Abstract Submitted
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Harmonic magnetic field reconstruction from external sensor arrays on HBT-EP[1] Q. PENG, N. RATH, J.P. LEVESQUE, P.J. BYRNE, D. SHIRAKI, A. COLE, M.E. MAUEL, G.A. NAVRATIL, Columbia University — In the vacuum region surrounding a toroidal plasma, it is natural to decompose the perturbed magnetic field in terms of an orthogonal representation of the magnetic scalar potential. In HBT-EP, the relatively thin radial region between the conducting wall and the plasma surface is large-aspect ratio ($R/a \sim 6$), and as a first approximation we expand the perturbed magnetic field in a cylindrical representation, as $B = \sum_{m,n} \vec{\nabla}\psi_{m,n}$, where $\psi_{m,n} = \psi_{m,n}(r)e^{i(m\theta - n\varphi)}$. Because HBT-EP has more than 200 magnetic sensors distributed in both toroidal and poloidal arrays, we have been able to reconstruct the perturbed vacuum field harmonic amplitudes, $\psi_{m,n}$ as a function of time under a variety of conditions, including variations of the plasma equilibrium and the magnitude of applied error fields. Using these harmonic amplitudes, we describe how to compute the Maxwell stress tensor in the vacuum region and to estimate the net torque on the plasma exerted by the surrounding resistive wall and error field coils.

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