Electronics Response Calibration Update

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Local BNL ProtoDUNE Meeting

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Current Status

Running the most up-to-date analysis on VD data

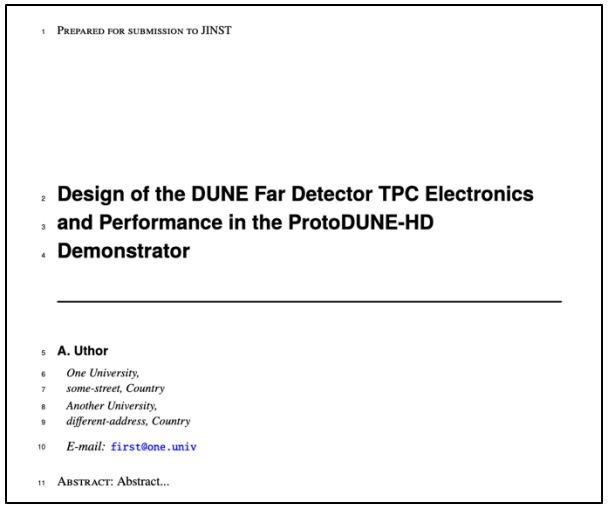
- Aiming for runs 21010 - 21073 (14 mV/fC gain) and/or 21214 - 21277 (7.8 mV/fC gain).
- Data is very old now, so we need to stage from tape to access it.
- ✓ Tried in a single run, and it works with no issues.

Electronics Response Visualizer is live now

- Thanks to Chao for sharing his wisdom!
- Visit here:

https://www.phy.bnl.gov/~chao/response-visualizer/

Starting preparation of plots for the Electronics Performance paper



Prepared for submission to JINST

Design of the DUNE Far Detector TPC Electronics and Performance in the ProtoDUNE-HD Demonstrator

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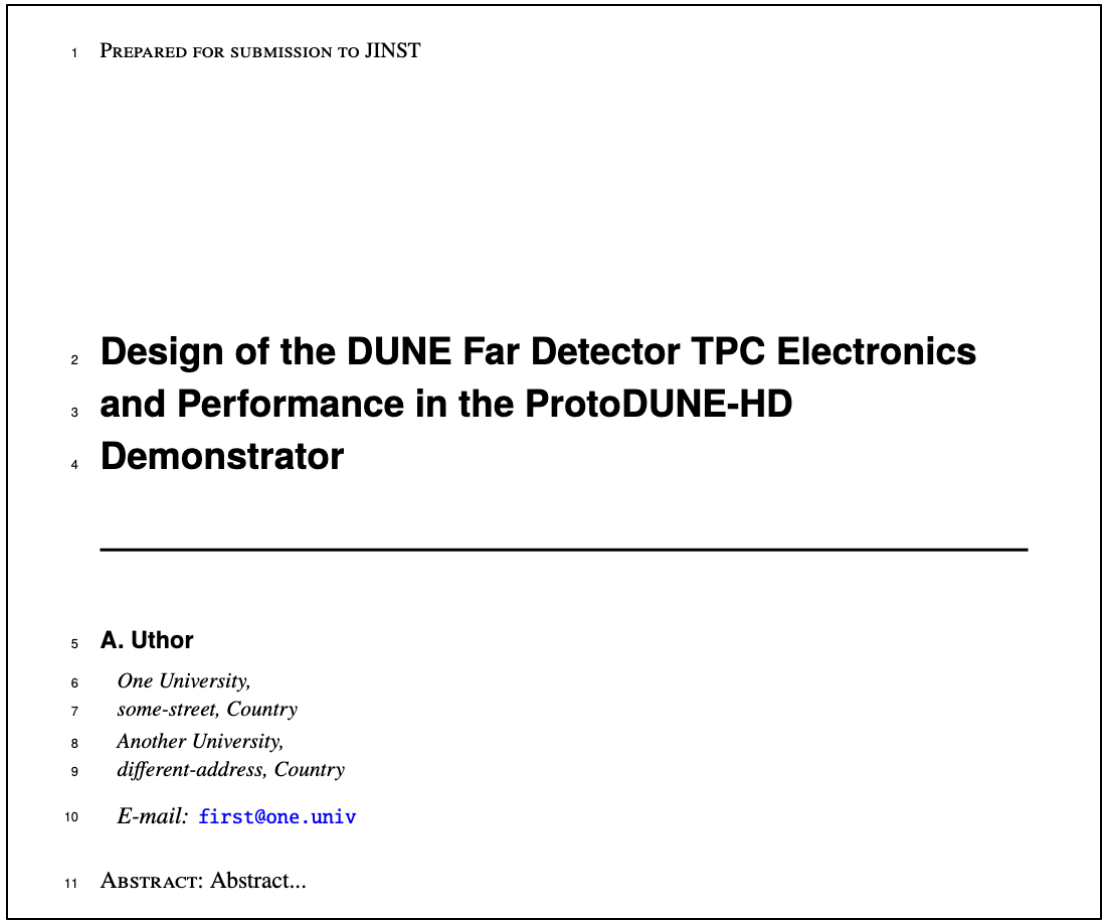
Abstract: Abstract...

Upcoming paper on FD TPC Electronics



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- Effort led by Roger Huang.
- Preparing for submission to JINST.
- Aiming to have a first draft to send for collaboration review by the end of the summer.

Upcoming paper on FD TPC Electronics

Contents

Electronics Performance: Pulser-Based Calibration

a. Examples of a response function fit to a channel

- A near-ideal response
- A very non-ideal response
- The corresponding example of ideal electronics response function fit to the same channel <u>after deconvolution.</u>

b. Histogram of distribution of some choice response function fit parameters of interest.

- Maybe some 2D histograms if there are interesting correlations?
- Suggestions?

1. Pulse shape studies/fits.
2. Gain/calibration plots using internal LArASIC pulser data.
3. Linearity plots using the same pulser scans.
4. Cross-talk plots, using the single-ASIC-channel pulser data.
5. Cross-checks on gain calibration using the WIB-DAC and internal gain-matching-off data.

Electronics Performance: Pulser-Based Calibration

a. Example of linear fit of response parameter (amplitude?) vs. injected charge for one channel.

b. Is the above plot different for induction and collection channels? If so, elaborate on this.

c. Histogram of distribution of the calibrated gain from all available channels.

d. Show the above for both 7.8 mV/fC and 14 mV/fC gain pulser scans.

1. Pulse shape studies/fits.
2. Gain/calibration plots using internal LArASIC pulser data.
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Electronics Performance: Pulser-Based Calibration

a. Plot of % non-linearity vs ADC code, evaluated by extrapolating a linear fit to the response of pulse injections that give amplitudes around the middle of the ADC range, and checking the actual deviation from this linear extrapolation.

1. Pulse shape studies/fits.
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Electronics Performance: Pulser-Based Calibration

a. 16 x 16 cross-talk table, showing with a large injection to channel X, how much response does channel Y show.

b. Possibly do this for both single-ended and differential mode. But maybe not needed if it's already very low for the single-ended data.

1. Pulse shape studies/fits.
2. Gain/calibration plots using internal LArASIC pulser data.
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Electronics Performance: Pulser-Based Calibration

These would be to show how much the gain obtained from WIB-DAC and gain-matching-off pulser scans deviate from the gain obtained from internal pulser scans (which are our main calibration method)

a. Overlay of response vs. injected charge data points and linear fits from the 3 types of pulsers for some representative channel.

b. Histogram of the ratio of the gain obtained from one method vs. the gain obtained from the "main" calibration for all channels.

1. Pulse shape studies/fits.
2. Gain/calibration plots using internal LArASIC pulser data.
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Electronics Performance: Signal-to-Noise

1. Raw noise, comparing at a few different relevant CE settings.
2. Noise after CNR with optimal settings.
3. Comparison of optimal noise to Coldbox results (to show how useful the FD Coldbox tests could be).
4. Signal-to-noise estimate with muon tracks.

Suggestions/Ideas? Let me or Roger know!