

Outotec® MillMapper

Measure Model Manage

MillMapper (developed by Scanalyse which is now part of Outotec) is a globally patented technology for mill liner condition monitoring and modelling. Unique in the industry, MillMapper provides an unprecedented level of information and allows your maintenance and operational personnel to extend liner life cycles, optimize liner design, prevent liner failures, optimize throughput and improve the performance of your mill.

Regular condition monitoring of mill liners helps improve the overall comminution performance.

Benefits

- Optimizes liner life and design
- Early detection of liner failure
- Remotely operated, no manual entry required
- Higher overall mill availability
- Improved forecasting from more accurate and reliable data
- Improved safety

Outotec

World's first mill condition monitoring technology

Several years of research in applying terrestrial laser scanners to a range of industrial machinery lead to the development of the world's first in-situ measurement, modelling and management of liners in grinding mills. MillMapper's globally patented, unique monitoring technology provides accurate measurement of liner thickness, weight and condition for the entire mill surface.

The intelligent software tracks and forecasts wear on your shell, discharge and feed end liners, providing accurate information on mill charge and a wide range of metallurgical parameters.

Operating principle

Scanning

Initially, the mill is scanned using a state-of-the-art laser scanner either by personnel entering the mill or remotely, by mounting the scanner on a support beam. Scanning is performed in as little as 15 minutes and can be scheduled to coincide with your planned inspection shutdown.

Using a specially calibrated terrestrial laser scanner, MillMapper records the entire visible internal surface of the mill, as opposed to conventional methods where only a few arbitrarily selected points are measured.

Unlike Ultrasonic Thickness Gauge (UTG) and manual measurements, MillMapper provides liner thickness measurements over the entire internal mill surface. Up to ten million thickness points are used to produce a 3D model and subsequent wear tracking curves.

3D Modelling

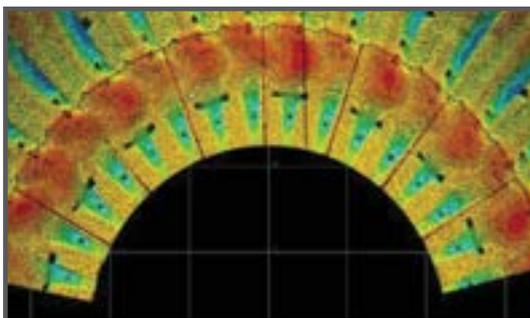
Following the scan, the raw data is uploaded and processed to deliver a high definition 3D model. This is

colour-coded according to liner thickness and provides point thickness measurements on all wear surfaces to an accuracy of $\pm 3\text{mm}$. The software automatically detects high wear zones and asymmetric wear patterns. Cracked liners, loose plates and broken grates are also easily detected.

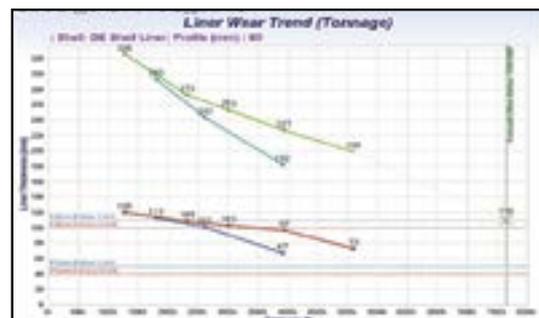
Reporting

Following automatic detection and flagging of the wear 'hot spots', the software produces precise wear curves and intelligent forecasting based on trend data gathered from over ten million thickness points on the liner. The reporting software also produces cross sectional and longitudinal profile curves and reline efficiencies.

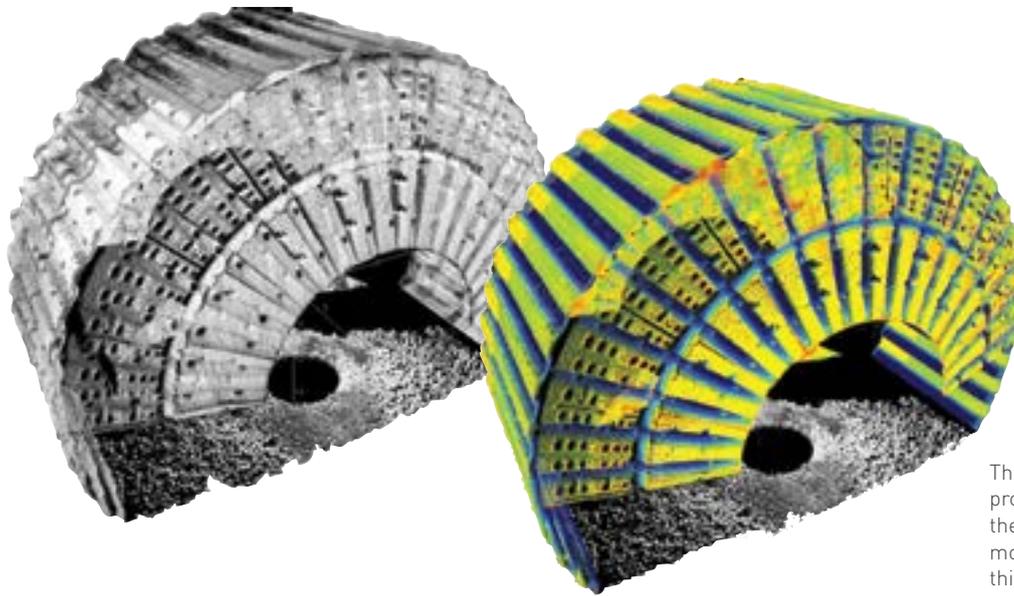
Operators can therefore establish critical thresholds that define reline criteria and also make informed decisions based on automated, consistent and repeatable measurements followed by rigorous statistical analysis.



Feed end of SAG mill showing extreme wear patterns on Inner liner



Wear curves for lifters and plates over two different life cycles



The advanced data processing converts the grey-scale surface model to a 3D liner thickness model

Measure Model Manage

Optimizing liner design

Liner designs can be optimized by providing historical cross-sectional and longitudinal wear plots for each liner type. Optimized liner design can increase throughput tonnage, extend reline schedules and minimize material wastage.

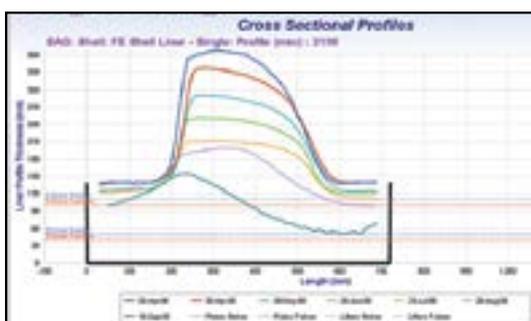
Reline forecasting

Reline forecasts are determined with advanced tonnage-based modelling techniques specifically designed to capture high wear zones within the mill.

Reline schedules can be optimized with confidence, the advanced forecasting algorithms capture dynamic wear rates over each liner lifecycle and historical data of several lifecycles can be compared to the current one.

Quick and simple

A mill scan usually takes between 15 and 30 minutes which can be simply integrated into regular shutdown schedules. This means a reduction in the duration of inspection shutdowns.



Cross sectional profiles shown over complete liner life

MillMapper deliverables

A detailed report from the MillMapper data is generated within a short time frame. Outotec's highly experienced MillMapper team reviews these reports and discusses recommendations in a one-to-one consultation. Sites are also encouraged to download the 3D models and reports from their scan and, using the integrated MillMapper software, can conduct a virtual inspection of the mill and review, in complete detail, any particular point.

- Detailed initial wear report
- One-to-one consultation follow-up
- 3D model and software
- Database package of site's wear history

Proven at site

MillMapper has provided clients with crucial recommendations that have prevented catastrophic liner failure and subsequent ongoing damage. At one particular site, imminent relines were recommended after detecting accelerated wear in several of the mills, saving over AU\$18M in 2009 in potential production losses and repairs.

Liner wear rates and high wear profiles have provided clients with the ability to forecast changeouts more accurately. This reliable forecasting has allowed clients to extend shutdown cycles and liner life. By extending scheduled shutdowns from 12 to 16 months, one client was able to save AU\$330K in a calendar year, with an ongoing reduction in operating costs of AU\$80K per annum.

Improved safety

Laser scanning can be performed remotely by mounting the scanner on a support beam. Remote scanning eliminates the need to perform a confined space entry, thus reducing safety risks, minimizing inspection downtimes and negating the need for lengthy safety procedures.



Scanner inserted on a beam

Advantages

Through improved knowledge of liner wear, MillMapper can optimize the liner life and design, detect early liner failure and deliver higher overall mill availability. MillMapper also has the following benefits over conventional thickness measurement techniques:

- Scanner mounted on a support beam for remote entry
- Improves safety by eliminating confined space entry
- Minimizes inspection shutdown times
- Captures wear data on the entire mill
- Reliable reline forecasting
- Optimizes liner designs
- Defines metallurgical parameters
- Identifies and prevents catastrophic liner failure

Process	Before MillMapper	With MillMapper
Liner thickness measurement	<ul style="list-style-type: none"> • 20-30 spot measurements with UTG or basic manual techniques 	<ul style="list-style-type: none"> • 10 million thickness points captured in as little as 15 minutes • No entry required • Automated, consistent, repeatable measurement • Reduced inspection downtime
Evaluate wear patterns in the mill	<ul style="list-style-type: none"> • Rely on visual inspection and spot measurements 	<ul style="list-style-type: none"> • Colour-coded 3D model and indepth report indicating accurate wear patterns, cracks and hotspots
Calculate mill charge	<ul style="list-style-type: none"> • Estimate by counting number of lifters exposed / rely on inaccurate load cell 	<ul style="list-style-type: none"> • Highly accurate charge downtime and mass measurement derived from scan file
Schedule reline	<ul style="list-style-type: none"> • Based on past history, spot measurements and estimations 	<ul style="list-style-type: none"> • Reliable forecasting • Optimization with tonnage-based wear tracking
Liner profile assessment	<ul style="list-style-type: none"> • Manual spot measurements 	<ul style="list-style-type: none"> • Liner thickness and profile measurements at all locations in the mill

Outotec provides leading technologies and services for the sustainable use of Earth's natural resources.

As the global leader in minerals and metals processing technology, Outotec has developed over decades many breakthrough technologies. The company also provides innovative solutions for industrial water treatment, the utilization of alternative energy sources and the chemical industry. Outotec shares are listed on NASDAQ OMX Helsinki.

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