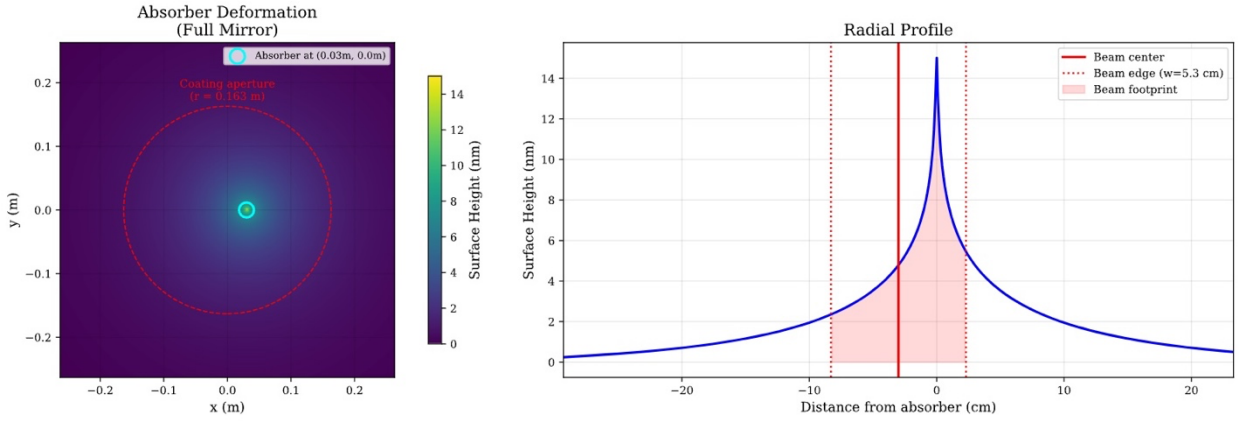
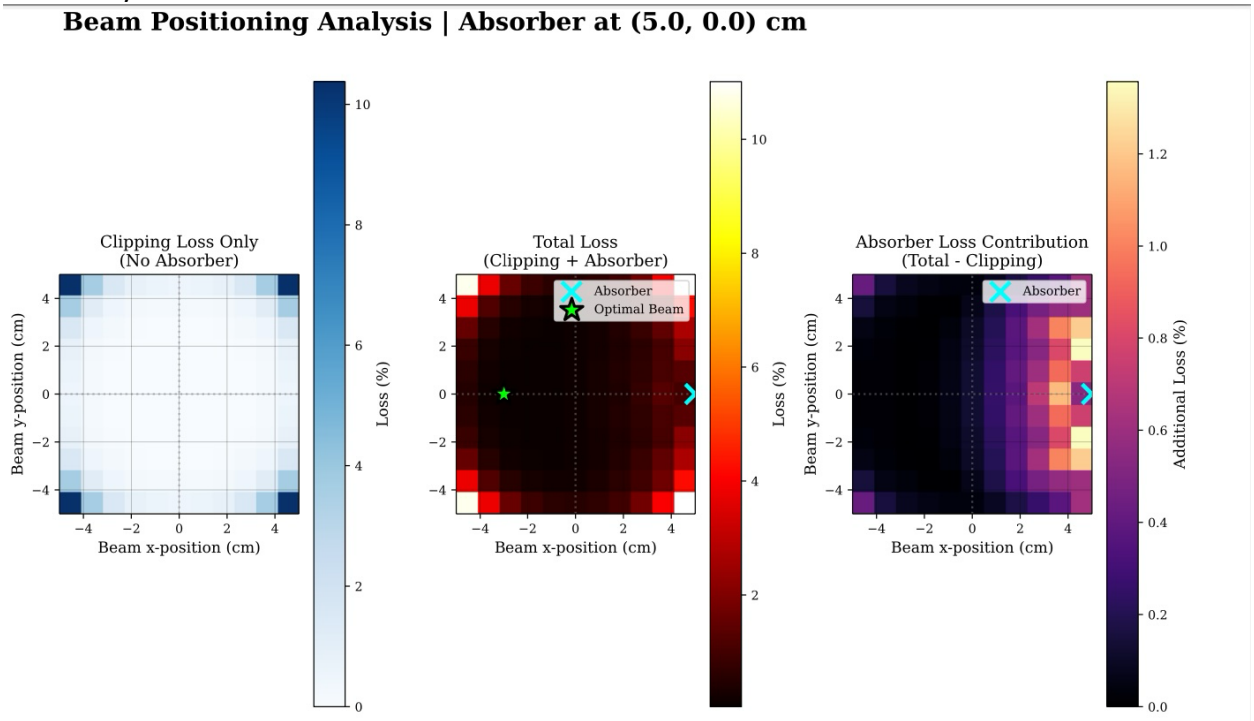
Radius of mirror = 0.263 m
Radius of aperture = 0.163 m
Absorber diameter= 30e-6 m (30 microns)
Absorbed power=40e-3 W (40 mW)
Mirror thickness=0.2 m (20 cm)

Absorber location: (3.0, 0.0) cm

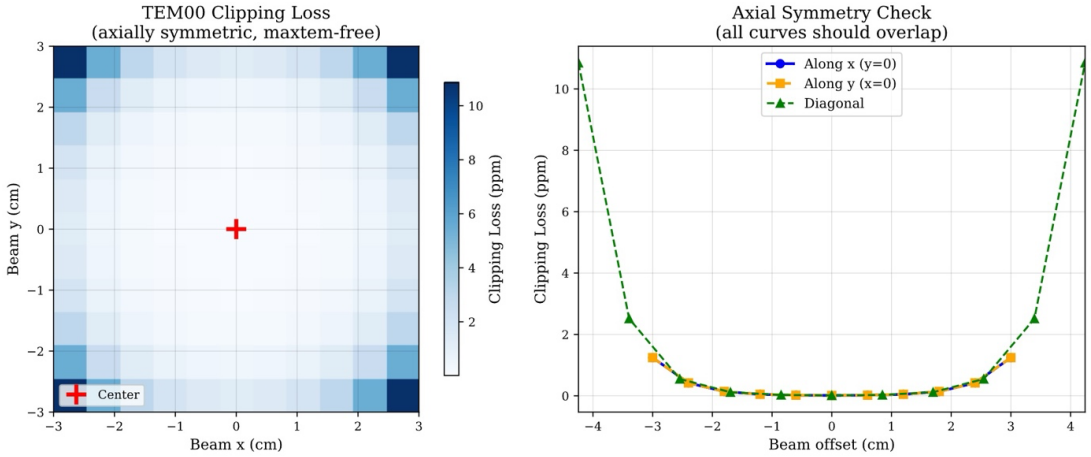


Full Cavity simulation method

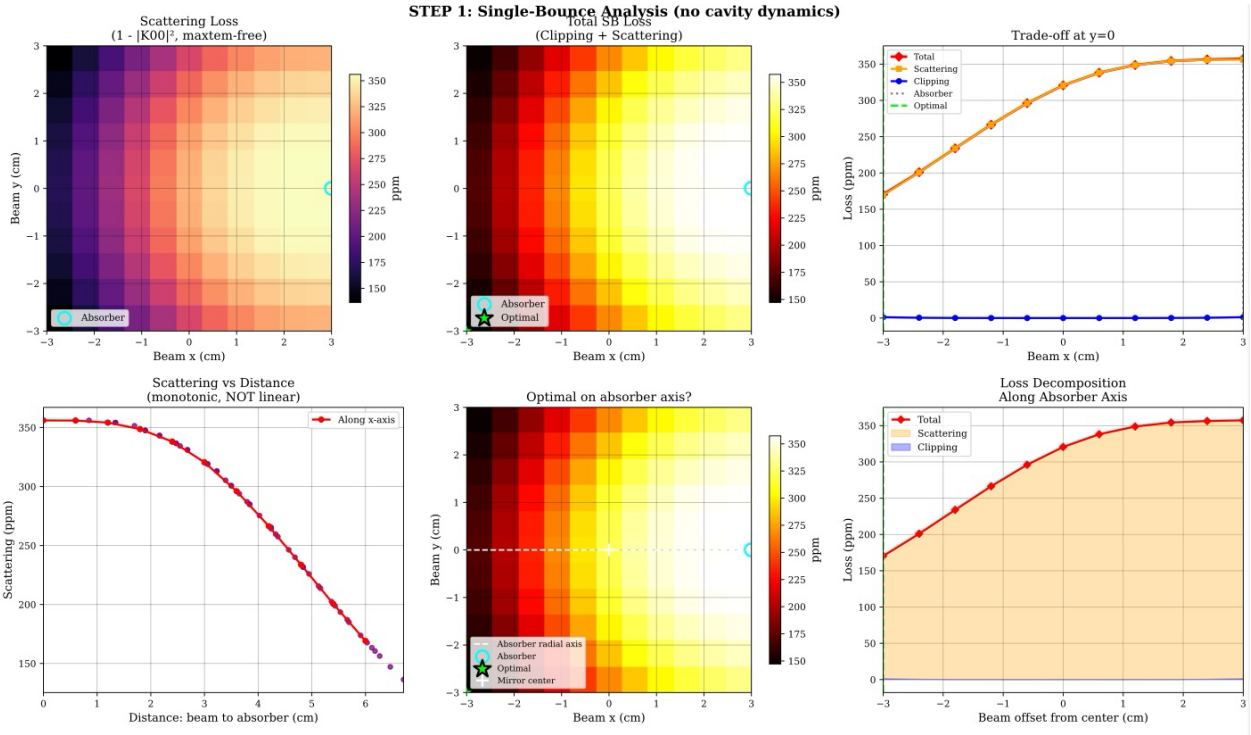


Single bounce scattering:
When a beam reflects off an imperfect mirror, power transfers between modes. The scattering matrix elementK_{abnm} tells you: "if 1 W arrives in TEM_{nm}, how much amplitude ends up in TEM_{ab}after reflection?" It computes the overlap integral

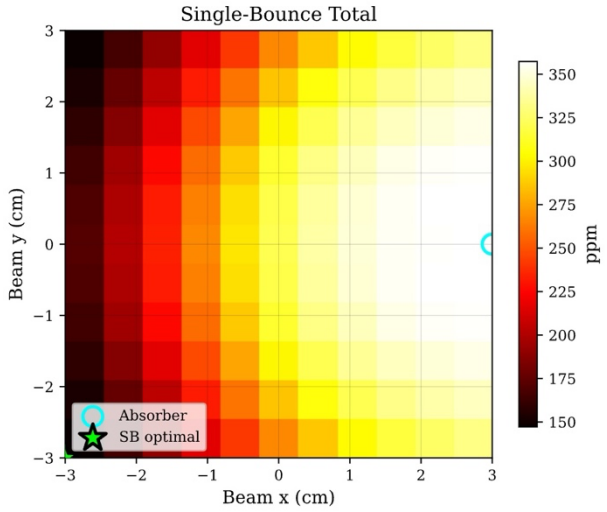
$$K_{abnm} = \iint U_{ab}^{*}(x,y,q) \cdot Z(x,y) \cdot U_{nm}(x,y,q)dxdy$$

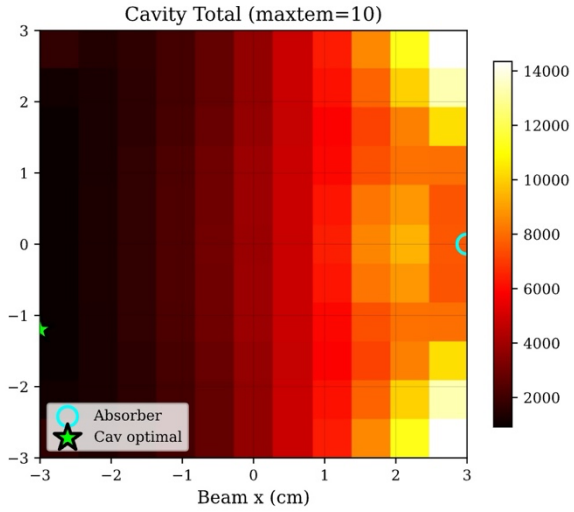


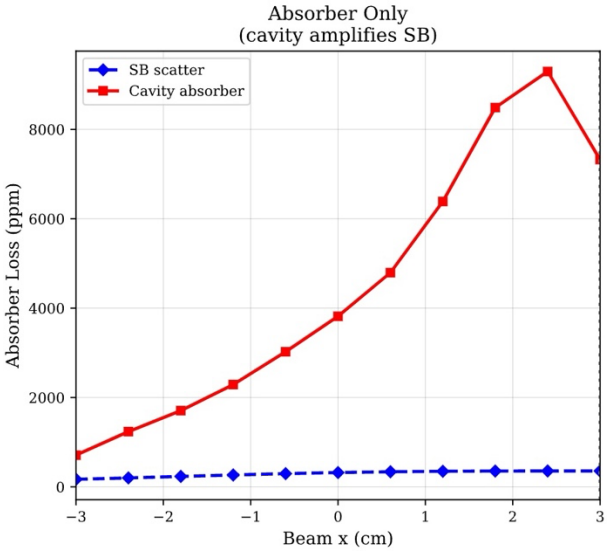
Power loss: 1 − |K00|^2 captures ALL scattered power — into every possible mode, regardless of order.

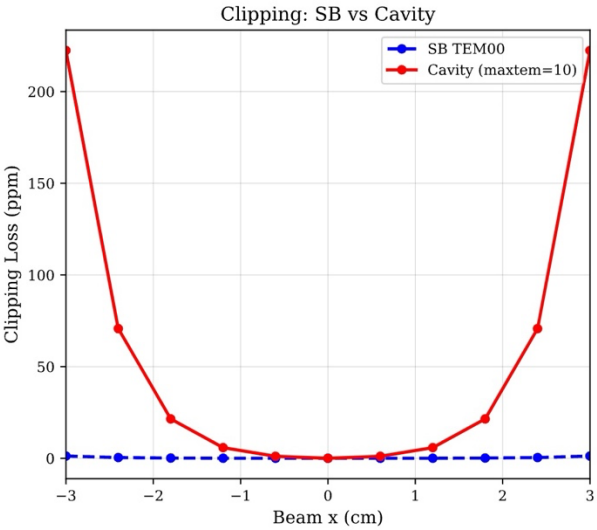


SB vs Cavity


Single-Bounce Total
Beam y (cm)
Beam x (cm)
ppm
Absorber
SB optimal


Cavity Total (maxtem=10)
Beam x (cm)
Absorber
Cav optimal

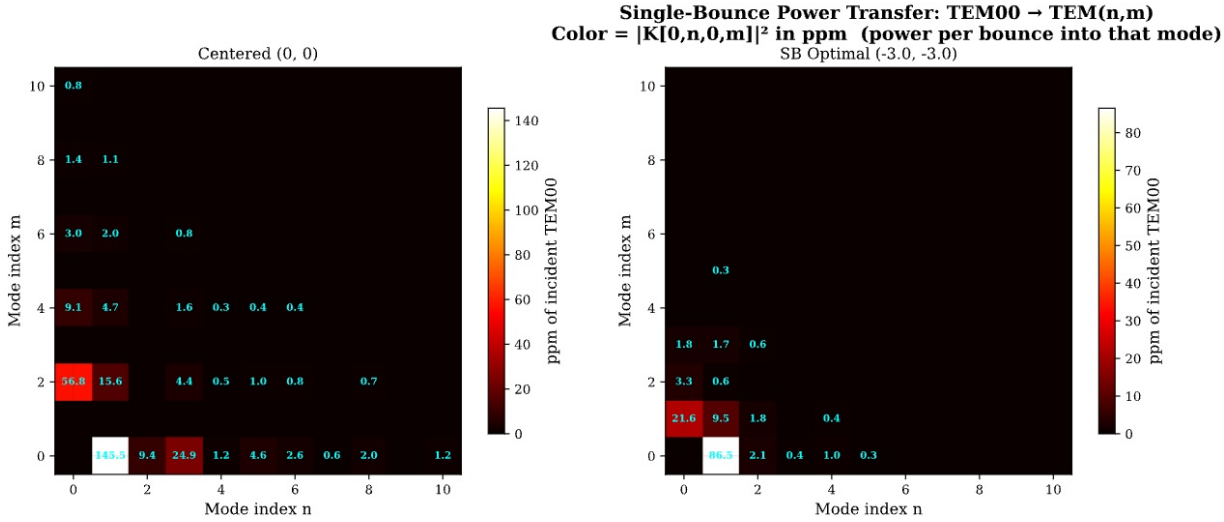

Absorber Only
(cavity amplifies SB)
SB scatter
Cavity absorber
Absorber Loss (ppm)
Beam x (cm)


Clipping: SB vs Cavity
SB TEM00
Cavity (maxtem=10)
Clipping Loss (ppm)
Beam x (cm)

This is the FRACTIONAL POWER of TEM00 that ends up in TEM(n,m) after one reflection.
|K[0, n, 0, m]|^2

```
=========================================================
 Centered (0, 0) | Total scatter = 297.91 ppm
=========================================================
 TEM10        145.52 ppm  ( 48.8%)
 TEM02         56.75 ppm  ( 19.1%)
 TEM30         24.95 ppm  (  8.4%)
 TEM12         15.59 ppm  (  5.2%)
 TEM20          9.39 ppm  (  3.2%)
 TEM04          9.12 ppm  (  3.1%)
 TEM14          4.65 ppm  (  1.6%)
 TEM50          4.56 ppm  (  1.5%)
 TEM32          4.44 ppm  (  1.5%)
 TEM06          3.03 ppm  (  1.0%)
 TEM60          2.57 ppm  (  0.9%)
 TEM16          2.04 ppm  (  0.7%)

=========================================================
 SB Optimal (-3.0, -3.0) | Total scatter = 134.30 ppm
=========================================================
 TEM10         86.49 ppm  ( 64.4%)
 TEM01         21.62 ppm  ( 16.1%)
 TEM11          9.46 ppm  (  7.0%)
 TEM02          3.30 ppm  (  2.5%)
 TEM20          2.10 ppm  (  1.6%)
 TEM21          1.85 ppm  (  1.4%)
 TEM03          1.77 ppm  (  1.3%)
 TEM13          1.74 ppm  (  1.3%)
 TEM40          0.98 ppm  (  0.7%)
 TEM23          0.63 ppm  (  0.5%)
 TEM12          0.58 ppm  (  0.4%)
 TEM30          0.42 ppm  (  0.3%)
```


Single-Bounce Power Transfer: TEM00 → TEM(n,m)
Color = |K[0,n,0,m]|² in ppm (power per bounce into that mode)
Centered (0, 0)
SB Optimal (-3.0, -3.0)
Mode index m
Mode index n
ppm of incident TEM00
0.8
1.4 1.1
3.0 2.0 0.8
9.1 4.7 1.6 0.3 0.4 0.4
36.8 15.6 4.4 0.5 1.0 0.8 0.7
145.5 9.4 24.9 1.2 4.6 2.6 0.6 2.0 1.2
0.3
1.8 1.7 0.6
3.3 0.6
21.6 9.5 1.8 0.4
86.5 2.1 0.4 1.0 0.3