THERMO-MECHANICAL DESIGN AND RADIATION ANALYSIS FOR THE ITER DIAGNOSTIC NEUTRAL BEAM CRYOPUMP

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This paper presents an overview of the structural design and optimization cycle for the main support structure of the Diagnostic Neutral Beam (DNB) cryopump of ITER. The goal was to take into account the thermal efforts provoked by the cooling down of the shielding, the structural efforts provoked by gravity forces by the manifolds, calculate its steady state effect over the structure, and propose design changes. The first step was to run a thermal conductive analysis with the expected thermal inputs in terms of boundary conditions temperatures. The following step was to run a static analysis with the expected structural loading inputs in terms of distributed loads, gravity-induced inertial acceleration, and considering the structural boundary conditions imposed by the upper and lowers suspensions. Finally, a radiation analysis was performed in order to calculate the heat loads on the cryogenic circuits. Required design changes derived from the aforementioned analyses are also described in this paper.

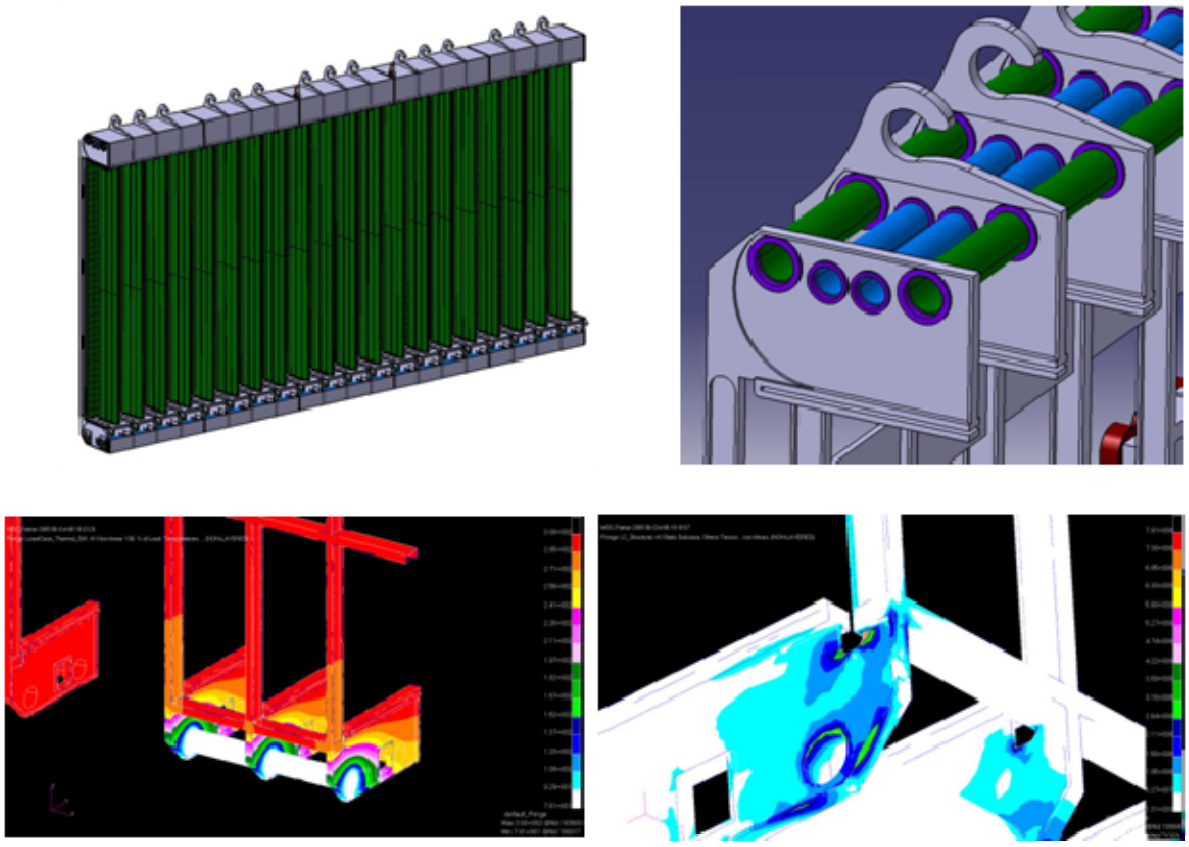

Figure 1: CAD overview of the DNB cryopump system (top left), detailed view of the 80 K and 4 K pipes (top right), cryogenic temperature distribution (bottom left), Von Mises stresses distribution (bottom right).