# HCIFS WFSC Experiment Manual

*He Sun 09/19/2019*

1. **Collect the flat filed images and run the data cube extraction**
   **(Related files: (a) "C:/Lab/FPWCmatlab/IFS/take_flatfield_images.m"; (b) "C:/Lab/crispy/crispy/HCIFS/cube_extraction.py")**
   1) **Initialize the filter wheels and the starlight express camera**
      **(run Sec #1 and Sec #2 in file (a))**
   2) **Turn off the superK laser (use the key), and take the dark frame image**
      **(run Sec #3 in file (a))**
   3) **Turn on the superK laser (please wait until the laser stabilized), and take the flat field images**
      - **(i. create a folder "C:/Lab/FPWCmatlab/IFS/flat*", and change the directory to that folder to save the flat field images;)**
      - **(ii. run Sec #4 and Sec #5 in file (a).)**
   4) **Run the data cube extraction Python file**
      - **(i. Start an Anaconda Prompt terminal;)**
      - **(ii. Change directory to "C:/Lab/crispy/crispy/HCIFS/;)**
      - **(iii. Activate the Python 2.7 environment, use the command "activate py27";)**
      - **(iv. Remove all the files in "C:/Lab/FPWCmatlab/IFS/data" and "C:/Lab/FPWCmatlab/IFS/flags";)**
      - **(v. Run the file (b), use the command "python cube_extraction.py".)**
   5) **Restore the IFS layout (plug the lens and pick-off mirror back);**
2. **Start system identification in python if you want to improve your model**
   **(Related files: (c) "C:/Lab/FPWCmatlab/Initialization_broadband.m", (d) "C:/Lab/FPWCmatlab/runEFC_broadband.m", (e) "C:/Lab/FPWCpy/HCIL_broadband_EM.py"**
   1) **Create a folder "C:/Lab/FPWCmatlab/dataLibrary/*" where you want to save your control data. Typically, the folder name is the date of the experiment;**
   2) **Change the "folder.dataLibrary" of case "ultron" in file (c) Sec #1 to be the folder you just created;**
   3) **Change the "folder" in file (e) to be the folder you just created;**
   4) **Change the "systemID_flag" in Sec #1 of file (d) to be "true";**
   5) **Make sure "n_EMitr" in file (d) equal to "n_systemID" in file (d);**
   6) **Run the system identification Python file**
      - **(i. Start another Anaconda Prompt terminal;)**
      - **(ii. Change directory to "C:/Lab/FPWCpy/";)**
      - **(iii. Activate the Python 3.6 environment, use the command "activate py36";)**

**(iv. Run file (e), use command "python HCIL_broadband_EM.py")**

3. **Run the main file for wavefront sensing and control**
   **(Related files: (c) "C:/Lab/FPWCmatlab/Initialization_broadband.m", (d) "C:/Lab/FPWCmatlab/runEFC_broadband.m", (f) "C:/Lab/FPWCmatlab/hardware/lab_initialization.m")**
   1) **Conduct Step 2.(1), 2.(2) if you didn't do Step 2.**
   2) **Change the "systemID_flag" in Sec #1 of file (d) to be "false" if you didn't do step 2;**
   3) **Calibrate the "camera.IFSflux" and "camera.center" in file (c) Sec #4;**
      **(i. Run Sec #1 in file (f) to initialize the DM;)**
      **(ii. Run Sec #7 in file (f). Please make sure the image "imgIFS" is not saturated;)**
      **(iii. Record the PSF center location by checking the "datacube", and assign the center to "camera.center" in file (c) Sec #4;)**
      **(iv. Assign the normalized peak values of PSFs of different wavelengths (variable "IFSflux") to "camera.IFSflux";)**
   4) **Run Sec #1 in file (d) to initialize the parameters for broadband control, make sure "simOrLab = 'lab'";**
   5) **Run Sec #2 in file (d) to initialize the DM and camera (if you have not started the camera);**
   6) **Run Sec #4 in file (d) to compute the state space model of the system, or load the pre-computed state space model;**
   7) **Run Sec #5 to start the system ID loop;**
4. **Turn off the lab hardware**
   **(Related file: (d) "C:/Lab/FPWCmatlab/runEFC_broadband.m")**
   1) **Run Sec #3 in file (d) to finalize the DM;**
   2) **Close the "MaxIm DL Pro 5" API;**
   3) **Turn off the superK laser.**