



MICE CM32

25th February 2012

Magnet Group Report

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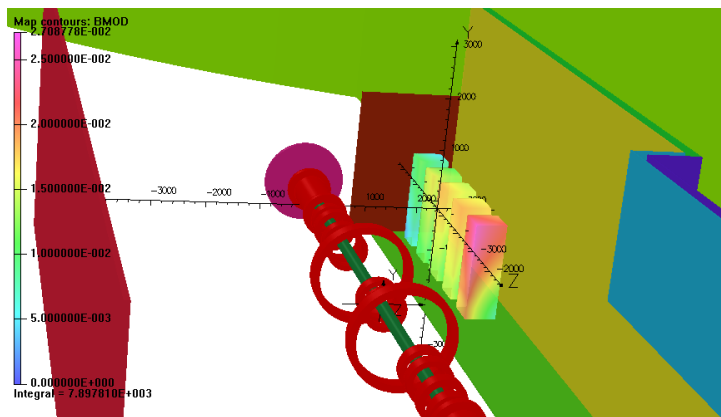
Mike Zisman



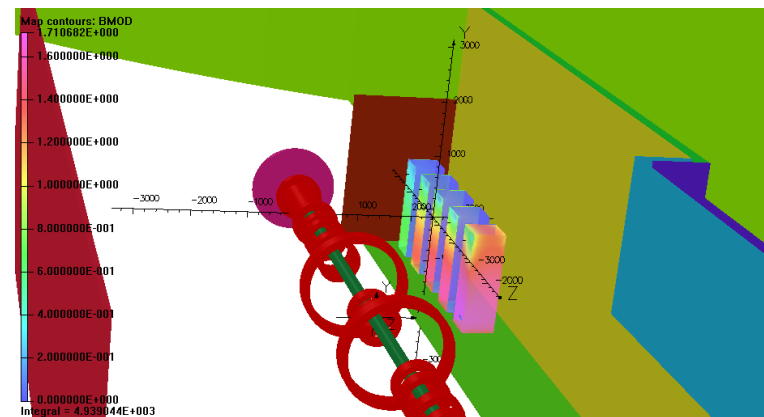


Conclusions from CM32

- Started to identify magnetically-sensitive components within the Cooling channel volume
- Used the TRD Magnetic-Shielding model to predict the magnetic field and potential shielding requirements in specific areas
- Adapted the model to predict the effect of inserting significant ferrous objects into the Cooling Channel



Predicted fields
without ferrous content



Predicted fields
with ferrous content





Magnet Group Tasks since CM32

- Finding solutions for Step IV
 - 15 compressors
 - Magnet control Rack
 - Electrical racks on the North Mezzanine extension

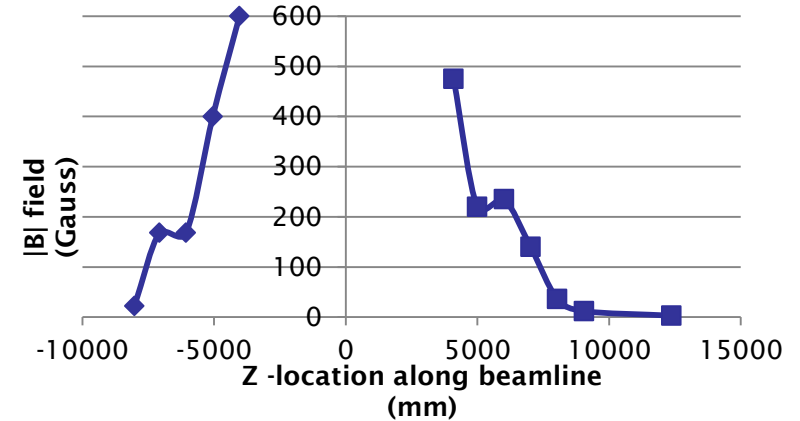
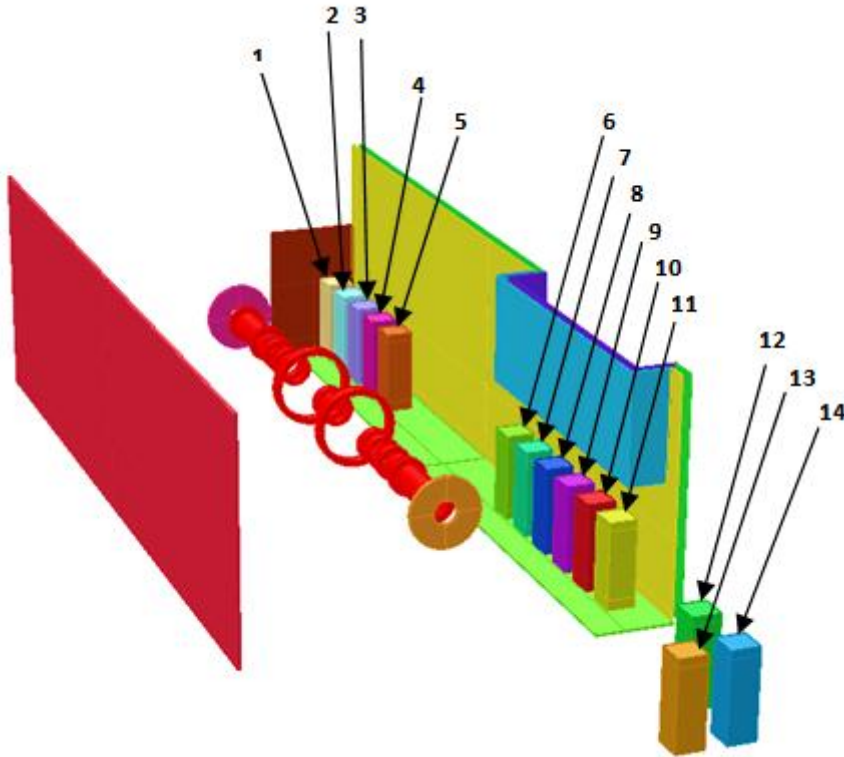
- Considering solutions for Step VI

- Understand the full extent of the shielding issues, by:
 - Gathering information on ferrous objects, or objects which may not operate in high fields



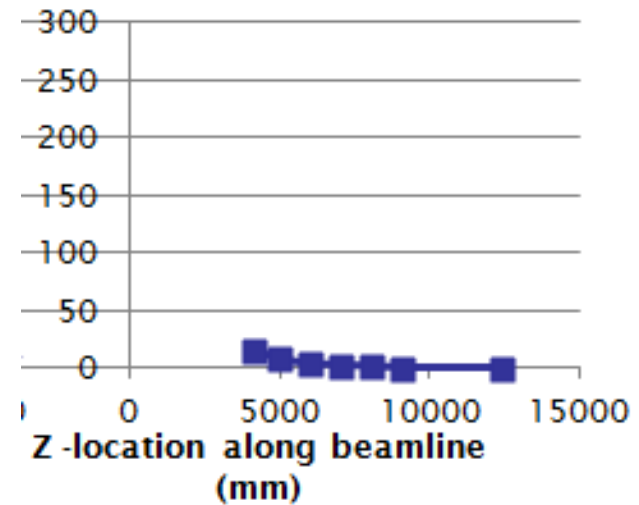
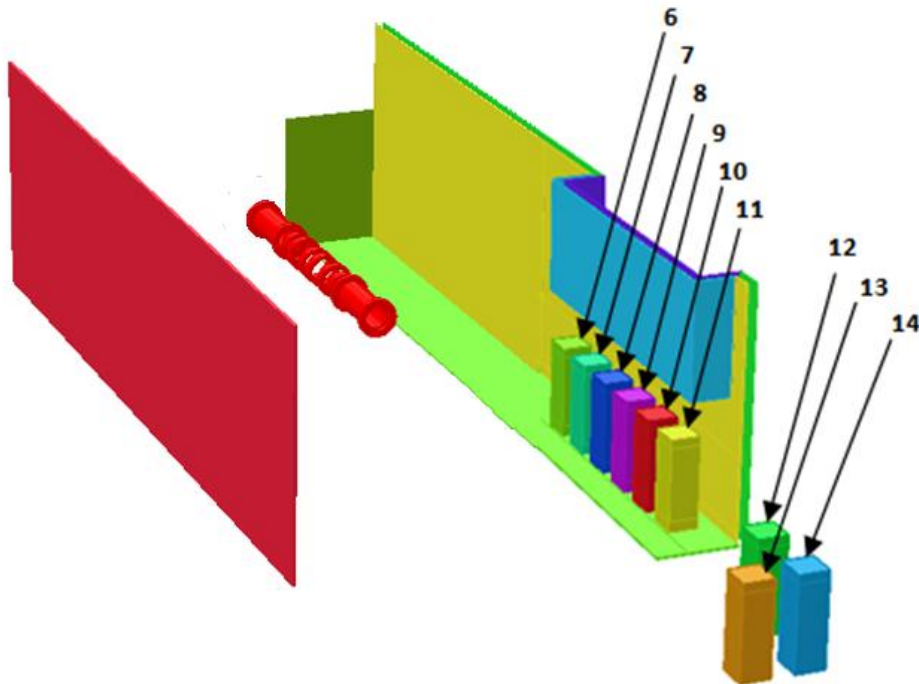


Step VI: Compressors





Step IV: Compressors

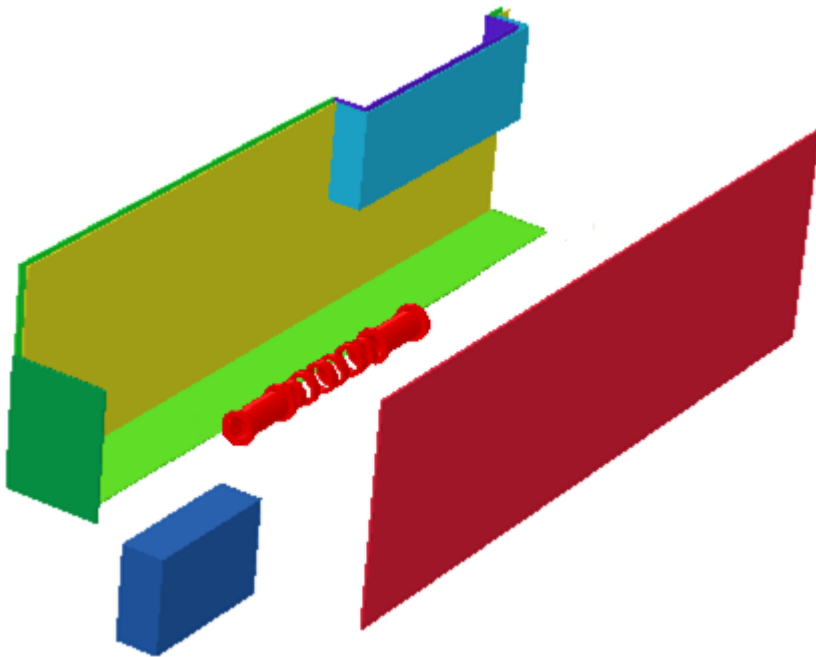




Step IV: Magnet Control Racks

Simplified solution shows it is possible to shield in 5mm US1010 iron and 5mm mu-metal if Aluminium racks are used.

In reality, we will need to provide protected access (labyrinth or air-lock style) to allow access during magnet operation.

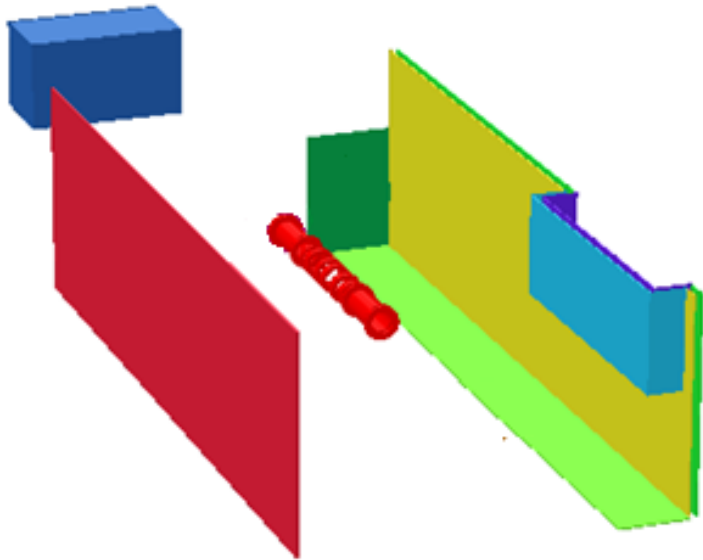


This implies serious modifications to the positions of magnet control racks, their services and the entrance to the trench.





Step IV: Electrical Racks on North Mezzanine



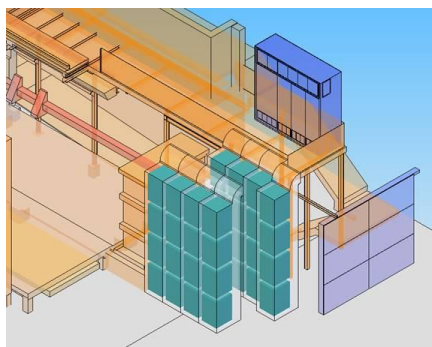
- 4 racks located on the north mezzanine
- 5mm US1010 iron and 5mm mu-metal if Aluminium racks are used.
- Estimated weight 3-5 tonnes – requires major modifications to the north mezzanine





Step VI Solutions

Modelling shows that it is not reasonably possible to shield the compressors or electrical racks in their currently proposed locations.



We need to consider:

- Compressors moved behind the beam stop, **which would still require shielding**, or against the west wall
- Electrical racks...???
- What else?





Information Gathering

What we know we need to consider:

- EMR control rack
- Vacuum system control racks
- Power supplies for conventional magnets
- Tracker system
- Hydrogen system
- Vacuum system
- PPS system
- Etc...

For every magnetically-sensitive object in the MICE hall, we need to know:

- Location (X, Y and Z coordinates w.r.t. Beamline centre in Step VI)
- Approximate object dimensions
- Mass of any ferrous material
- Sensitivity of components to magnetic fields





Conclusions

- Magnetic Field distortion
 - Previous analysis and reports overlooked massive distortion in magnetic field profile caused by presence of ferrous objects including magnetic shielding!
 - EG: Magnetic field in air in compressor locations $\sim 30\text{mT}$, which becomes 1.7T when ferrous content of cabinet and shielding taken into account.
- What about a partial yoke? (Pierrick's suggestion)
 - Forced to reconsider possibility of partial yoke around Cooling Channel magnets
 - Substantial issues re beam physics, forces, weight, and access for services and maintenance, etc.
- Focusing on a Step IV solution
 - Will still require considerable engineering compromises & effort to achieve, as well as substantial additional analysis by Vicky & Mike

