CORONAL DIAGNOSTIC SPECTROMETER
SoHO

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USER GUIDE TO CDS CALIBRATION SCIENCE ANALYSER

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1 Prerequisites

The program is run by a .run calibration command, this can be standalone (for replay, say) or from within the EGSE suite. All the main software is in the /cs/test/data_anal/egse directory. A few environment variables are needed to point to auxiliary data and to directories in which data files are created (remember these need write access!). They are:

CDS_PLAN_TECH Holds various auxiliary data files.

CDS_TM_DATA Holds the replay telemetry files.

CDS_CAL_FITS The directory to which the FITS data and log files are written.

CDS_CAL_RAW The directory to which any raw data files are written.

All these environment variables are defined in /cs/login (which should be sourced in your .login file) and so they can be redefined for local use.

Until further notice the program calibration.pro has replaced the original sci_ana.pro (old copies of which should be deleted). The calibration software calls upon many routines in the standard cds directories and it is therefore essential that it is run only with an up-to-date copy of the complete directory tree. The file /cs/cds.tar.Z always contains the latest available copy.

Several new options have been included on the main window control panel at the top of the screen, so from the left ......

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EXIT  - click this button to stop the whole thing.

CONTROL (Pull Down menu - PDM)  with options:

  start -  start ingestion of telemetry from either replay file or realtime
  =====    Some rules apply. 1) must have defined Gas characteristics first
                             2) if in replay mode a data file must have been
                                defined (See last item under this PDM). See
                                also "Start Packet" widget explained below.
                             3) ingestion must not already be running.
           Contravention of any of the above rules means that ingestion
           will fail to start.

           Some sensible things to do before starting:
                             1) Select a display of the relevant telemetry
                                header information (see "Header info" PDM
                                explained below)
                             2) If FITS file writing is enabled (the default)
                                create a sensible file name by selecting a
                                sequence from the master list (see "Sequence
                                Details" button on far right and explanation
                                below.

  stop  - stop ingestion of telemetry in either replay or realtime mode.
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====    Command is ignored if ingestion has not previously been started.
        If this command is issued after the receipt of a raster header and
        before the last data packet is received, the program will attempt
        to reconstruct the data from the information it already has.  This
        should be safe (in terms of crashing the whole thing) but is not
        recommended.  Note that the same thing happens if an ABORT packet
        is received - but note that ingestion continues after an ABORT is
        detected.

save variables - saves (in an IDL sense) some of the internal data variables
==============   in a file Science.dat in the current directory.  I have not
                 tested whether the variables saved allow reconstruction of
                 sensible data sets.  This mode is a hangover from the EM
                 and maybe should be withdrawn.  After using it and closing
                 the IDL session, try getting into IDL and typing:
                 restore,'Science.dat
                 and see what variables magically reappear.

select TM datafiles - select telemetry file(s) to be read in replay mode.
===================   If the files are not in the current directory, click
                      on the "Central Data" button to display the contents
                      of the central data directory defined by env. var.
                      CDS_TM_DATA.  It is OK to select more than one data
                      file, but be patient and wait for the program to check
                      each selection in turn (ie don't click on file names
                      at the speed you would like to!).  If you accidently
                      select the same file twice, the duplication will be
                      eliminated.  It only makes sense to select consecutive
                      (in time) files as the telemetry reading program will
                      automatically switch to the next file when it runs off
                      the end of the current one.


REVIEW CONTENTS  (PDM for historical reasons with only one option)
                 When selected this will display a widget listing all the
                 types of packets known to mankind.  The idea was simply to
                 display a cumulative count of packet types coming in.  Every
                 time a particular packet ID is detected the counter for that
                 ID is incremented - nothing else!  All the counters can be
                 reset by using the RESET button but only if the ingestion has
                 been stopped.  The counters are NOT reset by quitting this
                 display (with the Done button) - next time you come in, the
                 counters displayed will show the cumulative count since the
                 review was FIRST started.

HEADER INFO -  (PDM) displays all the relevant information contained in the
                header packets.  There are two options for each instrument.
                In each case you can select to display only the RASTER header
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information or you can choose ALSO (not only) to update the display with information contained in the exposure headers. I cannot see why you would ever want to do anything else but...

VIEW SPECIALS - gives PDM for choosing which (one at a time) special packets to interpret and display. The information displayed is updated whenever a special packet (id='30'x) of the correct format ID is detected.

RAW DATA - PDM with choice of instrument. For the GIS selection this will display a widget in which the raw GIS data will be dumped (format hex or decimal). These data may also be dumped to disk file - see "Dump To File" pdm within this widget. The file name is chosen automatically and is pretty well guaranteed to be unique since it uses the system time (to the nearest minute). The data (60 int16 words per record - these may need to be byteswapped upon reading) are simply written with an unformatted write. Data dumping to the disk file is terminated when this widget is quit using the "Done" button (even if the "Dump OFF" option in the "Dump to file" pdm is not used prior to exiting..

The same applies to the VDS raw data - but I do not have any details of what VDS raw data are.

MONITOR - PDM with choice of instruments. If this widget is enabled it is supposed to act as a crude rate meter. Whenever an exposure is completed the total counts in the data is plotted (against sample number). The plot is self-scaling. Although crude in form this option can probably be used for a variety of things since the code does not care how an exposure is defined or from what raster it originated. Each exposure could therefore be from an essentially infinite raster (there is actually a limit of 1000 samples) and the plot could be used as a rate meter during setup adjustments. For this application using the VDS it would only really make sense to use this with one or two data windows a few pixels wide and centred on lines of interest. Alternatively the exposures could come from observations taken at different source positions etc. etc..

VIEW VDS - button to enter a whole new world of VDS data with its own options of:

Done - button to exit this mode
====

Hardcopy - pdm to create hardcopy of current display. Only sends to
======== postscript printer defined with env. var. PRINTER. Scaling

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          of grey scale is less than optimal (ie rubbish) at present.

Analyse  -  pdm to provide some simple analysis possibilities viz:
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     Subtract A-B    Subtracts the image displayed in window B from that in
     ------------    window A and displays the result in a separate window
                     containing the full 1024x1024 image and a zoomed,
                     scrollable version.

     Zoom A/B        Creates a window in which a zoomed version of image
     --------        A or B is displayed.  Uses the standard IDL zoom
                     utility.  Instructions are given in the message window
                     but note that the zoom centre is determined by the
                     cursor location within the original window not the
                     zoomed one and that no zoomed window (not even a blank
                     one) appears before you click within the original
                     image.

     Profile         Creates a window in which to display a profile plot of
     -------         of some section of either image.  The size of the
                     profile is set with the sliders and the orientation
                     with the buttons.  Note that when you switch from
                     horizontal to vertical and vv. the range of
                     the allowable profile length changes.  Once a profile
                     has been displayed those data may be fitted by a
                     gaussian profile (use the "Fit profile" pdm).  There
                     are various options on the fitted profile to allow
                     different definitions of the background to be fitted
                     with the gaussian.  The results of the fit are given
                     in the message window.


Customize - pdm (with only one option) to allow changes to the display LUT.
=========   The only option implemented is to use the standard IDL xloadct
            routine.



View      - pdm allows user to select which data are displayed.
====        Options are:

   Select A/B - allows selection of which exposures are displayed in the A
   ----------   and B windows.  A smaller widget will appear in the left
                hand corner of the screen and if more than one exposure has
                been received a slider will allow the selection of the
                exposure to be displayed.  Note that on the slider the
                exposures are numbered from 0 to n-1.
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   Full VDS   - The exposure to be displayed can be selected as above, but
   --------     this time the display is in a special window which displays
                the full 1024x1024 VDS image and also a scrollable full
                resolution version.  This is the only way of inspecting data
                outside of the 1024x256 window normally used.


   Synthetic data - for those unable to get to real(?) data this option will
   --------------   load a vds_dummy image into both the A and B displays.
                    From there you can play with the various display options
                    but do not try to use "Select A/B" under this "View"
                    pdm - you have been warned!  If you really want to
                    change the data displayed then replace the file
                    $CDS_PLAN_TECH/vds_dummy_image with your own output from
                    vds_dummy.


Statistics    -  a pdm to allow some simple statistical analyses of the
==========       images displayed in A or B.  It has 2 options for each
                 window:

   Box cursor  -  displays a box cursor which may be manipulated
   ----------     (instructions in the message window).  To move the cursor
                  place the mouse cursor within the box and drag the box
                  while holding mouse button 1 (Left) down.  To resize the
                  box do a similar thing with the middle mouse button and
                  to get the statistics press the right hand mouse button.
                  Be patient with this one, the first time in I usually have
                  great difficulty in making the mouse 'pick up' the box
                  with the mouse button.  Don't know what the problem is -
                  we can ask Bill when he's here - he wrote the cursor
                  routine.  The calculated statistics are displayed in the
                  widgets just below the command buttons.

   Single point - As the name suggests will display the statistics of a
   ------------   single datum in one of the images.  Just click on the
                  image selected as the required point.  Results are in the
                  same place as above.



Spectral Lines - pdm to allow display of the positions of the emission lines
==============   expected from the source gases to be used in calibration.
                 The data on the lines are taken from the lists provided by
                 Barbara and Richard.  Where a range of wavelengths was
                 indicated in those lists, I have simply taken the central
                 wavelength of that range.  Display options are:
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    Display first order - means display ONLY first order line positions.  The
    -------------------   line positons are indicated by dashed lines at
                          +/-10 pixels from the anticipated line centre.

    Display second order - means display ONLY second order positions.
    --------------------

    Display All  -  means display both first and second order lines.
    -----------

    Display OFF  -  means do not display any line positions.
    -----------

                    Note 1) that if (as is very likely) the line data
                            files need to be updated, they can be found in
                            file:  $CDS_PLAN_TECH/VDS_cal_lines
                            keep the format the same!


                    Note 2) when in this general VDS analyser widget and
                            no option is being used that specifically
                            requires cursor input then the cursor can be used
                            anywhere within the A and B image displays to
                            request a wavelength/intensity value.  If
                            spectral line position display is also enabled,
                            the information fedback will include the line
                            identification.


VIEW GIS  -  button to enter the world of GIS data display and analysis.
             Options available within it are given below.  Note that many of
             the options will only work if a single GIS data band is displayed
             in either window A or B - you will be warned if an option requires
             this:


   Done - exit from this mode and return to top level
   ====

   Hardcopy -  pdm to choose a hardcopy of either of the display windows.
   ========    Plots are only sent to the postscript printer defined by the
               env. var. PRINTER.

   Analyse  -  pdm to provide simple analysis of GIS data.  Options are:
   =======
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   Subtract A-B  -  not yet implemented
   ------------

   Enlarge A/B  -  requires 2 cursor clicks on the displayed spectrum to
   -----------     define the limits for the enlargement.


   Fit Profile in A/B  -  pdm to select the fitting options (ie choice of
   ------------------     background definition) and then requires 2 cursor
                          clicks to define the range of data to be fitted.



   Point stats in A/B  -  Click on the display to have the details of the
   ------------------     datum returned in the message window.




View  -  pdm to allow choice of data displayed in windows A/B. Options are:
====

   Select A/B  - will display a widget to allow choice of exposure to plot
   ----------    in windows A/B.  Details of the chosen exposure will be
                 written to the information widgets.

   Synthetic data - will retrieve and display sample output from gis_dummy.
   --------------   Once these data are displayed, you may manipulate the
                    display but do not attempt to use the "Select A/B"
                    option above. If you wish to change the synthetic data
                    used then replace file $CDS_PLAN_TECH/GIS_dummy_image
                    with your own output from gis_dummy.


Plot axes  - pdm to allow the definition of the plot axes.  The choices are:
=========


   By pixel - use pixel or datum number as the abscissa variable.
   --------

   By wavelength -  use wavelength as the abscissa variable.
   -------------

   Linear counts  - plot the counts on a linear axis.
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   Logarithmic counts - plot the counts on a log axis.
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Spectral Lines - pdm to allow display of the positions of the emission lines
==============   expected from the source gases to be used in calibration. The data on the lines are taken from the lists provided by Barbara and Richard. Where a range of wavelengths was indicated in those lists, I have simply taken the central wavelength of that range. Display options are:

Display first order - means display ONLY first order line positions. The
-------------------   line positons are indicated by dashed lines at +/-10 pixels from the anticipated line centre.

Display second order - means display ONLY second order positions.

Display All - means display both first and second order lines.

Display OFF - means do not display any line positions.

Note 1) that if (as is very likely) the line data files need to be updated, they can be found in file: CDS_PLAN_TECH/GIS_cal_lines
keep the format the same!

Note 2) when in this general GIS analyser widget and no option is being used that specifically requires cursor input then the cursor can be used anywhere within the A and B image displays to request a wavelength/intensity value. If spectral line position display is also enabled, the information fedback will include the line identification.

The display of the various GIS bands is controlled by the five buttons for each window display. By clicking on these buttons any combination of GIS bands can be displayed.

GAS DETAILS - pdm to select the source gas and its setup parameters. Options are:

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Gas ID -  pdm to select gas from the three to be used.  When a gas is
======    selected the default setup parameters are displayed in the
          widgets below.  These widgets are editable if these defaults are
          not correct.  If the default values are inappropriate they can
          be changed by editing the IDL procedure file gas_event.pro

          Telemetry ingestion will not be allowed unless valid parameters
          have been entered for the gas characteristics.


SEQUENCE DETAILS  -  the details of the sequences to be run during calibration
                     are derived from the master file created by
                     Richard/Barbara.  When this widget is activated for the
                     first time, the file $CDS_PLAN_TECH/cal_table.dt is read
                     into memory and displayed in the widget.  Sliders are
                     provided to allow definition of the first and last
                     sequences to be displayed.  These values are remembered
                     from one call of this option to the next so, for instance,
                     if you are working on sequences with id's around 1800 then
                     set the start serial number to 1790 and the end serial
                     number to 1840 and then each time you press the "Sequence
                     details" button only sequences 1790-1840 will be
                     displayed which saves scanning through the whole lot.

                     The purpose of this display is so that the operator may
                     choose (after consultation with the EGSE operator) the
                     next sequence to be used.  This is important because it
                     is from the sequence entry in the displayed table that the
                     FITS file name is created.  To test this select a table
                     entry with the cursor (note that the line chosen must not
                     be one of the repeat lines) and note the display of the
                     FITS file name in the top-level widget (assuming FITS
                     writing is enabled!).
```

Below the top-level control buttons are some buttons to allow a choice of the telemetry mode (replay or realtime) and a choice of whether the data are written to FITS files or not. Widgets are provided to display the current replay file (if any) and the current FITS file name (if any).

The only other user input possible at the top level is in the "Start Packet" widget. This is provided to allow the user to specify at what packet within a replay file the telemetry reading is to start. First time around this must be determined by trial and error if you are after a particular data set, but once determined this option can save a lot of time.

A multi-line, scrollable message window is provided in the main widget. Keep an eye on this. I also tend to use the bell (or beep more like) function if attention is to be drawn to an important message.