# Recommendations for BEPC-II Superconducting Magnet Electrical Systems

These recommendations are of a general nature. There is a large amount of details that would have to be developed before a successful design of this electrical system could be finished.

Quench Detector

- Recommend a DSP based quench detection system. System flexibility and data logging are its main advantages.
- All signals should be logged continuously at a slow sampling rate and fast sampling rate transient data recorded upon a quench.
- All analog input voltages and currents should be isolated to $\pm$ 2.5 KV.
- Two types of detection schemes can be used. A fast coil difference schemes where the voltage of one coil is compared to another and if the difference exceeds a set limit a quench is detected. Another scheme is a current derivative, where the power supply current is used to calculate the di/dt voltage of the magnet coil and this is compared to the measured coil voltage and if the difference exceeds a set limit a quench is detected.
- For this quench detection system there would be 28 magnet coil signals, 24 superconducting bus signals, 24 gas cooled lead signals and 15 power supply current signals.
- All gas cooled leads would be monitored for an over-voltage condition by the quench detector.
- For all nested ( shunt ) power supplies the quench detection system will open an IGBT switches at the same time ( within 100 usec. ). This is to prevent excessive currents from flowing into the nested power supplies upon a quench.

Quench Protection

- The scheme of using an IGBT switch with energy extraction resisters across it and a SCR crowbar across the power supply output terminals is designed the remove current from the magnet circuit without creating dangerously high voltage transients.
- A ground connection in the center of the energy extraction resisters is used to balance voltage transients to ground during a quench. For nested power supplies this connection would not be used.

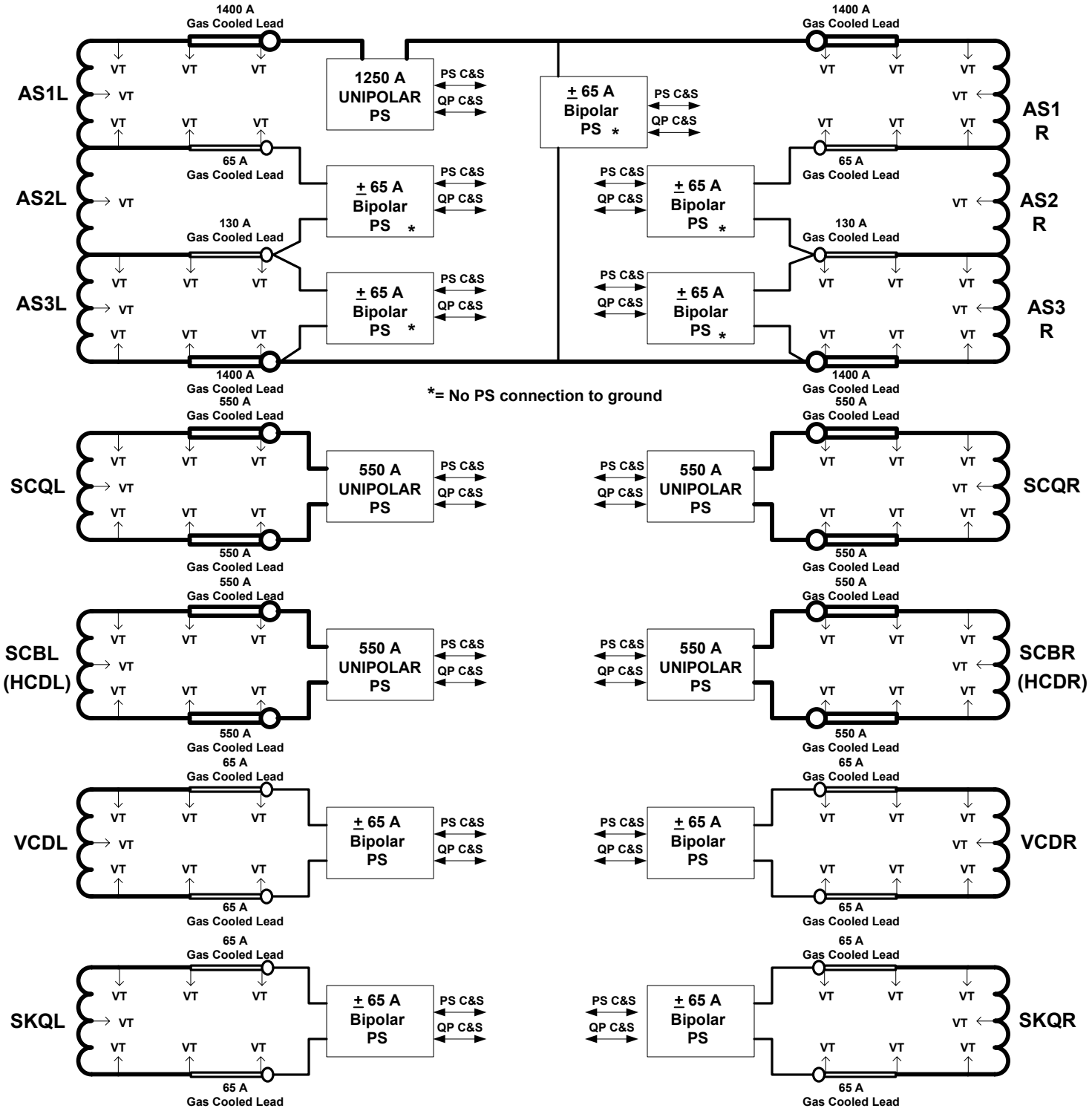
Power supplies

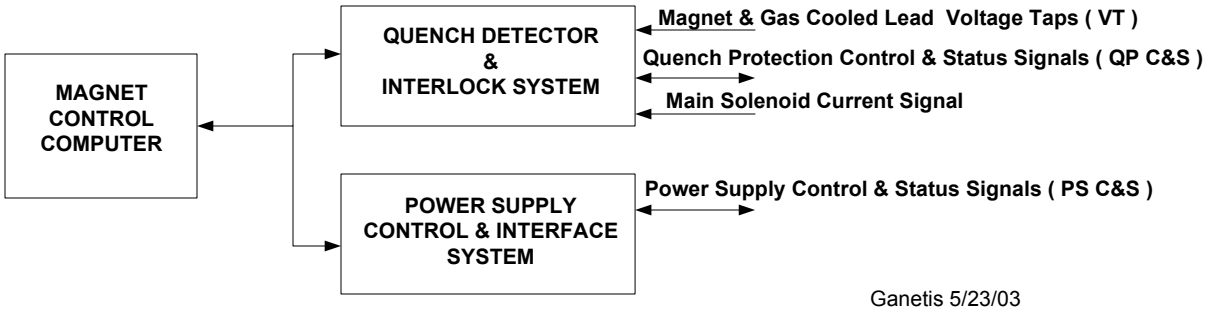
- All power supplies should be designed so they can operate ( or float ) 1 KV off ground.

Voltage Taps

- All voltage tap locations should have redundant taps. Two voltage taps for each location. Each tap should also have a 200 Ω resistor in series with it. These resisters should be placed as close as possible to the high current tap point. This will prevent damage to circuits in the event that a voltage tap gets shorted to ground

# BEPC-II Superconducting Magnet Electrical Circuits

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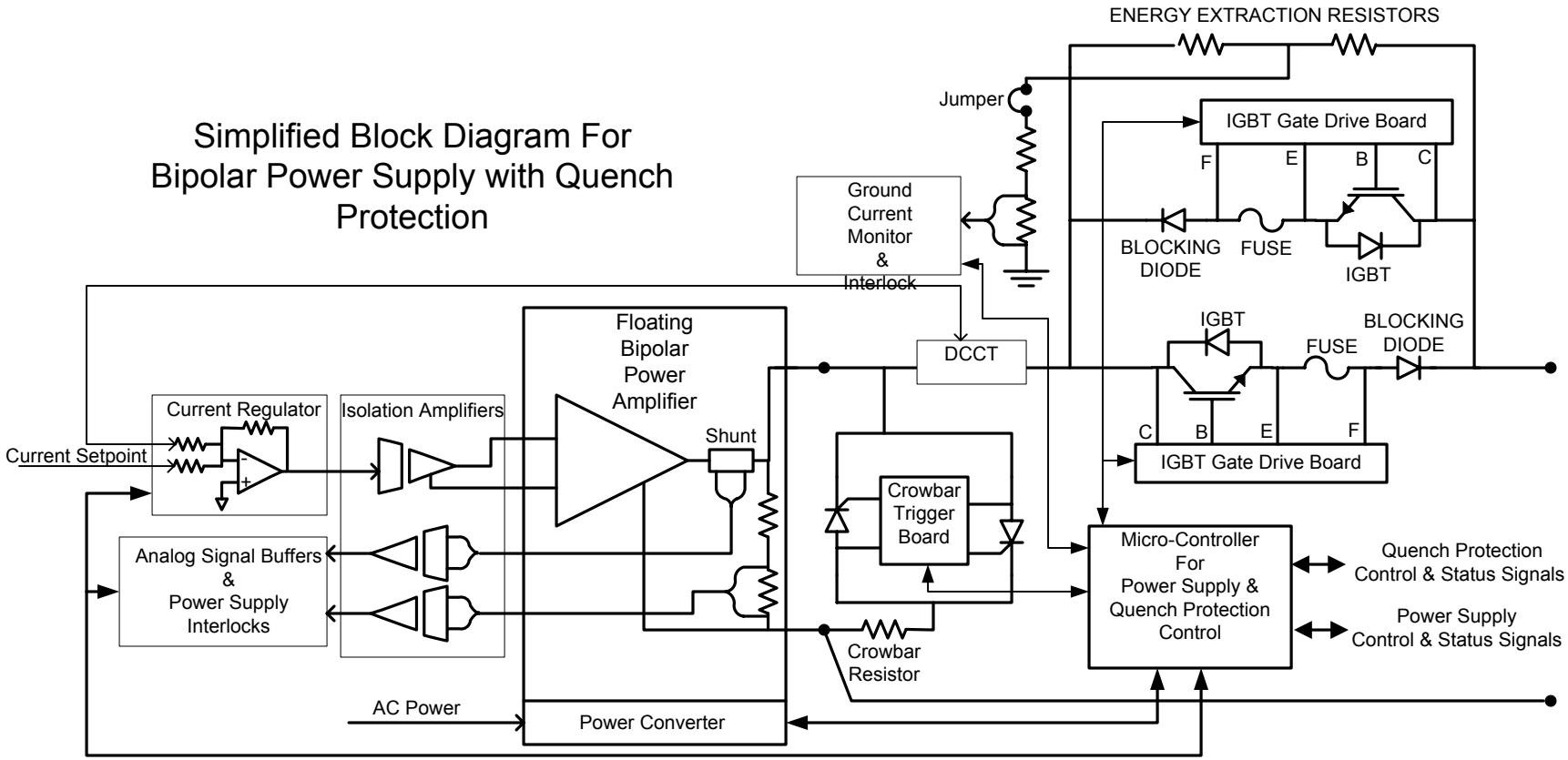
# Simplified Block Diagram For Bipolar Power Supply with Quench Protection

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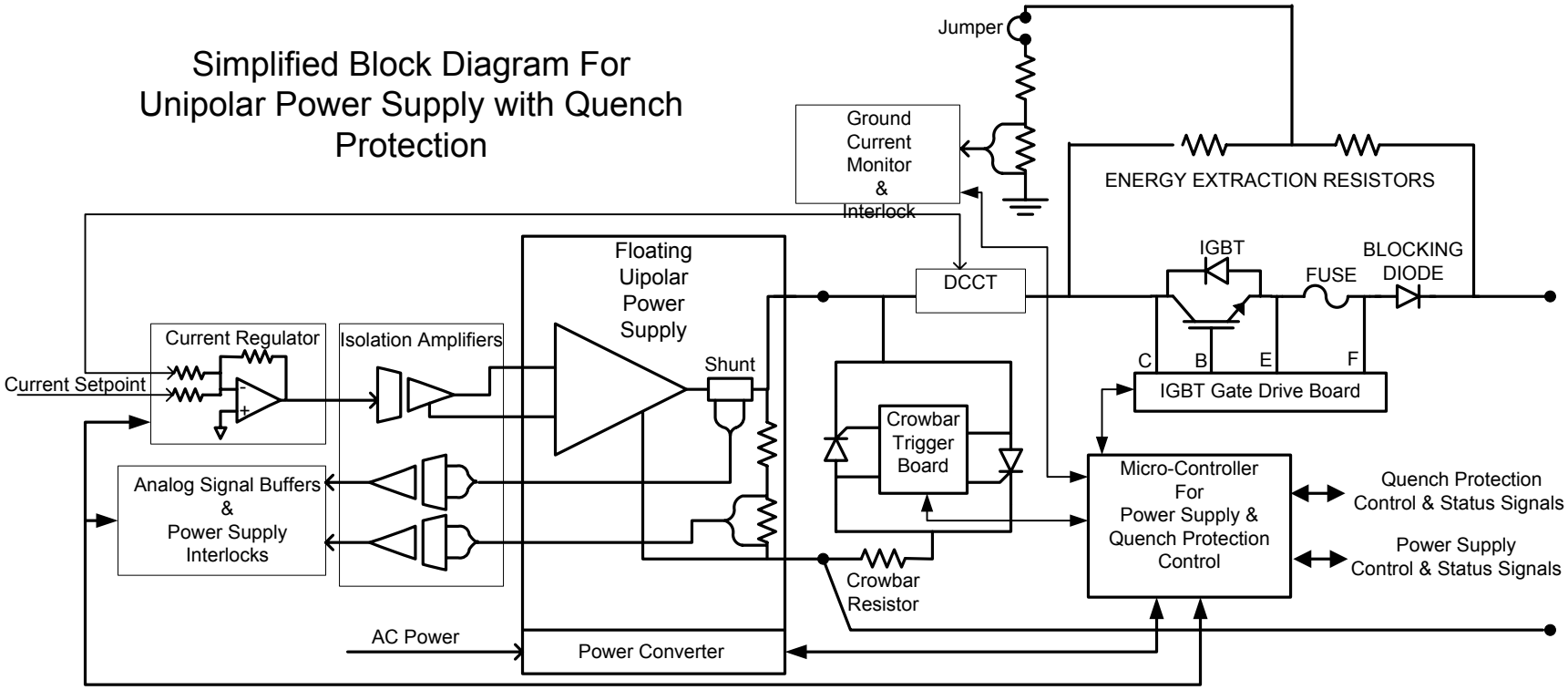
# Simplified Block Diagram For Unipolar Power Supply with Quench Protection

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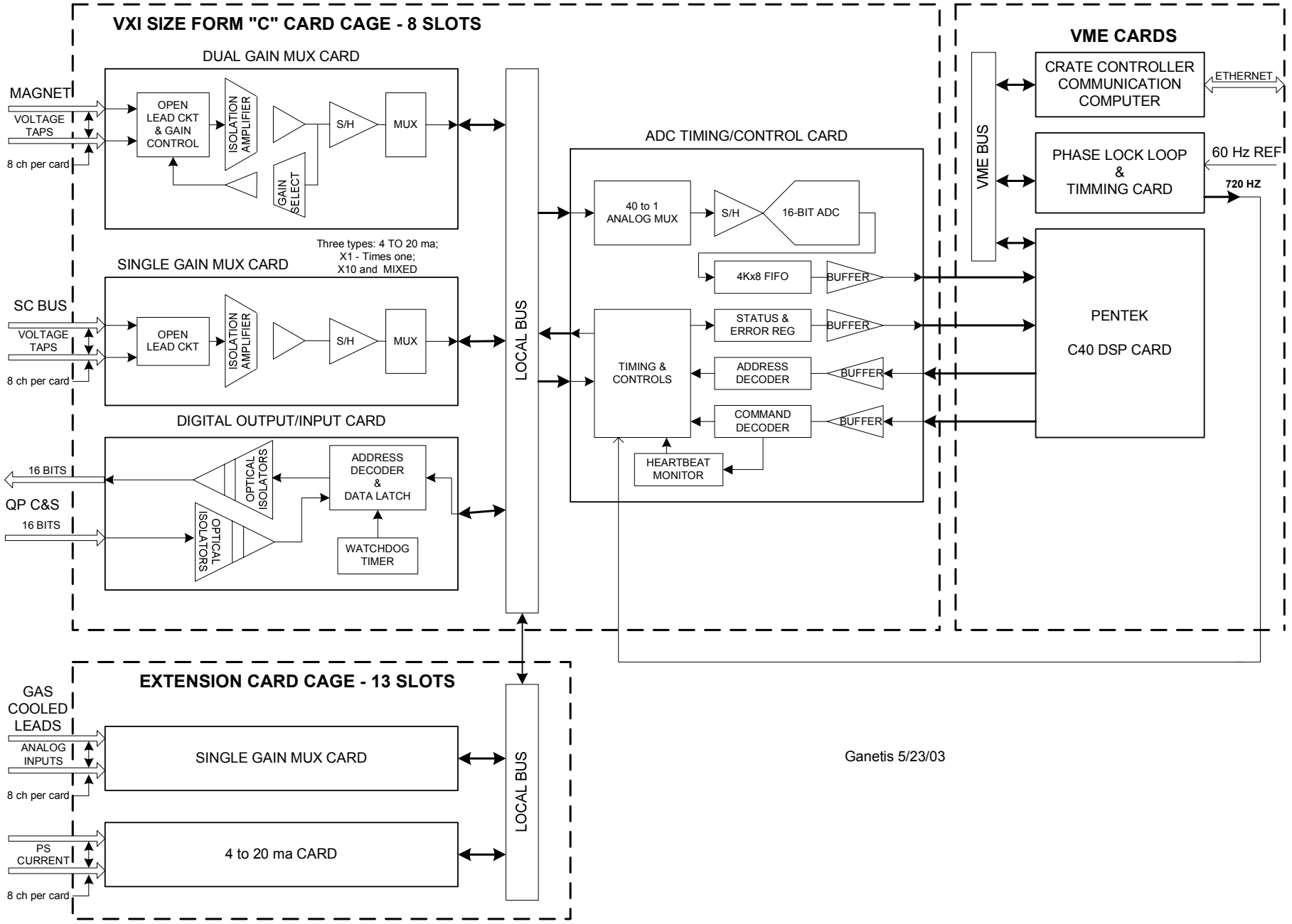
# RHIC TYPE QUENCH DETECTION SYSTEM BLOCK DIAGRAM

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