

## Developing a Monitoring System for Predictive Maintenance of a Conical Mill



Monitoring installed crushers in quarries requires a versatile and reliable system.

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- Christian ÉPIÉ, O'Mos

### The Challenge:

Making a mill monitoring system detect misuse of material, measure the wear of the internal mechanical components, generate a database for modeling the aging machinery, reduce machine downtime and reduce maintenance costs.

### The Solution:

Gathering physical parameters using a sensor chain; analyzing these parameters using the NI CompactRIO platform to make diagnosis in real time using the NI LabVIEW Real-Time Module, and then viewing the status of the machines and managing the log files using LabVIEW software.

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A cone crusher is an element in the manufacturing chain of particles. Its role is to reduce the size of these particles. It works by crushing the material between a fixed jaw and a conical movable jaw.

The developed monitoring system is applied to two identical machines (HP4 grinders from Metso Minerals), each weighing 25 tons, driven by induction motors of 315 kW. Each mill processes about 400 aggregate tons per hour.

### Measurements From Two Dozen Sensors

Monitoring requires the processing and analysis of various physical parameters. The sensors consist of six accelerometers, six PT100 temperature probes, four inductive sensors, four analog pressure switches, and two flow meters. Some sensors are embedded in the machines, close to the subsets; others, such as those for hydraulic monitoring and tachometers are installed outside of the mills.

### Looking for an Open Solution

For this project, we first selected online monitoring system manufacturers. We soon realized that the solutions proposed were closed and standardized so they only partially met our requirements.

Next, we submitted our needs to our National Instruments correspondent. The NI platforms and technologies were clearly a perfect solution to our problem. At this point, only one obstacle remained for us to overcome: could we find the appropriate skills to convert our expertise in vibration analysis and diagnosis in the form of a [LabVIEW](#) program?

After only five days of [LabVIEW Core](#), [LabVIEW FPGA](#), and [LabVIEW Real-Time](#), training courses we knew the LabVIEW environment was a great solution. It proved to be a source of inspiration and we could move forward while being sure we were going to do a good job.

### A High-Quality HMI

The LabVIEW Development System, among other things, let us create a high-quality interface so we did not need to buy a supervisory system.

### CompactRIO Adapts to Hostile Environments

We chose the CompactRIO platform because it is tough and easy to integrate into hostile environments such as quarries. Additionally, its low power consumption allows it to work well in enclosed locations. The high-quality connector can also handle vibrations and temperature changes without affecting the reliability needed for a monitoring system.

The developed system consists of an NI [cRIO-9074](#) real-time controller with [NI 9233](#), [NI 9203](#), and [NI 9481](#) C Series modules installed in it. The application was developed in LabVIEW using the [LabVIEW Real-Time](#) and [LabVIEW FPGA](#) modules.

### Driving Future Company Development

For our small company, which is primarily focused on service, the discovery and use of NI solutions is extremely important to drive future development. We appreciate NI technology as well as the quality and professionalism of our NI contacts.

Our client was very satisfied with the services rendered by the monitoring device. Furthermore, our first experience working with NI has given us confidence that we can develop our own vibration analysis equipment and improve our service offering.

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CompactRIO manages the signals from five different types of sensors.

#### Legal

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