LIGO

DIAGNOSTIC METHODS

- ● **Stimulus/response techniques**

  determine sensitivity to excitation

  measure the noise at a place uniquely sensitive

  make noise budget at GW chan. - analysis of variance and correlation

- ● **Examples**

  Frequency noise: drive laser loop/measure common mode response

  determine correlation gravitational wave channel/common mode chan.

  Beam angular noise: drive telescope mirror/measure on quadrant diode

  determine correlation gravitational wave channel/quadrant diode

DIAGNOSTICS

- **NEW (for LIGO) TOOLS**
- DATA ARCHIVING SYSTEM

  Significant advance not used in the prototypes

  measurement of environmental perturbations

  multiple signal visualization

  retrospective experimentation and measurement

- END to END MODEL

  currently used in acquisition modeling

  refined and applied to noise analysis

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EXAMPLE WORRIES and FIXES

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- ● **Excess seismic motion coupling**

  more control authority required in alignment (angle) or translation
  at low frequencies influencing noise in-band through the electronics
  Possible fixes: use PZT in tidal actuators, external active isolators

- ● **Excess scattering on test mass mirrors**
  reduction in high frequency sensitivity, low recycling gain
  Possible fixes: increase input laser power, co-add lasers

- ● **High thermal noise in a test mass**

  low Q in internal modes
  Fix: rehang the mass

- ● **Ruin a test mass**
  Fix: use one of the spare coated masses