**Research project and activity plan**

During the project will be considered two different topics:

1)numerical simulation of heat and mass transfer during baking/cooking processes;

2)numerical simulation of water jets coming from nozzles characterized by different shapes (installed in washing machine tunnels for meat carcasses).

**Topic 1**

Development of finite element models (3D) able to describe heat and mass transfer inside and on the surface of food product during the cooking on hot plate (*e.g.* flat bread) and baking in oven. Furthermore, the food volume modifications accruing during the baking/cooking processes (*e.g.* shrinkage or expansion) will be considered.

Relations between some food quality indexes (*e.g.* browning index in bakery and vegetable, textural parameters in meat, volume reduction in meat and vegetable), usually used to describe cooking performances, and model outputs (temperature or moisture content) will be investigated.

Furthermore, the energy consumption, in terms of heating and evaporation will be evaluated for different cooking set up.

**Topic 2**

Development of parametric CFD model able to describe the speed, pressure and temperature range of the water jets as a function of the nozzle shape (*e.g.* cylindrical/conical/spiral) and the inlet water flow conditions (input pressure/speed).

The models will allow to quickly evaluate the impact of numerous combinations of plant variables (washing machine tunnels for meat carcasses) on the dynamics of the impact of the jet with a solid body (meat carcasses).

*Activity plan*

*Topic 1 and 2 can be simultaneously developed following these steps:*

*I) bibliographic research;*

*II) definition of geometries, constitutive equations and boundary conditions (pre-processing);*

*III) solution of the equations by using a multiphysics simulation software (processing);*

*IV) result analysis (post-processing);*

*IV) model validation.*