ILD HCAL mechanical concept

-results of FEM studies-

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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



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chamber topview



FEM calculation -16 modules-



HCAL barrel module



horizontal hanging

maximum deformation: 0.09 mm maximum stress (von Mises): 13.9 N/mm²





vertical hanging 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 \leftrightarrow tensile



barrel -standing-



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barrel -fixation/ including chambers-



ECAL: weight load in one line



maximum stress (von Mises): 295 N/mm² 14/05/2008 ILD HCAL - mechanical concept (distributed weight: 4.06 mm/ 237N/mm²)

FEM calculation -8 modules-



14/05/2008

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HCAL barrel module – with staggered spacer-1.558+05 1.478+05 B.C. 1.STRESS 3.LOAD SET 1 1.398405 S:\services\CAD\ideas\home\kschio\DESY\FEM2_HCAL1_Kschioneck.mf1 STRESS Von Mises Unaveraged Top shell 1.32E+05 Min: 1.57E+00 mN/mm^2 Max: 1.55E+05 mN/mm^2 .C. L.STREAM R. LOAD SET 1 1.248+05 1.058+0 B.C. 1, DISPLACEMENT 1, LOAD SET 1 S:\services\CAD\ideas\home\kschio\DESY\FEM2_ECAL1_Kschioneck.mf1 1.16E+05 and Harri 1.14 DISPLACEMENT XYZ Magnitude Min: 0.00E+00 nm Max: 1.34E+00 nm 1.082+05 8.738+04 Part Coordinate System 1.018+05 8-152+04 7.572+04 9.288+04 6.252+04 0.518+04 4.402+04 7.748+04 6.96E+04 5.242+04 6.198+04 5,428+04 3.458+04 4.648+04 1.238+04 3.878404 1.758+0 3.108+04 1.162+04 2.328+04 1.558+04 7.748+03 horizontal hanging module standing 1.588+00 maximum deformation: 0.7 mm maximum deformation: 0.6 mm maximum stress (von Mises): 116 N/mm² maximum stress (von Mises): 91 N/mm² 9.118+04 8-658+04 B.C. 1,STRESS_3,LOAD SET 1 8.20E+04 S:\services\CAD\ideas\home\kschio\DEST\FEME_HCAL1_Kschioneck.sfl STRESS Von Mises Unaveraged Top shell Min: 2.79E+00 mN/mm*2 Max: 9.11E+04 mN/mm*2 7.748+04 B.C. 1,DISPLACEMENT_1,LOAD SET 1 S:\services\CAD\ideas\home\kschio\D 7.298+04 PLACEMENT XYZ Nagnitude : 0.002+00 mm Max: 6.332-01 mm 6.388+04 5.92E+04 5.478+04 vertical hanging 5.01E+04 4.562+04 4.108+04 3.648+04 maximum deformation: 0.4 0mm 3.198+04 2.738+04 2.28E+04 maximum stress (von Mises): 97 N/mm² 1.378+04 9.128+03 4.568+03 4.982+00



Brass

Brass CuZn38Pb2

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:	◆	\mathbf{h}
Spacer yes → no	^	1
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