Antiproton trap discussion

2019.4.26

Cold tube. (attached file, slides 1 to 3)

On the drawing, it seems that the two ends are different: at one end there are more Cu strips (hence narrower) and the tube simply stops; On the other end we see less strips (wider), and the tube ends with a larger radius section. Are the two ends really different, and why?

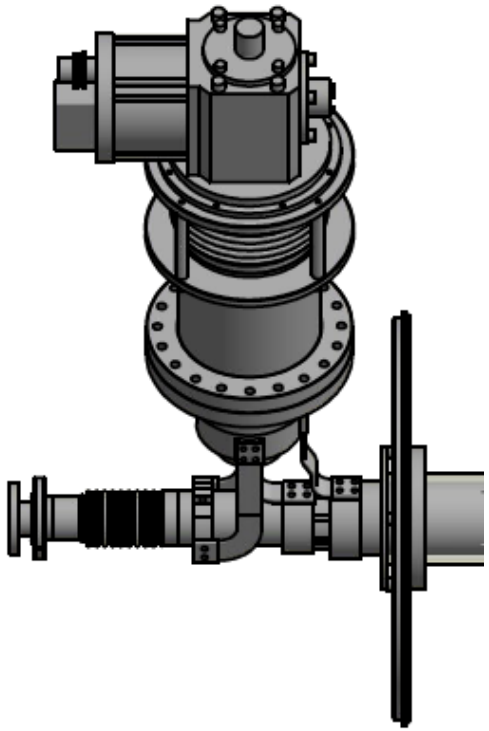
Asymmetry in radius is due to the space limitation of the bore of the magnet. CUHV pipe is inserted to the magnet bore from downstream(DSR). And we have larger diameter at DSR to accommodate focusing elements.
As for the strips at DSR, we originally planned to have as many slits as upstream tube. But, the company worried about the assembly process and mechanical strength → decided to use a cylinders with a cut at the bottom of the tube.

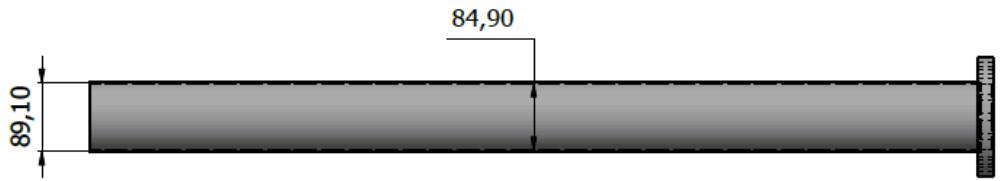
By the way, on one end (the one where the tube stops simply) the braid from the cold head is connected only to one Cu strip: how is the "cold" transmitted to the other strips? Will this be enough to cool the whole tube?

At the end, strips are merged(by welding) into a ring(with a cut at bottom) to be connected with the cold head.

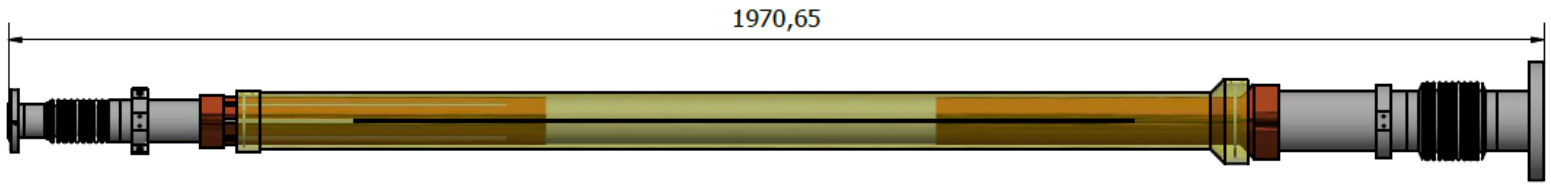
Closer to the center there is short section with no more strip division (strips connected to each other): will this be OK for eddy currents in case of a quench?

The central part also has a cut (about 3 mm gap) at the bottom of the tube.

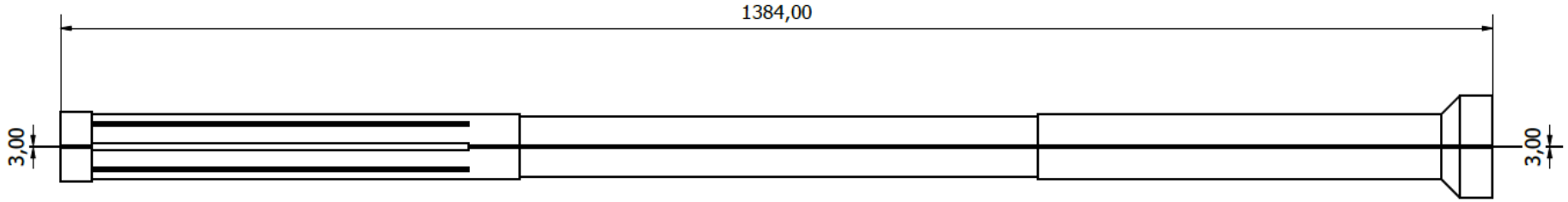




OVC



UHV assembly



Alignment of the cold tube. (slides 4 and 5)

It seems that the alignment of the cold tube is made by moving the two vacuum vessels at the ends.
We have some experience with the Riken trap: the alignment of the electrodes (hence the tube) with the magnetic axis must be very accurate. In the Riken trap this is done by motors on the ends, allowing easy movement.
How do you see the procedure for this alignment?

Going a bit more in detail: we see many adjustment screws on the supports of the end vessels, which seem to allow all motions. It might be difficult to adjust accurately the orientation of the tube (too many degrees of freedom). Have you thought about the procedure? Would it be possible to have: a) rails to constrain the motion to transverse (adjustable, but once), and motors or at least position sensors for the transverse motions?

It is indeed a good suggestion.
We are discussing with the company to have a rail(in transverse direction) with motors.
By the way, what kind of precision did you need to achieve with the RIKEN trap ?
We have a freedom of about 3mm in transverse direction relative to the magnet bore.

Cold heads.
The cold heads might induce vibrations to the tube. Would it be possible to support them directly from the bench rather than through the connection pipe, and leave the connection bellows free?

Company's opinion : they had several cases similar to us and the current scheme worked OK.
But, they have no measurement data.
Modification of support can be done later at CERN if needed.

Power Supplies
Will you come with the main power supply? Wih additional supplies for the shims?

We are thinking to use the main power supply for shims as well by switching the cables.
If we need to magnetization-demagnetization often, we should buy separate power supply for shims.

Cooldown (question for later)
In the manual they suggest to cool down the He part first with liquid N2. This will work if we use an open circuit for He after cooldown. But in the case we use He with recuperation , CERN has told us that they might not accept that we first put N2, since they fear pollution of the recuperated He with N2. Do you know if it will be possible to cooldown with He gas? (ie how much He gas would be needed and how much time?)

It may be a good idea to use He with recuperation. But no instruction in the manual.
We are asking JASTEC about this possibility. → Their response is slow as usual.
Q : is it still possible to use He without recuperation ?

Would it be possible to have a longitudinal and transverse cut (2D) of the magnet,where one can see the various vessels? Also, what is the operating pressure of each vessel?

We did ask JASTEC to provide drawings showing inner structure already several times. They refused.

For the operating pressure look magnet manual 3-2
- He vessel 49 kPa
- N vessel 20 kPa

In principle, CERN wants to test every pressure vessel at 1.25 ties the operating pressure. Hopefully this is possible? Do you have a report of such tests conducted at the factory, or other safety documents?

We are asking JASTEC about the pressure test.
* This magnet has been used for 10 years already w/o any problem.

Questions from our side

1. Is the antiproton beam energy to the target decided ?

2. Are we going to need a degrader ? When do we know about it ? (Dirk asked about the degrader option)

Kyunghoon(UNIST) is working on beam simulation is trying to calculate it. But at the moment he is focusing on the beam reacceleration and delivery to the target. H.V. switch we purchased can go up 5 kV and power supply up to 8 kV is ordered for the case of degrader option. Do you think that would be enough?
Mounting scheme of the degrader is incorporated in the CUHV pipe design.

3. Can you make a rail and platform with roller at CERN so that the trap can be mounted on it ?

4. All SUS used in the trap : 316 L. After machining, welding, polishing it becomes magnetic..
With heat treatment it becomes less magnetic. Any experience ?