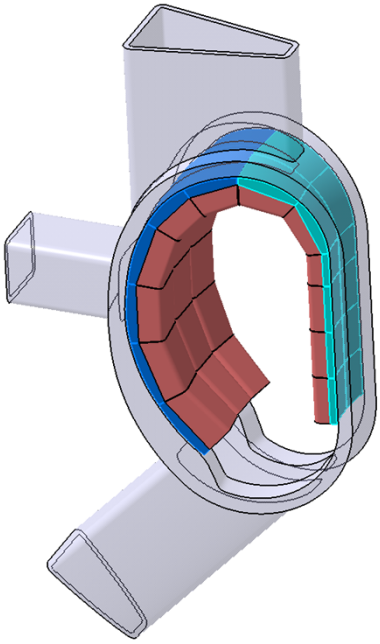
Karlsruhe Institute of Technology
Institute for Neutron Physics and Reactor Technology
Hermann-von-Helmholtz Platz 1
76344 Eggenstein Leopoldshafen
Germany

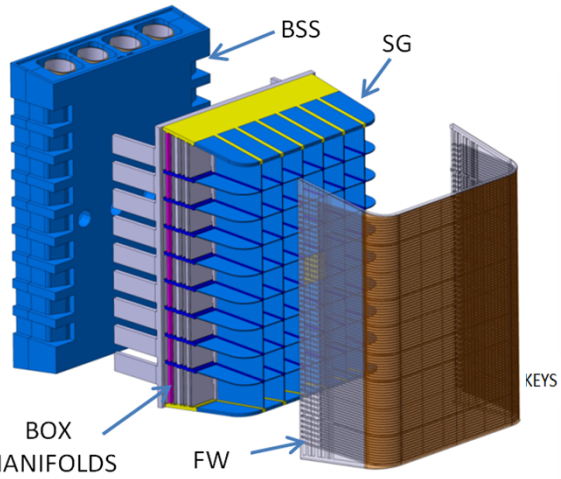
Advancement in HCPB DEMO Blanket design

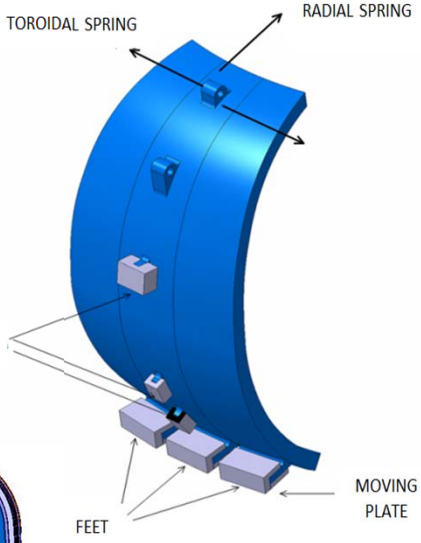
Dario Carloni[a], Qinlan Kang[a], Oliver Bitz[a], Francisco Hernandez[a], Christian Zeile[a], Ivan Alessio Maione[a], Prachai Norajitra[b], Lorenzo Virgilio Boccaccini[a]
[a]Institute of Neutron Physics and Reactor Technology, Karlsruhe Institute of Technology (KIT), Germany
[b]Institute for Applied Materials, Karlsruhe Institute of Technology (KIT), Germany

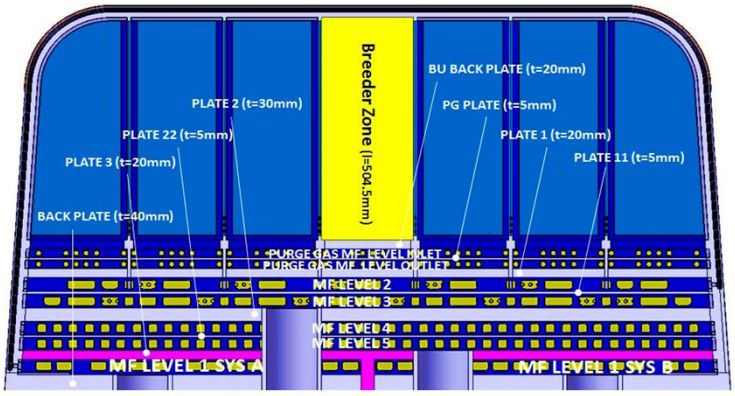
Blanket Main Requirements

- dimensions of the Blanket Segments, in particular in the radial direction
- remove heat from the plasma and transfer it to the cooling system
- provide TBR > 1.07 to ensure the required tritium for the plant operations
- provide shielding from neutrons to the VV
- ensure module structural integrity during normal and accidental conditions
- ensure compatibility of the blanket segments with the remote maintenance vertical scheme



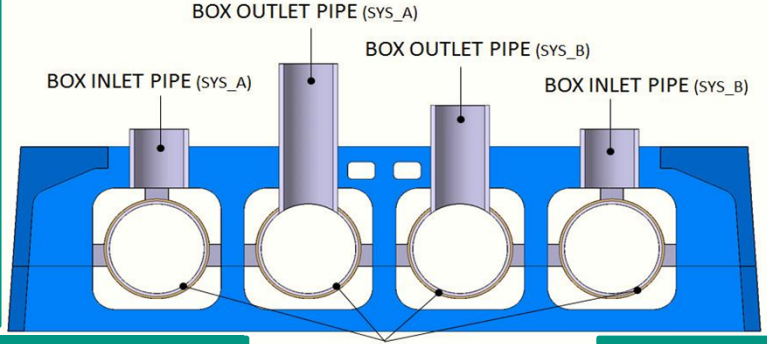






System Configuration

- 16 Blanket toroidal sectors
- 3 outboard (OB) and 2 inboard (IB) blanket segments
- Segment poloidal height of about 12 m
- 6 blanket modules x segment
- radial-toroidal - poloidal module size is about 1 m - 1 m - 2 m, respectively



Attachment to the VV

The attachment system has to cope with:

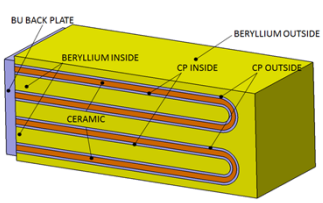
- Weight of the segment
- Electromagnetic forces
- Thermal Expansion of the Blanket

Electromagnetic loads coming from the Plasma Disruption (Eddy currents and Halo currents) can generate the Blanket vertical displacement (VD) and they actually lead the design of the attachment system

Box welded to the BSS

- Low stresses for the piping between BSS and box
- Increase of the space available for the box's internals (e.g. BUs and Box Manifold)
- Limited effects due to the thermal expansion
- No movable joints required (e.g.: keys, pins)
- Easy replacement of a failed module in hot cell (by welding cut)

BSST HOT PIPES + INSULATION



Blanket Dual Cooling

The dual cooling of the FW and module internal is characterized by two separate parallel cooling systems (flowing in counter flow direction), each able to remove 50% of the heat generated in the blanket, routed through the BSS to the module FW, then to the box internals and finally back to the BSS.