Transient Detection

UTChattSat

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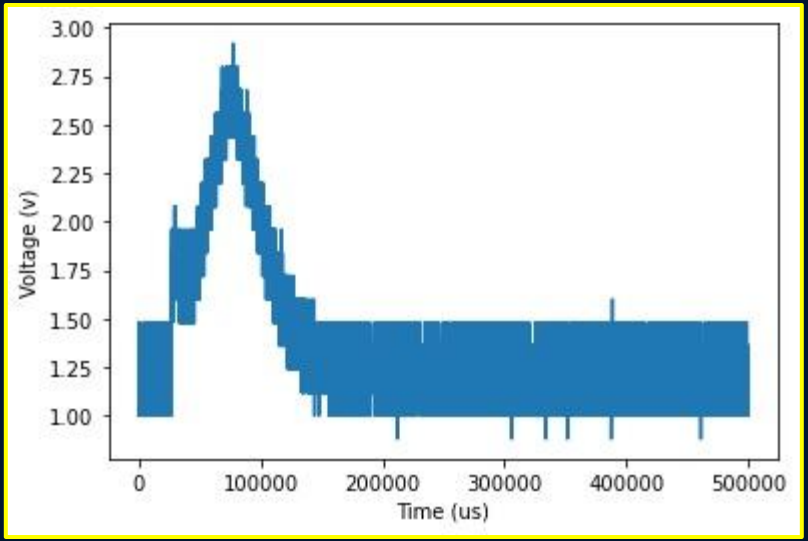
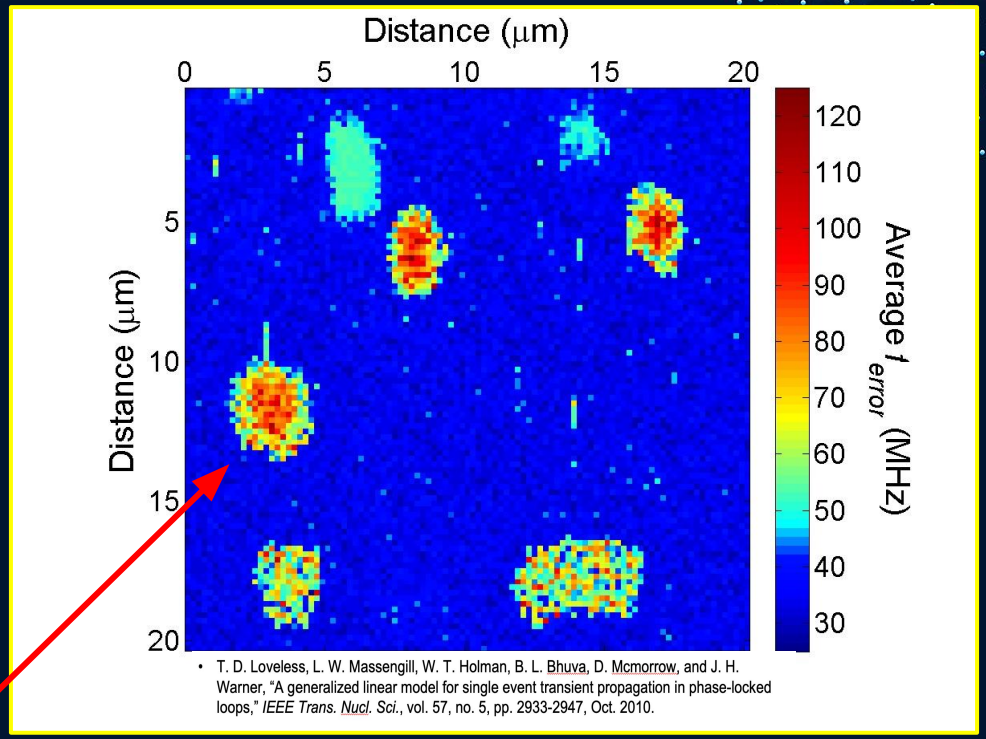
Goal?

Objective: Classifying transients



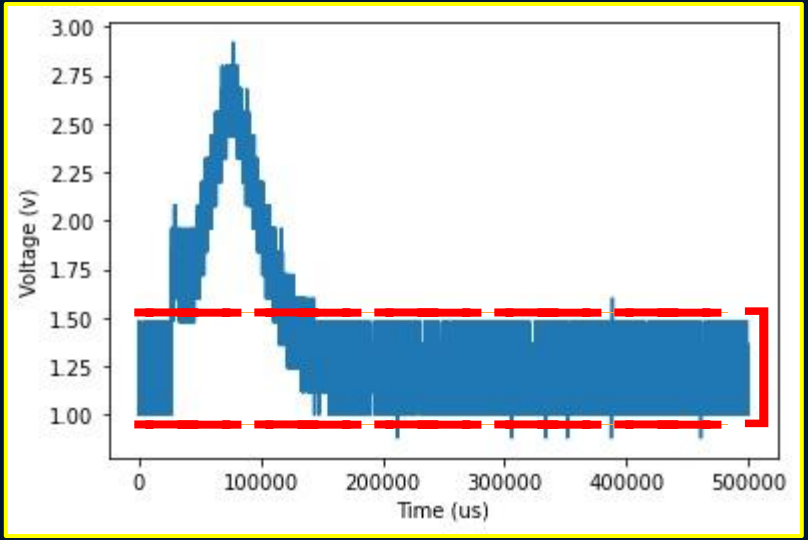
Transients are short intervals during which a signal evolves quickly in some nontrivial or relatively unpredictable way (Bello, 2005).

Example



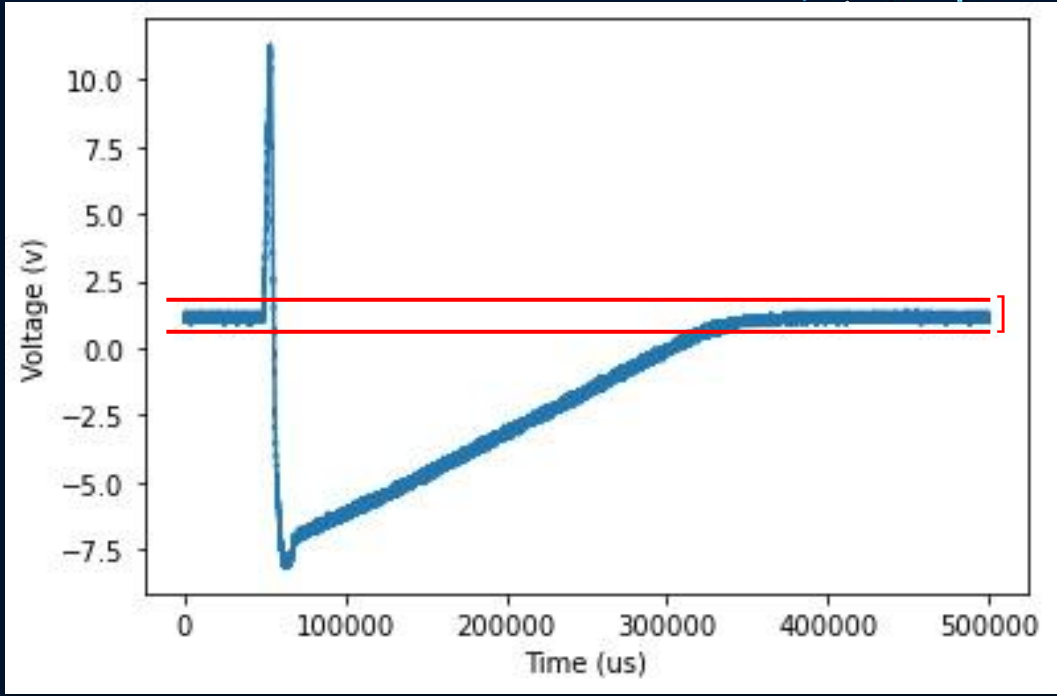
- T. D. Loveless, L. W. Massengill, W. T. Holman, B. L. Bhuva, D. Mcmorrow, and J. H. Warner, "A generalized linear model for single event transient propagation in phase-locked loops," *IEEE Trans. Nucl. Sci.*, vol. 57, no. 5, pp. 2933-2947, Oct. 2010.

HOW? Thresholding



If any part of this signal falls above or below this threshold, it is classified as a transient

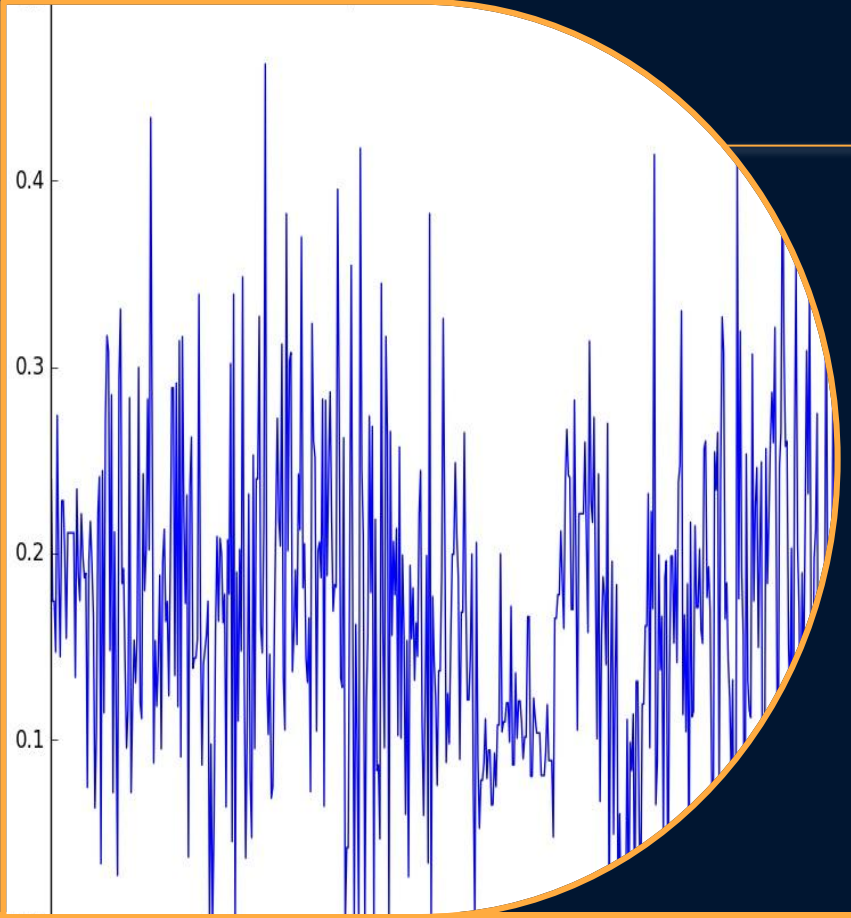
Another Look



Setting a Threshold

```
Threshold = ((Track > 1.5) | (Track < 0.75)).any() #Common threshold
```

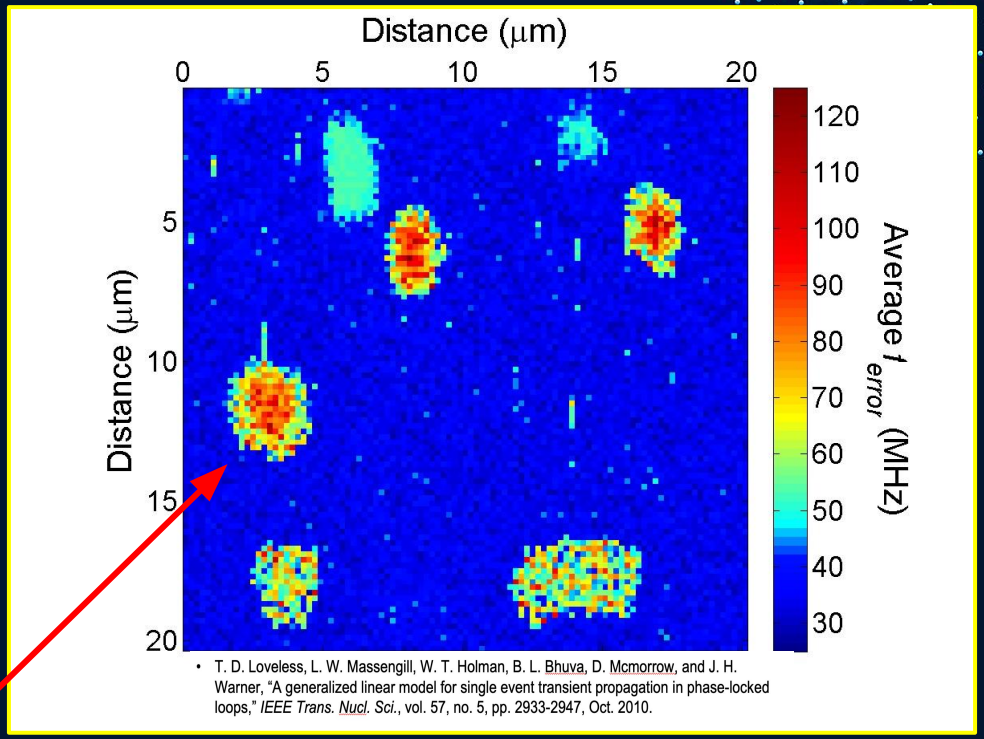
Returns TRUE when a signal is out of the set bounds. This was the common threshold that was set for all the transients in a data folder



Noise

Adding noise is critical because it tests whether or not the threshold can still classify a transient or not.

Coming back to this……



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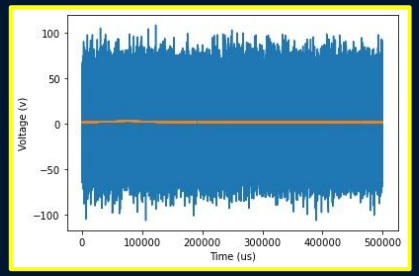
Continued

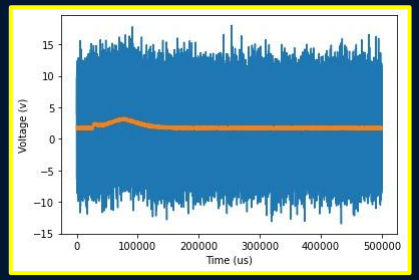
```
signal_power = (np.abs(Track.max()) + np.abs(Track.min())) / 2
for snr in [0.01, 0.1, 0.5, 1, 10, 100, 1000]:
    noisy_track = Track + np.random.normal(0,
    signal_power/np.sqrt(snr), len(Track))
```

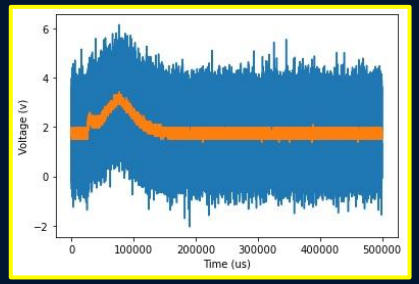
Noise

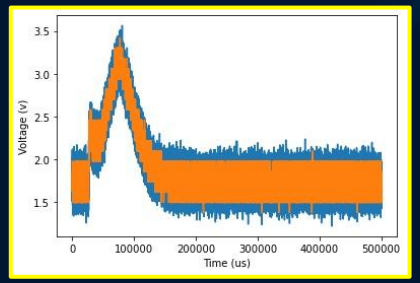
I added noise based on the SNR (Signal to noise ratio) for each transient. This helped me determine the amount of noise I should add instead of making it completely random.

Adding Noise









Importance, why?

Spurious signals can distort, and invalidate, important data. Therefore, it is very important that the generated spurious signals be minimized to the greatest extent possible. And this starts by being able to identify these signals.

Next Steps.....

The next step could include creating an ML model that finds the best threshold for all transients in a data folder

Conclusion

- By being able to detect transients, we can minimize spurious signals
- One way of detecting transients is through thresholding
- Horizontal thresholding can be effective in noisy signals

References

T. D. Loveless, L. W. Massengill, W. T. Holman, B. L. Bhuva, D. Mcmorrow, and J. H. Warner, “A generalized linear model for single event transient propagation in phase-locked loops,” IEEE Trans. Nucl. Sci., vol. 57, no. 5, pp. 2933-2947, Oct. 2010


THANK YOU!