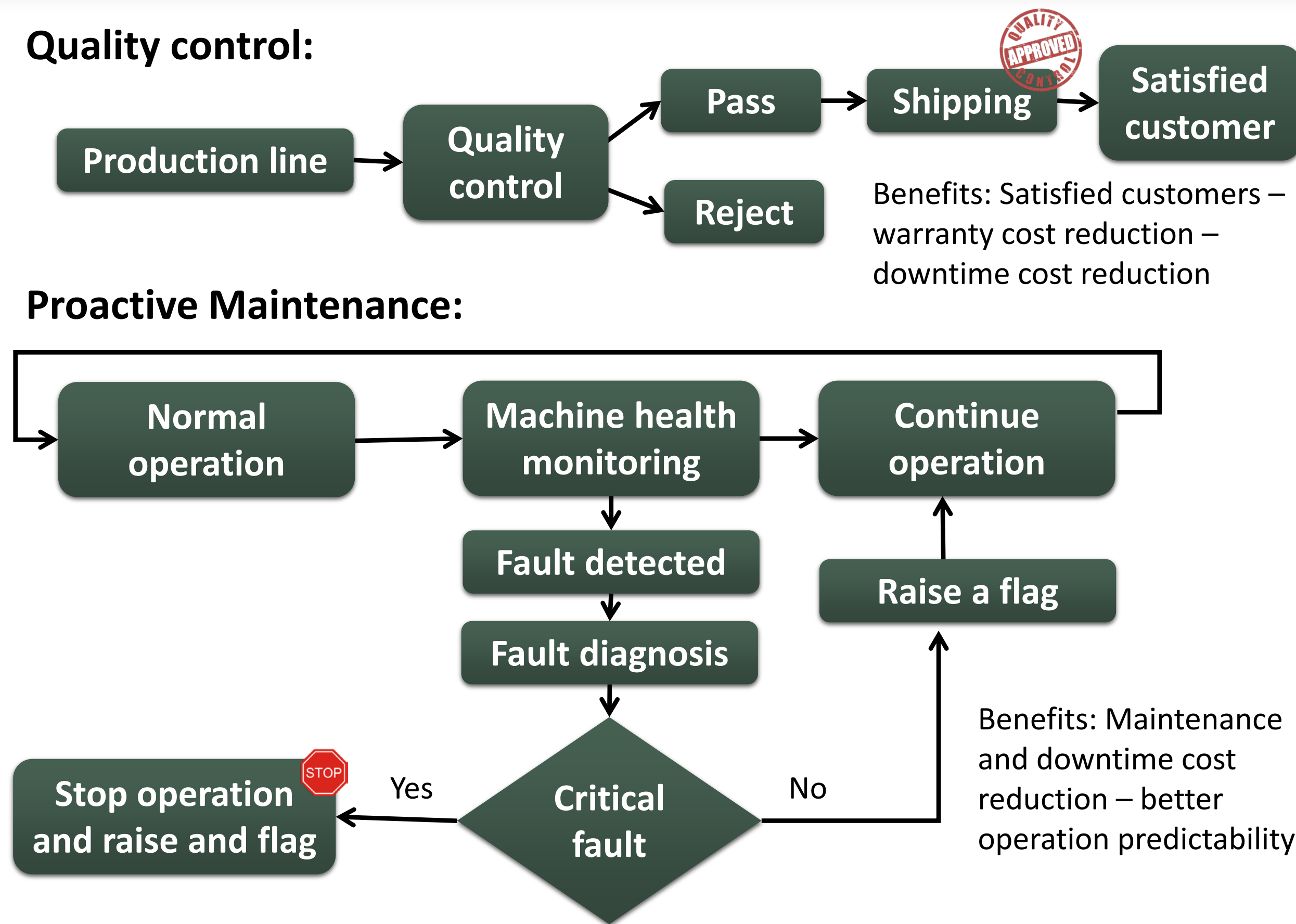


# Advanced Fault Detection and Diagnosis

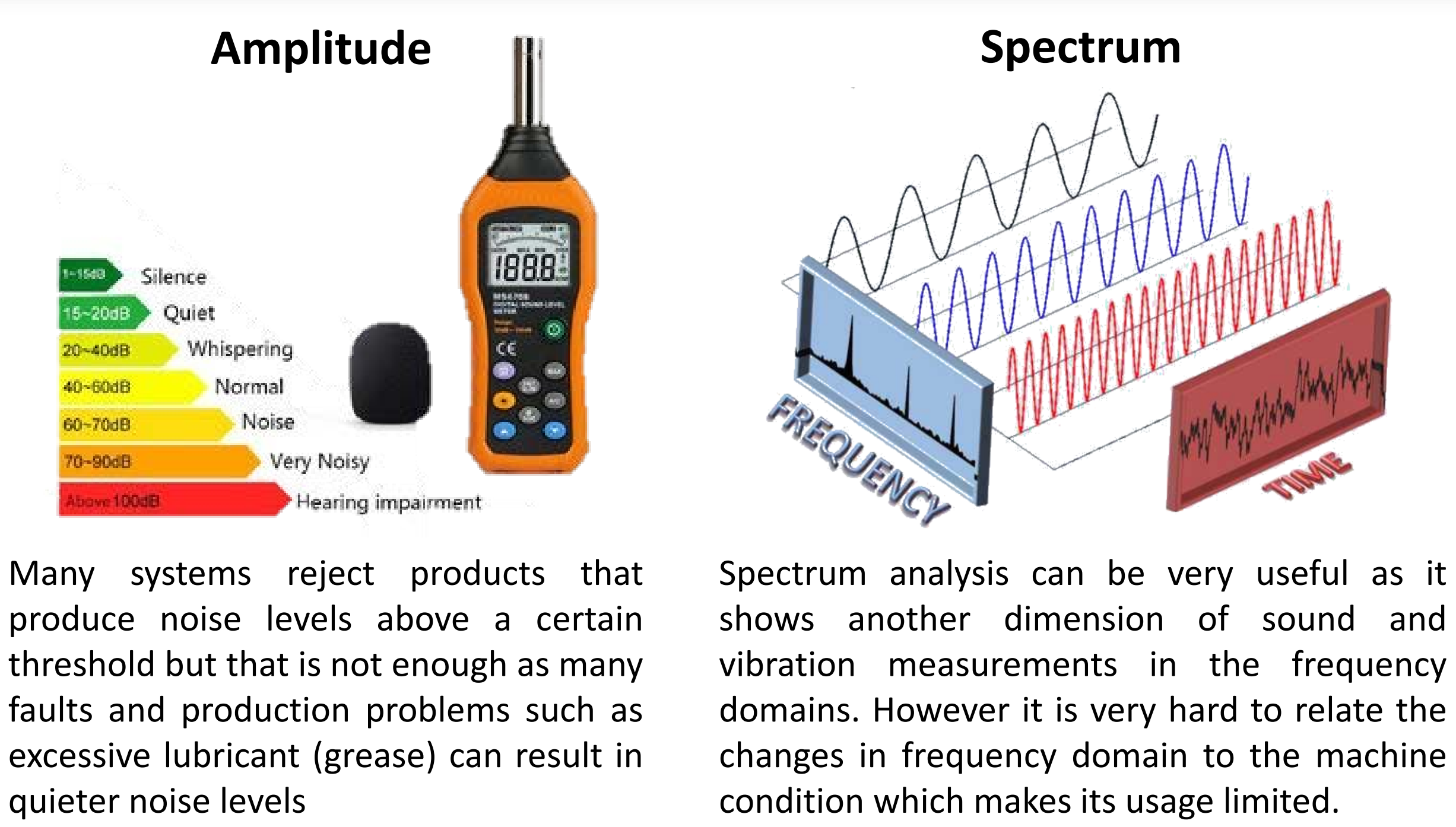
Centre for Mechatronics and Hybrid Technology  
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EECOMOBILITY (ORF) &  
HEVPD&D CREATE

## WHY FAULT DETECTION & DIAGNOSIS?

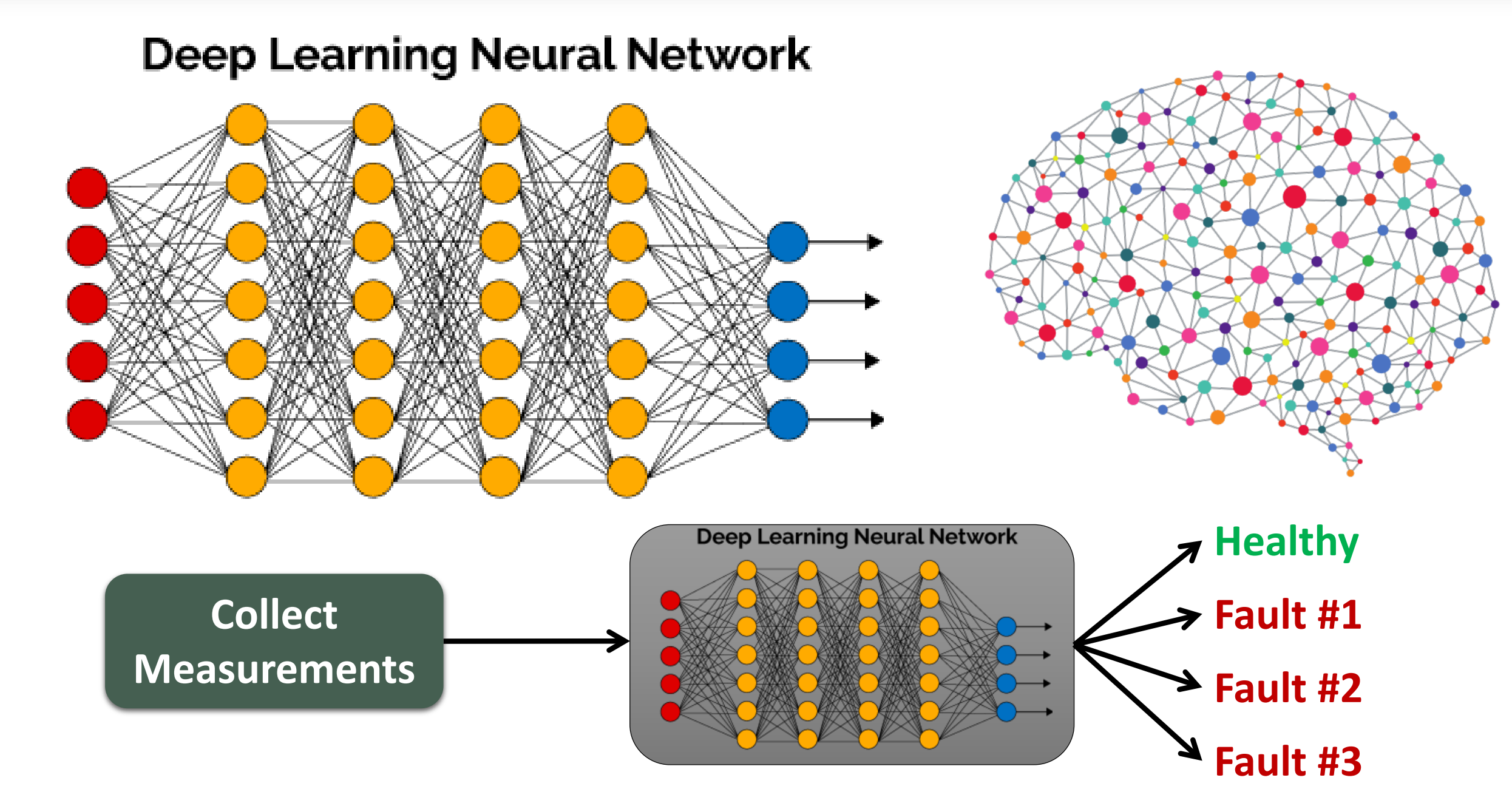


## WHY SOUND & VIBRATION IS COMPLEX



**Complexity:** to successfully use sound and vibration measurements to detect and diagnose faults, the analysis algorithm should take into consideration the changes in both time and frequency domains. Whether the changes are an increase or a decrease in sound and vibration levels.

## DEEP-LEARNING AI



Deep Learning is the leading Artificial Intelligence algorithm in many industries such as speech and image recognition. The Centre for Mechatronics and Hybrid Technology (CMHT) applied Deep Learning on fault detection and diagnosis applications. 100% fault detection success rates and 97.6% accuracy for fault diagnosis were achieved.

## SOUND & VIBRATION

**Sound**

**Vibration**

- The sound and vibration signals produced by rotary equipment is a result of their design, materials, and operating conditions. When a rotary equipment is faulty, it produces different sound and vibration signatures compared to a healthy baseline.
- Being able to detect the difference in sound and vibration enables fault detection and diagnosis.

## IEMSPCA

**Background noise filtration** is an important step to eliminate any confusion in the results.

**Wavelet analysis** is able to analyze the measurements both in time and frequency domains.

**PCA** is able to detect any changes in the time and frequency domains produced by wavelet analysis

**IEMSPCA algorithm** uses the difference in time and frequency domains to detect any deviation from baseline measurements. If there is any deviation baseline, further analysis is done on the fault signature to diagnose the fault type. IEMSPCA was tested and achieved 100% fault detection rates and 96.8% from fault diagnosis.

## COMMERCIAL IMPLEMENTATION D&V

Both technologies, IEMSPCA and Deep Learning are implemented for commercial use in D&V Electronics SV-PRO software. which is designed to provide different tools for sound and vibration analysis including traditional and advanced analysis types.