Miniball Coulomb Excitation Target Chamber

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May 2011

Contents

1 The Coulomb Excitation Target Chamber

Figure 1: View of the target chamber from above. In this picture, the beam goes from left to right. Inside the target chamber the CD is not mounted, but you can see its cables and the feedthroughs. The PPAC flange is also not mounted. Note, however, that from 2007, the PPAC was no longer mounted in the position indicated, but further down stream on an actuator.

The Miniball target chamber was made by IRES in Strasbourg and the sphere of the chamber was cut from a single piece of metal on a lathe. It is very thin-walled, so it can bend under its own weight. For this reason, it is essential to support it properly. There are two ways to do this:

- with the target chamber properly mounted with one end fixed with clamps to the cross-pipe where the turbo pump is and the other screwed down on the rails.
- with the side pieces attached, so that the side pieces take the weight.

In other words:

never mount or dismount without the target chamber without the side pieces attached.

2 Mounting

Clean all the surfaces which will make contact, using alcohol before you do anything.

First make sure the O-rings are inserted at either end of the target chamber and not on the flanges of the beamline itself, but on the target chamber. The

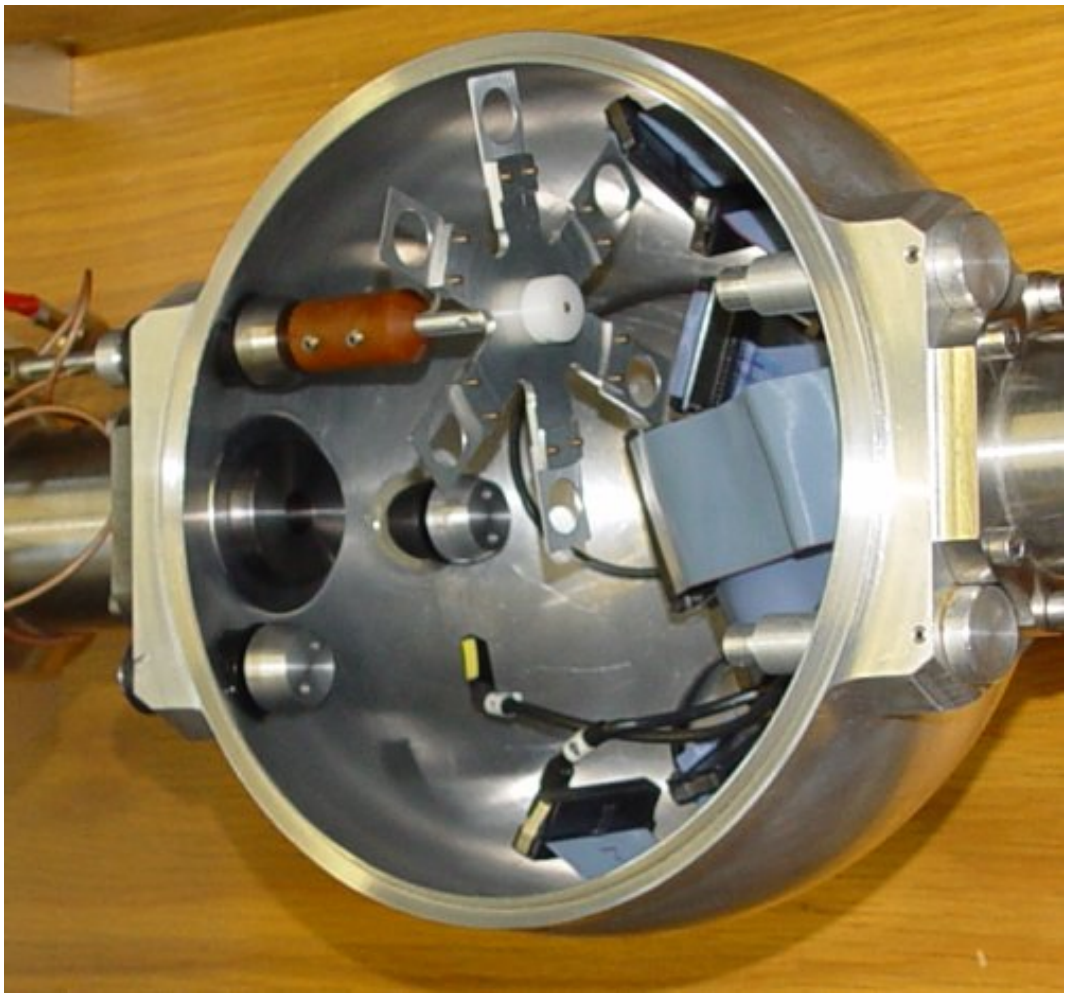

Figure 2: Close up of the target chamber with the target wheel and the cables for the CD, but without the CD itself. The flat cables are for the ΔE detector and the other cables for the E detector (PAD)

PPAC flange must be mounted onto the target chamber[1].

Then rest the rails (on the right side of figure 1) on the support at the downstream end of the target chamber support. This should take the weight.

At the other end (on the left of figure 1), there should be two pins which fit into holes on the support and the target chamber. Guide the target chamber so

[1]This has changed since 2007 as the PPAC is no longer mounted so far upstream.

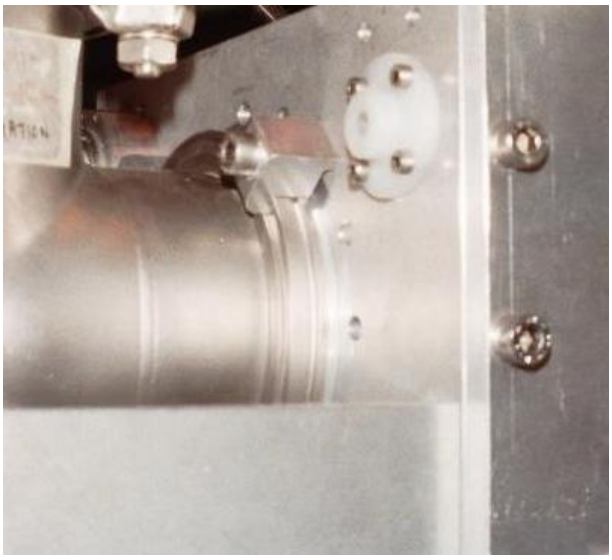

Figure 3: The upstream mounting of the target chamber. The beam goes from left to right. On the right side of the picture, you can see the side plates of the target chamber.

that these pins engage and can take some of the weight.

Make sure the O-ring at the upstream end (left on figure 1) is evenly squeezed between the target chamber and the support. Use the clamps to fix it into place and tighten it up (see figure 3. The target chamber and the support should fit snugly together without any gap and the O-ring should be compressed. If it is not compressed, then this means the O-ring is not inserted properly. Until this end is dealt with, don't even think of the other end, just let it rest on the rails. If you start tightening anything at the other end, it will pull on the upstream end, making it virtually impossible to get it right.

Bolt the upstream end of the target chamber to the support with the four bolts (these are behind the side plates).

Bolt the rails at the downstream end to the support. Now the target chamber is fixed and it is safe to remove the side plates. Never remove the side plates without having the target chamber bolted at both ends, as this will deform the target chamber.

Connect the bellow to the PPAC flange[2]. This should close both ends of the target chamber, so once the lid is on, it should be possible to pump.

[2]This has changed as the PPAC is no longer this far upstream.

Note that the correct O-ring for the lid is non-standard, but it was lost in Darmstadt, so the one we have, which is standard, doesn't fit very well.

3 The Heidelberg collimator

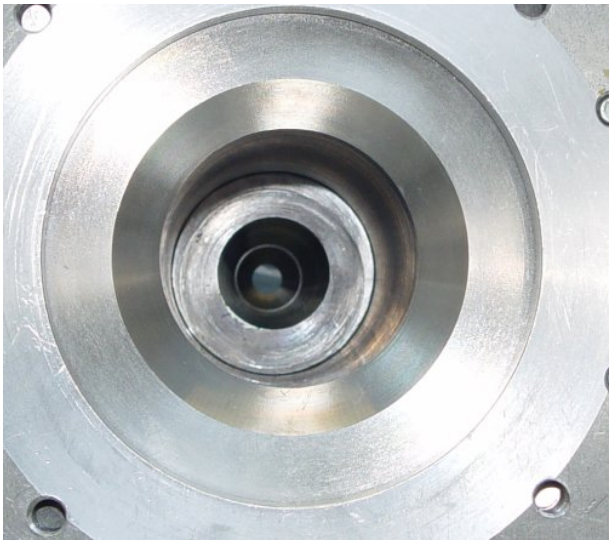

Figure 4: Collimator viewed from upstream

The Heidelberg people have designed a conical collimator which is designed to make it impossible for beam to fall directly on the CD.

However, after checking the alignment in 2009, we found that although the target position was perfectly aligned, the target chamber was slightly rotated, so that if the collimator is inserted it is slightly off axis. For this reason, the collimator cannot be used until the target chamber is properly aligned. In future, we need to put a small hole in the centre of the aperture where the collimator goes as well as one at the target position, when we align!

4 CD insert

There is an insert plug, which is inserted into the CD and which covers up the innermost part of the CD. This is designed to stop beam that would otherwise be scattered into the CD, causing too much radiation damage to the CD.

5 Selecting targets

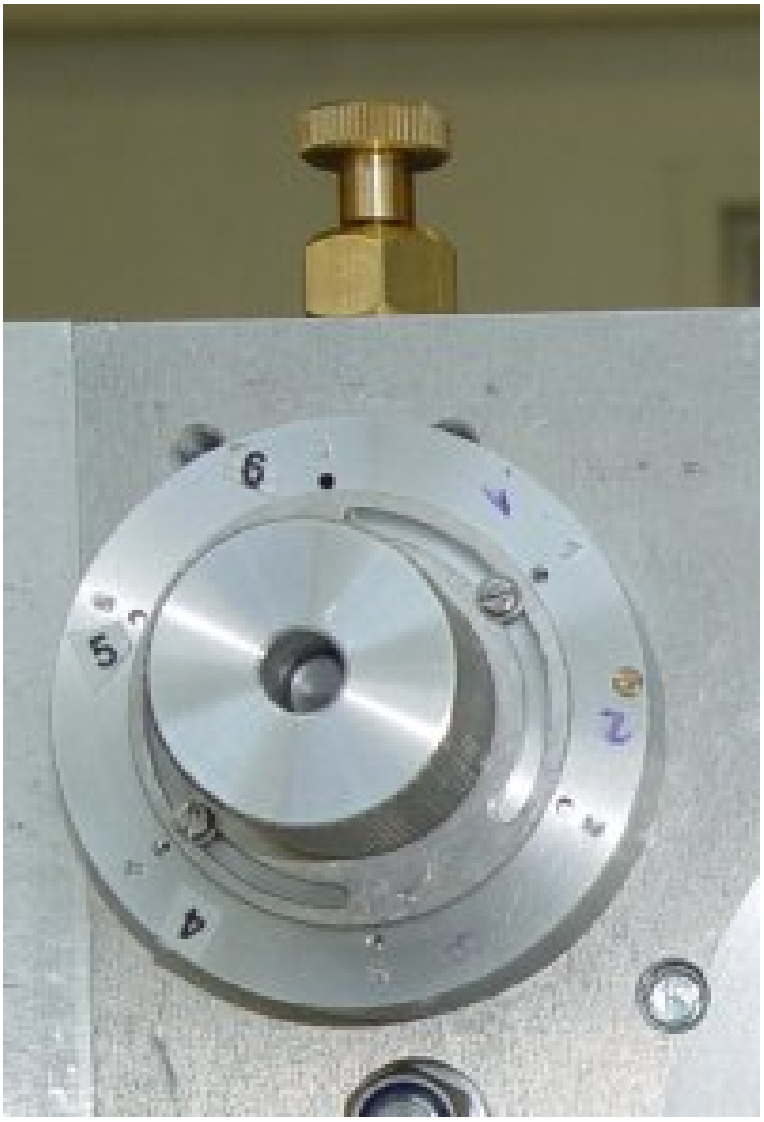

Figure 5: Target mechanism

There is a wheel and a pin to prevent the wheel from turning and to lock in a particular target. You have to lift the brass screw up in order to free the wheel, so that it can rotate. Then lower it to lock the wheel into position. It is designed so that you can only lower the pin into one of six positions.

6 Getting the target wheel aligned

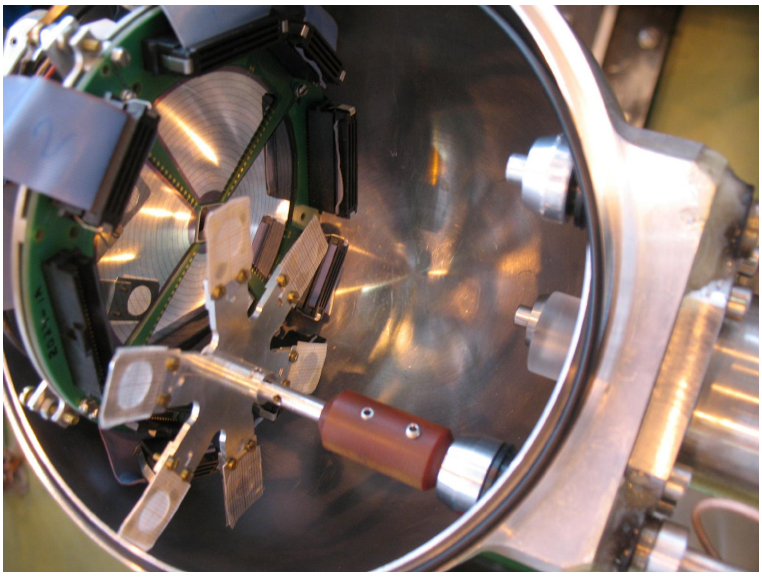

Figure 6: The target wheel is fixed to its spindle. The left screw in the brown collar goes into a hole in this spindle and the right screw goes into a hole in the feedthrough spindle. So there are no degrees of freedom here..

First of all, do not adjust the rubber band, which is fragile and hard to get at the right tension. Secondly, do not adjust anything inside the target chamber. The wheel locks onto the spindle with a pin and slot mechanism, which ensures that the target wheel can only be mounted in two ways, which are reproducible and (due to the symmetry) equivalent to each other. The spindle on which the target wheel is mounted goes into a brown collar which connects it to the spindle of the feedthrough. There are two screws, one to fix the spindle of the target wheel and the other for the spindle of the feedthrough. There are holes in the spindles and the screws should fully engage with these holes. Only then, is the position reproducible. The screw for the target wheel spindle should be flush with the brown collar, when the screw is all the way in. There is only one possible position and no degrees of freedom if it is mounted correctly. See figure 6. Do **not** try rotating the target wheel spindle with respect to the feedthrough spindle. This is not reliable. It can even slip during experiments, when the target wheel is turned.

In order to get the correct orientation of the target wheel, first free the two screws indicated in figure 7. This decouples the spindle which is locked by the pin from the feedthrough spindle. Then you can rotate the target wheel freely with the pin locked. Use the telescope to get a target lined up correctly in

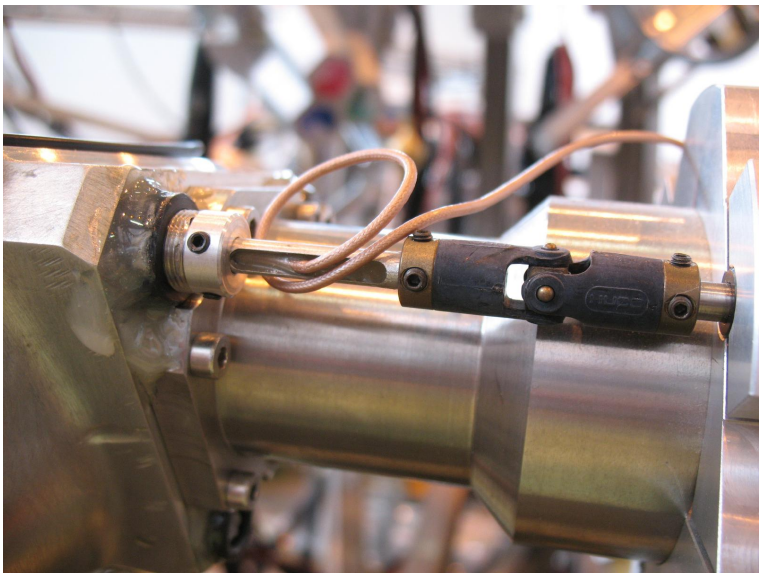

Figure 7: The screws used to adjust the orientation of the target wheel with respect to the positions selected with the locking pin.

the right position and then tighten the screws again. This method should be reproducible.

7 Targets

The Miniball target frames are 2 cm long, but the corners have to be cut as shown in figure 8 so that they can rotate properly inside the target chamber.

8 Technical drawings

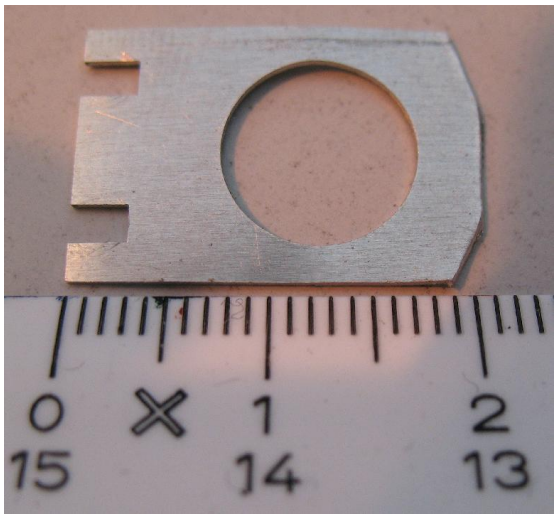

Figure 8: Form of Miniball target frames

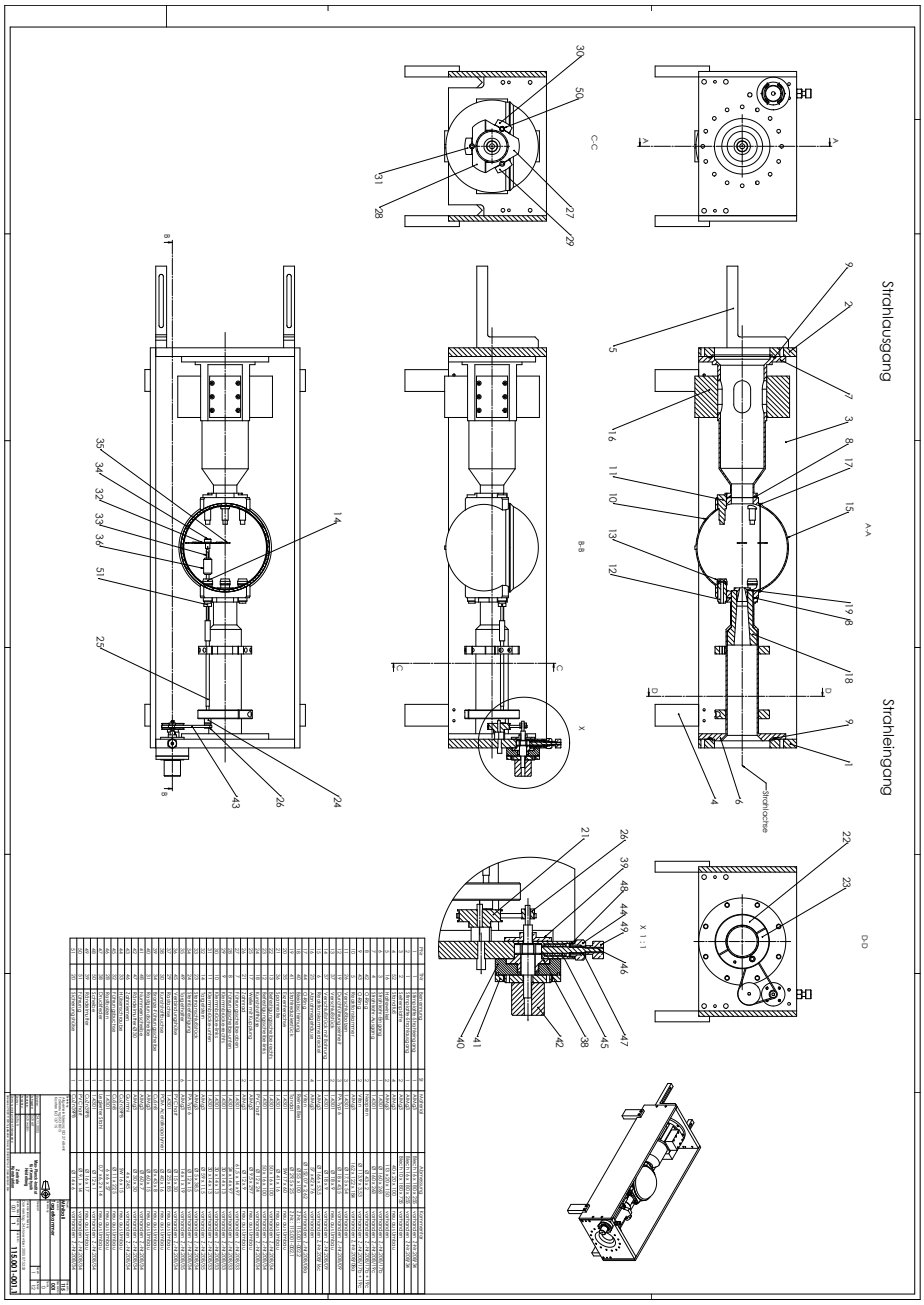

Figure 9: Technical drawing made by MPI Heidelberg when they modified the target chamber