

Progress report for the NASA Probe Concept, Cosmic Evolution Through UV Surveys (CETUS)

Sally Heap (UMD) sara.heap@Gmail.com

TAKE-AWAY:

- CETUS is an all-UV Probe mission concept having a 1.5m f/5 telescope with a wide-field camera, MOS, and high-resolution spectrograph
- It is essential that Probe-class missions (~\$1B) are productive over a long lifetime
- Recent technological advances suggest that CETUS will have long-lived detectors, both in the near-UV (Teledyne-e2v 4K x 4K EMCCD's with NüVü electronics) and in the far-UV (Berkeley SSL MCP detectors in formats needed by CETUS)

(For more information, see Heap et al. (2020), SPIE 1144408, Vol. 11444)

CETUS Far-UV Instruments: Camera & LUV/FUV spectrograph

MCP parameter\mission	CETUS FUV MCP	HST/COS FUV MCP
Detector type	XS (cross-strip), CsI photocathode	XDL, CsI photocathode
Larger Format	60 mm x 200 mm (spectrograph), 50 mm x 50 mm (camera)	2x85 mm X 12 mm; 9-mm gap ----
High Spatial Res.	20-micron FWHM	35-micron FWHM
Lower Gain	10^6	10^7
High count-rate limit	? > 10^6 cnt/s/segment (global)	0.67 cnt/sec/pix (local), 15,000 cnt/sec/segment (global)
Ultra-low background	0.05 events/sec/cm ² (pre-launch)	<0.5 events/sec/cm ² (pre-launch)
DQE at 1152, 1334, 1560 Å 1025 Å	58%, 32%, 18% (Siegmond 2019, Fig. 18) 45% at $\lambda = 1025$ Å	44%, 26%, 12% 42% at $\lambda = 1025$ Å
Long- λ Limit	~1800 Å (CsI cutoff)	~1800 Å (CsI cutoff)
Long stable lifetime	> 4×10^{13} events/cm ²	4 lifetime positions due to gain sag

Siegmond et al. (2019)
SPIE 11118-22

HST COS Instrument Handbook

See and thank Ossy for his talk today at this session



CETUS Near-UV Instruments: Camera, MOS, Spectrograph

Detector advances: 4Kx4K EMCCD from Teledyne-e2V and NüVü
Version 3 electronics

- Much lower detector noise, $<1 e^-$ (due CIC and excess noise factor)
- Longer useful lifetime through enhancement of charge transfer efficiency in NüVü electronics

Optical advances

- Next-generation microshutter array (Greenhouse, Kuttyrev, Li, Moseley)
- UV sensitization of EMCCD's via AR coating and 2-D delta doping of EMCCD's achieving $>50\%$ QE (Nikzad et al. 2012, 2017)
- SDSS-type filters extended into the UV for coverage, $\lambda=2000-4000$
- Higher efficiency echelle grating for the high-resolution spectrograph (McEntaffer, PSU)

