# 15511 - Measurement of the Expansion Proper Motions of the Ou4 Giant Bipolar Outflow to Determine its Distance and its True Nature

Cycle: 26, Proposal Category: GO

(Availability Mode: SUPPORTED)

**INVESTIGATORS**


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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) OU4-SOUTH-LOBE | WFC3/UVIS | 2 | 07-Dec-2018 14:00:39.0 | yes |

2 Total Orbits Used

**ABSTRACT**

Ou4 is a giant bipolar outflow with a total length of 1.2 degrees on the sky that was discovered in the optical in the direction of the blister HII region Sh2-129. The distance, the nature, and the driving source of Ou4 are, however, not known. Ou4 is relevant for the study of the eruptive phenomena producing collimated outflows from evolved low-mass binary stars and young, massive stellar systems. Our morpho-kinematics study of the Ou4 south bow-shock has allowed us to predict its expansion proper motion that is directly related to its distance. We propose to image the brightest [O III] emission of this bow-shock with the UVIS channel of the WFC3 in Cycle 24 and 26 in order to determine the distance of this largest known stellar bipolar outflow from its expansion proper motions. This measurement is crucial to determine the true nature of Ou4: either a foreground

planetary nebula or a giant bipolar outflow launched ~90,000 years ago by HR 8119, the young massive triple system ionising Sh2-129.

**OBSERVING DESCRIPTION**

The first epoch observation was obtained on 2016-10-23 with ORIENT=78.8 degrees. To increase the time separation between the first and this second observation, we increase ORIENT of about 180 degrees to allow scheduling in May 2019 and consequently change the pointing to survey the same area of the bow shock.

We use the observing strategy of the first epoch observation.

We use the WFC3/UVIS channel with the F502N narrow filter to survey the brightest emission of the 5007 A line of the [O III] doublet in the Ou4 giant bipolar outflow.

We execute dithered exposures using the B6 pattern (pre-defined WFC3-UVIS-MOS-DITH-LINE pattern has been modified), which combines two step over the chip gap to maximize the surveyed area and sub-pixel steps to improve the PSF sampling (WFC3 ISR 2010-09). The six frames are executed inside the same orbit for the best dither pointing accuracy. We use parallel buffer dumps.

We add a flash at the end of each exposure (12 electrons) to reduce the charge losses during the detector readouts.

## Visit

**Proposal 15511, second epoch imaging (01), implementation** Fri Dec 07 19:00:40 GMT 2018

**Diagnostic Status: No Diagnostics**

Scientific Instruments: WFC3/UVIS

Special Requirements: ORIENT 252D TO 256 D

*Comments: Two consecutive orbits. We require a specific orientation to maximize the time baseline, to survey the same area of the bow shock that was observed in 2016, and to put a V=10.7-mag star in quadrant C to prevent any filter and window ghost artifacts (the latter being produced in a such narrow filter image by star with V<12 mag in quadrant D; WFC3 ISR 2011-16) that would disturb our proper motion measurement. We use an angle tolerance to increase the schedulability (16-26 May 2019).*

## Patterns

| # | Primary Pattern | | Secondary Pattern | | Exposures |
|---|---|---|---|---|---|
| (1) | Pattern Type=WFC3-UVIS-MOS-DITH-LINE<br>Purpose=DITHER<br>Number Of Points=3<br>Point Spacing=2.632<br>Line Spacing= | Coordinate Frame=POS-TARG<br>Pattern Orientation=47.134<br>Angle Between Sides=<br>Center Pattern=true | Pattern Type=WFC3-UVIS-MOS-DITH-LINE<br>Purpose=DITHER<br>Number Of Points=2<br>Point Spacing=0.119<br>Line Spacing= | Coordinate Frame=POS-TARG<br>Pattern Orientation=33.715<br>Angle Between Sides=<br>Center Pattern=false | (1), (2) |

## Fixed Targets

| # | Name | Target Coordinates | Targ. Coord. Corrections | Fluxes | Miscellaneous |
|---|---|---|---|---|---|
| (1) | OU4-SOUTH-LOBE | RA: 21 13 23.4580 (318.3477417d)<br>Dec: +59 24 26.96 (59.40749d)<br>Equinox: J2000 | | V=(?)<br>2.25E-16 | Reference Frame: ICRS |

*Comments: The target is extended and has a very small expansion proper motion.*
*The pointing coordinates are optimized to maximize the emission survey.*
*The flux is our surface brightness threshold in erg/s/cm2/arcsec2.*
*Category=ISM*
*Description=[BIPOLAR OUTFLOW, EMISSION LINE NEBULA, HII REGION, SHOCK FRONT, WIND]*
*Extended=YES*

## Exposures

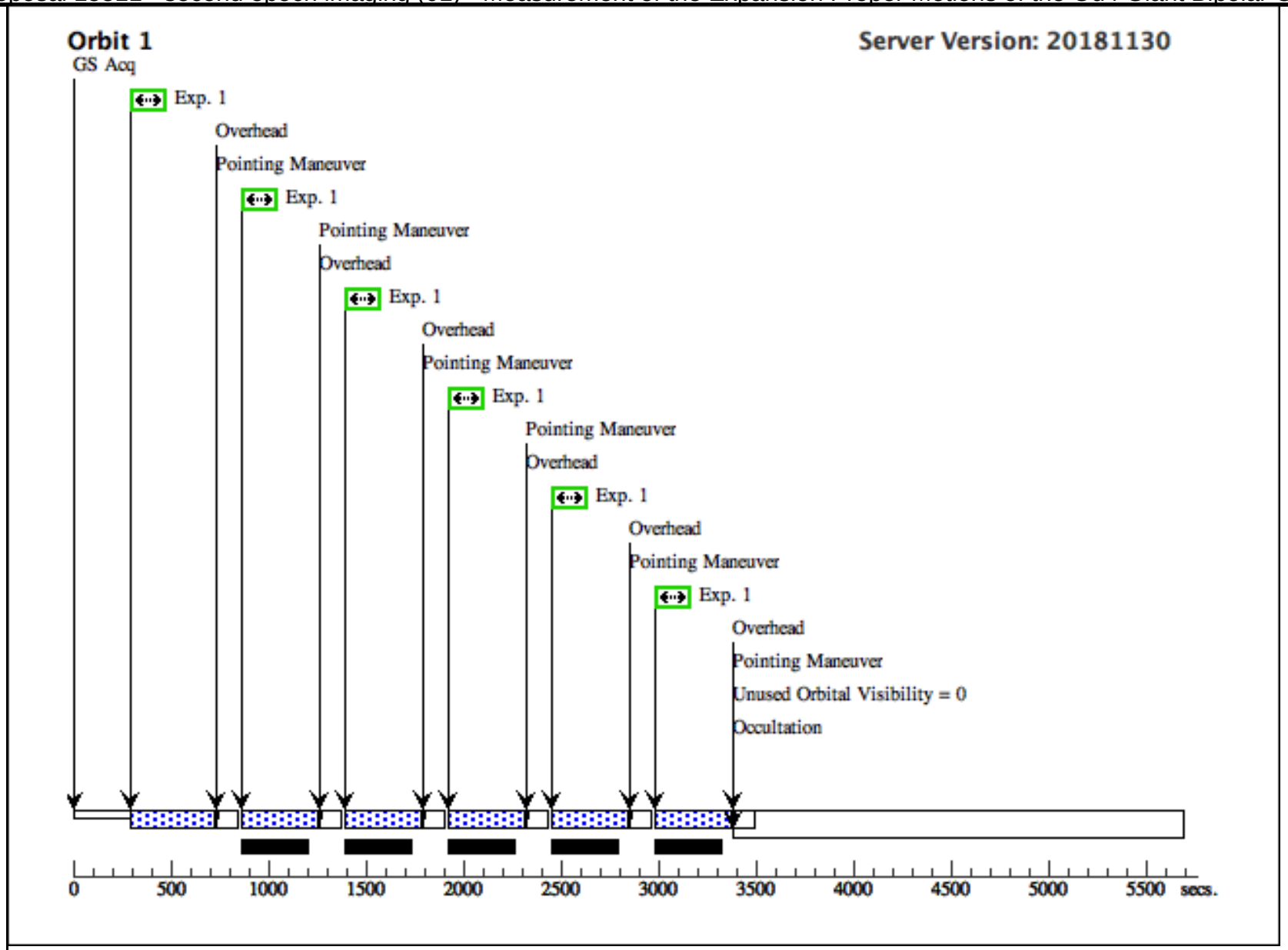
| # | Label | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time (Total)/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 1 | | (1) OU4-SOUTH-LOBE | WFC3/UVIS, ACCUM, UVIS | F502N | FLASH=12 | | Pattern 1, Exps 1-1 in second epoch imaging (01) (1) | 1000 Secs (2373 Secs)<br>*[==>396.0 Secs (Pattern 1,1)]*<br>*[==>395.0 Secs (Pattern 1,2)]*<br>*[==>396.0 Secs (Pattern 2,1)]*<br>*[==>395.0 Secs (Pattern 2,2)]*<br>*[==>396.0 Secs (Pattern 3,1)]*<br>*[==>395.0 Secs (Pattern 3,2)]* | ***[1]*** |

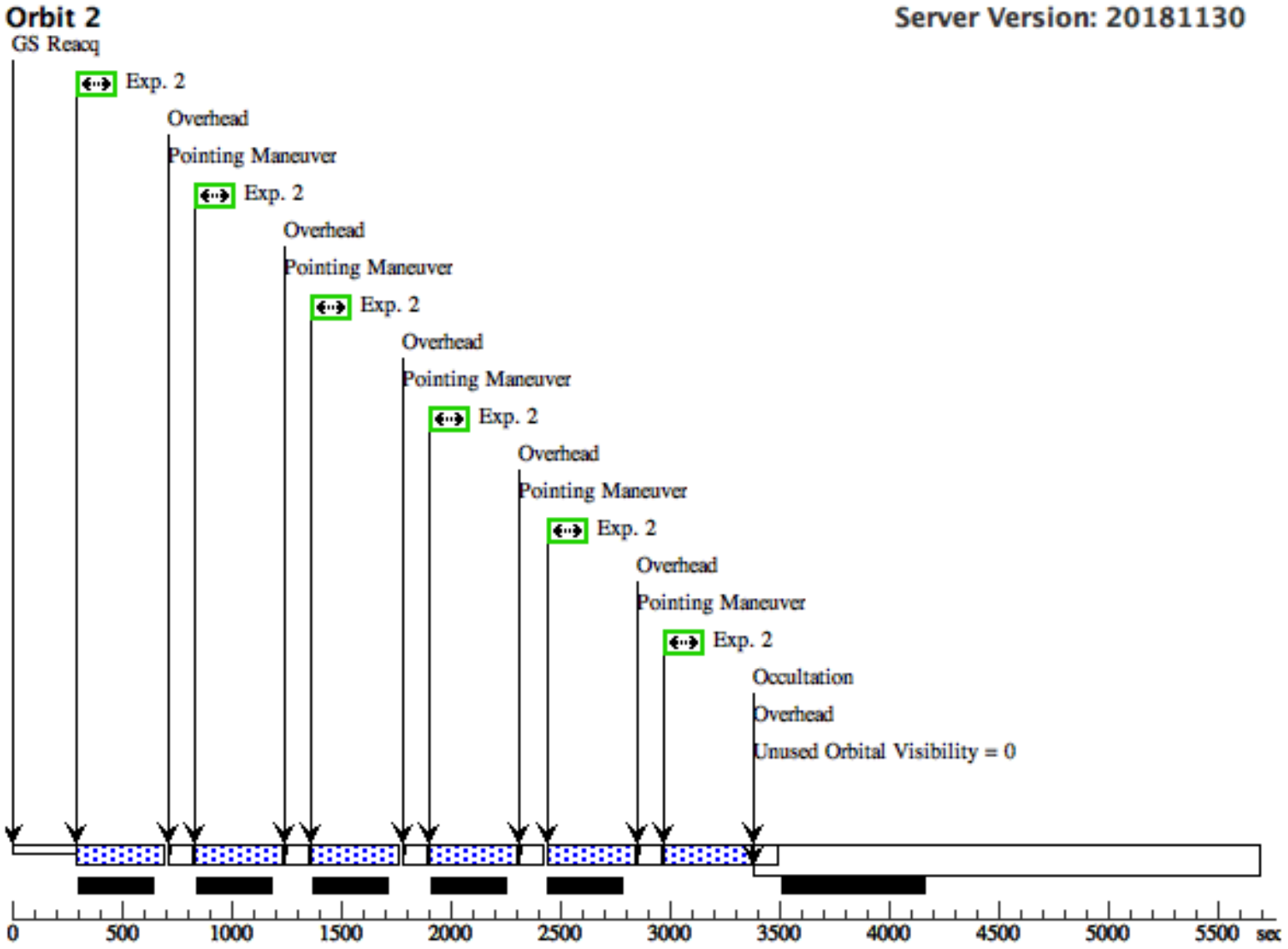
*Comments: We add a flash at the end of each exposure (12 electrons) to reduce the charge losses during the detector readouts.*

| 2 | | (1) OU4-SOUTH-LOBE | WFC3/UVIS, ACCUM, UVIS | F502N | FLASH=12 | | Pattern 1, Exps 2-2 in second epoch imaging (01) (1) | 1000 Secs (2404 Secs)<br>*[==>401.0 Secs (Pattern 1,1)]*<br>*[==>400.0 Secs (Pattern 1,2)]*<br>*[==>401.0 Secs (Pattern 2,1)]*<br>*[==>400.0 Secs (Pattern 2,2)]*<br>*[==>401.0 Secs (Pattern 3,1)]*<br>*[==>401.0 Secs (Pattern 3,2)]* | ***[2]*** |
|---|---|---|---|---|---|---|---|---|---|

*Comments: We add a flash at the end of each exposure (12 electrons) to reduce the charge losses during the detector readouts.*

Orbit Structure




Orbit 2
Server Version: 20181130
GS Reacq
Exp. 2
Overhead
Pointing Maneuver
Exp. 2
Overhead
Pointing Maneuver
Exp. 2
Overhead
Pointing Maneuver
Exp. 2
Overhead
Pointing Maneuver
Exp. 2
Overhead
Pointing Maneuver
Exp. 2
Occultation
Overhead
Unused Orbital Visibility = 0
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec