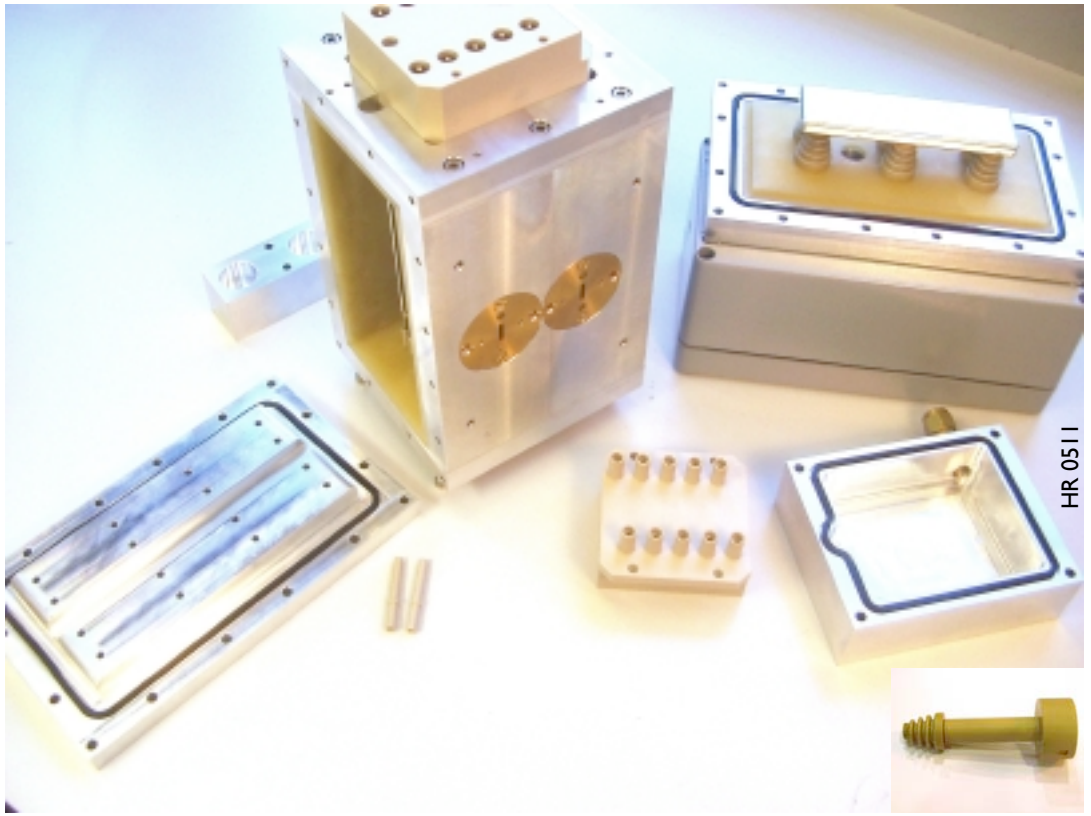
VdC, HVC, etc.

CMS Week 051205-09
Barrel Muon DT Session

Vd Chamber, HVC, etc.

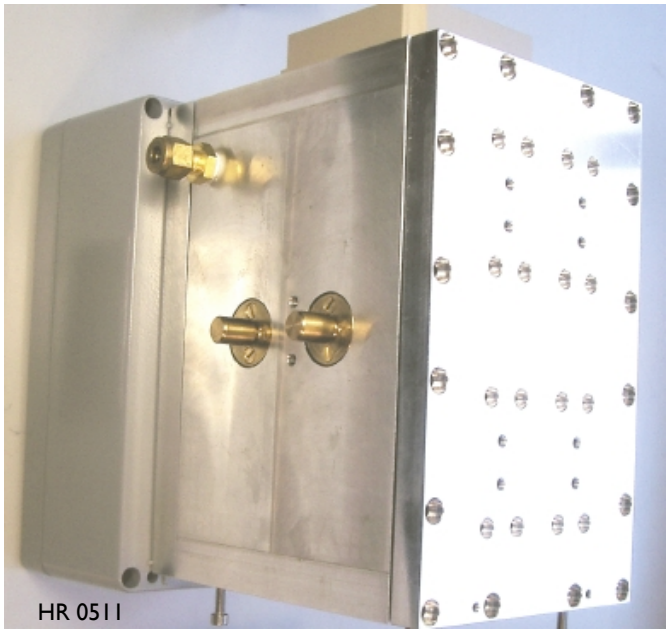
Hans Reithler / Aachen

Vd Chamber (1)

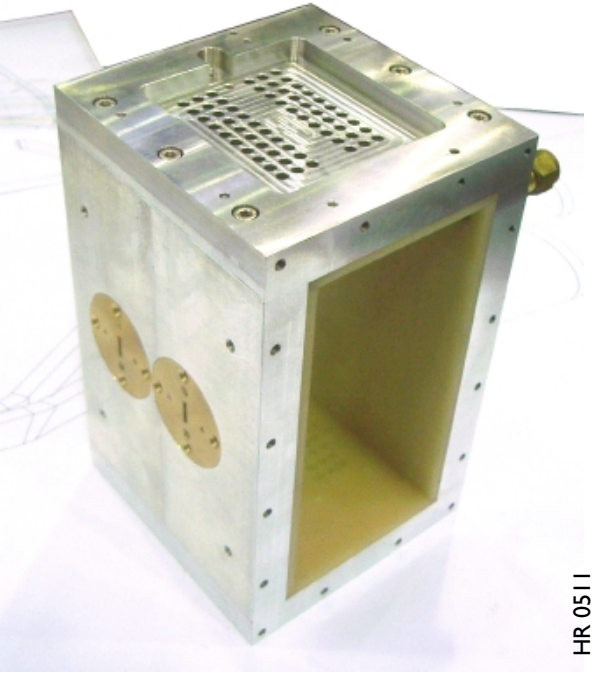


Main components of the Vd chamber. At the left is the cover housing the anode volume, in the central box is the drift volume with homogeneous field, at the right is the cover with the cathode, mounted on the box housing a HV filter. At the bottom are (left to right) feedthroughs for electrodes, housing for voltage divider, bottom cover and insulator for HV pin.

The two protruding small cylinders are holders for the Sr90 sources.

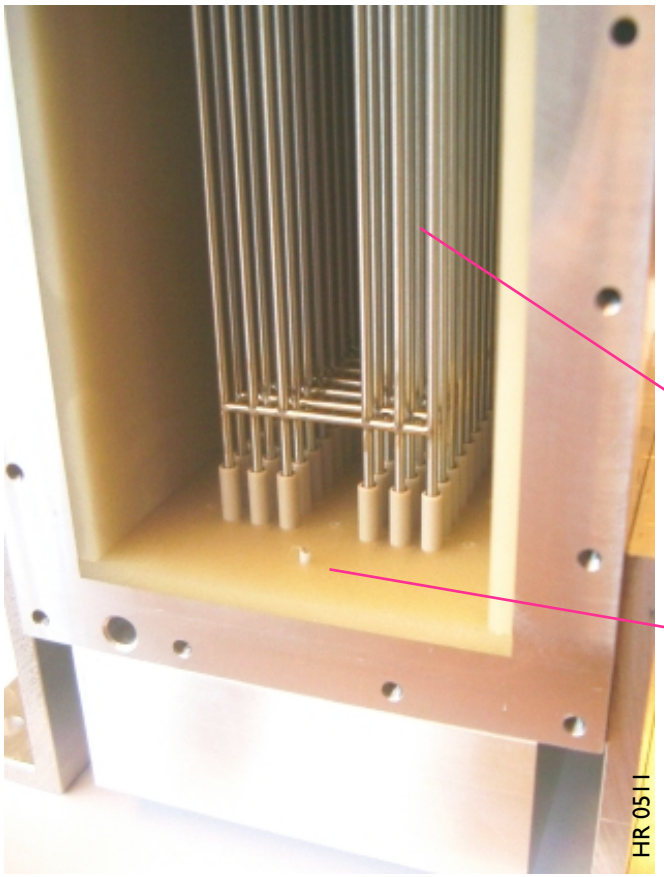


Open empty box. On the side, the two exit slits are visible; at the top are the holes for the field electrodes.



- View of the main components of the Vd chamber.

Vd Chamber (2)



- The anode and the field

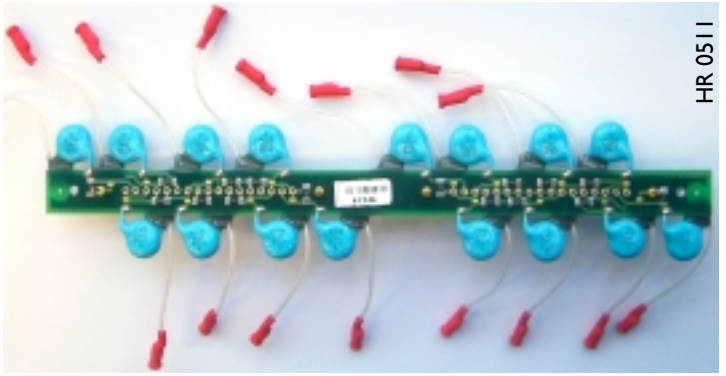
The 60 field electrodes are organized as 10 grids with 6 electrodes each. They consist of 2 mm diameter tubes.

The anode wire (on the photo only its support is visible).

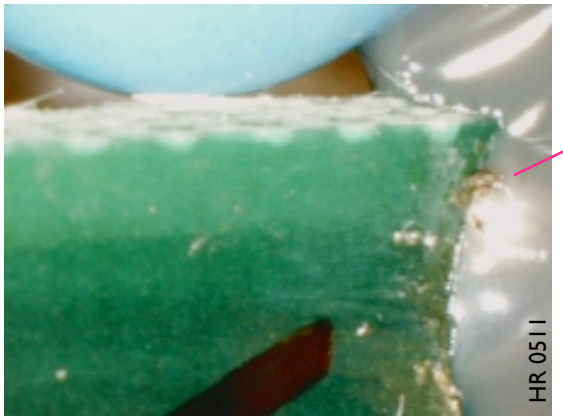
- One of the two scintillators, with its light guide and photomultiplier tube:

- Status: mechanics and its assembly are done; presently assembling the HV divider chain and preparing the preampl. and the rack assembly for the test of the prototype Vd chamber.

HVC Test (1)

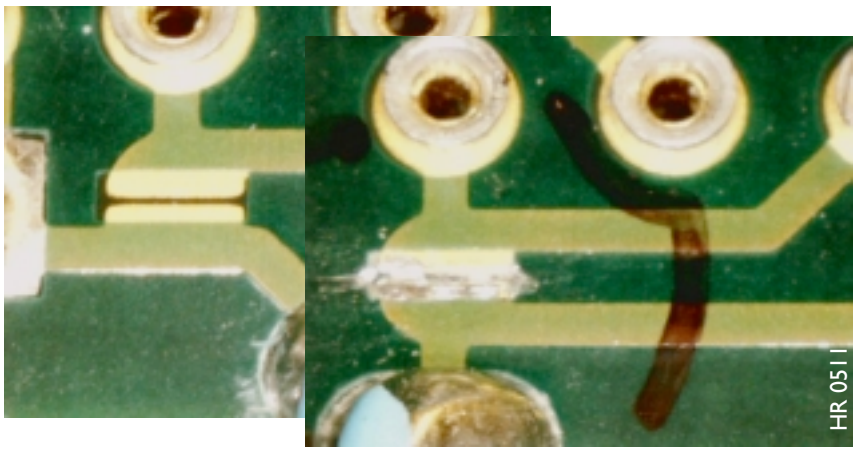


A 16 ch. High Voltage Coupling board "HVC".



nearly unprotected point under glue surface

A bad gluing.



A good (left) and a short-circuited (right) spark gap.

- Last batch of ~380 HVCs (out of ~11000) assembled at Padova, then glued at Aachen and shipped to ass. sites.
- Found sparking (bad gluing) and no signal (spark gap short circuited) while using the first ones. Called batch back for systematic test.
- Out of 380 x 16 glued points, ~5 were bad. Corrected.
- Out of 380 x 16 spark gaps, ~3 were bad. Corrected.
- Surprisingly, making a HV test it was found that a large fraction of the HVCs draws current! This is a surprise, because no significant HV problems with HVCs at all were reported so far.

HVC Test (2)

- **Result of HV test:**
  Test: @+5kV, in air.
  Tested a few in gas; got same current.

  Last batch: 320 HVCs --> 149 good + 170 (=53%) bad
  Earlier batch: 36 HVCs --> all good
  Earlier batch, "suspect" boards: 5 HVCs --> 3 good + 2 bad.

- **Check the point where there is HV on the HVC** (it serves only to support the capacitor):

Fig. 4: Same rear face of the HVC, viewing orthogonally to the PCB. It evidences that the HV pad of ~1.3 mm diameter is located dangerously near the PCB border. The red line shows here where the GND starts in the inner layers of the PCB (darker area).

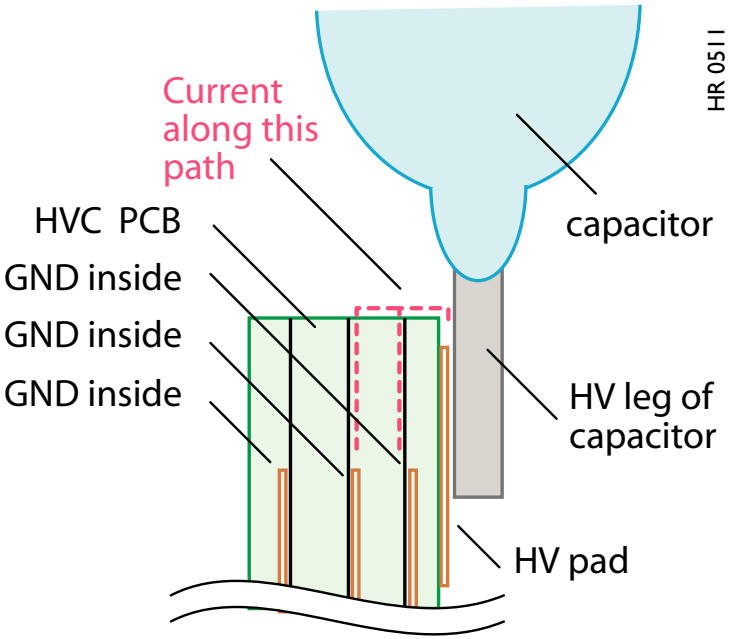
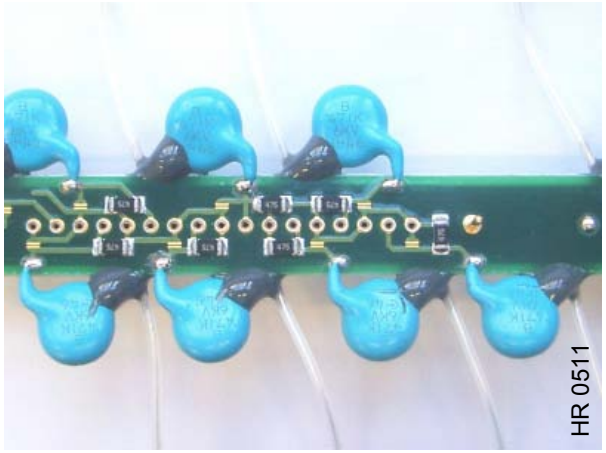


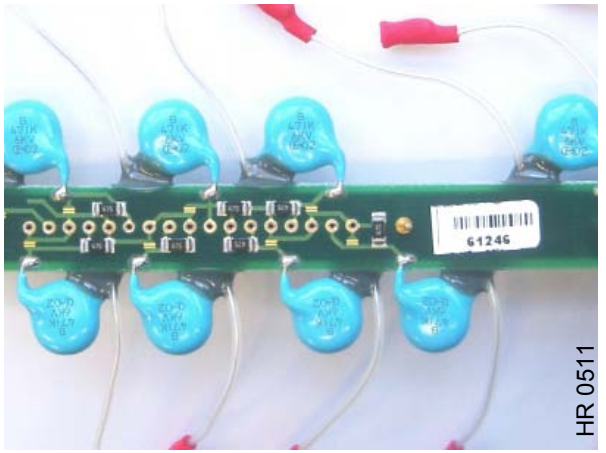
Fig. 2: Sketch illustrating the weak point: current may flow from HV pad to inner PCB layer, as shown in this enlarged cross-section of the border.

The PCB border is quite rough, the viscous glue may fail to moisten it and allow for HV current.

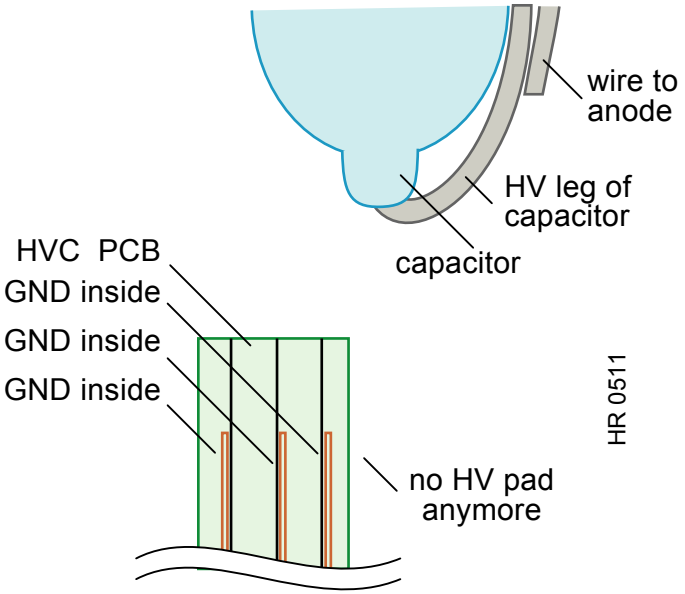
- **To cure this problem, increase the distance between HV leg and PCB** (see next slide).

HVC Test (3)

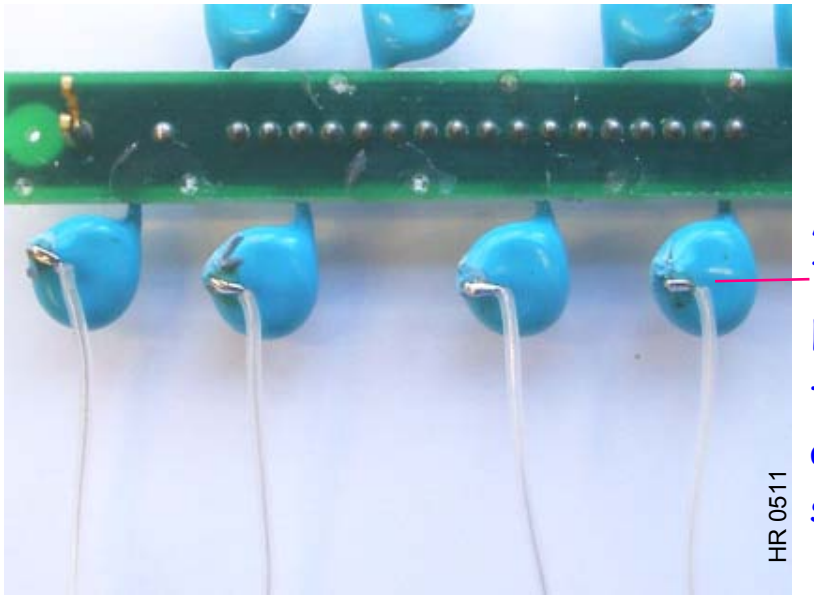




An HVC with (left) and without (right) current. At the left the HV leg of the capacitor (covered by glue) comes closer to the PCB border.



Sketch illustrating the cure:
the HV leg of the capacitor is bent away from the PCB (the signal leg of the capacitor, not shown, remains soldered to the other face of the PCB).
For clarity, signal leg and glue are not shown.



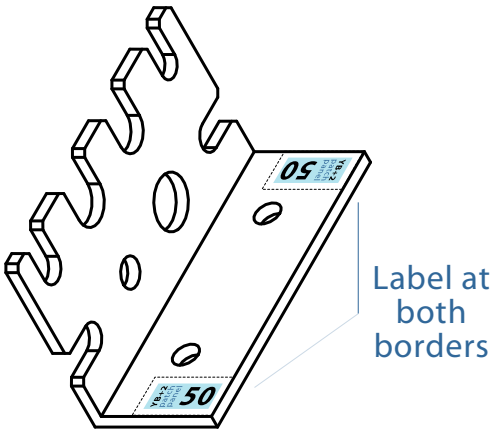
A modified HVC, prior to gluing.
The HV wire from the anode is kept far from the PCB border; there is no HV pad on the PCB anymore, ensuring a large HV safety margin.

- First 12 HVCs were successfully modified and tested: no current at 5 kV.
- The potential risk of this batch is high. Should also modify not only the 53% bad HVCs.
- The modification is time consuming (~45 min/HVC). Can some lab participate?

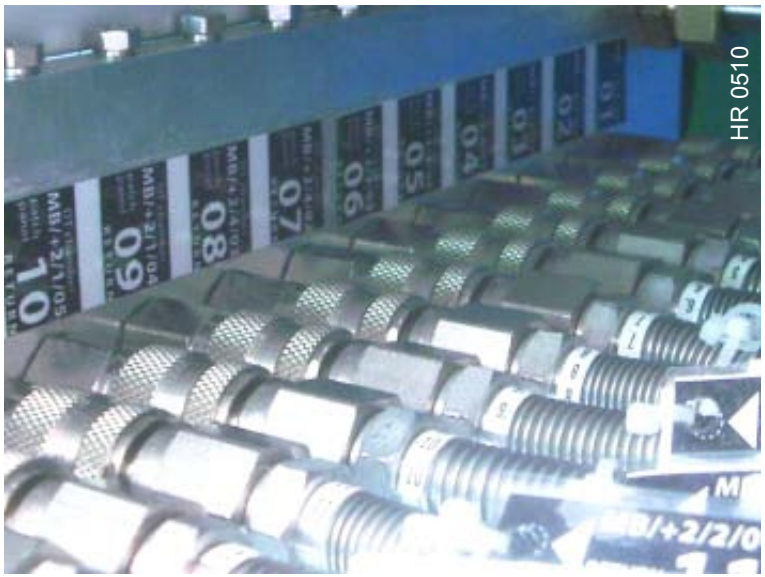
Further News (1)

- MB/w/4/9,11 (11 chambers) link to RPC: there was a mismatch in the position of the couplibg elements, between DT and RPC (were based on differents drawings). After several iterations, best solution was to cure on the RPC side only. Done. Thanks to all participants, especially to the RPC group, which had the final work.

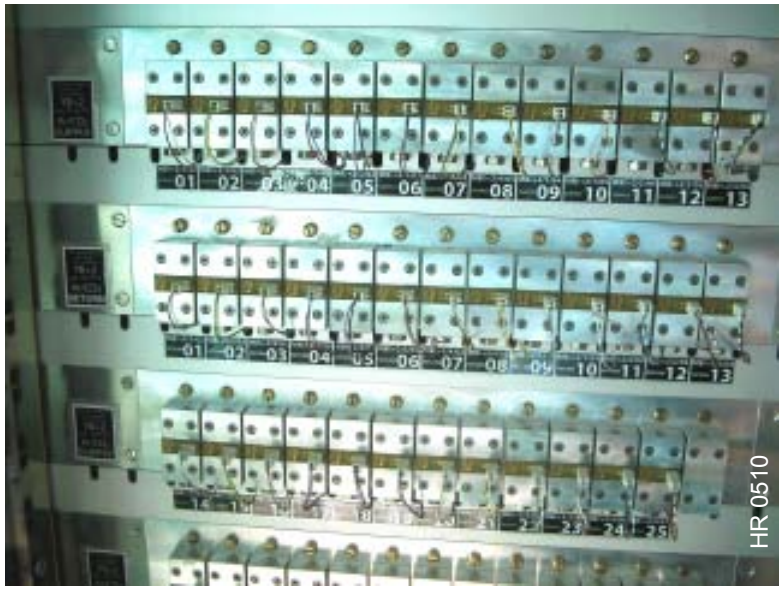
- Marking with (add.) labels done on YB+2 and YB+1 for DT, cooling, gas, patch panel, gas distribution rack. Labels printed for all wheels (for DT have to await final position assignment).



Labels on patch panel



Labels inside gas distr. rack



Labels on front of gas distr. rack

Further News (2)

- Recently observed "accidents" with gas and cooling valves:
  - ~ 3 cooling valves found at changed status next day (August)
  - Gas valve at rack exit found closed (...thus sending the gas through the safety valve. October)
  - 3 gas quick connectors found disconnected after a couple of days (November).

  This partial list evidences that there is some problem.

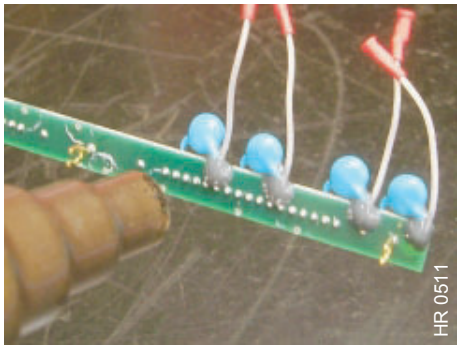
- For the cooling valves, check whether the handle can move by its own weight. For the gas valve and the quick connectors this is excluded because too much force is required.

- Can such a situation be easily recognized, during CMS runs?
  For the quick connectors, yes, because there are flowmeters on each single DT line.
  For the valves, the diagnostics is much more indirect, consuming time and eventually beam time.

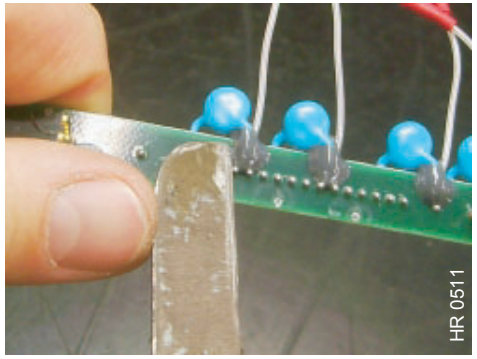
- Conclude: it is very recommendable to install some sensors permitting to check that the valves are at their nominal position.

Cooling valves around a distributor.

Appendix: HVC Upgrade



Step 1: warm the glue (~1 s)



Step 2: remove the glue (incl. pad, wire, capacitor leg)

Step 3: warm glue at leg

Step 4: remove wire, shorten leg

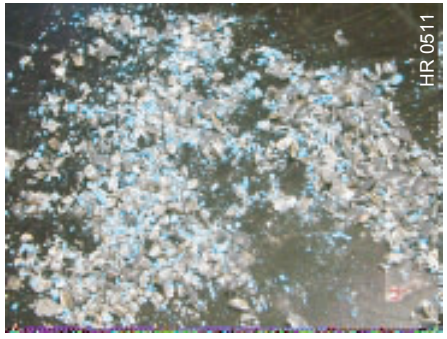
Step 5: bend HV leg

Capacitor prepared

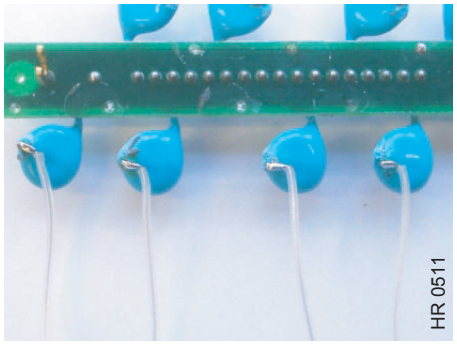
PCBs prepared

Capacitors prepared

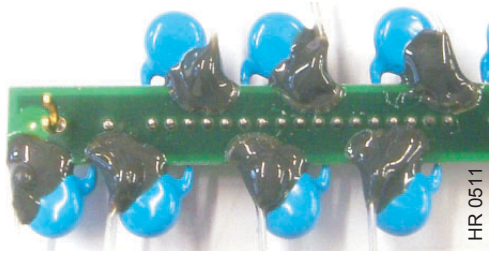
Wires prepared



Glue garbage



Step 6: HVC resoldered, ready to glue



First HVC upgraded.
(Can use a bit less glue)

- The procedure is simple. Total time about 45 min per HVC.