West Mezzanine Platform & RR2

20/08/13

West Mezzanine Platform

The original location of the compressors was to be adjacent to the experiment, inside of the south shield wall relative to the experiment; however the compressors were identified as magnetically sensitive components and analysis showed that the compressors were in fields strong enough to cause significant problems [1].

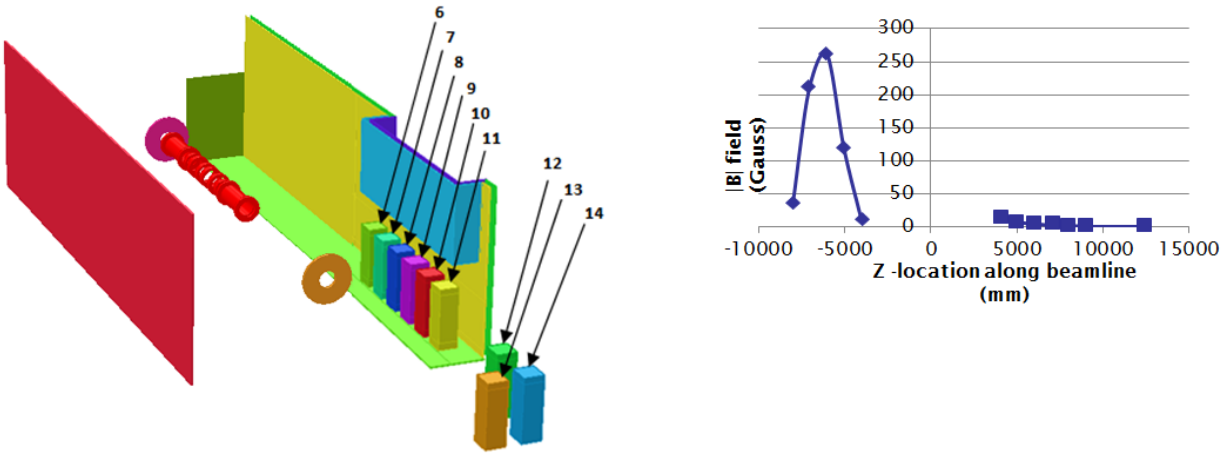

Fig xx: Step IV Analysis

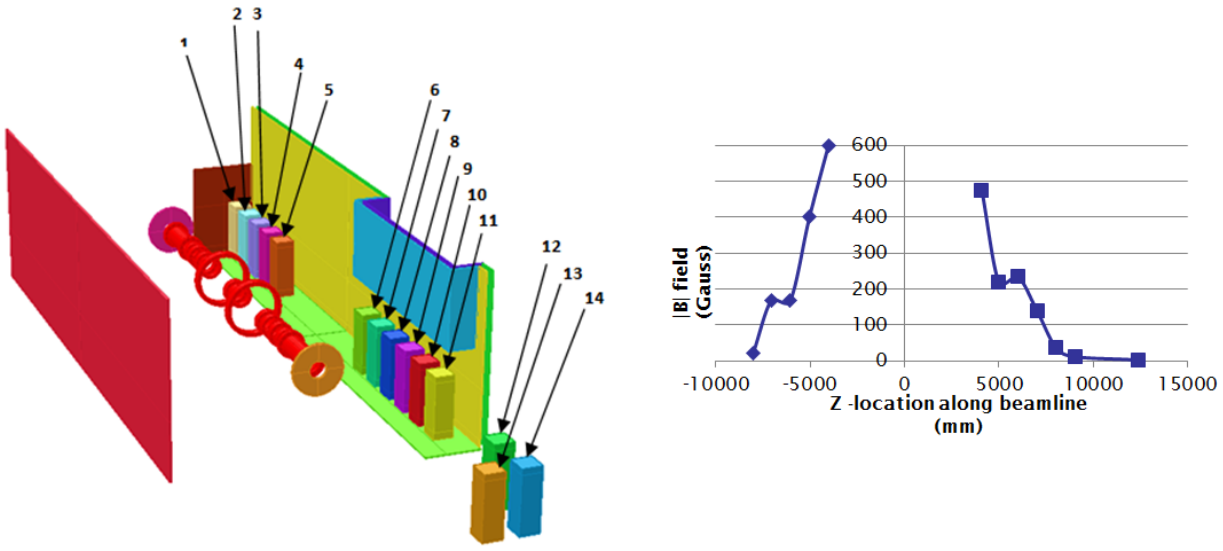

Fig xx: Step VI Analysis

The Technical Report Document Magnetic shielding model of the magnets was used to predict the magnetic fields in the vicinity of the compressors. This showed at Step IV that the compressors could only be run in a position downstream in the vicinity of the south shield wall, i.e. away from the short Step IV experiment, even then analysis showed they would require significant shielding (~£12k / compressor). The analysis showed at Steps V & VI, due to the more powerful RFCC magnets and the extended geometry of the experiment that the downstream position, even with shielding, was technically and financially unviable; this led to an investigation to relocate the compressors.

There were a number of limitations to relocating the compressors, the first was the space available in the MICE Hall. At this time a lot of space was already taken up by equipment or was reserved for future installations; space both in the

Hall and outside was reviewed to see if any suitable locations were available. Another limitation was the length of the pressurised helium hoses that link the compressors to the cold heads; Sumitomo did not recommend running their compressors at >30 m hose lengths and Cryomech specified line lengths of 100 ft. (~30.5 m) without a loss of performance and 132 ft. (~40.2 m) with a slight loss of performance but the compressors would require retuning; limited tests were undertaken at RAL to gauge these performance losses and wer found to be insiginificant with respect to requirements for MICE running [2]. In addition to potential for loss of performance there are more costs involved in purchasing longer hose lengths and also in handling and management of such long lines so the 30 m hose length was taken as the specification. For the upstream devices such as the AFC & SSs, as part of the installation they will be pulled offline on moving platforms; for the periods of time they are out of position an extra section of hose can be connected (taking hose length to > 30m) to allow the cold heads to continue running and keeping the devices cold but not necessarily at operational temperatures.

Out of all the locations considered for siting the compressors, the west wall was chosen as it was a relatively open space, but it is not at all uncluttered as shown in the photo below, importantly it is far enough from the magnets that the field is > XX Gauss [P SMITH to advise]

Fig xx: Current West Wall Environment

As shown in the photo above there was already electrical distribution, stairs and associated Personnel Protection System (PPS) access gates on the west wall (the lockers were only a temporary feature), so to make the space for the compressors a mezzanine platform was proposed to take the majority with a few on the ground floor.

At Step IV there will be 15 Cryomech compressors located on the west mezzanine platform and another 4 Sumitomo compressors on the ground floor at the north-west corner. More compressors will be located on the platform and the ground floor at the later Steps.

Step	Cryomech	Sumitomo
IV	15	4
V	+6	-
VI	+6	-

Table xx: Compressors required at each MICE Experimental Step

Each compressor has 2x high pressure helium hoses (feed & return) and a power cable that needs to be routed between the compressor and the cold head or cryostat.

There are only 4 x Sumitomo compressors that feed the cryostats for the Tracker. With their position in the north-west corner the services of the compressor that feeds the most south-easterly cryostat will have to follow a relatively direct diagonal path for much of the route to keep the length < 30 m, this is shown in the figure below.

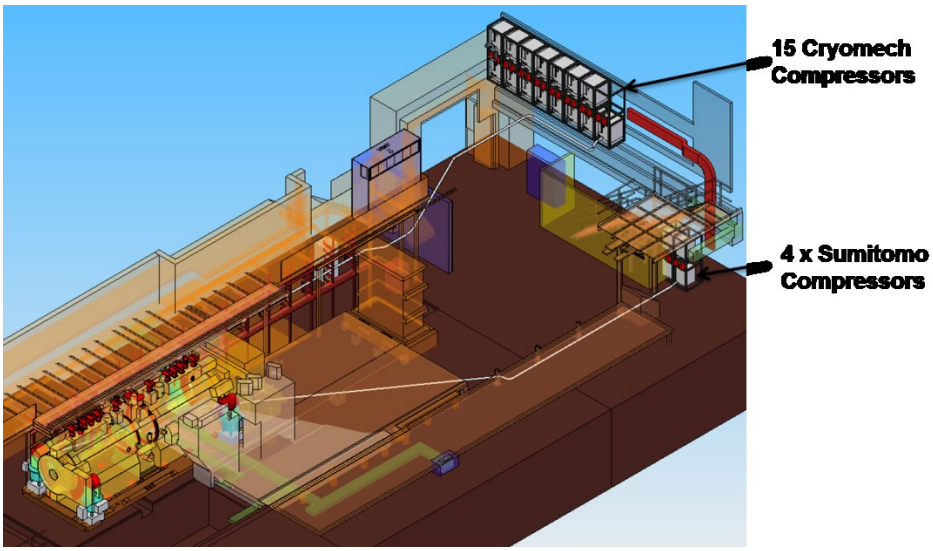

Fig xx: Sumitomo Compressor to Tracker Cryostat Hose Routing

The compressor services on the west mezzanine platform will be routed at a level above the main equipment door then down under the south mezzanine platform to the devices; the rest of the Step V & VI compressor services will join these. The Step V & VI compressors added on the ground floor will have their services routed up to the west mezzanine platform to join those of the compressors on the platform; as these services will have to rise ~3 m before being routed with the other services they will only be able to serve the closer downstream devices to keep hose length < 30 m.

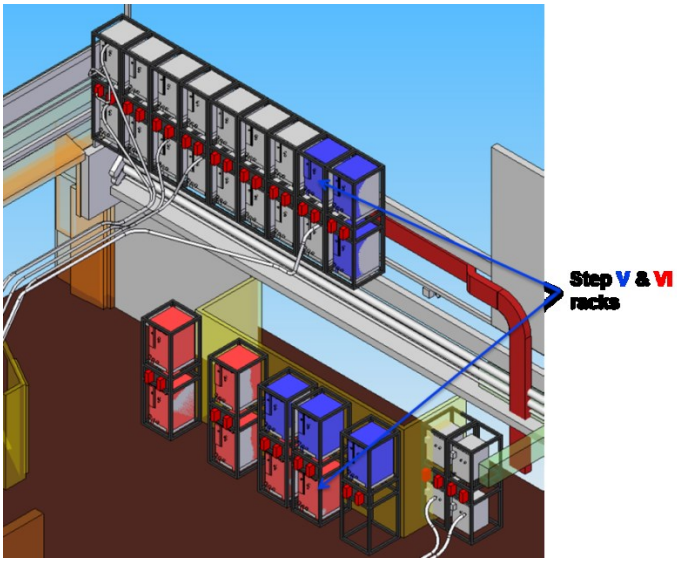

Fig xx: Step V & VI Racks

With the positions of the compressors and the hose / power cable routing resolved the structure of the west mezzanine platform and the services management we designed.

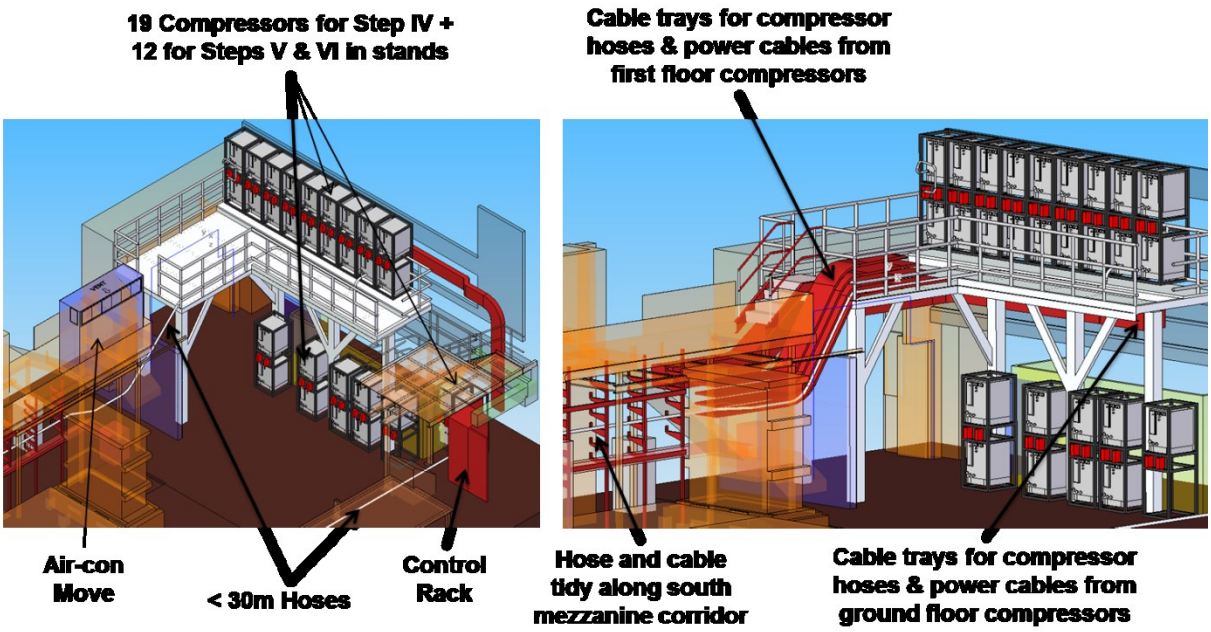

Fig xx: Compressor Layout for Various MICE Steps

The above figure shows the platform design, it will be manufactured from aluminium with stainless steel fasteners. There will be 2 points of access onto the platform, steps from the current south mezzanine platform and a ramp from the north mezzanine platform. The services management will consist of non-magnetic cable trays and reconfigurable cable 'tidies' to link the hoses and the power cables from the compressors to the cold heads.

Though the platform bridges the main equipment door the height and spacing of the legs are such that the entrance will not be restricted any less than the main equipment door.

The west end floor area will used for reception of the large experimental devices and their preparation before integration. The platform has been designed to fit closely with the existing PPS cage around the stairs so the west end reception area has been preserved as much as possible.

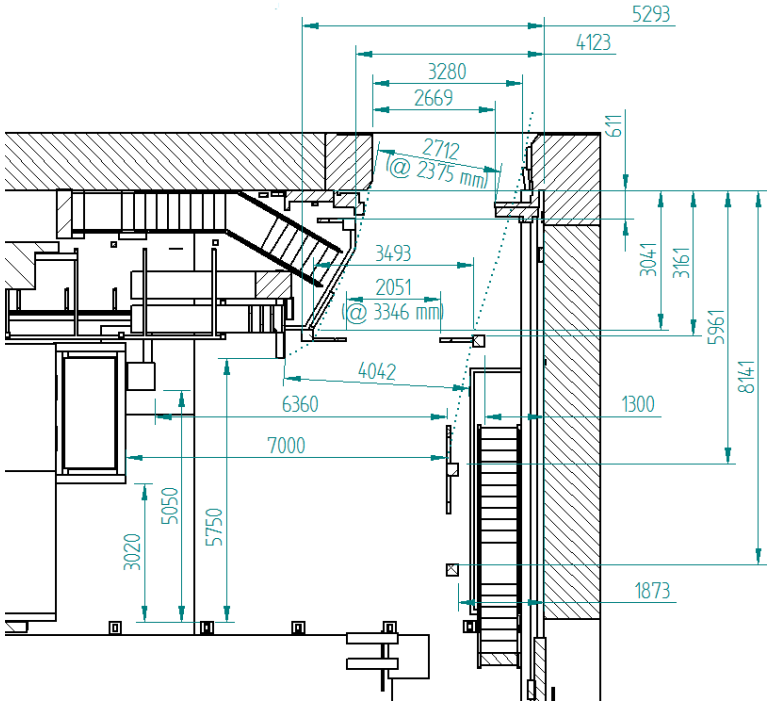

Fig xx: West End Reception & Preparation Area Including Access to Hall

There will be 2 possible methods of installing or replacing the compressors on the platform. On the main crane there is a smaller 500 kg auxiliary crane, it currently would clash with the uppermost compressors on the platform so it is being

raised and placed at the on the west side of the main crane; this will enable it to be used to handle the compressors into and out of the support frames. A scissor jack trolley has also been purchased that can be used to remove the upper compressors (the lower one are on wheels at around ground floor level); compressors can be moved on and off the platform to the north platform via the ramp. From the north platform the compressors can be lifted to the ground using the auxiliary crane on the main east crane, useful if for some reason the west end crane is unavailable.

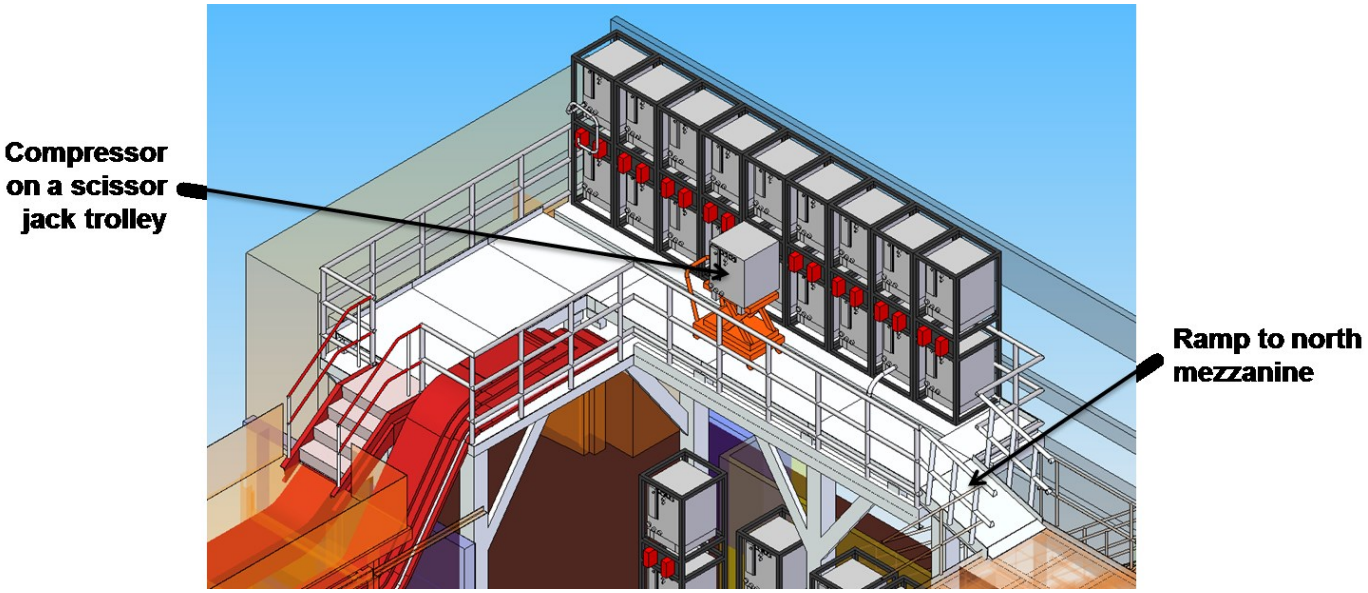

Fig xx: Installation / Removal of Compressors Using the Scissor Jack Trolley

The alternative location of the compressors, along with the engineering of the west mezzanine platform, were initially required to ensure compressors would not be affected by the magnetic field. If the Partial Return Yoke (PRY) is implemented there would be a significant reduction in the magnetic field in the compressor's original position under the south mezzanine platform adjacent to the experiment; it is likely this would be low enough for the compressors to run safely. However the PRY is a relatively large item and takes up a significant amount of space, some of this encroaching on the space under the south mezzanine platform where the compressors would have been positioned. So even if the PRY is implemented the compressors will still need to be moved, and still the west wall on a mezzanine platform would be the most viable location.

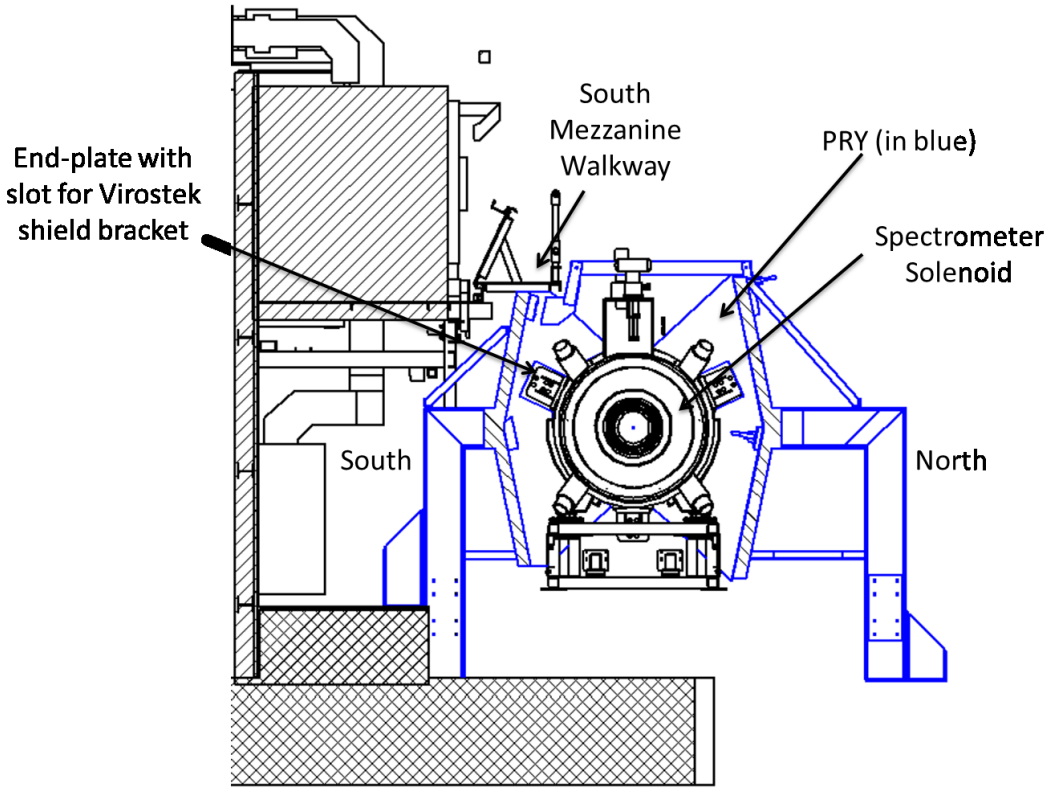

Fig xx: PRY, SS & South Mezzanine

The above figure shows the Step IV PRY and the space take up on the south side, the PRY for the RFCC will encroach a lot further under the platform. The box on the south side wall is the hydrogen fill assembly, which is a lower profile than the compressors with all the hoses connected, even that is being moved to enable good access when the PRY is installed.

Rack Room 2

As with the compressors, the electronic racks with sensitive components were also going to be located close to the MICE Experimental Devices in the MICE Hall. These racks too were shown to be in a field which would cause problems. Shielding was considered but there would be issues of cost (estimated to be ~£30k per rack for up to 15 racks), in addition the size and weight of the shielding cabinets and access to the racks were also considered to be significant issues. Consideration of these problems and the need for an alternative led to a kind offer from ISIS of more space opposite the current MICE Local Control Room (MLCR) where the electronics racks could be located. The 'rack room 2' (RR2) idea has been developed and shown to be far more acceptable from the cost and technical aspects than shielding the racks in close proximity to the Experiment in the MICE Hall.

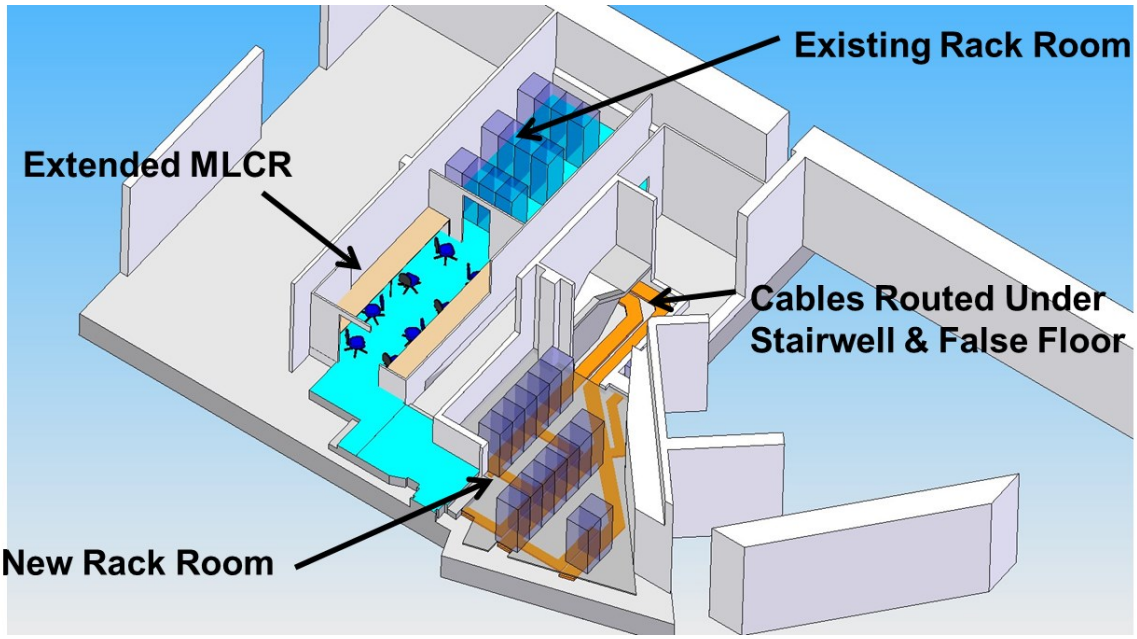

Fig 4: RR2 changes (also shown is a possible future extension to the MLCR)

Apart from the lower field in this location (xx Gauss, P Smith to advise) there is a significant advantage in being able to access the racks during experimental running, if the racks were in the MICE Hall this would have required controlled entry and experimental downtime, so this change is relevant if the PRY is implemented.

References

[1] V Bayliss et.al, Magnet Group Report at MICE Collaboration Meeting CM33, Glasgow, 25/06/12

[2] V Bayliss, MICE-NOTE-GEN-0393, 15/11/2012