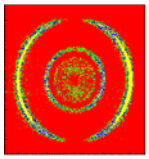
Meshes and masks for RoentDek detectors



RoentDek
Handels GmbH

Supersonic Gas Jets
Detection Techniques
Data Acquisition Systems
Multifragment Imaging Systems

RoentDek provides two types of meshes for mounting in front of MCP stacks with different sizes.

The free-standing meshes **Mesh40** and **Mesh80** for the 40 mm and 80/75 mm detector sizes (e.g. *DLD40*, *DET40, DLD80, Hex75*) are formed as bee-hive patterns etched out of UHV-compatible 0.05 mm thick Cu-alloy sheets.

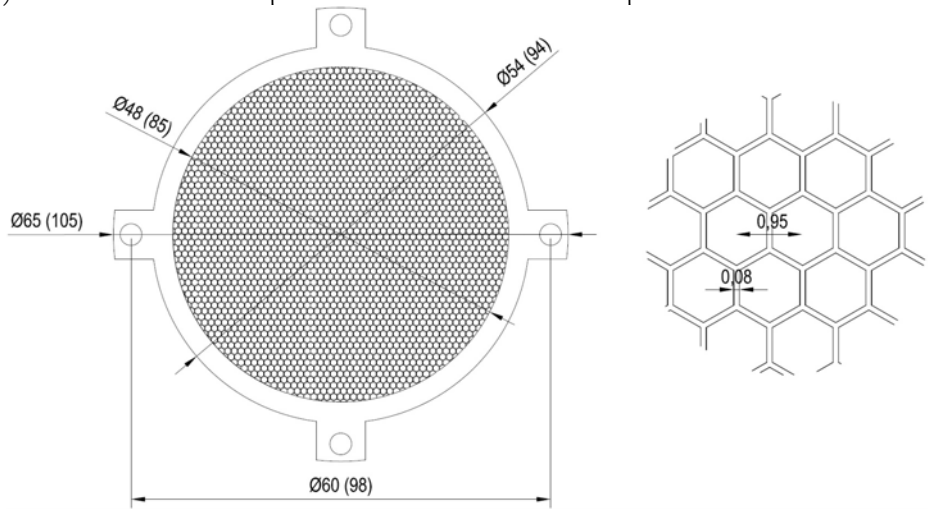


Figure 1: *Mesh40/80* (displayed here: *Mesh40*) showing all dimensions (for *Mesh80* in parentheses if different) *

The hexagonal-shaped cells have about 1mm mean diameter (center-to-center 0.95 mm) with a nominal obstacle width of 0.08 mm, yielding an optical transmission of > 80%.

Some applications require smaller open cells to minimize micro-lensing effects, e.g. if the mesh is used to define/separate regions with different electrostatic field gradients. For such applications the (woven) 316L stainless steel meshes **wMesh40/80/120** with 77% optical transmission can be provided. Their micro-structure is formed by 0.14 mm square cells (0.02 mm wire, center-to-center 0.16 mm). This mesh structure is clamped in 3 mm thick round Aluminium frames (UHV compatible) with different diameters for the 40 mm, 75/80 mm and 120/100 mm detector sizes (i.e. also for *DLD105/120* and *Hex100/120*). For **wMesh120** details please refer to the respective manual.

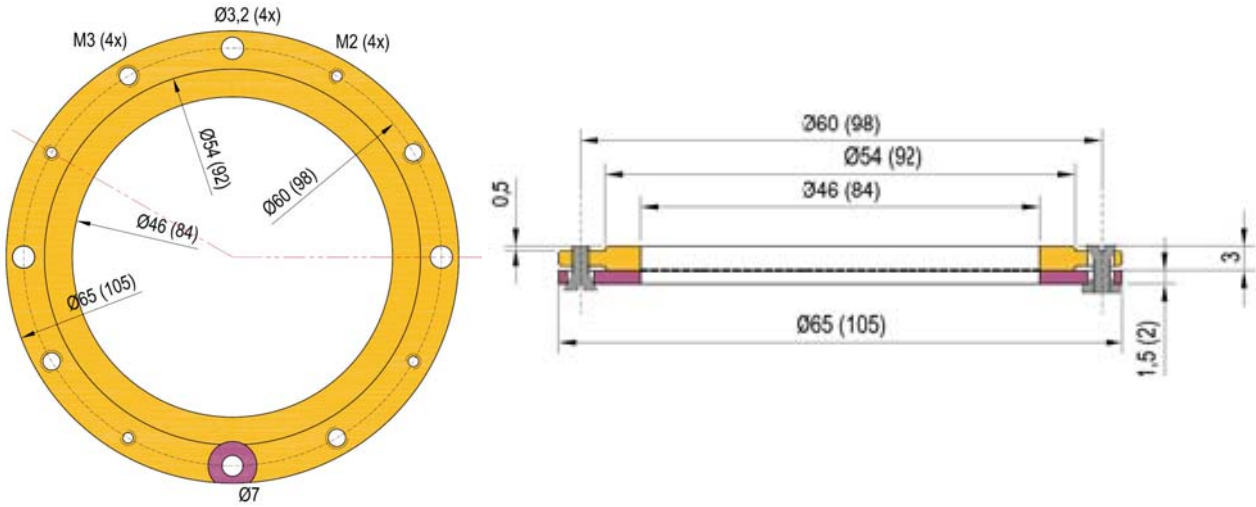


Figure 2: Sketch of *wMesh40/80* (displayed here: *wMesh40*) showing all dimensions (for *Mesh80* in parentheses if different). The RoentDek meshes can be mounted right onto a front ceramic ring or via spacers to a metal ring.

* **RoentDek** also provides etched calibration masks for determining detector linearity and resolution by a shadow projection. Some of those have a very high optical transmission and may also be used as a potential mesh, if large openings are tolerable.

The RoentDek calibration masks

RoentDek offers detector calibration masks which can be used to verify and (via special software routines) correct non-linearity effects in the imaging. Additionally, spatial resolution can be estimated. The bee-hive patterns in the **RoentDek Mesh40/80** can already be used for these purposes. The high-transparency mesh **HT_Mesh40/80** may even be permanently mounted (possibly also in between the individual MCP of a stack) to provide an embedded calibration grid. Alternatively, pin-hole masks are available so that linearity/resolution performance can easily be estimated from an acquired shadow image.

The masks shown below are etched out of 50 -100 micron thick Cu-alloy sheets. They can be mounted as the **Mesh40/80** (please observe the same advices for mounting and operational safety as described for those), preferably in direct contact with the MCP front ring.

The main elements in the **CalibMask40/80/120** are holes of diameter 0.4 mm and 0.15 mm respectively at 1 mm spacing*. Additional patterns near the center serve to estimated spatial resolution more precisely: The **CalibMask40** has a "window" field with bars of 0.1 mm thickness, the **CalibMask80** and **CalibMask120** additionally two fields with horizontal/vertical slits of 100, 70 and 50 micron width and a field with three open squares separated by 50 micron wide bars.

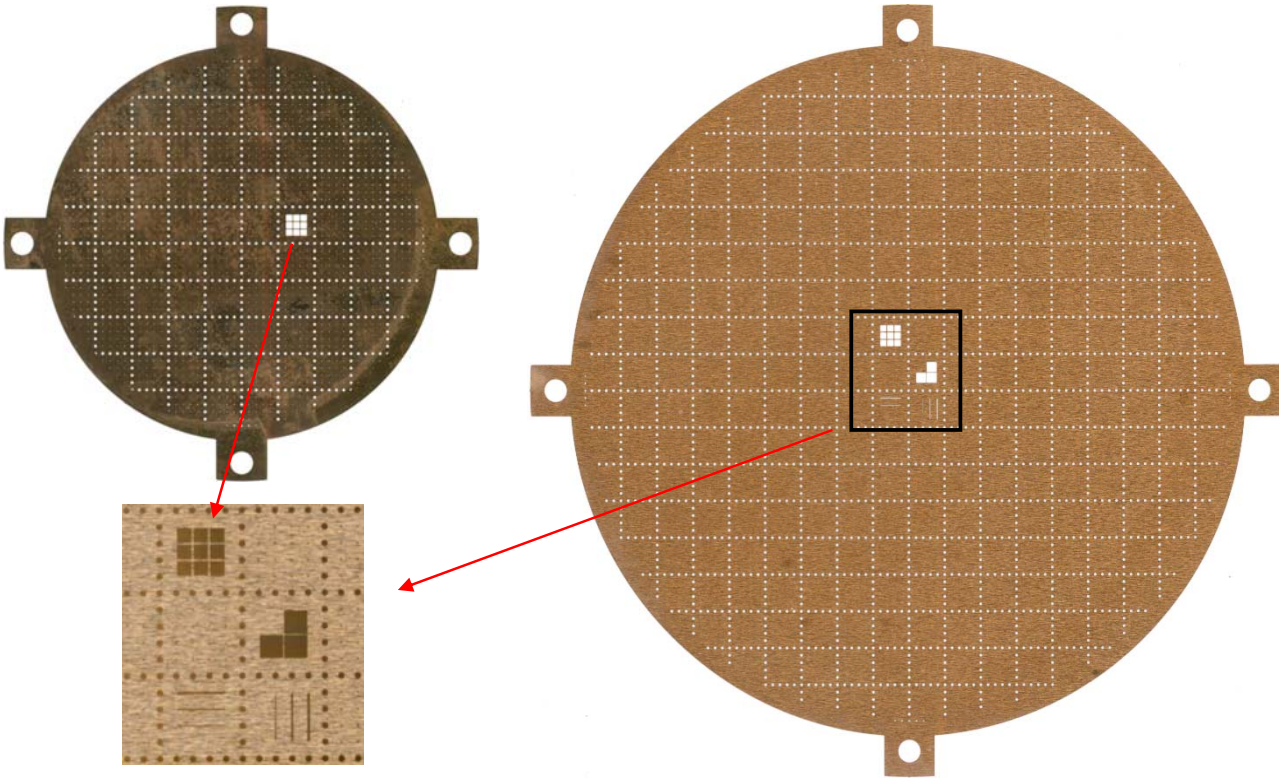


Figure 3: CalibMask40/80. The CalibMask120 (not shown) is similar to the CalibMask80, only bigger and for use with DLD105/120 or Hex100/120 detectors

When using any of the **CalibMask** on an MCP detector it is important to consider that their poor optical transmission of only a few % may increase pumping time considerably if the mask is mounted right on same MCP front rings without a venting gap. The local pressure at the MCP stack may be very different from the vacuum reading elsewhere in the chamber.

Furthermore, the very localized exposure to incoming photons/particle flux may lead to local saturation at comparably low overall count rate and may lead to premature local wear-out of the MCP stack. It is important to carefully calculate/control the maximum local rate and dose.

* Special pin-hole masks are available containing only holes (0.25 mm diameter throughout except for a central hole with 0.4 mm). Please inquire for additional test pattern masks available from **RoentDek**.

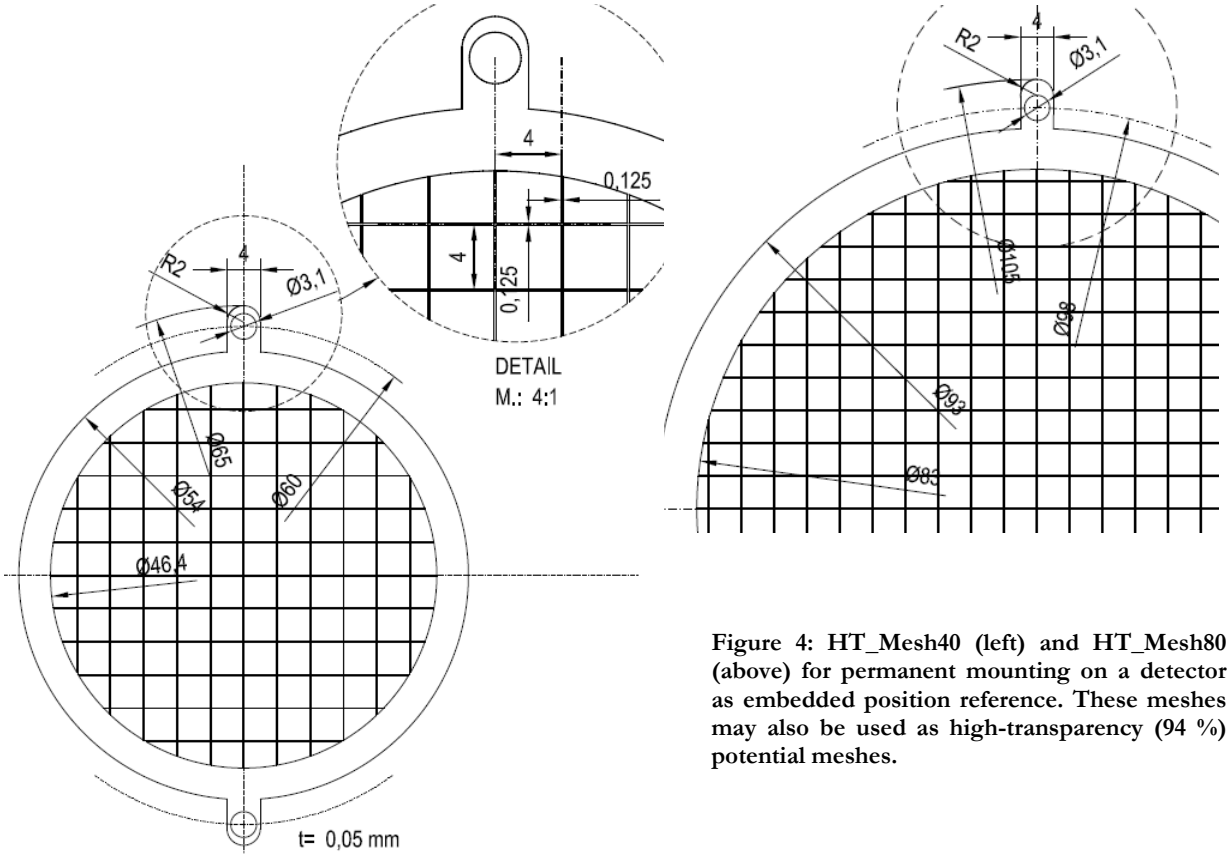


Figure 4: HT_Mesh40 (left) and HT_Mesh80 (above) for permanent mounting on a detector as embedded position reference. These meshes may also be used as high-transparency (94 %) potential meshes.

If a Cu ring is used in front of an MCP stack, a mask can easily be fixed at two M2 threads in the ring for example as shown in the figure below (left picture). In case a metal screw is used make sure that it does not protrude beyond the front ring's thickness and thus gets too close to the MCP back ring (risk of discharge). In this simplest mounting scheme the mask is always on the same potential as the front ring. It may be necessary adding a washer to allow for a venting gap between ring and mask.*

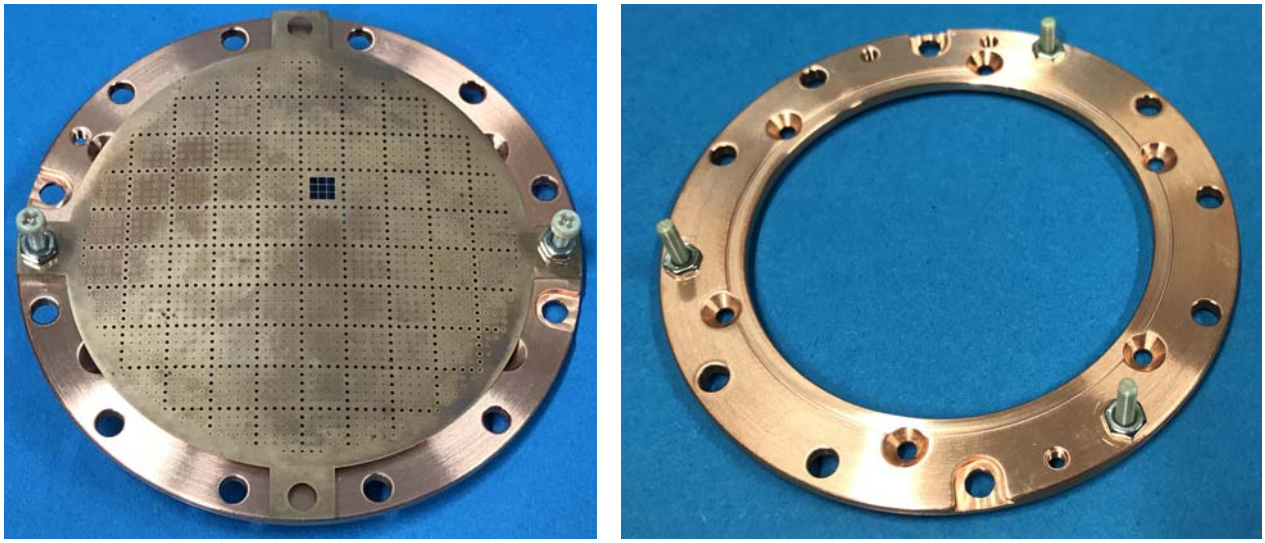
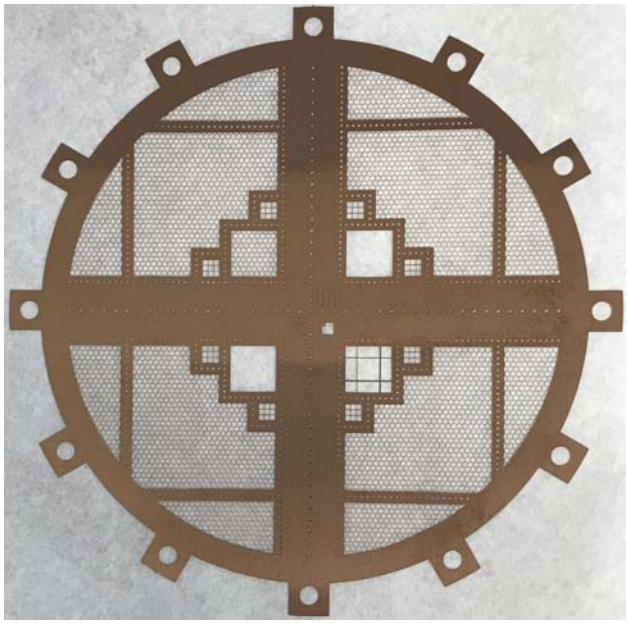
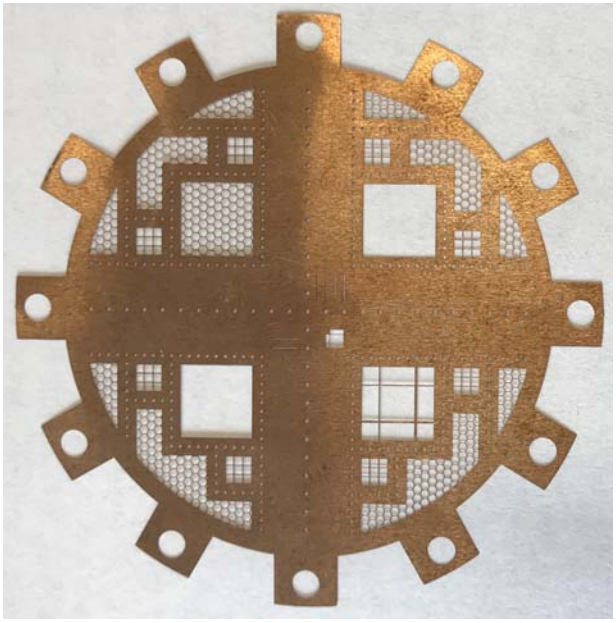


Figure 5: connecting options for meshes or masks Cu rings.

If a mesh/mask shall be mounted insulated from the front ring, extra spacers must be placed. PEEK screws can be mounted in some of the 3 mm holes and fixed by M2 nuts, either also made from PEEK or from stainless steel (then extra insulating washers must be placed before fixing the mesh).

*It turns out that an insulating washer may not always guarantee that a mesh/mask is insulated from the ring unless it is rigid enough not to touch the ring at an unsupported position.





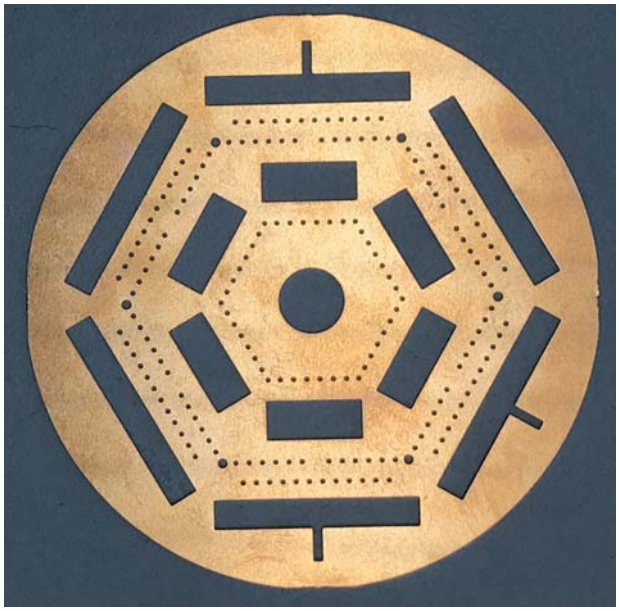


Figure 6: Examples for other calibration masks (here for 80 mm size) available from RoentDek, some not available for all detector sizes.