

Possible Applications of Tungsten Materials in Power Production and Future Large-Scale Projects

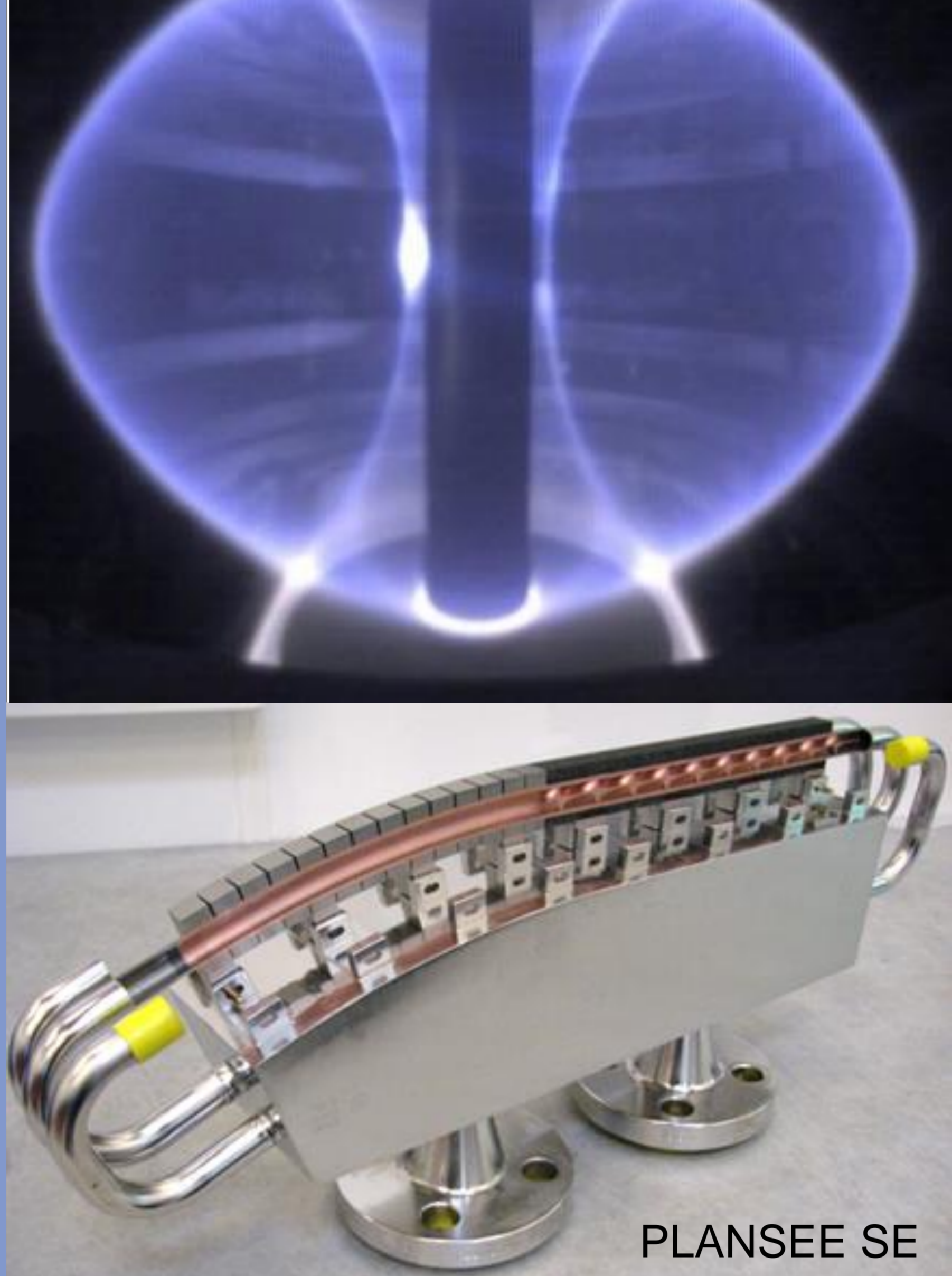
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Nuclear Fusion



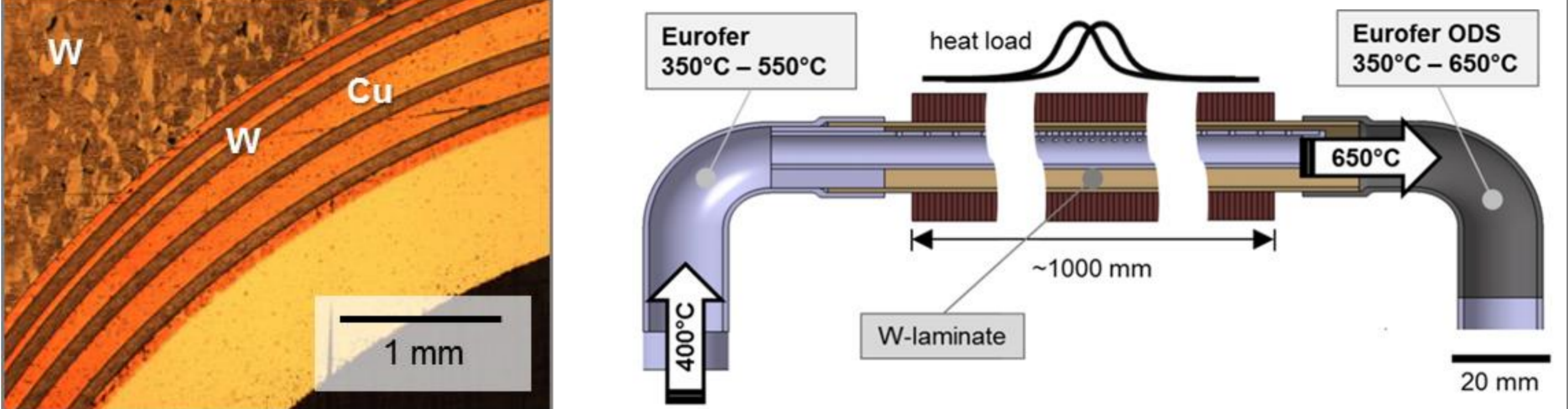
Armor Parts for a Fusion DEMOnstration Reactor
Operating Conditions: Heat flux 10-20 MW/m², neutron dose ~5 dpa, life-time 2 full power years (fpy), max. surface temperature 1800-2000 °C in vacuum, cyclic loads
Requirements: High erosion/sputtering resistance to limit the erosion rate to ~2 mm/fpy
Number of Parts: Several 100000 armor tiles of more or less complex shape, depending on the final design; required net amount of tungsten material 20-40 tons (every 2 fpy)
Fabrication Route: Mass fabrication by powder injection molding



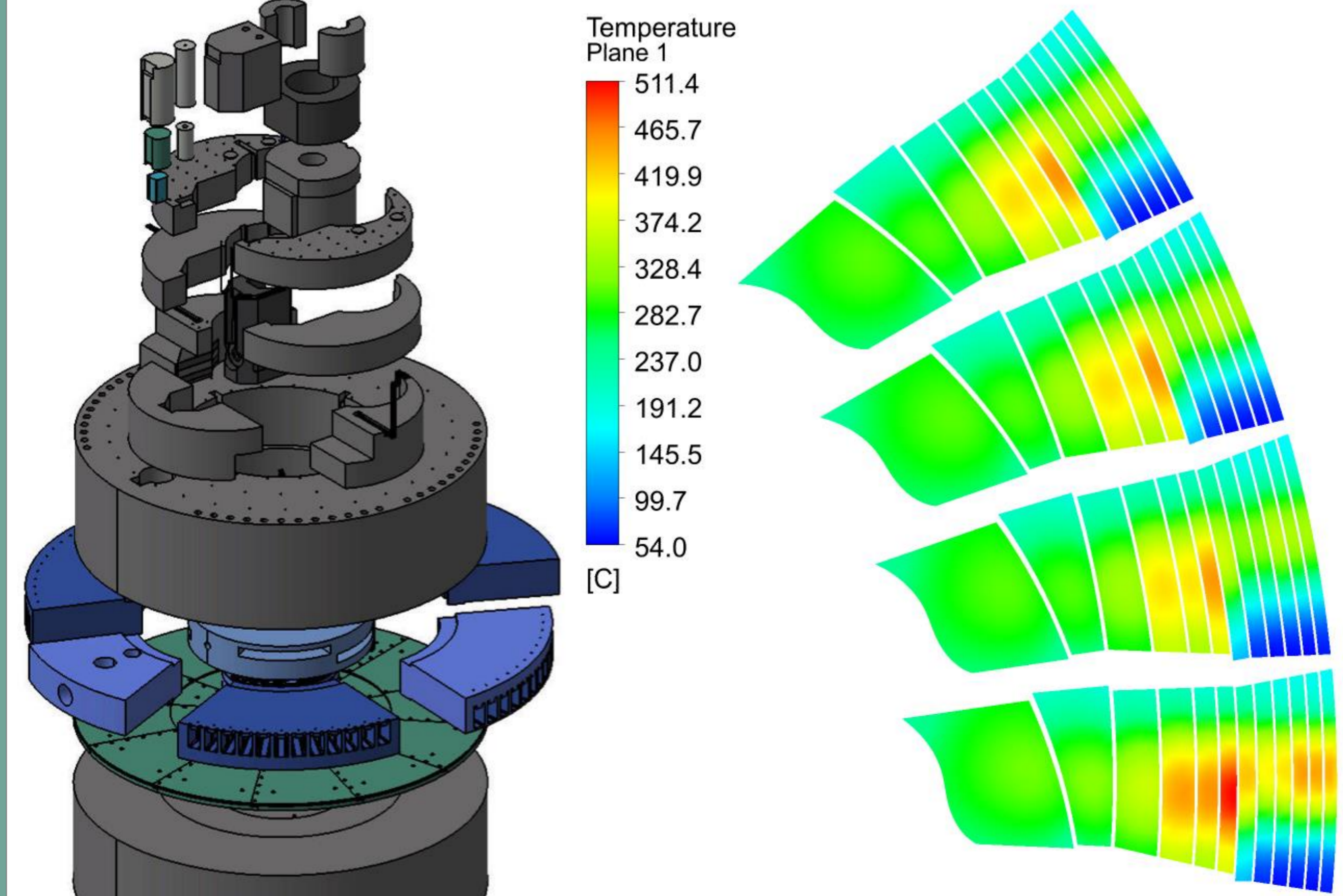
Solar Power



Cooling Structures for Concentrated Solar Power
Operating Conditions: Cooled by gas, molten salt, liquid metal, or other; typical operating temperatures 500-1000 °C
Requirements: Oxidation resistance, high absorption
Material: tungsten/molybdenum laminated pipes



Spallation



Rotating Target for the European Spallation Source (ESS)
Design: Helium cooled rotating wheel, 2.5 m diameter, 33 sectors, 13 tungsten slabs per sector of different thickness and shape
Operating Conditions: 5 MW proton beam, max. temperature in the target 500 °C
Requirements: Density >99%, high erosion resistance, net amount 4-7 tons of tungsten
Unknowns: long-term oxidation/erosion rate