

Trouble-shooting Tracks with Vibration detection and storage technology.
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One of the leading factors to scrapped wafers and excursions at Fab 11 Litho operations has been damage, both seen and unseen, done to wafers through handling on the tracks. The occasional broken wafer may be viewed as a nuisance and treated as such. But in reality such instances are always harbingers of more serious tool problems that may not get adequately addressed in typical preventative maintenance protocols or checklists. The more dramatic occurrences are where undetected or under-evaluated tool problems lead to major excursions covering many lots and many scrapped wafers. These events tend to cause great turmoil. Unfortunately, standard tool inspections didn't reveal any new information or actionable intelligence. The true gap in this scenario is that there was no good way to get an unbiased and accurate data-based evaluation of a wafer handling tools behavior. Additionally there are vibrations masked by environmental noises that are beyond human detection, but still significant, that contain important information about the tool.

The Vibration Detection wafer is a vibration detection / storage device that addresses the problems covered above. It is a vibration sensor, digital signal storage, and battery mounted on a silicon wafer. It collects vibration signals comparable to those experienced by production wafers. It collects and stores this information continuously while turned on. By running it through the tool on standardized recipes, identifiable and characteristic vibration waveforms are collected. The heart of the development work is the analysis, interpretation, and corrective action association of these waveforms.

Since the implementation of this technology scrapped wafers from wafer handling issues have been reduced by 46.9%. This also has significant benefits in maintenance as it allows a methodology for predictive maintenance and augments High Precision Maintenance (HPM) efforts. By developing baseline

waveforms, referred to as Fingerprints, the deterioration in tool performance can be identified and tracked. Also by the uniqueness of signals, corrective action can be quickly ascertained and adequately planned and executed.

There are three major functions that the Vibration Detection wafer addresses: wafer handling damage, trouble-shooting and maintenance planning, tool optimization. These functions are depicted on representative 'snap-shots' of waveforms which follow on page 2. Figures 1 and 3 show gross signals of poor wafer handling that require immediate corrective action. In both cases, damage to production wafers is significant. In Figure 1 the wafer is shifted by the pin chatter and could end up in the path of the closing oven lid leading to chipping or complete fracture. Figure 3 shows poor transfer and placement into a spin module. This is more insidious as the damage here could lead to thermal breaks in high temperature operations. Figures 2 and 4 show improved signals after corrective action was taken. Figure 5 is a demonstration of the predictive maintenance potential of the Vibration Detection wafer, where deterioration of guide rod bearings and/or lead screw bearings is seen in advance. Figure 6 demonstrates the third function of optimization. The speed and force of centering irises are excessive, but there was no effective way of measuring the existing situation, let alone making an objective adjustment, until Innersense was employed.

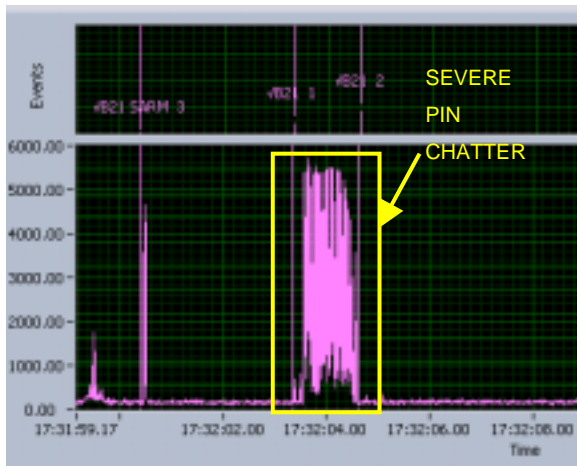


Figure 1. Display of severe Oven pin chatter, Waveform from a Track

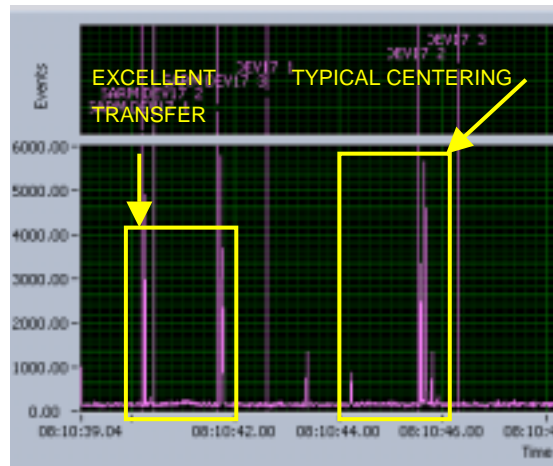


Figure 4. Display of acceptable wafer transfer at Developer 17, Waveform from a Track

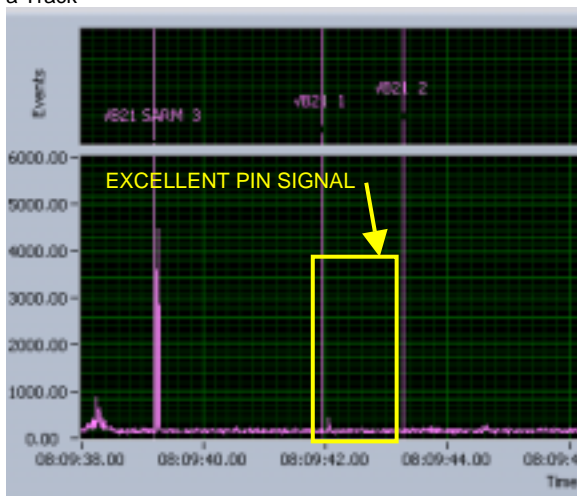


Figure 2. Display of an excellent pin signal, Waveform from a Track

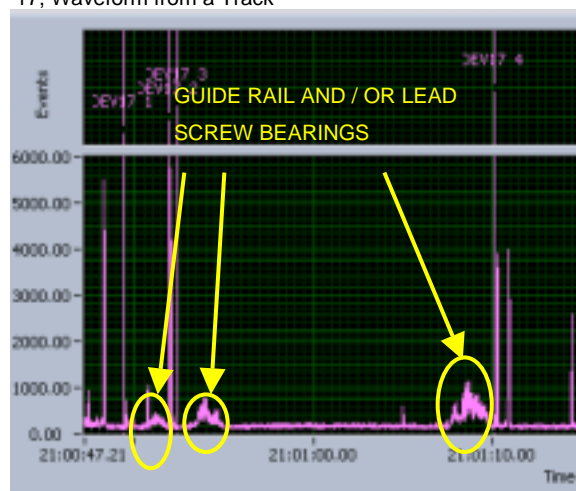


Figure 5. Display of deteriorating bearings at Developer 17, Waveform from another Track 4/4/06

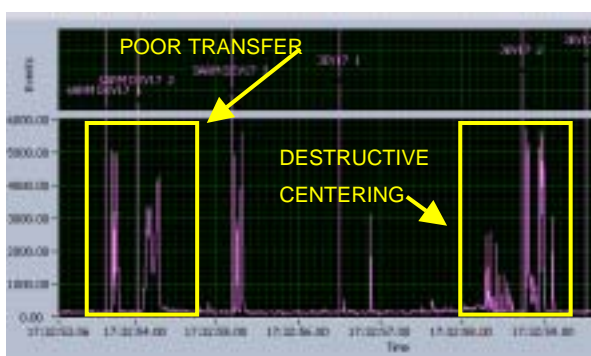


Figure 3. Display of severe wafer transfer and centering at Developer 17, Waveform from a Track

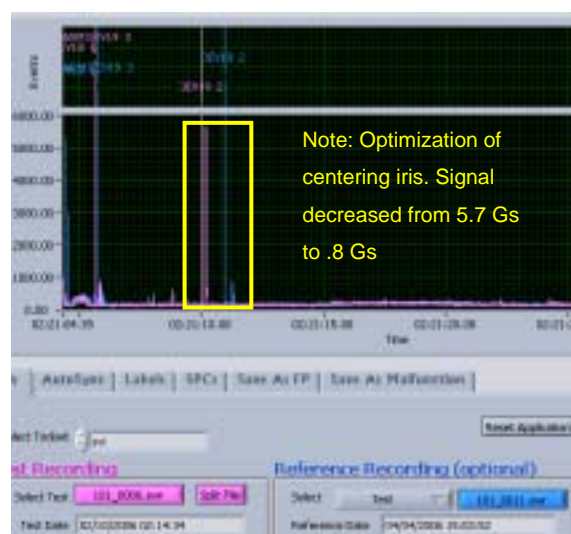


Figure 6. Display of centering iris at Developer 19, Waveform from yet another Track 2/10/06 & 4/4/06.