

Growth of Observing Programmes at ESO

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There has been a continuous growth in applications for ESO telescopes from the first calls for proposals in the late 1960s. Typically one thousand applications are now received per semester involving over 3000 astronomers worldwide. A brief history of the evolution of the allocation process is presented and a snapshot of the current procedures is given.

Introduction

The history of the European Southern Observatory (ESO) is marked by steady growth, from a few small telescopes at La Silla in the late 1960s, the expansion to 4-metre-class telescopes in the 1970s and 80s, to the opening of the Very Large Telescope (VLT) on Paranal in 1998. Today, on La Silla, ESO operates the MPG/ESO 2.2-metre, the 3.6-metre and 3.58-metre New Technology Telescope (NTT) with five instruments permanently mounted (two each on the 3.6-metre and the NTT). Cerro Paranal is equipped with the four VLT Unit Telescopes (UTs), the 4.1-metre Visible and Infrared Survey Telescope for Astronomy (VISTA), the 2.6-metre VLT Survey Telescope (VST), and the four 1.8-metre auxiliary telescopes of the VLT Interferometer (VLTI). Each of the UTs features three foci (two Nasmyth platforms and one Cassegrain focus), so that up to twelve instruments can be simultaneously offered and easily switched during the night. Currently eleven instruments are offered for normal operations at the VLT and three at the VLTI. ESO is also part an international collaboration involving the Max-Planck-Institut für Radioastronomie (MPIfR) and Onsala Space Observatory (OSO) for the Atacama Pathfinder Experiment (APEX) and 25% of the observing time is allocated to ESO.

The history of the number of proposals submitted to ESO (per semester [six months], called a Period) over the last 35 years is shown in Figure 1. In the pre-VLT era (i.e., before Period 63 [P63]), the

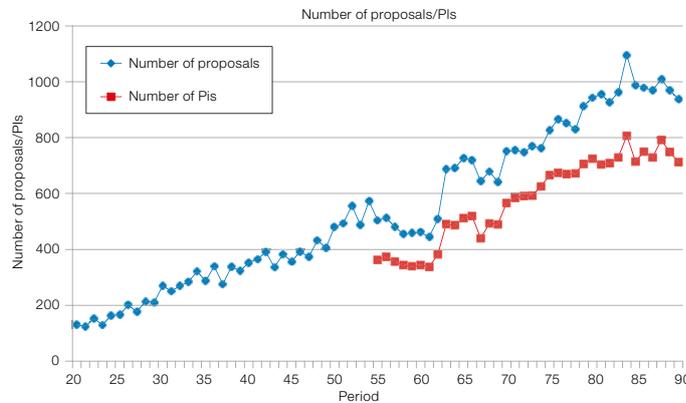


Figure 1. Number of distinct proposals received by ESO from P20 (1977) to P90 (2012). This is also known as the Breysacher plot, after ESO astronomer Jacques Breysacher, who produced the first version of the diagram (Breysacher & Waelkens, 2001). The number of distinct principal investigators is also plotted since P55. The peak observed in P84 coincides with the start of X-shooter operations.

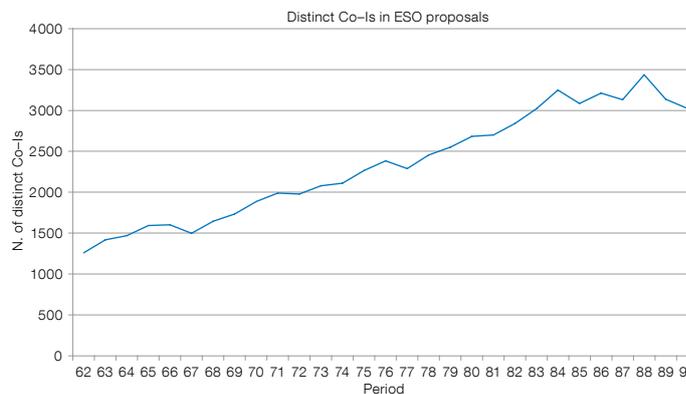


Figure 2. The growth in the number of distinct investigators (Co-Is) in ESO proposals is shown from the start of VLT operations (P62, October 1998) to P90 (October 2012).

number of proposals kept growing, eventually stabilising at around 500. The start of VLT operations was marked by a rapid increase, bringing the number of proposal submissions above ~ 700, followed by steady growth to today's ~ 950 proposals per semester, submitted by about 700 distinct Principal Investigators (PIs). The total time request averaged over the last four years is about 3170 nights per semester (about 65% for Paranal only), of which about 1070 nights are scheduled for execution.

The overall observatory pressure (defined here as the ratio between the submitted and the scheduled time) is ~ 3.0. However, at some telescopes (and particularly at some instruments, e.g., FORS2, X-shooter and HARPS), this exceeds 5.0. The increase in the number of investigators on ESO proposals from the start of VLT operations is shown in Figure 2, which presents the evolution of the number of distinct co-investigators (Co-Is). The current number is around 3000 individual users.

The distribution of the number of submitted proposals and requested time by site since the beginning of VLT operations is presented in Figure 3 (left and right respectively). Despite the expected decrease in demand for observing time at La Silla following the reduced number of telescopes offered at this site and the increasing instrumentation contingent at Paranal, it is still in demand. The time request for La Silla averaged over the last three years is about 900 nights/semester, to be compared with the ~ 1450 nights/semester during the first three years of VLT operations. The NTT and the 3.6-metre telescope remain in high demand, and the tendency is to request the time through Large Programmes (LPs; proposals requesting over 100 hours of telescope time that can be distributed up to four consecutive years on La Silla or two consecutive years on Paranal). This is reflected in the time allocation: in P90 at the 3.6-metre telescope ~ 73% of the time was allotted to LPs, 18% to Normal Programmes and 9% to Guaranteed Time Observations. With the deployment

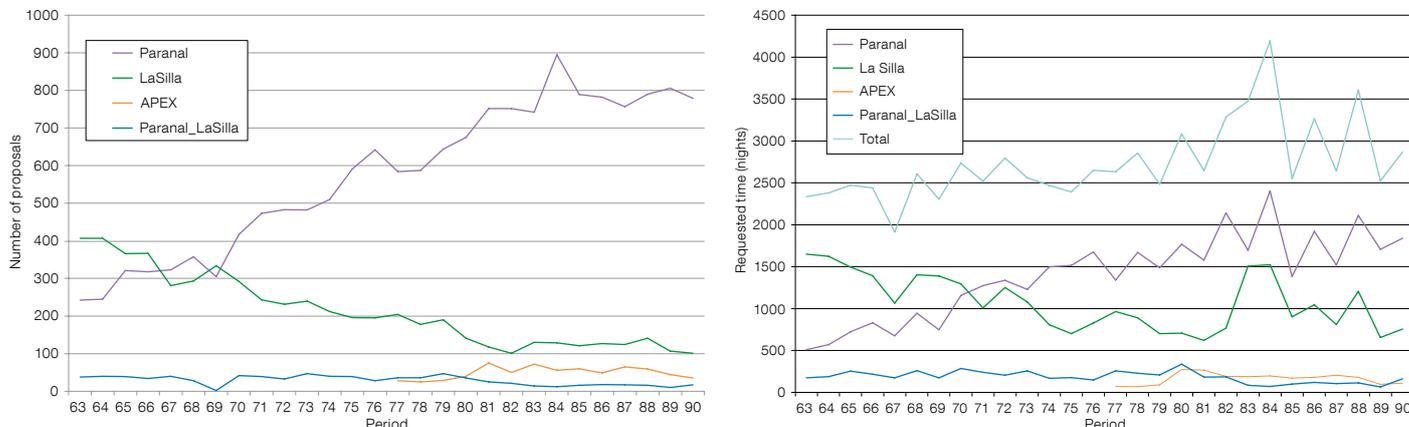


Figure 3. Number of proposals (all types) by site (left) and number of requested nights (right) plotted as a function of time since the beginning of VLT operations.

of the PESSTO public spectroscopic survey (which has an allocation of 90 nights/year), the NTT is moving towards a very similar configuration.

Proposal types

In parallel with the increased availability and demand for observing time, there has been an evolution in the types of observing proposals in order to adequately encompass the wide range of science programmes. In the current implementation, there are six different types of proposals:

1. Normal: Programmes that require less than 100 hours and span one semester.
2. Large: Programmes that require more than 100 hours and can span one or more semesters (up to four for Paranal and up to eight for La Silla). A Large Programme typically has the potential to lead to a major advance or breakthrough in a field and includes a plan for data reduction and analysis by a dedicated team.
3. Target of Opportunity (ToO): Up to 5% of the available general observing time may be used for ToO proposals. Within this framework it is also possible to apply for the Rapid Response Mode (RRM) implemented at the VLT. This mode allows users to trigger observations with a very fast reaction time (a few minutes).

4. Guaranteed Time Observations (GTO): These arise from contractual obligations of ESO to the consortia who have built ESO instruments. This time is only accessible to the GTO consortia.
5. Calibration: This type of proposal was introduced to allow users to complement the existing calibration of ESO instruments and to fill any gaps that might exist in the calibration plan.
6. Director's Discretionary Time (DDT): Up to 5% of the available general observing time may be used for DDT proposals in a current period. As opposed to the other proposal types described above, DDTs can be submitted at any time during the semester.

A new programme type, dubbed Monitoring Programmes, is also being implemented. This serves projects requesting small amounts of time (of the order of tens of hours) spanning several periods, and is meant to secure continuity to programmes aiming at time, for instance, coverage of slowly varying targets.

Most of the proposals received are for Normal Programmes. Typically 15 to 20 Large Programme proposals are received each semester. The other proposal categories (ToO and Calibration) only involve a few percent of the total proposal pool.

Observing modes

Since the beginning of VLT operations, time on ESO telescopes can be requested either in Visitor Mode (VM) or in Service Mode (SM). While VM allows the observer to take on-the-fly decisions and to make use of non-standard modes, SM enables the exploitation of the best atmospheric conditions or repeated short visits to the same target during a semester. VM is the classical observing mode, in which the observations are carried out by a visiting astronomer selected by the proposing team. SM observing runs are executed by observatory staff following an established priority order. For each telescope SM runs are grouped into three queues,

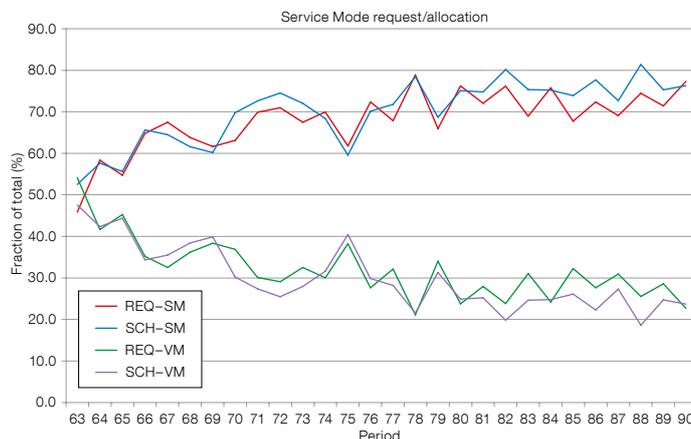


Figure 4. Time evolution of the fraction of VLT requested and scheduled time in SM (upper curves) and VM (lower curves) since the beginning of VLT operations. Statistics refer only to Normal and ToO programmes, excluding Large Programmes and GTO proposals.

which reflect their scientific ranking (see Silva, 2001). The rank classes are defined as follows:

- Class A: All possible efforts will be made to execute all observations corresponding to the runs in the requested observing period.
- Class B: These runs will be executed in the requested observing period on a best-effort basis.
- Class C: Filler runs. Observations will only be executed if the observing conditions do not permit observations for runs within classes A and B.

Although the original plan had foreseen a 50/50 distribution between the two modes, the popularity of SM steadily increased during the first five years of VLT operations. This is very clearly demonstrated by the evolution of the time request for the two modes (see Figure 4). From an almost equal 50% fraction recorded in the first semester, the share has evolved to the current situation, in which about 75% of the time is requested in SM. Rather than enforcing the original operations plan, ESO has followed the demand from the community. In the current schema SM is not offered for La Silla telescopes, which are operated in VM only.

Observing Programmes Committee and Proposal Review

Telescope time at ESO is allocated following the recommendations of the Observing Programmes Committee (OPC). It is the function of the OPC to review, evaluate and rank all the proposals submitted in response to the call on scientific merit. From this review process, the committee advises the Director General (DG) on the distribution of observing time, taking into account ESO's scientific policy. The OPC includes 13 panels to cover the four science categories:

- A: Cosmology (three panels);
 B: Galaxies and galactic nuclei (two panels);
 C: Interstellar medium (ISM), star formation and planetary systems (four panels);
 D: Stellar evolution (four panels).

The varying number of panels within each category is due to the different

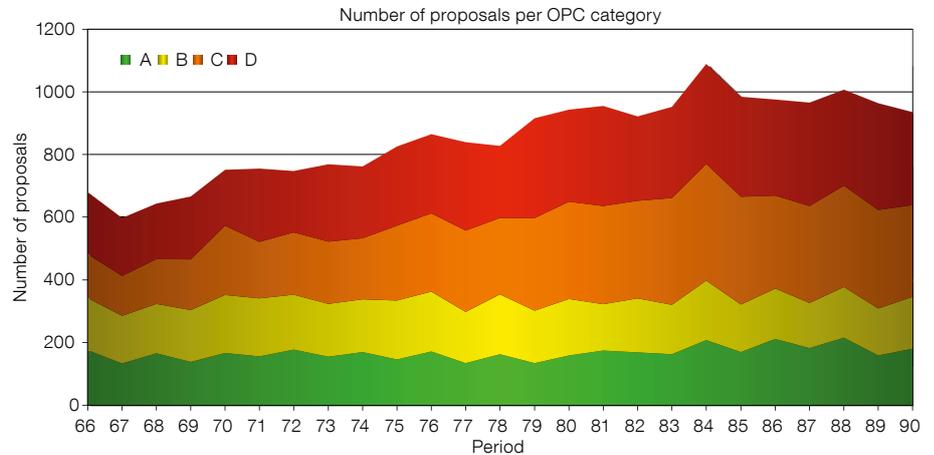


Figure 5. Distribution of submitted proposals by scientific category is shown for the last twelve years (A: Cosmology; B: Galaxies and galactic nuclei; C: ISM, star formation and planetary systems; D: Stellar evolution).

numbers of proposals which these categories receive each period. Interestingly, this number has evolved significantly since the beginning of VLT operations, when the proposals were evenly distributed across the four categories. The data covering the last twelve years of operations (see Figure 5) clearly show an increase of the number of proposals in category D (stellar evolution) and especially C (ISM, star formation and planetary systems). The growth in the latter is related to the expansion of the exoplanet field.

Each panel has six members, including one panel Chair and one co-Chair. Apart from the individual panels, the advisory committee, the OPC, is composed of the 13 panel Chairs, three panel co-Chairs (one in category A, two in B), and the OPC Chair, who is not a panel member. This corresponds to a total of 17 OPC members, and with 72 panel members, a total of 89 scientists.

The OPC and panel members are selected on the basis of their scientific competence. During the selection, some allowance is made for gender balance and for distribution across ESO member states, but these aspects are not rigidly enforced. The candidates are proposed by the OPC Nominating Committee. This board is advisory to the DG and is

composed of the Director for Science, the Head of the Observing Programmes Office (OPO), the former OPC Chair and two members of notable accomplishment in astronomy.

OPC members serve for two years (four ESO periods), while panel members serve for one year (two ESO Periods). A fraction of the panel members are invited to serve an extended, second one-year term, to ensure sufficient continuity in the review process. The high turnover ensures that, with time, a significant fraction of the community gains experience in the process from the inside.

ESO facilitates the OPC process, but does not take active part in the scientific evaluation of the proposals. ESO time allocation is carried out by implementing the OPC recommendations while accounting for any technical and scheduling constraints. A full description of the OPC process and an overview of the software scheduling tools used by OPO to facilitate the allocation of OPC prioritised proposals on the telescopes can be found in Patat & Hussain (2012).

Director's Discretionary Time

DDT proposals can be submitted any time. A DDT proposal must necessarily belong to one of the following categories:

- proposals of ToO nature requiring the immediate observation of a sudden and unexpected astronomical event;
- proposals requesting observations on a topical and highly competitive scientific issue;

- proposals seeking follow-up observations of a programme recently conducted from ground-based and/or space facilities, where rapid implementation should provide breakthrough results;
- proposals of a somewhat risky nature, requesting a small amount of observing time to test the feasibility of a programme.

The DDT proposals are reviewed by an ESO internal standing board, the DDT Committee (DDTC), which is chaired by the Head of OPO and includes ESO Faculty astronomers, the Director for Science and the VLT Programme Scientist. The DDTC is advisory to the DG, who takes the final decision based on a recommendation prepared by the Chair. Further details of the allocation process are presented in Patat & Hussain (2012).

Typically 50 to 60 DDT proposals are received per semester (at an average rate of two per week), with requests that range from tens of minutes to a few hours. Since DDT proposals can only be carried

out in Service Mode, they are normally considered for Paranal telescopes only. Successful DDT applicants are asked to submit a report within four weeks from the completion of the observations.

Perspectives

As is apparent from this overview, the ESO allocation and scheduling process has evolved to accommodate the varying needs of its community and to ensure the optimal use of observing time on all the telescopes. The present system is not without its weak points and the following article (Brinks et al., p. 21) summarises the findings of the OPC working group that recently reported (Brinks & Leibundgut, 2012). OPO is also studying the implementation of a new proposal submission system, which will feature a more integrated and user-friendly approach. On a longer term and in view of the forthcoming E-ELT era, ESO is also considering a more radical evolution to the next generation system. The operational scenario for the E-ELT is based on

a full adoption of the Paranal schema that is operational at that time. This includes time allocation with the E-ELT considered as another telescope of the observatory. With more than a decade before first light for the E-ELT, there is ample time to discuss and debate with the community the most appropriate methodology and philosophy for the time allocation. The process of consultation will start soon after the start of construction.

Acknowledgements

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360 degree view of the sky from Paranal showing the disc of the Milky Way extending across the sky. See Picture of the Week 11 June 2012 for an explanation.