

Sixth Monthly Report of the MI BPM Upgrade
December, 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:

The major areas of progress in December were the activities leading toward the final transition board design and the front-end software and overall system work on the MI40 and teststand systems. Work continues toward a project goal of having a functional replacement for a full house of MI BPMs by mid-January, 2006.

The transition board, as mentioned above, was a major focus for the project in December. The main limitation to getting this board into full production has been the availability of parts, both for the prototype boards and for the production boards. The first 8 channel prototype board was partially assembled (some parts were missing). Initial testing is encouraging. It is hoped that final parts and testing can be accomplished in January. The requisition to procure and assemble the boards will be prepared and submitted for approvals in January so that a minimal delay will be incurred when the final design is available for the assemblers.

The digital logic for the transition board is also moving forward. Designs for the circuit boards, the cables, and the logic itself are all being developed in tandem with the timing board and the transition board. This is necessary given the way that the system has to function together. First prototypes and test stands are being created.

The timing boards are being assembled, tested, and used in test stands and the MI40 setup. So far the timing boards have functioned properly or have been extended to provide the signals required for current investigations and integration work. It is expected that all the timing boards will be fabricated well in advance of the date that they are required.

All of the boards required crates, power supplies and backplanes. These will be a combination of 9U VME subracks (identical to the systems used in the TeV BPM upgrade) and special 6U frames. The VME subracks were ordered and delivery is expected in January. The special frames (6U), power supplies and backplanes required for the transition boards are either delivered, ordered or will be ordered soon.

The requisition for the bulk of the cables required for the project has been placed. This should allow for timely delivery of the large number of cables required for the final installation.

A great deal of effort and progress has occurred in the front end and online software. The MI40 and test stand systems are both taking data regularly, new functionality is being included, and debugging continues. Both closed orbit and turn by turn data has been taken under various conditions. The diagnostic and control applications have been created and are being used and debugged. State awareness is being implemented. ACNET devices are being created.

The project, along with the Main Injector Department, is starting to discuss details of final installation of commissioning of the MI BPM upgrade. Detailed planning will start in January and will take into account the shutdown and the needs of the MI Department and operations, as well as the availability of hardware, space and functionality of the new system.

Resources Used in December 2005:

The total time worked on the project in calendar December 2005 from the Computing Division was 5.7 FTE-months with 16 people contributing. The time worked from the Accelerator Division was 1.4 FTE-months with 12 people contributing. The total time worked from both Divisions was 7.1 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
December, 2005	1.4	5.7	7.1
SUM (through Dec, 2005)	13.3	24.3	37.6

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

Purchase requisitions/procard obligations through December, 2005:

Req #/PO/Fermi	PRN/PO/REQ Date	Sole?	Item	QTY	Cost/unit	Estim. Cost	Final cost
PO556099		N	Digital Receivers	70	\$7,200.00	\$504,000.00	\$504,000.00
PRN64960	6/15/2005		Misc mouser etc			\$945.00	
PRN64958	6/15/2005		Misc Coilcraft			\$1,765.00	
PRN64956	6/15/2005		Circuit boards etc			\$1,137.50	
PO563823/Req180362	6/20/2005	Y	Power Splitters	500	\$12.90	\$6,450.00	\$6,450.00
PO563836/Req180363	6/21/2005	Y	Resistors etc	4000		\$4,738.92	
PO564173/Req180559	7/11/2005		Encloser braket	500	\$4.70	\$2,350.00	
PO564712	8/5/2005		Fabrication	239	\$12.75	\$3,047.25	
PRN64956	6/10/2005						
PRN70444	10/21/2005		PC BOARDS			\$1,292.50	
PRN70446	10/21/2005					\$2,499.20	
PRN70451	10/21/2005		Misc Digikey etc			\$1,729.84	
PRN70452	10/21/2005		Misc Heiland etc			\$1,273.75	
PRN70458	10/21/2005		Misc Newark			\$99.86	
PRN70461	10/21/2005		Misc Maxim			\$601.42	
PRN70506	10/24/2005		Misc Kaparel			\$766.81	
PRN70512	10/24/2005		Misc Minicircuits			\$1,390.80	
PRN70801	10/31/2005		Labelset			\$354.00	
PRN72622	12/7/2005		CIREXX Boards			\$669.00	
PRN72625	12/19/2005		Transceiver			\$243.84	
PRN72626	12/19/2005		Regulators			\$323.30	
PRN65224	6/22/2005		Lasertab			\$215.86	
PRN66861	8/3/2005		PC Board			\$699.00	
PRN66940	8/4/2005		Resistors etc			\$1,765.00	
PRN66941	8/4/2005		Mouser etc			\$2,350.00	
PRN67451	8/16/2005		Resistors etc			\$837.50	
PRN69734	10/4/2005		Vynl cap Koon			\$25.00	
PRN69772	10/5/2005		Resistor			\$19.00	
PRN70625	10/25/2005		Misc Newark etc			\$819.22	
PRN70631	10/25/2005		RF-Transformer			\$2,425.00	
PRN70635	10/26/2005		Misc Digikey etc			\$1,003.20	
PRN70638	10/26/2005		Indicator etc			\$1,925.44	
PRN70641	10/26/2005		Resistor etc			\$1,881.20	
PRN70646	10/26/2005		MAX700 CPLD/Octal Buffer	75		\$1,358.00	
PRN70656	10/26/2005		Misc Mouser etc			\$2,330.00	
PRN70660	10/26/2005		Resistor/IC etc			\$2,087.50	
PRN70746	10/28/2005		Misc Newark etc			\$602.80	
PRN70801	10/31/2005		Label set			\$354.00	
PRN70839	10/31/2005		Circuit board			\$500.00	
PRN71019	11/4/2005		Resistor etc			\$508.00	
PO566311	11/4/2005		Lemo Connector	800	\$5.74	\$4,592.00	
PO566358	11/8/2005	Y	Connector	800	\$2.78	\$2,225.60	
PO566351	11/9/2005		Amplifier etc			\$10,009.60	
PO566412	11/10/2005		Connector etc			\$7,139.00	
PRN71307	11/10/2005		Resistor			\$241.00	

PO566439	11/15/2005	Y	Capacitor			\$13,188.00
PRN71633	11/21/2005		Chip board etc			\$664.40
PRN72231	12/14/2005		Misc Mouser etc			\$896.10
PO566311/Req183205	11/4/2005			800	\$5.74	\$4,592.00
PO566158	10/24/2005		Acopian PS	11	\$1,517.00	\$16,687.00
PO566244/Req182408-183233	10/31/2005	N		16	\$4,205.75	\$67,292.00
PO566124/Req182982	10/20/2005	N	MVME5500	11	\$3,015.00	\$33,165.00
PO566821	12/8/2005		Technobox	16	640.77	10,262.32
PO566784	12/20/2005		Casco			\$34,413.40
PRN71351	11/15/2005		Relay			\$2,440.00
PRN71357	11/15/2005		EMI Shields			\$1,138.75
PRN71392	11/15/2005		HW Kit - VME			\$387.25
PRN71424	11/15/2005		PCBoards			\$1,800.00
PRN71430	11/15/2005		PC Boards			\$399.96
PRN71484	11/16/2005		Boards			\$425.00
PO566452	11/16/2005		53.1 Mhz Bandpass Filter	1000	\$17.25	\$17,250.00
PRN71510	11/17/2005		Wireless resistors			\$288.00
PRN71589	11/18/2005		Relay			\$1,580.00
PRN71597	11/18/2005		Misc Arrow etc			\$1,747.00
PRN71605	11/18/2005		Inductor			\$420.00
PRN71627	11/21/2005		Misc Electronics			2357.14
PRN71628	11/21/2005		IC - misc			\$594.00
PRN71692	11/21/2005		Attenuator			\$393.75
						\$793,971.98

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

Meetings held, Reports Given:

Meetings were held in December on the following dates:

Project Meetings: December 6, 13, 20

A special software specification meeting was held on December 27.

Documents:

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

[2083-v1 MIBPM Electronics Vince Pavlicek et. al. 27 Dec 2005](#)

[2060-v2 A Quick Look at MI BPM Flash Data Robert K Kutschke 22 Dec 2005](#)

[2080-v1 Comparing H and V MI BPMs Using the Upgraded System Robert K Kutschke 22 Dec 2005](#)

[1951-v1 Monthly Report of the MI BPM Upgrade Project Steve Wolbers et. al. 08 Dec 2005](#)

[2042-v1 MIBPM Front-End Software Missing Functionality Luciano Piccoli 07 Dec 2005](#)

[2043-v1 Assessment of MI BPM turn-by-turn measurements Bob Webber 07 Dec 2005](#)

[1968-v4 MI BPM Transitionboard Manfred Wendt 06 Dec 2005](#)

[2036-v0 Main Injector BPM Software Design Luciano Piccoli 02 Dec 2005](#)

Subproject Leader Reports:

Rob Kutschke: Data Validation

The flow of data that started in late November continued through December. We were able to discover and report numerous teething problems; all were quickly fixed. Initially the work focused on closed orbit measurements but it soon broadened to include user triggered turn by turn and flash turn by turn measurements. All are now working correctly.

As it happens, the MI was running slip stacking when we were ready to collect data for the flash studies. Because of the slipping, this is one of the more complex MI states. We were able to understand the response of the BPM system even when slipping was

underway. Many features of the slipping were measured and the results agree with the known operation of the MI: this includes the slip rate, the presence in the FFTs of the data of the beat between the two RF frequencies, and the details of the interference when the Echotek window is timed to include bunches from two different batches. This work was shown as talks in several group meetings and its current state is summarized in Beams-doc-2060.

This work also showed that it is necessary to reprogram the timing card so that in flash mode it counts its pretrigger delay relative to the BES, not relative to the AA marker.

The above studies were done on a horizontal BPM. Marv Olson recabled the system, for a short time, to look at data from a vertical BPM. The differences between the response of the H BPM and the V BPM are as expected. This work was shown at group meetings and is summarized in Beams-doc-2080.

Over the Christmas break, Steve Foulkes added some features to the VME computer to save to disk the turn-by-turn data from all 8 flashes of a mixed mode cycle. With this feature he was able to measure the response of all 8 flashes as a function of the house delay. A detailed report on this data will be presented in January.