ALLEGRO: Noble-liquid calorimeter
Liquid Argon gaps analysis

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10/04/2024

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Mechanical status

- Material for the thermo-mechanical tests of absorbers has been order. Every tests will be carried out using stainless-steel sheets of 0.050mm and 0.100mm for future comparison.
  - Strength tests (results will be presented in the ICEC29).
  - Contraction tests.
  - Thermal shock tests

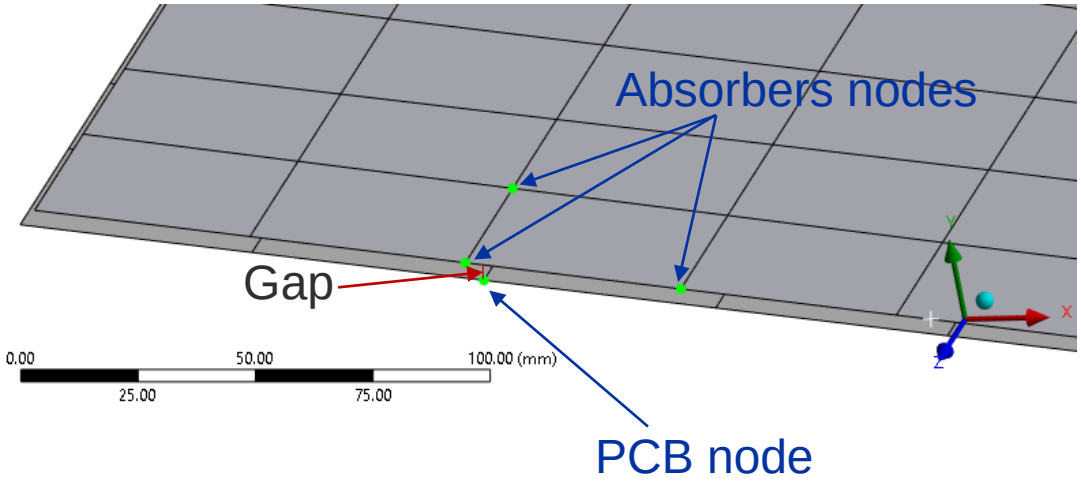
- Analysis of the variation of the liquid argon gap on going.

- Pierre Kast, from CPPM, is collaborating in the design of the spacers.

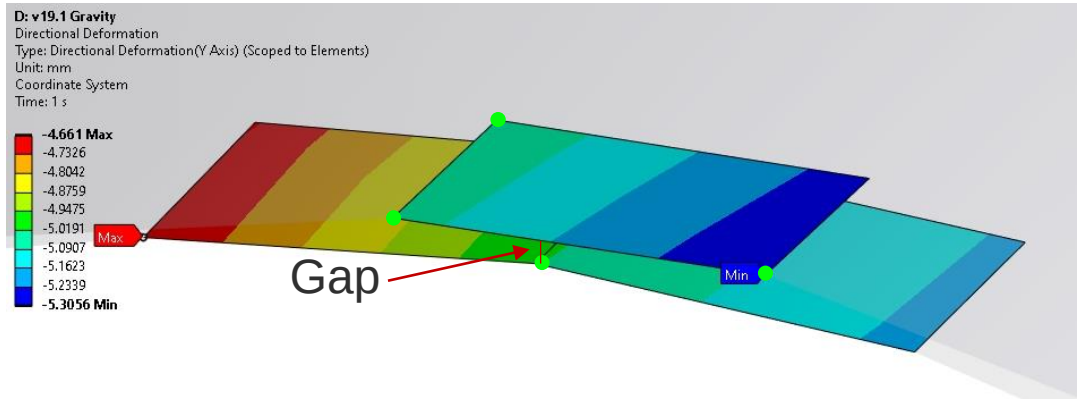
Liquid argon gap analysis

- The gap is calculated in the finite elements model by calculating the minimum distance between each node in the PCB to the plane containing the three nearest nodes in the absorber.
- The PCB is taken as reference because in the model each one has less nodes (500) than the absorbers (689). Which is traduced by a slightly more precise calculation in the deformed plane.

Initial situation

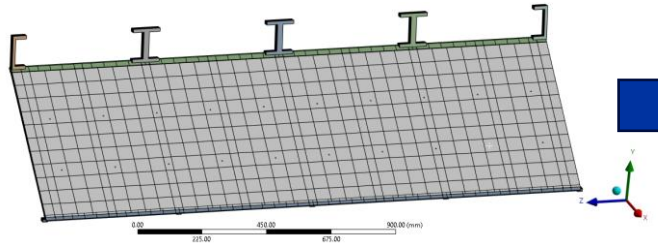


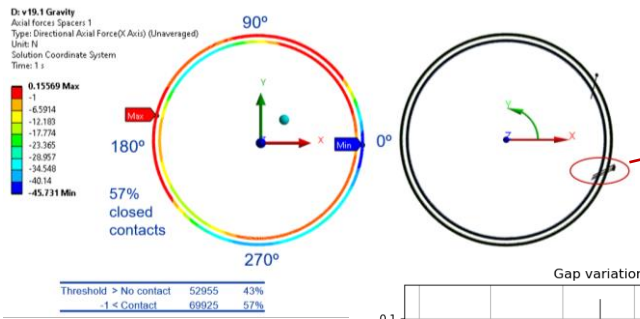
Gravity load case (deformation x50)

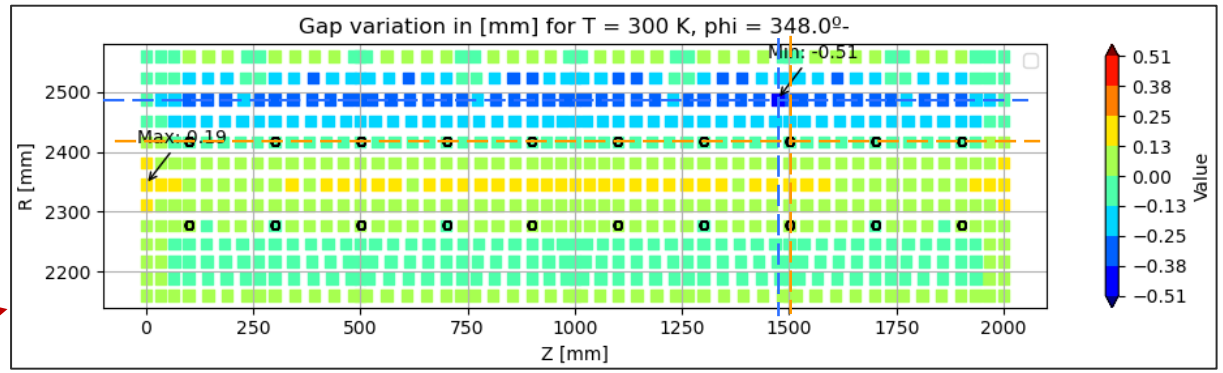


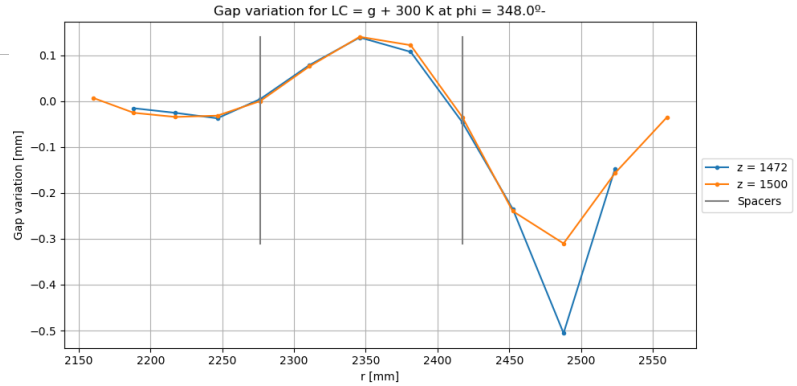
Gap variation in the simulation of a third barrel

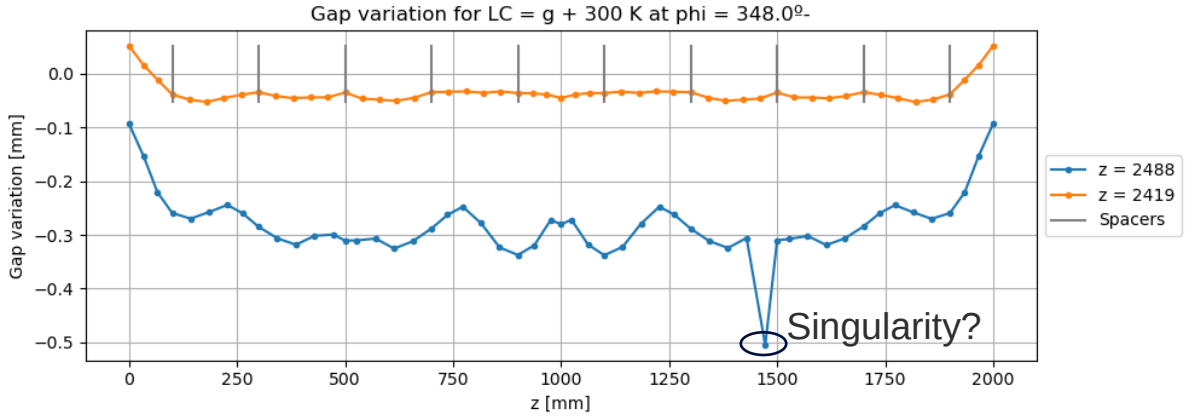
- When gravity is applied, the maximum gap reduction is 0.51mm.
- These results are under study, as can appear some singularities due to several reasons (see *Conclusions*).











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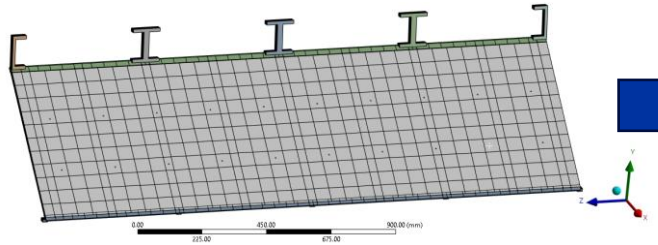
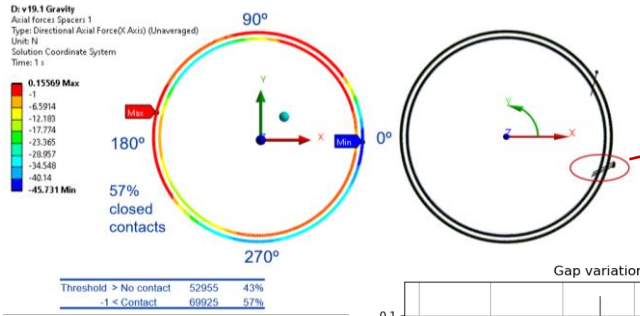
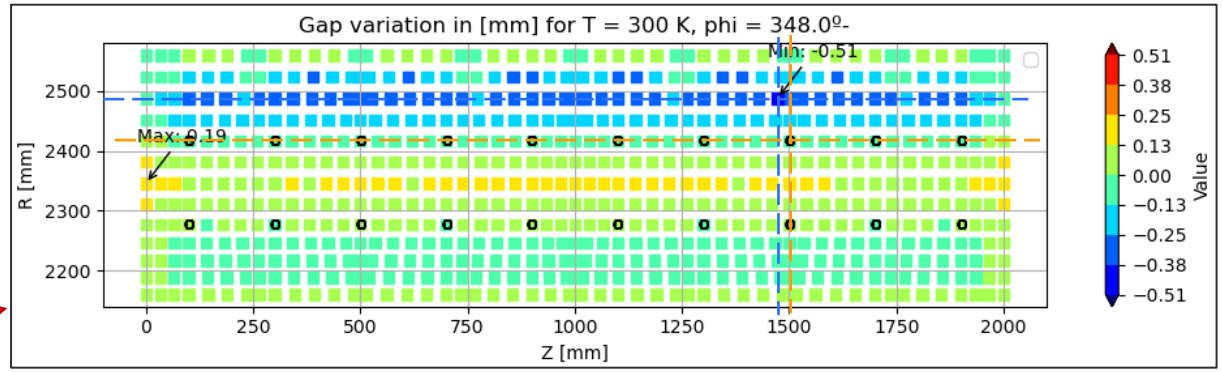
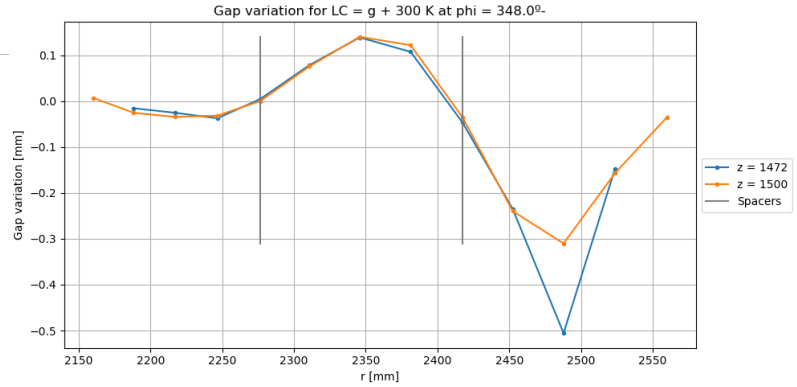
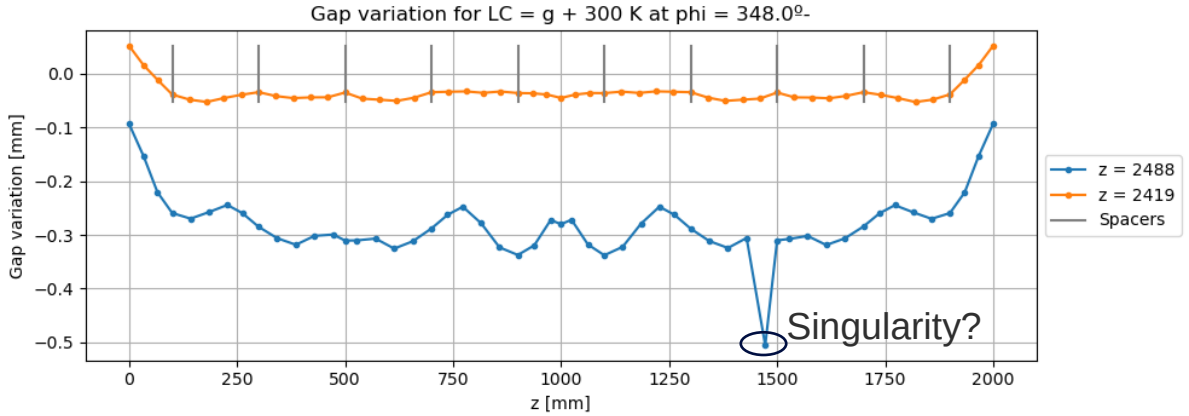




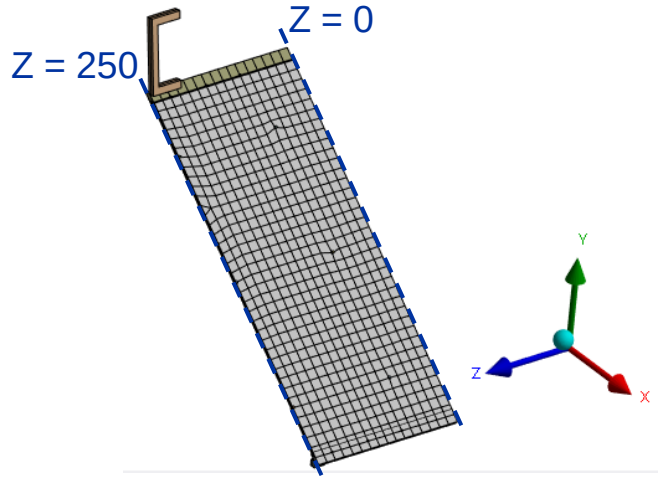




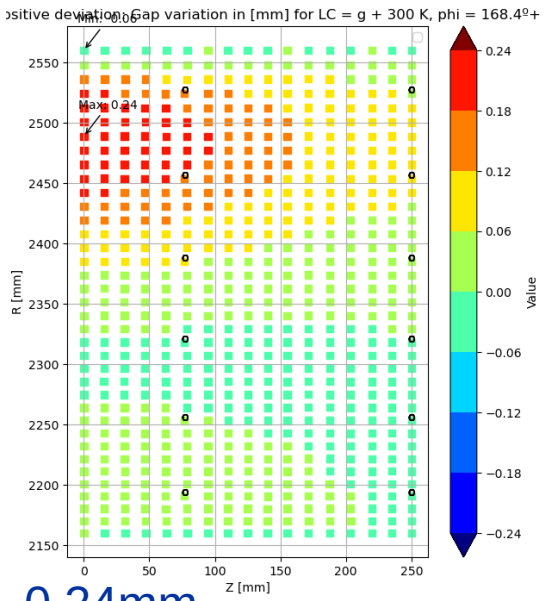


Two different FEM of 250mm length

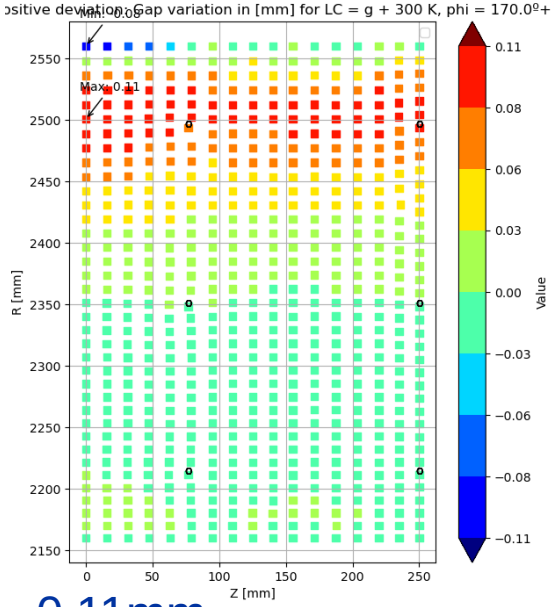
- Properties of these models are slightly different from the 2m model show in the previous slide. So, results are not comparable.
- However, it is useful to study how more spacers can affect the behaviour of the structure.
- Having more spacers does not mean less variation in the gaps.



Maximum increase of the gap

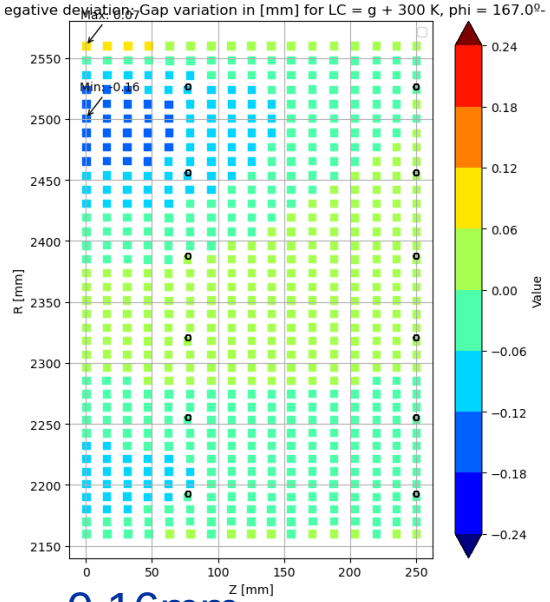


0.24mm

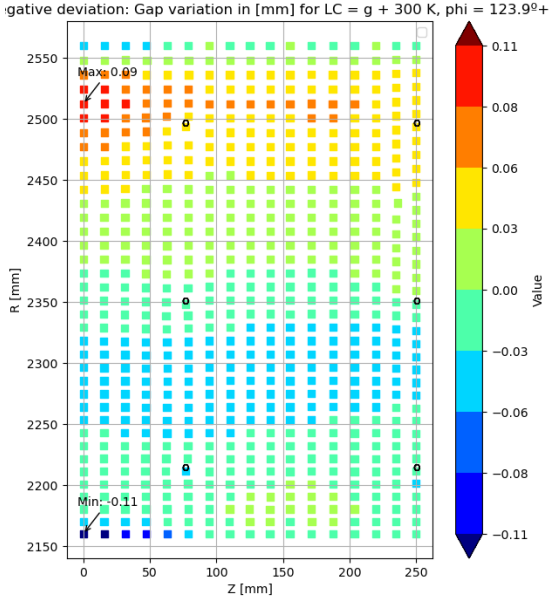


0.11mm

Maximum decrease of the gap



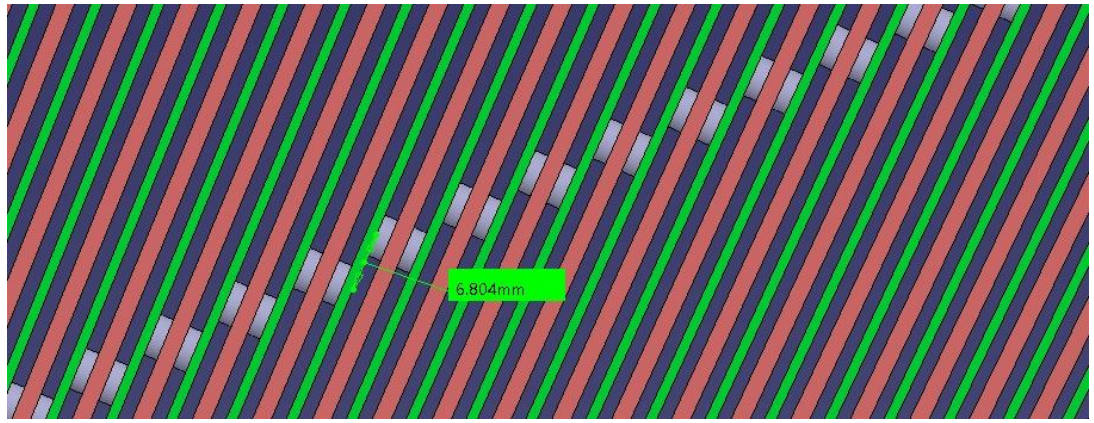
-0.16mm



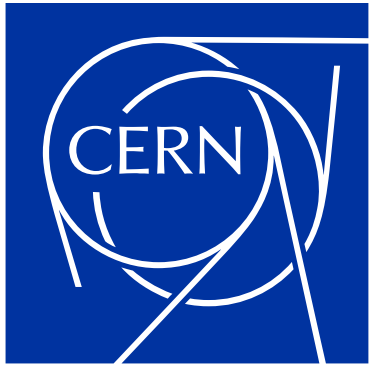
-0.11mm

Conclusions and next steps

- Gap variation studies in progress. Some questions are open:
  - What load case (thermal or gravity) responsible of each deformation.
  - What is the precision of the model we have now. Is the mesh too coarse?
  - Are the nonlinear contacts in the model working properly?
  - Why more spacers give more variation of the gap?
  - Does the misalignment of the spacers make a difference in the gaps?



- Strength tests will be performed before summer.
- Design and drawings of the test beam prototype (64 electrodes) at the end of the summer.



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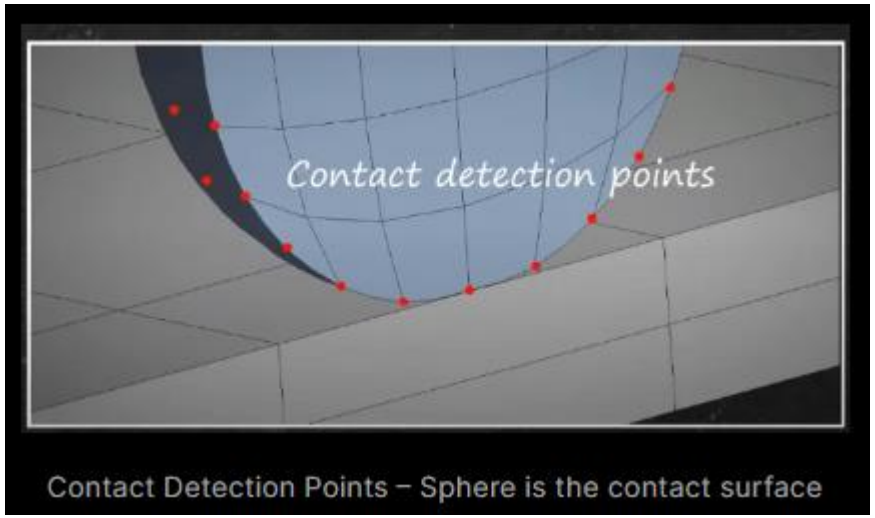
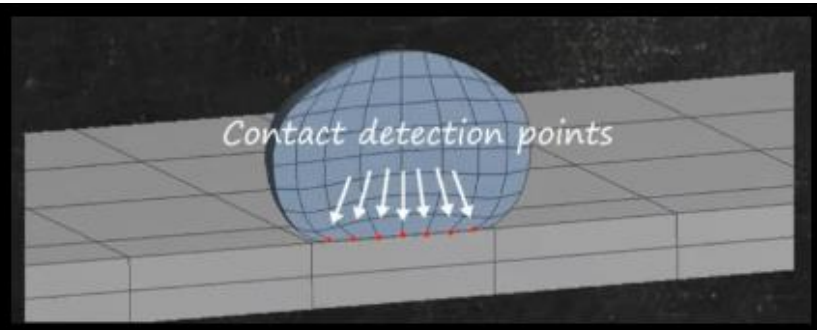
Backup 1: Contacts in FEM



Contact Detection Points – Sphere is the contact surface

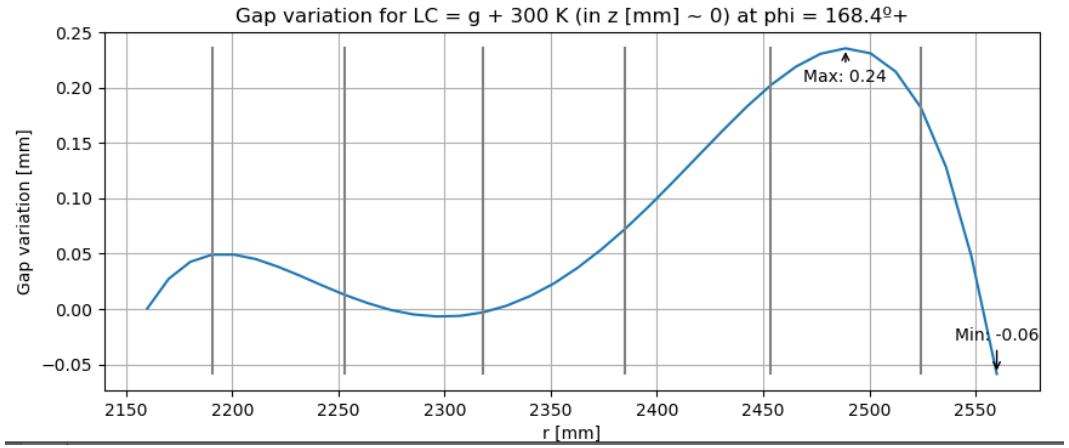


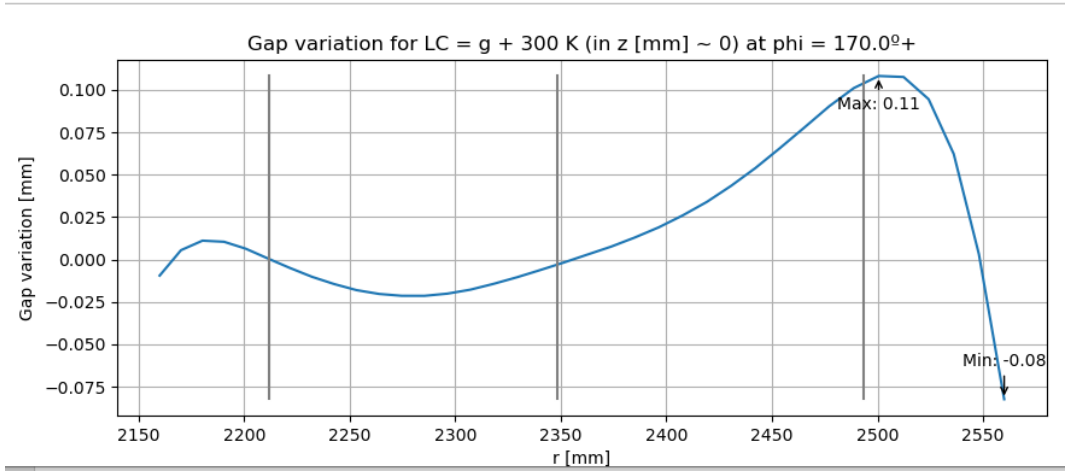
Softer Contact Side

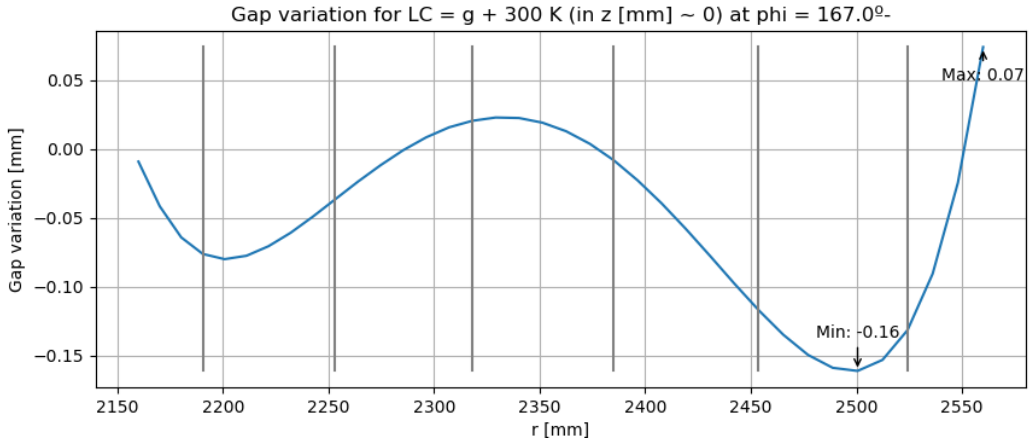
Item	Contact Side	Target Side
Mesh	Finer	Coarser
Geometry	Convex	Concave or flat
Material	Softer	Stiffer

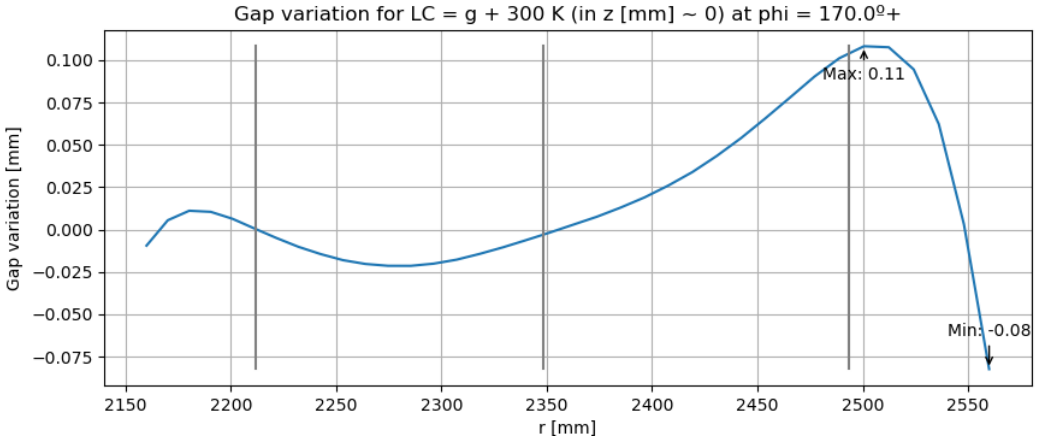
Best Practices Summary for Designation Contact and Target Sides

Backup 2: Graphs in the 250mm FEM









Backup 3: Summation of the gaps distance

- In the FEM of 2m long, all the gap values (in mm) has been summed to check the precision of the analysis.
  - T0 is the initial condition
  - T1: only gravity at room temperature
  - T2: gravity at 87K
  - T3: only thermal loads (87K)

- The values don’t make sense themselves, but they are useful for comparison.

Sum of the gaps in t0	7171974	
Sum of the gaps in t1	7172394	+0.006%
Sum of the gaps in t2	7264969	+1.297%
Sum of the gaps in t3	7265185	+1.300%