

An Easy Calibration Tool for Strain-Based DMT Monitors

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(with thanks to John Zweizig)



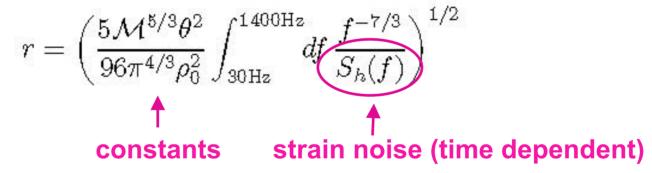
Outline

- Need for a simple & robust calibration class.
- Existing class: Calibrate
- New calibration classes
 - » philosophy
 - » documentation
 - » sample use
- What's next



Sensitivity Monitors

- SenseMonitor has demonstrated the value of monitoring the sensitivity of the IFOs to astrophysical sources of GWs.
- Major task of strain-based monitor is to calibrate the AS_Q data.
- SenseMonitor:



- Expect more sensitivity monitors for S4 (stochastic, bursts, periodic).
- Requires a simple, flexible DMT tool for AS_Q ⇒ strain calibrations.



Calibration

- Done in frequency domain
- Strain related to AS Q via

$$x_h(f) = \frac{1 + \alpha(t)\beta(t)G(f)}{\alpha(t)C(f)} x_{AS_Q}(f)$$

time-dependent gains

reference sensing and open-loop gain functions

- C, G fixed and measured during "calibration run"
- α computed from calibration line
- β computed from certain IFO channels (DARM_GAIN,
 ICMTRX 01).



Current Code: Calibrate.hh

- SenseMonitor's Calibrate class:
 - » Frequency domain
 - » Computes response function by comparing current calibration-line amplitude and control feedback gains to reference values
 - » It exists and it works, but ...



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- SenseMonitor's Calibrate class:
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 - » It's cumbersome user has to supply a lot of reference information by hand to the class. *Makes use difficult and prone to error.*

LIGO

New Calibration Tools: Philosophy

- Simple: Hide the nuts and bolts of the calibration from the user.
 - » Put all reference calibration data in a single file of specified format which the code can parse on its own
- Robust: Separate the different types of functions according to function:
 - » Put methods for calculating α , β into one class
 - » Put methods for applying response function into another
 - » Simple high-level class to drive it all
- Flexible:
 - » Allow calibrations using α , β computed on-the-fly or using stored values from the reference calibration file.



Current Status

- Most of the code is already written
 - » Taken from SenseMonitor's old Calibrate class
- Still to do:
 - » Specify format for reference calibration file must hold scalars, time series, frequency series. Frames? LIGO_LW? Other? Must coordinate with calibration team, DMT, search code programmers.
 - » Finish coding and debugging (weeks)



Summary

- New calibration tools are being developed for the DMT
 - » performs frequency-domain calibrations of power spectra
 - » simple, easy to use
 - » logical structure makes codes more flexible and easier to maintain
- Timeline for release ~ 1 month
 - » get your requests in now!