



Forward-Endcap - Activities at Bonn -

M. Kube, C. Lütz, M. Rossbach, C. Schmidt, U. Thoma,
G. Urff, C. Wendel

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Helmholtz Institut für
Strahlen- und Kernphysik



Production

- inserts, mountplates, interfaces
- alveoles

Photo sensor - VPTT

- test measurements
- teststation magnet

Cabeling

- cables photo detector
- patch panel PCB

Teststation

- current status

Inserts:

- 500 of 1000 produced
- estimated completion time may 2014

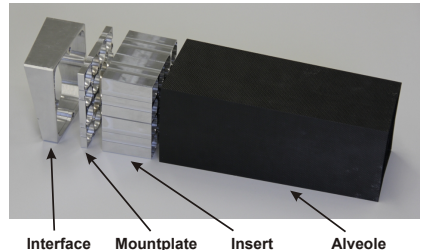
Mountplates:

- 219x 16er and 61x 8er on stock (214x 16er, 54x 8er)
- final "polishing" pending (vibratory grinding)

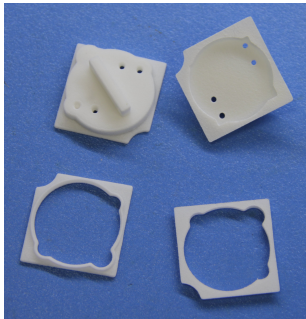
Interfaces:

- 161x pre-processed (3axis)
- final machining pending on 5axis last changes:
 - manipulator holes
 - due to alveole assembly

Drawings need to be finalized by KVI.

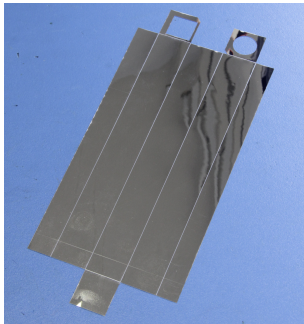


Capsule (Bonn)



- guide for glueing
- isolation of preamp heat
- nylon after 1000Gy
 - no problem visible
- will be ordered

Wrapping foil (Bochum)



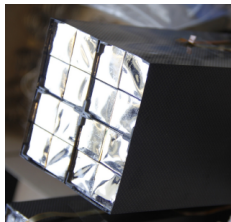
- laser precut
 - easy+precise folding
- will be ordered

Prototype - alveoles:

- front open
- crystal position fixed by small carbon bracket
 - Drawbacks:
 - inhomogeneous
 - further glueing step

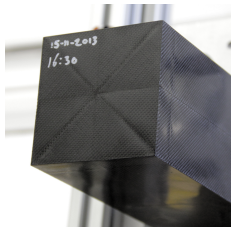
closed front with 0.18mm carbon

→ more care about crystal position



Important issues before production:

- front face wrapping procedure
- front face → edge rigidity
- fit of assembly inside alveole
- check fitting and dimensions due to new mold for higher production speed (120°C backing temp.)



New mold was manufactured by fibreworx and delivered pre-production samples:

1st batch:

- inserts get stuck to early → play in front (1-2mm)

2nd batch:

changes: mold shortened by 0.5mm

- result in good fit of insert,
- problems with rigidity of edges

3rd batch:

- improved tooling for post-processing
- front face has $0^\circ/90^\circ$ and $45^\circ/45^\circ$ carbon layer
→ improved edge rigidity
- prepreg cut by cnc → minimizes wrinkling



achieved wanted results → final production can start.

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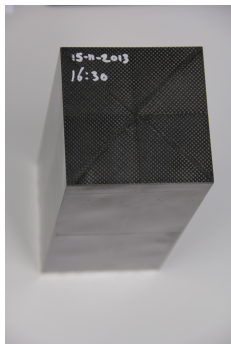
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- **result in good fit of insert,**
- **problems with rigidity of edges**

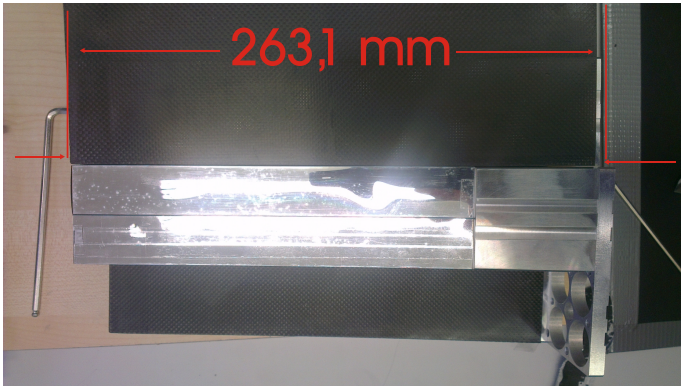
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→ **improved edge rigidity**
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Test assemblies:



Important issue:

- after production of parts and assembly → submodul must stay in limits

Length

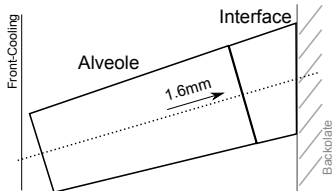
Measured length versus CAD

$\approx 263.1\text{mm} \rightarrow 261.6\text{mm}$

$\rightarrow 1.5\text{mm}$ too long (carbon+foil+capsule+play)

2mm play forseen, to get back 2mm play again

\rightarrow slight modifications to the interface forseen



Centering

First tests done w/o glueing the insert.

\rightarrow measured variation $\approx 0.5\text{mm}$

Forseen space between submodules 1mm.

Assembly tools needed

\rightarrow guiding the alveole during glueing

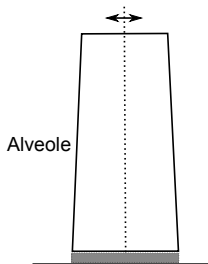
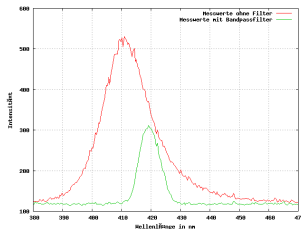
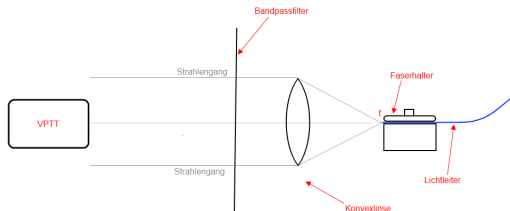


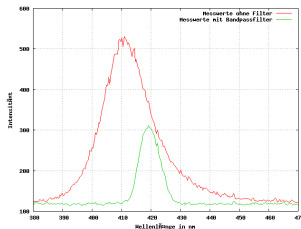
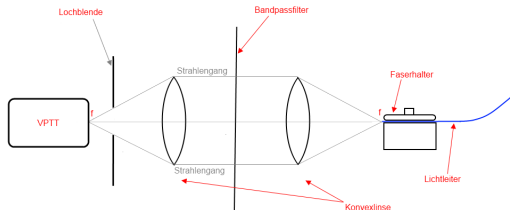
Photo detector readout chain (LNP+Shaping) is used. LED-Pulser tuned to be close to scintillation light (selected LED+bandpass filter).



Measurement methods:

- integral - complete tube illuminated

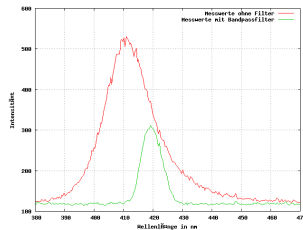
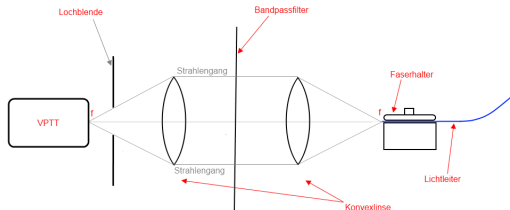
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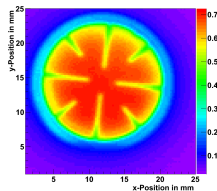
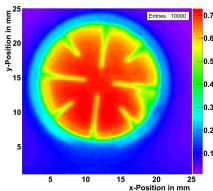
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- surface scan

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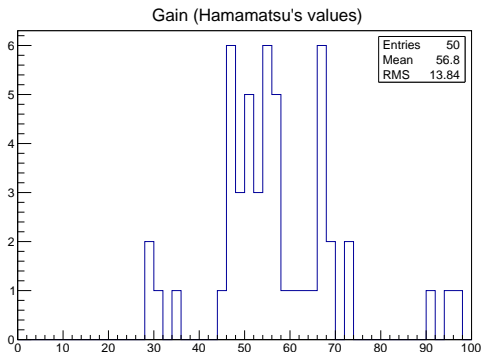
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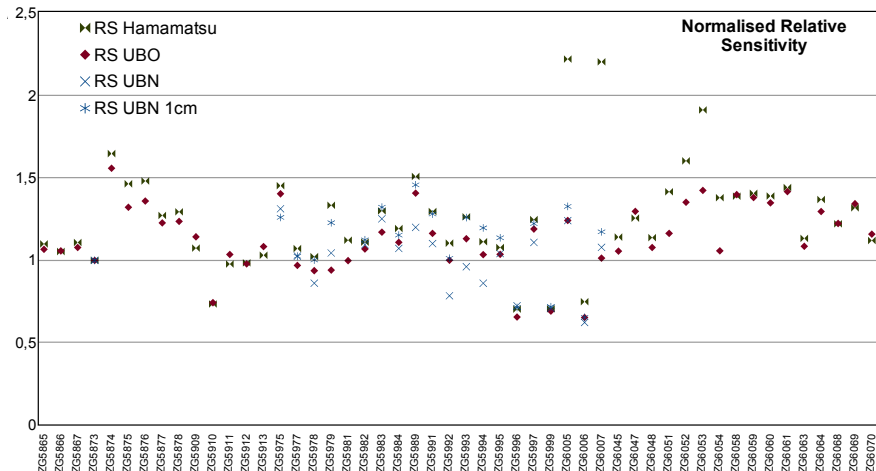
Measurements with pre-production run of 50 VPTTs done at Bochum and Bonn

Available parameters:

- Hamamatsu: gain, blue sens. (QEb)
- teststation@Bochum: gain (ratio of measured currents)
- teststation@Bonn: gain * blue sens. (QEb) * area (relative to PM)

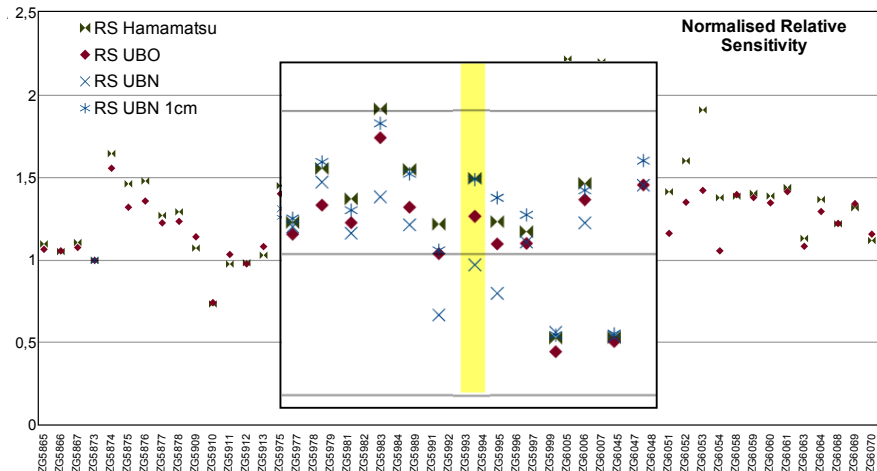


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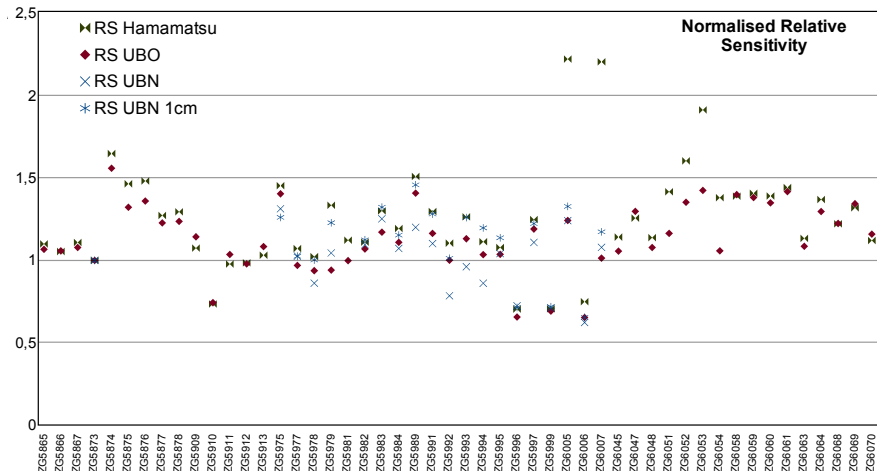
RS = Ratio of (Gain * QEb) to ref. VPTT (Gain * QEb)

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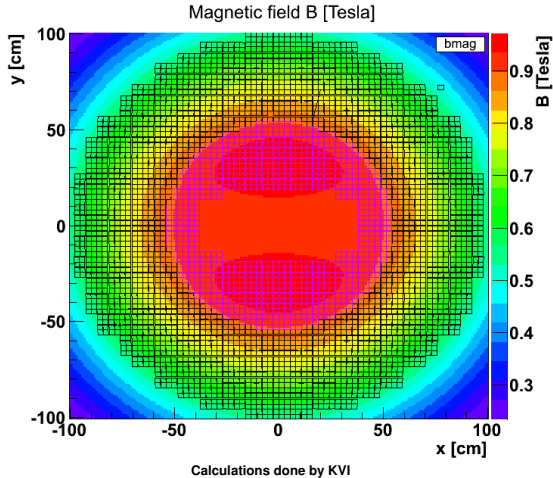
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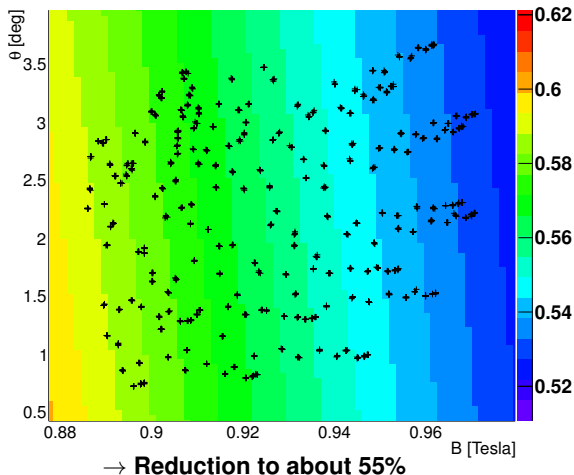
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Magnitude of the magnetic field at the position of the VPTTs. Simulation done for a 2T-field.



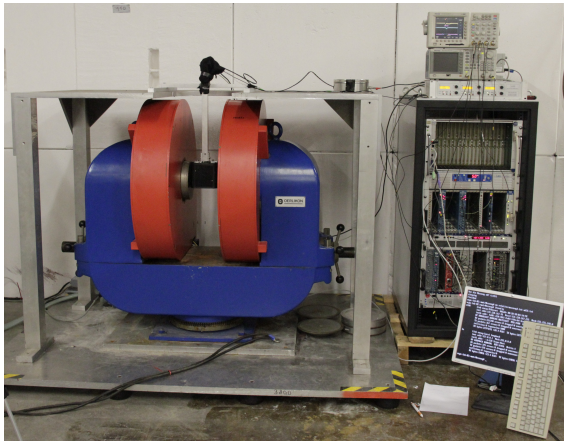
→ **VPTTs will see a field strength of about 0.8-1T**

Relative gain for all VPTTs at angle and field strength



Based on B-field measurements @Bochum ($\theta = 0^\circ, 6^\circ$). ϕ -dependence $\approx 5\%$

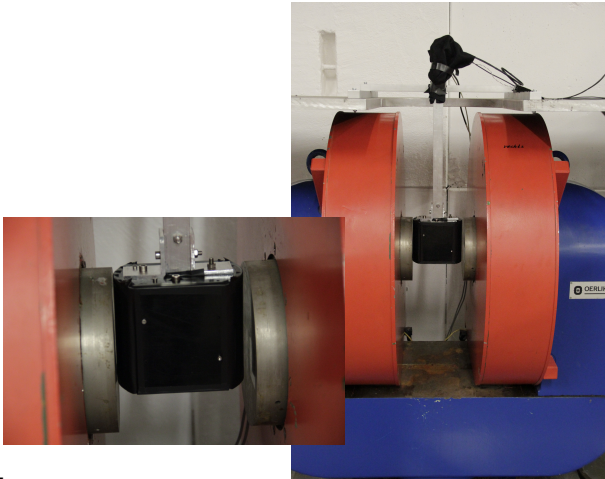
Setup for testing VPTTs in magnetic field NOW operational



Properties:

rotatable 360° , normal conducting, fields: $1.2T@16cm$ gap, $2T@6cm$ gap

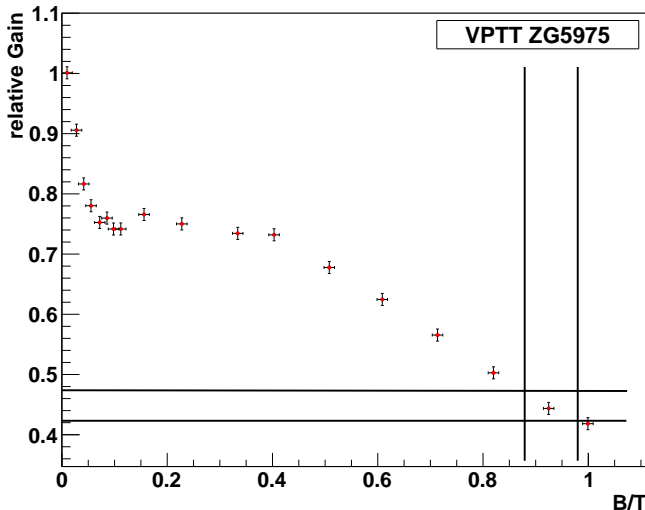
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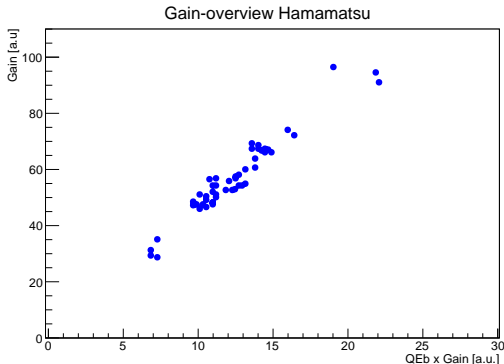
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VPTT ZG5975 @750V in magnetic field



CERN test-measurement:

S/N as good as APDs \rightarrow gain $> 24 \rightarrow$ x2 (B-field reduction) \rightarrow gain > 48

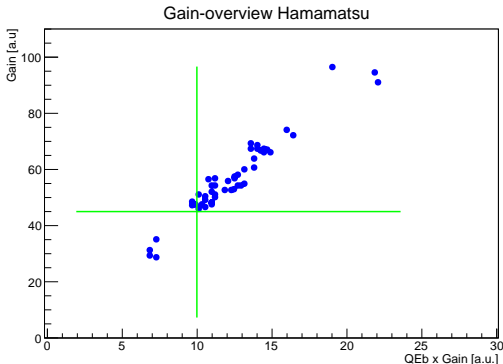


Next 100 VPTTs ordered:

- **wish:** $Gain > 45$, $QEb * Gain > 10$
- **Hamamatsu agreed on** $Gain > 30$, $Skb > 8$
- **to allow Hamamatsu to get more experience in production process**

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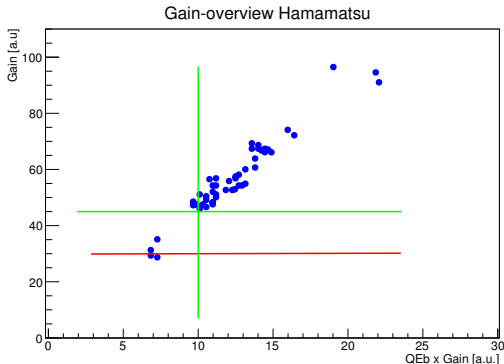


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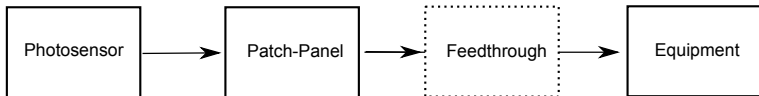
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Sections:

- **photo sensor cable set**
- **patch-panel PCB**
- **cables connecting patch-panel PCB to endcap borderline**
(LV/HV-cables, sensor-cables, signal-cables)
- **feed-throughs**

Photosensor cable set:

- **Signal cable UFL-plug + 1,3mm coax ($\approx 15\text{cm}$)**
- **ground lead ($\approx 5\text{-}10\text{cm}$)**
- **3x Low voltage cable AWG26 ($\approx 15\text{cm}$)**
- **2-3x High voltage cable AWG22 ($\approx 15\text{cm}$)**

Logical structure:

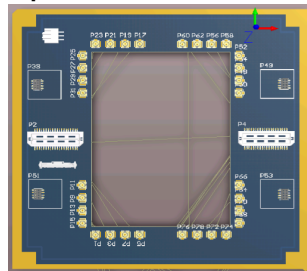
- All plugs for one compartement in each corner
- cuttable in the middle for 8er alveoles
- all HVs patched to panel
APD: 32; VPTT: 16
HV-plug: 4x GND, 4x/8x HV \rightarrow 12pin
- 4x sensor
- 32x UFLs (VPTT: only every 2nd used)
- LV: 3pin plug/photo detector

PCB:

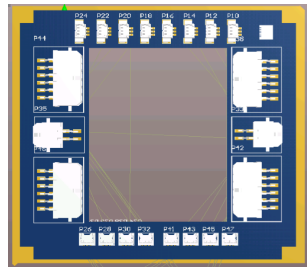
- 4 or 6 layer board
- tested LV alternatives
- no real alternative for HV found

total height: \approx 1cm to 1.5cm

top:

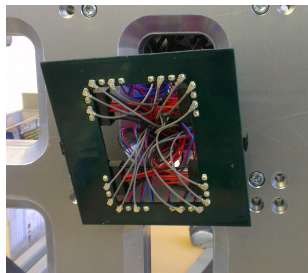
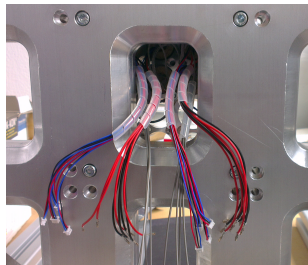


bottom:



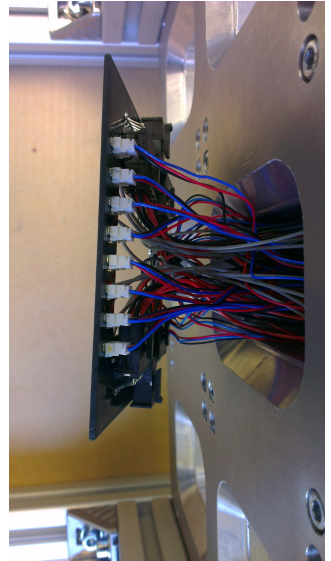
Mounting procedure:

- connecting voltage cables
- screwing PCB to backplate (spacer)
- connecting signal and sensor cables
- add clamp for UFL-plugs



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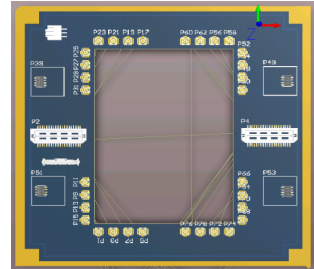
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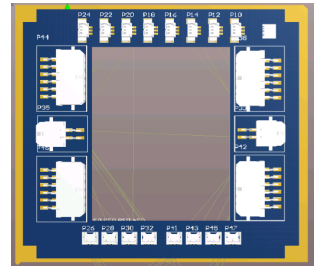
Next steps / current work:

- finalize part positioning
- do electrical routing (impedance matching) with help of pcb manufacturer
- build prototype for testing
- finalize ordering cable-set photo-sensor

top:



bottom:



After assembly of detector-submodule, a precalibration with cosmics will be done (2 submodules per climate chamber).

Status:

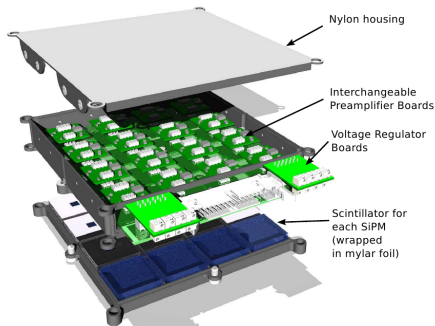
- **2 climate chambers installed (control system setup)**
- **Trigger detector developed → will be built in the next month**
- **Data acquisition in setup phase**
- **Mechanical parts in progress**



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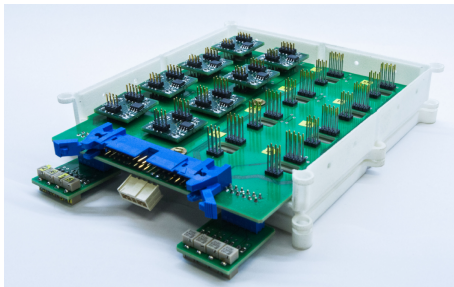
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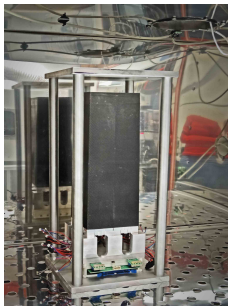
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