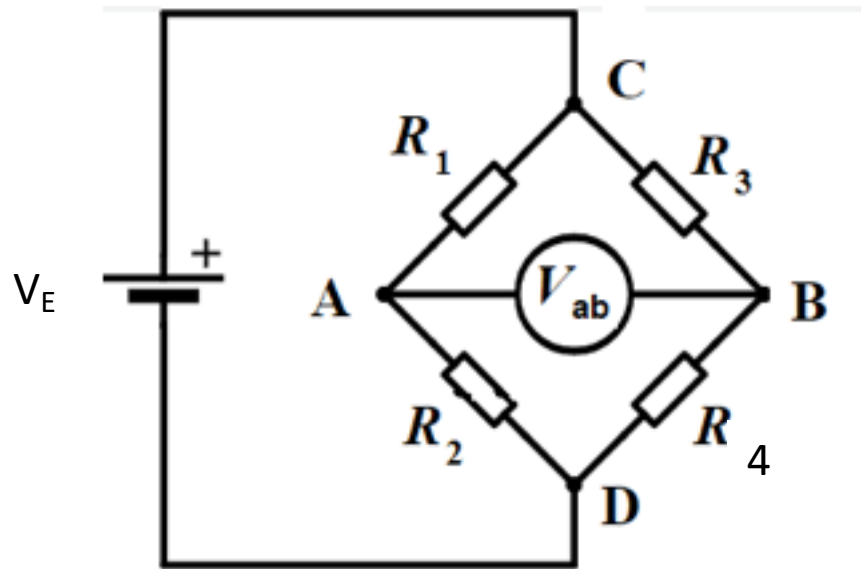


Strain Gage preparation

M. Beretta, B. Lenci, M. Testa

Strain Gage configuration



- R_1 attached on HS inside Climate Chamber (CC)
- R_2 nearby R_1 , not attached on HS, inside CC
- R_3 and R_4 outside CC
- $R_i = 350 \text{ Ohm}$

- $\Delta R_i / R_i = K \varepsilon_i$
- $\varepsilon_i = \Delta L_i / L_i$
- $K \sim 2$ is the gage factor
- $L_i \sim 7 \text{ mm}$ is the gage length

if $\Delta R_i \ll R_i$

$$V_{ab} / V_E = K/4 (\varepsilon_1 - \varepsilon_2 + \varepsilon_3 - \varepsilon_4)$$

During Thermal cycle:

- $\Delta R_1 / R_1 = K (\varepsilon_{\text{Mech}} + \varepsilon_{\text{Therm}})$
- $\Delta R_2 / R_2 = K (\varepsilon_{\text{Therm}})$
- $\Delta R_3 / R_3 = \Delta R_4 / R_4 = 0$

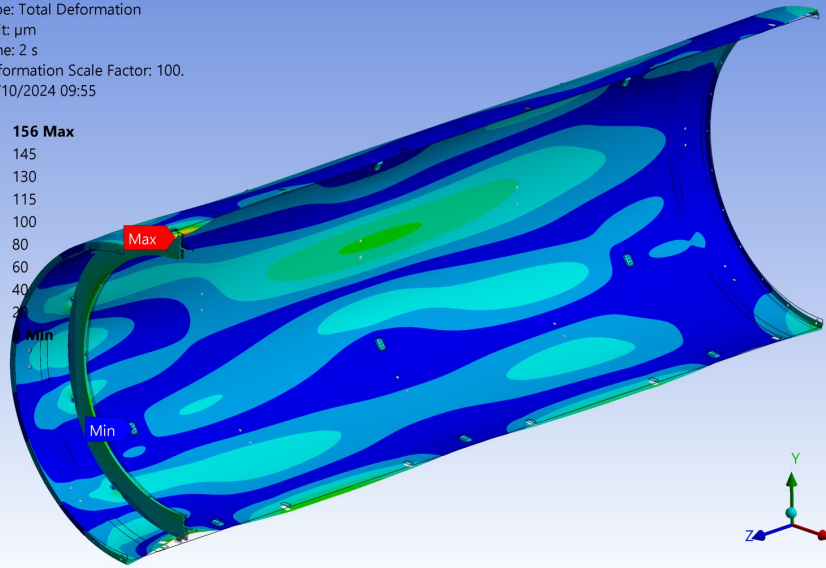
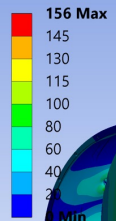
$$V_{ab} / V_E = K/4 (\varepsilon_{\text{Mech}} + \varepsilon_{\text{Therm}} - \varepsilon_{\text{Therm}}) = K/4 \varepsilon_{\text{Mech}}$$

Strain Gage: Expected signal

- $\Delta L_1 \sim 10\text{-}100 \mu\text{m}$ from Mauro's Ansys simulation (next slide)
- For $100 \mu\text{m}$:
 - $\varepsilon_{\text{Mech}} = \Delta L_1 / L_1 = 100 \mu\text{m} / 7 \text{ mm} \sim 1.4 \times 10^{-2}$
 - $V_{\text{ab}} / V_{\text{E}} = K/4 \times \varepsilon_{\text{Mech}} = 2/4 \times 1.4 \times 10^{-2} \sim 0.7 \times 10^{-2}$
 - $V_{\text{E}} \sim 15 \text{ V}$
- $V_{\text{ab}} \sim 100 \text{ mV}$ (x Amplification from electronics if needed)

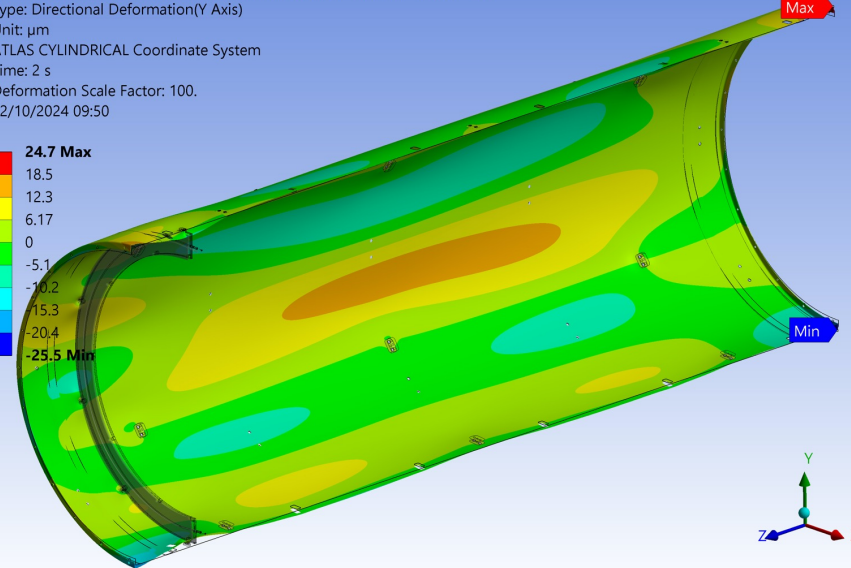
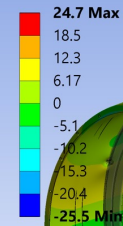
C: Endcap model v1.1 mesh 3.0

Total Deformation
Type: Total Deformation
Unit: μm
Time: 2 s
Deformation Scale Factor: 100.
22/10/2024 09:55



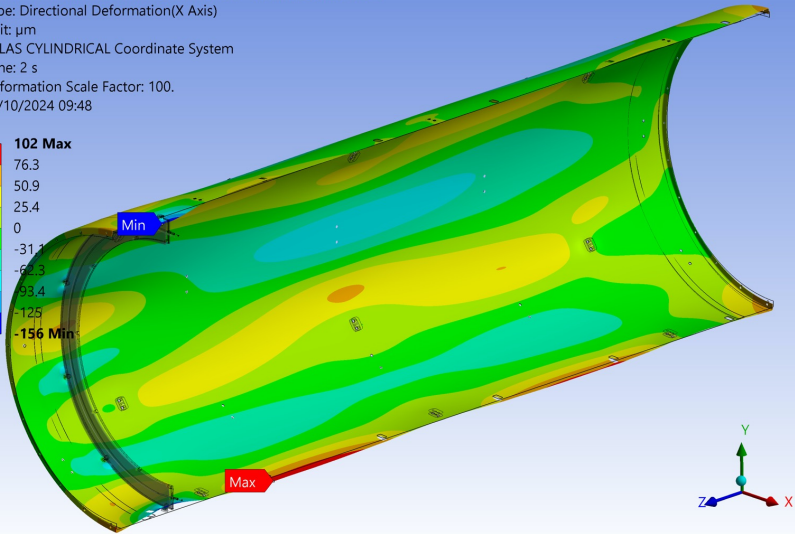
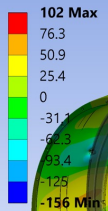
C: Endcap model v1.1 mesh 3.0

Y Axis - CIRCUMFERENTIAL Directional Deformation - L4 HALF-SHELL - 2. s
Type: Directional Deformation(Y Axis)
Unit: μm
ATLAS CYLINDRICAL Coordinate System
Time: 2 s
Deformation Scale Factor: 100.
22/10/2024 09:50



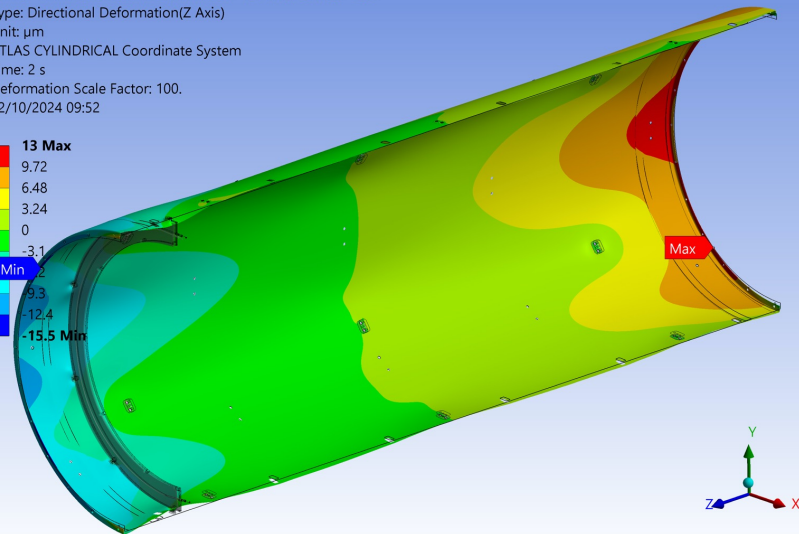
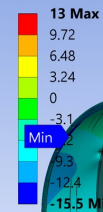
C: Endcap model v1.1 mesh 3.0

X Axis - RADIAL Directional Deformation - L4 HALF-SHELL - 2. s
Type: Directional Deformation(X Axis)
Unit: μm
ATLAS CYLINDRICAL Coordinate System
Time: 2 s
Deformation Scale Factor: 100.
22/10/2024 09:48



C: Endcap model v1.1 mesh 3.0

Z Axis - AXIAL Directional Deformation - L4 HALF-SHELL - 2. s
Type: Directional Deformation(Z Axis)
Unit: μm
ATLAS CYLINDRICAL Coordinate System
Time: 2 s
Deformation Scale Factor: 100.
22/10/2024 09:52



$T_{\text{start}} = +20\text{C}$
 $T_{\text{end}} = -55\text{C}$