

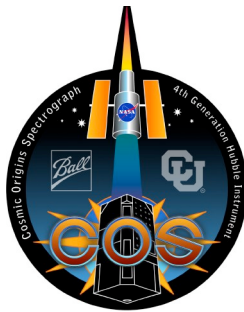
**Updated Exposure Times for the  
COS SMS LSSFN2P  
(COS Short System Functional Nitrogen<sup>2</sup> Purge)**

Date:	April 25, 2006
Document Number:	COS-11-0046
Revision:	Initial Release
Contract No.:	NAS5-98043
CDRL No.:	

Prepared By: \_\_\_\_\_ Date \_\_\_\_\_  
Dr. Steven Penton, COS Software Scientist, CU

Reviewed By: \_\_\_\_\_ Date \_\_\_\_\_  
Dr. Steven Osterman, COS Instrument Scientist, CU

Reviewed By: \_\_\_\_\_ Date \_\_\_\_\_  
Dr. James Green, COS Principal Investigator, CU



**Center for Astrophysics & Space Astronomy**  
University of Colorado  
Campus Box 593  
Boulder, Colorado 80309

REVISIONS						
Letter	ECO No.	Description	Check	Approved	Date	
-		Initial Release				
Original Release Name		Date	<b>THE UNIVERSITY OF COLORADO</b> At Boulder <b>The Center for Astrophysics and Space Astronomy</b>			
Drawn: S. Penton		4/25/06				
Reviewed:			Updated Exposure Times for the COS SMS LSSFN2P			
Approved:						
			Size	Code Indent No.	Document No.	Rev
			A		COS-11-0046	-
			Scale: N/A			

## Table of Contents

1. Introduction.....	1
2. Background.....	1
3. Exposure-Time Adjustments for the LSSFN2P SMS .....	3
4. Reduction in Lamp Usage.....	5

## Table of Tables

Table 2-1: Baseline LSSFN2P Exposures.....	2
Table 2-2: January 2006 LSSFN2P Statistics.....	2
Table 3-1: Revised LSSFN2P SMS Exposure Times .....	4
Table 4-1: Original and Revised LSSFN2P SMS Lamp Usage and Degradation.....	5

## 1. INTRODUCTION

This document recommends new, shorter exposure times for the periodic COS system functional test. Specifically, we are referring to the COS side-1 imaging science mission specification (SMS) LSSFN2P (COS Short System Functional Nitrogen<sup>2</sup> Purge). This SMS takes exposures with all internal lamps, apertures, and optics (but not all lamps with each optic). As the purpose of this functional test is merely to determine that the lamps, detectors, and electronics are functioning nominally, there is limited value in extended exposures.

Concerns over lamp lifetimes dictate that more modest exposures times, which still provide knowledge of the state of the instrument, be adopted. These exposures times are derived and presented in this document.

## 2. BACKGROUND

The SMS LSSFN2P contains 12 exposures, as outlined in Table 2-1. All exposures use the internal wavelength calibration lamps (PtNe-1 and PtNe-2) or the flatfield lamps (Deut-1 and Deut-2) and are obtained in time-tag mode. Also listed in the table are the exposures times, optical element, wavelength setting (in Å), current setting, and current in milli-Amps (mA).

The exposures and count rates listed in Table 2-2 were obtained during the most recent LSSFN2P SMS (January 2006). Note that for exposure number 8, only the FUV B-segment was active, while for exposure 9, only the FUV A-segment was active. During the January 2006 LSSFN2P SMS, exposure number 8 (CSIL06026152058) was not exposed for the entire 1800 seconds, but was anomalously aborted after 1350 seconds. For all other FUV exposures, both segments are active. Also listed in Table 2-2 is the actual lamp usage, in milli-amp hours (mA-hrs), of the baseline LSSFN2P exposures. For comparison, the entire September–October 2003 thermal-vacuum testing consumed ~ 0.8 Amp-Hours total for the four internal calibration lamps (22 to 375 mA-Hr per lamp), while a typical year of HST+COS science operations is estimated to consume < 0.5 Amp-Hours.

Table 2-1: Baseline LSSFN2P Exposures

Exposure Number	Detector	Exposure Time (sec)	Optic	Wavelength Setting (Å)	Lamp	Current Setting	Current (mA)
1	NUV	600	G185M	1850	PtNe-2	Med	10
2	NUV	600	G285M	2850	PtNe-2	Med	10
3	NUV	300	G225M	2250	PtNe-2	Med	10
4	NUV	300	G230L	3000	PtNe-2	Med	10
5	NUV	10	TA1	NA	PtNe-2	Low	6
6	NUV	10	TA1-BRT	NA	PtNe-2	Low	6
7	NUV	1200	G185M	1850	Deut-1	High	17
8	FUV	1800	G160M	1600	Deut-2	High	17
9	FUV	1800	G130M	1309	Deut-2	High	14
10	FUV	900	G140L	1230	PtNe-1	High	14
11	FUV	1800	G130M	1309	PtNe-1	High	14
12	FUV	1800	G160M	1600	PtNe-1	High	14

Table 2-2: January 2006 LSSFN2P Statistics

Exp #	Filename	FUV Segment	Exposure Time (sec)	Lamp Usage (mA-hrs)	Counts (cts)	Count Rate (cts/sec)
1	CSIL06026131512		600	1.67	60,787	101
2	CSIL06026133049		600	1.67	161,753	270
3	CSIL06026134126		300	0.83	111,847	373
4	CSIL06026135233		300	0.83	512,010	1707
5	CSIL06026135825		10	0.02	4,488	449
6	CSIL06026140342		10	0.02	207	21
7	CSIL06026143434		1,200	5.67	1,595,220	1329
8	CSIL06026152058	B	1,350	8.50	4,661,101	3453
9	CSIL06026160427	A	1,800	8.50	1,728,794	960
10	CSIL06026163136	A	900	3.50	299,660	333
		B			12,146	13
11	CSIL06026170825	A	1,800	7.00	98,490	55
		B			38,041	21
12	CSIL06026174434	A	1,800	7.00	232,039	129
		B			134,241	75

### 3. EXPOSURE-TIME ADJUSTMENTS FOR THE LSSFN2P SMS

To minimize lamp usage while still maintaining reasonable monitoring of COS with the LSSFN2P SMS, we adopted the following guidelines for determining revised exposure times:

- All future non-TA1 LSSFN2P SMS exposures taken with the wavelength calibration lamps shall produce 20,000 counts, while all exposures with the flatfield lamps shall produce 200,000 counts.
- All TA1 LSSFN2P exposures shall provide 4,000 counts.
- Except for the TA1 exposures, all future exposures will be performed using the **medium** current setting only. (These lamps are known to degrade much faster on the **high** current setting than the **medium** setting).
- For FUV exposures, these statistics apply only to the segment with the highest count rate.
- We also assume that the nitrogen purge rate in use during the January 2006 LSSFN2P SMS ( $2 \times 20 \text{ ft}^3$  per second) will be applied during all future LSSFN2P SMSs. If this is not the case, then the exposure times presented here will need to be adjusted.
- All exposures times are rounded up to the nearest five-second increment.
- No exposure will be greater than 1,200 seconds.

Table 3-1 gives the revised exposure times for the LSSFN2P SMS exposures. To convert count rates from the PtNe-1 **high** current setting to the **medium** current setting, we used count rates observed during the 2003 thermal vacuum testing. Specifically, the **high-to-medium** count rate ratio was taken to be  $1662/443 = 3.838$  (using COS exposure files CSIL03185010138 and CSIL03185005438). To convert from the count rates of the flatfield lamps **high** current setting to the **medium** setting, we also used values observed during the 2003 thermal vacuum testing. Specifically, the **high-to-medium** count rate ratio for the flatfield lamps was taken to be  $1448/460 = 3.148$  (CSIL03263105254/CSIL03291172306).

**Table 3-1: Revised LSSFN2P SMS Exposure Times**

Exp #	Lamp	FUV Segment	Original			Revised		
			Current Setting	Exposure Time (sec)	Counts (cts)	Current Setting	Exposure Time (sec)	Estimated Counts
1	PtNe-2		Med	600	60,787	Med	200	20,262
2	PtNe-2		Med	600	161,753	Med	75	20,219
3	PtNe-2		Med	300	111,847	Med	55	20,505
4	PtNe-2		Med	300	512,010	Med	15	25,601
5	PtNe-2		Low	10	4,488	Low	10	4,488
6	PtNe-2		Low	10	207	Low	195	4,037
7	Deut-1		High	1,200	1,595,220	Med	475	200,557
8	Deut-2	B	High	1,350	4,661,101	Med	185	202,876
9	Deut-2	A	High	1,800	1,728,794	Med	660	201,335
10	PtNe-1	A	High	900	299,660	Med	235	20,385
		B			12,146			826
11	PtNe-1	A	High	1,800	98,490	Med	1,200	17,106
		B			38,041			6,607
12	PtNe-1	A	High	1,800	232,039	Med	600	20,151
		B			134,241			11,658

**4. REDUCTION IN LAMP USAGE**

It has been estimated that the COS wavelength calibration lamps degrade 30% for every Amp-Hour of usage, while the flatfield lamps degrade 70% with each Amp-Hour. Table 4-1 below indicates the original and revised LSSFN2P SMS total exposure times, subdivided by current setting, total usage (in Amp-Hrs) and total degradation per LSSFN2P SMS (in percentage). The original SMS contained exposures which would degrade the lamps from 0.15% to 1.19%, while the revised SMS exposure times will only degrade the lamps by 0.04% to 0.17%.

**Table 4-1: Original and Revised LSSFN2P SMS Lamp Usage and Degradation**

Original SMS	Low Current	Medium Current	High Current	Total Usage	Degradation Rate	Degradation per LSSFN2P
Lamp	(sec)	(sec)	(sec)	(Amp-Hr)	(per Amp-Hr)	(%)
Pt-Ne #1	0	0	4500	0.018	30%	-0.53%
Pt-Ne #2	20	1800	0	0.005		-0.15%
D2 #1	0	0	1200	0.006	70%	-0.40%
D2 #2	0	0	3600	0.017		-1.19%

Revised SMS	Low Current	Medium Current	High Current	Total Usage	Degradation Rate	Degradation per LSSFN2P
Lamp	(sec)	(sec)	(sec)	(Amp-Hr)	(per Amp-Hr)	(%)
Pt-Ne #1	0	2,035	0	0.006	30%	-0.17%
Pt-Ne #2	205	345	0	0.001		-0.04%
D2 #1	0	475	0	0.001	70%	-0.06%
D2 #2	0	845	0	0.002		-0.12%