





# Deliverable 5.2: Low-resolution noise covariance matrix

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### **Revision History**

Version	Authors	Date	Changes
1.0	Maksym Brilenkov Hans Kristian Eriksen Elina Keihänen Simone Paradiso Anna-Stiina Suur-Uski Trygve Leithe Svalheim	December 3rd, 2019	Initial Version





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## **1** Overview

A critical component of any CMB data release is accurate and precise estimation of instrumental noise in the final sky maps. Traditionally, this is described through a so-called noise covariance matrix, which quantifies all pairwise correlations between any two pixels in the map. However, it is only useful if the noise is approximately Gaussian distributed.

Estimation of the noise covariance matrix in BeyondPlanck is based on samples drawn from the full joint posterior distribution. Technically, this is done by computing the outer product of smoothed and downgraded samples, averaging over all available samples. However, we note that with the BeyondPlanck approach, much greater flexibility is error propagation is possible than within a classical covariance description. In particular, the sample set itself represents the most general description of the errors possible.

The current deliverable has therefore been generalized to account for this greater flexibility, in that the delivered products are no longer a single covariance matrix, but rather a sample set, and a corresponding Python tool to summarize this information called "c3pp" (Commander3 post-processor). In addition to evaluating pixel-pixel covariance matrices, this also supports output of a wide range of summary statistics from the Commander3 Markov chains, including uni-variate posterior means and standard deviations; sample subsets; power spectrum samples to be inserted into a Blackwell-Rao estimator in the correct fileformat etc





## 2 Software

The c3pp tools is available through this link:

• <u>https://github.com/trygvels/c3pp</u>

Usage information and documentation is provided through the same link.



