



Noise Budget Infrastructure

how is data collected?

how are PSDs calculated?

what is calculated vs. what is measured?



Noise Budget Directory Layout

- Demo/Tour



Inside the Noise “atom” Functions

- Setup parameters
 - » Deal with input arguments, call getPars to load param files
- Get Reference Data
 - » Read in saved files from reference directory
- Get Machine State
 - » Read “live” gains, switches, matrix values, filter module TFs, etc.
- Get Current Data
 - » Read “live” noise spectra from the IFO
- Do Calculations
 - » Propagate signals through filters/gains, calibrate to DARM m/rHz
- Format output and return
 - » Save trace in current directory and return it



Data Collection & PSD Calculation

- Two methods are provided: `get_dtt_FFT` (spectra) and `get_dtt_TTS` (time series)
 - » Both can deal with multiple channels, but all channels are required to have the same sample rate
 - » Capabilities similar to those provided by mDV, but mDV is not used
- These functions in turn call NDS mex functions to fetch data over the network
 - » `NDS_GetChannels`, `NDS_GetData` from `UNIX_NDS_Client_beta4`
- `get_dtt_FFT`: calls `pwelch` to make PSDs
 - » Default PSD recipe: one-sided, Hann-windowed, overlapped, averaged, not detrended
 - » Takes the sqrt to make ASDs



What's Measured? What's Calculated?

- Depends on the noise source (must read the code)
 - » In general, things that can be obtained by measurement *usually* are
- Example measurements
 - » Dark noise, saved as a reference for each whitening configuration
 - » Seismic noise, acquired “live” from PEM data
 - » Intensity noise spectra (“live”) and coupling TF (reference data)
 - » MICH/PRC spectra (“live”) and coupling TF (reference data)
- Example calculations
 - » Shot noise, based on “live” measured value of photocurrent
 - » Radiation pressure noise, based on “live” measured optical power
 - » Suspension thermal noise, purely modeled
 - » Coil driver/actuation electronics noise
 - » Pendulum response of test mass



Summary

- The Good

- » “Atomic” approach to noise functions, providing a template to make them well-organized, easier to write and read
- » Record of our past experience: Which noise sources were important? How did we measure/model them?

- The Obsolete

- » Data-getting functions rely on old NDS mexes
- » Configuration-getting functions rely on the old conlog
- » All noise and TF measurement data is obsolete
- » Many noise atom functions need to be rethought to some extent

- Limitations

- » Documentation is spotty/scattered (presumably all in the ilog)
- » Scripts for obtaining reference data are not present in many cases
- » Single-stage pendulum model used for test masses
- » Designed to analyze/plot only the noise in DARM