



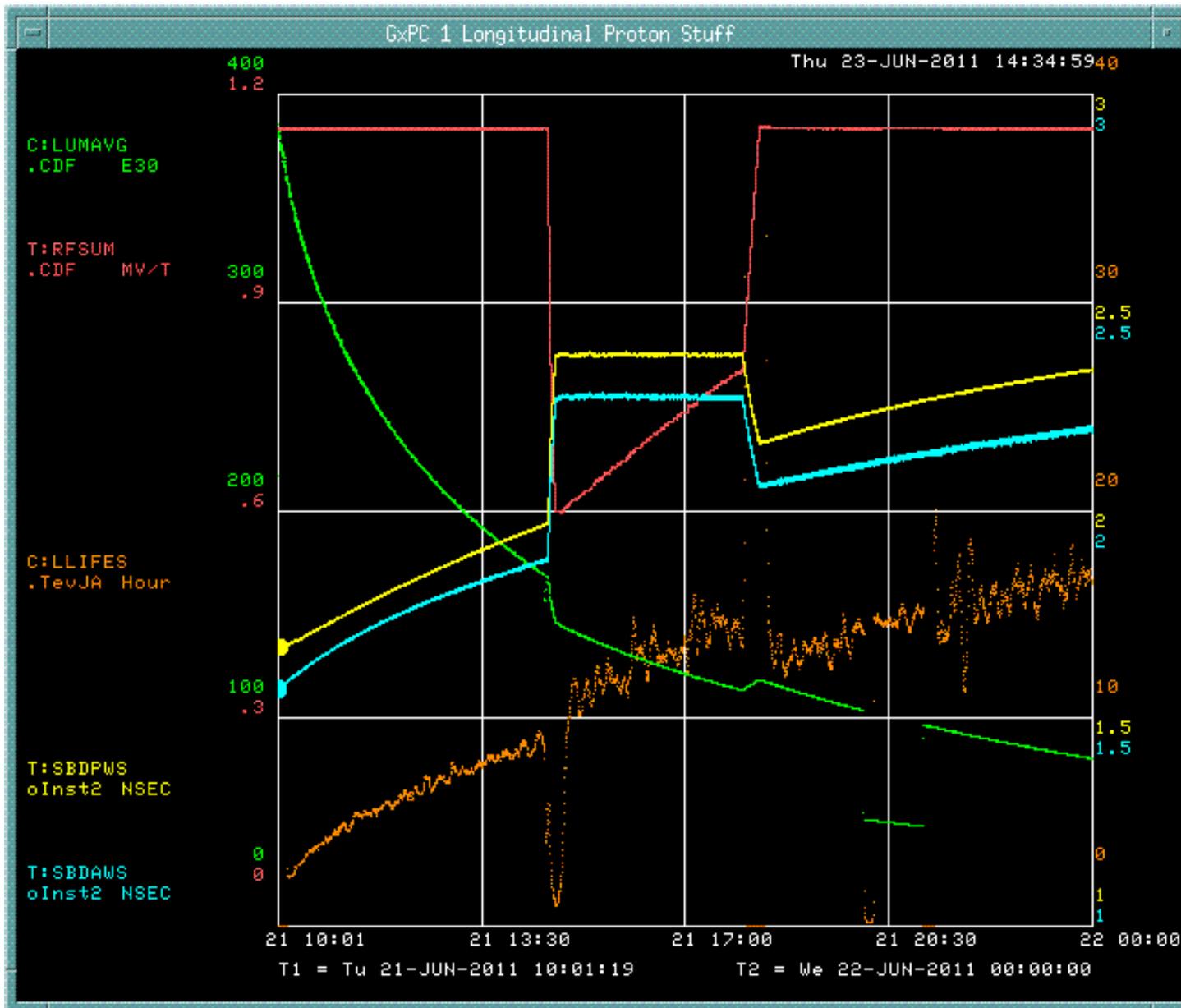
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# Test of Lumi-Leveling via Bunch Length

## Middle of Store 8829



# Executive Summary



RF reduced 50%

Lumi dropped 13%

Gradually raised RF over several hours to keep bunch length constant

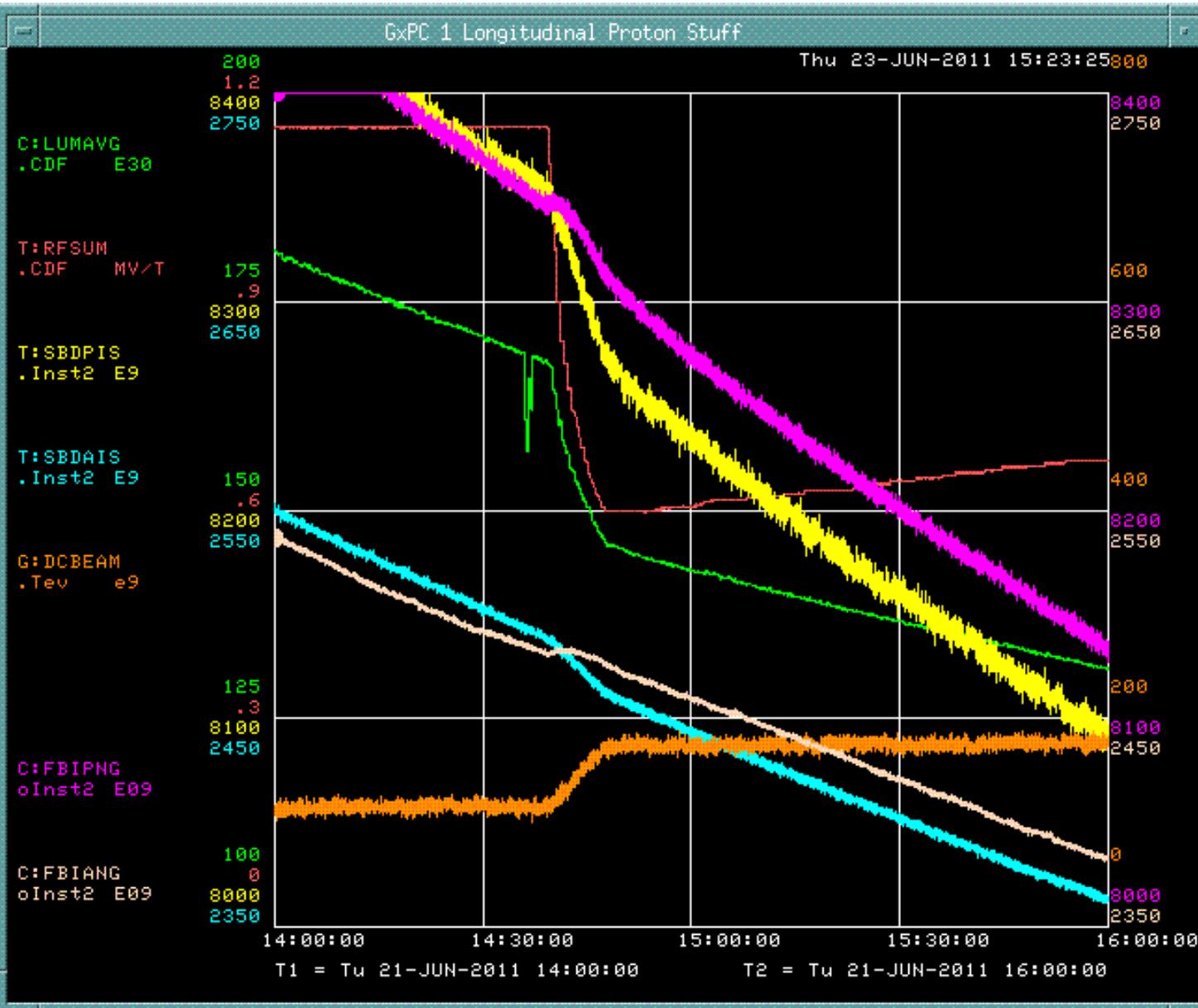
Asked CDF & D0 to turn off HV when ramping down RF and evaluating conditions (~30 min total)

CDF & D0 took data during the gradual RF increase and quicker ramp up at end of study

Lumi lifetime higher at same lumi



# Beam Intensities



- SBD & FBI on same scale
- behave a little differently
- < ~1.5% beam loss each
- DCBEAM increased ~80E9



# Luminosity Drop



From my notes in eLog:

Starting conditions...

From data logger: C:LUMAVG = 167.6  $\text{ub}^{-1}/\text{s}$ , T:SBDPWS = 1.97 ns, T:SBDAWS = 1.88 ns.  
Hourglass factor assuming 30 cm  $\beta^*$  = 0.558

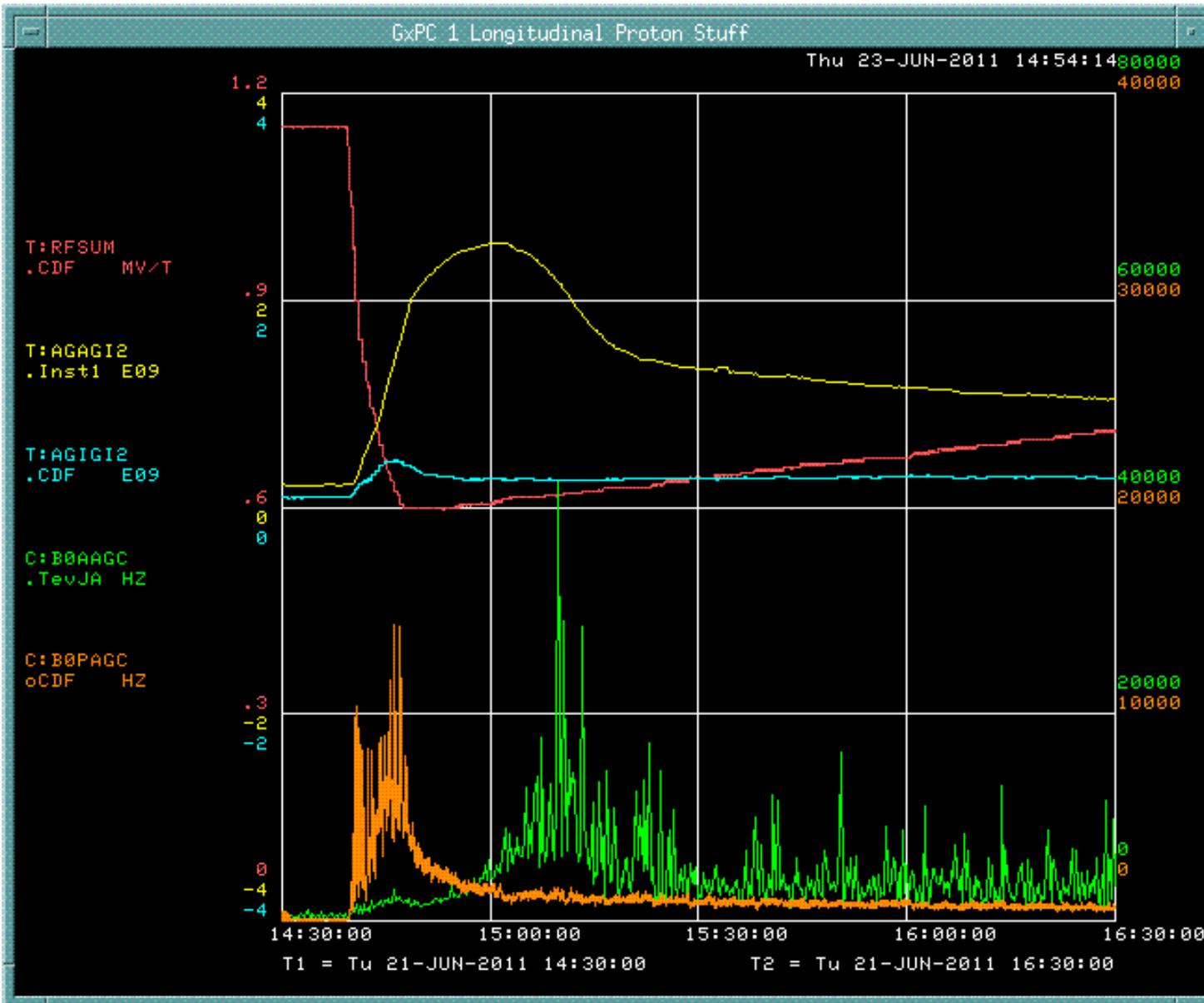
After lowering RF by 50%...

From data logger: C:LUMAVG = 145.9  $\text{ub}^{-1}/\text{s}$ , T:SBDPWS = 2.375 ns, T:SBDAWS = 2.267 ns.  
Hourglass factor assuming 30 cm  $\beta^*$  = 0.499.

- Neglecting any transverse emittance growth (should be really small over 18 min)
- Assuming bunches are Gaussian longitudinally (must have tails)
- Estimate ~1% beam loss (each beam)
  
- Expected lumi ratio = 0.877 and observed lumi ratio = 0.87 → good agreement



# Abort Gap Intensities & Losses from Abort Gap



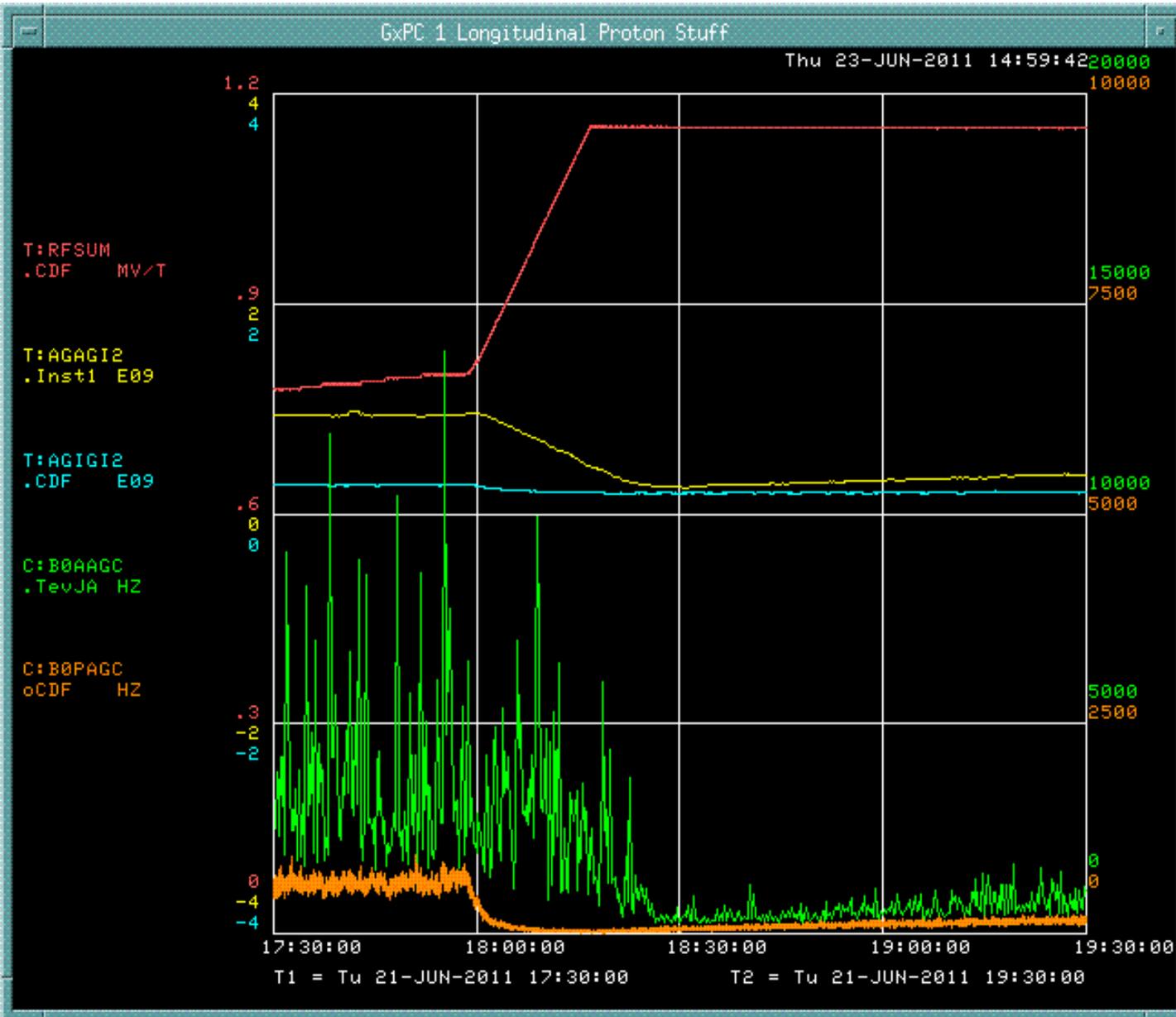
Generated more DC pbars than protons

Behavior like RF trip:

- TEL sweeps out protons
- pbars gradually spiral into collimators as lose energy from synchrotron radiation



# Abort Gap Intensities & Losses from Abort Gap



When ramping up RF at end:

- proton abort gap halo drops rather quickly
- pbar abort gap intensity and halo more gradually

Naively, I would have expected protons to be more gradual, too

“Source” of DC protons turned off more quickly than pbars?



# Summary



- Middle of store 8829 - lowered RF voltage 50%
  - good agreement between expected & observed lumi drop (12.3% -13%)
- Gradually knobbed up RF voltage to keep bunch lengths constant
  - automated feedback would be useful (prevent finger blister)
    - maybe just a time table in the T:APG ramp card
  - lumi lifetime was higher – removing longitudinal lifetime component
- More DC pbars than protons in abort gap
  - a little annoying for CDF, but not a show-stopper
- Ready to try at start of store for “real” leveling
  - Lower RF between Initiate Collisions and Remove Halo
  - Less DC pbars from shorter bunch lengths?
  - Maybe have TEL-2 ready to clean pbars from gaps?