tool for the SECCHI data

User Requirements Document

22/06/06, version 0.101

1 Introduction

This document describes the functionalities required by the users (i.e. the astronomers) for the visualisation tool developed by IAS for the SECCHI data.

This tool will basically provide a simple interface to let the user ask for all available data recorded by SECCHI instruments within a user-specified date range. Once the corresponding data list has been displayed on screen, the user will be able to chose which data he wants to visualiae. Once a set of data is visualised, the tool is able to display easily the next (or previous) available data within the required date range.

The typical configuration will include one data selection GUI (Graphical User Interface) where the user defines which kind of data he is looking for, and two data visualisation GUIs where the images will be displayed. A third visualisation GUI may be opened if the user also requires SOHO images.

The tool will be working on all operating systems where IDL is available.

This document is structured in two parts : a basic functionalities description and a detailed functionalities description.

2 Basic functionalities

2.1 Data selection

2.1.1 Data selection GUI

The data selection GUI allows to search among the available data using the following criteria :

- **Date range** : dates are specified with a text string containing both dates and time. Many dates specification formats are accepted, and will be processed using dedicated SSW routines.
- **Instrument name**
  - For SECCHI data, the instruments that can be chosen are EUVI, COR1, COR2, HI1 and HI2), and the EUVI images can be restricted to any combination of the available wavelengths (171,195,284,304Å).
  - For the SOHO data, the instruments that can be chosen are EIT, LASCO C1, LASCO C2 and LASCO C3, and the EIT images can be restricted to any combination of the available wavelengths (171,195,284,304Å)
  - For COR1/COR2 and LASCO C1/C2/C3, the user can chose among the available filters (e.g. Clear, Polarized -30, 0, 30, FeXIV, etc.).
  - **Note:** EUVI (or EIT) passbands and COR1/2 C1/2/3 filters could be grouped

together in a “filter” pulldown menu.

Each criteria associated to a probe (the 3 probes are STEREO A, STEREO B and SOHO) will be in a separated tab widget. It will however be possible to only define once the criteria (date AND/OR instruments and filters) for STEREO A and ask the tool to use the same criteria for STEREO B and SOHO.

A colour flag is associated to each instrument (and displayed next to it), in order to facilitate the interpretation of the results of a query. A colour convention will be defined.

Once the user has defined the above criteria, he can start the query by clicking on the “SEARCH” button.

The results of the query is displayed in a **chronological** table (whatever the instrument) containing one line per data file available, and matching the criteria required by the user. Each line of the list contains the following information :

- instrument name
- image acquisition date
- image wavelength (for EUVI and EIT only)
- Filter
- image acquisition duration
- image binning
- image polarisation information (can be put under filter)

Each line of the table is coloured using the same colour convention as the one used to materialize each instrument.

At startup only the search GUI appears, with the date fields filled in with the current date and the two days before date. The STEREO A/B and SOHO dates are synchronized by default. The default is all instruments selected on SECCHI and STEREO.

One clearly labeled button (e.g. Latest images) makes a search for the latest data (e.g. Last 2 days) and displays automatically the latest images of each available instrument (STEREO A, STEREO B SOHO). In this case, all instruments are automatically checked (see 3.3.1).

A check box in the options widget controls the behaviour when a search is performed. Either nothing happens and the application waits for the user to double click in an image of the list to display it. Or the soft automatically opens the first images of the list (one per selected instrument) **(“Auto display mode” TBC).**

At this step the following actions can be performed by the user :

- The user can start manipulating the displayed data in the visualisation windows.

The user can select any other file from the list. When a new line in the list is selected, it will be highlighted, and the previously highlighted file from the same instrument is unselected. If the line is double clicked, the corresponding data is visualised in the corresponding visualisation window.

2.1.2 Data access

Various methods can be used to access the SECCHI and SOHO data base :

- If the user is in a place where the whole databases are available (directly or mounted by NFS), the complete databases can be searched and visualised. This scheme will be implemented in version 1.0 of the application.
- If the user only possesses locally a few FITS files and wants to visualise them, it will also be possible to visualise these files.
- If the user has an internet connexion, it will also be possible to download the FITS files by ftp from the IAS server.

2.2 Data visualisation

2.2.1 Data Visualisation GUI

In order to display the images chosen by the user, separated data visualisation GUIs are automatically opened, one data visualisation GUI per probe (STEREO A, STEREO B, SOHO). If no data was found for a probe, no visualisation GUI is opened for that probe.

Each visualisation GUI is subdivided into 4 dedicated areas :

- **AREA 1** : main toolbar. It allows the selection of a specific tool such as pan, zoom, image removal, cursor location/value, best fit, printing, saving the contents of the data visualisation GUI in JPEG format and iconification (of AREA 4 of the data visualisation GUI).
- **AREA 2** : visualisation area. It allows to display the results of a query. One image is displayed per selected instrument, and projected according to the selected projection.
- **AREA 3** : image navigation. It allows to access the next/previous chronological image for one or several selected instruments, in linked/unlinked mode and/or compact/free mode.

  In compact mode, the time closest image is obtained for the selected instruments. This is the default mode. **This mode can be time consuming as all the necessary images need to be obtained in order to build a new visualisation scene.**

  In free mode, the next chronological image is obtained for the selected instruments.

LINKED	COMPACT	DESCRIPTION
0	0	**Mode = unlinked/free** Navigation occurs in on visualisation GUI at a time. Next/previous operation gets the next/previous chronological images for the selected instruments.
0	1	**Mode = unlinked/compact** Navigation occurs in on visualisation GUI at a time. Next/previous operation gets the next/previous closest in time images.
1	0	**Mode = linked/free** Navigation occurs simultaneously in all visualisation GUIs. Next/previous operation gets the next/previous chronological images for the selected instruments.
1	1	**Mode = linked/compact** Navigation occurs simultaneously in all visualisation GUIs. Next/previous operation gets the next/previous closest in time images.

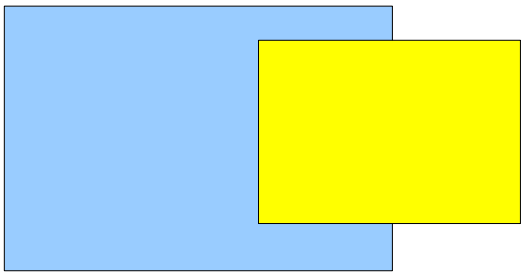
- **AREA 4** : image information/selection. It displays basic information in a table about the currently displayed images.

The visualisation GUI contains options accessible via a contextual menu The visualisation GUI can be moved and resized. When resizing occurs, the zoom factor remains the same, but “more” or “less” data is visualised.

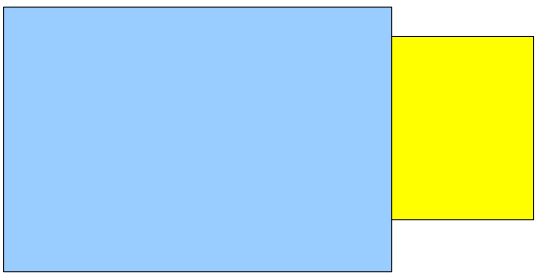
2.2.2 Image masking

In cases where images have overlapping areas as shown below, it is interesting to control the overlapping order as illustrated below :

yellow image on top



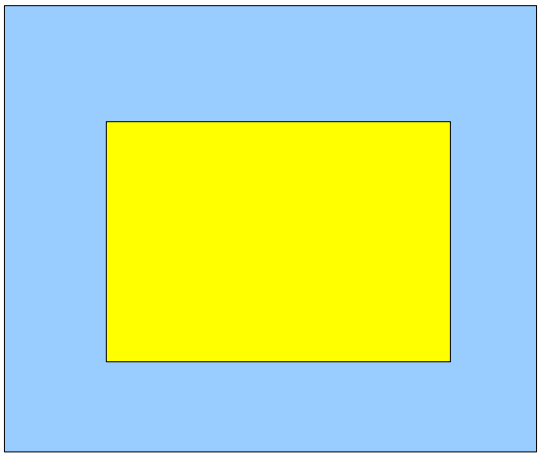
blue image on top



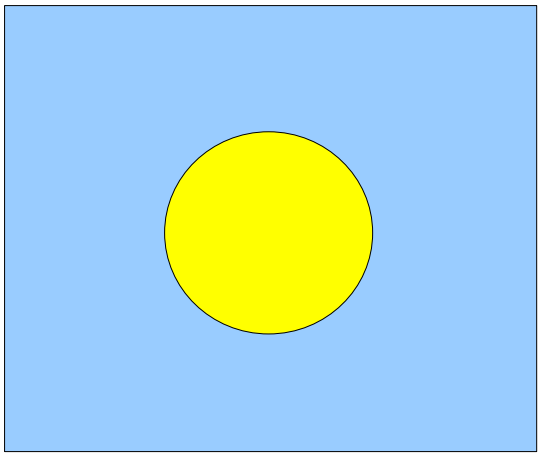
It is also interesting to define a mask as shown below (this way of masking is applicable for EUVI , EIT, COR1 and C1 data).

The display order is set by default as (from top to bottom), EUVI, COR1, COR2, HI1 and HI2. The order can be changed in the general options.

before applying a mask



after applying a circular mask on the yellow image, the blue data "behind" becomes visible.



The corners of the images can be masked (i.e the corners of LASCO images contain no data) so that they appear transparent in the visualisation GUI. The values of the masking radii and center can be parametrized in the general options. A mask can be applied to any instrument with different parameters for each instrument.

2.2.3 Image order

The order in which images are displayed in a data visualisation GUI can be modified. Images are stacked into the data visualisation GUI according to this order.

2.2.4 Projection/coordinates

Images can be projected in the visualisation, or displayed without any projection. Projections are necessary for HI1&HI2, but for he other instruments, significant processing time can be saved by not projecting since the projection errors are small. In case images are projected, one of the following projection can be used :

- Mercator
- Mollweide
- Lambert
- etc. (any projection that can display a full hemisphere of the sky).

When images are not projected, they are only placed into the visualisation, at the right position , but without projection.

One of the following coordinate system can be applied (grid is displayed) to the visualisation :

- Ecliptic/Heliocentric
- Heliocentric (with Solar North up)

Pixel location/value are displayed using the selected coordinate system.

The distance from the sun and the angle are displayed at the bottom right of the window.

The projection/coordinates wizard is intended to define which projection and coordinate system is associated with the data visualisation GUI. It also tells whether the images associated with a given instrument should be projected or not.

2.2.5 Colour palette

Depending on the instrument, each image is displayed using a default colour palette. This colour palette can be changed using a "colour palette wizard", and some of the colour palette parameters (gamma correction, transfer function, ...) can be changed to get the best possible colour palette.

The STEREO and SOHO images are digitized on 14 bits and stored on 16 bits. EUVI and EIT images are typically log scaled before display to reduce the dynamic range. The background removal in the LASCO/COR1/COR2 images have typically the same effect.

By default, each image is scaled min to max (or 0.1 and 0.99 percentile). EUVI and EIT images are log-scaled before disply. LASCO/COR1/COR2 are lin-scaled after background subtraction.

2.2.6 Data calibration (TBC)

What is meant here is the transformation of FITS pixel values into physical values prior to visualisation, using some calibration routines (these routines may need other data to be downloaded in order to perform the calibration)..

SSW library already provides routines dedicated to image calibration per instrument (EIT_prep.pro, LASCO_prep.pro, etc ...).

For the coronagraphs several models of dust corona are typically available (montlhy averaged, yearly averaged, etc.). These user has can chose one of these models (or a no calibration option) in the general options.

> Nb: one assumes that SSW is correctly installed locally, i.e. That all environment variables are set properly so that the existing software works properly. For example, the EIT/LASCO SSW routines need to know where the data are stored (EIT_LZ environment variable for EIT).

Exisite-t-il une liste des calibrations disponbiles par instrument ?

2.2.7 Filter

By default, once calibration is performed, no filtering sequence is applied to images prior to visualisation. A filter wizard is available and allows a user to define a filtering sequence per instrument.

The filters are chosen from a default list that can be extended with new filters written in IDL. Once

a filtering sequence was defined for an instrument, it can be activated or disactivated.

When activated, the filtering sequence associated with an instrument is automatically applied to the images prior to visualisation. Otherwise, the images are displayed using some default display settings to be defined.

The filters are applied on the scientific data prior to log-scaling or any other filter.

For the default display settings, several solutions are possible :

- Applying of a linear stretch on the 16bit images, in order to change them to 8bit.
- Applying a linear n% stretch on the 16bit images : in this case, n% of the lowest pixel values are set to 0, n% of the highest pixel values are set to 255. In between, a linear stretch is applied.
- Applying an histogram equalisation in order to display the 16bit images with the best possible contrast.

2.2.8 Visualisation enhancement

This wizard allows to enhance the visualisation of the images after a filtering sequence was applied on them.

Three types of enhancement filters can be applied the the displayed images :

- Linear
- Square root + Linear
- Log + Linear

2.2.9 Contextual options

Right-clicking on an image in the visualisation brings up a contextual menu with the following options :

- **"Display full image list"** : this option displays (in a chronological way) all the images available for a given instrument and allows to select and display one of them. The goal is to simplify image navigation.
- **"Display FITS header"** : this option displays the FITS header of the selected image in a widget table with one column, and one line per FITS attribute. In each cell, the attribute value is given. In difference mode, the two FITS headers are displayed in the table
- **"Zoom"** : this option allows to center the visualisation on a given image (depending on the selected instruments) and to apply a zoom factor on it. For example, if the data visualisation GUI displays HI1 data, the user can select the option Zoom->HI1->50% (available zoom factors are 25%, 50%, 75%, 100%) in order to center the visualisation on the the HI1 image with a 50% zoom factor.

2.2.10 Profiles tool (TBC)

The profiles tool allows the user to display intensity profiles along a selected line in the images. The cuts should read the values at the scientific data level. The user should have the option of log or linear scaling.

2.3 Printing

The contents of the visualisation GUI can be printed and/or exported to a local postscript file. The applicable properties for a particular printer can be edited and modified (number of copies, portrait or lanscape printing, ...).

2.4 Saving images

The content of the visualization GUIs can be saved to bitmap file formats such as JPEG or PNG at the resolution of the display. When multiple probes are selected, a postfix is added to the input filename to distinguish images.

2.5 Saving sequences *(to be confirmed)*

The user can save the full sequence of images as an mpeg movie or as individual bitmap images. This “save sequence as” feature works as follows. It is equivalent to clicking “next frame” through the sequence and saving the resulting individual bitmap frames. If the mpeg format is chosen, each frame is saved as a key frame in the mpeg file. If a bitmap image format is chosen, each frame is saved in an individual file, with a postfix specifying the image frame number or date (ex. 20060102.051234).

2.6 Saving/Reloading a STEREO session *(TBC)*

A STEREO session can be saved and lately restored. What is meant here is the ability of saving some user defined parameters, and the ability of retrieving them in later sessions.

For example :

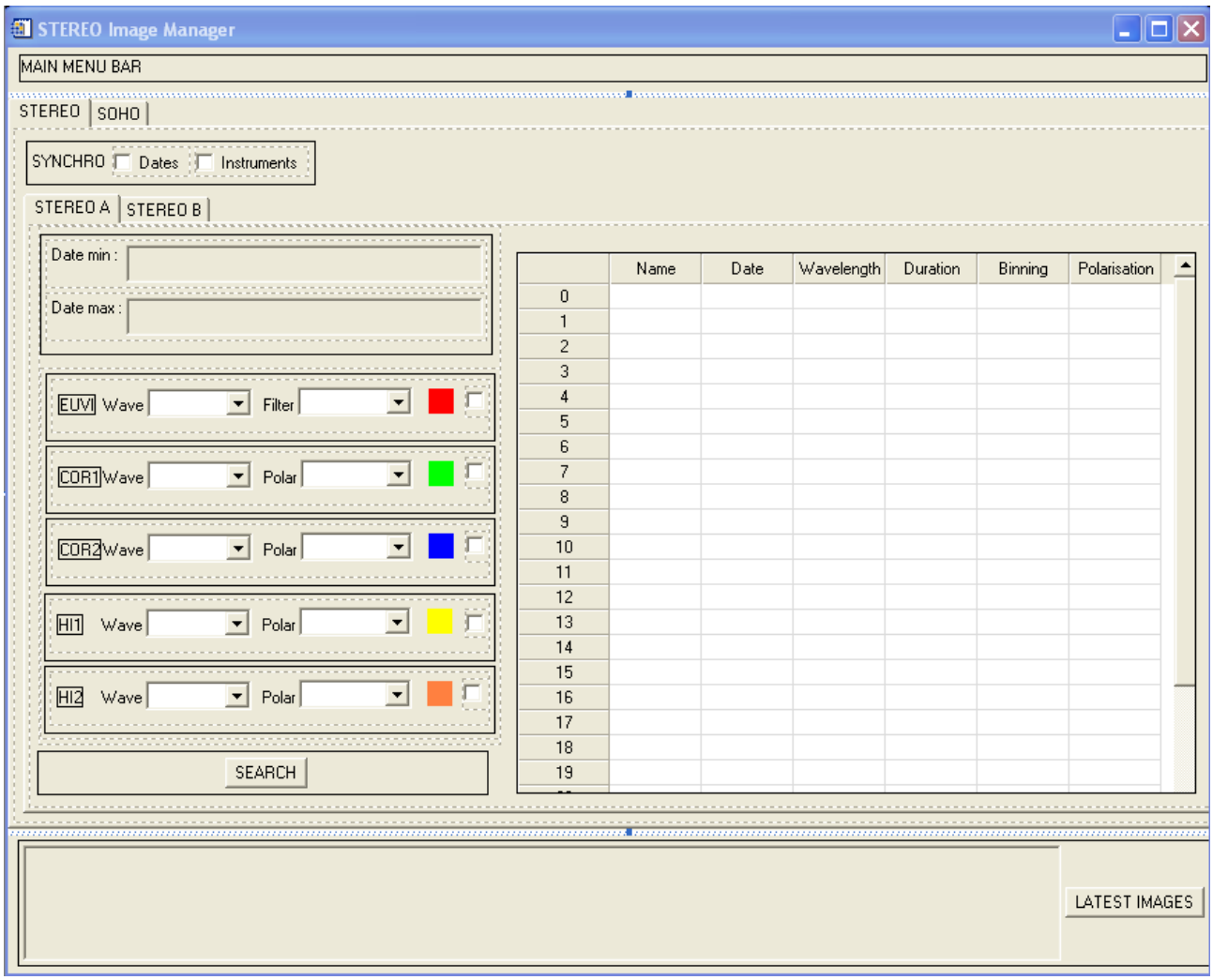
- Saving of the image masking parameters, e.g. Should HI1 be systematically displayed on top of HI2 or the opposite ? What mask should be applied to the EUVI and EIT data ?
- Saving of the filter sequences associated to all the instruments.
- Saving of the colour palette defined for each instrument.
- Saving of the projection used to display the data.
- Saving the size and position of the data visualisation GUIs.
- Saving the zoom factors used in each data visualisation GUI.

3 Detailed description of the required functionalities

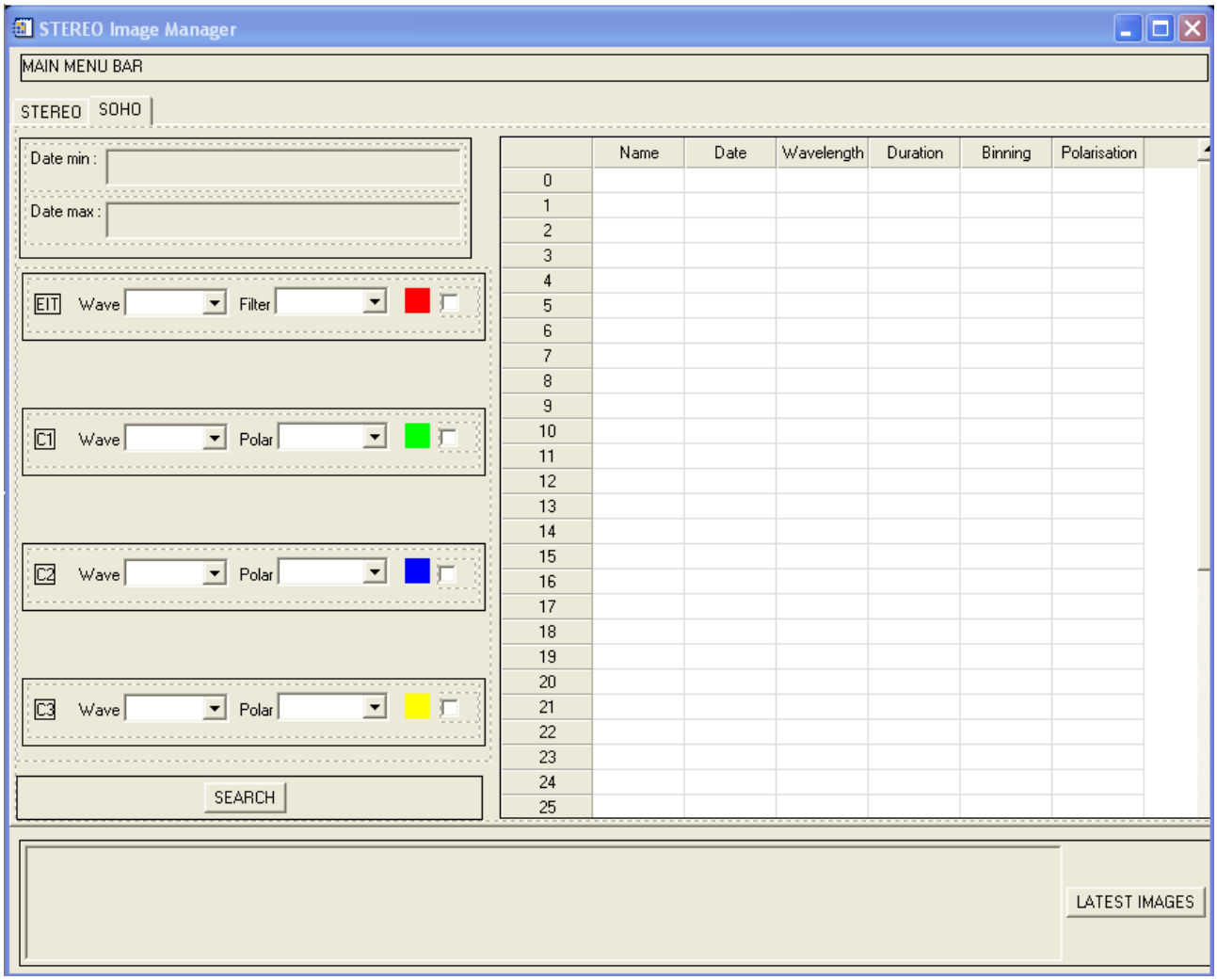
3.1 Data selection GUI

A possible implementation of the data selection GUI is shown below :

- For the STEREO tab :



- For the SOHO tab :



The data selection GUI is the entry point and the master window for the STEREO application. Closing that window closes any associated data visualisation GUIs. It contains :

- **A main menu bar containing** :
  - **A "File" menu with :**
    - A "Save configuration" entry, cf. 3.7.
    - A "Reload configuration" entry, cf. 3.7.
    - A "Preferences" entry, cf. 3.3.5.
    - A "Save sequence as" menu, with SOHO, STEREO A, STEREO B and ALL submenus, cf. 3.6. **(to be confirmed)**
      - Depending on the selection (SOHO, STEREO A, STEREO B or ALL), this option saves all the images from date min to date max in a MPEG sequence.
    - A "Quit" entry (for exiting the STEREO application).
  - **An "Options" menu with :**
    - A "Projection/Coordinates" that launches the "Projection/Coordinates wizard" (cf. 3.3.4). Whether or not each instrument is projected is be defined here.
    - A "Filters" entry (for the definition of filtering sequences to be applied to images

prior to visualisation) that launches the “Filter wizard” (cf. 3.3.7). Log , square root or linear scaling could also be put here.

- A “Colour palette” entry (for the definition of the colour palette to be used with each instrument) that launches the “Colour wizard” (cf. 3.3.5).
- A “Calibration” entry for the selection of the background models used for the coronagraphs. “No calibration” checkboxes should also appear here (cf 3.3.6).
- A “Masking” entry (for the definition of the masks to be applied on the instruments'imges) (cf. 3.3.2).
- A “Display order” entry (for the definition of the display order of the images for the STEREO and the SOHO probes) (cf 3.3.3)..

Note:

The order of the options in the “Options” may change during implementation.

- **A STEREO tab subdivided into STEREO A and STEREO B tabs.**
  - The STEREO tab contains a “synchronisation” area that allows to apply the same dates and/or instruments criteria to both STEREO A and STEREO B probes. The default state is to apply the same dates and instruments search criteria for STEREO A and STEREO B.
  - Each of STEREO A, STEREO B and SOHO tab contains :
    - A “date” area in order to define a date min and date max (all SSW date formats may be used) for the search. When the application is launched, the date of the day is displayed, and no visualisation GUI is visible.
    - A list of instruments to select from. Each instrument is materialized by two widgets droplist : a “Wave” droplist and a “Filter/Polar” droplist.
    - Wave and Filter/Polar can be one of :

	Wave	***Filter/Polar***	***Comments***
EUVI	171,195,284,304,ALL	Filter = Clear, Al+1, ALL	
COR1	**Orange, Blue, Clear, Deep Red, ALL (TBC)**	**Polar = +60, 0, -60, ALL (TBC)**	**Doit-on ajouter tB et pB ?**
COR2	**Orange, Blue, Clear, Deep Red, ALL (TBC)**	**Polar = +60, 0, -60, ALL (TBC)**	**Doit-on ajouter tB et pB ?**
HI1	**(TBD)**	**(TBD)**	
HI2	**(TBD)**	**(TBD)**	

* A check box in order to

- A scrollable table that displays chronologically the results of a query.
  - The results are chronologically displayed in a table whatever the instrument. Each line of the table is coloured using the instrument colour in order to facilitate the reading. For each instrument, the first file meeting the search criteria is

highlighted.

- Clicking a line in this table selects a file associated to an instrument, and deselects the previously selected file for the same instrument. It updates the respective data visualisation GUIs with the corresponding images, sets the corresponding radio button(s) in the image navigation area (AREA 3 of the data visualisation GUI).

• A "SEARCH" button :

- This button allows to run the dates/instruments query and display the results in the adjacent table. If dates and/or instruments are selected in the "synchronisation" area, then the same dates and/or instruments search criteria are applied to STEREO A and STEREO B (the search is then performed for both STEREO A or STEREO B).
- If images matching the search criteria are found (for STEREO A, STEREO B, or SOHO), a dedicated data visualisation GUI is launched. Each data visualisation GUI is updated each time a new search is ran.

- **A SOHO tab.**
  - The SOHO differs from the STEREO tabs by the list of available instruments, and does not have a synchronisation area. Otherwise, it works the same way. It must be possible to synchronize the SOHO dates with the STEREO dates (**TBD**).
  - Wave and Filer/Polar entries can be one of :

	Wave	***Filter/Polar***	***Comments***
EIT	171,195,284,304,ALL	Filter = Clear, Al+1, Blk East, Blk West, ALL	
C1	FeX, FeXIV, ALL	Polar = Clear, +60, 0, -60, ALL	**Une colonne pour Sum/Diff et Line Sca ?**
C2	Orange, Blue, Clear, Deep Red, IR, ALL	Polar = Clear, +60, 0, -60, ALL	
C3	Orange, Blue, Clear, Deep Red, IR, ALL	Polar = Clear, +60, 0, -60, ALL	

- **An "Information Log" area.**
  - This area is used to display system messages. For example : "no data found for STEREO A", "A catalog was not found on your system.
- **A "Latest images" button.**
  - This option searches the latest images available for all probes (STEREO A, STEREO B

and SOHO) and all instruments, in a two days interval.

- Example :
  - The date of the latest EUVI image is 03-jan-06 10:00. The table is filled with EUVI data from 01-jan-06 10:00 to 03-jan-06 10:00.
- The latest available image per instrument is highlighted in the data selection GUI tables.
- This option automatically selects all instruments from all probes in the data selection GUI.
- It displays 3 data visualisation GUIs (on per probe), with the "next" button disables as the latest image per instrument is displayed.

Note :

The row labels are useless (0, 1, 2 ...) and will not appear in the STEREO application. The columns are resizeable.

3.2 Data access (TBC)

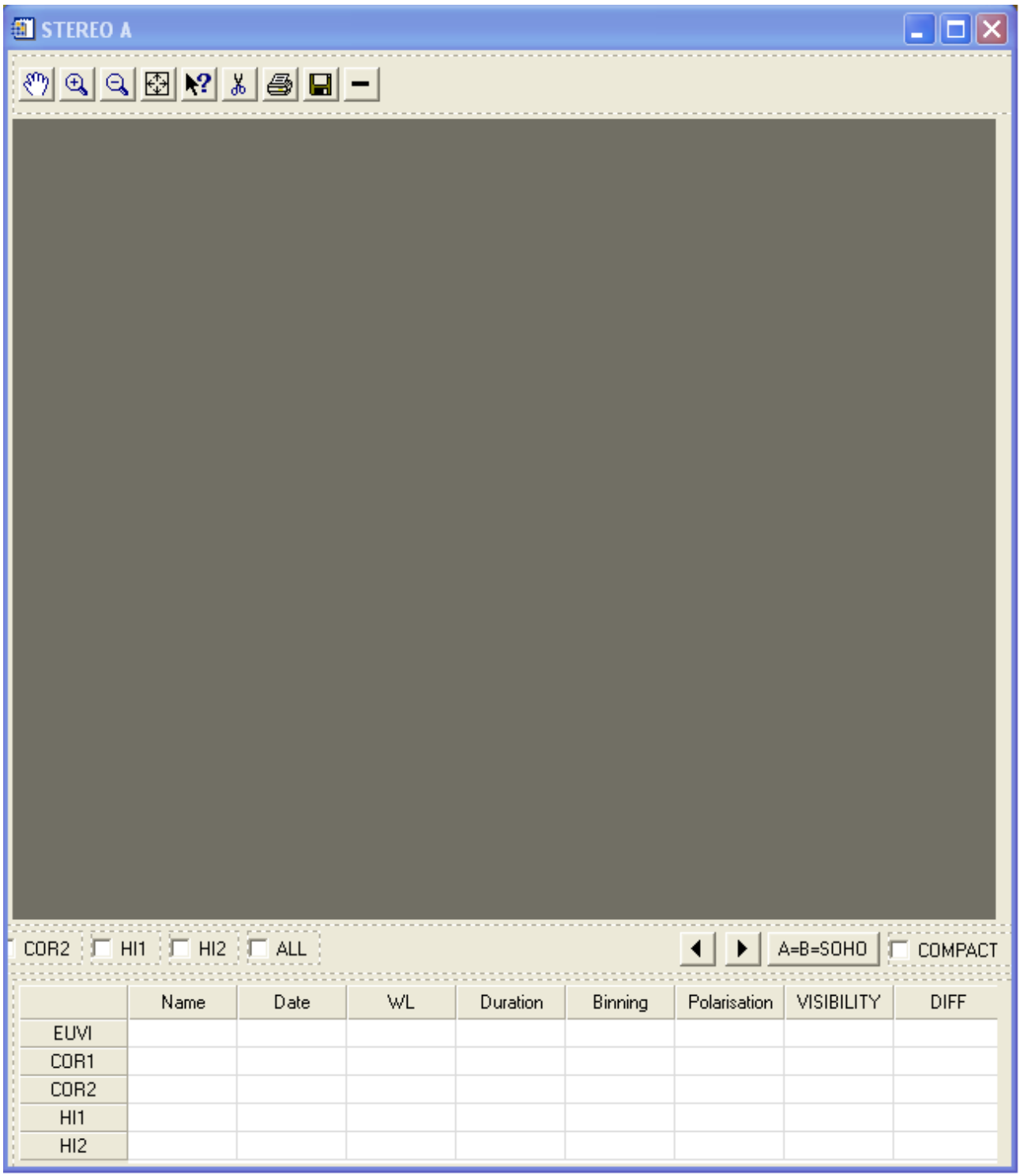
- For version 1.0 of the STEREO application, the catalog file and the database are both available on the local machine (or mounted via NFS).

3.3 Data visualisation

A data visualisation GUI is launched (or updated) each time a search query produces results. When the STEREO application is initially launched, only the data selection GUI is visible. After a successful search query, a data visualisation GUI appears (for STEREO A, STEREO B or SOHO). If a STEREO A, a STEREO B or SOHO data visualisation GUI already existed, it is updated with the results of the search query.

3.3.1 Data visualisation GUI

A possible implementation of the data visualisation GUI is shown below :



The 4 areas of the data visualisation GUI are described below.

AREA 1 : MAIN TOOLBAR

- It contains the main tools of the visualisation window : pan, zoom, cursor location/value, image removal, best fit

IMAGE PANNING

- Allows to click and drag the images'view elsewhere in the visualisation window.

IMAGE ZOOMING

- Zoom in and zoom out the images'view by a factor of TBD%, either when the user uses the mouse wheel or when the user has entered the corresponding zoom mode.
- Set the zoom to 25%, 50% or 100% of an image (25% means 1 screen pixel = 4 image pixels on one axis = 16 image pixels) (This option will probably be available in a contextual menu, when right-clicking on the data visualisation GUI, **TBD**).
- Set the zoom to a value that will allow to see all data images contained in the window.
- Set the zoom factor to view all data in the visualisation window (called "best fit visualisation").

CURSOR LOCATION/VALUE

- When activated, this option displays in the right bottom part of the data visualisation GUI the XY position of the pointer in the data visualisation GUI (depending on the coordinate system) and the (ρ, θ) position of the pointer in the data visualisation GUI. P ιs expressed by a number of sun radii and θ is the angle in degree with the horizontal line passing through the sun center.

IMAGE REMOVAL

- Removes the image associated to an instrument by clicking on that image. Set the "Visibility" attribute of that image to "OFF" (cf. AREA 4). This attribute can be set back to "ON", by setting the appropriate table attribute to "ON" (cf. AREA 4).

IMAGE PRINTING

- Prints the contents of the visualisation GUI, or eventually exports it to a local postscript file.
- See section 3.5.

IMAGE SAVING

- Saves the contents of the data visualisation GUI in a JPEG file in a directory selected by the user. File naming convention is : intr1_instr2_intrN.jpg. (instN is the name of the Nth selected instrument). The

ICONIFICATION

- Toggle button that hides/shows AREA 4 of the data visualisation GUI.

AREA 2 : VISUALISATION AREA

- By convention, after a "SEARCH" query is performed, the first image matching the search criteria is displayed for each selected instrument.
- Left clicking on an image displays a selection border around that image using the color convention as described in 2.1. Using a combination of CTRL key and left click allows to select several images.
- Selection of image(s) in the visualisation area (AREA 2) sets the corresponding radio button(s) in the image navigation area (AREA 3), and updates the corresponding line(s) in the image information/selection area (AREA 4).

AREA 3 : IMAGE NAVIGATION

- This area is dedicated to the “navigation” into the results of a query, as produced by the “SEARCH” button (cf 2.1.1).
- In this area, the instruments are materialized by a set of non-exclusive radio buttons. The colour convention doesn't need to be used as only one file per instrument is displayed.
- Only one radio button called “EUVI” or “EIT” is available in the set of radio buttons. The selection of one of these buttons means the selection of the selected wavelengths in the data selection GUI.
- An “ALL” toggle button allows to select/deselect all instruments.
- Two arrows (“previous” and “next”) allow to access the previous or next image file available for the selected instrument(s).
- A “A=B=SOHO” (bitmap **TBD**) toggle button allows to link SOHO, STEREO A, and STEREO B displays for navigation. Navigation occurs simultaneously for SOHO, STEREOA, STEREOB in compact of free mode. A specific bitmap is used to indicate a locked/unlocked state.
- In “linked” mode, when the end of a list was reached, the navigation is stopped in the data visualisation GUI where the end was reached, while navigation still progresses in the other one.
- A “COMPACT” (bitmap TBD) toggle button allows to activate the “COMPACT” mode.
- The same instruments may not be available in both visualisation GUIs, depending on the search criteria applied for STEREO A and STEREO B. In “linked” mode, navigation is independent of the selected instruments. It happens both in STEREO A and STEREO B data visualisation GUIs whatever the selected instruments.
- Backward and forward “slideshow” buttons are available. To run continuously through the sequence. Question: is it possible to exit such a process if it takes too long ?

AREA 4 : IMAGE INFORMATION/SELECTION

- This area contains a table with one line per selected instruments (in the data selection GUI). It displays the same information as the ones contained in the data selection GUI, but limited to the images currently displayed. The lines are not coloured, as only one data per instrument is shown.
- It contains two extra columns :
  - **VISIBILITY** : this attribute indicates whether an image should be displayed (the corresponding cell displays “ON”) or hidden (the corresponding cell displays “ON”). State toggles from “ON” to “OFF” when clicking in VISIBILITY cell.
  - **DIFF** : this attribute indicates the way navigation should be performed. When set (the corresponding cell displays “YES”), image(n) – image(n-1) is displayed (n>=1). Otherwise, the corresponding cell displays “NO”. State toggles from “YES” to “NO” when clicking in an DIFF case.

- **Note :**

  In area 4, VISIBILITY and DIFF are the only editable columns. Clicking a line in this table has no effect on the data visualisation GUI or the data selection GUI.

- This area is retractable in order to reduce the size of the data visualisation GUI using the "minus" icon in the main toolbar (AREA 1).
- A possible implementation of the data visualisation GUI is shown below.
  - In AREA 1, the icons are respectively : PAN, ZOOM IN, ZOOM OUT, BEST FIT, CURSOR LOCATION/VALUE (**TBD**), IMAGE REMOVAL, IMAGE PRINTING, ICONIFICATION OF AREA 4.
  - In AREA 2 is shown the visualisation area.
  - In AREA 3, the list of the selected instruments appears as a set of non-exclusive rasdio buttons. The "ALL" toggle button allows to select all instruments. The two arrow-shaped buttons are used for navigation, the "A=B" button (bitmap **TBD**) are used to link STEREO A and STEREO B data visualisation GUIs.
  - In AREA 4, appears the table that displays information about the visualised data.

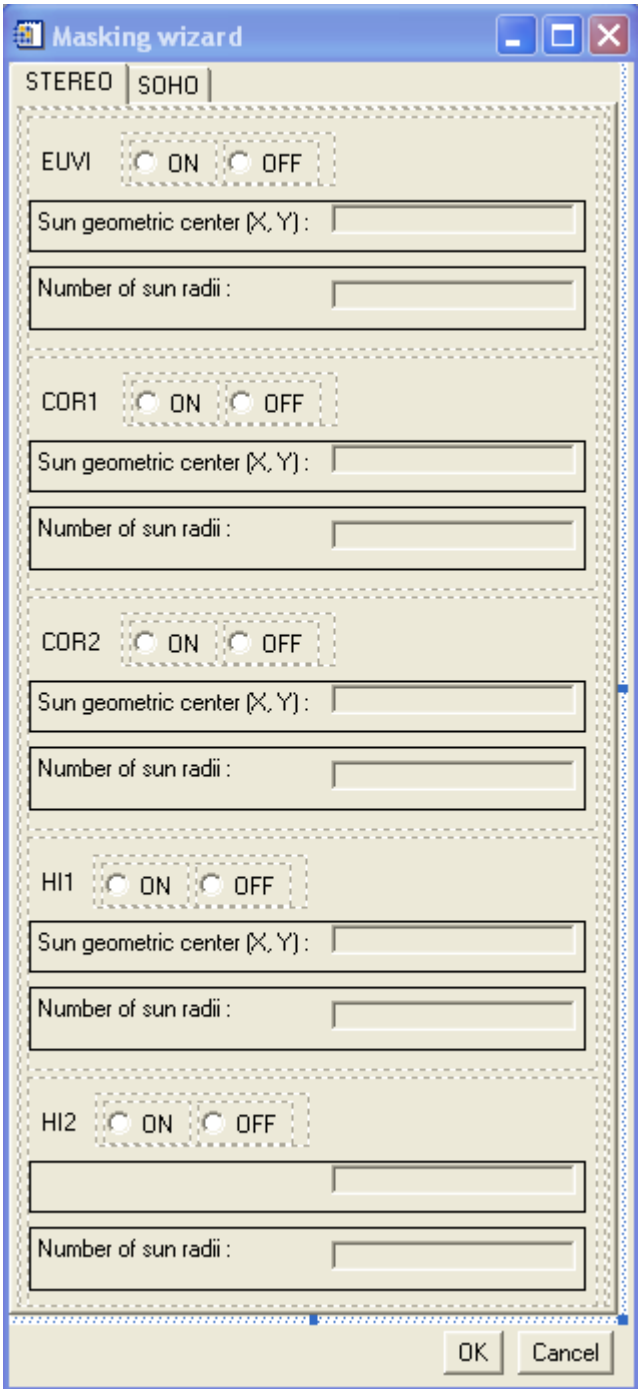
3.3.2 Image masking wizard

What is meant here is the possibility of viewing hidden data when images overlap.

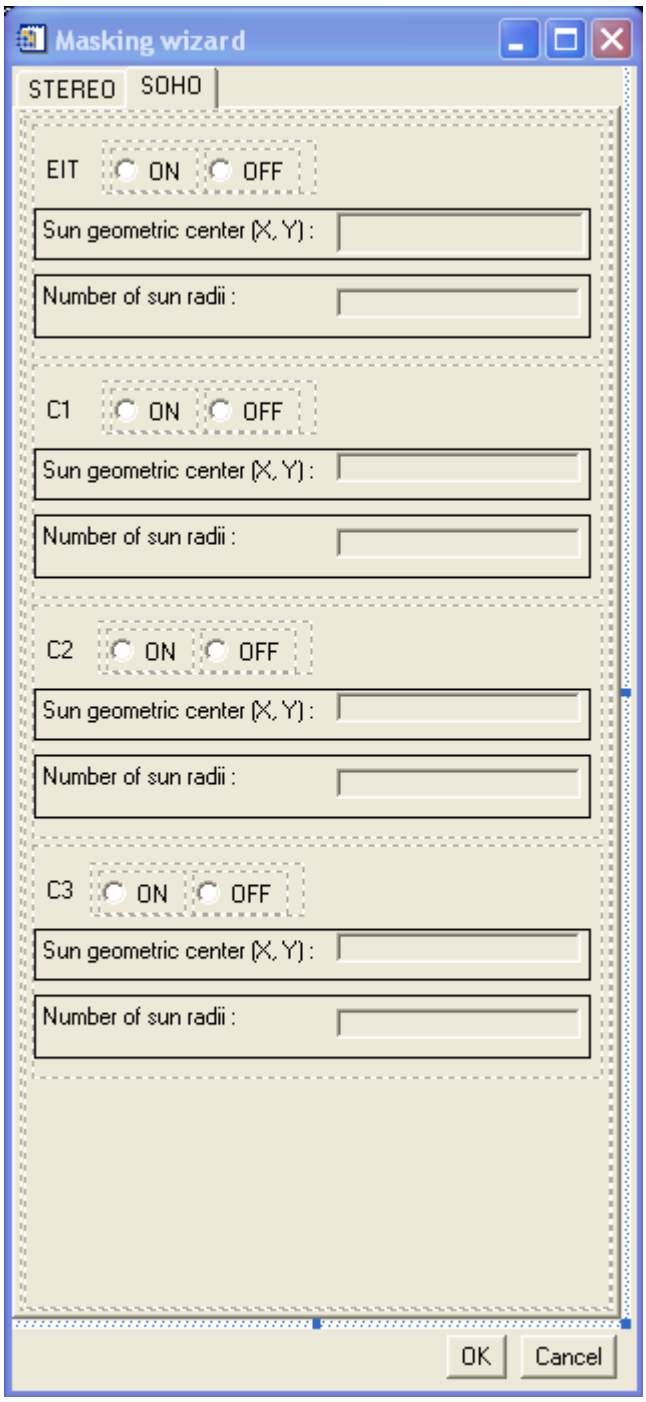
- For all the instruments, a mask is defined using 2 parameters :
  - Either the Sun geometric center (information available in FITS header) or the center of the image. For HI1 & 2, the center of the FOV by default. This parameter can be adjusted by the user in the options tabs.
  - A user adjustable number of solar radius.
- For images produced by all the instruments, an overlapping order can be defined for each instrument relative to the other instruments, for example :
  - HI1 on top of HI2
  - HI2 on to of COR2

  This can be achieved by displaying a pile of instruments. The order in the pile give the display order.
- Image masking is implemented in the "Options" entry in then main menu bar ("Image masking" submenu).
- The "Image masking" submenu contains the following option :
  - Define EUVI/EIT/C1/C2/C3/COR1/COR2/HI1/HI2 masks
  - Define the display order of the images.
- "Define EUVI/EIT/C1/C2/C3/COR1/COR2/HI1/HI2" masks launches the following GUI :

- For the STEREO tab :



- For the SOHO tab :



- "Sun geometric center (X, Y)" indicates the sun geometric center (in the current coordinate system) and can be modified by the user (**TBC**).
- "Number of sun radii" defines the number of sun radius to be used for calculating the mask. This value can be modified by the user (**TBC**).
- "Masking ON" option tells whether masking should be automatically applied (or not, "Masking ON" becomes "Masking OFF") to EUVI or EIT images.

3.3.3 Display order wizard

The order in which images are displayed in a data visualisation GUI is controlled by a display order wizard. A possible implementation for this display order wizard is shown below :

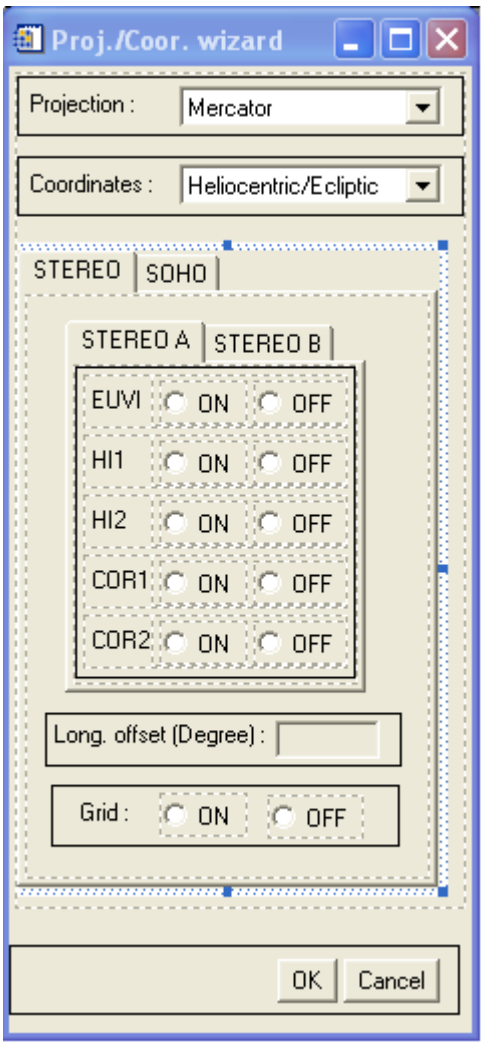
- For the STEREO tab :

- For the SOHO tab :

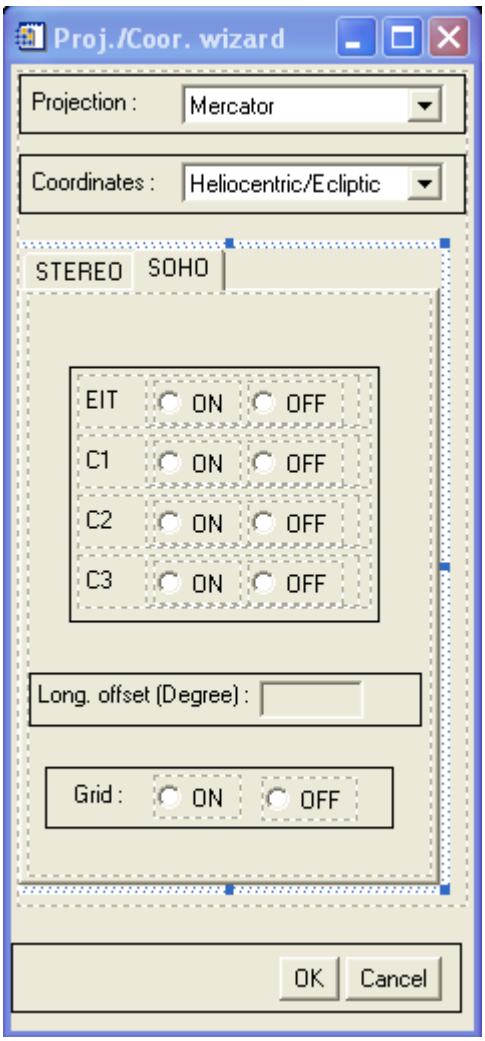
Each button can be “dragged and dropped” to another place in order to change the display order of the images. The OK button is used to confirm and save the display order. The Cancel button uses the previously defined display order.

3.3.4 Projection/coordinates wizard

- A possible implementation of the projection/coordinates wizard is shown below :
- For the STEREO tab :



For the SOHO tab :



The projection/coordinates wizard contains :

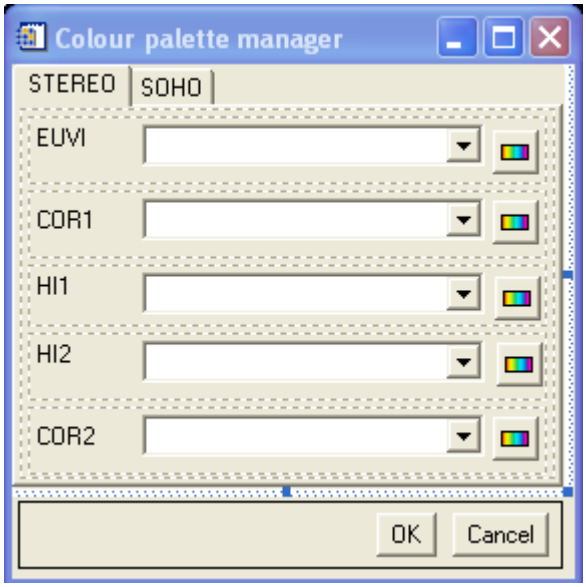
- A droplist widget for the selection of the current projection. (one from Mercator, Mollweide, Lambert, or None). Default is Mercator.
- A dtoplist widget for the selection of the current coordinate systems (one from Heliocentric/Ecliptic, Heliocentric with Solar North up or None). Default is Heliocentric/Ecliptic.
- A STEREO tab and a SOHO tab.
  - The STEREO tab is subdivided in a STEREO A and a STEREO B tab. Each of them displays a list of STEREO instruments. No need to distinguish EUVI/EIT wavelengths.
  - The STEREO tab displays a list of SOHO instruments.
  - In an instrument list, the user selects the instruments for which the images will be projected prior to visualisation, using the projection selected in the projection droplist. Default is that all images are projected prior to visualisation (e.g. all radio buttons associated to all instruments are checked, and the label widgets next to them displays “ON”).In order to save computing time, default is that only HI1 & 2 are projected prior to visualization. (e.g. the associated radio buttons are checked, and the label widgets next to them displays “ON”).
  - Even if some images may or may not be projected, a coordinate system is systematically used inside the data visualisation GUI.

- A “Long. Offset (Degree)” text area in which the user the specifies in degree the offset to the sun center.
- A “Grid ON/OFF” text area in which the user indicates whether or not the grid should be displayed.
- The “natural grid” is always displayed, even if some images were rotated.
- The OK button applies the user settings to the opened data visualisation GUIs, and to any data visualisation GUI lateley opened in the STEREO session, e.g. the contents of the data visualisation GUIs are rebuilt by reprojecting (or not) the images and applying the new coordinate system (if different).
- The Cancel button keeps the previous projection settings, and doesn't change the data visualisation GUIs contents.

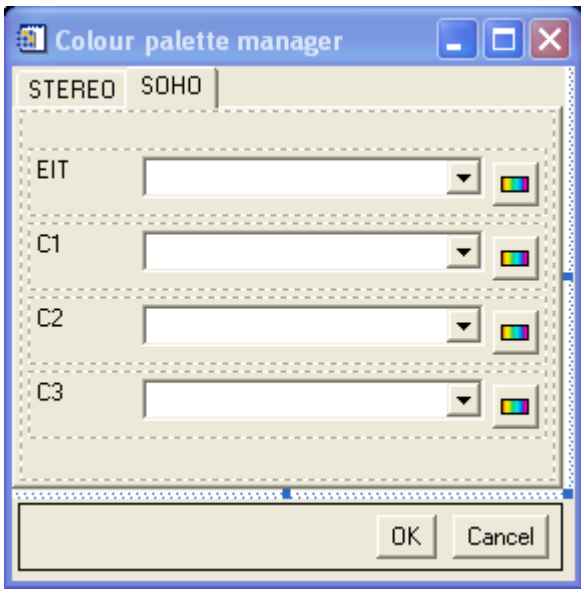
3.3.5 Colour palette wizard

A possible implementation of the colour palette wizard is shown below :

- For the STEREO instrument :

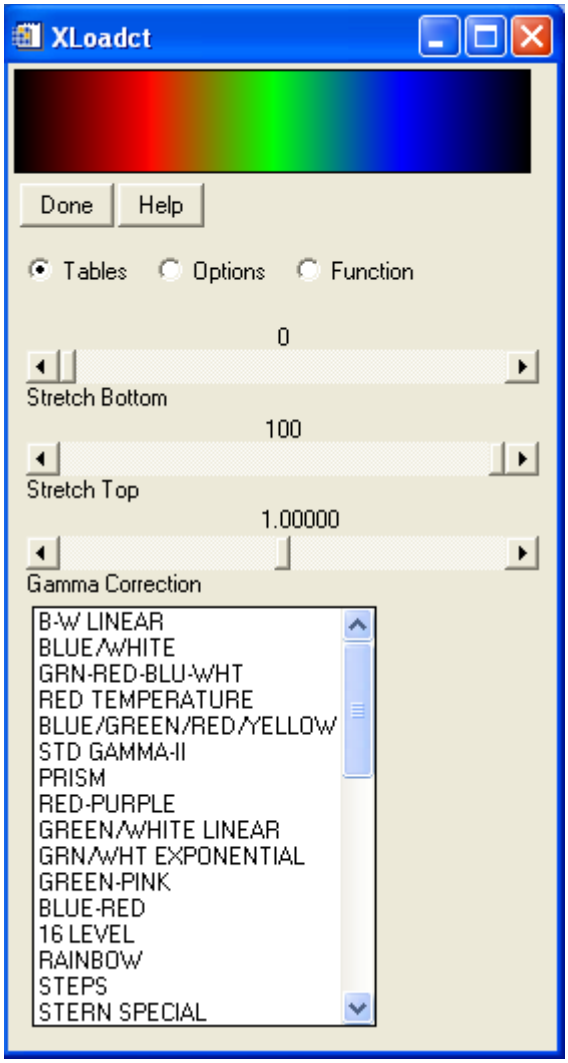


- For the SOHO instrument :



Two tabs are available :

- A STEREO tab and a SOHO tab.
  - Each tab contains the list of available STEREO instruments and next to it, a droplist widget allows to select a default colour palette to be used when displaying images for a given instrument.
  - The proposed colour palettes are the ones available in the IDL distribution (41 palettes), or some user defined palettes (**TBD**).
  - When launched, the colour palette wizard displays the colour palette currently associated to each instrument. Default is palette 0 (grey level).
  - Next to the droplist widget, a button widget allows to edit the colour palette associated to an instrument. When this button is used, the following GUI appears :



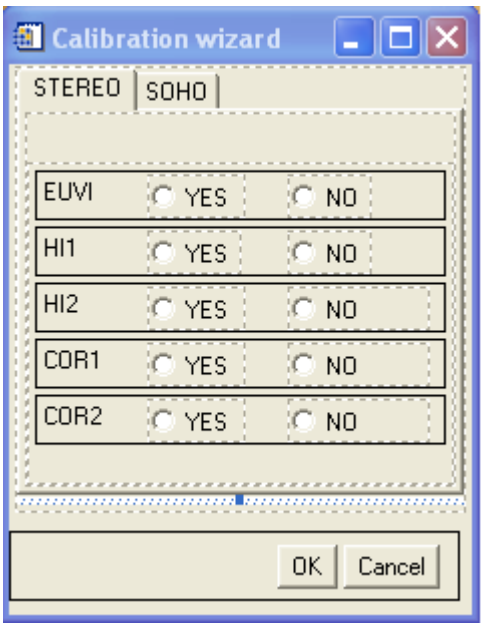
This GUI allows to tune some of the colour palette parameters (gamma correction, transfer function, ...) in order to get the best colour palette for a given instrument.

Note:

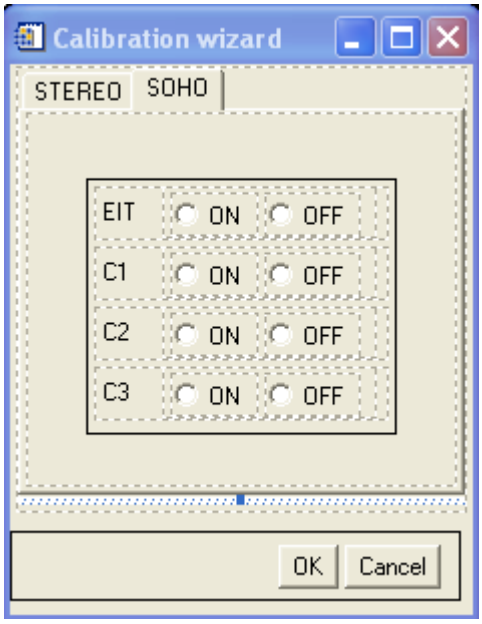
The projection wizard and the colour palette wizard can be put together in a general Preferences interface.

3.3.6 Data calibration wizard (TBC)

For the STEREO tab :

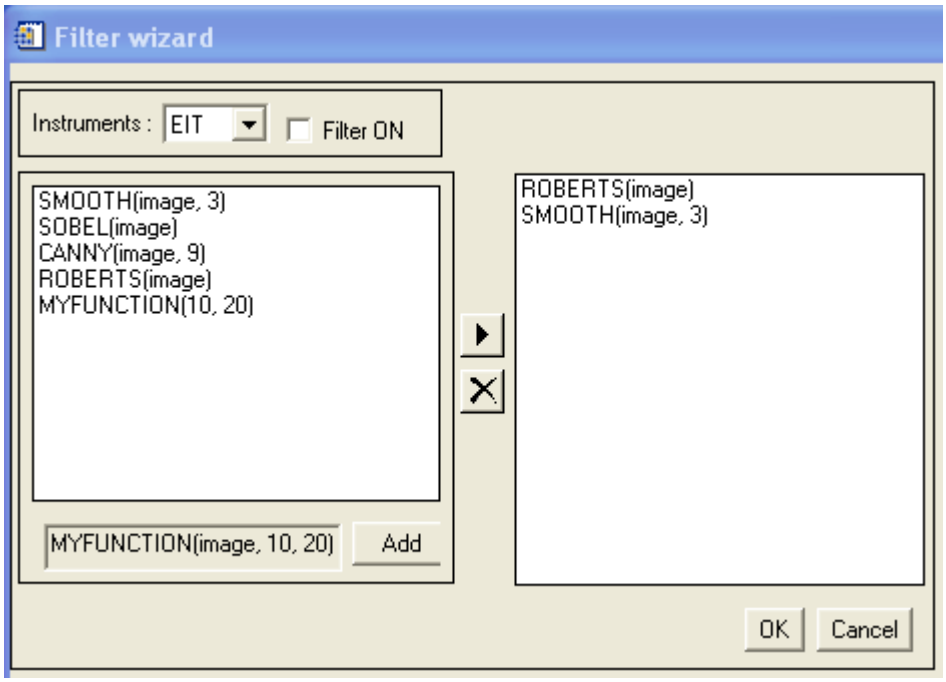


For the SOHO tab :



3.3.7 Filter wizard

A possible implementation for the filter wizard is shown below :



This wizard is accessible from the “Options” entry in main menu bar (Filter wizard submenu) . The instruments droplist widget contains the list of the available instruments. Next to it, the button “Filter ON” allows to activate/desactivate the filtering sequence on the images (“Filter ON” becomes “Filter OFF”).

When this button is in its “Filter ON” state, the defined filtering sequence is automatically applied to images prior to visualisation. Otherwise, it is not applied prior to visualisation.

The list on the left shows the available filters to select from. Below, in the text area, the user can call a user function, with a list of parameters, and add it to the list using the “Add” button. If IDL can't find the user function, or the user function contains an error, the user is warned that the function cannot be added to the list.

The right list displays the filter sequence constructed for an instrument. A filter can be added to the right list using the central “arrow” button. It can be removed using the central “delete” button.

When the “OK” button is pressed, the filtering sequences for the instruments are saved and are persistent during the STEREO session. The filter wizard is closed.

When the user navigates in the images lists, the filtering sequences are automatically applied to the images prior to visualisation (if the “Filter ON” option was activated).

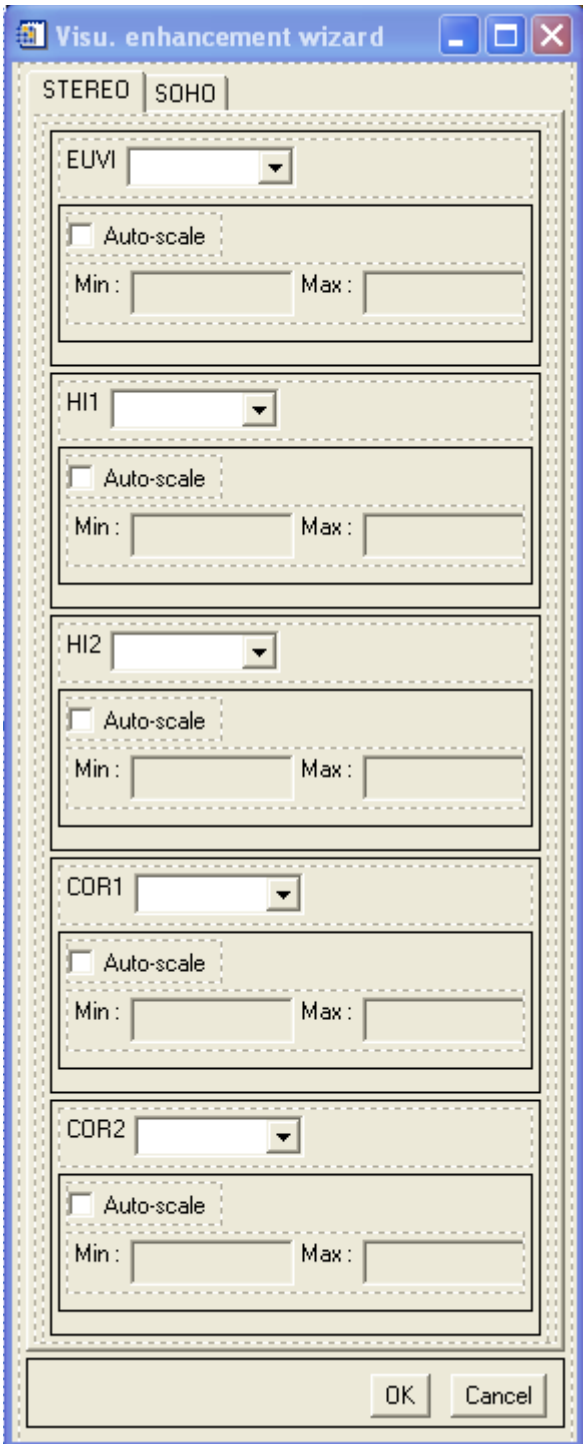
If the “Cancel button” is pressed, the last defined filtering sequences are not saved. If the “Filter ON” option was selected, the previously defined filtering sequences (if any) are applied to images during navigation.

In version 2.0, filter sequences per instrument could be saved and automatically restored each time the application is launched.

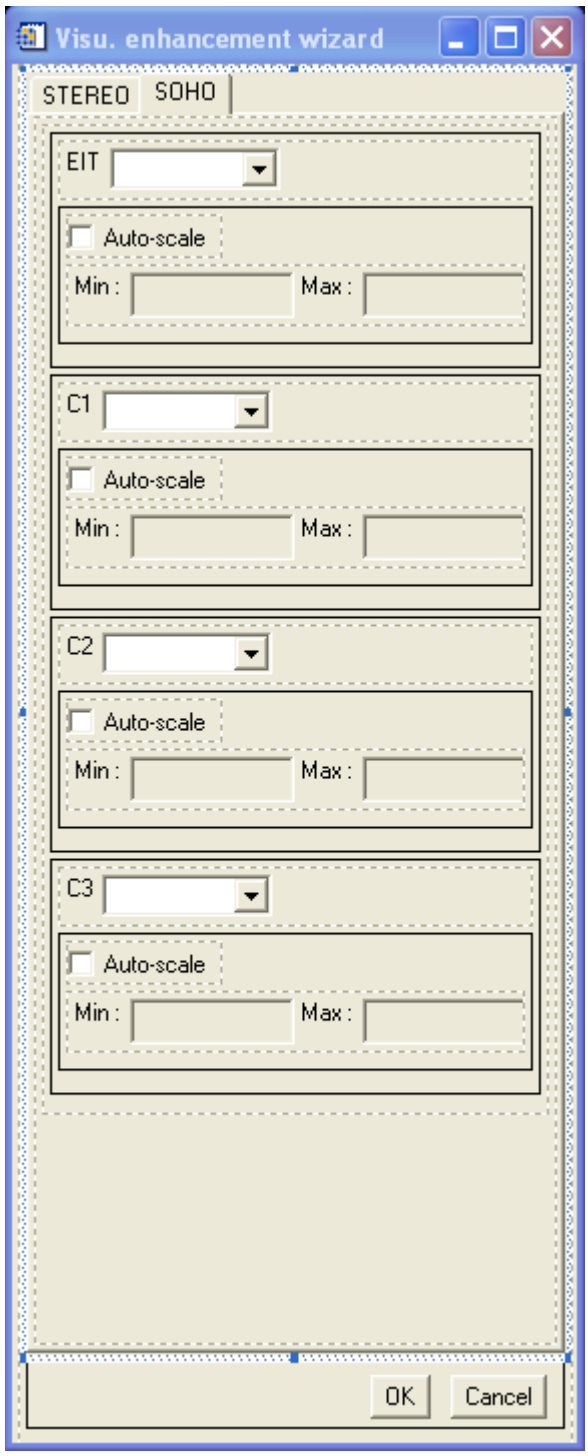
3.3.8 Visualisation enhancement wizard

A possible implementation for the Visualisation enhancement wizard is shown below :

- For the STEREO tab :



- For the SOHO tab :


Visu. enhancement wizard
STEREO
SOHO
EIT
Auto-scale
Min :
Max :
C1
Auto-scale
Min :
Max :
C2
Auto-scale
Min :
Max :
C3
Auto-scale
Min :
Max :
OK
Cancel

3.3.9 Contextual options

Right clicking on an image into the visualisation area (AREA 2) makes this image (e.g. an instrument) the current image (all tables and radio buttons must be updated accordingly), and a contextual menu appears.

The available contextual menu options are :

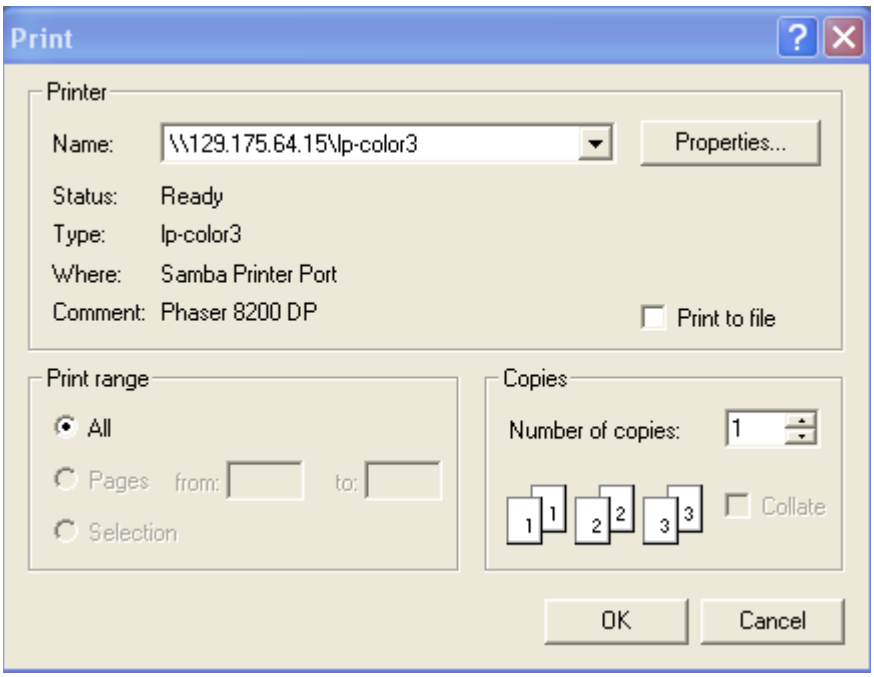
- **"Display full images list"**
  - This option displays the full images of the selected instrument in a separated chronological table (in the time interval defined in the data selection GUI). This allows to jump easily to any image without having to push continuously the "NEXT" button (all tables and radio buttons must be updated accordingly).
- **"Show FITS header"**
  - This option displays the FITS header in a table widget (one line per FITS attribute).
- **"Zoom"**
  - This option allows to center the visualisation on a given image (depending on the selected instruments) and to apply a zoom factor on it. It contains submenus, one per selected instrument. Each instrument contains itself submenus with 25%, 50%, 75% and 100% options. For example, if the data visualisation GUI contains HI1 and COR1 images, the ZOOM menu will look something like :
  - **ZOOM -> HI1 -> 25%**
    ->50%
    ->75%
    ->100%
    -> COR1->25%
    ->50%
    ->75%
    ->100%

3.3.10 Profiles tool (TBC)

- **Profil suivant une ligne droite ou non ?**
- **Niveau d'interactivite requis ?**
  - **Le profil peut-il etre modifie dynamiquement a la souris ?**
  - **Gestion des zones de recouvrement ?**

3.4 Printing

This option brings up a printer configuration GUI that allows to define the printer configuration prior to printing the data visualisation GUI contents. This printer configuration GUI already exists in IDL and can be used as is :



The “Print to file” option when selected brings up a file selection GUI allowing to define the full path and name of the postscript file.

3.5 Saving images

The content of the visualization GUIS can be saved to bitmap file formats such as JPEG or PNG at the resolution of the display. When multiple probes are selected, a postfix is added to the input filename to distinguish images.

3.6 Saving sequences (to be confirmed)

The user can save the full sequence of images as an mpeg movie or as individual bitmap images. This “save sequence as” feature works as follows. It is equivalent to clicking “next frame” through the sequence and saving the resulting individual bitmap frames. If the mpeg format is chosen, each frame is save as a key frame in the mpeg file. If a bitmap image format is chose, each frame is saved in an individual file, with a postfix specifying the image frame number or date (ex. 20060102.051234).

3.7 Saving/Reloading a STEREO session (TBC)

Some specific parameters can be used and lately restored. Typical information includes :

- The filter sequences associated to each instrument.
- The colour palette associated to each instrument.
- The projection used to display the data.
- The coordinate system associated with the projection.

This information can be saved in a text format that can be lately reloaded.