IRAM NOEMA interferometer

Observing Capabilities and Current Status

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This document is updated twice a year to reflect the capabilities of the interferometer 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. on the `NOEMA web pages`. The full links are also given on the last page of this document.

Contents

1 Progress of NOEMA

1.1 News

Scientific observations at NOEMA were maintained at a high efficiency level since the beginning of the COVID-19 health crisis in March last year, including the lockdown periods in France. The commissioning of Antenna 12 is foreseen to start toward the end of the current summer observing semester. The yearly antenna maintenance period is expected to finish in early December 2021. NOEMA will be operated hence with an 11-antenna array at the beginning of the winter observing period and with a 12-antenna array as soon as the antenna maintenance period and the commissioning of Antenna 12 is completed. The extension of NOEMA's baselines to up to ∼1700 m is moving forward with an anticipated completion in fall 2022. A new correlator mode of *PolyFiX*, offering the entire bandwidth at a spectral resolution of 250 kHz, is currently being developed and might become operational early 2022.

2 Conditions for the next Semester

During the course of the winter semester, we plan to schedule three configurations in the eleven antenna array. As soon as the twelve antenna array is operational, requested observing times will be automatically adapted, whenever necessary and possible, to account for the increased number of antennas in the array. The scientific goals of each concerned proposal will thereby be preserved with respect to requested rms noise levels and uv-coverages.

A preliminary configuration schedule for the winter period is outlined in Table 1. Adjustments to this provisional configuration planning will be made according to the availability of all NOEMA antennas, commissioning requirements in the frame of NOEMA, proposal pressure, weather conditions, and other contingencies. The configuration schedule in Table 1 should be taken as a rough guideline, in particular for astronomical targets that cannot

Table 1: Configuration Schedule for the Winter period

Conf	Scheduling Priority
C	November – January
A	January – February
C	February – March
D	March – May

be observed during parts of the winter period because of sun avoidance constraints. The latter can be easily verified for each target using the GILDAS package ASTRO.

The winter semester is very well suited for high frequency (1 mm) and high angular resolution observations (see also Section 3.2) but a significant amount of time is available for lower frequencies (2 mm & 3 mm) and lower angular resolution observations. Please indicate in your proposal if your scientific targets allow for self-calibration and hence a more flexible scheduling. Observations in Band 4 will not be offered this semester.

Pressure will remain high for the upcoming winter semester in the 1 mm band using in particular the extended C- and A-configurations, so the submission of proposals for the 3 mm band and low 2 mm band is strongly encouraged (i.e., requesting observing frequencies below 150 GHz). We also greatly welcome science targets that can be self-calibrated and/or are circumpolar, both factors that allow for very flexible scheduling. The significant increase of proposals over the past few years, targeting in particular the popular deep fields such as COSMOS or GOODS-North, has resulted in much higher pressure factors for sources in the LST range between roughly 06h to 16h.

Due to uncertainties from the ongoing COVID-19 health crisis, no guarantee can be given to automatically carry over A-rated or started B-rated projects from the current summer observing semester to the next winter semester. However, we expect to complete a large majority of the started projects in the current summer semester. In case of a unfavorable evolution of the COVID-19 pandemic in the next months, the same rules will again apply for the upcoming winter semester.

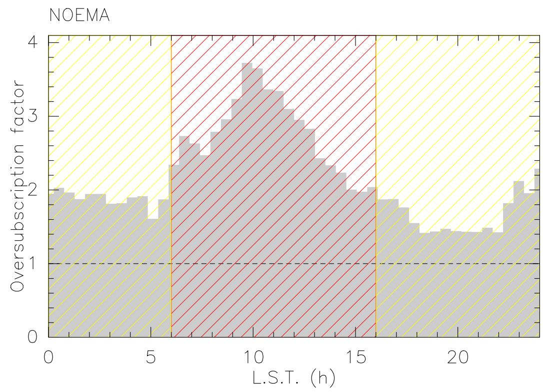

Figure 1: Oversubscription factor averaged over all NOEMA proposals of the past winter observing semesters.

Investigators who wish to check the status of their project may consult the `interferometer schedule` on the IRAM website, which is updated daily, or get in touch with the local contact of their project.

3 General Proposal Considerations

Please give high importance to the quality of your proposal. The NOEMA interferometer is a powerful, but complex instrument, and proposal preparation requires special care, especially in light of its new capabilities. In particular, your proposal should not only justify the scientific interest, but also the need for NOEMA. Proposers should note in their application whether the same or a similar proposal was or is intended to be submitted to another observatory, in which case a special justification is required to explain why NOEMA time is needed.

Do not hesitate to contact the NOEMA Science Operations Group (sog@iram.fr) in case of doubts and for questions related to the preparation of a proposal.

3.1 Proposal Category

Proposals should be submitted through `PMS` for one of the four categories:

STANDARD: Proposals that ask for a total of less than 100 h of observing time and for the standard capabilities of NOEMA's current status (see the following sections).

TIME FILLER: Proposals that can be considered as

Table 2: Winter configurations for eleven antennas

Name	Stations										
11D	W20	W12	W09	W05	E16	E12	E03	N17	N13	N09	N02
11C	W23	W20	W10	W05	E18	E12	E03	N29	N20	N11	N07
11A	W27	W23	W12	E68	E24	E18	E10	N46	N29	N17	N02

backup projects to fill in periods where the atmospheric conditions do not allow mapping, to fill scheduling gaps, or even to fill in periods when only a subset of the standard antenna configurations are available. These proposals will be carried out on a "best effort" basis.

SPECIAL: Exploratory proposals, whose scientific interest justifies the attempt to use the array beyond its guaranteed capabilities. This category includes for example non-standard frequencies for which the tuning cannot be guaranteed, non-standard configurations, special needs with respect to calibration and more generally all non-standard observations. These proposals will be carried out on a "best effort" basis. PIs interested in special programs should contact the Science Operation Group (sog@iram.fr) well before the deadline to discuss feasibility and observing strategies. Please select this category, if the proposal aims at using the new *PolyFiX* 250 kHz resolution full bandwidth mode. A clear statement should then be added in the Technical Justification of the proposal indicating as well whether or not this new mode is indispensable to reach the scientific goals of the proposal.

LARGE PROGRAM: Under the current Call for Proposals, certain restrictions still apply (see the `Large Program Policy` on the IRAM web site for general details). In the frame of NOEMA's construction, additional antennas and more capabilities of the correlator are expected to become available during the "lifetime" of a Large Program, usually spanning over several observing semesters. For the current Call for Proposals, the observing time request should be based on the availability and performance of **the eleven-element array**. We might adjust it and/or review the observing strategy in response to PI needs and enhanced array's capabilities. In addition, less than the standard 50% of the total scheduled observing time will be reserved for *Large Programs* using NOEMA at this point. This restriction is necessary to account for the significant investment of technical time still needed to bring the NOEMA project to its full completion in the upcoming years as well as the large number of already running GT[1] projects. PIs, who want to submit a new LP, are strongly encouraged to get in contact with us (sog@iram.fr) well before the deadline to discuss the observational feasibility of their LP.

The proposal category will have to be specified on the `PMS` web form and should be carefully considered by the proposers.

Within each of these categories, observations in Band 1, 2, and 3 can be requested which are described in more detail in Section 3.3 and in Table 3.

Short spacing observations on the 30-meter telescope should be directly requested on the interferometer proposal web form through `PMS`. A separate proposal for the 30-meter telescope is not required. The interferometer proposal form contains a box, labeled "Request for 30-meter short spacings" which should then be checked. The user will automatically be prompted to fill in an additional paragraph in which the need for short spacing data should be justified. It is essential to give here all observational details, including size and type of map, rms noise, spectral resolution, receiver, and time requested. The following documents may help to prepare your short spacing observations: `this Presentation` (especially page 23 for a brief summary) given at the 10th Interferometry School and `this Technical Report`. For further assistance, please contact the Science Operations Group (sog@iram.fr).
Please note that the the IRAM 30-meter telescope will start a major upgrade on April 1st, 2022 that will last till end of November 2022. Although short spacing observations will be accepted for NOEMA proposals for the upcoming winter observing semester, PIs should expect longer delays

[1] guaranteed-time

Table 3: Receiver characteristics

	Band 1	Band 2	Band 3
F_{LO1} range/[GHz]*	82.000–107.700	138.616–171.256	207.744–264.384
F_{sky} range/[GHz]*	70.384–119.316	127.000–182.872	196.128–276.000
T_{rec}/[K]**	25–45	35–55	40–70
G_{im}/[dB]	-15-...-10	-15...-10	-15 ... -10

* Guaranteed LO1 frequency ranges per offered band. The LO1 frequency is the center frequency between the USB and LSB that can both be simultaneously observed in one tuning (see Fig 2). The center frequency of the USB (LSB) is separated by +(−)7.744 GHz from the LO1 frequency. With an effective width of 7.744 GHz per sideband the lowest and highest sky frequencies that can be covered per tuning are therefore $F_{sky}=F_{LO1}\pm11.616$ GHz. The lowest and highest LO1 frequencies per band define the F_{sky} ranges that are guaranteed for this call.
** for LSB and USB.

than usual to carry out the short spacing observations at the IRAM 30-meter telescope which might not be scheduled before the end of 2022.

3.2 Array Configurations

Three main configurations (A, C and D) will be scheduled providing optimum coverage of the uv-plane (see Table 2).

The general properties of these configurations are (numbers refer to a source at 20° declination):

- `A` alone is well suited for mapping or size measurements of compact, strong sources. It provides a resolution of ∼ 1.0″ at 100 GHz, ∼0.4″ at 230 GHz.
- `C` provides a fairly complete coverage of the uv-plane and is well adapted to combine with D for low angular resolution studies (∼2.6″ at 100 GHz, ∼1.1″ at 230 GHz). C alone (∼2″ at 100 GHz, ∼0.9″ at 230 GHz) is also well suited for snapshot and size measurements, and for detection experiments at low source declination.
- `D` alone is best suited for deep integration and coarse mapping experiments (resolution ∼ 3.9″ at 100 GHz and ∼ 1.7″ at 230 GHz). This configuration provides both the highest sensitivity to extended structures and the lowest atmospheric phase noise.

The three configurations can be used in different combinations to achieve complementary sampling of the uv-plane, and to improve on angular resolution and sensitivity. Mosaicing is usually done with D or CD, but the combination ACD can also be requested (e.g. for high resolution mosaics). Check the Any bullet in the proposal form projects if the scientific goals can be reached with any of the three configurations or their subsets. There is a possibility on the `PMS` web form to restrict the choice of configurations, e.g., to C or D, if your project qualifies for Any of the more compact configurations. However, the Any bullet is only available if the "Point source detection" was selected for the respective technical sheet in `PMS`.

3.3 Receivers

All NOEMA antennas are equipped with 2SB receivers, providing low noise performance and excellent long-term stability. The receivers provide two orthogonal linear polarizations in all three bands. Each of the two polarizations delivers a bandwidth of 7.744 GHz in the lower sideband (LSB) and upper sideband (USB) simultaneously. The sky frequency ranges that can be covered in each band and further characteristics are given in Table 3.

Receiver tuning will preferentially be done on a fixed LO frequency grid of 500 MHz step width on which the receiver performance is optimized. Tunings that deviate from this tuning grid (see also Section 3.4.1) are still allowed but an explanatory statement should then be added to the "technical justification" in the proposal.

3.4 PolyFiX

PolyFiX can process a total instantaneous bandwidth of ∼ 31 GHz for up to twelve antennas that is split up into two polarizations in each of the two available sidebands (the *upper* and *lower* sideband). The centers of the two 7.744 GHz wide sidebands are separated by 15.488 GHz. Each sideband is composed of two adjacent *basebands* of ∼3.9 GHz width, called *inner* and *outer* baseband (see Fig. 1). In

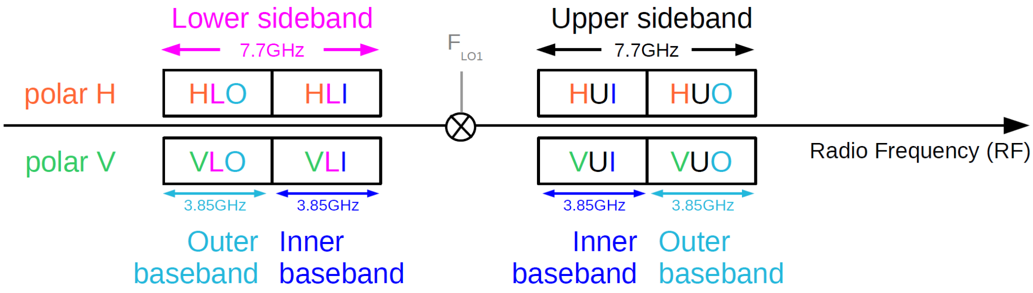

Figure 2: Basebands fed to the correlator

total, there are thus eight basebands which are fed into the correlator. The channel spacing is 2 MHz[2] throughout the 15.488 GHz effective bandwidth per polarization. Simultaneously to this low resolution mode, up to sixteen high-resolution *chunks* can be selected in each of the eight basebands (i.e. up to 128 chunks in total). Each of these has a width of 64 MHz and, in the current implementation step of *PolyFiX*, a fixed channel spacing of 62.5 kHz[2]. A number of contiguous chunks defines one *spectral window (SPW)*.

A new correlator mode of *PolyFiX* is currently being developed that, upon successful implementation, will be offered at shared-risk for the upcoming winter semester. Similar to the low resolution 2 MHz correlator mode, it will provide the full 7.744 GHz bandwidth per sideband in dual polarization but at a significantly increased spectral resolution of 250 kHz. The new mode cannot be combined with the very high spectral resolution windows at 62.5 kHz spacing. Proposals that want to take advantage of the new 250 kHz resolution full bandwidth mode should clearly state so in their Technical Justification and select the "Special" proposal category in `PMS`. The proposal should also clearly explain in the Technical Justification whether all (or most of) the proposal's scientific goals depend on the availability of the new correlator mode of *PolyFiX* or it can be (at least partly) done with the standard correlator mode.

Please note that there is a "non-exploitable, 20 MHz wide frequency area" (≡ LO2 zone) around the center of each sideband, i.e., in between the inner and outer basebands. Due to the filter response of the correlator, the noise level is also increased by up to a factor of two within a width of ±50 MHz around the center in each sideband. Important lines should therefore not be placed in this region (see also pages 19 and 20 in `this PolyFiX tutorial`).

The observations of very strong, steep-sided spectral lines require special care in the choice of the spectral resolution. The so called spectral leakage[3], a numerical effect inherent to the spectral processing using discrete Fourier transforms (FFT), shows up as e.g. spurious wings for sharp spectral features (like galactic maser lines); sharp in this context means that the ratio between the noise and/or emission levels in adjacent channels attains −13.3dB (i.e., ≃0.05). These strong lines should hence be observed with the highest currently offered spectral resolution of 62.5 kHz to minimize this effect. In case of questions, please do not hesitate to contact the NOEMA Science Operation Group (at sog@iram.fr).

3.4.1 ASTRO

For simple spectral *PolyFiX* setups using only the 2 MHz or the new 250 kHz spectral resolution full bandwidth mode, `PMS` can be used directly to prepare the frequency tuning and correlator setup of the respective technical sheet. However, for more complex setups especially those using high spectral resolution windows or those needing an off-grid tuning, the software ASTRO should be used to set up the receiver and correlator configuration. A description of the *PolyFiX* correlator and of the commands provided in ASTRO to prepare the correlator configuration can be found in `this PolyFiX tutorial`. Please use the `jul21b` version (or later) of GILDAS.

The essential ASTRO commands are:

- `TUNING`: receiver tuning

[2] due to default signal apodization with a sinc^2 function, the effective spectral resolution is 1.772 times the channel spacing.

[3] PolyFiX uses a triangular (Bartlett) weighting function causing artificial peak sidelobes at a level of −13.3dB in neighboring channels which is called spectral leakage.

- `BASEBAND`: selection of baseband(s)
- `SPW`: selection of chunks to define high resolution spectral windows
- `PROPOSAL`: exports a script that needs to be uploaded to `PMS`

Receiver tuning is done on a fixed grid of LO frequencies, spaced by 500 MHz throughout each receiver band, on which the receiver performance is optimized. For a correct receiver tuning, either the source LSR velocity or the redshift is needed or the (red)shifted frequencies should be used directly. In the latter case, the LSR velocity (or redshift) has to be set to zero in the source command. Also, the frequencies of molecular lines from the standard line catalogue in ASTRO that can be plotted over the spectrum (by setting `set lines on` in ASTRO) have to be redshifted by hand, i.e., a revised molecular catalogue needs to be uploaded in ASTRO (with `catalogue myfile.lin /LINE`). For more details see the internal help for the different ASTRO commands and `this PolyFiX tutorial`.

A typical session in ASTRO would be:

```
! Define a source with LSR velocity
SOURCE MYSOURCE EQ 2000 09:11:39.786 -
                   30:53:29.257 LSR 7.0

! choice of receiver tuning
TUNING 232.686 LSB 7500
! ASTRO will shift the IF centering by
! 180.6MHz to match the tuning grid
! unless the option /FIXED_FREQ is used
! that allows off-grid tunings

TUNING 232.686 LSB 7319.4 /ZOOM
! Plots the selected receiver band only

BASEBAND /MODE 2000 62.5
! select all 8 basebands in the low
! 2MHz resolution mode, allowing to
! define in addition the high spectral
! resolution windows at 62.5kHz

! define and display high resolution
! spectral windows (central frequency
! and width specified)
SPW /FREQUENCY 244.9 0.2
SPW /FREQUENCY 245.6 0.2
SPW /FREQUENCY 232.686 0.03
SPW /FREQUENCY 230.538 0.08
SPW /FREQUENCY 231.15 0.3
!
!
! Or for the 250kHz mode alone use
! BASEBAND /MODE 250
...

PROPOSAL /FILE MyFile.astro
! write the series of commands
! to set up the instrument;
! THE MyFile.astro NEEDS TO BE
! UPLOADED TO PMS
```

The `TUNING` command produces a plot showing the full 15.488 GHz bandwidth covered by both sidebands. The TUNING command checks that the LO frequency is located on the 500 MHz-spaced tuning grid. If this is not the case, the command moves the tuned frequency to a neighboring IF center frequency that matches the grid. The option /FIXED_FREQ can be used to ignore the tuning grid (e.g., if using the tuning grid does not cover all desired lines with the proposed tuning or if a contiguous spectral scan is requested).

`PMS` will only accept to load ASTRO scripts created with the PROPOSAL command (which uses the NOEMA OFFLINE syntax). This will allow `PMS` to show spectral coverages in a consistent way for any kind of projects (including line markers at the correct rest frequency for redshifted sources for instance).

In order to select the 250 kHz resolution full bandwidth mode, you may want to use in astro:

`BASEBAND /MODE 250`

as described above. However, this new mode cannot be combined with any high spectral resolution windows at 62.5 kHz channel spacing. Also, all eight basebands need to use the same correlator (full bandwidth) mode in this implementation step, i.e., a mixing between the 250 kHz and the 2 MHz resolution modes is not possible in the first year of its implementation. The new 250 kHz resolution full bandwidth mode will be offered, if it becomes available during the upcoming winter observing semester, at shared-risk and on a best effort basis only .

Please note that all ASTRO setups used for proposals in semesters S21 or older cannot simply be copied and need to be recreated for any new proposal in `PMS` or with ASTRO using the new syntax for the `BASEBAND` command and uploaded again to

PMS. PMS will not automatically upgrade ASTRO scripts copied from an older proposal and will issue a warning if an ASTRO spectral line setup is uploaded using the old syntax. Please use the latest GILDAS version (jul21b or later).

In order to facilitate the preparation of line surveys or scans that need at least two contiguous frequency tunings in one band, ASTRO offers a new command called SPECSWEEP (see also this PolyFiX tutorial, pages 62 to 64):

```
! Define a source with LSR velocity
SOURCE MYSOURCE EQ 2000 09:11:39.786 -
                  30:53:29.257 LSR 7.0

! 2 tunings, starting at 78GHz, using
! the default (2MHz) full bandwidth
! correlator mode and creating 2 files
! (mysweep-1.astro, mysweep-2.astro)
! ready to be uploaded to a
! technical sheet in PMS
SPECSWEEP /NTUNING 2 78 /FILE mysweep

! OR

! 2 tunings, ending at 110GHz, using the
! new 250kHz resolution full bandwidth
! correlator mode
SPECSWEEP 250 /NTUNING 2 110 MAX
```

3.5 Sensitivity

Investigators will be asked in PMS to specify the requested telescope time for each Technical Sheet. Based on the NOEMA performance at the time of publication of this document, PMS calculates the corresponding 1 sigma point-source sensitivity *for one representative frequency*. The representative frequency has to be within the frequency range and for high spectral resolution projects within one of the high resolution spectral windows that are selected in the respective technical sheet. The representative frequency can be different from the actual tuning frequency. Please note, that due to the large bandwidth and the dual-sideband mode, the noise can vary significantly with frequency in the available frequency range. Especially, if one of the sidebands is close to a receiver band edge and/or in the wing of an atmospheric absorption line, significant differences in the noise can occur within and between the sidebands. This should be taken into consideration when setting the representative frequency for each tuning. Please note that PMS takes into account variations of the noise across the entire 15.488 GHz bandwidth to calculate the *continuum* sensitivity.

In order to facilitate the preparation of your proposals, an online sensitivity estimator is available on this link, which is identical to the one used in PMS. Please note that this online tool uses a number of approximations to keep it simple and user friendly. Some values (e.g., angular resolutions) have hence only indicative nature and are not guaranteed as such.

Investigators should specify and justify the telescope times and corresponding point-source sensitivities in the "technical justification" of their proposal. **Please verify that your numbers match throughout the proposal.**

3.6 Track-Sharing Mode

Each technical sheet, i.e. frequency tuning, can be connected to several sources in PMS. In case that sources, sharing the same tuning, are reasonably close to each other and need reasonably short integration times, PMS allows the PI to specify a track-sharing mode (please check the track-sharing box in the technical sheet in PMS), which will result in a lower overall telescope time due to reduced overheads. Please note that PMS will issue a warning should the maximum distance between the track-shared sources exceed the recommended 15 degrees for instance and/or should the number of track-shared sources be larger than 15. These limitations have been chosen, among other reasons, to allow for gain calibrators that can still be reasonably close to all sources, and to reduce observing overheads due to slewing and calibration needs. However, the feasibility of track-sharing is not guaranteed even if no warning is given by PMS. In particular, Doppler tracking will be done by default on the mean LSR velocity of the targets. Users should check that the spectral lines of the two targets with the highest velocity difference to the mean velocity will not move out of the selected frequency range, which is especially important with respect to the frequency coverage of selected high spectral resolution chunks. Therefore, special care has to be applied when configuring the spectral setup.

3.7 Source Coordinates and Velocities

The interferometer operates in the equatorial J2000.0 coordinate system. Please do not forget to specify the exact coordinates and either LSR velocities or redshifts for the sources. The source list must contain all the sources (and only those sources) for which observing time is requested. The list must adhere to the standard sexagesimal notation. Source coordinates and velocities must be correct: wrong or incomplete source coordinates are a potential cause for proposal rejection.

A later swap of targets is not foreseen for regular projects.

Please note that targets below a declination of −30 degrees are not observable from the NOEMA site as their elevations hardly exceeds ≥10 deg during a reasonably long LST range. Very low-declination sources between declinations of −30 and −25 degrees are very difficult to observe and they do not rise much above 10 degrees in elevation and suffer from heavy shadowing in the compact configurations; if you are considering to observe such a very low-declination source please contact the science operation group well before the deadline (at sog@iram.fr) to discuss feasibility and observing strategies.

3.8 Sun Avoidance

For optimal antenna performance, a sun avoidance circle is enforced at 32 degrees from the sun.

3.9 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.

3.9.1 Duplication Check

In order to ensure the most efficient use of the NOEMA interferometer, proposals will be 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 will not be accepted. Header information of PdBI/NOEMA observations between December 1991 and Mars 2020 (for this Call) can be found in the CDS VizieR catalogue (*Centre de Données astronomiques de Strasbourg*). In the future, PIs will be able to perform a duplication check of their proposals also against programs observed in more recent semesters. However, for this deadline we kindly ask PIs to contact the NOEMA Science Operations Group at sog@iram.fr in case of doubts concerning duplication of observing programs from the last two years.

3.9.2 Protected Fields

Investigators should take note of the following protections put in place for GT programs when preparing their proposals:

- The **NIKA 2** protected GT observing fields are fenced against **new continuum driven** observations with NOEMA; the field coordinates and sizes are given on this `NIKA 2 homepage link`
- All **MIOP** observing fields and sources are protected against any new observing requests for which the science goals are similar to those of the respective MIOP; click on the following `MIOP homepage link` for details on the protected fields and for the individual MIOP abstracts

Possible conflicts between GT 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 GT fields (see links given above) when preparing their proposal. The conflicted source(s) should be retracted or exchanged if science goals are identical with those of the GT programs. 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 GT programs. For the upcoming winter semester, `PMS` will issue a general information when uploading or adding new sources to the proposal. The informations includes the links to the list of the coordinates for each GT field, ordered by project name or RA.

In the future, a direct coordinate check will be implemented for these GT fields within `PMS`.

3.10 Non-standard Observations

If you plan to execute a non-standard program, please contact the Interferometer Science Operations Group (sog@iram.fr) well in advance to the deadline to discuss the feasibility and possible observing strategies. Non-standard observations are for example very large-field mosaics, projects that need special calibration (e.g., an RF bandpass calibration to better than a percent in order to detect a very weak line over a very strong continuum), or projects that target frequencies that may fall (slightly) out of the guaranteed tuning ranges (see Table 3).

4 Documentation

Documentation for the IRAM NOEMA Interferometer can be retrieved from the `NOEMA Documentation web page`. Detailed up-to-date information is currently only available in the description of the `Current NOEMA capabilities` (i.e., this document).

5 Local Contacts

A local contact will be assigned to every A and B rated proposal that does not involve an in-house collaborator. He/she will assist you in the preparation of the observing procedures and provide help to reduce the data.
Assistance (write to sog@iram.fr) is also provided before a deadline to help in the preparation of a proposal. Depending on the program complexity, IRAM may require an in-house collaborator instead of the normal local contact.

6 Data Reduction

Proposers should take the following into account with respect to the reduction of their data:

- Due to the COVID-19 pandemic, face-to-face data reduction visits are still put on hold at the IRAM Grenoble headquarters. Until the situation evolves favorably, data reduction will be only supported remotely and on a best effort basis. Please check our webpages for regular updates. Similar to face-to-face data reduction visits, the assigned remote reduction weeks must be respected and extensions can be granted only in well justified and exceptional cases. Due to the large amount of observations performed at NOEMA and the impossibility to support data reduction during the first lockdown period in France, a large number of unreduced projects has accumulated. Delays for data reduction may hence be longer than usual. Please get in touch with your local contact for further details.

- The remote data reduction schedule allows for a higher flexibility than face-to-face visits, but we still have to avoid the presence of more than two groups at the same time also for remote data reduction sessions due to the limited resources. Please contact us well in advance to organise your data reduction sessions.

- In certain cases, proposers can be provided with updates as their observations progress. This service does not replace a careful data reduction after completion of the project. Please contact your local contact or NOEMA's Science Operations Group (sog@iram.fr) if you are interested in observational updates.

- Given significant upgrades and developments of the GILDAS software, reduction of NOEMA data has to be currently done **using the most recent version of the GILDAS package CLIC on specific computers at the IRAM headquarters in Grenoble**. However, any post-reduction processing like mapping, cleaning etc. is possible with locally installed GILDAS packages (i.e., installed on non-IRAM managed computers) like MAPPING, CLASS or GREG.

Links to online documentation mentioned in the text:

NOEMA Web Pages:
http://iram-institute.org/EN/content-page-56-7-56-0-0-0.html

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

GILDAS Version jul21b:
http://www.iram.fr/∼gildas/dist/index.html

Online NOEMA sensitivity estimator:
https://oms.iram.fr/tse/#noema

Interferometer Schedule:
http://www.iram.fr/IRAMFR/PDB/ongoing-last.html

Large Programs:
https://www.iram-institute.org/EN/content-page-412-7-57-412-0-0.html

Large Program Policy:
https://www.iram-institute.org/EN/content-page-414-7-57-412-414-0.html

Interferometry School Presentation on Short-Spacings:
http://www.iram-institute.org/medias/uploads/file/PDFs/IS-2018/pety-mosaicking.pdf

Technical Report on Short-Spacings:
http://www.iram-institute.org/medias/uploads/IRAM_memo_2008-2-short-spacings.pd

PolyFiX tutorial:
http://www.iram.fr/∼gildas/demos/astro/demo-astro-noema.pdf

The CDS VizieR catalogue:
PdBI (data before 2016)
http://vizier.u-strasbg.fr/viz-bin/VizieR?-source=B/iram/pdbi
NOEMA (data after 2016)
http://vizier.u-strasbg.fr/viz-bin/VizieR?-source=B/iram/noema

NIKA 2 homepage link:
http://www.iram.es/IRAMES/mainWiki/Continuum/NIKA2/

MIOP homepage link:
https://www.iram-institute.org/EN/content-page-415-7-57-412-415-0.html

NOEMA Documentation web pages:
http://www.iram-institute.org/EN/content-page-96-7-56-96-0-0.html

Current NOEMA capabilities:
http://www.iram.fr/GENERAL/calls/w21/NOEMACapabilities.pdf