The QSO Project:
Revision of Statistical Tool

Prepared by: Pierre Martin
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A. Introduction

The statistical tool in the QSO Tool Suite is mostly used in order to evaluate the time distribution between different Agencies and for other useful analyses related to queue observing efficiency, overheads, etc. However, some of the definitions and calculations currently used were originally implemented in the first version of the QSO tools. It is necessary to re-evaluate now some of these definitions and calculations and add up a few new ones in the context of MegaPrime and CFHTLS.

B. Notation and definitions

This section gives the definition of the statistics stored or computed in the database:

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>I-Time</td>
<td>Integration time(^1)</td>
</tr>
<tr>
<td>val</td>
<td>Validated</td>
</tr>
<tr>
<td>spec</td>
<td>Specified (Phase 2)</td>
</tr>
<tr>
<td>inst</td>
<td>Relative to instrument</td>
</tr>
<tr>
<td>OG</td>
<td>Observation Group</td>
</tr>
<tr>
<td>OB</td>
<td>Observation Block</td>
</tr>
<tr>
<td>IC</td>
<td>Instrument Configuration</td>
</tr>
<tr>
<td>exp</td>
<td>Relative to exposures</td>
</tr>
<tr>
<td>RO-Time</td>
<td>Read-out time</td>
</tr>
<tr>
<td>Exptime</td>
<td>Exposure time</td>
</tr>
<tr>
<td>Nbexp</td>
<td>Nb of exposure (in a pattern)</td>
</tr>
</tbody>
</table>

I-Time observed:

\[ ITime_{obs} = \sum_{Programs} \sum_{OGs} \sum_{OBs} \sum_{ICs} \sum_{exp_{obs}} (Exptime_{obs} + ROtime_{inst}) \]

I-Time lost

\(^1\) Our definition of I-Time includes the readout time
$$ITime_{obs} = \sum_{\text{Programs} OGs \ OBs \ ICs} \sum_{\text{Exp}_{\text{obs,grade}=5}} \sum (\text{Exptime}_{obs} + \text{ROTime}_{inst})$$

I-Time validated:

$$ITime_{val} = \sum_{\text{Programs} OGs \ OBs \ ICs} \sum (nb \text{exp}_{val} (\text{Exptime}_{spec} + \text{ROTime}_{inst}))$$

*NEW* “Effective” I-Time validated - for computation of Q efficiency

$$ITime_{val\_eff} = \sum_{\text{Programs} OGs \ OBs \ ICs} \sum \max \left( \frac{\text{NExp}_{val} (\text{Exptime}_{val} + \text{ROTime}_{inst})}{\text{NExp}_{spec} (\text{Exptime}_{spec} + \text{ROTime}_{inst})} \right)$$

Completeness:

$$\text{Completeness} = \frac{ITime_{val}}{ITime_{spec}}$$

Queue efficiency:

$$Q\text{efficiency} = \frac{ITime_{val\_eff}}{ITime_{obs} - ITime_{lost}}$$

Fraction lost:

$$Fraction\_lost = \frac{ITime_{lost}}{ITime_{obs}}$$

C. Statistics Tool Revision

The table in the statistics tool provides information on QSO programs and the current status of these programs. The difficulty in the actual revision comes from the fact that the table rows (calculations) are output of the stored procedure following inputs selected in the application, in particular the program grades (A,B,C,S). As explained below, some parameters would instead require the calculation to be done with two inputs for the program grade. It is probably simpler at the moment to consider these new parameters as special cases, not subject to the “input options” from the application. In other words, these new calculations are independent on the options selected in the “Sub-query Options of the application.

NOTE: We assume here that the calculations displayed depend on the “statistics type” options (e.g. Agency selection), as usual.

• **Hours Allocated**

Each entry field in a table row gives the total integration time (I-time) allocated by the Time Allocation Committee (TAC) for the given input options of a given Agency. Individual I-time for a specific is put into the Phase 2 Tool (PH2) by the QSO Team.
**Hours Allocated** = $\sum (I\text{-time of program sorted by selection criteria})$

- **Hours Allocated (A+B)**

Since the CFHTLS and some smaller Agencies do not have C programs, and that the actual time allocated on the telescope is for A and B grade programs only, the calculation for the agency time balancing starting in 2004B has to be modified. So for a given Agency, a new parameter, which will be used to calculate the new fractions, must be introduced:

$$\text{Hours Allocated (A+B)} = \sum (I\text{-time of A and B programs only})$$

This calculation is done independently on input options selected for the program grades.

- **Hours Calculated**

This calculates the total I-time actually entered into PH2 by the PIs for a given Agency for the program grade(s) selected. It can differ from the I-time allocated quite significantly since some programs are progressively built during the semester (e.g. CFHTLS). The name should now be changed:

$$\text{Hours Requested} = \sum (I\text{-time requested during Phase 2 for programs sorted by selection criteria})$$

- **Current Hours Observed**

This parameter gives the total I-time of OGs with the status “observed” found for a given Agency for the program grade(s) selected. No changes required except for the name:

$$\text{Current Hours Observed} \Rightarrow \text{Hours Observed}$$

- **Current Hours Validated**

This parameter gives the total I-time of OGs with the status “validated” found for a given Agency for program grade(s) selected. No changes required except for the name:

$$\text{Current Hours Observed} \Rightarrow \text{Hours Validated}$$

- **Fraction Requested (Alloc)**

This important parameter defines the fraction of time allocated for a given Agency within the entire pool of QSO programs. This is the fraction we are trying to achieve by the end of a semester. The current definition is the following:

$$\text{Fraction Requested (Alloc)} = \frac{[\text{Hours Allocated for programs input options}]}{[\text{Hours Allocated for programs input options for all Agencies selected}]}$$

This definition is now problematic for 2 reasons: 1) Time actually allocated on the telescope are actually for programs A and B only; 2) We now have smaller agencies without C programs and the CFHTLS also does not have C programs. So, to be completely fair, the fraction requested by time allocation should only be evaluated with respect to A and B programs. The new definition and calculation are the following:

$$\text{Fraction Allocated (A+B)} = \frac{[\text{Hours Allocated for programs A and B of a given Agency}]}{[\text{Hours Allocated for programs A and B of all Agencies}]}$$

This calculation does not depend on the input parameters for the program grades.
However, for information purposes, the old calculation should be kept in the table but under a different name. That way, information on individual program grades will be made available.

\[ \text{Fraction Requested (Alloc)} \Rightarrow \text{Fraction Allocated} \]

- \text{Fraction Requested (Calc)}

This fraction is similar to the previous one except that the calculation is based on the number of hours calculated from PH2, not the I-time allocated, which can be very different if programs are worked on during a semester. This parameter does not much have of an use now in the Stats Tool (very useful however for program viewer), so it can be removed from the table.

- \text{Relative Fraction Validated}

This parameter, fundamental to QSO, corresponds to the distribution of I-time actually validated between the different Agencies:

\[ \text{Relative Fraction Validated} = \frac{\text{[Hours Validated for program grade(s) selected]}}{\text{[Hours Validated for programs grade(s) selected for all Agencies selected]}} \]

For reason explained above, starting in 2004B, it must be kept closed to the “Fraction Allocated (A+B)” parameter. The actual calculation is correct since we take into account of the time used by C programs in the distribution of time between Agencies, but the appellation is wrong. The new name should be:

\[ \text{Relative Fraction Validated} \Rightarrow \text{Fraction Validated} \]

- \text{Fraction observed / Fraction Validated}

In principle, these parameters represent the fraction of time observed and validated for the entire QSO pool of programs. The current individual calculations are actually not correct and not useful. Another parameter giving the same information, the completeness, is already included (below), so these two parameters and calculations can be removed.

- \text{Number of Programs}

This parameter gives the total number of programs for a given Agency and no change is required:

\[ \text{Number of Programs} = \sum (\text{Programs in grade input options}) \]

- \text{Total Completeness}

This parameter gives the fraction of observations validated within a given Agency (the total of these individual values giving the completeness of the entire QSO pool of programs). The name should be changed but the calculation is correct:

\[ \text{Completeness} = \frac{\text{[Hours validated for program grade(s) selected for given Agency]}}{\text{[Hours requested for program grade(s) selected for given Agency]}} \]

- \text{Queue Efficiency}
This calculation essentially represents the total I-time validated over the total I-time observed, *at the exposure level*. The current calculation is done at the OB level and is not quite correct. A new version (v5) of the statistics stored procedure will output the corrected value.

**C. Other Issues**

**C.1. Quick Definition of Parameters**

To avoid any confusion, it would be useful to have a quick definition on the terms by placing the mouse over the parameter, as with the Program Viewer.

**C.2. Instrument Selection**

The actual do not have any selection made by the instrument. However, the statistics for QSO must be distinguished among the instruments, in particular when WIRCam becomes available. This should be for the next upgrade.

**C.3. Current Statistics Page**

The actual “Current “Statistics” Web page mostly extracts the information from the Statistics Tool. A certain number of changes will be requested as well, starting with the inclusion of the definition of these terms. Among the important ones, the “allocated” I-time in the first plot will have to be replaced by the actual calculation of I-time for A+B programs only. As well, the “Fraction Allocated” plot will need to use the “Fraction Allocated (A+B)” values instead of the total fraction including C programs. This is to be done when the new definitions/calculations have been implemented.