MPET repair, modification and upgrade 2010

The baking of the MPET in the beginning of 2010 had lead to several shorts in the tube of the MPET. This document describes the repair and the modifications of the MPET. At the same time we upgraded the detection and vacuum system. These upgrades are also documented here.

stephan ettenauer
(January, 2011)

Overview:

Hardware:

1) new wire terminals
2) ring between flange and tube
3) spacer between flange and frame rods
4) gap between XZT3 and XZT2 is increased by 3/8 inch because of (3)
5) remove standoff legs (structure is now expanding upstreams (see also (3)
6) ceramic tubes
7) place old wire spacers at new positions (now also for extraction wires)
8) clean up wires around trap
9) change direction of one of the BeCu foils for the LS
10) one BeCu foil broke
11) remove MCP
12) remove shield of MPET PLT feedthrough
13) shortening of the first lens of the new triple lens system
14) Vacuum system and detector upgrade

Electronics:

1) swapped resistors for XDC and XDT inside the multi feed-through breakout (IEX0400_revA). This is because previously the labeling was wrong (see my logbook 'titan 2009-1' at p.191-2). So, in the current configuration the resistors are placed identically to the previous setup, but now the labeling is correct.
2) MPET:FT4 is grounded
3) change labeling of MPET:XZT1 to MPET:XZT1AND3 (both power supply and cable)
4) change labeling of MPET:PLT to MPET:PLTP (both power supply and cable)
5) change labeling of MPET:XDT PLT(-) to MPET:PLTM (both power supply and cable)
6) change labeling of MPET:XZT3 to MPET:EL1AND3 (both power supply and cable)

Details on hardware changes:

1) new wire terminals

before changes:

Pictures of the old wire terminals (documented in the paper logbook with a picture of the trap on the front and in the MPET drawing IEX0520_revA) are shown below:

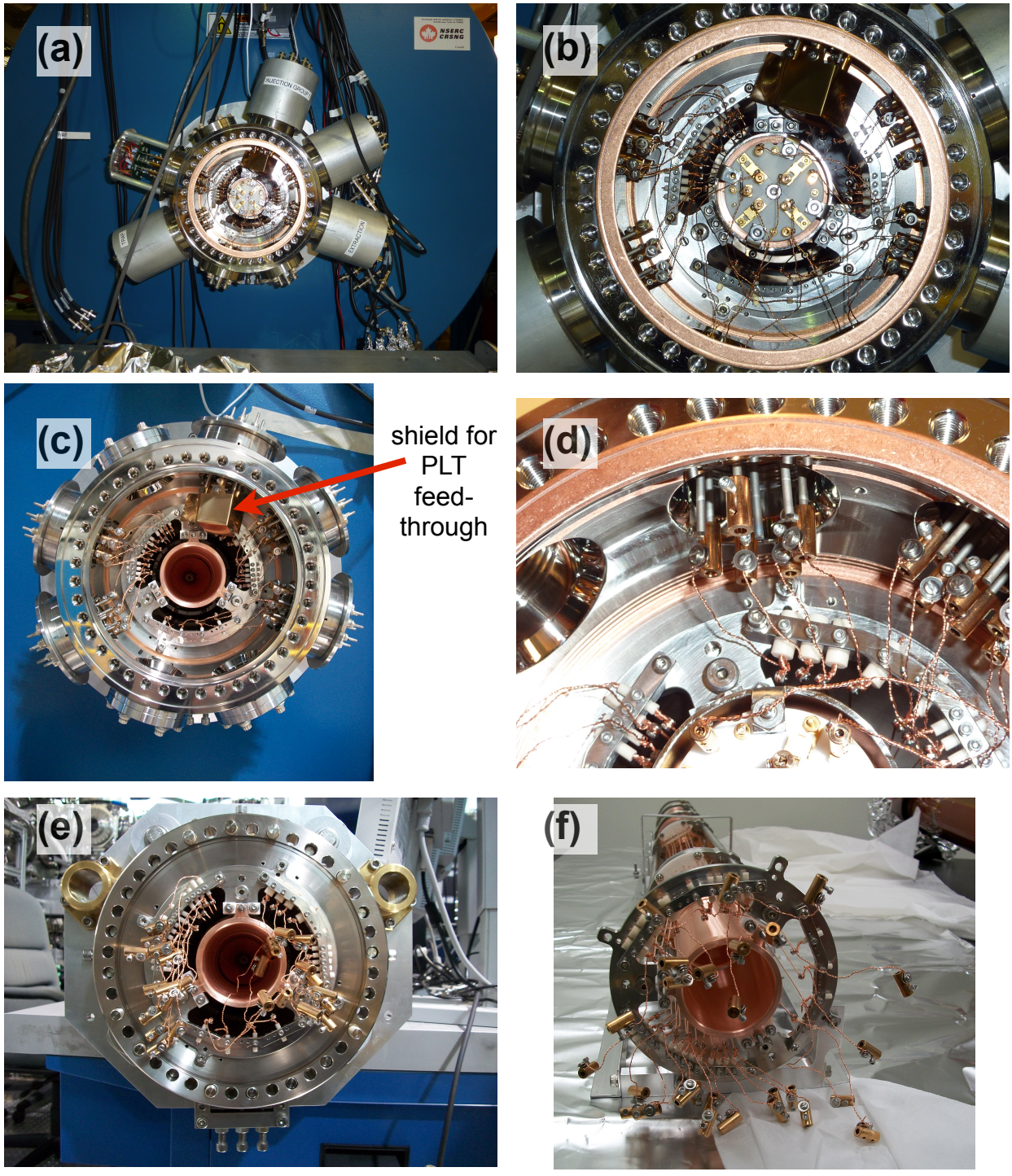


Figure 1

Description of Figure 1:
(a) Feed-through section with MCP. The feed-through section is attached to the titanium tube which is in the magnet bore.
(b) Magnification of (a)
(c) MCP removed
(d) Magnification of wires running from the feed-throughs to the wire terminals.
(e) Feed-through section removed and tube pulled out of magnet bore
(f) Trap structure pulled out of titanium tube.

Reason for changes:
The (twisted) wires coming from the feed-throughs were twisted around the wire terminals in order to connect to the wires which lead to the actual electrodes (see Figure 2). This method requires substantial amount of work to remove and reconnect the wires. Due to modification (2), we had to do this and decided to change the wire terminals to faster reconnect the wires and allow easier maintenance in the future.
Furthermore, during the baking one of these old connections actually broke.

Figure 2

After changes:

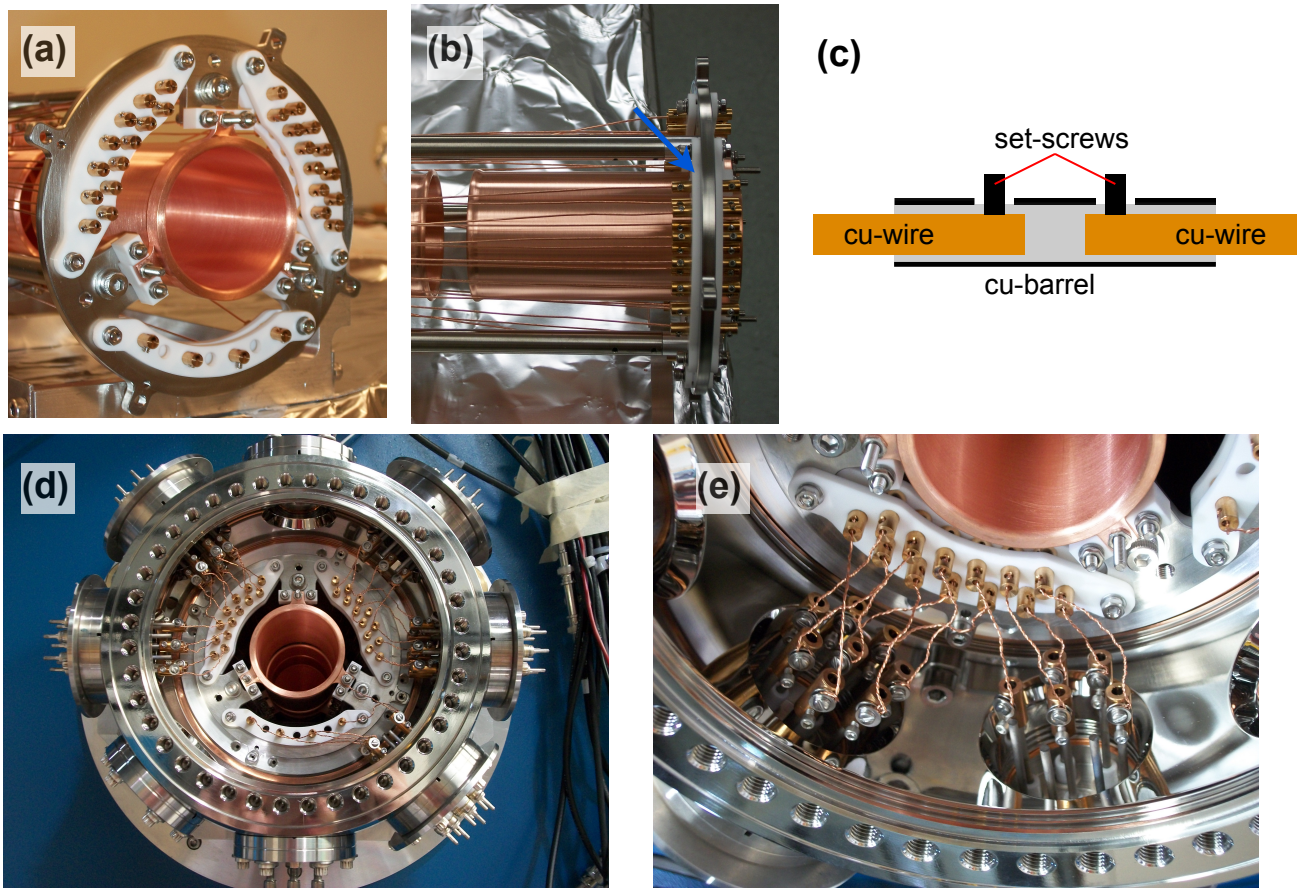


Figure 3

2) ring between flange and tube

Because of (1) we needed to place a ring between the tube and the last flange of the support structure: The blue arrow in Figure 3(b) denotes one of totally three new macor pieces (=parts of the new wire terminals) which do not fit into the titanium tube. The ring has a wider inner diameter than the tube to fit these pieces.

3) spacer between flange and frame rods

According to IEX0514_revA there should have been springs (IEX0474_revA) between the flange with the wiring terminals and the frame rods (see Figure 4). These would allow the expansion of the support structure (e.g. during baking). However, this setup was disadvantageous in two ways:

First, the support structure was forced to expand in the opposite direction of the wires: the wires were fixed to wire terminals which themselves could not move (because the flange is bolted onto the tube). At the same time the wires are also fixed in respect to the support structure, which expands towards the feed-through section. This probably caused a few of the shorts after the baking.

Secondly, the springs were actually missing in the assembly (see Figure 4), which means the trap was not constraint in the axial direction!

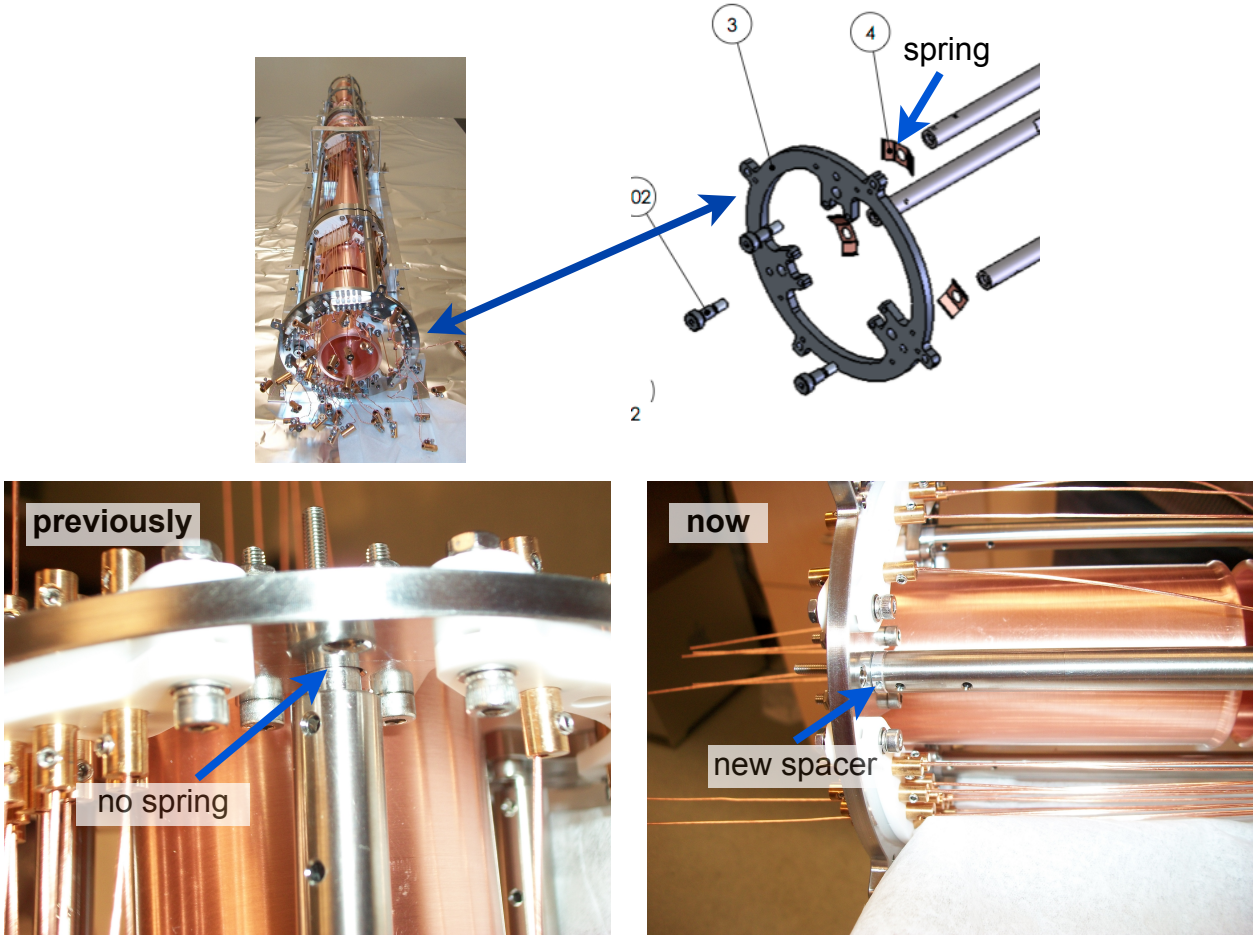


Figure 4

Instead of the springs, we now placed spacers between the flange and the rods (see again Figure 4). The length of the spacers in 4 are chosen in such a way that all electrodes (except XZT3, see (4)) are at the same position in the magnet as the initial drawings(without the ring in modification (2) but with the springs) had indicated.

4) gap between XZT3 and XZT2 is increased by 3/8 inch because of (3)
The electrode XZT3 is in fact mounted on the flange with the wire terminals. Because of (3) this means that the distance between XZT3 and XZT2 is now increased by 3/8 inch.

5) remove standoff legs (structure is now expanding upstreams (see also (3)
The standoff legs in the initial design (Figure 5) were probably added to prevent the first electrode touching the end of the tube. To allow for expansion the springs mentioned in (3) had been added. Sine we have now replaced the springs by spacers, we also removed the standoff legs (Figure 5 on the left). According to the drawings there should be enough space between the first electrode and the end of the titanium tube to allow expansion of the support structure in upstream direction.

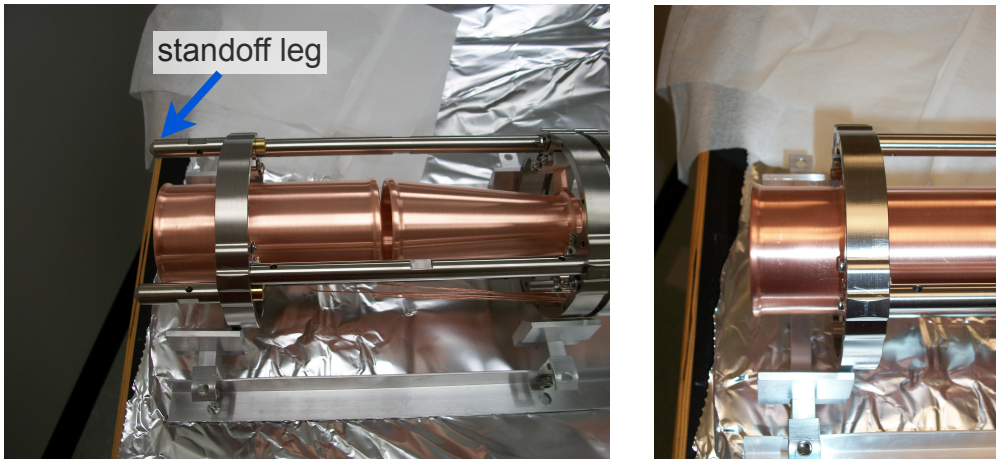


Figure 5

6) ceramic tubes
<u>before changes:</u>
The wires running inside the tube were previously held apart by wire spacers (see IEX0505_revA). This has lead to (often only temporary) shorts between electrodes as the wires could touch each other in certain sections (see Figure 6).

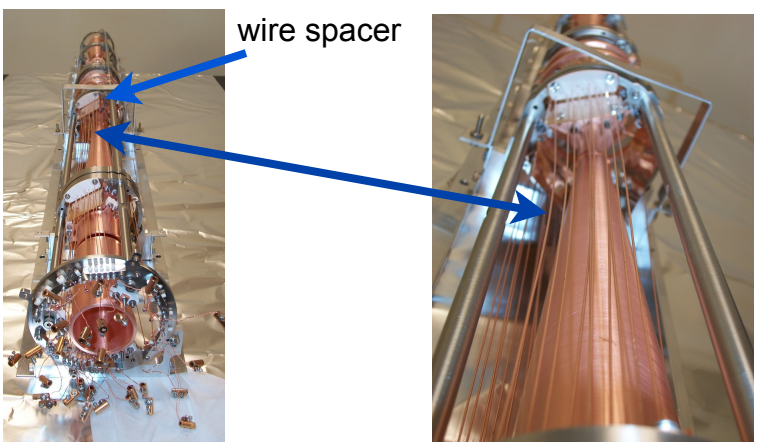


Figure 6

after changes:
In the critical section we removed the wire spacers and fabricated new ones to hold ceramic tubes. The wires are now inside these ceramic tubes (see Figure 7).

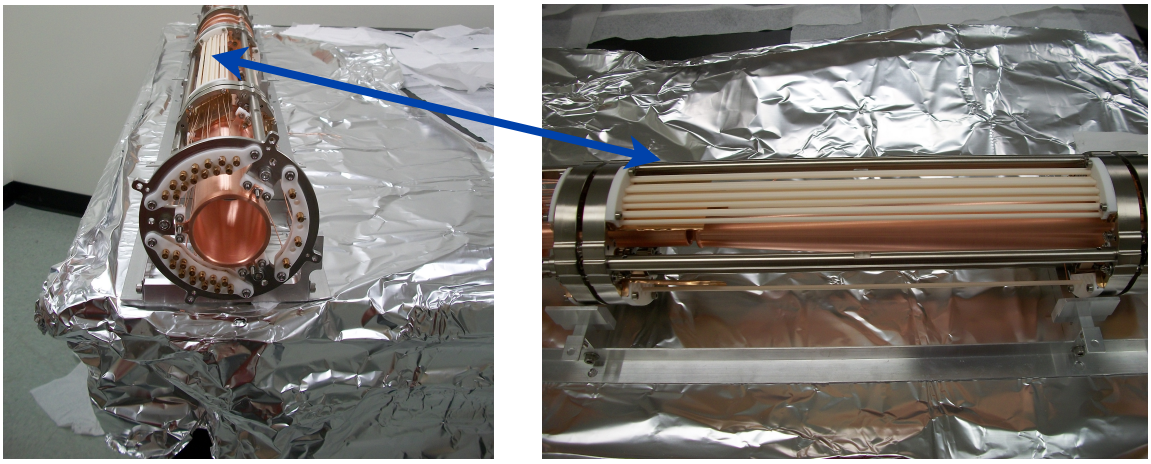


Figure 7

7) place old wire spacers at new positions (now also for extraction wires)
The old wire spacers which were freed up due to modification (6) are now placed at new positions: e.g. at the trap section:

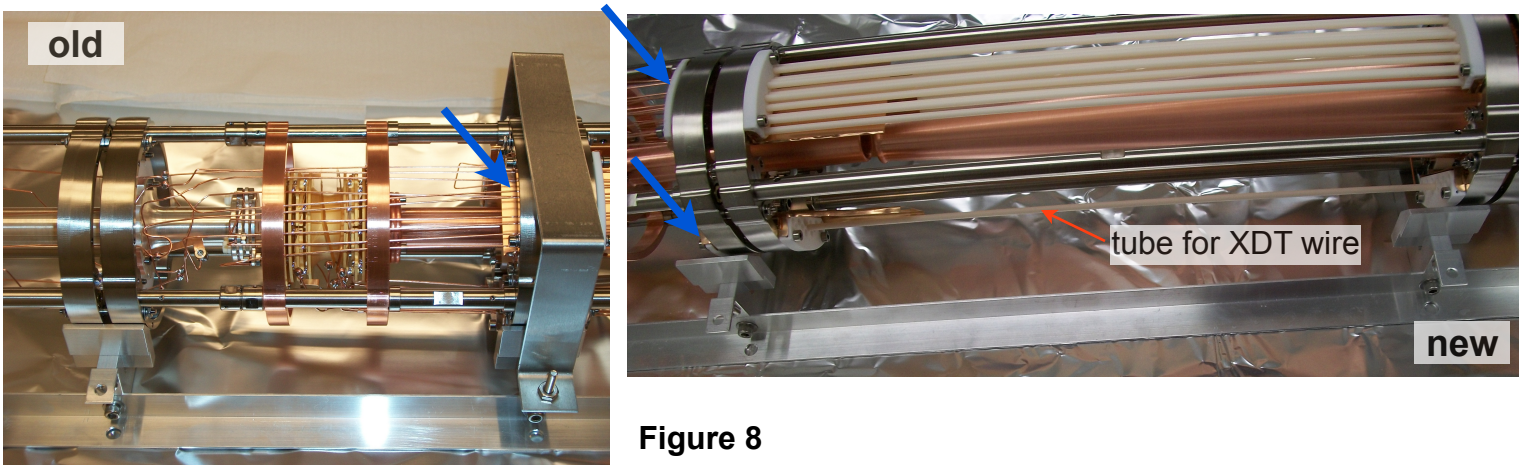


Figure 8

8) clean up wires around trap
Due to the baking and the amount of wire and BeCu foils in the trap section, many electrical shorts have occurred in this section. We have tried to clean up the wires as much as possible to avoid shorts in the future. However, the connection between the wires and the trap electrodes is clearly the weak spot of the setup. Since the wires are not well supported, it cannot be concluded that shorts will not reoccur in the future when the tube is moved or baked. Thus, before the trap is pulled out of the tube the next time,

some thoughts and time are required to improve the electrical connection between the wires and the trap electrodes. Mel has some ideas for this already.

9) change direction of one of the BeCu foils for the LS
For a similar reason as in (8), we changed the direction of one of the BeCu foils for one Lorentz steerer electrode to avoid two wires coming too close to each other.

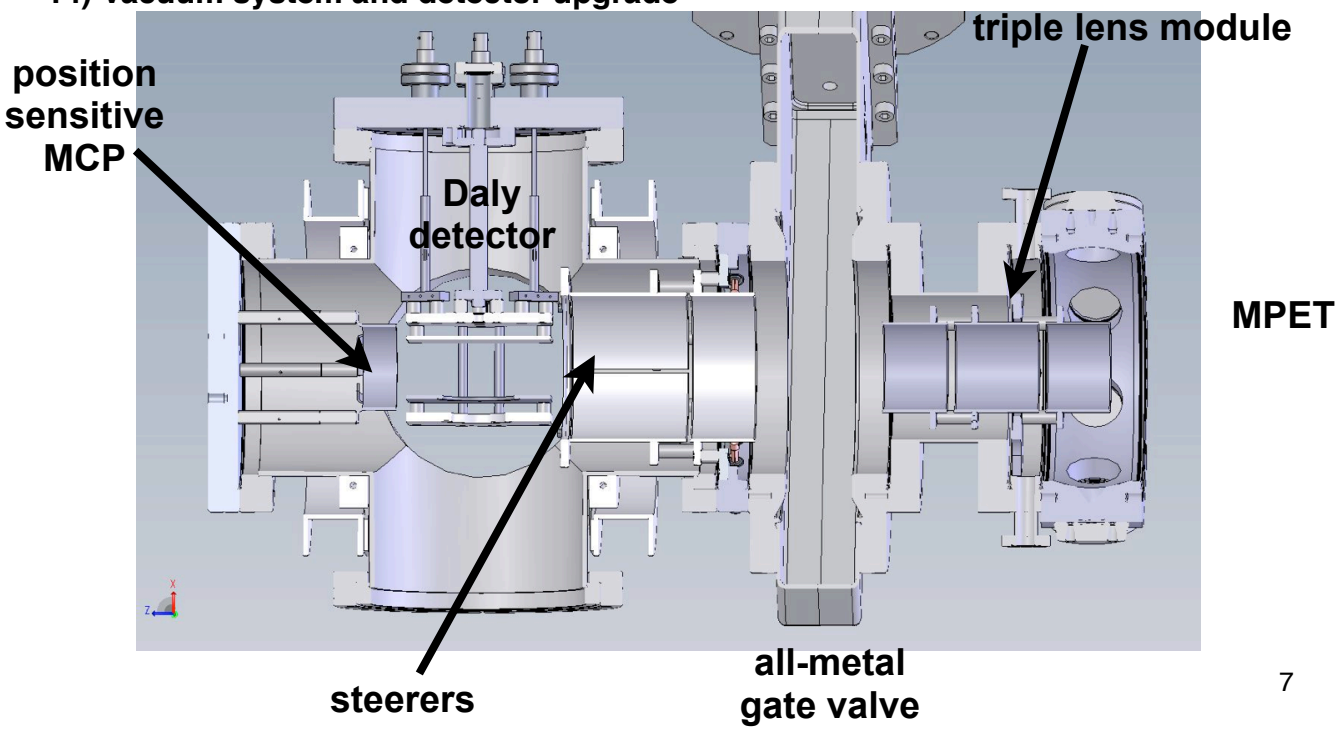
10) one BeCu foil broke
which was connecting the Cu wire with one of the segmented trap electrodes. We managed to connect the wire straight onto the trap electrode.

11) remove MCP
In the new detector system, the position sensitive MCP is not at the previous position next to the wire terminals any more.

12) remove shield of MPET PLT feedthrough
We removed the shield (see Figure 1c) which previously shielded the injection 1 feed-throughs (PLT and PLXA1-3) because it would have touched the first electrode of the new triple lens system. (This problem will even get worse, when moving XZT3 to its original position and reinstalling the long lens for the first electrode of the triplet (see 13)). As the PLT and PLXA1-3 wires are 'mixed' with other wires in the tube and the gap between the two lenses is now only 4 mm, I don't think that the absence of the shield will cause problems. Since the MCP has moved back, the shield does not need to protect the MCP either.

13) shortening of the first lens of the new triple lens system
The first lens of the triple lens system after the MPET extraction was shortened. Otherwise, it would have touched XZT3, which was moved (see (2) and (4)).

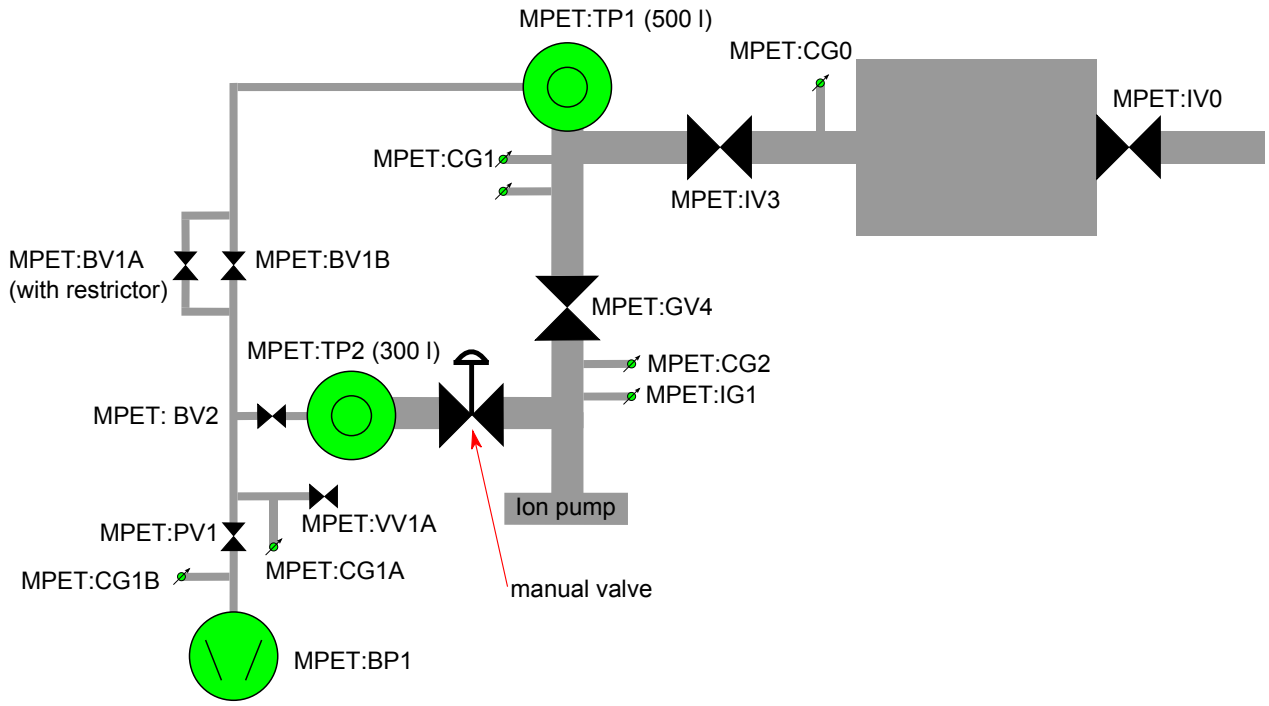
14) Vacuum system and detector upgrade



Mel has the detailed model (and drawings) of this setup.

REA for power supplies for this upgrade:
“PostMPET electrodes in EPICS” (March 16, 2010)

Vacuum:



REA (including interlock):
“Extension of MPET Vacuum system” (Benjamin, Sept 2nd 2010)