

# MI proton coalescing efficiency and proton multibatch operation

## Some observations

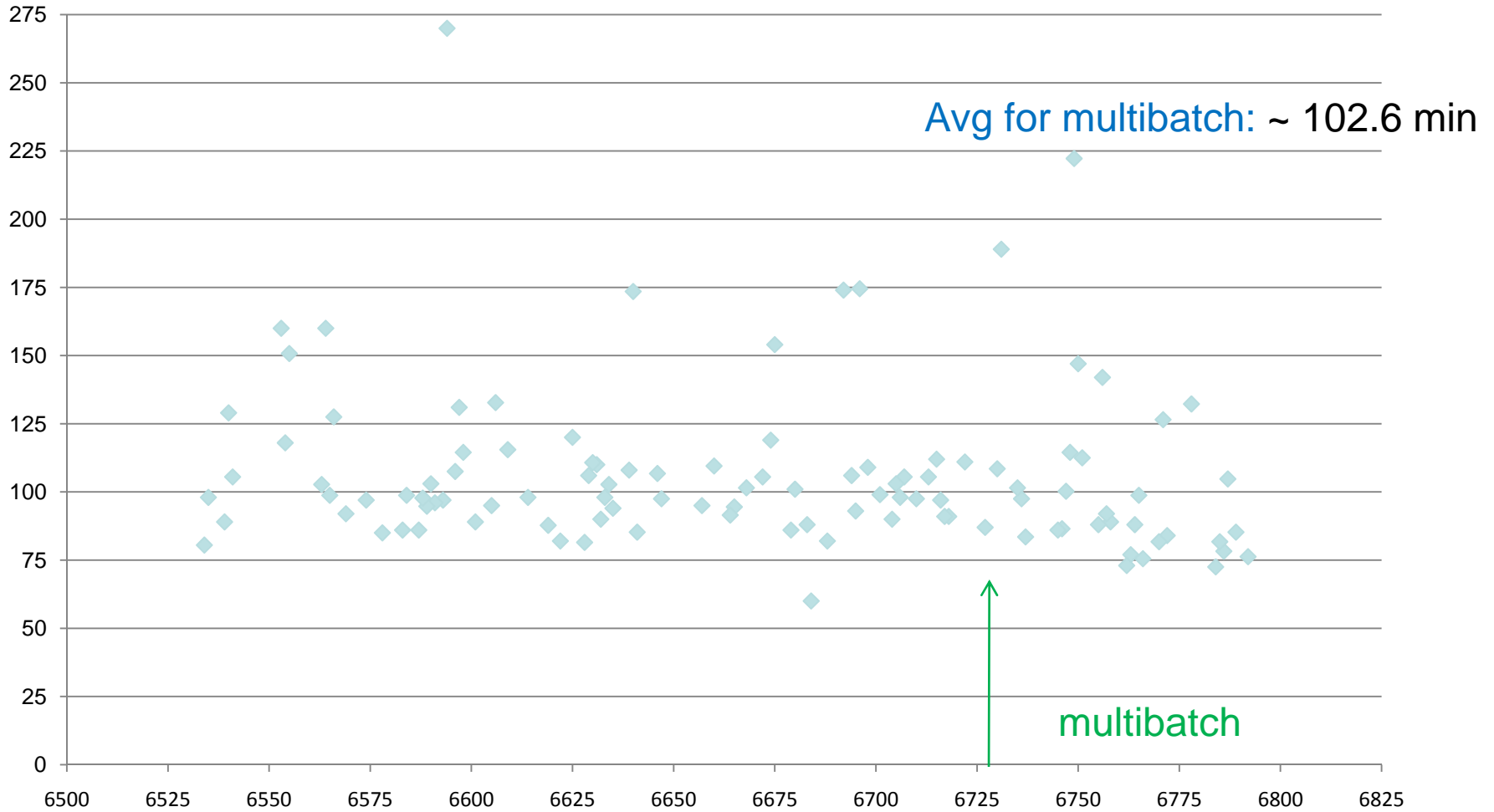
Vaia Papadimitriou

February 13, 2009

# Duration of shot setup

Nov. 1, 2008 – Feb. 10, 2009

## shot setup duration (minutes) vs store number



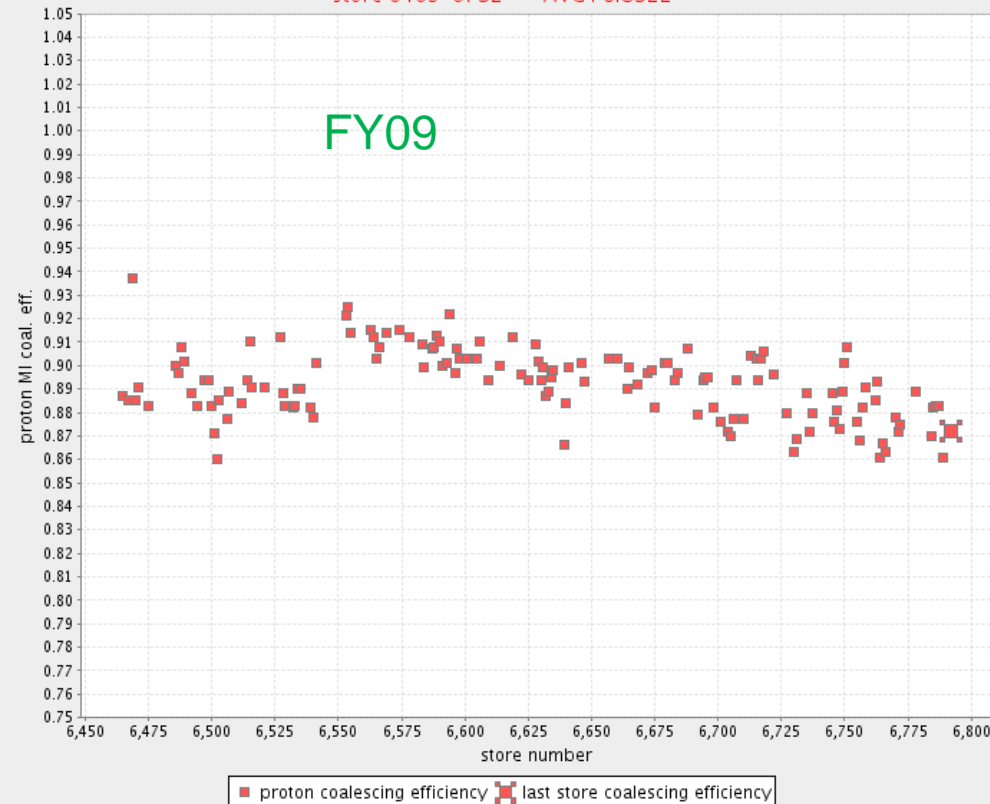
# MI proton coalescing efficiency

Nov. 1, 2008 – Feb. 10, 2009  
stores 6534-6792

Proton MI Coalescing Efficiency(avg) vs Store Number

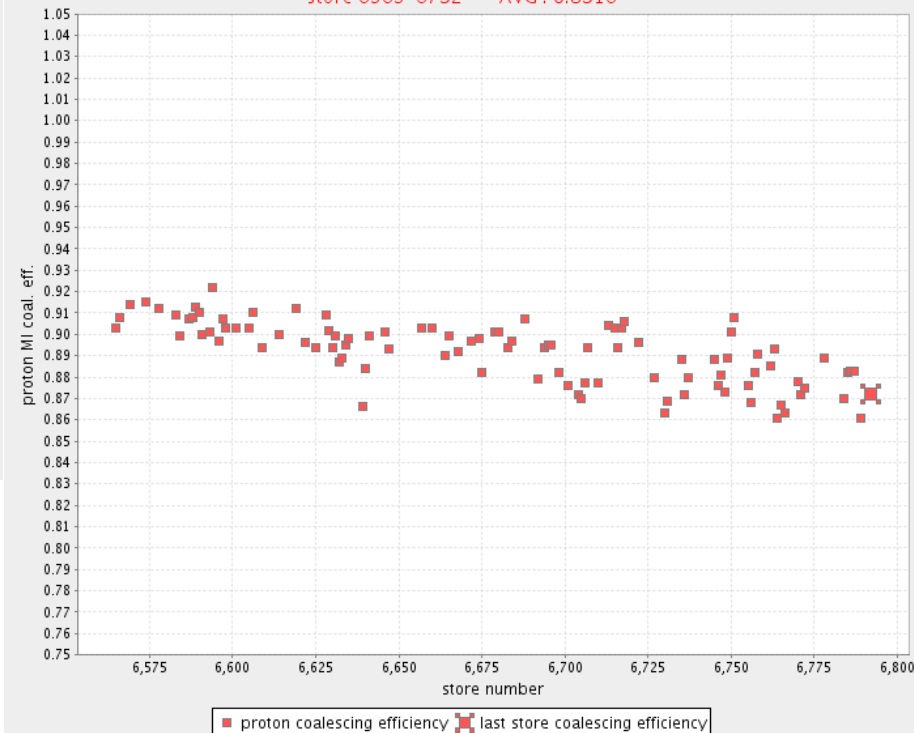
store 6465-6792    AVG : 0.8922

FY09



Proton MI Coalescing Efficiency(avg) vs Store Number

store 6565-6792    AVG : 0.8916

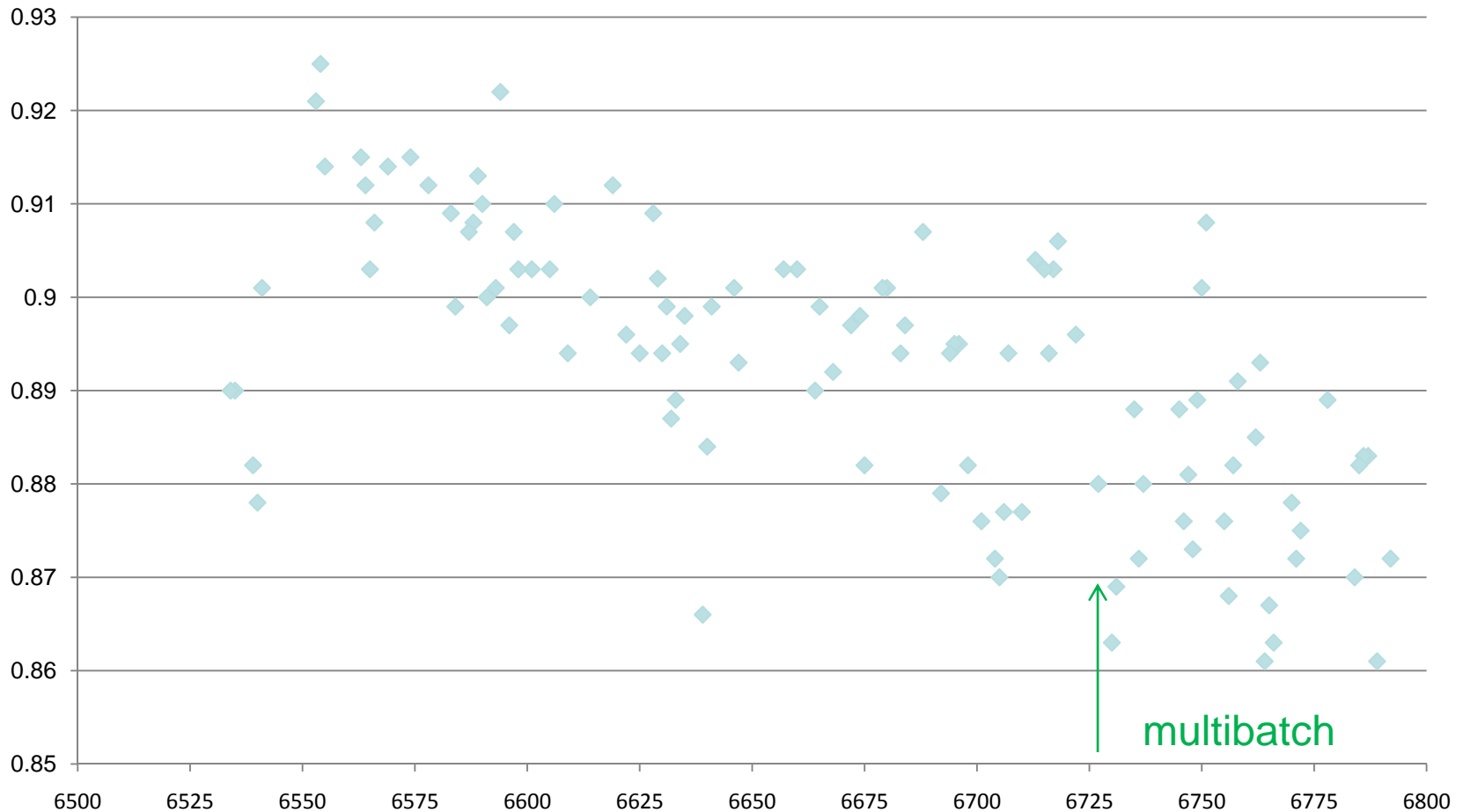


# MI proton coalescing eff. vs store number

Nov. 1, 2008 – Feb. 10, 2009

Zoomed in version

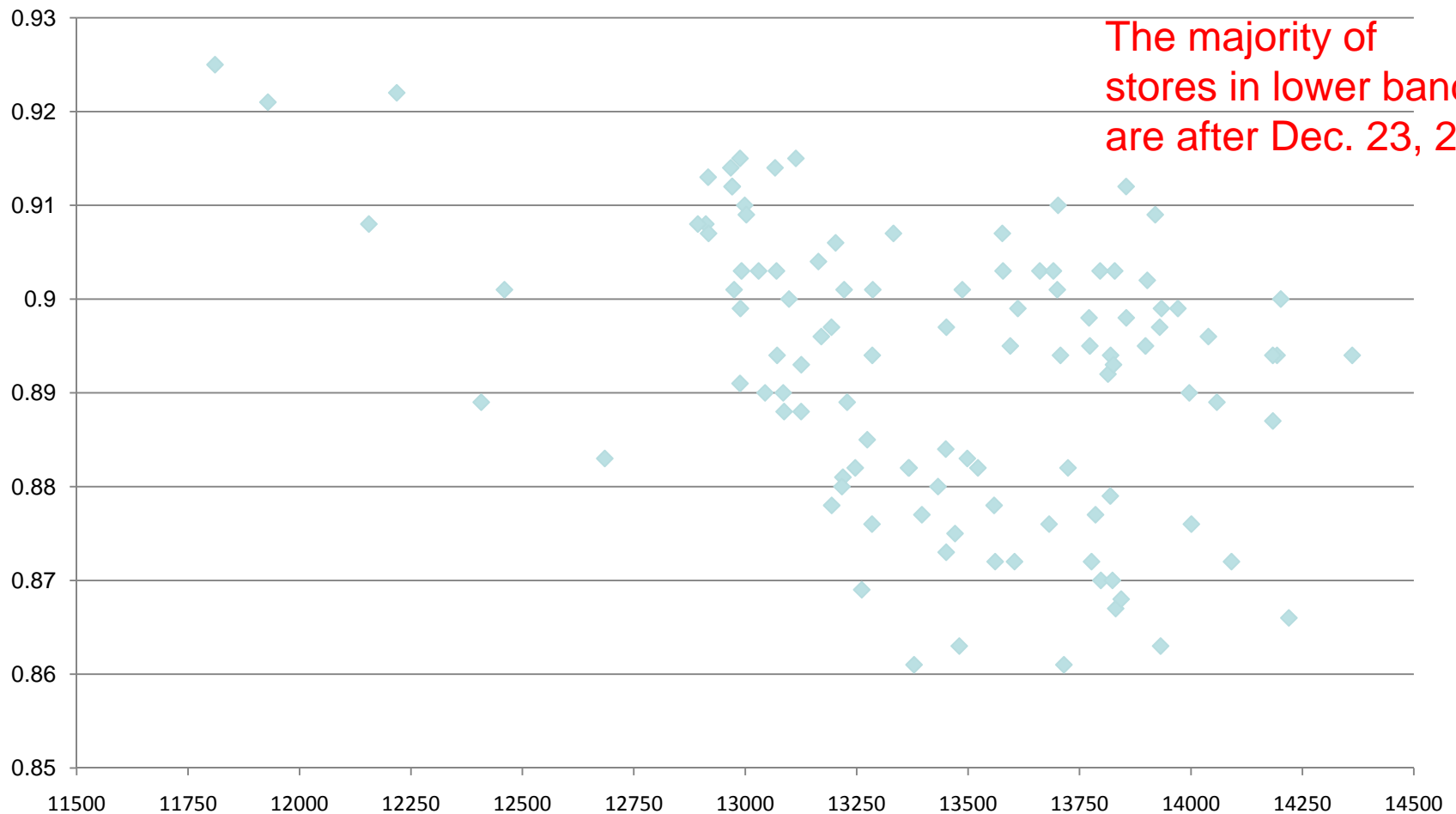
## # 145 p MI coalescing eff (avg) vs store number



# MI proton coalescing eff. vs proton intensity (e9) at 8 GeV

Nov. 1, 2008 – Feb. 10, 2009

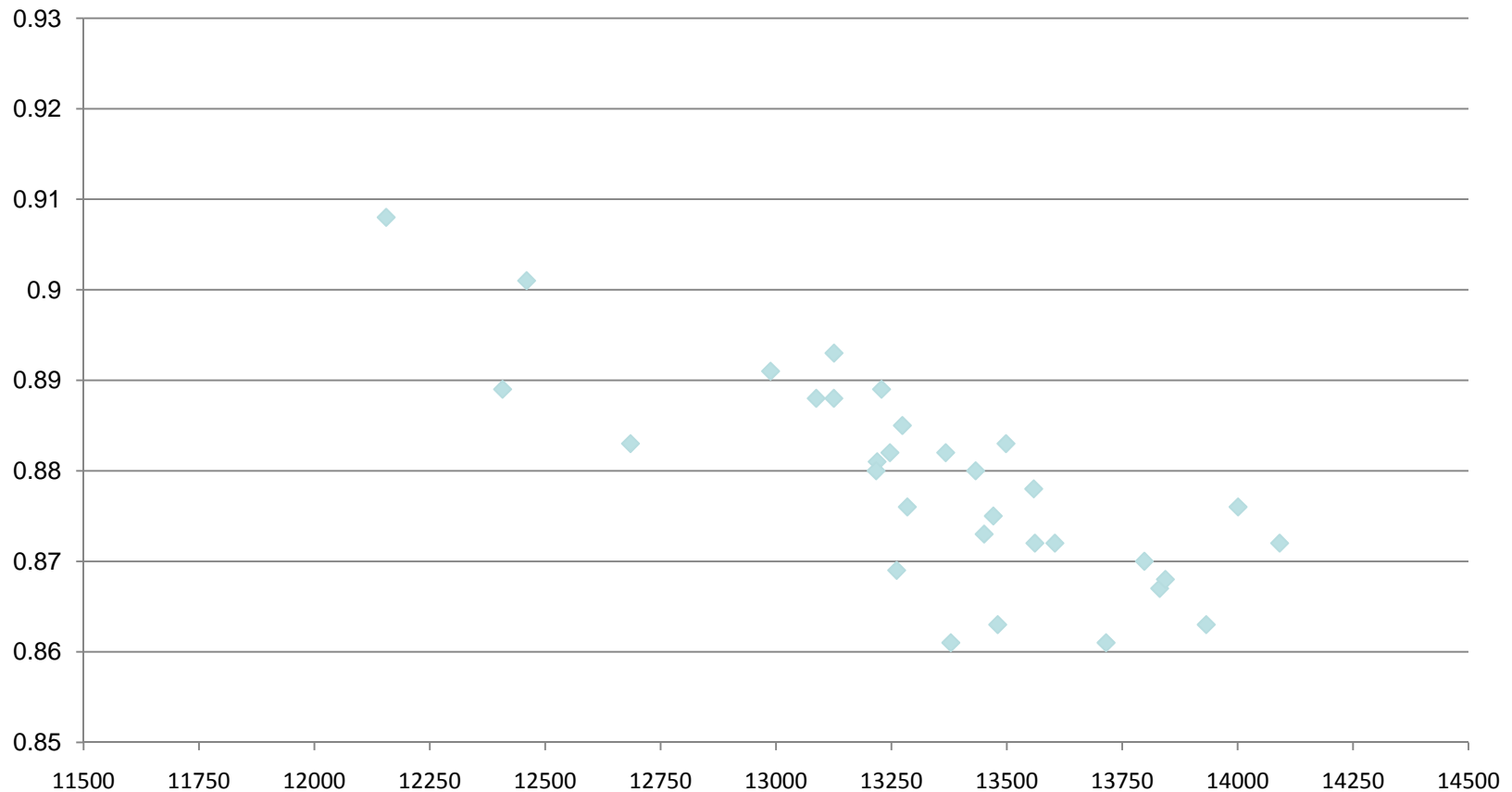
# 145 p MI coalescing eff (avg) vs #47 proton intensity at 8 GeV



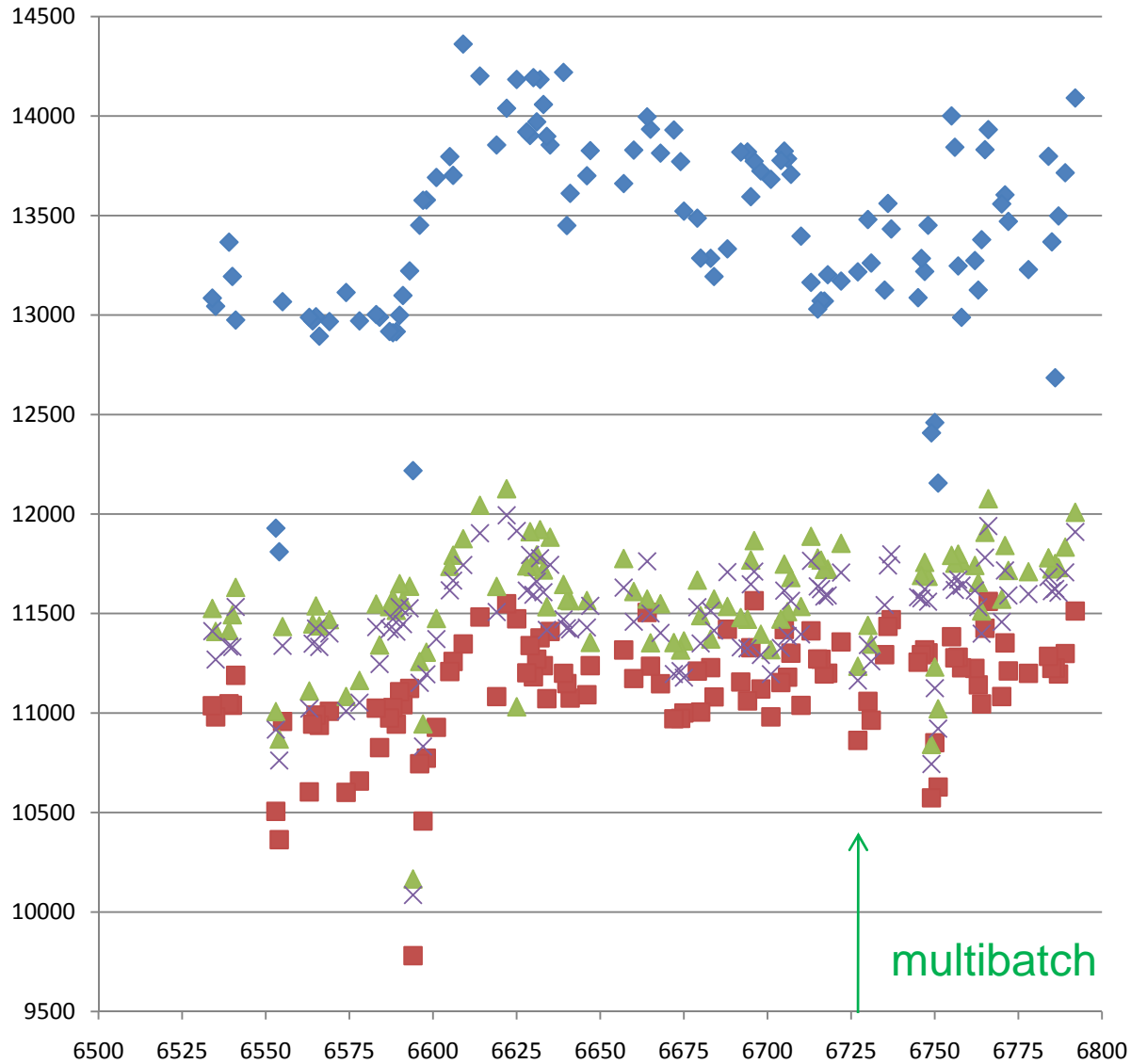
# MI proton coalescing efficiency vs proton intensity (e9) at MI 8 GeV

Jan. 13, 2009 – Feb. 10, 2009/multibatch operation

**# 145 p MI coalescing eff (avg) vs #47 p intensity at MI 8 GeV**



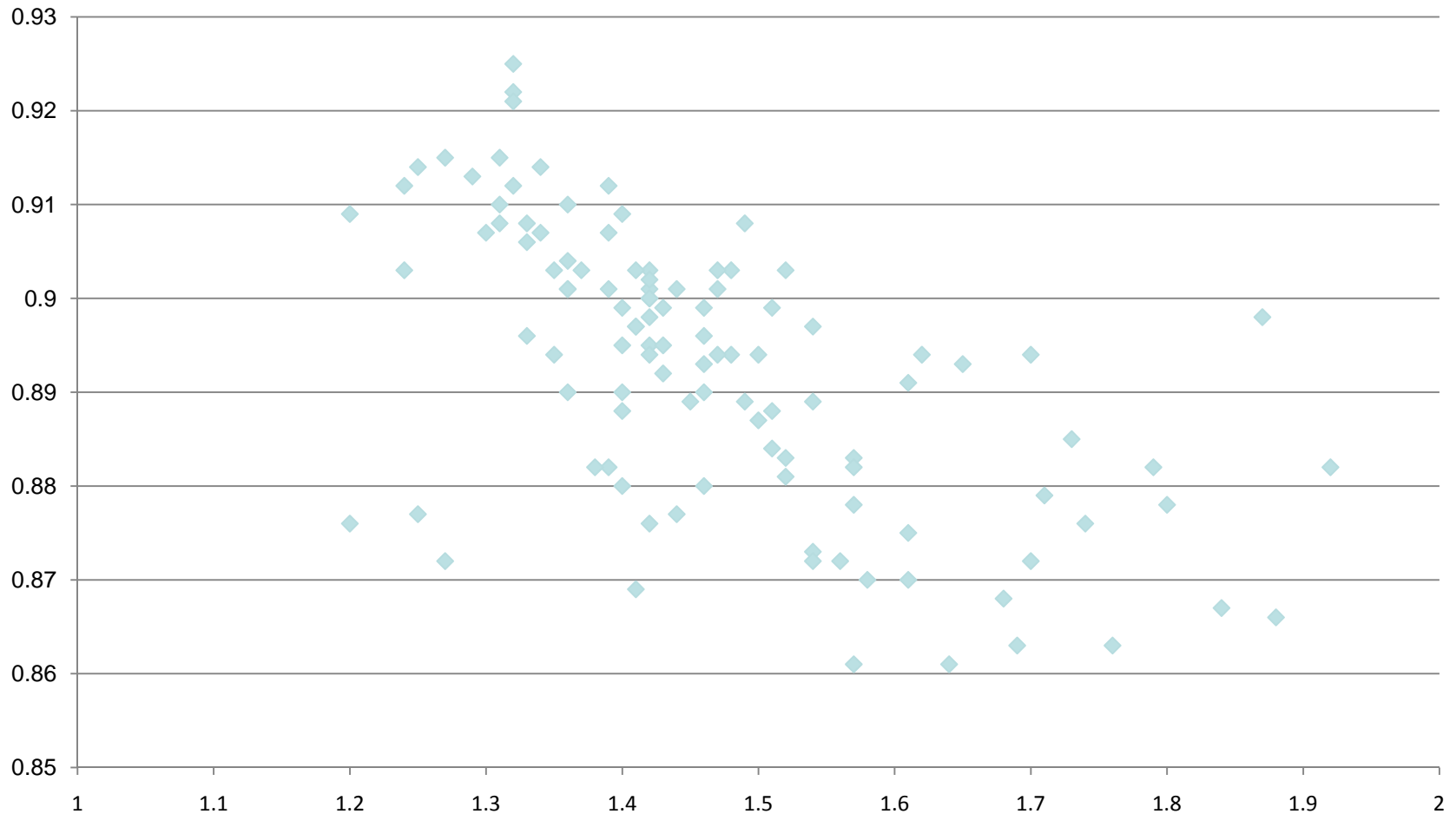
# MI proton and TeV 150 GeV intensities



# MI proton coalescing eff. vs 8 GeV proton longitudinal emittance

Nov. 1, 2008 – Feb. 10, 2009

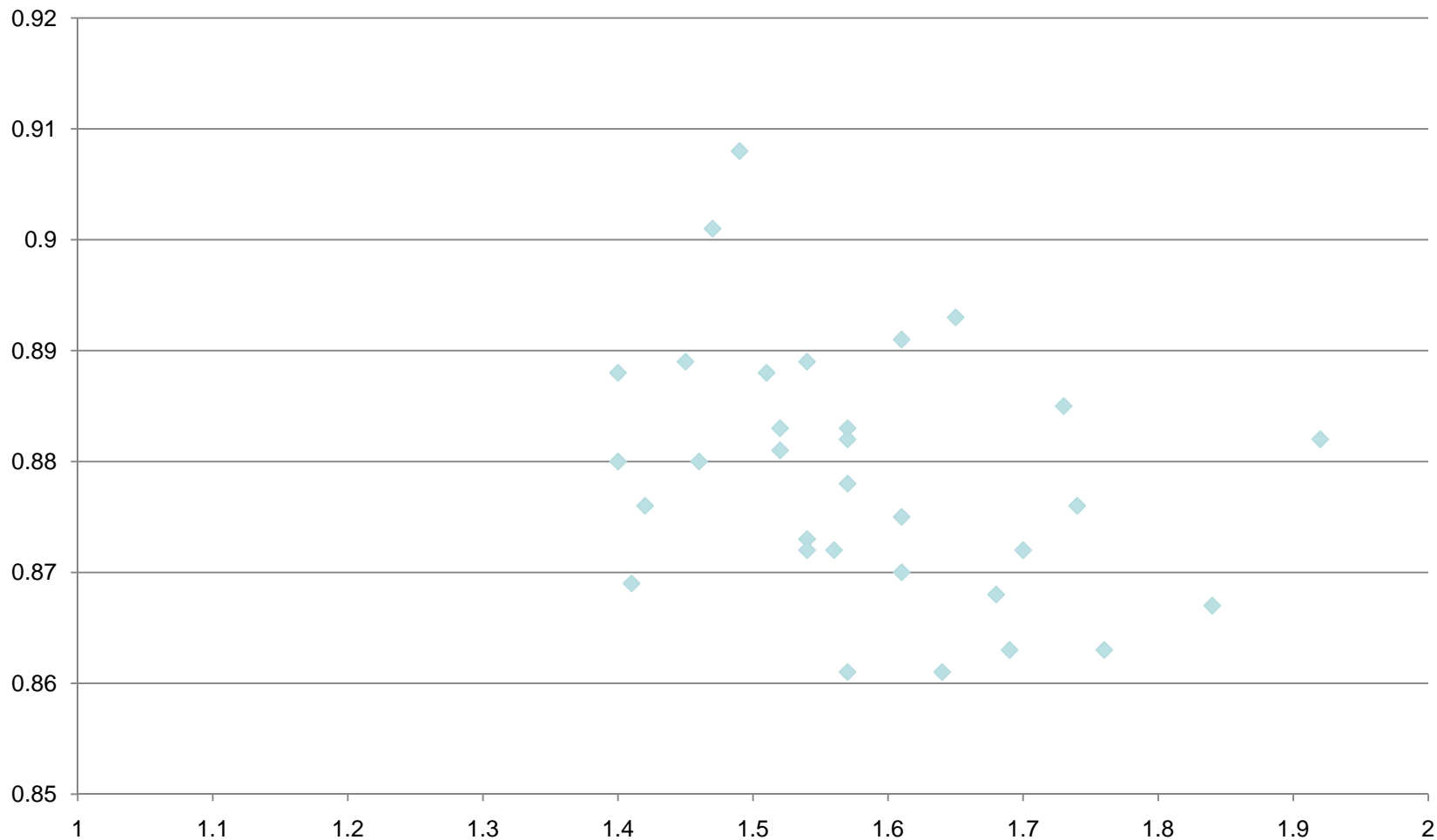
# 145 p MI coalescing eff (avg) vs MI 8 GeV long. emitt.





# MI proton coalescing eff. vs 8 GeV longitudinal emitt. after multibatch operation

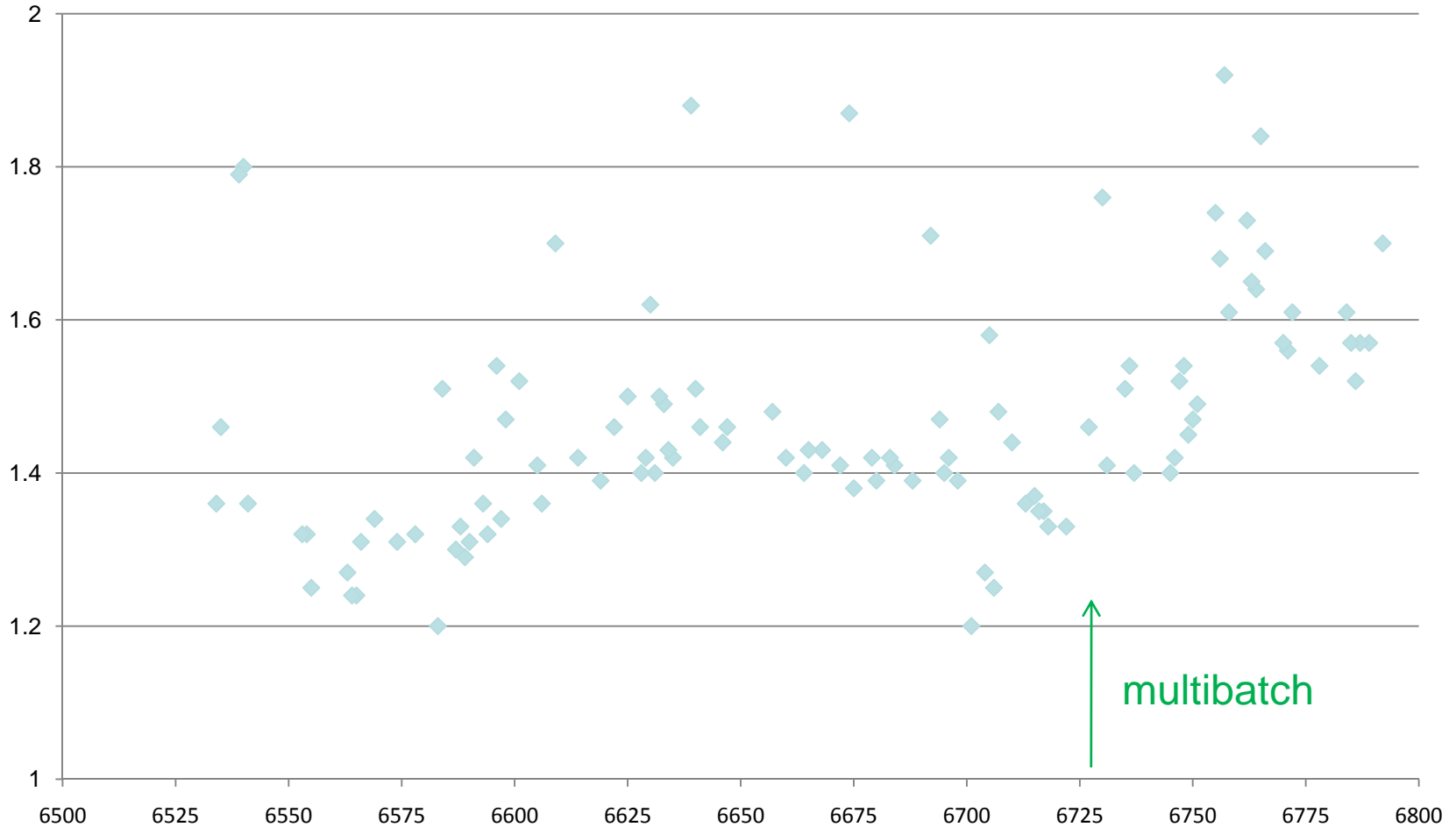
## # 145 p MI coalescing eff (avg) vs #200 MI 8 Gev long emitt



# MI proton longitudinal emittance at 8 GeV

Nov. 1, 2008 – Feb. 10, 2009

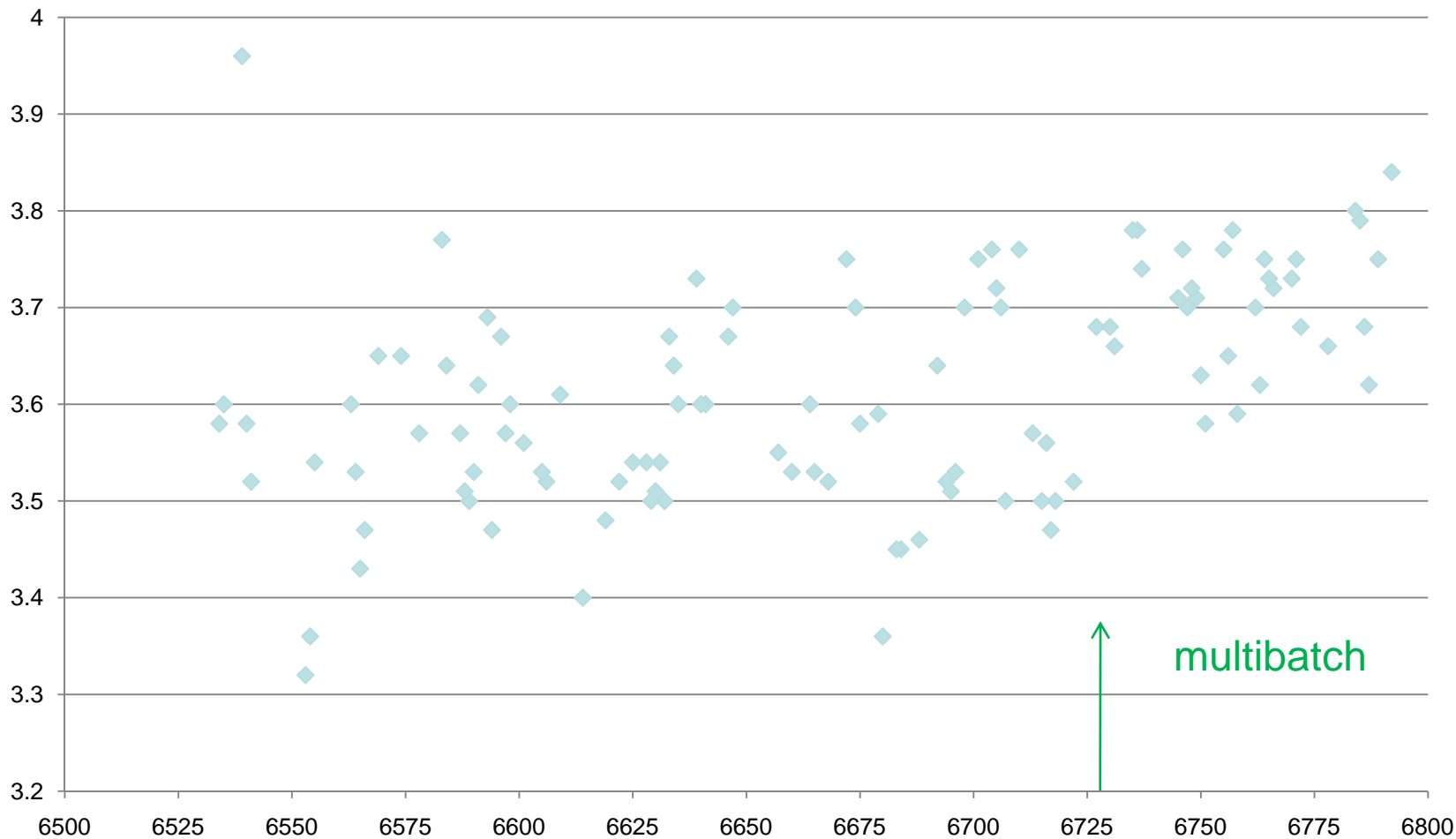
## # 200 Alt. P Longitudinal Emittance MI 8 GeV vs store number



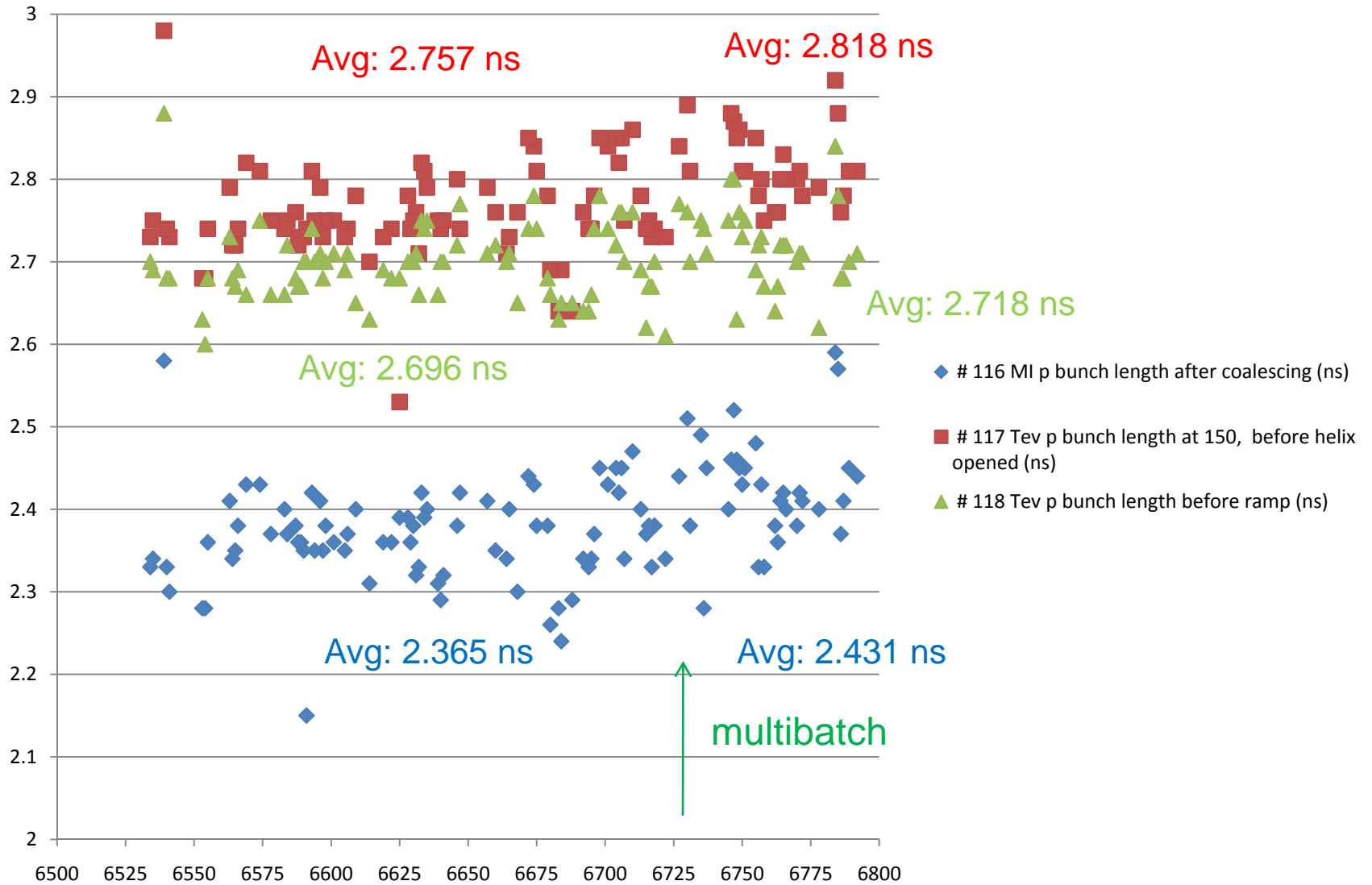
# MI proton longitudinal emittance at 150 GeV

Nov. 1, 2008 – Feb. 10, 2009

## # 204 Alt. P Longitudinal Emittance MI 150 GeV vs store number

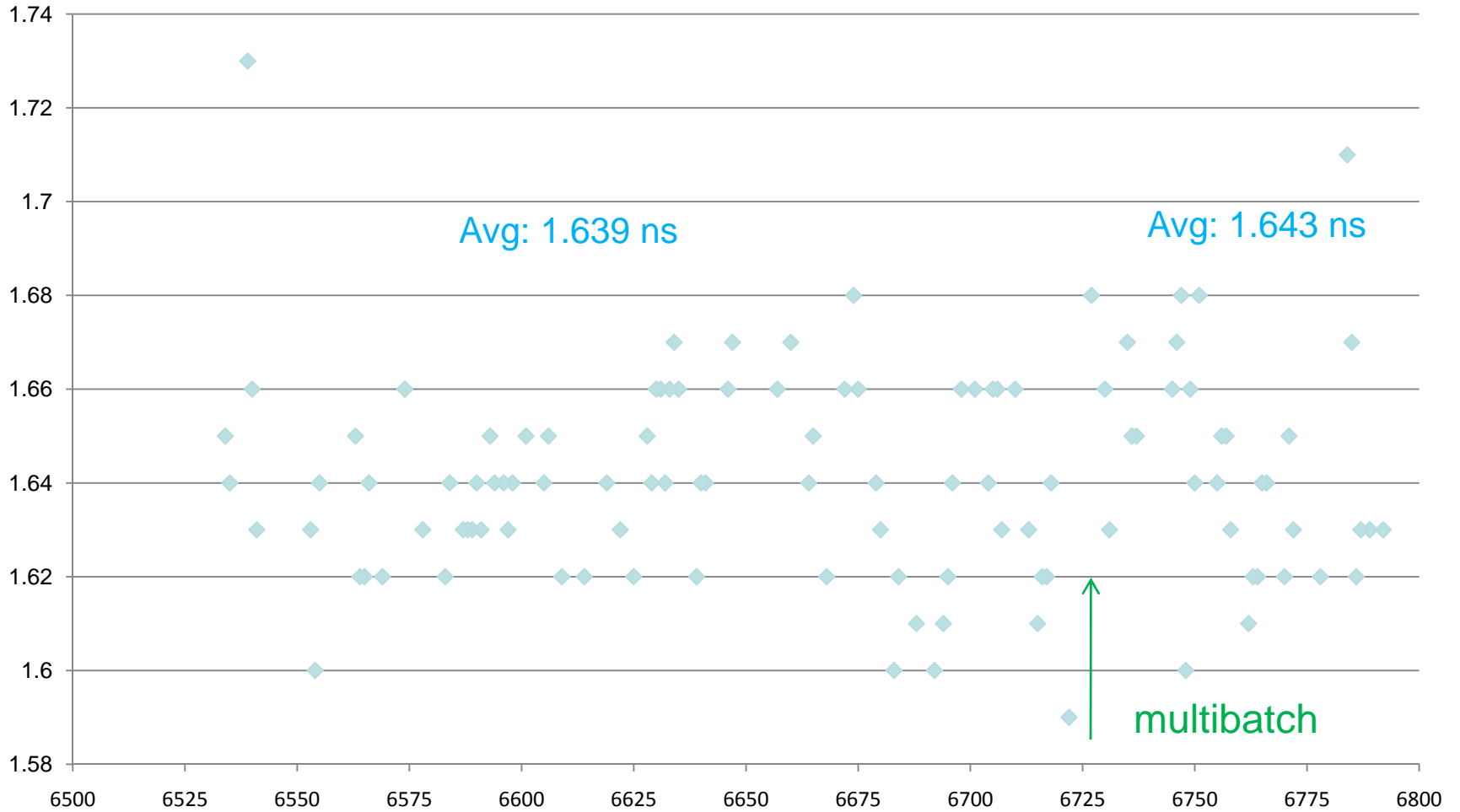


# proton bunch length at 150 GeV

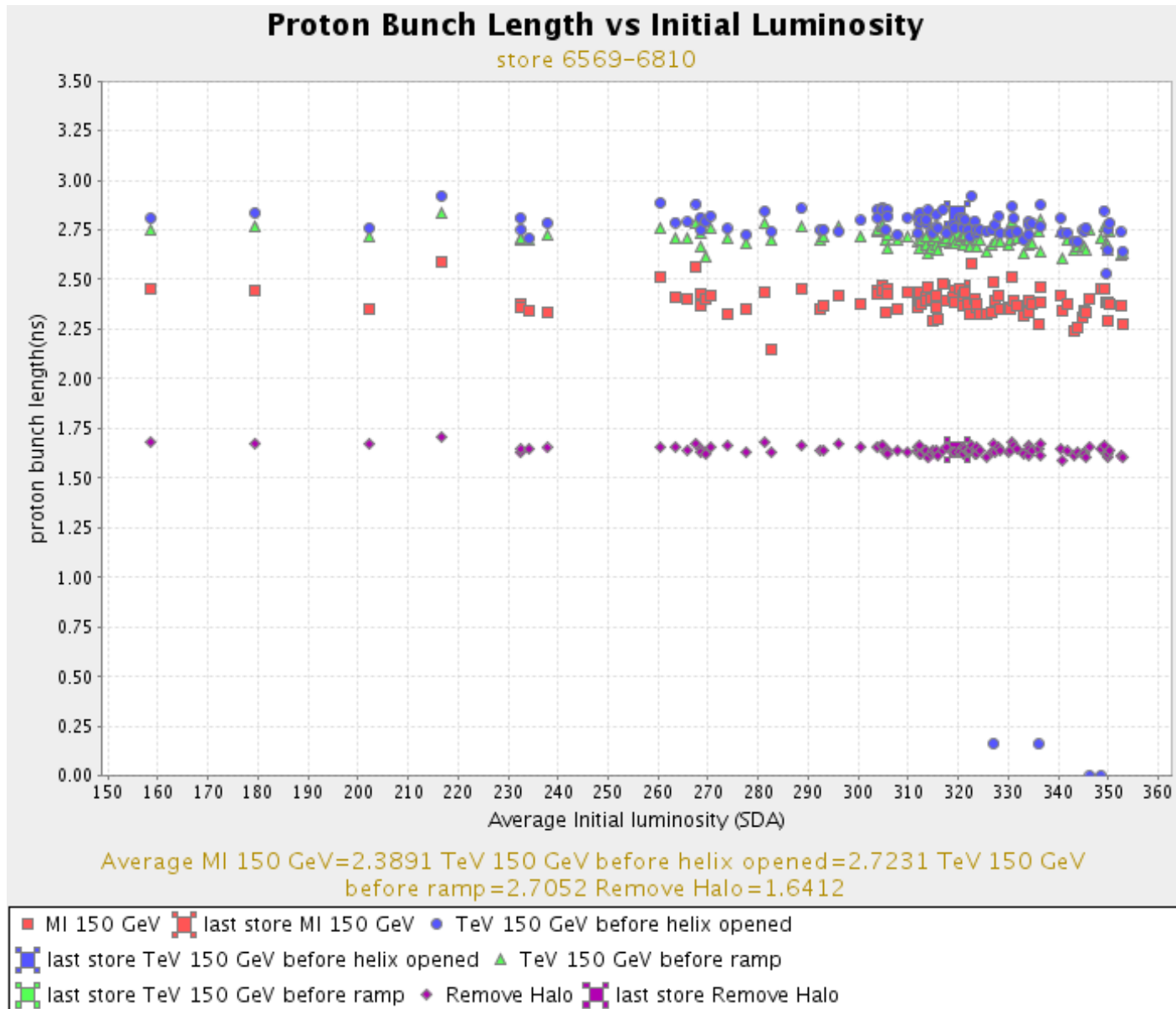


# proton bunch length at Remove Halo

## # 119 Tev p bunch length at Remove Halo (ns) vs store number



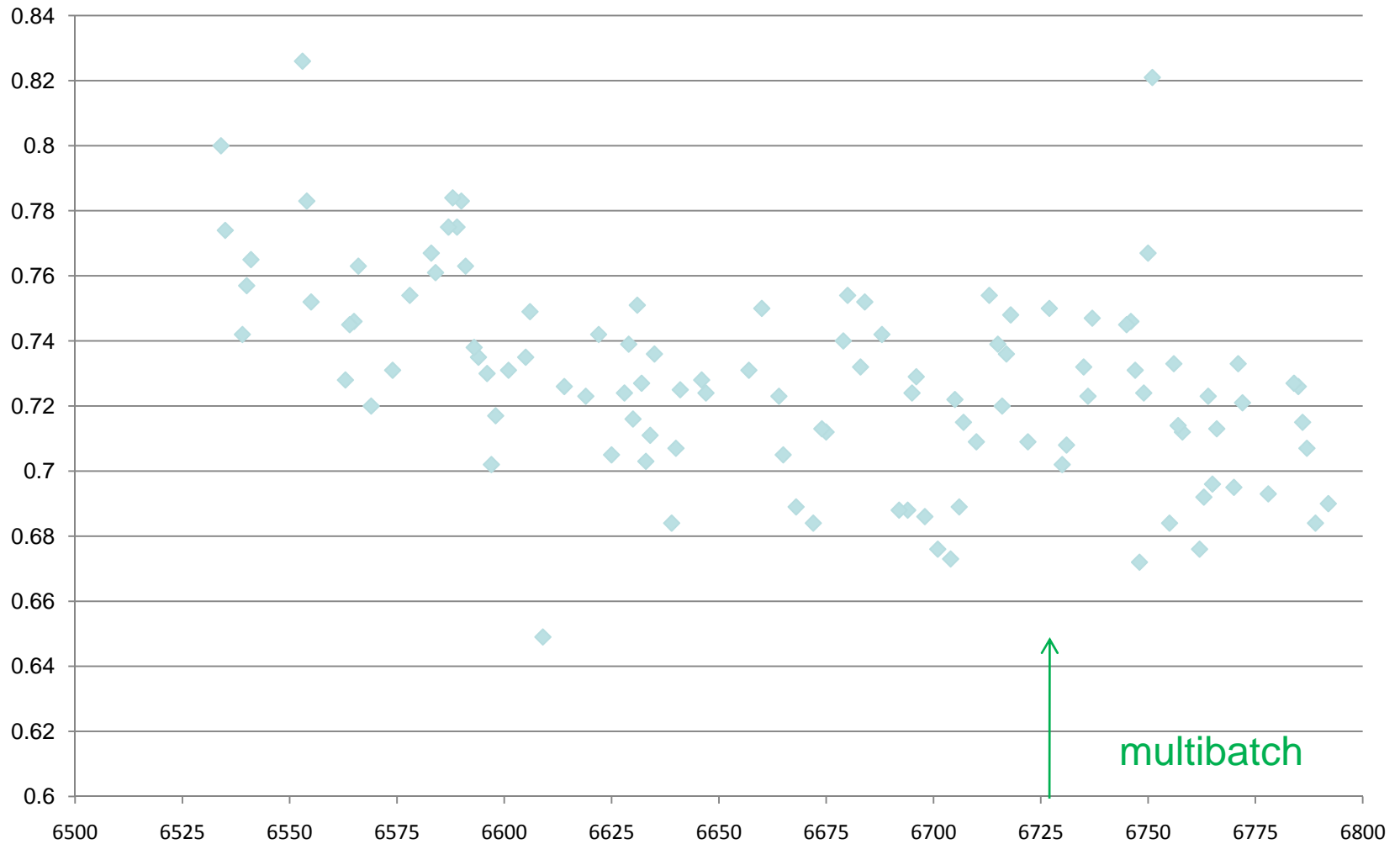
# proton bunch length at 150 GeV vs initial luminosity



# Efficiencies

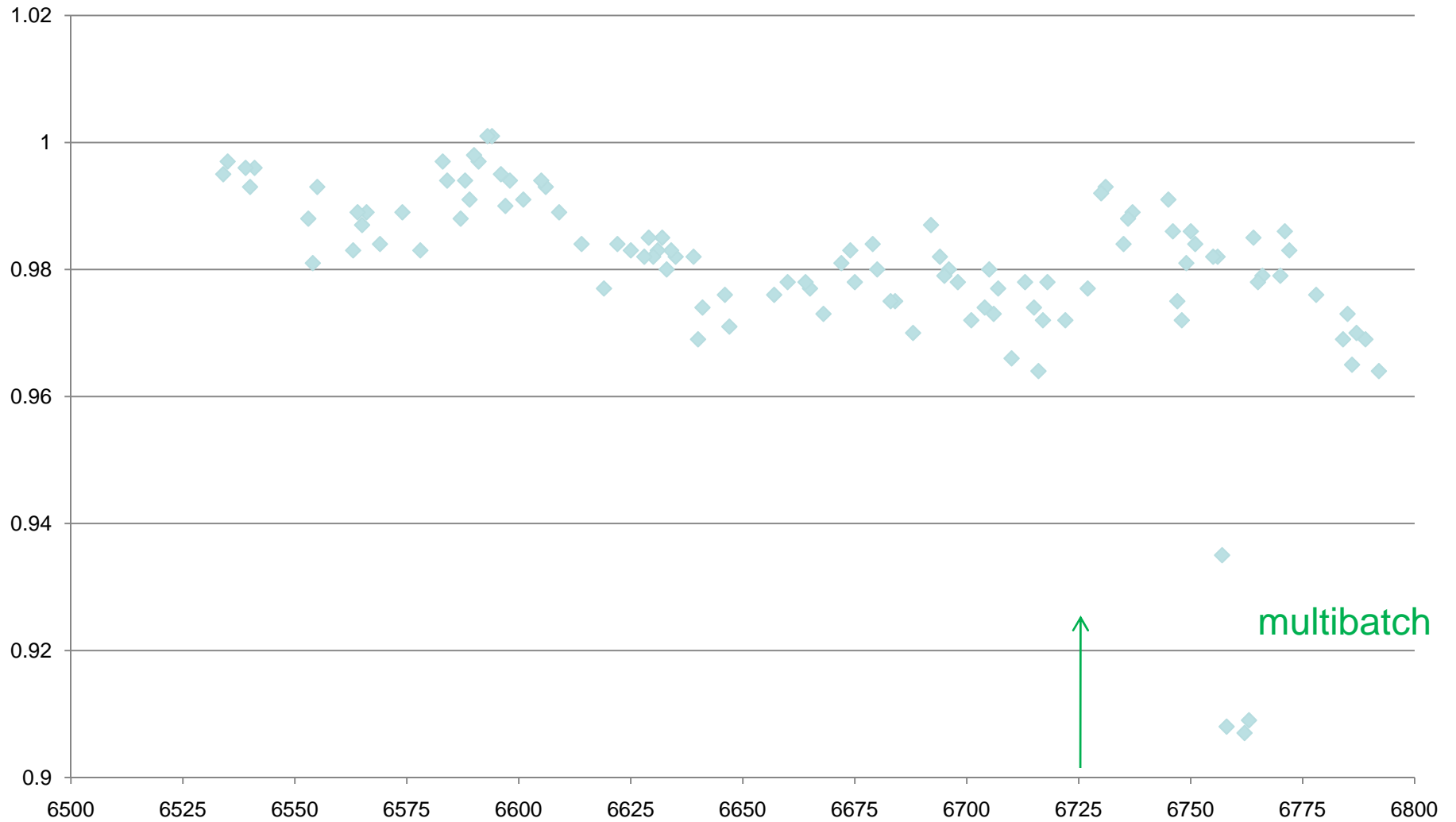
Nov. 1, 2008 – Feb. 10, 2009

## # 151 p overall Booster->Remove Halo vs store number



# Efficiencies

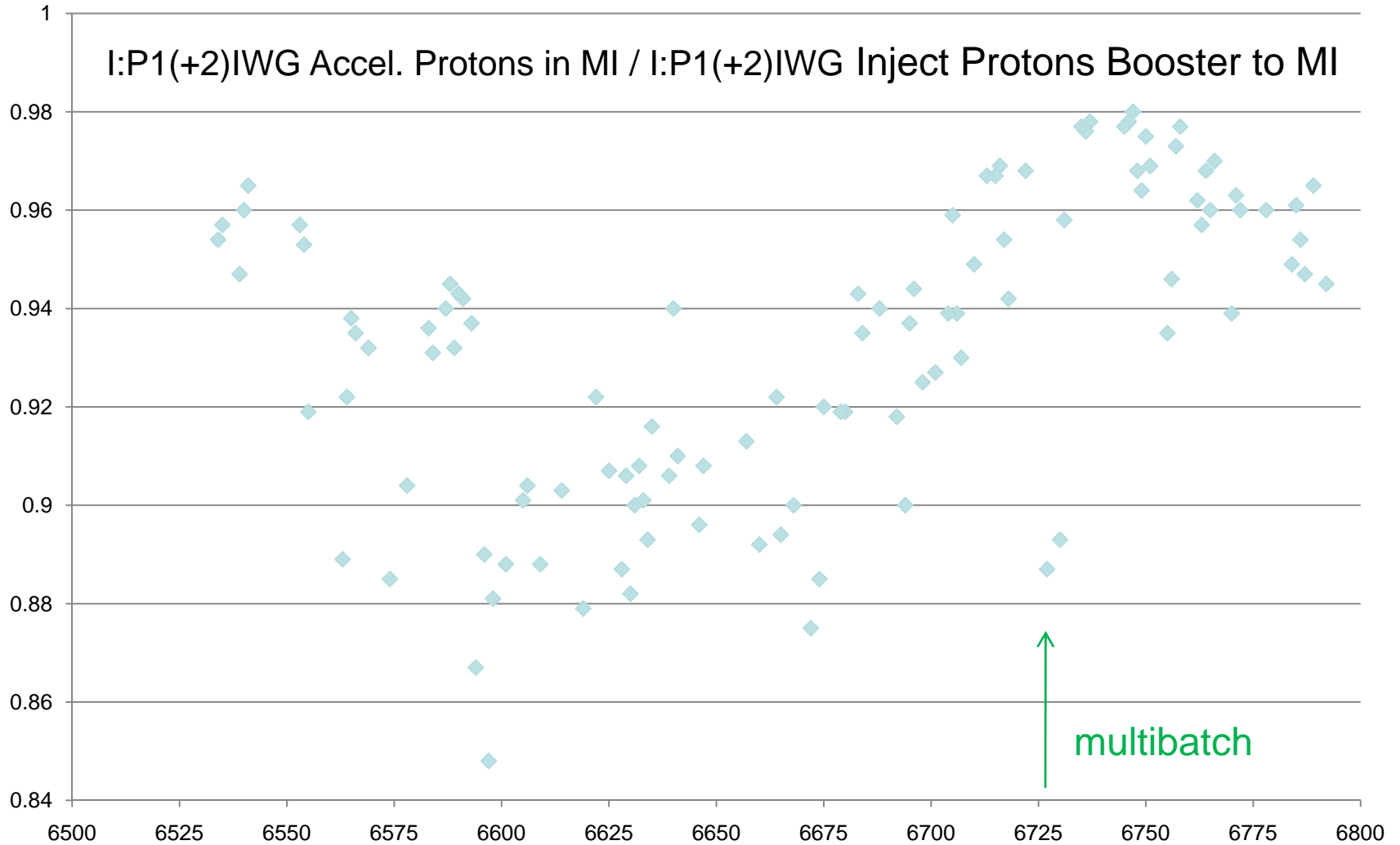
## # 143 p Booster to MI transfer eff vs store number





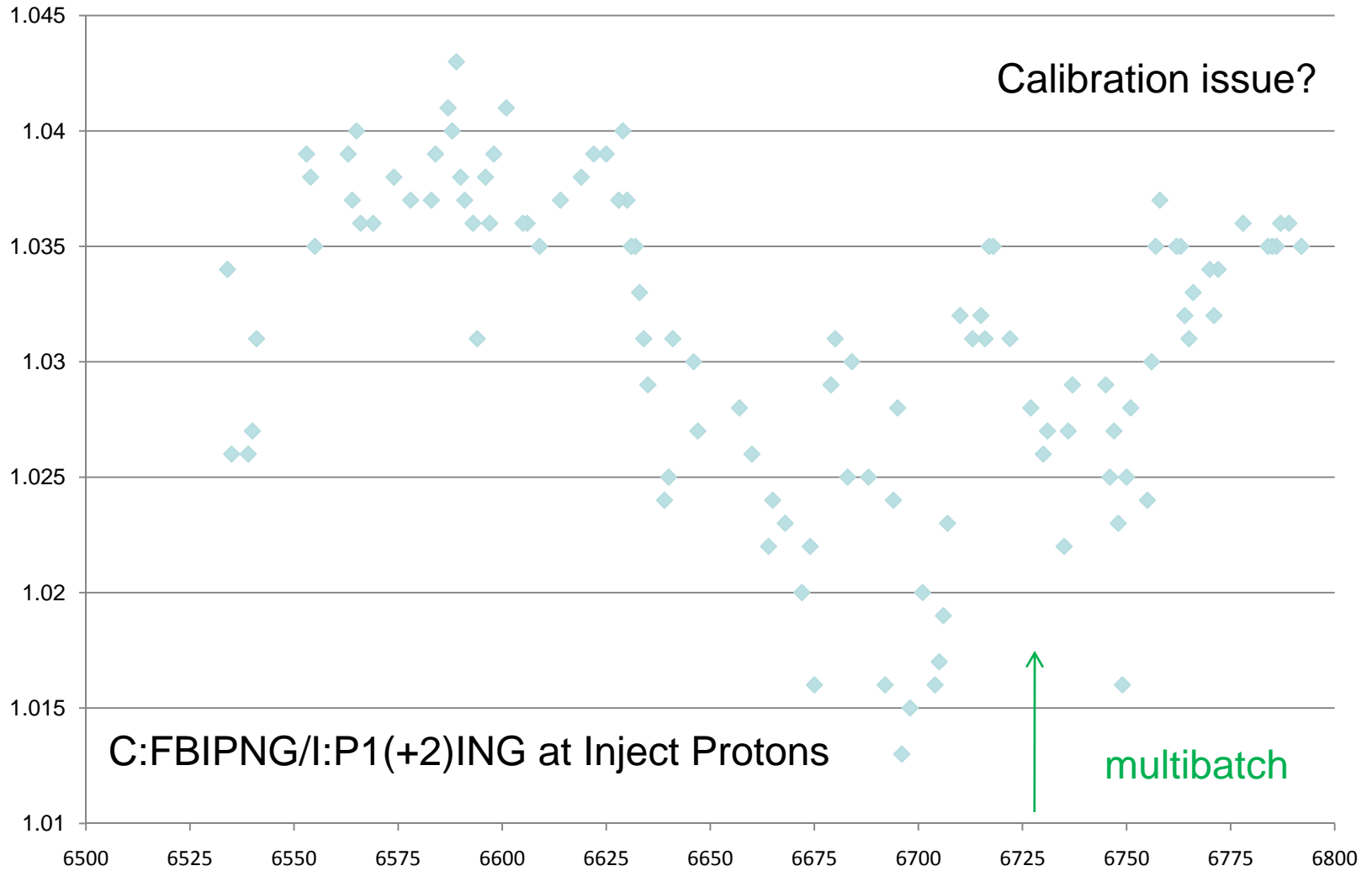
# Efficiencies

## # 144 p MI accel. eff vs store number



# Efficiencies

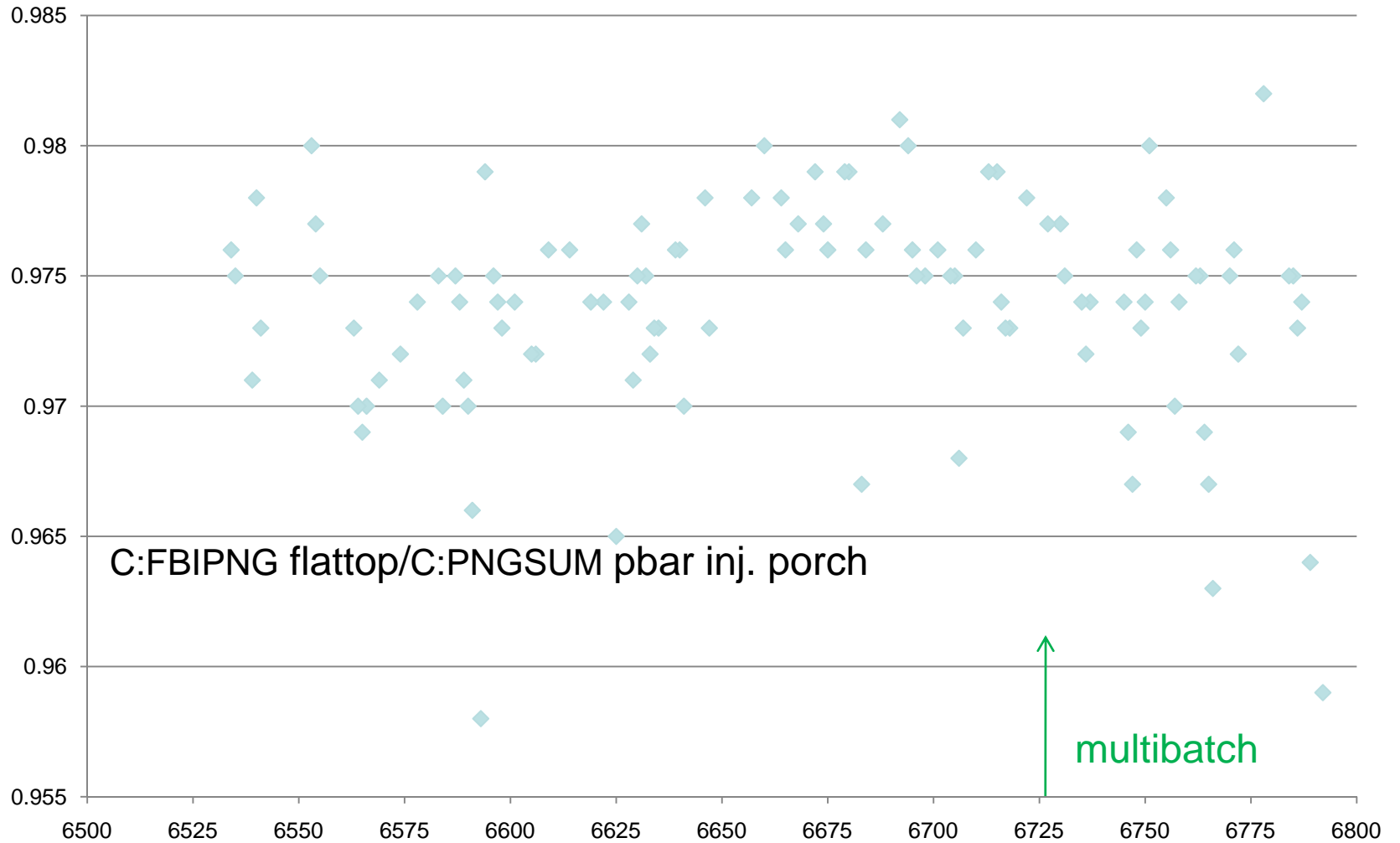
# 147 p Tev inj eff





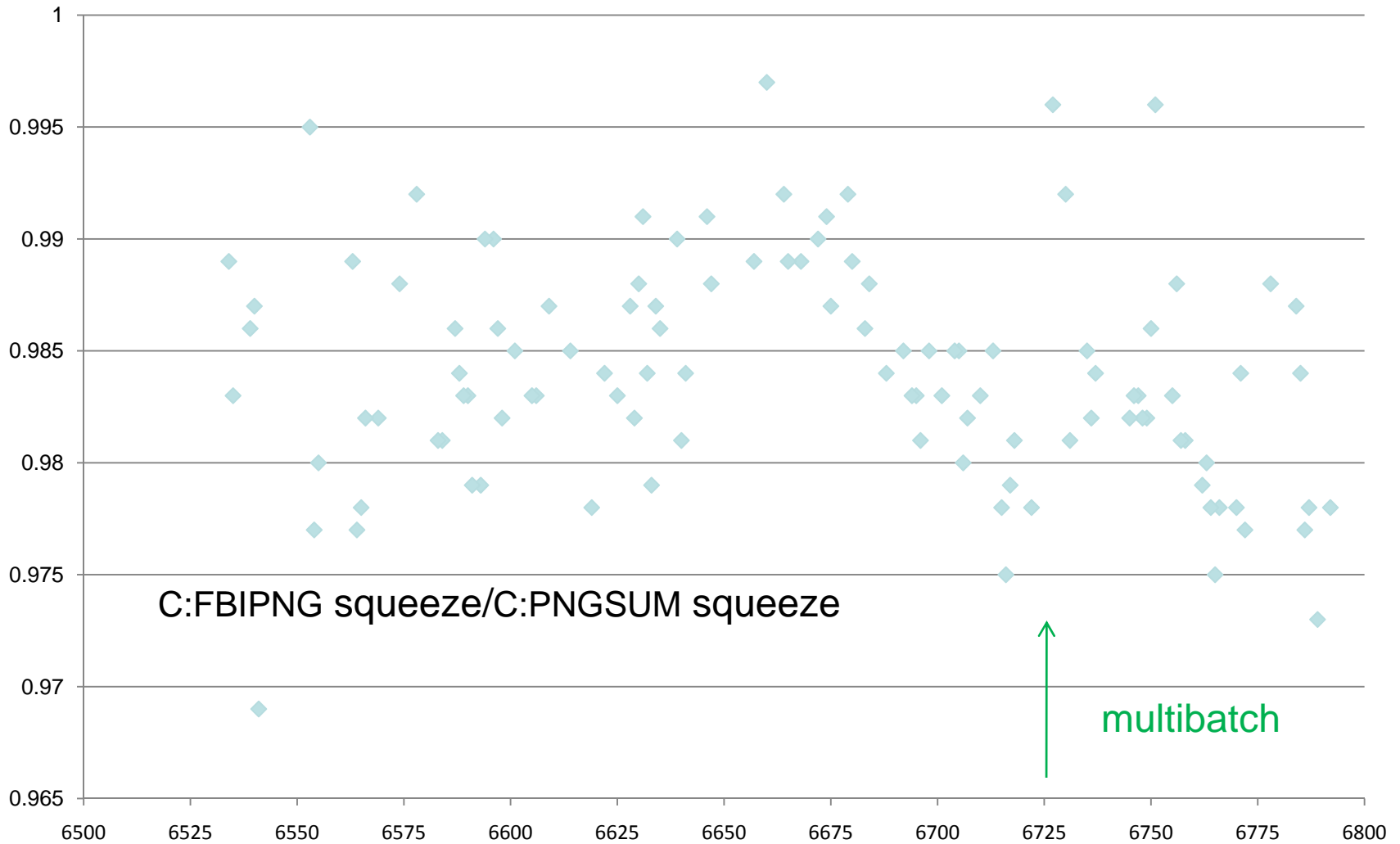
# Efficiencies

## # 149 p Tev accel. eff vs store number



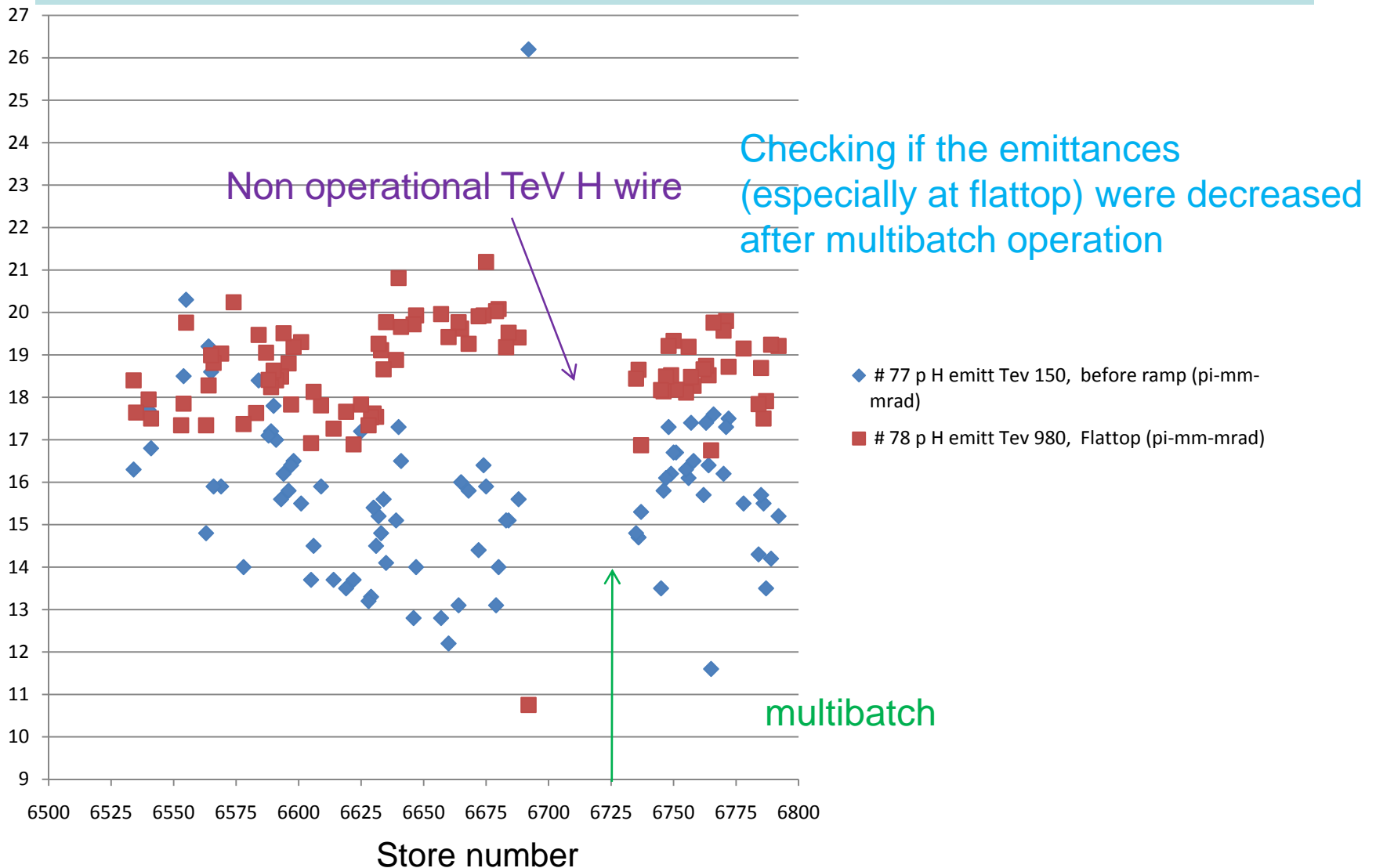
# Efficiencies

## # 150 p avg eff in Squeeze vs store number



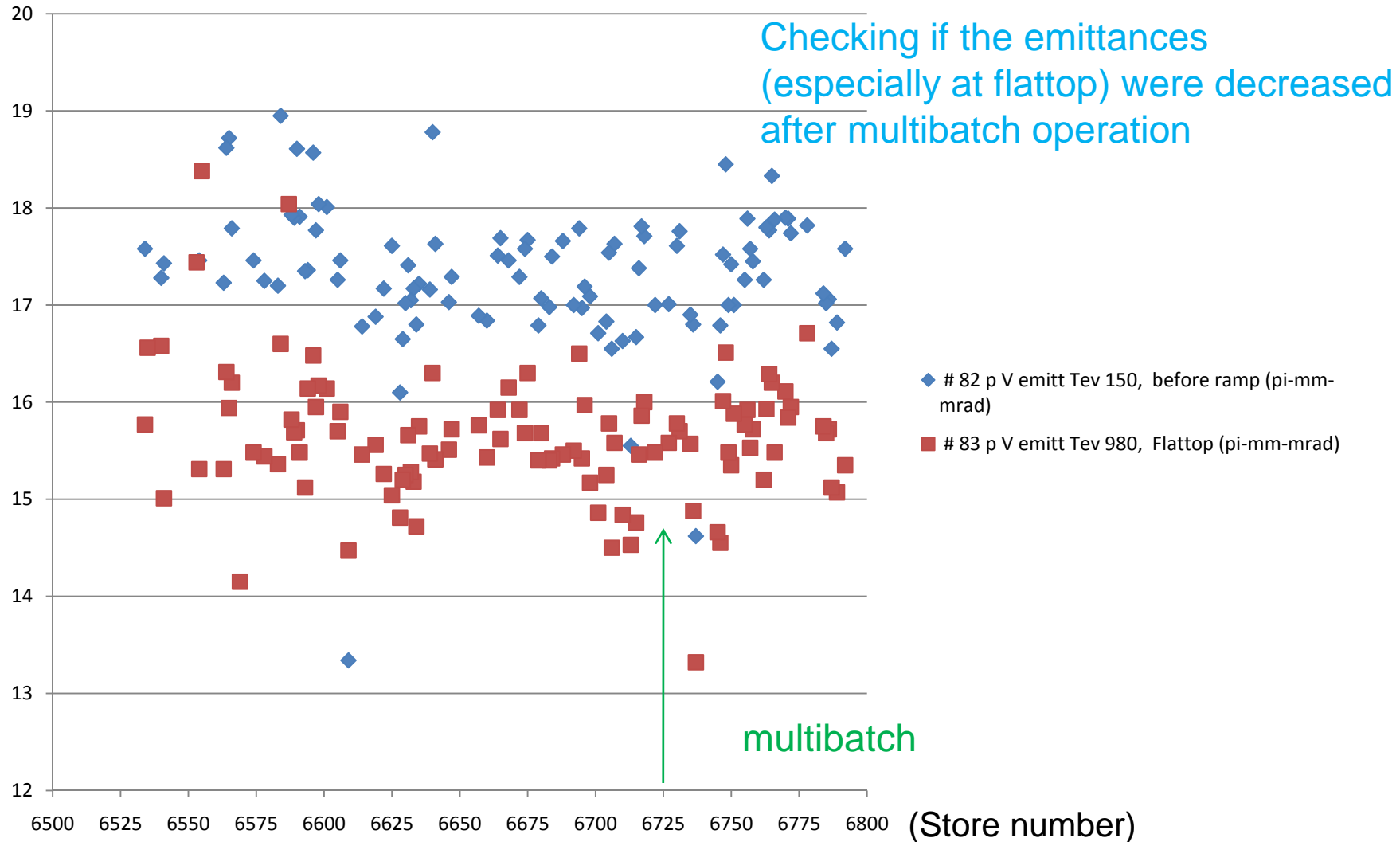
# Tevatron (150 GeV and flattop) proton horizontal emittance

Nov. 1, 2008 – Feb. 10, 2009



# Tevatron (150 GeV and flattop) proton vertical emittance

Nov. 1, 2008 – Feb. 10, 2009



# Conclusions

Stores between November 1, 2008 and February 10, 2009 have been examined in more detail for the proton MI coalescing efficiency and any possible correlations.

From around mid November, 2008 and on there is a slope downward to the proton MI coalescing efficiency.

There is a definite (and expected) anti-correlation with proton intensity but in the above period the stores lie on two different slopes, with the later stores mostly on the steeper slope.

There is a definite anti-correlation as well with the proton longitudinal emittance at 8 GeV.

There is an increase on proton 8 GeV longitudinal emittance



# Conclusions

for the past ~20 stores. The scatter in the 150 GeV longitudinal emittance is bigger, but there is an increase there as well.

It would be interesting to see recent emittance history as well for the Booster.

The proton bunch length at the Tevatron, at 150 GeV, before the helix was opened, has seen an increase as well for the same stores.

There is a step downward on horizontal flattop emittances after the fixing of the horizontal TeV wire. The wire became operational again after proton multibatch operation had started. Shot setup times though did not get decreased significantly till recently, so it is quite possible the decrease is independent of the duration of the shot setup. There is no obvious trend visible

# Conclusions

for the vertical flattop emittance during multibatch operation. More study is needed to check if the decrease in shot setup duration decreases vertical emittances as well.

Several additional proton efficiencies have been examined as well. Some of them exhibit interesting structure over the period of the three and a half months.