



# TPC Drift Velocity

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MIPP Software Meeting

February 8, 2007



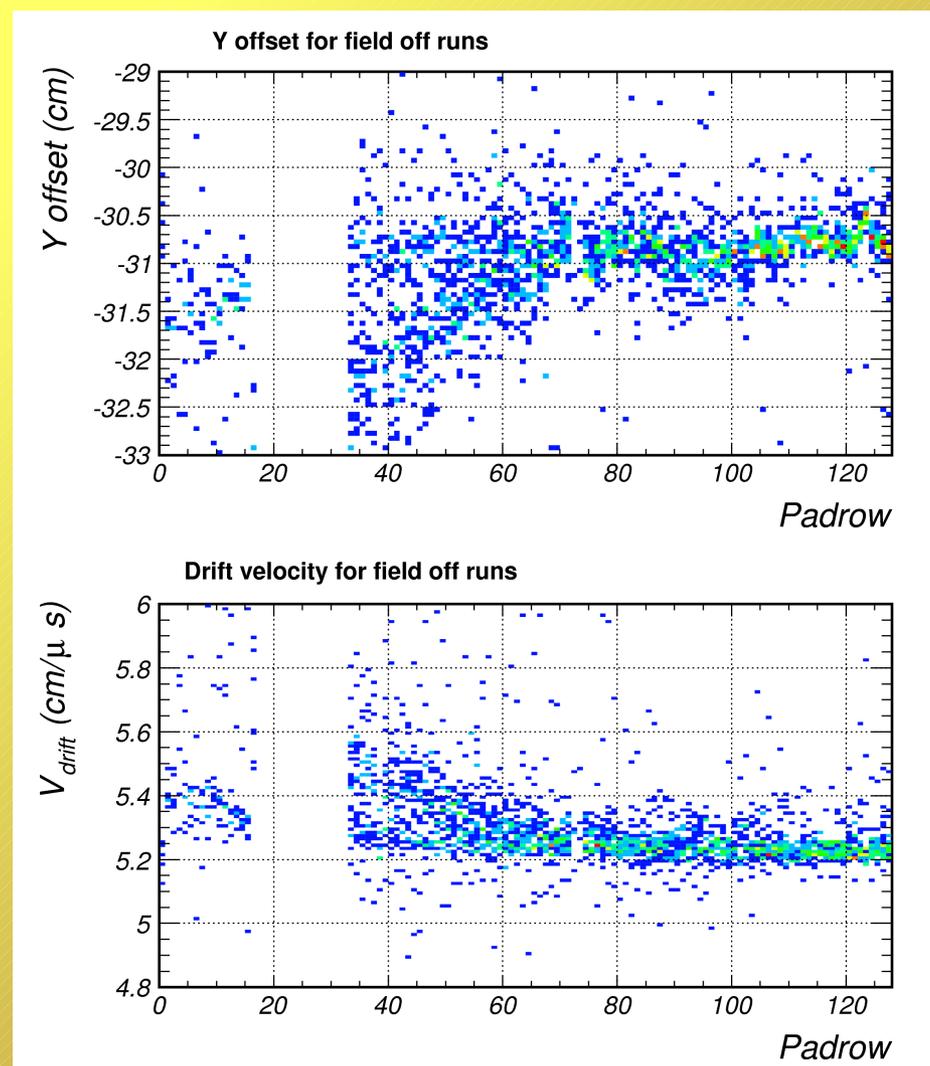
# Fitting for velocity

- If  $y$  and  $t$  are to be binned, then you have 2 choices of binning, and don't know which one is right
- The alternative is to compute the line that minimizes 2D distance from each point  $(y,t)$  to line  $y = y_0 + vt$



# Field-off results

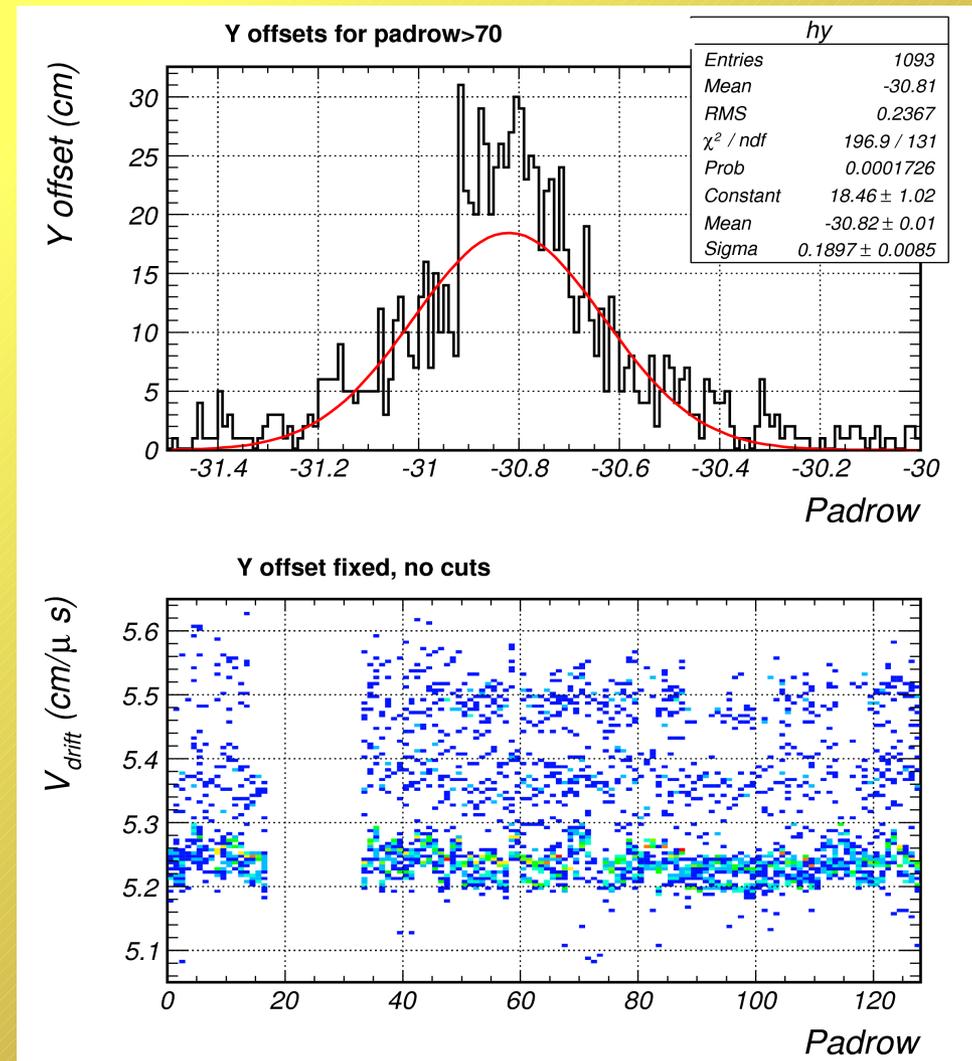
- Above padrow 70, everything looks good
- Below 70, the fitter tries to make things better by bringing  $y$  down and  $v$  up
  - Lever arm is very small
- Y-jitter is noticeable in the  $y$  offset plot





# Field-off results (cont.)

- Unlike drift velocity, there is no reason for y-offset to fluctuate, so it must be fixed
  - $-30.82 \pm 0.01$  cm is the best guess
- Drift velocity with fixed y offset no longer correlates with padrow





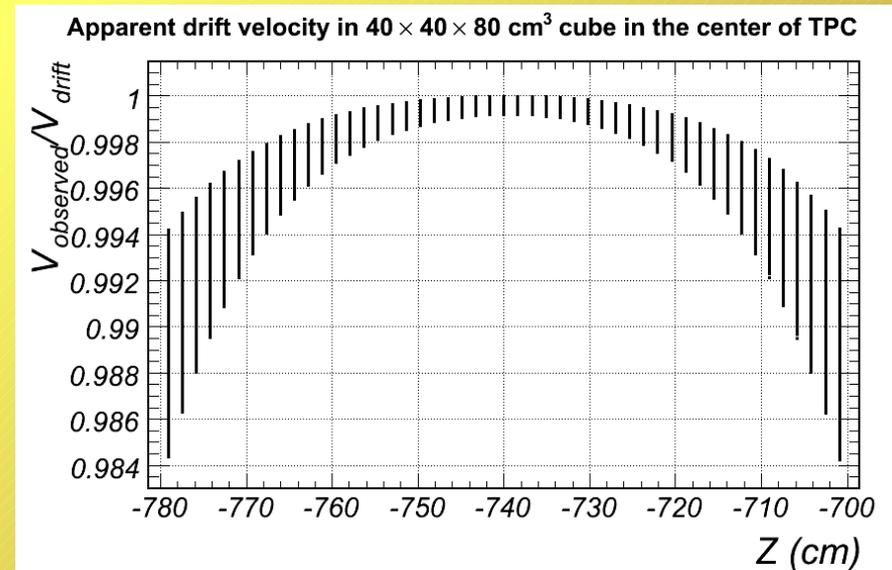
# Implications of fixed $y$ -offset

- I say that  $y$ -offset can be fixed because
  - Trigger timing was stable to  $\sim 3$  ns
  - Survey measurements of TPC  $y$  agree to 0.08 cm
- What if we get it wrong by 3 mm
  - Drift velocity will be wrong by  $\sim 1\%$
  - We should be able to see it from  $Y$ -residual correlations
  - We won't find out unless we run through a lot of data
  - TPCResCor may make the problem go away (good&bad)



# Turning the field on

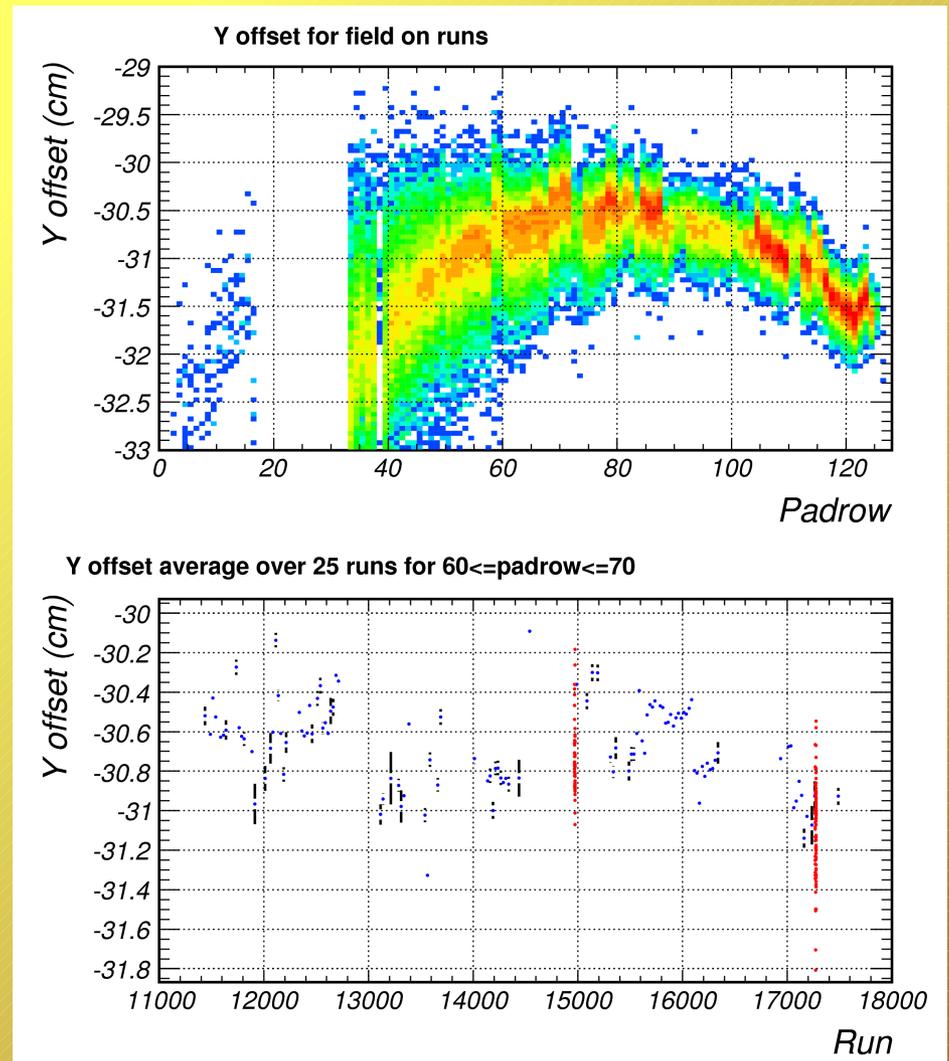
- We know that the drift velocity needs to be measured in the center of the TPC where the field is uniform
- Based on our knowledge of electron drift, ~8 padrows around the center will bias us by less than 0.1%





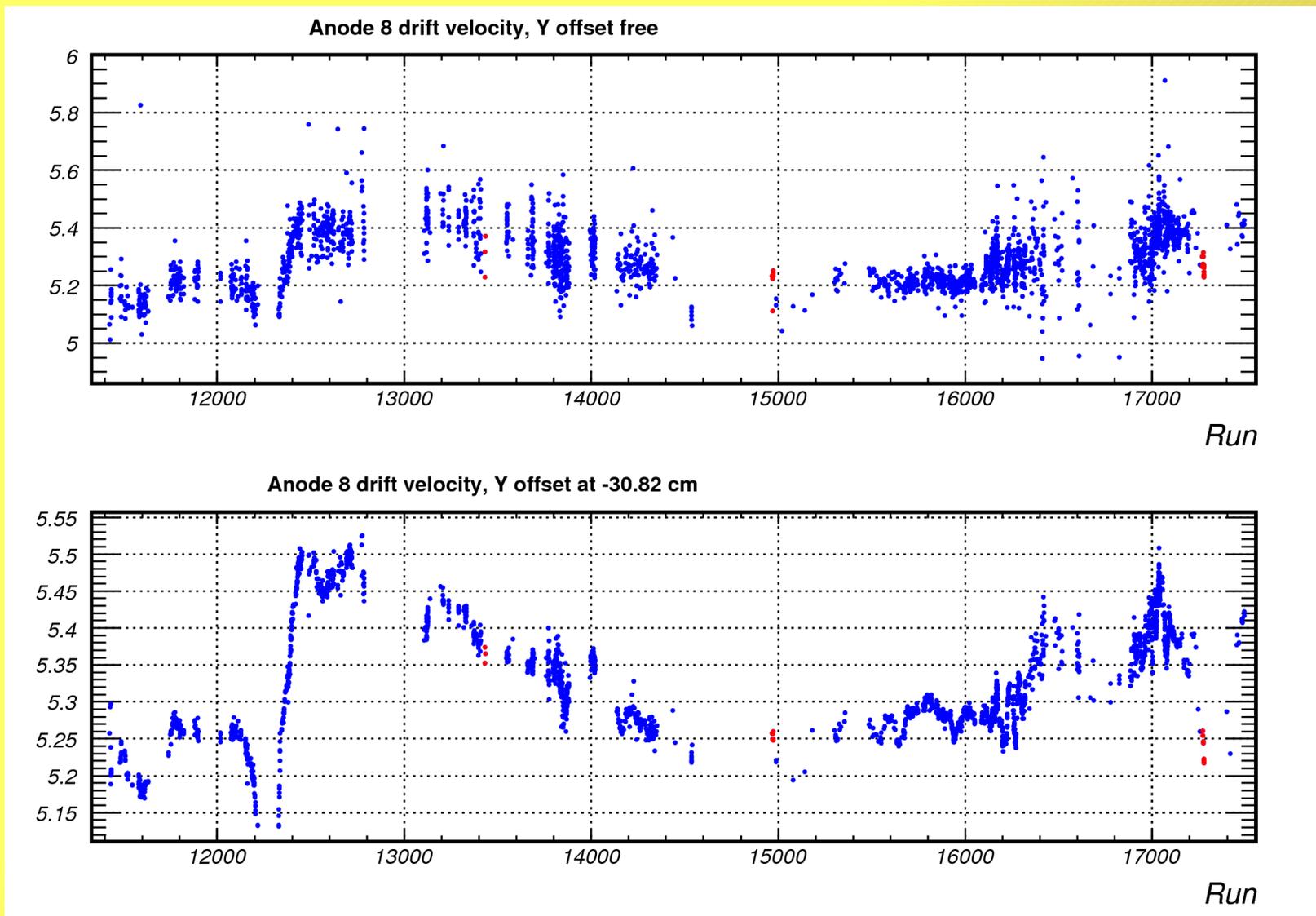
# Field-on Y offset

- The field on y offset is asymmetric because of different lever arm up front and in the back
- The red dots are field off runs, which do seem to vary and agree with field on runs
- When did we move the TPC?





# Field-on Drift Velocity





# What now?

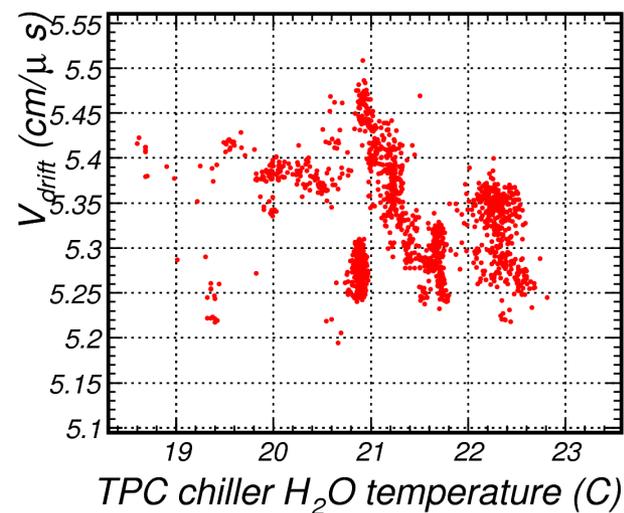
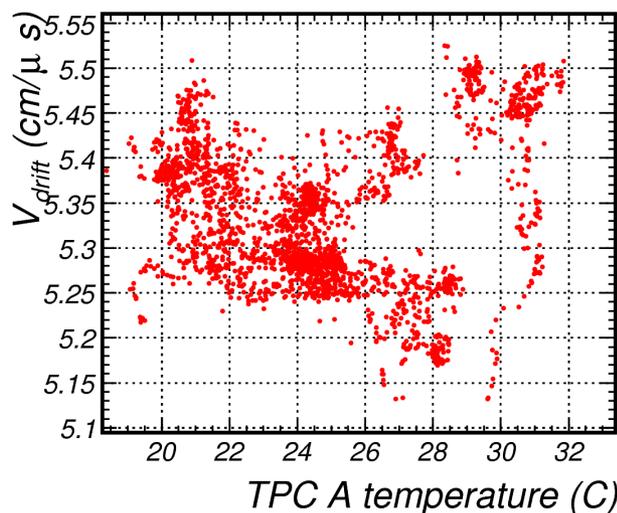
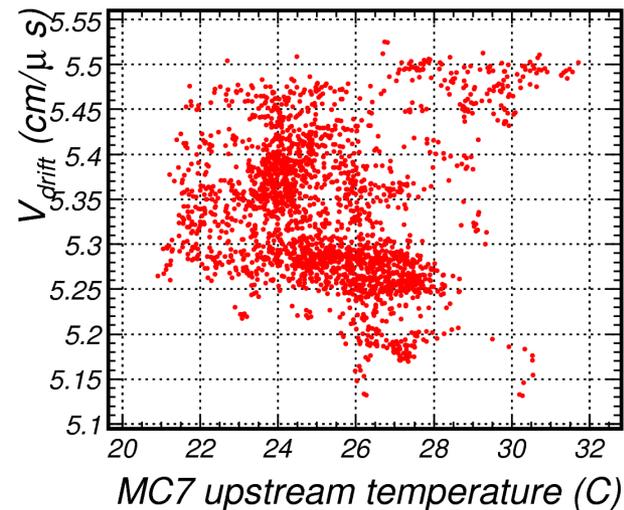
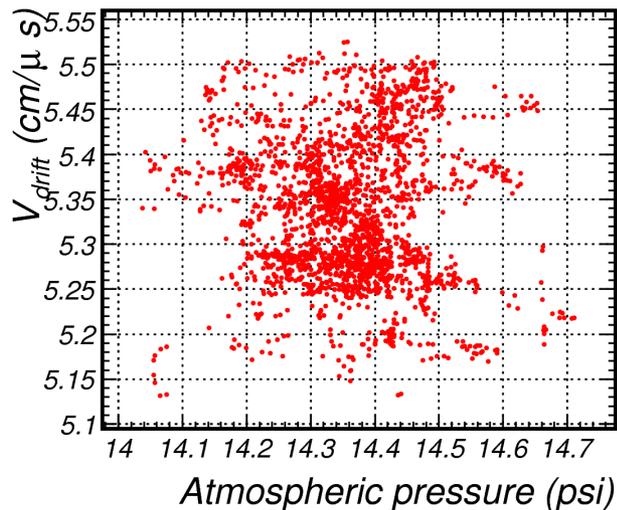
- With  $y$  offset fixed, the variation looks very real
  - The range is about 7%
- This means that we cannot use a single value of drift velocity for all runs
  - At the very least groups of runs should be combined

Let's look at correlations with the atmosphere...



# Correlations?

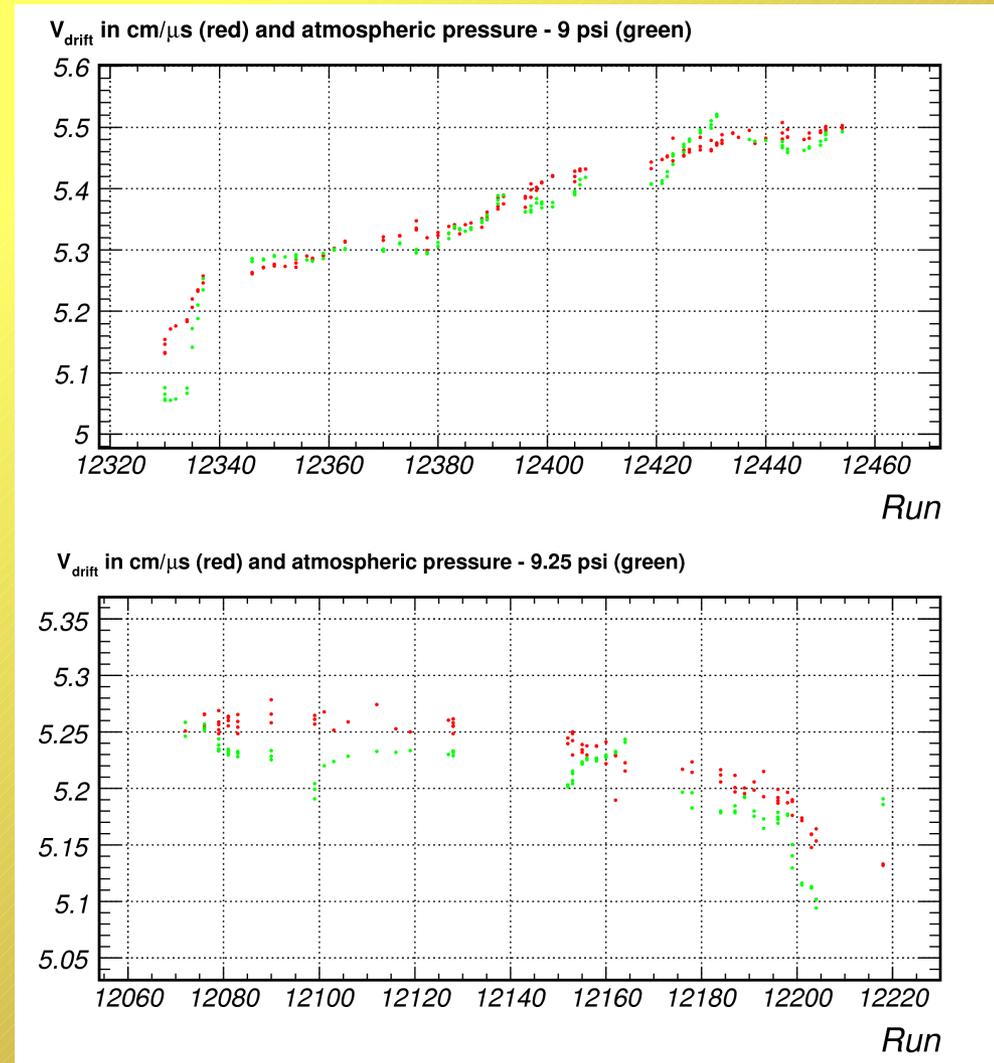
Note: not all variables are available for all runs





# Coincidences?

- I stumbled upon these two run ranges by accident, but they indicate that we do correlate with atmospheric conditions, except the function is much more complex than  $V_{drift} \sim T/P$  as one would naively expect





# Plans

- This talk is made with  $\sim 3/4$  of pass 2 subruns
- Let pass 2 finish and look at drift velocity dependence with everything
  - Compute  $V$  using statistics of anodes 7+8
  - NuMI runs are in a “valley” -- they don't have good data
- Y offset: Leave it? Make it run dependent?
  - I vote for leaving it at -30.82 cm. This is within 3 mm of all y offset averages

We have 8 periods with different targets in the beamline.

These are VtxConFit z positions for 3+ track vertices, chambers only.

Black histogram:

$$\sqrt{(x^2+y^2)} < 1.5$$

Red: everything else.

Can you find the VETO counter?

