ILD HCAL mechanical concept

-results of FEM studies-

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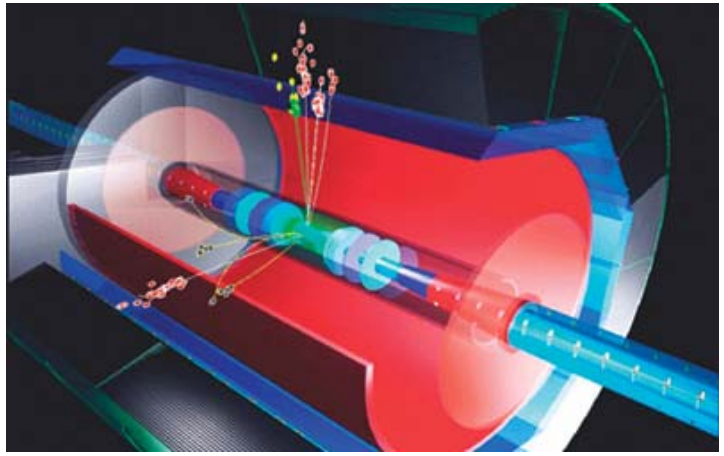
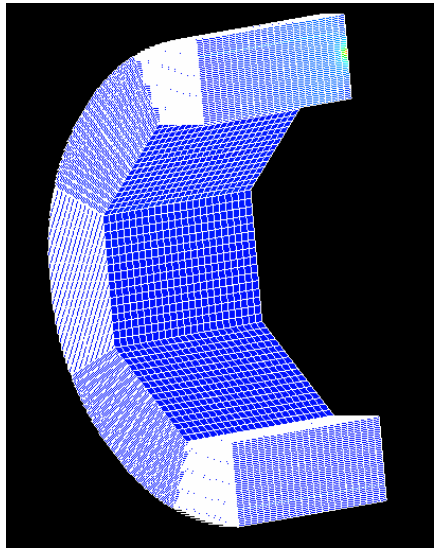
DESY



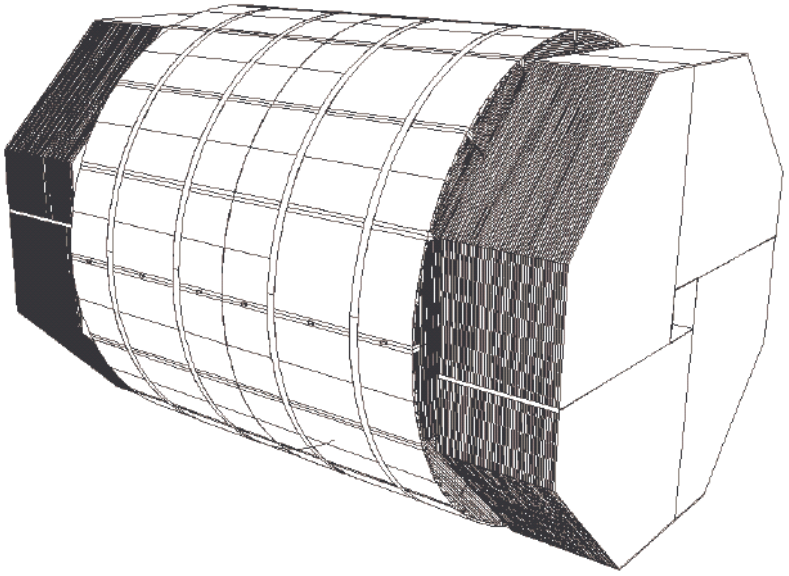


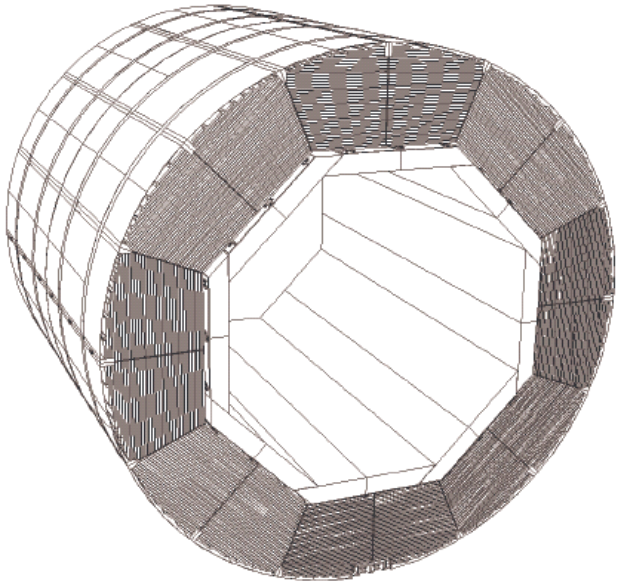
Overview

- the principle of the mechanical concept
- results of FEM calculation

TESLA and ILC detector

-Absorber structure stayed the same-



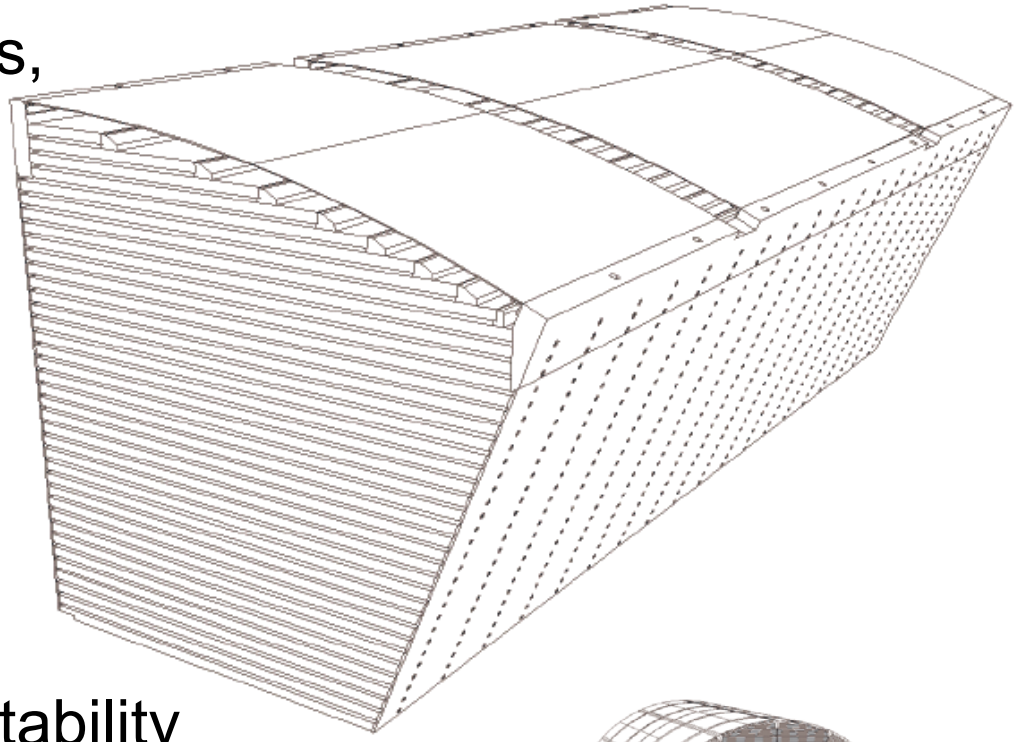


- TESLA concept exists
- Task: to understand and check the TESLA calculations in general

⇨ The TESLA concept is very agressive regarding stability and tolerances.

view of a barrel calorimeter module

side panel: 3mm thickness,
screw size: M6

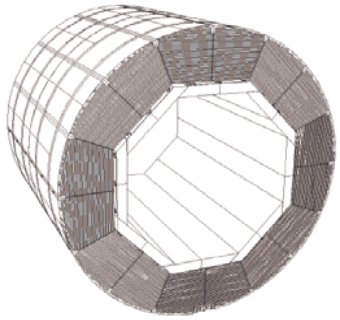


<u>advantage</u>

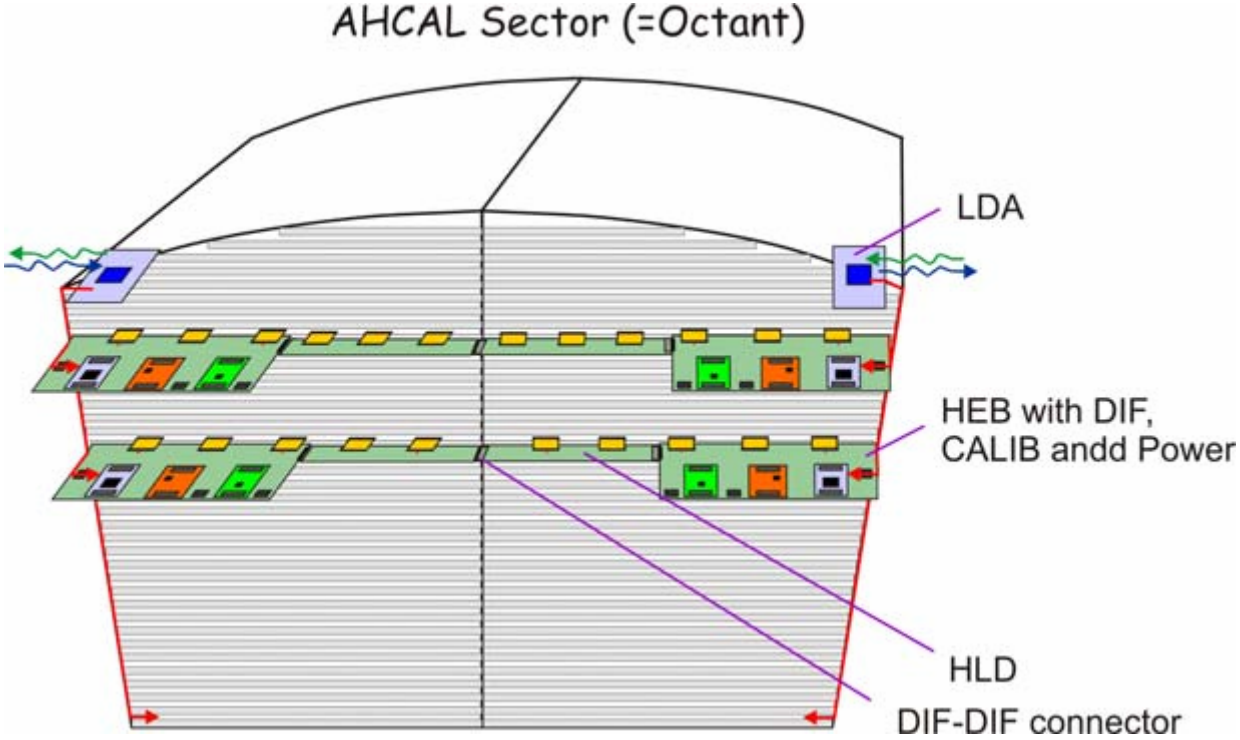
• slim support structure (small amount of φ-cracks)

<u>disadvantages</u>

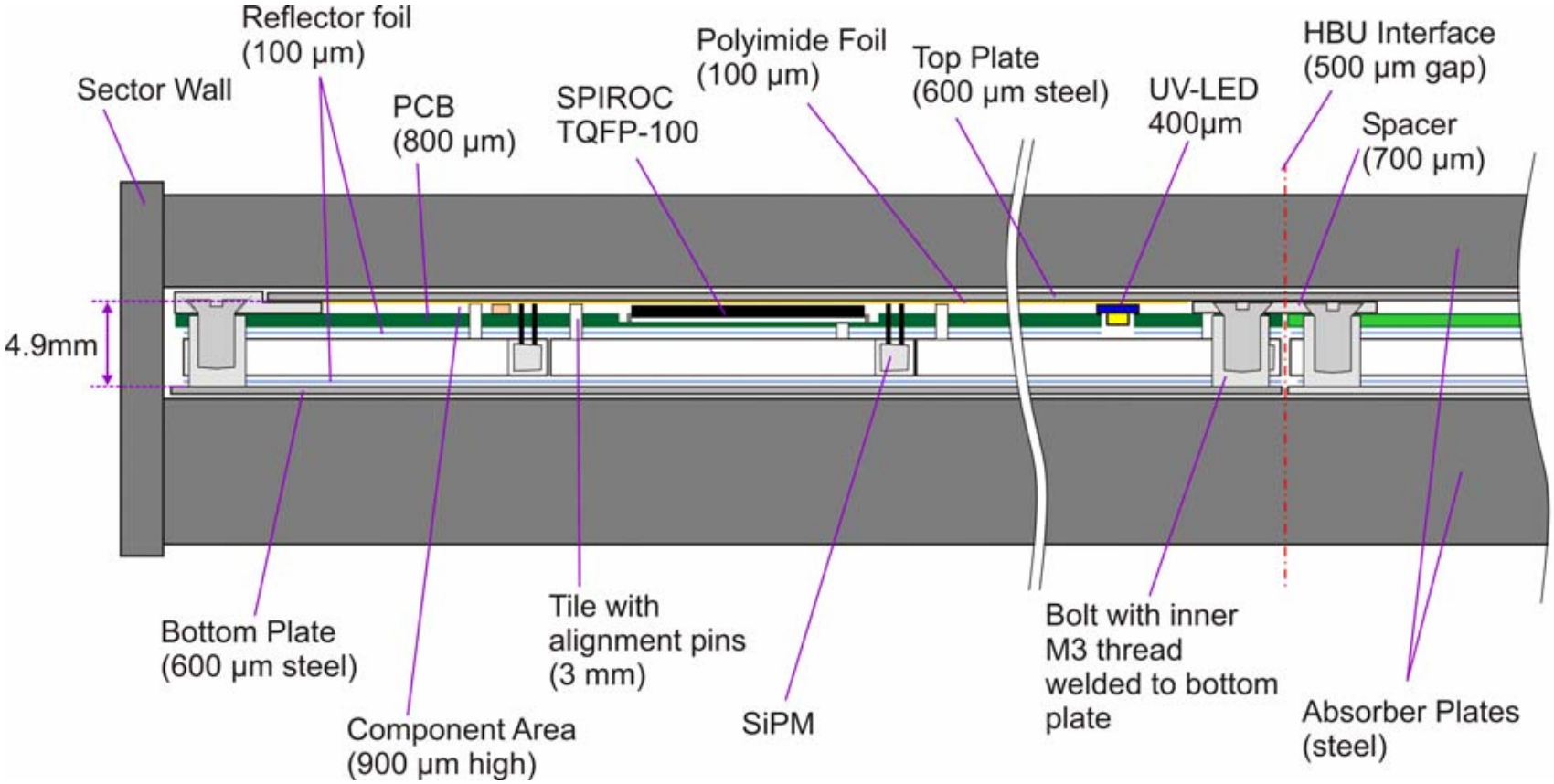
• uncertainties regarding stability
• high tolerance requirements (e.g. holes for screws, flatness of absorber plates)



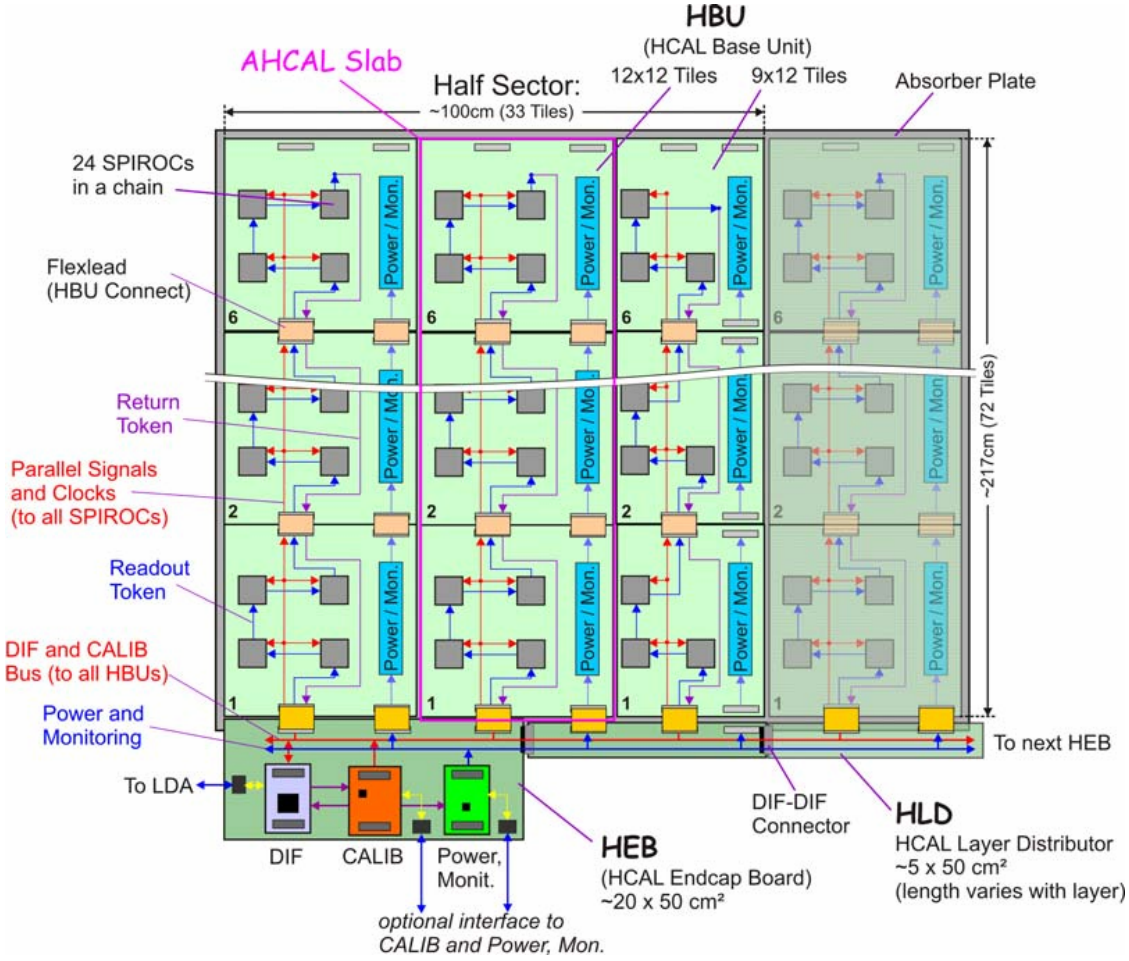
Octant with chambers



chamber cross section

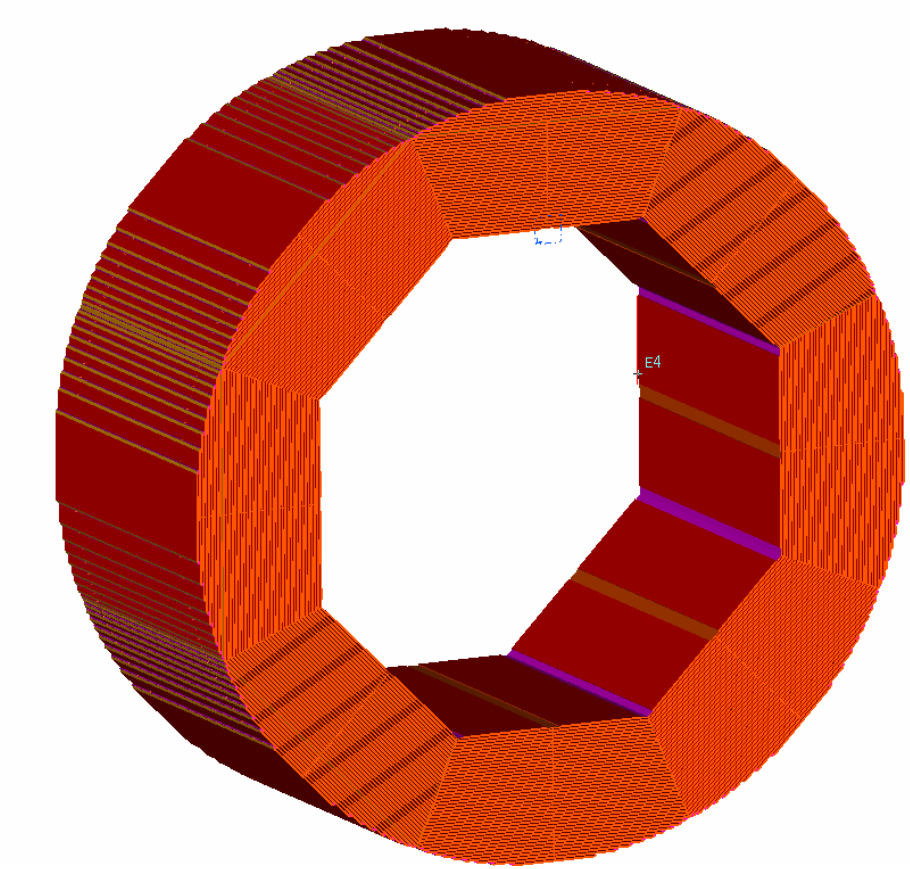


chamber topview

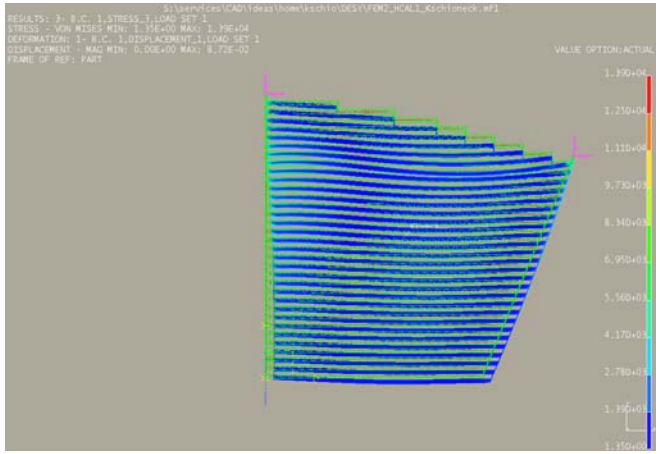


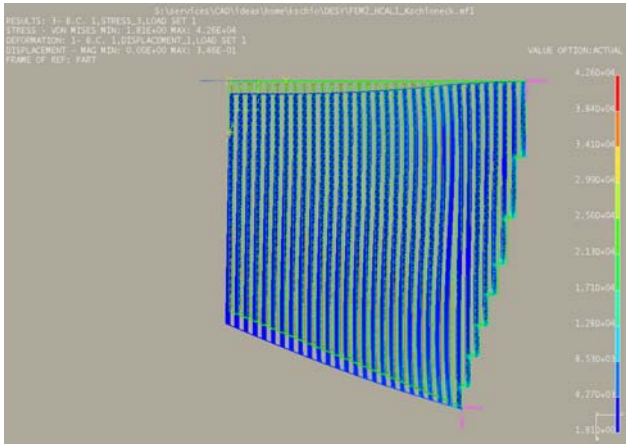
FEM calculation

-16 modules-



HCAL barrel module





<u>horizontal hanging</u>

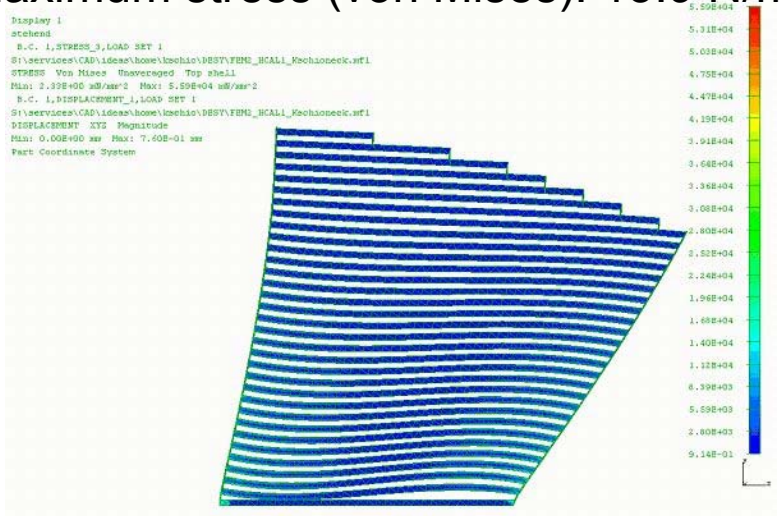
maximum deformation: 0.09 mm

maximum stress (von Mises): 13.9 N/mm²

<u>vertical hanging</u>

maximum deformation: 0.35 0mm

maximum stress (von Mises): 43 N/mm²

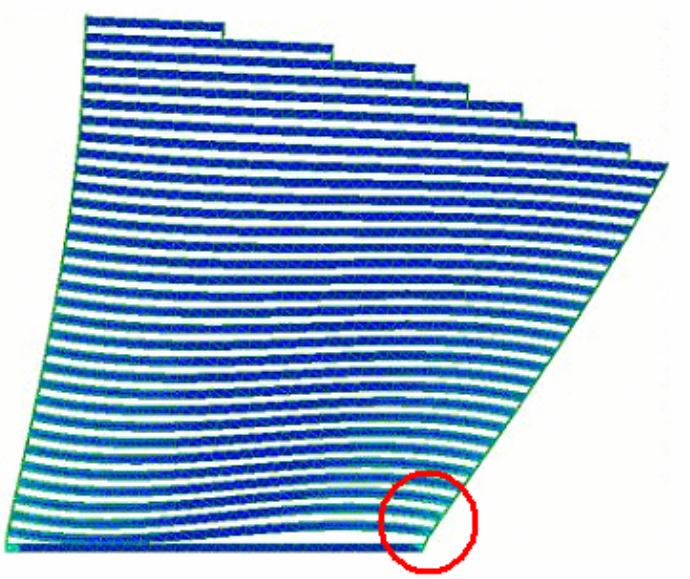


<u>module standing</u>

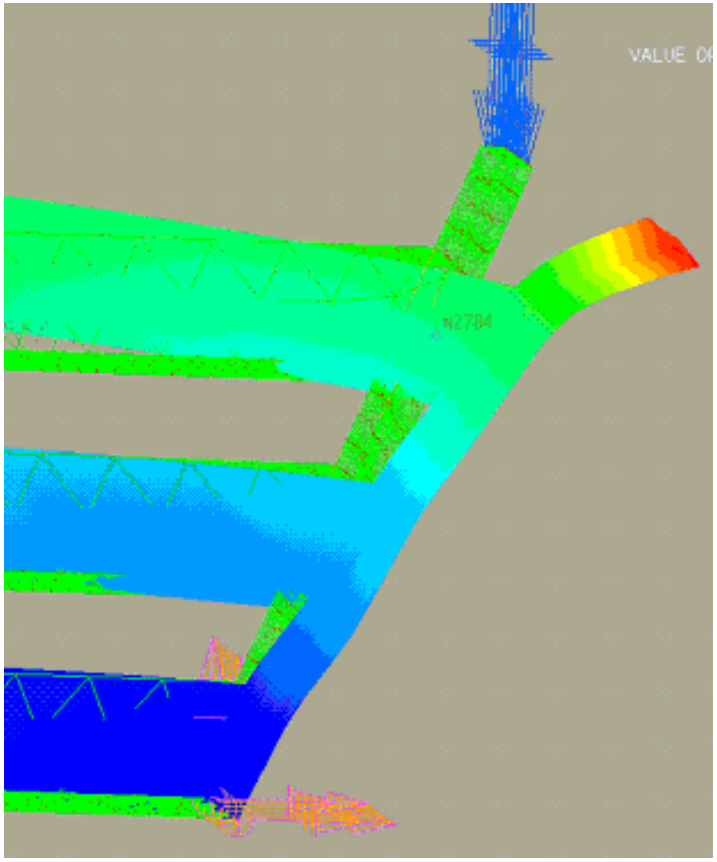
maximum deformation: 0.7 mm

maximum stress (von Mises): 60 N/mm²

How are these positive results possible?

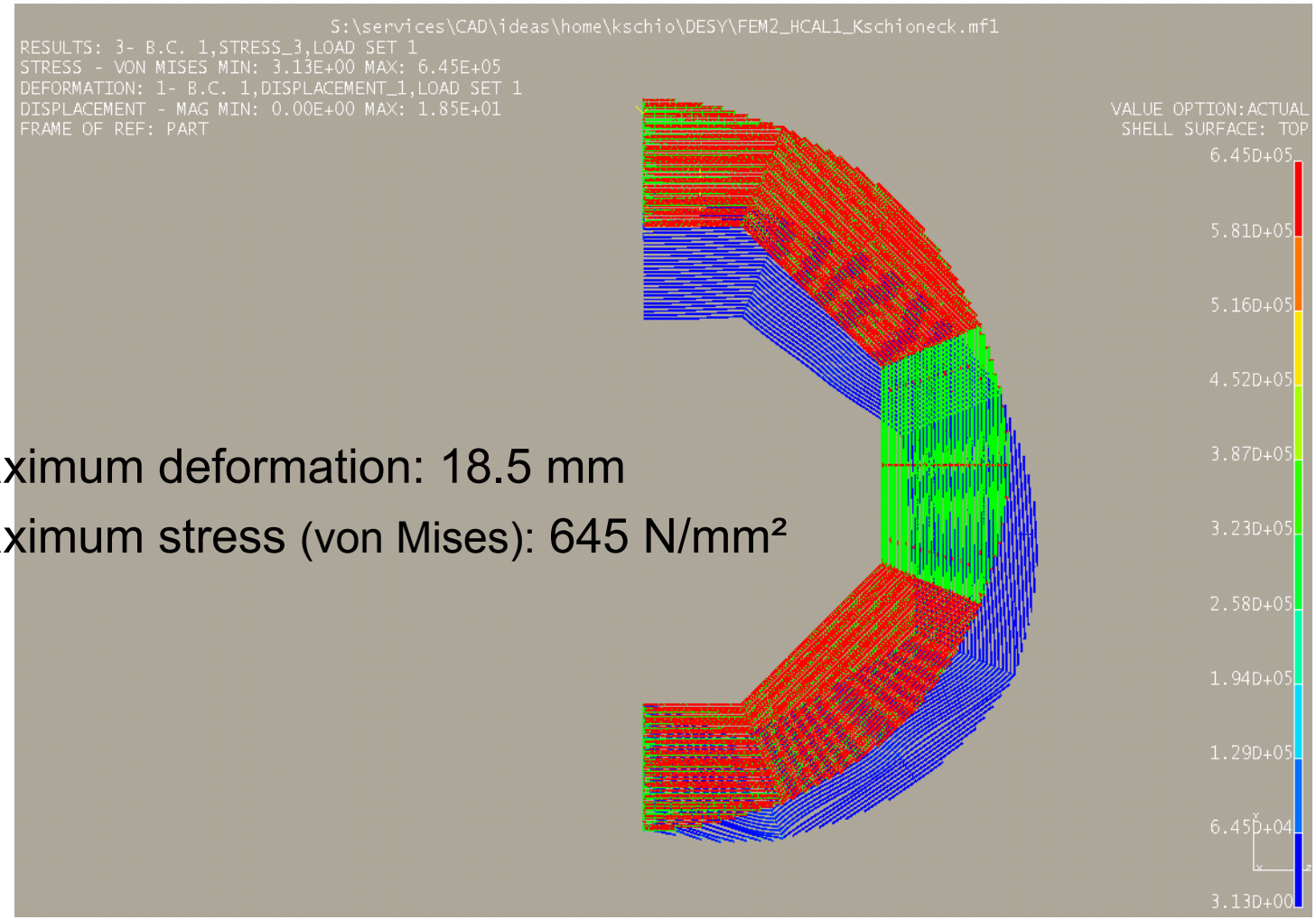


compression ↔ tensile



barrel

-standing-

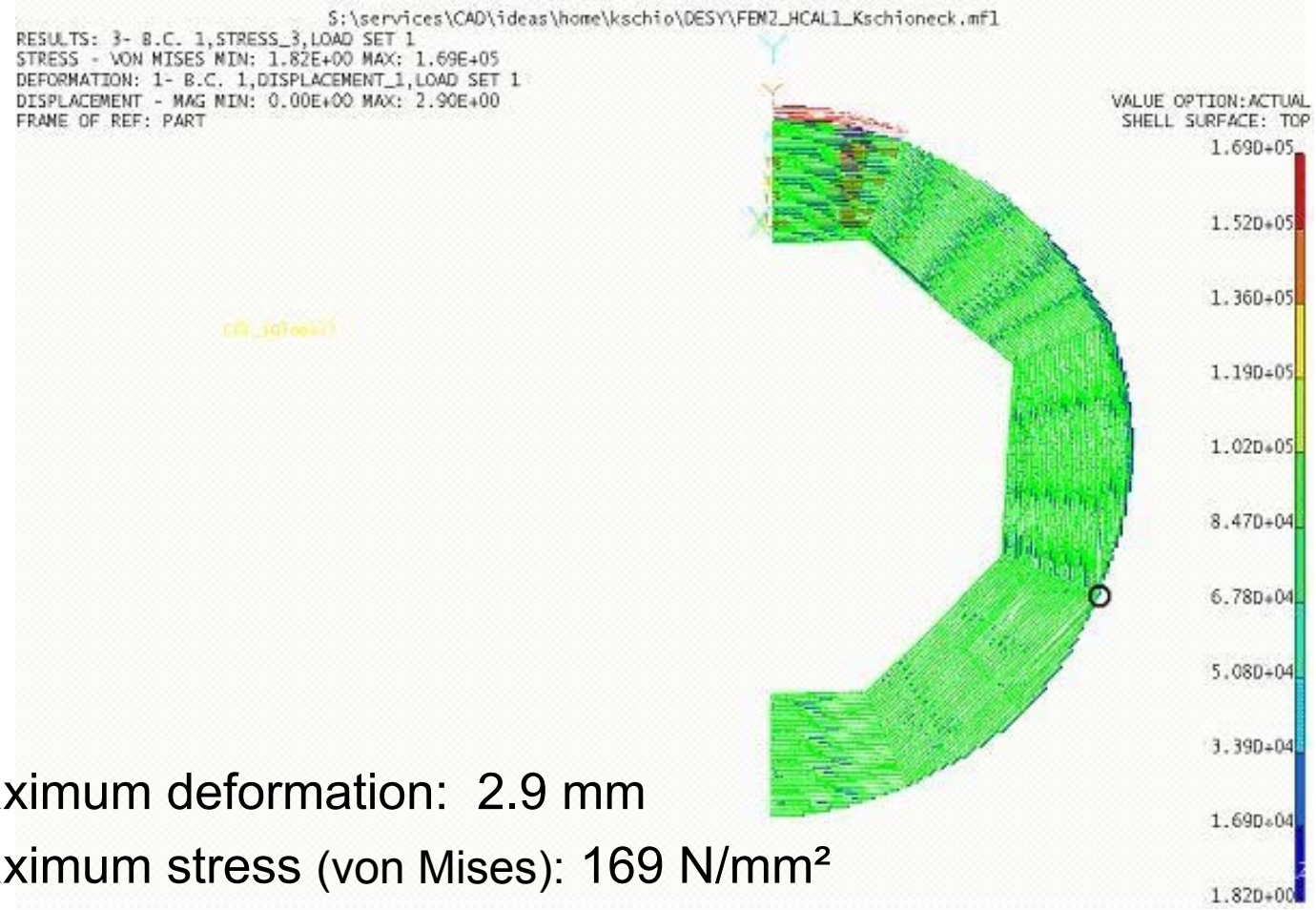


maximum deformation: 18.5 mm

maximum stress (von Mises): 645 N/mm²

barrel

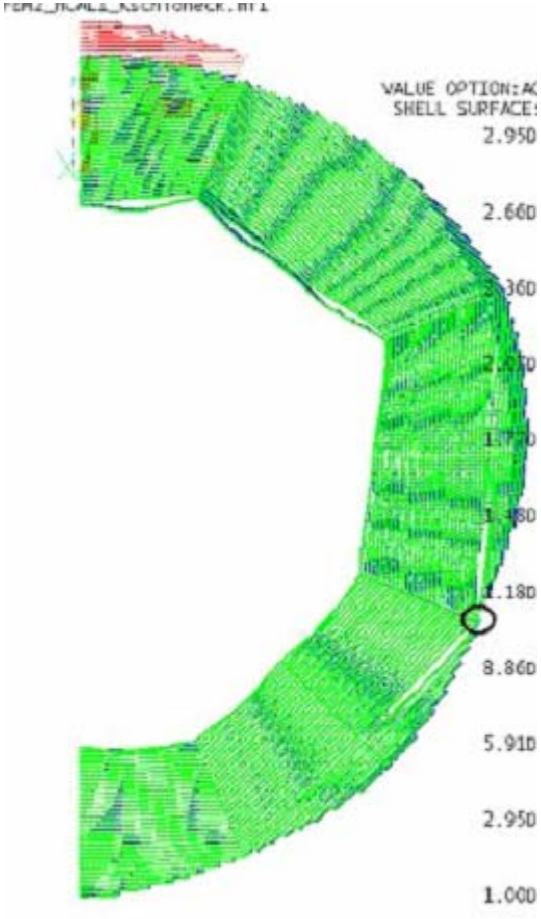
-fixation/ including chambers-

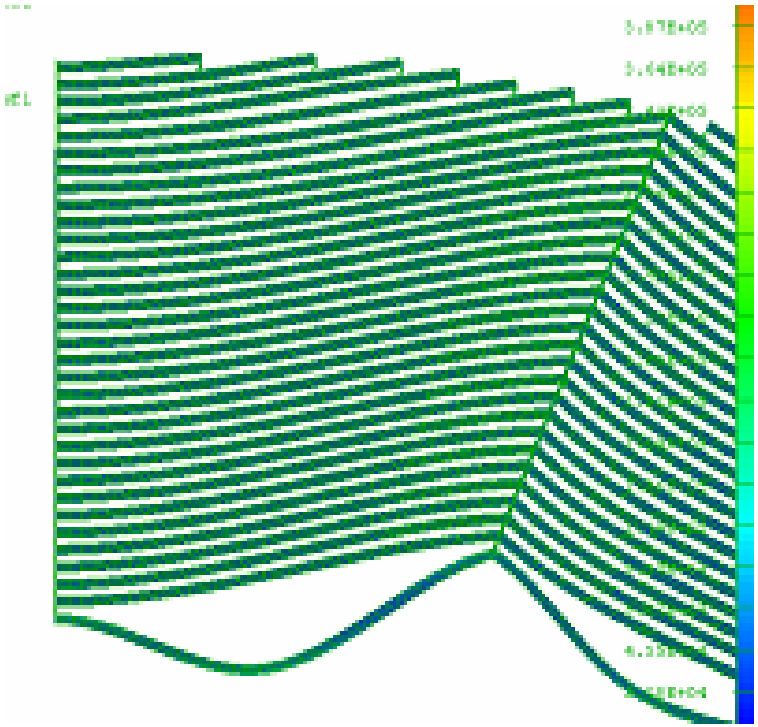


maximum deformation: 2.9 mm

maximum stress (von Mises): 169 N/mm²

ECAL: weight load in one line





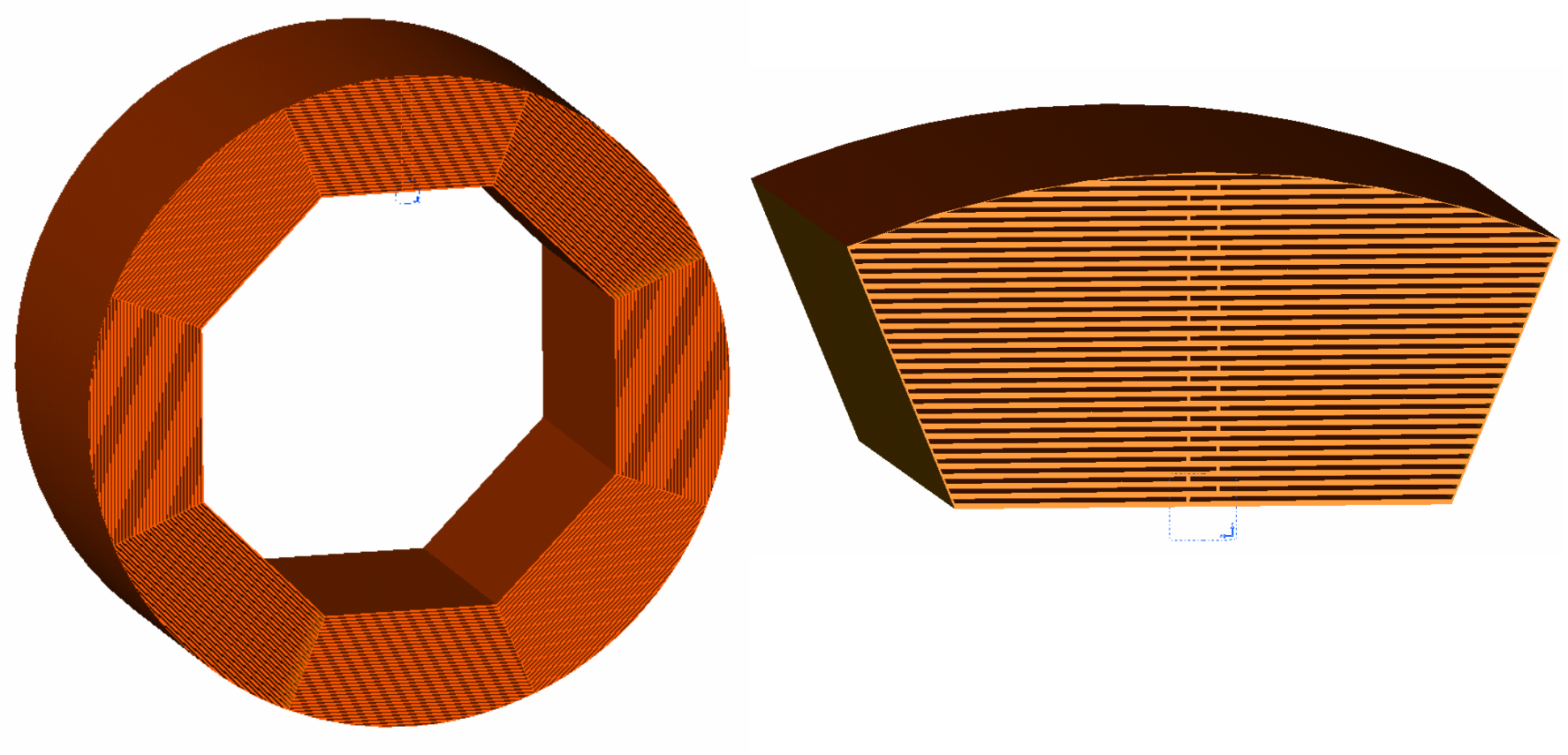
maximum deformation: 6.18 mm

maximum stress (von Mises): 295 N/mm²

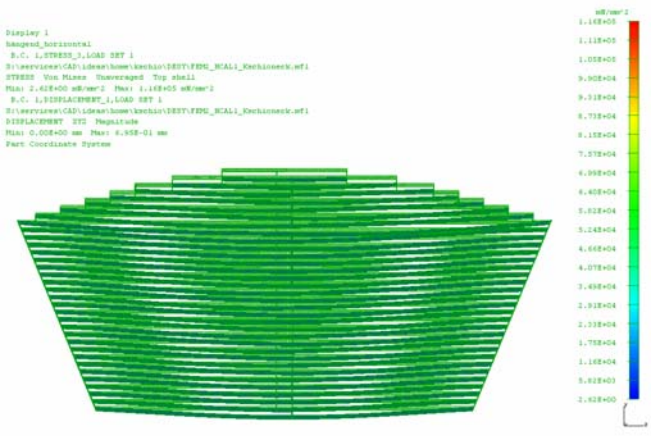
(distributed weight:
4.06 mm/ 237N/mm²)

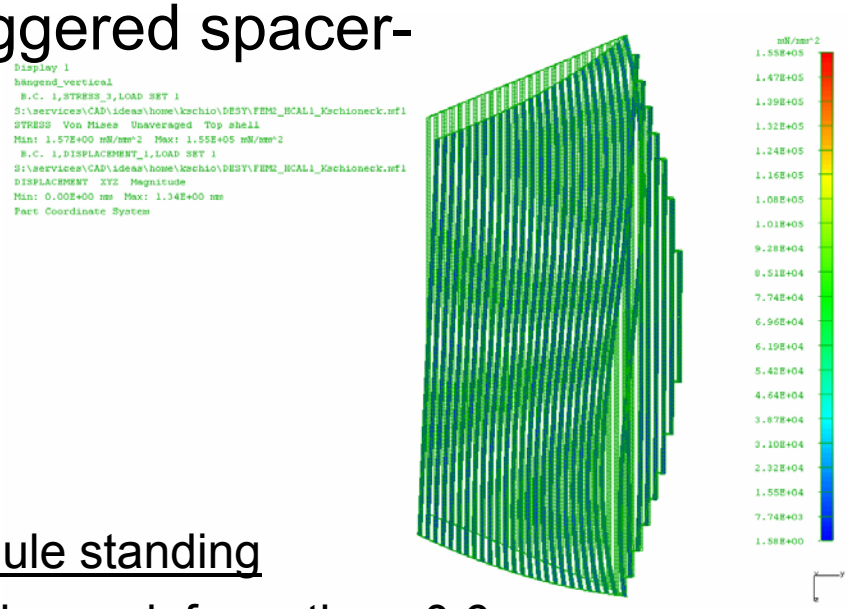
FEM calculation

-8 modules-



HCAL barrel module –with staggered spacer-





<u>horizontal hanging</u>

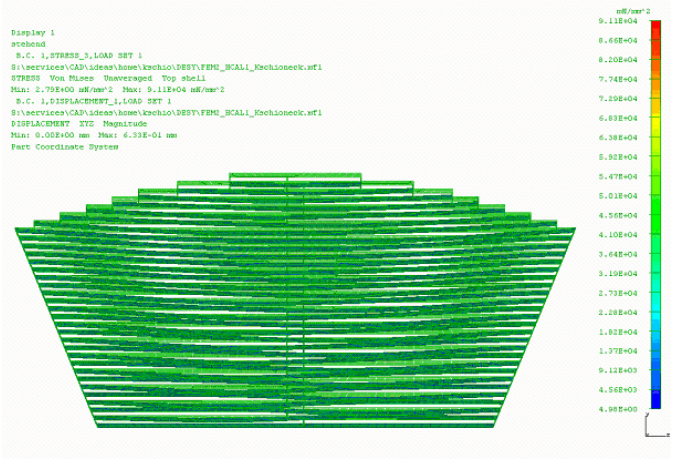
maximum deformation: 0.7 mm

maximum stress (von Mises): 116 N/mm²

<u>module standing</u>

maximum deformation: 0.6 mm

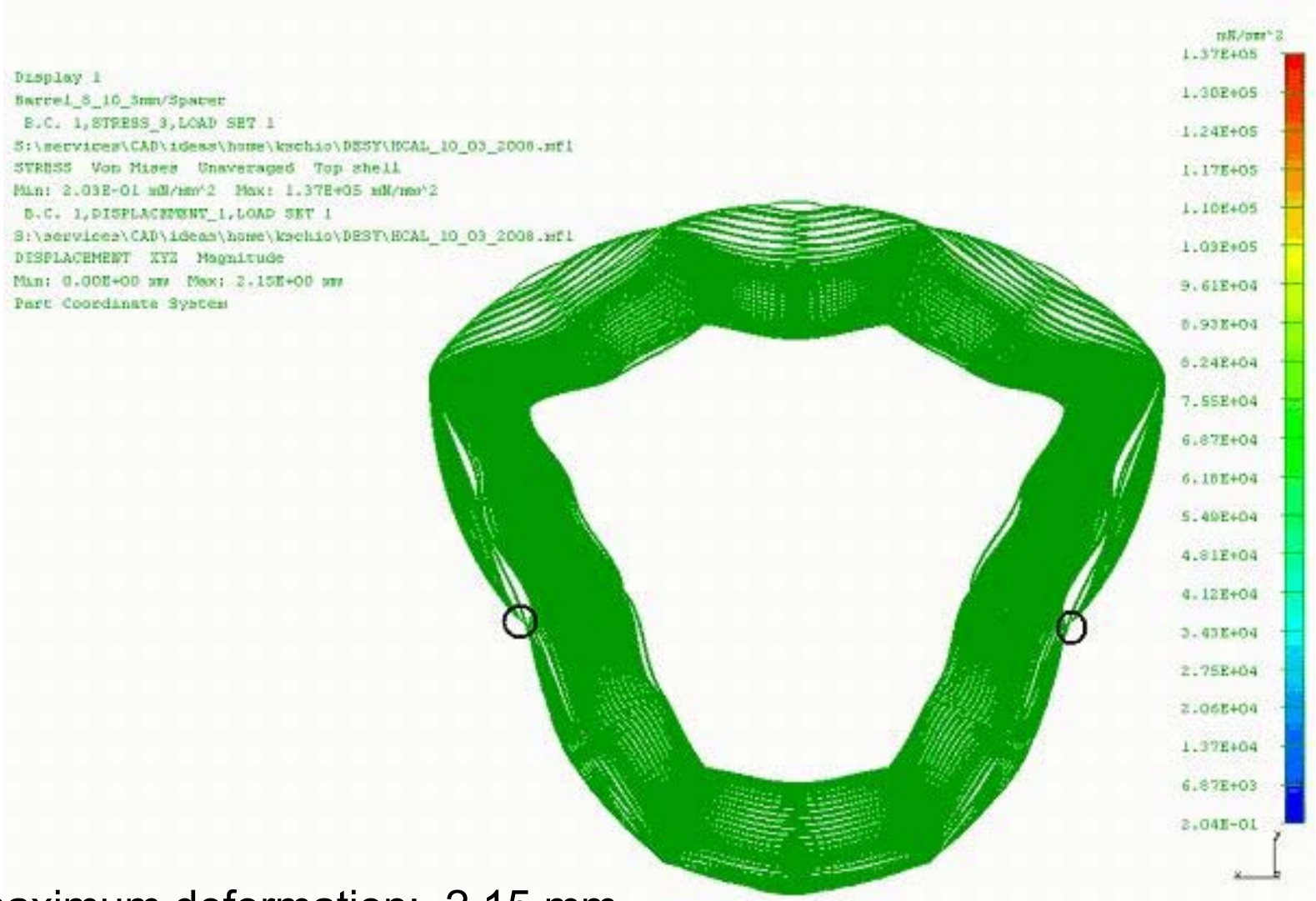
maximum stress (von Mises): 91 N/mm²



<u>vertical hanging</u>

maximum deformation: 0.4 0mm

maximum stress (von Mises): 97 N/mm²



maximum deformation: 2.15 mm

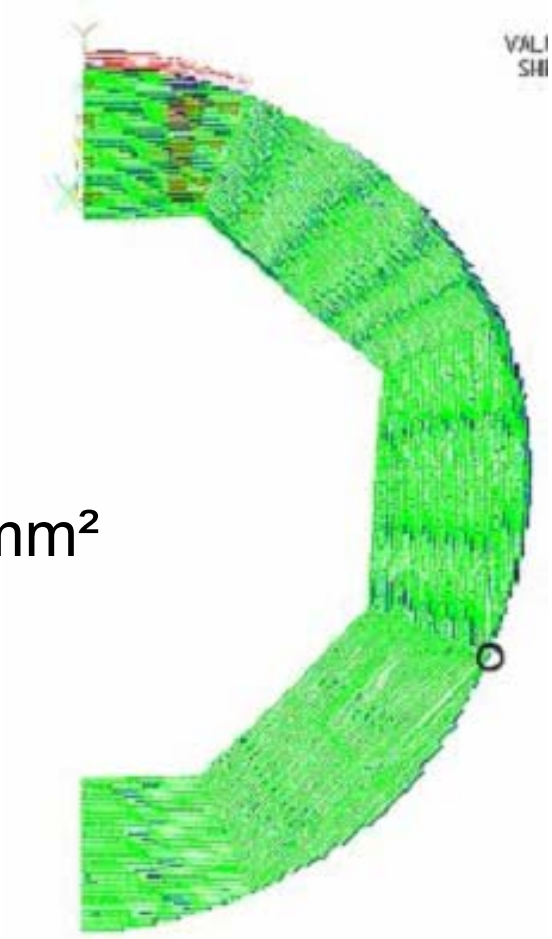
maximum stress (von Mises): 137 N/mm²

Brass

<u>Brass CuZn38Pb2</u>

maximum deformation: 6.35 mm

maximum stress (von Mises): 183 N/mm²



effects of changed parameter

Thickness side panel [mm]	3	5
Spacer	Yes	No
Material absorber plates	steel	brass
Thickness gaps [mm]	14	7

	displacement	stress
bigger sidepanel:	↓	↓
Spacer yes → no	↑	↑
from steel to brass:	↑	↓
smaller gap:	↑	↓

conclusion

- concept in general is possible but challenging
- next steps:
  - agreements for parameters to start real design
  - design and production of a model