



# RICH-II LabVIEW Remote Interface

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# Contents

- Overview
- RICH-I LabVIEW remote interface
  - Screenshots of remote interface
- Changes in remote interface for RICH-II
- Conclusion

# Overview

- LabVIEW remote interface for RICH-II will allow users to monitor detector's interlocks from a PC with LabVIEW, on the same subnet as the sbRIO
- Features of LabVIEW remote interface will be based on RICH-I LabVIEW remote interface, but with a few changes in how data gets to interface

# RICH-I LabVIEW Remote Interface

- Each cRIO in interlock system has its own remote interface
- Remote interface connects to cRIO using messaging
  - RICH program was based on SVT program
    - At time of SVT development, messaging was the standard to remotely connect to cRIOs
  - Messaging uses two first-in, first-out (FIFO) data buffers to write or read to another device
    - One FIFO buffer for PC-to-cRIO communication
    - Second FIFO buffer for cRIO-to-PC communication
  - FIFO buffers are uniquely made upon start of cRIO program or remote interface
    - Only one PC can connect to cRIO at a time

# RICH-I LabVIEW Remote Interface – Interlock Status Tab

Header is displayed for all pages of screen

**Connect to System** **Not Connected** **System Status Message** **Exit Program**

**Any Interlock Out of Limit?** **HV Enable Status** **LV Enable Status**

**OK** **HV ENABLED** **LV ENABLED**

**Interlock Status and Signal Monitoring** **Thresholds and Enable Control Settings** **Expert Control Settings** **Raw Data and System Monitoring** **Live Plots** **Averaging Study**

High Status		Low Status		
0	OK	OK	Temperature 1	
1	OK	OK	Temperature 2	
2	OK	OK	Temperature 3	
3	OK	OK	Temperature 4	
4	OK	OK	Temperature 5	
5	OK	OK	Temperature 6	
6	OK	OK	Temperature 7	
7	OK	OK	Temperature 8	
8	OK	OK	Temperature 9	
9	OK	OK	Temperature 10	
10	OK	OK	Temperature 11	
11	OK	OK	Temperature 12	
12	OK	OK	Temperature 13	
13	OK	OK	Temperature 14	
14	OK	OK	Temperature 15	
15	OK	OK	Temperature 16	
16	OK	OK	Humidity 1	
17	OK	OK	Humidity 2	
18	OK	OK	Humidity 3	
19	OK	OK	Humidity 4	
20	OK	OK	Humidity 5	
21	OK	OK	Humidity 6	
22	OK	OK	Humidity 7	
23	OK	OK	Humidity 8	
24	OK	OK	Humidity 9	
25	OK	OK	Humidity 10	
26	OK	OK	Humidity 11	
27	OK	OK	Humidity 12	
28	OK	OK	Humidity 13	
29	OK	OK	Humidity 14	
30	OK	OK	Humidity 15	

Signal Monitoring	
0	Temperature 1
1	Temperature 2
2	Temperature 3
3	Temperature 4
4	Temperature 5
5	Temperature 6
6	Temperature 7
7	Temperature 8
8	Temperature 9
9	Temperature 10
10	Temperature 11
11	Temperature 12
12	Temperature 13
13	Temperature 14
14	Temperature 15
15	Temperature 16
16	Humidity 1
17	Humidity 2
18	Humidity 3
19	Humidity 4
20	Humidity 5
21	Humidity 6
22	Humidity 7
23	Humidity 8
24	Humidity 9
25	Humidity 10
26	Humidity 11
27	Humidity 12
28	Humidity 13
29	Humidity 14
30	Humidity 15
31	Humidity 16

Latched Interlock Error	
0	Temperature 1
1	Temperature 2
2	Temperature 3
3	Temperature 4
4	Temperature 5
5	Temperature 6
6	Temperature 7
7	Temperature 8
8	Temperature 9
9	Temperature 10
10	Temperature 11
11	Temperature 12
12	Temperature 13
13	Temperature 14
14	Temperature 15
15	Temperature 16
16	Humidity 1
17	Humidity 2
18	Humidity 3
19	Humidity 4
20	Humidity 5
21	Humidity 6
22	Humidity 7
23	Humidity 8
24	Humidity 9
25	Humidity 10
26	Humidity 11
27	Humidity 12
28	Humidity 13
29	Humidity 14
30	Humidity 15

**Reset Latched Errors** **OFF**

- A. Control to connect to cRIO
- B. Connection status indicator
- C. System status message indicator
- D. Interlock Boolean sum indicator
- E. High voltage interlocks status
- F. Low voltage interlock status
- G. Tabs for other pages
- H. Immediate interlock status indicators
- I. Present sensor values
- J. Latched interlock indicators

Note: Indicators appear greyed out because screen is not running.

# RICH-I LabVIEW Remote Interface – Interlock Control Tab

Interlock Status and Signal Monitoring | Thresholds and Enable Control Settings | Expert Control Settings | Raw Data and System Monitoring | Live Plots | Averaging Study

**A Interlock Sensor Enables**

Index	Control	Sensor Name
0	Disable	Temperature 1
1	Disable	Temperature 2
2	Disable	Temperature 3
3	Disable	Temperature 4
4	Disable	Temperature 5
5	Disable	Temperature 6
6	Disable	Temperature 7
7	Disable	Temperature 8
8	Disable	Temperature 9
9	Disable	Temperature 10
10	Disable	Temperature 11
11	Disable	Temperature 12
12	Disable	Temperature 13
13	Disable	Temperature 14
14	Disable	Temperature 15
15	Disable	Temperature 16
16	Disable	Humidity 1
17	Disable	Humidity 2
18	Disable	Humidity 3
19	Disable	Humidity 4
20	Disable	Humidity 5
21	Disable	Humidity 6
22	Disable	Humidity 7
23	Disable	Humidity 8
24	Disable	Humidity 9
25	Disable	Humidity 10
26	Disable	Humidity 11
27	Disable	Humidity 12
28	Disable	Humidity 13
29	Disable	Humidity 14
30	Disable	Humidity 15
31	Disable	Humidity 16

**B Temperature Interlock Trip Thresholds**

Index	High Temperature	Low Temperature	Sensor Name
0	0 ≥ °C	0 ≤ °C	Temperature #1
1	0 ≥ °C	0 ≤ °C	Temperature #2
2	0 ≥ °C	0 ≤ °C	Temperature #3
3	0 ≥ °C	0 ≤ °C	Temperature #4
4	0 ≥ °C	0 ≤ °C	Temperature #5
5	0 ≥ °C	0 ≤ °C	Temperature #6
6	0 ≥ °C	0 ≤ °C	Temperature #7
7	0 ≥ °C	0 ≤ °C	Temperature #8
8	0 ≥ °C	0 ≤ °C	Temperature #9
9	0 ≥ °C	0 ≤ °C	Temperature #10
10	0 ≥ °C	0 ≤ °C	Temperature #11
11	0 ≥ °C	0 ≤ °C	Temperature #12
12	0 ≥ °C	0 ≤ °C	Temperature #13
13	0 ≥ °C	0 ≤ °C	Temperature #14
14	0 ≥ °C	0 ≤ °C	Temperature #15
15	0 ≥ °C	0 ≤ °C	Temperature #16

**C Humidity Interlock Trip Thresholds**

Index	High Humidity	Low Humidity	Sensor Name
0	0 ≥ %	0 ≤ %	Humidity #1
1	0 ≥ %	0 ≤ %	Humidity #2
2	0 ≥ %	0 ≤ %	Humidity #3
3	0 ≥ %	0 ≤ %	Humidity #4
4	0 ≥ %	0 ≤ %	Humidity #5
5	0 ≥ %	0 ≤ %	Humidity #6
6	0 ≥ %	0 ≤ %	Humidity #7
7	0 ≥ %	0 ≤ %	Humidity #8
8	0 ≥ %	0 ≤ %	Humidity #9
9	0 ≥ %	0 ≤ %	Humidity #10
10	0 ≥ %	0 ≤ %	Humidity #11
11	0 ≥ %	0 ≤ %	Humidity #12
12	0 ≥ %	0 ≤ %	Humidity #13
13	0 ≥ %	0 ≤ %	Humidity #14
14	0 ≥ %	0 ≤ %	Humidity #15
15	0 ≥ %	0 ≤ %	Humidity #16

**D Threshold Configuration Filename**

Configuration File Status: OK

Configuration File Time Stamp: 00:00:00.000 PM MM/DD/YYYY

Configuration File Size: 0 Bytes

- A. Controls for enabling interlock
- B. Limit controls for temperature interlocks
- C. Limit controls for humidity interlocks
- D. Configuration file status readback

Note: Indicators appear greyed out because screen is not running.

# RICH-I LabVIEW Remote Interface – Expert Control Tab

- A. Configuration settings for which cRIO connects
- B. EPICS-LabVIEW mode control
- C. Averaging control
- D. Trip delay control
- E. Interlock latching behavior control
  - Not used but left in program
- F. Software override to other RICH interlock cRIO

**Interlock Status and Signal Monitoring** | **Thresholds and Enable Control Settings** | **Expert Control Settings** | **Raw Data and System Monitoring** | **Live Plots** | **Averaging Study**

**A** Hardware Interlock cRIO IP Address: 129.57.160.214  
Current Control Mode: Hardware Interlock Control Loop  
Switch Target to Safe State  
Run Control | Stop Control  
CONTROL MODES IS DISABLED  
System is Locked to Hardware Interlock Control Loop

**B** Interlocks Trip Latch Status: OFF  
Threshold Control: UI Threshold Control

**C** Averaging Control

Channel	averaging enable	Number of Samples	Averaging Reset
0	Disable	0	Temperature 1
1	Disable	0	Temperature 2
2	Disable	0	Temperature 3
3	Disable	0	Temperature 4
4	Disable	0	Temperature 5
5	Disable	0	Temperature 6
6	Disable	0	Temperature 7
7	Disable	0	Temperature 8
8	Disable	0	Temperature 9
9	Disable	0	Temperature 10
10	Disable	0	Temperature 11
11	Disable	0	Temperature 12
12	Disable	0	Temperature 13
13	Disable	0	Temperature 14
14	Disable	0	Temperature 15
15	Disable	0	Temperature 16
16	Disable	0	Humidity 1
17	Disable	0	Humidity 2
18	Disable	0	Humidity 3
19	Disable	0	Humidity 4
20	Disable	0	Humidity 5
21	Disable	0	Humidity 6
22	Disable	0	Humidity 7
23	Disable	0	Humidity 8
24	Disable	0	Humidity 9
25	Disable	0	Humidity 10
26	Disable	0	Humidity 11
27	Disable	0	Humidity 12
28	Disable	0	Humidity 13
29	Disable	0	Humidity 14
30	Disable	0	Humidity 15
31	Disable	0	Humidity 16

**D** Trip Delay Control

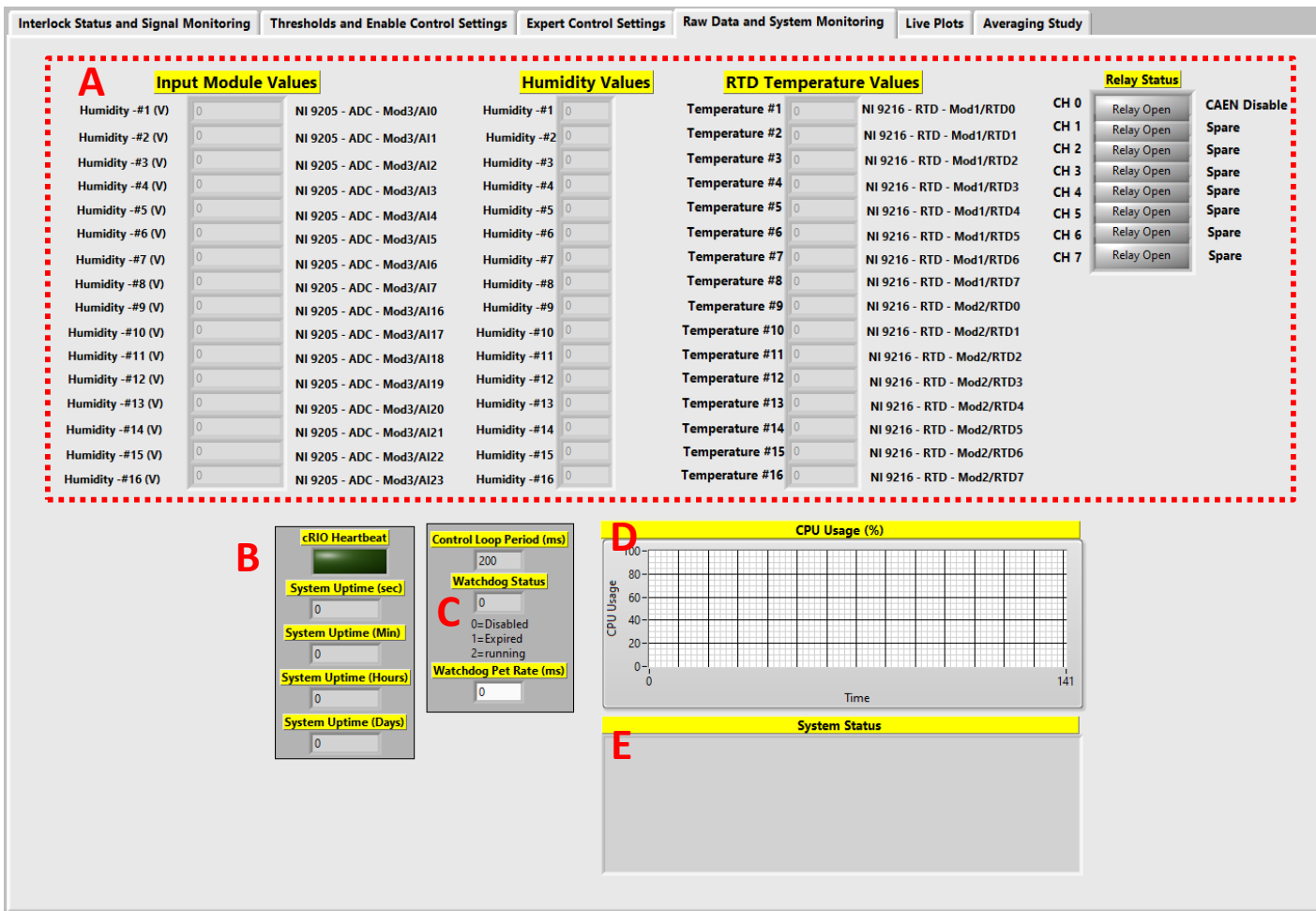
Channel	trip delay enable	trip delay times
0	Disable	0
1	Disable	0
2	Disable	0
3	Disable	0
4	Disable	0
5	Disable	0
6	Disable	0
7	Disable	0
8	Disable	0
9	Disable	0
10	Disable	0
11	Disable	0
12	Disable	0
13	Disable	0
14	Disable	0
15	Disable	0
16	Disable	0
17	Disable	0
18	Disable	0
19	Disable	0
20	Disable	0
21	Disable	0
22	Disable	0
23	Disable	0
24	Disable	0
25	Disable	0
26	Disable	0
27	Disable	0
28	Disable	0
29	Disable	0
30	Disable	0
31	Disable	0

**E** Control Configuration Settings  
THESE OVERRIDES WILL NOT HOLD DURING A REBOOT  
USER MUST USE FRONT PANEL SWITCHES FOR REBOOT OVERRIDE  
Latch All Interlocks On Trip  
Latch on Interlock Trips  
When Latch Trips ON - Requires Operator Reset upon  
When Re-Enable Below Thresholds  
System will re-enable crates  
Update Control Configurations  
Control Configuration changes are ONLY sent to the cRIO Chassis when you click "Update Control Configurations".  
YOU MUST PUSH "UPDATE CONTROL CONFIGURATIONS"

**F** Software Override to RICHCRIO  
OVERRIDE TO RICHCRIO DISABLED  
Closes Relay 7 on RICH1EPCRIO to allow remote override of RICHCRIO interlocks.  
Remote override will not hold if RICH1EPCRIO is rebooted.  
OVERRIDE DISABLED  
NOTE: IF CONTROLS ARE NOT WORKING, CHECK THRESHOLD CONTROL SETTING.

Note: Indicators appear greyed out because screen is not running.

# RICH-I LabVIEW Remote Interface – Raw Data Monitoring Tab



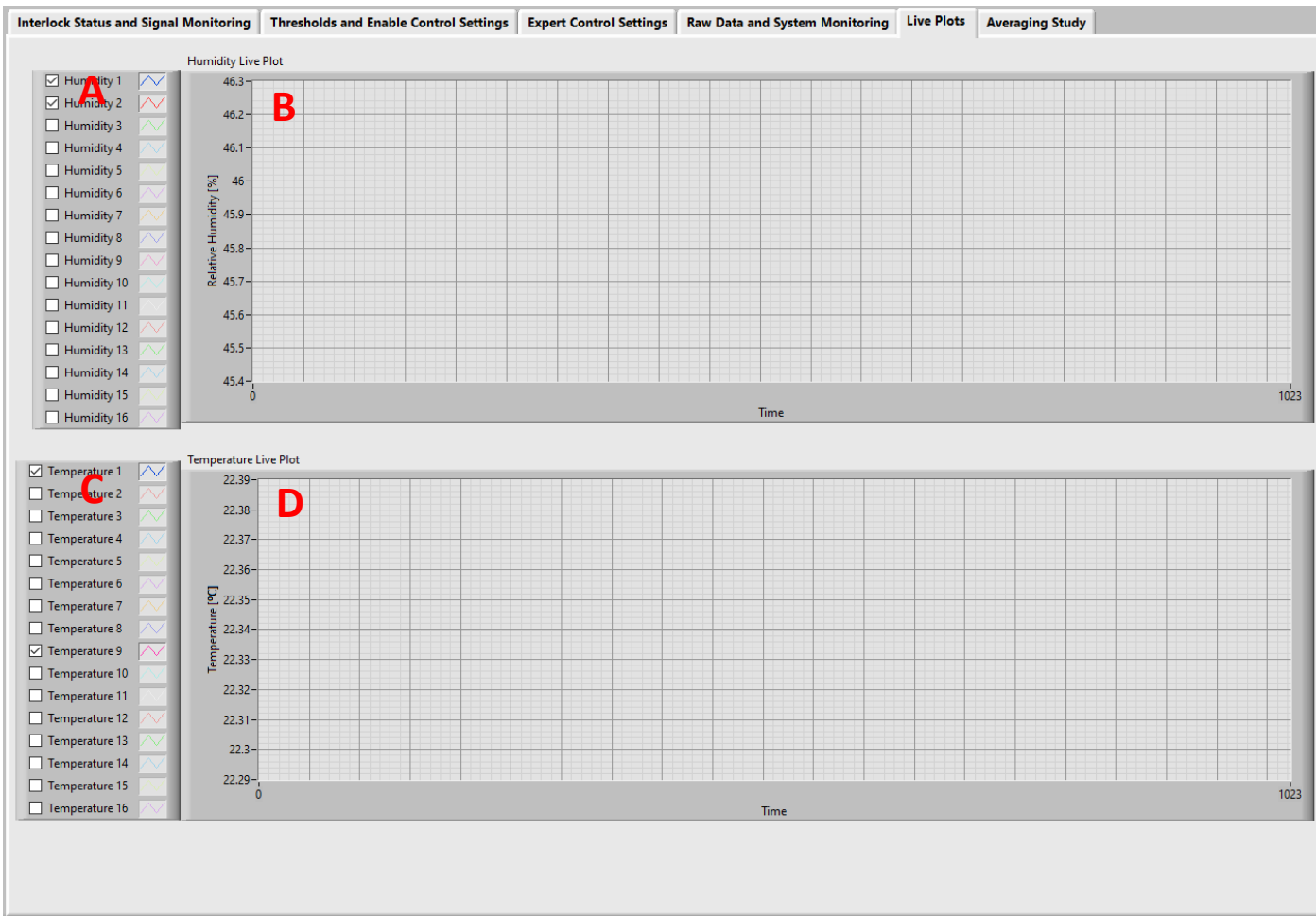
- A. Raw data monitoring from cRIO modules
- B. cRIO health readback
- C. Watchdog status
  - Not used but left in program
- D. CPU usage plot
- E. System status messages

Note: Indicators appear greyed out because screen is not running.



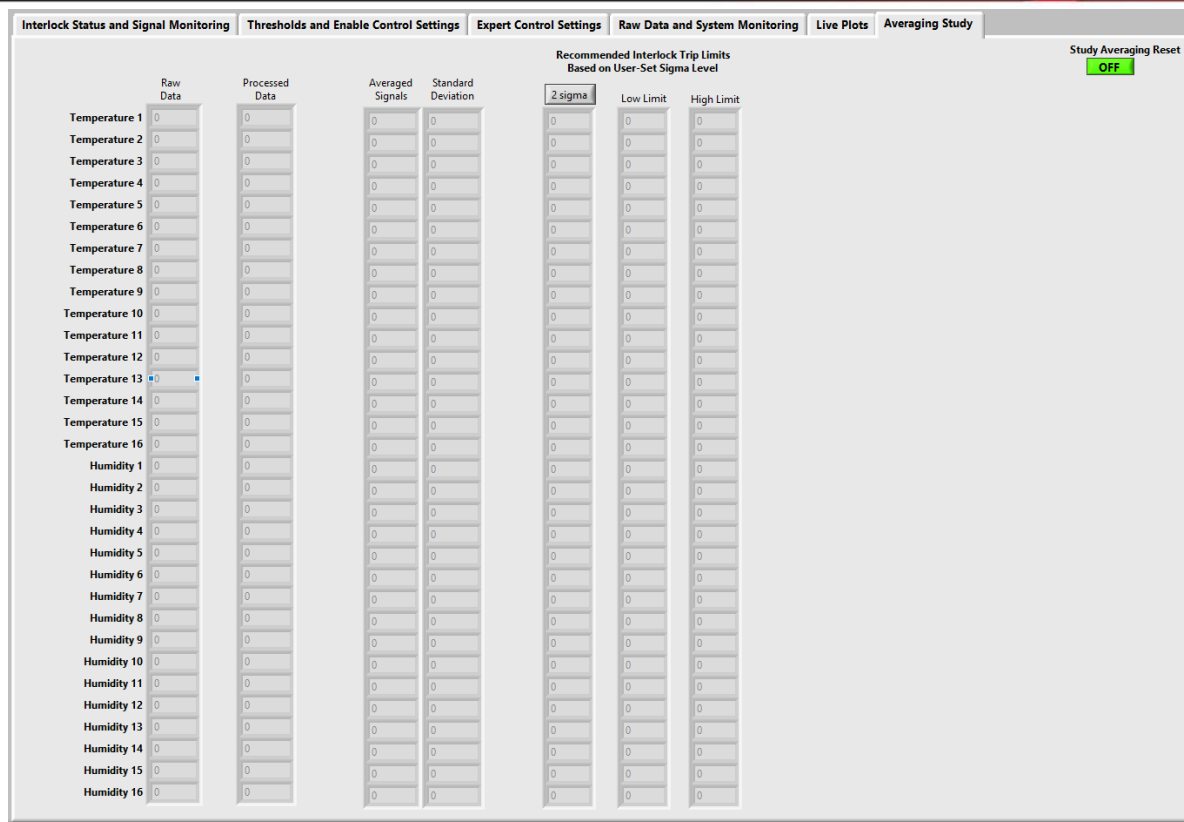
# RICH-I LabVIEW Remote Interface – Live Plots Tab

- A. Control to select humidity sensors to plot
- B. Humidity data live plot
  - Plotted data is not saved and only exists in LabVIEW
- C. Control to select temperature sensors to plot
- D. Temperature data live plot
  - Plotted data is not saved and only exists in LabVIEW



Note: Indicators appear greyed out because screen is not running.

# RICH-I LabVIEW Remote Interface – Averaging Study Tab



Note: Indicators appear greyed out because screen is not running.

- Tab was added for investigation into whether averaging subVI worked correctly; not needed for RICH-II
  - LabVIEW code for indicators on tab was used to verify results from LabVIEW's built-in averaging subVI

# Changes in Remote Interface for RICH-II

- Network variables will be used instead of messaging
  - Similar to all Hall B Gas System GUIs
  - Simplifies LabVIEW block diagram
  - Will allow multiple users to use remote interface at same time
- Unneeded features will be removed
  - Watchdog monitoring
  - Interlock latching behavior control
  - Averaging Study tab

# Conclusion

- RICH-II LabVIEW remote interface will have the same features as RICH-I's, but the LabVIEW code to get data will be different
  - Network variables will be used instead of messaging