

Update

Beam Position Optimization Algorithm

04/30/2024

Single-Arm cavity

LO → ITM ⇌ ETM

ONE cavity, ONE buildup

- Metric: $G_{\text{arm}} = \text{circ} / \text{input} \approx 280$
- Locking: maximize circ_power vs ETM.phi
- TCS: Map.remove_curvatures,
- ACS: Map.remove_tilts
- KNM: scattering of TEM₀₀ to HOMs by absorber

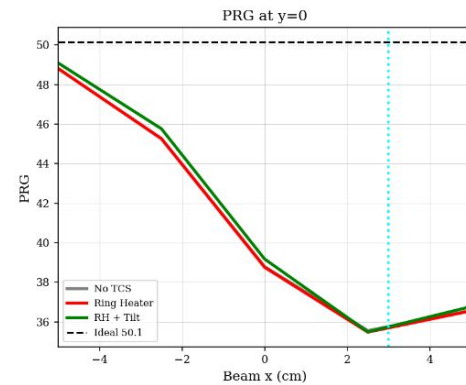
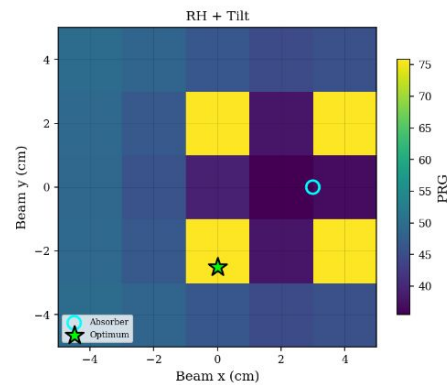
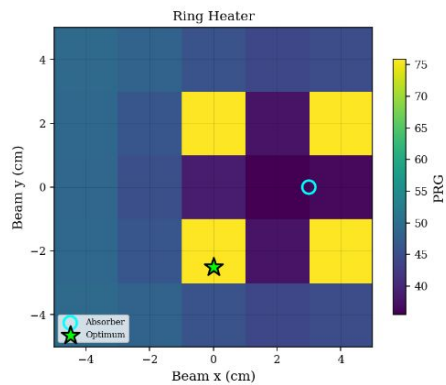
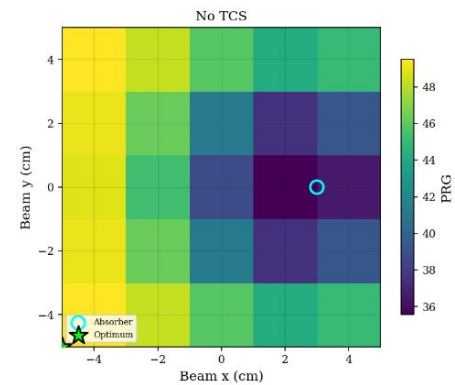
Full Interferometry

LO → PRM → BS → ITMX ⇌ ETMX (X arm)
↓ → ITMY ⇌ ETMY (Y arm)
↓ → SR3 → SR2 → SRM (SRC)

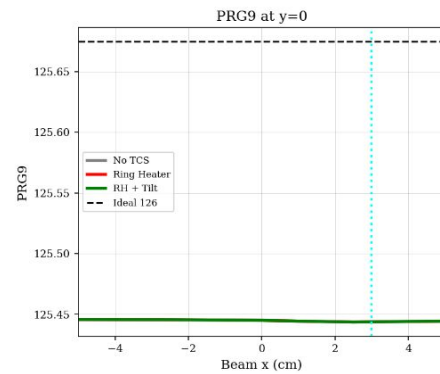
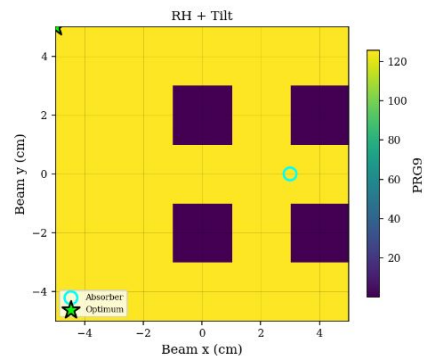
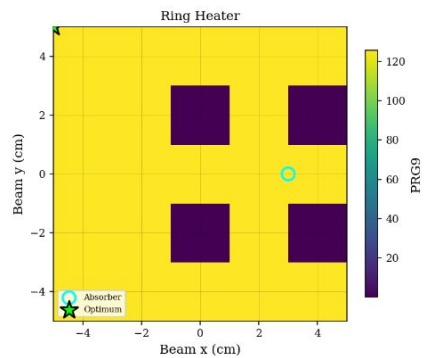
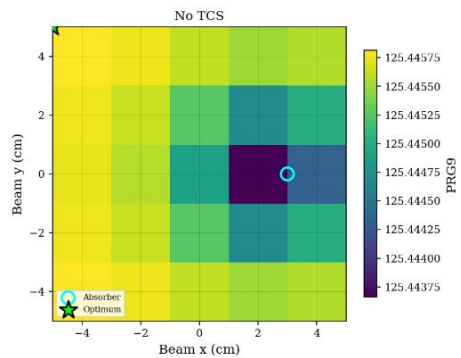
THREE nested cavities, THREE buildups

- Arm gain (AGX, AGY) ≈ 280 each
- Power Recycling Gain (PRG) ≈ 50 — new!
- Sideband recycling (PRG9) for sensing
- Five DOFs (CARM, DARM, MICH, PRCL, SRCL) locked simultaneously
- Apertures all 4 TMs + BS + recycling mirrors
- Arm aperture scaled: $R_{\text{TM}} = 0.17 \times (125/40)^{1/3} \approx 25$ cm
- TCS and ASC is unchanged
- Cost = PRG × PRG9 (lab standard)

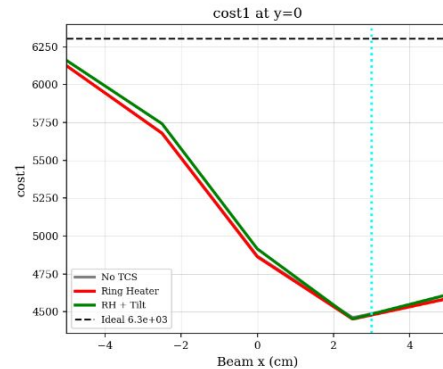
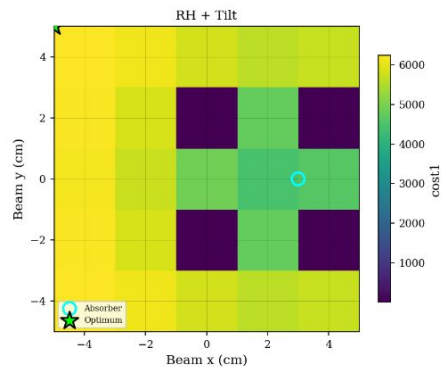
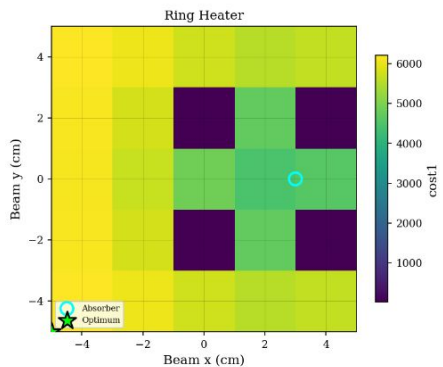
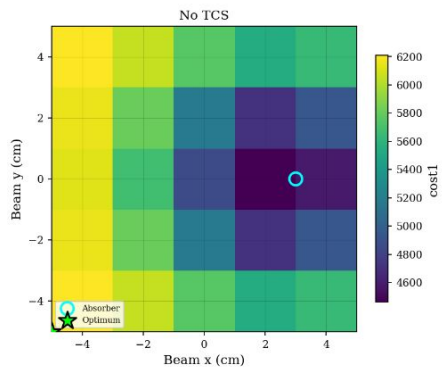
A+/O5 DRFPMI: Power Recycling Gain — absorber on ETMX



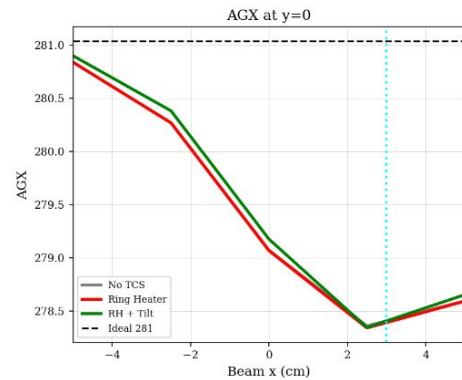
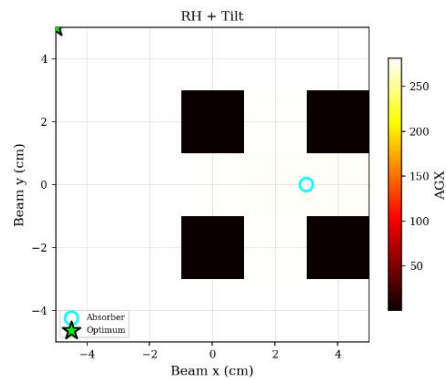
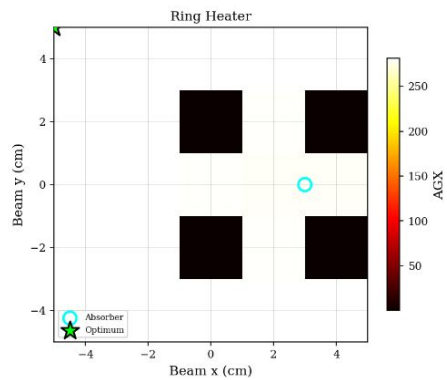
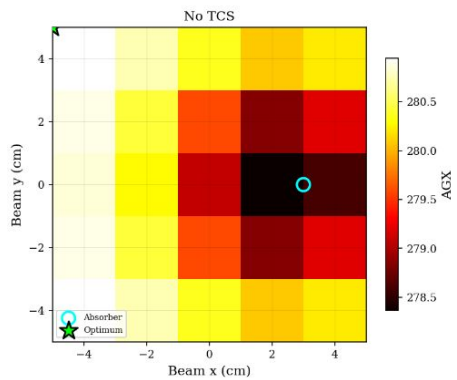
A+/O5 DRFPMI: PRG @ 9 MHz sideband — absorber on ETMX



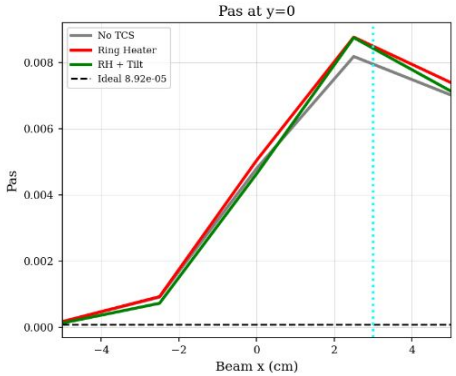
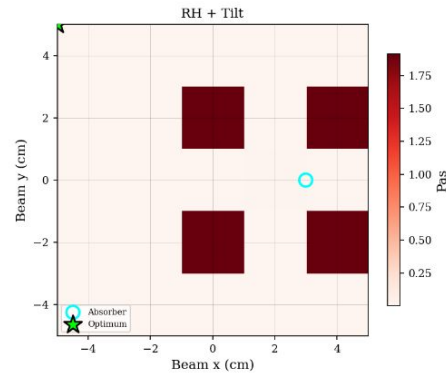
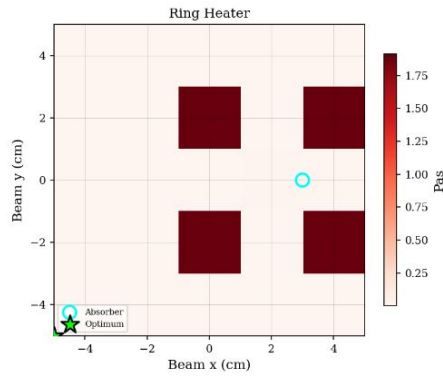
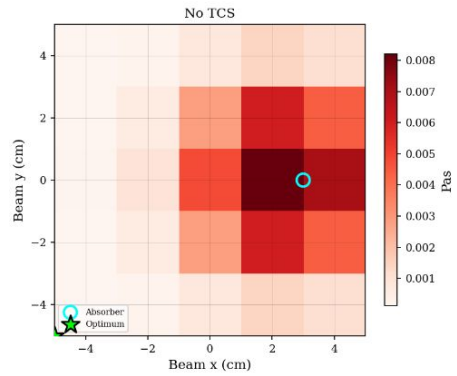
A+/O5 DRFPMI: Cost = PRG9 × PRG — absorber on ETMX



A+/O5 DRFPMI: X-arm Gain — absorber on ETMX



A+/O5 DRFPMI: AS Port Power — absorber on ETMX



A+/O5 Per-Mode SB Scatter — RH+Tilt on ETMX

