
Tevatron BPM Upgrade

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DOE Review
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Need for Upgrade

- Beam Position Measurements are important for:
 - Machine operations
 - Maintaining a stable orbit in the Tevatron
 - Injection tune-up (including 1st turn orbits)
 - Commissioning after a shutdown
 - Diagnosing problems
 - Accelerator Physics
 - Lattice measurements
 - TBT coupling measurements
- Need for an upgrade is clear:
 - Existing system is 20 years old with ancient hardware
 - Limited resolution of 0.15 mm (8 bit ADC technology)
 - Understanding orbits is more important in Run II.
 - Increasing beam intensities -> beam-beam effects
 - Double helix with 36 x 36 bunches

Timeline for Upgrade

- BPM accuracy requirements have been determined and reviewed (Internal Review June 4th, 2003)
 - Beams Division Document 554-v1
 - WBS 1.3.4.6.4 Tevatron BPM Upgrade
 - Work completed by April 2004
 - Cost estimate based on Recycler BPM upgrade (\$900k M&S + 60% contingency)
 - Includes major help from the Computing Division
 - Project organization has been formed
 - Project Manager (from Computing Division)
 - BPM Requirements Manager (from Tevatron department)
 - BPM specifications are in development
 - Complete specifications for software, diagnostics, interface to existing applications to be documented
 - Schedule Milestone ⇒ Technical Design reviewed by Oct. '03
 - Fabricated, Installed, Commissioned by April 2004
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BPM Requirements

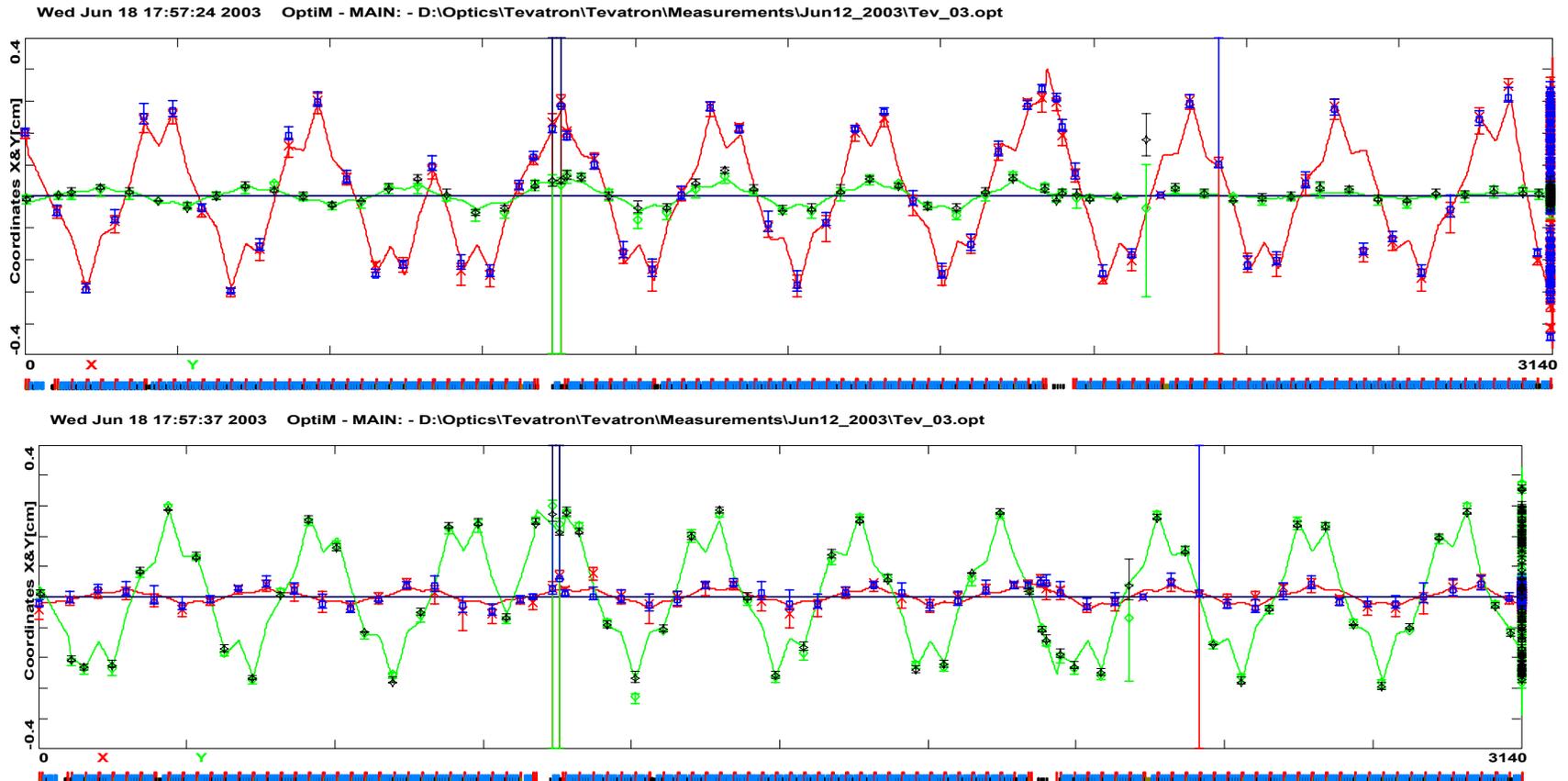
- Requirements meet operational needs.
- Lattice measurement precision improved from $\sim 10\% \Rightarrow \sim 2\%$

- BPM functionality
 - Measure both proton and antiproton orbits
 - FLASH data, (.i.e. 1st turn)
 - Interface with existing controls and applications programs
 - Maintain Beam Loss Monitor (BLM) system
 - Improved reliability
 - Better position resolution
 - Turn-by-turn capability

- BPM Accuracy
 - Best Orbit Position Resolution: 0.02mm
 - Position Linearity: 1.5%
 - Specification Range: $\pm 15\text{mm}$

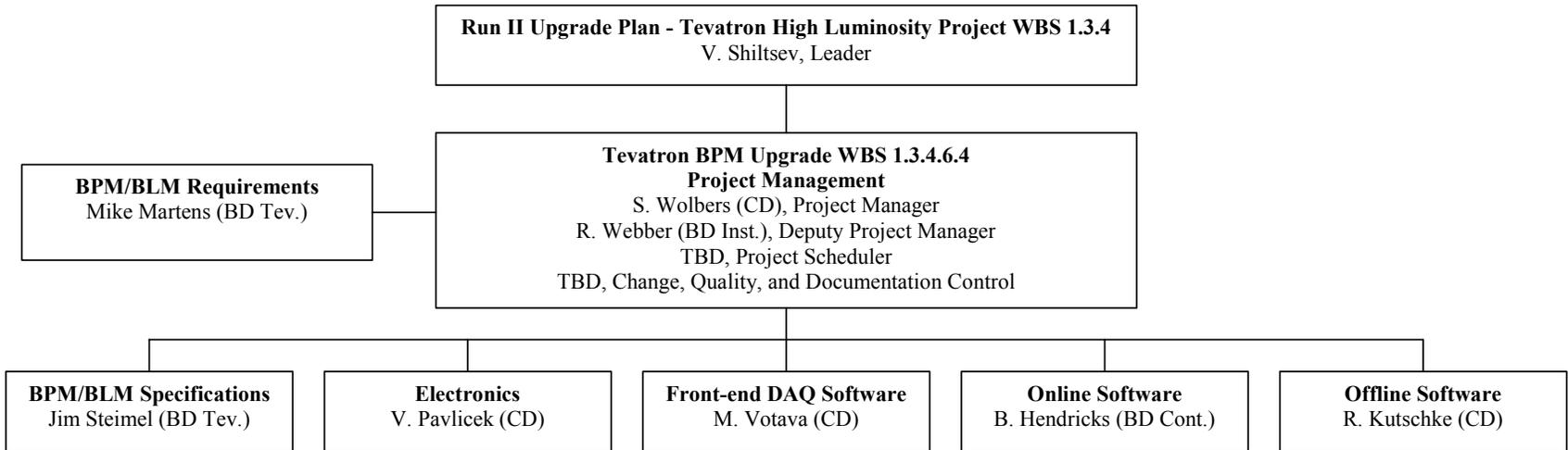
Lattice Measurements

Differential orbits for the Tevatron (V. Lebedev)



Experience with lattice measurements determines BPM precision

Tevatron BPM Upgrade Project Organization



Tev BPM/BLM related applications

Tevatron BPM display

Collects, displays, and archives orbit data.

Tevatron Orbit Program

Uses BPM orbit to calculate corrections for orbit smoothing.

MI \Rightarrow Tev Injection closure

Uses FLASH (1st turn) data to close injection from MI.

Shot Data Acquisition (SDA)

Collects orbits during a shot setup.

Tev BLM display

Collects and displays beam loss readings.

Tev BPM hardware diagnostics

Checks BPM electronics, cables, and power supplies.

Tev BPM test program

Checks that BPMs are responding as expected to 1-bumps.

Tev BPM Conclusions

- Beam Position Measurements are important.
- Run II upgrade plan includes Tev BPMs.
- BPM Requirement documentation has begun.
- Project organization with CD & BD exists.
- Technical design milestone of October 2003.
- Completed system by April 2004.