

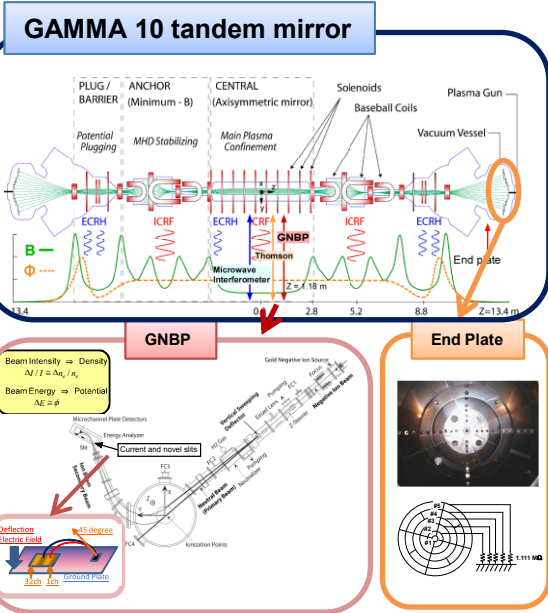
# Potential Fluctuation Study from the Core Plasma to End Region in the GAMMA 10 Tandem Mirror

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## Introduction

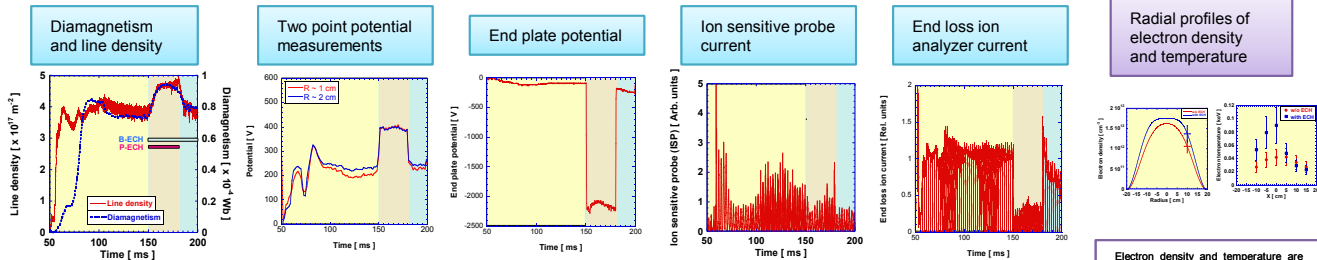
Correlation between the drift type fluctuation and anomalous radial transport was observed in GAMMA 10 and these fluctuations were suppressed by electron cyclotron heating (ECH) driven radial electric field.  
In divertor experiments, the correlations between core plasma and the end/edge plasma have to be studied.  
• We have developed new diagnostics, which are a **simultaneous two points measuring gold neutral beam probe (GNBP) for measuring the radial electric field and potential fluctuation and a high speed end plate potential fluctuation measurement system.**  
• The coherency of the potential fluctuations between the core plasma by GNBP and that of the end plate measurement was studied.

## Experimental apparatus



It is possible to measure the potential, density fluctuations and their phase difference at the arbitrary point simultaneously by GNBP.  
It is possible to measure the floating potential in end region of GAMMA 10.

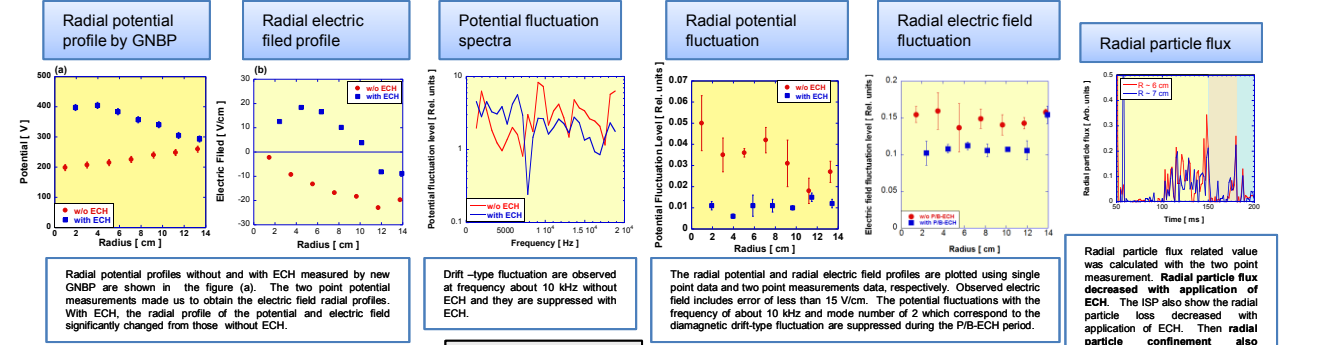
## Experiments



The plasma is heated and maintained with applying ICRF waves from t = 51 to 240 ms and the confinement potential is produced by applying B-ECH with power of 150 kW from t = 150 to 200 ms and P-ECH with power of 200 kW from t = 151 to 181 ms. The temporal evolution of two positions' potentials were measured by GNBP with a single plasma shot, and we changed the measuring position shot-by-shot. End plate potential is measured at the end plate. The central potential and end plate potential quickly increased during the P/B-ECH period.

Ion sensitive probe (ISP) at the central cell and the end loss ion analyzer (ELA) at the end region signals show that the current decrease with P/B-ECH. These show that the axial and radial particle confinement improved with application of P/B-ECH.

Electron density and temperature are measured by the microwave interferometer and Thomson scattering system, respectively. The electron density and temperature increased with application of ECH.



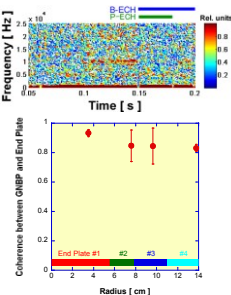
Radial potential profiles without and with ECH measured by new GNBP are shown in the figure (a). The two point potential measurements made us to obtain the electric field radial profiles. With ECH, the radial profile of the potential and electric field significantly changed from those without ECH.

Drift-type fluctuation are observed at frequency about 10 kHz without ECH and they are suppressed with ECH.

The radial potential and radial electric field profiles are plotted using single point data and two point measurements data, respectively. Observed electric field includes error of less than 15 V/cm. The potential fluctuations with the frequency of about 10 kHz and mode number of 2 which correspond to the diamagnetic drift-type fluctuation are suppressed during the P/B-ECH period.

Radial particle flux related value was calculated with the two point measurement. Radial particle flux decreased with application of ECH. The ISP also show the radial particle loss decreased with application of ECH. Then radial particle confinement also improved with ECH.

## Coherence between central and end potentials



The time evolution of coherence between the central potential fluctuation and the end plate fluctuation at the plasma center axis is shown. The frequency peak near 10 kHz is observed. The radial profile of coherences between the potential fluctuations measured by the new GNBP and end plate system before application of P/B-ECH.

## Summary

We successfully developed new diagnostics to investigate for the drift type fluctuations and anomalous radial transport and the fluctuations suppressed by ECH, which are a **simultaneous two points measuring GNBP and a high speed end plate potential fluctuation measurement system.** The radial electric field and its fluctuation successfully obtained by using simultaneous two point measurements. **The coherency of the drift type potential fluctuations between the core plasma by GNBP and that of the end plate measurement was clearly observed.** The application of ECH, the potential fluctuation is suppressed and the axial and radial particle confinement improved. **We have obtained the strong tools for investigating the correlation of the radial electric field and the potential fluctuations between core and edge plasmas.**

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