

# Pump Baseplate Resonance Responsible for Large Piping Vibration and Component Failures

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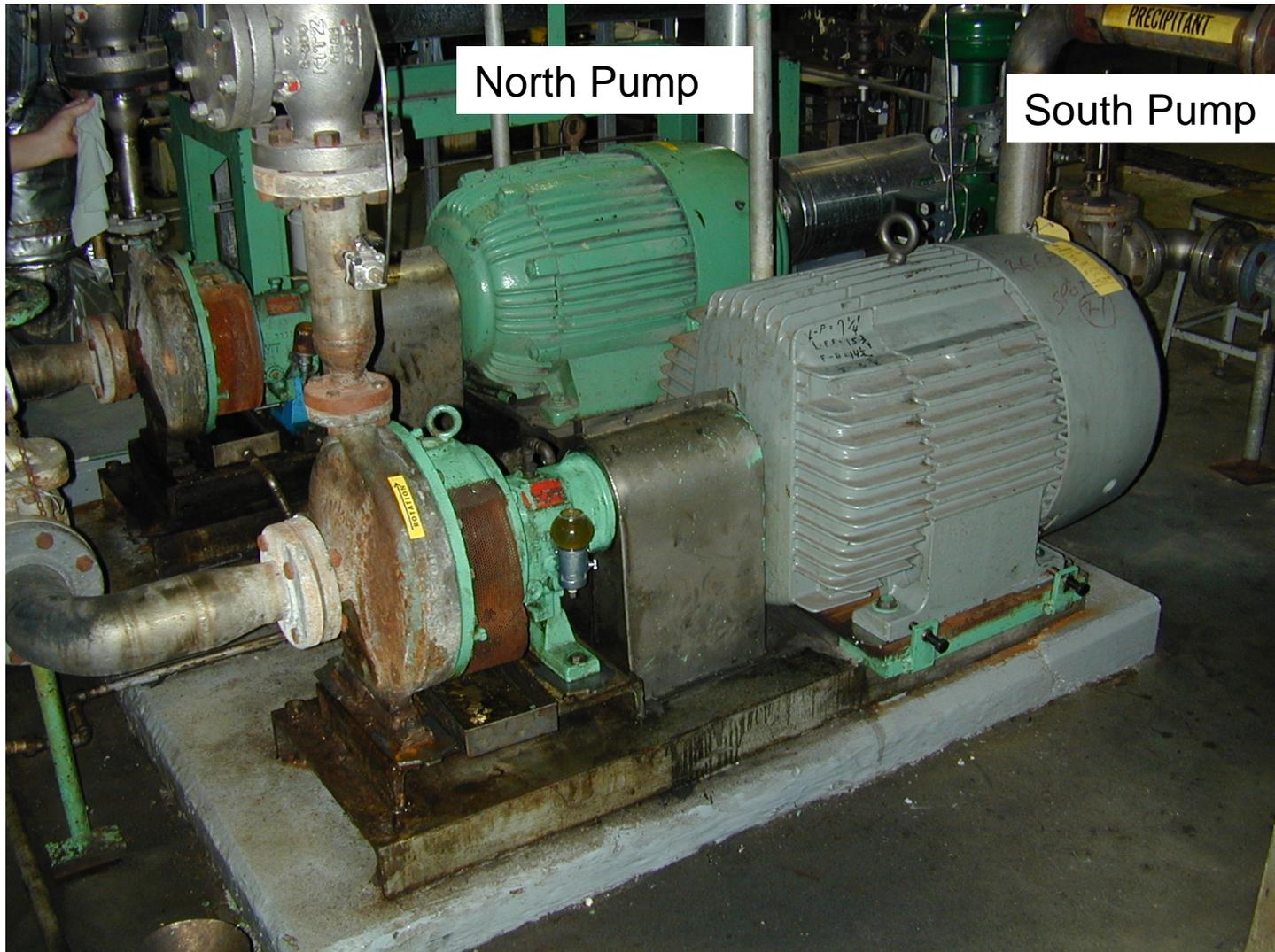
# Problem Statement

- Two overhang Centrifugal Pumps working in parallel
- Pumps driven by 75 hp motors, 3600 rpm
- Over 15 years of operation, experienced repeat failures on piping system, valves, couplings, impellers and housings
- Routine vibration measurement for trending do not show any discernable pattern

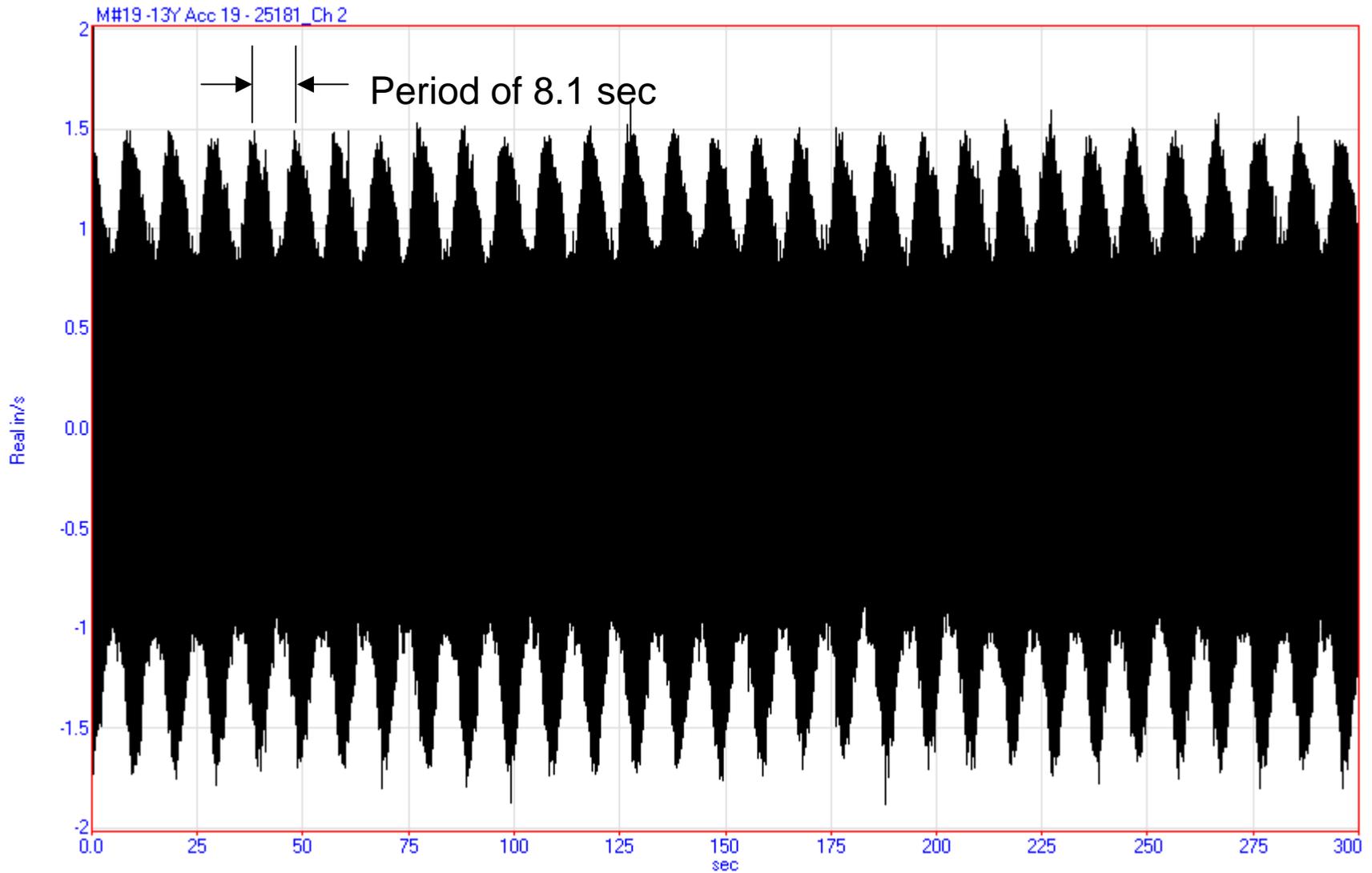
# Problem Statement (cont)

- Maintenance Personnel observed high vibration on the piping system where many of the failures occurred
- Initial thought was that piping resonance was excited and that shook the pump
- It had been a practice to tighten the pipe hanging supports to reduce vibration temporarily

# Problem statement (cont.)



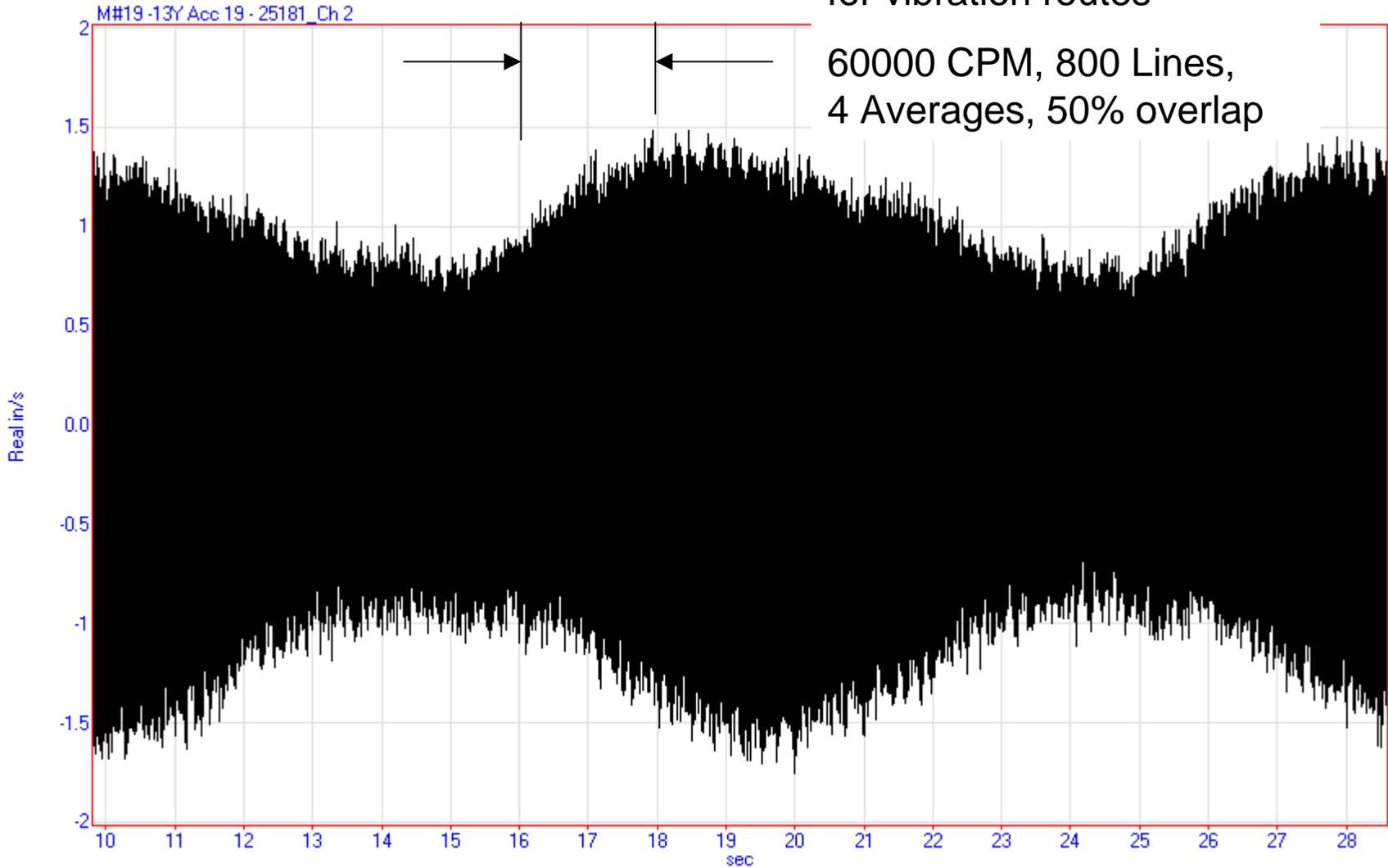
# Vibration Measurement on South Pump Bearing Housing, Coupling End Horizontal direction



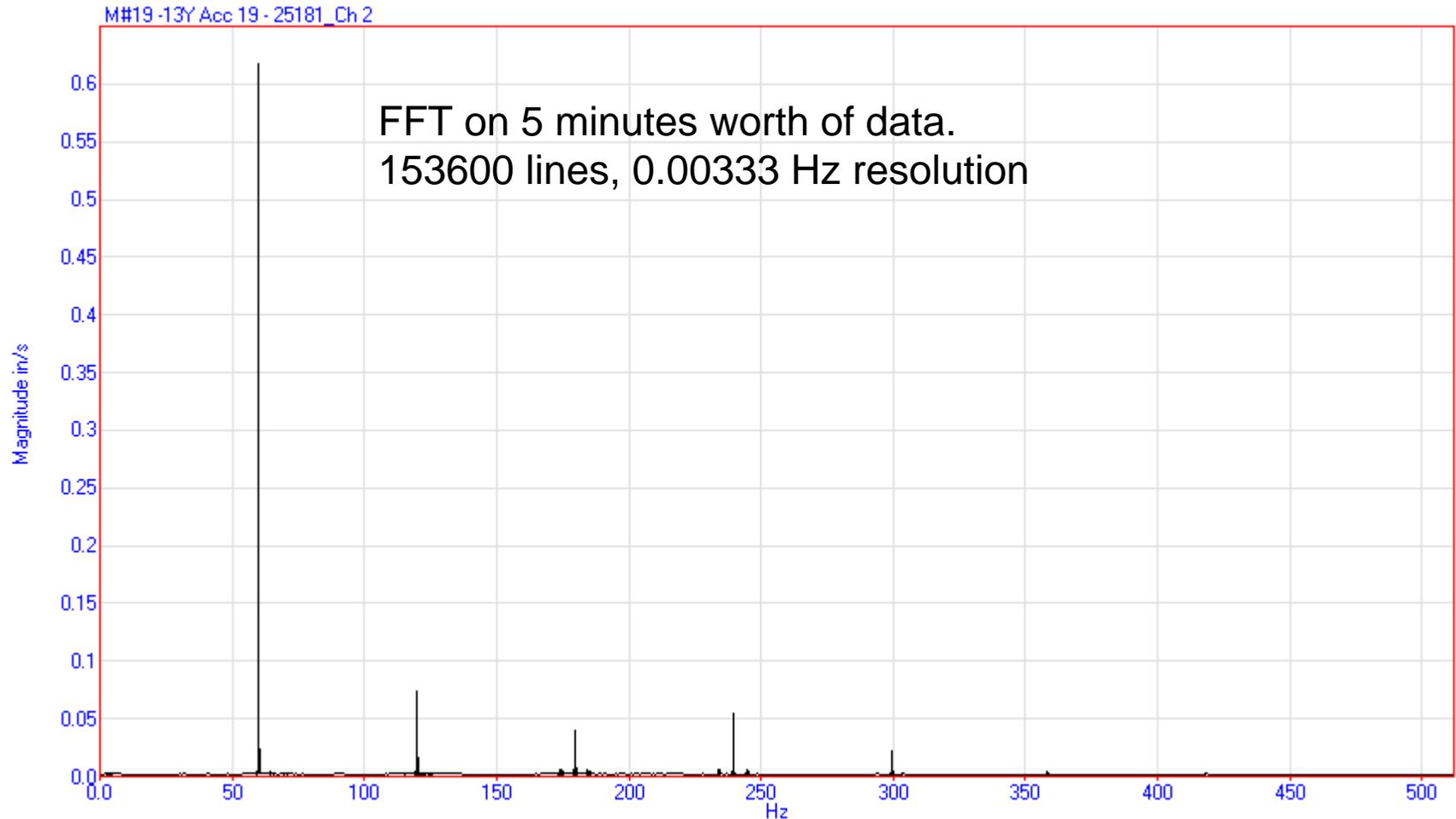
# Vibration Measurement on South Pump Bearing Housing, Coupling End Horizontal direction

Typical collection window for vibration routes

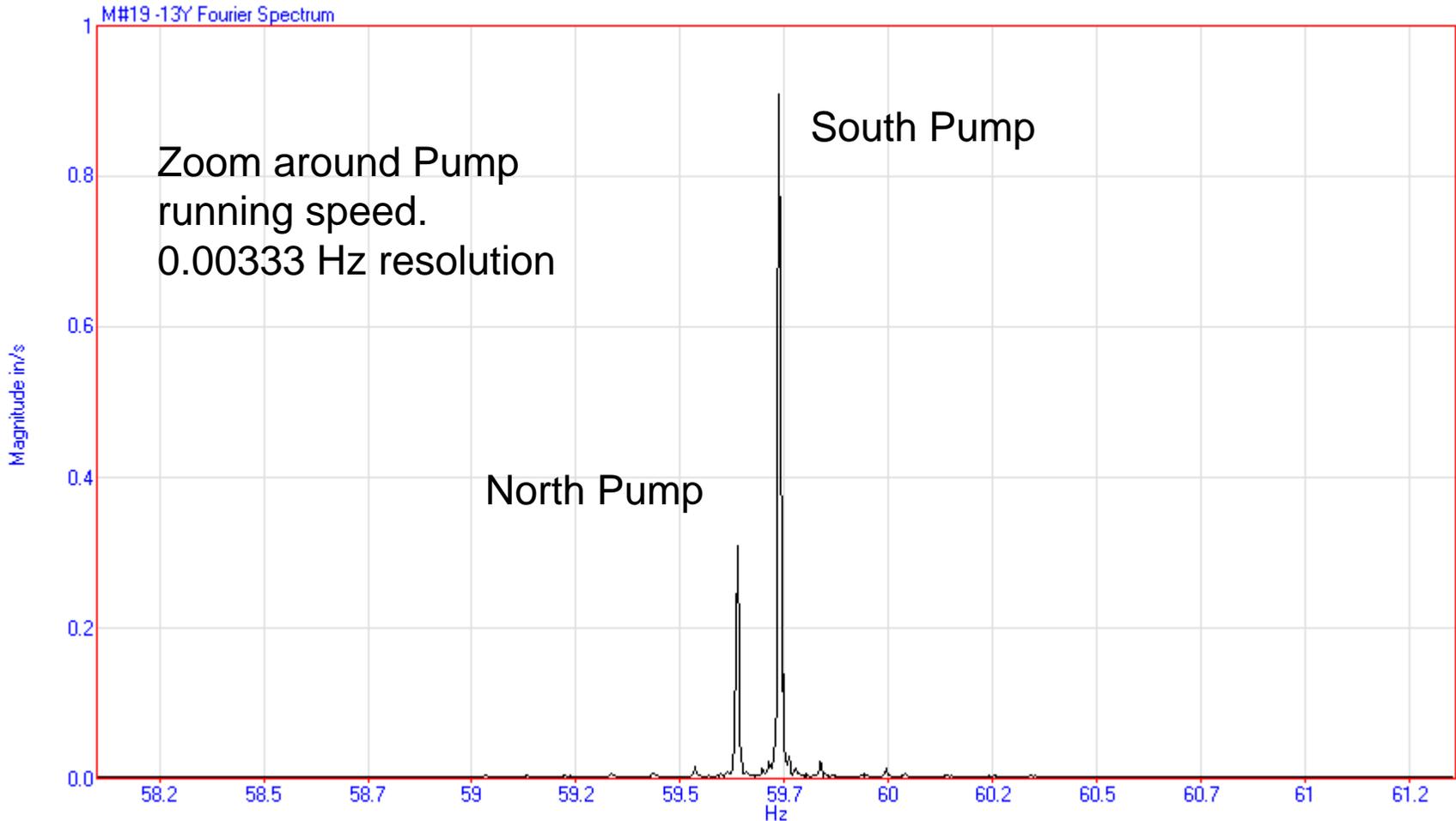
60000 CPM, 800 Lines, 4 Averages, 50% overlap



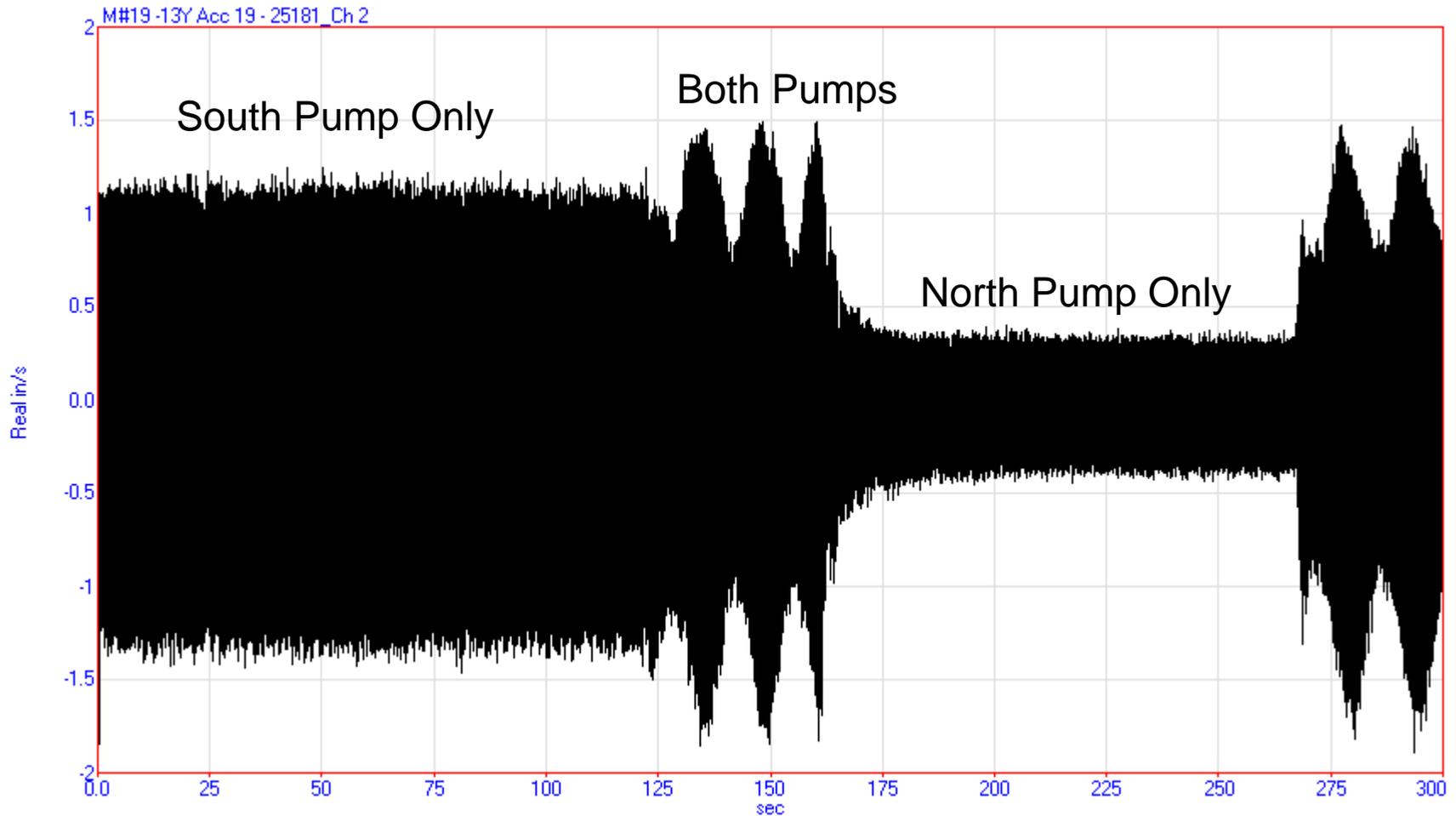
# Vibration Measurement on South Pump Bearing Housing, Coupling End Horizontal direction



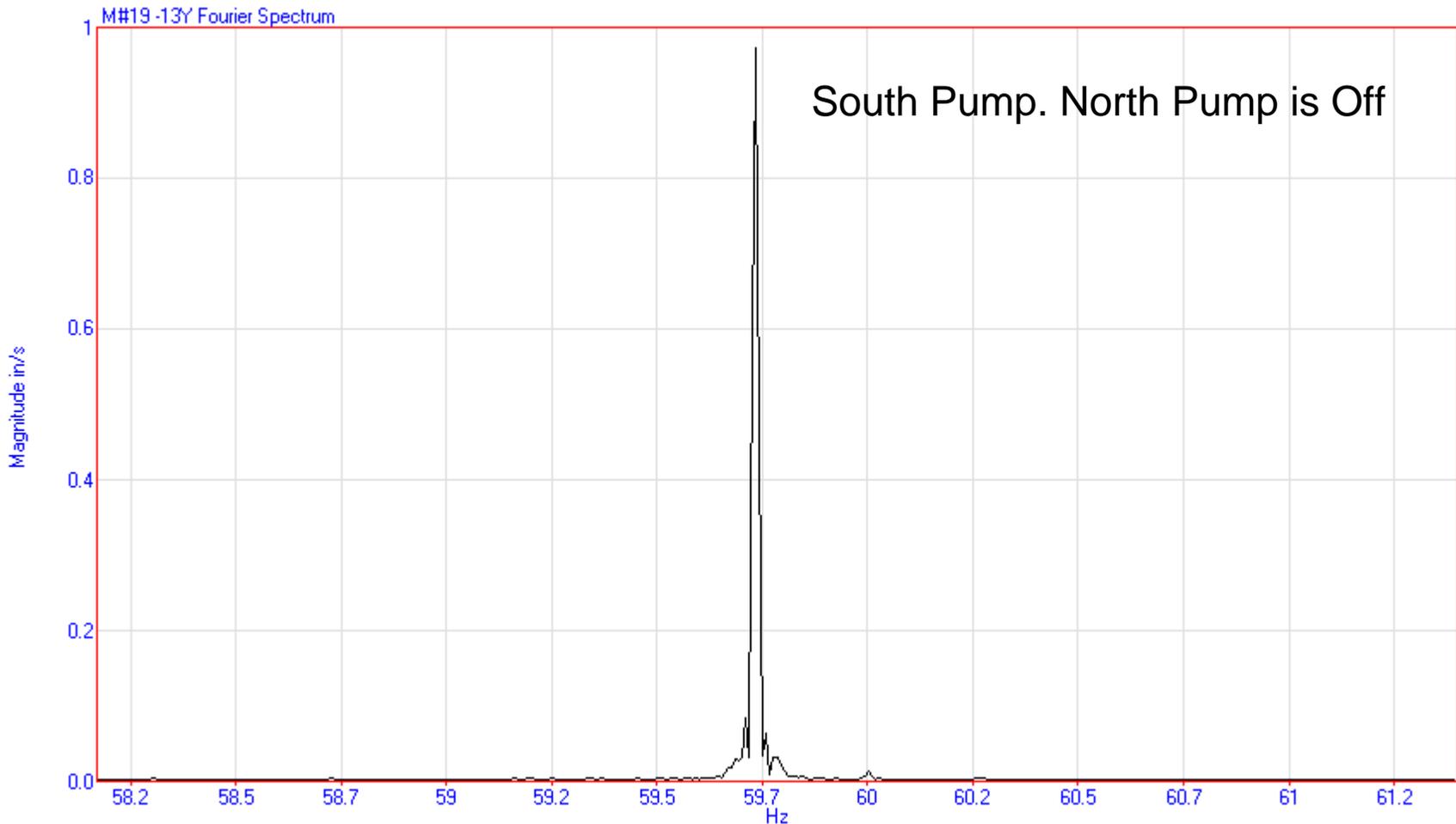
# Vibration Measurement on South Pump Bearing Housing, Coupling End Horizontal direction



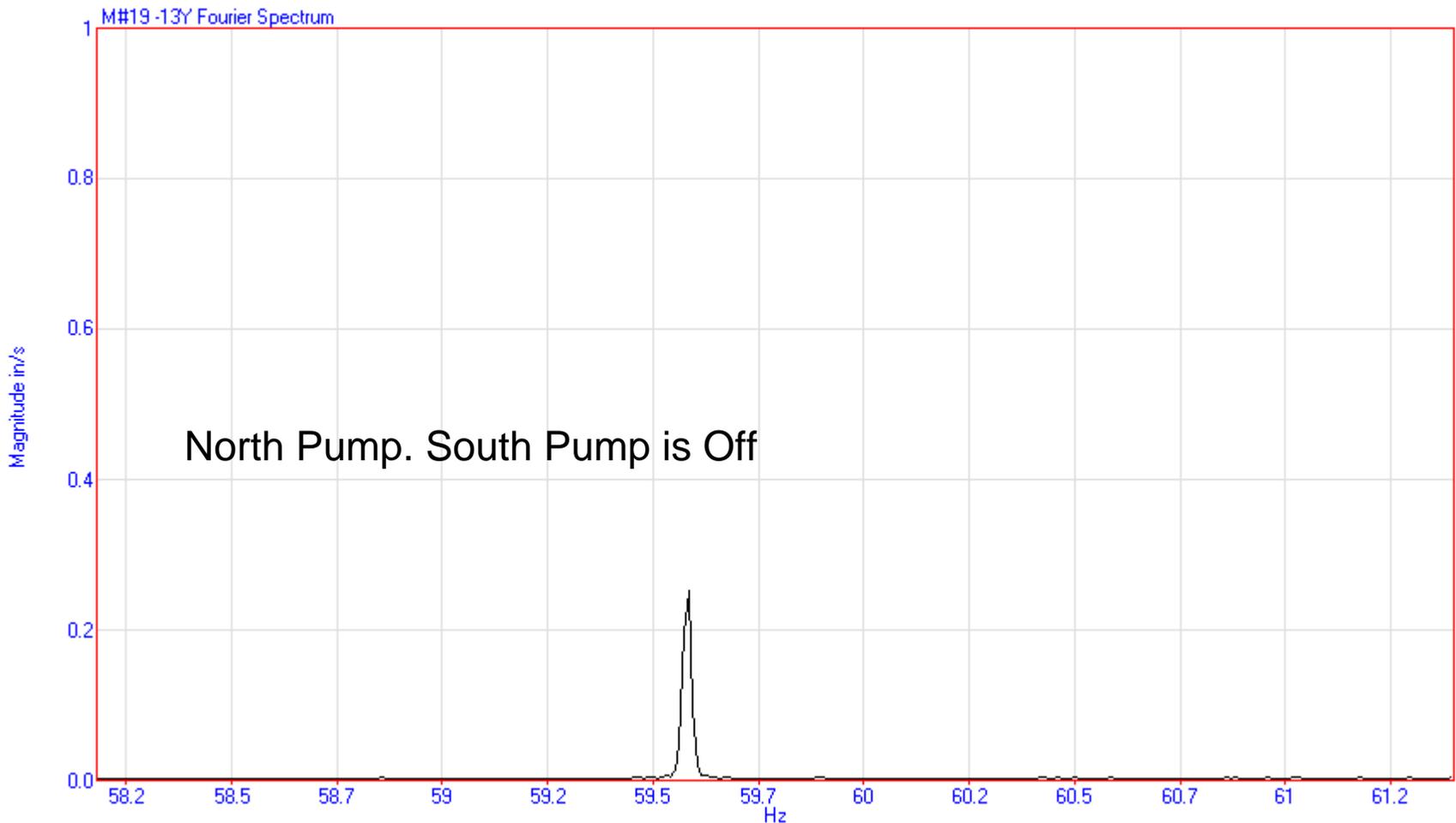
# Vibration Measurement on South Pump Bearing Housing, Coupling End Horizontal direction



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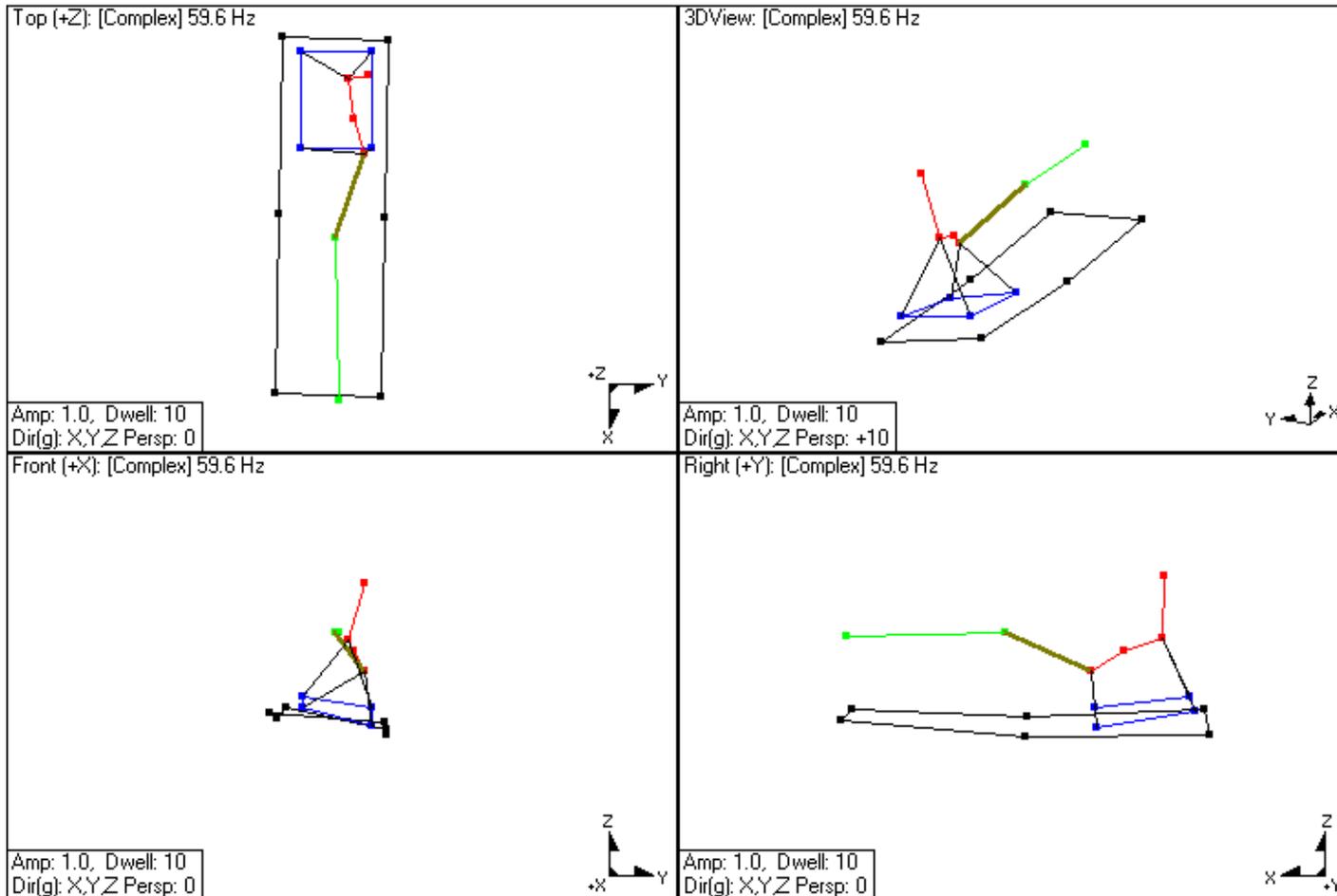


# Vibration Measurement on South Pump Bearing Housing, Coupling End Horizontal direction



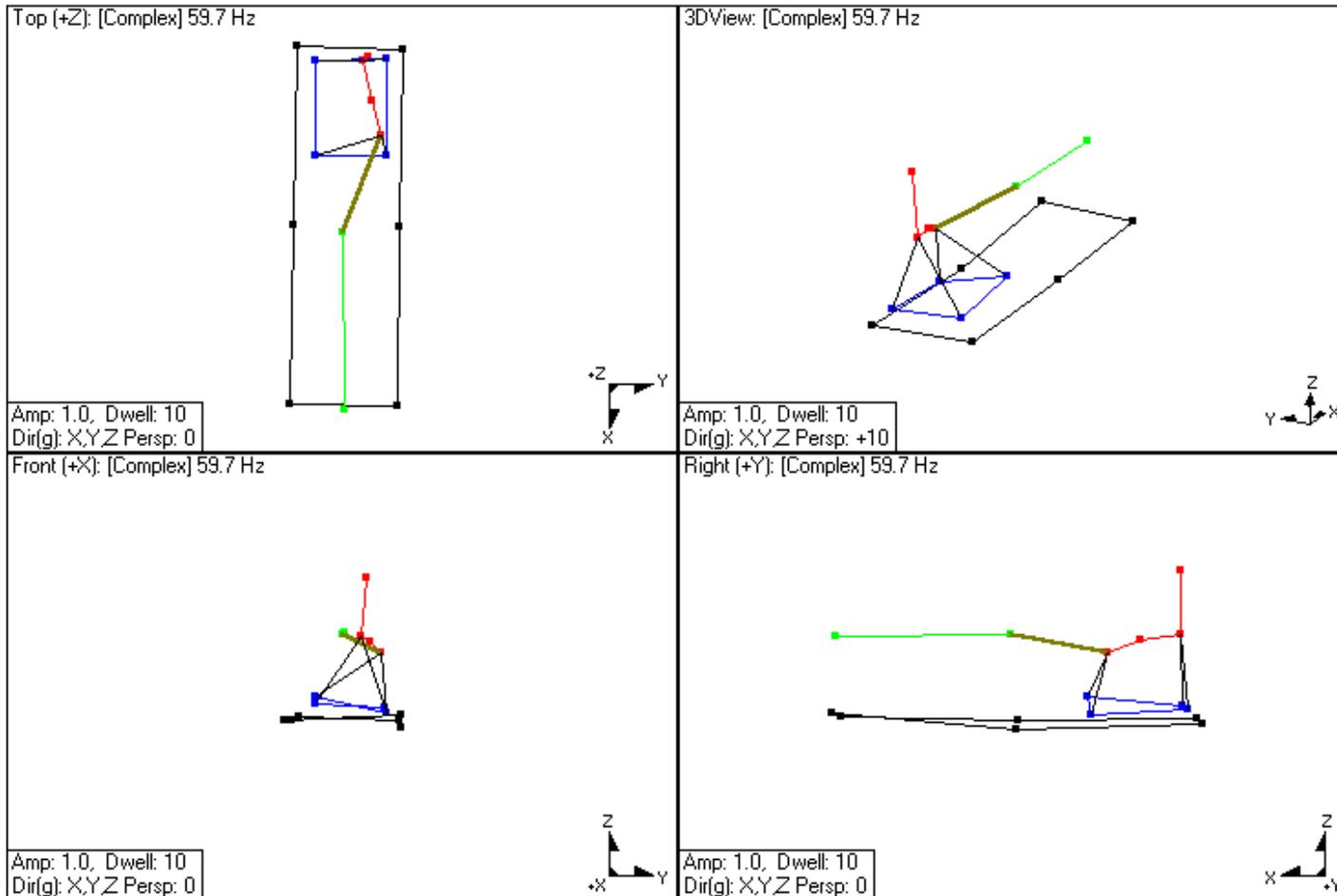
# ODS of the pumps

## North Pump



# ODS of the pumps

## South Pump



# Vibration Analyses

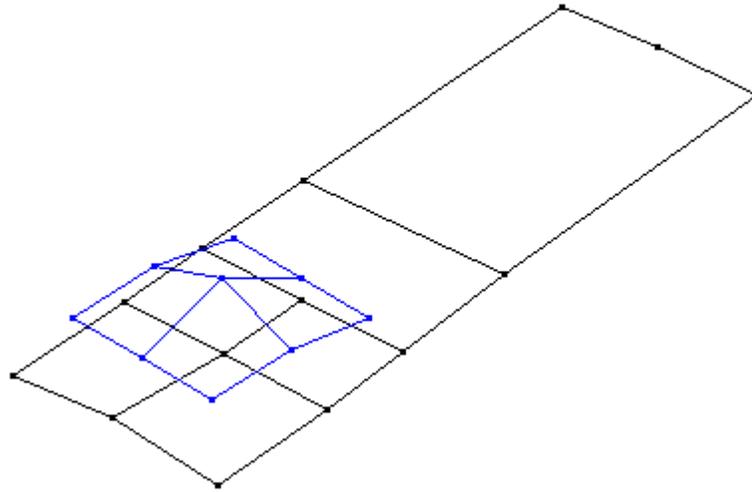
- All Vibration at running speed (1X)
- Previous attempts at balancing did not yield any significant improvements
- Maintenance Personnel thought the problem was a piping resonance

# Impact Testing

- Impact testing on the Inlet and discharge piping did not show any resonance in the vicinity of running speed
- Based on the evidence from the ODS, the baseplate was impacted in several directions. We found a natural frequency on the baseplate of the south pump at the running speed of that pump.

# South Pump Baseplate resonance

3DView: 59.7 Hz



Amp: 0.5, Dwell: 12  
Persp: +10



# Repairs

- Repaired the pump pad that had some cracks
- Changed the in-house baseplate for a fabricated baseplate that could be grouted in
- Corrected the local practice of tightening the pipe hangers to control vibration
- The pumps have been in operation for 5 years without major issues

# Current Look of the Pump Installation

