On SBD and DCCT data, Tevatron and Main Injector

Paul Lebrun

Fermilab

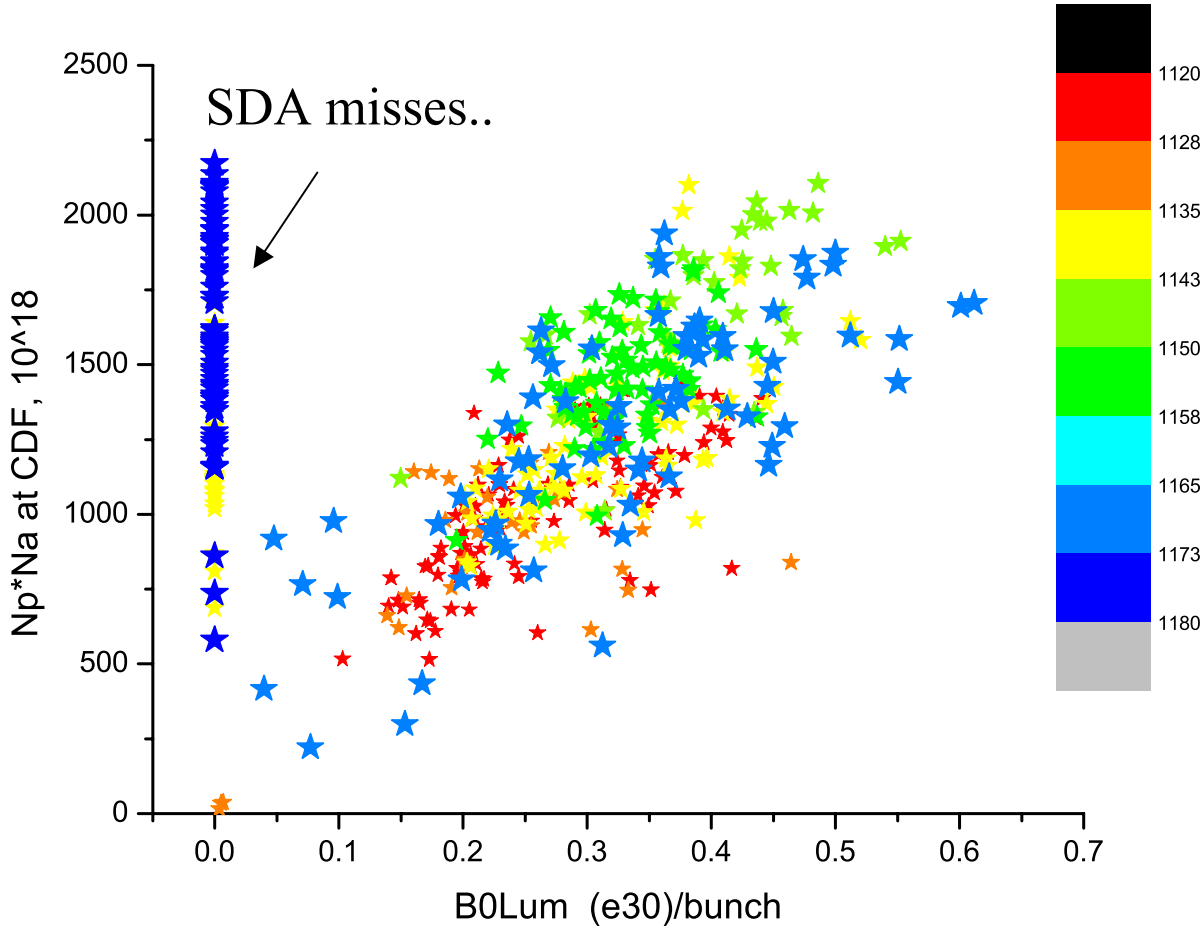
April 25 2002

Outline

- Errata on correlation between Luminosity (B0Lum) and the bunch intensities.. (numbering mistake..)
- Longitudinal dynamics MI -> Tevatron.
  - DC beam : how do we measure it, cross calibration between the DCCT and SBD.
  - Tevatron Satellite Bunch Intensities
  - SBD fits, MI vs Tevatron
- Caveats: Recent data, with “incomplete sets”

Old (2 weeks ago) Plot: Is the Np*Na product correlated with B0Lum counter?

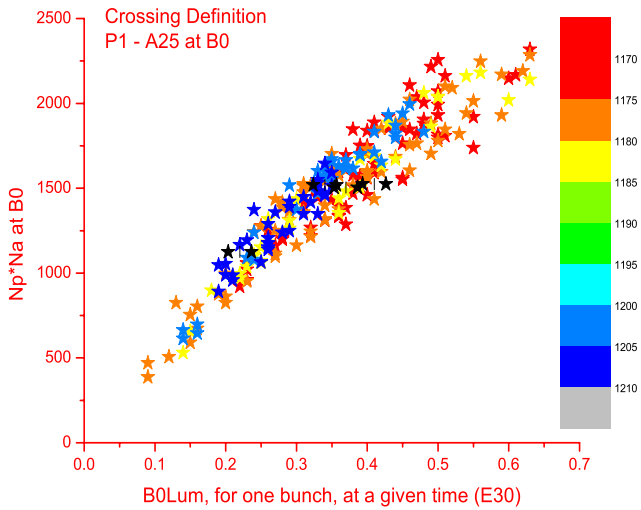
14 stores, 504 bunch int. products.

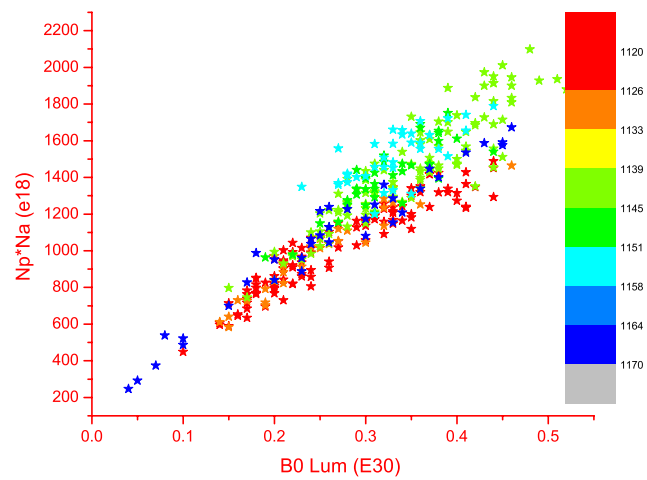


Yes, With Large Fluctuations ~ 10 % ! Emittance Fluctuations!

Corrected Plot : after proper re-numbering

*B0 Np*Na and Luminosity, bunch by bunch…*



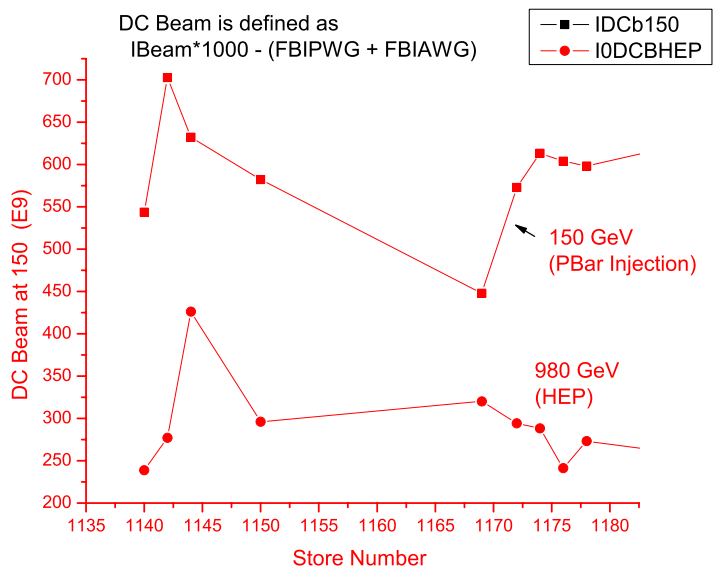


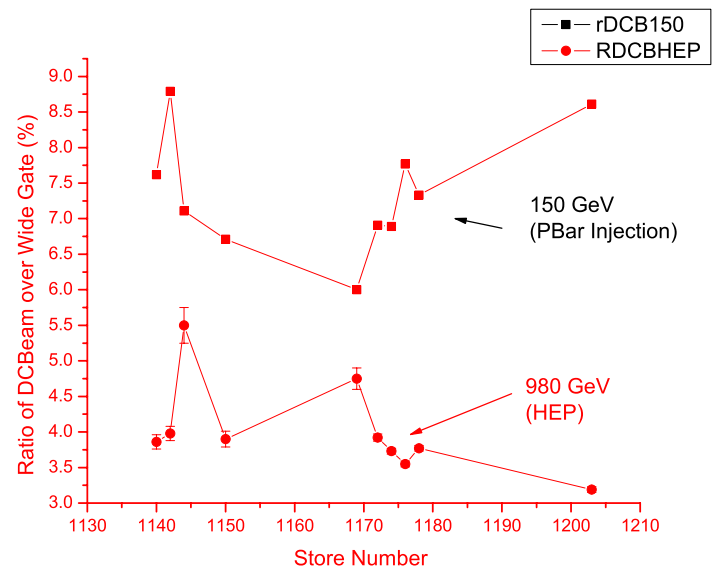
The "cyclic" cancellation of Luminosity difference CDF/D0, summed over all bunches, remains correct

Remaining fluctuations in the above plots are most likely due to bunch to bunch emittance fluctuations. To be studied! (The Tev Flying wire are now reporting correct emittances… S. Pordes, private comm.)

Similar data will be soon available from D0 (Currently, we only have the total Lum.)

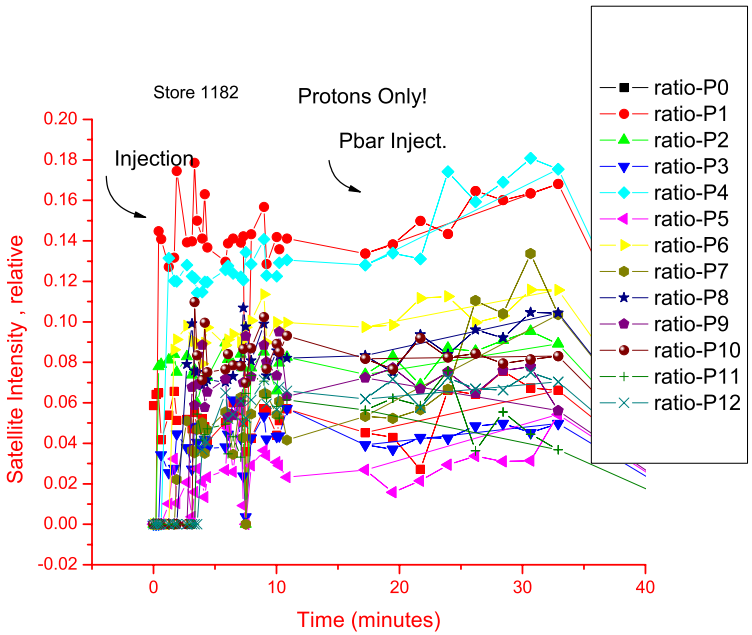
DCBeam in Tevatron, DCCT vs FBI

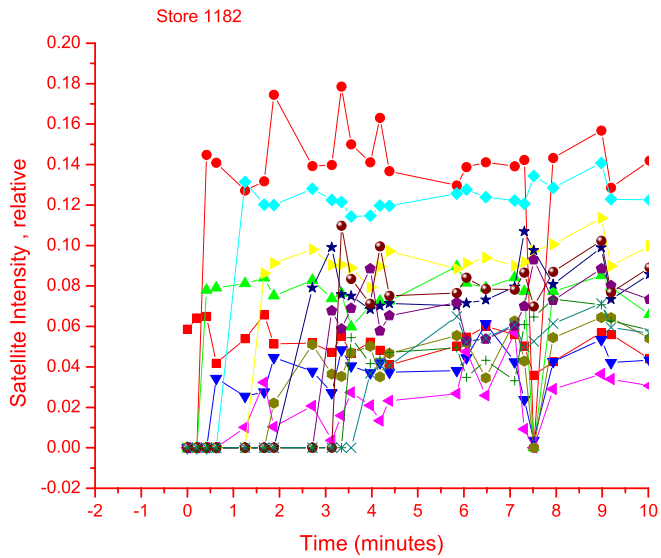




Is the Fast Integrator properly calibrated?
At flattop, there should be little DC beam left..
In any event, there seems to be significant DC Beam at 150 GeV .

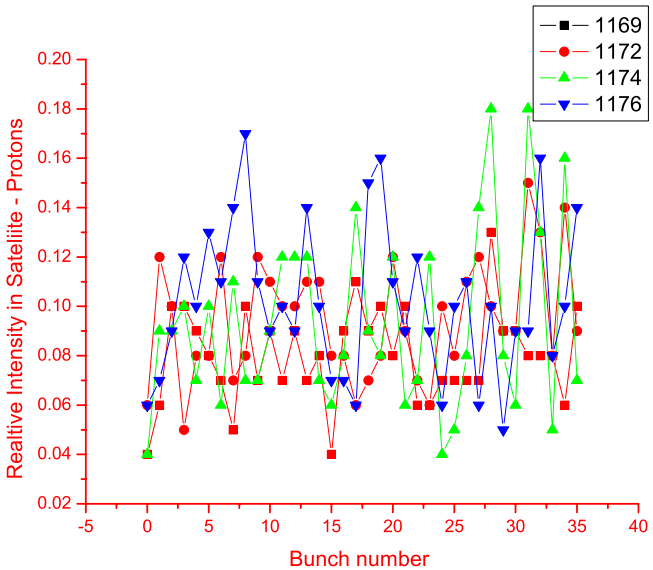
Relative Intensities in Satellite Bunches (TeV)

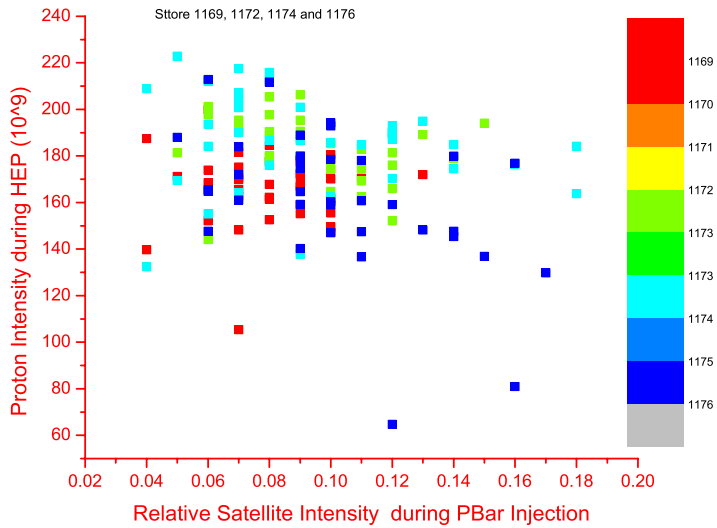




Relative Satellite Intensity = (FBIPWG – FBIPNG)/FBIPNG

Relative Tev Satellite Bunch Intensities.. II

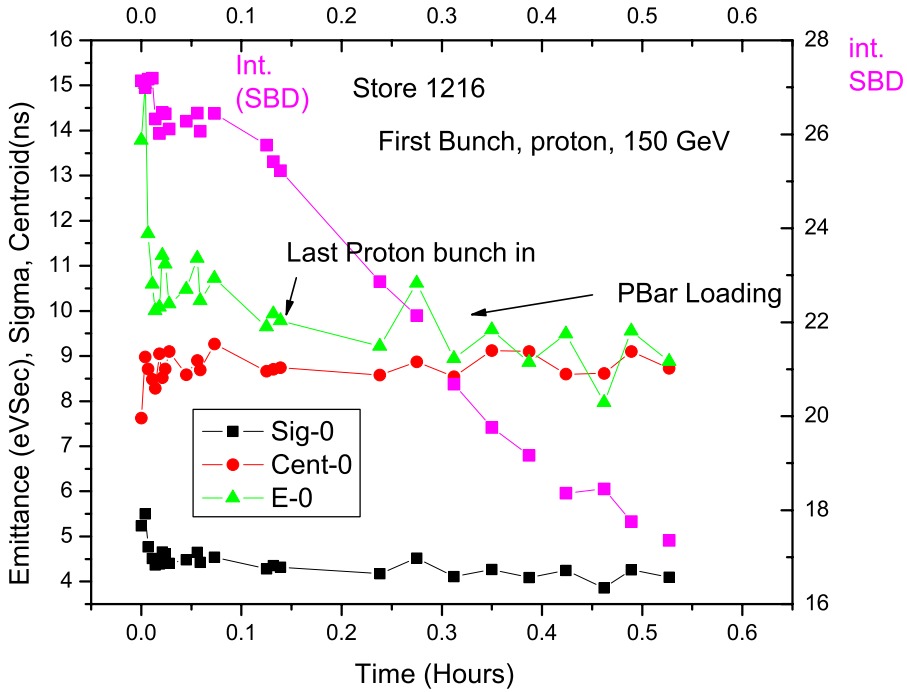




Large fluctuation, bunch to bunch.. No discernable pattern!
No obvious correlation between bunch intensity and relative satellite bunch intensity…

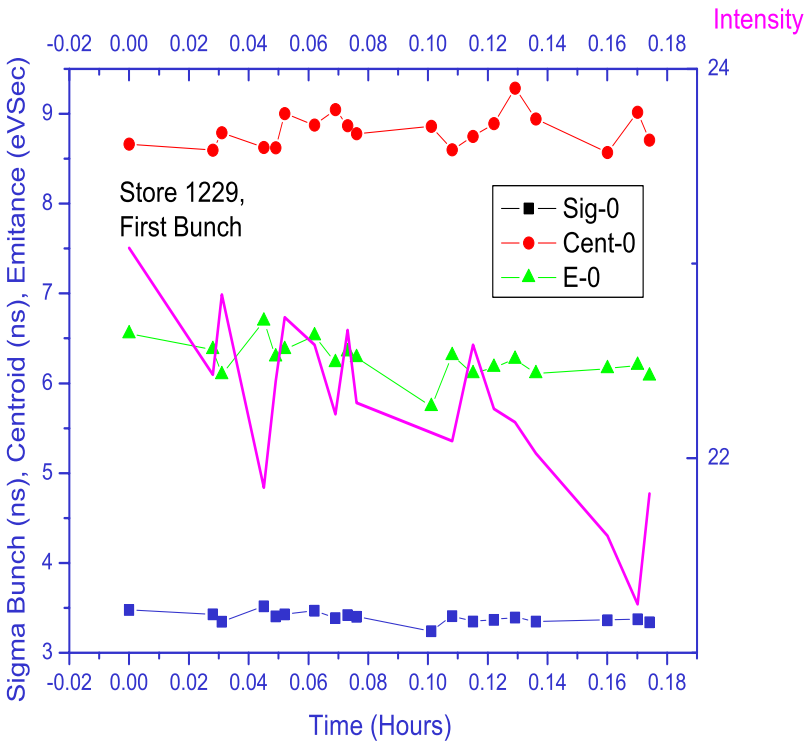
SBD Data, revisited, re-formatted, in SDA..

Thanks to Dave Capista, Jerry Annala !!.



While we can discuss Emittances calculation, There little doubt that The sigma of the bunch Is indeed larger than Expected, as we cross-checked one recent Measurement with the Raw data from front end. (on store 1240, April 24)

SBD synopsis at injection, Store 1229, 1st bunch

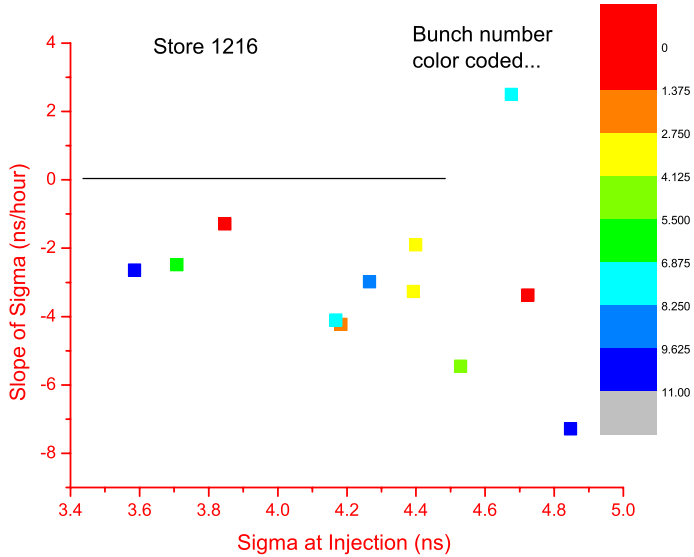


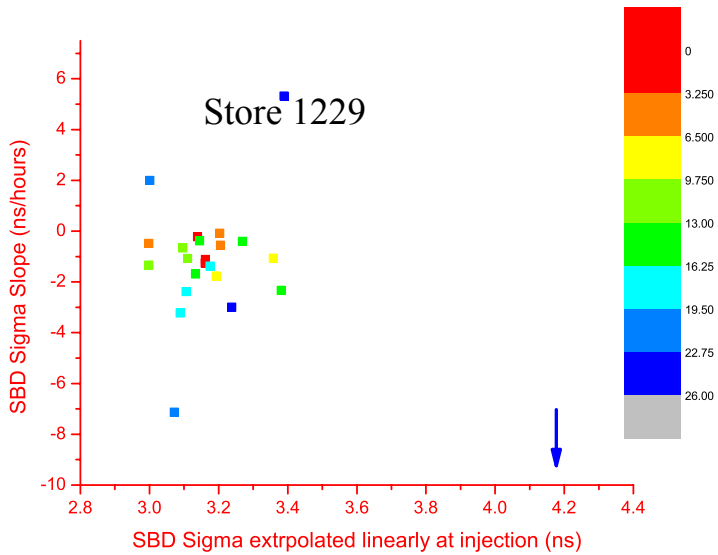
Coalescing or MI->TeV Store 1229 was a lot cleaner than store 1216!

Note also the fast decrease of bunch intensity at the beginning of the store is milder in this store compare to the previous one (~10 % vs 40%)

This sigma/emittance is still considered too large !

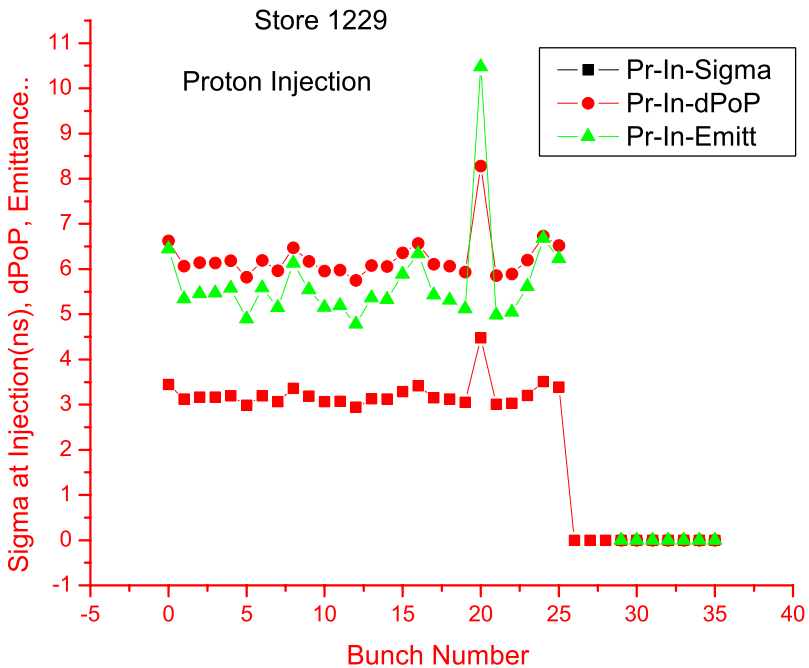
Bunch Length vs time, 150 Gev





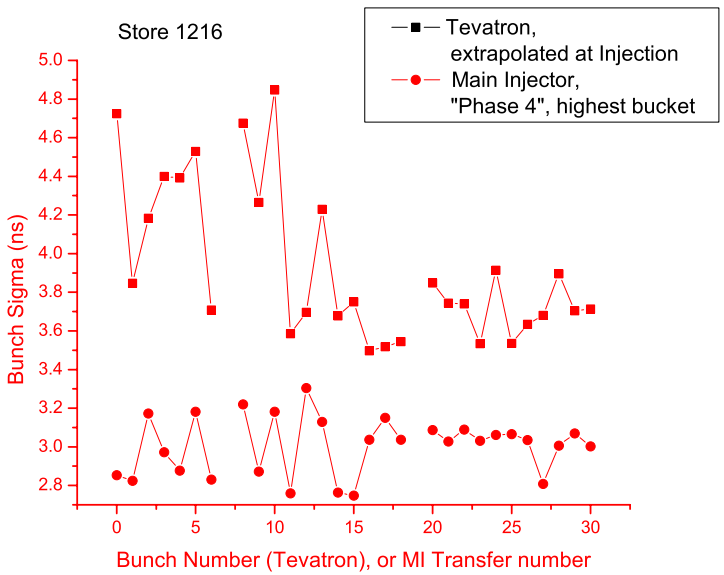
The bunch length decreases vs time, as anticipated if we scrape the beam.. (large dP/P -> large orbits displacement -> scraping! In addition, the slope of the bunch length seems to be correlated with the starting value of this bunch length To reproduced when SDA gives us more data point…

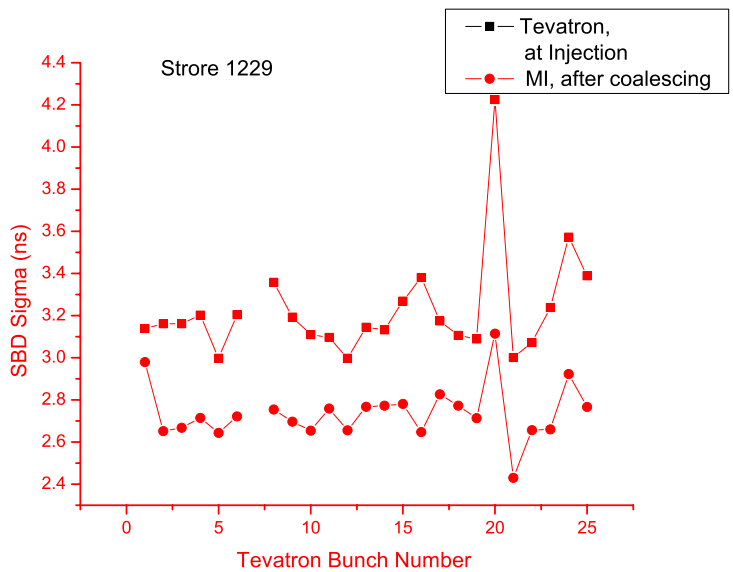
Bunch length at Injection, store 1229



Although store 1229 was pretty clean, we have a re-occurrence of a sloppy coalescing or transfer (bunch number 20 is "odd").

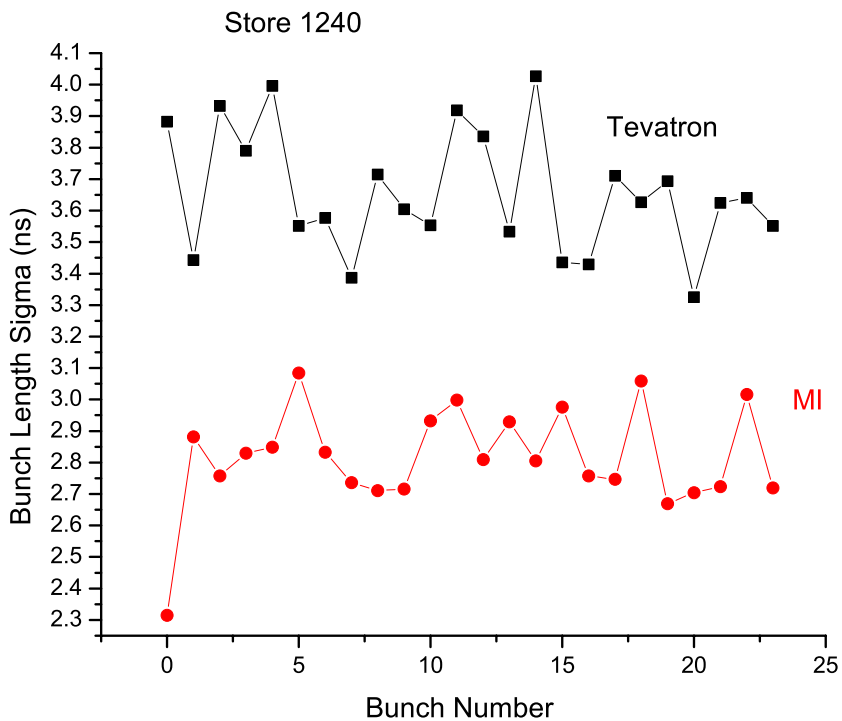
MI Coalescing or Transfer, or Injection problem?





The two curves are not displaced for graphical clarity → MI bunch length are systematically lower then Tev!
They are correlated when "sloppy shots" occurs.

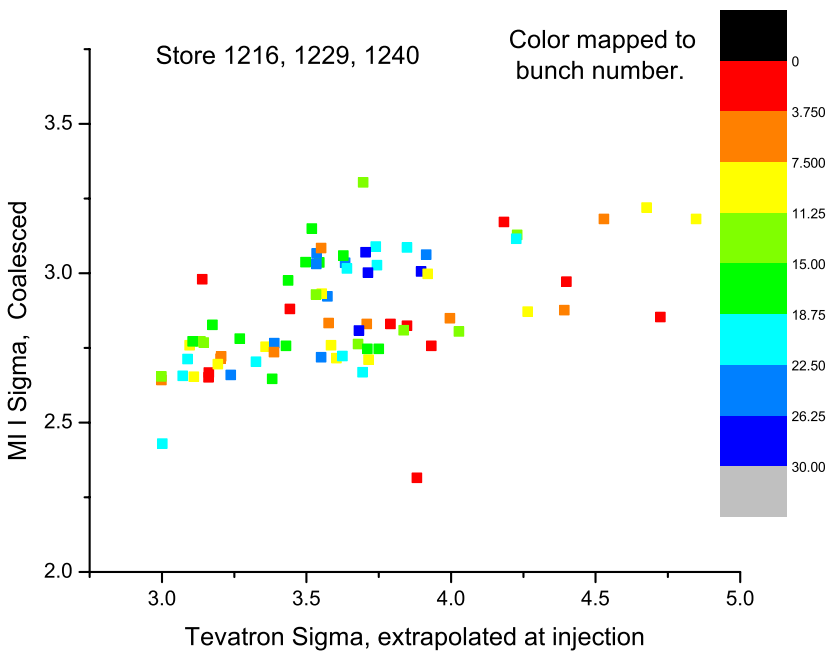
Bunch Length Sigmas: MI vs Tev, Store 1240



The systematic difference persists..
Note however that the first bunch seems to have coalesced well, but it's TeV length is not particularly smaller..

What are the errors on the these numbers?

Bunch Length Sigmas: MI vs Tev, Correlation ?



The correlation between MI Coalesced bunch length and Tevatron bunch length is weak, at best.

Outlook

- Evidently, work in progress..
- Instrumentation versus Beam physics, vs Machine problems.. We'll sort it out..
- More data is available!
  - MI Coalescing efficiency: there is significant intensity in other bunches, for T:SBD04I !
  - Bunch length prior to coalescing..
  - Correlation with Intensity ?
  - Antiprotons ?