PRFPMI Noise Budget Report for Commissioning Meeting on Mar 17, 2020

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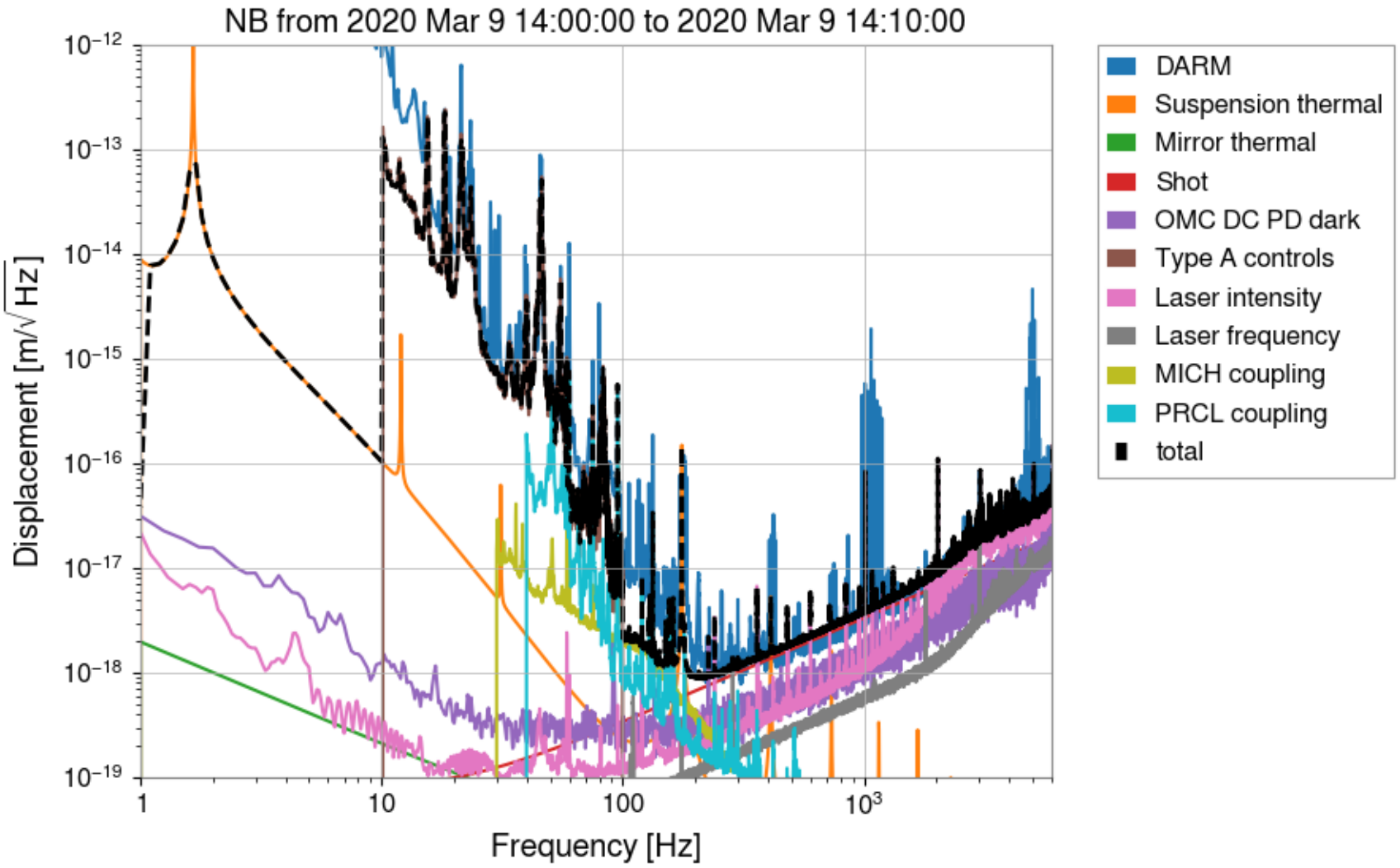
Noise Budget

- Made with NoiseBudgetter
  http://10.68.10.57:8000/NoiseBudgetter/
- Configuration files and data live in
  /kagra/Dropbox/Subsystems/MIF/NoiseBudget/PRFPMI/
  (see README.txt for details of each configuration file)
- Latest NB configuration file for Mar 9, 2020 14:00 (UTC) sensitivity is NPconf_20200314_1836.csv
- Configuration file is also commented and NoiseBudgetter is pretty self-explained

Latest Noise Budget

- See klogs #13481 and #13560

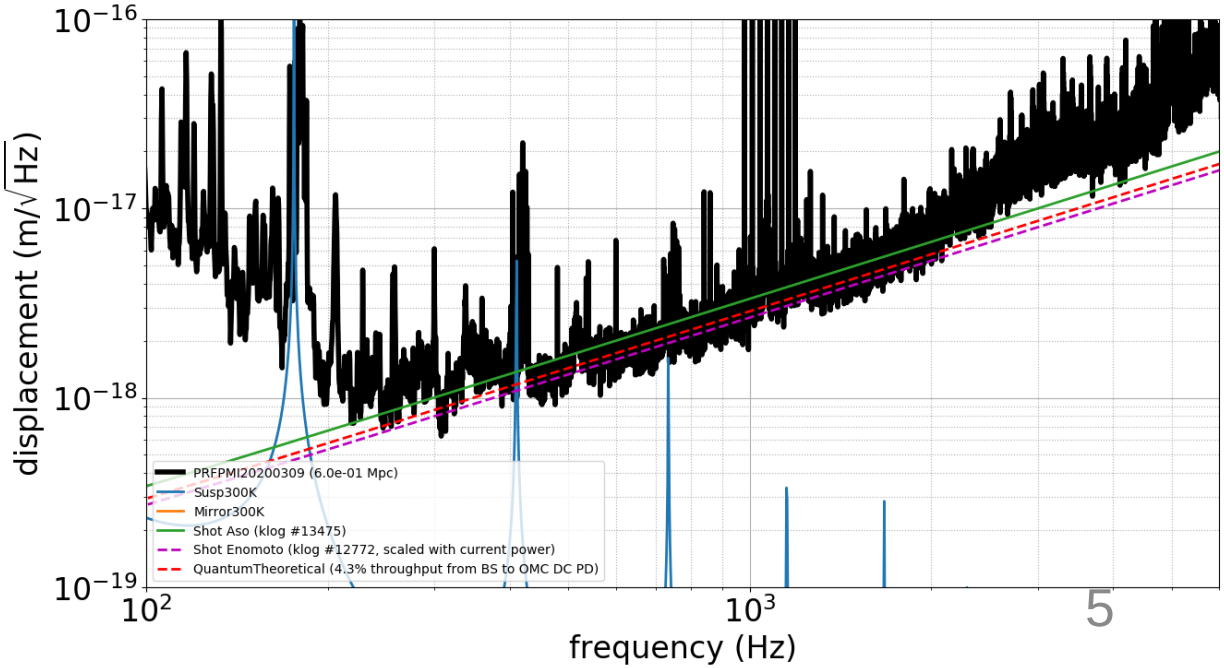


Thermal Noises

- Suspension thermal noise and mirror thermal noises are theoretical curves for 300 K Sapphire from Somiya-san's calculation (300Knew.nb)

Shot Noise

- Estimated by Aso-san (see klog #13475)
- Confirmed that Aso-san's estimation agrees within ~30% with estimation based on Enomoto-kun's previous estimation and my theoretical calculation based on BS to OMC DC throughput of 4.3 %
- Izumi-san also independently confirmed the calculation (klog #13580)



OMC DC PD Dark Noise

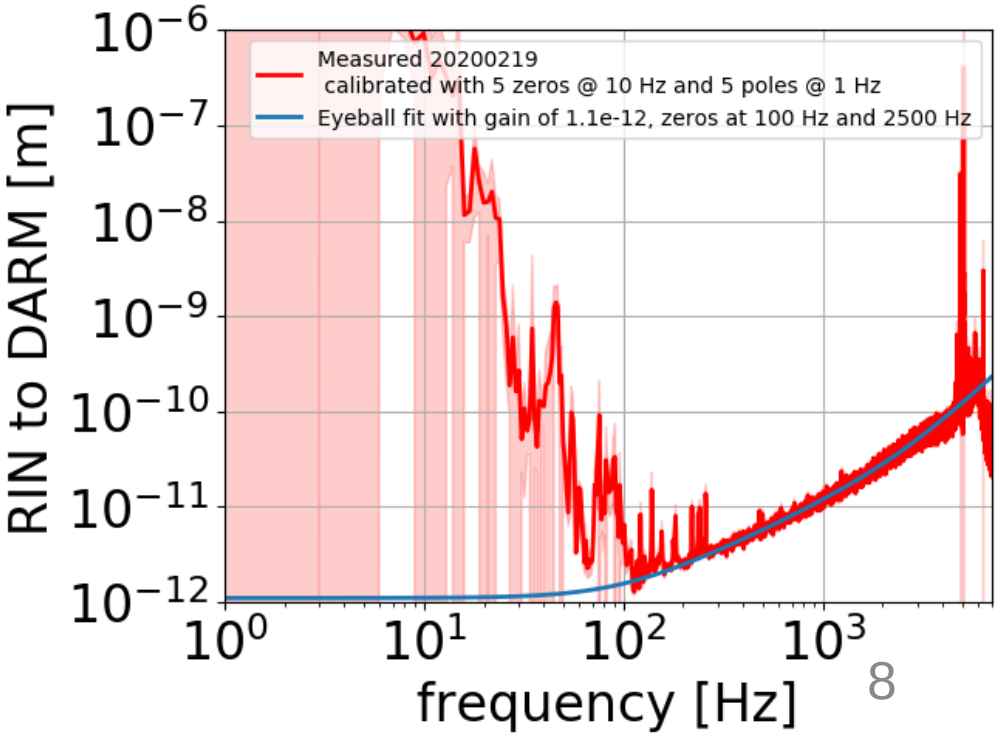
- Dark noise of OMC DC PD dark noise measured at K1:CAL-CS_PROC_DARM_DISPLACEMENT_DQ
- I'm not sure the details, but DARMsens.xml says it is measured on Feb.11 with 1stage wh. [Calibration still OK?]

Laser Frequency Noise

- Witness channel:
  K1:LSC-CARM_RESIDUAL_OUT_DQ
- Coupling:
  3e-14
- I took these from DARMsens.xml but I'm not sure where is this 3e-14 from (DARMsens.xml says based on 2020 Feb 14). [Who measured this?]

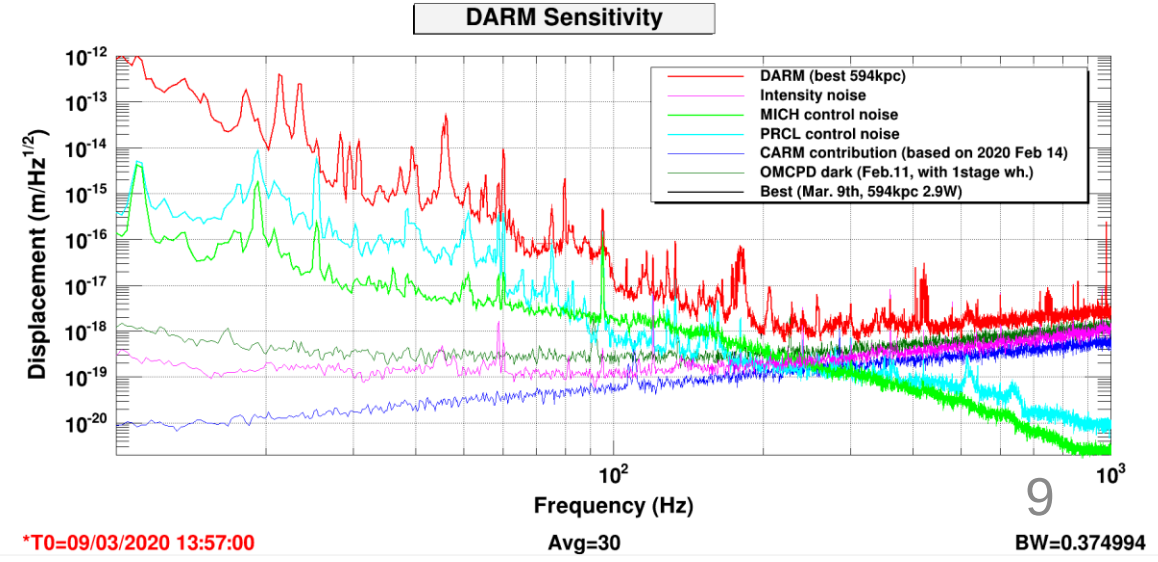
Laser Intensity Noise

- Witness channel:
  K1:PSL-ISS_FIRST_SERVO_PDA_RIN_OUT_DQ
- Coupling:
  DC gain of 1.1e-12 m and zeros at 100 Hz, 2500 Hz
- Coupling TF was measured when ISS is off, and eye-ball fitted with two poles (see klog #13028)



MICH and PRCL Coupling

- Witness channel:
  K1:LSC-MICH_IN1_DQ
  K1:LSC-PRCL_IN1_DQ
- Coupling:
  ./Couplings/TF_MICH_DARM_200312_mag.txt
  ./Couplings/TF_PRCL_DARM_200312_mag.txt
- Based on measurements by Yokozawa-san (klog #13518)
- With FF on ?



Type-A Controls Noise

- From Lucia *et al.* projection (klog #13474)
- Feedback signals of the local damping loops are projected to DARM using the TFs measured from local damping feed back point to DARM
- According to Lucia:

  The local damping feedback are:
  -broadband filter (UGF around 4 or 5 Hz)
  MN PS:L,T, R
  MN MNOPL: Y
  MN TMOPL:P
  IM TMOPL:P
  -several bandpass loops making use the actuators of MN, IM, and in some case TM actuators.
  In this configuration none broadband local feedback signal are sent to the TM stages.

- Noise from TM actuation, DARM and CARM controls are not included [NEEDS CONFIRMATION]

Other Noises to Add?

- LSC control noises
- Type-Bp and Type-B control noises
  - I recognize there are some measurements, but I cannot follow them all
  - If witness channel and TFs (or projected noise) are provided, I can help including them in the NoiseBudgetter
  - Best if you can NoiseBudgetter yourself
- PEM channels
  - If you have some PEM channels coherent to DARM and if you have their coupling functions to DARM, let me know.