

Beams Instrumentation for Run IIa

- Mandate of Instrumentation Department
- Organization and Resources
- Status, Projects, Schedule
- Remarks



Mandate:

- Hardware for generic Instrumentation for Beams Diagnostics
- (Generic = common devices used throughout the complex)
- Software provided by Controls Department

- Special devices (unique/few) on request of specific Machines
- Software provided by Instrumentation Department

- (Dampers are handled internally by the machine departments)



Organization and Resources

- New Department
 - split from RF&I Department October 1 2002
- New Instrumentation Department Head
 - Bob Webber as of November 1 2002
 - 25 people total:
 - 8 Electrical Engineers
 - 3 Engineering Associates
 - 4 Computing Professionals
 - 7 Technicians
 - 3 Physicists
- In present Run II situation, receiving essential support from Computing Division, Particle Physics Division and Technical Division.



Status

- **Generic Devices**

- 3 DC Beam Intensity Monitors
- ~20 AC Intensity Monitors (transfer lines)
- ~60 Multi-Wire Profilers (transfer lines)
- ~1000 Beam Loss Monitors (BLM)
- ~1350 Beam Position Monitors (BPM) (various types)

- **Special Devices**

- 3 Flying Wire systems (pbar, MI, Tevatron)
(bunch by bunch transverse profiles and Δp in Tev)
- 1 Synchrotron Light Monitor system (Tevatron)
(2 D bunch by bunch transverse profiles)
- 2 Sampled Bunch Display (SBD) (MI and TeV)
(bunch by bunch time profiles and intensities)
- 6 Beam Line Tuners (BLT) (RR, MI, TeV)
(measure injection errors by turn-by-turn positions)
- 4 Schottky tune Monitors (TeV)
- 5 Ionization Profile Monitors (Booster, RR, MI)



Present Run IIa 'Major' Projects

- pbar source
 - Flying wire system upgrade
- Main Injector
 - Beam Line Tuner
 - 2.5 MHz BPM's ?
- Tevatron
 - Beam Line Tuner (1000's of turns)
- BPM system studies
 - 1.7 GHz Schottky Detector *(RF Dept.)*
- Recycler
 - BPM system upgrade
 - Flying Wire system
 - 1.7 GHz Schottky Detector *(RF Dept.)*
 - (details in break-out sessions)



Ongoing Projects

- Transfer Lines

- New BPM readout for A1 and P1 (MI to TeV)
 - Dual pitch (0.5 & 1 mm SEM grids) A1 line
 - 0.5 mm SEM grids in P1 line
-
- Data Acquisition Upgrades to:
 - Synchrotron Light, Sample Bunch Display, Flying Wires
 - *(for higher data rate - obsolete computer and hardware interface systems)*

 - New PMT system for Flying Wires
 - *(switchable light attenuators, new PMT's, improved E-M shielding)*

 - Ionization Profile Monitors
 - *(attractive device - studies to characterize and techniques to calibrate)*



`Major' Projects Status

- Aim for installation during `January' shutdown
 - Schottky's OK
 - Beam Line Tuners OK
 - BPM systems Technically OK - budget issue
 - Flying Wire Systems Challenging - tunnel equipment will be in place.
- Ongoing Projects Status
 - Transfer Lines OK
 - Flying Wires' PMT's OK
 - Data Acquisition will be done by end of March
Upgrades 2003.
 - Ionization Profile Monitors R & D project.. ??



Dampers Projects Slide

- Booster - Longitudinal Dampers (*Proton Source dept*)

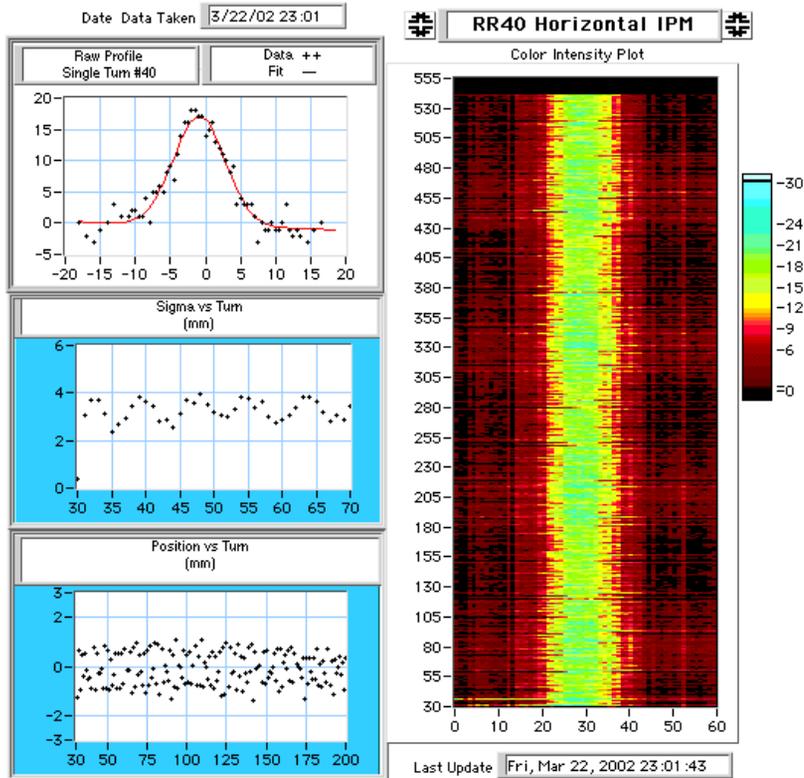
- Tevatron -Longitudinal-done; (*Tevatron dept.*)
- Horizontal and Vertical being commissioned
- Injection dampers in process

- Recycler and Longitudinal, injection (*Main Injector dept*)
- Main Injector and transverse dampers

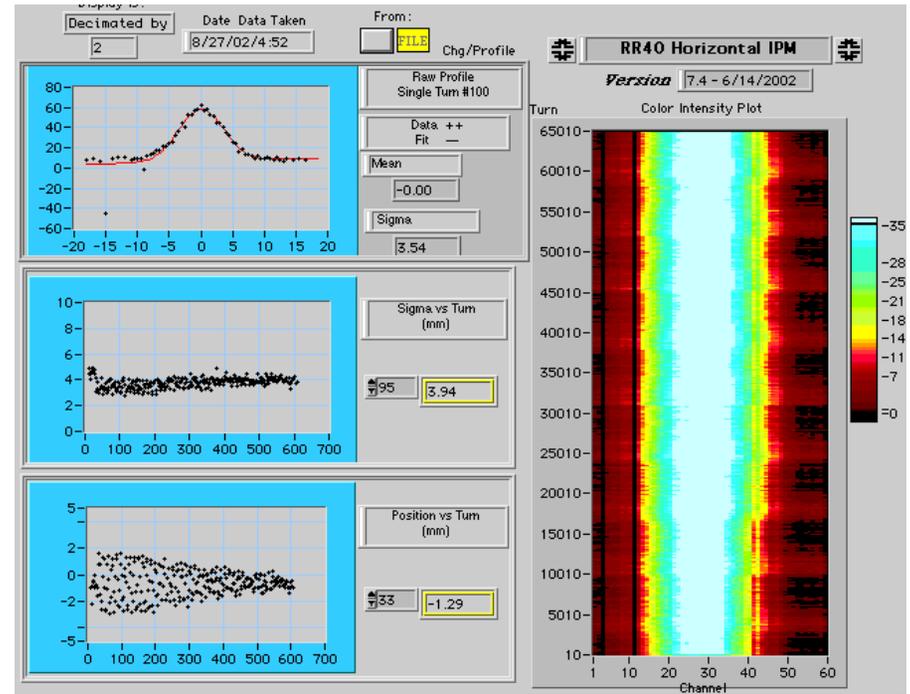
- (details in Proton and Tevatron sessions)



Ionization Profile Monitor in Recycler

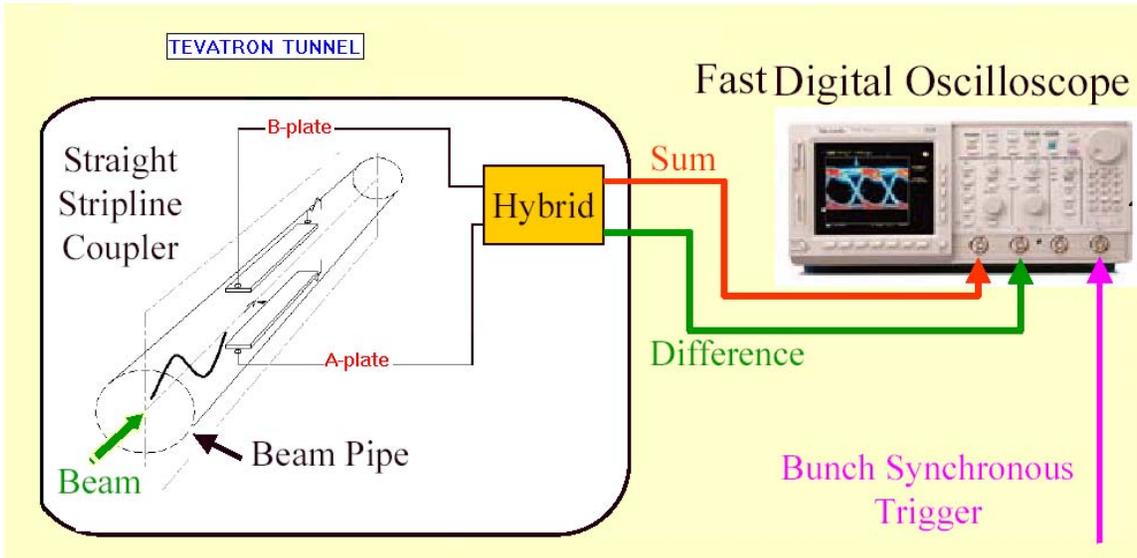


100's of turns



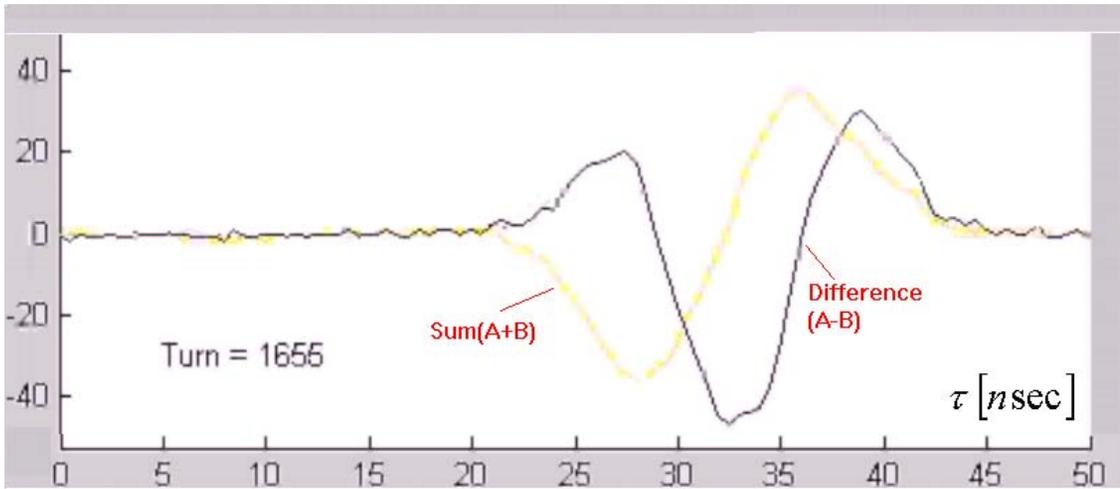
1000's of turns





2 Gs/s, 8 bits

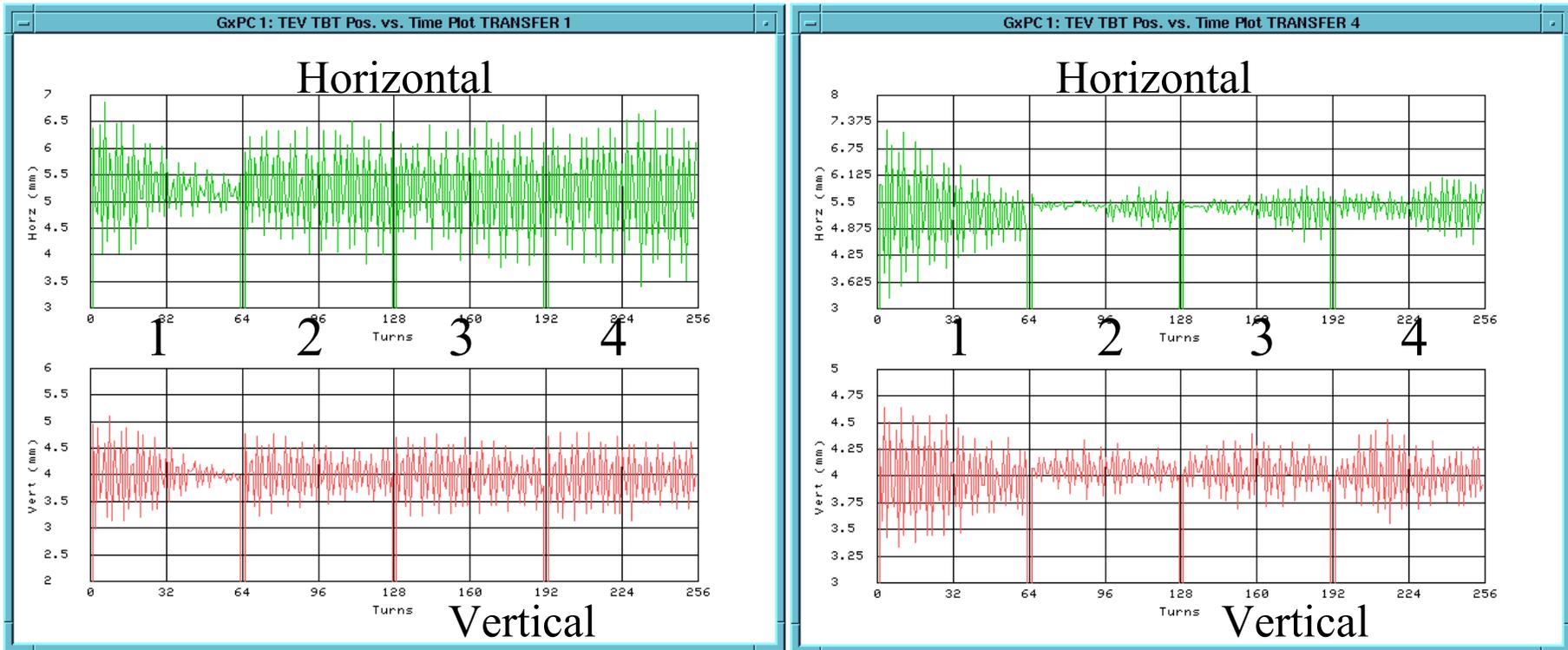
$$y = \frac{A - B}{A + B}$$



Yellow = A + B

Black = A - B

BLT in operation



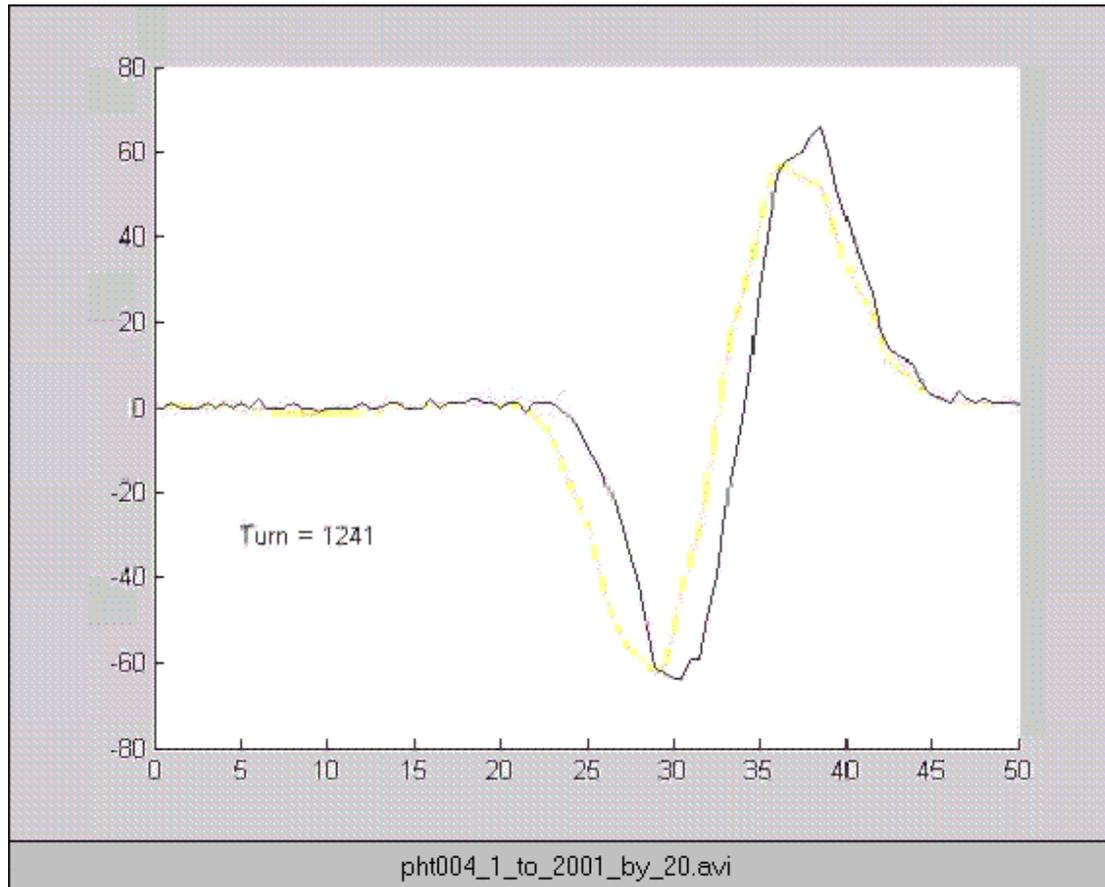
1st Injection

4th Injection



Stripline Signals in Tevatron (courtesy V. Scarpine)

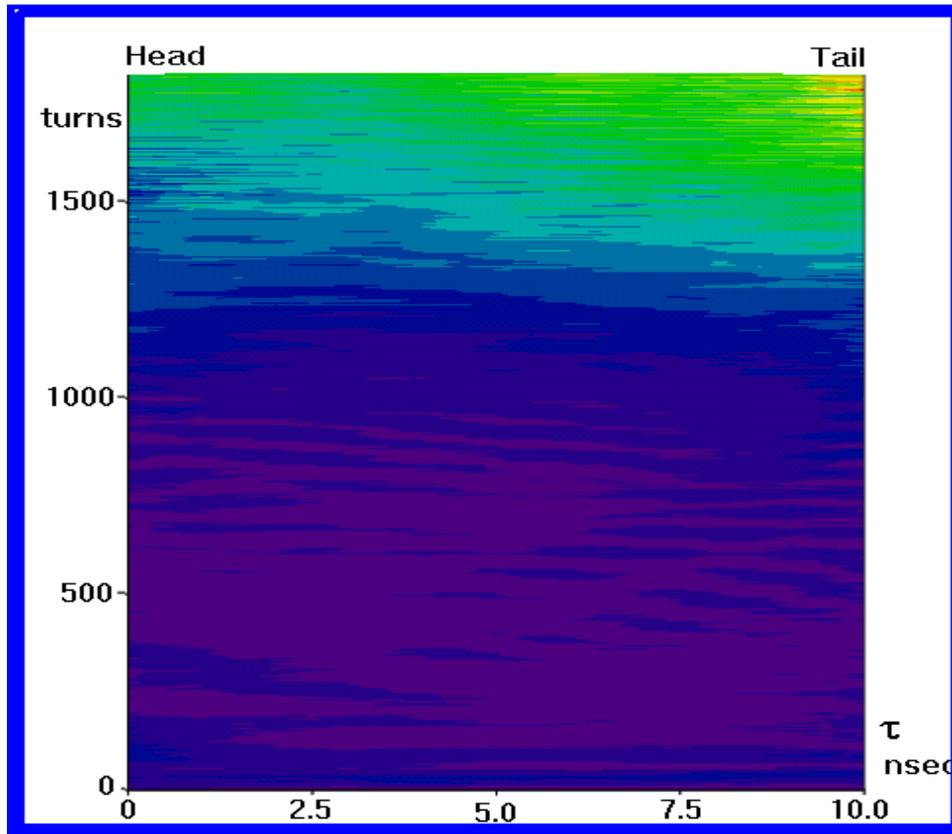
1 bunch - 2000 turns – every 20th turn



(A-B) position
(A+B) intensity

bipolar because
we see the
reflection

also gives Head tail oscillations, $\xi_v = -3$
(courtesy P. Ivanov)



green = large osc.

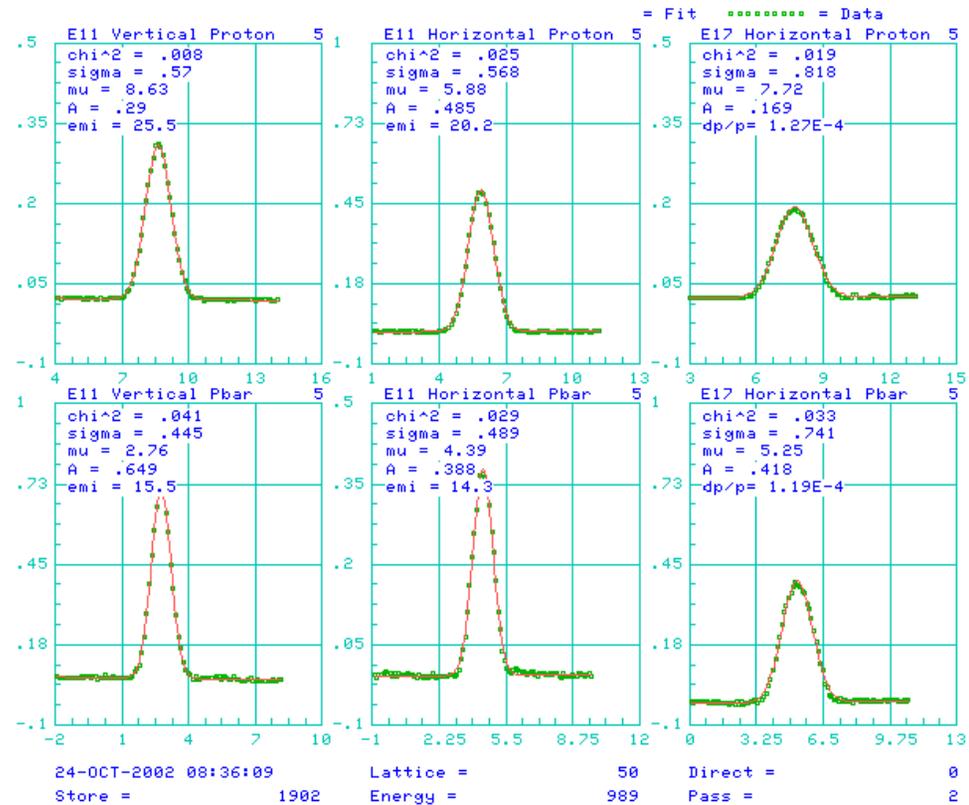
black = small osc.

Flying Wires in Tevatron (bunch by bunch, p & pbar together)

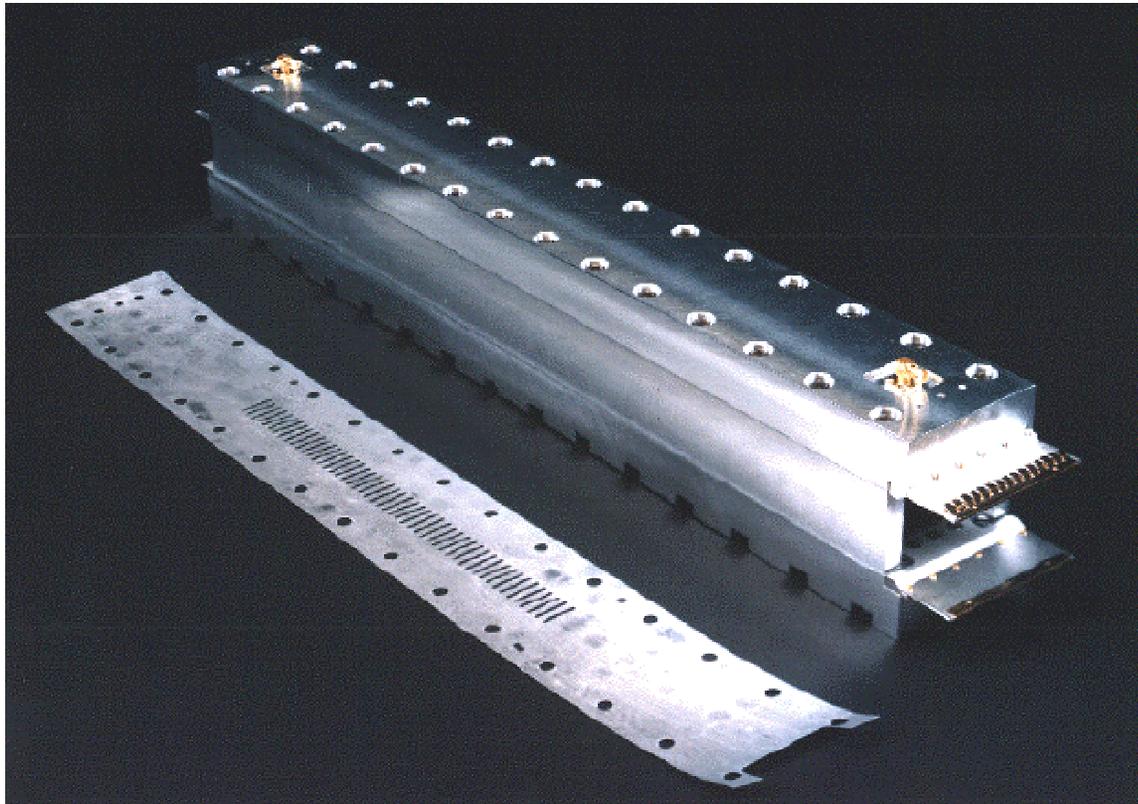
Vertical Horizontal Horizontal
(E11) (E11) (E17)

protons

pbars



1.75 GHz Schottky for Recycler/Tevatron



Remarks

- New Department and Department Head starts November 1.
- Have mobilized significant help from other Divisions in the laboratory - engineering, software, commissioning and analysis.
- Have received significant and effective help from SLAC in development of DDC based BPM's and BLT's
- Tevatron is good test bed for LHC and should encourage collaboration on instrumentation with CERN.



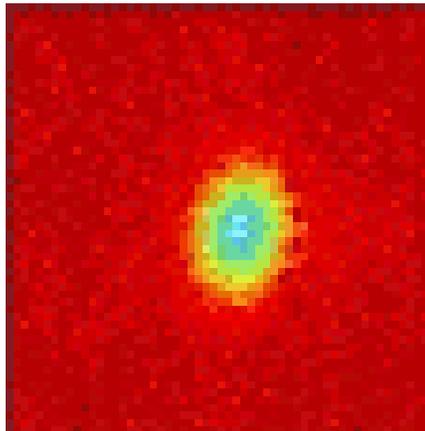
Remarks

- Department has its hands very full with operations and existing projects. It is difficult to find time for R&D or adoption of new techniques (eg Optical Transition Radiation devices to replace SEM grids).
- Existing devices are a rich source of data. Calibration is a weak point - convincing the machine physicist that the data are valid - particularly when they are not what's expected. This is being remedied by developing software to cross-correlate devices (thankyou SDA) and building-in calibration systems, recognizing this means both the hardware and the software.

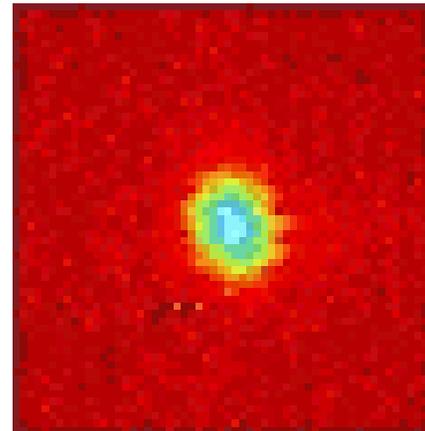


pbar bunches as seen by synch light

righties (most)



lefties (12, 24 & 36)



August 16th