



MEMORANDUM

TO: QSO, NEO, TCS
FROM: R. Savalle
DATE: 2003-06-27
SUBJECT: **Megaprime Breaker Specifications**

QSO-023/Version 1.1/FINAL

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1 History

Version	Date	Comments
1.0	2003-06-25	Initial revision
1.1	2003-06-27	Corrections by RS and PM

2 Context

This memo describes the telescope and instrument setup commands sent by QSO to NEO and TCS for operation of Megaprime.

3 Conventions used in this document

- A|B means exclusive or: A or B but not A and B
- [] means optional
- <X> means a variable
- REPEAT n { ... } means repeat n times the commands between the {}, n integer>1
- OB means Observation Block
- OG means Observation Group
- IC means Instrument Configuration
- OT means Observing Tool
- SO means Service Observer

4 Big picture

We describe here the sequences of setup commands created by the QSO breaker. The QSO breaker is run prior to observing to construct setup commands from observation specifications.

During observing, the SO uses the OT to execute these sequences. It should be noted that the SO has the ability to send subsets of commands. In particular, only an IC of an OB, or a subset of the exposures of an IC can be sent. In such cases, the OT logic ensure that the sequencing of the commands is preserved.

In some cases the SO can send commands out of sequence, by selecting them individually in the panel “NEO Commands”. However during normal operations, the SO is supposed to use only the OG/OB selection panel from where it is normally forbidden to send commands out of sequence.

5 Commands

5.1 Generalities

Each command is atomic: it either completely succeeds or completely fails. Commands sequences are designed to be executed as independent blocks. No state information about the telescope and acquisition systems is known at the time of creation or at the time of execution of the commands. Hence there exists redundancy in the command sequences. In particular, a setup request can be sent to put the system in a state where it already is.

5.2 Definitions

Command	Arguments	Description
tcoords (sidereal)	<POS> zenith with <POS>:=<ra> <dec> <eq> <pm_ra> <pm_dec> <name> <mag>	Request telescope tracking at sidereal rate at position <POS> or at zenith.
tcoords (non sidereal)	ns <POS1>,<T1>/<POS2>,<T2> [/<POS3>,<T3>] with <POSn>:=<ra> <dec> <eq> <pm_ra> <pm_dec> <name> <mag>	Request telescope tracking at non-sidereal rate defined by the arguments. NB: <Tn> is an unmodified Julian Date with 6 decimal places NB: Not currently (2003-06-27) available.
ocoords	abs t c <ora> <odec>	Request telescope (t) or coordinated (c) offset of <ora> arcsecs in RA direction (positive=East) and <odec> arcsecs in DEC direction (positive=North) NB: A telescope offset will normally be followed by a request for not guiding. NB: A coordinated offset will normally be followed by a request for guiding.
gcoords	N S [<GS1>/ [<GS2>/ [<GS3>/ [<GS4>/ [<GS5>]]]] select park none with <GSn>:=<ra> <dec> <eq> <pm_ra> <pm_dec> <name> <mag> with <name>:=<catalog name>_<star_name>	Request a guiding mode for the North or South guider, for the last sent telescope position and offset (if previously requested). The guiding mode is to be chosen among one of the guiding modes passed in arguments, in the listed order of preference, unless (for optimization purposes) the system is already guiding on the last sent telescope position and offset in one of the passed mode. Possible guiding modes:
		none do not guide
		park do not guide and move guide probe to a non-vignetting position
		<GS> guide on that guide star
		select guide on any guide star (TCS reverts to a MOF-controlled selection method)
filter	<filter>	Request to use filter <filter> for next exposure

go	[etype=OBJET FOCUS BIAS DARK] [nexp=<nbexp>] [etime=<exptime>] [raster=<raster>] [filename=odometer <filename>]	Take <nbexp> exposure(s) of type <etype> for <exptime> seconds with the raster and binning defined by <raster>, at the last sent telescope position and offset.

Other commands used by the MegaPrime breaker but not considered in this document:

- mode observing|engineering
- header _runid|_piname|observer|object|comment|sequence <value>
- nheader reset|<sequence> <keyword> <value> <command>
- say_logonly: <msg>
- og start|end

6 Macros

The following sequences can be inserted by the observer with the OT into the observing sequences produced by the breaker, at a specific position marked by the breaker. They are not designed to be sent alone. In part 7, we designate these optional macros as **[MACRO]**

6.1 Focus

Takes a focus exposure containing <nbexp> exposures of <exptime> seconds. Used at the beginning of an OB when a tcoords has already been sent.

FOCUS
filter ... gcoords N park gcoords S park go etype=FOCUS nexp=<nbexp> etime=<exptime>

6.2 Snapshot

This macro is a similar case to part 6.1.

SNAP
filter ... ocoords abs t 0.0 0.0 gcoords N park gcoords S park

```
go etype=OBJECT nexp=1 etime=10.0 raster="FULL BIN4"
```

7 Observing Sequences

In the following scenarios we assume that the SO uses the OT to send sequences created by the breaker and that the sequencing is enforced by the OT.

NB: The order of the macros FOCUS and SNAP can be inverted when both are present.

7.1 Flats

Not implemented by the breaker yet (2003-06-26). Pending on NEO implementation (see Exhibit 1: Specifications for FLAT Sequence). Desired sequence could be:

```
tcoords zenith
filter ...
gcoords N park
gcoords S park
go etype=SFLAT etime=<exptime>
```

7.2 Unguided single exposure (e.g. standard)

```
tcoords ...
[FOCUS]
[SNAP]
filter ...
ocoords abs t 0.0 0.0
gcoords N park
gcoords S park
go etype=OBJECT ...
```

7.3 Unguided dither pattern initial exposure and offset exposures

```
tcoords ...
[FOCUS]
[SNAP]
filter ...
ocoords abs t 0.0 0.0
gcoords N park
gcoords S park
go etype=OBJECT ...
REPEAT n {
ocoords abs t <oran> <odecn>
gcoords N park
gcoords S park
go etype=OBJECT ...
```

```
}
```

7.4 Unguided dither pattern offset exposures when resumed in the middle

NB: This is also the sequence for redoing a part of an unguided dither pattern.

```
tcoords ...  
[FOCUS]  
[SNAP]  
filter ...  
ocoords abs t <oral> <odecl>  
gcoords N park  
gcoords S park  
go etype=OBJECT ...  
REPEAT n {  
ocoords abs t <oran> <odecn>  
gcoords N park  
gcoords S park  
go etype=OBJECT ...  
}
```

7.5 Guided single exposure

```
tcoords ...  
[FOCUS]  
[SNAP]  
filter ...  
ocoords abs c 0.0 0.0  
gcoords N [<GS01>/[<GS02>/[<GS03>/]]]select  
gcoords S [<GS04>/[<GS05>/[<GS06>/]]]select[/park]  
go etype=OBJECT ...
```

7.6 Guided dither pattern initial exposure and offset exposures

```
tcoords ...  
[FOCUS]  
[SNAP]  
filter ...  
ocoords abs c 0.0 0.0  
gcoords N [<GS01>/[<GS02>/[<GS03>/]]]select  
gcoords S [<GS04>/[<GS05>/[<GS06>/]]]select[/park]  
go etype=OBJECT ...  
REPEAT n {  
ocoords abs c <oran> <odecn>  
gcoords N [<GS07>/[<GS08>/[<GS09>/]]]select  
gcoords S [<GS10>/[<GS11>/[<GS12>/]]]select[/park]
```

```
go etype=OBJECT ...
}
```

7.7 Guided dither pattern offset exposures when resumed in the middle

NB: This is also the sequence for redoing a part of a guided dither pattern.

```
tcoords ...
[FOCUS]
[SNAP]
filter ...
ocoords abs c <oral> <odecl>
gcoords N [<GS01>/[<GS02>/[<GS03>/]]]select
gcoords S [<GS04>/[<GS05>/[<GS06>/]]]select[/park]
go etype=OBJECT ...
REPEAT n {
ocoords abs c <oran> <odecn>
gcoords N [<GS07>/[<GS08>/[<GS09>/]]]select
gcoords S [<GS10>/[<GS11>/[<GS12>/]]]select[/park]
go etype=OBJECT ...
}
```

8 References

- QSO-004 - Communications interface between QSO and NEO, Version 1.6, 13 Aug 2000, R.Savalle
- QSO/NEO/TCS interface for Megaprime, Version 0.2, 3 Dec 2002, W.Cruise

Exhibit 1: Specifications for FLAT Sequence

Date: Mon, 02 Jun 2003 16:36:21 -1000
From: Pierre Martin <martin@cfht.hawaii.edu>
To: nop@cfht.hawaii.edu
Subject: On Flats in NOP.....

Hello,

Attn.: long message..... :(

Following a concern raised by CADC last week on some inconsistencies in the headers (in particular for the release date) on detrend data, I think it is time to discuss again the feasibility of integrating the flat fields within the normal QSO execution scheme.

First, why do we want to do that ? For two main reasons I think : 1) Consistency in the headers. It has happened in the past, for instance, that flats have been done with the wrong runID. That can make things really confusing later on, including for CADC (e.g. no way to tell if a flat was taken in Q mode or was for a classical observer). I think that most of the errors like that (e.g. wrong pi name) generated in headers prior to the NOP mode (and how many times have we heard CADC complaining about those ?) have been mostly eliminated now, except for the flats. 2) The release date for the data is introduced at a very high level (through the execution of the program in the observing tool), because each program can have a different release date. The keyword is not generated outside of QSO so flats do not have a release date, which is bad and is not appreciated much at CADC.

Why was it not done before? We can generate blocks and groups for flats in QSO and NEO has a etype=flat already. The problem with generating flats with CFH12K was twofold: there is not an easy way to generate the correct exposure time and the number of exposures from the observing tool. For the latter, it would be possible to stop the sequence from the OT but it's never very clean and that has caused problems in the past (including messing up the headers).

There are probably several ways to implement this once for all. It will necessitate some work on both QSO and NEO but I think it's worth to think about it. For instance, the control of the exposure time could be left entirely to the script in NEO. Sending the OG from QSO could first trigger a loop for the "flux" program. When the correct value is obtained for this particular filter, the flats start automatically with the "flat" script, changing the exposure times as before. The number of exposures could be controlled in two ways: different OGs with different number of exposures (nexp), selected by the SO as necessary, or from a more automated system where for instance, the maximum length of time to take flats for this filter could be sent from the OT and the script would stop and the OG be terminated when you reach that limit (e.g. "do flats in r' for 10 minutes and stop if last flat would exceed the 10 minutes period").

There are other ways, some simpler, some more sophisticated...

Anyway, this is certainly a good time to start discussing that. I do not think the flat script for MP is functional at the moment (true?) but data exist on the etime for the filters, etc. So, now it's certainly appropriate to implement that since we're becoming more and more operational....

Any ideas? Suggestions? Comments?

Thanks,

Pierre

Dr. Pierre Martin
Staff Astronomer
Canada-France-Hawaii Telescope