

# Aspoc Iphot correction and density estimation

## All Scripts

- edionoff
- Collect\_fpi\_data
- Collect\_data
- Photocurve
- Density\_estimate

## Detailed Description

- Edionoff: this script reads edi data to extract the times where edi was operating. Aspoc photocurrent reconstruction can only be done when edi is not operating as it interferes with the dependence of aspoc current and spacecraft potential.

Consider setting the time interval adequate, as it takes a lot of time for reading long period data. (>6 months). The times where edi was operating are saved as a asci text file in the chosen folder. The script collect\_data then uses this times to remove bad data.

Keywords:     t\_start: give start time in spedas notation  
                  t\_end: give end time in spedas notation  
                  probe: set probe (only on at a time!)  
                  fileSAVE: output directory for the .txt files  
                  local\_data\_dir: mms data directory  
                  append: set this to true if you want to add to already existing edionoff.txt file

- Collect\_data: this script has to run always before running any following programs. It loads edp (spacecraft potential) and aspoc data for all mms spacecraft. If a density estimation of a timerange with no aspoc data is wanted, run this script as well to get spacecraft potential data.

The script makes new folder in output\_dir named collected\_data if not existing and there it save the parameters as vsciaspb\_data.sav

Parameters description: tasp\*: time for aspoc data  
                          iasp\*: aspoc current  
                          tvsc\*: time for edp data  
                          vsc\*: edp s/c potential data  
                          q\* : quality parameter for data removal  
                          bi\*: edp data bitmask for data removal

Keywords:     local\_data\_dir: mms data directory  
                  datestart: give start time in spedas notation  
                  datestop: give end time in spedas notation

edionoff\_dir: directory of edionof .txt files made from edionoff script  
output\_dir: directory where the output vsciaspb\_data.sav is saved

- Collect\_fpi\_data: if the comparison of fpi density with reconstructed density or/and the calculation of photocurrent with fpi temperatures is wanted this script loads fpi data for the set interval and saves the needed parameters.

Only run this script if fpi data is needed.

Output\_dir of collect\_fpi\_data and collect\_data has to be the same!

Saves parameters as fpi\_data.sav

Parameters description: tne\*: time of fpi electron density data

ne\*: fpi electron density

ner\*: error of fpi electron density

tTe\*: time for fpi electron temperature data

Te\*: fpi electron temperature data

tni\*: time for fpi ion density data

ni\*: fpi ion density data

nir\*: error of fpi ion density

tTi\*: time for ion temperature data

Ti\*: ion temperature data

Keywords: local\_data\_dir: mms data directory  
output\_dir: directory where the output fpi\_data.sav is saved  
datestart: give start time in spedas notation  
datestop: give end time in spedas notation

- Photocurve: This script loads all the data in the collected data folder and interpolates to same frequency. It uses the initial\_parameters to find a fit for s/c potential and Photo current. The scatterplots of each mms s/c data with the regression parameters are saved as png in output\_dir. After fitting the density is calculated using the fitting parameters. The density comparison plots are saved as png as well.

Keywords: collected\_data\_dir: data directory of output data of previous scripts  
output\_dir: directory where all the plots are saved  
initital\_parameters: give initial parameters for mpfitfun  
this should be [Io1\_mms1, Vo1\_mms1, Vo2\_mms1, Vo3\_mms1] as it fits 3 parts

- Density\_estimate: Calculates the density from edp data using the fitting parameters given. Some temperature estimation has to be given for the density calculation as there is no fpi data. The script makes plots of the density calculated with all different temperatures given. The density data is saved in output directory as vsc\_densities.sav

Parameters description: dens\_data\_mms\*: array containing time in the first column and

reconstructed density in the other columns,  
calculated according to given temperatures in  
temp parameter

Keywords: temp: array containing the estimated temperatures  
collected\_data\_dir: data directory of output data of previous scripts  
output\_dir: directory where the output vsc\_densities.sav is saved  
fit\*: fitting parameters for each mms spacecraft of the photocurve script,  
input as [a,b,c,d,e,f] double or float

## Examples

- Getting fitting parameters for 2016-06-08 until 2016-06-12:

```
datestart='2016-06-08'  
datestop='2016-06-12'  
local_data_dir='M:\spedas\mms\'
```

```
COLLECT_DATA, datestart= datestart, datestop= datestop, local_data_dir= local_data_dir,  
output_dir='C:\data'
```

```
COLLECT_FPI_DATA, datestart= datestart, datestop= datestop, local_data_dir=  
local_data_dir, output_dir='C:\data'
```

```
PHOTOCURVE, collected_data_dir='C:\data', initial parameters=[70.d, 1.5, 5., 11.],  
output_dir='C:\fit'
```

- Reconstruct density for the time interval 2017-07-11 with no fpi data:

```
datestart='2017-07-11'  
datestop='2017-07-11'  
local_data_dir='M:\spedas\mms\'
```

```
COLLECT_DATA, datestart= datestart, datestop= datestop, local_data_dir= local_data_dir,  
output_dir='C:\data'
```

```
DENSITY_ESTIMATE, temp=[1e3, 1e4], fit1=[70, 1, 7, 10, 22, 4], collected_data_dir='C:\data',  
output_dir='C:\density'
```