Datamine Solutions for Industrial Minerals and Construction Materials, including Dimension Stones.

DATAMINE

Datamine Overview

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Global Presence

- 250 staff in 12 countries
- Canada, USA, Peru, Chile, Mexico, Brazil, Australia, South Africa, India, UK, Russia

Extensive Customer Base

- Spans large and small mining companies and service providers in more than 90 countries
- Added 200 sites in year to March 2014

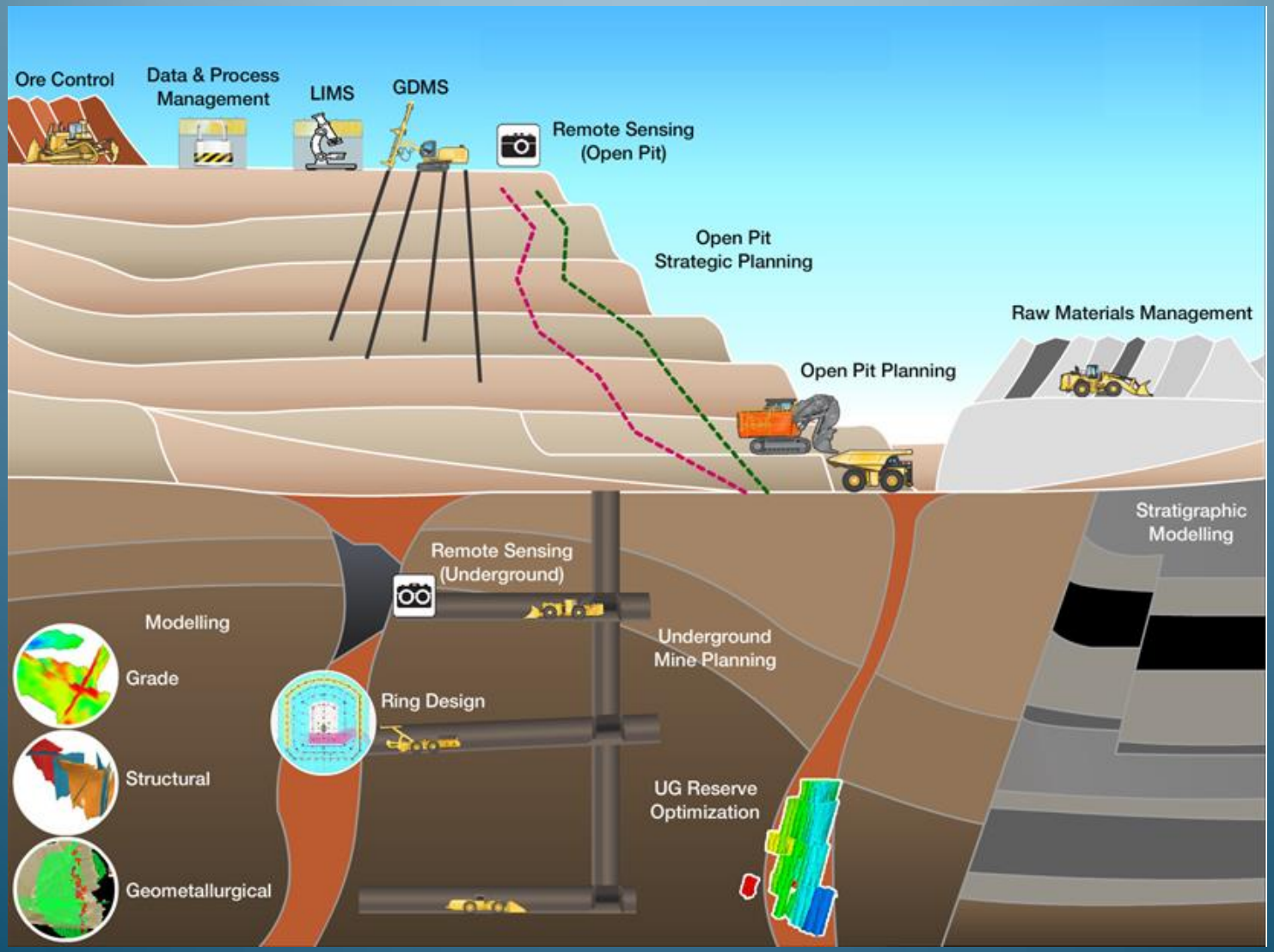
Comprehensive Solution Footprint

- Geology, mine planning and operations
- Trusted technology with a 30 year heritage in resource and reserve assessment

Complimentary Service Offerings

- Implementation
- Training
- Technical consulting

Software & Services Landscape



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Datamine: Industrial Minerals and Construction Materials, including Dimension Stones

Function	Product
Exploration and Resource Modelling & Estimation	Studio EM
Mine Design and Production Scheduling	Studio OP
	Studio 5D Planner (Underground)
Visualisation	InTouch Go or 3D PDF
Geotechnical Modelling	Sirovision

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Solution : Exploration, Resource Modelling & Estimation

Function	Product
Exploration and Resource Modelling & Estimation	Studio EM

Datamine's resource modelling systems deliver robust geological models for large and small mines across the full range of commodities and deposit types. These flagship products set the industry standard in this field with proven algorithms developed and refined over 30 years. Utilized by the world's major mining houses and consulting firms for the public reporting of resources and reserves, our resource modelling systems are robust, reliable and trusted globally.

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Solution : Studio EM

Datamine Studio EM is tailor made to meet the needs of exploration geologists. Leveraging the base technology of Datamine's hugely successful Studio software series, Studio EM includes point and string editing, wireframing, basic block modelling and estimation functionality as well as the ability to dynamically link to an existing drillhole database. Studio EM also has a full set of plotting functionality for producing section plots, plan plots, strip logs and reports as well as comprehensive 3D viewing and the option to publish 3D pdf files.

- Resource and reserve modelling is the process of using geological and assayed data from a mineral deposit to determine its prospects for economic extraction.
- The data available to a resource modelling study often comes from a variety of sources, can be disparate in its nature and has frequently been obtained at different times.
- Studio provides a rich environment within which to manage this data.
- Studio contains many useful functions; it is not practical to describe all of these in a single presentation.

Resource Modelling

- The main phases of a resource modelling study typically include:
- Drillhole and Sample Processing
- Statistical and Geostatistical Analysis
- Geological Interpretation and Structural Modelling
- Grade Estimation and Validation
- Resource Classification and Reporting

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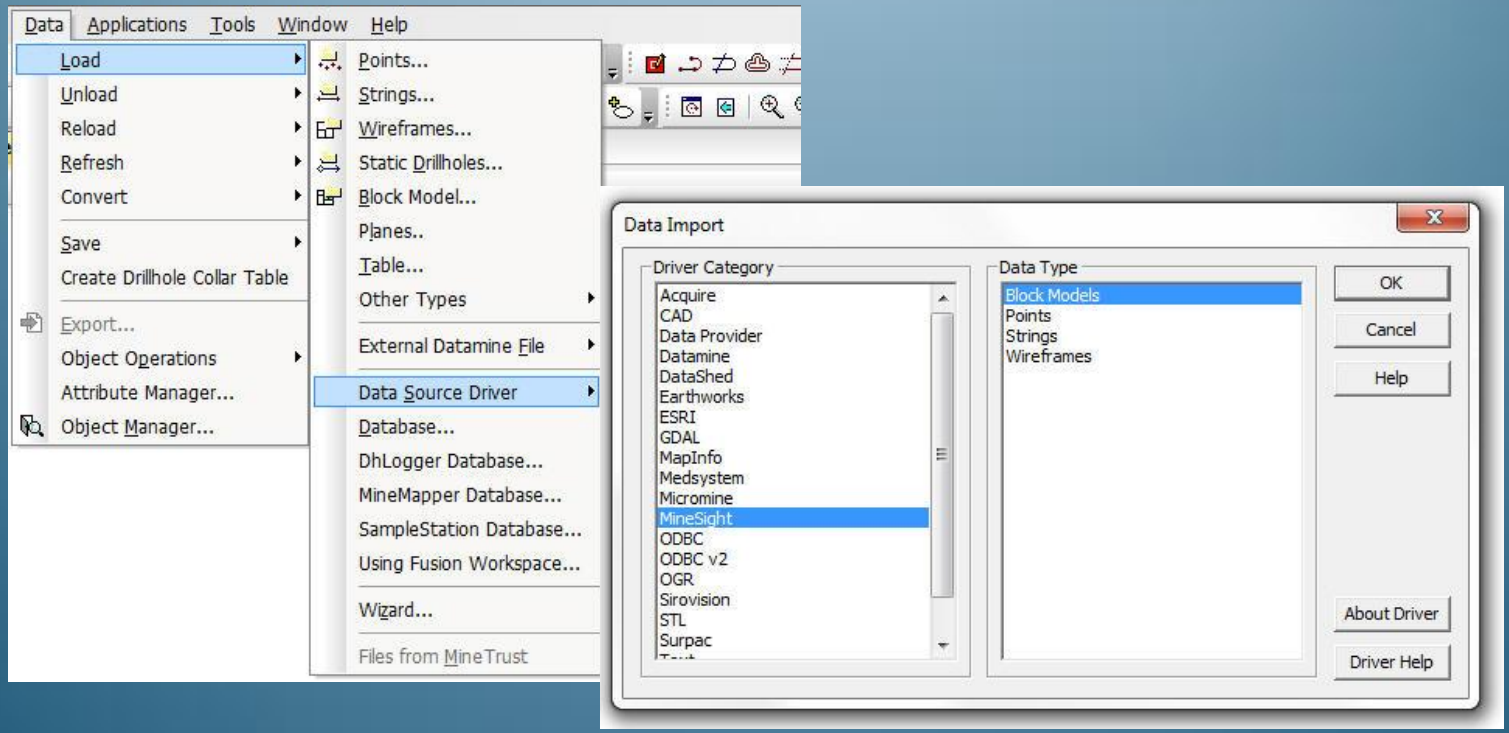
Data Import



Studio's drillhole data import is fast and flexible

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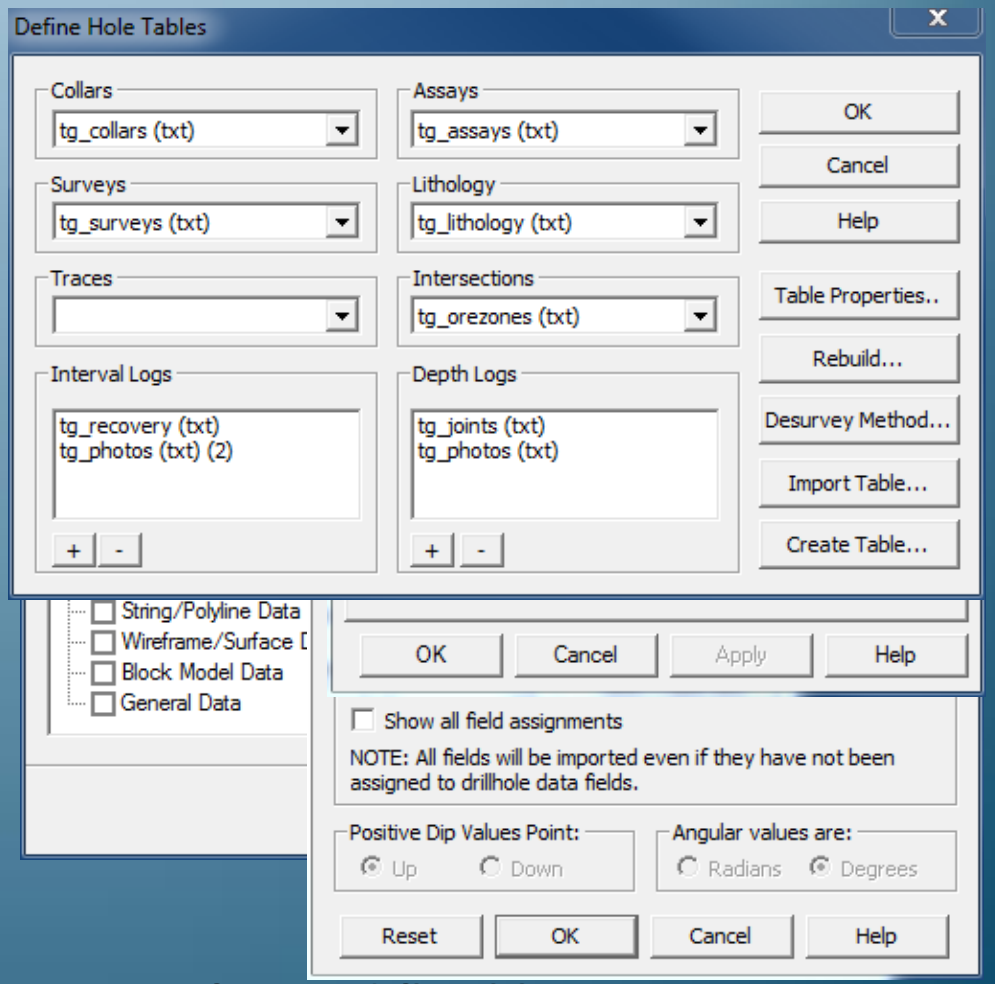
Drillhole Processing

An easy to use wizard allows data to be imported from a wide range of file and database formats

Matching the imported data to required information is straightforward

Alternative options for desurveying (locating hole samples in 3D space) are available

More tables can be defined as required



Studio's drillhole data import is fast and flexible

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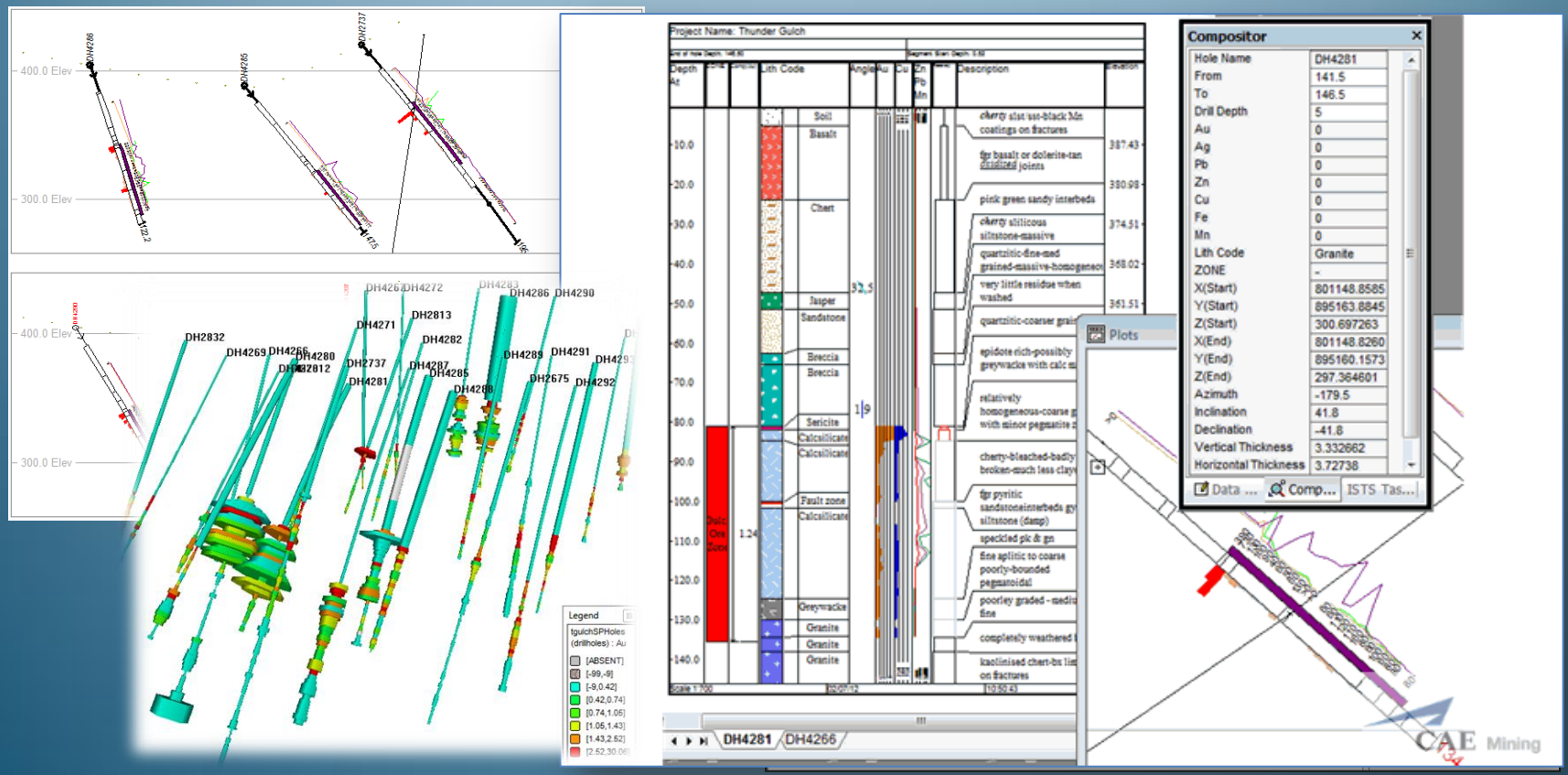
Drillhole and Sample Processing



Data is shared between 3D views, sections and logs

Simultaneous ways of visualizing and dynamically selecting data allows for rapid visual analysis

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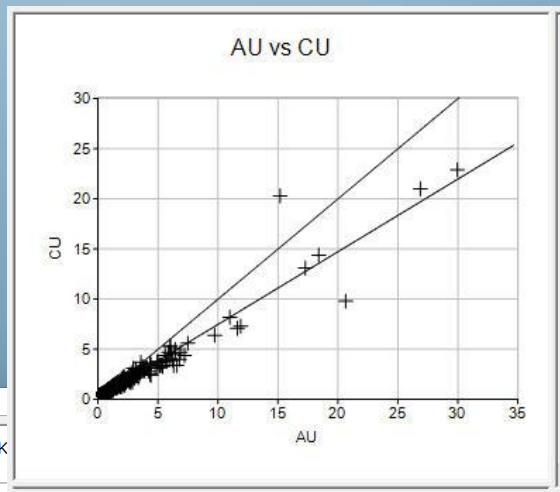
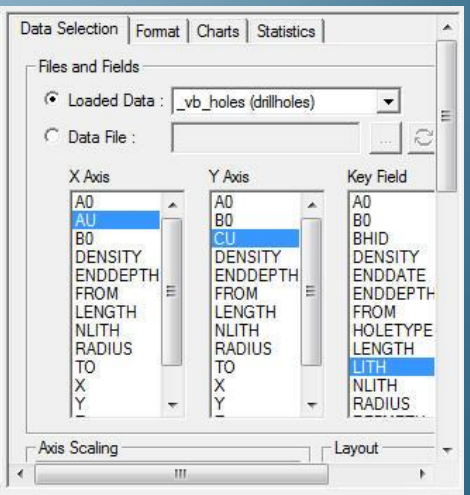
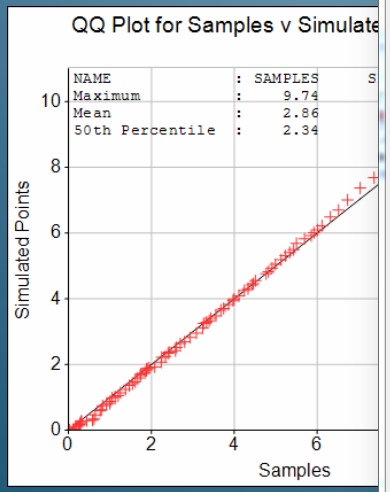
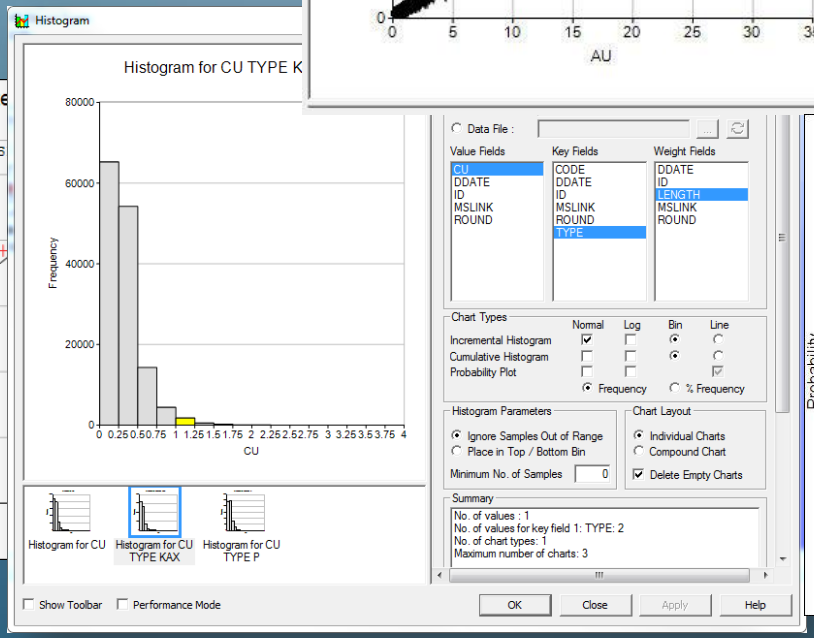
Statistical Analysis

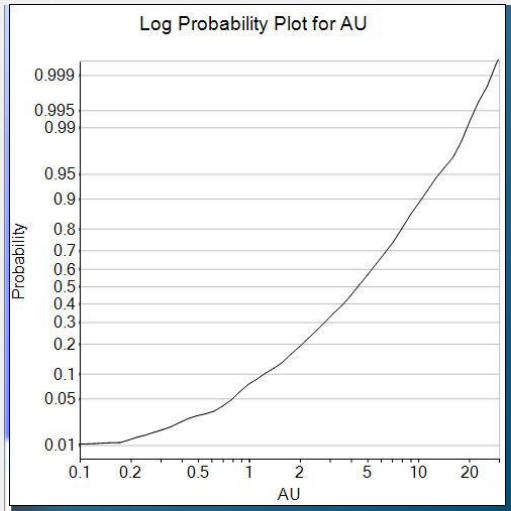
Easy to produce charts such as scatter plots and histograms help you to quickly understand the raw data's characteristics



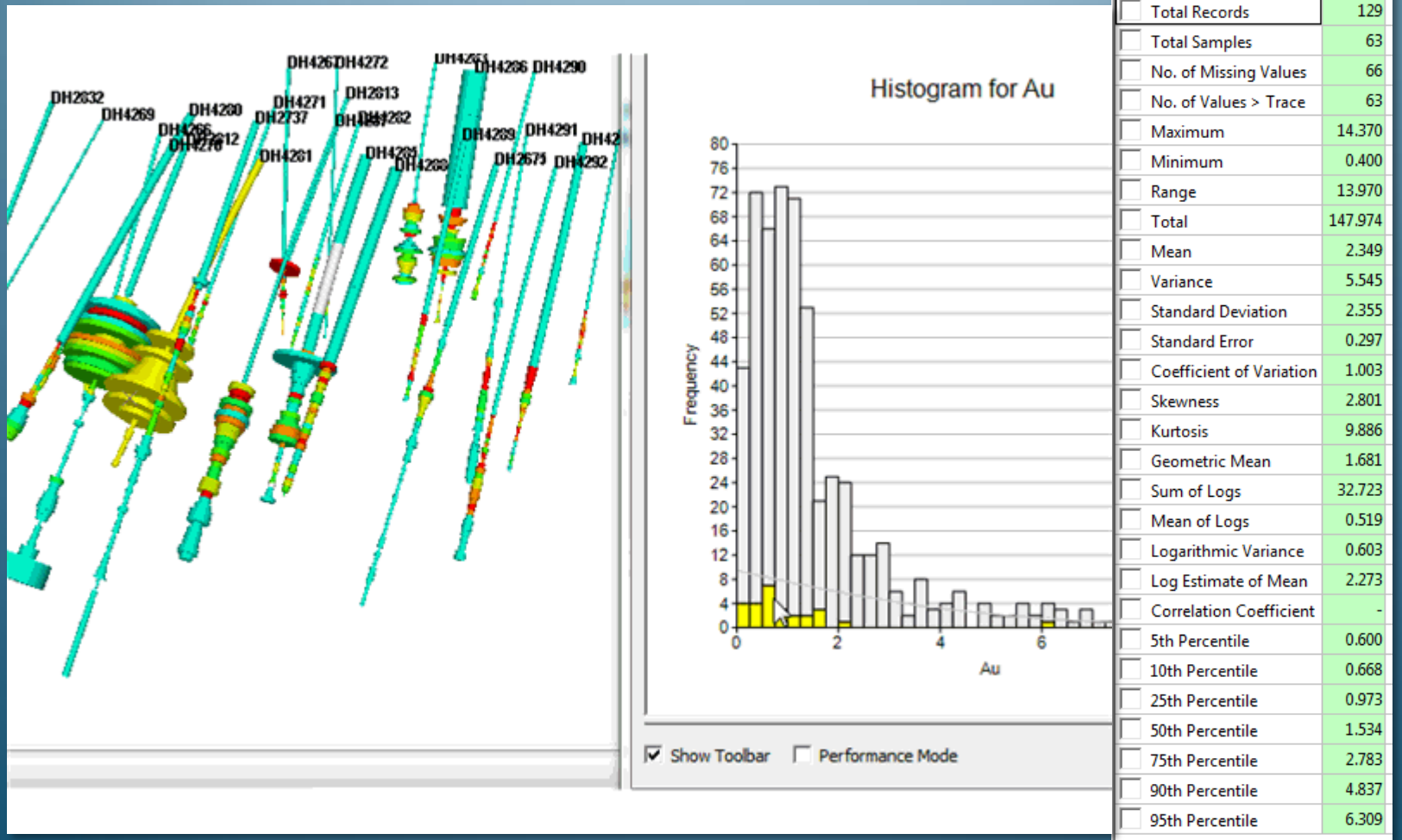








Statistical Analysis – Linked Windows



NAME	VALUE
Total Records	129
Total Samples	63
No. of Missing Values	66
No. of Values > Trace	63
Maximum	14.370
Minimum	0.400
Range	13.970
Total	147.974
Mean	2.349
Variance	5.545
Standard Deviation	2.355
Standard Error	0.297
Coefficient of Variation	1.003
Skewness	2.801
Kurtosis	9.886
Geometric Mean	1.681
Sum of Logs	32.723
Mean of Logs	0.519
Logarithmic Variance	0.603
Log Estimate of Mean	2.273
Correlation Coefficient	-
5th Percentile	0.600
10th Percentile	0.668
25th Percentile	0.973
50th Percentile	1.534
75th Percentile	2.783
90th Percentile	4.837
95th Percentile	6.309

Select data dynamically in either 3D or chart views to see the highlighted data in the other view.

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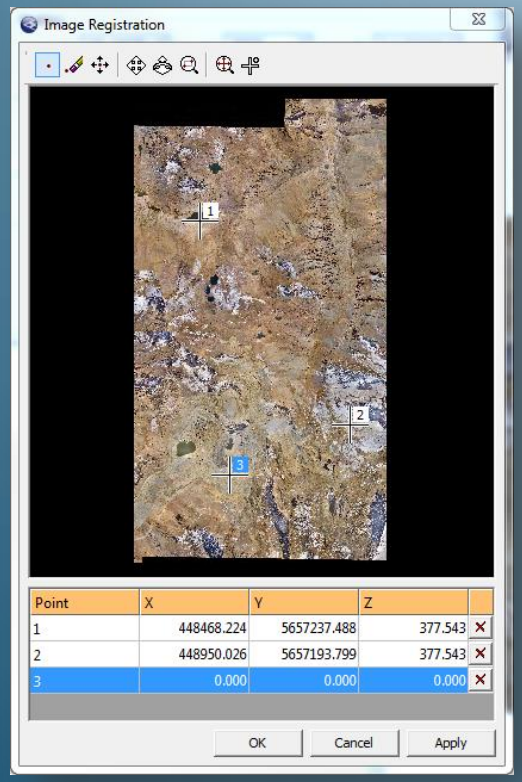
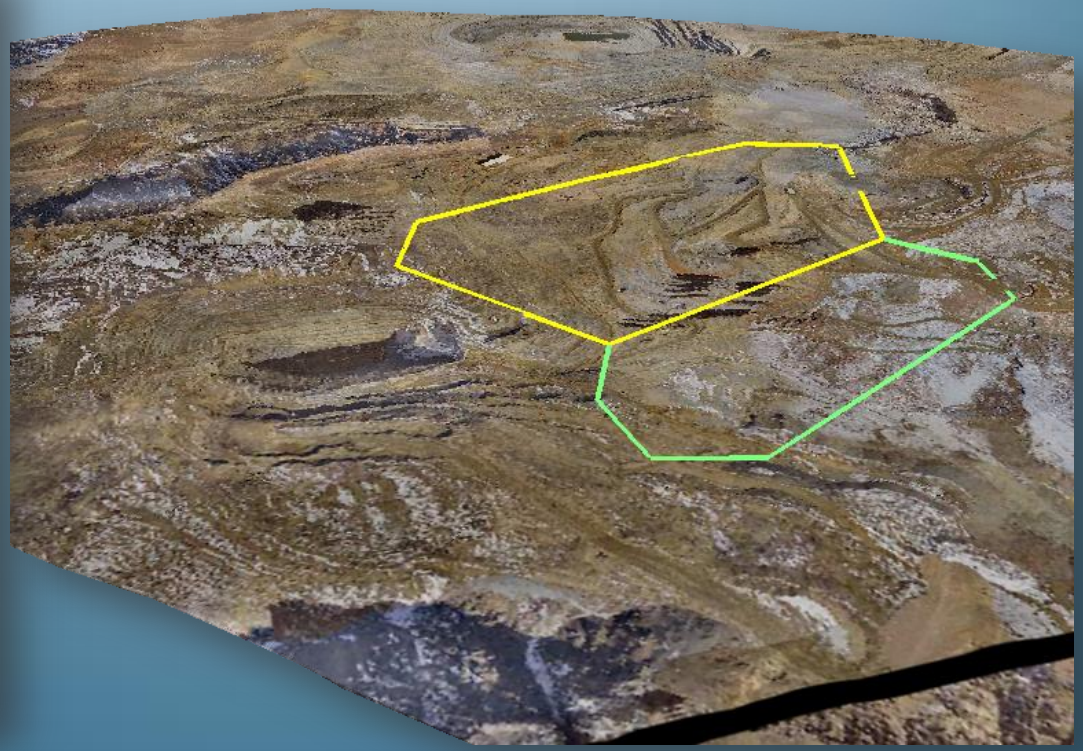
Image Draping and Registration





Correlation of data with surface imagery is easy. Studio automatically recognises a wide range of geo-referenced image formats or an easy to use tool is available for manual image registration.

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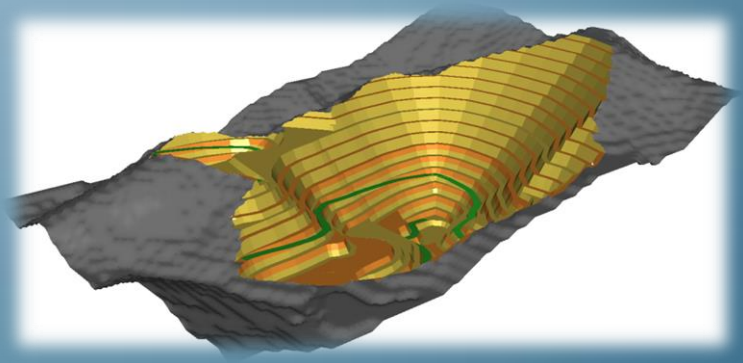
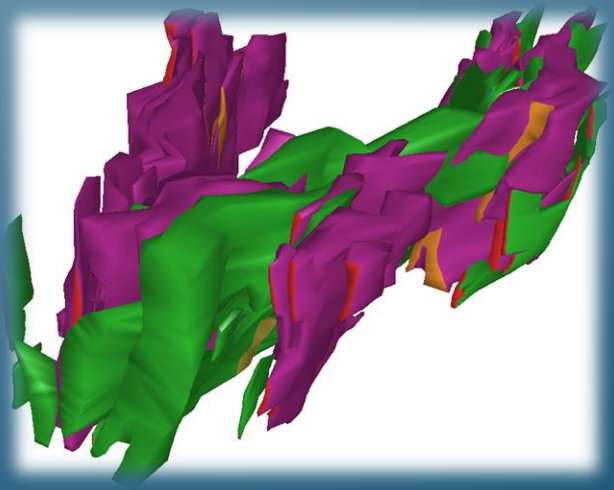
Structural and Volumetric Modelling

An accurate resource model will include boundaries of different geological structures and features, particularly those that affect the economics of its extraction or processing.

Boundaries can be used to model:

- Surface topographies
- Mineralization
- Structures (faults, dykes etc.)
- Lithology
- Weathering
- Existing voids





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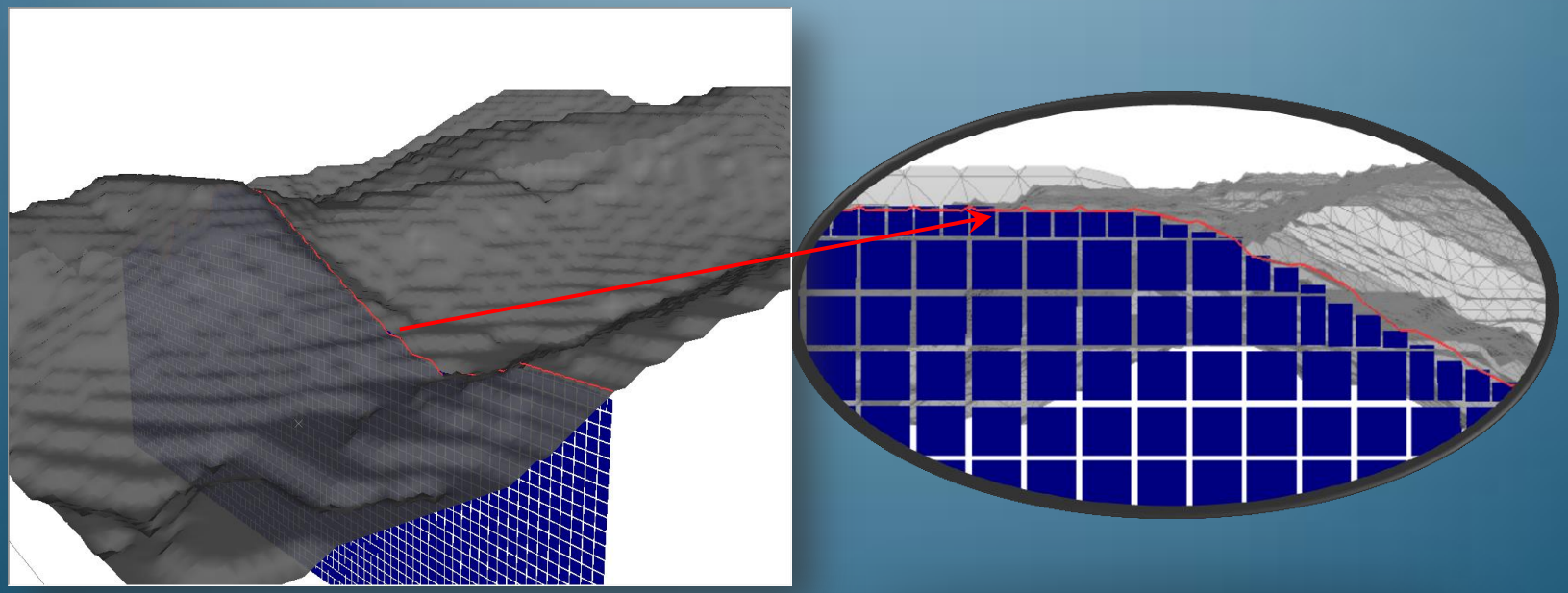
Structural and Volumetric Modelling

For continuous properties such as grade to be modelled accurately in the same object as structure block models are used.

Where required sub cells are used to accurately model boundaries.



Grade Estimation

In addition to structure, the cells in a resource model contain values of other parameters. Parameters can be text or numeric and can represent almost anything …:

- Grades
- Material Qualities
- Geotechnical parameters (e.g. blastability)

Studio contains a range of geostatistical functionality for interpolating values of parameters into models

Grade Estimation

The following estimation methods are available:

- Nearest Neighbour
- Inverse Power of Distance

Available variogram models are:

- Spherical (single or multiple structures)
- Exponential
- Gaussian

Multiple grades can be interpolated in a single estimation run using multiple methods and multiple dynamically expandable search volumes

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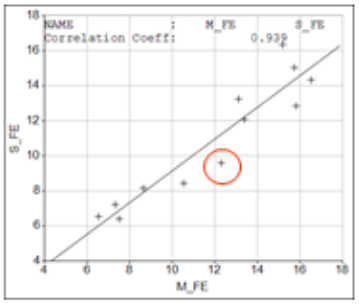
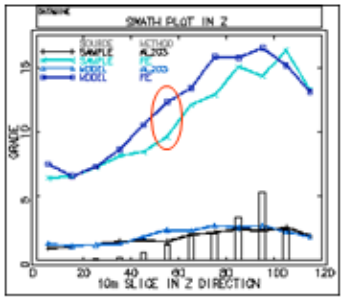
Model Validation and Reports

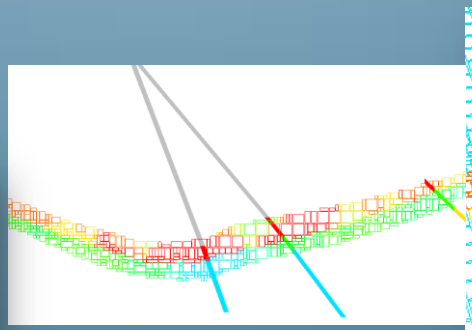
Interpolated model grades can be compared with sample data using graphical and tabular options

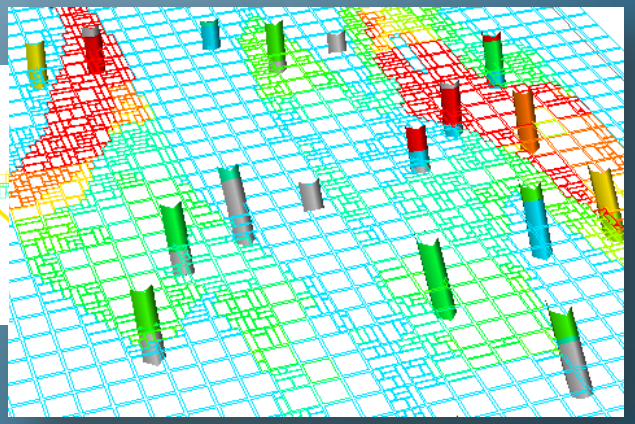
Comparisons can be made either globally or for selected subsets of the data

SOURCE (A12)	FIELD (A8)	NSAMPLES (N)	MEAN (N)	STANDDEV (N)	SKEW
SAMPLES	AU1	2080	2.38	1.61	
5mCOMPS	AU1	832	2.38	1.44	
10mCOMPS	AU1	416	2.38	1.34	
MODEL	OK_1	2413	2.4	1.17	
MODEL	ID_1	2413	2.41	1.18	
MODEL	NN_1	2413	2.43	1.68	
MODEL	NNC_1	2413	2.41	1.39	

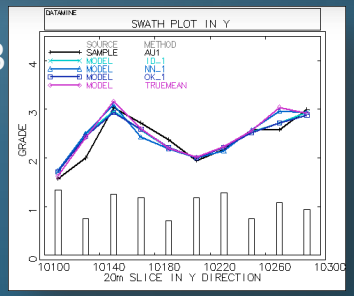








Comparison of Fe and Al2O3
Correlation coefficient
Samples: 0.848
Model: 0.852



Resource Evaluation

- Once you have a resource model it can be used to determine the economic viability of different extraction strategies
- Boolean and solid manipulation commands can be used to generate possible mining shapes. Evaluation of these can be done interactively or procedurally
- Processes also exist to slice models on key fields and output results tables that can be further processed.

Studio has a wide range of functionality for evaluating the contents of resource models and for considering alternative mining strategies

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Dynamic Evaluation

One example of evaluating shapes is to use outlines

Name	Mode
ZONE	Dominant Value
CU	Tonnes Weighted
AU	Tonnes Weighted

Tonnes Weighted
Volume Weighted
Field Weighted
Accumulated

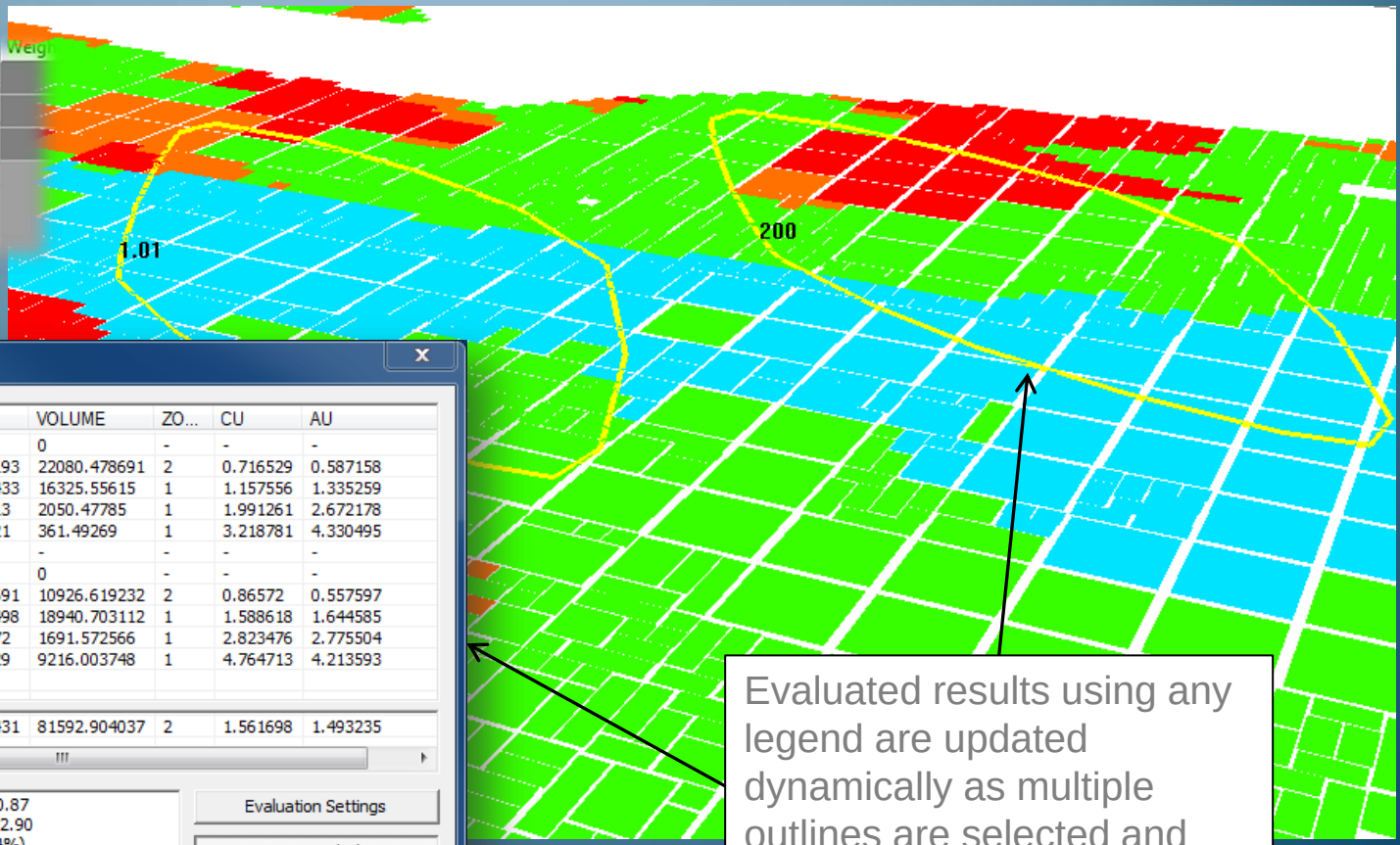

Table View

CATEGORY	BLOCK...	DENSITY	TONNES	VOLUME	ZO...	CU	AU
[ABSENT]	1.01	-	0	0	-	-	-
Low	1.01	3.389558	74843.064193	22080.478691	2	0.716529	0.587158
Marginal	1.01	3.472732	56694.274433	16325.55615	1	1.157556	1.335259
Medium	1.01	3.278327	6722.137113	2050.47785	1	1.991261	2.672178
High Grade	1.01	3.289674	1189.193021	361.49269	1	3.218781	4.330495
-	-	-	-	-	-	-	-
[ABSENT]	200	-	0	0	-	-	-
Low	200	3.452344	37722.453691	10926.619232	2	0.86572	0.557597
Marginal	200	3.373399	63894.541498	18940.703112	1	1.588618	1.644585
Medium	200	3.370934	5702.180072	1691.572566	1	2.823476	2.775504
High Grade	200	3.341861	30798.60029	9216.003748	1	4.764713	4.213593
Totals:	-	3.401845	277566.44431	81592.904037	2	1.561698	1.493235

Combine Block Results
Color Results
Save Results

Estimated Volume = 81710.87
Calculated Volume = 81592.90
Difference = 117.97 (0.14%)

Evaluation Settings
Dynamic Recalculation
Recalculate Now

Evaluated results using any legend are updated dynamically as multiple outlines are selected and edited.

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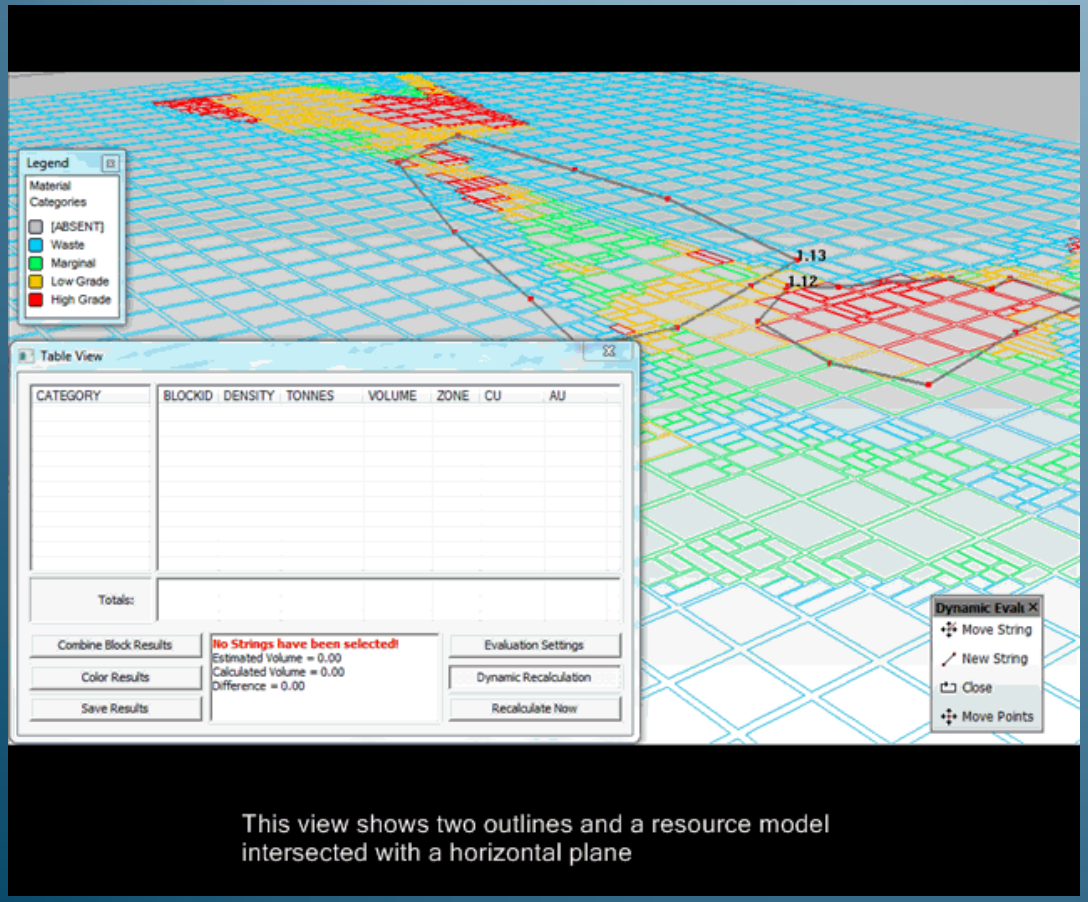
Dynamic Evaluation: Example



This view shows two outlines and a resource model intersected with a horizontal plane

Any set of 3D shapes defined by open or closed wireframes and/or outlines can be evaluated against a block model.

This example shows how 3D shapes defined by outlines together with up and down projection distances can be evaluated.

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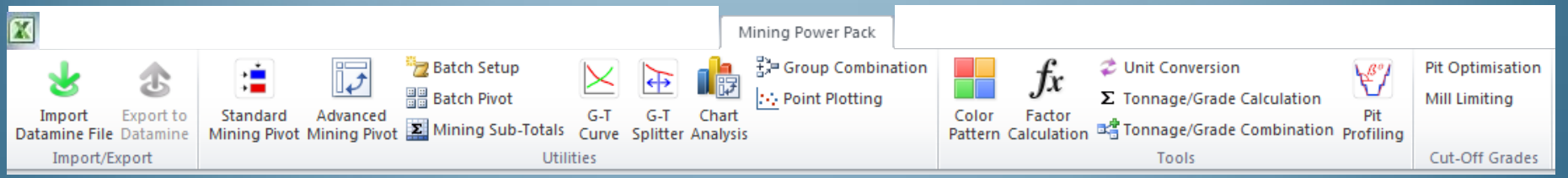
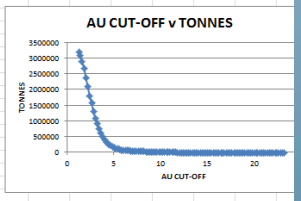
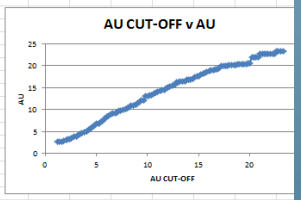
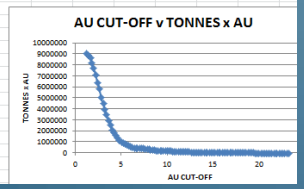
Results Analysis: The Mining Power Pack



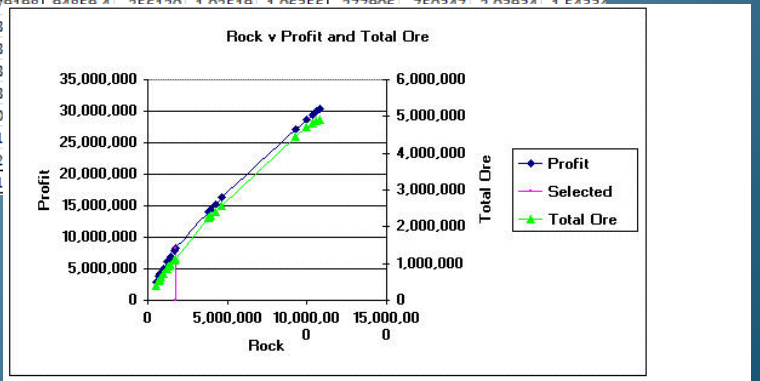
AU CUT-OFF	TONNES	AU	TONNES x AU	TONNES %	TONNES x AU %
1.2	3182836.8	2.8371904	9030314	100%	100%
1.4000001	3089391.8	2.8833025	8907651	97%	99%
1.6000001	2885372.8	2.9803393	8599390	91%	95%
1.8000002	2665575.8	3.0854261	8224437	84%	91%
2.0000002	2382286.8	3.2264977	7686442.5	75%	85%
2.2000003	2092711.3	3.3829429	7079522.5	66%	78%
2.4000003	1806342.5	3.5545979	6420821	57%	71%
2.6000004	1588950.3	3.6993825	5878135	50%	65%
2.8000004	1283597.3	3.9379272	5054712.5	40%	56%
3.0000005	1088944	4.1245217	4491373	34%	50%
3.2000005	919012.5	4.3139267	3964552.5	29%	44%
3.4000006	756843.75	4.5322952	3430239.25	24%	38%
3.6000006	619734.38	4.7601204	2950010.25	19%	33%
3.8000007	506925	5.0004225	2534839.25	16%	28%
4.0000005	398967.19	5.3019028	2115285.25	13%	23%
4.2000003	334800	5.5335574	1852635	11%	21%
4.4000001	269915.63	5.8326459	1574322.25	8%	17%
4.5999999	218362.5	6.1450386	1341846	7%	15%
4.7999997	174360.94	6.51262	1135546.5	5%	13%
4.9999995	144028.13	6.853776	987136.5	5%	11%
5.1999993	127237.5	7.0853019	901516.125	4%	10%
5.3999991	109771.88	7.3710155	809130.188	3%	9%
5.599999	95343.75	7.6530323	729668.813	3%	8%
5.7999988	74587.5	8.1984377	611500.938	2%	7%
5.9999986	67668.75	8.4304552	570478.375	2%	6%
6.1999984	58218.75	8.809495	512877.781	2%	6%
6.3999982	52818.75	9.066761	478894.969	2%	5%
6.599998	48051.563	9.3197298	447827.594	2%	5%
6.7999978	45857.813	9.4448509	433120.219	1%	5%
6.9999976	43621.875	9.5763187	417736.969	1%	5%
7.1999974	39993.75	9.8008575	391973.031	1%	4%
7.3999972	38010.938	9.9307823	377478.344	1%	4%
7.599997	35606.25	10.093706	359399.031	1%	4%
7.7999969	33834.375	10.219185	345759.719	1%	4%
7.9999967	30796.875	10.440993	321549.969	1%	4%
8.1999969	28307.813	10.647665	301412.094	1%	3%
8.3999968	24764.063	10.987265	272089.313	1%	3%
8.5999966	23540.625	11.114396	261639.828	1%	3%
8.7999964	21853.125	11.300487	246950.953	1%	3%
8.9999962	18604.688	11.732936	218287.609	1%	2%
9.199996	17887.5	11.838563	211762.297	1%	2%
9.3999958	14976.563	12.333994	184720.828	0%	2%
9.5999956	14807.813	12.367229	183131.609	0%	2%
9.7999954	11517.188	13.123037	151140.484	0%	2%







	ZONE											
	1				2				TOTALS			
BENCH	VOLUME	TONNES	AU	CU	VOLUME	TONNES	AU	CU	VOLUME	TONNES	AU	CU
-60					3437.5	9281.25	2.2514	2.05923	3437.5	9281.25	2.2514	2.05923
-50					45734.4	123483	2.09282	1.94317	45734.4	123483	2.09282	1.94317
-40	5703.13	15398.4	3.87031	3.07604	117953	318473	1.48185	1.4901	123656	333872	1.592	1.56324
-30	48593.8	131203	4.33743	3.48014	203109	548395	1.15339	1.20297	251703	679598	1.7681	1.6426
-20	107625	290588	3.89822	3.18576	297172	802364	1.01667	1.06167	404797	1092951	1.7828	1.62641
-10	175750	474525	2.78955	2.44264	305875	825863	0.93786	1.00258	481625	1300387	1.61357	1.52807
0	199438	538481	2.48061	2.11152	266906	720647	0.94187	1.01548	466344	1259128	1.59993	1.48421
10	226609	611845	2.41492	1.87624	154984	418458	1.00613	1.06575	381594	1030303	1.84274	1.54706
20	183047	494227	2.56489	1.79198	94859.4	256129	1.02518	1.06356	277906	750247	2.02934	1.54334
30	105203	284048	2.59293	1.8								
40	74500	201150	2.6406	1.8								
50	54421.9	146939	2.57481	1.8								
60	32062.5	86568.8	2.54578	1.8								
70	10703.1	28898.4	2.87385	2.0								
80	4828.13	13035.9	3.07071	2.1								
90	1250	3375	3.29909	2.2								
TOTAL	1229734	3320283	2.76083	2.1								



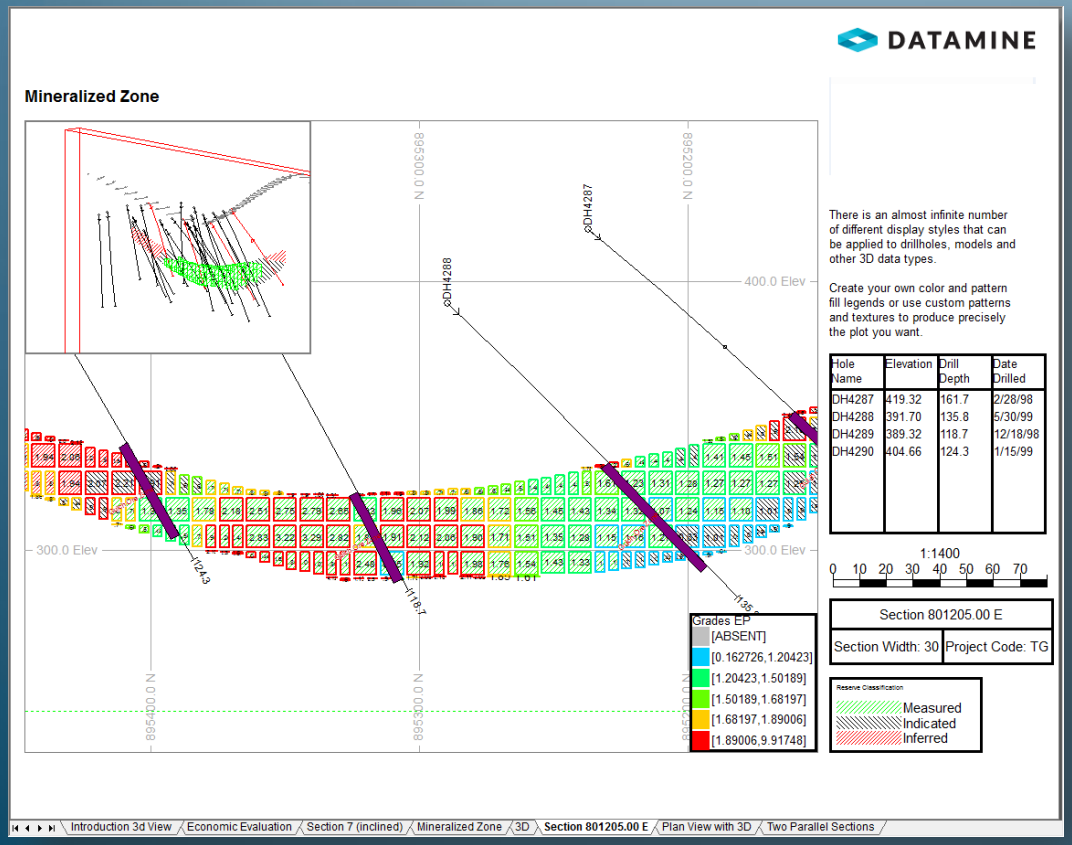
Profit	Rock	Total Ore	Total Waste	Strip	AG Recov.	PB Recov.	ZN Recov.	10
$	tonnes	tonnes	tonnes		grams	tonnes	tonnes	
0	1758760							
8,289,700	1,758,760	1,130,513	628,247	0.56	7,132,800	12,427	22,166	Data Selected
23,437,925	10,365,817	4,804,245	5,561,572	1.16	24,772,907	58,262	30,611	Reference Data - Last
	17%	24%	11%	48%	29%	21%	24%	Proportion of Reference
	83%	76%	89%	52%	71%	79%	76%	Relative Difference

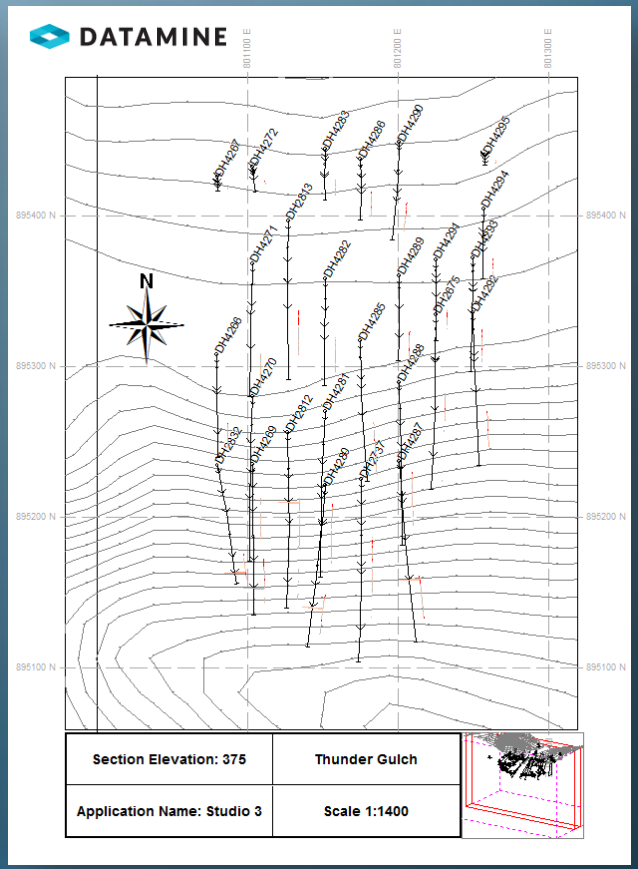
Studio comes with a powerful Excel plug in for analysing results files in more detail

DATAMINE

Presentation

Studio has completely integrated plotting functionality. Templates for layouts and default formatting makes it easy to use plotting for operational output as well as during resource and reserve studies.



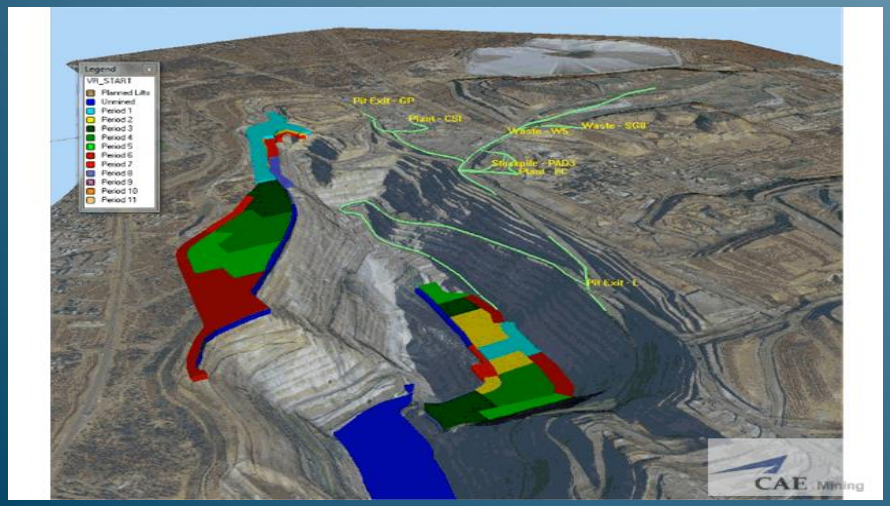


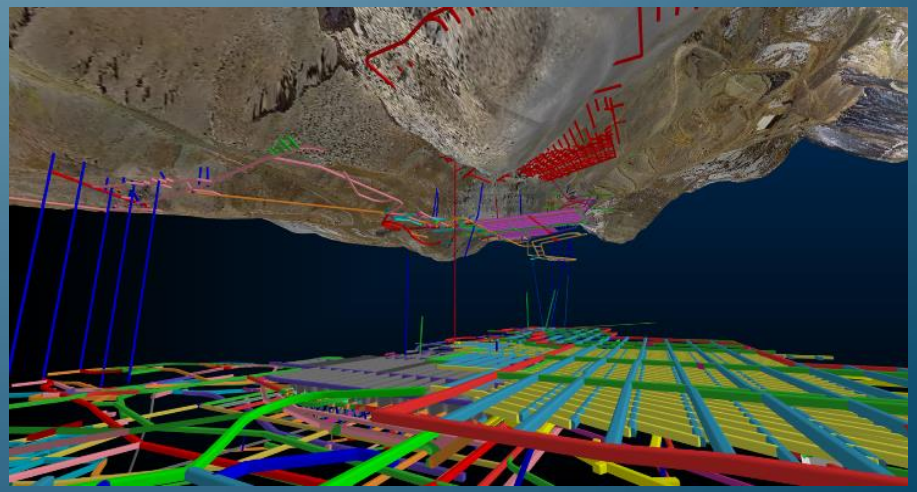
Solution : Mine Design and Production Scheduling

DATAMINE

Function	Product
Mine Design and Production Scheduling	Studio OP
	Studio 5D Planner (UG)

Datamine provides a full range of Mine planning applications from strategic long term optimization, Mine design and reserve generation through to short term material destination and operational equipment scheduling. This integration ensures robust strategic plans are executed reliably on the ground. With powerful animations and a range of other visual and numerical output formats, communicating plans throughout your organization is a breeze.





Open Pit Solution Overview

Datamine Software open pit planning solution incudes the following desktop and web based applications:

- Complete strategic pit planning package covering pit optimization, pushback generation, cut-off grade optimization, scheduling, haulage optimization and stockpile management
- Highly visual and interactive complete design and scheduling package for medium to short term planning
- Strategic risk analysis package understanding the main economic drivers by performing sensitivity analysis and the probability of achieving certain economic and mining outcomes using simulation

DATAMINE

StudioOP Functionality Overview

- Deriving from strategic / long term schedule (for example NPV Scheduler or RM Scheduler)
- Equipment allocation and tracking
- Detailed haulage analysis
- Dump & Stockpile design, sequencing and scheduling
- Stockpile management
- 3D graphical presentation tools
- Charting tools to monitor results
- Export to Excel, CSV and EPS
- Gantt chart reporting in EPS

Added Values

- Easy to use and flexible detail
- Emphasis on interactive graphics
- Results are practical/realistic
- Easy to detect bottlenecks

Activity Based Planning

DATAMINE

StudoOP Methodology

Inputs

- Mining Blocks
- Reserves

Setup

- Calendars
- Machines
- Haul Trucks
- Haul Routes
- Targets
- Activities/Process Flow

Schedule

- Block Schedule
- Process Flow

Reporting

- Excel™
- EPS Gantt Chart
- Animations
- Plots

	ID	Name	Description	Rate	Sta
		1		10000Tonnes/h	01/07/1
		Default		10000Tonnes/h	01/07/1
	ISTS_1	5000	50009_Default	10,000.0Tonnes/h	01/07/1
	ISTS_2	5002	50027_Default	10,000.0Tonnes/h	01/07/1
		2	50054_Default	10000Tonnes/h	02/07/1
		Default	50054_Default	10000Tonnes/h	02/07/1
	ISTS_3	5005	50054_Default	10,000.0Tonnes/h	02/07/1
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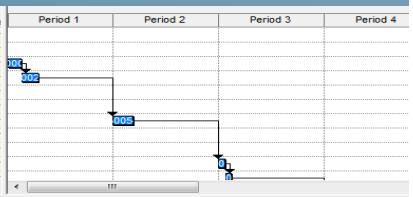
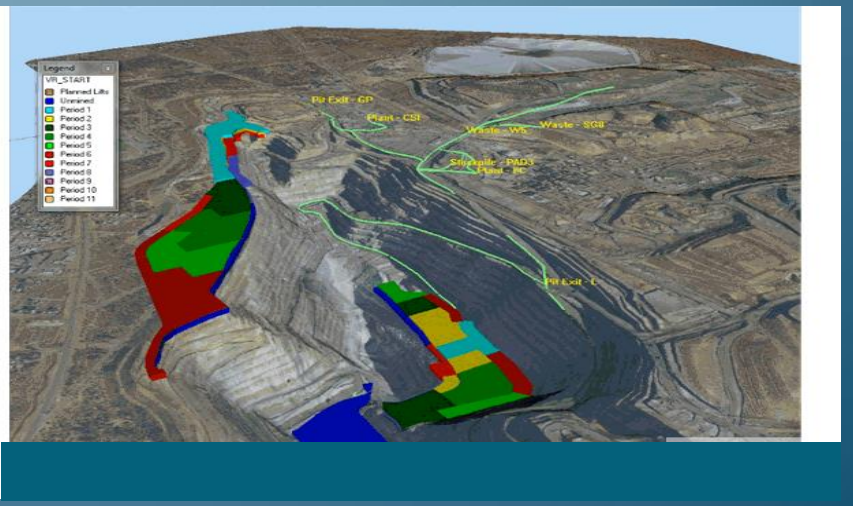
	ISTS_5	5003	50037_Default	10,000.0Tonnes/h	03/07/1



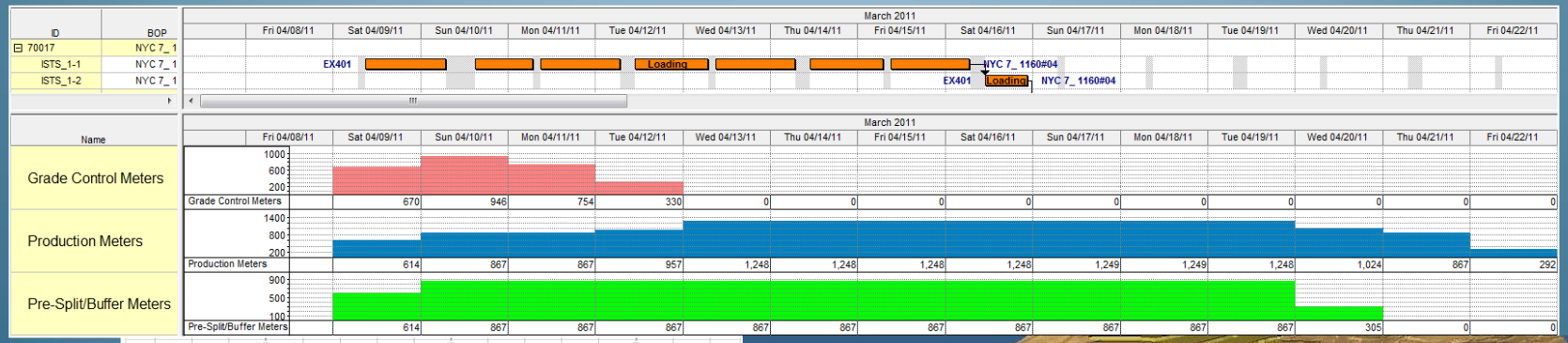
	Name	Description
	Tonnes	
	DRILL_M	
	BLAST_M	
	Density	
	Volume	
	AU	
	AUREC	
	TPH	

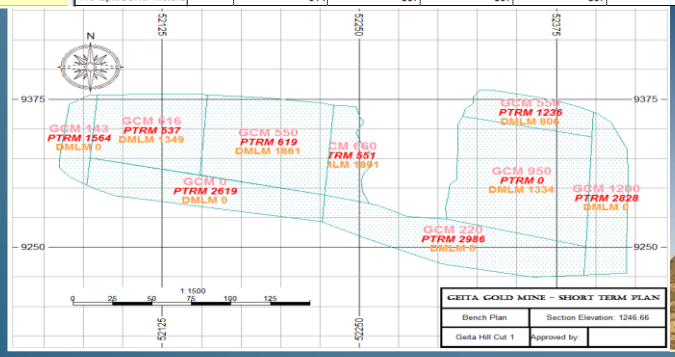
Period 1	Period 2	Period 3	Period 4
70,919	47,016	30,477	53,
2.86	2.89	2.94	
24,832.04	16,254.26	10,369.93	18,51
0.38	0.24	0.78	
41.20	29.21	69.31	5
395.53	248.30	678.80	45

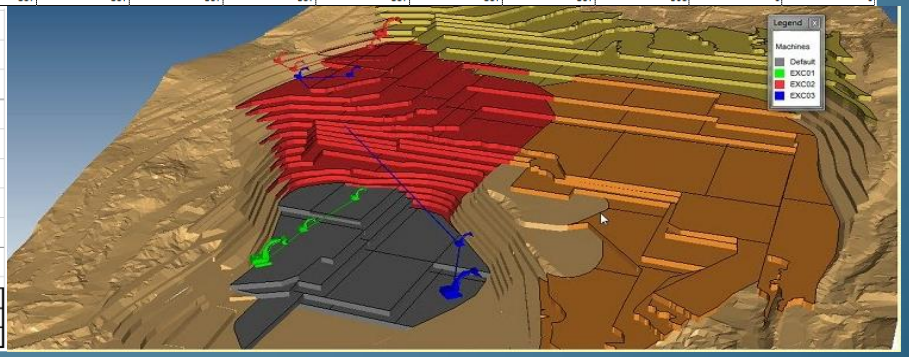


DATAMINE

Reporting





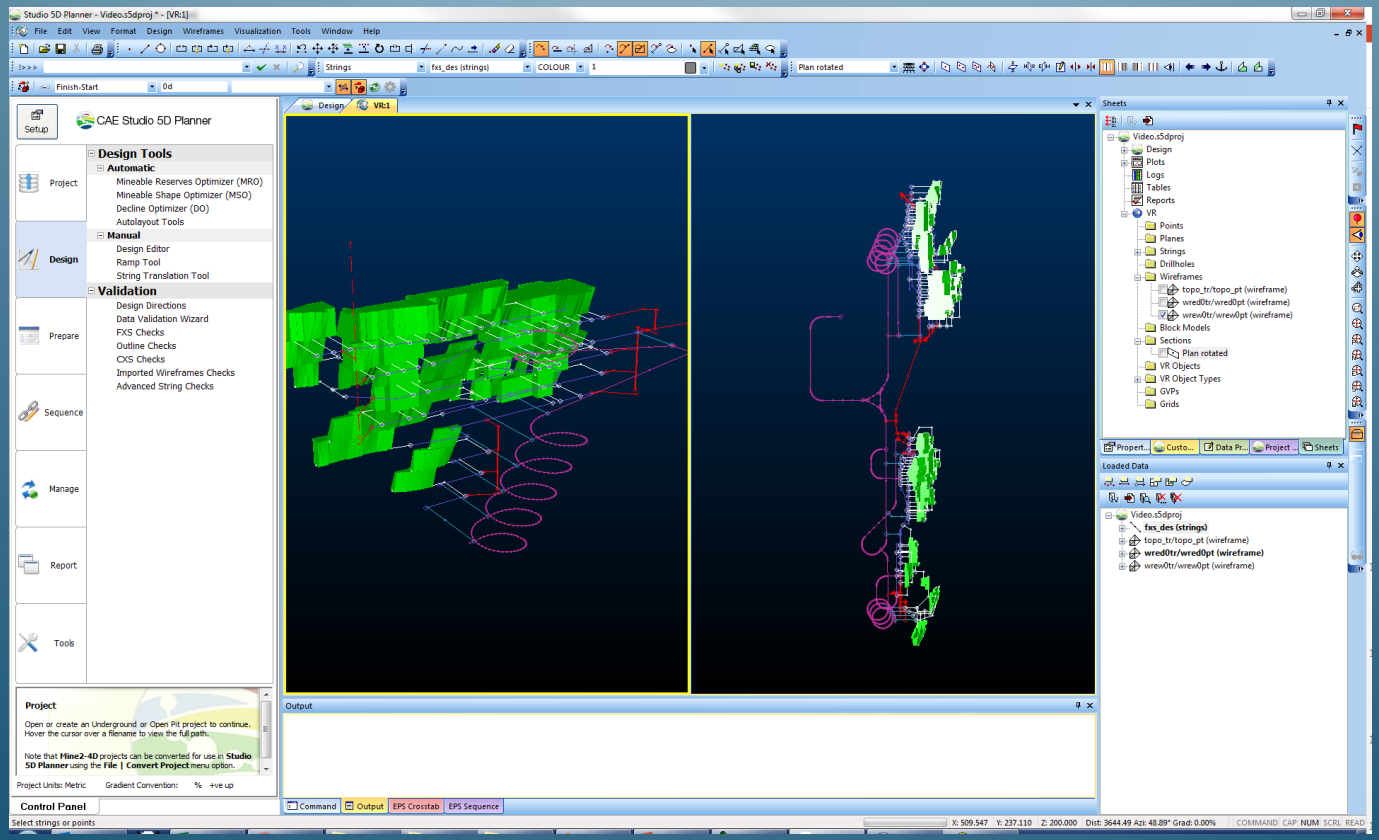


Reporting includes plans, sections, tables, animations, Gantt charts, and output to reporting tools such as Excel

DATAMINE

Studio5DP Planner

Design, Reserves, Sequencing

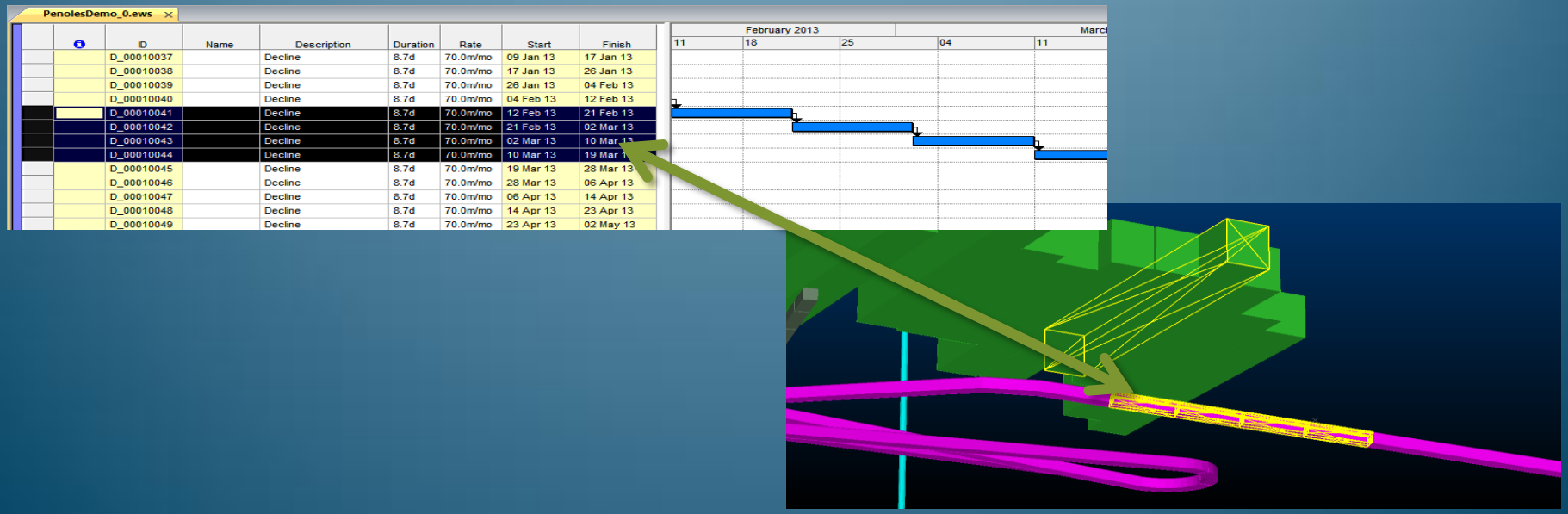


DATAMINE

Scheduling: EPS & InTouch

Adjust Schedule in EPS

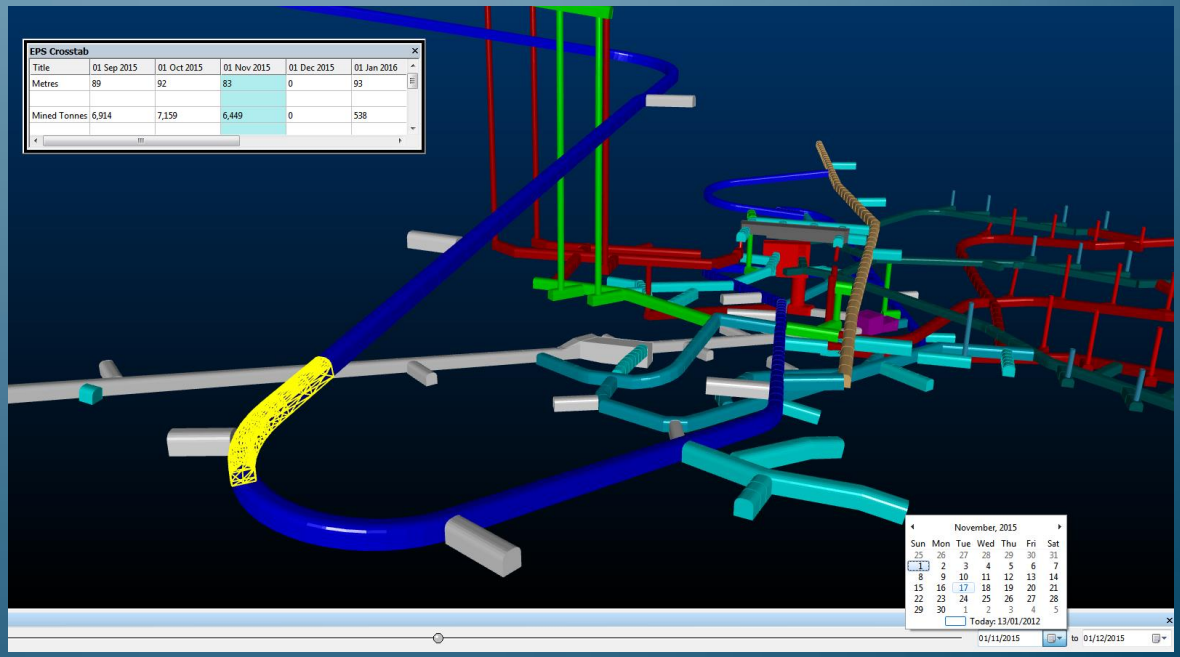
- Real-time selection and filtering of tasks
- Animation showing current sequence and schedule
- Create dependencies in either Gantt chart or visualizer



DATAMINE

Solution : 3D Visualisation

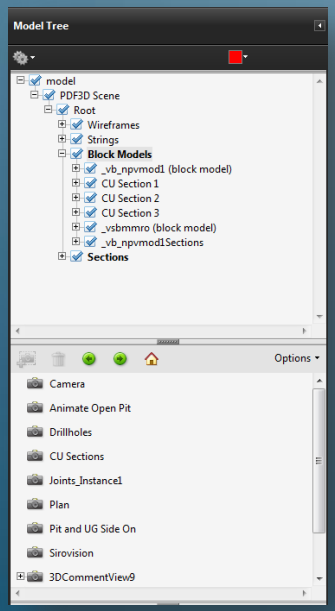
Function	Product
Visualisation	InTouch Go or 3D PDF

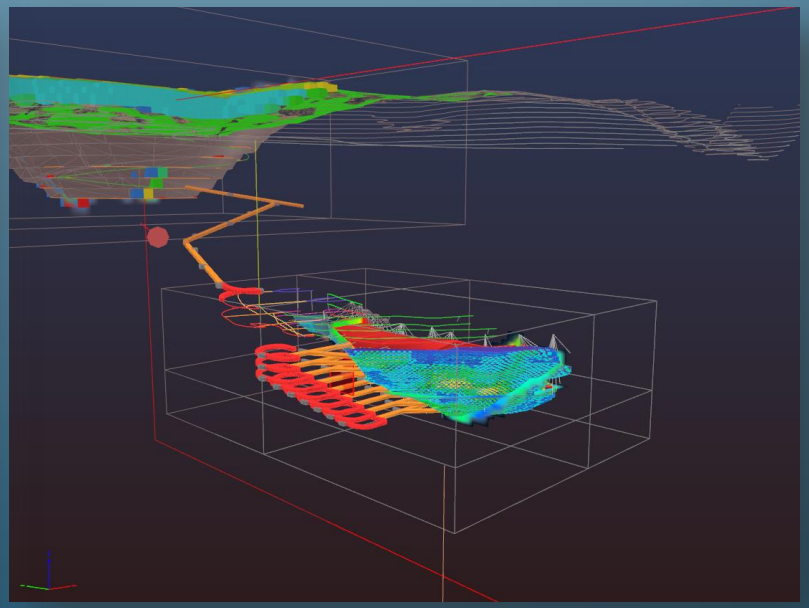


Export VR Window to Interactive PDF Document

The *Export to PDF3D* command allows you to save the content of the VR window to an interactive 3D document, which can then be used for publishing, sharing and viewing project data:

- export formats include *.pdf, *.u3d and *.prc
- an exported file which can be viewed using any PDF viewers e.g Adobe Reader
- file content which allows the interactive 3D viewing of data
- retention of labels, the VR folders and object names in the exported document
- a file which can be embedded in Word documents and PowerPoint presentations



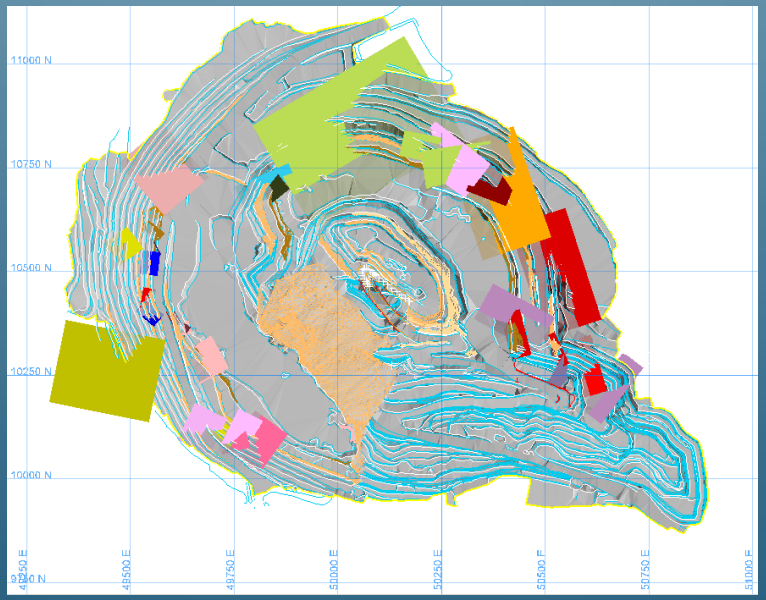


DATAMINE

DATAMINE

Solution : Geotechnical Modelling

Function	Product
Geotechnical Modelling	Sirovision



Sirovision

3D Model Generation:

Generates accurate, scaled 3D images of rock faces from stereo photographs taken in open pit and underground environments.

Geological & Geotechnical Mapping & Analysis

Enables structural mapping directly on to 3D surfaces with immediate geotechnical results.

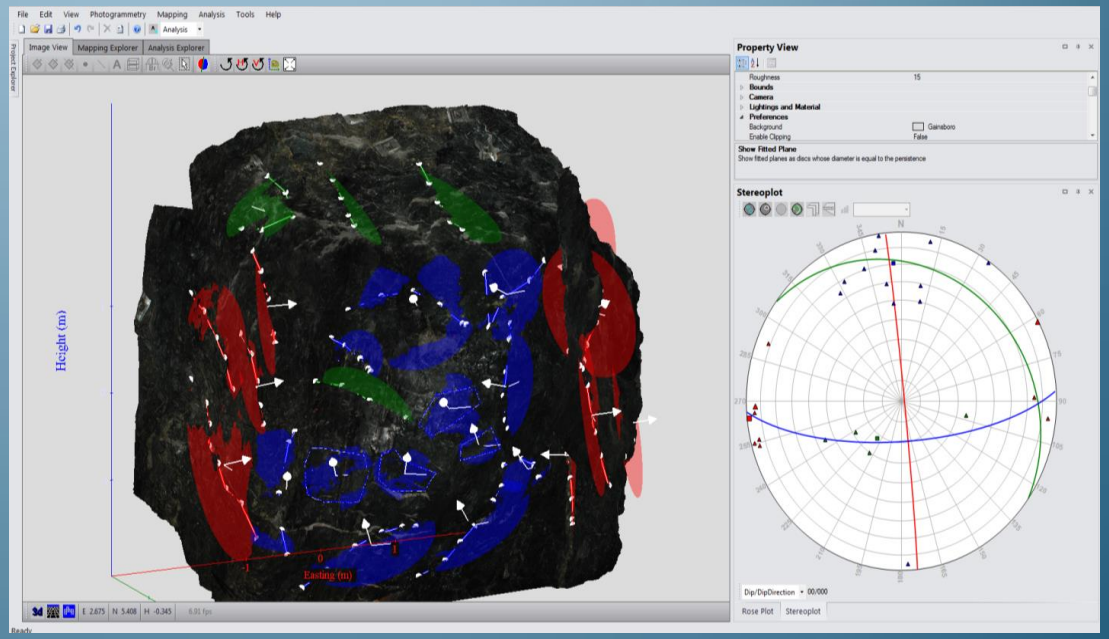
Discontinuity Set and Slope Stability Analysis

Seamless export of 3D images and structural data.

DATAMINE

Analysing Discontinuity Sets

- Add your own custom data.
- Define Analysis Sets using queries.
- Analyse sets on Spherical Projections and 3D Images simultaneously.
- Slope Stability Analysis tool detects wedges between joint sets.
- Display charts, histograms, tables and 3D models in reports.



DATAMINE

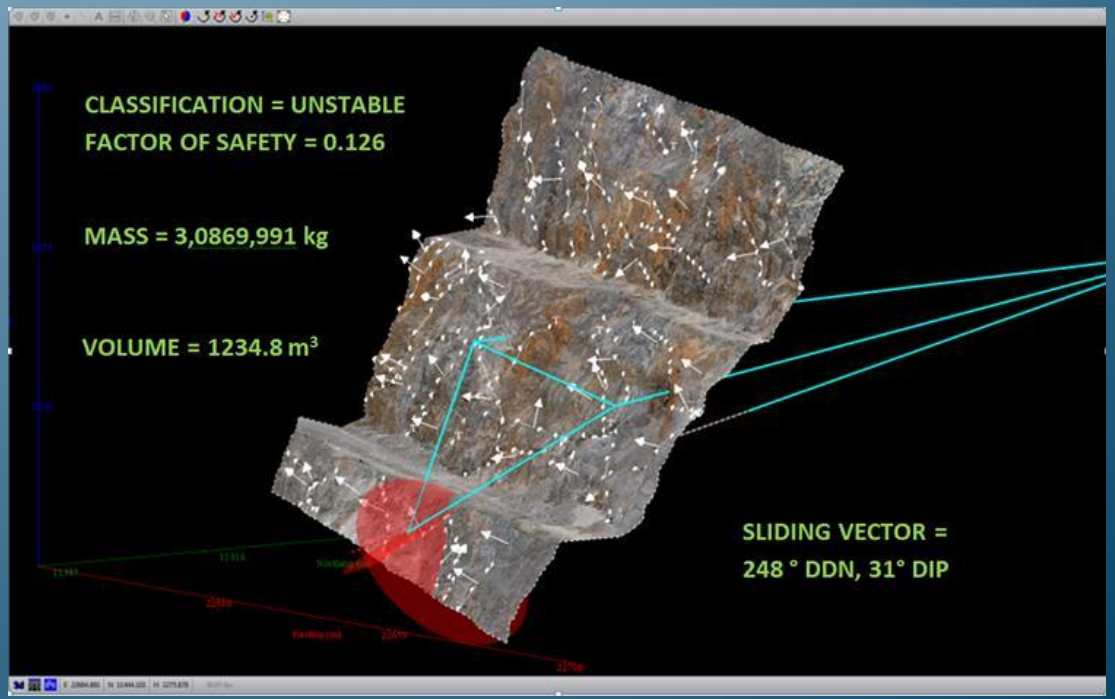
Slope Stability Analysis

Inputs

- Domain characteristics:
  - Rock Density
  - Cohesion
  - Pore Pressure
  - Angle of internal friction

Outputs

- 3D visualization of the wedge in real space.
- Mass in kgs
- Volume in m3
- Sliding Vector



DATAMINE

Picture Gallery