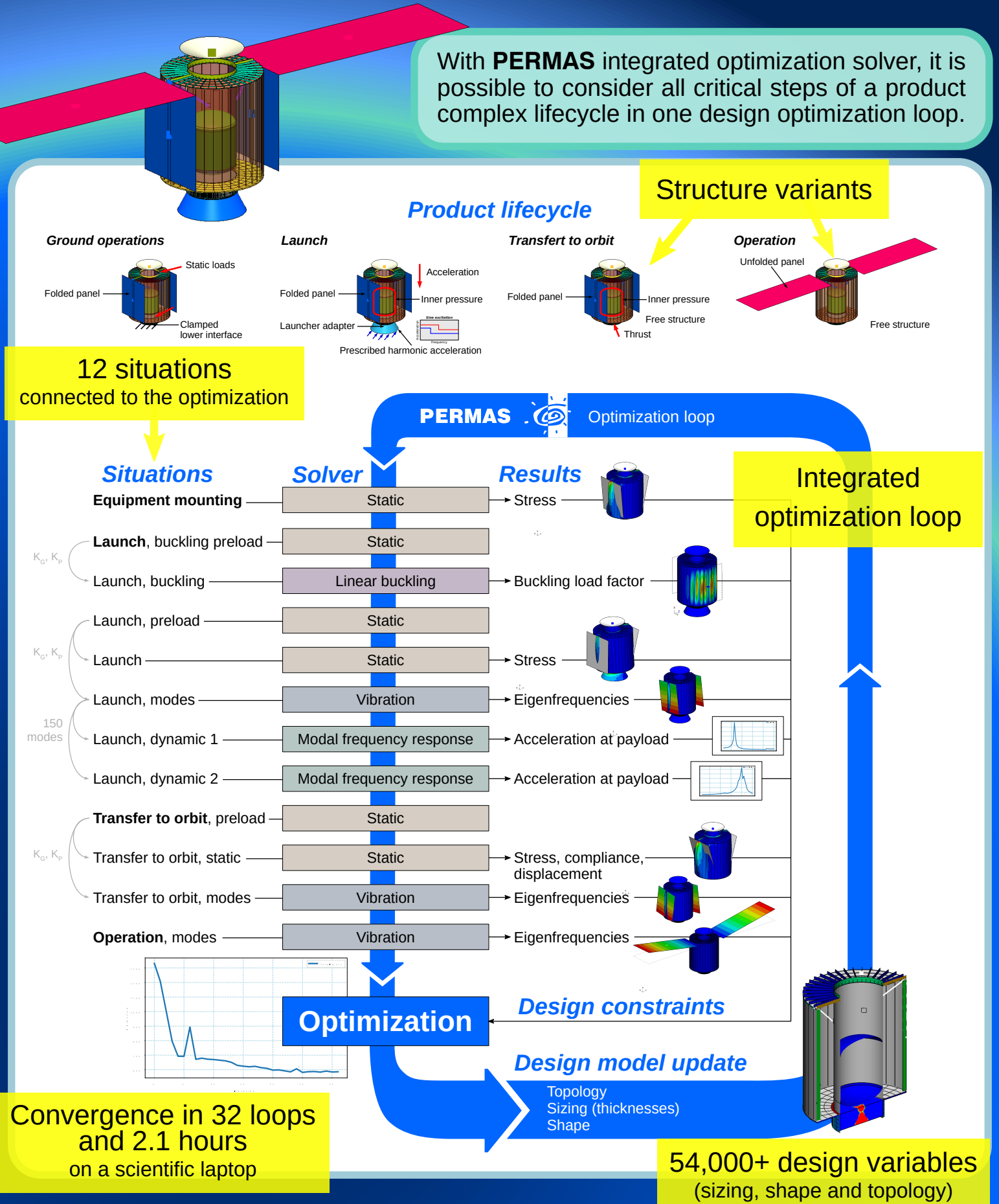


# PERMAS



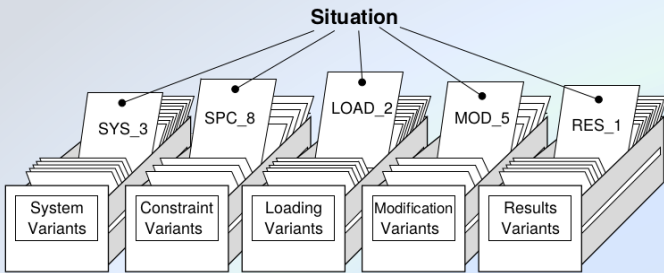
## Spatial Structure Optimization

With **PERMAS** integrated optimization solver, it is possible to consider all critical steps of a product complex lifecycle in one design optimization loop.



# Situations

PERMAS model organization is **modular**: loads, boundary conditions, etc. are defined in so-called variants, which are collected in situations, describing the conditions under which an analysis is performed. A single job can then solve various analyses in many situations. In an optimization process, the design constraints can refer to results from these multiple situations.

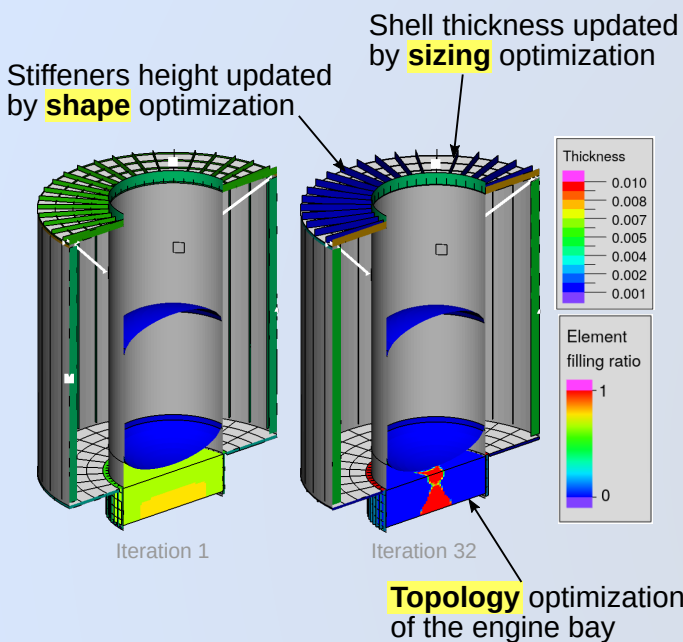


# Structure variants

**Meshes** can be connected or **disconnected** on a situation basis. This allows to model structural changes, such as jettisoned parts, or here the position of the panels.

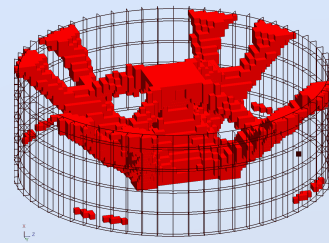
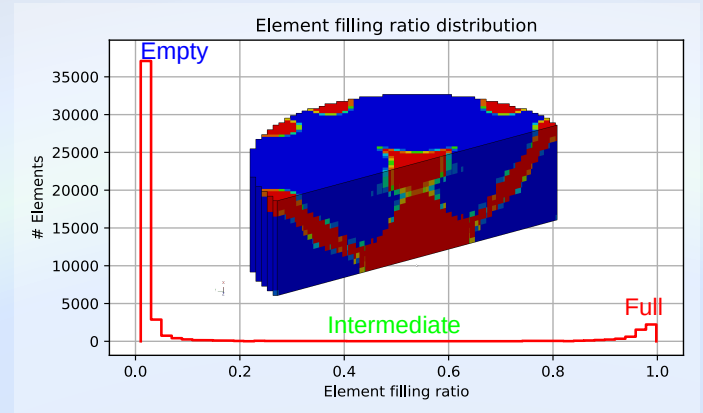
# Multi-modal optimization

- Shape (parametric or free)
  - Sizing (shell thickness, laminate ply angles,...)
  - Topology (element filling ratio, free sizing, laminate tailoring)
- can be combined in one optimization.

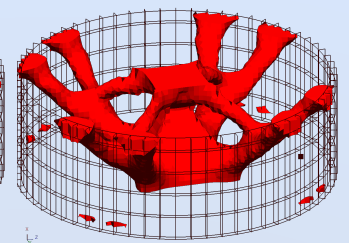


# Topology optimization

PERMAS enforces a **clear-cut mater separation** during topology optimization, making the results useful for the designer.



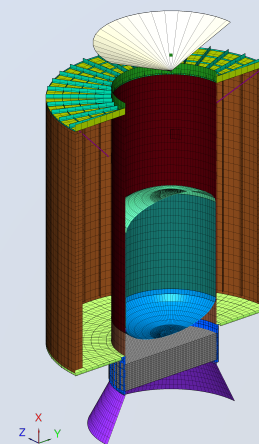
Final hull



Final smoothed hull

# Performance

The optimization converged in 32 loops. On a scientific laptop with 6 cores and 24 GiBytes available, the job ran out-of-core in 2.1 hours, that is less than **4 minutes per iteration**.



88,494 nodes  
88,318 elements  
317,000 unknowns  
**54,409 design variables**  
41,897 elements for topology optimization

For more information about optimization with **PERMAS**, visit our website [www.intes.fr](http://www.intes.fr) or send us an email at [point-contact@intes.fr](mailto:point-contact@intes.fr)

