Seeking new pointing and calibration sources at 350 μm
First observations with ArTéMiS @ APEX

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Summary

The catalogues currently used at APEX with bright, compact pointing sources and secondary calibrators at 350 μm contain only few objects. This creates problems at certain observing time-slots or sky locations, where none of these sources are available. This problem is not only faced by APEX but also by other sub-mm facilities like ALMA or, in the future, CCAT. At APEX, we are carrying out a program to substantially increase the number of pointing and calibration sources at 350 μm. One of the strategies was to observe a sample of about 200 candidates with the ArTéMiS camera. These were selected from the Planck Catalogue of Compact Sources (PCCS) and the Planck's Early Release Compact Source Catalogue (ERCSC), following compactness criteria and a lower cut in peak flux density of 5 Jy. We present here a brief summary of the selection criteria and the first results of the observational campaign carried out in September 2013, coinciding with the installation and first observations of the ArTéMiS camera onboard APEX.

The Planck-based sample

The most compact Southern (DEC < 35) sources were chosen from Planck's ERCSC and PCCS catalogs at 857 GHz (350 μm). The beam size of Planck at 857 GHz is about 4.2′.

- Selection criteria for sample 1 (ERCSC catalog)
  - 1) Fitted Gaussian FWHM < 1.2 beam size
  - 2) Elongation < 1.3 3) FLUX > 5 Jy
- Selection criteria for sample 2 (PCCS catalog)
  - 1) Effective Gaussian FWHM < 1.5 beam size
  - 2) From elliptical Gauss fit: max(FWHM)/min(FWHM) < 1.3
  - 3) APERFLUX > 5 Jy

Final sample: **212 sources** (merge of samples 1 and 2)

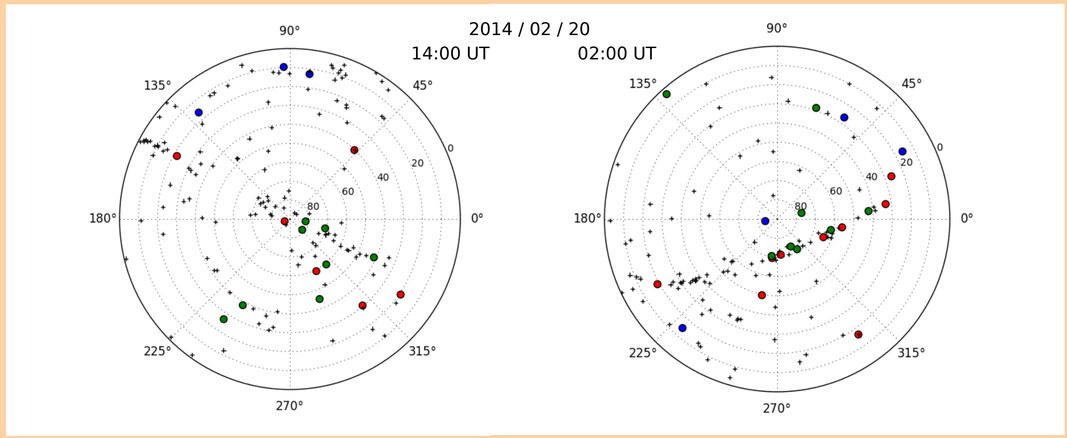

Fig 1. Plots showing the sky (horizontal coordinates) over Chajnantor, with 12 h difference. Red and blue circles are, respectively, current secondary calibrators and pointing sources at APEX. Black crosses are the proposed sample of 212 sources. Green circles are the most promising candidates observed with ArTéMiS@APEX in Sep 2013.

ArTéMis camera

ArTéMiS is a wide-field submillimeter camera operating at three wavelengths simultaneously (200, 350 and 450 μm). A preliminary version of the instrument (1152 pixels at 350 μm) was successfully installed and tested on APEX telescope in Chile, during austral winter 2013. ArTéMiS benefits from the exceptional conditions at APEX site in term of low atmospheric opacity in the submillimeter range. This instrument is developed by CEA (Irfu/SAp Saclay, France), CNRS/IAS (Orsay, France), CNRS/IAP (Paris, France) and University of Manchester (UK), in collaboration with ESO.

Observations with ArTéMis @ APEX

Observations were carried out at APEX on the first half of September 2013, after the installation and during the testing of the 350 – μm ArTéMis band. ESO, Sweden and MPIfR partners have invested time on this project and data are publicly available on the ESO archive (ID 492.L-0466A). Calibration factors, RCP files and pointing models are still preliminary and subject to improvement. The observing pattern was a raster of spirals (Fig 2) centred on each Planck position, and covering a FOV of about 3.5′ x 3.5′. Time spent on every source was about 140 s.

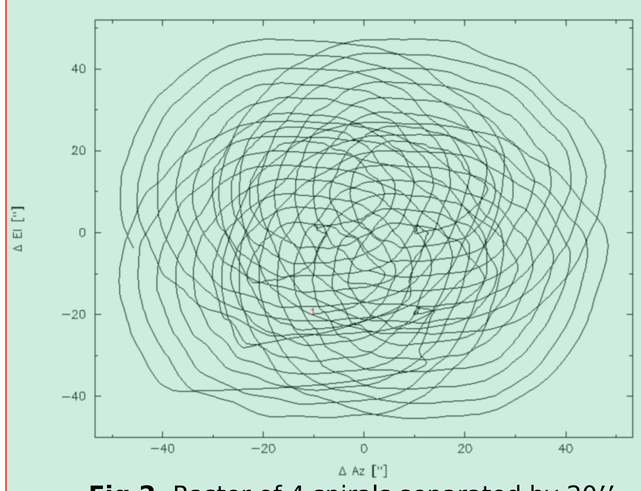

Fig 2. Raster of 4 spirals separated by 20′′ from each other. This pattern densely covers the central area of the map, and is centred on the Planck coordinate for each source.

- 137 / 212 sources (65% of the sample) observed
- pwv between 0.6 – 1.2 mm (zenith opacity ~ 1.3 – 2.2)
- RMS of the order of 1 Jy/beam (calibration uncertainty ~ 30%)
- About 20 compact objects detected at the level of > 4σ
- Other 20 fainter objects (tentative detections) should be re-observed with better weather conditions

Most significant detections

Data were reduced with BoA software, Signal-to-noise maps were produced in equatorial coordinates:

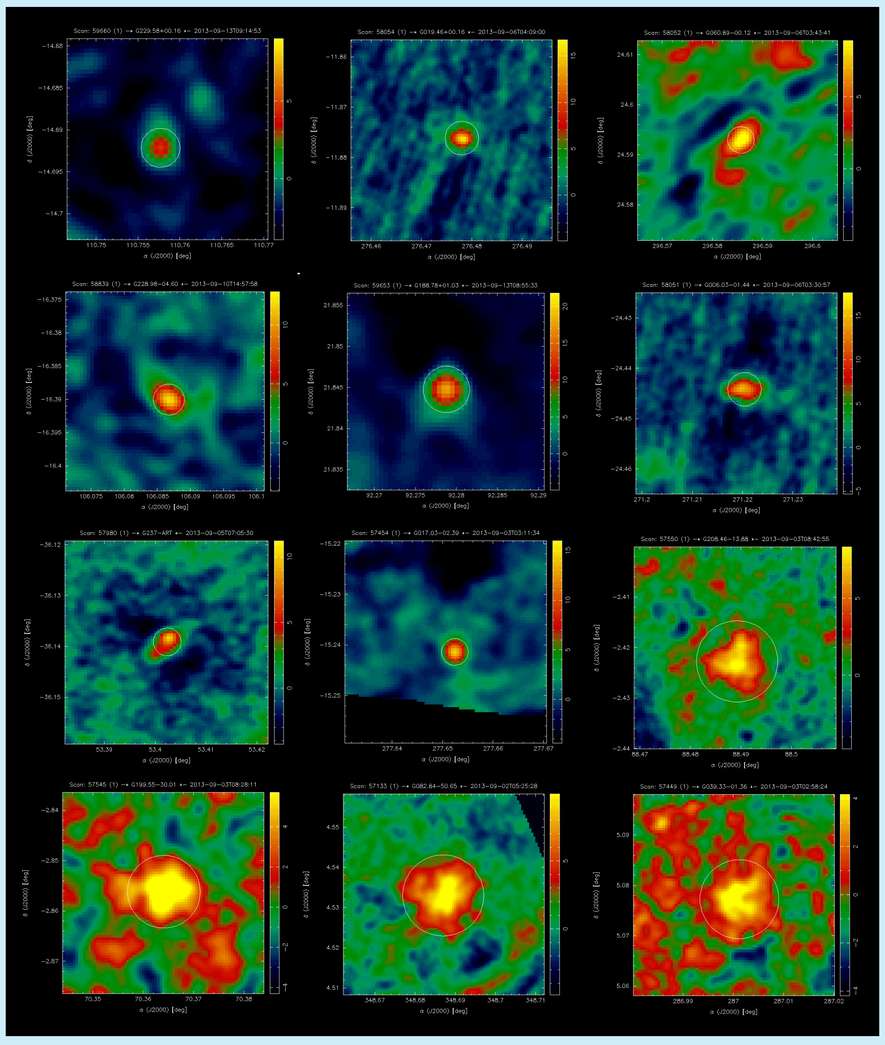

Fig 3. Signal-to-noise maps of the 12 most significant detections. These are good candidates for pointing/calibration sources. Positional offsets up to about 1′ have been found with respect to the Planck coordinates, which is consistent with the expected scatter of the Planck positions, of the order of 50′′ at 857 GHz. The final position errors are mostly driven by the error of the pointing model, estimated to be about 5′′ RMS.

Next steps

- Complete the candidate sample that meets the selection criteria (35% of sources)
- Observations at other frequencies (e.g., LABOCA) to get spectral index (SED)
- Improve positional accuracy (ALMA)
- Precise calibration with: (1) fully commissioned ArTéMis camera (2014) and (2) more adequate weather conditions (pwv ~ 0.5 – 0.8 mm)

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