- `ImageAnalyser`: main function that interacts with the GUI. A Matlab GUI tutorial is beyond the scope of this document, but have a look at tutorials for GUIDE to see how to edit Matlab GUIs. The GUI is `ImageAnalyser.fig` and you can edit it via GUIDE (right click on the file and click "Open in GUIDE", and the script is `ImageAnalyser.m`, where all the calls to subroutines happen.
    - `loadMainState`: restores all of the GUI options (check boxes, menu selections, etc.) from last time the GUI was closed. I don't know how to make it store the radio button state in the data plotter! It seems to work a little differently from the rest of the GUI elements.
    - `Newdatamenu_cont`: activated when "New Data" is pressed. If autoload is selected looks for new data continuously and calls `newdatamenu`. If autoload is not selected calls `newdatamenu` only once.
    - `newdatamenu`: This loads new images and copies and stores them in the appropriate directory. It also calls the analysis and display scripts. If "Single Species" mode is selected, only data for one species is processed. If "Single Species (simultaneous)" is selected, then this script processes images for both species.
        - `loadascii`: kind of redundant function to load the camera ascii images. It rotates the image once in addition to loading the image file.
        - `ana_sp1`: main analysis program for species 1. Calculates optical depth and performs fitting. If you would like to alter how the optical depth is calculated, this is where to do it. This script also optionally initiates fringe removal and Fourier filtering if necessary, and also calls the script to display the results in the GUI.
            - `applyFourierFilter_sp1`: applies a Fourier filter.
            - `fitfun`: Gaussian fitting function.
            - `fitsave_sp1`: saves fitting parameters.
            - `fitnewsave_sp1`: saves "new" fitting parameters (used for ROI changes later).
            - `datadisp_sp1`: calculates output parameters from fitting parameters and outputs them to the Results box in the GUI. This is where the physics happens.
                - `elementproperties`: function that stores physical properties of various species. Check this to make sure things like your absorption cross-section are correct.
                - `plotstorage_sp1`: stores output parameters in a MAT file for the Data Plotter.
                - `updateplottab`: updates the Data Plotter tab.
                    - `getplotrange`: figures out which files to display data for based on what is entered in the "Range" text box.
                        - `loadlogPlotter_sp1`: optionally called if saved data is being plotted.
                    - `setplotvariable`: sets what parameters are being plotted based on drop-down menu selection in the Data Plotter.

- keeproi_sp1: activated if the “Keep ROI” checkbox is ticked.
    - fitnewsave_sp1
    - datadisp_sp1
- pixel_sum_processing_sp1: Uses the pixel sum method to calculate the atom number.
- fittingTF_sp1: Thomas-Fermi fitting routine based on the double Gaussian fitting routine in the earlier version of the image analysis program. It’s not a fail-safe routine in the sense that it doesn’t always choose the right starting parameters for the thermal and BEC components.
    - fitnewload_sp1
    - bimodal_findstart: finds the initial guess parameters for the Thomas-Fermi fit. You may need to edit this if the fits are bad.
    - para_fit: fitting function for the BEC component.
    - datadispTF_sp1: calculates parameters and displays data in the “Results” box in the GUI.
        - Elementproperties

- ana_sp2: same as above for the first species. The only differences involve when data is plotted in the Data Plotter.
    - applyFourierFilter_sp2
    - fitfun
    - fitsave_sp2
    - fitnewsave_sp2
    - datadisp_sp2
        - plotstorage_sp2
        - pixel_sum_processing_sp2
        - updateplottab
            - getplotrange
                - loadlogPlotter_sp1
            - Setplotvariable

- Newdatamenu_sp2: processes data for species 2 only if the “Two Species (separate)” mode is chosen. More or less identical to newdatamenu, except only routines relating to species 2 are called.
- sumorcut: activated when the “Sum or Cut” drop-down menu option is selected. It will either plot the column sums in the *x* and *z* plots or cuts through the center of the cloud.
    - fitnewload_sp1: loads fitting parameters.
    - fitnewload_sp2
- saveMainState: saves the state of the GUI, meaning when the GUI is closed and opened again, all of the options will be the same as how they were left.
- olddatamenu_sp1: loads old images and processes them. This relies on the saved ascii files have a specific naming format. If you want to open old files with a different naming scheme, you will have to edit this file.
    - loadascii

        - loadlog_sp1: loads the DAT file that stores saved data (if it exists).
        - ana_sp1
    - Olddatamenu_sp2: same as above, but for species 2.
    - roimenu_sp1: recalculates everything and refits after a new ROI is chosen. This is a little buggy at present, but I haven't yet found the source of the bug.
        - fitnewsave_sp1
        - datadisp_sp1
    - zoomoutmenu_sp1: recalculates everything and refits after the images is zoomed out.
        - fitload_sp1
        - fitnewsave_sp1
        - datadisp_sp1
    - savedata: saves data in a DAT file organised by month when the "Save Data" button is pressed. This saves everything, including trapping frequencies entered in the GUI.
        - loadlog_sp1
        - savelog_sp1: saves the data in the DAT file.
        - loadlog_sp2
        - savelog_sp2
    - plotlinemenu: activates when then "Choose Point for Crosscuts" button is pressed.
    - setmapmenu: sets the colourmap based on the drop down menu in the "Plot Options" box.
    - roimenu_sp2
        - fitnewsave_sp2
        - datadisp_sp2
    - zoomoutmenu_sp2
        - fitload_sp2
        - fitnewsave_sp2
        - datadisp_sp2
    - updateplottab
        - getplotrange
            - loadlogPlotter_sp1
    - plotsaveddata: plots saved data in the Data Plotter instead of today's data. This requires the data to have been saved via the "Save Data" button.
        - setplotvariable_saveddata: sets which parameters are plotted based on drop-down menu selection in the Data Plotter.
    - exportplotterdataCSV: exports data from the plotter in a CSV file. It exports all plottable parameters.
        - getplotrange
    - exportplot: opens the Plotter Data plots in a separate Matlab figure for editing and saving.
        - getplotrange
            - loadlogPlotter_sp1
        - setplotvariablename
        - setplotvariable_saveddata

    - `exportfits_sp1`: exports the data and fits from the *x* and *z* plots in CSV files.
        - `fitnewload_sp1`
    - `exportfits_sp2`
        - `Fitnewload_sp2`
    - `removefringes_sp1`: removes fringes using the method of superposition after selecting an ROI for species 1.
    - `removefringes_sp2`: removes fringes using the method of superposition after selecting an ROI for species 2.
    - `Removefringes_PCA_sp1`: removes fringes using the method of principal component analysis (PCA) after selecting an ROI for species 1.
    - `Removefringes_PCA_sp2`: removes fringes using the method of principal component analysis (PCA) after selecting an ROI for species 2.
    - `configfileeditor`: GUI for editing the configuration files. Like the main GUI, `configfileeditor.fig` can be opened using GUIDE, and the main Matlab function is `configfileeditor.m`.
        - `loadConfigState`: loads the previous GUI options from last time the GUI was closed.
        - `saveConfigState`: saves the state of the GUI (text box selections, etc.)
        - `updateconfigvalues`: updates the config data values when a saved config file is loaded.
- `AutoloadNewData`: Calls the GUI is `AutoloadNewData.fig`. This program looks for new data continuously after you press start autoload button and after calling `autoload_newdatamenu_cont.`
    - `autoload_newdatamenu_cont`: This looks for new data continuously. When new data is detected it calls `Autoload_newdatamenu`.
    - `Autoload_newdatamenu`: same as `newdatamenu` minus `ana_sp1` and `ana_sp2`.
- `OfflineImageAnalyser`: Calls the GUI is `OfflineImageAnalyser.fig`. The script is `OfflineImageAnalyser.m`, where all the calls to subroutines happen.
    - `offline_image_analysis`: This is the main script where all the offline analysis happen. Here the program loops through all the files stored in the variable file and saves the calculated atom number values to an exel sheet.
        - `analyse_no_fit_sp1`: Calculates the pixel sum for species 1.
            - `find_at_no_sum_sp1`: Extracts the atom number from pixel sum for species 1
        - `analyse_no_fit_sp2`: Calculates the pixel sum for species 2.
            - `find_at_no_sum_sp2`: Extracts the atom number from pixel sum for species 2
        - `analyse_and_fit_sp1`: Performs a 1-D gaussian fit to the atom image for species 1.
            - `find_at_no_sp1`: Extracts the atom number from above fit only for species 1.
        - `analyse_and_fit_sp2`: Performs a 1-D gaussian fit to the atom image for species 2.

        - `find_at_no_sp2`: Extracts the atom number from above fit only for species 2.
- `remove_fringes_offline_sp1`: Same as `removefringes_sp1`.
- `remove_fringes_offline_sp2`: Same as `removefringes_sp2`.
- `remove_fringes_PCA_offline_sp1`: Same as `removefringes_PCA_sp1`.
- `remove_fringes_PCA_offline_sp2`: Same as `removefringes_PCA_sp2`.