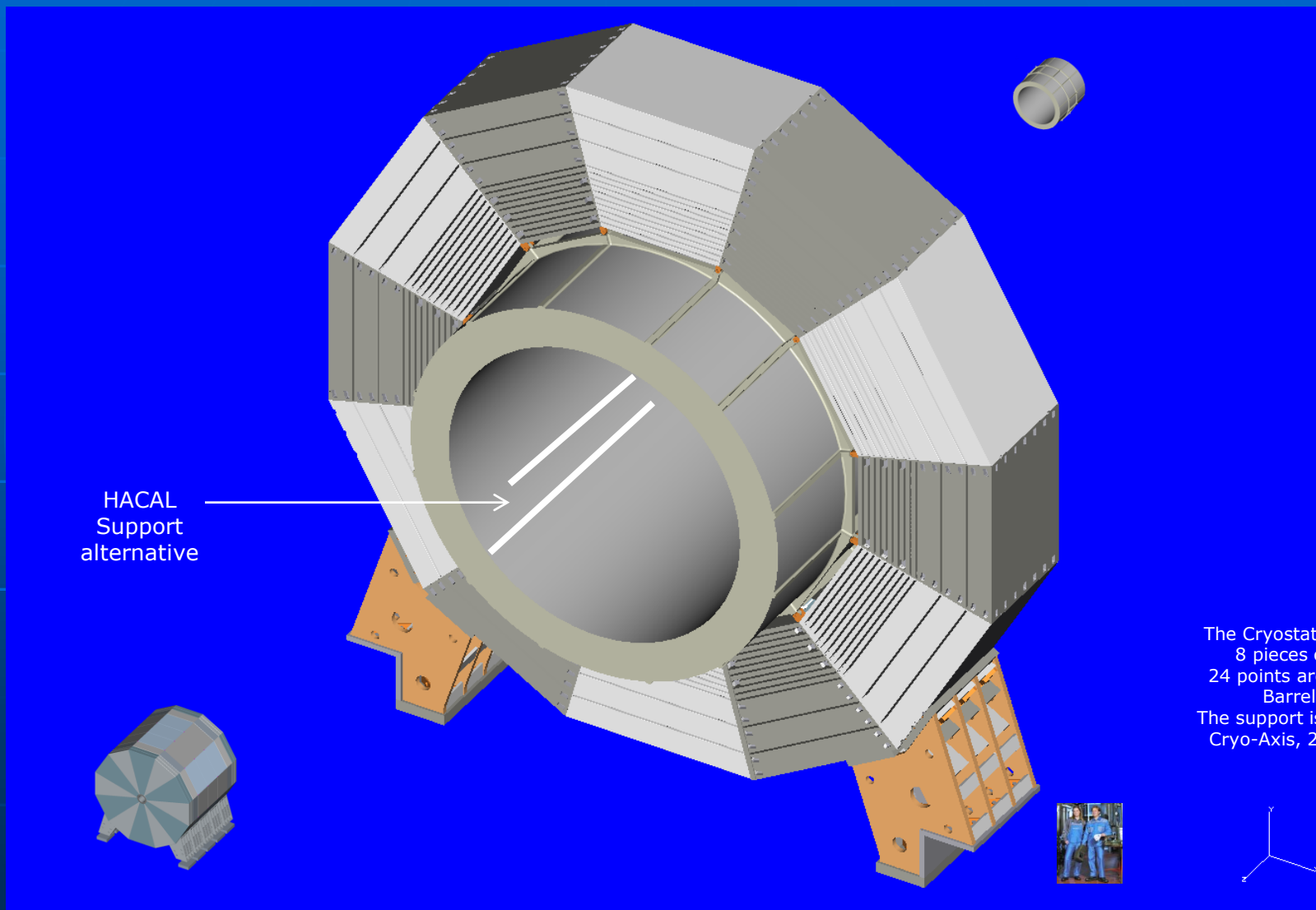
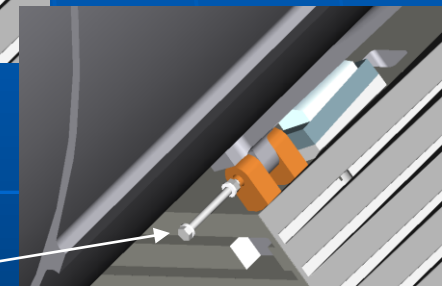
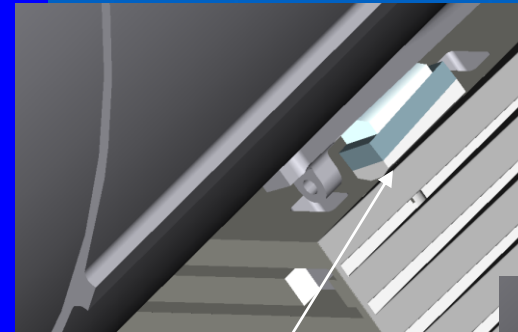
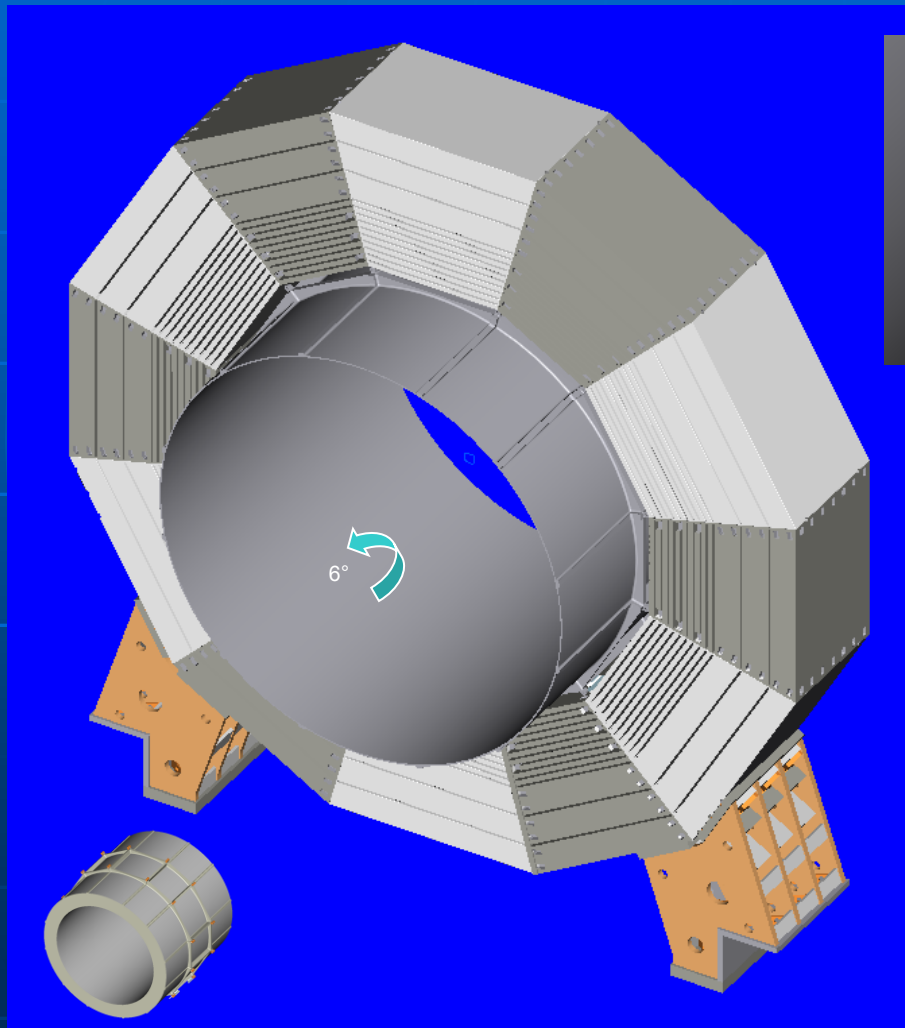


The Integration from HCAL, ECAL, TPC into CRYOSTAT / ILD

(FEM theory of adjustment)

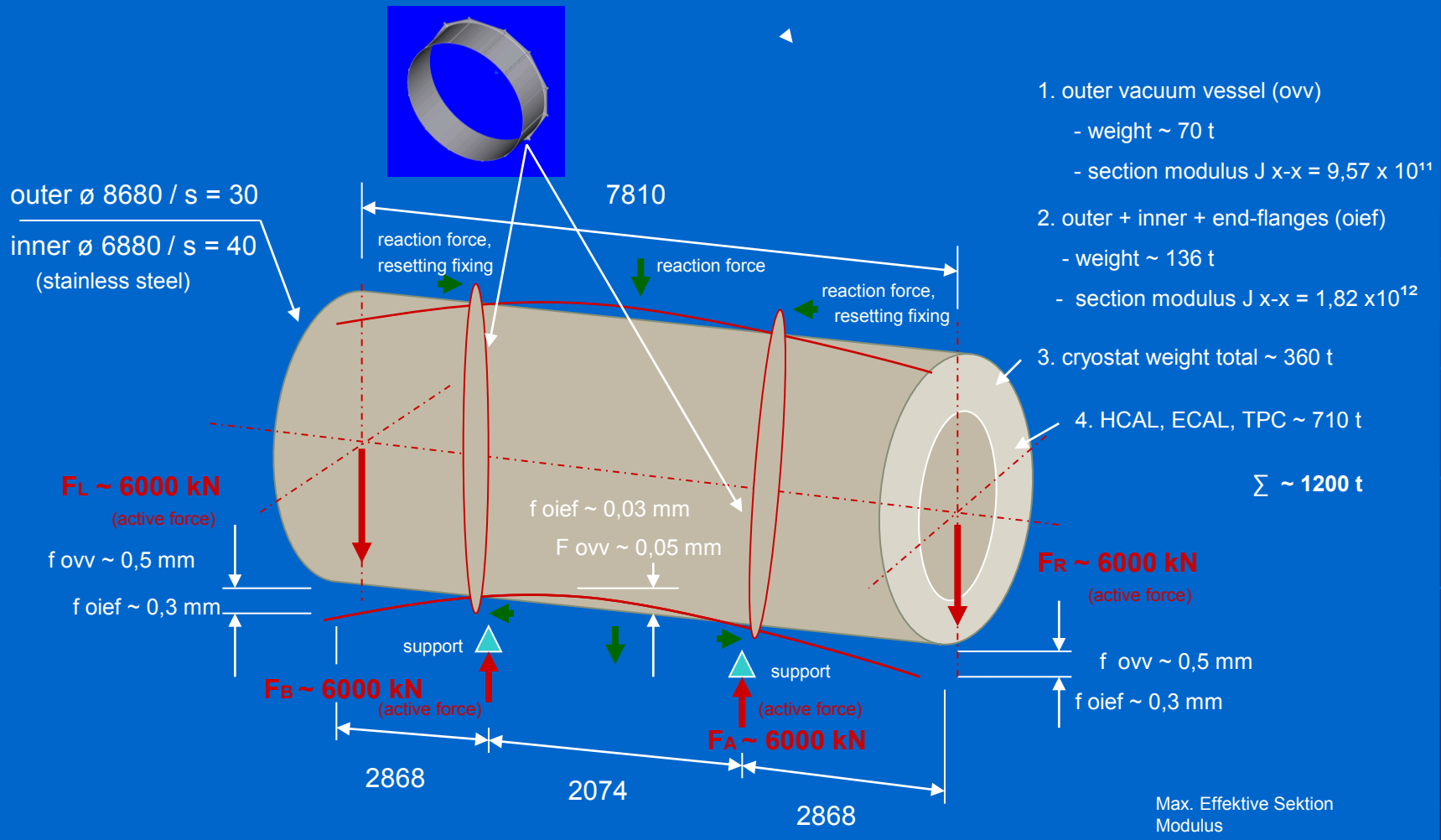


Calculation is without 8 fix foot inside, between cryostat and barrel
- only with fix point

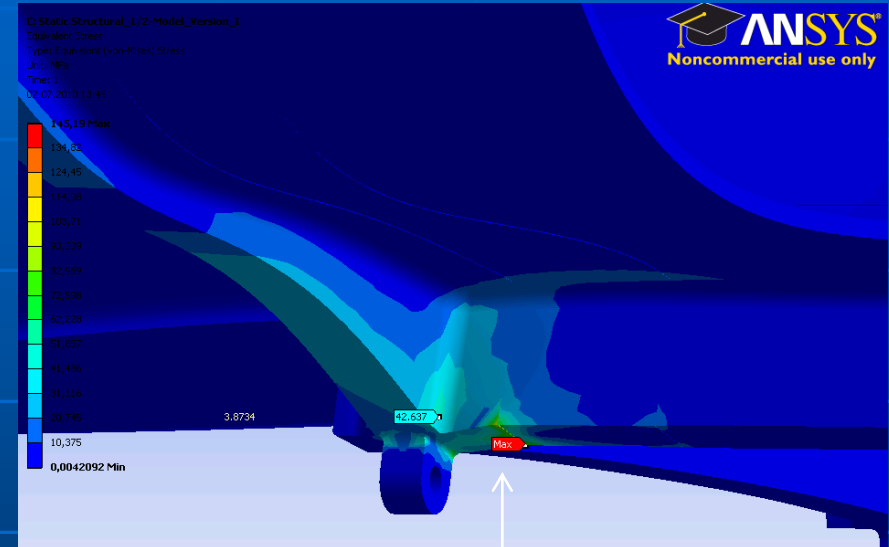
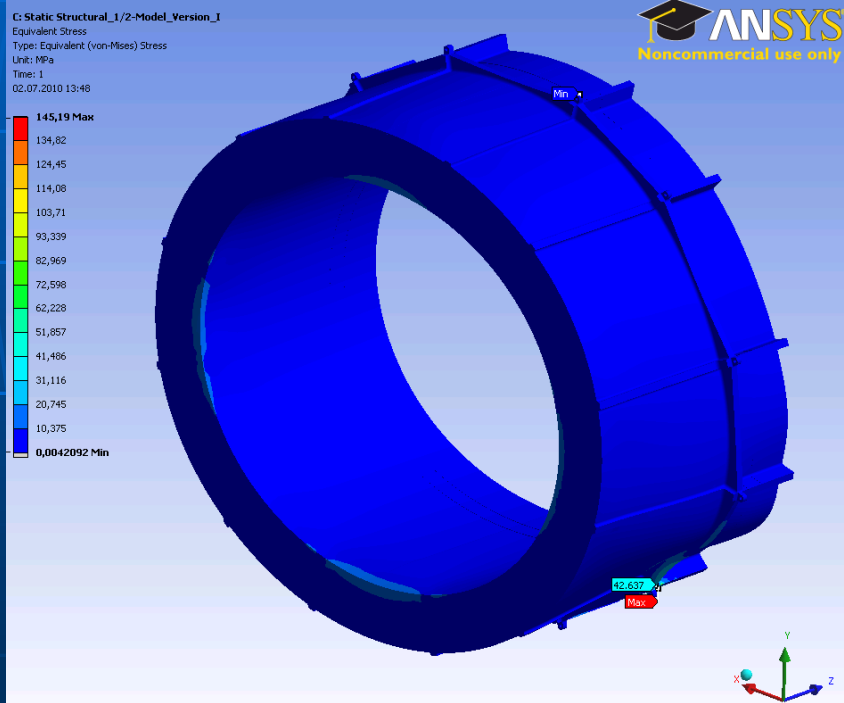


- after primary alignment
- tack weld each bracket to barrel individually,
- from point to point to fit and tack
- fit screw between barrel and OVV
- all bracket to barrel tack welding
- remove circular 6° OVV from barrel
- all bracket end welding
(alternative: welding without removal of OVV)

ILD cryostat: applied and resulting forces, deflection line



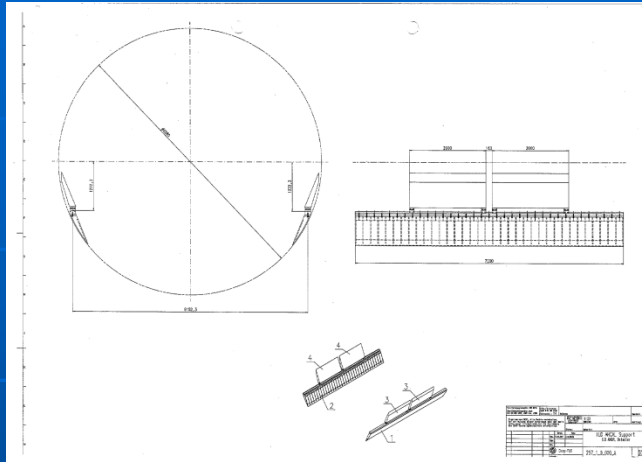
ILD Cryostat total stress



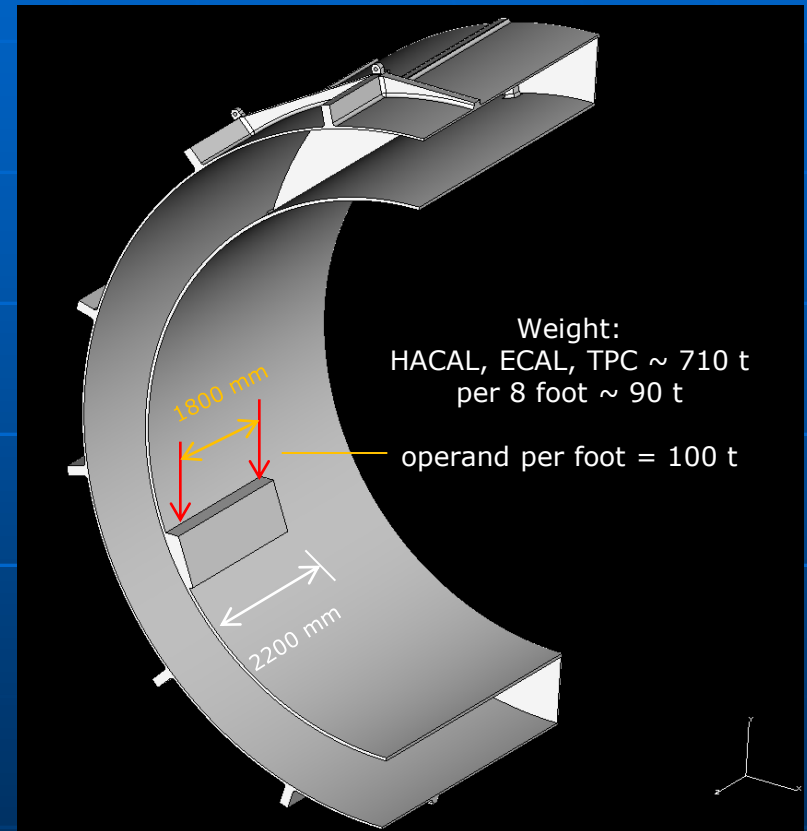
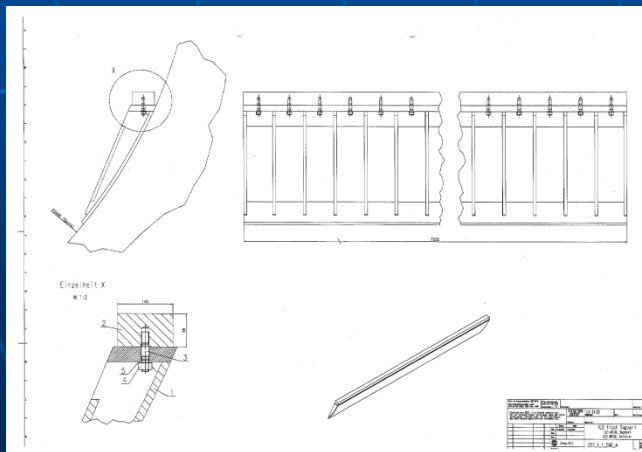
max. stress ~ 50 N/mm

boundary conditions (worst case)

Karsten's construction consists of support, the console below is welded on.



Design: K. Gadow



For the FEM calculation the support is symmetrically partitioned. A length of 2200 mm is taken into account.

FEM simulation / support HACAL Deformation

I-DEAS Visualizer

Display 1

FEM1

B.C. 2,DISPLACEMENT_7,LOAD SET 2

S:\services\CAD\ideas\home\stromhag\DESY\ILD_Barrel_to_Bond_20.mfl

DISPLACEMENT Magnitude Unaveraged Top shell

Min: 0.00E+00 mm Max: 1.45E+01 mm

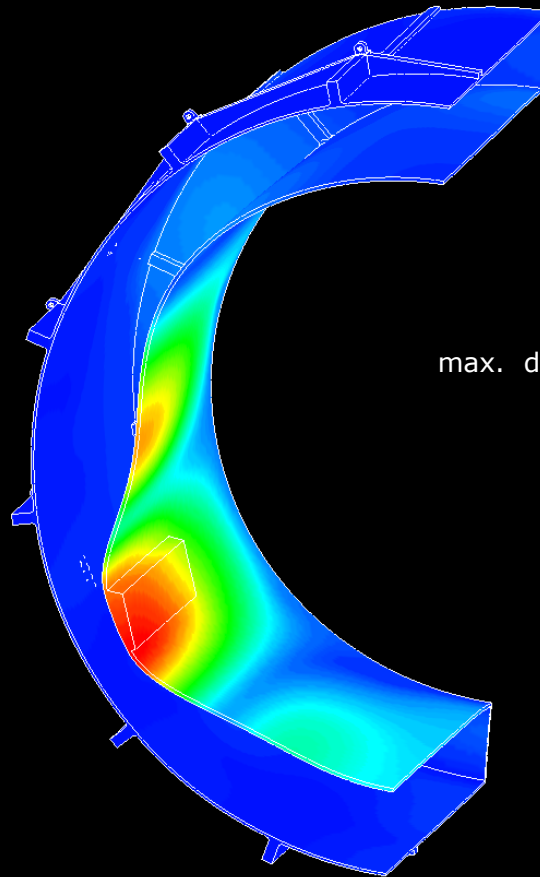
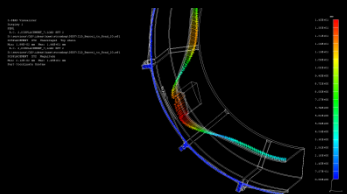
B.C. 2,DISPLACEMENT_7,LOAD SET 2

S:\services\CAD\ideas\home\stromhag\DESY\ILD_Barrel_to_Bond_20.mfl

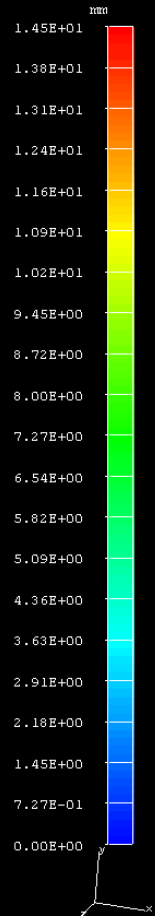
DISPLACEMENT XYZ Magnitude

Min: 0.00E+00 mm Max: 1.45E+01 mm

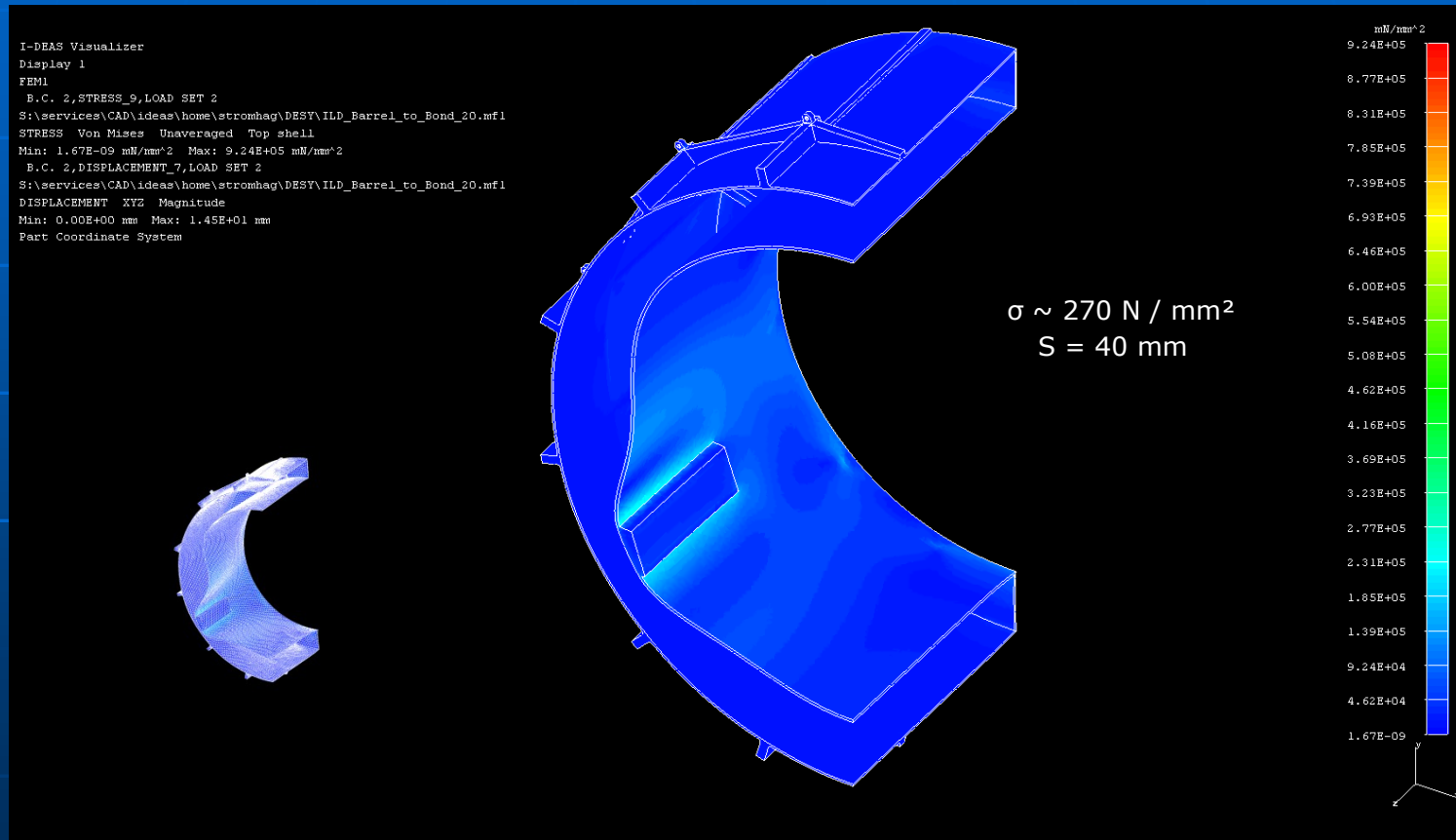
Part Coordinate System



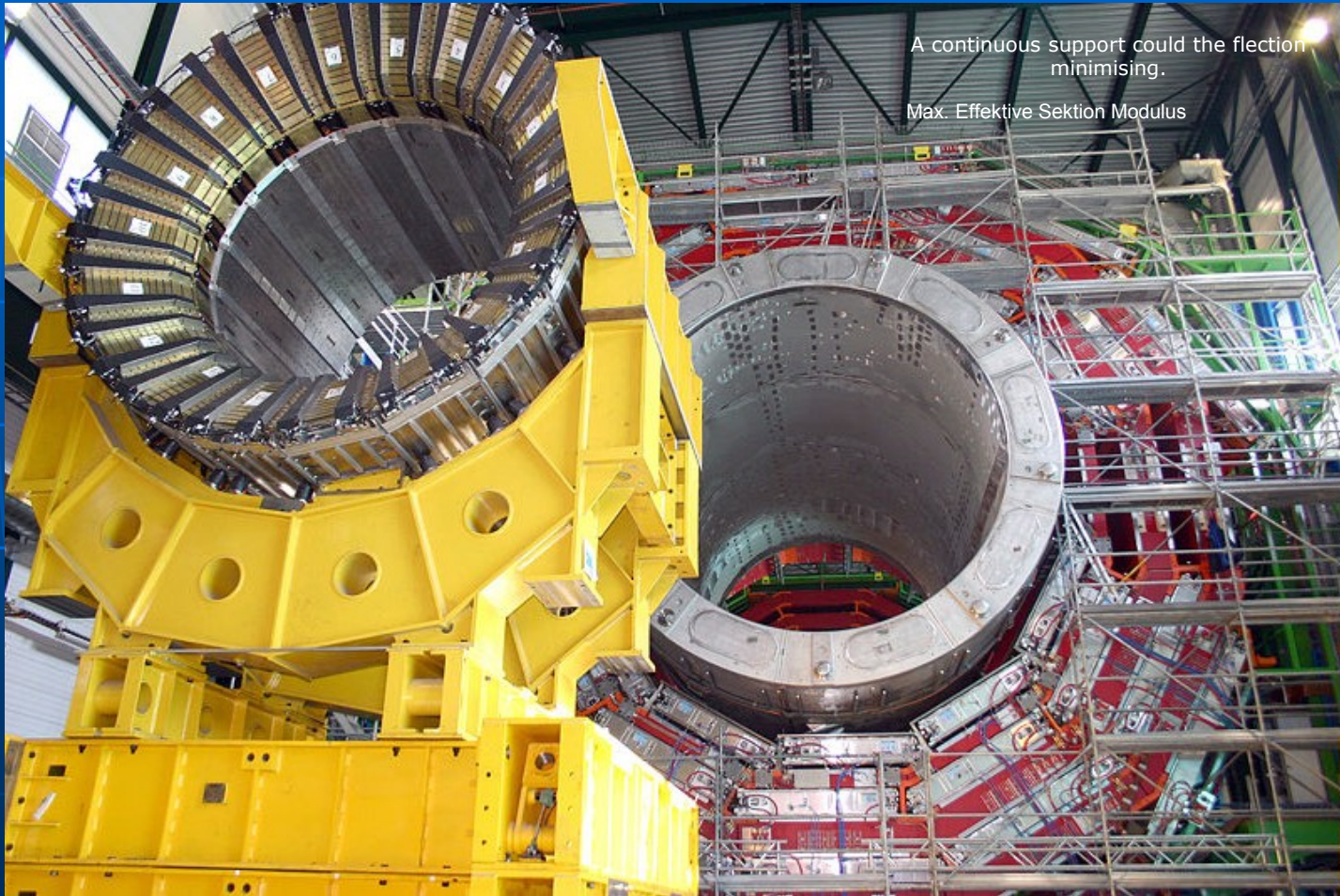
max. deformation ~ 15 mm
S = 40 mm



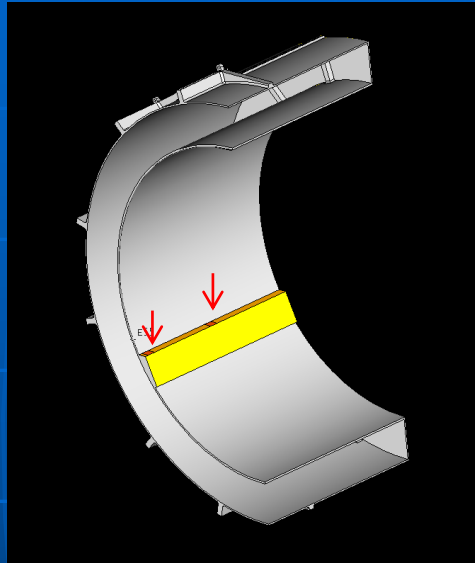
FEM simulation / support HACAL Stress



HCAL prepared for insertion / CMS



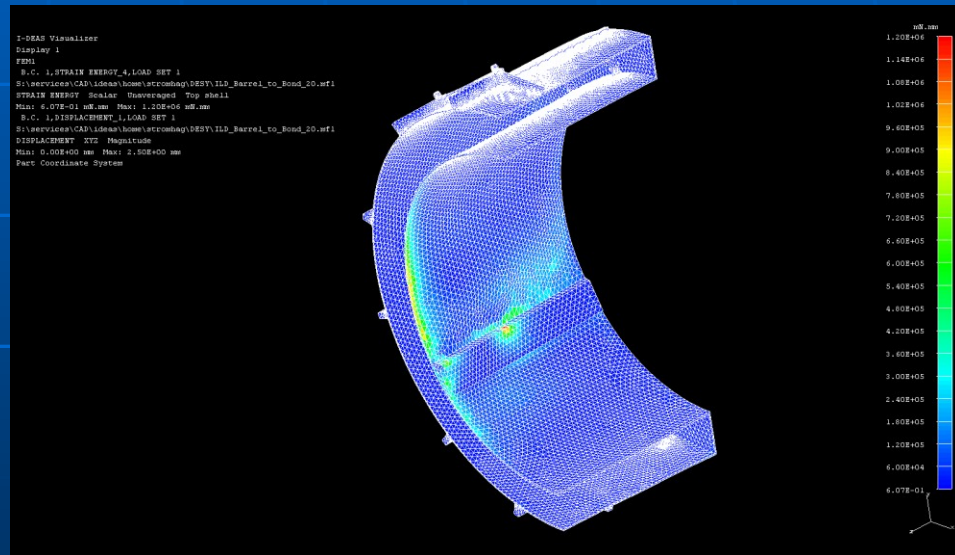
FEM Simulation / Support end-to-end long-welded-rails to locating flange



Weight:
HACAL, ECAL, TPC ~ 710 t
per 8 foot ~ 90 t

operand per foot = 100 t

max. deflection ~ 2,5mm
max. stress 120 N/mm²
S = 40 mm



conclusion

- In this note is described the status of the FEM calculation for HACAL in to Cryostat in .
- The design is only proposal, in detail with all calculation required and realistic.
- Insertion of ILD HACAL in to Cryostat in central barrel is adequate to CMS cryostat.
- strength analysis assumes “open-door design” (good safety factor)
- A lot of studies need to be performed:
 - design of supporting system
 - - all geometrical parameters
 - - finish cryostat constructions concept
 - - cryostat quench scenarios
 - - cabling concept
 - - power supply connection design
 - - cryostat safety instruction sheet
 - - scaffolding
 - - gas-, cables-, water-, power-connection