Detector Support Group
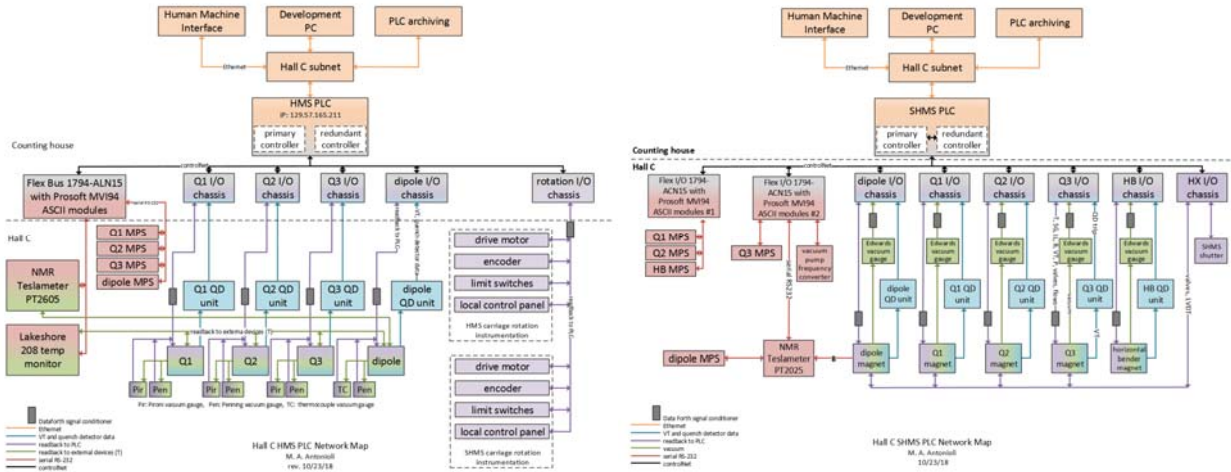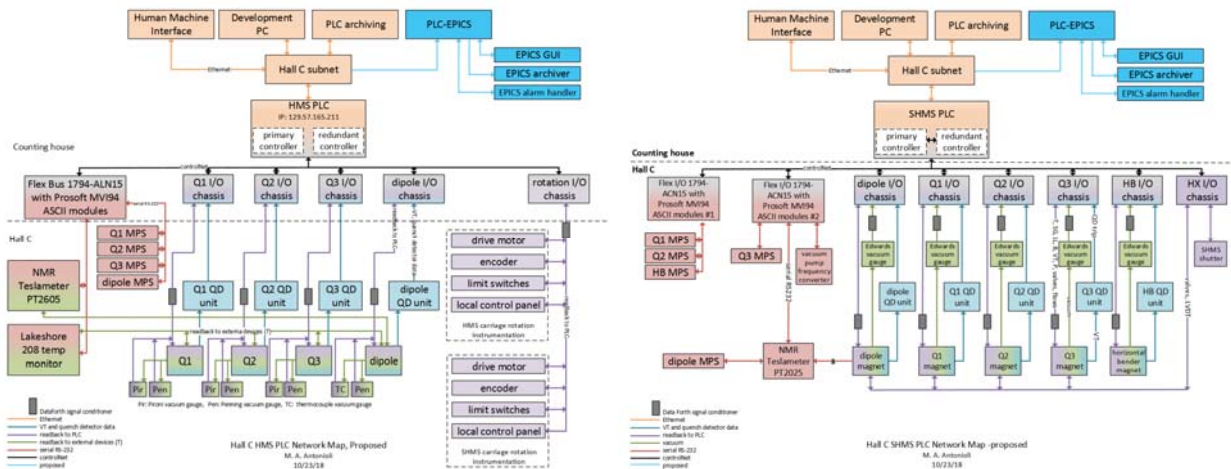### Weekly Report, 2018-10-24

Summary

Hall C Slow Control Systems

- Investigation into implementation of EPICS in Hall C slow control systems.
  - ✦ Implementation would include PLC-to-EPICS-PV converter software, CSS GUIs, interface to EPICS archiver, and EPICS alarm handler.
- Requested meeting with Stephen Wood and Jack Segal regarding EPICS work for Halls C & A.

Existing Hall C HMS (left) and SHMS (right) PLC controls system.

Proposed updates to HMS (right) and SHMS (left) controls system. Addition of EPICS system is in blue at top right of diagrams.

Hall C Magnets

- For PT2026 NMR unit, code added to SBC to automatically adjust the advanced RF parameters when PT2026 can't get a lock.
  - ✦ New code will be tested when HMS Dipole field is changed.
    - ▪ Dipole presently at ~1.4 T; PT2026 has no issues getting lock at 1.4 T.
- Additional functions requested by Hall C added to Quadrupole Current Loop Regulation routine:
  - ✦ Function to ramp MPS to 0 A if an interlock occurs.
  - ✦ Function to hold power supply if operator turns off current loop.
- Hardware procured to upgrade HMS PLC controller firmware from version 16 to version 20 for Windows 10 compatibility, see Table 1 below.
  - ✦ Software upgrade and PLC hardware installation for the upgrades will be done during the next shut down period.
  - ✦ To upgrade firmware version of SHMS PLC controller from v.16 to v.20, no new communication or redundancy modules were needed.

Qt	Part #	Description	Location
2	AB-1756-EN2T	Ethernet module	Hall C counting house
2	AB-1756- CN2	Controlnet module	Hall C counting house
2	AB-1756-RM2	Redundancy module	Hall C counting house
1	AB-1756-RMC1	Fiber Optic cable for Redundancy module connections	Ordered; yet to receive.

Table 1: Hardware to update HMS PLC system from firmware version 16 to version 20.

- Hardware procured for swapping ControlNet modules on remote SHMS PLC chassis with Ethernet modules, see Table 2.
  - ✦ SHMS PLC controller firmware upgrade completed over summer 2018 shutdown.
  - ✦ Two PLC Ethernet modules installed for Q1 and HX PLC remote chassis during the firmware upgrade for the SHMS PLC controller.
  - ✦ Four Ethernet modules will be installed in SHMS Q2, Q3, HB, and dipole PLC remote chassis during next shut down period.

Qt	Part #	Description	Location
1	AB-1756-EN2T	Ethernet module	SHMS-Q1 remote PLC chassis
1	AB-1756-ENBT	Ethernet module	SHMS-HX remote PLC chassis
4	AB-1756-EN2T	Ethernet modules	Hall C counting house

Table 2: Ethernet modules for replacing SHMS ControlNet modules.

Hall A

- Met with Bogdan Wojtsekhowski regarding hardware work on Hadron and EM calorimeters.
  - ✦ A meeting detailing the requested work will be forthcoming.
  - ✦ Tasks for calorimeters will include cable verification and module checks.

Hall A SOLID-HGC

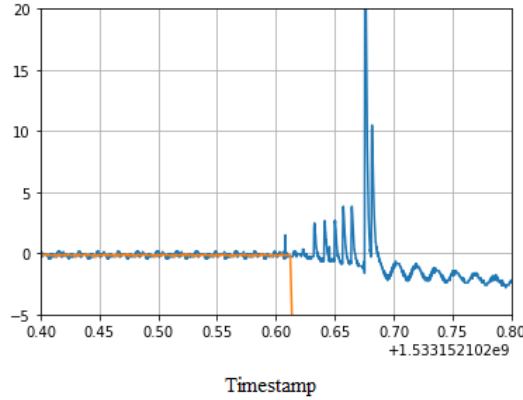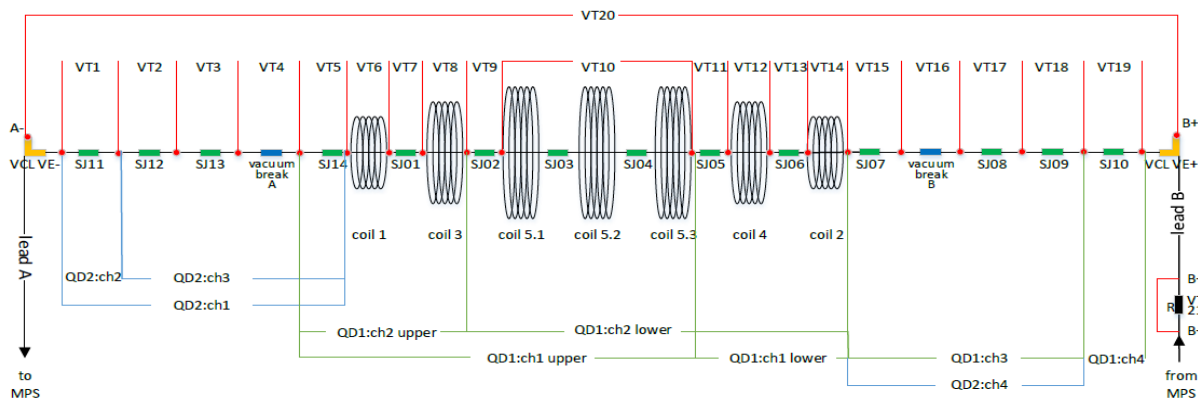- SOLID-HGC gas system P&I diagram and Components spreadsheet updated.

Hall B Magnets

- Program developed in Python to overlay plots of IDCCT current and voltage of VT20 to compare time difference between current and voltage changes during fast dumps.

Example plot of fast dump data with IDCCT signal overlaid with VT20 signal. Created by Amanda Hoebel on 10/23/2018

- Analyzed Solenoid load cell (LC) values over time to observe possible stress trends due to fast dumps.
  - ✱ Torus power state has largest effect on Solenoid LCs.
    - Solenoid LCs increase by ~400 lbsf when Torus is on.
    - According to Magnet Group, a difference when Torus is on is expected.
  - ✱ LC values change significantly during cryogenic warm-ups.
    - Observed change in LCs over summer shutdown when magnets were parked at 80 K.
    - According to Magnet Group, significant changes during warm-up were also expected.
  - ✱ There are no trends in LC values that can be correlated to fast dumps.
  - ✱ Three load cells have read zero for extended periods of time.
    - RS86103DS_BR_T, ZS86105US_BL_T, and ZS86108US_BL_B.
    - Unclear if cause is due to instrumentation failure.

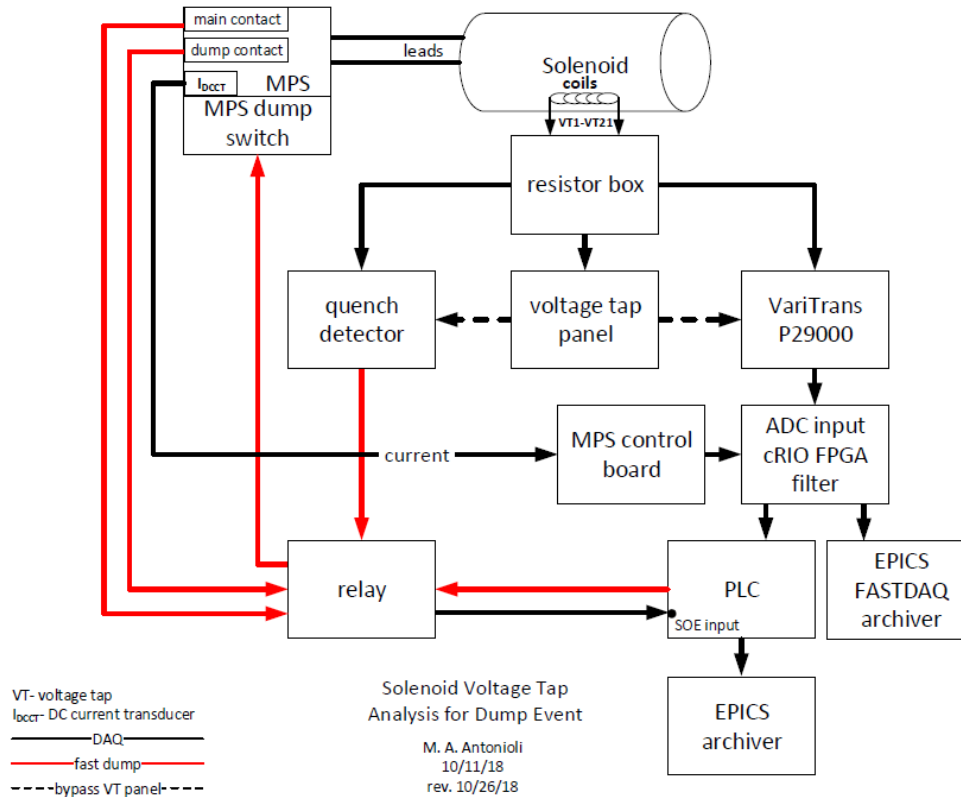- Drawing updated for Solenoid voltage taps to include QD channels.

SJ= splice junction
VT = voltage tap
VCL = vapor-cooled lead
QD=quench detector
ch=channel

Solenoid Voltage Taps
M.A. Antonioli
12/20/16
rev. 3/1/18
rev. 10/24/18

Abbreviated diagram for Solenoid Voltage Taps and Quench detectors connections

- Solenoid Voltage Taps Readout Instrumentation and Fast Dump Path diagram updated.

Abbreviated diagram for Solenoid Voltage Tap Instrumentation and Fast Dump Path

- Testing Yokogawa scope loaned by vendor continued.
  - ✶ Scope will be used to monitor voltages in Magnet Power Supply.
  - ✶ Scope loses ~1 s/day with respect to JLAB time.
  - ✶ Using SCPI commands, the scope and trigger time can be retrieved.
    - ▪ However, setting the time via SNTP to sync it with JLAB time only works via the front panel despite there being a command to do this remotely.
- Completed "*Solenoid-Torus fast dumps events due to VTs*" (Sep 2017 to Oct 2018) table.
- Completed *Solenoid Voltage Taps Values at Fast Dumps* table.
  - ✶ Completed fast dump event 16, 17, 18 and 19.

RICH
- Components received for the RICH N2 auto-change test setup.
- Python script developed to access MyaPlot for all PVs related to a user-defined tile number.
  - ✶ Script expedites debugging and investigation of fiber drops.
  - ✶ PVs plotted are for tile's FPGA voltages, and FPGA temperature, HV settings, LV settings, and the tile's PMT scaler counts.

HDice

- Documentation is being generated for review in July 2019.
  - Produced new documentation on the CAENels CT-box and DCCT head and its use in the new synchronization mode of the NMR system.
- Investigation into compatibility of HDice software on Windows 10 underway.
  - HDice group procured a new PC.
  - Computer Center's policy is that all new PCs have to have Windows 10.

LTCC

- Upcoming LTCC work reviewed with Hall B Engineering.
  - Design of LTCC gas system in progress.
  - 0-50 psig pressure transducer received for tanks and supplies
  - 0-3 inH$_2$O differential pressure transducer received for sectors.
- Development of controls and logic diagrams started for the LTCC gas system's modification.
  - A new MFC will be added to the gas return to control the flow of return gas.

DC

- Variety of CO_2/Ar gas mixtures tested using thermal conductivity transducers (TCT) to create a calibration curve for TCT-voltage and CO_2/Ar gas composition.
  - Mixtures tested were 8%, 9.93%, 10.1%, 10.2%, 10.3%, 11%, and 15%.
    - Percentages listed above are percent of CO_2 in mixture. Remaining gas in mixtures is Ar.

MVT

- Conducting tests to improve MVT exhaust flow.
  - Currently, MVT's exhaust is routed out to the target gas pad and high winds are causing flow fluctuations in the detector.
  - A new mass flow controller to supply ~8 Liters-per-hour of test gas into exhaust line of test set-up will be used.

Hall B Gas System

- Fabrication of third and fourth MFC power chassis completed.

cRIO Test Stations

- Automatic test for NI-9205 ADC module in ±1 V range developed.
- Triggering files developed for Agilent logic analyzer to test digital I/O signals on the sbcRIO FPGA I/O.
  - sbcRIO is being investigated for possible use in future detector slow controls and monitoring.

Antonioli, Mary Ann

- For **cRIO Test Station**, wrote, tested, and debugged NI-9205 ADC module automatic test for ±1 V.
- Began organizing documentation files for **HDice**.
- Made Visio drawing of **Solenoid** voltage tap analysis.

- Edited gas system note.
- Formatted and edited Amanda's Note on Hall C Quadrupole current loop regulation code.

Bonneau, Peter

HDice

- Investigated compatibility of HDice software on Windows 10.
  - ✶ HDice group procured a new PC; Computer Center's policy is that all new PCs have to have Windows 10.
  - ✶ NMR, Fast Resonance Scanner, Rotation of Target Polarization, hardware test programs, and device drivers investigated.
- Developed documentation on the use of the CAENels CT-box and DCCT head in the new synchronization mode of the HDice NMR system.

Hall C Slow Control Systems

- Investigated implementation of EPICS in Hall C slow control systems.
  - ✶ Implementation would include PLC-to-EPICS-PV converter software, CSS GUIs, interface to EPICS archiver, and EPICS alarm handler.
- Held daily status and planning meeting on the implementation of EPICS in Hall C Control systems.
- Requested meeting with Stephen Wood and Jack Segal regarding EPICS work for Halls C & A.
- Alternative control system hardware other than Allen Bradley will also be considered and investigated.

Hall A

- Met with Bogdan Wojtsekhowski regarding hardware work on the Hall A Hadron and EM calorimeters.
  - ✶ A meeting detailing the requested work will be forthcoming.

DSG

- Developed Agilent logic analyzer analysis triggering files for digital I/O signals on the National Instruments single-board cRIO (sbcRIO) FPGA I/O.
  - ✶ sbcRIO is being investigated for possible use in future detector slow controls and monitoring.
- Revised and edited top-level index pages for DSG website.

Campero, Pablo

Hall C

- To upgrade HMS PLC controller firmware from version 16 to version 20 for Windows 10 compatibility, the following hardware in Table 1 below was procured.
  - ✶ Software upgrade and PLC hardware installation for the upgrades will be done during the next shout down period.
  - ✶ To upgrade firmware version of SHMS PLC from v.16 to v.20 controller no new communication or redundancy modules were needed.

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Table 1: Hardware required procured to update HMS PLC system from firmware version 16 to version 20.

- For the swapping ControlNet modules on remote SHMS PLC chassis with Ethernet modules, PLC hardware in Table 2 below was procured.
  - ✶ SHMS PLC controller firmware upgrade completed over summer 2018 shutdown.
  - ✶ Two PLC Ethernet modules installed for Q1 and HX PLC remote chassis during the firmware upgrade for the SHMS PLC controller.
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Table 2: Ethernet modules for replacing SHMS ControlNet modules.

- Generated diagrams with the details of the DSG proposal for the EPICS implementation to the Hall C HMS and SHMS PLC controls, monitoring and archiving systems.

Hall B Magents

- Modified abbreviated diagram for Solenoid Voltage Taps Readout instrumentation and Fast dump path.
  - ✶ Bypassed VT panel from path to show the voltage tap readouts during normal Solenoid operations.
  - ✶ Added MPS and IDDCT signal readouts
  - ✶ Added EPICS FastDAq archiver block.
- Modified abbreviated diagram for Solenoid voltage taps.
  - ✶ Added Quench Detector channels
- Completed *Solenoid-Torus fast dumps events due to VTs* (Sep 2017 to Oct 2018) table.

- Completed *Solenoid Voltage Taps Values at Fast Dumps* table.
  - ✶ Completed fast dump event 16, 17, 18 and 19.

Eng, Brian

Hall B LTCC

- Meeting with Marc, Bob & Krister to go over upcoming LTCC work (design still in progress), from that ordered and received pressure sensors (0-50 psig for tanks/supplies/etc & 0-3"wc differential for sectors).

Hall B Magnets

- Continued testing Yokogawa scope, found that it loses ~1 sec/day (slower than JLAB time). Using SCPI commands can retrieve the scope and trigger time, but setting the time via SNTP only appears to work via the front panel despite there being a command to do this.
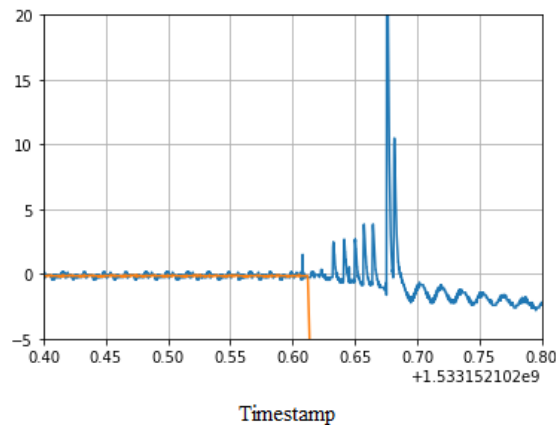
Hall C Magnets

- Added code to automatically adjust the advanced RF parameters when PT2026 can't get a lock, hasn't been tested much as Dipole is running at ~1.4T which is where it doesn't have any problems getting a lock with the default settings.

Hoebel, Amanda

Magnets

- Wrote program in Python that plots current of IDCCT and voltage of VT20.

Timestamp

Hall C

- Corrected Current Loop Regulation note.
  - ✶ Note had 4 tests conducted; corrected to 6 tests.
- Worked on Current Loop Regulation routine.
  - ✶ Added MPS ramp to 0A if interlock occurs.
  - ✶ Added function that holds power supply if operator turns off current loop.

Jacobs, George

RICH
- Completed RICH N2 gas system note
- Received components for the RICH N2 auto-change test setup

Hall A SOLID-HGC
- Updated SOLID-HGC gas system power point.
- Updated SOLID-HGC gas system P&I diagram and Components spreadsheet.

Leffel, Mindy

Hall B Gas System
- Completed fabrication of third and fourth MFC power chassis.
  - Made final connections and performed visual inspections.

DSG
- Completed annual standards of conduct (GEN101).
- Started performance appraisal.

Lemon, Tyler

Hall B Magnets
- Developed Python program to plot Solenoid load cell (LC) values over time to observe trends in their readings. Found that:
  - Torus power state has largest effect on Solenoid LCs.
    - Solenoid LCs increase by ~400 lbsf when Torus is on.
  - After affects from Torus field, LC values seem to increase the most due to cryogenic warm-ups.
    - Observed significant change in LCs over summer shutdown when magnets were parked at 80 K.
  - There does not appear to be any trend in LC values that can be correlated to fast dumps.
  - Three load cells have read zero for extended periods of time.
    - RS86103DS_BR_T, ZS86105US_BL_T, and ZS86108US_BL_B.
    - Unclear if cause is due to instrumentation failure.

RICH
- Wrote Python script to access MyaPlot for all PVs related to a user-input tile number.
  - Script stored on clonls2 at /home/clasrun/rich/DSG/getTileInfo.py.
  - Script expedites debugging and investigation of fiber drops.
  - PVs plotted are for tile's FPGA voltages, and FPGA temperature, HV settings, LV settings, and the tile's PMT's scaler counts.

McMullen, Marc

DC
- Continued working with Hall B on DC mixture composition.

* We are testing a variety of gases mixtures (CO_2/Ar).
* The mixtures will be 8%, 9.93%, 10.1%, 10.2%, 10.3%, 11%, and 15%
* This should provide enough points on a curve to make a plot.

LTCC

* Started working on controls and logic diagrams for phase 2 of the LTCC gas modification.
  * Hall B has informed that they will be adding a new MFC to the gas return to control the flow of return gas.

MVT

* Hall B is conducting a test to improve the exhaust flow for the MVT.
  * Currently, the exhaust is routed out to the target gas pad and is impacted by high winds, this causes fluctuations in the detector.
  * They have requested temporary use of a new MFC to supply ~8 Liters-per-hour and help with a MFM to readout the exhaust.