THE HEAVY ION BEAM DIAGNOSTIC PROJECT FOR THE TCV TOKAMAK

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Based on a contract between the Centre de Recherches en Physique des Plasmas, Lausanne Switzerland and the Kurchatov Institute and the UDIF company both of Moscow, a Heavy Ion Beam Probe (HIBP) diagnostic is under construction for the TCV (tokamak à configuration variable) tokamak in Lausanne. This equipment will be used for electric potential measurements in the core plasma and for the determination of the magnetic potential. This combination is of crucial importance for the understanding of the physics of improved confinement in toroidal facilities. With a special detection system it will also be possible to detect correlations between density and electric field fluctuations of closely spaced points in radial or poloidal direction.

Based on available ports a design has been chosen which maximizes total plasma coverage. A speciality of the TCV machine is to be able to produce plasmas of widely differing shapes. Beam trajectory calculations have been done to maximize the observable areas of the plasma cross-sections with special emphasis on radial profiles extending from the plasma center up to the edge. As far as correlation measurements are concerned, it is important to be able to observe simultaneously closely spaced points in either radial or poloidal directions. Interpretation of measurement results is considerably more difficult for other directions where the two components are mixed. The constraints are such that it is not possible to achieve this goal over the full plasma radius. Results of simulations will be shown to demonstrate what can be achieved.

Four different detection systems will be discussed and compared of which at least two will finally be implemented. A standard electrostatic analyzer with split-plate detector will be part of the basic system. The other three options are area detectors with different characteristics. The Multiple Cell Array Detector (MCAD) has the advantage that it has already been used and tested on other machines. The remaining two detectors under consideration either offer superb discrimination against the effect of unwanted radiation or particles (emitted secondary electrons, for example) or the microsecond time resolution required for correlation measurements.