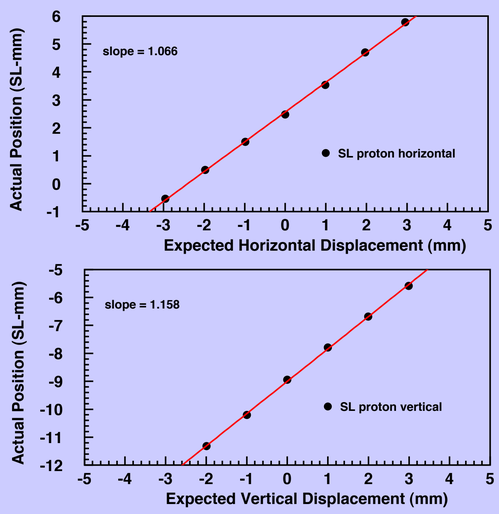
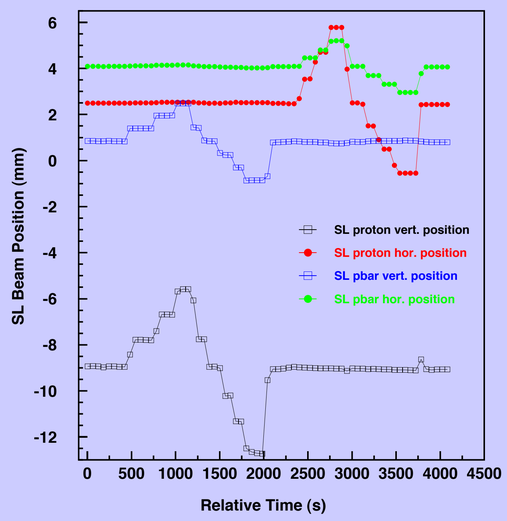
Performance of the Synchrotron Light Beam Monitor

Calibration of the Synclite Scale, Rotation and Resolution

Calibration of the Synclite system is important to getting accurate measures of the beam emittance. The distance scale, optical resolution and any rotation in the system must be known. The scale and optical resolution can be calculated and measured on the bench. The distance scale and any rotation of the system has also been measured in-situ by producing a closed-orbit 3-bump. The beam is bumped vertically or horizontally by a calculated amount and the motion of the beam measured in Synclite.

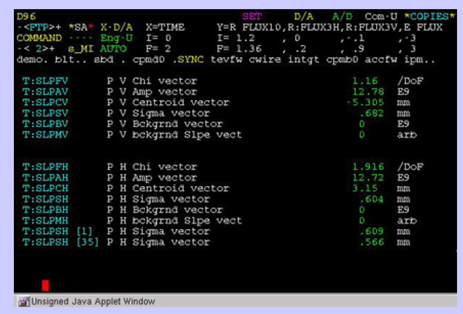




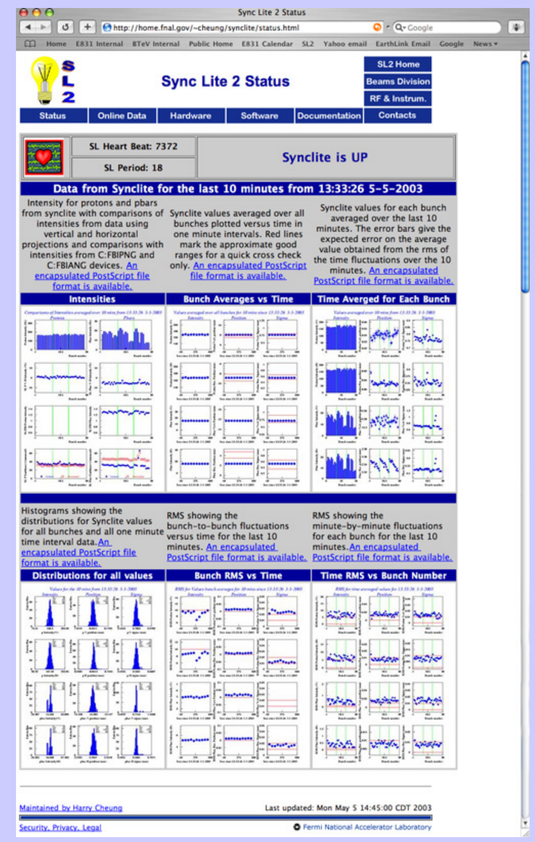
Results show that the scale obtained with beam bump study agreed with the expected scale by ~ 10%, which is the expected uncertainty in the lattice functions.

The Importance of Monitoring of the Instrumentation

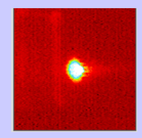
Monitoring of the status and results of the Synclite system is an important part of any beam instrumentation. Remote real-time access to the status and data is provided via Acnet with a text interface. The data is also logged to a circular data buffer every minute. The logged data can be accessed offline via a java class.



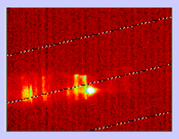
The status and results from Synclite are also accessible via a WEB page. Data from the past 10 minutes are fetched from the data logger and plotted. The status as well as time dependence of the measurements and calibrations can be studied online.



The optical resolution of the Synclite system was measured by scraping the beam with a collimator and studying the beam image size as a function of intensity. It was also studied by comparing the beam size as seen by Synclite to that measured in the Flying-Wire system.
The performance of the proton Synclite system is as expected. Although the antiproton Synclite system is giving useful measurements, it has an unexpectedly large resolution and an inconsistent distance scale.
We may be seeing a relected image from a dipole edge further away and are trying to resolve this issue.

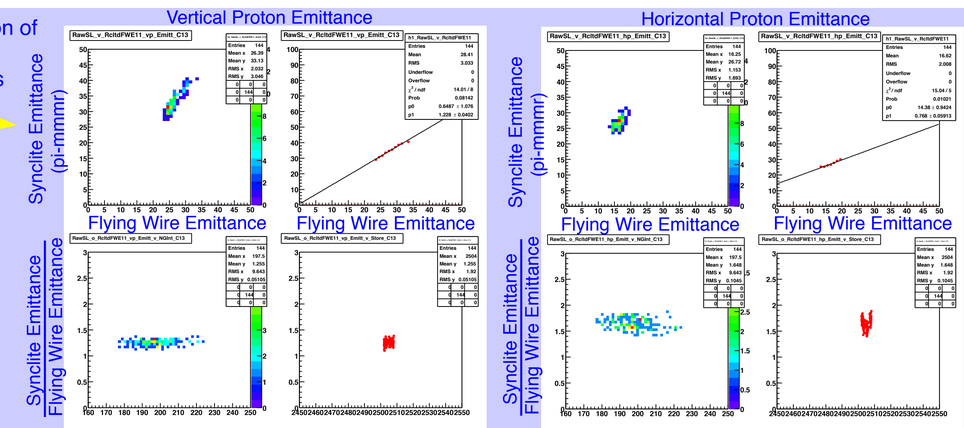


Pbar Image at normal MCP gain



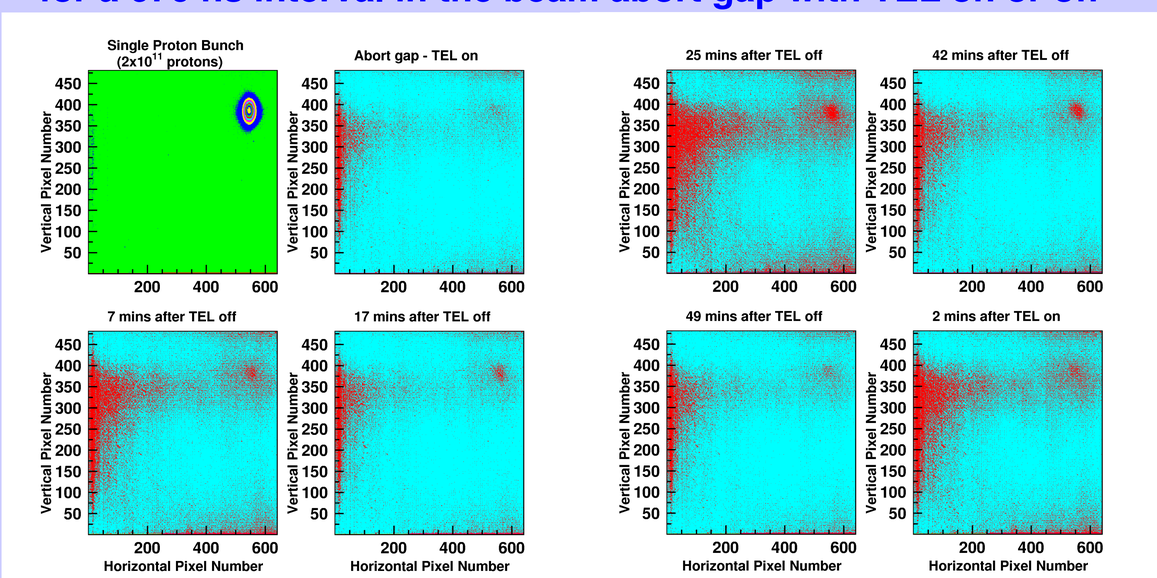
Pbar Image at high MCP gain showing reflections

Comparison of Proton Emittances



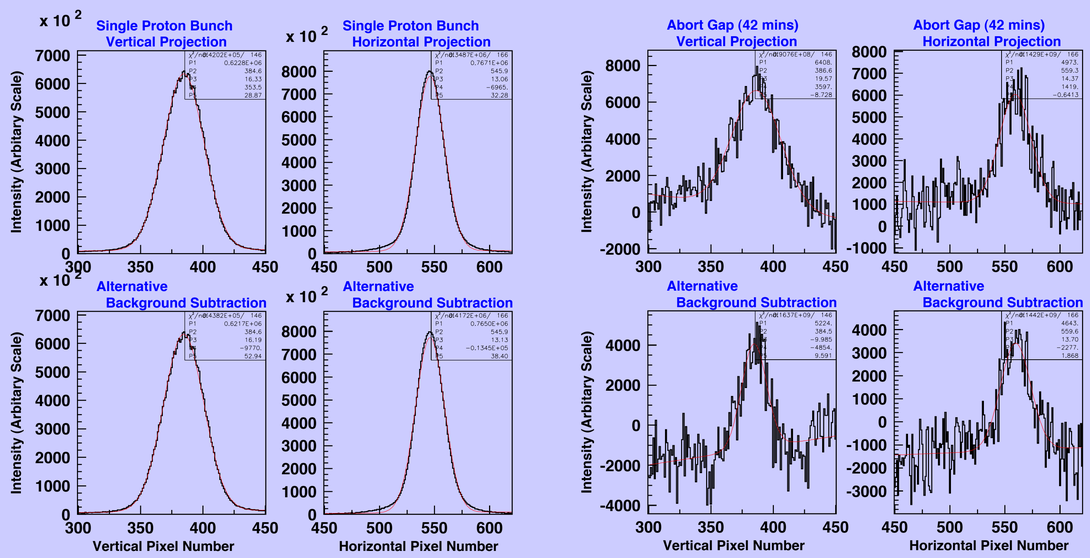
Measurement of DC Beam in the Tevatron

Images from the CID camera for a normal proton bunch and for a 670 ns interval in the beam abort gap with TEL on or off



With the TEL off we observed about 6×10^7 protons within the 670 ns window. This is less than 1/1000th of the intensity of a single proton bunch. Assuming a uniform DC beam in the Tevatron, this translates to about 2×10^9 protons in total, which is about 0.03% of the total number of protons in the 36 bunches.

Vertical and horizontal projections of the background subtracted data with fits using two different (subtraction) background images



The transverse sigmas of the beam in the abort gap have large uncertainties due to poor S/N. The central location of the DC beam is found to be at the same vertical location as the normal bunches while the horizontal location is 1mm closer to the Tevatron center. We are working on increasing the gain and Signal-to-Noise.

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