Detector Support Group
Weekly Report, 2018-10-31

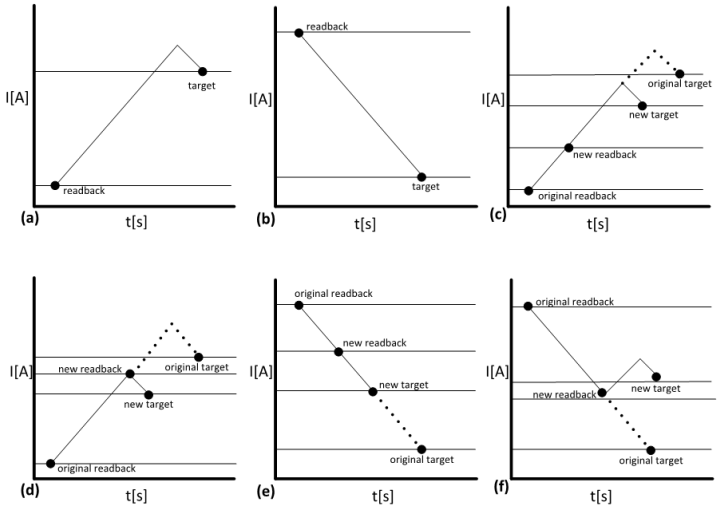
Summary

Hall C Slow Control Systems

- Spreadsheet of PVs that will be monitored, controlled, and archived in new EPICS system is being generated.
  - ✶ List will help determine configurations required to implement new controls system.
- Investigations underway of best way to implement EPICS in Hall C slow controls systems.
  - ✶ The PLC-to-EPICS interface will use EPICS EtherIP driver and a database of records made from Hall C PLC tags.
    - Hall B and Hall D use a similar PLC-to-EPICS configuration.
  - ✶ SHMS & HMS CSS GUI control screens will look like the current PLC HMIs to aid users in the transition to EPICS.
  - ✶ Users will be able to simultaneously run both EPICS control screens and PLC HMI.
  - ✶ Two DSG computers are being converted to Linux-based EPICS machines for system development.

Hall C Magnets

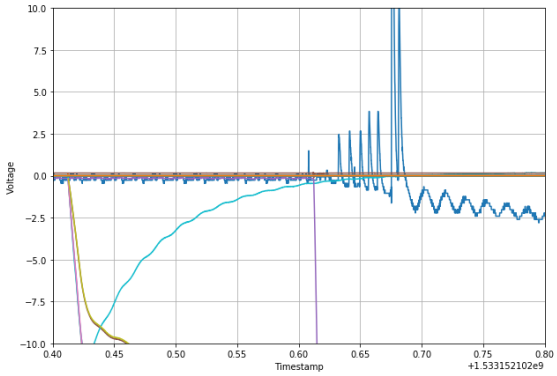
- Fast I/O ADC modules for PLC (model: 1756-IF4FXOF2F/B) researched for potential use in voltage tap data logging for SHMS and HMS PLC systems.
  - ✶ Module's four inputs are -10 – +10 V with 14-bit resolution.
    - 1756- IF16/B ADC modules currently in use have eight channels.
  - ✶ Module also has two 0 – 20 mA output channels with 13-bit resolution.
  - ✶ Maximum recommended data transfer rate uses Requested Packet Interval of 6 ms and a Real-time Sample rate of 300 µs.
    - Data will be logged at ~160 Hz.
- Additional debugging and error handling for PLC communication loss added to SBC's NMR code.
- In Current Loop Regulation Program, ability to hold power supply current if operator turns off current-loop added and is being debugged.
  - ✶ Program executes code in the wrong order, causing buttons to require pressing twice to register.
  - ✶ Attempted debugging by reordering code on function block diagram, adding additional sheets to function block diagram to force a sequence of execution, and adding a timer between components.
- MPS ramp diagrams created showing the six ramp behaviors tested during development of the Current Loop Regulation Program.
  - ✶ **(a)** – ramp behavior if target current is greater than MPS's original readback current when MPS is not ramping.
  - ✶ **(b)** – ramp behavior if target current is less than MPS's original readback current when MPS is not ramping.
  - ✶ **(c)** – ramp behavior if user inputs a new target current while the MPS is ramping up that is less than the original target current but greater than the MPS's latest current readback.
  - ✶ **(d)** – ramp behavior if user inputs a new target current while the MPS is ramping up that is less than both the original target current and the MPS's latest current readback.
  - ✶ **(e)** – ramp behavior if user inputs a new target current while the MPS is ramping down that is greater than the previous target current but less than the MPS's latest current readback.
  - ✶ **(f)** – ramp behavior if user inputs a new target current while the MPS is ramping down that is greater than both the previous target current and the MPS's latest current readback.



Six diagrams showing the ramp behavior tested in the Current Loop Regulation Program.

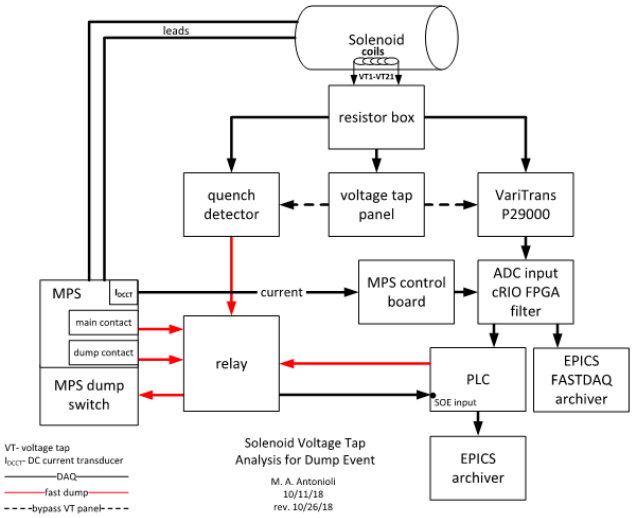
Hall B Magnets

- Failure of Torus VCL A band heater caused controlled ramp down.
  - ✶ Failed heater replaced with new heater (400 W, 120 VAC).
  - ✶ Control and operation of the new heater successfully tested by ramping Torus to 1000 A.
- New EPICS screen added to *clascss* to display PLC SOE timestamps and convert SOE timestamp format to readable date-time format.
- Changes in Solenoid load cells during fast dumps and controlled ramps analyzed.
  - ✶ For fast dumps, overall changes in radial load cells and their rates of change have been constant.
  - ✶ For fast dumps, axial load cells have changed less during recent dumps than in earlier dumps.
    - Axial LC ZS86101US_BR_B has varied the most (~50 lbsf) between dumps.
  - ✶ For controlled dumps, all load cells changes and rates of change have been constant.
  - ✶ Difference in overall load cell changes between fast dumps and controlled ramps is not significant.
    - Max difference was ~34 lbsf for RS86107DS_BL_B
    - ~30 lbsf load cell change previously said to be insignificant by Dave Kashy.
- Python program developed to overlay plots of FastDAQ data to allow easier viewing of VTs' and IDCCT behavior and timing during fast dumps.



Plot of Solenoid IDCCT and all voltage taps during fast dump. All signals are overlapped in plot to allow easier viewing of timing of VT and IDCCT behavior during dump.

- Solenoid Voltage Tap Analysis drawing revised to show MPS dump switch and IDCCT data path.



Visio drawing showing the instrumentation for Solenoid used to detect and record data for fast dump events.

- Solenoid Voltage Taps drawing revised to show quench detector channels.

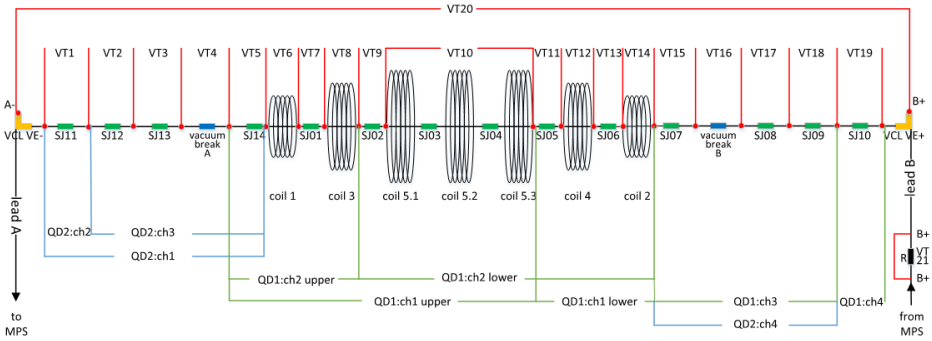


Diagram of Solenoid components showing location of voltage taps and taps monitored by each quench detector channels.

RICH

- RICH FPGA temperatures observed to falsely jump to a high value or zero for a few seconds before returning to a normal value.
  - ✶ Last week, noted FPGA false temperatures are occurring without fiber connections dropping.
  - ✶ Up to now, it appeared that each FPGA false temperature occurred at the same time as a dropped fiber connection.
    - EPICS only alarms on dropped fibers and high FPGA temperatures (if two consecutive high temperature readings separated by 10 seconds are recorded).

HDice

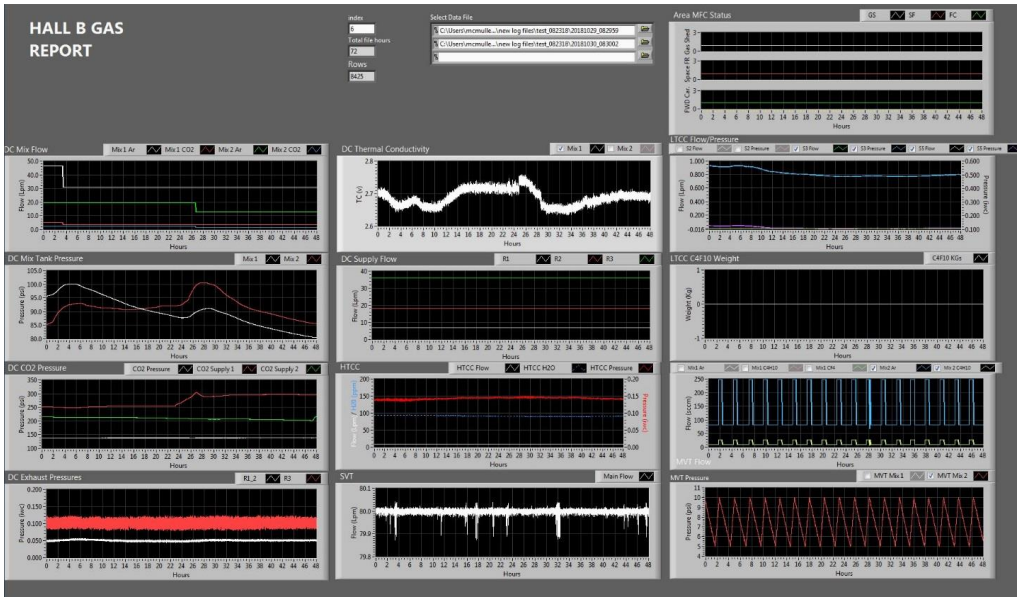
- Testing and reduction of noise on Rack #1 in progress.
- DSG will work with HDice Group to improve grounding of NMR instrumentation racks.
- New Windows 10 computer will be delivered to DSG lab for LabVIEW and instrumentation driver installation and testing of HDice program.
- Python program developed to analyze data files generated by LabVIEW RF-Box Attenuation test program.
  - ✶ LabVIEW's built in waveform analysis subVIs were having trouble measuring attenuated signal's amplitude if attenuation setting was -55 dB or less.
  - ✶ Python has better curve-fitting functionality, so a program was developed to measure signal's amplitude by fitting a sine wave to raw data from the oscilloscope.

MVT

- Two MFCs (one 500 sccm and one 1000 sccm) provided to Hall B for detector exhaust test setup.

Gas Controls

- Preliminary Gas Report display completed.
  - ✶ LabVIEW program allows user to display locally archived data for gas system.
  - ✶ Gas Report program developed to allow efficient daily monitoring of entire gas system.
  - ✶ Program gives user ability to view multiple daily log files at a time.
    - Data logger starts new a log file every morning at ~8:30 AM.



Gas Report display's LabVIEW front panel showing logged data from October 29 – 30, 2018.

Hall A SOLID-HGC

- Gas system P&I diagram and components spreadsheet updated.

DSG

- Note 2018-16 *Power Chassis for the Mass Flow Controllers of the Hall B Gas Controls and Monitoring System* posted to DSG website.
- Formatting and editing in progress for three DSG Notes that discuss:
  - Hall C spectrometer vacuum gauge
  - SHMS PLC upgrades
  - RICH nitrogen system upgrade.
- Top-level DSG website index pages created for Hall B subsystems.

Antonioli, Mary Ann

Hall B Magnets

- Revised Solenoid voltage tap analysis Visio drawing.
- Revised to Solenoid VT Visio drawing.

Hall C Magnets

- Revised to Hall C SHMS and HMS PLC network maps Visio drawings.
- Created new Visio drawing of six test types of Hall C current loop regulation code.

- Made final edits to and posted Noted 2018-16.
- Formatted and edited Tyler's Note on Hall C spectrometer vacuum gauge.
- Formatted and edited Brian's Note on SHMS PLC upgrades.
- Formatted and edited George's Note on RICH nitrogen system.

Bonneau, Peter

HDice

- Meeting with Xiangdong Wei:
  - Testing and reduction of noise on Rack #1 in progress.
  - DSG will work with Xiangdong to improve grounding, etc.
  - New Rack #1 computer with Windows 10 will be delivered to DSG lab for LabVIEW base installation, loading of HDice instrumentation drivers and programs, and testing.
- DSG note in progress on the LabVIEW hardware drivers needed for the development of CAENels CT-box current measurement system on HDice.

RICH

- We have seen that RICH FPGA temperatures falsely jump to a high value or zero for a few seconds before returning to a normal value.
  - Up to now, it appeared that each FPGA false temperature occurred at the same time as a dropped fiber connection. Epics alarms on dropped fibers
  - Last week, it was noticed that FPGA false temperatures are occurring without dropping the fiber connection as shown on the attached screenshot.
  - DSG will be investigating this issue.

Hall C Slow Control Systems

- Investigated implementation of EPICS in Hall C slow control systems.
  - The PLC to EPICS interface will use the EPICS EtherIP driver (as used in Halls B & D) along with the database of records made from Hall C PLC tags.
  - SHMS & HMS CSS GUI control screens will look like the current PLC HMI to aid users in the transition to EPICS control and monitoring.
  - Users can simultaneously run both EPICS control screens and PLC HMI.
  - Two DSG computers are being converted to Linux-based EPICS machines for system development.

- Held status and planning meeting on the implementation of EPICS in Hall C Control systems.

- Created top-level DSG website index pages for Hall B subsystems.

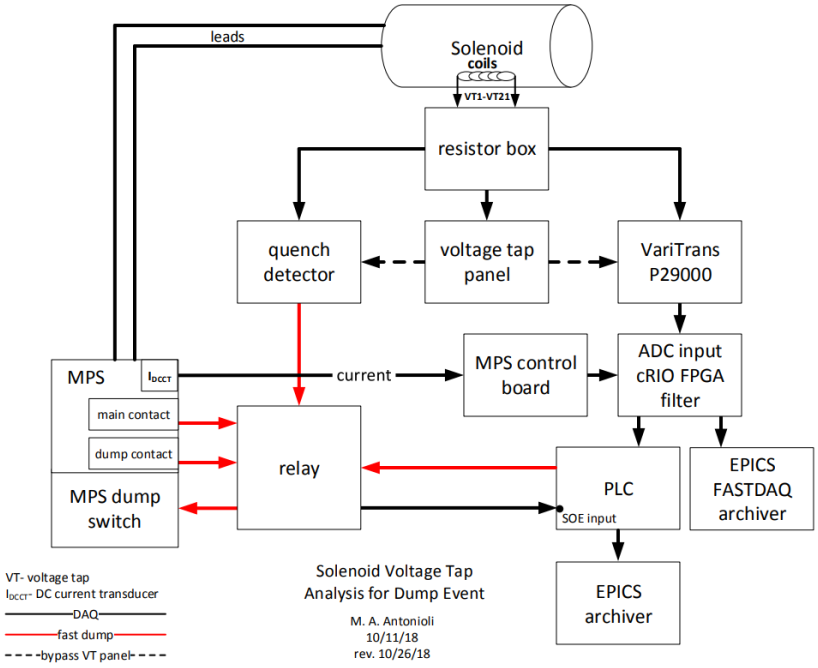
Campero, Pablo

Hall C

- Researched Fast I/O 1756-IF4FXOF2F/B ADC PLC module to be implemented for quench detection for SHMS and HMS PLC control systems.
  - 14 bit resolution module for an input range -10V – +10 V, and 13 bit resolution for an output range 0 — 20 mA (2 outputs).
  - Max recommended data transfer with Requested Packet Interval (RPI) of 6 ms and a Real time Sample (RTS) of 300 µs.
  - Only 4 input channels available for this Fast I/O module compared with the current 1756- IF16/B ADC modules in use, which have 8 channels in differential mode available (Spec to be considered since the replacement is planed)
- Debugging Quadrupole Current Regulation Loop PLC code to add function to hold power supply current if operator turns off current loop.
  - If the operator cancels the current loop while the MPS is ramping up/down, the MPS must stop ramping and hold at current Readout current became the set current in the MPS.
- Generating spreadsheet with the potential PVs that will be monitored, controlled, and archived in future EPICS
  - Extracting all PVs currently used in SHMS and HMS controls systems.
  - List of PVs will help to determine the magnitude of the EPICS implementation and configurations required.

Hall B Magents

- Modified abbreviated VTs instrumentation and Quench detection diagram
  - Modification includes the addition of the two relay contacts to monitor the MPS Main Contact and Dump contact in the PLC SOE module.



- Monitored Solenoid and Torus on a daily bases.
  - Issues with band heater for VCL A generated ramped down of the Torus.
  - The failed band heater on VCL A was replaced with new heater (400 W, 120 VAC)
  - Tested control operation of the heater by ramping Torus to 1000 A.

- Wrote Controlnet vs Ethernet modules Performance DSG note.
- Updated DSG webpage with Hall B magnets minutes meeting for FY18.

Eng, Brian

Hall B Magnets

- Worked with Nathan on adding the SOE Timestamps to EPICS/CSS: https://logbooks.jlab.org/entry/3615801
- Torus VCL heater failed over the weekend: https://logbooks.jlab.org/entry/3616409

Hall B Gas System

- Started work on converting MFC vi (that handles on MFCs on a cRIO) to be broken up into a sub-VI that will handle MFC arrays and use PSP variables (i.e. access shared variables programmatically)

Hall C Magnets

- Continued to add additional debugging for NMR code to handle things like when the PLC fails to respond, etc. Currently the code is fairly simple and will throw an exception when encountering an error.

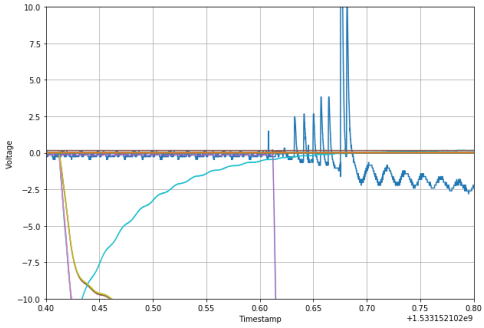
Hoebel, Amanda

Hall C

- Worked on Current Loop Regulation note.
  - Graphs of six tests created.
- Debugged Current Loop Regulation program.
  - Program is executing in the wrong order and causing buttons to require being selected twice to register.
  - Tried:
    - Reordering
    - Adding sheets to function block diagram
    - Adding timer

Magnets

- Wrote program in Python that plots current of IDCCT and all voltage taps.



Jacobs, George

Hall A SOLID-HGC

- Hall A SOLID HGC gas system note in progress
- Hall A SOLID-HGC Gas System detailed doc in progress
- More work on SOLID-HGC gas system P&I diagram and Components spreadsheet

Leffel, Mindy

- Completed performance appraisal.

Lemon, Tyler

HDice

- Developed Python program to analyze data files generated by LabVIEW RF-Box Attenuation test program.
  - ✶ LabVIEW's built in waveform analysis subVIs were having trouble measuring attenuated signal's amplitude if attenuation setting was -55 dB or less.
  - ✶ Python has better curve-fitting functionality, so a program was developed to fit a sine wave to raw data from the oscilloscope.
  - ✶ Results from test of NMR attenuator show that for all attenuation settings, there is an average difference of 0.390 dB ± 0.133 dB between the set attenuation and calculated attenuation of observed output signal.

Hall B Magnets

- Analyzed changes in Solenoid load cells (LCs) during fast dumps and controlled ramps.
  - ✶ Change in radial LCs and their rate of change have been constant for all fast dumps since February 19, 2018.
  - ✶ Change in axial LCs and their rate of change show a trend that the LCs change less during the more recent dumps than in earlier dumps.
  - ✶ Axial LC ZS86101US_BR_B has varied the most (~50 lbsf) between dumps.
  - ✶ All LC changes and rates of change appear to be constant for controlled dumps.
  - ✶ Difference between overall LC changes for fast dumps and controlled ramps is not significant.
    - Max difference was ~34 lbsf for RS86107DS_BL_B.
    - A ~30 lbsf change was previously said to be insignificant by Dave Kashy.

McMullen, Marc

LTCC

- Continued work on diagram of controls for gas system updates.

DC

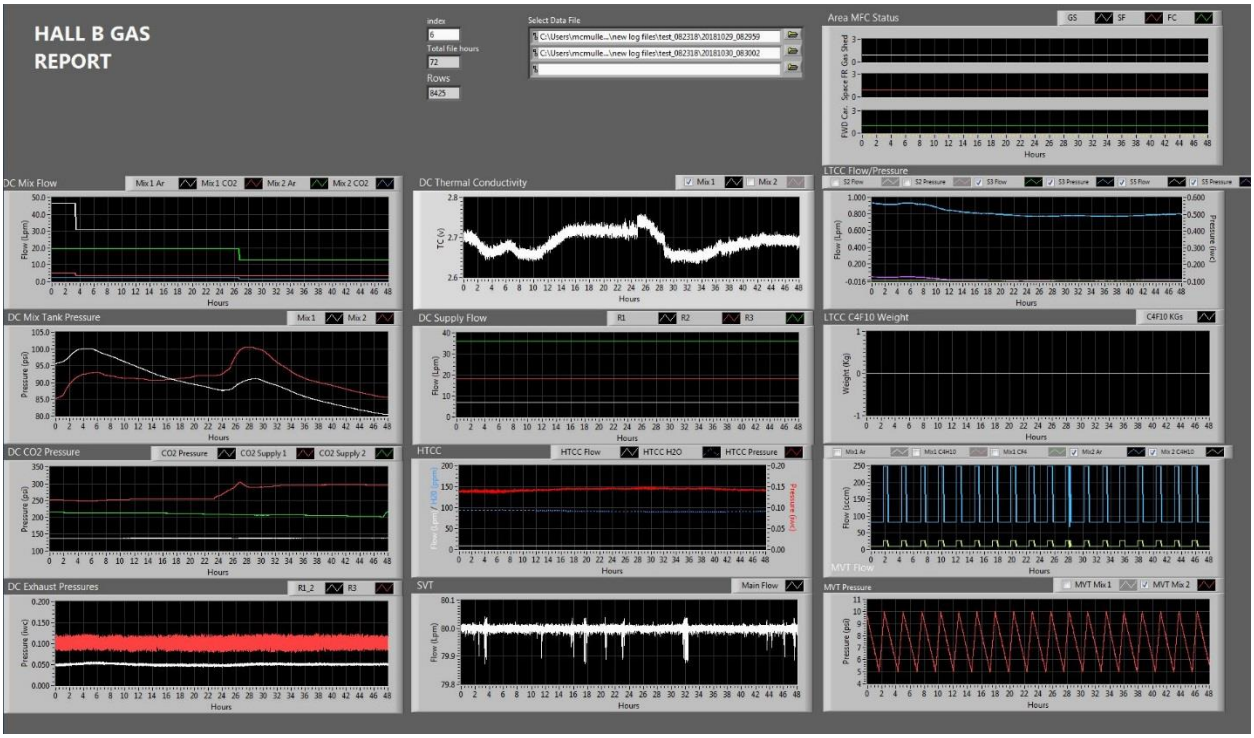
- Hall B mechanical has completed plots of multiple CO2/Ar gas mixtures and returned the results. Plotted a curve using the values provided. Requested that Hall B run the mix through the analyzer to complete the curve.

MVT

- Delivered two MFCs (500 and 1000sccm) to Hall B. Preset two channels on a MKS 647b controller to flow the DC Mix gas for the MVT test stand.

Gas Controls

- Completed the preliminary Gas Report display. Multiple days worth of data can be selected and displayed. The logger completes files every morning at ~8:30.



Gas report display LabVIEW User Interface.