

## greyvalues.m

To launch, type in the Matlab command window: 'greyvalues'.

**NB:** To trace the guideline, always remember that the first value of the grey profile will be extracted 90° to the right looking down the guideline, from the first point of the guideline (see reference image 'grey\_values\_line.png').

### Output folder (“imagenname\_profile#”)

- 1- 2 .CSV files with titles, all the grey values, the cleared ones and some calculations (distances, mean, min, max, absolute sd, relative sd and standard error of the mean).
- 2- .jpg image of the profile lines.
- 3- A matlab workspace (i.e.: '.mat' file) storing guideline coordinates.

**NB:** This code uses  $\text{mean} \pm 1\text{sd}$  to clear outliers. To change this, edit line 491.

## createfit.m

It requires a .CSV file produced by 'greyvalues.m' or formatted in the same way. The file must contain three columns with the x values (distance in  $\mu\text{m}$ ), the y values (greyvalues) and the relative errors on the greyvalues (standard error of the mean). The headers of these columns must be 'Real\_Distance', 'Mean\_Value' and 'Standard\_Error' error respectively. To launch type in the command window: 'createfit'

### Output folder (“inputfilename\_fit#”)

- 1- Data on fitting parameters saved as a Matlab workspace: y0, erf\_par, x0, Dt.
- 2- Data on residence time calculations saved as a Matlab workspace.
- 3- .png image of the fit.

## createfitFS.m

It requires the same input file as 'createfit.m' and produces the same outputs (“inputfilename\_fitFS#”).

**NB:** To run, it requires 'y0\_old' starting parameter from previous fitting calculations computed with 'createfit.m'.

## How “createfit.m” operates

Firstly, it creates a fit based on:

- 1- input data (.CSV file)
- 2- fitting equation

It then calculates residence time based on temperature, diffusion coefficient and pressure data, which are specific to each mineral and crystal, considered. Default values are for pyroxene crystals.

It also asks if calculations with a different  $Dt$  are needed. If so, a Matlab workspace previously saved containing data on  $Dt$  must be selected. The residence time based on the inserted  $Dt$  values is calculated and exported as a Matlab variable.

Every matlab variable referring to calculations with the inserted  $Dt$  parameter has '**\_inserted\_Dt**' in the name.

## How “createfitFS.m” operates

Firstly, it creates a fit based on:

- 3- input data (.CSV file)
- 4- fitting equation defined using as  $y_0$  parameter the  $y$  value of the first grey value.
- 5- the inserted ' $y_{0\_old}$ ' parameter.

This is done to derive a mathematically more meaningful  $y_0$  parameter for a second fit. Hence, a new equation is defined and used for a second fit. This produces the correct value for  $Dt$  which is used to calculate the residence time.

The code finally calculates residence time following the same procedure as 'createfit.m'