T1300404 ACB scatter
3-28-13

radius of baffle edge, m — $r := 0.004$

length of baffle plate edge, m — $H_p := 0.655$

length of baffle bend edge, m — $H_b := 2 \cdot 0.239 = 0.478$

laser wavelength, m — $\lambda := 1.064 \cdot 10^{-6}$

wave number, m^-1 — $k := 2 \cdot \frac{\pi}{\lambda}$

$k = 5.905 \times 10^{6}$

IFO waist size, m — $w_{ifo} := 0.012$

solid angle of IFO mode, sr — $\Delta\Omega_{ifo} := \frac{\lambda^2}{\pi \cdot w_{ifo}^{2}} = 2.502 \times 10^{-9}$

Transfer function @ 100 Hz, ITM HR — $TF_{itmhr} := 1.1 \cdot 10^{-9}$

Gaussian beam radius at ITM, m — $w := 0.055$

IFO arm length, m — $L_{arm} := 4000$

PSL laser power, W — $P_{psl} := 125$

arm cavity gain — $G_{ac} := 13000$

arm cavity power, W — $P_a := \frac{P_{psl}}{2} \cdot G_{ac}$

$P_a = 8.125 \times 10^{5}$

radius of Cryopump aperture, m — $R_{cp} := 0.3845$

height of manifold/cryo baffle ledge, m $H_L := 0.769 - 0.655 = 0.114$

height of opening above ledge, m $H_1 := R_{cp} - H_L = 0.271$

radius of ACB hole, m $r_{acbhole} := 0.172$

area of ACB hole, m^2 $A_h := \pi \cdot r_{acbhole}{}^2 = 0.093$

half-angle from centerline to Rcp, rad $\theta_{cp} := \frac{R_{cp}}{L_{arm}}$

BRDF, sr^-1; CSIRO, surface 2, S/N 2 $BRDF_1(\theta) := \frac{2755.12}{\left(1 + 8.50787 \cdot 10^8 \cdot \theta^2\right)^{1.23597}}$

transformation to x, y, coords $\theta\left(x, y, x_0, y_0\right) := \frac{\sqrt{\left(x - x_0\right)^2 + \left(y - y_0\right)^2}}{L_{arm}}$

BRDF, sr^-1; CSIRO, surface 2, S/N 2 in xy coords

$$BRDF_{xy}\left(x, y, x_0, y_0\right) := \frac{2755.12}{\left[1 + 8.50787 \cdot 10^8 \cdot \left[\frac{\sqrt{\left(x - x_0\right)^2 + \left(y - y_0\right)^2}}{L_{arm}}\right]^2\right]^{1.2359}}$$

motion of ACB @ 100 HZ, m/rt HZ $x_{ACB} := 1 \cdot 10^{-12}$

BRDF porcelainized steel, #2, 3 deg inc.

Reflectivity of baffle surface $R := 0.02$

break-over angle, rad $\theta_1 := 0.9 \cdot \frac{\pi}{180} = 0.016$

micro-roughness angle, rad $\theta_2 := 6 \cdot \frac{\pi}{180}$

$BRDF_0 := 50$

final slope modifier $\beta := 2.7$

micro-roughness constant $C_{mr} := \frac{2^{\frac{1}{(\beta)}} - 1}{\theta_1^{\,2}}$ $C_{mr} = 1.186 \times 10^3$

large angle BRDF, sr^-1 $BRDF_{\theta 2} := 0.035$

parametric BRDF function, sr^-1 $BRDF_{ACB}(\theta_i) := \frac{BRDF_0}{\left(1 + C_{mr} \cdot \theta_i^{\,2}\right)^{\beta}} + BRDF_{\theta 2}$

BRDF #4 Oxidized stainless steel, 3 deg inc.

Reflectivity of baffle surface $R := 0.02$

break-over angle, rad $\theta_1 := .8 \cdot \frac{\pi}{180} = 0.014$

max BRDF, sr^-1 $BRDF_0 := 7.5$

final slope modifier $\beta := 0.7$

micro-roughness constant $C_{mr} := \frac{2^{\frac{1}{(\beta)}} - 1}{\theta_1^{\,2}}$

$C_{mr} = 8.678 \times 10^3$

large angle BRDF, sr^-1 $BRDF_{\theta 2} := 0.03$

BRDF function, sr^-1

$$BRDF_{ACBoxy3}(\theta_i) := \frac{BRDF_0}{\left(1 + C_{mr}\cdot\theta_i^2\right)^\beta} + BRDF_{\theta 2}$$

BRDF #4 Oxidized stainless steel, 57 deg inc.

Reflectivity of baffle surface $R := .04$

break-over angle, rad $\theta_1 := 0.6\cdot\frac{\pi}{180} = 0.01$

micro-roughness angle, rad $\theta_2 := 10\cdot\frac{\pi}{180} = 0.175$

max BRDF, sr^-1 $BRDF_0 := 40$

final slope modifier $\beta := 0.95$

micro-roughness constant $C_{mr} := \frac{2^{\frac{1}{(\beta)}} - 1}{\theta_1^2}$

$C_{mr} = 9.797 \times 10^3$

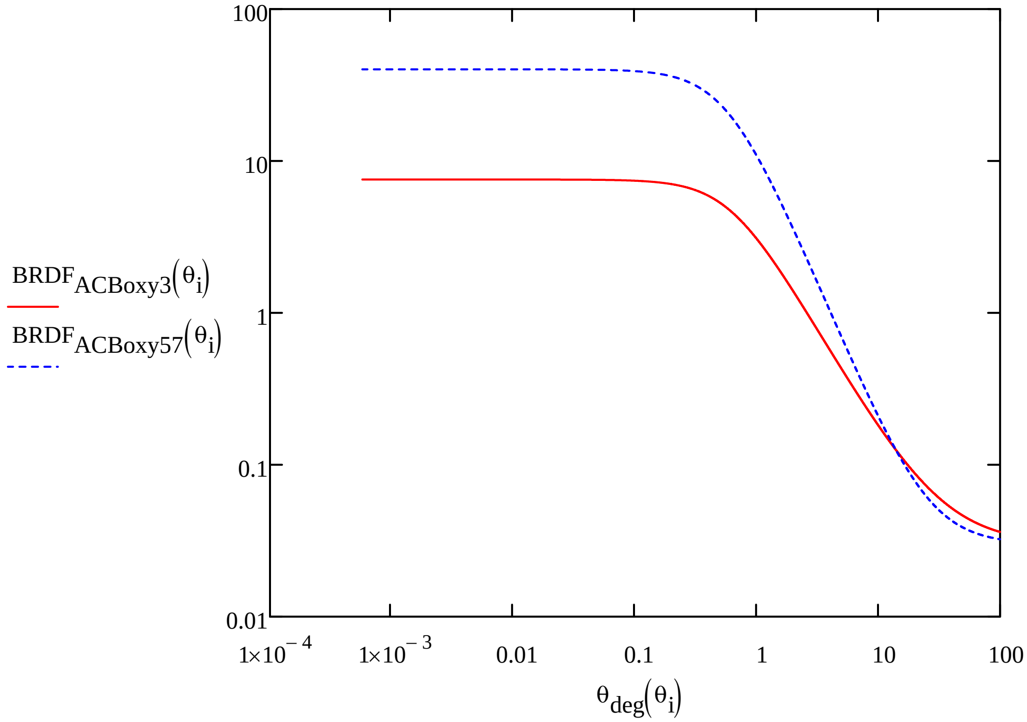
large angle BRDF, sr^-1 $BRDF_{\theta 2} := 0.03$

BRDF function, sr^-1

$$BRDF_{ACBoxy57}(\theta_i) := \frac{BRDF_0}{\left(1 + C_{mr}\cdot\theta_i^2\right)^\beta} + BRDF_{\theta 2}$$

angle in deg $\theta_{deg}(\theta_i) := \theta_i\cdot\frac{180}{\pi}$

$\theta_i := 0, 0.00001 .. 10\cdot\theta_2$



power through the cryopump baffle aperture (hits the arm cavity baffle), W

$$P_{acb\theta} := P_a \cdot \int_0^{\theta_{cp}} 2 \cdot \pi \cdot \theta \cdot BRDF_1(\theta)\, d\theta$$

$$P_{acb\theta} = 14.096$$

integration variable x, m $x := 0$

integration variable y, m $y := 0$

horizontal offset, m $x_0 := 0.2$

vertical offset, m $y_0 := 0.08$

power scattered out to radius Rcp, W

check the x, y calculation with no offset

$x_0 := 0$

$y_0 := 0$

$R := R_{cp}$

$$P_{acb} := P_a \cdot \left(\int_{-R}^{R} \int_{-\sqrt{R^2 - y^2}}^{\sqrt{R^2 - y^2}} \frac{BRDF_{xy}(x, y, x_0, y_0)}{L_{arm}^2} \, dx \, dy \right)$$

on-axis BRDF(x,y) function $P_{acb} = 14.096$

on-axis BRDF(θ) function $P_{acb\theta} = 14.096$

new value with offset

$x_0 := 0.2$

$y_0 := 0.08$

$R := R_{cp}$

$$P_{acb} := P_a \cdot \left(\int_{-R}^{R} \int_{-\sqrt{R^2 - y^2}}^{\sqrt{R^2 - y^2}} \frac{BRDF_{xy}(x, y, x_0, y_0)}{L_{arm}^2} \, dx \, dy \right)$$

power hitting ACB with COC off-set, W $P_{acb} = 12.363$

Area of cryopump baf aperture, m^2 $A_{cp} := \pi \cdot R_{cp}^2 = 0.464$

incident intensity, W/m^2 $I_i := \frac{P_{acb}}{A_{cp}} = 26.619$

reference tilt angle of baffle edge, rad $\theta_t := 0$

incident angle, rad

$$\theta_i(\theta_t, \theta_{xy}) := \text{acos}(\cos(\theta_{xy}) \cdot \cos(\theta_t))$$

input angle range, bend, rad

$$\theta_{xymaxb} := 33 \cdot \frac{\pi}{180} = 0.576$$

input angle range, bend, deg

$$\theta_{xymaxbdeg} := \theta_{xymaxb} \cdot \frac{180}{\pi} = 33$$

input angle range, plate rad

$$\theta_{xymaxp} := \frac{\pi}{2} = 1.571$$

input angle range, plate deg

$$\theta_{xymaxpdeg} := \theta_{xymaxp} \cdot \frac{180}{\pi} = 90$$

Scatter function from baffle plate edge

$$S_{poxy}(\theta_t) := \int_0^{\theta_{xymaxp}} \left[\int_{2 \cdot \theta_i(\theta_t, \theta_{xy}) - \frac{w_{ifo}}{L_{arm}}}^{2 \cdot \theta_i(\theta_t, \theta_{xy}) + \frac{w_{ifo}}{L_{arm}}} BRDF_{ACBoxy3}(\theta_s + 2 \cdot \theta_i(\theta_t, \theta_{xy})) \cdot \sqrt{w_{ifo}^2 - [L_{arm} \cdot (\theta_s -}\right.$$

$$S_{poxy}(\theta_t) = 1.264 \times 10^{-12}$$

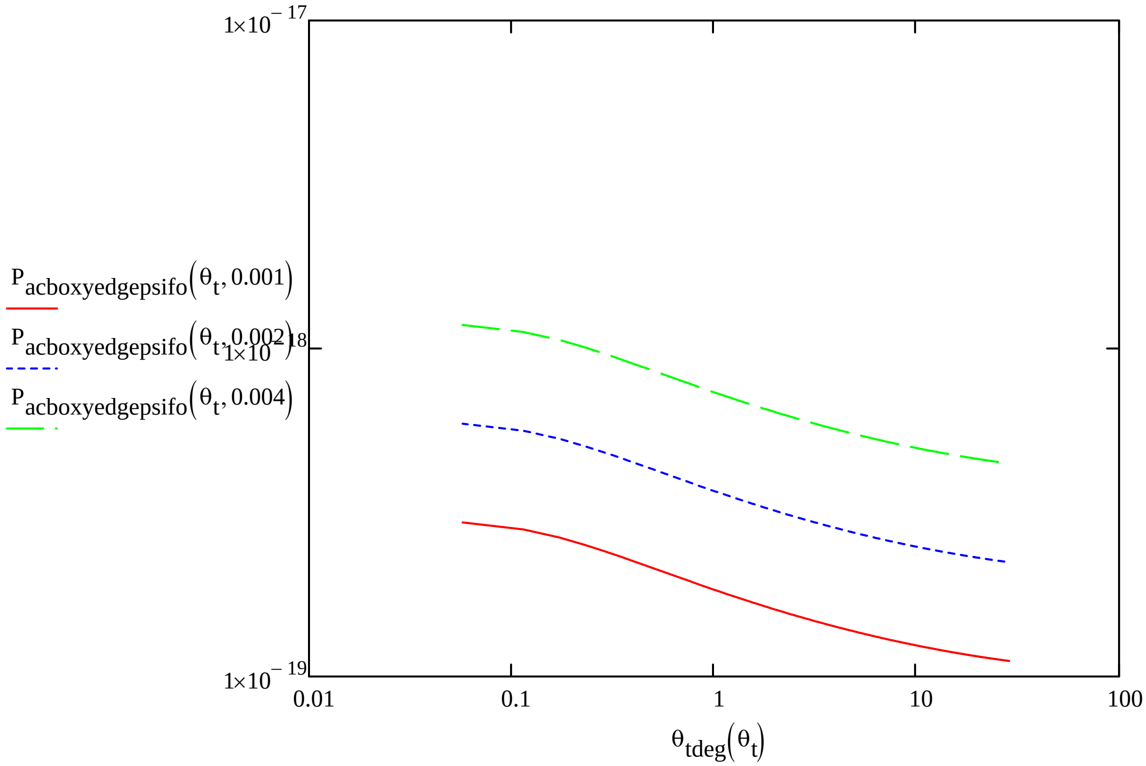
power scattered by the ACB baffle plate edge, W

$$P_{acboxyedgepsifo}(\theta_t, r) := 4 \cdot I_i \cdot r \cdot H_p \cdot BRDF_1(30 \cdot 10^{-6}) \cdot \Delta\Omega_{ifo} \cdot (S_{poxy}(\theta_t))$$

$$P_{acboxyedgepsifo}(\theta_t, 0.004) = 1.204 \times 10^{-18}$$

power scattered by baffle plate edge into IFO mode, W

$\theta_t := 0, 0.001 .. 0.5$ $\qquad$ $\theta_{tdeg}(\theta_t) := \theta_t \cdot \frac{180}{\pi}$



ACB displacement @ 100 HZ, m/rt HZ $\qquad$ $x_{ACB} = 1 \times 10^{-12}$

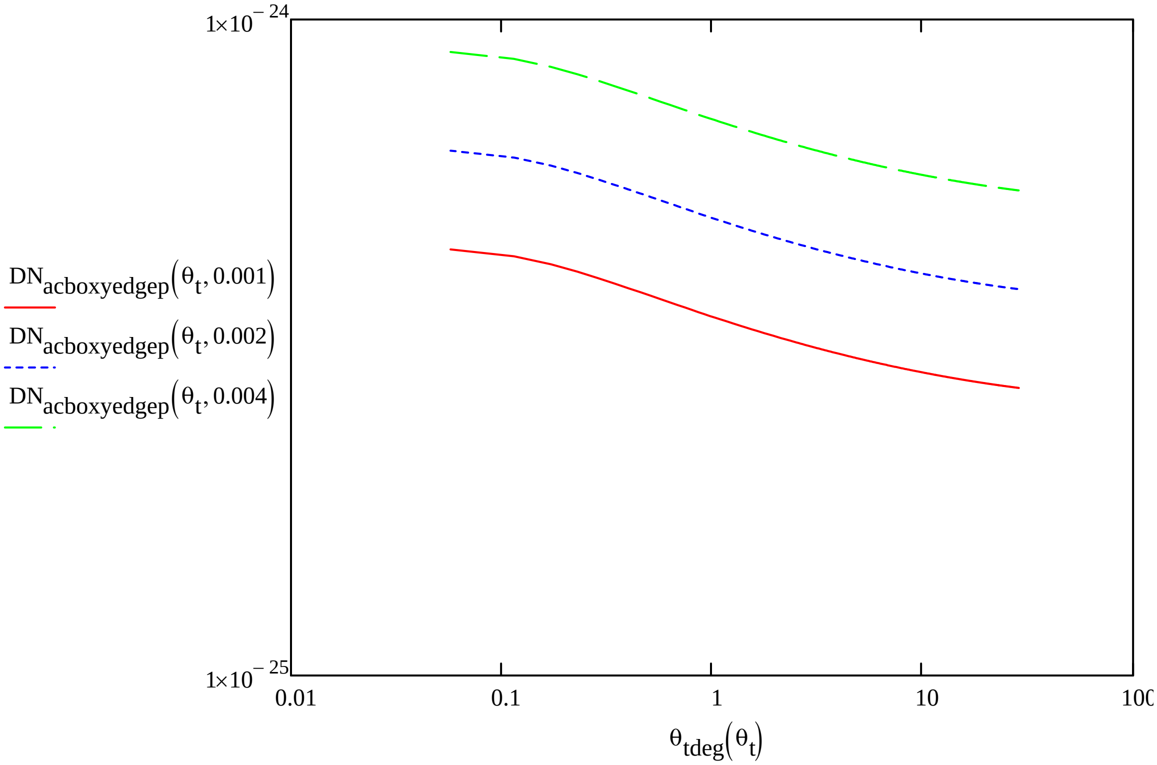
baffle plate edge scatter displacement noise @ 100 Hz, m/rtHz

reference tilt angle, rad $\qquad$ $\theta_t := 0$

$$DN_{acboxyedgep}(\theta_t, r) := TF_{itmhr} \cdot \left(\frac{P_{acboxyedgepsifo}(\theta_t, r)}{P_{psl}} \right)^{0.5} \cdot x_{ACB} \cdot \frac{2}{\sqrt{2}} \cdot k$$

$$DN_{acboxyedgep}(\theta_t, 0.004) = 9.017 \times 10^{-25}$$

$\theta_t := 0, 0.001 .. 0.5$



Scatter function from baffle louver bend

reference tilt angle, rad $\theta_t := 0$

$$S_{boxy}(\theta_t) := \int_0^{\theta_{xymaxb}} \left[\int_{2\cdot\theta_i(\theta_t,\theta_{xy})-\frac{w_{ifo}}{L_{arm}}}^{2\cdot\theta_i(\theta_t,\theta_{xy})+\frac{w_{ifo}}{L_{arm}}} BRDF_{ACBoxy3}(\theta_s + 2\cdot\theta_i(\theta_t,\theta_{xy}))\cdot\sqrt{w_{ifo}^{\;2} - \left[L_{arm}\cdot(\theta_s - \right.}\right.$$

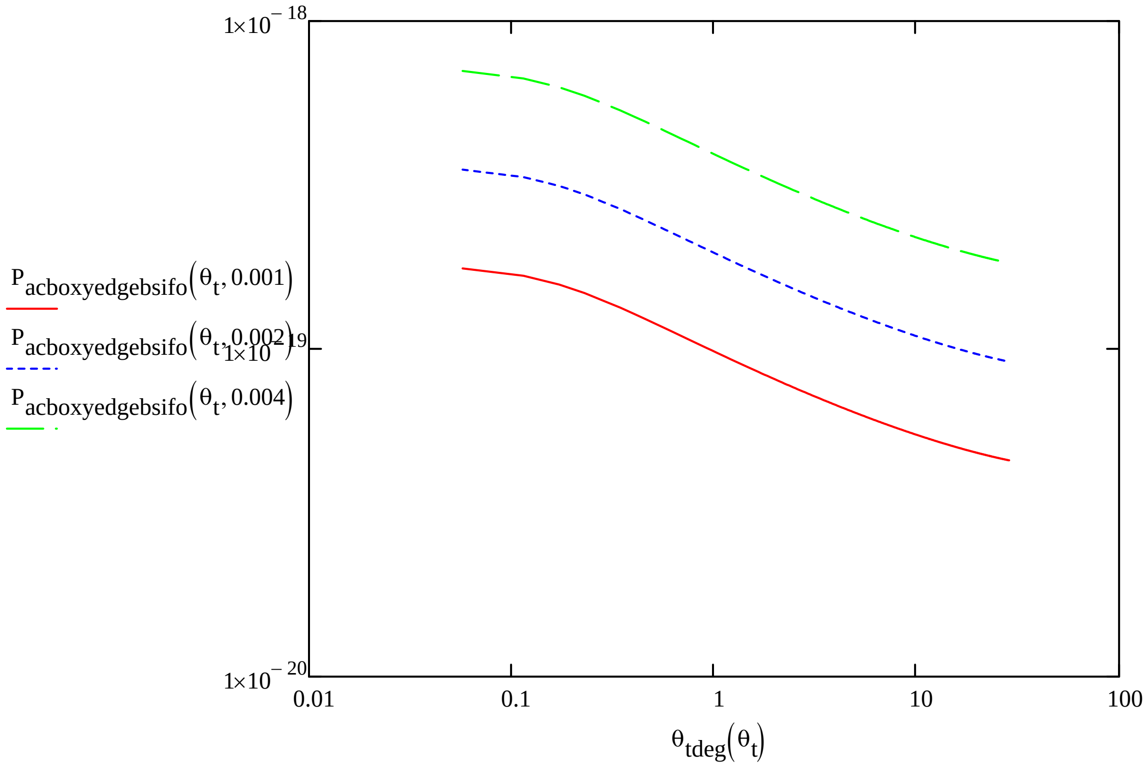
$S_{boxy}(\theta_t) = 1.034 \times 10^{-12}$

power scattered by the ACB louver edge bend into IFO mode, W

$$P_{acboxyedgebsifo}(\theta_t, r) := 4 \cdot I_i \cdot r \cdot H_b \cdot BRDF_1\left(30 \cdot 10^{-6}\right) \cdot \Delta\Omega_{ifo} \cdot \left(S_{boxy}(\theta_t)\right)$$

$$P_{acboxyedgebsifo}(\theta_t, 0.004) = 7.19 \times 10^{-19}$$

$\theta_t := 0, 0.001 .. 0.5$ $\theta_{tdeg}(\theta_t) := \theta_t \cdot \frac{180}{\pi}$



ACB displacement @ 100 HZ, m/rt HZ $x_{ACB} = 1 \times 10^{-12}$

displacement noise @ 100 Hz,
m/rtHz

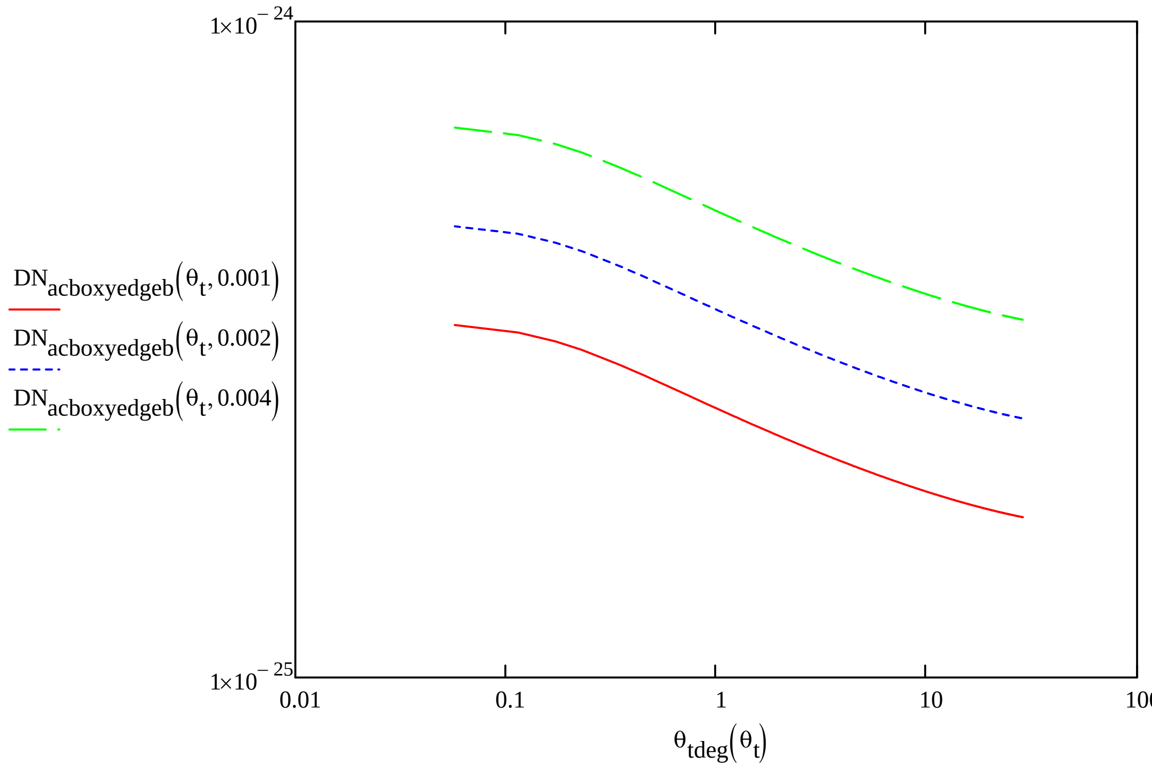
reference tilt angle, rad $\theta_t := 0$

louver edge bend scatter displacement noise @ 100 Hz, m/rtHz

$$DN_{acboxyedgeb}(\theta_t, r) := TF_{itmhr} \cdot \left(\frac{P_{acboxyedgebsifo}(\theta_t, r)}{P_{psl}} \right)^{0.5} \cdot x_{ACB} \cdot \frac{2}{\sqrt{2}} \cdot k$$

$$DN_{acboxyedgeb}(\theta_t, 0.004) = 6.967 \times 10^{-25}$$

$\theta_t := 0, 0.001 .. 0.5$



Louver Portion of ACB

area of ACB hole, m^2

$A_h := \pi \cdot r_{acbhole}^2 = 0.093$

area of manifold/cryo baffle ledge, m^2

$$A_L := \int_{H_1}^{R_{cp}} 2\cdot\sqrt{R_{cp}^2 - H^2}\, dH$$

$A_L = 0.043$

area of exposed ACB, m^2

$A_{ACB} := \pi \cdot R_{cp}^2 - 2.A_h - A_L = 0.236$

power incident on ACB louver portion, W

$P_{acboxy} := I_i \cdot A_{ACB}$

$P_{acboxy} = 6.272$

Power Scattered from the louver portion of baffle

$$P_{acboxysifo} := P_{acboxy} \cdot BRDF_{ACBoxy57}\left(2\cdot 57\cdot\frac{\pi}{180}\right)\cdot\frac{w_{ifo}^2}{L_{arm}^2}\cdot BRDF_1\left(30\cdot 10^{-6}\right)\cdot\Delta\Omega_{ifo}$$

$P_{acboxysifo} = 6.12 \times 10^{-18}$

Total scattered power from edge plate, louver bend, and louvers

vertical tilt angle, rad $\theta_t := 3\cdot\frac{\pi}{180}$ $\theta_t = 0.052$

bend radius, m $r := 0.001$

$P_{acboxyedgepsifo}(\theta_t, r) = 1.488 \times 10^{-19}$

$P_{acboxyedgebsifo}(\theta_t, r) = 7.237 \times 10^{-20}$

$P_{acboxysifo} = 6.12 \times 10^{-18}$

$$P_{acboxytsifo}(\theta_t, r) := P_{acboxyedgepsifo}(\theta_t, r) + P_{acboxyedgebsifo}(\theta_t, r) + P_{acboxysifo}$$

$$P_{acboxytsifo}(\theta_t, 0.004) = 7.004 \times 10^{-18}$$

fractional increase due to edge plate and bend

$$f_{p.b} := \frac{P_{acboxytsifo}(\theta_t, r)}{P_{acboxysifo}}$$

$$f_{p.b} = 1.036$$

effective incident power on ACB, W

$$P_{acboxy.eff} := P_{acboxy} \cdot f_{p.b}$$

$$P_{acboxytsifo.eff} := P_{acboxy.eff} \cdot BRDF_{ACBoxy57}\left(2 \cdot 57 \cdot \frac{\pi}{180}\right) \cdot \frac{{w_{ifo}}^2}{{L_{arm}}^2} \cdot BRDF_1\left(30 \cdot 10^{-6}\right) \cdot \Delta\Omega_{ifo}$$

$$P_{acboxytsifo.eff} = 6.341 \times 10^{-18}$$

scatter efficiency

$$\eta_{acb.eff} := \frac{P_{acboxy.eff}}{P_a}$$

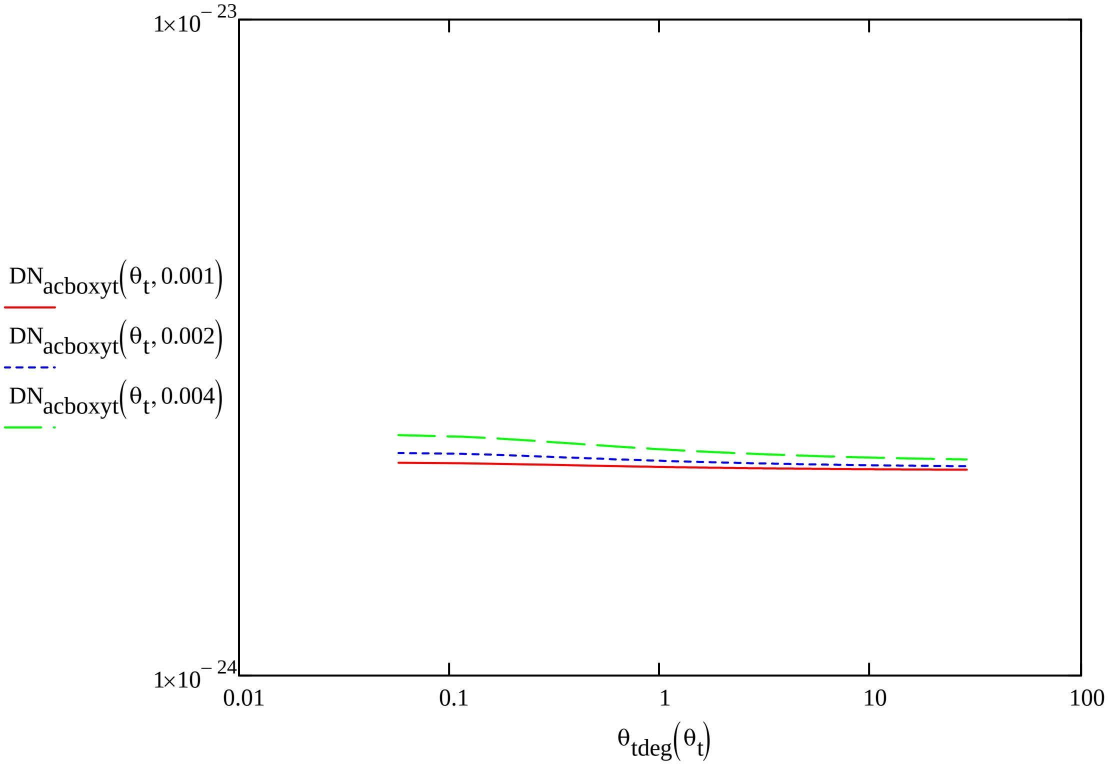
$$\eta_{acb.eff} = 7.999 \times 10^{-6}$$

total displacement noise @ 100 Hz,
m/rtHz

$$DN_{acboxyt}(\theta_t, r) := TF_{itmhr} \cdot \left(\frac{P_{acboxytsifo}(\theta_t, r)}{P_{psl}}\right)^{0.5} \cdot x_{ACB} \cdot \frac{2}{\sqrt{2}} \cdot k$$

$$DN_{acboxyt}(\theta_t, 0.004) = 2.175 \times 10^{-24}$$

$\theta_t := 0, 0.001 .. 0.5$



Virginio's parameters

arm power, W	$P_a = 8.125 \times 10^{5}$
PSL power, W	$P_{psl} = 125$
DARM transfer fcn	$TF_{itmhr} = 1.1 \times 10^{-9}$
motion of ACB, m/rtHz	$x_{ACB} = 1 \times 10^{-12}$
wave number, m^-1	$k = 5.905 \times 10^{6}$

scatter efficiency $\eta_{acb.eff} = 7.999 \times 10^{-6}$

BRDF of ACB, sr^-1 $BRDF_{ACBoxy57}\left(2\cdot 57\cdot\frac{\pi}{180}\right) = 0.032$

IFO beam waist, m $w_{ifo} = 0.012$

arm cavity length, m $L_{arm} = 4 \times 10^{3}$

BRDF of ETM, sr^-1 $BRDF_1\left(30\cdot 10^{-6}\right) = 1.364 \times 10^{3}$

solid angle of IFO mode, sr $\Delta\Omega_{ifo} = 2.502 \times 10^{-9}$

COMPARE FLANAGAN-THORNE WITH SMITH

Incident power on baffle louvers, W $P_{iacb} := I_i\cdot A_{ACB}$

Flanagan-Thorne reciprocity scattering cross-section

Flanagan-Thorne scattering cross-section

$$\sigma := \lambda^2\cdot BRDF_1\left(30\cdot 10^{-6}\right)$$

irradiance of TM by power scattered from adjacent surface, W/m^2

$$E_s = P_{iacb}\cdot BRDF_{ACBoxy57}\left(2\cdot 57\cdot\frac{\pi}{180}\right)\cdot\frac{1}{L_{arm}^{2}}$$

power scattered by TM into IFO mode

$$P_{sTMifo} = E_s\cdot\sigma$$

$$P_{sTMifo} = P_{iacb} \cdot BRDF_{ACBoxy57}\left(2 \cdot 57 \cdot \frac{\pi}{180}\right) \cdot \frac{\lambda^2}{L_{arm}^{\;2}} \cdot BRDF_1\left(30 \cdot 10^{-6}\right)$$

from the definition of $\Delta\Omega_{ifo}$

$$\Delta\Omega_{ifo} = \frac{\lambda^2}{\left(\pi \cdot w_{ifo}^{\;2}\right)}$$

the Thorne expression reduces to the Smith expression below

$$P_{sTMifo} = P_{iacb} \cdot BRDF_{ACBoxy57}\left(2 \cdot 57 \cdot \frac{\pi}{180}\right) \cdot \frac{\pi \cdot w_{ifo}^{\;2}}{L_{arm}^{\;2}} \cdot BRDF_1\left(30 \cdot 10^{-6}\right) \cdot \Delta\Omega_{ifo}$$

Smith scattering formalism

power scattered by ACB louver into IFO, W

$$P_{acbporcsifo} = P_{iacb} \cdot BRDF_{ACBoxy57}\left(2 \cdot 57 \cdot \frac{\pi}{180}\right) \cdot \frac{\pi \cdot w_{ifo}^{\;2}}{L_{arm}^{\;2}} \cdot BRDF_1\left(30 \cdot 10^{-6}\right) \cdot \Delta\Omega_{ifo}$$

Note: the identical results for coupled power into the IFO indicates that wifo is the correct beam radius for coupling into the IFO mode.

SCATTER FROM ROUGH CUT SS HOLE EDGE

Radius of baffle hole, m $\quad R_{bh} := 0.170$

thickness of baffle plate, m $\quad t := 0.047 \cdot .0254$

maximum width of exposed edge, m $\quad w_e := \dfrac{t}{\cos\left(33 \cdot \dfrac{\pi}{180}\right)}$

$$w_e = 1.423 \times 10^{-3}$$

exposed area of baffle hole edge, m^2

$$A_{bpe} := \int_{-R_{bh}}^{0} 2\cdot\sqrt{R_{bh}^2 - x^2}\,dx - \int_{-R_{bh}+w_e}^{0} 2\cdot\sqrt{R_{bh}^2 - (x - w_e)^2}\,dx$$

$$A_{bpe} = 4.84 \times 10^{-4}$$

incident power from opposite arm, W

$$P_{ie} := I_i \cdot A_{bpe} = 0.013$$

BRDF of edge, sr^-1

$$BRDF_{edge} := 0.1$$

power scattered into IFO mode, W

$$P_{acbedgesifo} := 4 \cdot I_i \cdot A_{bpe} \cdot \left(BRDF_{edge} \cdot \pi \cdot \frac{w_{ifo}^2}{L_{arm}^2} \right) \cdot BRDF_1 \left(30 \cdot 10^{-6} \right) \cdot \Delta\Omega_{ifo}$$

$$P_{acbedgesifo} = 4.975 \times 10^{-19}$$

displacement noise from cut edge
@ 100 Hz, m/rtHz

$$DN_{acbedge} := TF_{itmhr} \cdot \left(\frac{P_{acbedgesifo}}{P_{psl}} \right)^{0.5} \cdot x_{ACB} \cdot \frac{2}{\sqrt{2}} \cdot k$$

$$DN_{acbedge} = 5.795 \times 10^{-25}$$

Power Scattered from the louver portion of baffle

$$P_{acboxysifo} = 6.12 \times 10^{-18}$$

displacement noise from louvers @
100 Hz, m/rtHz

$$DN_{acboxys} := TF_{itmhr} \cdot \left(\frac{P_{acboxysifo}}{P_{psl}} \right)^{0.5} \cdot x_{ACB} \cdot \frac{2}{\sqrt{2}} \cdot k$$

$$DN_{acboxys} = 2.033 \times 10^{-24}$$

Ratio of cut edge to louver displacement noise

$$Ratio\_edge\_louver\_noise := \frac{DN_{acbedge}}{DN_{acboxys}}$$

$$Ratio\_edge\_louver\_noise = 0.285$$

REFLECTED ACB SCATTER

reflectivity of porcelain @ 57 deg $R_{porc57} := 0.001$

reflectivity of porcelain @ 3 deg $R_{porc3} := 0.02$

net reflectivity of porcelain after 4 bounces $R_{pnet4} := R_{porc57} \cdot R_{porc3}^{3}$

$R_{pnet4} = 8 \times 10^{-9}$

reflectivity of stainless steel @ 57 deg $R_{ss57} := 0.04$

reflectivity of stainless steel @ 3 deg $R_{ss3} := 0.02$

net reflectivity of ss after 4 bounces $R_{snet4} := R_{ss57} \cdot R_{ss3}^{3}$

$R_{snet4} = 3.2 \times 10^{-7}$

power through the cryopump baffle aperture (hits the arm cavity baffle), W $P_{acb} = 12.363$

Area of cryopump baf aperture, m^2 $A_{cp} = 0.464$

incident intensity, W/m^2 $I_i := \frac{P_{acb}}{A_{cp}} = 26.619$

area of exposed ACB, m^2

$A_{ACB} = 0.236$

power hitting ACB, W

$P_{ACB} := I_i \cdot A_{ACB}$

$P_{ACB} = 6.272$

BRDF of chamber wall

$BRDF_{wall} := 0.1$

$\Delta_{ifo} := 2.72 \times 10^{-9}$

$L := 4000$

Power reflected from porc baffle, W

$P_{acbporcrefl} := R_{pnet4} \cdot P_{ACB}$

$P_{acbporcrefl} = 5.018 \times 10^{-8}$

Power reflected from ACBporc
scattered into IFO mode , W

$$P_{acbporcrefls} := \sqrt{4} \cdot P_{acbporcrefl} \cdot R_{pnet4} \cdot BRDF_{wall} \cdot \frac{\pi \cdot w_{ifo}^{2}}{L^{2}} \cdot BRDF_1\left(30 \cdot 10^{-6}\right) \cdot \Delta_{ifo}$$

$$P_{acbporcrefls} = 8.424 \times 10^{-33}$$

Motion of BSC chamber @ 100 Hz, m/rt Hz

$x_{bscchamber} := 2 \times 10^{-11}$

displacement noise @ 100 Hz,
m/rtHz

$$DN_{acbporcrefl} := TF_{itmhr} \cdot \left(\frac{P_{acbporcrefls}}{P_{psl}}\right)^{0.5} \cdot x_{bscchamber} \cdot 2 \cdot k$$

$$DN_{acbporcrefl} = 2.133 \times 10^{-30}$$

Power reflected from ss baffle, W

$P_{acbsscrefl} := R_{snet4} \cdot P_{ACB}$

$$P_{acbsscrefl} = 2.007 \times 10^{-6}$$

Power reflected from ACBss
scattered into IFO mode , W

$$P_{acbssrefls} := \sqrt{4} \cdot P_{acbsscrefl} \cdot R_{snet4} \cdot BRDF_{wall} \cdot \frac{\pi \cdot w_{ifo}^{2}}{L^{2}} \cdot BRDF_{1}\left(30 \cdot 10^{-6}\right) \cdot \Delta_{ifo}$$

$$P_{acbssrefls} = 1.348 \times 10^{-29}$$

Motion of BSC chamber @ 100 Hz, m/rt Hz

$$x_{bscchamber} := 2 \times 10^{-11}$$

displacement noise @ 100 Hz,
m/rtHz

$$DN_{acbssrefl} := TF_{itmhr} \cdot \left(\frac{P_{acbssrefls}}{P_{psl}}\right)^{0.5} \cdot x_{bscchamber} \cdot \frac{2}{\sqrt{2}} \cdot k$$

$$DN_{acbssrefl} = 6.033 \times 10^{-29}$$

Ratio of reflected scatter from oxidized stainless and porcelainized steel

$$Ratio\_acbssrefl\_acbporcrefl := \frac{DN_{acbssrefl}}{DN_{acbporcrefl}}$$

$$Ratio\_acbssrefl\_acbporcrefl = 28.284$$

$$\overline{2\cdot\theta_i\left(\theta_t,\theta_{xy}\right)\big)\big]}^2\cdot\frac{L_{arm}}{L_{arm}^{\,2}}\,d\theta_s\Bigg]\cdot\cos\left(\theta_{xy}\right)\,d\theta_{xy}$$

)

$$\overline{2\cdot\theta_i\left(\theta_t,\theta_{xy}\right)\big)\big]}^2\cdot\frac{L_{arm}}{L_{arm}^2}\,d\theta_s\Bigg]\cdot\cos\left(\theta_{xy}\right)d\theta_{xy}$$

)