Field response check

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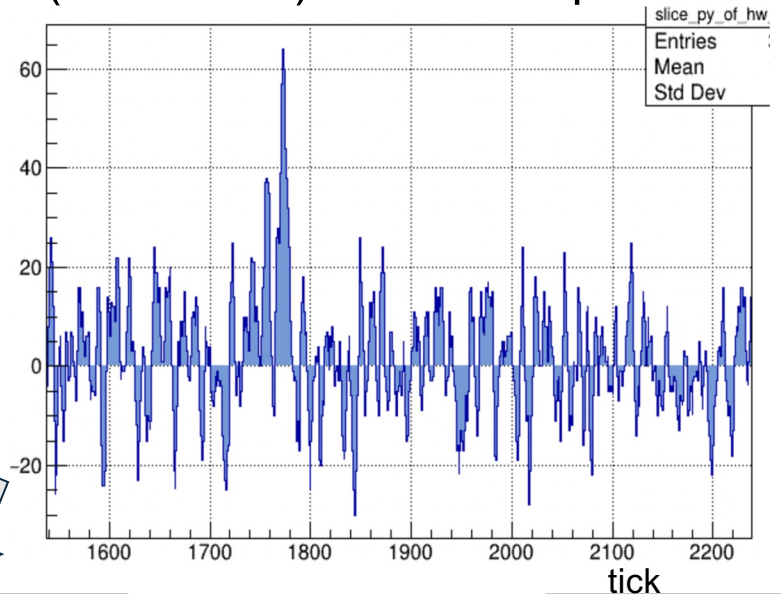
Wiener filter for APA1; w

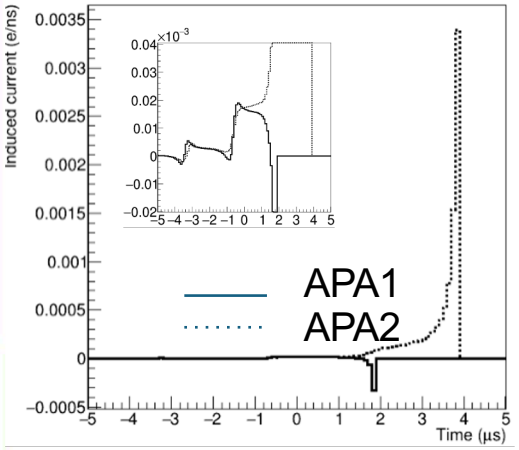
- Updated field response
- Induction feature introduces a different shape for power spectral density
  - **Need more calibration studies**

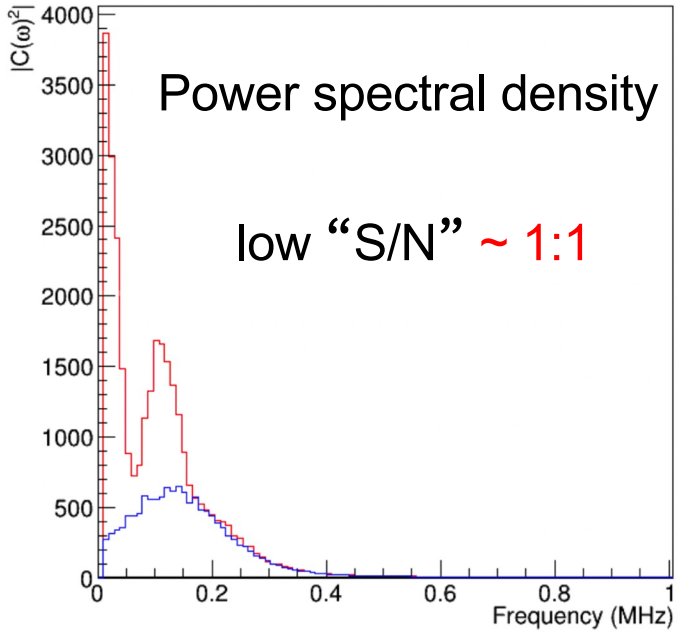
(Simulation) APA 1 – W plane



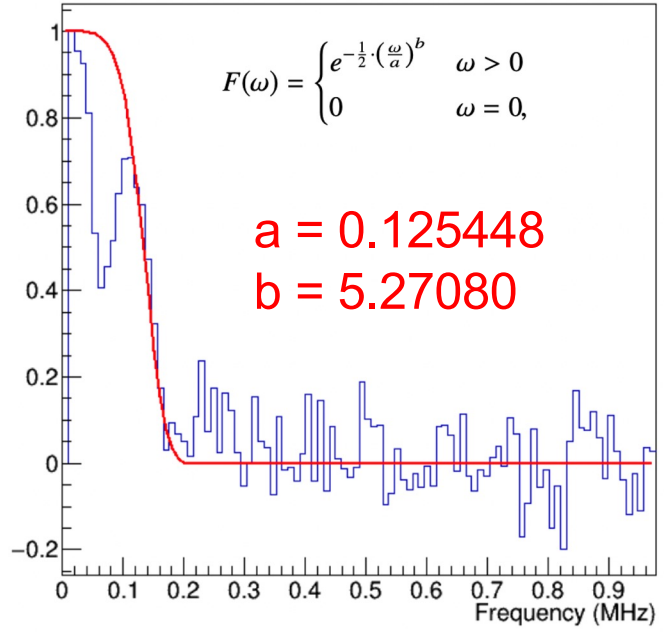
DFT

W plane; field response





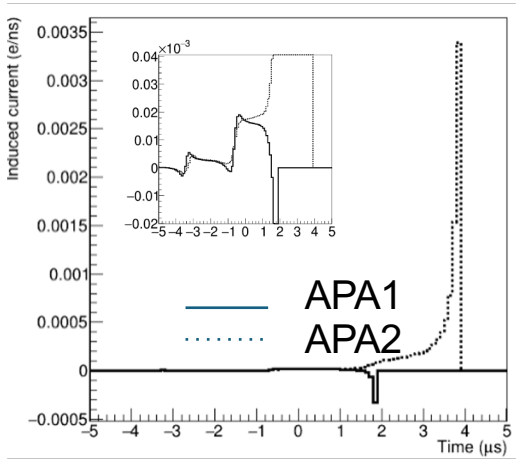
$$\frac{|M(\omega)|^2 - |N(\omega)|^2}{|M(\omega)|^2}$$

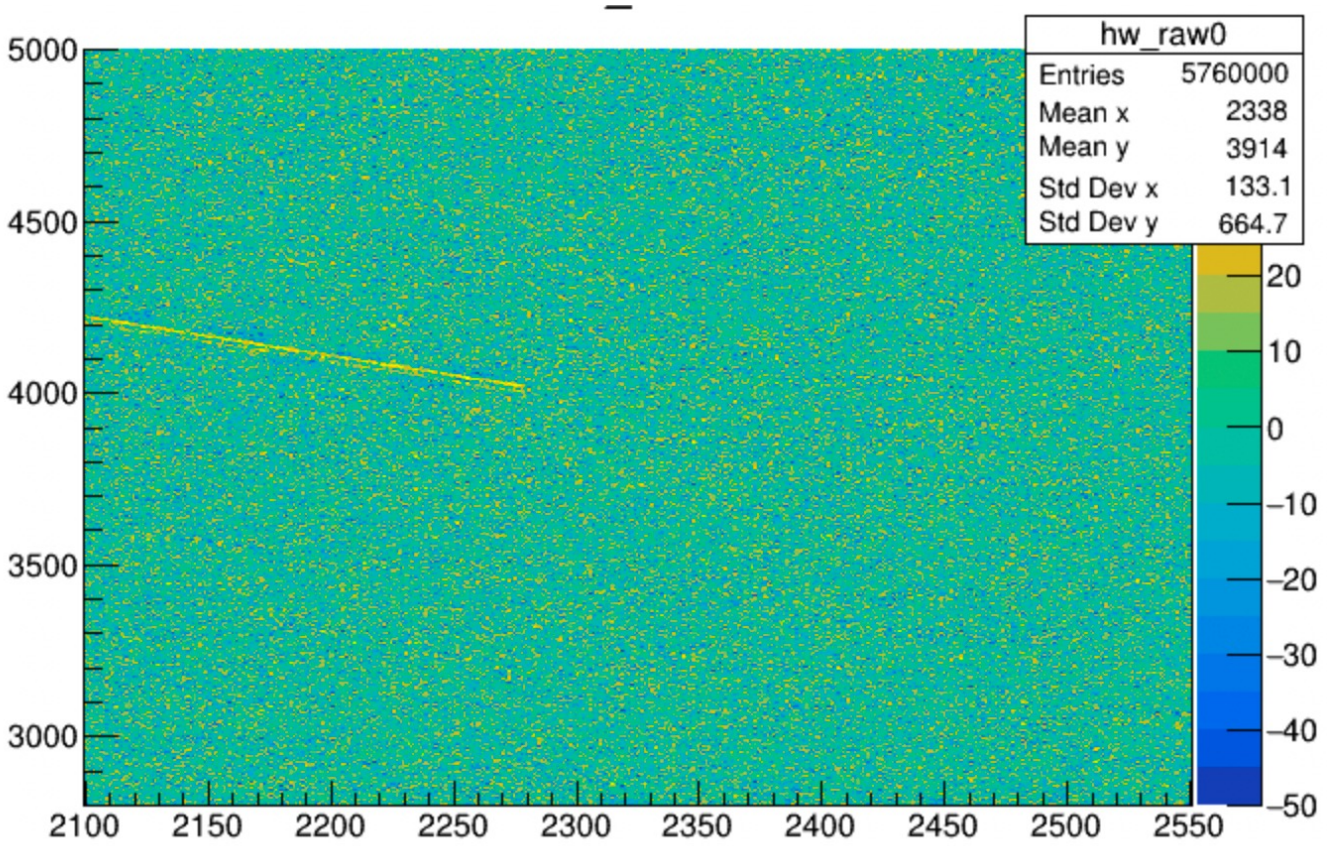


Beam simulation

- Gain: 7.8mV/fC
- Noise: "protodunehd-noise-spectra-7d8mVfC-v1.json.bz2
- Field response: from Garfield simulation.

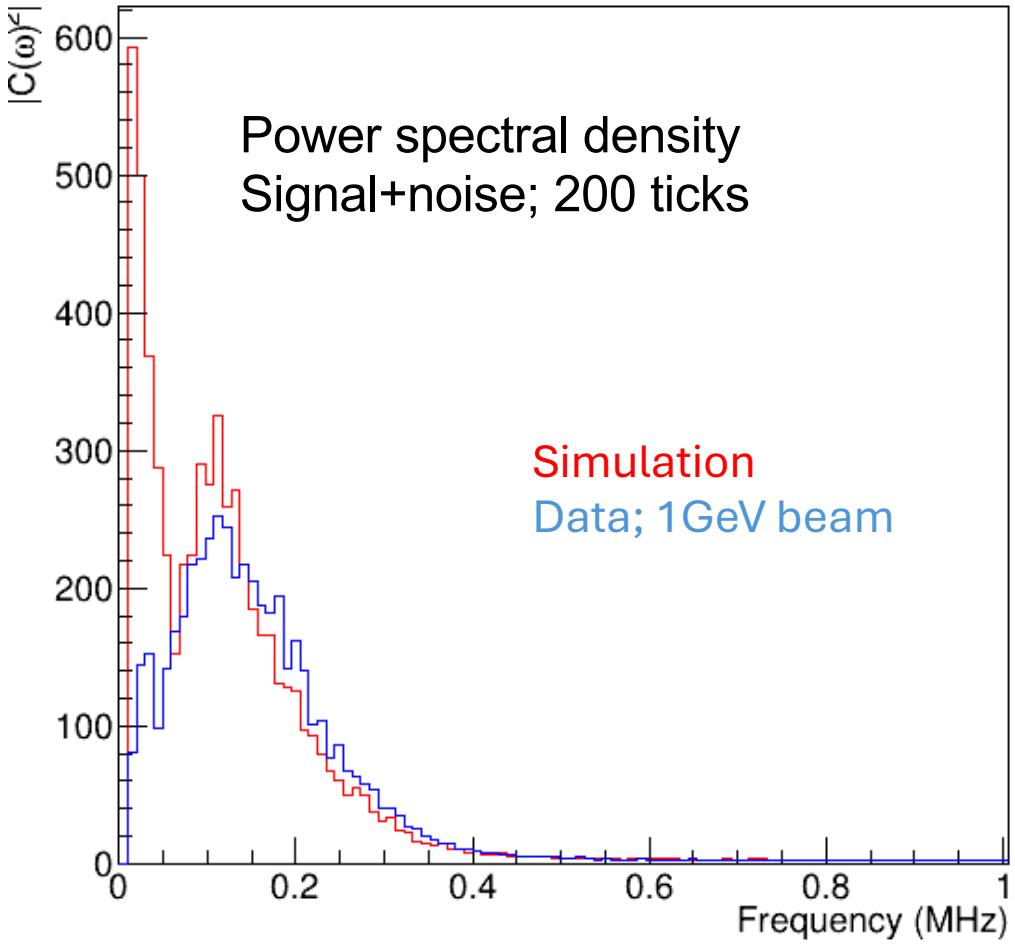
W plane; field response



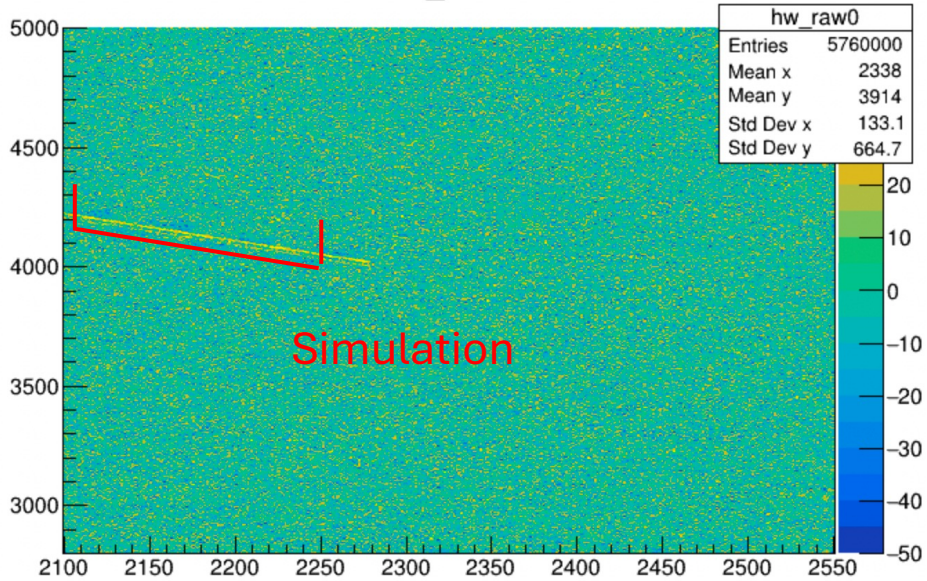


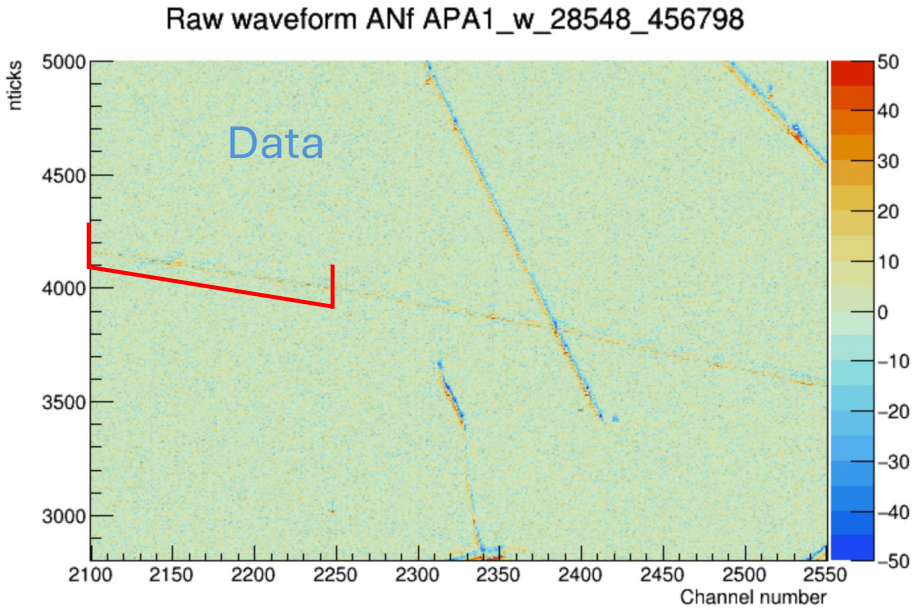

```
local beam_dir = [-0.178177, -0.196387, 0.959408];
local beam_center = [-27.173, 421.445, 0];

local track0 = {
  head: wc.point(beam_center[0], beam_center[1], beam_center[2], wc.cm),
  tail: wc.point(beam_center[0] + 100*beam_dir[0], beam_center[1] + 100*beam_dir[1], beam_center[2] + 100*beam_dir[2], wc.cm),
};
```

Power spectra comparison



Data shows less low frequency component.

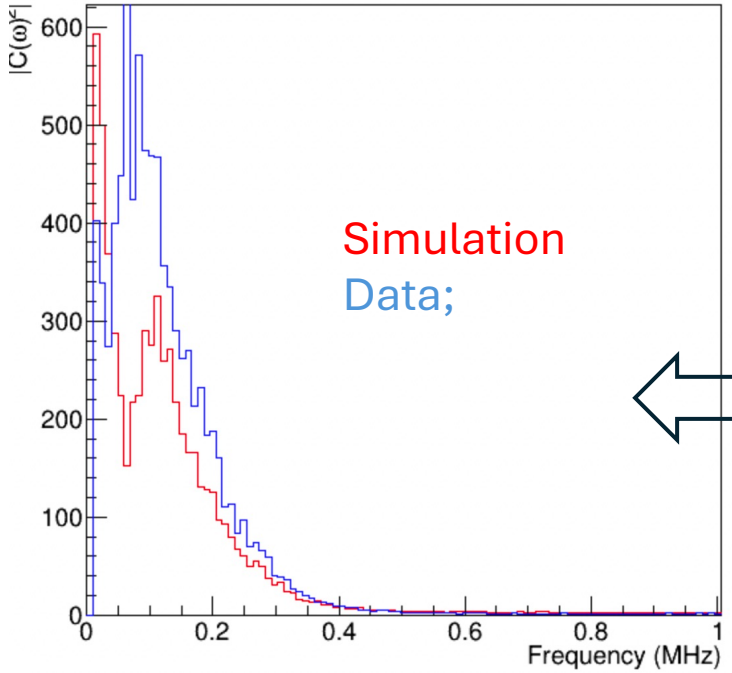


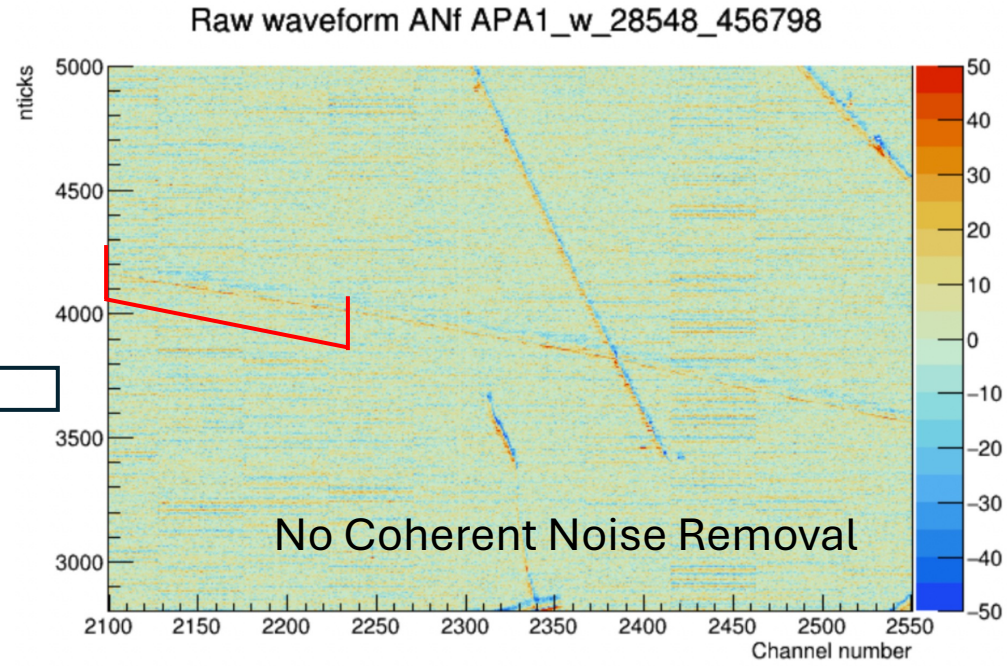


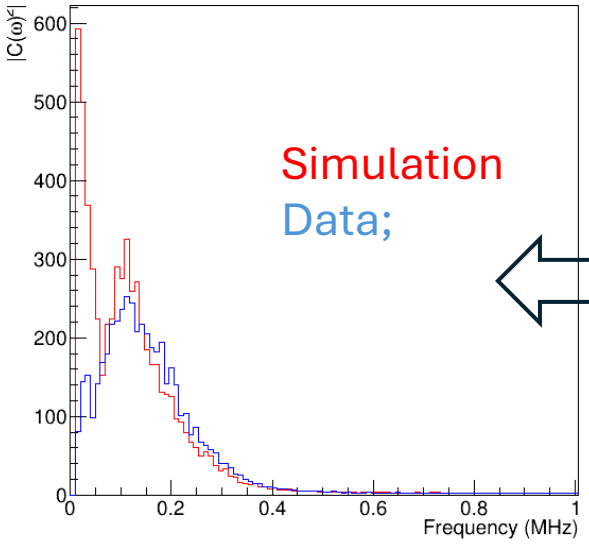
Power spectra comparison

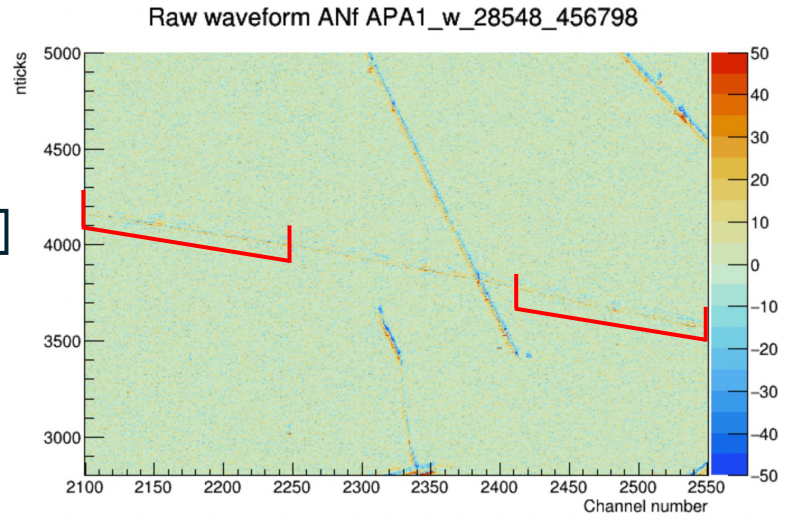
What cause the difference?

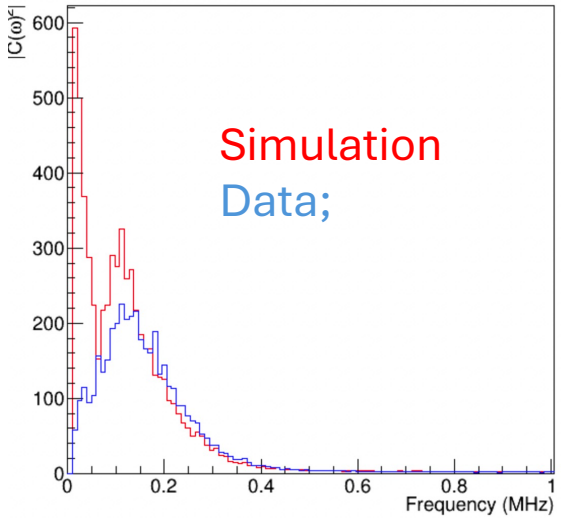
- Coherent noise removal?
  - ➢ It does reduce the low frequency component but not the major reason.
- Head/ tail?
  - ➢ No difference



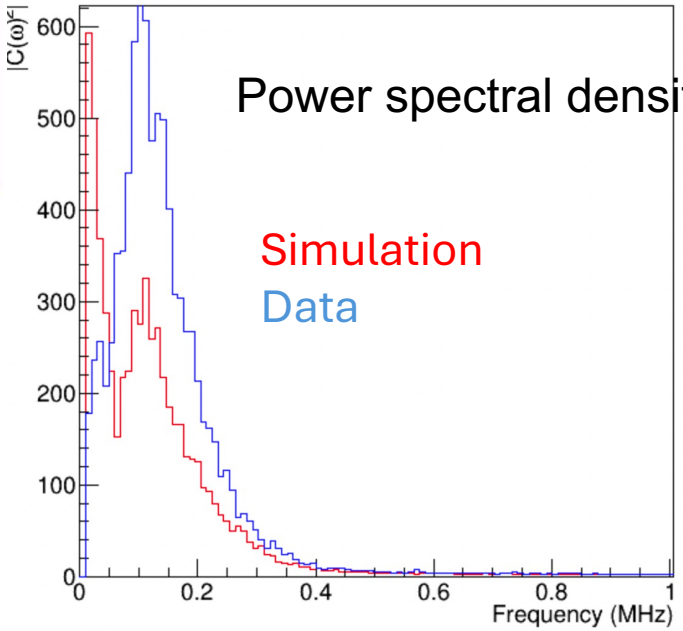


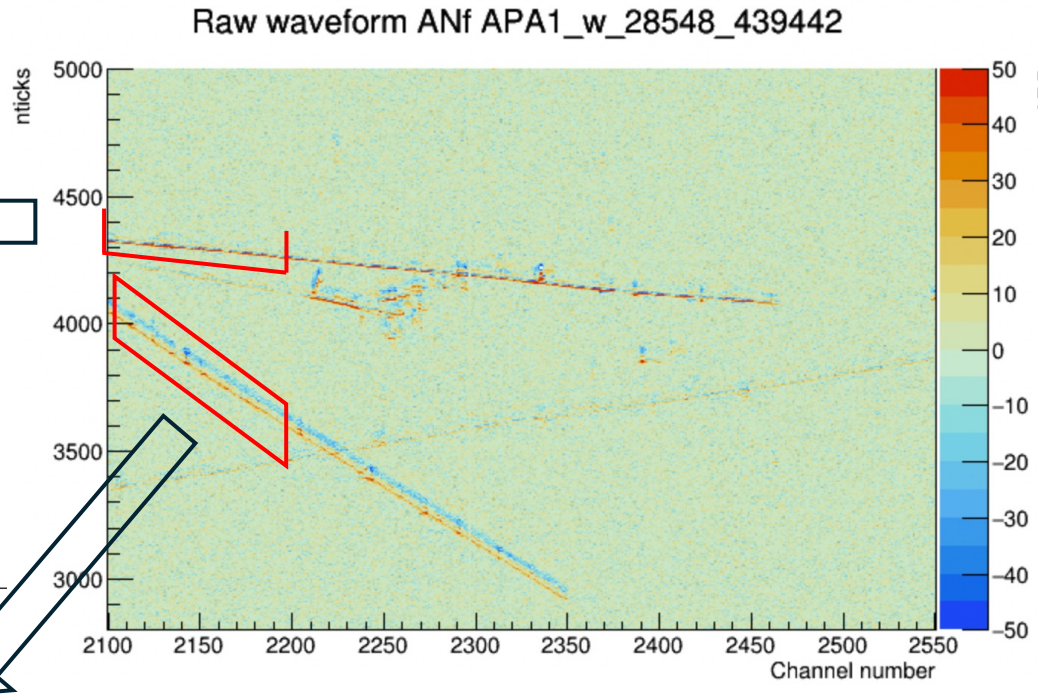


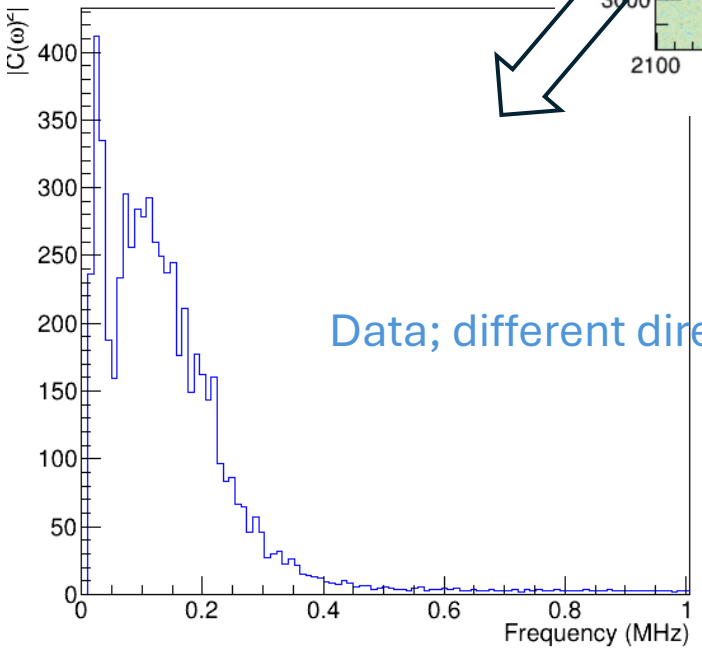




More events







Data; different direction

Looks similar to the simulation result but:

1. Not the same direction;
2. Still the low frequency component drop

Next

- As suggested by Xin, field response now has more collection effect compared to the data.
- Estimate the collection of the charge on v plane and w plane from data.
  - We can identify a beam track on 3 planes by eyes and derive the DC component, which should be the electron collection. We may adjust the field response simulation according to this.

- We may also want to compare data from other directions.