

WG2 – Task 5: Sensing and Actuation Meeting  
Cascina 26 November 2008

Scope of the meeting: start the discussion to identify the main topics to be investigated for the development of sensing and actuation (S&A) compatible with the noise curve sensitivity of ET.

S&A must be compliant with the needs of a cryogenic payload. The vacuum chamber should avoid windows as much as possible, in order to minimize thermal inputs due to radiation.

The problem of sensing and actuation will be found not only at the level of the test mass, but also on the marionetta. In fact, the idea is to cool the mirror from the marionetta, where the thermal contacts with the cooling system should be realized.

It seems clear that S&A must work at both room and cryogenic temperature. It could also be a hybrid system for the two working conditions (to be investigated).

### Sensing

A fiber can be used to inject laser light for optical levers.

One possibility is to place the positioning sensor into the vacuum chamber. In this case, positioning sensors capable of working at cryogenic temperature must be investigated.

Another possibility is to develop a sort of CCD made of fibers. In this scenario, the positioning sensor can be placed at room temperature.

An evaluation of the thermal input due to a small diameter window should be made.

### Actuation

The best solution would be acting at the level of the marionetta as last stage, thus avoiding the use of a reference mass. This is a very important issue in the control strategy, and must be well studied. The absence of a reference mass would imply the necessity of generating strong forces to control the system. If magnetic actuators are used, high currents are required. The cryogenic environment could allow the use of superconducting coils compatible with the need of high currents. The material to be used as magnet must be studied (which is the Barkhausen noise at low temperature?). It could be possible to use superconductive materials instead of magnets (in this case, what could be the solution for room temperature operation?).

An alternative idea could be using a sort of reference mass, which would act on the mirror for the first lock acquisition and then could be “turned off”. The residual coupling (and noise injection) in science mode of this solution must be evaluated.

### Time schedule

The timing of the work package is discussed. The identification of the control strategy for the lower suspension has to be performed in the 8-15 month period. An obvious partial overlap with the upper suspension control strategy and the design of the lower suspension mechanics must be considered.

### Organization of meetings and subgroups

The schedule of the meetings and the organization of subgroups will be defined in a forthcoming meeting.