Final Presentation

Model-Based Control Strategy for Continuous Bond CPW

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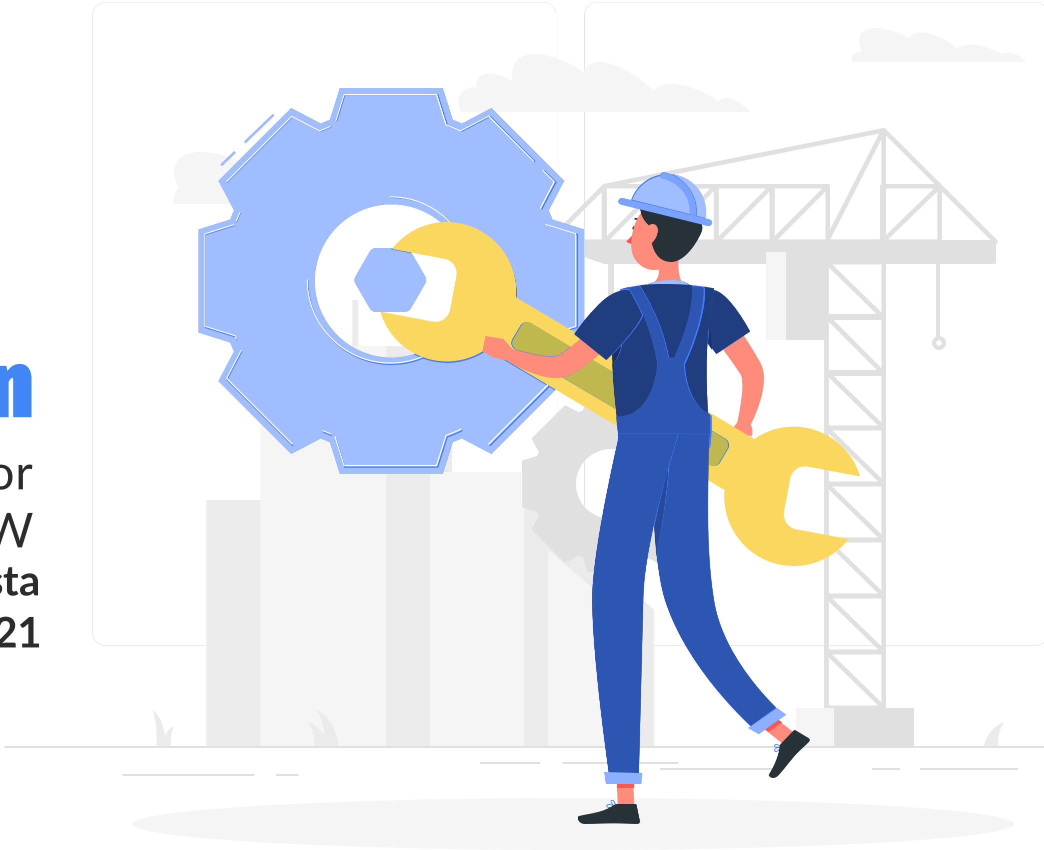


About Me

Rising Junior at the University of Florida

B.S. Computer Science and Statistics

First Time P&G Intern – BC R&D

Interests: ML/AI, Product Development, Entrepreneurship

Hobbies: Traveling/Eating, Kayaking/Hiking, Techy Stuff

Business Need

Baby Care is focused on eliminating diaper leakage

Creating quality CPW cuff to topsheet bonds minimized leakage

CAN digital methods with vibration data and models help?

Temporary Solutions

Restrict operational pressure

Functional method (BLC runoff) to diagnose over-bonding

Why vibrations?

Possible Solution

Past experiences within P&G
(A. Xiong in Luo Gang plant, J. Rosiak in Cape Girardieu plant and K. Nadipineni in Manchester plant)

Develop PCS for bond quality using model

Business Benefit and Value of Innovation

- Benefits in M&R costs
- Reduce and avoid effort
- Milestone for BC
- Lean qualification
- Productivity
- Scalability

Monetary impact is to be determined…

My Role

Visualize and analyze overall vibration data

Control chart data for overall vibrations from different conditions

Analyze FFT data and compare to predicted frequency signals

Collect and analyze PBQA data

Up to Midpoint

Installed and tested accelerometers on unit

Drafted “preparation steps’” in the digital work process before and after data acquisition and analysis

Acquainted myself with technical components of the project

EO – OCT6

EO conditions were categorized into A (OLD Eq.) conditions and B (NEW Eq.) conditions

Run Code	Condition	Pressure (Bar)	Stiffener Kit	Notes
B1	Target	2.3	X	
B2	Low	1.8	X	
B3	Ultra Low	1.4	X	2.5 mins long (high reject rate)
A1	Target	3.4		
A2	Low	2.7		
A3	Low	2.0		
A4	Target	3.4		
A5	High	4.0		
A6	High	4.5		
A7	Target	3.4		
A8	Ultra High	4.7		2 mins long
B4	Target	2.3	X	7 mins long

Analysis Tools

Python – Pandas (Data Manipulation), NumPy (Mathematics), Matplotlib (Visualization)

Jupyter Notebook – computational environment

Excel CSV – Data Source

Overall Vibration Data

Shows the behavior of the unit as it is running

Accelerometer measures z-axis (up and down) acceleration

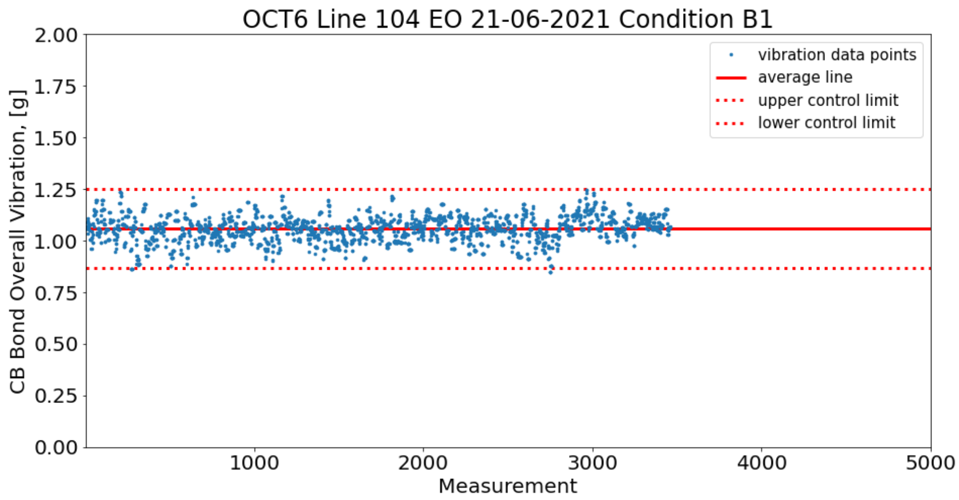
Control charting can help determine certain abnormalities in the unit as it runs

Using FFT algorithm allows to find frequency of sources that are driving the overall vibration

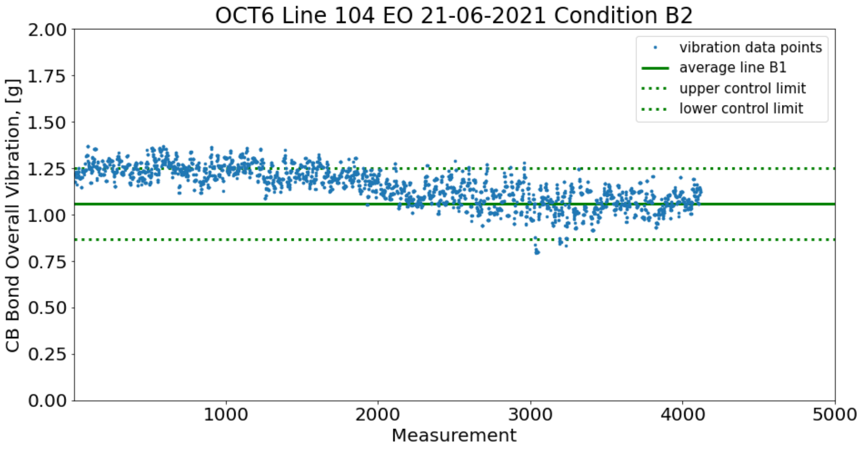
Control Charting

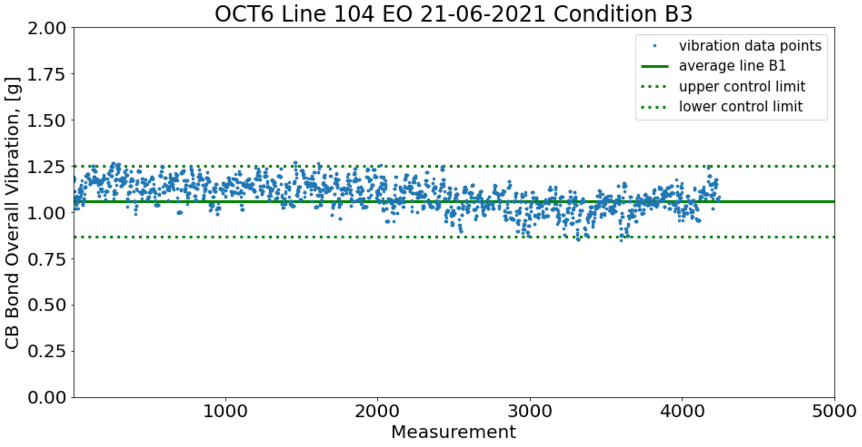
Establish the control parameters (B1 chosen)

Analyze each condition within those parameters to identify changes/look for signals

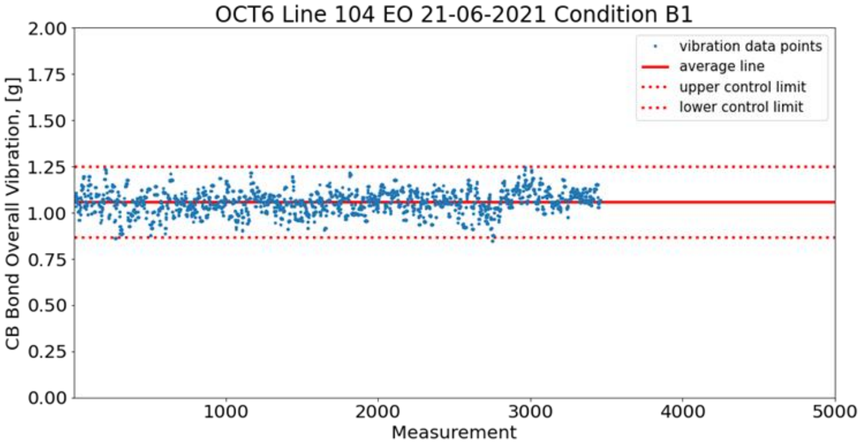


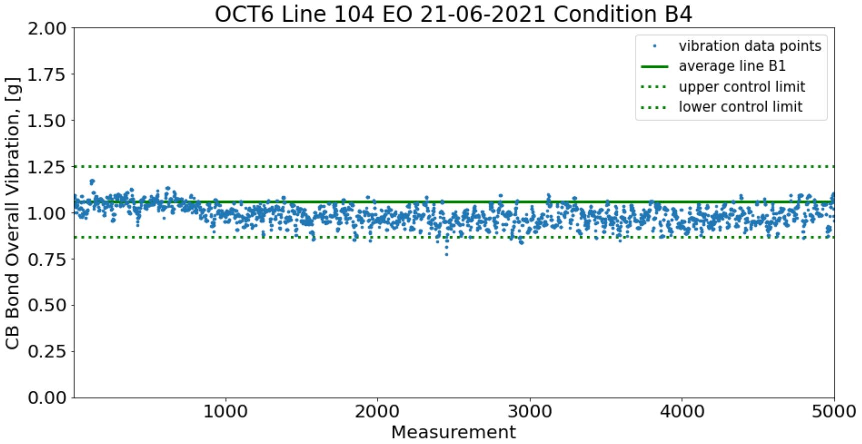
B Conditions – Low Pressure



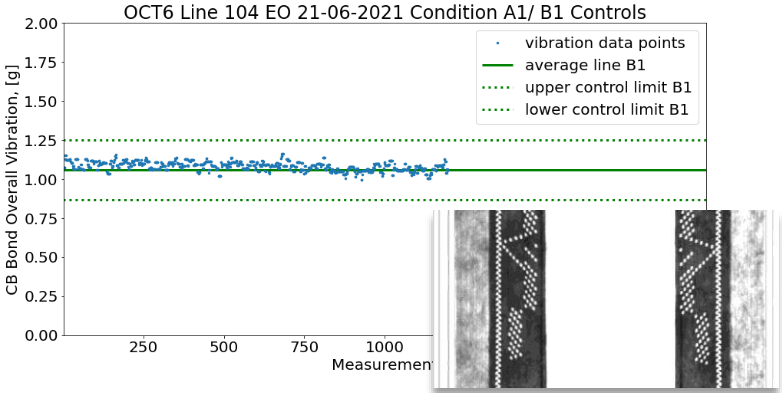


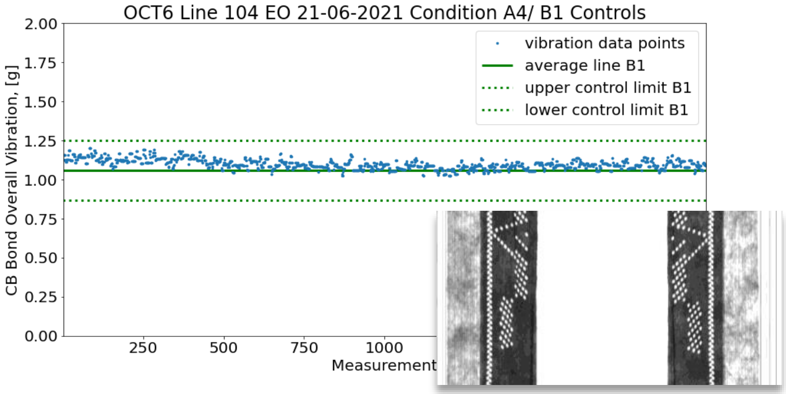
B Conditions – Target Pressure

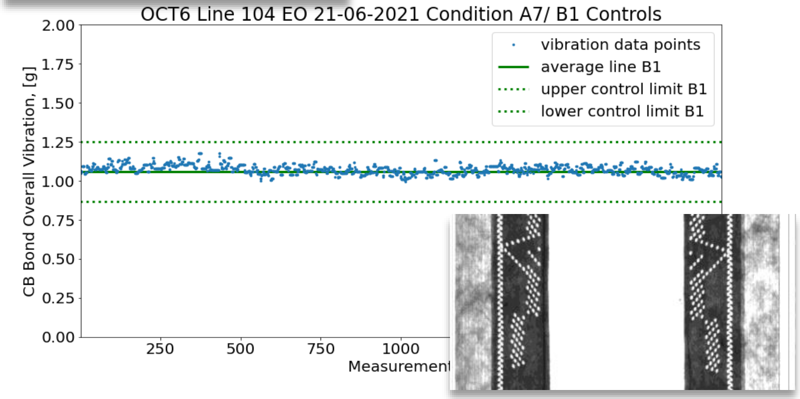




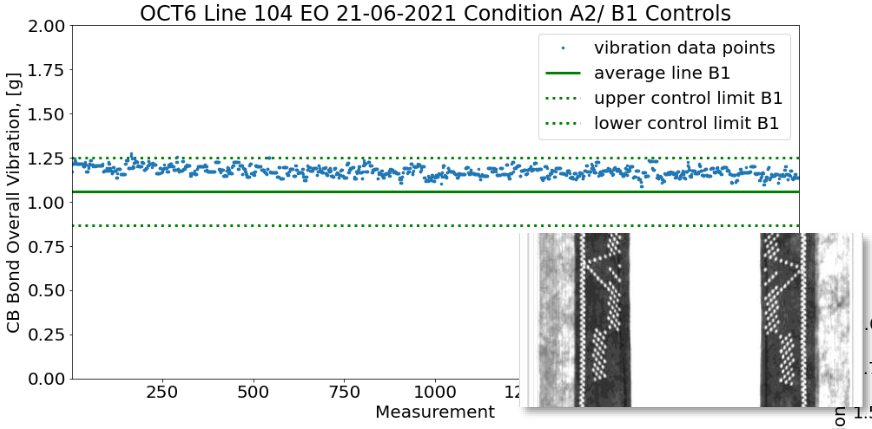
A Conditions – Target Pressure

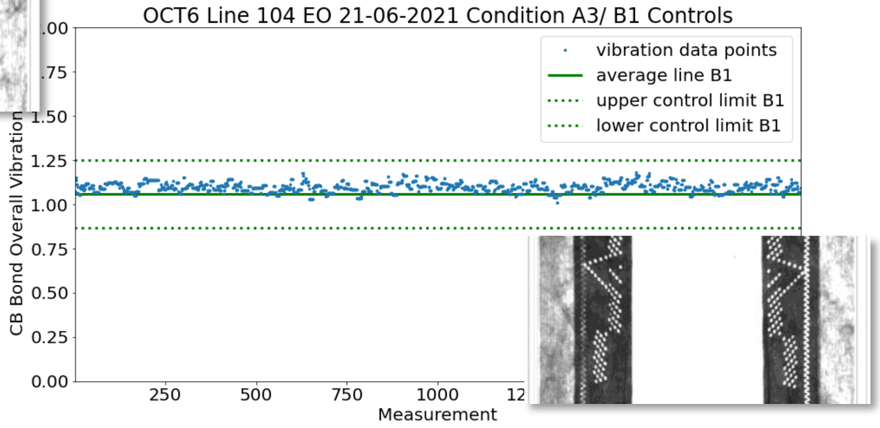




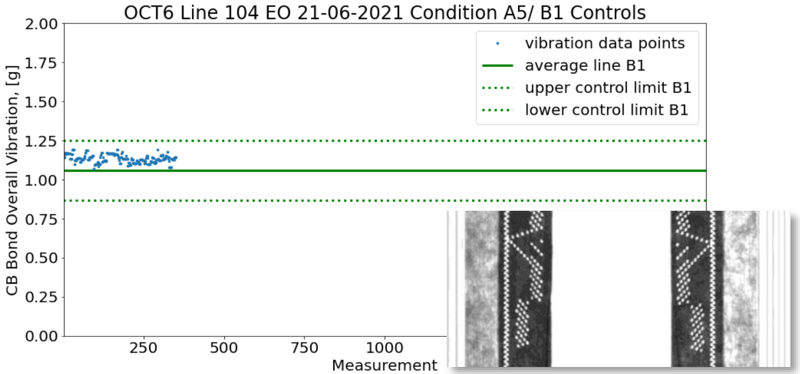


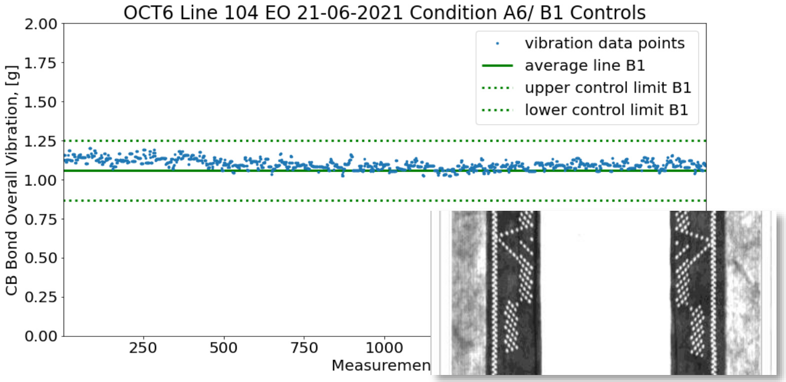
A Conditions – Low Pressure

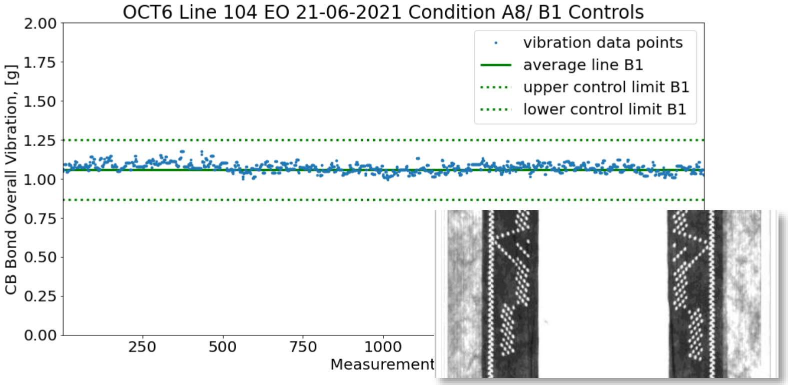




A Conditions – High Pressure







PBQA Data

Vibration fluctuations within a condition are not substantial to generate visible change

PBQA analysis can detect low pressure conditions

PBQA analysis cannot detect case of over bonding

EO – OCT6 Overall Vibrations Take Aways

PBQA data adequate to determine low pressure

Onset period at the beginning of trials

As equipment ages vibration standard deviation is reduced

Control charting can detect process changes

Control charting cannot easily detect if process is under or over bonding

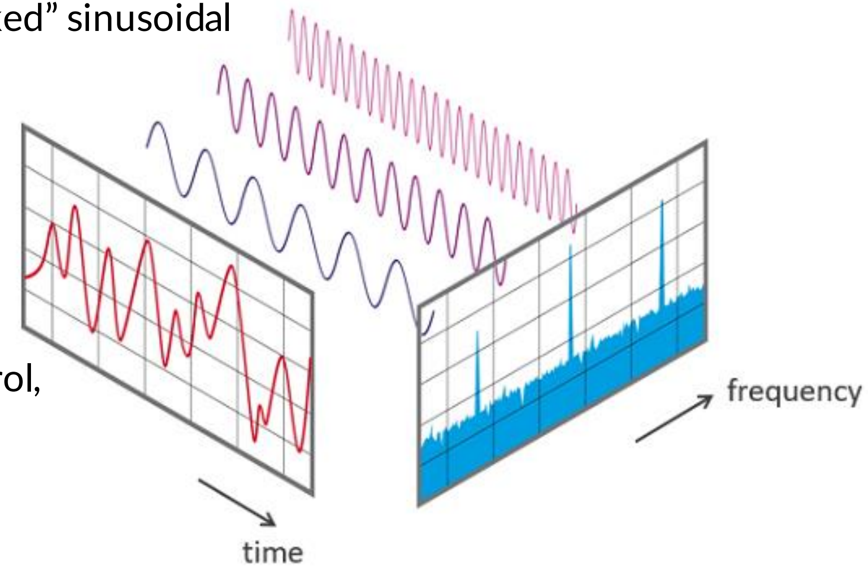
What is a Discrete Fourier Transform?

Vibration waveforms are composed of “stacked” sinusoidal components at different frequencies

Frequencies show up on the FT domain

The higher the peak the stronger the frequency

FFTs are used for fault analysis, quality control, and machine monitoring



Fast Fourier Transform

Our runs measure “bands” which show intensity of certain frequency regions

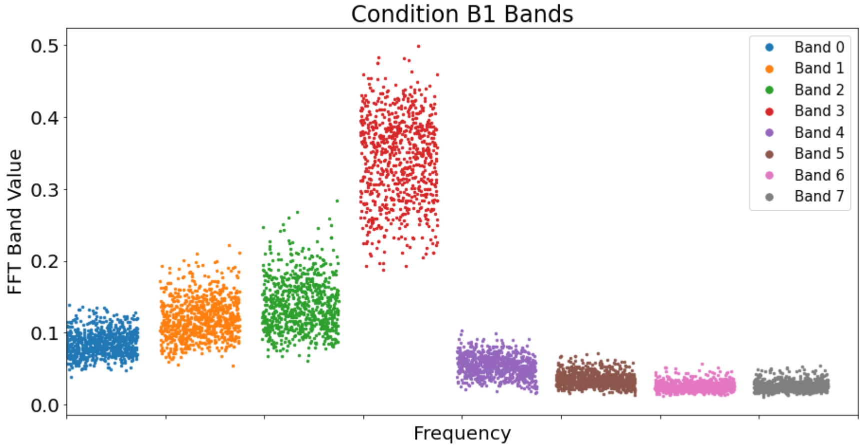
2750 – 5250 Hz is the area of interest as predicted by the model

MB007 Model predicts this frequency for cuff to topsheet bonds

Bands

Band	Enable	Measurement Mode	Band Limit Begin	Band Limit End	Domain
0	☑	Band Overall	2750.00	2850.00	Hz
1	☑	Band Overall	2850.00	2950.00	Hz
2	☑	Band Overall	2950.00	3050.00	Hz
3	☑	Band Overall	3050.00	3150.00	Hz
4	☑	Band Overall	4850.00	4950.00	Hz
5	☑	Band Overall	4950.00	5050.00	Hz
6	☑	Band Overall	5050.00	5150.00	Hz
7	☑	Band Overall	5150.00	5250.00	Hz

Fourier Transform



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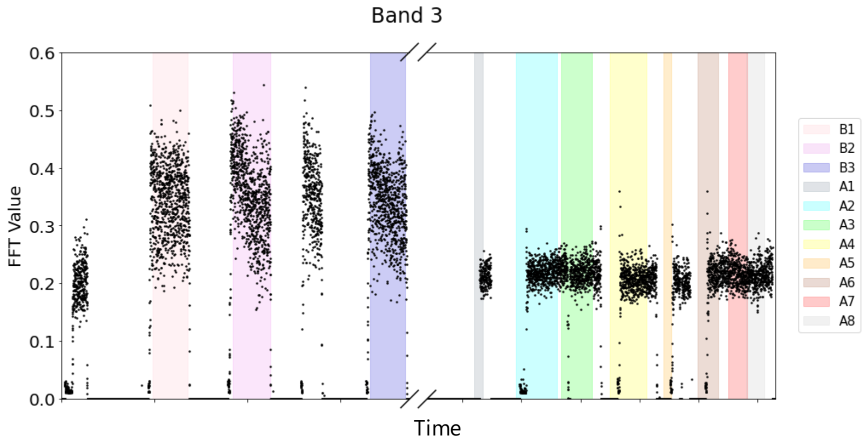

EO – OCT6 FFT Take Aways

Band 3 is most active band

There is a big drop in Band 3 between new and old equipment

New equipment values have a larger standard deviation

Validating MB007

Focus on Band 3 of FFT

Model predicted a fundamental frequency around 3000 Hz

Next Steps and Recommendations

Perform longitudinal analysis of the line's overall vibration

Focus on the intensity of Band 3 frequencies

Consider monitoring standard deviation of overall vibration measurements

Questions?

Thank you!

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