

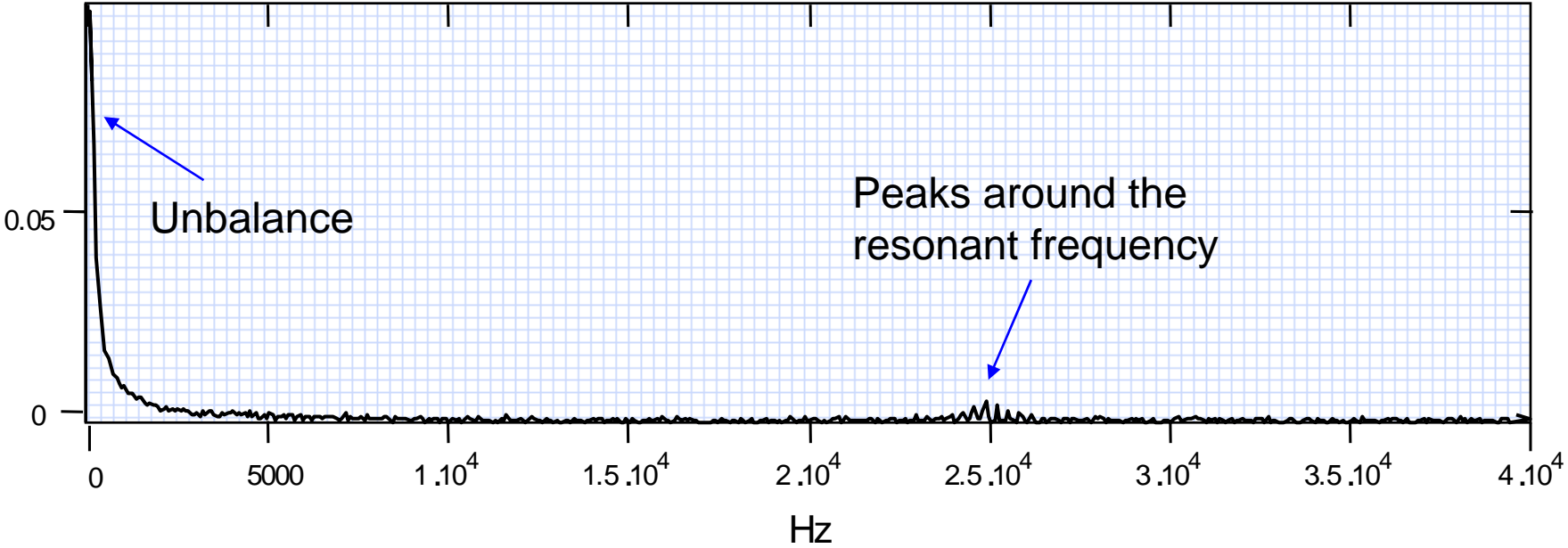


Using SPM to Trend Lubrication Condition in Rolling Element Bearings.

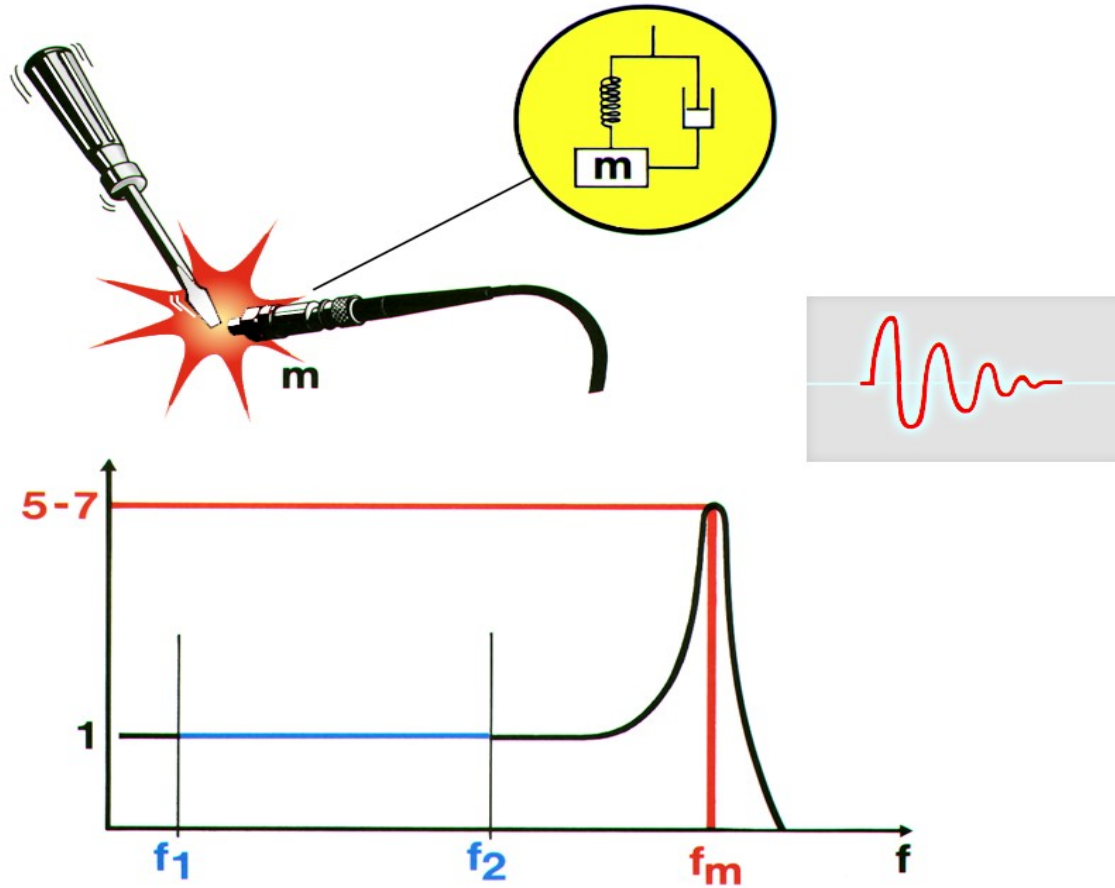
Shock Pulses



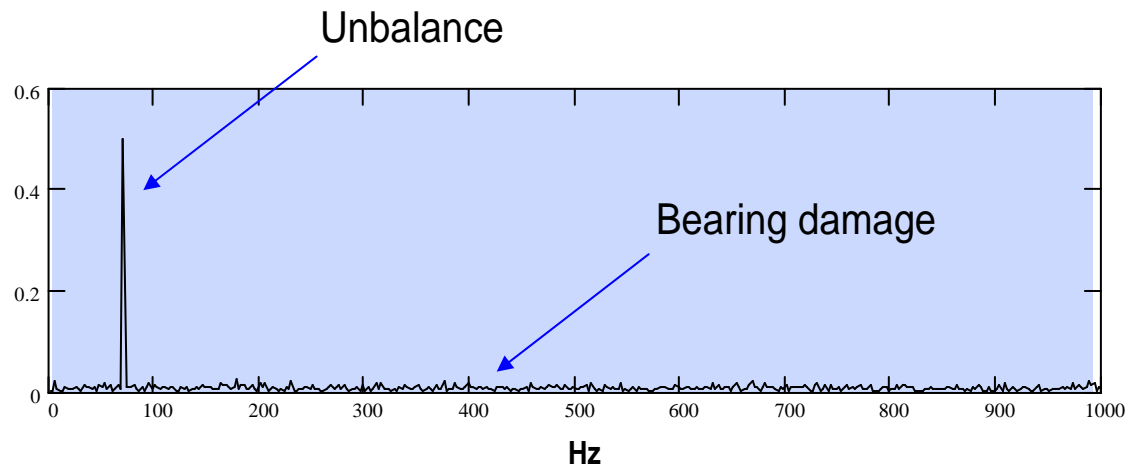
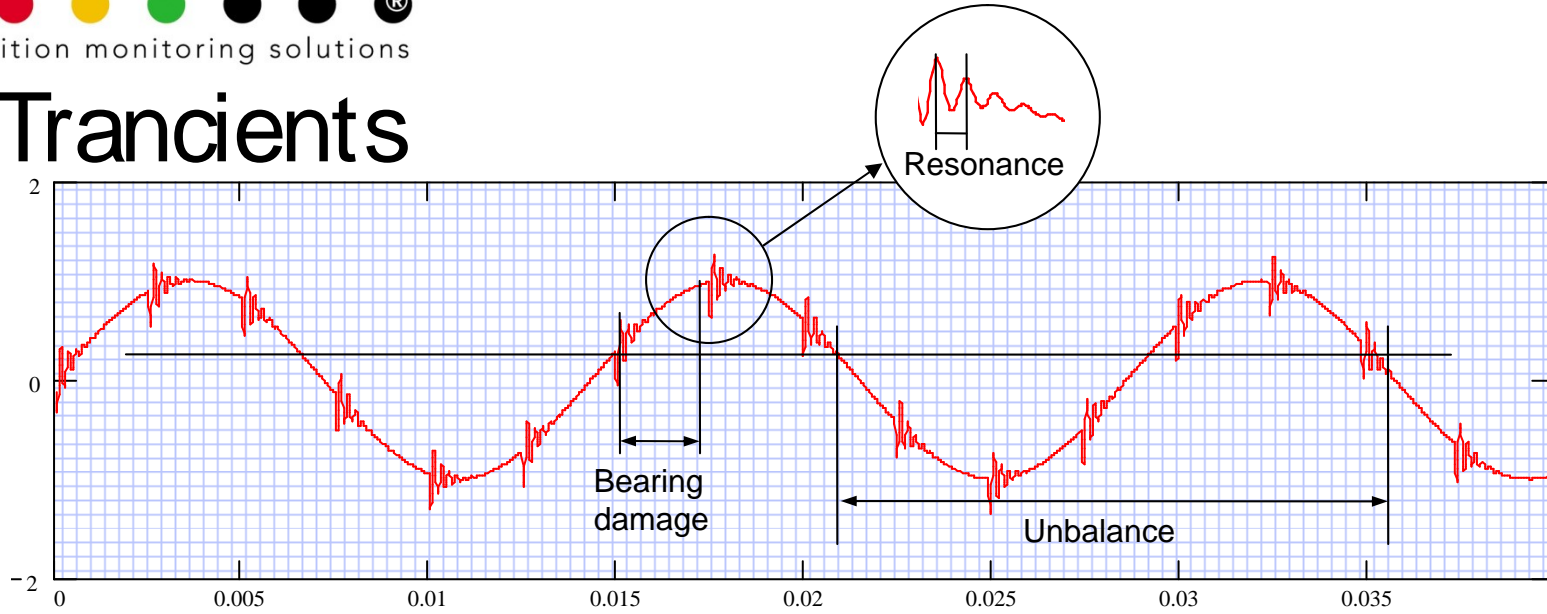
Resonance Frequency



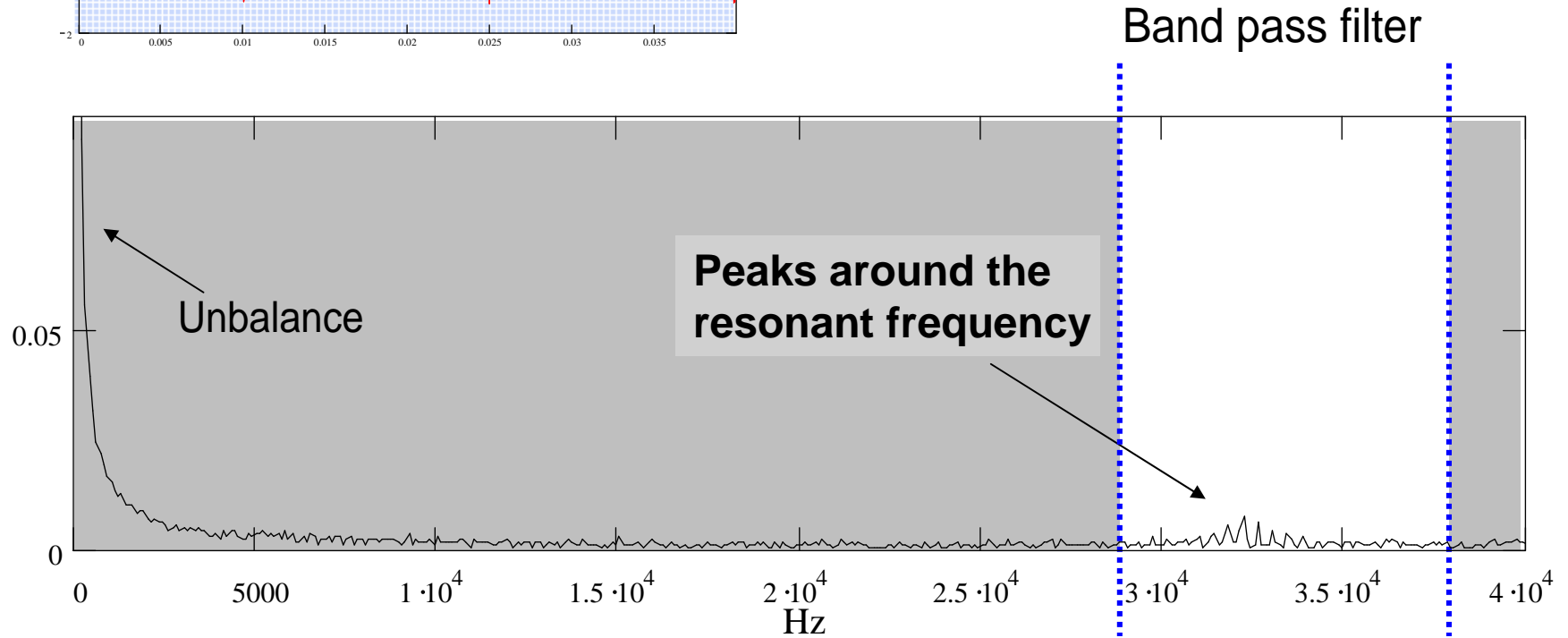
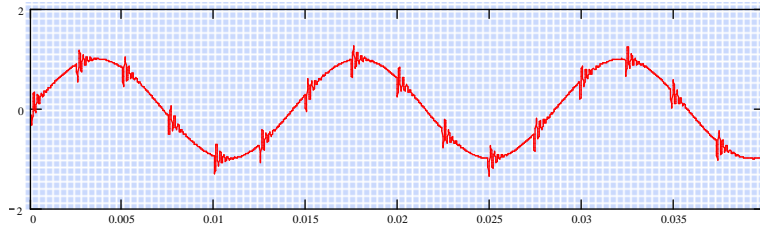
Shock Pulse Transducer

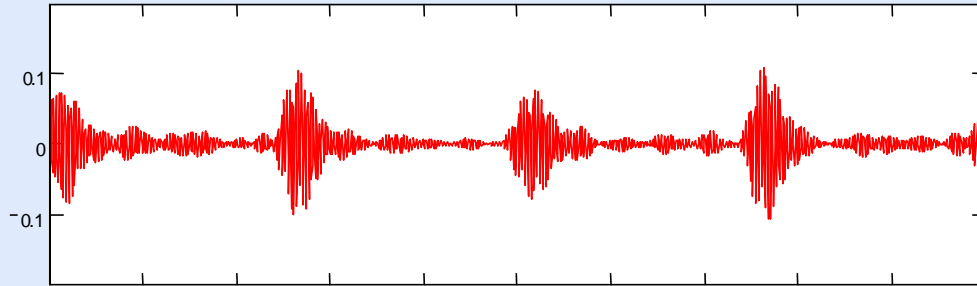


Trancients

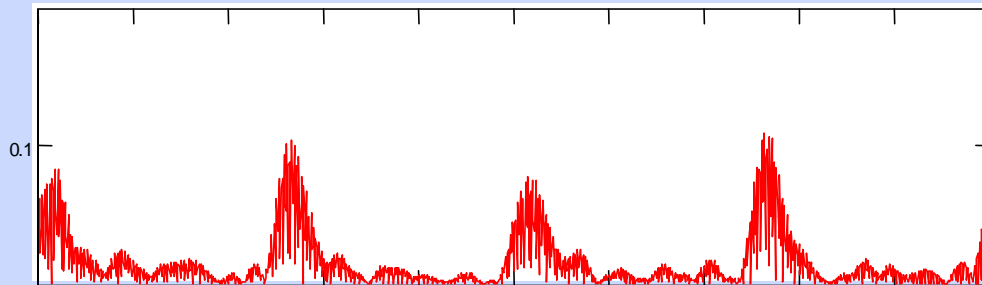


Enveloping at a Resonance Frequency

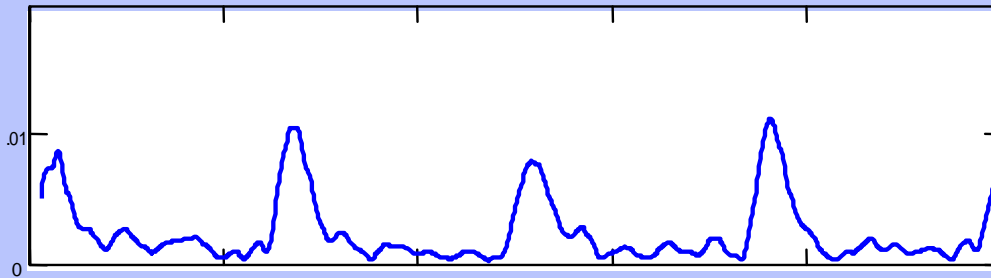




Signal after
band pass filter

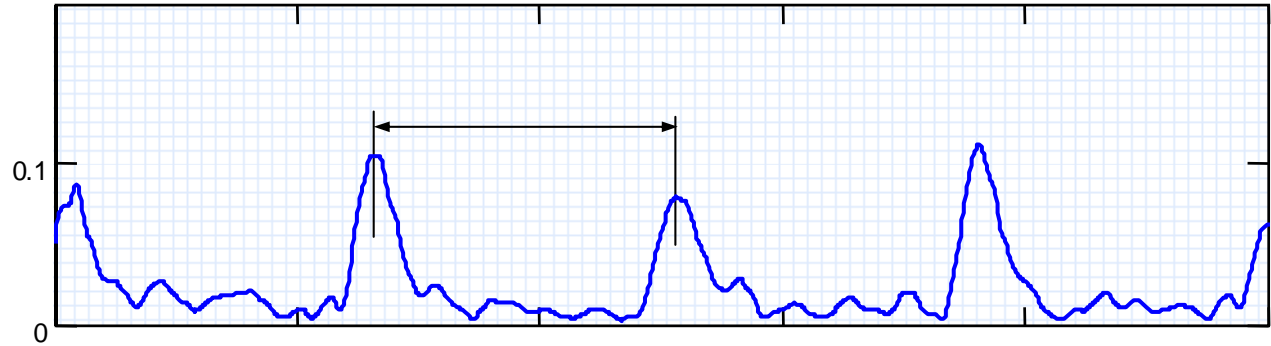
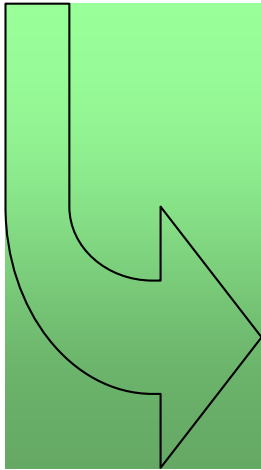
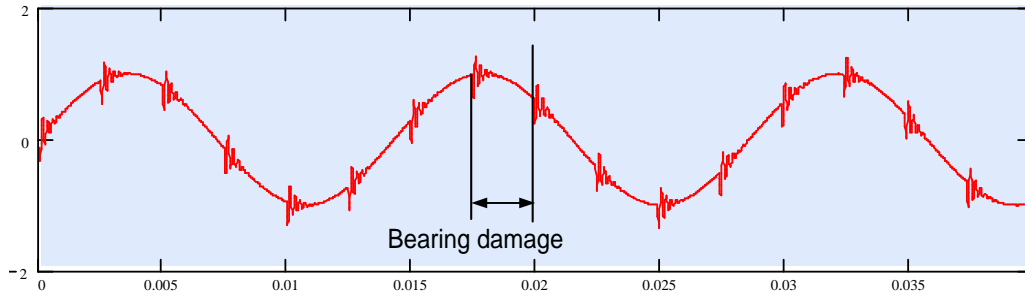


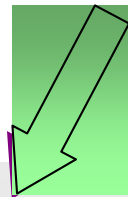
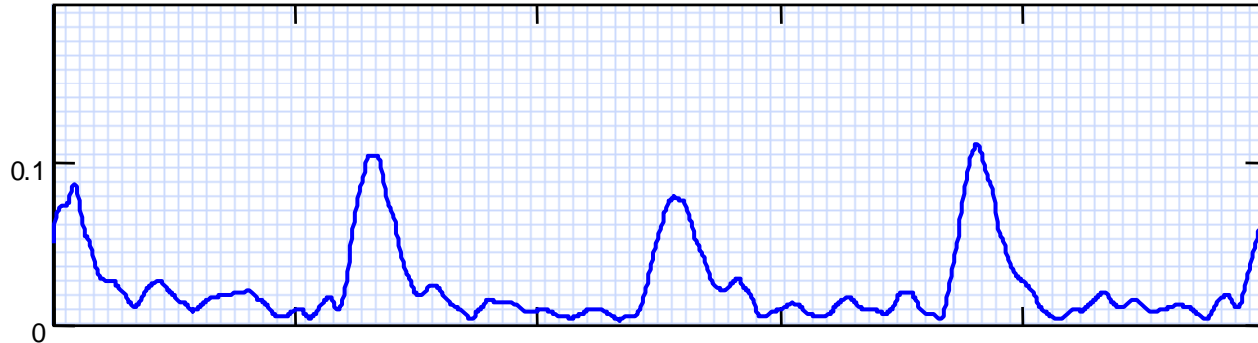
After rectifying



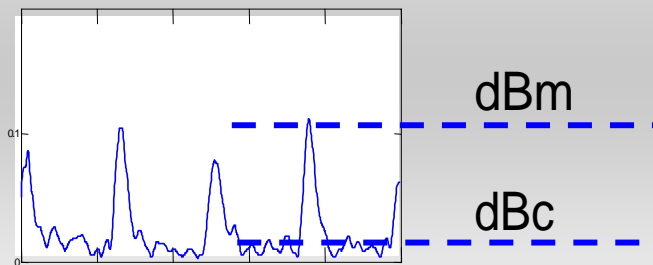
After enveloping

Peak detection

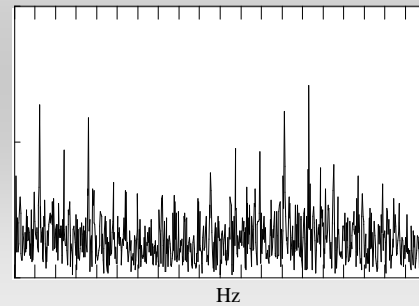


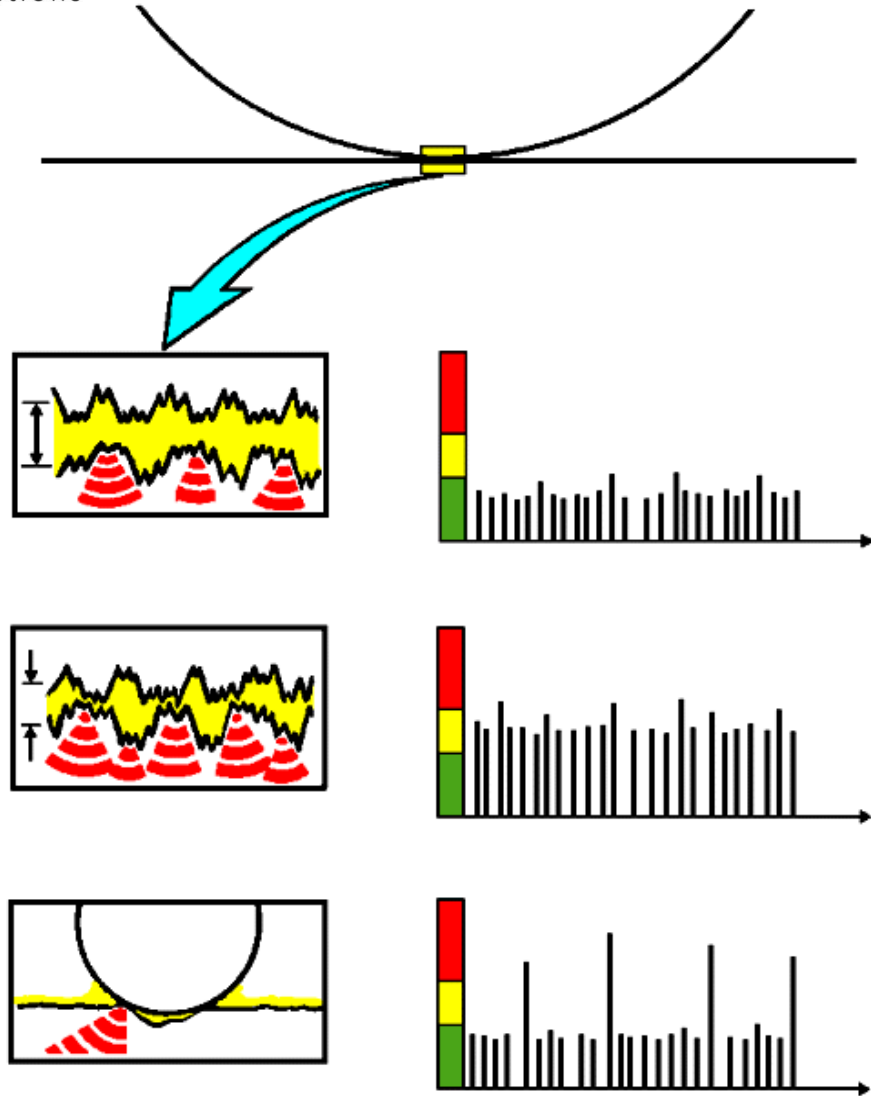


I. Time domain (SPM)

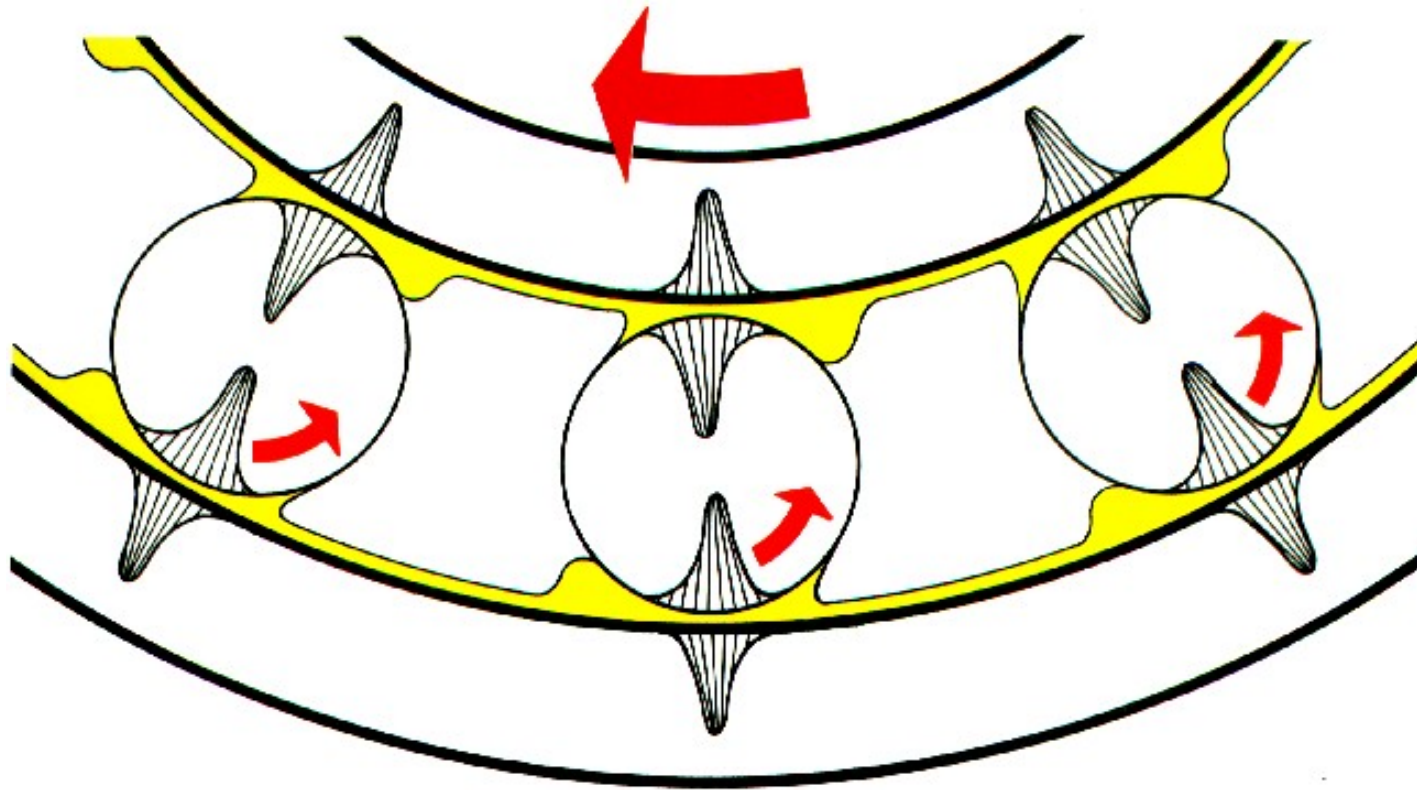


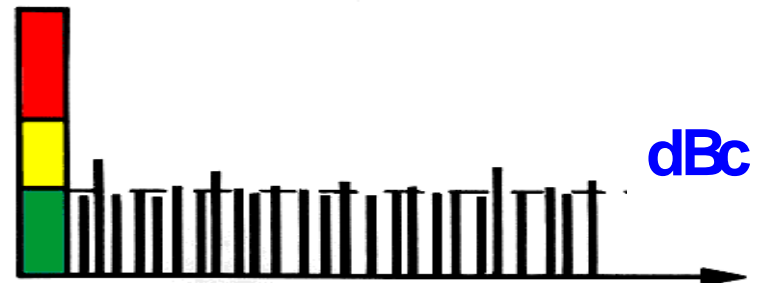
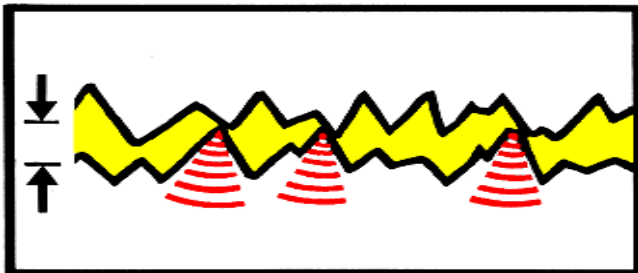
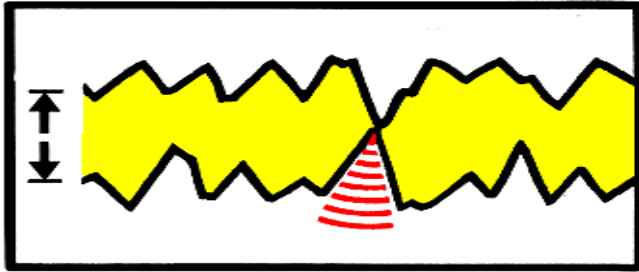
II. Frequency domain





Bearing Lubrication

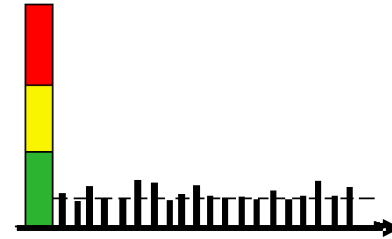




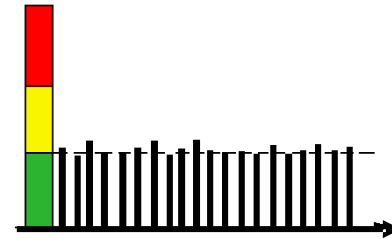
- ✓ The **dBc** value is effected by the lubrication condition in a bearing. It is commonly referred to as the background noise or the carpet noise of a bearing.
- ✓ The **dBc** value is calculated by sampling the incoming signal about a 1000/sec – an average of all the lower Shock Pulses.



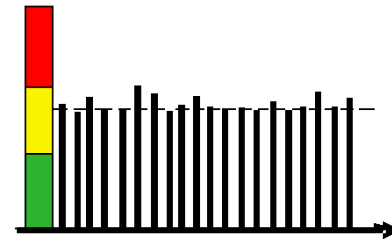
Full film lubrication

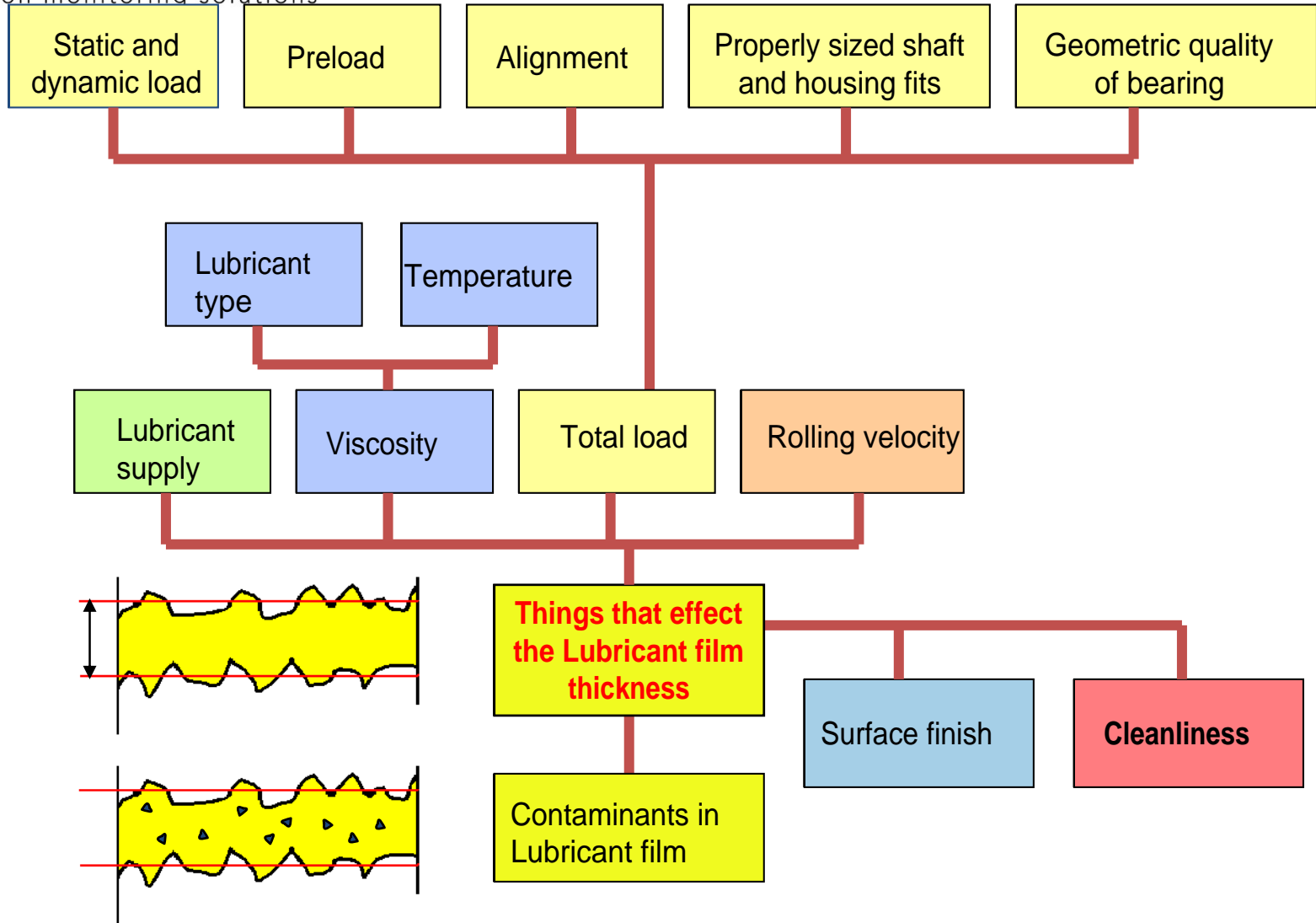


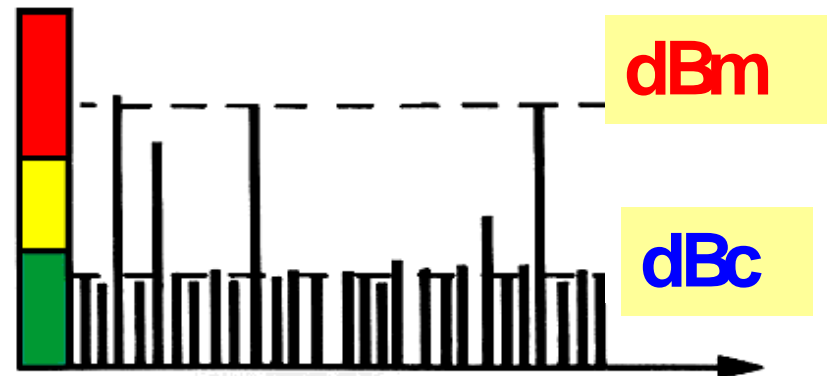
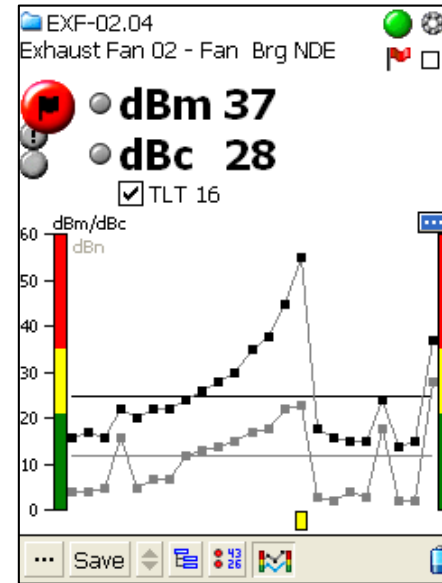
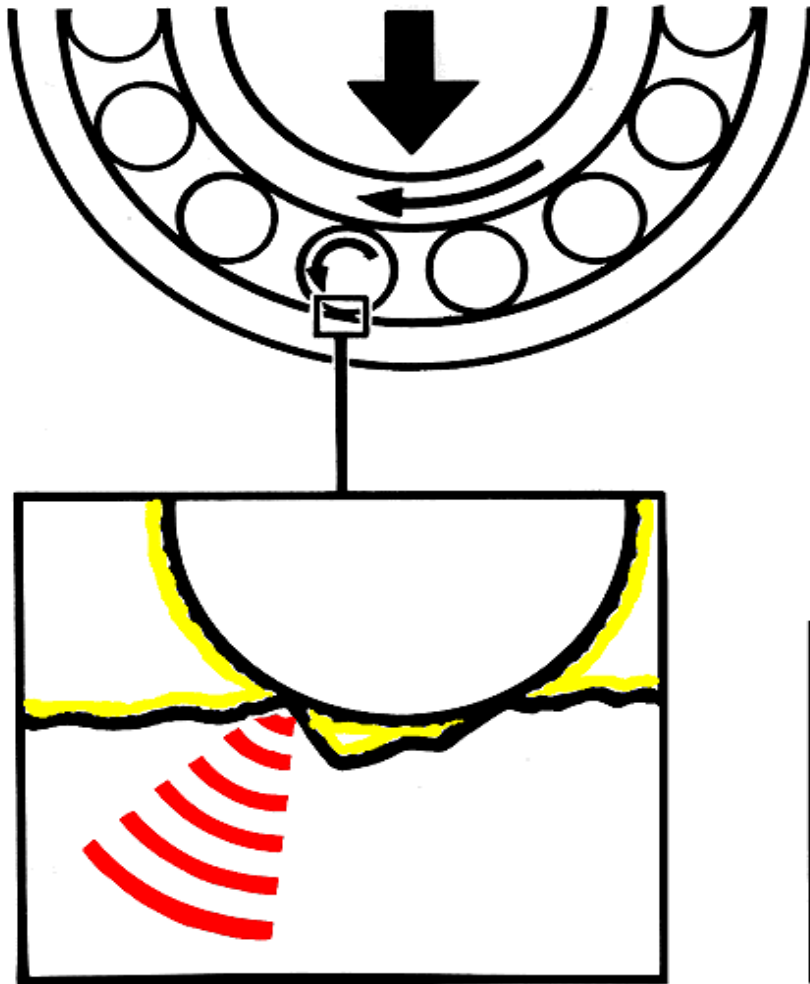
Partial lubrication



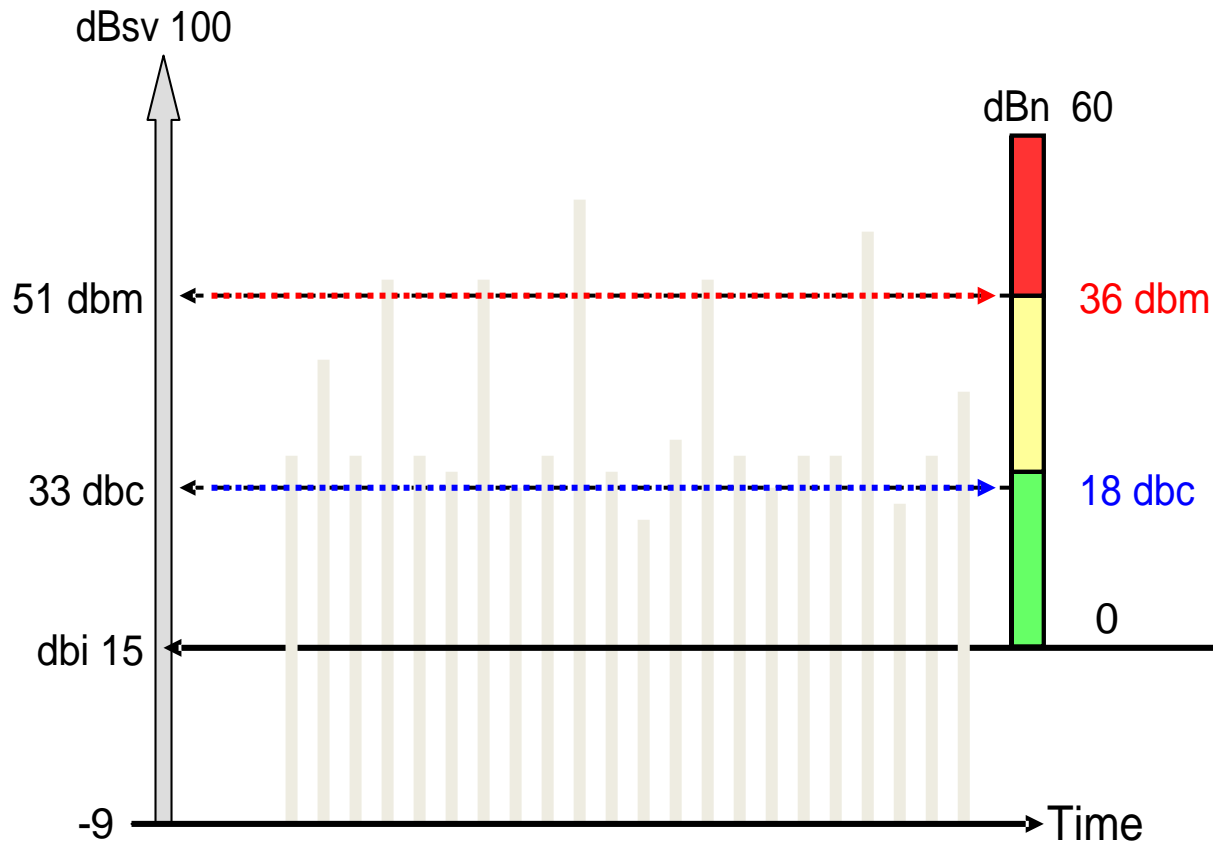
Boundary lubrication







SPM Evaluation Scale



Normalized measuring scale: $dBsv = dBn + dBi$

This becomes the starting point for the 0 – 60 Green - Yellow - Red scale.

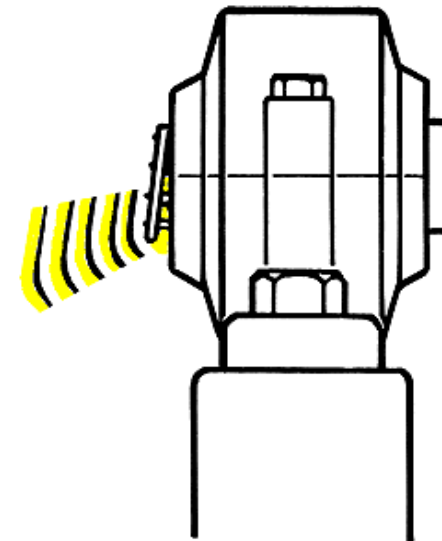
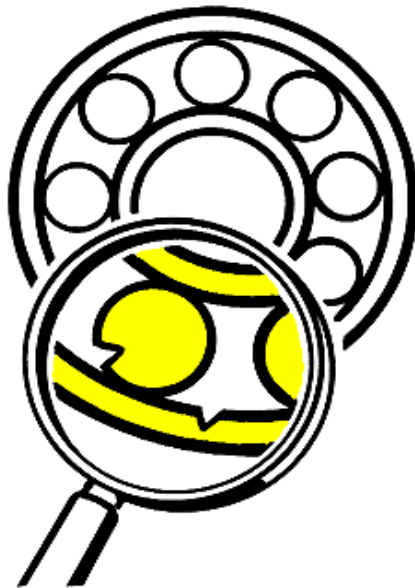
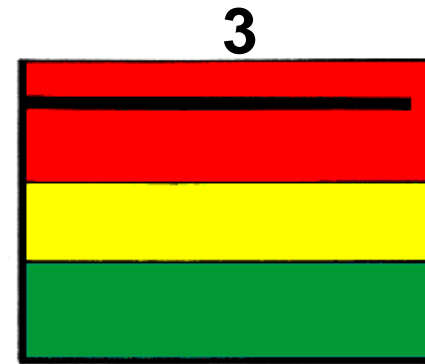
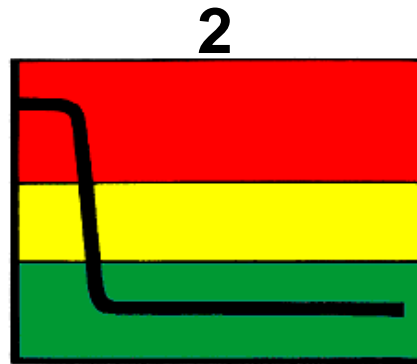
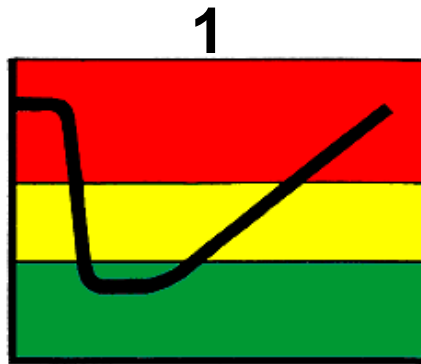
The dBi value is calculated once the RPM and Shaft Diameter have been input into the instrument or software.

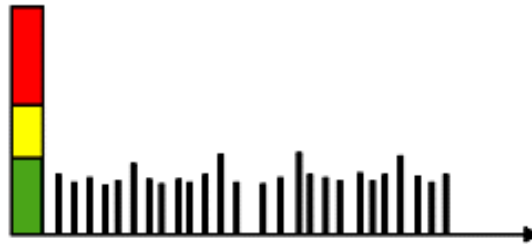
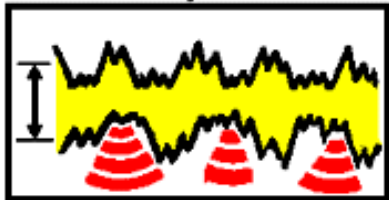
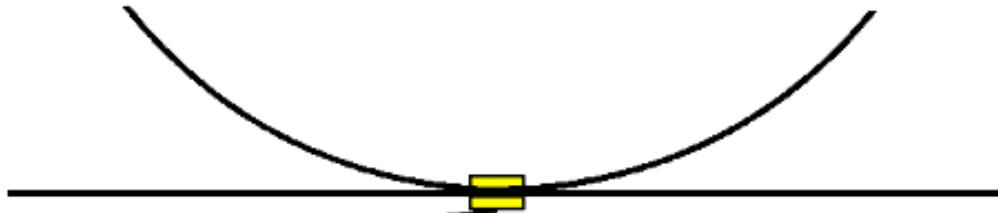
Measurement Results

Bearing Operating Condition:

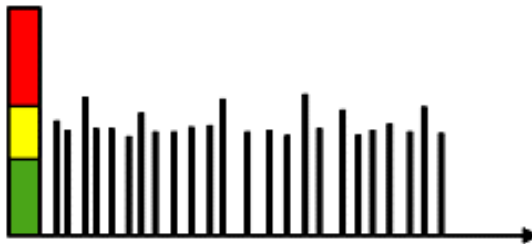
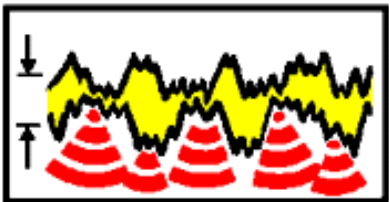
	Red	-	Bad (dBm 35 and more)
	Yellow	-	Caution (dBm 21 to 34)
	Green	-	Good (dBm up to 20)

SPM recommends changing the bearing when dBm reaches 55

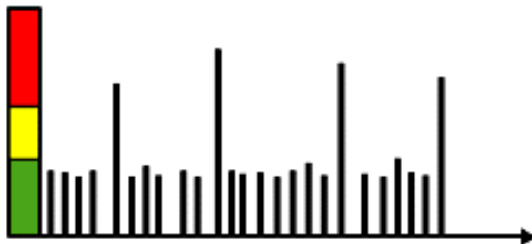




Low dBm/dBc readings with small delta indicates a good bearing

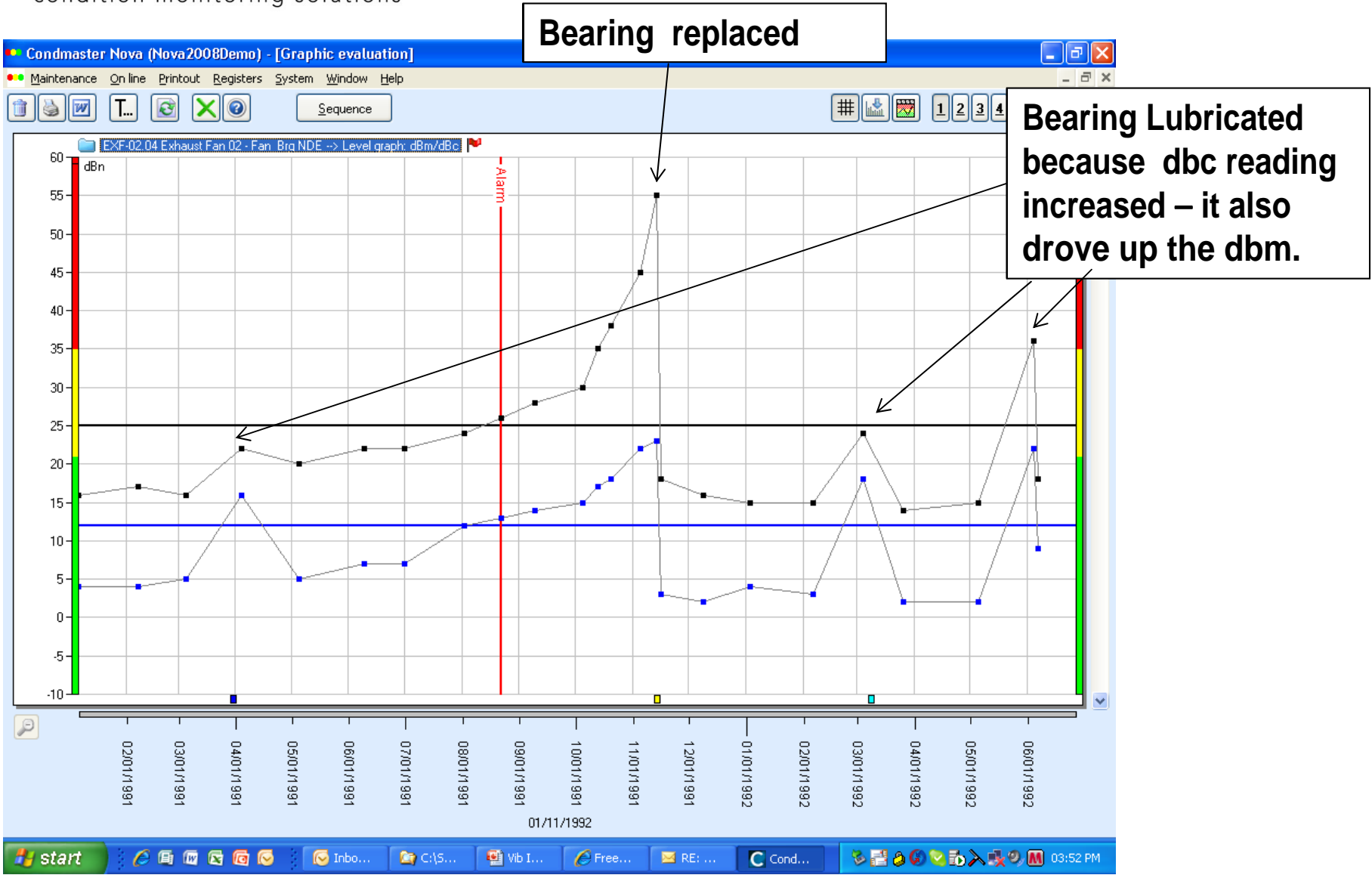


Small delta with elevated dBm/dBc readings typically indicate lubrication problems

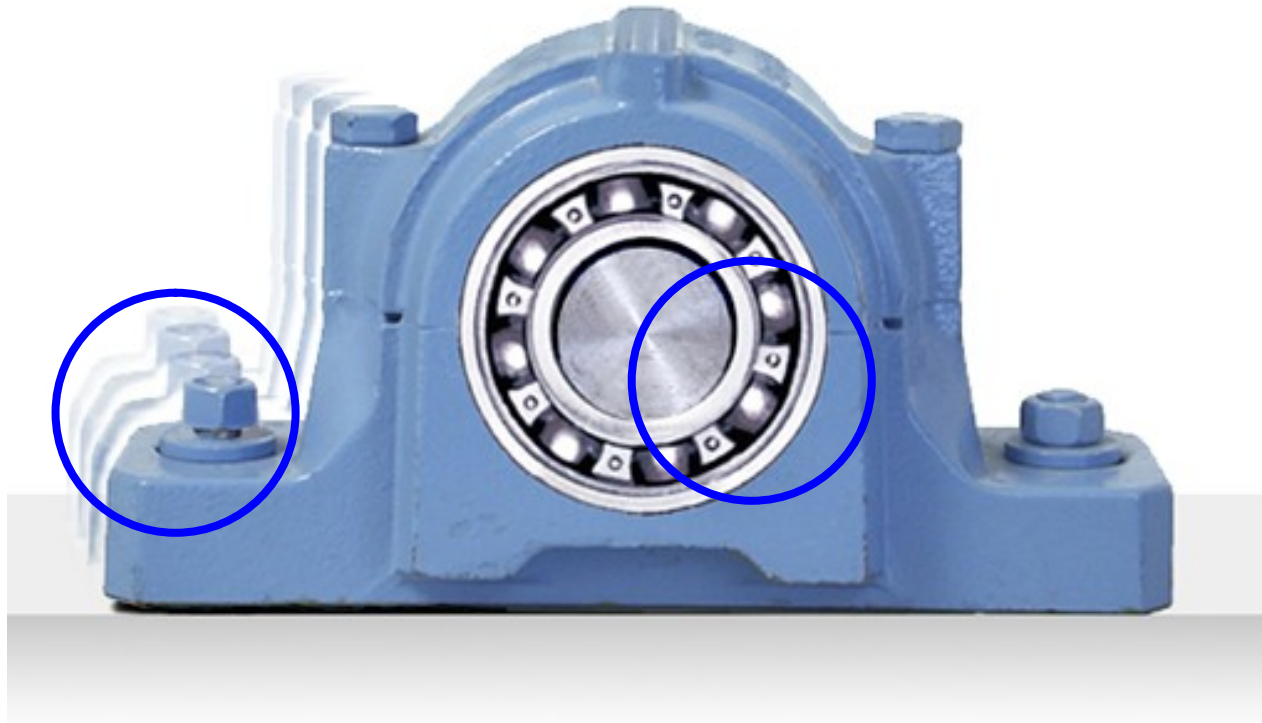


Large delta (15 or >) with elevated dBm/dBc readings indicate possible bearing damage or other mechanical problems

SPM dbm/ dbc trend graph



Signal Source?



Is the Red or Yellow SPM Reading from the bearing or outside source?



SPM Spectrum – used to confirm bearing and lubrication concerns

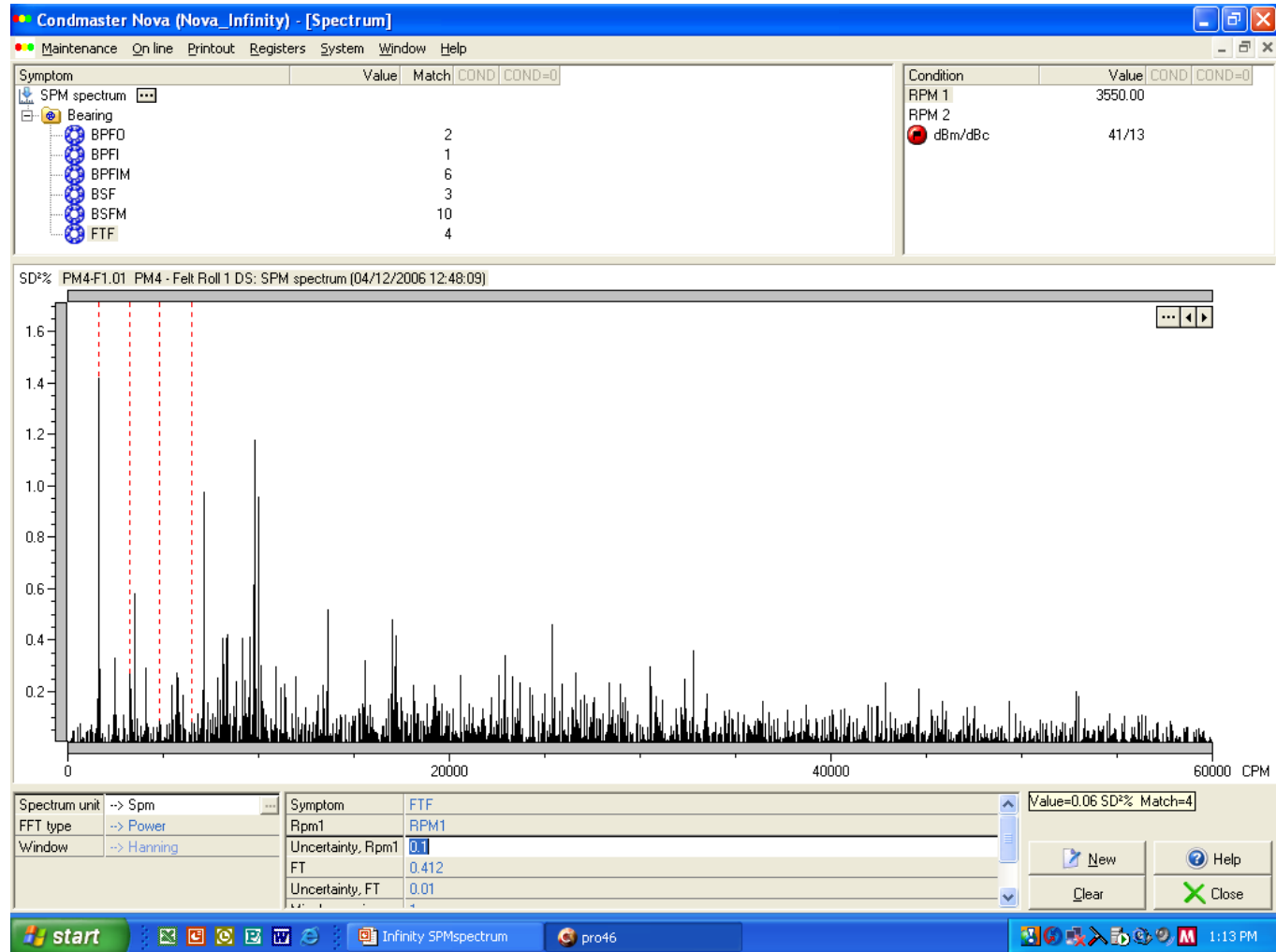
Add bearing coefficients in software to utilize Bearing Symptom feature

The screenshot shows the Condmaster Nova software interface. The main window is titled 'Condmaster Nova (Nova_Infinity)'. Below the title bar is a menu bar with 'Maintenance', 'On line', 'Printout', 'Registers', 'System', 'Window', and 'Help'. The main area is divided into several panes. On the left is a 'Measuring point tree' showing a hierarchy of folders and files. The central pane is titled 'Measuring point data' and shows a selected measuring point: 'PM4-F1.01 PM4 - Felt Roll 1 DS' with a sub-entry 'dBm/dBc (Leonova Infinity)'. Below this is a 'Variable speed' checkbox and a list of 'Available techniques' including 'SPM LR/HR', 'Vibration', 'Orbit analysis', 'User defined 1', 'User defined 2', and 'Checkpoint'. The right pane is titled 'SPM spectrum' and contains a 'Settings' table, a 'Symptom tree', and a 'Graph in instrument (Spectrum)'. The 'Settings' table has the following values: 'Always measure' (Yes), 'Upper frequency, Hz' (1000), 'Lines in spectrum' (1600), 'Window' (Hanning), 'Short time memory' (Full spectrum), 'Long time memory' (Peaks: 800), 'Spm spectrum type' (Pattern recognition (SD)), 'FFT type' (Power), 'Averaging type' (None), 'Zoom center', and 'Zoom factor'. The 'Symptom tree' shows a list of symptoms: 'Rotating inner race' (selected), 'Rotating outer race', 'Bearing' (selected), 'BPFO', 'BPFDM', 'BPFI', 'BPFIM', 'BSF', 'BSFM', and 'FTF'. The 'Graph in instrument (Spectrum)' shows a plot of 'SD²%' vs 'CPM' with a title 'SD²% PM4-F1.01 PM4 - Felt Roll 1 DS: SPM spectrum (04/12/2006 12:16:34)'. The plot shows several peaks, with the highest peak at approximately 15,000 CPM. The x-axis ranges from 0 to 60,000 CPM, and the y-axis ranges from 0 to 8. The bottom of the window shows a Windows taskbar with the 'start' button, several application icons, and the system tray showing 'Infinity UserDefined', 'Infinity SPMspectrum', 'pro46', and the time '12:34 PM'.



SPM Spectrum with Bearing Symptom in software

Bearing Symptom matches up with FTF in this example – confirming bearing damage.





Thank You!