orbit

August 15, 2005

Abstract

Create a FITS timeseries "HK-like" file from the ODF Spacecraft Reconstructed Orbit File.

1 Instruments/Modes

Instrument	Mode
EPIC	ALL
RGS	ALL
OM	ALL

2 Use

pipeline processing	yes
interactive analysis	yes

3 Description

This task makes position information from the XMM ODF available as a FITS format product file. It has been determined that this product would have value both for constructing Good Time Intervals (using **tabgtigen**) based on orbit information, and for possibly creating barycentric correction tables. It is felt that a FITS format file conforming as much as possible to established Orbit file conventions would be more useful than the ascii Orbit file provided in the ODF.

This task will utilise the OAL_getPosition routine to return the x-y-z components of the position vector in km as well as the x-y-z components of the corresponding velocity vector in km/s, both with respect to the reference Kepler orbit. Both sets of values will be written into a standard OGIP-compliant FITS binary extension table with a TIME column value, derived from a start, stop and sampling interval time, each specified by the user. This task will default to sampling the entire input file with a timestep interval of 60.0 seconds.

3.1 Detailed Description

The ODF Orbit file iis described in [1]. The Periodic Housekeeping data is described in [2].

4 Parameters

This section documents the parameters recognized by this task (if any).

Parameter	Mand	Type	Default	Constraints
outfile	yes	string	none	valid file name

Output orbit filename in FITS.

selecttimes	no	boolean	no	yes—no

Input starttime and endtimes or use default whole file.

starttime	no	real—string	none	>0.0 s

Start time for interval in any param "TIME" format.

endtime	no	real—string	none	>0.0 s

End time for interval in any param "TIME" format.

timestep	no	real	60.0	>0.0 s

Bin size (in sec) of step through Orbit information.

Note: The only param TIME format supported currently is
the "seconds since XMM reference time" mode.

5 Errors

This section documents warnings and errors generated by this task (if any). Note that warnings and errors can also be generated in the SAS infrastructure libraries, in which case they would not be documented here. Refer to the index of all errors and warnings available in the HTML version of the SAS documentation.

StartANDEndNotInODFRange *(error)*
Start AND End times
selected not congruent with input ODF obs times.

StarttimeGTEndtime *(error)*
Starttime entered greater
than Endtime entered.

StartDefault *(warning)*

corrective action: Start time entered less than ODF obs start time Default to obs start time from ODF

EndDefault *(warning)*

corrective action: End time entered greater than ODF obs end time Default to obs end time from ODF

StartANDEndAreDefault *(warning)*

corrective action: Start time AND End time are 0 Default to obs start time, obs end time from ODF

badTimestep *(warning)*
Default to 60 seconds
corrective action: Timestep parameter entered less than 0 or greater than time in file

6 Input Files

1. None. SAS_ODF must be properly set.

7 Output Files

1. FITS file with single binary extension containing seven columns; TIME in seconds since TSTART, x-y-z position vectors in km, and x-y-z velocity vectors in km/s.

8 Algorithm

```
subroutine orbit
 read_parameters    # get parameters from param file
 OAL_odfInfo        # get StartTime, EndTime of file

 open_outfile       # open FITS output file
 addTable           # create new table
 foreach column     # create 7 new columns: time, x, y, z, Vx, Vy, Vz
  addColumn
 next

 for start_time to stop_time, step sampling_interval

  OAL_getPosition   # return position and velocity vectors from ODF

  foreach column    # time, x, y, z, Vx, Vy, Vz
   fill_column_temp_pointer
   if (column_temp_pointer(i) not defined)
    column_temp_pointer(i) = HUGE
```

```
    end if
   next

  next

  OAL_proposalInfo   # get basic info to write as keywords
  write_attributes_to_outfile     # add proposal info as keywords
  release Table      # close FITS extension
  release Set        # close FITS file
  OAL_releaseMemory  # close ODF files
  close_outfile
 end subroutine orbit
```

9 Comments

- This task simply converts some of the available Orbit parameters from their current ODF ascii format (as a Spacecraft Reconstructed Orbit File). It is assumed these positional and velocity parameters can be better accessed in FITS for constructing possible GTI's.
- It is not clear the usefulness of the orbit file for barycentric correction but it is clear this file should be presented in a format that maximizes using preexisting software to calculate such values FROM this file.

10 Future developments

Currently, the OAL only returns the x-y-z positional coordinates from the orbit file. It is important for this to be expanded to also include the velocity vectors. The ESOC ICD XSCS Orbit Access Software document [3] describes other parameters users might eventually find useful to access in FITS format and may be included in later versions of this task as keywords.

It might be useful to arrange the output files to conform to a known standard, such as the XTE Orbit File, which are not only already OGIP- compliant, but would allow these files to take advantage of FTOOLS designed to read such formats. This can be accomplished with a slight expansion of the OAL_getPosition routine.

The OAL first attempts to extract the RECONSTRUCTED orbit file to fill the output file, and failing that, will extract the PREDICTED orbit file. It may be useful in the future to have a switch allowing the extraction of EITHER, chosen by the user.

References

[1] ESA. XMM Interface Control Document: Observation and Slew Data Files (XSCS to SSC) (SciSIM to SOCSIM). Technical Report XMM-SOC-ICD-0004-SSD Issue 2.5, ESA/SSD, June 2000. Found at the URL: `ftp://astro.estec.esa.nl/pub/XMM/documents/odf_icd.ps.gz`.

[2] K. Galloway. XMM technical note: Periodic housekeeping telemetry definition. Technical Report XMM-SOC-TN-0040-SSD 0.2, ESA/SSD, August 5 1999.

[3] S.Pallaschke. XMM ICD - XSCS Orbit Access Software. Technical Report XMM-SOC-ICD-0019-OAD Issue 1.0, ESA/ESOC/FCSD/OAD, October 1997.