ProtoDUNE-SP FE ASIC Test Procedure

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Revision 1.1

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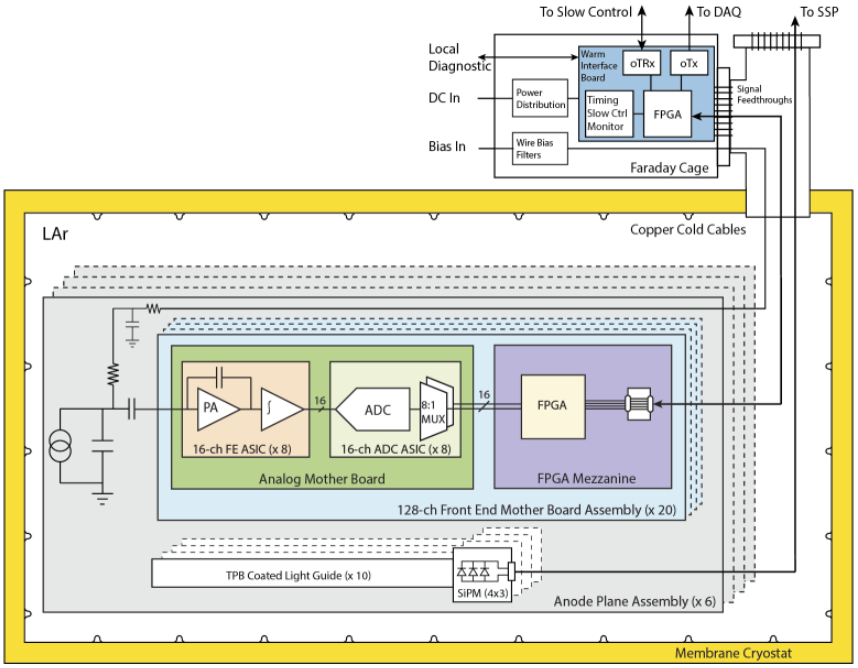

Figure 1: Overview of the ProtoDUNE-SP cold electronics readout system. The FE and ADC ASICs are shown on the Analog Motherboard (green box).

1 Introduction

This document describes the test procedure for the cold electronics Front-End (FE) ASICs for the ProtoDUNE-SP detector. The cold ASICs have been developed at Brookhaven National Lab for low noise and long lifetime operation in Liquid Argon Time Projection Chamber (LArTPC) detectors.

The Deep Underground Neutrino Experiment (DUNE) will have four 10 kton fiducial volume LArTPC detector modules approximately 1 mile underground at the Sanford Underground Research Facility (SURF) which observe particles from a neutrino beam generated at Fermilab [1] [2]. The ProtoDUNE Single Phase (SP) experiment is a ∼700 ton LArTPC detector which will be deployed at CERN in a test beam in 2018 [3]. ProtoDUNE-SP is a critical prototype for the first 10 kton DUNE far detector module.

2 Contact Information

The ASIC testing will be done by shifters working under the supervision of test leaders. If a shifter encounters a problem, a Shift Leader should be the first person to contact.

Shift Leaders
Jyoti Joshi: jjoshi@bnl.gov, (785) 424-5247
Guang Yang: gyang@nngroup.physics.sunysb.edu, (631) 590-9027

Software Support
Justin Hugon: jhugon@lsu.edu,
Brian Kirby: bkirby@bnl.gov,

Hardware Support
Jack Fried: jfried@bnl.gov,
Shanshan Gao: sgao@bnl.gov,

Computing Support
Brett Viren: bv@bnl.gov,

Shift Coordinators
Mary Bishai: mbishai@bnl.gov, (631) 344-4877
Elizabeth Worcester: etw@bnl.gov, (773) 220-6862

3 Safety and Training

All shifters working in Physics lab 1-216 must have the appropriate BNL training and have signed the lab Experimental Safety Review (ESR). This requires a BNL Guest ID. Once you have your BNL Guest ID, you can go to:

`https://www.bnl.gov/training`

from any computer and must complete the following online courses:

- Cybersecurity (GE-CYBERSEC)
- Physics Department ALARA (PO-RADALARA-W)
- Cryogen Safety (HP-OSH-025)

Note that even though the lab ESR will list more possible training courses, these are the ONLY ones you need for your shift work. Then go to:

`https://ias.bnl.gov/ESR/`

and add yourself to the ESR. The url for the ESR is on the internal BNL network, so you will either have to log in from a BNL computer or obtain a BNL domain account and request SSH and VPN access. For the work in lab 1-216, you will need to select: Department = Physics and ESRs = PO-067-2016.

Note that the ESR form will automatically select all possible training listed for the lab: shifters will **only** need to select the HP-OSH-025 training course

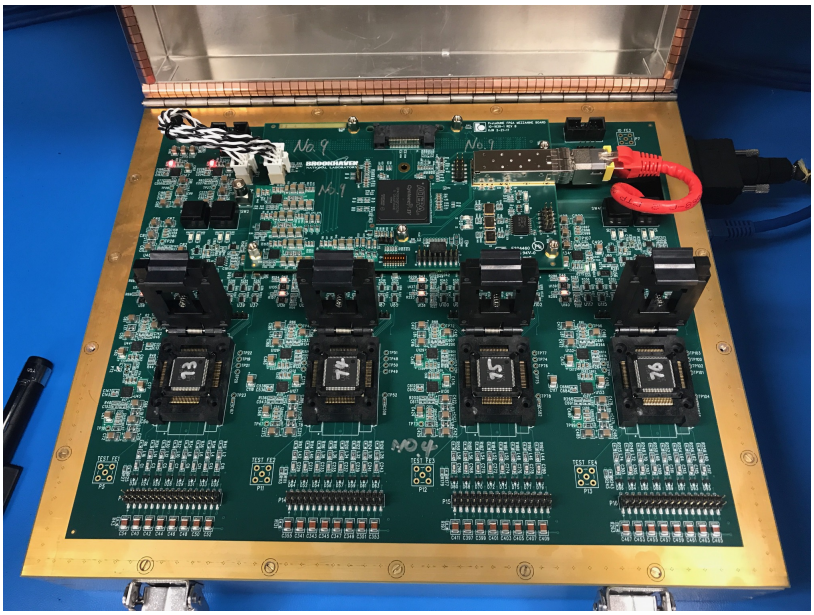

Figure 2: Quad-socket FE ASIC testboard.

listed above when adding themselves to the ESR. Once you are added, you will need to click the sign button in your list of ESR #s.

Finally BNL requires long pants, closed-toed shoes, and safety glasses to be worn at all times in the lab. The lab will provide safety glasses, if needed.

4 Equipment

The quad-socket FE ASIC testboard is shown in Figure 2. It is operated by a LV power supply with channel 1 (CH1) at 5.0V and CH2 at 2.5V. Both channels should not draw more than 1.5A during operation. The LV power to the testboard should remain ON at all times and shifters should not turn ON/OFF the LV power to the test board. In the case where a LV channel goes over 1.5A during FE ASIC testing, call the shift leader immediately.

5 FE ASIC Procedure

Get Software Going on a New Login

Do this when there is no GUI running or you are instructed to pick up a new release of the test software. If you see any errors during start up, stop and call the shift leader.

1. Log into the "CE Test Operator" account
2. Open a new terminal (Press windows key, type terminal, and press enter)
3. In the terminal, type "femb_feasic_testgui" and press enter. The GUI should pop up with all fields empty
4. Open another terminal
5. Change to run directory and launch Sumatra server: `cd ~/run; smtweb`

Test Procedure

Assumes GUI is already running. Try the steps in the previous section to get it going. If at any point during testing you see errors or are confused by something happening to the LV power supply, testboard, GUI or summary plots, stop and call the shift leader.

1. Make sure you have the anti-static bracelet on your wrist and it is plugged into the ground terminal on the power supply (device labeled RIGOL DP832)
2. Click "Load ASICs" button
3. Confirm that on/off LEDs on test board are GREEN. This means the power to the sockets is off and it is safe to remove ASICs. Confirm by checking the current drawn by CH1 (5.0V) of the power supply is ∼0.5A. If the current is higher or ANY of the LEDs are red the sockets are still powered. Contact the shift leader if the power won't turn off
4. Remove the already tested ASICs from the sockets, and replace them with the ones to be tested. The correct orientation of the FE in the socket is shown in Figure 3. The large dot should be in the upper right corner and the small dot in the lower left. Do NOT use the writing on the ASIC to align it.
5. Note the ASICs ID numbers (the number in marker on the top of the ASIC) in the log book before closing the socket
6. Put your name, the teststand ID, the test board ID (in marker on the circuit board with the socket), and the ASIC ID numbers in the GUI fields

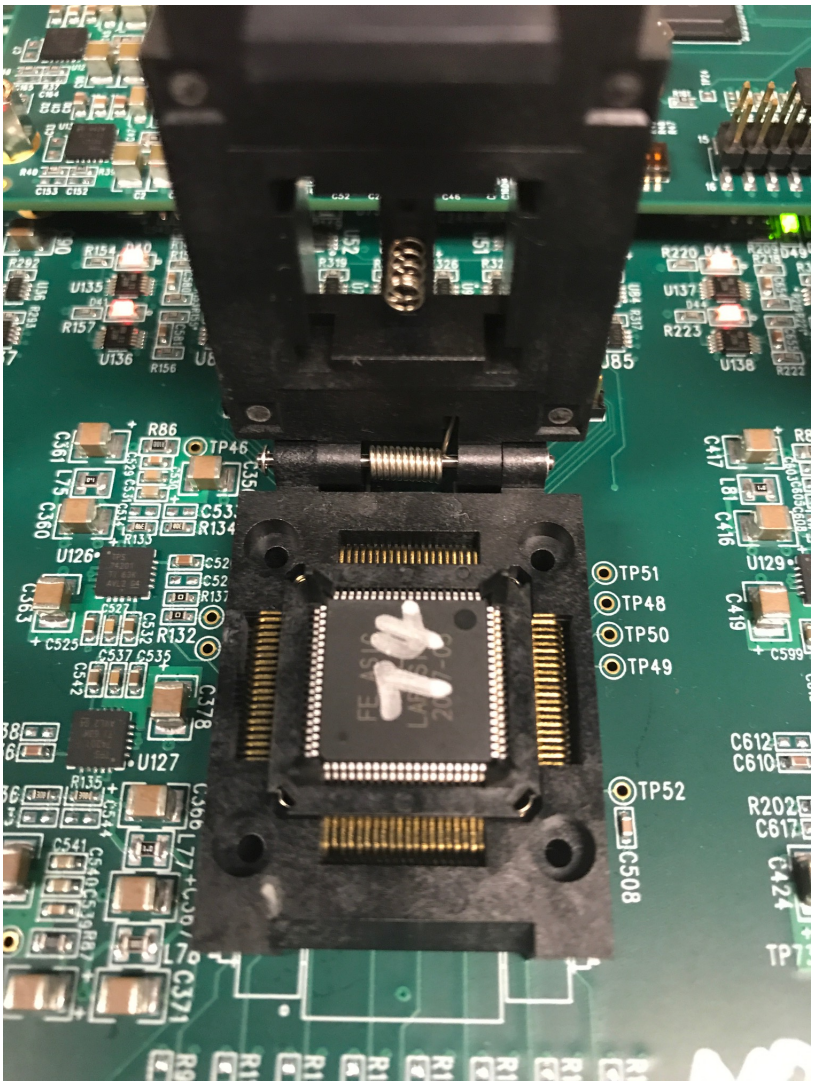

Figure 3: FE ASIC in correct orientation in socket.

7. Close the Faraday box and press “Start Testing”
8. Write the Timestamp for this run in the notebook
9. After one minute, refresh the entries in the web browser, and check that the png file for simpleMeasurement matches Figure YOLO
10. Periodically during the run refresh the entries in the web browser and check the most recent gain png file
11. When the test completes, write Pass, Fail, or Error for each ASIC in the notebook and click “Reset”

6 Other Notes

Shifters should never delete any data from any of the teststands for any reason. If a test run aborts for any reason, leave the LV power alone and call the shift leader. Do NOT try to delete any of the data directories.

If instructed to pick up a new test software release, log out of all terminals and reopen fresh terminals. Then follow the instructions for a new login.

References

[1] J. Strait et al. *Long-Baseline Neutrino Facility (LBNF) and Deep Underground Neutrino Experiment (DUNE) Conceptual Design Report Volume 3: Long-Baseline Neutrino Facility for DUNE June 24, 2015*. URL: http://arxiv.org/abs/1601.05823.

[2] R. Acciarri et al. *Long-Baseline Neutrino Facility (LBNF) and Deep Underground Neutrino Experiment (DUNE) Conceptual Design Report, Volume 4 The DUNE Detectors at LBNF*. URL: http://arxiv.org/abs/1601.02984.

[3] The DUNE Collaboration. *The Single Phase ProtoDUNE Technical Design Report*. URL: http://docs.dunescience.org:8080/cgi-bin/ShowDocument?docid=1794.