# FIRST STEPS

* Add this folder and all subfolders to your MATLAB path. Otherwise the code cannot find functions in other files.
* ‘post\_process.m’ is the starting point for both experimental and MSPM data processing.

# How to process a folder of experimental data (from the LabVIEW DAQ software for the Terrapin DAQ)

The DAQ software saves data as 3 text files per datapoint (RTD, TD and VoltCount). This code processes a folder of any number of such datapoints and stores the processed data in a ‘…\_RD.mat’ file (‘reduced data’).

‘post\_process.m’ defines some inputs. Then, ‘calibrate.m’ applies correction according to calibration data to the dataset. Finally, ‘reduce.m’ averages much of the raw data and calculates calculated variables, such as shaft power, heat input rate etc.

* Open ‘post\_process.m’. Adjust parameters:
  + environment pressure (1st section)
  + 3rd section:
    - ENGINE\_DATA refers to the file in the ‘ENGINE\_DATA’ folder that contains the properties of your engine. ‘T2\_ENGINE\_DATA’ is for the Raphael as used by Matthias. The volumes, piston diameters and strokes in this file need to be accurate!
    - Can adjust ‘path’ (optional)
    - ‘short\_output’ for including raw data in final output
    - ‘have\_DCH\_source’ is specific to the Raphael and defines whether the top plate heat exchanger was used.
* Open ‘calibrate.m’. This file contains all references to calibration data and must be updated whenever the setup is changed!
  + First section: path to RD and TC calibration file folders. See the existing calibration data for examples.
  + Next, curves are fitted to the RTD and TC calibration data. These curves can be viewed using the plotting code that is commented out.
  + Next, calibration data for all other sensors (voltage) is entered and curves are fitted similarly.
  + Below that, calibration is applied to the data and then stored in ‘C\_DATA’. Go through these sections and make sure the data is processed correctly according to your present setup.
* Open ‘reduce.m’. Check and update the parameters here:
  + *Inputs* section for hot and cold liquid properties
  + Further down in the loop, check the way all parameters are calculated based on your setup.
* There is more data to be input in the following functions that are referenced by ‘reduce.m’:
  + SIL\_180\_flow\_rate\_calc
  + SIL\_180\_specific\_heat\_calc
* Run 1st and then 3rd section of ‘post\_process.m’.
* A prompt will ask you to select the folder that contains the experimental data files you wish to process. **Make sure this folder contains no other .txt files than the experimental data.**
* The processed data file is saved into the same folder you selected.

# How to process a set of MSPM data folders

MSPM saves its results in a folder (usually ‘Runs’ in MSPM parent directory); every MSPM run is saved in a separate folder inside this folder.

‘post\_process.m’ defines some inputs and then calls ‘DataExtract.m’ which extracts data from an MPSM test set folder and stores the processed data in a ‘…\_MSPM.mat’ file.

* Open ‘post\_process.m’. Adjust parameters:
  + environment pressure (1st section)
  + layout (2nd section)
* Open ‘DataExtract.m’. Adjust parameters (first section):
  + ‘query’ variables to find the MSPM output files
  + Can adjust ‘start\_path’ (optional)
  + ‘PV\_order’ according to the order of the engine spaces in the PV output data of your model. Need to run the model and view the PV output file to find this after making a new model.
  + If data is not extracted correctly, go through the other code sections and adjust parameters. This code was only tested with Matthias’ models.
* Run the 1st and 2nd sections of ‘post\_process.m’.
* A prompt will ask you to select the folder that contains all the results folders from the test set you wish to process. **Make sure that only the results you want to process into one dataset are in this folder. This folder must have no other subfolders except the results folders.**
* The processed data file is saved into the same folder you selected.

# How to use the Plotting functions to plot and compare experiment and model datasets

The code in ‘Plotting’ can load several sets of experimental data (‘\_RD.mat’ files made with experimental post processing code) and model data (‘\_MSPM.mat’ files made with MSPM processing code). It can then compute the parameters to compare PV plots, and plot any data from the loaded datasets.

* Start by opening ‘AA\_Plots\_START.m’ and running the first section. The window that opens allows you to import any number of experiment and model datasets. The order in which you select them will be the order in which they are stored in the data structures ‘DATA\_EXP’ and ‘DATA\_MOD’.
* The other code files contain code to generate a variety of plots, some from only the experiment or model data and some that compare both. This code might be hard to read as only Matthias used it so far and didn’t comment much.
* If you wish to make plots that compare the PV curves between datasets, open ‘Plots\_PVcompare.m‘. This code compares the indicator diagrams between experiment and model runs based on the ratio of overlap between them. review the inputs in the 1st section and then run it. If desired it will plot the PVs of each data point and its overlap with the experiment.