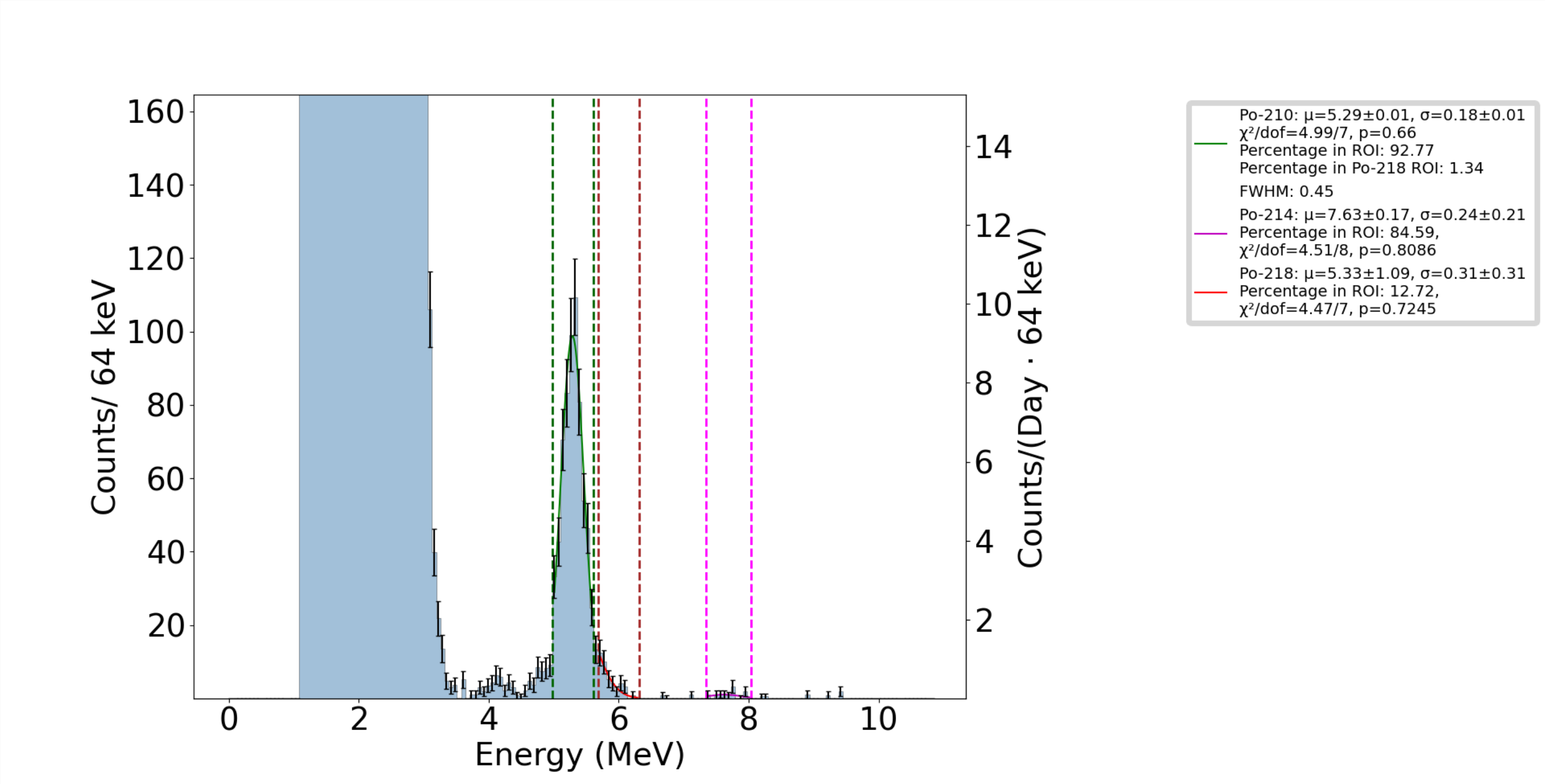
**Figure 15:** Gain is extremely low, resulting in poor data resolution

# Gain-Corrected Data, Run 720



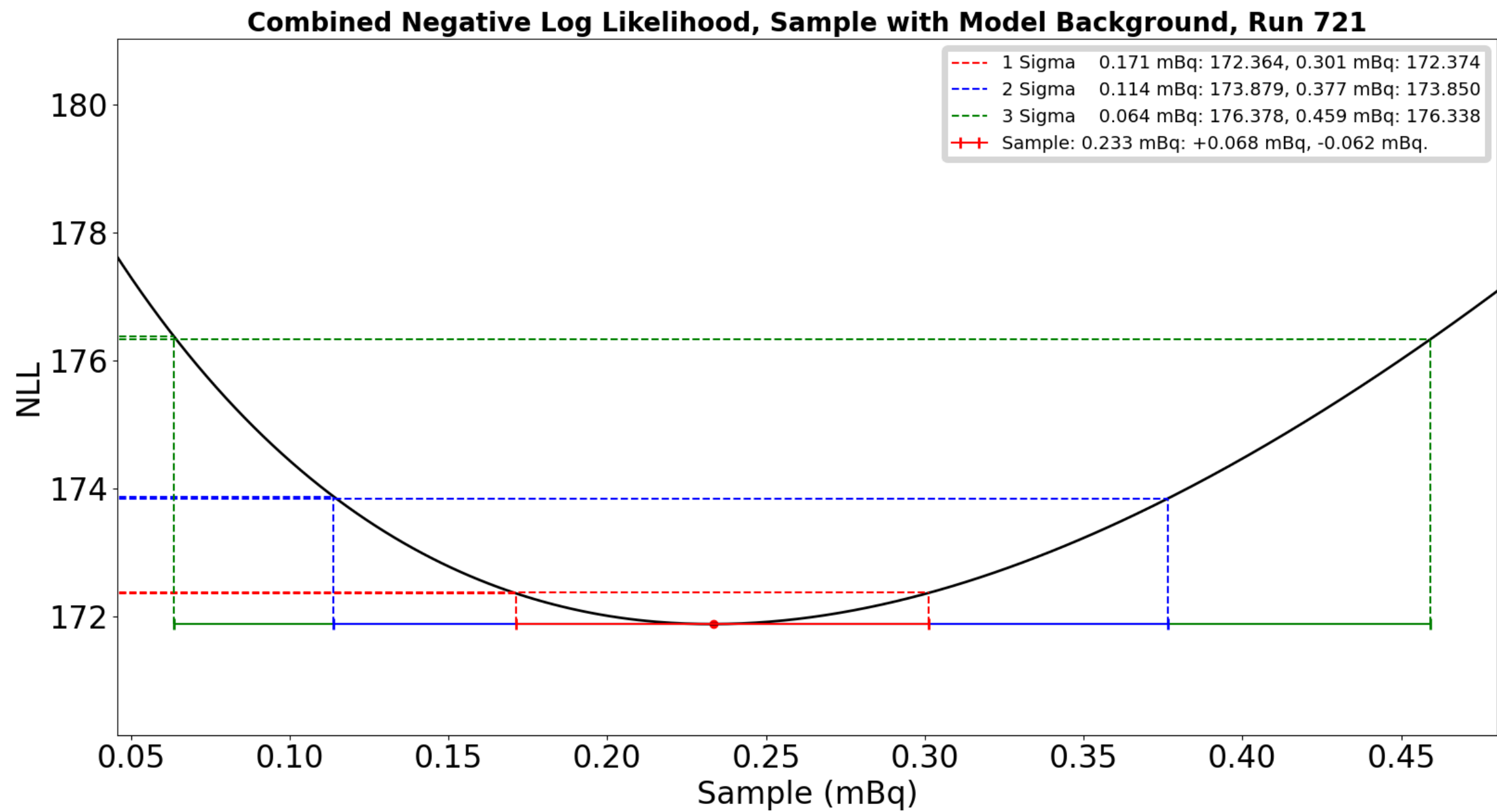
**Figure 16:** Data has been corrected to center the 5.3 MeV  $^{210}\text{Po}$  peak at MCA channel 1000

# Counts vs. Energy, Run 720



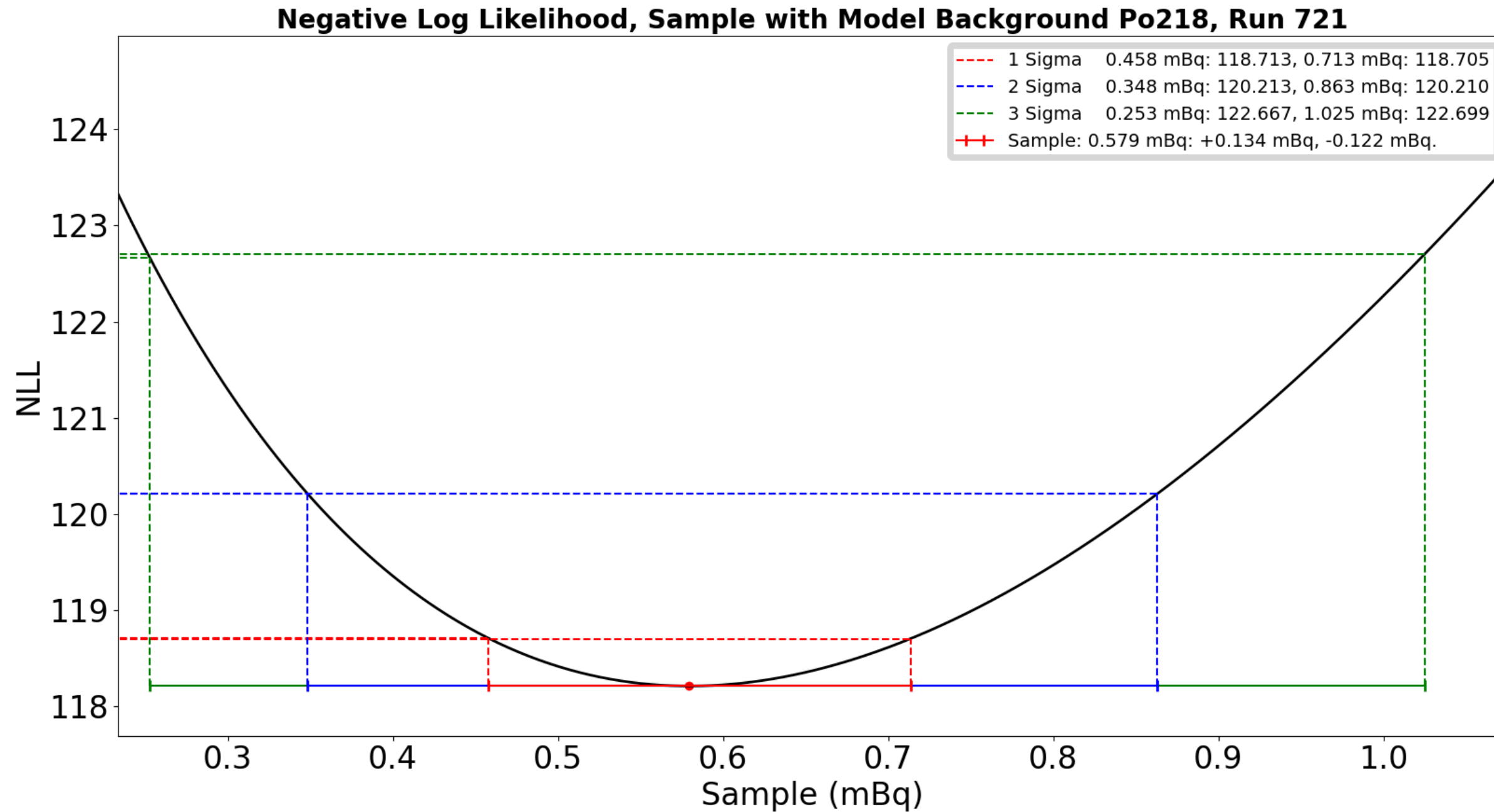
**Figure 17:**  $^{210}\text{Po}$  peak has poor resolution and bleeds into  $^{218}\text{Po}$  ROI

# Combined NLL, Run 720

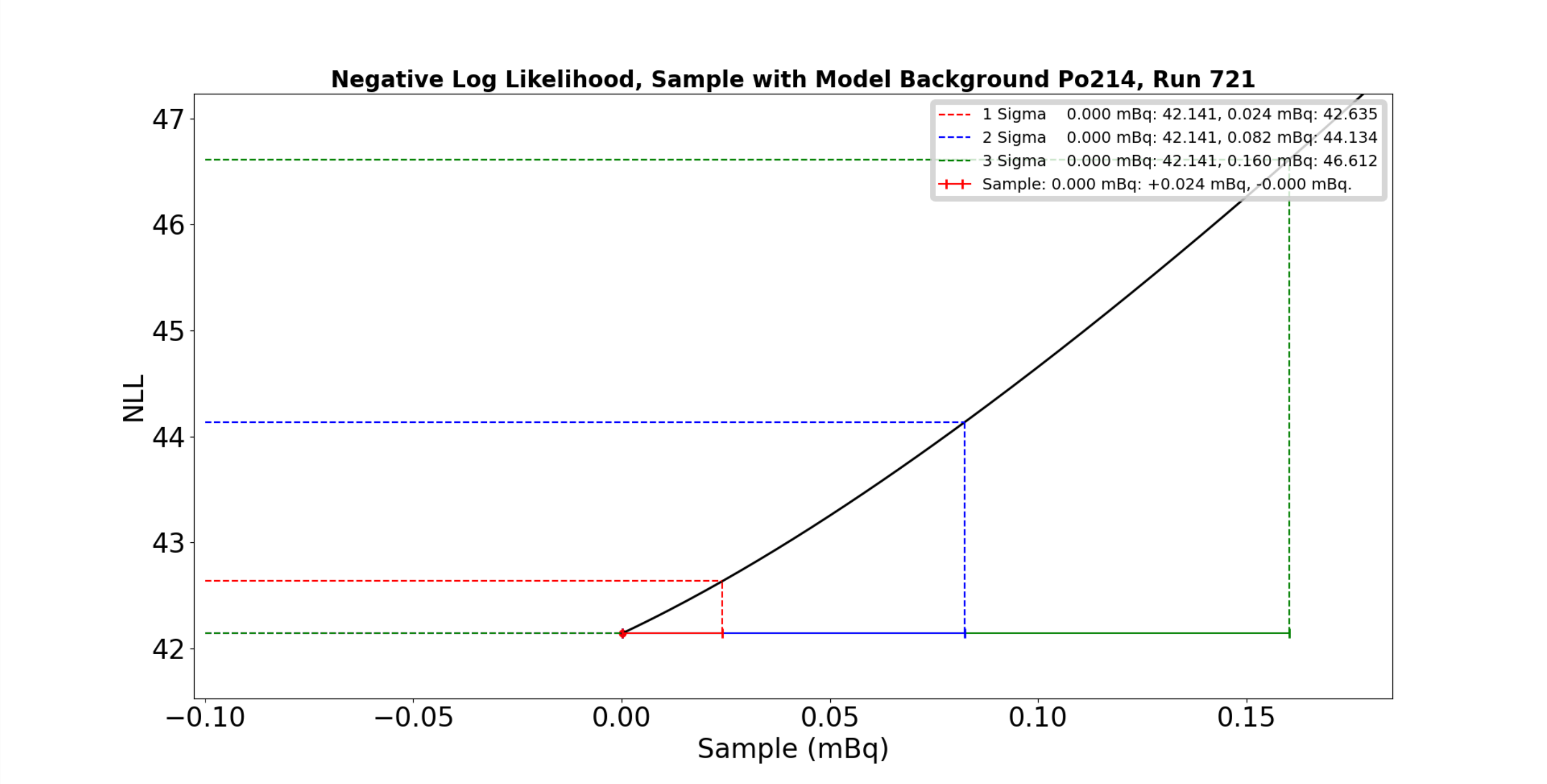


**Figure 18:** This rate is not used because of the resolution problems discussed earlier



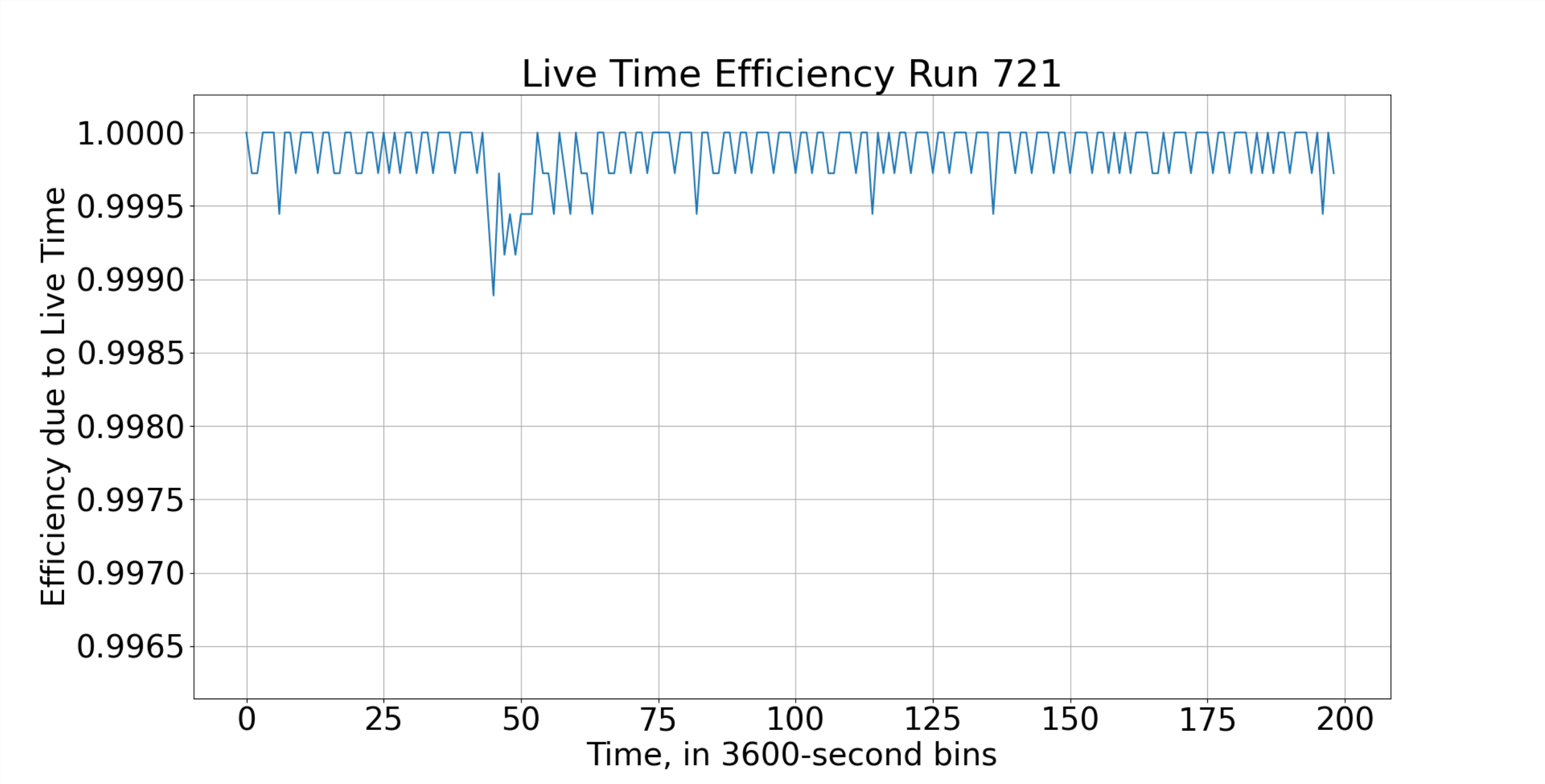


**Figure 19:** This rate is artificially high because of spillage from the  $^{210}\text{Po}$  ROI



**Figure 20:** This is the rate that was used to determine the emanation rate of Run 720

# Live Time Efficiency



**Figure 21:** Detector had relatively little dead time





# Notes on Run 721 Analysis

Run 721 exhibits low gain that appears to vary periodically. Unfortunately, there is no environmental data to compare the shifts to. Several bins had to be cut due to high noise. The low resolution exhibited by Run 721 gives way to  $^{210}\text{Po}$  events spilling over into the  $^{218}\text{Po}$  ROI. Because of this, the  $^{214}\text{Po}$  rate alone was used to determine the emanation rate for run 721. Overall, Run 721 appears to be consistent with our backgrounds.

[Back to Rate vs Time Run 721](#)

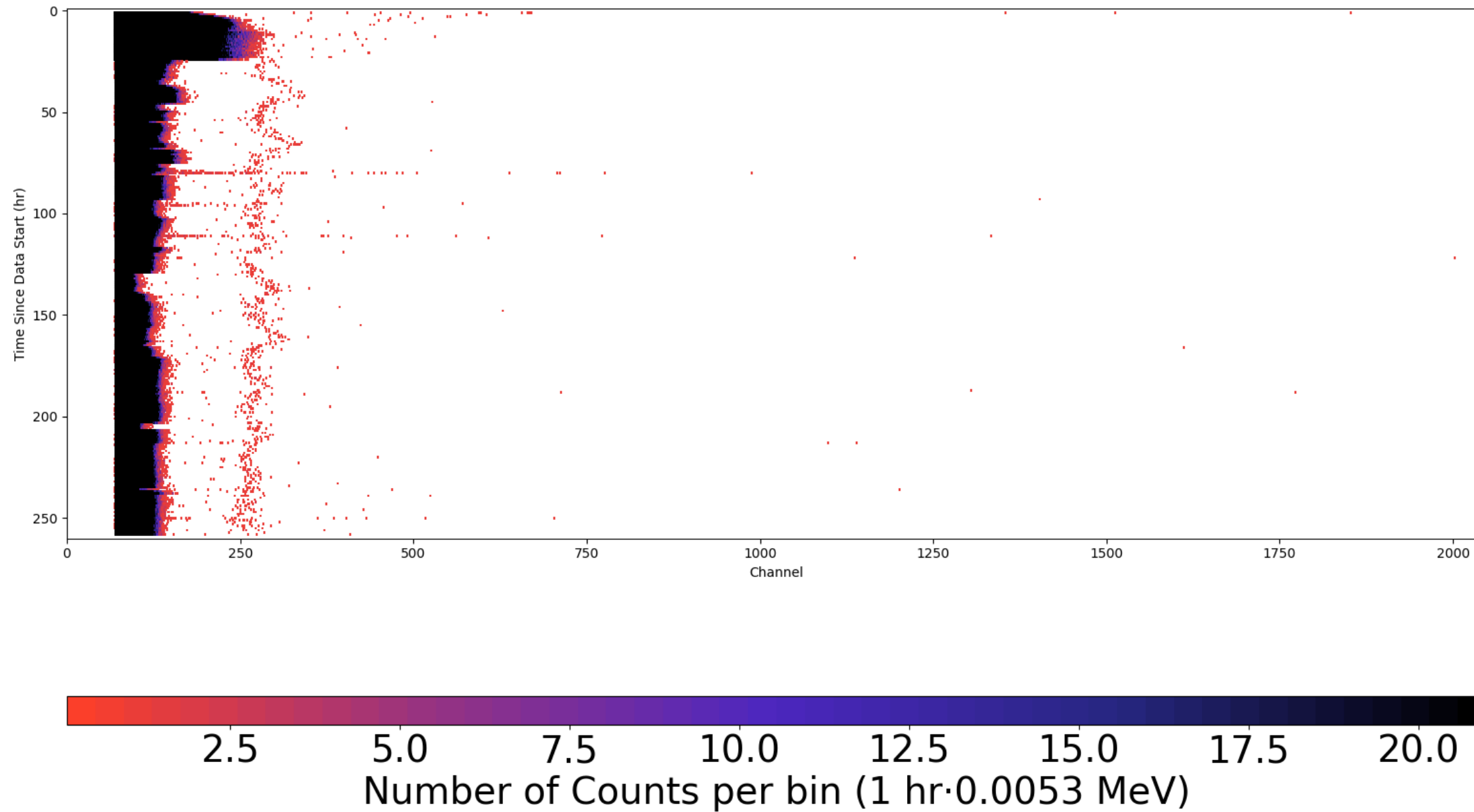


# Run 721 Backup Slides

The following slides contain additional data and information regarding Run 721.

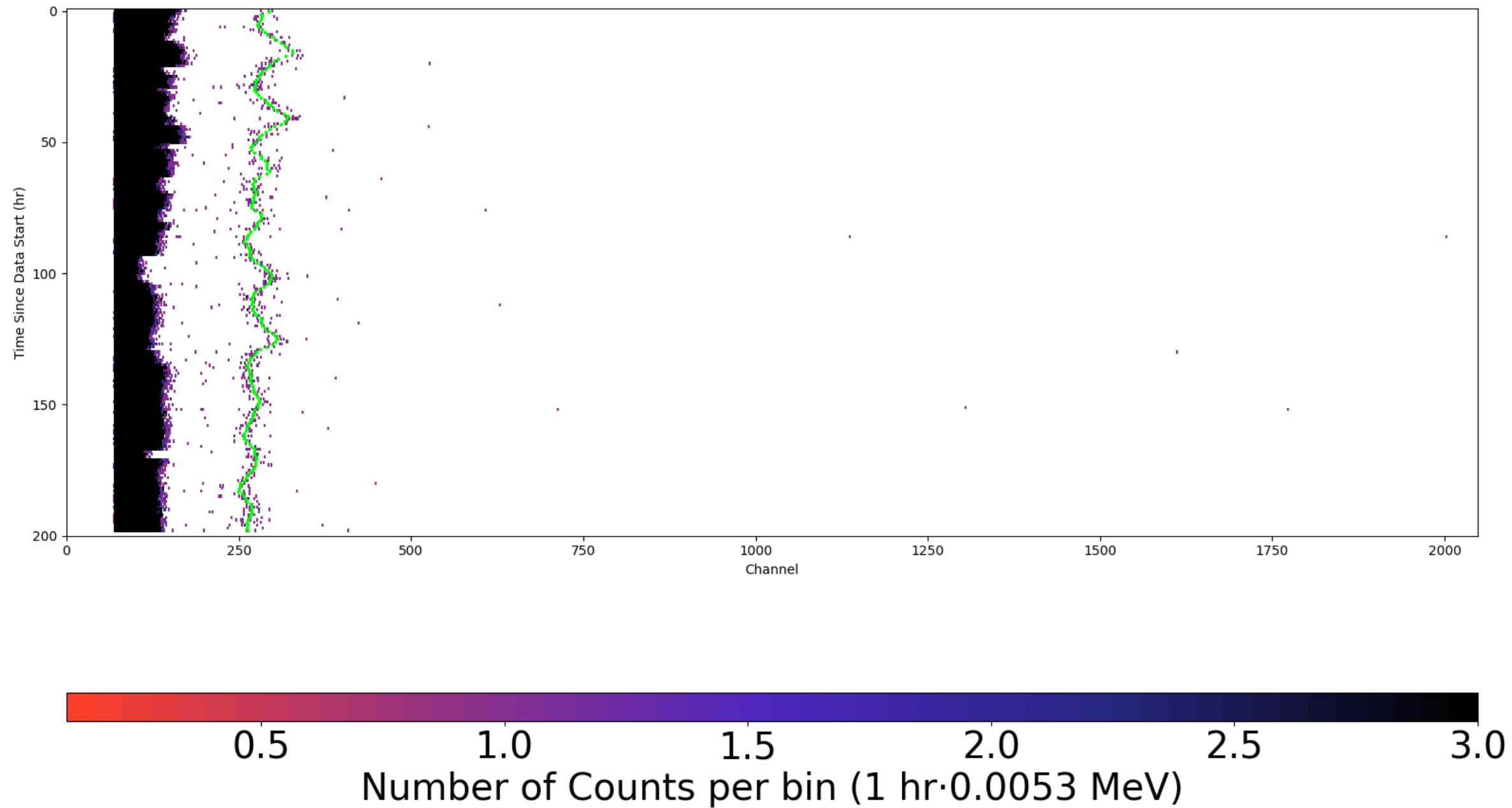


# Raw Data, Run 721



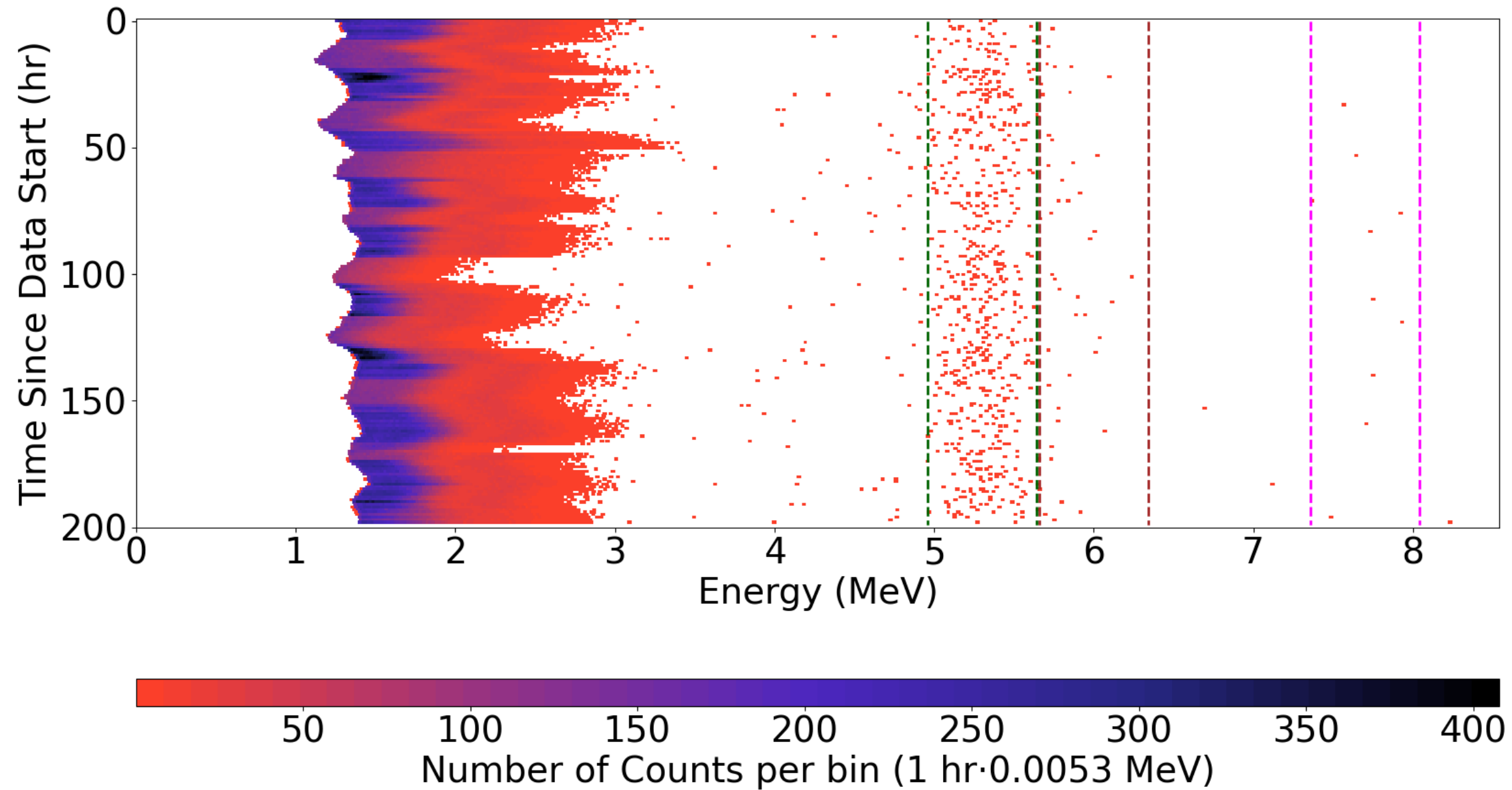
**Figure 22:** Run 721 exhibited both gain shift and areas of problematic noise

# Raw Data after Removing Bad Intervals, Run 721



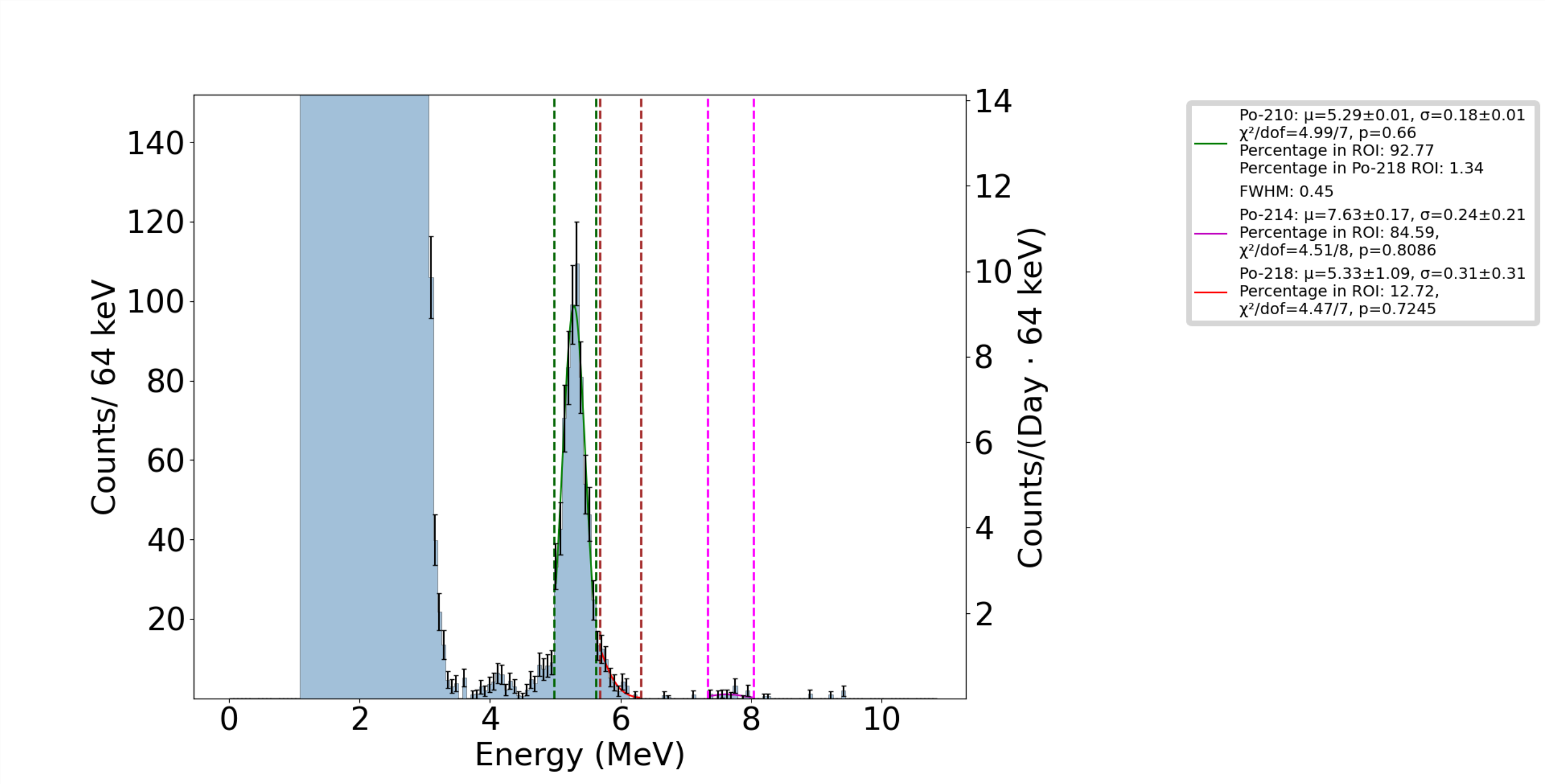
**Figure 23:** Gain is extremely low, resulting in poor data resolution

# Gain-Corrected Data, Run 721



**Figure 24:** Data has been corrected to center the 5.3 MeV  $^{210}\text{Po}$  peak at MCA channel 1000

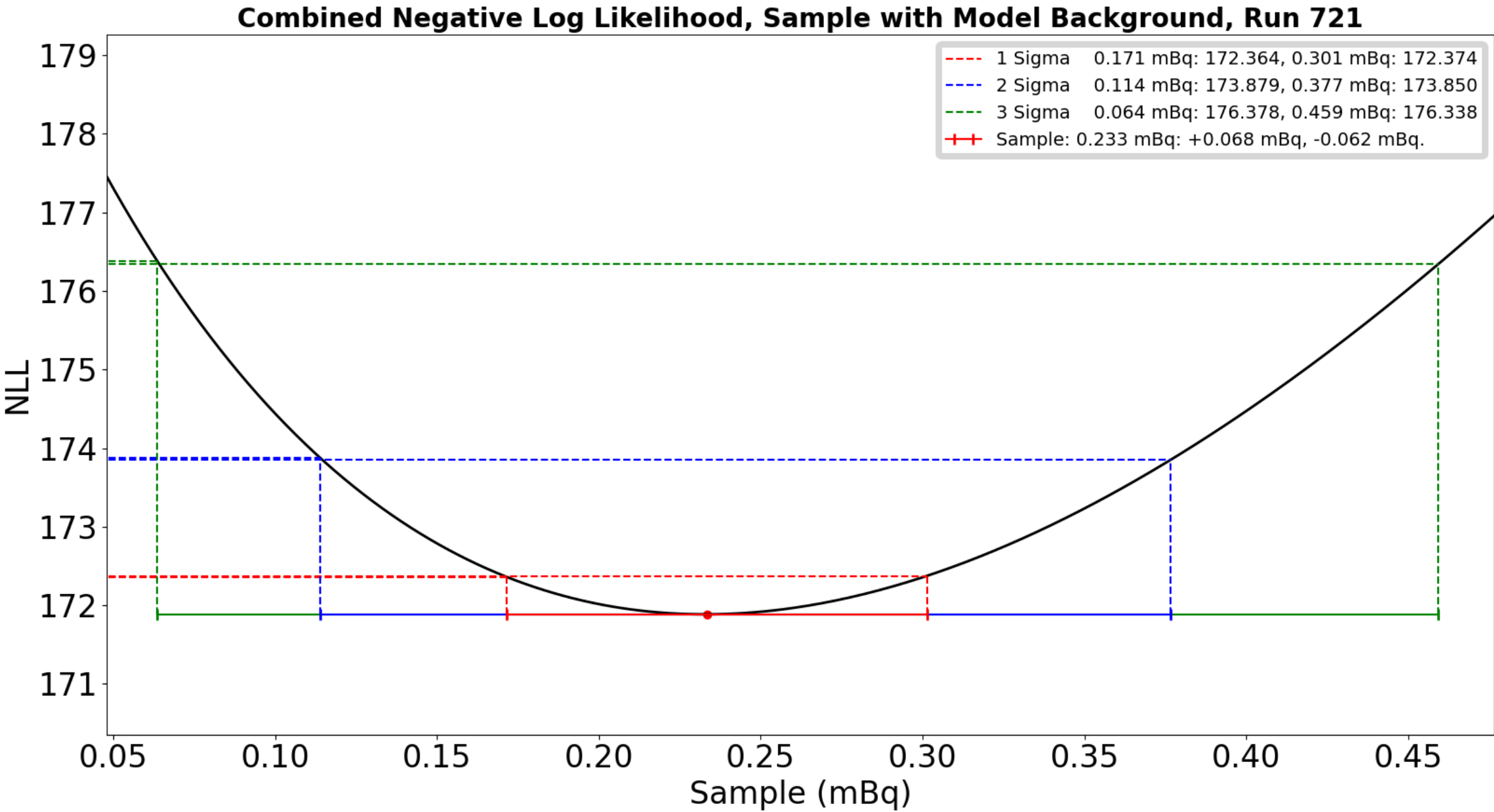
# Counts vs. Energy, Run 721



**Figure 25:**  $^{210}\text{Po}$  peak has poor resolution and bleeds into  $^{218}\text{Po}$  ROI

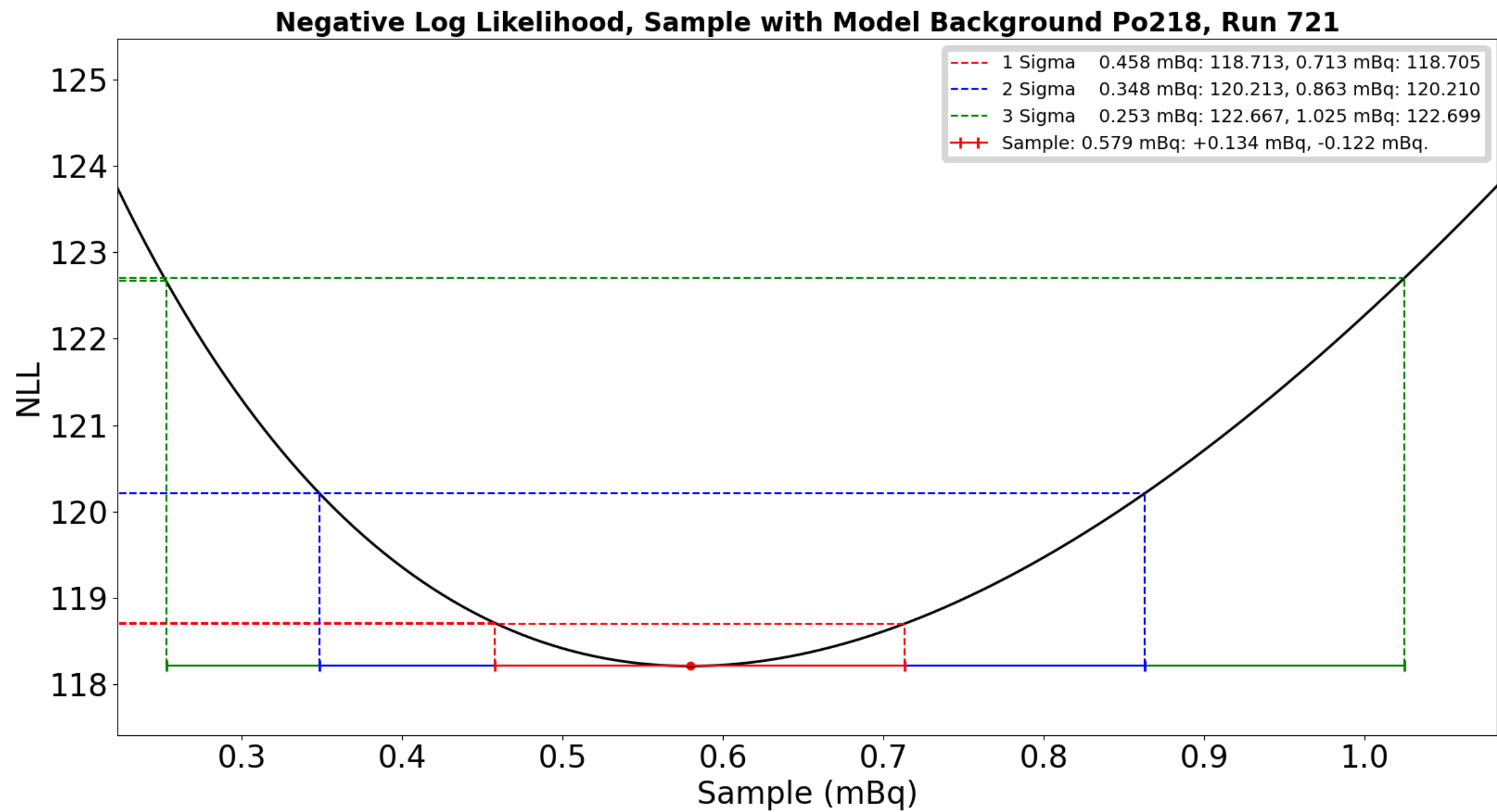


# Combined NLL, Run 721



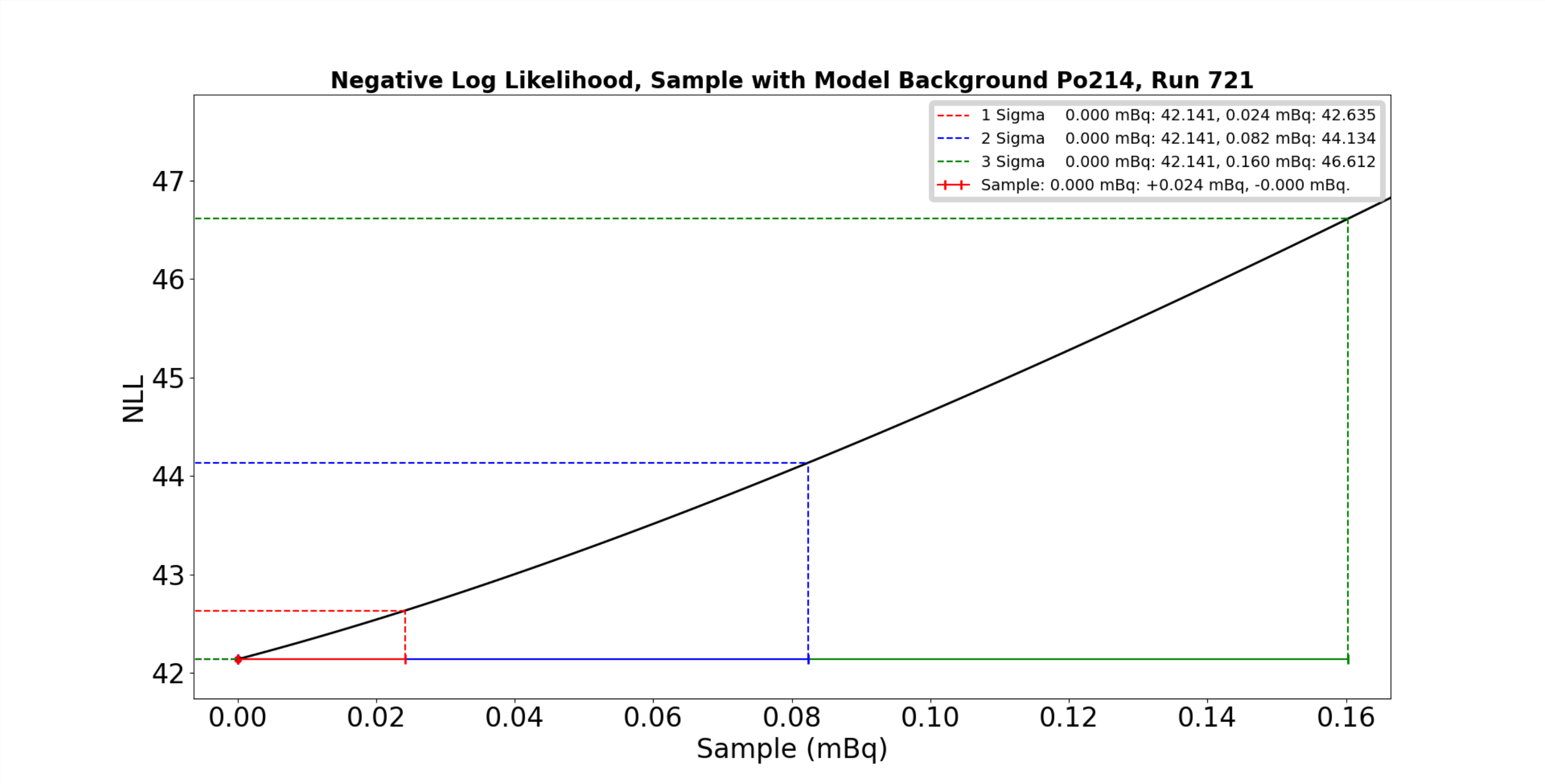
**Figure 26:** This rate is not used because of the resolution problems discussed earlier





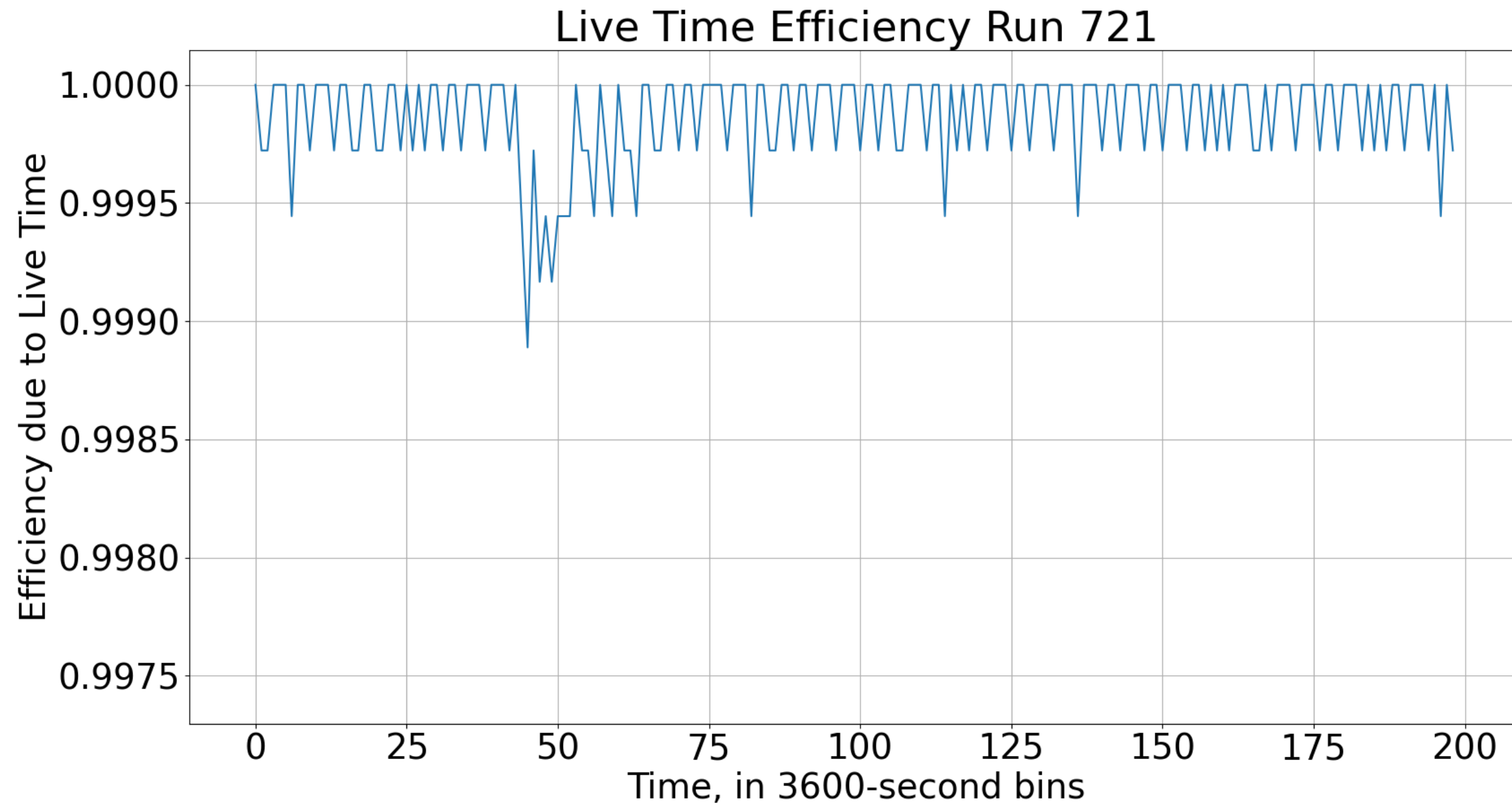
**Figure 27:** This rate is artificially high because of spillage from the  $^{210}\text{Po}$  ROI





**Figure 28:** This is the rate that was used to determine the emanation rate of Run 721

# Live Time Efficiency



**Figure 29:** Detector had relatively little dead time

# Notes on Run 721 Analysis

Run 721 exhibits low gain that appears to vary periodically. Unfortunately, there is no environmental data to compare the shifts to. Several bins had to be cut due to high noise. The low resolution exhibited by Run 721 gives way to  $^{210}\text{Po}$  events spilling over into the  $^{218}\text{Po}$  ROI. Because of this, the  $^{214}\text{Po}$  rate alone was used to determine the emanation rate for run 721. Overall, Run 721 appears to be consistent with our backgrounds.

[Back to Rate vs Time Run 721](#)

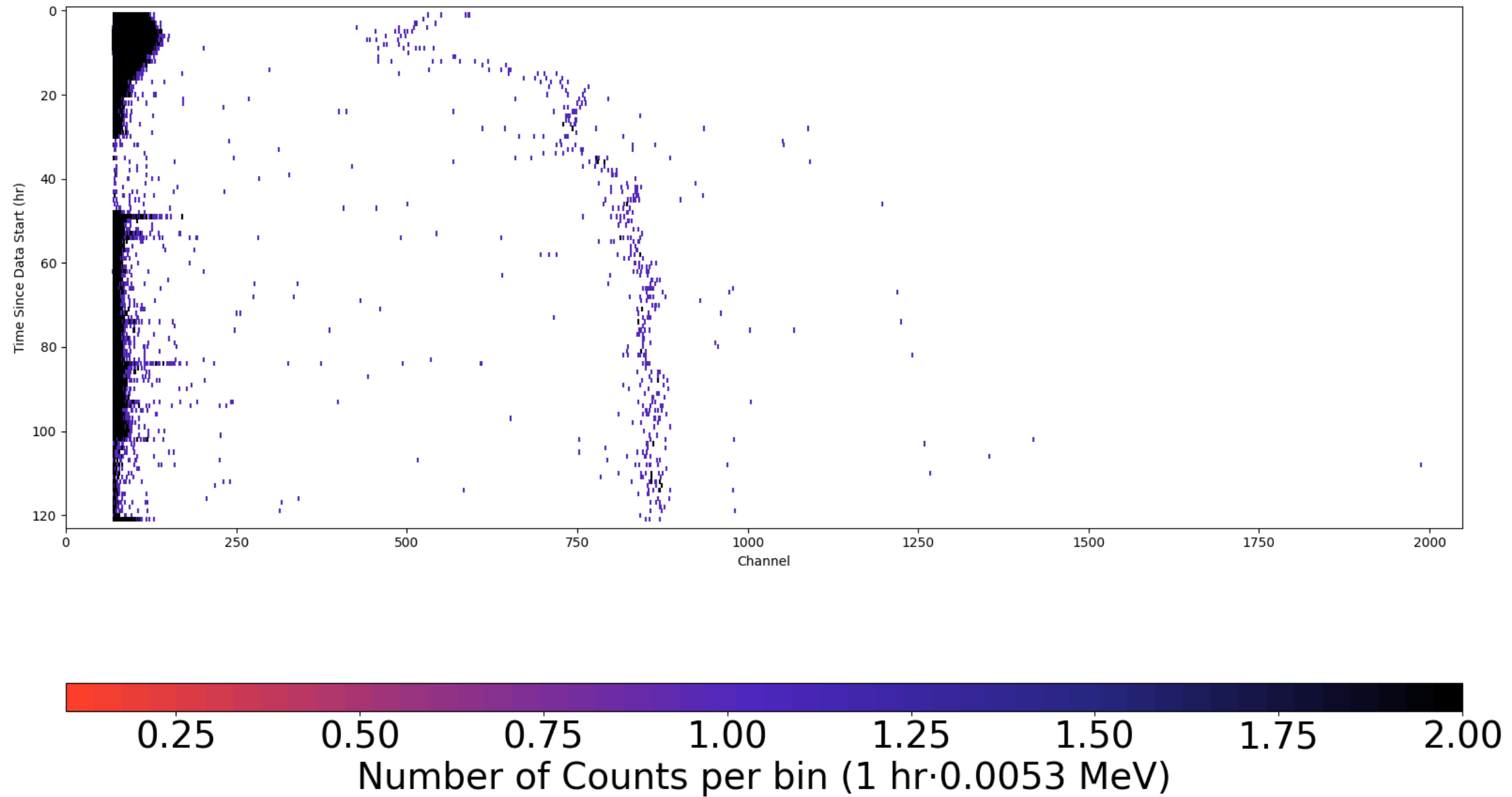


# Run 722 Backup Slides

The following slides contain additional data and information regarding Run 722.

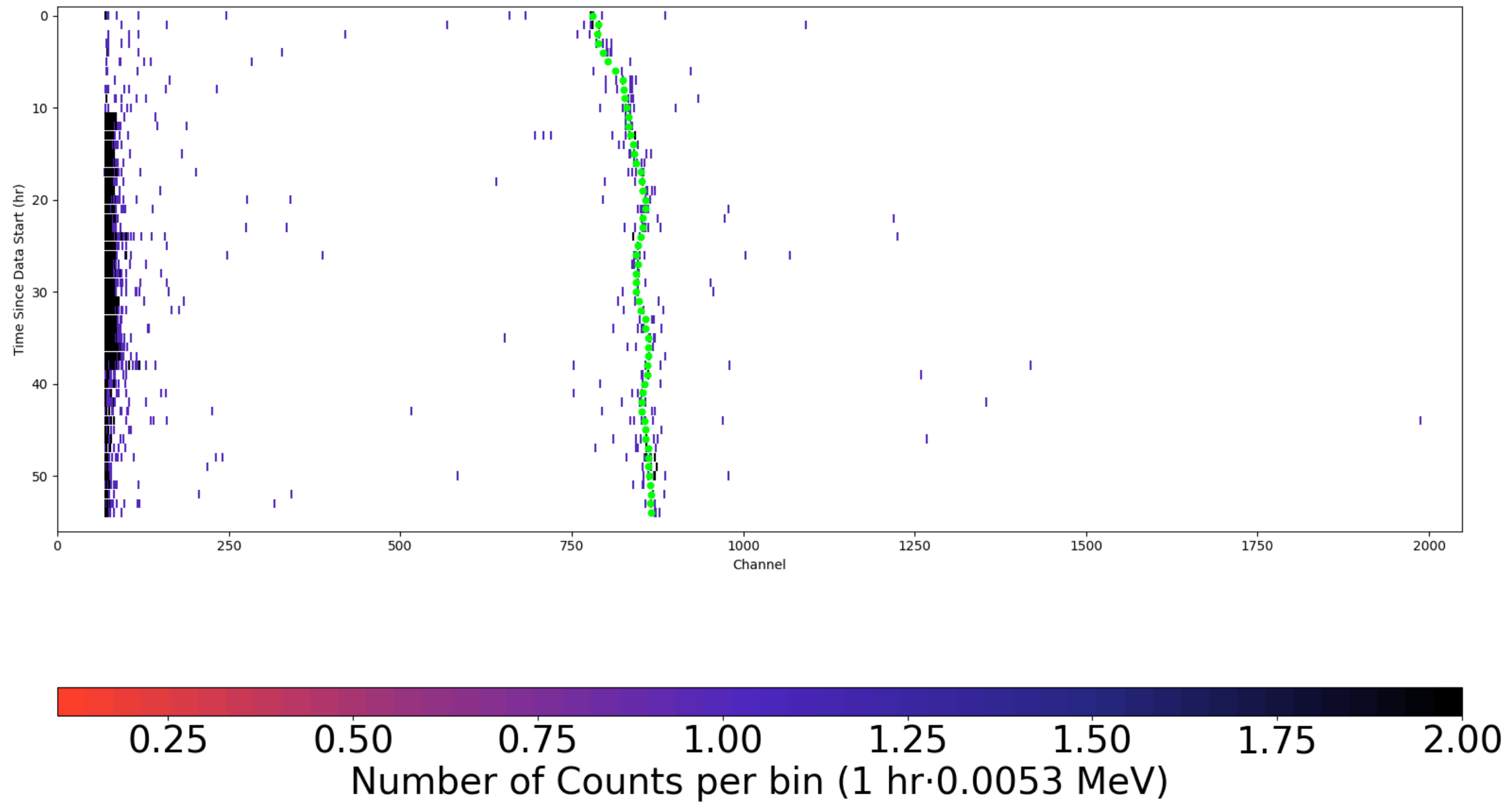


# Raw Data, Run 722



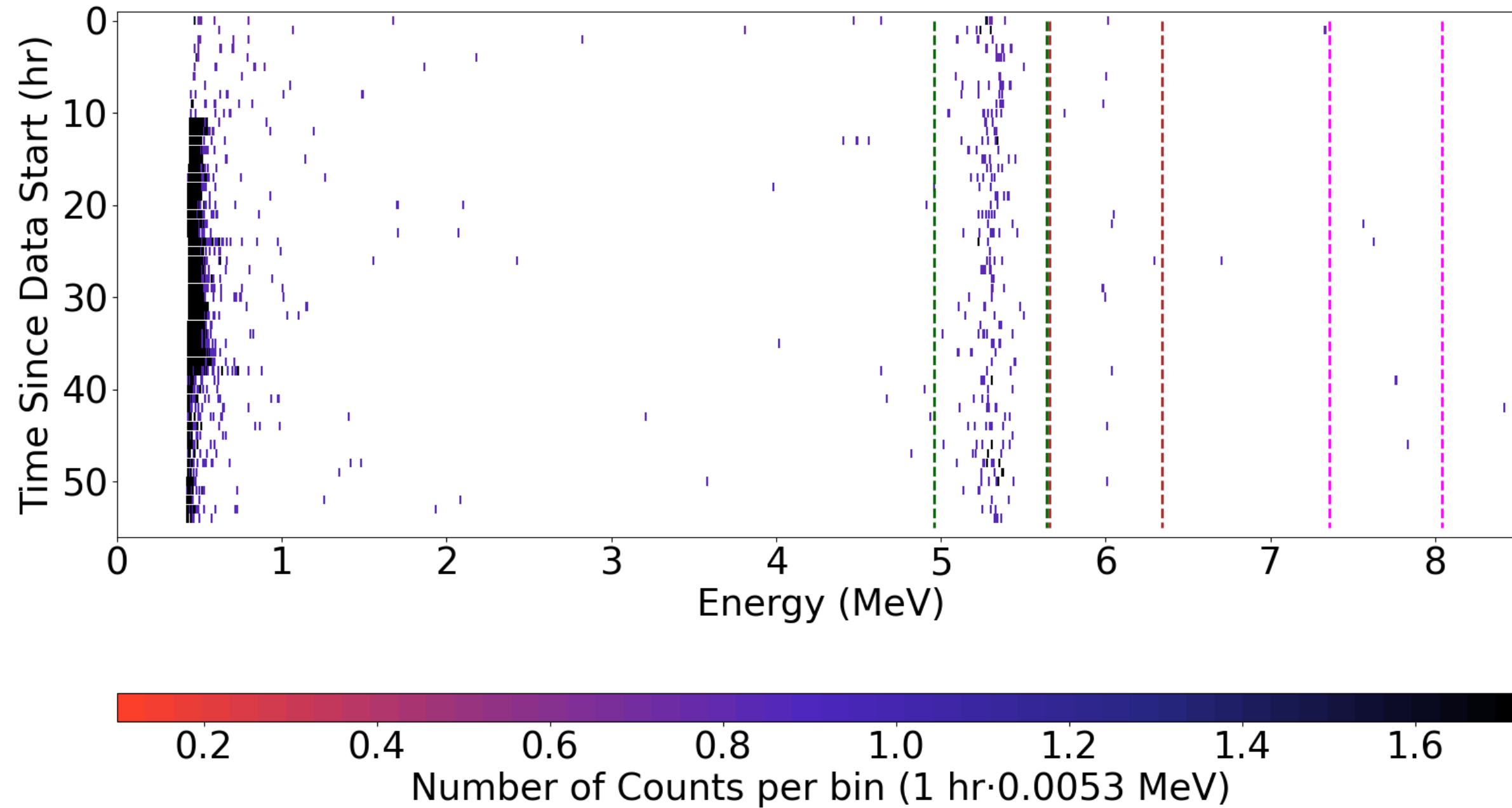
**Figure 30:** Run 722 exhibited such extreme gain shift that hours had to be removed to enable gain correction

# Raw Data after Removing Bad Intervals, Run 722



**Figure 31:** Data exhibits less extreme gain shifts and is able to be gain corrected

# Gain-Corrected Data, Run 722



**Figure 32:** Data exhibits relatively good resolution and no spillage is apparent

# Counts vs. Energy, Run 722

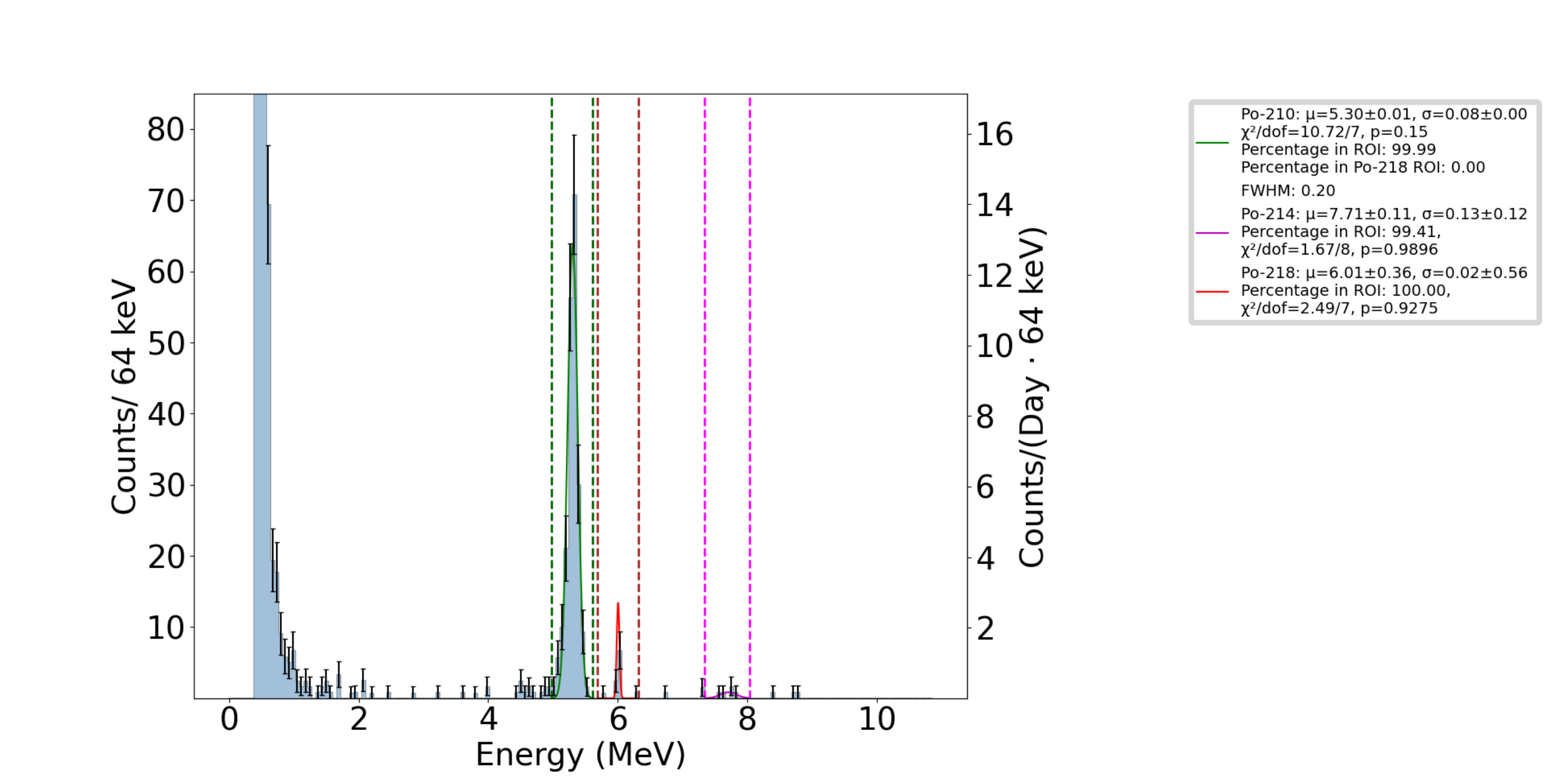
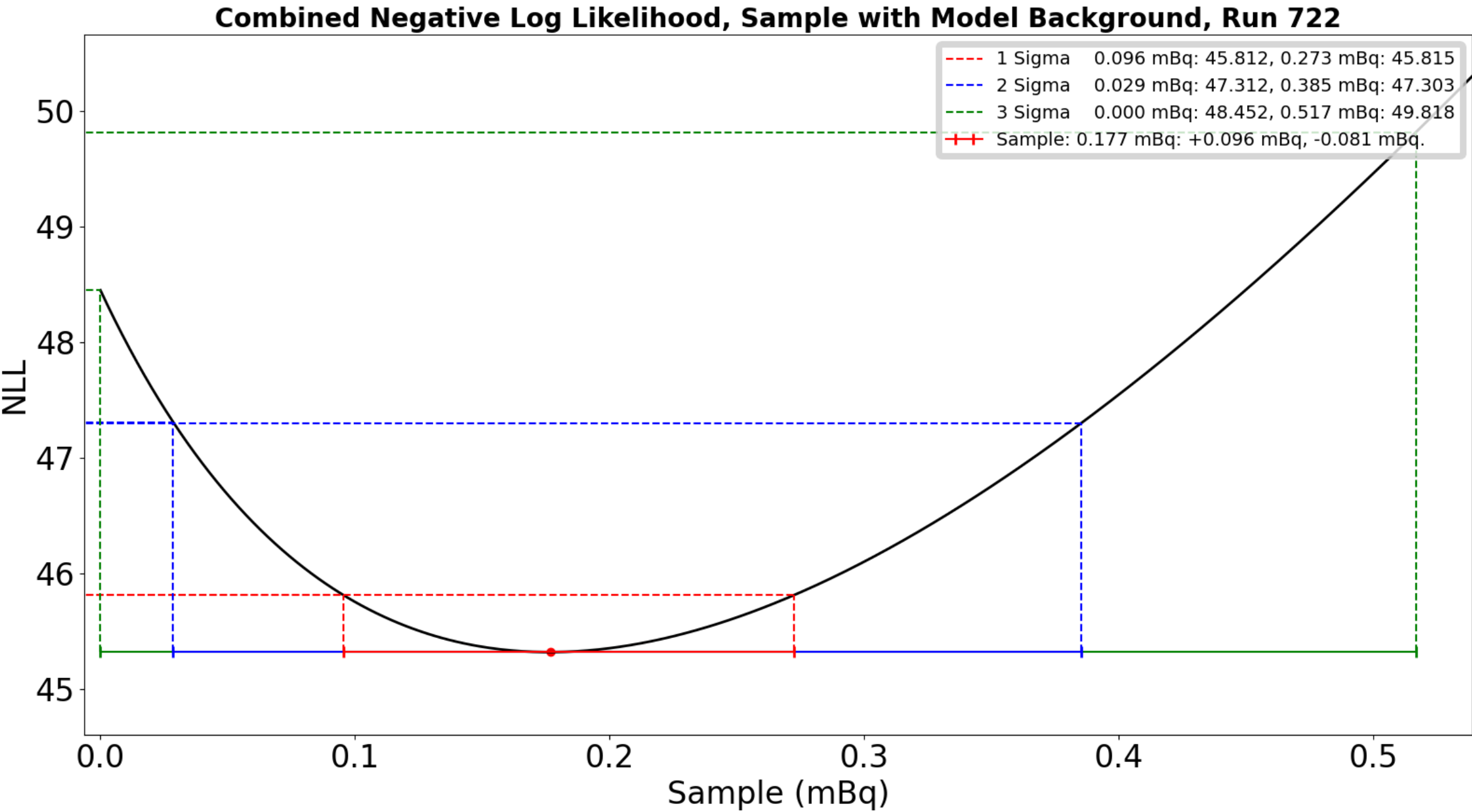


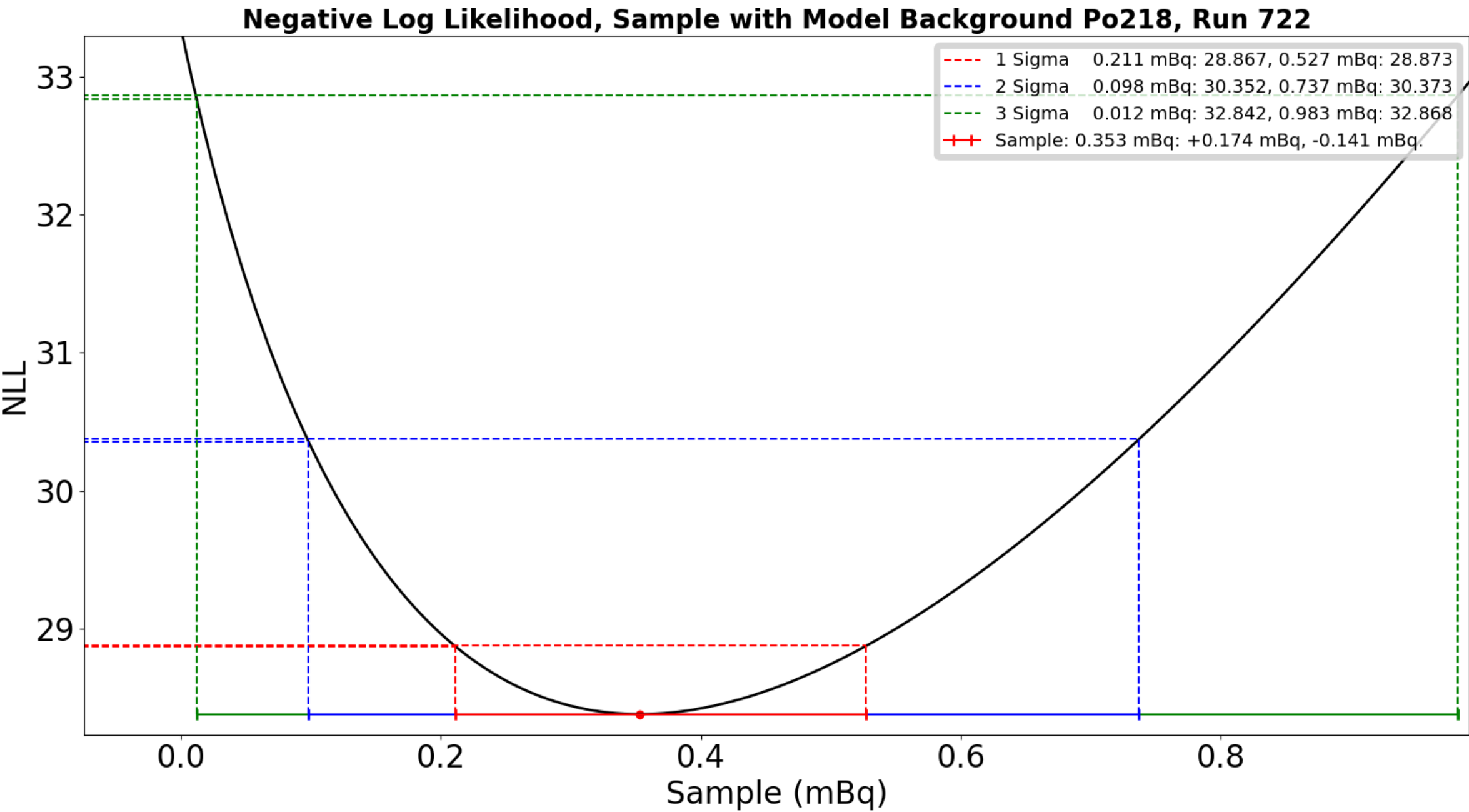
Figure 33: Each peak exhibits good resolution



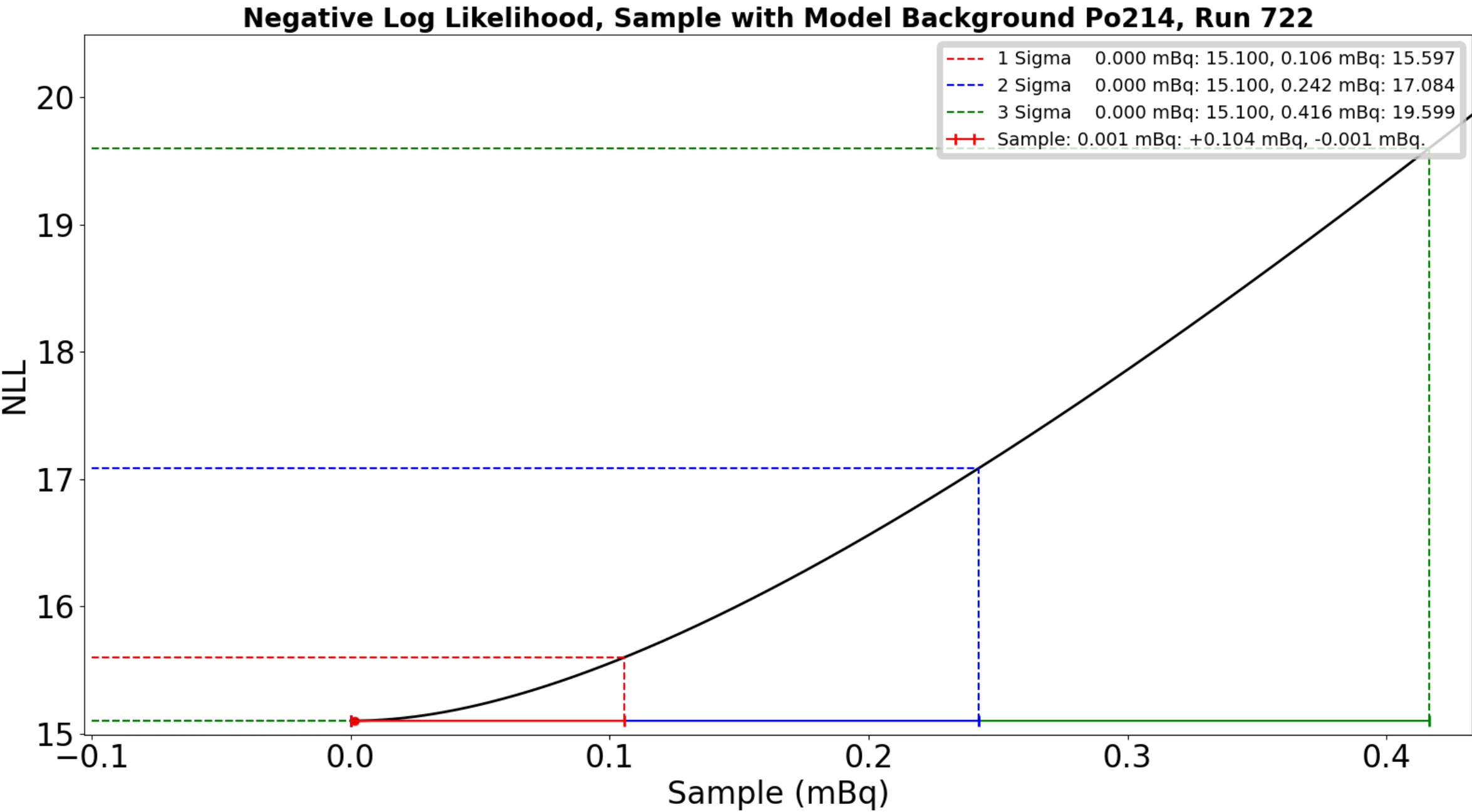




**Figure 34:** This rate is used for the emanation rate for Run 722

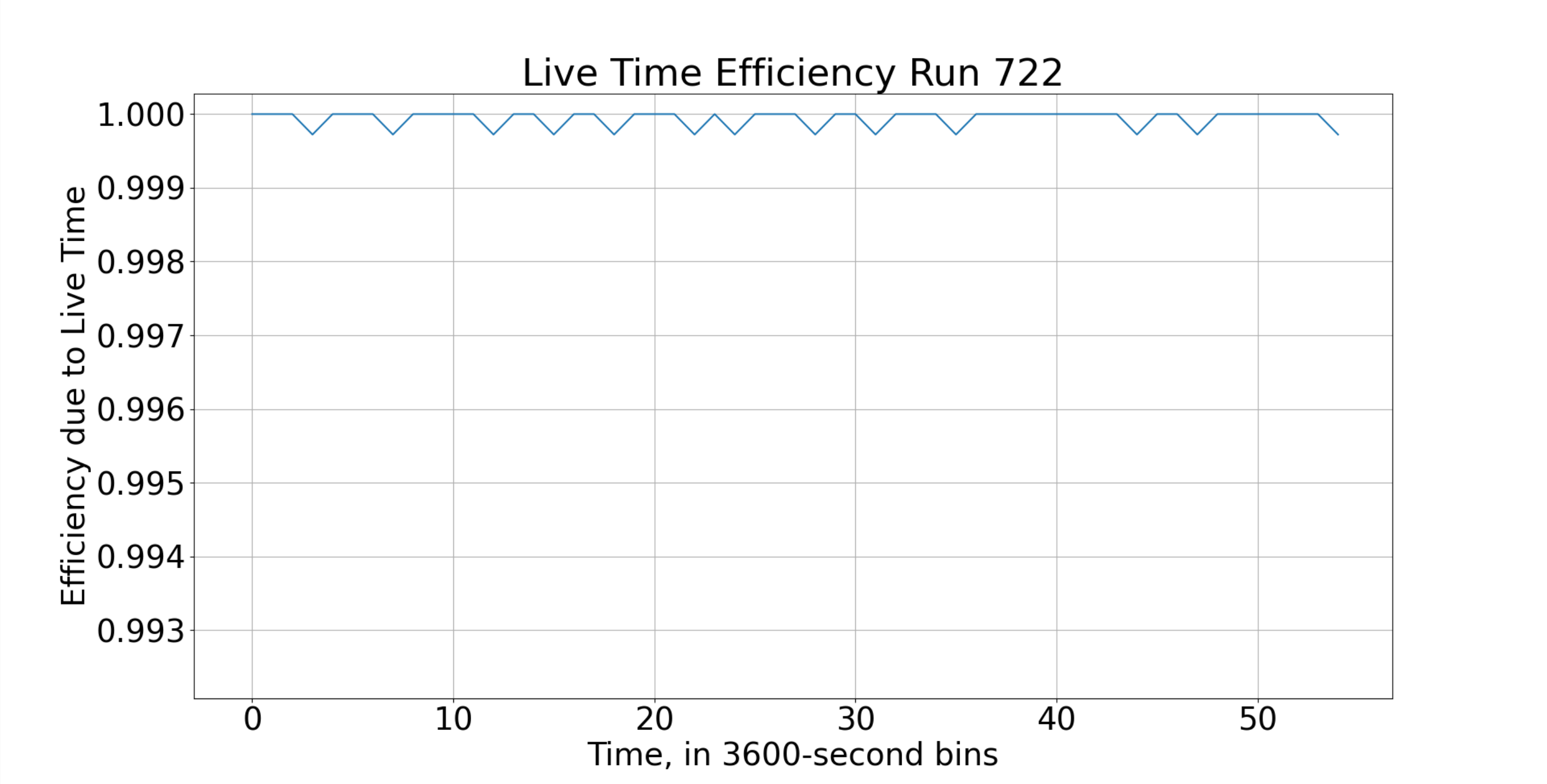


**Figure 35:** This rate is used to determine the combined rate



**Figure 36:** This rate is used to determine the combined rate

# Live Time Efficiency



**Figure 37:** Detector had relatively little dead time



# Notes on Run 722 Analysis

Run 722 exhibits such extreme shifts in gain that peak finding was impossible without removing several hours of data. However, there is better resolution and the combined rate was able to be utilized for this run.

[Back to Rate vs Time Run 722](#)

