CORONAL DIAGNOSTIC SPECTROMETER
SOHO

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CDS CATALOG DEFINITIONS

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1 Overview

Catalogs organized as relational tables are used in a number of places in the CDS ground-based environment. Not only is the catalog of scientific observations maintained in a relational database [6], but other catalogs have also been proposed to maintain information such as the daily science plan and the definitions of studies. This document is an attempt to draw together all these data, and define them more precisely.

We have two tools available to us to help maintain catalog data. The first is the relational database management system Oracle. This is perceived to be of particular value for maintaining the catalog of observations, but can also be used for other catalogs. In fact, catalogs of auxiliary data can greatly enhance the observation catalog. To make the Oracle database most useful, the server should be easily accessible from external sources. This implies that the Oracle server should be located in the SOHO Experiment Analysis Facility (EAF) in Building 26.

However, certain catalogs are necessary to properly operate the CDS instrument. An example of such a catalog is the database of raster definitions. Basic satellite operations should not rely on the network link between the SOHO Experiment Operations Facility (EOF) in Building 3, and the EAF. Therefore, these catalogs must be maintained within the EOF. Since it would be prohibitively costly to duplicate the Oracle server in both buildings, and since the catalogs involved are small enough not to justify the expense of an RDBMS, these operational catalogs will be maintained using IDL software. The UIT database software [2] will be used as a basis for this software. Databases maintained within IDL will be periodically uploaded into Oracle, but IDL will have primary control over these tables.

2 The CDS study/raster philosophy

CDS science planning is organized by studies and rasters. These concepts require some explanation.

A raster is a basic unit of a scientific observation. At the most basic level, it consists of a series of exposures scanning the solar image across the slit using a combination of scan mirror and slit mechanism movements. The step spacing between exposures is kept constant, as are all other instrument properties such as exposure time. Each raster results in an output data (FITS) file.

A study is a series of rasters strung together to form a complete observation designed to answer a particular scientific question. Examples of studies are shown in the CDS blue book [1].

It was felt that the CDS planning system should have enough flexibility that the parameters of a study could be modified without generating a completely new definition. Thus, it was decided that each raster and study would have two identifiers, a fundamental ID number and a variation index.

A fundamental raster ID, called RAS_ID, contains just enough information to specify which detector and slit is being used, and what the scan pattern is. For example, RAS_ID=3 might refer to a 4×4 arcmin raster using the NIS detector with the 4×240 arcsec slit. In order to extract the other information, such as the exposure time, needed to complete the raster definition, one would need to specify a variation index (RAS_VAR). For example, for RAS_ID=3 and RAS_VAR=1 the exposure time might be 13.9 seconds, while for RAS_VAR=2 the exposure time might be 18 seconds.

It's important to note that RAS_VAR by itself doesn't mean anything without the RAS_ID it belongs to. Each fundamental raster given by RAS_ID will have a series of variations with the first one having RAS_VAR=1, the second RAS_VAR=2, etc.

A study is defined by specifying a series of rasters, plus some information about how pointing should be handled. A fundamental study ID number (STUDY_ID) is defined in terms of the RAS_ID numbers. The study variation (STUDYVAR) is defined simply by adding the RAS_VAR numbers.

2.1 Pointing

When we talk about the pointing of a raster, we always refer to the position of the center of a raster relative to the center of the sun.

Pointing in a study can be handled in one of three ways:

1. Directly as part of the study. This should only be used in rare cases. An example of such a study is SYNOP where a series of rasters are made going down the central meridian from the north pole to the south pole.

   In the study database such pointing schemes are identified by setting POINTING=0 for each raster in the study. The parameters INS_X and INS_Y specify the pointing for each raster.

2. Deferred to the science plan. This will be the most commonly used type of pointing. Rather than embed the pointing directly in the study definition, the user specifies the pointing each time the study is used. This is identified by setting POINTING=1 for each raster in the study.

3. Relative pointing. This is similar to deferred pointing, except that only the pointing of the first raster is deferred. The pointing of the subsequent rasters are defined relative to the first. For example, one could tile four 4×4 arcmin rasters together to cover an 8×8 arcmin area.

   This scheme will be specified by setting POINTING=1 for the first raster. The rest of the rasters will have POINTING=-1 and the INS_X, INS_Y values will give the pointing relative to the first.

One can also do some mixing and matching between these three cases, by setting different values of POINTING for different rasters within the study. In the study header, there will also be a parameter called VAR_POINT will be set to either "Y" or "N" depending on whether the pointing is variable or not.)

2.2 Repeating rasters and studies

There are several ways in which one can specify that rasters should be repeated within a study,

One can use a "brute force" method by specifying the same RAS_ID and RAS_VAR several times within the same study. For example, SYNOP calls the same raster eight times. It must be defined this way because each raster uses a different pointing.

Also, the last raster in any study can be repeated. The number of times to repeat the last raster (N_RASTERS1) is given when the study is used—in this way it is similar to deferred pointing above.

It is anticipated that this will usually be used when the study consists of a single raster which is to be repeated a TBD number of times, but can used for other studies as well.

A third way to repeat rasters within a study is by specifying it directly within the study definition (N_REPEAT_R). This information is considered part of the study variation so that it can be easily modified without changing the fundamental STUDY_ID. However, the last raster in the study will be controlled only by N_RASTERS1 as explained above. Any repeat count within the study definition for the last raster will be considered only as guidance to the user when forming the plan.

Finally, an entire study can be repeated any number of times (N_REPEAT_S). This is specified when the study is used, in the detailed science plan. One can also specify that the study should be repeated with more than one target (N_POINTINGS). The interaction between N_POINTINGS and N_REPEAT_S requires some explanation.

Suppose that one wished to observe at two separate positions, and toggle back and forth between them ten times. One would then simply set N_REPEAT_S=10 and N_POINTINGS=2 and specify the two target positions. The N_POINTINGS loop is interior to the N_REPEAT_S loop.

Suppose, however, one wished to repeat the study 10 times first at one pointing location and then change pointing and do the same thing again at the second pointing position. Depending on how the study is defined one could do this in one of two ways. If the study consists of a single raster, one could then set N_RASTERS1=10 and N_POINTINGS=2. If, however, the study is more complicated then that, then one has to put two separate entries in the science plan—one for each pointing—each with N_REPEAT_S=10 and N_POINTINGS=1.

There are two parameters in the study header which relate to the number of rasters in the study, but with different definitions. N_RASTER_DEF simply gives the number of rasters in the definition—i.e. the number of entries in the "study2" and "study_var2" databases (Tables 10 and 9). Thus, it is insensitive to the values of the various N_REPEAT_R parameters.

On the other hand, N_RASTERS0 does take into account the N_REPEAT_R parameters, but does not count the last raster in the definition. This is so that the total number of rasters can be calculated through the equation

$$\text{N\_RASTERS} = \text{N\_RASTERS0} + \text{N\_RASTERS1}$$

Similarly, the total duration of the study can be calculated as

$$\text{DURATION} = \text{DURATION0} + \text{N\_RASTERS1} \times \text{DURATION1}$$

3 Science Planning

The CDS science plan consists of two parts. The first part consists of the information coming from the daily and weekly planning meetings. It is anticipated that this information will be supplied by the Science Operations Coordinator (SOC) using the format described in the Interface Control Document (ICD) [3], although it will need to be modified to include the information needed by the science plan [4]. This information will be ingested and maintained within a database. The fields that will be contained in that database are listed in Table 1.

Item	Type	Description
INSTRUME	C*1	Code specifying the instrument, i.e. "C" for "CDS", "S" for "SUMER", etc.
SCI_OBJ	C*50	Program description, e.g. "Bright Point Studies". This serves as a title for the observation.
SCI_SPEC	C*50	Specific scientific objective, e.g. "Density profile".
NOTES	C*50	May include references to specific studies or rasters to be run.
START_TIME	R*8	Start time of the observation.
END_TIME	I*2	End time of the observation.
OBJECT	C*2	Code for object planned to be observed.
OBJ_ID	C*6	Object identification (if applicable)
PROG_ID	I*2	If applicable, an ID number specifying that this observation is part of a continuing series.
CMP_NO	I*2	Campaign number, if applicable.
XCEN	C*50	Center(s) of instrument FOV along X axis, given as a comma-separated string.
YCEN	C*50	Center(s) of instrument FOV along Y axis.
DISTURBANCES	C*50	Description of any possible disturbances.

Table 1: ("sci_plan") SOHO science plan database, from the daily and weekly planning meetings.

The software routines which interact with this database are:

ADD_PLAN(): Adds a CDS science plan entry to the database, making sure that the item is valid and does not overlap any entries already in the database.

DEL_PLAN(): Deletes a CDS science plan entry from the database.

LIST_PLAN: Lists the entries in the science plan for a given time period, either for a particular instrument, or for all the instruments together.

GET_PLAN: Gets the plan for a given instrument at a specified time.

MOD_PLAN: Modifies a CDS science plan entry.

In addition to Table 1, there will be a separate catalog detailing what studies will be performed by the CDS instruments to satisfy the plan. This catalog will be referred to as the "detailed science plan" to distinguish it from the more general science plan described in Table 1.

Table 2 lists the structure of the CDS detailed science plan database. It would be linked via STUDY_ID and STUDYVAR to the Studies database (Section 4), and via CMP_NO and PROG_ID to the Campaigns and Programs databases respectively (Section 7). The requirements for some of these parameters are based on the needs of the CDS reformatting software [5], and of the science planning tool [4].

Associated with Table 2 is Table 3 which gives the pointings.

The routines which control this catalog are:

ADD_DETAIL(): Adds a detailed CDS science plan entry to the database, making sure that the entry is valid and does not overlap any other entries in the database.

Item	Type	Description
PROG_ID	I*2	Program ID, linking one or more studies together.
STUDY_ID	I*2	Number defining the study.
STUDYVAR	I*2	Number giving the study variation ID.
SCI_OBJ	C*50	Science objective from the daily science meeting.
SCI_SPEC	C*50	Specific science objective from the daily science meeting.
CMP_NO	I*2	Campaign number
OBJECT	C*2	Code for object planned to be observed
OBJ_ID	C*6	Object identification (if applicable)
DATE_OBS	R*8	Date and time of beginning of study
DATE_END	R*8	Date and time of end of study
ORIG_DUR	R*8	Original duration of the observation, in seconds.
N_RASTERS1	I*2	Number of rasters parameter for those studies with a variable number of rasters.
TIME_TAGGED	L*1	True if the start of the study is to be a time-tagged event. Otherwise, the study will begin immediately after the previous study.
TRACKING	L*1	True if feature tracking is to be used during the study.
N_POINTINGS	I*2	Number of pointings to use with the study. (See Section 2.1).
N_REPEAT_S	I*2	Number of times to repeat this study.
FLAG_MASTER	I*2	Set to 1 if flag master, 0 otherwise.
GSET_ID	I*2	GSET ID number.
GET_RAW	L*1	True if raw data should be collected.

Table 2: ("sci_details") CDS detailed science plan database.

Item	Type	Description
DATE_OBS	R*8	Date and time of beginning of study. This acts as a pointer to Table 2.
PT_IND	I*2	Pointing index, from 1 to N_POINTINGS from Table 2.
INS_X	R*4	Together with INS_Y, the input parameters for the instrument pointing position, relative to sun center.
INS_Y	R*4	...
ZONE_ID	I*2	Pointing zone ID.

Table 3: ("point_details") CDS detailed science plan pointing database.

Item	Type	Description
PROG_ID	I*2	Program ID, linking one or more studies together
STUDY_ID	I*2	Number defining the study
STUDYVAR	I*2	Number giving the study variation ID.
SCI_OBJ	C*50	Science objective from the daily science meeting
SCI_SPEC	C*50	Specific science objective from the daily science meeting.
CMP_NO	I*2	Campaign number
OBJECT	C*2	Code for object planned to be observed
OBJ_ID	C*6	Object identification (if applicable)
RCVR_START	R*8	Date/time of beginning of receiver status
RCVR_STOP	R*8	Date/time of end of receiver status
ORIG_DUR	R*8	Original duration of the observation, in seconds.
N_RASTERS1	I*2	Number of rasters parameter for those studies with a variable number of rasters. See section 2.2.
TRACKING	L*1	True if feature tracking is to be used during the study.
N_POINTINGS	I*2	Number of pointings to use with study. If zero, then either the study has fixed pointing, or the pointing comes from the flag. If one, then use the pointing from Table 5.
REPOINT	L*1	If 1, then enable repointing via the OPS.
GSET_ID	I*2	GSET ID number.

Table 4: ("sci_flag") CDS flag receiver science plan database.

DEL_DETAIL(): Deletes a detailed CDS science plan entry from the database.

LIST_DETAIL: Extracts a list of the detailed CDS science plan entries for a given time range.

GET_DETAIL: Gets a detailed CDS science plan entry for a specific time.

MOD_DETAIL: Modifies a CDS detailed science plan entry.

There would also be a catalog describing what CDS intends to do in the event of a flag. This is given in Table 4. It would be linked to the Studies and Campaigns databases in the same way as Table 2. Table 5 contains the pointings to use relative to the flag position. Normally, there would only be one pointing, with INS_X and INS_Y both set to 0. However, it is defined this way to be as similar to Tables 2 and 3 as possible.

The routines ADD_FLAG(), DEL_FLAG(), LIST_FLAG, GET_FLAG, and MOD_FLAG operate in the same manner as ADD_DETAIL, etc. described above.

The information in these science planning catalogs will be maintained for a period of two months (60 days). Periodically, entries which refer to dates older than this will be archived and removed from the active database.

Item	Type	Description
RCVR_START	R*8	Date and time of beginning of receiver status. This acts as a pointer to Table 4.
PT_IND	I*2	Pointing index, from 1 to N_POINTINGS from Table 4.
INS_X	R*4	Together with INS_Y, the input parameters for the instrument pointing position, relative to the flag position.
INS_Y	R*4	...
ZONE_ID	I*2	Pointing zone ID.

Table 5: ("point_flag") CDS flag receiver science plan pointing database.

4 Studies

The basic unit of CDS science planning is the study. These are predefined sequences of observations designed to answer a scientific or technical question. Examples of studies are given in the CDS "Blue Book" [1].

Studies are defined as a sequence of rasters. Although the studies are predefined, certain aspects are allowed to vary, such as the number of repeated rasters. Also, studies are allowed to have variations. Two studies are considered to be variations on the same study, and thus have the same study ID number, if they vary only in the variation numbers of the rasters making up that study. This allows basic parameters such as the exposure time to be varied without defining an entirely new study.

Five separate tables are required to define the various studies. The first, defined by Table 6, lists the available CDS studies. The second, Table 7 allows multiple titles to be used with the same fundamental study definition. The third, Table 8, separates each study into one or more variations. The fourth, Table 9, expands each study variation into a series of raster variations. Finally, Table 10 defines the fundamental rasters that make up the studies. (See section 5 for a further discussion of the relationship between fundamental raster IDs and raster variations.) The parameters STUDY_ID, TITLE_ID, STUDYVAR, and RAS_IND are used to link these five tables together, as is shown in the following diagram:

Table 6: "study"
↓ via STUDY_ID
Table 7: "study_title"
↓ via TITLE_ID
Table 8: "study_var"
↓ via STUDY_ID, STUDY_VAR
Table 9: "study_var2"
↑ via STUDY_ID, RAS_IND
Table 10: "study2"

Also, Tables 6 and 10 are directly related through the parameter STUDY_ID. Thus, one can define a fundamental study before defining any variations. However, one can't run the study until at least one variation has been defined.

Item	Type	Description
STUDY_ID	I*2	Number defining the study
VAR_POINT	C*1	If true ("Y"), then the pointing is controllable by the user. This parameter merely reflects the values of the POINTING parameters in Table 10.
N_RASTER_DEF	I*2	Number of rasters in the definition. If zero, then this is a "special" study that contains no rasters.

Table 6: ("study") CDS primary fundamental study definition database. This table lists the fundamental parameters for a study. The fundamental rasters that define the study are given in Table 10.

Item	Type	Description
STUDY_ID	I*2	Number defining the study
TITLE_ID	I*2	Number defining the title
OBS_PROG	C*8	Name of the study
TITLE	C*80	A descriptive title for the study
CATEGORY	C*1	The study category, either "T" for Test, "S" for Science or "C" for Calibration.

Table 7: ("study_title") CDS study title definition database. This table lists the identifying information for a study.

Item	Type	Description
STUDY_ID	I*2	Number defining the study
TITLE_ID	I*2	Number defining the title
STUDYVAR	I*2	Number giving the study variation ID. Studies can vary without changing the STUDY_ID number only by having different RAS_VAR values
SV_DESC	C*50	A short description of the study variation beyond what is implied by the associated fundamental study title.
N_RASTERS0	I*2	The number of additional rasters to be added to the user-defined parameter (N_RASTERS1 in the science plan) to form the total number of rasters in the study. See section 2.2.
DURATION0	I*4	The duration of the rasters represented by N_RASTERS0.
DURATION1	I*4	Number of seconds per raster for the user-supplied number of rasters. Total duration is then DURATION0 + DURATION1*N_RASTERS1 (from the science plan).
ZONE_ID	I*2	Pointing zone ID.
USABLE	C*1	Either "Y" or "N" to signal whether or not the study variation is usable. Normally "Y".

Table 8: ("study_var") CDS primary study variation database, listing the variations of the various studies.

Item	Type	Description
STUDY_ID	I*2	Number defining the study.
STUDYVAR	I*2	Number giving the study variation ID.
RAS_IND	I*2	Raster index within the study definition.
RAS_ID	I*2	Fundamental raster ID number. This should match the corresponding entry in Table 10.
RAS_VAR	I*2	Number giving the raster variation index.
N_REPEAT_R	I*2	Number of times to repeat this raster.

Table 9: ("study_var2") CDS secondary study variation database, with study variations broken up into a series of raster variations.

Item	Type	Description
STUDY_ID	I*2	Number defining the study.
RAS_IND	I*2	Raster index within the study definition.
RAS_ID	I*2	Raster ID number, pointing to the definition of the raster.
POINTING	I*2	Which user-supplied pointing to use for the raster. Valid entries are -1, 0, or 1. See section 2.1.
INS_X	R*4	Together with INS_Y, the pointing to use when user-supplied values are not allowed, or when pointing relative to the first raster in the study is used. Only valid when POINTING=0 or -1.
INS_Y	R*4	...

Table 10: ("study2") CDS secondary fundamental study definition database, with studies broken up into a series of fundamental rasters. One can either link Tables 6, 8, 9, and 10 all together, or simply Tables 6 and 10 by themselves.

As an example of how Tables 6 and 10 interact, suppose that the definition for study "SYNOP" contained the following information:

STUDY_ID	OBS_PROG	TITLE	N_RASTERS0	···
10	SYNOP	Synoptic Study	8	···

The corresponding information in Table 10 might then contain the following entries:

STUDY_ID	RAS_IND	RAS_ID	···
10	1	110	···
10	2	110	···
10	3	110	···
10	4	110	···
10	5	110	···
10	6	110	···
10	7	110	···
10	8	110	···

The interaction between Tables 8 and 9 follows the same pattern.

The following IDL routine control the interaction with the fundamental study database (Tables 6 and 10):

ADD_F_STUDY(): Adds a fundamental study definition to the database, and assigns the study ID number. Enforces the following database integrity constraints:

- There cannot be two entries in the database with the same values of the STUDY_ID or OBS_PROG parameters.
- The raster IDs must point to valid raster definitions.

LIST_F_STUDY: Lists the fundamental parameters of all available studies.

GET_F_STUDY: Extracts a fundamental study definition from the database.

and the following interact with the study variation database:

ADD_V_STUDY(): Adds a study variation definition to the database, and assigns the study variation index. Enforces the following database integrity constraints:

- The STUDY_ID parameter must point to a valid study definition.
- The number of raster variation indices must match the corresponding number of raster IDs in the fundamental study database.
- The raster variation parameters, when put together with their corresponding raster IDs from the fundamental study database, must point to valid raster variations
- The parameter USABLE must be either "Y" or "N".

LIST_V_STUDY: Lists the defined variations for a given study.

MOD_V_STUDY: Allows one to modify certain parameters in a study variation definition, namely those which annotate the study variation, not those which define it.

GET_STUDY: Extracts a complete study definition from the database, both fundamental and variation parameters.

Item	Type	Description
RAS_ID	I*2	Raster ID number.
DETECTOR	C*1	Either "G" or "N" for GIS or NIS respectively.
RAS_DESC	C*50	A short description of the raster, giving its purpose.
SLIT_NUM	I*2	Slit number.
XSTEP	I*2	Step size in the X direction, in arcsec
YSTEP	I*2	Step size in the Y direction, in arcsec
NX	I*2	Number of exposure locations in X.
NY	I*2	Number of exposure locations in Y.

Table 11: ("raster") Primary raster definition table, listing the fundamental parameters.

5 Rasters

A raster is the basic unit of a scientific observation. Each executed raster corresponds to a FITS data file. A study can be either a single raster, or a series of rasters.

There must be some flexibility in what constitutes a raster. It should be possible to modify certain aspects of a raster, such as the exposure time, without having to define an entirely new raster. However, at the same time, there should be particular aspects of a raster that are fundamental to that raster, such as the scanning pattern. The solution is to define specific rasters in terms of the fundamental parameters, and then variations of that raster by varying the non-fundamental parameters. Study variations can then be generated by selecting from the variations on the basic rasters defined.

Table 11 lists the fundamental parameters that define a raster, and Table 12 lists the parameters which define the raster variations. The latter is related back into the former through the RAS_ID parameter.

The following IDL routines control the interaction with the fundamental raster database:

ADD_F_RASTER(): Adds a fundamental raster definition to the database, and assigns the raster ID number.

LIST_F_RASTER: Lists the fundamental parameters of all available rasters.

GET_F_RASTER: Extracts a fundamental raster definition from the database.

and the following interact with the raster variation database:

ADD_V_RASTER(): Adds a raster variation definition to the database. Enforces a number of database integrity constraints, to maintain consistency with the associated line and data window lists.

MOD_V_RASTER: Allows one to modify certain specific parameters in the definition of a raster variation, namely those which annotate the raster variation rather than those which define it.

LIST_V_RASTER: List the defined variations for a given raster ID.

GET_RASTER: Extracts a complete raster definition from the database, including both fundamental and variable parameters.

Item	Type	Description
RAS_ID	I*2	Raster ID number.
RAS_VAR	I*2	Raster variation index number.
RV_DESC	C*50	A short description of the raster variation beyond what is given in the associated fundamental raster description.
EXPTIME	R*4	Exposure time in seconds, to millisecond accuracy.
LL_ID	I*2	Line list ID.
COMP_ID	I*2	Compression method ID.
COMP_OPT	I*2	Compression option parameter.
DW_ID	I*2	Data extraction window list ID.
IEF_ID	I*2	Inter-instrument event flag ID.
VDS_ORIENT	I*2	VDS orientation, either 0 (row) or 1 (column).
VDS_MAP	I*2	VDS mapping mode: 2=Normal, 3=Accumulate.
TEL_RATE	R*4	Estimated required telemetry rate, in kilobytes/sec.
DURATION	R*4	Estimated duration of the raster, in seconds.
USABLE	C*1	Either "Y" or "N" to signal whether or not the raster variation is usable. Normally "Y".

Table 12: ("raster_var") Secondary raster definition table, listing the parameters that define the raster variations.

6 Line and Window Lists

There are three kinds of line and window lists that are referred to in CDS operations:

Line list: A list of selected lines to be observed. This is a scientific view only, and does not include any information about how the lines map into detector pixels.

Data extraction window list: A list describing the specific pixels to be extracted and downloaded into the telemetry stream.

VDS window list: Specific to the VDS detector, this list describes which pixels are to be read out from the CCD. Rather than keep a database of such lists, it was decided instead to generate them on the fly based on the data extraction window list, and the VDS readout mode.

The definition of the line list database is given in Tables 13a and b. Table 13b is related back into Table 13a through the line list ID number, LL_ID. For each entry in Table 13a there will be several lines in Table 13b, one for each line in the line list. This pattern will be repeated for the data extraction list below.

The following IDL routines control the interaction with the line list database:

ADD_LINELIST(): Adds a line list definition to the database, and assigns the line list ID number. Enforces some database integrity constraints:

- The DETECTOR parameter must be either "G" or "N".
- The LL_TITLE parameter must be uppercase.

Item	Type	Description
LL_ID	I*2	Line list ID number.
DETECTOR	C*1	Either "G" for GIS, or "N" for NIS.
LL_DESC	C*50	Description of the line list, e.g. "Temperature sensitive line pairs".
N_LINES	I*2	Number of lines in the line list.

(a)

Item	Type	Description
LL_ID	I*2	Line list ID number, link into (a).
LINENAME	C*12	Line name, e.g. "He II 304".
LINE_IND	I*2	Line index number within a line list.
WAVELNTH	R*4	Wavelength in Ångstroms.
GR_ORDER	I*2	Grating order.
CEN_PIX	I*2	Central detector pixel.
WAVEBAND	I*2	Wavelength band, 1 or 2 for NIS, 1–4 for GIS.

(b)

Table 13: Line list database: (a) ("linelist") lists the different line lists, and (b) ("linelist2") lists the lines in the different line lists.

LIST_LINELIST: Extracts the names and descriptions of all the line lists from the database.

GET_LINELIST: Extracts a complete line list definition from the database for the requested line list.

The data extraction window list is similarly described by Tables 14a and b. The IDL routines which control access to these tables are:

ADD_DATAWIN(): Adds a data window list definition to the database, and assigns the data window ID number. Enforces the following database integrity constraints:

- The DETECTOR parameter must be either "G" or "N", and must match that listed in the associated line list (if any).
- The LL_ID parameter must point to a valid line list, or it must be zero.

LIST_DATAWIN: Extracts the descriptions of all the data window lists from the database, for a given line list ID number.

GET_DATAWIN: Extracts a complete data extraction window list definition from the database for a requested data window list.

Note that not all data extraction window lists need to be related back to line lists. An example of such a data window list would be one that extracted a complete spectrum. Such data window lists would have the line list ID number set to zero to signify that there is no associated list list.

Item	Type	Description
DW_ID	I*2	Data window list ID number.
DETECTOR	C*1	Either "G" for GIS, or "N" for NIS.
DW_DESC	C*50	A short description of the data window list beyond what is given in the associated line list description, e.g. "Full slit, 10 pixels wide".
LL_ID	I*2	ID number for the line list that the data extraction window list was derived from, or zero to signify that the data window list is not associated with a line list.
W_WIDTH	I*2	Width in pixels used to generate the windows.
W_HEIGHT	I*2	The height in pixels used to generate the windows. VDS only, for GIS this is set to zero.
VDS_BACK	I*2	Either 0 for off, or 1 for on, representing whether or not VDS background windows are being used. For GIS window lists this must be 0. If VDS_BACK is 1, then at least one of the window names must start with the characters "BACK" (case insensitive).
N_WINDOWS	I*2	Number of windows in the data window list.
N_FLAGS	I*2	Number of flag windows in the window list.

(a)

Item	Type	Description
DW_ID	I*2	Data window list ID number, link into (a).
WIN_IND	I*2	Window index number within a data window list.
WIN_NAME	C*40	Window name. Can either be derived from the corresponding line name, or can a description of the window use, such as "Full long wavelength spectrum" or "Background, quadrant A".
WIN_DEF	I*2*4	Data extraction window list definition. For the VDS detector the parameters are (Xstart, Ystart, Xlength, Ylength), and for the GIS detector the parameters are (Xstart, Xlength, 0, 0).
WIN_FLAG	I*2	Either 1 (true) or 0 (false) if can generate a flag.

(b)

Table 14: Data window list database: (a) ("datawin") lists the different data extraction window lists, and (b) ("datawin2") lists the windows.

7 Campaigns and Programs

The SOHO coordinated observing programs (sometimes called campaigns) catalog is maintained by the SOHO Science Operations Coordinator (SOC). This catalog includes, but is not limited to, campaigns and Joint Observing Programs (JOPs). A description of this catalog is given in another document [6]. The CDS planning software uses a copy of this catalog, which is mastered on the SOHO database server.

The descriptions of the SOHO campaigns are stored in a catalog with the format outlined in Table 15. The routines that interact with this database are:

LIST_CAMPAIGN: List all SOHO campaigns for a given range of dates.

GET_CAMPAIGN: Get a campaign description for a given campaign ID number.

Similarly, programs, which are multiple studies linked together, would be defined in a catalog with a format given by Table 16. Programs are similar to campaigns, in that an ID number links multiple observations together. However, the CDS program ID number is strictly internal to CDS, and does not refer to any other instrument or observatory.

Not all studies are part of either a campaign or program. It is anticipated that these categories would be reserved for specific instances. An example of a campaign would be when arrangements have been made in advance for simultaneous observations between CDS and a ground-based observatory. An example of a program would be an observation made at the same time each day, e.g. following an active region as it moves across the sun. Synoptic observations are another good example. In short, PROG_ID is a convenient way to associate studies together that are not contiguous in time.

There could be some generic campaigns, such as "CDS and SUMER coordinated observations" that could be referred to whenever appropriate during operations.

The routines which control access to the program database are:

ADD_PROGRAM(): Adds a program definition to the database.

LIST_PROGRAM: Lists the available program names and ID numbers.

GET_PROGRAM: Gets a program definition.

8 Miscellaneous

Some catalogs simply keep track of information that (almost) never changes. For example, the "compression" catalog (Table 17) exists merely to associate compression IDs with simple text descriptions. The routine GET_COMPRESS reads this catalog.

The database "object" (Table 18) simply lists all the two letter codes used to designate the various objects that can be observed. The routine LIST_OBJECT extracts the entire database, and GET_OBJECT extracts a particular object description.

The "instrument" catalog (Table 19) associates one-letter code values with the instrument names. The routine GET_INSTRUMENT can be used to get the name of the instrument given the code value, or vice versa.

Item	Type	Description
CMP_NO	I*2	Unique identifier number
CMP_NAME	C*20	Name of the campaign
CMP_DESC	C*80*5	Description of the campaign (multiline)
DATE_OBS	R*8	Starting date for the observing campaign
DATE_END	R*8	Ending date for the campaign
OBSERVER	C*40	Name of the observer in overall charge of the campaign.
COMMENTS	C*1	Either "Y" or "N".

(a)

Item	Type	Description
CMP_NO	I*2	Campaign number. Serves as link into (a).
INST_IND	I*2	Institute index.
INSTITUT	C*80	Name of the institute taking part in the campaign. If one of the SOHO instrument teams, then the value of this field will be the name of the instrument.
OBSERVER	C*40	Name of the observer overseeing the institution's or instrument's contribution to the campaign.
COMMENTS	C*1	Either "Y" or "N".

(b)

Item	Type	Description
···	···	Primary key fields from the catalog these comments apply to.
COMM_IND	I*2	Comment index. This field together with those above form the primary key for this catalog.
COMMENT	C*80	Character string comment.

(c)

Table 15: SOHO campaign definition database: (a) ("campaign") lists the campaigns, (b) ("institutes") lists the institutions taking part, and (c) lists the generic structure for the comments databases.

Item	Type	Description
PROGNAME	C*20	Name of the program
PROG_ID	I*2	Unique identifier number
PROGDESC	C*80*5	Description of the program (multiline)

Table 16: ("program") CDS program definition database.

Item	Type	Description
COMP_ID	I*2	Compression method ID.
COMPDESC	C*50	A short description of the compression method, such as "VBWL Blocksize 32".

Table 17: ("compression") CDS compression description database.

Item	Type	Description
OBJECT	C*2	Two-letter object code, e.g. "CH".
OBJECT_DESC	C*30	The expanded-out name of the object, e.g. "coronal hole".

Table 18: ("object") SOHO object name abbreviation database.

9 The Observation Catalog

The design of the CDS observation catalogs is modeled after that of the SOHO-wide catalog system [6]. It is split into two primary databases, MAIN which describes the data at the study level, and EXPERIMENT which describes the data at the raster level. The MAIN database is described by Table 20.

The EXPERIMENT catalog would also be structured along the lines of the SOHO-wide version, with extra information specific to CDS. Table 21 lists the basic fields that will be in this catalog. In addition, this catalog will contain fields for every keyword in Tables 2–6 in CDS Software Note No. 3, "Converting CDS Telemetry to FITS Files" [5]. There are two exceptions to this:

1. If a field (other than PROG_NUM) already appears in the MAIN catalog (Table 20), then it will not be repeated in EXPERIMENT.
2. In some cases the fields will not be in EXPERIMENT directly, but will be picked up via links to other catalogs. For example, rather than having LL_TITLE directly in the EXPERIMENT catalog, it's more efficient to pick it up via a link through LL_ID to Table 13.

Item	Type	Description
CODE	C*1	Code value, e.g. "C" for "CDS".
NAME	C*6	Instrument name.

Table 19: ("instrument") SOHO instrument name abbreviation database.

Item	Type	Description
PROG_NUM	I*4	Study counter number
PROG_ID	I*4	Link to Table 16
PROG_IND	I*2	Index when study is repeated via N_REPEAT_S
STUDY_ID	I*2	Link to Table 6
SCI_OBJ	C*50	Science objective
SCI_SPEC	C*50	Specific science objective
CMP_NO	I*2	Link to Table 15
OBJECT	C*2	Link to Table 18
OBJ_ID	C*6	Unique identifier for the object that was planned to be observed, e.g. active region number
DATE_OBS	Date	Start date and time of observing program (UT)
DATE_END	...	...
OBT_TIME	R*8	Onboard start date and time
OBT_END	...	...
XCEN	R*4	Together with YCEN, gives the center of the instrument field-of-view in solar coordinates. In units of arcseconds
YCEN	...	...
ANGLE	R*4	Orientation of vertical axis of instrument field-of-view relative to solar north
IXWIDTH	R*4	Together with IYWIDTH, gives the size of the instrument field of view in its own coordinate frame
IYWIDTH	...	...
SEQ_FROM	I*4	Range of observing sequence numbers. These correspond to the field SEQ_NUM found in the EXPERIMENT catalog
SEQ_TO	...	...
COMMENTS	C*1	Either "Y" or "N"
DATE_MOD	Native Date	Date and time when catalog record was last modified

Table 20: The MAIN catalog.

Item	Type	Description
PROG_NUM	I*4	Link to Table 20
SEQ_NUM	Integer	Unique identifier for this experiment. Note that this forms the "primary key" for this catalog
OBS_SEQ	C*12	A character string derived from the raster number and the variation number, e.g. "R4V3"
COUNT	I*2	Number of repeated observing sequences making up this experiment–for CDS this should always be 1
COMMENTS	Character (1)	Either "Y" or "N"
DATE_MOD	Native Date	Date and time when catalog record was last modified

Table 21: Fields to be included in the EXPERIMENT catalog. This table will also include additional fields as explained in the text.

10 Software Notes

As noted in the introduction, those catalogs that will be used for operations, namely those discussed in sections 3 through 7, will be maintained within IDL using the UIT database software [2]. Some considerations need to be kept in mind when developing software to use with this software.

The above catalogs have been described using a relational database approach, such as that used by many relational database management systems such as Oracle. This means that tables are related by having fields in common. For example, the line list (Table 13a) and data extraction window list (Table 14a) tables are related through the common field LL_ID. The UIT database system, however, uses what is known in database theory as a "networked" approach. (The term as used here has nothing to do with networking computers together.) This means that tables are related by having fields in one table point to specific records in another table. This distinction has two consequences when developing software using the UIT database system:

1. In the database which is related into another database, rather than using a common field as is described in this document, there will be instead a pointer field into the other database, with a name formed by taking the name of the other database and adding "_PTR" to it. For example, in Table 14a there will instead be a field called LINELIST_PTR to relate that table into Table 13a, . However, when incorporating these catalogs into ORACLE, they will be converted into a standard relational database form as described in this document. In any case, the common fields will be included in the UIT databases, so that enough information exists in the database to regenerate the pointers if necessary.

2. Because of the "network" approach of the UIT database software, records once added can never be removed from those catalogs which are pointed to from other catalogs. Otherwise, database integrity can be violated. However, this restriction is consistent with the requirement that definitions of entities such as studies, rasters, etc. be maintained over the lifetime of the mission. Thus, this imposes no additional restrictions on most of the catalogs.

Most of the ID numbers are generated so that the first ID number is 1, etc. The exception is STUDY_ID which starts from 0, because it is returned as a single byte in the telemetry stream.

References

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