Preparation of the 06/2012 NIKA run 4 at the 30m telescope

SL 13/4/2012, update 24/5/2012

Other details, updates and daily reports will be updated on the Wiki page:
http://www.iram.es/IRAMES/mainWiki/NikaRun4

Goals of the run

Test the NIKA prototype in its final position in the Nasmyth cabin of the 30m telescope. Full characterization of the system on sky, not an astronomical oriented run.

1. Test the new NIKA optics that should have better optical quality and less optical distortion.
2. Test the new IRAM optics designed to allow NIKA and GISMO to co-exist as permanent guest continuum receivers. Simply turning the mirror M4 to 2 different positions can allow using the two instruments alternatively.
3. Qualify the 1mm channel. The band-pass filters have been modified that should allow three times more photons on the Kids than on run3.
4. Test the quick-look offline processing scripts: Raw to fits, fits to IMBfits, IMBfits to plots (via Mopsic).
5. Test automation of Kid tunings.
6. Suppress the electronic cross-talk that induced common glitches and the Mars "plateau"....
7. Have a training session on how to start the NIKA cryogenics.
8. Test detectors with a better cosmetics (many missing pixels in the last run).
9. Test more canonical procedures (Focus, Skydip).

Hardware and people

Detectors to be tested

COMMON FILTERS: IR-blockers at 150 K and 50 K; 13 cm^{-1} low-pass at 50 K; 11 cm^{-1} low-pass at 4 K; 10 cm^{-1} low-pass at 1 K.

BAND 1.25 mm (dichroic in transmission) - NICA_8e (224 pixels array, Hilbert dual-polarisation design, pixels pitch 1.6mm on both x and y <=> 0.8 Fλ), 20-25nm (IRAM film), substrate 0.18 mm, backshort 0.47-0.49 mm. Amplifier SiGe Caltech LF4 (S/N 84, IRAM batch, Vd = 1.5 V). From laboratory measurements we estimate an NET of about 2-3 mK/sqrt(Hz) per pixel at 1 Hz. Central frequency 240-250 GHz (measured with the MpI). Resonances at 1.9-2.6 GHz (about 100 resonances, at the center, within the ROACH electronics band of 275 MHz). Two almost equivalent arrays are available (small differences in film thickness and backshort). Final decision will be made just before the run.

BAND 2 mm (dichroic in reflection + 5.7 cm^{-1} low-pass + 3.9 cm^{-1} high-pass) - NICA_8c (132 pixels array, Hilbert dual-polarisation design, pixels pitch 2.3 mm on both x and y <=> 0.77 Fλ with the current optics), 20 nm (IRAM film), substrate 0.3 mm, backshort 0.7 mm. Amplifier SiGe Caltech LF4 (S/N 70, IRAM batch, Vd = 1.5 V). From laboratory measurements we estimate an NET of about 3-5 mK/sqrt(Hz) per pixel. Resonances at 1.3-1.5 GHz. Three almost equivalent arrays are available (same thickness, same backshort). One easy option is to use the same array mounted in 2011.

FOV = 2.3' diameter for each of the arrays if fully used (rq: potential of the new optical system & cryostat = 2.8').

List of material that will come to the 30m by truck:

Cryostat ("cryogen free"), cryocooler, dilution fridge circulation rack, LN2 trap, RF electronics rack, computers, various other (but small) things, new optics (M5, M6, lenses), leak detector (the one at the telescope is probably not suitable: old oil pump).
Nb: responsible for all the NIKA hadware: Néel (Alain, Alessandro), except the M6 mirror and lenses: IRAM Grenoble (Samuel).

NIKA personnel for the run

Truck	= Travel by truck (**and spend one night at hotel Kenia in Pradollano or the 30m on arrival**)
Plane	= Travel by plane and sleep at the place scheduled for the next day (arrival) or preceding day (departure)
Granada	= Spend the night in the recidencia at IRAM Granada (with possibly a travel get there on the same day)
Pico Veleta	= Spend the night in the rooms at the 30m telescope
Kenia or 30m	= Spend the night either at the telescope in double occupancy rooms or at Hotel Kenia in Pradollano

		M	Tu	W	Th	F	Sa	Su	M	Tu	W
		28-May	29-May	30-May	31-May	1-Jun	2-Jun	3-Jun	4-Jun	5-Jun	6-Jun
A. Benoit	IN	Plane	Kenia or 30m							Vacation	
J. Macias-Perez	LPSC	Family	Kenia or 30m							Family	Plane
M. Calvo	IN	Truck	Kenia or 30m							Truck	
P. Camus	IN	Truck	Kenia or 30m			???	???	???	???	???	
N. Ponthieu	IPAG	Plane	Kenia or 30m							Granada	Plane
F-X. Desert	IPAG	Plane	Kenia or 30m							Plane	
S. Leclercq	IRAM	Plane	Kenia or 30m							Granada	Plane
R. Zylka	IRAM	Plane	Granada			Pico Veleta (30m rooms)				Granada	Plane

IRAM Spain: A. Sievers (AOD), others for installation and support

14 rooms at the telescope:
- 8 rooms taken by Granada staff
- 2 rooms taken by heterodyne pool visitors
- 1 room taken by RZ
- 3 rooms to be distributed with double occupancy: AB, PhC, MC, FXD, NP, JMP, SL

➔ 7 persons for 3 rooms is too much: we will decide on site who will stay at the telescope and who will go at the Hotel Kenia (Javier has already booked several rooms).

Contact and phone list:

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Planning of the test run

- Mon 28, May Arrival of truck with MC, PhC and at the telescope. Arrival of AB, FXD, NP, JMP, SL and RZ in Granada.
- Tue 29 3 - 4 hours access cabin: mount NIKA in cabin and cryocooler in spiral room.
- Wed 30 Cool down
- Thu 31 ~ 2 hours telescope time required for test and preparation (alignment…)
- Fri 1 – Tue 5, June On sky observations: 4 slots of 6 hours each.
- Tue 5 NIKA staff leave the telescope, NIKA prototype stays in place.

The 4x6 hours of observing time should contain Mars or Uranus or Neptune. We would perform the standard pointing, focus and map sequences on planets, quasars and faint source to assess the pointing and photometric calibrations, the focal plane geometry and beam maps, then the sensitivity. For best calibration some calibration scan will use the wobbler.
Optionally, if the weather allows it, we could do another pointing model session, in order to prepare the Run5. This Run 5 would be submitted to IRAM depending on the output of Run4. It would be more concentrated on astronomical qualification and could happen late in the Autumn 2012.
Total telescope time requested including installation: 30 hours.

Preparation of the run

In lab The questions below haven't been answered by the NIKA team because of busy lab work.

REMINDER FROM RUN 3 OUTCOME MEETING:

- **RF_dIdQ not good with big derivative** ➔ is it necessary to keep it in the data ?

- **PF should be** almost **perfect** ➔ **We need a proof** that PF is really reliably proportional to the incoming signal, with simulated data, and lab data.
- **Need to improve the software** (use run and lab data to test the software).
- **Electronic cross-talk** ➔ is it OK now ?
- **Focal plane distortion (unexpected central beams broadening)** ➔ apparently a combination of real optical effect and acquisition software default (RF), but no demonstration of this hypothesis; this will certainly stay a mystery, hopefully with the new optics and improved software this phenomenon will disappear.
- **Detector cross-talk** to be minimize through improved design. ➔ what's the status for the run 4 arrays ?
- **Plateau: need experiment in lab** to characterize it and find the best set of parameters **such that this effect disappears** while the response and sensitivity stay high (eg: changing gain). ➔ Status of the experiment in lab ? Note from RZ analysis: the "plateau" problem seems linked to beam broadening problem.

Receiver cabin

1. Protect GISMO (bubble plastics warp, bars… ?).
2. Get the anti-vibration table on a support stand at the place foreseen: see AB's pdf drawings, and SL's SketchUp (the sketchup is illustrative, the correct sizes should be obtained from AB). Check the shock absorbers.
3. Get the new position of M4 ready for NIKA: file the back of the mirror and/or the foot to allow reflecting the beam downward at 46 degrees from the horizontal axis. If this is not time consuming to drill the hole on the M4 mount disc to block the mirror at this new position, it may worth to wait and do it in real time during the installation of NIKA in case the positioning requires some unforeseen offset with respect to the drawings.
4. Compressed air feed line (few mm diameter tubes) to plug on the NIKA cryostat.
5. Helium gas feed line with a pressure regulator at 0.5 to 1 bar.
6. Water supply and He hoses for the cryocooler compressor in the cable spiral room.
7. 6 x 25 liters filled liquid nitrogen bottles in the cabin, no liquid He supply
8. If possible: access to a 380V three-phase socket and have a corresponding plug (to be mounted on a NIKA cable).
9. Presence of somebody authorized to manipulate M3 for alignment during the access time slots to the cabin of the first 3 days.

Network

10. Check the cabin to control room ethernet cabling system from run 3 is still usable (one optical link at 1Gb/s plus one 100Mb/s cable as backup).
11. Reserve 3 or 4 permanent IP addresses on the IRAM network for NIKA (see the NIKA network structure below).

NIKA network structure:

1) In the cabin, a 8 ports switch allowing to connect on the local network:
- The pumping group automat with the associate MMR3
- The Roach board A (monitor, console & SSH network)
- The Roach board B (monitor, console & SSH network)
- The Synthesizer A
- The Synthesizer B
- A plug available for a laptop used for tests during the installation/tuning phase

2) In the computer room, on the optical fiber port:
- A switch allowing to distribute:
  one line to the cabin (optical fiber)
  one line to the control room
  one line to the Cisco router
  one line to the Sami computer
- The NIKA Cisco router connected on one hand to the NIKA local network switch and on the other hand to the IRAM network with a fixed IP
- One Linux PC (Sami) connected on one hand on the local network via the NIKA switch, and on the other hand on the IRAM network with a fixed IP

3) In the control room:
- A 5 ports switch to distribute the NIKA local network
- A PC Windows to control the cryogenics connected to the local network
- An acquisition Mac connected to the local network and possibly to the IRAM network

The router may be configured to forward the access from outside to the PC in control of the cryogenics.
The acquisition Mac does not necessarily need to be accessed from outside.
It takes at least two fixed IP numbers in the IRAM network, 3 would be better, allowing access to the acquisition Mac from outside.
We could also potentially double the acquisition Mac.

Data acquisition and processing

For this run in June NIKA will not be incorporated in the telescope system (eg: NIKA receiver with its own pointing model in NCS and available in PaKo). However Hans informs that Granada plan to offer this upgrade for the next run (fall 2012 or later).
In any case the EMIR pointing model will be used as the default starting point.

The FTP server for the NIKA data will certainly be used, but not sure for the VNC connection; we will see once at the telescope.

Beside the usual OTF mode, we will try to have a wobbler mode for pointing and focus (cross-shaped scan) calibration.

IRAM can provide information on the wobbler phase (analog TTL signal, rectangular) and on the blanking time via coaxial cable, in the receiver cabin and in the control room. Note that the blanking signal had not been used by MAMBO2.
Alain has modified Camadia (the NIKA control software) to treat correctly wobbler data.
We expect that interfacing the wobbler mode with NIKA and the production of data files with this additional information should not be a problem. The most difficult will probably be the modification of analysis tools to handle this data.

The data acquisition and the data formatting software should create all the necessary data format after each scan, including IMBFITs (if possible with optimized file size, using integers when possible, avoid tables of zeros, redundant information, etc.) readable by the MOPSIC version modified for NIKA. A new raw-to-fits soft has been written by the NIKA team. The IMBFITs format that Xavier, Albrecht and Robert will use is a modification of the version 9 defined during the last months run 3 processing period, which will include the wobbler information. This has not been fully defined yet, but it will be done at the telescope.

The question was raised whether it be useful and feasible to have 2 instances of MOPSIC: one that Robert will use for data processing, another one available to the NIKA data team to learn from MOPSIC scripts? The answer is no: the only version of MOPSIC customized to be used with NIKA available will be the one used by Robert.

We will try to develop at the telescope an automated logbook generating webpages.

Observation goals: Geometry (pixel maps), Pointing model, Lobes structure, Sensitivity for strong to weak point sources and extended sources, Study of sky noise. Meander mapping with no on-off is the default, but also probably also other observing modes (cross-pattern focus and pointing, Skydips…).

Reminder from previous prep run:
Procedure to reach the best calibration level possible:
(- Creates the entity **NIKA in the NCS**.)
- Start with a pointing model copied from another receiver (e.g. MAMBO 2).
- Use the standard procedure of pointing (cross scans, and 3 points focus).
- **Map** a point source to know the **geometry of the array** (in sky).
- Take few hours to observe many **pointing references** (quasars).
- Transfer the data into **IMBFITS**.
- Calculate the NIKA pointing model (Robert will treat IMBFITS with **Mopsic**).
- Implement the **pointing model into NCS**.
- Do a pointing on a reference nearby a source regularly and focus some time to time (very rough indication: every 1h +/-30m for pointing and 2h +/- 1h for focus depending on observing conditions…).