First Ideas about the Mechanics of the DEPFET PXD @ SuperBelle

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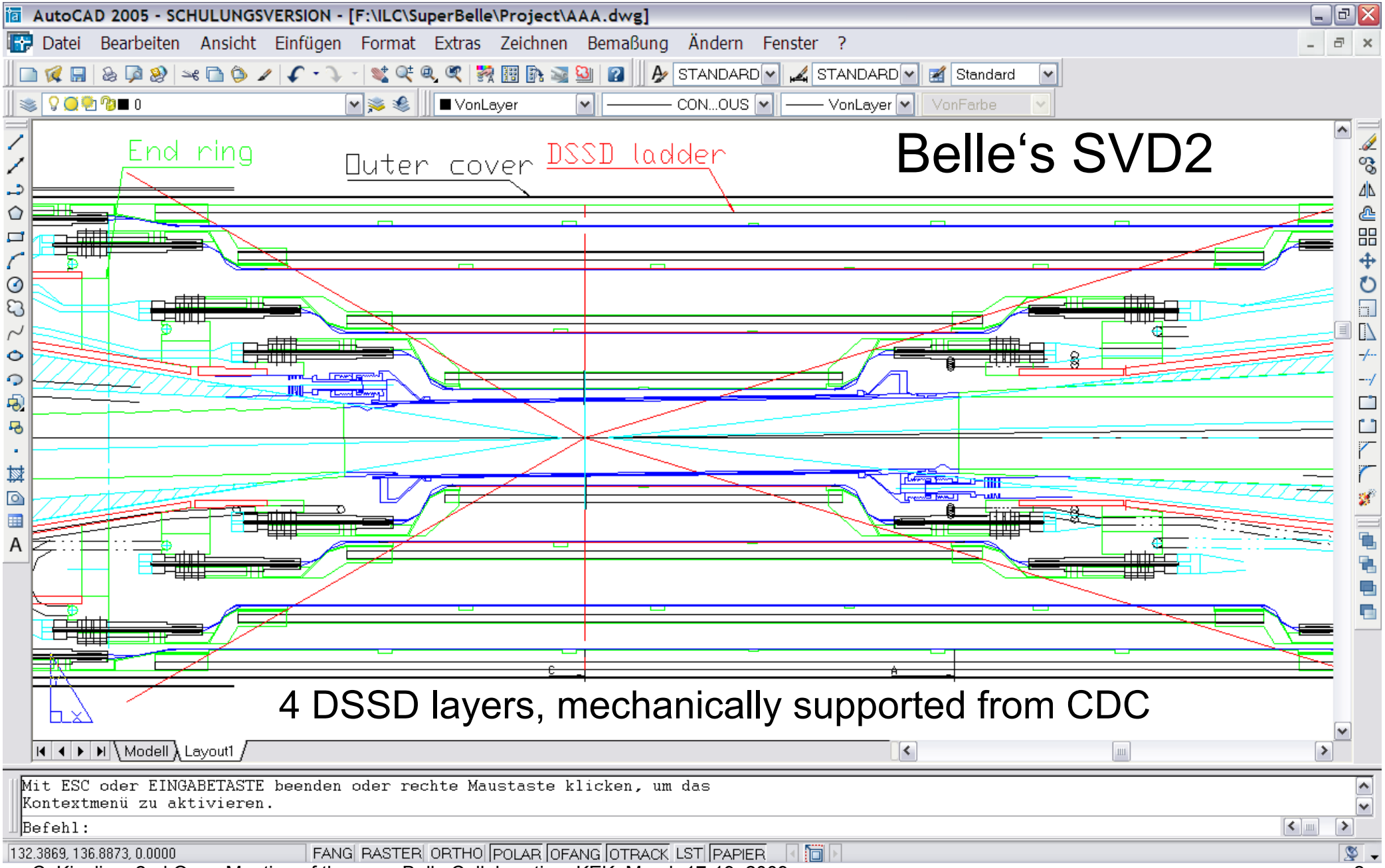
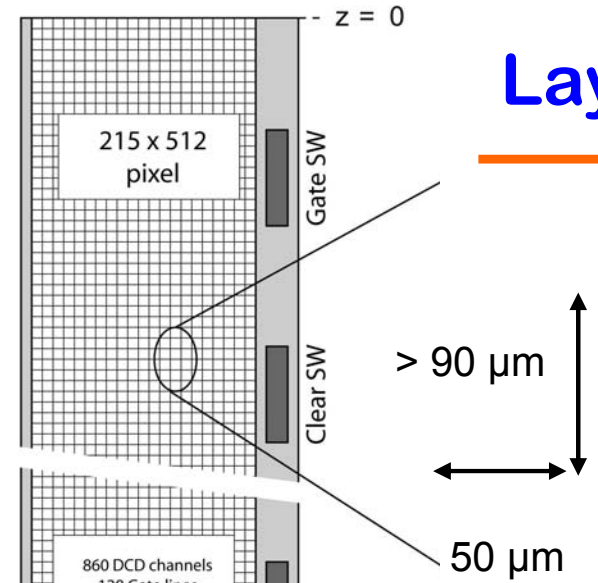
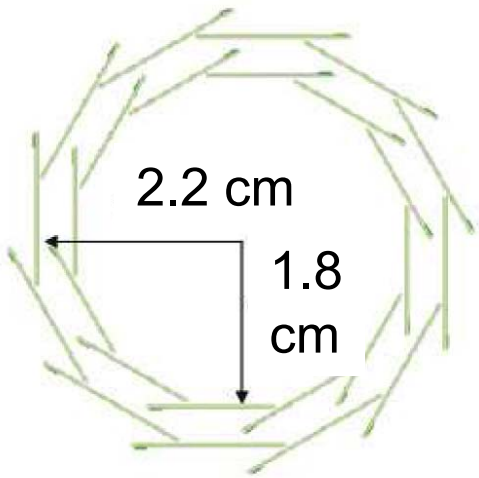
- Support of the Belle / SuperBelle SVD
- Discussion of the sensor dimensions
- Design of the PXD Support
- Conclusion

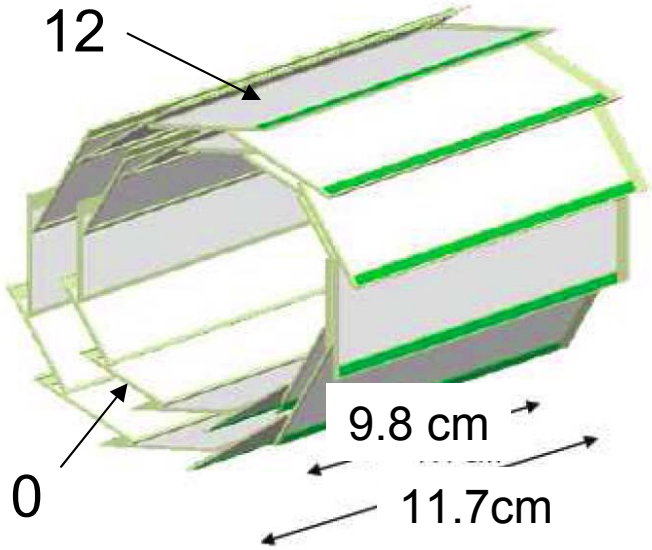
Support of the Belle / SuperBelle SVD



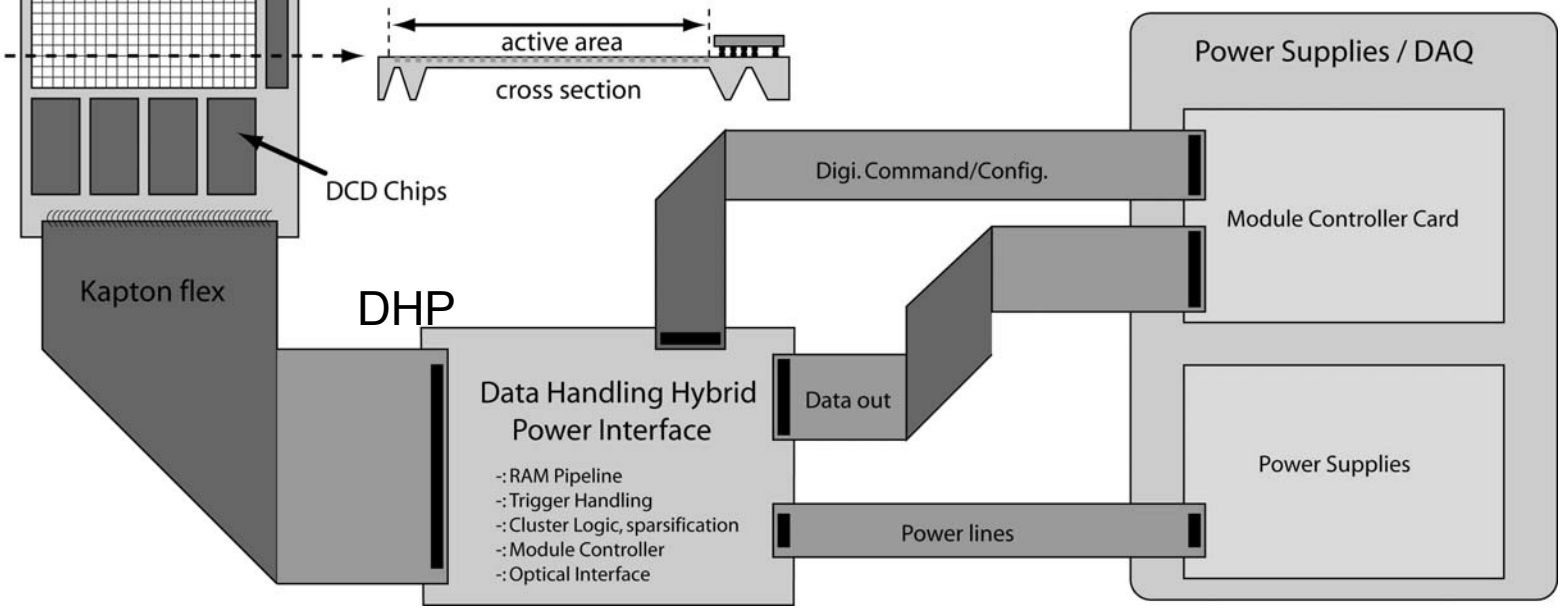
Layout of the DEPFET PXD for SuperBelle







(sensitive area)

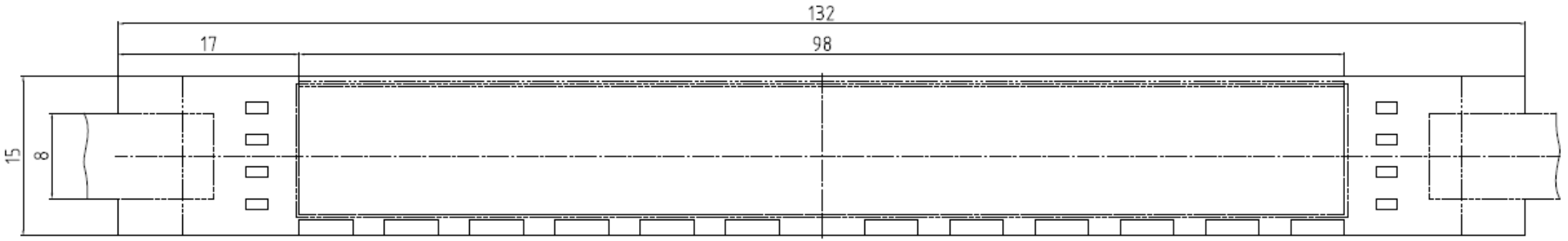


How to support the ladders?

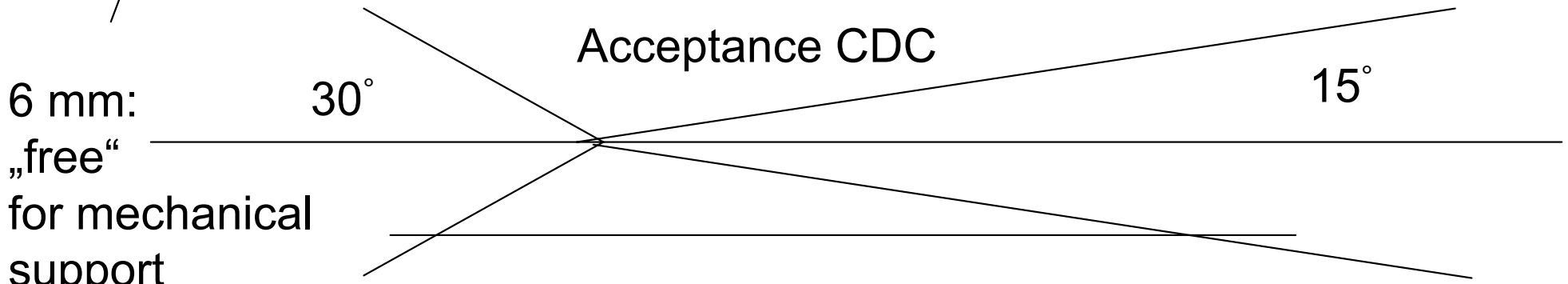
No consideration how to support the DHH so far

PXD Ladders: Size Limitations

Sensors cut from 6 inch wafers: max. sensitive length: 10 cm



DHP/DCD (11 mm space along the nodule)

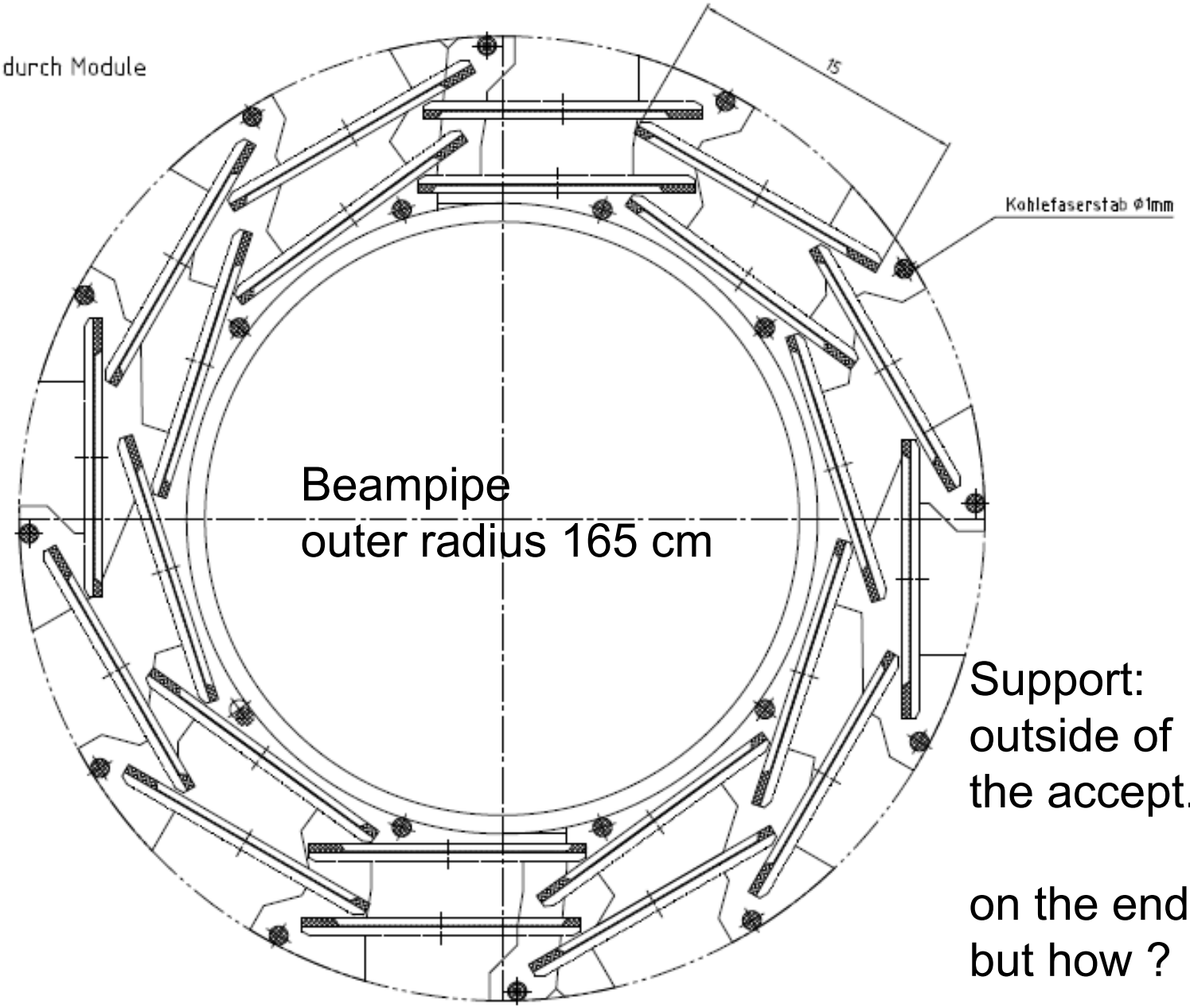


6 mm:
„free“
for mechanical
support
structures

This limits the maximal radius for innermost (monolithic) layer to 1.8 cm

PXD Ladders: Arrangement around the beam

Ladders should be mounted on the beampipe to get as close as possible to the vertex



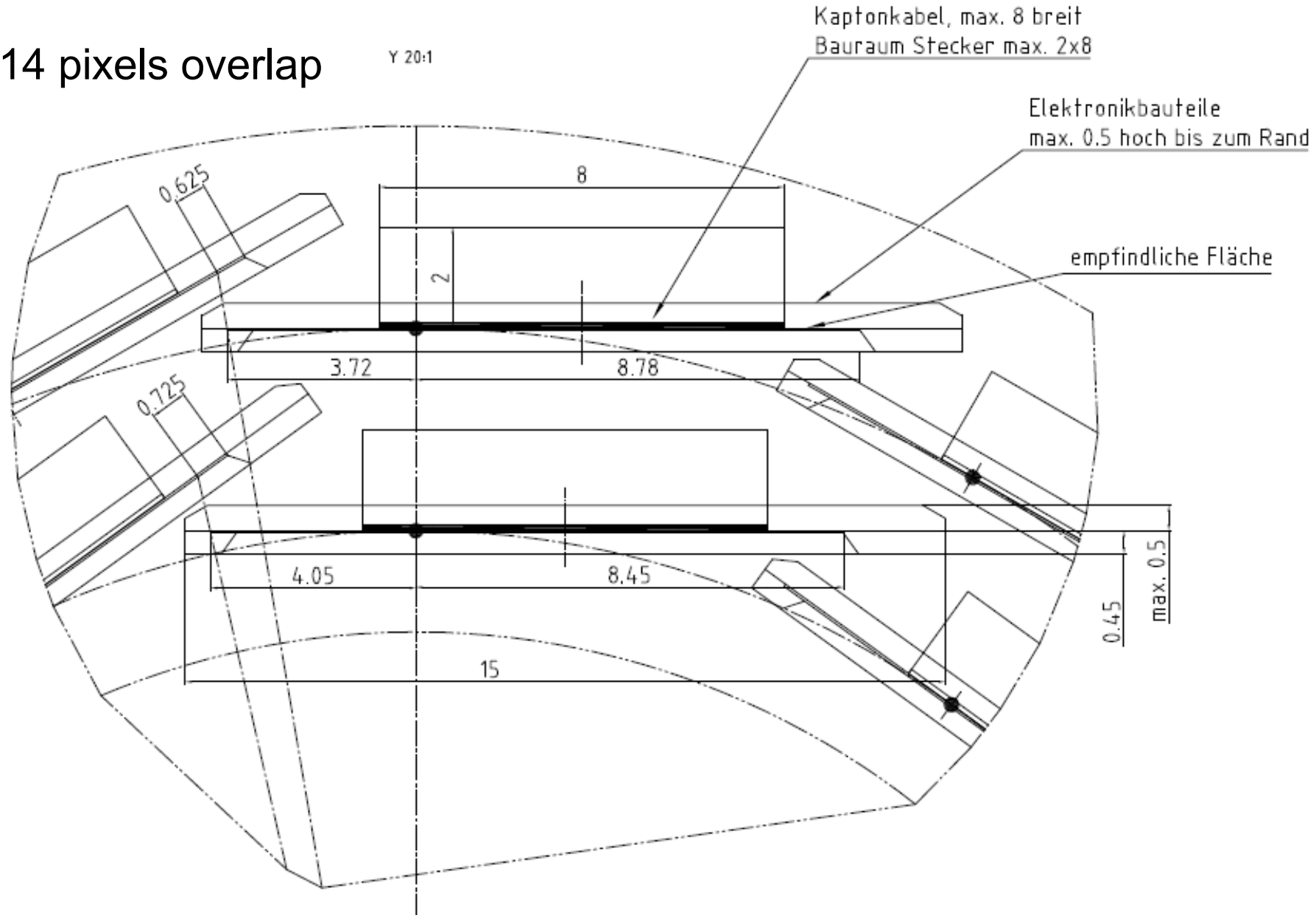
Layer 1 : 1.8 cm
Layer 2: 2,2 cm

Support: outside of the accept.,

on the ends, but how ?

Pixel Overlap

12 – 14 pixels overlap



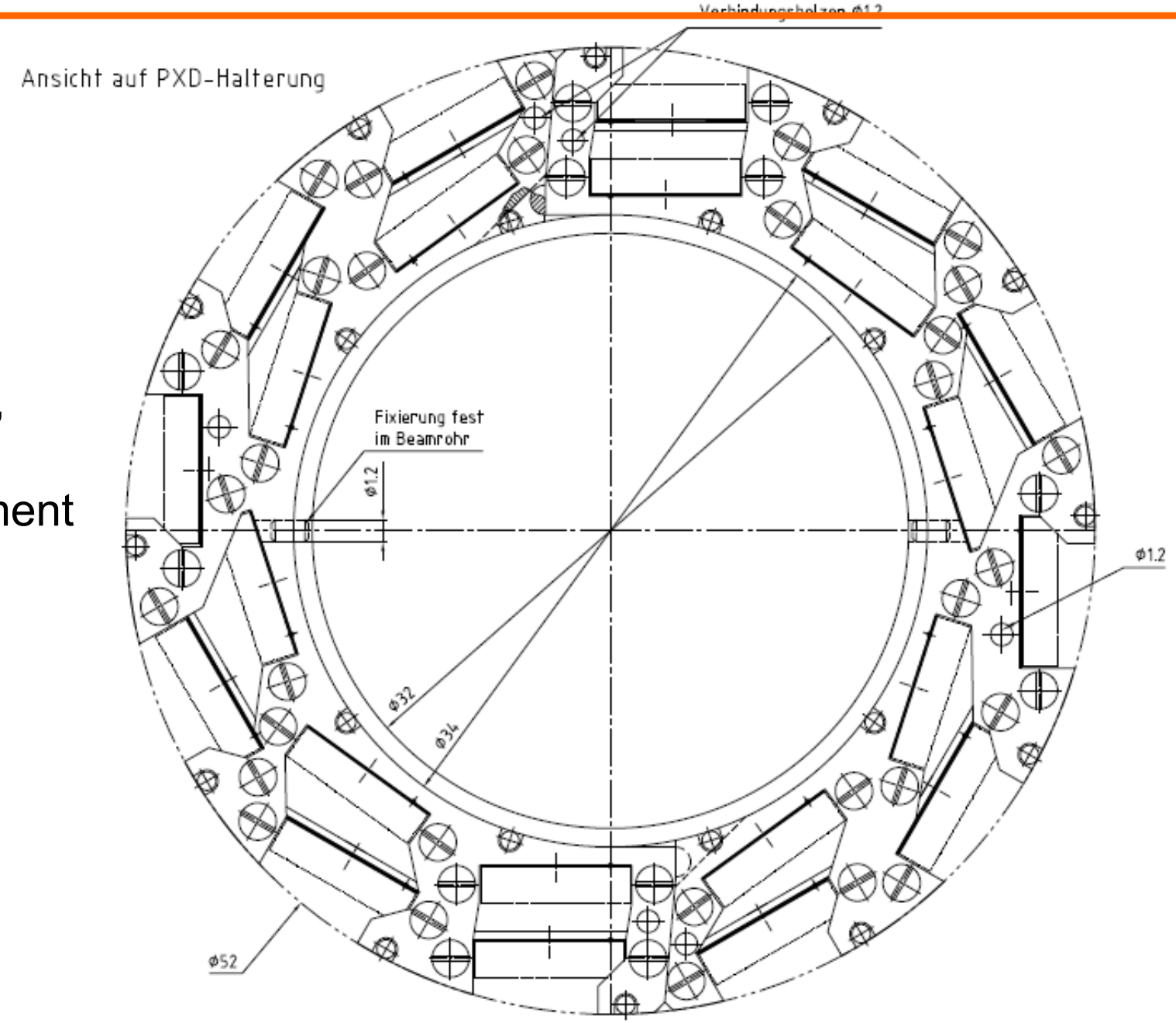
Support Structure on the ends

2 half shells,

front and back
connected
by carbon fibres,

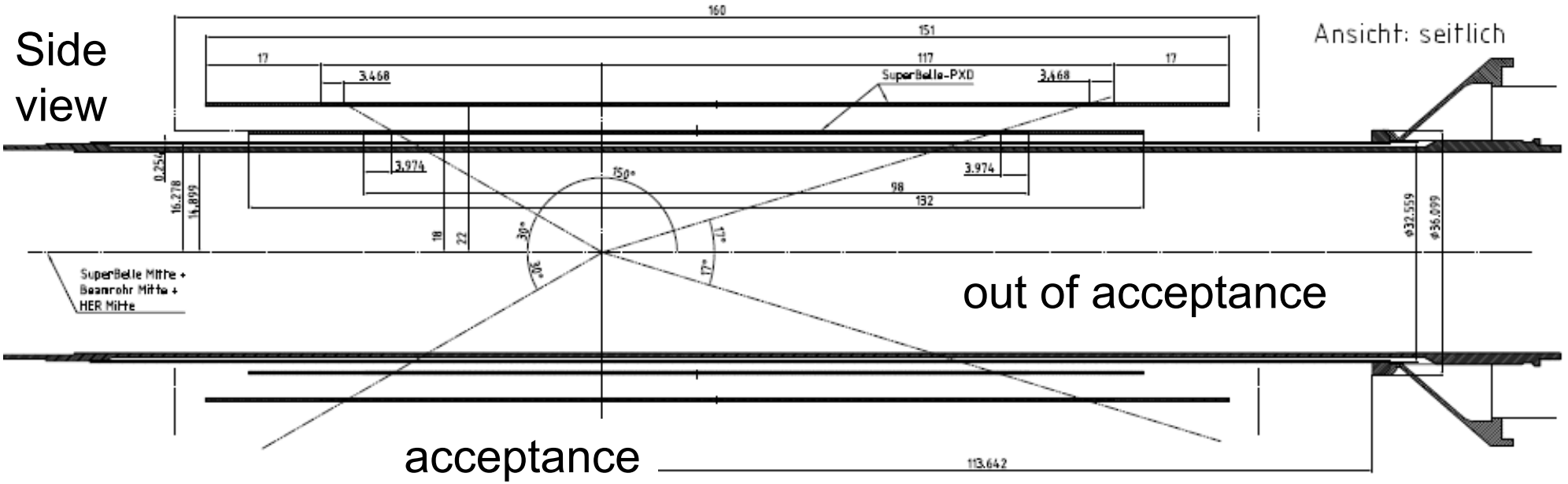
distance adjustment
by pins on the
beampipe

Half shells fixed
by screws

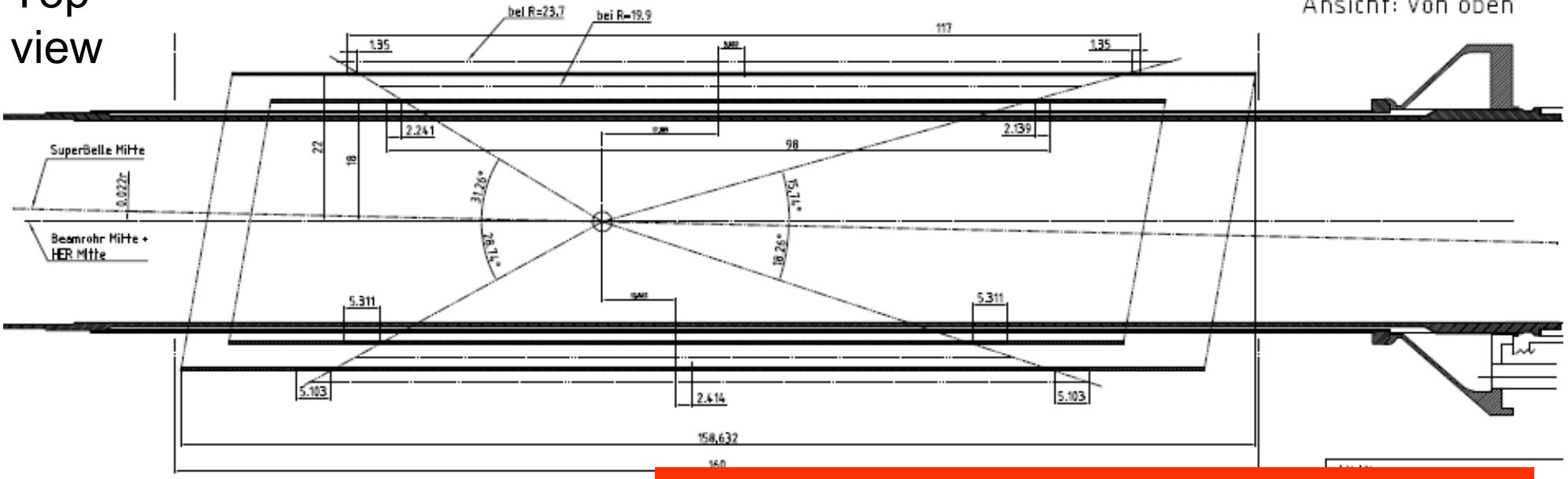


PXD Ladders: Longitudinal dimensions

Side view

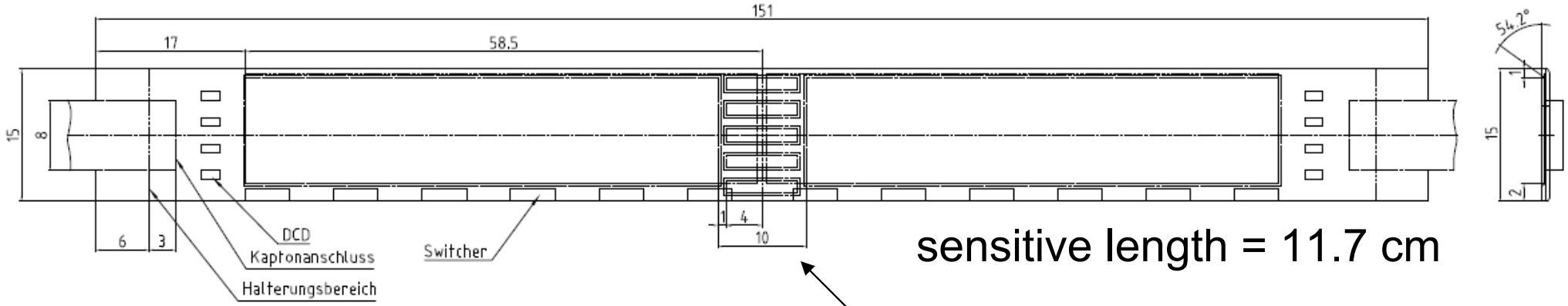


Top view



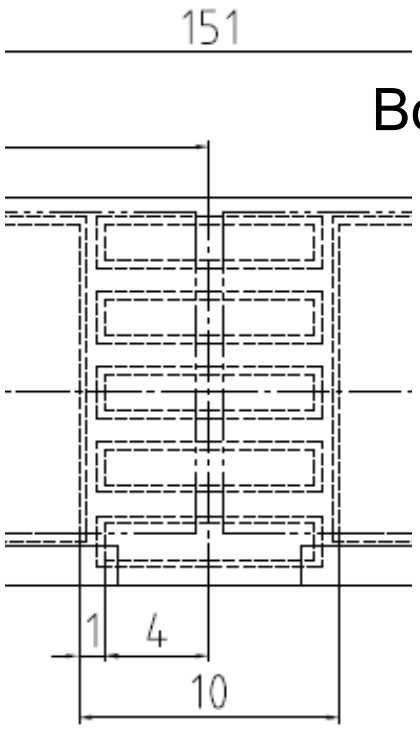
Outer layer must be mechanically divided

Division of the Outer PXD Ladder

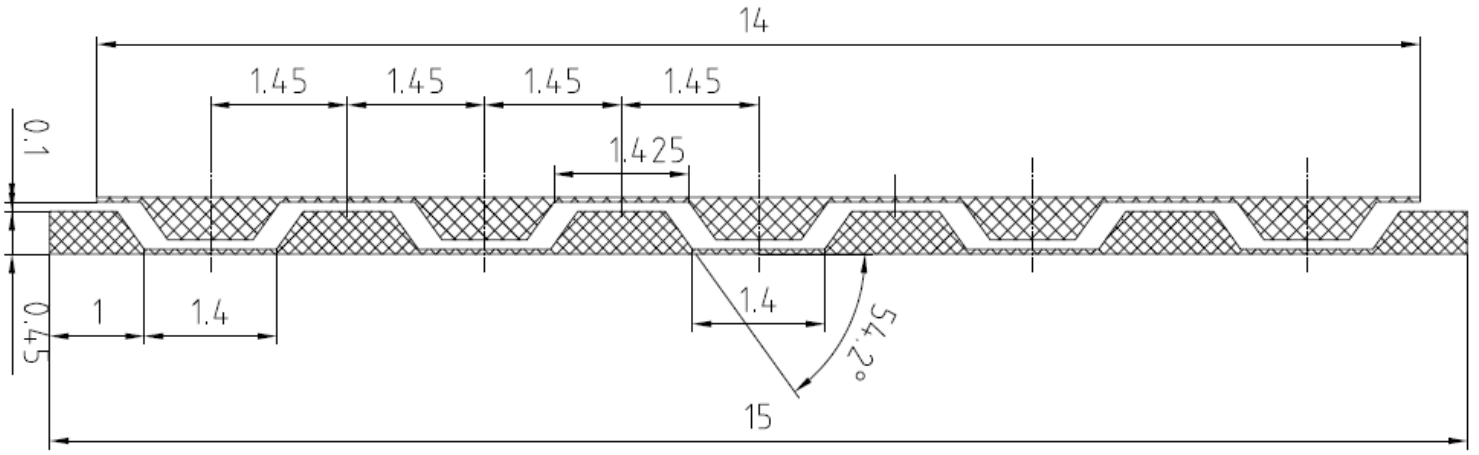


sensitive length = 11.7 cm

Mechanical separation

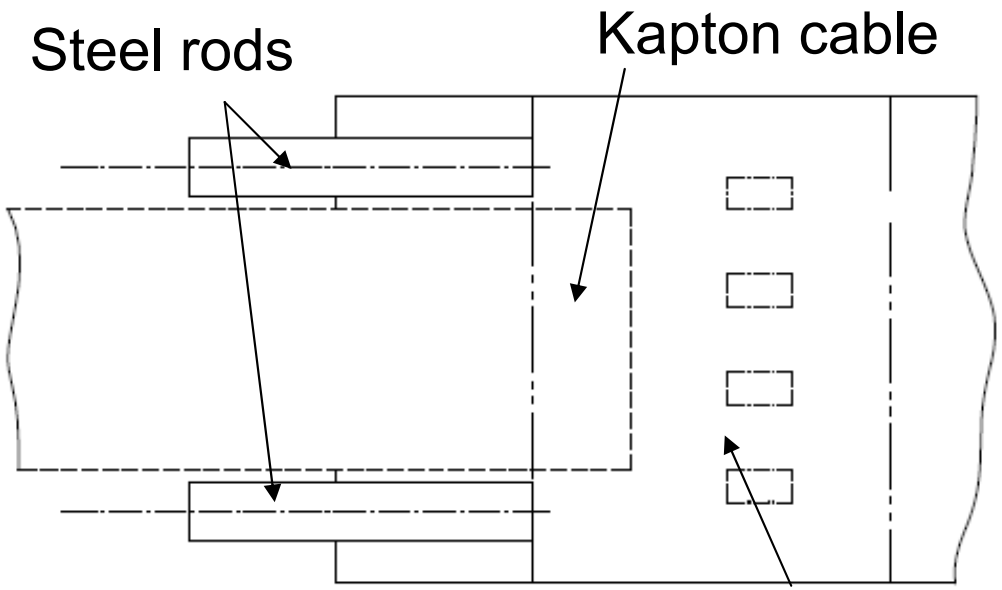


Bond area NOT thinned!

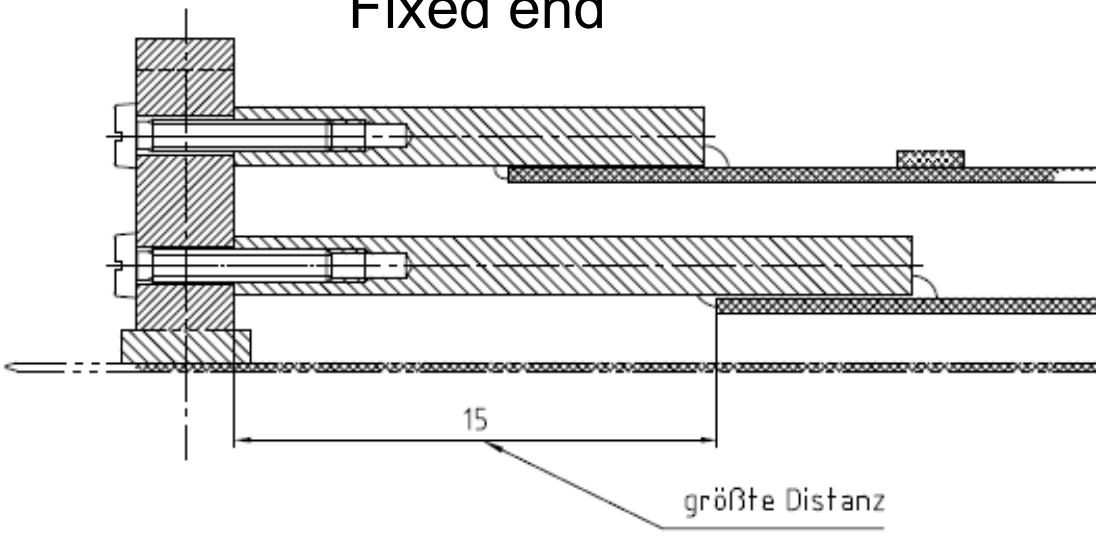


Note: separation will not be symmetric
(same nr. of pixel rows on each side required)

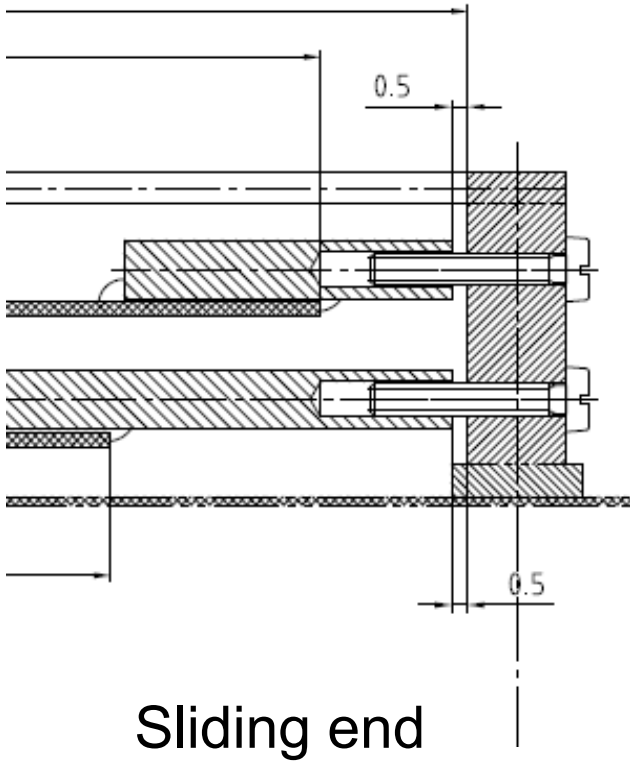
Support on the Ends, first Version



Fixed end

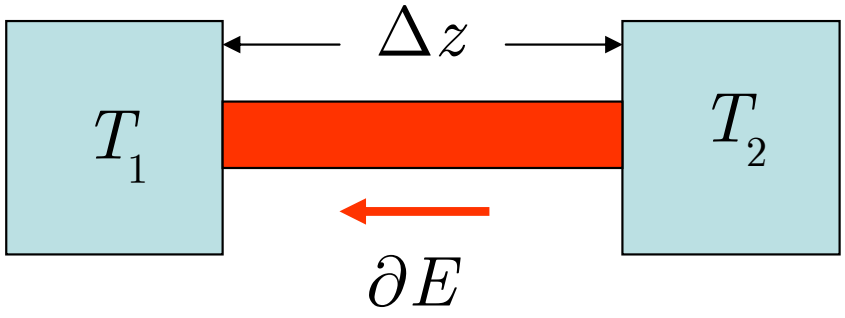


Precision-glued steel (alu) rods on each side

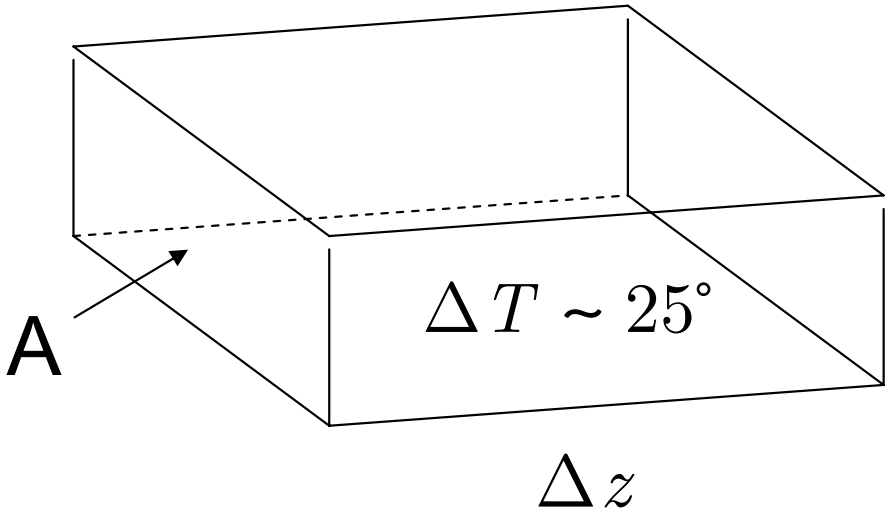


Sliding end

Why does this not Work? The Cooling Issue



$$T_1 \sim 15^\circ \qquad T_2 \sim 40^\circ$$



$$P = \frac{\partial E}{\partial t} = \lambda \cdot A \cdot \frac{\Delta T}{\Delta z}$$

$$J\left[\frac{W}{m^2}\right] = \lambda\left[\frac{W}{mK}\right]\frac{\partial T}{\partial z}$$

$$\text{Al:} \quad \lambda = 200\left[\frac{W}{mK}\right]$$

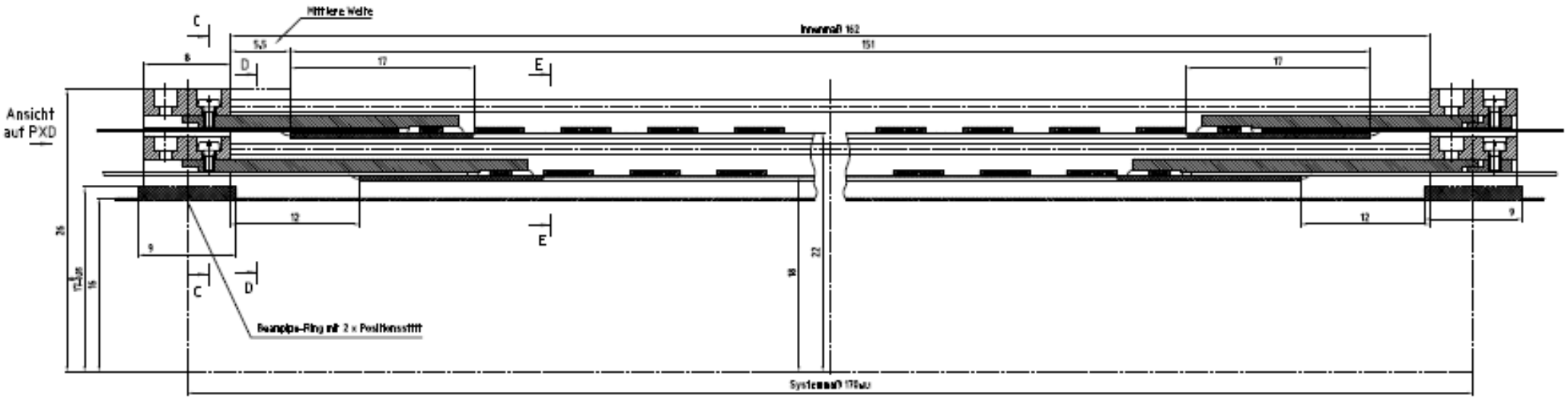
$$P = 5 \text{ W} \quad \Delta z \sim 2 \text{ cm}$$

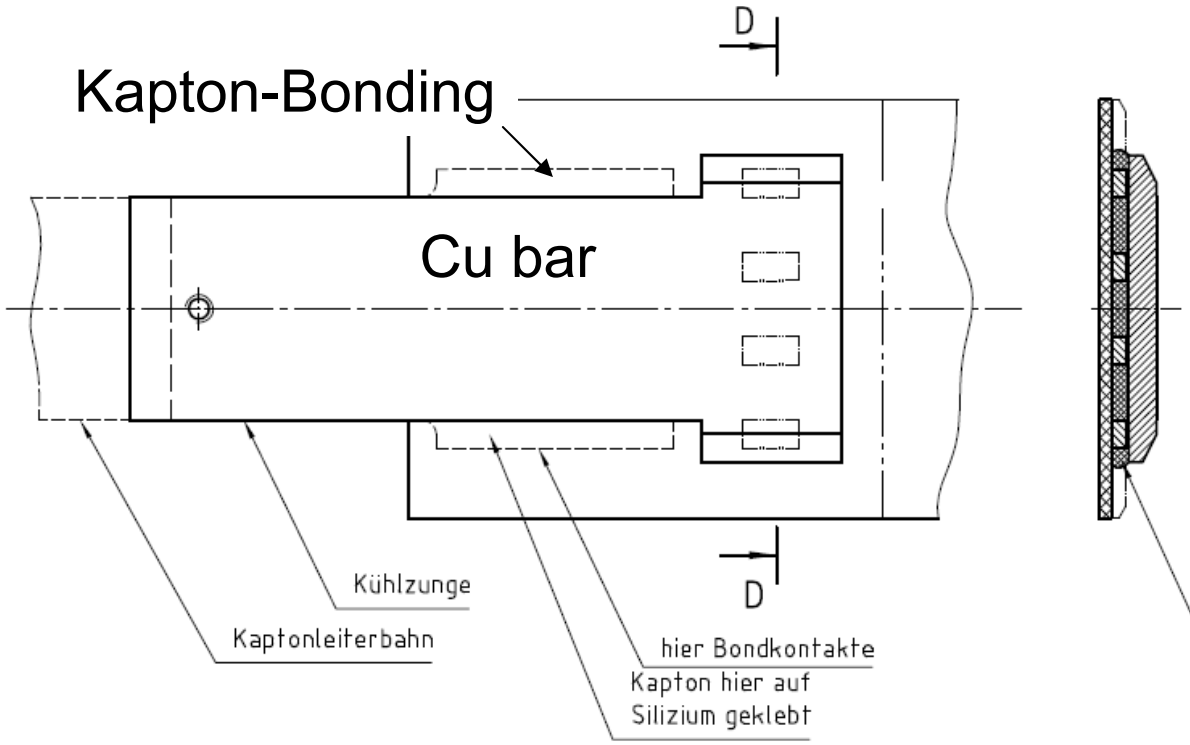
$$A \sim 20 \text{ mm}^2$$

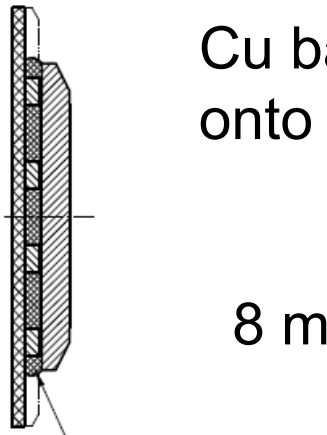
Steel: Factor 4 more !!!

Need Cu (λ=380) ⟶ 10 mm²

Design No. 2



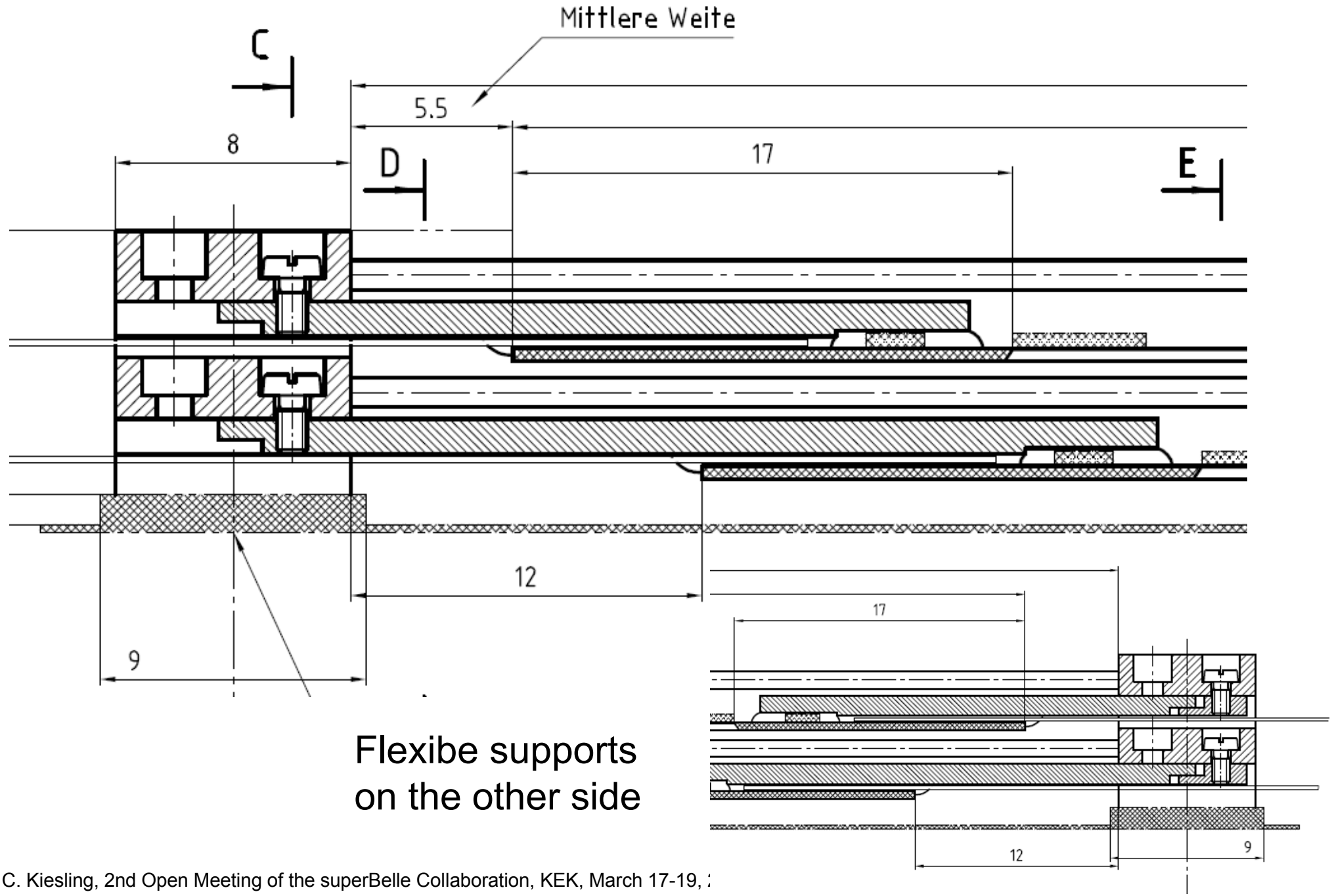




Cu bar glued
onto the electronics

8 mm x 1.2 mm

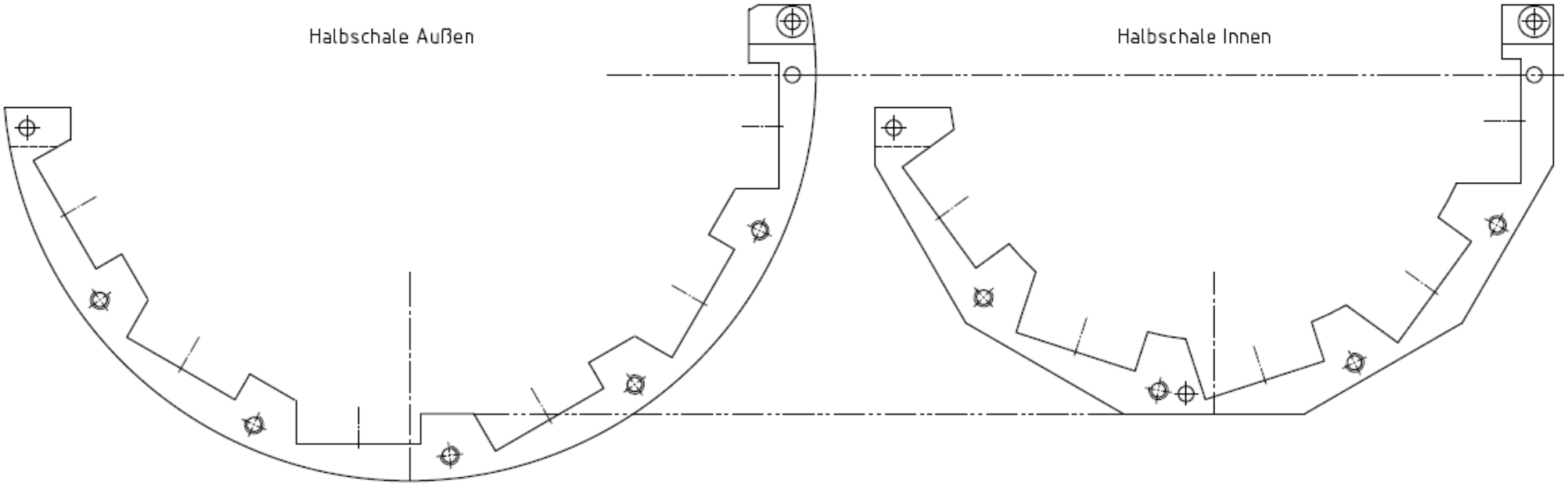
New Supports on the Ends



Flexibe supports
on the other side

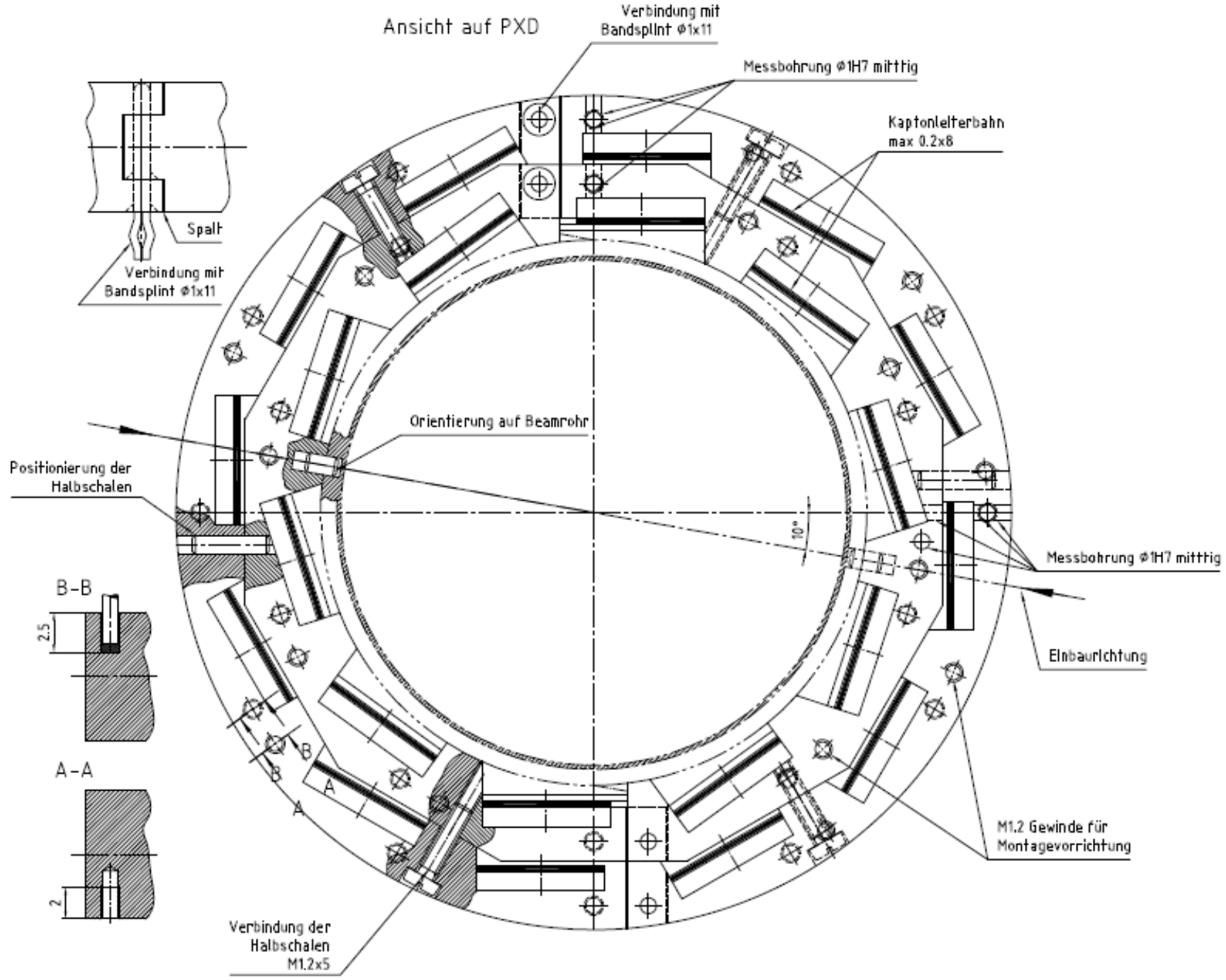
Increased Modularity

Inner and outer layers mechanically separated (2 half shells)

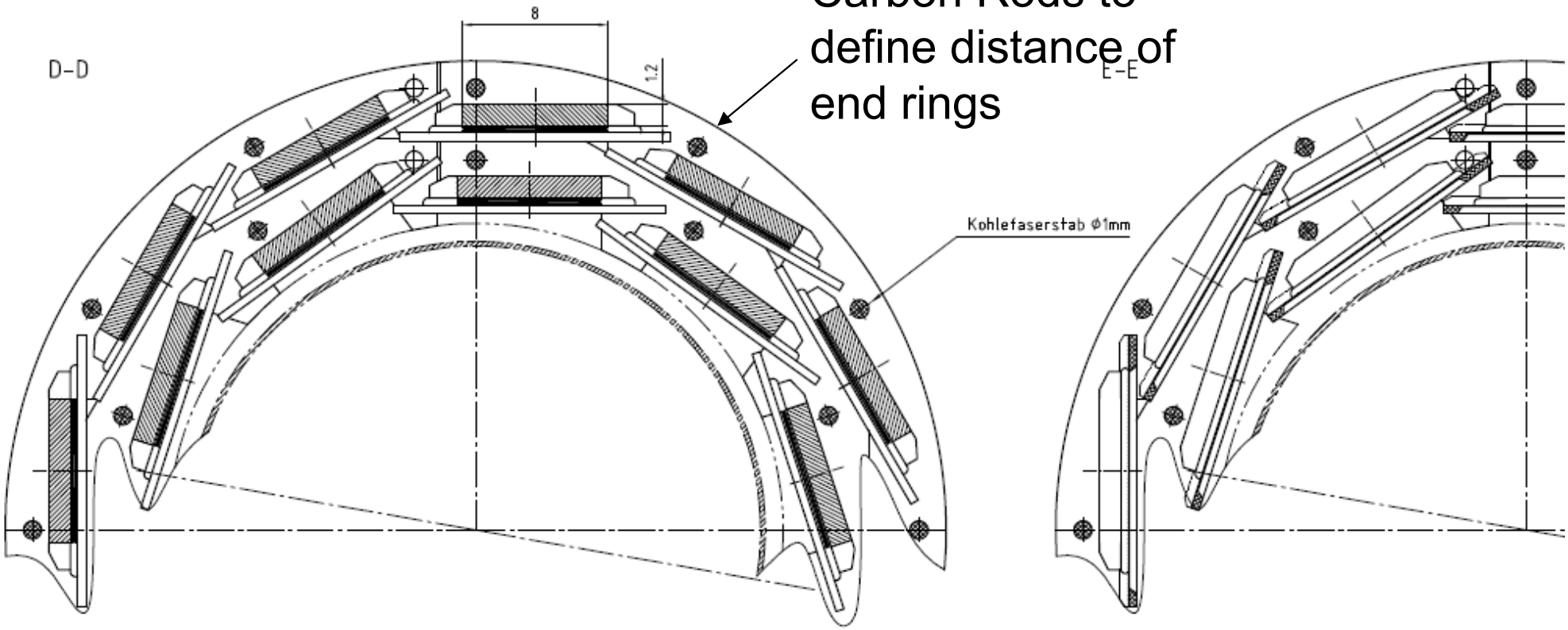


mechanics suited to add a layer 0 on the inside

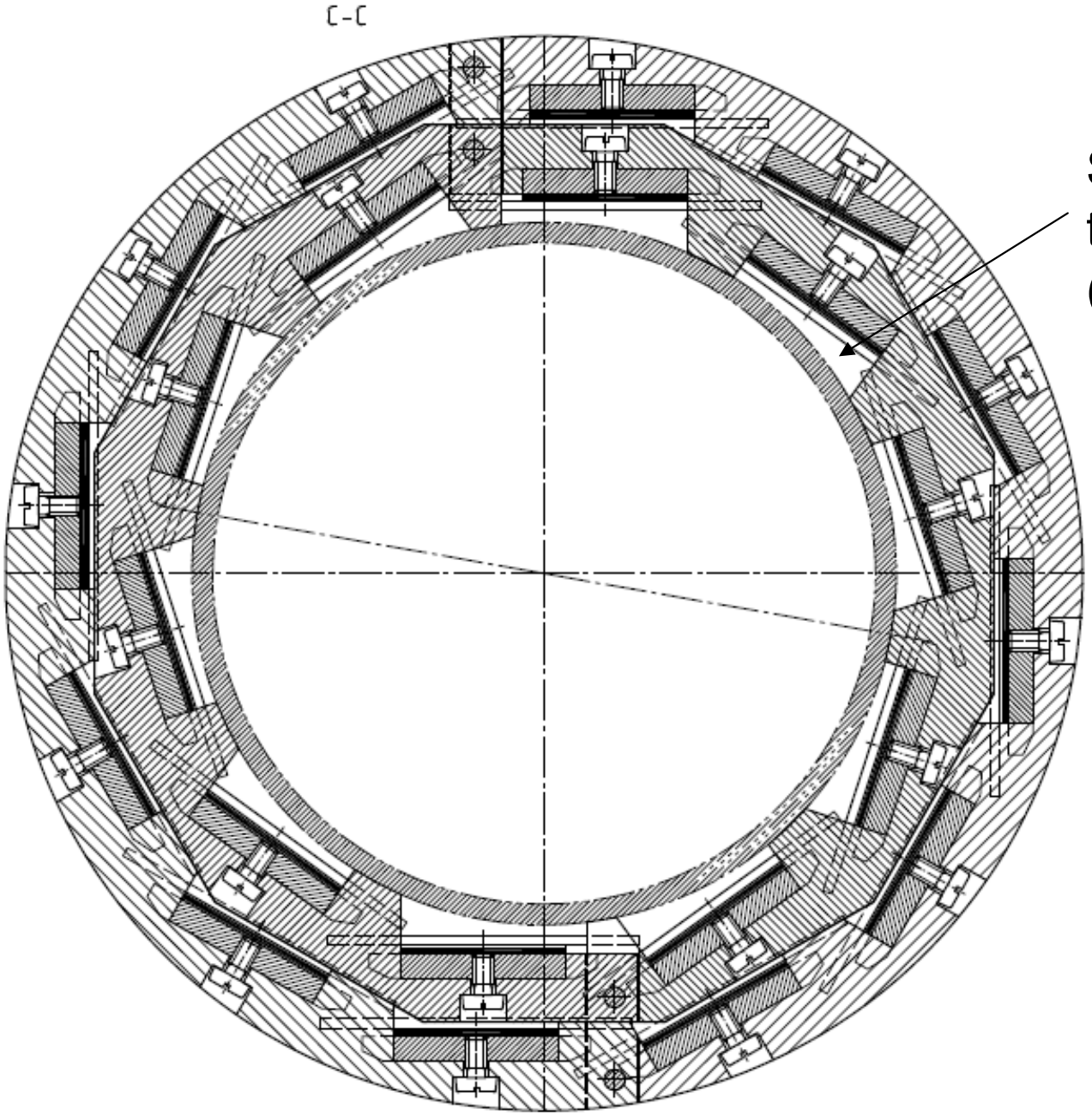
Assembly of the Two Layers



Cross Sections End / Sensitive Area



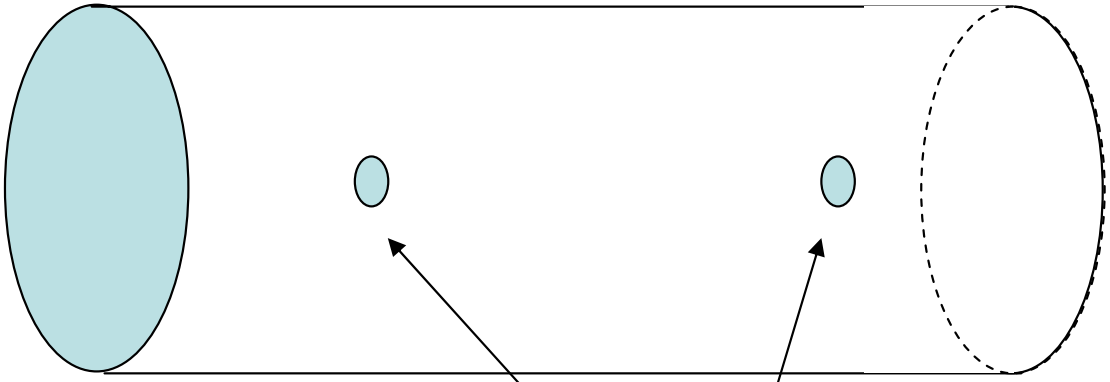
View on End Rings



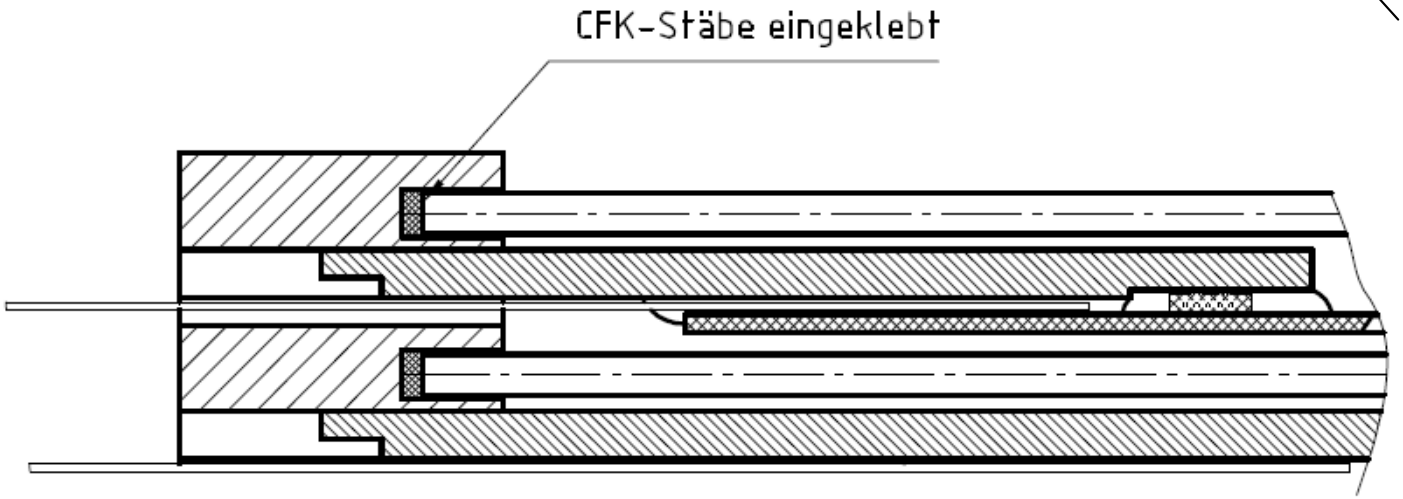
Space for cooling gas to the DEPFET / Switcher (inner layer)

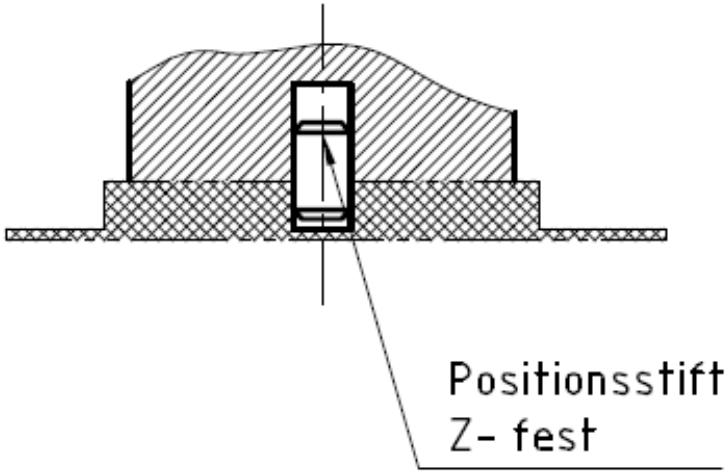
Outer layer to be cooled from above

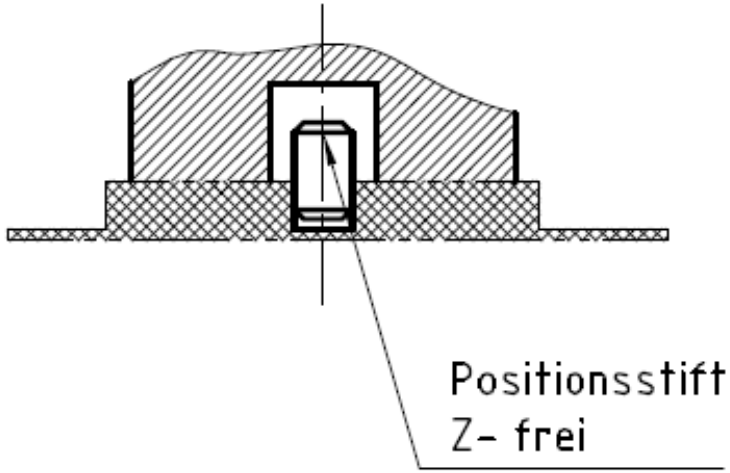
Mounting on Beampipe



Precision studs







Conclusions

- First ideas of mechanics has been discussed during last weeks

  Features:: PXD is mounted on the beampipe
  insist on monolithic sensor area for the first layer
  need to separate 2nd layer in order to keep acceptance
  due to tilt of beam axis need shifted ladder mechanics

  (need elaborate alignment strategy -> work is ongoing)

- Design has been prepared solving this problem

- Not studied yet: cooling of the sensor / switcher with gas

- No details yet on mounting of the DHH (Kapton-> Optical Fibre)

- Proposal: Start discussions with the IR / SVD groups