

Tilt Locking for laser stabilization

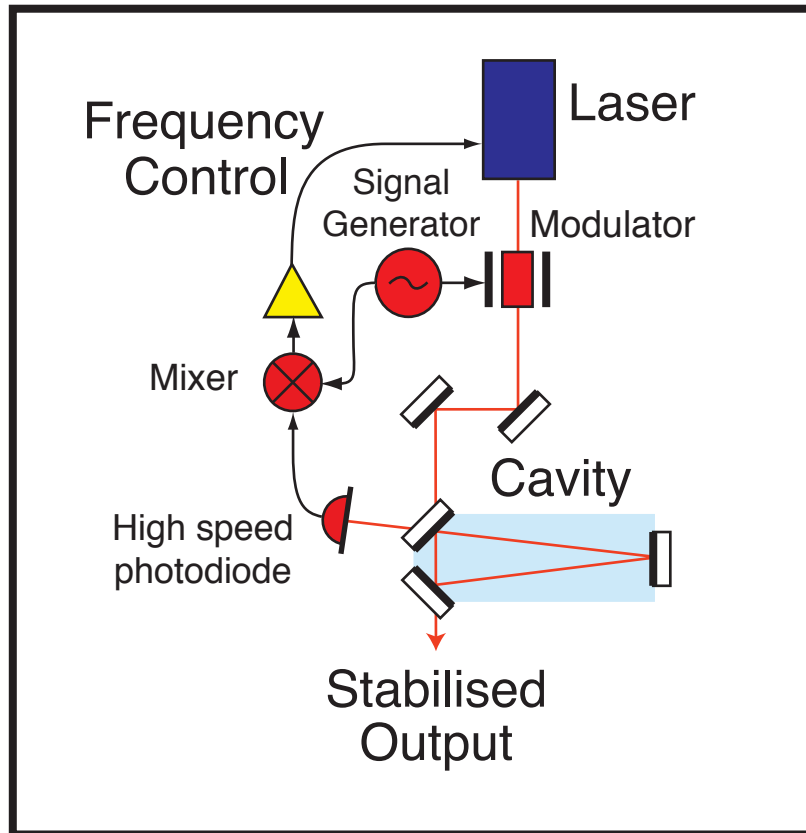
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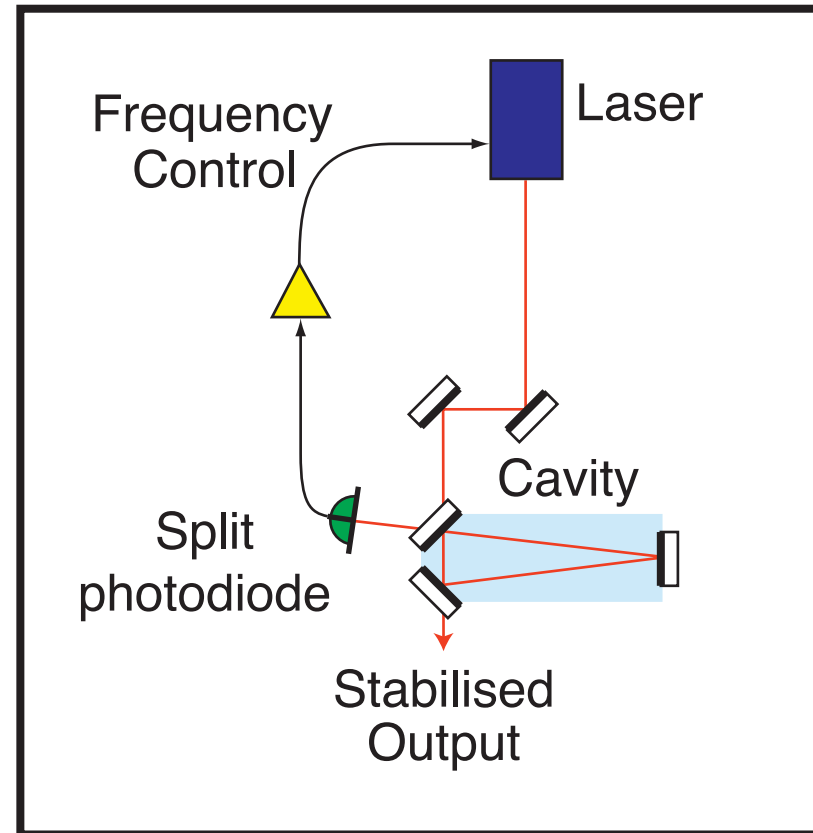
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Tilt Locking is a modulation free, high sensitivity technique for providing an error signal for locking a laser to a Fabry-Perot cavity resonance.

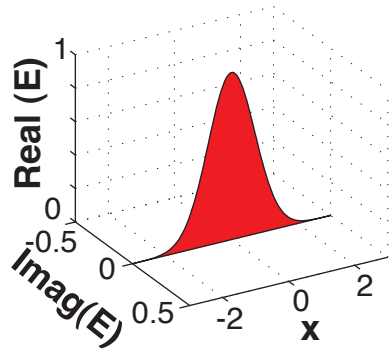
PDH Locking



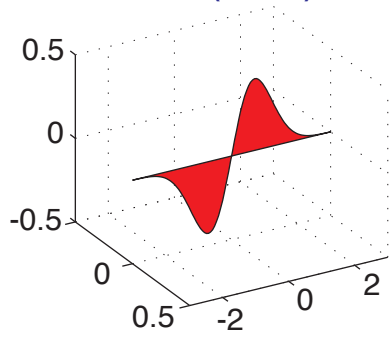
Tilt Locking



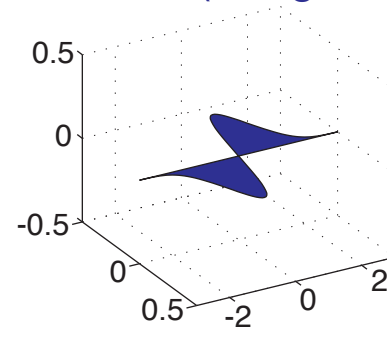
TEM00



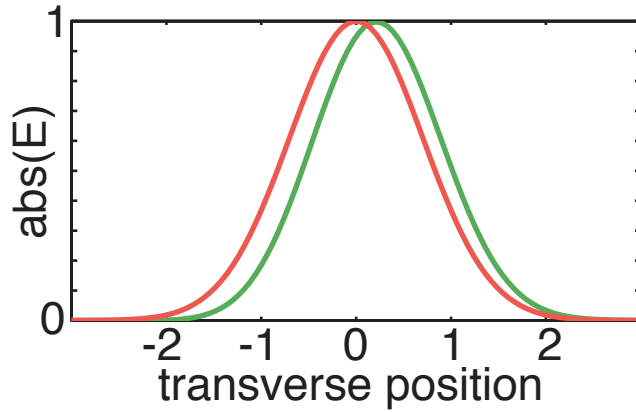
TEM01 (real)



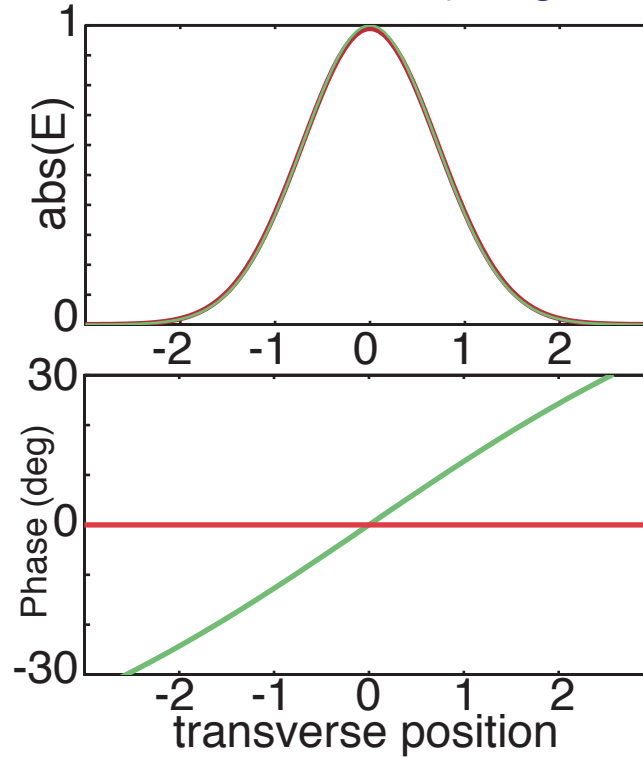
TEM01 (imaginary)

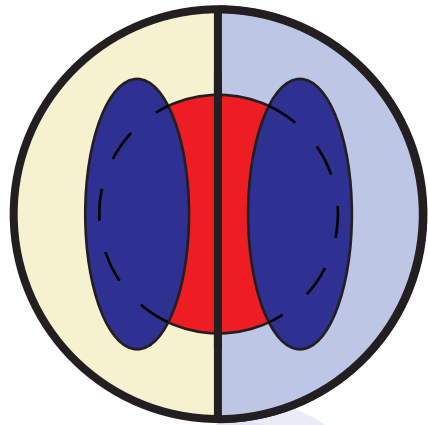


TEM00 and TEM01(real)

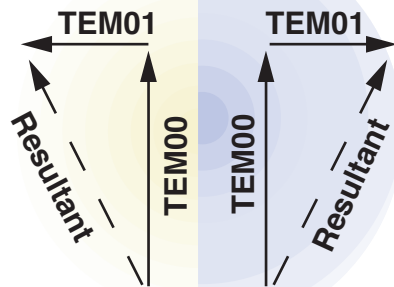


TEM00 and TEM01(imaginary)

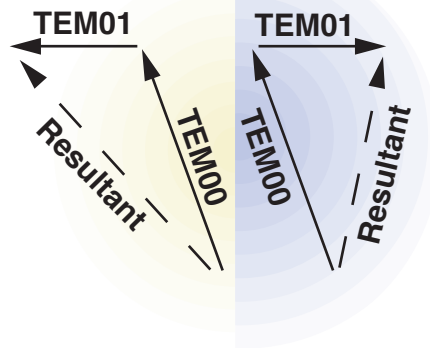




A two element, split photodiode is used to detect the beam reflected from the cavity. By subtracting the outputs of the two photodiode halves an error signal is obtained.



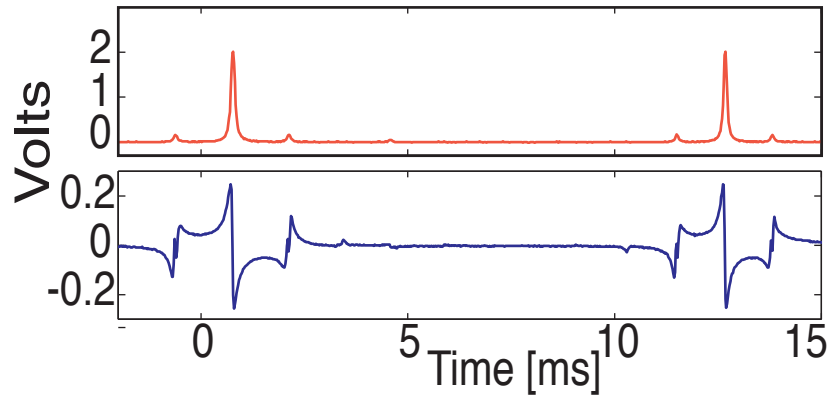
TEM00 mode on resonance



TEM00 mode slightly off resonance

Error Signals

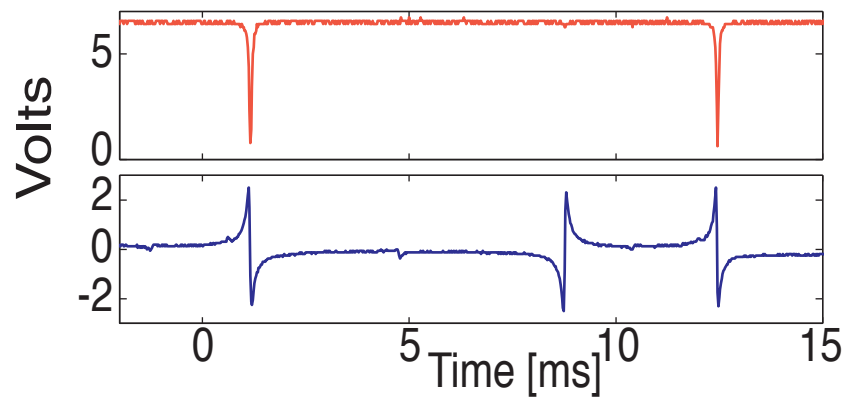
Pound-Drever-Hall



Power transmitted
through cavity

Pound-Drever-Hall
locking error signal

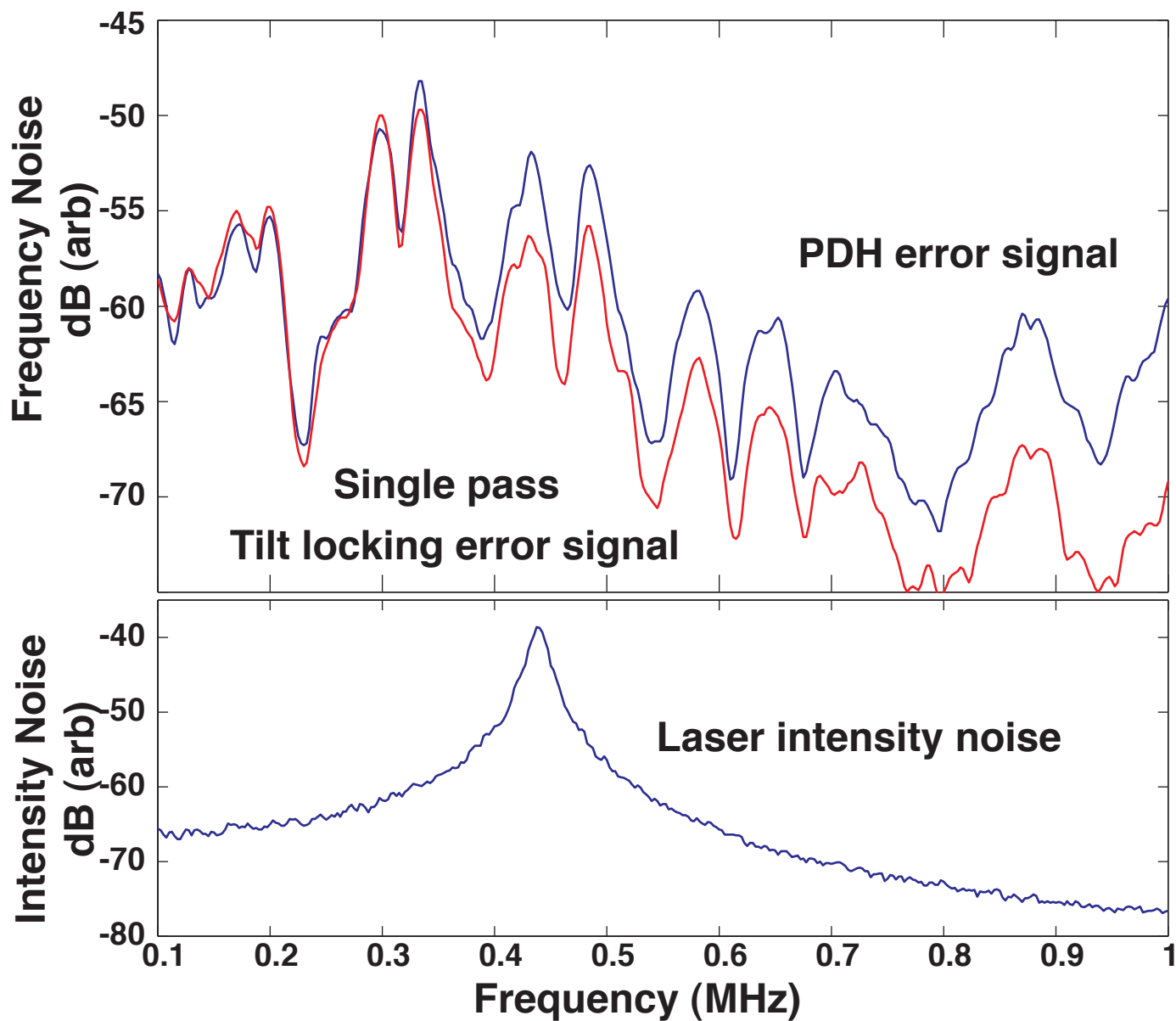
Tilt Locking



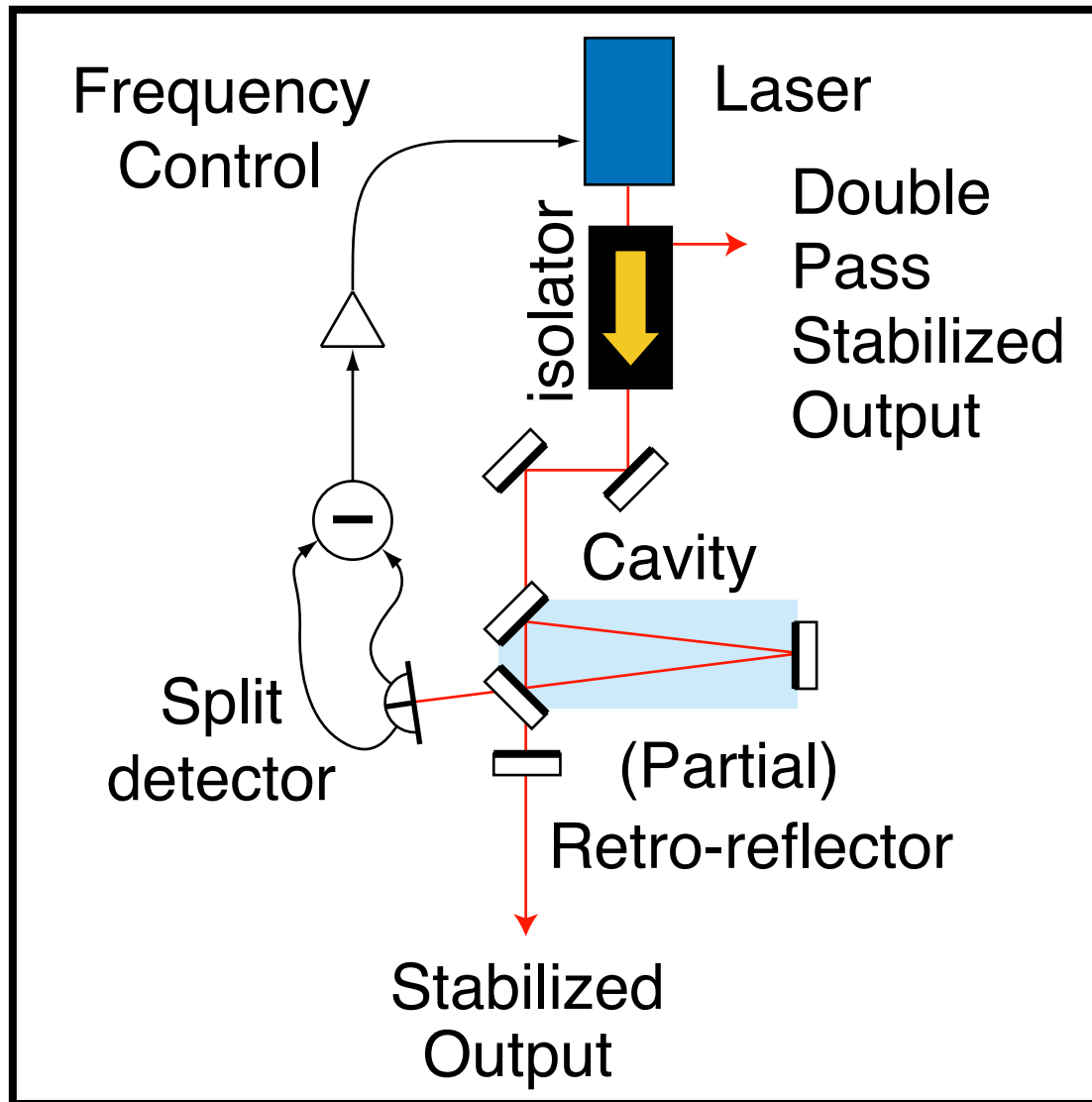
Power reflected
from cavity

Tilt locking error
signal

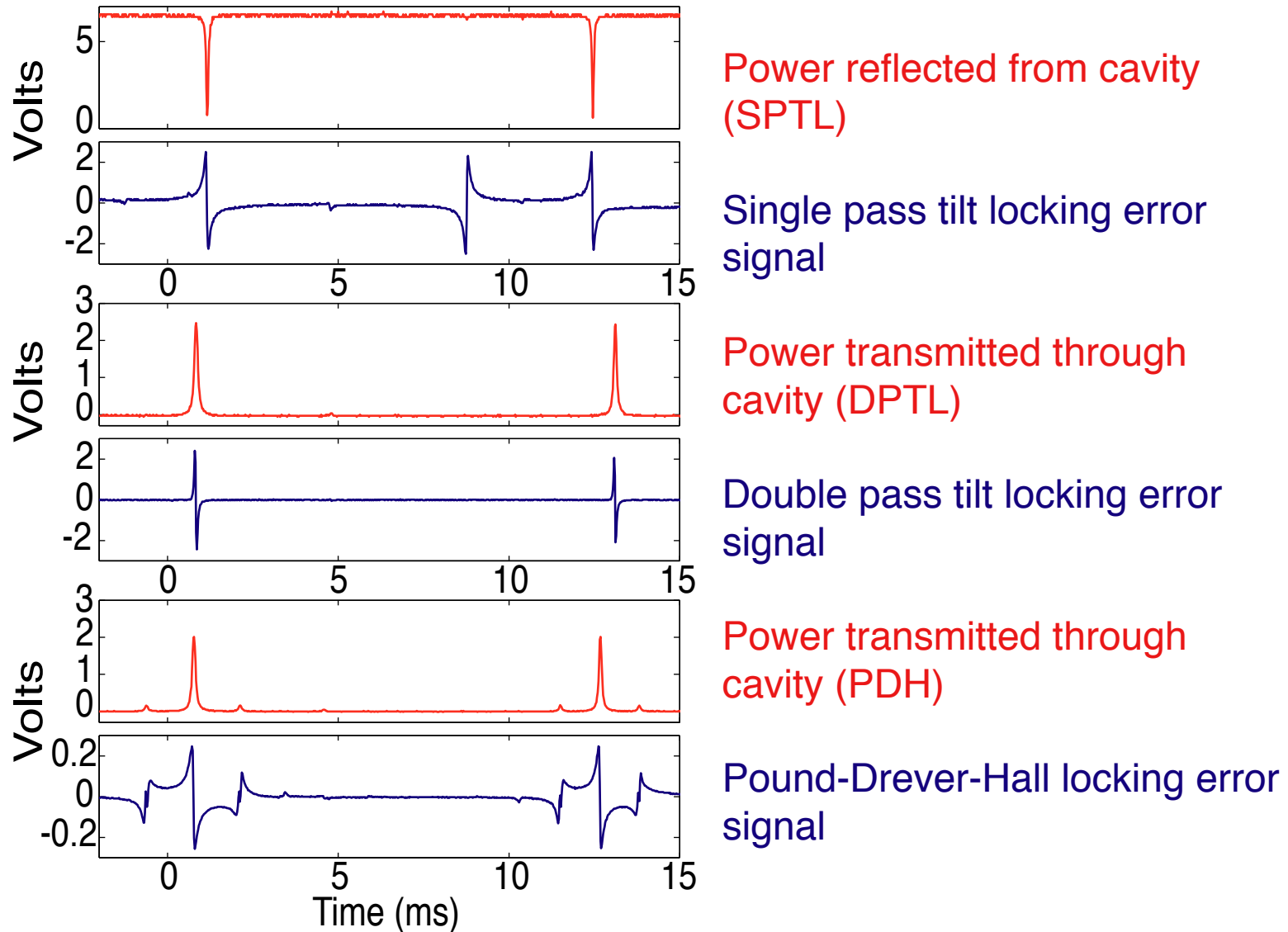
Immunity to Intensity Noise



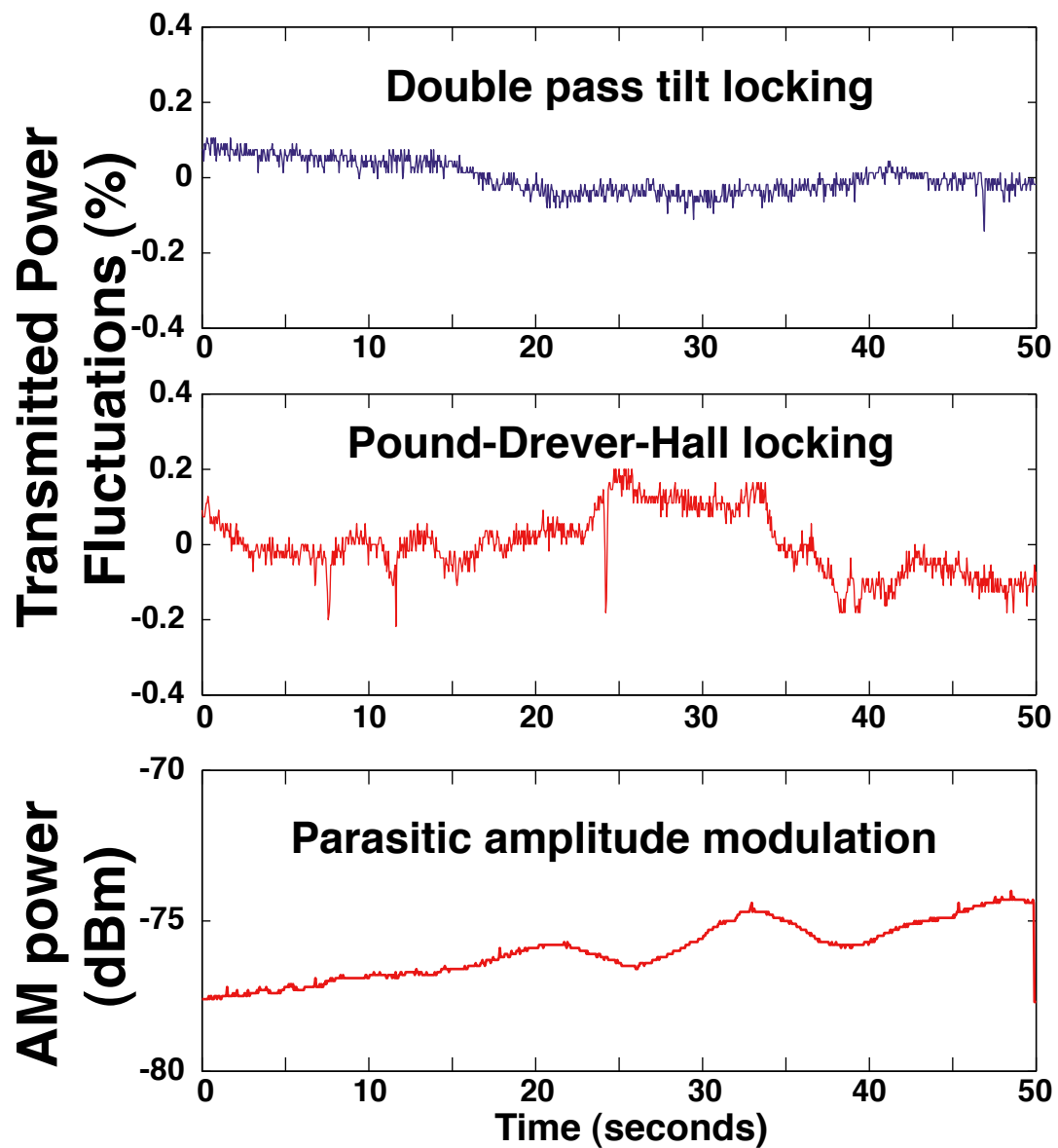
Double Pass Tilt Locking



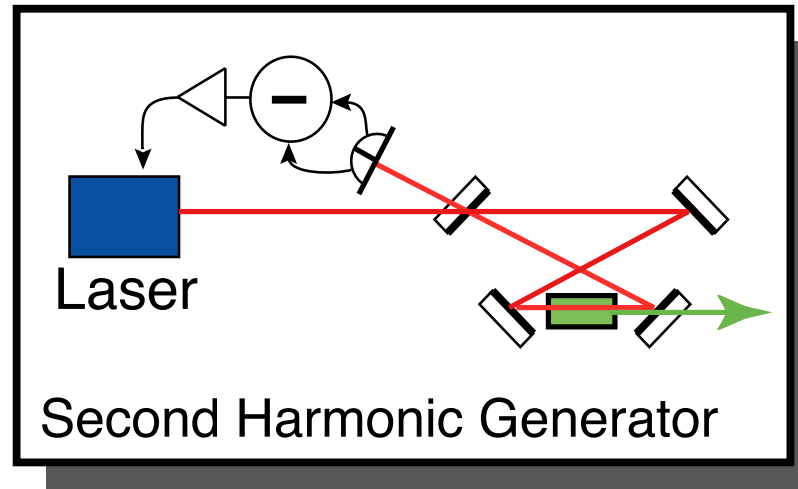
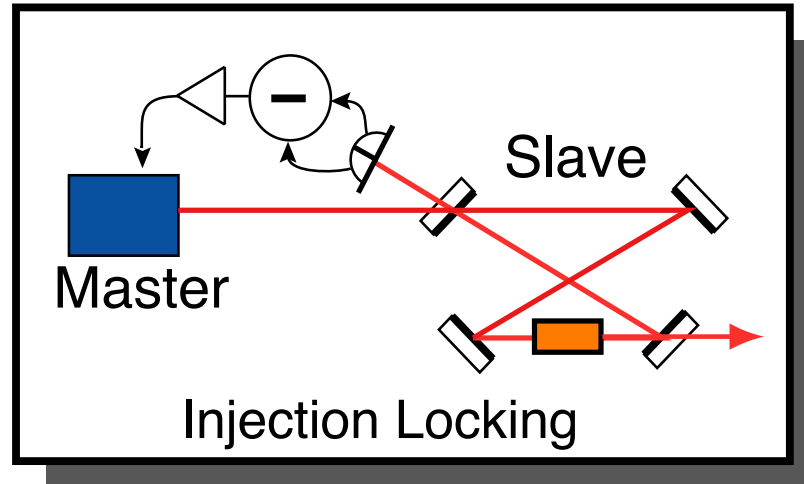
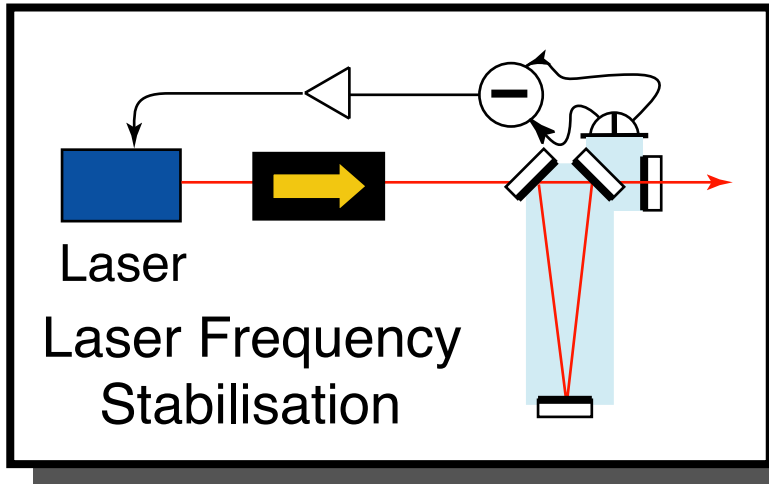
Tilt Locking Error Signals



Locking Stability



Tilt Locking Applications



Conclusion

Tilt locking is a viable alternative to modulation techniques for laser frequency control.

Similar performance (same shot noise limit and frequency response).

Requires no in-line components - suitable for high power stabilisation systems.