

ODI

Open Data Interface

ESTEC/RFQ 3-12487/08/NL/AT

One year duration

October 2008 – October 2009

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Main items

- MySQL database.
- CDF/ISTP/PRBEM compliant.
- SAAPS/SEDAT/SPENVIS data & metadata.
- SAAPS/SEDAT/SPENVIS will be updated to access data from the ODI database.

SAAPS/SEDAT/SPENVIS

- Spacecraft Anomaly Analysis and Prediction System (SAAPS)

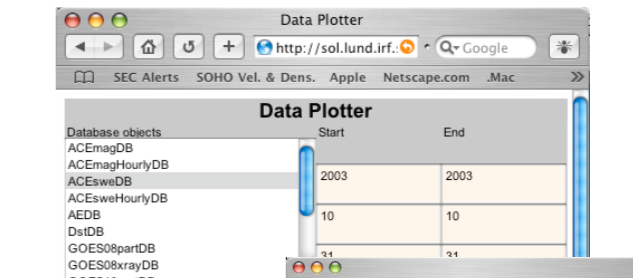
www.lund.irf.se/saaps

- Space Environment Database and Analysis Tool (SEDAT)

www.ukssdc.ac.uk/sedat/

- Space Environment Information System (SPENVIS)

www.spennis.oma.be/



[STFC](#) > [Space Science](#) > Home

Space Environment Database and A

The Space Environment Database and Analysis Tools (SEDAT) project is in environments, part of what is also known as "space weather". Energetic cha Particles can come from the sun (solar energetic particle events), can be encou geomagnetic sub-storms..

This project will assemble a database containing a large and comprehensive se the user will be able to select a set of space environment data appropriate to th

The project will also develop a set of software tools, which can operate on the data retrieved from the database. These tools will allow the user to carry out a wide range of engineering analyses. This approach differs from traditional space environment engineering studies. In the latter the space environment is characterised by a model that is a synthesis of previous observations. However, in SEDAT the environment is characterised directly by the observations. This approach offers several advantages to the engineering analyst, which are discussed in detail below (link TBD).

This work is being carried out by the [Space Science Department](#) of the [Science and Technology Facilities Council \(STFC\)](#) on behalf of ESA's [Space Environments and Effects Analysis section](#). It is funded under [ESTEC](#) contract 12854/98/NL/NB, as part of the Space Environments and Effects Major Axis of the Technology Research Programme (TRP).

These pages provide a range of information on the SEDAT Project as follows:

- [Project description](#)
- [Public documents](#)
- [Contact information](#)
- [Links to other pages](#)
- [Internal information](#) (access restricted)
- [Working documents](#) (access restricted)

The SEDAT project started in May 1998. The li plan to maintain and develop the lower level pag pages are always welcome. Please send them to t



SPENVIS

NAVIGATION

- Home
- Access
- Register
- Change Password
- Lost Password
- Models
- Help
- Credits
- Forums
- Bug tracker

SPENVIS

The Space Environment Information System

Welcome to **ESA's** Space Environment Information System, a WWW interface to models of the space environment and its effects, including the natural radiation belts, solar energetic particles, cosmic rays, plasmas, gases, and "micro-particles".

Need help?
Beside a large set of contextual help pages, the SPENVIS system includes a forum (P) where users can exchange their experiences and tips.
In case of problems, please consult our bug tracker system (B) and feel free to post any bugs.

Current version
The current public release of SPENVIS is version 4.6.1 built on March 6, 2009.

Registration
Use of SPENVIS on this site is **free of charge**, but a user registration is required. Please read the **rules of conduct** and fill out the registration form.
If you have forgotten your password, you can reset it [here](#). If you want to change your password, you can do it [here](#).

System requirements
SPENVIS requires a browser with JavaScript support (tested with Firefox 2.0.0.6 and MS-IE 7.0). Some outputs require a [VRML/X3D plugin](#) (tested with Octaga Player 2.3.0.3).

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SPENVIS

Spponsors:

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SEPTEM



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SPACE AND PLASMA TECHNOLOGIES

QinetiQ

DCH



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UNIVERSITY OF
Southampton
School of Engineering Sciences



Welcome to the Solar Energetic Particle Environment Modelling (SEPTEM) Project

Estec Contract No. 20162/06/NL/JD

BACKGROUND: Various populations of energetic particles in the energy range from eV to more than 10^{21} eV fill our solar system. The most energetic among them are the constant flux of galactic cosmic rays and the sporadic solar energetic particle (SEP) events. The latter have energies ranging from a dozen of keVs to a few GeVs and are either linked to a solar flare or the shock wave driven by a coronal mass ejection. SEPs are mainly protons, electrons and alpha-particles, with small mixtures of ^3He nuclei and heavier ions up to iron. Space weather effects such as radiation damage to on-board electronics, solar arrays, living organisms, etc. are all due to energetic particles. SEPs are especially a significant hazard to Earth-orbiting missions, as well as for future interplanetary missions.

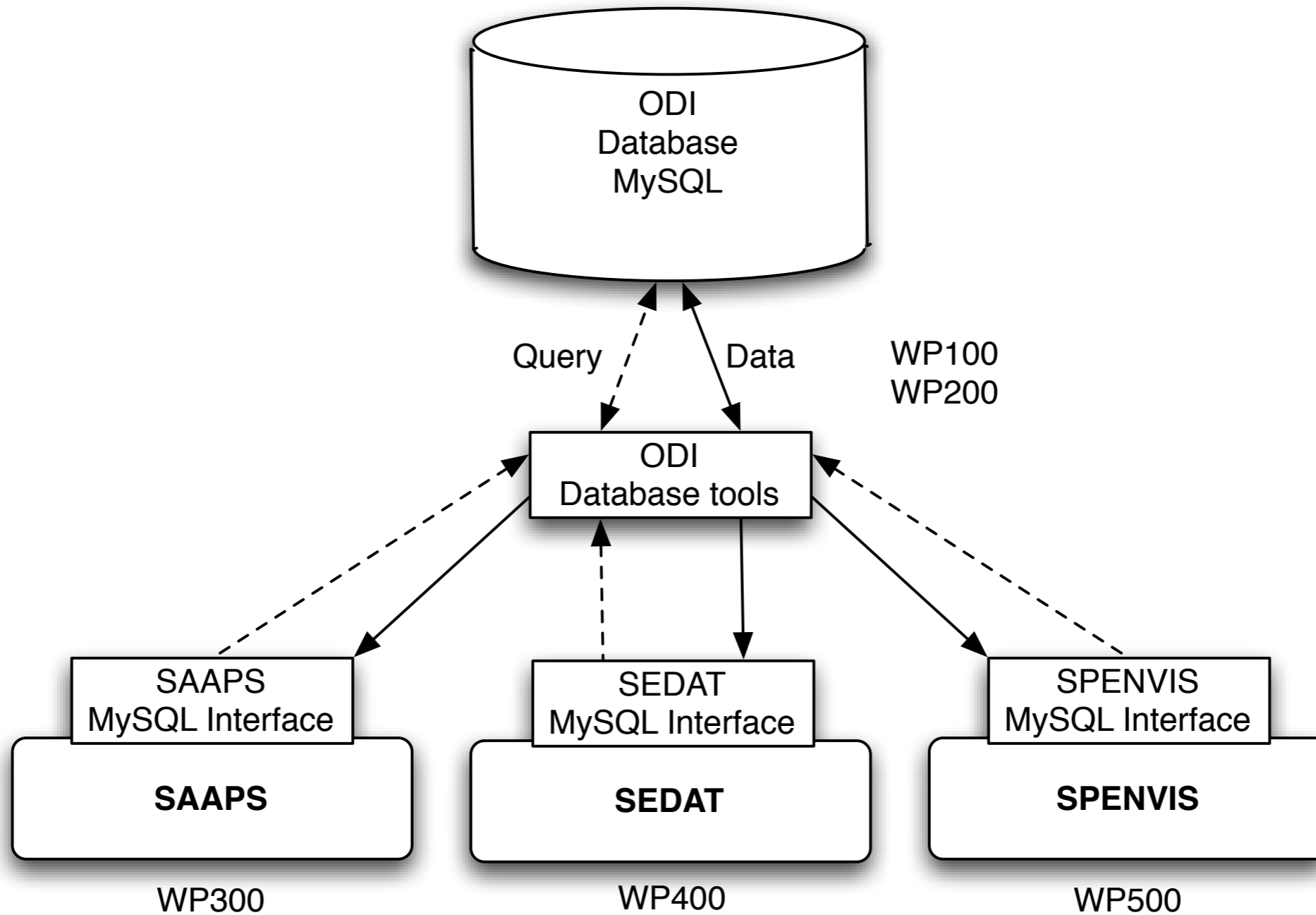
Many of the currently used standard models of the solar energetic particle environment were developed based on results published more than 15 years ago. Modern user requirements, as well as recent observational data and scientific advances, mean that these standards are currently in need of review and updating. Accurate modeling of the SEP environment constitutes a priority requirement for astrophysics missions and human exploration. Incorporating recent scientific results and a complete set of cross-calibrated data the SEPTEM project is working towards creating new engineering models and tools to address current and future needs.

OBJECTIVES: One of the important outputs of SEPTEM is the creation of a standard solar energetic particle dataset. A further output of SEPTEM for the user community will be a user-friendly webserver with access to the models being developed under this project, in particular:

- it will take advantage of new data and take into account recent advances in understanding the generation mechanism;
- it will enable automatic model and tools update and establish community consensus;
- rather than producing only mission-integrated fluence for a given confidence level (for dose, solar array degradation), models and tools will be designed and developed to produce new types of user products (suitable for SEU rate, system impact and radiation background), including, but not limited to, peak flux statistics, durations of high or arbitrary flux periods, and corresponding error and uncertainty estimates.

<http://www.oma.be/SEPTEM/>

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ISTP & PRBEM

International Solar Terrestrial Physics
spdf.gsfc.nasa.gov/sp_use_of_cdf.html

Panel on Radiation Belt Environment Modeling
craterre.onecert.fr/prbem/home.html

- The ISTP and PRBEM guidelines are defined using CDF.
- ISTP defines a set of valid CDF attributes, but not variables (except “Epoch”).
- PRBEM uses the ISTP attributes and defines a set of valid variables.

Datasets overview

ACE magnetic field	GOES-10 e and p	XMM/SREM
ACE plasma	GOES-10 x-ray	PROBA1/SREM
AE index	GOES-11 e and p	HELIOS1-2
Dst index	GOES-11 x-ray	SOHO/ERNE
Kp index	GOES-12 e and p	IMP8/CPME
Ap index	GOES-12 x-ray	IMP8/GME
F10.7	LANL el.	IMP8/EPE
Sunspot number	OMNI	INTEGRAL/SREM
GOES-5 e and p	SAMPEX/PET	SAC-C
GOES-5 x-ray	MIR/REM	Equator-S
GOES-6 e and p	ACE/SIS	Rosetta/SREM
GOES-6 x-ray	AMPTE/UKS	NOAA POES/SEM
GOES-7 e and p	AZUR	METOP-02/SEM
GOES-7 x-ray	CRRES/MEA	GIOVE-B/SREM
GOES-8 e and p	ISEE1-2	
GOES-8 x-ray	METEOSAT	
GOES-9 e and p	STRVIB/REM	
GOES-9 x-ray	UARS/PEM	

Mixed formats:
ASCII table, HDF, CDF/
ISTP, CDF/PRBEM.

MySQL

- MySQL is an open source Structured Query Language (SQL) relational database management system (www.mysql.com).
- Data are stored in tables with a given number of columns and one record per row.
- MySQL can not store vector or matrix data (exception: BLOB). It must be expanded over multiple columns or tables.
- Columns may be defined to hold only unique values thus avoiding storing of duplicate records (e.g. two records with the same epoch).
- Advanced search capabilities over multiple data sets by joining tables.
- “Fast” and “easy to use”.
- Different interfaces (command line, web, ...).
- Different programming interfaces (C, Java, Perl, PHP, Python, IDL, Matlab, Mathematica, ...).

Common Data Format (CDF)

“... is a self-describing data format for the storage and manipulation of scalar and multidimensional data in a platform- and discipline-independent fashion.”

cdf.gsfc.nasa.gov/

Global attributes

```
! Skeleton table for the "SREMrosetta_PACC_20090101.cdf" CDF.  
! Generated: Wednesday, 18-Feb-2009 09:48:17  
! CDF created/modified by CDF V2.7.2  
! Skeleton table created by CDF V3.2.4
```

```
#header
```

```
                CDF NAME: SREMrosetta_PACC_20090101.cdf  
DATA ENCODING: IBMPC  
MAJORITY: ROW  
FORMAT: SINGLE
```

```
! Variables  G.Attributes  V.Attributes  Records  Dims  Sizes  
! -----  -  
          0/12           13           13           0/z     0
```

```
#GLOBALattributes
```

```
! Attribute      Entry      Data      Value  
! Name          Number     Type      -----  
! -----  
"Project"        1:        CDF_CHAR  { "SREM aboard Rosetta" } .  
"Source_name"    1:        CDF_CHAR  { "Rosetta" } .  
"Discipline"     1:        CDF_CHAR  { "Space " -  
"Physics>Interplanetary " -  
"Science" } .  
"Data_type"      1:        CDF_CHAR  { "PACC>Processed " -  
"Accumulation Data" } .  
"Descriptor"     1:        CDF_CHAR  { "SREM>Standard Radiation " -  
"Environment Monitor" } .
```

CDF (cont.)

```
! Variable      Data      Number      Record      Dimension
! Name         Type      Elements    Variance    Variances
! -----
"label_COUNTERS" CDF_CHAR    3           F           T
! Attribute    Data
! Name         Type      Value
! -----
"FIELDNAME"    CDF_CHAR    { "SREM counter label" }
"VAR_TYPE"     CDF_CHAR    { "metadata" }
"CATDESC"      CDF_CHAR    { "SREM counter label" } .

! NRV values follow...

[1] = { "TC1" }
[2] = { "S12" }
[3] = { "S13" }
[4] = { "S14" }
[5] = { "S15" }
[6] = { "TC2" }
[7] = { "S25" }
[8] = { "C1 " }
[9] = { "C2 " }
[10] = { "C3 " }
[11] = { "C4 " }
[12] = { "TC3" }
[13] = { "S32" }
[14] = { "S33" }
[15] = { "S34" }
```

Metadata variable

Variable attributes

```
! Variable      Data      Number      Record      Dimension
! Name         Type      Elements    Variance    Variances
! -----
"EPOCH"        CDF_EPOCH  1           T
! Attribute    Data
! Name         Type      Value
! -----
"FIELDNAME"    CDF_CHAR    { "Time since 0 AD of accumulation" }
"VALIDMIN"     CDF_EPOCH    { 01-Oct-2001 00:00:00.000 }
"VALIDMAX"     CDF_EPOCH    { 01-Jan-2010 00:00:00.000 }
"LABLAXIS"     CDF_CHAR    { "Epoch" }
"UNITS"        CDF_CHAR    { "ms" }
"FILLVAL"      CDF_DOUBLE   { -1.0e+31 }
"VAR_TYPE"     CDF_CHAR    { "support_data" }
"DICT_KEY"     CDF_CHAR    { "time>epoch" }
"SCALETYP"    CDF_CHAR    { "linear" }
"MONOTON"     CDF_CHAR    { "INCREASE" }
"CATDESC"      CDF_CHAR    { "Accumulation interval centered epoch" } .
```

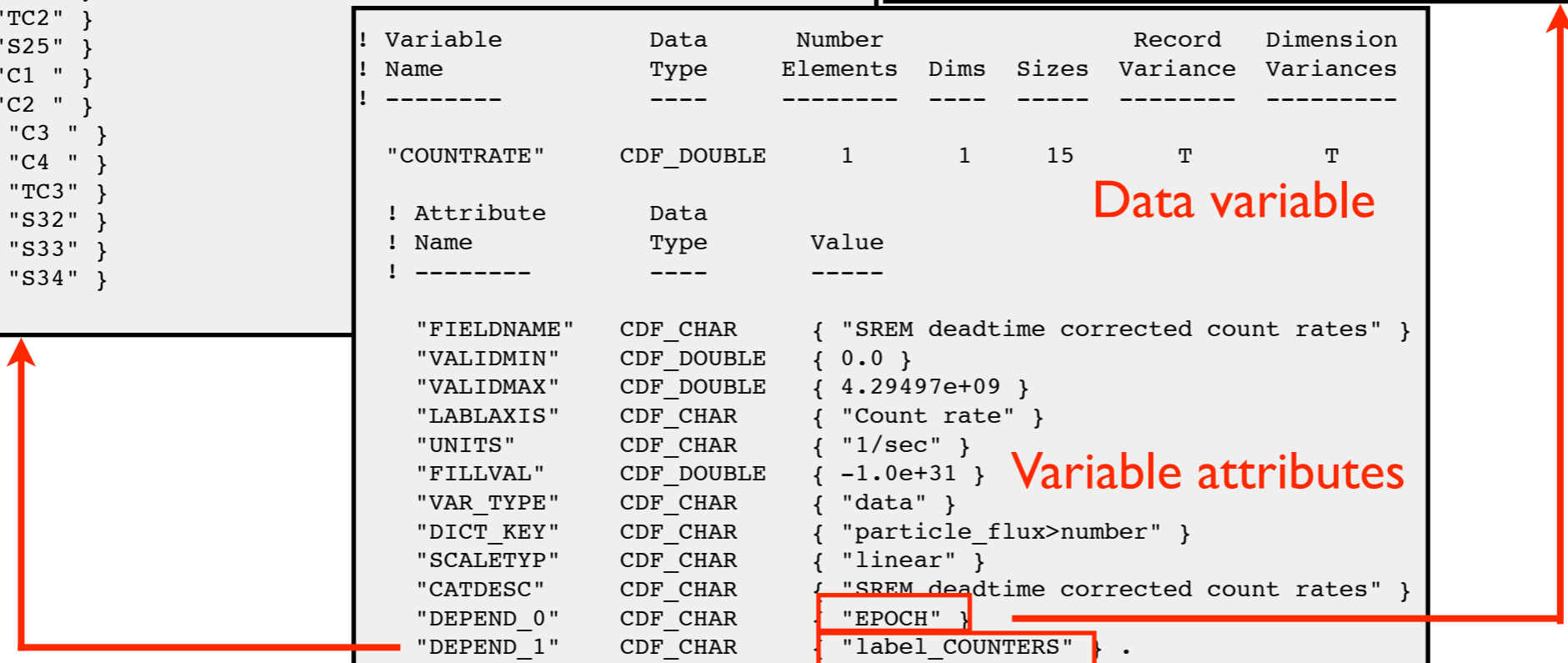
Support data variable

Variable attributes

```
! Variable      Data      Number      Record      Dimension
! Name         Type      Elements    Variance    Variances
! -----
"COUNTRATE"    CDF_DOUBLE  1           T           T
! Attribute    Data
! Name         Type      Value
! -----
"FIELDNAME"    CDF_CHAR    { "SREM deadtime corrected count rates" }
"VALIDMIN"     CDF_DOUBLE   { 0.0 }
"VALIDMAX"     CDF_DOUBLE   { 4.29497e+09 }
"LABLAXIS"     CDF_CHAR    { "Count rate" }
"UNITS"        CDF_CHAR    { "1/sec" }
"FILLVAL"      CDF_DOUBLE   { -1.0e+31 }
"VAR_TYPE"     CDF_CHAR    { "data" }
"DICT_KEY"     CDF_CHAR    { "particle_flux>number" }
"SCALETYP"    CDF_CHAR    { "linear" }
"CATDESC"      CDF_CHAR    { "SREM deadtime corrected count rates" }
"DEPEND_0"     CDF_CHAR    { "EPOCH" }
"DEPEND_1"     CDF_CHAR    { "label_COUNTERS" } .
```

Data variable

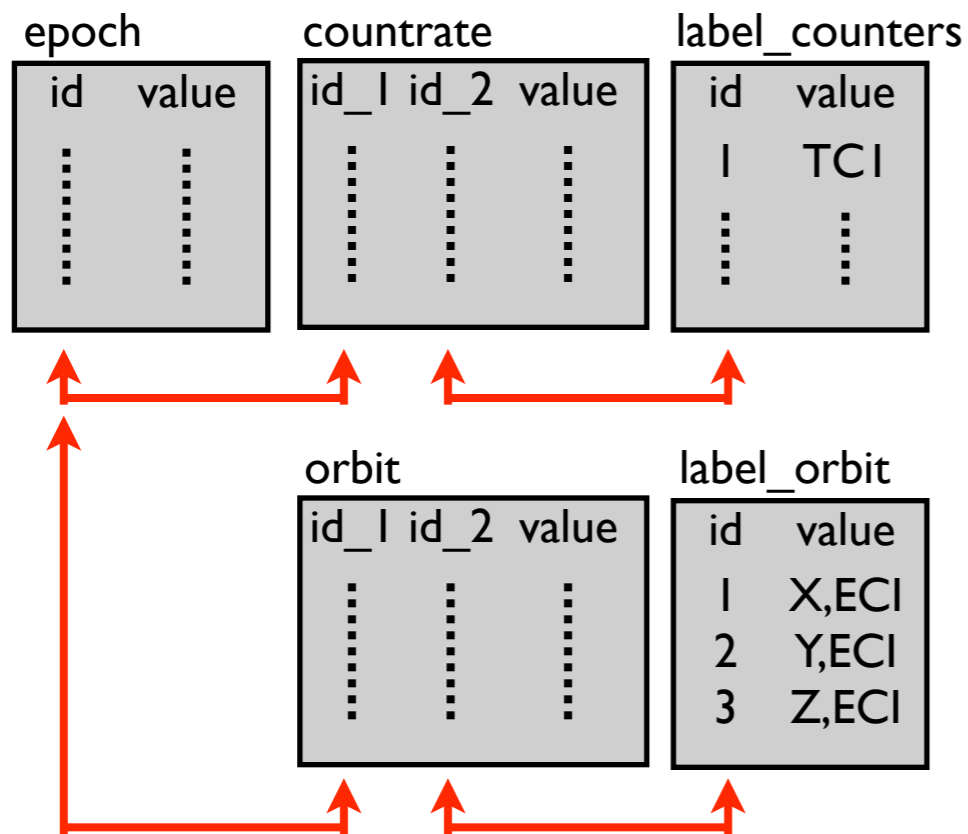
Variable attributes



CDF multi-dim variables to SQL tables

Multi-table approach

- Each CDF variable gets one table.
- Relations between tables using SQL keys based on the CDF dependencies.

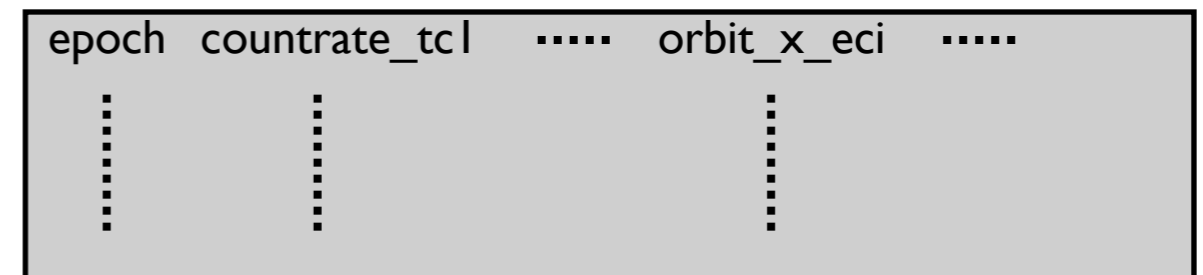


+Can store all types of CDF data sets.

- Performance?

Multi-column approach

- The “data” is stored in one SQL table per CDF data set.
- “Epoch” is a key variable.
- Each CDF “data” variable element gets one column.



+Simple table structure.

+Close resemblance to other data sets in table format.

- Metadata must be constant.

Status

- Code has been developed to automatically generate CDF/ISTP/PRBEM compliant data tables.
- A prototype multi-table approach database has been installed on the ESTEC server.
- The single-table approach is under development.
- A number of SEDAT perl scripts used for basic queries on the datasets are being adapted to use MySQL statements.
- Download scripts for GOES, IMP8 and ACE data have been developed; parser scripts to populate the database columns are under development.
- Tests have been performed with the IDL Dataminer to access the prototype database; IDL will be used for SEDAT and SPENVIS.
- Tests have been performed with Java JDBC to access data; Java is used in SAAPS.