A tunable Fabry-Perot wavelength calibrator

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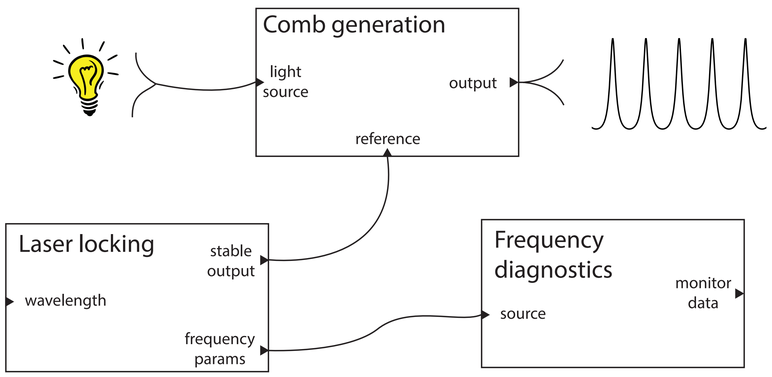
The Approach

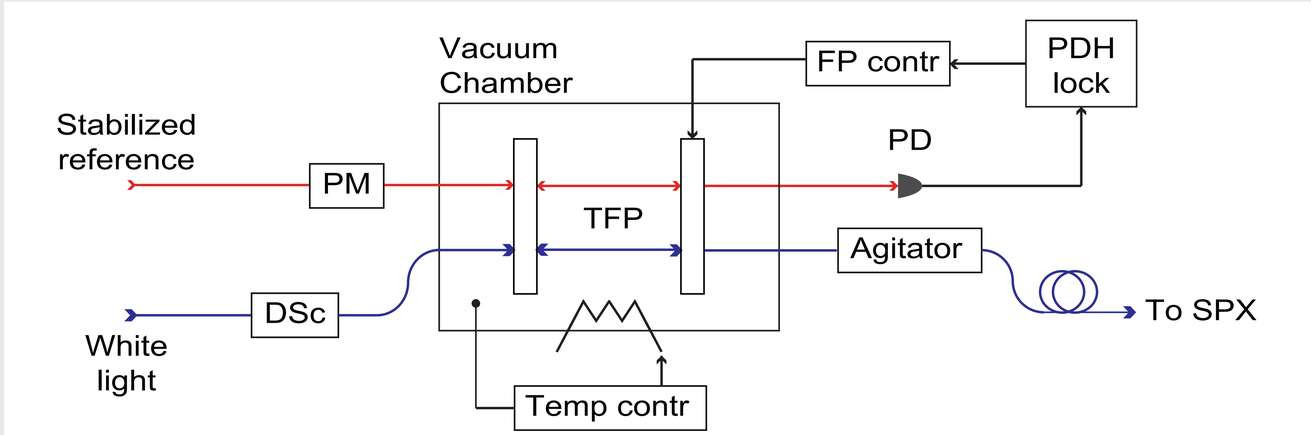
Motivation - A simple and cost effective wavelength calibrator for extreme precision RV spectrographs.
Top-level requirement - 5 cm/s line stability on a night-to-night basis for a 380-700 nm bandpass.
Top-level goal - 1 cm/s night-to-night line stability for a 380-700 nm bandpass.
Solution - Filter white light and actively lock a tunable Fabry-Perot (TFP) to a reference source. The TFP should have a finesse of 150 and free spectral range of 20 GHz to meet the requirements.

The Setup



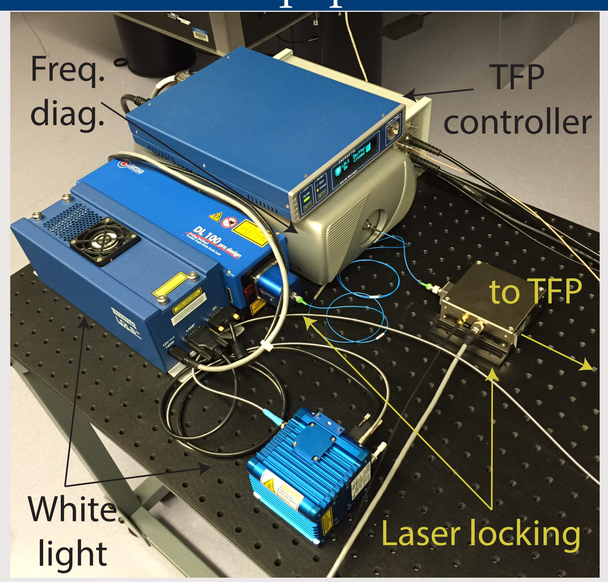
Comb generation - Filters white light with the TFP to produce a filtered calibration comb. A stabilized reference source is simultaneously filtered and used to lock the TFP, transferring the reference source stability to the filtered comb. The lock precision and reference source stability determine the calibration source stability.
Laser locking - Generates a stabilized reference to lock the TFP. We have chosen to lock a tunable laser to an Iodine hyperfine transition using the Pound-Drever-Hall (PDH) technique.
Diagnostics - Monitor stabilized source to alert user in case of locking error. Provide initial calibration for lock.

The TFP Design



PM -Polarization maintaining fiber couples reference source to TFP.
DSc - Optical doubler scrambler to provide even illumination of TFP for filtering.
Temp contr - Stabilizes temperature of the vacuum chamber.
TFP - Housed in vacuum and temperature controlled to prevent changes in dispersion.
FP contr - TFP controller for active stabilization based on the PDH lock error signal.
PDH lock - Pound-Drever-Hall locking scheme provides error signal to FP contr.
PD - Photodiode that senses frequency modulated reference source transmitted through TFP.
Agitator - Fiber agitator for temporal scrambling of the calibrator before coupling to the spectrograph.

The Equipment



The Specifications

Parameter	*Requirement*
Calibration line separation	5-10 pixels
Calibration line FWHM	<1 pixel
Peak intensity range	3dB
Line stability	5 cm/s
Laser stability	3 mm/s
Integration time	<30 seconds

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