Power transmission from the ITER model negative ion source

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In Cadarache development on negative ion sources is being carried out on the KAMABOKO III ion source on the MANTIS test bed. This is a model of the ion source designed for the neutral beam injectors of the International Thermonuclear Experimental Reactor (ITER). Its target performance is to accelerate a D^- beam, with a current density of 200 A/m^2 and <1 electron extracted per accelerated D^- ion, at a source pressure of 0.3 Pa. For ITER a continuous ion beam must be assured for pulse lengths of 1000 s, but beams of up to 3,600 s are also envisaged.

During previous campaigns, continuous beam pulses of duration up to 1000 s have been demonstrated both in hydrogen and in deuterium, however the current density of both beams were found to be low in comparison to the specifications of 200 A/m^2. At that time the D^- accelerated beam was collected on a calorimeter located 1.6 m downstream of the accelerator. The calorimeter used was made of water cooled copper, and the accelerated D^- current density was deduced from the energy arriving at the calorimeter divided by the acceleration voltage. A large discrepancy exists between measured accelerated currents and that which is transmitted to the calorimeter. The discrepancy in these values and the possibility that the accelerated current included electrons, either from extraction or stripping has been investigated. In addition a comprehensive study of the accelerator optics and beam transmission has been carried out. A new drift duct has being fabricated and installed which is well instrumented to allow the power deposited between the accelerator and the calorimeter, and the spatial distribution of that power, to be determined. Additionally the beam profile on a new inertial calorimeter are measured with an IR camera.

Results of experiments to determine the extracted and stripped electron content of the accelerated beam and studies into the effect of pulse length on the power transmission will be reported as well as results of the power distribution measurements.