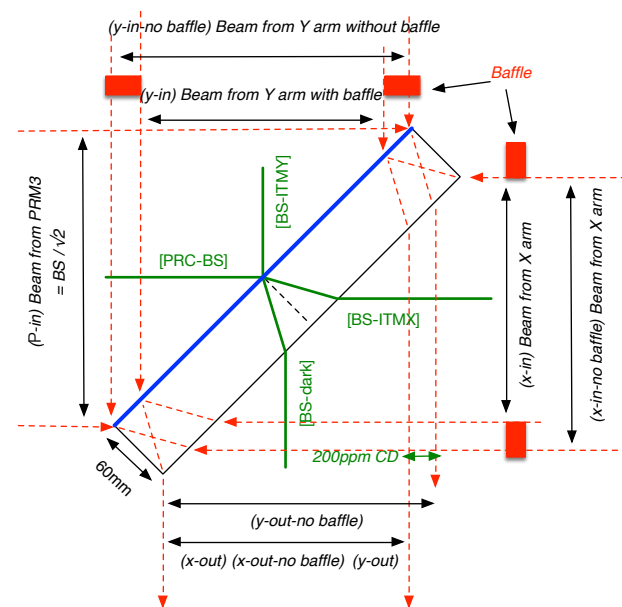
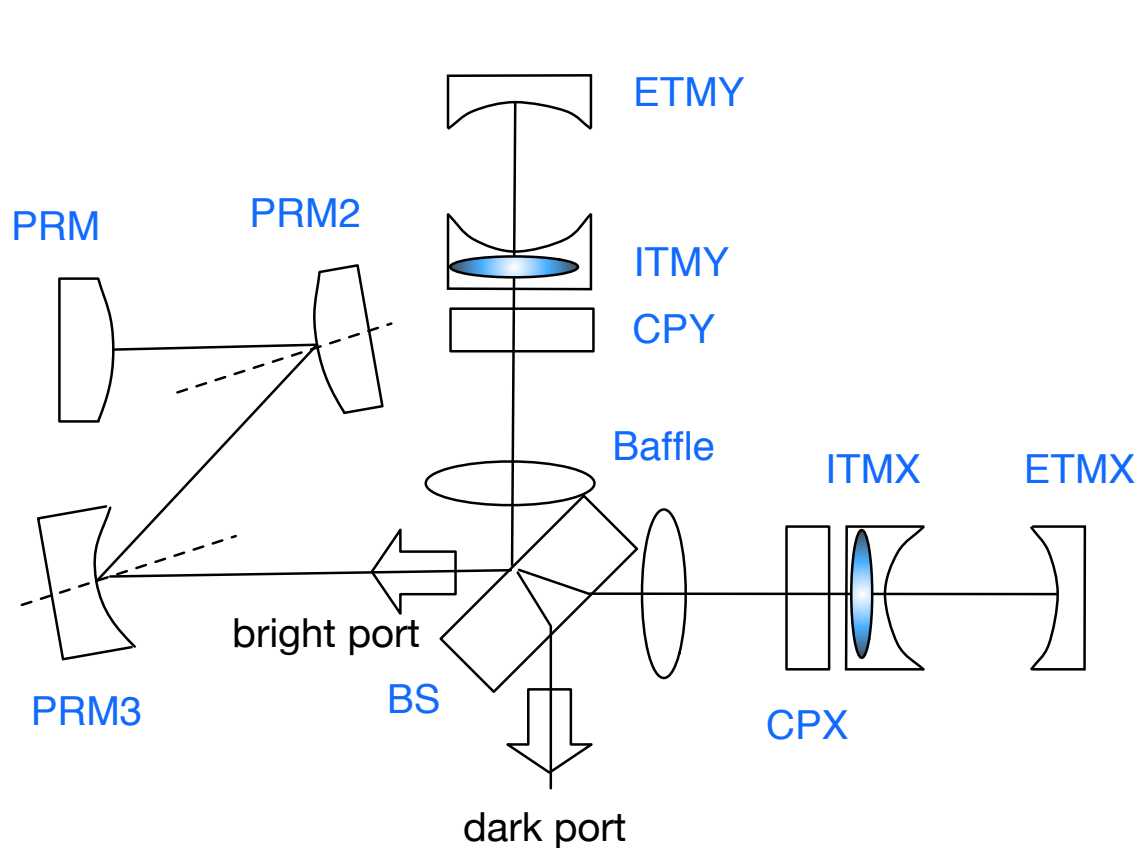
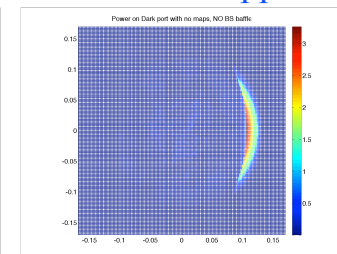
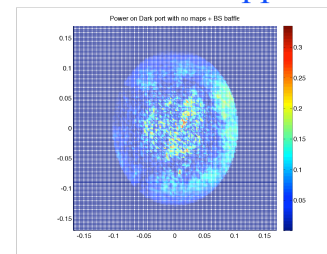


Loss related to geometry



With BS baffle
7ppm

Without BS baffle
210ppm

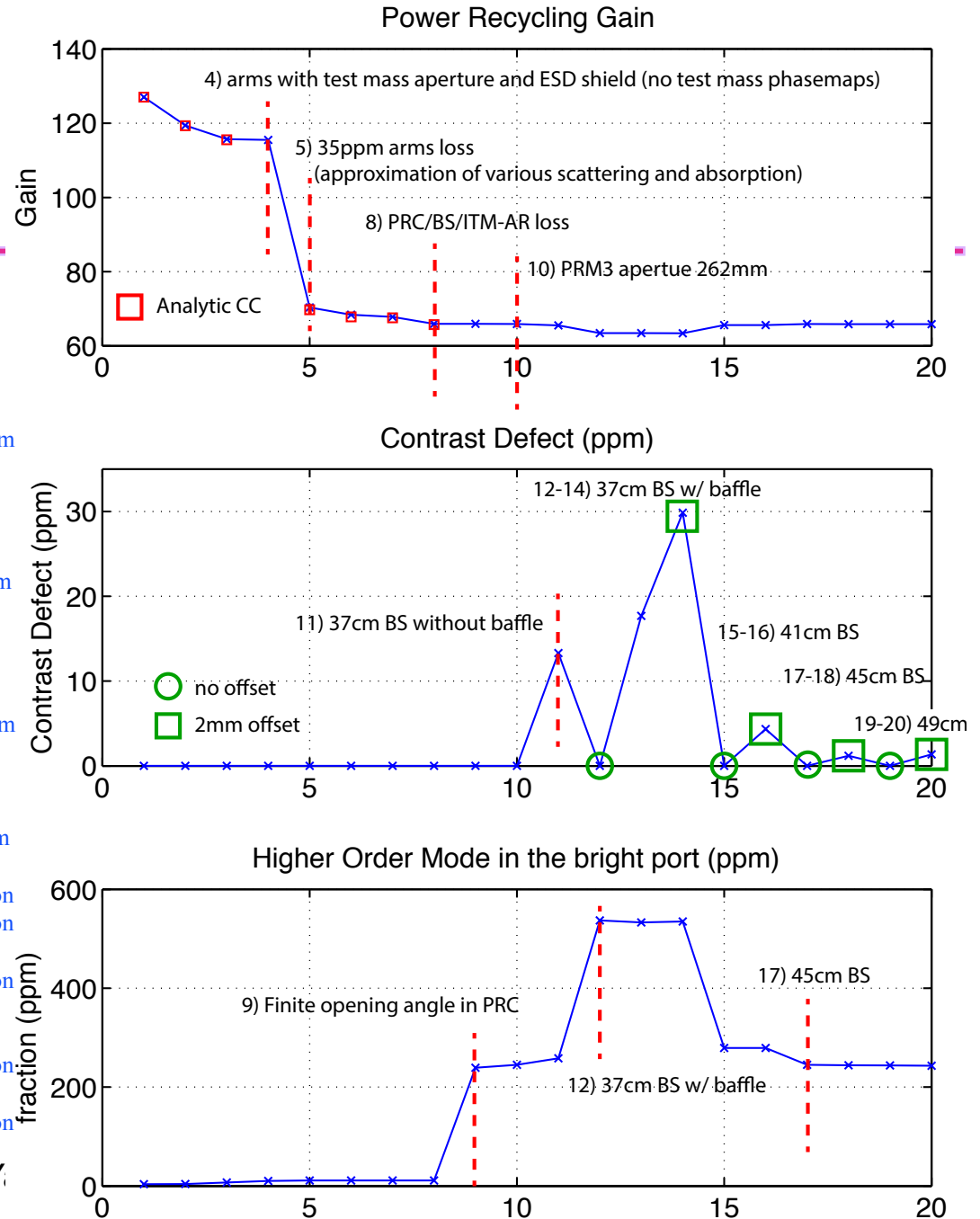




Performance limitation by design LLO case

T1400055

- 1) no loss at all, with large mirrors. A finite HOM (3.7ppm) looks a nice gaussian so probably the base mode parameter is slightly off.
- 2) 1) + ETM transmittance 3.7ppm
- 3) 2) + test mass aperture 326mm, round trip loss by the aperture is 1.94ppm (with 340mm, RTL is 0.6ppm)
- 4) 3) + 266mm ESD aperture, placed using BS baffle (266mmx266mm) in front of BS
- 5) 4) + 35ppm arm loss
- 6) 5) + power recycling mirror and beam splitter loss and transmission. Sum of losses + RM2 transmission is 583ppm
- 7) 5) + ITM AR side loss, (ITMX loss 206ppm, ITMY loss 330ppm)
- 8) 5) + 6) and 7), i.e., losses and transmission in the PRC, BS and ITM AR
- 9) 8) + finite opening angles in PRC (0.79° for PRM2 and 0.615° for PRM3). Among the total HOM of 240ppm, major ones are HG(1,0) of 12ppm and HG(0,2) of 210ppm.
- 10) 9) + PRM3 aperture 262mm
- 11) 10) + BS 367.1mm/60mm no baffle
- 12) 11) + BS baffle (210mmx260mm). Total HOM goes up to 540ppm from 260ppm by clipping using BF baffle. The major is HG(4,0) of 170ppm.
- 13) 12) with BS baffle facing to X arm offset by 1mm in horizontal direction
- 14) 12) with BS baffle facing to X arm offset by 2mm in horizontal direction
- 15) 10) + BS 410mm/67mm with BS baffle (237mmx260mm)
- 16) 15) with BS baffle facing to X arm offset by 2mm in horizontal direction
- 17) 10) + BS 450mm/73.5mm with BS baffle (260mmx260mm) : no performance impact by the BS baffle
- 18) 17) with BS baffle facing to X arm offset by 2mm in horizontal direction
- 19) 10) + BS 490mm/80mm with BS baffle (260mmx260mm)
- 20) 19) with BS baffle facing to X arm offset by 2mm in horizontal direction

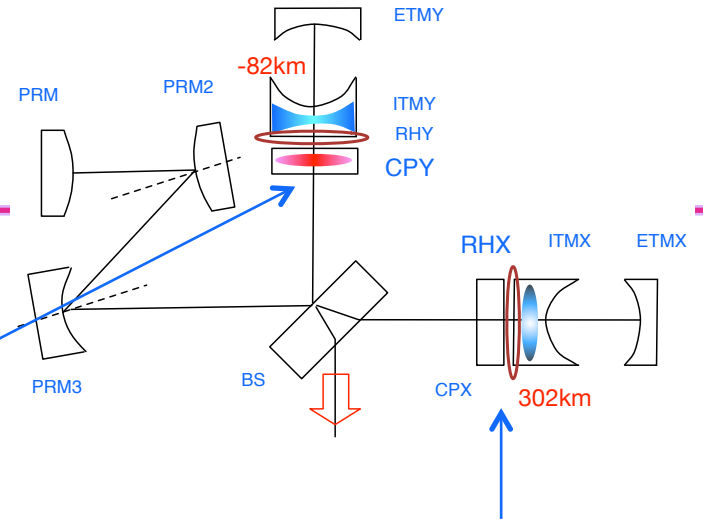




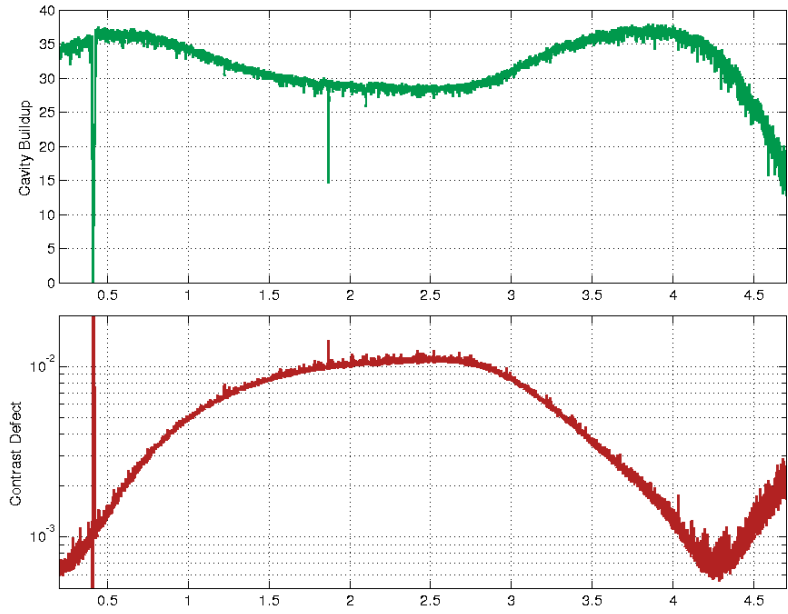
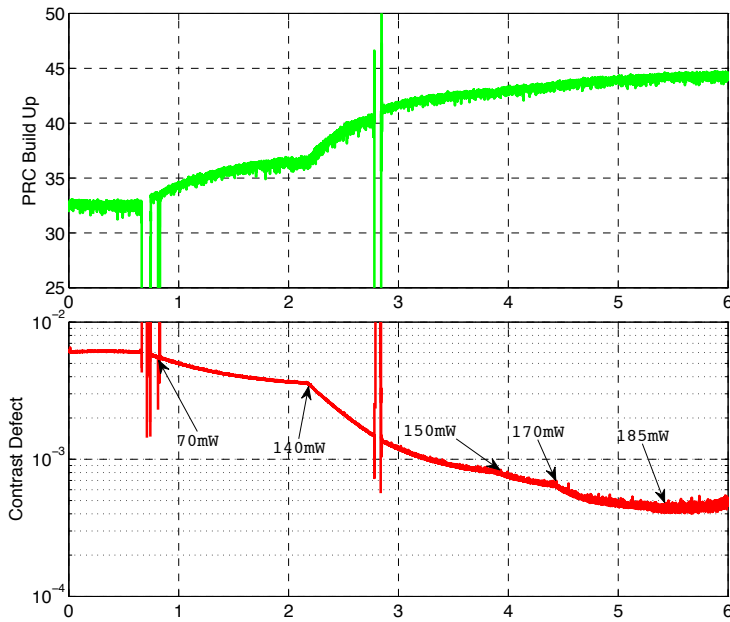
LIGO TCS corrections for LLO PRMI

RH optimal lens = $n(\text{SiO}_2) \times 82\text{km} = 1/0.84 \times 10^{-5}$

CP optimal lens = $82\text{km} = 1/1.22 \times 10^{-5}$



YARM CO₂ laser test in PRMI Carrier Configuration, PSL power = 3W



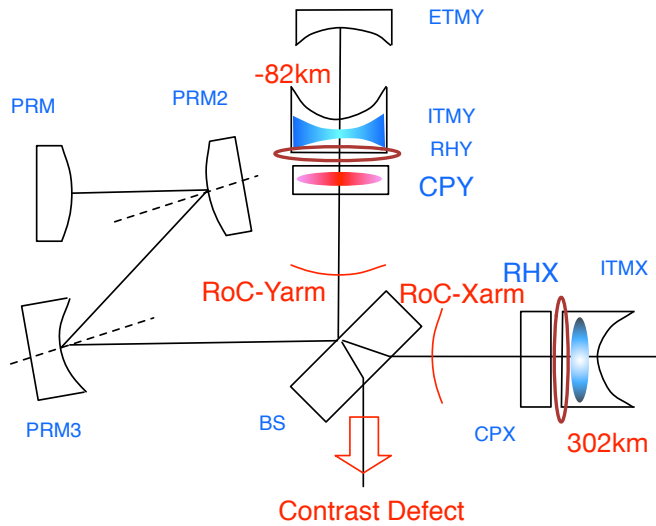
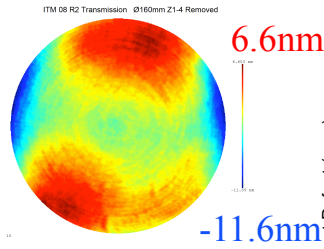
log11140 CD~400ppm, PRG~45

log#9733 CD~600ppm, PRG~35

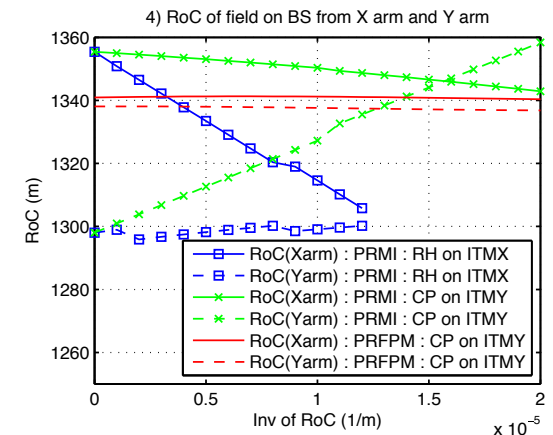
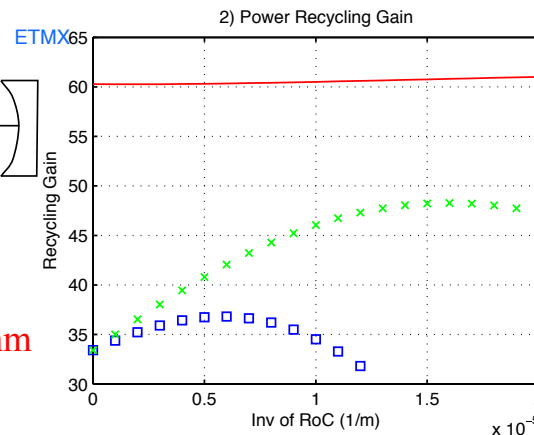
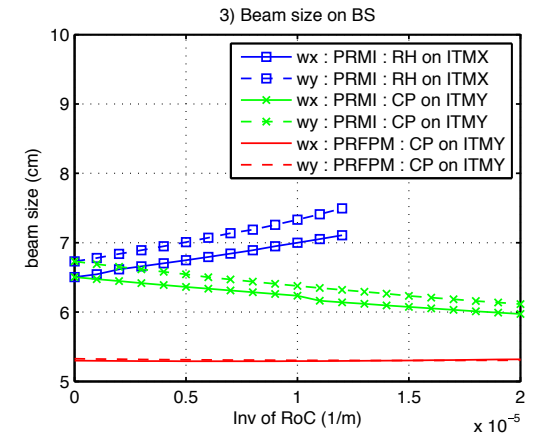
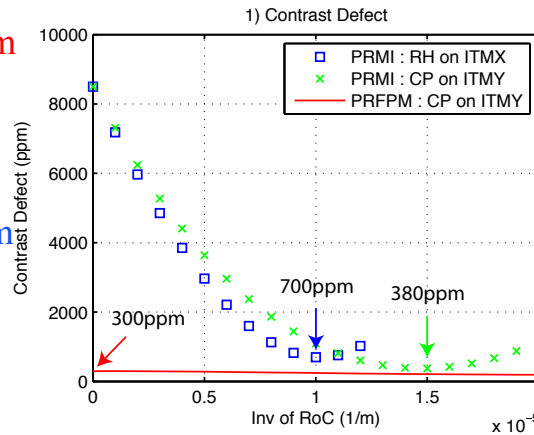
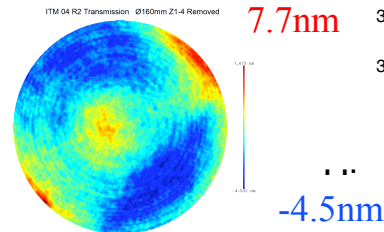


(In)Sensitivity on ITM SPTWE + CP lens

ITM08 / ITMY
transmission
map in 160mm
w/o power



ITM04 / ITMX



LIGO-G1400162

Yamamoto LLO April 3, 2014