

*LIGO Laboratory / LIGO Scientific Collaboration*

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**ADVANCED LIGO**

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**Removal of the ears and prisms at LASTI in  
July 2009**

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## Introduction

In the period of the 13<sup>th</sup> of July until the 17<sup>th</sup> of July work was carried out at LASTI to prepare for the monolithic suspension in which a 40 kg silica mass is suspended off another silica test mass by four silica fibres, welded to silica ‘ears’ that are bonded to the sides of the mass. This monolithic suspension is scheduled for September 2009 at LASTI.

The ears have been redesigned for the penultimate mass and test mass to allow for suspension with dumbbell cylindrical fibres instead of flat ribbon fibres (reference xxx). However, the masses already had been equipped with the ears for the ribbon fibres. Therefore, the masses will be turned upside down and the new ears will be bonded above the old ones. However, the old ears have to be removed so that they do not interfere with the fibres.

It was decided that the top of the ears should be machined off using a Dremel tool and the remainder ground down so it is not greater than 1mm in height.

Also wire break-off prisms were previously glued to the penultimate mass at a distance of 7mm from the centre of mass. When the mass is turned upside down this will be -7mm from the centre of mass. This could make the whole system dynamically unstable. Also the prisms were removed by soaking in water with detergent and were re-glued in the correct location.

## 1 Reference Documents

LIGO-T0900278-v1	Preparations for test hangs at LASTI
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## 2 Ear Removal

### 2.1 Procedure

- The penultimate mass was set-up on its V-block using the ergo arm, with one of the flat sides with ears up.
- A diamond scribe was used to scratch both sides of the weld horns at the shoulder (Figure 1). The horn is then snapped off by bending the horn towards the prism.

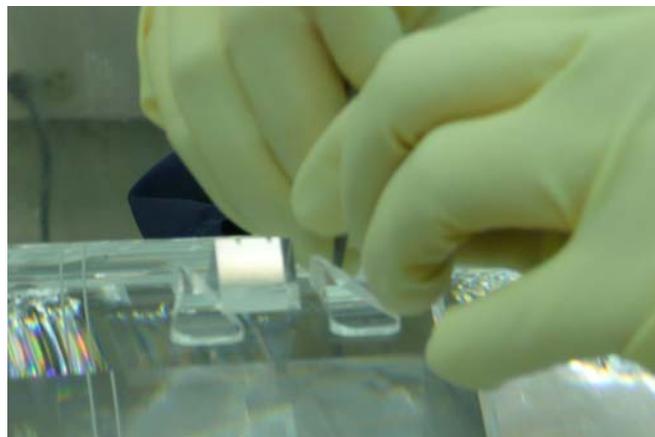


Figure 1: Diamond scribe being used to remove weld horn

- The flat was covered with a protective aluminium sheet (covered with Teflon at the bottom)
- The prism was protected by an aluminium cover
- The rest of the mass was covered with a layer of optical cloths and a house of aluminium foil, sealed with Kapton tape (Figure 2)



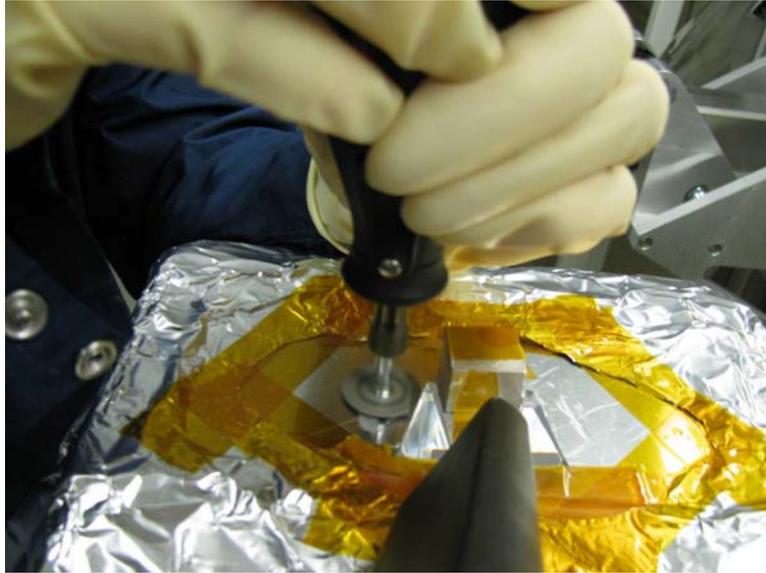
**Figure 2: Ears with prism and mass protected by metal plate**

- Personnel put on respiratory masks with P3 dust filters and protective goggles (Figure 3)



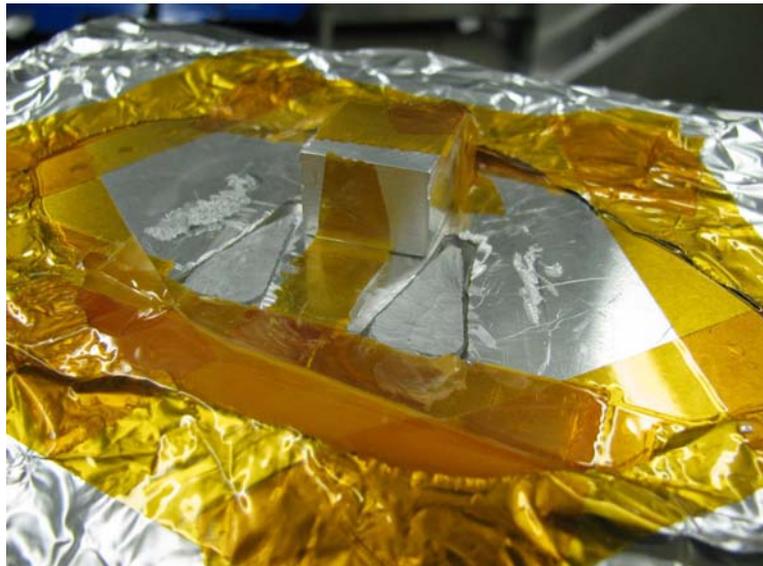
**Figure 3: Wearing protective goggles and respiratory mask with P3 dust filters**

- Turned on vacuum cleaner and held close (Figure 3)
- Used the Dremel tool with diamond cutting disc to remove one ear and then the other ear (Figure 4).



**Figure 4: Dremeling ear with diamond cutter**

- Vacuumed away excess dust



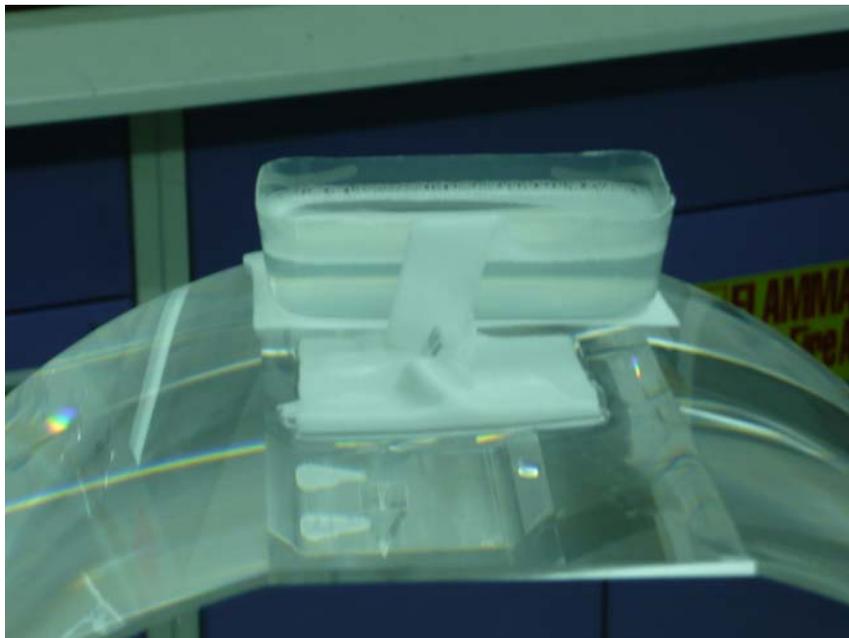
**Figure 5: Ears have been removed**

- Remove protective sheets
- Vacuumed away excess dust again
- Wiped with an optical wipe soaked in methanol and go around the edges of the ears with optical buds.
- Repeated this procedure for the other side

## 2 Prism Removal

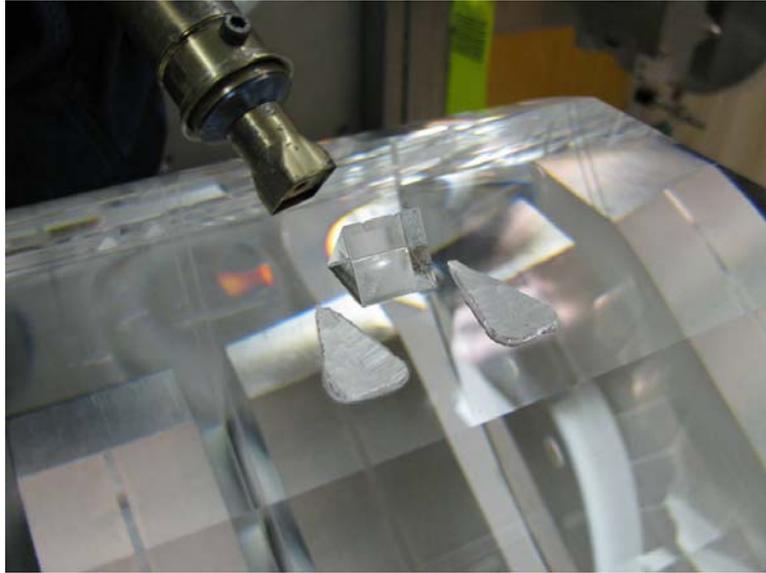
### 2.2 Procedure

- The penultimate mass was set-up on its V-block using the ergo arm, with one of the flat sides with ears up
- A clean room cloth was cut to fit around the prism with one end in a bath of DI water and Micro90
- The cloth soaked up the mixture from the bath and kept the prism wet
- This was left for ~8 hours until the prism came loose
- The surface was then cleaned with methanol and a small piece of leaf steel
- Repeated this procedure for the other side



**Figure 6: Prism with bath of DI water and micro90**

The ears on the 2<sup>nd</sup> penultimate mass seemed to be glued more securely. As the first procedure did not successfully remove the ears the procedure was repeated with the added step of applying heat to the glue with an air heat gun (Figure 7). This combined with the soaking was enough to remove the prisms successfully.



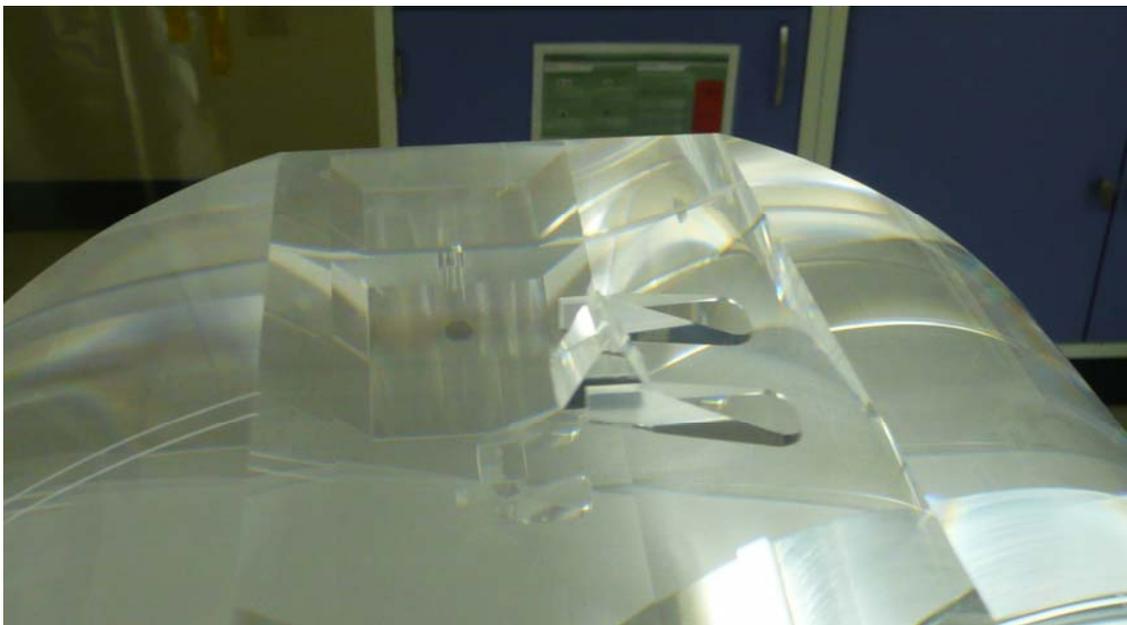
**Figure 7: Air heat gun being used on prism glue**

### **3 Result**

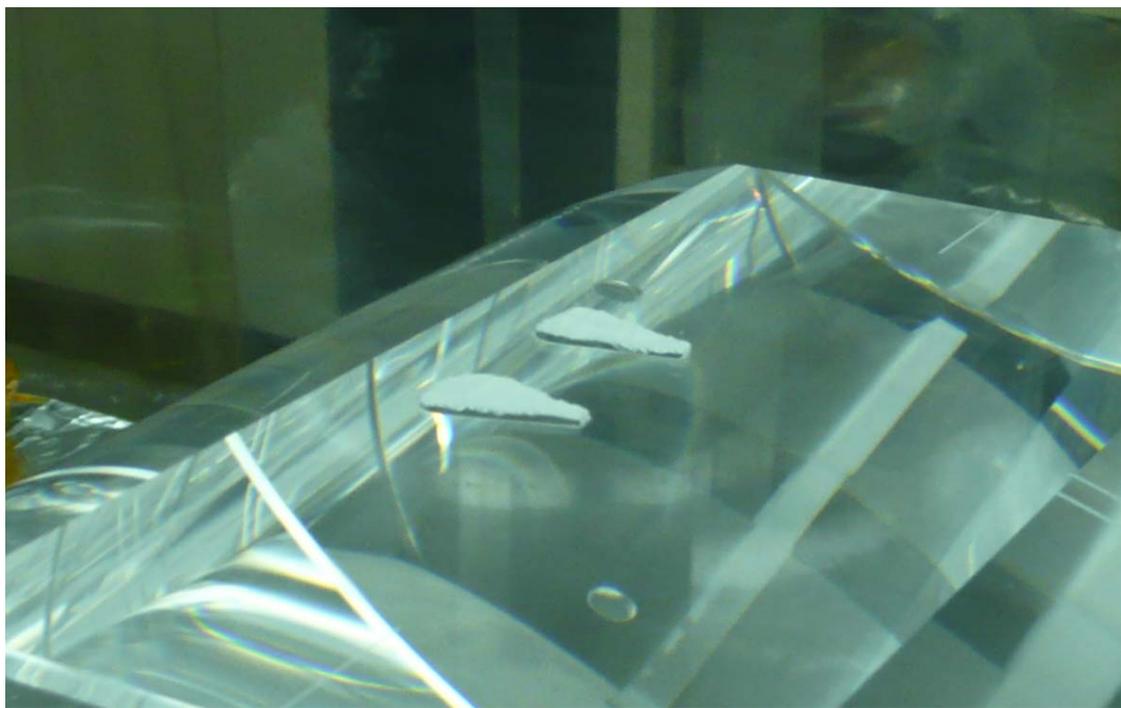
For both penultimate masses all ears (4 per mass) have been machined off successfully using a Dremel tool with diamond cutting disc. The remainder of the ears is now less than 1 mm high.

Also the prisms (2 per mass) have been successfully removed using a combination of soaking in detergent at room temperature and heating with an air heat gun.

The initial situation and end result are shown in Figure 8 and Figure 9 respectively.



**Figure 8: Mass before removal work**



**Figure 9: Mass after ear and prism removal**