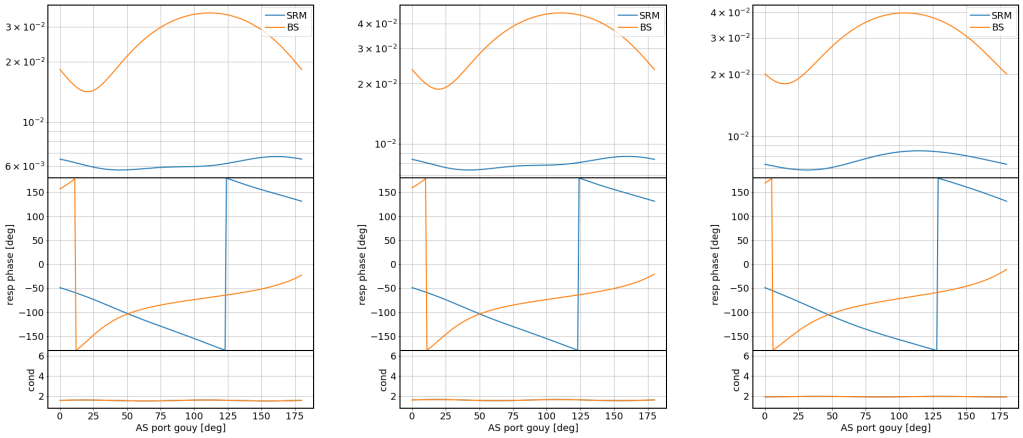
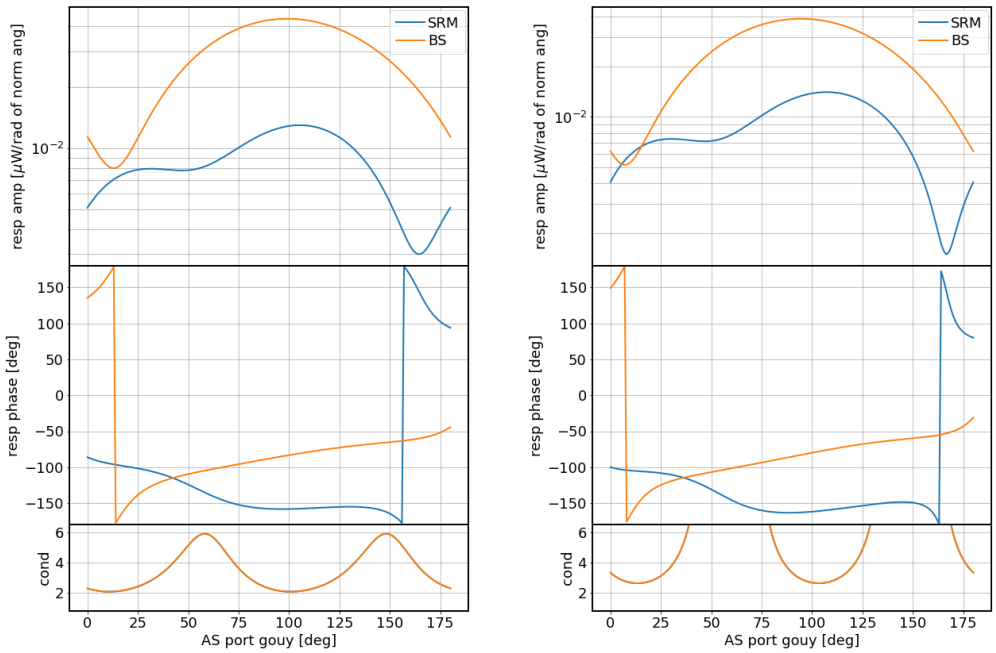


(a) DRMI; $T_{\mathrm{srm}} = 0.37$. (b) Full IFO; $T_{\mathrm{srm}} = 0.37$. (c) Full IFO; $T_{\mathrm{srm}} = 0.32$.

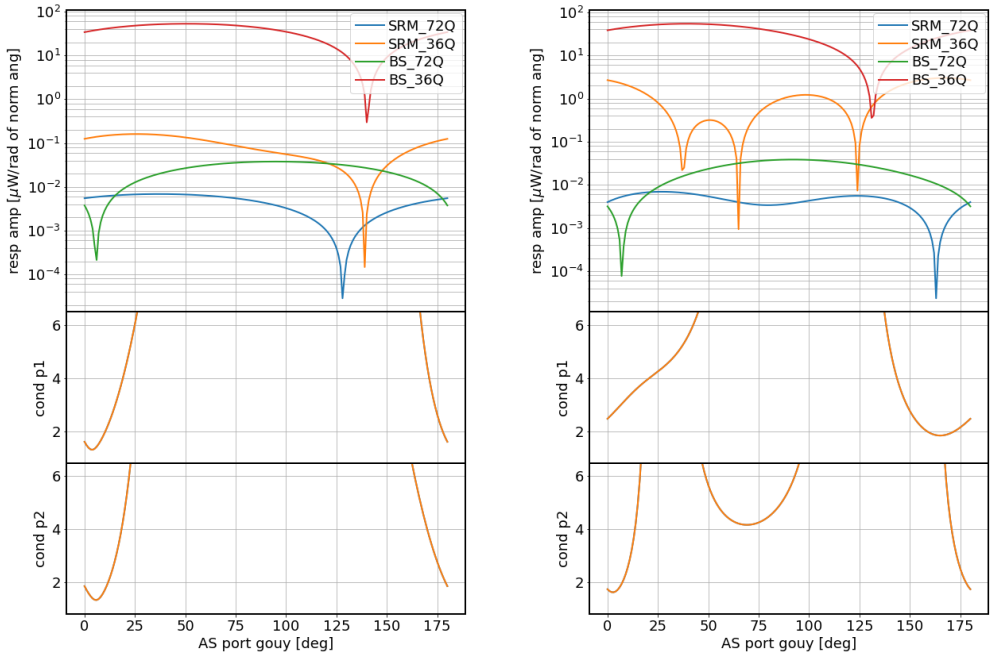
Figure 1: Nominal AS72 signal response under different conditions. From left to right: DRMI configuration with $T_{\mathrm{srm}} = 0.37$ (old SRM), full interferometer with $T_{\mathrm{srm}} = 0.37$, $T_{\mathrm{srm}} = 0.32$ (new SRM).



(a) Full IFO; $T_{\mathrm{srm}} = 0.37$.

(b) Full IFO; $T_{\mathrm{srm}} = 0.32$.

Figure 2: AS72 signal response when extra 100km ITMX thermal lens is present. If the AS72 sensing matrix measured measured NOW (with extra ITMX lens, $T_{\mathrm{srm}} = 0.37$) is well-conditioned with condition number less than 4, then after replacing the SRM, the sensing matrix should still be well-conditioned. According to previous simulations, extra ITMY thermal lens increases the condition number (i.e. damages the sensing matrix) less than ITMX lens, so we focus on ITMX here.



(a) Nominal.

(b) Extra 100km ITMX thermal lens.

Figure 3: Solution 1: use ASA_72Q and ASB36_Q (B is 90 degree gouy phase away from the A sensor) for SRM and BS, corresponding to "cond p2" (bottom panels), which gives us good condition number from 50-75 deg AS port gouy phase. For completeness, we also consider the case of using ASA_72Q/ASA_36Q (WFSs at the same gouy phase; corresponding to the middle panels, "cond p1"), which does not work. This scheme does not work under the nominal condition. Furthermore, right now the condition number has period of 180 deg instead of 90 deg, so it could not cover the region of 140-165 deg AS port gouy phase.

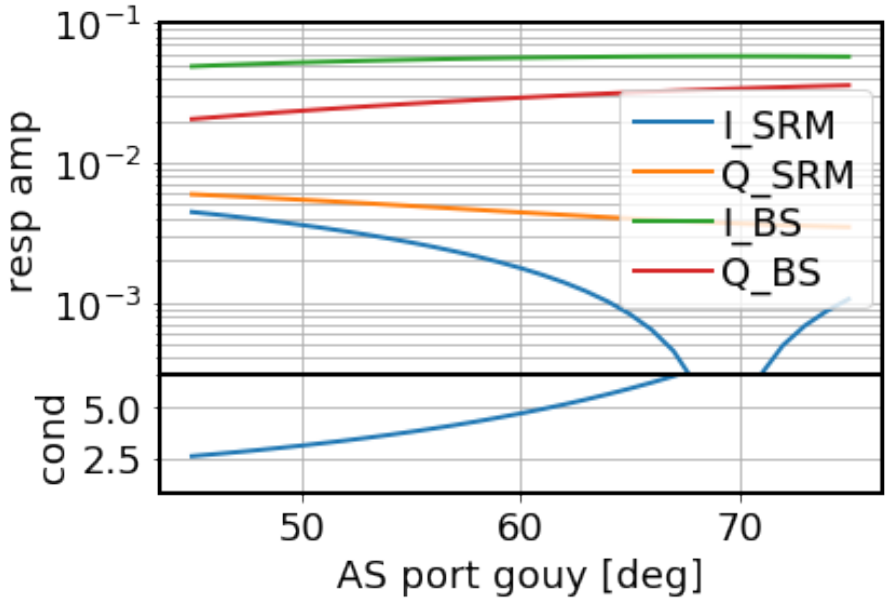


Figure 4: Solution 2: use ASA_72Q and (ASA_72I + ff × ASA_DCQPD) for BS and SRM, where the feeding-forward coefficient ff is set such that the I-phase signal is decoupled from spot centering motion. In the plot the I phase signal has already included the feeding-forward. This scheme should cover the region from AS port gouy phase 45-70 deg.