# 13036 - Hubble Observations of Kepler-Monitored AGN - GO orbits

Cycle: 20, Proposal Category: GO

(Availability Mode: SUPPORTED)


**INVESTIGATORS**

| *Name* | *Institution* | *E-Mail* |
|---|---|---|
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**VISITS**

| *Visit* | *Targets used in Visit* | *Configurations used in Visit* | *Orbits Used* | *Last Orbit Planner Run* | *OP Current with Visit?* |
|---|---|---|---|---|---|
| 01 | (1) ZW229-15 | WFC3/UVIS | 1 | 25-Jun-2012 22:01:39.0 | yes |
| 02 | (2) KA1858+48 | WFC3/UVIS | 1 | 25-Jun-2012 22:01:47.0 | yes |

2 Total Orbits Used


**ABSTRACT**

It is thought that some fraction of AGN optical variability is generated internally by viscous processes in the accretion disk and the remainder by the "reprocessing" by the disk of external emission from the variable, compact x-ray source. These two processes operate on very different timescales. For the past two years we have obtained high-precision, densely-sampled, long-duration optical light curves from Kepler and coordinated x-ray monitoring for a sample of AGN. These permit for the first time the measurement of both the optical variability of AGN over a wide range of timescales and its detailed relation with the x-rays, allowing a characterization of the relative importance of these two processes.

In order to properly model the disk emission and probe the origin of the variability, it is necessary to measure and subtract off the substantial but uncertainty contribution due to starlight in the underlying galaxy. Without this measurement it is impossible to determine the amplitude of the AGN variability. This cannot be accomplished with the Kepler data due to its poor angular resolution but instead requires high spatial resolution data that can only be obtained with HST. This and a companion proposal request 2 GO and 7 SNAP orbits for WFC3 imaging of the relatively low-redshift ($z < 0.16$) AGN that we are currently monitoring with Kepler. This will allow a determination of the absolute amount of variability, which in turn will establish the relative importance of intrinsic and reprocessing phenomena in the disk. Thus these proposed HST observations are crucial to obtain the full value of the already-extraordinary Kepler AGN light curves.

**OBSERVING DESCRIPTION**

All observations will utilize the WFC3-UVIS with broad-bandpass W350LP filter in order to minimize the exposure time needed to obtain adequate S/N. This filter is a good match to the Kepler 4200-9000 Å bandpass in the red but extends somewhat further into the blue.

We will utilize the 2kx2k subarray (e.g., UVIS1-2K2A-SUB) in order to cover the full galaxy in the case of Zw 229-15 and to assure inclusion of PSF stars in the case of KA 1858+48. We will utilize the standard 2-point dither (WFC3-UVIS-DITHER-LINE) and at each point will take a long (~850 sec), medium (200 sec) and short (5 sec) exposure, for a total of ~2110 sec on source. (The long exposure times have been set to 845 sec for Zw 229-15 and 867 for 1858+48 so as to minimize the unused visibility.) APT indicates an additional 360 sec for target acquisition, 5x165 sec to read out the subarrays and 6x12 sec to start the integrations, for a total of 1245 sec in overhead, allowing the entire observation to fit in a single 56-57 minute orbit.

We will combine all exposures using multidrizzle, excluding the saturated regions and charge-bleed regions around the AGN in the long exposures, in order to obtain final images with a wide dynamic range encompassing the AGN core out to the galaxy's outer disk.

## Visit

**Proposal 13036, Visit 01** Tue Jun 26 02:01:54 GMT 2012

**Diagnostic Status: No Diagnostics**

Scientific Instruments: WFC3/UVIS

Special Requirements: (none)

## Patterns

| # | Primary Pattern | | Secondary Pattern | Exposures |
|---|---|---|---|---|
| (1) | Pattern Type=WFC3-UVIS-DITHER-LINE<br>Purpose=DITHER<br>Number Of Points=2<br>Point Spacing=0.145<br>Line Spacing= | Coordinate Frame=POS-TARG<br>Pattern Orientation=46.84<br>Angle Between Sides=<br>Center Pattern=false | | (1-3) |

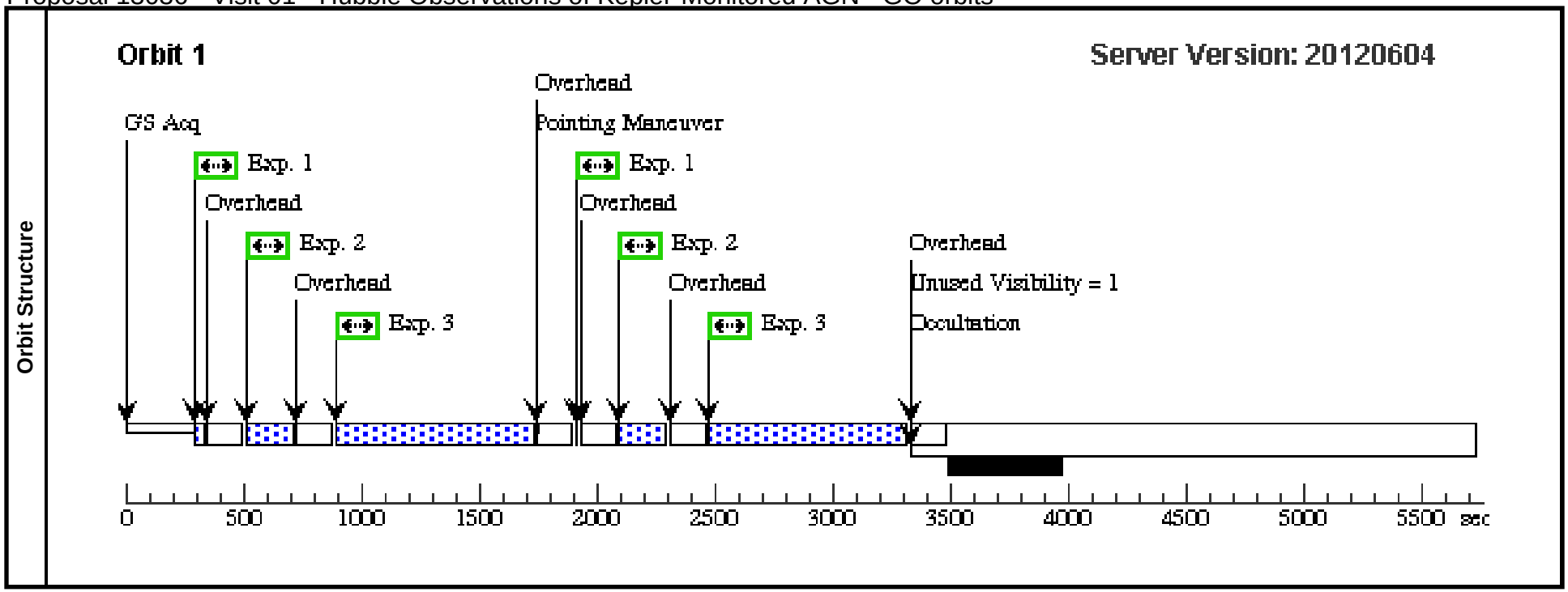
## Fixed Targets

| # | Name | Target Coordinates | Targ. Coord. Corrections | Fluxes | Miscellaneous |
|---|---|---|---|---|---|
| (1) | ZW229-15 | RA: 19 05 25.9392 (286.3580800d)<br>Dec: +42 27 39.64 (42.46101d)<br>Equinox: J2000 | | V=15.0+/-0.5 | Reference Frame: ICRS |

*Comments: This object was generated by the targetselector and retrieved from the NED database.*

## Exposures

| # | Label | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 1 | | (1) ZW229-15 | WFC3/UVIS, ACCUM, UVIS1-2K2A-SUB | F350LP | CR-SPLIT=NO | | Pattern 1, Exps 1-3 in Visit 01 (1) | 5 Secs<br>*[==>(Pattern 1)]*<br>*[==>(Pattern 2)]* | ***[1]*** |
| 2 | | (1) ZW229-15 | WFC3/UVIS, ACCUM, UVIS1-2K2A-SUB | F350LP | CR-SPLIT=NO | | Pattern 1, Exps 1-3 in Visit 01 (1) | 200 Secs<br>*[==>(Pattern 1)]*<br>*[==>(Pattern 2)]* | ***[1]*** |
| 3 | | (1) ZW229-15 | WFC3/UVIS, ACCUM, UVIS1-2K2A-SUB | F350LP | CR-SPLIT=NO | | Pattern 1, Exps 1-3 in Visit 01 (1) | 845 Secs<br>*[==>(Pattern 1)]*<br>*[==>(Pattern 2)]* | ***[1]*** |


Orbit Structure
Orbit 1
Server Version: 20120604
GS Acq
Exp. 1
Overhead
Exp. 2
Overhead
Exp. 3
Overhead
Pointing Maneuver
Exp. 1
Overhead
Exp. 2
Overhead
Exp. 3
Overhead
Unused Visibility = 1
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

## Visit

**Proposal 13036, Visit 02** Tue Jun 26 02:01:56 GMT 2012

**Diagnostic Status: No Diagnostics**

Scientific Instruments: WFC3/UVIS

Special Requirements: (none)

## Patterns

| # | Primary Pattern | | Secondary Pattern | Exposures |
|---|---|---|---|---|
| (1) | Pattern Type=WFC3-UVIS-DITHER-LINE<br>Purpose=DITHER<br>Number Of Points=2<br>Point Spacing=0.145<br>Line Spacing= | Coordinate Frame=POS-TARG<br>Pattern Orientation=46.84<br>Angle Between Sides=<br>Center Pattern=false | | (1-3) |

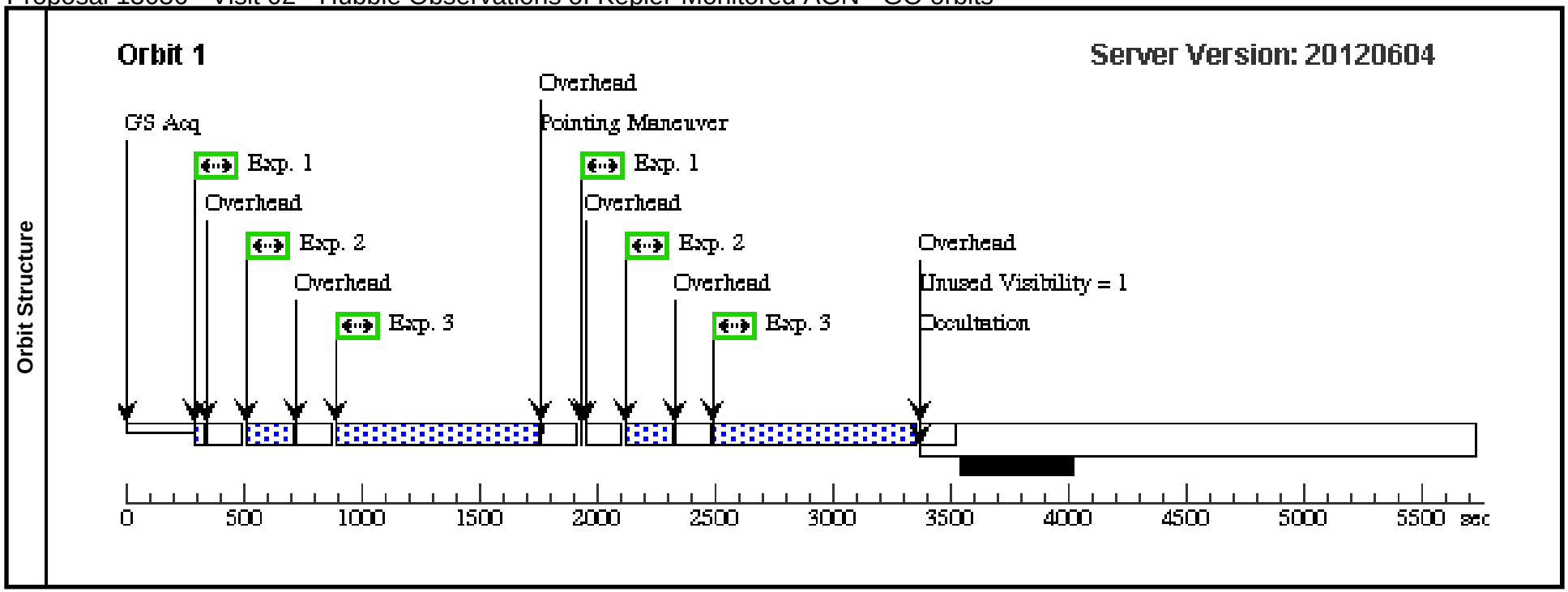
## Fixed Targets

| # | Name | Target Coordinates | Targ. Coord. Corrections | Fluxes | Miscellaneous |
|---|---|---|---|---|---|
| (2) | KA1858+48 | RA: 18 58 1.1000 (284.5045833d)<br>Dec: +48 50 23.00 (48.83972d)<br>Equinox: J2000 | | V=16.0+/-1.0 | Reference Frame: ICRS |

*Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.*

## Exposures

| # | Label | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 1 | | (2) KA1858+48 | WFC3/UVIS, ACCUM, UVIS1-2K2A-SUB | F350LP | CR-SPLIT=NO | | Pattern 1, Exps 1-3 in Visit 02 (1) | 5 Secs<br>*[==>(Pattern 1)]*<br>*[==>(Pattern 2)]* | <br>***[1]*** |
| 2 | | (2) KA1858+48 | WFC3/UVIS, ACCUM, UVIS1-2K2A-SUB | F350LP | CR-SPLIT=NO | | Pattern 1, Exps 1-3 in Visit 02 (1) | 200 Secs<br>*[==>(Pattern 1)]*<br>*[==>(Pattern 2)]* | <br>***[1]*** |
| 3 | | (2) KA1858+48 | WFC3/UVIS, ACCUM, UVIS1-2K2A-SUB | F350LP | CR-SPLIT=NO | | Pattern 1, Exps 1-3 in Visit 02 (1) | 867 Secs<br>*[==>(Pattern 1)]*<br>*[==>(Pattern 2)]* | <br>***[1]*** |


Orbit Structure
Orbit 1
Server Version: 20120604
GS Acq
Exp. 1
Overhead
Exp. 2
Overhead
Exp. 3
Overhead
Pointing Maneuver
Exp. 1
Overhead
Exp. 2
Overhead
Exp. 3
Overhead
Unused Visibility = 1
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec