MATISSE for VESPA tutorial

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MATISSE has been recently upgraded in order to retrieve data from the repositories available in VESPA. The first dataset for which this functionality has been activated is that from the imaging spectrometer VIRTIS onboard ESA's Venus Express. In the following, an example of the usage of MATISSE with VESPA will be described.

Warning: This example has been ran with Chrome browser, as Firefox could present some problems in the connections.

From the VESPA portal (http://vespa.obspm.fr/) search for observations acquired on Venus (i.e., Target Name = Venus). In this example we are looking for a specific observation, that described in the work by Muller et al. (2008) focused on the thermal emission from the surface of Venus. Therefore, we can proceed by specifically searching for the image cube shown in Fig. 9 of that paper, the VI0373_01 (second cube acquired in orbit 373 by the infrared channel of the instrument), by typing this in the "Obs ID" field in the VESPA query mask (Fig. 1) and then clicking "Submit".

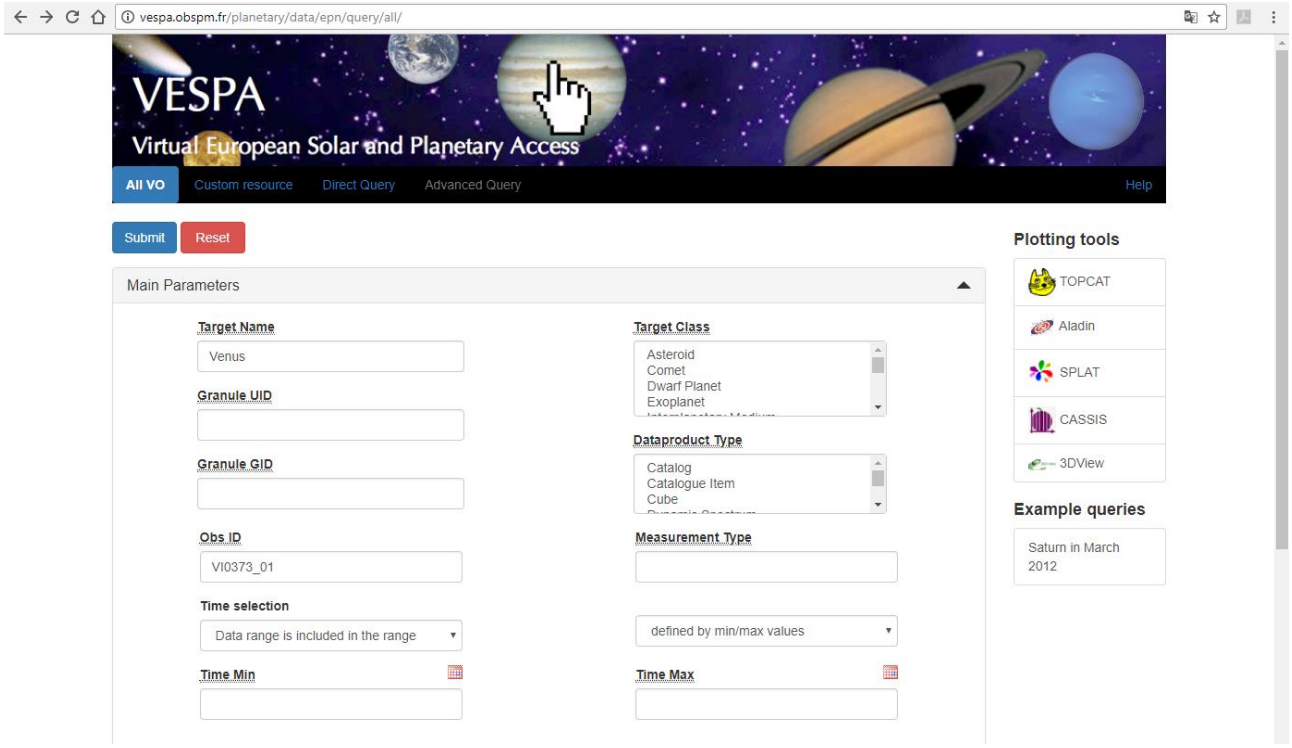

Fig.1: The selection mask of VESPA

From the EPN Resources table displayed, the table button on the right of "VVEx – VIRTIS Venus Express nominal mission" (it should be the only green line – Fig. 2) has to be clicked and the table with the two cubes (one for the observation and one for the geometries) found will appear.

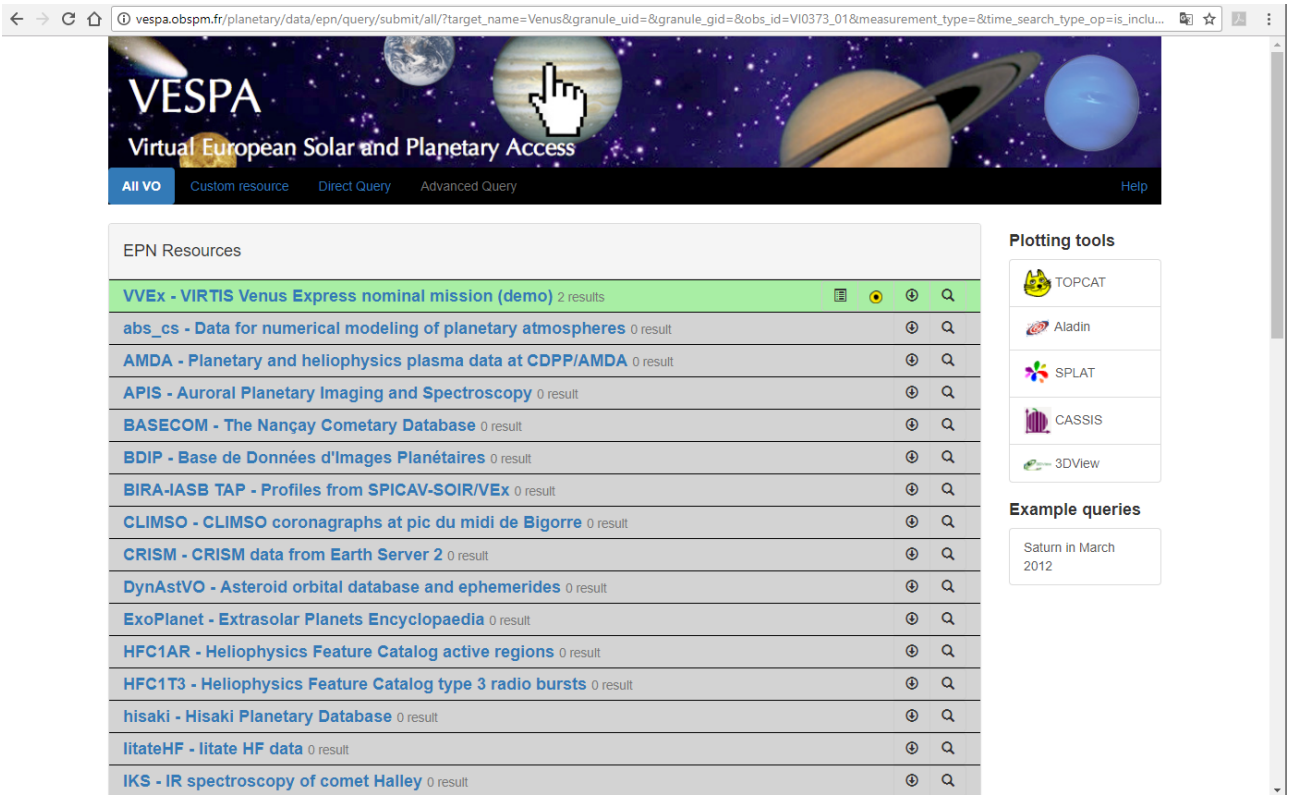

Fig. 2: The EPN Resources table of VESPA

At this point TOPCAT (available at http://www.star.bris.ac.uk/~mbt/topcat/topcat-full.jnlp) must be launched, then MATISSE must be open in the browser (https://tools.asdc.asi.it/matisse.jsp - without closing the VESPA page).

From the MATISSE homepage we need to click on the "Register with SAMP HUB" button, taking care to an icon that will likely appear on the right end of the address bar of Chrome (Fig. 3).

Warning: this last step is of capital importance and is due to the connection between a secure http protocol (the https of MATISSE) and a standard one (the http localhost by TOPCAT): browsers tend to avoid these connections, but this is the only way MATISSE can receive data from VESPA.

Fig. 3: The mixed content alert icon from Chrome

After the authorization to proceed with mixed content has been provided, it is needed to click once again on the "Register with SAMP HUB" button and then on "YES" in the window that will appear (Fig. 4). Now the MATISSE SAMP HUB is active as evidenced in the homepage of the tool.

Warning: MATISSE SAMP HUB must be activated again every time the MATISSE home page is accessed (also after clicking the “Back” button in the output page).

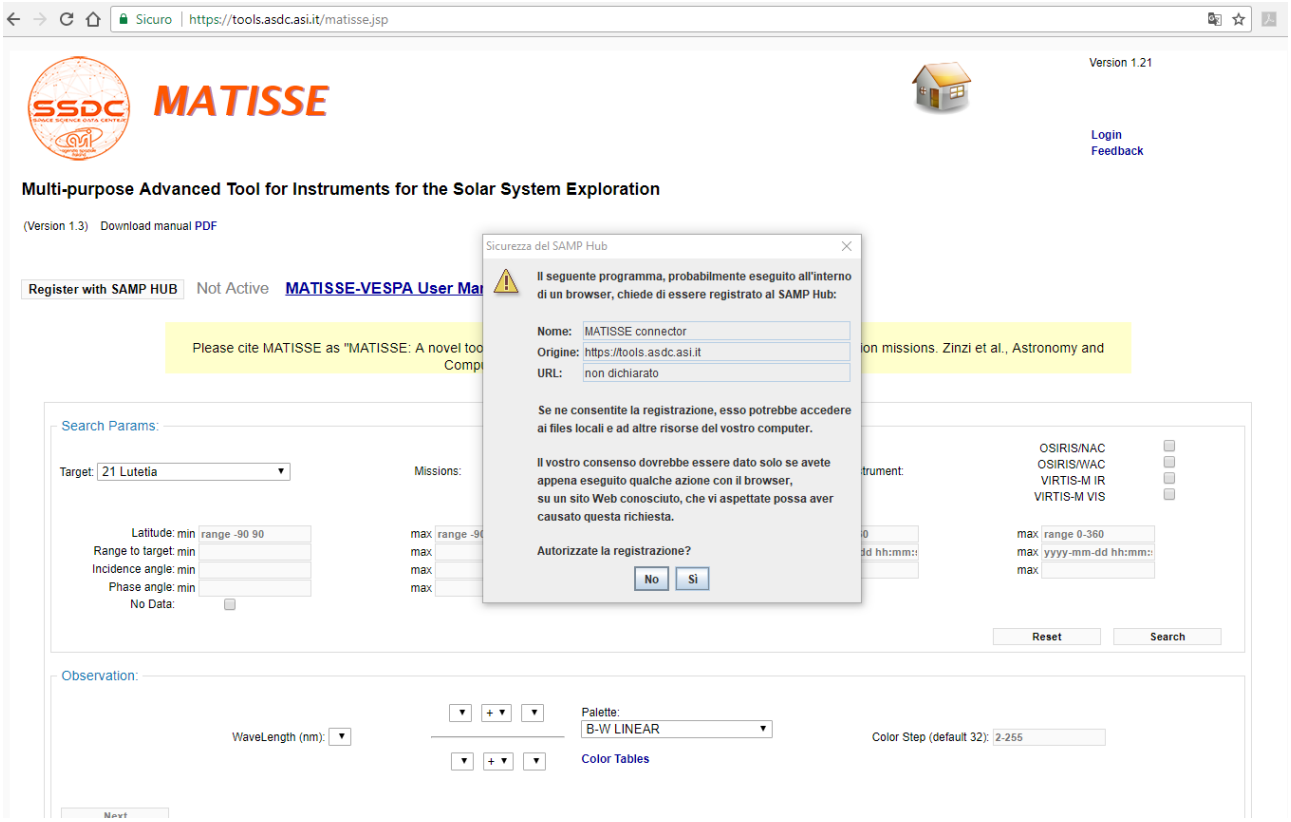

Fig. 4: The authorization window from MATISSE. A similar one is displayed by VESPA

To send data to MATISSE from VESPA one of the two rows (no matter which) of the VESPA table has to be selected and sent as tables by clicking on “Data Selection” and then “Send Tables” (Fig. 5). Finally, the file is displayed in the “Observation” section of the MATISSE homepage.

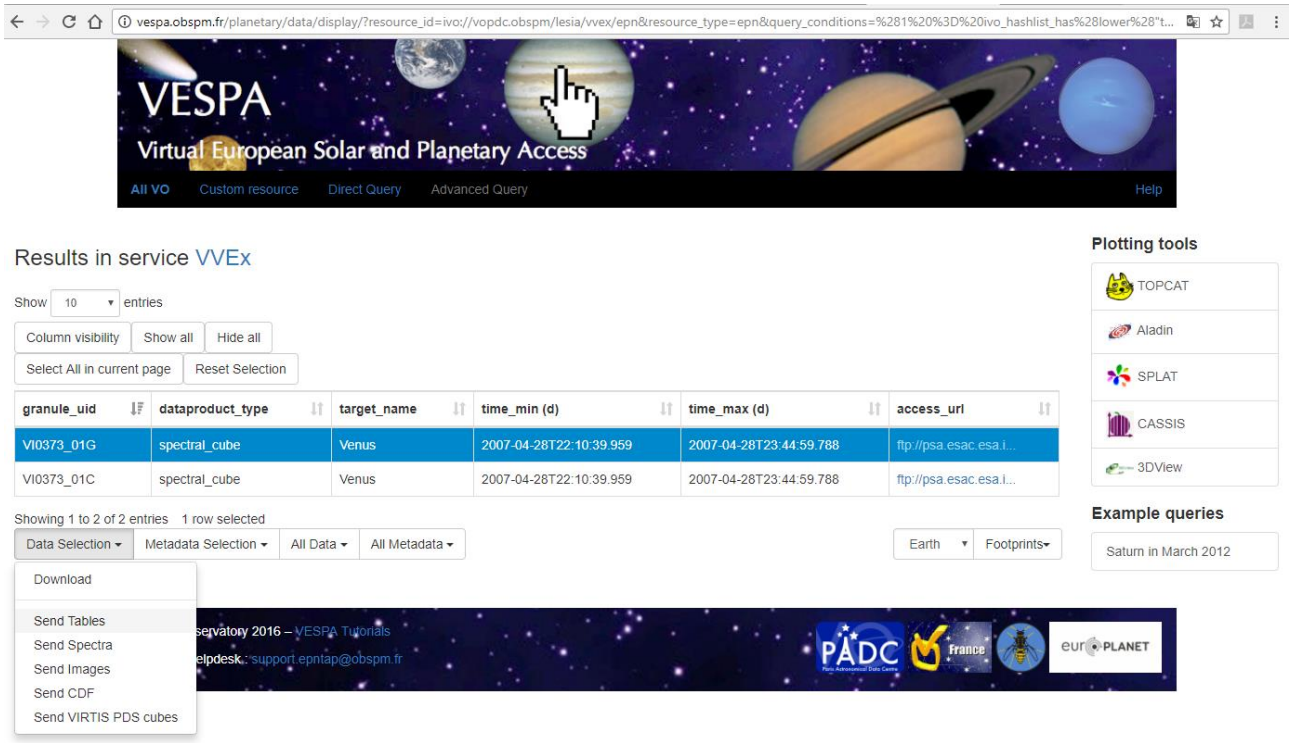

Fig. 5: The VESPA table page ready to send the data to MATISSE

In order to proceed with the example, we want to access the 1025 nm image, since this is representative of the surface temperature of Venus: this could be done by selecting the observation and choosing 1025 nm from the “Wavelength” selector (Fig. 6).

It is possible to select a different color palette: by clicking “Submit”, the MATISSE pipeline starts.

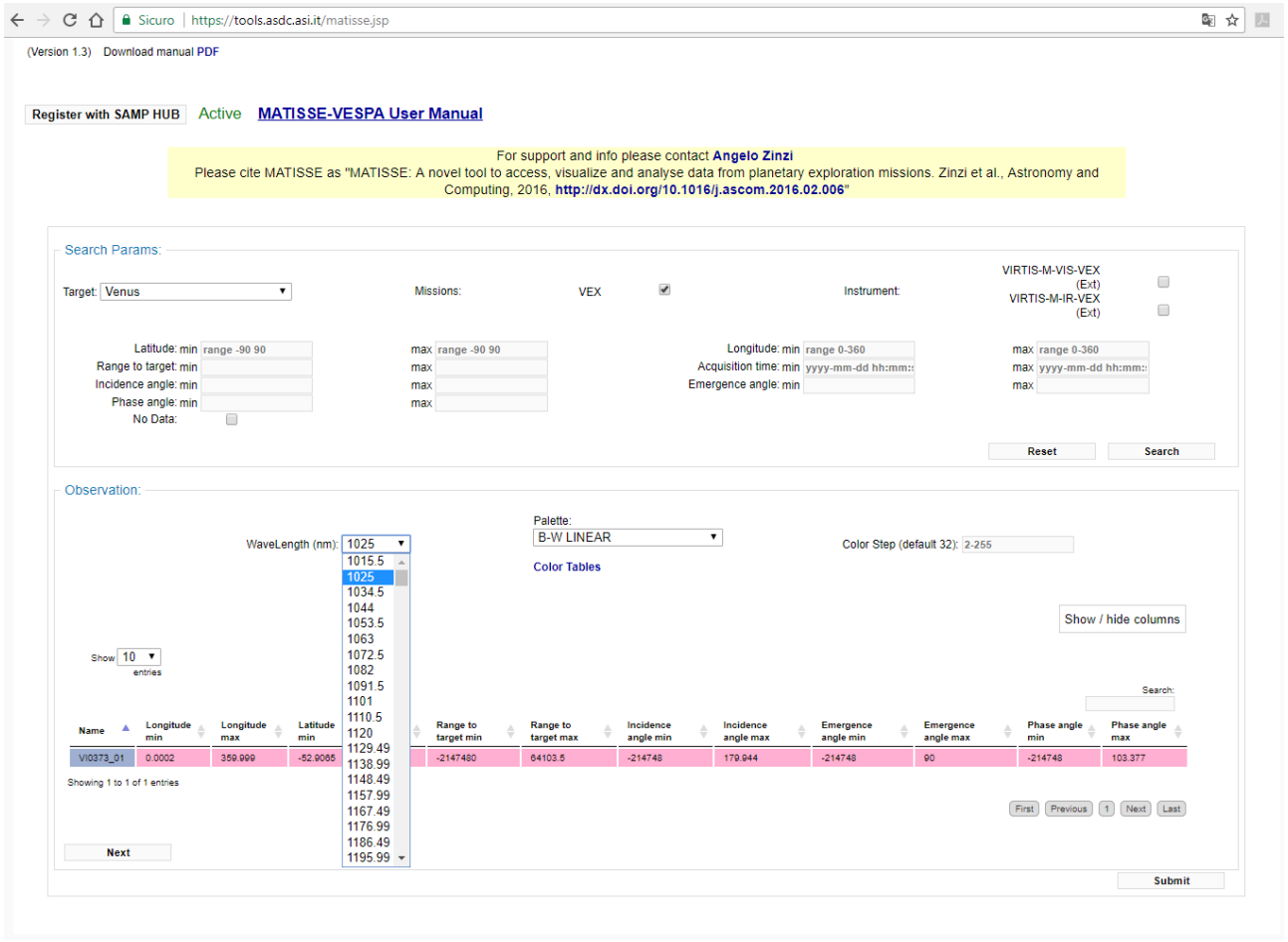

Fig. 6: The MATISSE page during the wavelength selection

After some minutes (generally up to 5), the output page of MATISSE will be displayed, with the projected images, one zoomed over the image margins and one global (Fig. 7).

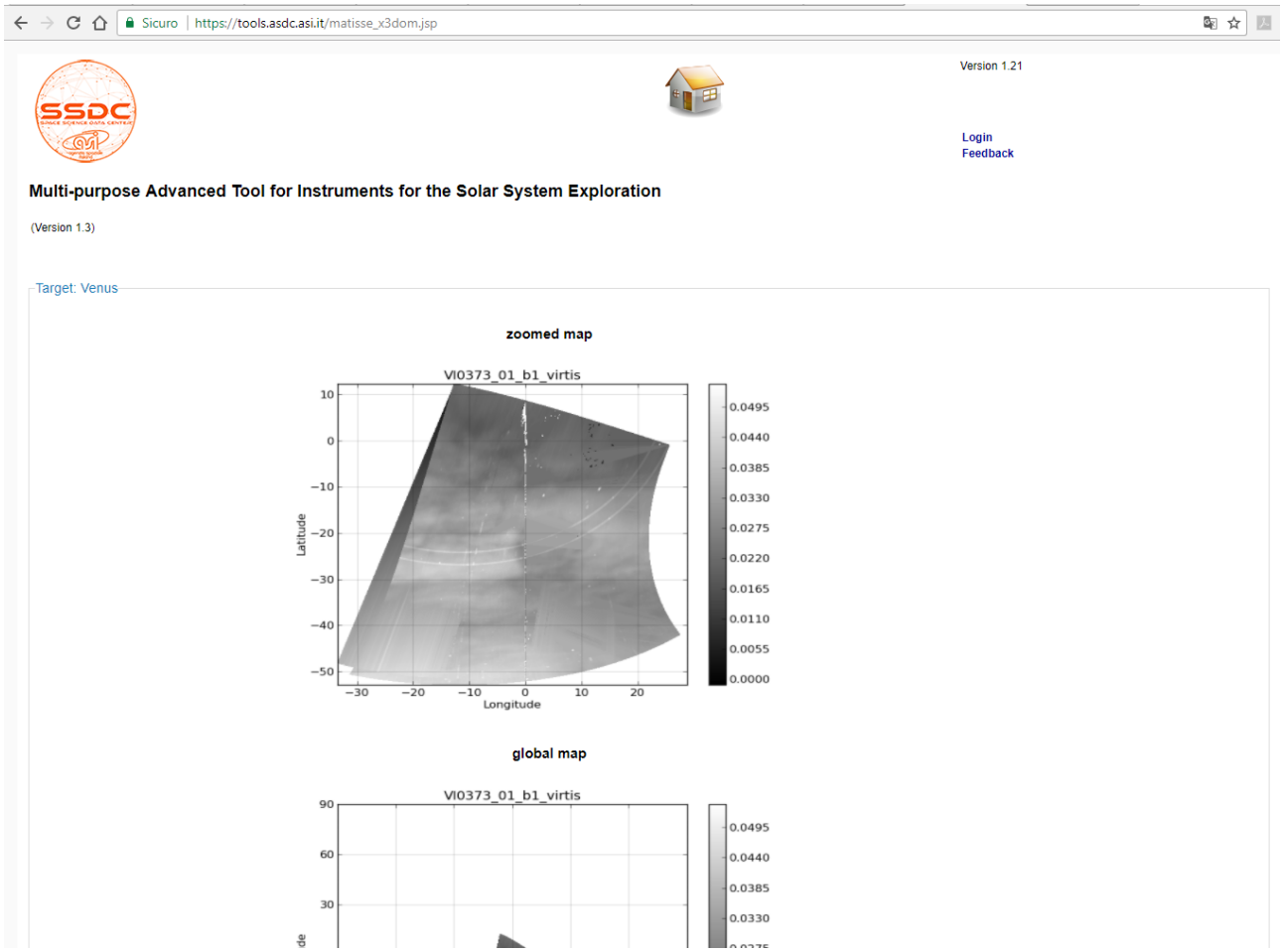

Fig. 7: The output page of MATISSE

From the links located on the bottom left of the page it is possible to download either 2D (GeoTIFF, FITS and ENVI) or a 3D (Paraview) file, which can be passed to other environments for further analysis (all these files comprise latitude, longitude and data values). These file are comprised in two "tarred" files (one for the 2D and one for the 3D).

In particular, by opening the FITS file in JS9 (https://js9.si.edu/) it is possible to obtain an image corresponding to the Fig. 9a of the paper by Muller et al.: the added value provided by the MATISSE tool is that the image generated by it is projected, differently from what shown in the cited paper.

The GeoTIFF file generated by MATISSE could be opened with QGIS or ArcGIS and a longlat projection is adopted (i.e., this projection is defined as +proj=longlat +a=a_radius +b=b_radius +c=c_radius +no_defs). However, by using the fits2vrt Python package (https://github.com/epn-vespa/fits2vrt) it is possible to obtain, from the FITS file in input, a virtual GDAL header capable of using the FITS file to produce a GIS raster file projected in the appropriate coordinate in meters.