GE Silicone Sealants ^{222}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 cm^2
- Overall, the sample was determined to emanate at a rate of $0.00^{+0.02}_{-0.00}$ 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}Po.
- The ^{218}Po rate wasn't used as poor resolution between the peaks of ^{218}Po and ^{210}Po likely caused ^{210}Po events to spill over into the ^{218}Po ROI

The Rate vs. Time plot for Run 717 follows.

See backup slides for Run 717

Rate vs. Time, Run 717

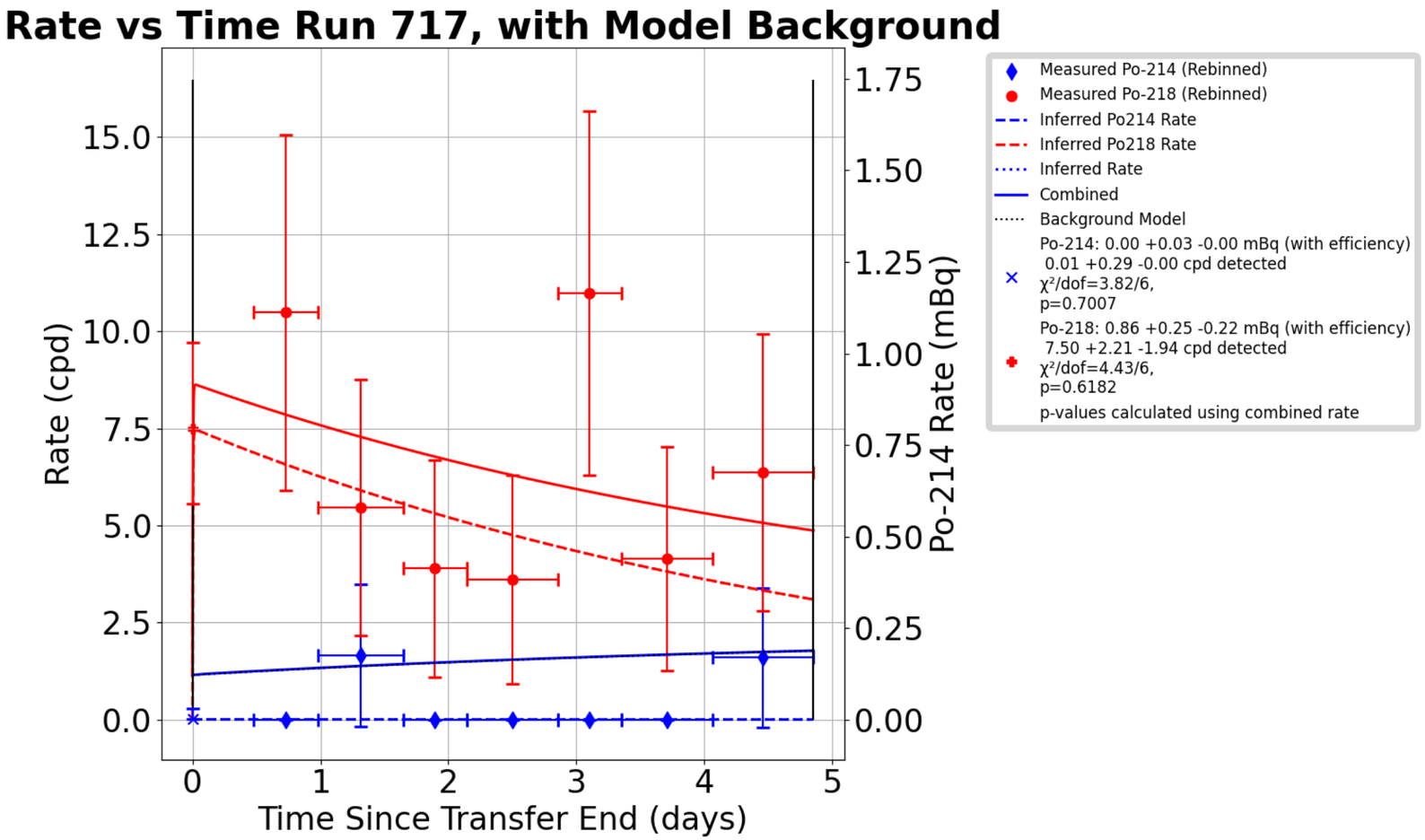

Figure 2: ^{222}Rn Emanation Rate: $\mathbf{0.00^{+0.03}_{-0.00}}$ **mBq** (from ^{214}Po Rate)

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}Po.
- The ^{218}Po rate wasn't used as poor resolution between the peaks of ^{218}Po and ^{210}Po likely caused ^{210}Po events to spill over into the ^{218}Po ROI

See Backup Slides for Run 720

Rate vs. Time, Run 720

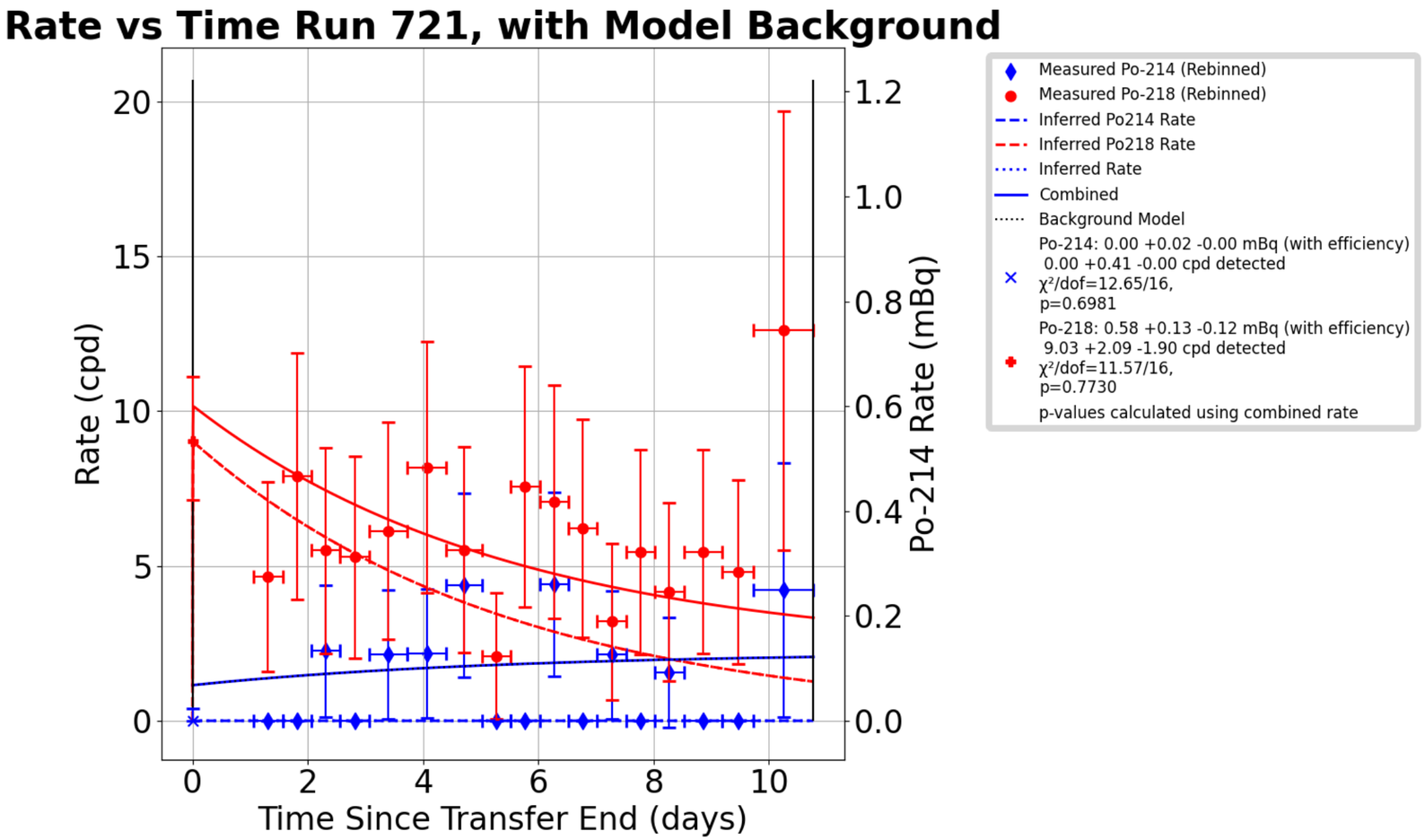

Figure 3: ^{222}Rn Emanation Rate: $\mathbf{0.00^{+0.54}_{-0.00}}$ **mBq** (from ^{214}Po rate)

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}Po.
- The ^{218}Po rate wasn't used as poor resolution between the peaks of ^{218}Po and ^{210}Po likely caused ^{210}Po events to spill over into the ^{218}Po ROI

Rate vs. Time, Run 721

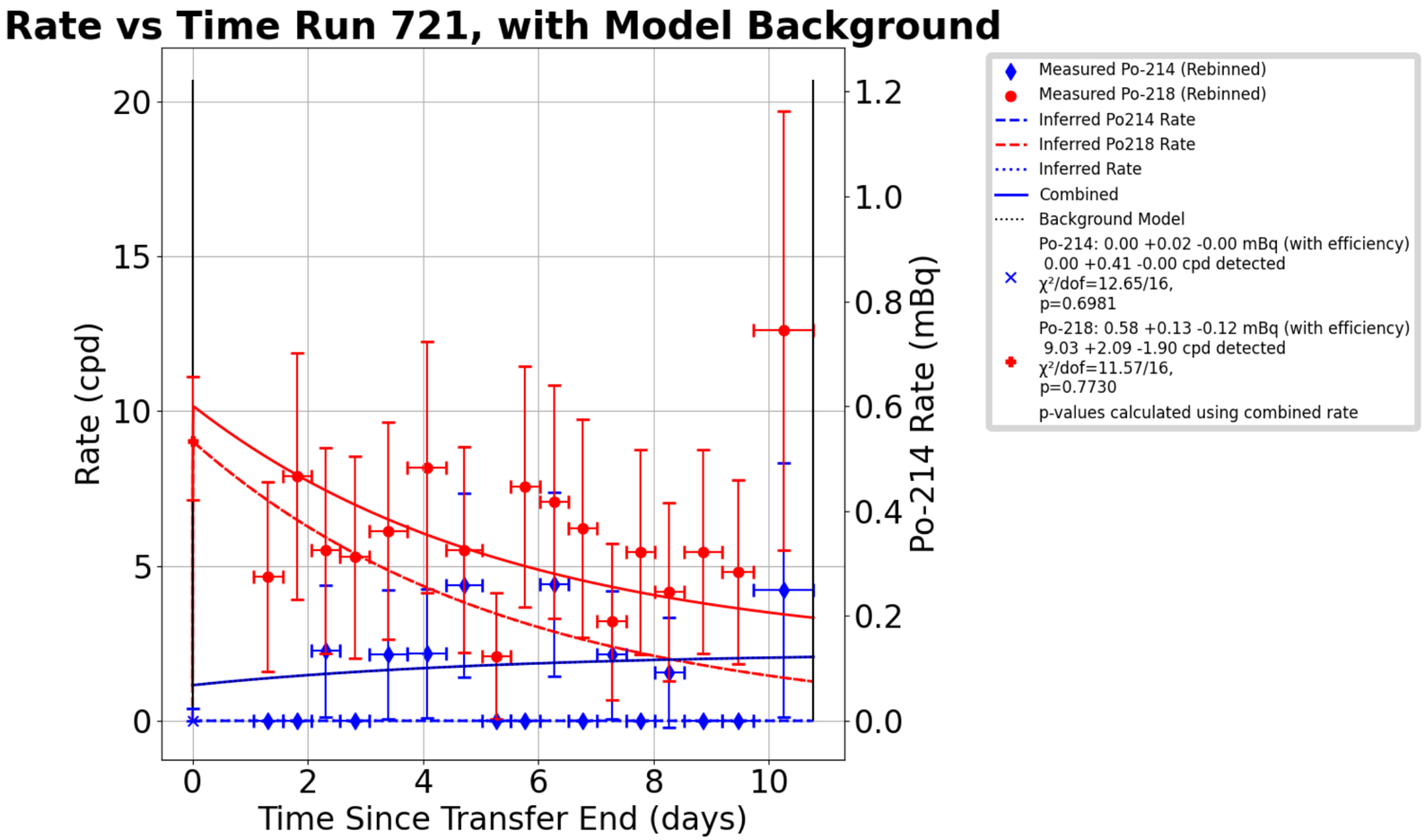

Figure 4: ^{222}Rn Emanation Rate: $\mathbf{0.00^{+0.02}_{-0.00}}$ **mBq** (from ^{214}Po rate)

Run 722 Analysis

- Emanation Rate was determined to be **0.00** $^{+0.10}_{-0.00}$ **mBq**.
- This determination was based on the observed emanation rate of ^{214}Po.
- The ^{218}Po rate wasn't used as poor resolution between the peaks of ^{218}Po and ^{210}Po likely caused ^{210}Po events to spill over into the ^{218} ROI

Rate vs. Time, Run 722

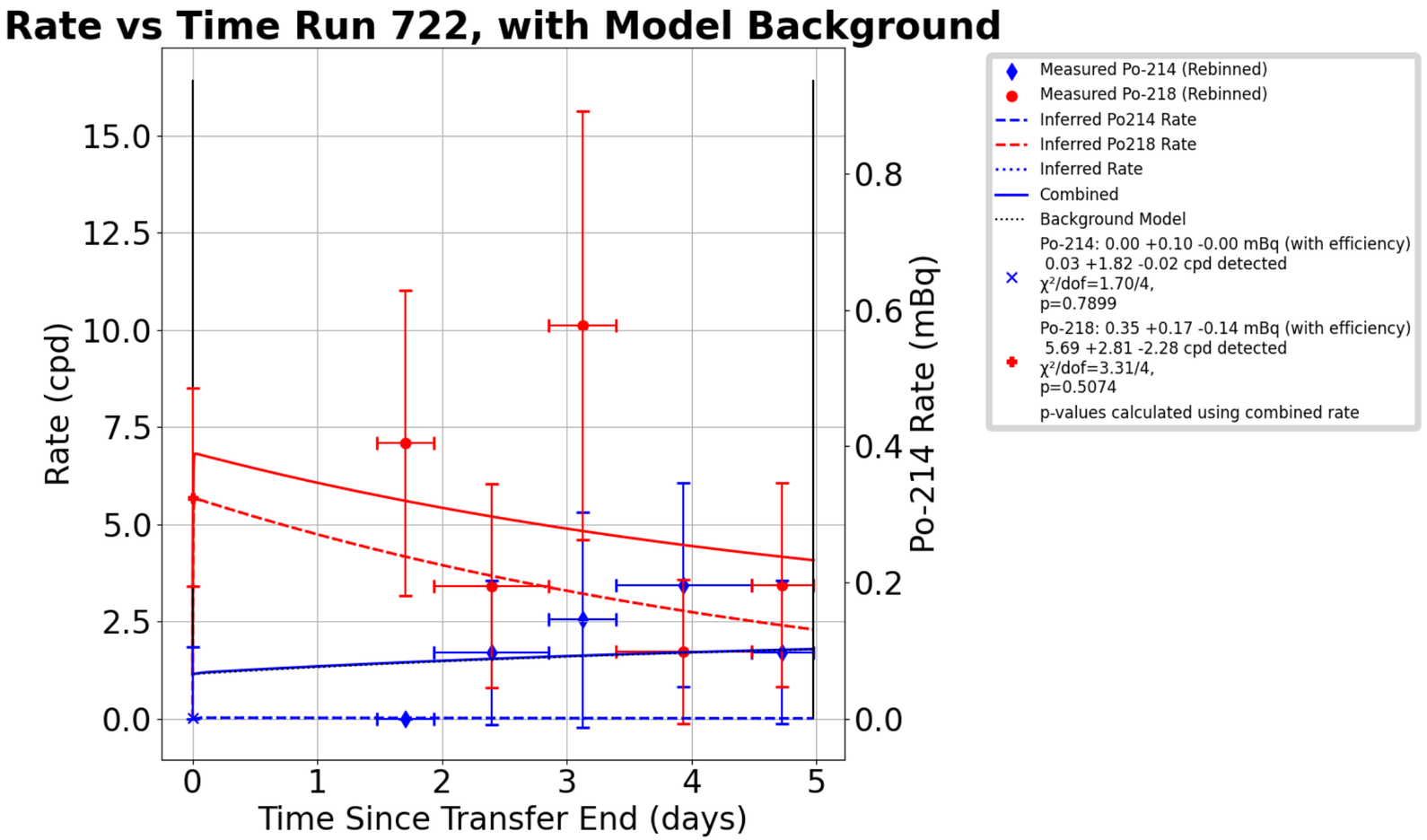

Figure 5: ^{222}Rn Emanation Rate: $\mathbf{0.00^{+0.10}_{-0.00}}$ **mBq** (from ^{214}Po rate)

Backup Slides

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

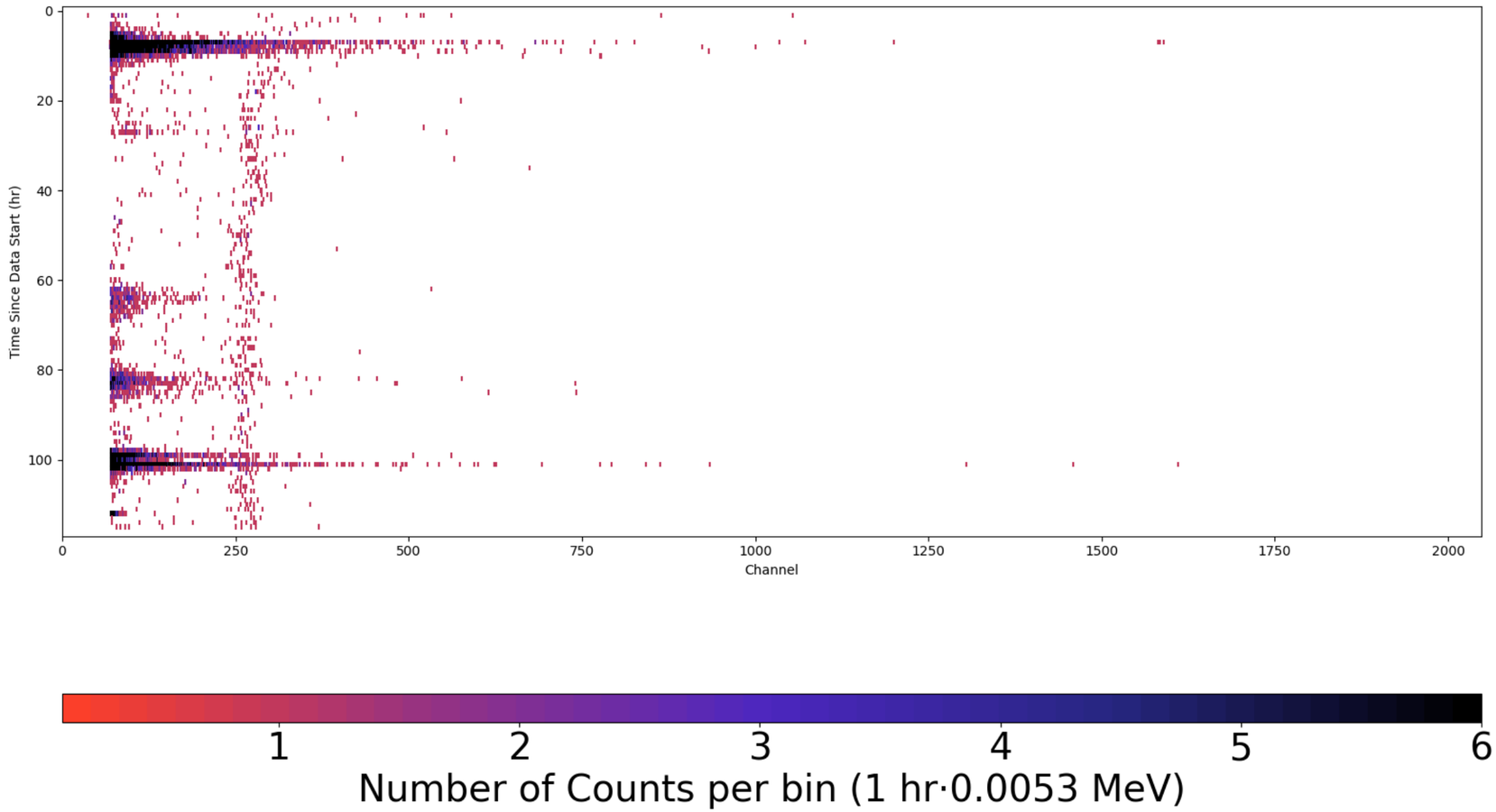

Figure 6: Large regions of noisy data had to be removed

Raw Data after Removing Bad Intervals, Run 717

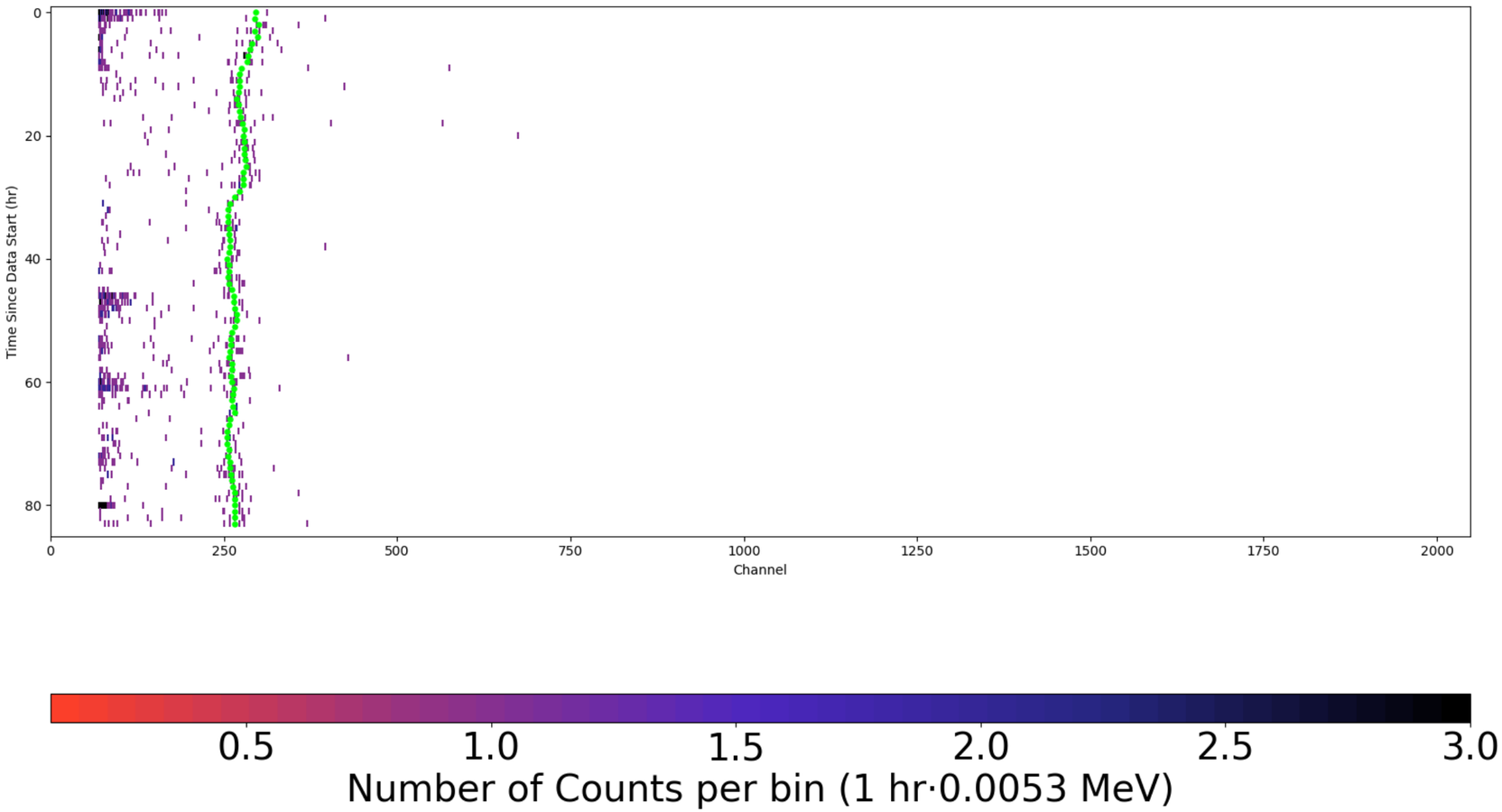

Figure 7: Gain is extremely low, resulting in poor data resolution

Gain-Corrected Data, Run 717

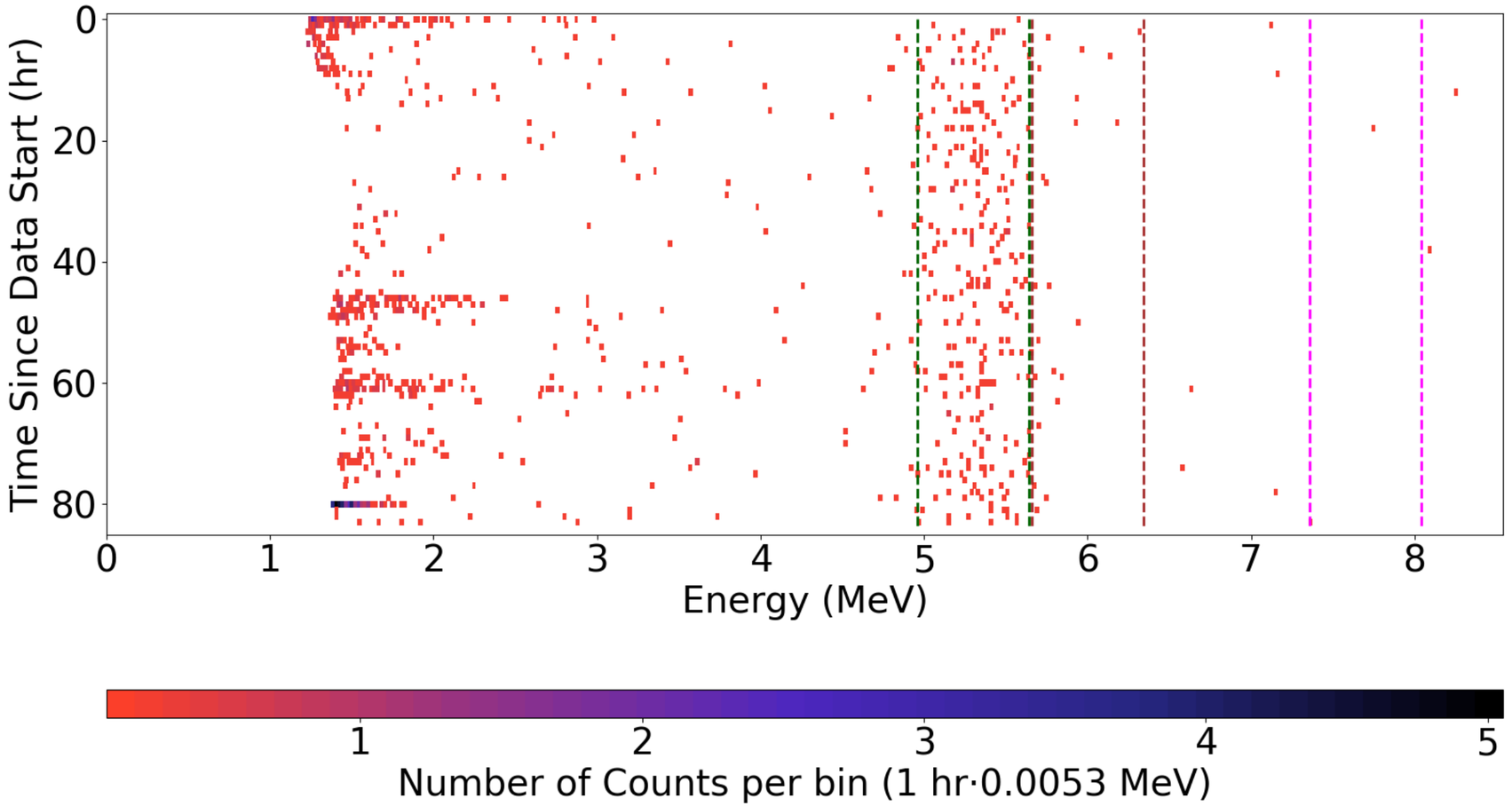

Figure 8: Data has been corrected to center the 5.3 MeV ^{210}Po peak at MCA channel 1000

Counts vs. Energy, Run 717

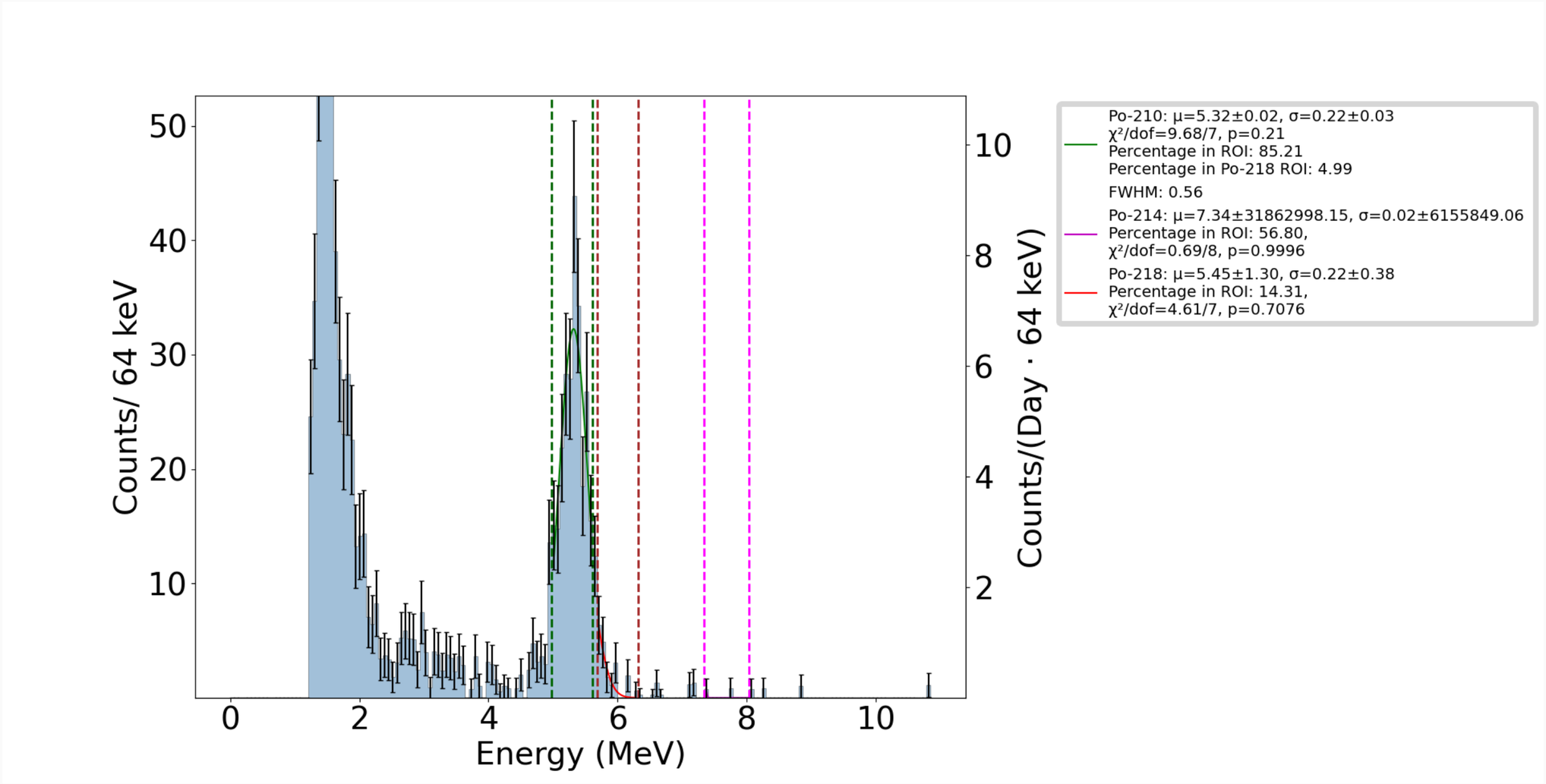

Figure 9: ^{210}Po peak has poor resolution and bleeds into ^{218}Po ROI

Combined NLL, Run 717

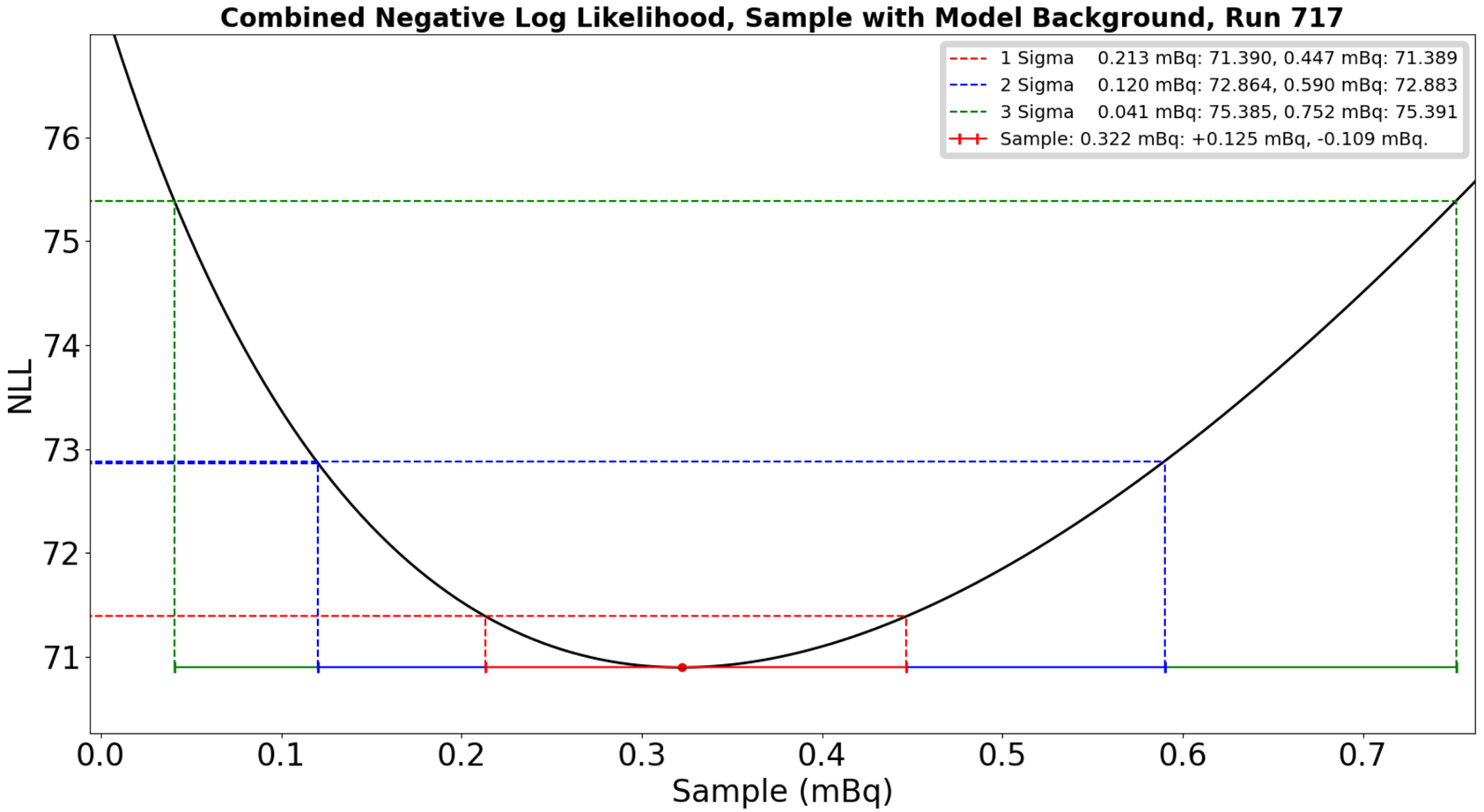

Figure 10: This rate is not used because of the resolution problems discussed earlier

^{218}Po NLL, Run 717

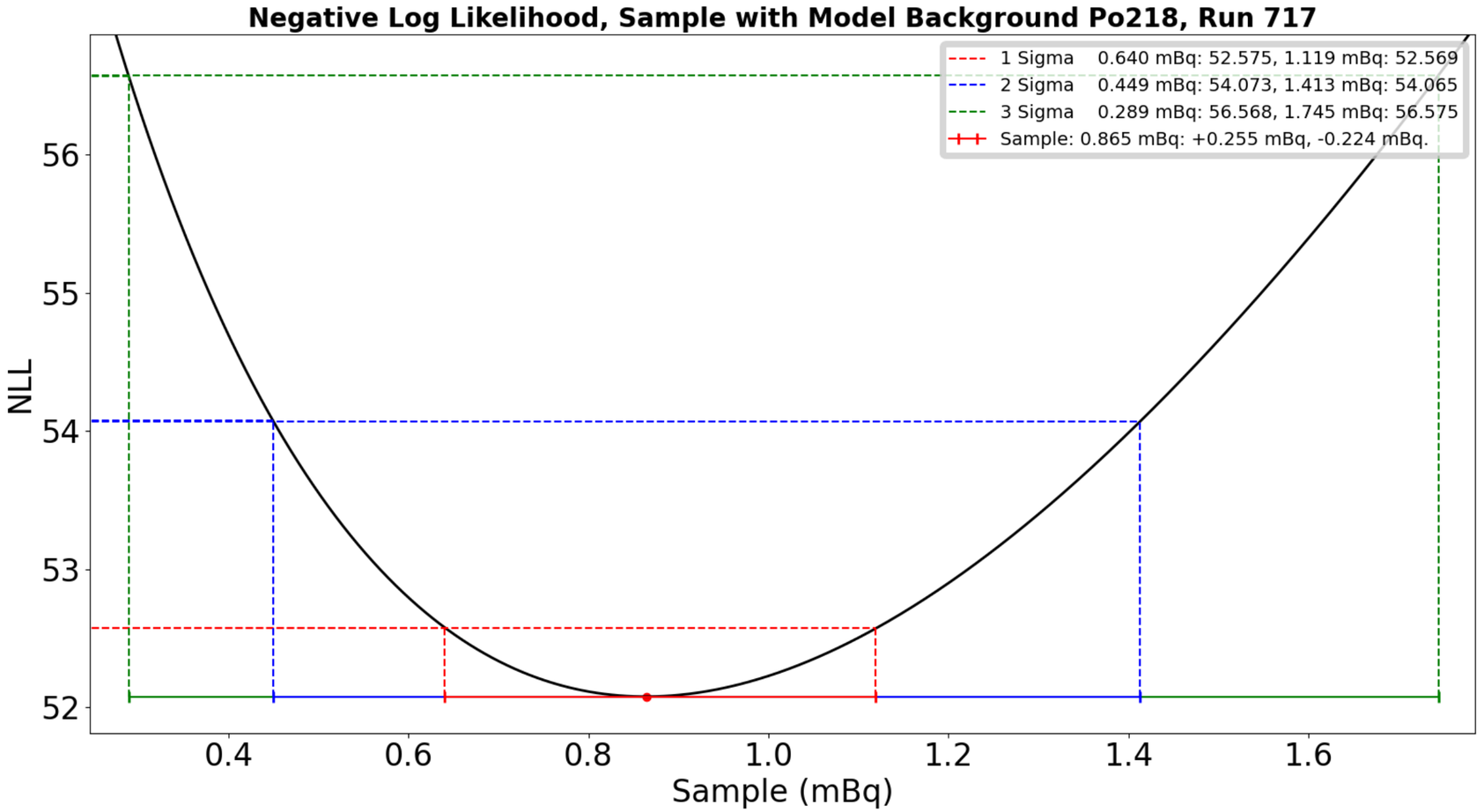

Figure 11: This rate is artificially high because of spillage from the ^{210}Po ROI

^{214}Po NLL, Run 717

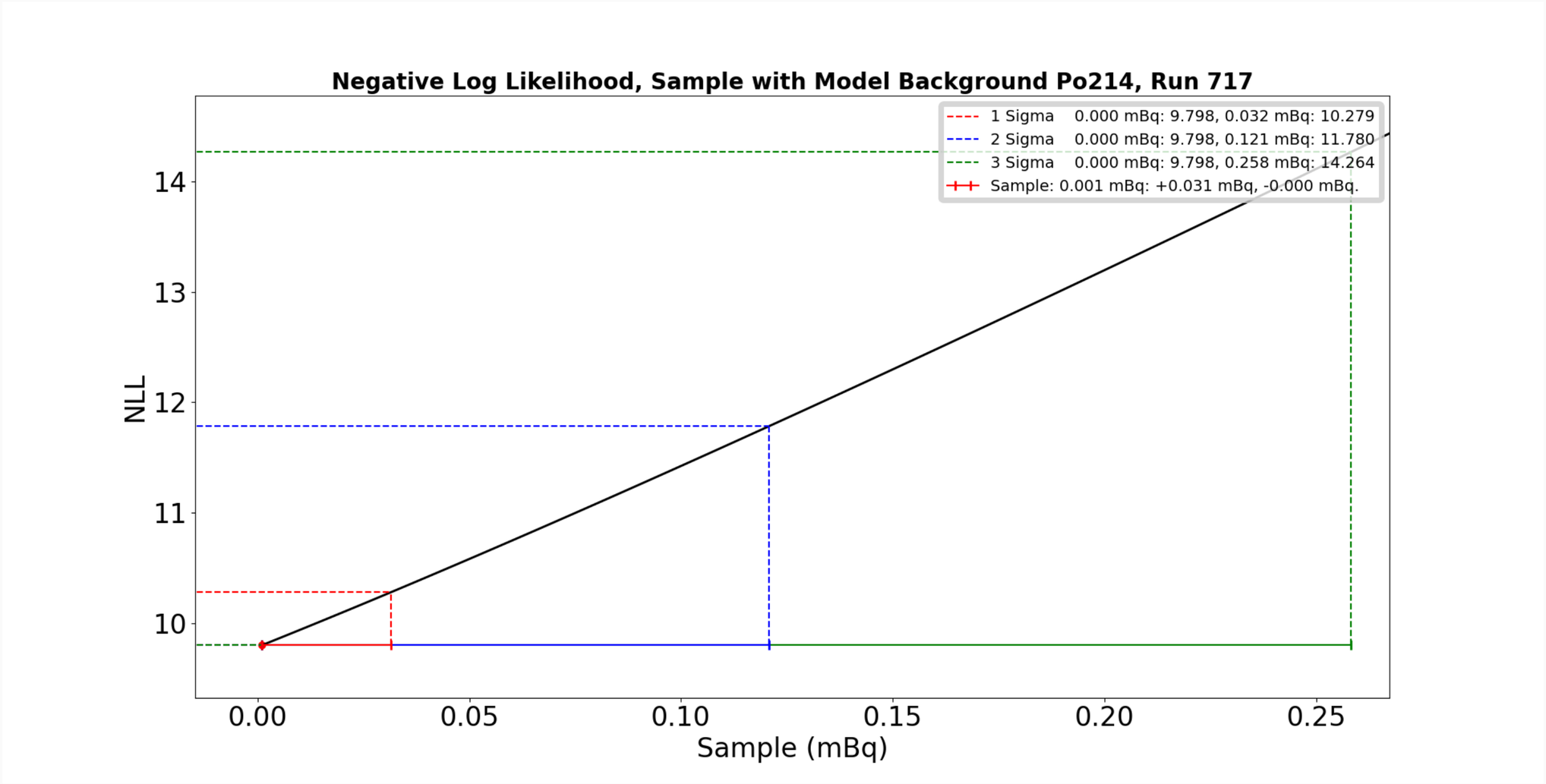

Figure 12: This is the rate that was used to determine the emanation rate of Run 717

Live Time Efficiency

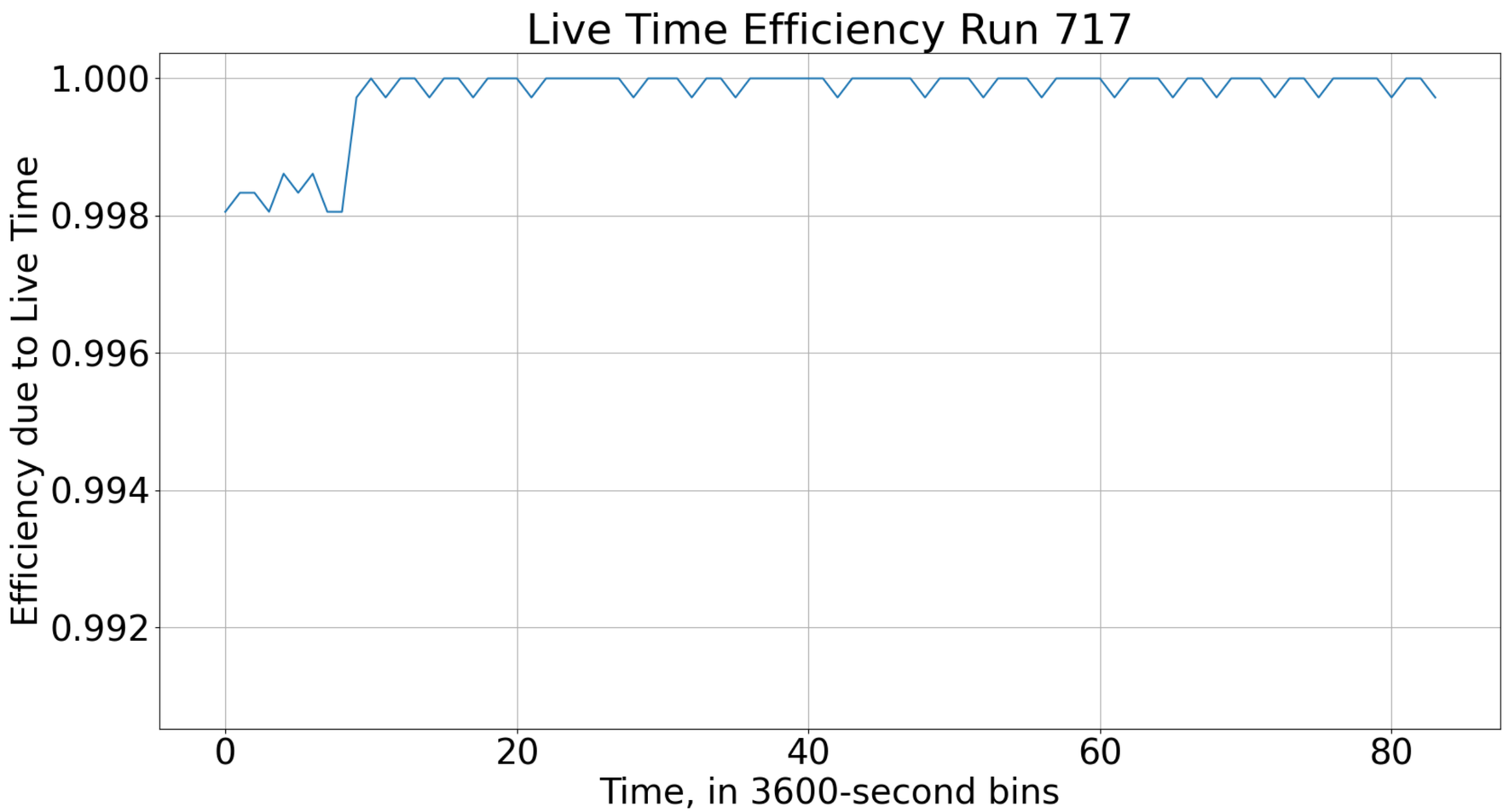

Figure 13: Detector had relatively little dead time

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}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}Po rate calculated to include spill-over from ^{210}Po events. Because of this, the ^{214}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

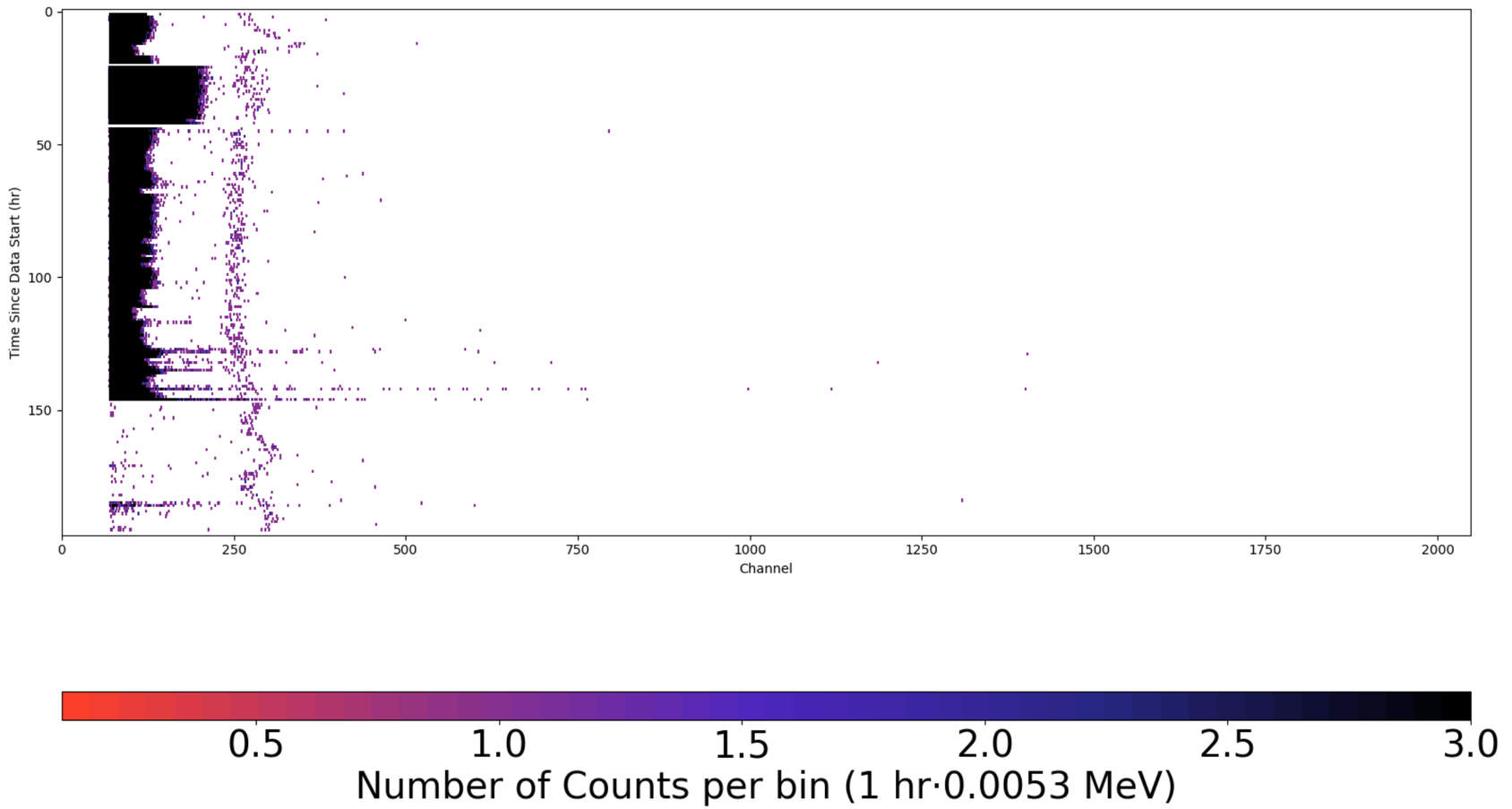

Figure 14: Run 720 exhibited both gain shift and areas of problematic noise

Raw Data after Removing Bad Intervals, Run 720

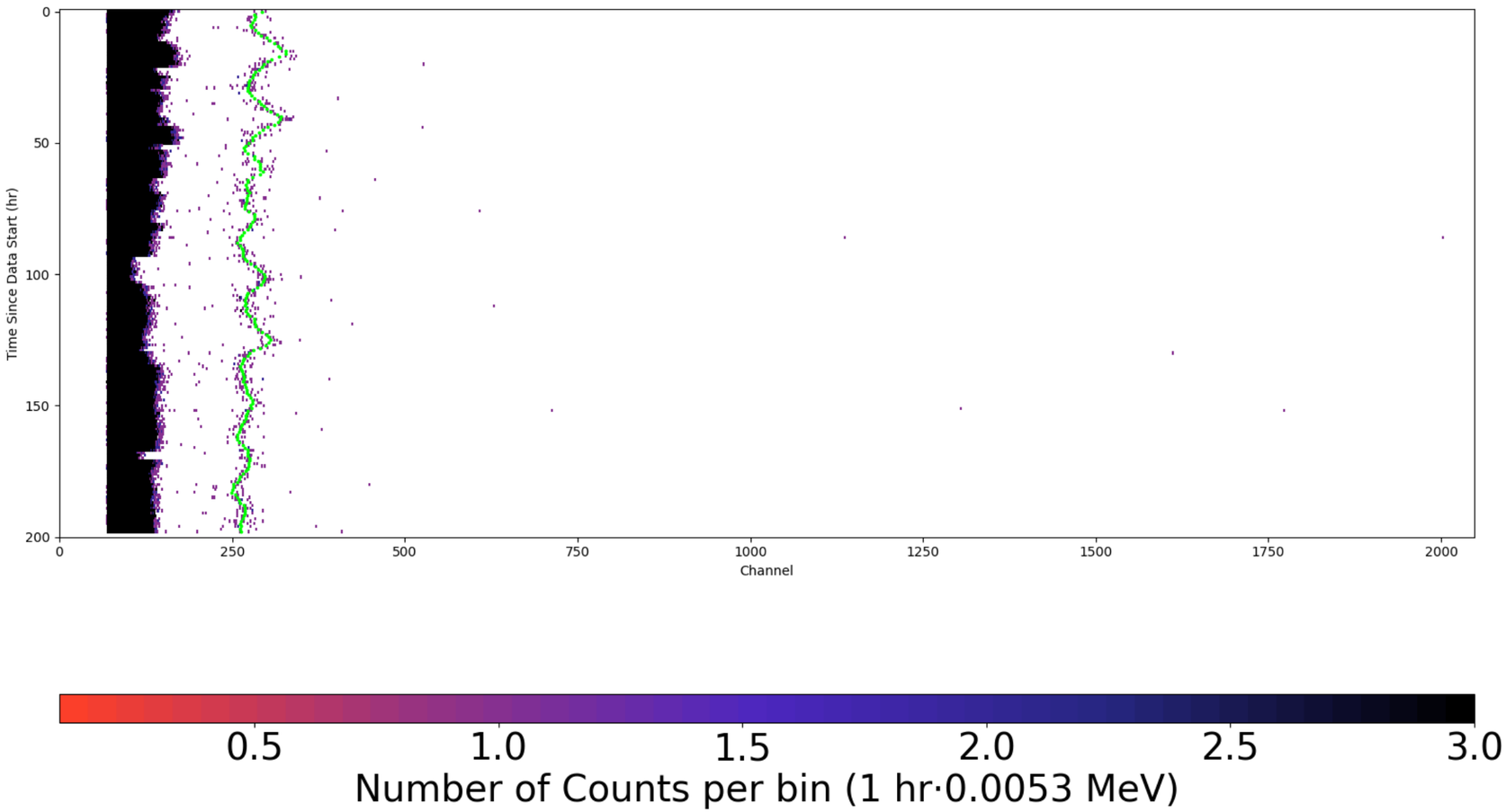

Figure 15: Gain is extremely low, resulting in poor data resolution

Gain-Corrected Data, Run 720

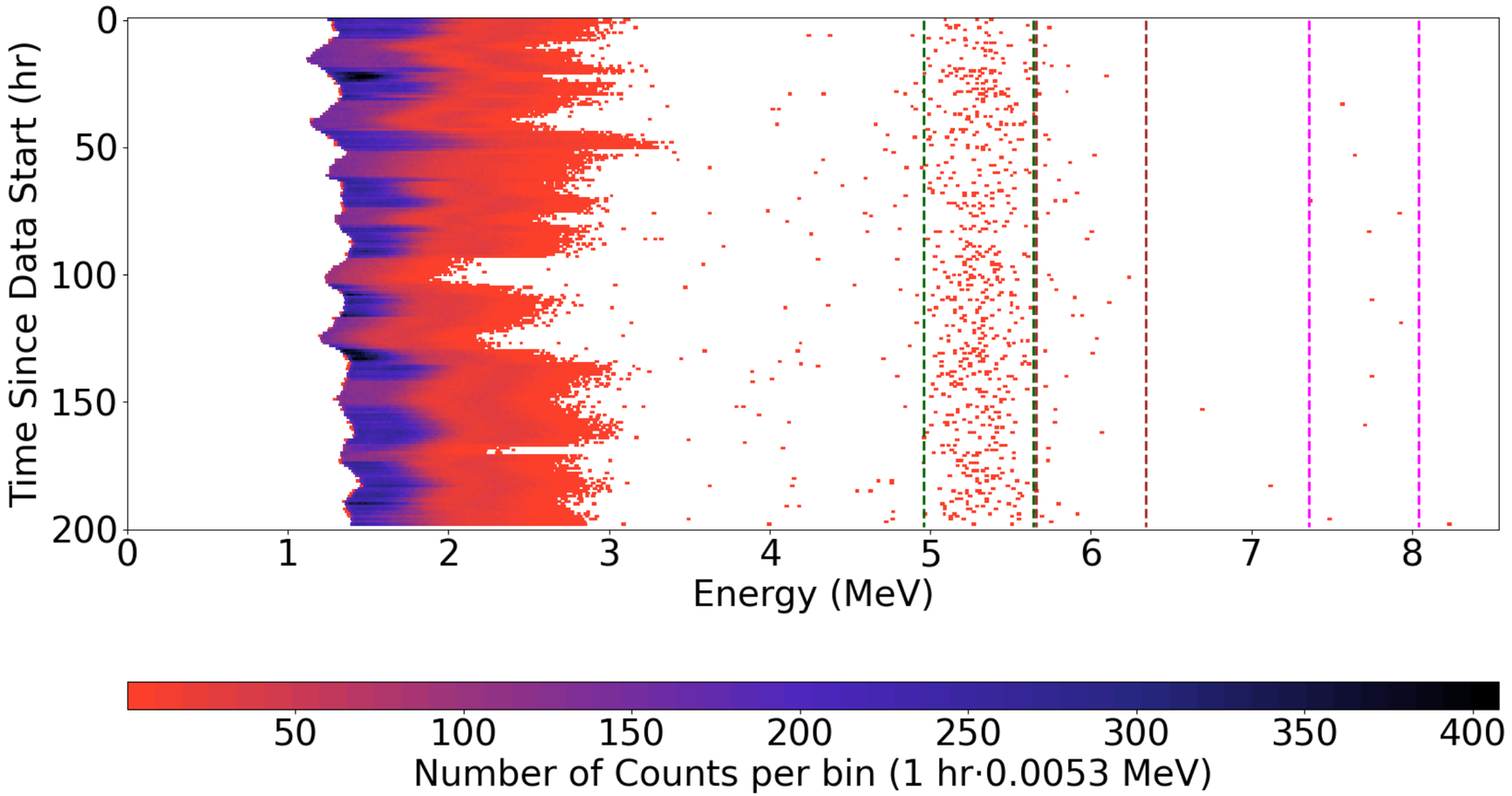

Figure 16: Data has been corrected to center the 5.3 MeV ^{210}Po peak at MCA channel 1000

Counts vs. Energy, Run 720

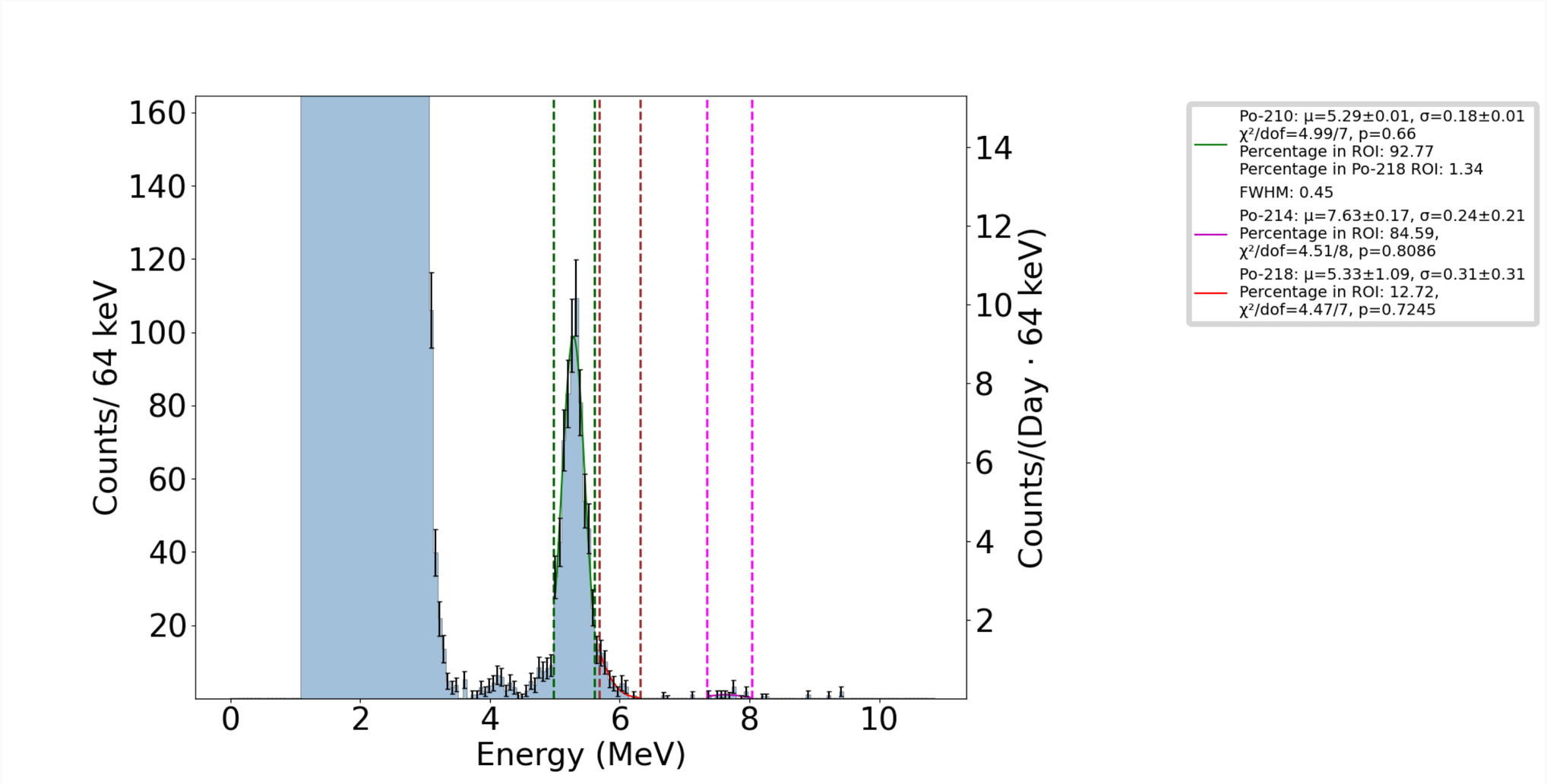

Figure 17: ^{210}Po peak has poor resolution and bleeds into ^{218}Po ROI

Combined NLL, Run 720

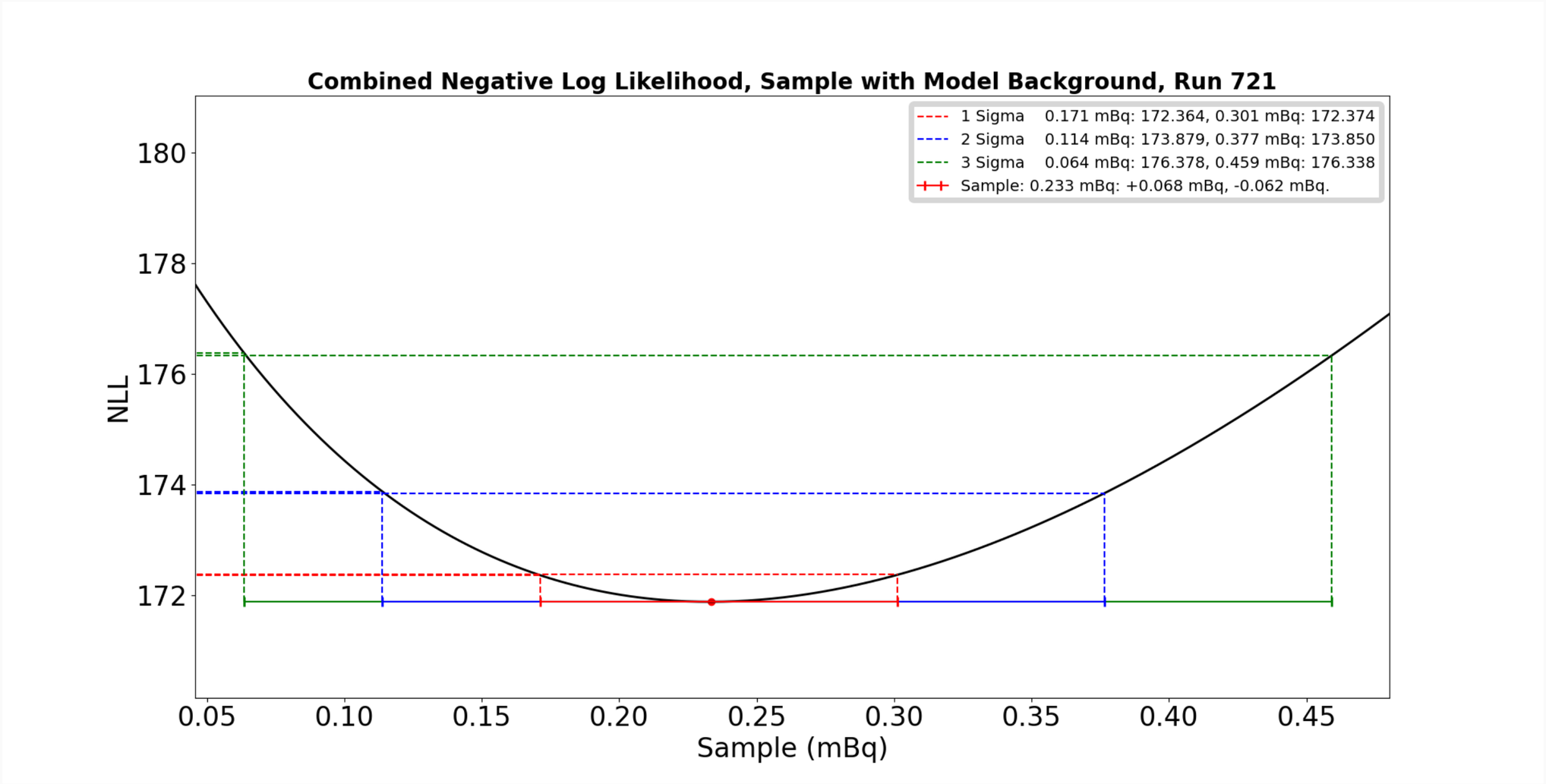

Figure 18: This rate is not used because of the resolution problems discussed earlier

^{218}Po NLL, Run 720

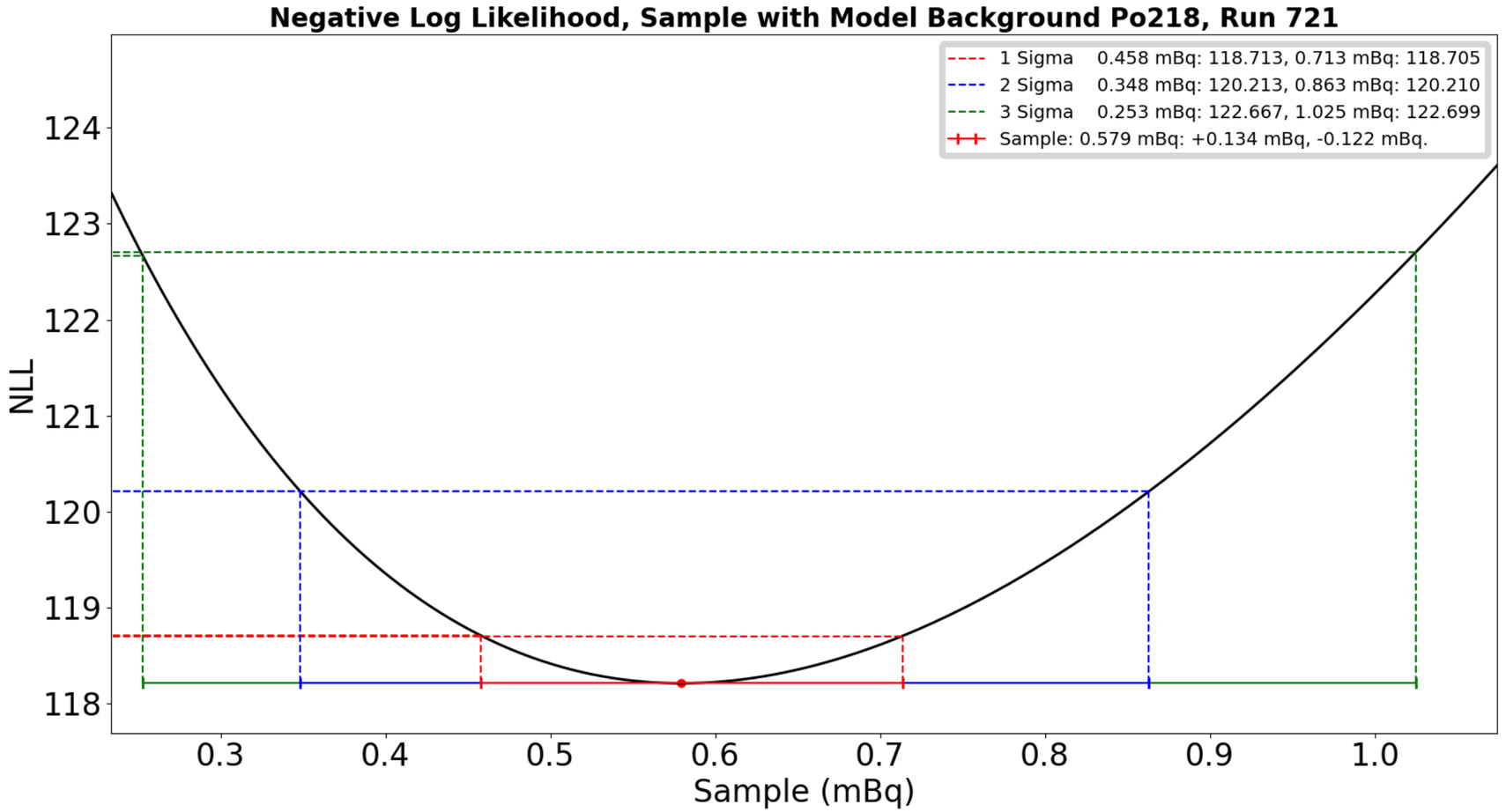

Figure 19: This rate is artificially high because of spillage from the ^{210}Po ROI

^{214}Po NLL, Run 720

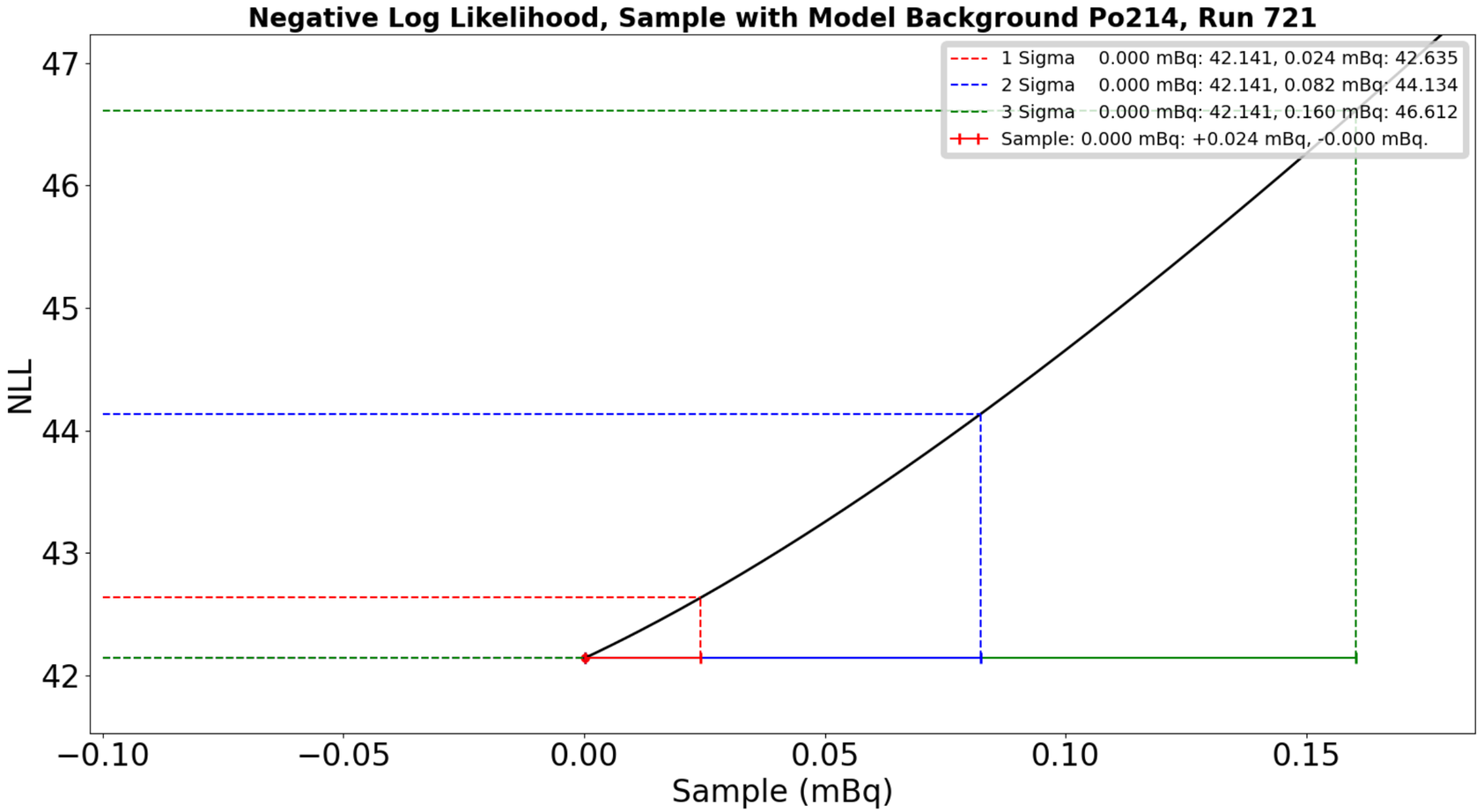

Figure 20: This is the rate that was used to determine the emanation rate of Run 720

Live Time Efficiency

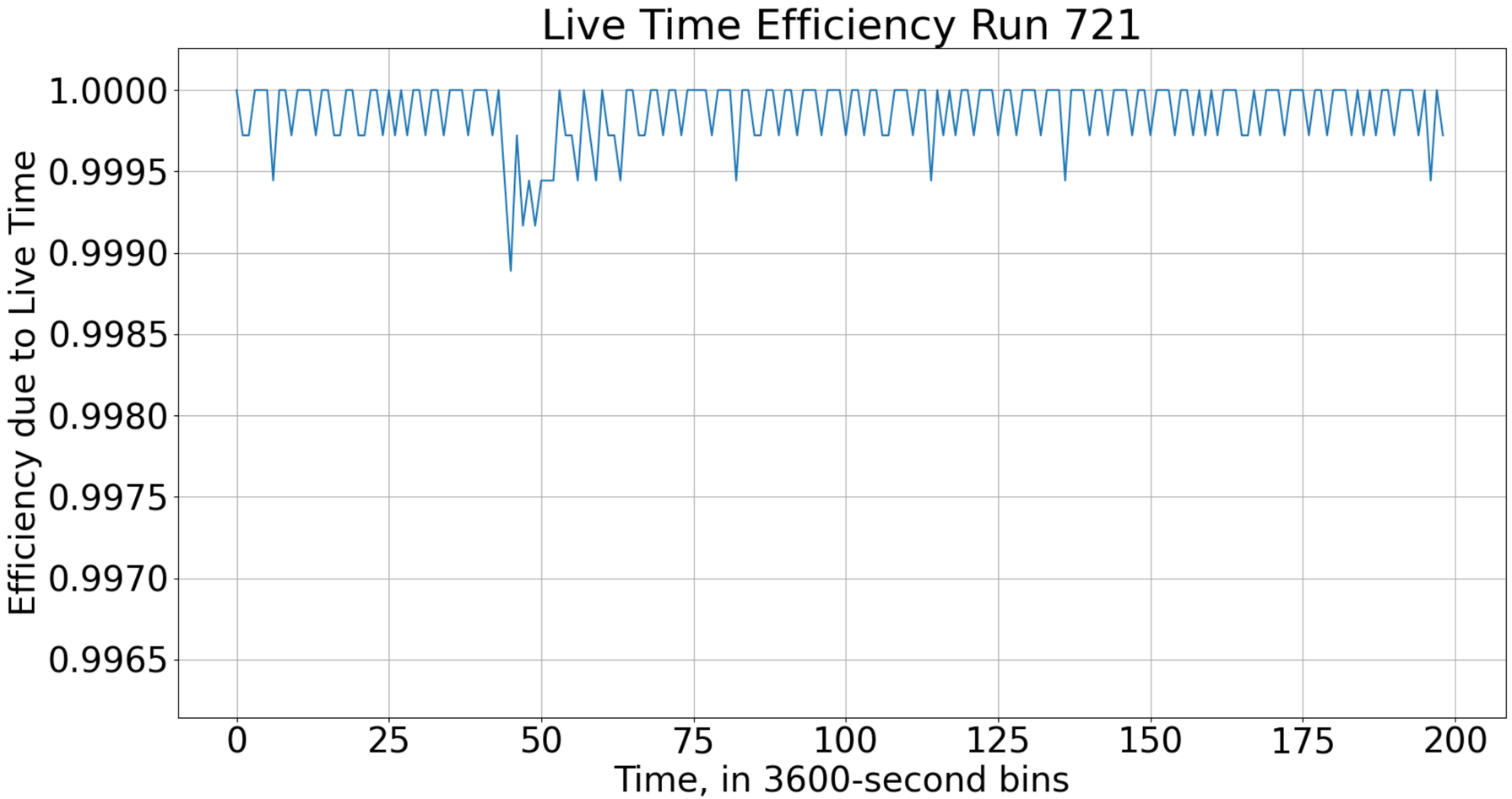

Figure 21: Detector had relatively little dead time

Notes on Run 720 Analysis

Run 720 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 720 gives way to ^{210}Po events spilling over into the ^{218}Po ROI. Because of this, the ^{214}Po rate alone was used to determine the emanation rate for run 720. Overall, Run 720 appears to be consistent with our backgrounds.

Back to Rate vs Time Run 720