

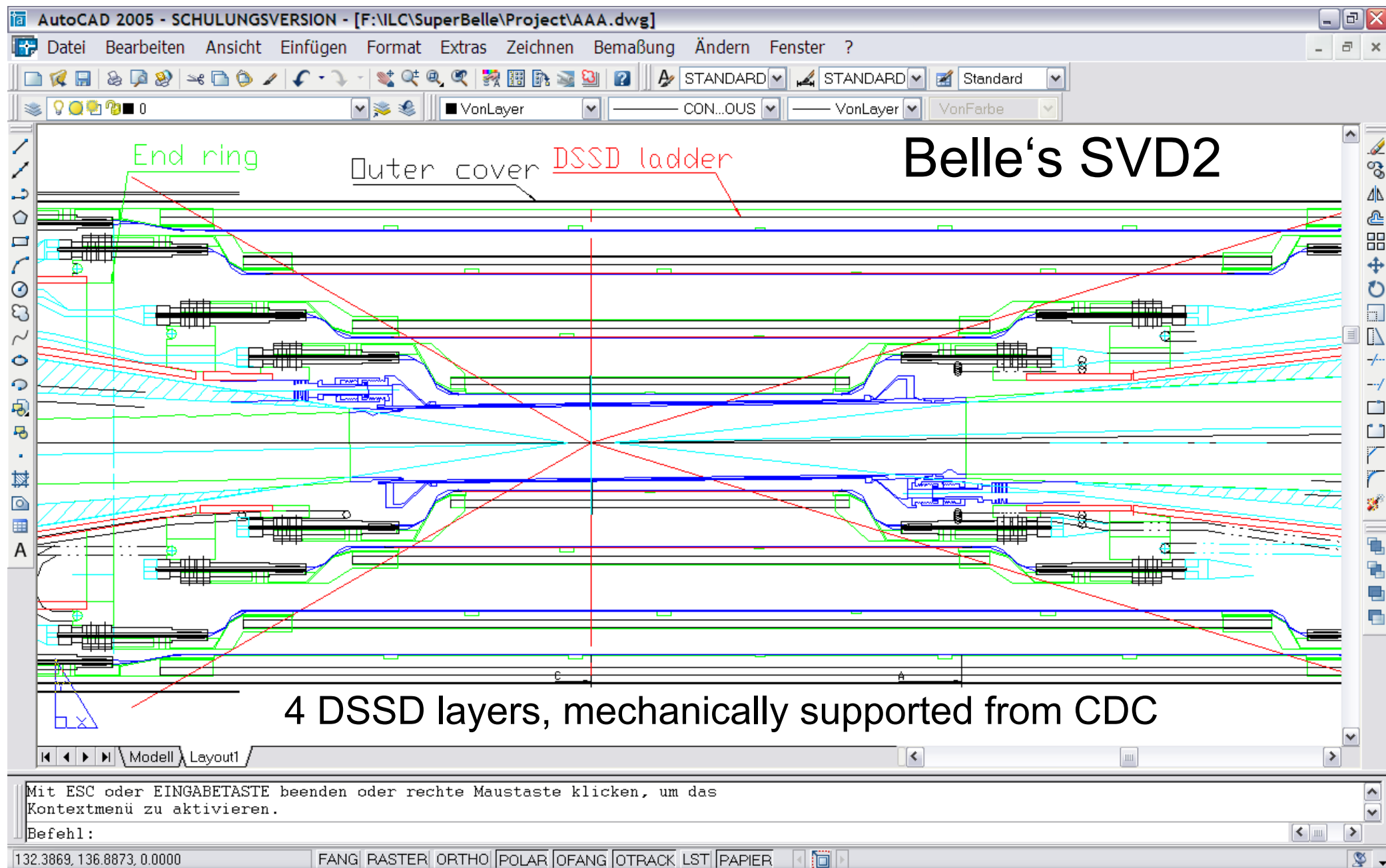


Mechanics of the DEPFET PXD @ Belle II

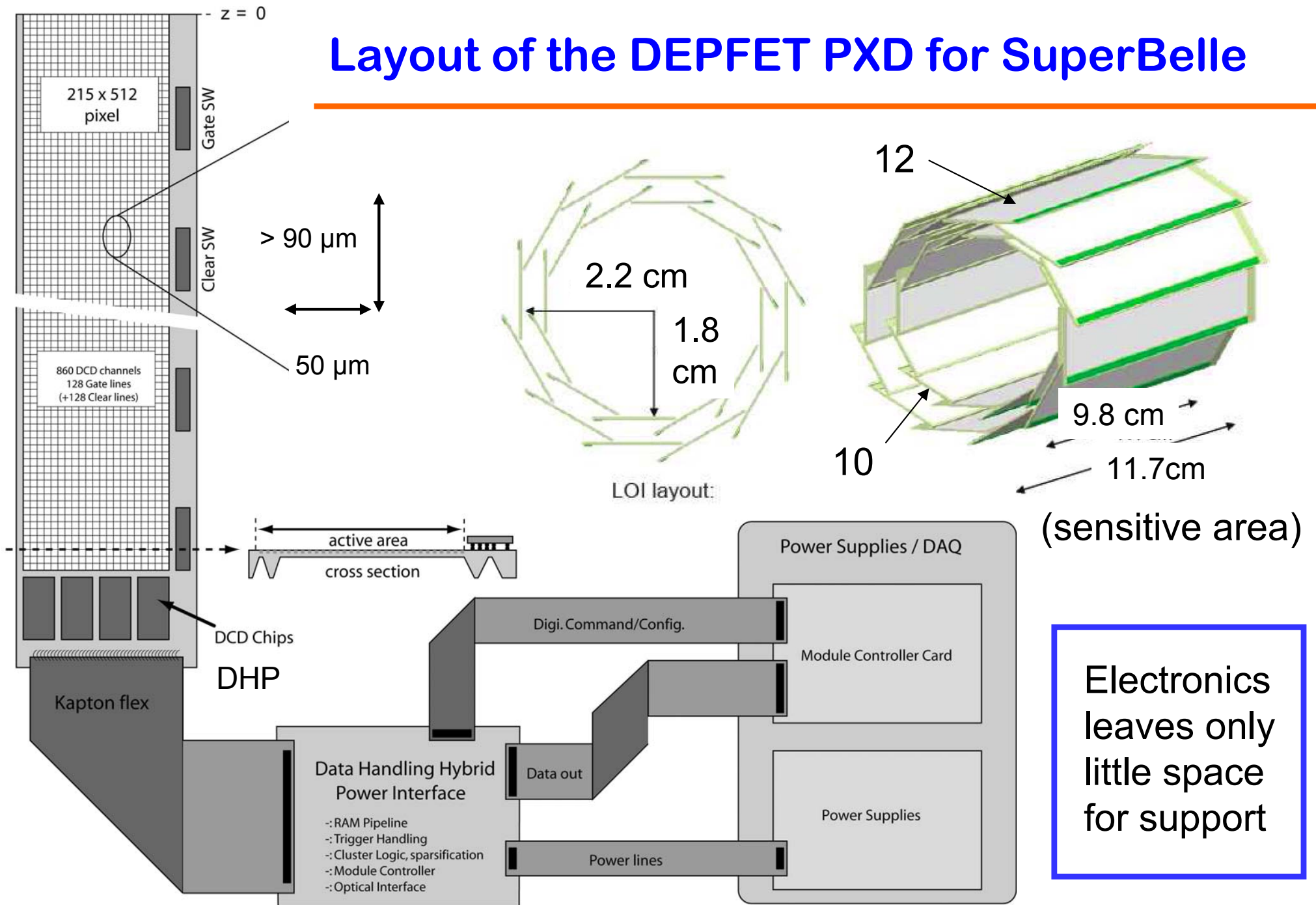
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MPI for Physics, Munich

- Discussion of the sensor dimensions
- Design of the PXD Support
- Cooling Issues
- Conclusions

Support of the Belle / Belle II SVD



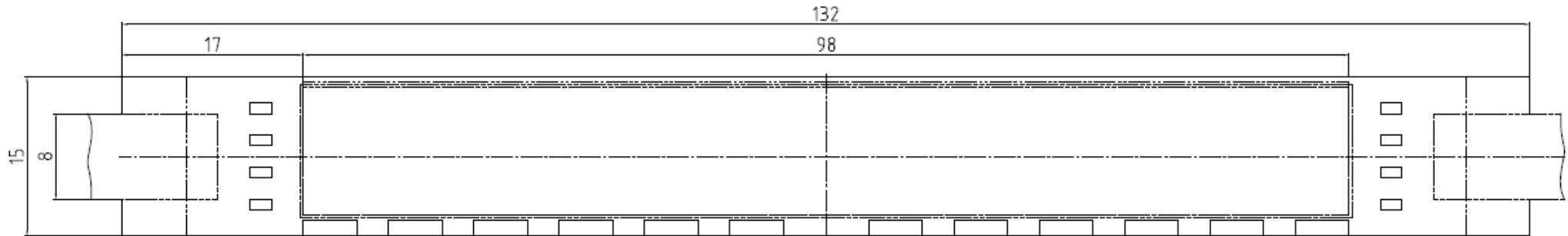
Layout of the DEPFET PXD for SuperBelle



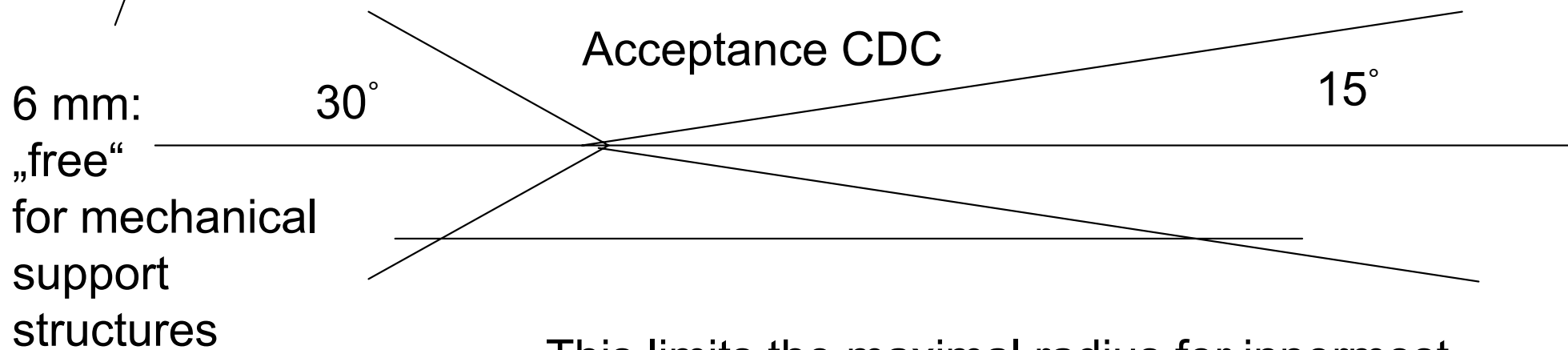
Electronics leaves only little space for support

PXD Ladders: Size Limitations

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



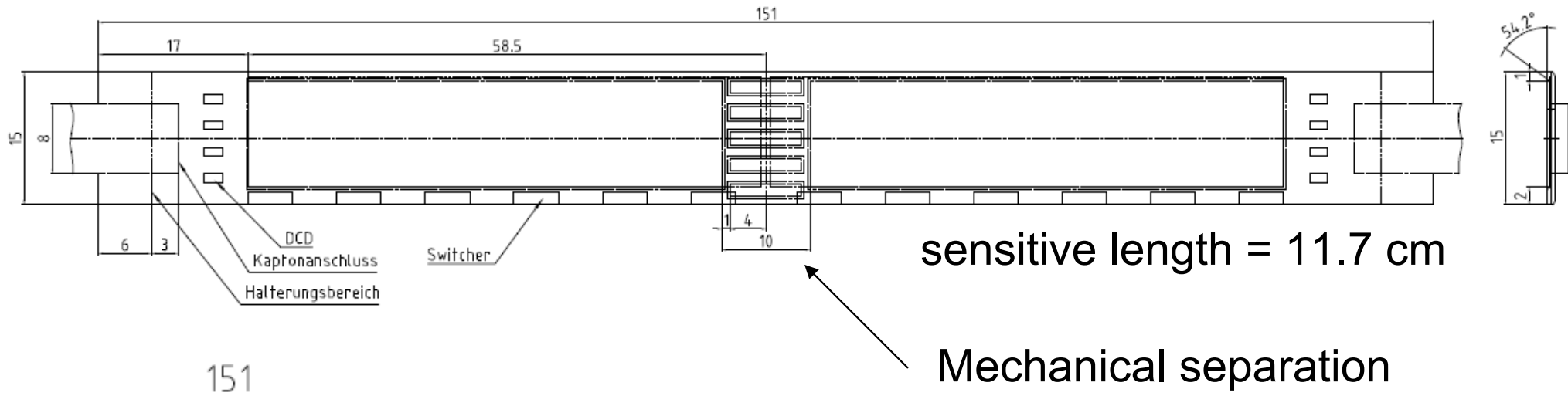
DHP/DCD (11 mm space along the nodule)



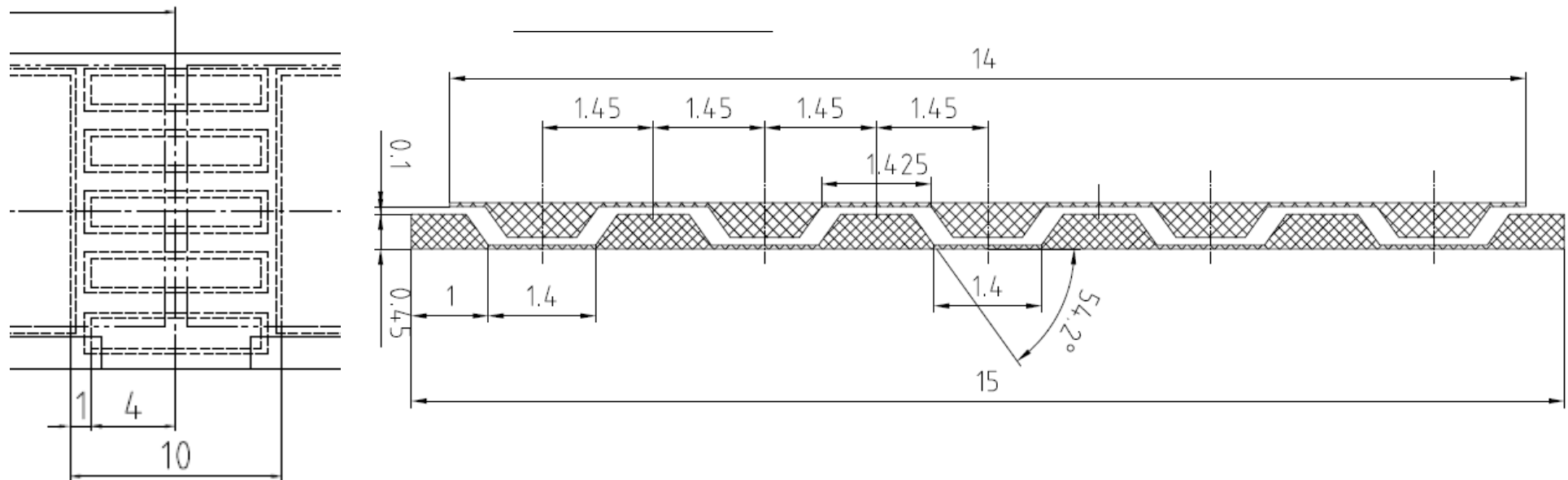
This limits the maximal radius for innermost (monolithic) layer to 1.8 cm

Now eaten up by Kapton connection

Division of the Outer PXD Ladder



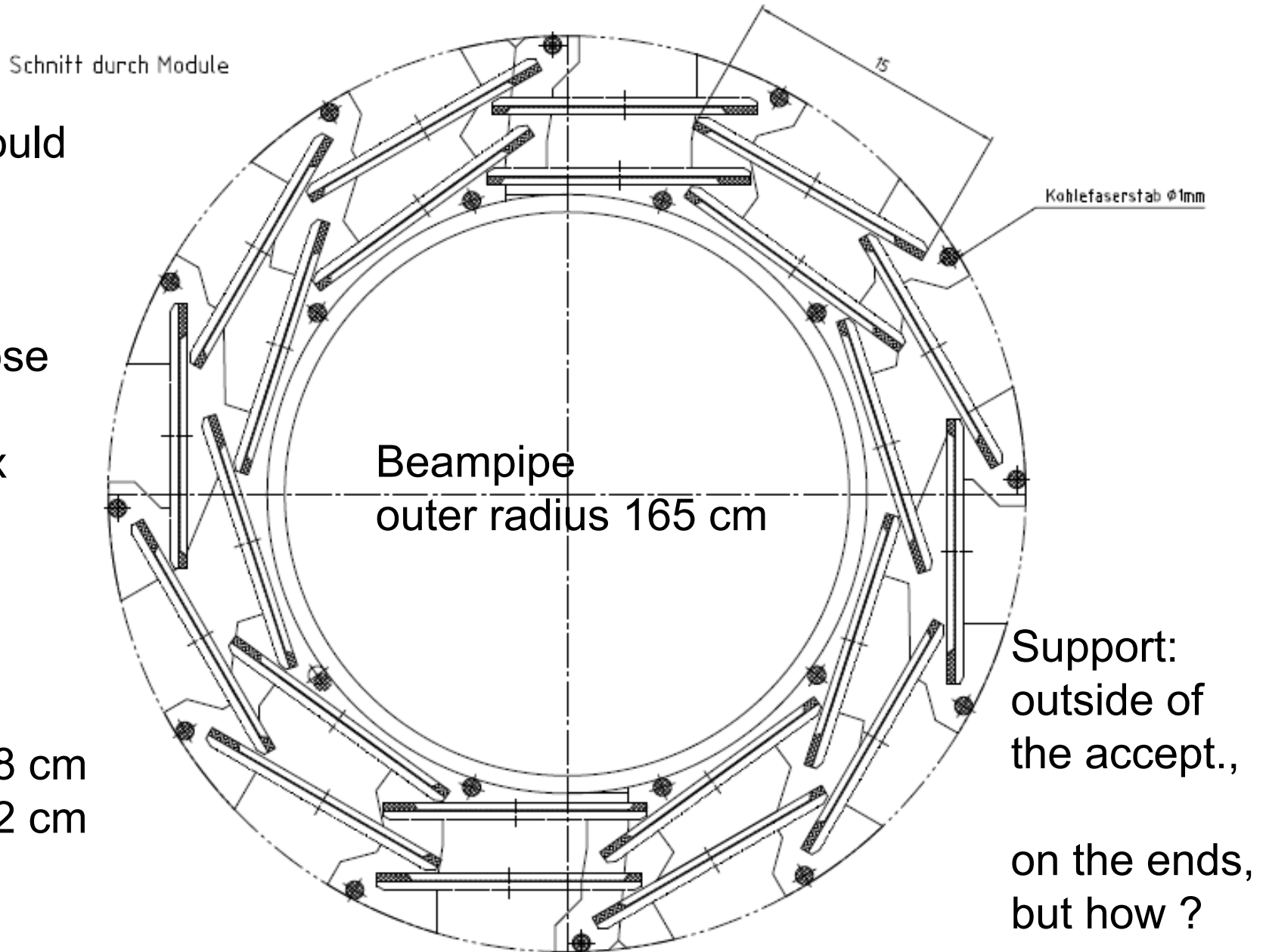
Bond area NOT thinned!



PXD Ladders: Arrangement around the beam

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

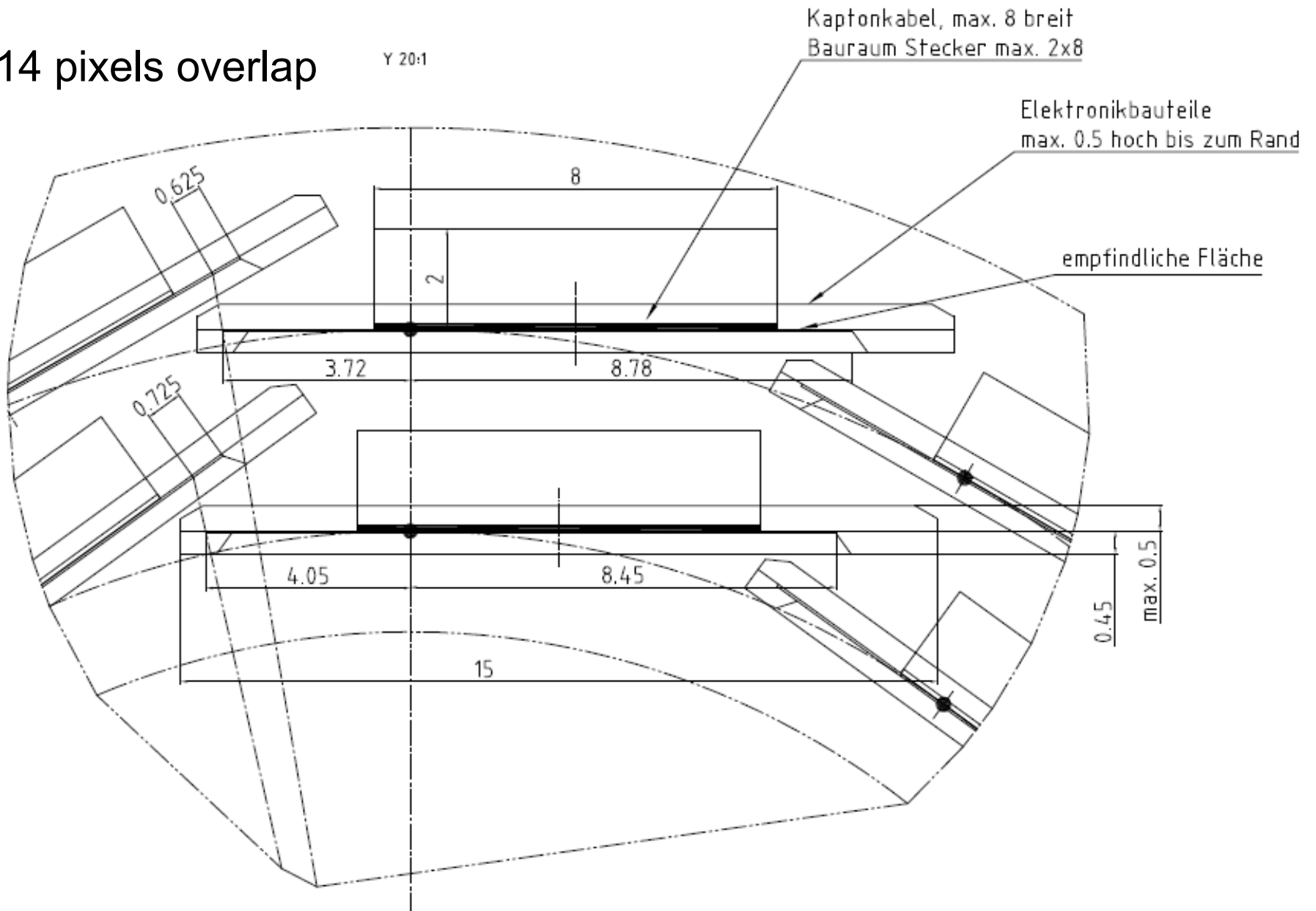
Layer 1 : 1.8 cm
Layer 2: 2,2 cm



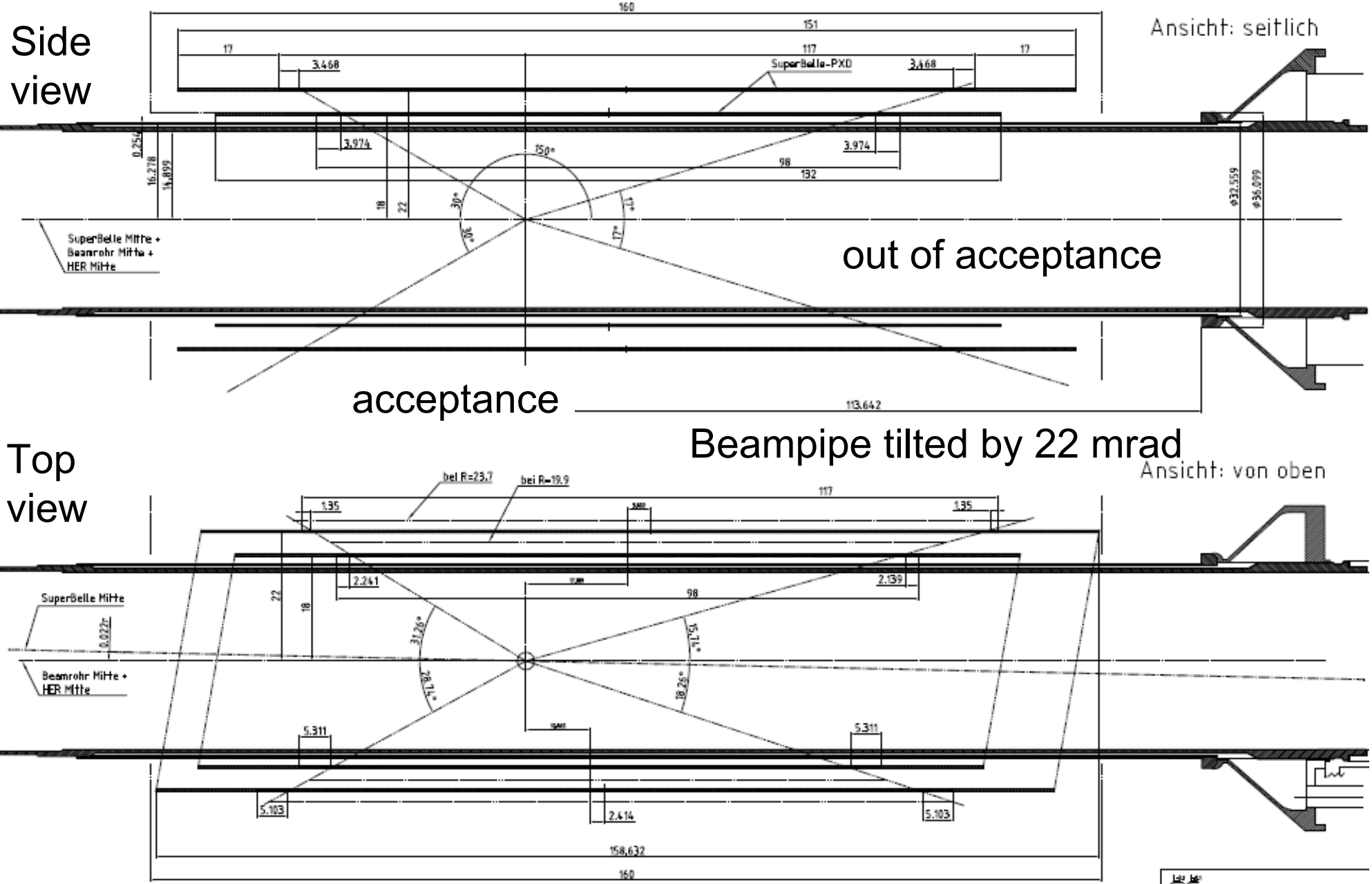
Support:
outside of
the accept.,
on the ends,
but how ?

Pixel Overlap

12 – 14 pixels overlap



PXD Ladders: Longitudinal dimensions

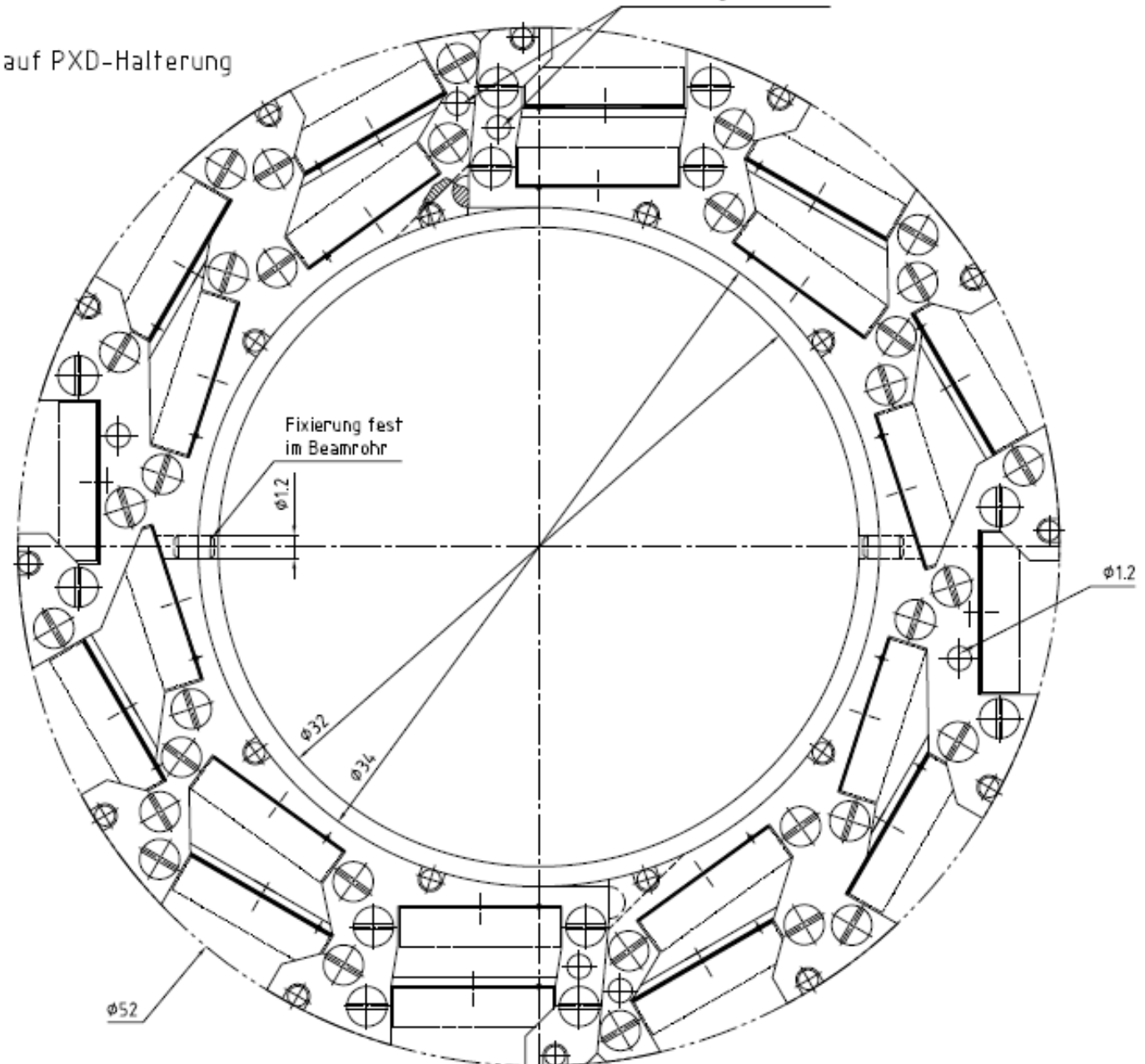


Support Structure on the ends (Version 1)

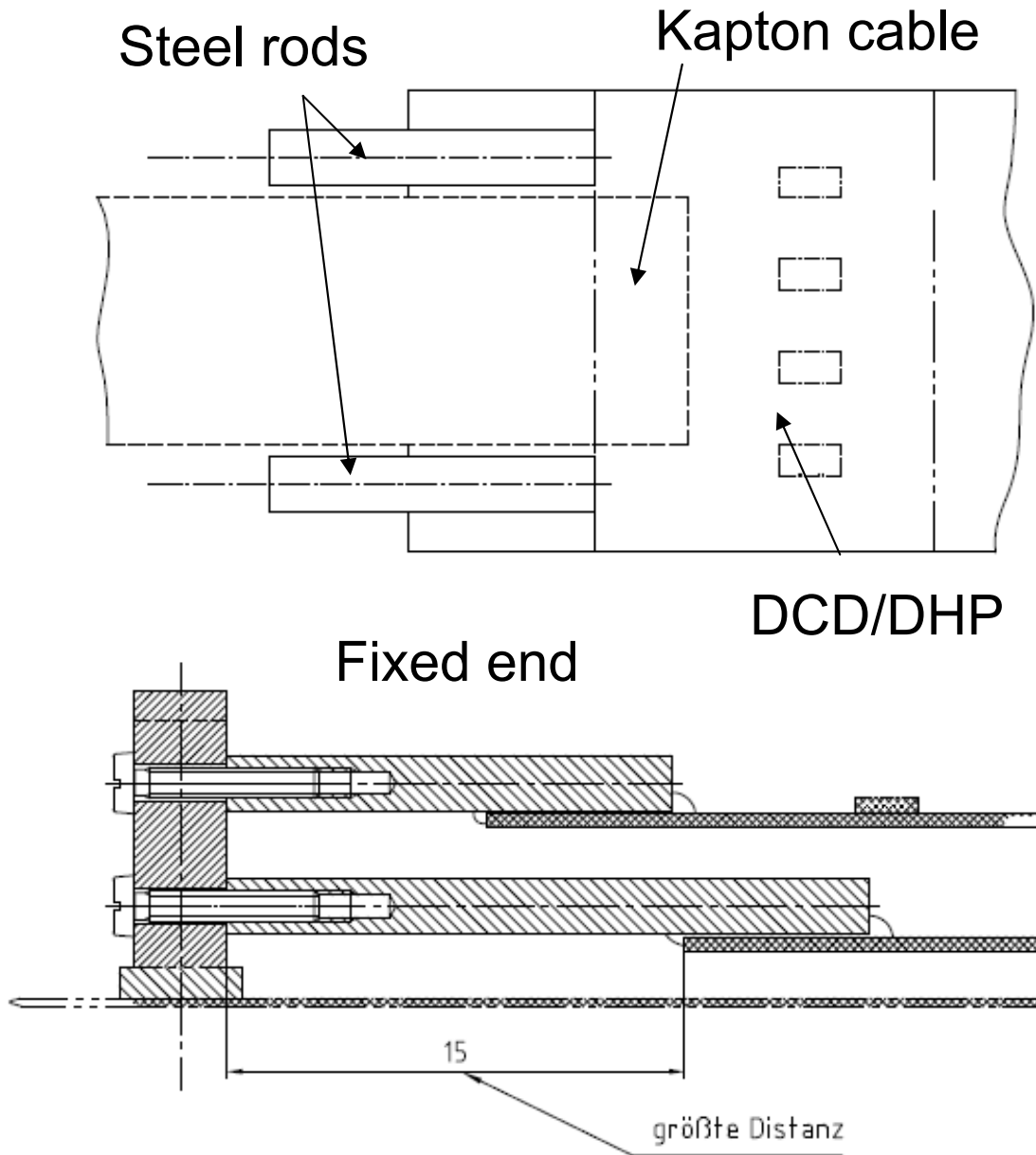
Verbindungsbohren $\phi 12$

Ansicht auf PXD-Halterung

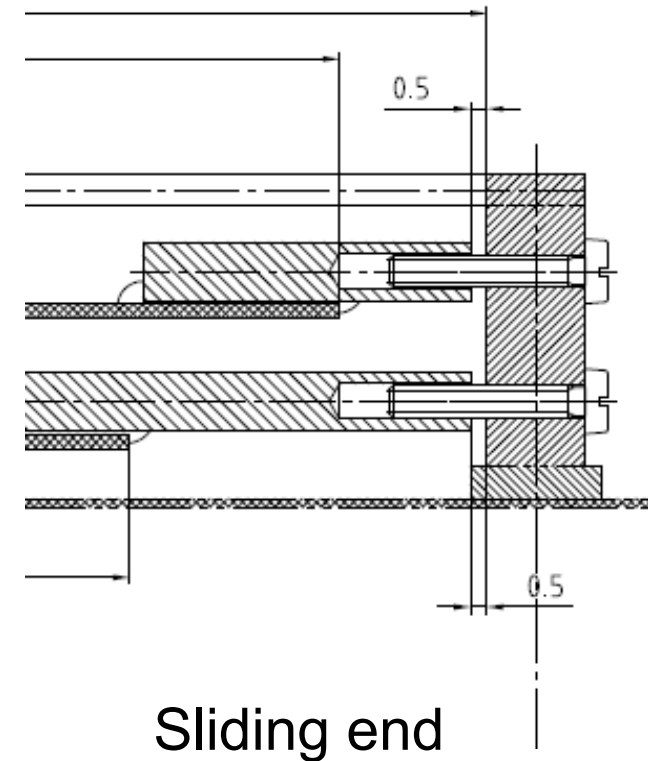
- 2 half shells,
- front and back connected by carbon fibres,
- distance adjustment by pins on the beampipe
- Half shells fixed by screws



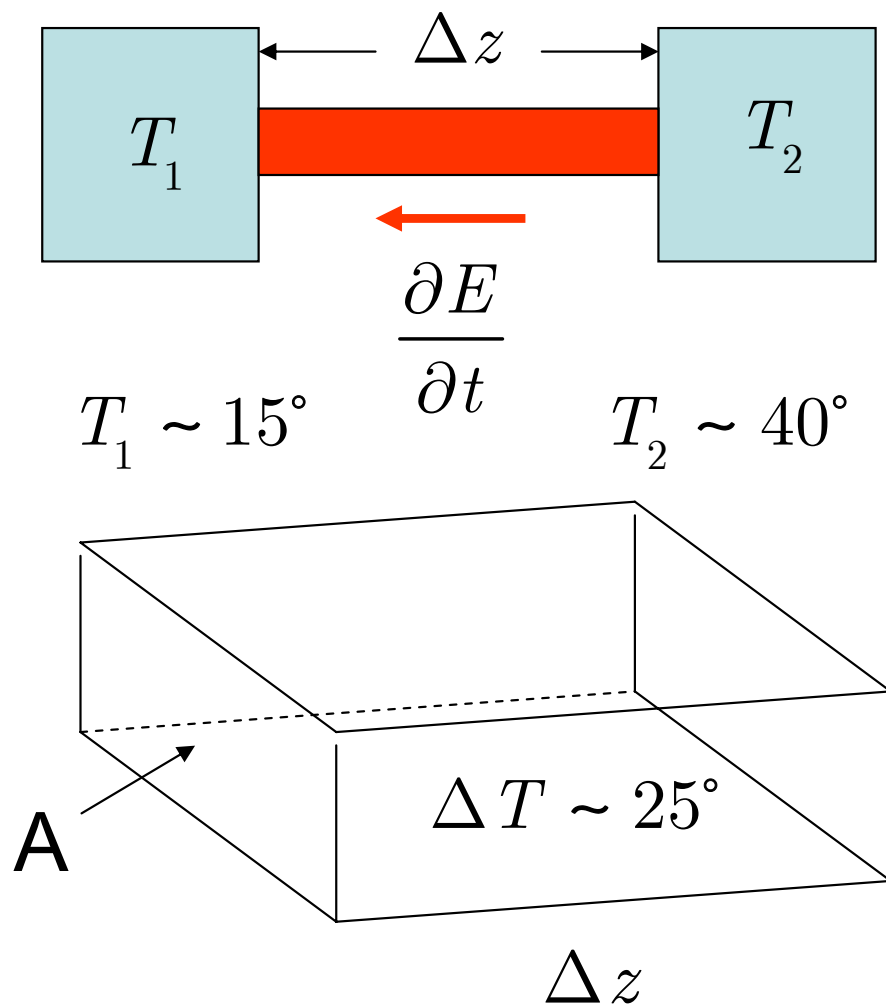
Support on the Ends, (Version 1)



Precision-glued steel (alu) rods on each side



Why does this not Work? The Cooling Issue



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

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

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

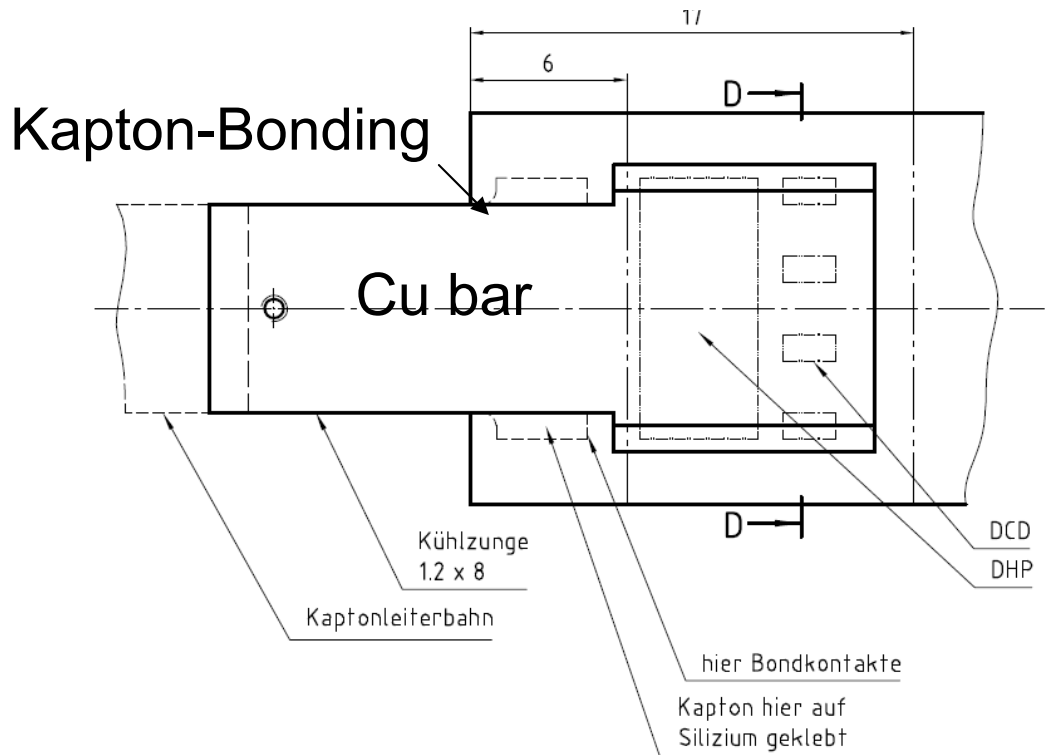
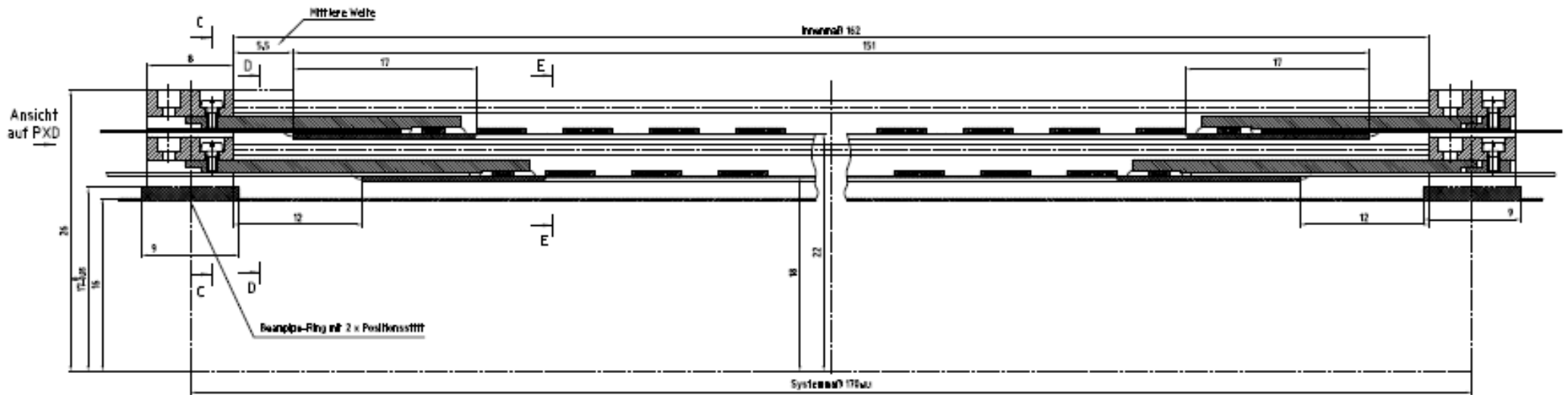
$$P = 5 \text{ W} \quad \Delta z \sim 2 \text{ cm}$$

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

Steel: Factor 4 more !!!

Need Cu ($\lambda=380$) \rightarrow 10 mm²

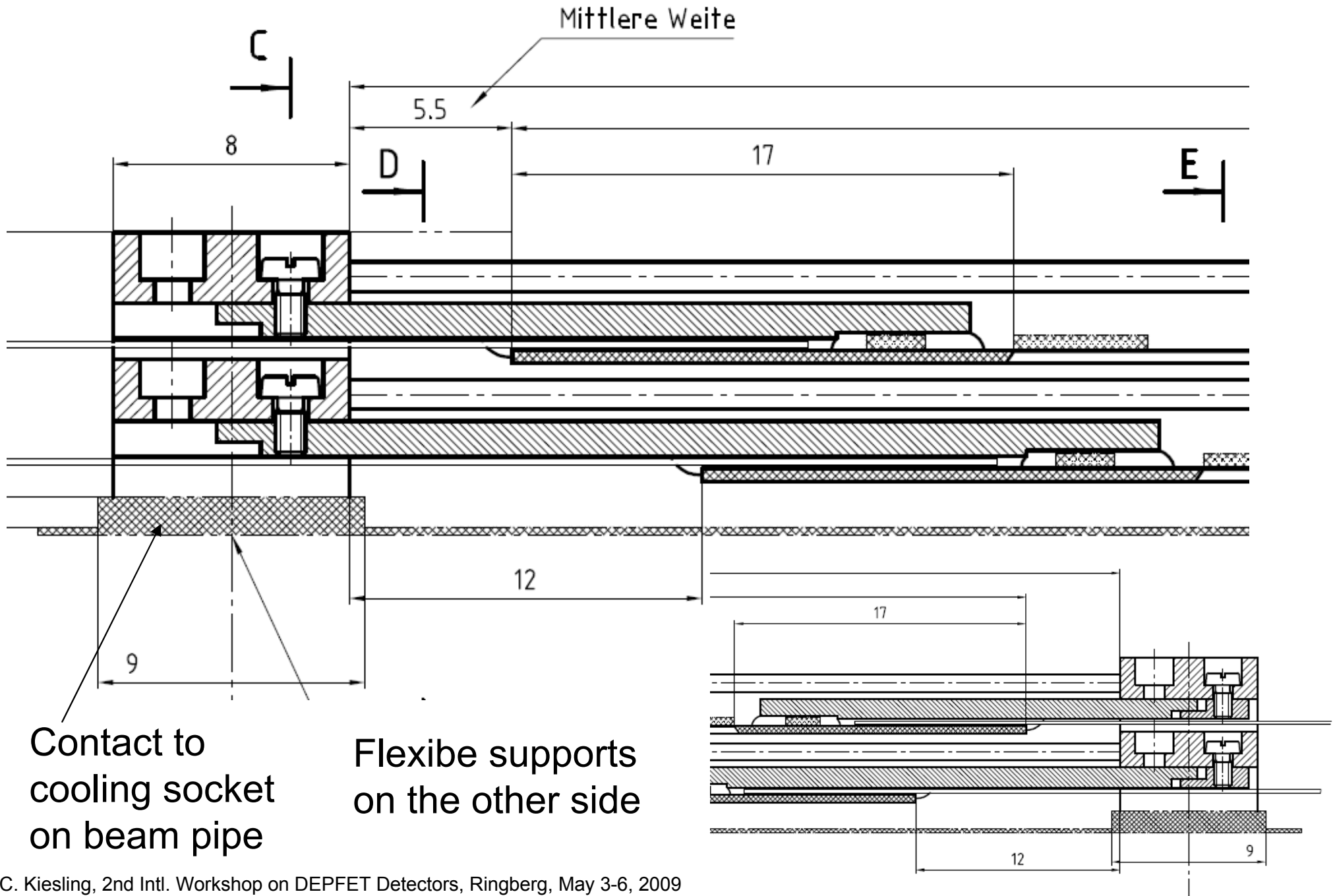
Design No. 2



Cu bar glued onto the electronics

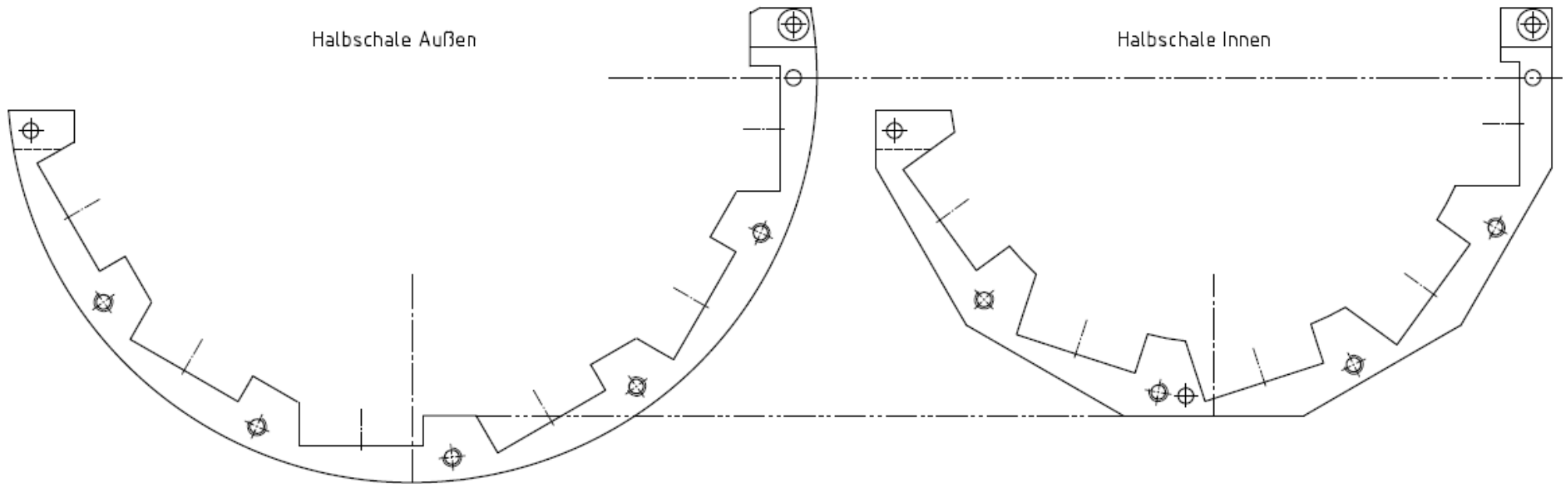
8 mm x 1.2 mm

Supports on the Ends



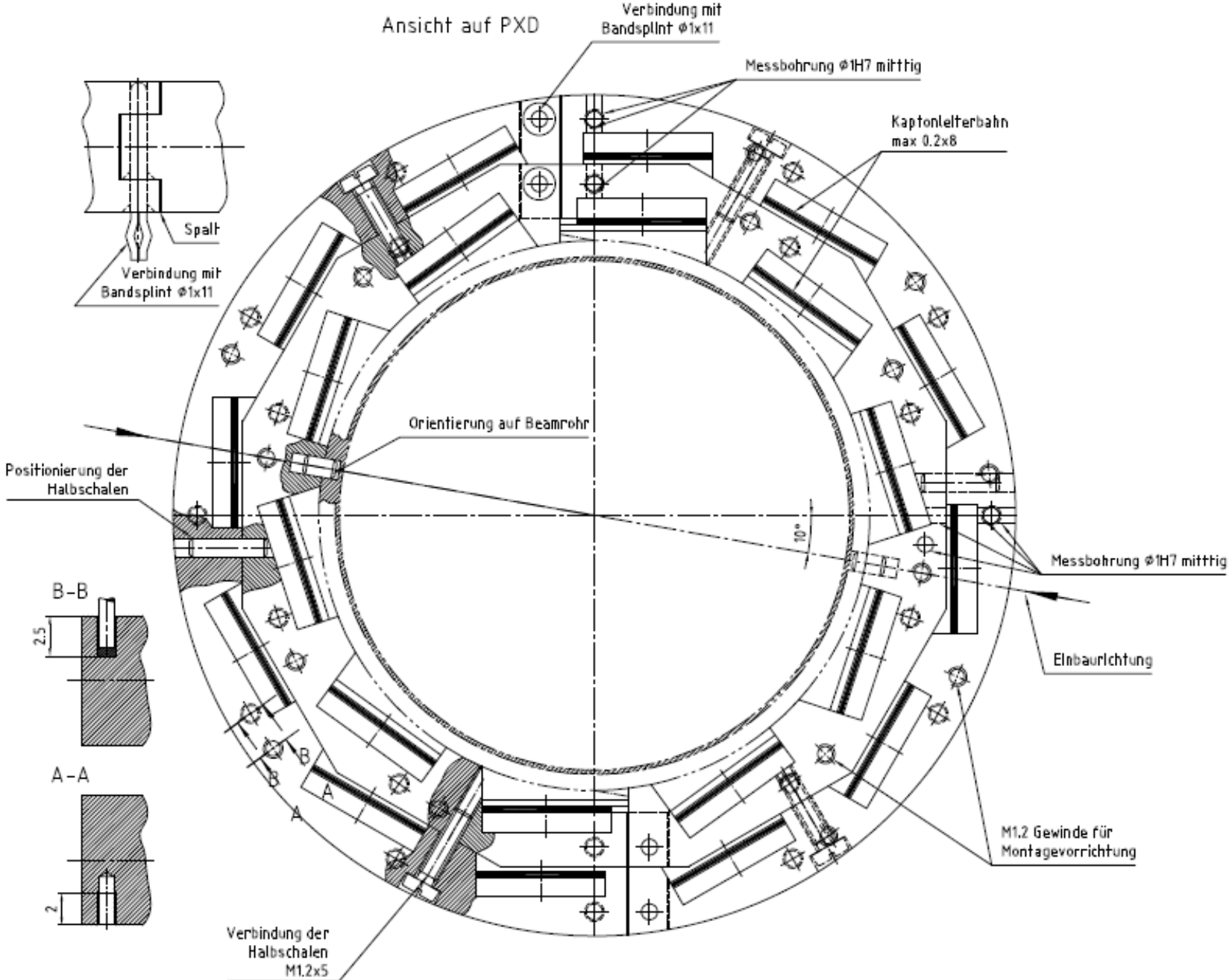
Increased Modularity

Inner and outer layers mechanically separated (2 half shells)

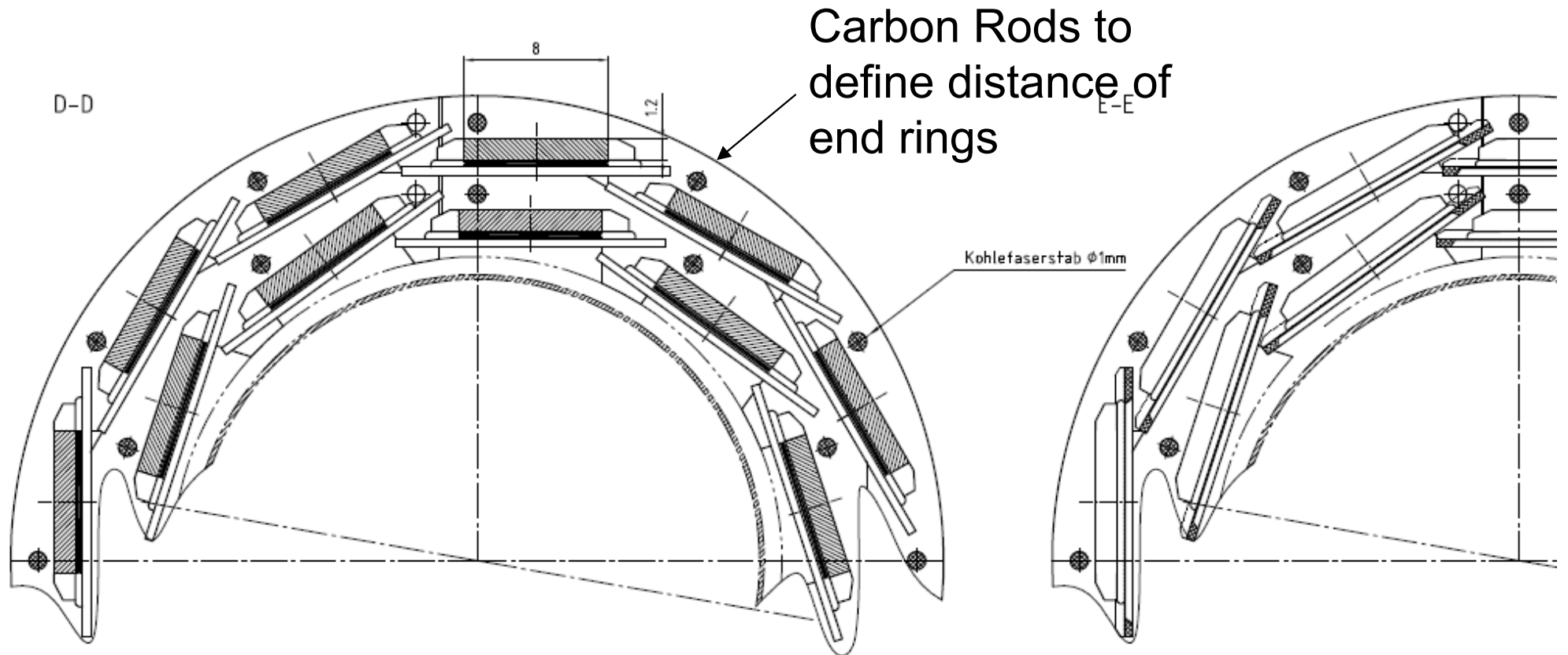


mechanics suited to add a layer 0 on the inside

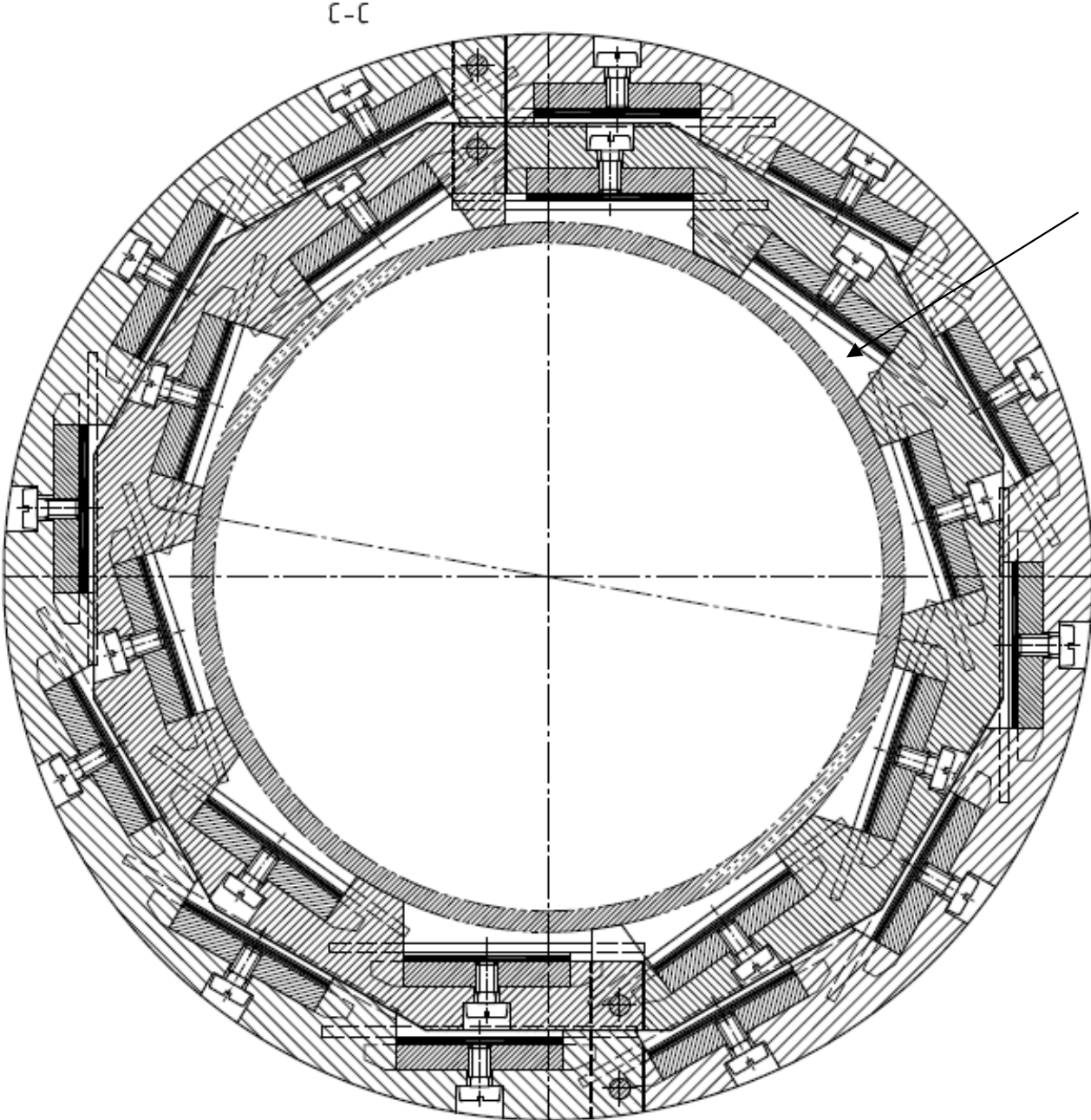
Assembly of the Two Layers



Cross Sections End / Sensitive Area



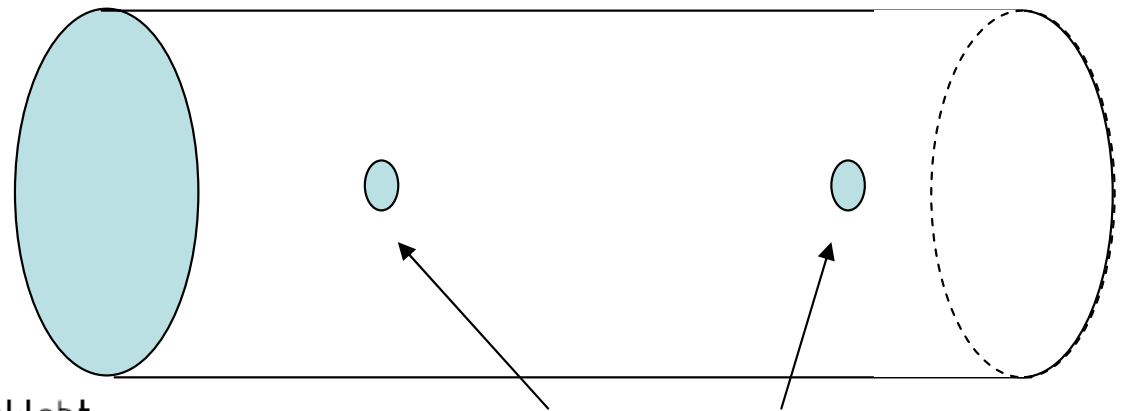
View on End Rings



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

Outer layer to be cooling from above

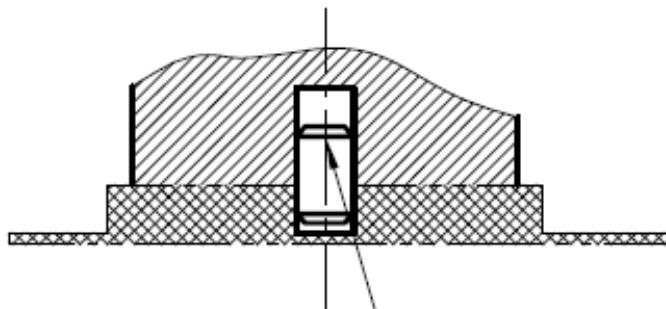
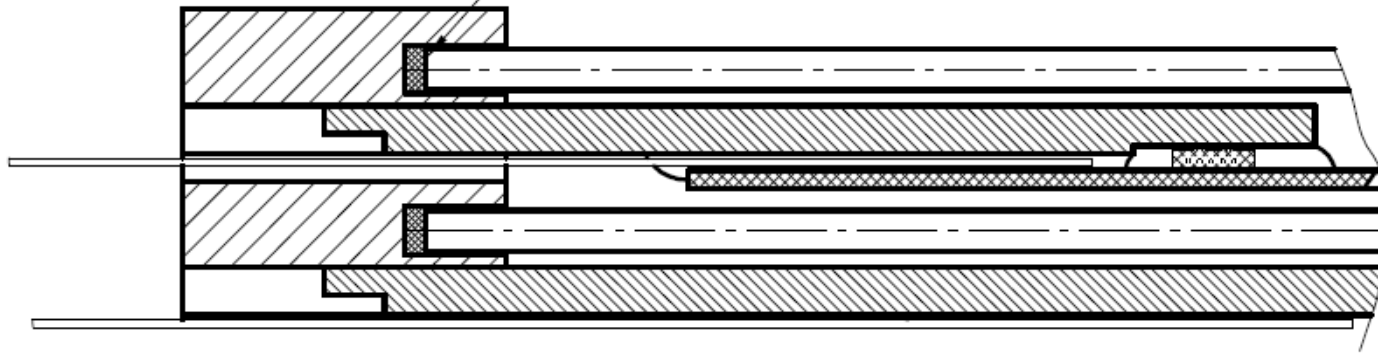
Mounting on Beampipe



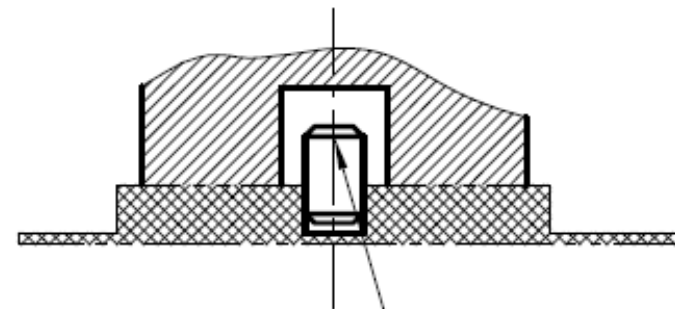
CFK-Stäbe eingeklebt

Precision studs

connecting the
end rings
by CFK rods



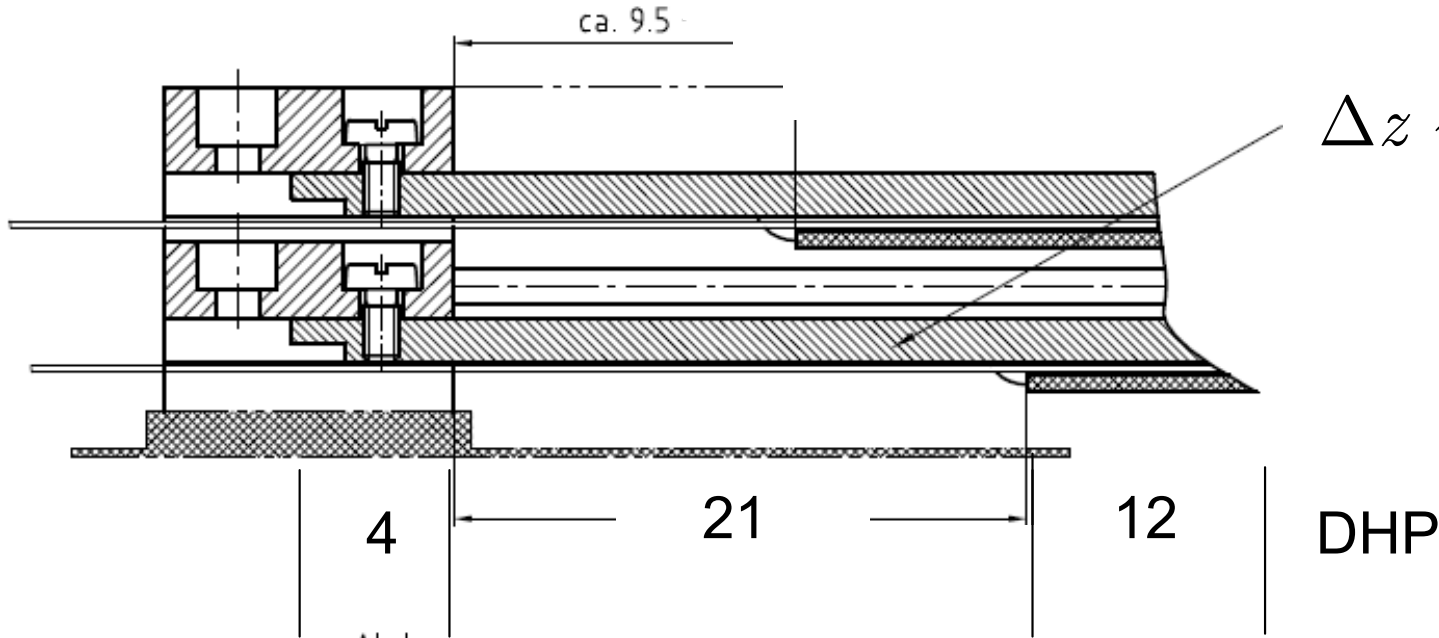
Positionsstift
Z- fest



Positionsstift
Z- frei

Cooling (cont.)

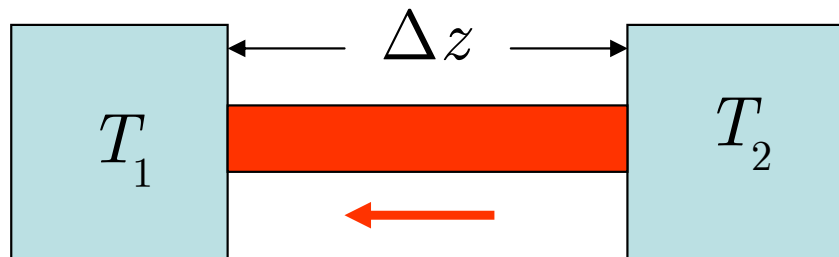
Tilt of beampipe (22 mrad) needs extended support structures:



$\Delta z \sim 40 \text{ mm}$

with Cu (10 mm^2):

$\Delta T \sim 50^\circ$



Need a cold spot
at about 0° Celsius!!

PXD in dry atmosphere!

Conclusions

- First ideas of mechanical support have been discussed

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)

- Integrated support / cooling solution envisaged
- Cooling of the DCD/DHP will need efforts (cold spot at 0° Celsius)
- Not studied yet: cooling of the sensor / switcher with gas
- Need discussions now with the IR / SVD groups: space / cooling