

Hydrocyclone Underflow Discharge Angle Monitoring and Control

Hydrocyclones are crucial classification devices in many mineral processing circuits. Hydrocyclones are designed to operate at specified feed conditions (pressure, flow and density) in order to operate optimally providing good separation with acceptable product density and flow.

Poor hydrocyclone performance can lead to overgrinding in a closed milling circuit; wasted energy; coarse particles being sent to downstream processes (such as flotation, leaching) or the loss of valuable dense media.

Knowing whether a hydrocyclone is roping, flaring excessively or operating normally is a basic indication of whether it is operating efficiently or not. **The Mintek CyLas instrument provides this information to operators and control systems.** This measurement can be integrated into a control system to **avoid undesirable states** or to **maintain the process at an optimum underflow flare angle.**

What is the CyLas?



The Mintek CyLas

The CyLas is an on-line instrument for measuring a hydrocyclone's underflow flare discharge angle.

It uses a laser to measure a point on the hydrocyclone underflow discharge, which then directly relates to the underflow discharge angle.

The CyLas's non-contact nature, rugged construction, lack of regular calibrations and integrated cleaning system means that the CyLas is an inherently low-maintenance instrument.

CyLas Installations

CyLas devices have been installed at various plants, either as a standalone device, or integrated with the Mintek MillStar control system.

The standalone option includes a user-friendly industrially rated touch panel. This protected screen can show the current discharge angle or trends of previous operation. The display can also be used to configure the CyLas (with password protection for critical parameters). The values from this unit can be used by the plant's PLC and SCADA network.



A CyLas field display unit

The functionality of the field box can also be replicated directly on the Mintek software control platform through the plant's PLC or DCS network.

The image to the right shows a hydrocyclone monitored by the CyLas. The CyLas can be mounted several meters from the hydrocyclone if necessary. The red dot on the hydrocyclones underflow is the CyLas laser light which assists with the aiming of the device.



Hydrocyclone monitored by the CyLas

Hydrocyclones discharging into covered launders can be simply measured through a small opening in the launder cover

Using the CyLas information

The CyLas can be used as a hydrocyclone roping detector or to give advance warning to operators when the hydrocyclone is operating outside the set limits.

Conditions such as cyclone wear and choking can also be identified by observing the hydrocyclone underflow discharge angle trends.

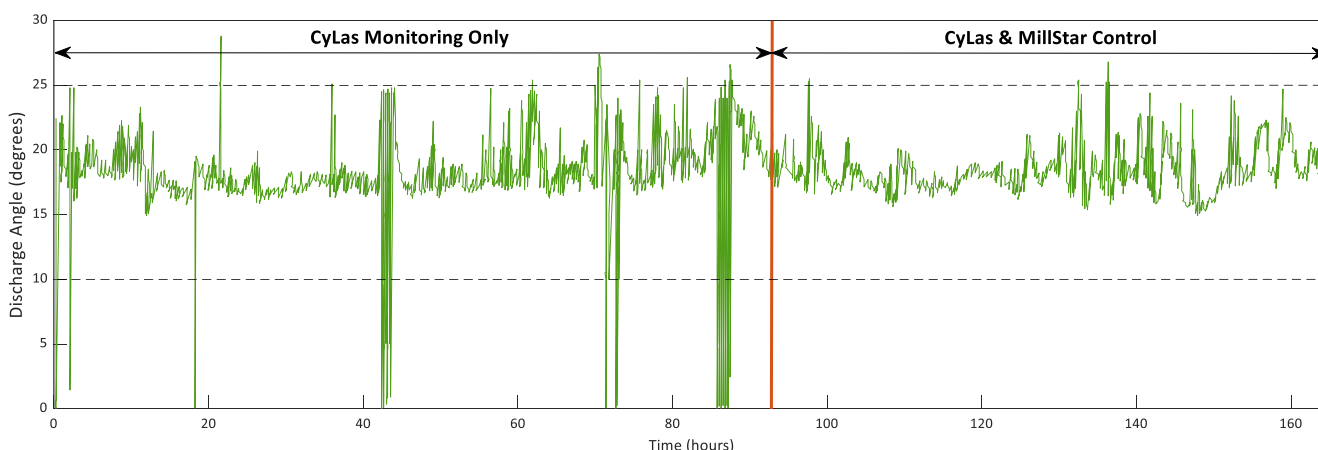
The discharge angle of hydrocyclones in a cluster can be used as a condition to open or close cyclones.

Integrating the CyLas with a MillStar control system

The CyLas measurement information is most useful when integrating it with a control system in order to automate the anti-roping, choking and cluster operation of cyclones.

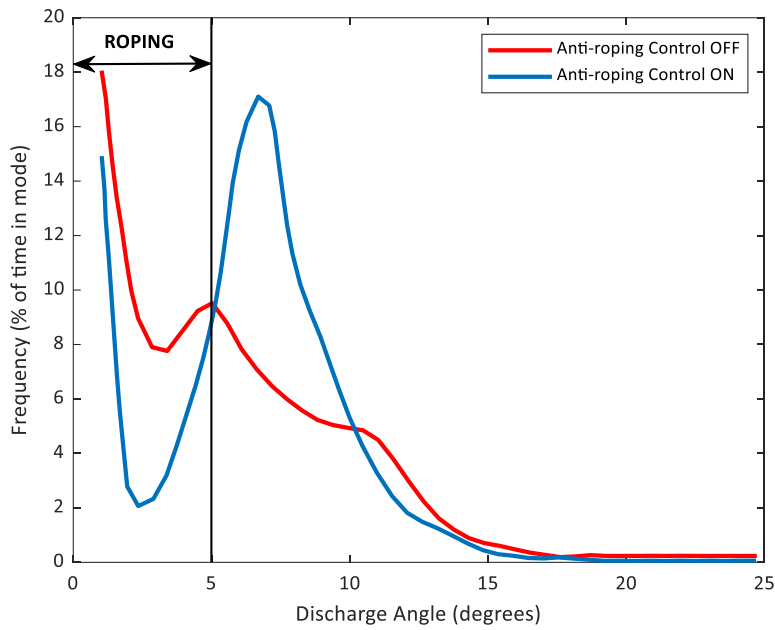
Most hydrocyclones have an upstream feed sump to assist in controlling the hydrocyclone feed flow rate, pressure and density. Controlling these variables independently is difficult as these systems are usually highly interactive, there are few manipulated variables available for control, and these processes are often upset by unmeasured disturbances. Mintek is an expert in applying robust controllers (such as the MillStar control system) to effectively control complex interactive processes such as these mill discharge circuits.

This is illustrated for Plant A below, where the CyLas installation required the underflow discharge angle to be maintained between 10° and 25° on a circuit that experiences significant external disturbances. The control system was able to **dramatically reduce the number roping events** (when the discharge angle is low) and to **reduce the number and duration of excessive discharge angle events**. This has a **positive effect on the quality of classification** which directly impacts performance of the downstream flotation circuit.



Plant A - Controlling the underflow discharge angle within a range

The performance of a MillStar anti-ropping control strategy at Plant B is shown below.



Plant B - Anti-ropping control strategy

This plant considered the hydrocyclone to be roping when the underflow discharge angle is below 5°. Plant B required avoiding roping as far as possible – while maintaining the flare angle at low values.

Integrating the cyclone underflow discharge angle measurements from the CyLas into the MillStar not only helped **reduce the number of roping instances**, but also allowed for **control close to roping** which was ideal for this plant. This is evidenced by the increased frequency of operation just above the nominal roping point when the controller is on.

The **optimised classification and reduction of roping** improved the feed to the downstream separation circuit.

The **industrially proven Mintek CyLas** is ready to help you **monitor and control** the performance of your cyclones in a **cost effective and robust** manner.

This white paper has been brought to you by Mintek. Feel free to pose any questions you might have to MillStar@Mintek.co.za. To connect with Mintek Process Control experts on LinkedIn, [click here](#).