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November 24, 2021

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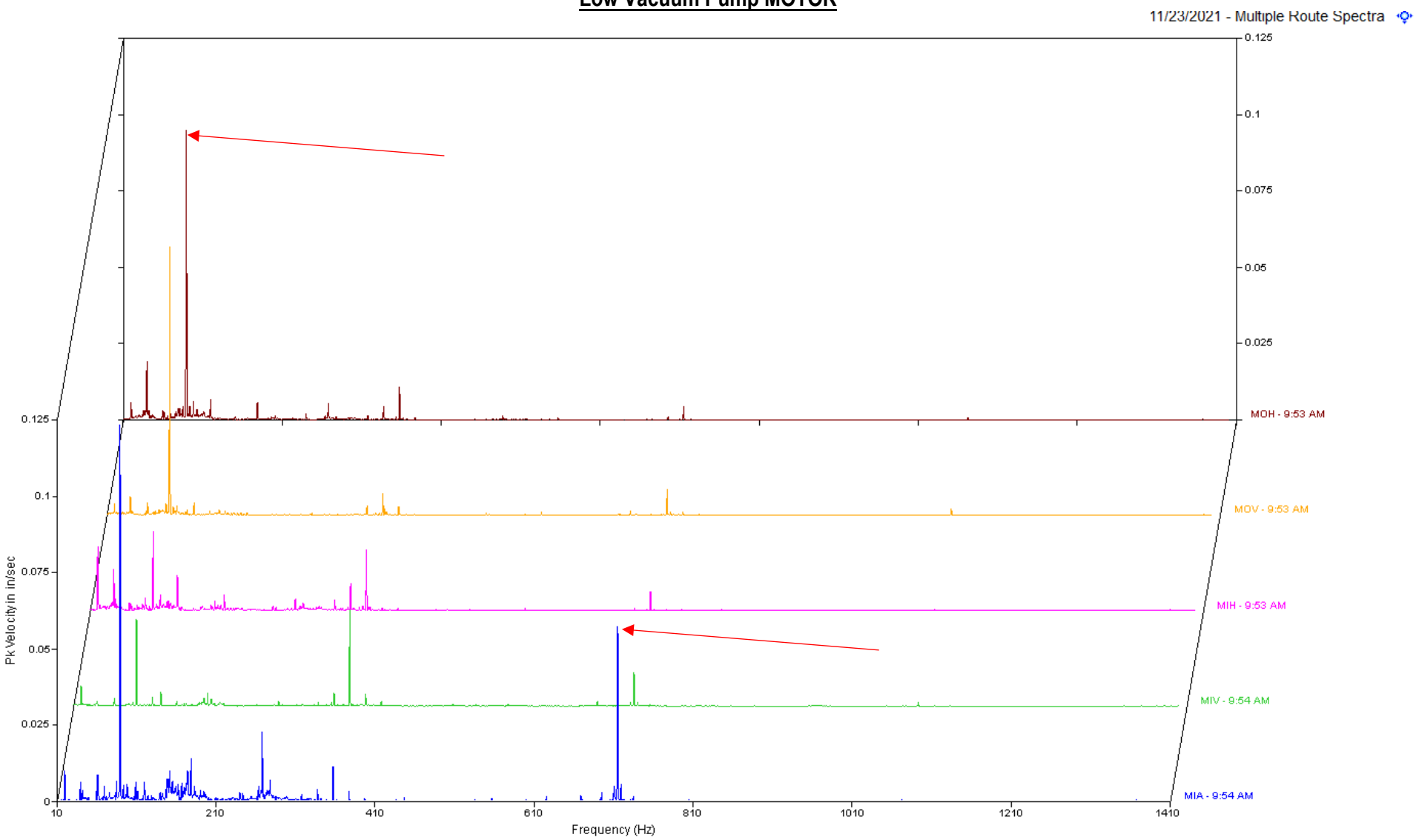
KTG
Memphis, TN

Scott,

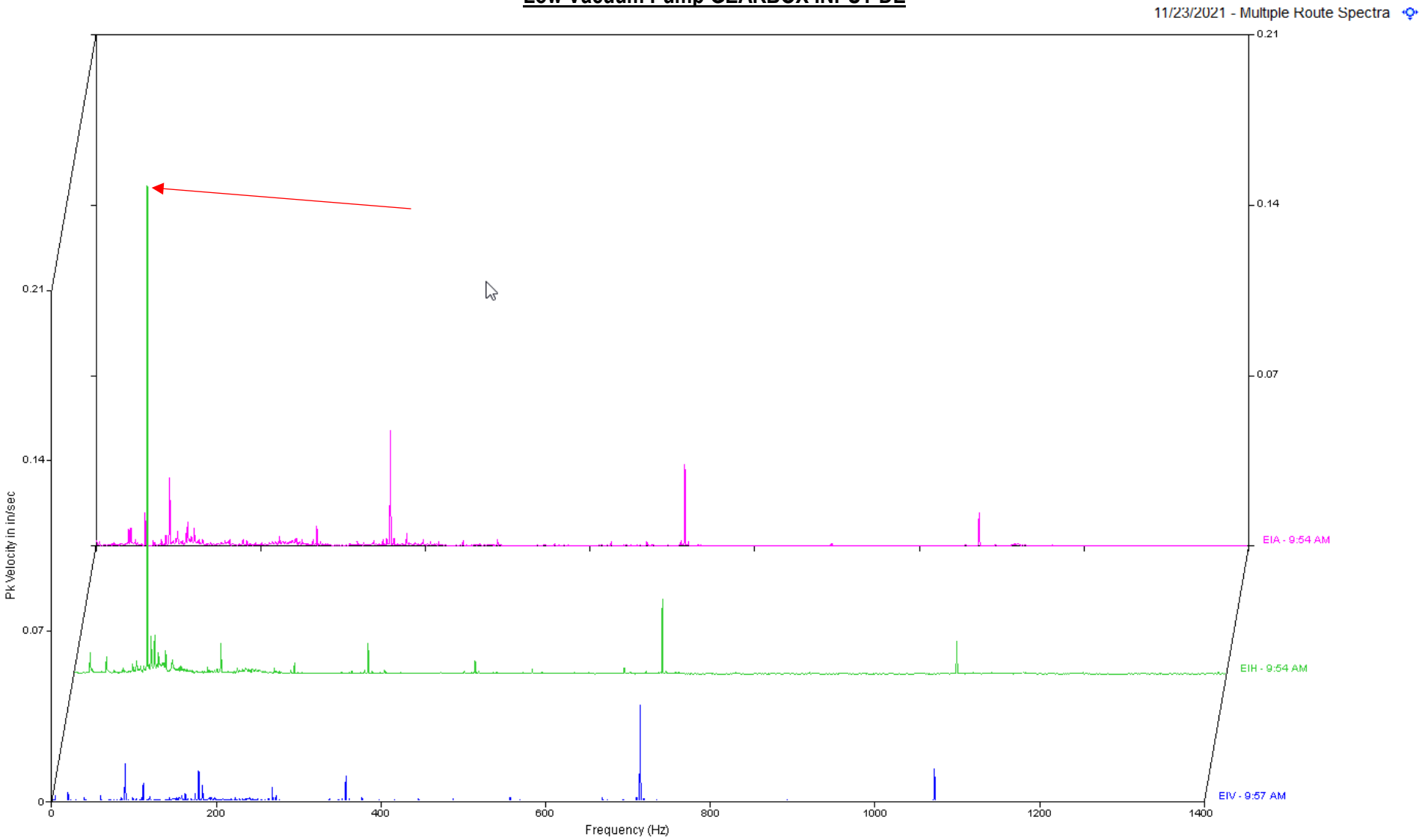
The following is a summary of findings from the vibration analysis on the Low Vacuum Pump, Low Vacuum Pump Spare, and Hi Vacuum Pump #4. Below you will data plots along with a brief description of the data provided.

Low Vacuum Pump MOTOR



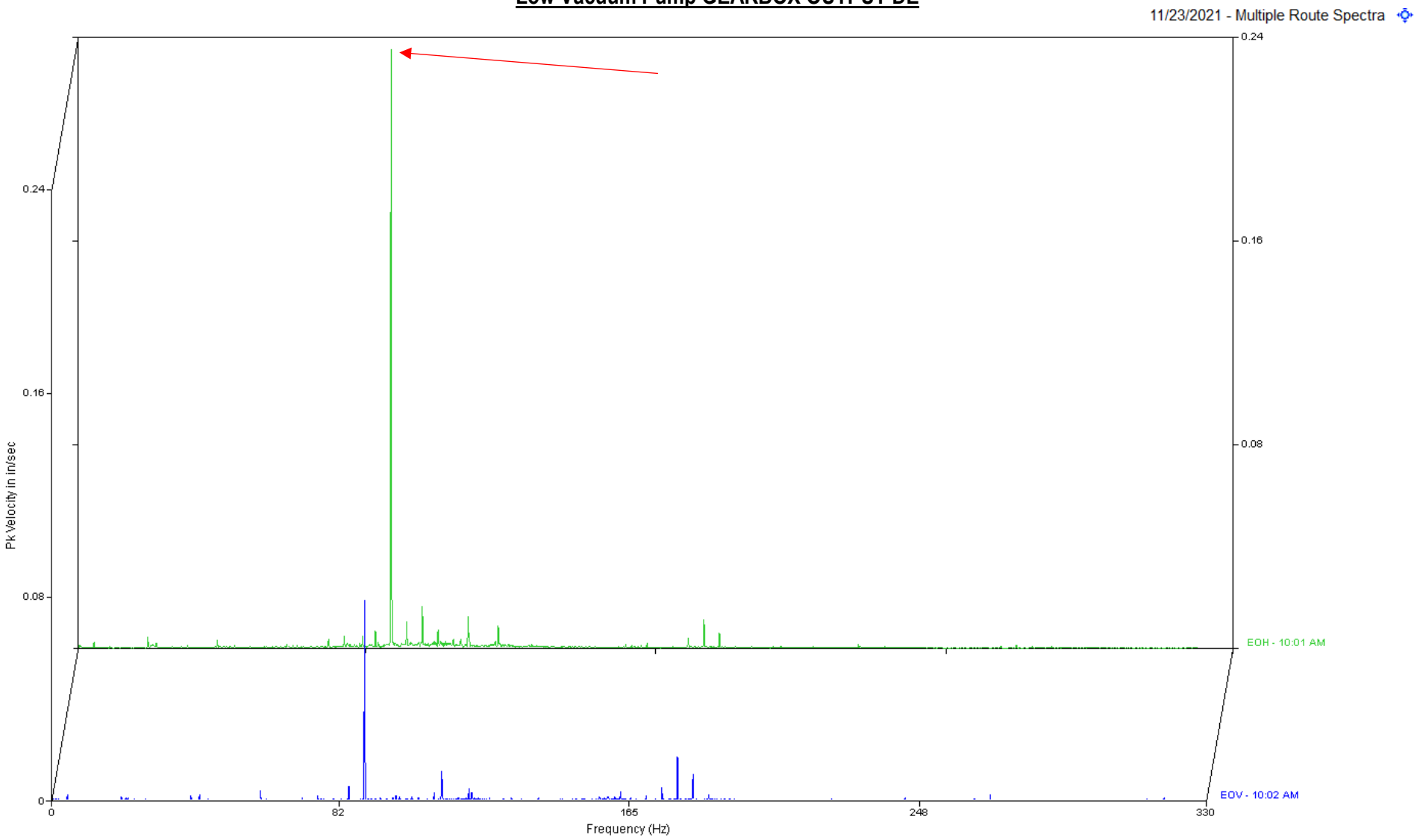
The plot above is drive motor. The first large peak is pump vane pass frequency. The second large peak seen in MIA is 2 x gear mesh frequency. No issues really to note here. All amplitudes appear to be low in the motor.

Low Vacuum Pump GEARBOX INPUT DE



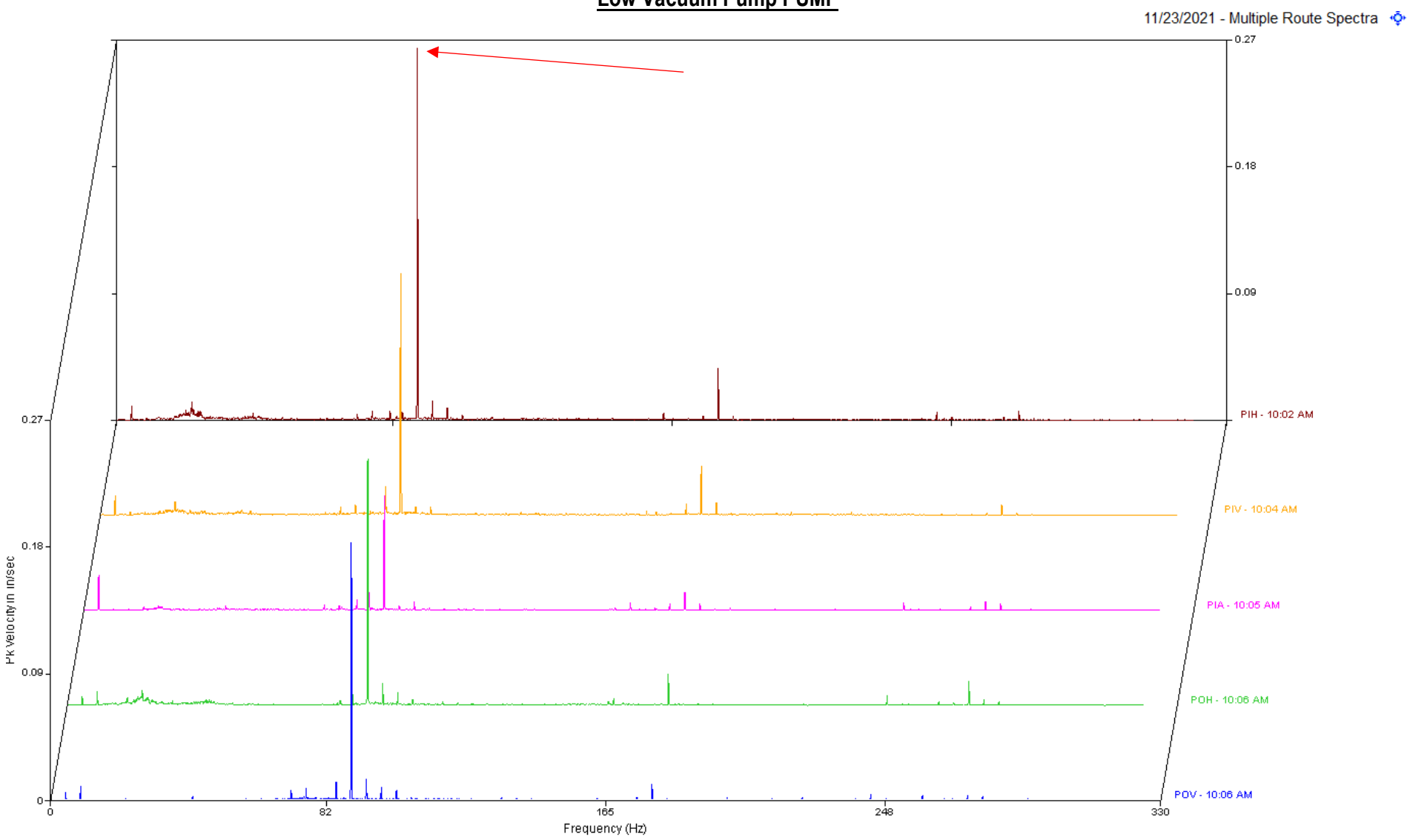
The data plot above is the Drive end of the gearbox input shaft. The dominant vibration seen in EIH (inboard horizontal) is the pump vane pass frequency. Other peaks in the spectra are gear mesh frequency and harmonics of GMF.

Low Vacuum Pump GEARBOX OUTPUT DE



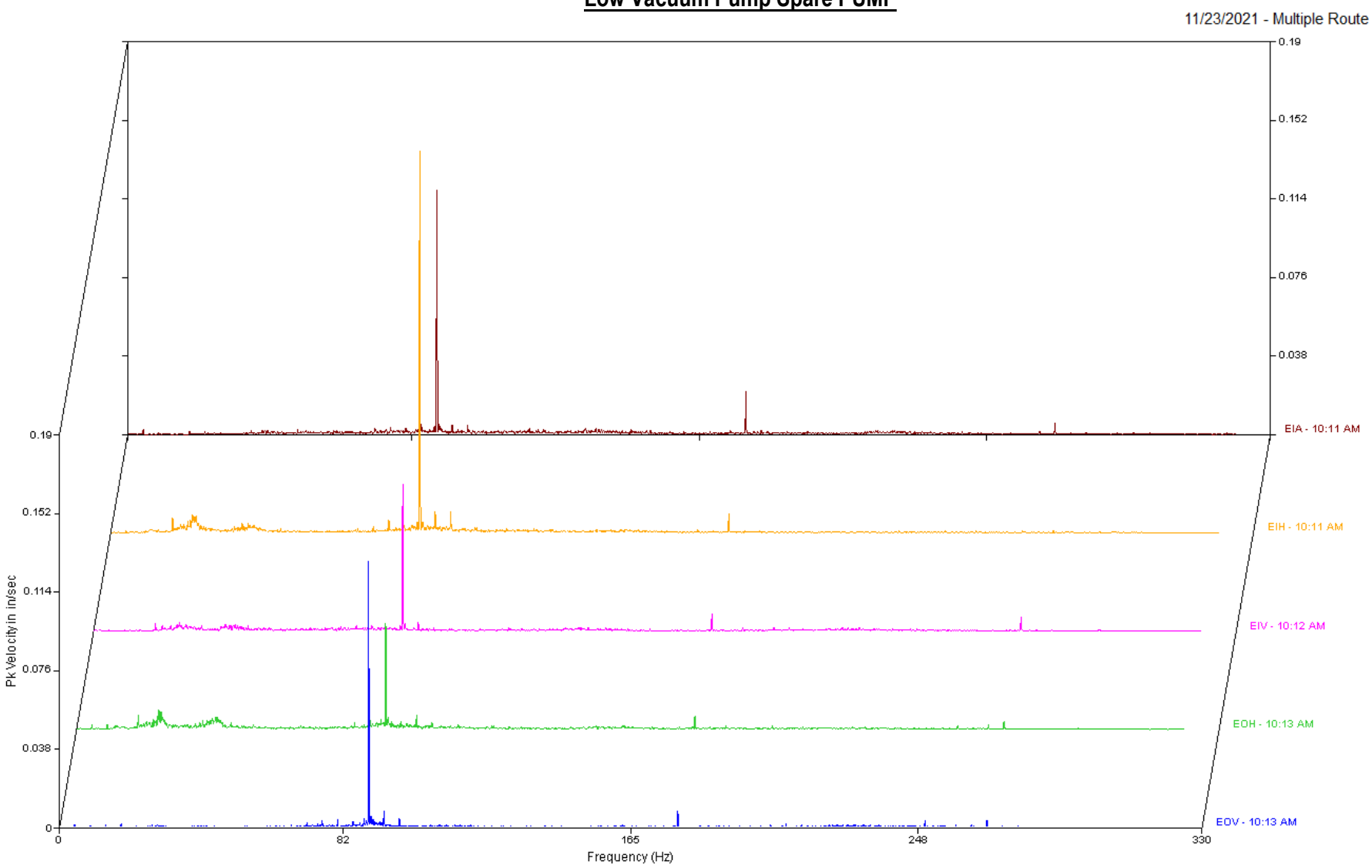
Plot above is the gearbox output drive end. Large peak seen here is the pump vane pass frequency. No real issues to mention here other than a slightly high amplitude of pump vane pass.

Low Vacuum Pump PUMP



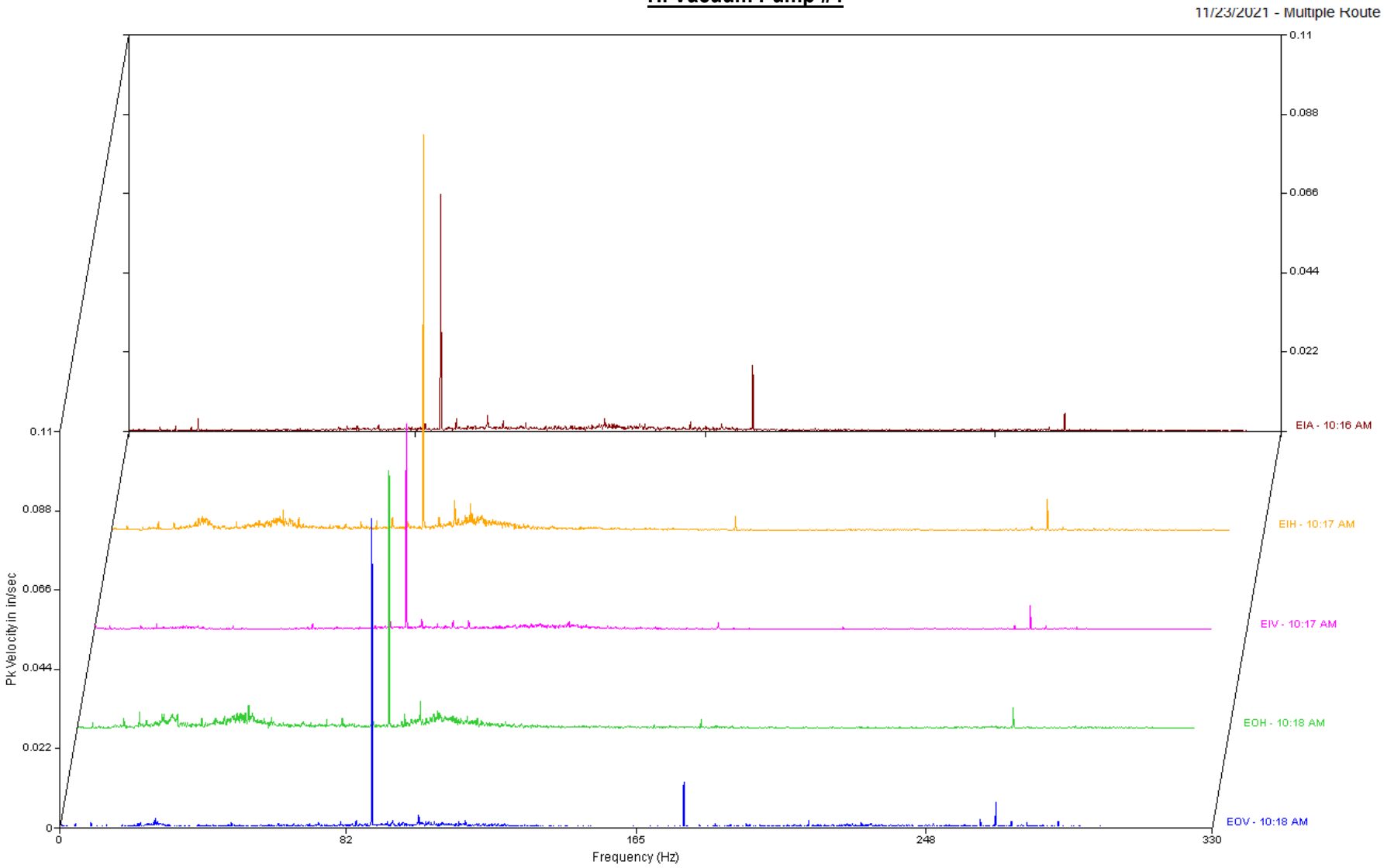
Data plot above is of the pump. Large peak is the pump vane pass. There are some small sidebands of pump rpm around this peak. This vane pass amplitude is slightly high for a newly rebuilt pump. The vane pass vibration may be process related if pump is getting too much water flow. Also the pump could have tighter clearances. It is difficult to say with no trendable vibration history of this pump.

Low Vacuum Pump Spare PUMP



This is from the spare pump next to the low vacuum pump. This pump also has a vane pass vibration but amplitudes are slightly lower.

Hi Vacuum Pump #4



Vane pass vibration is also present in the #4 vacuum pump (pump at the other end). Amplitudes are much lower on the pump.

Below are overall amplitudes in ips-pk and G's for each point collected.

Low Vacuum Pump

M=Motor E=Gearbox P=Pump

MEASUREMENT POINT	OVERALL LEVEL	HFD / VHFD
KTGVACPMP - KTG VACUUM PUMP	(23-Nov-21)	
	OVERALL LEVEL	1K-20KHz
MOH	.105 In/Sec	.300 G-s
MOV	.095 In/Sec	.182 G-s
MIH	.052 In/Sec	.222 G-s
MIV	.049 In/Sec	.333 G-s
MIA	.158 In/Sec	.465 G-s
EIA	.081 In/Sec	.495 G-s
EIH	.219 In/Sec	.609 G-s
EIV	.055 In/Sec	1.513 G-s
EOH	.247 In/Sec	2.379 G-s
EOV	.086 In/Sec	.833 G-s
PIH	.275 In/Sec	.903 G-s
PIV	.206 In/Sec	1.019 G-s
PIA	.098 In/Sec	.912 G-s
POH	.215 In/Sec	.992 G-s
POV	.199 In/Sec	1.276 G-s
POA	.083 In/Sec	.939 G-s

Clarification Of Vibration Units:

Acc	-->	G-s	RMS
Vel	-->	In/Sec	PK

Low Vacuum Pump Spare PUMP

E=Pump

MEASUREMENT POINT	OVERALL LEVEL	HFD / VHFD
MACHINE 26 - MACHINE 26	(23-Nov-21)	
	OVERALL LEVEL	1K-20KHz
EIA	.139 In/Sec	.049 G-s
EIH	.205 In/Sec	.059 G-s
EIV	.084 In/Sec	.114 G-s
EOH	.088 In/Sec	.047 G-s
EOV	.137 In/Sec	.067 G-s

Clarification Of Vibration Units:

Acc	-->	G-s	RMS
Vel	-->	In/Sec	PK

Hi Vacuum Pump #4

E=Pump

MEASUREMENT POINT	OVERALL LEVEL	HFD / VHFD
MACHINE 27 - MACHINE 27	(23-Nov-21)	
	OVERALL LEVEL	1K-20KHz
EIA	.077 In/Sec	.100 G-s
EIH	.120 In/Sec	.052 G-s
EIV	.064 In/Sec	.076 G-s
EOH	.095 In/Sec	.055 G-s
EOV	.097 In/Sec	.060 G-s

Clarification Of Vibration Units:

Acc	-->	G-s	RMS
Vel	-->	In/Sec	PK

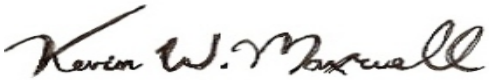
Conclusion

There does appear to be some vane pass vibration in the low vacuum pump that is being transferred into the gearbox and motor. This pump is higher in amplitude than the spare pump next to the pump in question and also much higher than the #4 Hi Vac Pump. During a visual inspection of the low vacuum pump, the pump was noticed to have a possible soft foot condition on the front left foot (facing drive end of pump). This may be causing some pump casing distortion and possible piping strain of the pump. There may also be process flow issues such as excessive water flow that could influence the vane pass vibration. Pump clearance may also affect vane pass. There isn't a lot of sidebands around vane pass which would indicate excessive impeller clearances or wear of the impeller.

We recommend checking the low vacuum pump for soft foot by loosening the pump feet and shimming where necessary. We also recommend re-aligning the gearbox to the pump and then the motor to gearbox after shimming any soft foot.

As always, it has been a pleasure to serve KTG. If there are any comments or questions, do not hesitate to contact us.

Sincerely,



ISO Certified Vibration Analyst, Category III

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