IRAM 30-meter Telescope

Observing Capabilities and Organisation

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This document is updated twice a year to reflect the current capabilities of the 30-meter telescope at the time of the Call for Proposals publication. Non-trivial changes with respect to the previous version are marked in red. Note that this document contains active links marked with a `different font` for an easy access to documentation, e.g. `IRAM web pages`. The full links are also given on the last page of this document.

Contents

1 The Telescope

This section gives a brief description of the 30-meter telescope characteristics. More information is available on `the 30-meter homepage`.

The new servo system installed in 2023 enables the telescope to track sources to higher elevations than in the past, up to an elevation of 88.5°. The maximum on-the-fly scanning speed has been set to $200''$/s which holds for all elevations up to 83.5°. At higher elevations the maximum speed is gradually reduced reaching $35''$/s at 88.5° elevation. Additionally, the newly painted primary surface has allowed the sun avoidance radius to be set to 5°.
For inquiries regarding the 30-meter capabilities, users are invited to reach out to the Science Operations Group at sog@iram.es .
The telescope blind 1σ rms pointing accuracy is better than $3''$ [3]. This is improved to $1''$ or less by regular, local pointing scans on quasars or planets. Observers are recommended to check the telescope pointing every 1 to 2 hours, depending on frequency, and the focus values every 2 to 4 hours and at sunrise/sunset.
Main beam efficiencies to be used for calibration of data taken from September 2024 onwards

are available on the wiki page of `30m telescope efficiencies`.
The listed point source sensitivities are valid for about 50° elevation. For the gain elevation dependence see [7, 8].
NIKA2 uses primary and secondary calibrators, which are observed througout the observing runs every couple of hours. Its calibration is described in [9].

2 Frontends

2.1 EMIR

Overview: The spectral line receiver EMIR (**E**ight **MI**xer **R**eceiver) operates in the 3, 2, 1.3 and 0.9 mm atmospheric windows (Fig. 1). These four bands are designated as E 090, E 150, E 230, and E 330 according to their approximate center frequencies in GHz. Each band provides two orthogonal linear polarization channels tuned to the same frequency as they share a single common local oscillator. The eight individual receivers of EMIR are aligned to better than 2″ between bands and better than 1″ between polarizations of any one band. All EMIR bands are equipped with dual sideband (2SB) mixers that offer 8 GHz of instantaneous bandwidth per sideband and per polarization (Fig. 2).
Table 1 lists the main characteristics of the EMIR receiver. A thorough description of the EMIR receiver is available in Carter et al. [12], and its users guide is available at the `EMIR homepage`.

Selection of EMIR bands: A set of warm switchable mirrors and dichroic elements are used for combining EMIR beams, or for directing the beams towards calibration loads.
In its simplest configuration, the warm optics unit selects a single EMIR band for observation. This mode avoids the use of dichroic elements and therefore offers the best receiver noise temperatures.
In its dual-beam configuration, the dichroic mirrors combine the beams of two receivers such that they look at the same position on the sky and have the same focus values within 0.3 mm. The following band combinations are possible: E 090 and E 150, E 090 and E 230, or E 150 and E 330 (see Tab. 1). The combination of bands is not polarization selective, i.e. the combined beams will stay dual polarization. The loss of the dichroic mirrors, which is small over most of the accessible frequency range, increases however the receiver temperatures by 10–15 K.
EMIR band edges are given in Figure 2 and Table 1. The lowest frequency that can be tuned at the center of the lower outer 4 GHz band of E090 is 72.68 GHz. The lower edge of the FTS at 50 kHz resolution is at 71.72 GHz allowing e.g. observations of the DCO^+ 1–0 line at 72.039 GHz. The frequency range of E 150 extends to 184 GHz with good performances of receiver temperatures and sideband ratios, but the calibration around the atmospheric water line at 183.31 GHz requires special care.
The width of the sidebands is 8.1 GHz covering the frequency range from 3.95 to 12.05 GHz with the FTS at 200 kHz resolution. This range is larger than the 7.9 GHz gap between the sidebands, and allows continuous coverage of 32 GHz.

Calibration Considerations: EMIR has its own calibration system. The external warm optics provides ambient temperature loads and mirrors reflecting the beams back onto the 15 K stage of the cryostat. This system has proven to be very reliable and constant over time. The absolute calibration accuracy is around 10% or better depending on the band considered.
All EMIR bands are equipped with tunerless sideband separation mixers, allowing simultaneous observations of both sidebands in separate IF bands. These mixers have been characterized in the laboratory for their image rejection and are expected to have the same performance on site (about −13 dB).
Filters have been installed in the Local Oscillator (LO) chains of the EMIR bands E 090 and E 150 which successfully suppress unwanted LO harmonics that had caused ghost lines in the past.

Doppler–tracking and velocity scale: It is common practice at radio observatories to correct the frequency of an observation for the strongly time variable velocity of the Observatory with respect to the solar system barycenter. This guarantees that lines observed near the Doppler–tracked frequency, usually the band center, always have the correct barycentric velocity, independent of the time of observation. At the 30-meter telescope, the local oscillator and its synthesizers are constantly adjusted during observations to track the changing Doppler factor for the reference frequency [13].

Connection to backends: The IF transport system consists of eight IF cables, each with a 4 GHz bandwidth, thus providing a total bandwidth of 32 GHz. This bandwidth can be entirely covered by

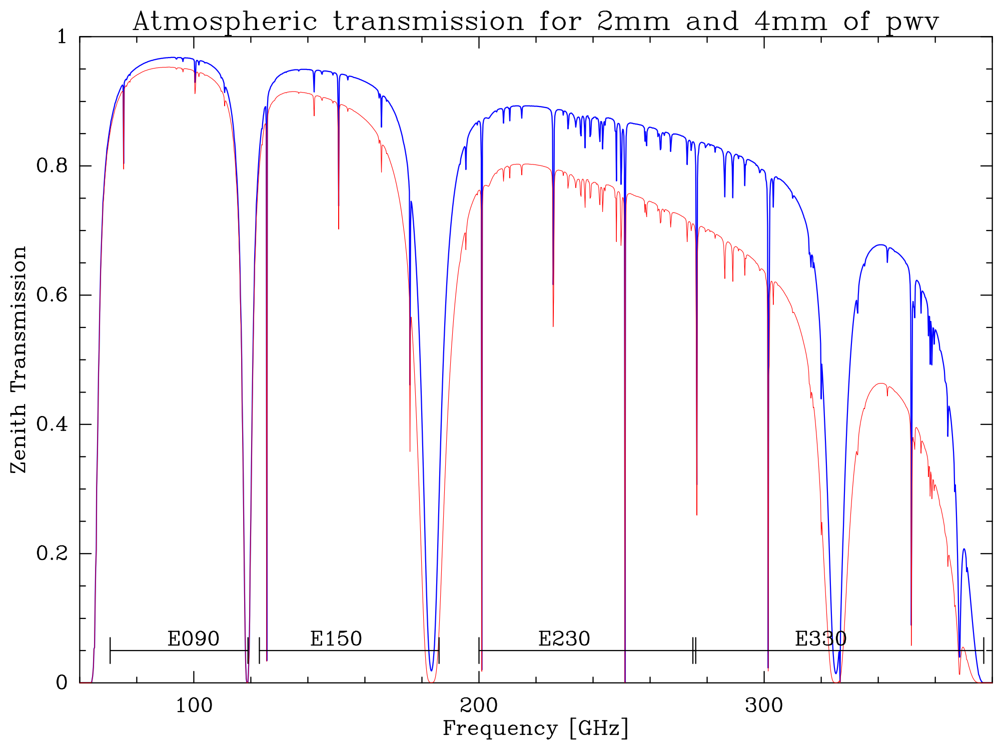


Figure 1: Atmospheric transmission at the 30-meter site between 60 and 380 GHz for 2 and 4 mm of precipitable water vapor, derived from the ATM model [1]. The EMIR bands are indicated.

Table 1: EMIR Frontend characteristics. The sky frequency range, F_{sky}, refers to the centers of the outer 4 GHz wide IF sub-bands. The lower (LSB) and upper (USB) sideband frequency range is also specified. 2SB stands for dual sideband mixers, and H/V for horizontal and vertical polarizations. T_{sb} and T_{db} are the SSB receiver temperatures in single– and dual–band observations, respectively, with T_{db} including a 15 K noise contribution from the dichroics. G_{im} is the image band rejection. E0/2, E1/3, and E0/1 stand for the possible band combinations E090/E230, E150/E330, E090/E150. The upper E 330 limit is 375 GHz using the installed YIG Local Oscillator. The fallback option is a Gunn Local Oscillator with 350 GHz upper frequency.

EMIR band	F_{sky} GHz	mixer type	polari-zation	bandwidth GHz	T_{sb} K	G_{im} dB	combinations E 0/2	E 1/3	E 0/1	T_{db} K
E 090	72.68 – 117	2SB	H/V	8	50	> 10	X		X	65
(LSB)	*73 – 97*									
(USB)	*89 – 117*									
E 150	125 – 184	2SB	H/V	8	50	> 10		X	X	65
(LSB)	*125 – 168*									
(USB)	*141 – 184*									
E 230	202 – 274	2SB	H/V	8	80	> 10	X			95
(LSB)	*202 – 263.5*									
(USB)	*217 – 274*									
E 330	277 – 350 (375)	2SB	H/V	8	80	> 10		X		95
(LSB)	*277 – 335*									
(USB)	*293 – 350 (375)*									

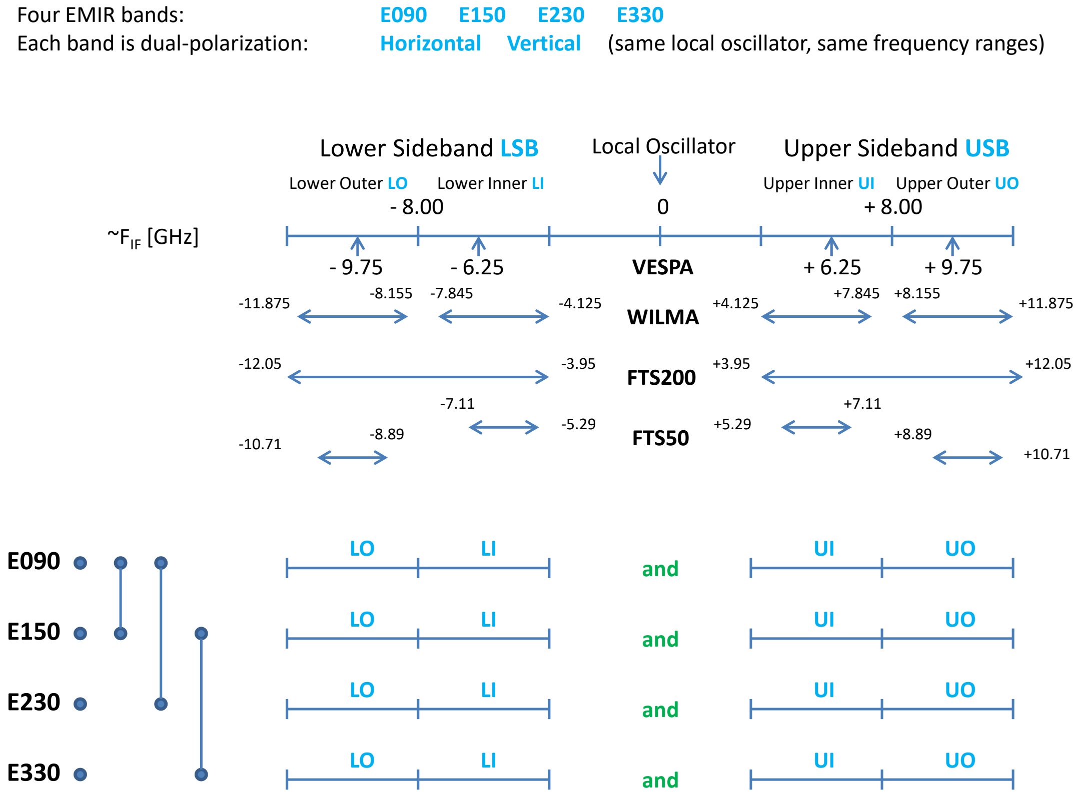


Figure 2: Visual overview of EMIR bands. Eight sub-bands can be transported to backends for a total of 32 GHz instantaneous bandwidth. Frequencies shown above the frequency scale indicate the central frequencies of the (sub-)bands. Frequencies at the sideband edges give the frequency coverage of the backends.

the FTS units, within limitations, at a spectral resolution of 200 kHz (see the backends section below for details).
An **IF switch box** in the receiver cabin is used to select 8 EMIR channels of 4 GHz bandwidth each. The design of the box allows the selection of all commonly used combinations of EMIR bands. A detailed description of the (im)possible sub-band combinations is available on the `EMIR homepage`.

ASTRO: EMIR frequency setups can be prepared using a set of commands in `ASTRO\PICO`. These take into account the available frequency limits, band combinations, and spectrometers, and plot the covered frequency ranges together with known spectral lines, taking into account source velocities or redshifts. Examples are given on the `GILDAS home page` under tutorials - ASTRO, but see also the help within ASTRO.

The following procedure gives an example:

```
observatory PICO 2021
set lines on
set frequency rest IF1
EMIR 72.68 LO
baseband
backend FTS NARROW
```

2.1.1 Radio Frequency Interference (RFI)

Observations may be affected by spurious signals from car radars. A search for such signals in the 76-77 GHz band and in EMIR spectra taken between 1/2020 and 10/2025 was conducted [11] to investigate the scope of this RFI. Averaged over this period, 2.3% of the data show the signature of car radars. The amount of affected scans is increasing in more recent years. All switching modes are affected.

Averaged spectra and waterfall plots provide examples of the spectral shapes of these interferences.

This RFI lies close to the interstellar DNC 1-0 line at 76.306 GHz, but may also hinder deep integrations on high-z sources. In case RFI is seen, it is advised to contact the Astronomer on Duty or the Science Operations Group at sog@iram.es .

2.2 NIKA2

NIKA2 is a dual-band camera working simultaneously at 1 and 2 mm wavelengths. It comprises three arrays of Kinetic Inductance Detectors (KIDs), 2×1140 pixels at 1 mm and 616 pixels at 2 mm. NIKA2 images an instantaneous circular field-of-view (FoV) of $6.5'$ in diameter. It exhibits half power beam widths (HPBW) angular resolutions of $\sim 11.1''$ and $17.6''$ at respectively 1 and 2 mm. Calibration strategies and commissioning results have been published in [9]. See the `NIKA2 homepage` which also links to the observing time estimator.

Information on the observing modes offered for NIKA2 and examples of the observing scripts is given `here`. In particular, it is in general recommended to make sure that the **scan sizes along the scanning direction** are large enough, i.e. **at least:** `FoV + 2×HPBW + (source size above the noise) + (2s * scan speed)`. The third term in the sum makes sure that KIDs instabilities are properly corrected by data reduction. The fourth term is added because known tracking deviations of the 30-meter telescope can hinder the quality of data records, up to 2s after the beginning of each sub-scan. Perpendicularly to the scan direction, there is no minimum size limit. Note that the size computed in this way is the `Delta(x)` described in the exposure time calculator documentation, and not the size of the final map. The latter is larger by one FoV size.

A measure of the overall stability of atmosphere and instrument is provided by the peak-to-peak variations of the timeline signal from the sky which is displayed by the online quick look data reduction software (cf. `piic tutorial`). See examples `here`). Observers may want to monitor stability to add this information to the scan entry in the `TAPAS data base`. The sky noise on a clear sky at 2 mm on science scans can show peak-to-peak variability between rather stable conditions of $\sim \pm 2$ Jy/beam and instable conditions of ± 10 Jy/beam and more. However, these fluctuations are seen by all pixels and are to a large degree calibrated out by common mode subtraction.

The quality of the resulting maps may also be impacted by pointing jitter due to anomalous atmospheric refraction [2].

NIKA2 was upgraded in March 2025. Dichroic, 1 mm detector arrays, thermal filters, and coated lenses have been successfully replaced. The 1 mm sensitivities have significantly improved owing to the enlarged bandwidths of the 1 mm arrays and the improved performance of the dichroic. Measurements of the noise equivalent flux densities (NEFDs) of the two 1 mm arrays in October 2025 result in a combined NEFD of 16 mJy$\sqrt{s}$. One of the 1 mm detector arrays (Array #3) was replaced in March 2026. Test observations indicate that the 1 mm NEFDs further improved, but still need to be confirmed. For now, the NEFD given above shall be used for the time estimates.

The new 1 mm bandwidths have been measured onsite with a dedicated Martin-Puplett interferometer and are available on the `NIKA2 homepage`. The 2 mm NEFD stays unchanged at 9 mJy$\sqrt{s}$. Test observations of the last months show a focus offset of 1.0 - 1.2 mm (along the sub-reflector's z-axis) between the 1 mm and the 2 mm arrays. The current observing rule is to focus the 1 mm array and accept a slightly broader and less efficient 2 mm beam. This issue is under investigation with an intervention currently planned for mid September 2026.

2.2.1 NIKA2 Polarimetry

Since the summer semester 2024, we invite proposals in open time for NIKA2 1-mm polarimetry. The polarimetry mode has been commissioned and the `piic` reduction software allows to create I, Q, U Stokes maps. The following quick overview of the polarimetry capabilities is based on the summary of the NIKA2 Pol commissioning report [10] and the updated `piic tutorial`.

NIKA2 polarimetry makes use of a half wave plate (HWP) rotating with 2.98 Hz in front of the entrance window of the cryostat thereby modulating the incoming signal. In addition, a wire-grid polarizer inside the cryostat splits the two 1 mm polarizations.

Before the upgrade in March 2025, it was confirmed that the NEFD in total intensity in polarimetry is comparable to the total power sensitivity reported in [9]. The sensitivity in polarization is better than in total power, with pre-upgrade values close to 20 mJy$\sqrt{s}$ in Q and U. After the upgrade, polarimetry tests are still pending. But it is expected that the Q and U sensitivities improved in a similar way as in total power (see above). The Q and U NEFD to be used for the time estimates is 16 mJy$\sqrt{s}$ as

assumed by the time estimator. Polarization angles are stable with a dispersion of less than about 5°.
To correct the Stokes maps for instrumental polarisation (IP) leakage of intensity to Stokes Q and U, it is recommended to regularly observe a non-polarized source like Uranus, ideally at the same elevation and focus as the science source. Specific instructions of the best cadence of observations are given at the telescope during the observing campaigns. The IP can be up to ±3% for compact sources. `piic` allows for correction of the IP. When observing in polarimetry and to avoid beam smearing, the scan speed shall not exceed 35-40″/s. Further advice for observers on how-to conduct polarimetric observations are available on the NIKA2 homepage `here`.

3 EMIR Backends

The following three spectral line backends can be individually connected to any EMIR band. Specific documentation on the backends available at the 30-meter telescope can be found on the `wiki pages`.

3.1 FTS

The Fast Fourier Transform Spectrometers, FTS, can be connected to EMIR. They consist of a series of 24 modules of Radiometer Physics [14, 15]. All FTS units work either at 200 kHz resolution or 50 kHz resolution. It is not possible to set them individually to different resolutions. At 200 kHz resolution, the 24 units provide 32 GHz of instantaneous bandwidth where each block of 3 FTS units covers a contiguous 4 GHz band of EMIR. At 50 kHz resolution, 3 FTS units cover the inner 1.8 GHz of the 4 GHz EMIR bands (see Fig. 2 for the exact frequency coverage).
Note that spectra may show platforming between the FTS units. For deep integrations on faint broad lines, it is recommended to use WILMA in parallel. The SOG at sog@iram.es may be contacted for advice.

3.2 VESPA

The Versatile Spectrometric and Polarimetric Array can be connected to EMIR. It is also used for polarimetry measurements (see Polarimetry section below). When connected to a set of 4 IF channels from EMIR, VESPA typically provides up to 12 000 spectral channels (up to 18 000 channels are possible in special configurations). Nominal spectral resolutions range from 3.3 kHz to 1.25 MHz. Nominal bandwidths are in the range 10 to 512 MHz. VESPA basebands can be offset from band center by up to ±250 MHz. The VESPA configurations and user modes are summarized in the VESPA users guide [25].

3.3 WILMA

The wideband autocorrelator WILMA consists of 18 units. Each unit provides 512 spectral channels at 2 MHz resolution covering a total bandwidth of 1 GHz. A subset of 16 units can also be connected to EMIR covering a bandwidth of 4×4 GHz. A technical overview of the architecture of WILMA is available `here`.

3.4 Continuum backends

The broad band continuum backend BBC with 8 GHz width, fully exploiting the bandwidths of EMIR, is available together with the narrow band continuum backend NBC of 1 GHz width. These continuum backends are mostly used for pointing and focus observations. They have been successfully used for flux monitoring observations of quasars (cf. e.g. [16]) and for observing in addition their linear and circular polarisations (cf. e.g. [17]). In a dedicated application, BBC has also been used for monitoring of pulsars (cf. e.g. [20]).

4 Special observing modes

4.1 On-the-fly

During the on-the-fly (OTF) observing mode, the telescope beam moves across the source at a constant velocity, while data are taken at a constant rate. Any scanning direction can be chosen and maps can be built up line by line. Individual lines can have any length. The maximum scanning speed depends on elevation. For NIKA2 it is currently the only observing mode. OTF is one of the observing modes with EMIR allowing for dump times as short as 250 msec.
The `NIKA2 time estimator` and the `EMIR time estimator` describe the optimum parameter settings for different sources and map sizes.
The conference paper [21] is providing a good introduction into spectral line (SL) OTF, after its commissioning, though receivers and the control system were changed in the meanwhile. A more elaborate technical report is also available [22].
Recent publications of OTF observations with the 30-meter telescope are, e.g., a NIKA2 paper on a

2 deg^2 survey of the Galactic plane [18] and an EMIR paper on ^{12}CO maps of nearby galaxies [19].

4.2 Frequency switching

Frequency switching is available for EMIR. This observing mode is of interest for observations of narrow lines where flat baselines are not essential. Frequency throws of 7.7 MHz or 15.4 MHz allow to reduce the standing waves of this observing mode. For a detailed report see [23]. This report also explains how to identify *mesospheric lines* which may easily be confused in some cases with genuine astronomical lines from cold clouds.

4.3 Wobbler switching

In wobbler switching mode the wobbling secondary reflector switches in azimuth between an ON and an OFF position. After one ON-OFF-ON-OFF-... cycle (i.e. after one subscan) the source is placed in the OFF beam by moving the telescope, resulting in two symmetrical OFF positions, each displaced by the beam throw from the ON position. Wobbler switching is an efficient observing mode for point-like sources like high-z quasars, i.e. sources smaller than the wobbler throw. This observing mode results in flat baselines, without any ripple in most cases.

- The maximum beam throw of the wobbler has been set to $\pm 100''$.
- The standard phase durations are 2 sec for spectral line observations and 0.26 sec for continuum observations.

Unnecessarily large wobbler throws should be avoided, since they introduce a loss of gain [4], particularly at the higher frequencies, and imply a loss of observing efficiency as the dead times increase.

4.4 XPOL

Polarimetric observations can be made using a dual–polarization band of EMIR connected to VESPA in a setup designated as XPOL [24]. XPOL generates simultaneous spectra of all 4 Stokes parameters. The following combinations of spectral resolution (kHz) and bandwidth (MHz) are available: 40/120, 80/240, and 320/480. More complex observing modes where VESPA is split into two bands are also possible (see the VESPA `user guide` [25]). A technical description of XPOL, along with sample observing scripts and beam maps, are available `here`.

XPOL profits from the performance of EMIR in several respects: smaller or negligible phase drifts, small and stable offsets between the two polarizations, and negligible decorrelation losses. The alignment between both polarisations of the 3 mm band E 090 is perfect after the installation of an orthomode transducer with a single horn.

The presence of polarised sidelobes makes observations of extended sources complicated as those sidelobes rotate with elevation, possibly because of the off–axis installation of EMIR. *Proposals for observation of extended sources should demonstrate that their observations are feasible in the presence of the known sidelobes.*

The 3mm instrumental circular polarisation has increased after the installation of new receiver cabin optics in April 2015 and after the installation of NIKA2 in October 2015. This can be calibrated in continuum observations, but hinders spectroscopic XPOL observations to measure the Zeeman effect. Details on the current status are presented `here`. Potential XPOL users are asked to contact the SOG (sog@iram.es).

4.5 VLBI

The 30-meter telescope is open for VLBI proposals. VLBI proposals for 3 mm shall be submitted via the NRAO submission tool. Links are provided at the `GMVA Website`. VLBI proposals for 1 mm shall be submitted via the pages of the `the Event-Horizon Telescope (EHT)` .

5 Data processing software

5.1 EMIR

`MRTCAL` is the `GILDAS`[1] software package calibrating spectroscopic EMIR data. For the moment, polarimetry (XPOL) and continuum (pointing, focus, skydip) data will continue to be automatically calibrated with `MIRA`.

`MRTCAL` was devised to give a higher calibration accuracy. In particular, the calibration is now a function of the RF/IF frequency with a determination of the calibration parameters, e.g., $T_{\rm sys}$, typically every 20 MHz. This particularly improves the calibration in the vicinity of atmospheric absorption lines. `MRTCAL` was also revised to be efficient and fast, in preparation of the arrival of the next generation of multi-beam receivers at the 30-meter telescope. The current speed limits are the reading and writing of

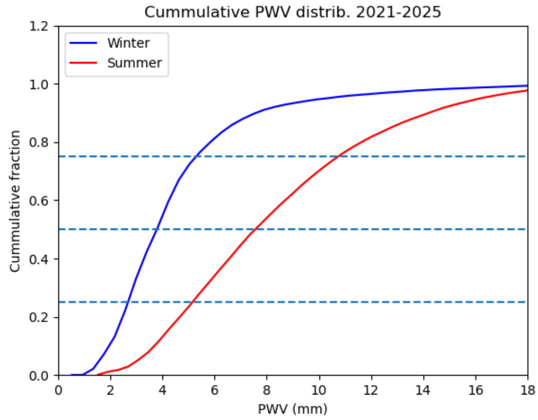
[1] http://www.iram.fr/IRAMFR/GILDAS

the data on disk. MRTCAL is able to calibrate data sets that do not fit in RAM memory.
MRTCAL documentation includes a quickstart tutorial, the user manual, the developer manual, and an overview document.
CLASS and GREG are the two main GILDAS software packages available for off-line data reduction of EMIR continuum and spectral-line data.

5.2 NIKA2

The PIIC-monitor software for NIKA2 is used as real-time monitor for a first data assessment, and in particular to display pointing and focus results. PIIC uses the most recent 225 GHz atmospheric opacities measured by the taumeter to obtain a first, rough calibration to the Jy/beam scale.

PIIC is also available for offline data reduction. It can be downloaded via the PIIC home page. PIIC is part of GILDAS and is developed and maintained by IRAM. The code and calibration files (KID geometry, flux calibration factors, flagging, sky opacities, etc.) are regularly updated. It is recommended to check for new versions from time to time. A summary of the calibration accuracy for all science runs is also provided.
During an observing run, a preliminary set of calibration products will be made available for a first, quick reduction. However, it may take several weeks after a pool week, during which the calibration scans are analyzed, before final calibration products become available to the users.
As in the past years, the IDL data pipeline, which has been developed by the NIKA2 consortium, may be used for data reduction. However, there will be no IRAM user support for the IDL pipeline.
The instrumental bandpasses [9] are available on the NIKA2 home page together with typical atmospheric transmission curves.



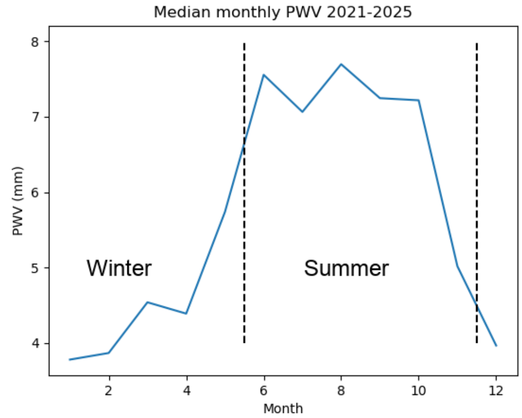


Figure 3: Amount of precipitable water vapor (pwv) derived from the 225 GHz taumeter at the 30-m observatory averaged over the period 2021 to 2025. **Upper plot:** Cumulative pwv distribution for the winter semester marked in blue (December to May) and for the summer semester marked in red (June to November). The dashed lines mark 25%, 50%, and 75% of the total time. **Lower plot:** Median monthly pwv. The dashed lines mark the boundaries of winter and summer semesters.

6 Observing time estimates

For summer semesters, proposers should base their time request on average summer conditions, corresponding to 7 mm of precipitable water vapor (pwv) while for winter semesters, proposers should base their time request on average winter conditions, corresponding to 4 mm of pwv. **Proposers requesting observations which need better than average conditions should add a careful justification.** Typically, only about 10% of the winter semester show values of less than 2 mm. The best four months are November to March where the median pwv drops below 5 mm (Fig. 3).
All over the year, conditions during afternoons can be degraded due to anomalous refraction [2]. The observing efficiency is then reduced and the flux/temperature calibration is more uncertain than the typical 10 percent.

6.1 EMIR

For EMIR, the concise on-line time estimator shall be used.

If very special heterodyne observing modes are proposed which are not covered by the Time Estimator, proposers must give sufficient technical details so that their time estimate can be *reproduced*. In particular, the proposal must give values for $T_{\rm sys}$, the spectral resolution, the expected antenna temperature of the signal, the signal/noise ratio that is aimed for, all overheads and dead times, and the resulting observing time.
Very demanding EMIR proposals, e.g. observations using E 330 above 300 GHz, or some very deep and/or high frequency continuum observations, will be observed with more flexibility in pool weeks.

6.2 NIKA2

The NIKA2 time estimator Python script is available on the `NIKA2 home page` together with a user document which gives several examples.

7 Proposal preparation

7.1 Technical pre-Screening

All proposals will be reviewed for technical feasibility in parallel to being made available to the members of the program committee. Please help in this task by submitting technically precise proposals. Note that your proposal must be complete and exact: the source position and velocity, as well as the requested frequency setup must be correctly given. Proposals for on-the-fly maps with EMIR or NIKA2 must provide information on the area to be mapped.

7.2 Duplication Check

In order to ensure the most efficient use of the 30-meter telescope, proposals are checked for duplication during the technical pre-screening. Unless scientifically justified, proposals that aim to reach the same goals as programs observed in previous semesters with similar or equivalent observing configurations with respect to target selection, observing frequency, angular resolution and sensitivity may not be accepted. Since September 2009, scan header data are made publicly available after a proprietary period of one year at the `Centre des Donnes astronomiques de Strasbourg (CDS) database` to allow for duplication checks. In case of doubts, users are kindly asked to contact the science coordinator, kramer@iram.fr .

7.3 Protected Fields

Investigators should take note of the following protections put in place for guaranteed-time observing (GTO) programs when preparing their proposals:

- The **NIKA2** protected GTO fields of the B-FUN polarimetry project, for which observations are ongoing, continue to be fenced against **new continuum driven** observations with NIKA2 and NOEMA.

  The field coordinates, sizes, and project abstracts are given on `the NIKA2 homepage`.

- Some of the **MIOP** observing sources and fields are still protected against any new observing requests for which the science goals are similar to those of the respective MIOP. The `MIOP homepage` gives details on the protected fields and provides the individual MIOP abstracts.

Possible conflicts between GTO programs and new proposals will be flagged during the technical pre-screening and may result in the (partial or complete) rejection of the proposal. Investigators are hence expected to check their target coordinates against the protected GTO fields. In case a conflicted source is wished to be kept it must be demonstrated in the proposal that the scientific goals are significantly different from the GTO programs.

8 Organizational aspects

8.1 General aspects – LST coverage

Over the past years, the 30-meter telescope has received an increased number of Galactic proposals aiming at the Orion and Galactic Center regions. The corresponding LST ranges 2h to 9h and 15h to 20h are oversubscribed, while the observing pressure is much less for the **LST range 10h to 15h** (Fig. 4).

8.2 Pooled observing

The pooled observing mode offers a flexible way of scheduling weather demanding projects. All NIKA2 projects and selected EMIR projects are scheduled in pool weeks. Contrary to the traditional scheduling where a fixed time slot is reserved in advance for a given project, pooled projects are scheduled dynamically during pool sessions, typically one week long, to better exploit the best weather conditions at the Pico Veleta. For instance, accepted EMIR high frequency ($\lambda \leq 1.3$ mm) proposals may be pooled

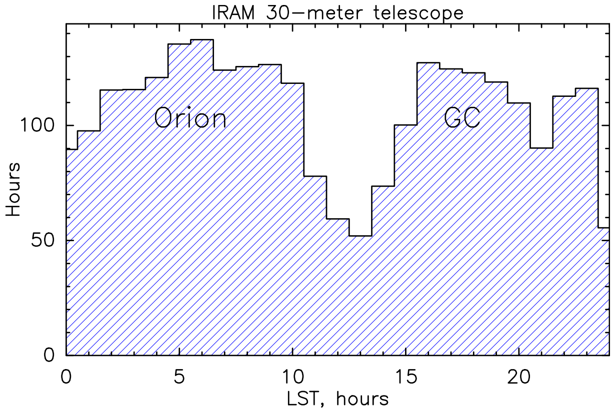


Figure 4: Number of requested observing hours of projects versus LST range for a typical, recent semester. The Orion and Galactic Center (GC) LST ranges are marked.

into the "1 mm weather" queue, in which case they would be observed when the atmospheric precipitable water vapor column (pwv) falls below 5 mm. Similarly, projects requesting less than 2 mm of pwv are usually pooled into the "best weather" queue. Heterodyne projects at 3 mm which are particularly weather-tolerant can be used as backup projects during pool sessions. They are observed when conditions are not suitable for higher frequency projects. A correct specification of the pwv on the technical summary page is therefore important. Pooled observations are offered since 2002 at the 30-meter telescope, and they have proven to be a very efficient and successful mode of observations.

Participation in the pools may be requested explicitly by ticking the appropriate box on the proposal form. The 30-meter science coordinator may also select projects that would benefit most from the pool scheduling flexibility, or are otherwise well suited to be included in the pools. Pooled observations should be simple and straightforward to carry out, using standard setups. For instance polarization measurements using XPOL are not appropriate for pool observing.

Projects participating in the pools will be observed by the PIs and Co-Is of participating pool projects. The organization of the observing pools is described in more details on the `IRAM 30-meter web site`. Questions concerning the pool organization can be directed to the science coordinator (kramer@iram.fr) or to the pool managers.

8.3 Service observing

To facilitate the execution of short ($\leq$8 h) programs, a "service observing" mode is available for some easy to observe programs *with only one set of tunings.* Observations are made by the local staff using precisely laid–out instructions by the principal investigator. For this type of observation, an acknowledgement of the IRAM staff member's help in the forthcoming publication is requested. In case of interest, this mode of observing should be specified as a "special requirement" in the proposal form. IRAM will then decide which proposals can actually be accepted for this mode.

8.4 Remote observing

`Remote observations` with the 30-meter telescope are routinely possible but restricted to experienced 30-meter observers. Observers who are new to the 30-meter telescope are required to come to the telescope for their first run(s). This will allow them to profit the best of their observing time and gain first-hand experience in close interaction with the support astronomer on duty and the operators.
In remote observing, the telescope is controlled in real time via vnc-viewers as described in a detailed user guide which is available via `this link` for internal users or on request. It is recommended to test the connections via the vnc-viewers a week or two in advance of the scheduled observing run, during office hours, but not on Tuesday maintenance days.

8.5 Local Contacts

The astronomer on duty may be contacted for any questions concerning the preparation of an observing run. The AoD schedule is available `here`.
The Granada astronomers (sog@iram.es) provide assistance with the preparation of proposals. Depending on the program complexity, IRAM may require an in-house collaborator.
Investigators of NIKA2 projects who require expert support in the implementation, execution or data processing of their project are requested to apply for a dedicated Local Contact in their proposal.

9 Miscellaneous

For more details on telescope and instrumentation, it is recommended to consult the telescope system summary `here`.
The applied calibration procedure for heterodyne observations is explained in a dedicated report [26].

A report describing calibration with `MRTCAL` is in preparation. More reports and publications related to the 30-meter calibration are compiled `here`.

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Links to online documentation mentioned in the text:

30-meter Web Pages:
`https://iram-institute.org/science-portal/30-meter-telescope/`

Schedule of Astronomers on Duty:
`http://www.iram.es/IRAMES/mainWiki/AstronomersOnDutySchedule`.

Telescope Efficiencies:
http://www.iram.es/IRAMES/mainWiki/Iram30mEfficiencies

The Proposal Management System PMS:
`http://oms.iram.fr/pms`

EMIR homepage:
http://www.iram.es/IRAMES/mainWiki/EmirforAstronomers

EMIR Backends:
http://www.iram.es/IRAMES/mainWiki/Backends

Polarimetry with EMIR (XPOL):
http://www.iram.es/IRAMES/mainWiki/PolarimetryforAstronomers

Time Estimator for EMIR:
https://www.iram.es/nte/

NIKA2 homepage:
http://www.iram.es/IRAMES/mainWiki/Continuum/NIKA2/

PIIC homepage:
https://publicwiki.iram.es/PIIC

Time Estimator for NIKA2:
https://publicwiki.iram.es/Continuum/NIKA2/Main#NIKA2_observing_time_estimator

GILDAS homepage:
https://iram-institute.org/science-portal/science-software/

CDS database:
`http://vizier.u-strasbg.fr/viz-bin/VizieR-3?-source=B/iram/`

TAPAS scan headers database (requires a project account):
https://tapas.iram.es/tapas/

VLBI/GMVA Homepage:
http://www3.mpifr-bonn.mpg.de/div/vlbi/globalmm/

VLBI/EHT Homepage:
https://eventhorizontelescope.org/for-astronomers/proposals.