CORONAL DIAGNOSTIC SPECTROMETER

SoHO

CDS SOFTWARE NOTE No. 18

Version 1 | 15 September 1994

CDS INTEROPERABILITY SOFTWARE

W. Thompson
Applied Research Corporation
NASA Goddard Space Flight Center
Laboratory for Astronomy and Solar Physics
Code 682.1
Greenbelt, MD 20771, USA

William.T.Thompson.1@gsfc.nasa.gov
pal::thompson

1 Overview

This document describes the CDS routines intended to support interoperability. The objective of this software is to allow other SoHO instrument teams to read and display CDS data. This software should also serve as a model for the other instrument teams to incorporate a CDS reader into their own software. To that end, we have deliberately written these routines to "stand alone" as much as possible, so that a minimum of CDS library routines will be needed to support them.

2 The interoperability routines

The following routines are provided:

CDS_IMAGE: This routine reads in a CDS image from a FITS file. Two kinds of files are supported: simple FITS files with a single two-dimensional image (quicklook files), or CDS FITS binary table files (science processed data). In the latter case, the routine reads in a data column, and the data are then integrated over the wavelength dimension so that a simple image is returned. An example of the latter file is found in "testdata2.fits". (On the CDS computers, this file is found in the directory "/cs/data/nis".)

CDS_SHOW_IMAGE: This routine displays in a window a CDS image read by the routine CDS_IMAGE. Axes are drawn around the image to signify data coordinates in arcseconds from the center of the Sun.

The calling sequence of CDS_IMAGE is

CDS_IMAGE, FILENAME, OUTPUT *[, COLUMN]*

where the optional parameter COLUMN is the column in the binary table to read in. For example, suppose that one wanted to read in the data corresponding to the Helium II line at 303.8Å. One could enter

```
IDL> cds_image, 'testdata2.fits', output, 'HE II 303.8'
```

or

```
IDL> cds_image, 'testdata2.fits', output, 4
```

because the Helium II line is stored within the fourth column of "testdata2.fits". However, it isn't necessary for the user to know this. If one leaves off the optional COLUMN parameter, then a list of the available data is displayed. For example,

```
IDL> cds_image, 'testdata2.fits', output
       1   FE XVI 335.4
       2   FE XVI 360.8
       3   MG IX 368.1
```

```
        4   HE II 303.8
        5   O IV 554.5
Enter column to read:
```

one can then enter in the column desired, either by name or by number.

The standard science processed data files will be FITS binary tables—the file "testdata2.fits" is an example of such a file. The idea has been discussed of providing additional "quicklook" files for planning purposes. These files would be simple FITS files containing two-dimensional images from a single wavelength region. The reason for this is to minimize network traffic. The CDS_IMAGE routine provides a single consistent view into both kinds of files. When used with such "quicklook" files, the optional COLUMN parameter is ignored.

The OUTPUT parameter is a structure which contains the data array and information about the data. For example if one enters

```
IDL> help,/struct,output
** Structure <400661c8>, 11 tags, length=57744, refs=2:
   ARRAY            FLOAT     Array(120, 120)
   LABEL            STRING    'HE II 303.8'
   UNITS            STRING    'COUNTS'
   MISSING          INT             -1
   AXES             STRING    Array(2)
   ORIGIN           DOUBLE    Array(2)
   SPACING          DOUBLE    Array(2)
   ROTATION         DOUBLE    Array(2)
   WAVELENGTH       DOUBLE           607.50200
   WAVEMIN          DOUBLE           606.92200
   WAVEMAX          DOUBLE           608.08200
   HEADER           STRING    Array(57)
```

The parameters AXES, ORIGIN, SPACING and ROTATION give information about the axes. HEADER is the FITS header from the file, and contains information such the date of observation and the exposure time, that can be extracted using the routine FXPAR. For example,

```
IDL> print,fxpar(output.header,'exptime')
           5
```

The routine CDS_SHOW_IMAGE displays the image read by CDS_IMAGE. For example, the commands

```
IDL> !p.charsize=2
IDL> cds_show_image,output
```

displays the image shown in Figure 1. (The first statement is to ensure that the lettering would be easily visible when replicated within this document.) Because CDS images are small, the image is shown three times the actual size.

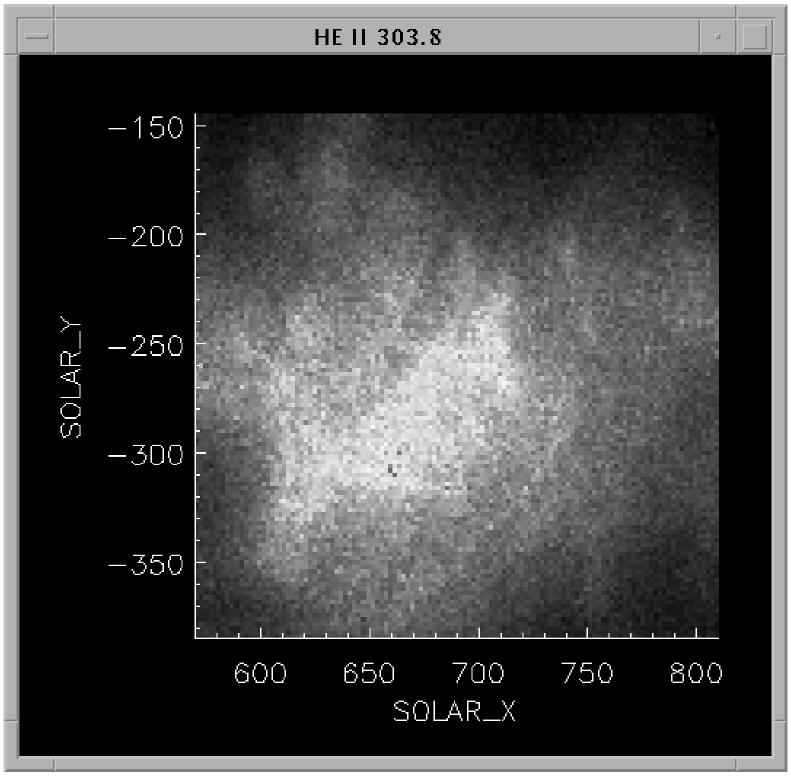

Figure 1: Sample output from CDS_SHOW_IMAGE.

3 Supporting routines

The following routines from the CDS library are provided to support CDS_IMAGE and CDS_SHOW_IMAGE:

READCDSCOL: Reads data stored within a column of a CDS FITS binary table into a structure variable containing the array and associated information.

DATATYPE: This routine returns the data type of a variable in a format specified by the optional flag parameter.

TRIM: Converts numbers into a string representation, and trims off leading and/or trailing blanks. Differs from STRTRIM in that trailing zeros after the period are also trimmed off, unless NUMBER is already a string, or an explicit format is passed.

VALID_NUM: The input string is parsed for characters that may possibly form a valid number. It is more robust than simply checking for an IDL conversion error because that allows strings such as "22.3qwert" to be returned as the valid number 22.3

In addition, the standard FITS binary table ("FX") routines are used to read in the FITS files. These can be found in the IDL Astronomy User's Library, or in the directory /pub/soho/soft/cds/fits on the anonymous ftp server umbra.gsfc.nasa.gov. If using a WWW browser such as Mosaic, one can use the URL ftp://umbra.gsfc.nasa.gov/pub/soho/soft/cds/fits