LASER INTERFEROMETER GRAVITATIONAL WAVE OBSERVATORY
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Quad Noise Prototype Cabling Routing

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The purpose of this document is to provide a picture book of the cable routing around the quad noise prototype. The motivation was to highlight the OSEM cable routing on the noise prototype for the purpose of shield grounding issues. However, the photographs are complete enough to highlight other clamping and routing issues of both the OSEM and ESD cables. The photographs are sufficiently complete that one can in general follow the cables all the way from the ISI to the test mass. Note that the quad noise prototype does not have shielding on the OSEM cables, whereas the production quads will.

The first figure is a sketch of where all the photographs were taken on the reaction chain. The second figure is a wide view photograph of the reaction chain to try to provide as much of a global view of the routing as possible. From the next figure on, Figure 3 to Figure 14, all the photographs go in order from top to bottom, starting with the ESD cables at the ISI table.

The top and UI masses have identical clamping geometry. Clamps are provided in three locations: one on center top of the stage, one on the center bottom, and one on the center of the inside face next to the main chain. Thus the cables are routed from the top, to the back, and on to the bottom of each of the rectangular stages. The UI mass OSEM cables obviously terminate at the UI mass. Since an OSEM exists at each corner of this stage, there are even more opportunities for a cable to electrically ground itself.

On the penultimate mass the cables come in at the top center and travel down to the bottom of this stage along the outside face of the mass, as opposed to the inside face like the stages above. The penultimate mass OSEMs terminate at this stage. Out the bottom of the penultimate mass the ESD cables travel alone down an improvised guide wire towards the test reaction mass. This guide wire holds the cables together to prevent seismic shorts to the structure.

Since any given cable travels a significant distance on each stage that it is fixed to, there are many opportunities for the shield of that cable to electrically ground itself to the suspension. It should be considered however, that flexibility is only needed between the masses. The cables may be given arbitrarily stiff shielding between the clamps within a stage.

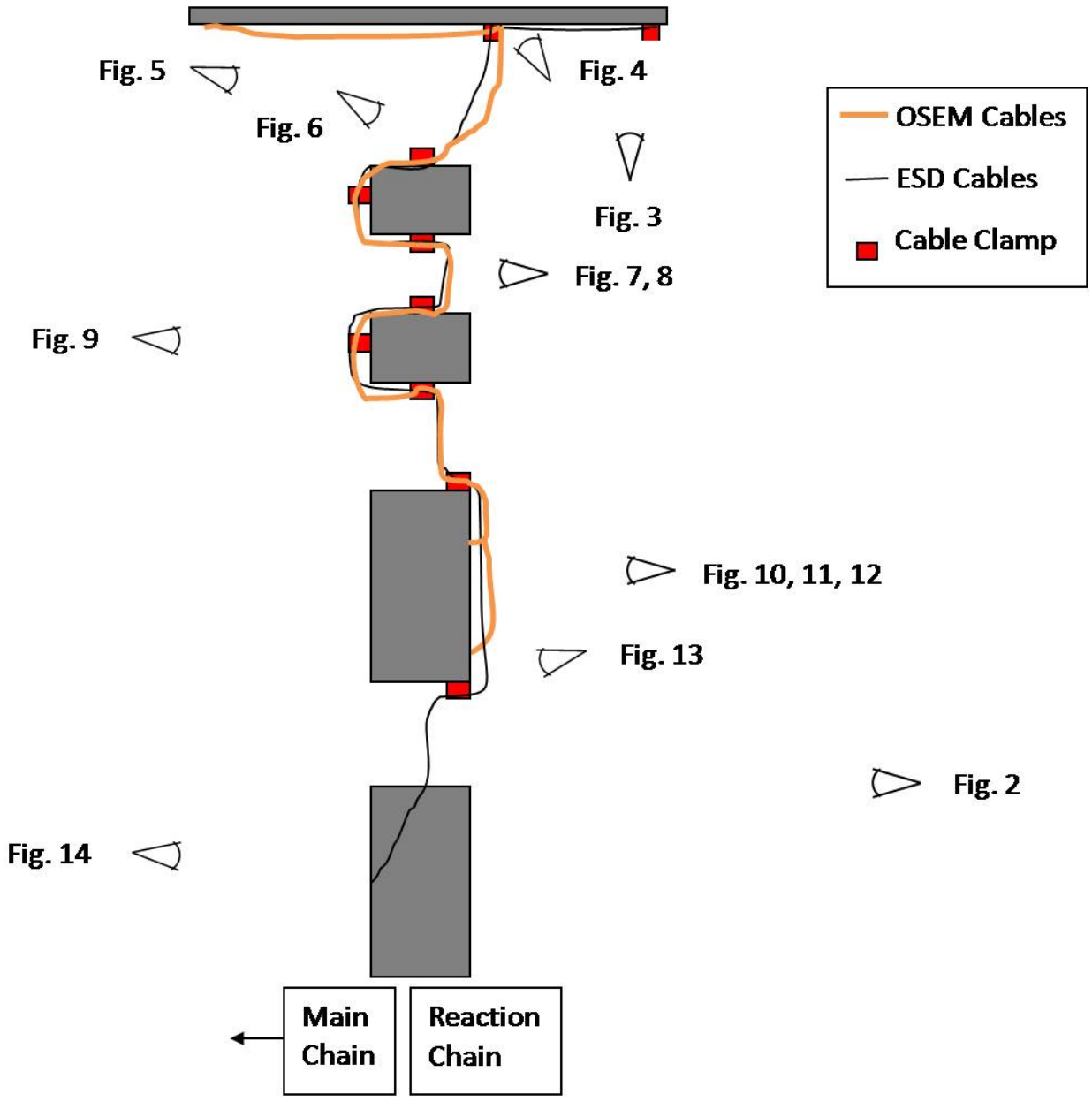

Figure 1: A sketch of where all the photographs in the following figures were taken relative to a side view of the quad reaction chain. The main chain, which is not shown, would hang to the left.

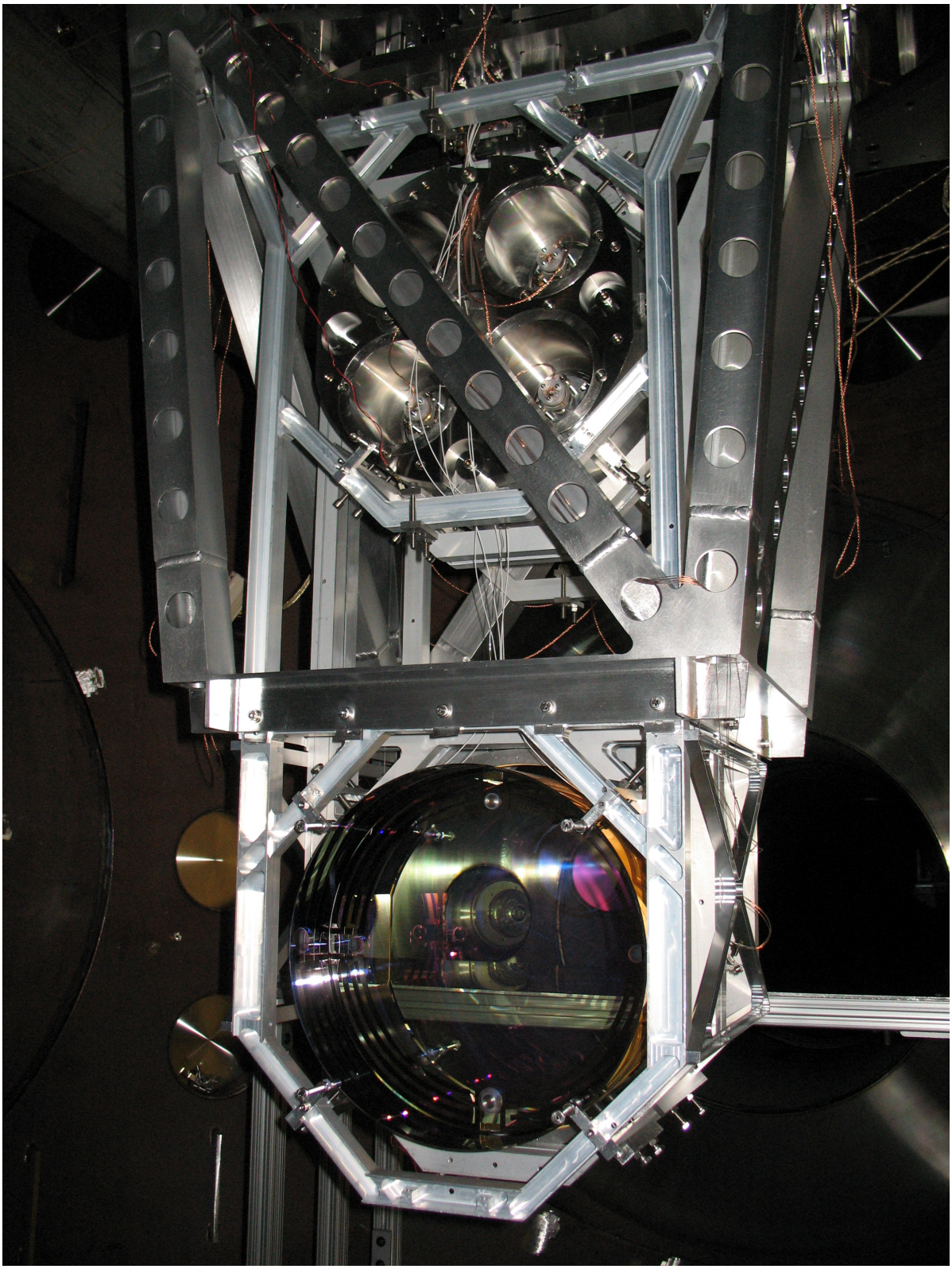

Figure 2: A wide view of the reaction chain from the bottom of the UI mass to the test reaction mass.

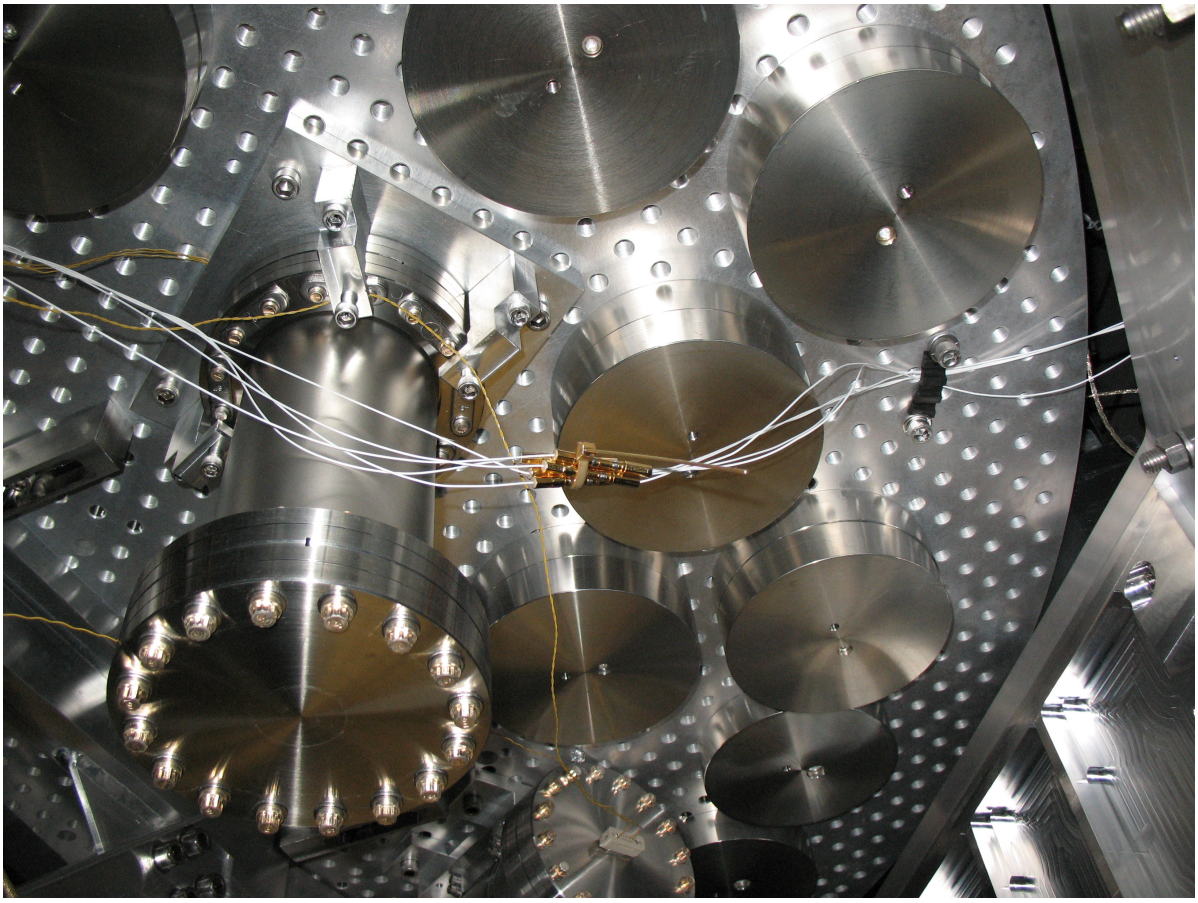

Figure 3: The ESD route from the BSC wall to the quad structure. The clamp is an improvised piece of viton, and is not an ideal solution. Viton was used for its compliance to protect the delicate cables. As of the quad installation, there was no formal clamp design for any quad cabling on the ISI.

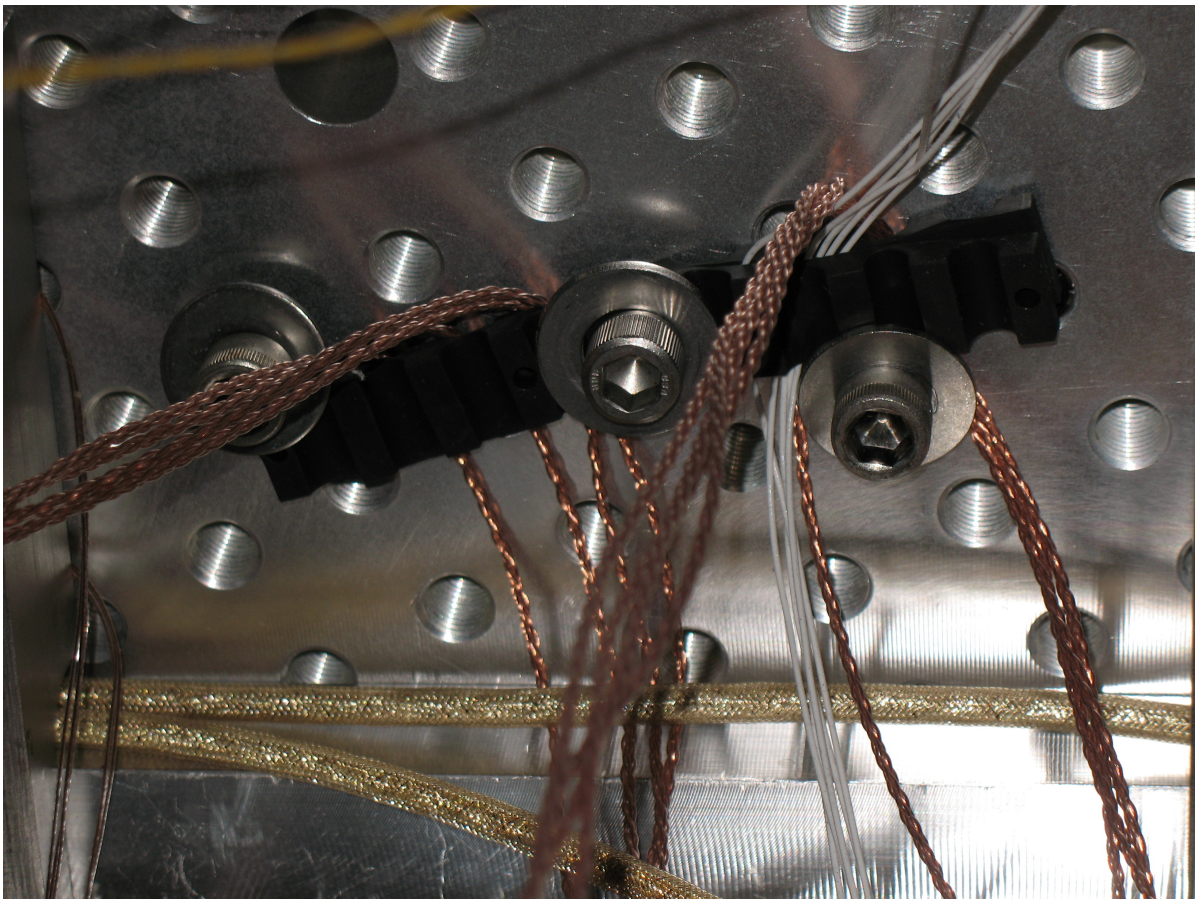

Figure 4: The ESD and OSEM cables clamped to the ISI table just before entering the quad upper structure. The clamp here is also an improvised piece of viton.

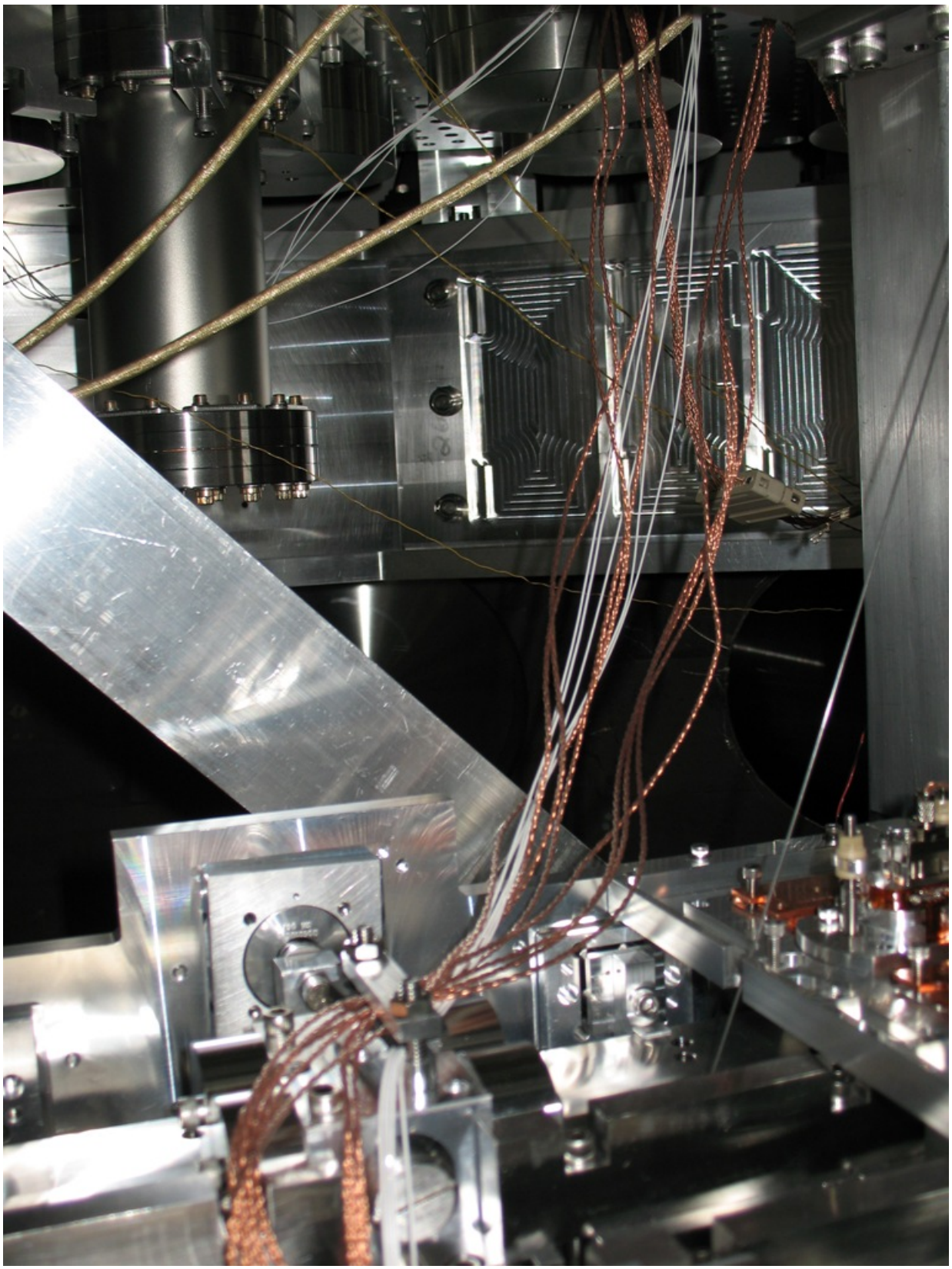

Figure 5: The picture shows the cables entering the top mass from the ISI table.

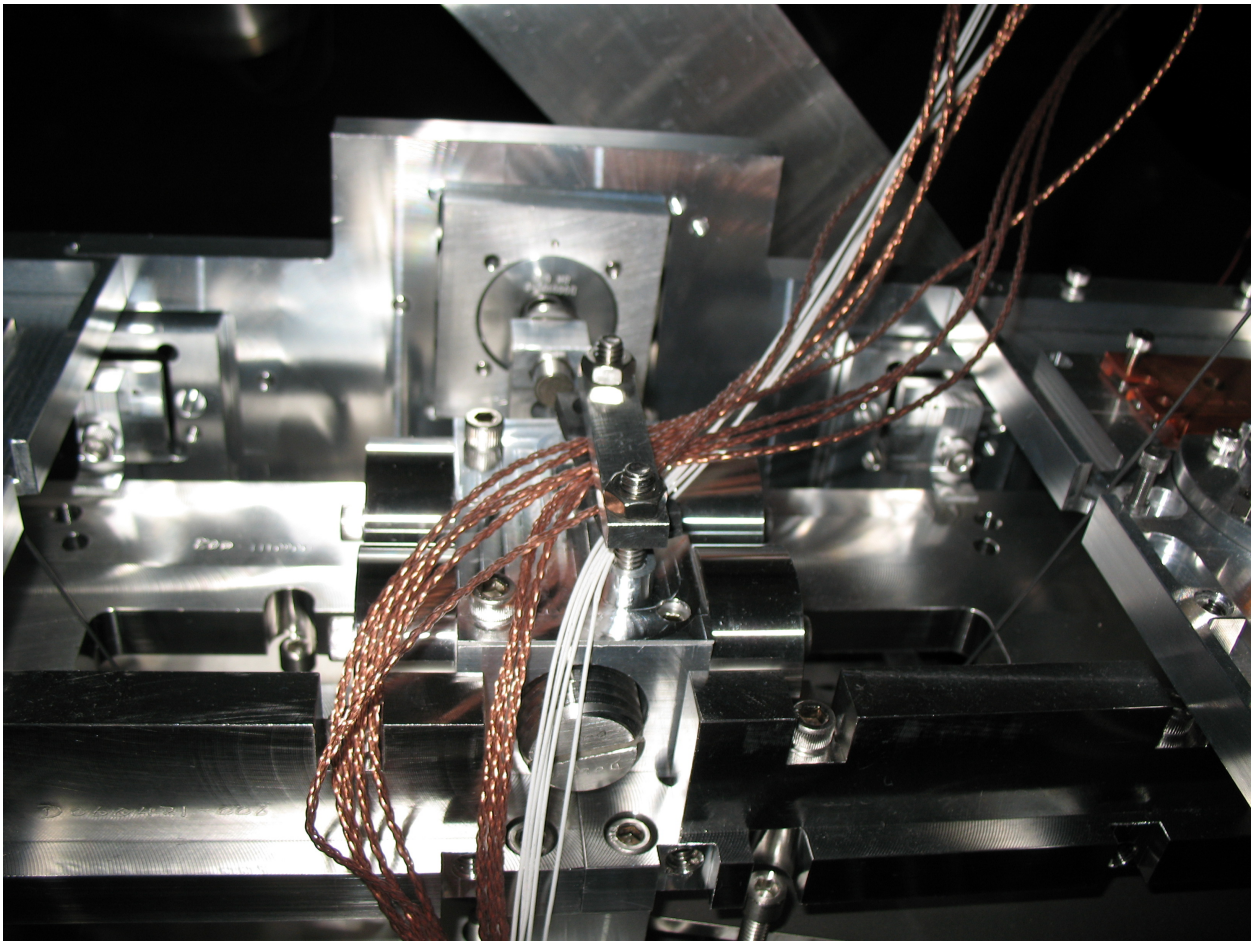

Figure 6: Close up of cables entering the top mass.

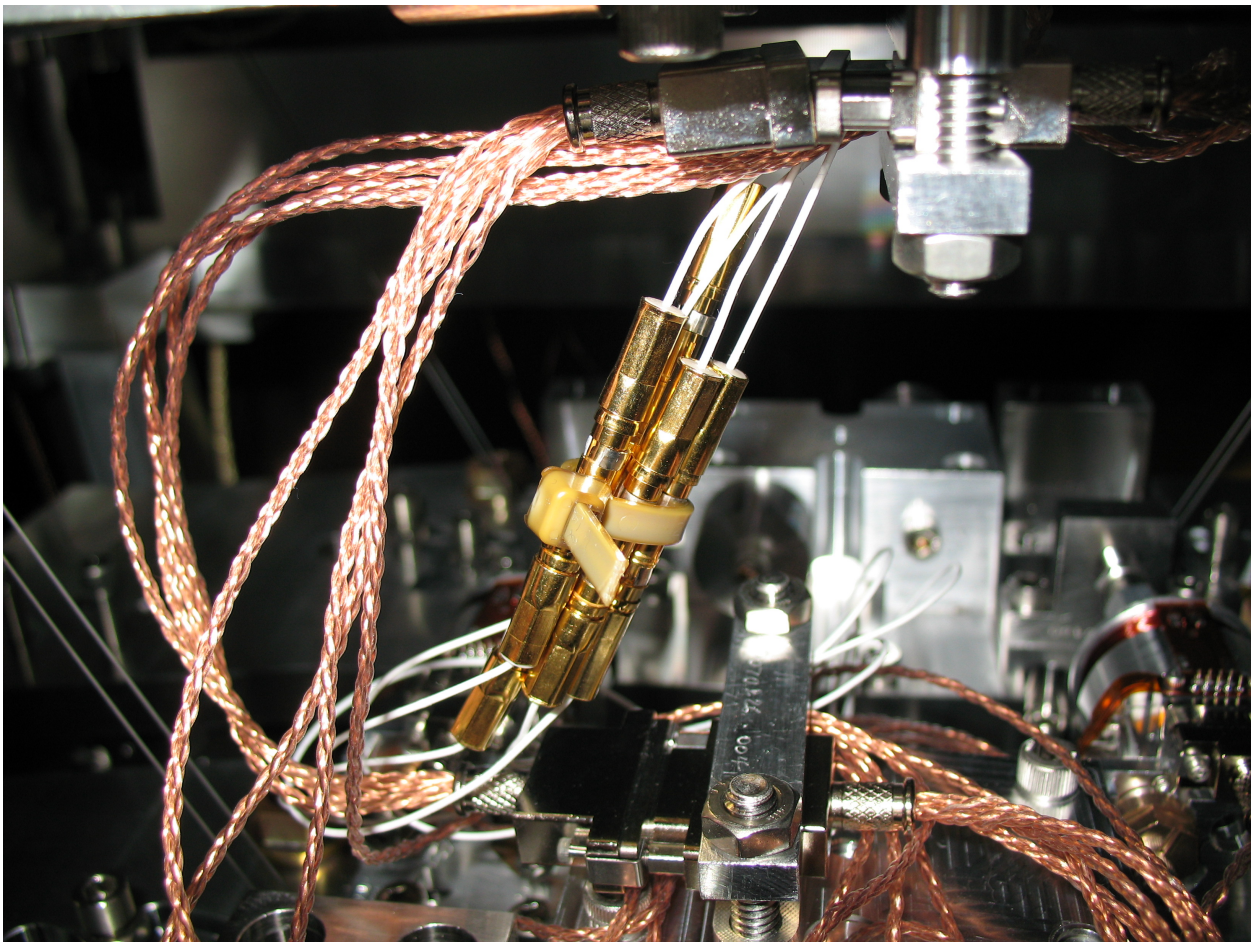

Figure 7: This photograph shows the reaction chain OSEM and ESD cables and connectors between the top mass and the UI mass. The cables have connectors so that the lower structure can be easily 'unplugged' from the upper structure when it is removed. The OSEM D-connectors are clamped directly at the masses to avoid interference with the suspension modes. Ideally, the ESD connectors should be clamped at the stages as well, but the geometry of the clamps only permits one type of connector at a time.

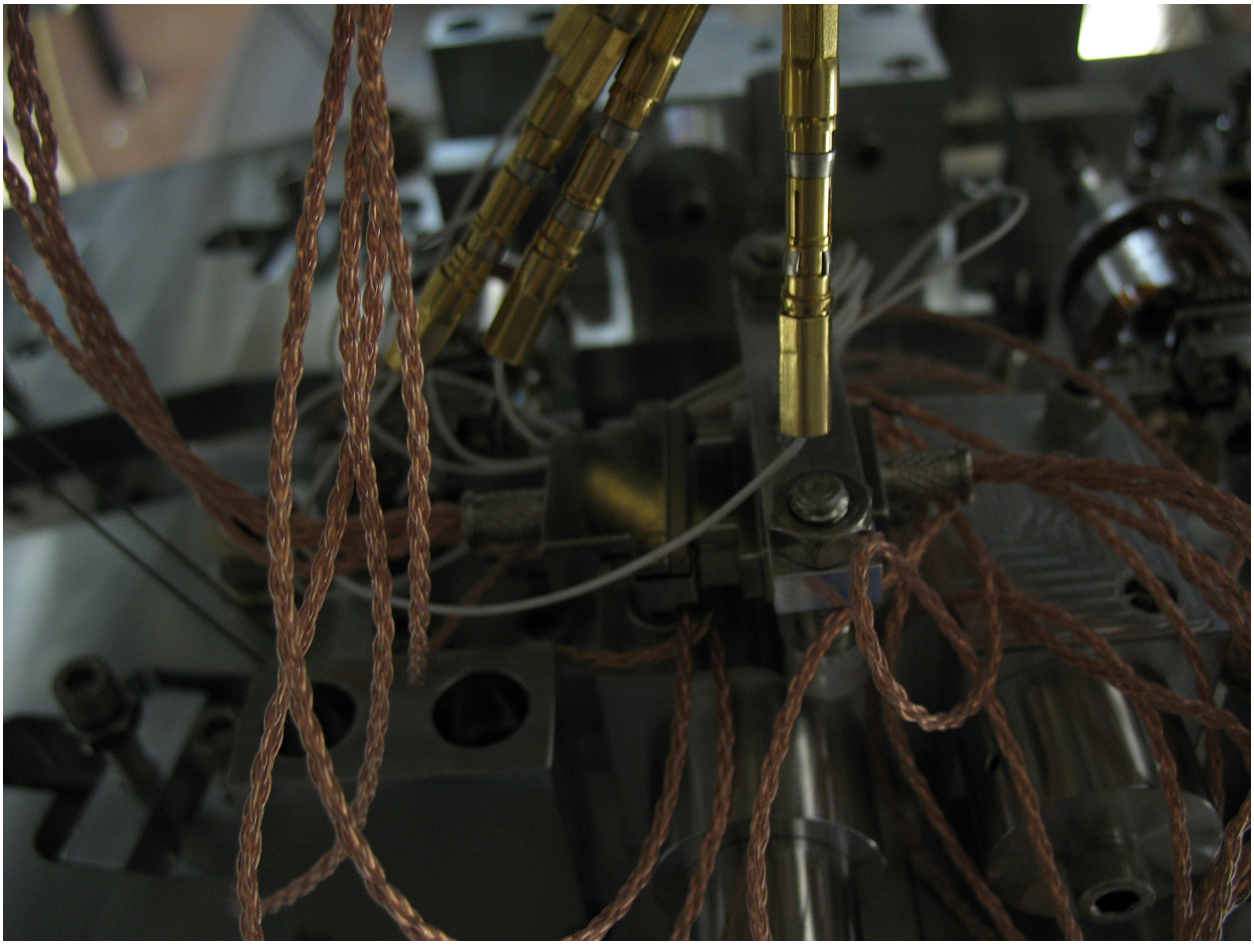

Figure 8: Top of the UI mass. The photograph was taken before the ESD connectors were bundled with the zip tie in the previous figure. This picture is meant to show the tangle of wires that tends to accumulates in this area. The reason being is that there are OSEMs in various locations on this stage, including right on top of the UI mass, so some cable must sit on top. Also, the lengths of wire to each OSEM is the same even though OSEMs are at varying distances from the clamp. Consequently, there are various amounts of slack to deal with.

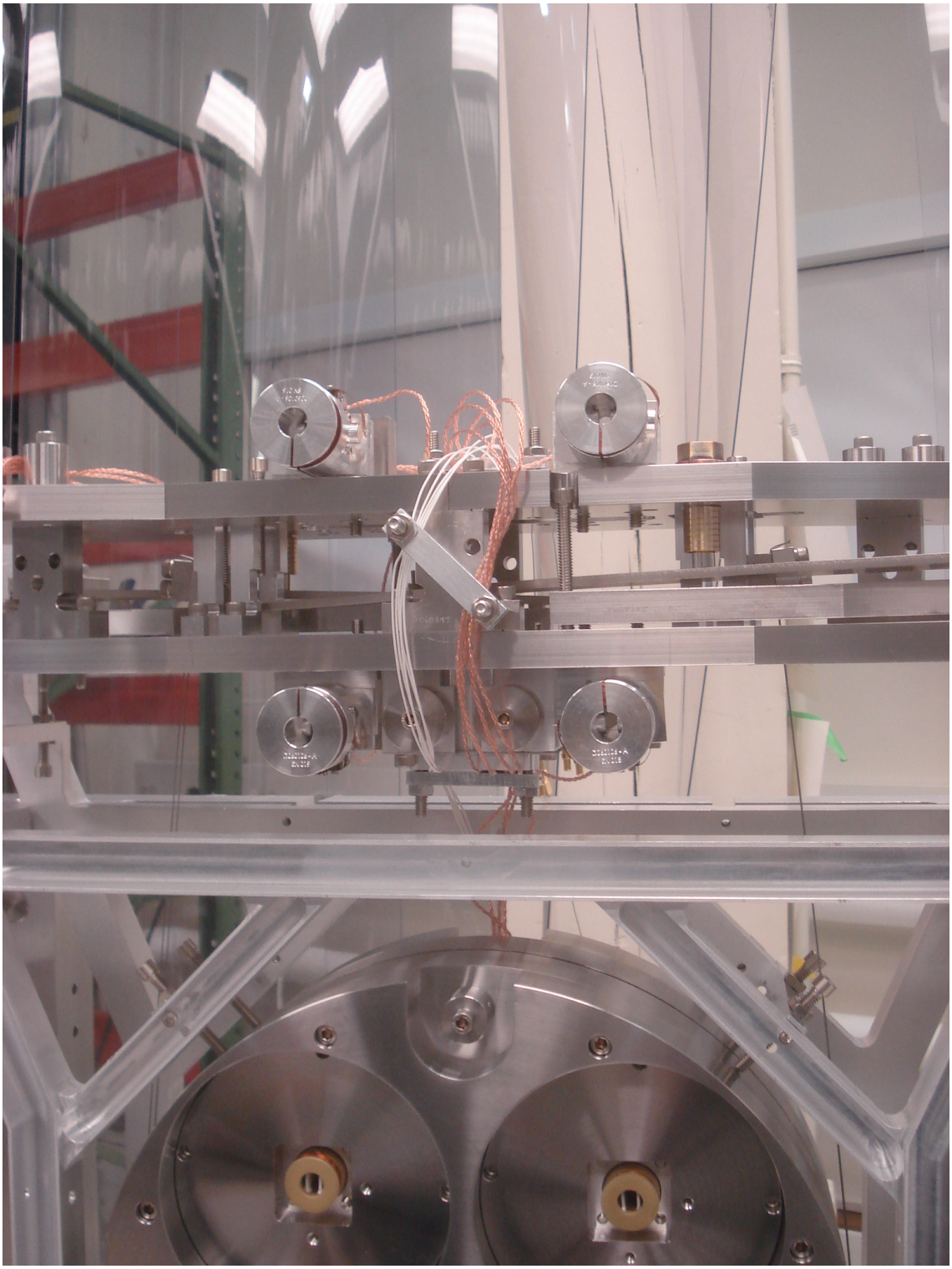

Figure 9: Back of the reaction chain while the quad was separated on the floor (side facing the main chain). Visible are two of the three clamps at the UI mass, one at the bottom and one in the middle facing the main chain. The clamp on top of this mass is not installed in this photograph.

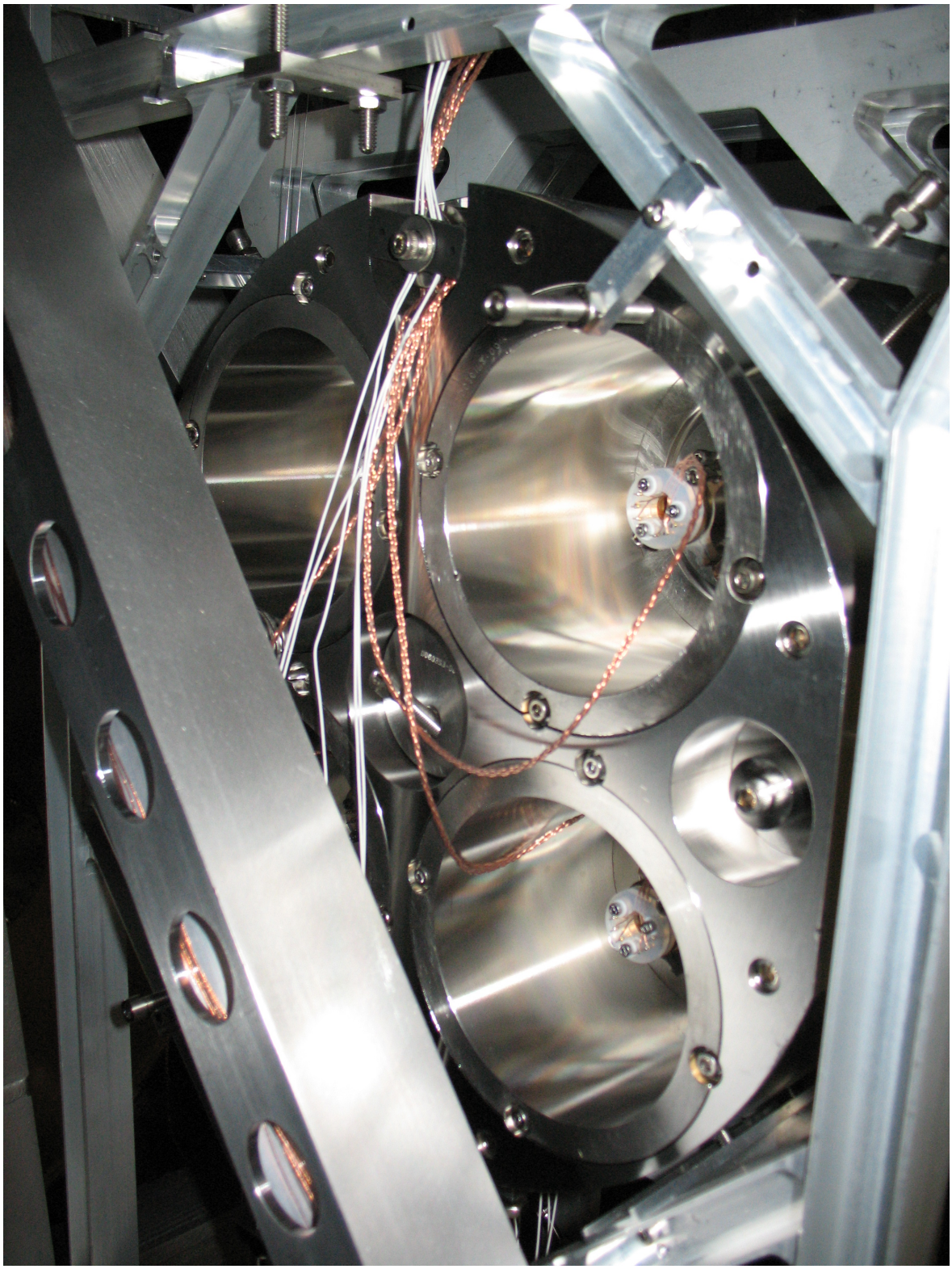

Figure 10: Penultimate mass. The ESD and OSEM cables run down the face of the penultimate mass.

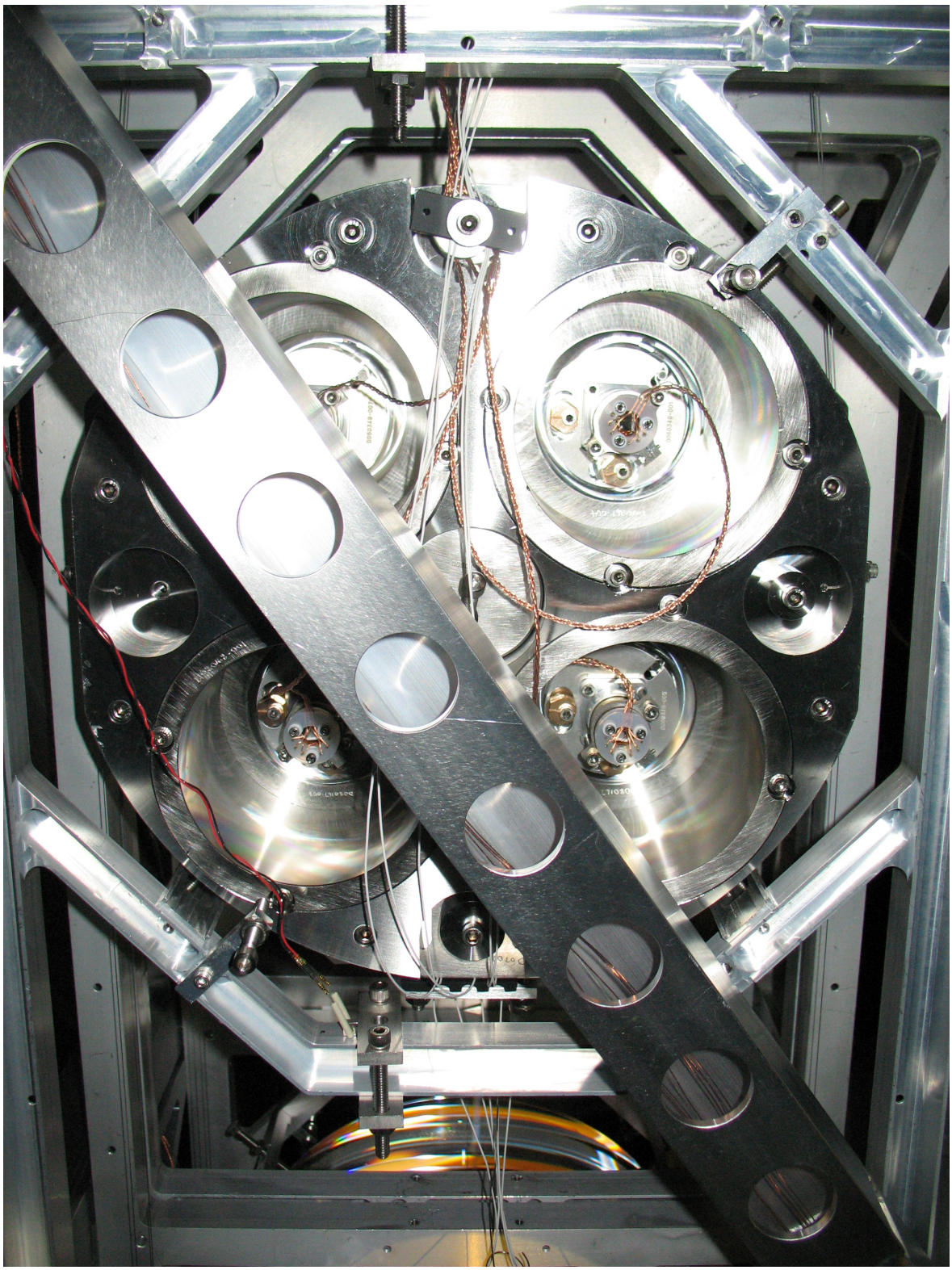

Figure 11: Penultimate mass. The ESD and OSEM cables run down the face of the penultimate mass. A better clamp is needed at the top of this stage. Here it is another improvised piece of viton.

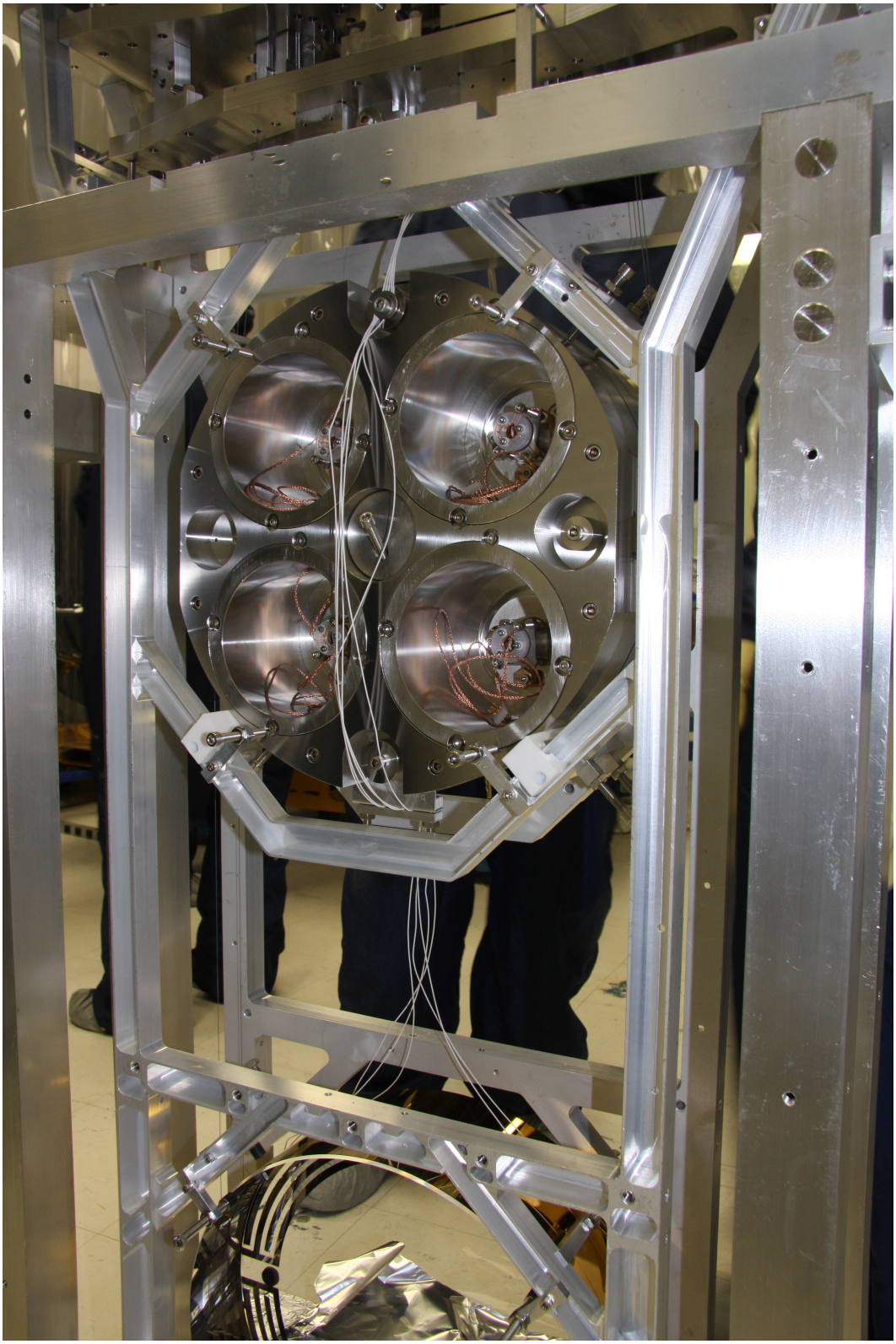

Figure 12: Penultimate mass while quad was on the floor. There is no obstructing sleeve in this view.

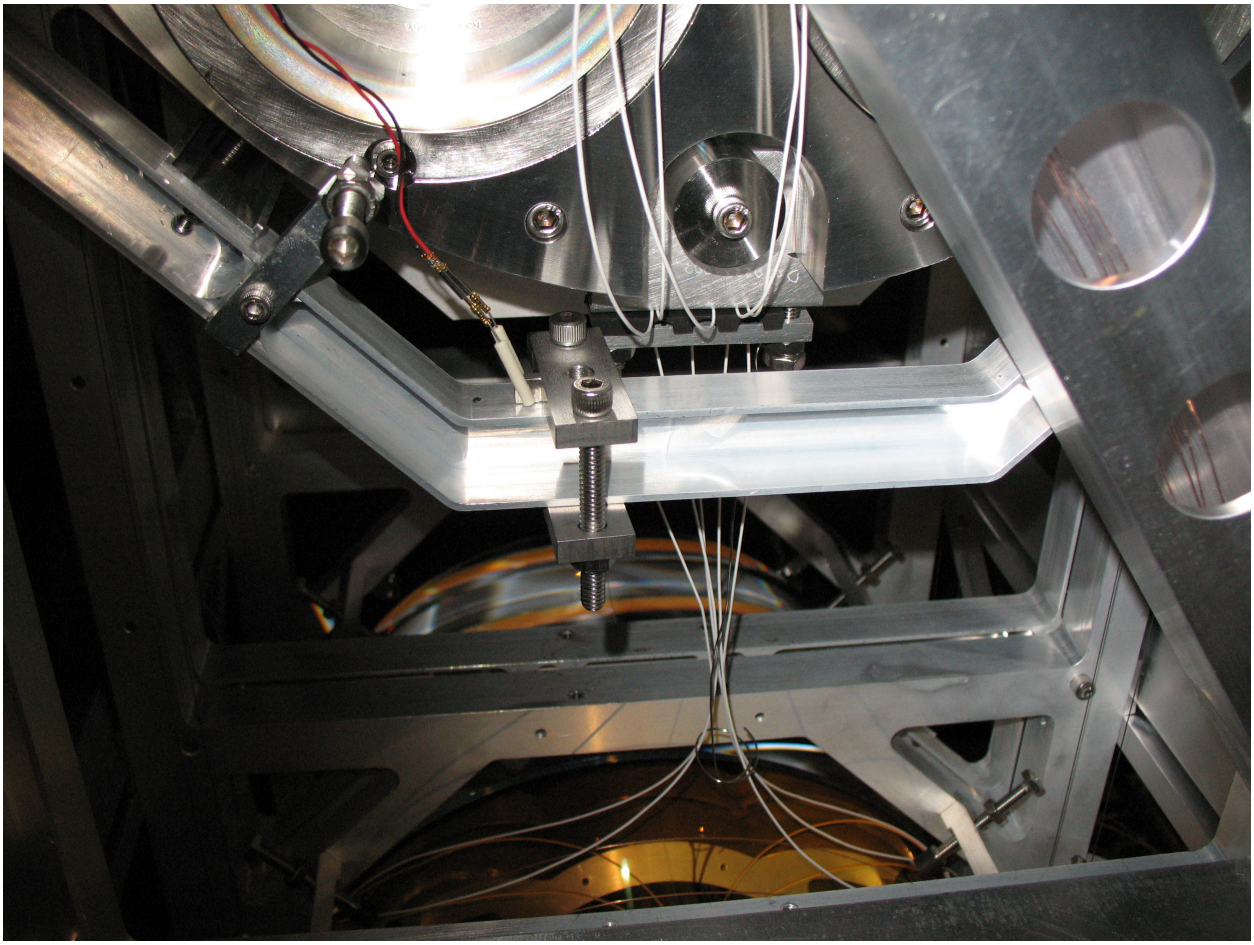

Figure 13: A close up of the cable clamp at the bottom of the penultimate mass. Also visible is the improvised guide wire steering the ESD cables to the top of the test reaction mass to prevent seismic shorts. Note that some ESD cables come to rest under the earthquake stops.

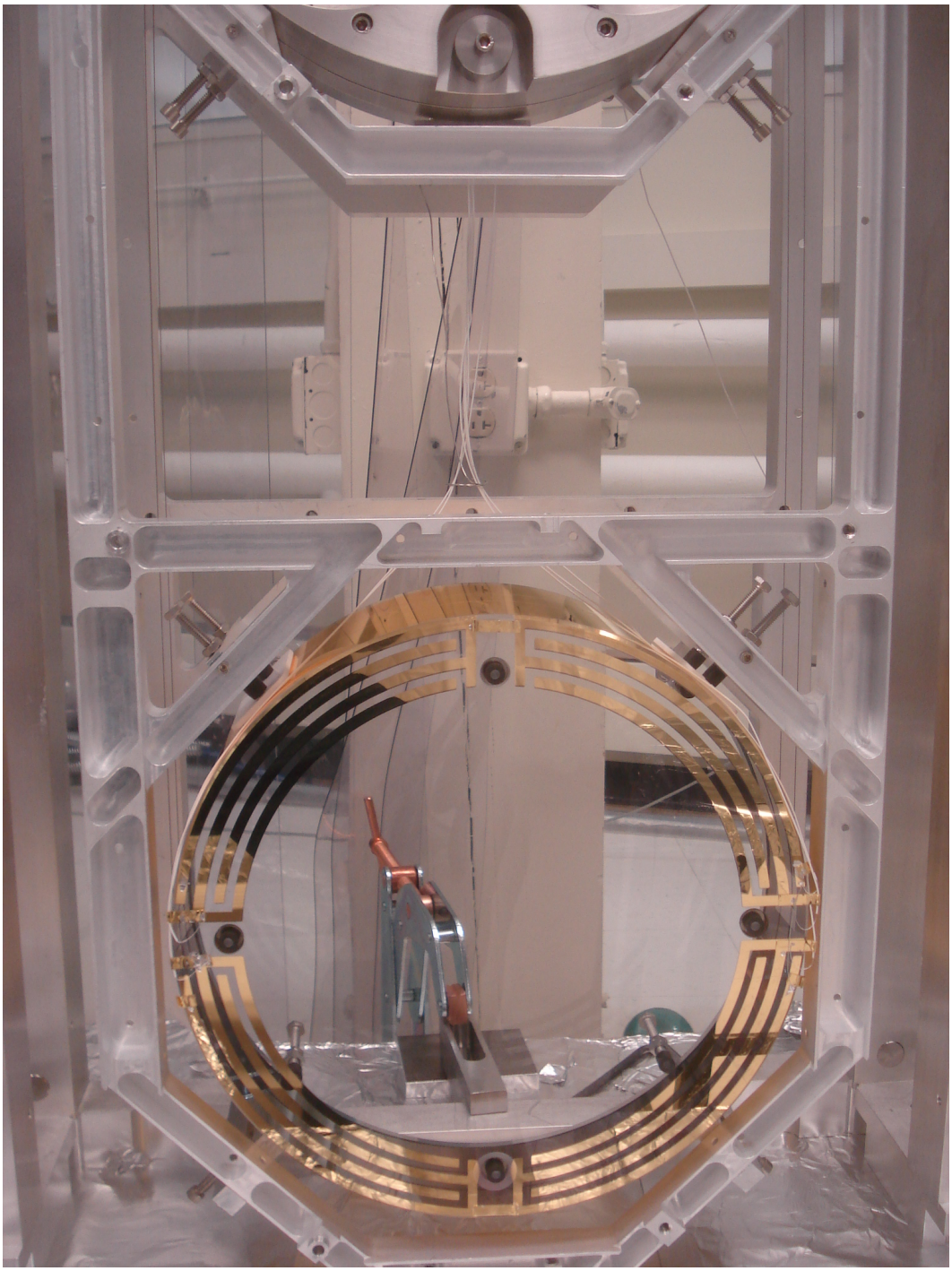

Figure 14: The test reaction mass from the main chain side when the quad was separated on the floor.