





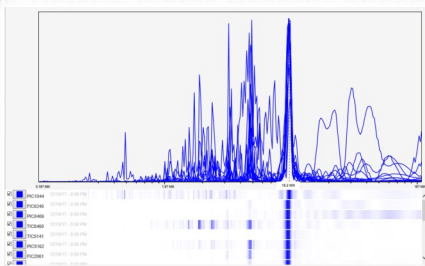


## Food & Beverage: Pinpointing the Root-Cause

This should be obvious: If there are a number of possible causes for an issue, then there is no one cause for which a corrective action can be both planned and executed. Not knowing what to fix hurts production. Fortunately PlantESP made it easy to isolate the sticky valve that was ultimately the root-cause and to quantify the significance of the issue. When the valve regulating the temperature of a critical and slow extraction process was afflicted by Stiction the resulting variability reverberated in the performance of numerous downstream processes. Engineering staff witnessed widespread change in control loop performance but they were unclear on the source of the oscillations as numerous options seemed likely. After running a series of PlantESP's standard reports the team focused on Valve Stiction Likelihood which showed a sizeable uptick in Stiction probability for the extraction loop. Other advanced forensic tools within PlantESP confirmed the report's findings and provided engineers with a clear root-cause to address. From many possibilities, one cause. For busy engineers tasked with maintaining optimal plant production, that's a significant difference maker.

### Valve Stiction Likelihood

Loop Name	Previous Stiction Likelihood	Current Stiction Likelihood	Percent Change	Previous Average Stiction Amount	Current Average Stiction Amount
TIC121 (Extract Temperature)	36.68 %	49.45 %	34.81 % 	6.18 %	6.93 %
PIC040 (Cate Sep.)	22.00 %	49.33 %	124.22 % 	7.52 %	7.63 %
TIC121 ( )	53.47 %	38.88 %	-27.29 % 	4.80 %	5.26 %
FIC2 (810 to )	21.89 %	31.63 %	44.48 % 	0.78 %	0.76 %
PIC (HP Steam)	39.22 %	31.32 %	-20.14 % 	2.99 %	4.76 %
PIC27 (pressure)	0.00 %	25.98 %	100.00 % 	0.00 %	0.49 %



Standard reports like Valve Stiction Likelihood keep process engineers aware of changes—whether subtle or significant—in the overall performance of the many, many PID control loops tasked with regulating production. Advanced forensic tools like Power Spectrum allow users to easily identify other controllers that share frequencies linked to the oscillatory behavior resulting from Stiction.

#### What was the cause?

PlantESP revealed that the temperature loop suffered from approximately 7% Stiction which caused the Controller Output to swing 14%. The sharp shifts in valve position were seen to occur every 16 minutes as the controller was unable to execute more subtle changes due to the existence of 'sticky friction'. Upon further investigation engineering staff learned that the valve had been repacked recently as part of routine maintenance with no change to the tuning parameters. As a result poor control resulting from Stiction had been exacerbated by tuning parameters that no longer reflected the process' dynamic behavior.

#### How did PlantESP find it?

Valve Stiction Likelihood is one of the many standard reports that capture changes in control loop performance. With one click the report hyperlinked to additional details of the flavor extraction temperature loop, providing visual confirmation of a 34.81% increase in the likelihood of Stiction. The detailed trend exhibited the saw-toothed pattern in behavior that occurs when any valve or other final control element is afflicted with Stiction. Each sudden shift in the valve's position was shown to occur every 16.2 minutes. Using PlantESP's Power Spectrum utility it became obvious that the valve's behavior resulted in similar oscillations that affected numerous downstream loops.