Actions and recommendations from the Resource Loaded Schedule Review panel and the MICE Project Board

In July 2014, the MICE project provided an initial response [1] to the points raised in the feedback from the Resource Loaded Schedule Review panel and the MICE Project Board following their meetings in April 2014. This document supersedes the initial response and completes the collaboration's responses in preparation for the November review of the project.

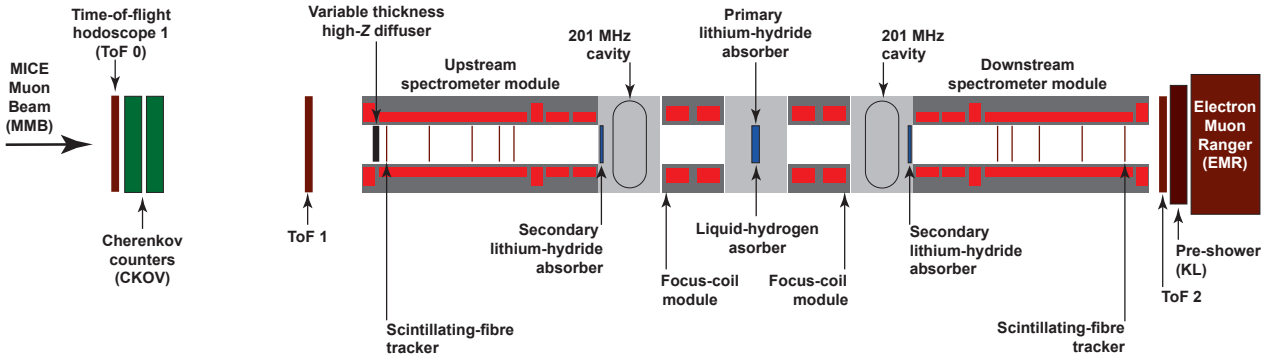

Figure 1: Schematic diagram of the configuration that will be used for the MICE demonstration of ionization cooling. Two single 201 MHz cavity modules and a focus-coil module will be added to the Step IV configuration. The central lithium-hydride absorber is sandwiched between the focus-coil and the single-cavity modules. Two secondary lithium-hydride absorbers placed between the cavities and the spectrometer modules increase the cooling effect and protect the trackers from x-rays and dark-current electrons.

Resource Loaded Schedule Review

1. **The project is required to undertake a full cost-risk-benefit analysis of the proposed expedited STEP V schedule for the next meeting.**
   In May 2014 the Particle Physics Projects Prioritization Panel (P5), an advisory panel to the US High Energy Physic Advisory Panel, made a number of recommendations concerning the future of the US Muon Accelerator Programme (MAP) and the US contributions to MICE. To respond to these recommendations, the DOE set up a Panel to review MAP, the US contributions to MICE and the status of the international MICE project. The DOE review Panel recommended that the MICE collaboration develop a simplified implementation of Step V that obviated the need to complete the coupling coil (CC) and the 201 MHz linac module (the RFCC). A schematic diagram of the revised layout is presented in figure 1.
   The response of the MAP to the review Panel's recommendations included a discussion of the cost of implementing the revised configuration, the schedule on which it could be completed and the risks that are retained in the revised project [2]. Since the cost, schedule and risk of the project through to completion will be contained in the project report, only a summary of the analysis presented in [2] will be given here.
   The principal change in going from Step V to the revised configuration is that the RFCC is no longer required. This has the following direct benefits:

- The integration and the commissioning of the CC inside the cryostat and cooled with cryocoolers is not required. Therefore, the US has delivered all magnets required to complete the experiment and no longer carries the risks associated with the CC or the implied financial burden; and
- Integration of the RFCC module is no longer required. This was a technically challenging part of the construction project with attendant schedule and financial risks. The fact that it is no longer required allows the resources to be redirected and the risks to be retired.

At RAL, the principal benefits of the revised configuration without the focus coil are:

- Substantial modifications to the infrastructure in and around the MICE Hall would have been required to implement the RFCC. The modifications to the South Mezzanine, the main entrance door to the MICE Hall and the access roadway are no longer required. This results in a reduction in both the cost and risk;
- The revised experimental programme has been planned using lithium hydride as the absorber material. Therefore, a second liquid-hydrogen delivery system is no longer required. Again, this represents a substantial reduction in cost and risk; and
- The RFCC module required substantial investment in electrical, vacuum and other services. The services required for the revised configuration place less stringent demands on the local project team again resulting in a reduction in the overall project cost and risk.

In addition to the direct benefits, the absence of the RFCC reduces the magnitude of the stray field that needs to be absorbed by the partial return yoke (PRY). As a result, the PRY required for the ionization-cooling demonstration is an extension of that which will be used at Step IV and will re-use essentially all the parts manufactured for the Step IV PRY.

The coupling between the magnets that make up the lattice in the revised configuration is reduced compared to that which would have pertained at Step V. Hence, the experience gained in operating Step IV may be taken as mitigating risks in the operation of the magnetic channel during the demonstration of ionization cooling.

The RF-power system is substantially simplified with one amplifier driving one cavity. In addition, the configuration being tested in the MTA, where the first MICE cavity will be exposed to the field of the MuCool magnet, is closely similar to that which will pertain in the cooling demonstration. Hence, the experience gained in the MTA will be of direct relevance to MICE.

Overall, the reconfiguration has resulted in a substantial reduction in risks across the project. As demonstrated in [3], the revised configuration is capable of allowing the study of ionization cooling with re-acceleration. Compared to Step V, there is a loss in 4D and 6D cooling performance and a loss in the number of configurations that can be studied. Details of the physics performance are given in [3].

2. **It is vitally important that the level 1 milestone, the completion of the installation for STEP IV that is currently scheduled for March 4th 2015 is met and the project team must ensure that everything is done to ensure this is achieved.**

   The project team agrees with the RLSR Panel's statement. The development of the sub-projects that must be completed successfully for the level-1 milestone to be delivered are continuously monitored. The project dash-board (`http://micewww.pp.rl.ac.uk/dashboard/`) gives a top-level view of progress towards the goal of completing the Step IV construction project by the end of Q1 2015.

   The critical path in meeting the 4^{th} March 2015 deadline remains delivery and installation of the partial return yoke (PRY). A 5 month delay on placing the order for the steel plate (to JFE in Japan) for the PRY was accrued due to problems with the procurement process at BNL followed by issues regarding the plate sizes raised after the procurement was moved to the Fermilab Procurement Office. A. Bross visited the steel manufacturer's corporate offices in Tokyo and their production facility in Kurashiki, Japan in August 2014. The outcome of that visit was to have JFE develop plans to expedite the shipping

of the material to the US. Unfortunately, due to a typhoon that hit Japan in October, some of the time gained has been lost. Presently, all the steel is inbound to the US with an expected delivery date 17^{th} November 2014. In parallel we have been working with Keller Technology to advance the schedule for the fabrication of the components of the PRY once the plate reaches their facilities. Keller is now contacting additional fabrication shops in their area so that the final machining of the steel plate can be parallelised at 2–3 facilities.

3. **The UK project management should redo the schedule projection taking into account the 35% contingency for concurrent tasks (the green line) by the end of May.**

   The UK PMO made a revision of the schedule projection including a consistent implementation of contingency at 35%. The schedule analysis was communicated to the chair of the RLSR panel on the 31^{st} May 2014 and may be found at:

   - `http://www.eng.dl.ac.uk/secure/mice/RLSR/2014-04%20RSLR/Schedules/Step%20IV%20Critical%20Path.pdf`

4. **The project should produce a coherent plan for the commissioning and the running of MICE for STEP IV for the next meeting.**

   A coherent plan for the commissioning and running of MICE has been prepared [4]. The present "default" run plan has been designed to fit into the Step IV running period obtained from the schedule analysis and includes:

   - The data taking necessary to align and calibrate the detectors and the magnetic lattice;
   - Sampling of the full momentum, betatron and emittance space for both liquid-hydrogen and lithium-hydride absorbers; and
   - Detailed scans of the betatron function and emittance at nominal momentum for both liquid-hydrogen and lithium-hydride absorbers.

   The full programme outline above will have to be reduced should running time be lost due to delays in the implementation of Step IV, extended commissioning of one or more magnets or equipment failure in MICE or ISIS. A set of priorities has been agreed to allow the collaboration to react to such eventualities. These priorities are listed in table 1. The list is ordered such that items are dropped successively from the bottom of the list should it become necessary to curtail the running time or should it not be possible operate the experiment safely 24 hours-a-day, 7 days-a-week. Should the running time be so short that the priority-1 programme could not be completed, then running with lithium hydride would be dropped since the ionization-cooling demonstration will be performed with lithium hydride.

5. **The committee reviewed the revised project planning methodology and agrees it is appropriate and gives a more representative value for future use in comparing the baseline to the optimistic and risk dates.**

   As noted in the July 2014 response to the RLSR Panel's feedback, progress in the milestones to the completion of Step IV is presented in the project dash-board (`http://micewww.pp.rl.ac.uk/dashboard/`). The schedule to complete the experiment with a demonstration of ionization cooling will be presented to the RLSR in November 2014. These milestones will be used to set the baseline for the remainder of the project and tracked in a revised dashboard.

6. **The dashboard and slip charts should be included in future reports.**

   The project team notes the Panel's comment and will continue to use the dashboard and slip charts as a means of monitoring and presenting the progress of the project. Indeed, the contents and presentation of the dashboard is under constant development in response to the changing needs of the project.

7. **The project should provide an optimum revised project plan for the completion and operation of STEP V within the financial constraints for the next meeting.**

Table 1: Prioritisation of data taking at Step IV. It is intended that items are dropped from the bottom of the table should it be necessary to curtail the running time.

1	Detailed scan (with $\sim$ 20k good muons per point) of the effect of empty, liquid-hydrogen and lithium-hydride absorbers as a function of betatron function (9 points) at the nominal momentum of 200 MeV/c.
2	1 & detailed scan (with $\sim$ 20k good muons per point) of the effect of empty, liquid-hydrogen and lithium-hydride absorbers as a function of momentum (9 points) at the (single) nominal betatron function (β) of 420 mm.
3	1, 2 & 100k good muons per point muons at the nominal $\beta = 420$ mm, $p = 200$ MeV/c, scanning over emittance (3 points) with empty, liquid-hydrogen and lithium-hydride absorbers.
4	1, 2, 3 & detailed scan (with $\sim$ 20k good muons per point) of the effect of liquid-hydrogen and lithium-hydride absorbers as a function of betatron function (9 points) and emittance (3 points) at the (single) nominal momentum of 200 MeV/c.
5	1, 2, 3 & sampling of 3×3 emittance, momentum matrix at three betatron functions with reduced sample size ($\sim$ 25k good muons per point).
6	1, 2, 3 & sampling of 3×3 emittance, momentum matrix at three betatron functions with reduced sample size ($\sim$ 50k good muons per point).
7	1, 2, 3 & sampling of 3×3 emittance, momentum matrix at three betatron functions with reduced sample size ($\sim$ 100k good muons per point).

Following the DoEs review of the MAP collaboration in August 2014, preparations for the implementation of Step V have ceased. Instead, a revised configuration capable of demonstrating ionization cooling has been developed. The schedule for the completion of the installation of Step IV, the commissioning and operation of the Step IV experiment and then the construction of the cooling demonstration be presented along with the financial implications for the UK and US in the project summary prepared for the RLSR [5].

Initial consideration of the time required to commission and operate the cooling-demonstration experiment is presented in [6] and [7]. The essential programme can be completed in line with the constraints imposed on the project following the August 2014 DOE review.

MICE Project Board

1. **The director of the MAP program should ask the DOE office of HEP to intervene to expedite the remaining procurement for the Partial Return Yoke fabrication. The timely delivery and installation of the PRY is critical to meeting the Step IV schedule.**
   The MAP Director pursued this issue with both DOE-OHEP and BNL senior management with the result that all Purchase Orders for procurement of the PRY were in place on the 27^{th} June 2014.
2. **Complete a risk/benefit analysis of the switch from the baseline program to an expedited delivery of Step V, for all components, by the next meeting.**
   The risk/benefit analysis of the switch from the delivery of Step V on an expedited schedule to the configuration shown in figure 1 has been presented in [2] and summarised in answer to RLSR recommendation 1.
3. **Begin a series of independent Machine Protection and Personnel Protection reviews of the integrated commissioning activities and early operation stages, and report back on progress at the next MPB meeting.**

The MICE Beam Protection system (BPS) consists solely of the "MICE Target OK" signal. The design and operation of this signal was reviewed by the ISIS safety modification panel in October 2011 and then installed by MICE and tested in conjunction with M. Arnold and D. Adams of ISIS in September 2012. The operation of the experiment since that time has been on the basis of the confidence gained during the review and, subsequently, in operation. Safety considerations for MICE construction, commissioning and operations are dealt with through the MICE-ISIS Safety Committee. The Committee meets every six weeks; Personnel Protection System (PPS) and BPS matters that arise are covered within that framework. Since the PPS was commissioned, the only "new" feature of MICE that might influence the PPS is the Partial Return Yoke (PRY). A review of the PPS system taking into account the presence of the PRY was carried out with ISIS staff on the 14^{th} October 2014. The implications of the PRY and necessary revisions to the search protocols were discussed. It was concluded that no changes to the PPS hardware was required so long as the appropriate modifications were made to the search procedures. This outcome will form a significant input to a pre-Step IV PPS review and update for ISIS that has been organised for the week of 8^{th}–12^{th} December 2014. This event will be based on the documentation necessary to explain how the PPS will operate during MICE commissioning and operation.

4. **Scientific output in refereed scientific and technical journals should be enhanced and made more visible, publishing in the worlds of both experimental physics and accelerator physics.**
   The project team agrees with the MPB and has taken steps to enhance the collaboration's rate of publication. The physics and technical papers presently in preparation are listed in table 2. To complete the documentation of the physics results from Step I, two papers are in an advanced stage of preparation. The first will document the performance of the EMR and the second will quantify the pion contamination in the MICE Muon Beam. It is now planned that the first Step IV paper will describe the hardware assembled for the measurement programme and report the principal characteristics of the muon beam transported through the experiment. Drafting of the technical sections of this paper has just started. The design and optimisation of the configuration to be used in the ionization cooling demonstration has been prepared in the form of a MICE technical report [3]. Following the rebaselining of the experiment at the November review it is the collaboration's intention to revise the technical note for publication formally to document the final configuration of the experiment. Finally, in order to complete the documentation of the Step IV experiment a number of technical publications are in preparation. The special issue on muon accelerators proposed by JINST offers a possible vehicle by which to publish the technical contributions. To enhance the accessibility of its scientific output a list of publications and conference contributions is maintained on the collaboration's WWW site. After a period of "beta-testing", the refurbished WWW site has been put into production (see `http://mice.iit.edu/refit`). The collaboration's publications are listed under the "Documents" drop-down menu. Work continues to streamline access to information on the WWW site.

Superconducting magnets

5. **Prepare to choose between FC1 and FC2 immediately after the FC2 test. In parallel with FC2 testing, complete the analysis that shows that FC1 is (or is not) adequate for Step IV and V. (There is probably not enough time after the test to rework FC2 if needed and still hold the Step IV schedule.)**
   On the 20^{th} May 2014 it was decided that FC1 will be used in Step IV since it is capable of supporting an excellent programme. It was recognised that FC2 might be shown to outperform FC1. This has proved to be the case and it has been decided to place FC2 on the beam line before the end of December 2014.
   The project is in discussion with TESLA over the schedule on which FC1 can be refurbished. Initial cost and schedule estimates need to be discussed in the context of the existing contract. In addition, the analysis of the currents required in the cooling demonstration configuration indicate that the demonstrated

Table 2: Physics and technical papers being prepared by the collaboration.

Title	Lead authors
Step I physics	
Electron Muon Ranger: performance in the MICE Muon Beam	A. Blondel, F. Drielsma, R. Asfandiyarov
Measurement of the pion contamination in the MICE Muon Beam	D. Orestano, D. Nugent, P. Soler
Step IV physics	
Commissioning of the MICE experiment in the Step IV configuration	C. Rogers
Ionization cooling demonstration	
Design and expected performance of the MICE demonstration of ionization cooling	V. Blackmore, J. Pasternak, C. Rogers
Technical	
The MICE target upgrade	C. Booth
The design construction of the MICE Electron Muon Ranger	R. Asfandiyarov, A. Blondel, F. Drielsma
The Reconstruction Software for the MICE Scintillating Fibre Trackers	S. Dobbs
The MICE Analysis and User Software framework	D. Ragaram

stable operation of the magnet (120 A in solenoid mode and 180 A in flip mode) is sufficient to support the revised configuration. The final decision regarding the refurbishment of FC1 will be taken following the re-baselining of the experiment and after taking advice on the terms of the contract.

6. **Present at least one paper on the spectrometer magnet experience at upcoming conferences. Though potentially painful and difficult, these lessons apply to many others in the field, and even to other vendors working for MICE.**

   A paper will be prepared for the International Conference on Magnet Technology that will take place in Korea in October 2015 (Seoul, 18–23 October 2015). S. Prestemon (LBNL) will coordinate the effort and H. Pang (LBNL) will initiate ANSYS studies on the thermal stability of the cold-mass bobbin used in the spectrometer solenoid. This analysis will be included in the submission.

7. **Pay special attention to risks that are shifting from other collaborators to RAL. Look for ways to encourage and/or enforce continued responsibility for those components by the home institution after delivery has occurred.**

   Both the scale of the risks and the balance of risk across the collaboration has once again shifted following the adoption of the revised configuration shown in figure 1. Overall the project risks are substantially reduced. The risk analysis is summarised in the project summary prepared for the November 2014 RLSR [5].

RF systems and controls

8. **Generate an integrated RF system testing plan, including both the alternative of using an early delivered RFCC module and also the present option of using a single cavity, so that valuable practical operation experience can be gained in a timely fashion and in parallel to operating Step IV.**

   The revised schedule for the project developed in response to the recommendations of the August 2014 DOE review has caused the collaboration to revise significantly the RF test plan. In particular, the start of operations with RF is significantly earlier and therefore the RF test plan had to be brought forward

and modified to deliver the requisite system in time. The MICE RF group has prepared an RF test plan that exploits the Single Cavity Test System (SCTS) that is in operation at the FNAL MTA. The test plan is summarised in [7].

9. **Prepare and present at the next meeting a plan for how the controls and sub-system teams will train and share information with the operations and maintenance crews, within both the collaboration and ISIS.**
   The mechanisms by which the controls and sub-system teams will train and share information is in preparation. The advice of Z. Bowden (ISIS Operations Division leader) was that the pressure of work on the ISIS technical teams during the long shutdown was such that discussions on joint working in support of MICE commissioning and operations should begin late in the shutdown. The first of a series of joint meetings is now scheduled for the 1st December 2014. The format of the meeting will be presentations on the commissioning and operation schedule and details of the systems requiring support. This will be followed by discussion of the necessary mechanisms for effective cooperation. It is anticipated that a series of actions will be generated which will be addressed in advance of a second meeting which will be scheduled early in the New Year.
10. **Implement a prioritised plan towards making the essential components of a control system operational for Step IV.**
    The necessary controls systems for MICE have been reviewed and the priority of each system has been identified. The prioritised plan for the completion of the controls and monitoring project for Step IV is presented in [8].

Data taking, simulation and reconstruction

11. **Present a combined physics/operations plan for Step IV data taking and analysis, clearly describing the critical early measurements to be made, and the plan towards first Step IV publications.**
    KL to redraft. Needs doc from SB. Need to define physics priorities.
    The work and documentation referred to in the response to RLSR recommendation 4 also addresses the planning of the data taking for physics and is presented in [9].
12. **Develop a plan for on-site support of online systems during Step IV running, ensuring that the experiment can run smoothly during this critical period.**
    A plan for on-site support has been prepared and agreed by the MICE Online Group. The plan is documented in [10].
13. **Fully integrate the online and offline development schedules into the overall experiment planning, showing where shortfalls in resources occur, and their effects on the overall schedule up to publications.**
    The schedule for the S/w&C project has been integrated into the overall MICE schedule. The resource implications and issues related to the levelling of resources continue to be evaluated.
14. **Present the methodology for track reconstruction and explain how it is being used to achieve the best possible resolution, at the next meeting.**
    The track reconstruction algorithms used to calculate track positions and momenta are described in [11]. A MICE Note has just been completed describing the track reconstruction in more detail [12]. This MICE Note will serve as the basis for the preparation of a paper to be submitted to a refereed journal.
    Global track reconstruction routines, which tie the momentum and position information determined by the scintillating-fibre tracker into the timing information provided by the ToFs, are under development. These routines will provide enhanced particle identification capabilities and the ability, during the cooling demonstration, to determine particle time at the tracker with respect to the RF phase.
    A paper to be submitted to a refereed journal describing the MAUS framework, including the global reconstruction algorithm, is in preparation. The status of the publication will be presented to the MPB at

its next meeting.

Commissioning and operations

15. **Develop and present at the next meeting a more detailed plan of Step IV commissioning and early operational activities in 2015, indicating the anticipated progress on each major component and sub-system, possible problem areas/delays and how these may affect timescales.**
    The cooling-channel commissioning plan has been developed and integrated with the commissioning of the beam-line systems [13]. It is expected that the MICE Local Control Room will be ready to take data from the beam-line systems well in advance of the commissioning of the cooling-channel magnets for which commissioning is scheduled to begin in June 2015. The commissioning plan will be presented to the MPB at the November 2014 meeting. A data-taking plan has also been developed which will provide the data required to meet the Step IV physics goals [9]. This will be held under review as the commissioning plan evolves. Significant contingency has been built into the plan to take currently unknown delays or problems into account and a measurement prioritisation list has been developed to modify the data-taking plan if this is required.
16. **Assure adequate participation of the operational team in Step IV installation and commissioning activities, in order for them to gain "hands-on" knowledge of the hardware, and of typical and possible issues of relevance to operation.**
    The operational team is made up of experts responsible for their individual subsystems. These responsibilities have been defined in the Assumptions Document referred to in the response to MPB recommendation 18 [14]. These experts will have detailed knowledge of the construction, installation and operation of the systems for which they are responsible and will produce documentation clearly outlining the operations of their system, and instructions for issues of relevance to operation. Knowledge exchange between the subsystem experts will be maintained through regular Operations Meetings as well as the day-to-day interactions of the experts with those working on the individual systems.
17. **Develop a policy and a corresponding plan for the active participation of non-UK and non-US collaborators in the installation and commissioning activities, and on operational shifts.**
    The Assumptions Document [14] described in the response to MPB recommendation 18 documents the agreed responsibilities of the collaborators for the installation, commissioning and operations activities. The Collaboration Board agreed on the shift policy for the commissioning and operations activities at its meeting in June 2014 [15]. The steps being taken to develop, and document, the commissioning and operations plans are presented in response to MPB recommendation 15.
    The project team recognises the thrust of the MPB's comment regarding the need to ensure the participation of non-UK and non-US collaborators in the commissioning and operations activities. However, it is clear to the project team that, without NSF support, some of the US groups will be unable to take leading roles in these activities. This would diminish the intellectual input to the activity as well as exacerbating the staffing problem.
    Therefore, in parallel to establishing the required policies through the preparation of the documents referred to above, a small fund has been established by which key personnel from overseas who would otherwise be unable to come to RAL can be supported. The fund is made up of some resources earmarked from within the MICE-UK allocation matched by funds from the experiment's Common Fund. These UK funds have been agreed upon with the Project Manager with a view to mitigating clear commissioning and operational risks. Management and oversight of this fund will be performed by the MICE Executive Board (EB). The agreed mechanism for accessing the fund is that the EB will consider recommendations from the Spokesman, the Project Manager or the Operations Manager.
18. **Fully define the expected contributions of the collaborating groups towards the commissioning, operation and maintenance efforts.**

Under the editorship of the Project Manager, the project team has developed an Assumptions Document that lists the assumptions it has made in the preparation of the construction, commissioning and operations schedules [14]. The contributions and responsibilities of the collaborating groups towards the commissioning, operations and maintenance efforts are documented in the Assumptions Document. The document has been presented to, and agreed by, the MICE Collaboration Board.

19. **Continue communications with ISIS on operational staffing and rebuilding the MICE liquid hydrogen team.**
    The rebuilding of the liquid-hydrogen team is underway under the oversight of the MICE/ISIS Safety Committee which has constituted a small working group to oversee the preparation of the system for operation at Step IV. The working-group activity follows that by which the system was successfully commissioned using the test absorber. Progress on the development of the liquid-hydrogen activity, and the operations-project staffing in general, will be presented to the MPB at its meeting in November.
20. **Identify means of presenting the ISIS team with full system drawings and specifications of the equipment that they will be involved in running.**
    A first meeting between the MICE Operations team and ISIS Operations has been scheduled for 1st December 2014. One of the goals of this meeting is to outline the requirements of ISIS and to review the status of MICE documentation. Once the requirements are understood the Operations Coordinator will ensure that all necessary documents are provided to ISIS personnel well in advance of the commissioning period.

References

[1] The MICE Executive Board, "Actions and recommendations from the Resource Loaded Schedule Review panel and the MICE Project Board." http://micewww.pp.rl.ac.uk/documents/94, 2014.

[2] The MAP collaboration, "Revised completion plan for the Muon Ionization Cooling Experiment (MICE) at Rutherford Appleton Laboratory." http://map-docdb.fnal.gov/cgi-bin/RetrieveFile?docid=4402&filename=DOE_Response_2014_0925_FINAL-docDB.pdf&version=1, 2014.

[3] V. Blackmore *et al.*, "The MICE Demonstration of Ionisation Cooling: Technical Note." http://mice.iit.edu/micenotes/public/pdf/MICE452/MICE0452.pdf, 2014.

[4] S. Boyd and V. Blackmore, "MICE Step IV Commissioning and Operations Plan." http://micewww.pp.rl.ac.uk/documents/106, 2014.

[5] The MICE International Project Office, "Resource Loaded Schedule, costs and risks for the completion of the MICE project." http://micewww.pp.rl.ac.uk/documents/107, 2014.

[6] C. Rogers and K. Ronald, "Demonstration of Muon Ionisation Cooling, Experimental and Operational Plan." http://micewww.pp.rl.ac.uk/documents/108, 2014.

[7] The MICE RF group, "Test and Commissioning Plan: MICE Demonstration of Ionisation Cooling." http://micewww.pp.rl.ac.uk/documents/109, 2014.

[8] Hanlet, P.M. and Rogers, C., "Controls System Prioritised Plan." http://micewww.pp.rl.ac.uk/documents/105, 2014.

[9] V. Blackmore and S. Boyd, "Planning the MICE Step IV Data Campaign." http://micewww.pp.rl.ac.uk/documents/97, 2014.

[10] Rogers, C. and Smith, P., "Computing On-Call Policy." http://micewww.pp.rl.ac.uk/documents/104, 2014.

[11] A. Dobbs, K. Long, E. Santos, D. Adey, P. Hanlet, *et al.*, "The Reconstruction Software for the Muon Ionization Cooling Experiment Trackers," *J.Phys.Conf.Ser.* **513** (2014) 022008.

[12] A. Dobbs *et al.*, "The Reconstruction Software for the MICE Scintillating Fibre Trackers." http://mice.iit.edu/micenotes/public/pdf/MICE451/MICE451.pdf, 2014.

[13] J. Pasternak *et al.*, "Magnet and Beam Commissioning at Step IV." http://micewww.pp.rl.ac.uk/documents/96, 2014.

[14] The MICE Executive Board, "MICE Assumptions Document." http://micewww.pp.rl.ac.uk/documents/??, 2014.

[15] A. Blondel, "Data taking shift policy for MICE." https://indico.cern.ch/event/321200/session/7/contribution/89/material/slides/1.pdf, 2014.