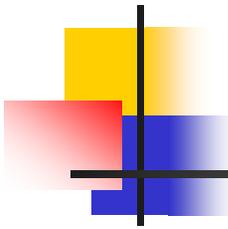


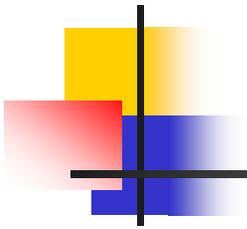
C0IR Quench Protection Monitors

- Three QPMs are required – B4, C0, and C1
- Trims have passive quench protection
- QPMs Use a Relative Quench Protection Algorithm:
$$V_r = V_c - L_c(di/dt)$$
 where V_r == resistive voltage
 V_c == cell voltage
 $di/dt = \Sigma V_c / \Sigma L_c$
- Relative di/dt compared with di/dt based on change in I from last sample as a reality check
- Quench limits +/- 0.25 volts (+/- 0.33 effective)
- Sampled at 60 Hz – averaged over three cycles
- Voltages are measured by Voltage to Frequency Convertors connected through isolating resistors to voltage taps on the coils.

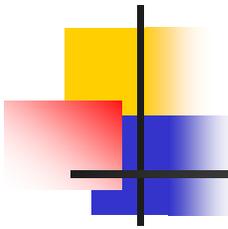
C0IR Quench Protection Monitors (cnt.)

- 
- Cell VFCs are +/- 100 volts (12.5 mV res.)
 - 20 KHz to 980 KHz for inputs -100v to +100 v
 - Counting pulse trains over a 60 Hz period filters out power supply noise
 - New HFUs - (900v, 7000 μ F) per channel
 - No external Dump resistors
 - 30 minute Uninterruptable Power supply
 - PPC processor housed in a VME crate with PMC cards for I/O.

Detection Margin



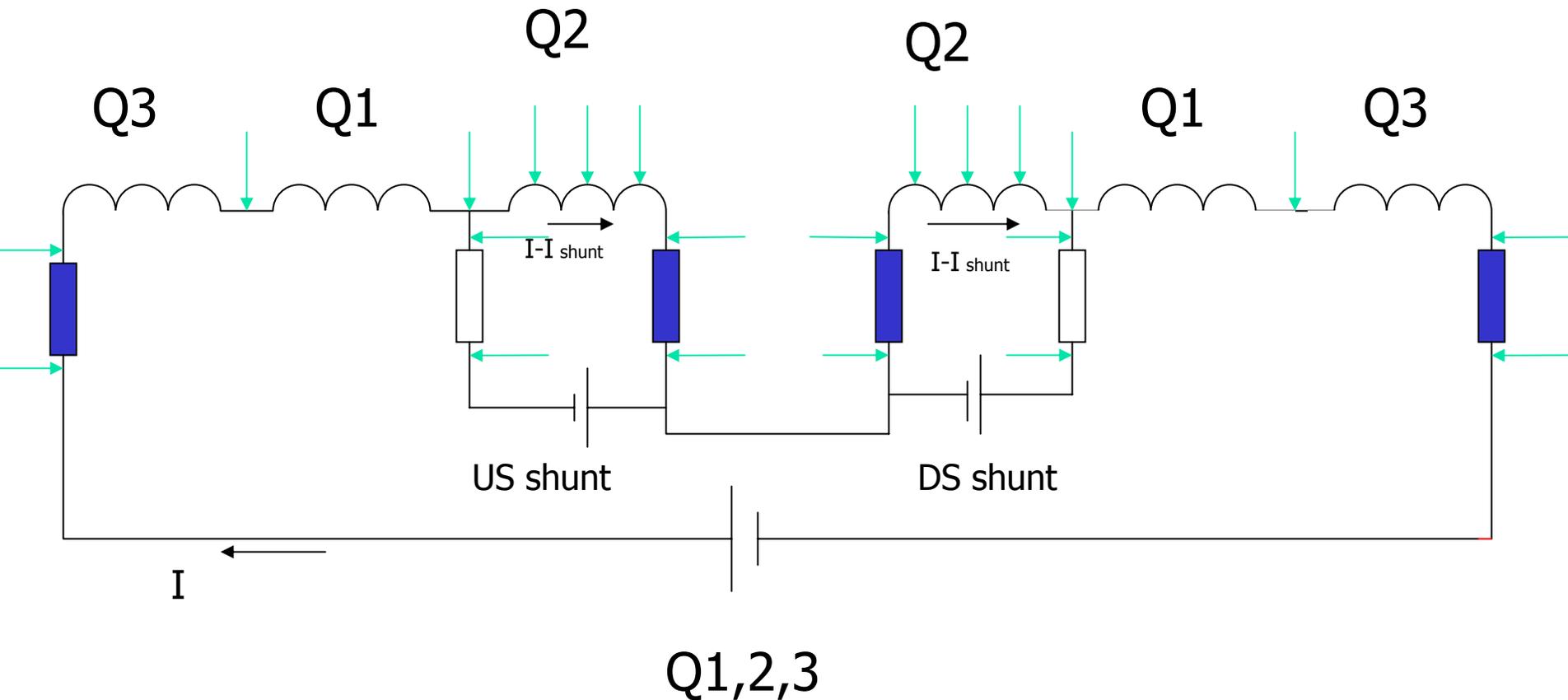
- Quench Integral Limit = $21 \times 10^6 \text{ A}^2 \text{ s}$ or 21 MIITs
- After firing heaters at 10 KA, 17 MIITs are used
- 4 MIITs are allowed for detecting the quench or 40 ms
 - It takes 10 ms to reach 0.25v at $I/I_c = 0.9$
 - Even linear quench growth will be detected in two line cycles or 33 ms



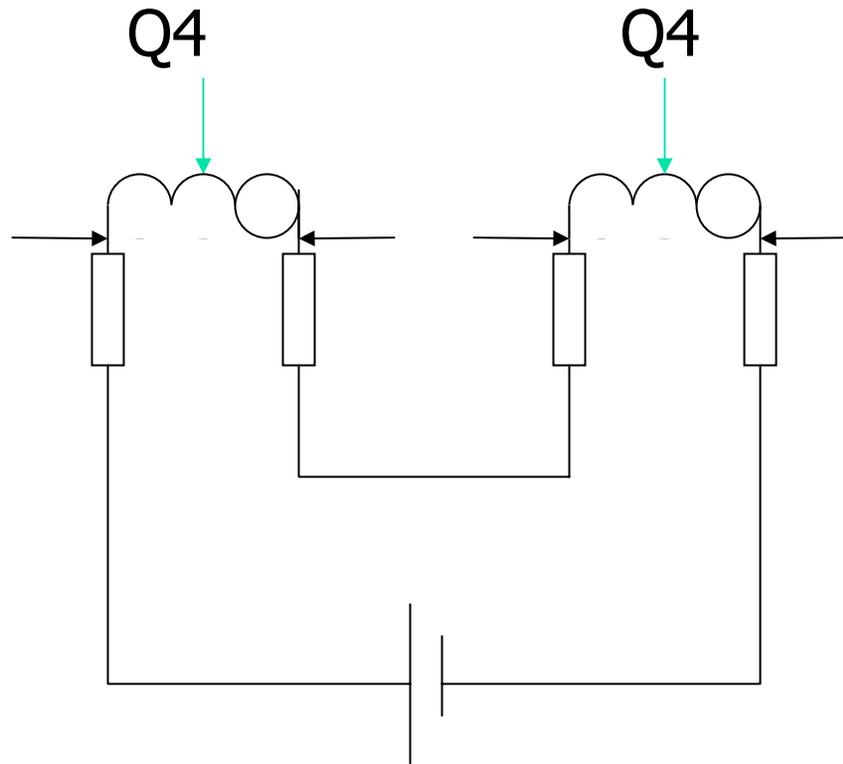
COIR QPM Software

- VME processor with Realtime operating system running code written in C and C++
- 720 Hz interrupt and 60 Hz interrupt are derived from T clock
- 720 Hz interrupt routine is used to keep power supplies on and HFUs from discharging
- 60 Hz interrupt routine reads the scalars and calculates resistive voltages
- Software tasks for communications to the control system – MOOC

Proposed Voltage taps for triplet

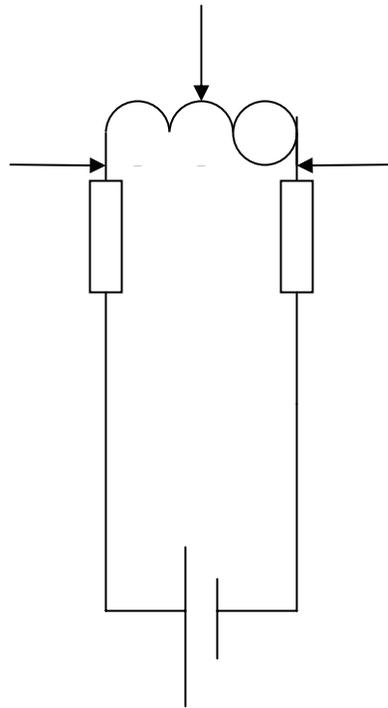


Proposed voltage taps for Q4 & Q5

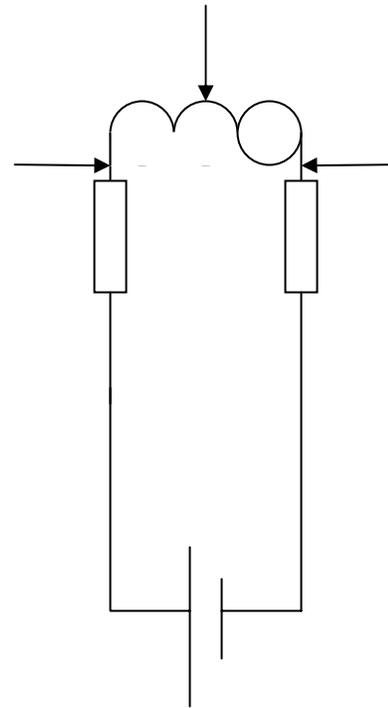


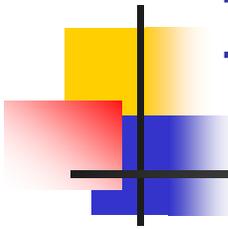
Proposed Voltage Taps for Q6 & Q7

Q6



Q7

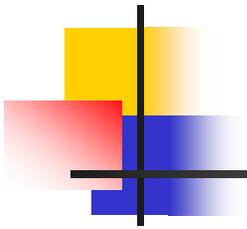




Issues for C0 IR Quench Protection

- Are the Number of voltage taps for single magnet circuits sufficient?
 - Halving the detection level will result in the same detection time
 - May decide to do simple $V_r = V_{c1} - V_{c2}$ algorithm
- New HFUs need to be developed that are LHC like in energy with a Tevatron control interface.

QPM Applications



- Java Application developed for B0/D0 will be modified to include B4, C0 and C1 Qpms