

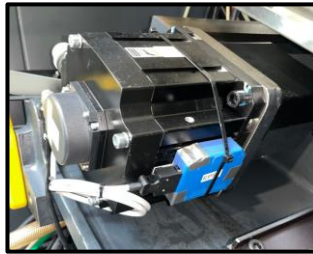
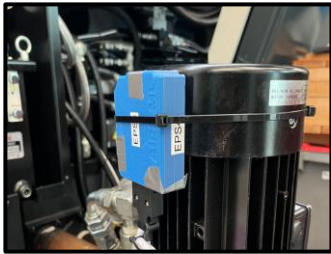
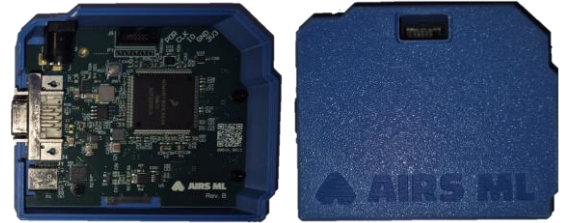
# Edge AI for CNC Machine Health Monitoring

**Problem:** Unplanned CNC machine failures cost manufacturers thousands in downtime, scrapped parts, and missed deliveries. Existing monitoring relies on cloud infrastructure, raising privacy, latency, and cost concerns.

**Our Approach:** We deployed our Edge Processing System (EPS) directly onto CNC machines at the AMRC. The system captures high frequency vibration data and runs AI inference entirely on premise. No cloud, no labelled fault data required.

**Deployment:** 3 CNC machines instrumented across the AMRC factory floor: DMG Mori NLX 2500, Haas VF6, and Starrag EcoSpeed. EPS units fitted at three key locations per machine: coolant motor, Z axis motor, and spindle. 2 months of continuous data captured.

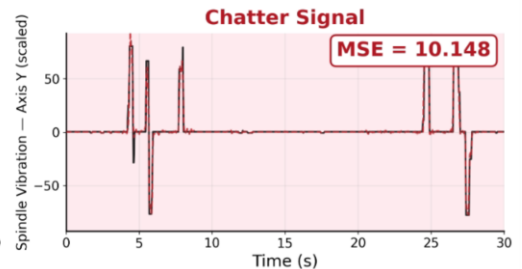
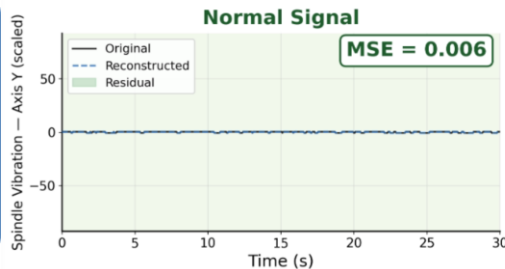
Edge AI using AIRS ML Daughter board



**Model Performance:** An unsupervised AI model for chatter detection was trained on normal operation data, eliminating the need for labelled fault cases. The Ecospeed and DMG Mori NLX recorded no process faults during the monitoring period. Chatter was observed on the Haas VF6 at 6,000 RPM. All model performance metrics below reflect detection results on this machine.

Autoencoder Reconstruction: Normal vs Chatter — Haas VF6 Spindle

High specificity keeps false alarms low.  
High sensitivity catches nearly every chatter event before it damages the part or tool.



Chatter detection running on live CNC machines with zero disruption to operations, zero cloud dependency, and zero need for failure training data. A retrofit, low cost, data private path to real time asset monitoring, extendable to spindle health, tool wear, and automated startup checks.

94.9%  
Accuracy

95%  
Sensitivity

0.956 AUC  
ROC AUC Score

96.8%  
Specificity