Beads Deposition Pattern Optimization for Pressurized Bonded Solar Pannel Application

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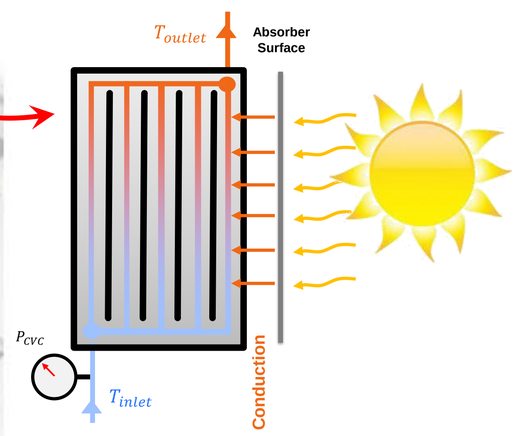
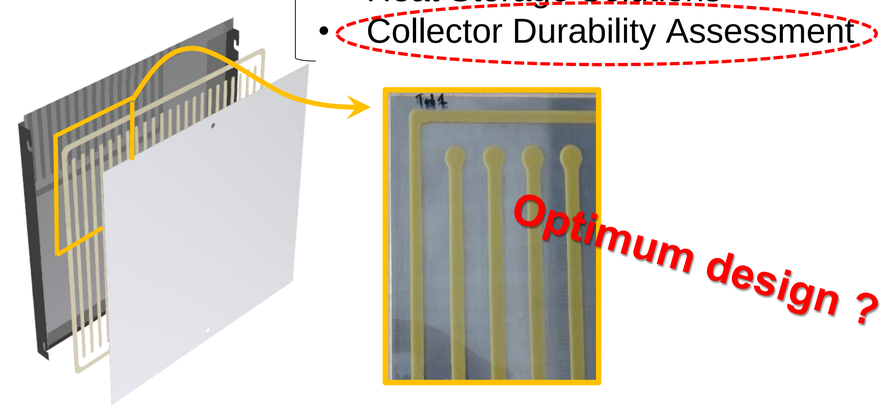
Introduction :

Need to improve thermal efficiency of ancient & new buildings for energy saving & reduction of greenhouse gaz emission, improvement of confort …



Batisol concept for building enveloppe
- Active skin for hot water production &/or cooling
- Modular concept
- Aesthetic architectural integration

Platsolar project :
- Coatings optimization
- System Control Protocols
- Heat Storage Solutions
- Collector Durability Assessment

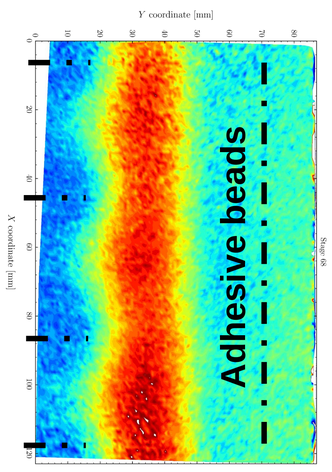


Two metal skins bonded with thick adhesive beads to ensure water tightness and create hydraulic circuit

Martinez, R. G., Goikolea, B. A., Paya, I. G., Bonnamy, P., Raji, S., & Lopez, J. (2017). Performance assessment of an unglazed solar thermal collector for envelope retrofitting. *Energy Procedia*, *115*, 361-368.

Martinez, R. G., Goikolea, B. A., Bonnamy, P., Raji, S., & Lopez, J. Concept, development and thermal characterization of an unglazed solar thermal collector for façade integration

Mechanical design :

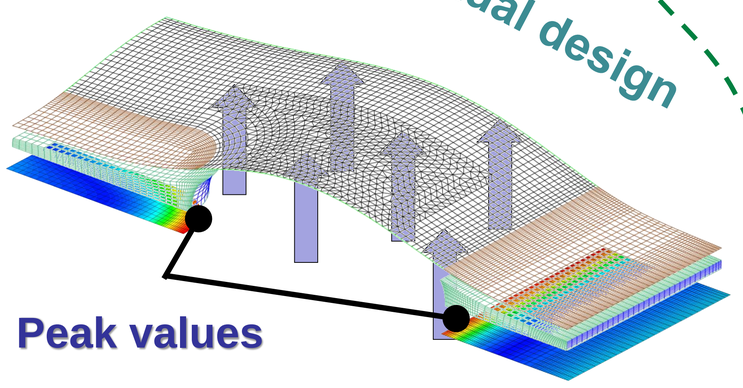


DIC observation of out-plane deflection

Peak stresses are observed at beads ends
Limiting maximum pannel pressure and service life

- Preferential erosion / dilatation depending on local stresses values
- Check for manufacturability

Actual design



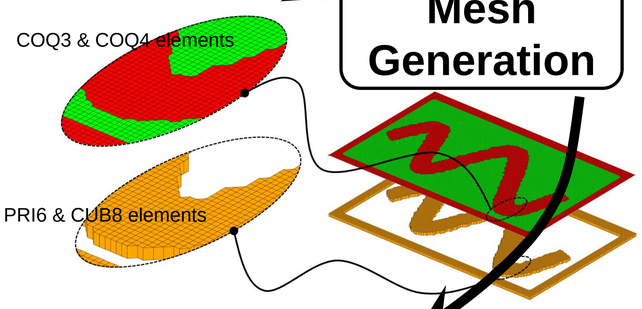
Pressurized panel deformation – FE simulation

Optimisation routine

Bmp b&W image

Initial Pattern

Mesh Generation



F.E. Simulation

Stress / Strain Analysis

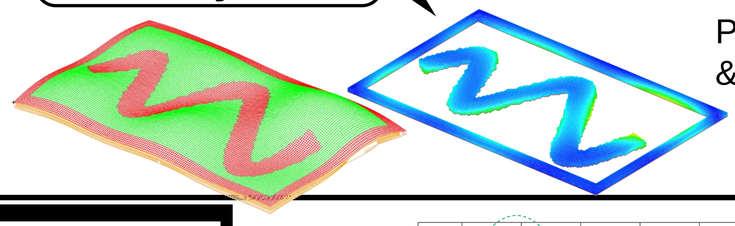
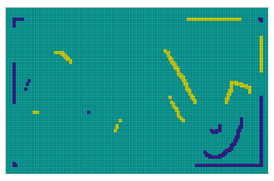


Plate deflection & stress in adhesive

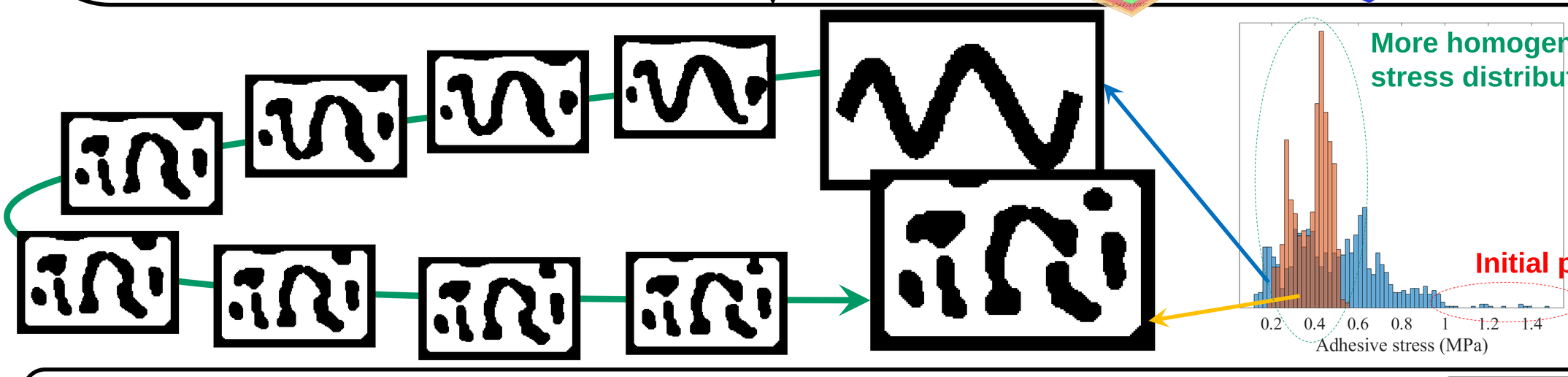
Check Criteria

NO

Pattern update



YES



Conclusions & Outlook :

- Peak stress location have been identified bonded pressurized pannels used as solar collectors
- Optimization routine is proposed using selective erosion / dilatation depending on local stress
- Many solution are obtained depending on optimization parameters
  - Experimental validation
  - Optimize mechanical and thermal performances simultaneously
  - Evolution of the optimization routine for more complex pannel geometry and shape, alternative applications