

## Lion Precision Uses NI LabWindows™/CVI Software and USB DAQ Hardware to Determine Machine Capability



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- Mark Kretschmar, Lion Precision (<http://www.lionprecision.com>)

### The Challenge:

Increasing the scan rate of multiple-channel data acquisition devices and reducing support time by creating an easy data acquisition interface for machine tool spindle analysis software that works with every computer every time.

[Read the Full Case Study](#)

### The Solution:

Using a NI multifunction data acquisition (DAQ) module and NI LabWindows/CVI software installation to automatically include USB data acquisition drivers and provide higher sample frequencies.

### Author(s):

Mark Kretschmar - Lion Precision (<http://www.lionprecision.com>)

Accuracies of less than 1  $\mu$  (0.000.4 in.) are often required to manufacture components for high-precision applications such as aerospace, disk drives, and medical devices. The machine tools used to cut these parts require very accurate spindles that rotate but have extremely little movement in any other direction. Temperature is a critical factor in holding tight tolerances. Heat generated by the spindle motor and changes in ambient temperature create thermal growth in the machine that affects the positional accuracy of the cutting tool. Users can predict a machine's ability to accurately cut parts by measuring the motions of the machine spindle at operating speeds and over the expected temperature range. Using LabWindows/CVI (<http://www.ni.com/lwcvil/>), we developed the Lion Precision Spindle Error Analyzer (SEA) to help users measure spindle error motions in real operating conditions and thereby predict how accurately the machine can hold part tolerances.

Without SEA, users cannot generate hard data to determine a machine's capability to produce extremely tight-tolerance parts. By testing machine tools with SEA before purchase, users report saving millions of dollars because they avoid buying expensive machines that they later find to be incapable of producing the required parts. Users also report enormous improvements in quality and associated improvements in revenue when using SEA to identify weaknesses in the manufacturing process.

SEA features Lion Precision high-performance, noncontact capacitive displacement sensors (resolutions better than 1 nm) to measure the position of a precision target rotating in the spindle. Five sensors are used to measure motions in five degrees of freedom. The system also provides for measurements from up to seven different temperature sensors. A high-density connector is included with the sensor system for easy connection to NI data acquisition hardware. The software interprets the sensor outputs as dimensional changes in position and displays the results as discrete values and visual plots. LabWindows/CVI creates all of the plots, including fast Fourier transforms (FFTs).

Detailed information, especially for FFT analysis, requires many samples per revolution. At faster spindle speeds, with as many as 12 channels of measurement, the scan rates become quite high, often taxing the capabilities of the hardware previously shipped with the product.

SEA is very popular and relatively easy to use, considering the complexity of the measurements. However, 20 to 30 percent of each sales engineer's time was spent on supporting the installation of the data acquisition hardware and software, particularly with laptops, the most common platform for SEA. As with all such inevitable issues, certain brands of computers required different workarounds and startup sequences.

We solved the sample frequency and installation problems by choosing NI multifunction DAQ as the data acquisition hardware for SEA.

The NI DAQ device, which has higher sample frequencies/scan rates than the previous hardware, eliminates hardware installation headaches because it interfaces through the USB port. Another factor in the installation simplification is LabWindows/CVI, which gives us the ability to create a single installation CD that installs SEA software and all data acquisition drivers and other required software with just one installation sequence. Users experience a significant reduction in time and complexity by not having to install the data acquisition drivers in a separate operation from a separate SEA installation CD.

Selecting USB DAQ as the exclusive data acquisition solution for SEA has had three distinct benefits. First, users now can scan at higher frequencies, enabling a better understanding of the nature of error motions discovered in machine tool spindles. Second, we have eliminated the extra step of installing a PCI board or PCMCIA card in the computer. And third, 20 to 30 percent of Lion Precision sales engineers' time has been saved with the elimination of hardware installation support calls.

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