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Repair to a severely damaged “horn” on E/ITM Ears

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## 1 Introduction

The purpose of this document is to record the work done on repairing horns on aLIGO ears that have had significant material lost. By significant material we mean when the horn height has been reduced by more than 2 mm or when a large part has been removed from the side of the horn such that some part of it is reduced by more than 2 mm.

## 2 Work carried out

We looked at repairing 3 different horns. The first was ground back until the cross-section was approximately 4 mm by 4mm, the second was ground at an angle until it was 2 mm on one side and 3.5 mm on the other, the third was cut at an angle such that the horn was 2mm high on one side and nearly 5 mm on the other.

### 2.1 Horn #1

A piece of 3 mm stock was welded onto this horn using the two lasers simultaneously. The weld took around 20 minutes and the part looked good afterwards – most if not all areas appeared to show that the silica had flowed.

### 2.2 Horn #2

The same process as for #1. The weld appeared strong and the stock was rigid. Vigorous movement of the stock by hand caused it to break, but did so above the repaired horn and the weld. This stock had not been polished

### 2.3 Horn #3

The process was continued with #3, which had been cut to resemble the damaged horn at LHO. The horn also has a crack across the ground surface and some chipping around the edges. A lot of material was used from the 3 mm stock to build up the horn. The repair was completed by removing the excess stock above 6 mm from the flat of the ear. This horn was tested by welding on a fibre and doing a pull test on the strength testing machine.

The welding of the fibre to the repaired horn was unremarkable and a reasonable looking weld was produced. The assembly was loaded into the testing rig and the load slowly increased until breaking point. The failure came at a 25 kg load, which is 2.5 times nominal load, if perhaps slightly lower than the mean value we have seen for cartridge tests.

### 2.3.1 Horn #3 at all stages

