

CERN Neutrino Platform Hardware

Installation and Maintenance

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The Classifier

- ▶ I wrote code to classify signals as real or fake using metadata on the signals. I used the FFT of a signal and the rate of attenuation in signal amplitude.
- ▶ The classifier was evaluated using the known "real" and "fake" signal sample from our notes.

The Classifier: FFT

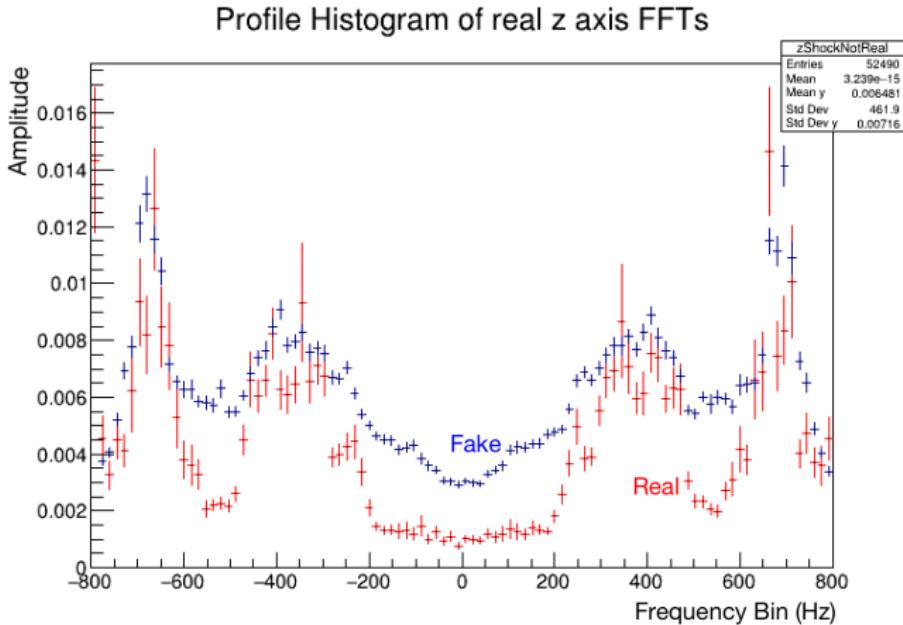


Figure: The frequency bands 0-200 Hz and 450-600 Hz show deviation between real and fake signals. These will be used in the classifier

The Classifier: Exponential Decay

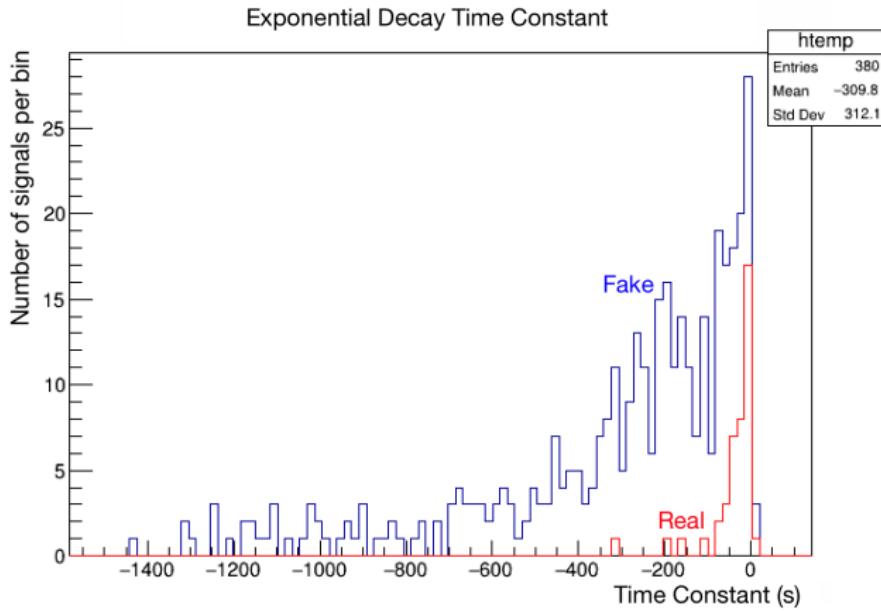


Figure: Time constant in exponential envelope of a signal for real and fake signals. Real signals persist in for longer, fake signals attenuate quickly

Classifier Performance: Bayesian Analysis

- ▶ Goal: answer the questions: given that a signal was classified as real (or fake), what are the odds it actually was real (or the odds that we should worry about it)?
- ▶ Simple Bayesian calculation tells us:

$$P(\text{real}|\text{classified real}) = 42\%$$

$$P(\text{real}|\text{classified fake}) = 2\%$$

- ▶ So it is fair to say when a signal is classified as fake we are confident in ignoring it. We are not as confident in trusting our positive result, but this will still allow nearly all of the problem signals to be eliminated

Conclusions

- ▶ While we are not exceedingly confident about our positive classifications, none of them are large amplitude. So while about half of these are real, none of them are worrisome.

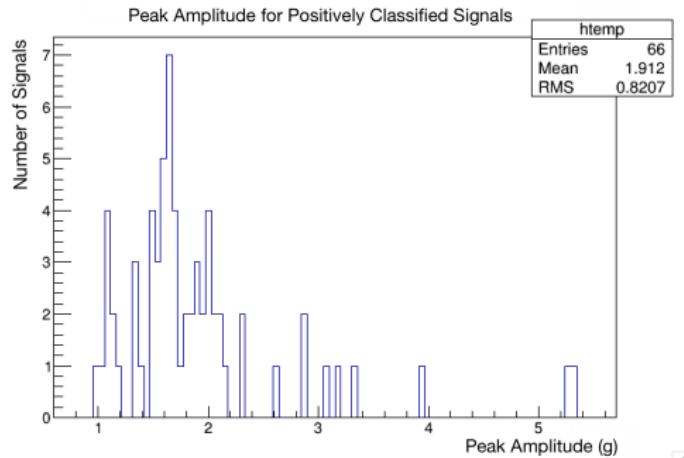


Figure: Distribution of peak amplitude for signals accepted by the classifier.

Hardware work!

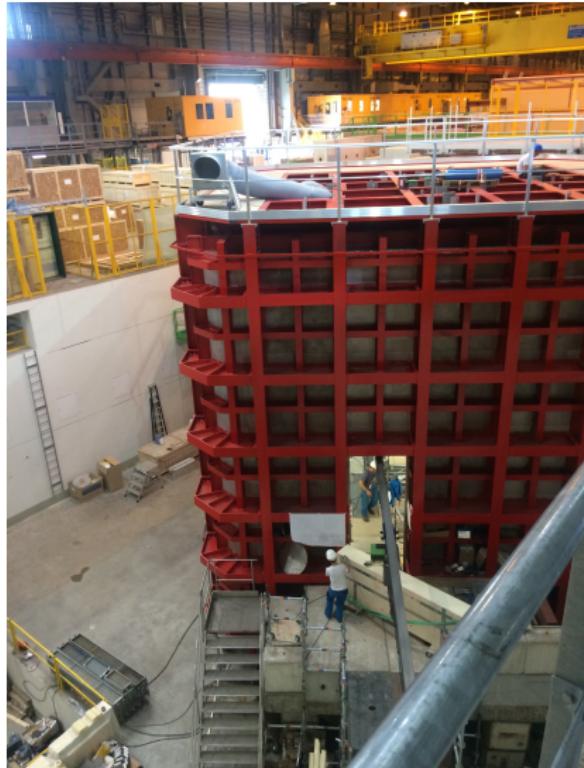


Figure: The ProtoDUNE-DP cryostat



Figure: Testing welds with Helium to be sealed



Figure: A crate arrived!

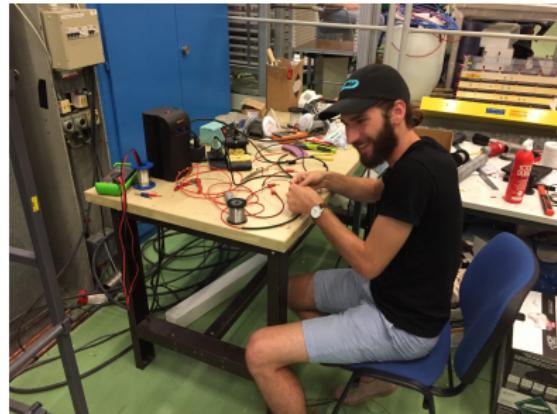


Figure: Soldering a high voltage cable to test electronics boards

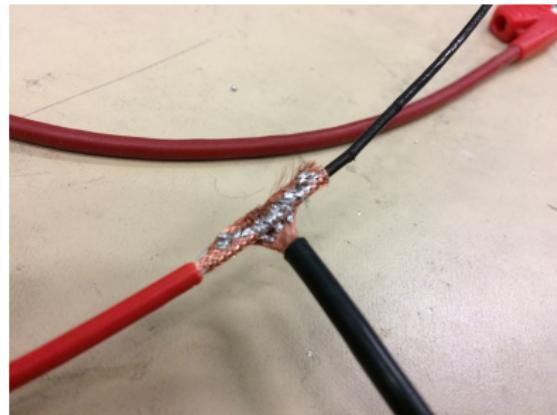
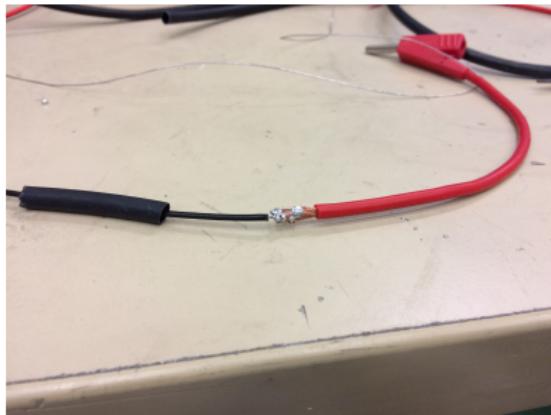


Figure: My work



"For science!!"

Any Questions?



Backup

- ▶ Some signals occurred without notes from Andrea or our transport.
- ▶ We would like to understand these signals.

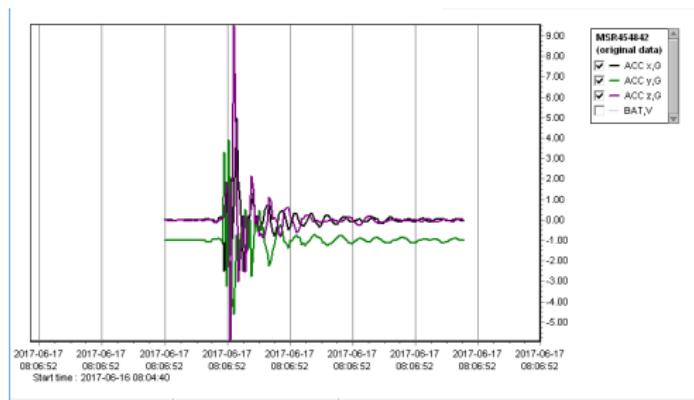


Figure: Signal with large magnitude (near 10 g) of unknown origin on ICARUS I

Backup

- ▶ I will use purity and efficiency as a metric. Purity = of all signals kept, the fraction of which were real. Efficiency = the fraction of real signals kept.
- ▶ After optimization I found a purity of 0.64 and an efficiency of 0.72.