AUTOMATION

ADVANCED CONTROL EXPERT (ACE)®

OPTIMIZED SOLUTIONS FOR THE MINING INDUSTRY

ANDRITZ

ENGINEERED SUCCESS

ENGINEERED SUCCESS

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Consistently operate your plant at peak efficiency with Advanced Control Expert

The Advanced Control Expert (ACE)®* is a virtual "expert operator" that works in conjunction with ANDRITZ's BrainWave®* solution to fully optimize a process. ACE increases mineral recovery and production, minimizes energy usage, and improves classification.

OUR TECHNOLOGY

BrainWave is patented predictive technology that is capable of controlling multiple variables while considering the effect of each adjustment on all measurements. BrainWave closely controls all targets to stabilize the process and ensure it reaches a set point and stays there.

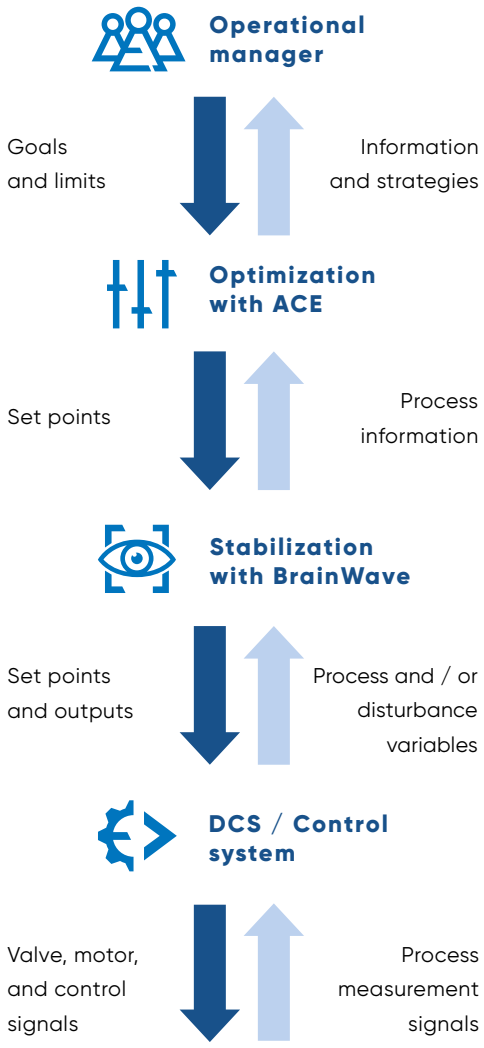
Once this stability is achieved, ACE determines the best set points and manages the process area, keeping costs as low as possible while continuously delivering a product that meets your specifications. ACE manages all operational constraints and limits, reconciles lab test data with operational goals, validates instruments, provides shift-to-shift stability, and sends all operational targets to BrainWave.

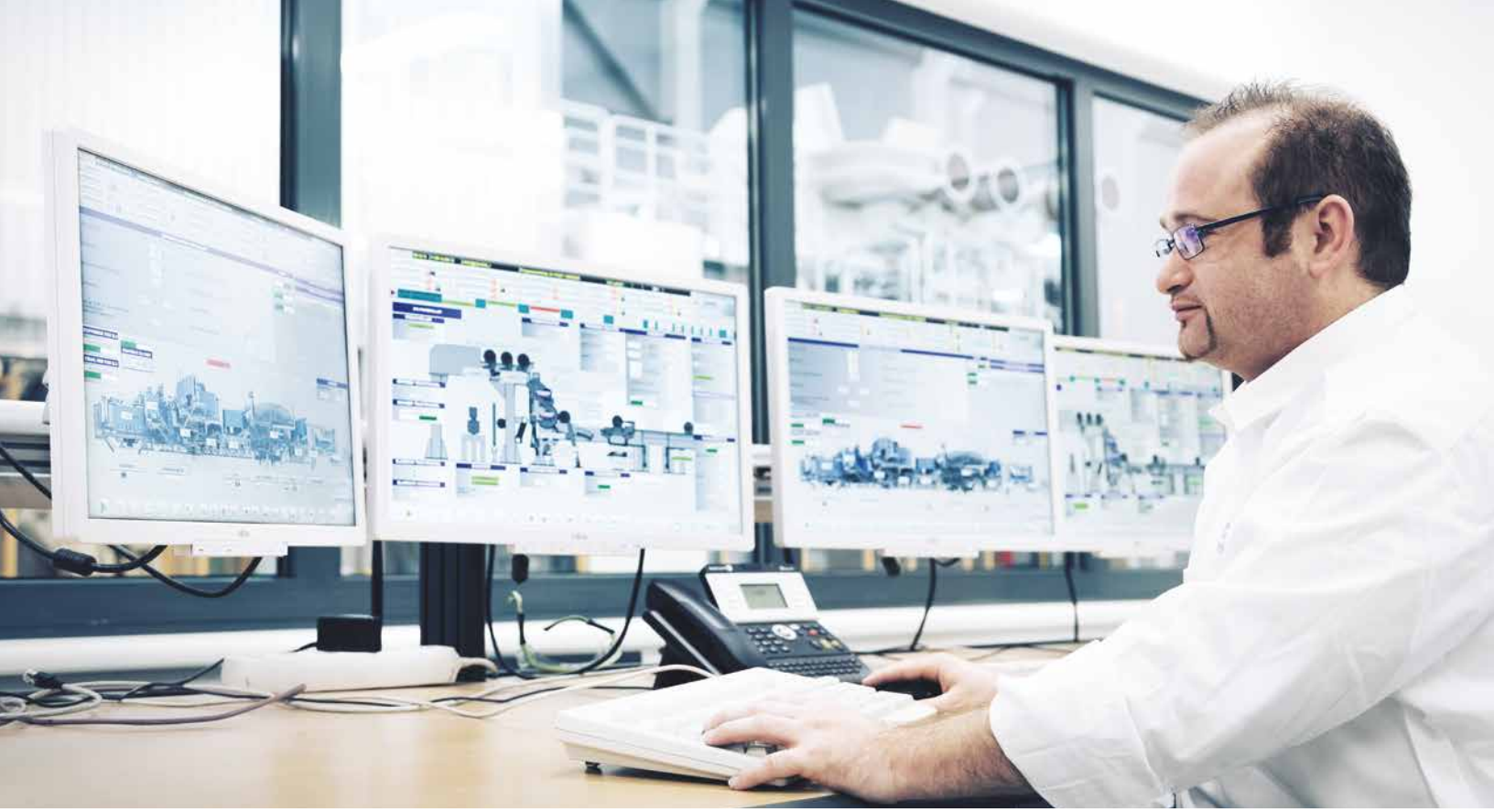
ACE can optimize many unit processes including, but not limited to, crushing, SAG and ball milling, flotation, thickening, acid plant and water management operations.

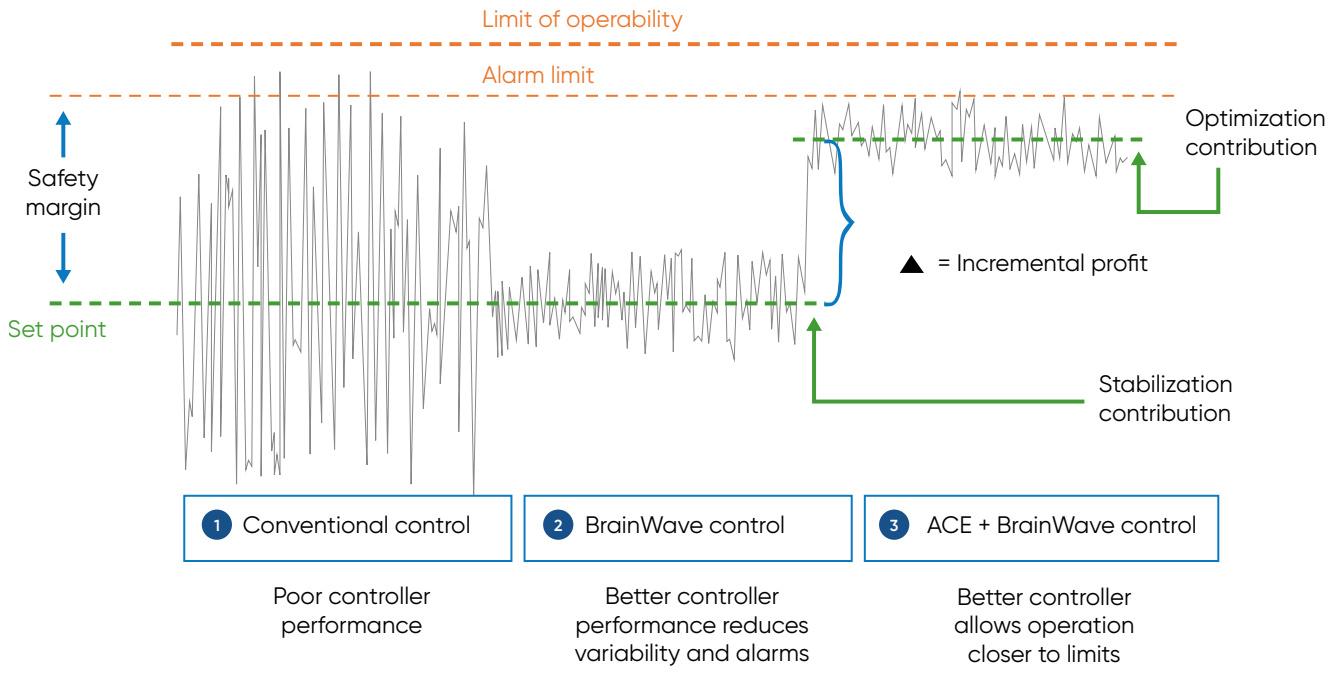
Communication between ACE and the human operator is critical. ACE continuously advises the operator on what is occurring and why, giving the operator a view into how ACE analyzes and guides the process. This level of involvement not only keeps the operator informed of any changes in strategy or constraints being managed, but also gives the operator full confidence in the actions ACE is taking.

Whether your goal is to maximize production or to minimize costs; we guarantee success.

PROCESS CONTROL HIERARCHY







1 Here the unit operation is poorly controlled. It has a large amount of variability and the set point cannot be raised without the risk of exceeding the limits of operability.

2 By applying BrainWave as a PID replacement, the unit operation now has far less variability. BrainWave accurately forecasts process responses and accounts for multiple objectives. It predicts and prevents disturbances before the process is pushed off target.

3 The addition of ACE, an automated "expert operator" that works in conjunction with BrainWave, fully optimizes the process. ACE determines the best set points so that the process operates at maximum efficiency.

Ball Mill ACE

CONTROL OBJECTIVES

- Control the pressure and solids percentage in the hydrocyclones
- Reduce P80 variability to maximize recovery in flotation
- Automatically control the number of cyclones in operation
- Manage the ball mill sump level
- Automatically rotate cyclones in service to prevent premature wear
- Protect the ball mill sump pump from overload
- Improve classification

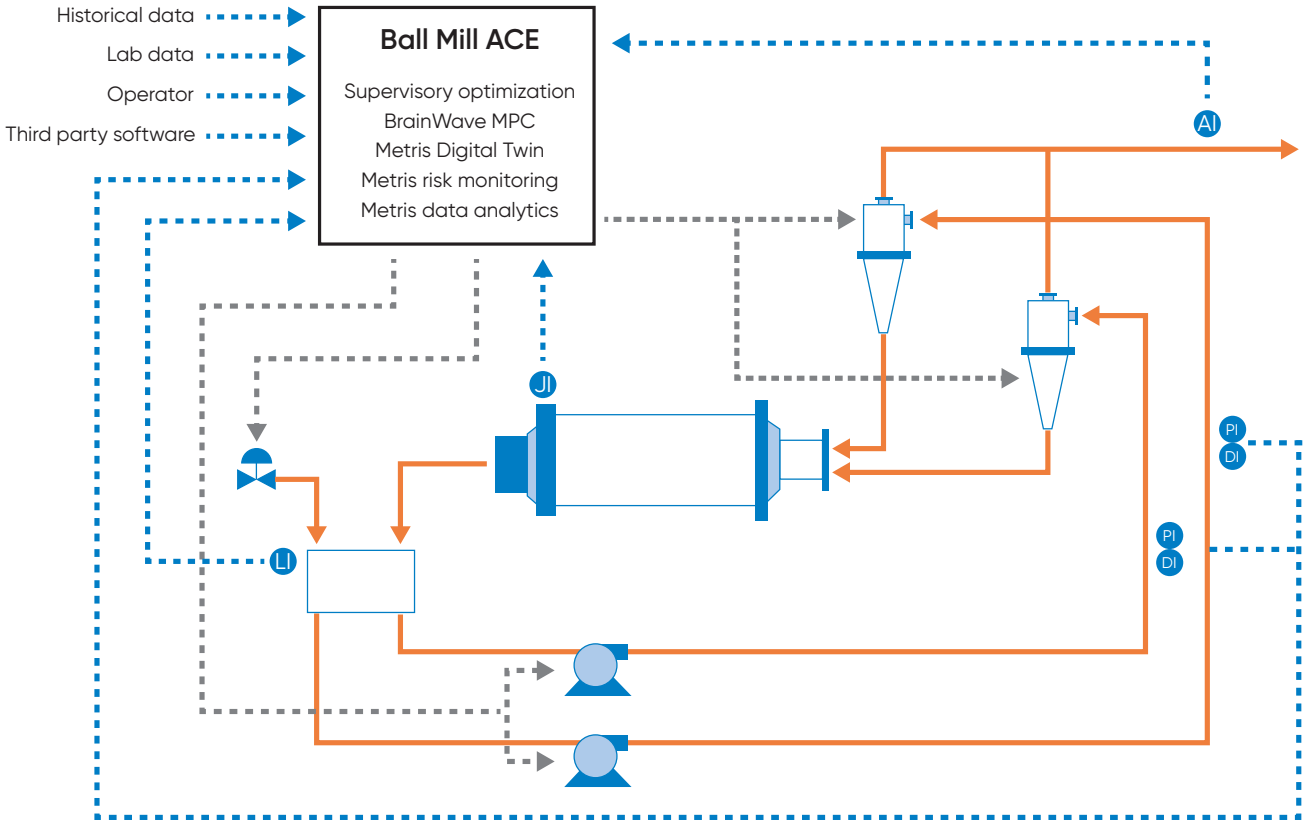
BALL MILL CASE STUDIES

Location: Collahuasi Mine

- Variability of the operating pressure of hydrocyclones reduced by 52.4%
- P80 variability decreased by 39.2%
- Copper recovery variability decreased by 36.46%
- Copper recovery in the rougher cells increased by 2.3%

Location: Minera Los Pelambres Mine

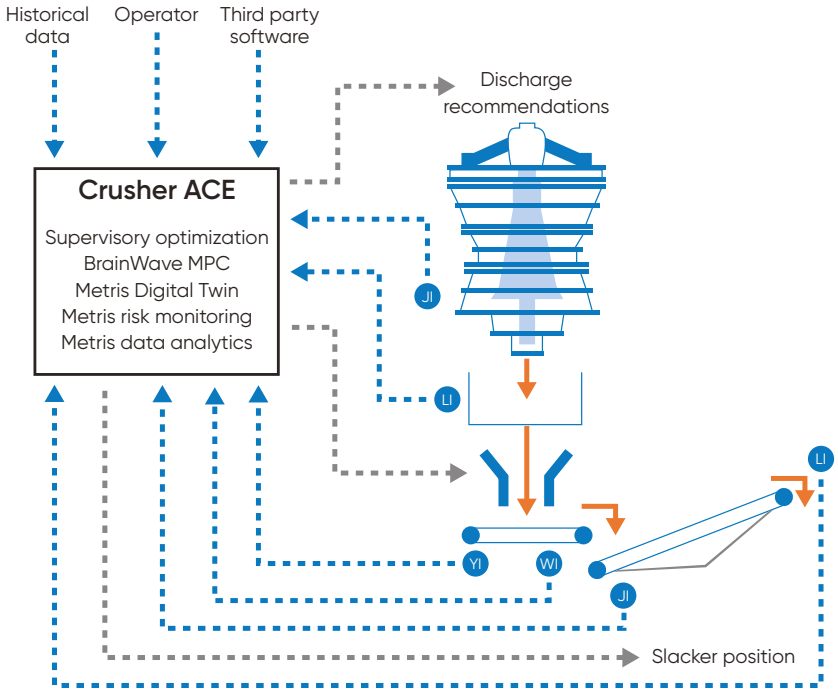
- Variability of the operating pressure of hydrocyclones reduced by 37%
- P80 variability decreased by 32%
- Copper recovery variability decreased by 33.5%
- Copper recovery in the rougher cells increased by 1.8%



Crusher ACE

CONTROL OBJECTIVES

- Reduce production variability
- Manage bin level
- Protect feeder and reduce crusher stress
- Protect equipment from high torque, current, temperature and vibration
- Make recommendations about truck dumping procedures based on bin level performance
- Automate the operation in order to achieve maximum productivity



PRIMARY CRUSHER CASE STUDIES

Location: Minera Collahuasi

- Reduced production variability by 25%
- Increased production rate by 10%

Success Story: Compañía Minera Doña Inés de Collahuasi

PRODUCT: PRIMARY CRUSHER ACE

The Collahuasi mine produces approximately 450,000 tonnes of copper concentrate per year and is the third largest copper concentrate plant in the world. Compañía Minera Doña Inés de Collahuasi had been operating its Collahuasi crusher manually for several years. Realizing that the effective operation of any process requires a reliable control system that minimizes human intervention, they approached ANDRITZ to help them design and implement an automated control strategy that would maximize mineral processing, improve stability and reduce equipment stress.

CONTROL OBJECTIVES

- Reduce production variability by automating the operation
- Keep the bin level operating within safety range
- Avoid overload of the main conveyor belt
- Make recommendations for truck dumping procedures based on process requirements

The Collahuasi copper mine is situated in northern Chile, about 180 km southeast of the port of Iquique, at an altitude of 4,000 m. The mine is a joint venture, 44% owned by Glencore, 44% by Anglo American plc, and 12% by Japan Collahuasi Resources B.V.

ANDRITZ's patented ACE and BrainWave advanced controllers were successfully installed and used to tightly control production in the Rosario primary crusher. This improved crusher production by up to 10% and decreased variability by 20–25%. Optimal operating conditions were better maintained without the risk of conveyor overload. Production was easily stabilized, even under the toughest operating conditions, and previously troublesome events, such as mineral type changes, were handled easily by the controller.

BENEFITS

- Automate operations and maximize production
- Keep bin level within the appropriate safety range
- Reduced variability in production
- Reduced equipment stress
- Realize a payback period of 6-10 months for most projects

SAG Mill ACE

CONTROL OBJECTIVES

- Stabilize Semi-Autogenous Grinding (SAG) mill weight (according to the Set Point (SP) set by the operator) in order to achieve constant grind performance and maximum production rate
- Control the fresh ore feed rate and mill speed according to weight control SP
- Minimize weight disturbances caused by changes in the ore mineral quality and pebbles feed rate
- Manage mill over-fill situations automatically to avoid excessive reductions in production rate
- Prevent premature wear of the mill liners by using a speed control based on sound emissions
- Improve energy efficiency
- Increase production
- Minimize energy consumption
- Manage power and torque limits to prevent mill overload

SAG MILL CASE STUDIES

Location: Minera Centinela Mine
- Reduced feed variability by 18%
- Increased SAG mill throughput by 13.5% and reduced energy consumption per tonne by 9.3%

Location: Minera Los Pelambres Mine
- Reduced feed variability by 5.6%
- Increased SAG mill throughput by 5.9% and reduced energy consumption per tonne by 5.4%

BENEFITS

- Automatically account for changes in variation of particle size or ore hardness
- Minimize production disturbances
- Maintain optimal production by minimizing changes to mill speed
- Maximize production rate while providing consistent grinding
- Payback period of 6-10 months for most projects

Success story: Antofagasta PLC Minera Los Pelambres

PRODUCT: SAG MILL ACE

Antofagasta PLC's Minera Los Pelambres has one of the largest open pit mines in Chile and produces approximately 320,000 tonnes of copper concentrate annually. When copper prices are high, producers look to increase production by eliminating process bottlenecks. At Minera Los Pelambres, as at many mines, SAG mill throughput was limiting overall production.

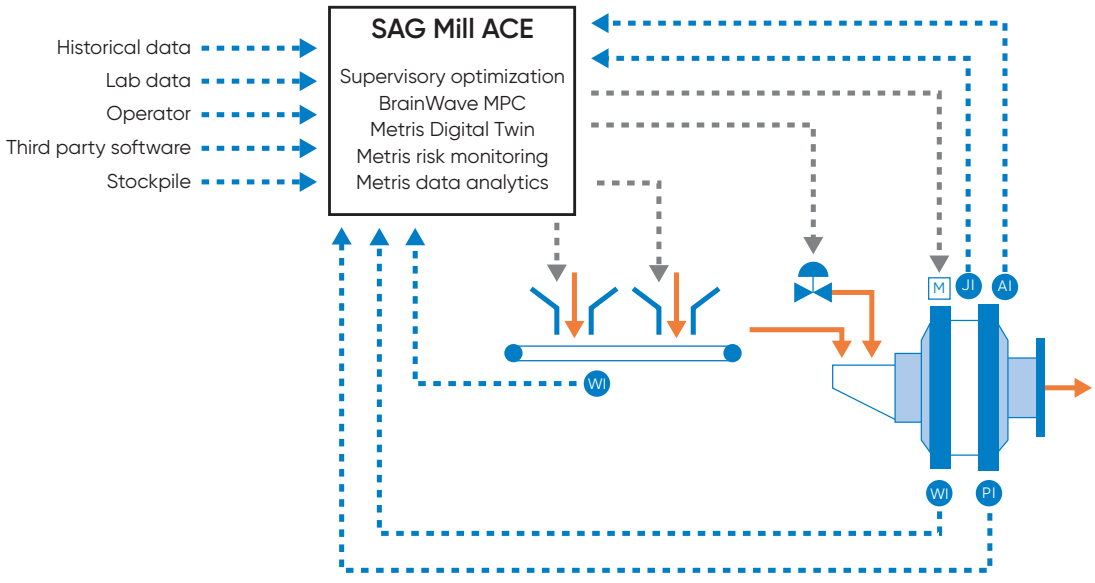
CONTROL OBJECTIVES

- Maintain the desired mill load, ensuring optimal mill operation
- Automatically account for changes in ore hardness
- Provide optimal compensation for pebble mill disturbances to minimize production disturbances
- Maintain optimal production by minimizing changes to mill speed
- Maximize production rate while providing consistent grind

ANDRITZ'S patented ACE and BrainWave advanced controllers were successfully installed at the mine's copper concentrator site in order to tightly control the weight in the SAG mill to promote optimum grinding. This strategy has improved mill throughput by 5.9%, reduced feed variability by 5.6%, and reduced energy consumption per tonne by 5.4%.

Once BrainWave was installed, the improvement was noticeable immediately. Optimal operating conditions were better maintained without the risk of mill overload. Weight was easily stabilized, even under the toughest operating conditions. Previously troublesome events, such as large and sudden changes in recycle, were handled easily by the controller.

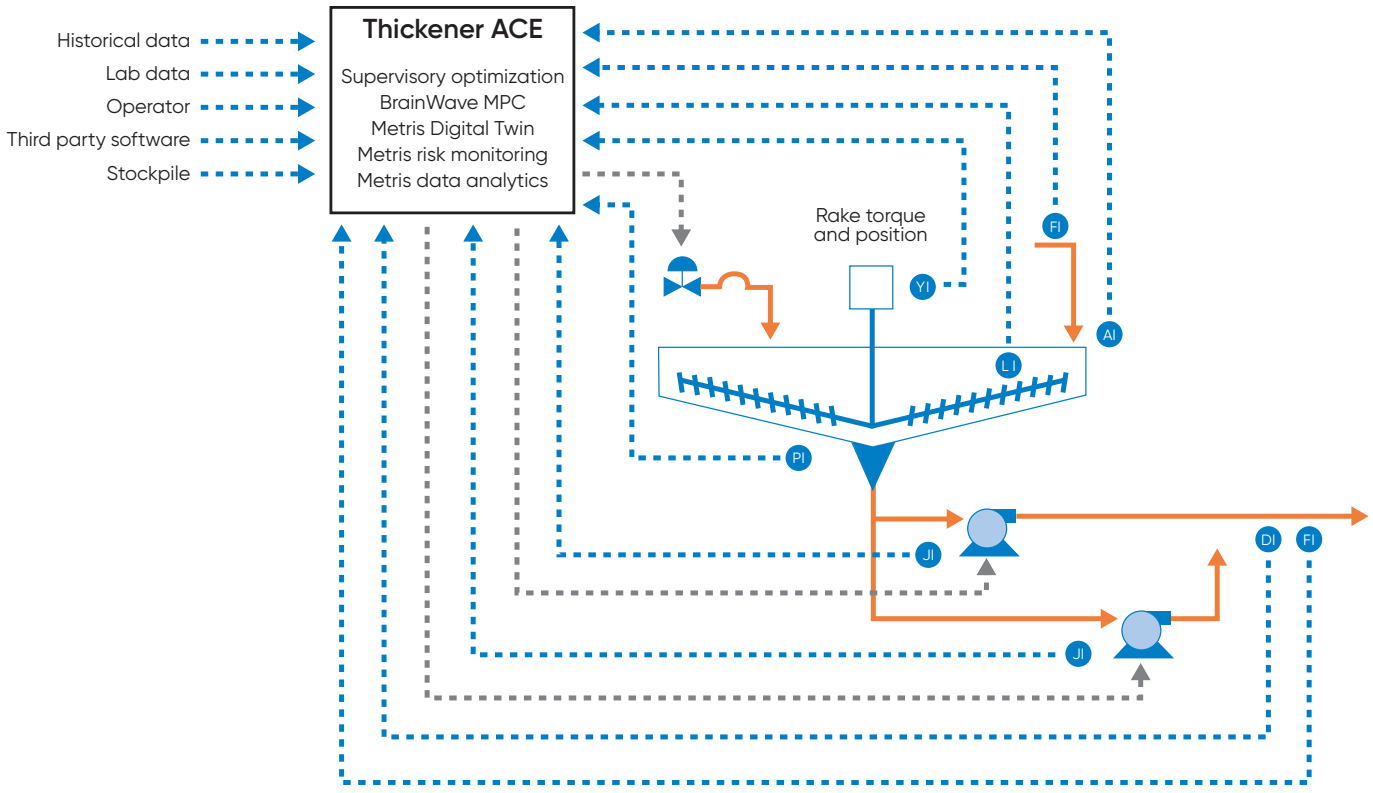
Working in concert, ACE and BrainWave offer advanced and improved control performance that translates directly into higher profits for customers.



Thickener ACE

CONTROL OBJECTIVES

- Reduce solid discharge variability
- Keep the rake torque within the proper range
- Protect the discharge pump and rake from stress
- Increase water recovery and discharge percent solids
- Reduce chemical flocculent consumption
- Automate and optimize the operation for maximum productivity



Flotation ACE

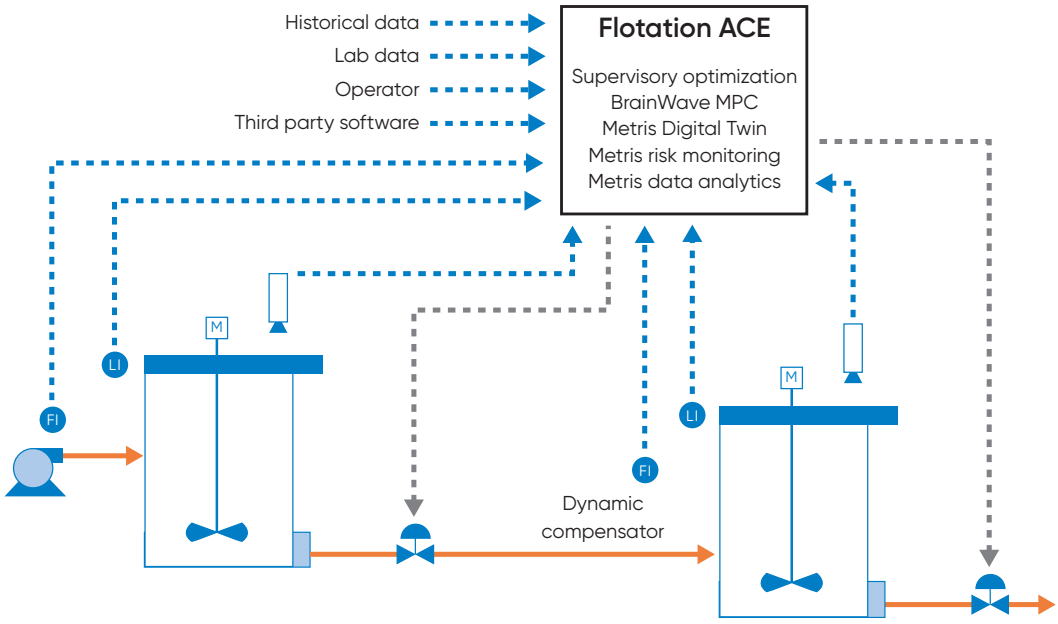
CONTROL OBJECTIVES

- Stabilize the froth depth and level in the flotation cells
- Increase mineral recovery by reducing variability of flotation cell levels

FLOTATION CASE STUDIES

Location: Minera Los Pelambres Mine
- Reduced variability in rougher cell levels by 21.6%
- Increased copper recovery in rougher cells by 0.7%

Location: Constancia Mine
- Reduced variability in rougher cell levels by 54-63%
- Reduced variability in cleaner and scavenger flotation cell level by 30-40%



WHY WORK WITH ANDRITZ

For over 20 years we've been providing modeling and OTS services to customers across a variety of different industry verticals, offering our customers proven OTS solutions that enable them to achieve their operator training objectives. We can connect our clients with any third-party DCS vendor, as well as develop software, offer flexible commercial models, and provide technical support 24/7 thanks to our global presence.

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