Here is an extract from an email to Brett:-

Hi Brett,

T040110-01-K has my thoughts on one way to integrate ECD and active damping - but this was meant to be no more than an proof of principle, and
I expect that there are much better approaches.

Janeen asked me to prepare a couple of paragraphs as a prelude to a discussion at next week's SUS telecon. I append what I have drafted below,
and welcome comments from you.

The work was done using a development of the standard quad models that may
have been on an evolutionary dead end, and so decayed away by now - but it
should be close enough to the currently supported models to be able to
follow what is happening.

I think the next effort should concentrate on evaluating "Laurent's approach" with ECD also present, with the aim of looking at the trades
between damping time and noise.

Cheers,

Ken

At first it was thought that very low noise OSEMs would be needed to reach Advanced LIGO science requirements, with damping strong enough to meet the 10s decay time goal that had been set. It was realised (1) that although the 10s decay time was required for acquisition, in science mode the requirement was for controllability, which - for many of the key degrees of freedom - would permit lower local

control gain. If, in addition, eddy current dampers - most effective for the higher-frequency modes - were added, OSEMs with noise similar to those used in Initial LIGO, at least around 10 Hz, would suffice (although there could be advantage to having reduced noise around 1 Hz). A crude demonstration of this operating in combination with modified versions of the basic "GEO" control design suggested that this was a reasonable approach.

In parallel Laurent (2) developed and tested the modal damping method on the MC triple controls prototype. This yielded better noise rejection, for a given damping time, than the GEO controllers.

Two questions then arise:

1) Would the modal approach suffice for most/all of the degrees of freedom to be damped in the TM quad suspensions? (Given the flexible approach to damping time implied above.)

2) If not, would modal control work well with ECD damping the higher modes.

I do not know the answer to 1, and strongly suspect the answer to 2 is "yes".

We need a plan for modeling and testing this to ensure we are where we need to be at the early stages of the noise prototype validation.

References:-

(1) for the topics of OSEM noise requirements and hybrid damping: T040110-01 see also references therein

(2) "implementing a modal control and estimator for a triple pendulum" T050197, see also references therein.

On Wed, 17 Jan 2007, Brett Shapiro wrote:

> Norna, Ken, Mark,
> I heard that one of you may have worked briefly on developing

local control filters for the quadruple pendulum. Is this true? If so, would I be able to take a look at them? Thanks for the help,

> Brett

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