New Folder Name Experiment Goals

Goals for Modulation/Topology Experiments
ICD Modtop Subteam
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1. Scope of Experiments

The contemplated experiments are an outgrowth of the modulation techniques and optical topologies analyzed by the ICD modtop subteam. The experiments are intended to test configurations faithful to the designs contemplated for LIGO, without requiring the high sensitivity or frequency range of LIGO.

The most important questions susceptible to experimental tests should be answered within a few months. The experiments can be done on optical benches in air, with strapped down components. We plan on dividing the work between the WBOL and the MIT optics lab.

2. Deliverables

1. Experimental example of complete system, including modulators, optical topology, and servo configuration.
2. Investigation of frequency dependence of signals, especially for frequencies equal to and greater than the characteristic frequencies set by optical storage times.
3. Exploration of the possibility of "servo runaway", by testing for stability against the most likely perturbations.
4. Check of "signal unscrambling" by measuring of contamination of principal signals from undesired degrees of freedom.
5. Investigation of sensitivity to several parameters—e.g. modulation phase, beamsplitter ratio.
6. Signal outputs as function of: asymmetry in arm lengths, modulation frequency, recycling cavity length, modulation depth.
7. Comparison of measurements with calculations, including signal strengths, visibilities, recycling gain for both carrier and sidebands.

3. Features

We anticipate that the goals can be met by experimental arrangements with the following features:

1. Low-loss optics for recycling mirror, beamsplitter, cavity mirrors, and critical pickoffs.
2. Low laser power ($\approx$ 100 mW).
3. Cavity arm lengths on the order of 3 m; arm knee frequency in the range 50–150 kHz.
4. Recycling factor in the range 10–30.
5. Modulation frequencies between 4 and 40 MHz.
6. Two arms parallel and adjacent, maximum common mode wherever possible.