HCLL and HCPB Coolant Purification System: Preliminary measurement and instrumentation plan

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The Coolant Purification System (CPS) together with the Tritium Extraction System (TES) and Helium Cooling System (HCS) are the principal auxiliary circuits of HCLL and HCPB TBMs to be tested in ITER. Among them, CPS is used to extract tritium from the cooling primary circuit as well as to guarantee removal of impurities which could interact with structural material. The reference process proposed for CPS is composed of 3 main successive steps (Step 1: Oxidation of Q_2 and CO to Q_2O and CO_2 using a metal oxide; Step 2: Adsorption of Q_2O and CO_2; Step 3: Adsorption of residual impurities by a heated getter).
Based on considerations in terms of safety, tritium accountancy and process control, instrumentation philosophy requires real-time tritium monitoring (which might be not very accurate) to control the processes in both TBM helium loops and special tritium accountancy procedure with regard to the interface with others sub-systems of the Tritium Plant. Furthermore, in addition to chemical speciation of the flow, the control of the process requires the measurement of other parameters such as the flowrate, the pressure and the temperature. For each monitored parameter, this paper describes the most suitable technologies, including a review of advantages, drawbacks and possible ways of improvement.