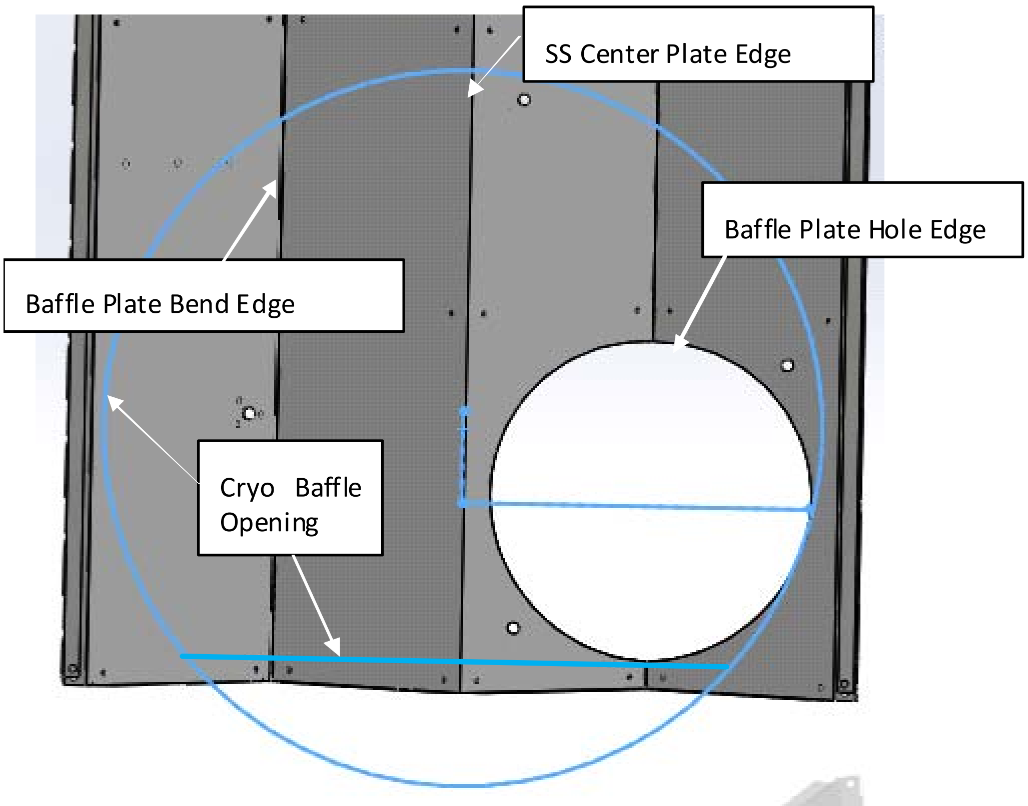
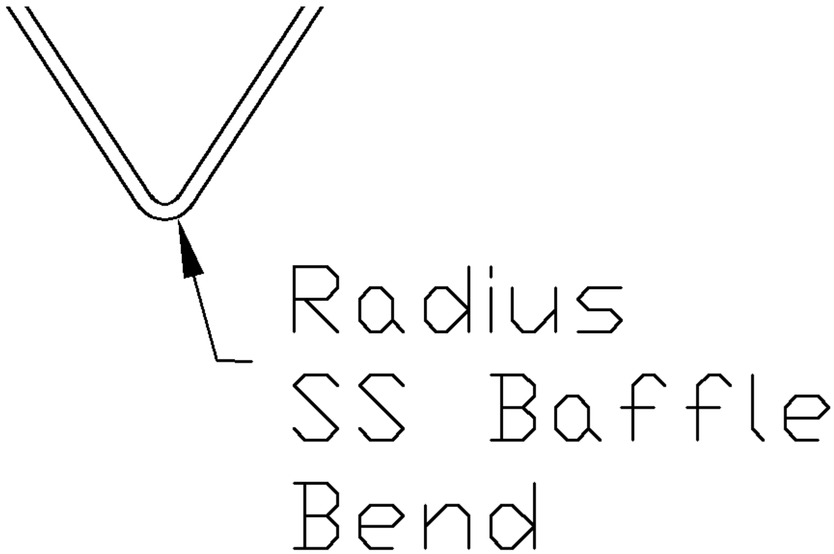
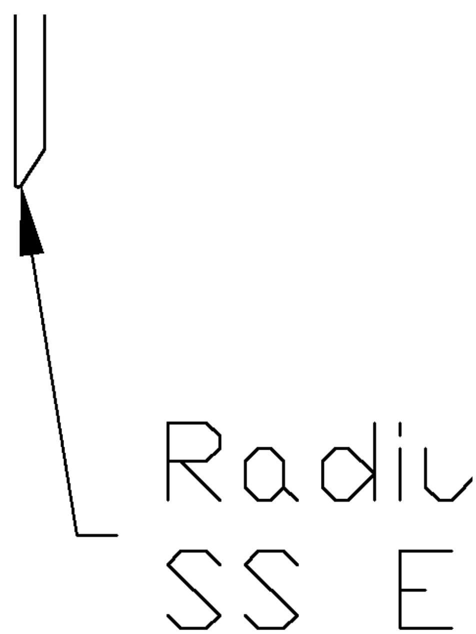
T1300716-v1 ACB Multi-AR coating on SS
8/27/13







Arm cavity power, W $P_a := 840000$

radius of SS baffle edge, m $r_{edgess} := 0.00005$

radius of SS baffle bend, m	$r_{bendss} := 0.0024$
length of baffle plate edge, m	$H_p := 0.655$
length of baffle bend, m	$H_b := 2 \cdot 0.239 = 0.478$
Frontal area of SS center plate cut edge, m^2	$A_{ssbp}(r_{edgess}) := 2 \cdot r_{edgess} \cdot H_p$
	$A_{ssbp}(r_{edgess}) = 6.55 \times 10^{-5}$
Frontal area of SS baffle bend edge, m^2	$A_{ssb}(r_{bendss}) := 2 \cdot r_{bendss} \cdot H_b$
	$A_{ssb}(r_{bendss}) = 2.294 \times 10^{-3}$
BRDF of SS cut edge, sr^-1	$BRDF_{edgess} := 0.1$
BRDF of photodetector, sr^-1	$BRDF_{pd} := 1 \cdot 10^{-3}$
BRDF of screw head sr^-1	$BRDF_{sh} := 5 \cdot 10^{-2}$
number of photodetector	$N_{pd} := 16$
number of screw heads	$N_{sh} := 3 \cdot N_{pd}$
radius of photodetector ring, m	$r_{pdbc} := 0.196$
Photoconductor radius, m	$r_{pd} := \frac{0.0114}{2}$
	$r_{pd} = 5.7 \times 10^{-3}$
photoconductor area, m^2	$A_{pd} := \pi \cdot r_{pd}^{2}$
	$A_{pd} = 1.021 \times 10^{-4}$
Screw head radius (#10), m	$r_{sh} := .004$

Screw head area, m^2	$A_{sh} := \pi \cdot r_{sh}^{2}$
	$A_{sh} = 5.027 \times 10^{-5}$
laser wavelength, m	$\lambda := 1.064 \cdot 10^{-6}$
wave number, m^-1	$k := 2 \cdot \frac{\pi}{\lambda}$
	$k = 5.905 \times 10^{6}$
ACB displacement @ 100 HZ, m/rt HZ	$x_{ACB} := 1 \cdot 10^{-12}$
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 Power, W	$P_{0} := 834174$
radius of Cryopump aperture, m	$R_{cp} := 0.3845$
half-angle from centerline to Rcp, rad	$\theta_{cp} := \frac{R_{cp}}{L_{arm}}$
half-angle from centerline to Rcp, rad (see ACB_PD_scatter_8-29-12)	$\theta_{pd} := \frac{r_{pdbc}}{L_{arm}}$

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

$$BRDF_1(\theta) := \frac{2755.12}{\left(1 + 8.50787 \cdot 10^8 \cdot \theta^2\right)^{1.23597}}$$

radius of manifold/cryo baffle, m

$$R_{cryo} := \frac{0.769}{2} = 0.385$$

height of ledge, m

$$H_L := 0.769 - 0.655 = 0.114$$

$$H_1 := R_{cryo} - H_L = 0.271$$

radius of ACB hole, m

$$r_{acbhole} := 0.172$$

area of ACB hole, m^2

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

$$A_h = 0.093$$

area of manifold/cryo baffle ledge, m^2

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

$$A_L = 0.043$$

area of exposed ACB, m^2

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

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

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

$$P_{acb} = 14.573$$

Area of cryopump baf aperture, m^2

$$A_{cp} := \pi \cdot R_{cp}^{\;2} = 0.464$$

incident intensity, W/m^2

$$I_i := \frac{P_{acb}}{A_{cp}} = 31.376$$

tilt angle of baffle edge, rad

$$\theta_t := 3 \cdot \frac{\pi}{180} = 0.052$$

$\theta_{xy} := 0$

incident angle, rad $\theta_i(\theta_t, \theta_{xy}) := \mathrm{acos}(\cos(\theta_{xy}) \cdot \cos(\theta_t))$

input angle range, bend, rad $\theta_{xymaxbend} := 57 \cdot \frac{\pi}{180} = 0.995$

input angle range, bend, deg $\theta_{xymaxbdeg} := \theta_{xymaxbend} \cdot \frac{180}{\pi} = 57$

input angle range, edge rad $\theta_{xymaxedge} := 60 \cdot \frac{\pi}{180}$

BRDF #4 Oxidized stainless steel, 3 deg inc.

Reflectivity of baffle surface $R := 0.02$

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

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

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

final slope modifier $\beta := 0.7$

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

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

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

BRDF function, sr^-1 $BRDF_{ACBoxy3}(\theta_i) := \dfrac{BRDF_0}{\left(1 + C_{mr} \cdot \theta_i^{\,2}\right)^{\beta}} + BRDF_{\theta 2}$

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 $BRDF_{\theta 2} := 0.04$

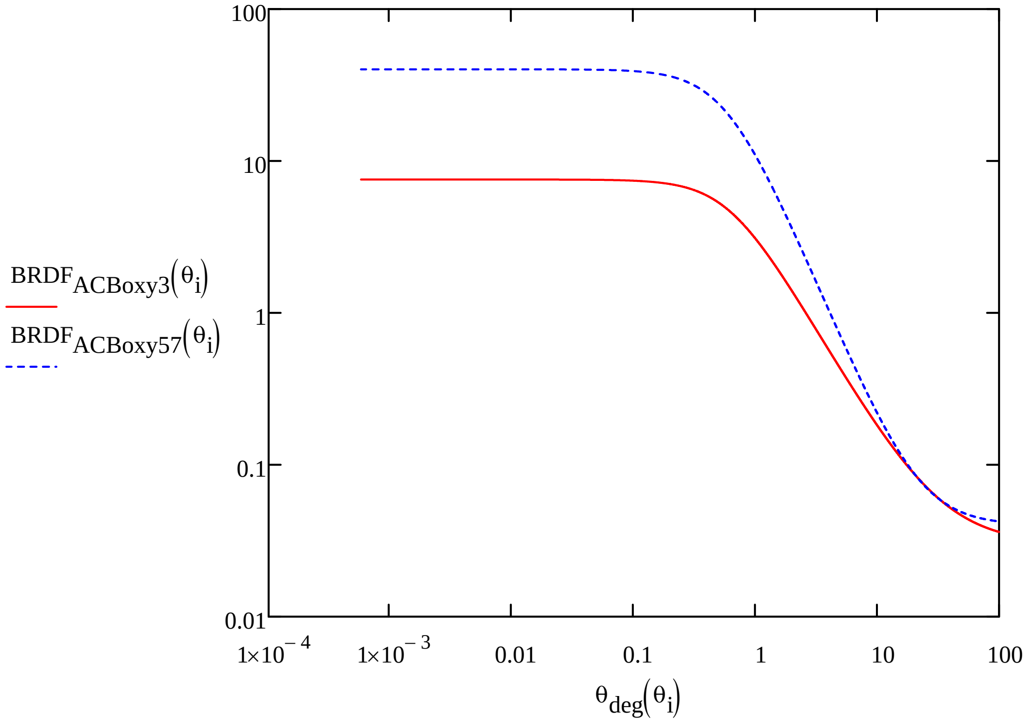
BRDF function, sr^-1 $BRDF_{ACBoxy57}(\theta_i) := \frac{BRDF_0}{\left(1 + C_{mr} \cdot \theta_i^2\right)^\beta} + BRDF_\theta$

back-scatter angle, rad $\theta_{57} := 2 \cdot 57 \cdot \frac{\pi}{180} = 1.99$

back-scatter BRDF, sr^-1 $BRDF_{ACBoxy57}(\theta_{57}) = 0.042$

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

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



BRDF Multi-AR 57 deg inc.

specular reflectivity $R_{mAR57} := 2.6\cdot10^{-5}$

break-over angle, rad $\theta_1 := 0.05\cdot\frac{\pi}{180} = 8.727\times10^{-4}$

micro-roughness angle, rad $\theta_2 := 20\cdot\frac{\pi}{180} = 0.349$

max BRDF, sr^-1 $BRDF_0 := 2000$

final slope modifier $\beta := 1.7$

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

$C_{mr} = 6.61 \times 10^{5}$

large angle BRDF, sr^-1 $BRDF_{\theta 2} := 3 \cdot 10^{-6}$

BRDF function, sr^-1 $BRDF_{mAR57}(\theta_i) := \dfrac{BRDF_0}{\left(1 + C_{mr} \cdot \theta_i^{2}\right)^{\beta}} + BRDF_{\theta}$

back-scatter angle, rad $\theta_{57} := 2 \cdot 57 \cdot \dfrac{\pi}{180} = 1.99$

back-scatter BRDF, sr^-1 $BRDF_{mAR57}(\theta_{57}) = 3.025 \times 10^{-6}$

BRDF multi-AR 15 deg inc.

specular reflectivity $R_{mAR15} := 0.08$

break-over angle, rad $\theta_1 := 0.017 \cdot \dfrac{\pi}{180} = 2.967 \times 10^{-4}$

micro-roughness angle, rad $\theta_2 := 20 \cdot \dfrac{\pi}{180} = 0.349$

max BRDF, sr^-1 $BRDF_0 := 5000$

final slope modifier $\beta := 1.6$

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

$C_{mr} = 6.159 \times 10^{6}$

large angle BRDF, sr^-1 $BRDF_{\theta 2} := 9 \cdot 10^{-7}$

BRDF function, sr^-1

$$BRDF_{mAR15}(\theta_i) := \frac{BRDF_0}{\left(1 + C_{mr}\cdot\theta_i^{\,2}\right)^{\beta}} + BRDF_{\theta}$$

back-scatter angle, rad

$$\theta_{15} := 2\cdot 15\cdot\frac{\pi}{180} = 0.524$$

back-scatter BRDF, sr^-1

$$BRDF_{mAR15}(\theta_{15}) = 1.443\times 10^{-6}$$

BRDF multi-AR 3 deg inc.

specular reflectivity

$$R_{mAR3} := 0.09$$

break-over angle, rad

$$\theta_1 := 0.04\cdot\frac{\pi}{180} = 6.981\times 10^{-4}$$

micro-roughness angle, rad

$$\theta_2 := 20\cdot\frac{\pi}{180} = 0.349$$

max BRDF, sr^-1

$$BRDF_0 := 2500$$

final slope modifier

$$\beta := 1.6$$

micro-roughness constant

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

$$C_{mr} = 1.112\times 10^{6}$$

large angle BRDF, sr^-1

$$BRDF_{\theta 2} := 2\cdot 10^{-6}$$

BRDF function, sr^-1

$$BRDF_{mAR3}(\theta_i) := \frac{BRDF_0}{\left(1 + C_{mr}\cdot\theta_i^{\,2}\right)^{\beta}} + BRDF_{\theta 2}$$

back-scatter angle, rad

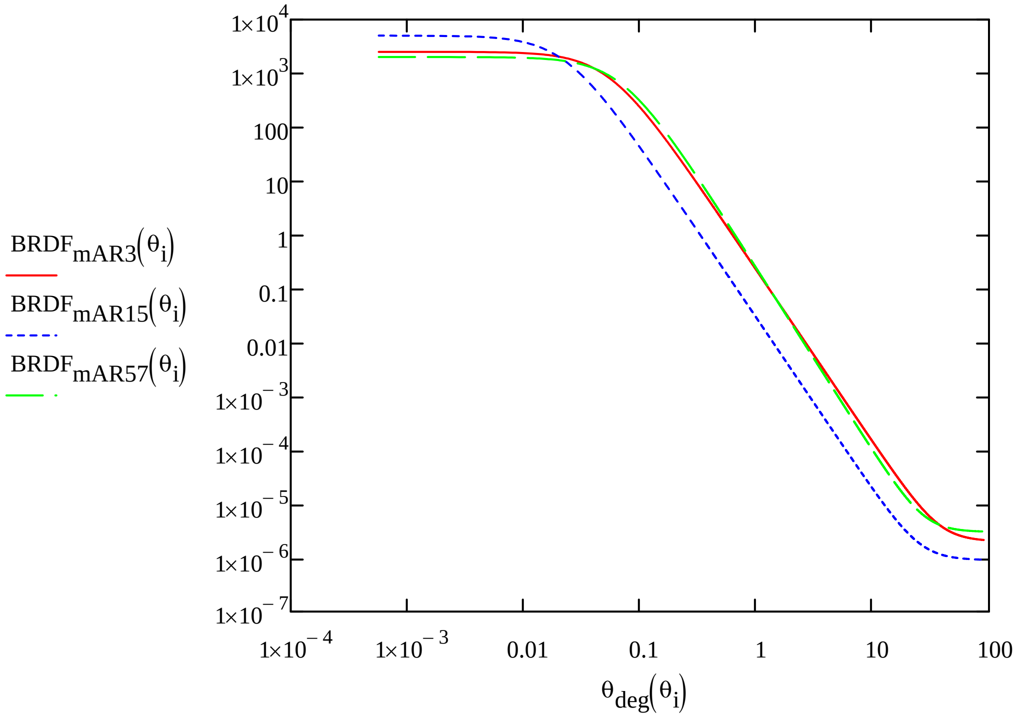
$$\theta_3 := 2\cdot 3\cdot\frac{\pi}{180} = 0.105$$

back-scatter BRDF, sr^-1

$BRDF_{mAR3}(\theta_3) = 7.26 \times 10^{-4}$

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

$\theta_i := 0, 0.00001 .. \frac{\pi}{2}$



BRDF Summary

$BRDF_{mAR3}(\theta_3) = 7.26 \times 10^{-4}$

$BRDF_{mAR15}(\theta_{15}) = 1.443 \times 10^{-6}$

$BRDF_{mAR57}(\theta_{57}) = 3.025 \times 10^{-6}$

back-scatter BRDF, sr^-1

$$BRDF := \begin{pmatrix} 3 & BRDF_{mAR3}(\theta_3) & BRDF_{mAR3}(\theta_3) \\ 15 & BRDF_{mAR15}(\theta_{15}) & BRDF_{mAR15}(\theta_{15}) \\ 57 & BRDF_{mAR57}(\theta_{57}) & BRDF_{mAR57}(\theta_{57}) \end{pmatrix}$$

incident angle

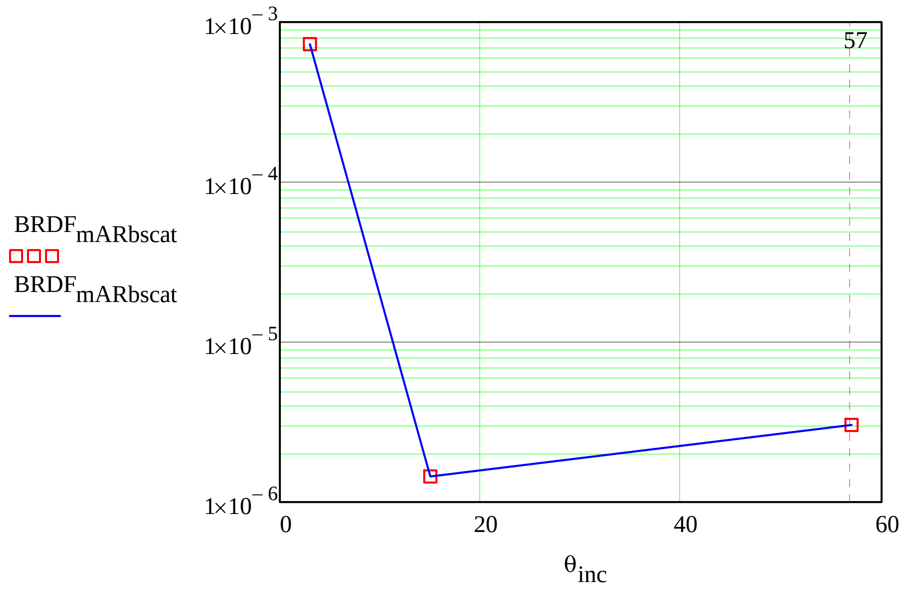
$$\theta_{inc} := BRDF^{\langle 0 \rangle}$$

$$\theta_{inc} = \begin{pmatrix} 3 \\ 15 \\ 57 \end{pmatrix}$$

back-scatter BRDF

$$BRDF_{mARbscat} := BRDF^{\langle 1 \rangle}$$

$$BRDF_{mARbscat} = \begin{pmatrix} 7.26 \times 10^{-4} \\ 1.443 \times 10^{-6} \\ 3.025 \times 10^{-6} \end{pmatrix}$$



Reflectance Summary

$R_{mAR3} = 0.09$

$R_{mAR15} = 0.08$

$$R_{mAR25} := \frac{\left(7.8 \cdot 10^{-4} + 9.7 \cdot 10^{-4} + 8.1 \cdot 10^{-4}\right)}{3}$$

$R_{mAR25} = 8.533 \times 10^{-4}$

$R_{mAR35} := 1.06 \cdot 10^{-4}$

$R_{mAR57} = 2.6 \times 10^{-5}$

$R_{mAR70} := 2.1 \cdot 10^{-5}$

Reflectance

$$R_{mAR} := \begin{pmatrix} 3 & R_{mAR3} & R_{mAR3} \\ 15 & R_{mAR15} & R_{mAR15} \\ 25 & R_{mAR25} & R_{mAR25} \\ 35 & R_{mAR35} & R_{mAR35} \\ 57 & R_{mAR57} & R_{mAR57} \\ 70 & R_{mAR70} & R_{mAR70} \end{pmatrix}$$

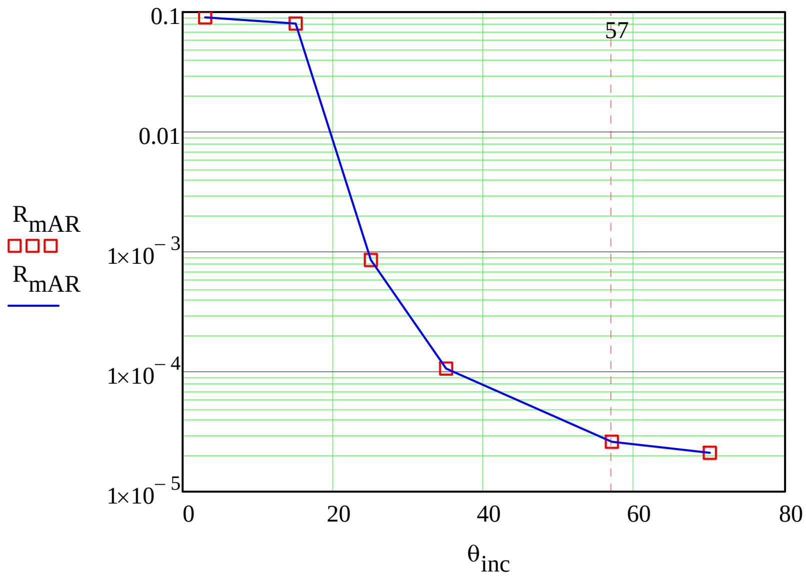
incident angle

$$\theta_{inc} := R_{mAR}^{\langle 0 \rangle}$$

$$\theta_{inc} = \begin{pmatrix} 3 \\ 15 \\ 25 \\ 35 \\ 57 \\ 70 \end{pmatrix}$$

ReflectanceDF

$$R_{mAR}^{\langle 1 \rangle} = \begin{pmatrix} 0.09 \\ 0.08 \\ 8.533 \times 10^{-4} \\ 1.06 \times 10^{-4} \\ 2.6 \times 10^{-5} \\ 2.1 \times 10^{-5} \end{pmatrix}$$



Scatter from photodetectors

number of photodetector $N_{pd} = 16$

photoconductor area, m^2 $A_{pd} = 1.021 \times 10^{-4}$

Power hitting the PD, W

$$P_{pd} := P_0 \cdot BRDF_1(\theta_{pd}) \cdot \frac{A_{pd}}{L_{arm}^2} = 3.706 \times 10^{-3}$$

power scattered by photodetector,
into IFO mode, W

$$P_{pdsifo}(\theta_t) := \sqrt{N_{pd}} \cdot P_{pd} \cdot BRDF_{pd} \cdot \frac{\pi \cdot w_{ifo}^2}{L_{arm}^2} \cdot BRDF_1(\theta_{pd}) \cdot \Delta\Omega_{ifo}$$

$$P_{pdsifo}(\theta_t) = 7.304 \times 10^{-22}$$

displacement noise @ 100 Hz,

m/rtHz

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

$$DN_{pd}(\theta_t) = 2.221\times 10^{-26}$$

Scatter from screw heads

number of screw heads $N_{sh} = 48$

Screw head area, m^2 $A_{sh} = 5.027\times 10^{-5}$

Power hitting the screw head, W

$$P_{sh} := P_0\cdot BRDF_1(\theta_{pd})\cdot\frac{A_{sh}}{L_{arm}^{\;2}} = 1.825\times 10^{-3}$$

power scattered by screw head into IFO mode, W

$$P_{shifo}(\theta_t, N_{sh}, BRDF_{sh}) := \sqrt{N_{sh}}\cdot P_{sh}\cdot BRDF_{sh}\cdot\frac{\pi\cdot w_{ifo}^{\;2}}{L_{arm}^{\;2}}\cdot BRDF_1(\theta_{pd})\cdot\Delta\Omega_{ifo}$$

$$P_{shifo}(\theta_t, N_{sh}, BRDF_{sh}) = 3.115\times 10^{-20}$$

displacement noise @ 100 Hz, m/rtHz

$$DN_{sh}(\theta_t, N_{sh}, BRDF_{sh}) := TF_{itmhr}\cdot\left(\frac{P_{shifo}(\theta_t, N_{sh}, BRDF_{sh})}{P_{psl}}\right)^{0.5}\cdot x_{ACB}\cdot\frac{2}{\sqrt{2}}\cdot k$$

$$DN_{sh}(\theta_t, N_{sh}, BRDF_{sh}) = 1.45\times 10^{-25}$$

OXIDIZED SS BAFFLE

Scatter from oxy SS center plate edge

power incident on SS center plate edge, W

$$r_{edgess} = 5 \times 10^{-5}$$

$$P_{itmbafpedgess} := I_i \cdot A_{ssbp}(r_{edgess})$$

$$P_{itmbafpedgess} = 2.055 \times 10^{-3}$$

Scattered power into IFO from oxy SS center plate edge

$$P_{acboxyedgebsifo}(\theta_t, r_{edgess}) := I_i \cdot A_{ssbp}(r_{edgess}) \cdot BRDF_{edgess} \cdot \frac{\pi \cdot w_{ifo}^2}{L_{arm}^2} \cdot BRDF_1(30 \cdot 10^{-6}) \cdot \Delta\Omega_{ifo}$$

displacement noise @ 100 Hz,
m/rtHz

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

$$DN_{acboxyedgeb}(\theta_t, r_{edgess}) = 1.157 \times 10^{-25}$$

BRDF geometric scatter function from oxy baffle bend

incident angle, rad

$$\theta_t = 0.052$$

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

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

$$S_{boxy}\left(\theta_t, BRDF_{ACBoxy3}\right) = 5.529 \times 10^{-13}$$

Scattered power into IFO from oxy SS baffle bend

$$P_{acboxybendsifo}\left(\theta_t, r_{bendss}\right) := I_i\cdot A_{ssb}\left(r_{bendss}\right)\cdot BRDF_1\left(30\cdot 10^{-6}\right)\cdot\Delta\Omega_{ifo}\cdot\left(S_{boxy}\left(\theta_t, BRDF_{ACBoxy3}\right)\right)$$

$$P_{acboxybendsifo}\left(\theta_t, 0.001\right) = 5.663 \times 10^{-20}$$

displacement noise @ 100 Hz,
m/rtHz

$$\theta_t := 3\cdot\frac{\pi}{180}$$

$$DN_{acboxybend}\left(\theta_t, r_{bendss}\right) := TF_{itmhr}\cdot\left(\frac{P_{acboxybendsifo}\left(\theta_t, r_{bendss}\right)}{P_{psl}}\right)^{0.5}\cdot x_{ACB}\cdot\frac{2}{\sqrt{2}}\cdot k$$

$$DN_{acboxybend}\left(\theta_t, 0.001\right) = 1.955 \times 10^{-25}$$

Power Scattered from the louver portion of baffle

$$BRDF_{ACBoxy57}\left(2\cdot 57\cdot\frac{\pi}{180}\right) = 0.042$$

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

$$P_{acboxylouvsifo} = 2.98 \times 10^{-17}$$

displacement noise @ 100 Hz,
m/rtHz

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

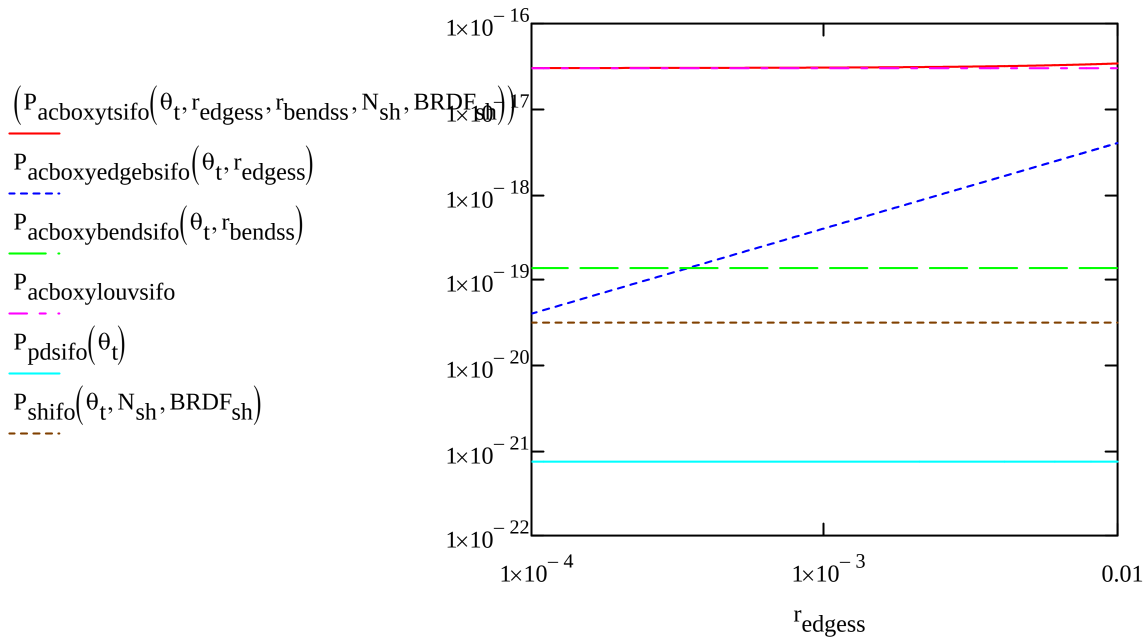
$$DN_{acboxylouv}(\theta_t) = 4.485 \times 10^{-24}$$

Total scattered power into IFO from oxy SS ACB

$$P_{acboxytsifo}(\theta_t, r_{edgess}, r_{bendss}, N_{sh}, BRDF_{sh}) := P_{acboxyedgebsifo}(\theta_t, r_{edgess}) + P_{acboxybendsifo}(\theta_t, r_b$$

$$P_{acboxytsifo}(\theta_t, r_{edgess}, r_{bendss}, N_{sh}, BRDF_{sh}) = 2.999 \times 10^{-17}$$

$$r_{edgess} := 0.0001, 0.00011 .. 0.01$$



$r_{edgess} := 5 \times 10^{-5}$

Note: the louver scatter dominates for oxy SS surface with edge radius < 0.003 m

total displacement noise @ 100 Hz,
m/rtHz

$$DN_{acboxyt}\left(\theta_t, r_{edgess}, r_{bendss}, N_{sh}, BRDF_{sh}\right) := TF_{itmhr} \cdot \left(\frac{P_{acboxytsifo}\left(\theta_t, r_{edgess}, r_{edgess}, N_{sh}, BRDF_{sh}\right.}{P_{psl}} \right.$$

$$DN_{acboxyt}\left(\theta_t, r_{edgess}, r_{bendss}, N_{sh}, BRDF_{sh}\right) = 4.489 \times 10^{-24}$$

Multi-AR_SS BAFFLE

Scatter from mAR-SS center plate edge

BRDF geometric scatter function from mAR-SS center plate edge

incident angle, rad

$$\theta_t = 0.052$$

$$\theta_i(\theta_t, \theta_{xy}) = 0.052$$

$$S_{bmAR}(\theta_t, BRDF_{mAR3}) := \int_0^{\theta_{xymaxbend}} \left[\int_{2\cdot\theta_i(\theta_t,\theta_{xy}) - \frac{w_{ifo}}{L_{arm}}}^{2\cdot\theta_i(\theta_t,\theta_{xy}) + \frac{w_{ifo}}{L_{arm}}} BRDF_{mAR3}(\theta_s + 2\cdot\theta_i(\theta_t,\theta_{xy}))\cdot\sqrt{w_{ifo}^2} \right]$$

$$S_{bmAR}(\theta_t, BRDF_{mAR3}) = 7.858 \times 10^{-17}$$

Scattered power into IFO from mAR-SSbaffle center plate edge

$$r_{edgess} = 5 \times 10^{-5}$$

$$P_{acbmARedgebsifo}(\theta_t, r_{edgess}) := I_i\cdot A_{ssbp}(r_{edgess})\cdot BRDF_1\left(30\cdot 10^{-6}\right)\cdot\Delta\Omega_{ifo}\cdot\left(S_{bmAR}(\theta_t, BRDF_{mAR3})\right)$$

$$P_{acbmARedgebsifo}(\theta_t, r_{edgess}) = 5.514 \times 10^{-25}$$

displacement noise @ 100 Hz,
m/rtHz

$$DN_{acbmARbend}\left[\theta_t, (r_{edgess})\right] := TF_{itmhr}\cdot\left[\frac{P_{acbmARedgebsifo}\left[\theta_t, (r_{edgess})\right]}{P_{psl}}\right]^{0.5}\cdot x_{ACB}\cdot\frac{2}{\sqrt{2}}\cdot k$$

$$DN_{acbmARbend}\left[\theta_t, (r_{edgess})\right] = 6.101 \times 10^{-28}$$

BRDF geometric scatter function from mAR-SS baffle bend

incident angle, rad

$$\theta_t = 0.052$$

$$\theta_i(\theta_t, \theta_{xy}) = 0.052$$

$$S_{bmAR}(\theta_t, BRDF_{mAR3}) := \int_0^{\theta_{xymaxbend}} \left[\int_{2\cdot\theta_i(\theta_t,\theta_{xy}) - \frac{w_{ifo}}{L_{arm}}}^{2\cdot\theta_i(\theta_t,\theta_{xy}) + \frac{w_{ifo}}{L_{arm}}} BRDF_{mAR3}(\theta_s + 2\cdot\theta_i(\theta_t,\theta_{xy}))\cdot\sqrt{w_{ifo}^{2}} \right.$$

$$S_{bmAR}(\theta_t, BRDF_{mAR3}) = 7.858 \times 10^{-17}$$

Scattered power into IFO from mAR-SS baffle bend

$$P_{acbmARbendsifo}(\theta_t, r_{bendss}) := I_i\cdot A_{ssb}(r_{bendss})\cdot BRDF_1(30\cdot 10^{-6})\cdot\Delta\Omega_{ifo}\cdot(S_{bmAR}(\theta_t, BRDF_{mAR3}))$$

$$P_{acbmARbendsifo}(\theta_t, r_{bendss}) = 1.931 \times 10^{-23}$$

displacement noise @ 100 Hz,
m/rtHz

$$DN_{acbmARbend}(\theta_t, r_{bendss}) := TF_{itmhr}\cdot\left(\frac{P_{acbmARbendsifo}(\theta_t, r_{bendss})}{P_{psl}}\right)^{0.5}\cdot x_{ACB}\cdot\frac{2}{\sqrt{2}}\cdot k$$

$$DN_{acbmARbend}(\theta_t, 0.001) = 2.331 \times 10^{-27}$$

Power Scattered from the mAR-SS louver portion of baffle

$$\mathrm{BRDF}_{mAR57}\left(2\cdot 57\cdot\frac{\pi}{180}\right) = 3.025\times 10^{-6}$$

$$P_{acbmARlouvsifo}(\theta_t) := I_i\cdot A_{ACB}\cdot \mathrm{BRDF}_{mAR57}\left(2\cdot 57\cdot\frac{\pi}{180}\right)\cdot\frac{\pi\cdot w_{ifo}^{\,2}}{L_{arm}^{\,2}}\cdot \mathrm{BRDF}_1\left(30\cdot 10^{-6}\right)\cdot\Delta\Omega$$

$$P_{acbmARlouvsifo}(\theta_t) = 2.159\times 10^{-21}$$

displacement noise @ 100 Hz,
m/rtHz

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

$$DN_{acbmARlouv}(\theta_t) = 3.818\times 10^{-26}$$

Total scattered power into IFO from mAR-SS ACB

$$P_{acbmARtsifo}(\theta_t, r_{edgess}, r_{bendss}, N_{sh}, \mathrm{BRDF}_{sh}) := P_{acbmARedgebsifo}(\theta_t, r_{edgess}) + P_{acbmARbendsifo}($$

$$P_{acbmARtsifo}(\theta_t, r_{edgess}, r_{bendss}, N_{sh}, \mathrm{BRDF}_{sh}) = 3.406\times 10^{-20}$$

$$r_{edgess} = 5\times 10^{-5}$$

$$P_{acbmARlouvsifo}(\theta_t) = 2.159\times 10^{-21}$$

$$P_{acbmARedgebsifo}(\theta_t, r_{edgess}) = 0$$

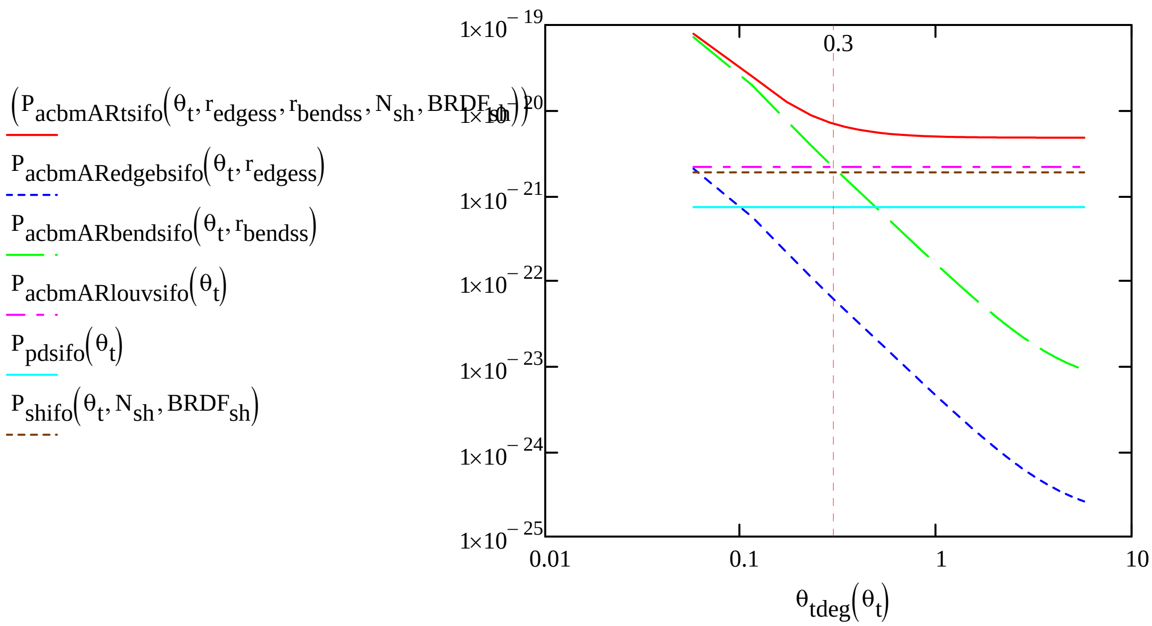
Reduce reduce screw head BRDF so that louver dominates the scatter

$BRDF_{sh} := 0.003$

Tilt the baffle so that edge scatter does not dominate

$\theta_{tdeg}(\theta_t) := \theta_t \cdot \frac{180}{\pi}$

$\theta_t := 0, 0.001 .. 0.1$

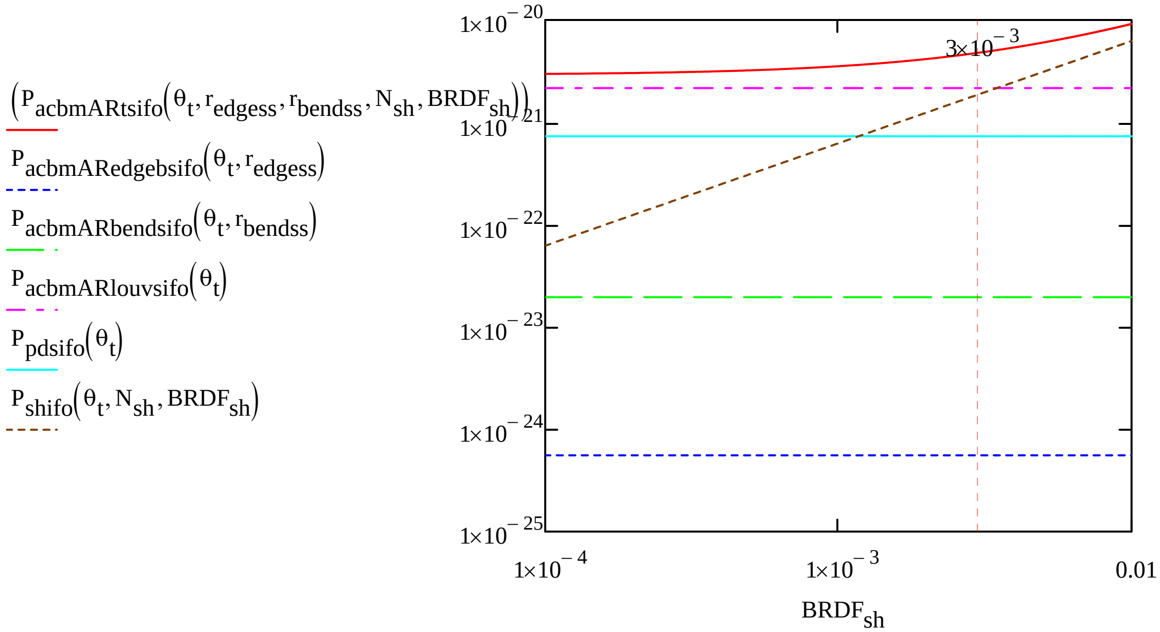


Note: the edge scatter does not dominate for tilt angles >0.3 deg

$\theta_t := 0.052$

$\theta_{tdeg}(\theta_t) = 2.979$

$BRDF_{sh} := 0.0001, 0.00011 .. 0.01$



$BRDF_{sh} := 0.003$

Note: the screw head BRDF must be < 0.003 sr^-1 for louver scatter to dominate

total displacement noise @ 100 Hz,
m/rtHz

$\theta_t = 0.052$

$r_{edgess} = 5 \times 10^{-5}$

$BRDF_{sh} = 3 \times 10^{-3}$

$$DN_{acbmARt}(\theta_t, r_{edgess}, r_{bendss}, N_{sh}, BRDF_{sh}) := TF_{itmhr} \cdot \left(\frac{P_{acbmARtsifo}(\theta_t, r_{edgess}, r_{bendss}, N_{sh}, BRD}{P_{psl}} \right.$$

$$DN_{acbmARt}(\theta_t, r_{edgess}, r_{bendss}, N_{sh}, BRDF_{sh}) = 5.68 \times 10^{-26}$$

Comparison of mAR coated SS to oxidized SS bafle

$$\frac{DN_{acboxyt}\left(\theta_t, r_{edgess}, r_{bendss}, N_{sh}, BRDF_{sh}\right)}{DN_{acbmARt}\left(\theta_t, r_{edgess}, r_{bendss}, N_{sh}, BRDF_{sh}\right)} = 79.004$$

Edge

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

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$$\text{endss}) + P_{acboxylouvsifo} + P_{pdsifo}(\theta_t) + P_{shifo}(\theta_t, N_{sh}, BRDF_{sh})$$

$$\left.\right)\right)^{0.5} \cdot x_{ACB} \cdot \frac{2}{\sqrt{2}} \cdot k$$

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

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

ifo

$$\theta_t, r_{bendss}) + P_{acbmARlouvsifo}(\theta_t) + P_{pdsifo}(\theta_t) + P_{shifo}(\theta_t, N_{sh}, BRDF_{sh})$$

$$\left.\frac{\cdots F_{sh})}{\;}\right)^{0.5} \cdot x_{ACB} \cdot \frac{2}{\sqrt{2}} \cdot k$$