

thesis outline

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title: DC Readout in Enhanced LIGO

1. Introduction
2. Description of LIGO detector operation
 - (a) arms, cavities, etc
 - (b) summary of changes made for Enhanced LIGO
 - (c) history of the noise during enhanced ligo
 - (d) future directions
3. DC Readout - theory of operation
 - (a) goals of dc readout
 - (b) calculation of optical gain and frequency response
 - (c) dominant noise coupling mechanisms
 - (d) Optickle model
4. Output Mode Cleaner - description
 - (a) physical design of the cavity
 - (b) requirements
 - (c) length control (LSC)
 - (d) input beam control (ASC)
 - i. QPD
 - ii. dither
 - iii. drumhead beacon
 - (e) automatic gain control (UGF servo)
 - (f) measurement of residual ASC And LSC error
 - (g) OMC optical characterization
 - i. mode scan
 - ii. reflectivity coeff from scattering measurement
5. DC readout - evaluation
 - (a) noise couplings - modeled and measured
 - i. laser frequency noise
 - ii. laser intensity noise
 - iii. oscillator amplitude noise
 - iv. oscillator phase noise
 - v. beam jitter noise
 - (b) noise budget of OMC-related noises
 - (c) noise performance versus DC offset
 - (d) optical gain versus DC offset
6. Appendicies
 - (a) Fabry-Perot cavities - derivation of useful formulae
 - (b) antenna pattern - derivation
 - (c) control theory basics