



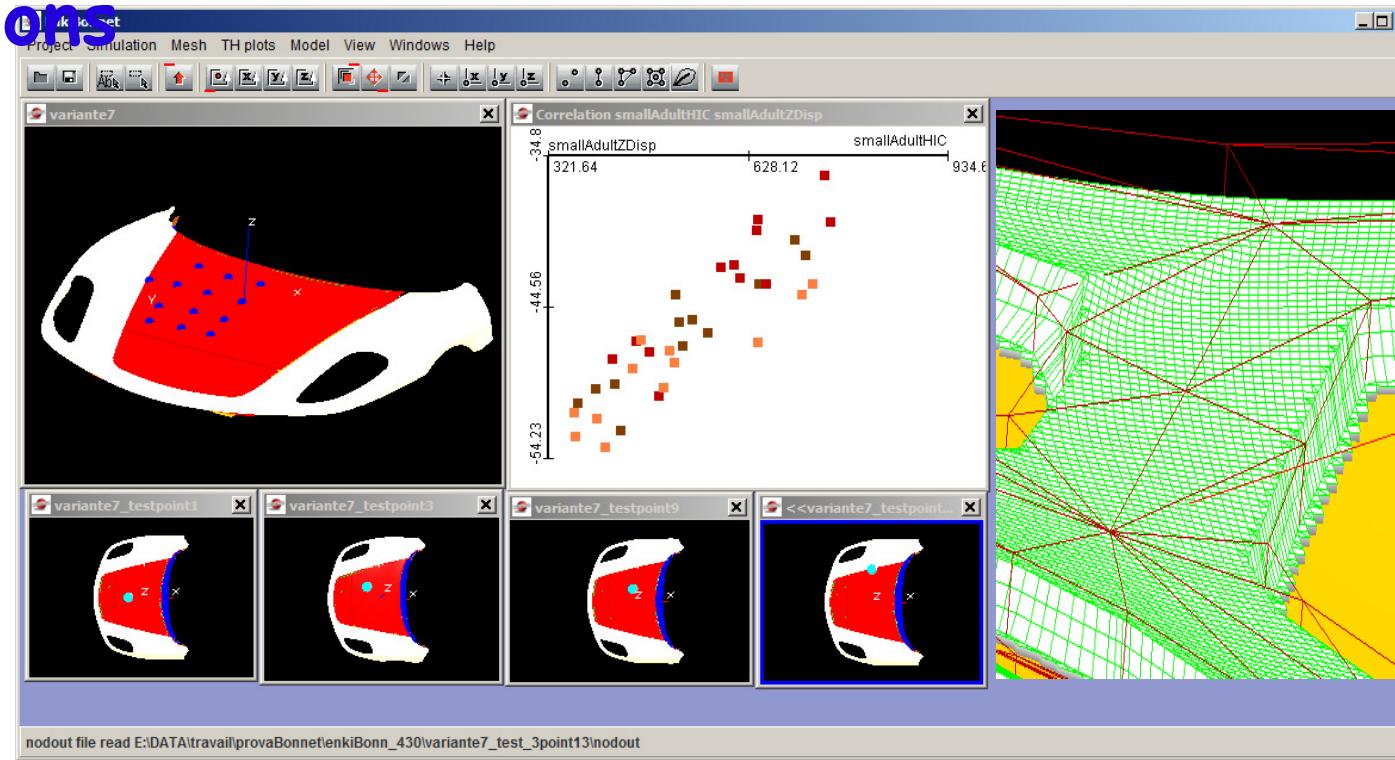
since 1993 ...



**RESEARCH  
INNOVATION  
OPTIMIZATION  
CUSTOM SOFTWARE - ENKIDOU**

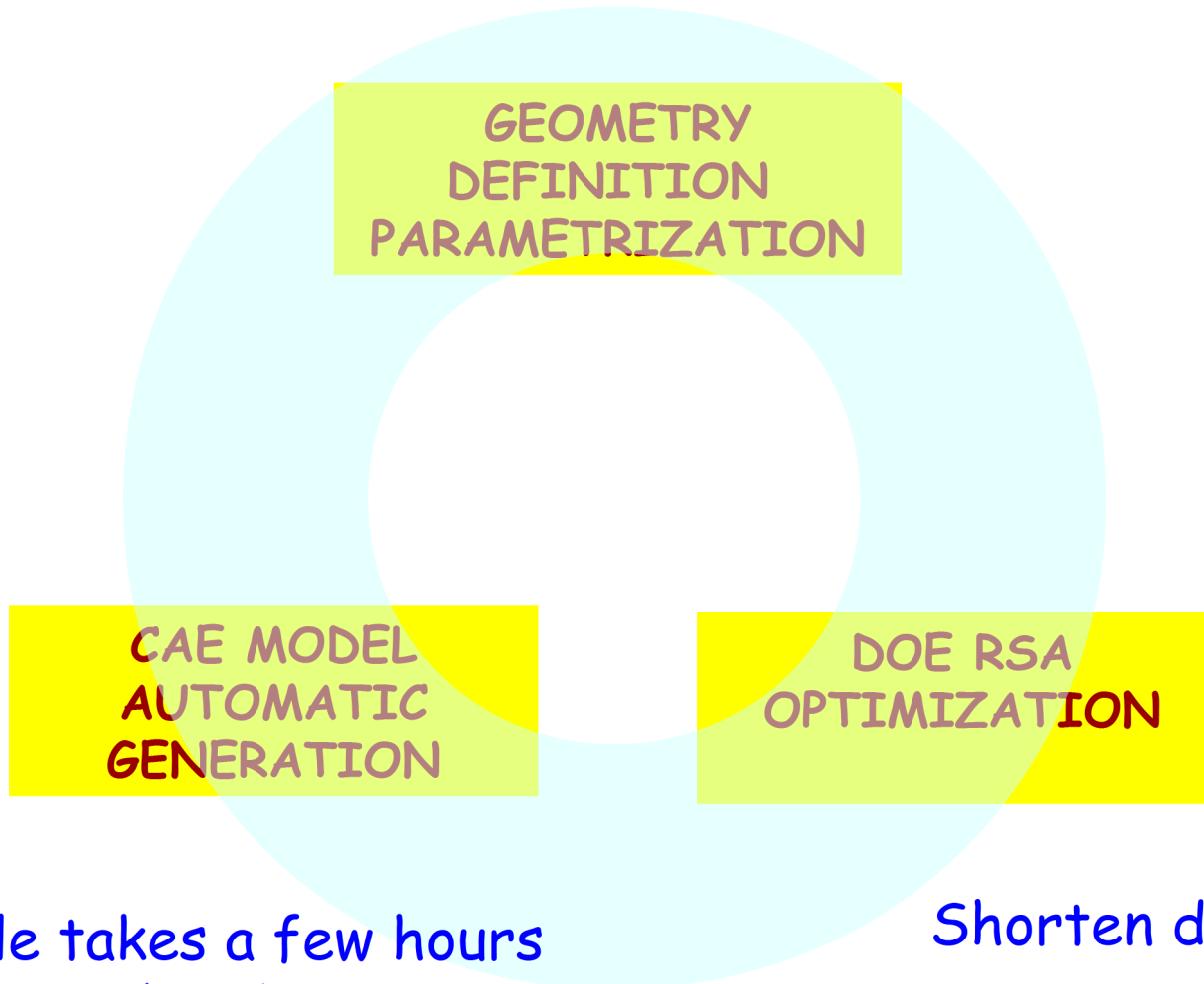
# WHAT IS EnkiBonnet ?

- Environment for bonnet design
- Based on LSDYNA and NASTRAN solvers  
easy extension to RADIOSS, PAMCRASH, ...
- Belongs to the family of ENKIDOU applications



# EnkiBonnet

**DESIGN =SIMULATION + OPTIMIZATION**

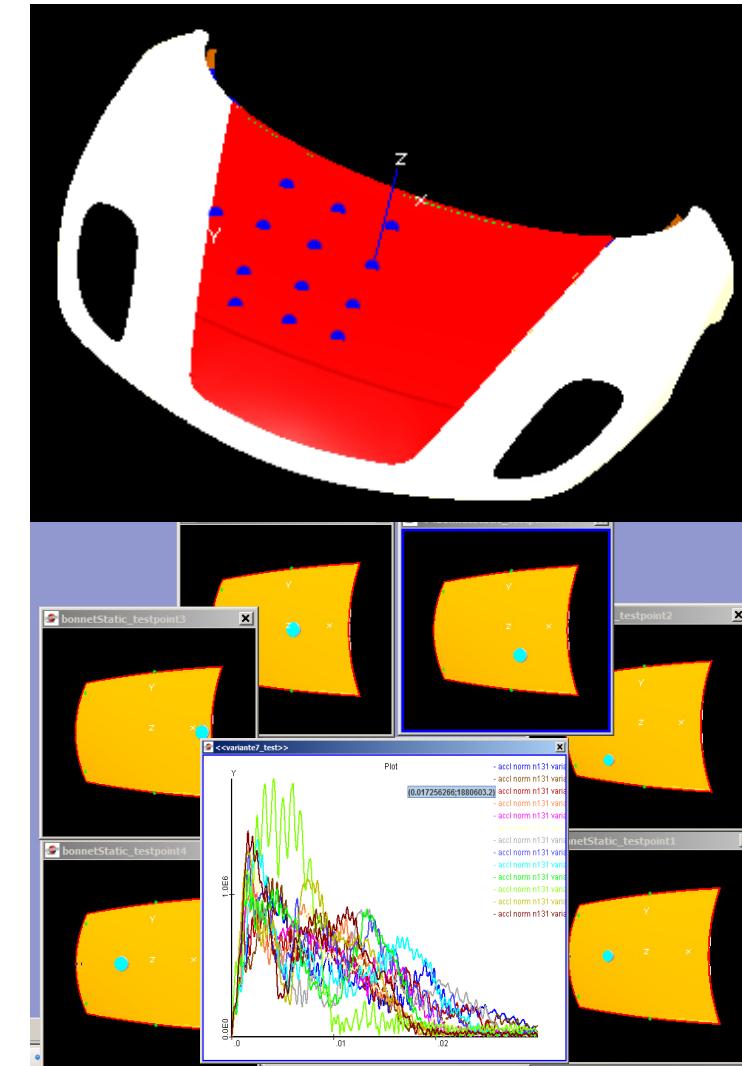


# EnkiBonnet ADDED VALUE

- Automatic pre and post processing
- Regulation/EURONCAP implementation
- Adapt to changing project data
- Parametric CAE
- Multi Disciplinary environment
- Interactive optimization
- Optimization with pedestrian layer

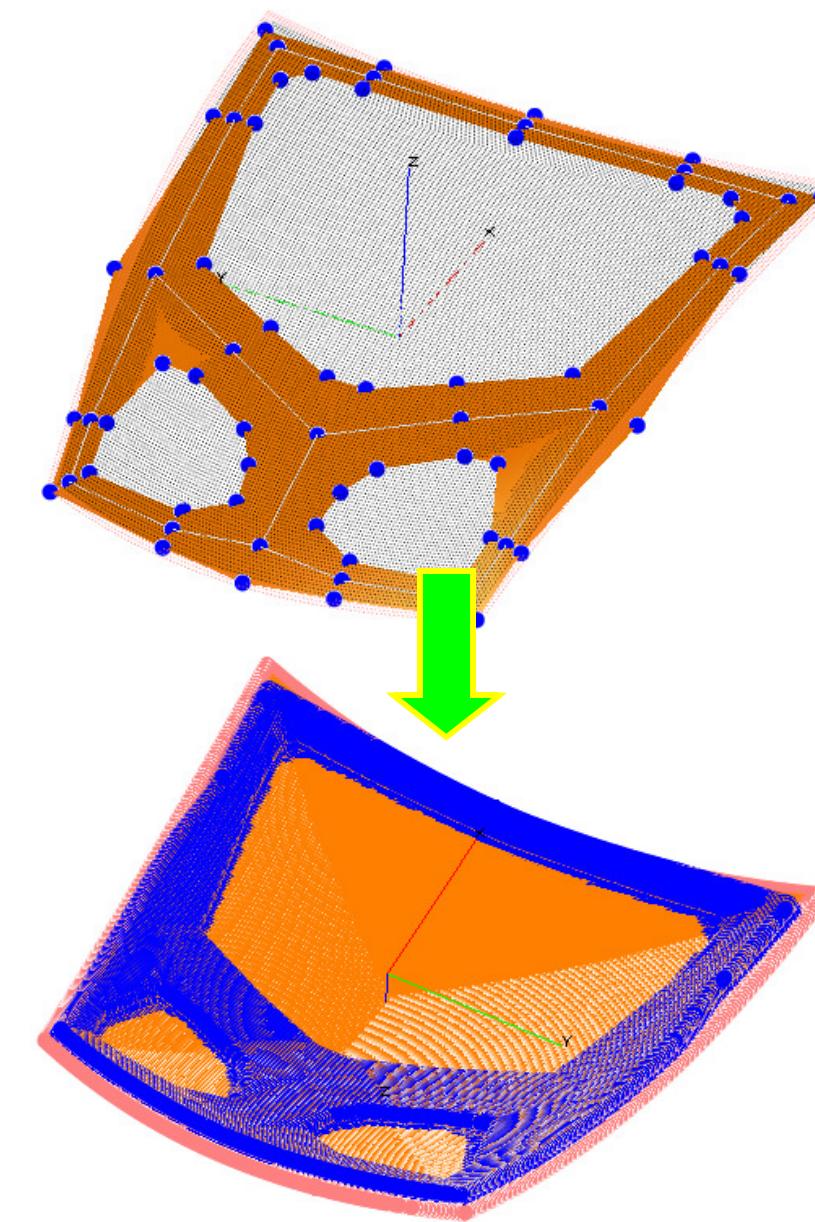
# PROCESS AUTOMATION (AUTOMATIC PRE and POST)

- Project structure
  - All bonnet versions
  - All bonnet design points
  - 100s/1000s of simulations
- Unit system / database management
  - Imported models
  - Generated models
  - Headforms and protocols
  - Materials, ...
- Multi - disciplinary
  - Head impact
  - Static and vibration
  - ...
- Impact point management
  - Interactive or automatic grid
  - Link to headform/protocol database
  - Link to optimization
- Automatic pre- and post-processing
  - Input file generation
  - HIC, stroke, acceleration, ...



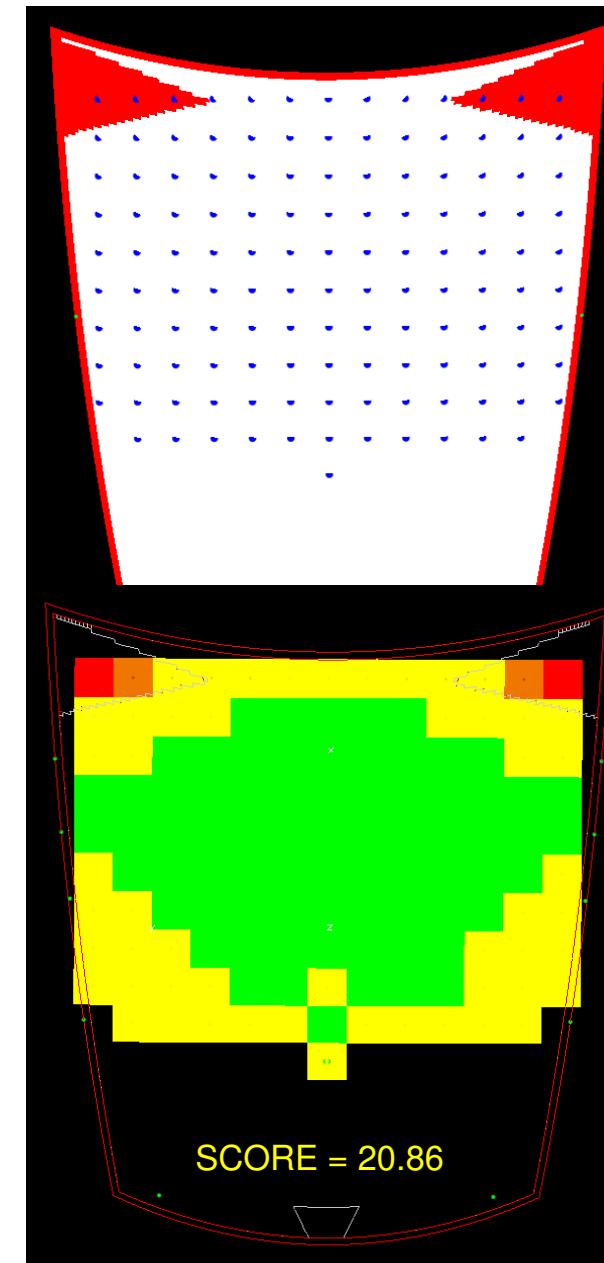
# PARAMETRIC GEOMETRY DESIGN

- Fully integrated
  - With optimization
  - With project structure
- Standard morphing capabilities
  - Macro-element mesh
- Automatic inner panel design
  - (Isotropic,) honeycomb layout
  - Standard, SMF layout
    - inner/outer links
    - Rib section
    - Skin features
    - Underlying obstacles
    - Clearance angles
- Fully automatic generation
- Ready to run



# EURO-NCAP ANALYSYS and DESIGN

- Line definition
  - Wrap around lines
  - Side reference lines
- Automatic impact point definition
  - Follow EURO NCAP protocol
  - Aiming point vs. Impact point
  - Impactor choice for WAD 1500-1700
- Process automation
  - Data deck generation
  - HIC and stroke computation
  - EURO NCAP score computation
- Post processing
  - Score computation
  - Color code presentation
  - .....
- Links
  - Inner panel generation
  - Optimization
  - ...



# EnkiBonnet optimization

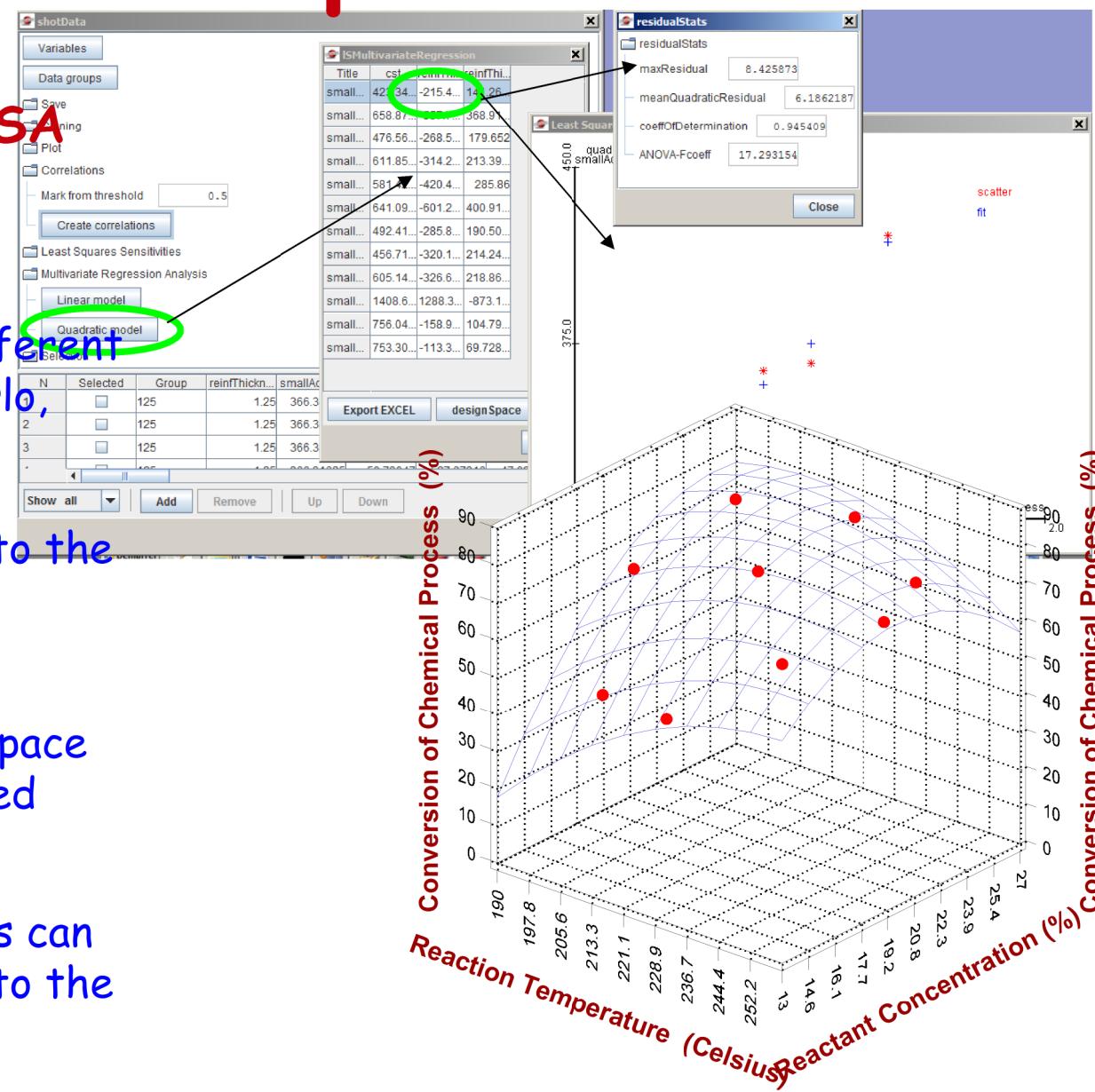
## INTERACTIVE RSA

Creates a table of design points or *shots*, using different methods (DOE, Montecarlo, common sense, ...).

Fits a quadratic surface to the shot table or a selection thereof.

Generates a new design space based on the approximated responses.

Several « optimal » points can be generated and added to the shot table.



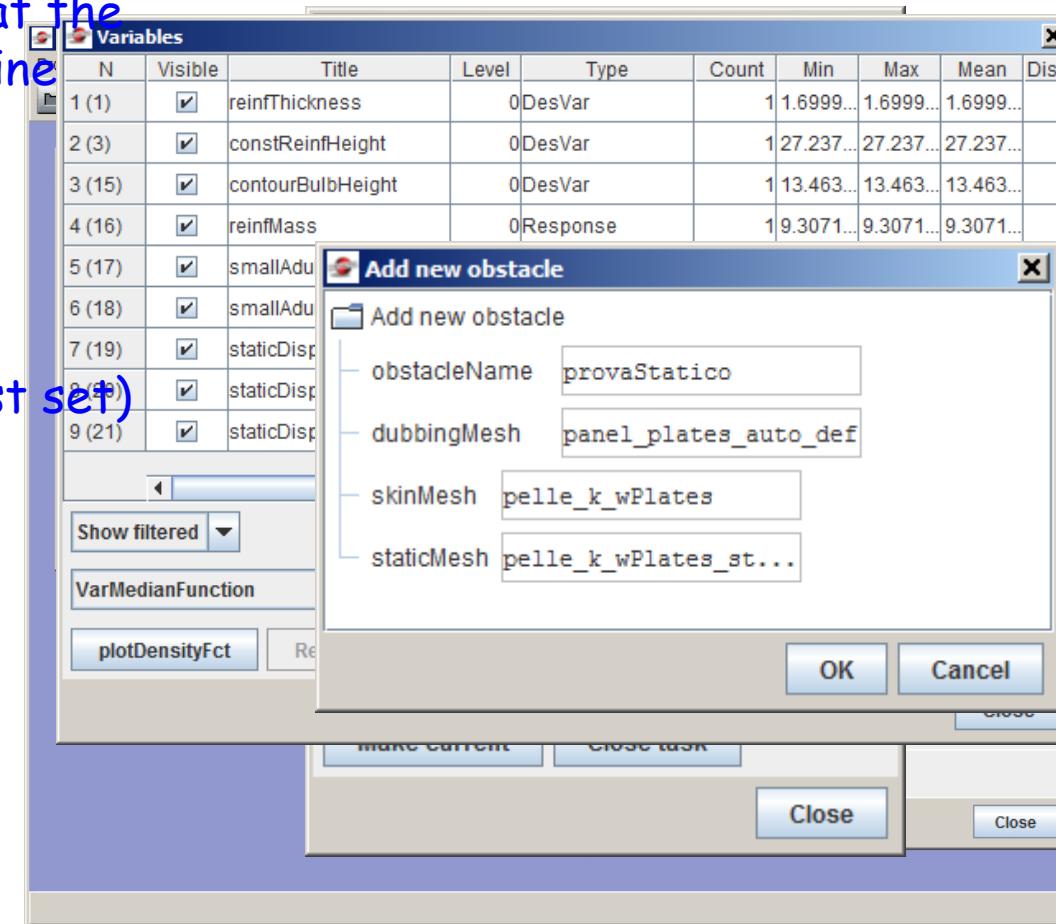
# STATIC ANALYSIS INTEGRATION

Define a static mesh (Nastran) at the root level. In this mesh, you define loads and boundary conditions

This mesh is associated to the bonnet/obstacle task

For each instance of bonnet (test set) a static task is added

Results from static test are cumulated with impact test and included in the optimization



# TIME HISTORY ANALYSIS

- Test set level
- Bonnet computation level
- Plotting
- Filtering
- HIC, ASI, ...
- Transformations
- Correlation analysis,  
Distance analysis

