

Towards a NEMO Prototype

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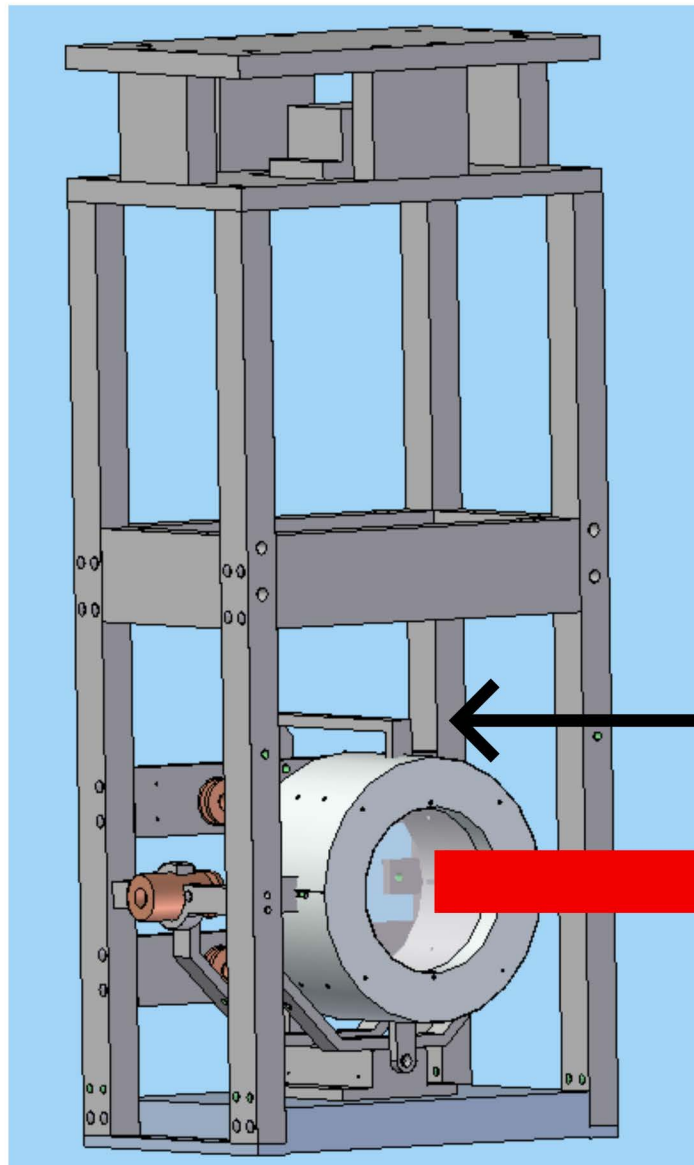


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LIGO Small Optic Suspension



7 meters

We are using a LIGO SOS Suspension, with a dummy mass for interchangeability between Fused Silica Substrates with Ion beam coatings & Silicon substrates with AlGaAs coatings

Contributors: AG-J, BG, CB, CZ, JL

LIGO Style Control & Data System

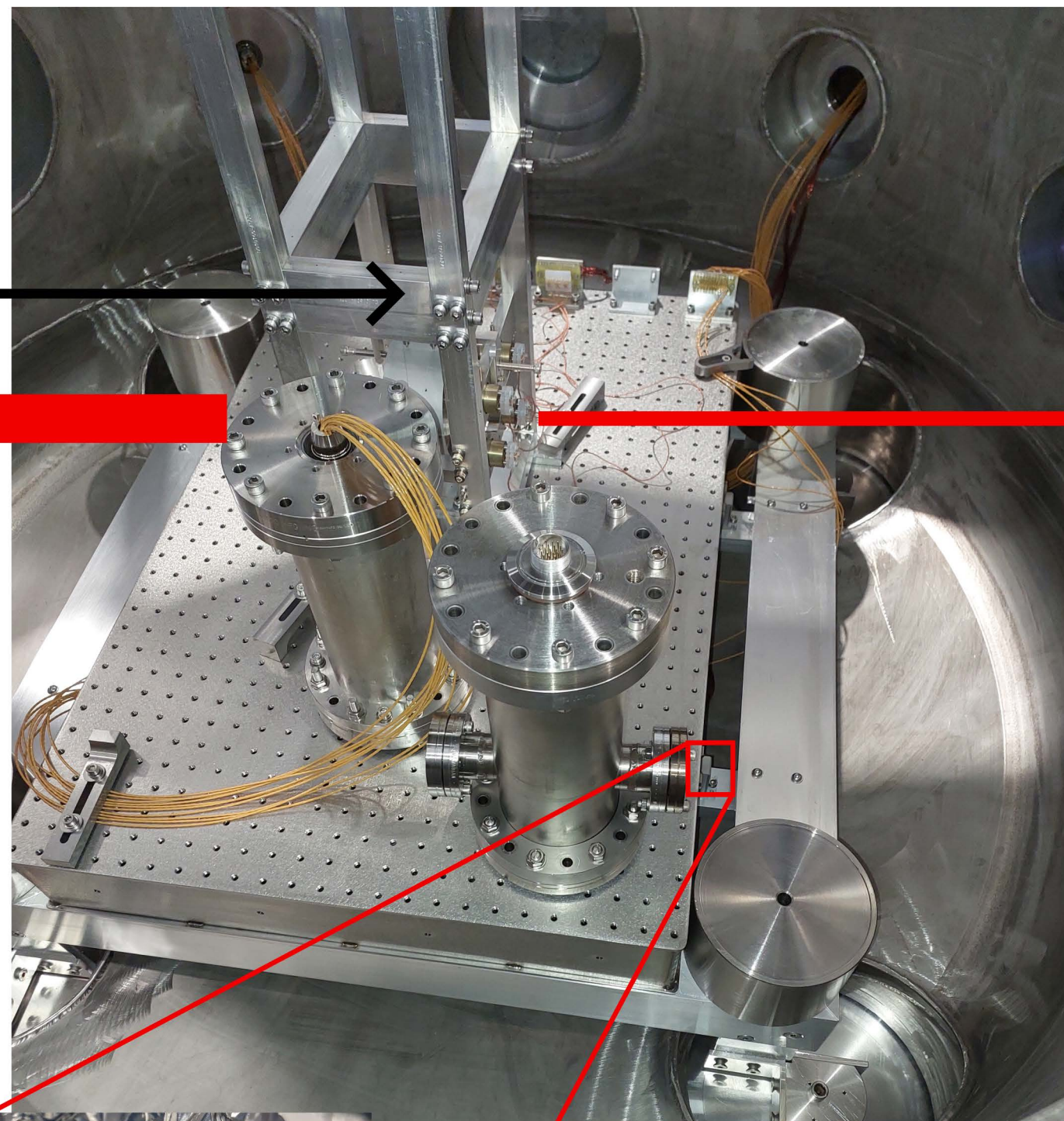


We are using a LIGO-Style CDS system with remote access via NoMachine.

Contributors: AA-J, C.B, AG-J, BS, JL, CZ

Phase 1 - 7m 'Simple' Cavity

Objective: To develop an ultra-stable 1995nm laser system, locked to a suspended cavity with Silicon optics and AlGaAs+GaAs coatings.



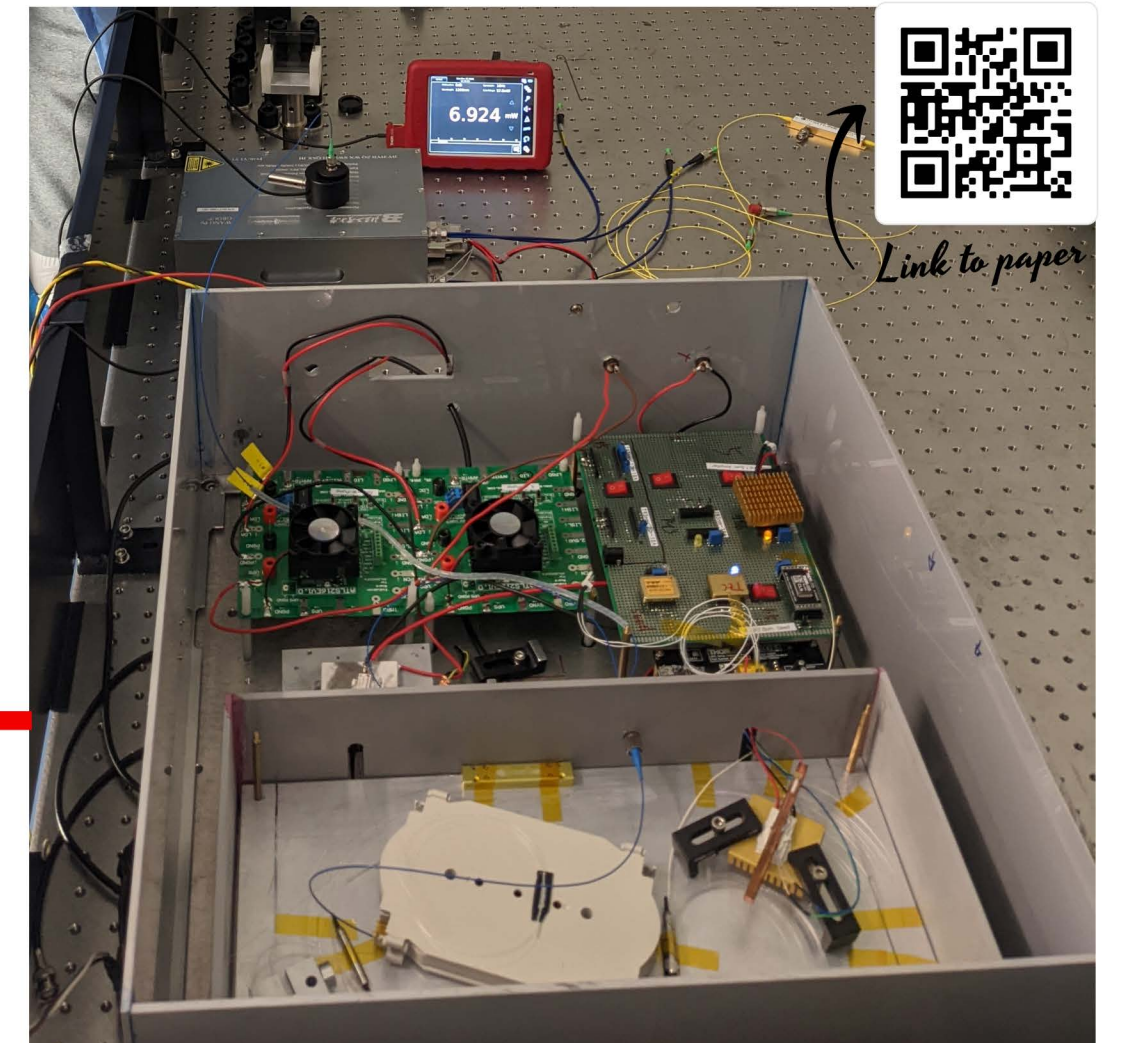
Piezo Pre-Actuation
(E/W & N/S)

Piezo Pre-Actuation
(Vertical)

We have developed a 5D piezo pre-actuation scheme to suppress suspension point motion. A Trillium Compact 120s is placed on the optical table, and table motion is suppressed using custom piezo actuation.

Contributors: JW, AA-J, AG-J, LJ, CB, BS, JL

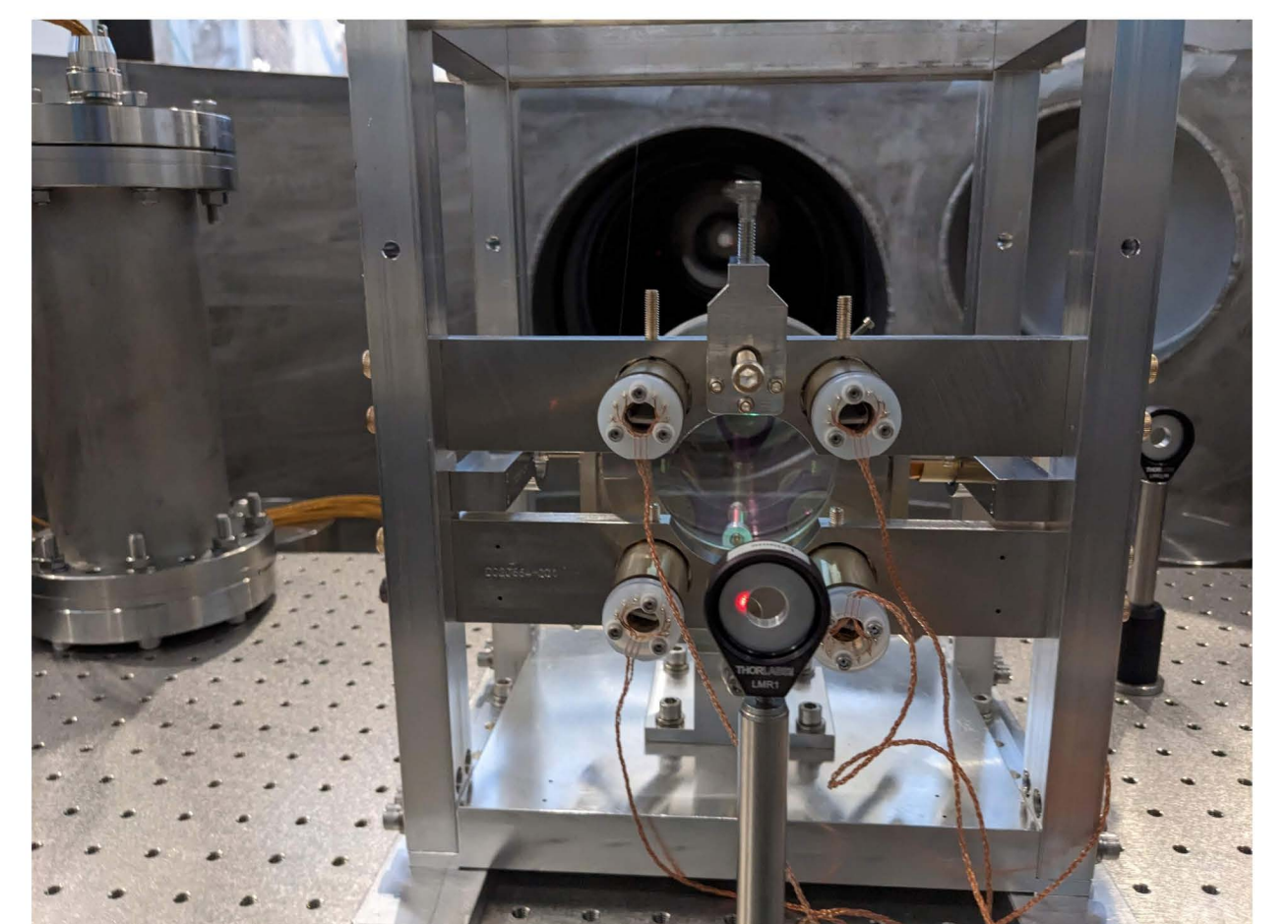
Custom 1995nm 5W Input Laser



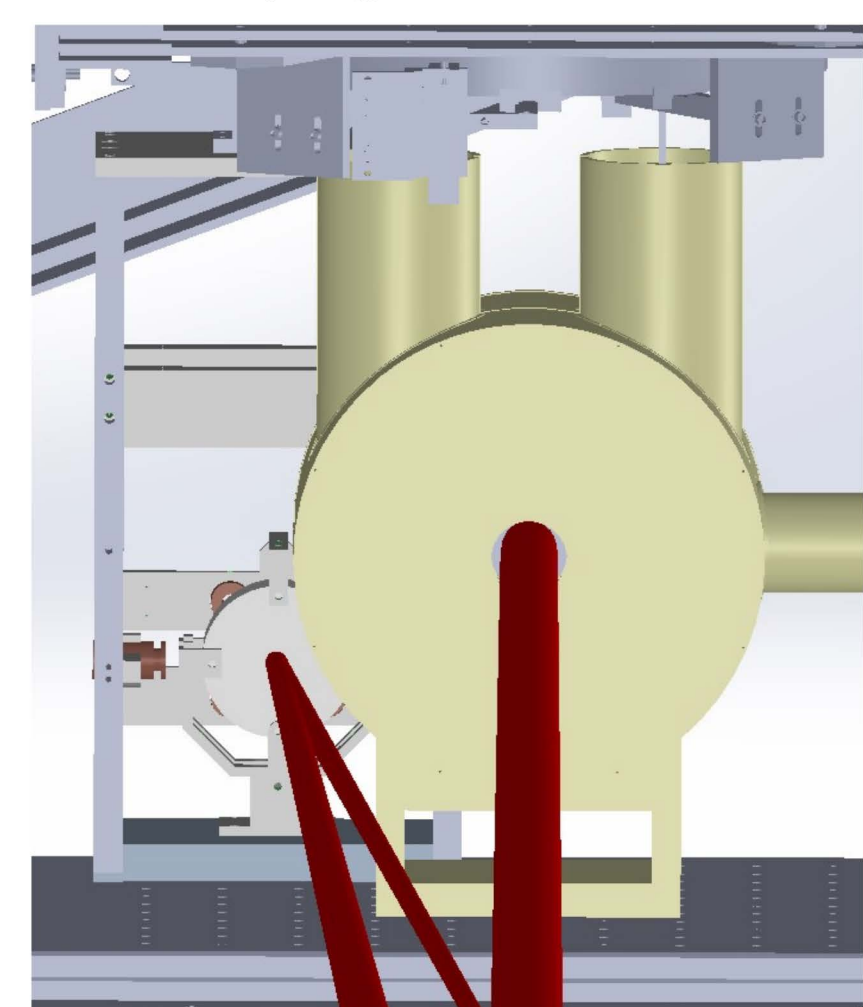
5W laser installed at Gingin.
Laser install, commissioning & mode matching: AA, AG-J & CZ

Laser: Optics Letters, Vol 45, Iss 17, pp 4911 ono

Installed ITM



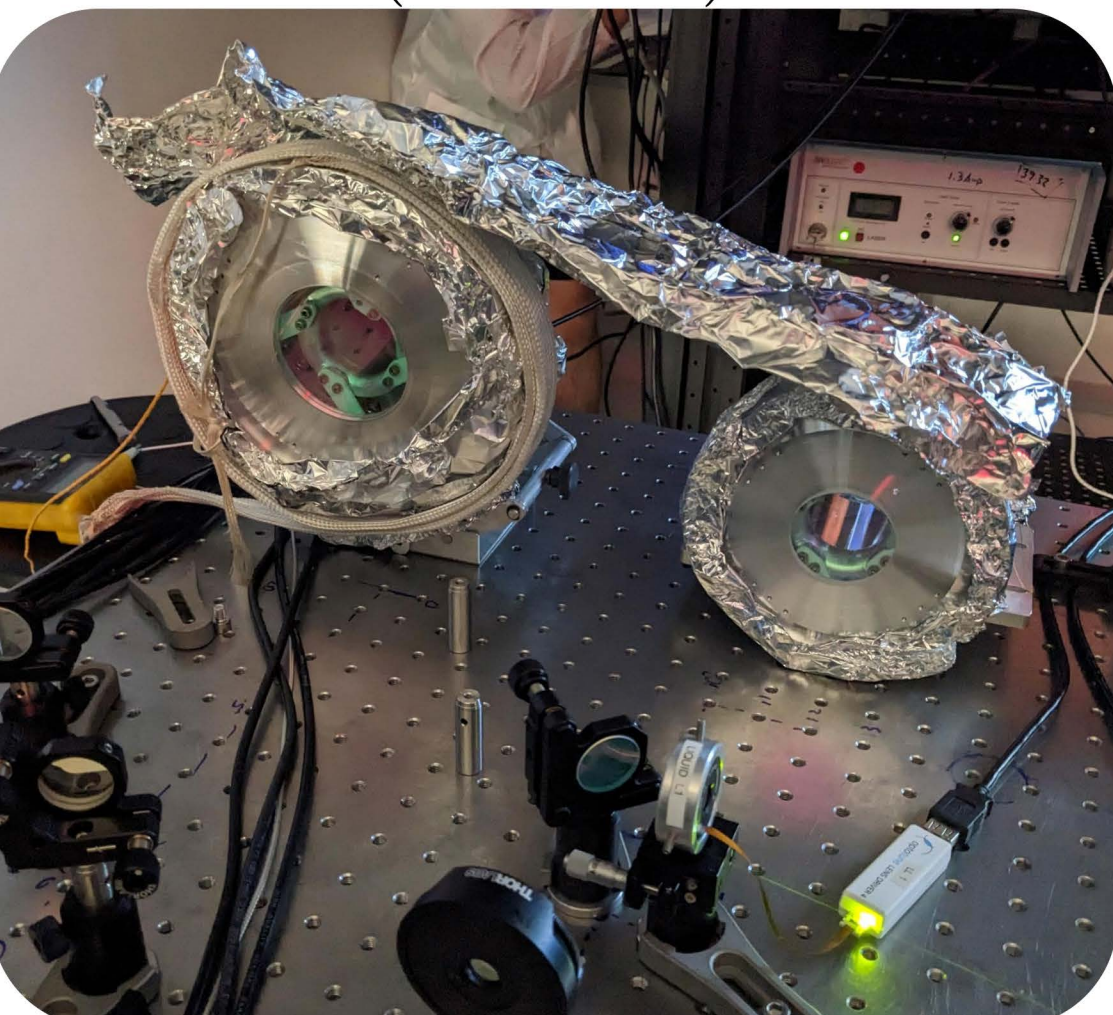
Cryogenic ITM



NEMO will operate with cryogenic test masses near 123 k. We have developed a cooling solution and are working to optimize the design.

Contributors: JP, BL, CZ, CB, AG-J

Thermal Suspended Active Mode Matching Stages (TSAMS)

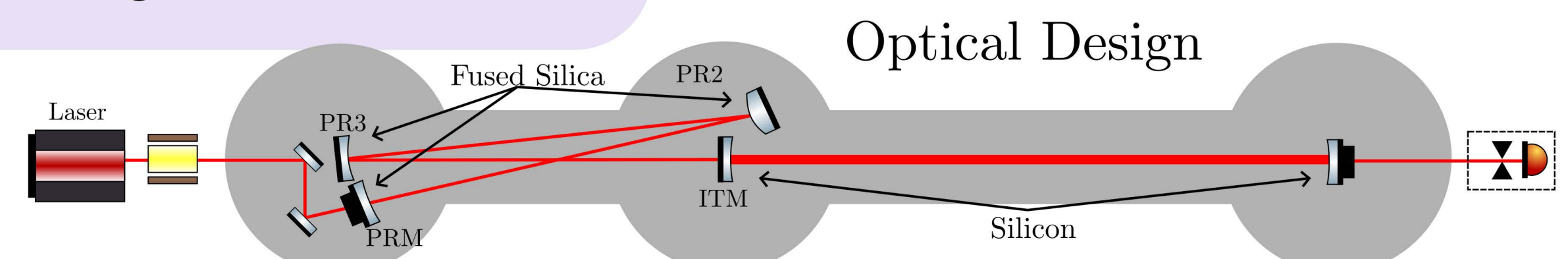


We will use a standard TSAMS and a modified large diameter TSAMS to achieve intra-cavity mode control.

Contributors: AG-J, HC, CB, MC, JL, CZ

Phase 2 - Coupled Cavity

Objective: To demonstrate a high-power coupled cavity, with cryogenic ITM, intracavity mode actuation and AlGaAs+GaAs coatings.



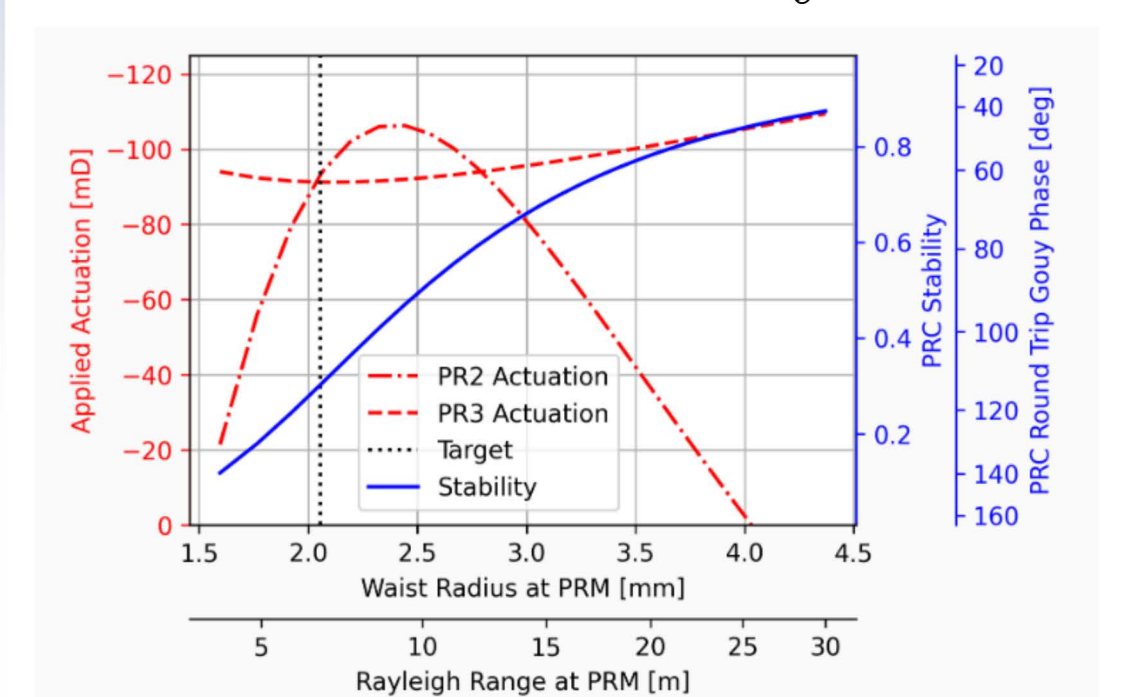
Mode mismatch losses can significantly degrade sensitivity in quantum enhanced gravitational wave detection. We propose a coupled cavity, with intra-cavity mode actuation. This cavity will allow us to demonstrate a cavity with very low mode mismatch losses. See poster #29, DCC G2301026 for details on the sensing scheme.

Contributors: AG-J, CB, BS, JL, CZ

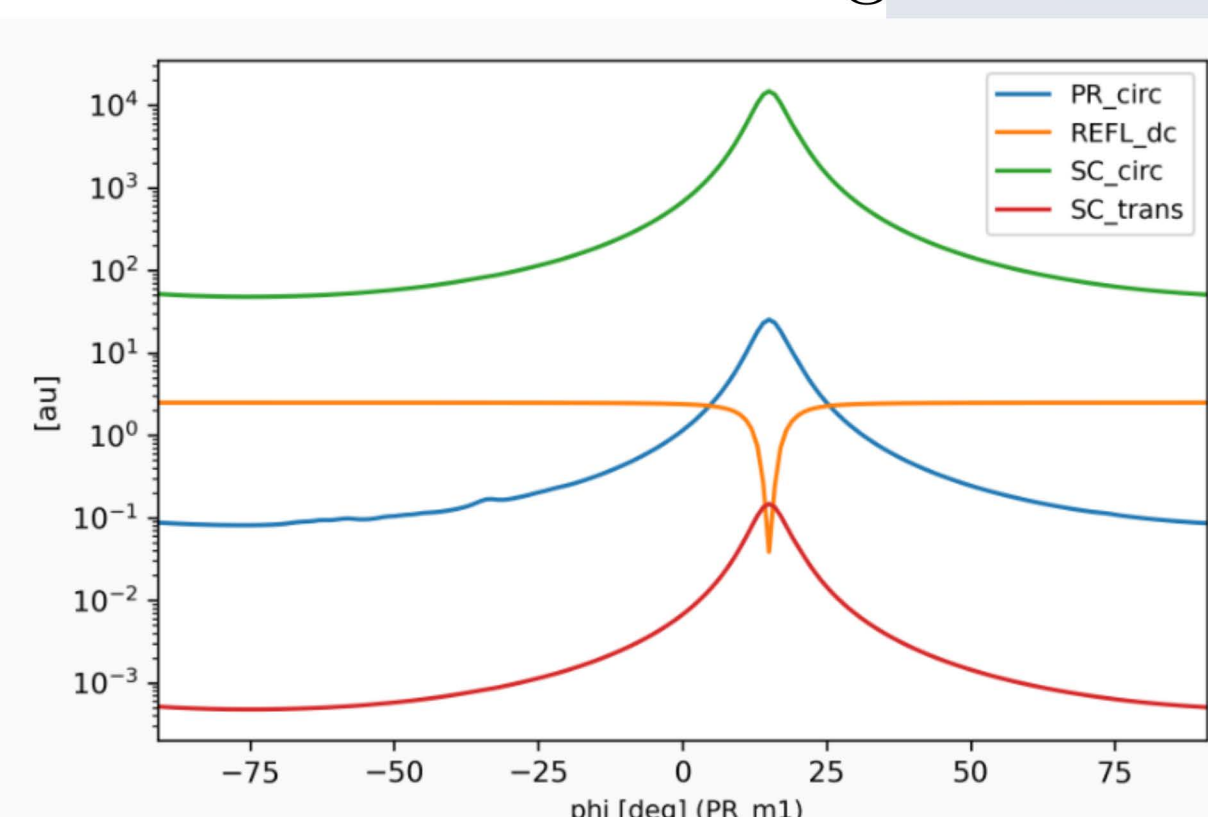
Key Optical Parameters

Component	ETM	ITM	PR3	PR2	PRM
Type	FS TM	Si TM	SAMS	SAMS	FSM
Beam Size [mm]	7.72	7.56	11.83	2.99	2.05
Gouy Phase [deg]	-64.4	63.9	-87.6	-45.0	0.0
Acc Gouy [deg]	0	128	131	138	183
Diameter [mm]	100	100	75	50	50
Curvature [m]	44.8	44.1	∞	-4	∞
Curvature [mD]	44.6	45.4	0	-500	0
Preload [mD]	N/A	N/A	+250	+250	N/A
Actuation [mD]	N/A	N/A	-97	-91	N/A
Design [mD]	N/A	N/A	+159	-347	N/A

Tune-able PRC Gouy Phase



>10 kW Circulating Power



Coupled cavity CAD & cryogenic shield renders courtesy BL. Cold head photograph © Cryomech. All other graphics AG-J.