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Macraes Continuous Improvement

Integrated Model Predictive Control & Mine-to-Mill Optimisation



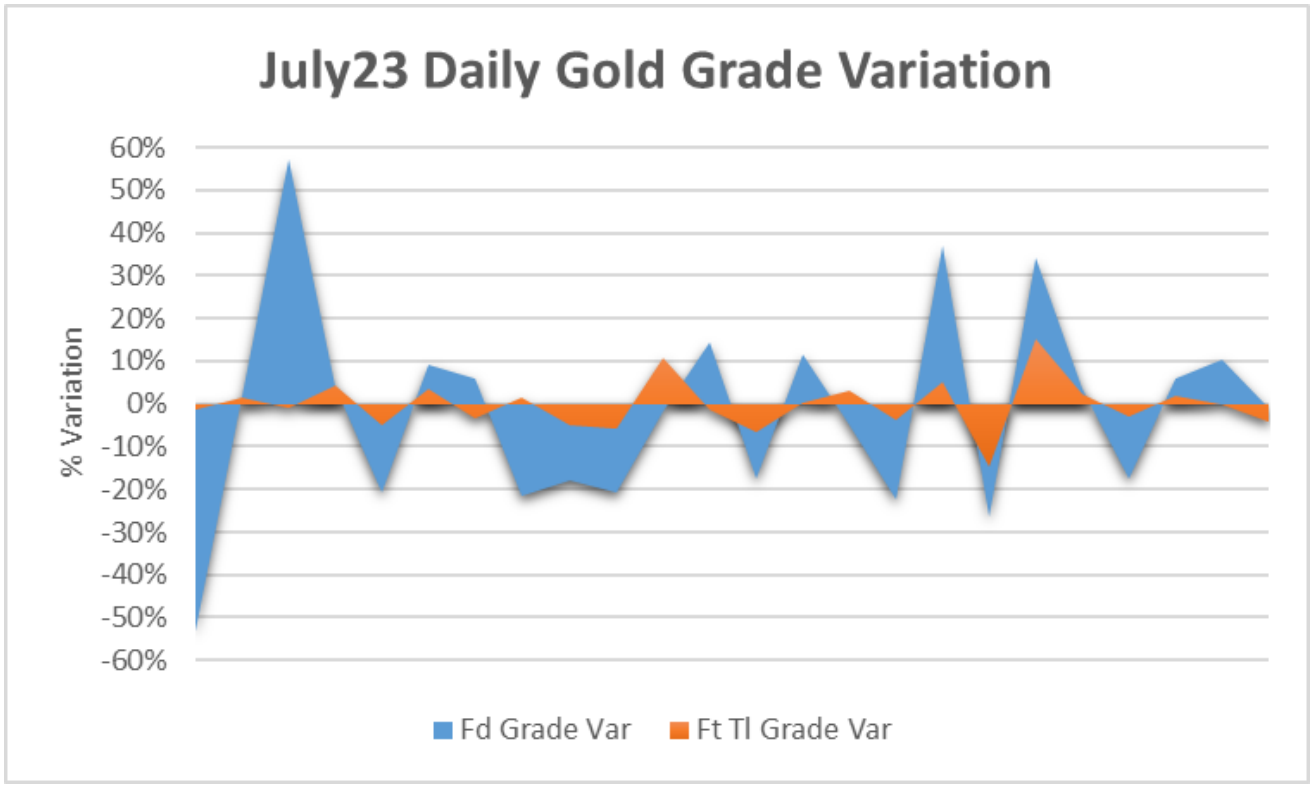
Tom Guy · AusIMM 2026

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The Challenge



Feed grade (blue) swings day-to-day while final-tail grade (orange) stays flat. % variation only.

Feed variability
Variable ore sources and hardness

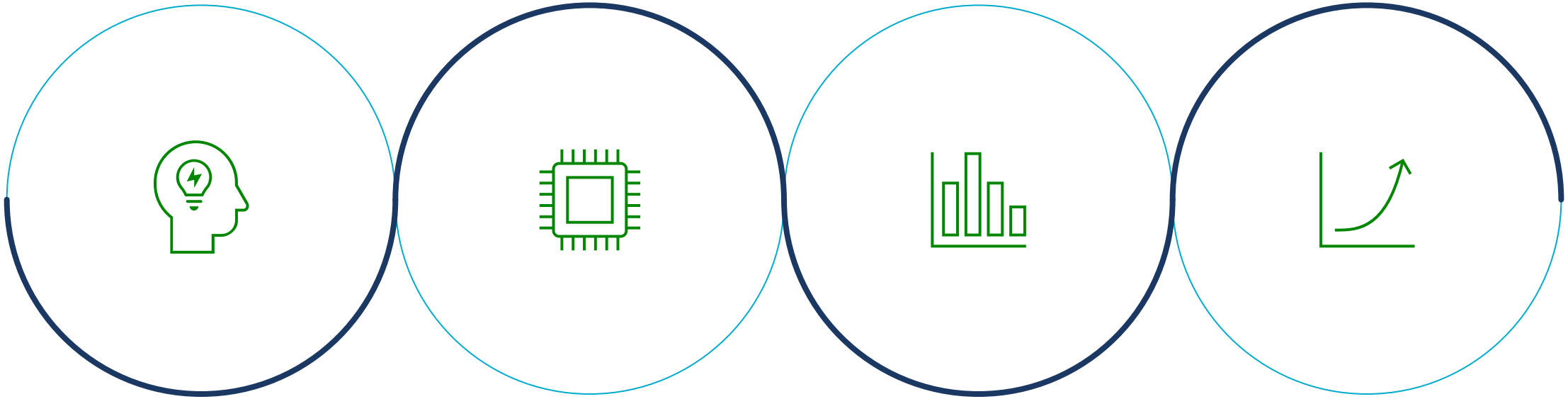
Frequent disturbances
Constant deviation from optimum

Throughput–recovery trade-off
One lever gained, the other lost

Operator load
Manual intervention holds stability

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Value Led – Start with why?



Problem First

Start from the operational problem, not the technology.

Digital as the means

Tools serve the outcome — they are not the outcome.

Target the Constraint

The grinding circuit shapes throughput and recovery.

Stabilize, then optimize

Control variability before chasing performance gains.

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The Integrated System

Mine to Mill + **MPC**



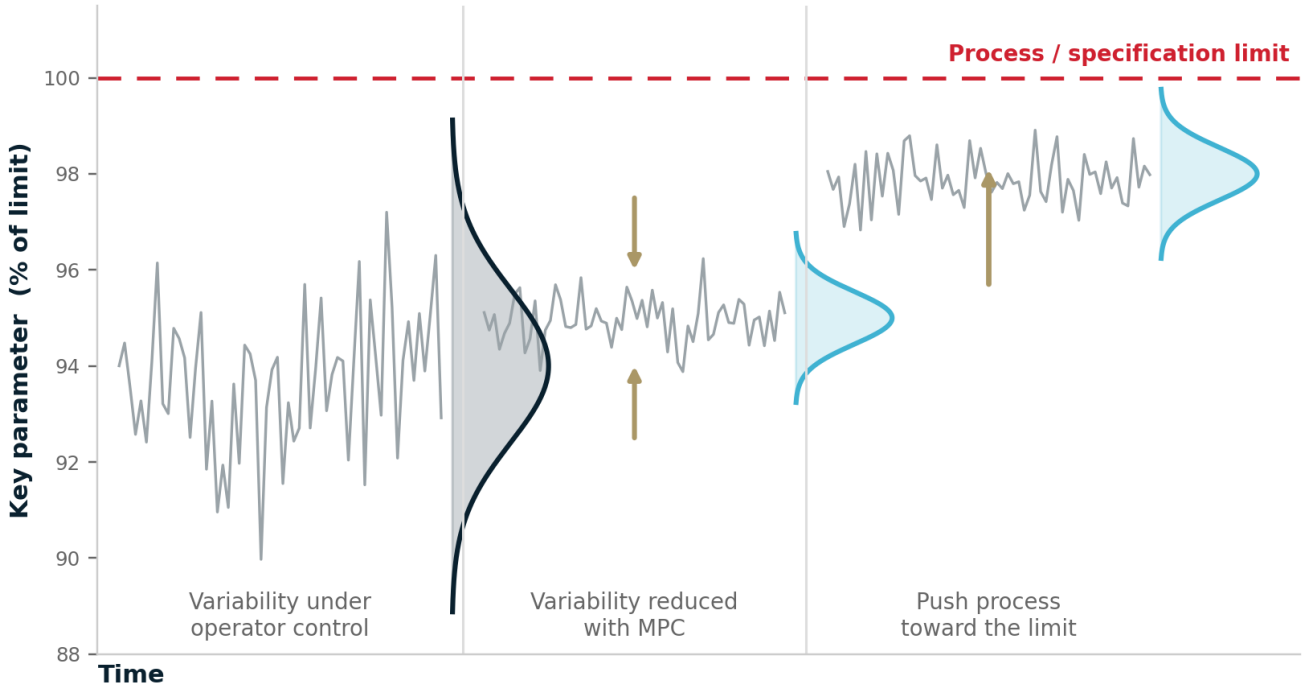




Full value is unlocked only when the two levers are connected.

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Pillar 1 — Pavilion8 MPC: What & Why



Illustrative concept (after Rockwell Pavilion8): reduce variability first, then move the setpoint toward the limit.

Model predictive control
Rockwell Pavilion8 on the grinding circuit (SAG + ball mills).

Multivariable
Manages many controlled and manipulated variables at once.

Anticipatory
Predicts and counters disturbances before they propagate.

Integrated
Layered onto the existing control system — not a rip-and-replace.

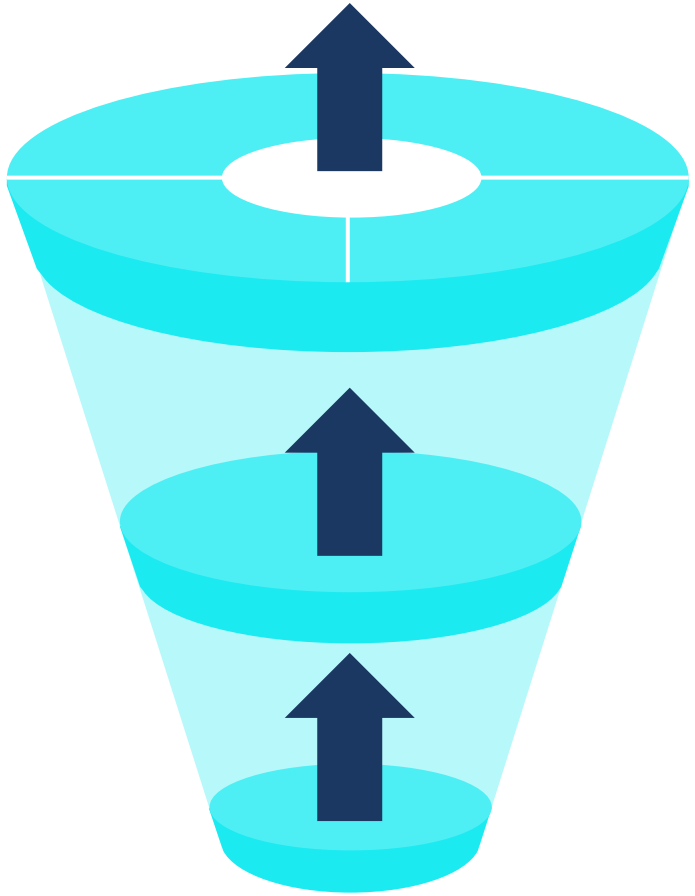
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Pillar 1 — How We Implemented It

Staged Commissioning

System Integration

Operator Engagement



Systematic rollout

Each module deployed and verified in turn

Additional to existing process control

Layered onto existing infrastructure, not replacing it

Build trust and capability from day one

User acceptance is the measure of success

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Pillar 1 — Early Results



Live Pavilion8 grinding control — SAG mill and cyclone variables (live value readouts masked). Source: Rockwell Automation / OceanaGold.

Results are qualitative and directional; commercial figures withheld.

Improved stability
Closer to target, more consistently

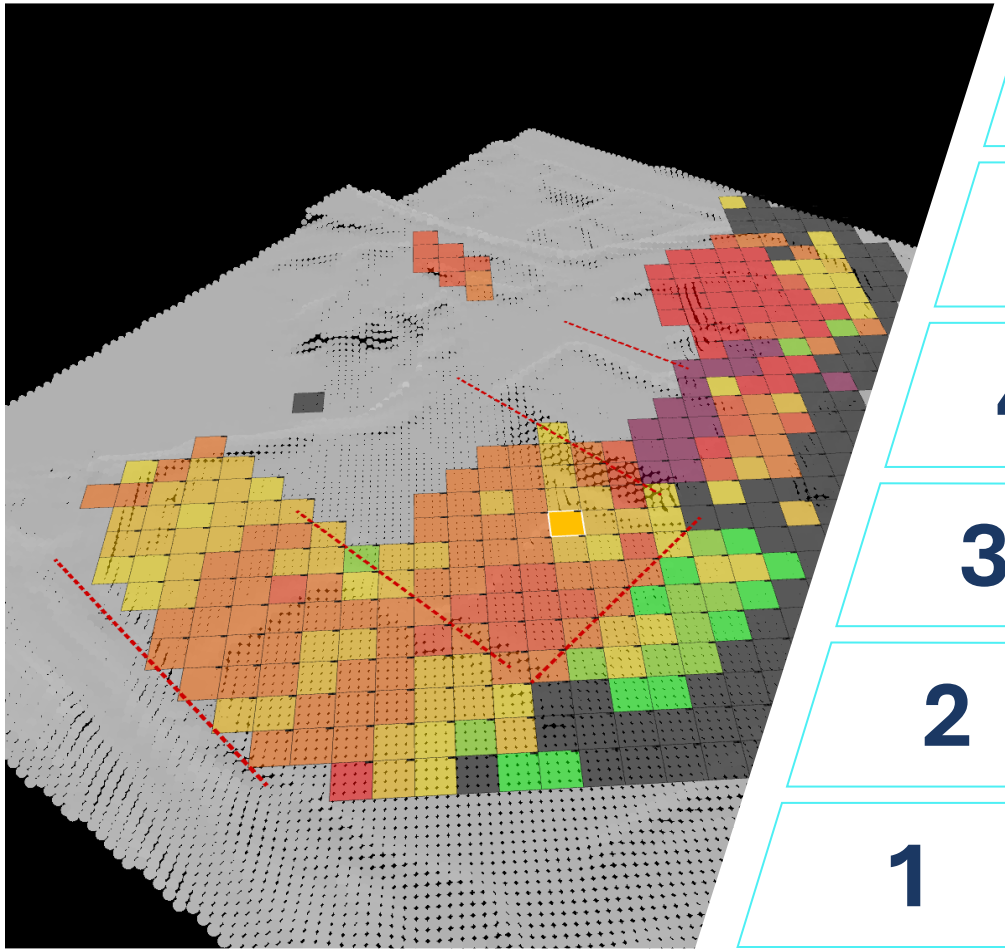
Reduced variability
Tighter control, including grind size

Higher average throughput
Consistency lifts the mean

Less manual input
Supervision, not constant intervention

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Pillar 2 — NTWIST Mine-to-Mill: What & How



6 **Survey adjustment**
Regular flyover used to update ROM volume

5 **Real time mill feed grade estimate**
Load events generated from ROM loader GPS, removing material from blocks.

4 **Predicted Mill Feed Grade**
Ability to model the mill feed based on digital twin and planned reclaim sequence

3 **Grade and tonnes assigned to ROM blocks**
Probabilistic model of dump events estimate the tonnes and grade in each cell

2 **Dump Events on Stockpile**
FMS records GPS Location of truck dump events on stockpile

1 **Mining dig blocks**
As trucks loaded grade assigned in FMS

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Pillar 2 — Early Trials & Status

Status: in progress

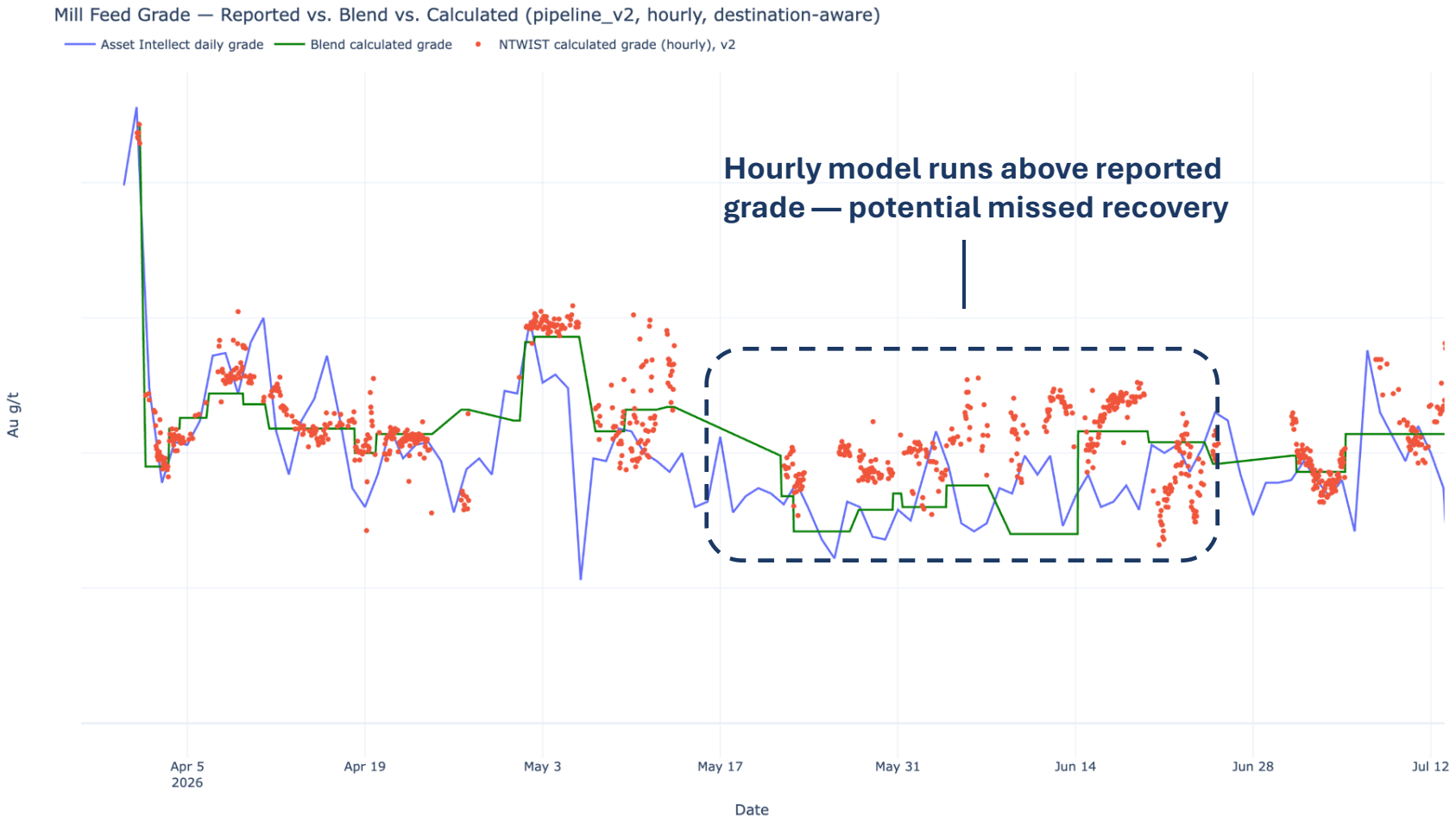
Trials underway at Macraes.

Live blend output

Predicted feed grade and ore-source mix in real time.

Emerging Gains

Reagent optimisation and additional recovery potential.



NTWIST hourly model vs reported daily assay, Apr–Jul 2026. Grade values masked.

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The Synergy

NTWIST gives MPC foresight

Feed-forward, not feedback

- Predicted grade and hardness before the ore lands
- MPC acts ahead of the disturbance
- Fewer swings for the controller to chase

Smarter blending at the ROM

- Reclaim sequenced to smooth grade and hardness
- Variability removed at source, not corrected later
- Stable feed widens the MPC operating window

MPC turns foresight into tonnes

Plan converted into tonnes

- Circuit held at target once feed is known
- Setpoints pushed closer to the constraint
- Grind size held tight for downstream recovery

Gains that compound

- Throughput and recovery lift together, not traded
- One integrated system rather than two tools
- Operators supervise instead of intervening

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Lessons Learned

Phased implementation

Prove each step before the next

Cross-department collaboration

Mining, processing and CI aligned

Strong change management

Operator trust decides adoption



Macraes control room — frontline engagement is the key for success.

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Key Takeaways and What's Next

Integration

Integration beats isolated tools

Upstream and downstream levers, connected

Next: complete NTWIST deployment

Trial to embedded operation

People

Change management is the multiplier

Adoption decides the result

Next: embed capability

People and systems, not one-off projects

Problem first

Digital is the means, not the goal

Start from the constraint, not the tool

Next: expand MPC scope

Proven approach, further circuits

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Questions?

Thank you

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Thank You

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