

## T1300424 Scattering Parameters Hartmann Beams

Motion of HEPI @ 200 Hz, m/rt Hz	$x_{\text{hepi}} := 2 \cdot 10^{-10}$	
Motion of HAM table @ 100 Hz, m/rt Hz	$x_{\text{ham}} := 1.3 \cdot 10^{-11}$	
Motion of HAM flange @ 100 Hz, m/rt Hz	$x_{\text{hamflange}} := 1.7 \cdot 10^{-11}$	
laser wavelength, m	$\lambda := 1.064 \cdot 10^{-6}$	
wave number, m <sup>-1</sup>	$k := 2 \cdot \frac{\pi}{\lambda}$	$k = 5.905 \times 10^6$
IFO waist size, m	$w_{\text{ifo}} := 0.012$	
solid angle of IFO mode, sr	$\Delta_{\text{ifo}} := \pi \cdot \left( \frac{\lambda}{\pi \cdot w_{\text{ifo}}} \right)^2$	$\Delta_{\text{ifo}} = 2.502 \times 10^{-9}$
Transfer function @ 100 Hz, ITM AR	$\text{TF}_{\text{itmar}} := 3.16 \cdot 10^{-11}$	
Transfer function @ 100 Hz, BS from SR	$\text{TF}_{\text{srbs}} := 4.46 \cdot 10^{-11}$	
<b>Ref. T070247</b>		
Transmissivity of ITM HR	$T_{\text{itmhr}} := 0.014$	
Transmissivity of ETM HR	$T_{\text{etm}} := 5 \cdot 10^{-6}$	
ETM transmitted power, W	$P_{\text{etmtr}} := 4.4$	
input laser power, W	$P_{\text{psl}} := 125$	
arm cavity gain	$G_{\text{ac}} := 13000$	
arm cavity power, W	$P_{\text{a}} := \frac{P_{\text{psl}}}{2} \cdot G_{\text{ac}}$	$P_{\text{a}} = 8.125 \times 10^5$

power in power recycling cavity both arms, W	$P_{rc} := \frac{2P_a \cdot T_{itmhr}}{4}$	$P_{rc} = 5.688 \times 10^3$
power in power recycling cavity arm, W	$P_{rca} := \frac{P_a \cdot T_{itmhr}}{4}$	$P_{rca} = 2.844 \times 10^3$
Gaussian power parameter in recycling cavity	$P_{0rc} := P_{rca}$	$P_{0rc} = 2.844 \times 10^3$
Power recycling cavity gain	$G_{rc} := \frac{2 \cdot P_{rca}}{P_{psl}}$	$G_{rc} = 45.5$
refl port signal ratio	$G_{refl} := 0.0010$	
as port signal ratio	$G_{as} := 0.001080$	
output signal power, W	$P_{sc} := P_{psl} \cdot G_{as}$	$P_{sc} = 0.135$
power after SRM, W	$P_{srm} := G_{as} \cdot P_{psl}$	
transmissivity of SRM HR	$T_{srmhr} := 0.200$	
power in signal recycling cavity, W	$P_{src} := \frac{P_{srm}}{T_{srmhr}}$	$P_{src} = 0.675$

reflectivity of BS HR	$R_{\text{bshr}} := 0.50$	
reflectivity of BS AR	$R_{\text{bsar}} := 50 \cdot 10^{-6}$	
Reflectivity of ITM HR	$R_{\text{itmhr}} := 0.9860$	
Reflectivity of ITM AR	$R_{\text{itmar}} := 50 \cdot 10^{-6}$	
reflectivity of AS septum port	$R_{\text{sp}} := 0.0025$	
reflectivity of PR3 HR	$R_{\text{pr3hr}} := 0.9999$	
transmissivity of PR3 HR	$T_{\text{pr3hr}} := 1 - R_{\text{pr3hr}}$	$T_{\text{pr3hr}} = 10 \times 10^{-5}$
reflectivity of PR3 AR	$R_{\text{pr3ar}} := 50 \cdot 10^{-6}$	
transmissivity of PR3 AR	$T_{\text{pr3ar}} := 1 - R_{\text{pr3ar}}$	$T_{\text{pr3ar}} = 1$
reflectivity of PR2 HR	$R_{\text{pr2hr}} := 0.9999$	
transmissivity of PR2 HR	$T_{\text{pr2hr}} := 1 - R_{\text{pr2hr}}$	$T_{\text{pr2hr}} = 10 \times 10^{-5}$
reflectivity of PR2 AR	$R_{\text{pr2ar}} := 50 \cdot 10^{-6}$	
transmissivity of PR2 AR	$T_{\text{pr2ar}} := 1 - R_{\text{pr2ar}}$	$T_{\text{pr2ar}} = 1$
transmissivity of PRM HR	$T_{\text{prmhr}} := 0.212$	
reflectivity of PRM HR	$R_{\text{prmhr}} := 1 - T_{\text{prmhr}}$	$R_{\text{prmhr}} = 0.788$
reflectivity of PRM AR	$R_{\text{prmar}} := 50 \cdot 10^{-6}$	
transmissivity of PRM AR	$T_{\text{prmar}} := 1 - R_{\text{prmar}}$	$T_{\text{prmar}} = 1$

reflectivity of SR3 HR	$R_{sr3hr} := R_{pr3hr}$	$R_{sr3hr} = 1$
transmissivity of SR3 HR	$T_{sr3hr} := T_{pr3hr}$	$T_{sr3hr} = 10 \times 10^{-5}$
reflectivity of SR3 AR	$R_{sr3ar} := R_{pr3ar}$	$R_{sr3ar} = 5 \times 10^{-5}$
transmissivity of SR3 AR	$T_{sr3ar} := T_{pr3ar}$	$T_{sr3ar} = 1$
reflectivity of SR2 HR	$R_{sr2hr} := R_{pr2hr}$	$R_{sr2hr} = 1$
transmissivity of SR2 HR	$T_{sr2hr} := T_{pr2hr}$	$T_{sr2hr} = 10 \times 10^{-5}$
reflectivity of SR2 AR	$R_{sr2ar} := R_{pr2ar}$	$R_{sr2ar} = 5 \times 10^{-5}$
transmissivity of SR2 AR	$T_{sr2ar} := T_{pr2ar}$	$T_{sr2ar} = 0.99995$
transmissivity of SRM HR	$T_{srmar} := 0.200$	
reflectivity of SRM HR	$R_{srmhr} := 1 - T_{srmhr}$	$R_{srmhr} = 0.8$
reflectivity of SRM AR	$R_{srmar} := 50 \cdot 10^{-6}$	
transmissivity of SRM AR	$T_{srmar} := 1 - R_{srmar}$	$T_{srmar} = 1$
Reflectivity of dichroic DCBS1	$R_{DCBS1} := 0.99$	
Transmissivity of dichroic DCBS1	$T_{DCBS1} := 1 - R_{DCBS1}$	
Reflectivity of viewport	$R_{vp} := 0.0025$	
Reflectivity of HWS mirrors	$R_{HWS} := 0.99$	
BRDF of plate beam dump, sr <sup>-1</sup>	$BRDF_{platebd} := 0.05$	
BRDF of chamber wall, sr <sup>-1</sup>	$BRDF_{wall} := 0.1$	
BRDF of viewport	$BRDF_{vp} := 0.005$	

BRDF of mirror	$\text{BRDF}_{\text{mirror}} := 0.005$	
BRDF of dichroic DCBS1	$\text{BRDF}_{\text{DCBS1}} := 0.01$	
BRDF of lens	$\text{BRDF}_{\text{lens}} := 1$	
Beam Waist after H2 SR3	$w_{\text{h2sr30}} := 0.114 \cdot 10^{-3}$	
Beam waist after H2 SR2	$w_{\text{h2sr20}} := 0.094 \cdot 10^{-3}$	
Beam waist after H2 VAC LENSX	$w_{\text{h2vac lensx0}} := 0.42 \cdot 10^{-3}$	
Beam waist after H2 VAC LENS Y	$w_{\text{h2vac lensy0}} := 2.739 \cdot 10^{-3}$	
Beam Waist after H1 SR3	$w_{\text{sr30}} := 0.114 \cdot 10^{-3}$	
Beam waist after H1 SR2	$w_{\text{sr20}} := 0.096 \cdot 10^{-3}$	
Beam waist after H1 VAC LENSX	$w_{\text{vac lensx0}} := 0.523 \cdot 10^{-3}$	
Beam waist after H1 VAC LENS Y	$w_{\text{vac lensy0}} := 0.152 \cdot 10^{-3}$	
reflectivity of FM HR	$R_{\text{FMhr}} := R_{\text{pr3hr}}$	$R_{\text{FMhr}} = 1$
reflectivity of BS AR	$R_{\text{bsar}} = 5 \times 10^{-5}$	
Reflectivity of SR3	$R_{\text{SR3}} := 0.9999$	
Reflectivity of dichroic DCBS1	$R_{\text{DCBS1}} := 0.99$	
Transmissivity of dichroic DCBS1	$T_{\text{DCBS1}} := 1 - R_{\text{DCBS1}}$	
Transmissivity of lens	$T_{\text{lens}} := 1 - 0.005$	$T_{\text{lens}} = 0.995$
Reflectivity of viewport	$R_{\text{vp}} := 0.0025$	
Reflectivity of HWS mirrors	$R_{\text{HWS}} := 0.99$	

transmissivity of SR2 HR

$$T_{\text{sr2hr}} = 10 \times 10^{-5}$$





