

# Cosmological application in the Grid environment: Detection of SZ Clusters of Galaxies in data from the ESA Planck satellite mission

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Several techniques have been proposed to detect the SZ clusters. Most of them are based on linear filters that try to take into account the frequency dependence of the SZ effect to combine information from different channels to produce a single map where the clusters can be detected with a higher SNR than in the individual frequency maps (Planck will image the microwave sky in nine frequencies ranging from 30 GHz to 857 GHz). Within the Planck Collaboration an exercise to detect SZ clusters using realistic simulations has been proposed. The purpose of this exercise is to compare the performance of different algorithms to detect the SZ clusters, give an estimation of their integrated flux (and error) and an estimation of their size (and error). We have tested our implementation of the Matched Multifilter (MMF) developed by Herranz et al. 2002. We have analyzed nine full resolution Planck sky maps and detected approx. 1100 clusters above the 5 sigma level.

### 3. Impact

To do this kind of analysis we have to analyze 9 all-sky maps at full Planck resolution (approx. 200 MB each). Then, we have to divide each one of these maps into 373 projected patches (512x512 pixels in size), this makes a total of 3357 patches (it would take 18 hours to run in a single CPU). Once we have the patches written to disk, we apply the MMF algorithm to the data. The analysis of each set of nine patches centered in the same region of the sky takes between 3 to 35 minutes, depending on the number of iterations. In our case, we want to estimate the size of the clusters properly, and, therefore, the analysis lasts approx. 35 minutes per region. Since there are 373 regions to be analyzed, it would take about 266 hours to do this analysis (approximately 10 days in single CPU). We have done this analysis in 13 hours using 20 working nodes.

### URL for further information:

<http://www.rssd.esa.int/index.php?project=Planck>

### 4. Conclusions / Future plans

This analysis using multifrequency maps required 13 hours of CPU time in each of the 20 planck vo working nodes and approx. 20GB of space at IFCA, 18 GB of which were the input patches to be analysed. The output of the analysis is a list of detected clusters (just a few KB's) and 373 combined maps, one per region, where the detection is performed (2 GB). In the future a version of the Planck Sky Model introducing the satellite systematics will be released and this analysis will be repeated.

### Provide a set of generic keywords that define your contribution (e.g. Data Management, Workflows, High Energy Physics)

Astronomy. Cosmology, Planck. Detection of SZ Clusters Galaxies.

### 1. Short overview

In 2008 ESA's Planck satellite will be launch. The main objective of this mission is to produce a map of the anisotropies of the Cosmic Microwave Background radiation (CMB), a relic radiation from the Big Bang. To study this map, the compact source emission from distant galaxies and clusters of galaxies must be detected and extracted. We report on the work done detecting SZ clusters in realistic simulations of Planck.

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