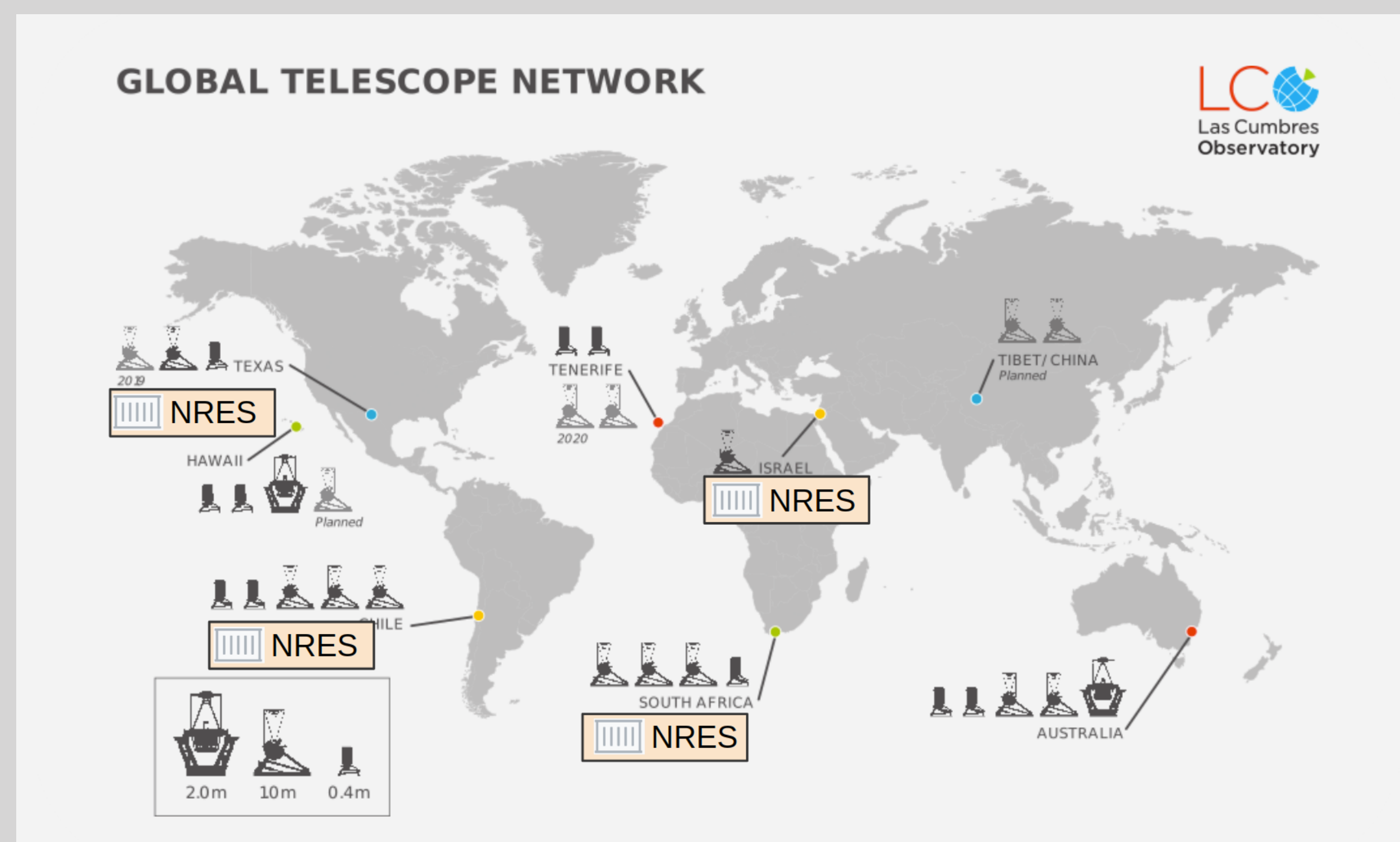
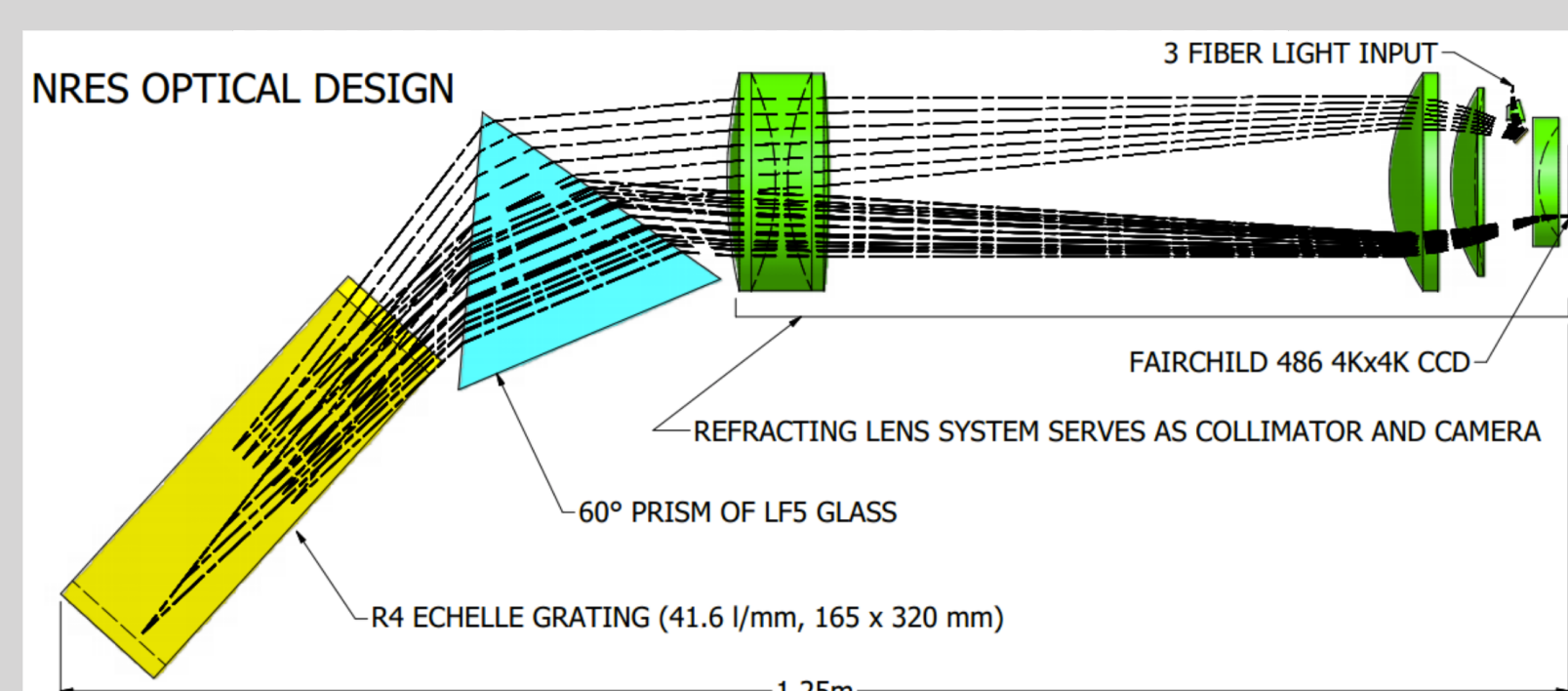


Four Robotic Echelle Spectrographs

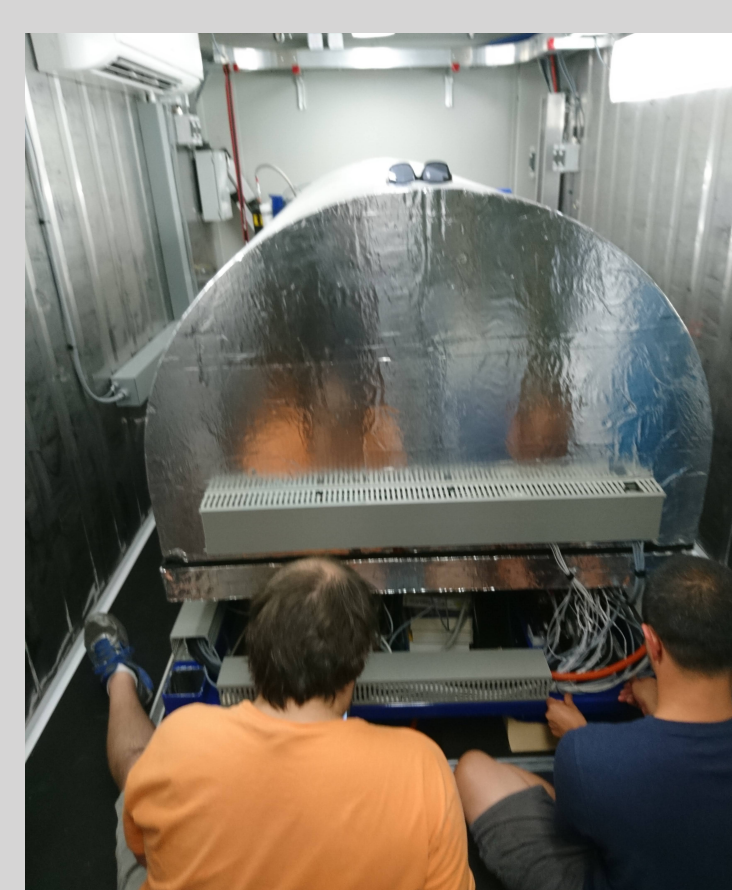
- Observatory Network:
- LCO operates a network of more than 20 robotically controlled 2m, 1m, and 0.4m telescopes.
- NRES is operating at four sites, fed by 1 meter telescopes.



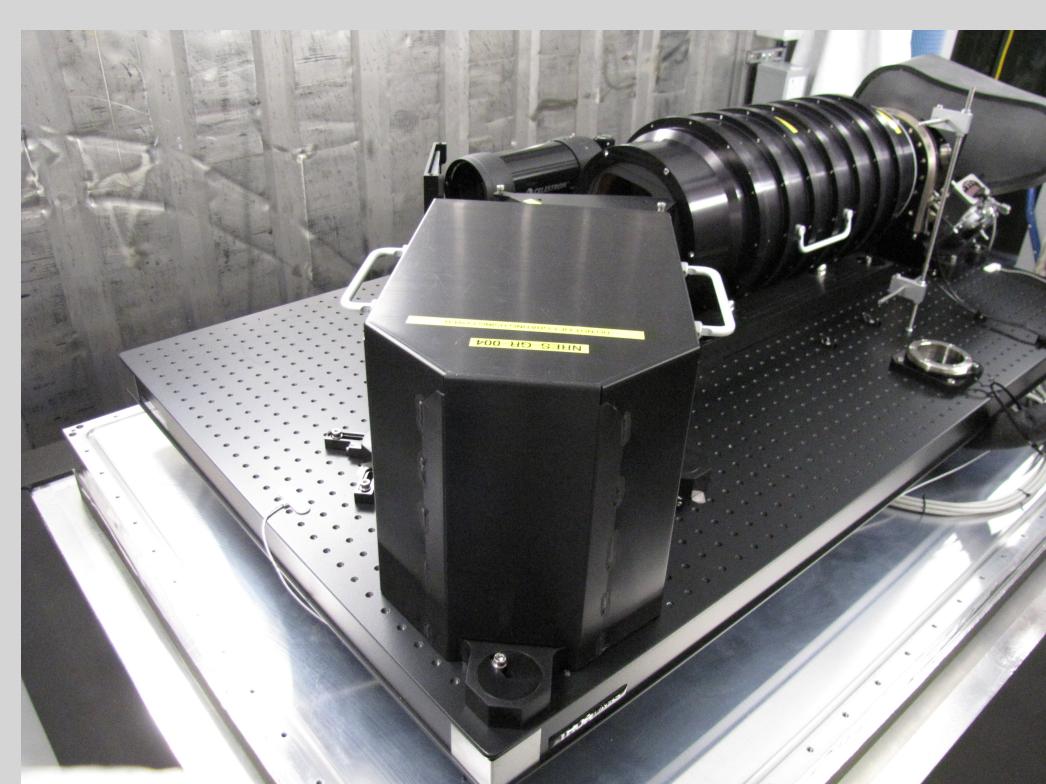
- NRES is **designed as a radial velocity machine**:
- Design goal of 3m/s accuracy.
- Fiber-fed spectrograph, $R \sim 50,000$, 380-870nm.
- Pressure & temperature stabilized design.
- 2 science input fibers, 1 simultaneous ThAr calibration input.
- **Robotic operations**:
- Scheduler dispatches observations to site.
- No human supervision of operations.
- Target acquisition based on scenery comprehension.
- Automatic **pipeline processing**.
- CCD processing, tracing, extraction & wavelength calibration.
- Cross-correlation with template spectra.
- Area of active development.



Optical Design



Spectrograph in thermal enclosure

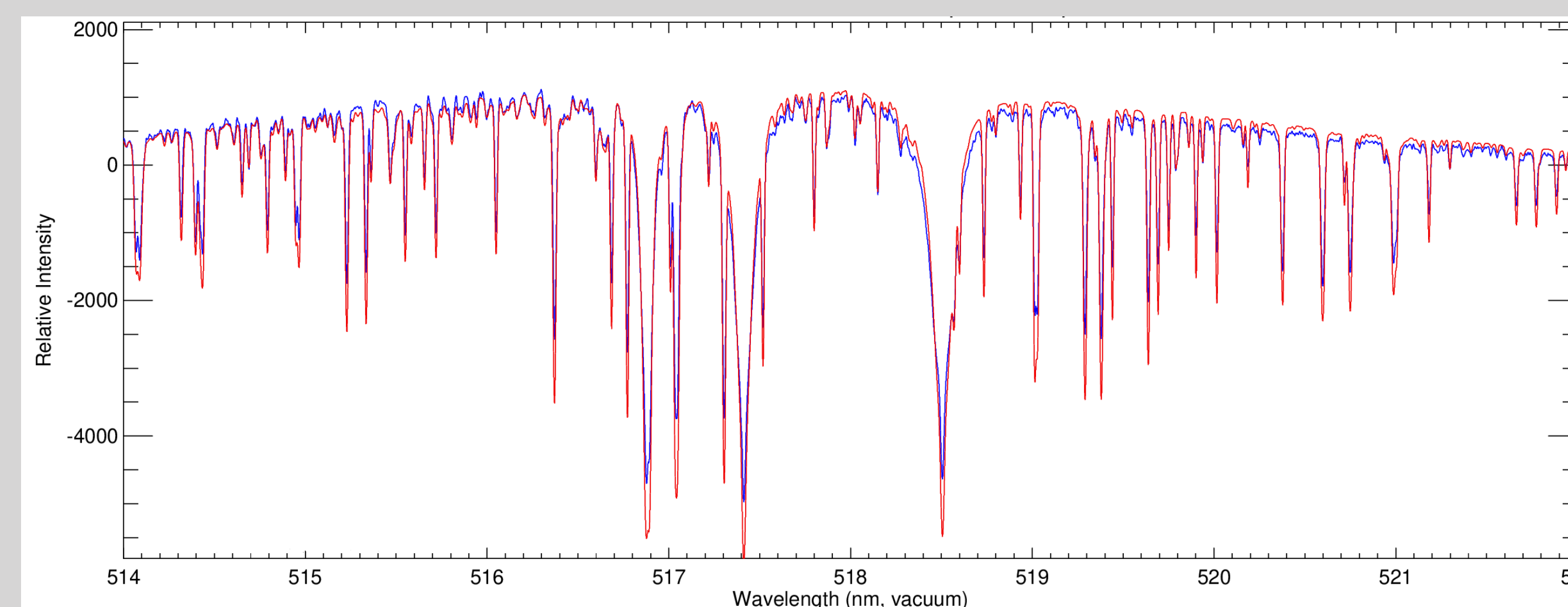


Assembled Spectrograph

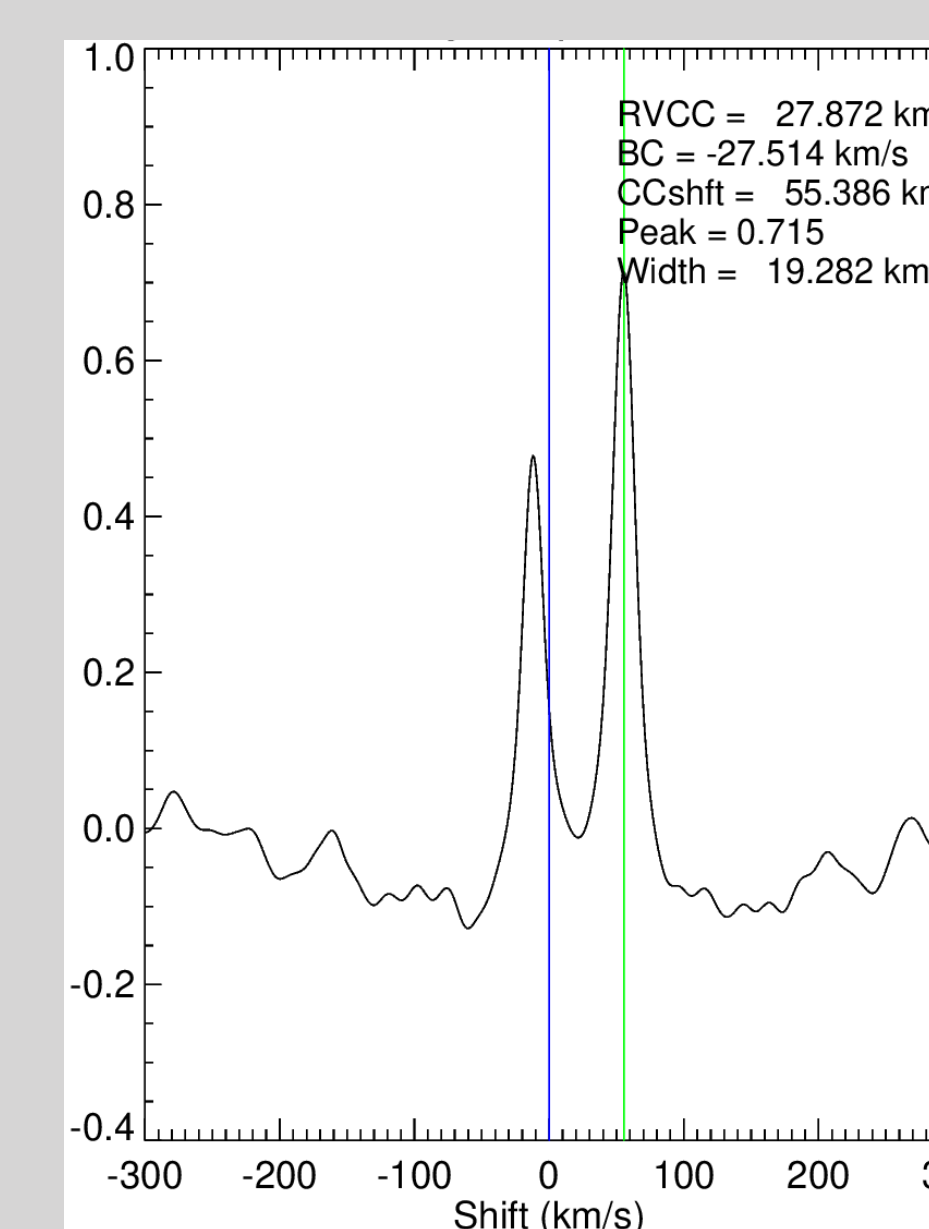
Current Results:

- Spectral classification of LCO's automatic data reduction pipeline delivers consistent results with e. g. GAIA DR2:

Extracted and wavelength calibrated NRES spectrum for HD126053 (blue line). Red line shows the best fit template spectra with $T_{\text{eff}}=5500$ K and $\log g$ of 4.0, GAIA DR2 gives an effective temperature for this star of 5715 K.

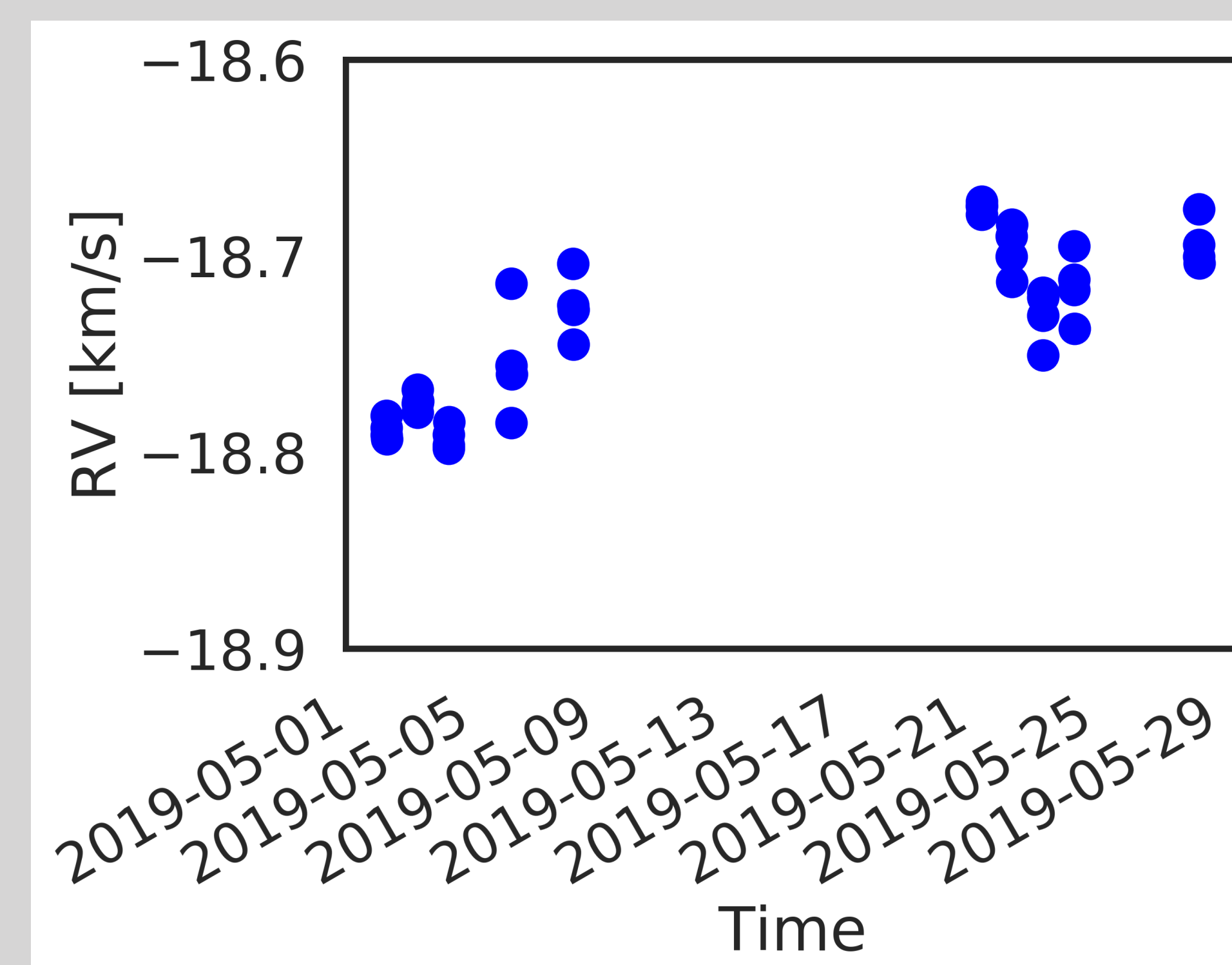


- RV obtained by cross-correlating the observed NRES spectra with templates, resulting CCF can give additional information:



Double peaked CCF, indicative of a double-lined binary. Green line indicates the shift of the highest peak in the CCF with respect to the template at rest.

- Internal RV accuracy from a single site < 50 m/s over several weeks.
- RV accuracy < 10m/s for single nights.
- Accuracy probably pipeline limited, work in progress.
- Working on site to site consistency.



RVs for HD126053 over a month from a single site (lsc). The RV standard deviation is 0.041 km/s.