# ITER TF COIL DOUBLE PANCAKE ASSEMBLY: LASER WELDING NUMERICAL SIMULATION

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## Abstract

In the frame of the ITER coils production, one crucial point is the Cover Plate welding to complete a coil layer, the so called Double Pancake, once the reacted and insulated conductor is fit inside the RP grooves. The scope of the activity here described is the assessment of the deformation induced by this laser welding through a FE numerical simulation, in order to find the welding sequence that minimize the global distortion.

The numerical simulation of welding processes is a difficult task, mainly due to the physics of the problem, characterized by a complex process affecting a small space region on a significantly larger model.
General purpose finite element codes, while providing the necessary features in order to model the thermo-mechanical process, cannot be efficiently customized and optimized for the specific problem. At the same time, specialized codes aim at the accuracy of simulation rather than at the speed of analysis.
In this activity, the Local-Global approach technique has been adopted using Abaqus Code, in order to be able to compare several long welding paths in acceptable time frames in spite of partial accuracy loss in favour of speed and ease of model definition.

The numerical methodology has been tuned and assessed on experimental data from welding samples, to define the laser torch characteristics and its effect in term of deformation induced.
Then, thermal or plastic strains, computed on detailed models reproducing the welding region has been applied on global models, reproducing the complete structure, with several welding sequences.
At the end in a rather quickly way (compared with the normal CPU time for welding distortion simulation) this numerical methodology has been applied and a set of welding sequences have been compared finding out the best sequence in term of Radial Plate global distortion.

Keywords: ITER, coils, laser welding, simulation, thermal analysis, structural analysis