

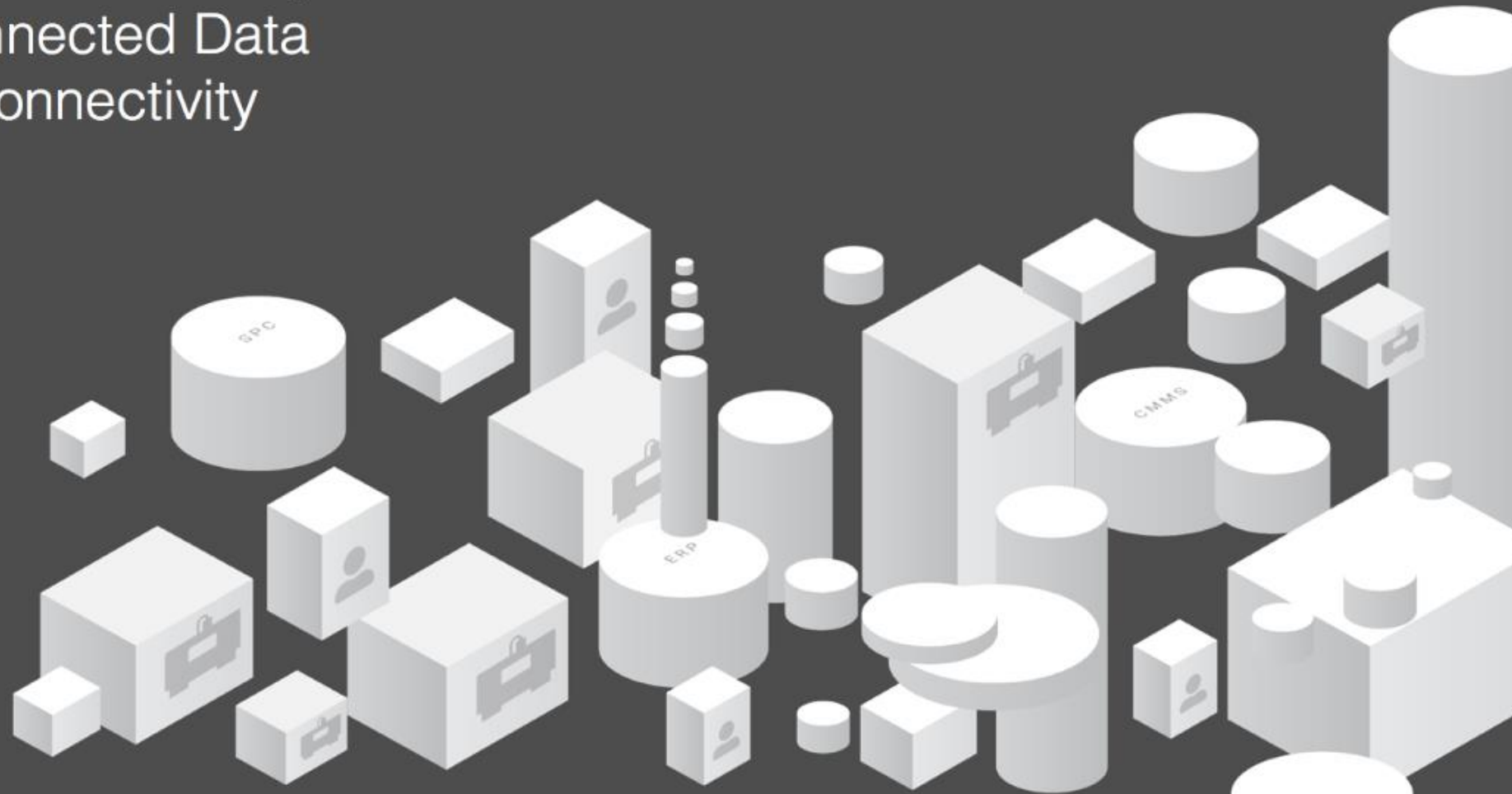


Manufacturing Analytics, Simplified

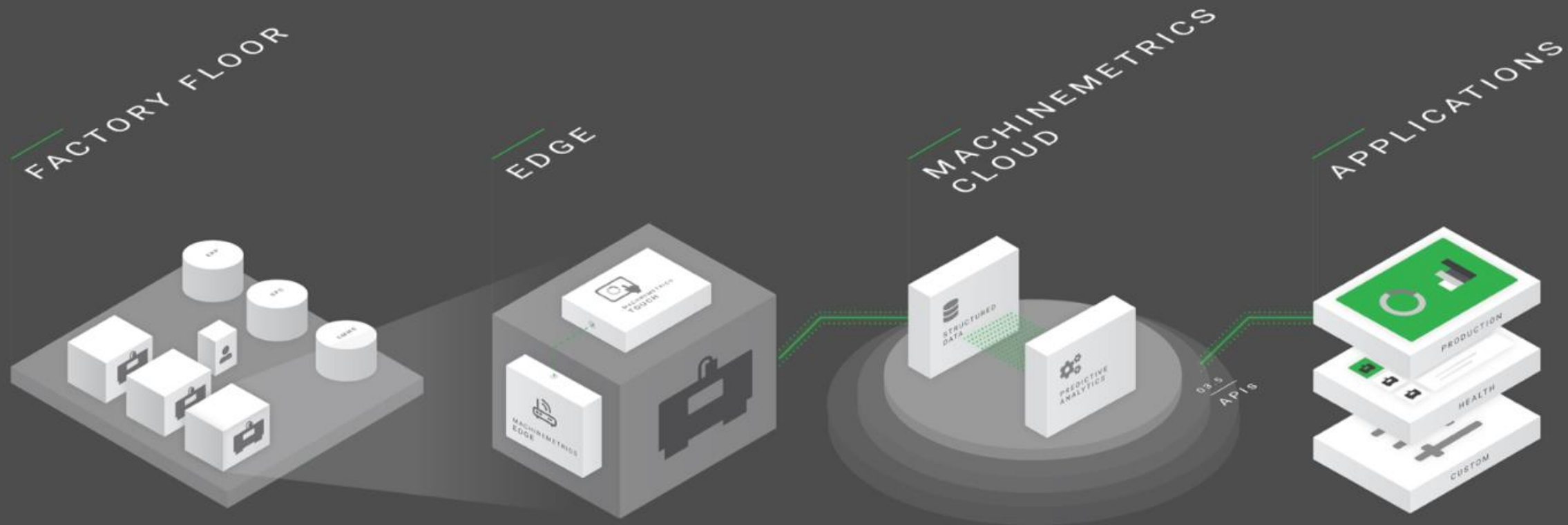
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# The Problem

Lack of Production Visibility  
Silos of Disconnected Data  
No Machine Connectivity

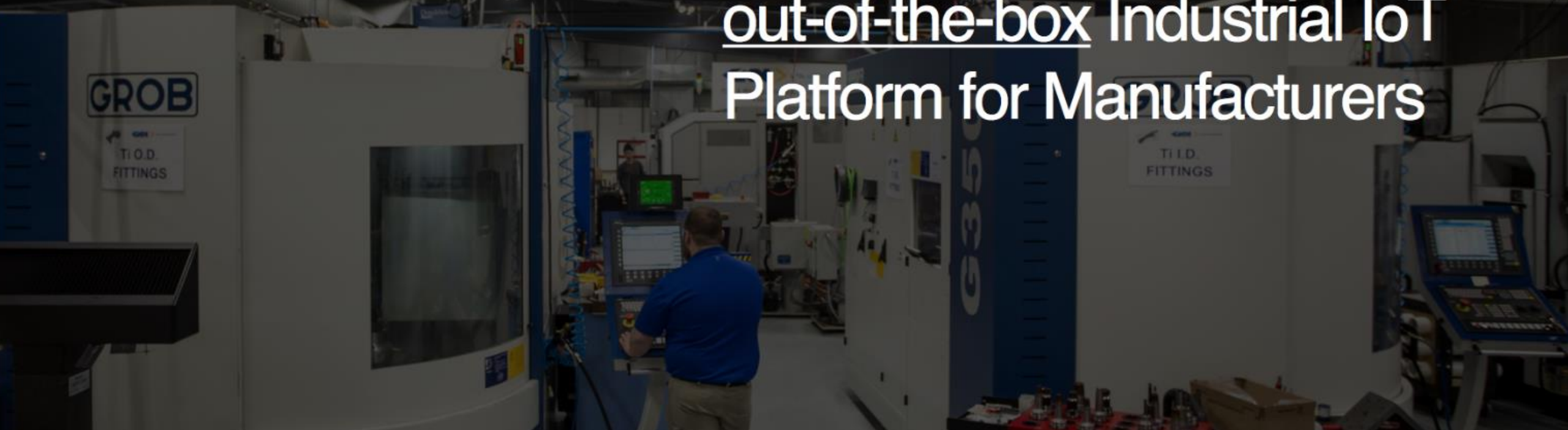


# The Solution



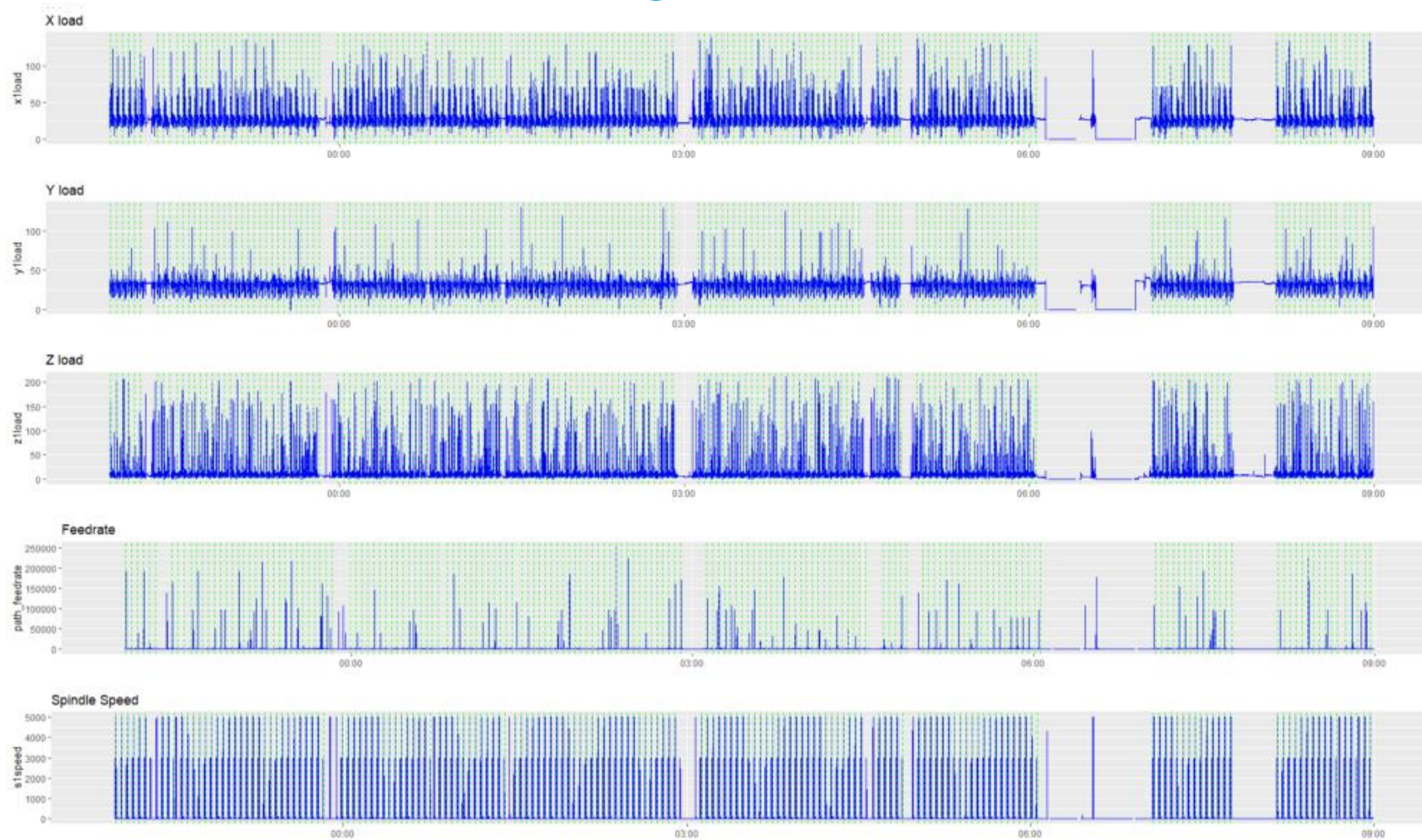


MachineMetrics is filling this gap with the first vertically integrated out-of-the-box Industrial IoT Platform for Manufacturers



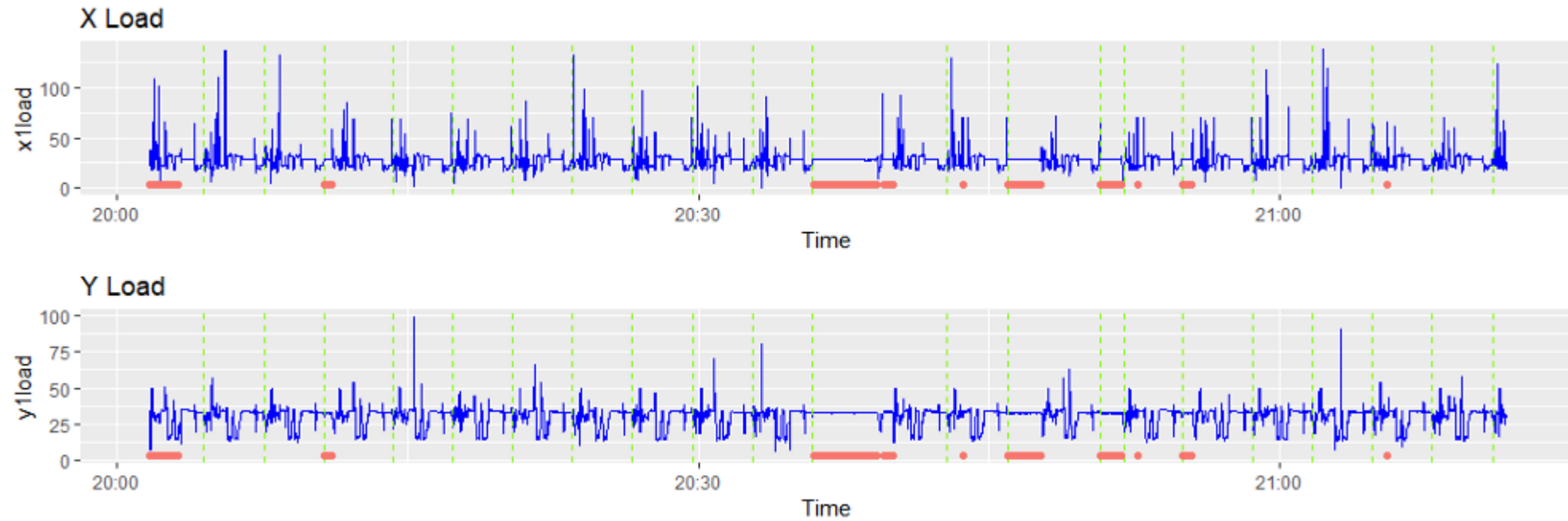


# Case Study: Applying Anomaly Detection on Control Data



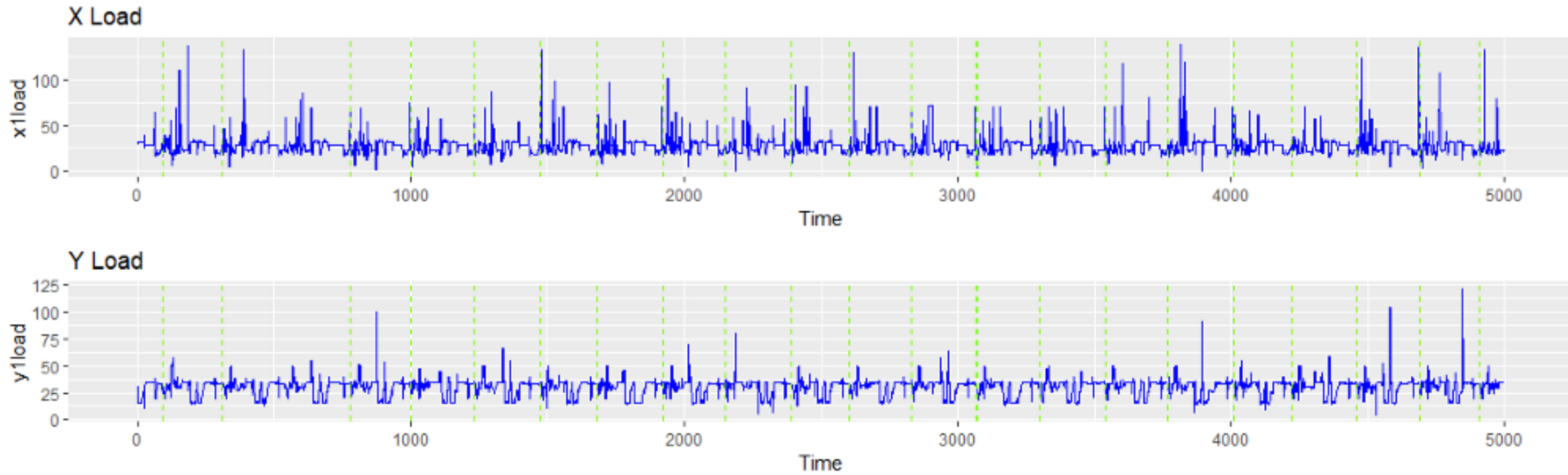
Add Part Counts

# Case Study: Applying Anomaly Detection on Control Data



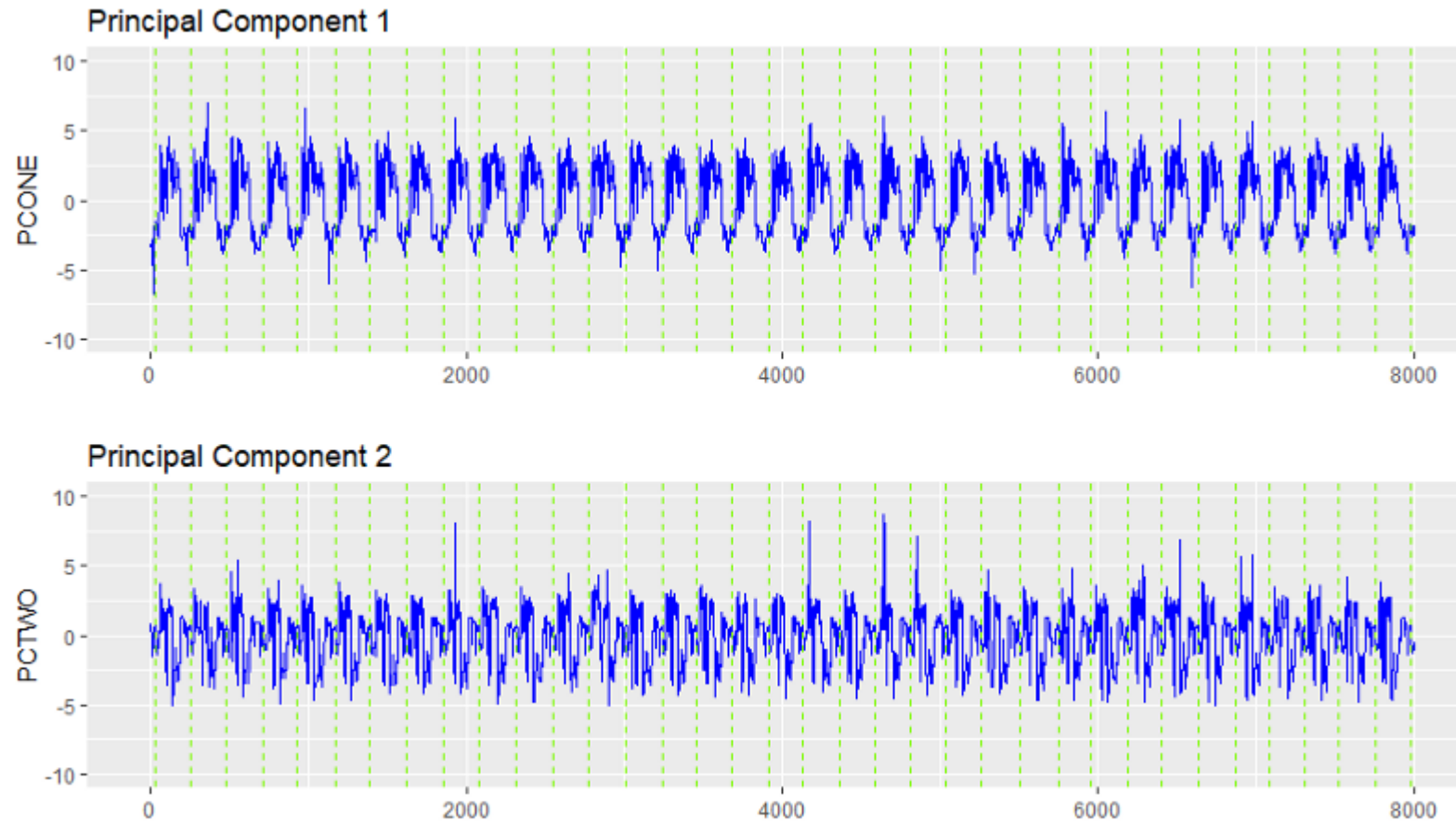
Remove periods of inactivity

# Case Study: Applying Anomaly Detection on Control Data



Obtain cleaned signal

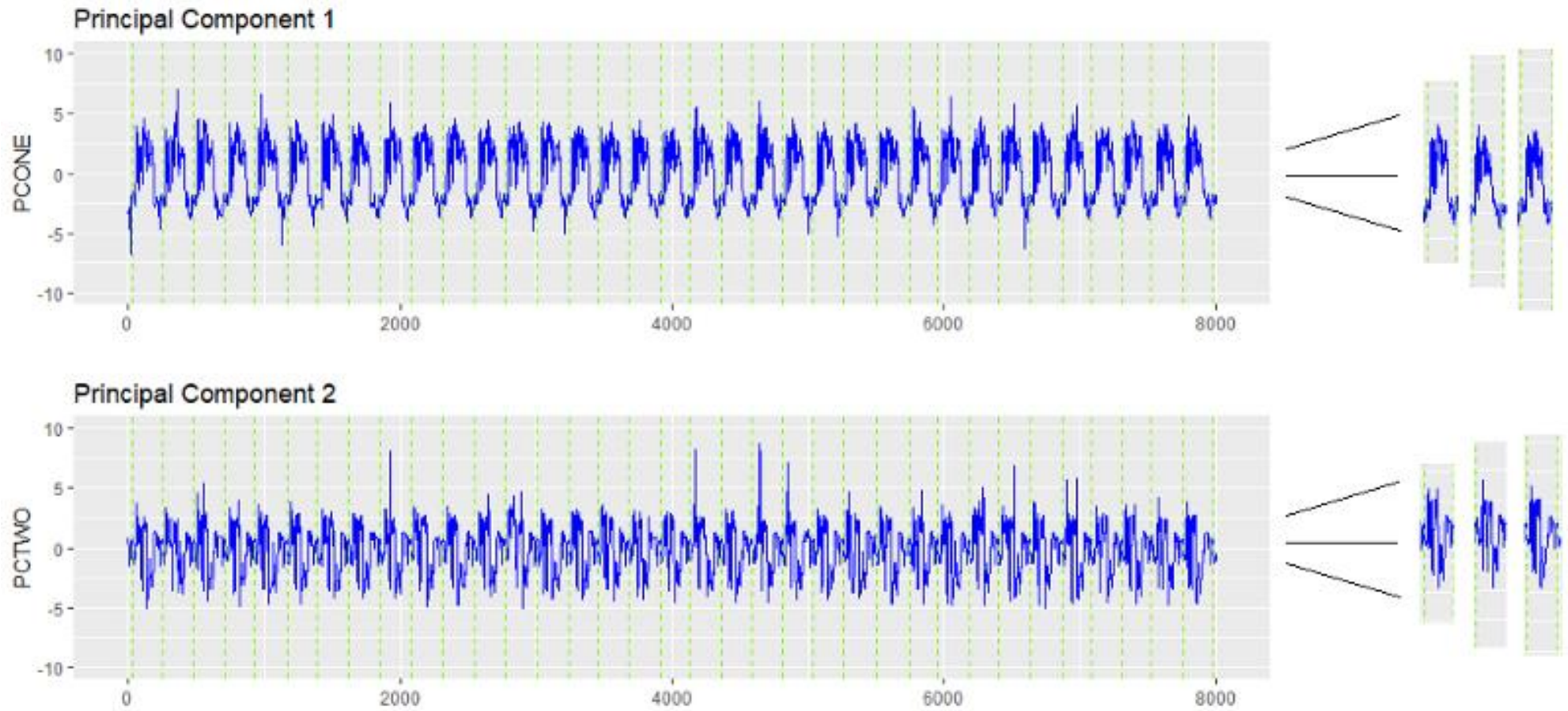
# Case Study: Applying Anomaly Detection on Control Data



Apply Principal Components Analysis (PCA)

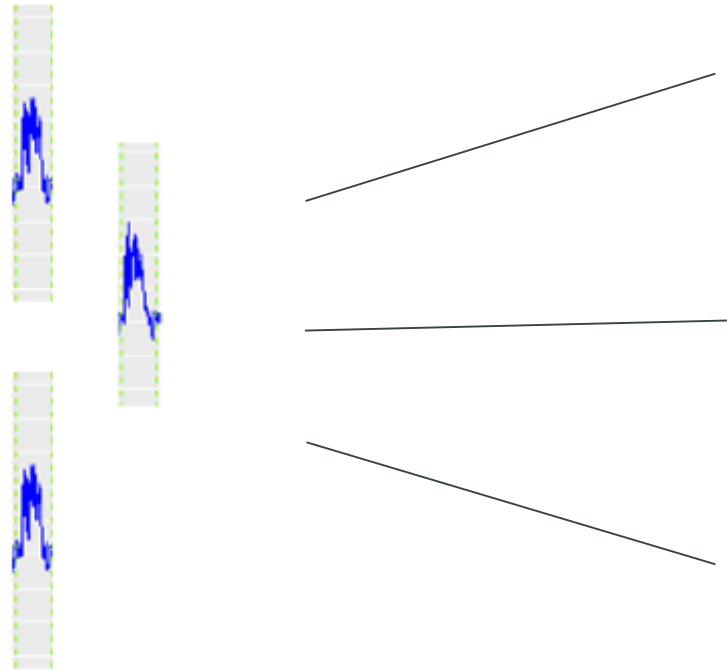


# Case Study: Applying Anomaly Detection on Control Data

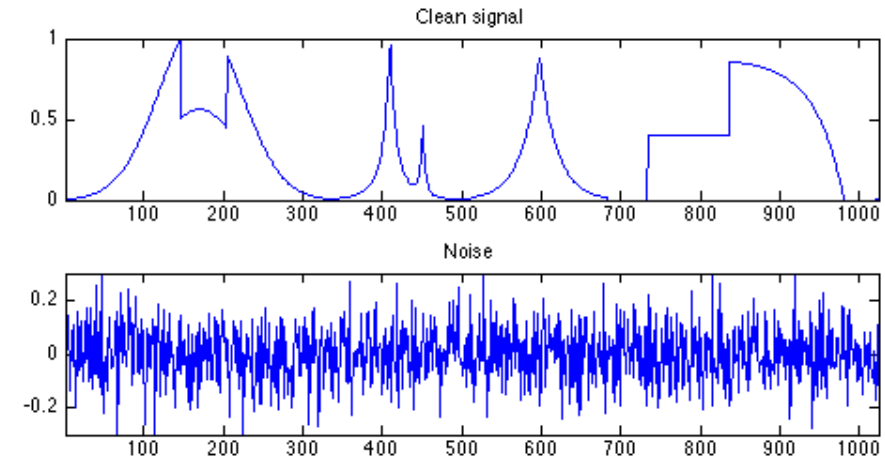


Apply PCA/Pull out Part Signatures

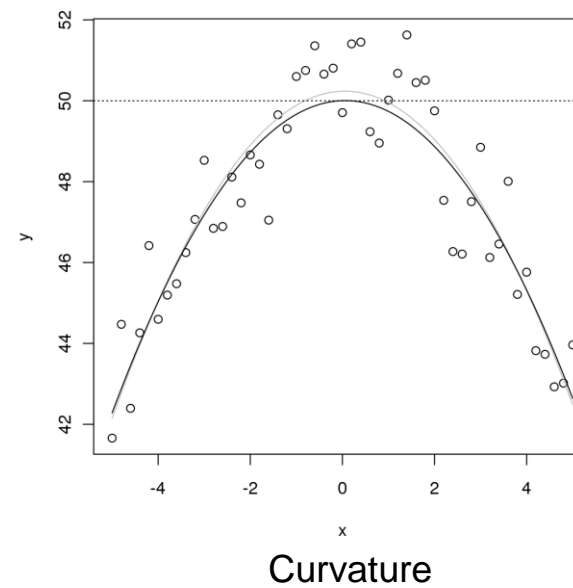
# Case Study: Applying Anomaly Detection on Control Data



Determine Time Series Features of each Part Signature



Entropy

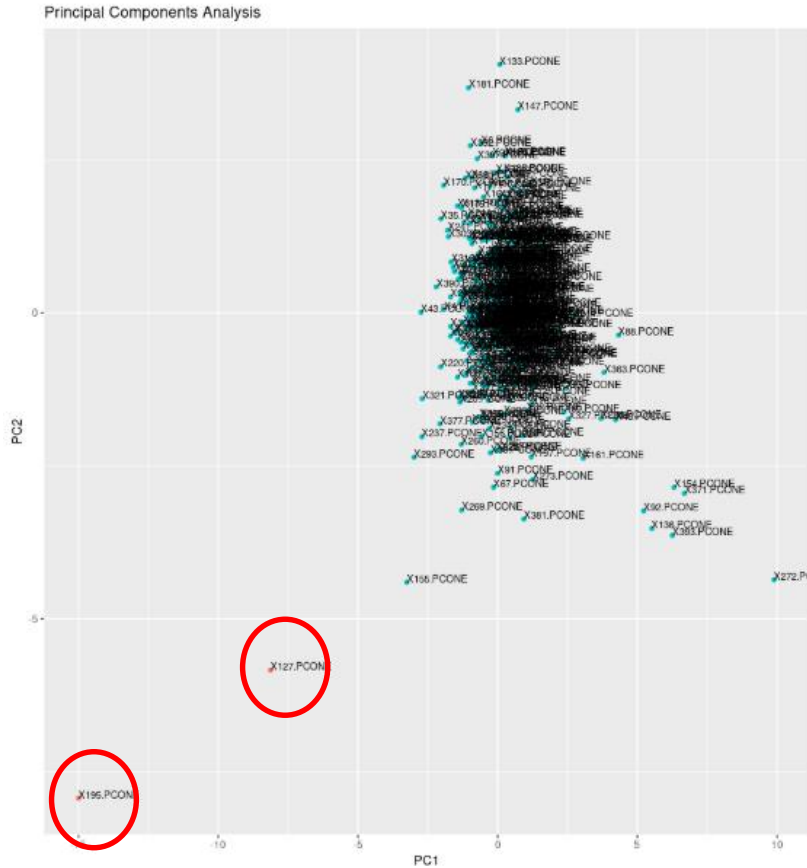


Others:  
Autocorrelation  
Maximum change of mean  
Flat spots  
...

# Case Study: Applying Anomaly Detection on Control Data

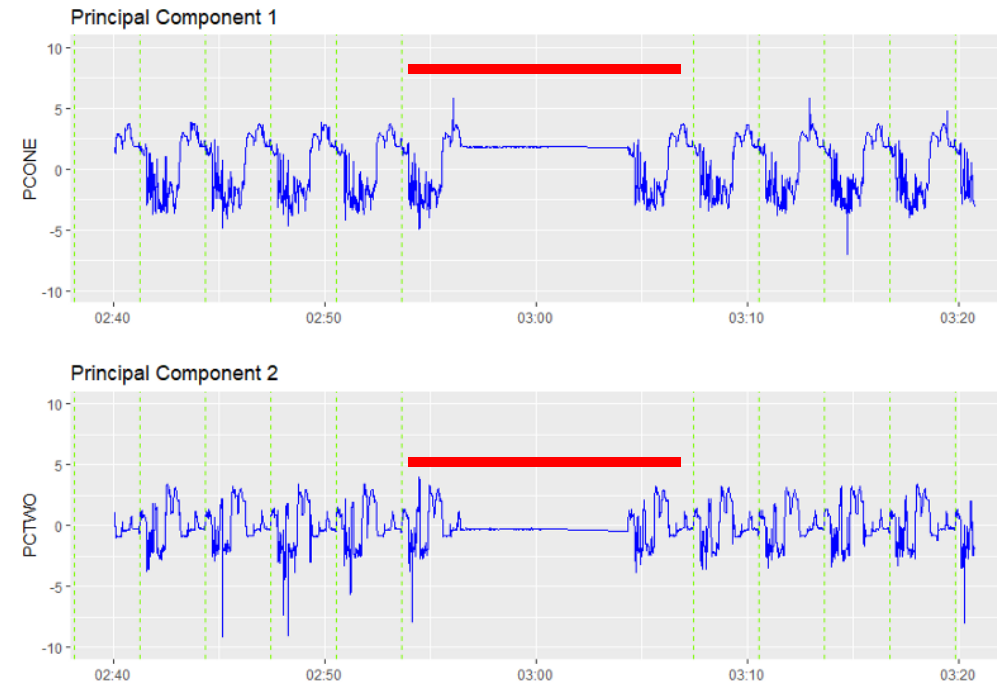
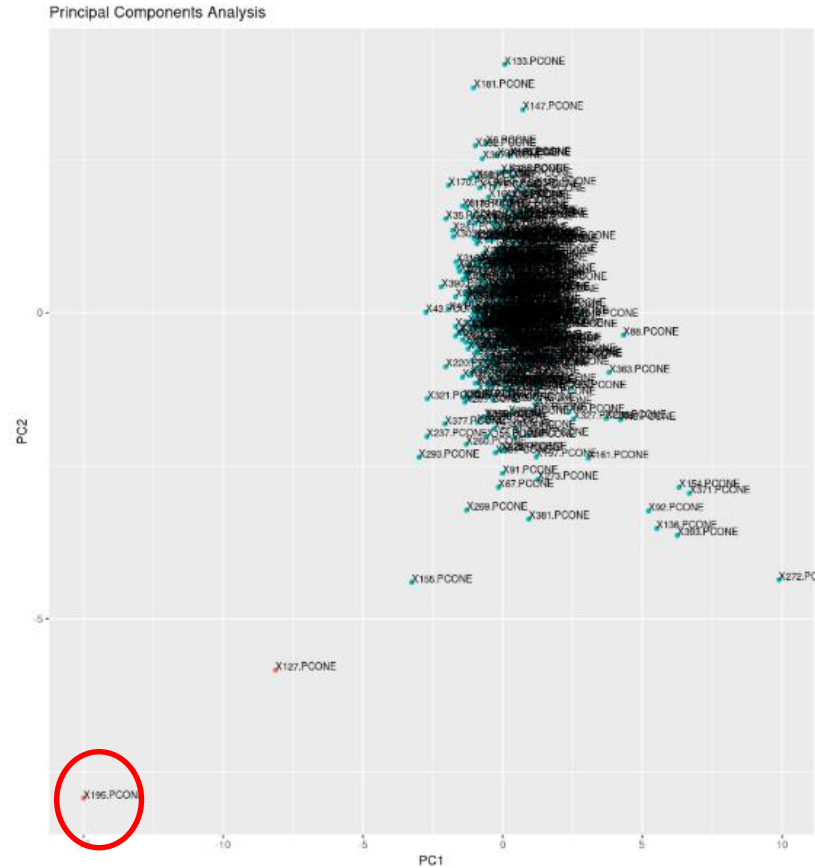
entropy	ACF1	lshift	vchange	fspots	curvature	spikiness	name
0.5791507	0.9541931	1.389647	0.6904390	17	9.5747627	1.490440e-06	X2.PCONE
0.5845898	0.9557680	1.381937	0.6170758	13	10.7799720	9.267802e-07	X3.PCONE
0.5619560	0.9616677	1.508141	0.7500458	18	9.6537984	7.909221e-07	X4.PCONE
0.5937982	0.9581793	1.523913	0.6597335	16	10.0559587	1.908598e-06	X5.PCONE
0.5775437	0.9653088	1.494504	0.7770098	19	10.5869821	1.339215e-06	X6.PCONE
0.6125979	0.9387312	1.605756	0.7763621	23	9.0914199	2.076235e-06	X7.PCONE
0.6002039	0.9507429	1.489281	0.7380794	14	9.4734195	1.766317e-06	X8.PCONE
0.5931458	0.9512399	1.512260	0.8086808	15	11.1473992	1.373689e-06	X9.PCONE
0.5874797	0.9499952	1.389640	0.7259521	19	9.9868468	1.487491e-06	X10.PCONE
0.6009636	0.9608396	1.561277	0.7500236	16	11.1157820	1.837510e-06	X11.PCONE
0.5807226	0.9498116	1.632102	0.7401149	16	9.4350794	1.388574e-06	X12.PCONE
0.5841583	0.9555851	1.543700	0.7869859	18	9.5975107	1.996555e-06	X13.PCONE
0.5940686	0.9487545	1.308387	0.5884752	14	9.6741774	2.015899e-06	X14.PCONE

Obtain Time Series Features for each Part Signature



Apply PCA on Time Series Features and Find Outliers with DBSCAN

# Results

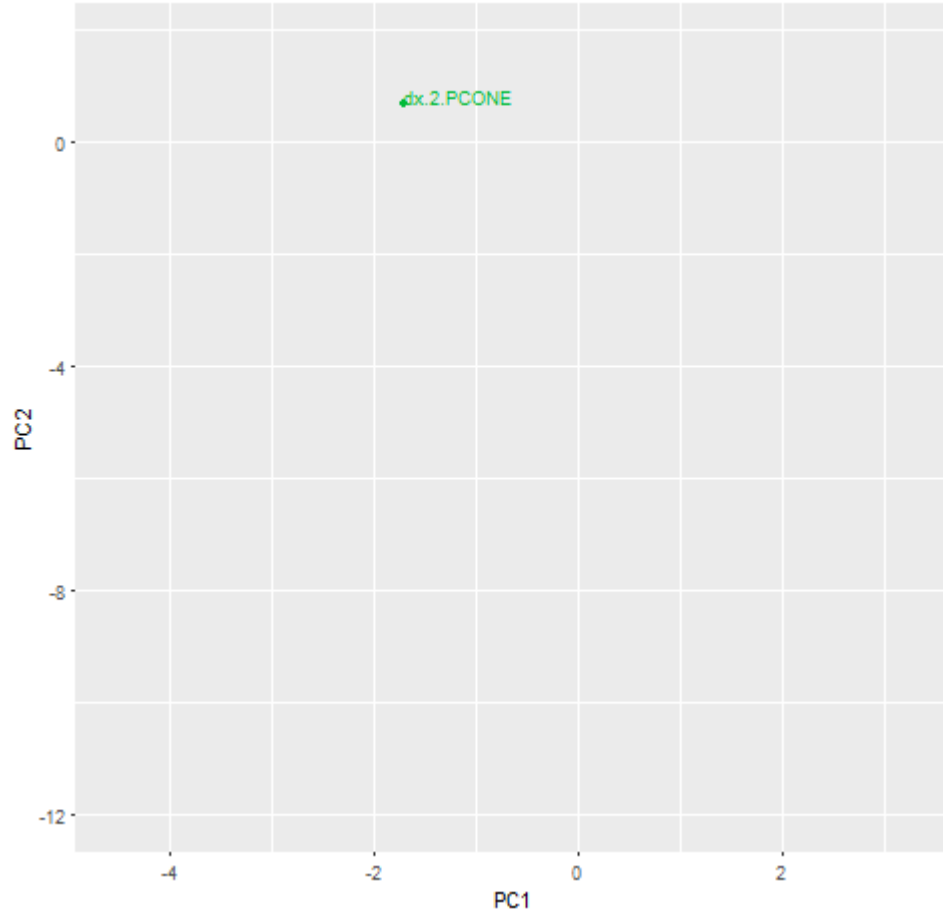


Machine Stall

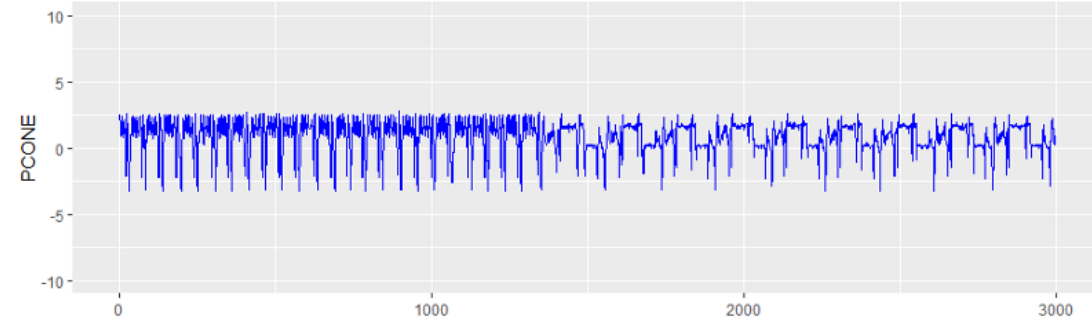
Apply PCA on Time Series Features and Find Outliers with DBSCAN

# Alternative Use Case

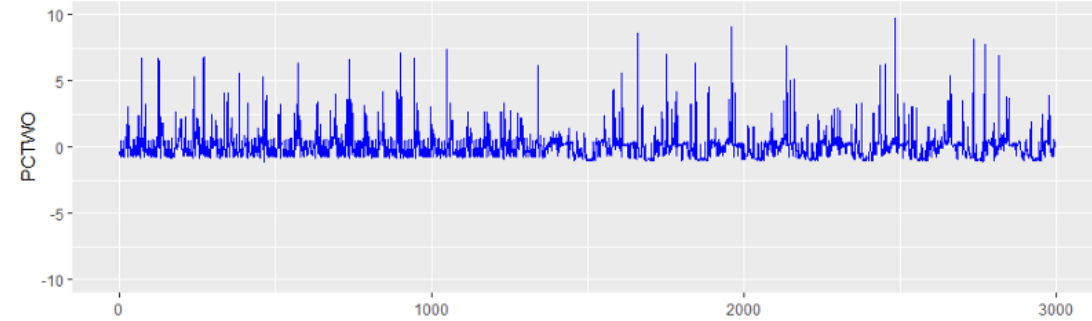
Part 2



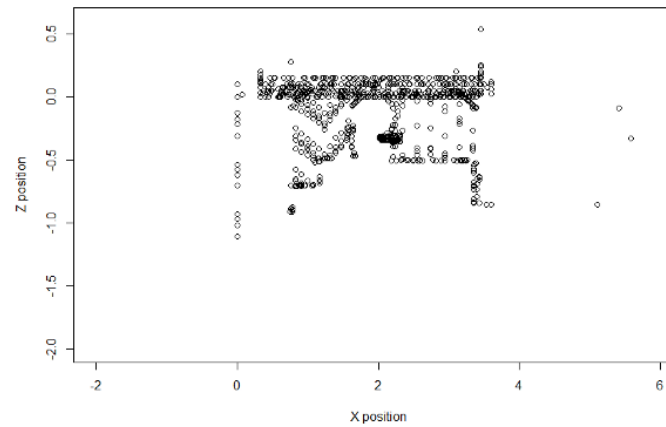
Principal Component 1



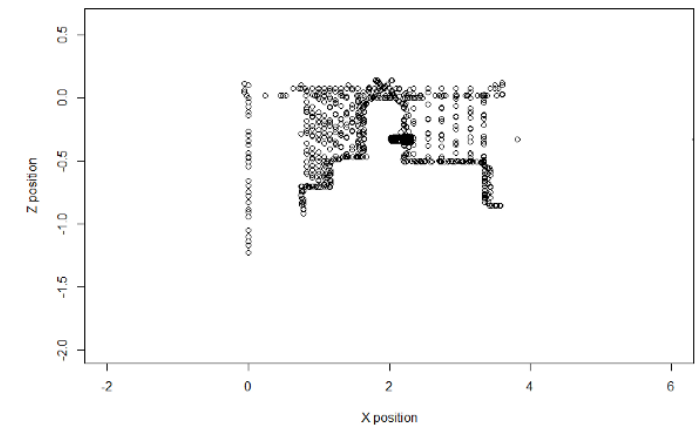
Principal Component 2



Part Type 1

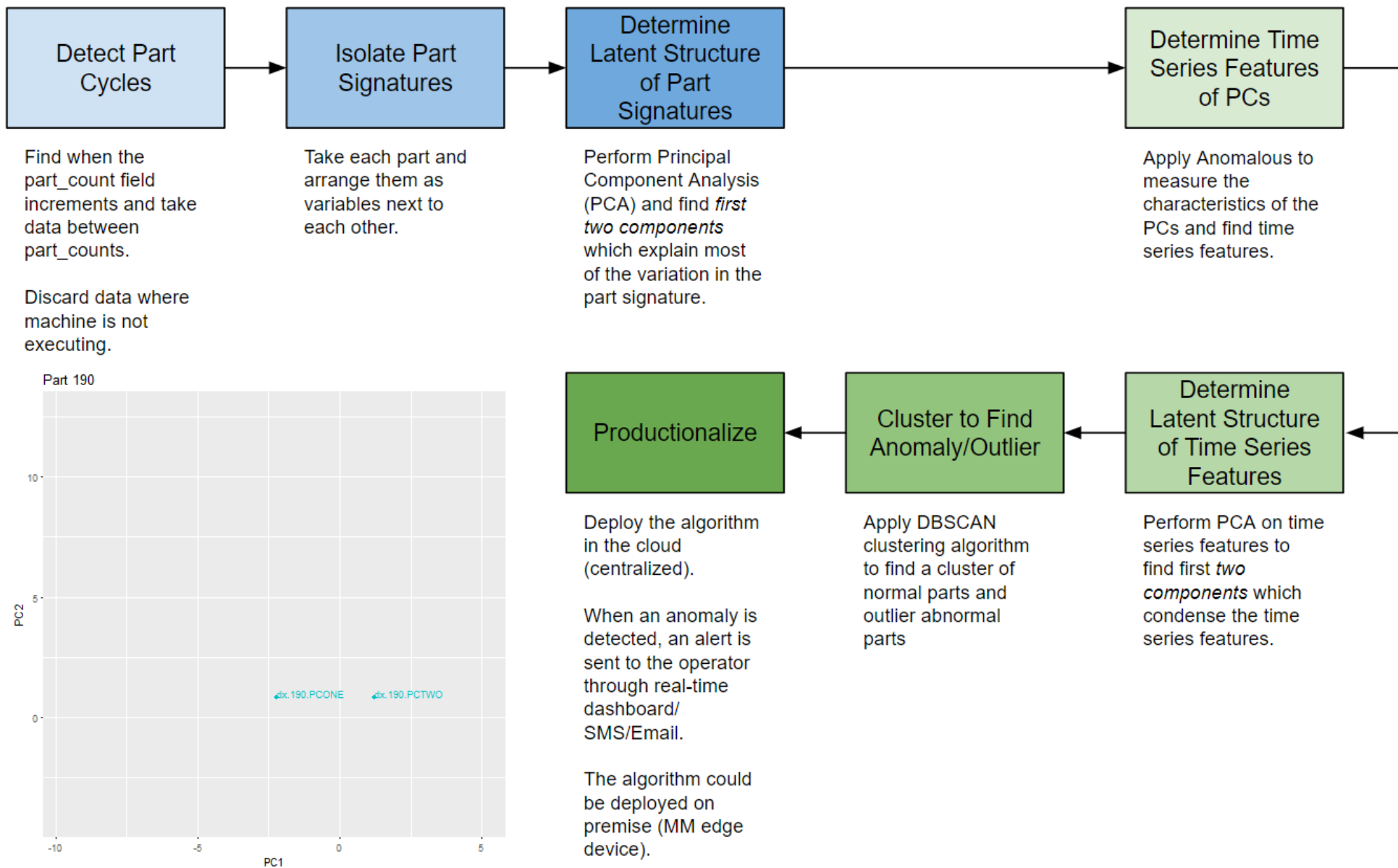


Part Type 2



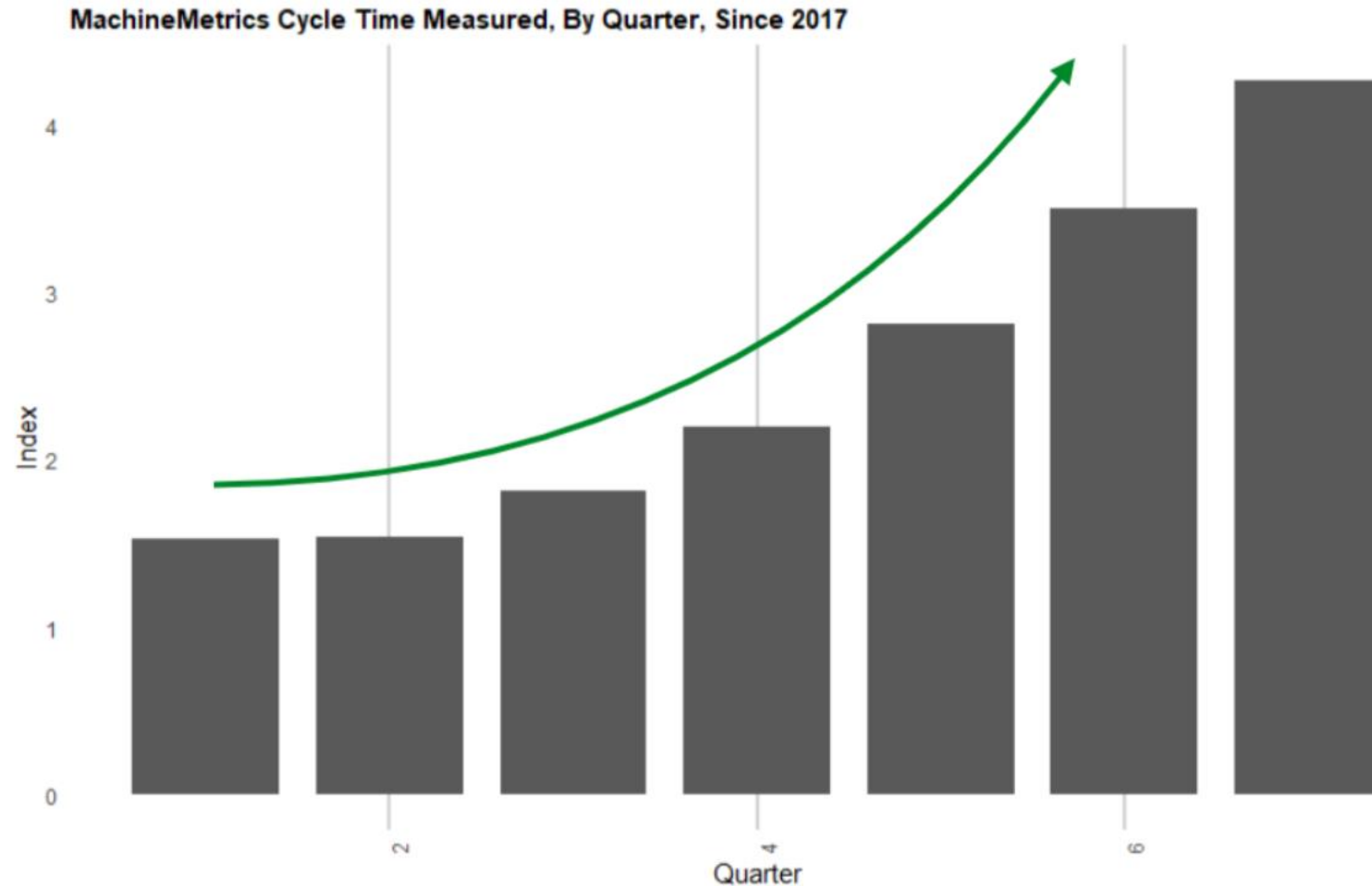


# Case Study: Applying Anomaly Detection on Control Data



"We believe a new, more powerful, business model has evolved...When built right, they create a reinforcing cycle: Their products get better, allowing them to collect more data, which allows them to build better models, making their products better, and onward. "

- WSJ





MachineMetrics has compiled the  
most powerful and largest set of  
machine data in the world.

# Appendix

# A Virtuous Cycle

