TMAC Detects Material Defect Mid-Cut—Preventing Tool Damage and Protecting Part Quality

RESULTS - INSTALL 12352

SITUATION

During a machining operation on a 2.5" 4140 steel bar, TMAC—a real-time tool monitoring and adaptive control system—issued an undercut alarm, signaling an unexpected drop in cutting load.

The operator inspected the active tool and found no signs of wear or damage. The previously used tool was also in good condition, leaving the cause of the alarm unclear. Further investigation revealed the issue was not tooling—it was the material.

A portion of the workpiece had fractured during machining due to a void or inclusion running through the center of the bar, creating a structural weakness that caused the part to break when the end mill engaged the edge.

Without immediate intervention, subsequent tools would have continued machining a compromised part—risking tool breakage, scrap, and potential machine damage.

RESULTS

- Prevented downstream tool damage from compromised material
- Contained the defect before impacting additional production
- Isolated and removed all suspect material from the process
- Protected part quality and enabled supplier corrective action

INDUSTRY

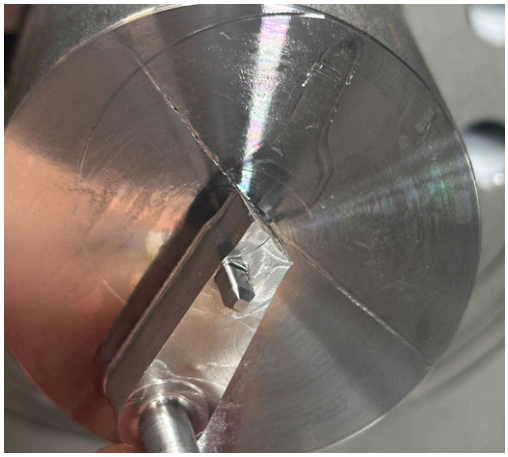
Precision Machining

MACHINE TYPE

Mill Turn

TECHNOLOGY

TMAC



Material inclusion revealed within 4140 steel bar after TMAC stopped the machine—preventing further tool damage and isolating defective parts.

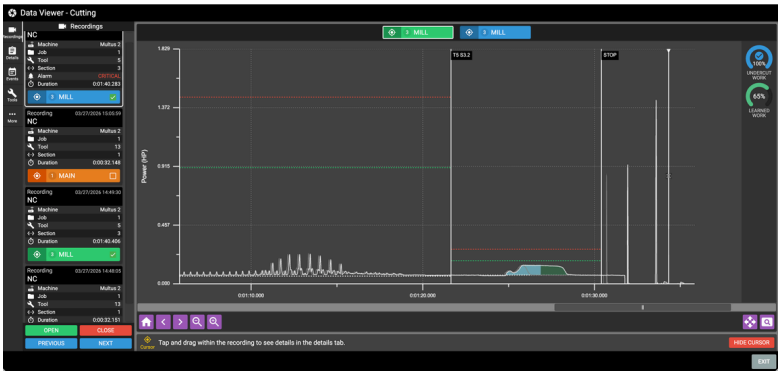
TMAC RESPONSE

TMAC detected the abnormal cutting condition in real time and automatically stopped the process—preventing further damage before the next tool engaged.

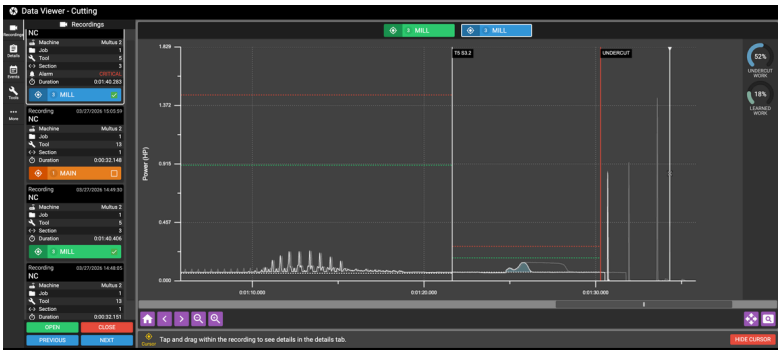
TMAC RESPONSE (CONTINUED)

This response enabled the team to:

- Prevent subsequent tools from engaging a fractured workpiece
- Avoid tool damage, scrap escalation, and potential machine impact
- Quickly determine the root cause as a material defect—not a tooling issue



TMAC monitoring showing successful cut within preset limits



TMAC monitoring showing undercut alarm that alerted the operator to find the corrupted bar

THE RESULTS

- Prevented downstream tool damage from machining a compromised part
- Contained a material defect before it impacted additional production
- Isolated all parts from the affected bar for inspection and validation
- Removed suspect material from production immediately
- Protected customer quality by preventing a potentially defective part from shipping
- Enabled supplier feedback to address the material issue at its source

THE VALUE OF REAL-TIME PROCESS MONITORING

Material defects are often invisible until failure occurs.

By monitoring the cutting process in real time, TMAC detects abnormal conditions the moment they happen—and can automatically stop the machine to prevent escalation.

In this case, TMAC not only protected tooling, but helped prevent a broader quality issue from reaching the customer.