

Survey Spectroscopy in the Large Plasma Device (LAPD)

Authors: Kian Orr¹, Phil Travis¹, Troy Carter¹

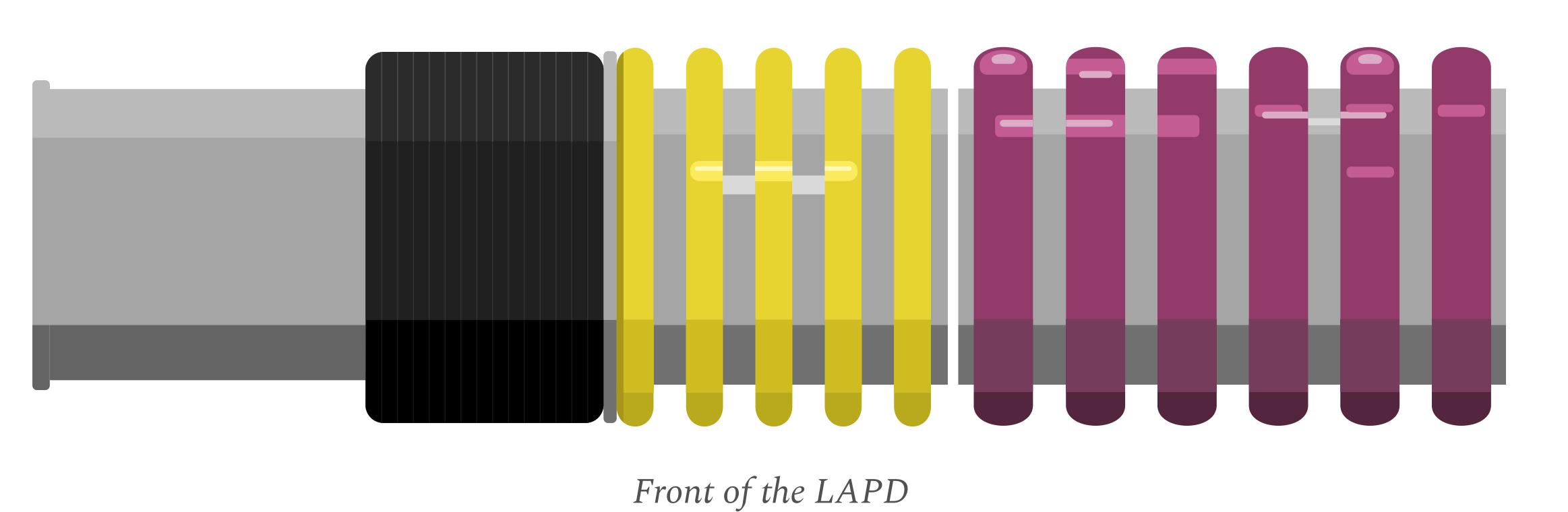
¹University of California, Los Angeles





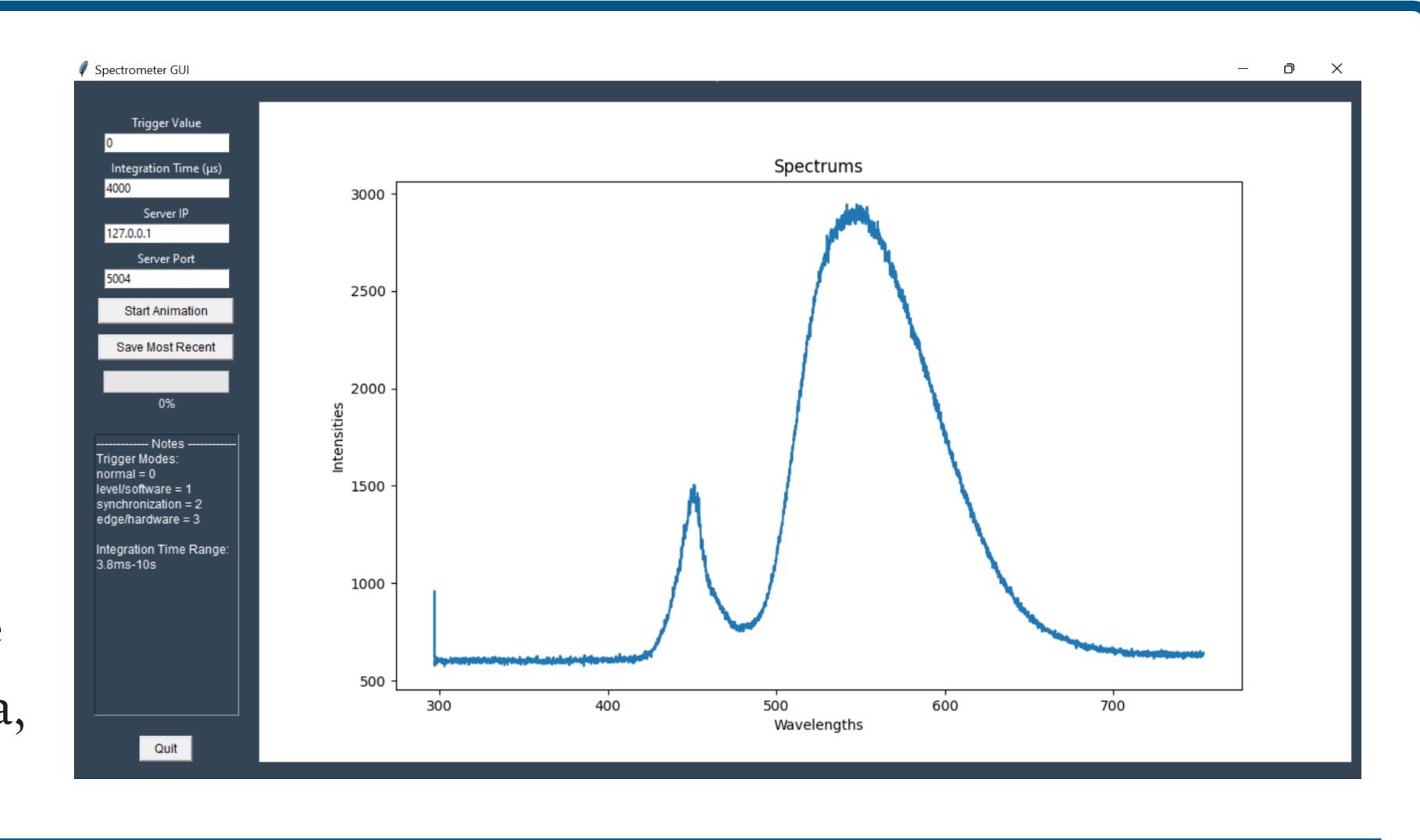
Summary

- Initial implementation of a survey spectrometer (with a range of 300 to 700 nm) on the LAPD -- a 20 meter long device used to study basic plasmas
- Created a **graphical user interface** compatible with an OceanInsight survey spectrometer (**box 2**)
- Identification of species within the LAPD, including carbon, nitrogen and hydrogen impurities (boxes 3 and 4)
- Implemented ColRadPy, a **collisional radiative solver**, to produce synthetic spectra for identification of and comparison to observed spectra (**box 5**)
 - Only requires an electron density and temperature
 - Provides the ability to comfirm temperatures by comparing line ratios of the same species



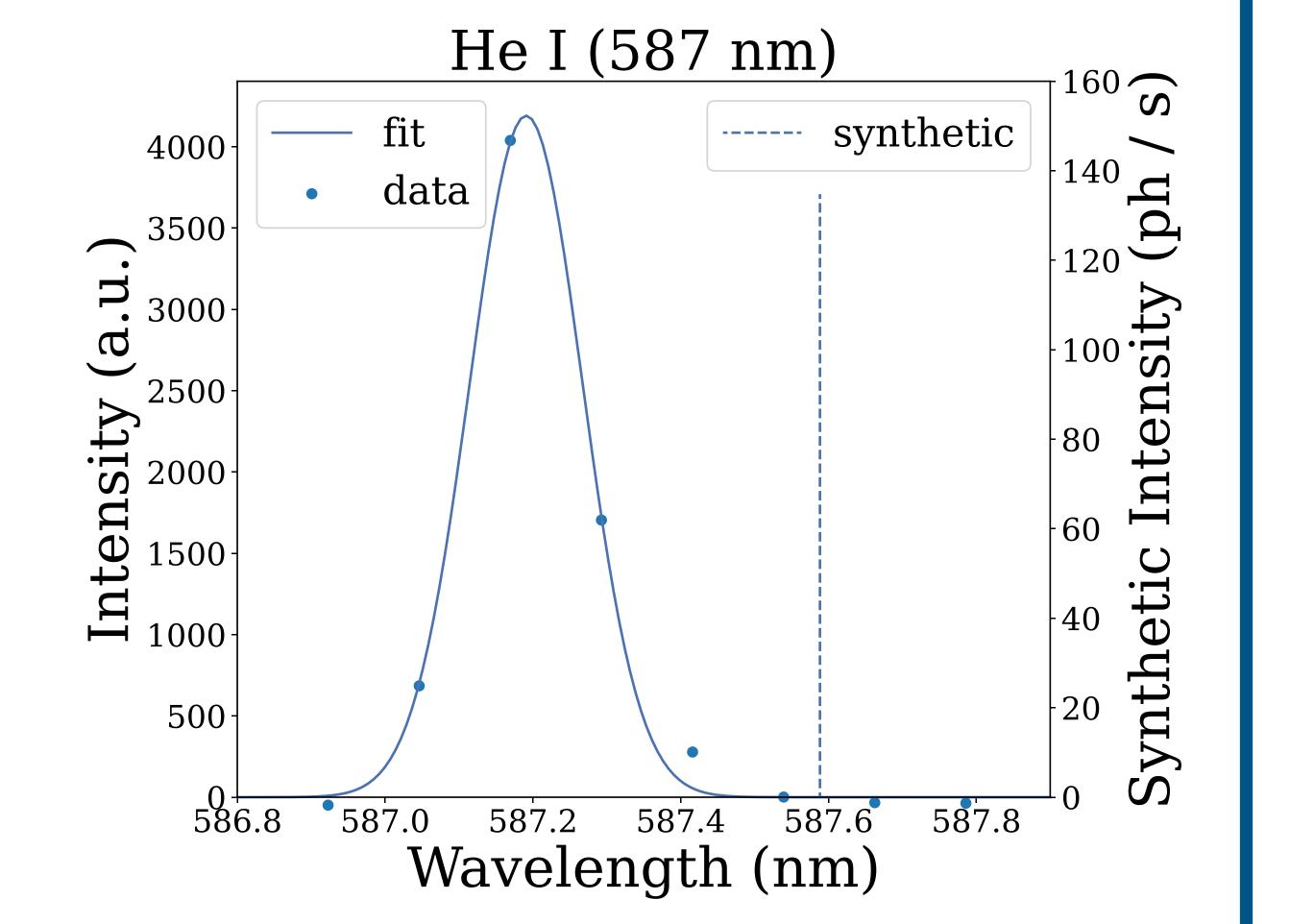
Development of a Graphical User Interface (GUI) for the Spectrometer

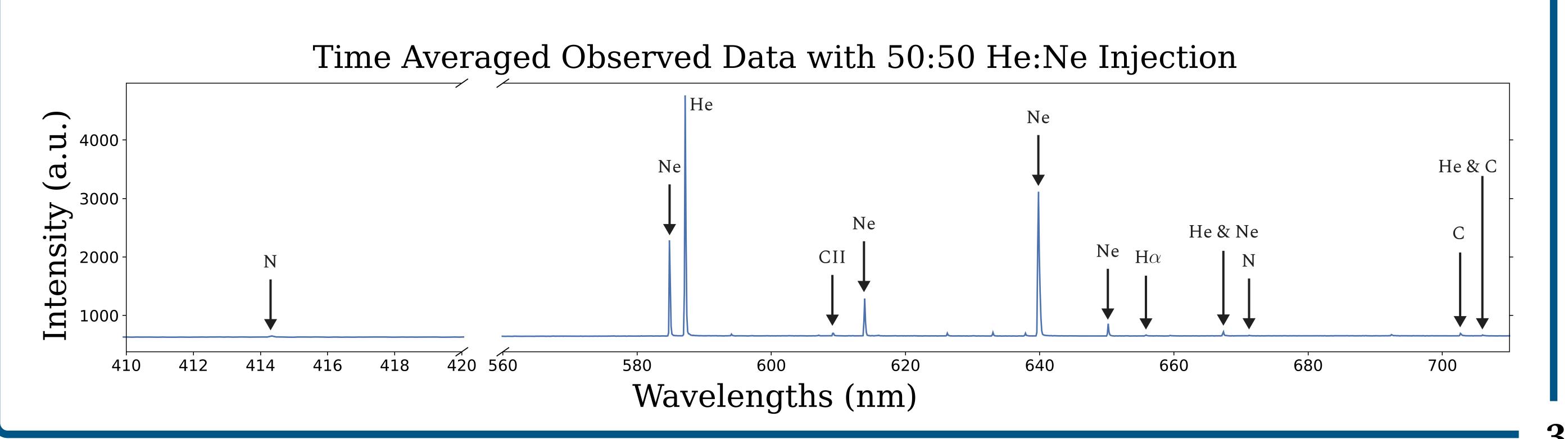
- GUI that communicates
 between the machine and
 control rooms, while
 displaying incoming data
- Ability to live update inputs like trigger mode and integration time
- Uses SeaBreeze to collect the data, a server to send the data, and Tkinter for the GUI



Overview of Line Identification within the LAPD

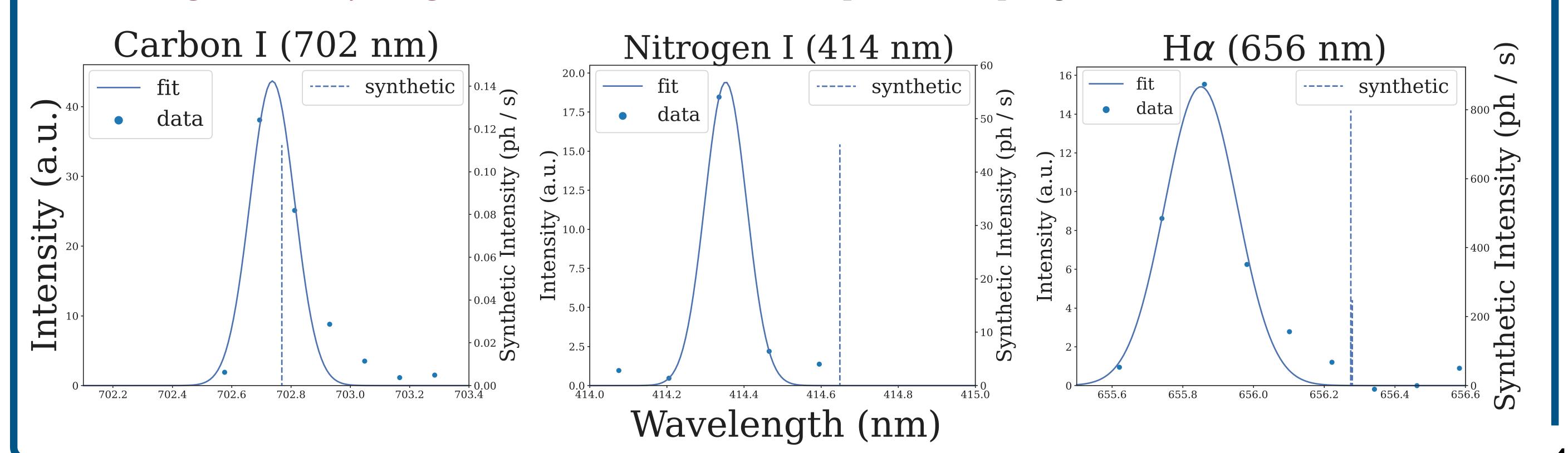
- Lack of calibration results in an offset for some wavelengths
- The inputted density for ColRadPy is from interferometry measurements
- Identifying lines allows for tracking of expected species, like helium, and unwanted impurities
- Impurities contaminate the plasma, introducing a factor that is not controlled



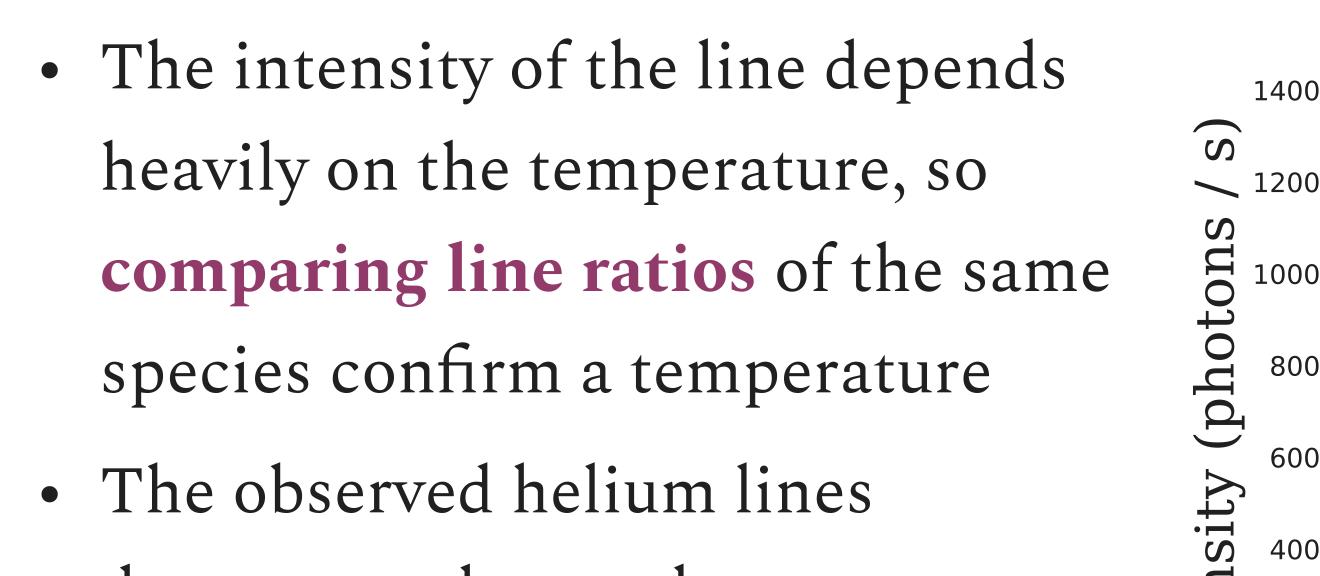


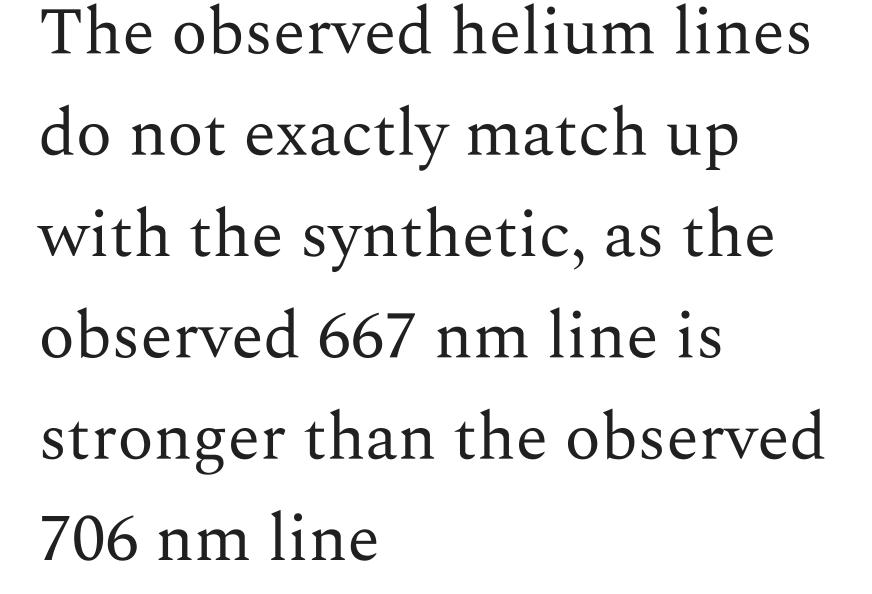
Detection of Impurities (Carbon, Nitrogen and Hydrogen)

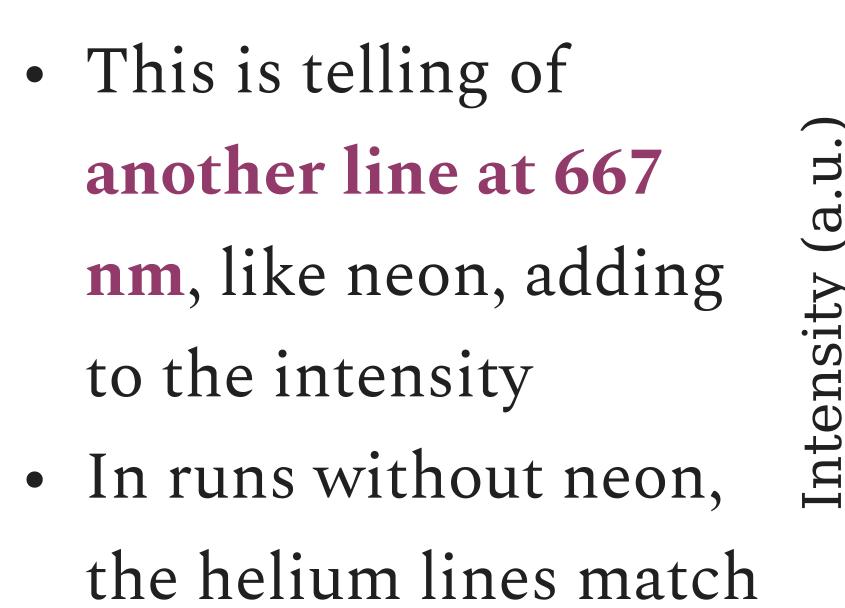
- Possible impurities within the LAPD include carbon, nitrogen and hydrogen
- A LaB6 plasma source with a graphite heater, along with the walls of LAPD, create a source of carbon
- Nitrogen and hydrogen come from the atmosphere seeping into the machine

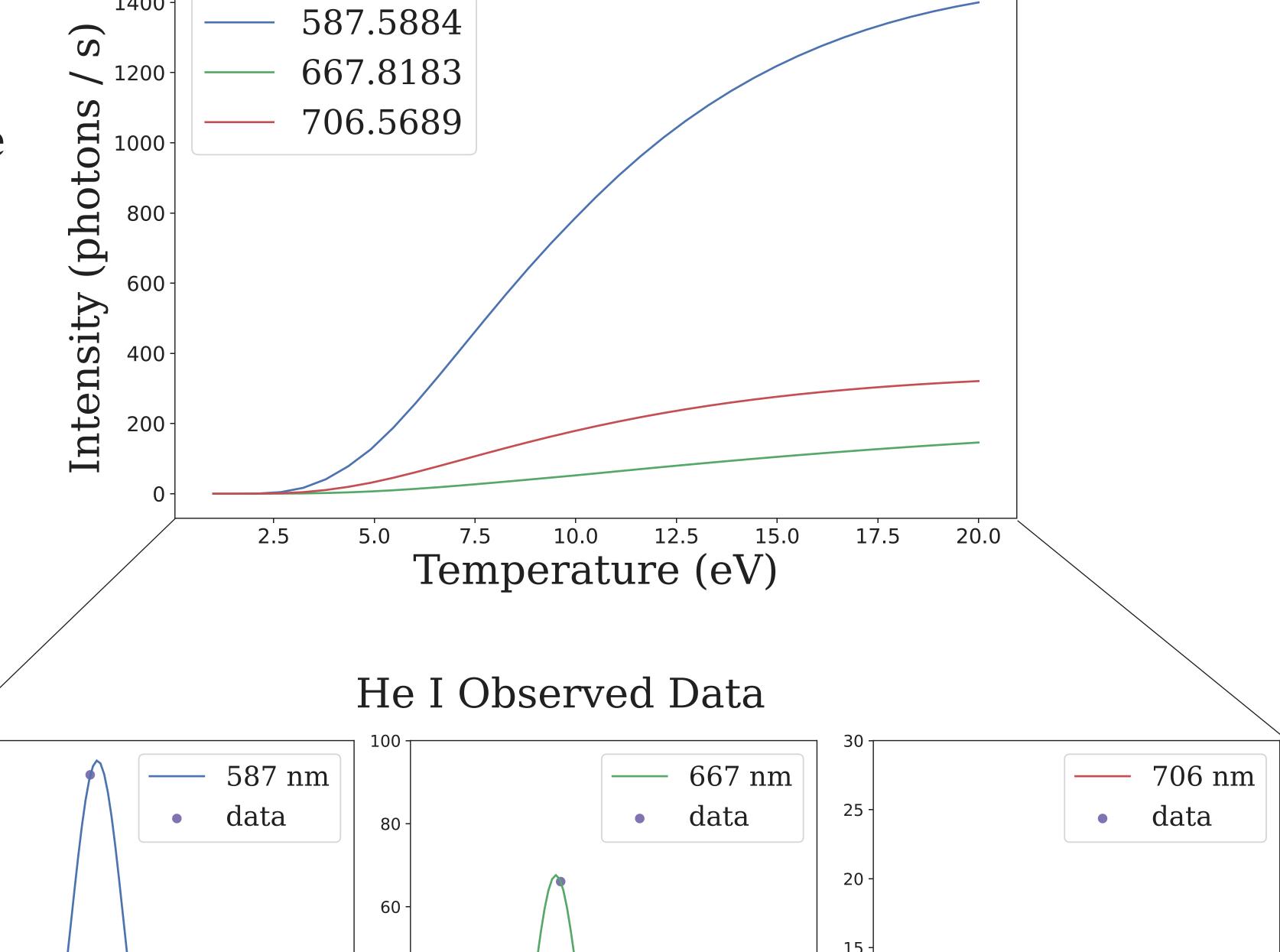


Synthetic Spectra and Observed Data Comparison

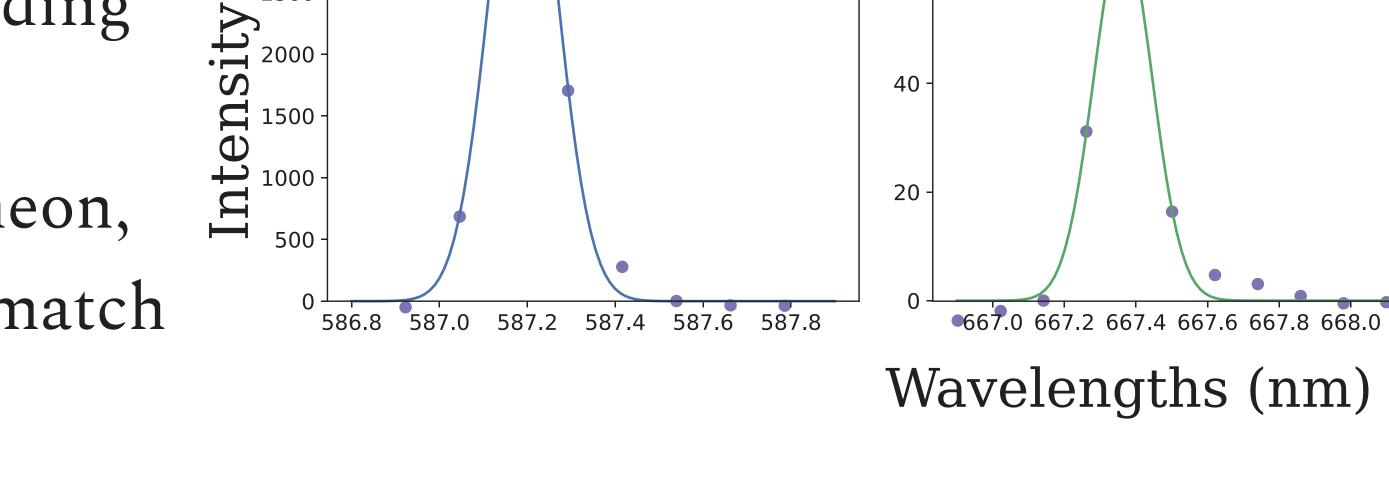








Affect of Temperature on Synthetic He I



Discussion and Future Work

Discussion

- This research provided a proof of concept, displaying the advantages of survey spectroscopy within the LAPD
- ColRadPy is a useful tool to model relative intensities between different lines emitted by the same species

Possible Future Work

- Line ratios as a method to determine density and temperature from observed lines
- Implementation of multiple views along the machine to understand the spatial evolution
- Machine learning classification algorithm to determine lines

5

6