



Mineral Processing Virtual Forum: Workshop Outcomes

At the GMG Mineral Processing Virtual Forum, participants were asked to recommend areas of focus and collaboration for key topics within the Mineral Processing Working Group. These inputs will go back to the project groups to feed into future priorities.

GMG has a group on Process Control. What are key elements to consider for inclusion in the guideline?	
Concepts and Models	<ul style="list-style-type: none"> - First principle models vs. big data and machine learning - Smart manufacturing concepts and methods - Derivation of the process model - Layering of controls to provide robustness and graceful degradation - Conceptual drift
Variables and Parameters	<ul style="list-style-type: none"> - Control based on environmental sustainability - Identify the critical parameters that can potentially influence KPIs - Direct and indirect variables that have influence on the process control - Feedback to control systems parameters - Standard methods of implementing multivariable control
Digitization	<ul style="list-style-type: none"> - Digital plant - Protocols for data ownership and shared IP - IT/OT protocols and interoperability - Cybersecurity - Application Programming Interfaces (API's)
Data	<ul style="list-style-type: none"> - Interoperability standards for programs in Distributed Control System (DCS)/Programmable Logic Control (PLC) platforms - Open systems process automation - Standards regarding status of a signal to ensure only valid data is used - Best practices of transfer of data from historians to formats / tables useful to data scientists - Sensors for every machine to measure amperes, especially on pumps - Best practices for sensor install locations to provide survivability and data quality - Maintenance of sensors including calibration and detection of sensor drift
Ongoing Refinement	<ul style="list-style-type: none"> - Plant simulation and real time monitoring - Process to share problems and solutions with community - Remote control of the process using new technologies - Online feedback and live control implementation



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Proposals have been received in these areas: Provide any input you feel the project groups should be considering if these projects move forward.	
Metal Accounting	<ul style="list-style-type: none"> - Identification of correct sampling streams for accounting purposes - Proportional metallurgical sampling system - Consider the tailings content in calculating the metal accounting - Understanding how metal accounting helps in better metal recovery - Periodic independent audits - Certification - Data transparency from mines to product - Incorporate review of literature on process monitoring with economic performance functions to date - Building upon previous guidance provided in AMIRA P754 Code of Practice for Metal Accounting - Metal accounting can be interdependent with geometallurgy and equipment efficiency with system thinking
GeoMetallurgy	<ul style="list-style-type: none"> - Define geometallurgy: integration between the functional areas of geology, mining and metallurgy to optimize mine production - Process models and best practices to efficiently develop them - Metallurgical parameter distribution on the block model - Sampling campaign / sample selection - Types of sensors for various minerals, various impurities, etc. - Production forecasting - Run-of-mine to final concentrates - Online run-of-mine data utilization to develop and optimize next steps of processing and efficiency - Metallurgical feedback to positively impact mine plan - Economic evaluations / models
Overall Equipment Efficiency (OEE)	<ul style="list-style-type: none"> - OEE should be evaluated in a constrained operation: performance vs. plan as compared to performance vs. capability - OEE should be superseded by overall production effectiveness and mine-to-mill production with the lowest environmental impact - Operational excellence - Need improved identification, tracking, and usage of "slows" (i.e., times when equipment is running below 100% capacity) - Standard time-usage model - Defining performance relative to nameplate/best observed/planned - Process modeling and integrating with other mineral processing steps for overall circuit - How to interpret OEE in a short interval control decision support system in a typical mine's operations - Discrete element method (DEM) - Achieve predictive preventative maintenance - Remote diagnosis - Extend the value chain; concentrate on copper wires - Lots of waste and hidden losses in smelter operations; we are losing a lot because of bad smelters and copper/nickel/lead/zinc refineries - Net Smelter Return (NSR) equations - How all the clouds from different providers will work together



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GMG has a group on Industrial Communion Efficiency. What are areas of collaboration towards improved communion efficiency?	
Groups	<ul style="list-style-type: none"> - Partner with various R&D teams of mining and mineral processing groups - Industry partners and NGO's such as the Coalition for Eco Efficient Comminution (CEEC) - Julius Kruttschnitt Mineral Research Centre (JKMRC) Research Group: Improved classification project - Indian Institute of Technology Hyderabad: Mineral processing group and chemical engineering team
Technical Solutions	<ul style="list-style-type: none"> - Discrete element method and multicomponent slurry rheology - Develop disruptive comminution technology alternatives to semi-autogenous grinding, ball mills, and high-pressure grinding rolls - Alternatives to traditional SAG/AG mill circuit designs can address challenges in comminution circuit efficiency (e.g., HPGR) - SAG mill liner design to reduce break-in period throughput reductions - Solutions for efficient design of alternative circuits - Particle size analyzer for mills - Online density analyzers - Voice sensors for every mill - Mill oil pressure sensors - The ball distribution vs. the feed input - Quickly optimize ball charge: level, ball size mix, ball material - Online dynamic observation to transport loads into mills with viscosity differences due to variations in particle size and % solids in the load (i.e., by using a control system simulator program)
Process Improvements	<ul style="list-style-type: none"> - Applying changeable mill speeds - Improved advanced process control of mills to more quickly react to changes in feed - Use dynamic grinding models for online optimization - Improved classification which can affect both comminution and separation