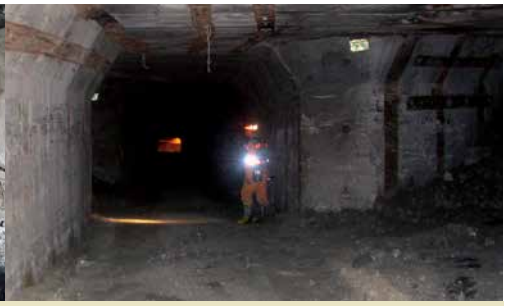
DASSAULT SYSTEMES

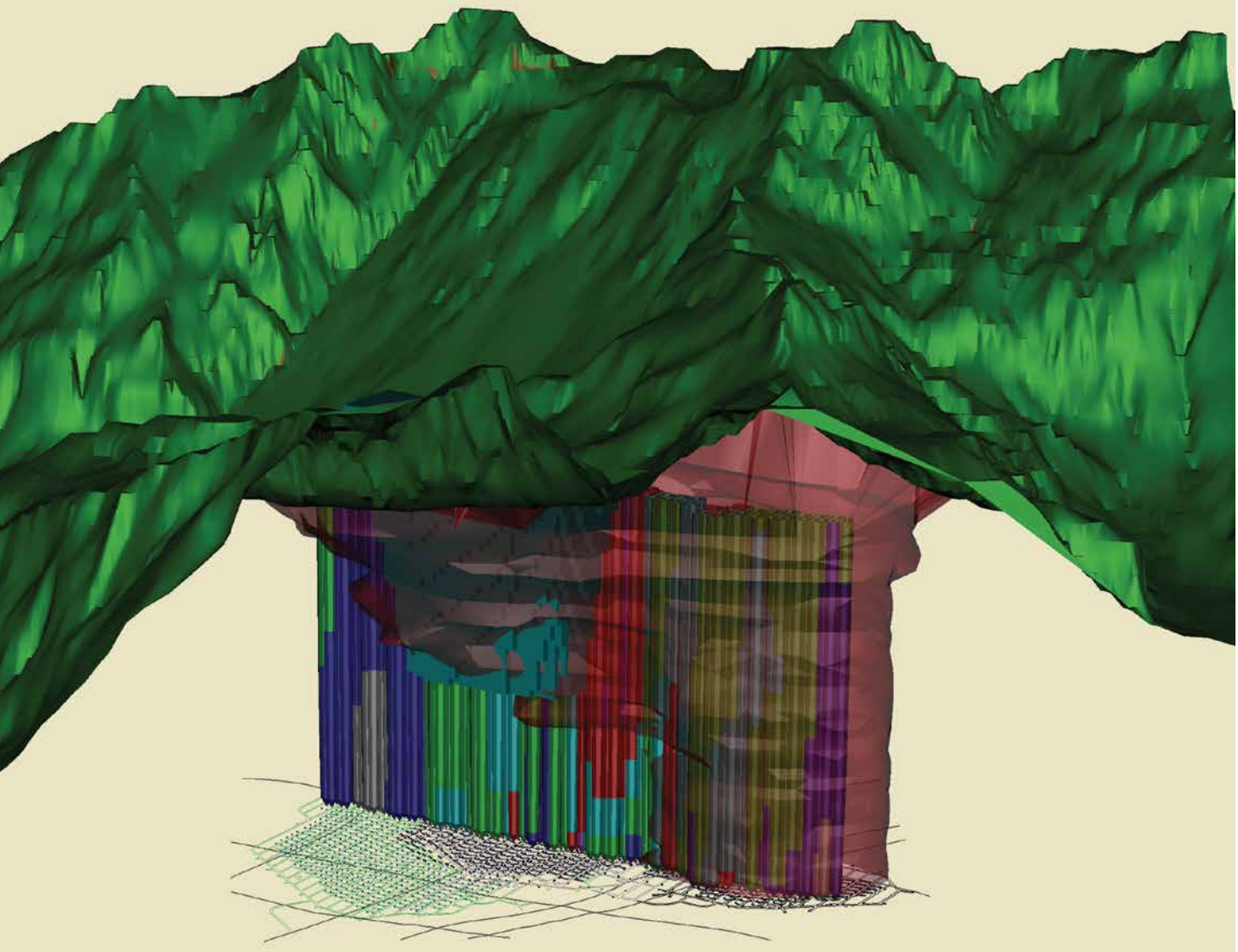
GEOVIA | PCBC

3DEXPERIENCE

LEADING BLOCK CAVE PLANNING AND SCHEDULING APPLICATION

Photo: Sandvik



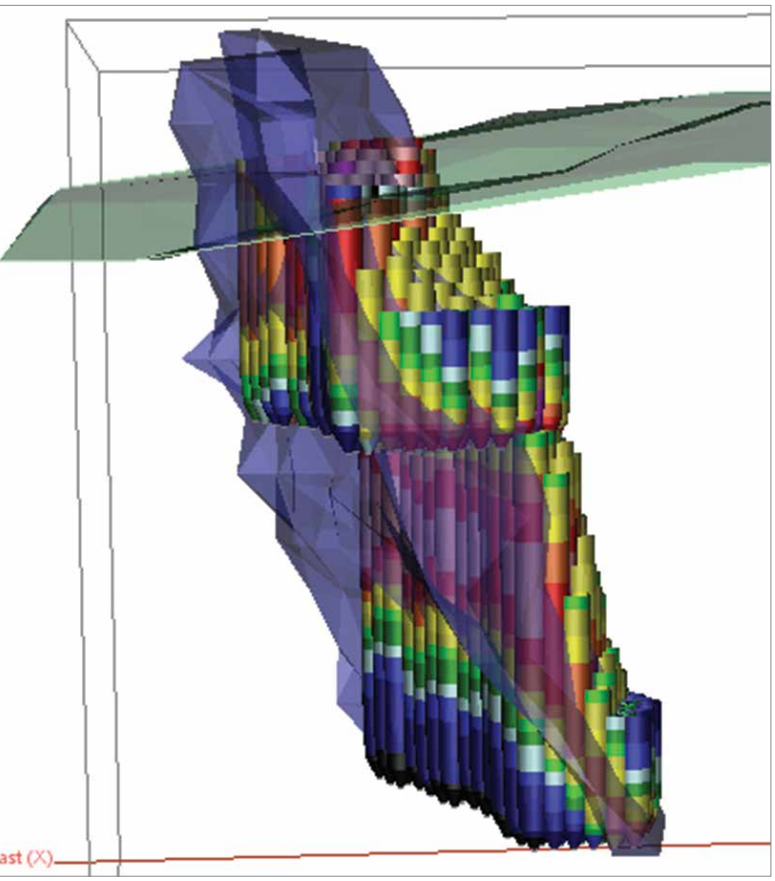


POWER AND FLEXIBILITY FOR YOUR BLOCK CAVE OPERATION

BENEFITS

- Risk reduction for large capital projects by evaluation of multiple scenarios.
- Better grade modeling and forecasting by using multiple material mixing options.
- Complete integration from pre-feasibility modeling right through to daily production which is unmatched in the block cave industry.
- Powerful production scheduling which can rapidly be updated and modified for real production statistics.
- Provides powerful management reports for effective monitoring of dynamic situations.

GEOVIA PCBC™ is a robust system designed specifically for the planning and scheduling of block cave mines. It has been developed over the course of more than 25 years by some of GEOVIA's most experienced technical professionals and has evolved to become a leader in its field. Today, PCBC is used at most of the major mining companies involved in block caving projects to perform tasks from feasibility studies to daily draw control.



Multi-lift layout with ore body and topography shown.

PCBC has a proven track record for providing critical information needed in the multi-million dollar start-up/ development stage, as well as for the ability to help keep production schedules current under the dynamically changing conditions of an operating mine.

KEY FEATURES

- Full integration with the GEOVIA GEMS™ system. Ready access to block models, polylines, points, graphics and underlying GEMS workspace technology reduces the setup time and increases confidence in the results.
- Draw cones definition and slice file construction are extremely flexible. Draw cone dip and orientation can be controlled for individual draw points. Variable cone dimensions with time can be modeled.
- Slice files can be constructed from homogenized (regular) block models or from partial block models and/or using multiple triangulated surfaces to control loose surface (or broken) material.
- Various mixing algorithms have been developed including pre-vertical mixing, sequential mixing, Laubscher's and Template Mixing. These allow for modeling of vertical or horizontal mixing, toppling and other cone related phenomena.
- Best Height Of Draw (BHOD) calculations are fast, flexible and effective. Use these calculations to determine mineable reserves, footprint outline and draw point valuations and column heights.

BLOCK CAVE SCHEDULER

Block Cave Scheduler is the flagship tool of PCBC. Proven in use at dozens of projects, it brings together all of the critical components that affect the block cave schedule, including:

- Draw point sequence. There are several ways to control and input a sequence.
- Rate of development of new draw points.
- Production Rate Curves (PRC) or maturity curves for each draw point.
- Variable production targets and shut-off grades per period.
- Accounts for past, minimum, maximum and total tonnage constraints per draw point.
- Numerous scheduling methods to control the way the cave develops and advances, including PAST (historical), AUTO (oldest first), LINDO (NPV optimisation), DILUTE (dilution minimisation), EVEN, SCALED and others.
- Strong interface between PCBC and Microsoft® Excel for both input and reporting.
- Numerous display options, including draw column depletion, HOD surface propagation, sequence analysis and interactive charting in Excel during a run.

"We have been using PCBC since 1997. The system provides what we call "PCBC grade," because the predicted grades very closely mirror actuals. PCBC has enabled us to mine more effectively, providing us with a complete solution encompassing long-term planning and daily draw control, which are linked through a central database. Our ability to maintain quality control/cave management with PCBC is enhanced because we always have direct access to the latest, correct data."

— Rudy Prasetyo, General Superintendent for Cave Management, PT Freeport Indonesia.

RELATED BLOCK CAVE MODULES TO PCBC

Advanced Flow Modeling

This module features Cellular Automaton in 3D (CA3D) tool, which works as a post-processer to the PCBC Scheduler. Providing an excellent graphical display, CA3D models open pit material movement above an active block cave allowing users to visually see and understand the movement mechanisms at play.

- Alternative flow models to help determine the best model to be applied to any site situation.
- More flexibility in multi-lift caving environments.
- A complete residual block model obtained directly after the analysis.

Cave Management System (CMS)

It is well known that draw control is a critical element of the overall cave management of a block caving operation. PCBC's CMS is designed specifically to automate and optimize this process. Developed for daily operation, the CMS will improve the productivity of cave management technicians, as well as provide powerful management reports for effective monitoring of dynamic situations.

- Strong interface capabilities with LHD dispatch and monitoring systems, including Tamrock and Modular Dispatch.
- Extensive use of Excel for reporting. This greatly facilitates implementation at an operating mine where technicians are more comfortable working with Excel. CMS still retains the ability to store key data in a secure SQL database.
- Storage of multiple data sources in different SQL tables for improved security access.
- Numerous configurable options to control the draw order.
- Interactive draw point information display for easy status interrogation with user-configurable status codes.
- User-configurable reporting for draw order, draw summary, exception reports and compliance.
- Effective highlighting of draw point exception conditions.
- Smooth month-end transition. Avoid the dangers and hassles of changeover from one month to the next.
- Track how rating are calculated and how they affect the priority calcuations.

Footprint Finder

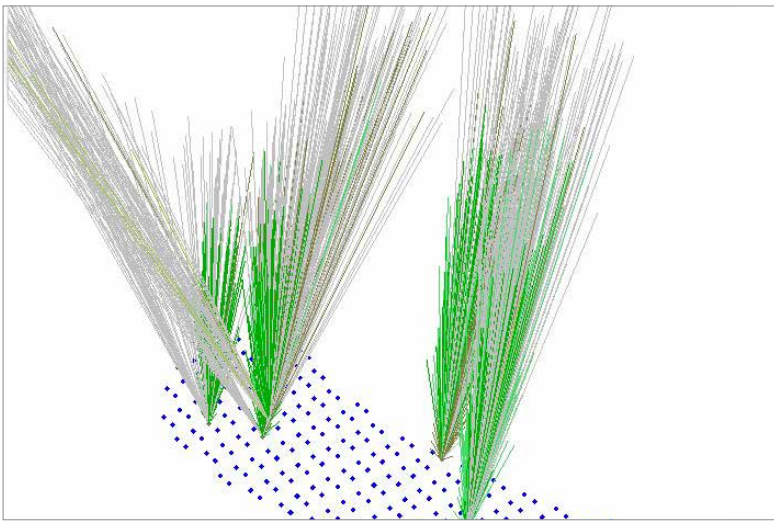
This is very useful in an early stage project to help identify the optimal elevation(s) at which draw point footprint(s) should be located.

- Block based optimisation. No need to generate a full draw point layout.
- Flat or inclined base surface. Can be made to follow any triangulated surface.
- Simple vertical mixing on the fly using Laubscher type mixing.
- Vertical discounting accounts for time taken to mine tall draw columns.
- Summary results to Excel for fast analysis.
- Evaluate complex schedules and sequences over multiple mining sectors.
- Complex batch simulation can be evaluated with hundreds of different schedules at different elevations in a single analysis.

LSQ Using Least Squares Sample Analysis in Block Caving

LSQ is intended for use at operating mines where sample analysis vs slice file forecast values is required.

- Efficient storage of monthly composited assays in a secure database.
- Compare actual grades with model (slice file) grades.
- Modify slice file based on assay data where appropriate.
- Use modified slice file data to generate improved production schedules.
- Process is analogous to the use of blast holes in an open pit to better estimate short range grades for mill feed and planning purposes.

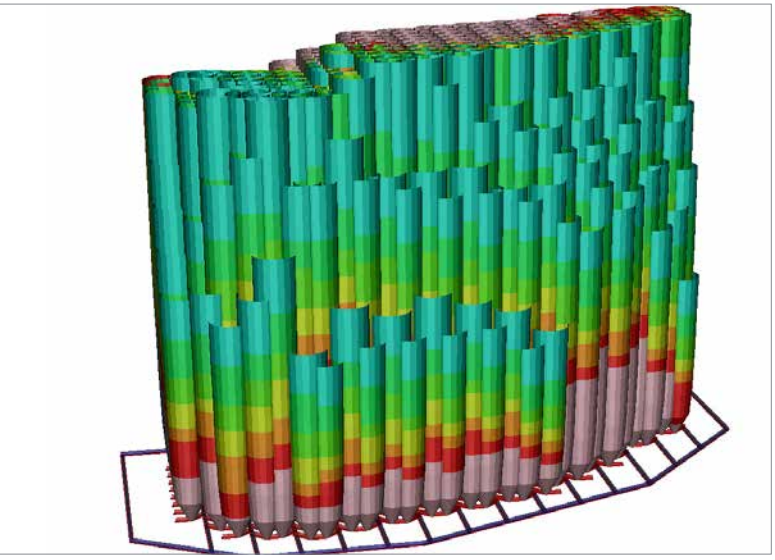


Three Dimensional Vector Display for Material Movement using the CA3D tool.

Block Cave Schedule Optimization

Provides more effective techniques for computing production schedules subject to multiple constraint sets and corporate planning objectives.

- The optimization algorithms are embedded into the production schedule.
- Different scheduling methods such QSMOOTH, QP and SURF provide access to specialised Linear (LP) or Quadratic Programming (QP) optimisers. Dilution constraints can be applied to both LP and QP while grade constraints can be applied to QP. These LP and QP schedule options allow for use of production block (or tunnel) constraints to better model maximum overall production capacity.



Columns of ore displayed above a block cave layout.

Operational Tools for Block Cave Mines

Provides the infrastructure to capture and analyse draw point geology observations such as rock type percentages.

- Efficient storage of monthly draw point geology or geotechnical observations.
- Comparison of actual vs forecast geological conditions per draw point and better mill forecasting.
- Generation of psuedo drillhole type displays to show historical geological information for comparison with block models or other drilling information.
- Analysis of cross sectional reconciliation, material migration and mixing conditions.
- Draw rate and cave surface propagation analysis.
- There is also a highly specialized module, which assists with the storage and analysis of convergence monitoring information in an active block cave. It is a critical component in an efficient cave management program.
- Efficient storage of tunnel convergence observations.
- Contouring of convergence data to highlight draw points which may be receiving excessive loading.
- Easy addition and management of convergence station data.

For more information email GEOVIA.PCBC@3ds.com or visit www.3ds.com/GEOVIA/PCBC

Our **3D**EXPERIENCE® platform powers our brand applications, serving 12 industries, and provides a rich portfolio of industry solution experiences.

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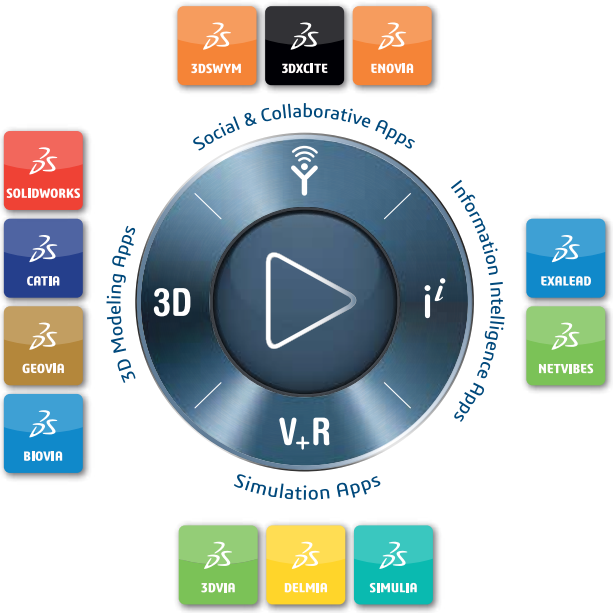

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