



FLITECAM's Backgrounds, Thermal and Otherwise

Ryan T. Hamilton
FLITECAM Instrument Scientist
Visiting Post Doctoral Scientist

SOFIA User's Group
April 15th, 2015





Recent History



- We've commissioned the instrument with just 6 fully operational SOFIA flights
 - Feb. 2014, OC2A
 - FLIPO configuration
 - 2 of those ½ flights due to scheduling/logistics
 - 2 more devoted to GI science, with commissioning as a fringe benefit
 - Compare to # of flights of other SIs...

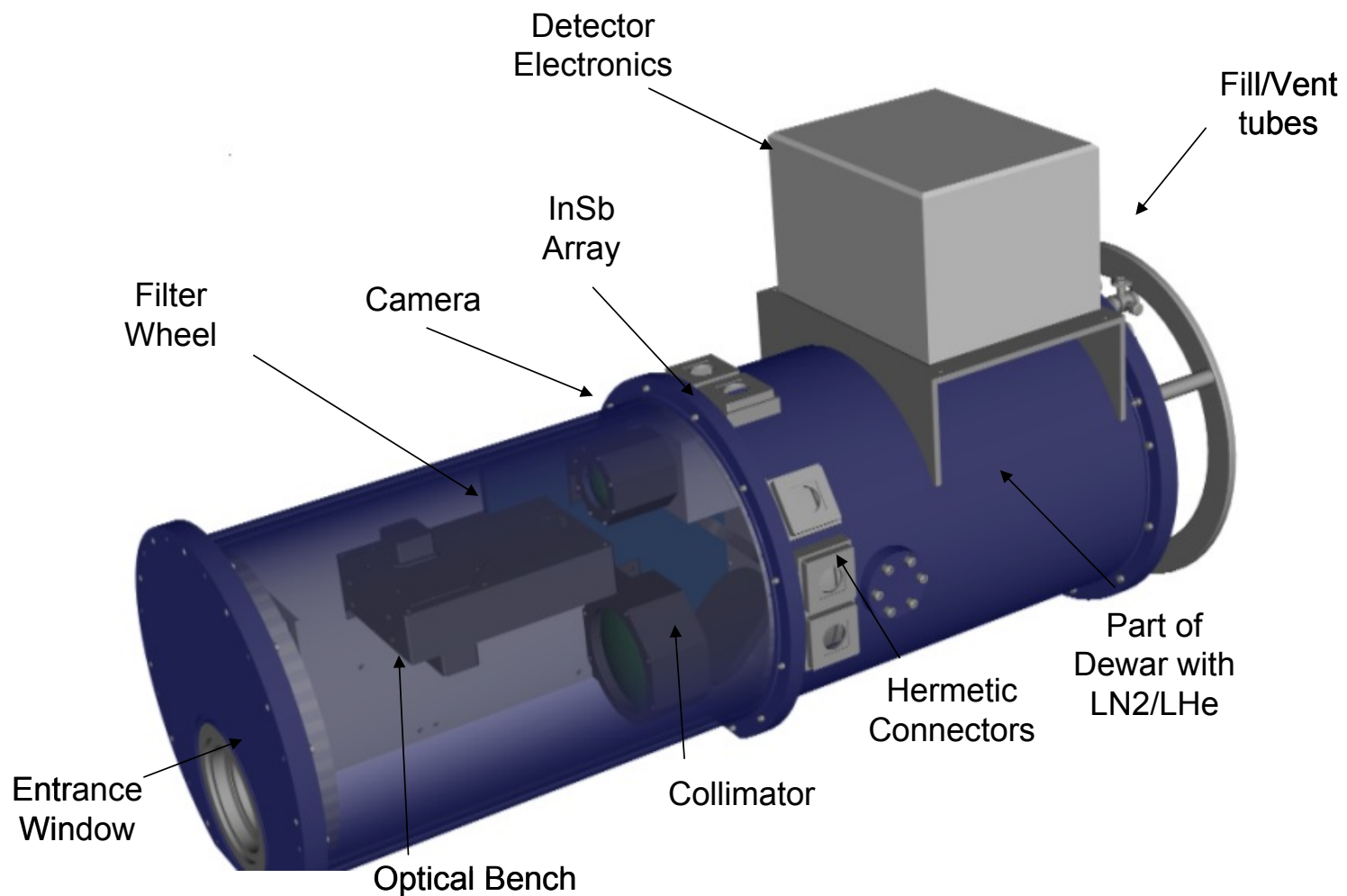




FLITECAM Overview

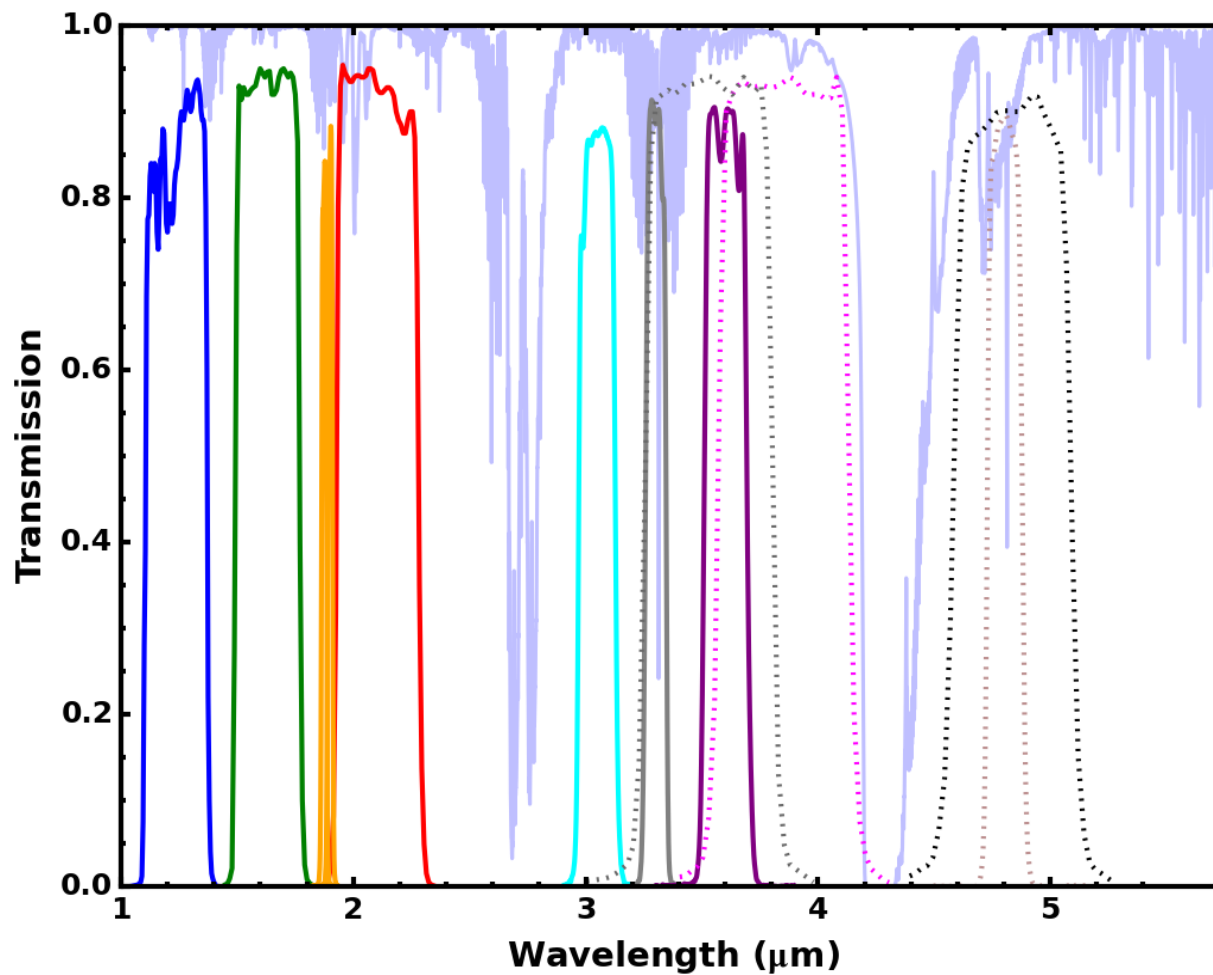


- LN₂ & LHe cryogen system, detector at 30 K



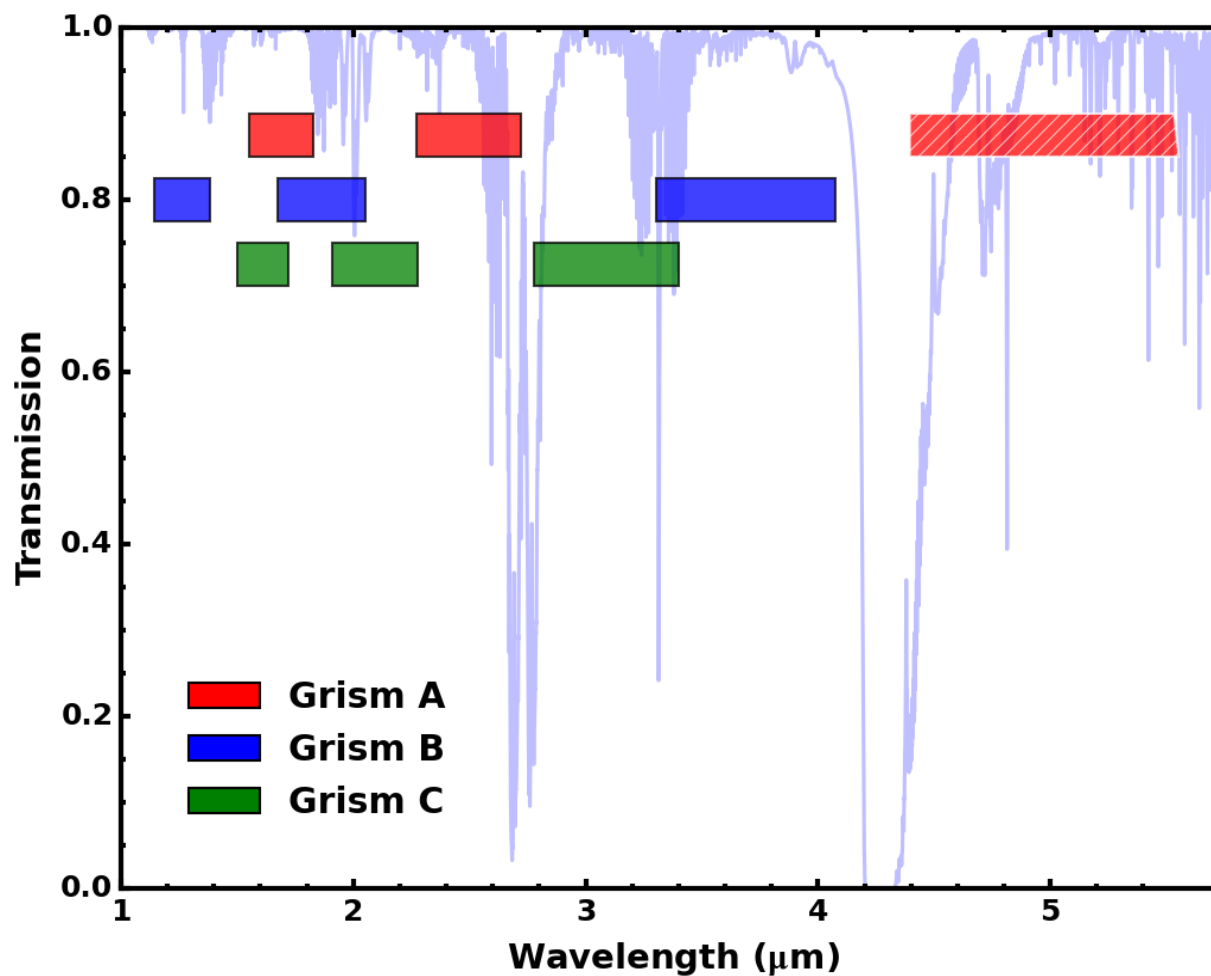


FLITECAM: Imaging



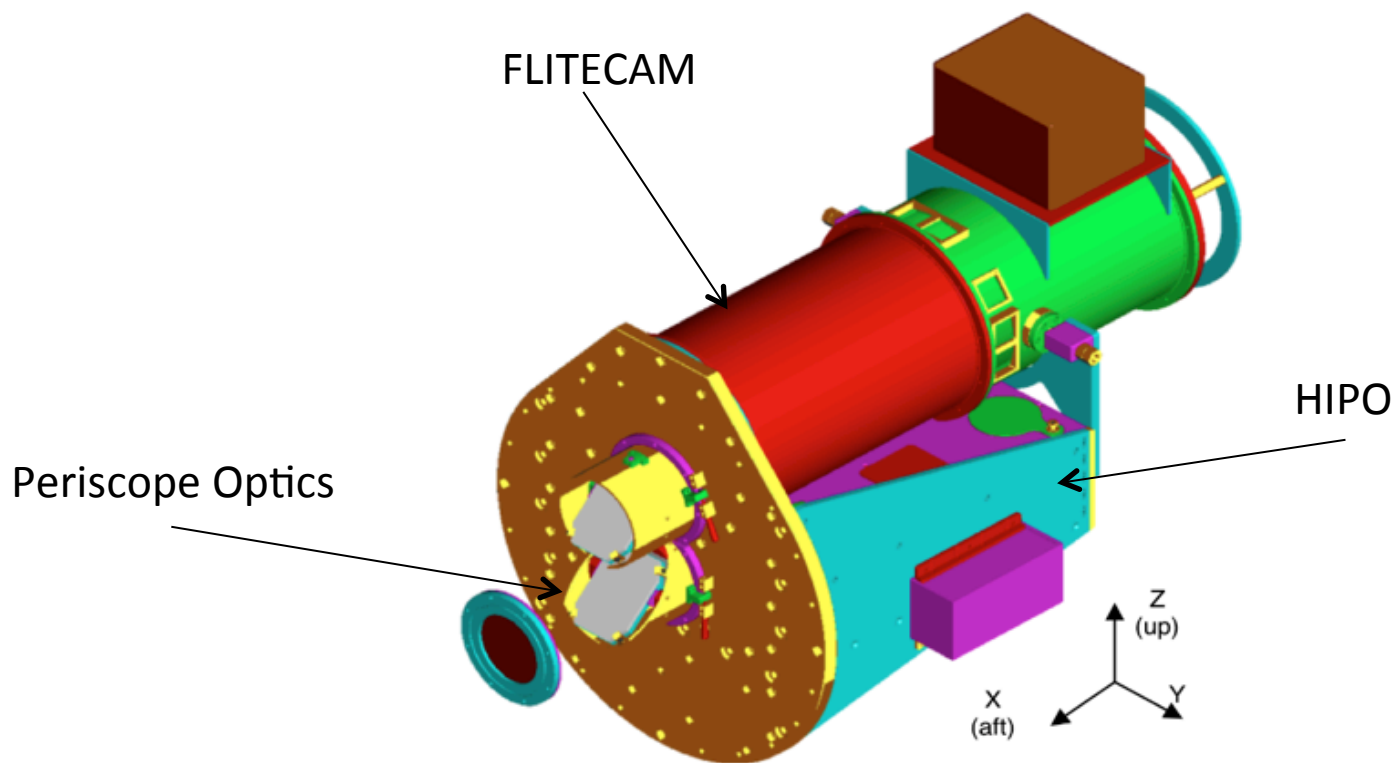


FLITECAM: Spectroscopy





FLIPO Additions



Measurement by the HIPO team show that the periscope optics, composed of a dichroic beam-splitter and fold mirror, are essentially at cabin temperature, rather than telescope temperature.





Grism Background Predictions

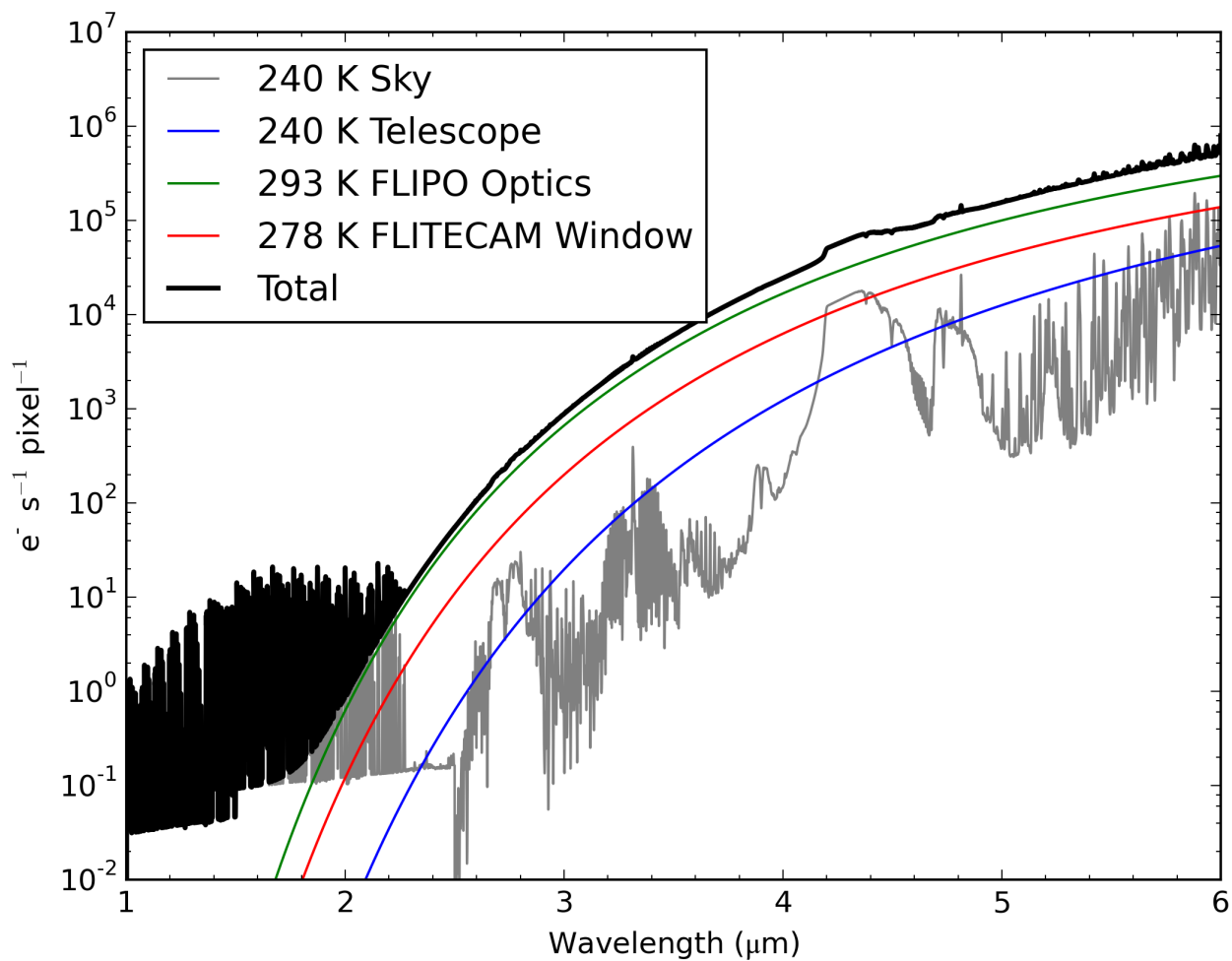


- W. Vacca's grism exposure time calculator includes a robust background calculation
 - Sky temperature + continuum + line emission
 - Telescope temperature & emissivity/throughput
 - FLITECAM window temperature & emissivity
 - FLITECAM system throughput
 - FLIPO optics temperature & emissivity/throughput
- Observed backgrounds w/in factor of 2, both imaging and spectroscopy
 - Contributions from window contamination? Water spots seen (and are bright) at $\lambda > 2 \mu\text{m}$



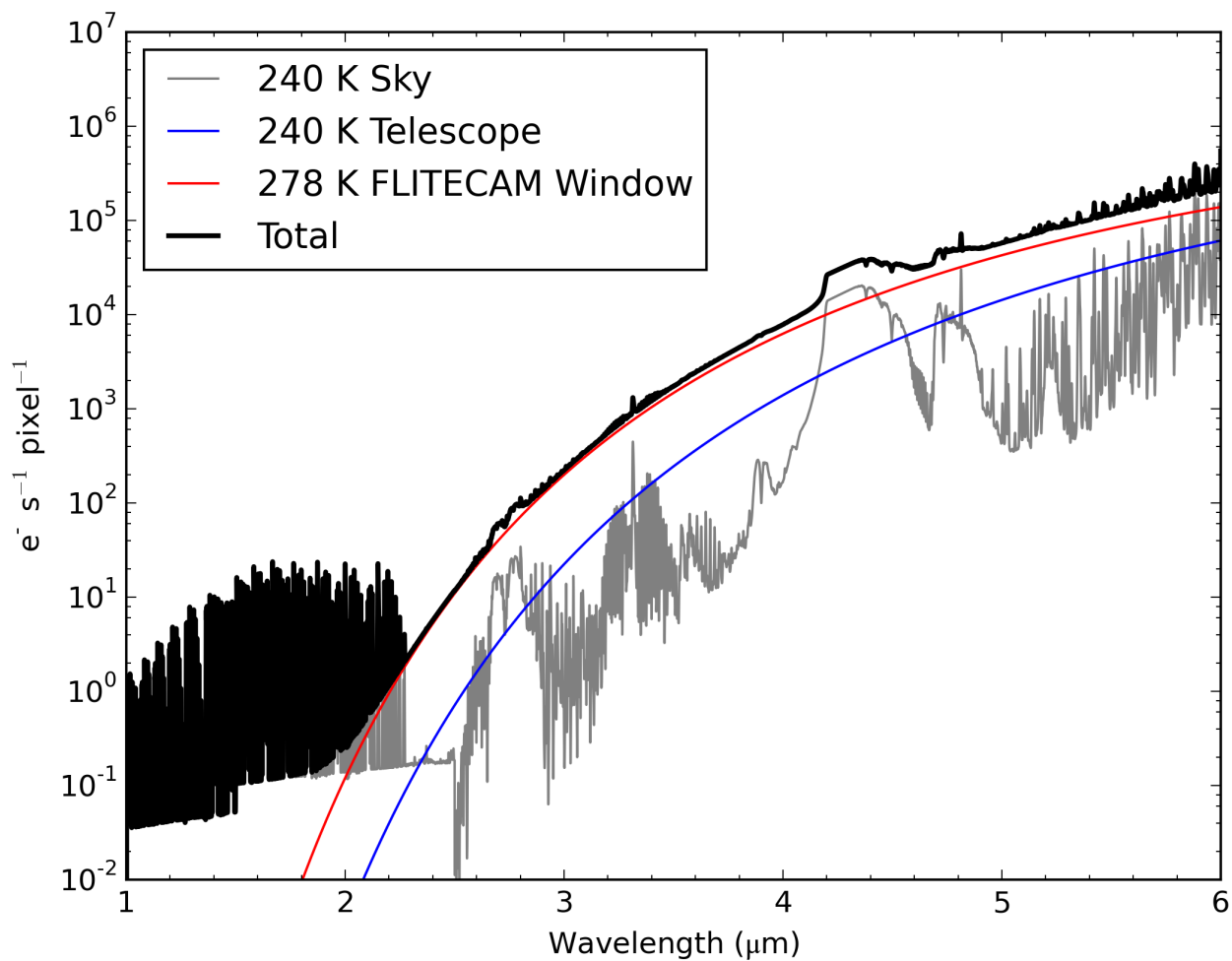


FLIPO



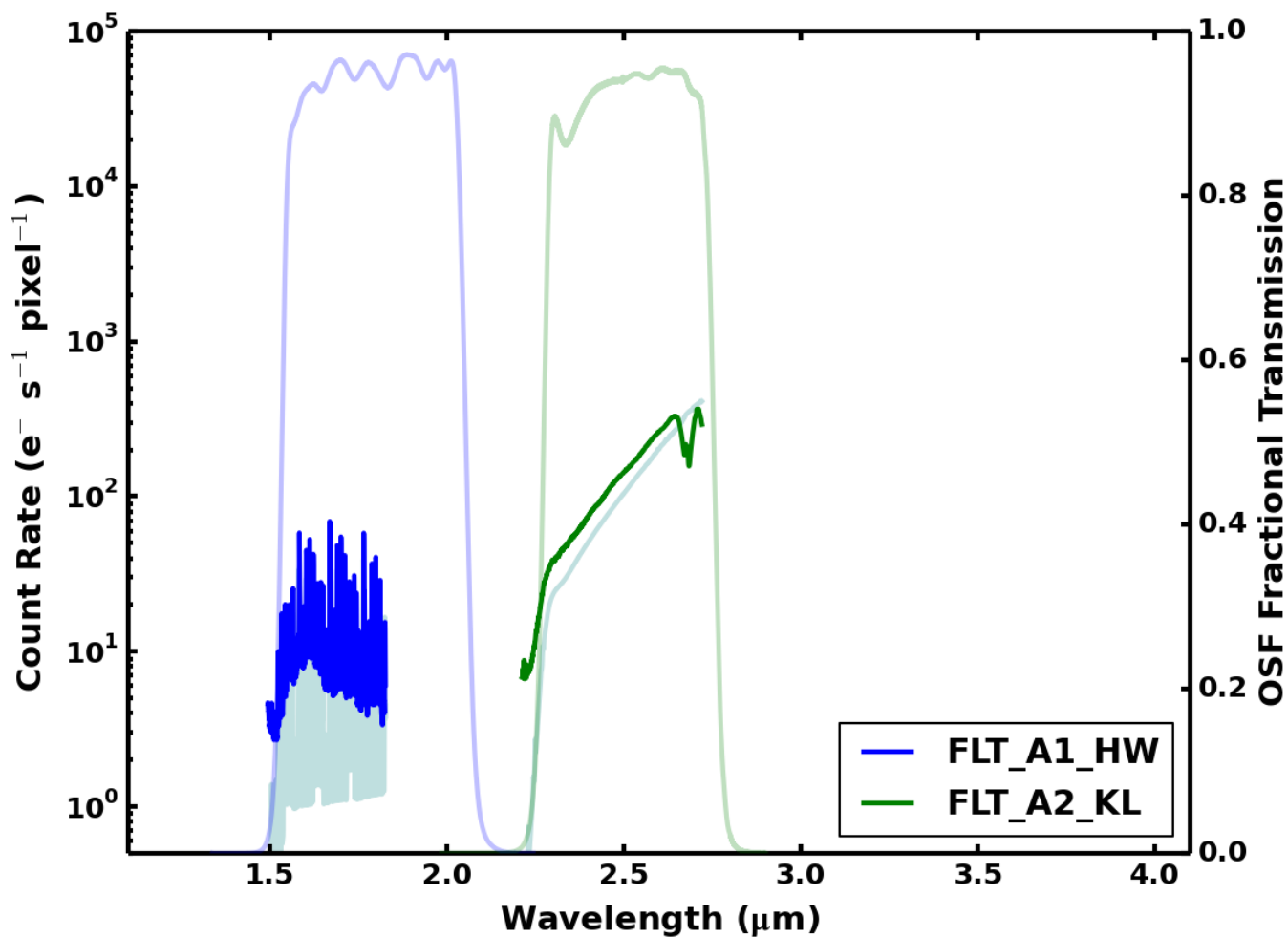


FLITECAM (Alone)



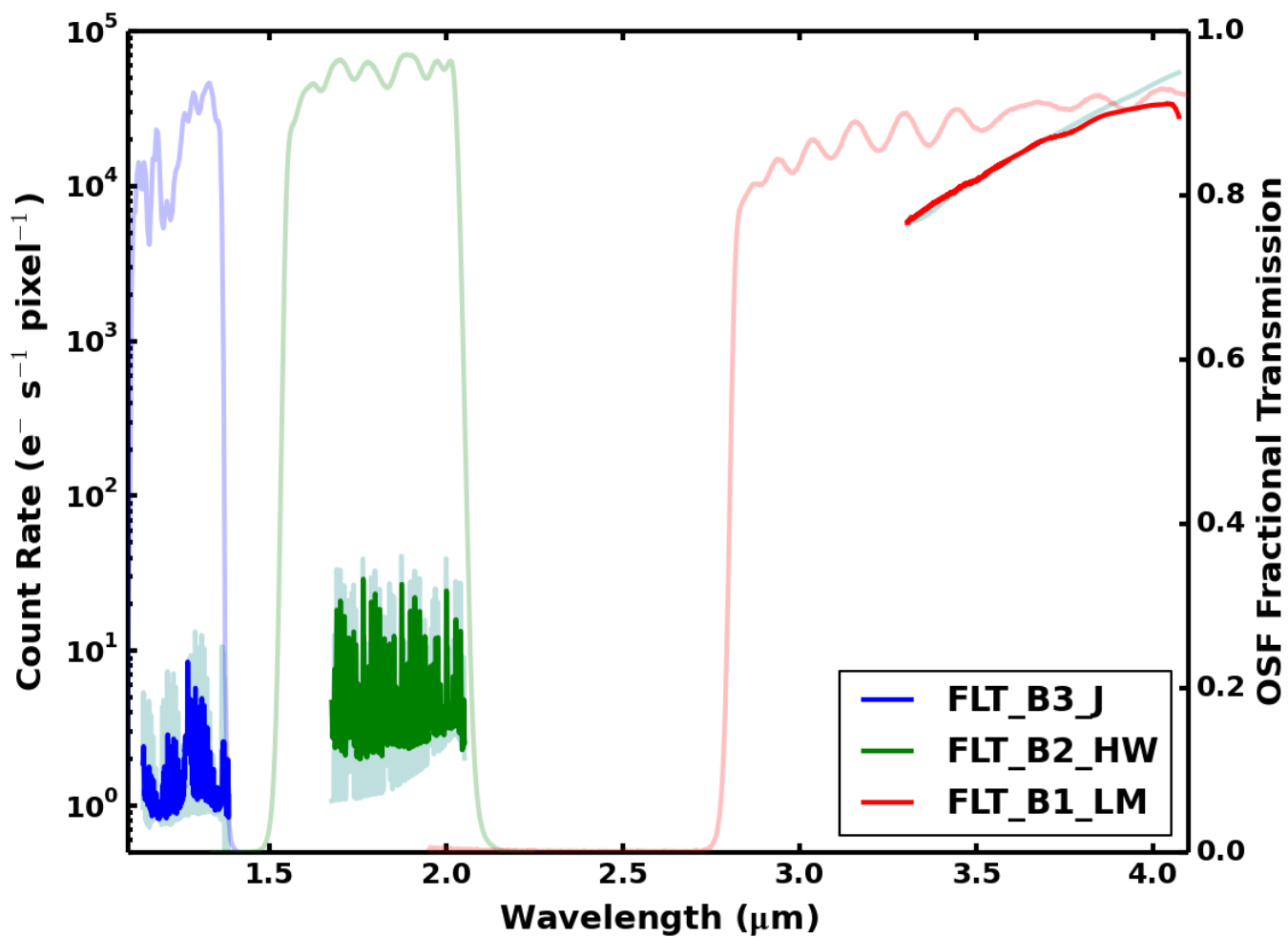


Grism Backgrounds



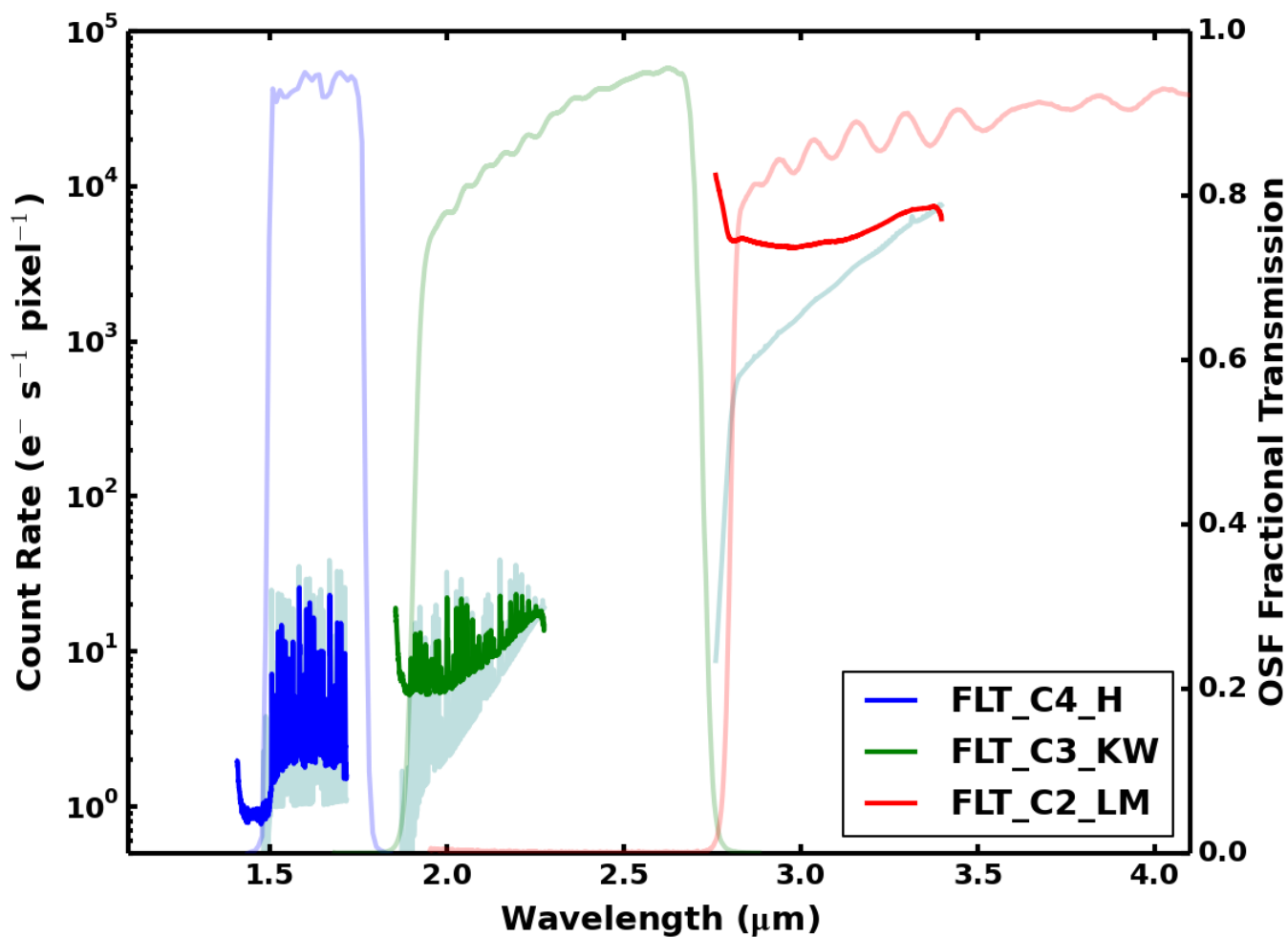


Grism Backgrounds





Grism Backgrounds





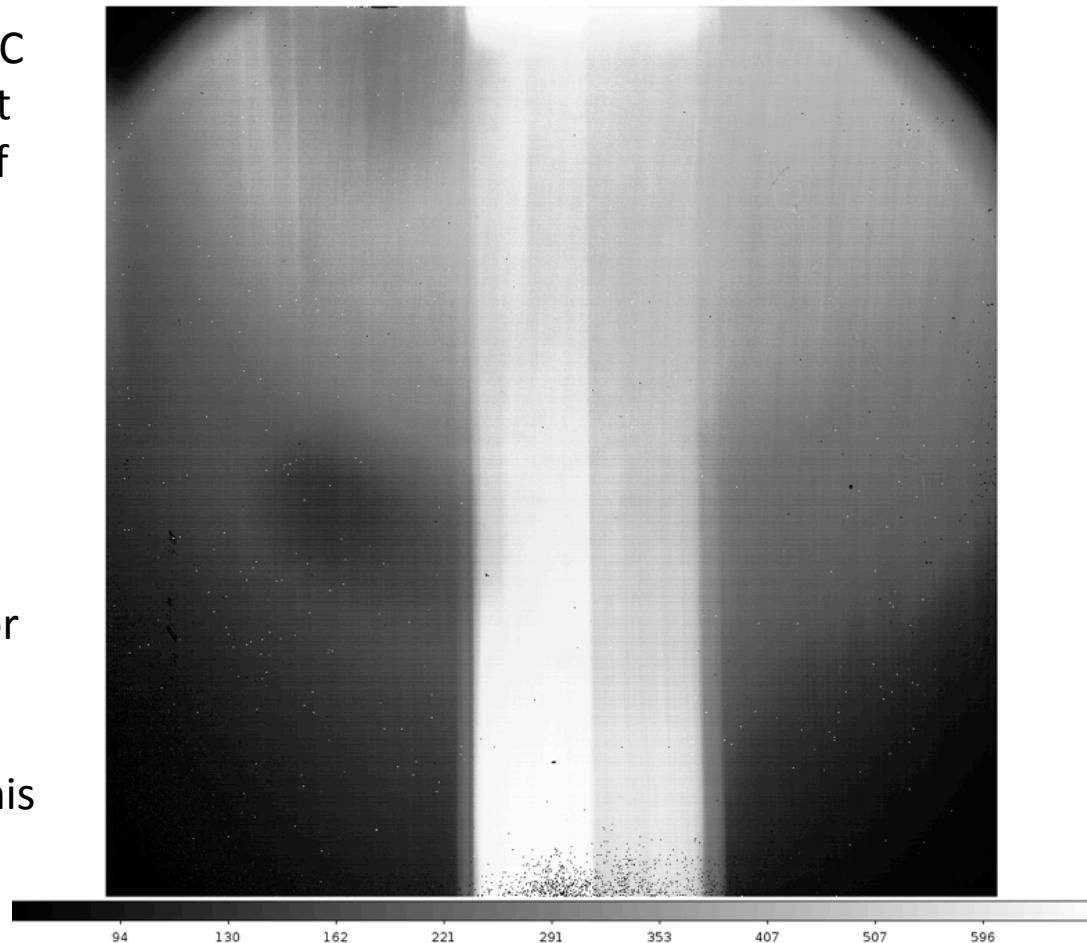
Grism Scattered Light?



Image of a spectrum with the C grism which clearly shows that there is illumination *outside* of the spectral region corresponding to the slit.

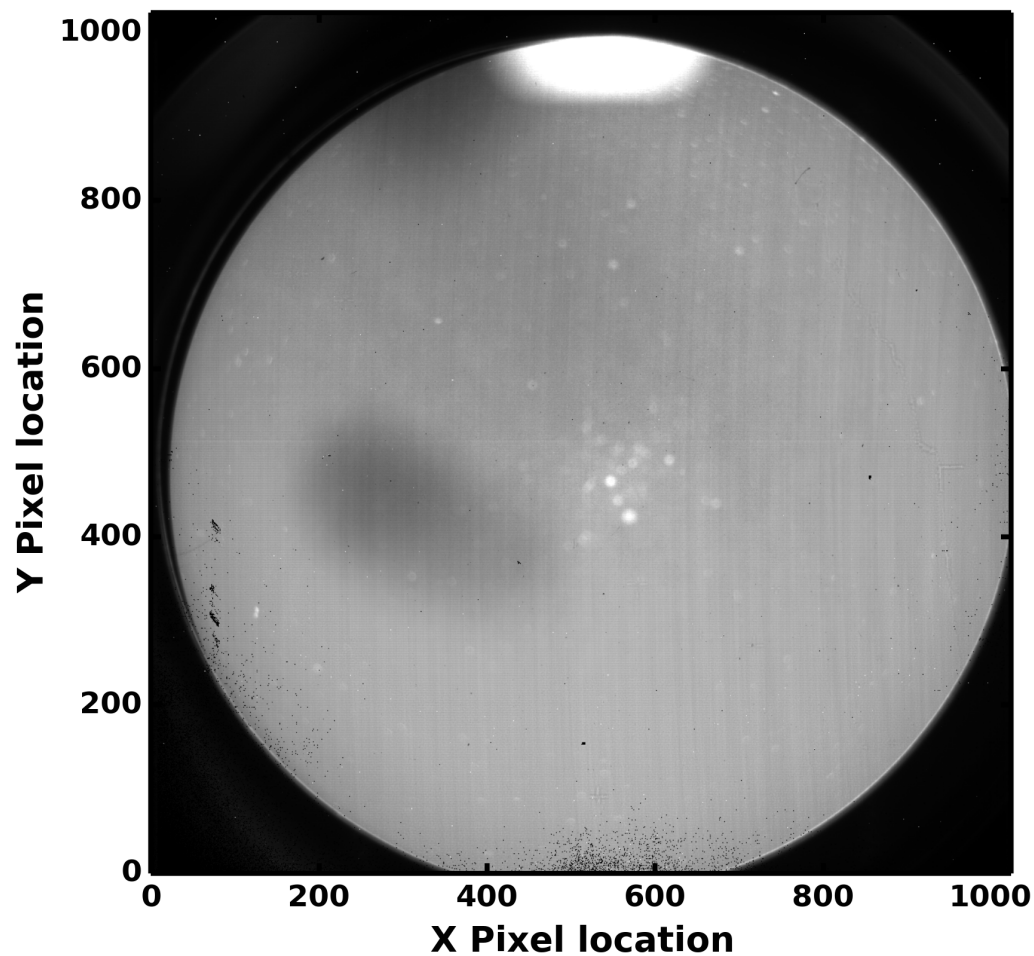
- An intrinsic problem with the C grism?
- Light leak associated with the grism holder/position?
- Scattered light from interior of filter wheel assembly?

Root cause not identified at this time, not enough data to proceed further.



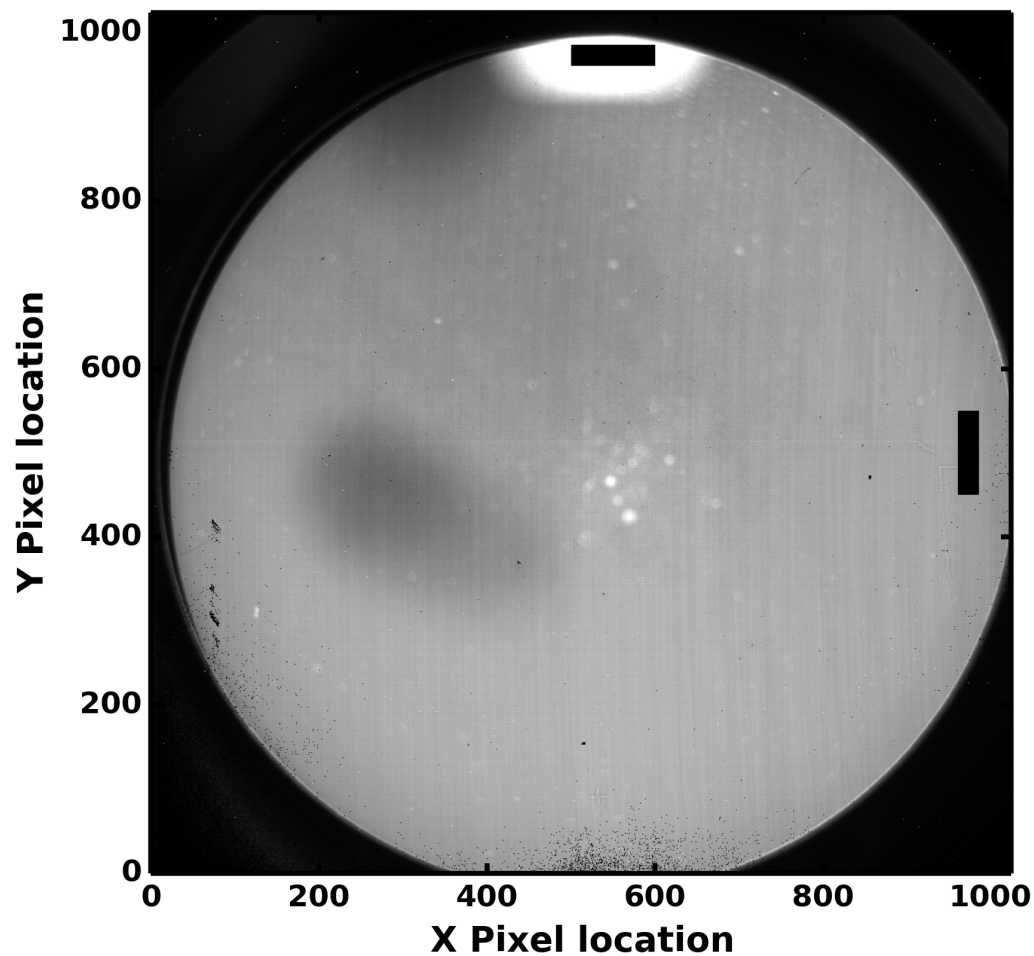


Other Background Oddities



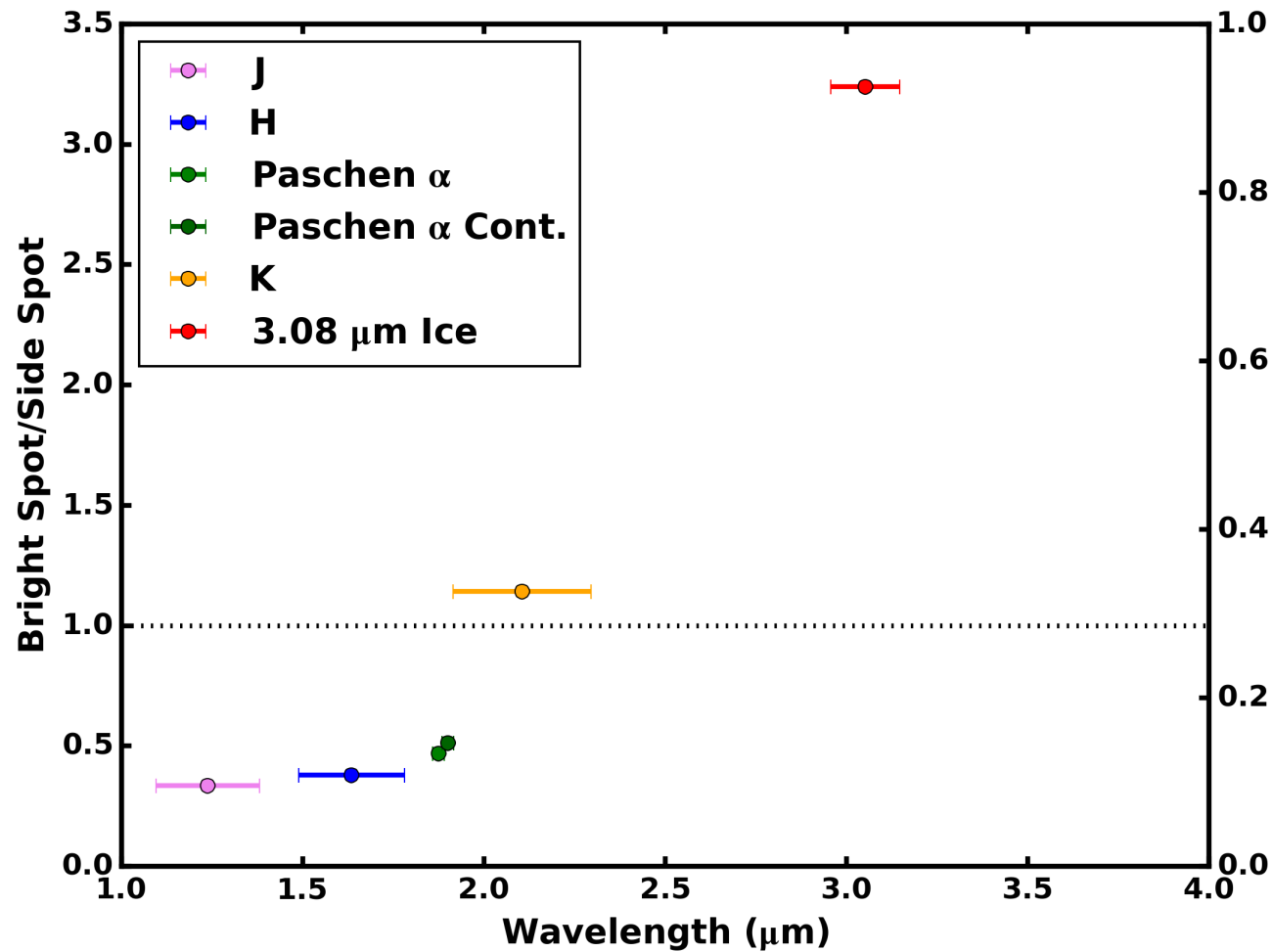


Other Background Oddities





Other Background Oddities





Mitigation



- Find and fix source(s?) of scattered light
 - Visual inspection of grism C - no new information
 - Window being replaced before next flights
- Aluminized tertiary to reduce TA emissivity
 - But would remove the FPI
- Upgrade FLITECAM detector electronics for faster readout capability
 - Significant time and monetary investment, should be coupled with detector upgrade to make sense
- Tub/tube cooling (Nasmyth blower)
 - Lack of funding for completion

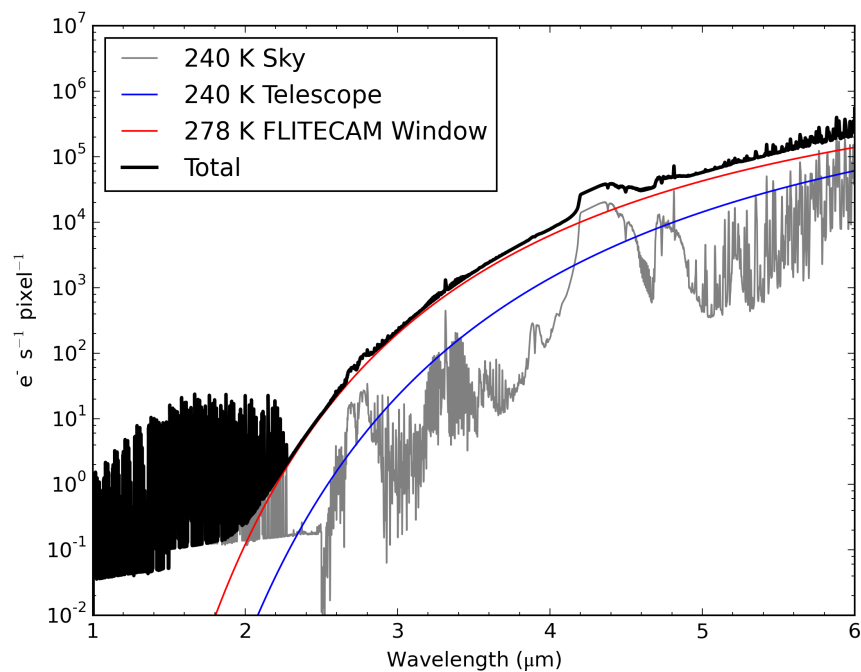




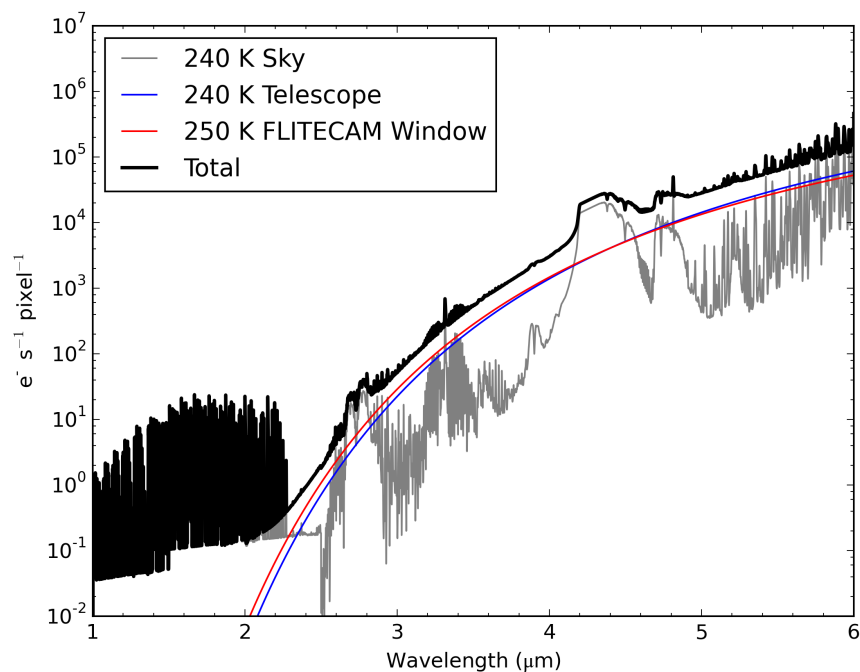
FLITECAM



Current



Cooled

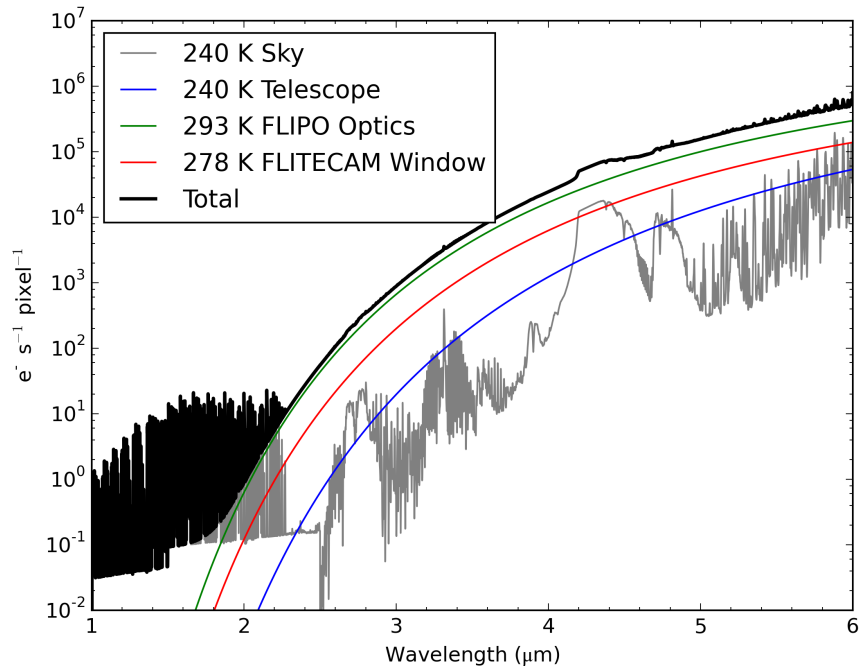




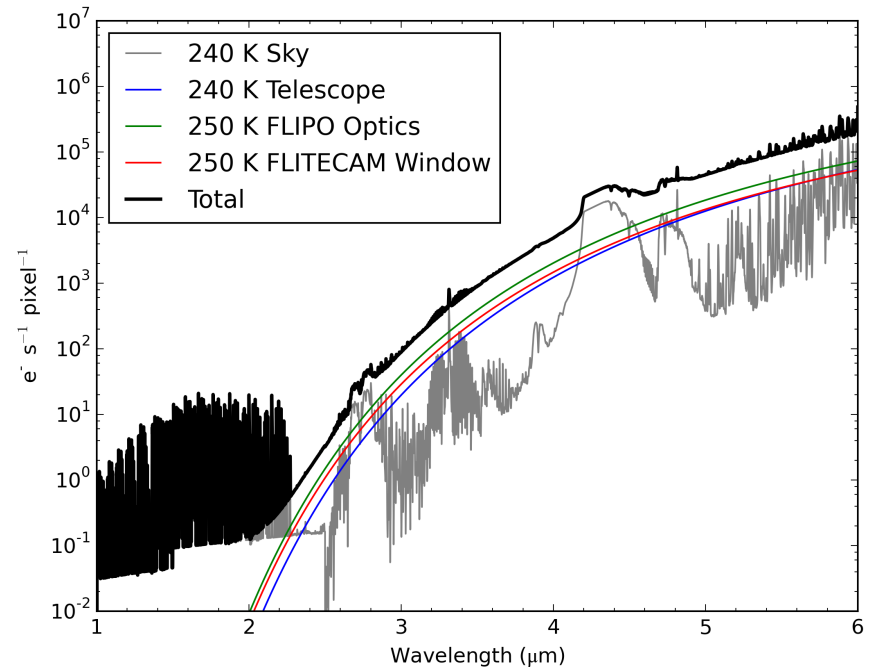
FLIPO



Current



Cooled





Conclusions



- Imaging always going to be dicey
 - Lab tests suggest minimum ITIME can be lower?
 - 0.2 vs. 0.3 seconds full frame will help
 - Requires electronics stability testing
- Small discrepancy between prediction and observations could be window-related?
 - Window being replaced, will reassess
- If FLITECAM flies solo, can assess scattered light and other imaging background artifacts
 - If seen, then know FLIPO optics aren't to blame
 - Window? Tub/tube source? TA source? Just don't know.
- No more to learn without additional flights



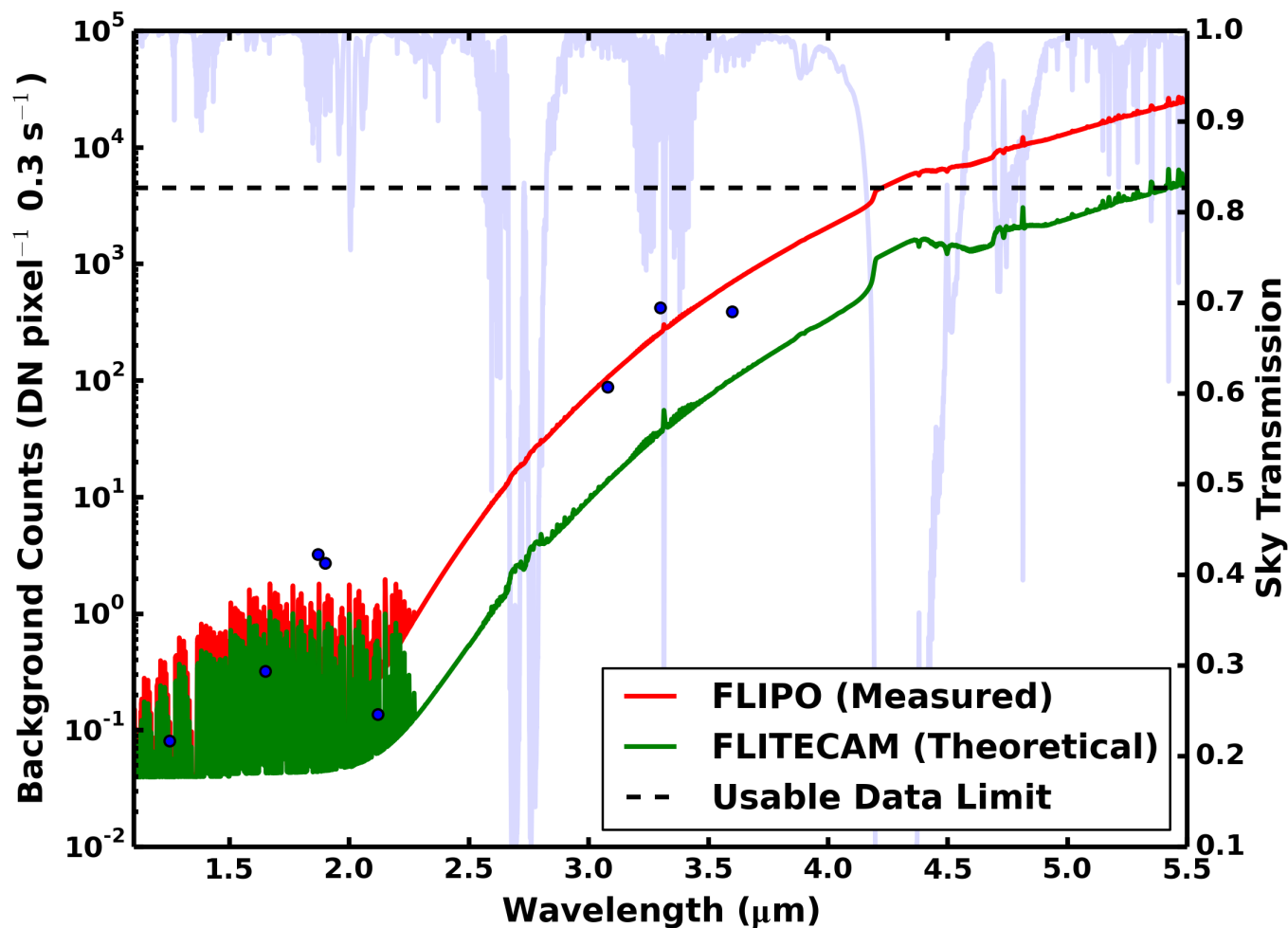


Backup Slides



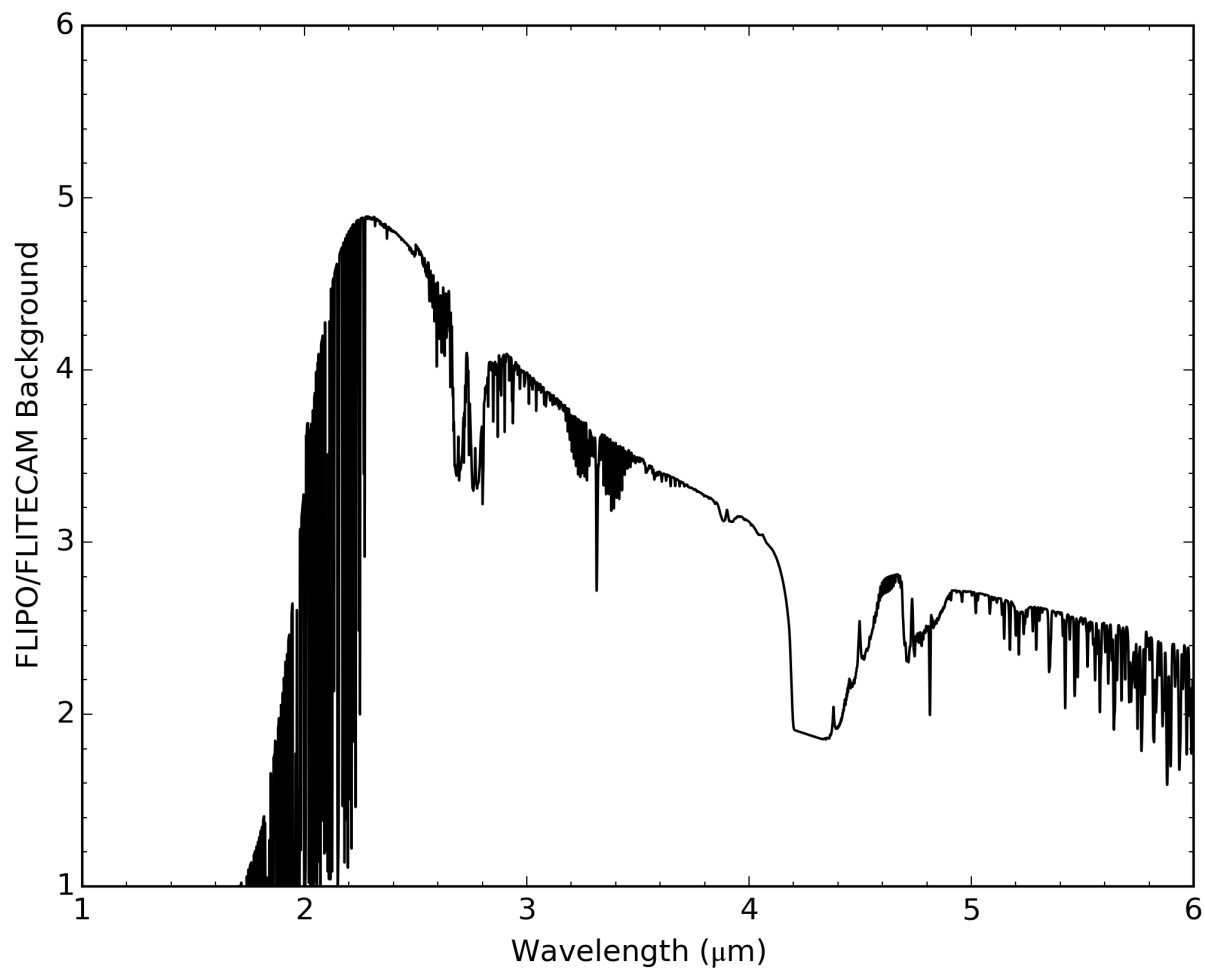


Imaging Backgrounds





FLIPO vs. FLITECAM

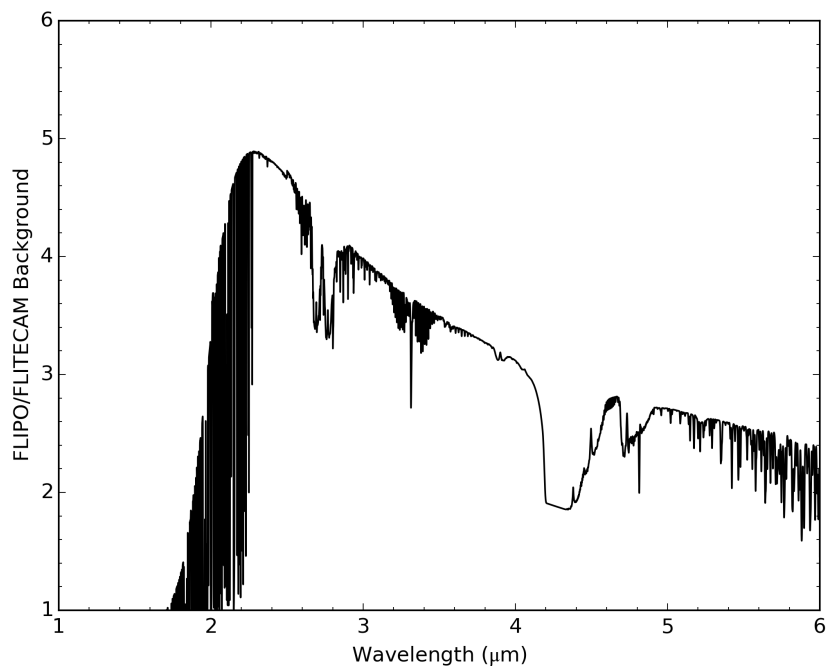




FLIPO/FLITECAM Background



Current



Cooled

