

CoRoT data: final pipe-line for faint stars

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Abstract. The observations made by the CoRoT satellite were divided into short and long periods called runs; for a detailed description of the runs see [1]. The global processing pipeline is divided in two sub-pipelines: the first one is dedicated to the corrections that can be applied to simultaneous data, while the second one needs the whole duration of each run to be applied. We present here the final form of the entire processing pipeline for the **faint stars channel**, which was previously called the *exo channel*.

1 / Pipeline EN0 to EN1

The first level of correction is applied to the raw data and is focused on the instrumental and environmental disturbances (see Fig. 1). At this level, only instantaneous corrections are performed, working on data taken at a given moment, and based on the calibrations made on board and on the ground [2].

The first pipeline for the faint stars field is similar to the one for the bright stars field; the main difference is the processing of the background and the offset. With more than 5000 stars observed by each CCD in one run, it was not possible to affect a background window for each star, so 196 windows were defined on board (49 sampled at 32s and 147 sampled at 512s) and used to compute a median background. With the increase of the dark current over time of the mission, the simple subtraction of the median value was not sufficient and an additional term that modeled the dark current evolution along the y-axis of the CCD was used.

The other steps of this pipeline are identical to the corresponding steps of the bright stars pipeline, see [3] for more detail.

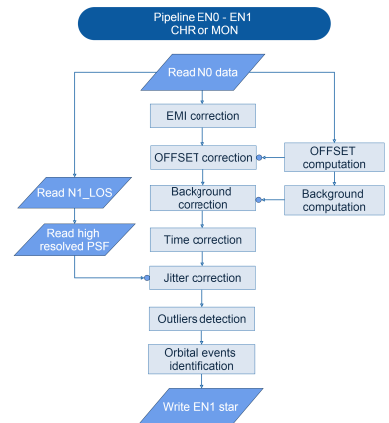


Fig. 1. Flowchart pipeline EN1

2 / Pipeline EN1 to EN2

Once N1 data are produced, a second level of correction is necessary to reach the scientific requirements of the mission. The successive corrections work on the whole duration of the signal [4]. Figure 2 presents, in blue, the pipeline used for the current version of the data, v1.x to v3.x, and in green the additions made for the final version of the data, v4.x, see section 3.

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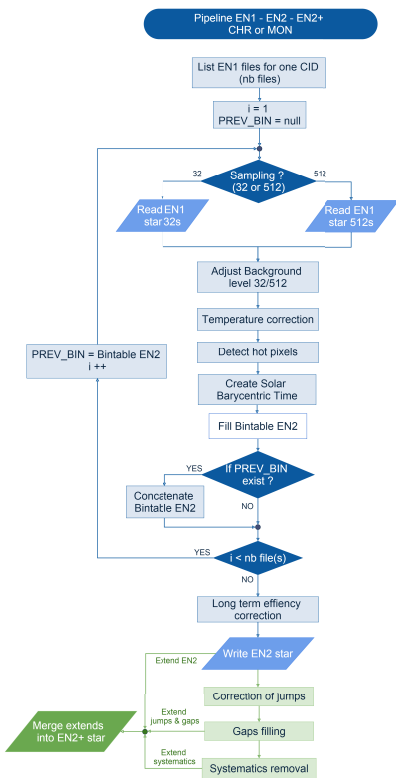


Fig. 2. Flowchart pipeline EN2

The chromatic targets (CHR) and the monochromatic ones (MON) follow the same correction pipeline. On this channel, many stars have been oversampled from 512 seconds to 32 seconds; the first part of the pipeline works with the files before concatenation, with a unique sampling:

- Adjust Background level: due to the specific localization of the background windows along the y-axis, a constant difference exists between the 32s-median background and the 512s-median one. A correcting offset is used to bring both to the same overall median.

- Temperature correction: during the mission, the CCDs temperature was controlled, and was corrected using several commands. Each command is compensated by measuring the height of the jump and its impact on the light curve.

- Time conversion: the CoRoT Julian time used throughout the process is converted into Heliocentric Julian time.

Then, the data from a same target are concatenated and the long-term efficiency decrease is corrected. Due to several causes (increase of the dark current, opacity of the focal box), the efficiency of the collection of photons decreases throughout the mission, causing a long-term trend. A correction factor, linked to the observed intensity of the star, is computed in the linear approximation and applied to the data.

In addition to the thousands CHR and MON files, tens of stars were observed as imagettes, and are recorded in specific files. Those files follow an equivalent pipeline of correction as the MON/CHR files [5].

3 / A final step: the EN2 legacy

The final version of the data (v4.x), implements a new extension, including further steps of correction. First, the Terrestrial Time (TT) replaces the Universal Time (UT) and the Heliocentric Julian Date is converted to Solar Barycentric Time as seen in Fig. 2. In the new extension, the several jumps occurring due to particle impacts or abnormal behavior of the on board coding, are detected by comparing the flux by windows of 2.8 hours, and corrected by using a fitted exponential trend. Then, with the gap filling interpolation by Inpainting method [6] and the removal of systematics, the best legacy possible for the CoRoT data, is stored in the final EN2 product.

References

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