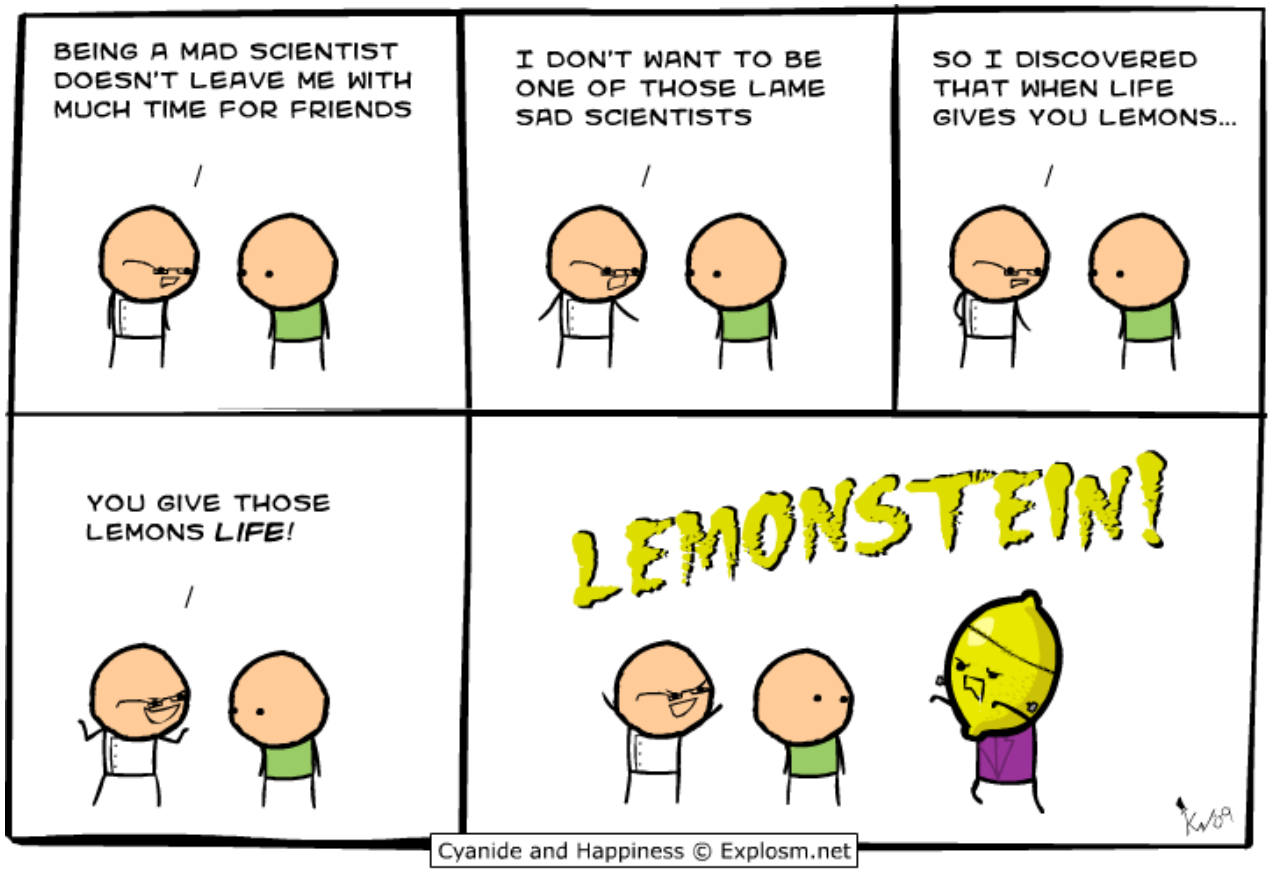
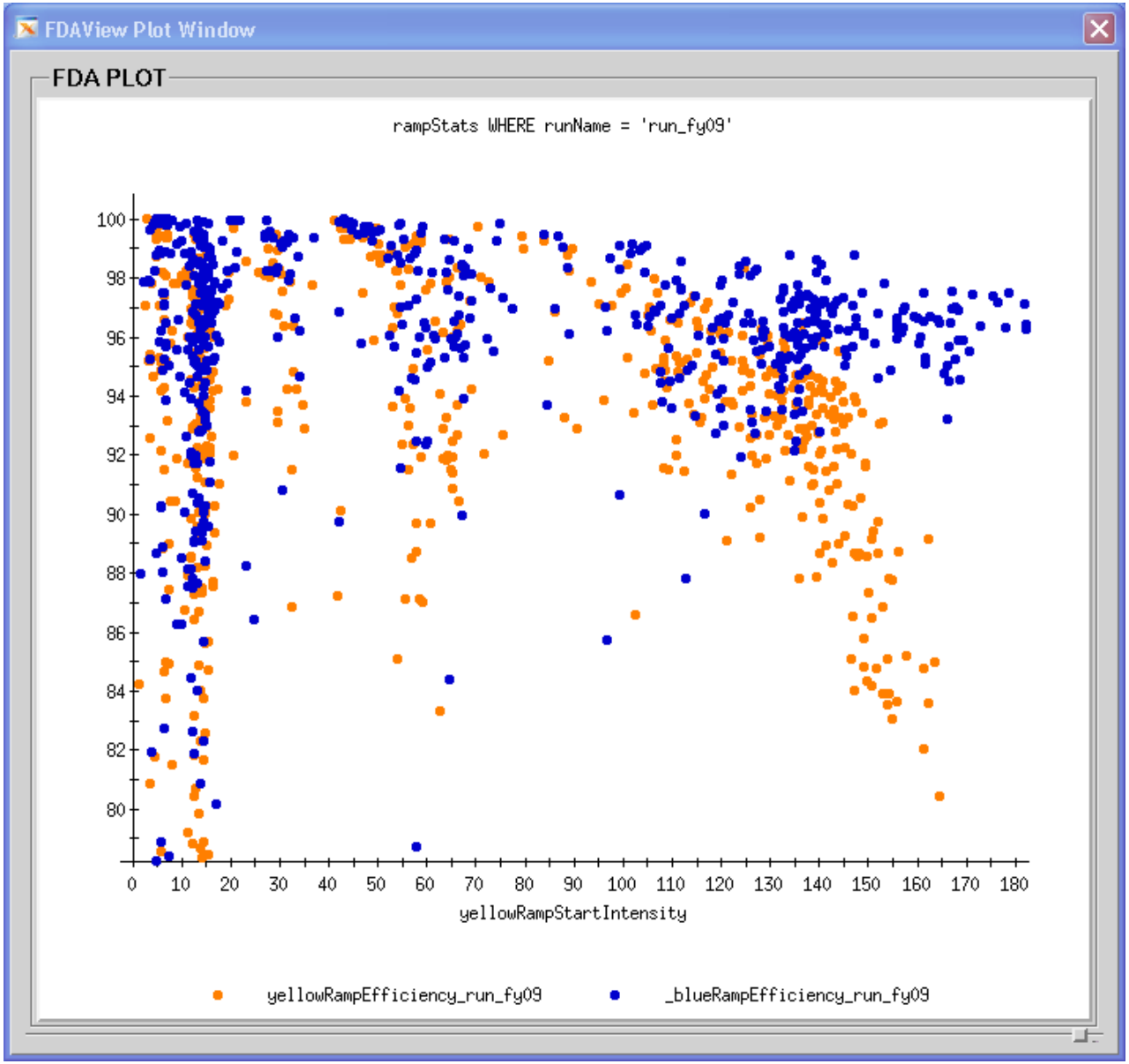
Yellow Ramp Transmission Efficiency

V. Schoefer, W. Fischer



So…our yellow problem could be worse…

The Problem



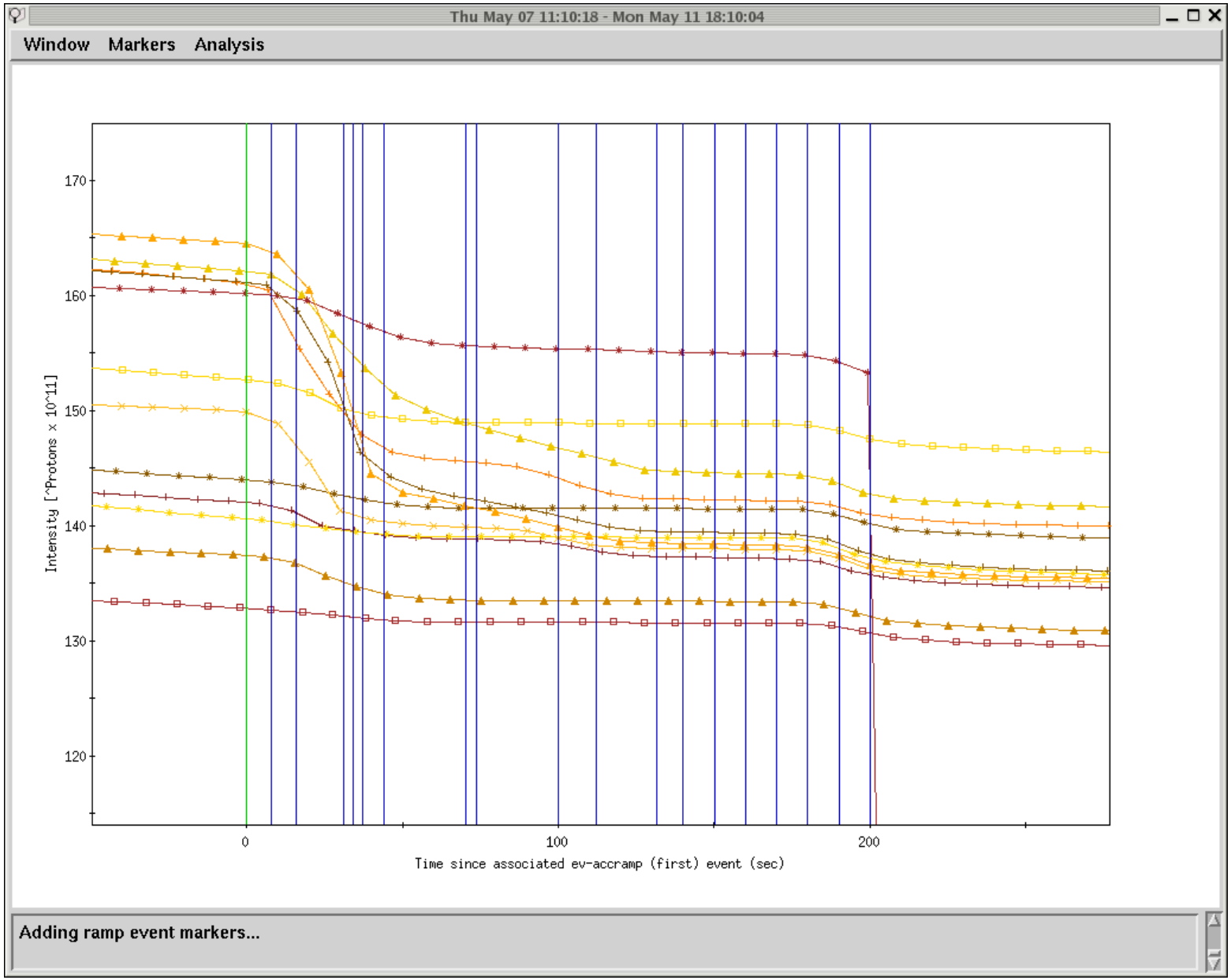
Run 09 ramp efficiency vs. Intensity at accramp

Blue and yellow diverge starting at ~90e11

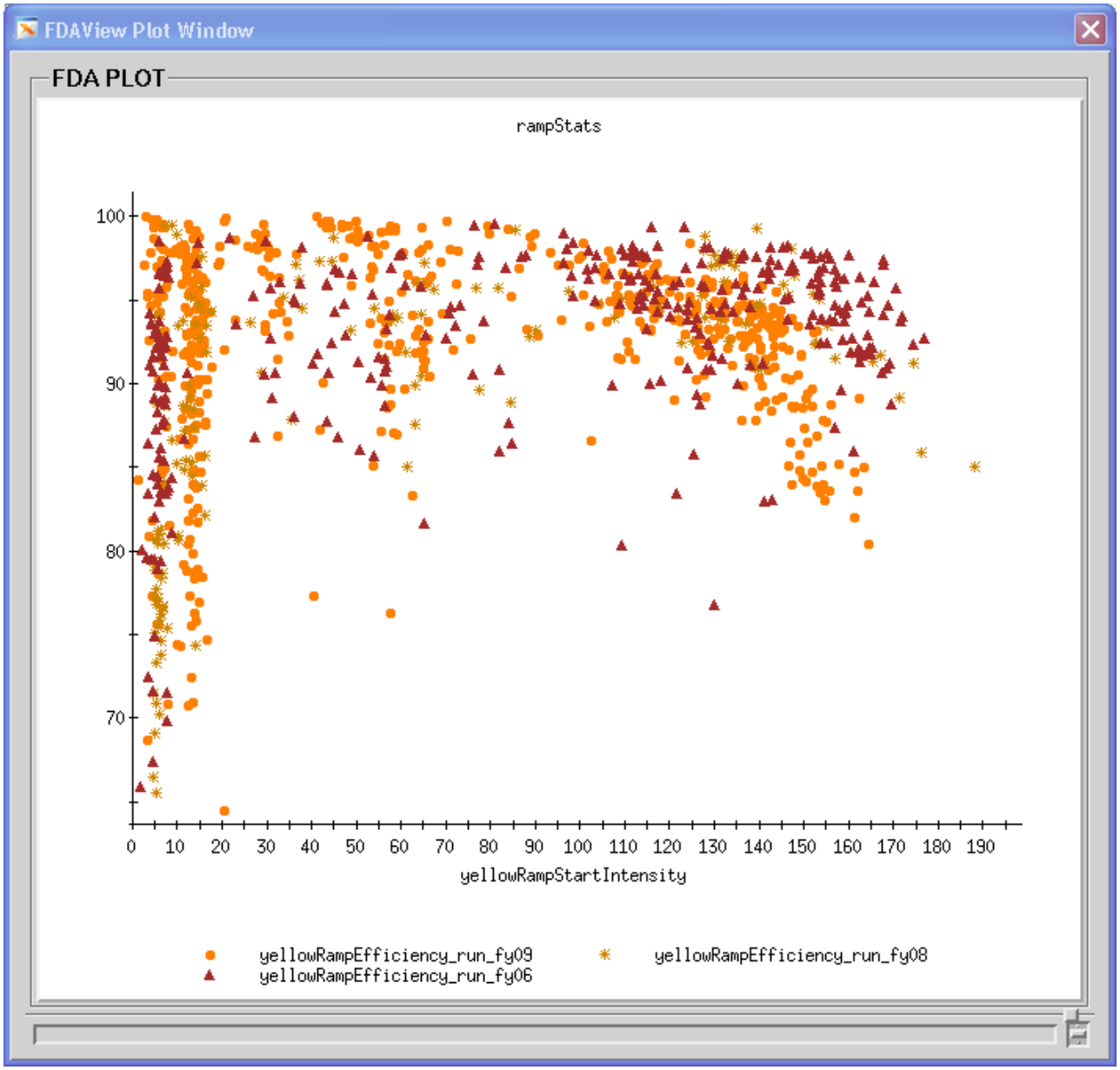
Huge negative slope in yellow at ~140e11

At the highest intensities, blue loses 2-4% of initial beam, yellow loses 20%

A profile of the problem



History



Yellow ramp efficiency vs. start intensity Runs 06, 08, 09

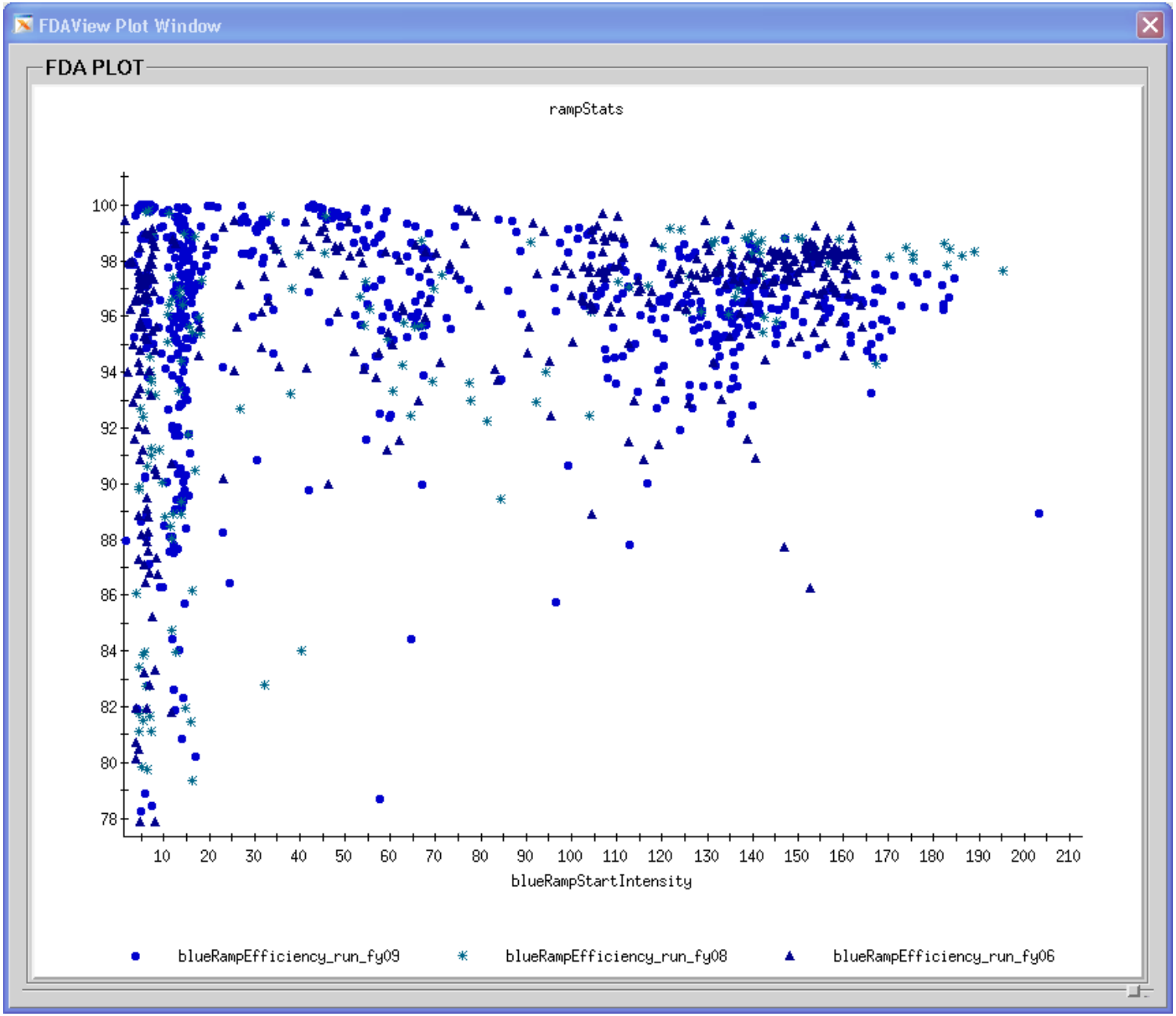
At highest intensities:

Run 06 has losses at the 5% level

Run 08 at 10-15%

Run 09 at 20%

Same data for blue, Runs 06, 08, 09:



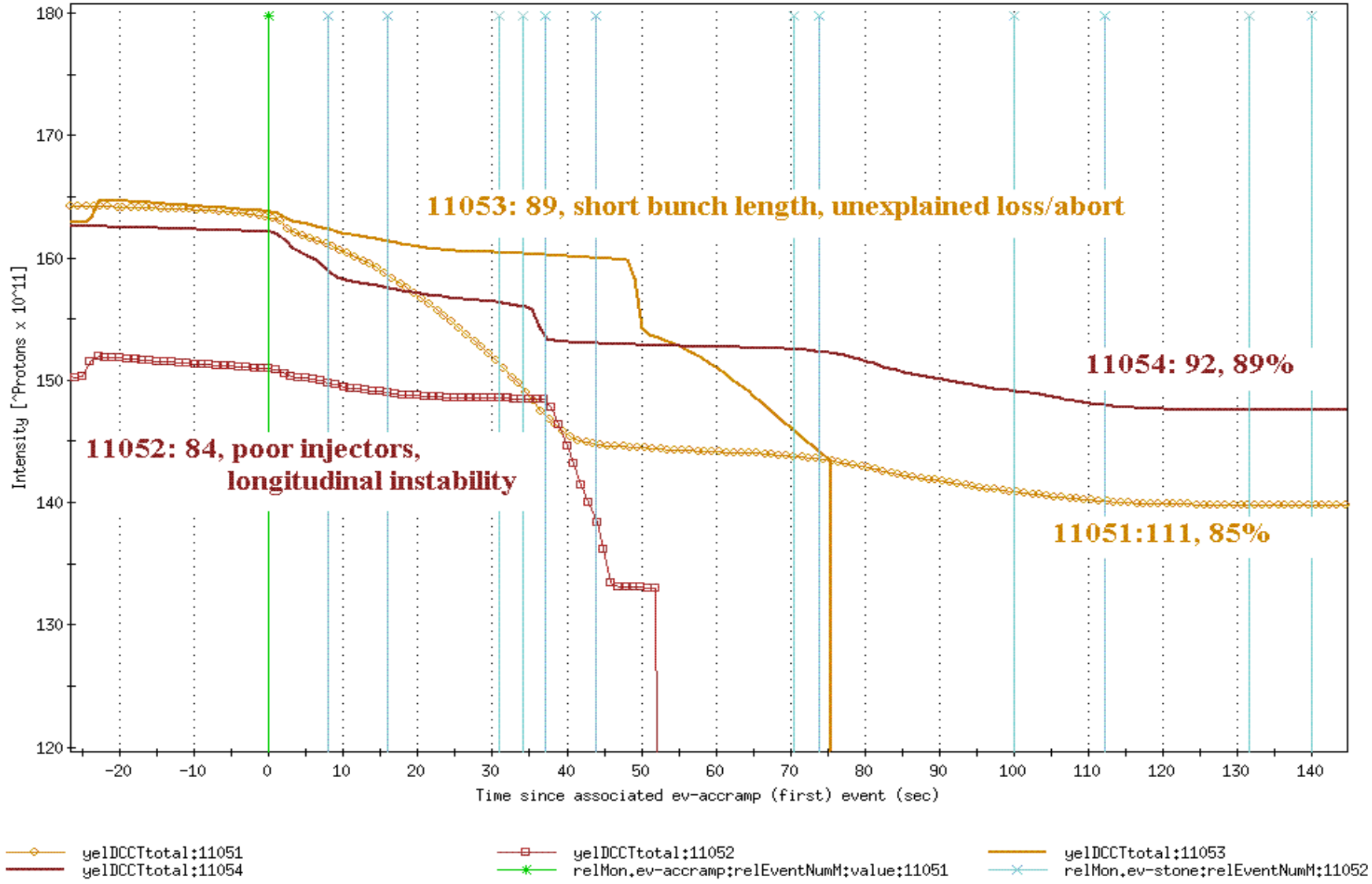
Experimental Procedure

Ramp with constant total intensity in varying number of yellow bunches. (Always six bunches in blue).

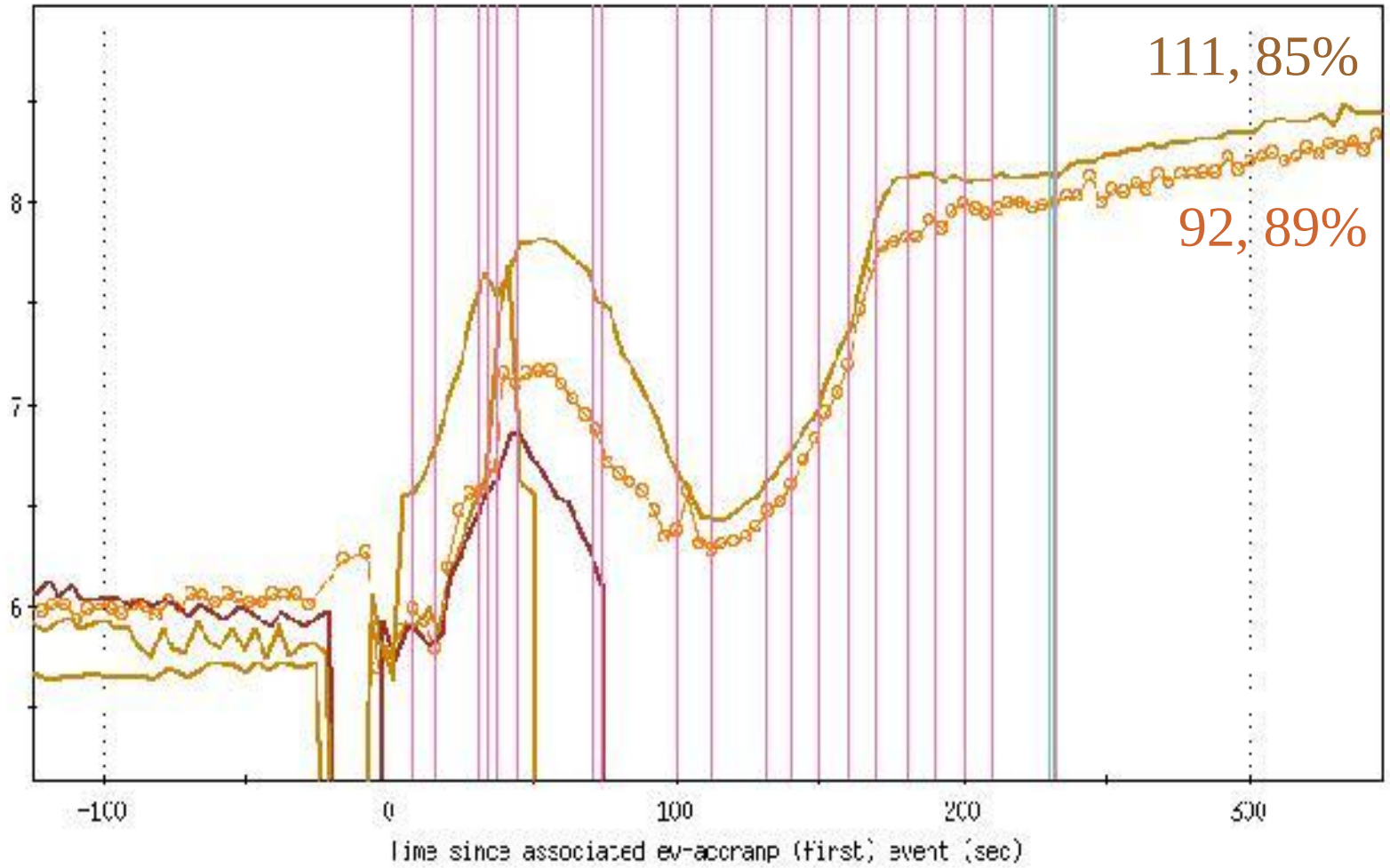
i. If the effect disappears with 6xN, not LRBB
ii. If effect goes with bunch number, suspect e-cloud.
iii. Check for transverse emittance growth along bunch train

Previous experience ramping high intensity bunches at very low bunch number (6, 12) already argues against single bunch effects.

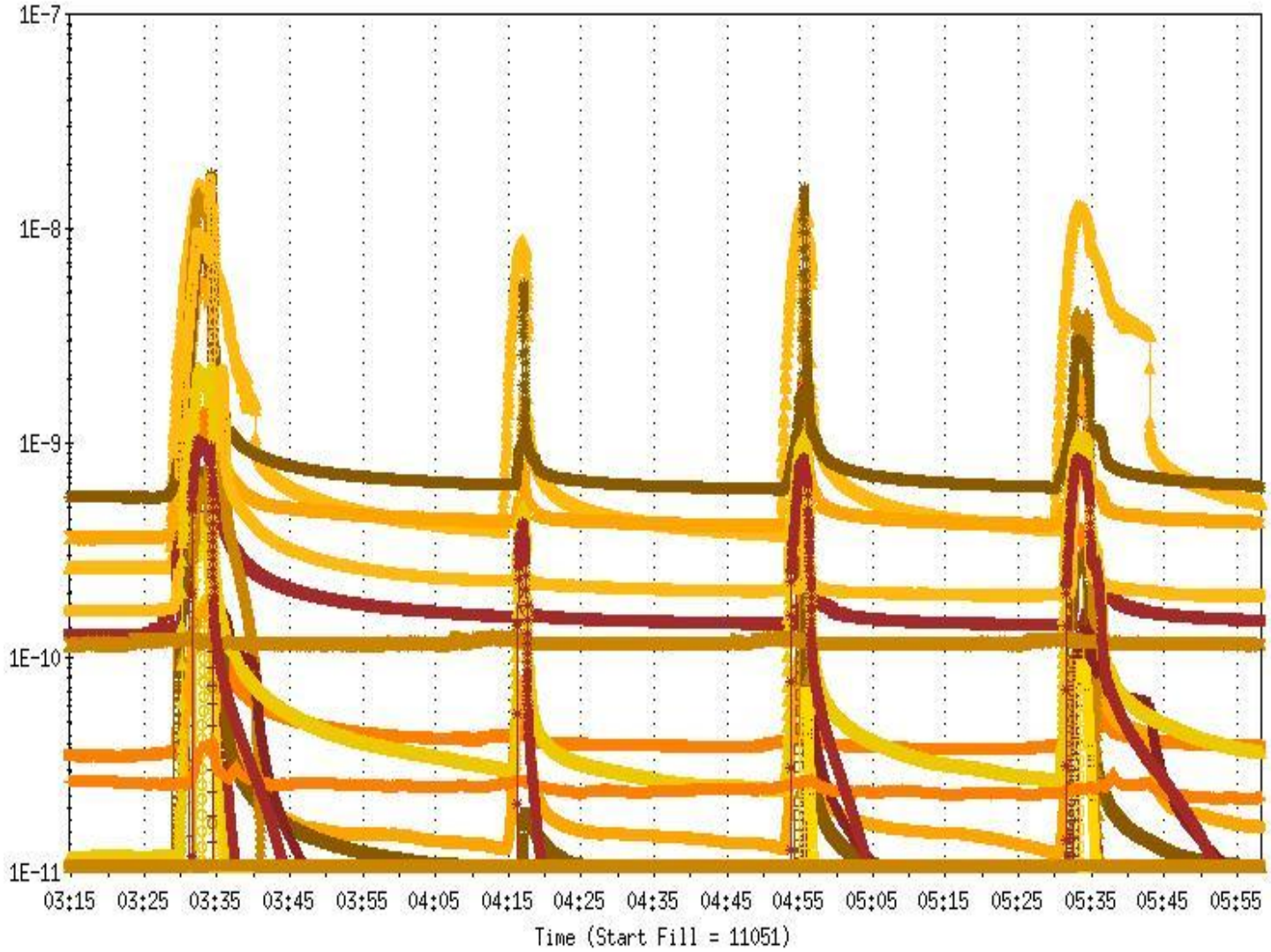
Four ramps


11053: 89, short bunch length, unexplained loss/abort
11054: 92, 89%
11052: 84, poor injectors,
longitudinal instability
11051:111, 85%
Intensity [^Protons x 10^11]
Time since associated ev-accramp (first) event (sec)
yelDCCTtotal:11051
yelDCCTtotal:11054
yelDCCTtotal:11052
relMon.ev-accramp:relEventNumM:value:11051
yelDCCTtotal:11053
relMon.ev-stone:relEventNumM:11052

Bunch lengths



Vacuum data



Peak is ~ the same for all four ramps. Occurs near CNI.

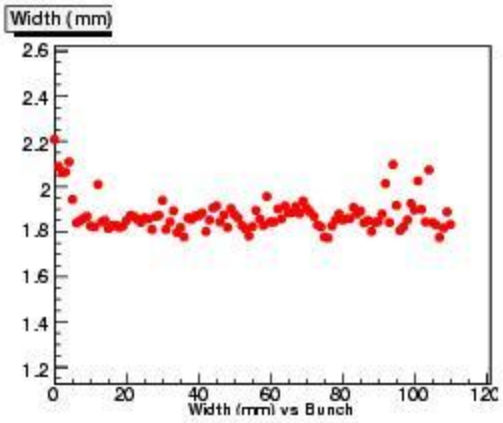
Average is higher by nearly a decade for 111 bunches (from StoreAnalysis, not shown)

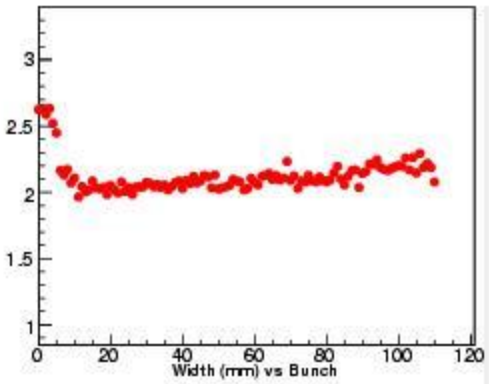
Vacuum is typically at its worst right at the end of injection

CNI Emittance

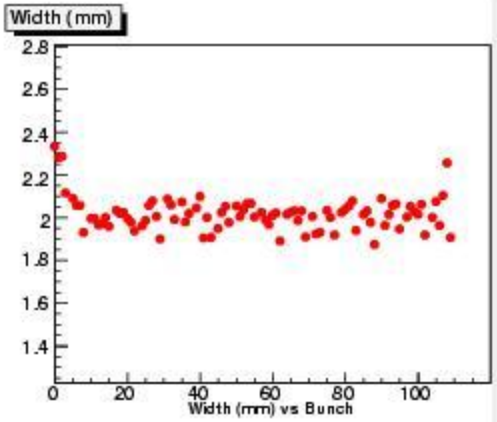
V6 (Hor profile) H3 (Ver profile)

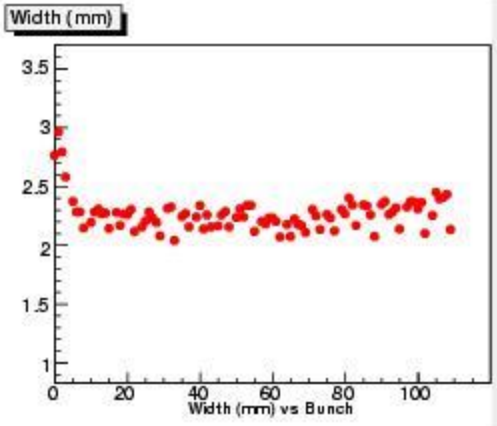
11051 (111)





11054 (92)





Results

- Consistent with e-cloud.
- Longitudinal effects and their lack of reproducibility not clearly understood (by me)
- No real clues about any other causes.

Future possibilities

- Long bunch lengths from 9 MHz work could render the issue moot, but does not fix the underlying weakness in the yellow ring (which may be getting worse).
- A significant data mining effort of the last run could find correlations despite irreproducibility.
- Dedicate a low energy proton ramp as a test bed to study e-clouds.
- Microwave measurement of e-clouds.
- Measure tune shift as function of longitudinal position in bunch??? S.C pickups?