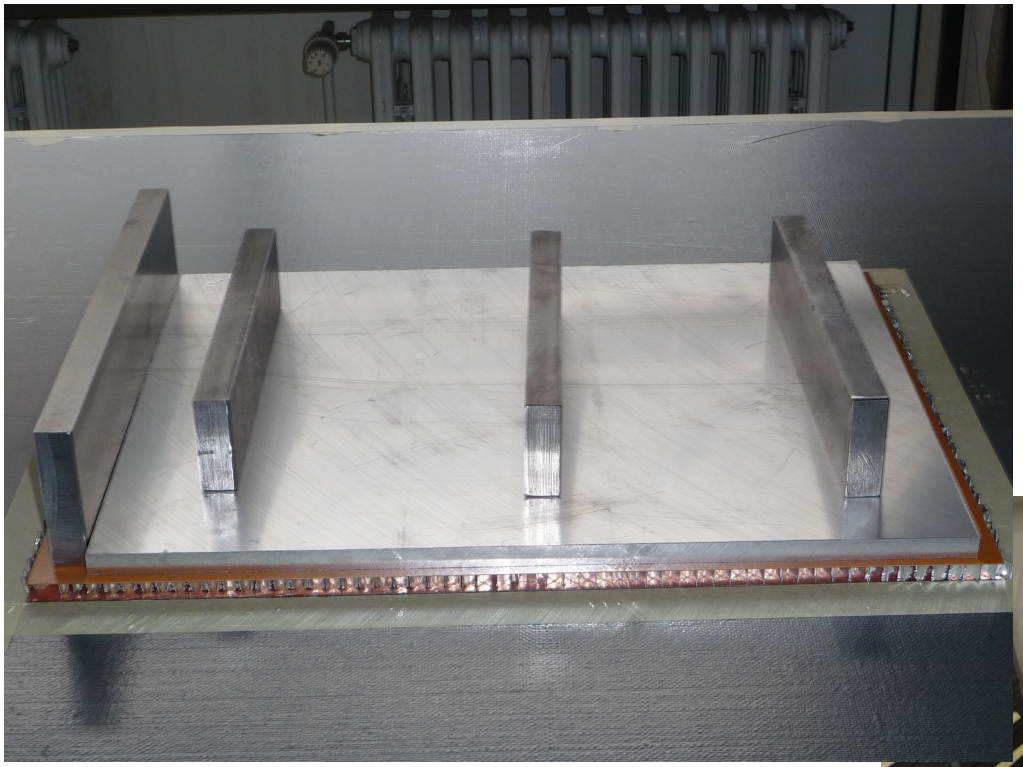
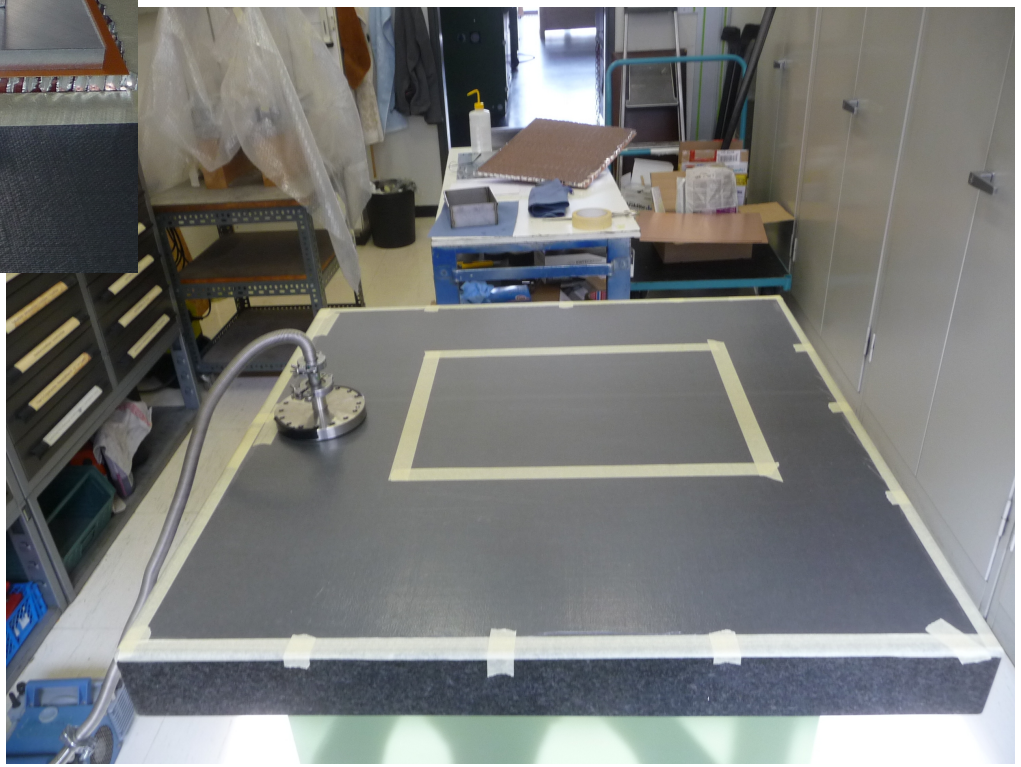
# LMU Report: First Steps of Sandwich Glueing
# Fr4 - Honeycomb - Fr4 0.5 mm – 10mm – 0.5 mm



FR4: one sided copper clad
Hexcel aluminum honeycomb

37 cm

51 cm



mesh covered by
50 microm PE foil
with holes

Ralf Hertenberger, LS Schaile, LMU

- FR4 0.5 mm  copper clad  single side
- 10 mm Hexcel aluminum honeycomb
- Araldite 2011

glue always copper side to aluminum
use always vacuum on lower part when glueing

a vacuum bag for the upper part is not yet available
use flat plates ( 0.1 mm ) as load instead

prepared 2 sandwiches: 50 cm x 37 $cm^2$
50 cm x 51 $cm^2$

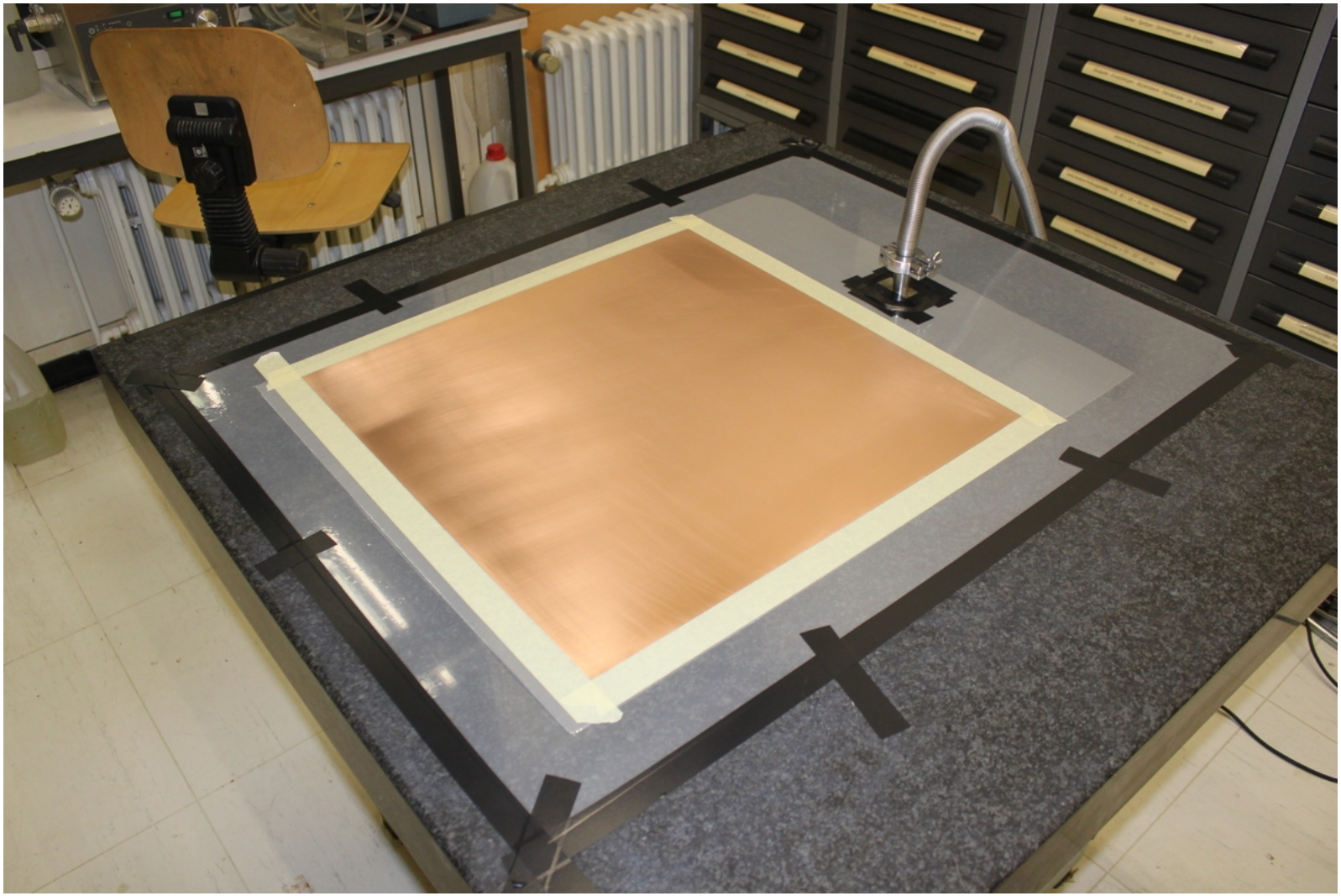
glue upper and lower FR4 using different methods

determine the planarity of the “second glueing”

determine the bowing of the sandwich @ 11 kg load

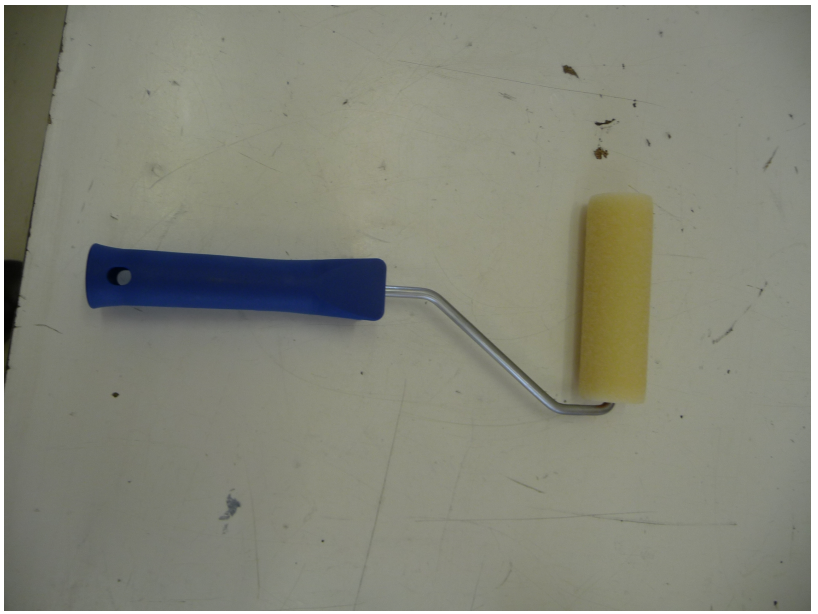
cut the sandwich into pieces

all glueing procedures:
apply vacuum through mesh from underneath



in the following, we apply 2 different glueing methods

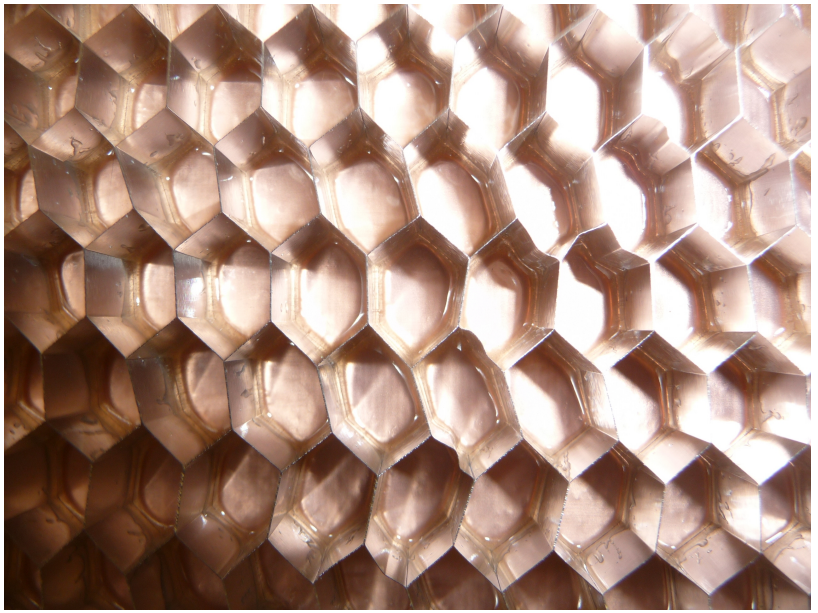
# Glueing First Side:
# Application of Glue by Paint Roller on FR4 and on Honeycomb

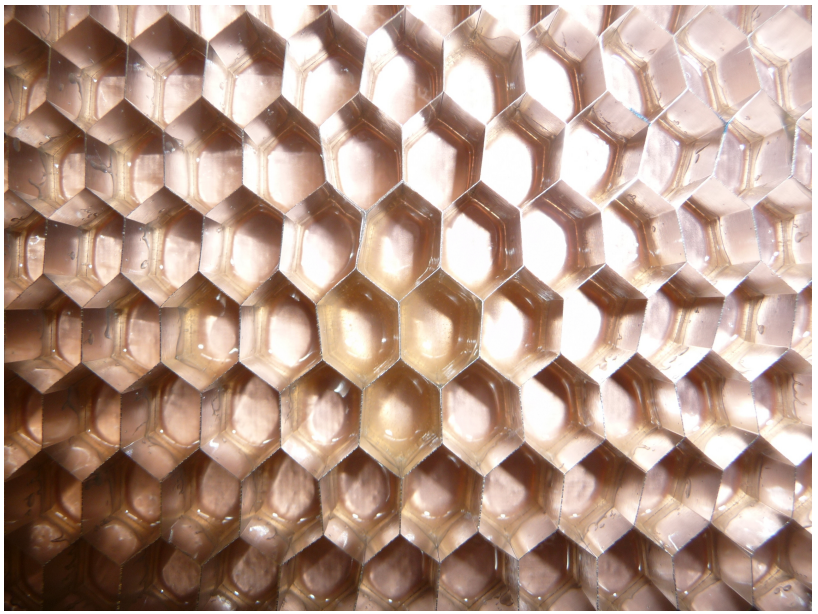


application of
thin (0.1mm)  homogeneous layer
of Araldite 2011 on FR4

difficult to apply homogeneous
and well defined layer of glue on
honeycomb

honeycomb acts as a wipe-off grid !





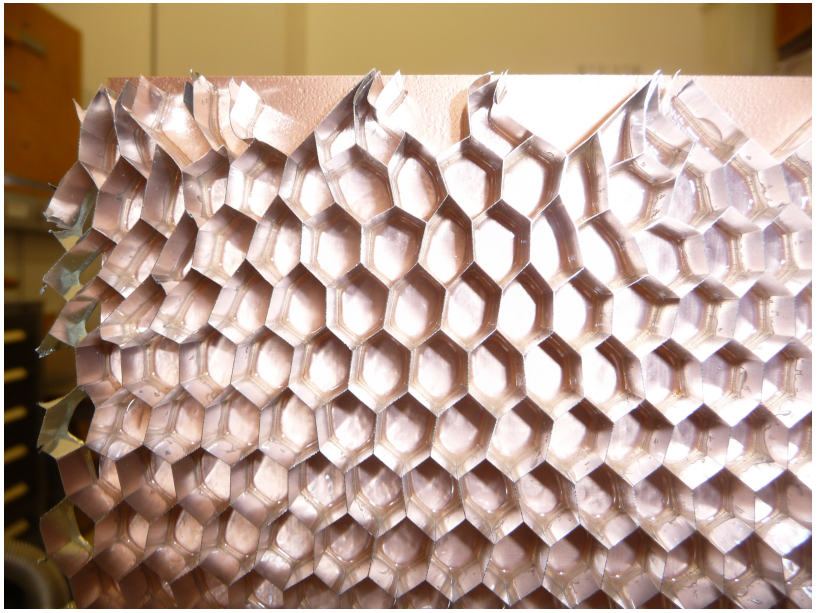
# Result of Glueing by Paint Roller

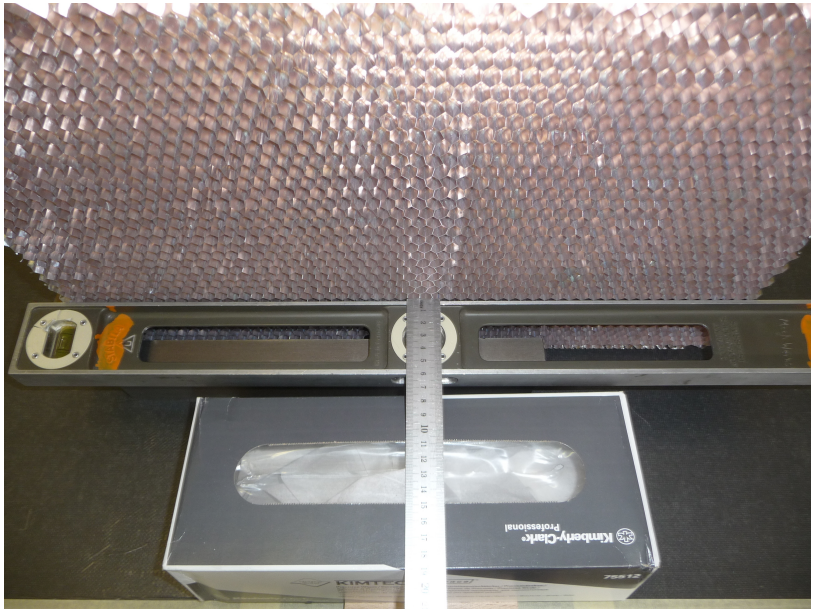
all hexagonal contacts are well covered by glue

the FR4 surface is only punctually covered by glue (shrinking)

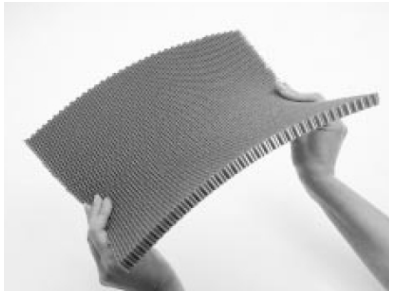
nice glue joints over large areas, but spots of glue-bumps in some hexagonal cells

deformation of FR4-honeycomb-structure by 1-2mm @ 51 cm



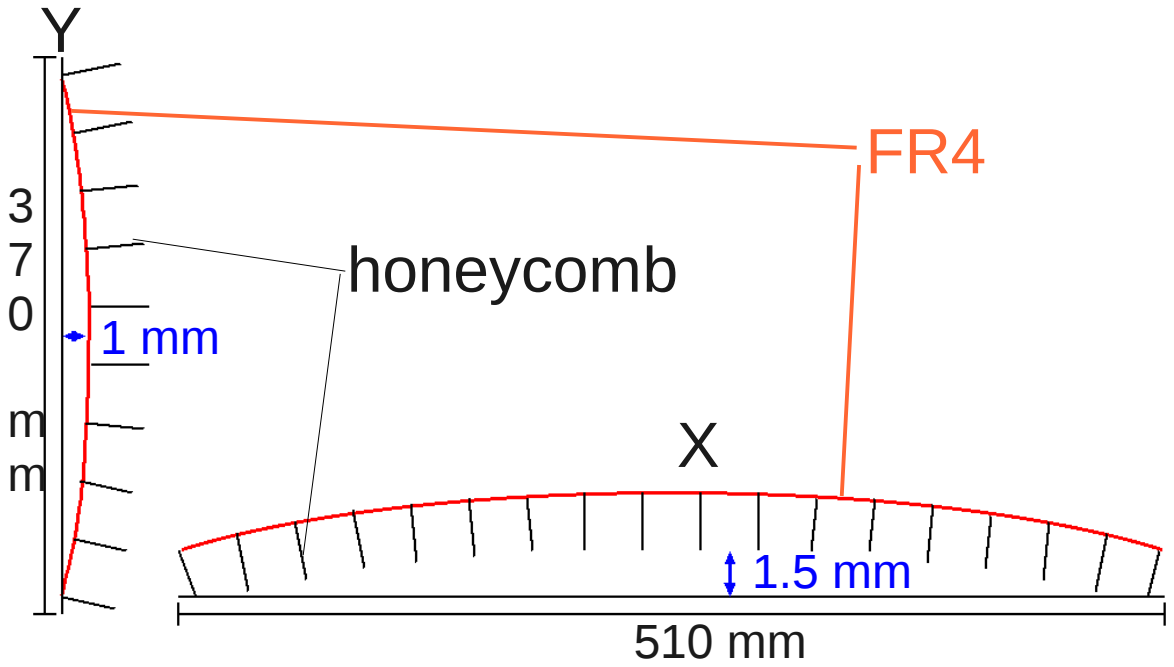


# Deformation of FR4-Honeycomb Structure
## Anticlastic Curvature

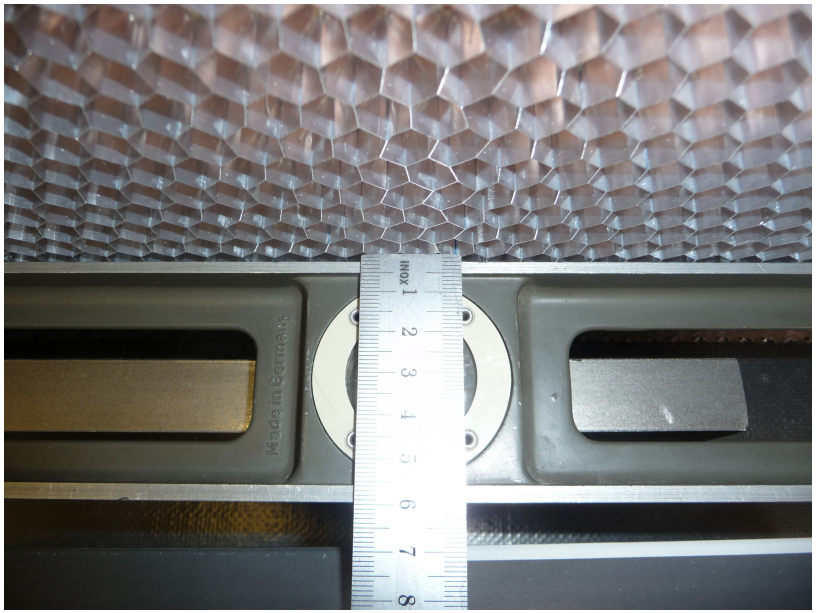


konvex - konkav
deformation in
X – Y direction

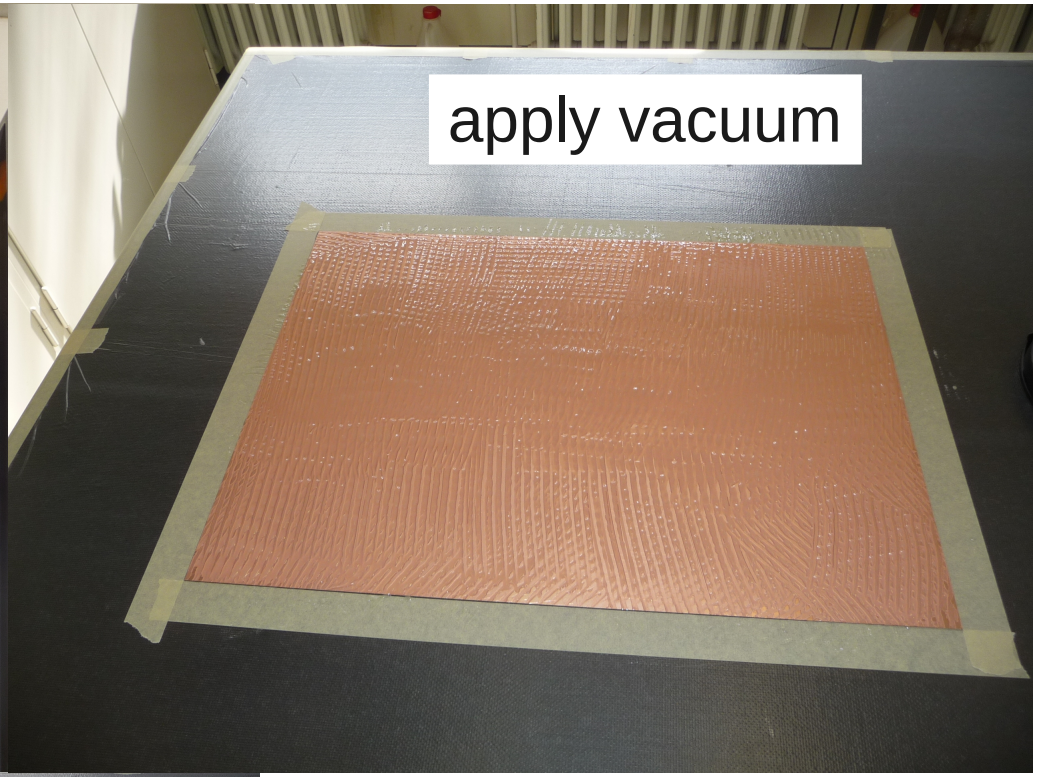
gravity sufficient
for compensation

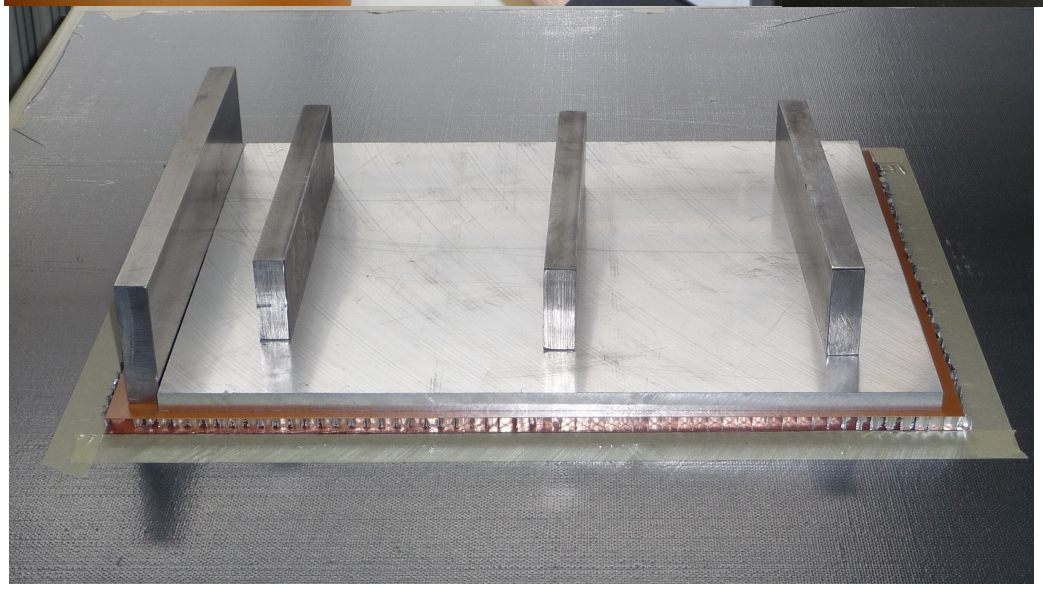






# Glueing Second Side using Notched Trowel
# Araldite 2011 only on FR4, HC not Wetted



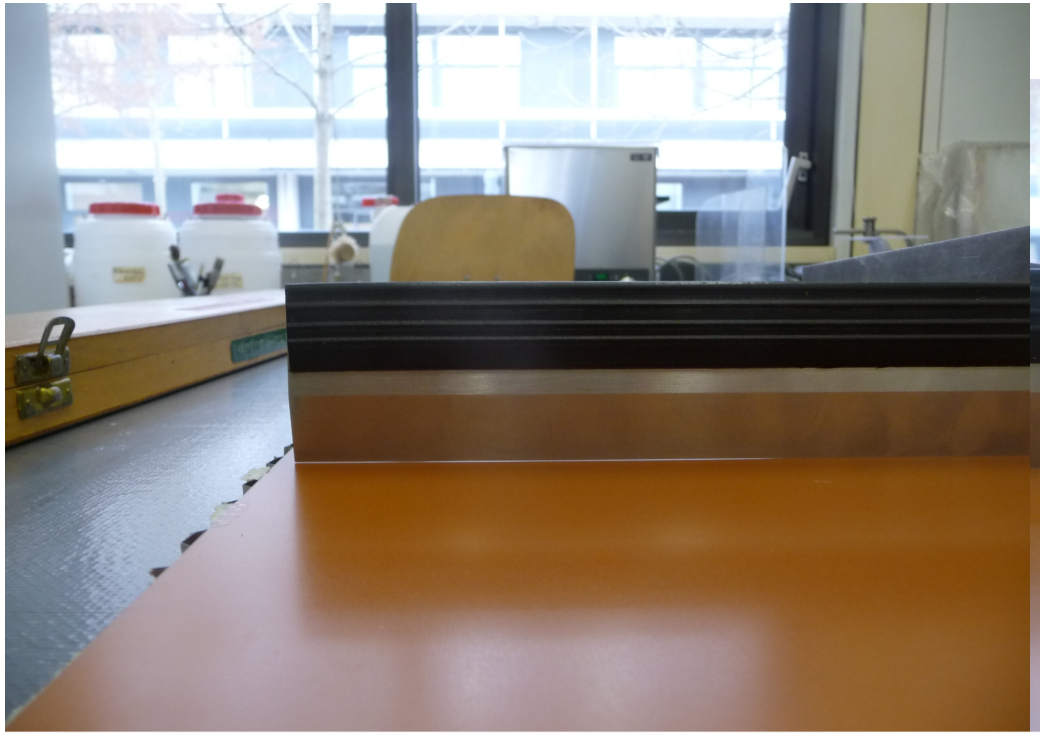



quality of glue joints:
also glue-bumps in some hexcel cells

both FR4-planes delaminate under application of force

CuO: acts as release agent

# Planarity of the Surface Glued in Second Step




accuracy of planarity at some points only 0.1 mm
mostly better than 0.05 mm
3 measurement positions each
in both directions

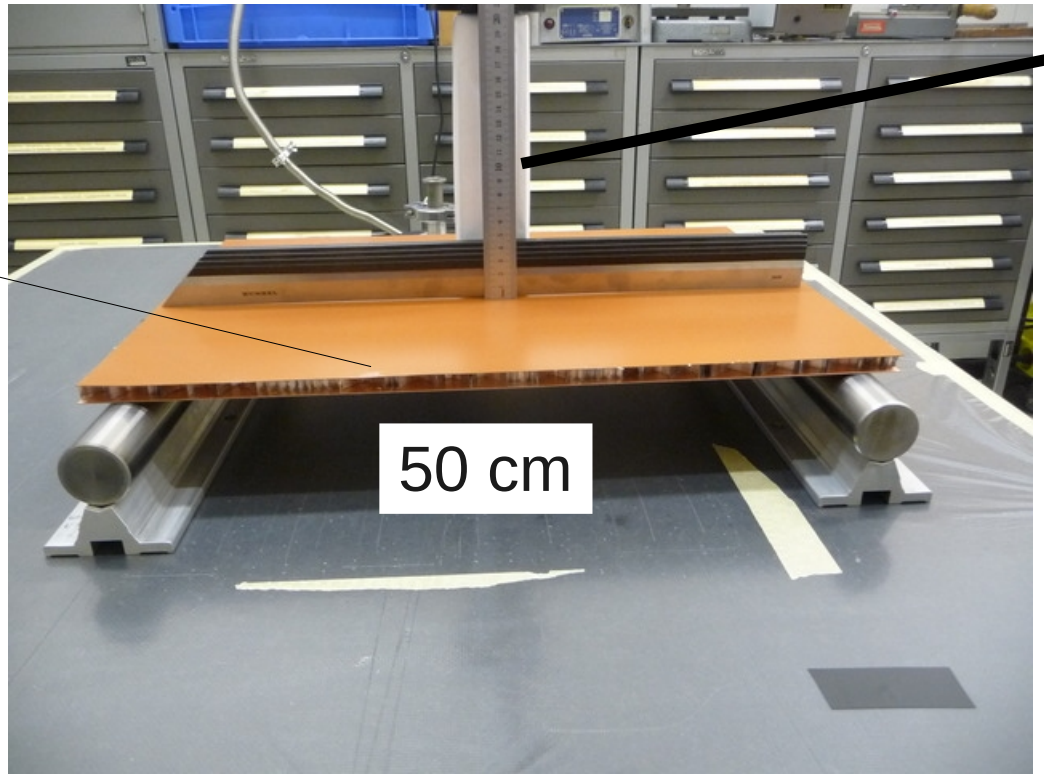
accuracy of table-surface not fully transferred to FR4
( variation of thickness not measured )

# Load the Sandwich with a Pb Brick

spot of glue

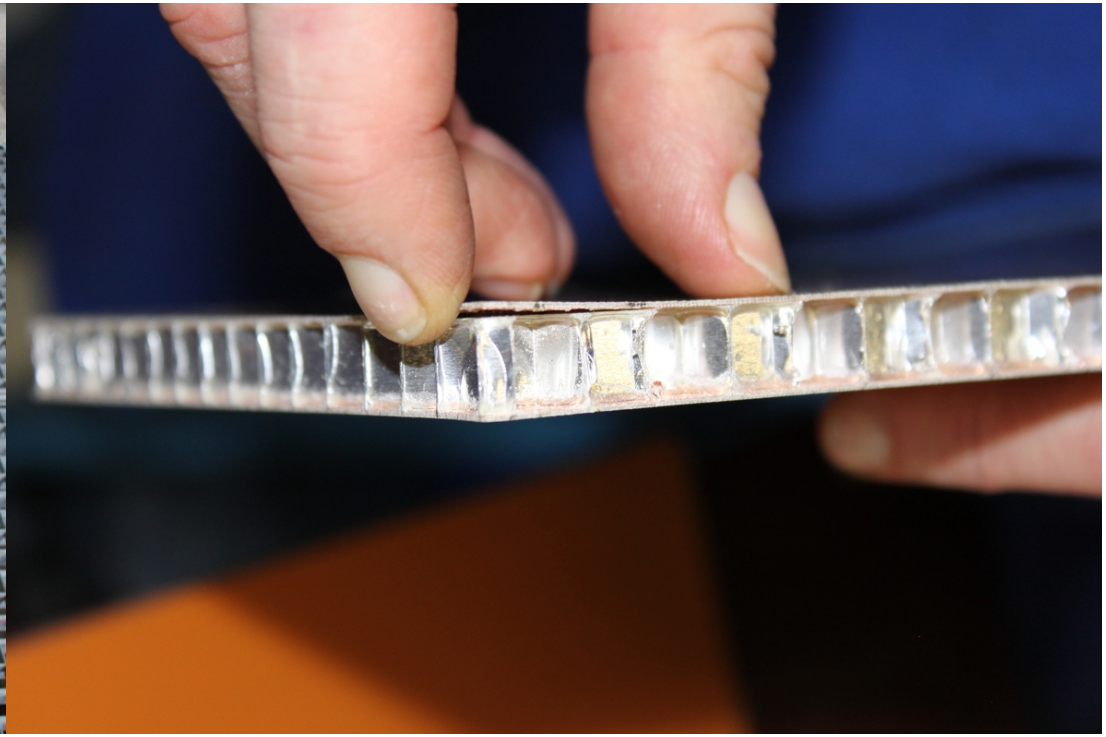
to be avoided

vacuum pressure ?



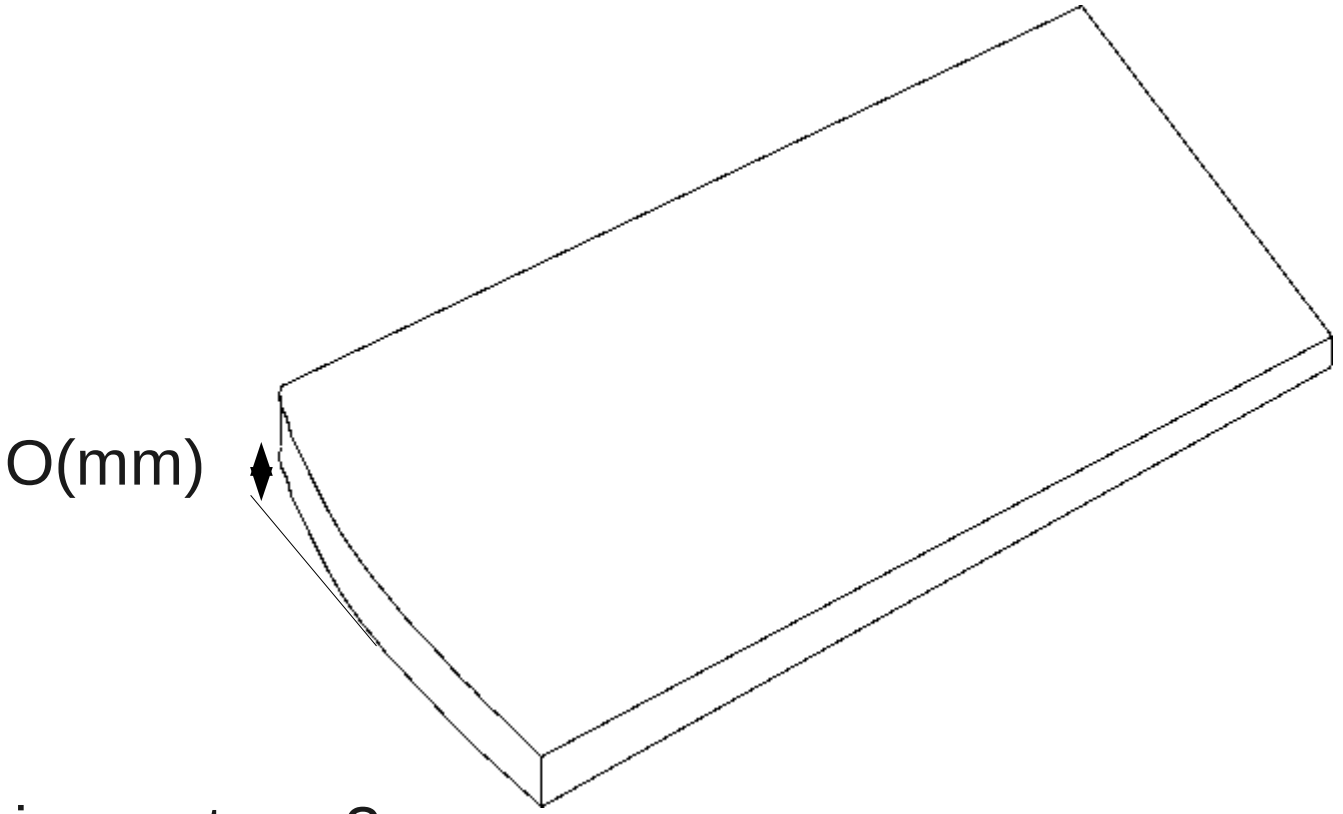

bowing of 0.85 mm @ 11.34 kg
stable over 3 days
reversible
=> ? thicker panels on exterior of quadruplet ?
~ $D^3$

# Apply Force:  Cut Sandwich into Pieces

jig-saw is rocking and shaking  headset needed => FORCE
the cutting of the honeycomb bars is noticed
the FR4 delaminates only at the edges
the glue joint is stable in the interior

Twist of the Sandwich-Plate after Cutting

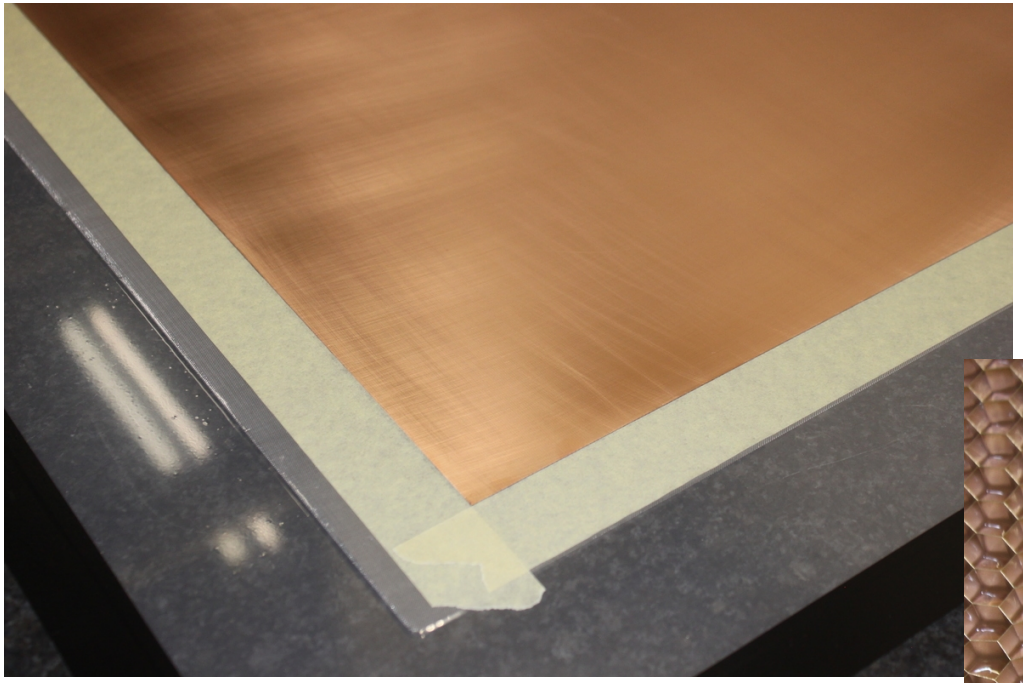



inner stress?

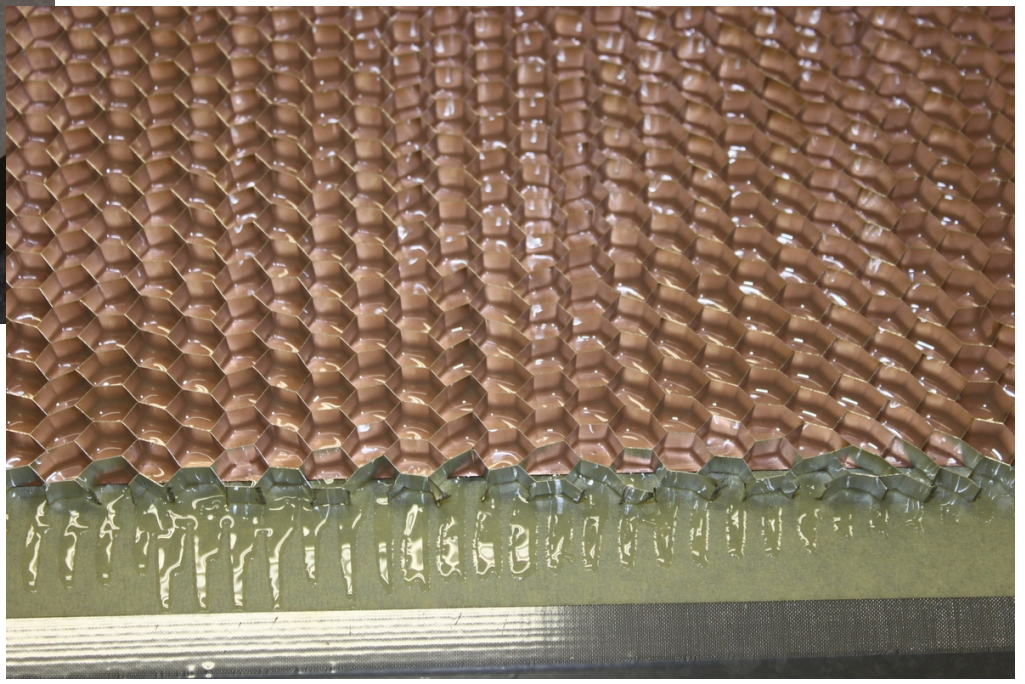
how can we guarantee that our sandwiches do not bend in this way?

not well studied, under investigation with a larger piece

# Improved Bond on Copper



test piece: 51 x 50 cm

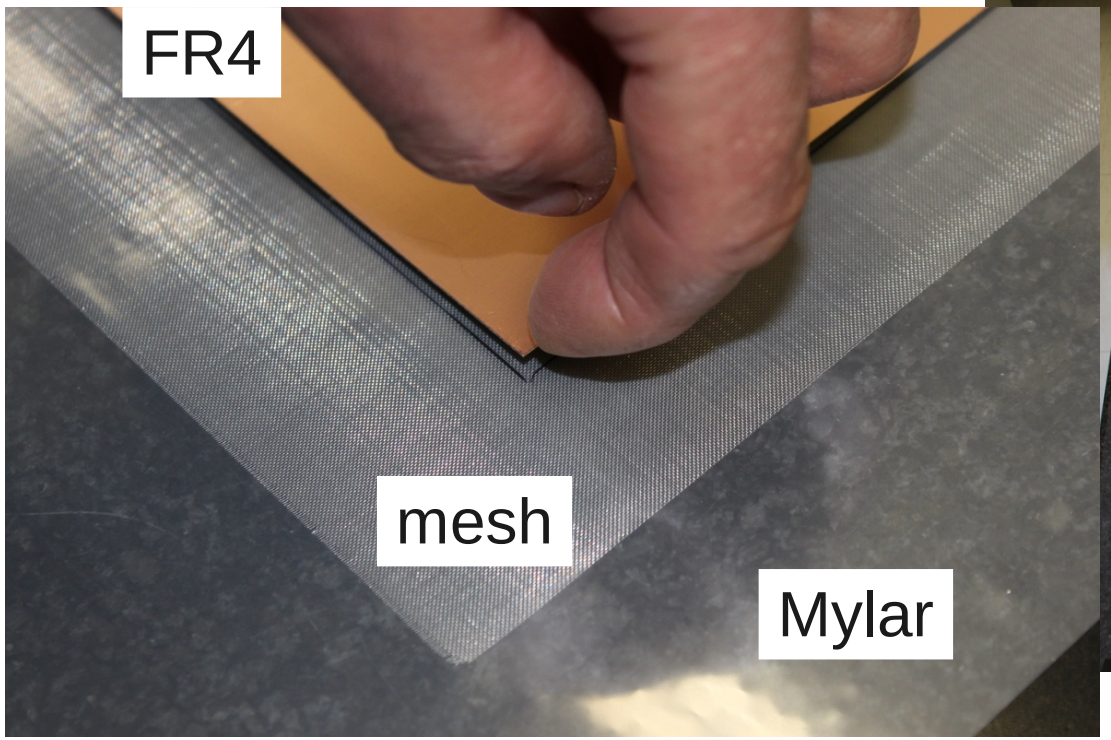


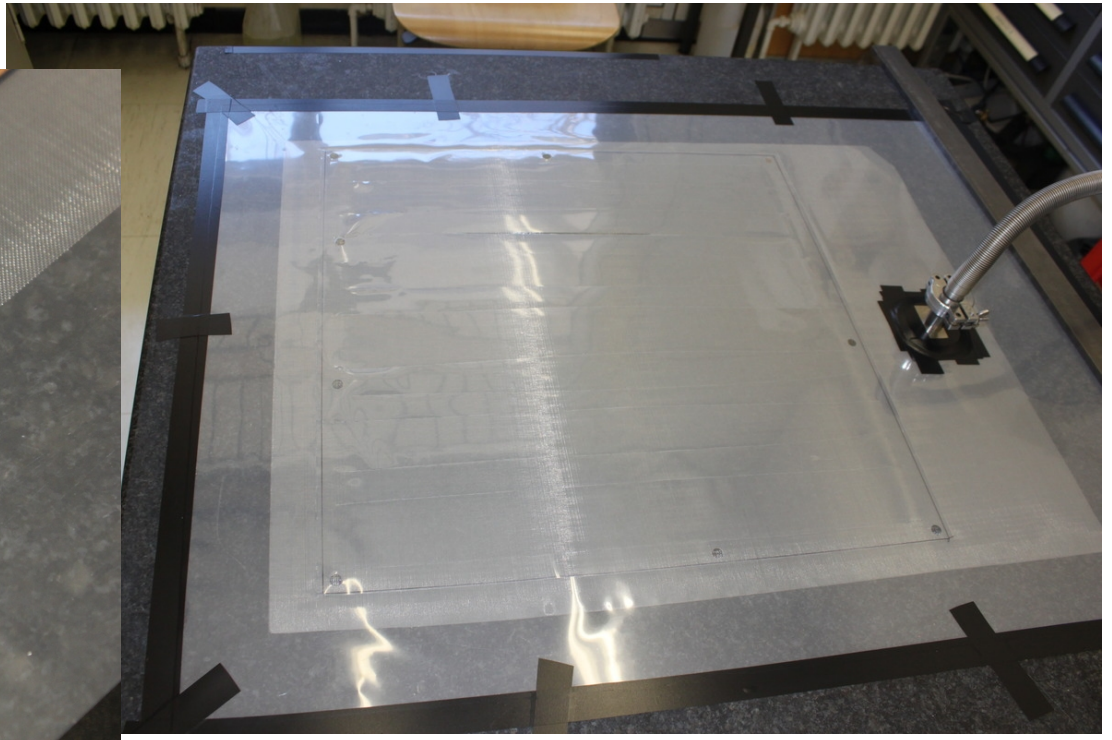
roughing the surface  =>
remove CuO +
surface treatment with acetone

apply glue in bands on Cu
no glue on hexcel

nice wetting of hexcel cells
no delamination when pulling => stronger bond

# The Vacuum Applicator



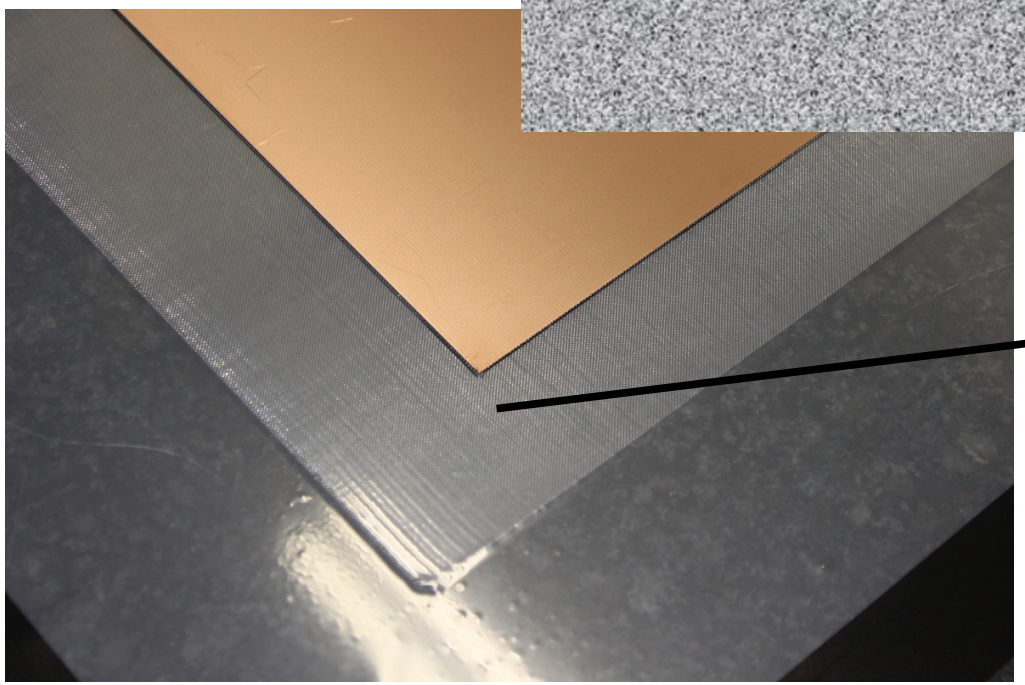



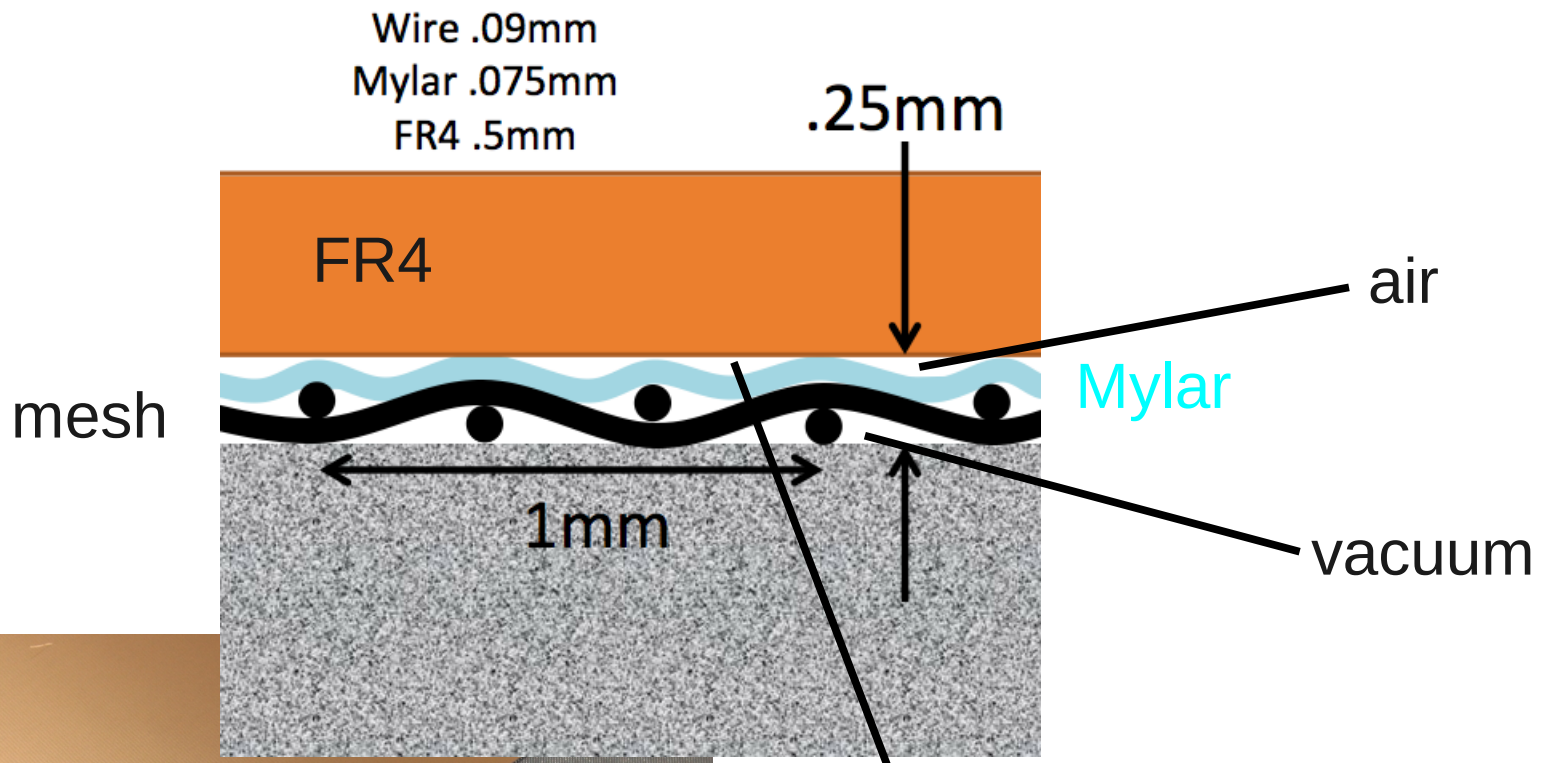
8mm holes in the edges
cuts along pumping direction

mesh: stainless dia: 0.09mm 3 lines/mm
Mylar: 0.075 mm 20 % tolerance!!!

only small force needed to lift an edge
corner is lifting when rolling viscous glue

# General Consideration on Pumping through Mylar






leakage through channels

thicker Mylar? 20 % ?

## Open Questions:

Accuracy of Mylar  20 %  or better???

Can we omit the Mylar ?
The mesh is certainly more accurate
Alternative sealing method?

How big is the experimentally experienced
contact pressure at other institutes?

How to dose the glue homogeneously?

How to avoid glue on the surrounding
and on the FR4 surface under vacuum?

Where to order 5.000 mm distance pieces
for the drift region

.....

## Next steps:

improve glueing procedure

develop stiffback: aluminum plate with vacuum grooves

build large O(m2) sandwich

determine its precision  ( Freiburg ? )

build a back-to-back layer (double layer)

...