PANDA Fw Endcap EMC, status prototype

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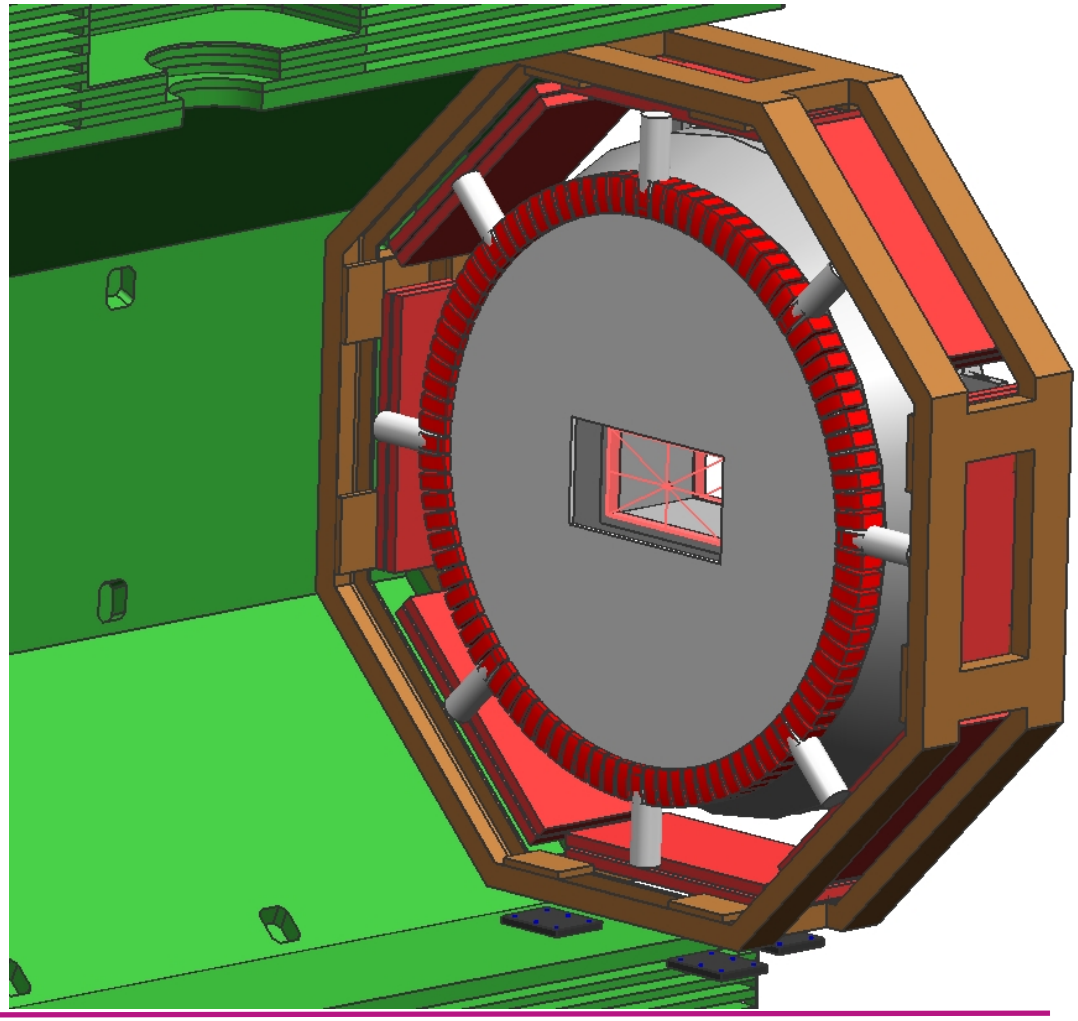
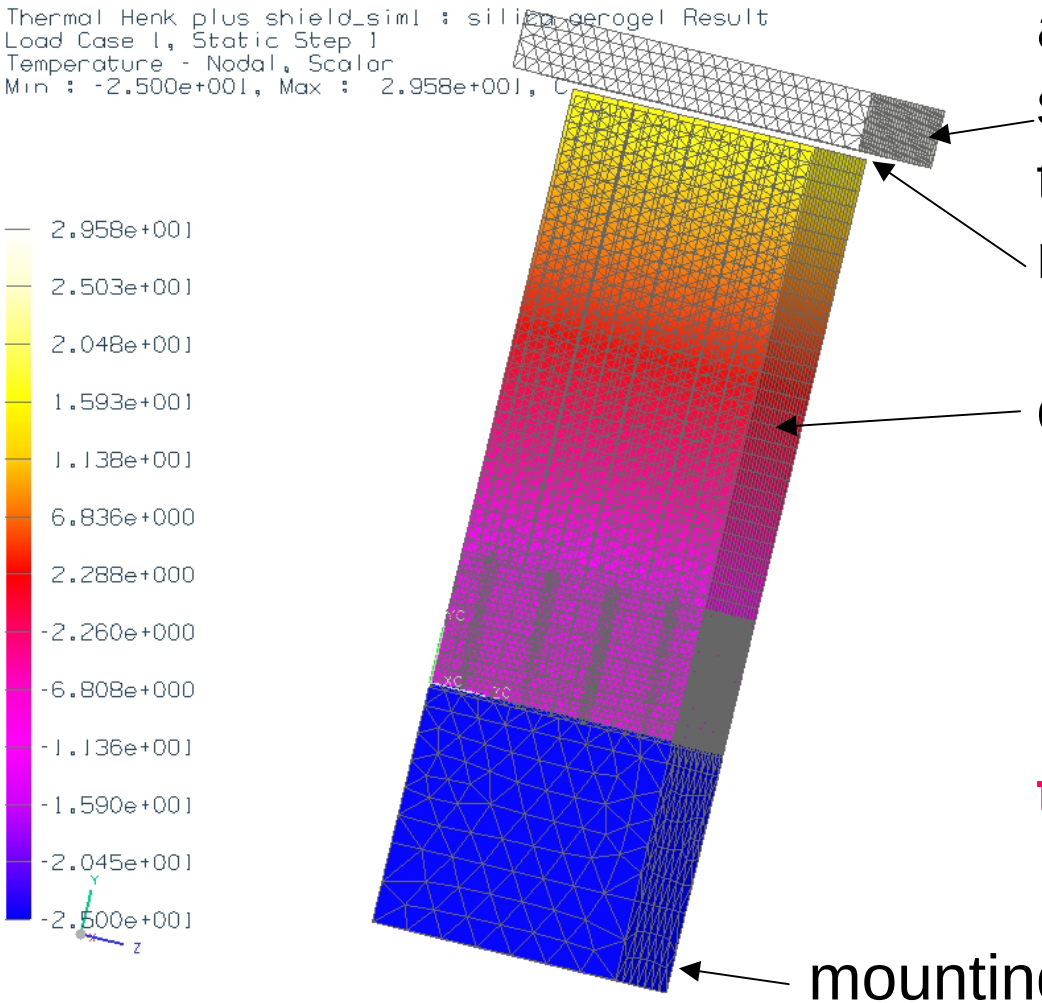


Unigraphics FEM calculations

thermal insulation and cooling:
front cover,
cold-warm connections

model of complete single alveole

with 16 crystals, VPT and Al mounting structures



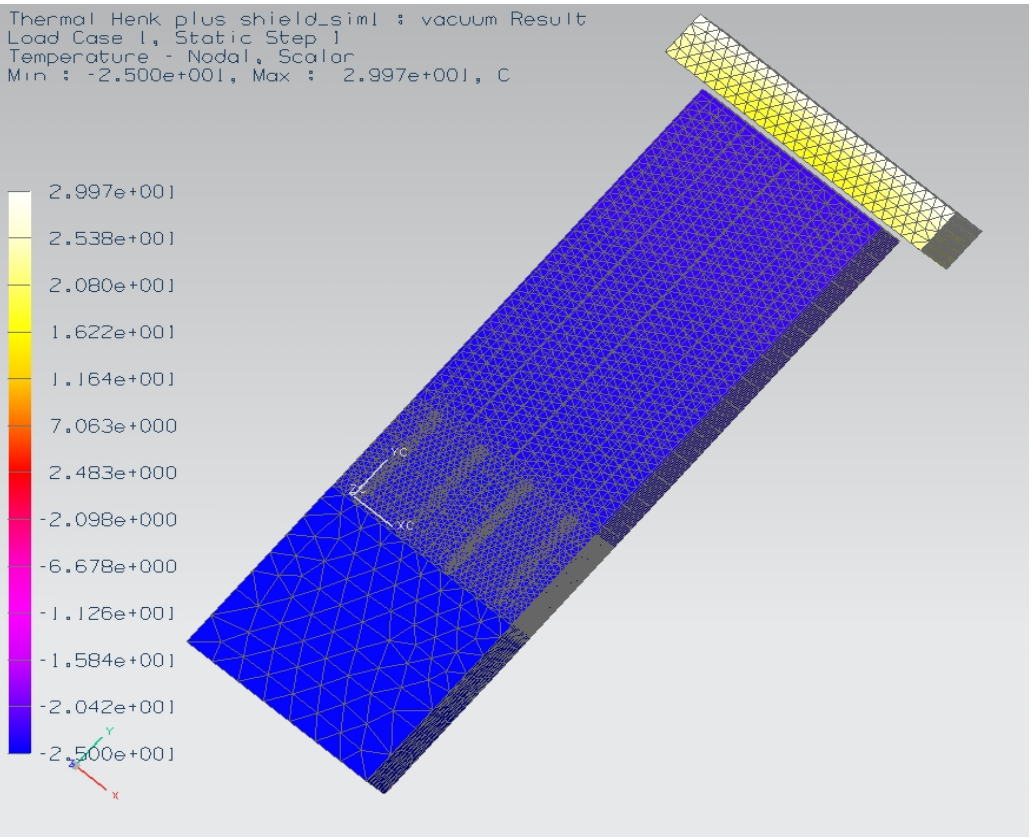
ambient temperature T=30° C
silica aerogel insulation,
thermal cond. k = 0.024 W/(K m)
no contact, only radiation

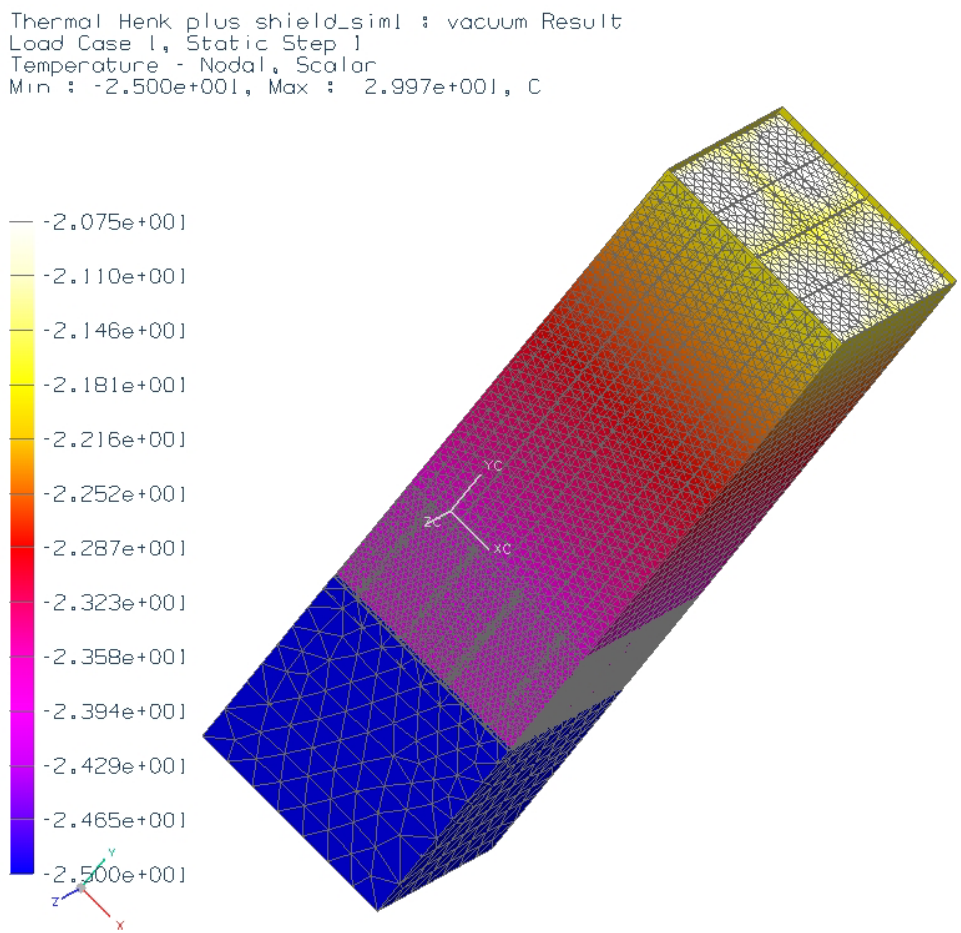
continuous boundary conditions
on the side faces

too large temperature gradient:
need better insulation

mounting plate cooled to T=-25° C

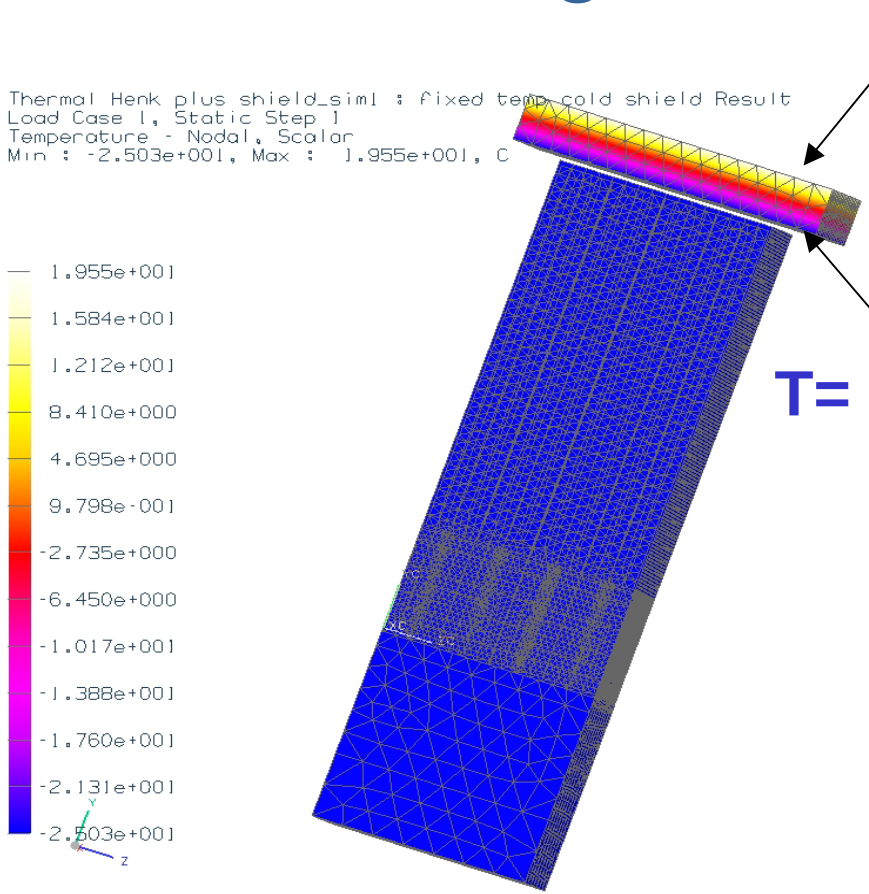
perfect front insulation: vacuum

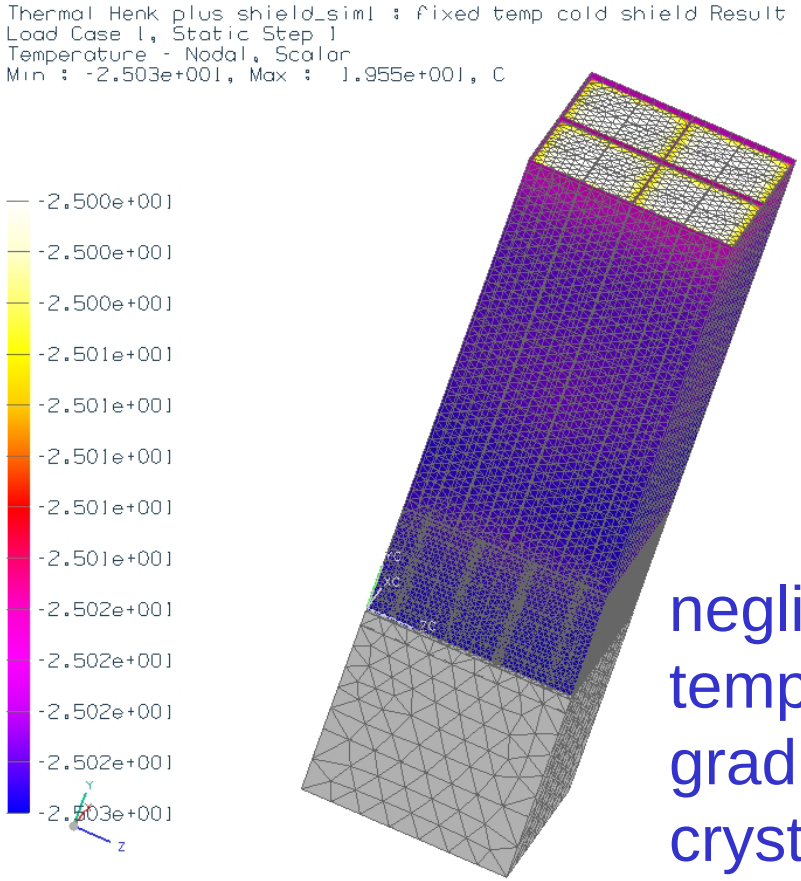




even with vacuum insulation: temperature gradient of 4 K

front cooling



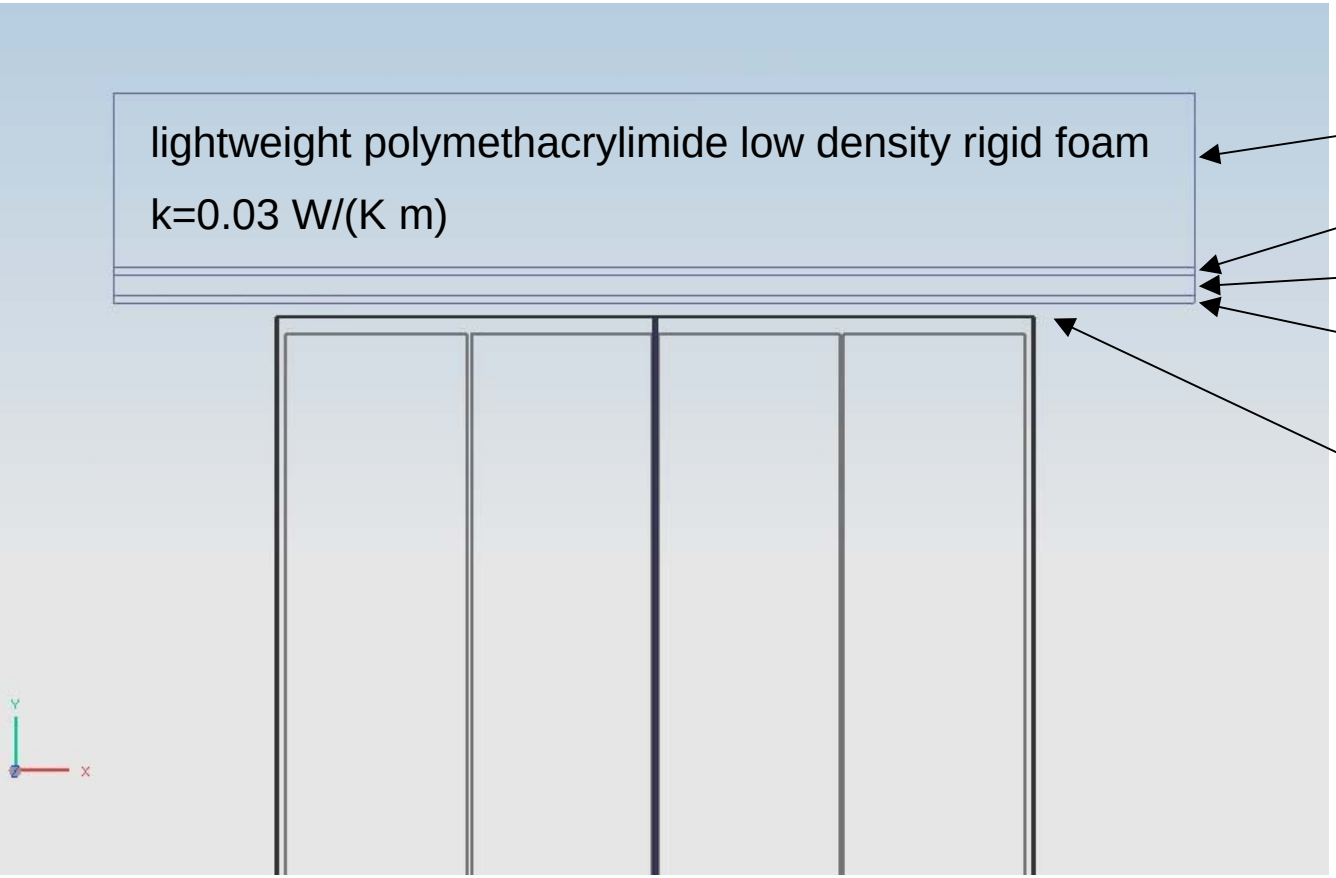


negligible temperature gradient in crystals

shield facing the crystals kept at -25°C

how can we achieve this?

composite shield



25 mm Rohacell

1 mm Al

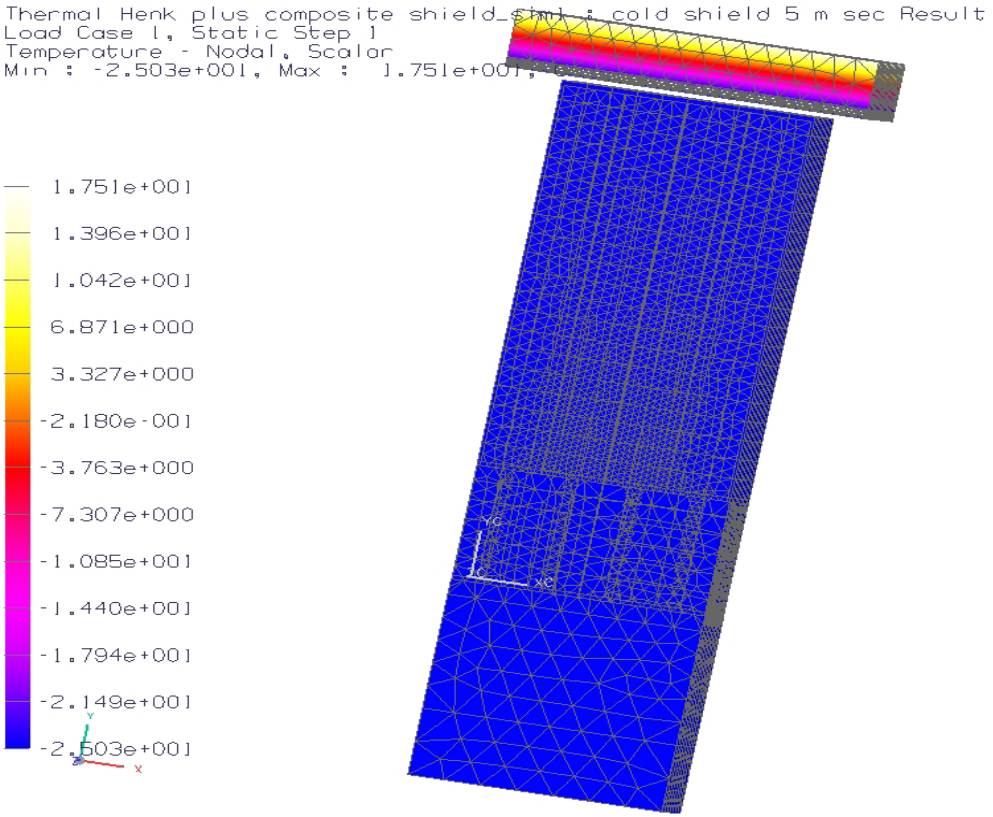
3 mm N_2 at T=-25°C

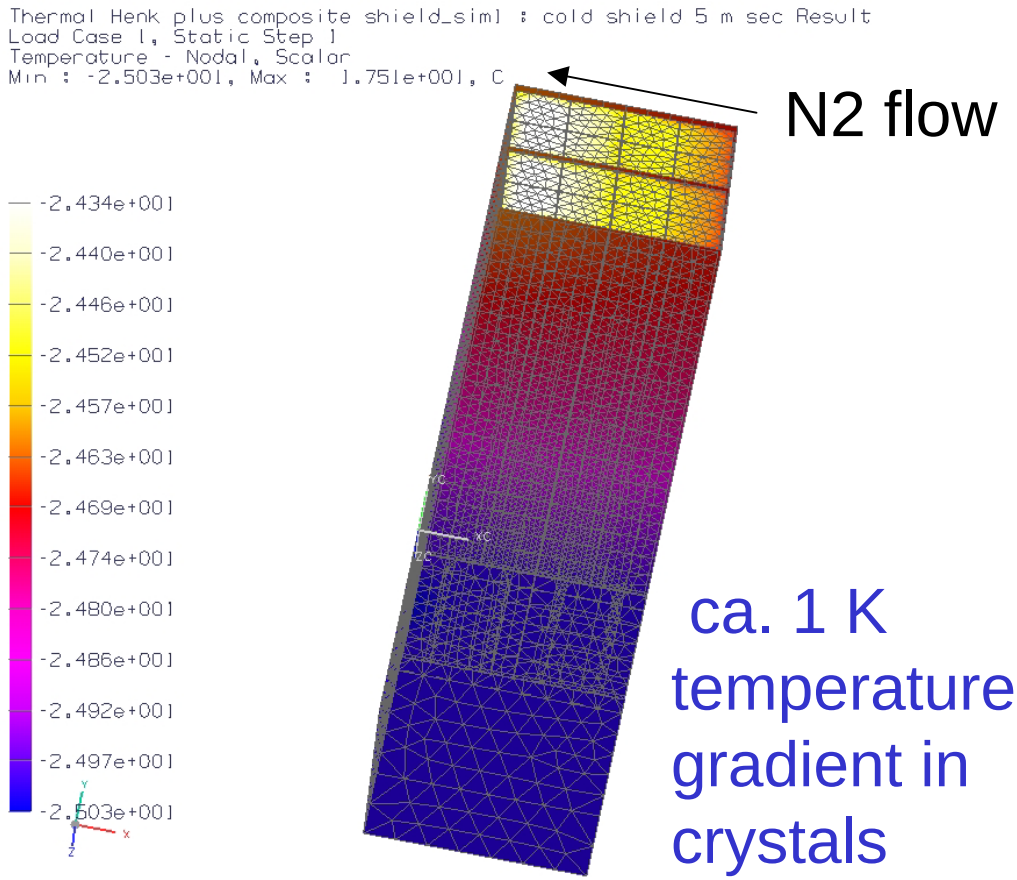
1 mm Al

no contact yet!

moderate dry N_2 flow in 3 mm gap: 5 m/s

composite shield + front cooling

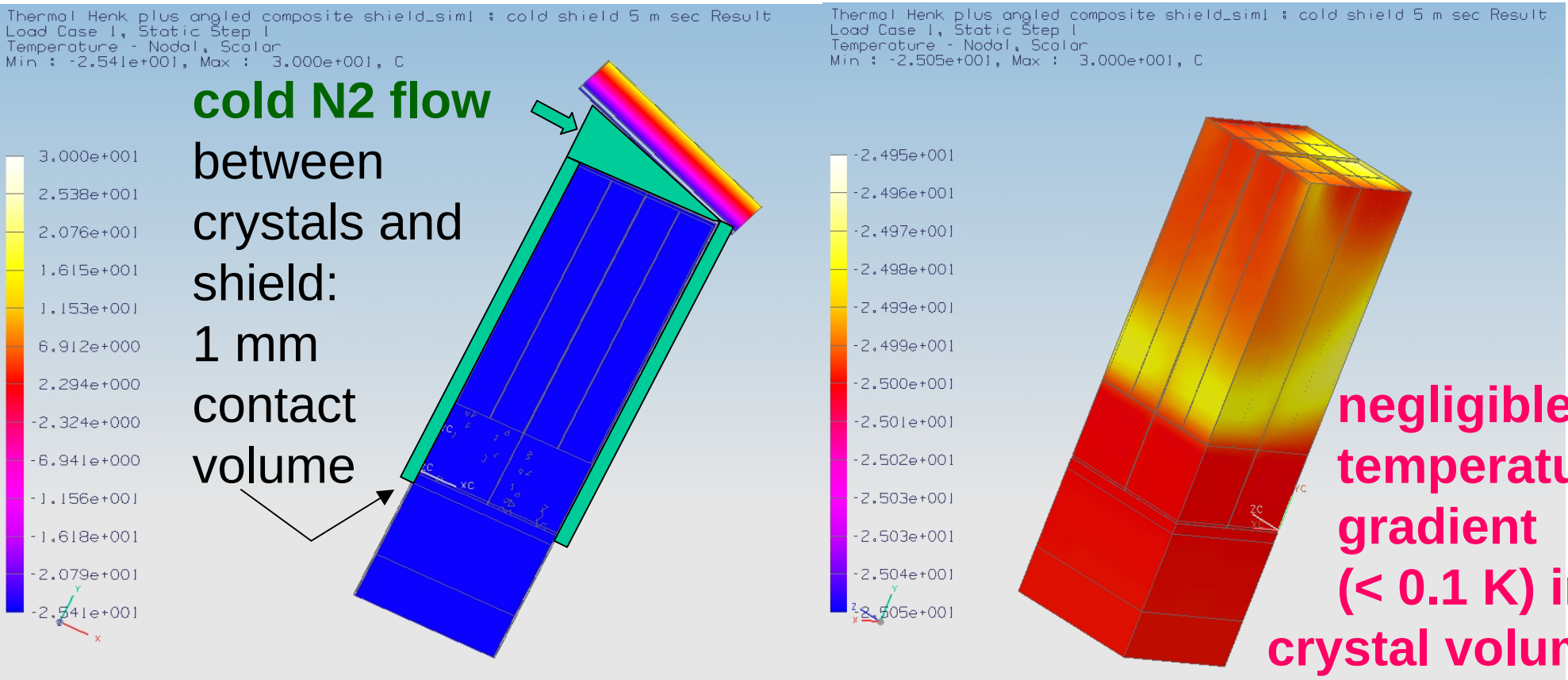




ca. 1 K temperature gradient in crystals

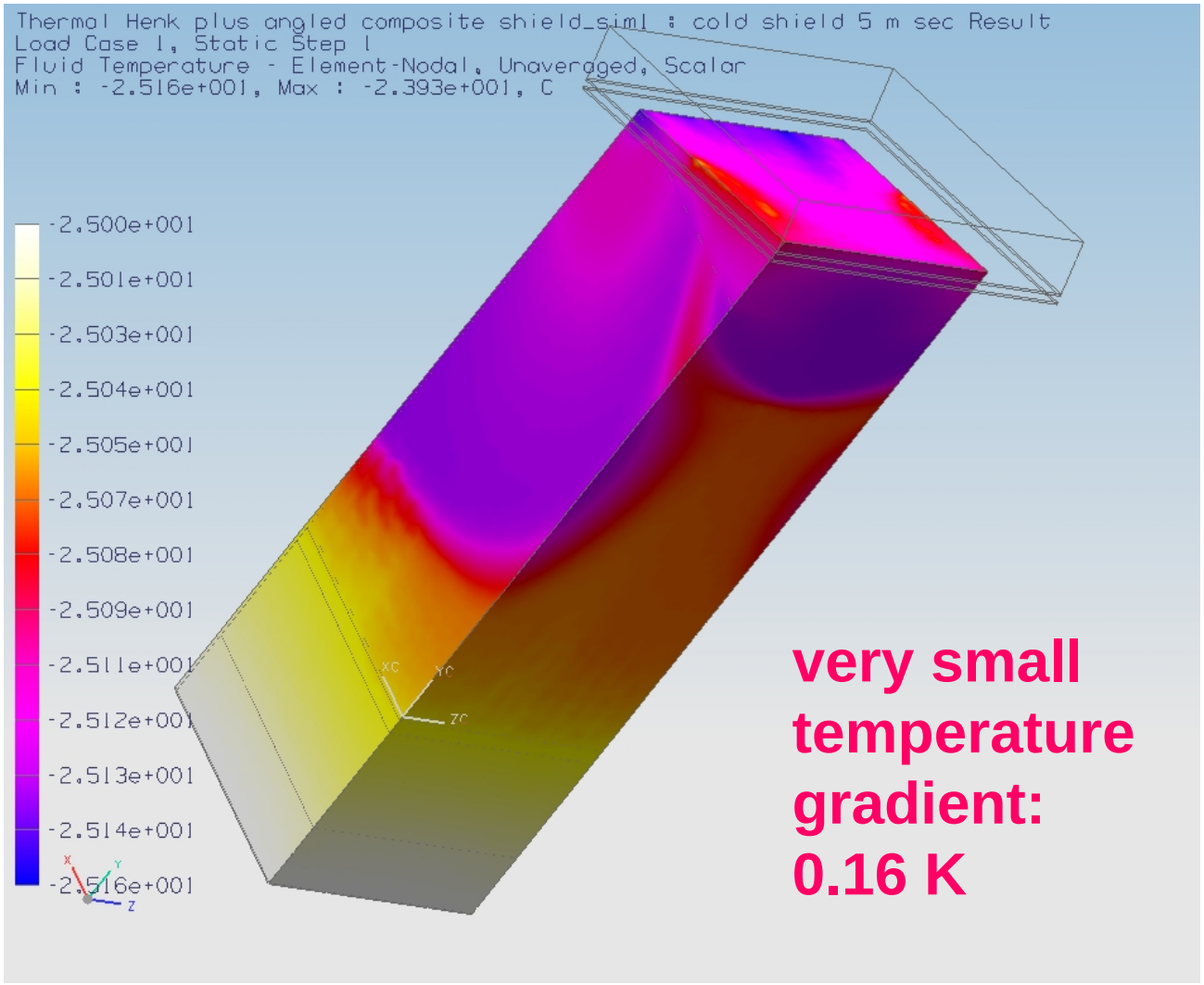
composite thermal shield:
25 mm Rohacell, 3mm dry N_2 at T=-25°C between 2x 1mm Al

cold N_2 contact volume: conduction and convection



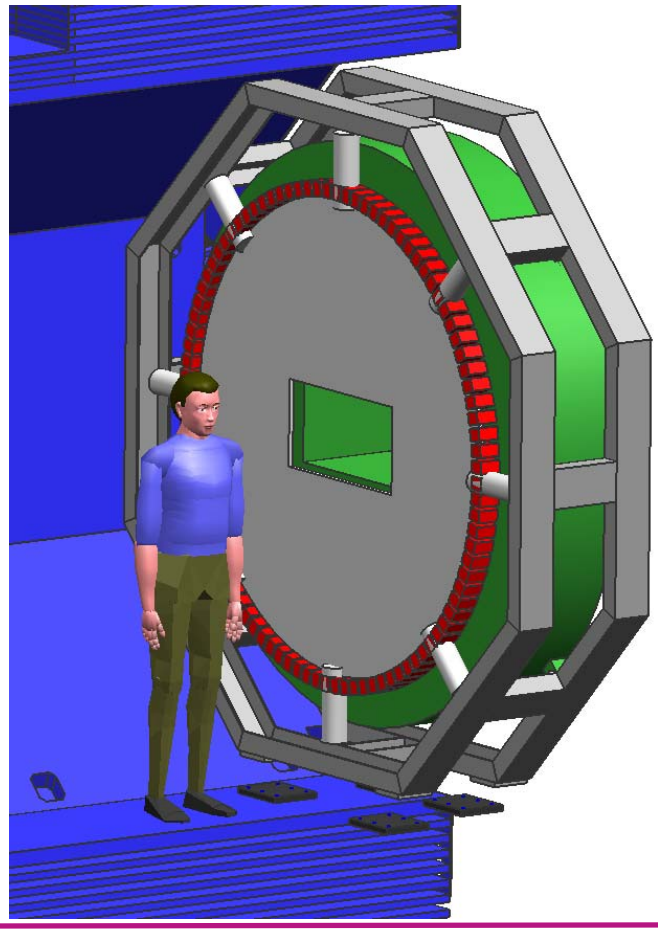
planar Endcap setup:
staggered arrangement of alveoli with triangular gaps: max. angle 20º, filled with cold dry N_2 at T=-25ºC (flow 5 m/s)

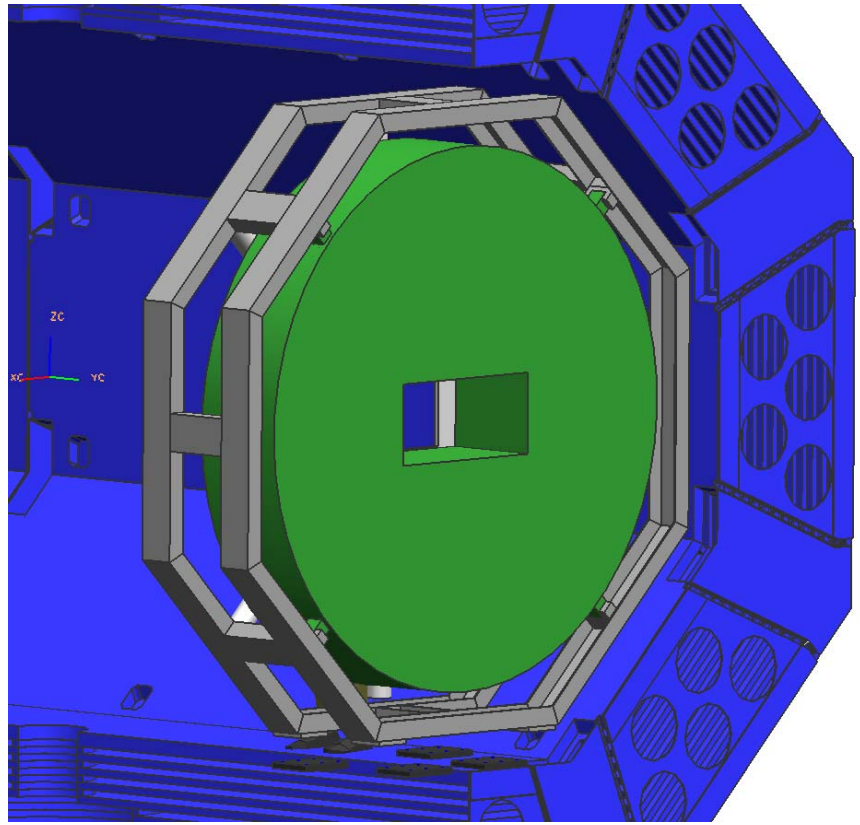
temperature distribution in N_2 volume



insulating endcap mounting

self-supporting endcap frame, resting on bottom layer of solenoid



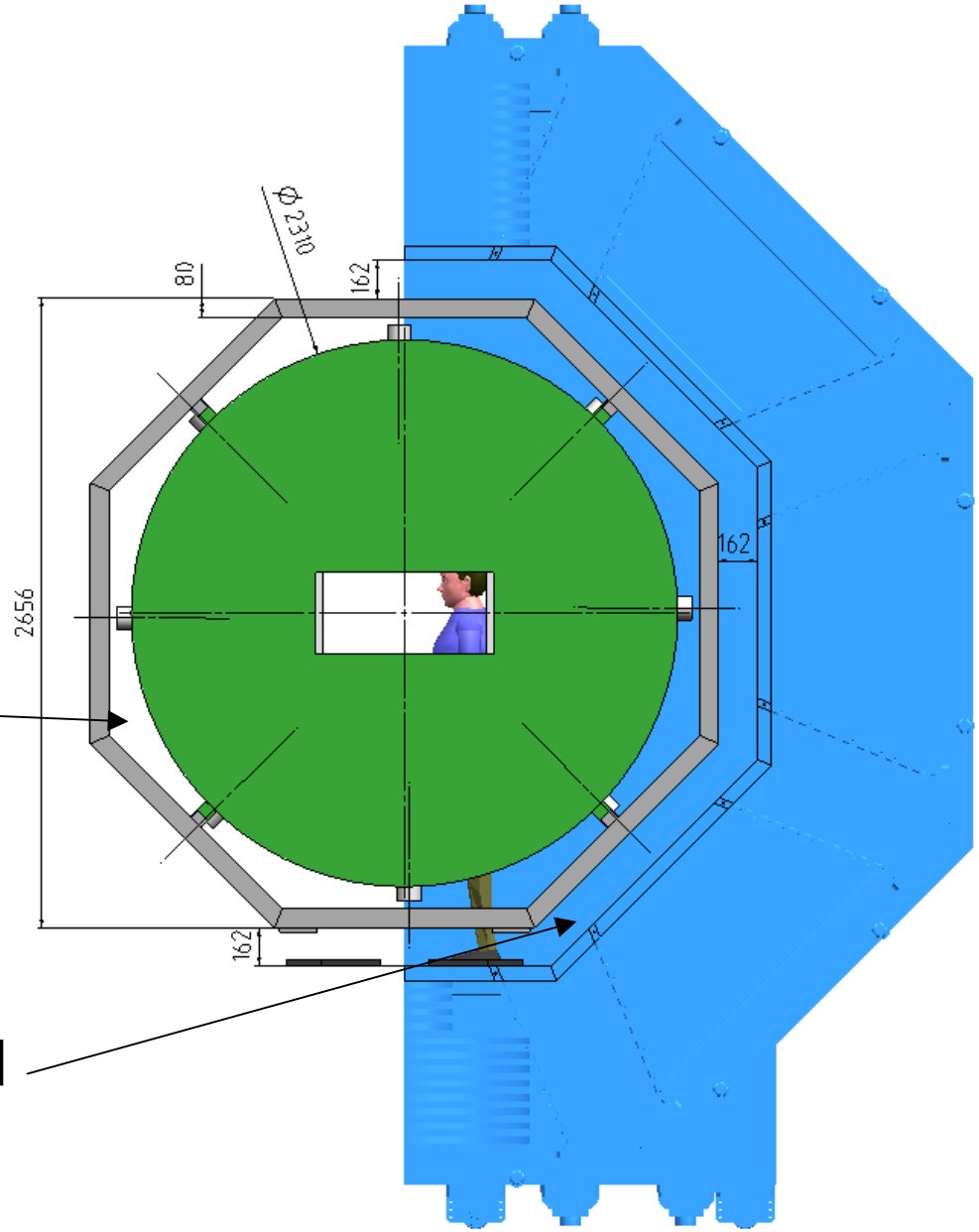


current frame size

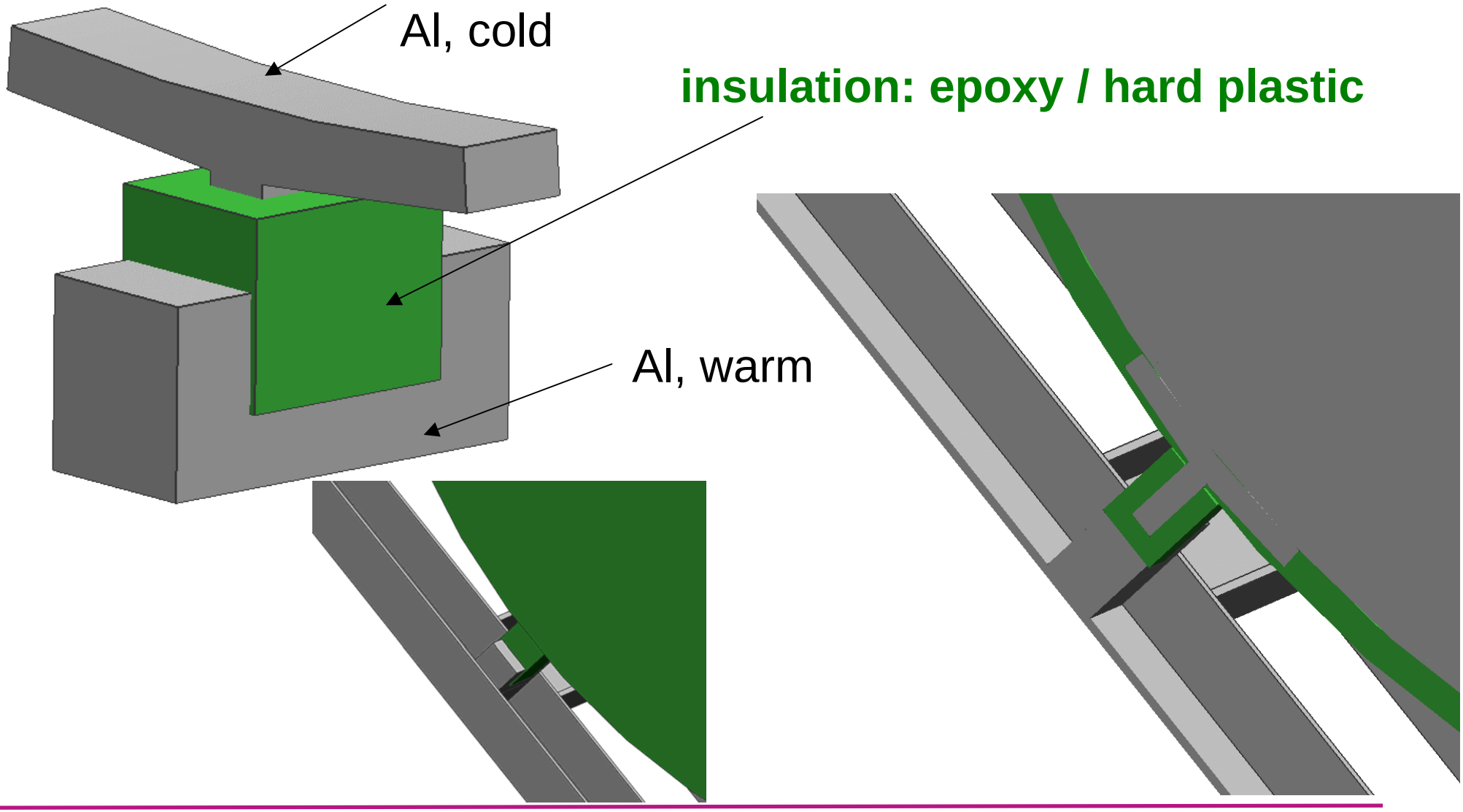
with space available for

electronics
between endcap and
mounting frame

and mounting frame and solenoid

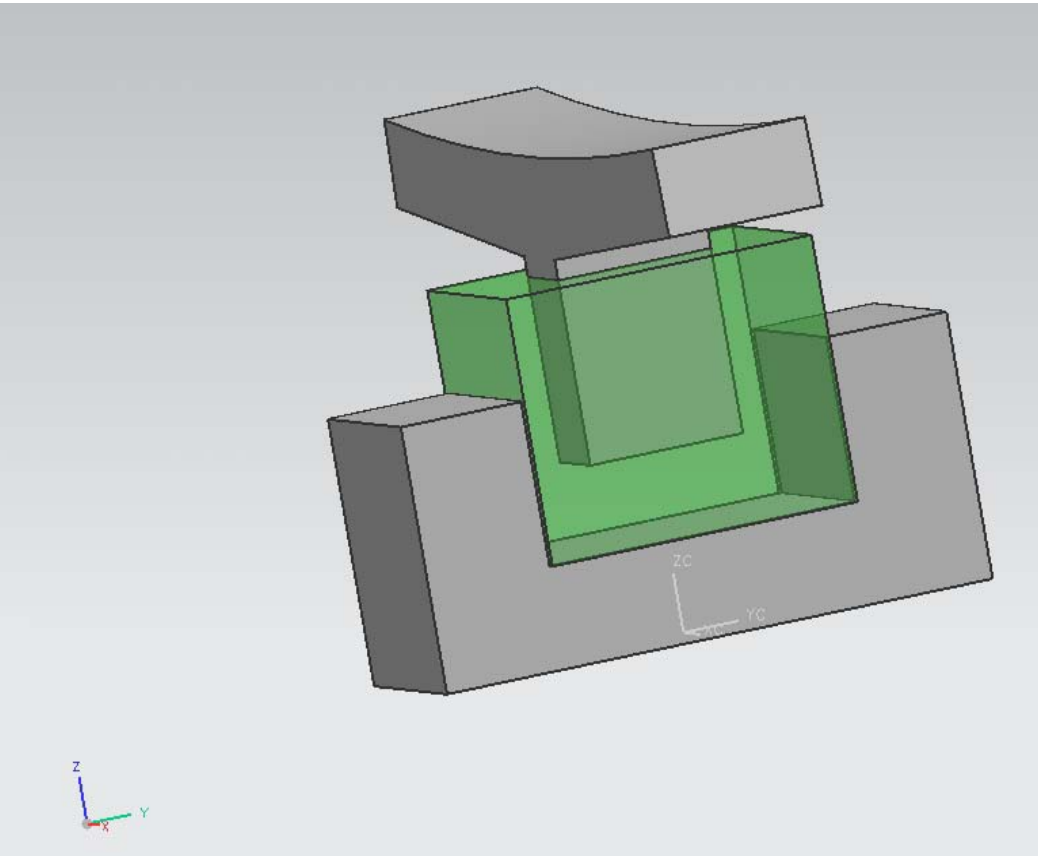


contact points cold - warm

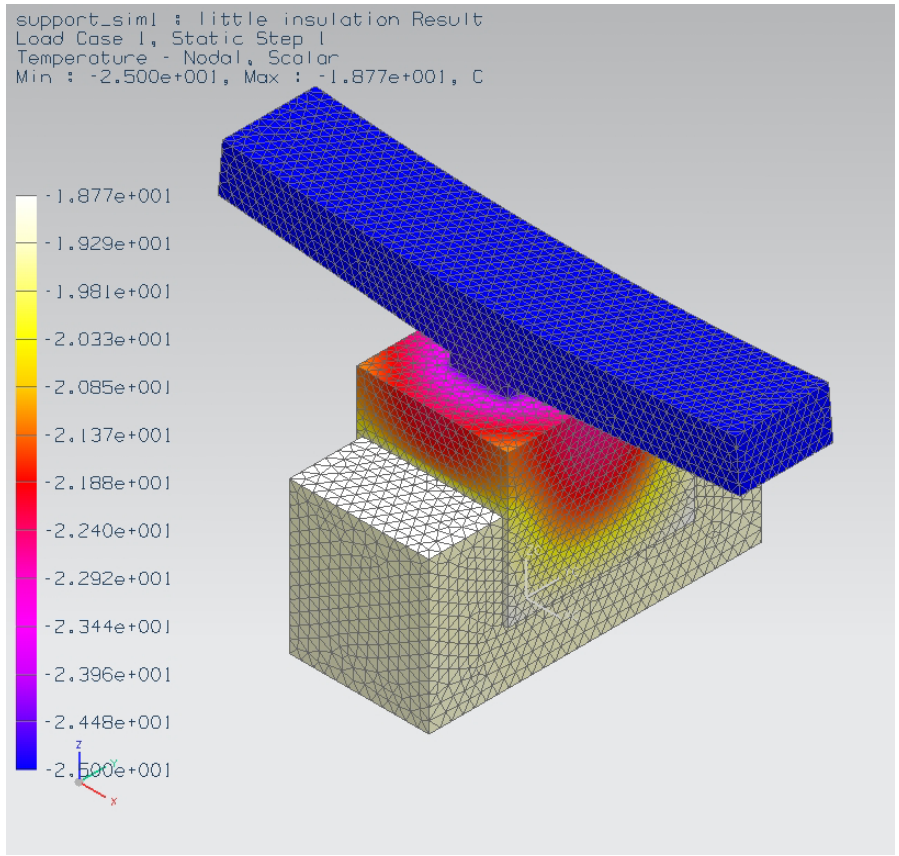


Cold-warm connection

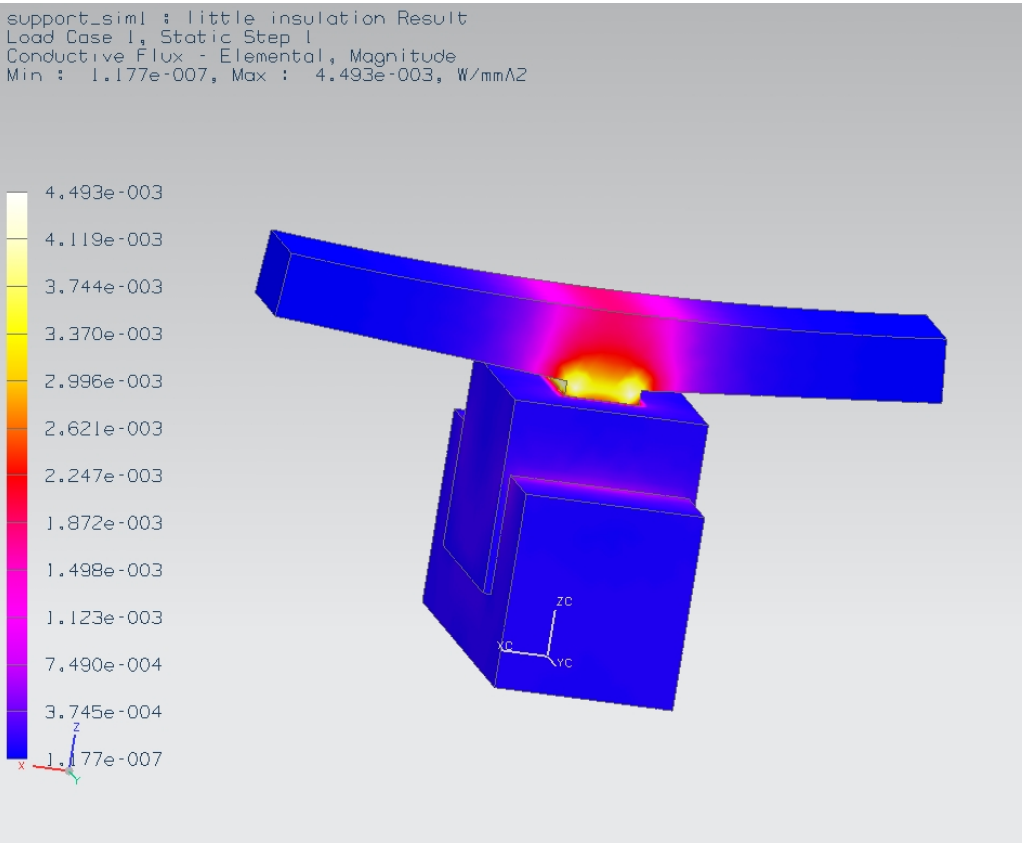
mechanical construction

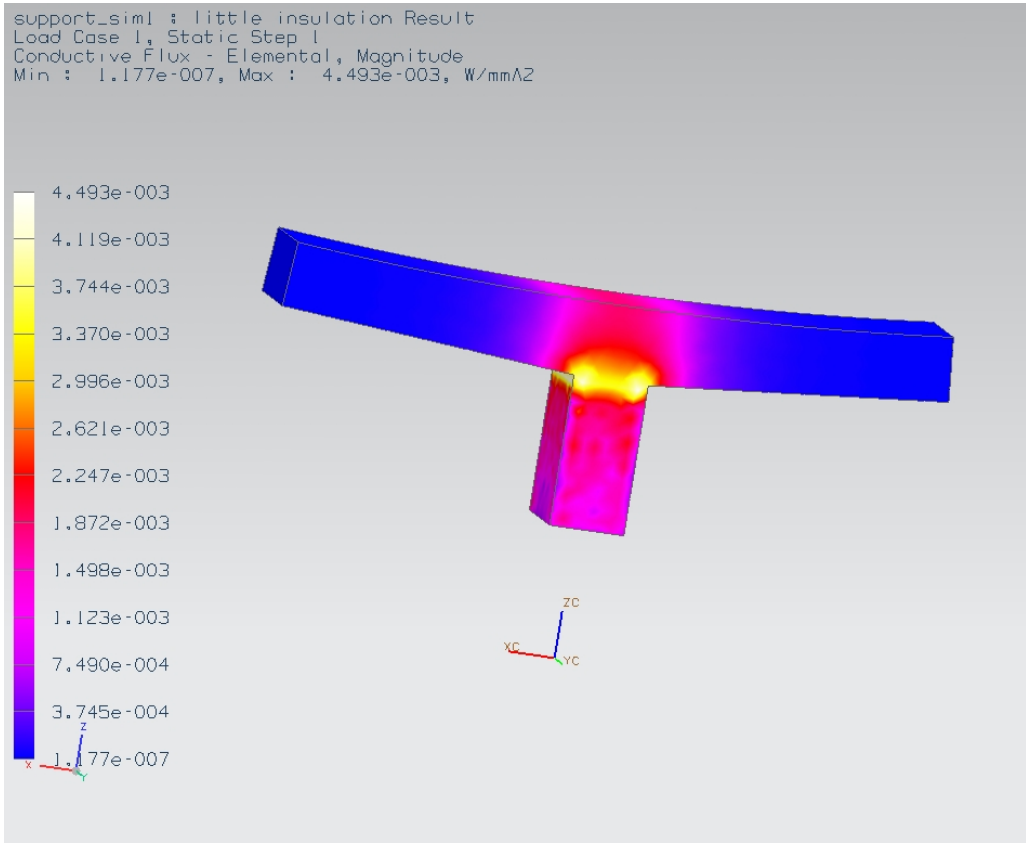


temperature gradient



heat flux

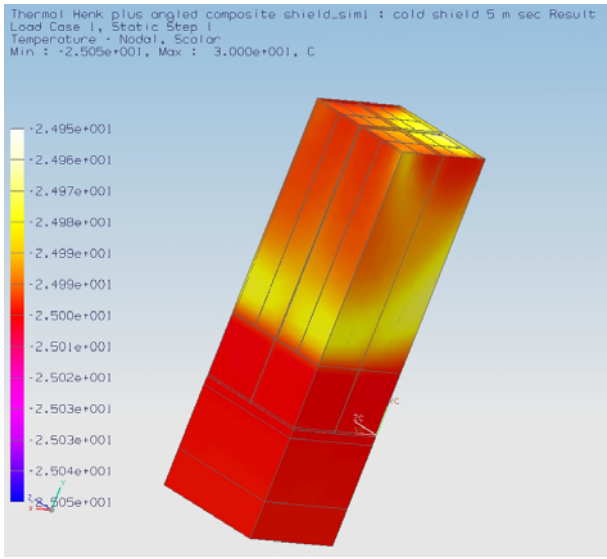


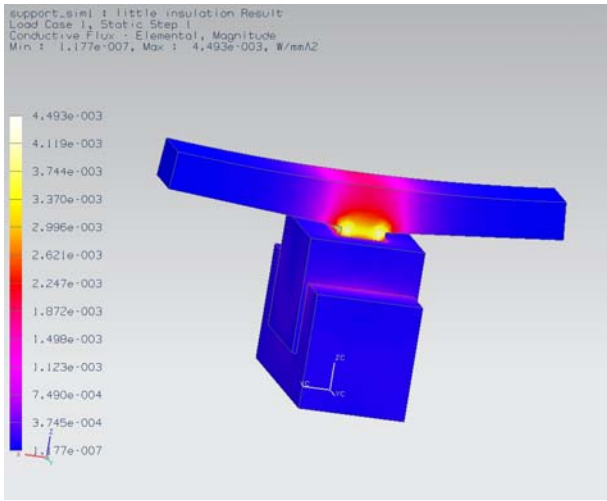


work in progress, preliminary resultson heat flux:
max. 5 mW /mm^2 seems acceptable

summary

small temperature gradient (< 0.1 K) can be achieved by composite shield with cooling by moderate internal and external N_2 flow





Al contact pins in insulating epoxy / hard plastic block seem to provide an acceptable heat flux