

# Report on the Delivery Ring AIP Review

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Held 25 February 2016, Fermilab

Committee Members: Cons Gattuso, Dave Harding, Jim Lackey, Chris Polly, Mike Syphers (Chair), Bob Webber.

## Intro

A review of the Delivery Ring Accelerator Improvement Project (AIP) was carried out on 25 February 2016 at Fermilab. This was not a technical review; the charge (see below) was to comment on the remaining scope and the viability of project completion within the remaining budget and within the current resource-loaded schedule. The AIP team was very well prepared and presented the committee with coherent, relevant information in a very efficient manner, effectively managing all expectations of the committee.

## Addressing the Charge

1. Is there a viable plan for completing the remaining scope of work? **Yes**  
Are there any areas of missing scope? **No**

2. Can the work be completed in accordance with the current resource-loaded schedule? **No**

Are additional resources needed?

**The necessary resources have been identified, but the availability of these resources on the necessary timescale is in question. Re-planning the schedule for the work remaining, taking into account outside competition for resources and other schedule constraints, would allow the project to better monitor progress.**

If the current schedule is not achievable, can all work needed to run beam to g-2 be completed before January 2017? by March 2017?

**The AIP activities can very likely be completed by March 2017 to support beam delivery to the Delivery Ring for initial commissioning for g-2.**

3. Can the project be completed within the remaining budget?

**Yes. There appears to be more than adequate contingency in the AIP for the remaining scope of work.**

Date: 29 February 2016

## Findings

- The project manager is concerned that it will be extremely difficult or impossible to meet the existing schedule for completion by October 2016.
- The AIP funding for the Delivery Ring was advanced to FY16 in order to allow commissioning for Muon g-2 to begin as early as Nov 2016. The additional components from the Muon g-2 Project that are also needed for commissioning the beamlines have an early date of March 2017, obviating the pressure to complete the AIP in FY16.
- The BLM and BPM systems both rely almost entirely on re-used hardware.
- The BPM work is just now getting underway and a proposed completion date of August was presented.
- The BLM presentation indicated the advisability to test the ion chambers reclaimed from the Tevatron, but acknowledged that there is no plan for how this will be done.
- The ion chamber BLM system is not used for Muon g-2 operation and would not be strictly needed for commissioning Muon g-2. It is required for Mu2e commissioning and operations.
- Technical Division (TD) is building three identical C magnets, one of which is part of the delivery ring AIP. The other two will be paid for by Muon g-2 and spares. The magnets are being built on a WIP (work in progress) task owned by TD. When all three are complete, the total cost will be divided three ways and appear on the AIP financial reports as a lump sum.
- The first of the C magnets is complete and under test, and it should be ready for installation next week. The coil for the second magnet is ready, the core is being prepared for assembly, and the magnet should be complete in March. All components are in hand for the third magnet.
- The M&S costs of the C magnets have overrun the budget, but SWF is significantly lower than projected, leading to an EAC total very close to budget
- Similarly, TD is building three pulsed septum magnets with three funding sources. Although the design concept is not new, all the parameters are

different. The core is curved and must run in pulsed mode. Magnet parameters, especially the inductance, have changed.

- The technical design review for the septum magnets was only held this month. The design is currently being revised in response to the review recommendations. The projected delivery is November 2016. The cost for engineering to date is under the budget.
- The kicker work is critical path for the Delivery Ring AIP and requires the same resources to be managed across the production of 4 kickers (1 Recycler AIP, 2 Delivery Ring AIP, and 1 Muon g-2 Project).
- The Muon Campus Installation Coordinator(s) is(are) sequencing installation. Installation work will be done when it is most efficient to do so, based on the overall view of this and other Muon Campus projects.

## Comments

- No missing scope of work was identified or perceived.
- The project appears to have a viable plan for the remaining scope of work, however it will be extremely difficult or impossible to meet the existing schedule for completion by October 2016.
- Technician support may run into a conflict with summer shutdown work.
- The amount and type of work requires more time than the schedule allows
  - o There is a heavy reliance/need for specialized technical experience in several of the tasks; individuals with this experience are in demand for other projects at the lab.
  - o The quality and expertise of required resources is more important than just the number of resources.
- It is important to optimize the remaining work on the Delivery Ring AIP such that all the components needed for commissioning beam to g-2 are ready in synchrony with the completion of the final Muon g-2 Project beamline scope.
- In many cases, the same resources are needed to complete Delivery Ring AIP scope and Muon g-2 Project scope. The team is doing a good job of managing the relative prioritization to optimize the commissioning date and meeting the needs of both schedules.

- Based on what was presented, it is reasonable to expect project completion by March 2017. January 2017 would appear to be an aggressive schedule for completion, though the components required to run g-2 should be attainable by that date. This is only possible if the necessary resources are appropriately allocated; understanding all the demands on these resources implies an update of the resource-loaded schedule.
- Financially, the project appears to be very healthy. A total of \$1.44M of remaining contingency on \$3.3M of work-to-go is 44% contingency on work remaining. Furthermore, the project has nearly completed a ground up evaluation of ETC and only finds -\$50k variance to complete (over budget).
- The BPM and BLM systems represent no technical risk. However, the indicated August completion date seems both unrealistic and unnecessary.
- The BPMs only need to be ready when the Muon g-2 Project deliverables will be ready to commission beam through the Delivery Ring and minimal risk would be retired early. Both the BPM and BLM work should be included in any rescheduling or re-planning activity that takes place.
- The C magnet is nearing completion and the cost is well understood. The major uncertainty is the time at which the spare will be complete, allowing the cost transfers to be executed.
- The septum magnet is a challenging device. Although a technical review has just been completed, no components have been ordered. The tight interaction of the magnet parameters with the power supply performance puts pressure on the schedule.
- Initial testing of the septum power supply and magnet can only be done together and *in situ*, which introduces risk into the schedule.
- Contingency in the project might be considered to acquire an additional transformer for the Muon Campus.

## Recommendations

1. The remaining work for the Delivery Ring AIP should be rescheduled in a way that optimizes the interleaving of work with the g-2 project and remains consistent with the completion of the M4/M5 line for Muon g-2. Named resources should be used in the resource-loaded schedule where appropriate.
2. Due to the kicker work being close to critical path on Muon g-2 and on the critical path for the Delivery Ring AIP, every effort should be made to acquire the needed logistical support to make the production of PFL windings and load/connectors move forward as efficiently as possible.
3. The need to calibrate BLM ion chambers in the test beam or elsewhere should be determined and any cost and schedule impacts should be included in planning.
4. Continue incorporating lessons learned from previous installation activities and capture lessons learned from this AIP.