# 16918 - The afterglow and host of GRB 210905A at z=6.3

Cycle: 29, Proposal Category: GO

(Availability Mode: SUPPORTED)

**INVESTIGATORS**

| *Name* | *Institution* |
|---|---|
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| Dr. Luca Izzo (CoI) (ESA Member) | University of Copenhagen, Niels Bohr Institute |
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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) GRB210905A | WFC3/IR | 2 | 10-Mar-2023 16:00:45.0 | yes |
| 02 | (1) GRB210905A | WFC3/IR | 2 | 10-Mar-2023 16:00:45.0 | yes |
| 03 | (1) GRB210905A | WFC3/UVIS | 2 | 10-Mar-2023 16:00:46.0 | yes |

6 Total Orbits Used

**ABSTRACT**

The recently discovered GRB 210905A is the highest redshift GRB for which an early, high-S/N, mid-high resolution afterglow spectrum has been obtained. In addition to providing the redshift, this spectrum exhibits numerous metal lines and a complex velocity structure spanning ~360 km/s, and blueshifted by ~1000 km/s from a tentative Ly-a emission line. Modelling of the Lyman-alpha damping wing reveals the host column density, and puts constraints on the neutral fraction of the surrounding intergalactic medium. Analysis of the abundances gives an average metallicity Z~Zsol/20. In addition, the afterglow of this GRB started bright and has declined slowly, implying a late jet break. This suggests a wide jet and hence a particularly high energy event, perhaps indicative of an unusual progenitor star. Here we seek HST WFC3/IR F140W imaging to obtain a final late-time point on the afterglow light curve to constrain any break, and an image after the afterglow has faded, to provide a subtraction template and characterisation of the host galaxy. This would make it the first galaxy at z>6 detected in emission for which detailed absorption line abundances for multiple species are available.

**OBSERVING DESCRIPTION**

We will obtain two vists for observations of GRB 210905A. The first will aim to capture light from the afterglow while the second will search for the host galaxy. Both visits will use F140W. The first will be a two orbit visit while the second will require a 4-orbit exposure. We will use a standard 4 point dither pattern for the 2 orbit visit and a 8-point dither pattern for the 4 orbit visit, acquiring two exposures per orbit.

# Proposal 16918 - Visit 01 - The afterglow and host of GRB 210905A at z=6.3

## Visit

**Proposal 16918, Visit 01, completed** Fri Mar 10 21:00:47 GMT 2023

**Diagnostic Status: No Diagnostics**

Scientific Instruments: WFC3/IR

Special Requirements: SCHED 100%; BEFORE 30-JUN-2022:00:00:00

## Patterns

| # | Primary Pattern | | Secondary Pattern | Exposures |
|---|---|---|---|---|
| (2) | Pattern Type=WFC3-IR-DITHER-BOX-MIN<br>Purpose=DITHER<br>Number Of Points=4<br>Point Spacing=0.572<br>Line Spacing=0.365 | Coordinate Frame=POS-TARG<br>Pattern Orientation=18.528<br>Angle Between Sides=74.653<br>Center Pattern=false | | (1) |

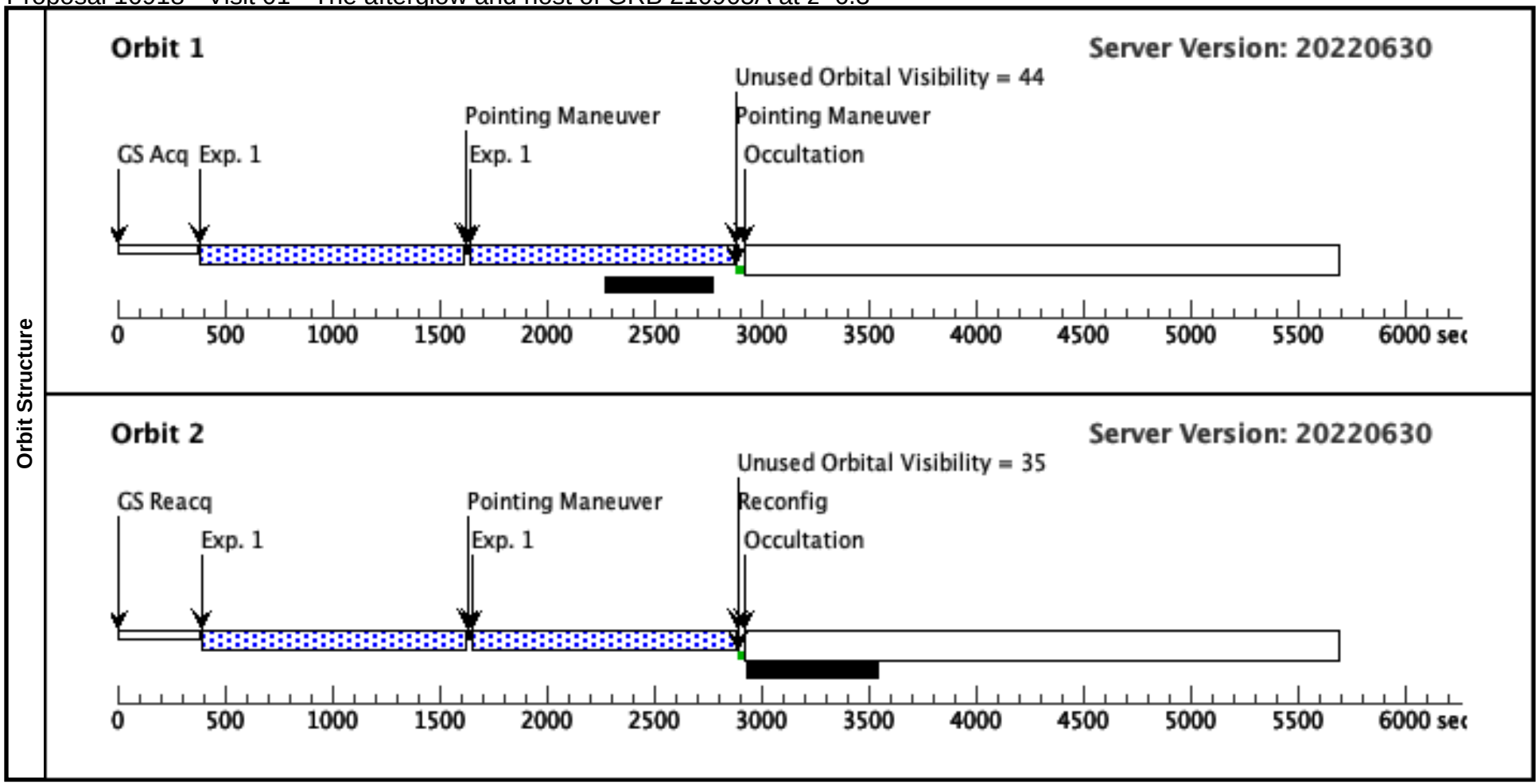
## Fixed Targets

| # | Name | Target Coordinates | Targ. Coord. Corrections | Fluxes | Miscellaneous |
|---|---|---|---|---|---|
| (1) | GRB210905A | RA: 20 36 11.5700 (309.0482083d)<br>Dec: -44 26 24.80 (-44.44022d)<br>Equinox: J2000 | | V=30+/-2<br>H(AB)~27 | Reference Frame: ICRS |

*Comments:*
*Category=GALAXY*
*Description=[STARBURST]*

## Exposures

| # | Label | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time (Total)/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 1 | | (1) GRB210905A | WFC3/IR, MULTIACCUM, IR | F140W | NSAMP=13;<br>SAMP-SEQ=STEP200 | | Pattern 2, Exps 1-1 in Visit 01 (2) | 1199.231335 Secs (4796.925 Secs) | |
| | | | | | | | | *[==>(Pattern 1)]*<br>*[==>(Pattern 2)]* | ***[1]*** |
| | | | | | | | | *[==>(Pattern 3)]*<br>*[==>(Pattern 4)]* | ***[2]*** |


Orbit Structure
Orbit 1
Server Version: 20220630
Unused Orbital Visibility = 44
Pointing Maneuver
Pointing Maneuver
GS Acq
Exp. 1
Exp. 1
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000 sec
Orbit 2
Server Version: 20220630
Unused Orbital Visibility = 35
GS Reacq
Pointing Maneuver
Reconfig
Exp. 1
Exp. 1
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000 sec

## Visit

**Proposal 16918, Visit 02, implementation** Fri Mar 10 21:00:47 GMT 2023

**Diagnostic Status: No Diagnostics**

Scientific Instruments: WFC3/IR

Special Requirements: SCHED 100%; SAME ORIENT AS 01; AFTER 31-MAR-2023:00:00:00

## Patterns

| # | Primary Pattern | | Secondary Pattern | Exposures |
|---|---|---|---|---|
| (2) | Pattern Type=WFC3-IR-DITHER-BOX-MIN<br>Purpose=DITHER<br>Number Of Points=4<br>Point Spacing=0.572<br>Line Spacing=0.365 | Coordinate Frame=POS-TARG<br>Pattern Orientation=18.528<br>Angle Between Sides=74.653<br>Center Pattern=false | | (1) |

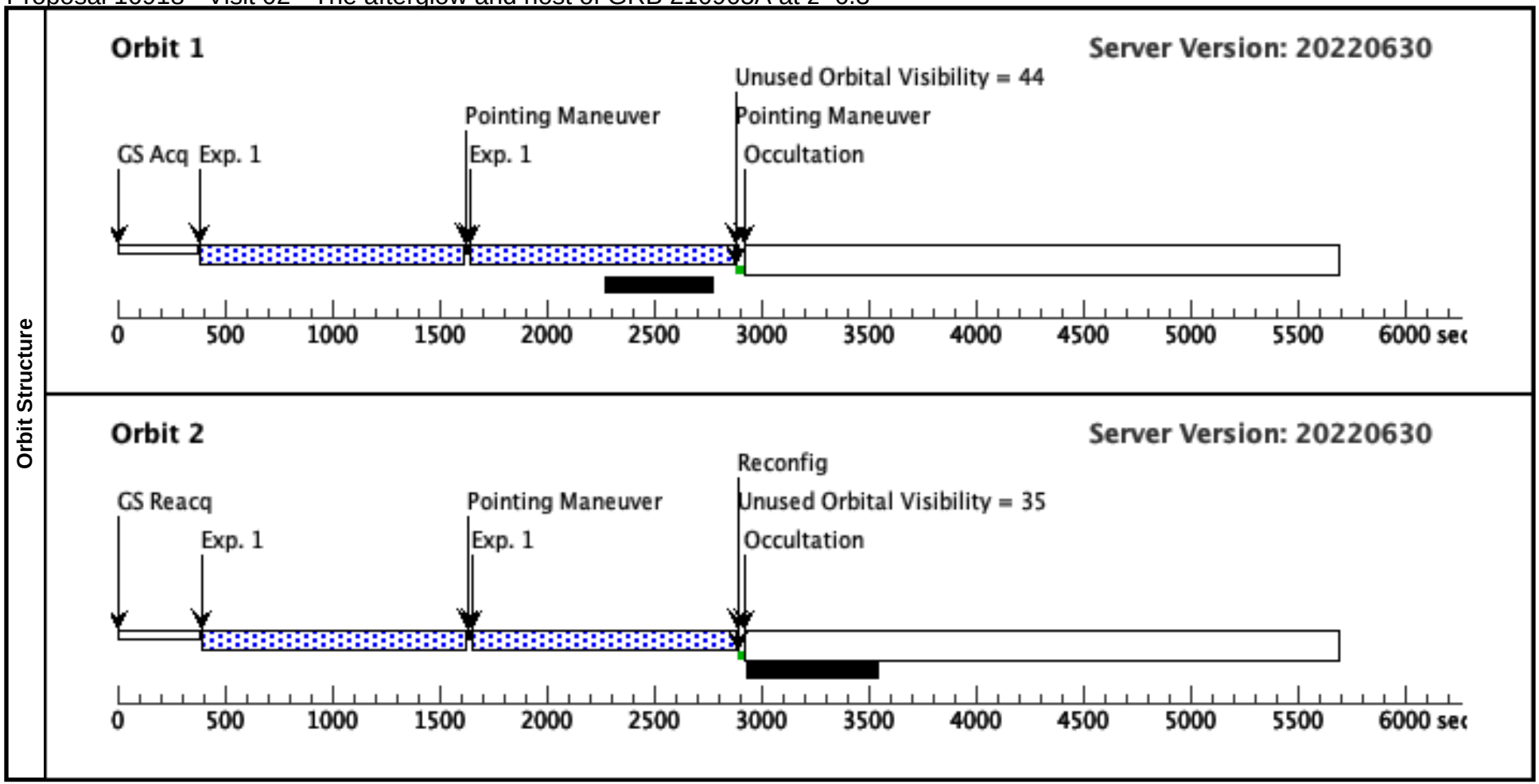
## Fixed Targets

| # | Name | Target Coordinates | Targ. Coord. Corrections | Fluxes | Miscellaneous |
|---|---|---|---|---|---|
| (1) | GRB210905A | RA: 20 36 11.5700 (309.0482083d)<br>Dec: -44 26 24.80 (-44.44022d)<br>Equinox: J2000 | | V=30+/-2<br>H(AB)~27 | Reference Frame: ICRS |

*Comments:*
*Category=GALAXY*
*Description=[STARBURST]*

## Exposures

| # | Label | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time (Total)/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 1 | | (1) GRB210905A | WFC3/IR, MULTIACCUM, IR | F140W | NSAMP=13;<br>SAMP-SEQ=STEP200 | | Pattern 2, Exps 1-1 in Visit 02 (2) | 1199.231335 Secs (4796.925 Secs)<br>*[==>(Pattern 1)]*<br>*[==>(Pattern 2)]* | *[1]* |
| | | | | | | | | *[==>(Pattern 3)]*<br>*[==>(Pattern 4)]* | *[2]* |


Orbit Structure
Orbit 1
Server Version: 20220630
Unused Orbital Visibility = 44
Pointing Maneuver
Pointing Maneuver
GS Acq
Exp. 1
Exp. 1
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000 sec
Orbit 2
Server Version: 20220630
Reconfig
GS Reacq
Pointing Maneuver
Unused Orbital Visibility = 35
Exp. 1
Exp. 1
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000 sec

## Visit

**Proposal 16918, Visit 03** Fri Mar 10 21:00:47 GMT 2023

**Diagnostic Status: No Diagnostics**

Scientific Instruments: WFC3/UVIS

Special Requirements: (none)

## Patterns

| # | Primary Pattern | | Secondary Pattern | Exposures |
|---|---|---|---|---|
| (1) | Pattern Type=WFC3-UVIS-DITHER-BOX<br>Purpose=DITHER<br>Number Of Points=4<br>Point Spacing=0.173<br>Line Spacing=0.112 | Coordinate Frame=POS-TARG<br>Pattern Orientation=23.884<br>Angle Between Sides=81.785<br>Center Pattern=false | | (1), (2) |

## Fixed Targets

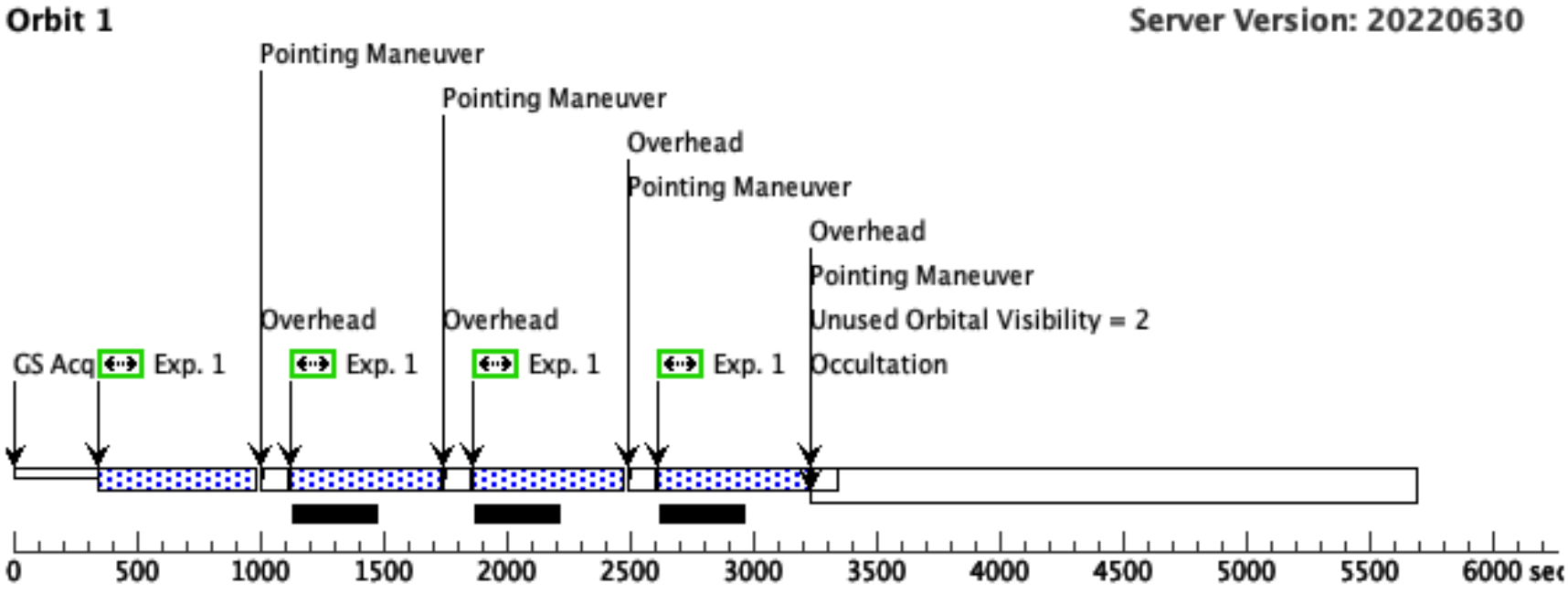
| # | Name | Target Coordinates | Targ. Coord. Corrections | Fluxes | Miscellaneous |
|---|---|---|---|---|---|
| (1) | GRB210905A | RA: 20 36 11.5700 (309.0482083d)<br>Dec: -44 26 24.80 (-44.44022d)<br>Equinox: J2000 | | V=30+/-2<br>H(AB)~27 | Reference Frame: ICRS |

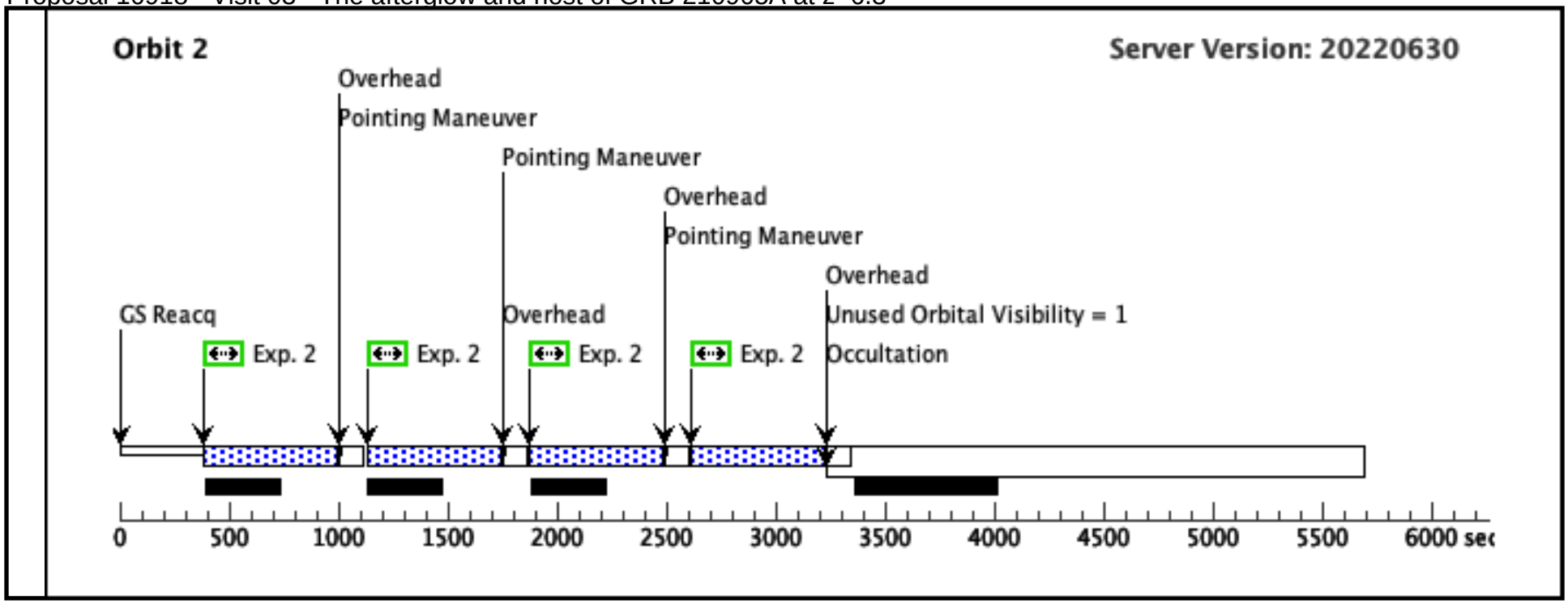
*Comments:*
*Category=GALAXY*
*Description=[STARBURST]*

## Exposures

| # | Label | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time (Total)/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 1 | | (1) GRB210905A | WFC3/UVIS, ACCUM, UVIS2-C1K1C-CTE | F775W | CR-SPLIT=NO; FLASH=12 | | Pattern 1, Exps 1-1 in Visit 03 (1) | 370 Secs (2440 Secs)<br>*[==>610.0 Secs (Pattern 1)]*<br>*[==>610.0 Secs (Pattern 2)]*<br>*[==>610.0 Secs (Pattern 3)]*<br>*[==>610.0 Secs (Pattern 4)]* | ***[1]*** |
| 2 | | (1) GRB210905A | WFC3/UVIS, ACCUM, UVIS2-C1K1C-CTE | F775W | CR-SPLIT=NO; FLASH=12 | | Pattern 1, Exps 2-2 in Visit 03 (1) | 370 Secs (2432 Secs)<br>*[==>608.0 Secs (Pattern 1)]*<br>*[==>608.0 Secs (Pattern 2)]*<br>*[==>608.0 Secs (Pattern 3)]*<br>*[==>608.0 Secs (Pattern 4)]* | ***[2]*** |

Orbit Structure




Orbit 2
Server Version: 20220630
Overhead
Pointing Maneuver
Pointing Maneuver
Overhead
Pointing Maneuver
Overhead
GS Reacq
Overhead
Unused Orbital Visibility = 1
Exp. 2
Exp. 2
Exp. 2
Exp. 2
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000 sec