Summary of the 1st NIKA pool

I. Hermelo, C. Kramer, N. Billot, and S. Leclercq

November 27, 2014

1 Overview

The 1st New IRAM KIDs Array (NIKA) open run took place at the IRAM 30 m radiotelescope (Sierra Nevada, Spain) from February 18th to 28th, 2013. In general the weather conditions were favorable, allowing to observe a total of 118 hours. Two standard observing modes[1] were offered to carry out the observations:

- **On-the-fly:** Data are taken while the telescope follows a traditional zig-zag pattern.
- **Lissajous:** Data are taken while the telescope follows a Lissajous curve pattern.

The pool data base[2] was used by the observers at the telescope to add comments to the observations logsheet and also by the principal investigators to follow the progress of the observations from their home institutes.

NIKA behavior during the pool was good in terms of stability.

The NEFD was measured to be better than the values advertised in the Call for Proposal, namely 35 and 14 mJy $\sqrt{s}$ for the NIKA 1 and 2 mm bands, respectively. The final NEFD will be derived after the pipeline upgrade, which will be used to generate the final version of the data products. The point source photometry was estimated to be correct at the 15% level at 1 mm and 10% level at 2 mm.

On the other hand, problems with the data acquisition software produced holes on the data collected. About 15% of the data was lost. Workarounds were introduced on the data reduction software by the Neel team to deal with these losses. Further investigations found that a fine tunning of the parameters of the kernel of the mrt-lx1 computer could fix the problem of the missing data. In order to check this a few hours of technical time were scheduled on May 2014. During this run only the electronics were used, i.e.; NIKA was not cooled down. After analyzing the data collected it was concluded that the new kernel configuration fixed the problem. However, somehow the problem showed up again on October 2014 during the polarimetry technical run. In this case the holes in the data were originated by an incorrect configuration of the buffer used for the TCP transfer. The problem was apparently solved before the beginning 2nd NIKA pool (November 2014) by reducing the buffer size.

[1] http://www.iram.es/IRAMES/mainWiki/Continuum/PoolPreparation
[2] https://pools.iram.es

2 Pool statistics

A total of 228 hours were scheduled at the IRAM 30 m radiotelescope for the 1st NIKA open run. The weather conditions during the pool were favorable most of the time (see Figure 1), allowing us to observe 52.0% (118 hours) of the total amount of hours allocated. The median value of the opacity was 0.12, based on the taumeter readings at 225 GHz. The 47.1% of the 2457 scans were obtained under excellent weather conditions (i.e., $\tau_{225\,\mathrm{GHz}} \leq 0.15$). On the other hand, 18.8% were taken under the "test" project, which was used when unstable weather conditions or technical problems did not allow to observe properly. Data for all the projects were collected. Table 1 summarizes the statistics at the end of the pool.

Project			$t_{allocated}$	$t_{observed}$		t_{target}	
ID	Priority	PI	*h*	*h*	%	*h*	%
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
118-13	5	EL	5.0	4.5	89.4	4.2	94.3
146-13	5	PA	27.0	18.0	66.7	16.0	88.8
234-13	5	MB	0.8	1.6	199.4	1.4	88.5
237-13	5	RA	27.0	25.1	93.1	22.9	90.9
239-13	5	FB	8.0	7.0	87.7	6.1	87.5
240-13	4	RI	34.0	19.5	57.5	17.2	88.1
166-13	3	ASA	10.0	5.7	57.0	5.3	92.9
151-13	2	LB	10.0	3.6	35.9	3.4	93.9
173-13	2	JL	8.0	3.1	39.4	2.8	88.7
174-13	2	AM	4.0	1.1	26.9	1.0	96.4
193-13	2	IH	31.4	5.7	18.0	5.4	95.2
226-13	2	ACT	5.0	5.0	99.3	4.6	92.1
230-13	2	RW	16.5	2.4	14.5	2.1	89.6
231-13	2	AO	15.0	5.2	34.4	4.7	90.2
232-13	2	HD	27.0	11.4	42.1	10.4	91.9

Table 1: Statistics of the projects scheduled during the 1st NIKA pool. The three first columns correspond to the project name, the rate assigned by the IRAM program committee, and the initials of the PI, respectively. Column 4 corresponds to the total amount of allocated hours for each project. Columns 5 and 6 are the total amount of hours that the project was observed and its percentage of completion, respectively. Finally, columns 7 and 8 correspond to the time spent on the target and the percentage that this time represents in terms of $t_{observed}$.

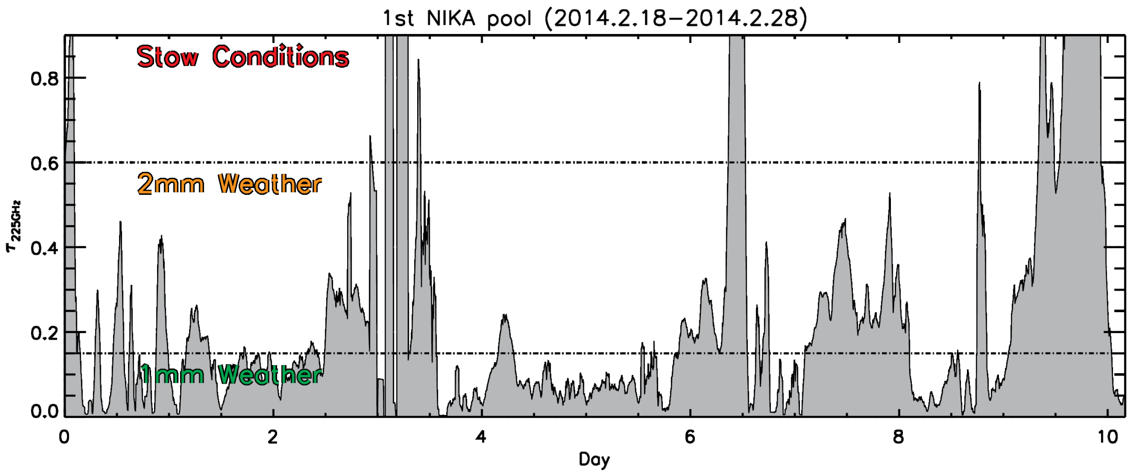

Figure 1: Taumeter readings during the 1st NIKA pool.

3 Pointing, focus and calibration

Pointing corrections were systematically done every ∼ 90 minutes. The pointing scans consisted on 1.′5×1.′5 Lissajous maps. The median value and the rms for the pointing corrections in azimuth and elevation (see Figure 2) are ΔAZ = −1.7 ± 4.7 and ΔEL = −0.6 ± 3.4, respectively.

Focus corrections were based on five consecutive 1.′5×1.′5 Lissajous maps taken at five different focus values (ΔZ_0, ΔZ_0 ± 0.6 mm, ΔZ_0 ± 1.2 mm). The corrections were calculated with second order fits to the integrated intensity and the FWHM. The new value of the focus was determined as the value that maximizes the flux and minimizes the FWHM. When the weather conditions were good enough, this was based on the NIKA 1 mm data. In the other cases, the correction was based on the NIKA 2 mm data. The day time evolution of focus corrections were well behaved and predictable. The median value and the rms of the values used is ΔZ = −1.70 ± 0.33 mm (see Figure 3).

Uranus was used as primary calibrator. The integrated flux densities of Uranus measured with the NIKA 1 and 2 mm band were 36.4 Jy and 15.3 Jy, respectively. These values are in perfect agreement with the expected values at 1 and 2 mm of 35.0 Jy and 15.1 Jy from the Bendo et al. (2013) model.

We also measured the integrated flux density of the asteroid Ceres using NIKA. It was found that the flux at 1 mm was 2.2 Jy, which is about 12% higher than the value predicted by the Müller et al. (2013) model (1.971 Jy, see Figure 4).

4 Data reduction

The online data processing pipeline worked smoothly during the pool allowing fluent observations. Pointing, focus, and science scans were reduced by the observers with no major problems.

The offline data processing pipeline is still in development. A preliminary version of the data products (v0) was distributed immediately at the end of the pool. A second version (v1) of scientific quality was released on June, 2014. Point sources as faint as 4 mJy at 1 mm were clearly detected. It is important to note that the Lissajous scanning pattern shows systematic artifacts in the maps, likely due to the elevation motors. For this reason, this

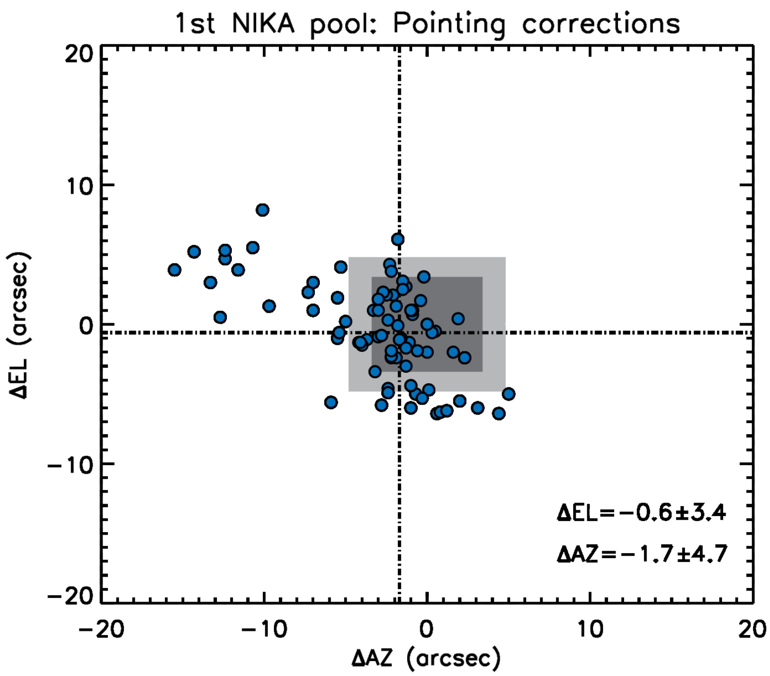

Figure 2: Pointing corrections applied during the NIKA pool. The dark and the light shaded areas correspond to the NIKA 1 and 2 mm pixel size, respectively.

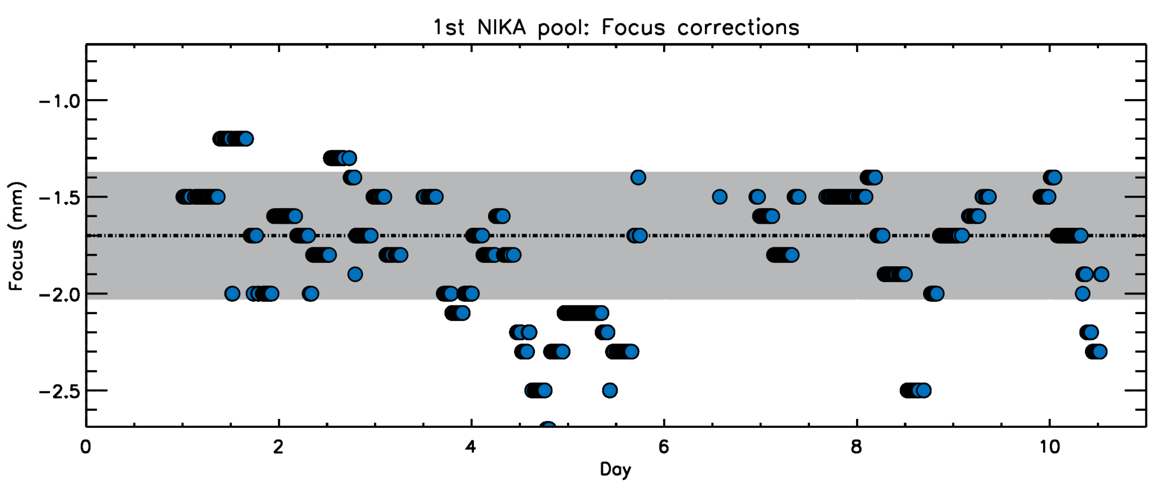

Figure 3: Focus corrections used during the NIKA pool. The horizontal black dashed line and the gray shaded area correspond to the median value and to the rms, respectively.

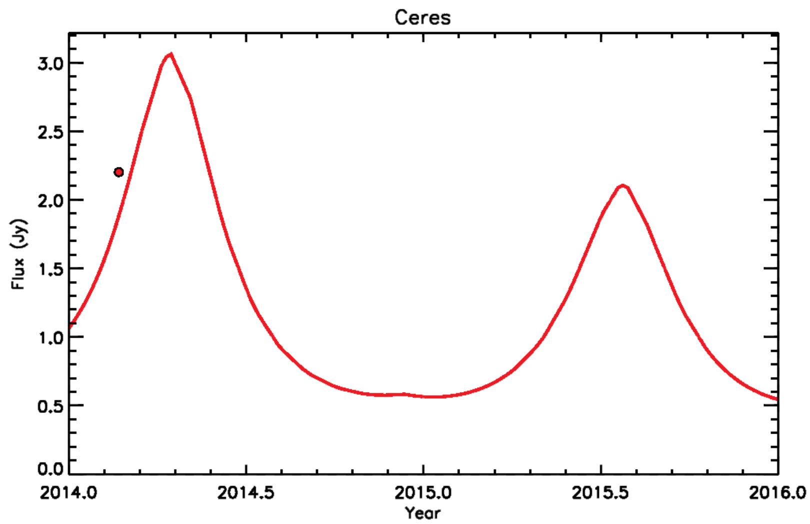

Figure 4: Ceres integrated flux density at 1 mm measured with NIKA (filled circle) and Müller et al. (2013) model predictions (solid line).

observing mode is no longer recommended to map extended sources. The NIKA team is working on the final version (v2) of the data products, which will mitigate as much as possible these artifacts.

References

Bendo, G. J., Griffin, M. J., Bock, J. J., et al. 2013, MNRAS, 433, 3062

Müller, T., Balog, Z., Nielbock, M., et al. 2013, Experimental Astronomy