Technical Evaluation Report
"DDL Stim Pulse Rate Trade Study"

Date:	November 6, 1998
Document Number:	COS-11-0002
Revision:	Initial Release
Contract No.:	NAS5-98043
CDRL No.:	SE-05

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Letter	ECO No.	Description	Check	Approved	Date
		Initial Release			

Original Release Name	Date
Drawn: E. Wilkinson	11-6-98
Reviewed:	
Approved:	

THE UNIVERSITY OF COLORADO

At Boulder

The Center for Astrophysics and Space Astronomy

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Size	Code Indent No.	Document No.	Rev
A		COS-11-0002	-
Scale: N/A			

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The purpose of this report is to investigate and hopefully define the requirements for the operational frequency of the DDL stim pulse system. (Note: This document was previously distributed as COS-TER-0001)

1. SCENARIOS REQUIRING STIM PULSES

1.1 I&T ACTIVITIES

Ken Brownsberger has expressed to me that having a high stim pulse rate would bedesirable during integration and test activities. This is based on his ongoing experience with FUSE, during which they have to wait a annoying amount of time to get sufficient counts to initiate various software scenarios. For example, if the exposure is supposed to end at 100,000 counts and the stim rate is 100 c/s you have to wait almost 20 minutes to acquire enough counts to trigger the software flags.

1.2 LONG INFLIGHT EXPOSURES

Long inflight exposures are defined as being one or more orbits where a single orbit will provide about 40 minutes of exposure or 2400 seconds.

1.3 SHORT INFLIGHT EXPOSURES

Short inflight exposures are defined as having exposures of 1 to 40 minutes. In this case at 1-2 Hz stim pulse rate you would get between 60 and 120 pulses at the short end of the exposure estimate.

1.4 INFLIGHT TESTING

If the detector requires on orbit testing this would likely occur when COS is not the prime instrument aboard HST. Therefore, calibration wavelengths can be used to better track instrument performance provided the HV can be turned on. If the HV cannot be turned on, then the stim pulses represent the only way of tracking instrument performance. If the power cannot be turned on, then it is likely the detector system has much bigger problems than thermal drift and a high stim pulse rate would not be required.

2. DERIVED STIM PULSE REQUIREMENTS

2.1 I&T INTEGRATIONS

Requirement: Variable stim pulse rate with a wide dynamic range from 0.1Hz to 50kHz.

2.2 LONG INFLIGHT INTEGRATIONS

Requirement: Provide accurate positions for the stim pulse locations over more than 2400 seconds.

2.3 SHORT INFLIGHT INTEGRATIONS

Requirement: Provide accurate positions for the stim pulse locations over more than 60 seconds.

3. MEETING THE REQUIREMENTS

From previous experience on FUSE we know that fitting a gaussian to a line with 100 total will provide errors of less than 0.002 pixels for the centroid and sigma. So the requirement for the total number of counts in the stim pulse lines should be greater than 100, although 50 may be acceptable. Now, if a minimum exposure is 60 seconds and the stim pulse rate is 2 Hz the minimum number of counts in a stim pulse image is met.

As for the I&T requirement, a 1-2 Hz frequency will be inadequate and in the end run time consuming and costly. A multiple rate setting function is desirable, although this could be implemented through some sort of GSE. If the low rate stim pulse is the only option, then perhaps additional stim data may be acquired during HST pointings while the satellite is slewing to a new target.

Probably the most efficient way to address this issue is to set the stim pulse rate such that you get sufficient statistics during a wavelengths calibration exposure. The appropriate action is then to wait until the radiometry of the wavelength calibration design is completed.

4. CONCLUSIONS

The HST/COS FUV detector should have the capability to provide at least three rates; 0 Hz, low rate, and high rate. The exact rates will have to be considered carefully to make sure they will meet the needs of the instrument during all phases of it's development. The primary action is now for UCB to review the requirements and comment on the feasibility of implementing a stim pulse with multiple rates.