

# Limiting Atmospheric Emission Lines with On-Detector Subarrays

Theodore Grosson<sup>1\*</sup>, Edward Chapin<sup>2</sup>, Tim Hardy<sup>2</sup>, Jordan Lothrop<sup>2</sup>, Alan McConnachie<sup>2,1</sup>, Richard Murowinski<sup>2</sup>

<sup>1</sup>University of Victoria, Victoria, Canada, <sup>2</sup>NRC Herzberg, Victoria, Canada

\*tgrosson@uvic.ca

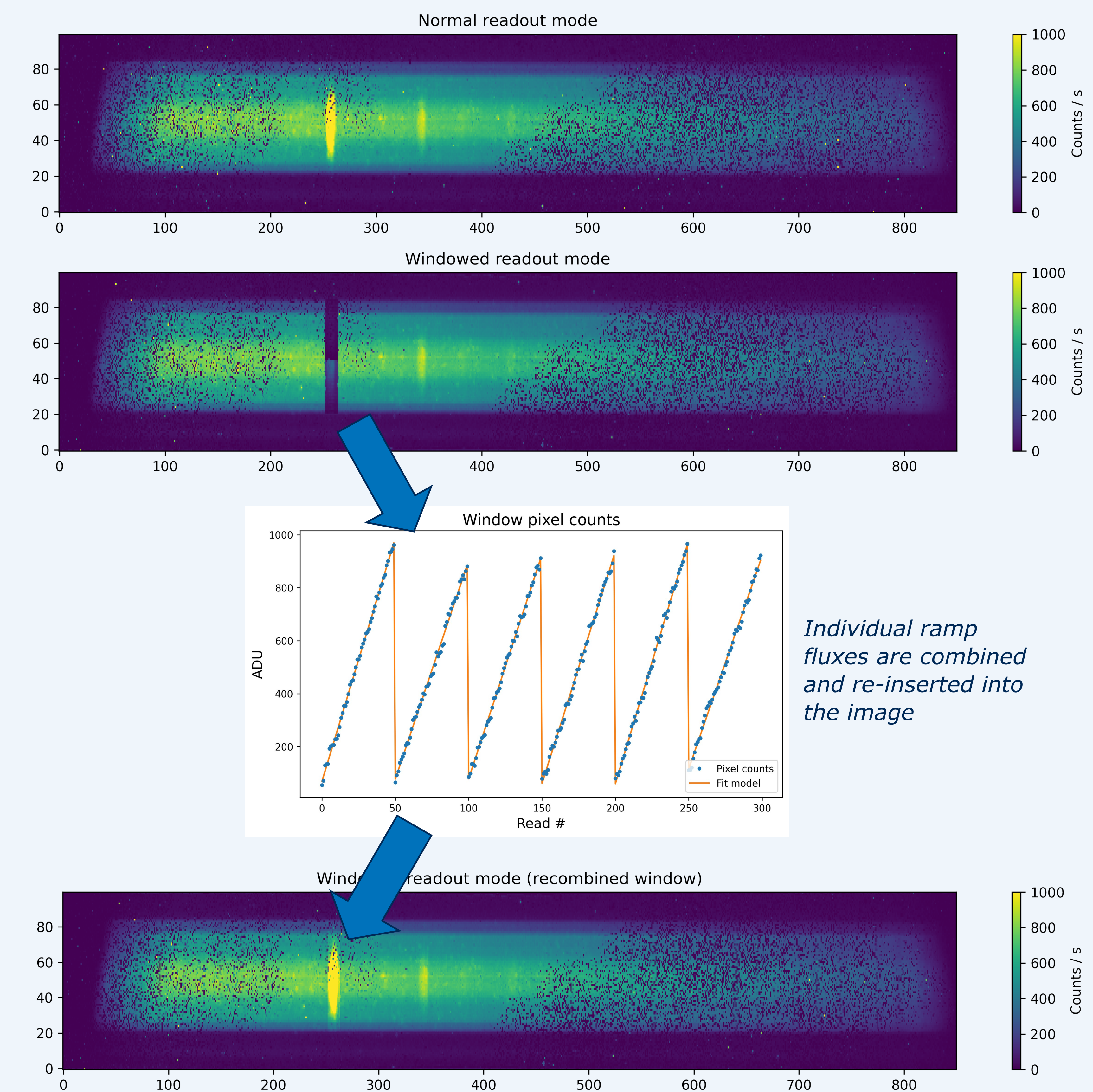


## Summary

We present first results of an on-telescope demonstration of a new technique to suppress bright atmospheric emission lines in near-infrared spectroscopic observations. On large ground-based telescopes, near-infrared spectroscopy is often limited by these lines, which can saturate on the order of minutes. Using a HAWAII-2RG detector on the 1.2-m McKellar Spectrograph at the Dominion Astrophysical Observatory in Victoria, Canada, we reset detector regions which contain bright emission lines before they have the chance to saturate, while the rest of the detector continues integrating. This allows for longer exposures without sacrificing the spectral region surrounding the bright lines.

## Experimental Setup

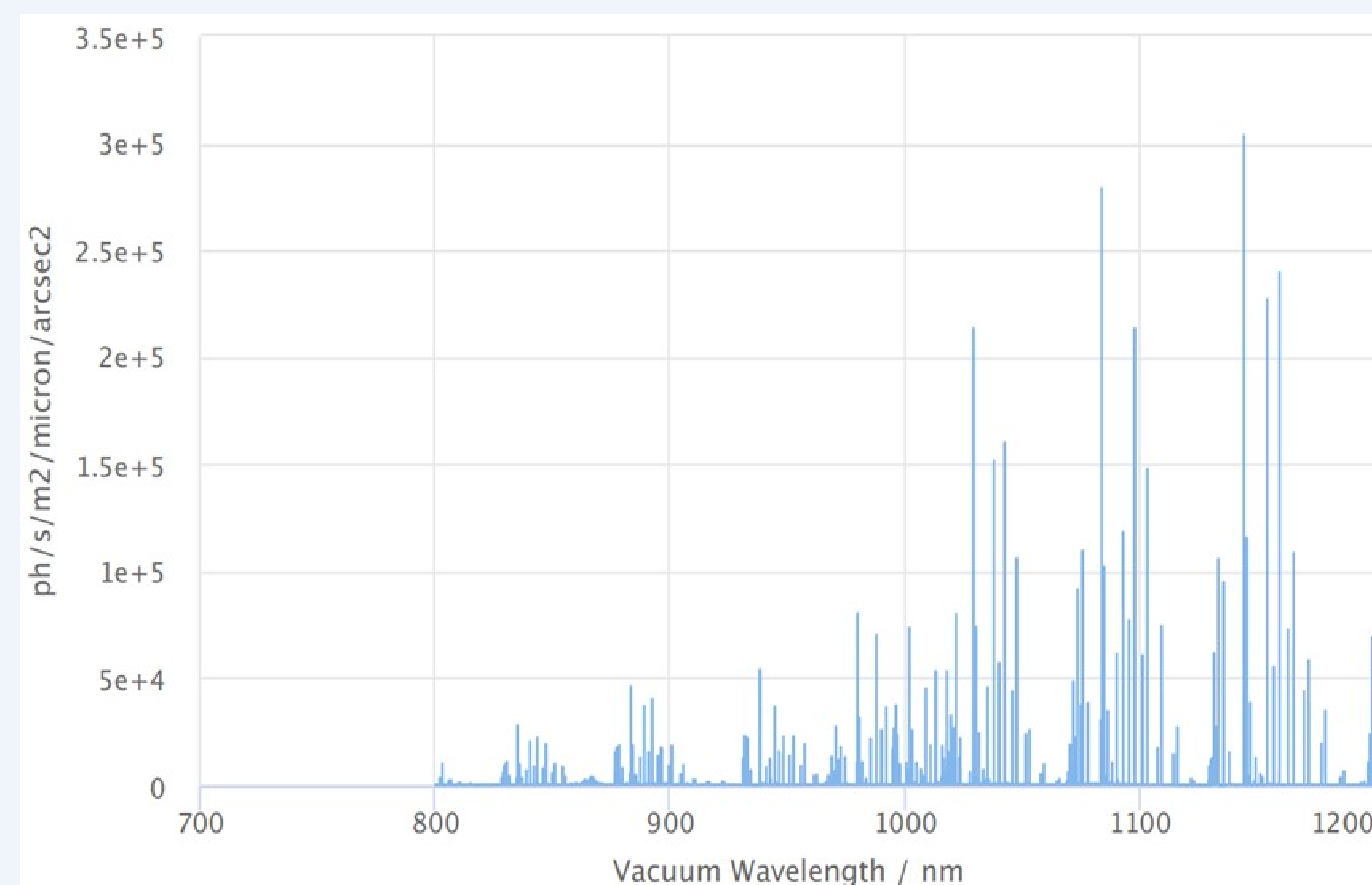
- Lines are faint on 1.2-m telescope in Victoria, so observe Ar arc lines + continuum with H2RG and ARC controller
- Place window over line of interest and reset periodically
- Nondestructive reading means we can recombine the reset lines back into the image
- Theoretically limitless dynamic range!



Detector installed at Dominion Astrophysical Observatory, Victoria

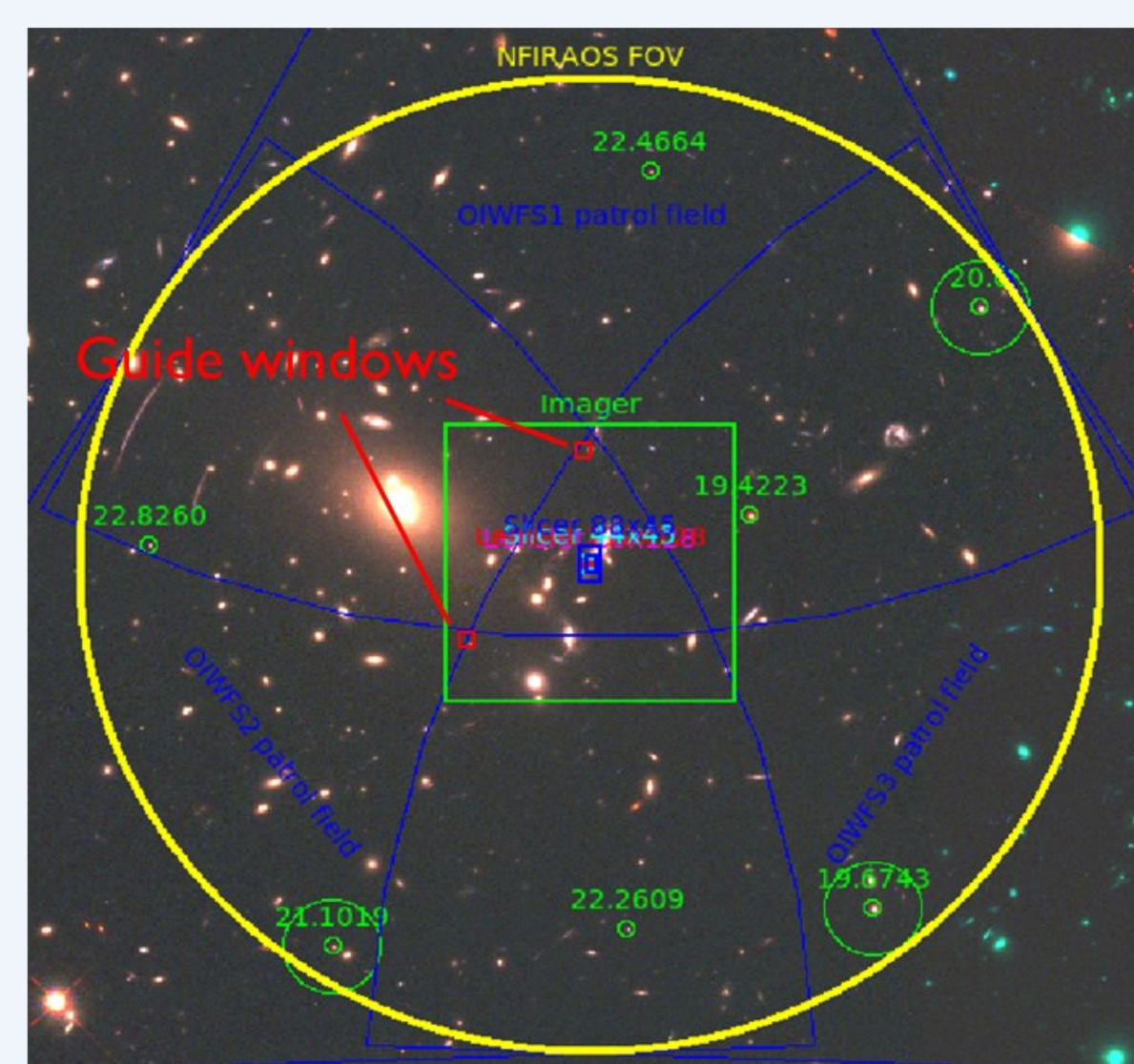


## The Problem



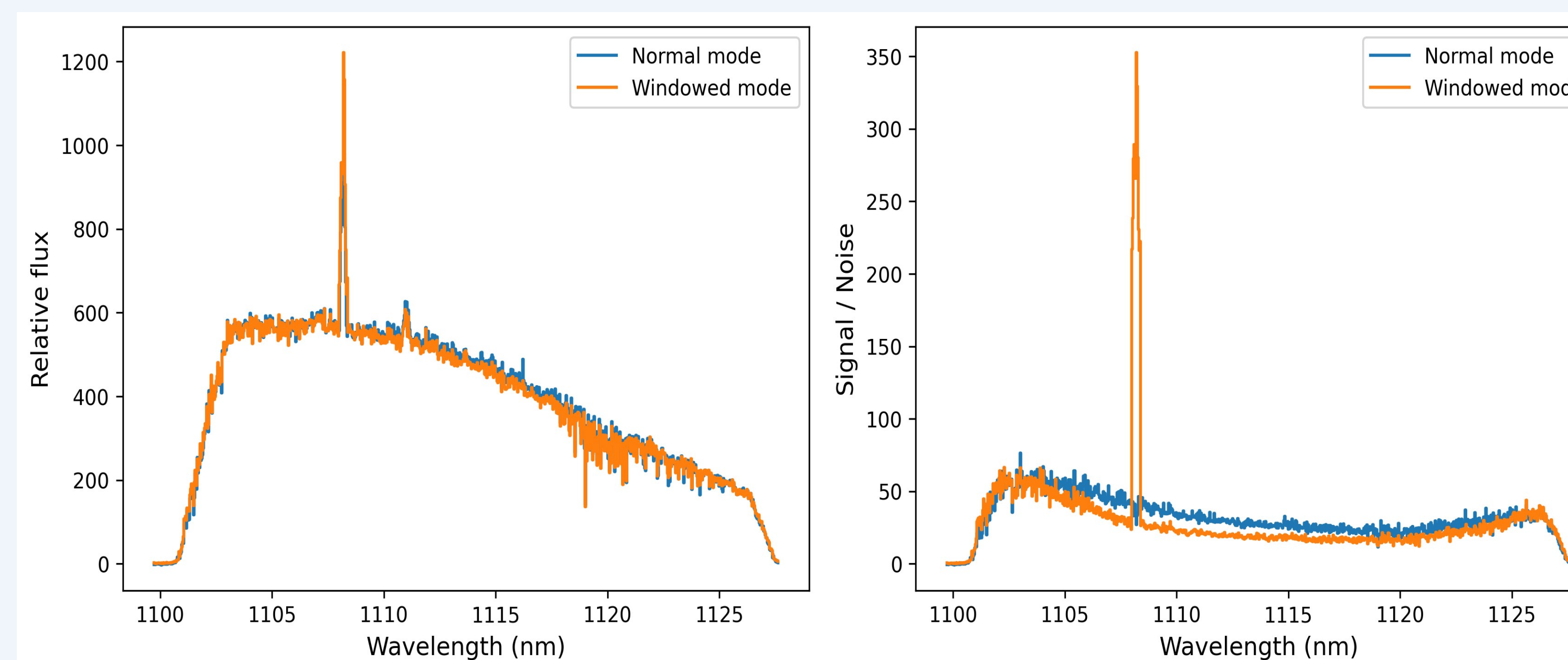
ESO SkyCalc model of OH emission lines

- OH ro-vibrational emission lines can be many times brighter than faint targets — limited exposure time before saturation
- Longer exposure times sacrifice all information around sky lines and risk bleeding, persistence
- Solution: use detector subarrays as developed for e.g. NFIRAOS (TMT) to reset regions containing lines before saturation
- Compare performance with typical readout modes



Use of On-Detector Guide Windows on NFIRAOS

## Preliminary Results



Extracted (column median) spectra and SNR of the two cases above

- Resetting subarrays achieves the goal of preventing saturation in longer exposures
- Inside window, SNR increases due to increased read rate
- Outside window, SNR decreases — due to increased dark current?
- Limited by IR background on 5μm cutoff detector
- Investigating dark current increase, differences in spectra