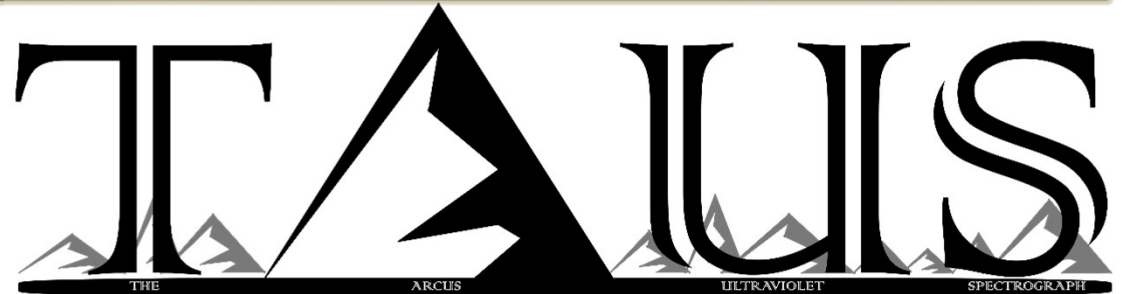




The Arcus Ultraviolet Spectrograph (TAUS)



Arcus Community Science Meeting – May 4th 2023

Kevin France
University of Colorado



TAUS Outline

- Performance Summary
- Instrument Overview
 - Technology
- Observing Modes
 - Point source observations
 - Extended Source Mapping
- Data Products
- Q & A



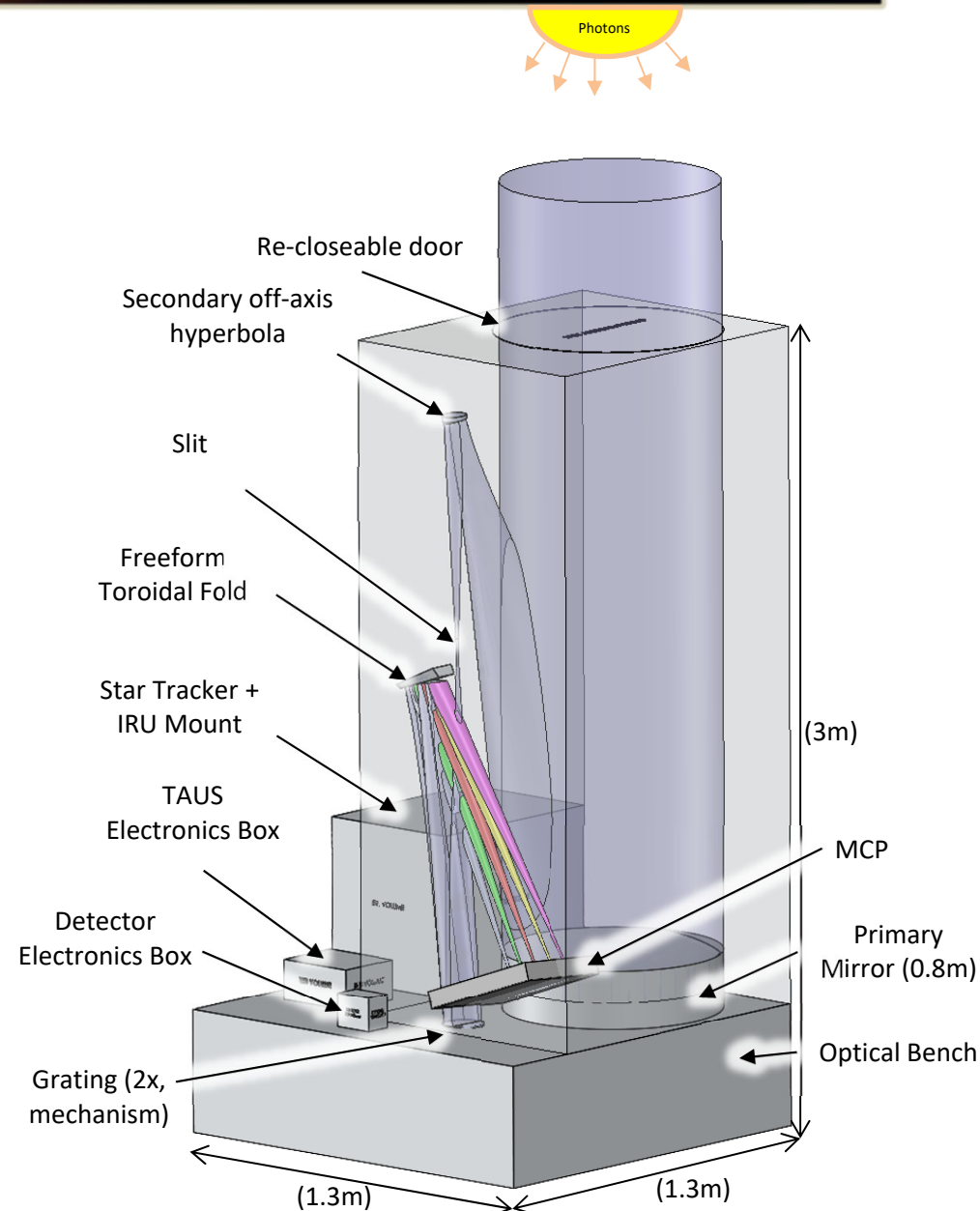
TAUS Performance Summary

- FUV Spectroscopic Instrument, 1000 – 1300 Å
- Resolving Power $\geq 22,000$ at 1050 Å (13.6 km/s)
 - mission baseline requirement = 17,000 (17.6 km/s)
- Sensitivity: S/N = 18 per resolution element for $F(1050 \text{ Å}) = 5 \times 10^{-15} \text{ erg/cm}^2/\text{s}/\text{Å}$ in a 100ks exposure
 - S/N = 10 for $F(1050 \text{ Å}) = 1.7 \times 10^{-15} \text{ erg/cm}^2/\text{s}/\text{Å}$
- Long-slit imaging, 1" [~ 5 "] angular resolution at center [edge] of 10" x 360" slit



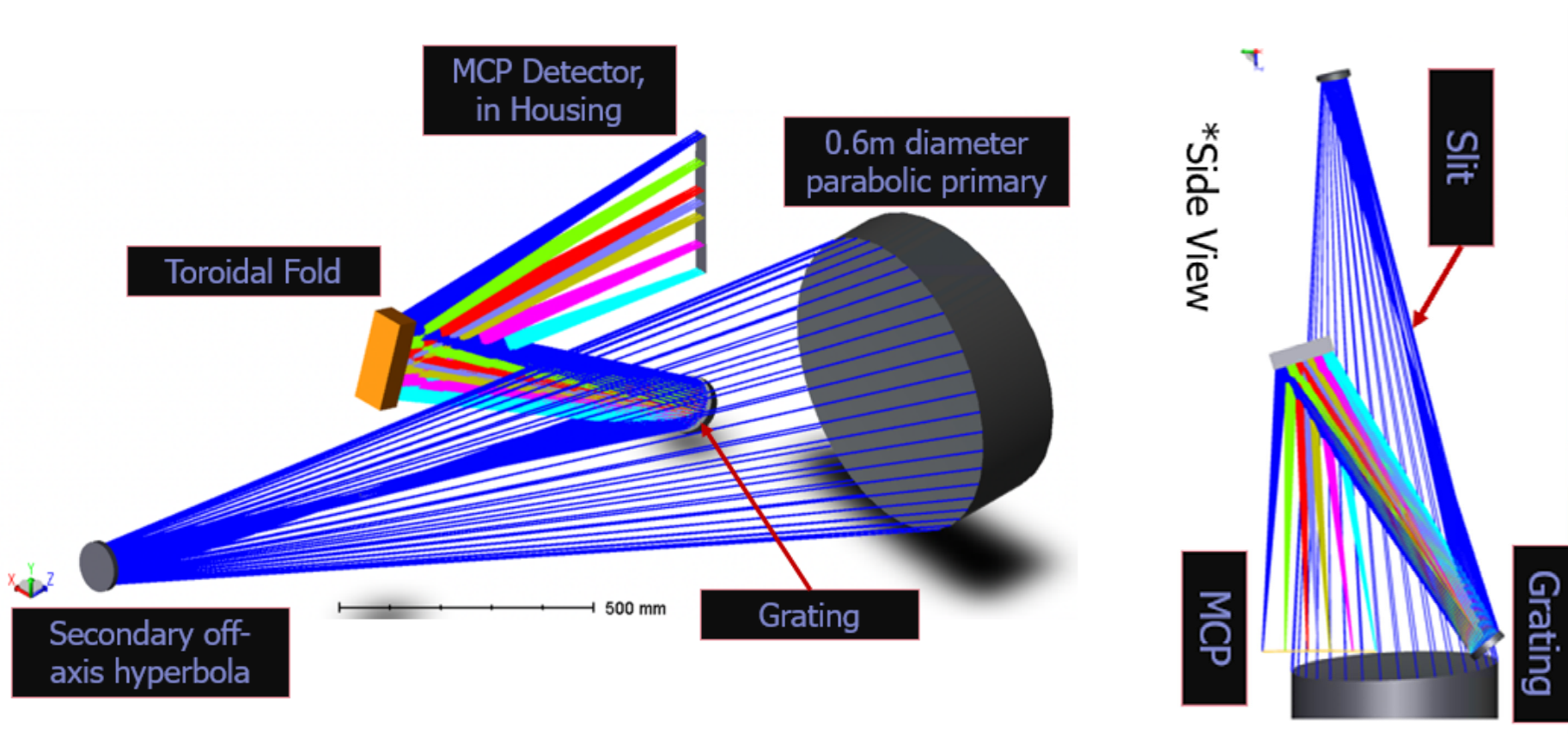
TAUS Instrument Overview

- TAUS is designed to operate simultaneously with the Arcus/X-ray Telescope
- All data are recorded in “time-tag mode” with 0.1s cadence
- Data products include 2-D detector images and photon lists, calibrated 1-D spectra, and source light curves





TAUS Instrument Overview

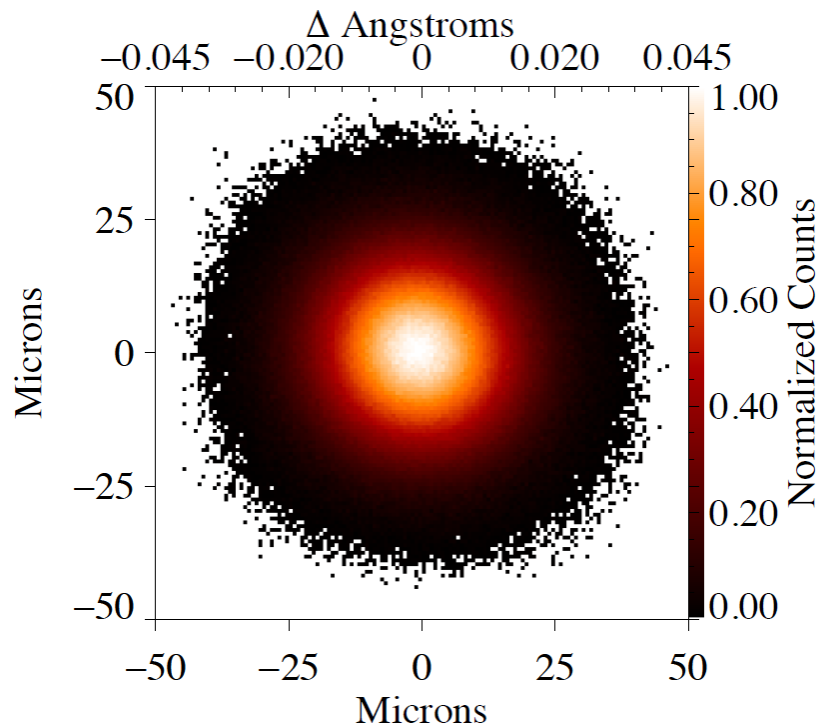


Off-axis Cassegrain feeds FUV spectrograph,
 $R > 22,000$ (G110M 1000 – 1300 Å) mode.
(study underway to add G140M: 1200 – 1580 Å)

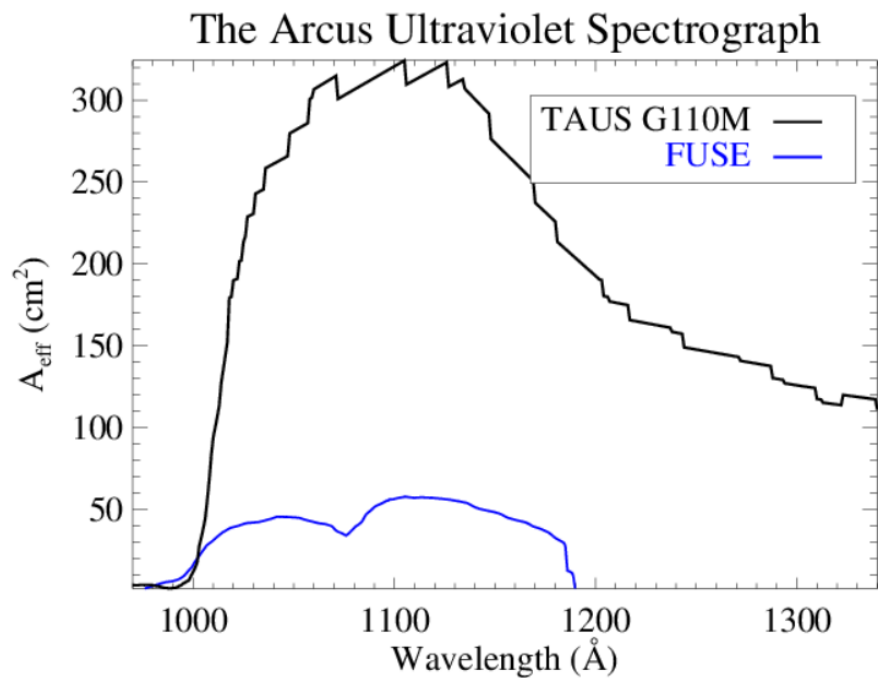


TAUS Instrument Overview

Optical PSF, with errors and aberrations, at O VI 1032 Å



Instrument Effective Area

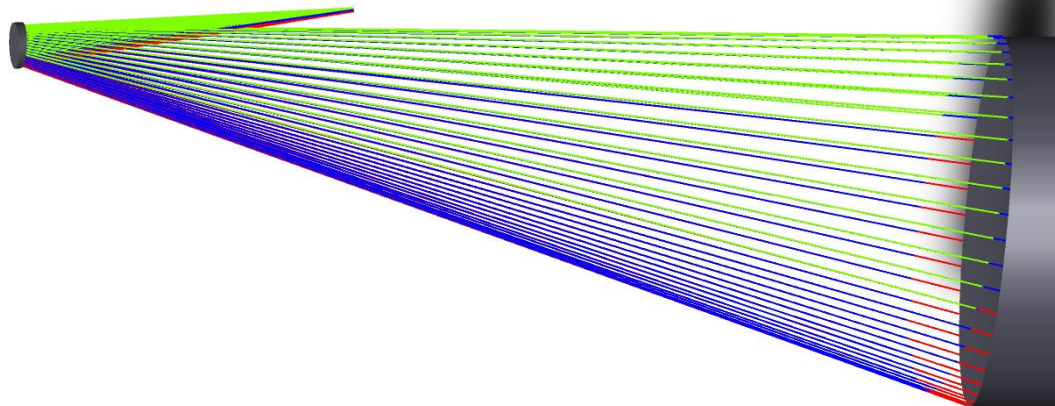


Arcus-TAUS is optimized for the Lyman UV, below the nominal HST cutoff of 1150 Å.

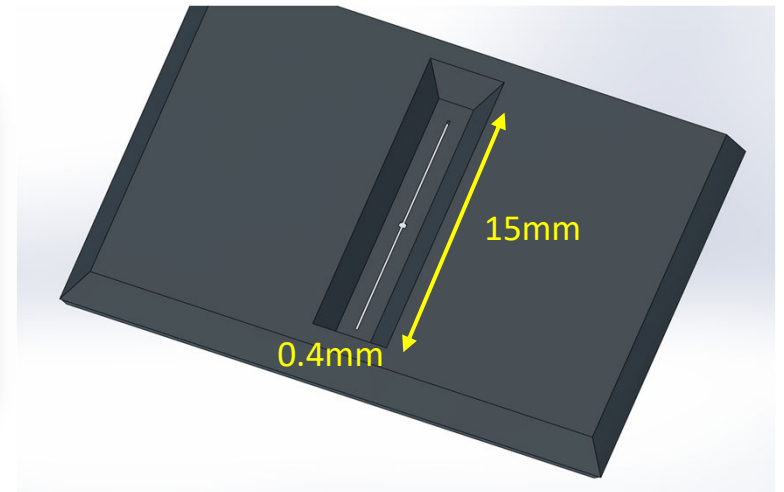


TAUS Technology

- 0.6m off-axis Cassegrain
 - Focus at a 6' x 10" slit with 30" central point-source aperture



1e+03 mm

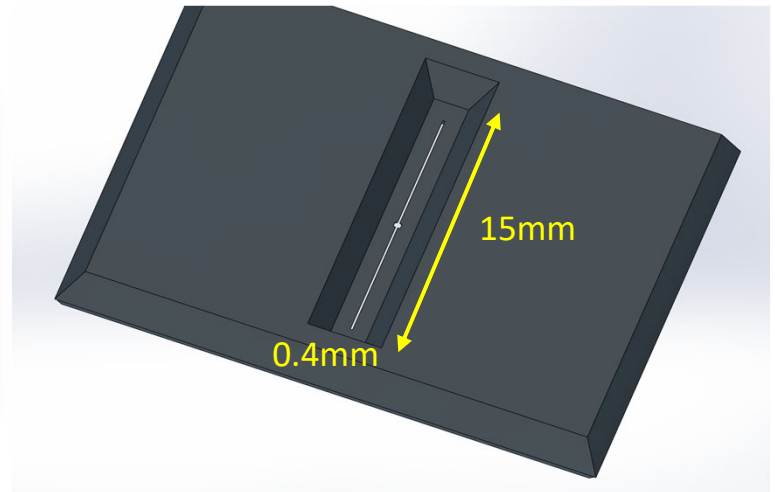
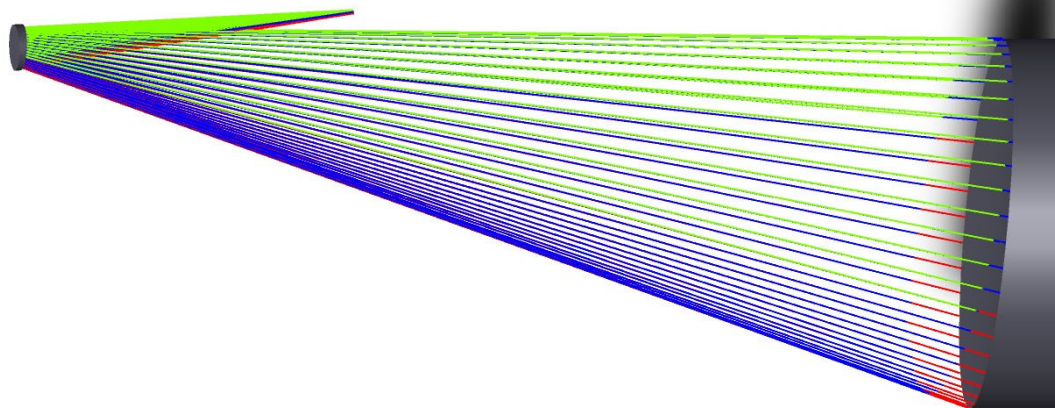


Representative slit



TAUS Technology

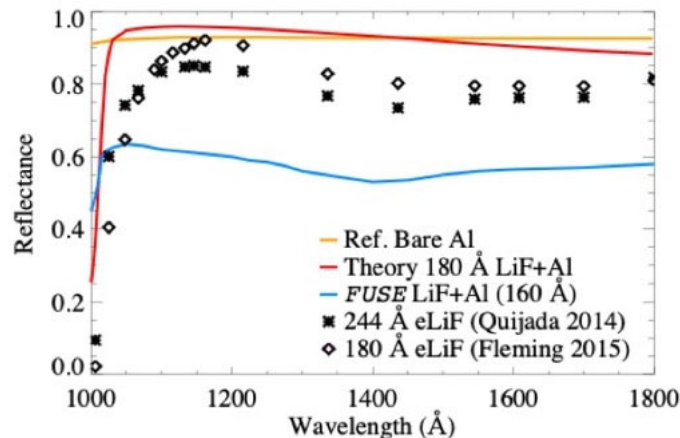
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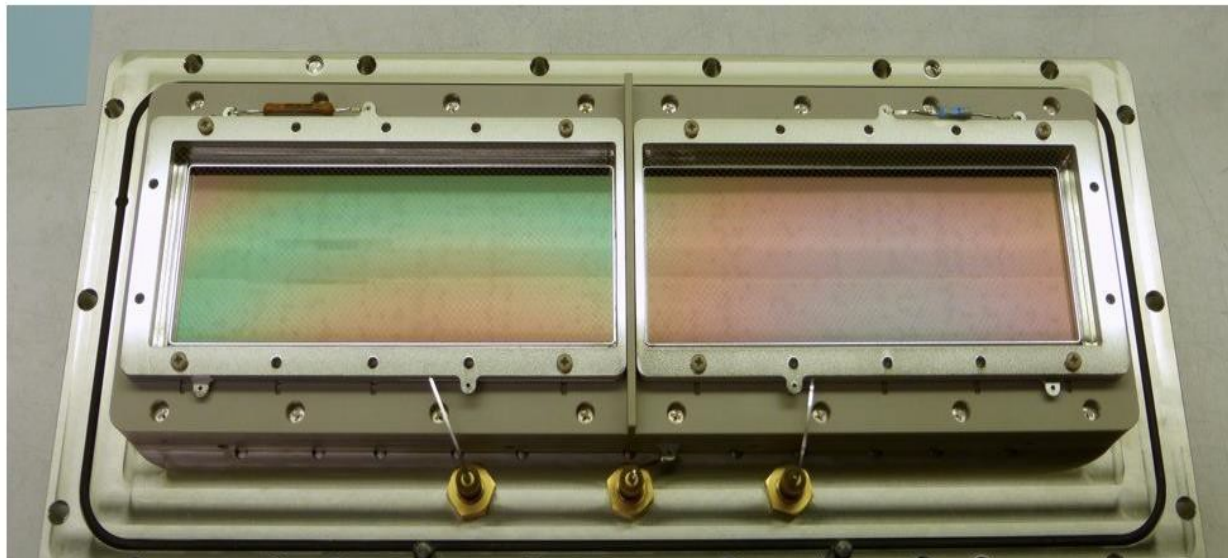


Enhanced Lithium Fluoride (eLiF) mirror coatings reliably deliver coating reflectance > 75% at 103 nm, against 67% for FUSE and 73% maximum for conventional LiF+Al. Baseline coating from LUVUOIR decadal study.

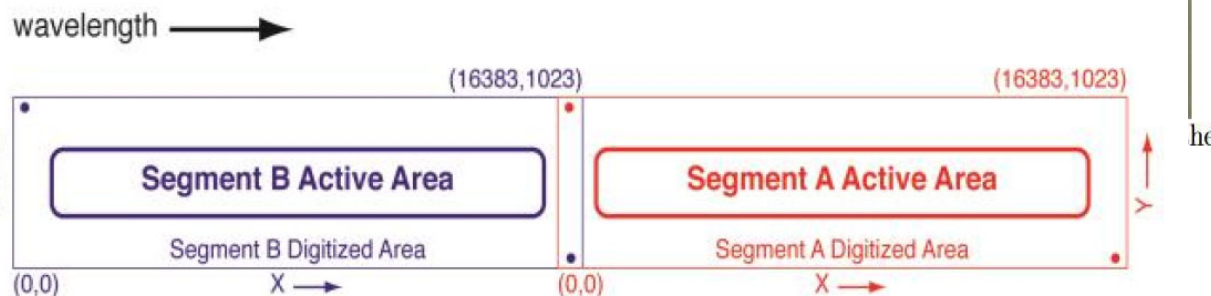


TAUS Technology

- 330mm x 30mm open-face MCP detector
 - Photon-counting (0.1 s)
 - No Read Noise
 - Mitigates contamination concerns associated with cold detector in sensitive FUV bandpass



- 2 segment microchannel plate, open face for highest QE at $\lambda < 1300 \text{ \AA}$
- Gap between the segments covered by grating adjustment mechanism
- Heritage from FUSE, HST-COS, SISTINE rocket, planetary missions





TAUS Observing Modes

- One grating mode covering the 1000 – 1300 Å wavelength range (G110M; 970 – 1350 Å possible with grating tilt)
- Point sources are centered in the slit, $R \geq 22,000$ at 1050 Å

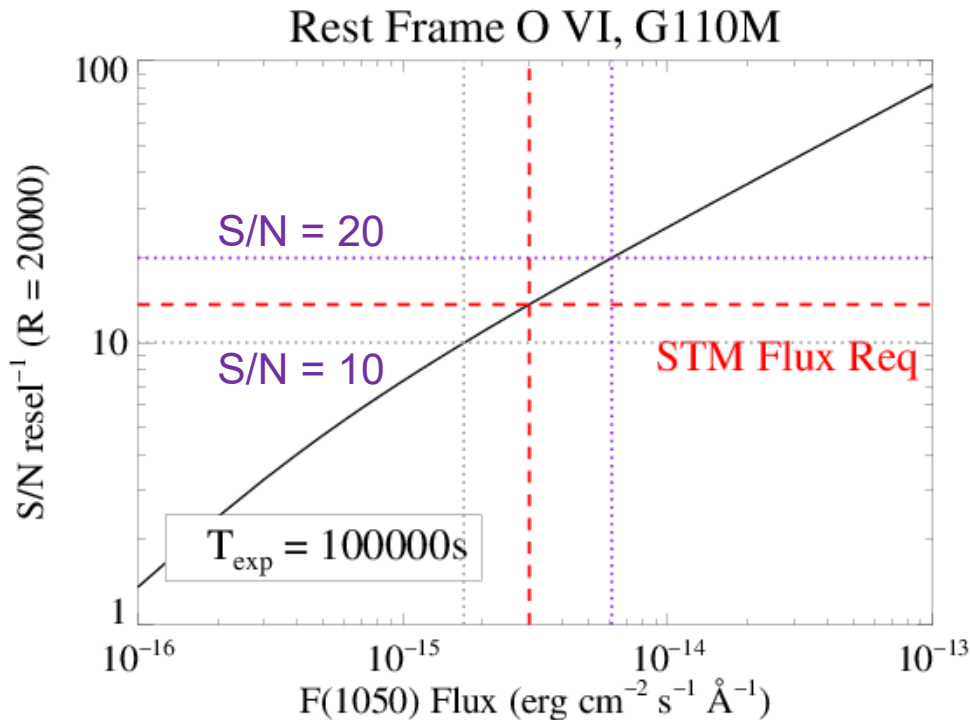
Science Performance



TAUS Observing Modes

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Science Performance

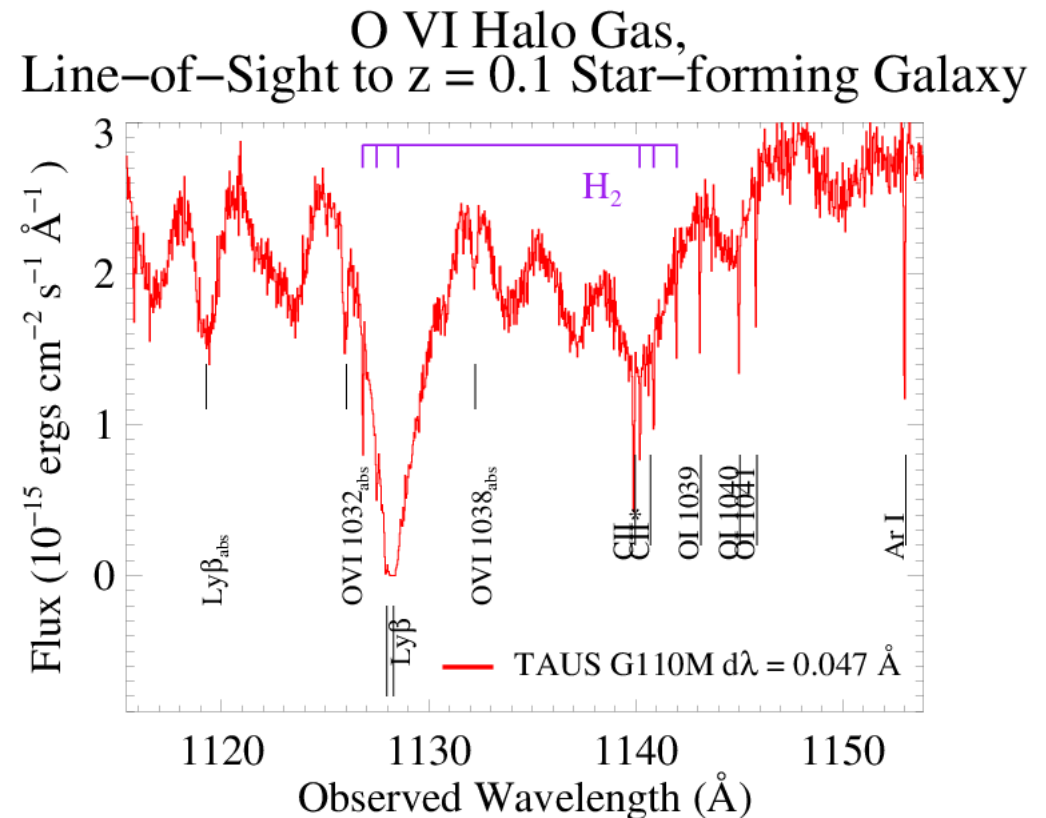
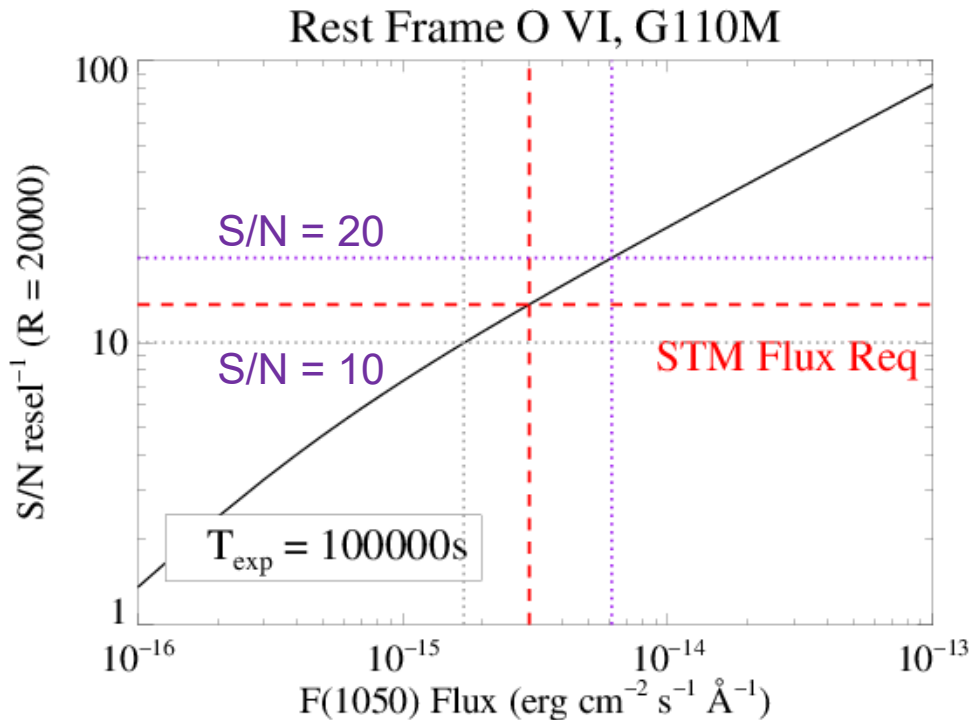




TAUS Observing Modes

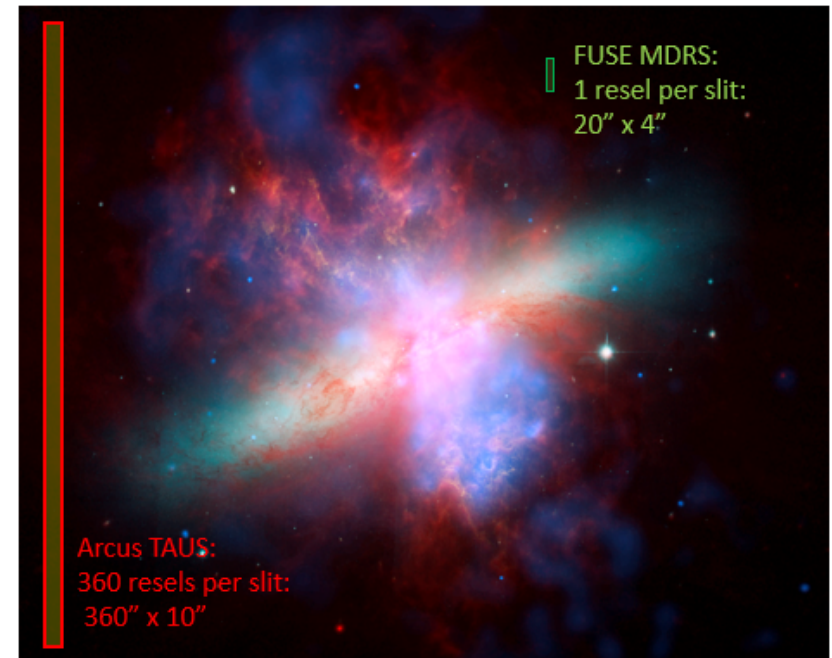
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Science Performance





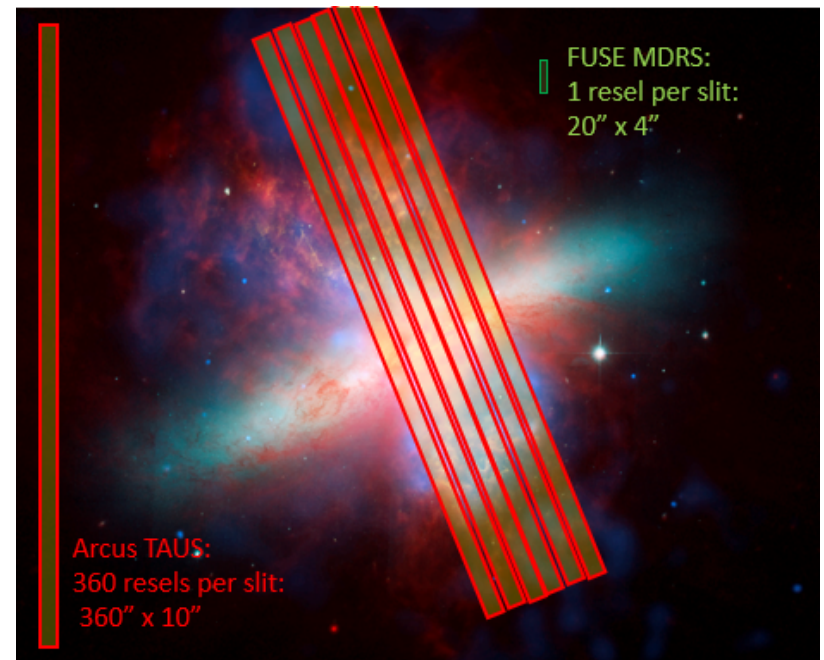
Spectral Mapping with Arcus/TAUS



Ex: Galactic Halo Surface Brightness Maps



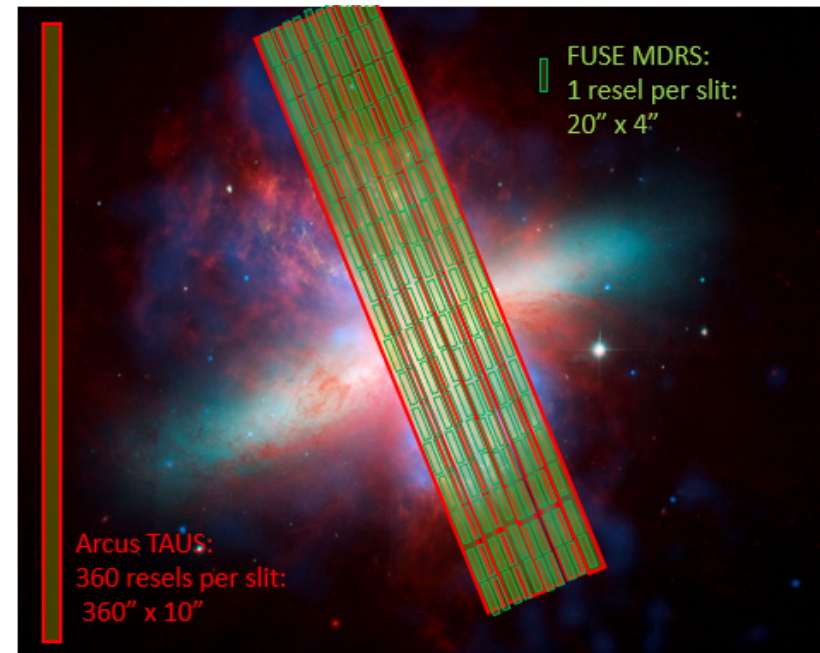
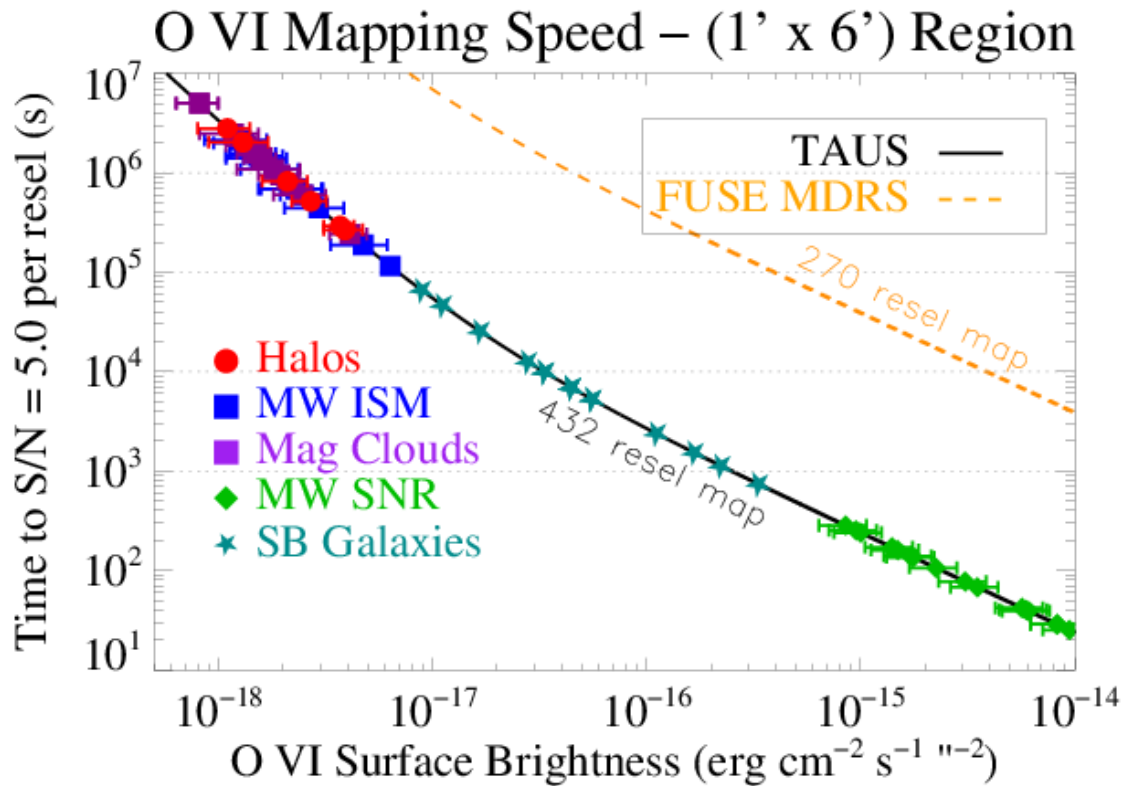
Spectral Mapping with Arcus/TAUS



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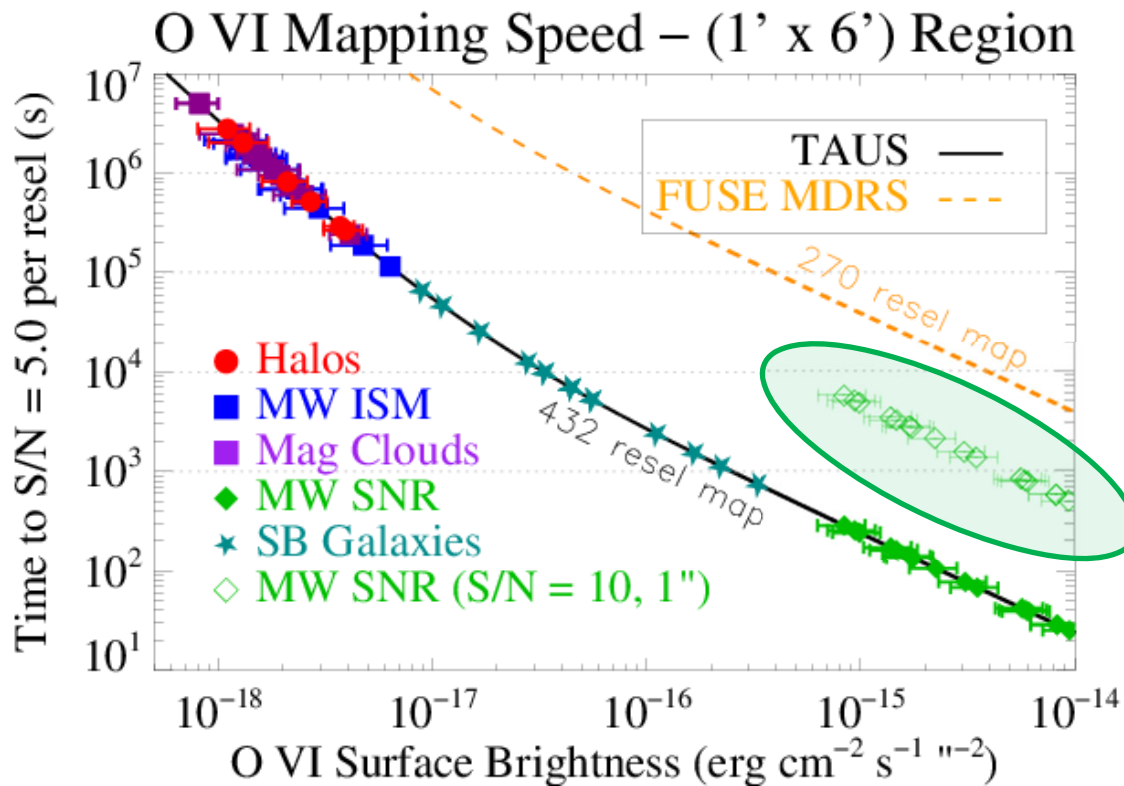
Spectral Mapping with Arcus/TAUS



Ex: Galactic Halo Surface Brightness Maps
(10'' x 5'' resolution elements, "resels")



Spectral Mapping with Arcus/TAUS



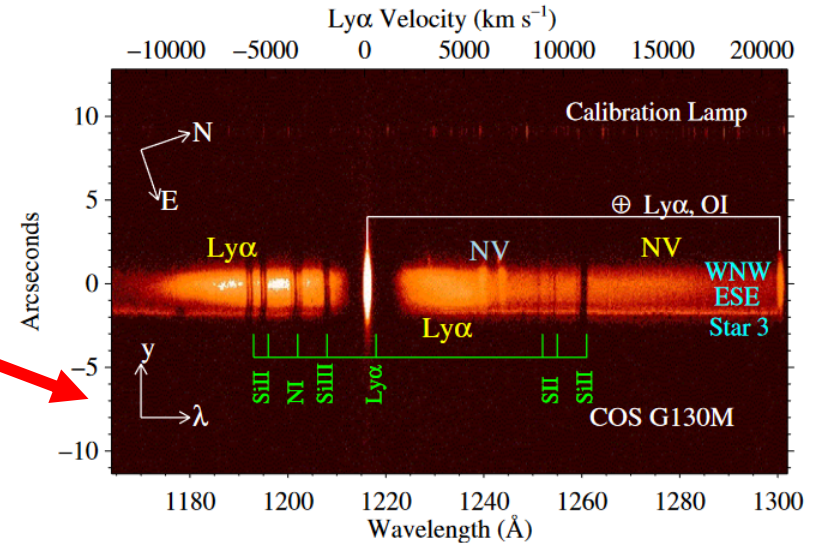
Ex: Galactic/Magellanic Cloud Supernova Remnants
(10'' x 1'' resels)



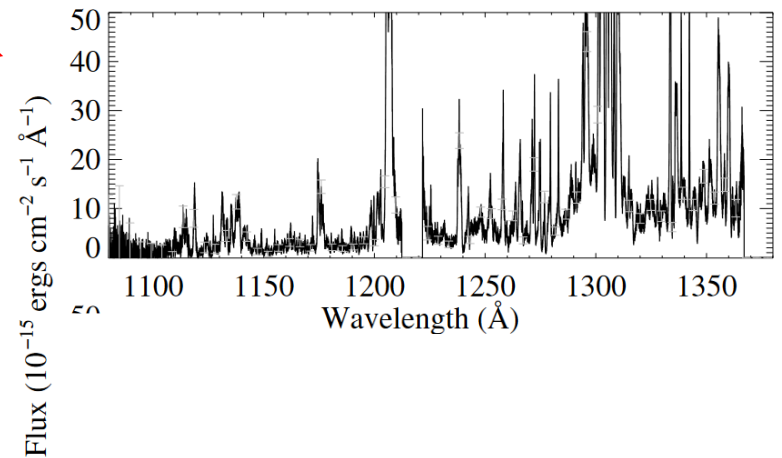
Arcus/TAUS Data Products

TAUS Data:

CORRTAG: [λ ,y,t,PH] photon lists with detector related corrections applied



X1D: fully calibrated, one dimensional spectrum in $\text{erg cm}^{-2} \text{s}^{-1} \text{\AA}^{-1}$ as a function of wavelength (in \AA) for each observation



RATE: contain the count rate as a function of time (integrated light curves)



Questions?

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