



Revolutionizing Rock Fragmentation: Advanced 3D Analysis Techniques with FragMetriX

Q1: Should the overlap in both in flight direction and between tracks be 80%? In this case, should a certain spot appear in 5 subsequent photos?

A1: As a rule of thumb, the overlap should be 80% in both directions in order to avoid anisotropy of data. A spot would then appear 5 times in both directions. If the number of pictures becomes large, it is possible to optimize but this was out of scope of the webinar.

Q2: Is there any possible approach to estimate block volumes? Not just equivalent key dimension?

A2: Fragmenter uses the equivalent mesh width to size a block. Estimation of volumes are much more difficult since only one side of a block is visible, and this would require a significant modelling effort in obstructed areas. Anyways, 3GSM provides other tool for measuring volumes, e.g. for muck piles, volume changes, or more complex volumes in underground excavations.

Q3: Would performing a pre-blast and post-blast flight help the process at all?

A3: In that regard, a full data set would include pre-blast flight, a muckpile flight, and a post-blast (post-loading) flight. The last one could already be used for a pre-blast flight for the next blast.

The volume difference between the pre-blast and post-blast flight would give the bank volume, while the muckpile flight and the post-blast flight would give the muck pile volume. In such way the muck pile swell as a measure of loosening could be determined.

In addition, the pre-blast survey would give burden per holes and an estimate of geologic conditions, the muck pile would give the fragmentation, and the muck pile shape (e.g. power trough).

Q4: The example shared during webinar is a very flat muck pile for analysis. How does the process/analysis change with a less-than-ideal muck pile, in the underground setting, or using fewer/lower quality images?

A4: The Fragmenter requires the generation of a dedicated surface for the fragmentation analysis. There are two options to generate this dedicated surface – Top Down and From View.

Top Down will be sufficient for most of the muck piles in quarry operations surveyed by aerial imagery with Nadir flights. From View is the preferred method if the muck pile has a significant slope and it was surveyed towards this particular direction (e.g. from the ground or with inclined cameras).

Q5: Can we use RAW images or only JPEG is supported?

A5: The image formats to be used to generate 3D models should be in jpg or png. The original exif of the camera should also be part of the image file.

Q6: Does the fragmentation analysis also work with cell phone cameras?

A6: In principle, yes. When using hand-held cameras, you shall take the photos ideally perpendicularly to the muck pile surface. This entails usually to take the photos from an elevated position, which is more easily achievable with drones.

Also, with hand-held cameras you should pay attention on image quality, in particular to avoid motion blur. Cell phone cameras may come with varying camera qualities (distortions, colour richness, etc.) and you should verify the applicability of your cell phone camera at first. You may also consider digital SLR or mirrorless cameras.

Hand-held cameras many times do not include camera GPS – so the use of scaling elements or ground control points is necessary in such case. As for cell phone camera, the quality of the built-in GPS needs to be verified.

Q7: Can you use models from other devices such as LiDAR?

A7: FragMetriX's particle detection is based on a hybrid 3D surface analysis combined with a 2D image processing. This means the data must also come with these qualities. Pure lidar scans with only point clouds without texture will not work.

FragMetriX provides an interface to the e57 and obj format which can potentially include 3D geometry and photo textures. If this information (3D geometry + texture) is available, also data from outside of the FragMetriX workflow can be used. It is necessary to ensure that the data is in sufficient quality (images) and resolution (ground sampling distance).

Q8: How are sizes of fragments determined?

A8: The surface patch delineated by the particle polygon is used to fit an ellipsoid to that patch. The ellipsoid has three principal axes, from which the minor and intermediate axis are chosen to form a cross-section ellipse. The size of the particle is then a size of the square mesh of a virtual size through which the particle fits. This should virtually emulate the sieving process.

This method does not consider regions which are partially hidden underneath overlying muck. For very flat patches the 3D method is replaced by an analogous 2D method.

**Q9: Can you combine several measurements or analyses?
For example, if you have several models as loading the
muck pile advances.**

A9: Currently you can analyse one mask at a time. It is possible to export the data to csv format and combine the results of several masks in a spreadsheet program. We gladly take this question as a potentially future feature.