

Morphologi G3 – Malvern Panalytical

INTRODUCTION

The Lumetics LINK™ software platform scans network locations for new measurement data files, copies data directly to a centralized database, and provides a powerful user interface for rapid multi-measurement multi-technique data aggregation, visualization, analysis, and reporting. LINK employs a client/server-based architecture where the LINK server hardware is provided by the end user and resides on the end user’s network. The LINK client is a portable web-based application that may be placed on any computer with network connectivity to the LINK server. For successful import, the LINK webserver requires read access to the folders where user data resides.

The Morphologi G3 provides an advanced particle characterization tool for the measurement of particle size and particle shape from 0.5 microns to several millimeters.

DETAILS

LINK requires the exported.TXT and particles.TXT data files. The BMP particle image files are optional. Data files must be exported from the Morphologi G3 software using the Lumetics G3 Export Template. Particle images may optionally be imported as BMPs, and therefore may be exported as thumbnail images from LINK as BMPs.

LINK requires the data to be in the following format:

- One folder per measurement
- Metadata is exported in the **exported.txt** file, with the Record # as the first column
- Particle information is found in the **particles.txt** file
- Thumbnails are exported in the same folder as the exported.txt and particles.txt folder.

Particle count/concentration for each supported morphological parameter occurs at a pre-defined bin spacing and measurement range as per the following table:

Parameter Name	Bin Spacing	Meas. Start	Meas. End
Area (Pixels)	100	1	1000
Area (µm ²)	100	1	10000
Aspect Ratio	0.01	0	1
Centre X Position (µm)	100	0	100000
Centre Y Position (µm)	100	0	100000
Circularity	0.01	0	1
Convexity	0.01	0	1
Edge stitched particle	1	0	1
Elongation	0.01	0	1
Fiber Elongation	0.01	0	1
Fiber Straightness	0.01	0	1
Fiber Total Length (µm)	0.25	1	2500
Fiber Width (µm)	0.25	1	2500
Frame Column	1	0	100
Frame Index	1	0	1000
Frame Row	1	0	100
HS Circularity	0.01	0	1
Intensity Mean	1	0	255

Intensity SD	1	0	255
Length (µm)	0.25	1	2500
Magnification	0.1	0	100
Major Axis (deg)	1	0	180
Max. Distance (µm)	0.25	1	2500
Particle Diameter (µm)	0.25	1	2500
Perimeter (µm)	1	1	2500
Scaling Factor	1	0	100
Scan Area Correction	1	0	1
SE Volume (µm ³)	1000	1	100000
Solidity	0.01	0	1
Width (µm)	0.25	1	2500

The Morphologi G3 TXT data file example is as follows:

Record #	Comments	Date	Image Path	Instrument	S/N	Record #	S/W Version	Sample Name	Source	Image DB	Image File Path	Edited	Edited On	File Name	File Path	Reason
10	No real particles, just spectra	31 January 2017 15:45:57	Training_10(1).img	MAL1147555	10	8.21	Point spectra	Morphologi instrument	Training_10(1).img	Training_10(1).						

The following is the default Morphologi G3 specific export method:

1. Create Folder for Exported Data
 - In Windows, create a folder for each of the exported Morphologi G3 files.
 - NOTE: Each exported file must be in its' own folder.
2. Copy LINK Export Template (NOTE: Perform this step once)
 - Contact Lumetecs for the *LINK G3 Export Template (.edf)* file.
 - Copy this file to the Documents folder containing the Morphologi G3 Export Templates.
 - By default, this will be: C:\Users\Public\Documents\Malvern Instruments\Morphologi\Export Templates
 - NOTE: the location may vary depending on installation preferences (e.g. it may be in a specific user's folder).
3. Export Results
 - In the Morphologi G3 Records tab, select a single measurement for export.
 - Select File -> Export -> Export Result... and configure menu as shown below.
 - Browse for the location of the data folder (see Step 1 above). The filename MUST be 'exported.txt'
 - In the Parameters tab, select Use export template parameters and select the Lumetecs G3 Export Template. If you do not see this template, return to Step 2.
4. Export Particles
 - From the Morphologi G3 main screen, first ensure the record is still selected and then select File -> Export -> Export Particles...
 - Browse to folder from Step 1, name the file particles.txt (MANDATORY) and select other options as shown below in File tab. Leave all other tabs as Default.
5. Export Images
 - From the main screen of the Morphologi G3 software select File -> Export -> Export Images.... Select the data folder from Step 1. Click OK.
 - Note: it may take a few minutes to export the images.

Import Method options can be defined and calculated each measurement during import if it is first created/defined and then requested within an Import Method. The default Morphologi G3-specific import method settings are:

- Default Sub-Populations: **None**
- Number of Thumbnails to Crop: **250**
- Ignore Thumbnails less than: **5 µm**
- Import Images in order of Largest-to-Smallest: **Yes**
- Advanced Image Selection: **None**
- Automated Metadata Extraction: **None**
- Dilution Factor: **1 (no dilution)**

Sub-Populations

In addition to the total particle population data set, sub-populations based morphological parameter filters may be generated at the point of measurement import. An unlimited number of sub-populations may be specified for each measurement. For



each sub-population, the particle count/concentration vs. morphological parameter will be available, as well as representative particle thumbnail images. The sub-populations do not count towards the measurement limit per project. Additional Sub-Populations will affect import speeds.

When creating as sub-population, select a **Morphological Parameter** from the pre-defined list and specify the filter criteria. Select the + to add the filter term to the **Live Expression View**. The **Live Expression View** can be edited directly. Brackets, mathematical operators/values, logical ANDs or ORs are valid operators. Syntax must be exact, for successful application.

Thumbnail Images

Specify the maximum number of particle thumbnail images to be imported to the LINKdb for each measurement population. Apply a size threshold (the default is 5 microns). Choose whether particles should be first sorted from largest to smallest (based on ECD) or imported in their order of appearance during the analysis. These selections apply to the total particle population and all defined sub-populations.

Advanced Image Selection Criteria: Specify the number of thumbnail images for various particle parameter ranges of interest. The total number of images may not exceed 5000.

Automated Metadata Extraction

Specify criteria for automated metadata extraction from measurement file fields (e.g. Comments, File Name, Import Path etc...) utilizing specified delimiters. Both metadata name and value may be extracted or only the value only.

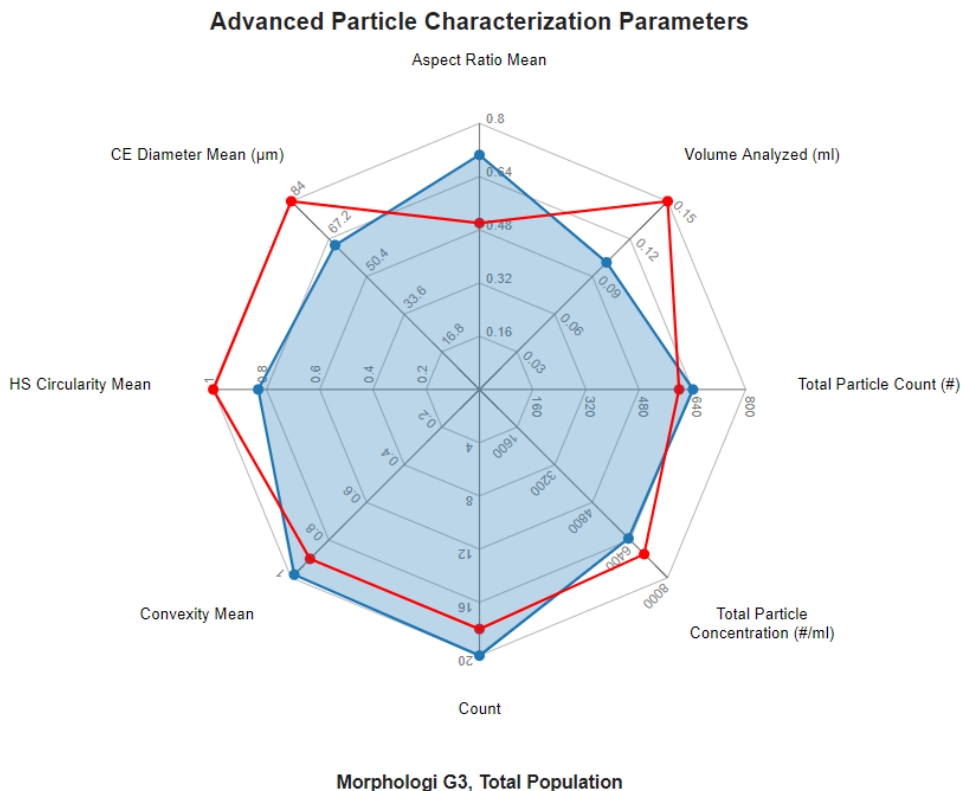
Dilution Factor

Specify a dilution factor for automated particle count/concentration data adjustment. This selection applies to the total particle population and all defined sub-populations. A **LNK_Dilution_Factor** may also be applied after import, utilizing the **Add/Edit LINKdb Fields** feature.

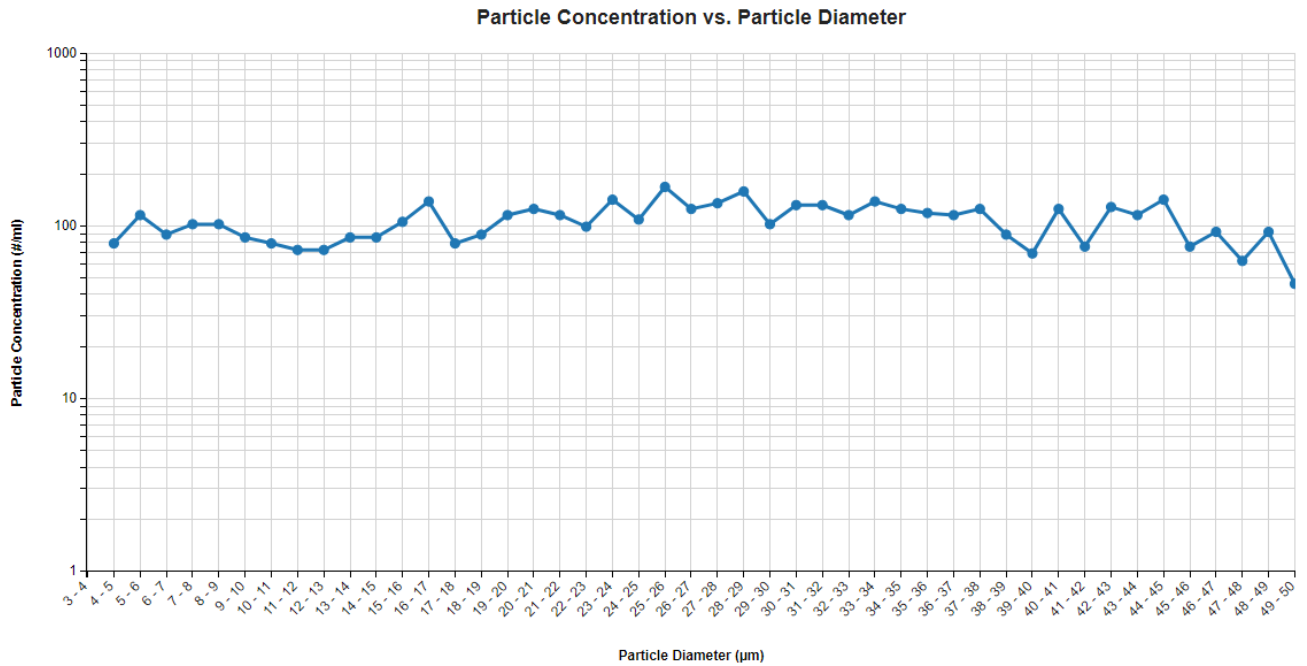
EXAMPLES

Included below are sample dashboards from Morphologi G3 measurement files:

1. Radar Chart plotting multiple particle characterization parameters with limit lines/acceptance mask



2. Histogram plotting binned raw data for Particle Concentration vs. Diameter



3. Tabular Summary examples

Measurement Summary Table – Measurement Results

Sample Name	Volume Analyzed (ml)	Volume (%) (Particle Diam. (µm) >=1) - AVG	Particle Count (#) (Particle Diam. (µm) >=1) - AVG	Total Particle Concentration (#/ml) - AVG	Total Particle Count (#) - AVG	≥1µm AVG	2-10µm - AVG	≥10µm AVG	HS Circularity Mean - AVG	Count - AVG	Convexity Mean - AVG	CE Diameter Mean (µm) - AVG	Aspect Ratio Mean - AVG
Sample A	0	100	1	9.87	1	10	0	0	0.84	15	0.93	62.00	0.80
Sample B	0	100	1728	17058.24	1728	17,058	1,718	15,341	0.82	22	0.89	60.00	0.50
Sample C	0	100	196	1934.85	196	1,935	0	1,935	0.83	20	0.98	64.43	0.71

Measurement Summary Table – Instrument Settings

Sample Name	Analysis Date	Version	Source ID - AVG	S/W Version	Record # - AVG	Instrument S/N	Image DB	Date
Sample A	2017-01-31 15:4...	8	10	8	10	MAL1147555	Training_10(1).img	31 January 2017 1...
Sample B	2011-05-25 11:2...	7.40.029	2	7.40.029	3	MAL1009013	Example Data_2(1...	May 25, 2011 11:...
Sample C	2012-08-29 08:0...	7.40.029	5		8	MAL1009015		August 29, 2012 8...

CONTACT LUMETICS

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