

## Longitudinal control of marginally stable interferometers

In order to reduce as much as possible the effect of mirror thermal noise on the arm cavities, the radius of curvature of the mirrors was chosen to ensure that the beam size is maximal in both the mirrors and the cavities. Such a recycling cavity geometry requires or long and stable (LIGO) or short and marginally stable recycling cavities (Advanced Virgo).

The stability of a cavity has a strong impact on the resonance condition of the Higher Order Modes which is met almost at the resonance of the fundamental mode for cavities close to instability.

The generation of HOMs translates into degradation of the quality of the error signals by adding offsets, multiple zero-crossings or distorting the linear region.

In this paper the effect of low stability recycling cavities, even lower than the Advanced Virgo stability ( $1-g = 0.19 \cdot 10^{-5}$ ), on the longitudinal interferometer control will be studied presenting also the control solution to overcome to this challenge.