

Fifth Monthly Report of the MI BPM Upgrade  
November, 2005  
wbs item 1.1.3.2 of the Run 2 Luminosity Upgrade Project  
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**Project Definition:**

The MI BPM Upgrade will replace the current BPM electronics and the data acquisition system used to transfer information between the BPMs and the Accelerator Controls Systems. As part of the project, the software used to read out, transfer, store, and analyze the BPM data will be upgraded. The goal of the project is to provide a BPM system based on modern hardware and software that gives the higher resolution and expanded functionality necessary to efficiently understand and operate the Main Injector now and for the foreseeable future including the needs for Run 2 and NUMI. Deliverables of the project include all relevant documentation, manuals, user's guides and any other written records necessary for maintaining the system.

**Project Manager's Summary:**

In November progress continued on all fronts. For the first time data was taken using prototype or first production versions of upgrade hardware and software. This is a big step toward finalizing the design as well as starting the process of integrating the new system into the Main Injector.

After some difficulty with delivery schedules with the company that was fabricating the combiner boards we finally took possession of the remaining assembled boards around November 1, 2005. With these boards and the parts that were left over from the assembly job the installation of the standard combiner boards can proceed as rapidly as access to the accelerator is available. By the end of November 123 combiner boards were installed in the MI tunnel. This was over half the total to be installed. Each access approximately 30 boards + boxes are installed. Three or four more accesses will complete the job.

A great deal of progress was made in November on the transition board. The two-channel prototype was used to make measurements of the performance of the design, to test changes, and to feed those changes into the 8 channel board design. All of this work is documented in beams-doc-1968. The transition board layout review was held November 10, 2005. After the review the final layout was prepared and 5 prototype boards have been ordered. They will be stuffed at Fermilab and checked out and tested before the final fabrication order is placed. The intent is to place the order as soon as possible so that boards can be fabricated in quantity and can be used to check out full systems before the shutdown next March. Stefano Rapisarda has joined the effort and has been working with Manfred Wendt and Bill Haynes to design and program the IO control for the transition boards.

The first MI timing board was fabricated at Fermilab in November. It was checked out on the test stand and was found to be adequate for the MI BPM upgrade project. A second board and all remaining boards will be fabricated as quickly as possible given the availability of parts and effort. The first two boards will be used on the test stand in FCC and in MI40.

The bulk of the cables required for the project have been specified and the requisition for those cables was written and placed during November.

The front end software for the project has moved forward nicely to the point where data is being taken with MI BPM upgrade software on production hardware. The system is able to take closed orbit data at 500 Hz and to collect triggered turn by turn data. One near-term goal is to get the software into a state that replicates the current (old) MI BPM system's performance. A second goal is to have the software be "state aware" and able to deliver data based on the instructions given by the "I6 replacement" program.

New applications W27 and W14 have been created to provide the diagnostic program functionality and I6-like functionality (different configurable data collection for different MI cycles coupled to the RF system timing) for the upgraded system. FTP capability exists for data from the MI40 setup.

A BPM has been connected to the upgraded hardware (prototype transition board, MVME 5500, Echotek, timing board) in the MI40 service building. This is where the project will begin to implement the upgraded system, first on one BPM, next on multiple BPMs, then on to a full "house" of BPMs (approximately 12 devices) and on to a full installation. The project goal is to have a house functioning by mid-January 2006.

Once data was available from the MI40 setup (the day before Thanksgiving) it was possible for analysis and understanding (and debugging) to get underway seriously.

### Resources Used in November 2005:

The total time worked on the project in calendar November 2005 from the Computing Division was 5.1 FTE-months with 16 people contributing. The time worked from the Accelerator Division was 2.1 FTE-months with 10 people contributing. The total time worked from both Divisions was 7.2 FTE-months. The following table gives the estimated or reported effort for both divisions (in FTE-months) since July, 2005.

<u>Month</u>	<u>AD Effort</u>	<u>CD Effort</u>	<u>Total Effort</u>
July, 2005	2.1	2.4	4.5
August, 2005	1.4	2.7	4.1
September, 2005	2.8	3.7	6.5
October, 2005	3.5	4.7	8.2
November, 2005	2.1	5.1	7.2
SUM (through Nov, 2005)	11.9	18.6	30.5

The effort listed here is time worked and does not include vacation, sick leave, holidays, etc.

### Purchase requisitions/procard obligations through November, 2005:

This section will be updated in December. The budget is sufficient to cover all known expenditures.

### Milestones:

1.1.3.2.1.2	MI BPM: Review (Milestone)	7/25/2005
1.1.3.2.4.2	All Combiner boxes available	10/25/2005
1.1.3.2.3.1.3.5	Transition module PO issued	1/10/2006
1.1.3.2.6	MI BPM system complete	8/15/2006

The October 25 milestone for combiner boards was achieved during November (officially November 28, 2005). The remaining combiner boards plus parts was received from the company in early November and therefore installation of the boards in the MI tunnel is proceeding as quickly as possible given the access opportunities.

The January 10, 2006 milestone is achievable but depends on the availability and delivery of some long lead-time parts for the Transition module. The system complete milestone is not expected to change.

## **Meetings held, Reports Given:**

Meetings were held in November on the following dates:

Project Meetings: November 1, 8, 15, 22, 29

Transition and Timing Board final layout review: November 10

## **Documents:**

The following documents were written and added to the Accelerator Division Document Database during November, 2005.

[1526-v4 MI BPM Meeting Notes and Minutes](#) [Steve Wolbers](#) 30 Nov 2005

[2030-v1 A Quick Look at MI BPM Data](#) [Robert K Kutschke](#) 23 Nov 2005

[1949-v2 Main Injector Beam Position Monitor Upgrade Software Specifications for Data Acquisition](#) [Luciano Piccoli](#) *et. al.* 17 Nov 2005

[2012-v4 MI-BPM Upgrade Cable Specification](#) [Adim Yousif](#) *et. al.* 17 Nov 2005

[1822-v4 MI Service Building Survey \(BPM electronics space\)](#) [Marv Olson](#) 17 Nov 2005

[1951-v1 Monthly Report of the MI BPM Upgrade Project](#) [Steve Wolbers](#) *et. al.* 10 Nov 2005

[2007-v2 Extra Wide Aperture BPM Test Stand Measurement Results](#) [James A. Fitzgerald](#) 03 Nov 2005

[2018-v1 Echotek 814gc Data Transfer Rates](#) [Steve Foulkes](#) 02 Nov 2005

## **Subproject Leader Reports:**

### **Rob Kutschke: Data Validation**

This month saw the arrival of the first data from the test transition board and front end crate at MI 40. My first look at this data is described in Beams-doc-2040. Motivated in part by these data, we discovered configuration problems with the echotek, timing and transition boards. Most of these have since been corrected and an updated version of the document, demonstrating the improved data, is in preparation.