

CHANGE REQUEST

VIR-CRE-02/02

Title: Suspension Thermostabilization System

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Lab: VIRGO Pisa Suspension Group
DATE: 11/10/02

Sub-systems/Items affected by the change: (WBS number and name):

4900 Suspension Electronics

Reason for change

Temperature fluctuations inside the towers affect a few performance of the superattenuator (SA). The main evidence is that temperature fluctuations induce variations on the vertical length of each mechanical filter and, consequently, of mirror vertical position (up to 6 mm/K). Taking into account the specifications on mirror position stability, the above effect sets a first requirement on the temperature stability to a value better than 0.1⁰C. This constrain on the temperature is not guaranteed for long time scale unless a SA temperature control is used. Moreover, other effects suggest to achieve an even better SA thermal stability:

- i) During the CITF commissioning, a temperature correlation with the correction signal of the pitch mirror motion has been observed. Temperature correlation with the longitudinal mirror correction is less evident due to the interferometer delocks. This temperature dependence will produce higher effects in the 3 Km ITF.
- ii) The filter vertical elongation cycles, induced by day/night temperature oscillation, cause mechanical click noise due to relaxations of blade inner stress (however, only with the 3 Km ITF running, it will be possible to know if this kind of noise affects the Virgo sensitivity).

Summary description of Change (If required attach complementary information such as drawings)

The SA thermostabilization system is designed to keep the temperature inside the towers at a working point of a few degrees above room temperature. In such a way, the system has to heat and not to cool. From the experience gained on a reduced scale prototype, the expected stability is better than 20 m⁰C over a time scale of months. The heat is provided by a set of four thermally insulated Joule heating belts (6.3 m long, 0.9 m high), wrapped on the tower rings. Each heater is individually fed by a 300 W linear power supply, remotely controlled by a digital servo loop that takes the error signal from the thermal probes and the vertical LVDT position sensors mounted on the SA. The control is configured to accept other feedback signals (as the GX_y signal from camera mirror), if necessary.

- Components needed for one tower: 4 power supplies, 4 heating belts, 5 thermal sensors;
- Electronics boards needed for one tower: one ADC, one DAC, one 8 channel temperature readout.

The Virgo Pisa Suspension Group will take care of assembly. The electronics will be developed and realized with the Virgo Pisa / EGO Electronic Group.

Documents affected by the change : none

Documents attached: none

Estimated impact	Summary
Performance	Thermal stability better than 20 m ⁰ C
Cost:	About 9 kEuro/tower
Schedule:	Assembly of a thermostabilization system on NE tower: by the first half of November. Test and full operation system: by the end of the Year.
Other:	
Decision Date:	
Observations	The assembly on other towers will be scheduled according to Virgo general planning.