# Software for hyper-spectral data pre-processing

This software is developed and expressly adapted for the ASD FieldSpec spectroradiometer. It was designed to read the output of the instrument and to solve problems that generally affect hyper-spectral experimental ASD data. The software is based on two GUIs and it is characterized by an easily readable, graphic visualization of spectra, from which the absorption band depth (ABD) can be obtained for a selected wavelength. The output format of the ASD data is a binary file with an .asd extension. The binary file, that provides a single spectrum, can be processed using a functionality of software, by means of GUI, that allow to select one or more binary files to produce a spectral library in a unique .txt file. The spectral reflectance is re-calibrated with the "convex-hull" methodology to eliminate the convex shape, which is typical of reflectance spectra. Moreover the software (two files .fig and eight files .m) is built in order to be adapted to other instruments by means of OOP (Object Oriented Programming), e.g., the reading of ASD data is achieved by means of read_asd_v1.m and read_asd_v2.m that, in case of other instruments, must be modified according to correct data format of data file. In the table below a summary of GUIs controls is reported.

| GUI | GUI controls | GUI functionality | Matlab function (file.m) or/and Matlab figure (file.fig) |
|---|---|---|---|
| GUI1 | Push button "Callback ch_removal interface" | Call GUI2 | call_ch_removal.fig call_ch_removal.m |
| GUI1 | Pop-up menu "Choise of asd type file (v1 or v2)" | Allow to choose the type of asd spectrum file | call_ch_removal.fig call_ch_removal.m |
| GUI1 | Green Edit box | Allow to insert the range to remove sensor bad calibration | call_ch_removal.fig call_ch_removal.m |
| GUI1 | Violet Edit box | Allow to insert the ranges to remove atmospheric band with noise | call_ch_removal.fig call_ch_removal.m |
| GUI2 (Control Panel) | Push button "File Selection" | Allow to select one or more files for spectra aggregation in unique matrix for pre-processing | ch_removal.fig ch_removal.m |
| GUI2 (Control Panel) | Pop-up menu "Remove sensor bad calibration" | Allow to choose if to remove sensor bad calibration or not | ch_removal.fig ch_removal.m |
| GUI2 (Control Panel) | Pop-up menu "Atmospheric Band Removal" | Allow to choose if to remove atmospheric band with noise or not | ch_removal.fig ch_removal.m |
| GUI2 (Control Panel) | Pop-up menu "Signature Normalization" | Allow to normalize the spectra with convex hull technique | ch_removal.fig ch_removal.m |
| GUI2 (Control Panel) | Slider block "Left Tail Removal" | Remove the left tail in case of noise | ch_removal.fig ch_removal.m |

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| GUI2 (Control Panel) | Slider block "Right Tail Removal" | Remove the right tail in case of noise | ch_removal.fig<br>ch_removal.m |
| GUI2 (Control Panel) | Slider block "Wavelength for vertical section (Depth Peak)" | Calculate the absorption band depth values at the selected wavelength | ch_removal.fig<br>ch_removal.m |
| GUI2 (Control Panel) | Blue Edit box | Allow to remove the noise left tail for a correct convex hull calculus | ch_removal.fig<br>ch_removal.m |
| GUI2 (Control Panel) | Push Button "OK" | Active the selected controls and save files with extension .txt with data (raw data or processed data) | ch_removal.fig<br>ch_removal.m<br>read_asd_v1.m<br>read_asd_v2.m<br>read_multiple_asdfiles.m<br>convex_hull_spectra.m |
| GUI2 | Top graph | Plot the spectra according to selected controls | ch_removal.fig<br>ch_removal.m<br>convex_hull_spectra.m<br>function_zoom.m |
| GUI2 | Edit texts below top graph | Allow to insert X and Y zoom ranges | ch_removal.fig<br>ch_removal.m<br>convex_hull_spectra.m<br>function_zoom.m |
| GUI2 | Push bottom "Run Zoom" | Plot the zoom of the top graph | ch_removal.fig<br>ch_removal.m<br>convex_hull_spectra.m<br>function_zoom.m |
| GUI2 | Bottom graph | Plot the depth peak for all selected spectra | ch_removal.fig<br>ch_removal.m<br>convex_hull_spectra.m<br>function_zoom.m |
| GUI2 | Push bottom "Run section" | Allow to calculate the absorption band depth values at the selected wavelength | ch_removal.fig<br>ch_removal.m<br>convex_hull_spectra.m<br>section_run.m |