# 12907 - Stationary components in the DG Tau jet: A new challenge for jet models?

Cycle: 20, Proposal Category: GO

(Availability Mode: SUPPORTED)

**INVESTIGATORS**



| *Name* | *Institution* | *E-Mail* |
|---|---|---|
| **Dr. Peter Christian Schneider (PI) (ESA Member) (Contact)** | **Universitat Hamburg, Hamburger Sternwarte** | **cschneider@hs.uni-hamburg.de** |
| Dr. Gregory J. Herczeg (CoI) | Peking University | gherczeg1@gmail.com |
| Prof. Manuel Guedel (CoI) (ESA Member) | University of Vienna | manuel.guedel@univie.ac.at |
| Dr. Jochen Eisloeffel (CoI) (ESA Member) | Thuringer Landessternwarte Tautenburg (TLS) | jochen@tls-tautenburg.de |
| Dr. Hans Moritz Guenther (CoI) (AdminUSPI) | Smithsonian Institution Astrophysical Observatory | hguenther@cfa.harvard.edu |
| Prof. Jurgen H.M.M. Schmitt (CoI) (ESA Member) | Universitat Hamburg, Hamburger Sternwarte | jschmitt@hs.uni-hamburg.de |
| Dr. Jan Robrade (CoI) (ESA Member) | Universitat Hamburg, Hamburger Sternwarte | jrobrade@hs.uni-hamburg.de |
| Dr. Francesca Bacciotti (CoI) (ESA Member) | Osservatorio Astrofisico di Arcetri | fran@arcetri.astro.it |
| Mr. Lorenzo Maurri (CoI) (ESA Member) | Osservatorio Astrofisico di Arcetri | maurri@arcetri.astro.it |
| Dr. Linda Podio (CoI) (ESA Member) | Institut de Planetologie et d'Astrophysique de Grenoble | linda.podio@obs.ujf-grenoble.fr |



**VISITS**

| *Visit* | *Targets used in Visit* | *Configurations used in Visit* | *Orbits Used* | *Last Orbit Planner Run* | *OP Current with Visit?* |
|---|---|---|---|---|---|
| 01 | (1) V-DG-TAU | STIS/CCD<br>STIS/FUV-MAMA | 3 | 11-Jul-2012 22:03:37.0 | yes |
| 02 | (1) V-DG-TAU | STIS/CCD | 1 | 11-Jul-2012 22:03:47.0 | yes |

4 Total Orbits Used

**ABSTRACT**

Jets from young stellar objects play an important role for star formation as they can regulate the angular momentum balance of the system. The jet from the classical T Tauri star DG Tau stands out due to its stationary very high temperature plasma (T>10^6 K) very close to the driving source observed in deep multi-epoch X-ray observations. This X-ray emitting jet material is significantly hotter than previously studied material and not predicted by current jet theories.

Our HST observations during Cycle 18 reveal intermediate temperature FUV C IV emission (T~10^5 K) co-spatial with the X-rays and indications for a further stationary low temperature component (T~10^4 K). In order to investigate the nature of the stationary component(s), we propose to obtain new epoch STIS long-slit spectra with the slit oriented along the jet axis. By studying the evolution of the individual emission components we will determine if C IV and X-ray emission are physically connected and constrain their respective heating processes. We will also test if further stationary components exist in addition to the known moving emission regions which result from episodic mass-loss events.

**OBSERVING DESCRIPTION**

The goal of the proposed observations is to spatially resolve the kinematics of the intermediate (T = 10^5 K) and low temperature (T = 10^4 K) material within the DG Tau jet. No stellar FUV emission has been detected in the previous observations, so that all FUV emission comes from the jet. The interemediate temperature plasma will be traced by C IV emission at ~1550 A and we dedicate three orbits for the associated STIS G140M exposures. For the comparison of the C IV emission with the lower temperature ionic emission one additional orbit with the STIS G750M grating is needed to measure the current forbidden line emission. The position angle of the jet (PA=226 deg) is known from previous observations (HST and ground based AO). A tolerance of ±1deg in position angle is acceptable for this jet. The 52 × 0. 2 slit will include virtually all of the relevant high-velocity emission.

Setting the G140M grating to the wavelength range 1513–1567 includes the C iv emission line doublet (1548 and 1551 A) and ro-vibrationally excited H2 emission at 1521 A and 1525 A. The FUV exposures will be dithered along the slit to identify hot pixel (dither amplitude of 0.5").
A short ACQ exposure (STIS CCD with F28X50LP filter) is needed to center the jet in the slit. As the target is acquired with the CCD, we will take a short G430L exposure prior to the FUV observations in order to check the current accretion state of DG Tau.

The two visits (optical and FUV) should be performed within 15 days to ensure that the jet evolution is negligible between the exposures.

Detector Safety:

We know from our last FUV observations of DG Tau that the expected global (< 200 counts s1 ) and local count-rates (<0.1 counts/sec/pix) are significantly below the STIS brighness limits. The slit orientation is identical to our last program and no other (bright) sources will illuminate the slit. Further information on surrounding sources can be found in the observation description of Prop 12199. In particular, no other bright sources are known. As discussed for Prop-ID 12199, the two unknown BOT sources (N9QL001759, N9QL009269) do not violate any brightness limit.

## Visit

**Proposal 12907, FUV long-slit spectrum (01), implementation** Thu Jul 12 02:03:53 GMT 2012

**Diagnostic Status: No Diagnostics**

Scientific Instruments: STIS/CCD, STIS/FUV-MAMA

Special Requirements: SCHED 100%; ORIENT 90D TO 92 D; ORIENT 270D TO 272 D; GROUP 01,02 WITHIN 15D

*Comments: This visit is dedicated to the FUV MAMA exposures (G140M) and the short G430L optical spectrum.*

## Patterns

| # | Primary Pattern | | Secondary Pattern | Exposures |
|---|---|---|---|---|
| (1) | Pattern Type=STIS-ALONG-SLIT | Coordinate Frame=POS-TARG | | (3) |
| | Purpose=DITHER | Pattern Orientation=90.0 | | |
| | Number Of Points=3 | Angle Between Sides= | | |
| | Point Spacing=0.5 | Center Pattern=false | | |
| | Line Spacing= | | | |

## Fixed Targets

| # | Name | Target Coordinates | Targ. Coord. Corrections | Fluxes | Miscellaneous |
|---|---|---|---|---|---|
| (1) | V-DG-TAU | RA: 04 27 4.7000 (66.7695833d) | | V=12.5+/-1.1 | Reference Frame: ICRS |
| | Alt Name1: GSC01820-00330 | Dec: +26 06 16.10 (26.10447d) | | The C IV is about 2e-14 erg/s/cm^2. | |
| | | Equinox: J2000 | | | |

*Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. The alternate name is also from the SIMBAD database.*
*The target uncertainties pertain to the difference between the expected, proper-motion corrected position from Ducourant et al. (2005) and the 2MASS position for epoch 2012 given here. We regard this as the uncertainty since both values do not agree for the same epoch.*

## Exposures

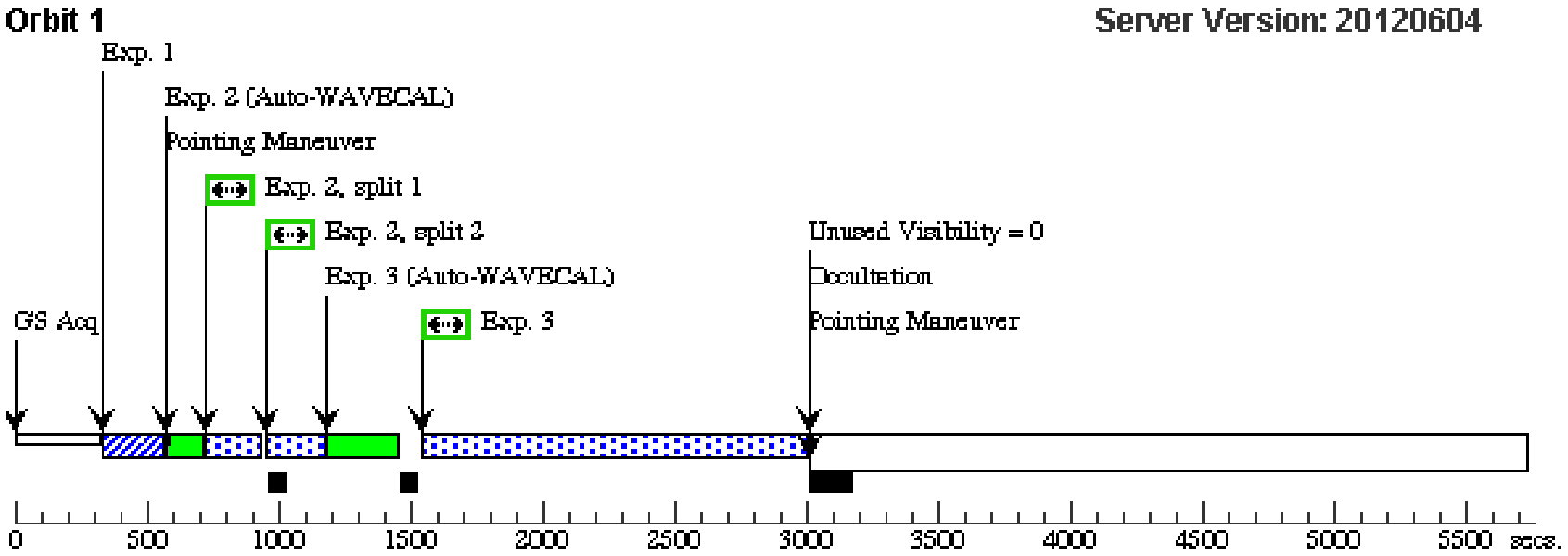
| # | Label (ETC Run) | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 1 | FUV-ACQ | (1) V-DG-TAU | STIS/CCD, ACQ, F28X50LP | MIRROR | ACQTYPE=POINT | GS ACQ SCENARIO BASE1B3 | | 0.2 Secs | |
| | | | | | | | | *[==>]* | ***[1]*** |
| 2 | Blue-optical | (1) V-DG-TAU | STIS/CCD, ACCUM, 52X0.2 | G430L 4300 A | CR-SPLIT=2 | | | 360 Secs | |
| | | | | | | | | *[==>(Split 1)]* | ***[1]*** |
| | | | | | | | | *[==>(Split 2)]* | |

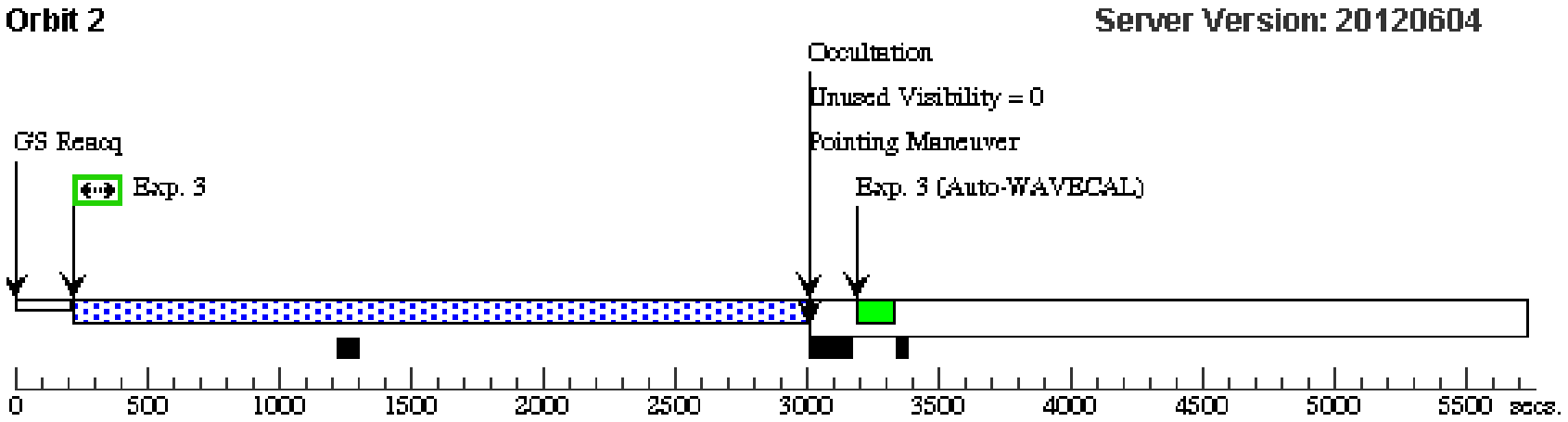
*Comments: CR-SPLIT=2 should be sufficient for cosmic ray removal since the exposure time is sufficiently short.*

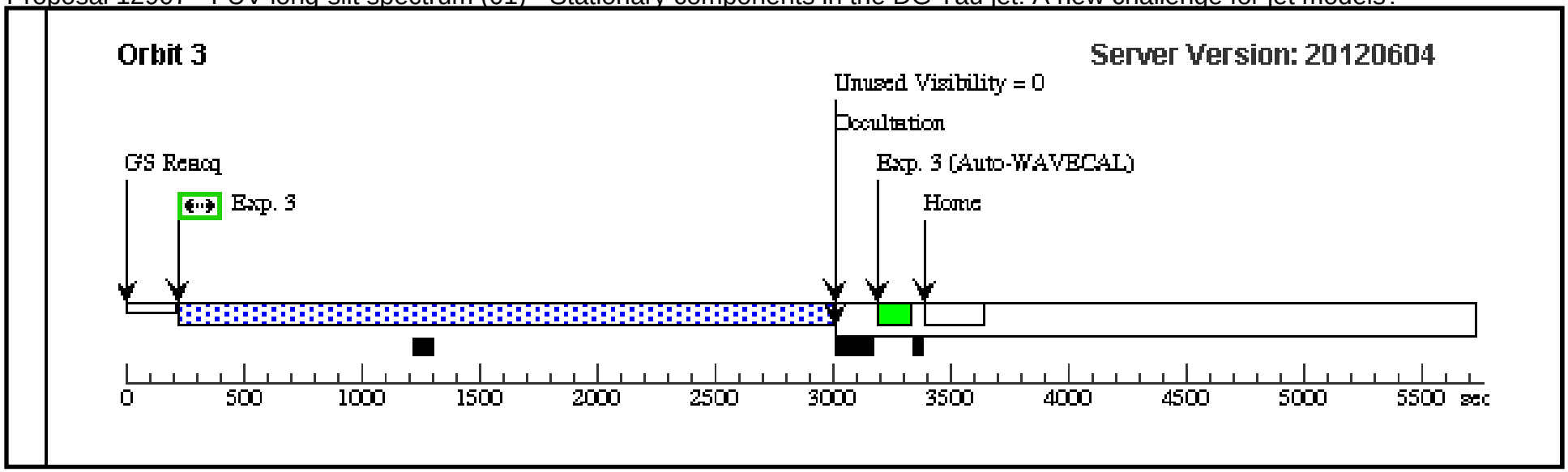
| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 3 | (STIS.sp.415004) | (1) V-DG-TAU | STIS/FUV-MAMA, TIME-TAG, 52X0.2 | G140M 1540 A | BUFFER-TIME=1000 | | Pattern 1, Exps 3-3 in FUV long-slit spectrum (01) (1) | 1000 Secs | |
| | | | | | | | | *[==>1441.0 Secs (Pattern 1)]* | ***[1]*** |
| | | | | | | | | *[==>2761.0 Secs (Pattern 2)]* | ***[2]*** |
| | | | | | | | | *[==>2761.0 Secs (Pattern 3)]* | ***[3]*** |

*Comments: The FUV observations will be dithered along the slit (dither amplitude 0.5") for an improved hot pixel removal.*

Orbit Structure




Orbit 3
Server Version: 20120604
Unused Visibility = 0
Occultation
GS Reacq
Exp. 3
Exp. 3 (Auto-WAVECAL)
Home
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

## Visit

**Proposal 12907, Optical long-slit spectrum (02), implementation** Thu Jul 12 02:03:57 GMT 2012

**Diagnostic Status: No Diagnostics**

Scientific Instruments: STIS/CCD

Special Requirements: SCHED 100%; ORIENT 90D TO 92 D; ORIENT 270D TO 272 D; GROUP 02,01 WITHIN 15D

*Comments: This visit is dedicated to the G750M long-slit spectrum. No dithering is applied to these exposures.*

## Fixed Targets

| # | Name | Target Coordinates | Targ. Coord. Corrections | Fluxes | Miscellaneous |
|---|---|---|---|---|---|
| (1) | V-DG-TAU<br>Alt Name1: GSC01820-00330 | RA: 04 27 4.7000 (66.7695833d)<br>Dec: +26 06 16.10 (26.10447d)<br>Equinox: J2000 | | V=12.5+/-1.1<br>The C IV is about 2e-14 erg/s/cm^2. | Reference Frame: ICRS |

*Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. The alternate name is also from the SIMBAD database.*
*The target uncertainties pertain to the difference between the expected, proper-motion corrected position from Ducourant et al. (2005) and the 2MASS position for epoch 2012 given here. We regard this as the uncertainty since both values do not agree for the same epoch.*

## Exposures

| # | Label | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 1 | G75M-ACQ | (1) V-DG-TAU | STIS/CCD, ACQ, F28X50LP | MIRROR | ACQTYPE=POINT | GS ACQ SCENARIO BASE1B3 | | 0.2 Secs<br>*[==>]* | <br>***[1]*** |
| 2 | G750-ACCUM | (1) V-DG-TAU | STIS/CCD, ACCUM, 52X0.2 | G750M<br>6581 A | CR-SPLIT=3 | | | 3000 Secs<br>*[==>691.0 Secs (Split 1)]*<br>*[==>692.0 Secs (Split 2)]*<br>*[==>692.0 Secs (Split 3)]* | <br>***[1]*** |

## Orbit Structure