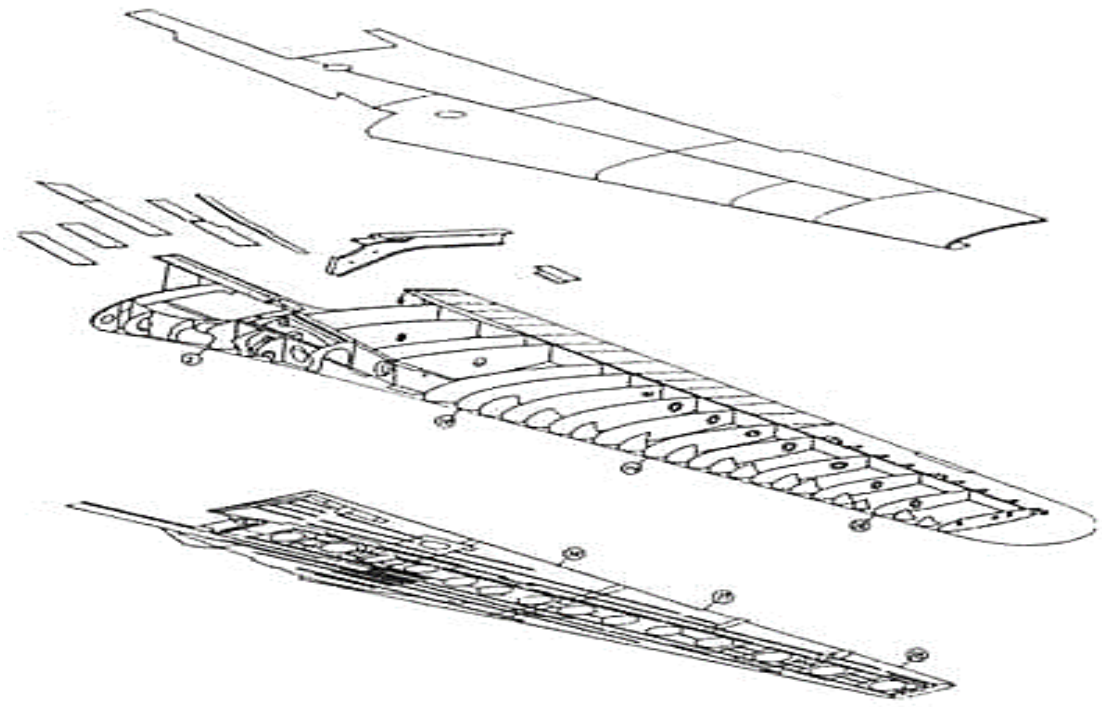


Wing panel fastening and gap control

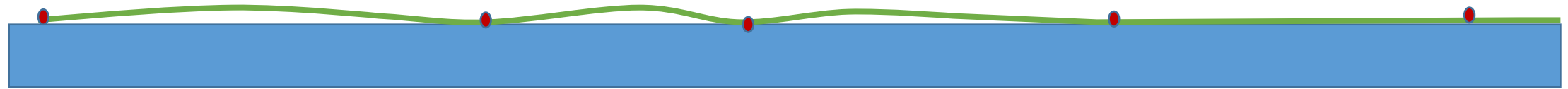


© AIRBUS S.A.S. 2010 - COMPUTER RENDERING BY FIXION - GWLNSD

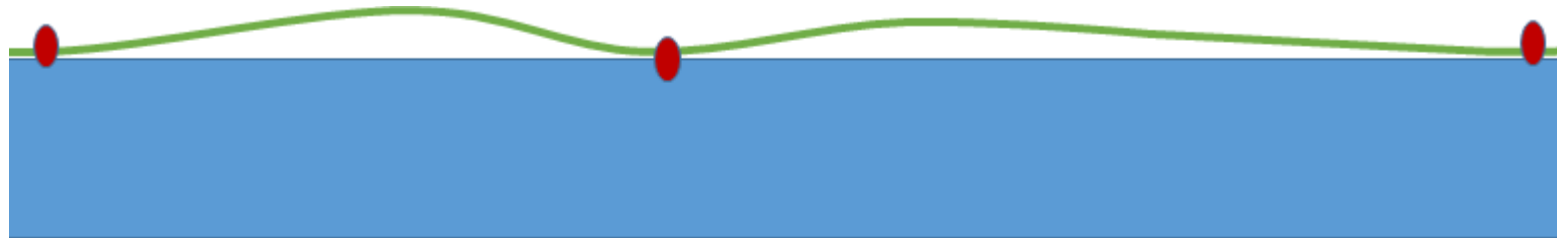
Prof. Matti Heilio (LUT)
Florian Gensheimer (UKOLD)
Nadezhda Zaitseva (SPBPU)
Ramona Maraia (LUT)
Sebastian Springer (LUT)



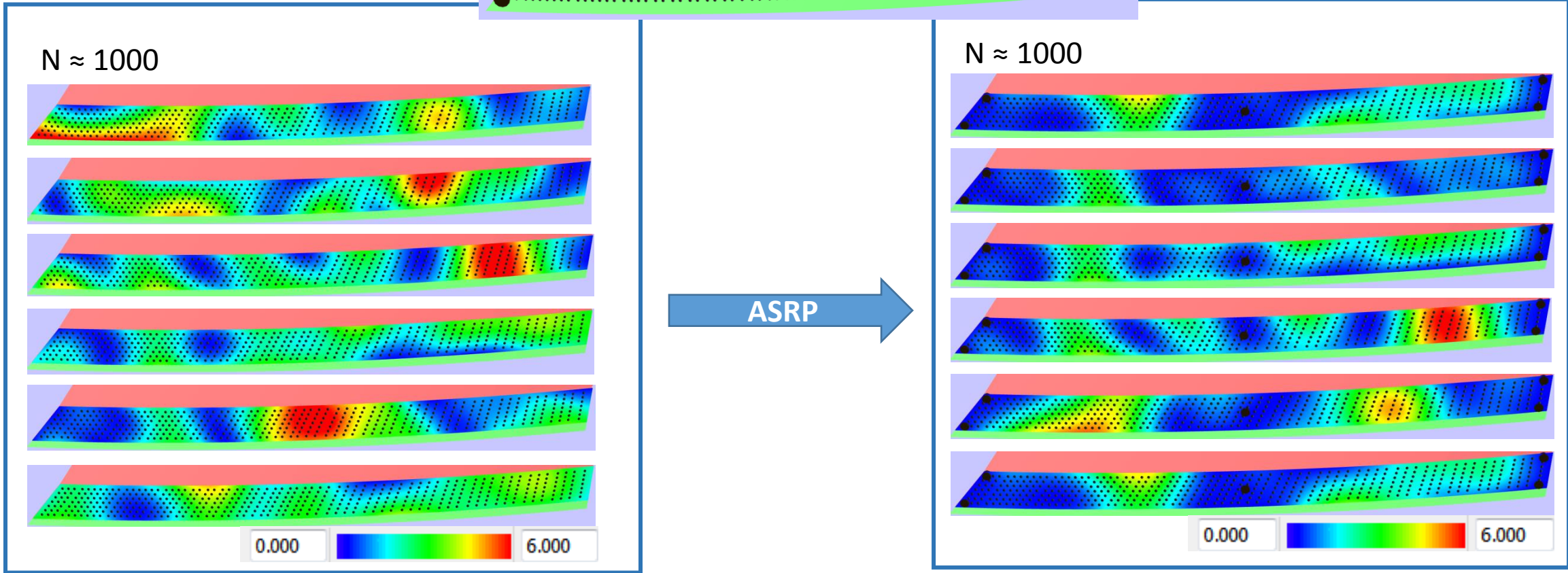
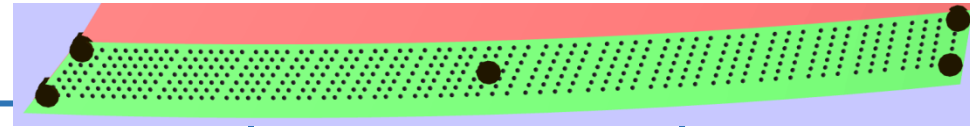
Random shape of skin → gaps



Target : Gap < 0,2mm



Current procedure

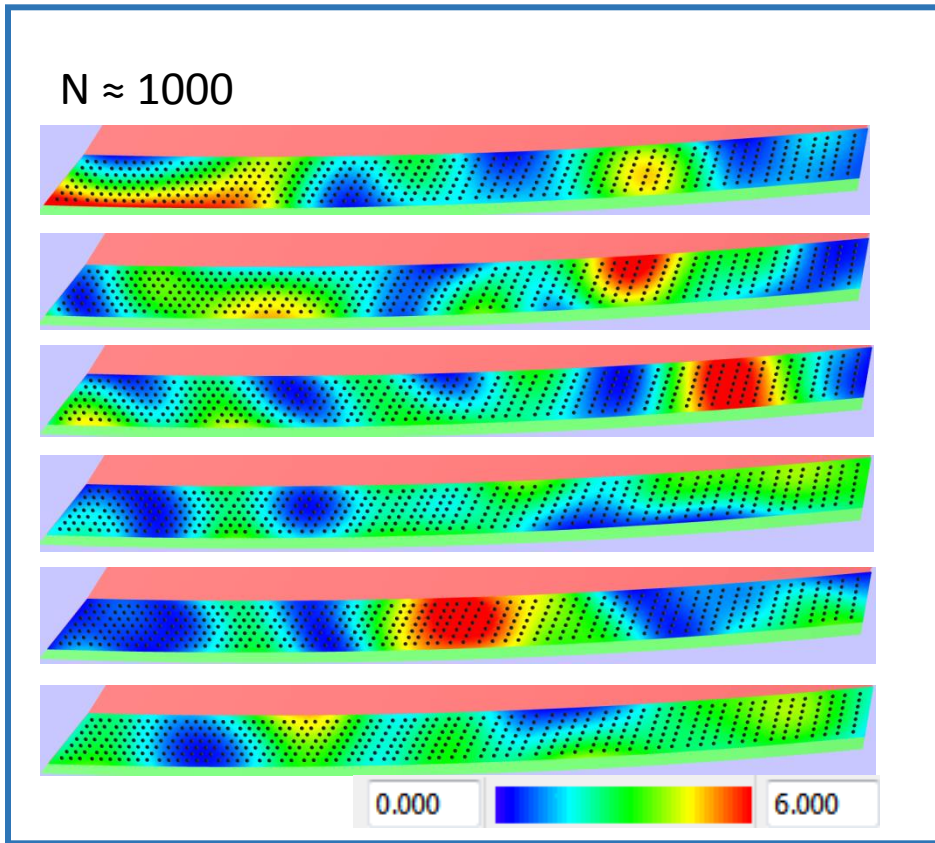
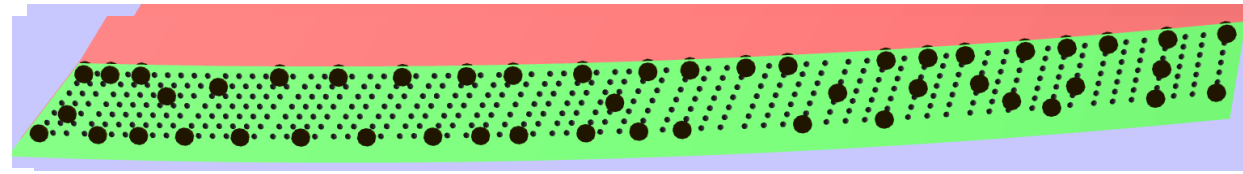


$P = 7.0\%$

$P = 22.6\%$

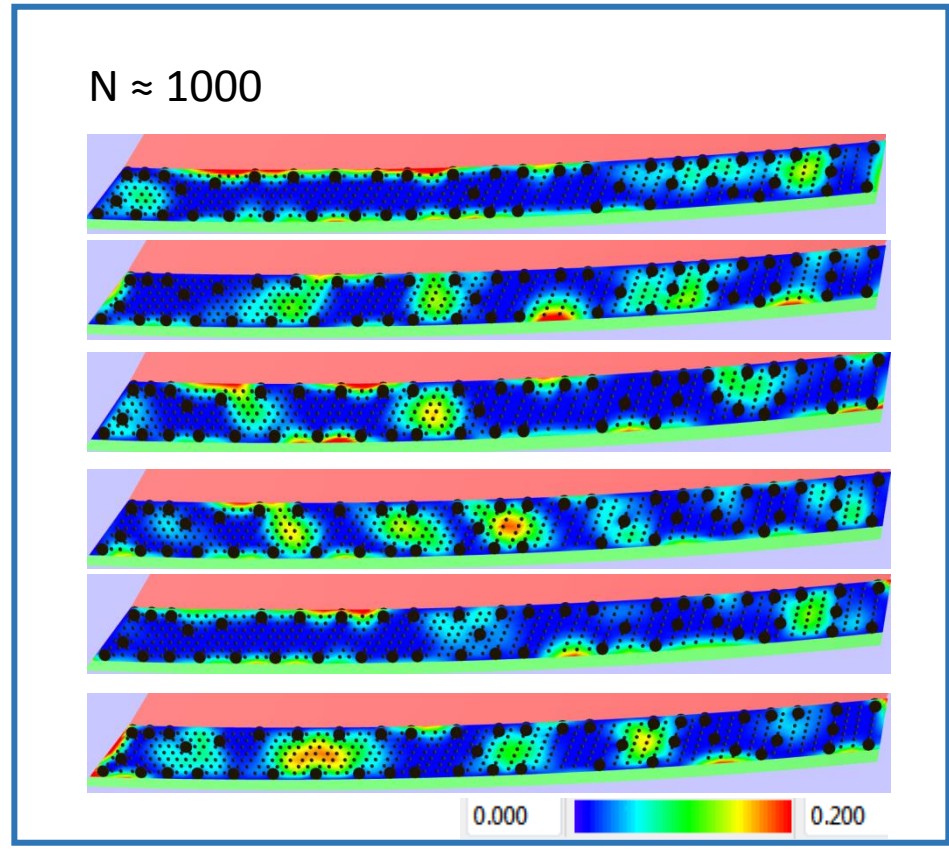
$$P\{Gap(x, y) < 0.2 \text{ mm}\} = \frac{\text{Number of points, where gap} < 0.2 \text{ mm}}{\text{Number of all points}}$$

Current procedure



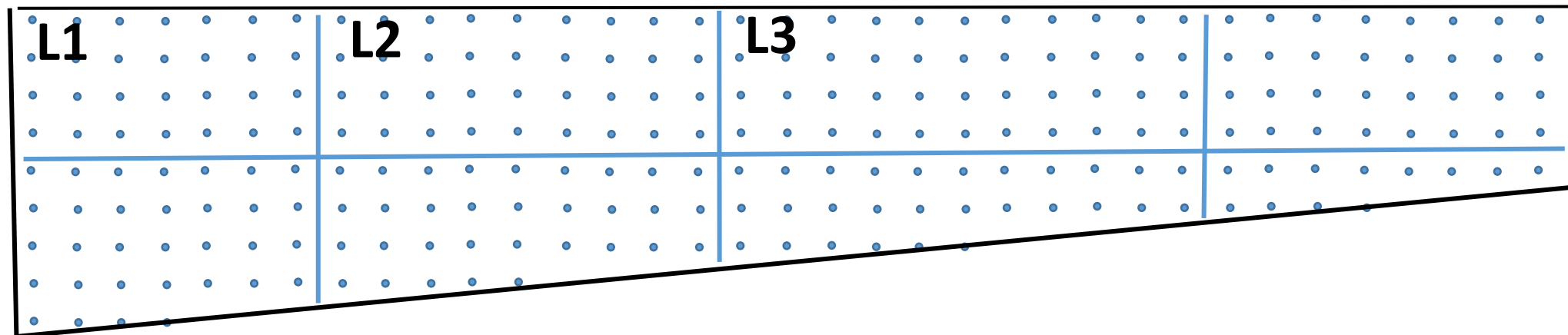
$P = 7.0\%$

ASRP →



$P = 98.9\%$

Matrix of possible fastener positions



Strategy

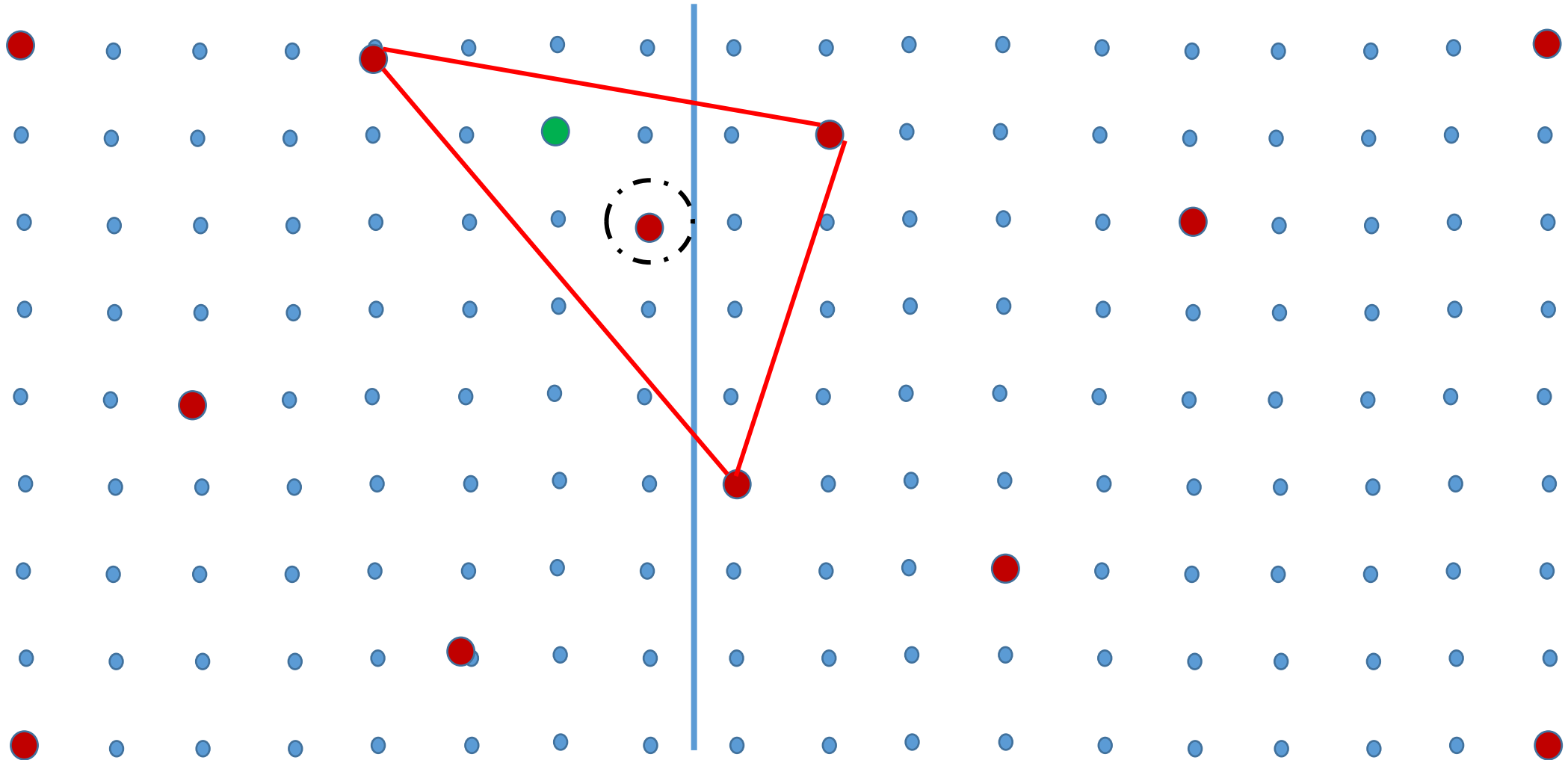
1. Divide wing in a set of zones $\{L_i\}_{i=1}^M$
2. Put initial fasteners, if they are not pre-installed.
3. While Total gap $> G_{max}$

$$\forall i = 1, \dots, M$$

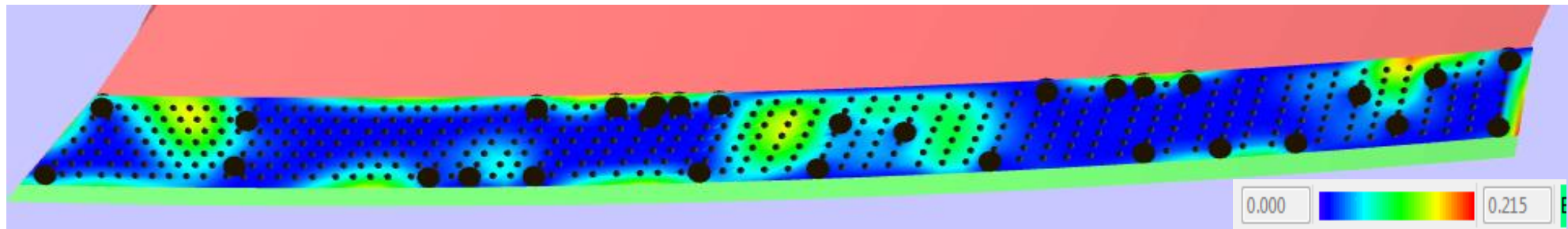
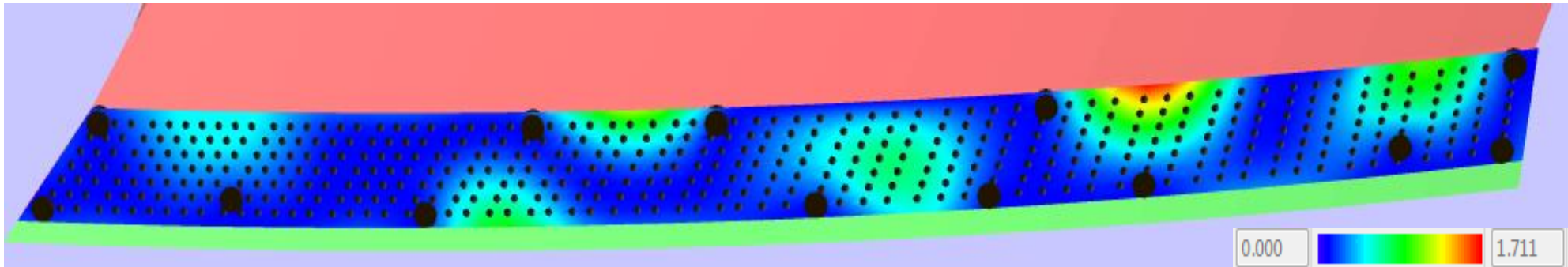
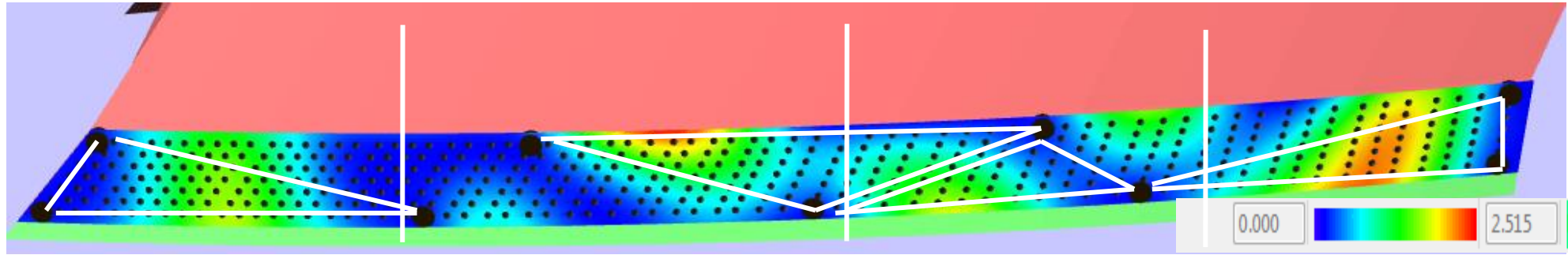
$$x_{cand} = \operatorname{argmax}_{x_j \in L_i} P\{Gap(x_j) < G_{max} | T_j\},$$

Where T_j is the triangle built from the 3 closest fastened points around x_j and fix it.

Where to add the next fastener?

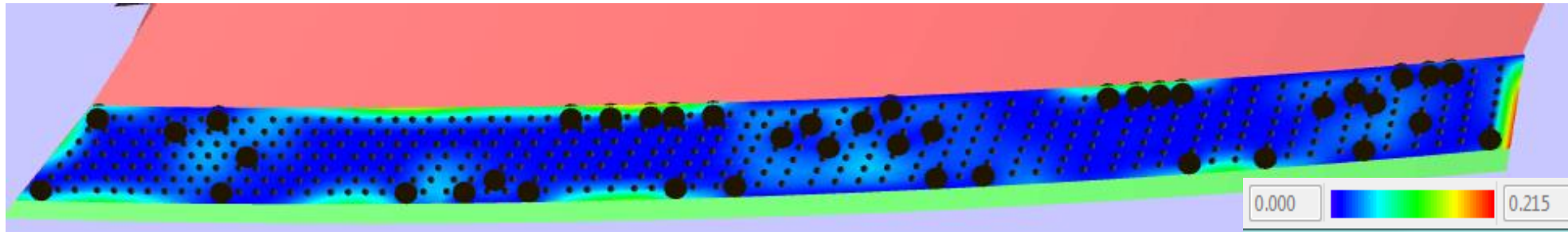


The example

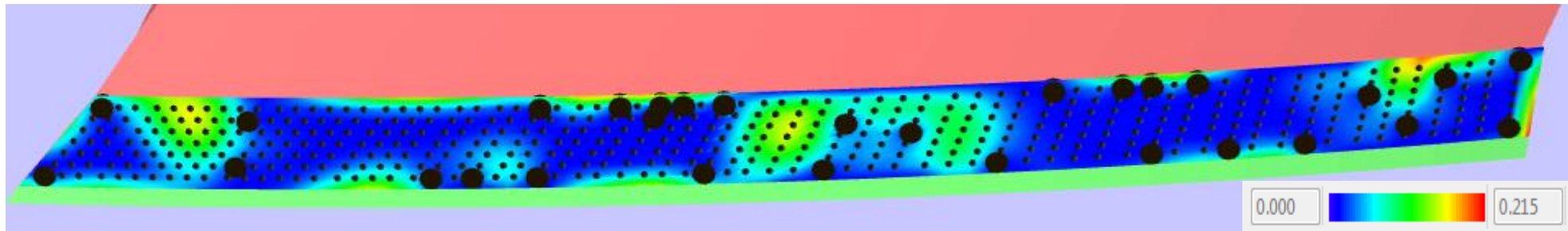


The example

Old: 41 fasteners out of 468 holes (8.76 %)



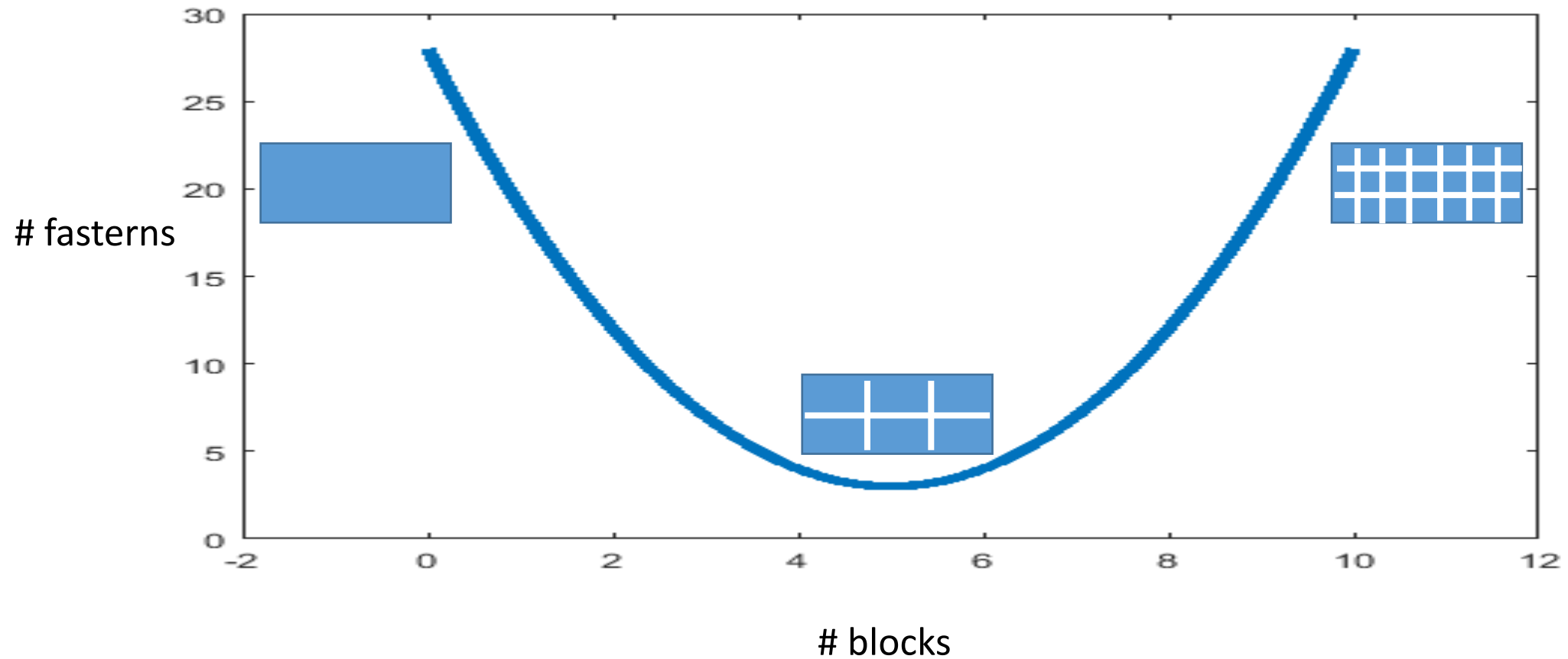
New: 30 fasteners out of 468 holes (6.41 %)



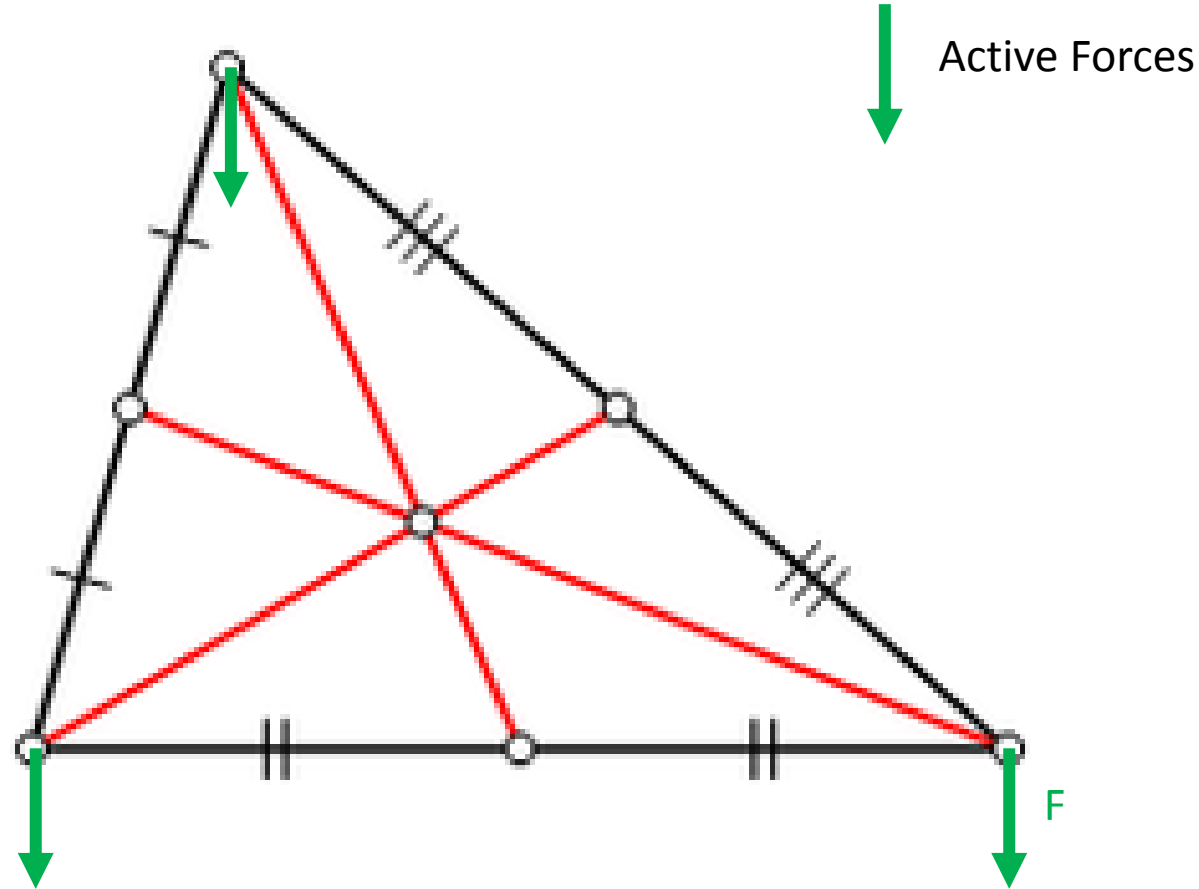
=> 27 % less fasteners

Possible Improvements 1/2

- Optimize the number of blocks



Possible Improvements 2/2



Possible idea for further research?

- Take max 20 temporary fasteners (gap $\Delta z = 0$)
- Fix outer points by setting also $\Delta x = \Delta y = 0$

Apply next fastener and compute the actual displacements and the mechanical bulging effect on neighbouring area

