Main window and settings

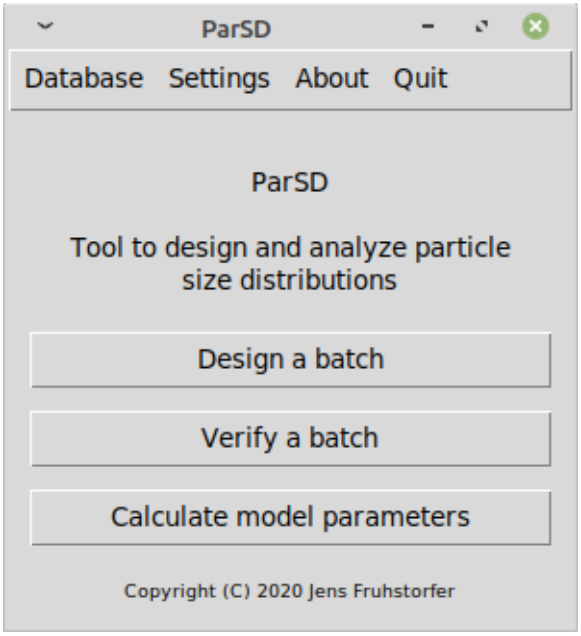


Figure 1: The main window of ParSD app

The main window opens when the application is started. Besides showing the application name and a disclaimer, it is constituted of a task bar and a main menu, cf. Figure 1. The main menu leads to the main functions of the application:

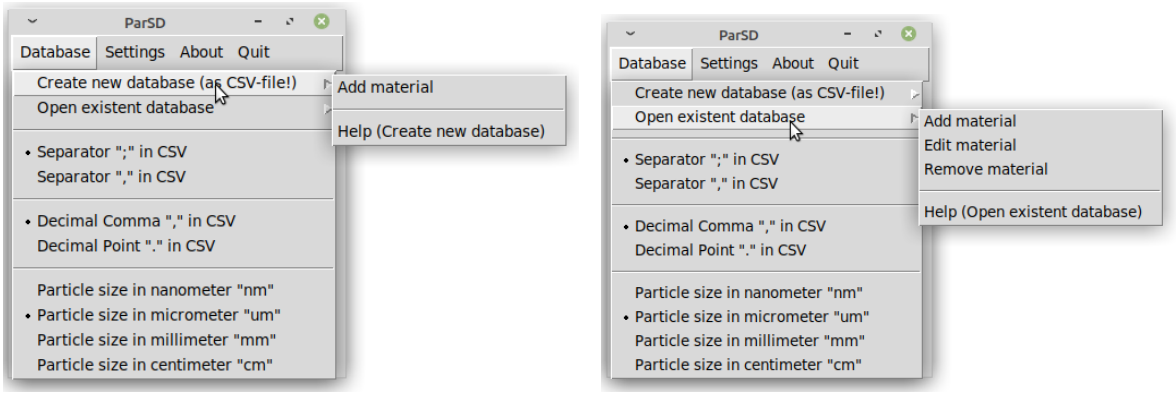
Design a batch In this main function, for a defined particle size distribution, the amounts of selected raw materials (the batch) to approximate optimally this distribution are calculated.

Verify a batch In this main function, a defined particle size distribution and a defined batch (amounts of raw materials) are given and compared.

Calculate model parameters In this main function, for a defined batch (amounts of raw materials), the parameters of a selected particle size distribution model to approximate this batch optimally are calculated. This function can be used for reverse engineering.

The task bar contains the menu items 'Database', 'Settings', 'About' and 'Quit'. The last one closes the application similar to clicking the close-button usually in the upper right corner of the dialog window. Before closing the program, changed settings are saved. The 'About' menu item contains the subitems 'Version/Info', 'Authors', 'Contributors', 'License', 'Citation info', 'Help (Current dialog)' and 'Documentation' of which the last one opens the Documentation, the Help-subitem the part of the documentation about this dialog box and related objects. The others open message-boxes with information on the application, the developers and the license.

The database menu item, cf. Figure 2, contains the settings for the database files of type CSV, abbreviation for 'Comma-separated values'. It is possible to choose a decimal place separator (decimal comma or decimal point) and a separator for the values in the file (comma or semicolon). Standard are either decimal point and data separated by commas or decimal comma and data separated by semicolon. Furthermore, the particle or component size magnification has to be chosen. In the



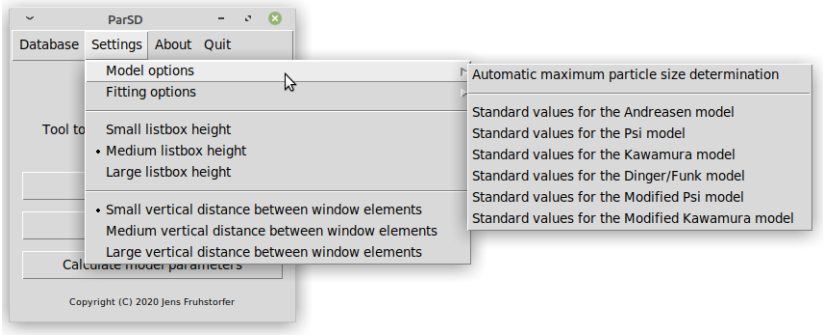
(a) Create new database subitem (b) Open existent database subitem

Figure 2: The task bar 'Database' menu item

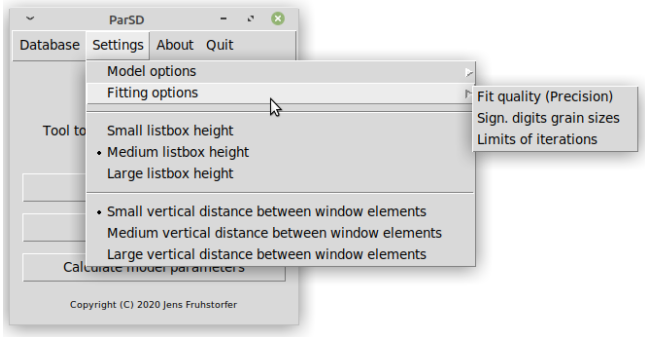
database this is not saved. It is recommended, that the user decides for one style because within a single run of the program, all used files require the same setup to work with each other.

The subitems of the Database menu item link to the database functions. It is possible to create a database and add a first material (cf. Figure 2(a)). The Help for this function is also accessed from the submenu. Furthermore, it is possible to open an existent database and to add, edit or remove materials (cf. Figure 2(a)). Also for these database functions, the corresponding Help is accessed from that submenu.

The settings menu item, cf. Figure 3, contains the view settings for the larger result-windows. If used on a notebook or subnotebook with small display or on a computer with a screen with a low resolution, a small listbox height and a small vertical distance between the window elements might be best. Otherwise it can happen, that the window cannot be shown completely.



(a) Model settings subitem

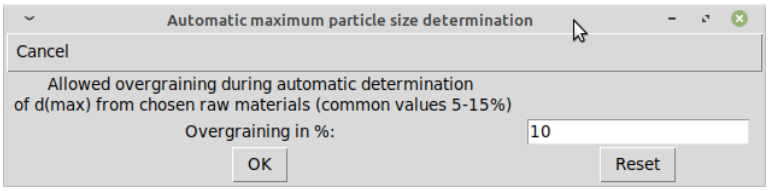


(b) Fitting settings subitem

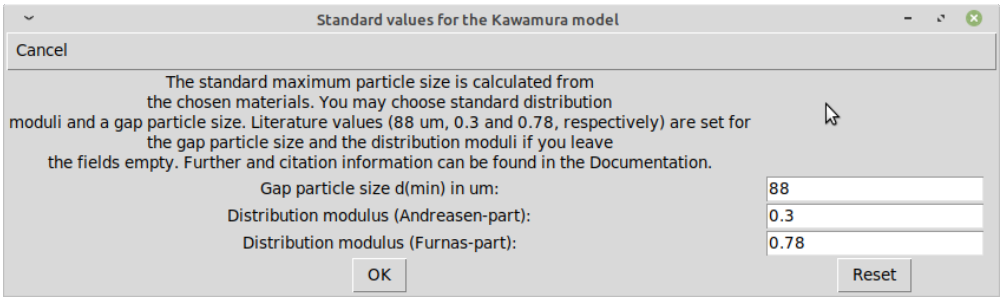
Figure 3: The task bar 'Settings' menu item

The subitems of the Settings menu item are the settings for the models and the fitting. The model

settings, cf. Figure 3(a), contain links to the setup of how to determine the maximum particle size automatically and for each model to a dialog where the standard values can be set up. In the dialog 'Automatic maximum particle size determination' (Figure 4(a)), a value for the overgraining in percent is defined. Every natural crushing or milling process followed by sieving or other separation techniques leads to raw materials spanning from a bit lower to a bit larger particle sizes than the used component sizes of the sieves. For the determination of the maximum particle size only the overgraining, the amount of grains larger than the defined upper size, is important. Values between 5 and 15 % are common. Furthermore, it can be noted that the reset-button restores not a standard value, but the value from before editing, which is also important to recognize for the dialogs 'Standard values for the ... model' (Example in Figure 4(b)) where chosen literature values can be set by emptying the fields. However, for different applications different standard values might apply. An overview together with citation information is given in the Methodology Documentation.



(a) Overgraining adjustment



(b) Standard values

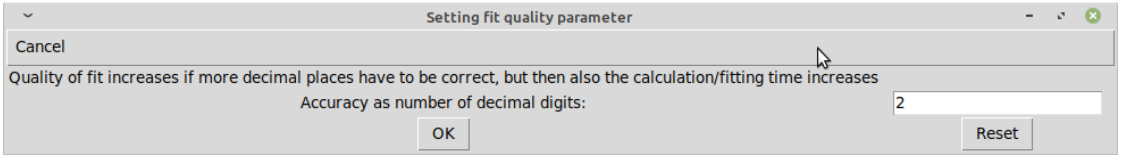
Figure 4: Dialogs for setting up the models

The fitting subitem contains the setup options for the modelling:

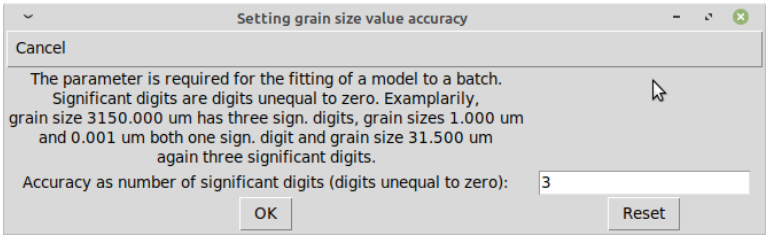
1. The fit quality (Figure 5(a)) is adjusted by defining the number of decimal places of the values to calculate that have to be correct. For example, if a batch has to be calculated that should contain raw materials only as multiples of 5 %, no decimal places are required; but if one raw material is contained with an amount of 0.32 %, then two decimal places are required.

2. The second option dialog defines the number of significant digits for the grain sizes, cf. Figure 5(b). For a standard sieve series, a value of 3 is adequate, but if your component sizes differ, you can adjust it here. For higher numbers, the results for the optimum particle sizes get more detailed—e.g. in a standard sieve series but with a number of signif. digits of 5, it is possible that your optimum maximum particle size is for a batch with 3 mm grains is 2983.3 µm which might be not required in this detail, but leads to a much longer calculation time.

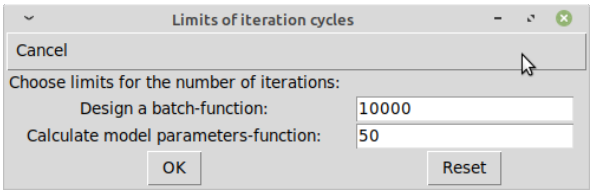
3. The third option lets the user set up limits for the iterations of the different main fitting functions (Figure 5(c)). For the 'Design a batch' function, for the author's experiments up to 7000 iterations were necessary. For the function 'Calculate model parameters', a lower number of iterations (in the author's experiments up to about 30) was required. The limits have to be defined because it is possible that rounding issues occur or that the particle size optimization is not converging and then the optimization process could run infinitely.



(a) Fit quality



(b) Significant digits



(c) Iteration limits

Figure 5: Dialogs for setting up the fitting options