QSO Semester Boundaries
A Discussion for SAC

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1. Introduction

One of the goals set for the Queued Service Observing (QSO) mode was to achieve the highest completion level possible for the science programs submitted by the investigators. In particular, for the grade A programs ("must do"), the goal was to reach a completion of 100%. For B programs, 75-100% seemed more realistic and this is what we tried to achieve.

During the first semester (2001A), we were far from reaching these numbers. This is, however, comprehensible because the whole chain composing the New Observing Process (NOP) was a new and challenging undertaking and the observing efficiency suffered from all kind of adversary factors, including our inexperience with the queue mode and severe scheduling constraints of the telescope for instruments other than CFH12K. The statistics for the second semester (2001B) were much better on that side and except for two exceptions (discussed below), basically all A programs were completed or close to be completed. Also, most B programs were done at a high completion level. All this despite about 30% of QSO I-time lost to weather, a fraction higher by about 10% compared to the previous semester.

Completion of programs remains a high priority for the QSO Team and is a constant factor considered in the preparation of the queues. However, there are several difficulties during a semester that can result in a completion level lower than expected, the primary one being the weather. There are, of course, several others. As discussed below, it could become advantageous to *recycle programs* not fully completed during a semester to the next semester. However, there are some non-trivial issues in implementing such a model.

2. Program Completion: The Main Issues

Several factors can contribute to lessen the completion level for QSO programs:

1. *Weather:* This is, of course, the main factor and can affect all the programs on a global manner, or sometime more specifically (for instance, programs with time constraints). The effect of bad weather, however, *is more severe if occurring during the runs at the beginning or the end of a semester*. In particular, it can be a real problem for programs with targets only observable during short periods of time during these runs. One of the A programs in 2001B, done at a very low completeness is the best example: one long program (30hrs), with only one target visible for 5 hours during the second part of the nights of the last run of the semester. We had only one good night over nine during that run so the program could barely be started… This has happened also for some B programs for 2001B and 2002A as well.

2. *Program Requirements:* In general, *programs with easier constraints have higher chances to get the data*. On the contrary, programs requesting data to be gathered exclusively during photometric nights are more difficult to carry out. It is also much more difficult to complete longer programs than shorter ones, although some very

long programs have been completely done in the past. And, as mentioned above, *programs with targets visible for a small fraction of the time during the semester are much more susceptible to be affected by bad weather*.

3. *Telescope Scheduling Constraints:* Due to conflicting requests from different instruments at CFHT (or classical mode with CFH12K), the QSO runs cannot always been optimally scheduled according to the targets of certain programs (in particular, again for the beginning and end of the semester). This has been an important factor for 2001 programs *because no QSO runs could be scheduled at the end of these semesters*.

4. *QSO Procedures*: A major concern *of all queue mode systems* is to get a bimodal distribution of data at the end of a semester: programs completed at 100% or close, and programs not started at all. The pressure to absolutely finish the higher ranked program can result in such a distribution. It has been a problem for instance at WYIN and is one of the reasons why their queue experiment failed. It is then important to try to get a useful set of data, at least to the lower ranked B programs, if possible. It means that some of the higher ranked programs completion level could be a bit lower than expected. Of course, these considerations always take into account the science that must be achieved, and the actual status of the pool of QSO programs.

5. *TAC Evaluation:* The review process of QSO programs is fundamental because the ranking evaluation has a much larger weight in the queue mode than in the classical mode. It is important, however, to apply realistic criteria in the ranking of the programs. For instance, the longest program for Canada in 2002A is the lowest ranked of all A+B programs, needs 8 different filters, and most targets are only visible at the very earliest or very latest of the semester. In such a case, a high completion level can never be achieved It is also difficult for the different TACs to get a general overview of *all* the programs and their constraints. As a result, it happens sometime that too many programs might compete for the same target range at the same time. *This can be really problematic if the competition occurs near the semester boundaries*.

6. *Agency Time Balancing:* It is, of course, important to achieve a good equilibrium in the distribution of the time allocated to the different Agencies. It means that from time to time, the choice of the programs to be undertaken might be decided by this criterion, and not the completeness level of actual, started programs. The fact that balancing must be achieved on a short time scale (semester) makes matter even more difficult.

3. Plausible Solutions

A priori, a way to solve the problem of completion appears to be *recycling of the programs* through the subsequent semester(s). They are several alternatives regarding which programs could be recycled, or what could be changed in the queue system to improve the completion level.

- *Recycling non-completed A programs.* Grade A programs contain the observations with the highest priority to be done in a semester. For the reasons mentioned above, not all the A programs can be completed during a semester. Except for some cases (for instance, targets visible in the middle of a semester and not reaching a low airmass), most of these programs could be recycled in the next semester. The fraction of additional time required will probably reach 10-15% of the total number of nights allocated for a given semester.

- *Recycling non-completed A + B programs.* Grade A and B programs, not-completed, could all be recycled. This would require considerable time added to the current semester. It does not guarantee either that B programs will be fully finished because the pressure will remain on A programs.

- Recycling A (and B?) programs which achieved already a *definite completeness level*. A plausible scenario is to recycle programs already completed at a certain level. At WYIN, for instance, programs completed at 75% or more where recycled while all the other programs were removed from the queue database. Despite looking as a good compromise, this solution could introduce two significant problems: 1) The bi-modal distribution of completeness becomes worse; 2) Ambiguous definition of

the recycling completeness limit with respect to the science to be achieved (a program at 80% could be scientifically viable while another one at 50% could be "useless" if not recycled).

- *Lessen the completeness goal for A programs* to increase chances of higher completion for B programs. Relaxing the goal for 100% completeness level for A programs could help getting more data for B programs. Unfortunately, it does not eliminate situations discussed above regarding bad weather hitting a highly ranked program.

- Recycling (A and/or B) programs with a large fraction of their targets visible only for a small fraction of the current semester. For instance, programs with 50% of their targets visible only during the first 2 runs of the semester could be considered for recycling.

4. Logistics

The general idea of recycling QSO programs during the subsequent semester is appealing. However, there are several logistics issues related to the recycling model:

- For obvious reasons, the schedule for a given semester is generally done 2-3 months before the beginning of the semester. It means that the number of QSO nights for the subsequent semester is allocated while an important fraction of the QSO nights for the current semester has yet to come. For instance, almost 50% of the queue nights for 2002A are still to come when the schedule for 2002B will be done (beginning of May). So, the exact completeness of the programs is far from being known while preparing the schedule for the next semester. The total time really needed to recycling programs can only been very approximate.

- For the same reason, the matter is even more complicated for TAC. They must consider the additional time that should be allocated for the next semester for recycled programs in their allocation of time. While this number cannot be known in advance, it even more complicated if we consider the appropriate distribution among the different Agencies (that is, the exact number of hours necessary for recycling programs can be very different from an Agency to the other).

- On more general considerations, introducing a recycling model for QSO represent a major change in the policy of CFHT regarding observations undertaken at its facility. It has always been clear that except for exceptional circumstances, programs that could not be fully done in a given semester, due for example to bad weather or technical problems, should not be automatically rescheduled for the next semester. The investigators have to first resubmit their proposals to be evaluated by TAC. An automatic recycling of QSO proposals definitively introduces a major difference here between the classical and service modes.

- What role should be played by the diverse TAC in recycling QSO programs? Programs could be automatically recycled without being first reviewed by the TAC or, an evaluation of the merit for programs potentially susceptible to be recycled could be also done by the TAC. It is very possible that *the priority among the recycled programs would be judged differently that at the first evaluation by TAC*. For example, the top A program finished at 80% and with a useful set of data already could have a lower priority in the context of recycled programs than a B program with 30% completeness requesting 100% of the data to be scientifically valuable. This evaluation could be done by the QSO Team but the TAC might want to be involved. Is it realistic, however, to ask for a review of plausible programs to be recycled?

- Technically, there are no immediate problems in recycling programs since all the programs are kept in the queue database. However, management of the programs will be a bit more complex and will necessitate some additional efforts. With the CHFLS having its own conditions, handling this new

strategy will not be very trivial (for example, we will have to constantly evaluate the priority of a program according to its completion level and the possibility of recycling or not).

5. Final comments and a Suggestion

At the moment, the logistics issues regarding the recycling model are certainly not easy to solve. It will certainly introduce changes, not all obvious to foresee, in the dynamics between all the QSO programs. In particular, I am very worried about the changing priorities that will have to occur between the recycled programs and the regular programs during a semester. In any case, it seems way too soon to implement such an option. During the next semester for once, both wide-field cameras are expected be used but only MegaPrime will be available for 2003A. Some non-completed 2002B programs with CFH12K, that could a priori be recycled in 2003A, might not be appropriate for MegaPrime (for instance, because the filters will be different or non-standard filters are necessary). At the same time, 2003A will be the first complete semester with MegaPrime and we can expect that the completion level of several programs will not be as high as we would like for several reasons (camera problems, heavy calibration plan, CFHLS, larger overheads than expected, etc.). Recycling those programs could make the semester 2003B quite difficult if we are dealing with a large number of them. Understanding the relationship between the CFHLS and the regular PI programs (which could eventually lead to revision of some constraints or strategy in the CFHLS) will also take some time and will be much easier if we are not mixing program from different semesters.

Hence for all of these reasons, I cannot recommend the implementation of the recycling model at this time. With the arrival of MegaPrime, CFHLS and the pending logistic issues, implementing such a change could be more problematic than useful. Semester boundaries are restrictive for QSO programs and an alternative should be eventually found.

A Suggestion …

Another alternative and worth exploring would be to replace the actual 6 months semester model for the scheduling of the telescope time CFHT semesters by a schedule covering an entire year. Investigators would then be allowed to submit proposals and expect their observations to be carried out (or their observing runs to be scheduled) within the next 12 months, if accepted. This does not remove entirely the problem of the boundaries but will certainly be an improvement. When the observing year boundary should be is an open matter but since it is likely that QSO runs will occur each month with MegaPrime, a one year period will eliminate most of the boundary restrictions. From a CFHT point of view, offering an instrument one year in advance could be seen as risky but in the MegaPrime/WIRCAM era, it is not so since the number of different instruments requested and used is expected to be smaller.