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THE FIRST YEARS OF GTC SCIENCE OPERATION, BY NUMBERS

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RESUMEN

El Gran Telescopio Canarias de 10.4 m inició su operación en 2009. En los dos años pasados desde entonces el GTC ha visto importantes cambios y mejoras que han ayudado grandemente en su explotación científica. En lo que sigue se llama la atención sobre los hitos principales de estos primeros años de operación científica y se abordan brevemente algunos aspectos de la operación. Además, se mencionan algunas ideas de naturaleza más estratégica que pretenden maximizar el rendimiento científico del GTC en los años venideros.

ABSTRACT

The 10.4 m Gran Telescopio CANARIAS came into operation in 2009. During the two years since that date the facility has seen important changes and improvements that have helped its scientific exploitation. This paper highlights some of the basic results of these first years of science operation and briefly sets out aspects of our operational methodology. Furthermore, some critical aspects of a more strategic nature are mentioned with the view of maximizing the scientific return of the facility in future years.

Key Words: GTC — telescopes

1. THE TELESCOPE

The GTC was conceived as a general-purpose facility with a capability to host several instruments simultaneously. The development of not only the instrumentation suite, but also of the telescope itself is ongoing. In spite of this, the facility is well capable of delivering high-quality data in an efficient manner, as is proven by the many projects that are published in these proceedings.

With its RMS pointing error of about 2 arcsec, an open-loop tracking stability of 2 arcsec/hour, routine guiding stability of 0.1 arcsec for essentially indefinite periods of time, and blind offset accuracy of 0.2 arcsec over relatively short distances, one can conclude that the telescope is in good working order. Moreover, during the years a gradual, laborious program of mirror re-aluminization has been started, now leading the on overall reflectivity of M1 of about 85%. More work remains to be done, a task that will never end during the working life of the telescope, to ensure that its 73 square meters of effective light collecting area is maximally exploited.

The optical quality of the GTC and of its only operational instrument, OSIRIS, is very good. Image quality is normally limited by natural seeing, in spite of the fact that detailed characterization of the optics is still underway and that the level of automation of the active optics is still limited.

Several other areas of improvements and developments are being worked on. Without wanting to be exhaustive, I mention the work on the dome shutter that does not yet fully open, general issues related to system reliability, improvements in the quality of the motion of the M2 chopper, achieving routine optical phasing of the M1 mirror, non-siderial tracking, high-frequency "fast" guiding, and improvements in the data handling tools.

2. SCIENCE EXPLOITATION

From the previous paragraphs it will have become clear that although GTC is operational and doing well, the ongoing developments of both the facility as well as its instrumentation pose quite significant complications when trying to deliver science in a routine fashion. In order to streamline the night-time operation a number of improvements have been implemented that have increased the overall effectiveness, in term of science data delivered, by some 20 percent since the start of operation. But further work remains to be done in this area.

During a typical night at the telescope only two people are present: a staff astronomer and the telescope operator. Between them they have to operate the full system with all its complexity, and resolve faults that might occur; there is no night-time engineering support. Data handling activities such as quality control, data packaging and time accounting take place during normal week days, as is the overall planning of observing priorities. GRANTECAN has opted for a relatively low-cost support model, and

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hence the service that can be offered to the community is rather restricted.

The overall demand for the telescope from the user community has seen large fluctuations from one semester to the next. The overall oversubscription factor has peaked at 6, but in the last year has reduced to about 2.5. We expect that as new instrumentation modes for OSIRIS and CanariCam come on line, this will help to attract more interest.

Of the available nights to date about one quarter has been devoted to commissioning activities while the bulk of the time has been used for regular science observations. Of the science time, in round figures about 10% has been lost due to technical problems, while some 30% of the time the weather was too poor to observe.

GTC is operated mainly in queue-scheduled mode, where programs are selected in a dynamic fashion based on their ranking by the time allocation committees, matching their requirements to the prevailing observing conditions. To date, a total of 1840 hours worth of data have been delivered to the community, of which some 340 hours were devoted to a small number of large ESO-GTC programs. A total of 97 programs have been fully completed, under the correct observing conditions and according to the requirements of the PI. This is where the advantage of queue-scheduled observing becomes apparent, since in the case of classical observing, where programs are scheduled on fixed dates, the risk of not catching the right sky conditions is large, in particular for demanding observations. Queue-scheduled observing does imply a major overhead for the observatory in terms of planning, preparation and execution of the observations, and in the data handling processes.

To date 19 science papers based directly on data from the GTC have been published in refereed papers (10 in 2010 and so far 9 in 2011). Although the year 2011 is not finished yet, it appears that the publication rate for GTC falls below that of similar telescopes in their early lives (see Crabtree 2008). Time will tell how the numbers will develop in the near future, but it is of great importance that the science productivity of the telescope does not fall behind that of its competitors.

3. A FORWARD LOOK

What follows is strictly a personal view on what I consider are important aspects for the operational success of the GTC in the near future.

First, there are obvious attractions to operating a telescope in queue-scheduled mode. But there is also a drawback to this, which is particularly relevant during the early parts of the life of a large telescope like GTC: the lack of direct interaction with the user community. A year ago GTC opened its doors to visiting observers, but the uptake has been low. Obviously this implies that PIs are generally content with the observations as they are executed by the observatory, but as a consequence the direct interaction with the community is limited. Hence we collectively miss the opportunity to learn from each other; for the PIs to directly influence and feed back their views on the way the observatory works, and to learn the tricks-of-the-trade that come with each instrument, which may be of benefit in the planning of observations and in the data analysis.

Second, I believe it is of crucial importance that the scientific productivity (volume and impact) the coming year will be at par with, or better than that of other grand telescopes.

Third, the GTC enjoys an extensive instrument development program. However, what we see is that it takes much longer than anticipated to put instruments in use for science. This for a variety of reasons. The obvious risk is that the instrument may not be unique, or state-of-the-art anymore by the time it becomes available, and that some of the key science objectives are already completed elsewhere. Maybe the balance between volume of instrumentation developments and the time it takes to get instruments operational on the telescope should be revisited.

And last but not least: the GTC is a fantastic tool for astronomy and astrophysics, with a tremendous potential. Probably until the ELTs come on line it will remain the largest telescope in the world. Exploitation of its cutting edge requires, in my view, a clearer strategy, a more aggressive development approach, and a stronger participation by the user community in both the operation and development of the facility.

REFERENCES

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