50-L signals with new 3D $\rightarrow$ 2D responses

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Topics

- 3 types of field response calculations:
  - 2.5D "trick" for 50-L
  - 3D $\rightarrow$ 2D for 50-L
  - 2D MicroBooNE wires
- 3D $\rightarrow$ 2D fields w/ Wire-Cell signal processing of 50-L data
  - 2.5D Trick field responses
- Multiple (2) 2D slices across 3D geometry
  - single hole + "micro wire" geometry to reduce computation
  - slices chosen to go through hole diameters
  - 0 ± 5 strips, 6 paths across 1/2 strip
- Solve fields on each 2D slice with Garfield FEM
- Average over slices to get 2D

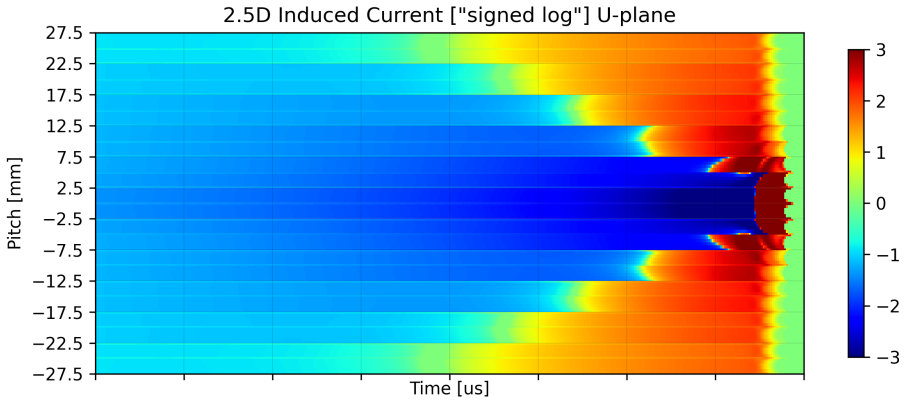
50-L Field Responses from Francesco

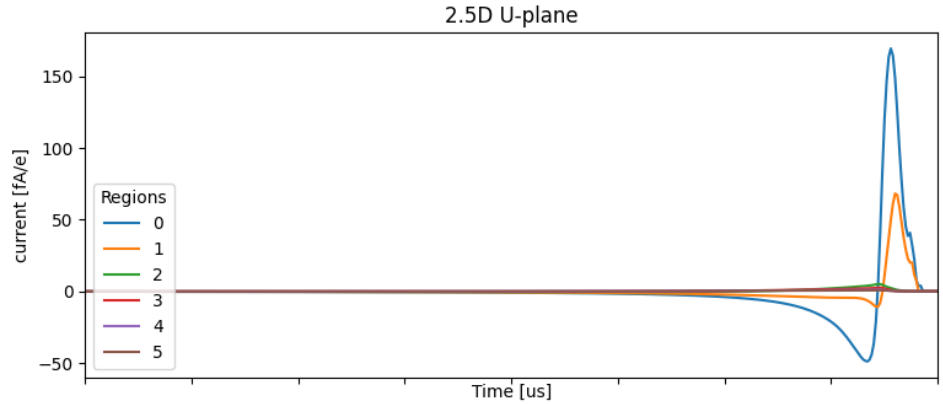
- Finite-difference method
- 2D calculation provides far-field boundary conditions for:
- 3D calculation for near-field
  - ind: 12×4 paths, 0 ± 5 strips
  - col: 12×6 paths, 0 ± 3 strips
- Average over 4 or 6 paths along strip to get 2D: "3D $\rightarrow$ 2D"
  - Convert to Wire-Cell toolkit's JSON format
  - Use WCT's 2D simulation and signal processing

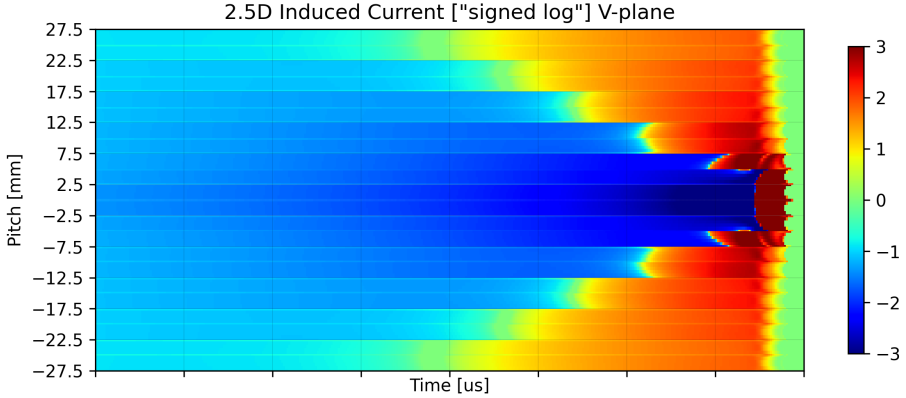
MicroBooNE wire responess

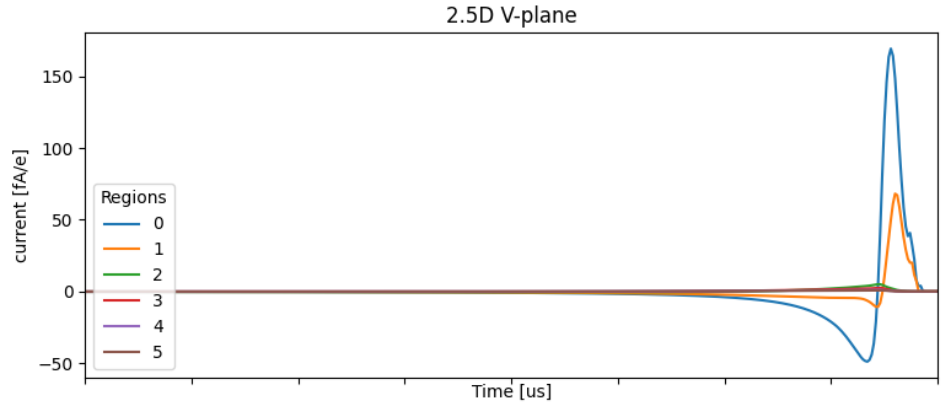
- 2D model, infinite wires, regularly spaced
- 0 ± 10 wires, 6 paths across 1/2 wire region
- Solve fields with Garfield FEM
- Reproduces MicroBooNE data well on average

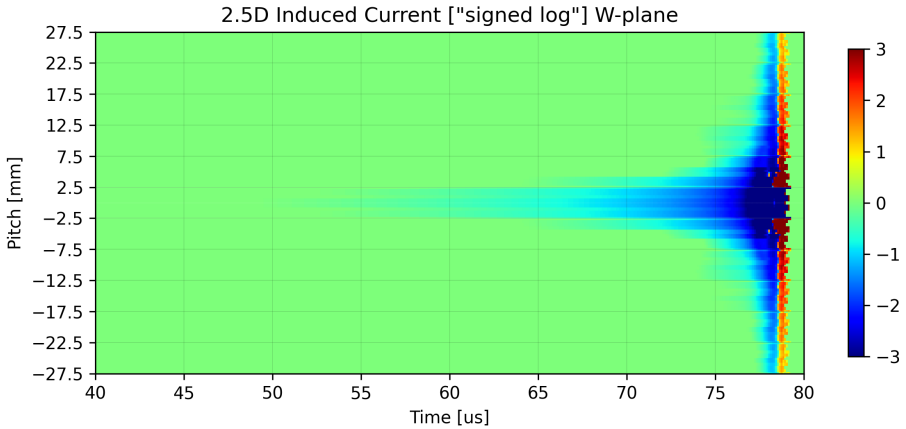
50-L 2-plane 2.5D trick responses (ignore top)

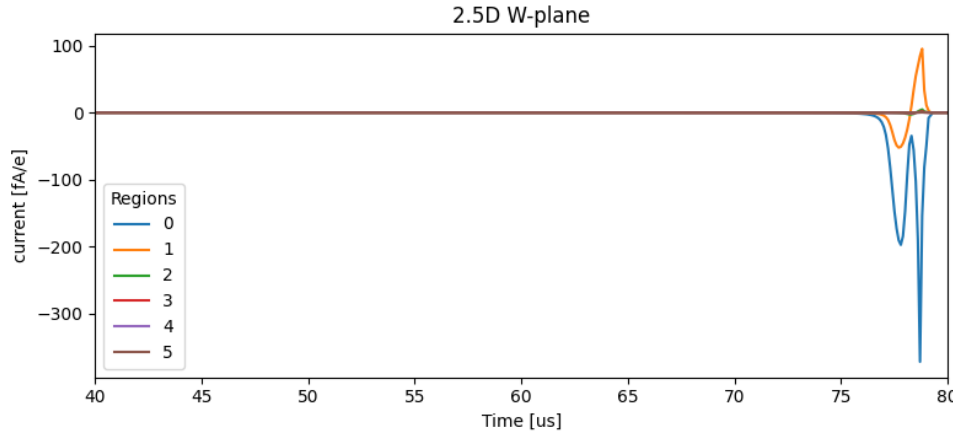




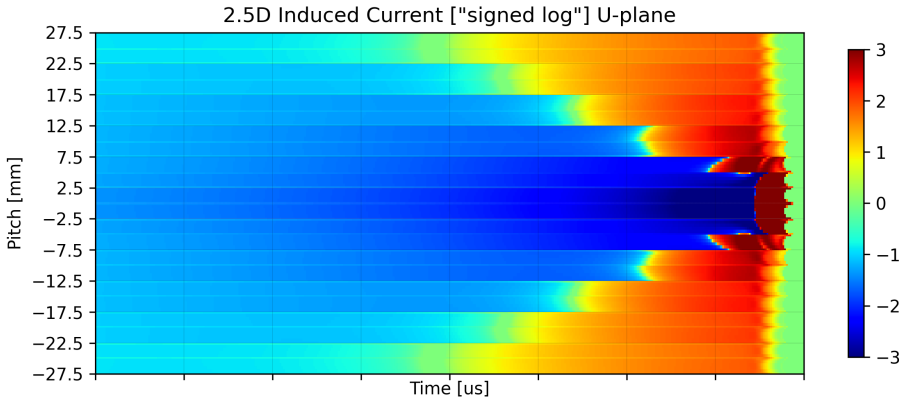


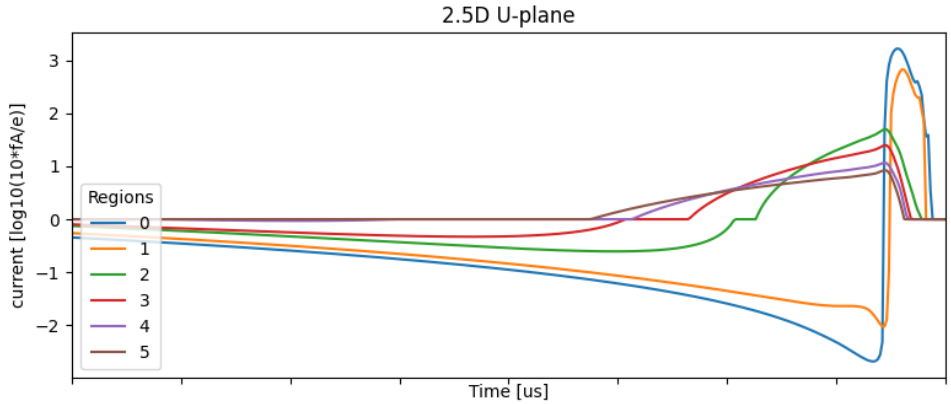


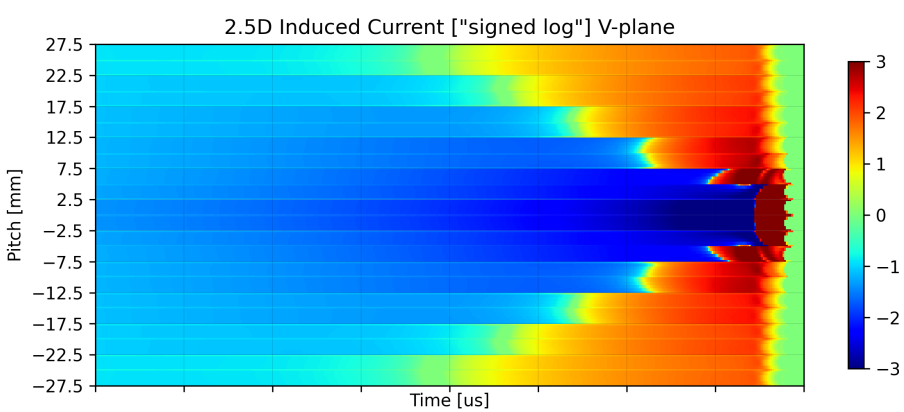


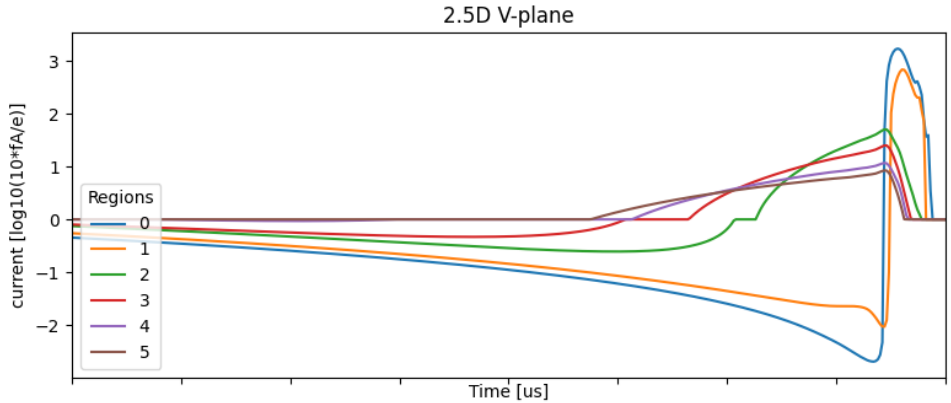


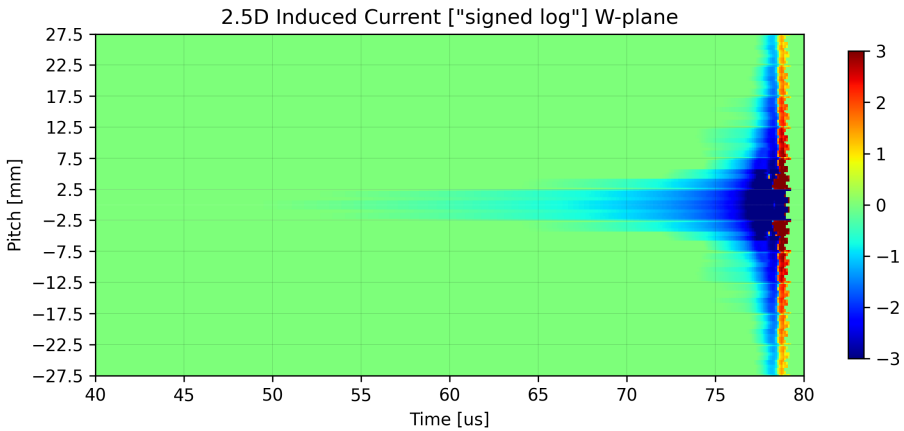
50-L 2-plane 2.5D trick responses (log10 wf)

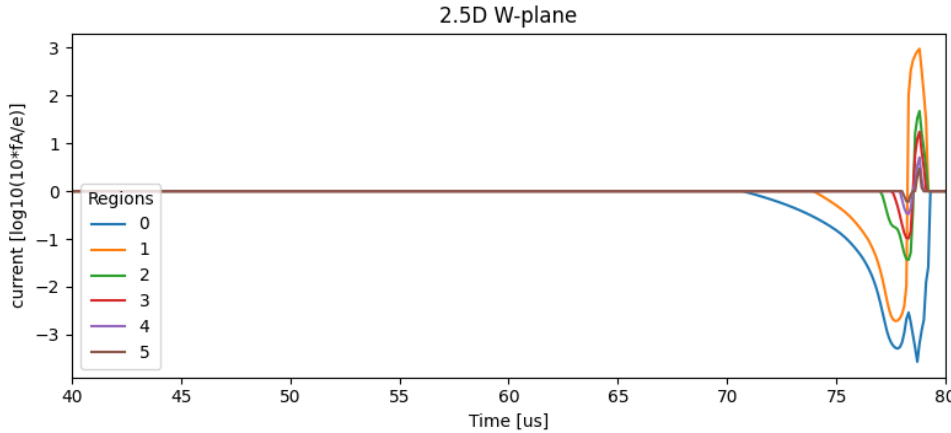




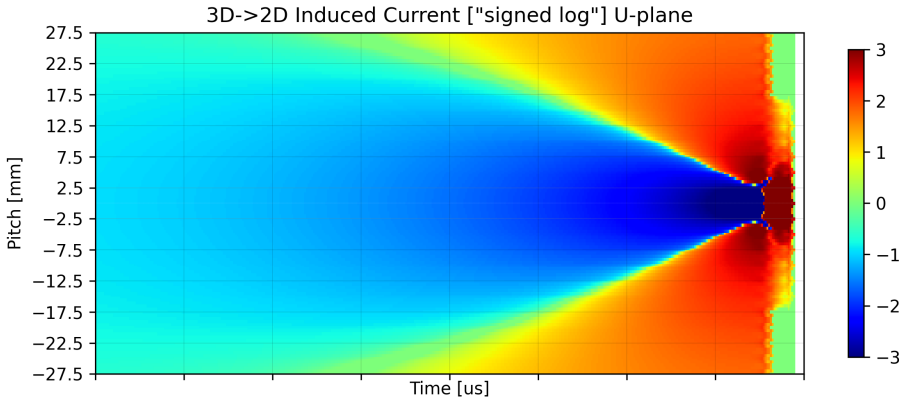


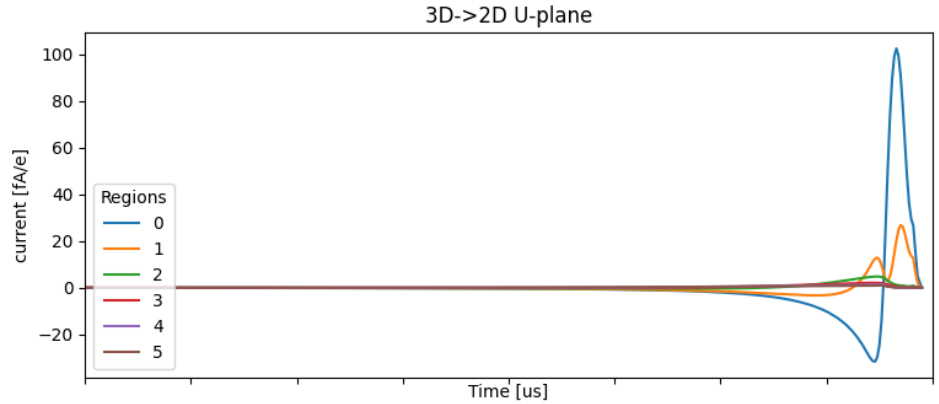


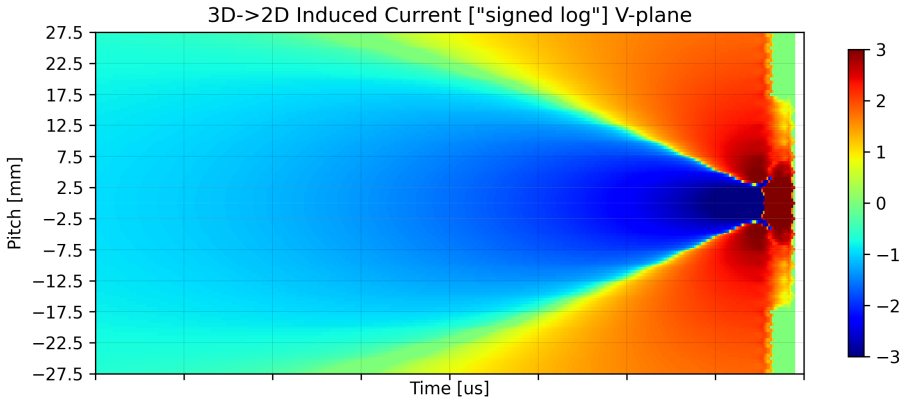


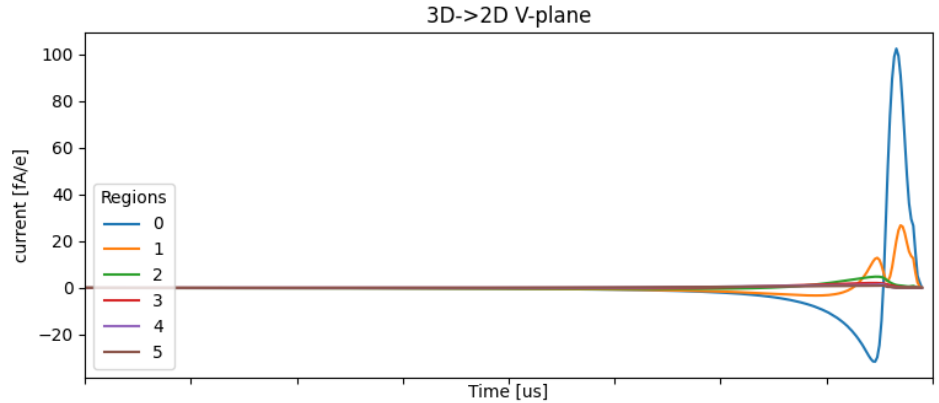


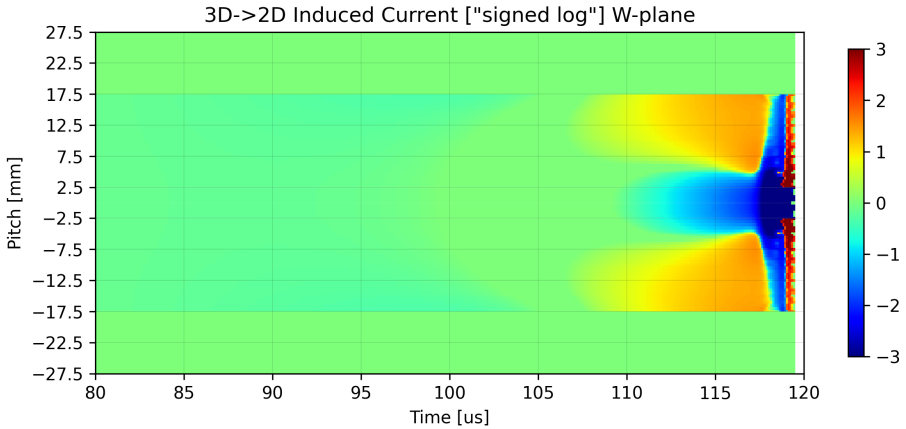
50-L 2-plane 3D → 2D responses (ignore top)

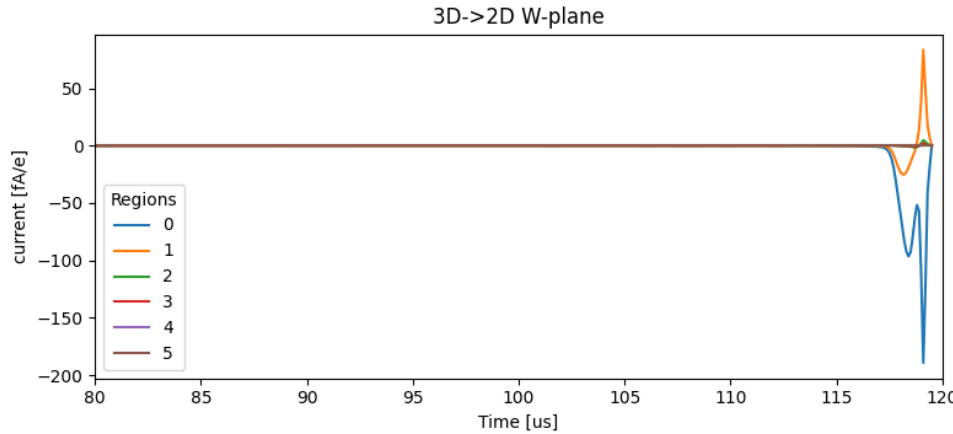




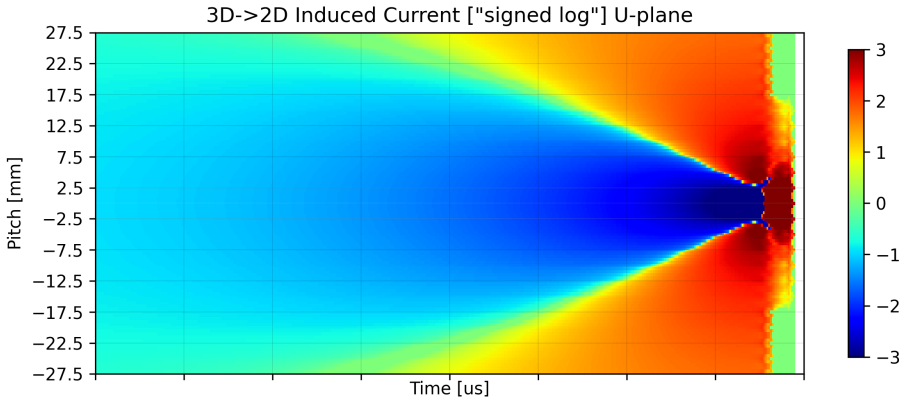


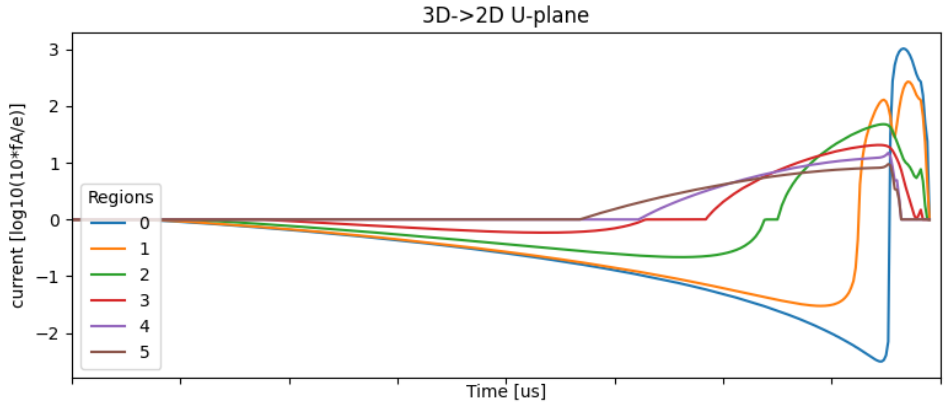


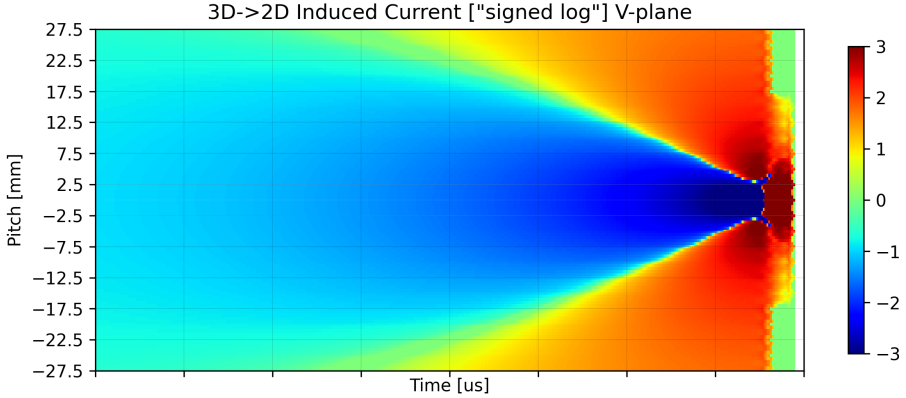


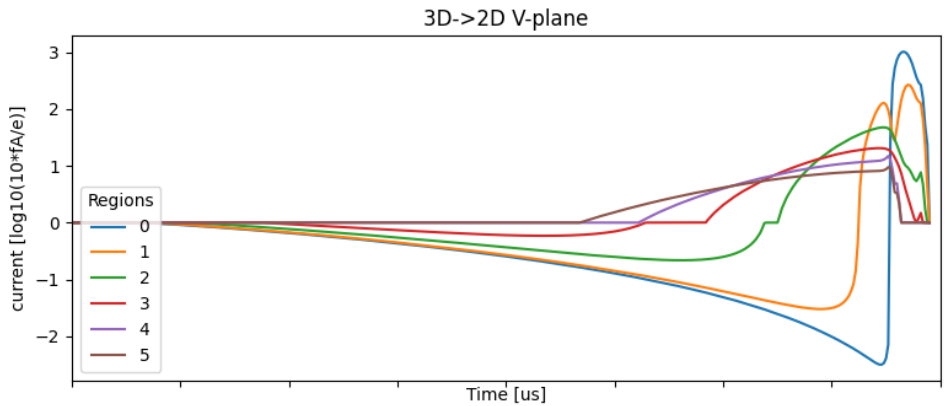


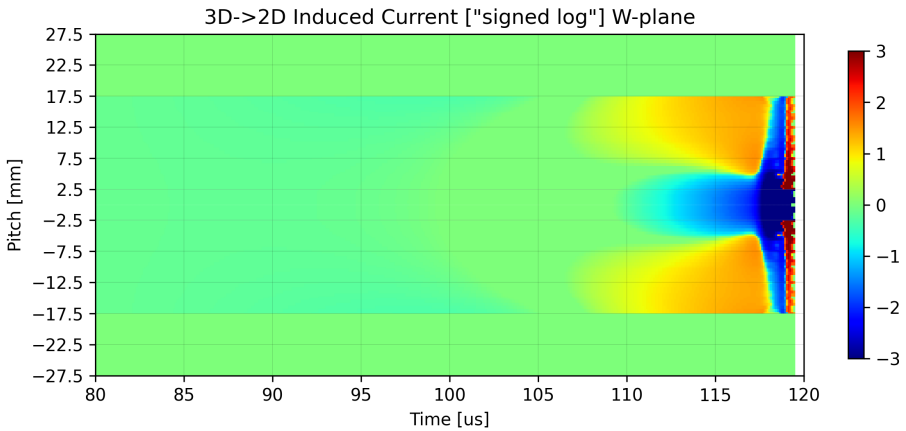
50-L 2-plane 3D → 2D responses (log10 wf)

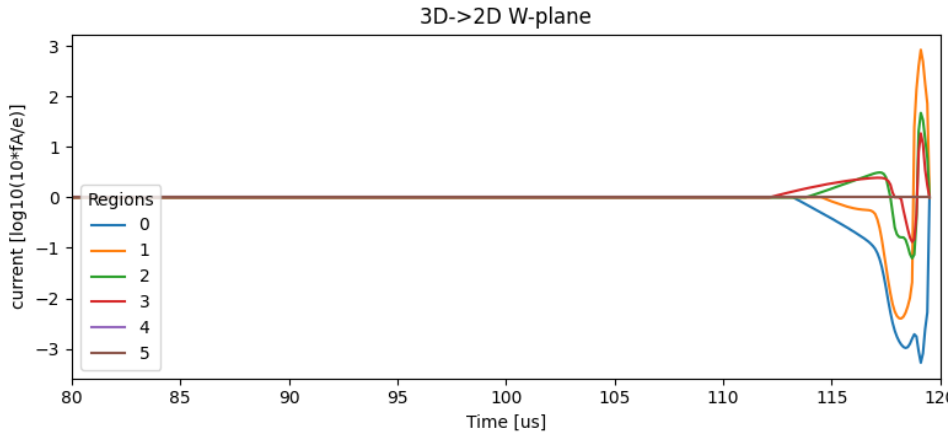




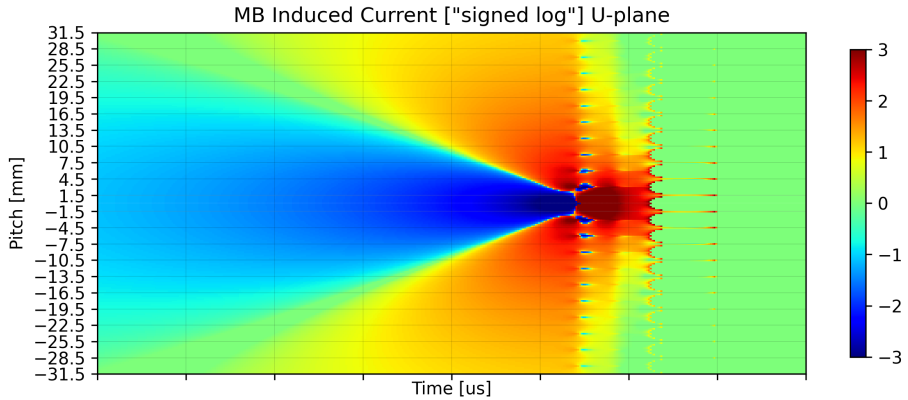


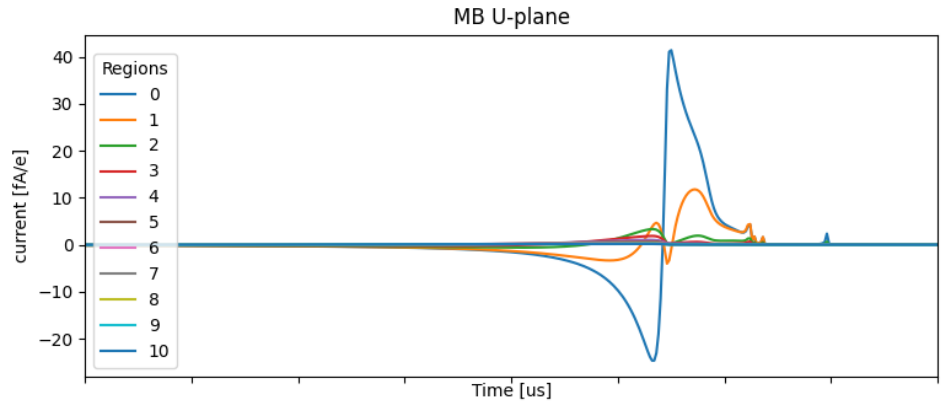


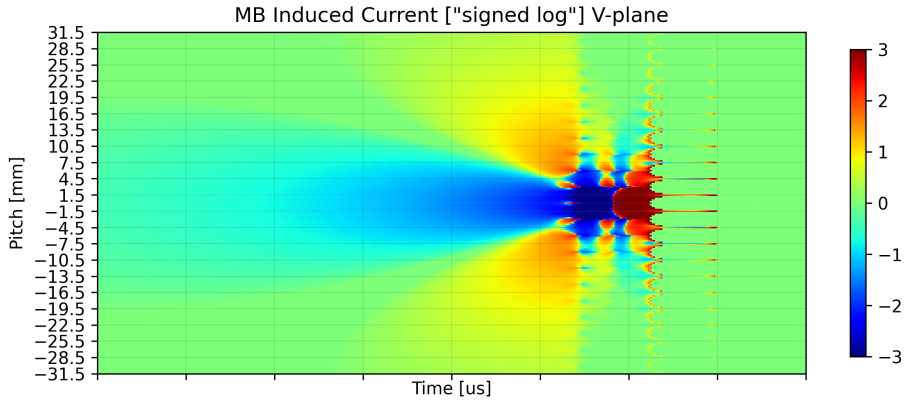


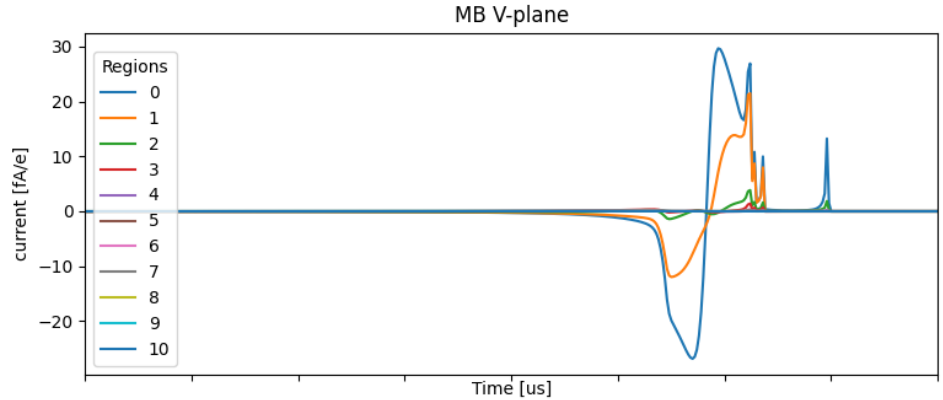


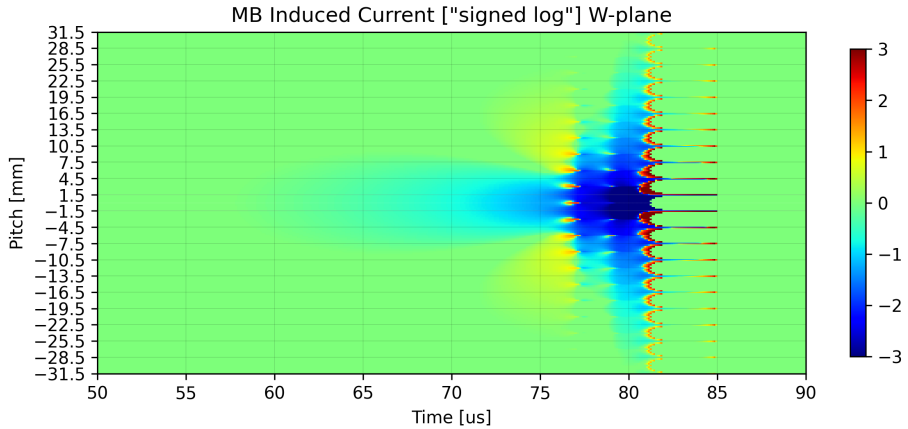
MicroBooNE 3-plane responses

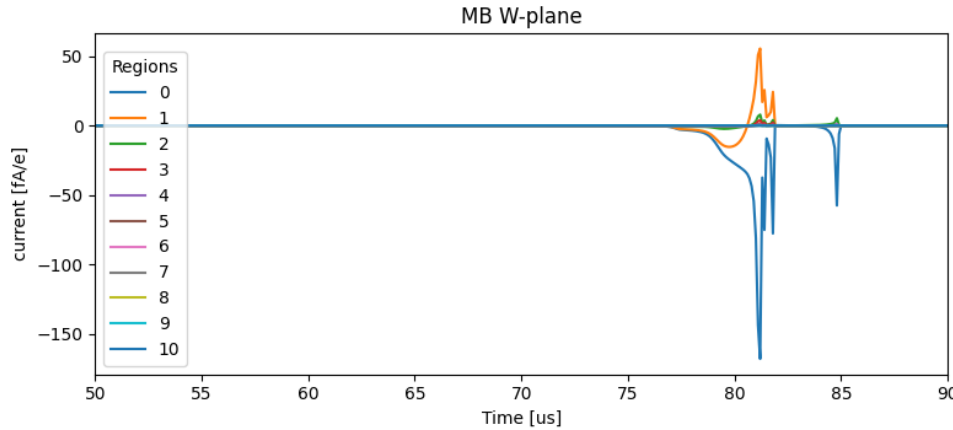




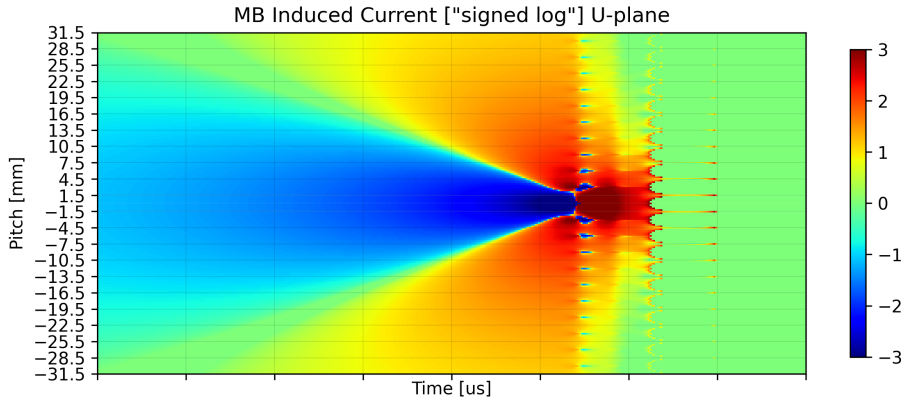


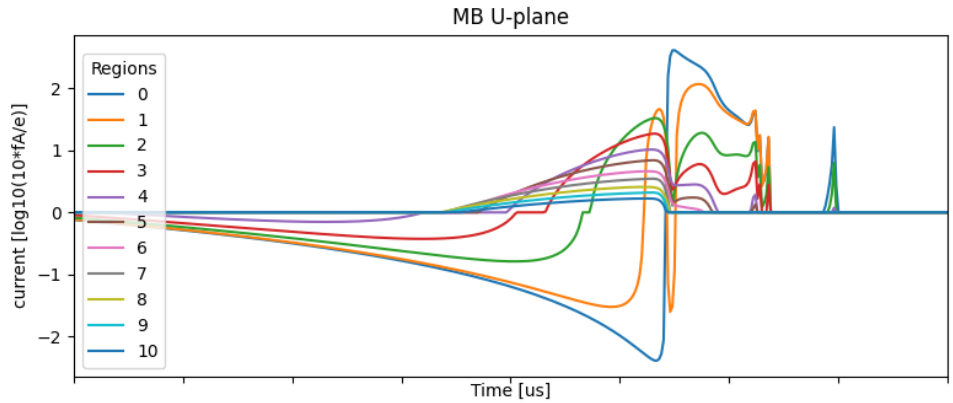


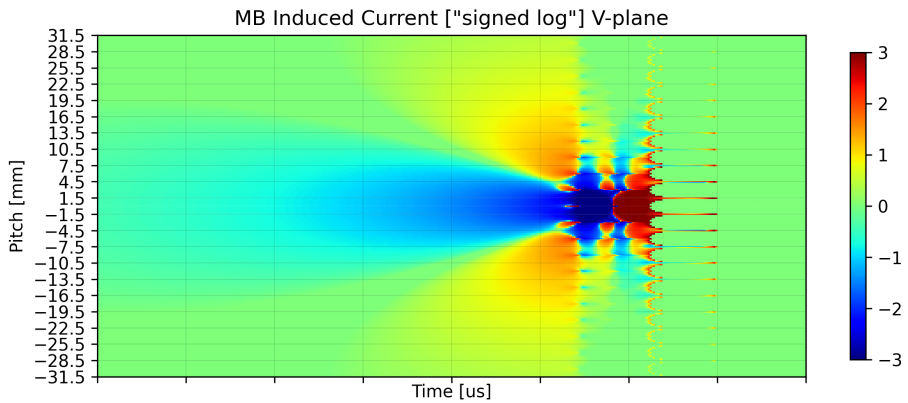


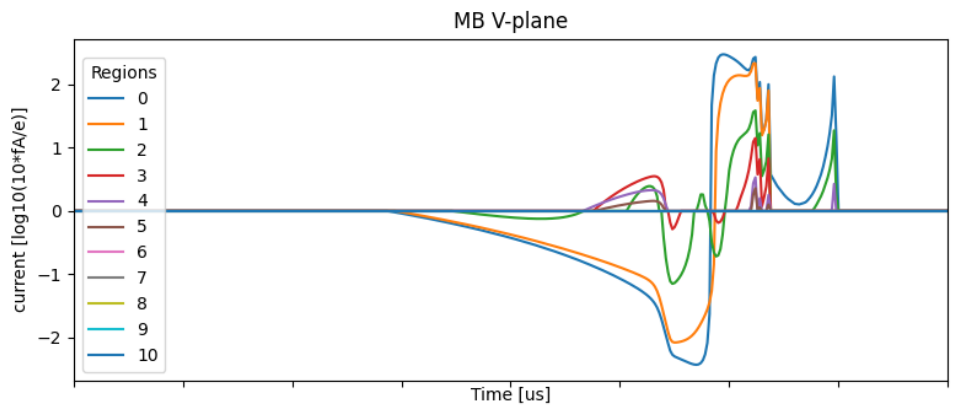


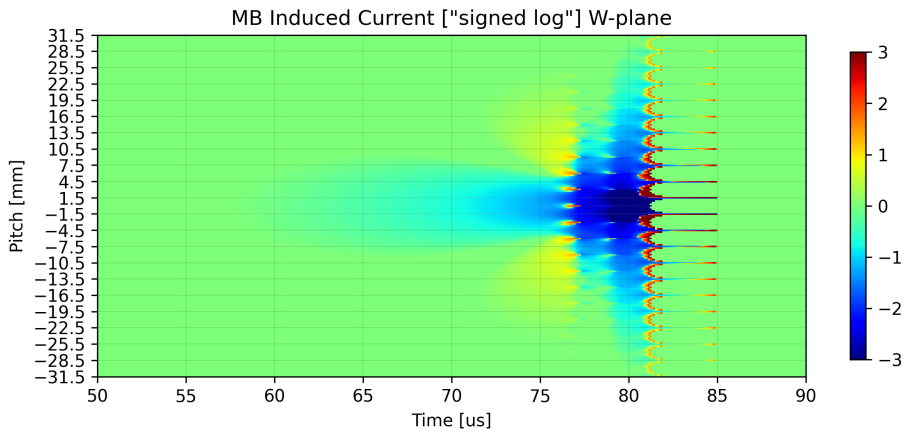
MicroBooNE 3-plane responses (log10 wf)

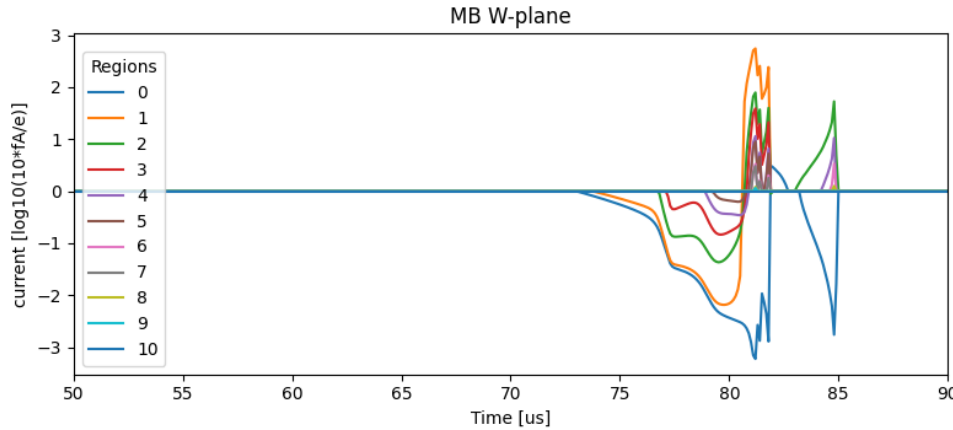








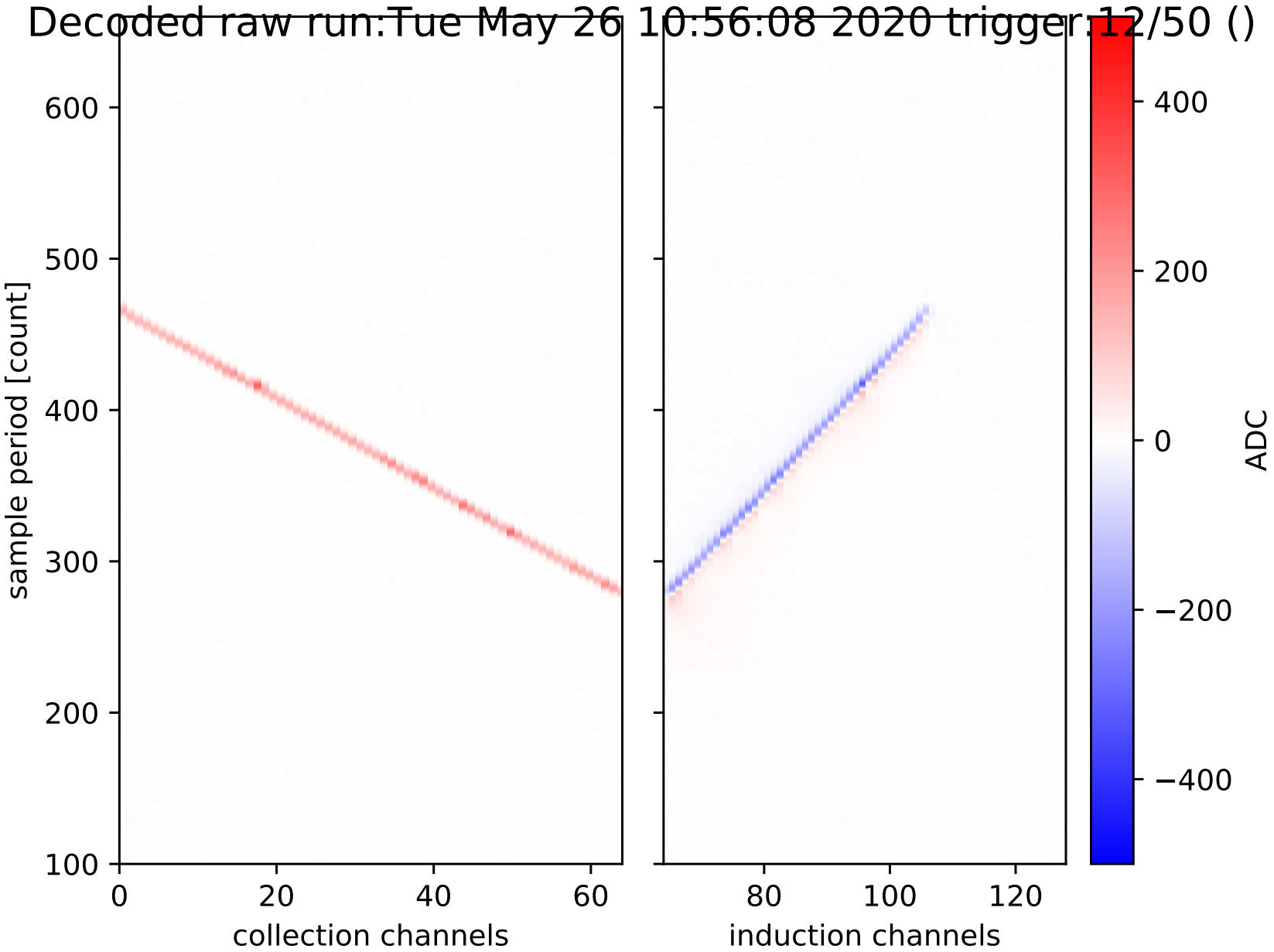




Discussion

- 3D $\rightarrow$ 2D much smoother and "natural looking" than 2.5D trick.
- Early, induction-like lobe seen in 3D $\rightarrow$ 2D and MB not in 2.5D
  - 2.5D "single hole + micro wire" leads to more centrally focused weighting field?

50-L data + PCBro decoding

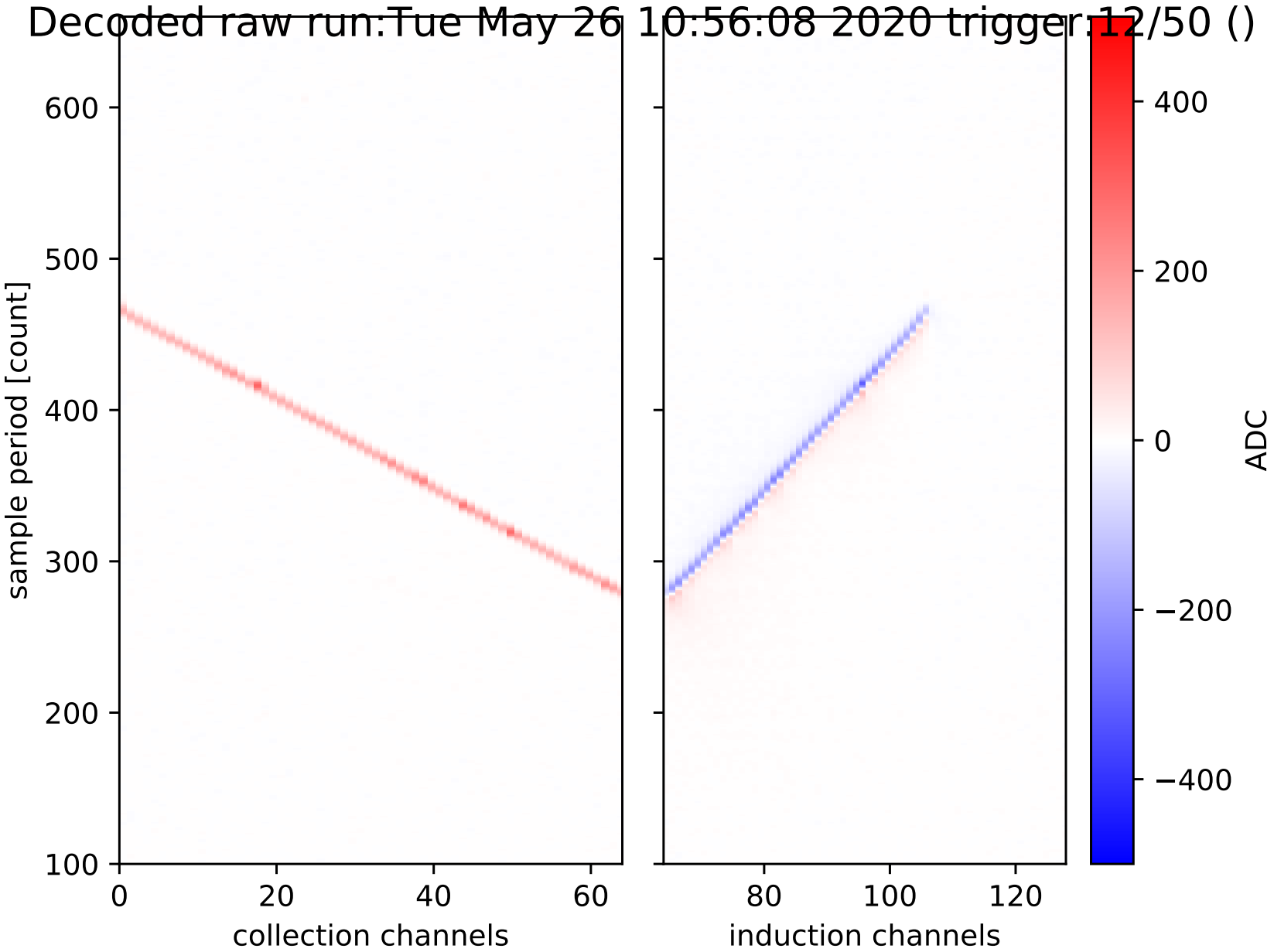


50-L data + 3D $\rightarrow$ 2D fields + WCT signal processing

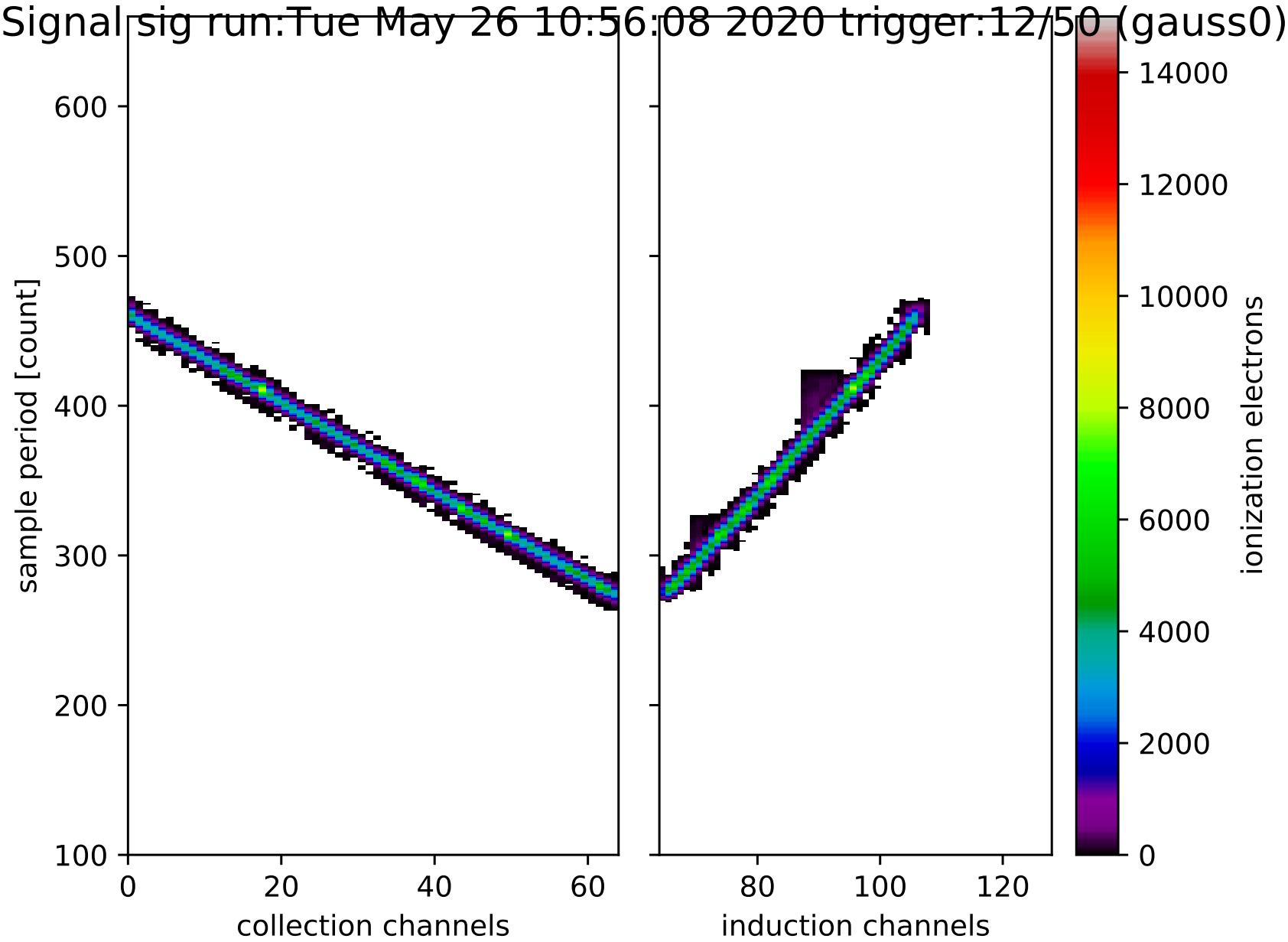
Notes on next plots:

- Raw colors clamped at ± 500 ADC
- MIP signal $\approx$ 5000 ionization electron.
- If looks blurry, turn off PDF viewer anti-aliasing
- Signal color scale chosen to enhance lower variations.
  - mid color at 1 MIP, max at 3 MIP.

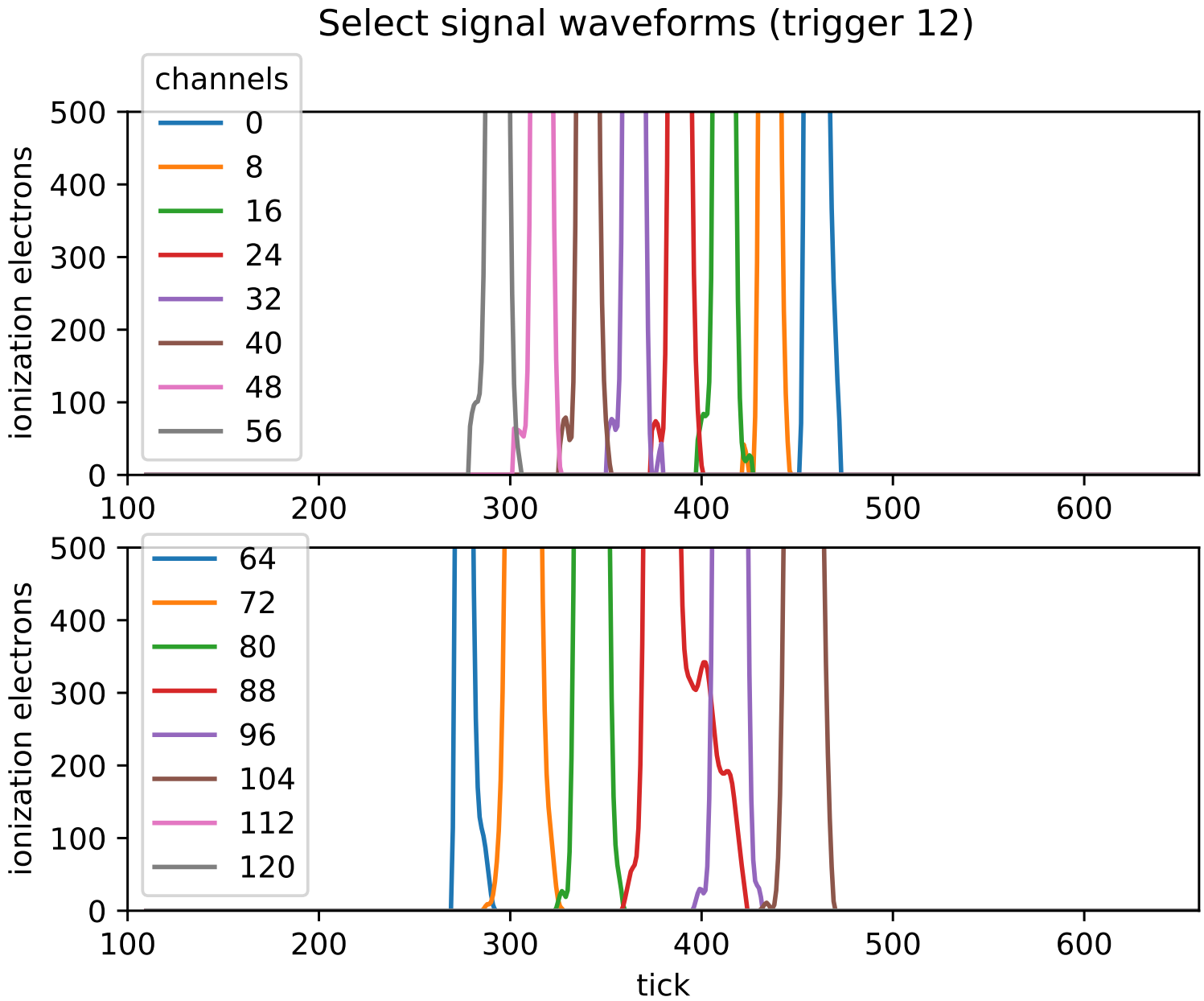
Raw ADC (159048336841-12)



Signal (159048336841-12)



Waveforms foothills (159048336841-12)

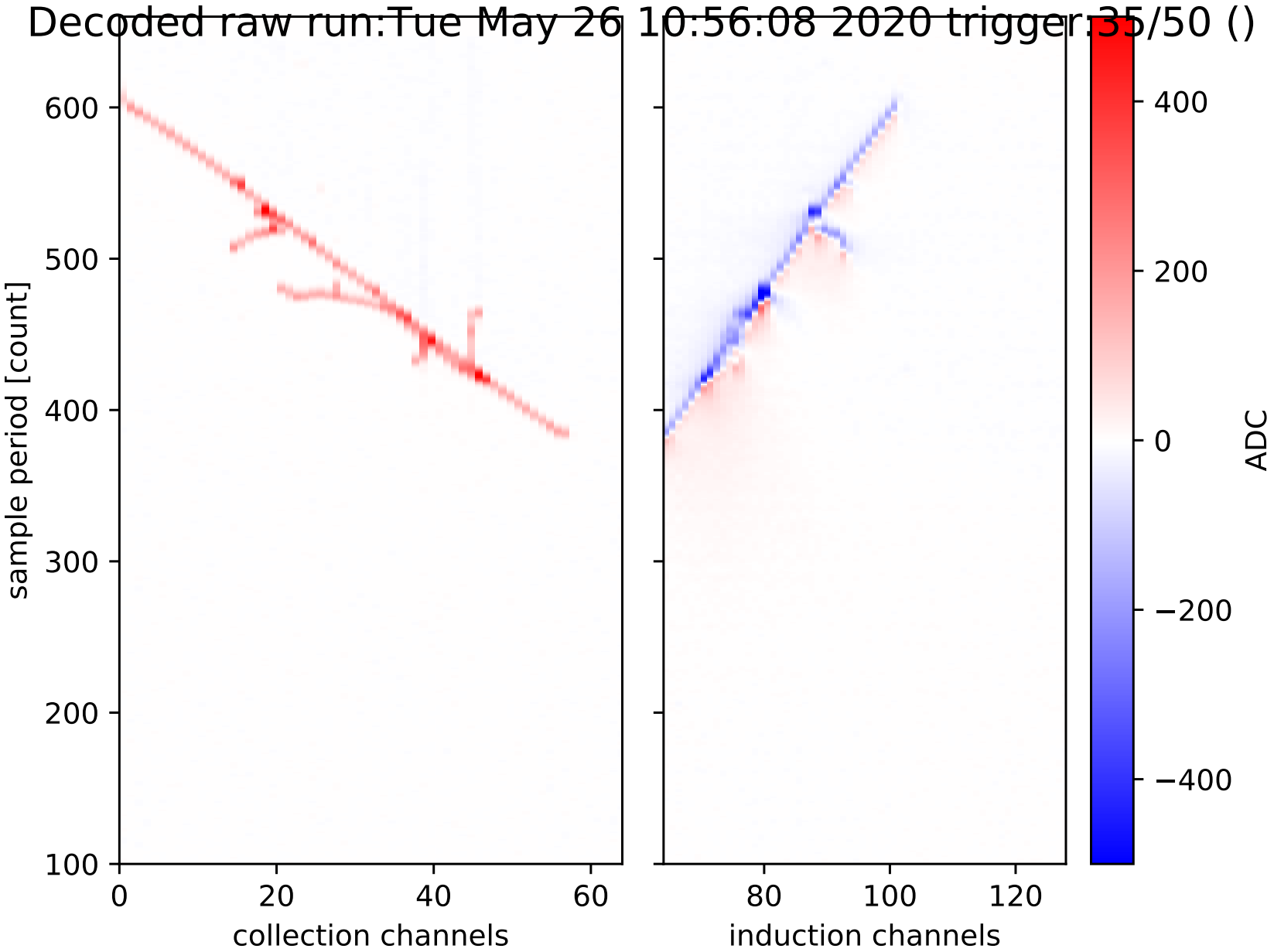


Possible issues

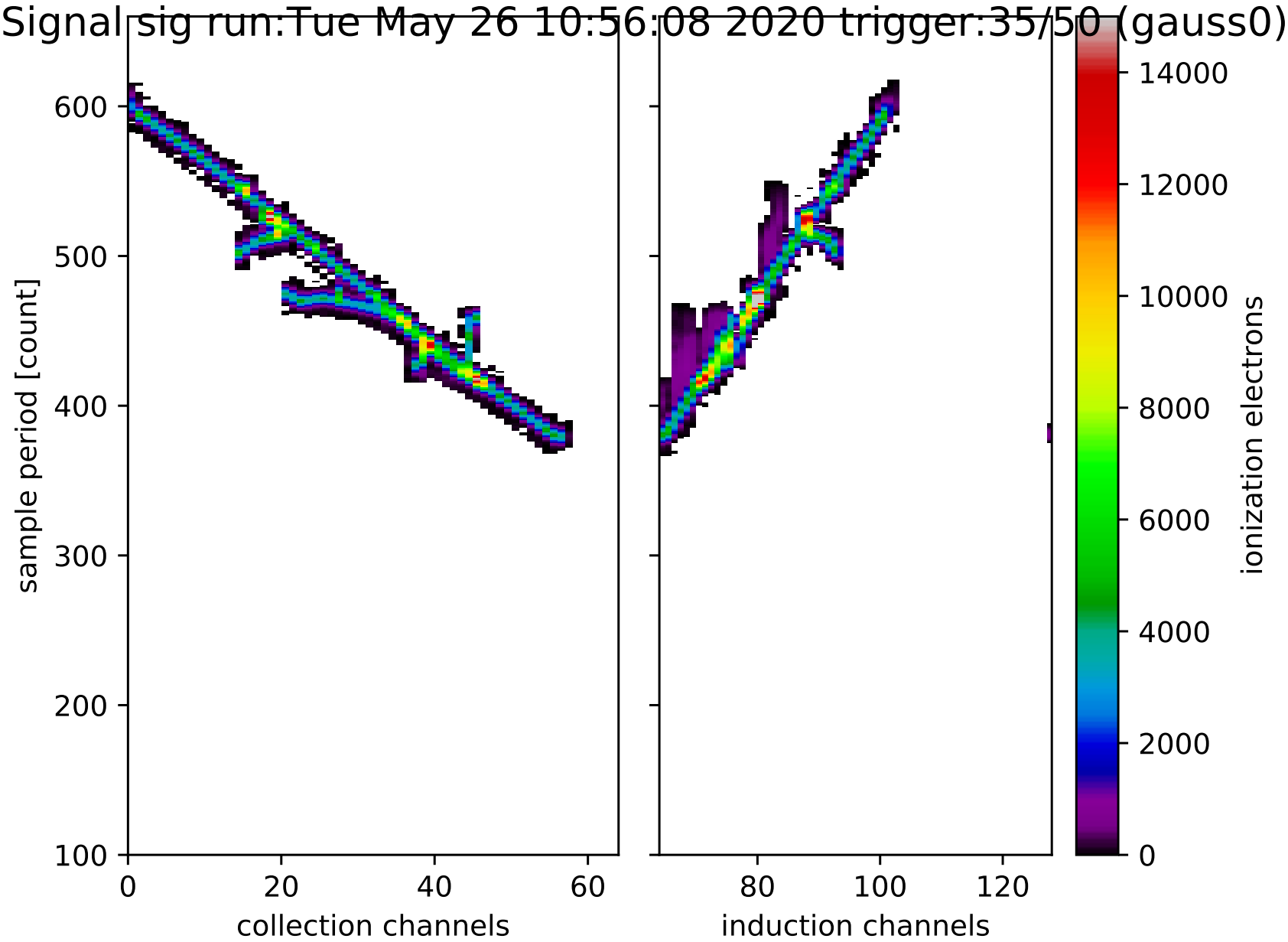
Generally very good deconvolution results.

- A large "tear drop" of low charge (4-6% MIP) seen in some induction plane signals.
- A hint of low charge (2% MIP) "pre shadow" in some collection signals
- Some of induction plane inefficiency for low-signal near large shower

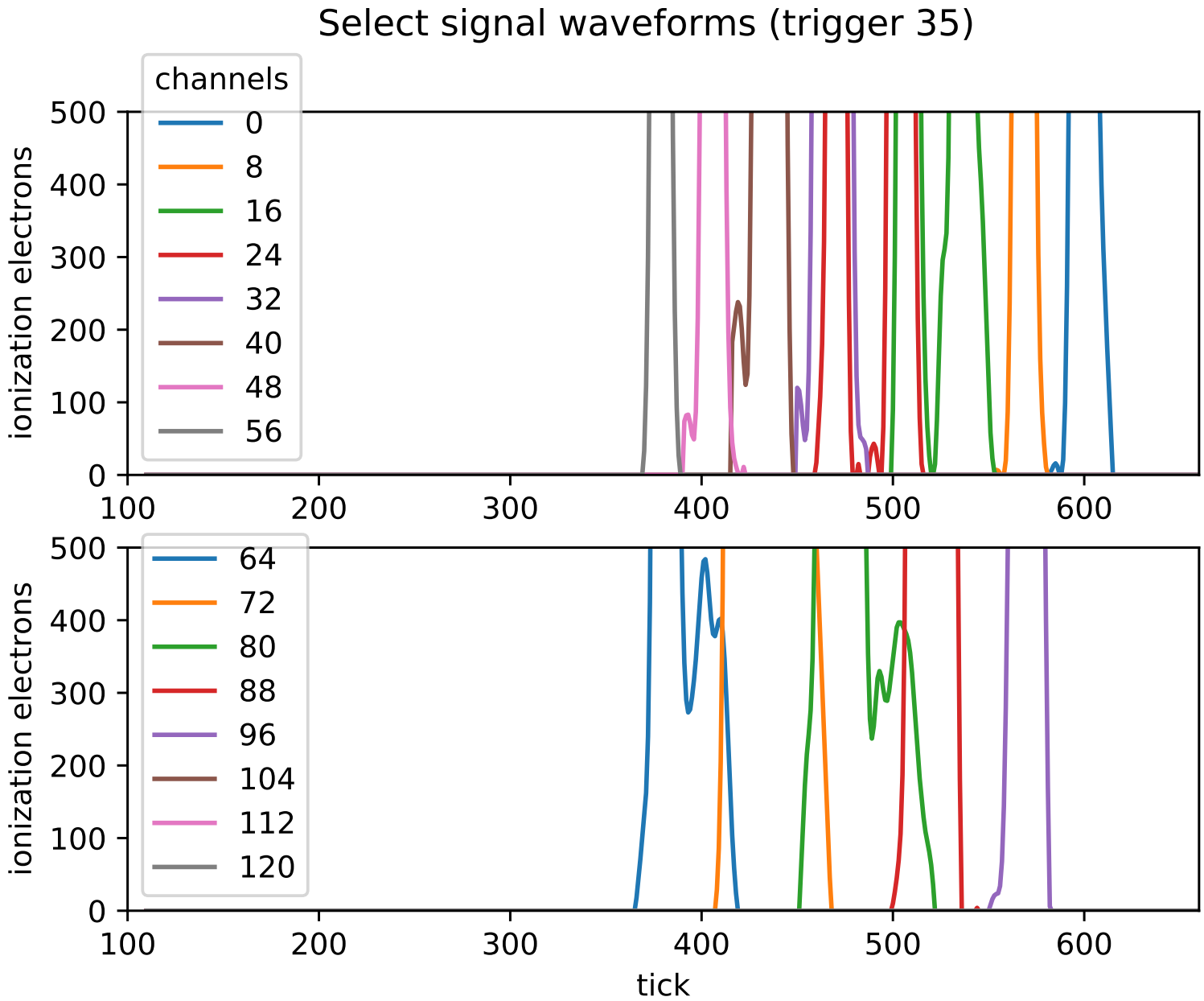
Raw ADC (159048336841-35)



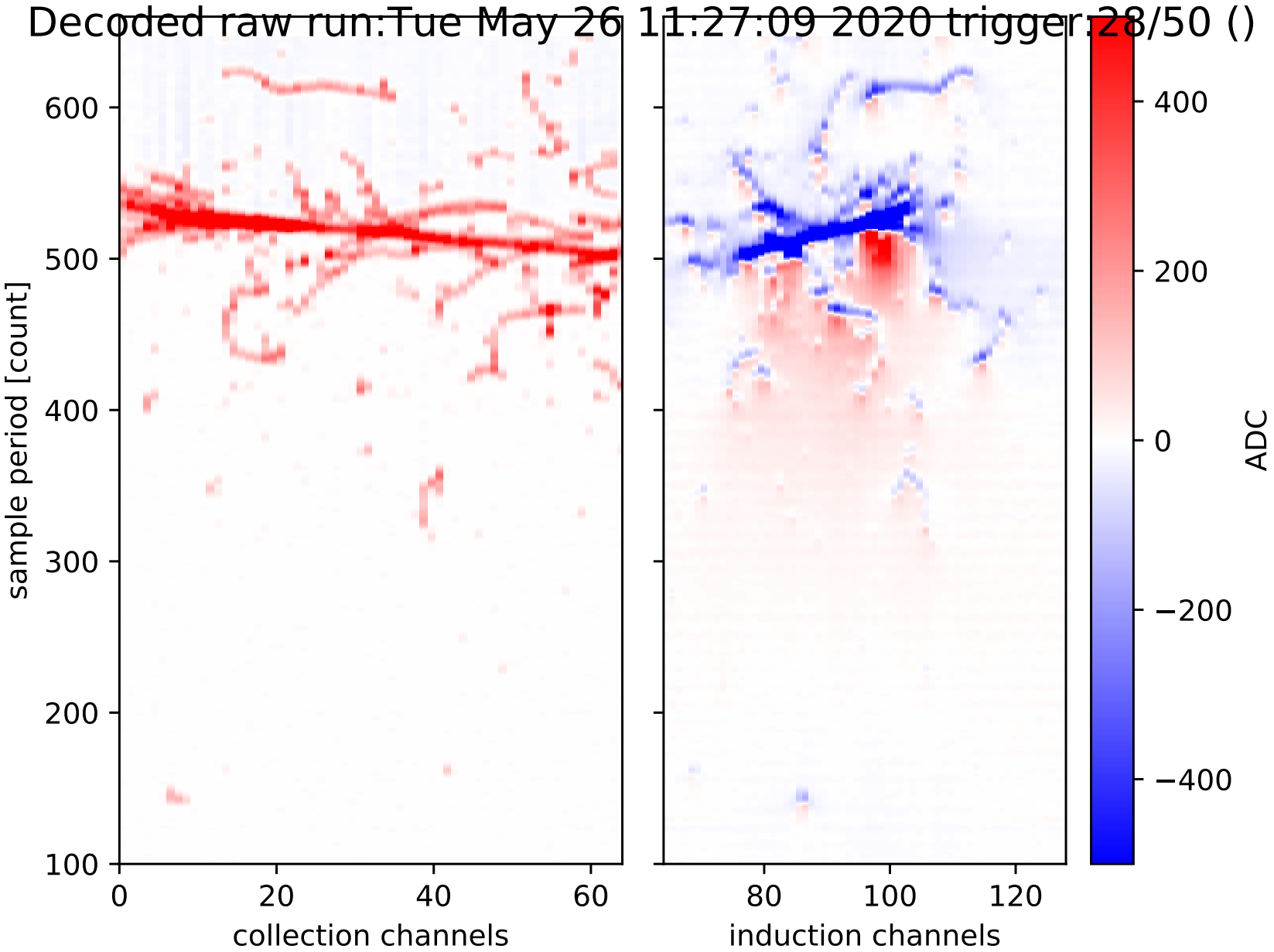
Signal (159048336841-35)



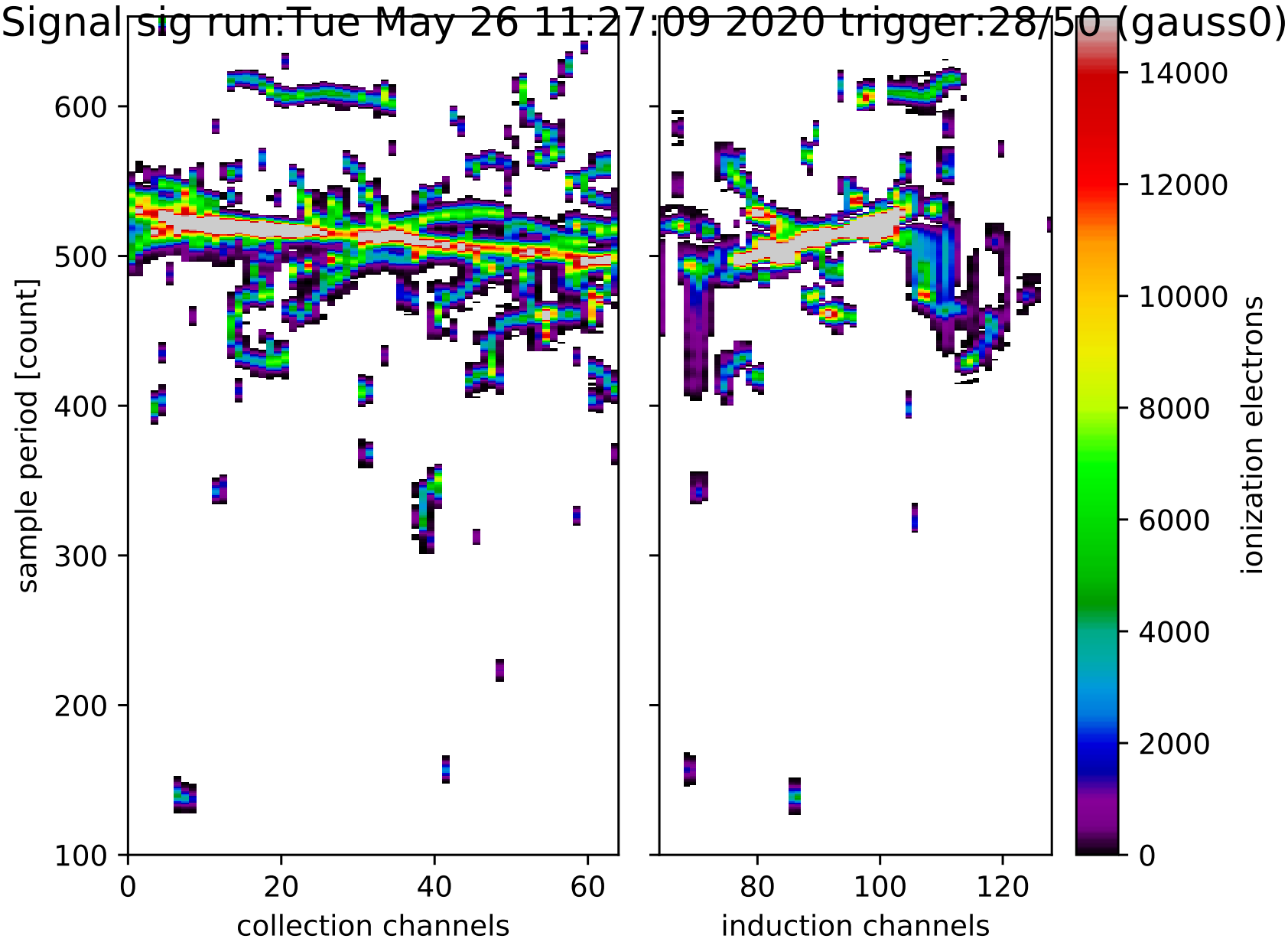
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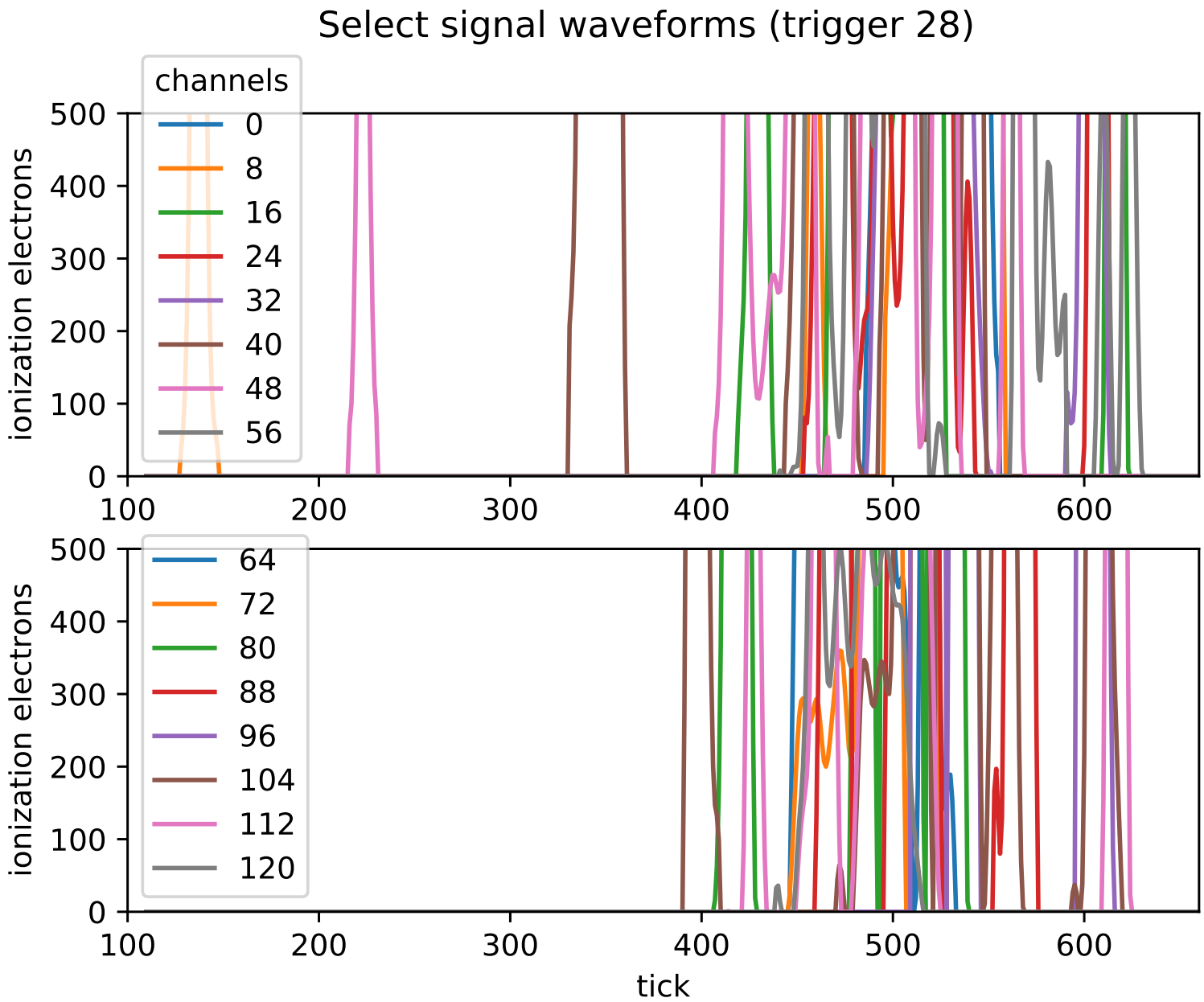
Raw ADC (159048522967-28)



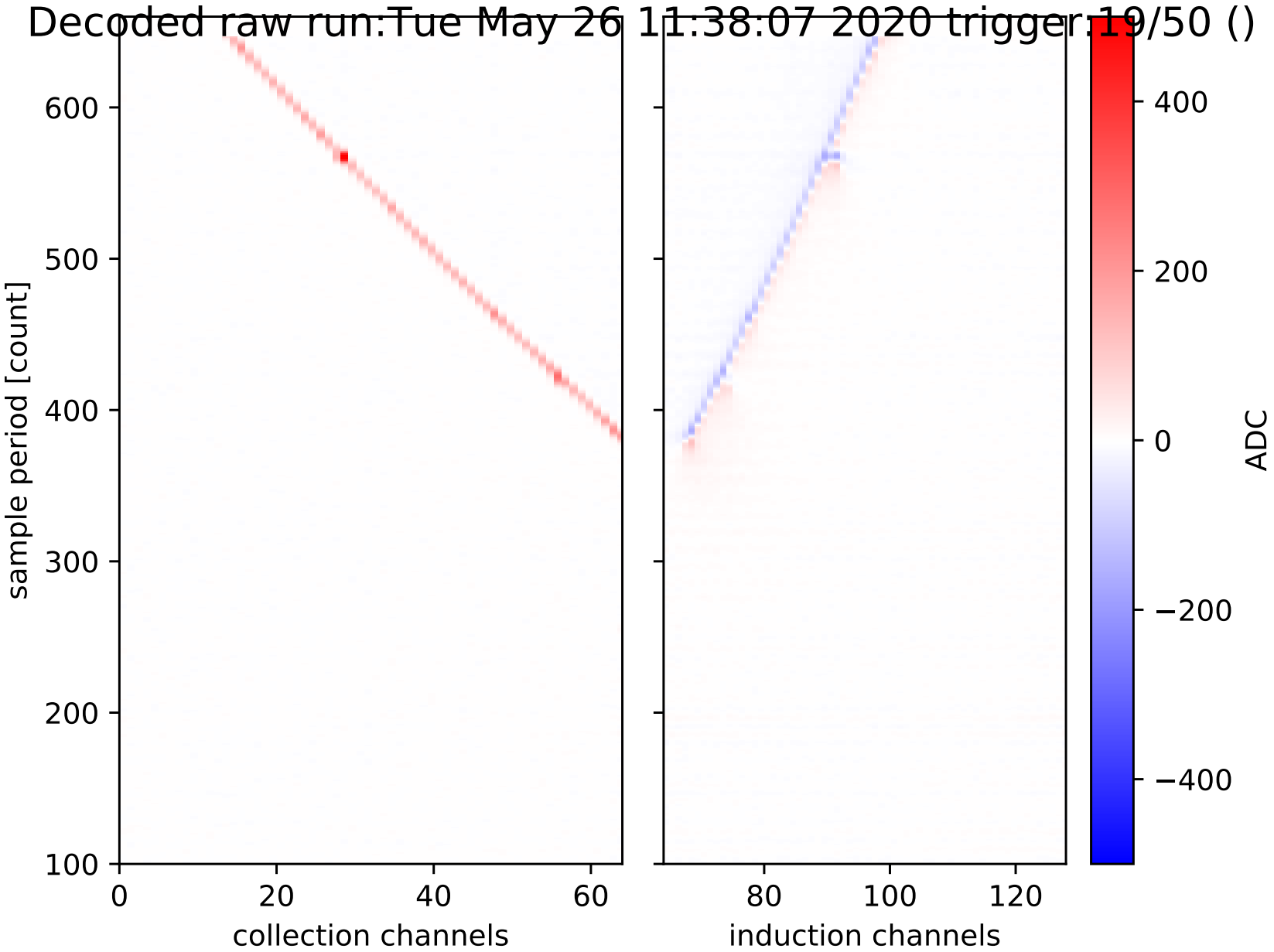
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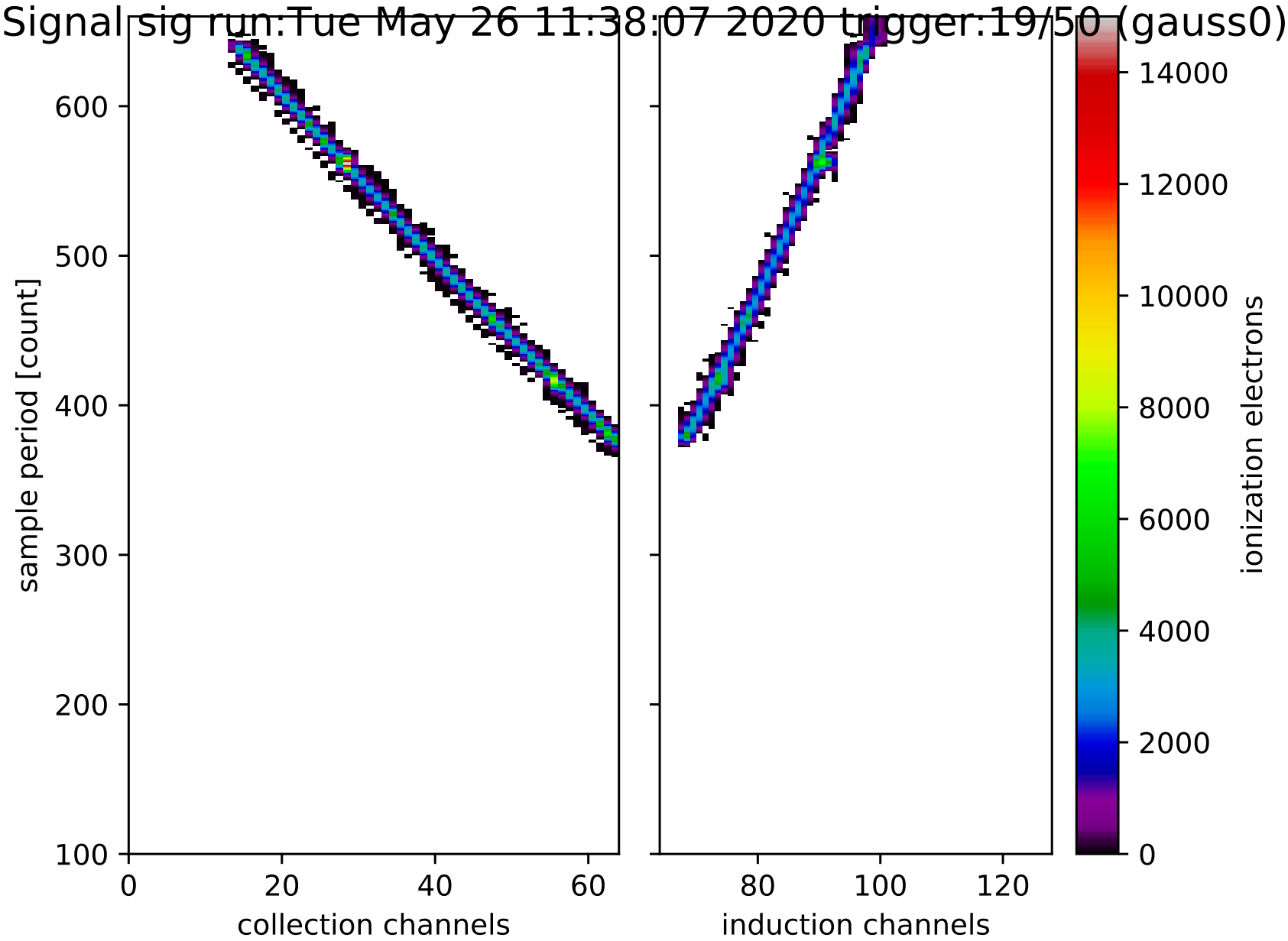
Waveforms foothills (159048522967-28)



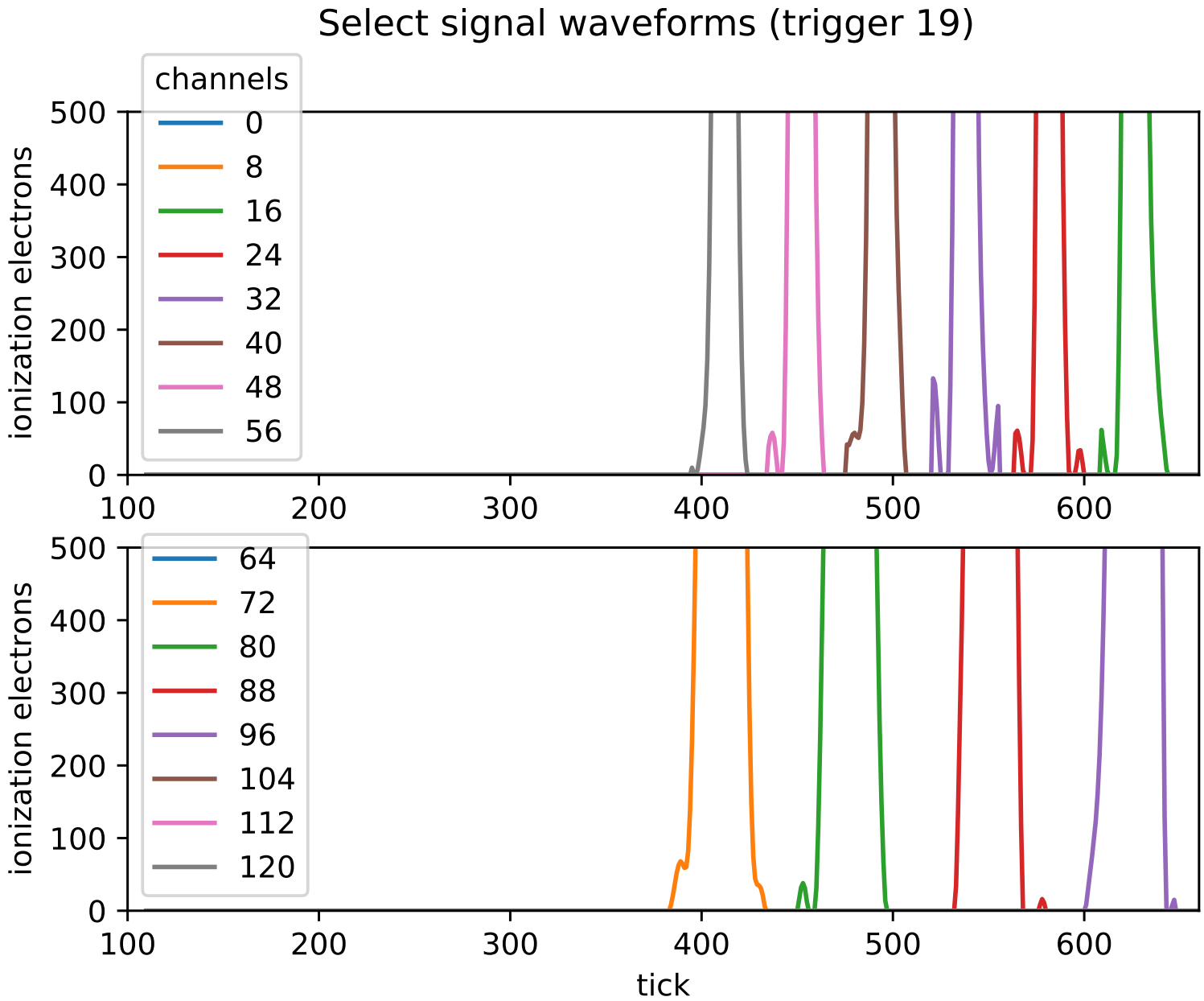
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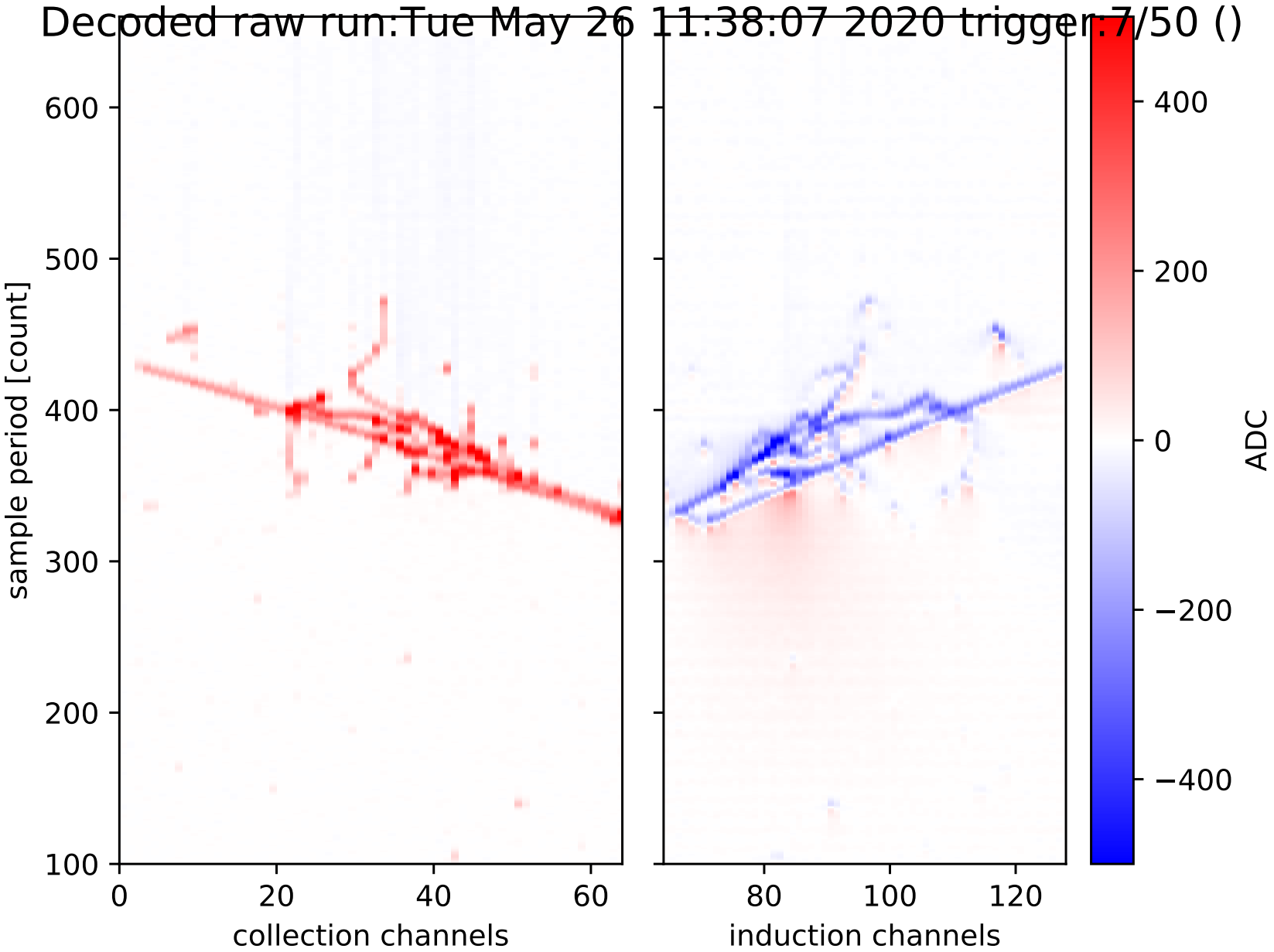
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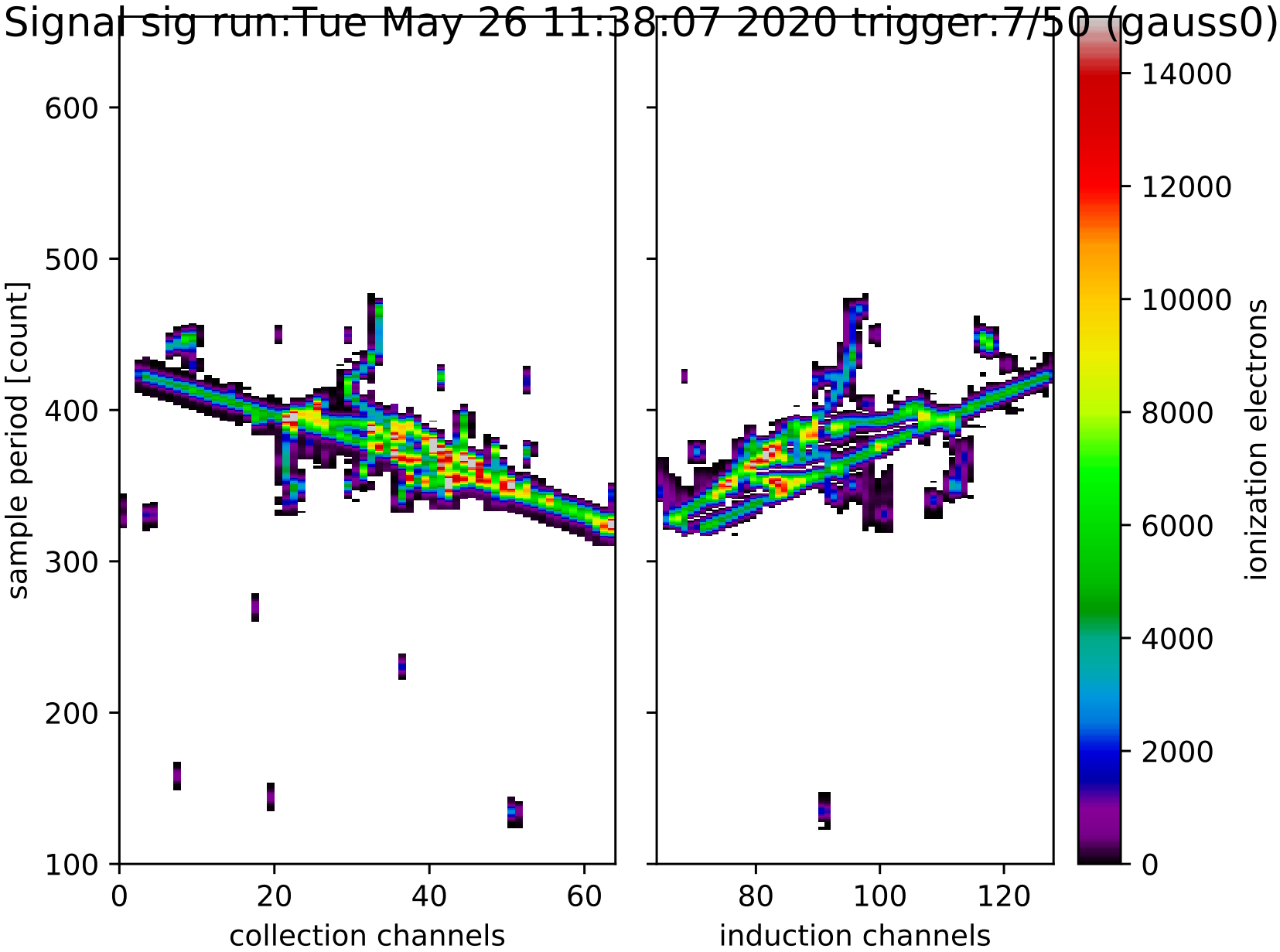
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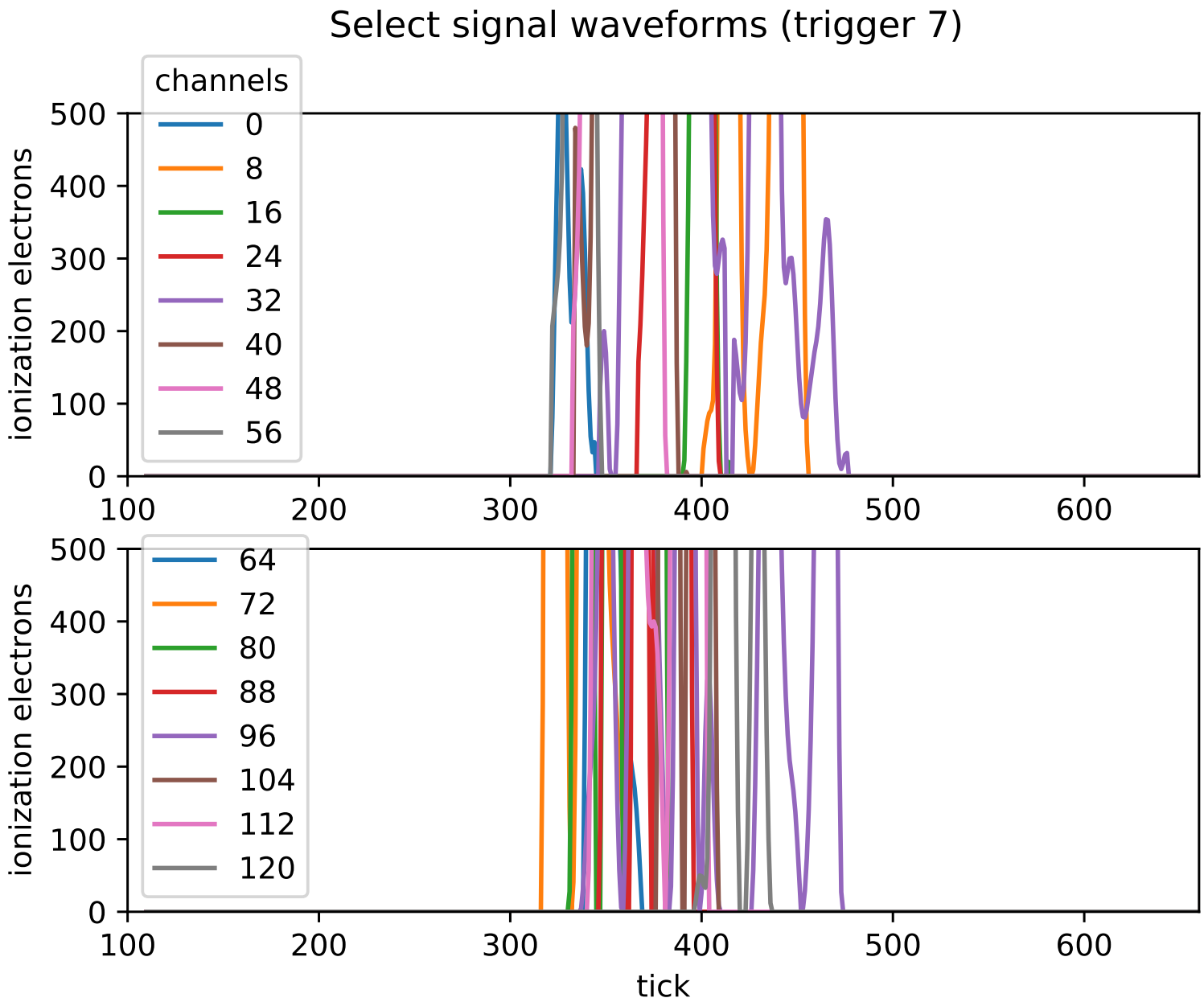
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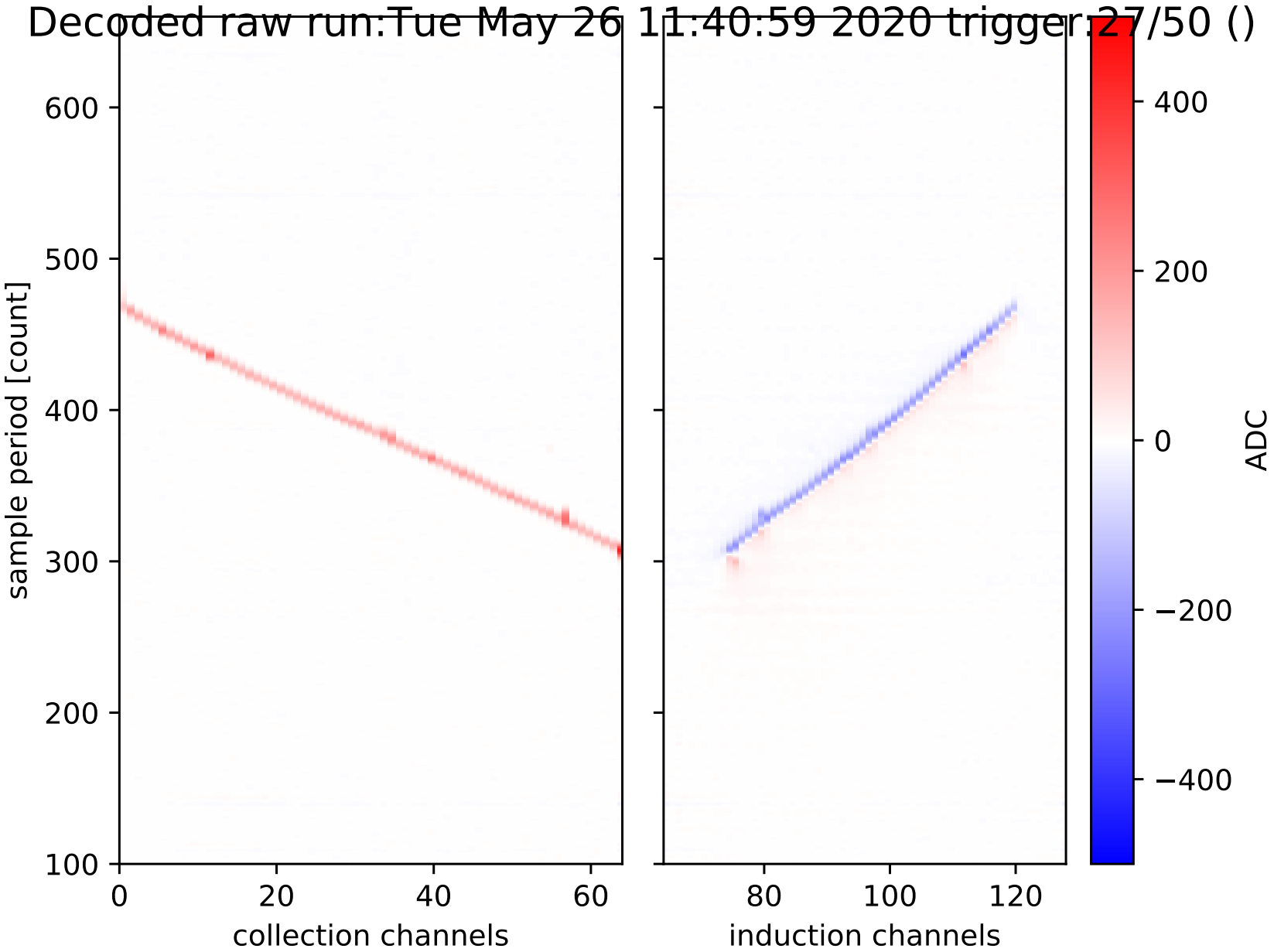
Signal (159048588724-7)



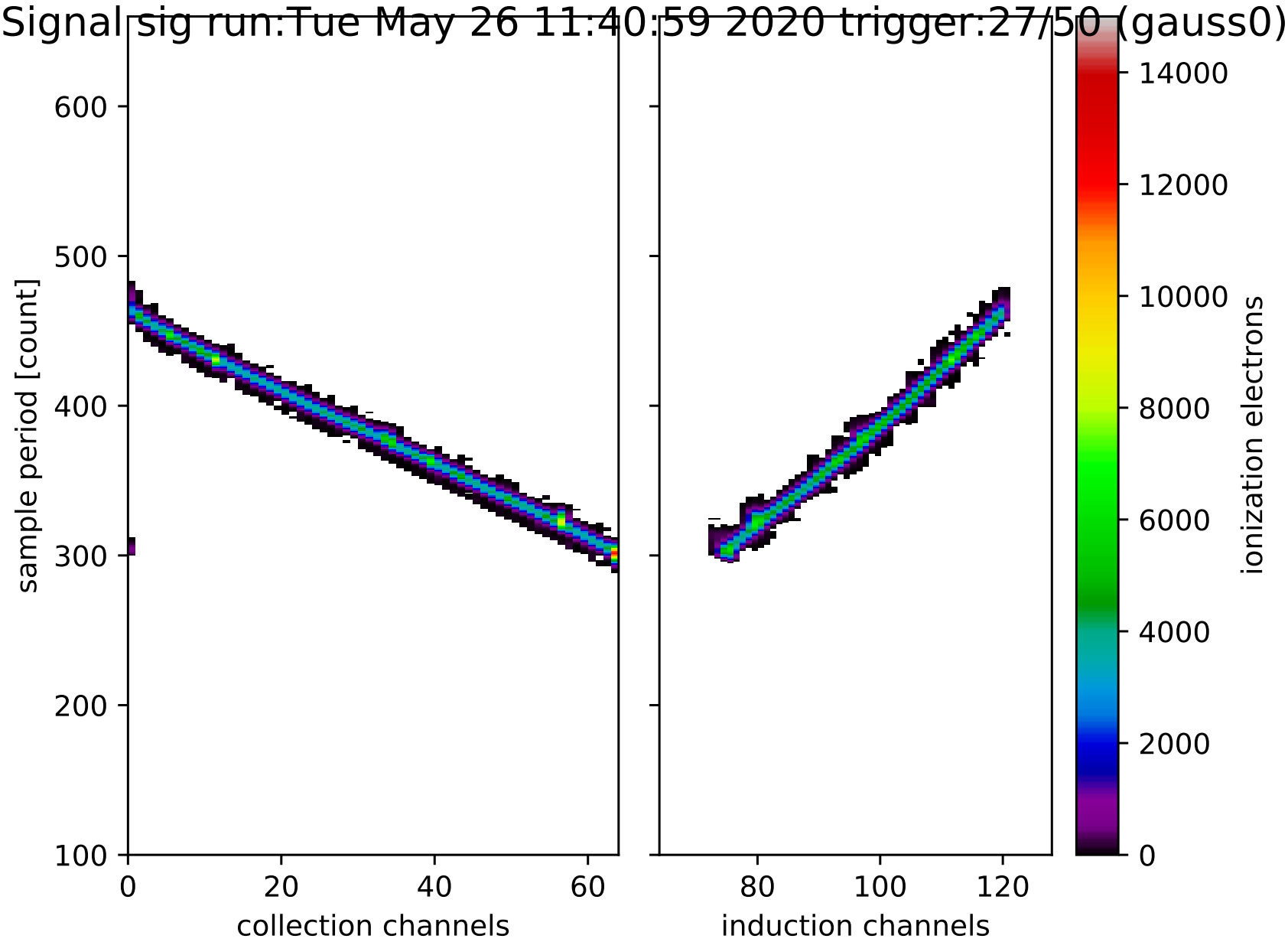
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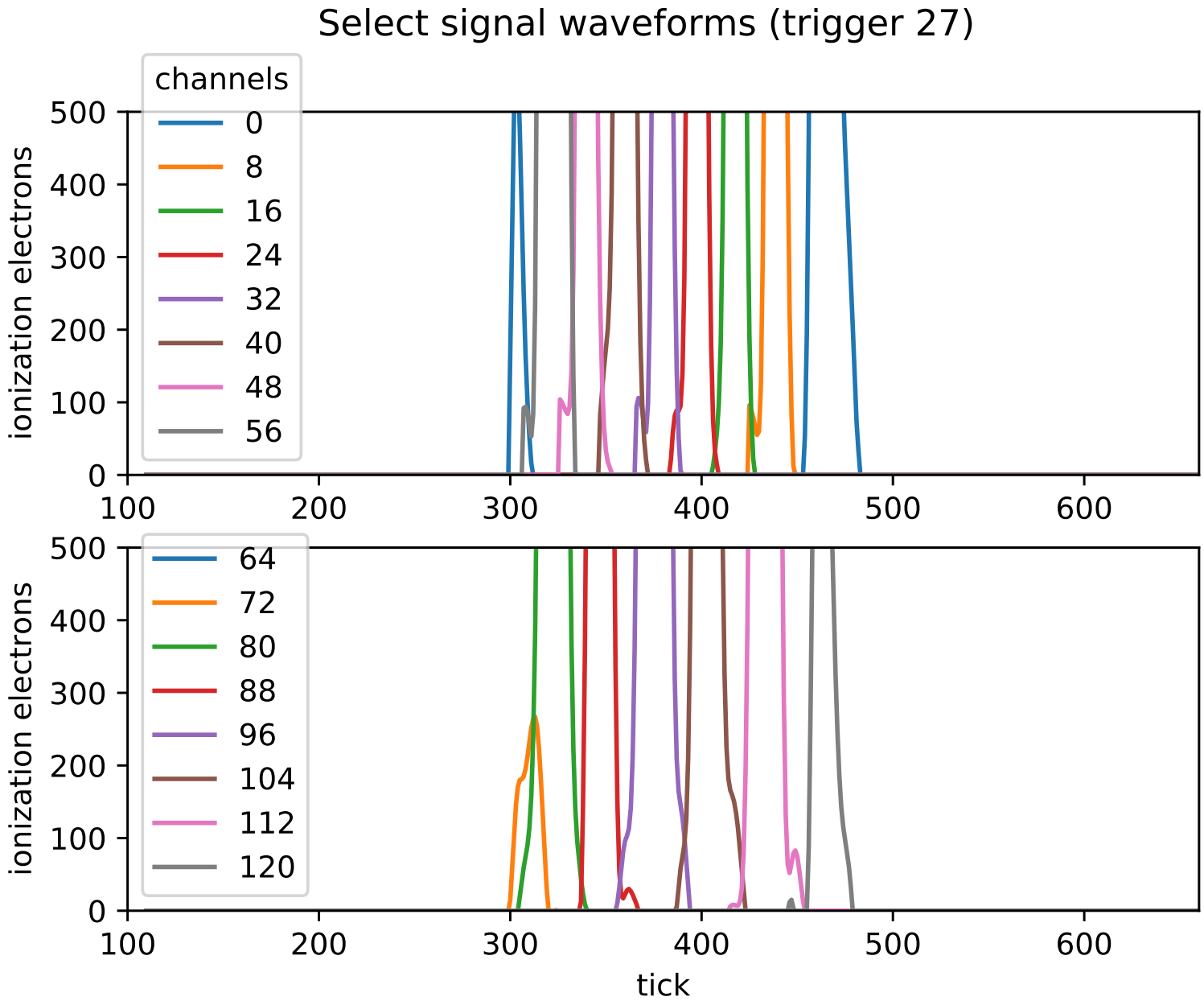
Raw ADC (159048605964-27)



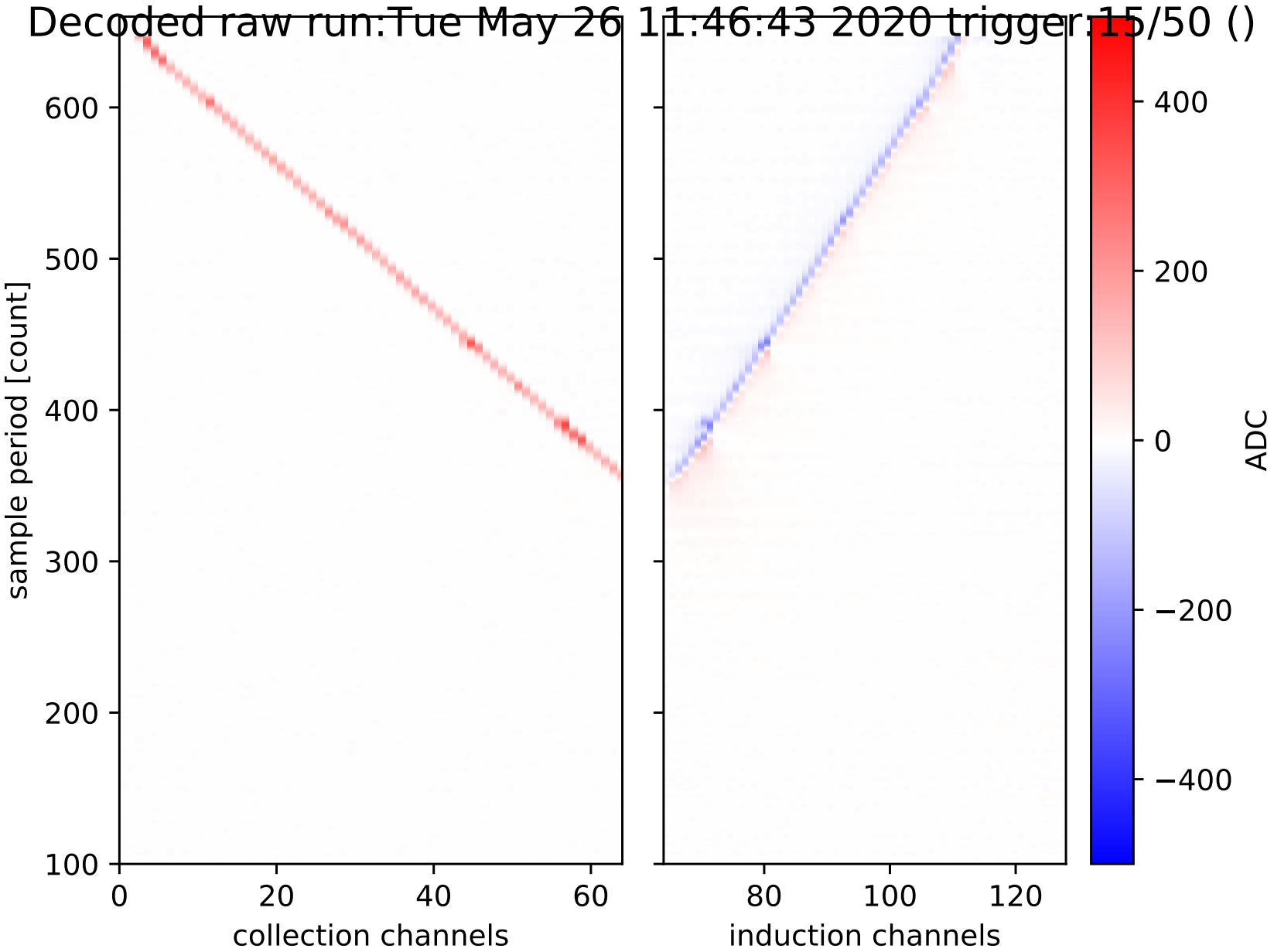
Signal (159048605964-27)



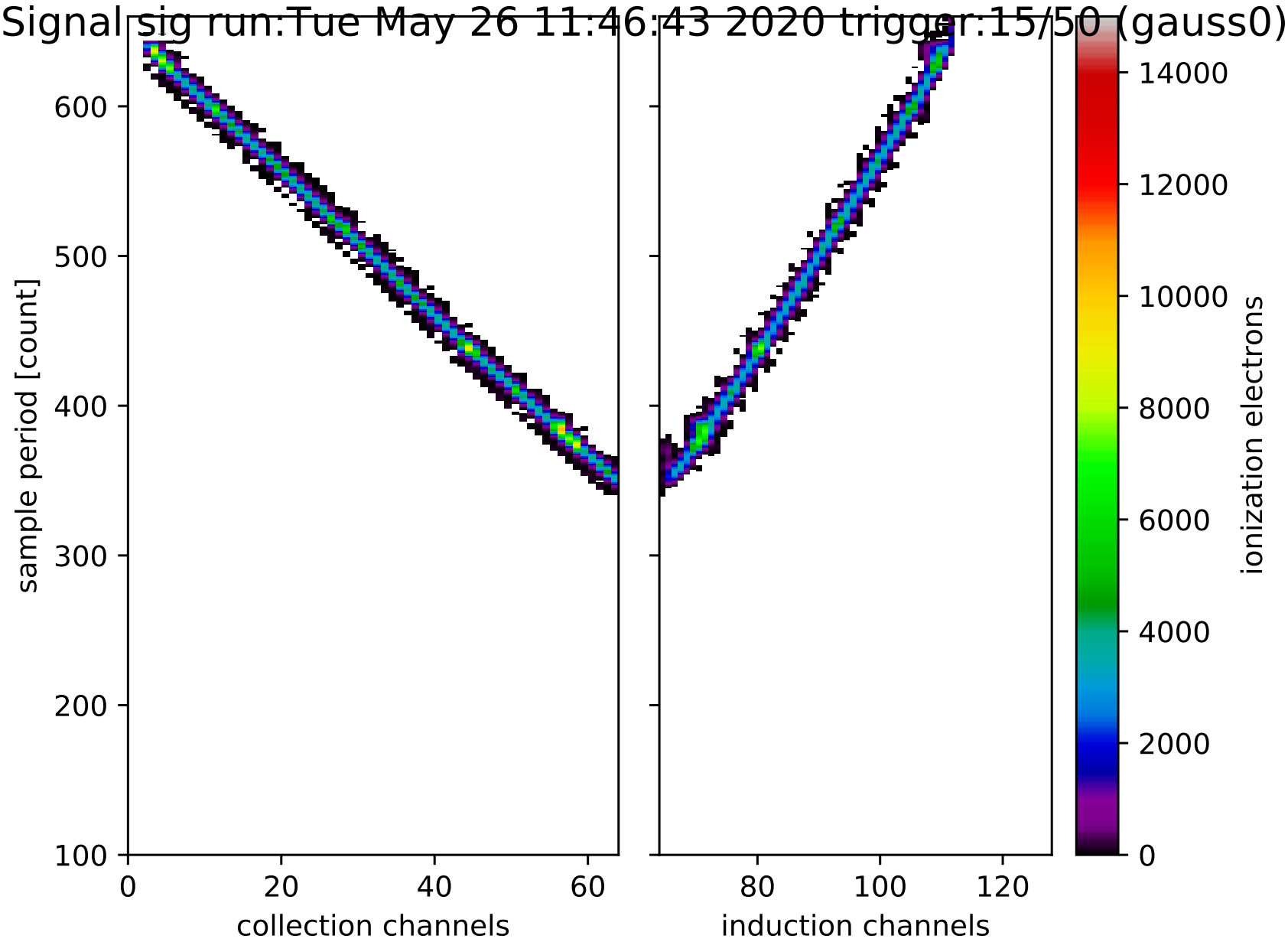
Waveforms foothills (159048605964-27)



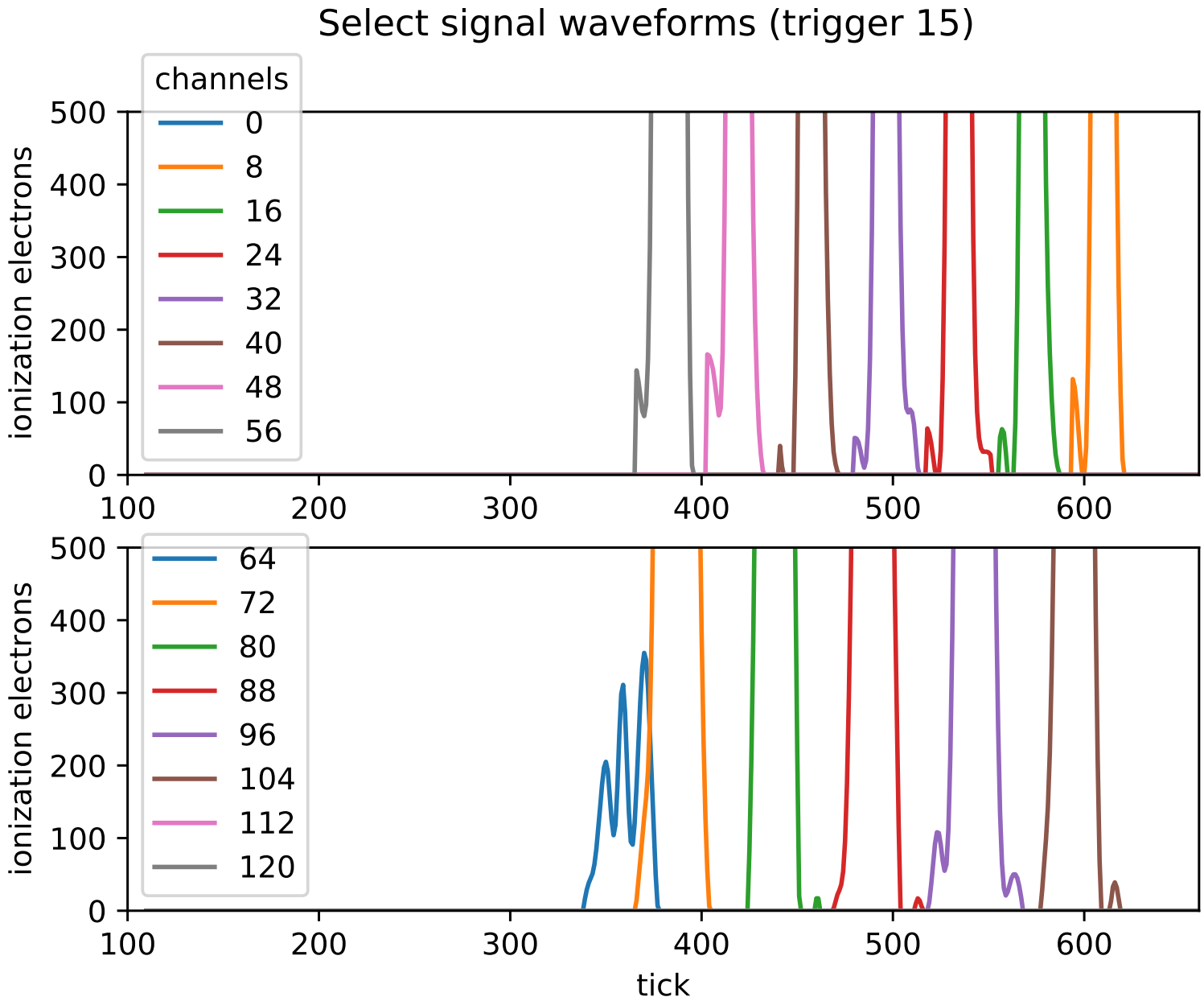
Raw ADC (159048640377-15)



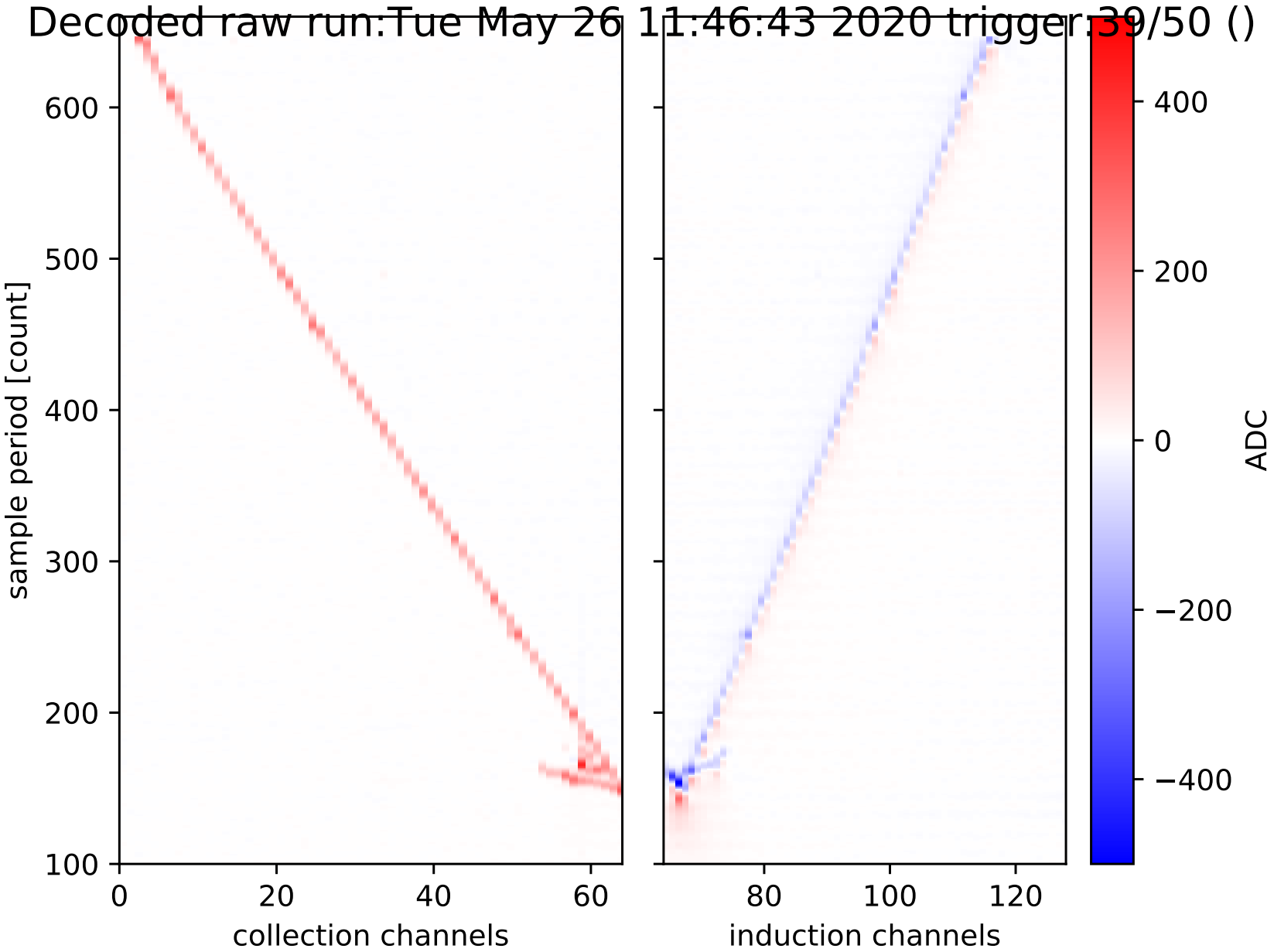
Signal (159048640377-15)



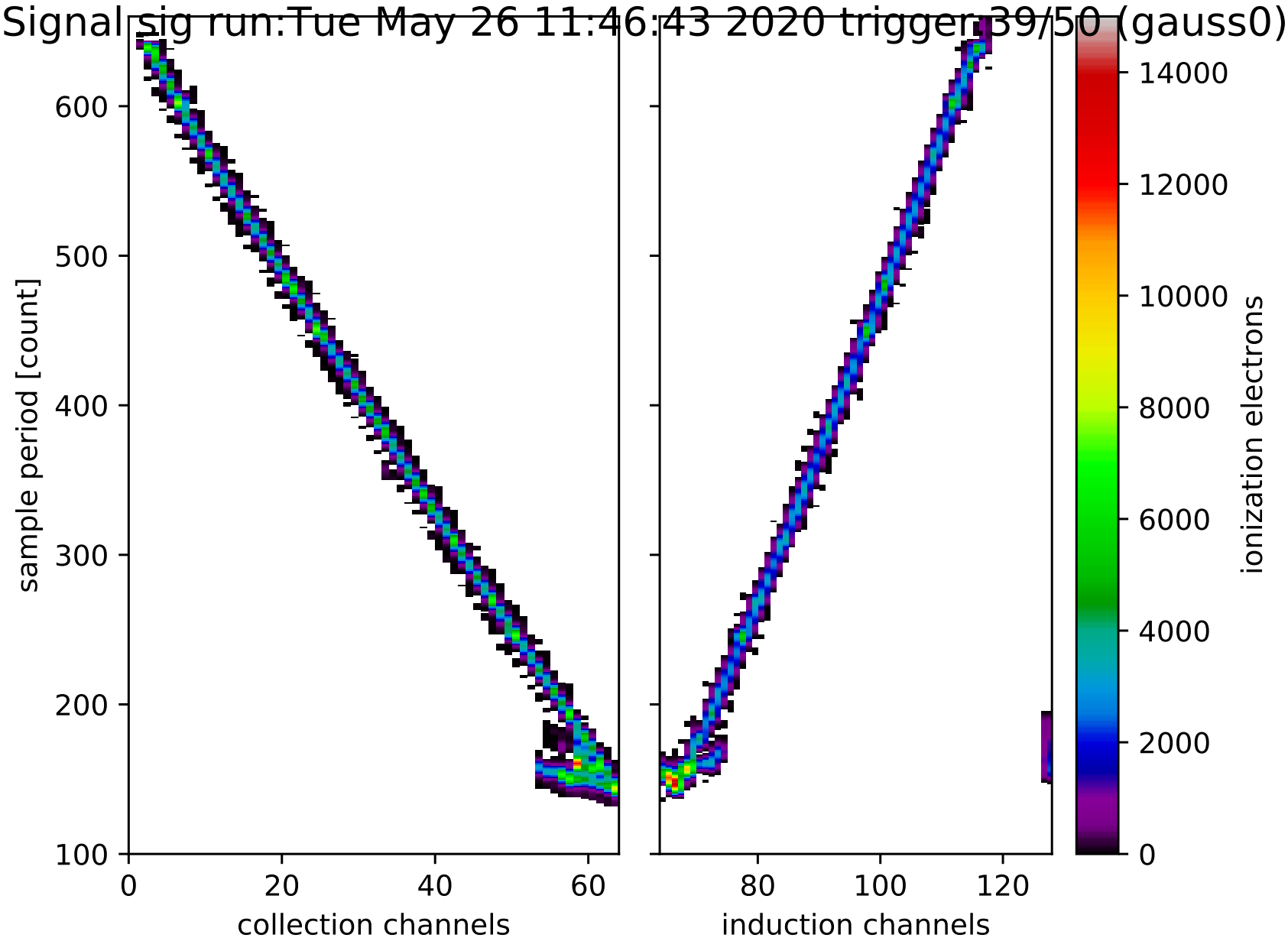
Waveforms foothills (159048640377-15)



Raw ADC (159048640377-39)



Signal (159048640377-39)



Waveforms foothills (159048640377-39)

