



LASER INTERFEROMETER GRAVITATIONAL WAVE OBSERVATORY

RECORD OF DECISION/AGREEMENT (RODA)

Document	LIGO-M 070055-00 -Y	
Date:	April 17, 2007	
Title:	RODA: Dimensions of the Large MMT Mirror (MMT3) and the Recycling Mirrors (PRM & SRM) for the Marginally Stable Recycling Cavities	
To the Attention of:	COC: Garilynn Billingsley SUS: Janeen Hazel-Romie, Mark Barton, Calum Torrie, Norna Robertson IO: David Reitze, David Tanner, Muzammil Arain, Guido Mueller, Luke Williams System: David Shoemaker, Peter Fritschel, Dennis Coyne, Carol Wilkinson	
cc:	Aligo_coc, aligo_sus, aligo_io, aligo_sys	
From/signatories:	Name/Title:	David Reitze, IO Leader Signature: _____
	Name/Title:	Norna Robertson, SUS Leader Signature: _____
	Name/Title:	Garilynn Billingley, COC Leader Signature: _____
	Name/Title:	Peter Fritschel, System Scientist Signature: _____
	Name/Title:	_____ Signature: _____
	Name/Title:	_____ Signature: _____
System(s) affected:	<input type="checkbox"/> Initial LIGO <input checked="" type="checkbox"/> Advanced LIGO <input type="checkbox"/> Other: _____	
Nature/Scope:	<input checked="" type="checkbox"/> Design Decision <input type="checkbox"/> Requirements Decision <input type="checkbox"/> Work Scope Decision <input type="checkbox"/> Working Agreement between Groups <input type="checkbox"/> Other _____	
Subsystem(s) affected	<input checked="" type="checkbox"/> Relevant Subsystem(s)/Component(s): Input Optics (IO): Large MMT3 mirror Core Optics (COC): Power Recycling Mirror Suspensions (SUS) subsystem: Large MMTs mirror suspension, Power Recycling Mirror Suspension	
Primary Contacts	Group or Affiliation and Contact	David Reitze, Janeen Hazel-Romie, Garilynn Billingsley
Reference Documents:		

DECISION/AGREEMENT STATEMENT:

The current baseline adv. LIGO interferometer design has nearly unstable recycling cavities (power and signal, PRC & SRC). For the baseline marginally stable recycling cavity design case, IO and SUS agree to adopt the dimensions for the large MMT mirror (MMT3) and the Recycling Mirrors (both the Power and Signal Recycling Mirrors, PRM & SRM) as **265 mm** in diameter and **10 cm** in thickness. The wedge angle and orientation of wedge angle for MMT3 is **0.5 degrees** and **oriented horizontally with the thick side facing the positive y-arm**. The wedge angle for the PRM is **TBD** (currently it is 0.253 degrees and oriented vertically with the thick side down, but this is subject to change). The MMT3 is a single pendulum suspension, whereas the PRM & SRM are both triple pendulum suspensions.

For the alternative stable recycling cavity design case, IO and SUS agree to adopt the dimensions for the large MMT mirror (MMT3) as **265 mm** in diameter and **10 cm** in thickness (i.e. unchanged from the marginally stable recycling cavity design case). For the stable RC, the MMT3 is a triple pendulum suspension. The PRM and SRM would be small, triple suspensions with a **TBD** sized optic.

Discussion (non-binding in the agreement):

RODA M050397-02 defines the core optic sizes, including the Recycling Mirrors (RM). This RODA reiterates the RM size, makes it clear that this size applies to both the power and signal recycling mirrors (PRM, SRM) and defines the MMT3 size.

Hiro Yamamoto has done FFT modeling¹ of the loss in the recycling cavity with an ITM of 265 mm diameter, a BS optic with a 370mm diameter, 6 cm thickness and 9cm long flats. In the Michelson cavity the power loss is < 40ppm with TEM00 mode loss < 30ppm. Reducing the RM aperture to 265 mm does not result in additional loss even if the beam is off-center by 1 cm (for alignment). We are confident that we can align the core optics back through the recycling cavities and match centering to the MMT3 to within 1 cm.

¹ H. Yamamoto, T070052-00, pending.