ESO Optical/Infrared Telescopes Science Operations Policies

This document is CONFIDENTIAL until Council review, afterwards it is for PUBLIC DISTRIBUTION

Distribution to Scientific Technical Committee and Council members, their colleagues with a need-to-know, and their supervisors is authorised. This distribution also applies to AU Observers.

Scientific Technical Committee is invited to recommend to Council the document on ESO Optical/Infrared Telescopes Science Operations Policies.

Council is invited to approve the document on ESO Optical/Infrared Telescopes Science Operations Policies.
ESO Optical/Infrared Telescopes
Science Operations Policy

1. Preamble
This document defines the policies applied to the selection of observations, the operations and the data handling of all ESO optical/near-infrared telescopes (“telescopes” in the following). As of 2020, the telescopes were the La Silla telescopes (3.6m and New Technology Telescope – NTT), the Very Large Telescope (VLT), the Very Large Telescope Interferometer (VLTI), and the survey telescopes (VISTA and VST), all operated within the La Silla Paranal Observatory. The policies defined here shall also be applicable to the Extremely Large Telescope (ELT). This document replaces the VLT/VLTI Science Operations Policy (Cou-996 rev.) which has been in force since 2005.

Throughout, it is understood that necessary approvals by the Director General or the Director of La Silla Paranal Observatory can be delegated.

2. Philosophy
The telescopes are operated to optimise scientific excellence, to maximise the scientific return of ESO by undertaking observations that have the potential to yield significant scientific advancements, and to exploit synergies between them as well as with other facilities. The telescopes are operated within an end-to-end process which starts with proposal solicitation and ends with data preservation and publication. The proposal selection process shall ensure that the most exciting and fundamental research is selected for observations. The scheduling process and the telescope operations shall maintain the potential for scientific excellence implied in the research proposals. ESO supports the community with tools for data reduction for instruments it offers. ESO supports an open data policy.

3. Proposal Selection and Scheduling
All observations are based on an approved proposal. Telescope time is requested through regular open calls for observing proposals. Two generic observing modes are offered: (1) visitor mode (VM), or designated VM, where a proposer is either present at the telescope or guiding the observations through an adequate communication channel, and (2) service mode (SM), where observations are executed by the observatory when conditions are suitable. Some instruments or programme types may be offered only in one mode.

Under some circumstances, a facility may be operated by ESO in conjunction with a consortium of instrument builders or successful proposers (e.g. ePESSTO; NTT/SOXS), as governed by a management plan agreed between the consortium and ESO.

Science observations are complemented with the required calibrations and the observatory ensures that calibrations are obtained for the scientific exploitation of the data. Calibration observations are limited to the basic analysis needs; special calibrations for specific purposes need to be requested separately. Technical time and maintenance shall be scheduled at regular intervals, as needed. The goal is to use no less than 90% of the telescope time for science observations.

3.1 Proposal types
Different proposal types tailored for specific science cases and scientific and technical requirements are offered. Existing types are listed individually here. New types may be defined in the Call for Proposals (§3.2), as the need arises. The Director for Science suggests
changes to the existing proposal types, on the basis of advice from the relevant Programme Scientist(s), for approval by the Director General.

3.1.1 Regular Programmes

These are requests of several nights or hours of observations. Regular programmes may in special cases extend over more than one scheduling period. They include special scheduling modes, like Target of Opportunity (ToO) observations or Monitoring programmes.

Targets of opportunity are expected transients whose occurrence (and possibly position) is undetermined at the time of proposal submission. In addition to the scientific justification and the instrument set-up, a generic description of the astrophysical transient event should be provided in the proposal; the specific information (position, exposure time, etc.) are provided when the observations are triggered. ESO offers various time constraints on triggers depending on the urgency of the observations.

ESO will publish ToO policies, including a revision history, and will refer to these in each Call for Proposals (§3.2).

3.1.2 Large Programmes

Scientific projects which require large amounts of observing time and may run over more than one period are called Large Programmes (LPs). The allocated time span should be the minimum required to complete the programme. LPs should potentially lead to a major advance or breakthrough in astrophysics. They require a strong scientific justification and a plan for data handling, reduction and analysis. LP data products (reduced data, catalogues, etc.) shall be delivered to the ESO Science Archive Facility. The fraction of observing time available to LPs is defined in the Call for Proposals (§3.2); it should be reviewed occasionally, based on analysis of the impact of LPs relative to other proposal types.

The Observing Programmes Committee (OPC – see §3.3) reviews progress against the commitments made in the proposal and may recommend future time allocation is postponed subject to conditions or may recommend cancellation of future time allocation. Time allocation for future observing periods needs to be confirmed by the respective OPC, based on progress reports.

The fraction of telescope time allocated to LPs is reported to Council during the annual presentation of consolidated telescope statistics.

3.1.3 Fast-Track proposals

Fast-Track (FT) proposals provide a shorter duty-cycle than Regular Programmes, allowing users to obtain data for amounts of time below a threshold (e.g. 20 hours). Deadlines for FT proposals are at the discretion of the Director General, asynchronous with Regular and Large Programmes. FT proposals must justify why they could not be submitted through the Regular Programme channel. Pilot studies are eligible. Only standard modes can be requested, excluding visitor instruments.

The life cycle of FT proposals is limited to the time that separates two FT calls.

A maximum amount of time is allocated to the FT channel, defined by the Director General in the Call for Proposals (§3.2) and adjusted according to demand to maintain a healthy over-subscription rate.
3.1.4 Surveys

Observing programmes requesting large amounts of dedicated observing time, spanning several years, are defined as Surveys. Surveys should lead to scientifically useful data which are of general interest to a broader community. The solicitation and selection processes (§3.2–3.3) for Surveys are different from proposal selection for other programme types. Surveys are reviewed annually. Raw survey data are always immediately public. Survey products are delivered to the ESO Science Archive Facility according to a management plan agreed between the survey consortium and ESO.

3.1.5 Guaranteed Observing Time

ESO’s contractual obligations to external consortia can be compensated through guaranteed observing time (GTO). GTO for VLT, VLTI and ELT is regulated in a number of existing Council documents (Cou-1301, Cou-1543 Public, Cou-1628, Cou-1789 rev.). Where the specific design, operational mode or science goals of an instrument necessitate deviations from the policies laid out here, the individual GTO Agreement takes precedence.

GTO proposals are submitted by the consortia as specified in the regular Call for Proposals (§3.2) and reviewed alongside Regular and Large Programmes (Cou-1301, see also §3.3). GTO teams are requested to submit a target list ahead of every Call for Proposals (§3.2) so that their targets can be protected against duplicated observations with the same instrument set-up. These target lists remain in force for any FT proposal deadlines that occur between Calls for Proposals for Normal and Large Programmes. GTO teams provide a specific, unambiguous description of the targets, with field coordinates, and the field size to be observed. If approved by ESO Council, ToO programmes (see §3.1.1) can be proposed, requiring unambiguous description(s) of the trigger(s). Instrument set-ups and integration times for each target are given explicitly. The total observing time for all targets shall not exceed the allocated GTO time, with a buffer determined by the Director General to allow efficient VM scheduling.

The GTO target list must be approved by the Director General before the Call for Proposals (§3.2) is issued.

3.1.6 Director’s Discretionary Time

Up to 5% of the available science time over a scheduling period is set aside for Director’s Discretionary Time (DDT) programmes. Proposals requesting DDT may be submitted at any time. Such proposals typically address scientifically compelling questions, often with time-critical observations of unexpected astronomical events, or rapid follow-up of recent space- or ground-based observations which may lead to a breakthrough result.

3.1.7 Technical Time requests

The observatory requires telescope time to perform technical tests and to commission new capabilities. Technical Time is not available to the community and is assigned in response to requests submitted by ESO teams, including instrument commissioning teams and maintenance teams for calibration, checks and tests.

Technical Time should be limited to the minimum required to maintain safe and efficient operations and keep the performance of telescope and instruments. Unused technical time is returned to science operations. Data considered of scientific value can be released by the Director of La Silla Paranal Observatory.
3.1.8 Science Verification proposals

New ESO instruments are typically first offered to the community via a competitive Call for Science Verification (SV) proposals, with the objective of exercising the end-to-end processes for the first time and quickly releasing scientifically interesting data to the community.

3.1.9 Host State proposals

Time allocation of qualifying proposals whose Principal Investigator (PI) is affiliated with an institute of the Host State (Chile) 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 VLTI, at least half of this 10% shall be dedicated to projects of Chilean astronomers in collaboration with astronomers from ESO Member States. The ELT agreement (13 October 2011) stipulates that “out of the 10% E-ELT observing time allocated to Chilean scientifically meritorious proposals [...] at least 7.5% is devoted to projects of Chilean astronomers in cooperation with astronomers from ESO Member States.”

3.1.10 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 (§3.3) with a Non-Member State proposal seeking to do similar science, preference is given to the ESO Member State proposal.

For the specific case of ELT, Council may restrict the percentage of time allocated to Non-Member State proposals such that outstanding proposals from these communities are executed while protecting the interests of ESO Member States and potential ELT partners.

3.2 Proposal solicitation and submission

A Call for Proposals (CfP) is issued at regular intervals, typically once or twice each year, as determined by the Director General, for available telescopes and telescope combinations. Not all telescopes, instruments or proposal types need be offered in all Calls.

Calls for Fast-Track proposals – for Regular programmes only – may be issued at shorter intervals.

Special Calls are issued for Surveys. These always require a significant element of competition. They may be restricted to specific telescopes or instruments, or may aim to optimise synergies with, e.g., space missions. Surveys selection typically follow a two-step process: a Call for Letters of Intent then, later, an invitation for proposal submission.

The CfP contains all the information necessary for proposal submission, including a list of the facilities offered, as well as observing modes, proposal types and the technical details for the preparation of proposals (see Appendix for a non-exhaustive list).

The CfP details the policies applicable for the Call.
Technical information about telescopes, instruments, operations and calibrations, with links to more in-depth information, are made available in the CfP. The CfP also specifies any additional information required in a proposal (e.g. information about overheads).

ESO provides tools to prepare an observing proposal and to fill in the required technical information. Additional tools, e.g. exposure time calculators or instrument simulators, to assess the feasibility of an observing programme, are made available by ESO.

An observing proposal shall describe the science case, the scientific targets of the observations, technical information about the telescope and instrument set-up(s), and the requested observing time. An observing proposal shall contain all information required to define the scientific observation, including observing constraints, calibration requirements, dependencies on other observations.

Each observing proposal shall identify a single person who acts as PI and is responsible for the proposed scientific project. The PI (or a designated representative) is the contact person for all communications with ESO.

Upon submission, each proposal receives a unique identification (Proposal ID).

### 3.3 Proposal evaluation

The peer review process is organised by ESO. All observing proposals are evaluated on the basis of their scientific potential.

The Observing Programmes Committee meets to review proposals received as a result of the regular CfPs. The OPC may be supported through expert panels and referees. OPC, panel members and referees are recruited from the astronomical community. OPC and panel members typically serve for a few observing periods. ESO assists the OPC for technical clarifications and feasibility issues.

For Fast-Track proposals, and other cases at the discretion of the Director General, Distributed Peer Review (e.g. Patat et al. 2019, Messenger, 177) may be used instead.

SV proposals are reviewed by the SV team, which typically comprises the relevant ESO Programme Scientist, Instrument Scientist, User Support Scientist, Quality Control Scientist, and the instrument PI and Co-PI, or their designates, which make a recommendation to the Director General.

DDT proposals are reviewed by a team of expert referees selected from the ESO Faculty, which make a recommendation to the Director General.

Technical Time Requests are collected by the Director of Operations and presented to the Director General for approval.

For all proposals other than Fast-Track Proposals (§3.1.3), DDT (§3.1.6) and Technical Time Requests (§3.1.7), the OPC selects those that are most scientifically compelling and makes a recommendation to the Director General that they be executed.

Surveys are evaluated in a two-stage process. The OPC is assisted in the selection of Surveys by a special panel, the Public Survey Panel (PSP). The PSP is constituted for several years to match the length of surveys (typically about 5 years). A call for Letters of Intent for Surveys may be issued when a new facility (or large amounts of telescope time) become available. Letters of Intent should contain a scientific rationale, observing strategy, estimated observing time and a description of the planned creation of science-ready data products. The PSP
reviews the projects presented in the Letters of Intent and elaborates a coordinated set of Surveys. This process may involve merging of proposed Surveys to achieve the optimal set of surveys. Survey teams thus selected are then invited to submit a full Survey proposal on the basis of the comments and recommendations received from the PSP. Survey proposals shall contain an updated scientific rationale, an observing strategy, a detailed breakdown of the observing time, specifications for the science-ready data products, and a publication plan. The proposals are then reviewed by the PSP, which provides a recommendation to the OPC, which in turn provides a recommendation to the Director General. Surveys are approved by the Director General after a corresponding survey management plan is provided.

Survey and LP proposals are discussed in special sessions of OPC. Progress reports of current Surveys and LPs are also discussed by the OPC. The OPC issues recommendations to the Director General on whether such programmes should continue.

3.4 Scheduling

The scheduling process follows the scientific rank of the proposals and seeks to optimise the scientific return. Proposals may be assigned priorities according to their rank.

VM observations are scheduled on fixed calendar dates as either nights or fractions of nights (to one decimal place), while SM observations are allocated hours (to one decimal place) of execution.

Duplication of observations should be avoided, in particular GTO targets are protected against duplicated observations. A duplication is considered to be an observation of the same target with a scientifically equivalent instrument set-up, independent of the observing time. Time evolution is not considered a duplication.

GTO programmes scheduled in VM are not entitled to compensation for bad weather or instrument failure: only losses due to failures of telescopes or instrument components provided by ESO can be compensated. GTO may also be scheduled in SM, with an appropriate penalty, and a limit on the total duration of carry-overs, if the relevant GTO Agreement foresees and allows it (e.g. where it is required to achieve the scientific objectives).

Additional considerations for scheduling observing programmes may be applied by the Director General. The Director General approves the telescope schedule, including technical time, before the applicants are informed.

3.5 Observation preparation

The observational descriptions are prepared by the PI or a designated person in advance of the observations. These descriptions define the exact observing set-up (target position, instrument set-up, exposure times, constraints and any additional information) and need to stay within the science objectives of the original proposal and the allocated time. Changes must be approved by ESO.

ESO provides the necessary tools (e.g. Phase 2 software, templates, survey tools), guidance and support for the preparation of the observation descriptions. The observation descriptions are — after the corresponding feasibility checks — forwarded with the corresponding priorities to the observatory.

4. Observations

Only observations described in an approved proposal and defined in the observation descriptions are allowed. The observatory strives to optimise the scientific return by
considering the interaction between individual telescopes (e.g. laser collisions, combined foci, time-critical observations) and implements procedures for forecasting important atmospheric parameters.

Visitors requesting targets not listed in the approved proposal (e.g. backup targets) require approval by the Director of La Silla Paranal Observatory before observations take place.

Special observations, e.g. ToO or DDT programmes, can be scheduled at short notice. Under exceptional circumstances the Observatory Director may interrupt ongoing observations, including VM observations.

The observatory provides calibration observations according to a published calibration plan. Any special calibrations need to be requested separately.

For data obtained during SM, data quality control is performed to check whether the constraints are fulfilled. Observations outside the requested constraints may be repeated at a later time. ESO implements a quality check to assure proper operation of the instrumentation and to monitor its long-term evolution.

Raw data are offered to the PI or delegated person a short time after the observations through the ESO Science Archive Facility.

Compensation for weather or technical losses can be granted only in exceptional cases. Incomplete observing runs may be terminated for several reasons. They include substantial scientific completeness of the project, technical reasons that prevent the observations or operational constraints limiting the chances of future observations.

The progress of Large Programmes and Surveys is reviewed by the OPC (§3.3).

Financial travel support for visitors may only be granted to astronomers affiliated with institutions from ESO Member States and countries in a strategic partnership with ESO.

5. **Data Reduction and Data Products**

ESO provides the tools for data reduction from observations obtained with its instruments. Tool description and documentation are available for users. All data reductions of offered instrument modes are described by examples and detailed tutorials.

ESO creates reduced data (instrument signature removed) for the most often-used instrument modes. Reduced data are fully described to be useful to users (e.g. units, accuracy, limitations).

Large Programmes and Surveys are required to deliver well-described and documented data products for dissemination through the ESO Science Archive Facility (§6). For Surveys, the level of these data products is defined in management plans agreed between ESO and the survey consortium. In cases where telescopes or instruments are operated by a consortium, the data products are provided to ESO as defined in special agreements.

6. **Archive**

Data from the ESO telescopes are archived in (and distributed from) the ESO Science Archive Facility. ESO implements quality assurance processes so that the holdings of the ESO Science Archive Facility are characterised to a known and certified accuracy.
ESO signed the European Open Science Cloud Declaration and subscribes to the FAIR principles of that declaration. The ESO data should be findable, accessible, interoperable and reusable.

7. **Data Rights**

All data obtained with ESO instruments are ESO property. ESO usually grants exclusive access rights for a limited amount of time (sometimes referred to as the proprietary period) to the PI for the science data acquired for an observing programme. This may include data products generated by ESO (§5). The length of the proprietary period is set by the Director General and communicated in the CfP. The proprietary period starts when the raw data are made available to the PI.

Extensions of the proprietary period may be exceptionally granted by the Director General, based on well-justified reasons. After expiration of the proprietary period, related information (e.g. the proposal abstract, observation logs) become publicly available.

Information related to the science data (e.g. metadata, calibration data) are public immediately. Exceptions may be granted by the Director General. Such exceptions are flagged to Council during the annual presentation of consolidated telescope statistics.

8. **Publications**

Publications based on observations collected at ESO telescopes must state this in a footnote to the article title or in the acknowledgments, as outlined on the ESO Publications Policy page. The observing run ID(s) must be clearly identified by their ESO reference number (proposal ID or archive request number). The typical text is:

*Based on observations collected at the European Southern Observatory under ESO programme <Proposal ID> [or <request number>].*
Appendix

Subsidiary Document – Call for Proposals

The following items should be defined in the Call for Proposals for ESO telescopes.

- Proposal types being offered, and any changes of proposal types
- Instruments and instrument modes being offered
- Definition and policies of observing modes (e.g., Visitor Mode, Service Mode, dVM)
- Applicable proposal review process (e.g. distributed peer review)
- Definition of Large Programme, i.e. execution time above which a Large Programme is defined (currently 100 hours or 10 nights)
- Any limits on the fraction of time to be awarded to e.g. Targets of Opportunity, Regular, Large or Fast-Track Programmes
- Definition of Monitoring Programmes
- Policies for Visitor Instrument Programmes
- Policies with respect to Director’s Discretionary Time proposals
- Restrictions on who can apply (e.g. non-Member States)
- Specific Target of Opportunity and Rapid Response Mode policies (e.g. over-rides)
- Target lists for Guaranteed Time Observations
- Target protection policy, if different from the relevant policy document
- Length of proprietary period, if not waived in the proposal

Approvals

Decisions by the Director General:

- Changes of proposal types
- Frequency of calls for proposals, incl. Fast-Track
- Approval of target list for Guaranteed Time Observations
- Approval of proposal selection
- Schedule (approval), incl. technical time
- Over-rule Observing Programmes Committee ranking, in special cases
- Approval of changes of observation descriptions between P1 and P2
- Approval of Director’s Discretionary Time programmes
- Public Survey programmes, after management plan acceptance
- Length of proprietary period, incl. extensions of proprietary period
- Non-publication of metadata in the archive

Decisions by the Director of La Silla Paranal Observatory:

- Approval of backup targets
- Interruption of ongoing observations
- Public release of data from technical time