Mining Analytics Quality Assurance Quality Control

In the mining industry is QA/QC - Quality Assurance/Quality Control - of utmost importance for a sound deposit evaluation process. Octoplus Information Solutions (Pty) Ltd has over the years developed a set of QAQC tools that is used to assist resource estimators and Laboratories to evaluate their sampling data for quality. It supports to evaluation of Precision and Accuracy

MAQ Toolkit – Your QAQC analysis tools from Octoplus Information Solutions (Pty) Ltd offers you the following:

- QAQC analysis of assay data: interactive or semi batch – you are in control
- Standard statistics - all you need in one package – calculating the Precision, Accuracy, Contamination, Outliers
- Investigate your assay results for outliers using a variety of outlier methods
- Apply and compare various outlier methods prior to making a final choice
- All results are written to a journal file for future referencing and auditing purposes.
- Parameter driven with your own compiled lookup tables
- Calculate for a lab your own Method Precision Parameters based on your own historical data and:
    - Compare new data with this benchmark
    - Calculate appropriate limits for your standards
    - Monitor a laboratory's monthly precision performance
- Lightning fast results – e.g. full analysis of 10 000 paired samples in less than 15 seconds.
- Powered by proven analytical software
- Standard and customised training offered
- Dedicated development personnel.
- MAQ Toolkit installation as easy as receiving an e-mail

The MAQ Toolkit comprises the following modules:

MAQ Twin Stream – to calculate precision & investigate for outliers
MAQ Blank & Standards – calculates accuracy & investigates for contamination
MAQ Calculate Method Precision Parameters – calculates the method precision of a laboratory
A set of tools that assists with the maintenance of the different control tables

The MAQ Twin stream module

Twin stream data refers to paired assay results which are analysed at the same laboratory with little time difference between the analyses. Duplicate data can include field duplicates (sample is split in the field and submitted with a different ID) or pulp duplicates (pulp sample returned by lab is submitted under a different ID at a later stage). Check assay data refers to samples that are analysed at both the primary- as well as a second laboratory for control purposes. Once both results have been received they are then matched and evaluated in the MAQ toolkit. The evaluation process in the MAQ toolkit comprises 12 evaluation steps that are executed in sequence – either interactively or semi-automatic. Because different outliers techniques may yield different results, the MAQ toolkit users have up to 4 different techniques to choose from being – Power Function, KSigma, Scott Long's original Method and Method Precision. The user can apply and compare the results of each of these methods prior to making a final choice as to which method is more appropriate.
The toolkit also calculates the precision (either intra or inter laboratory) which can be used as an additional "pass or failure" criteria. Step 1 prompts the user to specify the data (samples) file to be analysed. Step P2 & P3 give some initial XY scatter & QQ-plots. Step P4 allows the user to change some of the default analysis parameters. Step P5 cleans the data - removes missing data etc. and stores these in a folder called "rejected file". P6 gives access to one of 4 outlier method to be used. Identified outliers may be compared and once a final choice has been made the outliers are also added to the rejected file together with a comment. P7-P10 gives a number of statistics after outliers are removed (in step 6), mostly tables and plots, including a precision plot. Step P11 allows the data to be trimmed – data in the left and right tail of sample distribution is removed to investigate any possible influence large or low grade results may have. Step 12 gives a summary of the most important statistics reported in the analysis. A typical analysis, run in semi-batch (automatic mode) on 10 983 Twin Stream samples took 11 seconds to process.
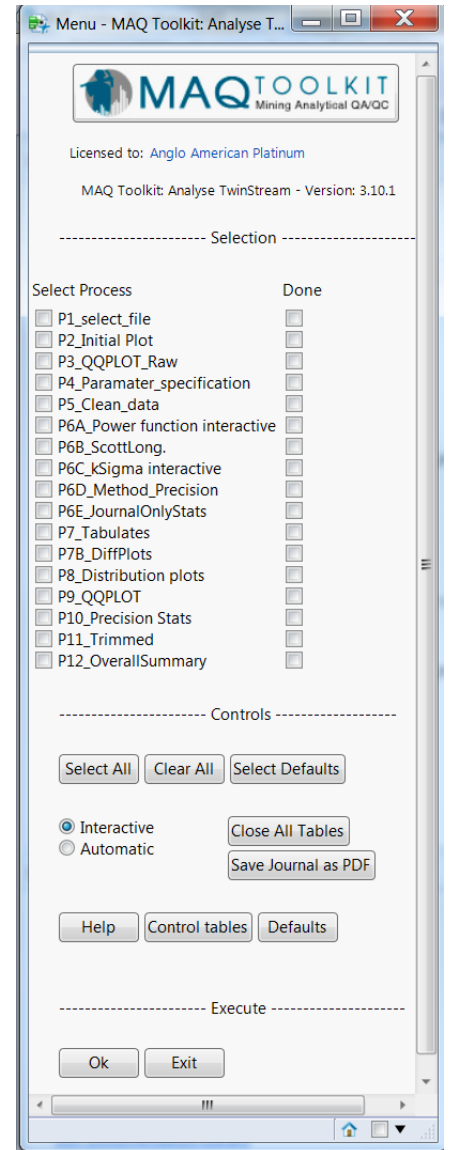
The MAQ Blanks & Standards module

The purpose of certified reference materials is to obtain an indication of the accuracy (%Bias) of a lab by comparing the certified value of a standard to the reported result. Blanks are certified materials that ideally should contain no values of the element(s) that are being analysed for, eg coarse silica. The purpose of using Blanks is to investigate for any possible contamination.

The MAQ Blanks & Standards module reports on the calculated %Bias, a number of Control Charts, based on different control limits (eg certified limits and JMP's own calculate control limits based on the data which may be used for comparison purposes) and gives an indication if any potential sample swap has taken place. A normal run includes 11 steps that may either be executed interactively or semi-automatically. Step P1 prompts the user to specify the required sample file (data to be analysed) and does some data cleaning. P2 allows the user to change some of the default analysis specifications.

Please note that when the module is executed in the semi-automatically mode the evaluation is based on the default settings. These can however be adjusted prior to evaluation. Steps P3-P8 does report a variety of statistics – plots, control charts and tables. P9 gives a plot that tries to identify if sample swaps could have taken place. P10 removes outliers (standard samples that were greater than the Upper Control Limits (UCL – Control charts) or smaller then Lower Control Limit (LCL – Control Chart). Program P11 gives a %Bias plot after outliers are removed. In this module the user is only required to execute sequentially up to step P2 – after that the steps can be executed in any random order. All results are again stored in a journal file and any rejected data (outliers, unidentified standards etc.) are stored in a rejected file. A typical analysis, run in semi-batch (automatic) mode on 509 standard samples, took 13 seconds to process.
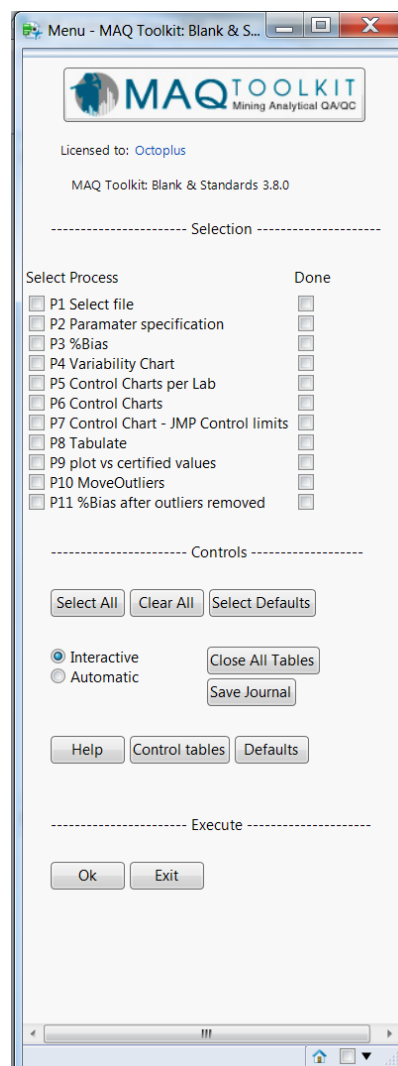
The MAQ Calculate Method Precision module

This module allows you to calculate the Method Precision for specific laboratory parameters – using your historical assay results for that lab. The method precision is a 99.7% confidence interval for a specific analytical method, a specific element at a specific grade. The module calculates a slope as well as an intercept value that can be used in the formula to calculate the method precision. Historical data is used. If possible it is advised that the method precision is also calculated per reef-type as mineralogical differences could have an influence on the method precision of a laboratory. Those values can be added to one of the control files of the 'Twin Stream' application of the MAQ Toolkit and be used as a tool to identify potential outliers (e.g. Step P6D of the MAQ Twin Stream module. Knowing what a laboratories analytical capability is will allow you to determine if the certified limits (as provided by the certificates) are too "tight". If this is the case then appropriate new limits can be calculated based directly the laboratories analytical capabilities. The method precision of a lab can also be monitored on a regular basis to determine if they still perform within their limits. New samples can then be tested against those standards to give an indication if the Laboratory precision improves or deteriorates.
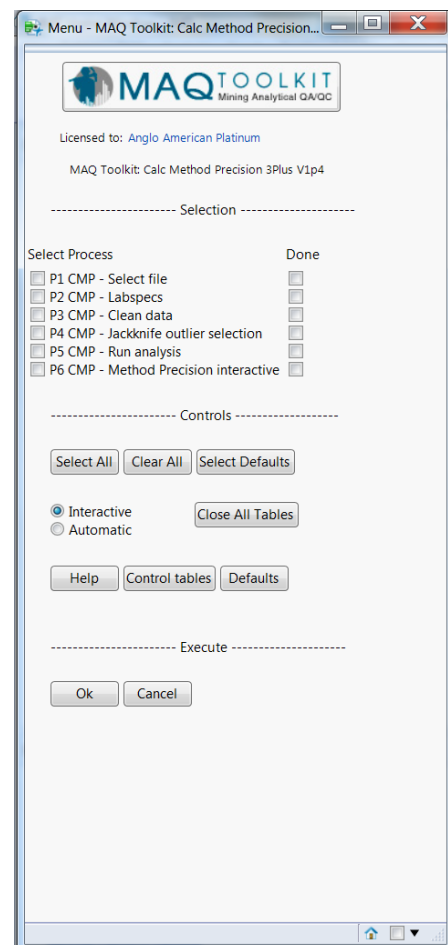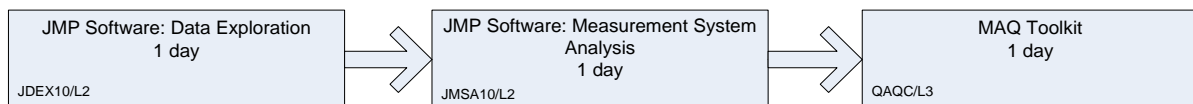
MAQ Toolkit – developed by Octoplus Information Solutions (Pty) Ltd

The MAQ Toolkit is developed and maintained by Octoplus Information Solutions (Pty) Ltd (Octoplus located in Pretoria) and comprise tools that enable the end-user to do their own QAQC analysis on their own data using a proven software using internationally accepted formulas and procedures . The software is powered by JMP, a product of SAS Institute (Pty) Ltd in the USA.

Octoplus training

Octoplus offers SAS/JMP developed training as well as its own developed training.

Recommended training path for the analysis of sampling and QAQC evaluations of assay data

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│ JMP Software: Data       │      │ JMP Software: Measurement│      │   MAQ Toolkit           │
│ Exploration              │ ──▷  │ System Analysis          │ ──▷  │   1 day                 │
│ 1 day                    │      │ 1 day                    │      │                         │
│                          │      │                          │      │                         │
│ JDEX10/L2                │      │ JMSA10/L2                │      │ QAQC/L3                 │
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Data Exploration – 1 day
Navigate the JMP interface
Manage data effectively in JMP
Explore data by using JMP software's extensive graphical capabilities
Create and manage reports in JMP

Measurement System Analysis – 1 day
Understand measurement variation
Estimate repeatability and reproducibility
Use graphical analysis to understand measurement error
Estimate bias and linearity
Perform attribute gauge studies.

MAQ Toolkit – 1 day
Analyse paired data
Analyse Blank & Standards data
Calculate parameters for the Method Precision Outlier method

This is a 3 day course, which teaches the user to work with measurement data (such as assay results). At the end of the course the user will have a broad understanding of a variety of analysis tools available to him/her to give an informed opinion about the measurement data analysed. The course will also provide the trainee with a sound overview of analytical QAQC principles.

It includes all the statistics normally used for the analysis of QAQC data – if in the rare situation that a user wants to do additional statistics, the course also teaches the user some other statistical methods available not necessarily used in the Toolkit, but available in JMP.

MAQ Toolkit – developed by Octoplus Information Solutions (Pty) Ltd

Octoplus has been intensively involved in the development of QAQC software since 2006 – which is constantly improved & upgraded and currently successfully being used at a number of major mining companies in South Africa.

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