

AGIPD Mechanics

Annette Delfs, FS-DS

Consortium Meeting 12.11.2015



- Status of engineering work
- Status of parts to be produced/purchased
- Status of mounting
- Status/results of interposer tests
- Summary



- **Status of engineering work**
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Engineering work is finished for most of the parts needed. Exceptions are:

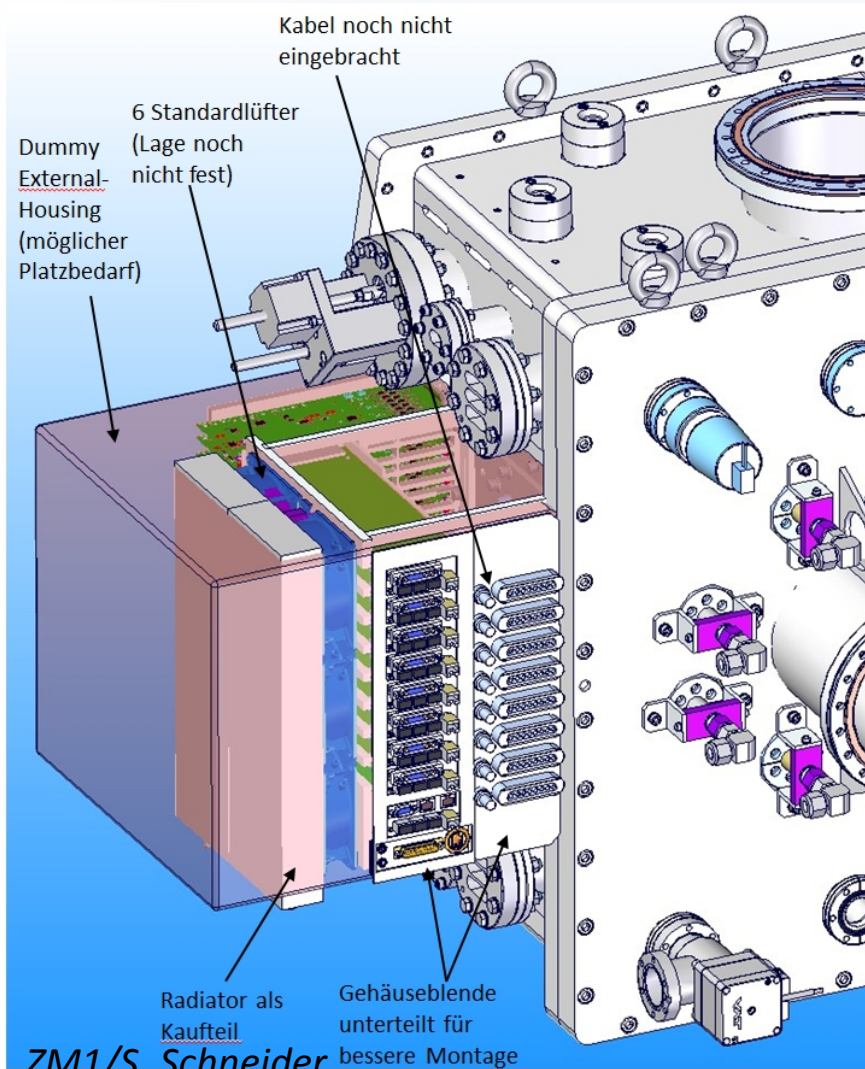
- External Housing / Cooling of External Boards (under progress by ZM1/S. Schneider)
- Interface for distribution of coolant and thermal insulation of cooling tubes (unprocessed)



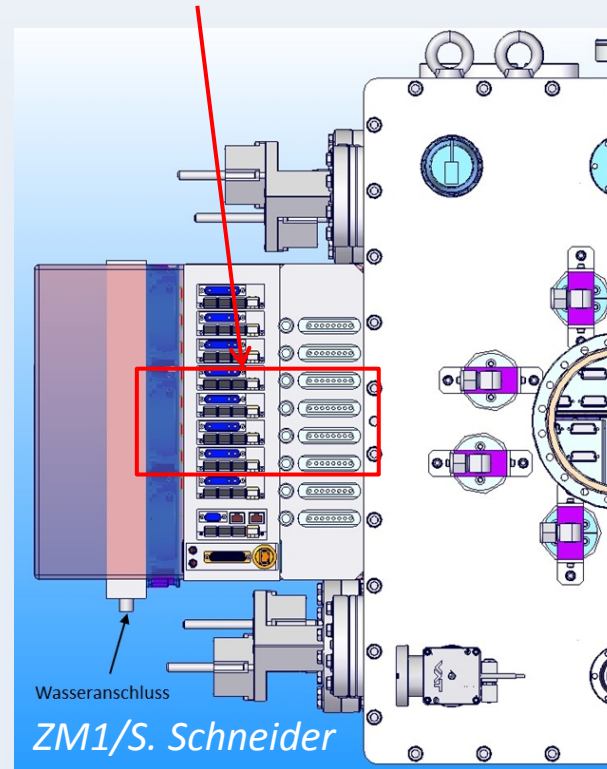
External Housing / Cooling of External Boards:

- Until end of November:
 - Simulation of air flow in housing, optimizing the set-up (radiators, combination with heat pipes)
 - Detailed design for EMC-protection (already discussed and agreed with Peter Göttlicher)
- December: Detailed design for the cooling
- January: Order parts, bits and pieces

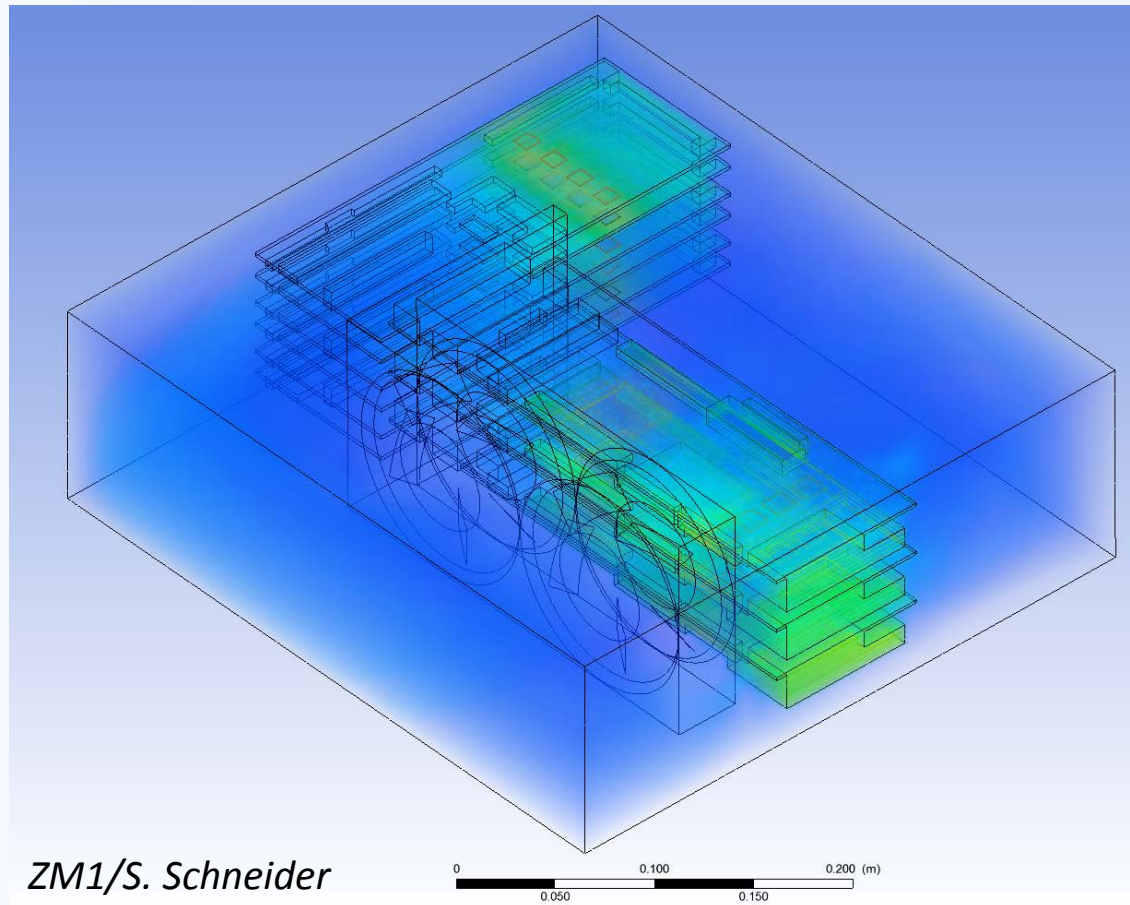
Status of engineering work



- Present design in SPPS
- Simulation for height of 1 fan (see red box)



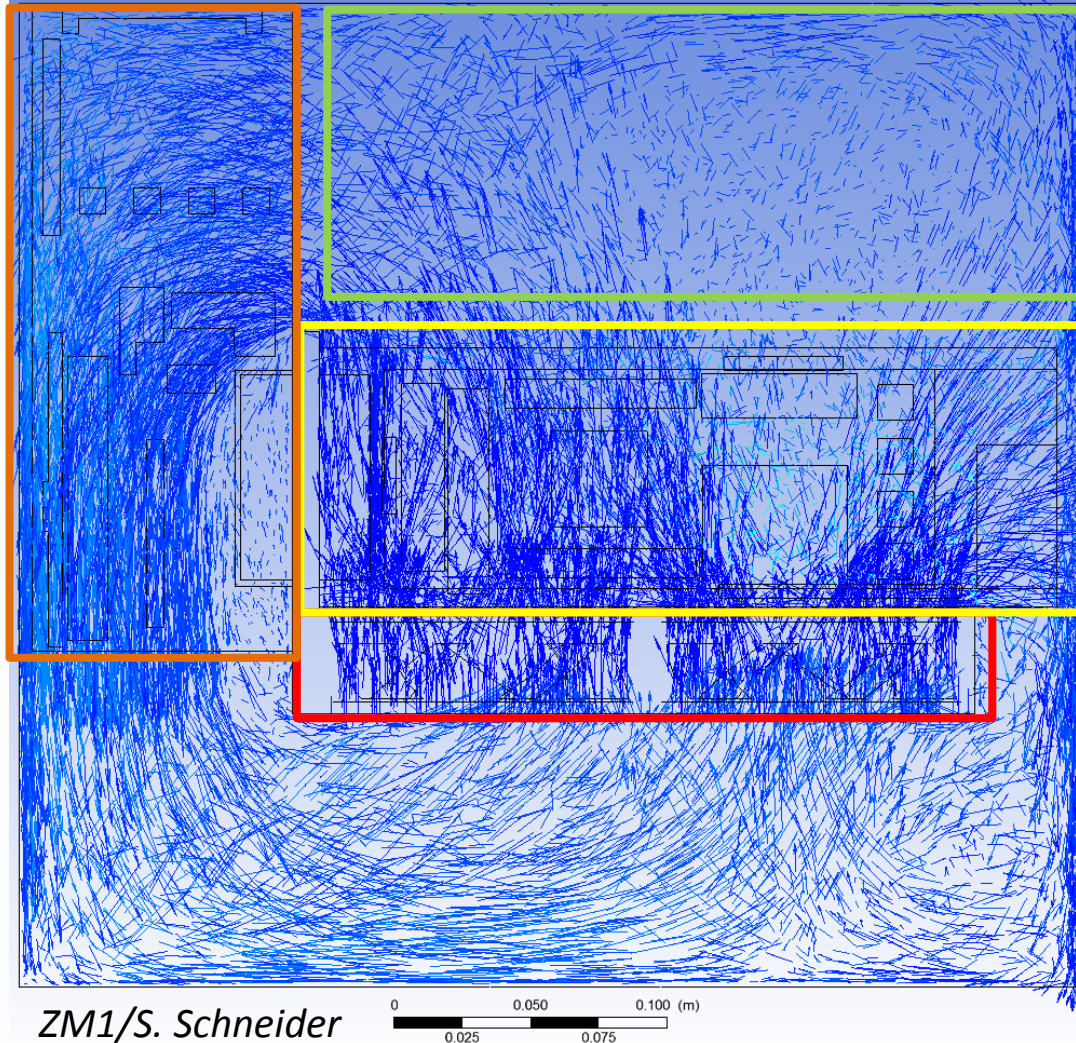
Development of heat on the boards



Status of engineering work



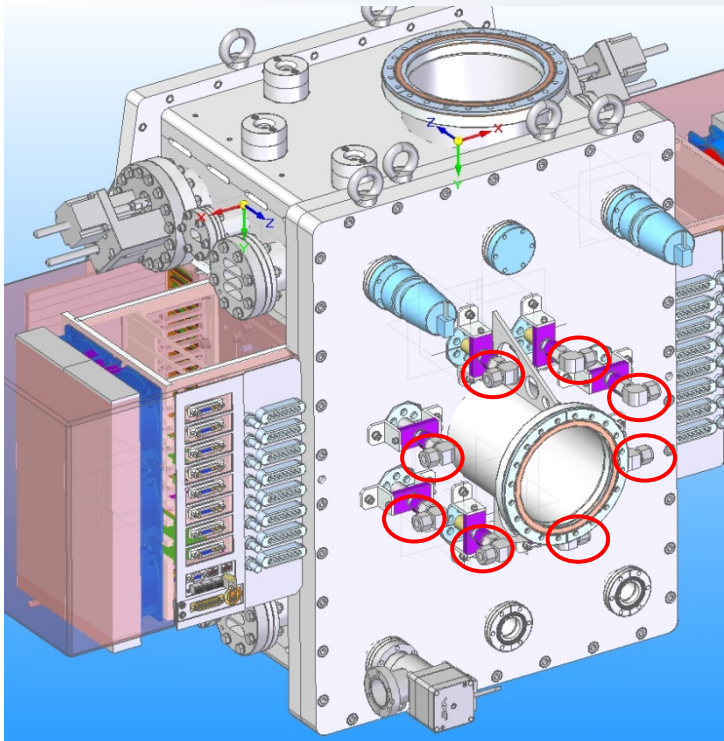
beam →



Air flow in housing (top view)

- vacuum chamber
- fans
- carrier board
- mother/daughter
- power cables not in simulation yet

Interface for distribution of coolant and thermal insulation of cooling tubes



- 90°-Swagelok-Fittings can be fixed at any angle.
- Connection from Swagelok to distribution of coolant must be specified.
- Design of thermal insulation still waiting for specification of coolant distribution.



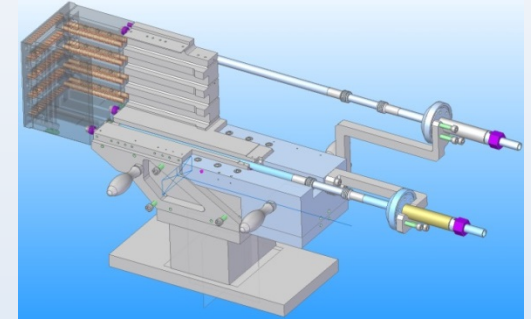
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Except of the forementioned parts all parts are already delivered or in final stage of production.
In order as needed that is:

➤ Cooling blocks, adapters, counter weights, mounting tables + tubes holders, parts for adjustment of cooling blocks

- Cooling blocks: **delivery end of week 47**
- Adapters: **ready**
- Counter weights: **ready**
- Mounting tables: **ready**
- Tube Holders: **ready**
- Parts for Adjustment: **ready**



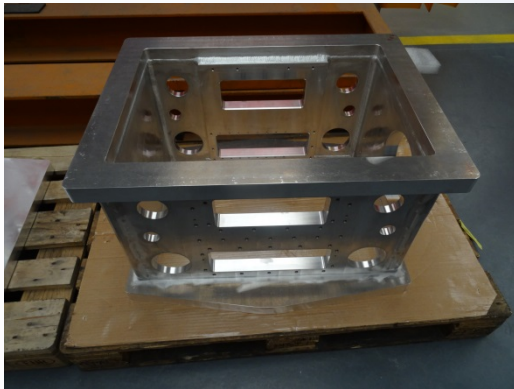
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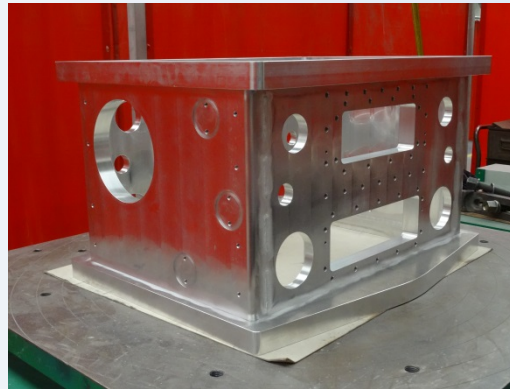
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- Vacuum chamber
 - welded, final machining this week, tests and ready for shipping next week, **at DESY week 48**
- Table for vacuum chamber
 - **1 ready**, parts for the second table at hand, have to be assembled



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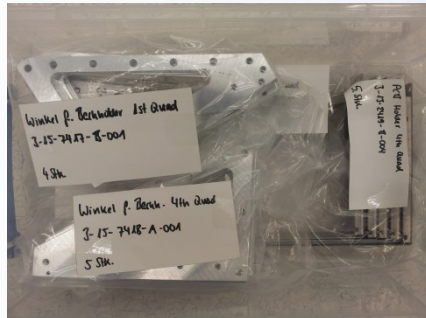
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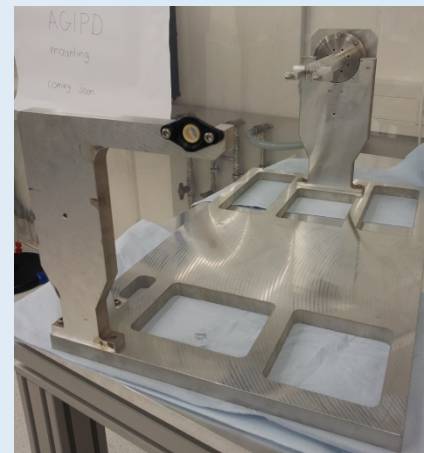
- Motion stages and actuators
 - ready for 1st 1M, in production for 2nd 1M
- Vacuum boards
 - ready week 47 for 1st quadrant, 12 in preparation
 - not yet ready for second 1M



- Holders and bits and pieces to assemble the quadrants
➔ ready

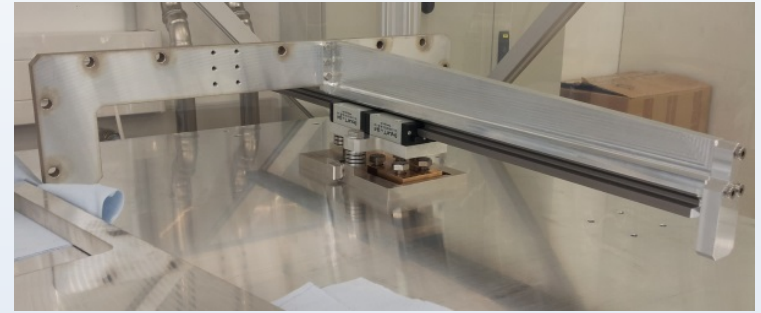


- Device to turn assembled quadrants
➔ ready



- Device to install quadrants into vacuum chamber

→ ready

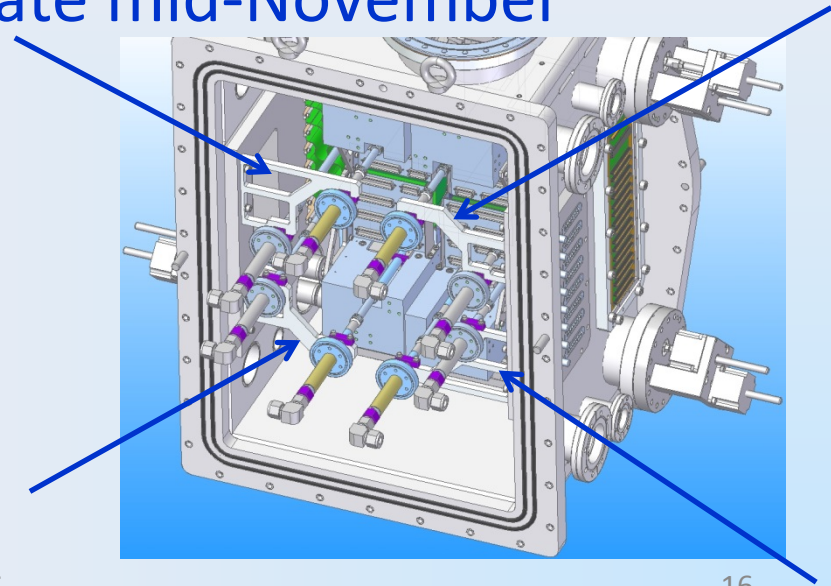


- Cooling tube holders

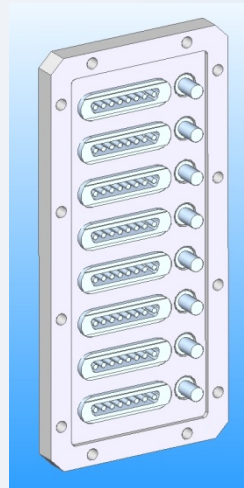
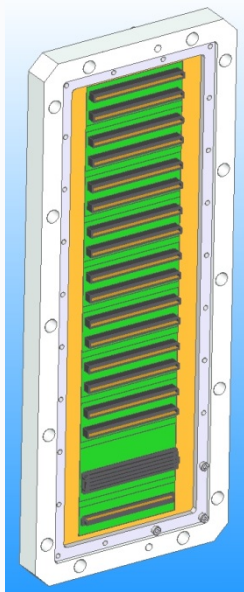
→ in production, delivery date mid-November

- Adjustment tools for installing the quadrants

→ in production, delivery date mid-November



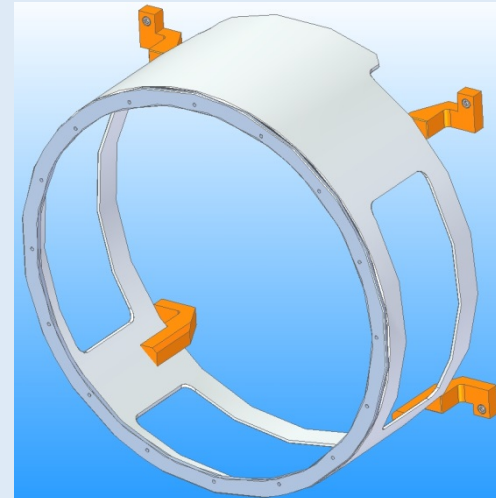
- Flange for vacuum interface board
 - in production, delivery date mid-November
- Rectangular flange with power feedthroughs
 - Delivery this week (3 pcs.)



- Feedthrough flanges DN 63 and DN 40
→ **Delivered last week** (4 pcs. each), quality controlled, **to be cleaned**



- Detector Hood
→ **in production**, delivery date **mid-December**





- 1x vacuum pump per instrument
→ to be specified by SPB and MID
- 1x pneumatic angle valve for SPB
→ to be ordered
- 1x manual angle valve for MID
→ to be ordered



- 2x vacuum gauges PKR 251 per instrument
→ to be ordered
- 1x venting valve per instrument
→ to be specified by SPB
- 1x burst disc or pressure relief valve per instrument
→ to be specified by SPB and MID



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- Mounting of quadrants can start as soon as the cooling blocks are available (end of week 47).
- After delivery and quality check of vacuum chamber, mounting of motion stages and actuators can be done (likely in December).



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- Status of engineering work
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- *Issue:* broken sensor modules
- *Suspicion:* copper interposer is not strong enough
- *Actions:* simulation, tests in lab

Delamination of sensor

LTCC broken

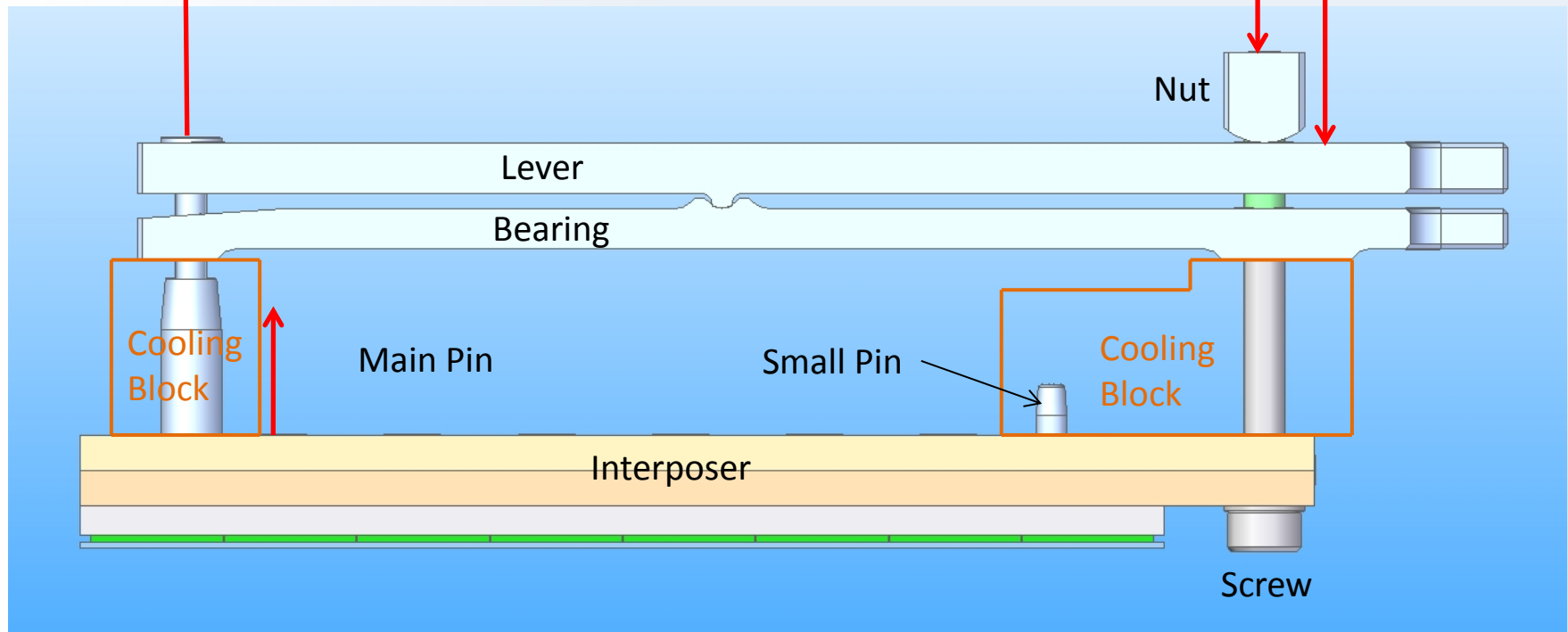
Interposer bended



Simulation set-up

Lever moves up on this side and pulls the main pin (and the interposer) upwards

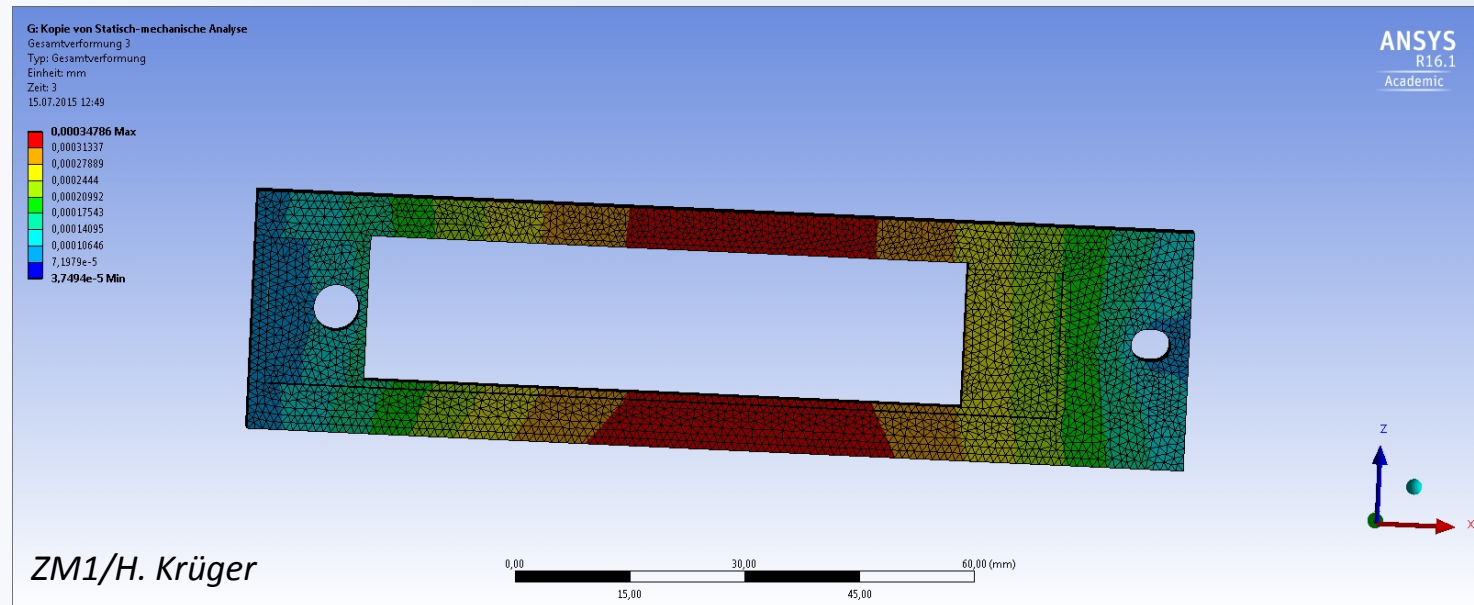
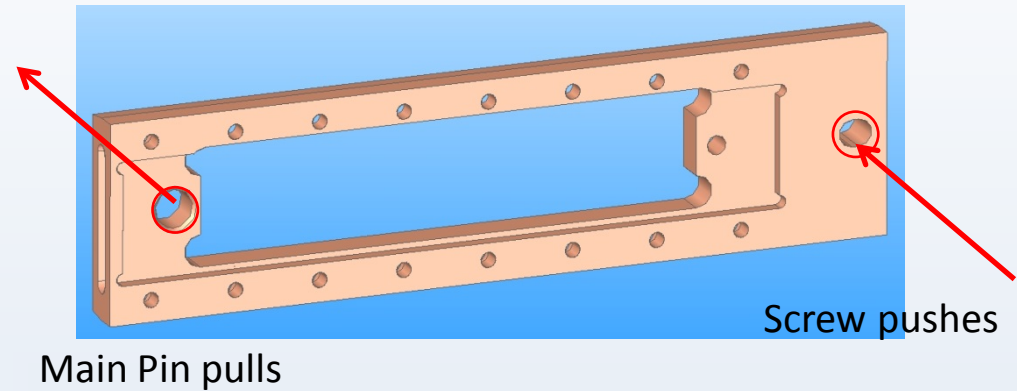
Tightening screw pushes lever down



Simulation

■ = 0.35 μm

→ Forces induced by pulling lever are not an issue!

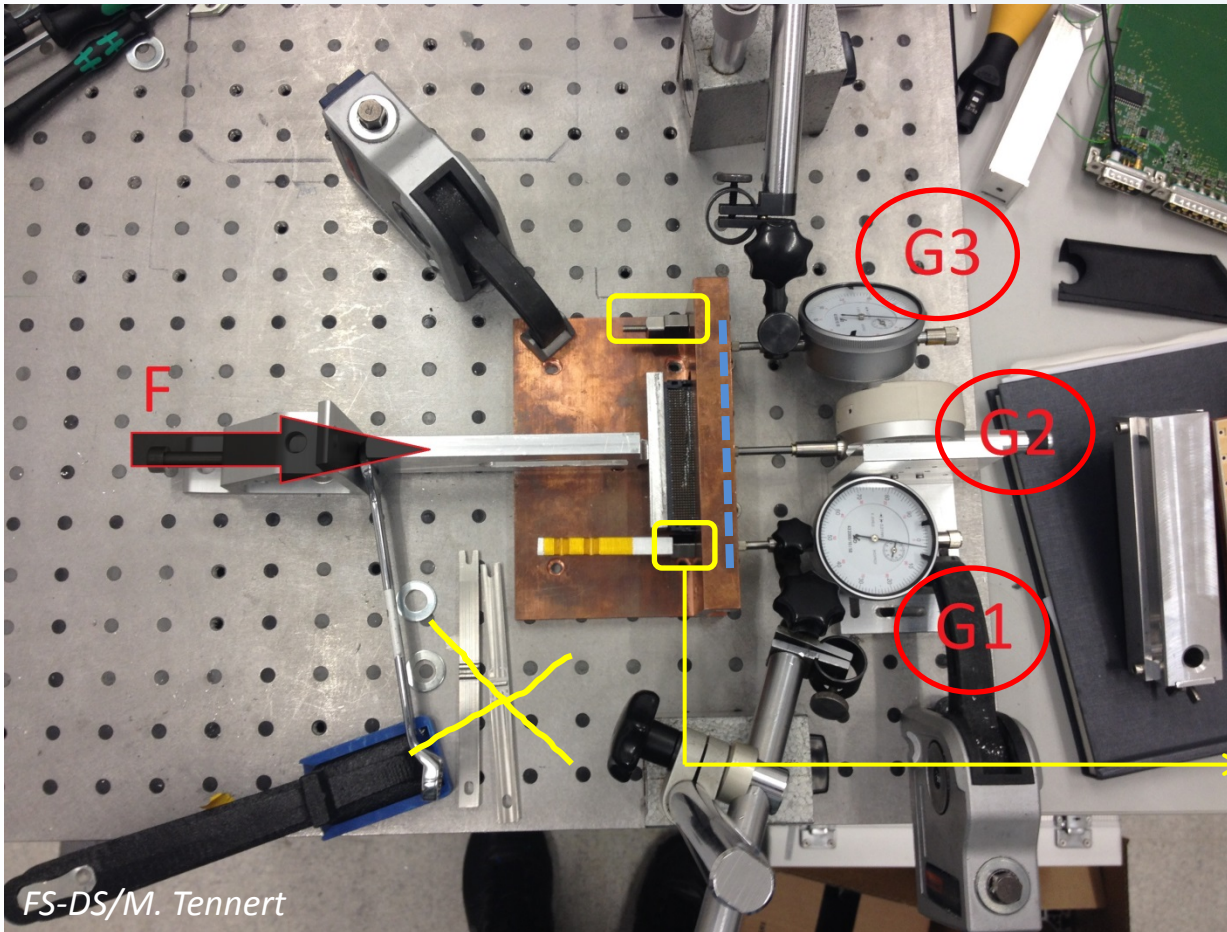




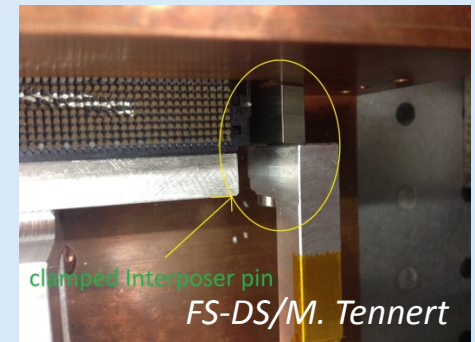
Tests in lab

- If forces of the pulling lever are not the issue, it must be the plug-in forces of the 500 pin connector.
- Test in lab results in weight of 11.42 kg needed to plug in the connectors.
- On the test-setup weight of 11.42 kg was transferred to a torque of 0.14 Nm (set-up see next slide).

Tests in lab

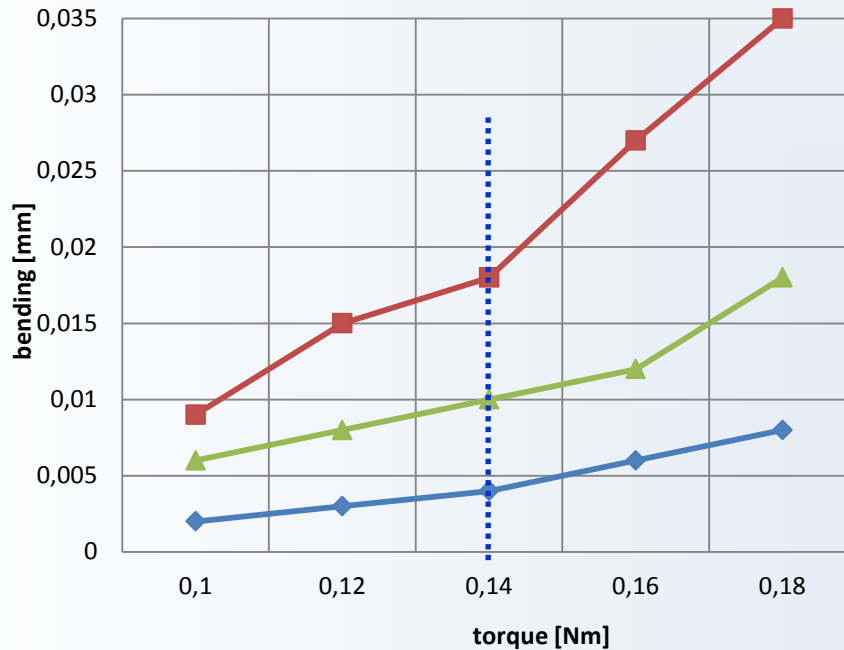


- Both sides of the interposer fixed to copper block, no pulling lever
- Dial gauges G1 and G3 survey the fixed points, G2 shows bending
- Interposer with LTCC used for test (invisible)



Tests in lab

bending of interposer by plug-in of connector



Bending at force of 11.42 kg
(blue dotted line):

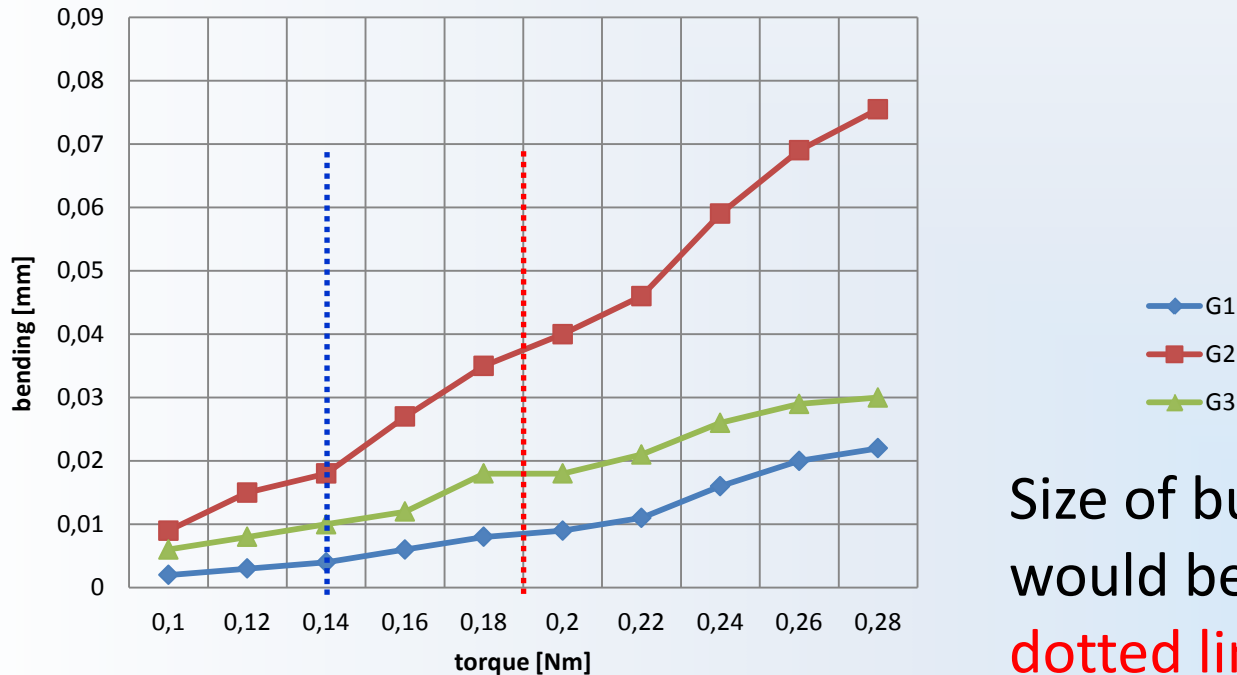
$$G2 - [(G1 + G3)/2] = 11 \mu\text{m}$$

- ◆ G1
- G2
- ▲ G3

M. Tennert

Tests in lab

bending of interposer by plug-in of connector



M. Tennert

Size of bump bonds would be hit at **red dotted line**.

(corresponds to 15 kg)



Why was the sensor module broken then?

→ Pulling lever pushed connector with brutal force into the interposer.

Will this happen again? (and why did it happen?)

→ No.

- Cooling block of single module did not have correct distance.
- All quadrant-cooling blocks will be checked before mounting to be on the safe side.



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- *Status of engineering work:*
 - External housing / cooling of boards scheduled to be designed end of 2015; order of parts scheduled for early January.
 - Design from/to Swagelok fitting on cooling tube of detector has tbd with XFEL.
- *Status of parts to be produced / purchased:*
 - *Most parts were/will be delayed by ~3-4 weeks, but no showstoppers so far.*
- *Status of mounting:*
 - *Mounting of quadrant starts with delivery of cooling blocks (end of week 47).*
 - *Mounting of motion stages and actuators into vacuum chamber planned for December.*
- *Status of interposer tests:*
 - Deficient stability of interposer could be excluded as an issue by simulation and tests.
 - Correct geometry on quadrant cooling blocks will be checked.



Thanks for your attention!

Questions?