Report of the 21st GTC User's Committee Meeting

February 10 – 11, 2020. Held at the IAC, in La Laguna.

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1. General Remarks

The 21st GTC users committee (GUC) meeting was held at the main building of the Instituto de Astrofísica de Canarias in La Laguna, Tenerife. The GTC director and representatives of the science, engineering and development divisions reported to the GUC about the current status, performance and maintenance of the telescope, as well as plans for new developments, including the status of future instruments and new proposals to improve instrumentation. This document summarizes the most important issues presented and the topics discussed during the meeting, including the recommendations from the GUC.

Funding situation

The financial situation of GTC is still critical, as the budget has not increased for years. There is no commitment yet from the Canarias Government to fund GTC in the coming years. Despite this limitation, GTC has managed to hire new staff by making effective usage of different employment programmes. Funding for new developments has been secured from several sources (in particular, to buy new detectors, as explained below). Nevertheless, the situation is still very worrisome.

New GTC instrumentation plan

Development of future instruments for GTC has been frozen until the Canarian government defines its funding commitment. The proposals presented in the *Science with GTC* meeting are detailed at the following link

http://www.gtc.iac.es/instruments/nextgeneration.php.

These proposals will be evaluated by an external panel of experts, who will also consider the wider issue of the strategic role of GTC from 2025 onwards. While the process is stalled, GRANTECAN is accepting new proposals. These proposals must have the same format as in the announcement (e.g. the document must contain a scientific case, a conceptual design and a cost estimation). GTC wants the community to be fully aware that any new instrument that is selected requires the removal of an existing instrument, as no more foci are available.

2.- Responses from the GTC director to the GUC recommendations from the previous meeting

- There have been new developments concerning funding for FRIDA and its construction. This issue will be discussed below.
- Surgical changes have been made to web pages, in response to suggestions.
- It seems possible to achieve good flat-fielding for MEGARA's blue VPHs with sky flats and so acquisition of a powerful blue lamp is no longer so urgent, although it is still considered a priority.
- EMIR's ETC is being continuously updated with real data from observations. Warnings about the increased noise and its effects on spectra of faint targets have now been included in documentation.

- No human resources can be devoted at present to the creation of tools that can be considered crucial to prepare observations (i.e. FMAT or MOS mask design tools for OSIRIS) or the publication of a GTC Newsletter. Bugs and small changes are made by support astronomers, in collaboration with developers. **Users are encouraged to read this report and the successive calls for proposals for updated information**.

- No urge from the community to start offering large programmes on GTC has been identified. The Users Committee has not received any input on this, either.

3.- Update on science operations

GUC members were given reports on the performance of the telescope and all its instruments. The presentations can be downloaded from the GUC pages. In the following, we summarise some of the news presented.

In semester 2019A, 928 hours of observations were delivered to the users. 15% of the time went to guaranteed time programmes. The Spanish community received 92% of the open time; the Mexican community was given 3.9% and UF received 3.2%. The remainder went to the international programmes. Over the long term, the Spanish community has received just below 89% of the time; Mexico, 3.8% and UF, 1.9%. Proposals from the IAC take 62.5% of the Spanish time.

At present, 75% of the A queue programmes and 40% of the B queue programmes are completed. Despite the large number of proposals included in the C queue (70% over-allocation), 70% of the proposals that have been in the queue have received some data. In 2019A, after all the new instruments have been running for some time, observatory overheads have decreased below 2%.

By February 1, the number of published papers using GTC observations was 528, including 228 with a first author from Spain, 30 from Mexico and 17 from the UF. GTC showed that the number of published papers is comparable to that of the Keck telescopes at the time of their ninth year of operations, and well above that of Gemini. Typically, papers are published between 2 and 3 years after the programme is completed. DDT requests still consume only a fraction of the maximum amount of time that can be allocated. **Users are reminded that DDT cannot be used for observations that require immediate response, as the evaluation process takes some time.**

The right ascension range between 10 and 12 hours is still heavily oversubscribed. There are many guaranteed time programmes requesting this range, and they take priority. In consequence, even A-band programmes may not be started. On the other hand, there are some RA ranges that are undersubscribed. Details may be found in the presentations available on the GUC pages. In addition, at the moment, bright time is generally undersubscribed all over the sky. GTC is receiving very few proposals accepted in visitor mode and encourages the use of this mode, as the observing efficiency is generally higher.

In semester 2019B, six instruments were offered and the oversubscription factor was around 4. Despite this, OSIRIS is still being used around 40% of the time, mostly in long-slit mode. Important changes are happening in the near future. The highly successful visitor instrument Hipercam cannot be offered any more, as all the foci will be in use. Canaricam will not be offered after semester 2020A, and will be decommissioned. The NEFER module, a visiting instrument attached to OSIRIS, has not been requested by the community. It has suffered a major breakdown, and will not be offered in the near future.

Engineering teams are working on data quality control tools for improved data acquisition (for example, image reconstruction in MEGARA, or dithering in EMIR). A major effort is being dedicated to the development of a full engineering model of the whole proposal submission and execution process, with the aim of identifying major weaknesses and bottlenecks. The results of this model will be used to improve the observing programme tools and scheduling, including, for instance, automatic

propagation of information from Phase I to Phase II. These new tools will unify formats for all the GTC communities.

Engineering teams continue working on important operation and maintenance tasks, such as system obsolescence, UPS upgrades, preparation of the maintenance platform for the folded Cassegrain (critical for OSIRIS migration), design and instrumentation for diurnal mirror alignment (expected 2023) and upgrades on all instruments as required.

GTC has received a grant from the Canarian government to create a 1000 kWh photovoltaic power plant on the ceiling of the auxiliary building. Technical studies show that thermal inertia is very low and there is no risk of affecting temperature gradients close to the dome. This development will reduce costs and reduce the carbon footprint of the telescope.

4.- Updates on instrumentation and GTC archive

There have been some new developments resulting in changes with respect to the schedule advanced in the previous report.

MIRADAS will be arriving during 2020, and is likely to be offered for the 2021B semester. It will be mounted at the folded Cassegrain focus E.

OSIRIS will be moved from its current location (Nasmyth B) to the Cassegrain focus in early 2021, in order to liberate a focus for **FRIDA**. Once ***OSIRIS*** is migrated, GTC plans to start commissioning its Adaptive Optics system, needed for ***FRIDA***. ***OSIRIS*** will be offered for part of semester 2020B, but will be moved before the semester finishes. Funding has been received to acquire a new detector for ***OSIRIS***. Replacement will almost certainly occur once ***OSIRIS*** has been recommissioned at the Cassegrain focus. Once ***OSIRIS*** is removed from its current location, **HORuS** cannot be offered any more.

EMIR is mounted at the Nasmyth A focus. Funding has also been received for a new detector for ***EMIR***, which would eliminate current problems with faint targets. At present, high detector noise prevents spectroscopy of sources fainter than about $m_{\mathrm{AB}} = 20$. However, the new detector is not expected before mid 2021, and therefore the upgrade will take place after this. Meanwhile, users are very strongly advised always to use the latest version of the ETC, which takes into account the current state of the detector. A complete report on the sensitivity problems and possible corrective actions has been requested from the PI. The data reduction pipeline is now working and produces science quality products.

MEGARA is working within specifications, mounted on folded Cassegrain focus F. A new cover has been placed around the instrument to minimise stray light, and the broken MOS positioners are being replaced. The pointing accuracy has been improved, although some problems have been reported with blind offsets. The reduction pipeline is constantly being updated and the instrument team will pass GTC some scripts that will result in an easier manipulation of the final results. A number of papers based on ***MEGARA*** data have already appeared. A quick-look reconstructed image, based on the light received in each spaxel, will be added to the quality control process and sent to the users. However, a tool to create a wholly reconstructed image (for example, using datacubes from overlapping pointings) is not straightforward to implement.

Hipercam has been very successful as a visiting instrument, with more than 200 hours of observing time delivered. It was removed from focus E to make room for **Canaricam**, which is having its last run during semester 2020A, once several technical problems have been solved. After this, ***Canaricam*** will be decommissioned and the focus occupied by ***MIRADAS***. Given the high interest of the community in using ***Hipercam***, the instrument team have obtained funding to study if it is physically feasible to permanently mount ***Hipercam*** on the telescope, using the auxiliary folded Cassegrain focus G. If the results are satisfactory (meaning that there is no collision with ***MEGARA***, mounted on

the neighbouring focus F), the CSUG will be consulted about its return to the telescope approximately 2 years from now.

HORuS is routinely included in the observing queue as a visitor instrument. There are some issues with faint targets (around magnitude 17), since sky subtraction is difficult to attain. Moreover, such faint stars are not visible in the acquisition camera. There is a working pipeline that can be provided by the PI. Users are encouraged to contact the PI. There are some papers in press, but unfortunately ***HORuS*** cannot be used once ***OSIRIS*** is moved to the Cassegrain focus.

Canaricam was received in March 2019, after improvements. A major issue with the controller (noise, linearity) has been solved, but in January 2020, the Wollaston became stuck. The instrument was removed for repair. It is back at the telescope, where it will operate until ***MIRADAS*** arrives. ***Canaricam*** will no longer be offered.

The adaptive optics system (**GTCAO**) is in a very advance stage of development and it may start being installed at the Nasmyth B focus during 2021. The laser guide system (**LGS**) is progressing towards full design and is scheduled now for 2023. Meanwhile, funding for the detector in ***FRIDA*** has been secured. Although there are still some funding shortages, several positive developments have taken place over the past few months. The cryostat has been completed, and the optical system and IFU unit should be ready in a few months. With these advances, the instrument team is counting on delivery to the telescope in late 2021. In the meantime, they have obtained financial support to study and reduce vibration sources in the telescope, which is important for the best performance of AO systems.

During the meeting, the GUC was informed of a new proposal for a visiting instrument. The Mirror-slicer Array for Astronomical Transients (**MAAT**) is not an instrument on its own, but a new module for ***OSIRIS*** that acts as an integral field unit for a small part of the ***OSIRIS*** field of view. It can be used as a slicer for observations of a single object, increasing the resolving power of all ***OSIRIS*** grisms and allowing spectrophotometry. It can also be used to obtain integral field spectroscopy, over a field of view of 14.20'' x 10''. It has no moving parts or cables, and it behaves as a typical ***OSIRIS*** mask box – it can be placed in the optical path as any other mask. GTC cannot commit any funding or significant effort to its development, but – if approved by the relevant bodies – may consider it as a visiting instrument, offered to the whole community. As a first step, GTC has asked the GUC to compile information about the interest that this new unit may have for the community – provided that the instrument team finds all the funding needed for the project from external sources.

There have been no updates on the high resolution spectrograph, which will be built by China. It is not expected before 2025.

GTC has just started to deliver data for observing programmes through the GTC archive. Reduced data are available in the archives, some of them provided by the instrument teams and others reduced by the archive staff. The archive team would like to receive suggestions from the community on how to prioritise tasks, functionalities and activities in the archive.

5.- Time Allocation Committee (CAT) summary for semester 20B

The Spanish CAT received 165 proposals for semester 2020B, 55% of them requesting GTC observing time, for a total of 2289 hours. With the standard 70% overallocation, 935 h were allocated. The over-subscription factor is ~4.2 for the Spanish community. Further details can be found in the presentation. The call for Spain-Mexico collaborative proposals was not issued for this semester either. Work towards an agreement between the IAC and GTM directors is in progress.

Nine ToO proposals were approved, for a total of 153 h (out of 710 h requested). GTC is concerned about the impact that ToO proposals are having on their schedule, especially after some proposals with many observations have not produced any papers.

6.- Summary of recommendations from the GUC

1.- The GUC would like to congratulate GTC for having secured funding for new detectors (EMIR, OSIRIS and FRIDA). This is an important development with a clearly positive impact on the community.

2.- The GUC were very relieved to learn about the important steps taken towards the development of FRIDA. There are still non-negligible concerns about the budgetary conditions and the lack of testing under cryogenic conditions. The GUC want to stress the need for a complete data reduction pipeline that provides science-grade products, since such a complex instrument cannot be fully exploited without it. A development plan for the software needed for data acquisition and reduction would be greatly welcome.

3.- The GUC highly appreciates the decision by the MEGARA team to supply complements to the existing pipelines. Now that the instrument is isolated from stray light and all the positioners will soon be fully operational, MEGARA is really a very competitive instrument. The GUC is glad to hear that communication between GTC and the instrument team has become fluid again, and congratulates both on these recent developments. Nevertheless, the GUC is concerned about problems with the MOS mode.

4.- The GUC is concerned about the apparent lack of support by the Canarian government. The GUC fully endorses efforts by GTC to negotiate a solution. Once the agreement is reached and funding opportunities exists, the community should be reminded of the open call for proposals for new instrumentation. The initiative to organize a meeting to discuss the role of GTC in the era of extremely large telescopes should also be recovered.

5.- Although a halogen lamp for internal flats in MEGARA may not be a priority, if sky flats are an alternative, the GUC consider that it should still be seen as a necessity in the mid term.

6.- There are reports that HORuS is not reaching expectations for sources fainter than $V = 16$. As long as HORuS is offered, this situation should be made known in the web page.

7.- The GUC is still worried about the possibility that poor-quality automatically reduced data will be offered in the public archive and released with the raw data one year after observations. The GUC still plan to conduct a poll to evaluate the opinion of the whole GTC community.

8.- At the moment, raw data corresponding to a given observation are becoming public one year after the observation is taken. Given the small size and limited resources of the community, the GUC recommend that raw (and reduced) data are not public until one year after the whole programme has been completed, as done by other major observatories, such as *HST* or *Chandra*.

9.- The GUC will endeavour to evaluate the interest within the community in the development of MAAT. The team behind the proposal is encouraged to look for support. Based on the information gathered, the GUC will produce a recommendation.

10.- The GUC acknowledge that GTC is concerned about the pressure that a large number of accepted ToO observations have on the queue, and understand that that this represents an important source of stress on already thinly stretched human resources. The GUC fully agrees with the direction that GTC should not have to take decisions about priority between competing proposals. We recommend that this issue is raised to the Steering Committee so that an effective solution can be found.

11.- The GUC recommend that future tenders for instruments request specific conditions for pipelines, so that the end users obtain science grade data, ready for scientific analysis, at the end of the reduction process.

12.- The GUC endorse the decision of GTC and the CAT to discuss ways to use bright time, if the pressure from the community continues to be low.

13.- The GUC recommend GTC to impose strict time limits on presentations in future GUC meetings.

14.- The GUC supports GTC on their continued effort to reduce its carbon footprint.