THE CASCADING PEBBLE DIVERTOR SYSTEM

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The high heat flux and erosion rates expected in a spherical tokamak (ST) power plant and a component test facility (CTF) based on the ST has led to consideration of the cascading pebble divertor system. This is particularly suited to the ST due to its relatively low parallel power density and offers the advantages of a solid surface that is continuously replenished. The pebbles are typically 3mm in diameter and formed from tungsten coated silicon carbide or graphite. These pebbles fall through the upper divertor leg particle flux as a toroidal curtain before flowing through ducts to the lower divertor where they form a similar curtain. The heated pebbles then pass out of the vacuum chamber into holding tanks and then into a fluidised bed heat exchanger. Here the pebbles are cooled and dust and damaged pebbles removed. The pebbles are then transferred to an upper tank by a pneumatic conveyor where the remaining gas is removed and the pebbles flow into the upper divertor again.

Systems analysis coupled with experimental work and manufacturing trials have been used to develop the design so far but further work is needed to improve the prediction of the divertor power densities and further develop the systems and components to demonstrate their performance. This should include an early demonstration of the interaction of plasma with the cascading pebbles which could be achieved using the MAGNUM PSI facility.