Optimizing telescope time with ESPaDOnS

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CFHT always strives to optimize and maximize the time spent on the sky so that users obtain as much data as possible. Limitations imposed by hardware, such as the time needed for telescope slews and dome rotation, can be managed by Queue Coordinators, who carefully plan sequences of observations to minimize those overheads. Another way to optimize the use of telescope time is to accumulate photons, not based on a pre-determined exposure time, but until the Principal Investigator’s requested SNR is reached. When sky conditions are excellent, for example when the image quality gets as low as 0.4", the initial exposure time can be significantly reduced while still attaining the SNR needed for a scientific goal. Other hardware limitations, such as time spent reading out a detector, can be addressed with hardware and software upgrades. The Olapa 2amp project reduces the readout time by about half, by using both amplifiers on the e2v chip instead of just one.

**OPTIMIZING SKY TIME WITH CAREFUL NIGHT PLANS**

The Queue Coordinator has the responsibility of choosing appropriate targets that minimize telescope motion and dome rotation.

**OPTIMIZING SKY TIME BY HELPING THE OBSERVER QUICKLY ACQUIRE TARGETS**

Due to a pointing accuracy of only about 30", the remote observer has to confirm targets by comparing the actual field of view with finding charts.

The acquisition was automated to save a little bit of time, by creating a mosaic.

The mosaic consists of a dither pattern of 5 images. Each individual image is 75" x 75". The resulting stitched image is 2’ x 2’. The time to offset the telescope, take the individual images, and stitch them together is 25 seconds.

**OPTIMIZING SKY TIME BY REACHING A GOAL SNR INSTEAD OF A GOAL EXPOSURE TIME**

The QSO SNR mode stops exposures when the goal SNR has been reached.

Pros:
- Entirely optional
- PI can indicate the goal SNR at their favorite wavelength
- Flux and SNR are tracked in real time by using the Exposure Meter
- Exposure stops as soon as goal SNR is reached
- Can save a lot of time when sky conditions are excellent (up to 50%)
- Since Feb 2016, QSO-SNR has saved 4h out of 8h requested
- Works best for spectroscopy and non-variable targets

Cons:
- PI has to use the ETC and provide a goal SNR
- Cannot be used under variable sky conditions in polarimetric mode without introducing spurious polarization signals
- Exposures cannot be lengthened
- Relies on a precise and accurate calibration of the Exposure Meter
- Requires more flexibility from the QSO team if the planned queue is shorter than expected

**OPTIMIZING SKY TIME BY KEEPING THE DETECTOR READOUT TIME AS SHORT AS POSSIBLE**

Potential estimated gains are on average 1h/day for calibrations and 0.5h/night on science exposures.

Current readout times for Olapa (1amp) vary between 32s (Fast) and 60s (Slow).

In 2016A (over 27 nights), on average, 1h/night was spent reading out science exposures, and 2h/day were spent reading calibrations.

The Olapa 2amp mode can decrease the readout time by a factor of almost 2.

The work is still ongoing.