



Aplicando Evolution Strategy para maximizar el VAN de un proyecto a través de la Optimización de Leyes de Corte

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Paper Original de Christie Myburgh y Steve Craig –
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Motivación



- Los problemas reales de planificación, dada su complejidad, son difíciles de manejar en un tiempo razonable.
- Existen muchas herramientas buenas, pero son difíciles de configurar y demoran mucho tiempo en entregar resultados.
- El objetivo es maximizar el valor presente neto a través de una política de leyes de corte y una secuencia de extracción para una mina a cielo abierto.
- Este trabajo muestra la innovadora forma en que los algoritmos evolutivos son combinados con los conceptos de búsqueda local y programación lineal para proponer una solución a lo anterior descrito, esta solución es Maptek Evolution Strategy.

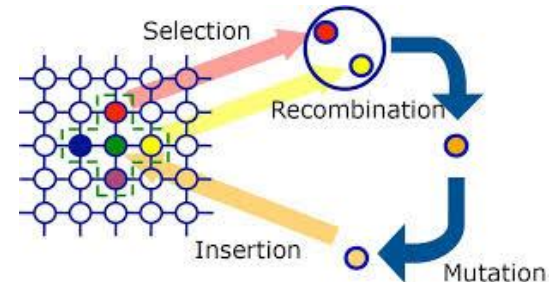
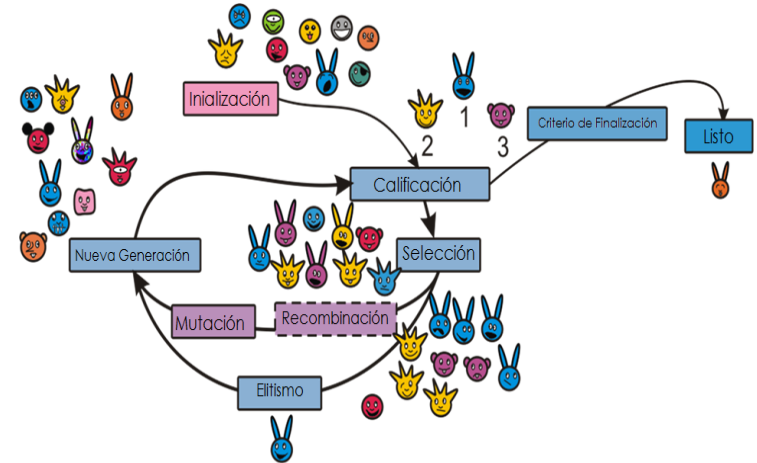
Optimización de Ley de Corte

- Kenneth Lane propuso un marco de referencia para modelar este problema.
- El algoritmo maximiza el VAN de un proyecto tomando en cuenta el valor del dinero bajo tres restricciones, Mina, Planta y Refinería.
- Objetivo: Max VAN

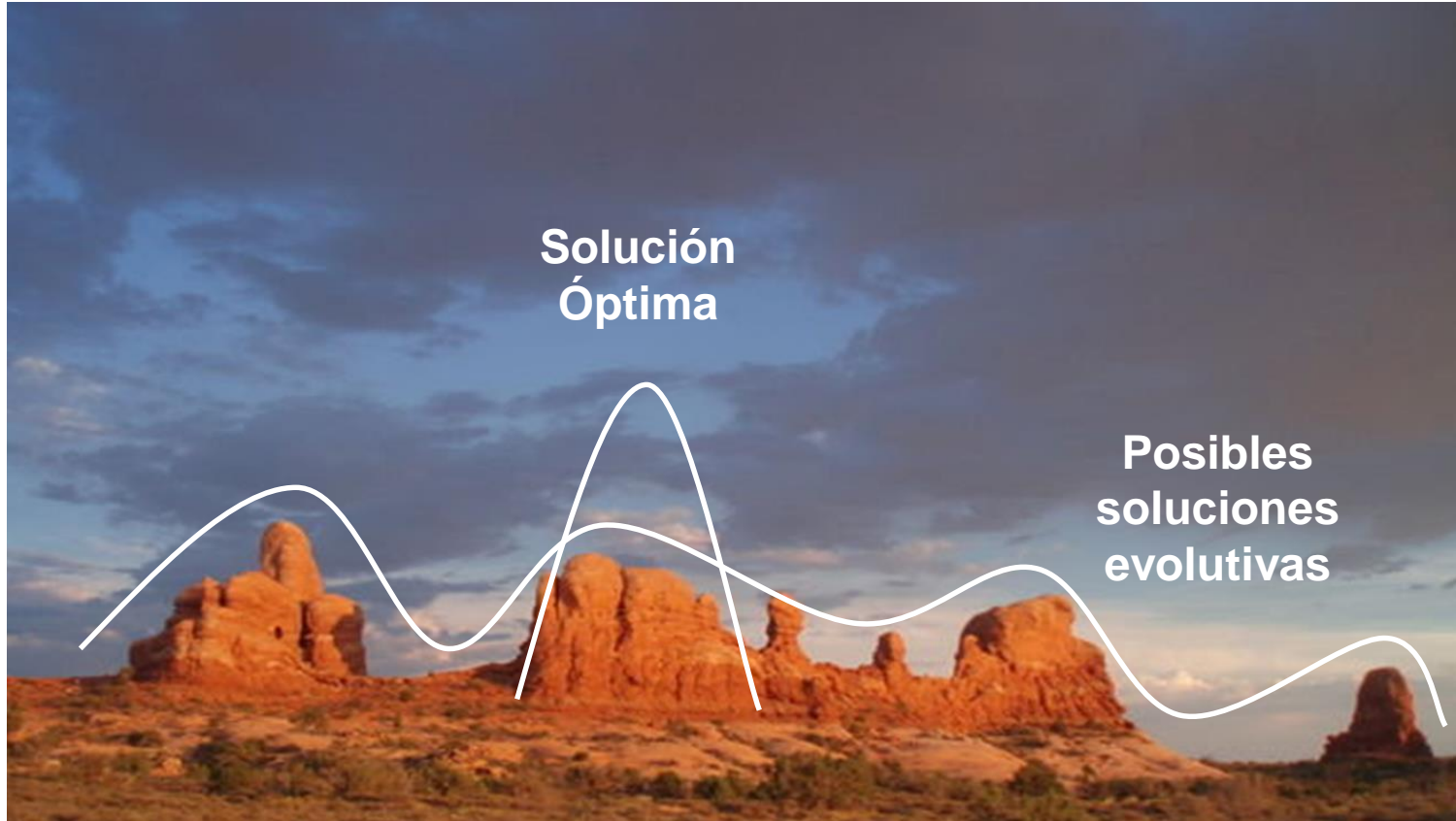


Algoritmos Evolutivos

- Los algoritmos evolutivos son métodos de optimización y búsqueda de soluciones basados en los postulados de la evolución biológica. En ellos se mantiene un conjunto de entidades que representan posibles soluciones, las cuales se mezclan, y compiten entre sí, de tal manera que las más aptas son capaces de prevalecer a lo largo del tiempo, evolucionando hacia mejores soluciones cada vez.
- Los algoritmos evolutivos, y la computación evolutiva, son una rama de la inteligencia artificial. Son utilizados principalmente en problemas con espacios de búsqueda extensos y no lineales, en donde otros métodos no son capaces de encontrar soluciones en un tiempo razonable.

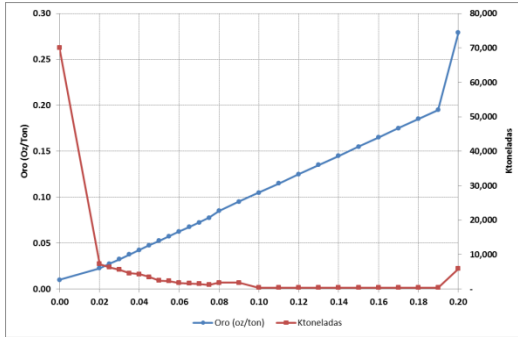


En busca del óptimo



- El objetivo de la optimización de ley de corte en Maptek Evolution - Strategy es maximizar el VAN bajo restricciones de capacidad, múltiples procesos, múltiples minas y secuencias de extracción.
- Información Base:
 - Fases de extracción
 - Capacidades (Mina, Planta, Refinería) por periodo.
 - Modelo Económico (Costos) y Precios.
 - Reservas Mineras.
 - Curva Tonelaje ley es calculada para cada mina/fase/banco/litología.

Evolution vs Lane Optipit



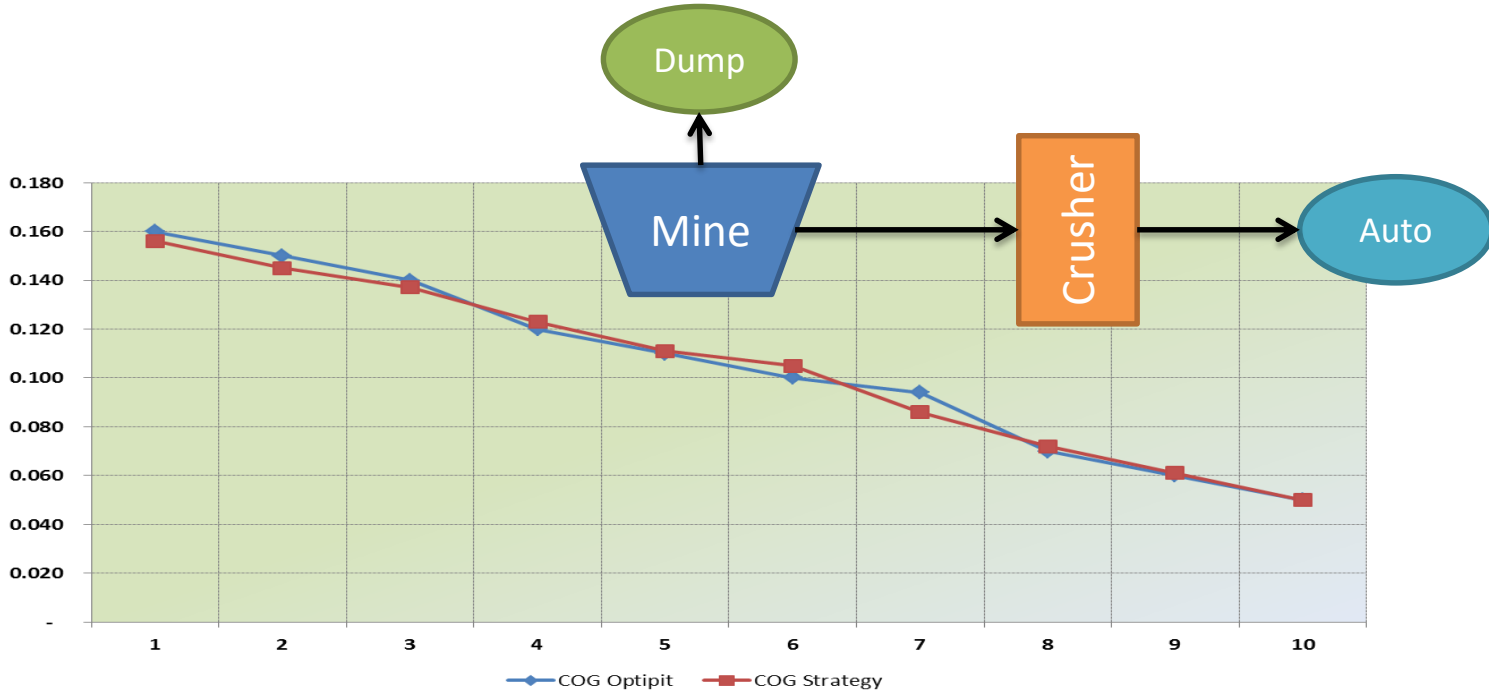
Parametros	Sigla	Valor	Unidad
Precio	(P)	600	\$/oz
Costo Venta	(s)	5	\$/oz
Costo Proceso	(c)	19	\$/ton Mineral
Recuperacion	(y)	0.9	
Costo Mina	(m)	1.2	\$/ton
Costos Fijos	(fa)	8.35	\$/año
Capacidad Mina	(M)	Unlimited	
Capacidad Proceso	(C)	1.05	tonnes
Tasa de Descuento	(d)	15	%

“Value Creation Through Strategic Mine Planning and Cutoff Grade Optimization”

SME Annual Meeting
 K. Dagdelen CSM
 K Kawahata CSM
 Feb25-28, 2007
 Denver Colorado

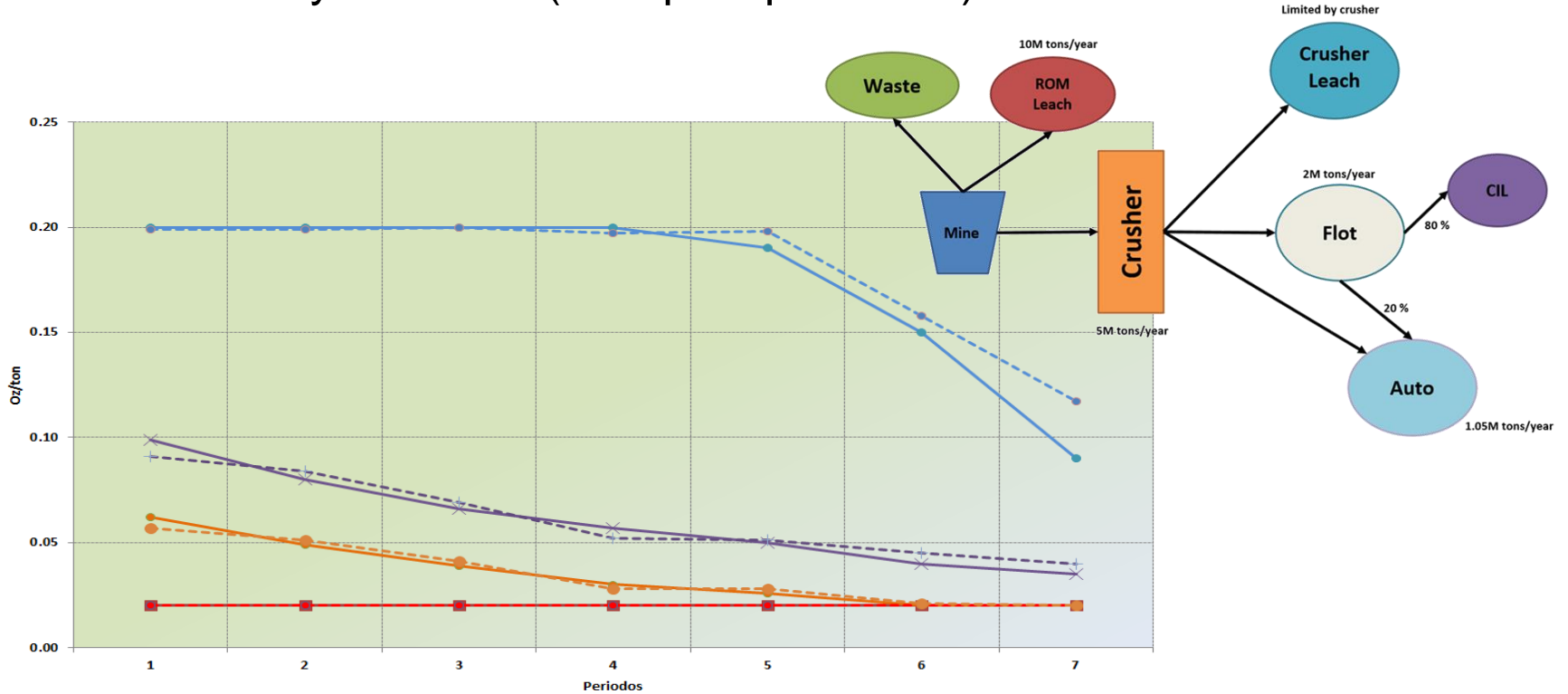
Caso 1

- Gráfico Ley de Corte (1 proceso)

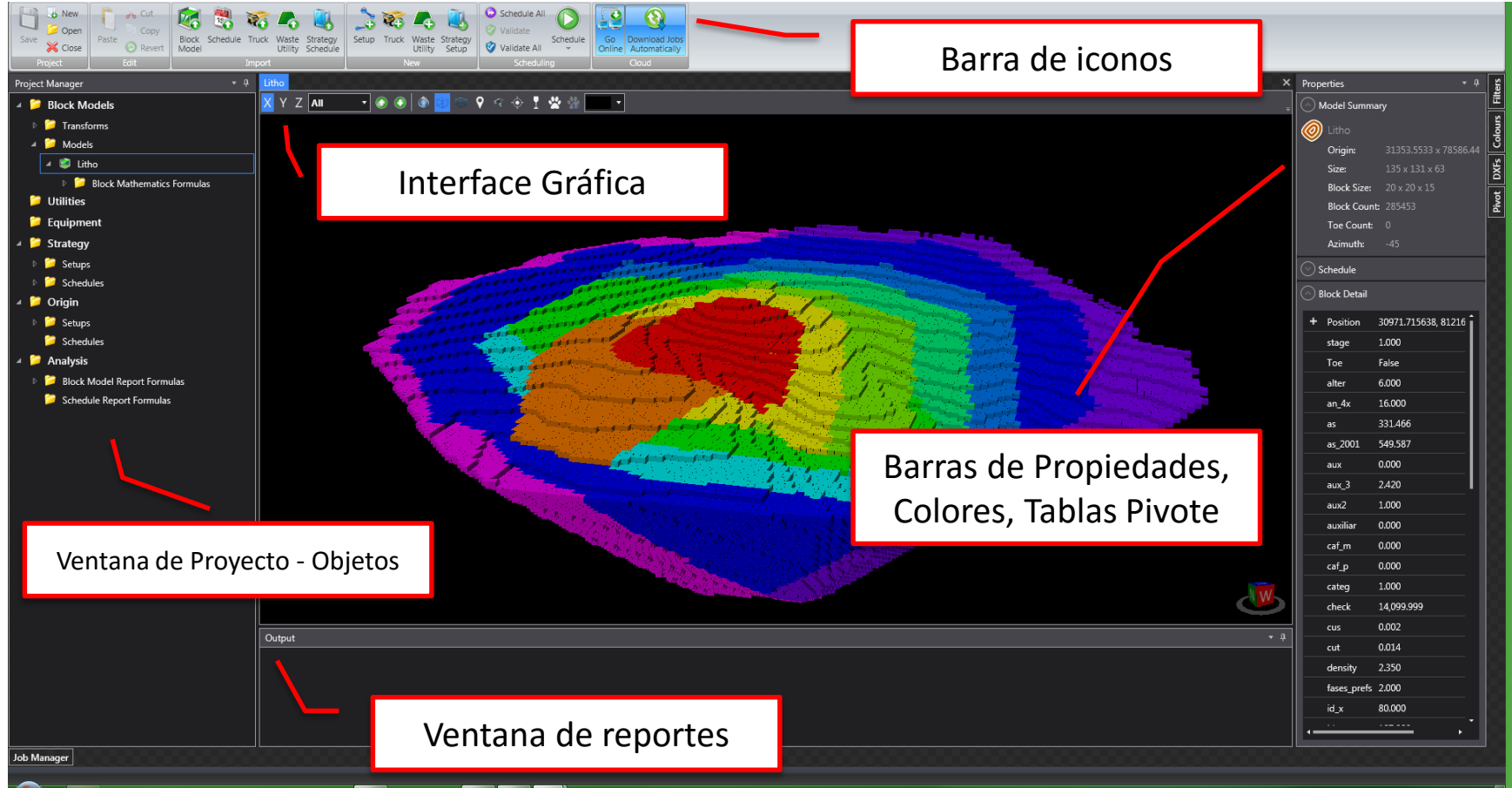


Caso 2

- Gráfico Ley de Corte (múltiples procesos)



Esto es Evolution



The screenshot shows the Evolution software interface with several components highlighted by red boxes and lines:

- Barra de iconos**: A toolbar at the top containing icons for New, Open, Save, Close, Copy, Paste, Revert, Block Model, Schedule, Truck, Waste Utility, Strategy, Setup, Validate, Schedule, Go Online, and Download Jobs Automatically.
- Interface Gráfica**: The central 3D visualization area showing a colorful topographic map of a site.
- Ventana de Proyecto - Objetos**: A tree view on the left side of the interface listing project objects such as Block Models, Transforms, Models, Litho, Block Mathematics Formulas, Utilities, Equipment, Strategy, Setups, Schedules, Origin, and Analysis.
- Ventana de reportes**: An output window at the bottom left of the interface.
- Barras de Propiedades, Colores, Tablas Pivote**: A properties panel on the right side of the interface displaying various parameters for the selected object.

Property	Value
Origin	31353.5533 x 78586.44
Size	135 x 131 x 63
Block Size	20 x 20 x 15
Block Count	285453
Toe Count	0
Azimuth	-45
Position	30971.715638, 81216
stage	1.000
Toe	False
alter	6.000
an_4x	16.000
as	331.466
as_2001	549.587
aux	0.000
aux_3	2.420
aux2	1.000
auxiliar	0.000
caf_m	0.000
caf_p	0.000
categ	1.000
check	14,099.999
cus	0.002
cut	0.014
density	2.350
fases_prefs	2.000
id_x	80.000

Simple – Drag and Drop



Nuevo modelo de planificación

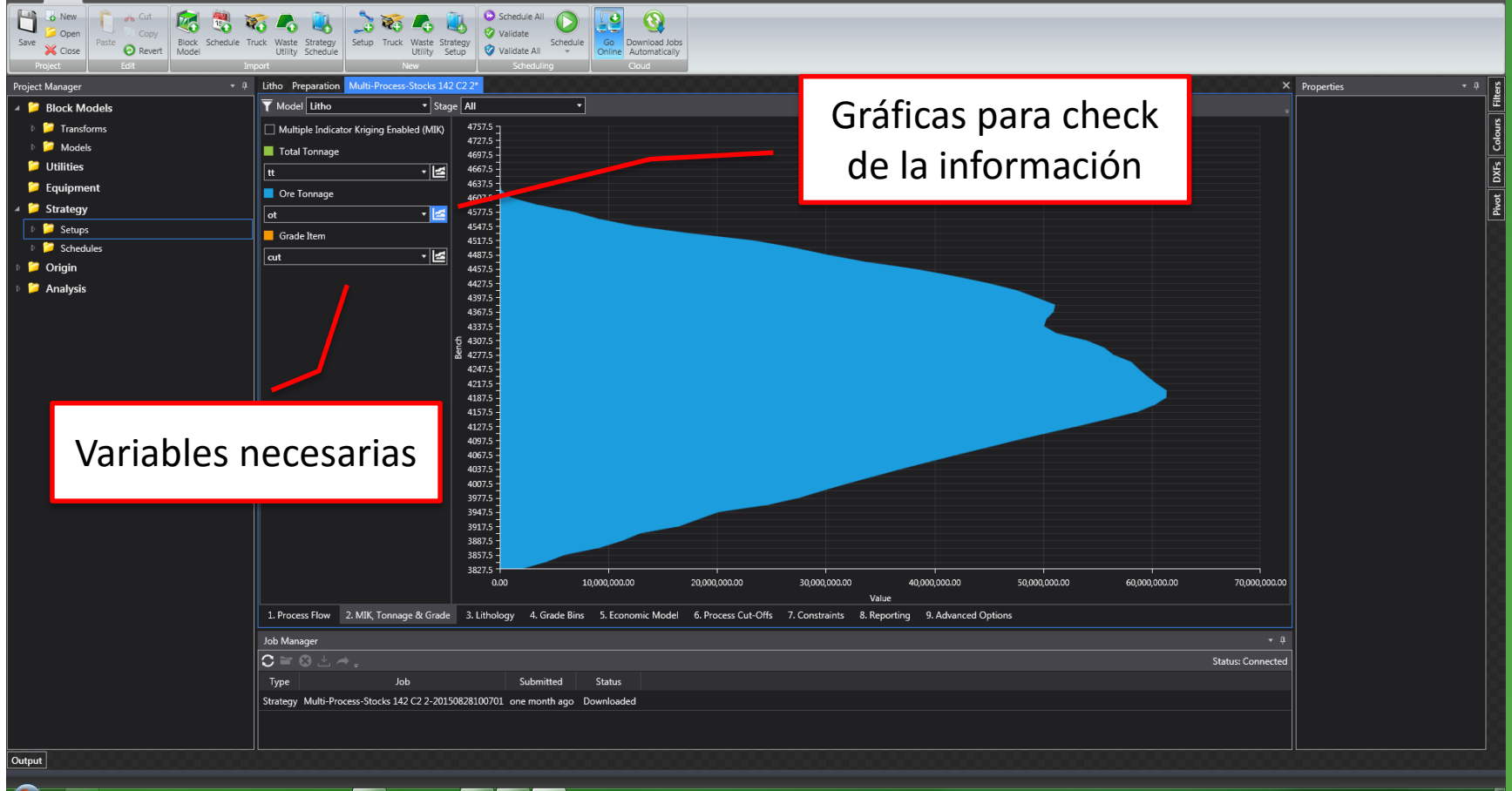
Modelos de Bloques
Drag & Drop

Job Manager

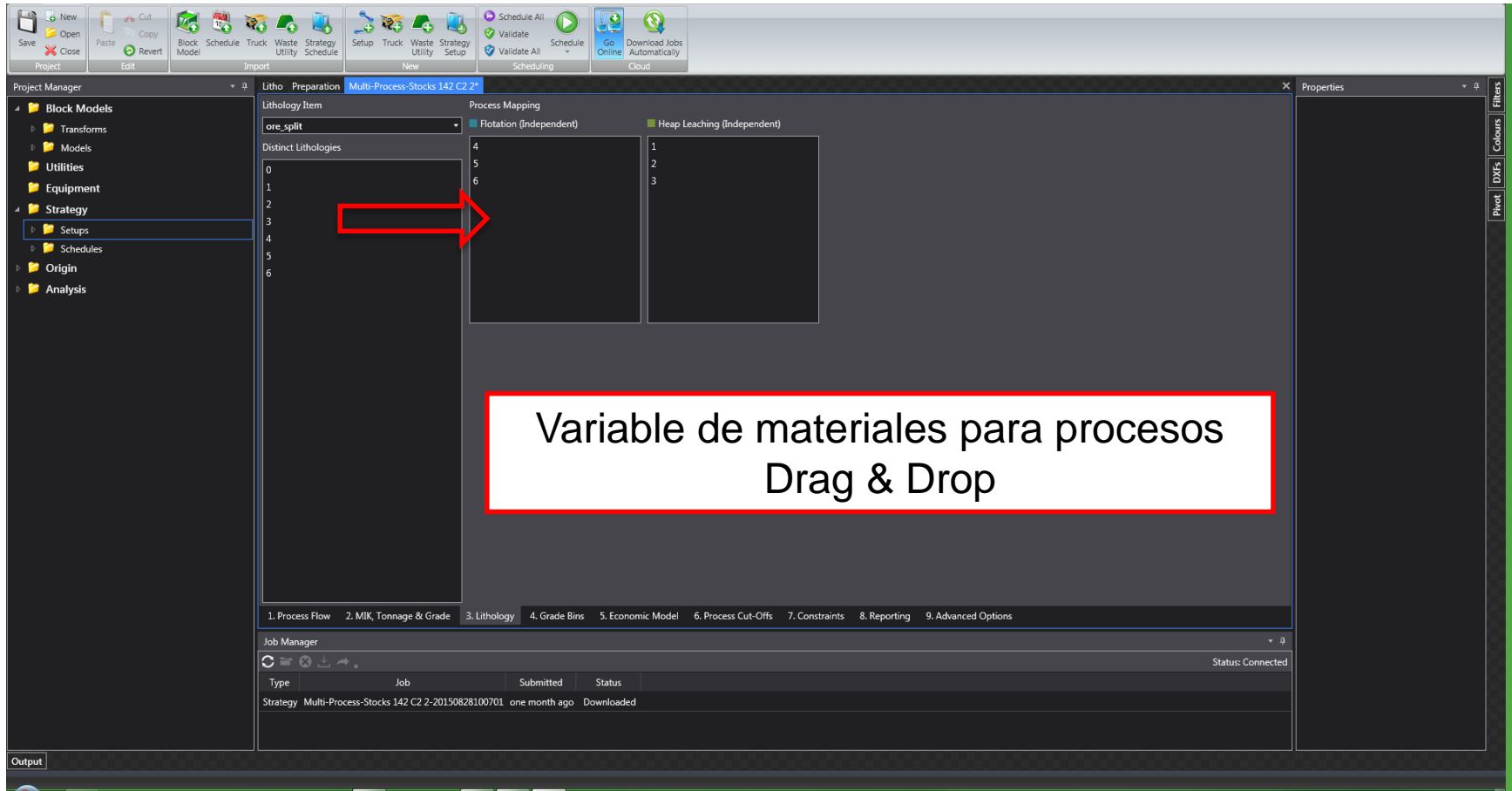
1. Process Flow 2. MIK, Tonnage & Grade 3. Lithology 4. Grade Bins 5. Economic Model 6. Process Cut-Offs 7. Constraints 8. Reporting 9. Advanced Options

Output
Validation successful. This Setup is ready to be scheduled.

Auditable



Litos - Directo desde el modelo de bloques



The screenshot displays the MAPTEK software interface. The main window is titled 'Multi-Process-Stocks 142 C2 2'. The 'Process Mapping' section is active, showing a list of 'Distinct Lithologies' (0-6) and two process categories: 'Flotation (Independent)' and 'Heap Leaching (Independent)'. A red arrow points to the 'Distinct Lithologies' list. A red box highlights the text 'Variable de materiales para procesos Drag & Drop'.

Variable de materiales para procesos
Drag & Drop

Bins – Directo desde el modelo de bloques

Project Manager | Litho Preparation | Multi-Process-Stocks 142 C2?

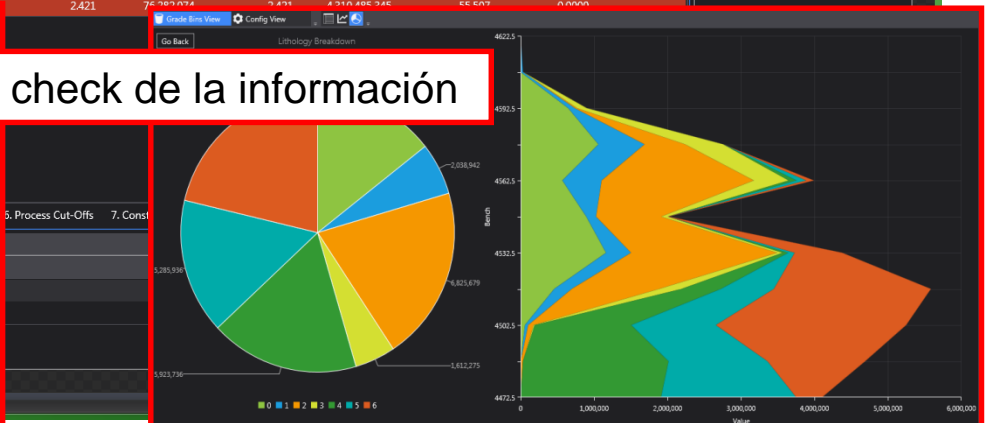
Grade Bins View | Config View | Litology

Lower	Upper	Ore Units	Inc Metal Units	Cumulative Metal U					
0.000	0.300	2,406,314,278	4,716	1,688,165,588					
0.300	0.400	248,804,083	85,829,249	1,688,160,872					
0.400	0.500	157,771,208	70,382,288	1,602,331,623					
0.500	0.600	110,014,308	60,446,137	1,531,949,335	0.446	1,655,366,983	0.968	4,310,485,345	1.604
0.600	0.700	125,307,811	81,663,855	1,471,503,198	0.549	1,497,595,775	1.023	4,310,485,345	1.878
0.700	0.800	210,943,532	159,395,756	1,389,839,343	0.756	1,387,581,468	1.060	4,310,485,345	2.106
0.800	0.900	226,762,930	191,976,376	1,230,443,587	0.652	1,262,273,657	1.101	4,310,485,345	2.415
0.900	1.000	178,689,890	169,728,579	1,038,467,211	0.847	1,051,330,125	1.170	4,310,485,345	3.100
1.000	1.100	177,882,709	186,664,713	868,738,632	0.950	824,567,195	1.259	4,310,485,345	4.228
1.100	1.200	143,543,388	164,737,307	682,073,919	1.049	645,877,305	1.345	4,310,485,345	5.674
1.200	1.300	110,524,783	137,830,325	517,336,612	1.148	467,994,596	1.457	4,310,485,345	8.211
1.300	1.400	67,557,156	90,977,820	379,506,287	1.247	324,451,208	1.594	4,310,485,345	12.285
1.400	1.500	44,626,733	64,504,035	288,528,467	1.347	213,926,425	1.774	4,310,485,345	19.149
1.500	1.600	25,460,463	39,313,550	224,024,432	1.445	146,369,269	1.971	4,310,485,345	28.449
					1.544	101,742,537	2.202	4,310,485,345	41.367
					2.421	75,783,074	3.471	4,310,485,345	66.607

Grade Bins
Directo del modelo de bloques



Gráficas para check de la información



Simple – Modelo Económico



Modelo Económico

- Precios
- Costos
- Capacidades
- etc.

	Period 1	Period 2	Period 3	Period 4	Period 5
Start Date	01-Jan-2015	01-Jan-2016	01-Jan-2017	01-Jan-2018	01-Jan-2019
End Date	31-Dec-2015	31-Dec-2016	31-Dec-2017	31-Dec-2018	31-Dec-2019
Admin/Fixed Cost	\$44,000,000.00	\$44,000,000.00	\$44,000,000.00	\$44,000,000.00	\$44,000,000.00
Mining Capacity (tonnes)	170,000,000	173,350,000	173,350,000	173,350,000	173,350,000
Capital Injection	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Total Crusher Capacity (tonnes)	15,000,000	30,000,000	40,000,000	45,000,000	45,000,000
Total Processing Capacity (tonnes)	15,000,000	30,000,000	40,000,000	45,000,000	45,000,000
Total Refining Capacity (units)	1,999,999,998	1,999,999,998	1,999,999,998	1,999,999,998	1,999,999,998
Rehabilitation Cost (\$ per tonne)	\$0.0000	\$0.0000	\$0.0000	\$0.0000	\$0.0000
Mining Cost Escalation	0.00 %	0.00 %	0.00 %	0.00 %	0.00 %
Crusher Capacity (tonnes)	15,000,000	30,000,000	40,000,000	45,000,000	45,000,000
Flotation Capacity (tonnes)	13,000,000	28,000,000	30,000,000	43,000,000	45,000,000
Recovery (%)	99.999999	99.999999	99.999999	99.999999	99.999999
Recovery Default (%)	\$5.8000	\$5.8000	\$5.8000	\$5.8000	\$5.8000
Recovery Default (%)	\$20.9000	\$20.9000	\$20.9000	\$20.9000	\$20.9000

Tasa de Descuento
Definición de Stocks

Alternativa de Costos
y Recuperaciones
desde modelo de
bloques

Inyección Dinámica
de Capital

Calendar View | **Config View** | Variable Costs | **Dynamic Capital**

Discount Factor

The fraction by which cash flows for a period are multiplied to calculate the Net Present Value (NPV)

Discount Rate (%)

10.00

Cut-off Grade Optimisation

Turn-off cut-off grade optimisation.

Global Minimum Cut-off

0.3000

Stockpiles

Allowing stockpiles will cause the schedule to auto-create stockpiles for each process defined in your process flow. You will also need to define stockpile rehandle and recovery values within the calendar.

Allow Stockpiles

Process Stockpile Capacity

Name	Capacity (tonnes)	Fixed Cut-off
Flotation	999,999,999	0.0000
Heap Leaching	999,999,999	0.0000

Calendar View | **Config View** | Variable Costs | **Dynamic Capital**

Optional. Select an item in the model to use as the cost. You will also need to define the cost escalation factor within the calendar.

Mining Cost

mcost

Rehabilitation Cost

Grade

Variable Process Costs

Processes

Flotation

Processing Cost

pc_flot

Processing Cost Default

3.25

Recovery

rec_flot

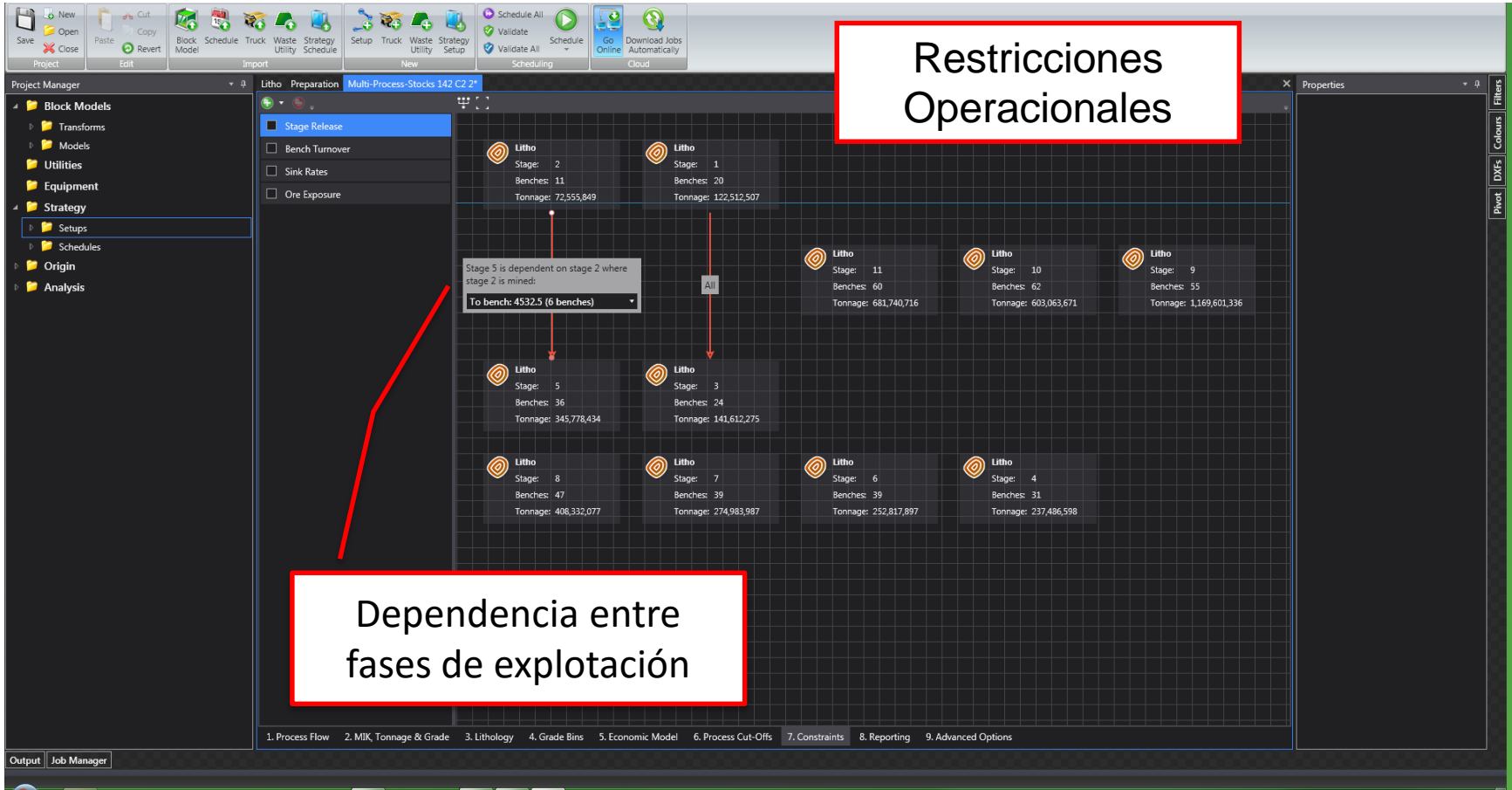
Recovery Default (%)

89.40

Calendar View | **Config View** | Variable Costs | **Dynamic Capital**

Stage	Capital
Stage 1	\$0.00
Stage 2	\$0.00
Stage 3	\$0.00
Stage 4	\$0.00
Stage 5	\$10,000,000.00
Stage 6	\$0.00
Stage 7	\$0.00
Stage 8	\$0.00
Stage 9	\$0.00
Stage 10	\$0.00
Stage 11	\$0.00

Restricciones



The screenshot displays the MAPTEK software interface for a project named "Multi-Process-Stocks 142 C2 2". The main workspace shows a network of Litho stages, each represented by a circular icon with a target symbol. The stages are connected by arrows indicating dependencies. A red arrow points from a text box at the bottom to a specific dependency message: "Stage 5 is dependent on stage 2 where stage 2 is mined: To bench: 4532.5 (6 benches)".

Restricciones Operacionales

Dependencia entre fases de explotación

Project Manager

- Block Models
 - Transforms
 - Models
- Utilities
- Equipment
- Strategy
 - Setups
 - Schedules
- Origin
- Analysis

Properties

1. Process Flow 2. MIK, Tonnage & Grade 3. Lithology 4. Grade Blirs 5. Economic Model 6. Process Cut-Offs 7. Constraints 8. Reporting 9. Advanced Options

Output Job Manager

Restricciones



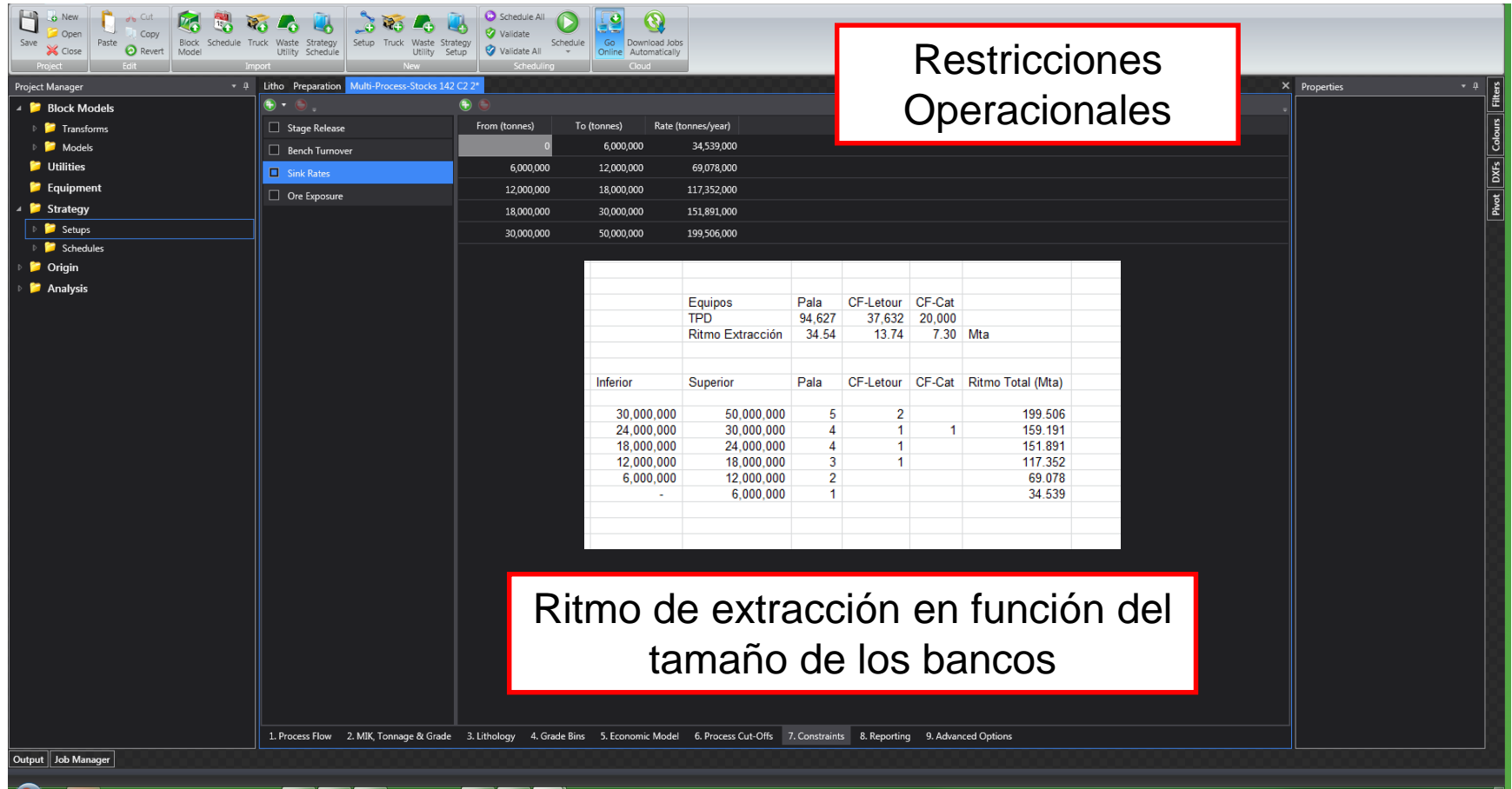
Restricciones Operacionales

	Period 1	Period 2						
Litho								
Stage 1	10	9	8	8	8	8	8	8
Stage 2	10	9	8	8	8	8	8	8
Stage 3	10	9	8	8	8	8	8	8
Stage 4	10	9	8	8	8	8	8	8
Stage 5	10	9	8	8	8	8	8	8
Stage 6	0	0	0	0	0	10	10	10
Stage 7	0	0	0	0	0	10	10	10
Stage 8	0	0	0	0	0	10	10	10
Stage 9	0	0	0	0	0	10	10	10
Stage 10	0	0	0	0	0	10	10	10
Stage 11	0	0	0	0	0	10	10	10

Numero de Bancos x Periodo

1. Process Flow 2. MIK, Tonnage & Grade 3. Lithology 4. Grade Bins 5. Economic Model 6. Process Cut-Offs 7. Constraints 8. Reporting 9. Advanced Options

Restricciones



The screenshot displays the MAPTEK software interface for 'Multi-Process-Stocks 142 C2 2'. The 'Sink Rates' constraint is selected in the 'Preparation' tab. A table shows the relationship between bank size (From/To tonnes) and extraction rate (tonnes/year). A detailed table below shows the extraction rate (Ritmo Extracción) for different equipment types (Equipos) across various bank sizes. The bottom navigation bar includes: 1. Process Flow, 2. MIK, Tonnage & Grade, 3. Lithology, 4. Grade Bins, 5. Economic Model, 6. Process Cut-Offs, 7. Constraints, 8. Reporting, 9. Advanced Options.

Restricciones Operacionales

From (tonnes)	To (tonnes)	Rate (tonnes/year)
0	6,000,000	34,539,000
6,000,000	12,000,000	69,078,000
12,000,000	18,000,000	117,352,000
18,000,000	30,000,000	151,891,000
30,000,000	50,000,000	199,506,000

Equipos	Pala	CF-Letour	CF-Cat	
TPD	94.627	37.632	20,000	
Ritmo Extracción	34.54	13.74	7.30	Mta

Inferior	Superior	Pala	CF-Letour	CF-Cat	Ritmo Total (Mta)
30,000,000	50,000,000	5	2		199.506
24,000,000	30,000,000	4	1	1	159.191
18,000,000	24,000,000	4	1		151.891
12,000,000	18,000,000	3	1		117.352
6,000,000	12,000,000	2			69.078
-	6,000,000	1			34.539

Ritmo de extracción en función del tamaño de los bancos

Restricciones



Restricciones Operacionales

Restricciones Operacionales Globales

Restricciones Operacionales x Fase

Restricciones Operacionales x Proceso

Item: Litho

	Period 1	Period 2	Period 3	Period 4	Period 5
Stage 1					
Stage 2					
Stage 3					
Stage 4					
Stage 5					
Stage 6					
Stage 7					
Stage 8					
Stage 9					
Stage 10					
Stage 11					

Process: Litho

	Period 1	Period 2	Period 3	Period 4	Period 5
Upper	0	0	0	0	0
Lower	0	0	0	0	0

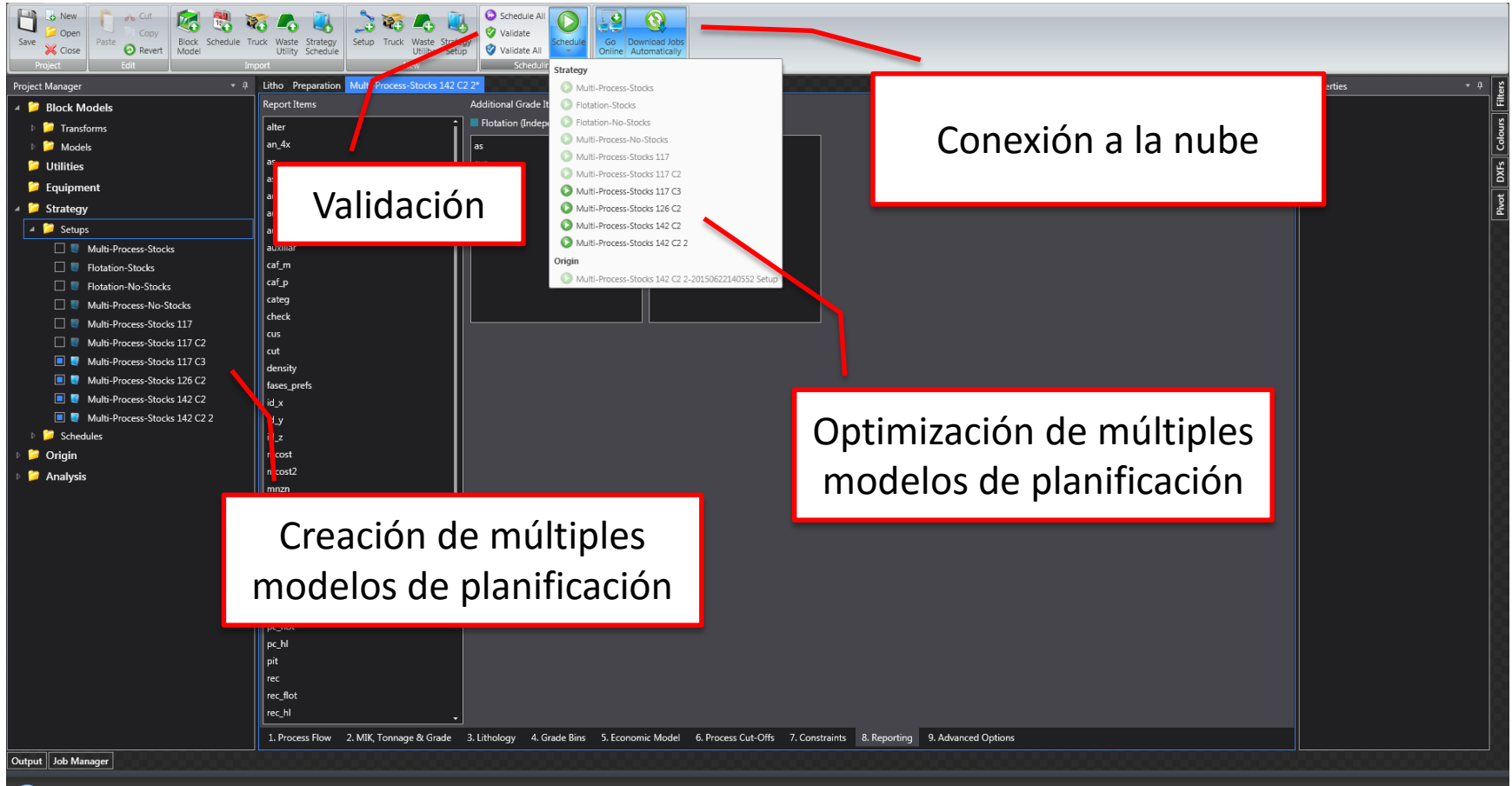
Reportabilidad



The screenshot displays the MAPTEK software interface. The top menu bar includes options like 'New', 'Open', 'Save', 'Close', 'Paste', 'Copy', 'Revert', 'Block Model', 'Schedule', 'Truck', 'Waste Utility', 'Strategy Setup', 'Setup', 'Truck', 'Waste Utility', 'Strategy Setup', 'Schedule All', 'Validate', 'Validate All', 'Schedule', 'Go Online', and 'Download Jobs Automatically Cloud'. The main window is titled 'Litho Preparation Multi-Process-Stocks 142 C2 2'. On the left, the 'Project Manager' tree shows a hierarchy: 'Block Models' (containing 'Transforms', 'Models', 'Utilities', 'Equipment'), 'Strategy' (containing 'Setups', 'Schedules'), 'Origin', and 'Analysis'. The 'Setups' folder is selected. The main area is divided into 'Report Items' and 'Additional Grade Items'. The 'Report Items' list includes: alter, an_4x, as, as_2001, aux, aux_3, aux2, auxiliari, caf_m, caf_p, categ, check, cus, cut, density, fases_prefs, id_x, id_y, id_z, mcost, mcost2, minzn, nueva, nueva2, ore_split, ot, ot_flot, ot_hl, ot2, pc_flot, pc_hl, pit, rec, rec_flot, and rec_hl. The 'Additional Grade Items' section has two columns: 'Flotation (Independent)' with items 'as', 'cus', and 'rec_flot'; and 'Heap Leaching (Independent)' with items 'as', 'cus', and 'rec_hl'. A red-bordered box in the center contains the text 'Reportabilidad desde el modelo de bloques'. The bottom status bar shows a navigation menu: '1. Process Flow', '2. MIK, Tonnage & Grade', '3. Lithology', '4. Grade Bins', '5. Economic Model', '6. Process Cut-Offs', '7. Constraints', '8. Reporting', and '9. Advanced Options'. The 'Output Job Manager' tab is active at the bottom left.

Reportabilidad desde el modelo de bloques

Optimización



The screenshot displays the MAPTEK software interface with several key elements highlighted by red boxes and arrows:

- Validación:** A red box highlights the 'Validate' and 'Validate All' buttons in the top toolbar.
- Conexión a la nube:** A red box highlights the 'Go Online' and 'Download Jobs Automatically' buttons in the top toolbar.
- Optimización de múltiples modelos de planificación:** A red box highlights the 'Strategy' dropdown menu, which lists various optimization strategies such as 'Multi-Process-Stocks', 'Flotation-Stocks', and 'Multi-Process-Stocks 117 C2'.
- Creación de múltiples modelos de planificación:** A red box highlights the 'Strategy' list in the left-hand pane, showing multiple instances of 'Multi-Process-Stocks' models.

The interface also shows a 'Project Manager' on the left, a central workspace with a 'Report Items' list, and a bottom status bar with navigation tabs for different optimization stages.

The screenshot displays the MAPTEK software interface with the following components:

- Project Manager:** A tree view on the left showing a hierarchy of 'Block Models' (Transforms, Models, Utilities, Equipment, Strategy) and 'Schedules'.
- Main Chart:** A line graph titled 'Gen 26' showing NPV (Net Present Value) over 25 generations. The y-axis ranges from 2,176,798,338 to 3,076,798,338. Two lines are plotted: 'Best NPV' (blue) and 'Worst NPV' (red). Both lines show an upward trend, with the Best NPV reaching approximately 3,076,798,338 and the Worst NPV reaching approximately 2,976,798,338 by generation 25. A blue box in the top right corner of the chart area displays: 'Gen 26', 'Best NPV: 3.153.189.062', 'Worst NPV: 3.141.968.387', and 'Feasible: Yes'.
- Secondary Charts:** Below the main chart are two smaller charts: 'Best Violation' (green line at 0%) and 'Feasible Ratio' (yellow line at approximately 100%).
- Job Manager:** A table at the bottom showing job status, with 'Status: Connected' and 'downloaded' visible.
- Annotations:** Two red-bordered boxes with white text are overlaid on the image. One box, containing the text 'Reportabilidad desde la nube', is positioned over the main NPV chart. The other box, containing 'Descarga de resultados', is positioned over the Job Manager table.

Reportabilidad



Project Manager

Block Models

- Transforms
- Models
- Utilities
- Equipment
- Strategy
 - Setups
 - Multi-Process-Stocks
 - Flotation-Stocks
 - Flotation-No-Stocks
 - Multi-Process-No-Stocks
 - Multi-Process-Stocks 117
 - Multi-Process-Stocks 117 C2
 - Multi-Process-Stocks 117 C3
 - Multi-Process-Stocks 126 C2
 - Multi-Process-Stocks 142 C2
 - Multi-Process-Stocks 142 C2 2
 - Schedules
 - Multi-Process-Stocks-201412300356...
 - Flotation-No-Stocks-20141230041529
 - Multi-Process-No-Stocks-201412300...
 - Multi-Process-Stocks-201502110033...
 - Multi-Process-Stocks-201504291402...
 - Multi-Process-Stocks 117 C2-201505...
 - Multi-Process-Stocks 117-20150505...
 - Multi-Process-Stocks 117 C3-201505...
 - Multi-Process-Stocks 117 C3-201505...
 - Multi-Process-Stocks 117 C2-201505...
 - Multi-Process-Stocks 126 C2-201505...
 - Multi-Process-Stocks 142 C2-201506...
 - Multi-Process-Stocks 142 C2 2-2015...
 - Flotation-No-Stocks-20150619122505
 - Flotation-No-Stocks-20150619123320
 - Flotation-No-Stocks-20150619124812

Overall Schedule Totals

Totals	Period 1	Period 2	Period 3	Period 4	Period 5	Period 6	Period 7	Period 8	Period 9	Period 10
Discount Factor	1.00	1.10	1.21	1.33	1.46	1.60	1.75	1.91	2.08	2.26
Mined Tonnes	4,310,485,345	97,632,044	173,350,000	173,350,000	166,905,836	160,461,672	154,017,508	147,573,344	141,129,180	134,685,016
Mill-Feed Tonnes	1,196,581,268	15,000,000	30,000,000	40,000,000	45,000,000	50,000,000	55,000,000	60,000,000	65,000,000	70,000,000
MCost	\$2,586,291,207	\$58,579,226	\$104,010,000	\$104,010,000	\$100,143,502	\$96,277,004	\$92,410,506	\$88,544,008	\$84,677,510	\$80,811,012
PCost	\$3,849,558,354	\$45,250,000	\$93,999,999	\$126,500,000	\$142,750,000	\$159,000,000	\$175,250,000	\$191,500,000	\$207,750,000	\$224,000,000
Rehandle	\$188,771,706	\$0	\$667,523	\$910,366	\$0	\$0	\$0	\$0	\$0	\$0
Rehabilitation	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Closure Cost	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Admin/Fixed	\$1,249,600,000	\$44,000,000	\$44,000,000	\$44,000,000	\$44,000,000	\$44,000,000	\$44,000,000	\$44,000,000	\$44,000,000	\$44,000,000
Capital	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Revenue	\$15,039,749,899	\$297,288,647	\$520,618,108	\$604,361,766	\$756,962,033	\$874,451,077	\$673,682,348	\$542,488,904	\$928,687,098	\$1,047,186,252
Profit	\$7,165,528,632	\$149,459,421	\$277,940,585	\$328,941,400	\$470,068,531	\$583,590,950	\$381,994,059	\$242,886,192	\$636,967,098	\$750,458,252
Incremental NPV	\$3,161,534,006	\$3,161,534,006	\$3,313,282,044	\$3,338,875,604	\$3,310,927,625	\$3,124,945,003	\$2,795,489,458	\$2,654,844,939	\$2,653,154,621	\$2,651,500,102

Litho

Crusher

WASTE

Flotation

Cut-off	0.79	0.84	0.71	0.78	0.71	0.92	0.78	1.00
Total Tonnes	1,174,106,544	13,000,000	28,000,000	38,000,000	43,000,000	43,000,000	43,000,000	43,000,000
Total Grade (Wavg)	1.520	1.520	1.341	1.146	1.280	1.132	0.986	1.571
Total in situ Metal	1,190,527,606	19,758,503	37,545,219	43,534,189	55,029,933	62,500,916	48,657,168	42,396,149
Total Recovered Metal	981,679,253	17,664,101	33,358,003	38,919,565	49,196,760	55,875,819	43,499,509	34,728,924
Global Recovery (Avg)	89.40 %	89.40 %	88.85 %	89.40 %	89.40 %	89.40 %	89.40 %	89.40 %

Schedule Overview | Charts | Stages | Accumulation | Process/Litho | Stockpile Reclaim | Stockpile State at Start of Period | Grades | Process Constraints

Job Manager

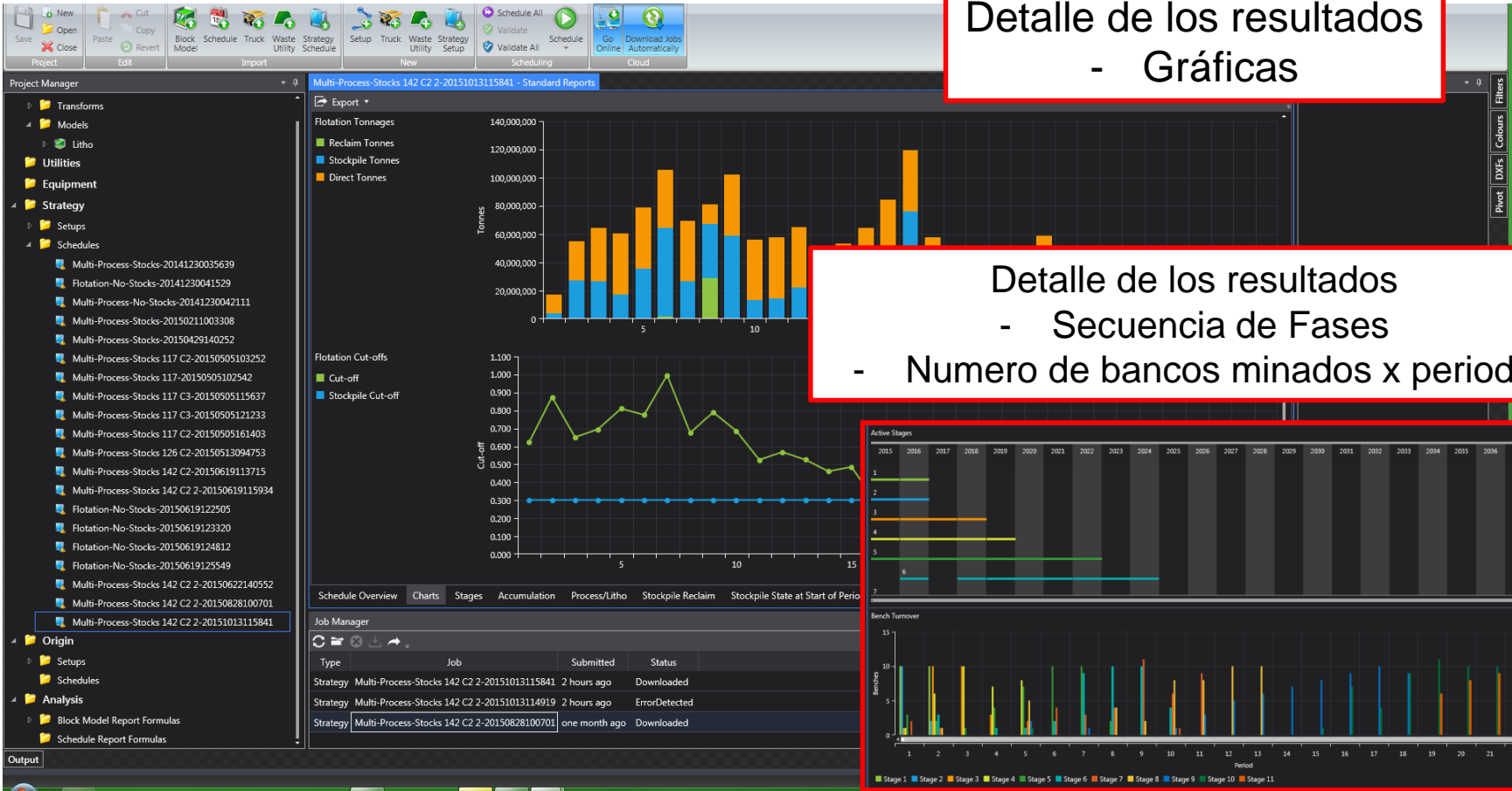
Type	Job	Submitted	Status
Strategy	Multi-Process-Stocks 142 C2 2-20150828100701	one month ago	Downloaded

Output

Detalle de los resultados

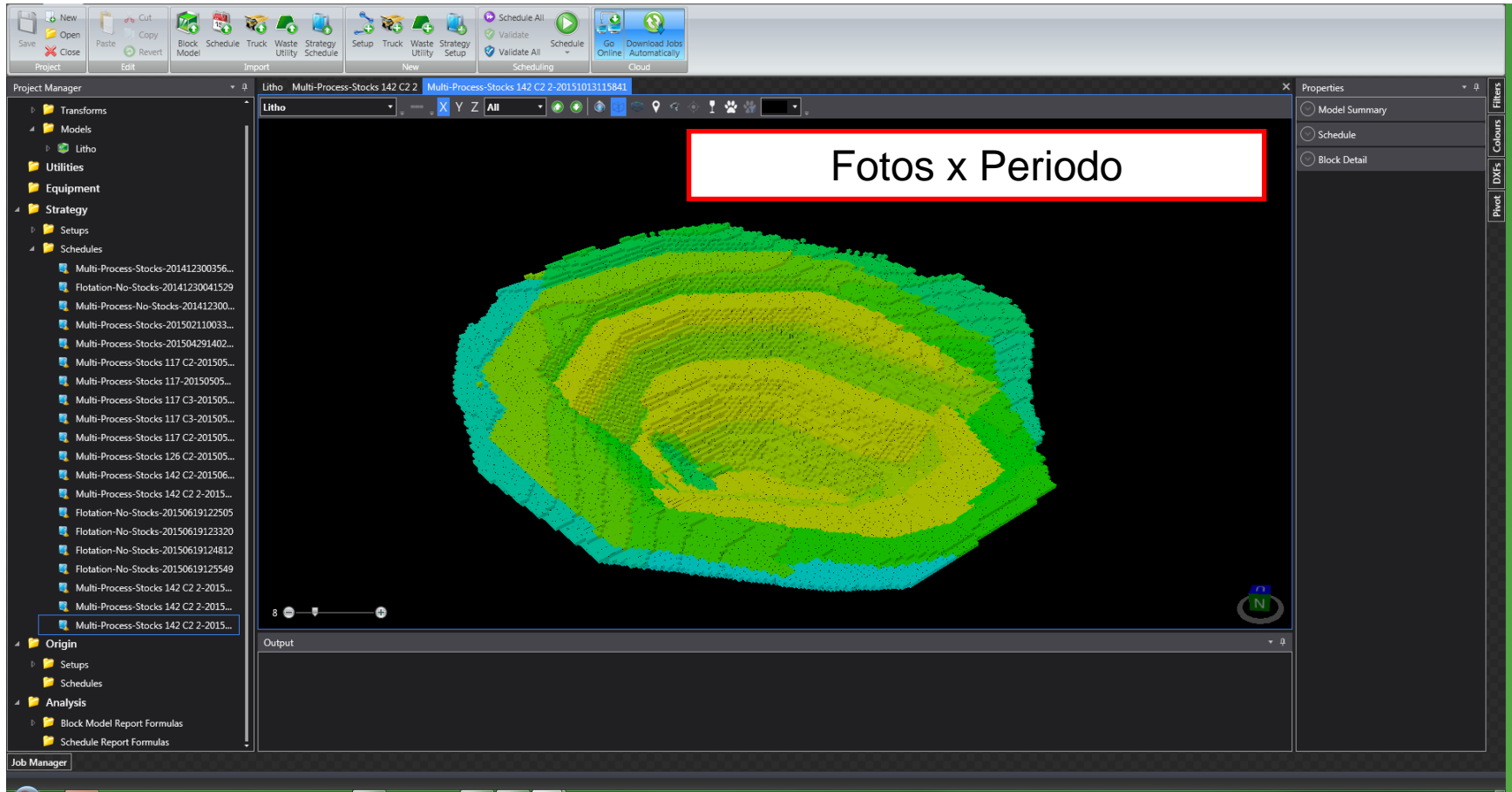
- Flujos de caja
- Movimientos x Rajo
- Movimiento x Proceso
- Leyes de Corte x proceso y stock

Detalle de los resultados
- Gráficas



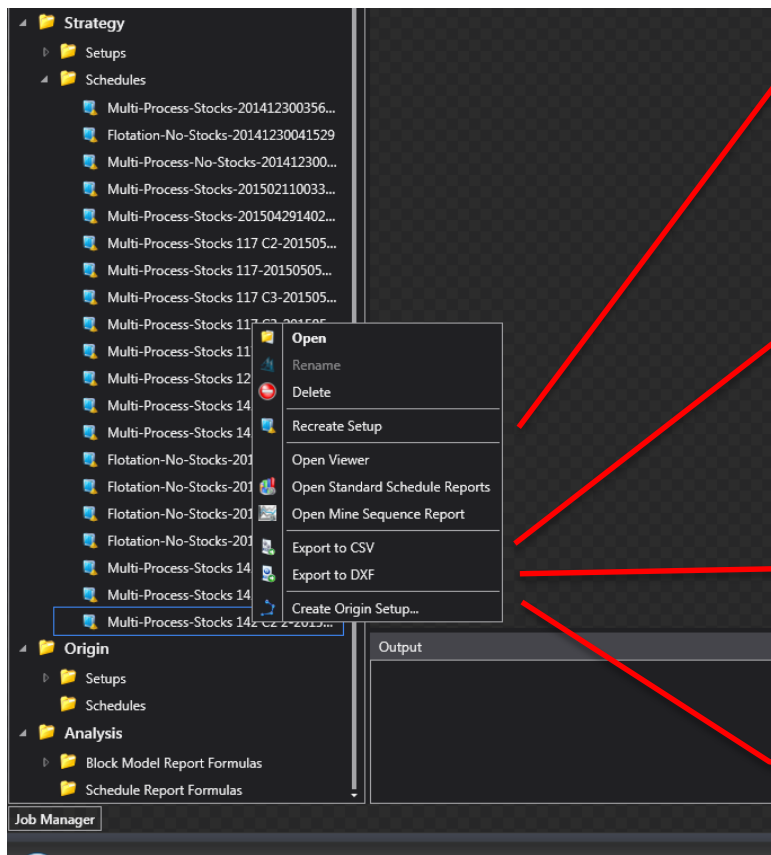
Detalle de los resultados
- Secuencia de Fases
- Numero de bancos minados x periodo

Fotos x Periodo



The screenshot displays the MAPTEK software interface. The central window shows a 3D topographic map of a terrain, rendered with a color gradient from blue (low elevation) to red (high elevation). A white text box with a red border is overlaid on the map, containing the text "Fotos x Periodo". The interface includes a menu bar at the top with options like "Project", "Edit", "Import", "New", "Scheduling", and "Cloud". On the left, a "Project Manager" pane lists various project files, with "Multi-Process-Stocks 142 C2 2-2015..." selected. On the right, a "Properties" pane shows options for "Model Summary", "Schedule", and "Block Detail". The bottom of the interface features a "Job Manager" pane and an "Output" window.

Otras Características



Reconstruir configuración
desde el resultado

Exportar modelo de bloques
con variables del plan minero

Exportar

- Sólidos x periodo
- Fotos x Periodo

Crear desde el resultado de Strategy
una configuración de Origin

Conclusiones



- Genera plan mineros
- Optimiza la ley de corte por periodo
- Interface orientada a objetos
- No requiere manejar cubicaciones o bases de datos adicionales (Excel, Access, etc.) ya que trabaja directo sobre modelo de bloques
- La configuración se hace de manera local, lo que permite utilizar los recursos del computador en otras tareas
- La optimización se realiza en la nube permitiendo una muy rápida obtención de resultados (solo minutos)

Conclusiones



- Incorpora conceptos económicos para agregar valor al proyecto (NPV, Inyección Dinámica de Capital, Precios y Costos variables en el tiempo, etc.)
- Incorpora conceptos mineros para generar planes operativos y factibles (numero de bancos por periodo, Sinking Rate, blending, etc.)
- Si el usuario pierde la configuración que realizó la puede recuperar desde el resultado
- No es solo datos numéricos (o planilla Excel), también hay gráficas que apoyan el entendimiento y desarrollo de los problemas
- Una gran variedad de reportes y animaciones
- Muy fácil de configurar
- Muy fácil de aprender
- Directa interacción con Vulcan

Conclusiones



- LO MÁS IMPORTANTE es que al ser fácil de configurar y rápido al obtener resultados **permite al usuario gastar su tiempo en el análisis de múltiples resultados** y no en la configuración del modelo



Gracias!!!

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