

# LHCb VELO module mounting procedure DRAFT 0.0

LHCb Velo Group

## Abstract

The idiot's guide to module mounting

# 1 Nomenclature

The LHCb VELO module (see figure 1) consists of an R and phi silicon sensor mounted on a hybrid, glued to a carbon fibre paddle with a carbon fibre/invar base. There are two types of modules, called R-modules and **Phi-modules**. The R-module is defined as one where the R-sensor is on the same side as the cooling attachment, and the Phi-module has the sensors in the opposite orientation. The two types of modules can be identified in different ways, either by looking at the shape of the silicon and noting, for example, the dog leg on the phi sensor, or by looking at the **hybrid scratch pad**, which has a number engraved on the R side of the module, but not the phi side. An example of a mechanical grade Phi-module is shown in figure 3. This photo also shows a mechanical grade set of **cooling cookies**. The **short kaptons** are shown in figure ???. They are labelled as belonging to the R or Phi side of the module. For each side of the module, there are two flavours, **HT**, which is mounted on the left side of the hybrid and **non-HT**. They are labelled, and in addition the HT cable is plainly visible by the isolation around the HT line, shown in the figure. This figure also shows the module mounting frame with its associated pieces, and the tool for attaching the cooling cookie screws.

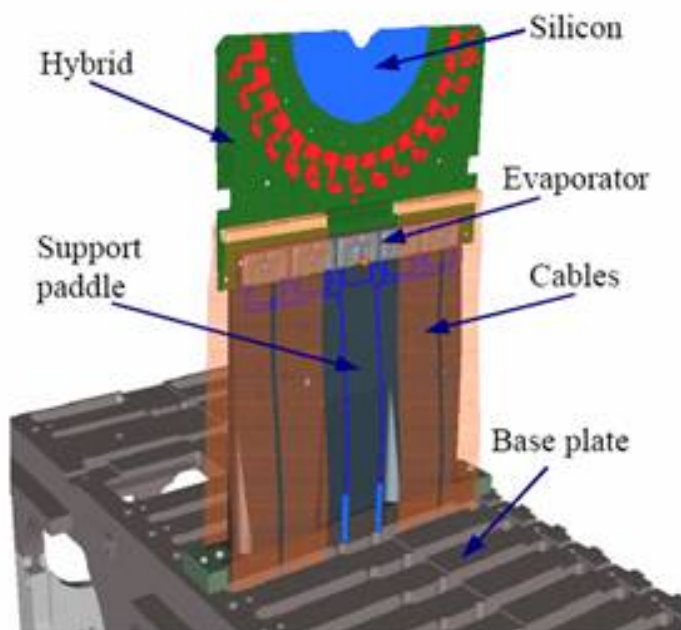


Figure 1: Module mounted on baseplate

To be finalised: design of module “pedestal”

## 2 Rules for working in Assembly Lab

- Overshoes and overcoat worn inside assembly area
- Trained personnel only. For module mounting itself, a named “module handling expert” to comprise one of the two shifters.

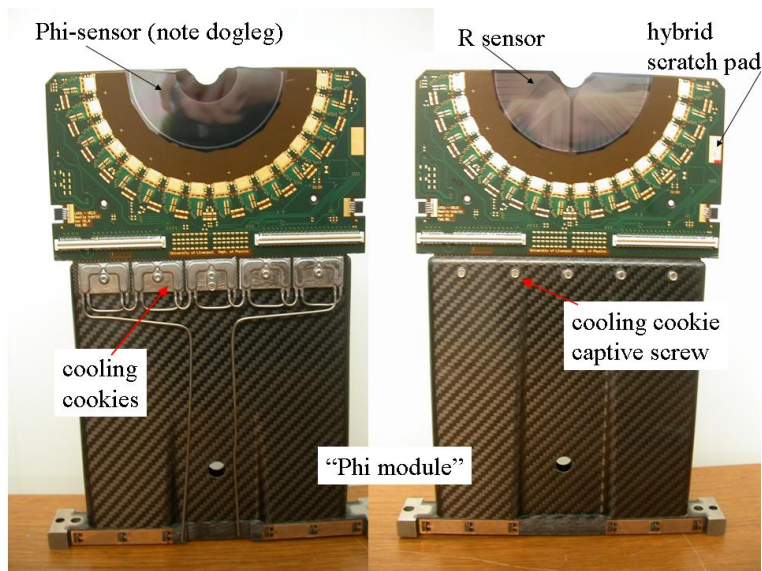


Figure 2: Phi-module (mechanical grade) with cooling cookies attached

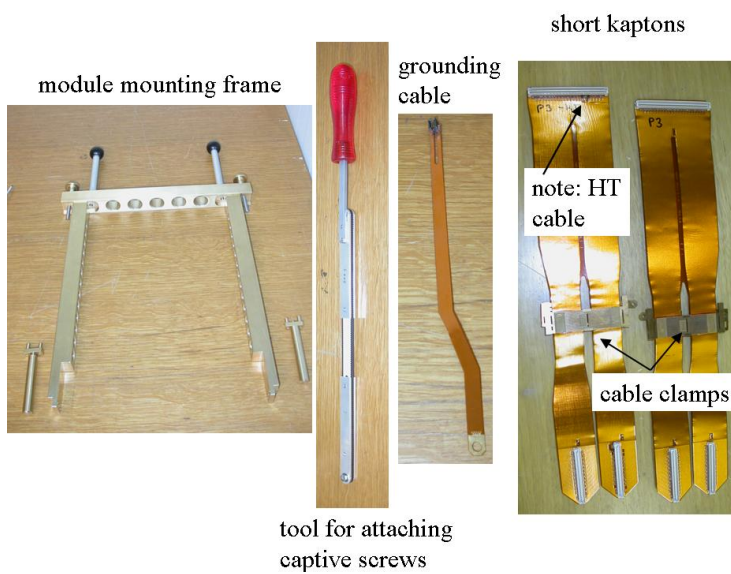


Figure 3: Module mounting frame, tool for attaching captive screws, grounding cable, and short kaptons

- Two people in assembly area: one works, one watches. Orientation of hands or implements never to cross bond pad area (e.g. come from underneath hybrid etc.)
- All items logged in and out of clean room
- Clean area, no loose items worn, untied shoelaces, pens in pockets, etc.
- Clear labelling of “left” and “right” halves, with associated positions of module types, as EDMS approved document and posted in assembly area
- Adequate ceiling lighting and bench lighting to be provided
- air conditioning: 20 V/H changes for ISO 7 cleanliness
- ESD procedure to be established

### 3 Mounting Procedure

... **Step 10** Position prepared on module base. Relevant repeater board inserted and LV, HV, DAQ cables attached. Thermal camera positioned. Type of module (R or Phi) identified. Thermaflow protection removed (?) Adjacent modules covered for protection (?) Screws on top of module handling frame advanced fully. Module footprint cleaned.

**Step 11** Base plate rotated into position at comfortable working height.

**Step 12** Cooling cookies pin loosened (photo), cooling cookies retracted (photo) and fixed in position.

**Step 13** Module unpacked from box and installed on pedestal. Type of module, hybrid number, and cable numbering verified. Ground cable identified.

**Step 14** module handling frame approached in horizontal position and dowel pin inserted. Frame rotated into position and dowel pins pushed into place. fixation screw attached.

**Step 15** Module unscrewed from pedestal, while handling frame is held, then inserted into base plate in correct orientation (check position of dowel pin).

**Step 16** Module attached to baseplate.

**Step 17** Module handling frame fixation screws removed. Dowel pin fixation removed. Module handling frame removed from baseplate.

**Step 18** Cooling cookies brought forward and cooling cookie screws located and tightened using torque screwdriver to force ? (tbc).

**Step 19** Frame mounted to protect hybrid faces during short kapton cable insertion

**Step 20** First short kapton position verified (number, R or Phi, HT or non HT) inserted into position, and clamped with kapton clamping tool (photo)

**Step 21** Cable clamp located and pulled tight. Verify by pulling on cable and checking visually for movement above the clamp.

**Step 22** Second short kapton

**Step 23** Third short kapton

**Step 24** Fourth short kapton

**Step 25** Short kapton-long kapton connections (procedure to be verified)

**Step 26** Simple cable connectivity verified on outside of vacuum tank

**Step 27** Temperature monitoring and HV current monitoring switched on and kept permanently on

- Step 28** Fast LV electrical module check ( $\approx 20$  s, no cooling)
- Step 29** hot gas supplied for thermaflow (NB, the cookies are not visible as they are covered by kaptons)
- Step 30** Gas tight frame mounted with viewing window for thermal camera, nitrogen flow started
- Step 31** Cooling started, module viewed with thermal camera
- Step 32** Power on module and electrical check
- Step 33** Power off, cooling off, wait for all parts to come back at least 5 degrees above dew point
- Step 34** Thermal camera dismantled and light tight frame mounted
- Step 35** Cooling on, power on, electrical check with HV (to 50V)
- Step 36** Electrical check of adjacent modules
- ....

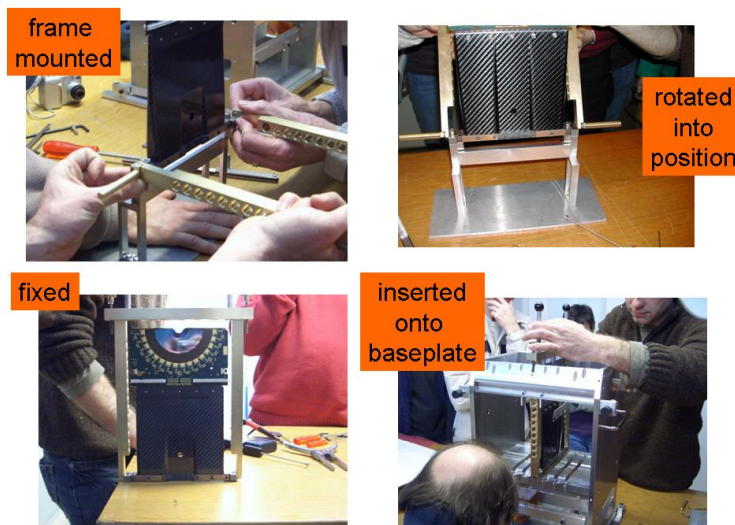


Figure 4:

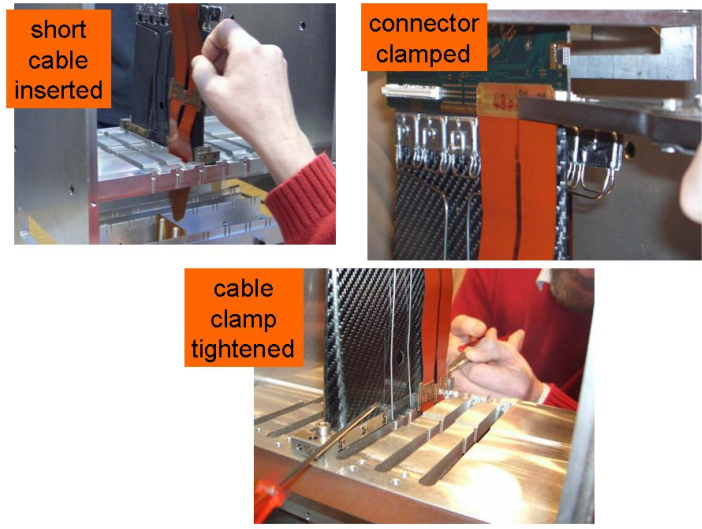


Figure 5:

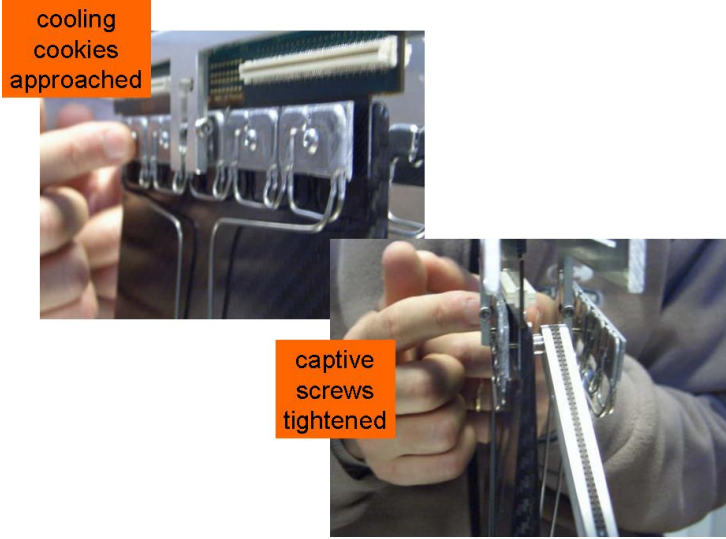


Figure 6:

## References