3 sigma = reproducible?

I think the answer is "No".

Define sigma as (standard deviation)/(sample size)^0.5, both the green and pink samples in the following figure give 3-sigma detections (mean/sigma > 3), yet both of the means are very different from the mean of a much bigger sample (blue), which contains the two smaller ones. The bigger sample gives only 2-sigma detection. The smaller samples gave 3-sigma simply because the noise move the means to much larger values.

distributions of q within a 10"✕10" square at ~ (38,37)

70 cycles
10 cycles
10 cycles