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Bayesian inference of electron cyclotron emission radiometer calibration by changing the magnetic field

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Changing the toroidal magnetic field is one of the relative calibration method to obtain the relative calibration coefficients of electron cyclotron emission radiometers (ECE). At the meanwhile, for the HL-2A, there is a Thomson scattering diagnostic system, which can get the accurate electron temperature (Te). By cross comparison with Thomson scattering Te of the center channel, the absolute Te profile can be obtained by ECE. In general, magnetic field calibration method is a simple and handy way to obtain the calibration coefficients that just need two similar shot but a difference of 1.35% on the magnetic field and has been utilized on HL-2A for many years. For this method, the assumption is that the Te profiles is consistent. It means a little different between the two Te profiles like vertical and horizontal plasma displacements will cause prominent calibration error. In order to reduce the calibration error, displacement, Te perturbation of core region and magnetic field changes analysis has been done. Result shows that 3.7% magnetic field difference can improve the accuracy of calibration. In the meantime, Bayesian inference has been utilized to further improve the accuracy of calibration and get the most probable calibration coefficients and the confidence interval. As shown of Bayesian inference result, it's little different with the mean value of the original data, the coefficients of the area outside the core is confident and the biggest uncertainty is from the core region but which is acceptable.

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