DESCRIPTION OF THE SUCCESSIVE VERSIONS OF THE COROT DATA

Version	Date	Comments
1.0	**30/092014**	Initialisation

Related documents

[1]	COROT.LESIA.08.002	The « Ready to Use » CoRoT N2 data
[2]	*Astronomy and Astrophysics*. 2009. vol. 506. pp. 411-424.	The CoRoT satellite in flight: description and performance.
[3]	À paraitre	Article de Marc
[4]	A paraître	Bilan des observations (AB)

1. INTRODUCTION

The purpose of this document is to present the processing applied to the CoRoT data according to the version of the data.

The distributed CoRoT data are N2 data ; they proceed from N1 data using N1->N2 pipe-line. The data files are fits files, described in [1].

The version of the data is given by the keyword N2_VER in the primary header of the fits files[1].

As each new version improves the quality of the data, it is recommended to use the latest version.

In this document, we give a short description of the successive steps of the processing and then, we present the different versions of each type of data.

A detailed description of the processes of correction can be found in [2] and [3].

In the faint stars channel, each STAR file (CHR, MON, IMAG) is accompanied with a EN2_WINDESCRIPTOR file; the version of the windescriptor file is the same as the version of the lightcurve.

Warning :
In version 1, 2 and 3, the time is expressed in UT, UT Heliocentric, UT +HelReg ; and the Julian date is expressed using a CoRoT specific origin (1st of January 2000 at noon)

In version 4, data have a different structure and above all, a different time stamping: TT and TDBT. This version will be available mid 2015.

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[1] The keyword PIPE_VER indicates the version of the pipe-line used to produce the data, not the version of the data. It has been used for processing purpose and is of no use for the final user.

2. SHORT DESCRIPTION OF THE SUCCESSIVE STEPS OF THE PROCESSING

> ➤ **The aim of the pipe-lines (N0->N1 and N1->N2) is to correct the raw data from instrumental and environmental perturbations, well known and modelled so far.**

2.1 Versions 1 to 3

➤ **N0 -> N1 processing :**
  ➤ The corrections are applied in the following order:
    ➤ **Elimination of the aliasing** appearing on a CCD when reading another CDD : this is done by using patterns measured in the calibration phase
    ➤ On the **seismology** field, removal of the residuals of **offset and background**
    ➤ On the **exo** field, subtraction of the **offset** and of the **background** obtained as the **median** of the observed **backgrounds** in order to eliminate the hot pixels in the background light curves
    ➤ On the exo chromatic light curves, **computation of the white light**
    ➤ Correction of the **duration of the exposure and absolute dating**
    ➤ **Jitter corrections** using high resolution PSF on the seismo field and medium resolution PSF on the exo field
    ➤ Correction of **relativistic aberration** via the modification of the focal equivalent to the dilatation (resp contraction) of the field of the of view
    ➤ Detection of **energetic particle impacts**: a point is considered as an impact when the difference between the signal and the median calculated on a sliding window is higher then 5 σ. Data are not modified at that step, a warning is included in the data (see STATUS word below)
    ➤ Orbital events are indicated taking into account the absolute date of the data: SAA, inbound and outbound Earth eclipses (see STATUS word below)
➤ **N1 -> N2 processing:**
  ➤ For both seismo and exo data:
    ➤ Translation from UTC to heliocentric time basis
    ➤ Compensation of the diminution of the quantum efficiency
    ➤ Correction of the effect of the changing of the CCD temperature
  ➤ For seismo data,
    ➤ Resampling from a 1s basis to a 32s
    ➤ Resampling to regular heliocentric time basis
    ➤ Elimination of the discontinuity due the the changing of the on-board mask
  ➤ For exo data,
    ➤ Merging of 512s and 32s files
    ➤ Detection and flagging of the hot pixels
    ➤ Creation of a 'windescriptor' file containing an extraction of the on-board full image, the size of the on-board mask and some useful information about the observed target.

2.2 Version 4

To be added

3. BRIGHT STAR CHANNEL

These files are named: AN2_STAR_<CorotID>_<data_start_date>_<data_end_date>.fits ;
Example : AN2_STAR_0000012345_20070411T150824_20070508T213552.fits

version	Corrections
1.0	• Cross-talk corrections using ground-measured patterns • Marginal correction of the offsets and backgrounds • First and rough jitter correction using a poor estimate of the excursions
1.1 ; 1.2	• Optimisation of the computation of the PSF
1.3 ; 1.4	• Correction of a bug in the reading of the gain: the correct value for each half-CCD is now used • Better jitter correction: the excursion is computed relatively to the same mean value along the whole run
1.8	• Correction of the discontinuity caused by the breakdown of DPU1 • Warning on the data where the jitter excursion can't be corrected; in this case, the value is interpolated • Correction of minor bugs on the STATUS word (valid/invalid data)
1.9 ; 2.1	• Incorporation of the flag for ingress and egress of the earth eclipses
3.0	• Better dating of the SAA and earth eclipses: the flags are coherent between N1 and N2 pipe-lines • Only positive outliers are marked (instead of positive and negative) • **Correction of he effect of the decrease of the quantum efficiency**
3.1 ; 3.2 3.3	• **New jitter correction: the relativistic aberration is taken into account through the variation of the focal of the telescope** • Correction of he changes of the temperatures of the CCDs
3.4	• New version of the correction of the loss of efficiency according to the flux: the coefficients of the correction have be recomputed using the data of all the runs • The flux of the two sequences (initial sequence with initial photometric mask and second sequence with optimised photometric mask) are normalized using the small images (imagettes)

4. FAINT STARS CHANNEL

Faint stars are observed using different methods:
- a few stars, up to 40, are acquired as a small portion (10*15 pixels) of the image called imagette observed during 32 seconds
- for the other stars, up to 11400, the total flux in the PSF is computed on board for each exposure ; the monochromatic mode produces only white flux whereas the "chromatic" mode produces pseudo-RGB fluxes (see [2] for a further description). Some stars, up to 2000, are acquired at 32s rate while most of them are accumulated over 16 exposures leading to a 512s sampling.

The exact number of each set of stars depends upon the run [4].

4.1 Data from onboard lightcurves

These files are named: EN2_STAR_<type>_<CorotID>_<data_start_date>_<data_end_date>. fits ; <type> is either MON or CHR.

Example: EN2_STAR_MON_0123456789_20070411T150824_20070508T213552.fits

Version	Corrections
1.1	• Cross-talk corrections, offset subtraction, backgrounds subtraction. • Very rough jitter correction on chromatic light-curves • No jitter corrections on mono-chromatic light-curves
1.2 ; 1.3	• Correction of a bug in the reading of the gain: the correct value for each half-CCD is now used • Addition of lacking information in the headers of the files
1.4	• Incorporation of the flag for ingress and egress of the earth eclipses • Correction of the discontinuity caused by the breakdown of DPU1
2.0	• **Computation of a "white flux" on chromatic lightcurves by addition of the 3 "colours"** • New calculation of the line of sight based on the computation of the PSF
2.1 2.1b	• Better dating of the SAA and earth eclipses: the flags are coherent between N1 and N2 pipe-lines • Change in the indication of impacts of charged particles: only positive outliers are marked (instead of positive and negative)
2.2	• Better PSF determination due to hot pixel elimination before calculation • Adjustment of the filtering of the outliers on the duration of the orbit
3.0	• **New jitter correction: the relativistic aberration is taken into account through the variation of the focal of the telescope** • **Correction of the loss of efficiency** • **Correction of the changes of the temperature of the CCDs** • *Remark:* In data from the pipe-line version 2.3, the star information in the EN2_WINDESCRIPTOR is updated from EXODAT via a web service

3.1	• Change in the order of the correction: the effect of the jumps of the CCD temperature are applied after the correction of the loss of global efficiency (this is not correct and is fixed in version 3.4)
3.2	• The increase of the dark current with the position of the star on the CCD is taken into account (with a small bug fixed in version 3.4
3.3	• New version of the correction of the loss of efficiency according to the flux : the coefficients of the correction have be recomputed using the data of all the runs
3.4, 3.5	• Correction of the previous bugs
3.6	• Improvement in the correction of the background: both 32s and 512s median values are upgraded to the overall median value.

NB : versions in grey should not be used as they contain bugs.

4.2 Lightcurves from onboard small images (« imagettes »)

These files are named: EN2_STAR_IMAG _<CorotID>_<data_start_date>_<data_end_date>.fits ;
Example : EN2_STAR_IMAG_0123456789_20070516T060050_20071015T063522.fits

co-Is version	Corrections
1.0 1.0b 1.1	• Calculation of light curves from on board imagettes. • Correction of the cross-talk, subtraction of the offset and of the background. • The algorithm is based on the determination of a significant mask • The reconstruction is performed using the LOS.
1.2	• Improvements of the STATUS word and of the position of the orbital events • Information in WINDESCRIPTORs are read directly from Exodat via a web service
2.0	• **Major change: the centroid of the spread image is calculated and its coordinates are given in two new columns** • Improved corrections of the jitter • Correction of the jumps of the CCD temperature: their date and the "quality" of the correction are given in the primary header. • Correction of the global loss loss of efficiency • The number of pixels of the reconstructed colours are integers (previous bug fixed)
2.1	• Improvement in the correction of background including better correction of the dark current
2.2	• Subtraction of the loss of efficiency according to the mean flux of the lightcurve.
2.3	• New improvement in the correction of background: both 32s and 512s median value are upgraded to the overall median value.