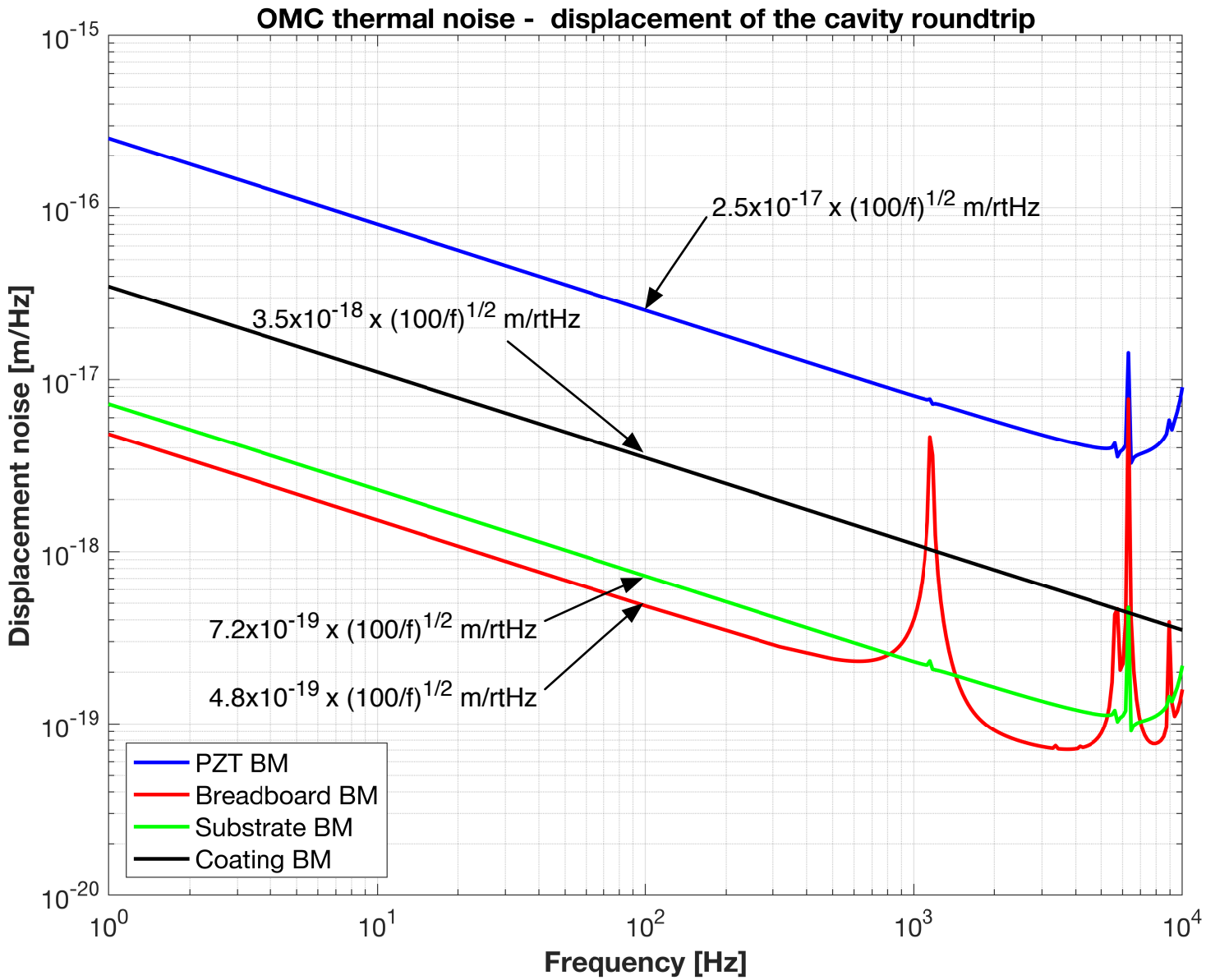
OMC thermal noise



OMC thermal noise

- Coating brownian motion

- Assume aLIGO coating quality
  (Actual OMC coating: TiO2/SiO2)

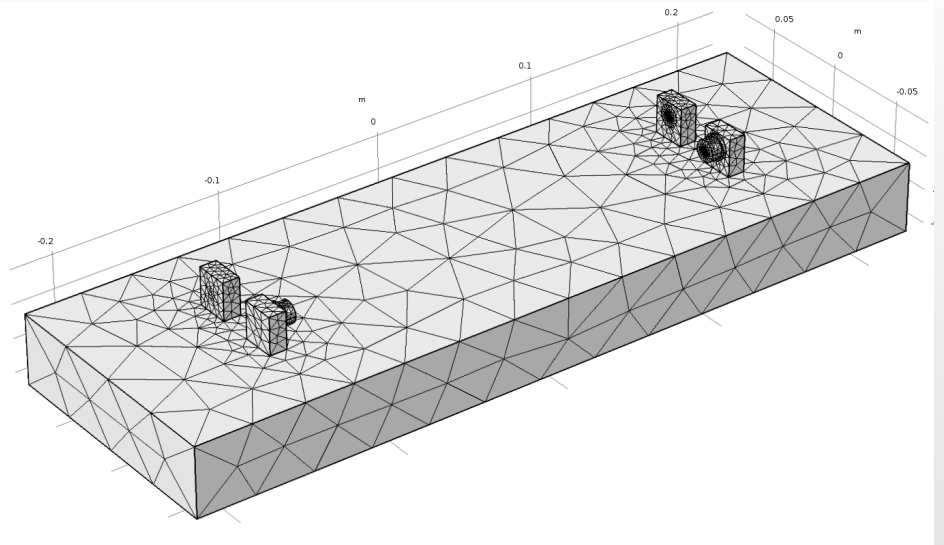
- Use results from S. Gras et al, PRD 95, 02201 (2017)
  => Eq.24 wL=500um for the OMC

- The obtained number is a single mirror displacement.
  Multiply by sqrt(4) x 2 for 4 mirrors and the roundtrip length

OMC thermal noise

- Substrate/Breadboard/PZT brownian motion

- Direct approach
- Constructed a simplified OMC model in COMSOL
- Used available similar materials (Corning 7940 and PZT-5A) instead of 7980 and NCE51F.



- Applied gaussian pressure on the four spot positions (w0=500um)
- Obtained the max stored elastic energy in each component

$$W_{\mathrm{diss}} = 2\pi f U_{\mathrm{stored}} \phi \qquad x^2_{\mathrm{BM}} = \frac{2k_{\mathrm{B}}T}{\pi^2 f^2 F_0^2} W_{\mathrm{diss}}$$

- ϕ(FusedSilica) = 10^{-7}, ϕ(PZT) = 1/80 (cf NCE51F spec)

http://www.noliac.com/products/materials/nce51f/

- Multiply by 2 for the roundtrip length.