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**Ear Position and Angular Alignment Requirements for  
Advanced LIGO Optics**

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This is an internal working note  
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## 1 Introduction

The position and angular alignment requirements for the bonding of the ears to the optics of Advanced LIGO are discussed.

## 2 Ear alignment requirements

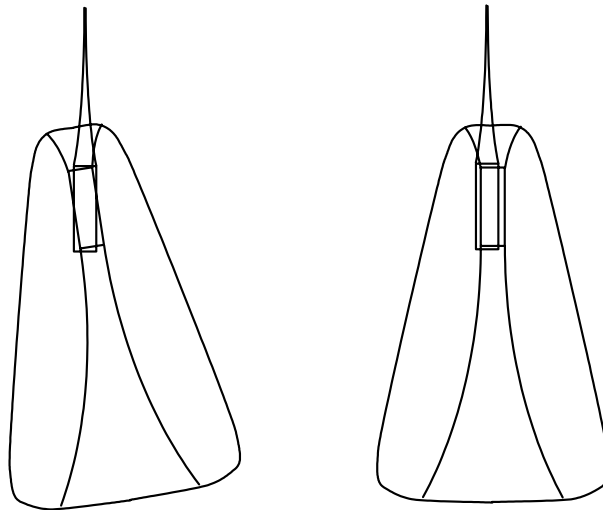
There two options:

- 1) the ears are a reference for the fibre head positioning;
- 2) the ears are just attaching points.

In the first case the error on ear positioning is directly transferred to the fibre and then to the static position of the mass.

In the second case the ears have to give a “reasonable” attaching point during the operation of welding. In case of fibre replacement the ear loses any referencing task therefore it is better to consider the ears as simply attaching points.

Any rotational and translational misalignment is not relevant as long as there is still enough material of contact between fibre head and ear and the safety is not compromised. In Figure 1 two exaggerated cases are shown.



*Figure 1 Two kinds of ear misalignment. In both cases the error can be compensated by correct positioning of the fibre head.*

If the ears are no longer a reference during the welding then a suitable jig holding the fibres has to be designed and tested.

It is possible to reach easily a precision of  $\pm 0.1$  mm and  $\pm 2e-3$  radians in linear and in angular positioning of the ears using a jig as in GEO 600. These values are perfectly compatible with the welding requirements.