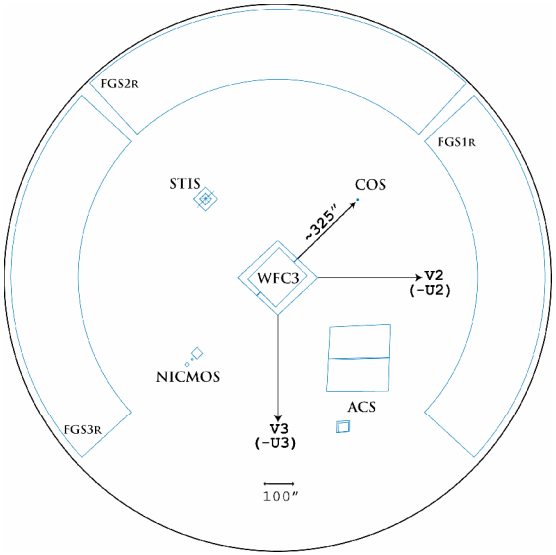
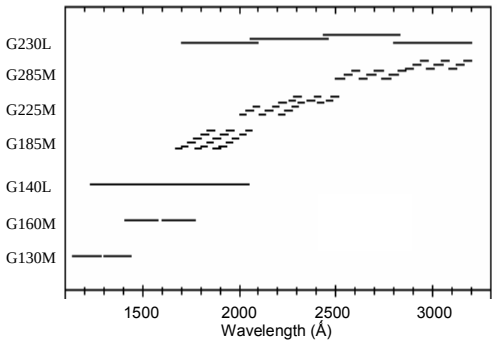
HST Field of View



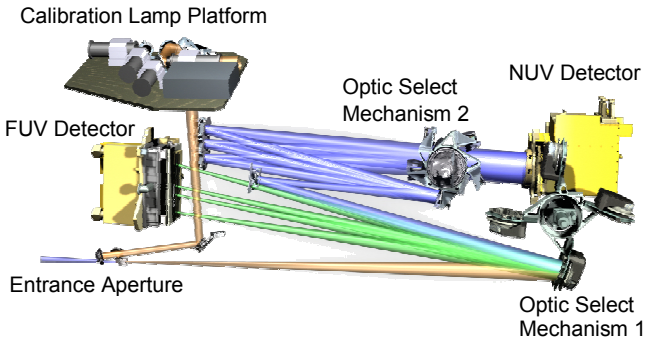
The HST focal plane showing the instrument complement after Servicing Mission 4. The COS FUV and NUV channels view the same 2.5 arcsec patch of sky, but not simultaneously. Instrument apertures and separations are shown to scale.

COS Wavelength Coverage by Mode



Wavelength coverages available with common COS spectroscopic modes. The ranges for different grating tilts are offset in the vertical direction. Additional settings may be available for some modes. Notice non-continuous spectral ranges for NUV modes.

COS Optical Design



External light enters at lower left; common path to first element at lower right. FUV path in green; NUV path in blue; PtNe and D_2 input calibration beams in tan.

COS Spectroscopic Mode Summary

Spectral Element	Nominal Wavelength Range	Wavelength Coverage per exp (Å)	Resolving Power ($\lambda/\Delta\lambda$)
G130M	1150 - 1450	300	20000-24000
G160M	1405 - 1775	375	20000-24000
G140L	1230 - 2050	820	2400-3500
G185M	1700 - 2100	3 x 35	16000-20000
G225M	2100 - 2500	3 x 35	20000-24000
G285M	2500 - 3200	3 x 41	20000-24000
G230L	1700 - 3200	1 or 2 x 400	1500-2800

COS

Cosmic Origins Spectrograph

Far Ultraviolet (FUV) Channel

- 1-reflection; aberration-corrected along dispersion
- 2 side-by-side 16k x 1k pixel delay line MCPs
- TIME-TAG; pulse-height recording
- 3 gratings; 300-800 Å spectral range
- R=3000; 20,000 [1150-2050 Å]

Near Ultraviolet (NUV) Channel

- Fully corrected optical design
- 1k x 1k 25µm/pixel MAMA
- TIME-TAG recording
- 4 gratings, 1 imaging mirror and filter
- 100-800 Å non-contiguous spectral range
- R=2000; 20,000 [1700-3200 Å]

The Cosmic Origins Spectrograph has been built through a collaborative effort between the University of Colorado, Ball Aerospace, and Goddard Space Flight Center. COS will be installed on the Hubble Space Telescope (HST) during HST Servicing Mission 4. The COS principal investigator is James Green (CU).

COS is designed to primarily observe point sources. Equipped with state-of-the art detectors and optics and optimized for maximum FUV throughput, COS provides moderate and low resolution spectroscopy throughout the HST-accessible satellite ultraviolet, dramatically increasing faint object discovery power and the spectroscopic efficiency of HST.

For further information, please visit:
http://www.stsci.edu/hst/cos

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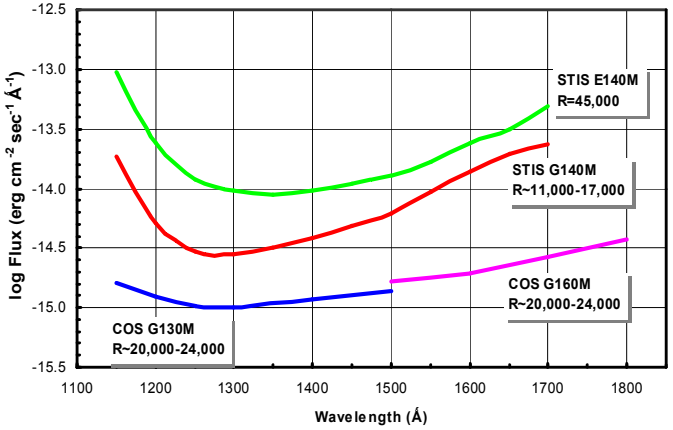
COS and STIS FUV Throughput Comparison

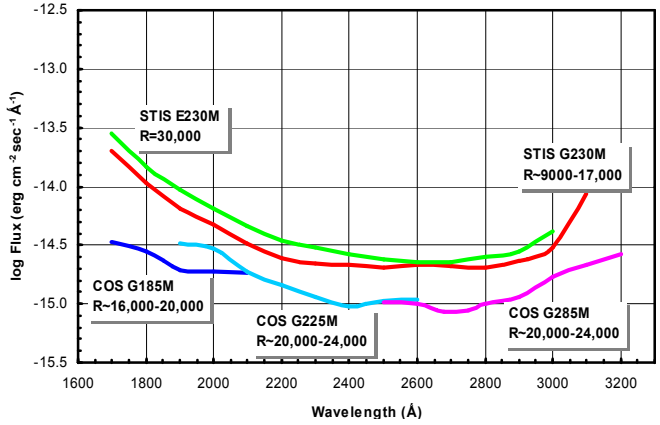


The figures above and below compare COS Primary Science Aperture (PSA) and STIS medium resolution (M mode) performance by indicating the limiting flux for which S/N=10† can be achieved in 3600 sec exposures with uniform binning corresponding to R~10,000 (bins of 0.15 Å for FUV and 0.24 Å for NUV. The superior light gathering power of COS provides >10x the FUV throughput of STIS and up to 70x STIS FUV observing speed.

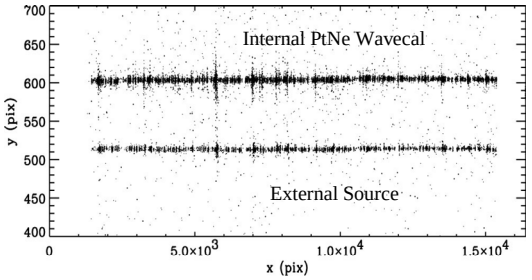
Note: COS Bright Object Aperture (BOA) performance limits are ~100x brighter due to the BOA ND2 filter.

† COS flat fields will support S/N=30 and for FP-split observations in certain circumstances S/N~100.

COS and STIS NUV Throughput Comparison

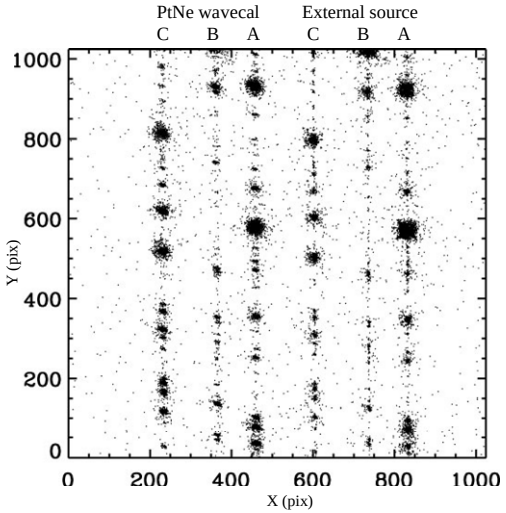


COS FUV Format



The figure above shows the typical spectrum format for a single COS FUV MCP detector segment. The COS FUV detector consists of two such segments separated by a small gap. Two spectra may be recorded as shown above. The lower spectrum is from an external source illuminating the prime science aperture (PSA); the upper spectrum is from the internal PtNe wavelength calibration lamp which illuminates the wavelength calibration aperture (WCA).

The figure below shows the typical spectrum format for the COS NUV MAMA detector. Three separate segments – labeled A, B, and C - of the dispersed first-order spectrum are directed by separate pickoff mirrors to illuminate slightly offset positions on the detector. The left-most three stripes are from the internal PtNe wavelength calibration lamp. The three stripes to the right are from an external source illuminating the PSA.



COS NUV Format

COS and STIS Detector Characteristic Comparison

	COS/FUV	STIS/FUV	COS/NUV	STIS/NUV
Spectral coverage (Å)	1150-1775(M) 1230-2050(L)	1150-1700	1700-3200	1600-3200
Effective Area (cm^2)	2800 (M) 2400 (L) (at λ1300)	400 (M) 1700 (L) (at λ1300)	900 (M) 750 (L) (at λ2500)	350 (M) 900 (L) (at λ2500)
Resolution ($\lambda/\Delta\lambda$) H M L	N/A 20000-24000 2400-3500	110000 10000-40000 1000	N/A 16000-24000 1500-2800	110000 10000-30000 500
Number of pixels along dispersion	32768	1024 (2048)	1024	1024 (2048)
Background (cts/sec/resel)	4.3 x10^{-5}	350 x10^{-5}	1.9 x10^{-3}	17 x10^{-3}
Background equivalent F_λ (erg cm^{-2} sec^{-1} $Å^{-1}$)	0.5-8 x10^{-18}	20 x10^{-18}	1.3-3.8 x10^{-16}	13.8 x10^{-16}

COS Time-TAG Mode Summary

- Default mode for FUV and NUV; 32 msec sampling
- FUV pulse-heights improve background removal
- Unique TAGFLASH mode acquires wavecal spectra during science exposures; no on-target time lost
- Fully processed photon list product; can be binned or time-sliced to user requirements

COS Imaging Mode Summary

Imaging Characteristic	COS/NUV
FOV area ($arcsec^2$)	12.5 (full diameter) 4.9 (un-vignetted)
Broadband throughput	0.07 (λ2300) 0.02 (λ3300)
Pixel scale (arcsec)	0.024
Number of pixels	166 (full diameter) 100 (un-vignetted)
Background equivalent F_λ (erg cm^{-2} sec^{-1} $Å^{-1}$)	~5 x10^{-19} (HSTMAG ~ 24.5)
Number of filters	1 (broad-band, 1700-3200 Å.)