HD Technology Case Study:

Bearing monitoring

of

Paper Machine K25, Vrancart SA, Romania

by

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1 Introduction

This case study describes online condition measurement taken from a couch roll bearing in paper machine K25 at Vrancart S.A. Adjud in Romania, one of the most important producers of corrugated cardboard, paperboards and tissue papers in the country. The total of finished pulp and paper/paperboard products is approximately 80,000 tons/year.

The customer is making investments in upgrading the paper machine to increase its typical working speed. To accomplish this, a reliable system for continuous condition monitoring is needed. At the time of writing, the online system Intellinova from SPM monitors a total of two hundred measurement points in the press section and five dryer groups.

The subject of this case study is the couch roll bearing in the drive-end. Since this is a large and very expensive bearing that is very important for the working process, it is essential that it be carefully monitored.

2 Conclusion and summary

To determine the most suitable measurement technique for this application, several methods were used on each measuring point. SPM HD and HD ENV were used for bearing monitoring, while ordinary vibration measurement was used to detect other types of problems, e.g. internal seals etc.

The measurements results showed that on this application, the SPM HD and HD ENV methods both provided early warning and clear signals related to the bearing damage. Thus, which method to choose is a question of user preferences.

To continuously monitor the condition of critical parts of the paper machine, one Intellinova Compact INS06 unit and six Intellinova Standard INS10 units are used.

From the very beginning of the measurements on July 1st, 2016, right up until the time of bearing replacement on January 5th, 2017, HDm/HDc levels were continuously high; about 35 dB, which is on the alarm evaluation limit.

In the time signal, fourteen clear shocks per 1 revolution can be observed. In the spectrum, there are visible harmonics matching the BPFO bearing symptom for this 23096 FAG bearing.

3 Application description

The couch roll is a rotating, perforated metal cylinder at the end of the forming section of the paper machine. The function of the couch roll is to remove water from the wet web through the application of vacuum. It also serves as the final "wrap" where the wet web leaves the forming fabric and is guided onto the felt and into the wet-press section. The surface of the couch roll is covered with rows of small holes. Baffles within the interior of the couch roll direct the vacuum toward the segment of the roll where the wet web is on the fabric.

Image 1 below shows the couch roll bearing, located at the transition from the forming section (a.k.a. wet end) of the paper machine to the press section. The forming section ends with the couch roll, which passes the paper forward to the press section. The operating speed of the couch roll varies from 55 to 128 RPM.

Image 1. *Paper machine couch roll.*

4 System setup

4.1 Measuring equipment

- Online system Intellinova Standard INS10 with INV80A
- Sensor: DuoTech SLC144 TB
- RPM sensor: 1 x Proximity switch

4.2 Measuring techniques

- SPM HD
- EVAM
- HD ENV, Filters 3 and 4

4.3 Condmaster setup

Settings used in Condmaster Ruby 2016.3.2 are as follows.

Measuring technique SPM HD:

- Measuring time: Same as FFT measurement
- Short/long time memory: Time signal and FFT
- Upper frequency: 100 Orders
- Lines in spectrum: 3200
- Symptom Enhancement Factor: 5
- Max RPM = 200
- Min RPM = 50

Measuring technique EVAM:

- Short/long time memory: Time signal and FFT/Full spectrum
- Time Signal unit: ACC
- Spectrum unit: VEL
- Upper frequency: 1000 Hz
- Lower frequency: 2 Hz
- Lines in spectrum: 3200

Measuring technique HD ENV - Filter 3 (500-10 000 Hz) / Filter 4 (5000-40 000 Hz)

- Short / long time memory: Time signal and FFT
- Upper frequency: 100 Orders
- Lines in spectrum: 3200
- Symptom enhancement factor: 3
- Max RPM = 200
- Min RPM = 50

5 Case description

Measuring point PU1-GE - DE GAUTSCH

5.1 SPM HD measurement results

Fig 1. *SPM HD trend graph HDm/HDc, from July, 2016, to February, 2017.*

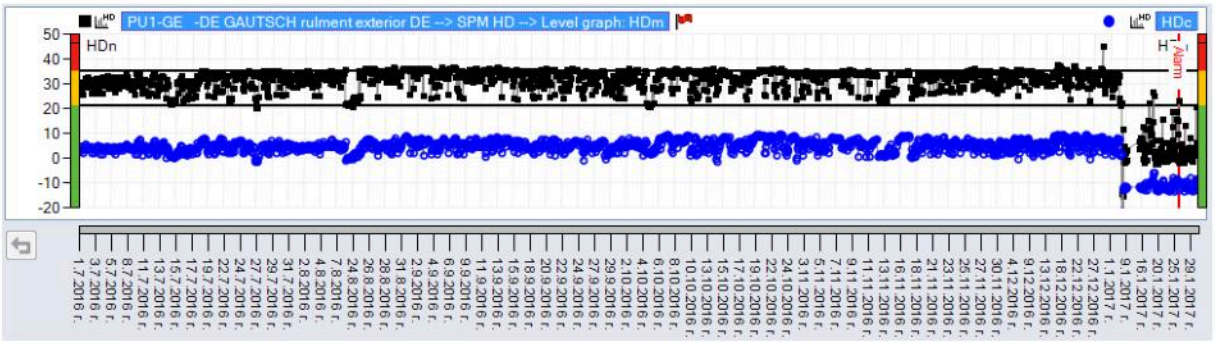


Fig 2. *SPM HD averaged trend graph HDm (10 averages), from July, 2016 to February, 2017.*

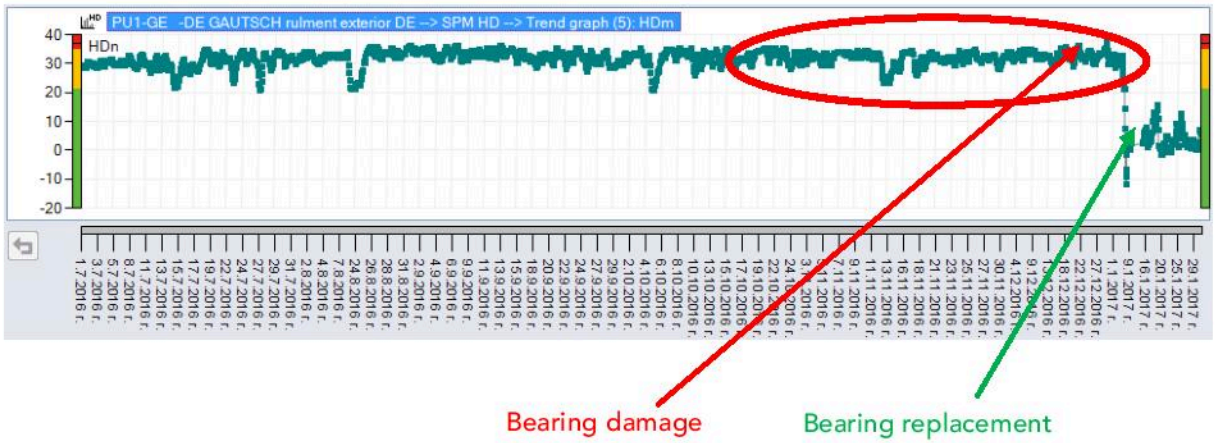
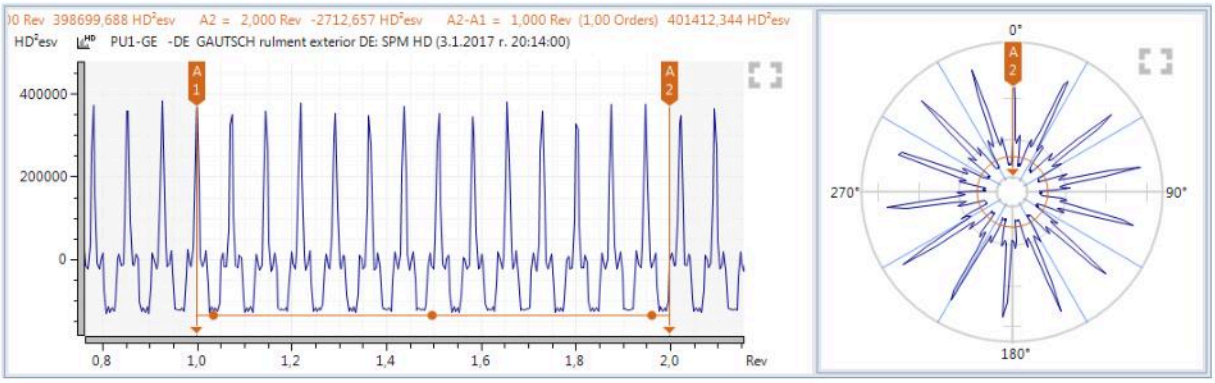


Figure 3 shows a typical time signal for an outer race damage.

Fig 3. *SPM HD Time signal and Circular plot diagram.*



Very clear match of the BPFO symptom in the spectrum in Figure 4.

Fig 4. *SPM HD Spectrum.*

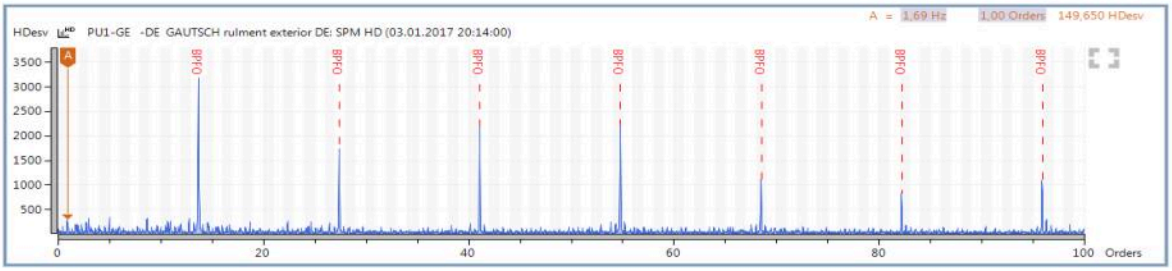
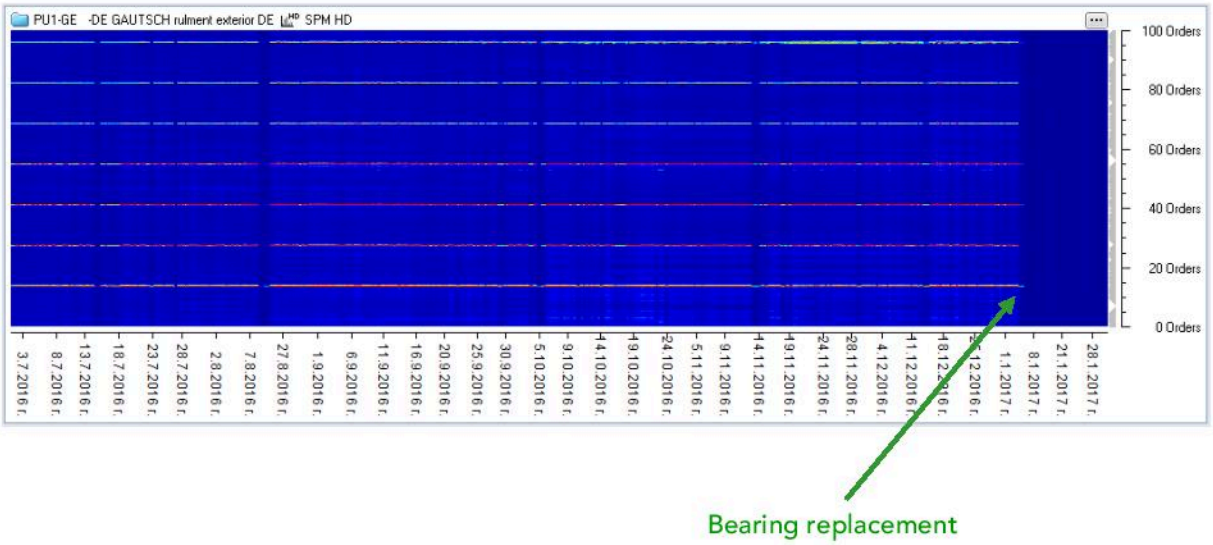


Fig 5. *SPM HD Colored Spectrum Overview.*



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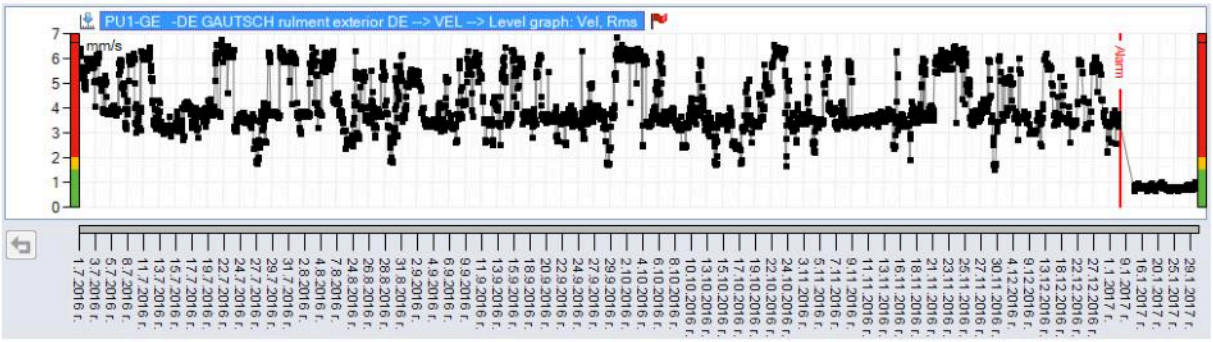
5.2 Vibration velocity measurement results

Fig 6. *Velocity – VEL, trend graph, from July, 2016, to February, 2017.*



The signals just above 50X (see below) are related to the plastic seals of the vacuum chamber inside the roll. When the bearing was replaced, the seals where also replaced.

Fig 7. *Velocity – VEL, Spectrum.*

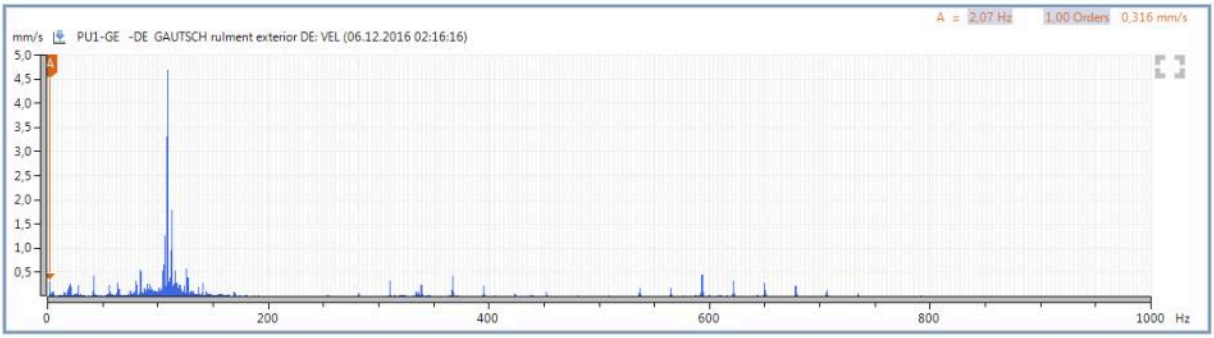
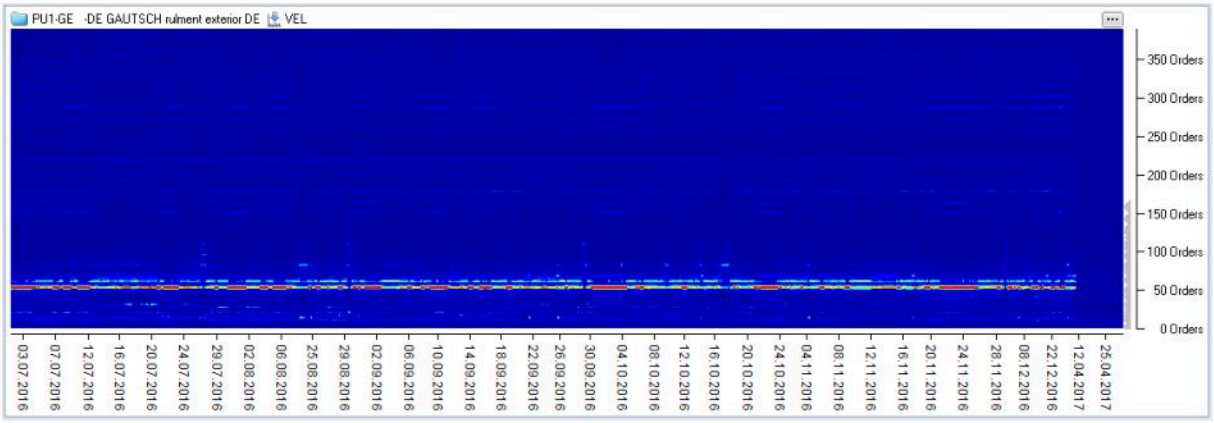


Fig 8. *Velocity - VEL, Colored Spectrum Overview.*



5.3 HD ENV measurement results

Manual alarm levels were used for HDrp settings.

Fig 9. *HD ENV - Filter 3, trend graph from November, 2016, to February, 2017.*

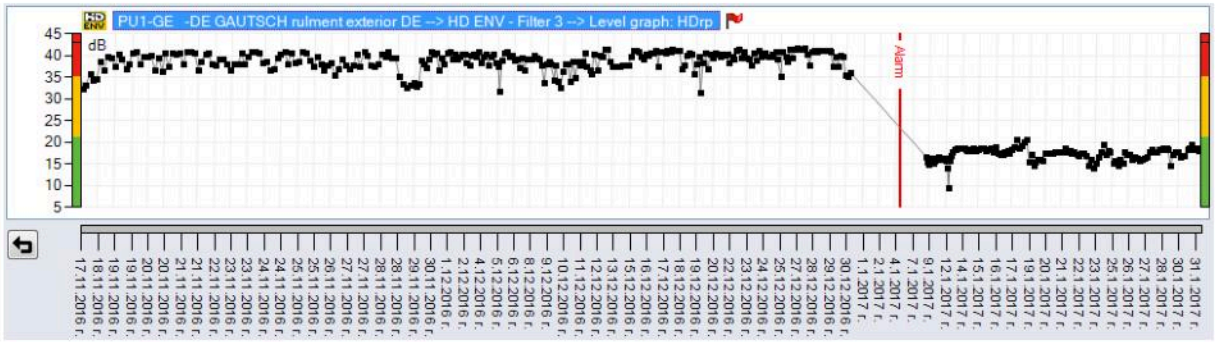


Fig 10. *HD ENV - Filter 4, trend graph.*

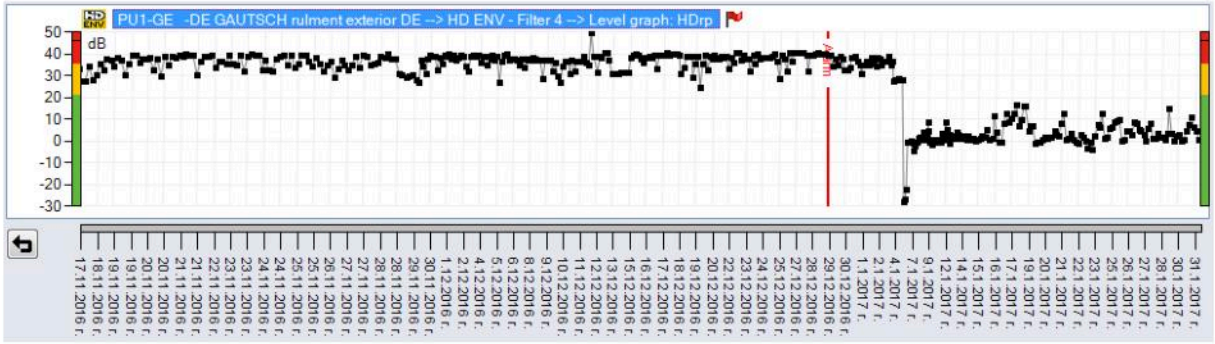
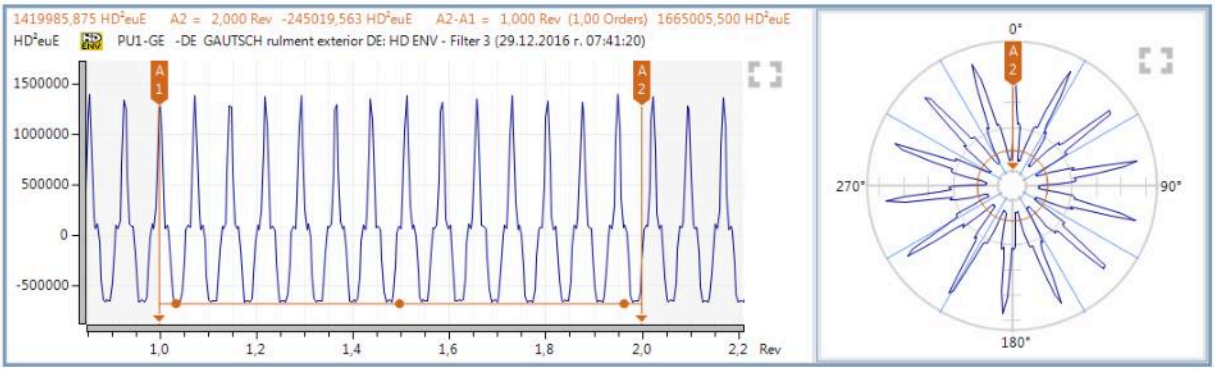


Figure 11 below shows a typical time signal for an outer race damage.

Fig 11. *HD ENV - Filter 3, Time signal and Circular plot diagram.*



In Figure 12, a very clear BPFO match can be seen in the spectrum.

Fig 12. *HD ENV - Filter 3, Spectrum.*

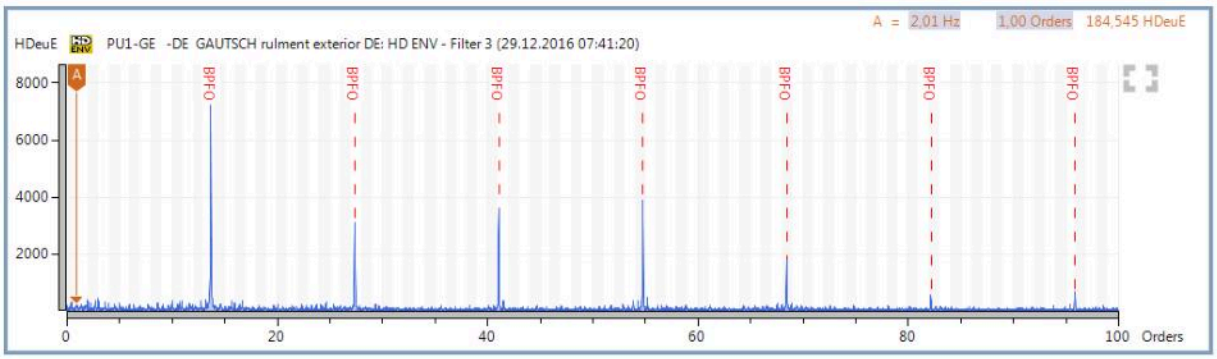


Figure 13 again shows a typical time signal of an outer race damage.

Fig 13. *HD ENV - Filter 4, Time signal and Circular plot diagram.*

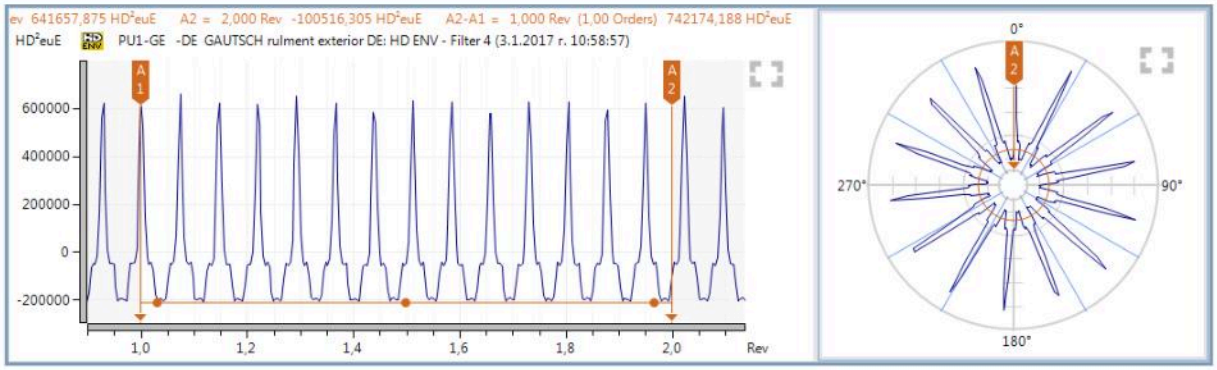


Fig 14. *HD ENV - Filter 4, Spectrum.*

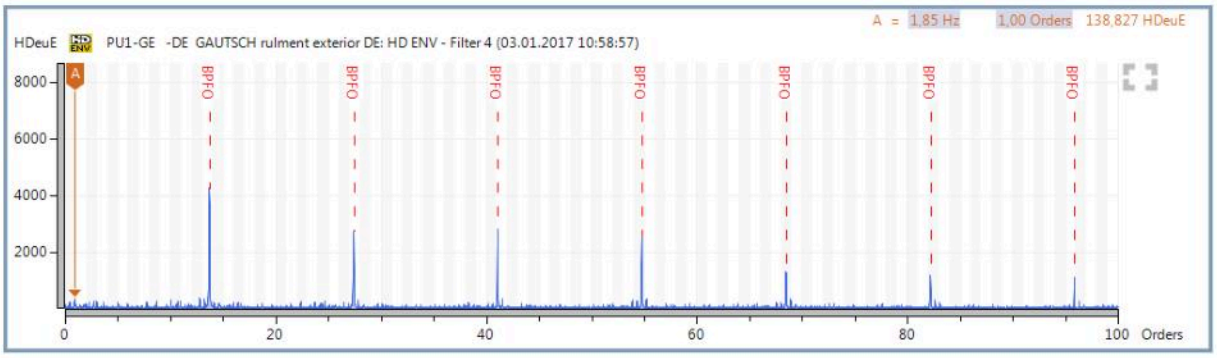


Fig 15. *HD ENV - Filter 3, Colored Spectrum Overview.*

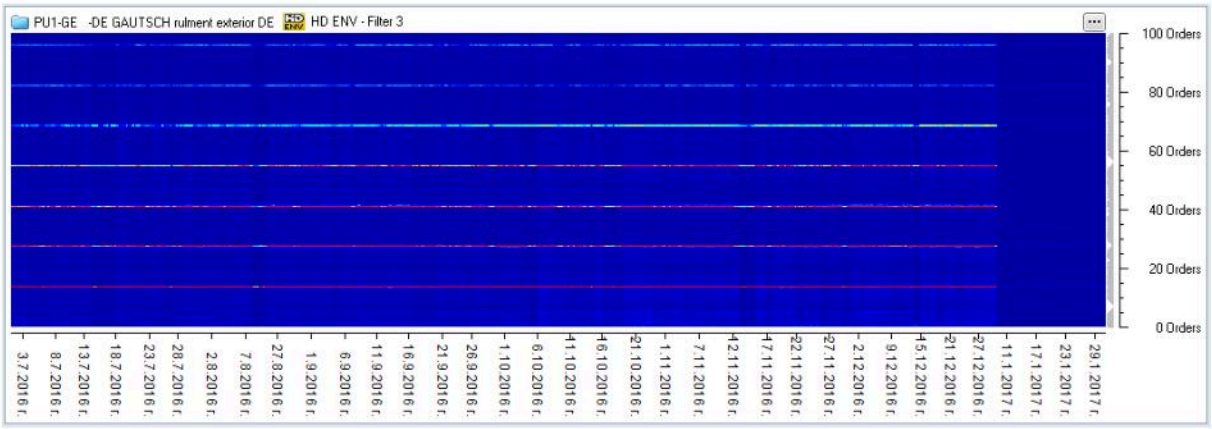
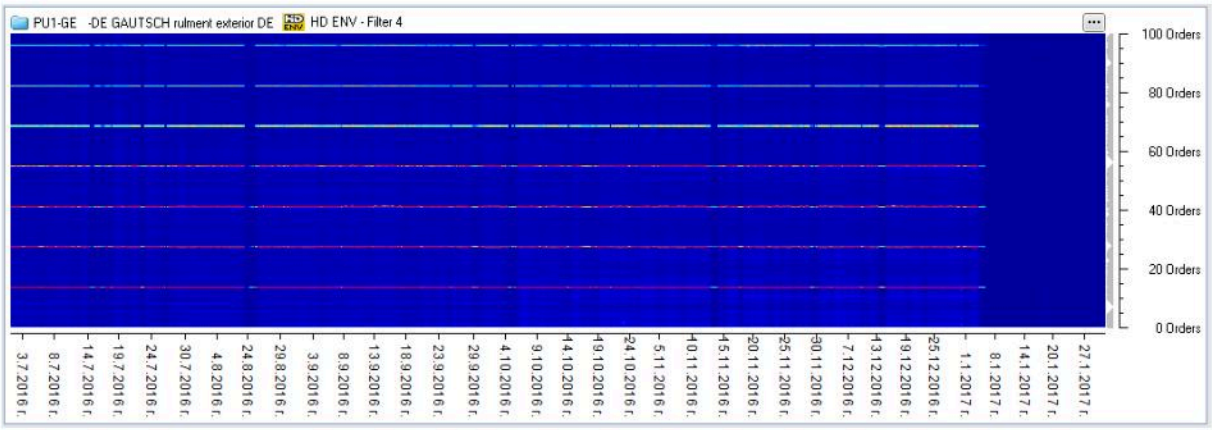


Fig 16. *HD ENV - Filter 4, Colored Spectrum Overview.*



6 Appendix

Below are photographs of the bearing after replacement. The outer ring was cut for easy dismounting. On it, the severe surface damage is visible.

Image 2. *Damage to the bearing outer race.*

Image 3. *Outer race bearing damage.*

Image 4. *Outer race damage.*

6.1 Reference

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