

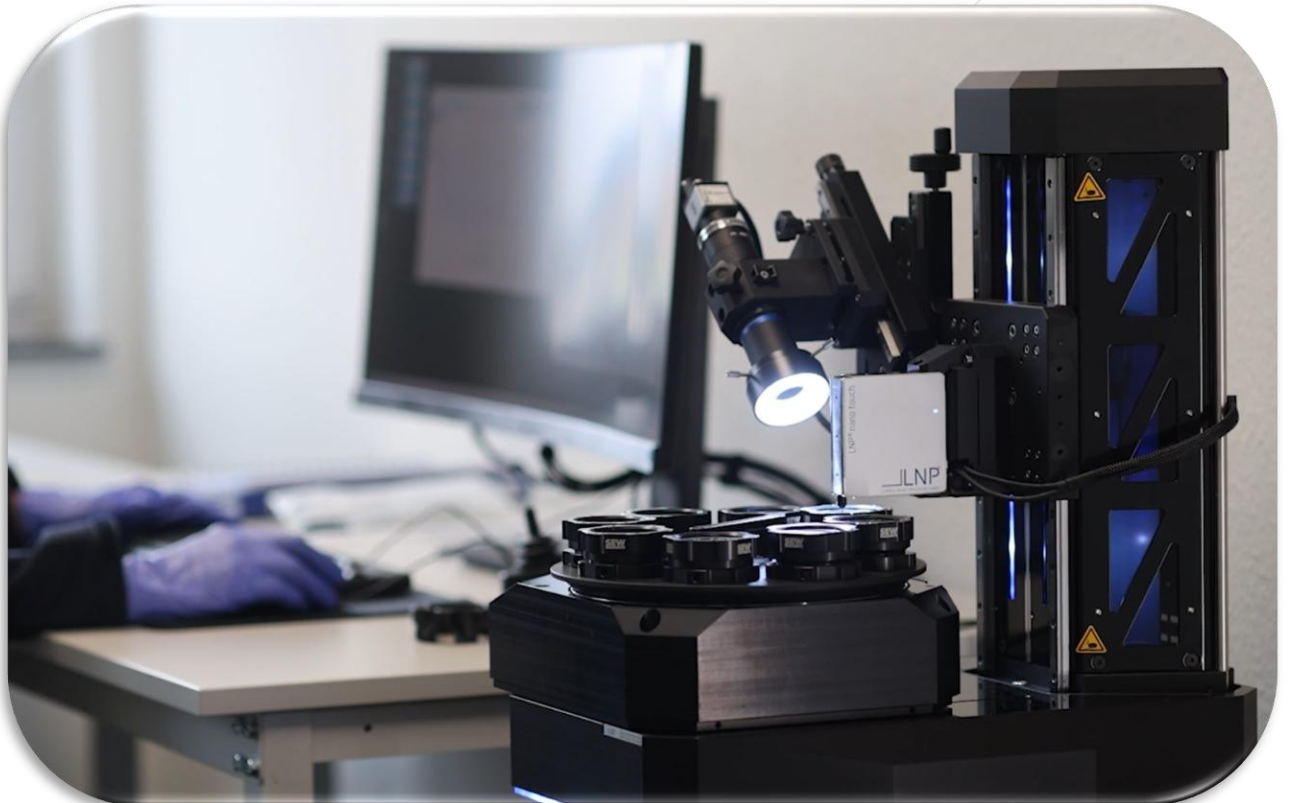


# **High-Resolution Micro-Indentation Analysis of Radial Shaft Seals:**

## **Advancing RSS evaluation at OPR**

## **Advanced Micro-Indentation System for the Analysis of Radial Shaft Seals in Operation at OPR**

Since March 2025, OPR has been operating a state-of-the-art micro-indentation system specifically developed for the high-resolution analysis of radial shaft seals (RSS) following dynamic oil compatibility testing. This innovative system represents a major step forward towards an objective, reproducible and fully automated evaluation of the interaction between lubricant and seal during dynamic testing.



## **Fully Automated Testing of Up to Eight Radial Shaft Seals**

The system is designed to automatically test up to eight radial shaft seals in parallel, significantly increasing throughput while ensuring consistent and reproducible results. The testing procedure is divided into two main stages:

### **1. Tactile Measurement of the Wear Band**

In the first stage, the contact track of each seal is scanned at 20 equally spaced positions around the circumference. This tactile measurement accurately determines both the position and the width of the running track, serving as a foundation for precise, position-specific mechanical testing.

### **2. High-Resolution Indentation in the Wear Band Center**

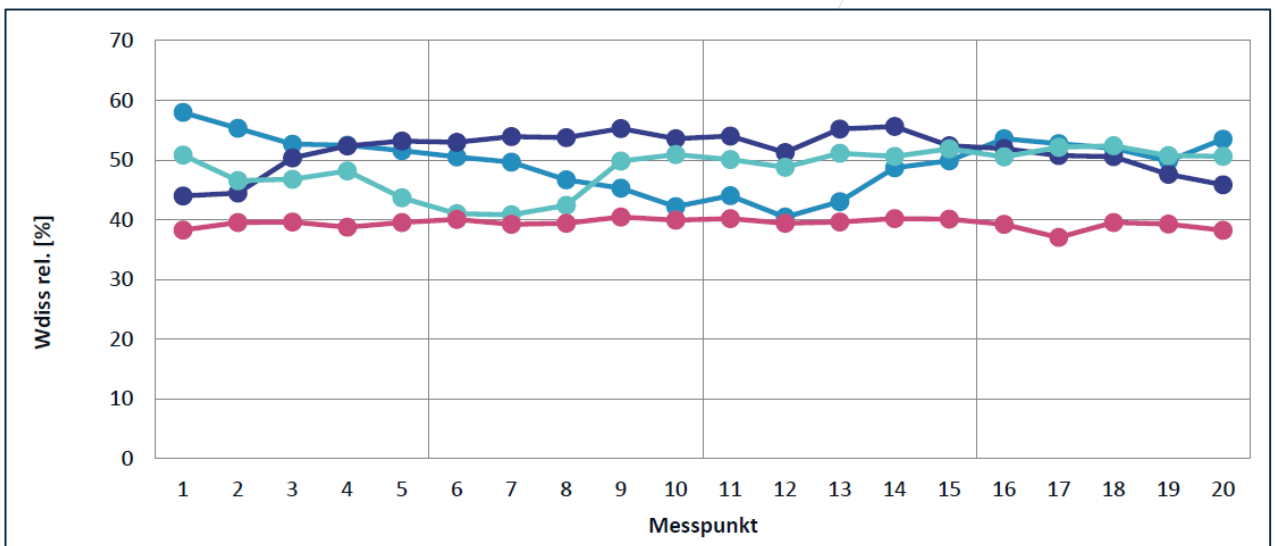
In the second stage, micro-indentation measurements are conducted at the same 20 circumferential points—each exactly in the center of the running track. This high-resolution technique enables the detection of minute mechanical property changes at the sealing lip.

## Objective, Quantifiable Assessment of Material Changes

The indentation analysis provides two critical mechanical parameters:

- **Stiffness** — characterizing the elastic response of the sealing edge
- **Dissipated Work** — indicating plastic deformation and internal friction

By comparing these values with reference data, the system can detect, quantify, and interpret chemical or thermal degradation effects on the sealing lip with high precision. This allows for a reliable evaluation of seal integrity and material behavior under different oil and temperature conditions.



Results of dissipated energy measurement on 20 points of different Radial Shaft Seals

## **Strategic Potential for Industry-Wide Standardization**

The introduction of this technology marks a significant milestone in the standardization and digitalization of seal testing. Medium term, the system has the potential to replace traditional manual evaluation methods entirely. OPR is already in close cooperation with leading OEMs to drive the industrial acceptance and further development of this approach

## **Dual Analysis Already in Use Today**

As of now, every radial shaft seal analyzed by OPR undergoes both conventional manual evaluation and micro-indentation analysis. This dual approach not only ensures maximum accuracy but also supports the gradual transition toward a fully automated, data-driven quality assurance process.



Indentation Measurement on a FKM Radial Shaft Seal

# OPR

ELASTOLABS

OUR KNOW-HOW. YOUR SUCCESS.

## High-Resolution Micro-Indentation Analysis of Radial Shaft Seals:

### Advancing RSS evaluation at OPR

Do you have any questions or need support?  
Do not hesitate to contact us.



Marius Gebhard

+49 151 101 788 65

[marius.gebhard@oprgroup.de](mailto:marius.gebhard@oprgroup.de)