



European  
Southern  
Observatory



# ESO CALL FOR PROPOSALS

## P115

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Proposal Deadline:  
26 Sep 2024, 12:00 CEST



# **Call for Proposals**

## **ESO Period 115**

**Proposal Deadline: 26 September 2024,  
12:00 noon Central European Summer Time**

**Issued 22 August 2024**

The European Southern Observatory (ESO) invites proposals for observations at ESO telescopes during Period 115 (1 April 2025 – 30 September 2025). The conditions and policies for proposing for observations are outlined and linked in this document. The Call for Proposals follows the [ESO Optical/Infrared Telescopes Science Operations Policies](#) document.

Approved: -----

Xavier Barcons

*Director General*

*The preparation of the ESO Call for Proposals is the responsibility of the ESO Observing Programmes Office (OPO), with support from ESO staff throughout the organisation. This document is a fully linked PDF file with links that allow the reader to navigate within the document (internal links, in orange) or to open a web browser (external links, in blue). The Table of Contents is bookmarked within the PDF file. For questions regarding the preparation and submission of proposals to ESO telescopes, please contact the [ESO Operations Helpdesk](#).*

*ESO Call for Proposals Cover: Mafalda Martins  
ESO Call for Proposals Editor: Annalisa De Cia*

# Contents

<b>1</b>	<b>General terms</b>	<b>1</b>
<b>2</b>	<b>Information for this Period</b>	<b>3</b>
2.1	General	4
2.2	VLT	4
2.3	VLTI	5
2.4	La Silla	6
2.5	Restrictions to Large and Monitoring Programmes	6
2.6	Visitor Instruments	7
<b>3</b>	<b>Expected changes</b>	<b>7</b>
3.1	Instrumentation	7
<b>4</b>	<b>Practical guidelines</b>	<b>8</b>
4.1	Designing the observing runs	9
4.2	Exposure Time Calculators (ETCs)	9
4.3	Preparation of the observations	10
4.4	ToO programme execution	10
4.5	Specific information for VLTI programmes	10
4.6	Support to La Silla users	11
4.7	Monitoring in Service Mode	11
4.8	Pre-imaging	11
4.9	Calibration Plans	12
4.10	Data reduction software	12
<b>5</b>	<b>Definitions and policies</b>	<b>12</b>
5.1	Proposing team	12
5.2	Proposal types	12
5.2.1	Normal Programmes	12
5.2.2	Large Programmes (not offered in Period 115)	13
5.2.3	Monitoring Programmes	13
5.2.4	Guaranteed Time Observations (GTO) Programmes	14
5.2.5	Calibration Programmes	15
5.2.6	Director's Discretionary Time (DDT) Programmes	15
5.3	Run types and other proposal properties	16
5.3.1	Target of Opportunity (ToO)	16
5.3.2	Non-Member State proposals	17
5.3.3	Host State proposals	17
5.3.4	Joint VLT/I-ALMA proposals	18
5.3.5	Joint VLT/I-XMM proposals	18
5.4	Observing modes	19
5.4.1	Service Mode (SM)	19
5.4.2	Visitor Mode (VM)	20
5.4.3	Designated Visitor Mode (DVM)	21
5.5	Policy regarding offered/available observing configurations	22
5.6	Phase 2 Service Mode policy	22
5.6.1	Service Mode run prioritization	22
5.7	Observing programme execution	23
5.7.1	Target and setup changes	23
5.8	Data rights, archiving, data distribution	24
5.9	Publication of ESO telescope results	24
5.10	Press releases and other communication products	24
<b>A</b>	<b>Appendix. Scientific keywords</b>	<b>25</b>
<b>B</b>	<b>Appendix. Acronyms</b>	<b>29</b>



# 1 General terms

ESO proposals may be submitted by any group or individual. The Principal Investigator (PI) is the primary responsible for the proposal, on behalf of all co-Investigators (Co-Is), and may delegate certain privileges to a Delegated Principal Investigator (dPI). More information and policies on the responsibilities of the proposing team are described in Sect. 5.1.

All members of the proposing team are required to have an [ESO User Portal](#) account with updated email addresses, affiliations and scientific keywords. Affiliations are used to assess potential conflicts of interest in the review process.

Proposals are submitted via the [p1 proposal preparation tool](#). Co-Is can be added by submitting their User Portal email and will receive a notification when they are added to (or removed from) a proposal. An **application programming interface (API)** for the p1 proposal interface is now available (see the [p1 API Tutorial](#) webpage). Submitted proposals can be updated (un-submitted and re-submitted) until the deadline. Guidelines for the usage of the tool p1 and the proposal preparation are presented in Sect. 4 and on the [p1 introduction](#) webpage.

The **programme types** offered this period are Normal Programmes (including the joint VLT/I-ALMA and VLT/I-XMM proposals), Monitoring Programmes, Calibration Programmes and Director's Discretionary Time programmes. These are defined in Sect. 5.2. Large Programme proposals are invited once a year, and not offered in this call. ESO encourages the community to submit proposals for Normal Programmes requesting large amounts of time, up to 99.9 hours. ESO has been actively working to ensure that the review process is science-driven and reduce the bias against resource-intensive proposals.

The proposal **dual-anonymisation** is mandatory and important for reducing unconscious bias. Rules, guidelines, and examples are described on the [Dual-Anonymous Guidelines](#) webpage. Failure to abide by these rules may lead to the proposal's disqualification. Personal information on the proposing team can be disclosed only in the following fields of the proposal, which are not distributed for review: "Investigators", "Background and Expertise", "Previous Usage" and "Applicants' Publications".

Scientific keywords are important for the assignment of proposals to the reviewers. Users must select at least two **scientific keywords**, and at most five keywords (ten keywords for Large Programmes). The keywords must be selected in decreasing order of relevance (i.e., the first selected keyword is the most relevant), in the proposals as well as in the User Portal. This is important for a better assignment of the proposals to the reviewers. No keywords are required for Calibration Programmes. Scientific keywords are listed in Appendix A.

For most programmes, the maximum total length of the **"Scientific rationale"** is 2 pages, including figures and references. Figures and/or tables are optional and are restricted to the second page of the scientific description. For Large Programmes, the maximum total length of the "Scientific Rationale" is 5 pages, where up to three pages should be used for text, and up to two pages for figures and tables, placed at the end.

The **observing modes** include Service Mode (SM), Visitor Mode (VM) and Designated Visitor Mode (DVM). These are described in Sect. 5.4. The "Mode Justification" field of the proposal should be used to justify the preferred mode and eventual alternatives to be considered.

All proposers must include time for all **overheads** (telescope + instrument) in their proposals (see the [Overheads](#) webpage). For both La Silla and Paranal instruments, the [p2 demo](#) web interface can be used to prepare mock observations and estimate the total execution time including overheads.

Proposing teams must avoid **duplications** of observations that are equivalent to those already in the Archive (see the [Science Archive Facility](#) webpage) or planned by the Guaranteed Time Observations (GTO) proposals (see [GTO Plans](#) for Period 115). The GTO description and policies are presented in the [GTO policy](#) webpage and in Sect. 5.2.4.

The definitions of the **observing conditions** can be found on the [Observing Conditions](#) webpage, which shows the probability of the combined sky transparency and seeing values being realised throughout the year at Paranal. Incorrect constraints on observing conditions cannot be modified after the final

submission of a proposal.

Seeing at Paranal is better than 0.5'' about 10% of the time, while episodes of precipitable water vapour smaller than 0.5 mm are encountered six to seven nights per year (Kerber et al. 2014, MNRAS 439, 247), mostly during the southern winter. ESO encourages the unique science that can be carried out under these **excellent conditions**. The best chances to access such excellent observing condition is for proposals with targets distributed over a range of Right Ascension (RA).

ESO encourages programmes that can effectively exploit the **worst observing conditions** on the VLT. More specifically, ESO invites proposals that request turbulence category 85% or 100%, thin/thick clouds and have no moon constraints and no time constraints. A webpage on [Any-weather proposals](#) provides more information. Any-weather proposals do need to present a coherent science case for the scientific evaluation. In the interest of maximizing scheduling flexibility, proposing teams are encouraged to consult the [Forecast of telescope pressure](#) webpage.

The **evaluation of proposals** is done through the [Distributed Peer Review \(DPR\)](#) or the [Observing Programmes Committee \(OPC\) and the Expert Panels](#), covering a broad range of scientific areas. ESO is actively working on improving the assignment of proposals to reviewers, based on their expertise (through the scientific keywords). Proposing teams should make sure that proposals are self-contained and that the scientific context of their proposals and its relevance for general astrophysics are emphasised in a way that can be understood by their peers regardless of their expertise. Large Programmes are evaluated by the entire OPC across all scientific categories and they should clearly explain the relevance of the proposed programme to general astrophysics. Proposals are evaluated based on their scientific merit and the importance of their contribution to the advancement of scientific knowledge. If the proposal is a re-submission of an old proposal then the feedback by the reviewers should be addressed in this new submission. If significant problems are identified in the review feedback provided by the OPC or DPR, the PI may [contact ESO](#) to highlight the possible issues. ESO will then review the cases individually to determine the appropriate course of action.

ESO is employing **DPR** for about half of the submitted proposals. The DPR is assigned to Normal and Monitoring proposals requesting less than 16 hours and that do not include any ToO runs. The [DPR rules and guidelines](#) must be followed. Failure to abide by these rules may lead to the proposal's disqualification. More details and background information on DPR at ESO can be found in [Patat et al. \(2019, Msngr, 177, 3\)](#) and [Jerabkova et al. \(2023, Msngr, 190, 63\)](#). The PI can delegate the reviewer's role to one of the co-Is listed in the proposal, either when specifying the list of co-Is, or at the time of proposal submission, when the PI is informed about the assigned review process (DPR vs. OPC/Expert Panels).

If **Artificial Intelligence** services are used to help write a proposal, the PI remains responsible for the content of the proposal and ensuring the text is properly referenced according to normal scientific standards.

Please read the appropriate online documentation and **User Manual** (including the Calibration Plan), accessible from the [Instruments](#) webpage, for detailed information on the instruments not covered in this document.

For **VLTI** users needing assistance to prepare their VLTI proposals, the community-supported [VLTI Expertise Centres](#) – distributed throughout Europe – can offer in-depth support. They also offer support for observation preparation, advanced data reduction and analysis. Further guidelines for VLTI programmes can be found in Sect. 4.5.

ESO encourages unexperienced users to ask for **support from ESO scientists** with relevant scientific expertise. Requests for support should be sent to [science\\_p1support@eso.org](mailto:science_p1support@eso.org) including a title and abstract of the proposal, at least three weeks before the proposal submission deadline. This information will be treated confidentially. Interested ESO scientists may support and contribute to the proposals as co-Is.

For any other requests for support or questions regarding preparation and submission of proposals to ESO telescopes, please submit your enquiries through the [ESO Operations Helpdesk](#).

Useful information about Phase 1 can be accessed from the [Important Links](#) webpage (e.g., telescope pressure and definitions of observing constraints). Any updates after the release of this Call for Proposals will be listed on the [Late Breaking News](#) webpage.



## 2 Information for this Period

ESO invites proposals for observations at ESO telescopes during Period 115 (1 April 2025 – 30 September 2025)<sup>1</sup>. The ESO proposal submission deadline is:

26 September 2024,  
12:00 noon Central European Summer Time.

It is the PI's responsibility to resolve any problems related to submitting their proposal well before the deadline. ESO cannot provide support beyond one hour before the deadline. Congestion in the proposal submission system may occur, specially in the last hour before the submission deadline. PI and Co-Is will receive a confirmation e-mail upon submission. No changes to submitted proposals can be accepted after the deadline.

The [Instruments](#) offered in Period 115 are reported below. Acronyms are defined in [Appendix B](#).

Paranal			
Telescope	Focus		
	Nasmyth A	Cassegrain	Nasmyth B
UT1		FORS2	KMOS
UT2	FLAMES	VISIR	UVES
UT3	SPHERE	X-SHOOTER	CRIRES
UT4 - AOF	HAWK-I	ERIS	MUSE
ICCF	ESPRESSO		
VLT1/UT	GRAVITY MATISSE Visitor Focus		
VLT1/AT	GRAVITY MATISSE PIONIER Visitor Focus		

Table 1: Paranal instruments offered in Period 115.

<sup>1</sup>Currently, the nominal duration of an observing night is 10h for odd and 8h for even periods. This will change with the advent of the Yearly Cycle (Sect. 3).

La Silla		
Telescope	Focus	
	Nasmyth B	Fibre fed from Cassegrain
3.6m	n/a	HARPS NIRPS
NTT	EFOSC2 ULTRACAM Visitor Focus	n/a

Table 2: La Silla instruments offered in Period 115.

The main functionalities of these instruments can be found in the [Instruments Summary Table](#).

The important recent changes regarding La Silla and Paranal instrumentation and facilities are presented in the [Recent Changes in Instrumentation](#) webpage, and reported for convenience in Sect. 2.2 for the VLT, Sect. 2.3 for VLTI, and Sect. 2.4 for La Silla instruments. Please also consult the News section for the individual [Instruments](#) (e.g., the [MUSE News](#)).

## 2.1 General

- Joint VLT/I-ALMA proposals are offered this period (see Sect. 5.3.4).
- Joint VLT/I-XMM proposals are offered this period (see Sect. 5.3.5).
- GTO will be carried out in this period with GRAVITY and MATISSE (UTs and ATs), as well as with ESPRESSO (VLT), ERIS (UT4), and NIRPS (3.6-metre), as outlined in Sect. 5.2.4.
- 4MOST surveys have already been selected and there is no plan for a specific call for 4MOST observations in the next years.

## 2.2 VLT

- The telescope pressure at UT3 and UT4 for certain ranges of RA and observing conditions remains very high due to ongoing commitments (in particular Large Programmes). Proposals requesting time in the ranges listed below may be allocated time only if they are ranked particularly highly enough and request complementary or more relaxed constraints.
  - UT3:  $16\text{h} < \text{RA} < 19\text{h}$  with Turbulence Category  $\leq 30\%$  and any moon
  - UT4:  $9\text{h} < \text{RA} < 15\text{h}$  with Turbulence Category  $\leq 50\%$  and dark or gray time
- In the past periods the number of programmes that qualified for any-weather queues was fairly large for UT2, UT3 and UT4. Proposals exploiting less favourable weather constraints for UT1 are particularly encouraged.
- The Rapid Response Mode (RRM, see Sect. 5.3.1) is offered for specific instrument modes or settings, listed in Table 3.
- No VLT Visitor Focus is available in P115.

Rapid-Response Mode (RRM)	
Instrument	Modes/settings
FORS2	Broad-band imaging, longslit spectroscopic, imaging polarimetric and spectro-polarimetric modes
UVES	Standard wavelength settings
XSHOOTER	All modes
SPHERE	ZIMPOL imaging and polarimetry modes, IRDIS classical imaging mode, and IRDIFS in imaging mode
HAWK-I	All filters; brightness restrictions on objects in the field (see User Manual)
MUSE	All modes

Table 3: Instruments, modes and settings offered for RRM in Period 115.

## 2.3 VLT

- MACAO is decommissioned and replaced by the visible mode of GRAVITY+ AO (GPAO-VIS). CIAO (in off-axis mode only) is integrated to GPAO and renamed GPAO-NIR. Both are offered only in Natural Guide Star mode in Period 115.
- The NGS limiting magnitude will be  $G_{RP} = 12.5$  mag in the visible and  $K = 10$  mag in the infrared, for all instruments on VLT-UT.
- GRAVITY (astrometric measurements): GRAVITY astrometric measurements are still under development (see, e.g., the following articles: Gravity collaboration, 2017, A&A 602, A94 and The Messenger 170, 10). Proposers who need help with the preparation of GRAVITY astrometric observations are invited to contact the [ESO Operations Helpdesk](#) well in advance of the deadline.
- GRAVITY dual-field wide mode: The dual-field wide observing mode is offered for the UTs and the small and large (previous astrometric) configurations of the ATs. This mode allows fringe tracking from a target that is up to 30 arcsec away from the science target by using the VLT Star Separators to separate the beams. The magnitude limits of the fringe tracker and acquisition camera and the expected sensitivity for the science camera in this mode can be found on the GRAVITY webpages and are based on a preliminary characterisation of the mode. Due to the need of good atmospheric conditions (turbulence category 30% and better), observations are strongly encouraged to be carried out in service mode to ensure that the conditions are met. Note that the dual-field wide mode only provides relative measures (differential visibilities and phases), no absolute visibilities, due to atmospheric effects when separation increases. Calibrations of the interferometric transfer function are thus not needed and not offered for this mode.
- For the GRAVITY dual-field wide mode at the limit of system performance, in particular for crowded fields or embedded objects, it is recommended to confirm positions and magnitudes of AO-guide and fringe tracking stars in images with sufficient angular resolution, not relying purely on catalogs. Such images might also be provided as additional finding charts. We are in the process of further characterizing the performance of the GRAVITY-wide mode as a function of separation of the FT star and the atmospheric conditions. Note that the offered maximum separation of 30 arcsec distance may be optimistic unless the weather is excellent and both the FT and SC stars are bright. With more typical conditions, the maximum separation may be somewhat smaller.
- MATISSE: MATISSE is fully available in the GRA4MAT mode with the ATs. With the UTs, chopping with GRA4MAT is only available in VM until a full characterisation of the chopped data quality, and only shorter L band DITs are offered. The instrument offers the choice of various

spectral resolving powers covering either L and/or M-band (depending on the resolving power) and N-band. The HIGH+ mode is only available with the GRA4MAT mode.

- MATISSE is offered for narrow off-axis mode for exo-planet and similar observations (with GRAVITY as fringe tracker), meaning while GRAVITY tracks fringes on a source, MATISSE can point to a nearby offset position. See the MATISSE news page for details.

## 2.4 La Silla

- HARPS and NIRPS can be operated simultaneously to collect spectra from 380 nm to 1919 nm (with a gap from 689 nm to 974 nm) in a single acquisition. Users requesting to use both NIRPS and HARPS should select NIRPS instrument in P1 and declare the intention of using both instruments in the Special Remarks field of the proposal.
- The NIR LFC for NIRPS is not yet fully operational and might be available during this Period (after remaining issues are resolved).
- The Cassegrain Visitor focus of the 3.6-m telescope will no longer be offered, as long as NIRPS/HARPS are operating
- The EFOSC2 multi-object spectroscopy mode has been decommissioned.
- ULTRACAM: This PI instrument is offered to the ESO community for up to 5% of the observing time at the NTT in Period 115. Operation of this PI instrument requires the presence of the instrument team, so ULTRACAM programmes will preferentially be scheduled contiguously on periods of several nights. For questions on the instrument and observation strategies, users shall contact the instrument PI, Prof. Vik Dhillon ([vik.dhillon@sheffield.ac.uk](mailto:vik.dhillon@sheffield.ac.uk)), at least two weeks prior to submitting their proposal. The ULTRACAM consortium is committed to support the PIs and observers from the ESO community that have been awarded telescope time with ULTRACAM. The ULTRACAM team will support the execution of the observations and the subsequent data reduction to allow the scientific exploitation of the data obtained with ULTRACAM.
- The Visitor focus of the NTT continues to be available during Period 115, see Sect. 2.6.

## 2.5 Restrictions to Large and Monitoring Programmes

- Large Programmes are not offered in Period 115.
- CRIRES: Monitoring Programmes are offered in all modes
- Monitoring Programmes for ESPRESSO are only offered in 1-UT mode.
- Due to the uncharacterized performances of GPAO, Monitoring Programmes on VLTI/UTs are temporarily suspended but will be available again after the full completion of the implementation and characterization of the GPAO systems.
- The cooling pump of the PIONIER detector is currently not performing, and the temperature sensor of the detector is not functional. This situation may affect the performance of the instrument. While a spare for the pump has been identified, the temperature sensor problem remains. A direct consequence of the instrument status is that no Monitoring Programs are offered for this period.
- HARPS and NIRPS are not offered for Monitoring Programmes, given the operational constraints.
- EFOSC2 is not offered for Monitoring Programmes, given its decommissioning plan (see Sect. 3.1)
- ULTRACAM and Visitor instruments are not offered for Monitoring Programmes this period.

## 2.6 Visitor Instruments

Visitor instruments can be mounted at ESO telescopes to permit innovative observations by teams with their stand-alone instruments or to test new instrumental concepts for the development of new facility instruments. The requirements for visitor instruments are substantially reduced compared to the requirements for a fully integrated facility instruments.

The VLT visitor focus is not offered in Period 115. Two visitor foci are available in the VLTI laboratory for interferometric instruments. In Period 115 visitor instruments can be mounted at the NTT telescope.

The links below provide some guidelines and technical information for proposing a visitor instrument:

- For the VLT (Visitor Focus not offered in Period 115): [Visitor Focus](#) and [Applications for Use of the VLT Visitor Focus](#)
- For the VLTI: [Visitor Focus](#) and [Applications for Use of the VLTI Visitor Focus](#)
- For the NTT: [Visitor Focus](#)

## 3 Expected changes

The expected future changes regarding La Silla and Paranal instrumentation and facilities are presented in the [Expected Changes in Instrumentation](#) webpage, and included in Sect. 3.1 for convenience. Please also consult the webpages on [VLT/I & La Silla Instrumentation Development](#).

- The Call for Proposals for the La Silla Paranal Observatory will move to a yearly cycle in 2025 (see the related [Science Announcement](#)). To address the increased duty cycle resulting from this change, a Fast Track Channel with staggered deadlines throughout the year will be introduced simultaneously. The criteria and frequency for the Fast Track Channel are under discussion with the ESO advisory committees (Scientific and Technical Committee and Users Committee). The community will be informed regularly about the implementation of the yearly call and the Fast Track Channel through newsletter posts and direct emails to active Principal Investigators. The change follows the recommendations of the Time Allocation Working Group, ([Patat et al. 2018, Msngr, 173, 7](#)).
- The transition between the current Periods and the Yearly Cycle is being designed. Large Programmes will be offered in one of the Calls for Proposals of 2025.

### 3.1 Instrumentation

- MOONS, the Multi-Object Optical and Near-infrared Spectrograph is expected to reach full Provisional Acceptance Europe (PAE) in the fourth quarter (Q4) of 2024 and be installed and commissioned on UT1 Nasmyth A in Q2-3 2025. MOONS is planned to be offered in P117 with early GTO in Period 116. MOONS corrector is on UT1, blocking the UT1 focus.
- FORS2 & FORS-Up. The [FORS Upgrade project \(FORS-Up\)](#) is an upgrade of FORS1. FORS2 will remain in nominal operation until the conclusion of Period 116. The Multi-Object Spectroscopy Unit (MXU) and Polarisation mode functionalities will be temporarily suspended from the end of Period 115 or the start of Period 116. The full operational capability of FORS-Up, encompassing all current modes, is expected to be achieved by Period 118.
- VISIR: ESO plans to decommission VISIR in the coming semesters, because the demand and allocations for this instrument have been very modest. Moreover, no further spare parts for maintaining the instrument are available. Proposers should take into account that VISIR will likely be decommissioned as early as P116.
- ERIS. Development for offering in the future pupil tracking for standard NIX imaging and IFS observations is ongoing.

- VLTI instruments and facilities: The implementation of LGS and Gravity+ Adaptive Optics (GPAO) across the Unit Telescopes (UTs) is ongoing. The implementation of one LGS on each UT1-2-3 is planned for Q4 2025 and LGS-GPAO mode will be commissioned in Q1 2026 and available in Q2-3 2026 on all UTs with VLTI.
- 4MOST: The 4-metre Multi-Object Spectroscopic Telescope (4MOST) instrument's PAE on the VISTA telescope is expected in Q1 2025. The VISTA telescope is being upgraded to facilitate the installation of 4MOST. Operations are expected to start in Q4 2025 at the earliest.
- VISTA will not be offered in a regular Call for Proposals in the near future, because the spectroscopic Public Surveys for 4MOST have already been scheduled.
- EFOSC2: ESO plans to decommission EFOSC2 at the end of Period 115.
- SOXS: The installation and commissioning of SoXS – the Son of X-SHOOTER – is expected to start by the end of Period 114 and the instrument is planned to be offered in Period 117, with early GTO in Period 116.

## 4 Practical guidelines

This section presents some practical guidelines, in addition to what is presented in Sect.1, and including additional support for inexperienced users.

Observing proposals must contain a title, abstract, scientific keywords, definition of the observing runs (including desired instruments and observing conditions, e.g., seeing in V band at zenith or turbulence parameter, atmospheric transparency, lunar illumination etc.), a description of the time already awarded to the proposed project, any special remarks (optional), a scientific rationale, a target list, a justification for the requested lunar phase and constraints, time, telescope, observing mode, any special calibration, a description of any duplication with ESO Science Archive and with GTO targets justification, and a summary of the proposed observations. The “Scientific Rationale” contains two sections: “A) Scientific Rationale” and “B) Immediate Objective”. In addition, the following non-anonymised information must be included in the proposals: a list of co-investigators, the background and expertise of the proposing team, their previous usage of ESO telescopes, and their recent publications.

All Phase 1 proposals must be prepared and submitted using the web-based [proposal submission tool p1](#). Further details can be found in the [p1 introduction](#) and [p1 help](#) webpages. The [p1demo](#) can be used to get familiar with the tool. Proposing teams are also encouraged to consult tutorials and p1-related videos from the [Users Workshops](#).

Proposers should select the relevant programme type when creating their proposal in p1. Programme Types are defined in Sect. 5.2.

A PDF file containing the “Scientific Rationale” of the proposal must be uploaded by the proposers. Templates and instructions are available at the [p1 help](#) webpages or directly in [p1](#). The formatting of the templates should be used, without modifications, including figure captions.

A calculation of the observing time needed to accomplish the scientific goals must be carried out and summarised in the proposal. Further justification of the observing constraints can be provided in the “Lunar Phase and Constraints Justification” field. It is therefore important that proposers consult technical documentation or instrument experts regarding the instrument capabilities and sensitivities. The [overheads](#) webpage provides a summary table of all the overheads that should be accounted for. A more detailed computation can be obtained by running the [p2demo](#) version of the web-based tool p2 for the preparation of La Silla and Paranal observations (Phase 2). Instrument-specific performance and observing conditions are described in the respective User Manuals (available for all [Instruments](#)) and briefly summarised on the [Observing Conditions](#) webpage.

Links to useful proposal preparation software tools (e.g., the [ESO Exposure Time Calculators \(ETCs\)](#), the [Ephemerides and Position](#), [Airmass](#), [Extinction Calculators](#), weather information, [Archives and Catalogues](#), the [Skycat tool](#)) can be found in the [Observing Tools and Services](#) webpage. Information on standard stars and sky characteristics, as well as additional tools, are available on the [Observer's Tools and Generic Standard Stars](#) webpage.

In case you need practical assistance to prepare your proposal, please contact ESO via the [ESO Science Operations Helpdesk](#). This platform can be used for all questions and comments related to the proposal submission (how to prepare your proposal, what error messages really mean, etc.), as well as questions concerning technical requirements of the planned observations, instrument performance, Observatory policy, etc.

## 4.1 Designing the observing runs

An observing programme, as described in a single proposal, may consist of one or more observing runs.

Investigators are requested to specify the observing mode of each run: Service Mode (SM), Visitor Mode (VM), Designated Visitor Mode (DVM), depending on their availability. The observing modes are described in Sect. 5.4. Proposers should request Service Mode for observations that benefit from the short-term scheduling flexibility offered by this mode. Visitor Mode runs are encouraged for complex observations and/or for those users who have never visited Paranal, even if the observations are straightforward. Users should make use of the “Mode Justification” field of the proposal to justify their preferred mode or why an alternative mode should also be considered. Changes from the requested observing mode may be implemented by ESO due to scheduling and/or scientific priority reasons. If a certain instrument mode is offered exclusively in either Service Mode or Visitor Mode, this overrides these scheduling considerations.

Multiple runs should only be requested for observations with different instruments and/or for different observing modes, run type (normal, ToO, pre-imaging), different VLT baseline configurations (if applicable), and/or for differing observing conditions (e.g., seeing, sky transparency, etc). In particular, Service Mode runs should not be split according to time-critical windows, or used to group targets according to their Right Ascensions. Proposers should split Visitor Mode observations at different epochs (e.g., due to different target RAs) into separate runs. While time requests are done in hours, Visitor Mode observations will be converted to nights (considering the actual night duration) when scheduled. Proposals may request a mix of Visitor/Service Mode observations if they are split into separate runs. The definition of a single run differs for Service Mode and Visitor Mode observations; further guidelines are available in Sect. 5.4.1 and 5.4.2, respectively.

All observing constraints must be specified for all instruments, including the precipitable water vapour (PWV). Time (scheduling) constraints must be specified correctly in the proposal. Missing or inaccurately specified constraints are unlikely to be considered by the scheduler. Observing constraints and targets are binding. The related policies are presented in Sect. 5.6.

Known targets must be specified in the proposal. If targets are not known at the time of submission, but can be provided by more than one week before the execution, this should be described in the Special Remarks (see policies in Sect. 5.7.1). Target of Opportunity runs (see Sect. 5.3.1) must be requested if a reaction time within one week is required to observe the new targets.

Proposers are particularly encouraged to simplify any time constraints as much as possible to increase the chances of their observations being scheduled. Guidelines on the handling of time-critical OBs are available at the [Time-critical OB execution policy](#) page.

## 4.2 Exposure Time Calculators (ETCs)

Proposing teams are recommended to use the latest version of the Exposure Time Calculators (ETCs) available in the [ETC](#) webpage. Proposers are requested to describe all details necessary to reproduce their ETC calculations in the “Time Justification” field of their proposals, to justify the time and observing constraints requested. Failing to do so may result in the Observatory concluding that the programme is not feasible. The version number of the ETC should be included as well.

While the sky background values used in the ETCs generally reflect actual conditions on Paranal, the almanac mode should be used, if possible, to account for local effects such as those from zodiacal light. The ETCs require the turbulence categories or the image quality (IQ) to properly estimate the observing time necessary to complete the programme. Proposers should ensure that the observing conditions specified in the proposal are consistent with those used in the ETC, including the requested

sky transparency and lunar phase. Non-photometric sky transparency can be simulated by adding 0.1/0.2 mag to the object magnitude for CLEAR/THIN–CIRRUS conditions, respectively.

### 4.3 Preparation of the observations

Observations at all ESO telescopes are carried out by executing Observation Blocks (OBs) provided by the users. La Silla and Paranal observers must use the [Phase 2 preparation tool p2](#) for the creation of OBs. Complete information on the preparation of OBs in Phase 2 can be found on the [Phase 2 Observing Preparation](#) webpage.

Proposing teams with runs allocated in Service Mode will be required to specify their observing programme by submitting a Phase 2 package in advance to ESO. This package consists of OBs, finding charts, a Readme form and, if applicable, ephemerides. Please consult the [Service Mode Guidelines](#) and [OB Rules](#) webpages.

All Paranal Visitor and designated Visitor Mode users are asked to prepare their observations using the web-based tool [p2](#). Please consult the [VM Guidelines](#) webpage. For general definitions related to Phase 2 preparation, visitors should read the [Phase 2 workflow](#) webpage before arriving at Paranal.

Further Observing Modes definitions and policies can be found in [Sect. 5.4](#).

Additional support for VLTI users can be found in [Sect. 4.5](#).

Due to the reduced operations at La Silla, OBs scheduled in DVM must be submitted using the [p2ls](#) web interface by the Phase 2 deadline. Please note that observations will be executed by a telescope operator and contact with the PI is therefore very limited. Additional support for La Silla users can be found in [Sect. 4.6](#).

### 4.4 ToO programme execution

Target of Opportunity (ToO) observations are discussed in [Sect. 5.3.1](#). Successful proposers of ToO runs will have to prepare OBs for their observations well ahead of the beginning of an observing Period. If the targets are unknown, ToO OBs will have to be “dummy” OBs with default values for target coordinates, integration times etc. At the time of occurrence of the predicted event, the PI of the programme (or one of their delegates) will be required to copy one of the template OBs and update it with all the missing relevant information (target, exposure time, filters, Finding Charts, etc.) and trigger ToO observations. See the [ToO](#) and [RRM procedures](#) webpages for further details.

### 4.5 Specific information for VLTI programmes

Proposers of VLTI observations with PIONIER should check the feasibility of their proposed observations with the visibility calculator, VisCalc, available from the [ETC](#) webpage. Visibility calculations for GRAVITY and MATISSE are included in the dedicated GRAVITY and MATISSE ETCs. At Phase 2, users are also encouraged to select a suitable calibrator star for their planned observations using the CalVin tool, which is also available from the above link.

**VLTI observation type:** For each observing run, one or more observation types that best describe the proposed observations must be specified:

- snapshot: standalone concatenations without further links to other observations in terms of time links or filling the uv plane;
- time series: time series of concatenations that are repeated once or more often over the period, as a guideline, due to need to cycle through different AT configurations, possible cadences are either a few days in a row, or not more than 2-3 times per period per AT configuration;
- imaging: a set of concatenations with different baseline configurations to fill the uv plane for the purpose of image reconstruction; in this case, special care is taken at execution to uniformly fill the uv plane; it is highly recommended to request imaging in SM; imaging in VM should have a strong science case justification;



- astrometry: GRAVITY dual-feed observations with the purpose of extracting astrometric information.

Third-party tools may be used under the responsibility of the proposers, while ESO cannot offer support or check their accuracy.

**Naming convention for AT configurations:** AT configurations are requested by generic names (“Small”, “Medium”, “Large” and “Extended”). The standard configurations are described in more detail in the [VLTI Configurations Overview](#) webpage.

**Imaging slots (ISLs) for VLTI-AT:** ISLs are periods of about 2 weeks centred around new moon in February, May, August and November of every year, during which VLTI-AT goes through all configurations in pure SM, primarily execute “imaging” proposals, but could also be used for “snapshot” and “time series” SM programmes (according to their priorities). PIs of GTO Programmes, Large Programmes and programmes requiring Visitor Mode are requested to adhere to this restriction for their planning. The exact time location of ISLs will be indicated in the [public schedule](#) at the start of Phase 2.

**VLTI pre-imaging:** VLTI pre-imaging can help identify the target at the VLTI and confirm its magnitude, as well as exclude possibly extended, crowded, or embedded targets. Any required VLTI pre-imaging is to be executed with a normal imaging instrument of sufficient angular resolution and in the same band as the intended VLTI instrument, not with the VLTI instrument itself.

## 4.6 Support to La Silla users

La Silla instruments are offered in VM and DVM only, with restrictions on the latter. Runs with a duration of less than three nights may only be scheduled in DVM. The duration of each run for La Silla instruments must be at least three nights, except for Calibration Programmes or runs using Visitor Instruments or for combinations of contiguous EFOSC2 (totaling at least three nights). In certain cases, exceptions may be made for highly-ranked La Silla runs that require DVM observations. Proposals for long runs are strongly encouraged on the La Silla telescopes. Splitting of runs into sub-runs that have durations of less than a half-night should be avoided. Runs requesting observations that take up less than one night may be rejected on operational grounds. Runs of Visitor Instruments are normally scheduled in blocks of at least three nights and they may be rejected at scheduling if this condition cannot be met.

Users who wish to participate to the HARPS/NIRPS timesharing coordination for exoplanets search programmes requiring nominal sampling and standard instrumental configuration shall contact Prof. François Bouchy ([francois.bouchy@unige.ch](mailto:francois.bouchy@unige.ch)) at least two weeks prior to submitting their proposal. Proposals approved to participate to the HARPS/NIRPS time-sharing must add ‘3.6m time-share’ tag from the Tags section of the P1.

## 4.7 Monitoring in Service Mode

Monitoring a target in Service Mode in a particular Period is carried out on a best-effort basis only, i.e., a monitoring sequence in any Period may be interrupted by long periods of unsuitable weather conditions, Visitor Mode scheduling or instrument unavailability. All the time needed to monitor targets in one observing Period should be included in one single run, even if multiple targets/fields are required.

## 4.8 Pre-imaging

If pre-imaging for observations with a spectroscopic mask (e.g. with FORS2) is required, a separate pre-imaging run must be specified in the proposal, to be executed in Service Mode. Failure to do so will result in the deduction of the time necessary for the pre-imaging from the allocation to the main part of the proposal. See the [FORS2](#) webpage for more details.

## 4.9 Calibration Plans

ESO provides a standard set of calibrations for all Paranal instruments, the so-called calibration plan. The primary purpose of the calibration plan is to provide instrument and sky calibrations in order to reduce the science observations. In addition, the calibration data are used to monitor instrument performance via a daily [Quality Control](#) process, executed by Paranal Science Operations. The calibration plans are provided in the respective instrument user manuals and cover both day-time (instrument internal) and on-sky calibrations.

**Service Mode runs:** Given ESO's calibration plan, Service Mode proposals need to request the time for the science observations as computed by the Exposure Time Calculator. The calibration plan combined with ESO's Quality Control process guarantees that those data can be securely calibrated. Programs requiring night-time calibrations that would allow to go beyond the precision delivered by the calibration plan should request the required additional calibration time in the proposal.

**Visitor Mode runs:** The execution of night-time calibrations are the visiting astronomer's responsibility. The visitor should be aware that 30 minutes per night are reserved for the observatory to comply with the standard calibration plan. These calibrations ensure a baseline calibration accuracy for the benefit of the ESO Science Archive Facility.

## 4.10 Data reduction software

In collaboration with the instrument consortia, ESO maintains data reduction pipelines for most of the VLT/I instrument modes. The ESO pipelines, including download links and pipeline user manuals, can be found on the [VLT/I pipelines](#) webpage. The same ESO pipelines are deployed on Paranal and used to process data for the Quality Control process. Information about Paranal data processing, Quality Control and instrument performance monitoring is provided on the [Quality Control](#) webpages.

# 5 Definitions and policies

The Call for Proposals follows the [ESO Optical/Infrared Telescopes Science Operations Policies](#) document. Some of these policies are summarised in this section, along with more detailed definitions.

## 5.1 Proposing team

In each submitted proposal, one single person, namely the Principal Investigator (PI), is the primary responsible, and the PI may delegate certain privileges to a Delegated Principal Investigator (dPI). Both the PI and dPI can submit, retract, and/or delete a proposal, although the ultimate responsibility for the content of the proposal lies with the PI. The PI also acts as the official contact between ESO and the proposers for all later correspondence (Phase 2 information, data distribution, etc.). By submitting a proposal, the PI takes full responsibility for its contents, including the names of CoIs, and PI, dPI (if applicable), and their collaborators agree to follow the ESO policies and regulations, including the conditions specified in the present Call for Proposals.

PIs and Co-Is identify themselves uniquely in Phase 1 proposals by their User Portal credentials. Each individual is allowed to have only one account in the User Portal database; multiple accounts must not be created. Failure to comply with this restriction may lead to the rejection by ESO of the corresponding proposals.

## 5.2 Proposal types

### 5.2.1 Normal Programmes

Normal Programmes are limited to a time request of less than 100 hours.

## 5.2.2 Large Programmes (not offered in Period 115)

An ESO Large Programme is defined by the following:

- A programme requiring a minimum of 100 hours of ESO telescope time. For ESO telescopes, one night in Visitor Mode is defined to be eight hours in even Periods and ten hours in odd Periods.
- A programme that has the potential to lead to a major advance or breakthrough in the field of study, has strong scientific justification and legacy value, and a plan for a quick and comprehensive effort of data reduction and analysis by a dedicated team.
- Large Programmes can span from one to four Periods (up to a maximum of two consecutive years).
- All ToO run types (see Sect. 5.3.1) can be submitted as part of Large Programmes.

ESO strives to execute Large Programmes over shorter periods of time, aiming at two semesters by default. The community should submit Large Programmes that do not extend over a number of Periods larger than that set by their scientific requirements.

During the period of execution of a Large Programme, and upon its completion, the PI is expected to report regularly to the OPC on the programme's progress. They may also be asked to outline the progress and/or outcome of the programme at ESO Large Programmes and Surveys workshops, like the [2008](#) or [2015](#) workshop.

PIs of successful proposals for Large Programmes (including GTO) are required to provide all data products (processed images and spectra, processed integral fields spectrograph data cubes, catalogues) for ingestion and publication into the ESO archive. More information on the science data products is available on the [ESO Science Data Products Standard](#) document. Proposals that waive proprietary rights are encouraged. PIs of Large Programmes are asked to take particular care when completing the field Data Product Delivery Plan of the proposal in which they must provide detailed information on the data quality assessment and data reduction. In case of instruments supported by the availability of [ESO Data Streams](#), the proposers should detail the additional steps applied to the data products for their Large Programme, in addition to the calibration/reduction levels applied to the ESO processed science data. They are also required to include the planning for the publication of data products (both in terms of content and timeline), which must be finalised within two years of the completion of the data acquisition for the programme. In the case of instruments supported by ESO Data Streams, the proposers must provide the timeline for ingestion and publication of their higher-level reduced products in the ESO science archive. Large Programme proposals must include a precise timeline for the publication of data products in order to comply with ESO's policies. Such publication is intended in the ESO archive: any availability of data products from other project-specific web pages, or refereed publications e.g. CDS, is not compliant to the ESO science policies.

Publication of data products in the ESO science archive ensures the storage, dissemination and usage of the Large Programme data conjointly with the entire ESO archive science content. Furthermore, the minting of the DOI associated with any data collections enables higher traceability of the science data products, citation and usage. Guidelines for the submission of these data products, including a description of the required metadata and formats, can be found on the [Phase 3](#) webpages.

## 5.2.3 Monitoring Programmes

Monitoring Programme (MP) proposals enable users to request a limited amount of time to monitor targets (or classes of targets) over more than one Period. Monitoring Programmes are defined by the following criteria:

- requiring less than 100 hours of ESO telescope time.
- requesting a minimum of two Periods and spanning up to four consecutive Periods (up to a maximum of two consecutive years).

Both Service Mode and Visitor Mode observations are allowed. For Service Mode runs, the time request for each semester should be contained within a single run (per instrument and per constraint set) to enable observations within time-linked scheduling containers.

All ToO run types (see Sect. 5.3.1) can be submitted as part of Monitoring Programmes.

Monitoring Programmes will be evaluated in the same way as Normal Programmes but must be amongst the highest-ranked programmes in order to be scheduled.

Monitoring Programmes are subject to the same instrument restrictions as Large Programmes (see Sect. 2.5).

#### 5.2.4 Guaranteed Time Observations (GTO) Programmes

Guaranteed Time Observations (GTO) arise from contractual obligations of ESO vis-à-vis the external consortia who build ESO instruments and are described in the [GTO Policy page](#).

GTO teams can submit proposals for Normal (GTO Programmes) and Large Programmes (GTO Large Programmes), and are subjects to the same restrictions and requirements of Normal and Large Programmes, respectively. GTO teams should specify the appropriate GTO contract keyword in the p1 proposal preparation tool.

GTO runs must be conducted in Visitor Mode. The only exceptions are those explicitly stated in the contractual agreement between ESO and the corresponding external consortium. However, ESO may exceptionally transfer some GTO runs from Visitor Mode to Service Mode for operational reasons, such as the availability of certain VLTI baselines or instruments. Should some GTO be transferred from Visitor Mode to Service Mode, a penalty of 20% of the observing time applies. Some GTO Programmes require ToO runs, if this option is explicitly mentioned in the GTO contract.

GTO teams are requested to submit a target list ahead of every Call for Proposals so that their targets can be protected against duplicated observations with the same instrument set-up. Target protection for GTO Large Programmes can span up to four Periods. The nominal proprietary period of GTO Large Programmes remains with a maximum of one year starting as soon as the data have been ingested into the ESO Archive. Exceptions to this rule must be authorised by the Director General, and must be requested before the proposal is submitted.

The list of GTO protected targets are published in the [GTO Programmes](#) webpage. GTO teams are required each period to provide the complete lists of the targets of the GTO Programmes that they proposed for or that will be executed in that period.

All GTO proposals will be evaluated and ranked together with Normal and Large Programme proposals in order to provide feedback to the GTO teams on the scientific standing of their GTO Programmes. In exceptional cases, poorly ranked GTO proposals may not be scheduled. GTO policies are summarised in the [ESO Optical/Infrared Telescopes Science Operations Policies](#) document.

The table below provides a detailed description of the current commitment to GTO consortia.

GTO Contract	Telescope	Instrument	First Period	Last Period	Total entitlement (nights)	Remaining time (nights) <sup>(1)</sup>	Time in P115 (nights) <sup>(2)</sup>
ERIS-consortium	UT4	ERIS	111	120	195.0	129.0	21.5
ESPRESSO <sup>(3)</sup>	UT	ESPRESSO	102	115	293.0	0.4	0.4
GRAVITY-consortium-AT	VLTI-AT	GRAVITY	97	115	139.0	10.5	10.5
GRAVITY+ <sup>(4)</sup>	VLTI-UT	GRAVITY+	114	122	69.3	66.3	8.3
MATISSE-consortium-UT <sup>(4)</sup>	VLTI-UT	MATISSE	103	118	37.5	5.5	1.4
MATISSE-consortium-AT	VLTI-AT	MATISSE	103	122	173.0	36.5	4.6
NAOMI-IPAG	VLTI-AT	ALL-VLTI	105	115	28.0	1.1	1.1
NIRPS-consortium	3.6m	NIRPS/HARPS	111	120	725.0	431.8	72.0

(1) At the start of ESO Period 115. Corrected for the losses in P105.

(2) Average forecast: (remaining time)/(remaining semesters).

(3) Nights with 1 UT.

(4) Nights with all 4 UTs.

**NOTE:** The total entitlement may include approved compensations for technical losses and possible contractual modifications. For P115 the accounting is indicative. Possible losses in P113 and P114 are not accounted for.

### 5.2.5 Calibration Programmes

ESO operates many complex instruments with many possible configurations and observing modes. Although the Observatory executes a rigorous calibration plan for each instrument, ESO does not have the resources to fully calibrate all potential capabilities of all instruments. On the other hand, the astronomical community has the opportunity to perform calibrations for certain uncalibrated or poorly calibrated modes, or to develop specialised software for certain calibration and data reduction tasks. Calibration Programmes allow users to complement the existing calibration of ESO instruments and to fill any existing gaps in the calibration coverage. Up to 3% of the available observing time may be made available for Calibration Programmes.

Regular workshops are also held to bring together instrument scientists and astronomers to discuss their experiences and identify challenges to continuously improve the calibration of ESO's instruments, such as the [2017 ESO Calibration workshop](#).

Proposers should clearly state in the "Scientific Rationale" what are the limitations of the existing calibration plan and the expected improvement that can result from the proposed observations. Moreover, the proposal should emphasise the relevance and the overall scientific gain of the calibration techniques and products resulting from these observations.

Calibration Programmes are reviewed by ESO with regards to their technical and operational feasibility and presented to the OPC for approval.

Successful proposers will be required to deliver documentation, data products and software to ESO to support future observing programmes. The procedure to be followed is described on the [Phase 3](#) webpages. The raw calibration data, as well as the advanced calibration products that are obtained as part of Calibration Programmes are non-proprietary and made available to the entire community through the ESO archive, and the respective instrument webpages. The PIs of Calibration Programmes are required to deliver to ESO the resulting Advanced Data Products within one year of the completion of the corresponding observations. Scientific publications that make use of the data or results of Calibration Programmes will have to make reference to the corresponding proposals.

### 5.2.6 Director's Discretionary Time (DDT) Programmes

The description and policies of Director's Discretionary Time (DDT) Programmes can be found on the [DDT Policy](#) webpage.

Up to 5% of the available observing time may be used for DDT proposals in the current Period. These programmes are generally of short duration (< 5 hours), though a longer time request may be granted if justified by a strong science case. Only DDT proposals belonging to one of the following categories will be considered:

- proposals of ToO nature requiring the immediate observation of a sudden and unexpected astronomical event;
- proposals requesting observations on a highly competitive scientific topic;
- proposals asking for follow-up observations of a programme recently conducted from groundbased and/or space facilities, where a quick implementation should provide break-through results;
- proposals of a somewhat risky nature requesting a small amount of observing time to test the feasibility of a programme.

DDT proposals may be submitted at any time. They must be prepared using the p1 proposal submission tool. Approved DDT proposals are carried out in Service Mode on Paranal or in Visitor Mode override on La Silla.

DDT proposals are reviewed by a DDT committee, which issues recommendations to the Director General, or their delegate. Urgent requests must be clearly identified in the Special Remarks field of the proposal. Very few non-time-critical DDT proposals are foreseen to be approved so proposers should provide a clear justification why the programme should be considered for DDT allocation and why it was not submitted

through the regular cycle. In the absence of such a justification, the proposal will not be considered for DDT allocation, and the proposers will be encouraged to resubmit their proposals in the next regular cycle. As a general rule, proposals originally submitted in the regular cycle and that were not allocated time should not be submitted as DDT proposals.

## 5.3 Run types and other proposal properties

### 5.3.1 Target of Opportunity (ToO)

The content of this section is reported on the [ToO policy](#) webpage.

ESO recognises two categories of Targets of Opportunity:

1. Unpredictable ToOs are those concerning unpredictable astronomical events that require immediate observations. The occurrence of such events cannot be anticipated on a sufficient timeframe to allow them to be the subject of a proposal prepared by the regular proposal submission deadline. They qualify for application to DDT proposals (Sect. [5.2.6](#)).
2. Predictable ToOs are those concerning predictable events in a generic sense only. These are typically known transient phenomena and follow-up or coordinated observations of targets of special interest, triggered by the proposing team.

Target of Opportunity observations are requested strictly as ToO runs pertaining to any programme type. ToO runs are defined as runs for which the target and/or observation epoch are not known at proposal submission, typically by more than one week before the observation needs to be executed.

Three different types of ToO runs are defined:

- Rapid Response Mode (RRM), for observations to be triggered via the automated Rapid Response Mode system within 4 hours after an event;
- Hard ToO runs, for manually triggered observations that must be carried out as soon as possible or at most within 48 hours of receipt of the trigger by the Observatory, or that involve a strict time constraint (i.e., that must be executed during a specific night);
- Soft ToO runs, for manually triggered observations, which can be scheduled for execution within a time window of 7 days.

Targets that are unknown at the time of the proposal submission but can be observed more than one week after they have been identified can be observed as part of normal (non-ToO) runs.

ToO runs will be evaluated in the same way as normal (non-ToO) runs but must be amongst the highest-ranked runs in order to be scheduled.

RRM observations have overriding priority over other observations, unless the latter are strictly time-critical. This is assessed by ESO before the start of the Period (and at the approval of DDT Programmes during the Period), based on information provided in the proposal. Visitor Mode runs that have time-critical observations that cannot be moved to other nights (typically planetary transit where only one window is available during the scheduling period or simultaneous observations with another facility) are protected against RRM triggers. The list of protected runs is available on the [RRM-protected runs](#) webpage. RRM triggers will be accepted during Service Mode and Visitor Mode runs. An RRM trigger cannot interrupt an already on-going RRM observation.

For all approved ToO runs, generic Observation Blocks (OBs) must be submitted at Phase 2 using the [p2](#) tool. These OBs are updated by the PI once the target is known. Information on OB preparation can be found in the [ToO](#) and [RRM procedures](#) webpages.

The observing strategy at execution must be the same as what was requested and approved in the proposal, and the triggers may not exceed the allocated time. The observations will be conducted in Service Mode and, in exceptional cases, ongoing programmes may be interrupted.

Eventual follow-up observations of a ToO target should use a normal (non-ToO) run, possibly with specific time constraints, if the observations take place more than one week after the reception of the first trigger for that object. Follow-up runs are allocated time only if the respective ToO is also approved.

RRM runs must be exclusively used for triggering the RRM system. Follow-up observations of a target observed using the RRM system must be requested through the activation of a hard or soft ToO trigger, or a non-ToO run, depending on the classification described above.

ToO (and RRM) runs are not carried over to a following Period. In case the programme includes a normal run for ToO follow-up observations, such runs can be exceptionally carried over to enable the planned follow-up, provided that the related ToO is triggered within the originally allocated period.

The RRM is offered for specific instrument modes (see Sect. 2.2 and Table 3). Users interested in using RRM for modes not currently offered for RRM should contact ESO through the [ESO Operations Helpdesk](#) at least two weeks before the proposal submission deadline.

## ToO execution

ToO observations will be executed after the proposing team will trigger them. OBs for hard and soft ToO runs will be scheduled for execution following the acceptance by ESO of an activation trigger.

Upon receiving an RRM alert indicating the coordinates of the target and the associated Observation Block (OB), any ongoing integration will automatically be terminated and the RRM OB will be executed, unless the procedure is aborted by the operator due to safety concerns. Following an RRM trigger the telescope will be at the target's location within about 6 minutes, not including any change of focus, and depending on the instrument and the target position.

RRM triggers can require a change of focus. If the RRM trigger requires a change of focus, the telescope is expected to point at the location of the target within about 12 minutes. The time required for the change-of-focus is not counted as part of the RRM runs.

For practical guidelines on ToO runs execution please see Sect. 4.4 and the [ToO](#) and [RRM procedures](#) webpages.

### 5.3.2 Non-Member State proposals

A proposal is designated as Non-Member State proposal if more than 2/3 of the applicants are from institutes not affiliated with an ESO Member State, the Host State, or with a party with which ESO has established a partnership which enables access to specific ESO facilities on an equal footing with ESO Member States, independently of the affiliation of the Principal Investigator. In cases where an ESO Member State proposal is rated equally during the proposal evaluation process with a Non-Member State proposal seeking to do similar science, preference is given to the ESO Member State proposal.

### 5.3.3 Host State proposals

Proposals whose PI is affiliated with an institute of the Host State (Chile) are counted as Host State proposals, independently of the fraction of non-member state Cols.

Time allocation of qualifying Host State proposals is regulated by the "Interpretative, Supplementary and Amending Agreement" to the 1963 Convention between the Government of Chile and ESO (dated 18 April 1995). This states that "Chilean scientists who present meritorious projects shall have the right to obtain up to 10% of the observing time of ESO telescopes". For VLT and VLT1, at least half of this 10% shall be dedicated to projects of Chilean astronomers in collaboration with astronomers from ESO Member States.

Following the recommendations of the OPC, the ESO Director General grants observing time based on the OPC ranking and the availability of telescope time.

### 5.3.4 Joint VLT/I-ALMA proposals

Joint VLT/I-ALMA proposals are proposals to observe primarily with ESO VLT/I and that also request ALMA time. The [joint VLT/I-ALMA proposals](#) webpage reports their full description and policies.

- Joint proposals requesting ALMA time will comply with both ESO and ALMA Policies.
- ESO may allocate up to 50 hours of ALMA time per yearly Cycle on each of the ALMA Arrays (i.e. 12m, 7m, and TP).
- Joint proposals submitted to ESO cannot request ALMA time for VLBI or phased array observing modes.
- ALMA Large Programmes are not allowed when joint proposals are submitted to a partner observatory, and therefore the amount of ALMA time requested must be less than that of the ALMA Large Program threshold (see the ALMA Proposer's Guide for a definition of a Large Program).
- Only Normal VLT/I-ALMA joint proposals are offered at ESO.
- When submitting a VLT/I-ALMA joint proposal through ESO, the proposing team must include in their "Scientific Rationale" a strong justification for the need of both facilities in order to reach the proposed science goals.
- Joint VLT/I-ALMA proposal will only be approved or rejected for both facilities. Partial approvals will not be considered, as the concept is that the science goals of a joint programme can only be achieved acquiring data with both facilities.

Joint proposals will be allowed to request array configurations offered between the time the project will enter the ALMA queue (i.e. upon project preparation after proposal approval as indicated below) until the end of the ongoing ALMA Cycle, as well as those offered in the upcoming ALMA Cycle.

PIs are responsible for summarizing the Technical Specification for the requested ALMA observations when submitting their proposal via the ESO p1 interface. PIs will provide the Technical Specification by uploading a PDF document produced from an ad-hoc template. The template is available to the user directly from the p1 interface (see the [fac-simile template](#)). The Technical Specification will be used for initial technical assessment. As indicated in ALMA Proposer's Guide, an incomplete Technical Specification may lead to the rejection of the proposal on technical grounds.

The Joint ALMA Observatory will evaluate the ALMA projects based on the technical feasibility of the requested observations, the scheduling feasibility considering the requested array configuration and time constraints. It is the proposers' responsibility to provide a full and comprehensive scientific and technical justification for the requested observing time at both facilities. Both the ESO and ALMA observatories will perform feasibility checks of the approved proposals. They each reserve the right to reject any observation determined to be unfeasible for any reason. The rejection by one Observatory could jeopardise the entire proposed science programme.

PIs of Joint VLT/I-ALMA proposals should add the 'Joint VLT/I-ALMA' tag from the Tags section of the p1 proposal preparation tool.

### 5.3.5 Joint VLT/I-XMM proposals

ESO may award up to 290ksec (~ 80 hours) of XMM-Newton observing time. Similarly, the XMM-Newton project may award up to 80 hours of ESO VLT observing time. Proposals that request different amounts of observing time on each facility should be submitted to the Observatory for which the greatest amount of time is required. This applies to the duration of an XMM-Newton cycle, which normally extends over two ESO observing Periods.

Proposers wishing to make use of this opportunity will have to submit a single proposal in response to either the XMM-Newton or the ESO Call for Proposals: proposals for the same programme submitted to both observatories will be rejected. A proposal to ESO will be reviewed exclusively through the ESO proposal evaluation process. A proposal submitted to the XMM-Newton Observatory will be reviewed



exclusively by the XMM-Newton OTAC. The primary criterion for the award of observing time is that both VLT and XMM-Newton data are required to meet the scientific objectives of the proposal. The project does not need to require simultaneous XMM-Newton and ESO telescope observations.

Target of Opportunity runs and “Triggered Observations” are possible in this cooperative programme. However, proposals requiring simultaneous observation with both facilities, with a reaction time of less than two working days from an unknown triggering date, will not be considered. It is the responsibility of the PI to inform both observatories immediately if the trigger criterion is fulfilled. It is the proposers’ responsibility to provide a full and comprehensive scientific and technical justification for the requested observing time on both facilities.

Both the ESO and XMM-Newton observatories will perform feasibility checks of the approved proposals. They each reserve the right to reject any observation determined to be unfeasible for any reason. The rejection by one Observatory could jeopardize the entire proposed science programme.

Apart from the above the general policies and procedures currently in force for the final selection of the proposals, the allocation of observing time, the execution of the observations, and the data rights remain unchanged for both ESO and the XMM-Newton Observatory.

PIs of Joint VLT/I-ALMA proposals should add the ‘Joint VLT/I-XMM’ tag from the Tags section of the p1 proposal preparation tool.

## 5.4 Observing modes

ESO’s observing modes are Service Mode (SM), Visitor Mode (VM), and Designated Visitor Mode (DVM). A brief description of each mode is reported in this section, and their advantages are discussed in [Rejkuba et al. 2018, Msng, 173, 2](#).

As part of the Phase 1 proposal, investigators are requested to specify which observing mode they desire. While every effort will be made to follow the proposed observing mode, ESO does reserve the right to allocate time in an observing mode that is different from the one requested. Note especially the restrictions of available modes detailed in Sect. 2 and 4.

The telescope and instruments will be operated by observatory staff only.

### 5.4.1 Service Mode (SM)

Service Mode (SM) observations are performed by the Observatory throughout the Period, when the observing conditions are suitable and without coordination with the proposing team at the execution time. Service Mode is offered on all Paranal observing facilities. It is also well suited for programmes that require the best observing conditions (which occur at unpredictable intervals) or for any weather programmes that have targets spread over a large range of RAs. More information on the Service Mode philosophy are discussed in the [General Philosophy of Service Mode Observations](#) webpage.

Please consult the Phase 2 webpages for the latest information on [SM policies](#). The Phase 1 constraints are binding (see Sect. 5.6).

The [SM OB rules](#) webpage reports the full rules and advices for OB preparation, and a few that are related to the proposal preparation are mentioned below.

- All overheads must be included in the OB Total Execution Time. Guidelines are provided in the [Overheads](#) webpage.
- Some observing strategies cannot be supported in Service Mode; in particular, real-time decisions about the sequencing of OBs, complex OB sequencing, or decisions based on the outcome of previously executed OBs.
- OBs are normally executed non-contiguously. It is not possible to reduce acquisition overheads by requiring the sequential execution of OBs with the same target field. Exceptions to this are made for OBs within concatenation scheduling containers; also see the programmes with linked time requirements item below.

- Multi-mode, multi-configuration OBs (e.g. combining imaging and spectroscopy) are normally not permitted in Service Mode.
- OB execution times (and OB concatenations) must be below 1 hour. In exceptional cases a Phase 2 Waiver Request for longer OBs can be submitted and considered for approval. In such cases, ESO will consider the OB successfully executed if the constraints were fulfilled during the first hour of execution, even if conditions degrade after that time. Proposers are especially encouraged to plan for OBs substantially shorter than one hour if the execution conditions are particularly demanding.
- Time constraints must be indicated in the proposals and in the OBs.

Once the OBs are completed, they are reviewed by ESO to ensure full optimisation and compliance, and ultimately be accepted. Accepted OBs are executed by ESO staff based on their OPC-recommended priority (see Sect. 5.6.1 and the [Programme Priority Groups](#) webpage) and a proper match between the requested and the actual observing conditions.

#### **Fulfillment of Phase 2 constraints.**

ESO will consider an OB as successfully executed if all the conditions in the constraint set are fulfilled. OBs executed under conditions marginally outside constraints by no more than 10% of the specified value will not be scheduled for re-execution.

#### **Programmes with linked time requirements.**

SM is also intended to support programmes with special timing requirements. However, proposers planning such programmes should keep in mind that at most 60% of both bright and dark time is allocated to SM (on Paranal), and that observing conditions cannot be predicted when a time-series is started. This means that timing sequences that are long or complex, timing links that are very restrictive, and time-series for observations requiring excellent observing conditions, are unlikely to be successfully completed. Proposers for programmes requiring time links are strongly encouraged to consider how they may simplify their timing sequences as much as possible, as this will minimise the risk that the observations become unfeasible. They should also read the [Time-critical OB execution policy](#) webpage. If a given OB cannot be executed within its intended observability window, it will be removed from the observing queue and will not be attempted again. If it was part of a time-linked series, then the time-series observation will continue with the next OB when appropriate. ESO will not restart a sequence of linked observations if the pre-specified timing constraints cannot be fulfilled. More details on how the p2 tool can be used to time-link, group or concatenate various OBs, are described on the [Phase 2 preparation](#) webpages.

#### **VLTI imaging programmes.**

PIs of VLTI imaging programmes can request to repeat all observations of a time-critical imaging campaign if it was not finished within the requested time, under the following conditions: (i) the run is A-ranked; (ii) the time interval during which the image needs to be completed (Imaging Time) is specified in the proposal; (iii) the Imaging Time is not shorter than one month, and (iv) the guarantee concerns not more than the ESO-recommended number of uv points for imaging (currently 15 concatenations per target). Possible additional points are taken on a best-effort basis, and expire outside the Imaging Time interval.

### **5.4.2 Visitor Mode (VM)**

In Visitor Mode, the astronomer is present at the observatory during the observations. Each approved VM run will be allocated specific calendar nights. One of the programme investigators will travel to the Observatory and execute the observations.

Visitor Mode enables direct interaction with the observatory staff and flexible planning of the observations that includes the possibility to adjust the observing programme to the prevailing conditions. The Service Mode rules, such as 1h OB length, are not applicable. This can lead to lower overheads and more efficient use of allocated time. Visitor Mode is also conducive to training young astronomers in observing. Visitor Mode may be necessary in case of complex observing strategies and/or modes not supported in Service mode. The latter should be specified in the "Observing Mode" box in p1 to ensure that the technical requirements for the mode selection are correctly accounted for during the telescope scheduling. The

Observing Mode justification can also be expressed as a preference or point to the possibility of young astronomers' training.

Typical completion probability for Visitor Mode runs is very similar to that of the A-rank class Service mode observing runs due to 10-15% chance of complete weather loss in Visitor Mode. Therefore, on Paranal telescopes that also support Service mode, the Visitor Mode runs are scheduled when their scientific ranking is equivalent to that of A-rank Service mode runs on the same telescope. Lower-ranked Visitor Mode runs are considered for conversion to Service mode B-rank class proposals in case there are no technical reasons that prevent that.

Data acquisition for all ESO instruments will be done by executing Observation Blocks (OBs), i.e., observing sequences specified by the astronomer based on templates provided by ESO. VM investigators are strongly encouraged to prepare their OBs before arriving on the site using the [p2 web](#) tool for OB preparation. At the telescope, OBs can be created or further modified in real-time (except for the FORS2 MXU mode). VM investigators will be required to arrive on Paranal before the start of their observing run as follows: 24 hours for UVES, and 48 hours for all other instruments. On La Silla, visiting astronomers shall arrive 1 to 2 days before the start of the observations, and may leave the site up to 1 to 2 days after the end of their observing run according to the transportation schedule (see the [La Silla Science Operations](#) webpage). Observers should note that twilight during Visitor Mode runs is used by the observatory and will be given to observers on a best-effort basis.

Programmes must be executed as specified and approved at Phase 1. The proposer should prepare a backup/alternative programme to be executed in place of the primary programme if the observing conditions are not ideal. The original science case and goals should be followed. Such backup programmes must be approved by ESO at least two weeks in advance of the observing run. Requests sent on shorter notice, in particular within less than 48 hours from the start of the run, may not be processed on time. In those cases, the corresponding data will not be accessible from the ESO Science Archive Facility until the request is approved. The corresponding requests must be submitted via the Change Request tab in p2. If the conditions prevent the Visiting Astronomer's primary programme to be executed the telescope will be used for the execution of Service Mode observations, if no backup programme is in place and Service Mode observations are possible on that telescope. Raw data are available for download shortly after acquisition.

VM proposers must include overheads for all science exposures. Guidelines are provided in the [Overheads](#) webpage.

Rarely the Observatory may interrupt Visitor Mode observations to allow Service Mode observations. In general, the Observatory does not compensate for weather or technical losses of observing time. However, compensation may be granted by the Director of the Observatory under exceptional circumstances.

VM observations may be interrupted by time-critical DDT (Sect. 5.2.6) or ToO runs (Sect. 5.3.1). As far as possible, the execution of observations for such programmes will be confined to scheduled Service Mode nights. Under exceptional circumstances, the Director of the Observatory may decide to interrupt VM runs to allow ToO observations. ToO runs in the Rapid Response Mode (RRM) may also interrupt VM observations. Policies regarding compensation in case of interrupted observations and other possible issues related to ToO observations can be found on the [ToO policy](#) webpage.

Additional information for users assigned Visitor Mode time can be found on the [Visitor Mode Phase 2 Guidelines](#) webpage.

### 5.4.3 Designated Visitor Mode (DVM)

Designated VM observations on Paranal are scheduled on specific dates/slots as if they were regular Visitor Mode runs, but they are executed by an ESO staff member, in close contact (e.g., via phone or video link) with the Principal Investigator, or someone the PI designates to serve as the liaison with the Observatory.

ESO reserves the right to allocate telescope time in DVM instead of regular VM for any runs with a duration smaller than one night and a justified need for VM.

The web-based tool POEM (Paranal Observatory Eavesdropping Mode) has been offered for observations in Designated Visitor Mode. Details on POEM are available in the [POEM Instructions](#) webpage. More

details on DVM, including all requirements concerning the preparation of DVM runs are provided on the [Paranal Science Operations](#) webpages. As for normal Visitor Mode runs, users can request additional science targets, instrument setup changes and backup targets. However, such requests must be submitted at least four days in advance of the run, in line with the submission of the overall material to the Observatory. Otherwise, such requests will not be processed.

Due to the reduced operations at La Silla, the Designated Visitor Mode is generally restricted to runs requesting less than three contiguous nights. Nevertheless, runs requesting observations that take up less than one night may be rejected on operational grounds. OBs scheduled in DVM must be submitted using the [p2 web](#) tool for OB preparation by the Phase 2 deadline, following instructions given at the time of the webletters release. Observations will be executed by a telescope operator and contact with the PI is therefore very limited.

## 5.5 Policy regarding offered/available observing configurations

Users will be promptly informed if it becomes impossible to support some currently offered instrument mode, and may be asked to switch from Service Mode to Visitor Mode or vice versa. In general, runs requiring non-standard configurations will only be accepted in Visitor Mode.

The use of non-standard instrumental modes or configurations requires prior approval by ESO, as indicated in the instrument manuals. This approval must be obtained before submitting the Phase 1 proposal. Corresponding requests, including a brief justification, must be submitted through the [ESO Operations Helpdesk](#) at least two weeks before the proposal submission deadline. Failure to follow this rule may lead to the rejection of the proposal by ESO for technical reasons. Users who wish to request a new (own) filter to be installed, particularly in the cryogenic instruments (e.g., HAWK-I, VISIR) must approach ESO via the ESO Helpdesk at least 3 months before submitting a proposal requesting that filter. Failure to follow these guidelines may lead to the rejection of the proposal by ESO for technical reasons.

## 5.6 Phase 2 Service Mode policy

Observing constraints, targets, and instrument setup requested in Phase 1 proposal are binding (see the webpage on the [Agreement between Phase 2 material and Phase 1 request](#)).

To optimise the use of ESO telescopes in Service Mode for a given Period, it is necessary to maintain a proper mix of runs requiring a variety of observing conditions, and with targets spread over the entire range of RAs. For this reason, proposers are requested in their Phase 1 proposal to specify not only the targets with accurate coordinates, but also the required observing conditions (lunar phase, seeing, sky transparency). Due to their essential role in determining the long-term scheduling of Service Mode time, the constraints specified at Phase 1 are binding. During Phase 2 preparation, the observing constraints can be relaxed, but you cannot become more stringent.

Successful proposers will not be allowed to change the instrument setups, target lists and/or times per target that were requested at Phase 1 in their Phase 2 submissions, unless explicitly authorised by ESO. Only relaxing observing constraints is allowed at Phase 2. See Sect. [5.7.1](#) for more details on how to request waivers for Service Mode runs.

### 5.6.1 Service Mode run prioritization

The OPC-recommended priority for programme execution are defined in the [Programme Priority Groups](#) webpage and reported below. All programmes allocated observing time in Service Mode are assigned to one of the following priority groups:

- **Group A:** High Priority: These programmes are considered to have the highest scientific value and are executed first as observing conditions allow. ESO makes every possible effort to complete programmes in this Group. This includes the possibility of carrying over programmes in this category to the next semester, in case that their degree of completion at the end of the allocated semester is too low for the fulfillment of the scientific goals, and if they are not time-critical. Large Programmes are automatically considered as high priority programmes. Within group A they are ranked higher

than Normal Programmes. Target-of-Opportunity (ToO) runs cannot be considered for carryover status. As Monitoring Programmes span multiple Periods for the purposes of monitoring individual targets/fields this removes the necessity for carryover of most runs. Monitoring Programmes are considered for carryover after their last semester for up to one more visibility period. All PIs of programmes in Group A are informed about one month prior to the next Call for Proposal deadline about the carryover eligibility of their programme.

- **Group B:** Medium Priority: Programmes in this group have lower scientific priority than Group A and are executed only when no Group A programme can be executed. ESO tries to complete all programmes in this Group, but incomplete programmes are terminated at the end of the allocated semester. The likelihood that any given Group B programme is executed decreases as more stringent observing constraints are requested.
- **Group C:** Low Priority: These programmes have lower scientific priority than those in Groups A and B but have relaxed constraints (see below), which allows them to be scheduled when the external conditions are not suitable for the execution of any programmes in Groups A and B. The programmes in Group C would not have been scheduled if Visitor Mode had been the only observing mode offered by the Observatory. However, the flexibility of Service Mode scheduling allows in this way a scientifically valuable use of the telescope time even under conditions that would be unsuitable for the execution of higher-ranked programmes.

## 5.7 Observing programme execution

Observations in both Visitor and Service Mode must be executed as described in the Phase 1 proposal, including the instrument modes and specified targets. Departures from Phase 1 specifications and targets will not generally be allowed, unless a sound scientific justification exists, and provided that the change involves neither a significant increase in the pressure factor on oversubscribed regions of the sky nor a scientific conflict with another, already approved, observation.

Observations requiring the use of the Four Laser Guide Star Facility (4LGSF) are subject to the policies described in the [VLT Laser Guide Star Facility Policies](#).

### 5.7.1 Target and setup changes

Observing constraints, targets, and instrument setup requested in Phase 1 proposal are binding (see Sect. 5.6 and the [Agreement between Phase 2 material and Phase 1 request](#) webpage).

Programme Change Requests are petitions to deviate from observations as proposed at Phase 1 (e.g. new or different targets, new instrument, new/different observing modes, etc.). The formulation of the scientific justification and the submission of such petitions is done via [p2](#).

For any other departure from Phase 1 specifications a justification must be provided in writing to [paranal@eso.org](mailto:paranal@eso.org) at least one month before the beginning of the observations for runs scheduled in Visitor Mode. For Service Mode runs, these requests and associated justifications must be submitted via the Waiver option of the Change Request tab in [p2](#) at least one week before the Phase 2 deadline. Instructions are available on the [Phase 2 Waiver Requests and Programme Change Requests](#) webpage.

Approved new targets and instrument setups will not be protected against target duplication from other programmes. ESO reserves the right to reject the changes if they are insufficiently justified, conflicting with any other approved programmes, or imply significant changes in the overall distribution of scheduled targets in the sky. Observations of targets for which no authorisation has been obtained are not allowed at the telescope.

Teams asking for observations that envision the need for additional or a change of targets, or for adapting their observing strategy after the start of the Period (following, e.g., Gaia data releases), must declare it with a note in the Special Remarks field of the proposal. The note must include the time scale and the expected cadence of the target change requests. In addition, the proposals must provide scientific and technical justifications for such approach in their “Scientific Rationale” and “Time Justification” field. The request will undergo a scientific review by the OPC/Expert Panels or DPR. Proposals that are scientifically highly ranked and can be supported in terms of target list changes and strategy requirements

will be considered for scheduling. Targets or instrument setup changes requested after proposal approval are not protected against target duplication from other programmes. Deviations from this rule will only be considered under exceptional circumstances and will be treated in the same way as requests for extensions of the proprietary period.

## 5.8 Data rights, archiving, data distribution

For both Visitor Mode and Service Mode observations, the [ESO Science Archive Facility](#) is the sole access point to data obtained with ESO telescopes. All data obtained with ESO facilities are ESO property, but ESO grants a 12-month proprietary period for science and acquisition data to the PI of the programme, which applies to each data file individually. The proprietary period starts as soon as the data are made available to the PI or respective delegates via the archive, i.e., as soon as the data are ingested, which typically happens a few hours after the observation.

The information contained in the headers of all data files is immediately public. At the end of the proprietary period, the raw data and the abstracts of proposals are made public. In addition, for a selection of instruments (see the [ESO Data Streams](#) webpage), also the reduced data are made public. Exceptions to this [ESO Data Access Policy](#), such as an extension of the proprietary period, may be granted in exceptional cases. The corresponding requests have to be justified in detail and submitted to the Director General for approval. Justifications based only on lack of time and/or resources to complete the data analysis will not be considered. Requesting a shorter proprietary period than the nominal 12 months is possible using the “Proprietary Time” pull-down menu when adding or editing observing runs in p1. Raw data from Public Surveys, Calibration Programmes and calibration data are not subject to a proprietary period and become publicly available as soon as they are ingested into the ESO Archive.

## 5.9 Publication of ESO telescope results

Publications based on observations collected at ESO telescopes must state this in a footnote to the article’s title or in the acknowledgments, as outlined on the [ESO publications policy](#) webpage. The observing run ID(s) must be clearly identified by their ESO reference number(s) as shown in the following example:

*“Based on observations collected at the European Southern Observatory under ESO programme 115.XXXX.”*

## 5.10 Press releases and other communication products

Should you consider that your results are relevant for the wider public or journalists, please consider sending your paper to the Department of Communication ([press@eso.org](mailto:press@eso.org)), preferably no later than when the paper is submitted for publication. Further information can be found in this [ESO announcement about press releases](#).

ESO reserves the right to use for press releases any data obtained with ESO telescopes as part of programmes with allocated ESO time.

## **A Appendix. Scientific keywords**

### **COSMOLOGY**

cosmology: cosmological parameters  
cosmology: dark energy  
cosmology: dark matter  
cosmology: diffuse radiation  
cosmology: distance scale  
cosmology: early universe  
cosmology: inflation  
cosmology: large-scale structure of universe  
cosmology: miscellaneous  
cosmology: observations  
cosmology: primordial nucleosynthesis  
cosmology: theory

### **GALAXIES**

galaxies: abundances  
galaxies: active  
galaxies: BL Lacertae objects  
galaxies: bulges  
galaxies: clusters  
galaxies: distances and redshifts  
galaxies: dwarf  
galaxies: elliptical and lenticular, cD  
galaxies: evolution  
galaxies: formation  
galaxies: fundamental parameters  
galaxies: general  
galaxies: halos  
galaxies: high-redshift  
galaxies: interactions  
galaxies: intergalactic medium  
galaxies: irregular  
galaxies: ISM  
galaxies: jets  
galaxies: kinematics and dynamics  
galaxies: Local Group  
galaxies: luminosity function, mass function  
galaxies: Magellanic Clouds  
galaxies: magnetic fields  
galaxies: nuclei  
galaxies: peculiar  
galaxies: photometry  
galaxies: quasars  
galaxies: Seyfert  
galaxies: spiral  
galaxies: star clusters  
galaxies: star formation  
galaxies: starburst  
galaxies: stars clusters: individual  
galaxies: statistics  
galaxies: stellar content  
galaxies: structure

### **INTERSTELLAR MEDIUM (ISM), NEBULAE**

- ISM: abundances
- ISM: atoms
- ISM: bubbles
- ISM: clouds
- ISM: cosmic rays
- ISM: dust, extinction
- ISM: evolution
- ISM: general
- ISM: Herbig-Haro objects
- ISM: HII regions
- ISM: jets and outflows
- ISM: kinematics and dynamics
- ISM: lines and bands
- ISM: magnetic fields
- ISM: molecules
- ISM: planetary nebulae
- ISM: supernova remnants

## **PLANETARY SYSTEMS**

- comets
- earth
- exoplanets
- interplanetary medium
- Kuiper Belt
- meteorites, meteors, meteoroids
- minor planets, asteroids
- moon
- near earth objects
- Oort cloud
- planet-disk interactions
- planets and satellites
- protoplanetary disks
- zodiacal dust

## **STARS**

- stars: abundances
- stars: AGB and post-AGB
- stars: atmospheres
- stars: binaries
- stars: black holes
- stars: brown dwarfs
- stars: chromospheres
- stars: circumstellar matter
- stars: coronae
- stars: distances
- stars: early-type
- stars: evolution
- stars: formation
- stars: fundamental parameters
- stars: gamma-ray burst
- stars: general
- stars: Hertzsprung-Russell diagram
- stars: horizontal-branch
- stars: interiors
- stars: jets
- stars: kinematics and dynamics
- stars: late-type



- stars: low-mass
- stars: luminosity function, mass function
- stars: magnetars
- stars: magnetic field
- stars: mass loss
- stars: neutron
- stars: novae, cataclysmic variables
- stars: oscillations (including pulsations)
- stars: Population II
- stars: Population III
- stars: pre-main sequence
- stars: protostars
- stars: pulsars
- stars: rotation
- stars: solar-type
- stars: subdwarfs
- stars: supergiants
- stars: supernovae
- stars: variables
- stars: white-dwarfs
- stars: Wolf-Rayet

## **THE GALAXY**

- Galaxy: abundances
- Galaxy: bulge
- Galaxy: center
- Galaxy: disk
- Galaxy: evolution
- Galaxy: formation
- Galaxy: fundamental parameters
- Galaxy: general
- Galaxy: globular clusters: general
- Galaxy: globular clusters: individual
- Galaxy: halo
- Galaxy: kinematics and dynamics
- Galaxy: local interstellar matter
- Galaxy: nucleus
- Galaxy: open clusters and associations
- Galaxy: solar neighborhood
- Galaxy: stellar content
- Galaxy: structure

## **THE SUN**

- Sun: abundances
- Sun: activity
- Sun: atmosphere
- Sun: chromosphere
- Sun: corona
- Sun: coronal mass ejections (CMEs)
- Sun: evolution
- Sun: faculae, plages
- Sun: filaments, prominences
- Sun: flares
- Sun: fundamental parameters
- Sun: general
- Sun: granulation
- Sun: helioseismology

Sun: heliosphere  
Sun: infrared  
Sun: magnetic fields  
Sun: oscillations  
Sun: particle emission  
Sun: photosphere  
Sun: radio radiation  
Sun: rotation  
Sun: solar wind  
Sun: solar-terrestrial relations  
Sun: sunspots  
Sun: transition region  
Sun: UV radiation  
Sun: X-rays, gamma rays

## B Appendix. Acronyms

4LGSF	4 Laser Guide Stars Facility
4MOST	4-metre Multi-Object Spectroscopic Telescope
AOF	Adaptive Optics Facility
AT	Auxiliary Telescope for the VLT Interferometer
CIAO	GRAVITY Coudé Infrared Adaptive Optics system for the VLT Interferometer
Col	Co-Investigator
CRIRES	CRyogenic high-resolution IR Échelle Spectrometer
DDT	Director's Discretionary Time
dPI	Delegated Principal Investigator
DOI	Digital Object Identifier
DVM	Designated Visitor Mode
EFOSC2	ESO Faint Object Spectrograph and Camera 2
ERIS	Enhanced Resolution Imager and Spectrograph
ESO	European Southern Observatory
ESPRESSO	Échelle SPectrograph for Rocky Exoplanets and Stable Spectroscopic Observations
ETC	Exposure Time Calculator
FLAMES	Fibre Large Array Multi Element Spectrograph
FORS2	FOcal Reducer/low dispersion Spectrograph 2
GALACSI	Ground Atmospheric Layer Adaptive Corrector for Spectroscopic Imaging
GRA4MAT	GRAVITY fringe tracker used for MATISSE
GRAVITY	Second generation VLTI instrument in the K band
GPAO	GRAVITY+ Adaptive Optics
GTO	Guaranteed Time Observations
HARPS	High Accuracy Radial velocity Planet Searcher
HAWK-I	High Acuity Wide field K-band Imager
ICCF	Incoherent Combined Coudé Focus
IFU	Integral Field Unit
IR	Infrared
IRDIS	InfraRed Dual-Band Imager and Spectrograph
ISAAC	Infrared Spectrometer And Array Camera
ISL	VLTI imaging slot
KMOS	K-band Multi-Object Spectrograph
LGS	Laser Guide Star
LPO	La Silla Paranal Observatory
LST	Local Sidereal Time
MACAO	Multi-Applications Curvature Adaptive Optics
MATISSE	Multi AperTure mid-Infrared SpectroScopic Experiment
MOONS	Multi-Object Optical and Near-infrared Spectrograph for the VLT
MUSE	Multi-Unit Spectroscopic Explorer
MXU	Multi-object spectroscopy with exchangeable masks
NAOMI	New Adaptive Optics Module for Interferometry
NFM	Narrow Field Mode (a mode of MUSE)
NGS	Natural Guide Star
NIRPS	Near Infra-Red Planet Searcher
OB	Observation Block
OMEGACAM	Wide Field Imager for the VST at Paranal
OPC	Observing Programmes Committee
OPO	Observing Programmes Office
p1	web-based phase 1 proposal preparation tool
p2	web-based phase 2 proposal preparation tool
PI	Principal Investigator
PIONIER	Precision Integrated-Optics Near-infrared Imaging ExpeRiment
POEM	Paranal Observatory Eavesdropping Mode

PWV	Precipitable Water Vapour
RA	Right Ascension
RRM	Rapid Response Mode
SM	Service Mode
SOXS	Son of X-Shooter
SPHERE	Spectro-Polarimetric High-contrast Exoplanet REsearch
ToO	Target of Opportunity
ULTRACAM	High speed camera
USD	User Support Department
UT1	Unit Telescope 1 (Antu)
UT2	Unit Telescope 2 (Kueyen)
UT3	Unit Telescope 3 (Melipal)
UT4	Unit Telescope 4 (Yepun)
UV	Ultra Violet
UVES	UV-Visual Échelle Spectrograph
VIRCAM	VISTA InfraRed CAMera
VISIR	VLT Imager and Spectrometer for mid-InfraRed
VISTA	Visible and Infrared Survey Telescope for Astronomy
VLT	Very Large Telescope
VLTI	Very Large Telescope Interferometer
VM	Visitor Mode
VST	VLT Survey Telescope
WFM	Wide Field Mode (a mode of MUSE)
X-SHOOTER	UV-Visual-NIR medium resolution échelle spectrograph
ZIMPOL	Zurich IMaging POLarimeter

## C Appendix. List of Links

ESO Optical/Infrared Telescopes Science Operations Policies: <a href="https://www.eso.org/public/about-eso/committees/cou/cou-154th/external/Cou_1847_rev_Science_Policies_050520.pdf">https://www.eso.org/public/about-eso/committees/cou/cou-154th/external/Cou_1847_rev_Science_Policies_050520.pdf</a>	iv
ESO Operations Helpdesk: <a href="https://support.eso.org/">https://support.eso.org/</a>	iv
ESO User Portal: <a href="https://www.eso.org/UserPortal/">https://www.eso.org/UserPortal/</a>	1
p1 proposal preparation tool: <a href="https://www.eso.org/p1/">https://www.eso.org/p1/</a>	1
p1 API Tutorial: <a href="https://www.eso.org/sci/observing/phase1/p1intro/p1api_python_tutorial.html">https://www.eso.org/sci/observing/phase1/p1intro/p1api_python_tutorial.html</a>	1
p1 introduction: <a href="https://www.eso.org/sci/observing/phase1/p1intro.html">https://www.eso.org/sci/observing/phase1/p1intro.html</a>	1
Dual-Anonymous Guidelines: <a href="https://www.eso.org/sci/observing/phase1/dual-anonymous-guidelines.html">https://www.eso.org/sci/observing/phase1/dual-anonymous-guidelines.html</a>	1
Overheads: <a href="https://www.eso.org/sci/facilities/lpo/cfp/overheads.html">https://www.eso.org/sci/facilities/lpo/cfp/overheads.html</a>	1
p2 demo: <a href="https://www.eso.org/p2demo">https://www.eso.org/p2demo</a>	1
Science Archive Facility: <a href="https://archive.eso.org">https://archive.eso.org</a>	1
GTO Plans: <a href="https://www.eso.org/sci/observing/teles-alloc/gto.html">https://www.eso.org/sci/observing/teles-alloc/gto.html</a>	1
GTO policy: <a href="https://www.eso.org/sci/observing/policies/gto_policy.html">https://www.eso.org/sci/observing/policies/gto_policy.html</a>	1
Observing Conditions: <a href="https://www.eso.org/sci/observing/phase2/ObsConditions.generic.html">https://www.eso.org/sci/observing/phase2/ObsConditions.generic.html</a>	1
Kerber et al. 2014, MNRAS 439, 247: <a href="https://ui.adsabs.harvard.edu/abs/2014MNRAS.439..247K/abstract">https://ui.adsabs.harvard.edu/abs/2014MNRAS.439..247K/abstract</a>	2
Any-weather proposals: <a href="https://www.eso.org/sci/facilities/lpo/cfp/statistics">https://www.eso.org/sci/facilities/lpo/cfp/statistics</a>	2
Forecast of telescope pressure: <a href="https://www.eso.org/sci/observing/phase1/pressure.html">https://www.eso.org/sci/observing/phase1/pressure.html</a>	2
Distributed Peer Review (DPR): <a href="https://www.eso.org/sci/observing/phase1/distributed-peer-review.html">https://www.eso.org/sci/observing/phase1/distributed-peer-review.html</a>	2
Observing Programmes Committee (OPC) and the Expert Panels: <a href="https://www.eso.org/sci/observing/phase1/OPCandPanels.html">https://www.eso.org/sci/observing/phase1/OPCandPanels.html</a>	2
contact ESO: <a href="https://support.eso.org/new-ticket">https://support.eso.org/new-ticket</a>	2
DPR rules and guidelines: <a href="https://www.eso.org/sci/observing/phase1/distributed-peer-review.html">https://www.eso.org/sci/observing/phase1/distributed-peer-review.html</a>	2
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Instruments: <a href="https://www.eso.org/sci/facilities/lpo/cfp/instruments.html">https://www.eso.org/sci/facilities/lpo/cfp/instruments.html</a>	2
VLT Expertise Centres: <a href="https://european-interferometry.eu/vlti-expertise-centers/">https://european-interferometry.eu/vlti-expertise-centers/</a>	2
science_p1support@eso.org: <a href="mailto:science_p1support@eso.org">mailto:science_p1support@eso.org</a>	2
ESO Operations Helpdesk: <a href="https://support.eso.org/">https://support.eso.org/</a>	2
Important Links: <a href="https://www.eso.org/sci/observing/phase1/links.html">https://www.eso.org/sci/observing/phase1/links.html</a>	2
Late Breaking News: <a href="https://www.eso.org/sci/observing/phase1/lbn.html">https://www.eso.org/sci/observing/phase1/lbn.html</a>	2
Instruments: <a href="https://www.eso.org/sci/facilities/lpo/cfp/instruments.html">https://www.eso.org/sci/facilities/lpo/cfp/instruments.html</a>	3
FORS2: <a href="https://www.eso.org/sci/facilities/paranal/instruments/fors2/">https://www.eso.org/sci/facilities/paranal/instruments/fors2/</a>	3
KMOS: <a href="https://www.eso.org/sci/facilities/paranal/instruments/kmos/">https://www.eso.org/sci/facilities/paranal/instruments/kmos/</a>	3
FLAMES: <a href="https://www.eso.org/sci/facilities/paranal/instruments/flames/">https://www.eso.org/sci/facilities/paranal/instruments/flames/</a>	3
VISIR: <a href="https://www.eso.org/sci/facilities/paranal/instruments/visir/">https://www.eso.org/sci/facilities/paranal/instruments/visir/</a>	3
UVES: <a href="https://www.eso.org/sci/facilities/paranal/instruments/uves/">https://www.eso.org/sci/facilities/paranal/instruments/uves/</a>	3
SPHERE: <a href="https://www.eso.org/sci/facilities/paranal/instruments/sphere/">https://www.eso.org/sci/facilities/paranal/instruments/sphere/</a>	3
X-SHOOTER: <a href="https://www.eso.org/sci/facilities/paranal/instruments/xshooter/">https://www.eso.org/sci/facilities/paranal/instruments/xshooter/</a>	3
CRIRES: <a href="https://www.eso.org/sci/facilities/paranal/instruments/crises/">https://www.eso.org/sci/facilities/paranal/instruments/crises/</a>	3
HAWK-I: <a href="https://www.eso.org/sci/facilities/paranal/instruments/hawki/">https://www.eso.org/sci/facilities/paranal/instruments/hawki/</a>	3
ERIS: <a href="https://www.eso.org/sci/facilities/paranal/instruments/eris/">https://www.eso.org/sci/facilities/paranal/instruments/eris/</a>	3
MUSE: <a href="https://www.eso.org/sci/facilities/paranal/instruments/muse/">https://www.eso.org/sci/facilities/paranal/instruments/muse/</a>	3
ESPRESSO: <a href="https://www.eso.org/sci/facilities/paranal/instruments/espresso/">https://www.eso.org/sci/facilities/paranal/instruments/espresso/</a>	3
GRAVITY: <a href="https://www.eso.org/sci/facilities/paranal/instruments/gravity/">https://www.eso.org/sci/facilities/paranal/instruments/gravity/</a>	3
MATISSE: <a href="https://www.eso.org/sci/facilities/paranal/instruments/matisse/">https://www.eso.org/sci/facilities/paranal/instruments/matisse/</a>	3
Visitor Focus: <a href="https://www.eso.org/sci/facilities/paranal/instruments/vlti-visitor.html">https://www.eso.org/sci/facilities/paranal/instruments/vlti-visitor.html</a>	3
GRAVITY: <a href="https://www.eso.org/sci/facilities/paranal/instruments/gravity/">https://www.eso.org/sci/facilities/paranal/instruments/gravity/</a>	3

MATISSE: <a href="https://www.eso.org/sci/facilities/paranal/instruments/matisse/">https://www.eso.org/sci/facilities/paranal/instruments/matisse/</a> . . . . .	3
PIONIER: <a href="https://www.eso.org/sci/facilities/paranal/instruments/pionier/">https://www.eso.org/sci/facilities/paranal/instruments/pionier/</a> . . . . .	3
Visitor Focus: <a href="https://www.eso.org/sci/facilities/paranal/instruments/vlti-visitor.html">https://www.eso.org/sci/facilities/paranal/instruments/vlti-visitor.html</a> . . . . .	3
3.6m: <a href="https://www.eso.org/sci/facilities/lasilla/telescopes/3p6.html">https://www.eso.org/sci/facilities/lasilla/telescopes/3p6.html</a> . . . . .	4
HARPS: <a href="https://www.eso.org/sci/facilities/lasilla/instruments/harps/">https://www.eso.org/sci/facilities/lasilla/instruments/harps/</a> . . . . .	4
NIRPS: <a href="https://www.eso.org/sci/facilities/lasilla/instruments/nirps/">https://www.eso.org/sci/facilities/lasilla/instruments/nirps/</a> . . . . .	4
NTT: <a href="https://www.eso.org/sci/facilities/lasilla/telescopes/ntt.html">https://www.eso.org/sci/facilities/lasilla/telescopes/ntt.html</a> . . . . .	4
EFOOSC2: <a href="https://www.eso.org/sci/facilities/lasilla/instruments/efosc/">https://www.eso.org/sci/facilities/lasilla/instruments/efosc/</a> . . . . .	4
ULTRACAM: <a href="http://www.vikdhillon.staff.shef.ac.uk/ultracam/">http://www.vikdhillon.staff.shef.ac.uk/ultracam/</a> . . . . .	4
Visitor Focus: <a href="https://www.eso.org/sci/facilities/lasilla/instruments/visitor/VisitorInstruments.pdf">https://www.eso.org/sci/facilities/lasilla/instruments/visitor/VisitorInstruments.pdf</a> . . . . .	4
Instruments Summary Table: <a href="https://www.eso.org/sci/facilities/lpo/cfp/instrument_summary.html">https://www.eso.org/sci/facilities/lpo/cfp/instrument_summary.html</a> . . . . .	4
Recent Changes in Instrumentation: <a href="https://www.eso.org/sci/facilities/lpo/cfp/recent-changes.html">https://www.eso.org/sci/facilities/lpo/cfp/recent-changes.html</a> . . . . .	4
Instruments: <a href="https://www.eso.org/sci/facilities/lpo/cfp/instruments.html">https://www.eso.org/sci/facilities/lpo/cfp/instruments.html</a> . . . . .	4
MUSE News: <a href="https://www.eso.org/sci/facilities/paranal/instruments/muse/news.html">https://www.eso.org/sci/facilities/paranal/instruments/muse/news.html</a> . . . . .	4
ESO Operations Helpdesk: <a href="https://support.eso.org/">https://support.eso.org/</a> . . . . .	5
vik.dhillon@sheffield.ac.uk: <a href="mailto:vik.dhillon@sheffield.ac.uk">mailto:vik.dhillon@sheffield.ac.uk</a> . . . . .	6
Visitor Focus: <a href="https://www.eso.org/sci/facilities/paranal/instruments/visfocus.html">https://www.eso.org/sci/facilities/paranal/instruments/visfocus.html</a> . . . . .	7
Applications for Use of the VLT Visitor Focus: <a href="https://www.eso.org/sci/facilities/paranal/instruments/visfocus/applications.html">https://www.eso.org/sci/facilities/paranal/instruments/visfocus/applications.html</a> . . . . .	7
Visitor Focus: <a href="https://www.eso.org/sci/facilities/paranal/instruments/vlti-visitor.html">https://www.eso.org/sci/facilities/paranal/instruments/vlti-visitor.html</a> . . . . .	7
Applications for Use of the VLT Visitor Focus: <a href="https://www.eso.org/sci/facilities/paranal/instruments/vlti-visitor/applications.html">https://www.eso.org/sci/facilities/paranal/instruments/vlti-visitor/applications.html</a> . . . . .	7
Visitor Focus: <a href="https://www.eso.org/sci/facilities/lasilla/instruments/visitor/VisitorInstruments.pdf">https://www.eso.org/sci/facilities/lasilla/instruments/visitor/VisitorInstruments.pdf</a> . . . . .	7
Expected Changes in Instrumentation: <a href="https://www.eso.org/sci/facilities/lpo/cfp/foreseen-changes.html">https://www.eso.org/sci/facilities/lpo/cfp/foreseen-changes.html</a> . . . . .	7
VLT/I & La Silla Instrumentation Development: <a href="https://www.eso.org/sci/facilities/development.html">https://www.eso.org/sci/facilities/development.html</a> . . . . .	7
Science Announcement: <a href="https://www.eso.org/sci/publications/announcements/sciann17641.html">https://www.eso.org/sci/publications/announcements/sciann17641.html</a> . . . . .	7
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FORS Upgrade project (FORS-Up): <a href="https://www.eso.org/sci/facilities/paranal/instruments/fors/forsup.html">https://www.eso.org/sci/facilities/paranal/instruments/fors/forsup.html</a> . . . . .	7
proposal submission tool p1: <a href="https://www.eso.org/p1">https://www.eso.org/p1</a> . . . . .	8
p1 introduction: <a href="https://www.eso.org/sci/observing/phase1/p1intro.html">https://www.eso.org/sci/observing/phase1/p1intro.html</a> . . . . .	8
p1 help: <a href="https://www.eso.org/sci/observing/phase1/p1intro/p1_help.html">https://www.eso.org/sci/observing/phase1/p1intro/p1_help.html</a> . . . . .	8
p1demo: <a href="https://www.eso.org/p1demo/">https://www.eso.org/p1demo/</a> . . . . .	8
Users Workshops: <a href="https://www.eso.org/sci/observing/phase2/User_Workshops.html">https://www.eso.org/sci/observing/phase2/User_Workshops.html</a> . . . . .	8
p1 help: <a href="https://www.eso.org/sci/observing/phase1/p1intro/p1_help.html">https://www.eso.org/sci/observing/phase1/p1intro/p1_help.html</a> . . . . .	8
p1: <a href="https://www.eso.org/p1">https://www.eso.org/p1</a> . . . . .	8
overheads: <a href="https://www.eso.org/sci/facilities/lpo/cfp/overheads.html">https://www.eso.org/sci/facilities/lpo/cfp/overheads.html</a> . . . . .	8
p2demo: <a href="https://www.eso.org/p2demo">https://www.eso.org/p2demo</a> . . . . .	8
Instruments: <a href="https://www.eso.org/sci/facilities/lpo/cfp/instruments.html">https://www.eso.org/sci/facilities/lpo/cfp/instruments.html</a> . . . . .	8
Observing Conditions: <a href="https://www.eso.org/sci/observing/phase2/ObsConditions.generic.html">https://www.eso.org/sci/observing/phase2/ObsConditions.generic.html</a> . . . . .	8
ESO Exposure Time Calculators (ETCs): <a href="https://www.eso.org/observing/etc/">https://www.eso.org/observing/etc/</a> . . . . .	8
Ephemerides and Position, Airmass, Extinction Calculators: <a href="https://www.eso.org/sci/observing/tools/calendar.html">https://www.eso.org/sci/observing/tools/calendar.html</a> . . . . .	8
Archives and Catalogues: <a href="https://www.eso.org/sci/observing/tools/catalogues.html">https://www.eso.org/sci/observing/tools/catalogues.html</a> . . . . .	8
Skycat tool: <a href="https://www.eso.org/sci/observing/tools/skycat.html">https://www.eso.org/sci/observing/tools/skycat.html</a> . . . . .	8
Observing Tools and Services: <a href="https://www.eso.org/sci/observing/tools.html">https://www.eso.org/sci/observing/tools.html</a> . . . . .	8
Observer's Tools and Generic Standard Stars: <a href="https://www.eso.org/sci/facilities/paranal/sciops/tools.html">https://www.eso.org/sci/facilities/paranal/sciops/tools.html</a> . . . . .	8
ESO Science Operations Helpdesk: <a href="https://support.eso.org/">https://support.eso.org/</a> . . . . .	9

Time-critical OB execution policy: <a href="https://www.eso.org/sci/observing/phase2/SMPolicies/Ti&lt;br/&gt;meCriticalOBfailure.html">https://www.eso.org/sci/observing/phase2/SMPolicies/Ti meCriticalOBfailure.html</a> . . . . .	9
ETC: <a href="https://www.eso.org/observing/etc">https://www.eso.org/observing/etc</a> . . . . .	9
Phase 2 preparation tool p2: <a href="https://www.eso.org/sci/observing/phase2/p2intro.html">https://www.eso.org/sci/observing/phase2/p2intro.html</a> . . . . .	10
Phase 2 Observing Preparation: <a href="https://www.eso.org/sci/observing/phase2.html">https://www.eso.org/sci/observing/phase2.html</a> . . . . .	10
Service Mode Guidelines: <a href="https://www.eso.org/sci/observing/phase2/SMGuidelines.html">https://www.eso.org/sci/observing/phase2/SMGuidelines.html</a> . . . . .	10
OB Rules: <a href="https://www.eso.org/sci/observing/phase2/SMGuidelines/SMRules.html">https://www.eso.org/sci/observing/phase2/SMGuidelines/SMRules.html</a> . . . . .	10
p2: <a href="https://www.eso.org/sci/observing/phase2/p2intro.html">https://www.eso.org/sci/observing/phase2/p2intro.html</a> . . . . .	10
VM Guidelines: <a href="https://www.eso.org/sci/observing/phase2/VMGuidelines.html">https://www.eso.org/sci/observing/phase2/VMGuidelines.html</a> . . . . .	10
Phase 2 workflow: <a href="https://www.eso.org/sci/observing/phase2/p2intro/p2Features.html">https://www.eso.org/sci/observing/phase2/p2intro/p2Features.html</a> . . . . .	10
p2Is: <a href="https://www.eso.org/p2Is/">https://www.eso.org/p2Is/</a> . . . . .	10
ToO: <a href="https://www.eso.org/sci/observing/phase2/SMSpecial/TOOObservation.html">https://www.eso.org/sci/observing/phase2/SMSpecial/TOOObservation.html</a> . . . . .	10
RRM procedures: <a href="https://www.eso.org/sci/observing/phase2/SMSpecial/RRMObservation.&lt;br/&gt;html">https://www.eso.org/sci/observing/phase2/SMSpecial/RRMObservation. html</a> . . . . .	10
ETC: <a href="https://www.eso.org/observing/etc">https://www.eso.org/observing/etc</a> . . . . .	10
VLTI Configurations Overview: <a href="https://www.eso.org/sci/facilities/paranal/telescopes/vlti/c&lt;br/&gt;onfiguration/">https://www.eso.org/sci/facilities/paranal/telescopes/vlti/c onfiguration/</a> . . . . .	11
public schedule: <a href="https://www.eso.org/LPOschedule/public">https://www.eso.org/LPOschedule/public</a> . . . . .	11
francois.bouchy@unige.ch: <a href="mailto:francois.bouchy@unige.ch">mailto:francois.bouchy@unige.ch</a> . . . . .	11
FORS2: <a href="https://www.eso.org/sci/facilities/paranal/instruments/fors/overview.html">https://www.eso.org/sci/facilities/paranal/instruments/fors/overview.html</a> . . . . .	11
Quality Control: <a href="https://www.eso.org/sci/facilities/paranal/quality-control.html">https://www.eso.org/sci/facilities/paranal/quality-control.html</a> . . . . .	12
VLT/I pipelines: <a href="https://www.eso.org/sci/software/pipelines/">https://www.eso.org/sci/software/pipelines/</a> . . . . .	12
Quality Control: <a href="https://www.eso.org/sci/facilities/paranal/quality-control.html">https://www.eso.org/sci/facilities/paranal/quality-control.html</a> . . . . .	12
ESO Optical/Infrared Telescopes Science Operations Policies: <a href="https://www.eso.org/public/a&lt;br/&gt;bout-eso/committees/cou/cou-154th/external/Cou_1847_rev_Science_Policies_050520.&lt;br/&gt;pdf">https://www.eso.org/public/a bout-eso/committees/cou/cou-154th/external/Cou_1847_rev_Science_Policies_050520. pdf</a> . . . . .	12
2008: <a href="https://www.eso.org/sci/meetings/2008/LP2008.html">https://www.eso.org/sci/meetings/2008/LP2008.html</a> . . . . .	13
2015: <a href="https://www.eso.org/sci/meetings/2015/Rainbows2015.html">https://www.eso.org/sci/meetings/2015/Rainbows2015.html</a> . . . . .	13
ESO Science Data Products Standard: <a href="https://www.eso.org/sci/observing/phase3/p3sdpst.d&lt;br/&gt;pdf">https://www.eso.org/sci/observing/phase3/p3sdpst.d pdf</a> . . . . .	13
ESO Data Streams: <a href="https://www.eso.org/sci/observing/phase3/data_streams.html">https://www.eso.org/sci/observing/phase3/data_streams.html</a> . . . . .	13
Phase 3: <a href="https://www.eso.org/sci/observing/phase3.html">https://www.eso.org/sci/observing/phase3.html</a> . . . . .	13
GTO Policy page: <a href="https://www.eso.org/sci/observing/policies/gto_policy.html">https://www.eso.org/sci/observing/policies/gto_policy.html</a> . . . . .	14
GTO Programmes: <a href="https://www.eso.org/sci/observing/teles-alloc/gto.html">https://www.eso.org/sci/observing/teles-alloc/gto.html</a> . . . . .	14
ESO Optical/Infrared Telescopes Science Operations Policies: <a href="https://www.eso.org/public/a&lt;br/&gt;bout-eso/committees/cou/cou-154th/external/Cou_1847_rev_Science_Policies_050520.&lt;br/&gt;pdf">https://www.eso.org/public/a bout-eso/committees/cou/cou-154th/external/Cou_1847_rev_Science_Policies_050520. pdf</a> . . . . .	14
2017 ESO Calibration workshop: <a href="https://www.eso.org/sci/meetings/2017/calibration2017.html">https://www.eso.org/sci/meetings/2017/calibration2017.html</a> . . . . .	15
Phase 3: <a href="https://www.eso.org/sci/observing/phase3.html">https://www.eso.org/sci/observing/phase3.html</a> . . . . .	15
DDT Policy: <a href="https://www.eso.org/sci/observing/policies/ddt_policy.html">https://www.eso.org/sci/observing/policies/ddt_policy.html</a> . . . . .	15
ToO policy: <a href="https://www.eso.org/sci/facilities/paranal/sciops/ToO_policies.html">https://www.eso.org/sci/facilities/paranal/sciops/ToO_policies.html</a> . . . . .	16
RRM-protected runs: <a href="https://www.eso.org/sci/observing/teles-alloc/rmm-protected-runs.html">https://www.eso.org/sci/observing/teles-alloc/rmm-protected-runs.html</a> . . . . .	16
p2: <a href="https://www.eso.org/sci/observing/phase2/p2intro.html">https://www.eso.org/sci/observing/phase2/p2intro.html</a> . . . . .	16
ToO: <a href="https://www.eso.org/sci/observing/phase2/SMSpecial/TOOObservation.html">https://www.eso.org/sci/observing/phase2/SMSpecial/TOOObservation.html</a> . . . . .	16
RRM procedures: <a href="https://www.eso.org/sci/observing/phase2/SMSpecial/RRMObservation.&lt;br/&gt;html">https://www.eso.org/sci/observing/phase2/SMSpecial/RRMObservation. html</a> . . . . .	16
ESO Operations Helpdesk: <a href="https://support.eso.org/">https://support.eso.org/</a> . . . . .	17
ToO: <a href="https://www.eso.org/sci/observing/phase2/SMSpecial/TOOObservation.html">https://www.eso.org/sci/observing/phase2/SMSpecial/TOOObservation.html</a> . . . . .	17
RRM procedures: <a href="https://www.eso.org/sci/observing/phase2/SMSpecial/RRMObservation.&lt;br/&gt;html">https://www.eso.org/sci/observing/phase2/SMSpecial/RRMObservation. html</a> . . . . .	17
joint VLT/I-ALMA proposals: <a href="https://www.eso.org/sci/observing/phase1/JointVLT-ALMA.&lt;br/&gt;html">https://www.eso.org/sci/observing/phase1/JointVLT-ALMA. html</a> . . . . .	18
fac-simile template: <a href="https://www.eso.org/sci/observing/phase1/JointVLT-ALMA.html">https://www.eso.org/sci/observing/phase1/JointVLT-ALMA.html</a> . . . . .	18
Rejkuba et al. 2018, Msngr, 173, 2: <a href="http://www.eso.org/sci/publications/messenger/archive/no.17&lt;br/&gt;3-sep18/messenger-no173-2-6.pdf">www.eso.org/sci/publications/messenger/archive/no.17 3-sep18/messenger-no173-2-6.pdf</a> . . . . .	19
General Philosophy of Service Mode Observations: <a href="https://www.eso.org/sci/observing/phas&lt;br/&gt;e2/SMPPhilosophy.html">https://www.eso.org/sci/observing/phas e2/SMPPhilosophy.html</a> . . . . .	19
SM policies: <a href="https://www.eso.org/sci/observing/phase2/SMPolicies.html">https://www.eso.org/sci/observing/phase2/SMPolicies.html</a> . . . . .	19

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Overheads: <a href="https://www.eso.org/sci/facilities/lpo/cfp/overheads.html">https://www.eso.org/sci/facilities/lpo/cfp/overheads.html</a> . . . . .	19
Programme Priority Groups: <a href="https://www.eso.org/sci/observing/phase2/SMPPhilosophy/ProgrammePriority.html">https://www.eso.org/sci/observing/phase2/SMPPhilosophy/ProgrammePriority.html</a> . . . . .	20
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Phase 2 preparation: <a href="https://www.eso.org/sci/observing/phase2/p2intro/p2Features.html">https://www.eso.org/sci/observing/phase2/p2intro/p2Features.html</a> . . . . .	20
p2 web: <a href="https://www.eso.org/sci/observing/phase2/p2intro.html">https://www.eso.org/sci/observing/phase2/p2intro.html</a> . . . . .	21
La Silla Science Operations: <a href="https://www.eso.org/sci/facilities/lasilla/sciops/">https://www.eso.org/sci/facilities/lasilla/sciops/</a> . . . . .	21
Overheads: <a href="https://www.eso.org/sci/facilities/lpo/cfp/overheads.html">https://www.eso.org/sci/facilities/lpo/cfp/overheads.html</a> . . . . .	21
ToO policy: <a href="https://www.eso.org/sci/facilities/paranal/sciops/ToO_policies.html">https://www.eso.org/sci/facilities/paranal/sciops/ToO_policies.html</a> . . . . .	21
Visitor Mode Phase 2 Guidelines: <a href="https://www.eso.org/sci/observing/phase2/VMGuidelines.html">https://www.eso.org/sci/observing/phase2/VMGuidelines.html</a> . . . . .	21
POEM Instructions: <a href="https://www.eso.org/sci/facilities/paranal/sciops/POEM_instructions.html">https://www.eso.org/sci/facilities/paranal/sciops/POEM_instructions.html</a> . . . . .	21
Paranal Science Operations: <a href="https://www.eso.org/sci/facilities/paranal/sciops/index.html">https://www.eso.org/sci/facilities/paranal/sciops/index.html</a> . . . . .	22
p2 web: <a href="https://www.eso.org/sci/observing/phase2/p2intro.html">https://www.eso.org/sci/observing/phase2/p2intro.html</a> . . . . .	22
ESO Operations Helpdesk: <a href="https://support.eso.org/">https://support.eso.org/</a> . . . . .	22
Agreement between Phase 2 material and Phase 1 request: <a href="https://www.eso.org/sci/observing/phase2/SMPolicies/Phase2Phase1.html">https://www.eso.org/sci/observing/phase2/SMPolicies/Phase2Phase1.html</a> . . . . .	22
Programme Priority Groups: <a href="https://www.eso.org/sci/observing/phase2/SMPPhilosophy/ProgrammePriority.html">https://www.eso.org/sci/observing/phase2/SMPPhilosophy/ProgrammePriority.html</a> . . . . .	22
VLT Laser Guide Star Facility Policies: <a href="https://www.eso.org/sci/facilities/paranal/sciops/LG_SF_policies.html">https://www.eso.org/sci/facilities/paranal/sciops/LG_SF_policies.html</a> . . . . .	23
Agreement between Phase 2 material and Phase 1 request: <a href="https://www.eso.org/sci/observing/phase2/SMPolicies/Phase2Phase1.html">https://www.eso.org/sci/observing/phase2/SMPolicies/Phase2Phase1.html</a> . . . . .	23
p2: <a href="https://www.eso.org/sci/observing/phase2/p2intro/">https://www.eso.org/sci/observing/phase2/p2intro/</a> . . . . .	23
paranal@eso.org: <a href="mailto:paranal@eso.org">mailto:paranal@eso.org</a> . . . . .	23
Phase 2 Waiver Requests and Programme Change Requests: <a href="https://www.eso.org/sci/observing/phase2/SMGuidelines/WaiverChanges.html">https://www.eso.org/sci/observing/phase2/SMGuidelines/WaiverChanges.html</a> . . . . .	23
ESO Science Archive Facility: <a href="https://archive.eso.org">https://archive.eso.org</a> . . . . .	24
ESO Data Streams: <a href="https://www.eso.org/sci/observing/phase3/data_streams.html">https://www.eso.org/sci/observing/phase3/data_streams.html</a> . . . . .	24
ESO Data Access Policy: <a href="https://archive.eso.org/cms/eso-data-access-policy.html">https://archive.eso.org/cms/eso-data-access-policy.html</a> . . . . .	24
ESO publications policy: <a href="https://www.eso.org/sci/observing/policies/publications.html">https://www.eso.org/sci/observing/policies/publications.html</a> . . . . .	24
press@eso.org: <a href="mailto:press@eso.org">mailto:press@eso.org</a> . . . . .	24
ESO announcement about press releases: <a href="https://www.eso.org/sci/publications/announcements/sciann17369.html">https://www.eso.org/sci/publications/announcements/sciann17369.html</a> . . . . .	24