Solenoid/Torus Controlled and Fast Dump Investigations

Date: February 25, 2019
Time: 13:30 – 14:00

Attendees: Pablo Campero, Brian Eng, Ruben Fair, Probir Ghoshal, Tyler Lemon, and Nick Sandoval

1. Torus and Solenoid went to Controlled Ramp Down on February 24, 2019 at ~ 15:52.
    - 1.1. Noticed that $\Delta P_{(Sup-Ret)}$ value dropped below its set threshold 55 psi, initiating a controlled ramp down for both magnets.
        - 1.1.1. Interlock recently added on Torus and Solenoid PLCs reacted as expected.
    - 1.2. Both magnets ramped to full field after $\Delta P_{(Sup-Ret)}$ reached ~ 58 psi.

2. Solenoid Fast Dump occurred on February 25, 2019 at ~ 04:18 due to major fault on PLC controller.
    - 2.1. PLC lost the .ACD file project, which affected controls on the Solenoid and EPCIS monitoring.
    - 2.2. Solenoid PLC reported major power up fault. According to Allen Bradley documentation:
        - 2.2.1. PLC detected a "non-recoverable fault".
        - 2.2.2. PLC in this state do not open any connections or allow transitions to run mode.
    - 2.3. Solenoid .ACD PLC project file was downloaded to the PLC after it was rebooted.
    - 2.4. PLC communication re-established to enable controls and monitoring of the Solenoid.

3. Discussion about test performed to check Solenoid and Torus MPS LCW supply flows based in ΔP analysis.
    - 3.1. For test performed on February 25, 2019, Hall B LCW level 1 supply valve was throttled until the supply pressure for the Solenoid and Torus MPS was ~ 78 psi (Normal operation value ~ 112 psi)
        - 3.1.1. The test was performed slightly different to the real scenario (when LCW:92_Flow_makeup fluctuation causes Hall B LCW Level return pressure increments), since there is no way to control the LCW return pressure.
        - 3.1.2. After supply pressure dropped to 78 psi; Solenoid MPS did not trip, only Torus tripped at $\Delta P_{(Sup-Ret)}$ ~ 45 psi.
    - 3.2. More testing will be required to be confident about this trip values.

4. Summarized functionalities added for the Torus, Solenoid and DBX PLCs.
    - 4.1. Added *Controller Fault Handler* routine, which will write the current control log to the SD cards.
    - 4.2. Saved current project to SD card with the options set to load on empty memory and put the PLC into run mode.

5. Actions to be performed
    - 5.1. Based on results of data acquired from the last magnet fast dumps; it was agreed that the Controlled ramp down interlock based on $\Delta P_{(Sup-Ret)}$ for both Solenoid and Torus will be changed from 55 psi to 48 psi.
    - 5.2. Investigate option to automatically write the controller log to the SD card.
        - 5.2.1. Test to be performed in the DSG PLC test stand.
    - 5.3. Contact Rockwell technical support to get more information about recent faults on Solenoid and DBX PLCs.