

LASER INTERFEROMETER GRAVITATIONAL WAVE OBSERVATORY
- LIGO -
CALIFORNIA INSTITUTE OF TECHNOLOGY
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Fiber Noise Cancellation scheme

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A pickoff from the stable PSL light with frequency f_0 double passes AOM1, driven at a frequency $f_1/2$. The light then travels to the fiber, gaining some noise n . It is then frequency doubled. Assuming the feedback loop sets $f_1 = n$ and there are no additional noise sources, the output light is given by $f_0 + n'$, where n' is noise caused by the frequency doubling process (Figure 1).

A pickoff from the beam after the fiber double passes through AOM2 and is shifted by a fixed frequency f_2 . The light is reflected back into the fiber, again adding noise n , to give a frequency of $f_0 + 2n - f_1 + 2f_2$. The signal is detected by an RF photodetector and demodulated at $2f_2$, frequency divided by 2, demodulated at $f_1/2$, and frequency divided by 2 again to give an $n/2$ signal. It is low pass filtered, and the resulting signal drives the VCO for AOM1 to compensate for the fiber noise n at low frequencies.

how the GPS will help.

The noise df_2 introduced by AOM2 will be directly present in the outout of the fiber (Figure 2).

- Electronics
 - RF frequency doubler and divider have phase noise floors of -178 dBc/Hz and -165 dBc/Hz, respectively.
- Phase matching - the signals that are being demodulated have to have the same phase.

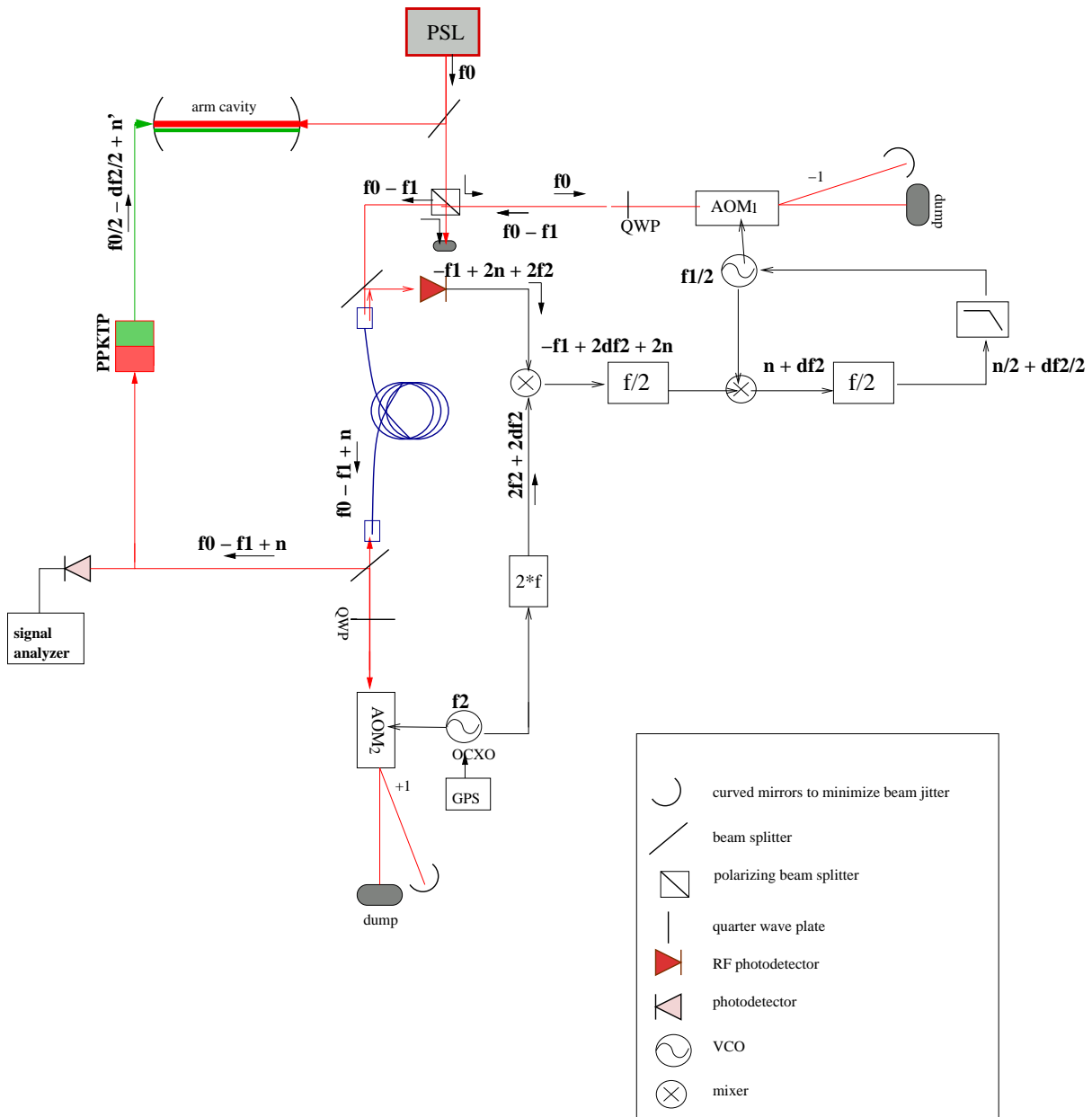


Figure 2: Auxiliary Lock System with a bit of noise