INSTRUMENT DEVELOPMENT LABORATORY
UNIVERSITY OF HAWAII MANOA

RFCeval

USERS MANUAL
Version 0.1

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1 Introduction

This users manual is intended to provide a general guideline for the use of the RFCeval circuit boards, which use the Self –Triggered Recorder for Analog Waveforms (STRAW3) chip and the LABRADOR sampling ASICs. The RFCeval board, STRAW3 chip and LABRADOR chip were designed by Gary Varner for use in UHE cosmic ray detections. The RFCeval boards run on low power while sampling RF transients at high speeds ~GSa/s. These custom devices are suitable for many applications in neutrino detection and cosmic ray physics. If further technical information is required or a copy of the Schematics is needed please contact IDLAB technical support at idlab@phys.hawaii.edu.

2 Installing, Testing and Calibrating the STRAW 3 on RFCeval

The most recent version of software for the Straw 3 chip is “straw3_wave_4.c”. It is located in the directory /WinDriver/wizard/STRAW3EV/ on the test station computer. The updated version of the firmware is called RFCEVAL2. A hard copy of the software and firmware are provided in a technical document located at www.phys.hawaii.edu/~idlab.

2.1 Installing, Testing and Calibrating the STRAW 3

1. Seat RFCeval securely into the backplane of the computer and turn the power on.

2. Confirm that all LEDs are green.

3. Initially set the potentiometer P_VIREF to .7 Volts by connecting a negative lead of a voltmeter to ground and the positive lead to VIREF. Turn the potentiometer clockwise until you see the voltage change to .7 Volts on the voltmeter. Set the potentiometer P_ROVDD to 2.5 Volts by connecting the negative lead of the voltmeter to ground and the positive lead to ROVDDA. Turn clockwise until you reach 2.5 Volts.

4. Turn on the Agilent waveform generator and set the waveform to the Square wave option and set the Frequency to 10 HZ and the Amplitude to a High of 0.0 Volts and a Low of –1.0 Volts.

5. Now connect the output of the Agilent waveform generator to the input connector for the trigger on the RFCeval board and turn the output button on.

6. Power on the 6060B signal generator and connect a Commscope 5765 high performance cable or equivalent cable to Channel 0 of the RFCeval board. Set the frequency to 50 MHZ and the Amplitude to 50 mV and turn the RF output on.
7. On the test station computer cd to the directory /WinDriver/wizard/STRAW3V/linux and run the software program by typing ./straw3_wave_4 and hitting Enter.

The Program is set up to generate two output files currently. The first is RFC_Avg.txt, which takes 100 reads of each channel for a given frequency and amplitude and calculates the average. The second is RFC_SidDev.txt, which calculates the Standard deviation of 100 reads on each channel. When the RF output on the signal generator is turned off you can expect counts around 1400 with the settings specified in this document.

2.2 Installing, Testing and Calibrating the LABRADOR Chip

1. Seat RFCeval securely into the backplane of the computer and turn the power on.

2. Confirm that all LEDS are green.

3. Initially set the potentiometer P4 to 1.2 Volts by connecting a negative lead of a voltmeter to ground and the positive lead to SPARCAL. Turn the potentiometer clockwise until you see the voltage change to 1.2 Volts on the voltmeter.

4. Turn on the Agilent waveform generator and set the waveform to the Square wave option and set the Frequency to 10 HZ and the Amplitude to a High of 0.0 Volts and a Low of −1.0 Volts.

5. Now connect the output of the Agilent waveform generator to the input connector for the trigger on the RFCeval board and turn the output button on.

6. Power on the 6060B signal generator and connect a Commscope 5765 high performance cable or equivalent cable to Channel 0 of the RFCeval board. Set the frequency to 50 MHZ and the Amplitude to 50 mV and turn the RF output on.

7. On the test station computer cd to the directory /WinDriver/wizard/LABRADOR/linux. This directory contains two programs for testing the LABRADOR chip. The first program is named lab_test6. This program takes 100 samples of the ADC’s and calculates the Average and Standard Deviation. The second program called lab_wv1 calculates the pedestals. To run the lab_test6 program type ./lab_test6, likewise for the lab_wv1 program.

2.3 Running the Gui for the Labrador chip

To start the Gui for the Labrador Chip cd to the directory /WinDriver/wizard/LABRADOR/linux. Type the command ./dalib_gui at the command line and press enter. The following Gui display will pop up.
Click on single trigger or continuous and select channels 1, 2, and 3 on the upper panel. You should see the following noise on the display.
Now turning the RF output on while hooked up to channel 2 with a frequency of 100MHz and an amplitude of 80mV, you will see a nice Sine wave on channel 2.

3 Programming RFCEval

3.1 STRAW 3 CHIP
The latest version of the firmware is called RFCEVAL2 and a copy can be found on the website at www.phys.hawaii.edu/~idlab.

1. Seat RFCEval Board securely into the backplane and turn power on to the computer.
2. Confirm that all LEDS are green.
3. Connect one end of the HW-JTAG_PC Parallel cable to the laptop and the other end to J88 connector on RFCEval. There are 6 color-coded cables to be connected to the J88 connector pins. VCC(red), GND(black), TCK(yellow), TDO(blue), TDI(white) and TMS(green)).
4. Startup the Xilinx project navigator on Gary’s computer and program.
5. Go up to the file pull down and select open project.
6. Find the project labeled RFCEVAL2 and open it.
7. Click on RFCEVAL_it and the Xilinx program with load all the appropriate files.
8. On the lower left hand side in the Xilinx window, you will see a section that’s labeled Processes for Current Source. Click on Configure Device and Xilinx will compile the software.

9. The Xilinx program should detect four devices.

10. Click on the first device and highlight `ctrl_top.jed` from your list of options.

11. Click on the second device and highlight `straw_top.jed` from your list of options.

12. Click on the fourth device and highlight `ctrl_sw.jed` from your list of options.

13. Now right click on the `ctrl_top.jed` device and chose the option to program it and then do the same for the `straw_top.jed` device and then `ctrl_sw.jed`. MAKE SURE TO PROGRAM THE `ctrl_top.jed` FIRST, then the `lab_top.jed` and then the `ctrl_sw.jed`. 14. Then your finished you can close out of the program and do not save changes to the file.

3.2 LABRADOR CHIP

The latest version of the firmware is called LABRADOR6 and a copy can be found on the website at [www.phys.hawaii.edu/~idlab](http://www.phys.hawaii.edu/~idlab).

1. Seat RFCeval Board securely into the backplane and turn power on to the computer.

2. Confirm that all LEDs are green.

3. Connect one end of the HW-JTAG_PC Parallel cable to the laptop and the other end to J88 connector on RFCeval. There are 6 color-coded cables to be connected to the J88 connector pins. VCC(red), GND(black), TCK(yellow), TDO(blue), TDI(white) and TMS(green)).

4. Startup the Xilinx project navigator on Gary’s computer and program.

5. Go up to the file pull down and select open project.

6. Find the project labeled LABRADOR6 and open it.

7. Click on LABRADOR_it and the Xilinx program with load all the appropriate files.

8. On the lower left hand side in the Xilinx window, you will see a section that’s labeled Processes for Current Source. Click on Configure Device and Xilinx will compile the software.

9. The Xilinx program should detect four devices.

10. Click on the first device and highlight `ctrl_top.jed` from your list of options.

11. Click on the third device and highlight `lab_top.jed` from your list of options.

12. Click on the fourth device and highlight `ctrl_sw.jed` from your list of options.

13. Now right click on the `ctrl_top.jed` device and chose the option to program it and then do the same for the `lab_top.jed` device and then `ctrl_sw.jed`. MAKE SURE TO PROGRAM THE `ctrl_top.jed` FIRST, then the `lab_top.jed` and then the `ctrl_sw.jed`. 14. Then your finished you can close out of the program and do not save changes to the file.