

Interface Box for Dual Power Amplifier Modulators in Main Injector

Diana Ayala, Elgin Community College – Susanna M. Stevenson

FERMILAB-POSTER-24-0241-AD-STUDENT

Introduction

The Proton Improvement Plan II (PIP-II) aims to enhance the current Fermilab particle accelerator complex to intensify and accelerate more beam. To achieve this, a second power amplifier will be added to the Main Injector (MI) cavities. However, the control unit could only read signals coming from the previous power supplies, so the interface box was designed to facilitate the issue.



Figure 1: Front and back panel of interface box



Figure 2: Upgraded modulator in MI 60

The main purpose of the interface box is to sum two signals from the power supplies into one signal before sending them over to the control unit, but other functions include:

- Latching the LCW and Grid supply error circuits
- Generating filament current ramp circuit

This manuscript has been authored by Fermi Research Alliance, LLC under Contract No. DE-AC02-07CH11359 with the U.S. Department of Energy, Office of Science, Office of High Energy Physics.

Procedure

Soldering:

The soldering aspects of the project include the main circuit board, the LED board, the LCW board, and the wires that connect the main board to various parts.

Assembly:

Mounting holes were drilled in the bottom and side panel to secure the main board and power supply, respectively. The front panel features the LED board, LCW board, POT's, and BNC shells. As for the back panel, it is made up of the multipin connectors, BNC shells, a 120V plug and fuse.

Testing:

Boolean Logic is checked to make sure we receive the expected output whenever two signals are sent to the interface box. A signal generator is also used to ensure the ON/OFF/Reset circuits in the Filament and Screen supply work properly.

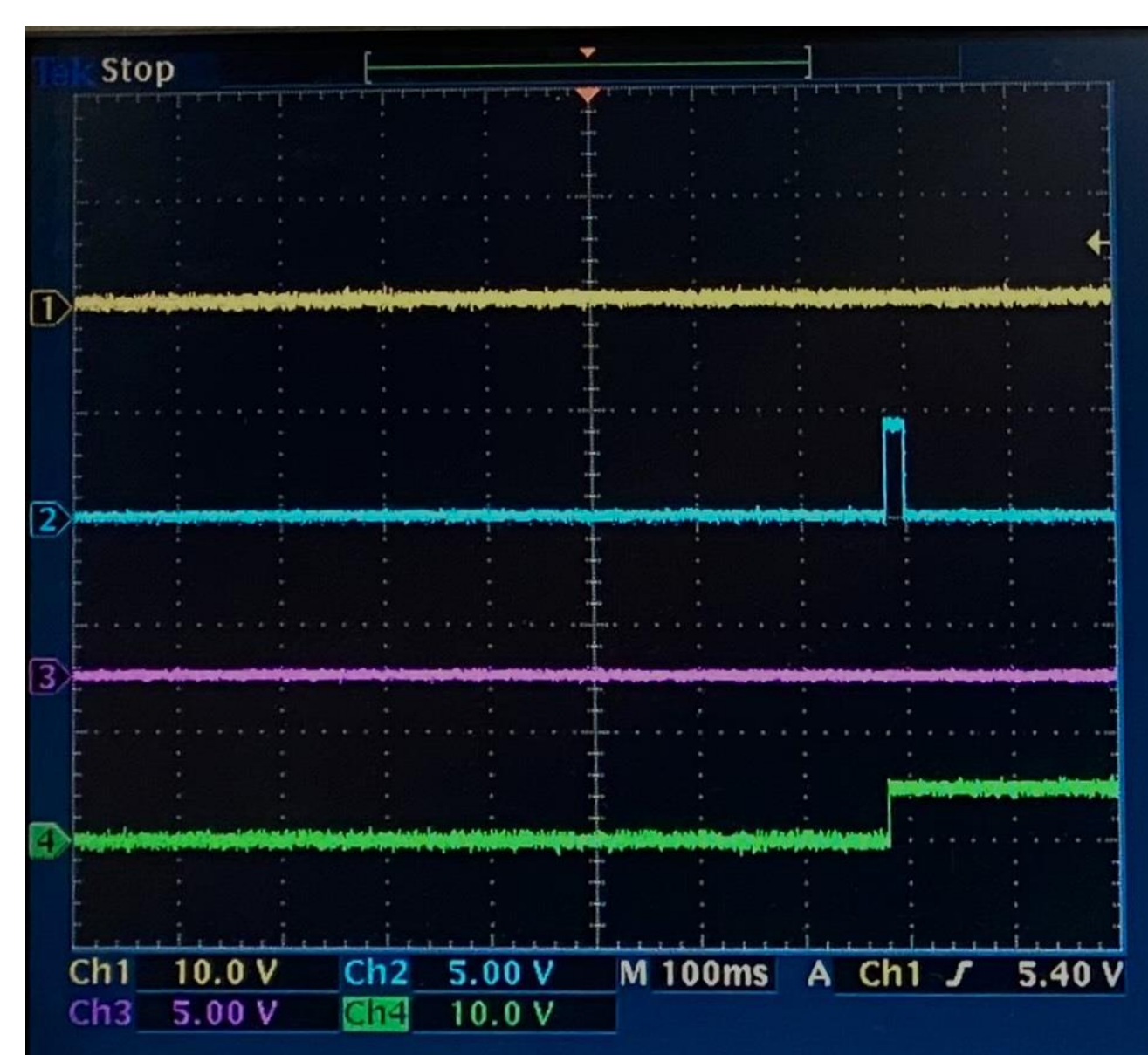


Figure 3: Oscilloscope reading for Screen's OFF circuit

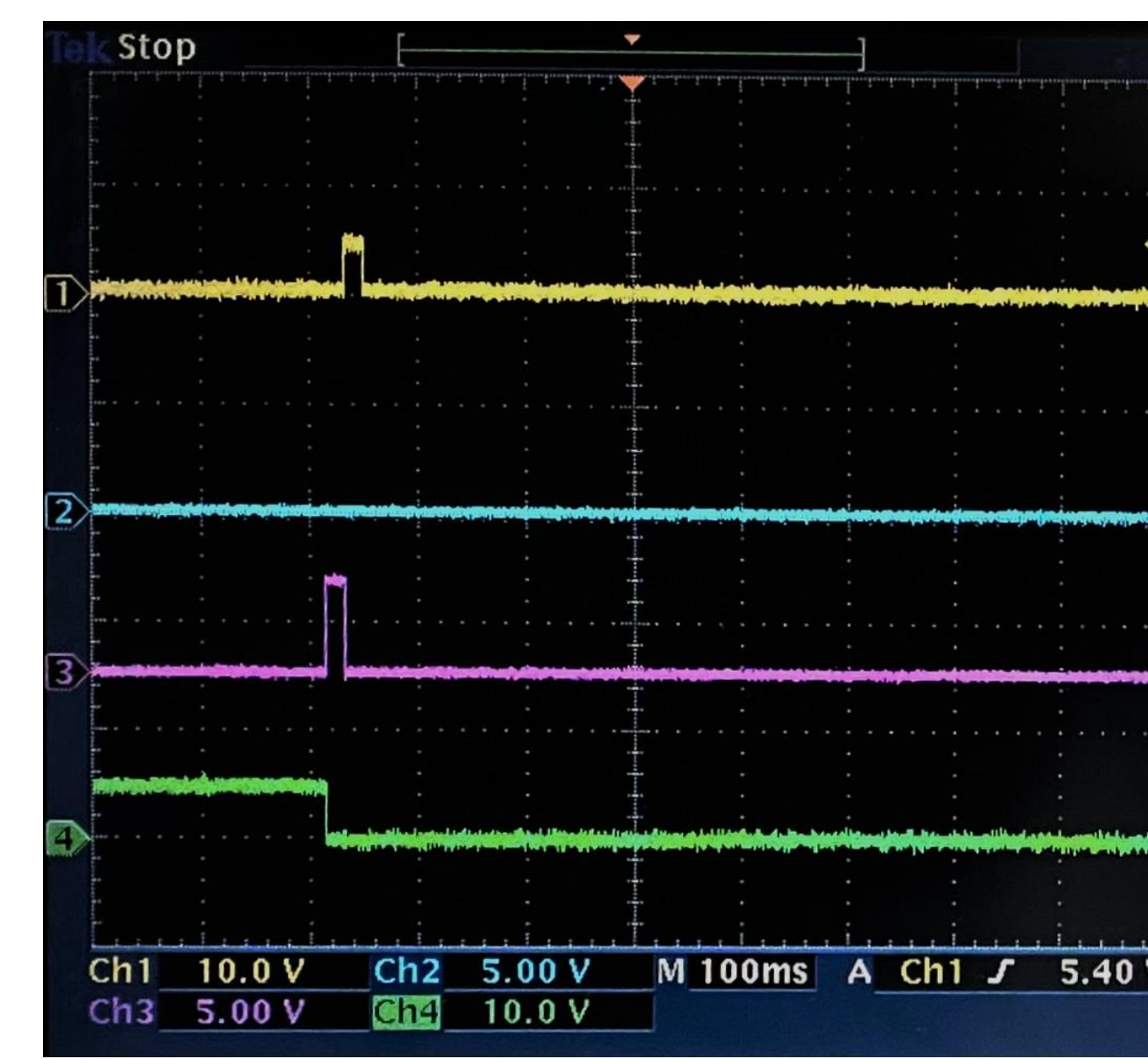


Figure 4: Oscilloscope reading for Filament's ON and RESET circuit

Conclusion

In the past, designs of the interface box were modified to counteract reoccurring problems, but the last design was set to be mass-produced. Seven have been successfully made this summer enabling the next few years' worth of station upgrades to be completed.

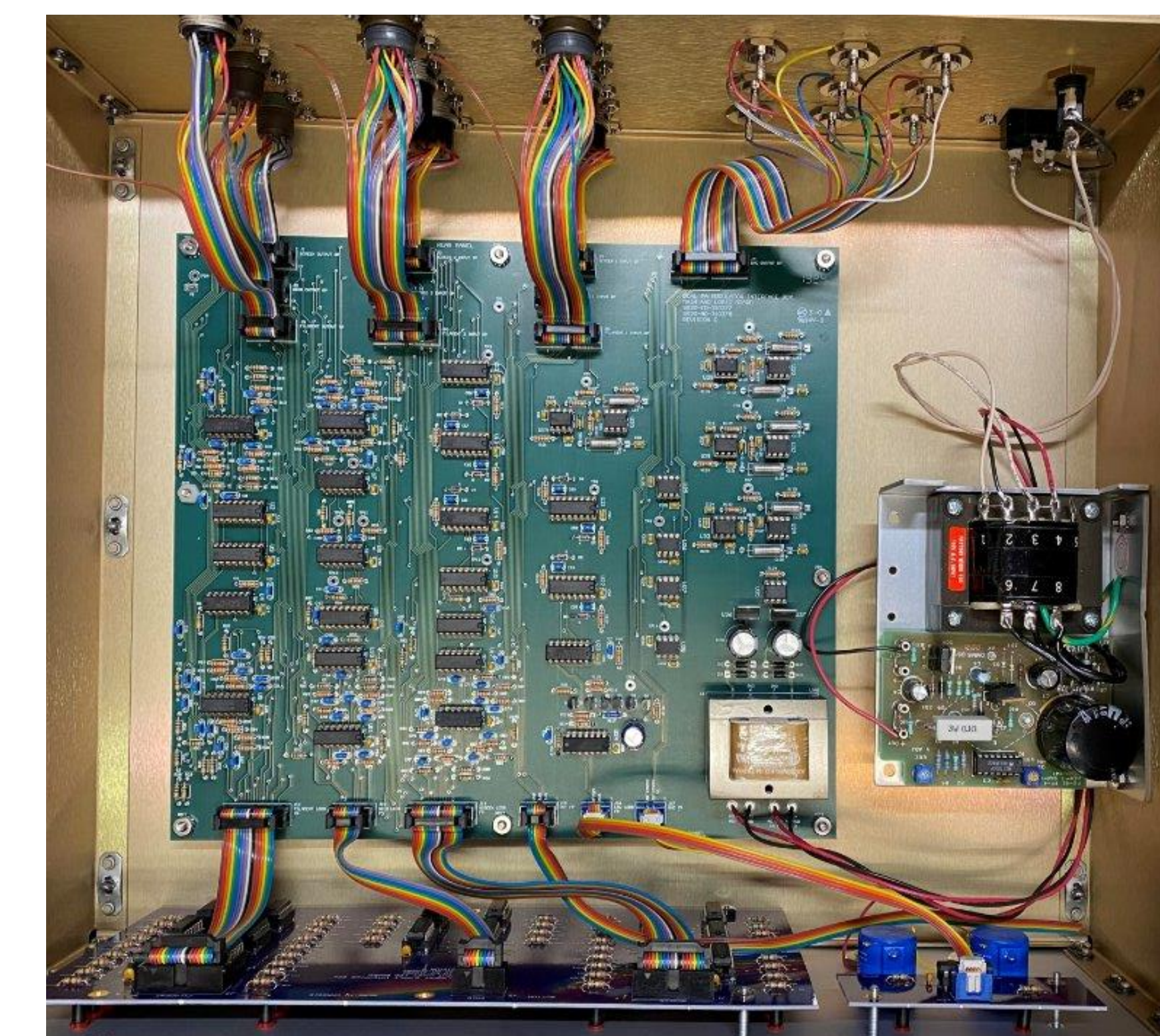


Figure 5: Interior of the interface box



Figure 6: LCW board

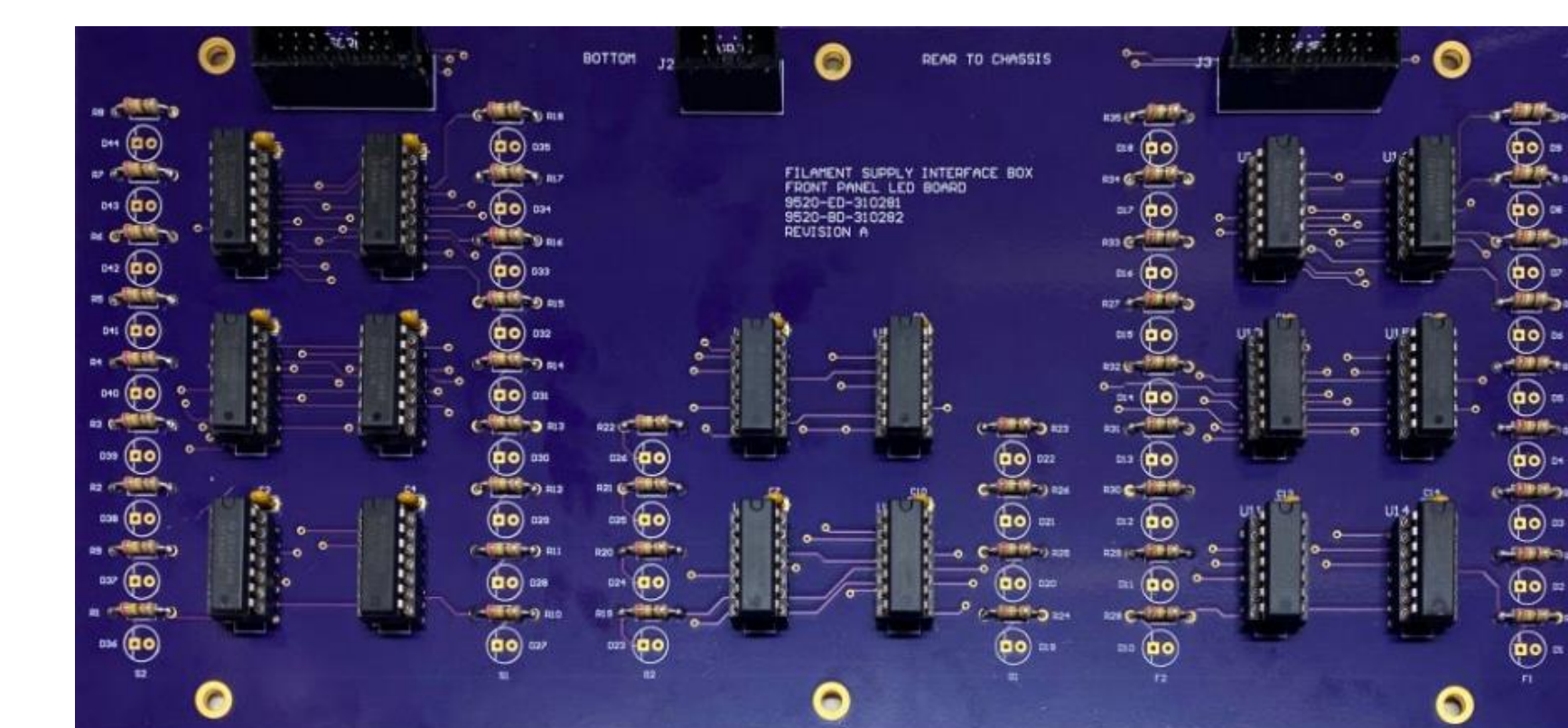


Figure 7: Backside of LED Board

This work was supported in part by the U.S. Department of Energy, Office of Science, Office of Workforce Development for Teachers and Scientists (WDTs) under the Community College Internship (CCI).