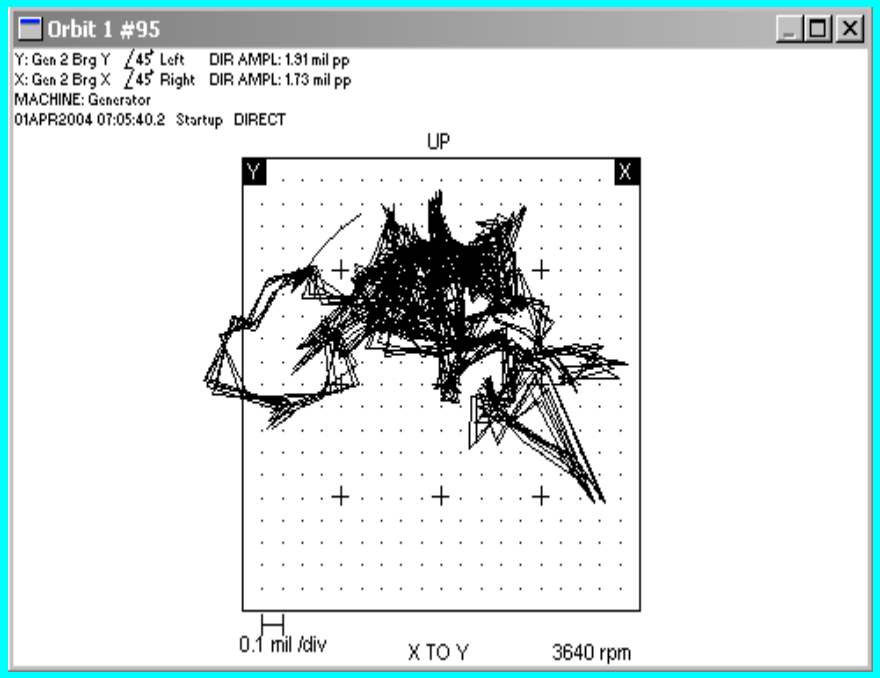
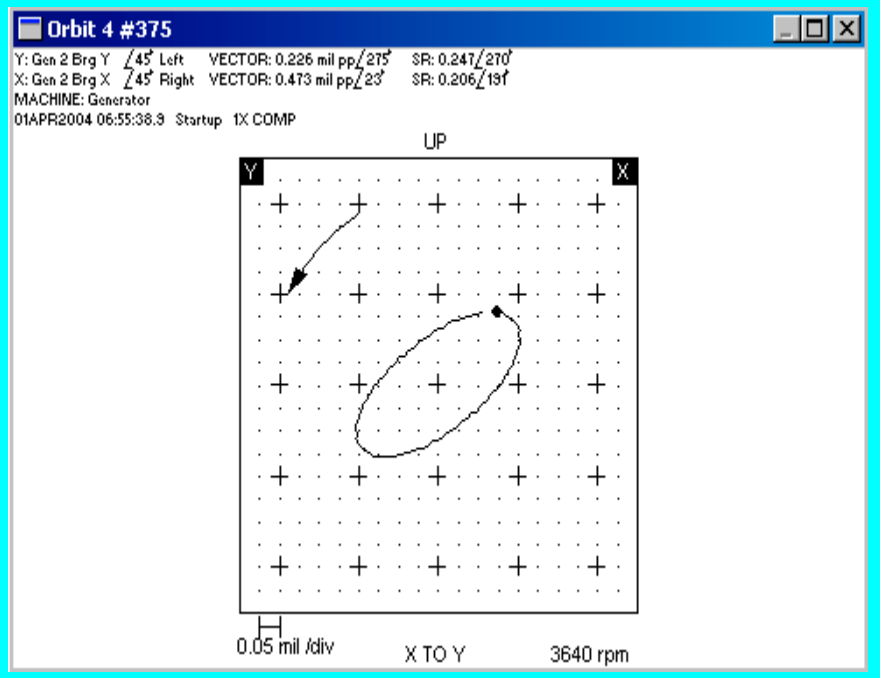
Proximity Signal Use

What are we looking at?





GE imagination at work

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Proximity Signal Use

What are our Goals:

- Accurate information to provide:
  - Machinery Condition Monitoring
  - Machinery Diagnostics
  - Machinery Reliability Improvements
  - Etc.

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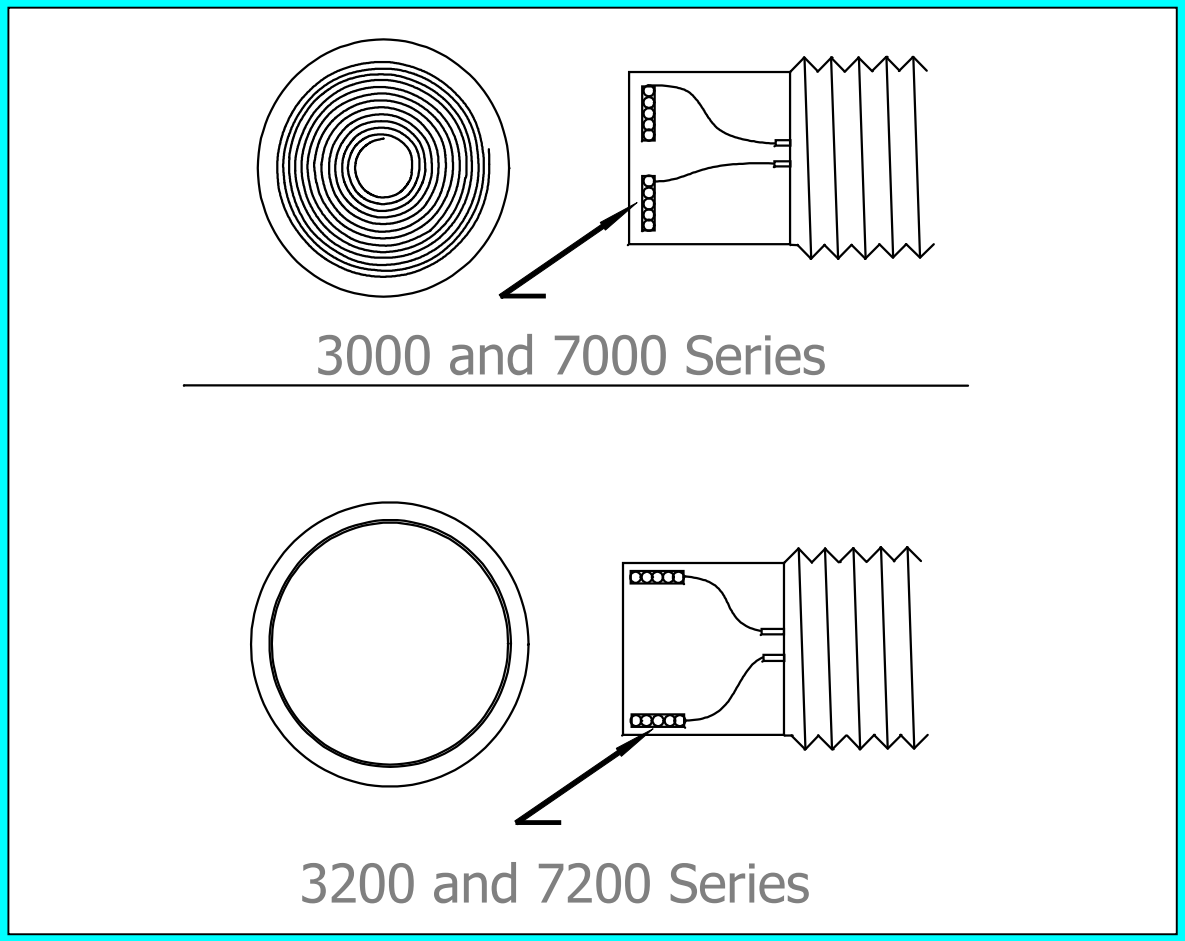
Proximity Signal Use

Probe
Coil
Types



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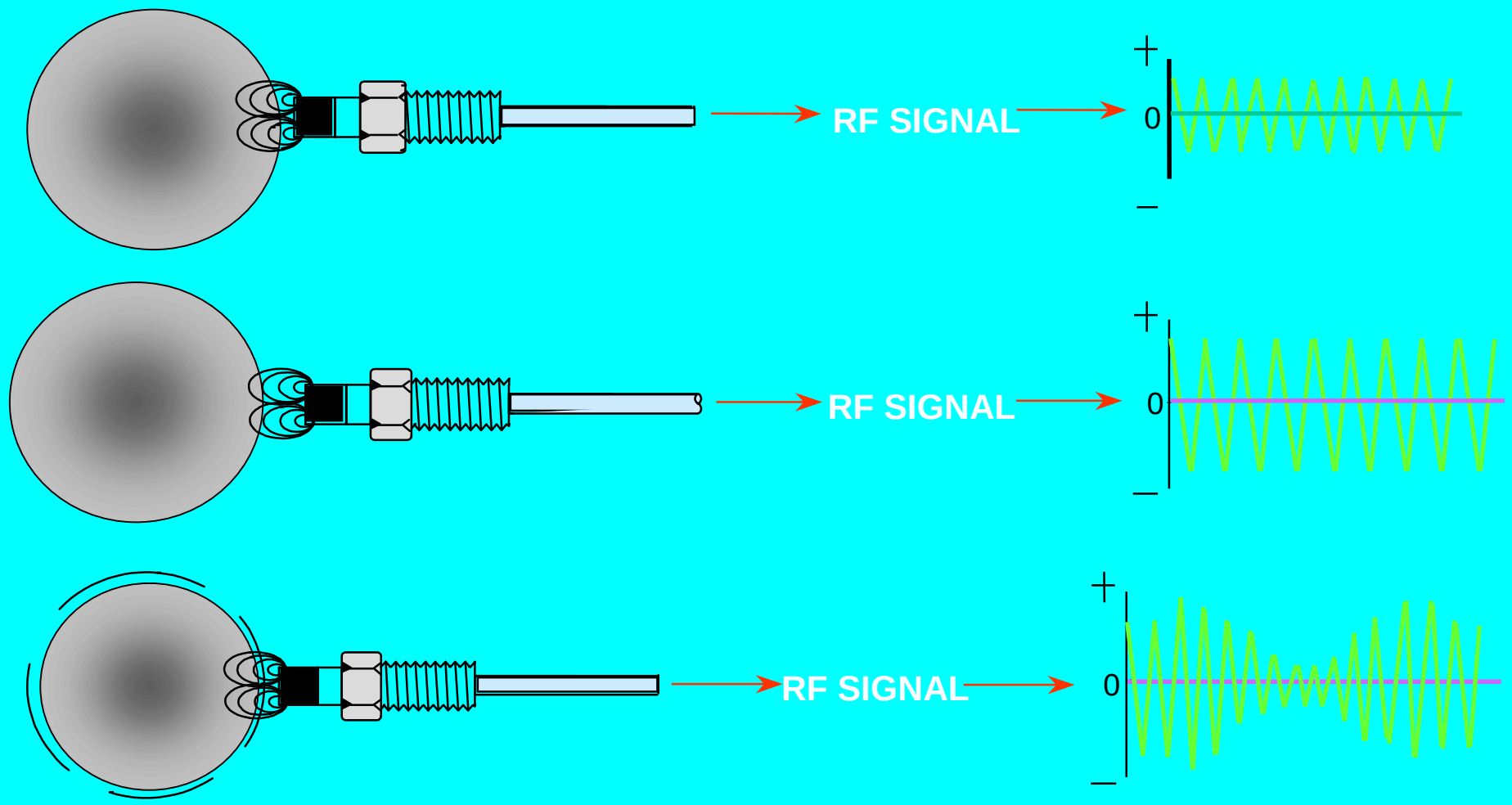
Proximity Signal Use



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Proximity Signal Use

Common Installation Problems

- Cross coupling effects
- Probe tip side clearance
- Radial probe orientation
- Bracket resonance
- Incorrectly gapped probes
- Noise and signal errors
- Wrong target material
- Target area has an overlay (I.e. chrome, etc.)

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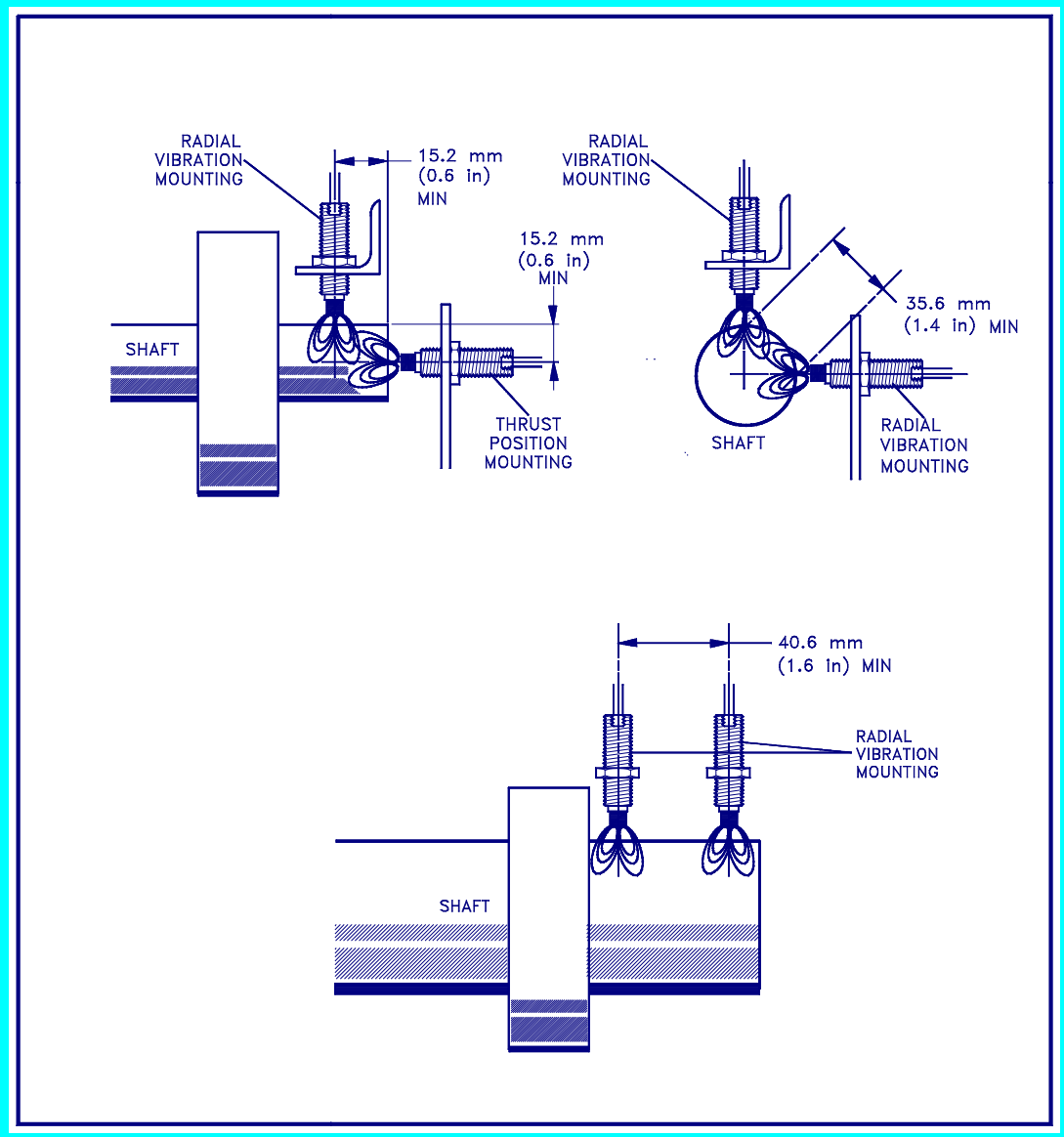
Proximity Signal Use

Cross coupling effects



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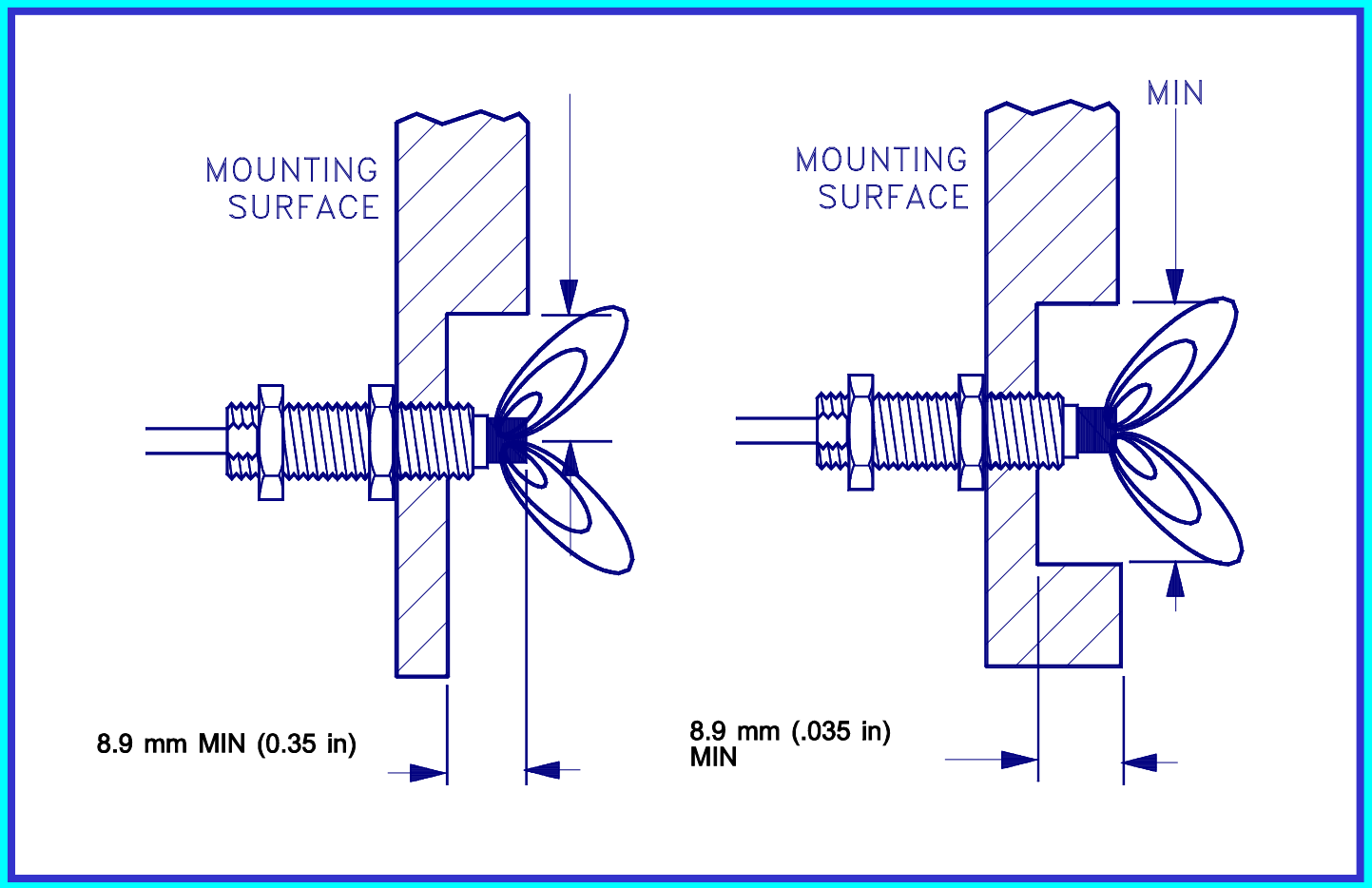
Proximity Signal Use

Probe tip side clearance



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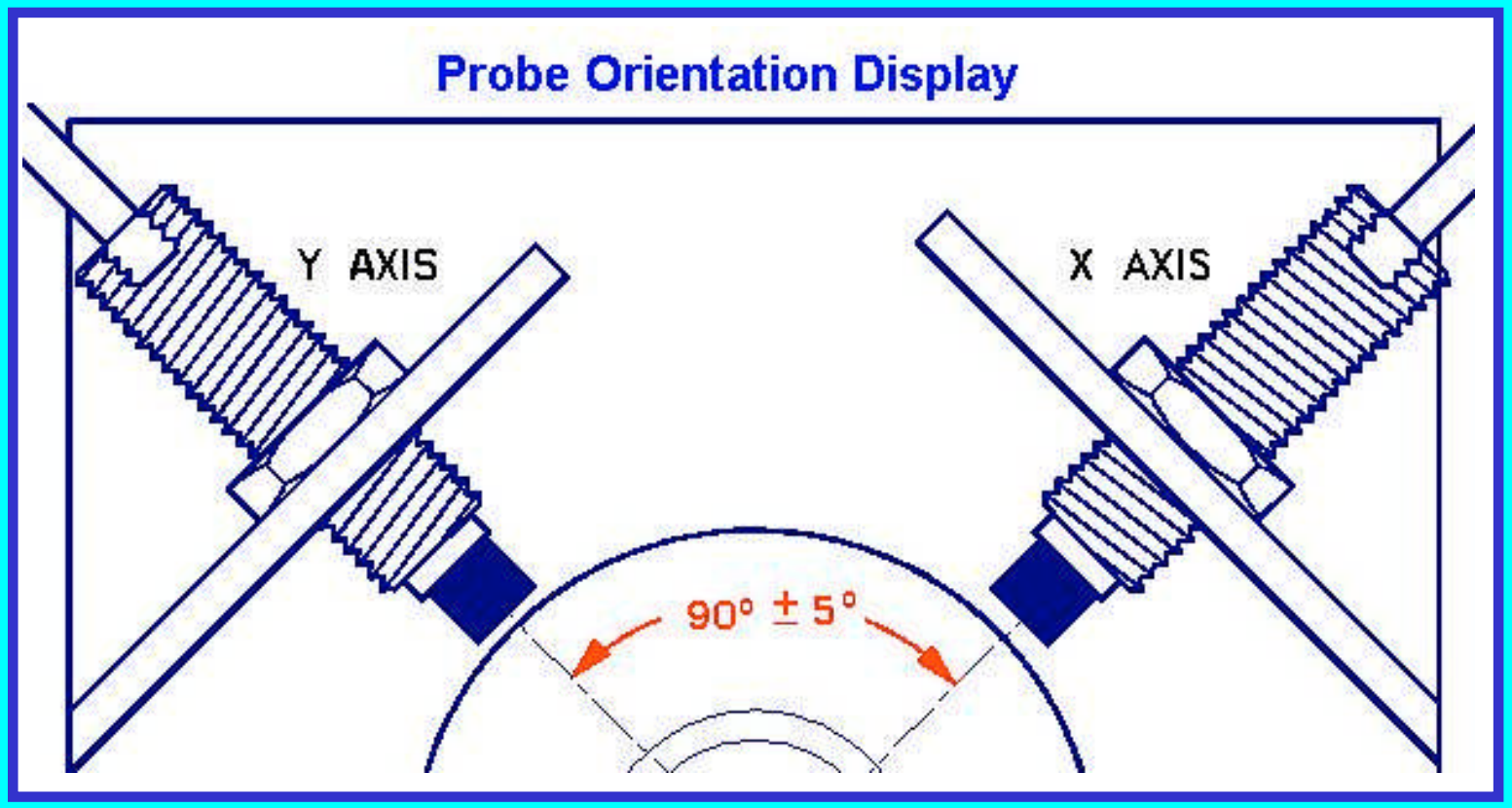
Radial probe orientation



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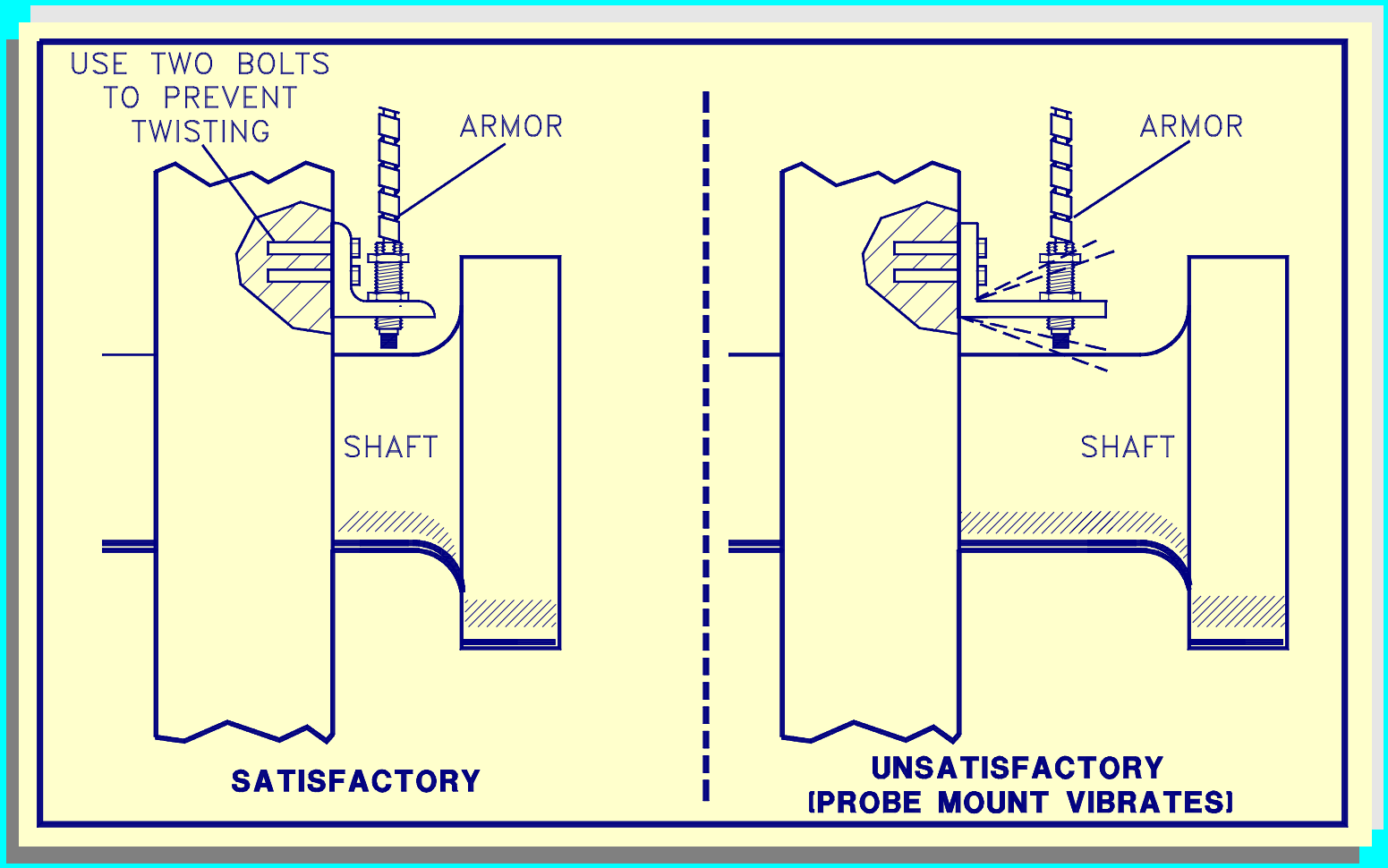
Bracket resonance



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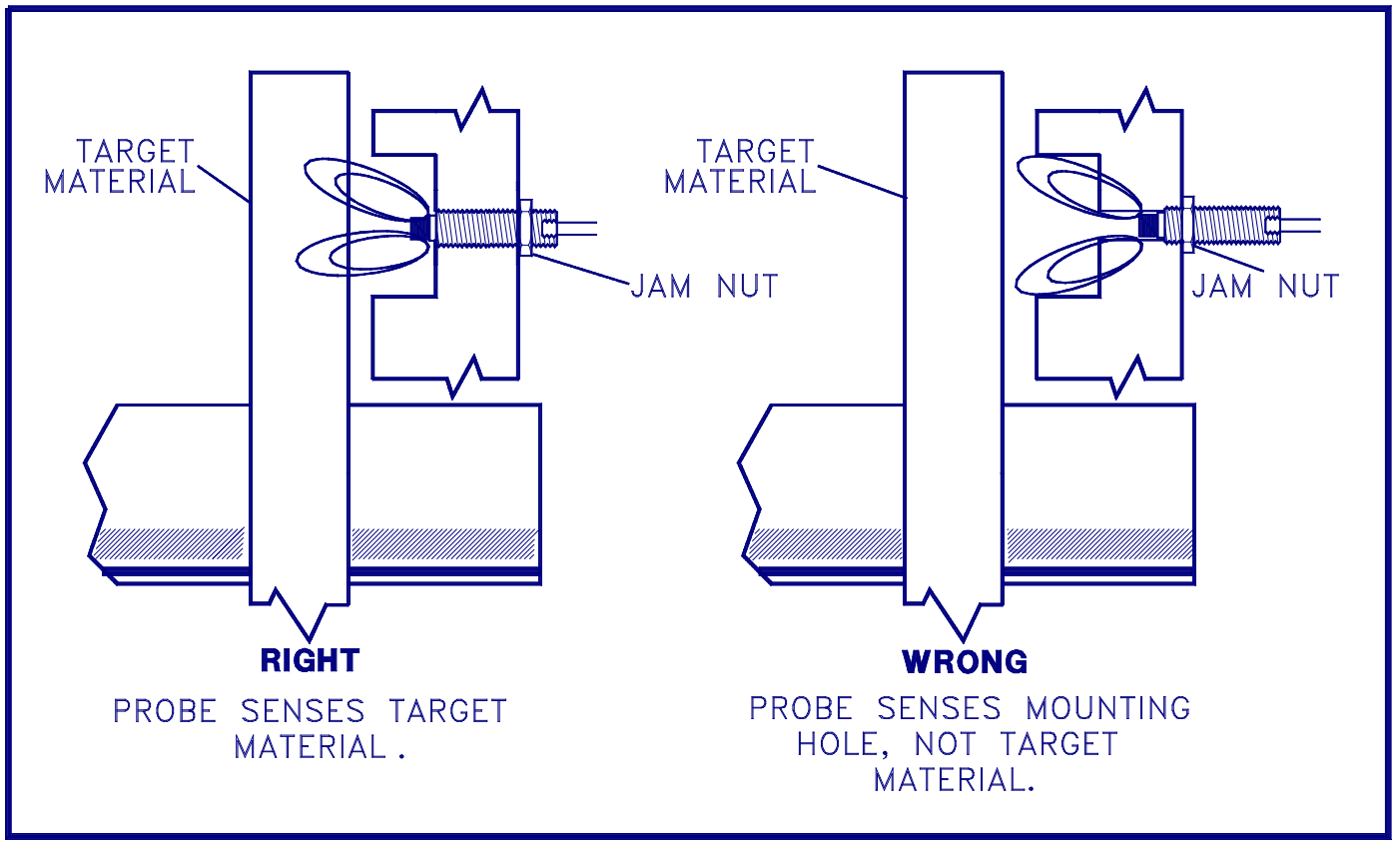
Incorrectly gapped probes



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Proximity Signal Use

Noise and signal errors

Noise Definition – Undesirable signal components that:

- Distort the Data.
- Contains no relevant information to the measurements being taken.
- Interferes with the ability to accurately diagnose the machine condition.

What can cause errors?

- Ground loop problems
- Electrical noise from other signal cables
- Integration noise.
- Runout.
- Transducer resonance.
- Mismatched parts
- Target Material Issues

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Proximity Signal Use

Noise and signal errors

Removing or eliminating noise:

- Proper electrical installation practices
  - Single point ground, shielded cables, verify cable and connector integrity, separate cable trays, etc.
- Proper grounding practices
  - Perform grounding using philosophy that we are looking at two circuits; a power circuit and a signal circuit.
- Proper matching of transducer system components
- Filters
- Compensation

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Proximity Signal Use

- **Transducer System**
  - Three pieces are tuned to get a proper signal.
    - Probe, Extension Cable, and Proximitor.
    - If any of the components do not match, this will change the scale factor and the amplitude levels will not be accurate.
    - There are many variables that would determine how far off of the curve the ‘modified’ scale factor would be.

- Just please be sure that the components have to be a matched set!!

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Proximity Signal Use

- **Target Material Issues**
  - It is critical to have the properly identified target material to ensure accurate signals.
    - Typical transducer systems are calibrated to send a 200mV/mil signal (scale factor) when the target is 4140 steel.
      - If the target is not 4140 or similar the scale factor of that material needs to be verified and if significantly different the system can be calibrated as necessary.
      - If the target has an overlay the scale factor and response of the transducer system can be affected. Chrome plating or any corrosion resistant overlay will cause problems on an off the shelf system.

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Proximity Signal Use

- Glitch
- We list several items together that affect the signal and call it Glitch.
  - Surface scratches
  - Residual magnetism.
  - Electrical runout.
  - Mechanical runout.
- All of the above items will show up as amplitude levels and ‘vibration’ at shaft speeds that are too low to create real dynamic motion. If you are at 200 rpm on a 3600 rpm machine and your monitor says there is over 1 mil of vibration, it is probably ‘Glitch’ and needs to be corrected.

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Proximity Signal Use

What signal(s) do we actually see from a Proximity Probe?

- The DC signal
  - Quantifies the gap between the probe tip and the target
- The AC signal
  - Quantifies the variation in the DC signal to determine the shaft movement to and away from the probe.

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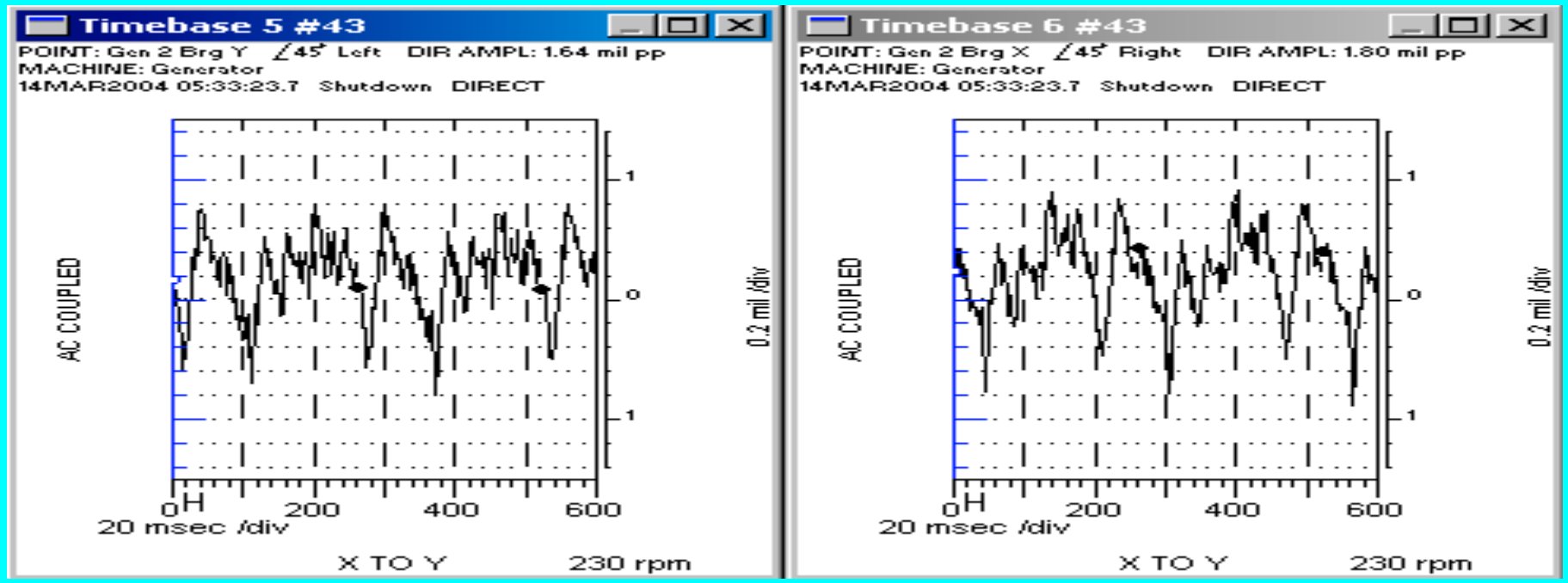
Proximity Signal Use

Here are some raw signals at slow roll



Y – 1.64 mils at 230 rpm

X – 1.60 mils at 230 rpm

Generator Front Bearing Data at slow roll

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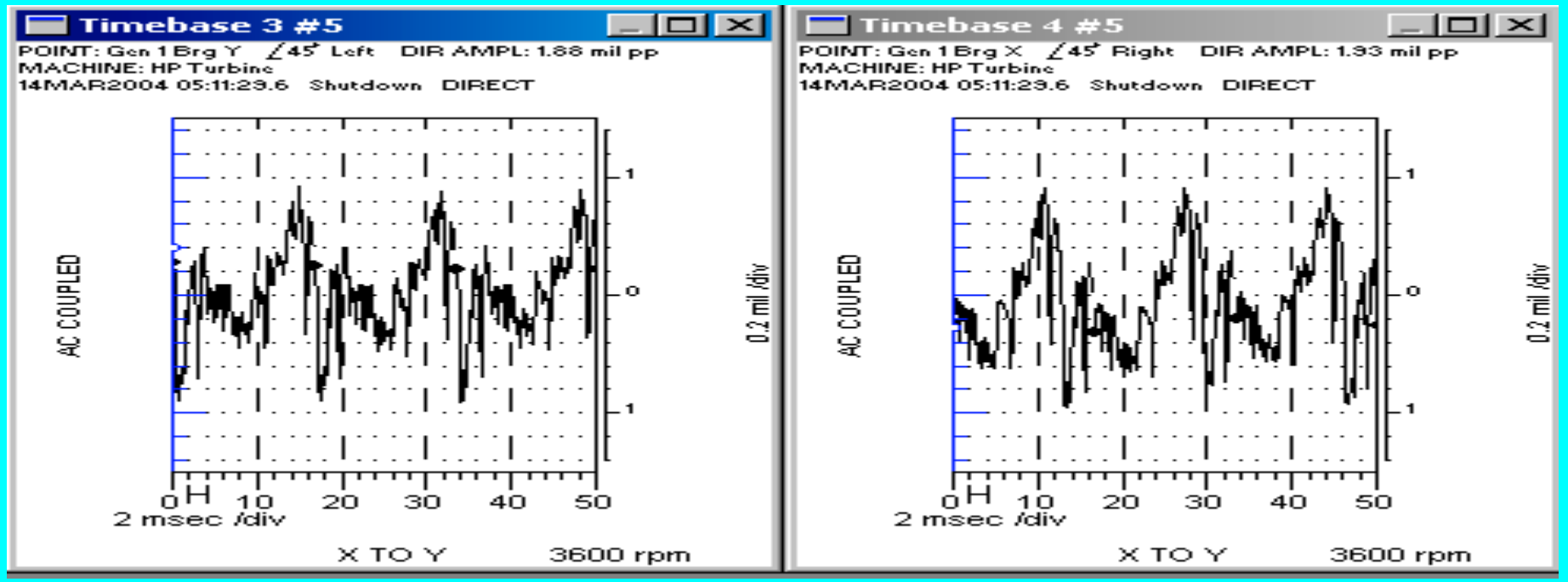
Proximity Signal Use

Here are those raw signals at operating speed



Y – 1.88 mils at 3600 rpm

X – 1.93 mils at 3600 rpm

Generator Front Bearing Data

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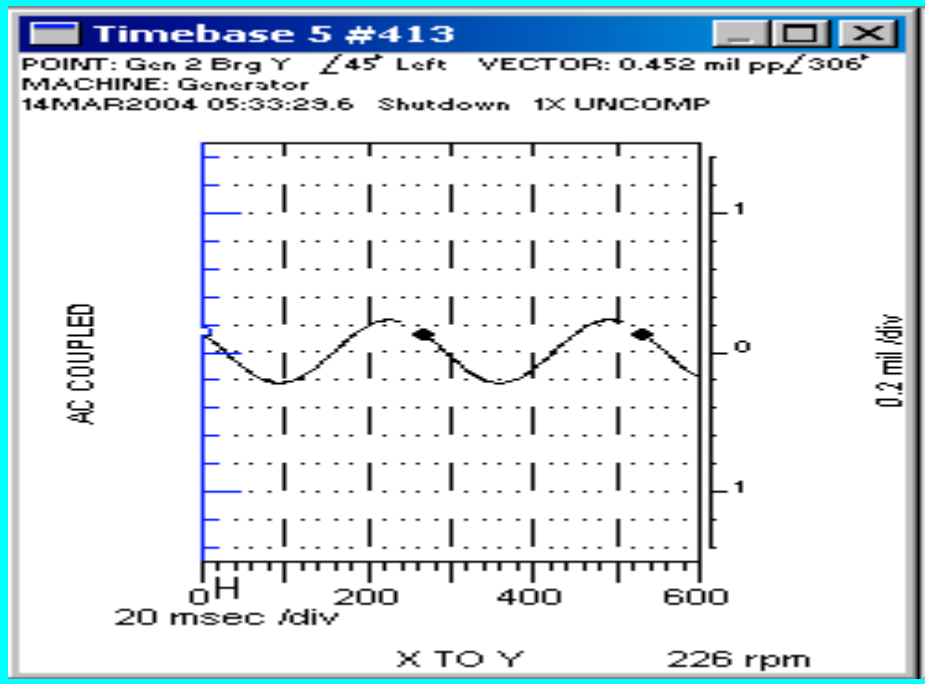
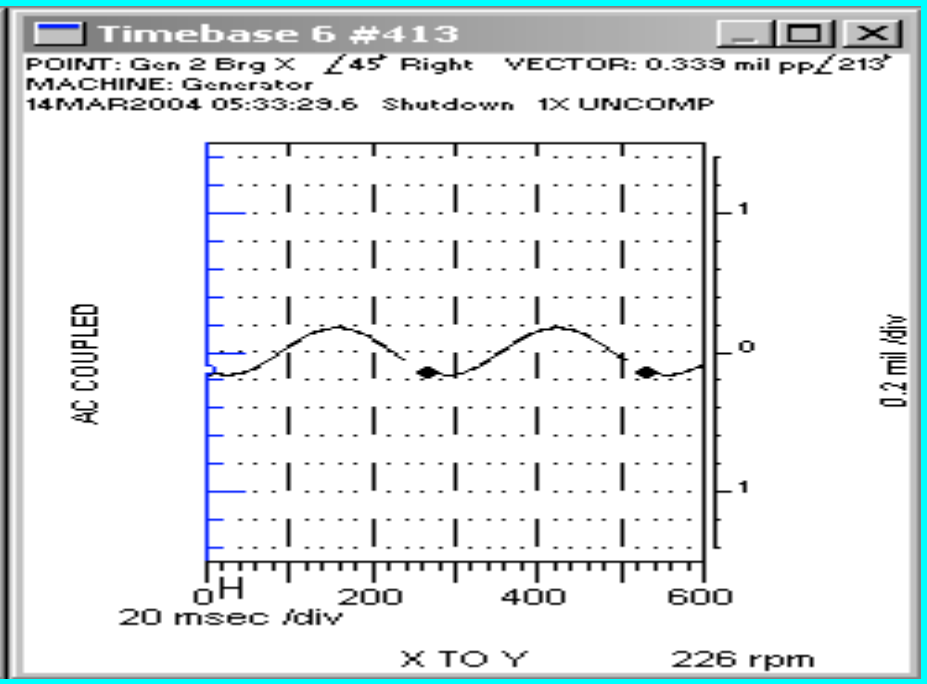
Proximity Signal Use

Filtered Data





Y – 0.45 mils at 230 rpm

X – 0.34 mils at 230 rpm

Generator Front Bearing Data

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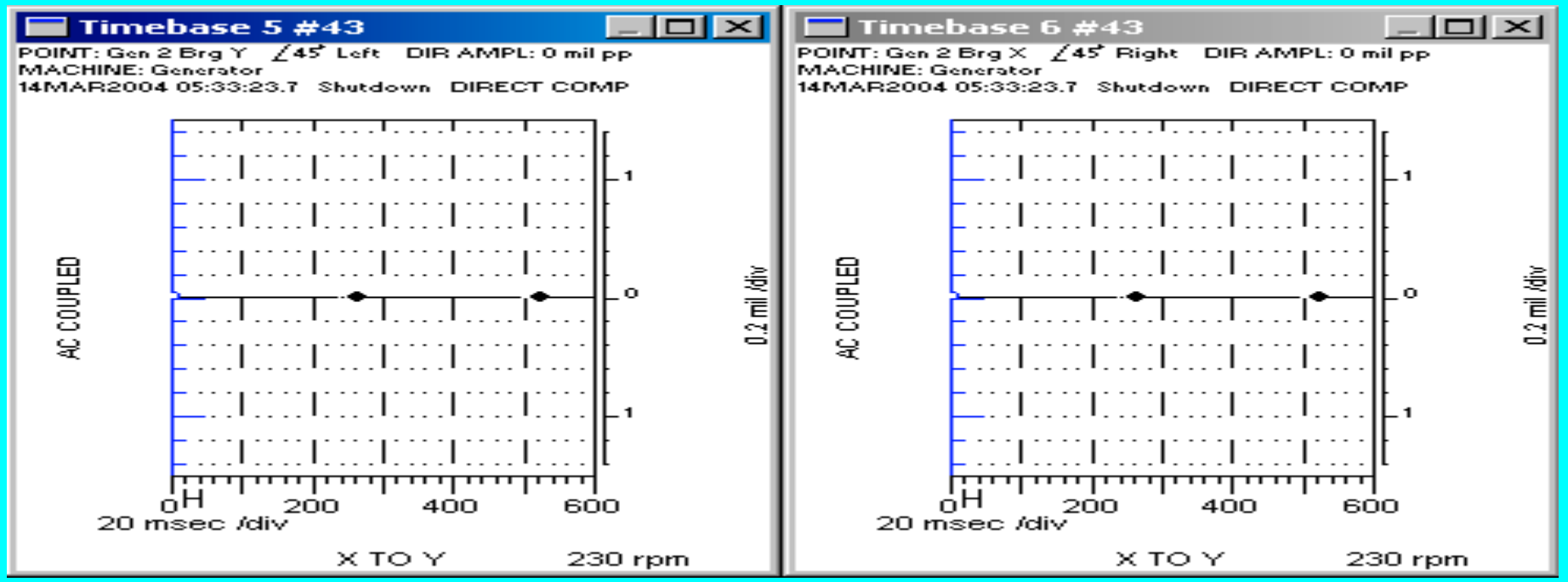
Proximity Signal Use

Compensated Data



Y – 0 mils at 230 rpm

X – 0 mils at 230 rpm

Generator Front Bearing Data

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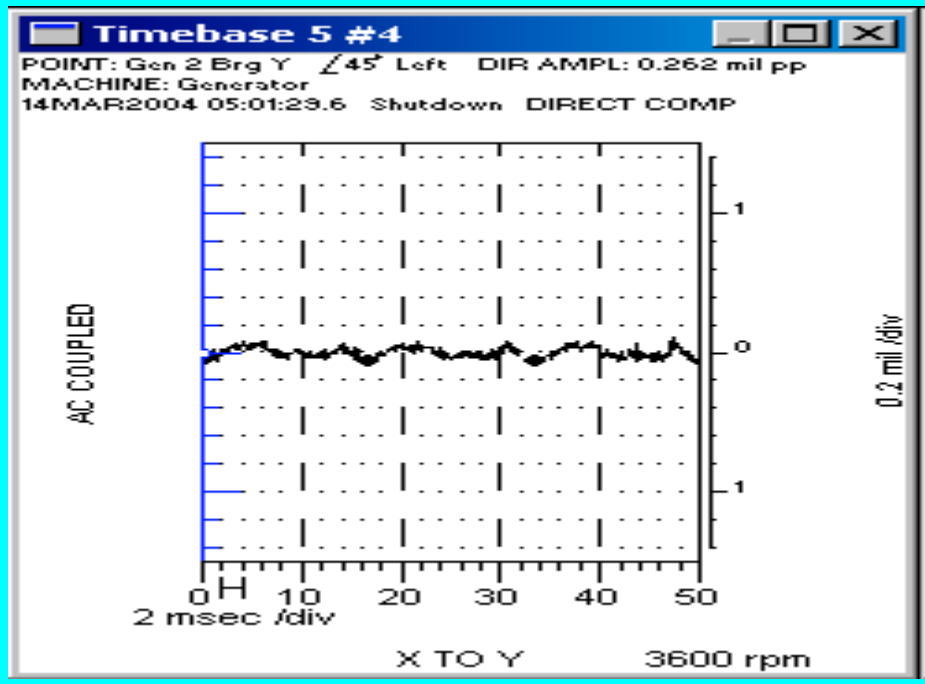
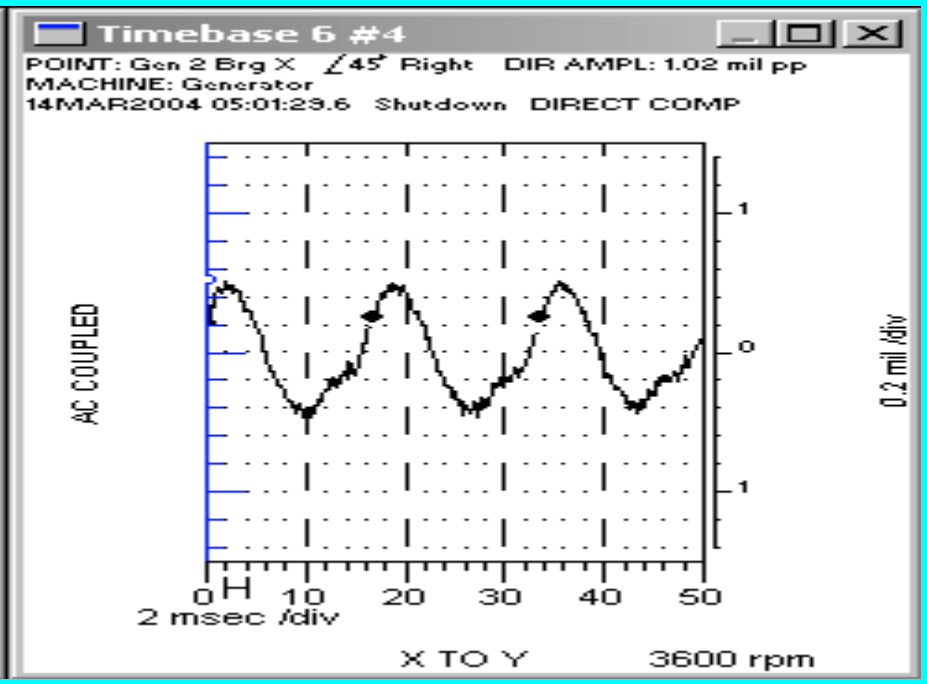
Proximity Signal Use

Compensated Data





Y – 0.26 mils at 3600 rpm

X – 1.02 mils at 3600 rpm

Generator Front Bearing Data

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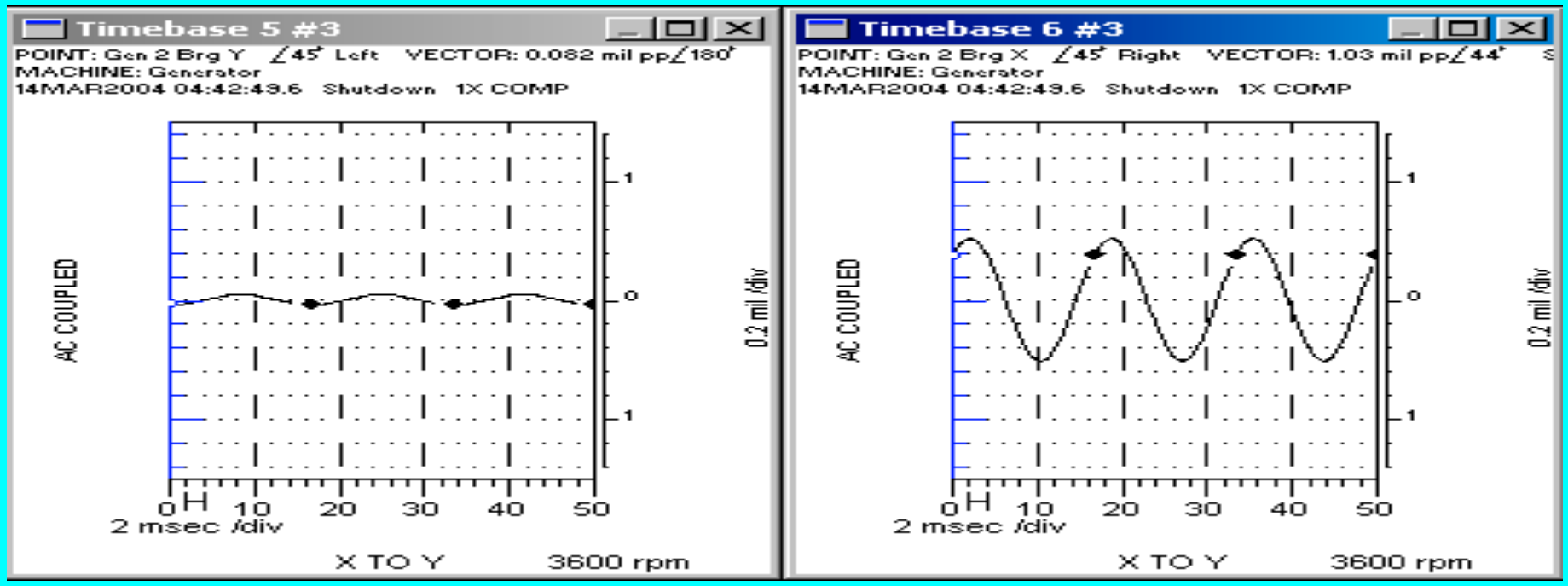
Proximity Signal Use

Filtered and Compensated Data



Y – 0.08 mils at 3600 rpm

X – 1.03 mils at 3600 rpm

Generator Front Bearing Data

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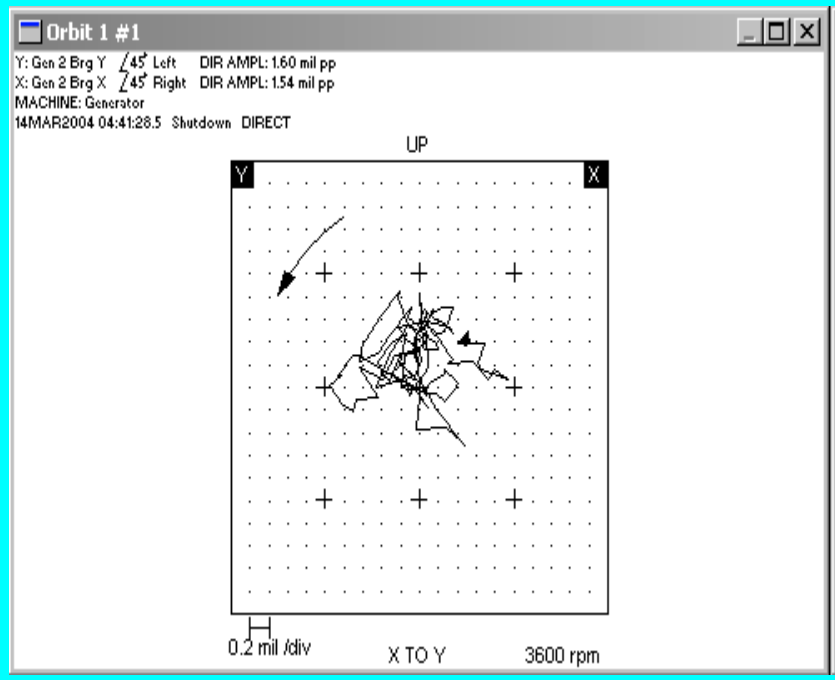
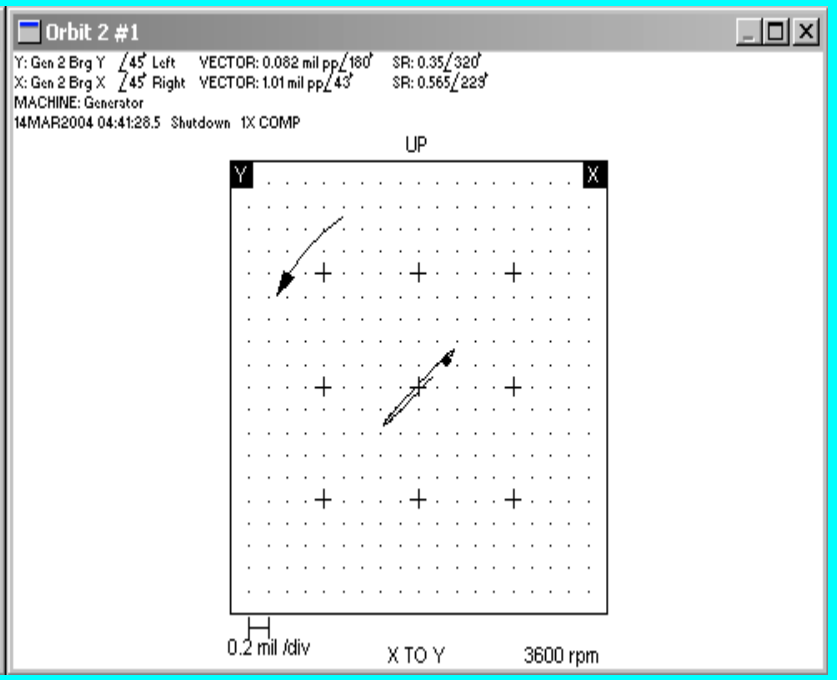
Proximity Signal Use

Orbits – Are Combined Waveforms





Raw Orbit at 3600 rpm

Filtered and Compensated Orbit at 3600 rpm

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Proximity Signal Use

How does filtering and compensation affect spectral data?

- If we remove runout, we affect the 1X
- If we remove noise or ‘glitch’ (I.e. scratches, magnetism, etc.) we typically see a reduction in 1X multiples.
- A quick and dirty way (if you can catch coast down or start-up data) to determine if multiples are made from FFT calculations of noise, is to see if the 1X multiples drop in amplitude with a drop in speed. If the multiples stay relatively the same amplitude over a large speed range, it is probably noise and not real vibration.

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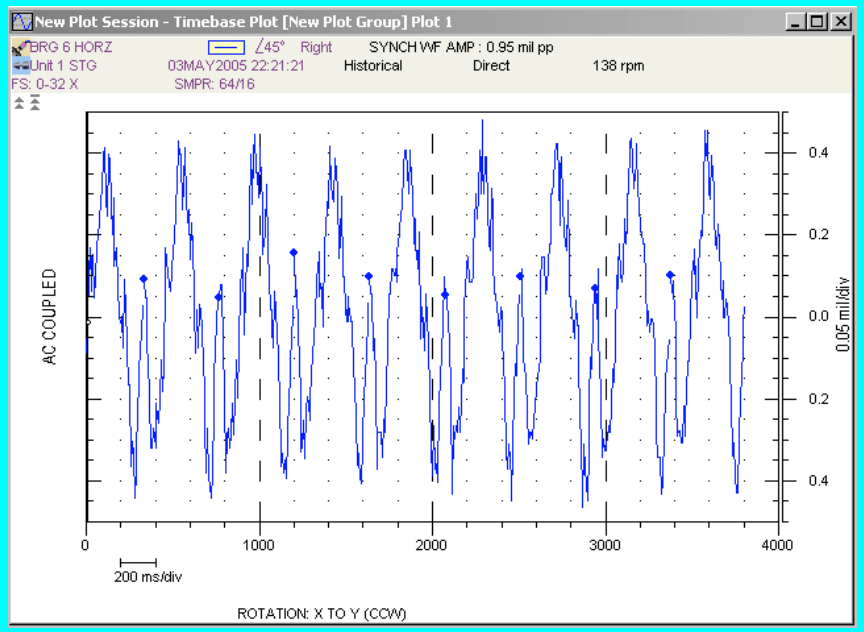
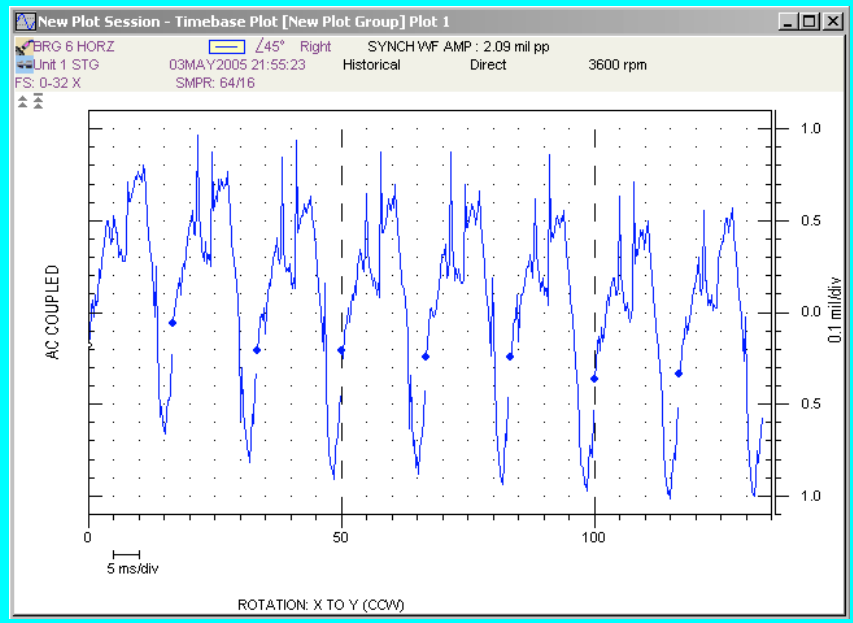
Proximity Signal Use

Here is the raw signal



138 rpm and 0.95 mils



3600 rpm and 2.09 mils

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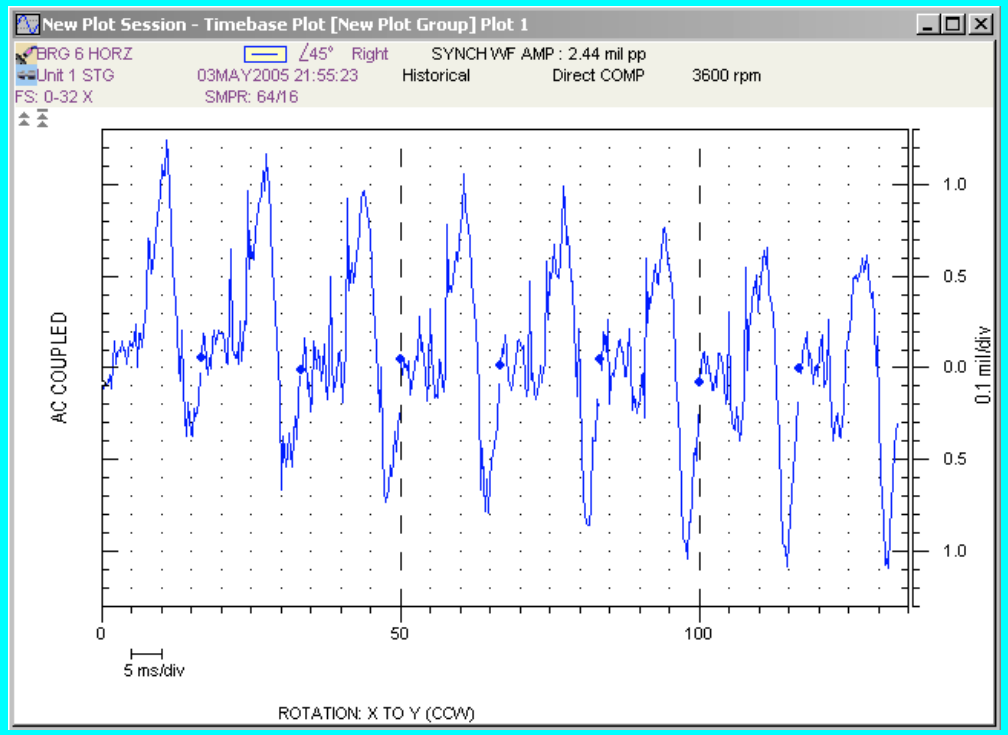
Proximity Signal Use

Here is the compensated signal:



Compensated and 2.44 mils

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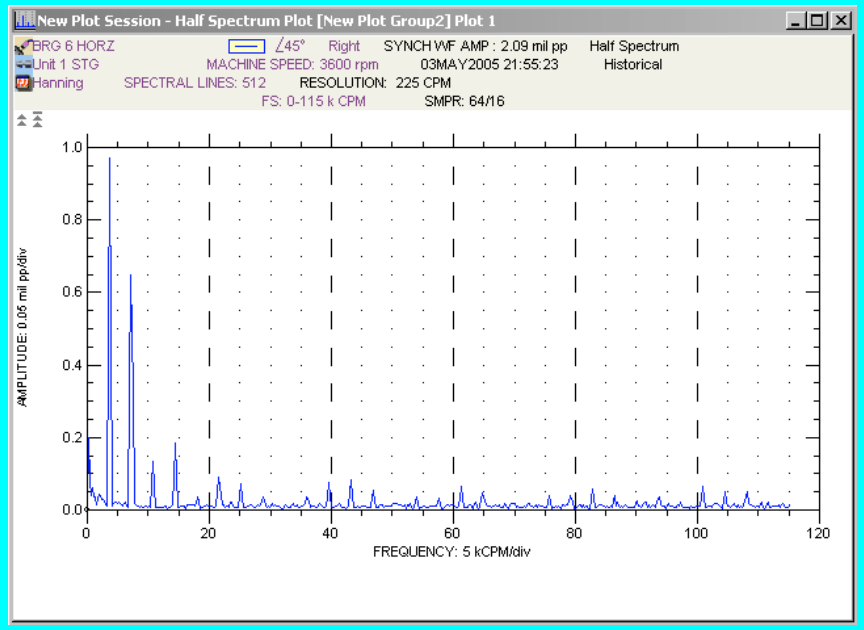
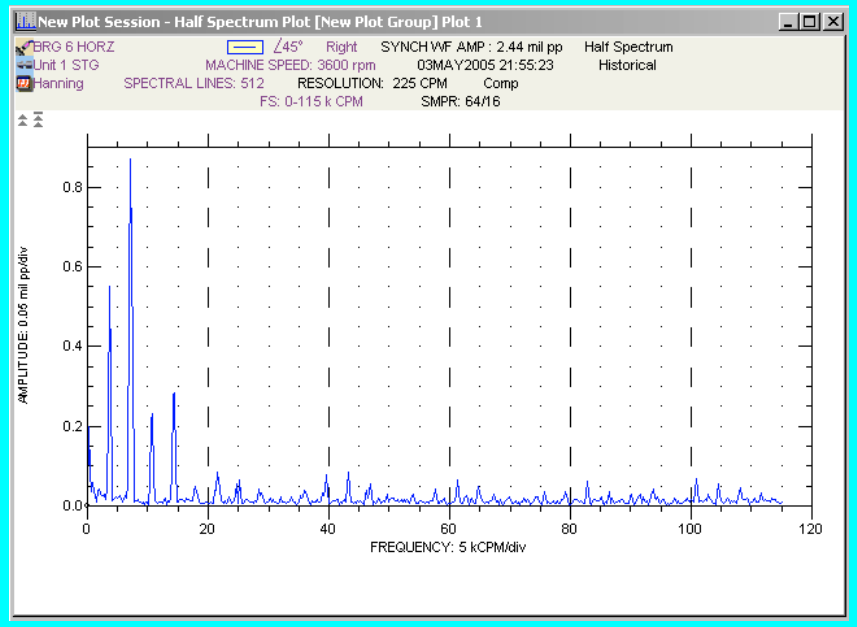
Proximity Signal Use

Here is the raw spectrum and then compensated spectrum:





Uncompensated and 2.09 mils

Compensated and 2.44 mils

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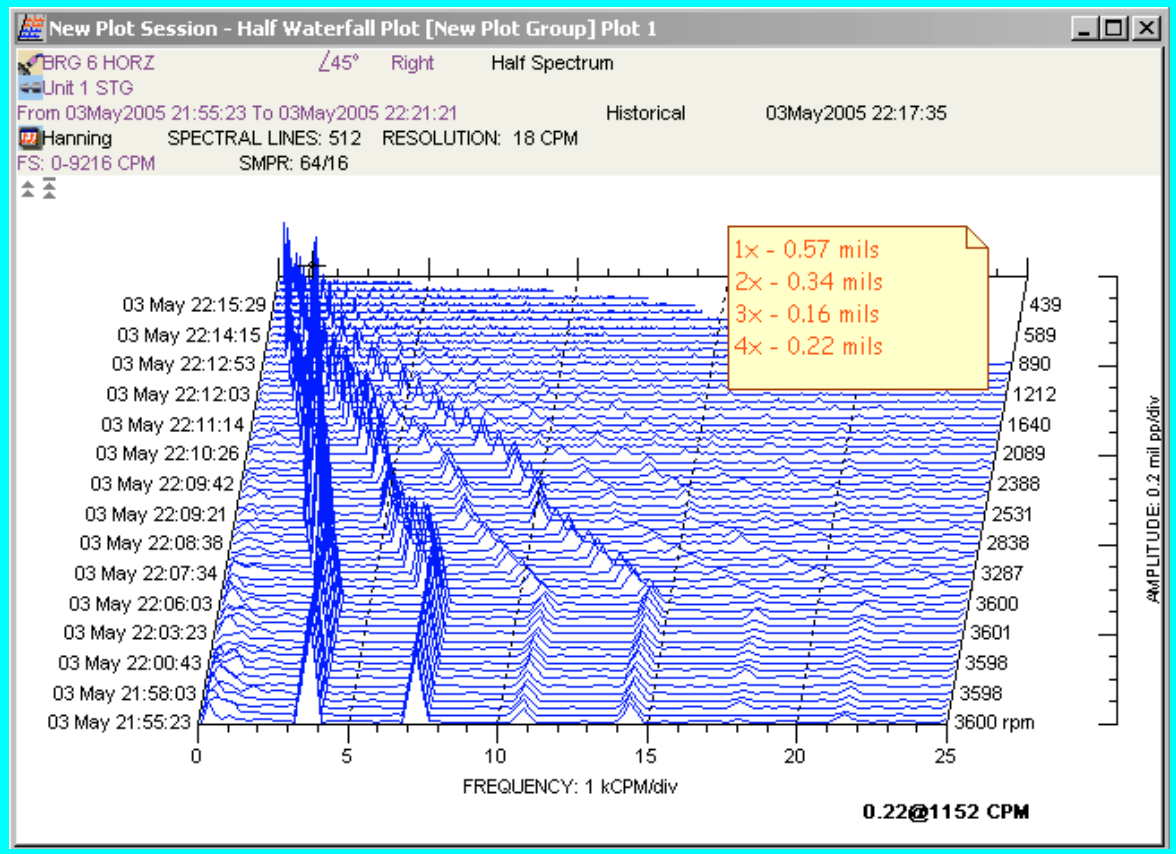
Proximity Signal Use

Uncompensated waterfall plot:



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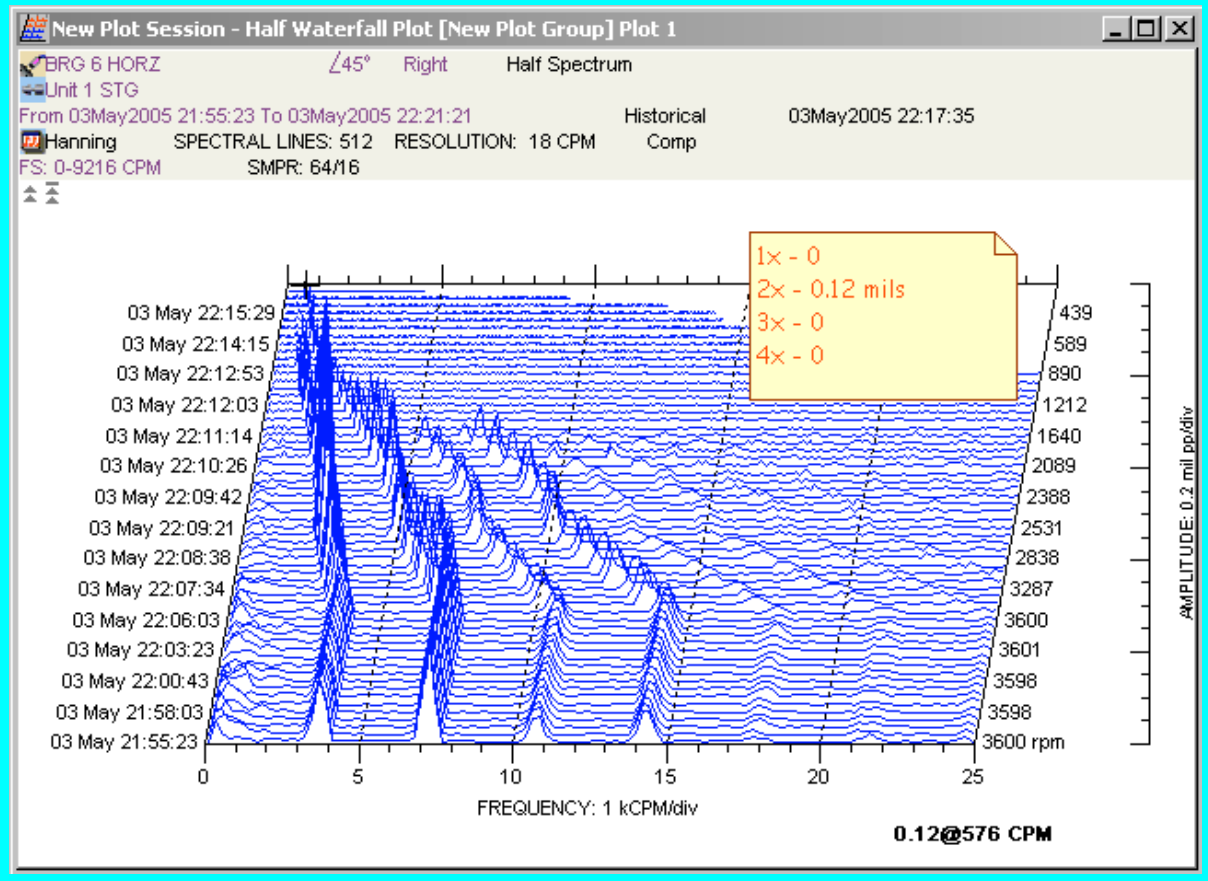
Compensated waterfall plot:



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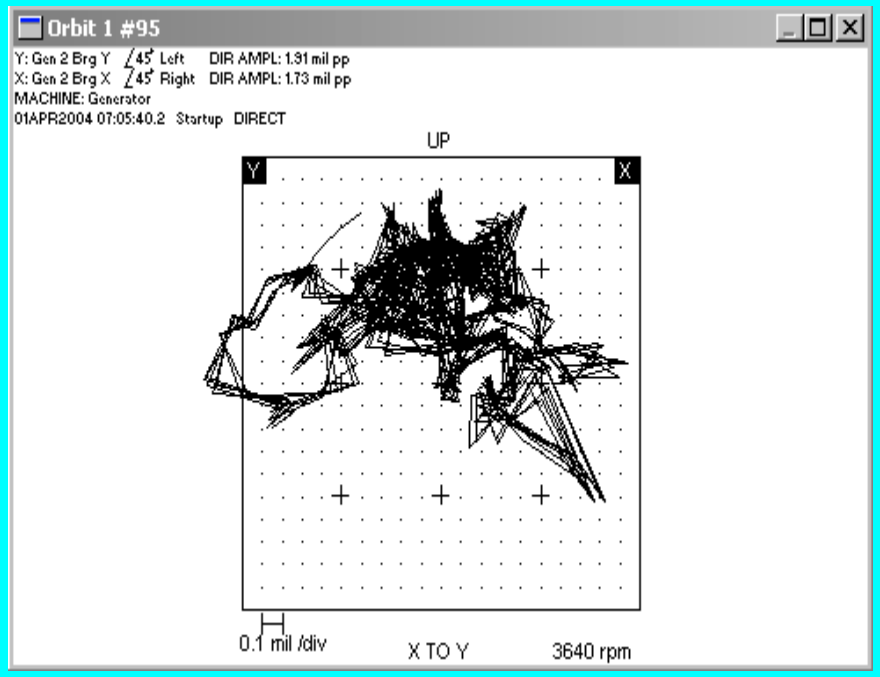
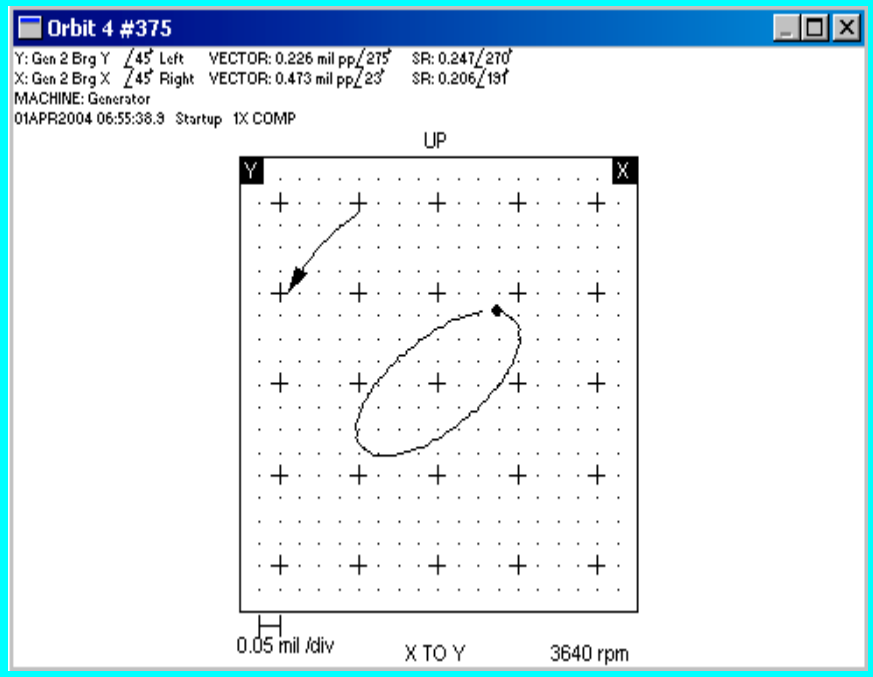
Proximity Signal Use

What are we looking at?





What I want are the tools to make the plot on the left look like the plot on the right and be reasonably sure that I know where the weaknesses are in the signal processing.

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Proximity Signal Use

Any Questions?

The End.

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