Chapter 7
Summary

Internal structural behaviour of central cell bulk electrons and end loss ions is observed with newly developed matrix-type X-ray detectors as well as ion energy spectrometer arrays [31]. The data are analysed and compared with the scaling relation between the anchor and the central cell diamagnetisms for MHD stabilization in the GAMMA 10 plasmas with the minimum-B inboard anchors. In particular, MHD destabilization experiments by the use of neutral cold gas injection in the anchor MHD stabilizer hot ions clarify the start up details of the interchange instability due to the degradation in the anchor diamagnetism by the cold gas puffing [23].

A synchronized rotation of whole plasma column through the central cell, anchor, and end regions in GAMMA 10 is found as the first internal plasma structural data; that is, a rigid rotational interior structure having the $\boldsymbol{E}\times\boldsymbol{B}$ rotational angular velocity with an azimuthal mode number of m=-1 is found by the direct internal diagnostics with the X-ray matrix detectors. The rigid rotation is consistently found to be triggered when the plot in the scaling surface of the MHD stability approaches and almost crosses the stability boundary. The above described interior plasma structural behaviour with the plot in the scaling surface for the MHD anchor stabilization provides important information on tandem mirror plasma stabilizations for not only the present central cell hot ion plasma sustainment but also future tandem mirror scaling based designs.

By the use of the power balance studies under various plasma parameter conditions, particularly under the conditions with direct electron cyclotron heating in the central cell, the first systematic investigations of the electron confinement are made: It is found that the central-cell electron temperatures are well explained by the confinement due to the thermal barrier potentials; this

confinement property is consistently interpreted by classical mechanism alone (Pastukhov's theory), and no need of anomalous uncontrollable processes for the interpretation of the confinement of the central cell electrons are found. This important result also suggests the future extension and development of the essential role of tandem mirror potential formation in the electron confinement.