

Automation instruments

To measure, control, and improve operations



The challenge: You are producing tons of product every day—how do you know it's meeting specification?



The solution: Measure. Control. And profit.

As a global market leader for advanced production systems for pulp and paper, ANDRITZ AUTOMATION understands the challenges that your operation faces when it comes to controlling your processes and producing top-quality product. Competition is fierce. Your mill must run at peak performance. Product quality is a must. You can't improve what you can't control, and you can't control what you can't measure. That's why ANDRITZ AUTOMATION offers a suite of state-of-

the-art online instruments to measure critical operational parameters and help mills achieve maximum performance.

Our instruments have been helping mills across North America, South America, and Europe attain the most accurate analysis of product quality.

All our instruments are automated and installed at your mill to provide a live, ongoing picture of your operation. Best of all, our instruments are supported by a team of development engineers and process experts who

have years of hands-on experience at pulp and paper mills around the world.

Our global, industry-specific experience means we understand your issues and can provide you with the right solution for your mill. In addition, our experts bring the power of our instruments right to your site, no matter where it is in the world. By implementing ANDRITZ AUTOMATION instruments, you will achieve the best information about your operation. Better information means you can achieve better control—and be more competitive.

Benefits

- Control and measure crucial parameters in key pulping process areas
- Reduce energy consumption
- Improve frequency of measurement
- Minimize equipment wear and tear
- Achieve more consistent operation
- Produce higher value products



“At long last, there is a sensor that can measure and improve the control of pulp quality. Clearly the most significant development in pulp quality monitoring in the last 20 years.”

Confidential Customer



“Pulmac testing has been phased out, and total reliance on FiberVision has eliminated slowdown due to dependence on Pulmac data. Historically unreliable Pulmac test data had caused slowdown of the machine. FiberVision units have totally eliminated this problem. As a result, the mill has increased both GWD and TMP production.”

Art Stickney, Area Manager, Pulp Mill
Verso Paper



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The challenge: To measure and control pulp drainage accurately and consistently

The solution: FiberVision pulp quality sensor

FiberVision is a state-of-the-art on-line sensor that helps pulp operations reduce specific energy consumption, achieve higher value product, improve frequency of measurement and decrease downtime.

FiberVision is the first sensor to measure specific surface area

Canadian Standard Freeness (CSF) and Schopper-Riegler (SR) have long been the traditional drainage measurements in the pulp and paper industry. These often-contested and sometimes ambiguous results are only relative indicators.

Because freeness is a global and empirical parameter, it cannot be used to determine the key parameters in the development of fiber characteristics such as fiber bonding potential, surface area, fibrillation, fines content, compressibility or specific volume.

FiberVision: Seven analyzers in one

- Freeness analyzer
- Surface area analyzer
- Fiber length analyzer
- Shive analyzer
- Vacuum response analyzer
- Pulp brightness
- Pulp properties predictor



FiberVision is different. It's a tool that directly measures these fundamental parameters—and the effectiveness of your process.

Specific surface area monitors fiber development effectiveness

FiberVision provides simple measurement of fibrillation, fines generation, and fiber development. In fact, FiberVision is the only

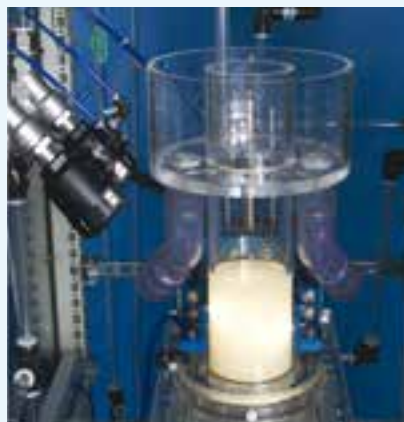
sensor that directly measures the specific surface area of fibers. If the specific surface area of fibers goes up, then fibers are better fibrillated and have more bonding potential, reduced fiber coarseness, and more chemical absorption capabilities. The direct outcome is a more consolidated, stronger, and smoother sheet.

FiberVision fractionates the pulp to measure fiber and fines surface independently

FiberVision is equipped with a unique fractionation system. Fines are separated from fibers in the drainage column in order to differentiate between the specific surface area of fibers (fibrillation) and that of fines (fines generation).

Specific volume tracks fiber swelling and water retention

FiberVision is the only sensor that directly measures the specific volume of fibers, a volumetric measure of the cellulose and bound water in the fiber structure. Specific volume is a direct measurement of fiber swelling, internal fibrillation, and water retention. It is also a key parameter in the prediction of bulk and sheet consolidation.



▲ FiberVision's proprietary filtration column is the key to improved accuracy and innovative measurements. Operators can now use specific surface area, fiber length and many other pulp properties automatically provided by FiberVision to control their processes.



Proprietary “shive enrichment” technology

Shives are separated from the pulp by a screening system in order to accurately measure their length, width and area. Other sensors measure shives in a high-consistency fiber suspension, resulting in statistical errors on shive size and quantity.

Vacuum response curve, compressibility and porosity

FiberVision derives several other key characteristics of the fibrous mat from the proprietary “vacuum response curve.” Compressibility measures the resistance of the fibrous mat and predicts its ability to form dense sheets. Mat porosity quantifies pore size distribution. Mat flocculation provides a measure of the ability of fibers to form either a finely structured or a flocculated sheet.

Brightness sensor

Built on a proprietary principle, the brightness sensor is fully integrated into the FiberVision platform. This additional measurement complements the fiber length and surface area data provided by FiberVision. Together, these properties give the user a full picture of pulp quality.

High-resolution fiber morphology measurements

FiberVision provides a wide range of morphological measurements, including fiber length, fiber width, fiber curl, and coarseness. Accuracy is ensured by the high resolution of the imaging process and the very large number of fibers processed.

Multiple sampling streams

Up to eight pulp streams can be automatically sampled with FiberVision. Thanks to the innovative sampling technology, sampling points can be located at large distances from the sensor, without the risk of plugging or wasting pulp. In addition, FiberVision can be fitted with a twelve-cup automated batch sampler in order to measure manual samples.

DCS and mill-wide connectivity

FiberVision can easily be connected to your DCS and mill-wide system. Data transfer can be accomplished via current loops, network connections, or PI system data exchange. Remote connection can also be initiated for data and video monitoring, or for long-distance troubleshooting.

Benefits

- Save energy by fine-tuning power and settings of refiners and grinders
- Decrease steam requirements in dryer by reducing fine contents and water retention on machine table
- Reduce use of strength additives by increasing fibrillation and paper strength properties
- Optimize water retention, allowing for higher machine speed in dryer-limited applications
- Improve runnability and reduce machine breaks by increasing fibrillation and compressibility
- Improve density, porosity, and optical and mechanical properties
- Reduce variability through around-the-clock measurement of pulp properties, combined with advanced process control

Optimize process efficiency with six critical criteria

FiberVision monitors the efficiency of any optimization (such as a new refiner plate pattern, grinder stone sharpening, or a change in chemical charge) according to six criteria.

1. Surface generation

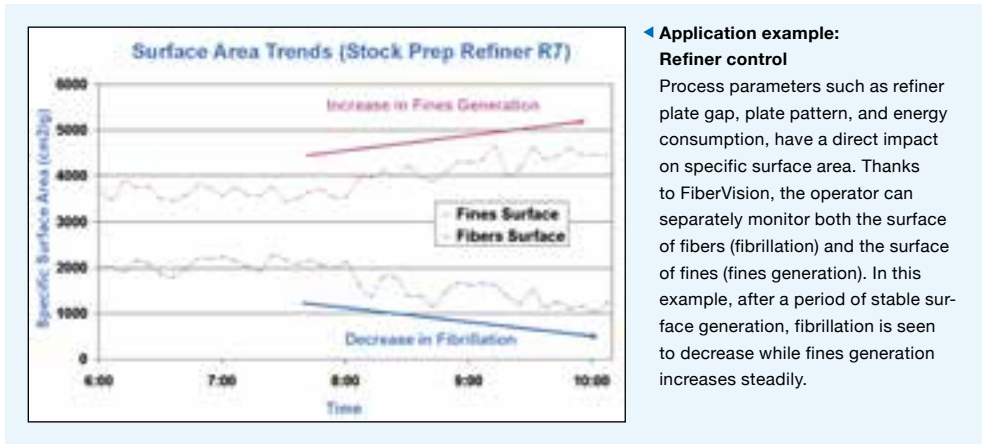
Increased pulp surface can significantly increase fines generation.

2. Fibrillation surface

An increase in surface area of the fiber fraction leads to better bonding and less “fiber rise.”

3. Swelling/water retention

The measurement of swelling and water retention is an important factor for high-density, well-consolidated sheets with high bulk and absorbency.



Application example: Refiner control

Process parameters such as refiner plate gap, plate pattern, and energy consumption, have a direct impact on specific surface area. Thanks to FiberVision, the operator can separately monitor both the surface of fibers (fibrillation) and the surface of fines (fines generation). In this example, after a period of stable surface generation, fibrillation is seen to decrease while fines generation increases steadily.

4. Fines surface

Well-developed, high-volume fines are beneficial to sheet properties.

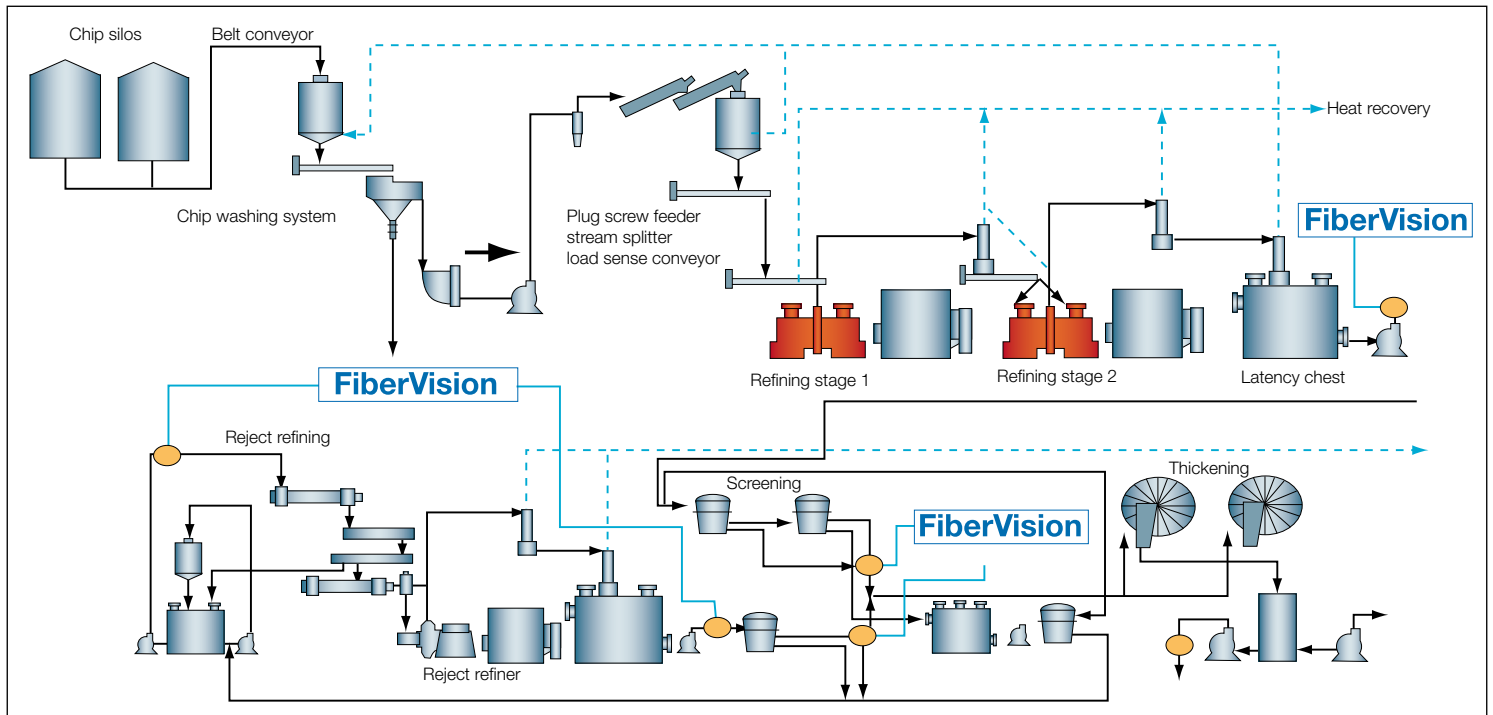
5. Fiber length/coarseness

Long and coarse fibers are critical for high tear and reinforcement pulps.

6. Shives content

Shives are not desired for any paper grade, but if treated correctly have the potential to contribute to the sheet structure.

Typical FiberVision installation ▼

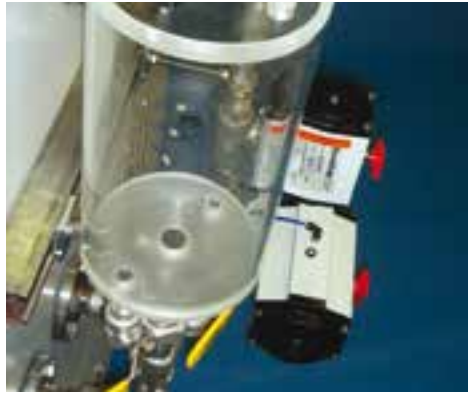


“By separately measuring the Specific Surface Area of the fibers and that of the fines, FiberVision has given us a lot of information regarding the refining process and its relation to fiber quality. The progress that we have made in the understanding of the refining process will result in substantial energy savings and improved paper quality.”

Jocco Dekker, R&D Manager
Wageningen UR

“We benchmarked four fiber quality analyzers for monitoring groundwood and TMP pulp quality and found out that FiberVision has given us the best information. Fiber property measurements from the FiberVision were used to develop a refiner control algorithm which improved pulp quality and reduced energy consumption.”

Dr. Patrick Tessier
Consultant to International Paper



Feature	FiberVision	Competition
Freeness (CSF)/Schopper-Riegler (SR)	✓	✓
Custom drainage indices	✓	✗
Fiber morphology (length, width, curl)	✓	✓
Fiber length classification	✓	✓
Fiber length vs. fiber width diagrams	✓	✓
Bauer McNett simulation	✓	✗
Shive morphology	✓	✓
Shive enrichment technology	✓	✗
Shive classification	✓	✗
Specific surface area of pulp	✓	✗
Specific surface area of fibers	✓	✗
Specific surface area of fines	✓	✗
Specific volumes (internal fibrillation)	✓	✗
Mat compressibility	✓	✗
Vacuum response curve	✓	✗
Mat flocculation	✓	✗
Mat porosity	✓	✗
Prediction of tensile, burst, bulk, etc.	✓	✗
Online sampling points	Up to 8	1 to 8
Offline sampling points	12+1	✗

The challenge: To detect stickies in pulp before they contaminate key process areas

The solution: PulpVision real time stickies detection

The PulpVision online stickies and dirt analyzer gives mills a superior tool for detecting stickies, dirt, ink, and shives in a pulp flow.

With PulpVision, the operator is constantly informed about particle count, particle size, total particle area, and trend curves. Stickies and dirt specks are automatically classified using TAPPI size standards or other international standards.

The online PulpVision system inspects more than 20 liters (6 gallons) of pulp per minute. This rate is hundreds of times higher than is possible through manual methods.

PulpVision can easily detect particles as small as 25 microns—or one thousandth of an inch—nearly invisible to the human eye. PulpVision delivers precision, speed, and reliability in stickies and dirt analysis. Most importantly, it delivers peace of mind.

Principle of operation

The PulpVision system includes one or more

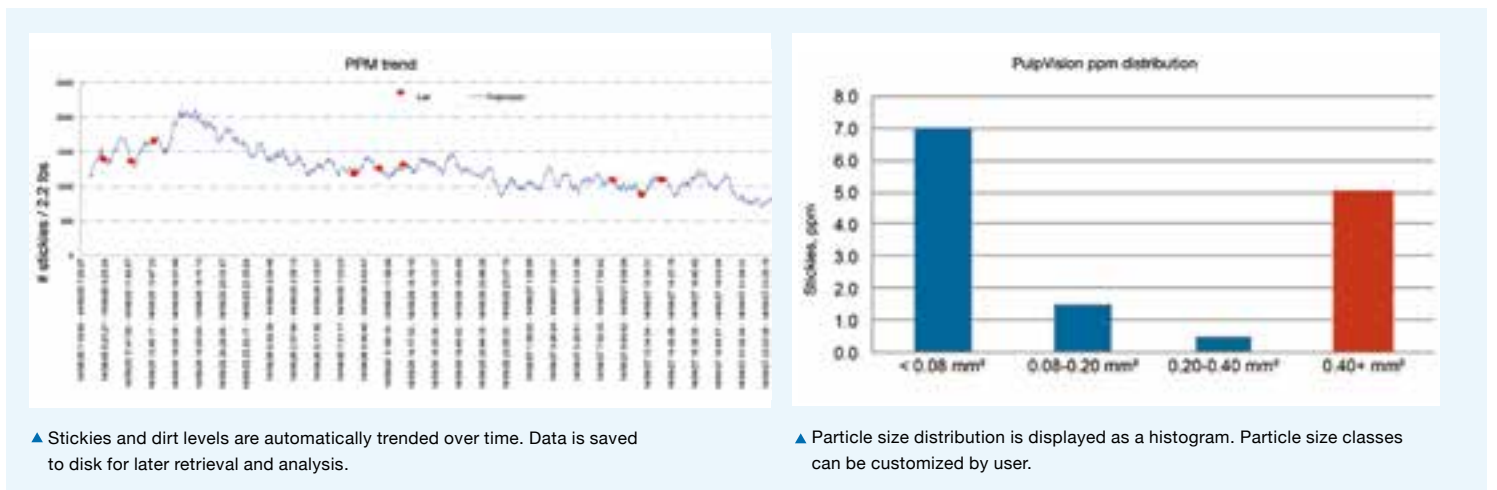


online sensors and a powerful computer workstation. Pulp flows through an observation cell where up to 25 images per second are recorded by a high speed video camera synchronized with a strobe light.

The video images are transferred to the workstation for real-time analysis. PulpVision can detect and analyze any contrasted particles, including ink, dirt, shives, and stickies.

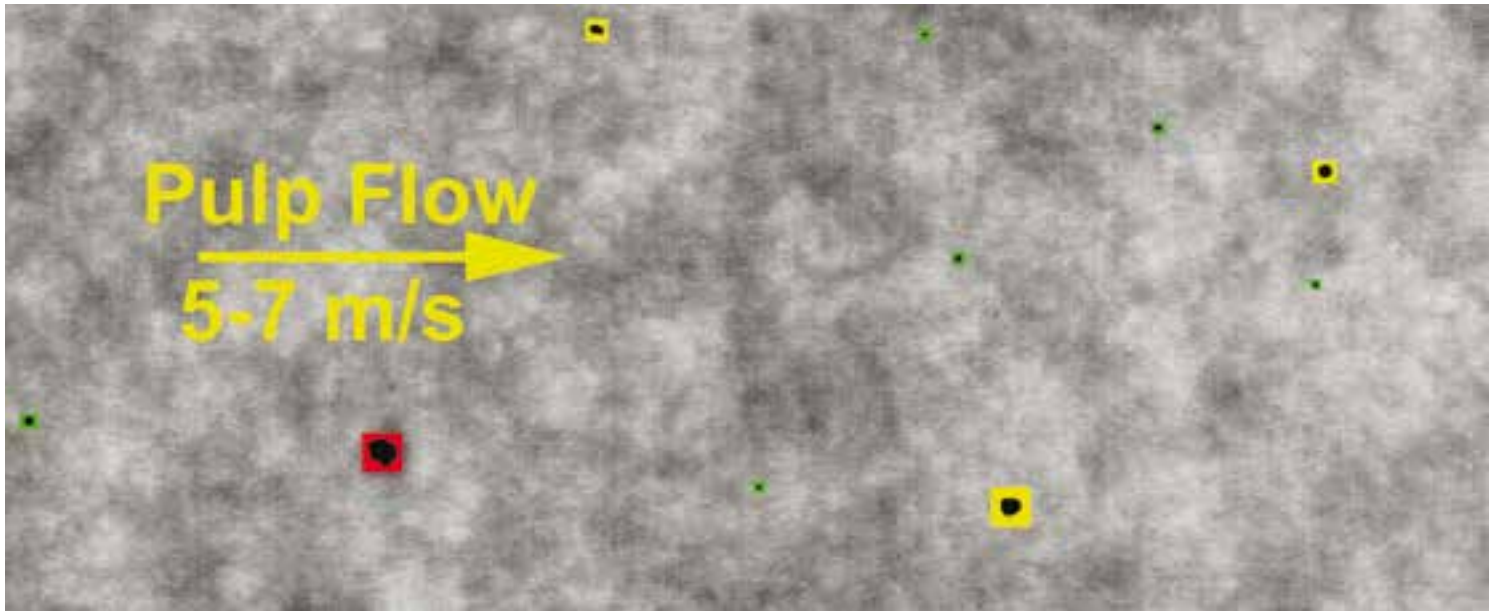
Applications

PulpVision can be installed for recycled, unbleached, and bleached pulp. It monitors pulp quality before reaching the paper machine and ensures the cleanliness of market pulp. It will also measure cleaning/deinking efficiency. It optimizes post-consumer fiber blends and will help in the troubleshooting of screens and cleaners.



▲ Stickies and dirt levels are automatically trended over time. Data is saved to disk for later retrieval and analysis.

▲ Particle size distribution is displayed as a histogram. Particle size classes can be customized by user.



Features

PulpVision has a wide range of features to help operators collect the best information, including:

- Real time online detection
- Continuous measurement
- No operator bias
- Response time of less than one second
- Proprietary “flow-through” design
- Proprietary “adaptive thresholding”
- DCS connection via OPC
- Available in three resolutions
- Analyzes largest quantity of pulp
- Insensitivity to flocculation
- Insensitivity to air bubbles



Benefits

- Protect machinery, storage tank, and stock preparation circuits against stickies and dirt contamination
- Detect spikes in stickies and dirt contamination in real time
- Automate stickies detection
- Replace tedious and subjective manual detection with automated tracking of contamination levels
- Troubleshoot operation by measuring stickies, dirt levels, and size distribution

The challenge: To provide real and accurate plate gap measurement to the refiner

The solution: GapScan measuring system

GapScan is a unique measuring system that improves the entire refining process by providing constant control and adjustment of the gap between the rotor and stator disc. GapScan helps mills meet the market demands on both pulp quality and refiner control.

The refining gap has a major impact on the pulp quality. Gap changes occur during operation due to chip feeding variation. The exact measurements provided by GapScan, and the quick data transfer, enable the DCS to adjust the gap precisely and guarantee smooth and stable operation to help mills achieve the best pulp quality.

Operation area and improvements

GapScan is placed directly in the refining zone. It measures the real refining gap during all phases of production and production preparation. This allows real-time, real data measurement that is independent of temperature and pressure, and enables fast and ac-



curate control. The accurate measurements provided by GapScan and the quick data transfer enable accurate, precise gap control for smooth and stable operation guaranteeing best pulp quality. In addition, automatic

adjustment of the plate gap distance helps to stabilize pulp quality. Optimum gap adjustment leads to cost-efficient operation.

Benefits

- Achieve best pulp quality, right from the beginning
- Stabilize pulp quality
- Measure in real time
- Measure with small thermal time
- Achieve more efficient operation





Features

GapScan features include:

- One sensor for two values, gap and temperature
- Accurate measurement
- Simple configuration, two-point calibration
- Long life and lifetime information
- Temperature compensation
- Refining zone gap measurement
- Sensor status information



Overview of GapScan components ▼



Sensor (RPGS)

- Accurate measurement of plate gap and temperature within the refining zone
- Resistant against residual magnetism
- High measurement frequency (real-time measurement)
- Easy installation and calibration; installation in any refiner plate possible
- Maintenance-free
- All ANDRITZ refiners are designed to accept the sensor



Cable (RPSC)

- Fast data transfer, high frequency
- Resistant to oil, steam, and high temperatures
- Shielded



Control unit (RPGE)

- Provides the highest speed measurement
- Allows dynamic control, unlike other systems available
- Simple connection to customer's DCS via 4 mA to 20 mA output
- Self-diagnosing and reporting to DCS or local device

The challenge: To detect and avoid equipment failures

The solution: Advanced condition diagnostics

You've invested millions of dollars in your equipment. When it fails, your mill can be out of commission for hours, or even days, severely impacting your profit. In some cases, it can even mean a loss of life. That's why you need the most accurate measurement tools available on the market: advanced condition diagnostic (ACD) systems.

Vibration measurement tools are ineffective when it comes to slowly rotating equipment like lime kilns, hydraulic drives, and wash press bearings. With some equipment such as recovery boilers, by the time a problem is detected by a conventional measurement tool, it is simply too late.

ACD will change the way you think about equipment monitoring. These tools monitor machines that are difficult or impossible to observe and analyze, using new technology that is designed to detect and predict problems before they occur. ACD improves the overall availability of process time for pulp mill areas and equipment. These online diagnostics allow mills to plan maintenance and



upgrades, and improve overall plant safety. The system is particularly valuable in detecting incipient failures.

The ACD system monitors friction levels and detects changes on bearing running conditions and lubrication before critical failures occur. In many cases, the source of the friction (for example, lubricant breakdown, metal in lubricant, lubricant cooling system failure, improper loading) can be corrected, helping the mill to avoid equipment failure—and downtime. On pressure vessels, ACD detects active crack propagation and leaks online.

All ACD tools use ACU sensors developed and manufactured by ANDRITZ. They are

completely remote-controlled and provide a complete diagnostic solution. We offer the tools for the following standard applications:

- Kiln ACD
- Digester ACD
- Recovery boiler ACD
- DD washer ACD
- Wash press ACD
- Pulp dryer ACD

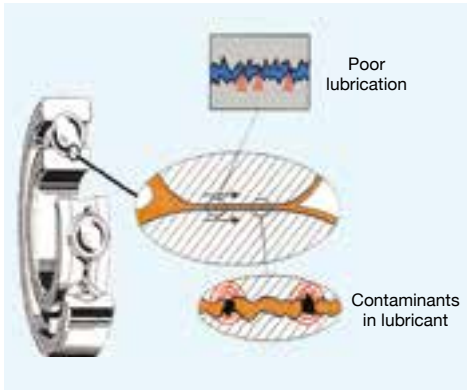
We can also custom design a solution for any rotating equipment you wish to monitor.

Our technology

ACD tools use acoustic emission (AE) technology. Rapid changes in micro-structures of material generate elastic waves (acoustic

Benefits

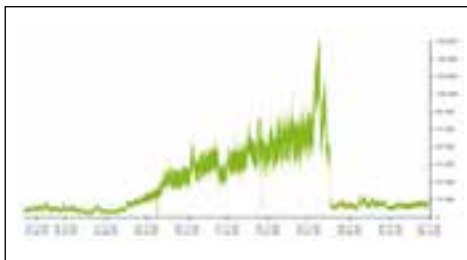
- Monitor machines that are difficult to analyze or observe
- Improve mill process time
- Plan maintenance and upgrades
- Improve overall plant safety



▲ Poor lubrication or contaminants in lubricant cause increased emission levels.



▲ The location of the ACU-230 sensor installed on a lime kiln carrying roller friction bearing. The sensor features a separate sensor head and electronics in separate aluminium enclosure, ideal for applications with high temperature at the monitoring area.



▲ Acoustic emission count trend, indicating increasing friction and unstable function on a slowly rotating robust bearing on digester outlet device over several days.

emission). Ultra-sensitive piezo sensors then detect and continuously record the amount of energy generated. Acoustic emission technology is very adept at detecting overload, lubrication problems, crack propagation, and incipient machine faults. Low-frequency background noise and audible noise have no effect on measurement.

ACU sensors are typically located at bearing housings, and on gearboxes and pressure vessels. Data produced by ACU sensors is sent to our ACD-server, which offers a web-based human-machine interface (HMI). Sensor indicators on the HMI are marked with colors corresponding to the level of acoustic emission. For example, green



indicates normal running conditions, yellow indicates an alert that requires attention and correction, and red indicates an alarm with critical running conditions.

Browser-based HMI data is available for all users in the plant's network. ANDRITZ experts can help you interpret the data to identify the problem being detected. Remote user and diagnostics support is also available.

Universal features

- Acoustic emission-based measuring principle
- Online diagnostics
- Fault detection before any vibration can be detected by other means
- Friction and lubrication condition monitoring
- Alarms and warning

The challenge: To achieve an accurate picture of your kiln's condition

The solution: Kiln advanced condition diagnostics

Kiln ACD is an effective tool for monitoring the operation of calciners and kilns, and for providing predictive maintenance diagnostics.

In particular, kiln ACD can be used to diagnose product ring plugging, carrying roller alignment, and thrust roller and gearbox load. It is also an ideal tool for condition monitoring.

It helps reduce the risk of costly shutdowns by detecting damage in drive operations. It can help with maintenance procedures by putting a damaged gearbox and bearings into the maintenance cycle in a proactive, controlled manner.

Condition diagnostics are conducted during regular operation.



Features

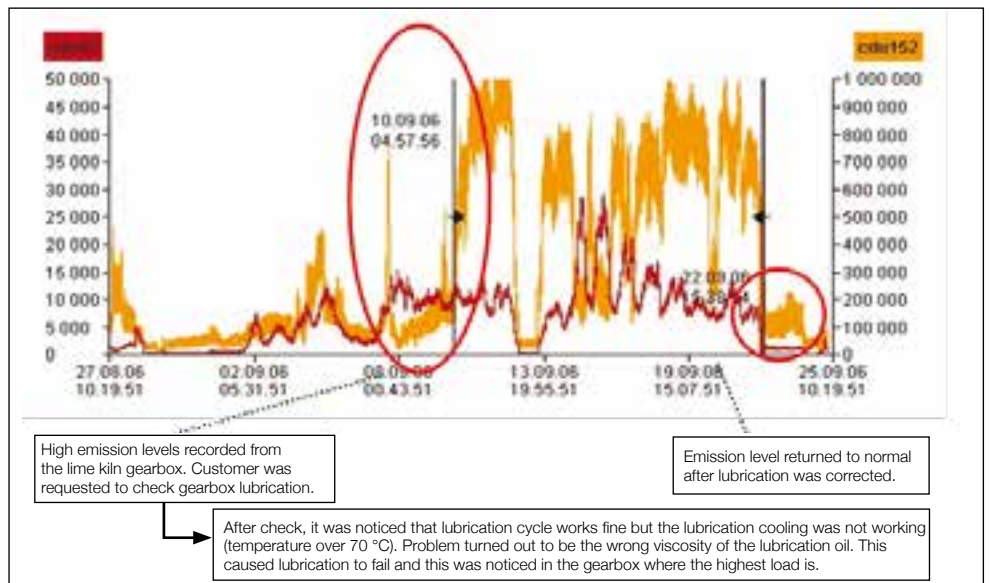
Kiln ACD has a number of features to monitor kilns, including:

- Acoustic emission-based measuring principle
- Online diagnostics
- Fault detection before any detectable vibration
- Detecting ring formation
- Providing kiln alignment information
- Bearing diagnostics
- Thrust roller load condition monitoring
- Friction and lubrication condition monitoring

Benefits

- Detect potential damage in drive operations—reduce risk of costly disruptions to operations
- Avoid disruptions by putting damaged gearbox/bearings into maintenance cycle in a controlled manner
- Conduct condition diagnostics during regular operation

Kiln ACD detecting process error, and allowing system to be corrected ▼



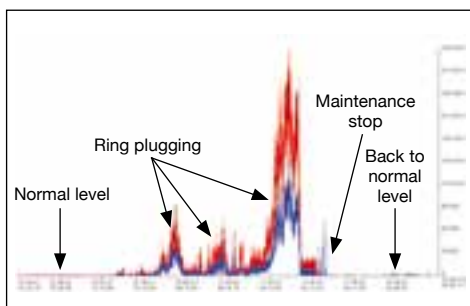
Kiln condition monitoring – application scenarios

Scenario 1: Product ring plugging

Product ring plugging can be detected as acoustic emission levels increase in specific carrying roller bearings. An example of product ring plugging is shown in the figure below.

Formation of the ring was detected several days before the kiln was stopped for maintenance. This gave mill personnel valuable time to organize maintenance activities.

As a result of alarms given by kiln ACD, the kiln was stopped early enough to avoid irreparable damage to the kiln and bearings. After the kiln shutdown and completion of maintenance, acoustic emission levels returned to normal. Inspection of the kiln's condition revealed that no damage occurred.

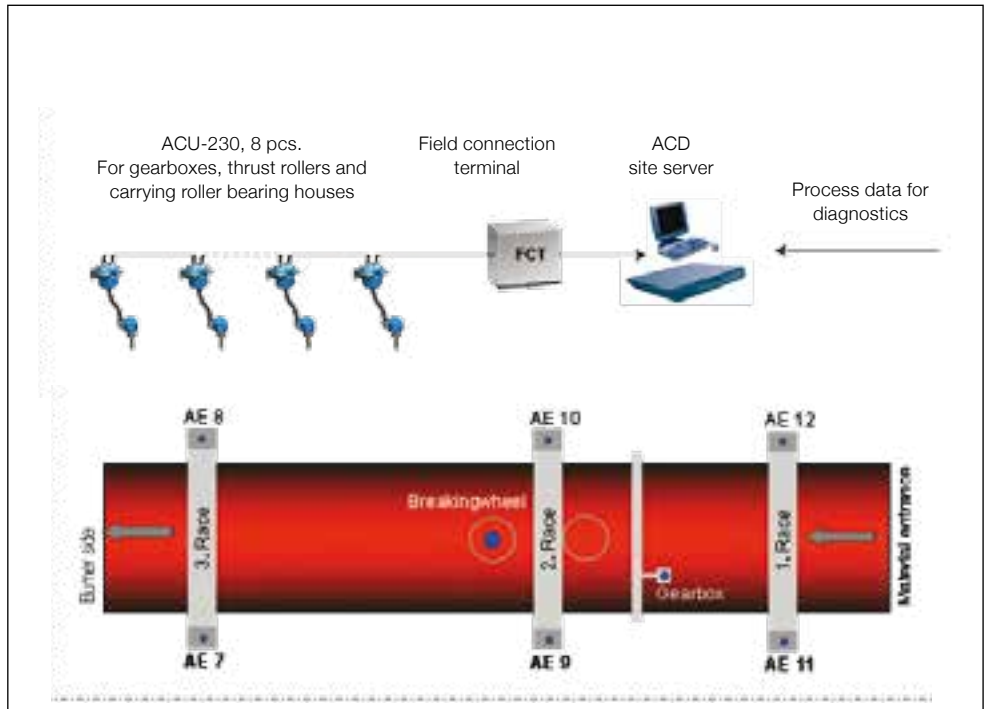


▲ Formation of product ring plugging as seen by kiln ACD

Scenario 2: Kiln alignment

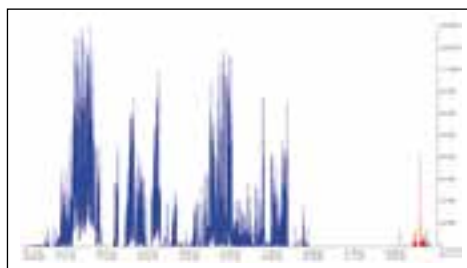
Sensors on carrying roller bearing housings indicate load on the bearings. Changes in loading conditions are detected online as they occur. This makes alignment of the carrying rollers faster and more accurate compared to traditional alignment methods.

In cases where kiln rotation speed is changed but no further adjustments are made, consequent kiln behavior will change.



▲ A typical kiln ACD system configuration

In one case, a heavy load on the upper thrust roller occurred over four months. Due to sensitive detection, the excessive load was found and corrected before any damage could occur. The lime kiln was resting on the lower thrust roller at certain intervals, as can be seen in the figure below.



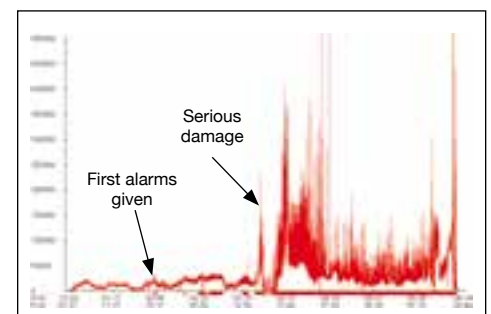
▲ Effect of lime kiln alignment on thrust roller load

Before new roller alignment, the load on the lower thrust roller was much lower than on the upper thrust roller. Since the adjustments, the kiln has been running well and

in-line. Continuous lime kiln diagnostics reveal whether additional alignment is needed over time.

Scenario 3: Carrying roller bearing condition monitoring and diagnostics payback

Sensors mounted on carrying rollers can reveal bearing fault development over several months, as seen in the figure below. This is an example of long-term diagnostics.



▲ Development of serious carrying roller bearing fault over a long period

Automation solutions

Release your full potential



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