

September 2004 Report of the Tevatron BPM Upgrade  
wbs item 1.4.5.4 of the Run 2 Luminosity Upgrade Project  
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October 11, 2004

**Project Manager's Summary:**

During September the project made progress in all hardware, software and installation tasks. Two items (the Timing and Filter boards) were cause for some schedule concern and those will be discussed further.

Most of the final work required to prepare space in racks for the new BPM electronics and to route cables in the service buildings was finished in September. There are a few remaining issues to resolve and these will be addressed either during the shutdown or as we prepare to commission the houses. The detailed installation plan will be developed as the delivery schedule for hardware is better known and after discussions with the Tevatron department. The BPMs in the B0 and D0 final focus regions are of different construction (half-length) and have their analog signals split and sent to the old Tevatron BPM electronics and collision point monitors (cpm). After some investigations of these BPMs it has been decided to read out both ends of all of the B0 and D0 BPMs, and to leave the splitters in the system for the proton and possibly the antiproton signals. This will require some work in the tunnel at B0 to connect the pbar ends of the BPMs. That work is scheduled for mid-October, when access is most convenient.

A major step for the project is the final approval and first delivery the first installment of 18 production quality Echotek boards. This delivery is ahead of the most recent schedule and the rate is higher than previous expectation. The boards will be tested as they arrive with a modified version of the so-called "Prep Test" that was used for the Recycler Echotek boards. Minor modifications were made to the test taking into account the differences of the Tevatron boards and to allow for better handling of the data collected during the tests.

Both the timing and filter boards moved closer to final production. The timing board was shown to be fully functional (with the exception of a few functions that remain to be implemented and tested) and approval was given by the project to move forward to production of 38 boards. The schedule for assembly, delivery, checkout and installation is not yet known but is likely to impact the installation schedule of crates in the service buildings. The filter board was very close to final approval by the project by the end of September. Purchase requisitions for board assembly for both boards was moving to procurement to speed the process as much as possible. The filter board is also expected somewhat later than the earlier plans and not in time for installation during the shutdown. Both of the boards' schedules will be watched closely.

Given the expected schedule of filter and timing board delivery the wbs was updated to reflect later installation times than originally planned. Some but not all of the full VME crates will be installed during the shutdown. Some of the pilot timing and filter boards

will be used for the initial commissioning installations. As parts arrive the final electronics modules will be installed after the end of the shutdown. Commissioning will still begin after the shutdown ends.

Other hardware and material is arriving. The filters are arriving at the rate of 100 matched pairs per week. All of the VME crates have arrived. Cables are beginning to arrive. All of the hardware is tracked and tested. Test setups have been established and weekly reports are given about the status of the tests, any problems encountered, statistics, etc.

The front end and online software are both advancing. The front-end software is concentrating on the readout rate. 500 Hz (the spec) has been achieved for one and two boards in a VME crate. Extending the measurements to more boards in a crate will be next. The online software framework is being extended to handle the new system in preparation for commissioning.

Gustavo Cancelo and Eric James, working with Jim Steimel and others, continued to investigate the Echotek board with a goal of producing a "baseline" configuration for the Echotek board, the front-end software and signal processing to produce the required measurements (closed-orbit, turn-by-turn and first turn and pbar) by the time we commission the first crate after the beam returns.

### Resources Used in September 2004:

The total number of FTE-months devoted to the project in calendar September 2004 from the Computing Division was reported to be 8.4 FTE-months with 23 people contributing. The total number of FTE-months devoted to the project from the Accelerator Division was 2.3 FTE-months with 6 people contributing. The total effort from both Divisions was 10.7 FTE-months. The following table gives the estimated or reported effort for both divisions (in FTE-months) since August of 2003.

<u>Month</u>	<u>AD Effort</u>	<u>CD Effort</u>	<u>Total Effort</u>
August, 2003	1.2	2.3	3.5
September, 2003	1.4	4.1	5.5
October, 2003	5.4	6.0	11.4
November, 2003	1.6	5.0	6.6
December, 2003	1.4	4.4	5.8
January, 2004	1.7	5.1	6.8
February, 2004	2.3	6.7	9.0
March, 2004	2.1	7.6	9.7
April, 2004	2.0	7.7	9.4
May, 2004	1.4	8.3	9.7
June, 2004	1.6	8.7	10.3
July, 2004	2.0	8.1	10.1
August, 2004	1.5	8.0	9.5
September, 2004	2.3	8.4	10.7
SUM (through Aug)	27.9	90.4	118.3

The effort is consistent with the wbs estimates of approximately 10-12 FTE per month during this period. The effort listed here is productive time worked and does not include vacation, sick leave, holidays, etc.

**Purchase requisitions/procard obligations in September, 2004:**

Req #/PO/Fermi	PO Date	Item	QTY	Estim. Cost
175326	9/29/04	<i>TGF fabrication</i>		\$32,300.00
PO559276/174413	9/8/04	<i>EMI Sheilds LeaderTech</i>		\$4,128.00
PO559338/174415	9/20/04	<i>Arrow PCB RA, VME Conn</i>		\$3,955.50
PO559337/174415	9/8/04	<i>Casco (Relay, SPDT, RK1..)</i>		\$10,320.00
PO559324/174462	9/28/04	<i>Mini-Circuits (SMT RF Trasform, mini-circuits...)</i>		\$3,064.70
PO559335/174460	9/22/04	<i>Casco- conn Jack</i>		\$6,156.40
PO559336/174459	9/3/04	<i>Arrow PCB RA, VME Conn</i>		\$2,283.00
PO559537/174738		<i>Kaparel-Front Panel Part</i>		\$1,942.50
PRN54356	9/17/04	<i>Digikey</i>		\$1,484.36
PRN54537	9/17/04	<i>Arrow Electronics</i>		\$750.00
175335	10/4/04	<i>Filter card fabrication</i>		\$82,500.00
PO559171	9/10/04	<i>System cables -Casco</i>		\$51,032.00
PO559479	9/8/04	<i>Air Dam module - Elma</i>		\$6,864.00
		<i>Monthly Total</i>		\$148,884.46

**Milestones:**

The project had no milestones in September. However, one of the October milestones was achieved early!

<u>Milestone date</u>	<u>Actual Date</u>	<u>Milestone</u>
October 19, 2004	September 27, 2004	Core electronics 1 <sup>st</sup> production board

## Meetings held, Reports Given:

Meetings were held in September on the following dates:

Project Meetings: September 1,2,8,15,16,22,23,29

## Documents:

The following documents were written and added to the Accelerator Division Document Database in September:

[Beams-doc-1381-v1 Echotek Board and Other Hardware Testing Status Timothy J. Kasza](#) 29 Sep 2004

[Beams-doc-1349-v3 Timing Generator Fanout PRR Vince Pavlicek et. al.](#) 28 Sep 2004

[Beams-doc-1360-v1 BPM Test signal spectrum analysis and batch envelope filter Gustavo Cancelo](#) 23 Sep 2004

[Beams-doc-1359-v1 Echotek Update Eric James](#) 23 Sep 2004

[Beams-doc-1358-v1 TeV BPM Data Registers Michael A. Martens](#) 23 Sep 2004

[Beams-doc-1356-v1 Tevatron BPM Upgrade \(Talk 9/21/04\) Steve Wolbers](#) 22 Sep 2004

[Beams-doc-792-v8 Minutes from the Tevatron BPM Upgrade Project Meetings Steve Wolbers et. al.](#) 20 Sep 2004

[Beams-doc-1351-v1 More on Echotek Board Setup Eric James](#) 18 Sep 2004

[Beams-doc-1335-v6 Tevatron Beam Position Monitor \(BPM\) Upgrade EchoTek ADC Board Test Report Mark J Bowden et. al.](#) 13 Sep 2004

[Beams-doc-1114-v10 Test the Modified EchoTek Board Dehong Zhang et. al.](#) 09 Sep 2004

[Beams-doc-1334-v1 Filtering with the greychip Gustavo Cancelo](#) 03 Sep 2004

## **Subproject Leader Reports:**

### **Technical Coordinator: Jim Steimel**

The month of September saw the near completion of the BPM upgrade shutdown tunnel work, all of the cables for the BPMs have been connected, tested, and documented with the exception of the collision point monitors at D0 and B0. Work will begin for these locations on Oct. 15 after the detector plugs are moved in. Service building preparation work is nearly complete with the exception of decommissioning the main ring BPM electronics in the F3 and F4 service buildings.

Other efforts focused on producing a reliable test stand for specifying the EchoTek configurations for different modes of beam operation. The test stand construction was completed, and the system is currently returning data for closed orbit measurements using an external simulated beam signal. Efforts for October will focus on optimizing the closed orbit algorithm and testing the system with turn-by-turn triggering.

### **Electronics: Vince Pavlicek**

The electronics group supported the close out of the test crate operation in the A3 service building and supported expansion of the testing area in FCC3. Also, simulations of the Echotek signal processing are well defined and are allowing comparisons between existing algorithms and several proposals for the final Echotek algorithm.

Production cables, Echotek modules, analog filter pairs and air dams are arriving in quantity and QC test definitions are completed and test procedures settling out. Upgrade parts for the two pilot sub racks are still pending. Long lead-time items for analog module and timing module are 80% in house.

Timing card and Filter card design testing completed and Production Readiness Reviews are being prepared. Only testing of the TClk decoder remains to be completed but production does not depend on this test. A modest timing and interrupt issue was discovered in the testing and solved by a joint effort of the hardware and software groups. The Filter card is ready to go to production.

The layouts for both cards were updated and prepared for production bid submission. An early version was submitted to one manufacturer in order to scale the production costs and provide starting information for the purchasing process.

### **Front-end/DAQ software: Margaret Votava**

The work performed in the month of September can be divided into: integration and testing of new timing board; profiling and improvement of system performance; EchoTek boards testing; code clean up and improvement; and documentation.

Available new functionality of the timing board was tested, and unit tests are being added. The unit tests should help testing incoming production timing boards. A missing interrupt from the timing board was noticed when profiling the system. Happens at about a 10 - 20% frequency.

The system has been profiled and major tasks report the time taken. During the profile we found a bad behavior of the EchoTek interrupt handler (high execution time), which was improved and now executes more efficiently (less VME access). Found minor problem regarding interrupt vectors, where the EchoTek boards can only generate interrupts with odd interrupt vectors (lowest bit is always 1). DMA and arming operations were improved. Put together a system with six EchoTek cards and achieved the rate of 430Hz (with no delays between boards).

Acceptance test of EchoTek boards have concluded and a detailed report was generated (beams doc #1335-v6). Helped restoring the PREP test stand for testing incoming EchoTek boards.

The source code is now using standardized trace levels for each major task in the system (e.g. readout, timing operations, driver operations, acnet access). Libraries now use same makefile structure (RFIES based) and same compiler version (gcc 2.96). New ACNET devices were created for reading out data, and the turn-by-turn device was tested with the online code (using software generated data). The BPM tasks have now defined priority, according to the specification and design documents. Inherited recycler timing board code was cleaned up and now has only Tevatron type operations.

### **Online software: Brian Hendricks**

During the past month, the BPM configuration database has been extended to support the new frame types and data types required by the Tevatron upgrade. Work was also begun to make use of this new information in the BPMUTI library. Charlie Briegel has been working with the people at Dawn to get an appropriate means for reading crate status information. This work is still ongoing.

### **Offline software: Rob Kutschke**

Little work was done on the project this month due to vacation and other lab commitments. I have worked a little with Gustavo to understand what the Echotek board is actually doing.

### **Hardware tracking/testing: Tim Kasza**

During the month of September, significant effort was made to store, track and test key hardware components. A test stand was assembled and made operationally ready in preparation for acceptance testing of Echotek A/D boards. On September 27<sup>th</sup>, 18 Echotek A/D boards arrived and were entered into the CD equipment-tracking database. Acceptance testing began and proceeded forward using the same diagnostics that were used to test the Recycler boards. Seven of these boards have channel(s) with measured gains slightly below the minimum specification. These boards are on hold pending an analysis of channel gain distribution. Another board displays bad Differential Non-linearity on one channel and its status is also on hold.

Lark filters and various cables began to arrive in large quantities. The Project's electronics group tested the first initial 27 pairs of filters. Going forth, it was decided that filter acceptance testing would proceed by sample testing 10% of the filters. Sample testing just got underway during the last few days of September. To improve analysis of filter testing results, changes were made to the Network Analyzer's filter test templates to include maximum and minimum acceptance specifications. The filters and cables are being stored in a locked 2-door cabinet (SL42, FCC 3<sup>rd</sup> floor). A spreadsheet was created to track filter and cable inventory and sample filter testing activity. All (100) 6 foot N to SMB unlabeled cables arrived in September. Also, (784) 4 inch SMB to SMB slot jumper cables were received.