# Order Tracking with SKF @ptitude Observer

## Background to order tracking

If you are going to collect vibration measurements on a variable speed machine that has no stable speed, you will probably end up with spectra that are not sufficient. If a normal FFT is taken during a speed variation, the peaks in the spectrum will smear out; they will either be smaller and wider or completely disappear (→ **fig. 2**). This is because the number of samples per time unit will always be the same independently of the speed. For example, it will be difficult to find peaks from bearing frequencies in the normal spectrum collected during a speed variation.

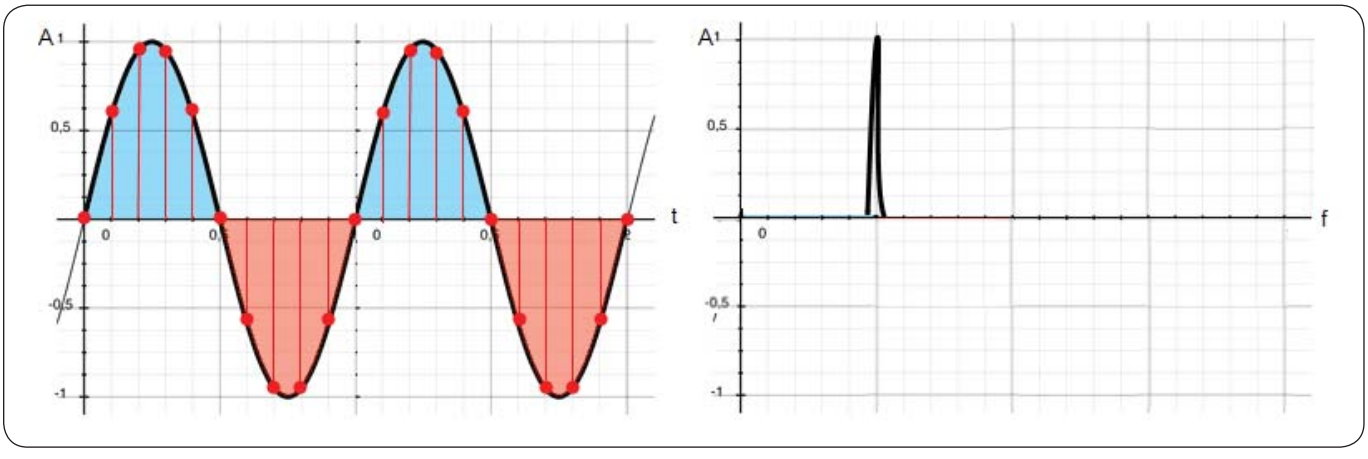


*Fig. 1. Sampling and FFT during constant speed.*

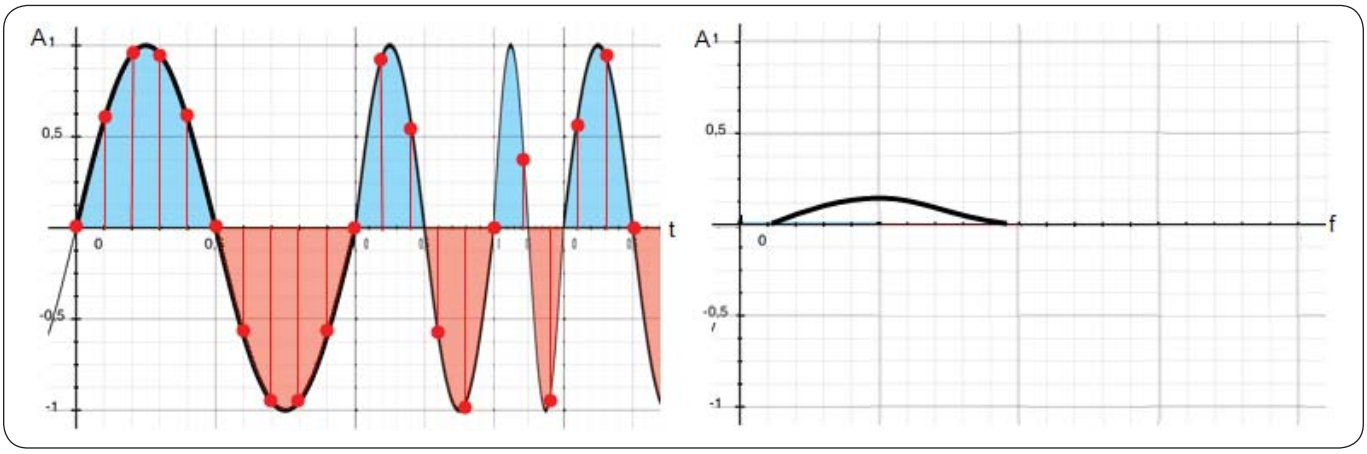


*Fig. 2. Sampling and FFT during variable speed (consider that in real life speed variation is gradual and it does not jump between revolutions).*

When measuring vibrations on a variable speed machine, there is a need to constantly follow the speed and adjust the number of samples to the speed. This is done with order tracking in the SKF Multilog On-line System IMx and SKF @ptitude Observer on-line systems.

## The functions behind the order tracking in SKF Multilog IMx

To be able to perform a good FFT, there is a need to have the same number of samples for each revolution independently of the speed. The Order Tracking function in the SKF Multilog IMx uses the speed measured on each revolution to adjust the number of samples for that revolution afterwards. Finally, the FFT is calculated based on a time waveform that appears to be in stable speed (→ **fig. 3**); the FFT will not have problems to perform a good spectrum. In this case, the FFT is calculated during a specific number of revolutions and not during a specific time.

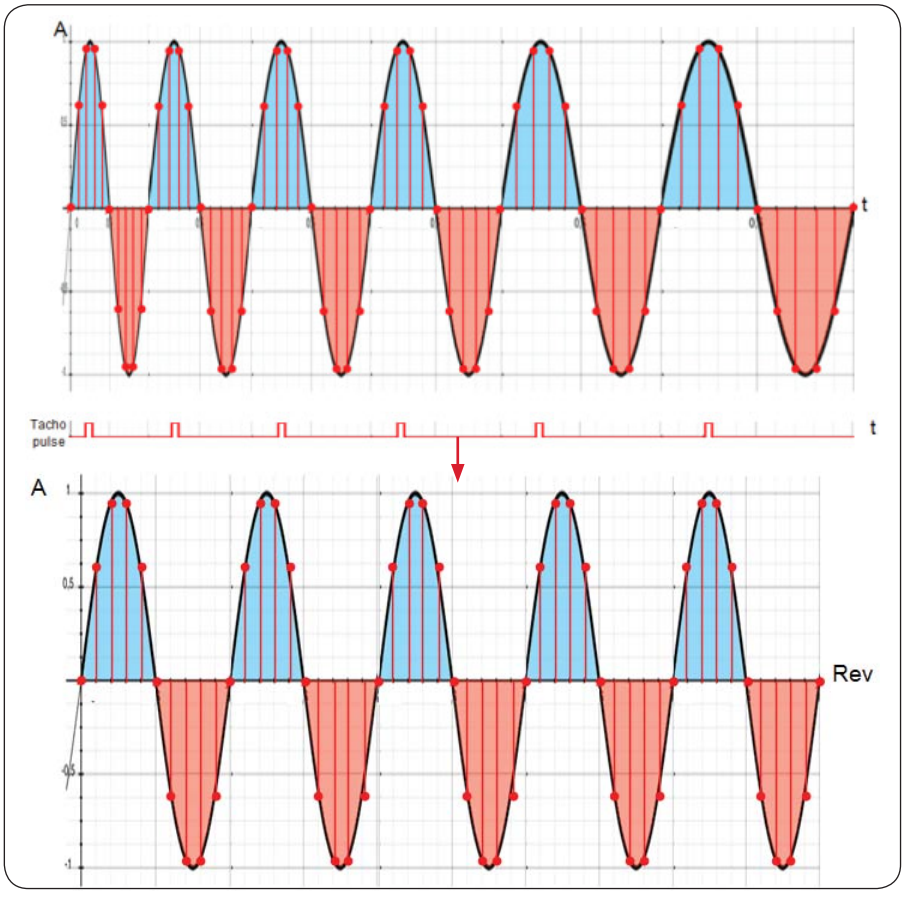


*Fig. 3. Sample rate normalized for every revolution.*

In order to get appropriate values with order tracking measurements, the speed variation should not be more that 100% when increasing and 50% when decreasing the speed during the measurement (i.e., the number of revolutions in the setup). Refer to *Order tracking revolutions setup.xls* to get an estimate of the number of revolutions you will need in your setup according to your specific case.

# Procedure

- Start SKF @ptitude Observer and Monitor.
- Create SKF Multilog IMx units, channels and hierarchy according to the manual.
- Right-click on a machine and choose **Add / Meas. point**.
- Highlight **IMx** and double-click **Order tracking** or **Order tracking Envelope**.
- The differences for an order tracking point compared with standard vibration points are the FFT settings (**Spectra** tab).
  - The settings for the FFT is for an order tracking point in **No. of lines** and **No. revolutions**.
  - No Fmax is chosen.
  - The maximum frequency is chosen as **Max order** according to the number of revolutions and number of lines. 1 600 lines and 32 revolutions results in a **Max order** of 50X.
  - This gives an Fmax of 1 000 Hz at 1 200 r/min. and Fmax of 1 250 Hz at 1 500 r/min.
  - Fmax will change with the machine speed
  - Also note that low frequency cutoff is in orders (X).

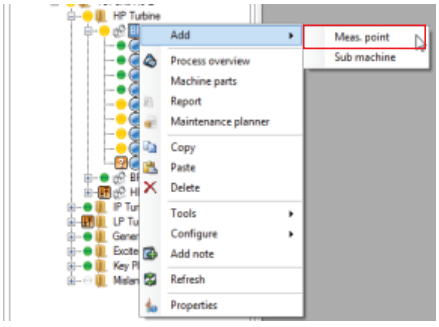


*Fig. 4. Add a point.*

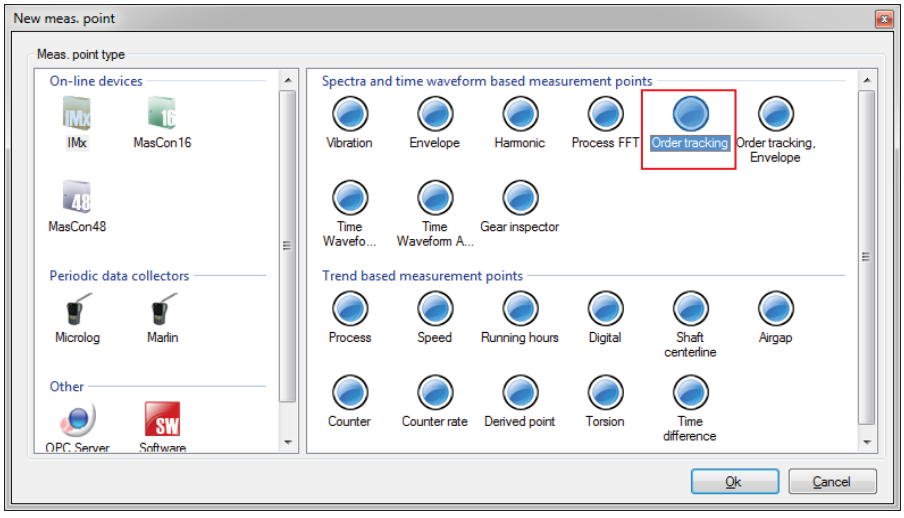


*Fig. 5. Select Order tracking or Order tracking Envelope.*

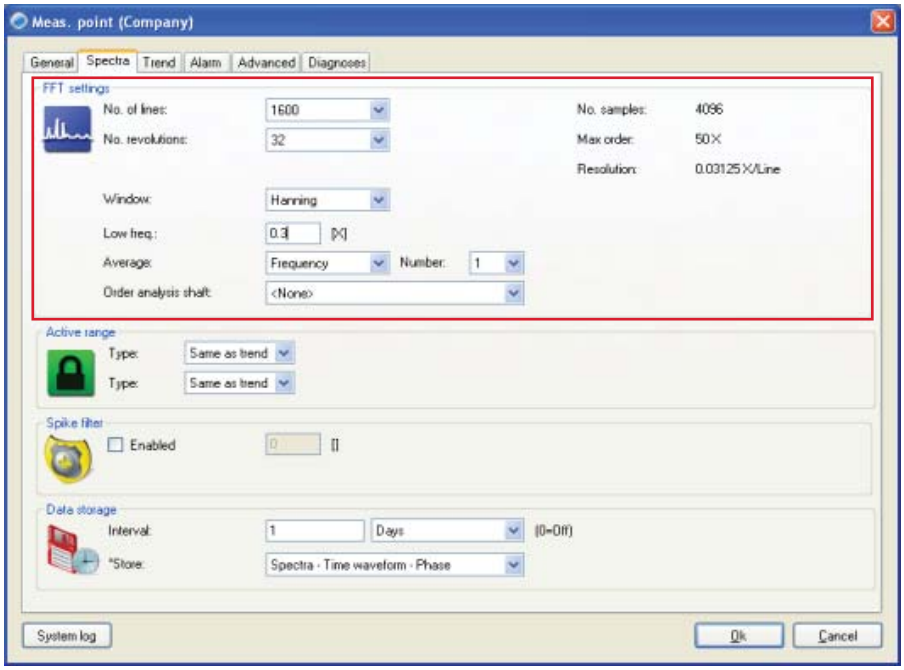


*Fig. 6. Meas. Point's Spectra tab.*

## Order tracking in a real machine

**Fig. 7a** is with an order tracking in env3 and **fig. 7b** is without. Both spectra are taken at the same time during a speed variation from 900 to 1 100 r/min. The speed variation took five seconds

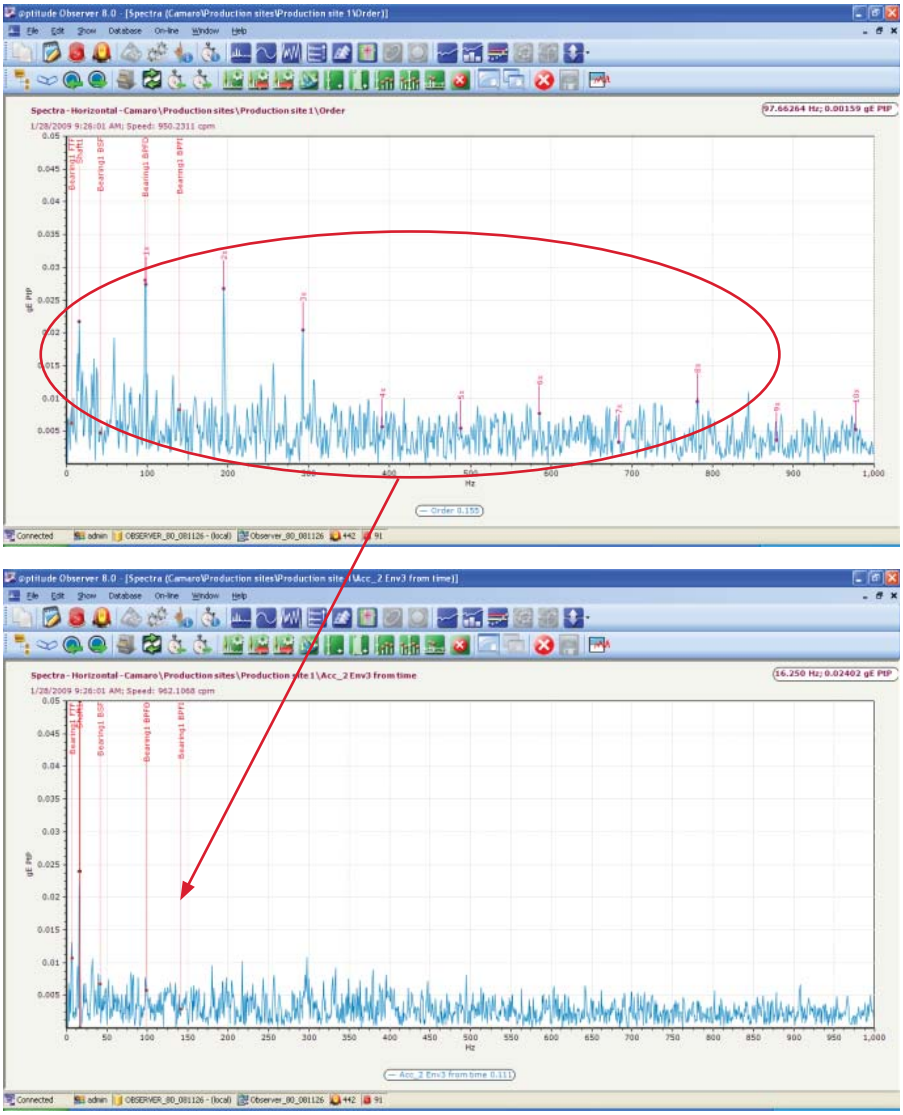

*Fig. 7. a) FFT with order tracking showing a BPFO problem (top graph), and b) FFT without order tracking (bottom graph).*


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