

August 2004 Report of the Tevatron BPM Upgrade
wbs item 1.4.5.4
Bob Webber, Stephen Wolbers
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Project Manager's Summary:

The Tevatron BPM Upgrade project progressed steadily in August. A prototype VME crate with upgrade hardware and software was installed in the Tevatron in the A3 service building, the system was connected to two BPMs (A34 and A35) and proton and antiproton positions were read out and available both online in the Controls system (ACNET) and offline for further data analysis. This was an important integration milestone for the project.

August was a month for finalizing or coming close to finalizing the hardware specifications and purchases for the project. This includes the Echotek boards, the filter boards, the timing boards and the cables. The first four Echotek boards (production version) arrived on August 20. This was certainly later than the original or updated schedules and will delay somewhat the final fabrication, testing and installation of the boards. Nevertheless the boards did arrive, were tested, and have been found to be acceptable. Therefore, the boards will be released for production of the 150 boards required for the project.

The timing and filter board prototypes and software progressed during August, both for the integration tests and for final design decisions. Requisitions for the long lead-time items were written and submitted in August. Delivery of these parts will pace the final production of the boards and the ability to install finished crates. The requisition for the cables was placed during August. Again there are some long lead-time items.

Given the pace of hardware 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. As parts arrive the final electronics modules will be installed after the end of the shutdown. Commissioning will still begin after the shutdown ends.

The front end and online software both advanced nicely and were instrumental in the big integration success mentioned above. Work continues to develop the production software. This includes the diagnostics programs, where some progress has been made to integrate the Tevatron BPM.

Work in the service buildings continued in earnest as the shutdown began (on August 23) and access to the racks was easier to obtain. In addition, the pbar cables are being connected to the pbar ends of the TeV BPM pickups in the tunnel and terminated on the other end in the service buildings.

Resources Used in August 2004:

The total number of FTE-months devoted to the project in calendar August 2004 from the Computing Division was reported to be 8.0 FTE-months with 20 people contributing. The total number of FTE-months devoted to the project from the Accelerator Division was 1.5 FTE-months with 7 people contributing. The total effort from both Divisions was 9.5 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
SUM	25.6	82.0	107.6

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

Purchase requisitions/procard orders placed in August, 2004:

PO	Date	Item	Est Cost
PRN53601	8/25/04	IC from digikey	\$565.44
PRN53602	8/25/04	IC from Newark	\$267.13
174462	8/26/04	Mini-Circuits	\$3,200.00
PRN53512	8/24/04	MiniCircuits	\$915.00
PRN53489	8/23/04	MAX4820EUP	\$502.00
174413	8/24/04	EMI Sheilds LeaderTech	\$4,128.00
174415	8/24/04	Digi Key	\$18,294.50
PRN53596	8/25/04	Light pipes for FC Lumex 1000	\$1,450.00
174460	8/26/04	Heilind Electronics	\$6,696.00
174459	8/26/04	Arrow Electronics	\$2,685.00
PO559171	8/20/04	System cables	\$74,958.00
TOTAL			\$113,661.07

Milestones:

The project had two DOE milestones in August, one of which was delayed from July.

August 20, 2004	First modified Echotek boards delivered
August 23, 2004	First production quality crate installation begins

The first modified Echotek boards arrive on August 20, 2004. This was a many times delayed milestone that has finally been achieved.

The crate installation is scheduled for the shutdown and beyond. Crate installation, cabling preparation and other related activity continues.

Meetings held, Reports Given:

Meetings were held in August on the following dates:

Project Meetings: August 2, 4, 5, 9, 11, 16, 19, 25, 26

Documents:

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

[Beams-doc-792-v7 Minutes from the Tevatron BPM Upgrade Project Meetings Steve Wolbers et. al. 27 Aug 2004](#)

[Beams-doc-1315-v1 Performance of New Echotek for the Last Two Shots Before the Shutdown Robert K Kutschke 26 Aug 2004](#)

[Beams-doc-1319-v1 Tevatron BPM Upgrade: Cancellation of Proton Signal on Robert K Kutschke 26 Aug 2004](#)

[Beams-doc-1311-v1 Tevatron BPM Upgrade Status Report Robert K Kutschke 20 Aug 2004](#)

[Beams-doc-1310-v1 Tevatron BPM Upgrade: First Online Antiprotons Robert K Kutschke 19 Aug 2004](#)

[Beams-doc-1276-v1 Tevatron BPM Front End Software User's Guide Margaret E Votava et. al. 17 Aug 2004](#)

[Beams-doc-1303-v1 Seeing AntiProtons with the New Echotek Board Robert K Kutschke 13 Aug 2004](#)

[Beams-doc-1301-v1 Outliers in the T:HPPA34 Data Robert K Kutschke 12 Aug 2004](#)

[Beams-doc-1205-v3 Tevatron BPM Upgrade Calibration Specifications: Part II Robert K Kutschke 11 Aug 2004](#)

[Beams-doc-1299-v1 First Look at the Data from the New Echotek Robert K Kutschke 10 Aug 2004](#)

[Beams-doc-1297-v1 Graychip in the EchoTek board Eric James 06 Aug 2004](#)

[Beams-doc-1296-v1 Graychip filters and simulations Gustavo Cancelo 06 Aug 2004](#)

[Beams-doc-1281-v1 Tevatron BPM Upgrade Steve Wolbers 03 Aug 2004](#)

Subproject Leader Reports:

Technical Coordinator: Jim Steimel

Technical coordination for the month of August focused on the commissioning of a first prototype upgrade system in the Tevatron before the shutdown. A system consisting of a new version of the Echotek down-converter, the new MVME processor, a recycler version timing card, a new timing card (for the PLL A/D trigger), and a new filter module was constructed and installed at A3. One horizontal and one vertical BPM were connected to the system and monitored both proton and pbar signals. The frontend software was debugged to the point of allowing closed orbit position sample rates of 20 Hz with acceptable reliability. The communication path to the online application programs was tested and debugged. The system ran for over a week before the shutdown with all data archived for later analysis.

After the shutdown, most of the A3 test components were used to create an extra test stand for specifying the Graychip configurations for different Tevatron BPM operating modes. Also, work in the service buildings was nearly concluded, and connection of the pbar ends of the pickups in the tunnel has begun.

Electronics: Vince Pavlicek

The electronics group supported the test crate installation and operation in the A3 service building by collecting and moving equipment and responding to hardware issues. Also supported was the testing of the four pilot Echotek modules. Production sub racks began arriving in quantity, 26 out of 31 in August. 15 were checked out according to the QC spreadsheet. Upgrade parts for the two pilot sub racks are still pending. Timing card and Filter card testing continued. The eight Timing card AtoD clock outputs were verified. The BSync decoder was debugged and decoded the two event codes that were operating on the link. VME interrupts were debugged and one implemented to be used for SYNC output testing. The SYNC logic was verified and tested to generate variable delay SYNC outputs. The command link to the Filter card was debugged and control of the filter card relays and diagnostic signal was tested. Only an interrupt issue and testing of the TClk decoder remain to be completed before the Timing card can go to production. The Filter card has some testing remaining for the diagnostic signal and then it can go to production. The timing card has a footprint error and needs several traces corrections to the layout before production. The layout is up to date; however, as the changes are being made to the layout as they are discovered. The Filter card also has a footprint error and a trace change but it is also being kept up to date. Long lead-time items for analog module and timing module have been or are in the process of being ordered. The requisition for the production cables was placed, and the final specifications for the cable labels were

collected to be sent to the manufacturer. The Air dam requisition went out to bid and quotes arrived at the end of the month.

Front-end/DAQ software: Margaret Votava

There was a lot of hard work in August and we made significant strides. The first of the month was a big push to get the A3 house up with two bpms before the end of the shutdown. We managed to get closed orbit data running at about 20Hz for a couple of weeks of data and data for the diagnostic pages on the last day. We had difficulty with the new clock generator because we were pushing it into the integration stand (project goal) when it was still premature. All data eventually was taken with the old recycler timing cards. Several small issues were discovered and many kludges made to get the system running, we will be spending September getting those issues resolved before moving onto TxT measurements. The software was currently limited to running at a little less than 100Hz, we are waiting for the new DMA-chaining firmware from Echotek before starting to analyze.

The 4 pilot boards also arrived at the end of August and we worked at incorporating in new driver changes, and running the acceptance tests so they could be released for products.

A very preliminary front end software users guide has been put into the documentation database.

Online software: Brian Hendricks

During the past month, the BPM library support was modified to support the use of the temporary system at A3. The data for those two BPMs was inserted in the data set with those of the rest of the ring. Library support was also added for turn by turn data. The turn by turn diagnostic application was modified to support the development system at FCC. The turn by turn data structures were also modified to properly support raw data and to fit under the ACNET device size limit. The BPM diagnostic application had its data display component completed, and the ability to write the raw BPM data to a file was added.

Offline software: Rob Kutschke

Early in the month I completed document 1205-v2 which describes the initial calibration algorithms which are needed in the new front end code. The daq team has since implemented these algorithms in their code. On August 9 the first data from the new Echotek boards in the A3 house came online. Since then I have spent most of my time looking at data from these boards. This work uncovered a several small problems which were promptly fixed. On every shot for which the new boards were functional, I prepared calibrations for the subtraction of the proton contamination on the anti-proton cables. On August 19 the calibrated anti-proton positions and intensities were made available online. The coefficients in the subtraction algorithm show a significant store to

store variation; this is currently under investigation. This work was documented in documents 1299, 1300, 1301, 1303, 1306, 1310, 1315 and 1319. I also gave a summary presentation to the Tevatron department meeting on August 20. This presentation is available as document 1311.

There are two problems which were discovered and which need to be addressed by other parts of the project. Why are there many more outliers in the online data than in the offline data (Beams-doc-1301)? Why does the board not exhibit the 5-fold stable phase pattern which was present in the Recycler Echotek board (Beams-doc-1306)?

There remains a lot of work on understanding the data acquired in the past few weeks. This will be done during the shutdown.