

# Using Computational Fluid-Dynamics (CFD) for the Evaluation of Tomato Puree Pasteurization: Effect of Orientation of Bottle.

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**Introduction:** This poster focuses on evaluate the effect of orientation of container on temperature distribution, flow pattern, position of slowest heating zone (SHZ), processing time and quality changes in tomato puree during pasteurization, using CFD.



Figure 1. Product considered for CFD analysis.

**Computational Methods:** Natural convection heating of tomato puree was simulated by solving the governing equations of continuity, momentum and energy conservation, using the finite element method with the COMSOL Multiphysics<sup>®</sup> software.

$$\nabla \cdot \mathbf{v} = 0 \quad \rho c_p \left[ \frac{\partial T}{\partial t} + (\mathbf{v} \cdot \nabla) T \right] = k \nabla^2 T$$

$$\rho \left[ \frac{\partial \mathbf{v}}{\partial t} + \mathbf{v} \cdot \nabla \mathbf{v} \right] = -\nabla p + \mu \nabla^2 \mathbf{v} + F$$

$$F = -\rho_{ref} \beta (T - T_{ref}) g$$

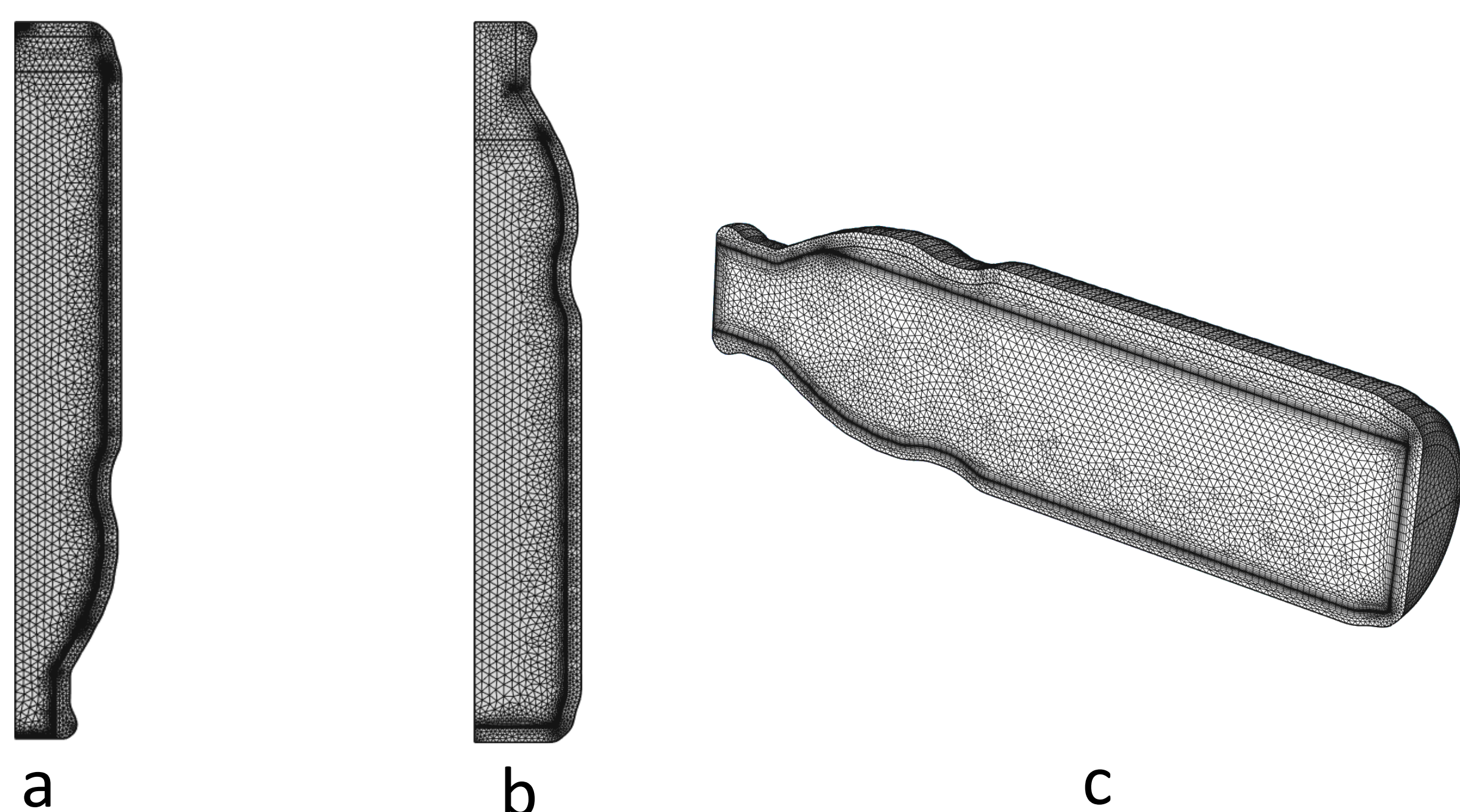


Figure 2. Meshed geometry for a) conventional, b) inverted and c) horizontal orientations.

**Results:** The simulations show the influence of orientation on flow pattern and on the movement of the SHZ (Figs. 3 and 4). It was observed that the lowest processing time and the lowest loss of quality were obtained for the horizontal orientation (Table 1).

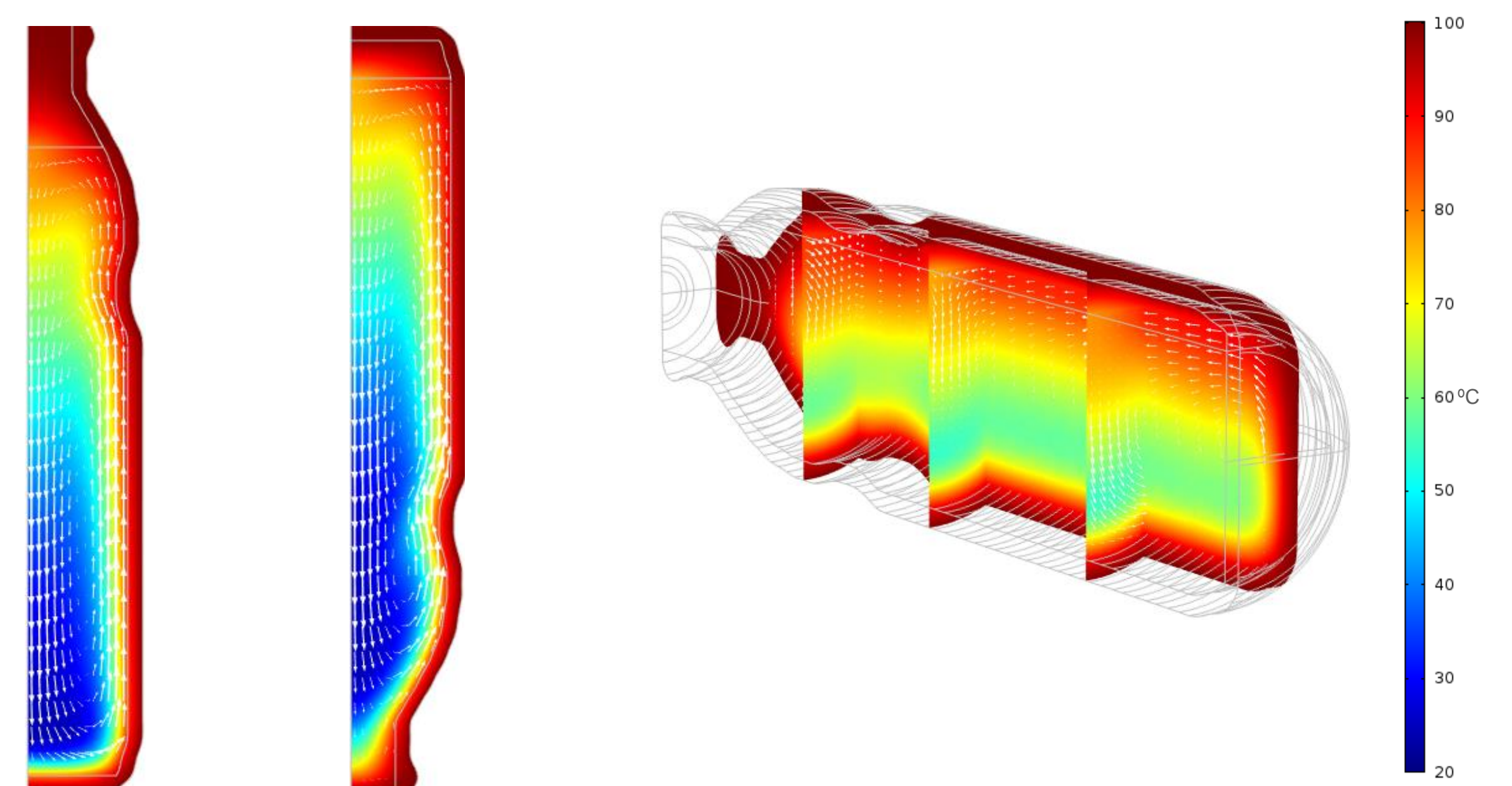


Figure 3. Velocity vectors and temperature profiles after 1005s.

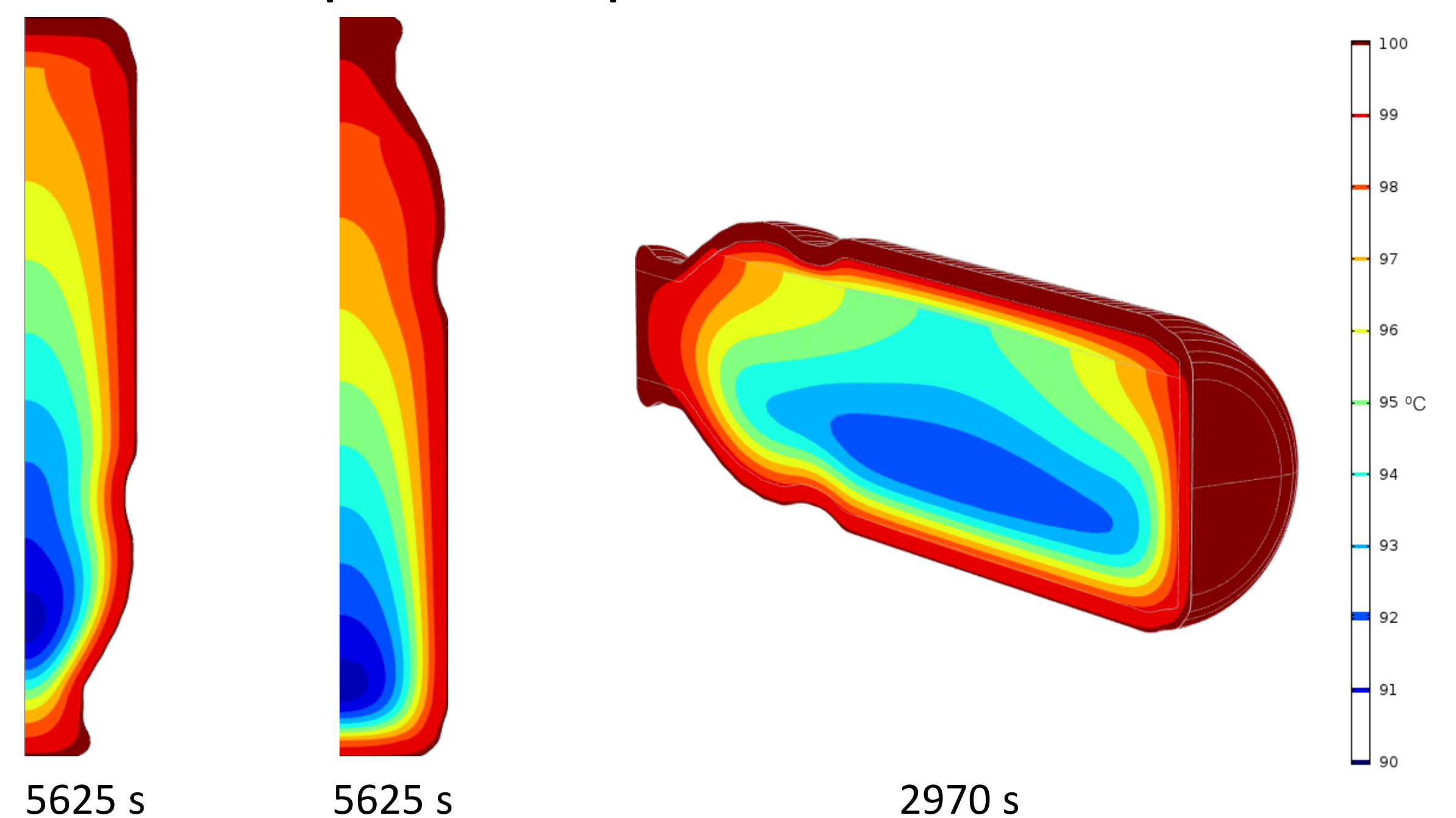


Figure 4. Isothermal contours showing the position of SHZ at the end of thermal process.

Orientation	Pasteurization time (s)	Cooking value (min)
Conventional	5625	37.20
Inverted	5625	36.53
Horizontal	2970	19.92

Table 1. Pasteurization times and Cooking values for the different orientations.

**Conclusions:** The results suggest that the horizontal position could be considered as an interesting alternative of processing in order to reduce the processing time and improve the quality of tomato puree packaged in bottles.