4.2: Electrical Design Review

- EDR Written Information
  - Pierre Avila, Omar Leon, Ramona Perez, Scott Y. Allan
- EDR Powerpoint Presentation
  - Ramona Perez
- Drawings
  - Adrianna Angulo, Scott Y. Allan, Ramona Perez

4.2.1 Basic Safety Requirements

- Overall block diagram
  - PD Cable Block Diagram attached
- Designer under CDM regulations
  - Ramona Perez, Werner Boeglin
- Class of equipment
  - Class I
- Listing of hazards or risk assessments/precautions
  - 50V power supply with needed SHV output connection.
  - No cable connections should contact metal surfaces.
- Precautions
  - 50V Power Supply: Power on at beginning of the day and power off at the end of the day.
  - Preamplifiers: Wait 5 minutes after powering down the whole electronic system before disconnecting the preamplifiers.
  - The active area of the detectors is never to be touched!
- CE Marked
  - Model 2003BT Silicon Surface Barrier Detector Preamplifier
    - Specifications sheet attached
  - Canberra 2111 Timing Filter Amplifier
    - Specifications sheet attached
  - National Instruments PCI-5105 8-Channels
    - Specifications sheet attached
  - Computer
    - Specifications sheet attached
- Will modifications and/or conditions of use invalidate CE marking?
  - No

4.2.2 Earthing Requirements

- Earthing point discussion needed
  - To avoid ground loops we want to keep our detectors isolated from the MAST RP body and earthed at the MD05 Power Distribution Unit M/014/90/014
• PD Design currently electrically isolates all detectors from the RP body with PEEK 1000
• Breakdown voltage of PEEK insulator is 43.2kV/mm (dielectric strength: 24kV/mm or 24MV/m, thickness: 1.8mm)
  ○ Scott Y Allan comment: The RP earth may be different to your cubicle earth but I think we can keep these separate. I think the screens of your coaxial cables in your probe head will need to be earthed through a single cable, which we have in the RP shaft. I’ve attached a cable drawing from one of our other probe heads to show how this is done.
• Size of conductor – potential fault current/ physical strength
  ○ The maximum current generated by the amplifier if it short circuits to the earth is 80mA at 24V.

4.2.3 Documentation (Technical Construction File)
• Design calculations relating to electrical safety (Cable Ratings: refer to 4.2.6 Cable sizes & Types)
• AC supply point, available vs. required capacity interlocked/non-interlocked
  ○ The MD05 cubicle to be used is an existing cubicle which has the AC power points
  ○ Scott Y Allan has the Electrical Drawing for the MD05 cubicle
• Allocation of plant & cable numbers
  ○ CCFE’s Drawing Office will allocate cable numbers when they copy the PD Cable Block Diagram into their computer system
• Cable schedules
  ○ See PD Cable Block Diagram
• Drawings
  ○ PD Cable Block Diagram attached
  ○ PD Sequence Diagram attached
  ○ MD05 Electrical Drawing provided by Scott Y Allan
• Test and commissioning schedules to the extent these affect safety
  ○ During the equipment installation
• Maintenance requirements
  ○ None unless damage has been done

4.2.4 Cable Routing
• Tray work is to be done by CCFE employees
• Type of cable and adequacy of electrical and mechanical protection
  ○ Insulating wrap to be used on cable connections to prevent metallic contact.
  ○ See 4.2.6 Cable size & type.

4.2.5 Control Requirements
• I/O requirements
  ○ During a total power up, the ADNACO box must be powered on before the computer.
  ○ During a total power down process, the computer must be turned off before the ADNACO box.
• Signal conditioning
- Preamplifier
  - Specifications sheet attached
- Amplifier
  - Specifications sheet attached
- Ferrite cores
  - Specifications sheet attached

- Remote control
  - Probe will need to be moved radially
  - Probe will need to be rotated manually (+/- 10 degrees)

- Interfaces
  - A remote connection over the network to our computer is needed to control our data acquisition software, digitizer, and computer

- Timing and sequence diagrams
  - PD Data Collection Sequence Diagram attached

- Data collection
  - SIGNAL → DETECTOR → PREAMPLIFIER → AMPLIFIER → DIGITIZER → COMPUTER
  - Data transferred from the digitizer to the computer upon receiving a trigger signal from MAST DATAC

### 4.2.6 Power Requirements

- Electrical design under CDM regulations
  - Clarification needed
- Supply rating (Voltages & Current)
  - Power Estimates
    - ADNACO box: 300W
    - Computer: 330W
    - Amplifier: 1.3W - 2W
    - Preamplifier: 100mW - 360mW
    - 50V Power Supply unit: 100W
- Interlocked/ non-interlocked
  - MD05 cubicle is not PASS interlocked
- Circuit allocation
  - See Electrical Drawing for MD05 cubicle provided by Scott Y Allan
- Means of isolation
  - System can be isolated by shutting off power to the MD05 cubicle
- Internally generate voltages and earthing arrangements
  - See Cable Block Diagram
- Cable size & type
  - LMR195 coaxial cables, 50 Ohm
    - Specifications sheet attached
  - 5106C multi-conductor cable
    - Specifications sheet attached
  - Adnaco-FC1 multi-mode LC-LC duplex fiber optic cable
    - Specifications sheet attached
- Kapton insulated coaxial cables, 50 Ohm
  - Specifications sheet attached
- IEC 60320 power cables