

Abstract Submitted
for the DPP06 Meeting of
The American Physical Society

HIBP Designs for measurement of the electric field in HSX¹ XI

CHEN, Rensselaer Polytechnic Institute, JON HILLESHEIM, HSX Plasma Lab, UW-Madison, PAUL SCHOCH, DIANE DEMERS, KENNETH CONNOR, Rensselaer Polytechnic Institute, DAVID ANDERSON, HSX Plasma Lab, UW-Madison — Understanding the relative roles of neoclassical and anomalous transport in advanced stellarators is critically dependent on knowledge of the radial electric field. A feasibility study has shown that it is practical to measure the radial electric field in the Helicallly Symmetric eXperiment, HSX, using ion beams. Two options have been explored, a standard Heavy Ion Beam Probe, HIBP, and a system that measures the deflection of an ion beam due to the plasma electric field. The standard HIBP measures the local space potential at multiple points, allowing a calculation of the radial electric field. Estimated signal levels are similar to some previous systems, most notably the EBT HIBP. It is also capable of measuring fluctuations in potential and density. The second option studied measures the change in a probing ion beam trajectory due to the electric field. HSX vacuum magnetic fields are virtually unchanged by the plasma, therefore changes in the beam trajectory due to plasma would be dominated the plasma electric field. The changes are path integrated and the local electric field is determined by running multiple trajectories and inverting. A beam deflection system is simpler and needs a lower ion accelerator voltage than a HIBP, but it provides less information.

¹Work supported by US Dept. of Energy grants.

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Date submitted: 23 Jul 2006

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