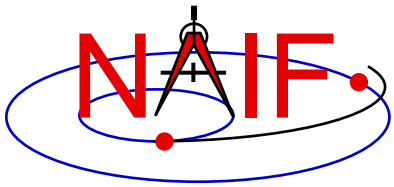


Kernel Summary Applications

Navigation and Ancillary Information Facility

The contents of binary kernels can be summarized using kernel summary tools.

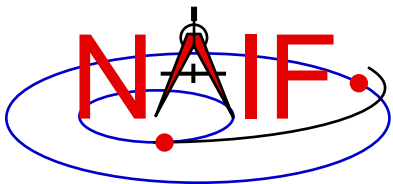
- ***brief*** displays the bodies and associated time coverage in an SPK file or set of SPK files.
 - *brief* also works on binary PCK files
- ***ckbrief*** displays the structure(s) and associated time coverage in a CK file or set of CK files.
- ***dskbrief*** displays a summary of spatial coverage and attributes for a DSK file or set of DSK files.
- ***spacit*** displays a segment by segment summary of the contents of a CK, SPK, binary PCK, or EK/ESQ file.
 - *spacit* also identifies the SPK or CK data type present in each segment.
 - *spacit* does not work on DSK files.



BRIEF

Navigation and Ancillary Information Facility

- ***brief*** is a command line program for summarizing the contents of SPK or binary PCK files
- The files to be summarized can listed on the command line, given in a meta-kernel provided on the command line, or provided in a list file
- ***brief*** provides command line options for
 - displaying coverage boundaries as date UTC, DOY UTC, or ET seconds past J2000 (default time format is calendar ET)
 - » to display time as UTC an LSK file must be provided on the command line
 - displaying centers of motion along with the bodies
 - treating all input files as if they were a single file
 - displaying a summary only for files covering a specified time or time range or containing data for a specified body
 - displaying a summary in tabular format or grouped by coverage
 - and many others ...



BRIEF - Usage

Navigation and Ancillary Information Facility

```
Terminal Window

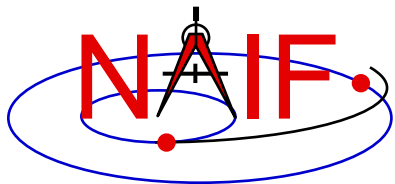
$ brief
...
BRIEF is a command-line utility program that displays a summary for
one or more binary SPK or binary PCK files. The program usage is:

% brief [-options] file [file ...]

The most useful options are shown below. For the complete set of
options, run BRIEF with the -h option. The order of options is not
significant. The case of option keys is significant: they must be
lowercase as shown below.

-c          display centers of motion/relative-to frames
-t          display summary in a tabular format
-a          treat all files as a single file
-utc        display times in UTC calendar date format (needs LSK)
-utcdoy      display times in UTC day-of-year format (needs LSK)
-etsec       display times as ET seconds past J2000

An LSK file must be provided on the command line to display times in
UTC formats. FK file(s) must be provided on the command line to
display names of any frames that are not built into the Toolkit.
```



BRIEF - Example

Navigation and Ancillary Information Facility

```
Terminal Window

$ brief de405s.bsp m01_cruise.bsp

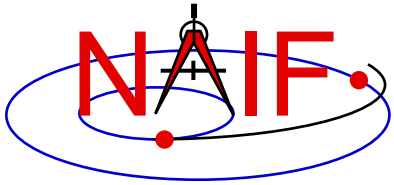
BRIEF -- Version 3.0.0, January 14, 2008 -- Toolkit Version N0063

Summary for: de405s.bsp

Bodies: MERCURY BARYCENTER (1)   SATURN BARYCENTER (6)   MERCURY (199)
        VENUS BARYCENTER (2)    URANUS BARYCENTER (7)  VENUS (299)
        EARTH BARYCENTER (3)    NEPTUNE BARYCENTER (8) MOON (301)
        MARS BARYCENTER (4)     PLUTO BARYCENTER (9)   EARTH (399)
        JUPITER BARYCENTER (5)  SUN (10)               MARS (499)
Start of Interval (ET)           End of Interval (ET)
-----
1997 JAN 01 00:01:02.183        2010 JAN 02 00:01:03.183

Summary for: m01_cruise.bsp

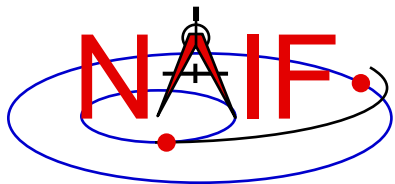
Body: MARS SURVEYOR 01 ORBITER (-53)
Start of Interval (ET)           End of Interval (ET)
-----
2001 APR 07 16:25:00.000        2001 OCT 24 05:00:00.000
```



CKBRIEF

Navigation and Ancillary Information Facility

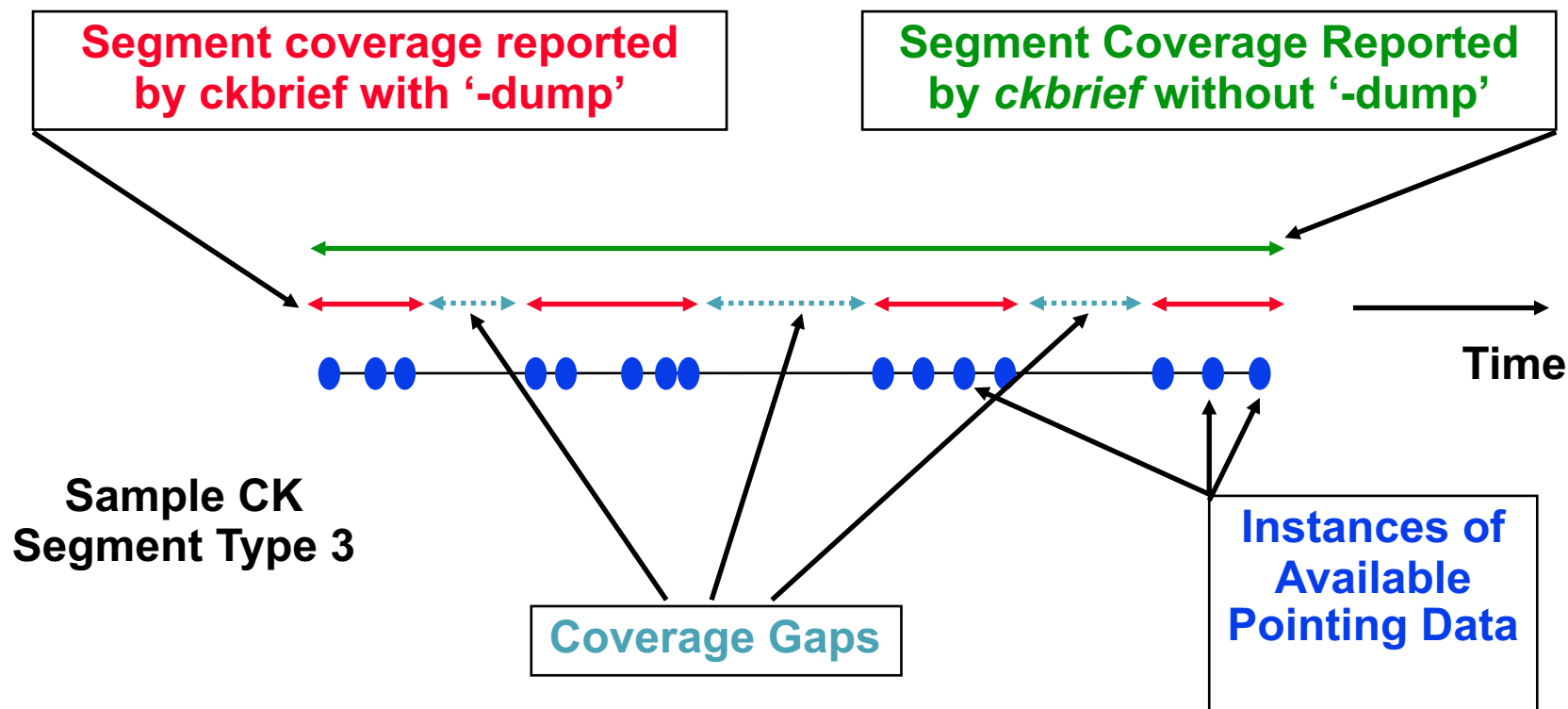
- ***ckbrief*** is a command line program for summarizing the contents of CK files
- The files to be summarized can be listed on the command line, given in a meta-kernel provided on the command line, or provided in a list file
- ***ckbrief*** provides command line options for
 - displaying coverage at interpolation interval level
 - displaying coverage boundaries using UTC, DOY UTC, SCLK, or encoded SCLK (default time format is calendar ET)
 - » To display times as ET, UTC, or SCLK, both an LSK file and a SCLK file(s) must be provided on the command line
 - displaying frames with respect to which orientation is provided
 - displaying the names of the frames associated with CK IDs
 - » An FK file(s) defining these frames must be provided on the command line
 - treating all input CK files as if they were a single file
 - displaying summary only for files with data for a given CK ID
 - and many others ...

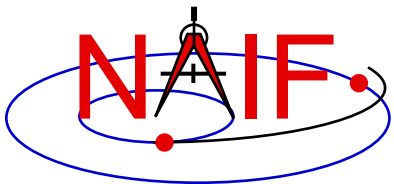


CKBRIEF – Interval Summary

Navigation and Ancillary Information Facility

- There often are coverage gaps within a CK segment
- Using the ‘-dump’ option allows one to get a complete list of continuous coverage intervals for each segment





CKBRIEF – Usage

Navigation and Ancillary Information Facility

```
Terminal Window

$ ckbrief

...

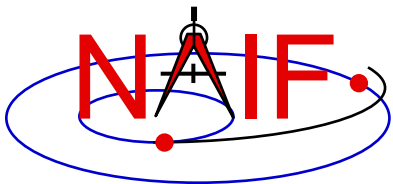
CKBRIEF is a command-line utility program that displays a summary for
one or more binary CK files. The program usage is:

% ckbrief [-options] file [file ...]

The most useful options are shown below. For the complete set of
options, run CKBRIEF with the -h option. The order of options is not
significant. The option keys must be lowercase as shown below.

-dump      display interpolation intervals
-rel       display relative-to frames (may need FK)
-n         display frames associated with CK IDs (may need FK)
-t         display summary in a tabular format
-a         treat all files as a single file
-utc       display times in UTC calendar date format (needs LSK&SCLK)
-utcdoy    display times in UTC day-of-year format (needs LSK&SCLK)
-sclk      display times as SCLK strings (needs SCLK)

LSK and SCLK files must be provided on the command line to display times
in UTC, ET, or SCLK formats. FK file(s) must be provided on the command
line to display names of any frames that are not built into the Toolkit.
```



CKBRIEF – Example

Navigation and Ancillary Information Facility

```
Terminal Window

$ ckbrief -sclk 981116_981228pa.bc sclk.ker

CKBRIEF -- Version 5.0.0, February 11, 2009 -- Toolkit Version N0063

Summary for: 981116_981228pa.bc

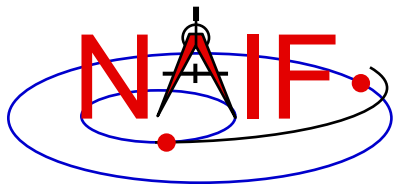
Object: -82000
Interval Begin SCLK          Interval End SCLK          AV
-----
1/1289865849.116            1/1293514473.118            N

$ ckbrief -utc sclk.ker naif0007.tls 990817_990818ra.bc

CKBRIEF -- Version 5.0.0, February 11, 2009 -- Toolkit Version N0063

Summary for: 990817_990818ra.bc

Object: -82000
Interval Begin UTC          Interval End UTC          AV
-----
1999-AUG-17 17:30:01.418    1999-AUG-17 23:05:42.039  N
1999-AUG-17 23:05:45.289    1999-AUG-18 06:06:05.874  N
1999-AUG-18 06:06:09.124    1999-AUG-18 11:52:17.741  N
1999-AUG-18 11:52:20.991    1999-AUG-18 13:30:00.953  N
```

CKBRIEF - '-dump' Example

Navigation and Ancillary Information Facility

```
Terminal Window
$ ckbrief mgs_spice_c_kernel_2004-099.bc MGS_SCLKSCET.00053.tsc naif0007.tls -dump
-rel -utc

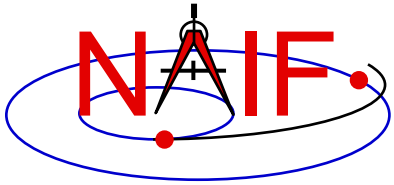
CKBRIEF -- Version 5.0.0, February 11, 2009 -- Toolkit Version N0063

Summary for: mgs_spice_c_kernel_2004-099.bc

Segment No.: 1

Object: -94000

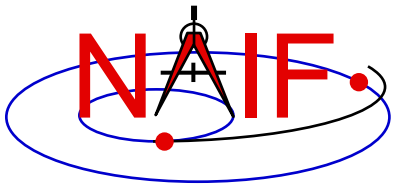
Interval Begin UTC      Interval End UTC      AV  Relative to FRAME
-----
2004-APR-08 00:00:59.809 2004-APR-08 06:53:47.805 Y   J2000
2004-APR-08 06:54:07.805 2004-APR-08 06:54:07.805 Y   J2000
2004-APR-08 06:54:19.805 2004-APR-08 06:54:35.805 Y   J2000
2004-APR-08 06:54:51.805 2004-APR-08 06:54:55.805 Y   J2000
2004-APR-08 06:55:07.805 2004-APR-08 06:55:07.805 Y   J2000
2004-APR-08 06:55:23.805 2004-APR-08 06:55:23.805 Y   J2000
2004-APR-08 06:55:35.805 2004-APR-08 11:59:55.802 Y   J2000
2004-APR-08 12:00:55.802 2004-APR-08 23:59:55.795 Y   J2000
```



DSKBRIEF

Navigation and Ancillary Information Facility

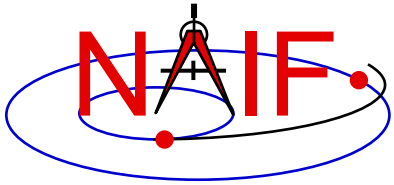
- ***dskbrief* is a command line program for summarizing the spatial coverage and additional attributes of DSK files**
- **DSK files to be summarized can be listed on the command line or given in a meta-kernel provided on the command line**
 - Additional text kernels containing body, frame, and surface name-ID associations must also be provided to produce complete summary output
- ***dskbrief* provides command line options for**
 - generating extended, full, and segment-by-segment summaries
 - treating all input files as if they were a single file
 - displaying gaps in spatial coverage
 - controlling the number of significant digits in the output
 - and a few others



Comment Manipulation Tools

Navigation and Ancillary Information Facility

- Every kernel should contain metadata – called “comments” – describing the file contents, intended usage, etc.
- In binary kernels – SPKs, CKs, binary PCKs, DSKs and EKs – comments are stored in a special area of the file called the “comment area.”
- *commnt* can read, extract, add, or delete comments stored in the comment area
 - **Caution:** you cannot add or delete comments if the kernel file is not in native format for the machine on which you’re working.
 - » You can convert a non-native binary format file to native binary format by converting the file to “transfer format” using *toxfr* and then converting it back to binary format using *tobin*.
 - » Or use the *bingo* utility (available only from the NAIF website and Fortran toolkits).



COMMNT

Navigation and Ancillary Information Facility

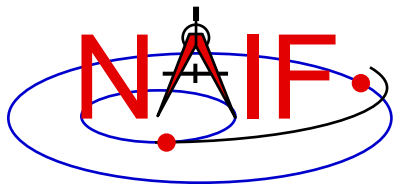
- ***commnt*** is both a command line utility and an interactive menu-driven program
- In command line mode, ***commnt*** provides options to
 - print comments to the screen

```
$ commnt -r kernel_file
```
 - extract comments to a text file

```
$ commnt -e kernel_file text_file
```
 - add comments from a text file

```
$ commnt -a kernel_file comment_file
```
 - delete comments

```
$ commnt -d kernel_file
```
- **Important**
 - When comments are added, they are appended at the end of the existing comments
 - Comments should be deleted **ONLY** if being replaced with better comments



COMMNT - Command Line Example

Navigation and Ancillary Information Facility

```
Terminal Window

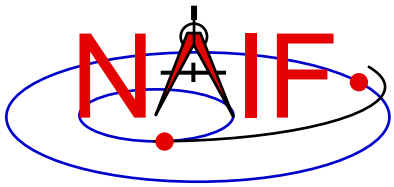
$ commnt -r de405.bsp | more
; de405.bsp LOG FILE
;
; Created 1999-10-03/14:31:58.00.
;
; BEGIN NIOSPK COMMANDS

LEAPSECONDS_FILE      = /kernels/gen/lsk/naif0007.tls
SPK_FILE              = de405.bsp
SOURCE_NIO_FILE       = /usr2/nio/gen/de405.nio
BODIES                = 1 2 3 4 5 6 7 8 9 10 301 399 199 299 499
BEGIN_TIME            = CAL-ET 1950 JAN 01 00:00:41.183
END_TIME              = CAL-ET 2050 JAN 01 00:01:04.183

; END NIOSPK COMMANDS

A memo describing the creation of the DE405 generic planet ephemeris is avail
able from NAIF or from the author: Dr. Myles Standish of JPL's Solar System Dy
namics Group. Because this memo was produced using the TeX processor and inclu
des numerous equations

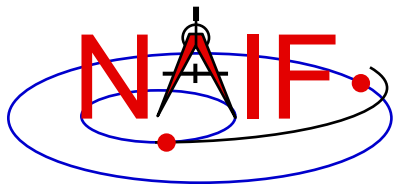
>>> Beginning of extract from Standish's DE405 memo <<
...
```



FRMDIFF

Navigation and Ancillary Information Facility

- ***frmdiff*** is a command line program for sampling the orientation of a reference frame or for computing the difference between orientations of two reference frames based on provided set(s) of SPICE kernels
- In sampling mode, ***frmdiff*** computes a set of transformations from one frame to another frame over a specified interval with a specified time step
- In comparison mode, ***frmdiff*** computes two sets of transformations for two pairs of “from” and “to” frames and then computes the difference in rotation and angular velocity between these transformations over a specified interval with a specified time step
- Depending on the execution mode and the requested output type ***frmdiff*** prints to the screen:
 - only the maximum rotation or the maximum rotation difference,
 - a complete table of rotations or differences (as angle and axis, SPICE- or engineering-style quaternions, matrices, or Euler angles), or
 - a statistical analysis of rotations or differences.



FRMDIFF – Comparison Example

Navigation and Ancillary Information Facility

```
Terminal Window

$ frmdiff -k naif0009.tls cas00130.tsc cas_v40.tf -s 10 -b 2009-JAN-09 00:00 -e 2009-JAN-10 00:00 -t
dumpaa 09009_09025pa_fsiv_lud2.bc 09006_09011ra.bc > output.txt

$ cat output.txt
#
# Comparison of 3143 rotations
#   from 'J2000' (1) to 'CASSINI_SC_COORD' (-82000)
#   computed using
#       naif0009.tls cas00130.tsc cas_v40.tf
#       09009_09025pa_fsiv_lud2.bc
#
# with 3143 rotations
#   from 'J2000' (1) to 'CASSINI_SC_COORD' (-82000)
#   computed using
#       naif0009.tls cas00130.tsc cas_v40.tf
#       09006_09011ra.bc
#
# with a 10.000000000000 second (0:00:00:10.000000) step size
# within the non-continuous (with 1 gaps) time period
#
#   from '2009 JAN 09 15:17:06.359' TDB (284786226.35996 TDB seco...
#   to   '2009 JAN 10 00:01:06.184' TDB (284817666.18419 TDB seco...
#
# Times are TDB seconds past J2000.
# angle is shown in radians.
#
# time, angle, axis_x, axis_y, axis_z
+2.8478622635996E+08 +5.4958832051797E-05 +8.2101753099566E-01 +4....
+2.8478623635996E+08 +5.4931030131424E-05 +8.2046010733260E-01 +4....
```