Current Status of the Main Interferometer Design

Alignment Sensing and Control Design

(by Michimura)

- LHO visit by Michimura
  - Consulted with LIGO ASC people
- Preliminary Design of iLCGT/bLCGT ASC Scheme
  - Signal extraction ports
  - Sensing matrix
  - Feedback filters
  - Shot noise coupling
- Angular Optical Spring Instability is a Big Problem.
  - High-freq UGF is required --> Shot noise contamination at OBS band
- Negative g-factor is strongly preferable to avoid this problem

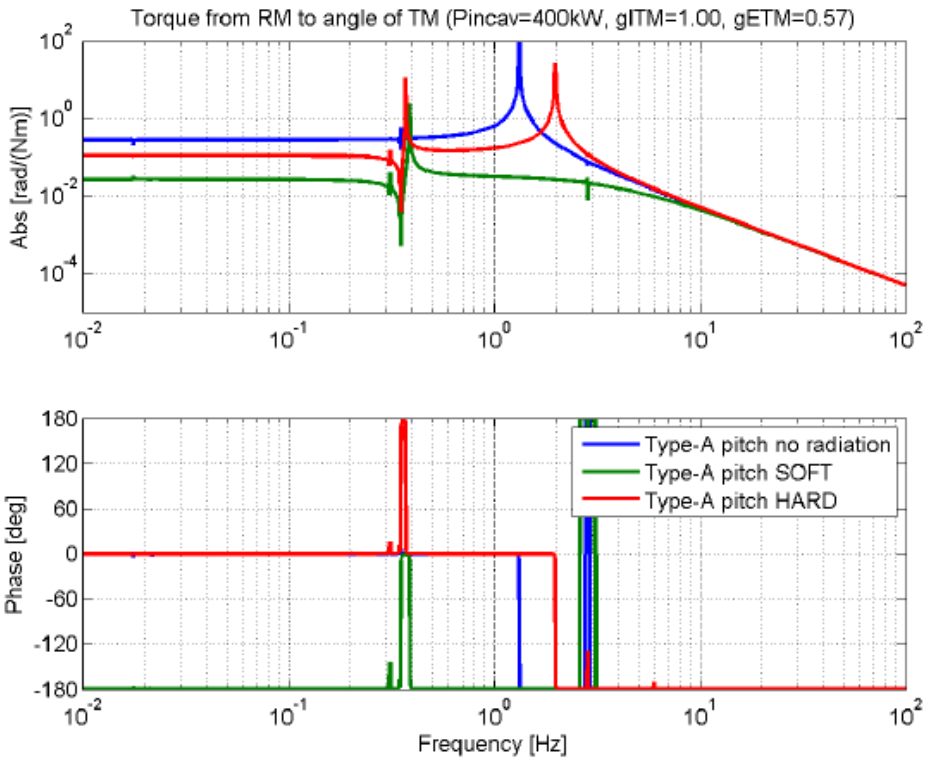
Final decision on the g-factor will be made soon
(sorry for the long delay :-( )

- Current plan of the ASC scheme
  - Suspensions should reduce the RMS angular motion small enough if they work as designed.
  - Large angular resonances reside at low frequencies (around 0.5Hz)
    - These resonances happen at upper stages
      ----> should be damped at those stages by local sensors
  - WFS will be used only at DC
  - Are the resonances of the mirror (pitch/yaw) excited (mainly by the length actuation) ? ---> No for Virgo.

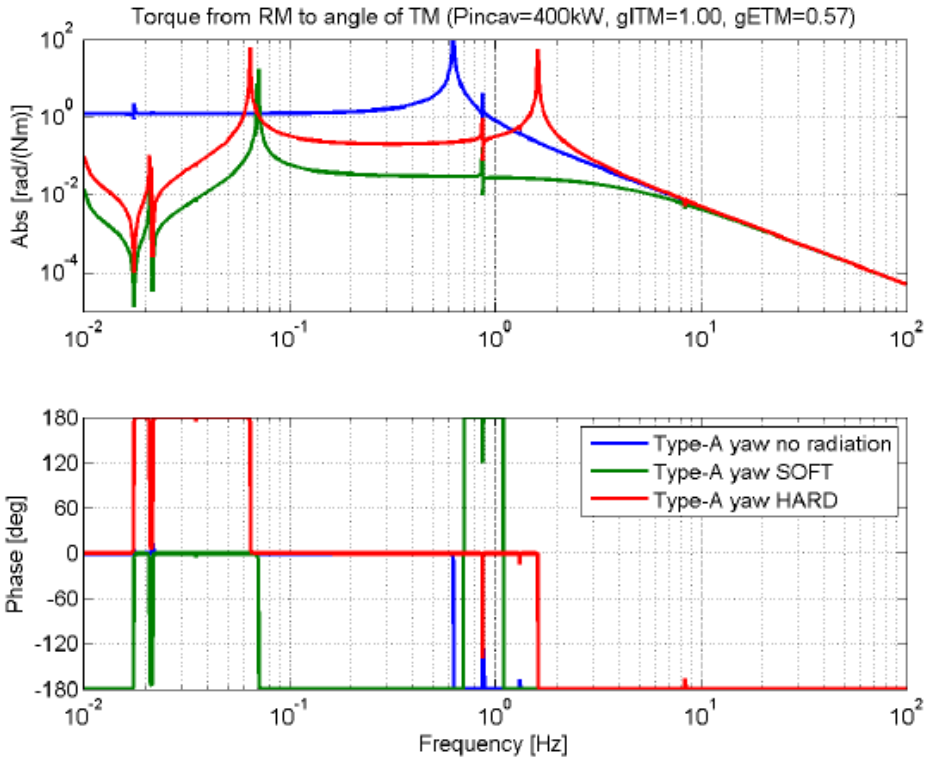
Opto-mechanical TF

- gITM=1.00, gETM=0.57(flat-7km)
- kSOFT=-33.8 Nm, kHARD=4.4 Nm

pitch



yaw

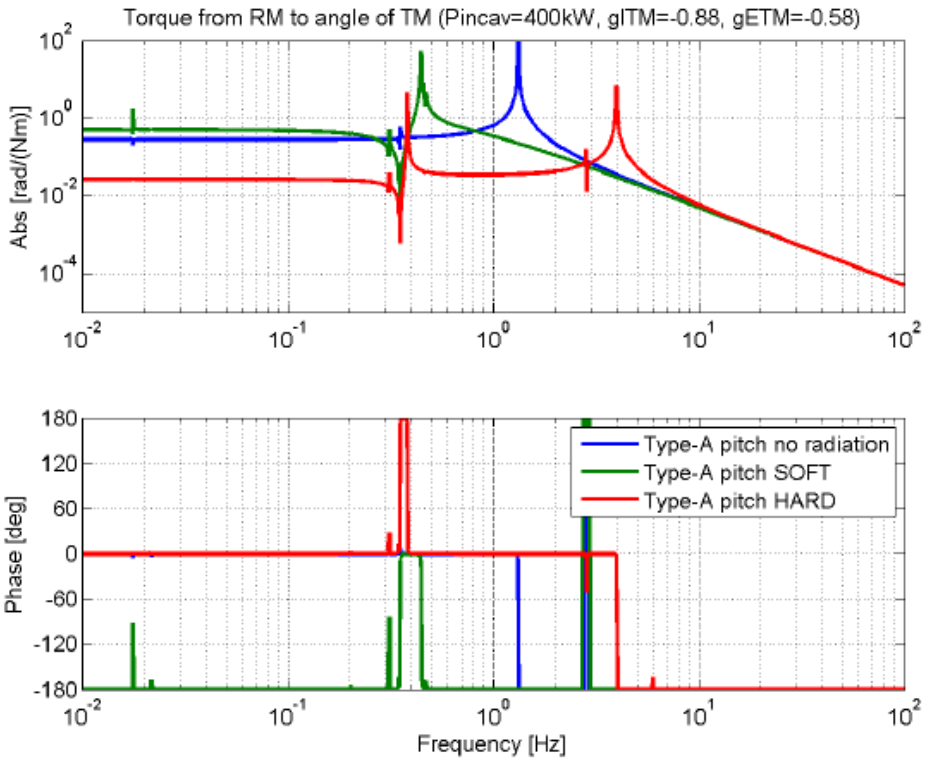


SOFTがunstableで、共振周波数も高いため、SOFTを制御するのは大変そう

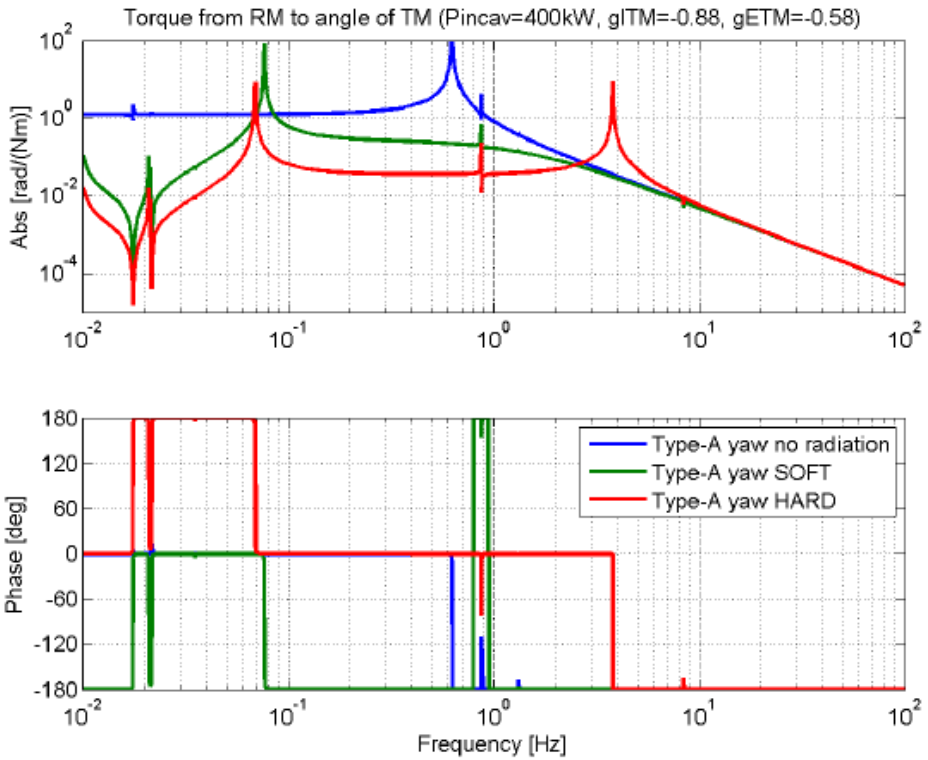
Opto-mechanical TF

- gITM=-0.88, gETM=-0.58(1.6km-1.9km)
- kSOFT=-4.6 Nm, kHARD=28.2 Nm

pitch



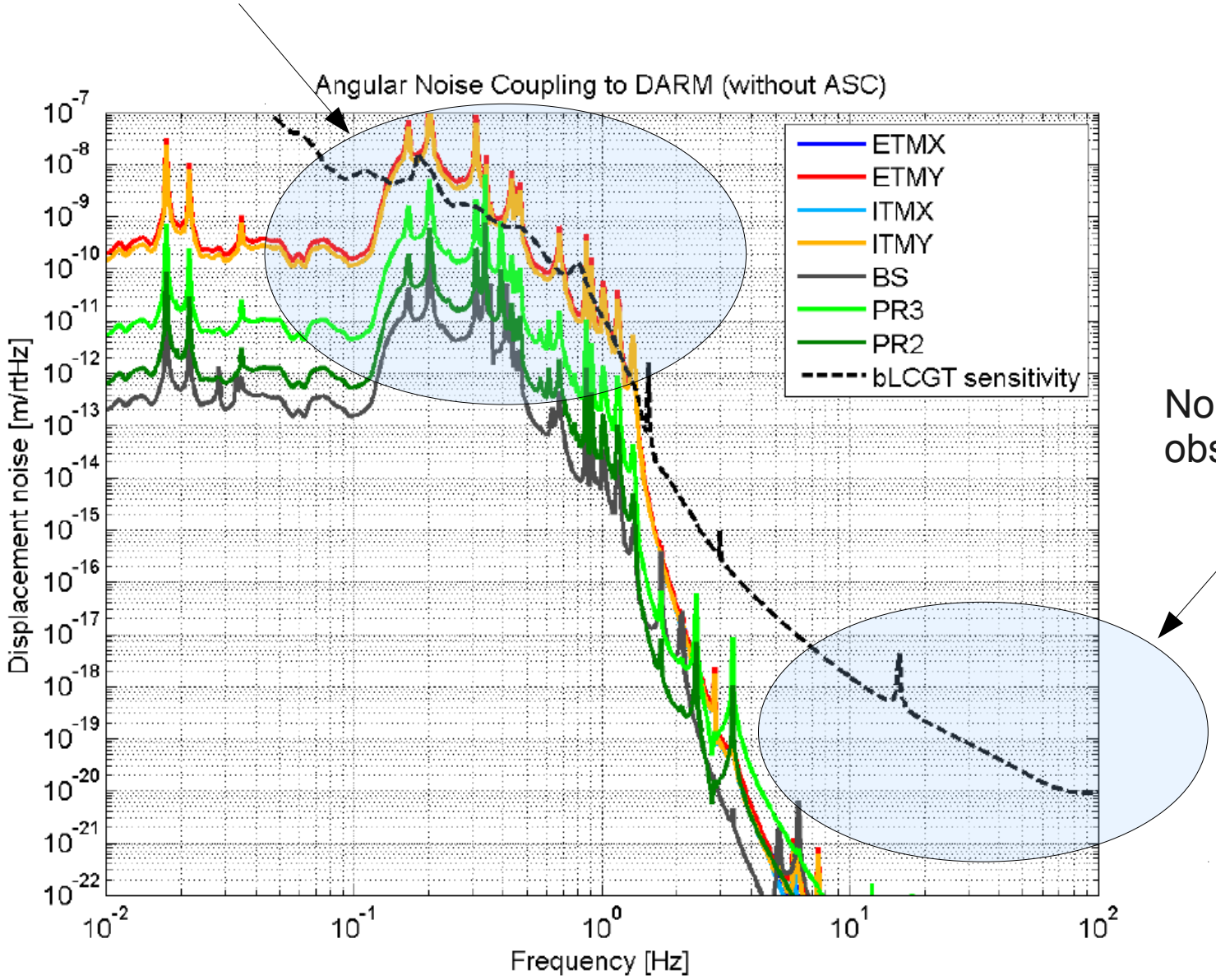
yaw



SOFTはunstable。pitchのSOFTに関してはまあまあ？
yawのSOFTは共振周波数ちょっと高い。
HARDが結構高い。

Angular noise coupling without alignment control

Better damping must be done



No problem in the observation band

Hierarchical Control of the Mirrors

(by K. Yamamoto)

- Checked the actuator noise coupling using a simple suspension model
- Driving solely on the final mirror

  ====> The actuator noise will be comparable to the target sensitivity
  No safety margin: Not acceptable.
- Driving the penultimate masses for low frequency

  ====> Noise margin is more than 100 times.

TO DO

- How to combine the penultimate mass drive and the final mass drive
- Use more realistic suspension model

PRC/SRC folding design

(by Agatsuma / Chen)

The folding telescope is extremely susceptible to the error in the ROC of PR3

===> Is it possible to cancel the error by moving the mirrors after the fact ?

(Preliminary) Answer

Yes We Can !

1% ROC error ----> Moving the mirrors by 14cm