

Peter Fritschel <pf@ligo.mit.edu>
To: Brian Lantz <blantz@stanford.edu>
Cc: Dennis Coyne <coyne@ligo.caltech.edu>
Re: help on impact of not meeting SRC HAM-ISI isolation requirement

April 19, 2009 7:21 AM

Brian,

Let me try to clarify the situation. A couple of useful references are:

T080192-01, Displacement Noise in the Advanced LIGO Triple Suspensions
G0810021-v1, Some Advanced LIGO Systems Topics

As you know all across Adv LIGO what we call requirements are typically a tradeoff between performance and technical feasibility and complexity. When we concluded some years ago that a single-stage HAM ISI would be sufficient, we then established a 'requirements' curve at the level we thought such a system could attain, being very conservative for the performance above 20-30 Hz. Since then (about a year ago) we discovered that the interferometer is more sensitive to the signal recycling cavity length than we had thought. With the HAM ISI as-built performance and the triple suspensions, SRC noise was no longer expected to be at the technical noise level (1/10-th the quantum-photon pressure at high power) at all frequencies (in particular below 20-25 Hz); this is shown in G0810021-v1.

And so we ask the question: what level of ISI noise would we need to meet the technical noise target for SRC noise down to 10 Hz? The answer is the curve I sent you a couple of days ago. Clearly the ISI is not going to get there near 10 Hz. But with the feedforward you are proposing it can get there or pretty close at the upper end of the 10-20 Hz octave. And that's good because that's where it is more important, since the overall interferometer strain noise is lower there.

Maybe this isn't as concise as Dennis was hoping (the answer to his first two questions is 'yes'). Treat the curve I sent you as a target. One of the reasons we try to set all technical noises at the 1/10-th level is so that there is some tolerance to not meeting this level with the really hard ones. Finally, there may be some improvement coming with the triple suspensions; the SUS folk are looking at putting more compliance in the vertical direction, with a potential of 2x more vertical isolation above ~10 Hz. But this is not at all a sure thing yet.

Peter

On Apr 17, 2009, at 3:27 PM, Dennis Coyne wrote:

Peter,
Brian has indicated the revised HAM SEI isolation requirements on pg. 57 of his NSF technical talk ([G0900312-v2](#)). Brian will indicate that these revised requirements are only an issue for 2 SRC HAM chambers per IFO. However, meeting these requirements, even with stage 0 feed-forward looks difficult. We would like a concise statement from Systems on the impact of failing to meet the revised requirements. Is it true that this requirement is set at 1/10 of the fundamental noise (quantum - photon pressure at high power?) and so may not limit overall IFO performance if exceeded? Can you please craft a concise statement that puts the risk of failing to meet this challenge in context?
Thanks,
Dennis