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Construction of PREMUX and preliminary experimental results, as preparation for the HCPB Breeder Unit mock-up testing

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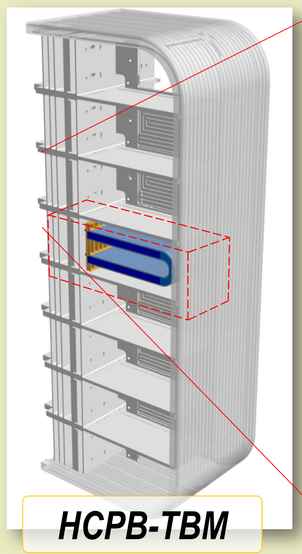
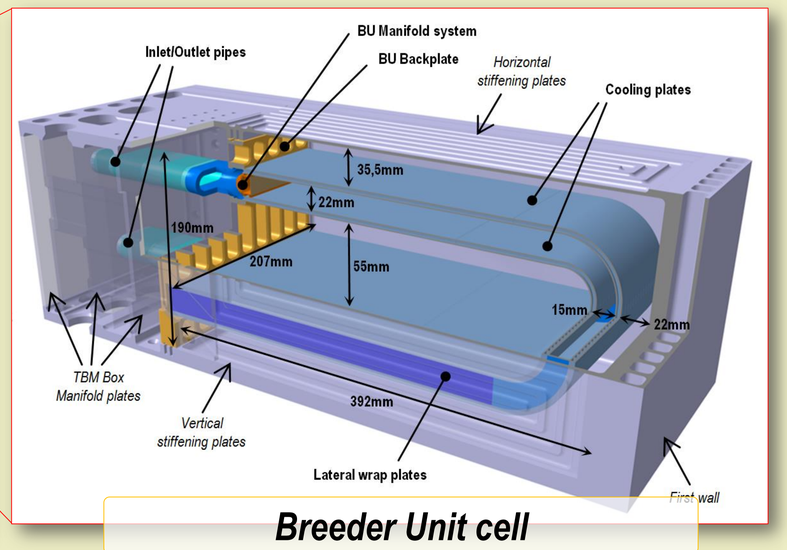
THE HCPB-TBM BREEDER UNIT (BU) IN ITER



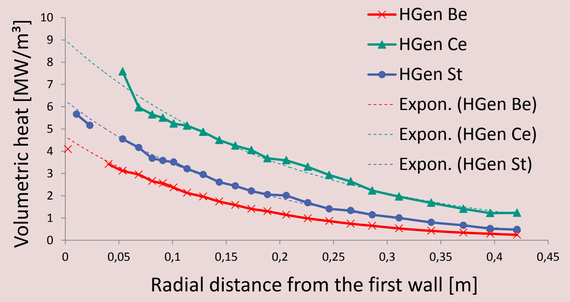
HCPB-TBM



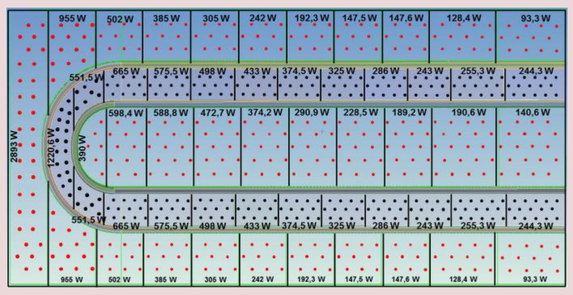
Breeder Unit cell

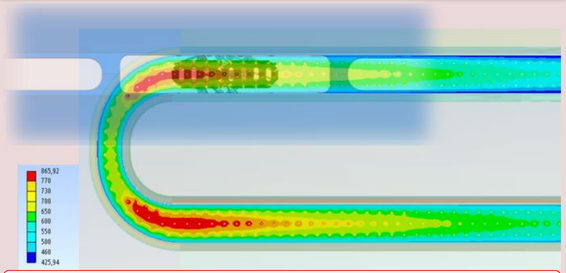
Mid-term goal: out-of-pile qualification of the thermo-mechanical performance of a HCPB-TBM Breeder Unit mock-up for ITER

BU MOCK-UP (BU MU) CONCEPTUAL STUDIES FOR AN OUT-OF-PILE TESTING



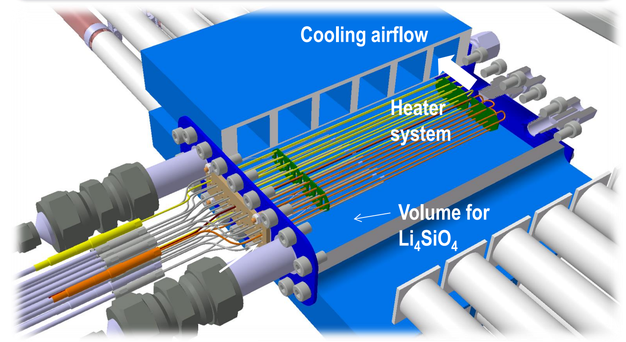
The discretization of the neutronic volumetric heat in cells of homogeneous heat is the basis for the out-of-pile BU MU concept. The idea is to insert a blocks of wire heaters in each cell that will reproduces this neutronic heat.

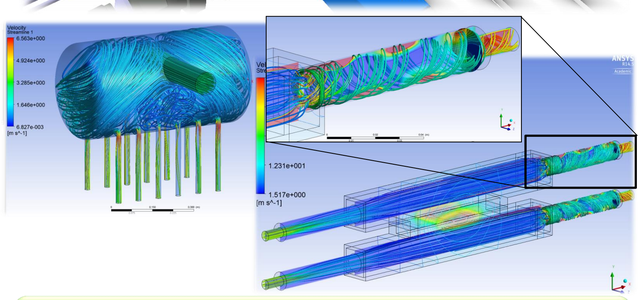




BU temperature distribution

THE PREMUX DESIGN

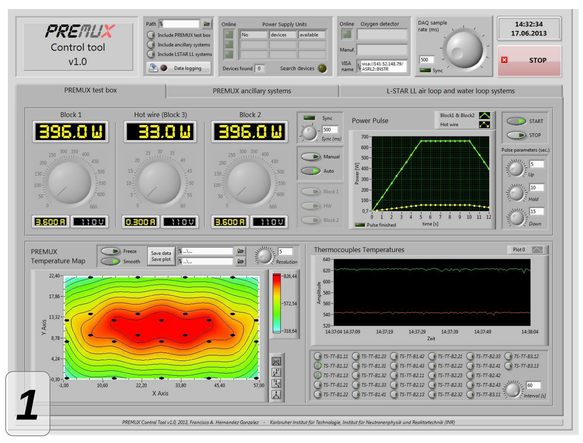


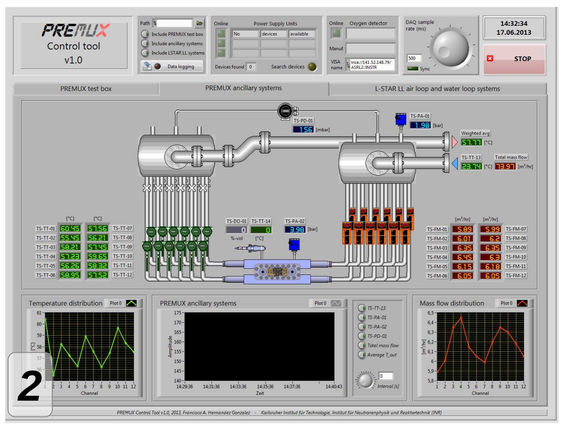


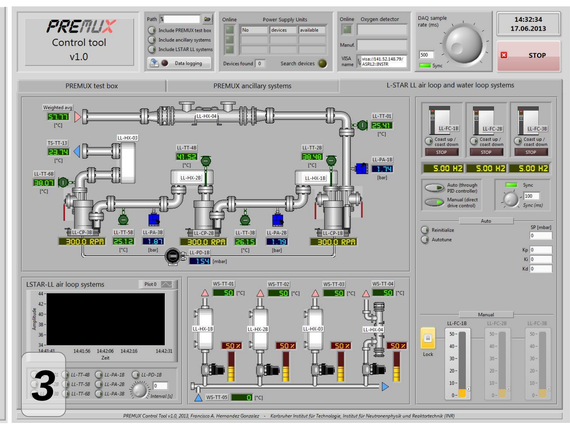
PREMUX experiments aims at testing this key concept step, reproducing a slice of the BU MU. Comprehensive studies have been done during the design of PREMUX to keep relevant conditions to a BU MU.

PREMUX CONTROL TOOL AND TEMPERATURE RECONSTRUCTION

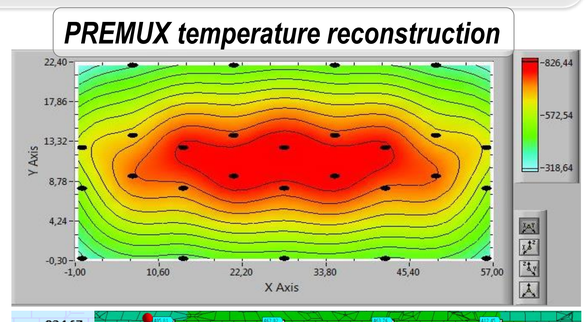
A *PREMUX Control Tool* software has been developed in Labview to monitor PREMUX systems. Three panels allows the real time monitoring of: (1) Li_4SiO_4 temperature monitoring and heater control, (2) PREMUX ancillary systems monitoring, and (3) L-STAR/LL loop systems control and monitoring.

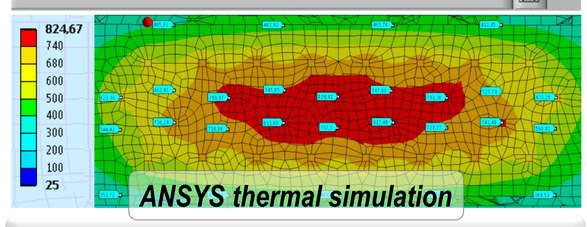






PREMUX temperature reconstruction





ANSYS thermal simulation

One special feature is the implementation of a real time temperature reconstruction of the pebble bed test section with biharmonic spline interpolation.

Preliminary tests simulating the thermocouple signals in the Li_4SiO_4 shows the adequacy of the method.

CONSTRUCTION OF PREMUX AND TEST CAMPAIGN PLANNING

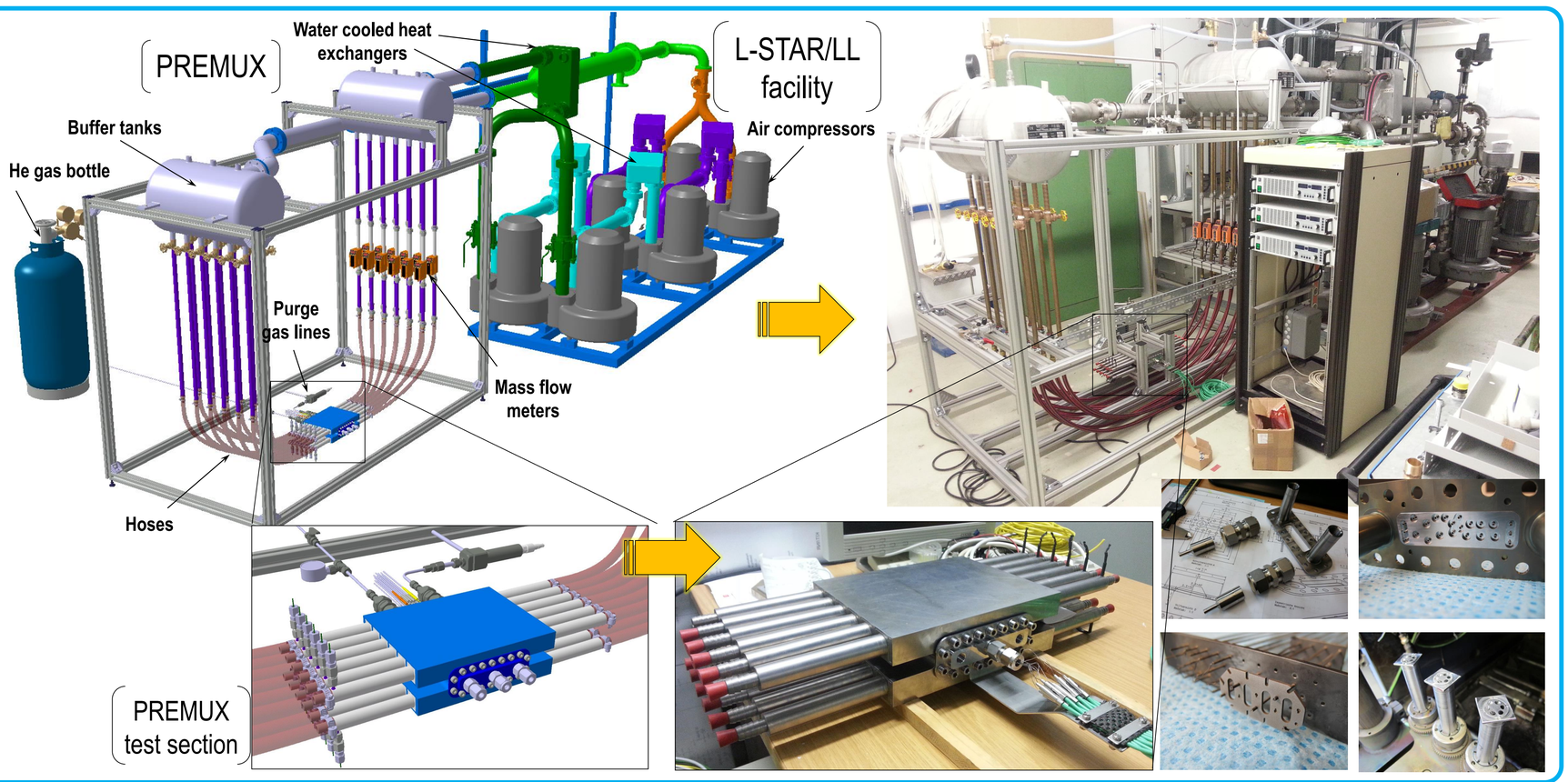
PREMUX is integrated in L-STAR/LL Large Loop (air loop, max. 0.3 MPa, max. 660g/s 25 °C to 390 °C).

PREMUX will consist in 3 series of experiments:

(1) steady state power runs, increasing the power deployed by the heaters and measuring the Li_4SiO_4 temp.

(2) runs reproducing ITER power pulses

(3) runs for determination of the pebble bed thermal conductivity by pulsed hot wire method



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