

Contents

Abstract	ii	3 Parallel Electron Currents	71
Acknowledgement	iv	3.1 Introduction	71
1 Introduction	1	3.2 Experimental Technique and Results of Measurements	72
2 The Interchangeable Module Stellarator	10	3.2.1 Electron Temperature	73
2.1 Device Parameters and General Diagnostics	11	3.2.2 Electron Density and Pressure	75
2.2 Device Magnetics	12	3.2.3 Parallel Electron Current Density	79
2.3 Langmuir Probe Measurements	21	3.3 Calculation of the Parallel Current	81
2.3.1 Electron Temperature Measurements	21	3.3.1 Calculation of the Pfirsch-Schlüter Current	84
2.3.2 Ion Saturation Current Measurements	25	3.3.2 Estimation of the Bootstrap Current	96
2.4 Parallel Electron Current Measurements	27	3.4 Comparison of Measured and Calculated Currents	103
2.5 Inducing and Measuring a Flow in IMS	33	3.5 Summary and Discussion	108
2.5.1 Operation of the Biased Electrode	34	4 Bias-Induced Ion Flows	115
2.5.2 Review of Mach Probe Theory	35	4.1 Introduction	115
2.5.3 Characteristics of the IMS Mach Probe	42	4.2 Review of Neoclassical Theory for Induced Plasma Flows	116
2.5.4 Comparison of Measured Flows and Calculated Drifts	57	4.3 Calculation of the Flows and Flow Decay Rates	127
2.5.5 Summary and Discussion	67	4.4 Comparison of Measured Ion Flows with Theory	144
		4.4.1 Measured Ion Flow Direction versus Major Radius	145
		4.4.2 Measured Flows versus Neutral Pressure	148
		4.4.3 Measured Flow Decays versus Neutral Pressure	154
		4.5 Summary and Discussion	158
		5 Summary and Conclusions	164
		Bibliography	170