Mice Collaboration Meeting CM27

STFC Rutherford Appleton Laboratory, UK
7th-10th July 2010

Daresbury Laboratory
Electrical Infrastructure Report

Authors :
Ian Mullacrane
John Webb
Steve Griffiths
Chris White

Recent Electrical Infrastructure work

Power feeds for Cryo compressors via distribution boards and local sockets for Phase 2 compressors.

3-phase power sockets for cooling channel compressors mounted on shield wall

Power Distribution

400 / 208 V Distribution transformer installed for Spectrometer Solenoid power supplies

Water cooling pumping system for cooling channel compressors

Power feeds and inverter drives.

Personnel Protection System

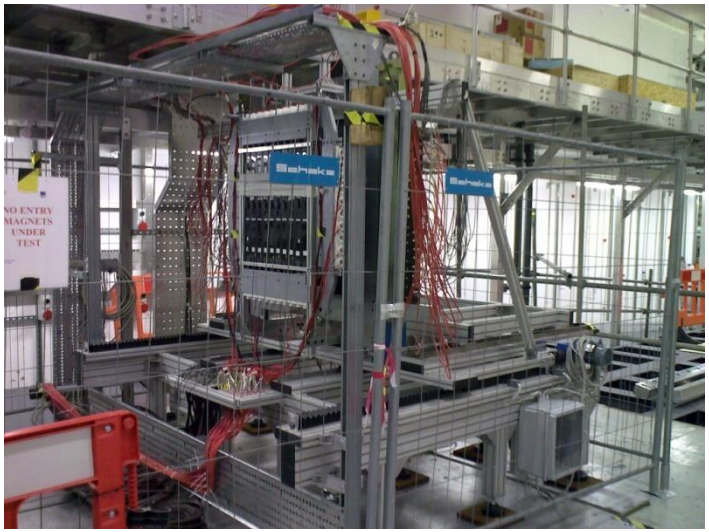
- *PPS field wiring in MICE Hall complete*
- *Rack wiring termination now about 80% complete*

Recent Electrical Infrastructure work

Target: additional interlocks for PSU Inhibit installed

Luminosity Monitor cable installation completed

TOF 2 / KL Relocation and Cabling. Modifications made to drive system control box. Reinstalled and tested.



Electrical Infrastructure

Liquid Hydrogen system prototype controller
(PLC & Intrinsic Safety Barriers)

Control Testing at AS Scientific (Abingdon) during cool down

Gas panel under construction with electrical testing to follow

Future Electrical Work for MICE

- Install cabling systems for EMR Detector
- Complete Gas Panel Control tests for H_2 delivery system at AS Scientific
- Upgrade MICE Hall Mains Power Distribution System to meet expected load requirements
- Build & Install 1st Spectrometer Solenoid Control System
- Install Magnet Power Supply cabling
- Transfer Tracker controls into larger rack to allow room for control crate and power distribution equipment
- Separate tracker cryostat interlocks and relay to Control Room (Temperature, vacuum, pressure etc.)

DL Electrical Visit to LBNL/Wang NMR to Review Spectrometer 22nd & 23rd Feb 2010

Following the Visit, a Report / Recommendations and Actions Document was written and circulated as a discussion document.

The following is a summary of the main contents

Recommendations/Actions

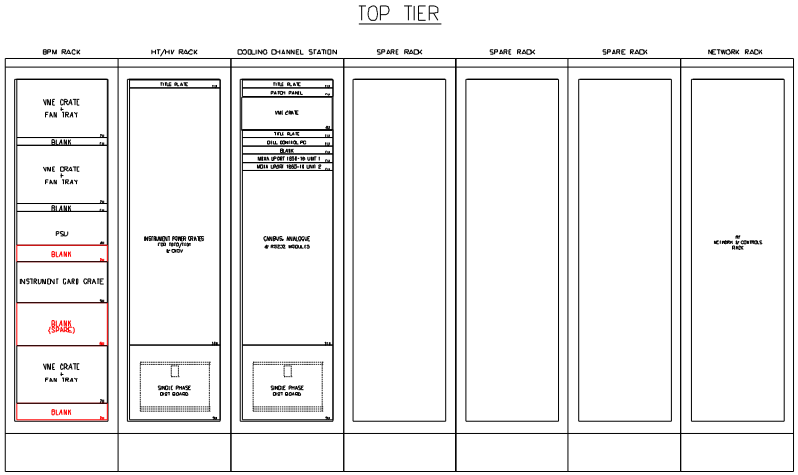
- Re-arrange the present Spectrometer power supply racks from a TWO rack power supply system into a THREE rack system and house the dump circuits in the additional rack.

- This removes the cooling water supplies from the power supply racks and re-establishes the cable access space at the bottom of the racks.

- House the FOUR Lakeshore 218 (temperature monitoring) units and the TWO AMI 135 (Liquid Helium level sensing) units in the re-arranged racks.

Recommendations/Actions

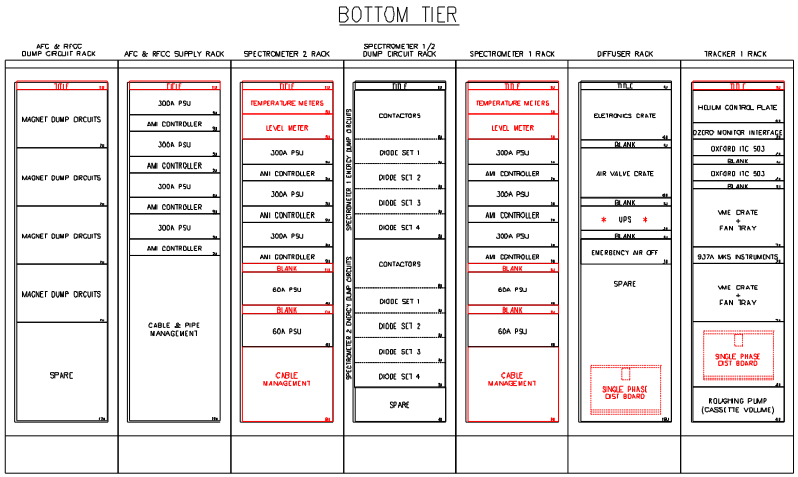
- "Due to the above rack requirements, investigate whether additional space can be provided in the MICE Hall. This could prove useful for anticipated additional rack space required for future AFC and RFCC power supplies and dump circuits".



Upper Tier (left to right)

- BPM
- High Voltage equipment
- Control System
- Spare
- Spare
- Spare
- Network

Planned rack layout is now as shown

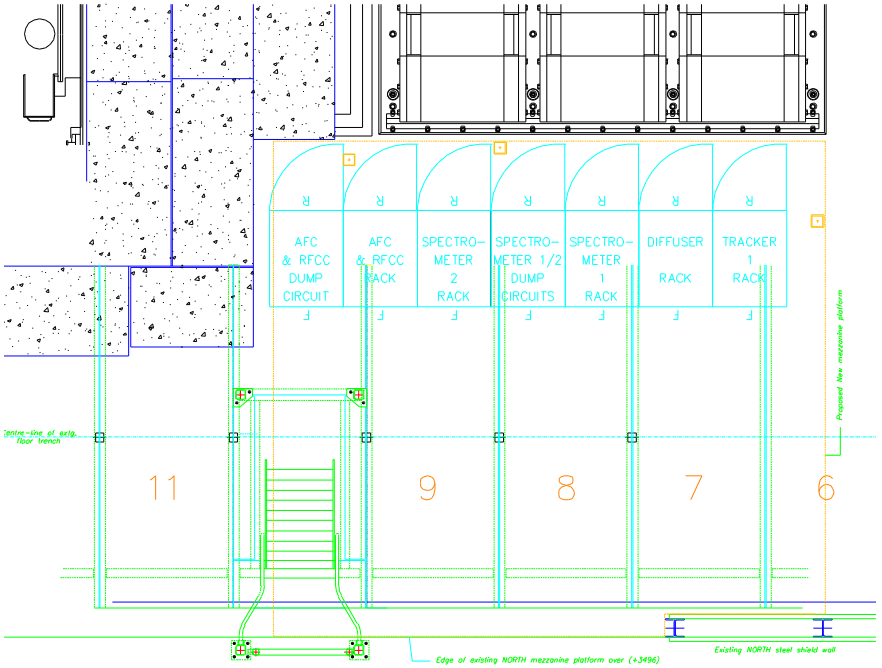


Lower Tier (left to right)

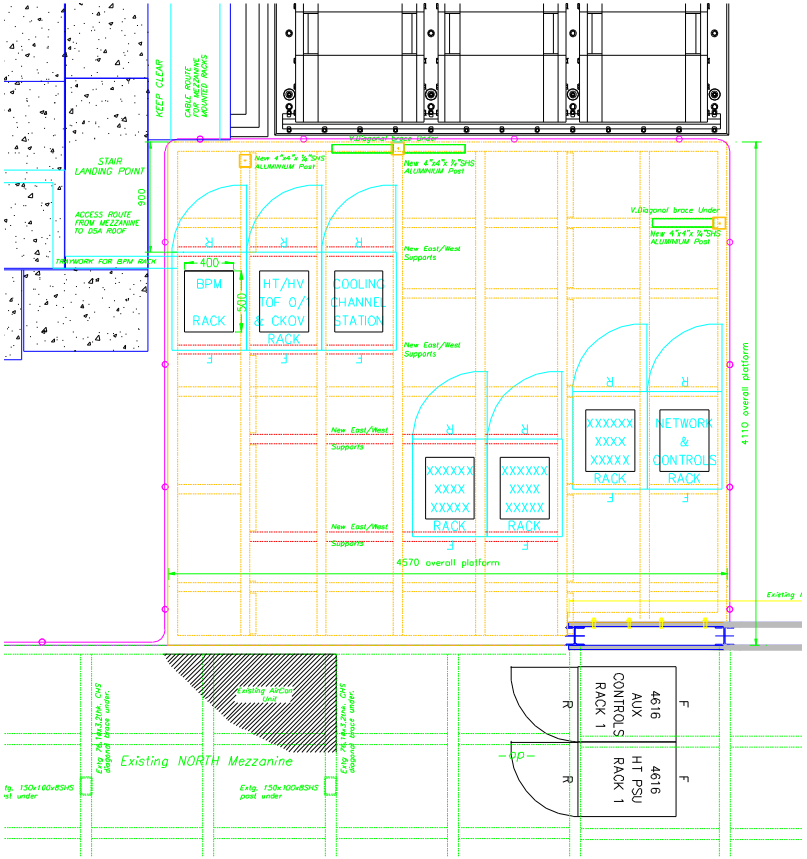
- AFC & RFCC Dump Circuits
- AFC & RFCC Power Supplies
- Spectrometer Solenoid #2 Power Supplies
- Spectrometer Solenoid Dump Circuits
- Spectrometer Solenoid #1 Power Supplies
- Diffuser
- Tracker

Rack Layout – Plan Views

Ground Floor Level



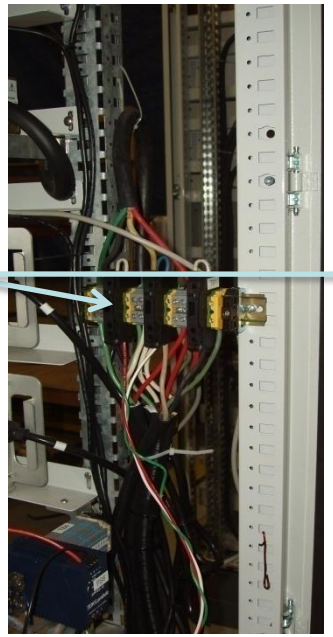
Mezzanine Level

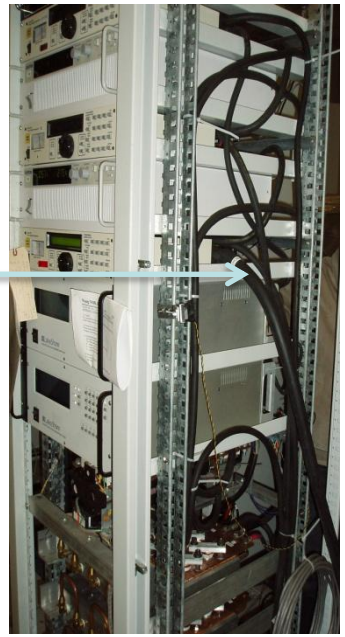


Science & Technology Facilities Council

Recommendations/ Actions

- STFC DL electrical staff to modify rack wiring and power distribution/cable management in line with UK electrical standards.





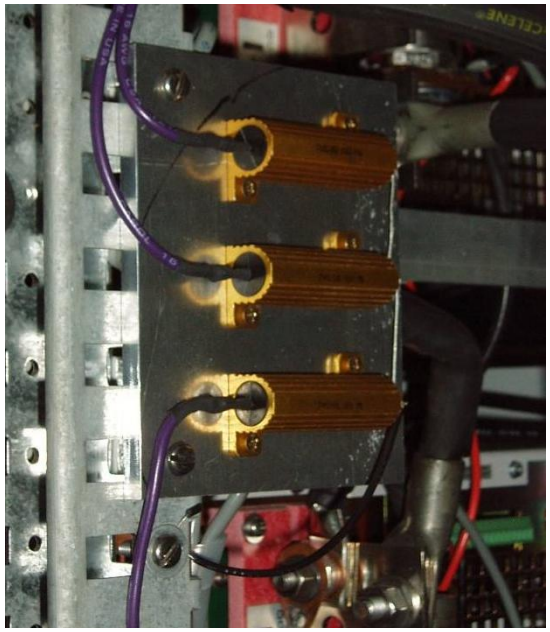
- Spare 300A Xantrex power supply and AMI controller to be sent to UK to aid design

- Control of the DC contactors to be undertaken by the MICE Spectrometer control system. Could also incorporate a PPS interlock if required.

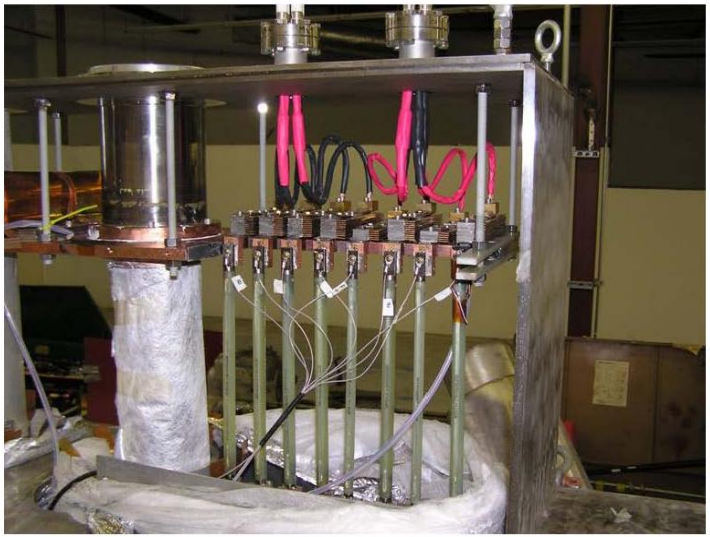
- Water cooling systems to dump circuits should be flow and temperature monitored with possible UPS back up for an anticipated 30min period of RAPID discharge.

Recommendations / Actions

DL EE&PS Group power supply specialists strongly recommend that earth leakage protection/interlocking be implemented. An earth fault / leakage would cause an undetected current to flow in the MICE Hall protective earth network.



10 Ohm Leakage Resistors for Xantrex 300A Power Supplies



Upper leads and HTS leads assembly in magnet turret

Voltage taps to be made available for quench diagnostics to highlight areas of concern and as a means to prevent internal HTS lead over heating.

Additional external circuitry will be required to achieve this.

Further Recommendations / Actions

• DL EE&PS Group power supply specialists to liaise with Wang NMR directly, as agreed, to gather further information on the AMI420 quench detection system and the Lakeshore 60A power supply earth leakage arrangements to assist in resolving any issues.

• Fermilab to provide requirements for mapping and operating procedures considering the long ramp times with no quench protection. (Note: during long ramp times (many hours), with no quench protection, the spectrometer must be supervised at all times).

• Spectrometer PSU sequence control to be provided by MICE Spectrometer control system. This will require documented information following tests at Wang and magnet mapping at Fermilab. This could prove a KEY requirement.

• Wang NMR to provide a full circuit schematic diagram of the discharge diode arrangements, both INTERNAL and EXTERNAL. This will allow a detailed energy discharge analysis to be performed, to verify that all circuit components are rated accordingly, if not already done.

Further Recommendations / Actions

- Investigate the FULL extent of a Helium release in the MICE hall (possibly all 18 magnets) during a quench, to see if additional extraction/monitoring is needed.

- Check water flow rates in the MICE Hall are sufficient for cooling of cryogenic compressors. (Steve Virostek)

- DL electrical design to investigate the locations of the requested MAG ON lamps for the SC magnets and ensure that non-magnetic fittings are used around the cooling channel.

For complete reference please refer to full report document from IM/JW and Wang NMR PS & Control documentation from Spectrometer Review Nov 10th 2009.