Real-time Exposure Control and Instrument Operation with the NEID Spectrograph GUI

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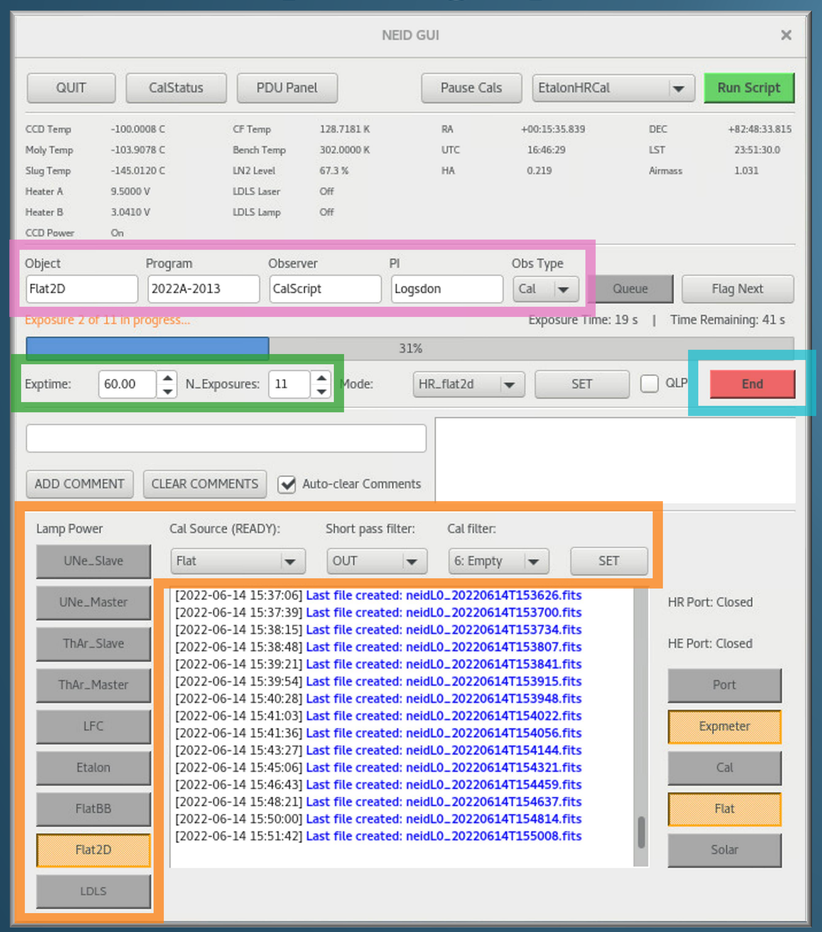
NEID is a high resolution ($R \sim 120{,}000$) optical ($380\ \mathrm{nm} < \lambda < 930\ \mathrm{nm}$) spectrograph on the WIYN 3.5-m telescope at Kitt Peak National Observatory. NEID was designed to achieve sub-m s^{-1} instrumental radial velocity precision to facilitate detection and characterization of low-mass exoplanets. Here, we describe two of the interfaces that are used for typical nightly observations.

Observing with NEID

- **1.** Set the observing parameters (object name, program, observer, PI) to ensure accurate data processing and delivery
- **2.** Configure the calibration bench (light source, turret, neutral density filter) if using simultaneous calibrations
- **3a.** ***Fixed exposure time***: Set the exposure time and number of exposures using the Spectrograph GUI
- **3b.** ***SNR-triggered exposures***: Set the SNR threshold, number of exposures, max exposure time, and trigger options using the Exposure Control GUI
- **4.** Start the observing sequence! Monitor your progress using the inset plots and progress bars.

Use the Queue button to configure these settings automatically!

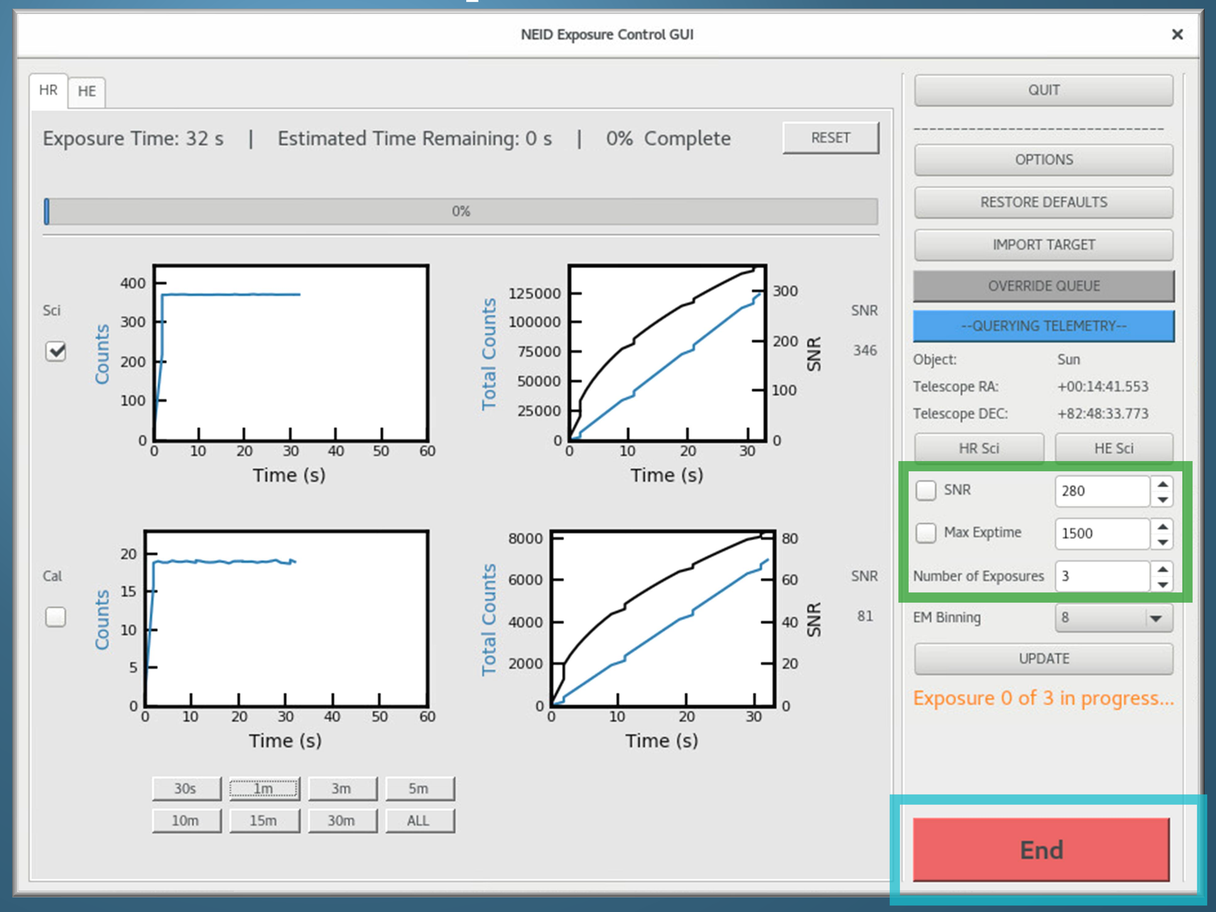
NEID Spectrograph GUI

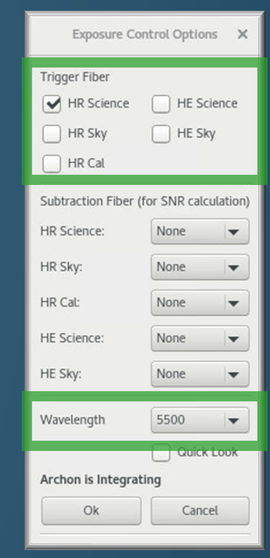


The NEID GUIs are integrated into the instrument control software[1], facilitating easy communication and interaction with other instrument subsystems

Access to the nightly observing queue allows observers to automatically configure observation parameters, improving efficiency and reliability and enforcing consistency across epochs

NEID Exposure Control GUI





Inset plots constantly update with data queried from the NEID exposure meter, allowing observers to monitor the progress of exposures and rapidly react to guiding failures, changing observing conditions, and other emergent issues.

The SNR-triggered observing mode allows users to (a) reliably achieve specified photon noise precision thresholds and (b) minimize flux variations for observations with multiple epochs, reducing the impact of charge transfer inefficiency on radial velocity precision

With data from NEID's chromatic exposure meter, we can measure the flux-weighted midpoint of each exposure at the level necessary for precise barycentric radial velocity corrections

NEID observations also rely on several other GUIs, which facilitate target acquisition and guiding as well as communication with the NEID port adapter and the WIYN telescope

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