LESSONS LEARNED FROM DESIGNING AND MANUFACTURING OF THE COIL SUPPORT STRUCTURE OF W7-X

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Wendelstein 7-X (W7-X) is a fully optimised low-shear stellarator and shall demonstrate the reactor potential of this fusion plant. It is presently under construction at the Greifswald branch institute of IPP. The W7-X coil system consists of 20 planar and 50 non planar coils. They are supported by a pentagonal 10 m diameter, 2.5 m high called coil support structure (CSS). The CSS is divided into 5 modules. The full central ring structure (80 tonnes) had been completed and delivered at IPP Greifswald since October 2009. Currently, the four first modules were successfully assembled with the coils meeting the tight manufacturing tolerances.
Since 2004, the manufacturing of CSS has represented a technical challenge at industrial level and the need for proven techniques and manufacturing processes in accordance to the highest quality standards. The production of these components has required a management of monitoring for quality and tests especially for the raw material and the machining. For instance on complicated geometries of CSS, the cast austenitic steel was the preferred material for complex parts. Casting austenic steel is rather economic to manufacture and has good mechanical properties at low temperature and a good weldability.

Designing, structural calculation, raw material procurement, welding & soldering technologies, milling, drilling, accurate machining, helium cooling pipe forming, laser metrology, ultra sonic cleaning and vacuum test are some of the key points used all along this successful manufacturing process.
The main project management and detailed technical challenges will be presented. The lessons learned in the large scale production of this complex and major component such as W7-X coil support structure will be presented as relevant experience for the realisation of similar big components for future fusion devices, such as ITER.

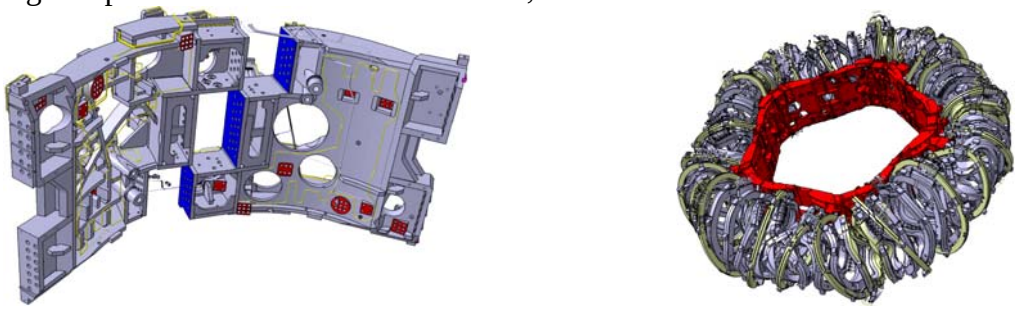

Figure 1: 3 D view of half-module assembly and coil support structure of W7-X.