M9 Q1 Q2 Magnet Health Check: Original Version dated Oct. 9, 2020 by Syd Kreitzman

Background:

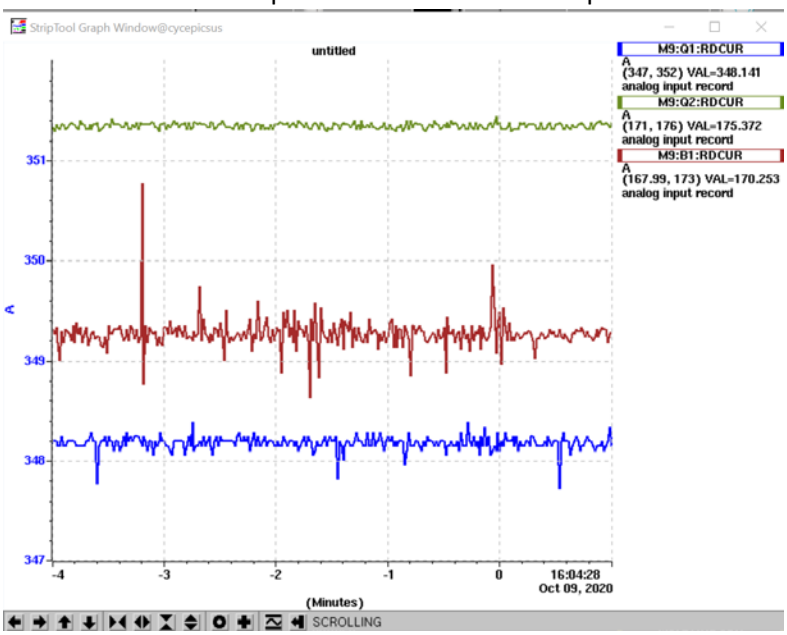
In Sep. 2020 TRIUMF completed installing a refurbished M9 front end, which included a new M9Q1 magnet (manufactured by Sigma-Phi and rated for 80V/750A) and a refurbished M9Q2 magnet which contained a new set of singly cooled coils (rated at 80V/350A). This document outlines the state of these magnets at installation, and a set of procedures to assess their health periodic health.

At installation:

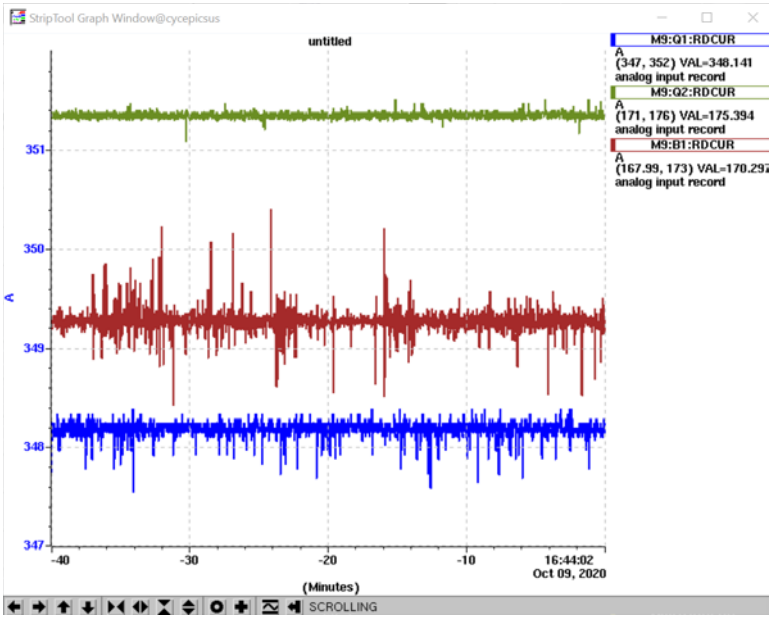
Settings: Q1 Q2 and B1 magnet polarity switches to Forward
Q1=350A, Q2=175A and B1=170A
EPICS striptool span=5A for each current
PSs set into remote mode

Epics Striptool responses:

Short term response after 30 min warmup:



Medium term response after 60 min warmup:



Note that as of the report date (Oct. 9, 2020)

1. Q1 has isolation amplifiers installed and its power supply ground fault detection circuit is bypassed. This is because a small ground fault (see below) was detected after installation, and it is suspected that this was caused by poor water conduction during the initial testing.
2. Q2 seems well behaved.
3. B1 and Q2 PSs are identical, but the B1 readback is significantly more erratic than Q2's and needs to be checked for ground faults.

The M9A EPICS system does not provide voltage readback, however the magnets have front panel meters from which this information can be recorded. The following table contains the front panel information for the Settings as above.

	Q1	Q2	B1
Current Setpoint (A via) EPICS	350	175	170
PS Meter Remote Current setpoint (V)	4.647	5.002*	4.855
PS Meter Current Readback (A)	349.43	175.47	170.38
PS Meter Voltage Readback (V)	22.3	28.363	27.598

*reference readback switch on PS is "flakey"

Apart from examining and comparing the current read-back response to that above, ground fault integrity can be ascertained by the following two methodologies (information supplied by Dan Louie).

Method 1:

1 With the power supply running, measure the voltage between the positive output terminal to building ground, this should be zero.

2 With the power supply running, measure the voltage between the negative output terminal to building ground, this should also be zero.

Method 2:

1 Isolate the magnet by disconnecting the DC cables (both positive and negative) at the power supply or magnet

2 Use a DVM meter to measure the resistance between the magnet coil and building ground

3 The resistance should be very high, more than 40 Mohm, on most DVM the display will show 'OL'

4 If the resistance is in the kOhm range, it very likely there is a ground fault

5 If the resistance is in the low Mohm range and the magnet is water cooled, then the water and/or hoses might be the problem