	VEGA

How to process VEGA data

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CHANGE RECORD

VERSION	DATE	SECTION/PAGE MODIFIE	COMMENTAIRES
1.0	09/07/2009	All	First issue
2.0	28/08/2009	1 and 4.4	Possibilité d'utiliser l'ancien code de traitement pour déterminer les bandes spectrales
3.0	01/09/2009	3 and 5	Ajout d'une description de l'interface utilisateur et d'une documentation sur les outils de post-traitement
4.0	23/09/2009	4.7	Ajout d'une description des fichiers de sélection
5.0	24/09/2009	All	English version + update on GUI use
5.1	6/10/2009	6,6.1,AnnexB	Modification structure res; Addition of ArgB and u,v coordinates
5.2	22/10/2009	6,6.2,AnnexA, AnnexB	Modification structure res; Addition of parameters required to create an oifits file Ajout du keyword DS.NOISE.RATIO qui donne une information sur la qualité de la correction du trou de centreur Ajout du keyword OIFITS dans la routine vega_post_ac_cal
5.3	25/10/2009	6,6.1,6.2 AnnexB	Documentation of the KEYWORD in vega_post_ac_cal function
5.4	09/11/2009	B.2,B.3	Ajout du keyword INDIV dans vega_post_ac_cal Et du keyword OIFITS dans vega_post_ic_cal Changement du keyword POLY par FPOLY dans vega_post_ic_cal
5.5	21/11/2009	6.3 + annex B	Add the vega_read_diff function
5.6	24/11/2009	3.1	New configuration for the raw data conversion
6.0	18/10/2010	All	Important updates
7.0	17/02/2011	All	Remove the "installation of software and data" parts. Separation of case 2T and 3T. Description of plotsp function.
7.1	23/04/2011		Addition of vega_post_ic procedure
7.2	07/06/2011		New keywords on vega_post_ic + Addition of section 3.1 for some good recipes…
7.3	22/10/2011		New keyword /ascii in vega_post_ic noCP in vega_gen_conf_file use of select file in vega_post_ac_raw_3t
8.0	26/11/2011		Documentation for V² with new functions, including better estimates of errors, systematic errors due to calibrator.

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8.1	11/12/2011	16/17/23	Vega_post_ic in 3T/4T mode
8.2	08/02/2012		Function vega_post_ac_raw and cal (new)
8.3	21/02/2012		Update of the vega_post_ac structures
8.4	02/05/2012		Addition vega_select_file_4t Change in vega_post_ac_raw (select files) Change in vega_post_ac_cal (pic option)
8.5	28/6/2012		Add sigma keyword in vega_post_ac_cal
9.0	15/12/2014	All	Development of introduction, simplification of the details put on the web page now.

For online information please refer to the wiki
https://vega-wiki.oca.eu/foswiki/bin/attach/DataReduction/WebHome

1 Introduction and important notes

The VEGA data processing is installed on vega.oca.eu computer in Nice and pc-datarvega+vegamwi on Mount Wilson. Data are installed on vega.oca.eu and on demand on the others.

1.1 Main steps of the processing

1. Installation of the data: conversion of the raw data and processing of the spectral calibration law. This step is performed at the end of each run and it's not under responsibility of the general user.
2. Use the GUI to prepare the processing. This step aims at defining the various processing that one want to apply on a set of data folders.
3. Generate the script and start it to process the data
4. Visualize the results; identify the eventual problems (information in the observing log, OPD errors, loss of fringes…) and tag the corresponding data files.
5. Use the set of IDL functions to estimate the final products of the processing (spectrum, V², differential visibilities), perform the calibration and generate the final results in the oifits format.

1.2 Two modes of processing and important note

1. AC mode (AutoCorrelation mode) for absolute squared visibility estimates. In that mode one science folder is associated with at least one calibrator folder. The result is V² for a given spectral band.
2. IC mode (InterCorrelation mode) for differential visibility estimates. In that mode each data folder is independent. The result is Amplitude and Phase of the differential visibility as a function of wavelength.

Before configuring one or many complete processing which will generate an important work of analysis, it is mandatory to check the data quality on a simple and fast processing on V²and tag, if necessary, the bad blocks. Those have to be discarded for the IC mode.

1.3 Tips for the preparation of your processing

1. All folders from a same night, same spectral configuration and same detector, either science or calibrator, could be processed simultaneously in the same processing configuration.
2. One processing configuration (independently of the number of folders) must correspond to one working directory.
3. Before starting the configuration of the processing, perform the important following steps:
   a. Identify your whole set of data and identify the corresponding observing logs on the web page.
   b. Generate a simple processing (AC mode, one band of 15nm) and process all the data folders of a same set (one night, one detector, one spectrograph configuration). Check the results with the posttools and tag your data according to your criteria (observing log, bad OPD, loss of fringes…) and store carefully the so-generated select file.
   c. Depending on your scientific goal and on the results of step b, decide the whole set of processing you will perform. Remember that (one processing)=(one night, one detector, one or many data folders with the same spectrograph configuration, one configuration processing (AC or IC, spectral parameters of the processing))=(one working directory).

     d. In your result folder (/data/$USER), generate the arborescence of working directories. A good policy is:

          i. Level0: /data/$USER/Vxx or /data/$USER/NAMEOFSTAR

          ii. Level-1: AC-R-B1, AC-R-B2…, IC-B-C1 where AC or IC represents the two mode of processing, R or B the detector, B1-B2… the chosen spectral bands for the AC mode, C1-C2… the spectral configuration chosen for the IC mode.

4. You can use the same Level-1 folder for different nights but you will need to rename each 'cmd' files in the Level-1 folder to identify it with the night: "mv vega_data_reduction.cmd cmd25122012.cmd" before preparing the second processing for the second night. If you use a Level-1 by night, the name of the night (YEAR.MM.DD) may be inserted in the name.

5. Copy the select files created in step 3.b in the corresponding working directories.

1.4 Tips for AC mode

1. In HR mode the total spectral band is about 8nm whereas in MR mode it is close to 45nm for the red detector. These numbers are 6 and 30 respectively with the blue detector.

2. It is known that due to the spectral decorrelation of the fringes introduced by the atmospheric turbulence, spectral bands larger than 15nm should be avoided as much as possible.

3. Because of limitations in the correction of artefacts introduced by the photon counting regime of the VEGA data, it is imperative to avoid processing AC bands with width smaller than 1/3 of the total spectral band of the detector.

4. As a consequence the standard configuration in MR mode is to define three adjacent spectral bands of 15nm on the red detector and 2 on the blue detector. In HR mode it is usually preferable to use the whole spectral band of the detector.

5. More to come: HF zone definition, cumul versus non-cumul, bad photon centroiding hole correction identification…

1.5 Tips for IC mode

1. In IC mode the principle is to define a wide spectral band called the reference one and a narrow spectral band called the science band.

2. The reference band should be ideally centered on the most interesting spectral feature of the band (usually one spectral line) and its width should be sufficient to cover a good part of the continuum spectrum on the left and on the right of the spectral pattern. The width of the reference band should in principle not be larger than 15 to 20nm but in some case of low signal to noise ratio it's worth trying to use larger spectral reference band in MR mode. In HR mode the total spectral band could be used.

3. The width of the science band depends on the scientific goal, the spectral feature and on the data quality. Different tests are usually needed. The parameters of the science band set during the preparation of the processing permit to define its width, its initial spectral position and the step for moving it..

4. The IC data are usually analyzed by cumulating all the blocks of a data folder. Thus bad blocks identified in the observing log or during the AC mode processing should be discarded before the preparation of the processing. This is usually done by using the select files (see Sect. 1.1 and 1.3).

# 2 Select the data and configure the initial processing

The GUI is used for configuring a processing. The following steps have to be done:

    1) start IDL, compile the application and run it :

[user@vegadrs] $ idl

[user@vegadrs] IDL> @compileProject

[user@vegadrs] IDL> vegadrs
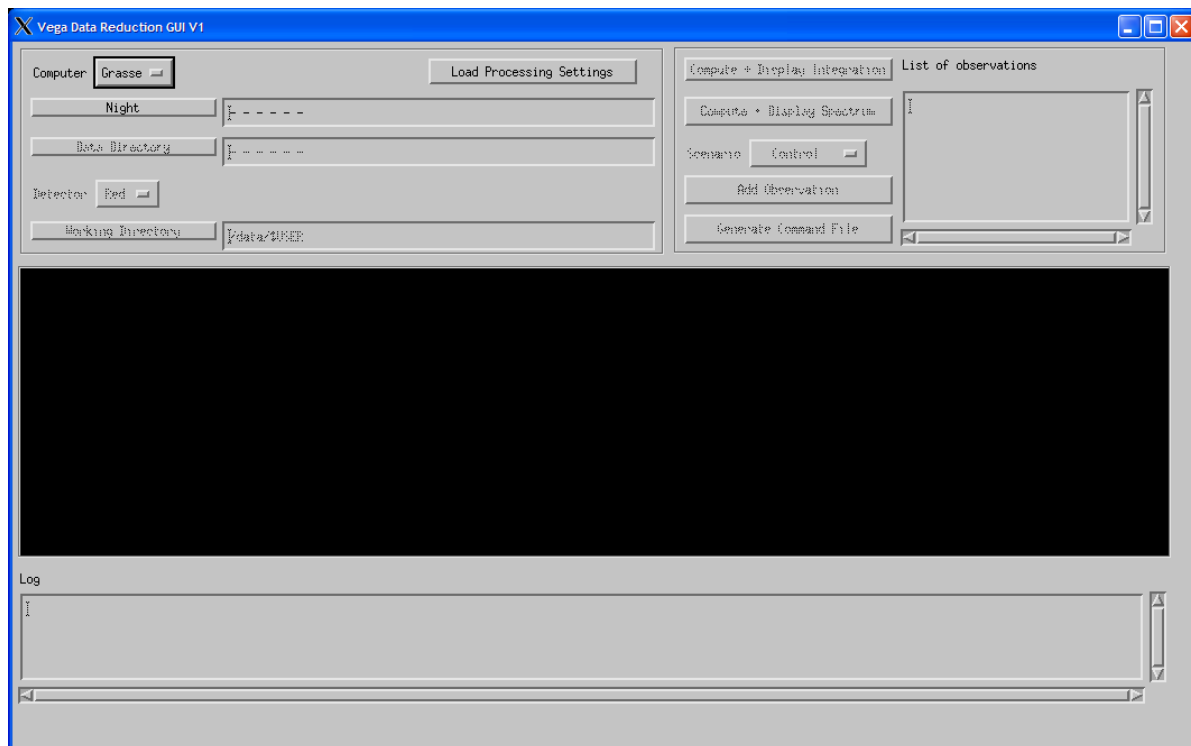
    2) ~~Select the site (Grasse/MWI) where the data are located. Default is Grasse~~. This function is not implemented. The application can only process local data.

    3) Select the night

    4) Select one data directory

    5) Select which detector you want to process

    6) Set your working directory.

                    Use a different working directory every time you start a new process
                         Selections are made in the right part of the popup window
                         Navigation among directories is made in the right part

    7) Click on « Compute+Display Integration ». A new window appears :
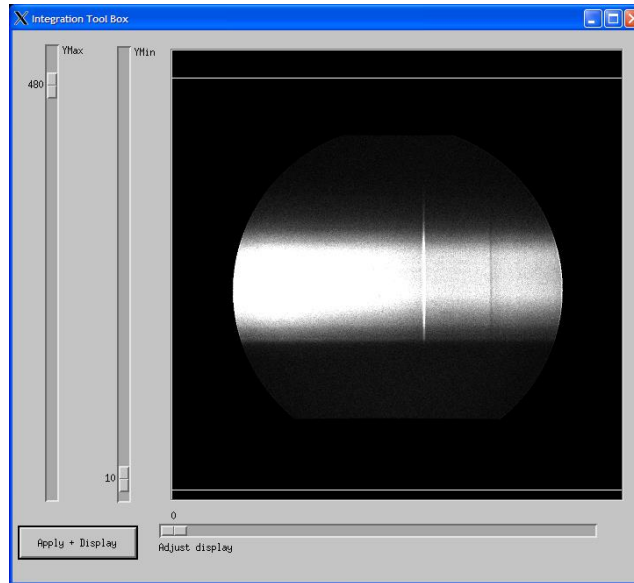
8) Use the "Adjust Display" slider to adjust the display and use the Ymax, Ymin sliders to define the vertical windowing (not smaller than the slit limits). When done, click on "Apply+Display" to correctly take into account the vertical windowing for the spectrum calculation. Then close the integration window.

9) Click on « Compute + Display Spectrum ». In the « Spectrum Tool Box» window, select the continuum regions and set their limits. Then select the degree for the polynomial fit and then click on « Show Fit ». When happy, click on « Display corrected Spectrum » and you will get the flattened and calibrated spectrum. Close the toolbox window.
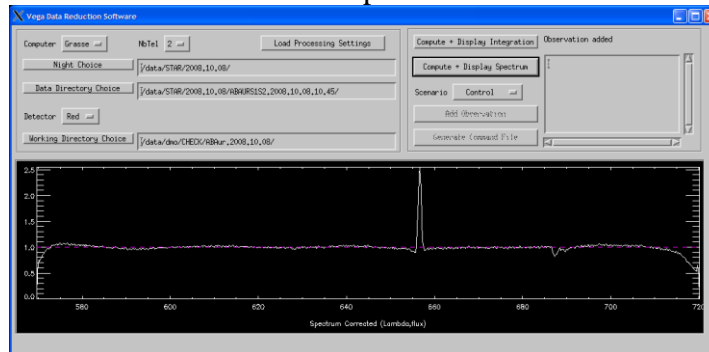

10) Selection of the processing scenario. Four modes are available:

- Control: not implemented
- Autocorrelation: Spectral density on one spectral band. The processing is firstly done on the sum of all the individual files. The position of the high frequency signal is then used on the individual files to measure the raw V^2.
- Intercorrelation: Cross-spectral density of two spectral bands. The processing is done on the sum of all the individual files. In this mode it is possible to define a processing where the spectral windows will take a series of different values. This is done by selecting a step

and range for moving the windows. Use 0 and 0 for spectral band 1 if you want that the reference window stays constant.

- Temporal: The VEGA observing blocks usually contain 2500 frames. When conditions are good, it is possible to process each block not as a whole but as a series of a certain number of frames. The processing is then applied on shorter sequence than the total duration of a block. Enter the number of frames per sequence you want to process in the Nb Frame/Block window. If the total number of frames per observing block is not 1000, one should add a keyword in the command file (NBIMFILE 3000, for example if the number of frames per block is 3000).
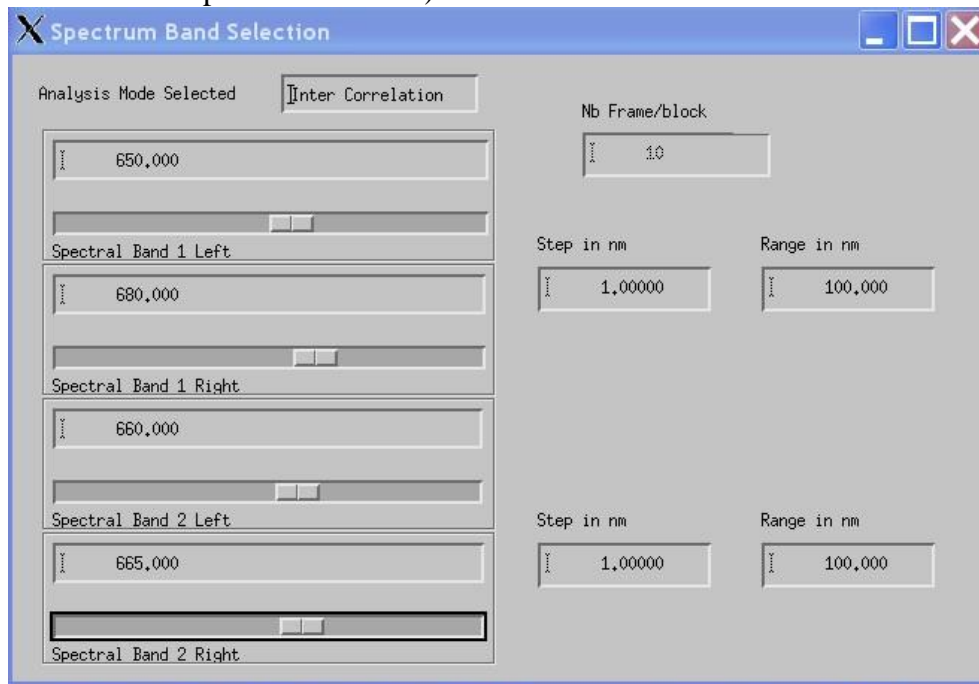
11) The processing is now ready and you can select all the data that you want to process on the same way. This means data with the same spectrograph configuration. Just click « Add Observation ».
12) When ready, click on « Generate Command File »
13) If you want to configure other processing on the same directories, just select a new working directory, set your processing configuration and generate a new command file.
14) If you want to apply the same processing on a different night and different folders with the same spectrograph configuration, just do steps 3 to 6 and 11 and 12. If you wish to use the same working directory do not forget to rename first the cmd file generated during the first preparation.

3 Generating the script and processing the data

3.1 Principles

The Command File is used to generate the processing script. Just go in the Working Directory and identify the Command File 'file.cmd'. Then generate the script:

$ vega_gen_conf_file file.cmd

If you are processing 3T data and you do not want to calculate the closure phase (this is a very long step) then use the following syntax:

$ vega_gen_conf_file file.cmd noCP

You should then have obtained in the Working Directory a new directory named by the date of the night (YYYY.MM.DD) and a file *lance_ac_yyyy.mm.dd.csh* or *lance_ic_yyyy.mm.dd.csh* depending of the processing choice. The directory YYYY.MM.DD should contain one directory for each selected observation. These directories contain the information for the processing: one file « file.conf » for each data file and a file «command_ac.csh» or «command_ic.csh ». The configuration files contain all the information about the data and the results of the processing. The content of these file is described on Annex A.

The processing itself is started with the command:

$ csh lance_ac_yyyy.mm.dd.csh

or

$ csh lance_ic_yyyy.mm.dd.csh

Note that you can record the messages by using the following syntax:

   $ csh lance_ac_yyyy.mm.dd.csh > lance_ac_yyyy.mm.dd.log

You can also start the processing with the possibility of closing your session:

   $ nohup csh lance_ac_yyyy.mm.dd.csh > lance_ac_yyyy.mm.dd.log &

3.2 Some useful information

- If valid DataDirectoryName.select files are present, their content is used to remove the blocks that have been previously identified as bad.
- If one wants to let the program find the fringe position in each data block, just run "remfixsuphf.csh" in each of the result directory or add the corresponding entry at the correct position in the lance_xx_xxx.csh file.
- To cancel the previous operation, just run "restorefixsuphf.csh" in each of the result directory.
- To bin observing blocks before the processing, use the "binner.csh" script (binner.csh 3 algolr) that will for example allows you to process the data by packets of 3 individual blocks. This has to be run into each of the result directory and to be added at the correct place in the lance_xx_xxxx.csh file.
- In Intercorrelation mode, it is possible to eliminate a band inside the reference window (for example an intense spectral line). For doing that one just has to add LMIN3 lambdaMin and LMAX3 lambdaMax in the command file before running vega_gen_conf_file.

- Do not remove the spectrum.dat file. It will permit you to reload all the initial settings of the processing and define new scenario of processing.
- The results of the processing are stored in fits or ascii format in each directory of the YYYY.MM.DD directory. The results of the processing are found in the conf file. They can be opened with simple text editor.
- A library of IDL functions helps in viewing the results. To use the library:

   [user@vegadrs] $ idl
   [user@vegadrs] IDL> @start_vegadrs

4 Final scientific processing (to be reviewed…. Caution)

After the initial processing, it is possible to identify the individual files that have to be rejected during the scientific processing. The term "scientific processing" means that you will use the same set of data (except the filtered files) but you will configure one or many different processing (each one in a separate WorkingDirectory) for example: AC on different bands, one IC etc…

4.1 Rejecting bad individual files

After the initial processing and the quality check, it is possible to indicate which files have to be rejected. To do that one has to edit Text File called "DataDirectoryName.select" (example GLYRS1S2.2008.07.28.08.25.select). These files have to be stored in the same location as the "CommandFile.cmd file". If you want to reject files number 2, 5, 8 for example, just enter the following lines in the select file:

   FILE2.BAD 1
   FILE5.BAD 1
   FILE8.BAD 1

These files are now automatically generated by the function vega_select_file (see 6.1.1) but manual edition is still feasible.

4.2 Configuration of the scientific processing

1) Start again the GUI as in step 1) of Section 4.
2) Click on "Load Processing Settings" and load the command file used during the initial processing. This will allow you to recover your initial configuration (night, data, detector, windowing, spectrum flattening).
3) Select a new Working Directory where you will store the new processing files.
4) Choose the Scenario and configure your processing
5) Click on Generate Command File
6) Repeat steps 3-4-5 for the various processing you want to do.

4.3 Manual configuration of processing

You could copy the initial cmd file in a new directory, edit it and change the configuration of the processing. Do not forget to change the WORKINGDIR parameter to the new directory.