Calibration pipeline for VIR data

F.Carraro(1), S. Fonte(1), A. Coradini (1), G.Filacchione(2), M. C. De Sanctis (2), E. Ammannito (1), M. T. Capria (1,2), M. Cartacci (1), R. Noschese (1), F. Tosi (1), F. Capaccioni (2).

(1) INAF-IFSI, Rome, Italy, (2) INAF-IASF, Rome, Italy

Abstract

During the second quarter of 2011 VIR-MS (VIS and IR Mapping Spectrometer) [1] aboard Dawn mission [2] has approached Vesta in order to start a long period of acquisitions that will end at the beginning of 2012. Data acquired by each instrument always require a calibration process in order to remove all the instrument effects that could affect the scientific evaluations and analysis. VIR-MS instrument team has realized a calibration pipeline which has the goal of producing calibrated (1b level) data starting from the raw (1a level) ones. The other goal of the tool has been the check of the goodness of acquired data by means of the evaluation of a series of minimum requisites of each data file, such as the percentage of the saturated pixels, the presence of spikes or the mean S/N ratio of each qube.

1. VIR Calibration tool

An apposite tool, named *VIR Calibration*, has been developed to complete the calibration process. The main phases of this pipeline are the following ones:

1) detilt process, to remove effects of misalignment of optical components of the VIR instrument;
2) defective pixels analysis, to evaluate the quality of each pixel of the detector;
3) despiking process, to remove spikes due to high energy particles;
4) saturation analysis, to evaluate the result of the chosen integration times;
5) SNR analysis, to evaluate the signal to noise ratio;
6) Application of the calibration matrix.

For each analysis a specific accurate algorithm has been realized and validated during first runs of the calibration tool. A representation of the calibration pipeline is shown in Figure 1.
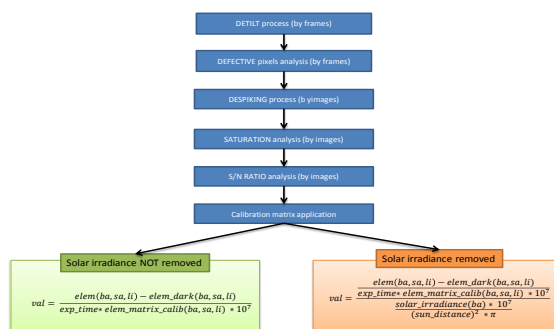

Figure 1: Schema of the calibration pipeline.

2. Informatics instruments

Great attention was required in choosing the informatics instruments used for the realization of the tool. After having considered both pure calculations performance and development speed and security, Java has been the selected language for the development of the calibration tool. Some other issues as the portability of Java programs over a wide range of operative systems and the possibility to implement features to make the tool able to work through the internet make this language suitable for the creation of a complete and efficient tool. IDL has been also used to implement a part of the pipeline dedicated to the detilt process because of its speed in performing this calculation.

3. Results

The *VIR Calibration* tool is able to calibrate a qube data file in a few minutes. The tool generates, starting from a 1a level file, the corresponding 1b level file and a series of products such as files containing info about saturation, SNR, despiked pixels, histograms from the calibrated file and from the SNR analysis. The tool also creates a report showing the results from the main analysis and is able to send mail to the whole VIR-MS team containing the report and the log files from the process.

References

[1] M.C. De Sanctis, et al., The VIR Spectrometer, Space Sci Rev DOI 10.1007/s11214-010-9668-5, 2010.

[2] C.T. Russell, et al., Dawn: A journey in space and time.