

Seventh Monthly Report of the MI BPM Upgrade
January, 2006
wbs item 1.1.3.2 of the Run 2 Luminosity Upgrade Project
Bob Webber, Stephen Wolbers, Bakul Banerjee
February 8, 2006

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 January the first prototype system was installed in MI40 as a replacement for the old house 44 BPMs electronics. A picture of the first installation as it looked on January 25, 2006 (the installation date) is shown here. The two types of crates are shown – a 6U VME-style crate on the top with the prototype analog transition boards and I/O system, and a DAWN 6U VME crate on the bottom with 3 Echotek boards, a MVME 5500 processor, and a MI-style timing board. The system has been taking data and will be used to validate the design as well as to implement features required for the updated system.



MI 40 (house 44) upgrade.

Many members of the project are working on the MI40 installation. In addition to this very important work many other major activities were being actively pursued during January. This includes continued installation of combiner boards when accesses allowed it, receiving and testing cables, preparation for final hardware acquisitions, software development and debugging, discussions of timing details, etc.

A large amount of work was devoted to the fabrication of the three transition boards required for the MI40 installation. This included building the first board and validating the design (and making changes as required), and then constructing the other two 8-channel boards. Andrea Saewert worked extremely hard to make this possible.

The digital logic for the transition board is also moving forward. Prototype boards have been built and are being used both on teststands and in the MI40 installation. An “improved” design may be pursued for the final system.

All of the timing boards required for the project have been assembled. Work continues to add functionality and debug the cards as necessary and as we learn more about how the system will actually need to run in this fairly complicated environment.

All 6U VME and VME-style frames and backplanes are either on order, are being delivered, or will be ordered very soon. The first 6U VME subrack from DAWN experienced a power supply failure early in testing. A second unit has been requested so that validation and final delivery of the full order can be pursued.

Cables are being delivered as they are being built by the vendor. Cable testing will be done by Tim Kasza’s group in the Computing Division. The cables should all be delivered well in time and should not be an issue for the project completion.

Most of the front end and online software effort in January has been devoted to functionality required for the MI40 installation (base functionality for house 44 replacement) as well as enhanced functions such as raw mode and safe mode. Additional functionality to allow state “awareness” is and will continue to be worked on.

The project, along with the Main Injector Department, is starting to discuss details of final installation of commissioning of the MI BPM upgrade. Work will continue on the MI40 (house 44) installation as well as on all of the various hardware and software tasks until the shutdown. During the shutdown the final combiner boxes will be installed in the tunnel. Final hardware acquisition and testing will occur. Final systems will be integrated and tested in preparation for final installation and testing. Near the end of the shutdown we will decide on the strategy for full installation and commissioning of the upgraded system. The goal is to fully commission the new system as soon as possible after the beam returns in late May or early June.

Resources Used in January 2006:

The total time worked on the project in January 2006 from the Computing Division was 4.1 FTE-months with 15 people contributing. The time worked from the Accelerator Division was 3.1 FTE-months with 13 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.

Month	AD Effort	CD Effort	Total Effort
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
December, 2005	1.4	5.7	7.1
January, 2006	3.1	4.1	7.2
SUM (through Jan, 2006)	16.4	28.4	44.8

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

Purchase requisitions/procard obligations through January, 2006:

No significant requisitions were placed in January. Final preparations for the large transition board RFP (72 boards) were completed and the requisition will be placed in February.

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 transition module PO was delayed by approximately 6 weeks compared to this but is expected in mid-to-late February. The delay was due to work that was required to finalize the design before releasing the purchase for fabrication to bid. All boards are expected to be in hand before the end of the shutdown for final installation and commissioning. The project is in good shape to install and commission as soon as beam returns and should finish in summer 2006.

Meetings held, Reports Given:

Meetings were held in January on the following dates:

Project Meetings: January 3, 10, 17, 24, 31 : Minutes beams-doc-1526

A special timing meeting was held on January 27.

Documents:

The following documents were written and added to the Accelerator Division Document Database during January, 2006.

[2122-v1 MIBPM Timing Discussion](#) [Robert K Kutschke](#) 31 Jan 2006

[2118-v0 Timing for the MIBPM System](#) [Robert K Kutschke](#) 27 Jan 2006

[2115-v2 More Details of Injection and Extraction Flashes](#) [Robert K Kutschke](#) *et. al.* 27 Jan 2006

[2107-v1 Control Values for the MI BPM Transitionboard](#) [Manfred Wendt](#) 24 Jan 2006

[2104-v1 Overview of Timing Fanout Generator Module for MI BPM](#) [Bill Haynes](#) 17 Jan 2006

[2103-v1 MIBPM Upgrade Front End Software Status](#) [Steve Foulkes](#) 17 Jan 2006

[2101-v2 MI BPM EchoTek/GrayChip Bandwidths](#) [Bob Webber](#) 16 Jan 2006

[2102-v1 Anti-proton Transfers with the New MI BPMs](#) [Robert K Kutschke](#) *et. al.* 12 Jan 2006

[2099-v1 MI BPM Installation Requirements](#) [David P Capista](#) 11 Jan 2006

[1951-v1 Monthly Report of the MI BPM Upgrade Project](#) [Steve Wolbers](#) *et. al.* 11 Jan 2006

[1949-v5 Main Injector Beam Position Monitor Upgrade Software Specifications for Data Acquisition](#) [Luciano Piccoli](#) *et. al.* 05 Jan 2006

[2086-v1 Note on Position Sensitivity of the Sum Signal from a Main Injector BPM](#) [Bob Webber](#) 03 Jan 2006

Subproject Leader Reports:

Rob Kutschke: Validation

During the month of January, we exercised many new capabilities of the prototype system. During these exercises, a few teething problems were discovered with the timing card and the front end software; these were promptly fixed by Bill Haynes, Steve Foulkes and Luciano Piccoli. Some of these are discussed in Beams-doc-2115. I measured the resolution for closed orbit mode in MI state 28 for both an horizontal BPM and a vertical BPM (Beams-doc-2080-v2). As expected the vertical BPM has better resolution, about 10 microns for vertical and 15 microns for horizontal. I also measured the resolution as a function of intensity for MI state 24, slow spill to the MTEST/MIPP (Beams-doc-2080-v2).

Based on work done in December the project team decided that, for injections from the Booster, that the flash timing be done relative to the BES, not relative to the MI \$AA marker. Once the change was made I demonstrated that this mode works. (Beams-doc-2115-v2). For flash turn by turn data we scanned the Echotek window so that it sampled all positions around an orbit. Using this data I measured, for mixed mode, the disruption of the NUMI bound beam when the beam bound for the anti-proton production target is extracted. (Beams-doc-2115-v2). The frequency content of the turn by turn data was also described in this document; it is particularly interesting during slip stacking.

We measured anti-proton transfers from the accumulator to the Recycler in both closed orbit (Beams-doc-2102) and in flash mode; the flash mode data was presented at meetings but has not yet been written up. A byproduct of this was a crude understanding the timing for flashes in this mode.

Based on experience with the prototype system, and on discussions with the project team, I developed a plan to expand the structure of the timing delays to give it the flexibility required to meet the project requirements. This is written up in Beams-doc-2122.

Finally we took the first measurements of raw mode data; after correcting for a data formatting problem, the mode has been shown to work. (Beams-doc-2127).