The Astronomer – Observer Interface

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Abstract. The minimal information exchange between the astronomers, who are not present while their observations are obtained at the telescope, and the observer performing said observations is laid out and detailed. This will define the main interaction of astronomers and the observatory in service mode and will be one of the critical areas for acceptance by the astronomical community.

1. Introduction

Once the decision to transgress the current conventional modes of operating ground-based optical and infrared telescopes to a new observing regime has been made concepts to transform the ideas into workable schemes have to be developed. This paper describes some of the concepts for a simple and clear design of the information flow between astronomers and observers at ESO. Astronomers in the context of this paper are the persons interested in the scientific content of the data while observers are the acting figures at the telescope.

Currently the responsibility of data procurement rests completely with the astronomer who performs the observations autonomously, sometimes assisted by technical experts. Removing the astronomer from the process of data acquisition implies that all information which has been available to the expert scientist in judging the scientific quality of the observations is delegated to an expert observer with technical and operational knowledge of the astronomical instrument. This splitting of the process demands profound and complete information exchange and thus should lead to as clean and transparent an interface as possible. A successful implementation fosters an increase in the observatory's performance by making optimal use of all available expertise.

There are, of course, two interfaces to be considered: the input information for the successful procurement of the scientific data and the delivery of the data to the astronomer. The former constitutes a new layer of communication while the latter is solved by providing much of the needed information in the data file headers and associated logs which are available to the astronomer. Here, we will concentrate on the information passage which defines the observational procedures.

At ESO a dedicated group of astronomers has drafted a proposal for the implementation of service observing as it was outlined in the science operations plan for the VLT (Baade 1995, see also Baade these proceedings). The group consisted of D. Baade, R. Fosbury, P. Grosbøl, J. Spyromilio, J. Wampler, and myself. The ideas outlined here present some of the results from the discussions in this group (Grosbøl & Leibundgut 1995). The technical implementation in the framework of the general data flow of the VLT is described by Grosbøl & Peron (1995 and these proceedings).

The VLT is not the first observatory to embark on the experiment of service observing. Successful examples are the operations of the Hubble Space Telescope and many radio telescopes, as well as collaborative efforts among scientists in the community at large and observatory astronomers. While all these examples are very useful in providing guidelines, the special requirement of rapid reaction to particular meteorological conditions adds a new quality to scheduling and operations of telescopes like the VLT or Gemini. It was thus deemed necessary to develop a new design for the service operations of the VLT.

2. Observation Blocks

It is our believe that the definition of all scientific observations should be created by the applying astronomers. This implies that we can design procedures which are understandable and manageable by people not exposed to them on a frequent basis. At the same time the process has to be transparent in order to empower the astronomers to make best use of it. As such it is important to provide the users with a concept as familiar to them as possible.

We have defined several distinct "qualities" which are important for observations. They are the identification of the celestial target, the technical description of the instrument and telescope operations during the observation, a description of conditions and requirements which apply to a given observation (e.g. meteo, time, accuracy), calibrations needed to achieve the proposed scientific result, and general comments. Each of these "qualities" is described separately for every observation and combined to form what was christened the "Observation Block".

A restriction imposed on the observation blocks was to create a suitable unit for scheduling observations at short notice (flexible scheduling). To have units small enough for rapid reactions observation blocks define only observations of a single celestial object (Chavan 1995). Another limitation we introduced was to confine an observation block to a single instrument or instrument mode.

An important feature of observation blocks is their modularity. This offers the possibility of self-referencing and multiple uses of its parts. We envisage the possibility to call another observation block to, e.g., guarantee a sequence of observations. Individual parts of observation blocks can be reused for observations of a different object or the same object with a different setup. Calibrations can be specified for each individual or a set of observations and can be combined by the scheduler to be run as often as necessary.

For illustration purposes we give an example of a possible implementation of observation blocks in the following. The case of an observation of a field in the Large Magellanic Cloud with the Infrared Spectrograph and Array Camera (ISAAC) to search for heavily obscured Asymptotic Giant Branch stars is presented.

Observation block of the LMC AGB search field 1:

target info:	`AGB-LMC1.loc`
instrument operation template:	`ISAAC-IOT01, AGB-LMC1.iot01`
calibration:	`ISAAC-ICT01, AGB-LMC1.iot01`
conditions, requirements:	`AGB-LMC1.cond`
comments:	`Field 1 of the search campaign of AGB stars in the LMC`

The observation block is simply a file with pointers to other files each of which contains specific information required for the observation. The target file holds the celestial position of the object as well as one of a suitable guide star possibly with additional information. Instrument operation templates will be developed by ESO to ease the operation of regularly used instrumental modes (see below). Calibration needs can be specified separately. The file `AGB-LMC1.cond` contains a description of the demands on the observation while the comment section conveys supplementary information. Additional categories not included in the example could be specifications of object acquisition (possibly another template) and pointers to other observation blocks which are associated with this one (e.g. observation of standard stars). Since we are allowing for several exposures within a single observation block (e.g. imaging in several filters for a single target) several templates (or sequences) could be called.

Collecting all astronomical information in a central unit has the advantage to access the relevant information quickly without foregoing modularity. For the observatory the observation blocks are the natural place where to tie on additional information, like the rating of the proposal, the proposal abstract, and book keeping utilities.

ESO is planning to provide complete "standard" observation blocks for regular instrument calibrations, focus exposures, skyflats, and also certain standard star observations.

We have tried to develop a well-structured format of the observation blocks and their subunits in order to prevent misunderstandings or communication problems. It is essential to have a clearly structured entity while also offering a free format subunit (like the comments). The hope is to design a robust concept which can be understood by the astronomer, the observer, the scheduler, and the technical environment (telescope and instruments). The challenge is to create a structure appealing to human apprehension and suited for machine processing.

3. Instrument Operation Templates

As a special example of one of the subunits of observation blocks we describe here instrument operation templates. All instruments of the VLT will be operated through sequences (Allaert 1995, these proceedings). To relieve the astronomer from designing their own sequences ESO will offer some standard sequences for which only a few parameters have to be specified. The work of the astronomer consists in determining which instrumental parameters are needed once the appropriate template has been chosen. A more detailed description of templates can be found in the ISAAC manual (Spyromilio 1995).

Templates (and sequences) will allow the astronomer to completely control the instrumental setup even though not present during the observation. The templates represent predefined operations making the handling of observations much more user friendly. By using well-defined templates the observations can also be linked properly into online reductions.

In the example the templates are specified by their name (`ISAAC-IOT01`) and a parameter file (`AGB-LMC1.iot01`) which defines all particulars of the ISAAC setup and the mode of telescope operation during the observation (e.g. chopping).

4. Summary

It has to be emphasized that the actual implementation of service observing as a major operational mode of future telescopes can only succeed if sufficient acceptance by the astronomical community can be gained. Astronomers should retain control over their observations as much as possible even though they will not assist the data acquisition in real time. By providing them with a structure like the observation blocks and its subunits they can define observations with a high degree of specification.

The fact that similar concepts have been developed independently by UKIRT (Bridger, these proceedings) and Gemini (Walker, these proceedings) is encouraging. It might even offer the possibility of exchanging or translating observation definitions into the ones of another observatory. The Hubble Space Telescope has led the way for many of the concepts and can be used for guidance in some aspects. To be able to swiftly react to changing meteorological conditions, however, asks for a more detailed description of the requirements of observations. Nevertheless, the lessons learnt by STScI are very relevant for the development of ground-based scheduling systems (Johnston & Miller 1994). Astronomers will accept the radical changes much easier when they can recognize some of their traditional ways in the system and feel in control.

Acknowledgments. I would like to thank all participants in the working group for invigorating discussions which led to the concepts outlined here.

References

Allaert, E. 1995, Sequencer Manual, VLT-MAN-ESO-17220-0737

Baade, D. 1995, VLT Science Operations Plan, VLT-PLA-ESO-10000-0441

Chavan, A. M. 1995, Scheduling Tool, OSDH-SPE-ESO-00000-0005

Grosbøl, P. & Leibundgut, B. 1995, Problem Statement of the VLT Online Data Flow, VLT-SPE-ESO-10100-0749

Grosbøl, P. & Peron, M. 1995, Analysis Document of the VLT Online Data Flow, VLT-SPE-ESO-10100-0790

Johnston, M. D. & Miller, G. E. 1994, Intelligent Scheduling, eds. M. Zweben & M. S. Fox (San Francisco: Morgan Kaufmann), 391

Spyromilio, J. 1995, ISAAC Manual, VLT-MAN-ESO-14100-0841