

pca_tomography_plus

This program executes the complete procedure of the PCA Tomography in a data cube. For the correct execution of this program, it's necessary that the initial data cube have a header containing the parameters "CRVAL3", "CRPIX3" and "CDELTA3" (related to the wavelength calibration). If that is not the case, then, these parameters can be added to the header using the program "header_correct_plus". The data cube generated by the program "pca_tomography_plus" will also have a header containing these three parameters. To use this program, first of all, it's necessary to provide the following parameters (which must be added to the section "input parameters" in the program's script):

datacube: name of the data cube (full path) in which the PCA Tomography will be applied.

outfolder: directory where ALL the files generated by this program will be saved.

extension: extension of the data cube that will be used in the PCA Tomography process. If the cube has just one extension, then it must be taken the value 0 for this parameter.

minspecpx and maxspecpx: values of the lowest and highest spectral pixel to be used in the execution of the PCA. If the user intends to make a re-binning in the data cube before the execution of the PCA, then, the parameters minspecpx and maxspecpx must correspond to the values of the already binned data cube.

minspatpx_x and maxspatpx_x: values of the lowest and highest spatial pixel of the horizontal axis of the data cube's images to be used in the execution of the PCA.

minspatpx_y and maxspatpx_y: values of the lowest and highest spatial pixel of the vertical axis of the data cube's images to be used in the execution of the PCA.

eigenvectors_list: name of the file (full path) containing the numbers of the eigenvectors that will be used to construct the eigenspectra and tomograms. This file must be configured in the following way:

```
eigenvectorA  
eigenvectorB  
.  
.  
.  
eigenvectorN
```

where eigenvectorA, eigenvectorB,... and eigenvectorN are the numbers of the eigenvectors whose eigenspectra and tomograms must be constructed by the program

eigenvectors_number: number of eigenvectors to be used to generate the eigenspectra and tomograms. Obviously, this number must be equal to the number of eigenvectors mentioned in the file corresponding to the parameter "eigenvectors_list".

logfile: name of the logfile to be created.

PC: name of the file, to be created, containing the table with the obtained eigenvectors (corresponding to the columns of the table).

SCORE: name of the file, to be created, containing the table with the data in the new coordinate system. In other words, this table contains the tomograms (corresponding to the columns of the table) obtained with the PCA.

average_spectrum: name of the file, to be created, containing the average spectrum of the data cube.

Eigenspectra_prefix: prefix of the names of the eigenspectra files to be created. These files (all in txt format) will have two columns of values: the first of them will have the values of the wavelengths and the second column will have the weights of each wavelength on the eigenvector. The final names of the files will be given in the following way:

eigenspectra_prefixN1.txt
eigenspectra_prefixN2.txt
eigenspectra_prefixN3.txt
.
.
.
eigenspectra_prefixNi.txt

where N1, N2, N3,..., Ni correspond to the numbers of the constructed eigenvectors

tomograms_prefix: prefix of the names of the tomograms files to be created. These tomograms (all in fits format) will have headers, whose parameters can, eventually, be altered using the program "header_correct_plus". The final names of the tomograms files will be given in an analogous way of that of the eigenspectra.

eigenvalues_file: name of the file, to be created, containing the eigenvalues of the obtained eigenvectors.

After providing these parameters, the program shall be initiated. The following question will, then, appear to the user:

"Do you wish to perform a re-binning in the datacube (yes/no)?:" (1)

The possible answers to this question are “yes” or “no” (the answers “y” or “n” will also be accepted by the program). The re-binning process makes a spectral interpolation and reduces the number of spectral pixels in the initial data cube. Since, sometimes, IDL can’t allocate enough memory to execute the PCA Tomography in very large data cubes, the option of re-binning can solve this problem. If the user’s answer to the question (1) is “yes”, then, the following message will appear:

"Enter the value of the reduce factor for the re-binning: " (2)

The “reduce factor” corresponds to the number (integer) by which the initial number of spectral pixels of the data cube will be divided, resulting in the number of spectral pixels of the final data cube (re-binned). Only integer numbers can be used as “reduce factors” and it’s necessary that the initial number of spectral pixels of the data cube be divisible by the value of the provided “reduce factor”.

After the procedure of re-binning (which can be done or not by the user), the following messages will appear sequentially:

"Enter the value of the size of the spatial pixels (in arcsec) along the horizontal axis:" (3)

"Enter the value of the size of the spatial pixels (in arcsec) along the vertical axis:" (4)

The user must provide, then, the two requested parameters, which will be used, only, to compose the headers of the tomograms to be constructed.