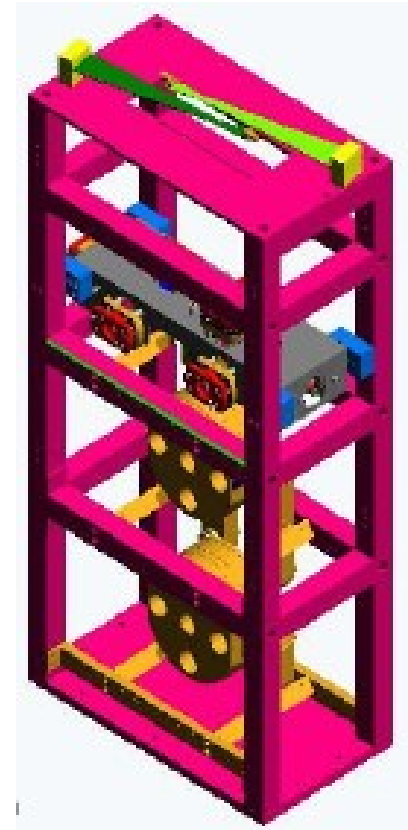
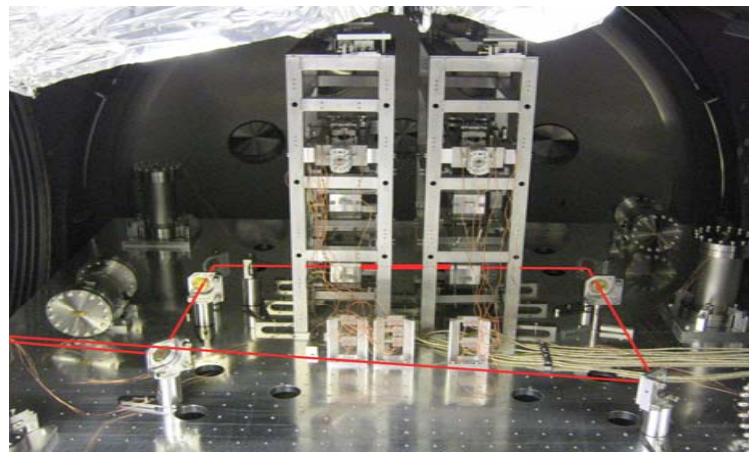


HAM Small Triple Suspension: Preliminary Design Review

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For the SUS team
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- Design of input modecleaner suspension was based on the GEO triple pendulums. Design features:
 - » Triple pendulum with two stages of blades
 - » Silica mass: 150 mm diam. x 75 mm thick (~3 kg)
 - » Wire suspension (originally to be silica)
- Noise requirement to which we designed: $3 \times 10^{-17} \text{ m}/\sqrt{\text{Hz}}$ at 10 Hz
- Two essentially identical so-called “controls” prototypes were designed and built in 2002/2003, one for testing at Caltech and the other for delivery to LASTI.
 - » designed to demonstrate the mechanical design and control aspects – used metal masses and metal wires
- At LASTI full characterisation carried out including comparison to MATLAB model
 - » mode frequencies, transfer functions, active damping
- Further work - test of independent modal control with a state estimator for damping - minimises sensor noise re-injection (Laurent Ruet thesis)
 - » tested using the second modecleaner triple pendulum, sent from Caltech, as quiet reference
- More recently one was used for cavity tests with the quad controls prototype, primarily for investigating the electrostatic drive on the quad.

- With the decision in spring of 2008 to move to a stable recycling cavity configuration, it was recognised that the IMC suspension design could be used for two of the three mirrors which now make up each recycling cavity
 - » PRM and PR2 in the power recycling cavity
 - » SRM and SR2 in the signal recycling cavity.
- The IMC suspension name has therefore changed to HAM Small Triple Suspension (HSTS) to cover all the above suspensions as well as the original IMC.
- Details of revised noise requirements for the HSTS have not been formally given to SUS, but expected transfer functions and thermal noise estimates have been supplied to ISC.
- Electronics requirements are actively being worked on but not yet completed, see <http://ilog.ligo-wa.caltech.edu:7285/advligo/TripleSuspensionActuation>
 - » US ISC and SUS teams are responsible for delivering these to the UK SUS team, who have the responsibility to design to the requirements.

All documents listed below, and more, can be found on the review wiki at http://ilog.ligo-wa.caltech.edu:7285/advligo/IMC_Design_Reviews

- Preliminary design review design checklist: E080355-00
 - » For each point on the checklist we have listed the document(s) which address that topic (where such exist).
- General description and useful details of the triple design: G030350-00-D
- Results from the LASTI characterisation work: T050063-00
- Measurements on the mode cleaner at Caltech: T030135-05 (*not yet posted*)
- Modal control implementation to reduce sensor noise re-injection: T050197-00
 - » Further details in Laurent Ruet's thesis: P070054-00
- Use of steel wire suspension: T060008
 - » Wire suspension PDR report: T060024
- No reaction chain needed: T020059
- Assembly procedure document: E030518-01
- Lessons learned: section 7 of T030135-07