Procemin·GEOMET·2017

13th International Mineral Processing Conference
4th International Seminar on Geometallurgy

Drilling Specific Energy Application to Estimate SAG TPH in Short Term Planning, Teck Carmen de Andacollo

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[1]Compañía Minera Teck Carmen de Andacollo, Teck Resources Limited, Chile.
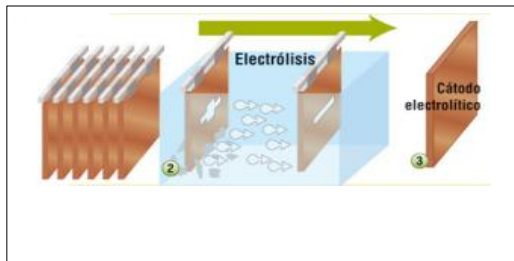[2]Camborne School of Mines, University of Exeter, Penryn Campus, England.

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TECK CARMEN de ANDACOLLO
Geographic Location

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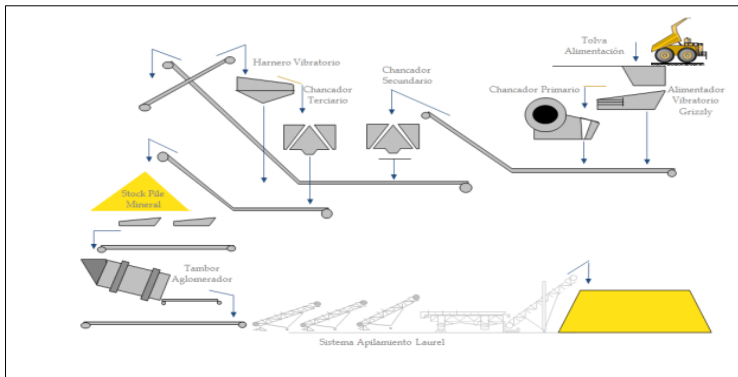GECAMIN

TECK CARMEN DE ANDACOLLO
Productive Process

LEACHING PLANT PROJECT

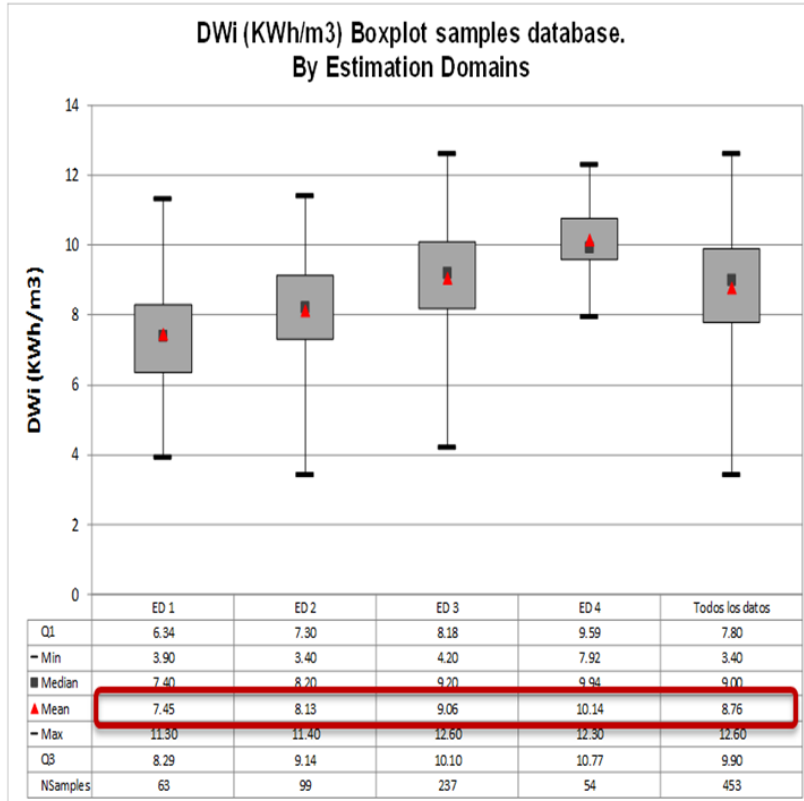**HYPOGENE PROJECT CONCENTRATE PLANT**

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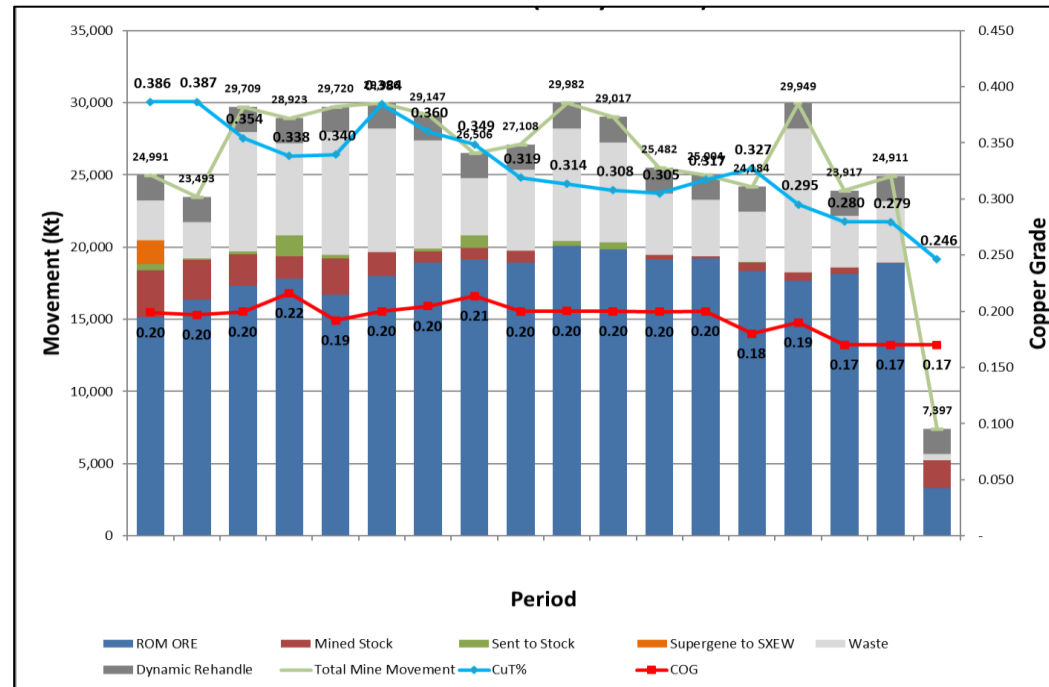
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Hardness Model

Basic statistic

DWi (KWh/m3) Boxplot samples database.
By Estimation Domains

	ED 1	ED 2	ED 3	ED 4	Todos los datos
Q1	6.34	7.30	8.18	9.59	7.80
— Min	3.90	3.40	4.20	7.92	3.40
■ Median	7.40	8.20	9.20	9.94	9.00
▲ Mean	7.45	8.13	9.06	10.14	8.76
— Max	11.30	11.40	12.60	12.30	12.60
Q3	8.29	9.14	10.10	10.77	9.90
NSamples	63	99	237	54	453

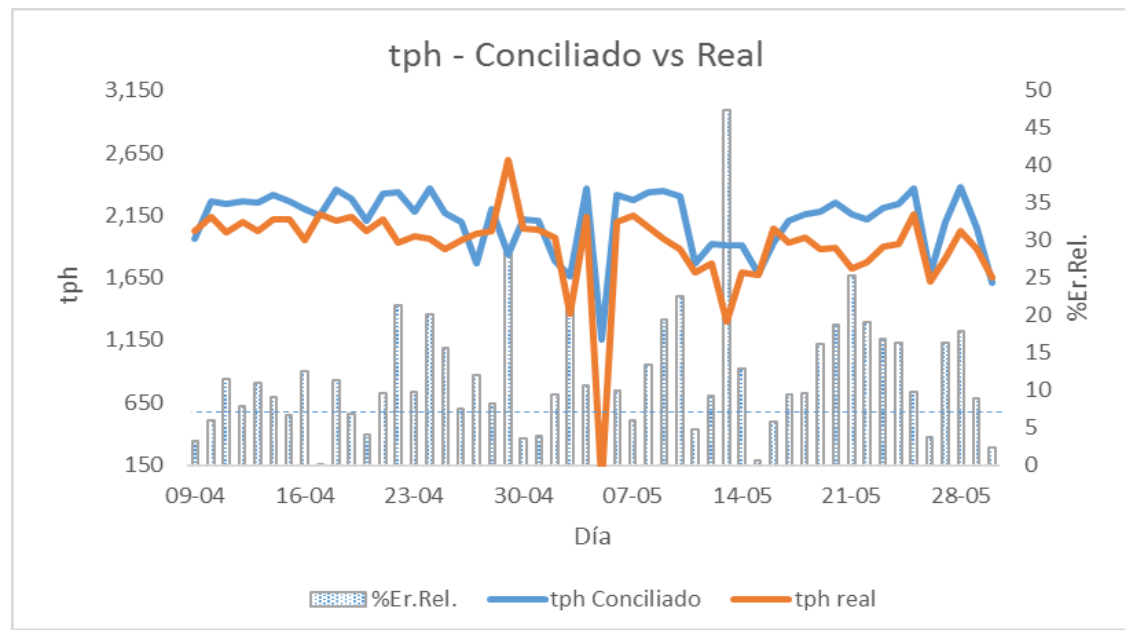**Hardness samples position**

F10 F4 F6 F9 F5 F8 F7
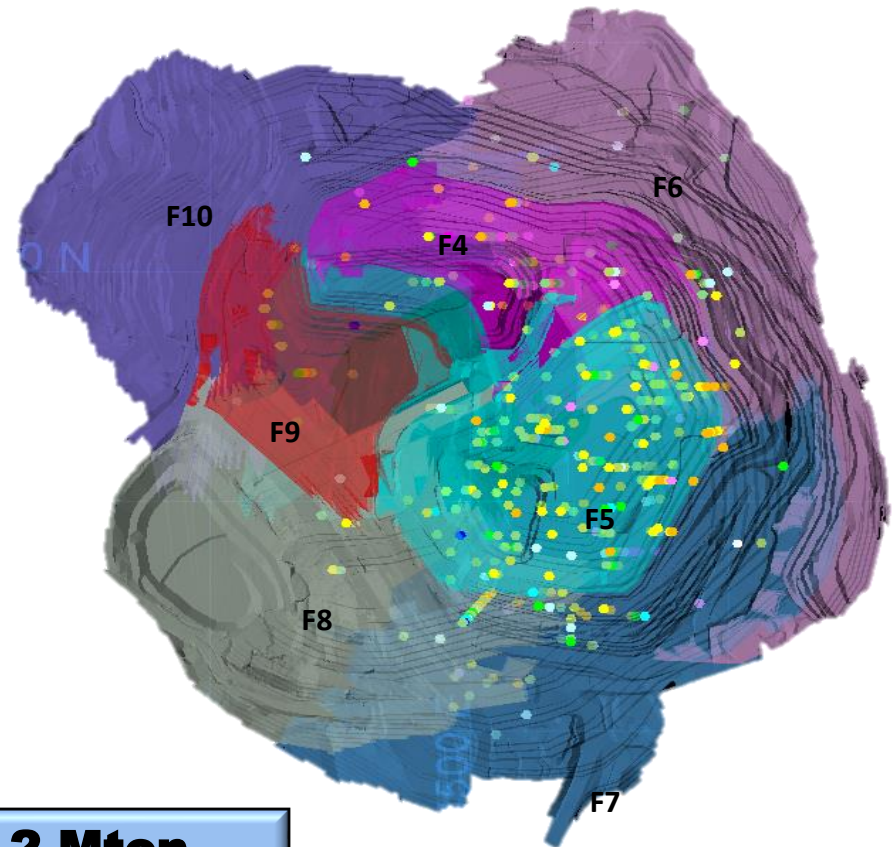
**1 datum every 1.2 Mton**

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TPH Model

- The Variable of greatest impact is *Ore Hardness.* LONG TERM TPH Model is based on Drop Weight Index (**DWi** Kwh/m^3).

- **LONG TERM TPH Model** is used to estimate the SAG throughput**, for SHORT TERM PLANNING.** It shows *10% deviation*, with a positive bias.

TECK CARMEN DE ANDACOLLO
Drilling Specific Energy (EEP) Development

Mine Planning Development

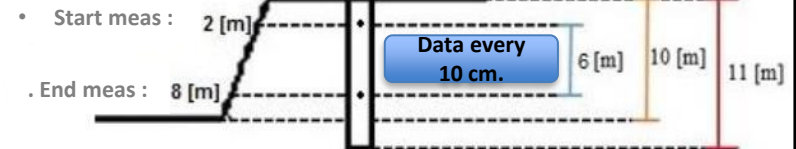Metallurgical Development

Geological Development

Mine Operational Development
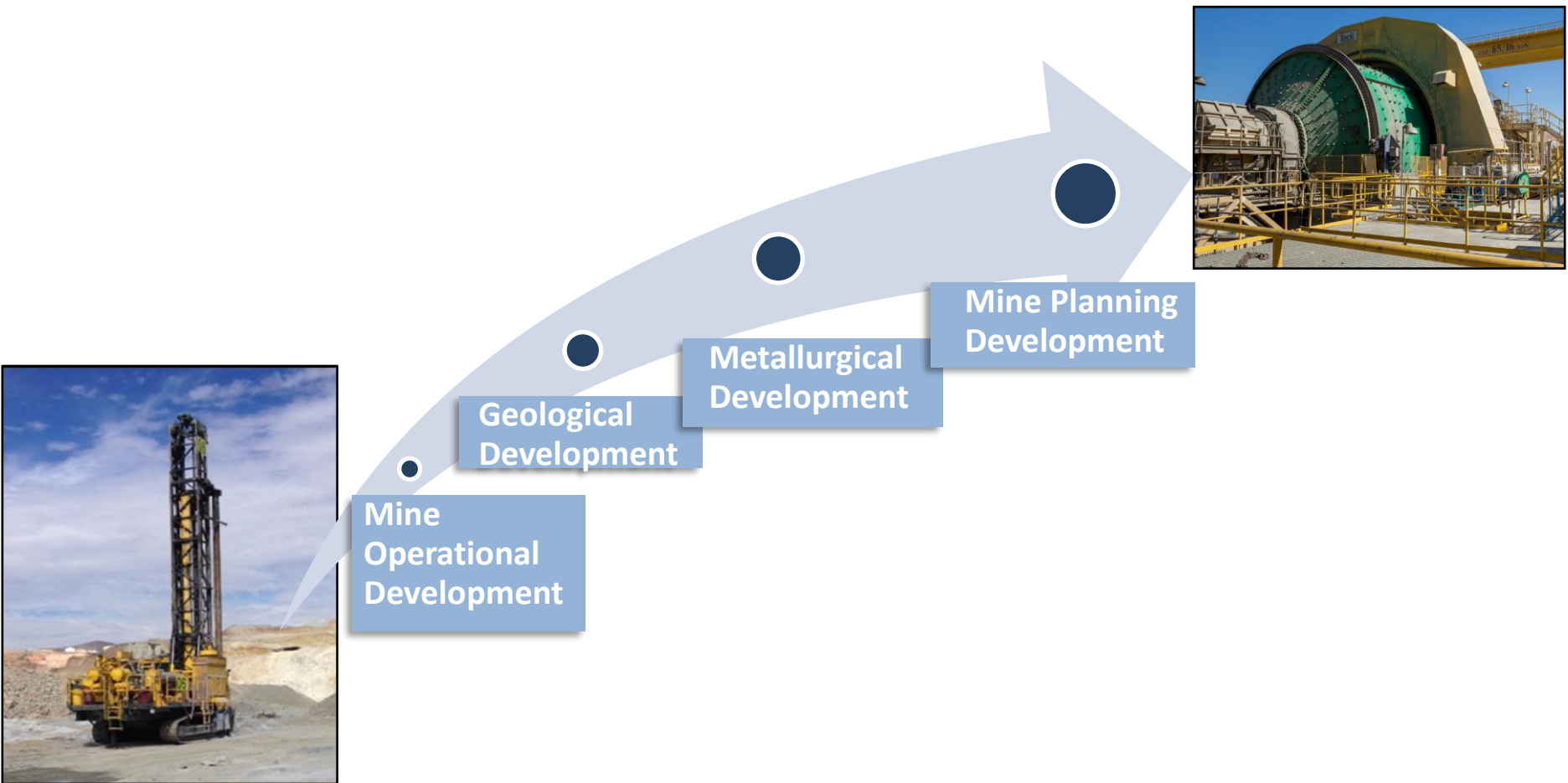
EEP: Operational Development of the Mine

- 2013 > Implementation of High Precision System for drilling machines (Thunderbird TMS® System)

Pulldown pressure

Rate of Rotation

Torque

Rate of penetration
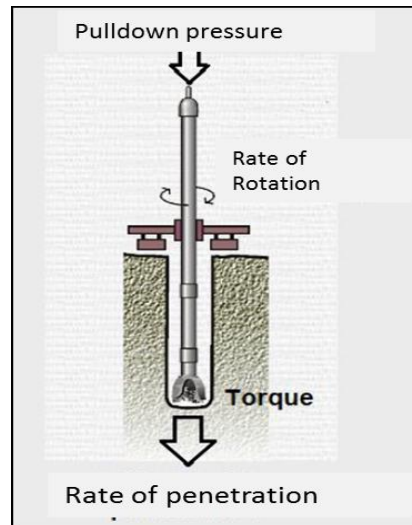
EEP is a Function of:
- Rate of Rotation (RPM)
- Rate of Penetration (ROP)
- Torque Pressure (TQ).
- Pulldown Pressure (WOB).
- Bit Diameter (BD).

Blast hole

- Start meas : 2 [m]

Data every 10 cm.

6 [m]   10 [m]   11 [m]

. End meas : 8 [m]

- Three drill machines drilling simultaneously by different operators in different shifts. EEP Data without Bias.

Note: The "EEP" equation used at Teck CDA was formulated by R. Teale in **1964**.
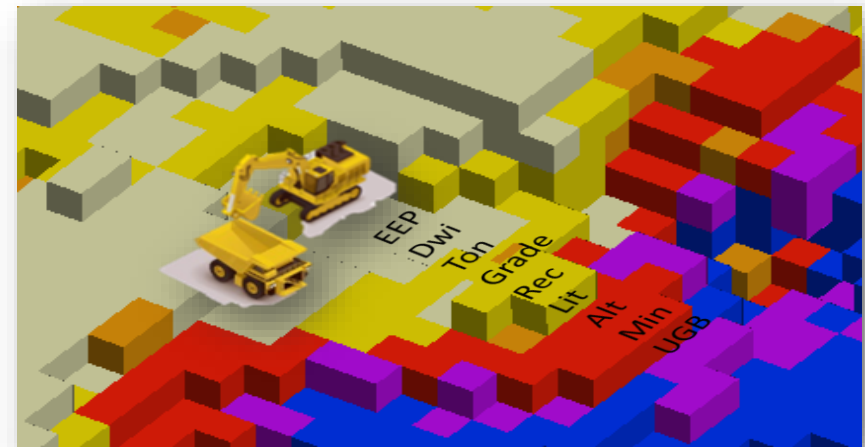
EEP : Geological Development

Drilling Specific Energy *is an expression of the natural rock strength to the force produced by drilling and it is* **closely related to the geological domains modeled for the rock mass.**
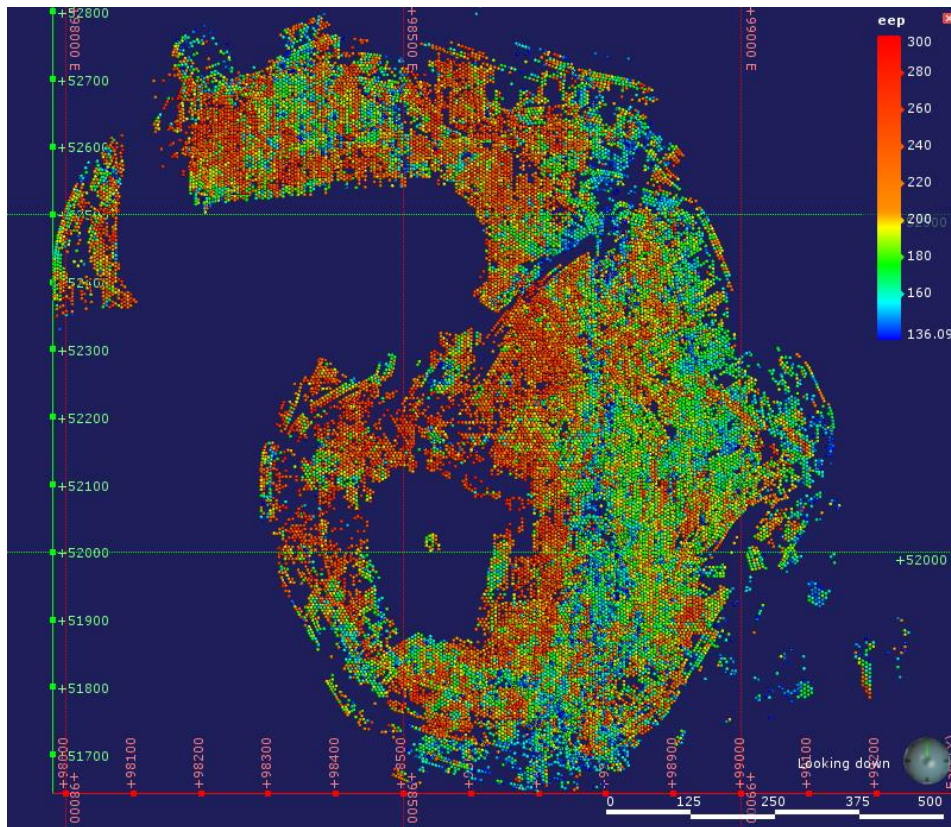
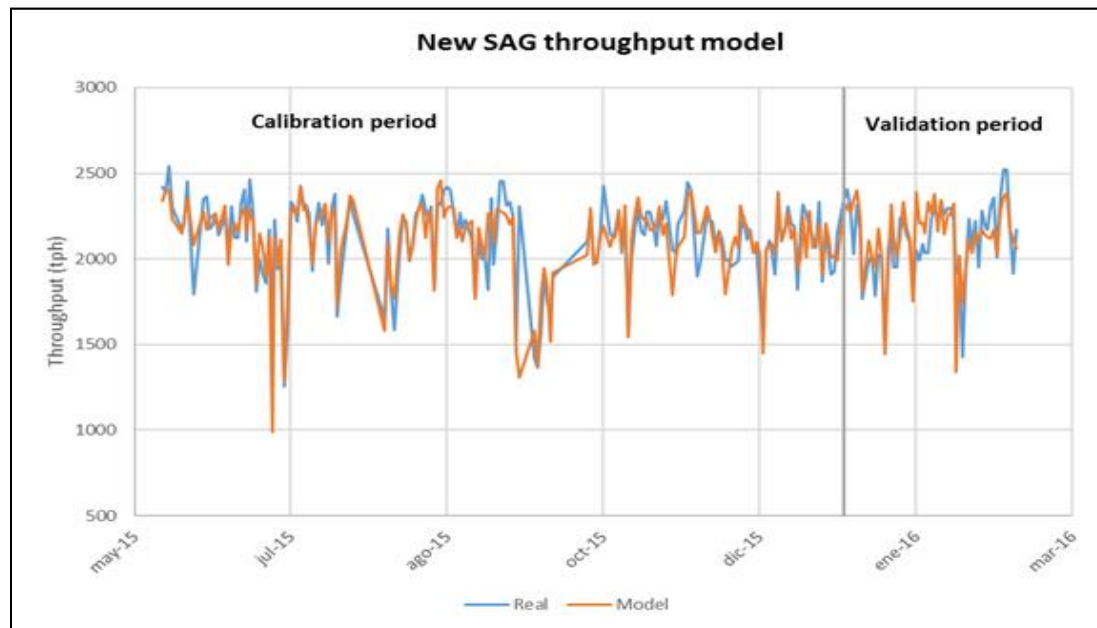*For the Grade Control Model we run a estimation of EEP values through ID² estimation (16x11x11m searching).*

1ᵗʰ Run   **2ᵗʰ Run**
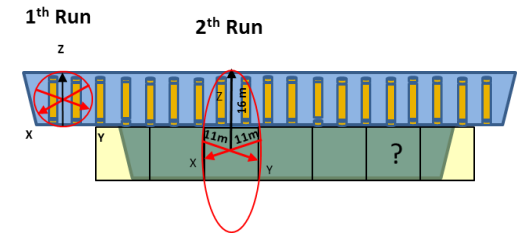
Always with **hard boundaries,** following the geological features
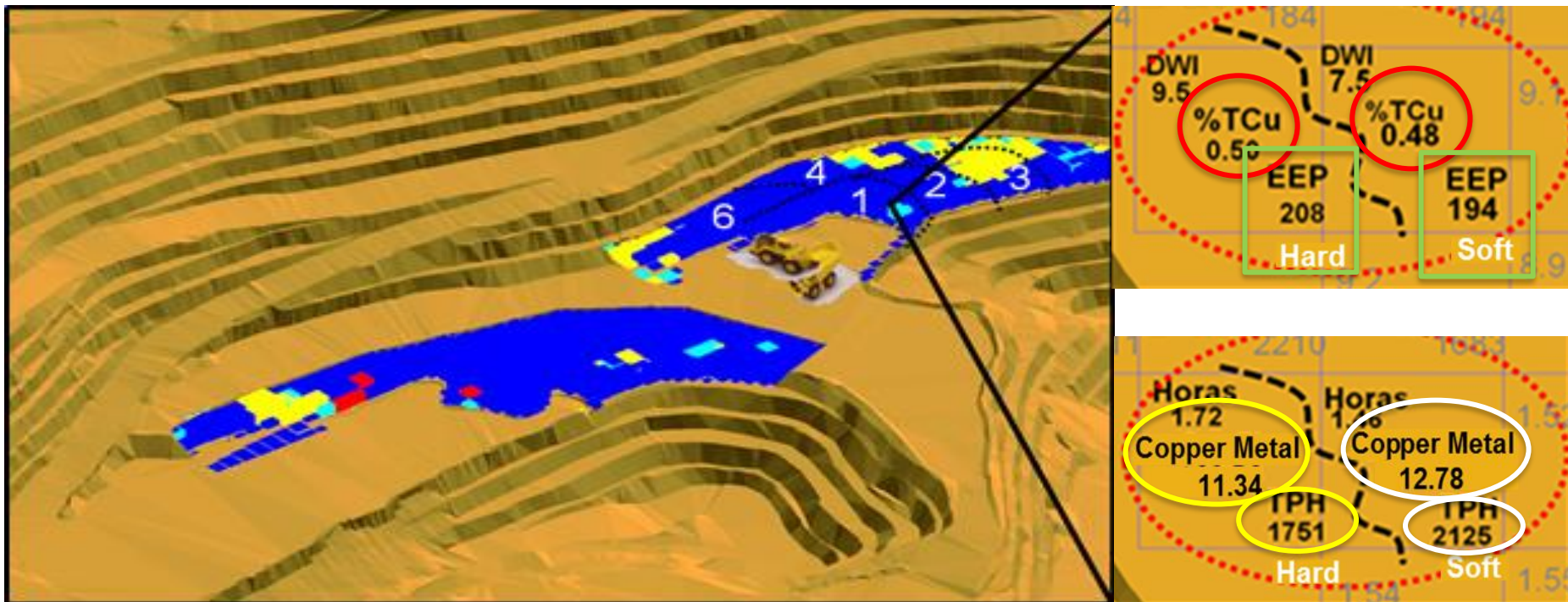
EEP : Geo-Metallurgical Development

TPH Modelling:
- Developed during 2015 -2016
- Statistical analysis with 274 operating days.
- Includes daily operational parameters of plant

EEP : Application to Estimate SAG TPH in Short Term Planning

- Seeks to maximize Copper Metal production by hour.
- Ensures the mining sequence and optimizes the blending plan.
- Optimize the loading and hauling fleet utilization.
- The reliability of the short term mining plan increased

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EEP : Application to Estimate SAG TPH in Short Term Planning

Conclusions:

The use of the EEP in addition to the DWi allowed us to:

- Decrease the error of Tph estimate, dropping from 9.4% to 5.6%.

Metric	Units	Long Term Model Value	New short Term Model Value
Average error	%	9.4	5.6
Variation	tph	247	154

- Increase the base of geo-metallurgical characterization   **1 datum every 620 ton**

- Available online data to use (Thunderbird ➡ Wenco ➡ Acquire ➡ Vulcan).
- Optimize the use of resources in the mine and the plant.
- Allows to build the mining plan based on Copper Metal per hour, not only based on copper grade.

Other benefits:
- No additional infrastructure required to measure EEP in labs (Capex).
- More comprehensive vision of the mining business.

Thank you

The Carmen de Andacollo scientific and technical information disclosed in this presentation has been reviewed and approved by Rodrigo Marinho, P.Geo., Technical Director, Reserve Evaluation, Teck who is a qualified person under NI 43-101

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