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The linear simulation of the plasma response of the RMP in BOUT++ framework

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BOUT++ 2023 workshop

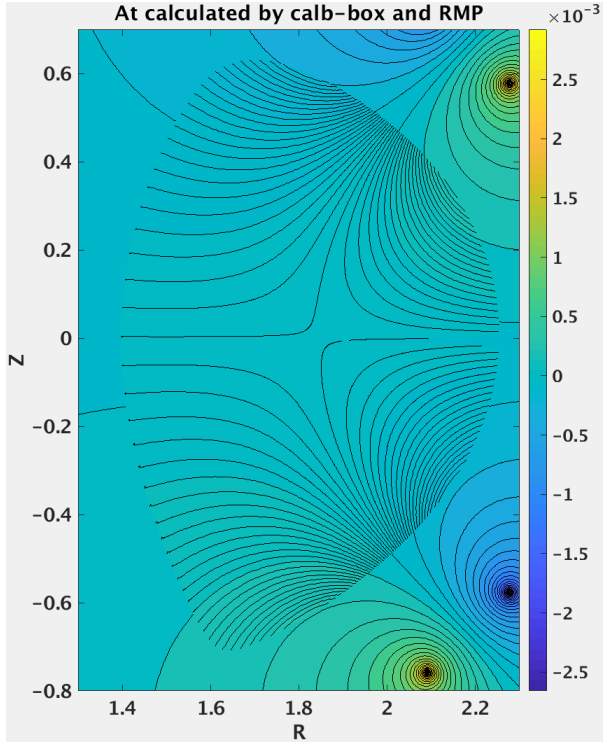
January 12, 2023

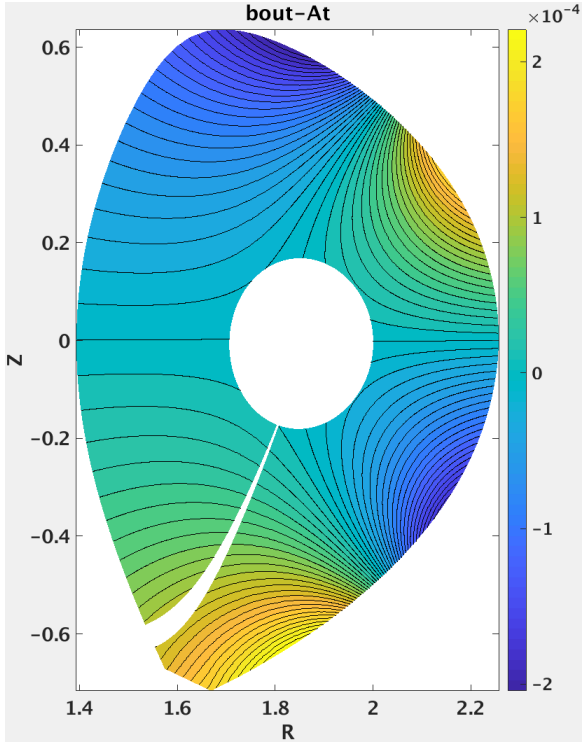
The two-field model is used to simulate the plasma response of RMP

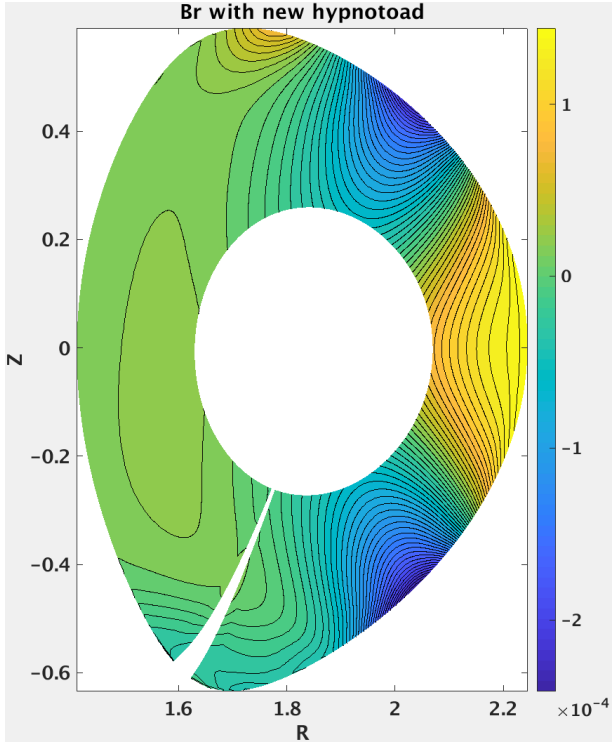
$$\frac{\partial \tilde{\varpi}}{\partial t} = B_0 \nabla_{\parallel} J_{\parallel} + \mu_{i,\parallel} \partial_{\parallel 0}^2 \tilde{\varpi}$$

$$\frac{\partial \tilde{\psi}}{\partial t} = -\frac{1}{B_0} \nabla_{\parallel} \tilde{\phi} + \frac{\eta}{\mu_0} \nabla_{\perp}^2 \tilde{\psi}$$

- The vacuum RMP field which calculated in MAPS code is applied as the outer boundary condition of ψ







The data analysis based on BOUT++ output

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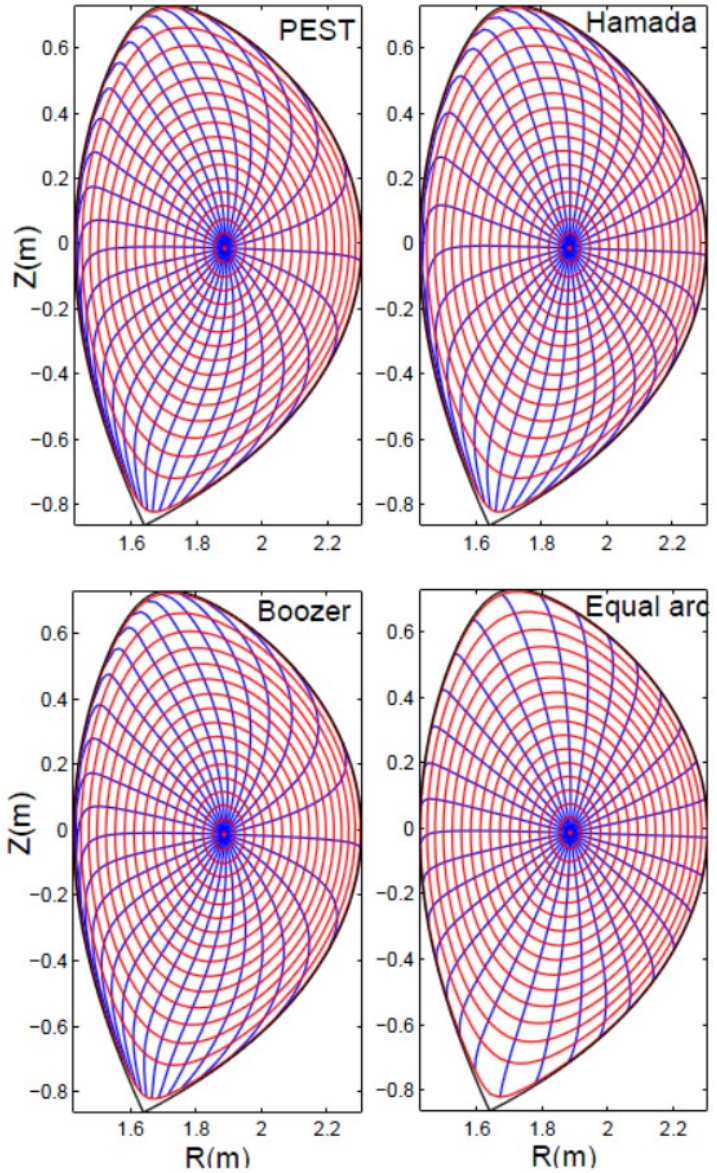
$$\vec{B}\cdot\nabla\psi_p = \frac{d\psi_p}{d\rho}\vec{B}\cdot\nabla\rho = 2\psi_{bm}\rho_p\vec{B}\cdot\nabla\rho_p = 2\psi_{bm}\rho_p B^\rho$$

$$\Rightarrow B^\rho = \frac{\vec{B}\cdot\nabla\psi_p}{2\psi_{bm}\rho_p}$$

$$\vec{B}\cdot\nabla\zeta = B^\zeta = \vec{B}\cdot\nabla\phi = \frac{B_t}{R} = \frac{g}{R^2}$$

$$\frac{B^\rho}{B^\zeta} = \frac{\vec{B}\cdot\nabla\psi_p}{2\psi_{bm}\rho_p}\frac{R}{B_t}$$

$$B_n = \frac{\vec{B}\cdot\nabla\psi_p}{|\nabla\psi_p|} = \frac{\vec{B}\cdot\nabla\psi_p}{RB_p}$$



The spectrum comparison between MAPS and BOUT++

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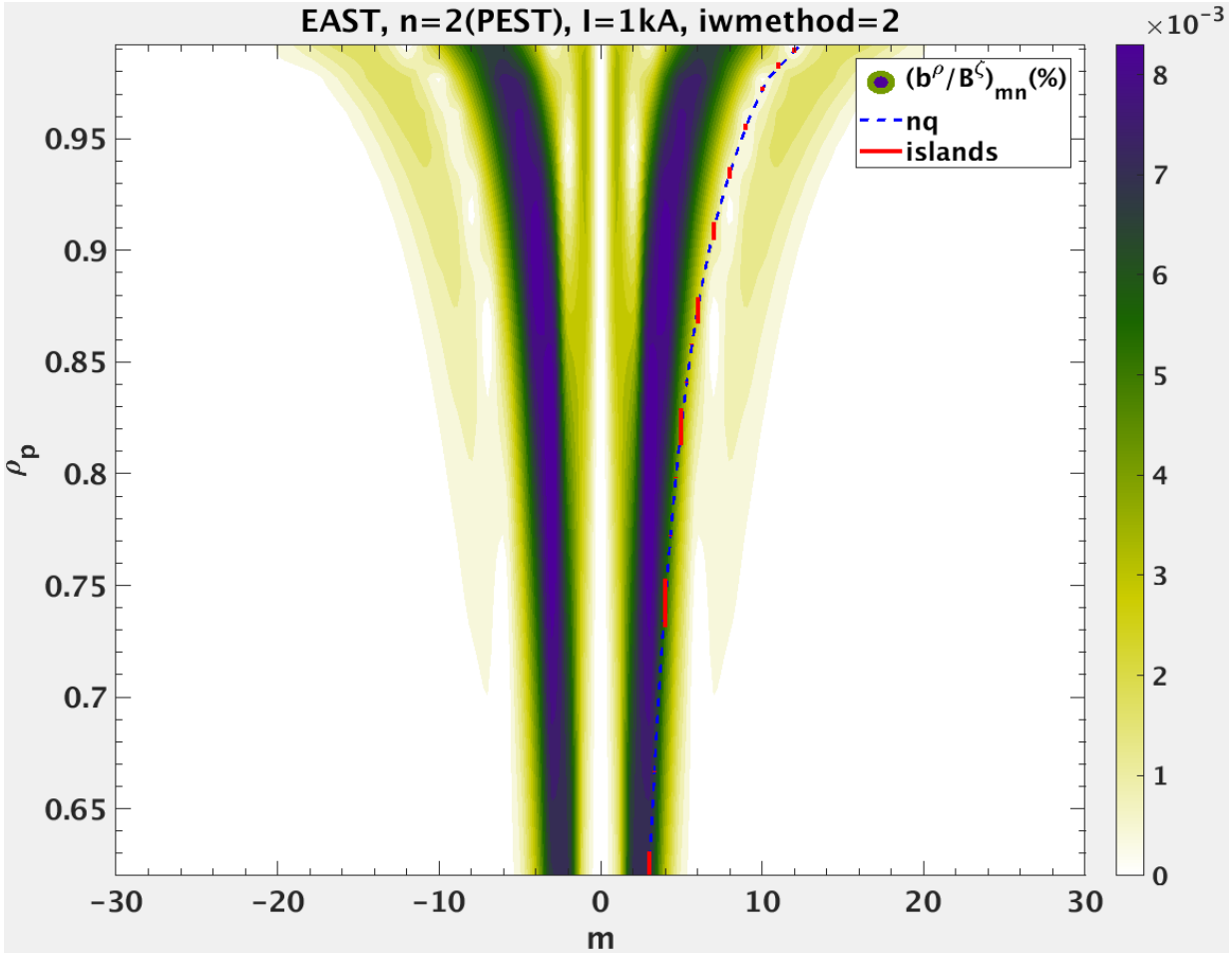

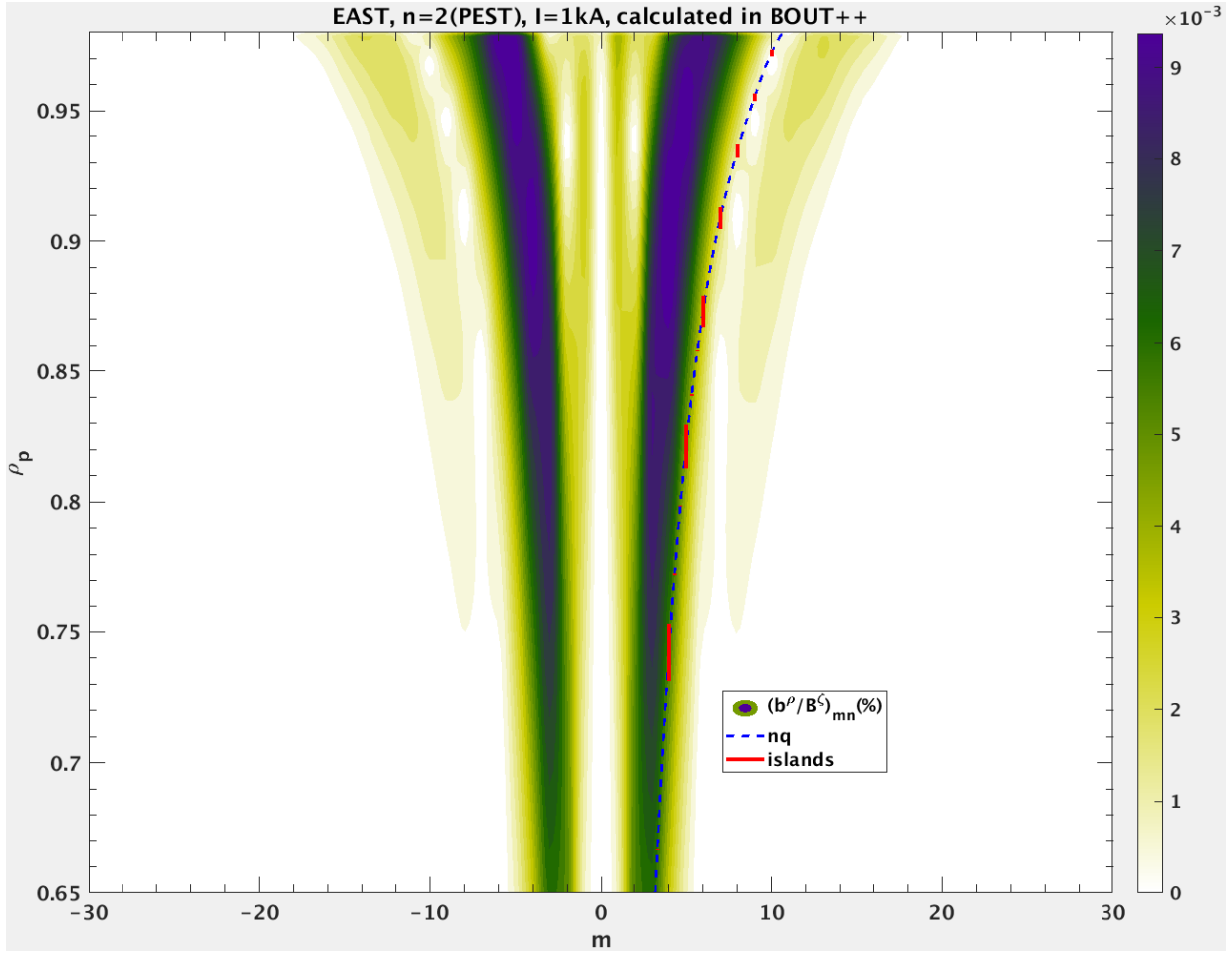

The spectrum comparison between MAPS and BOUT++ cont.

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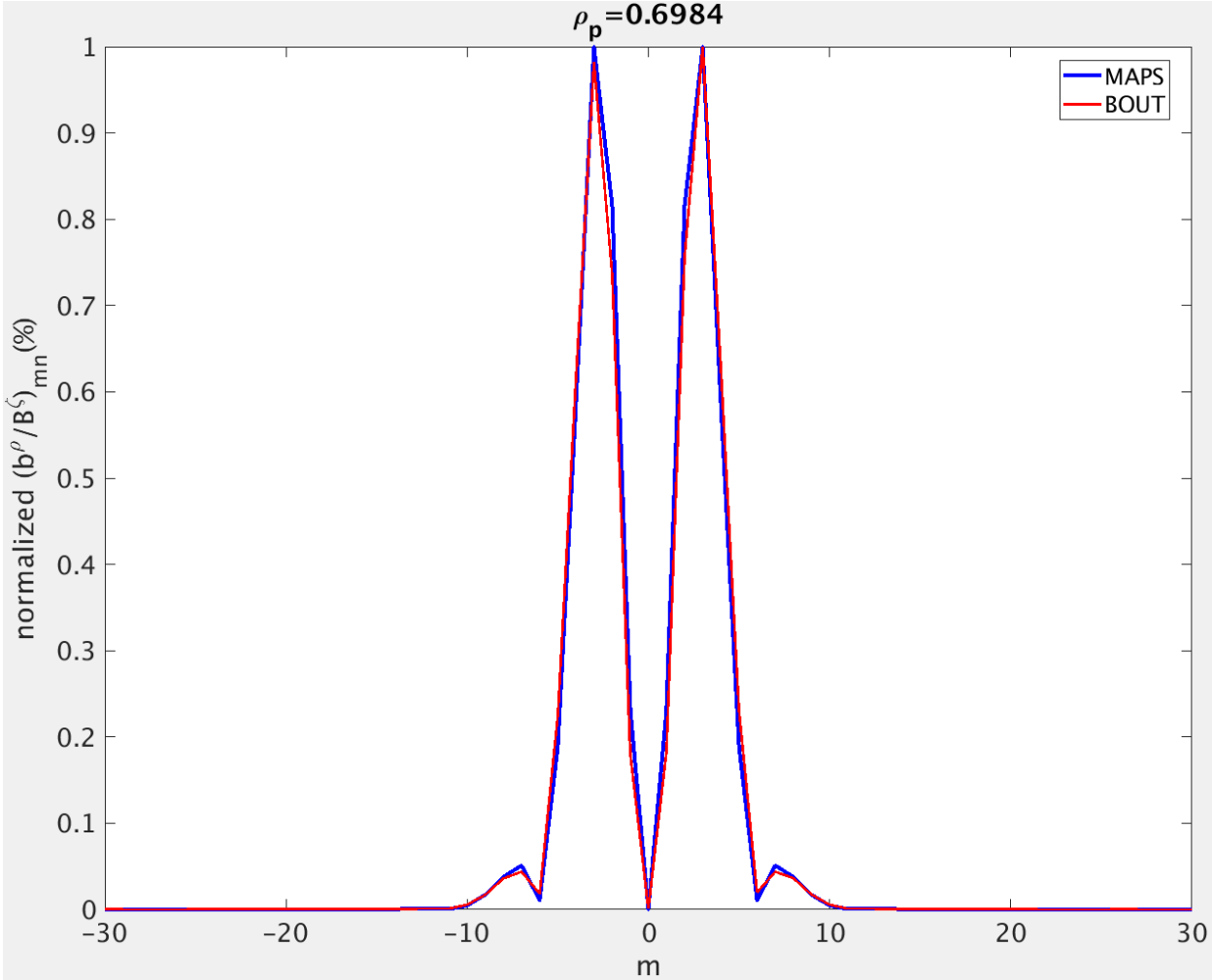

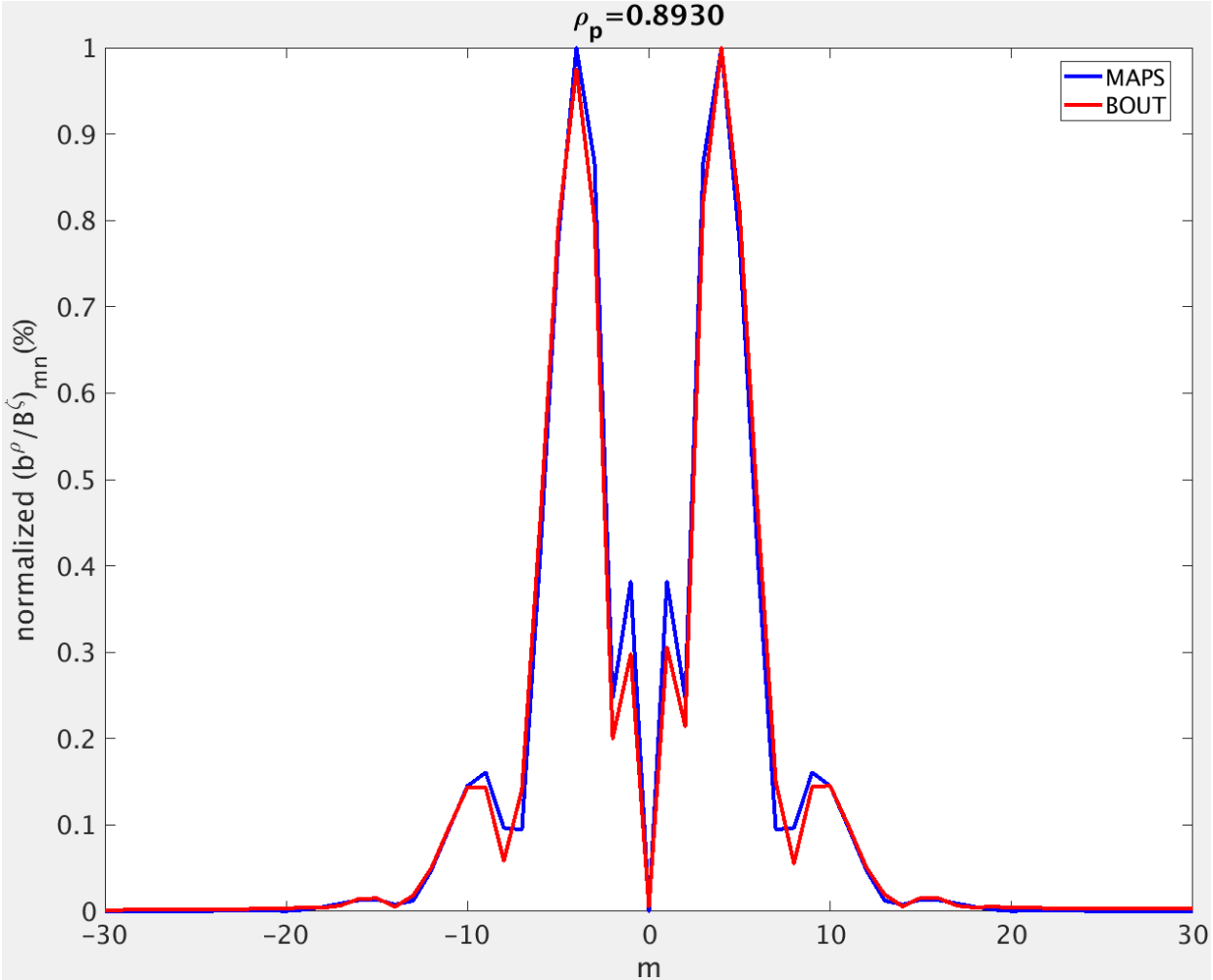

The linear plasma response to RMP

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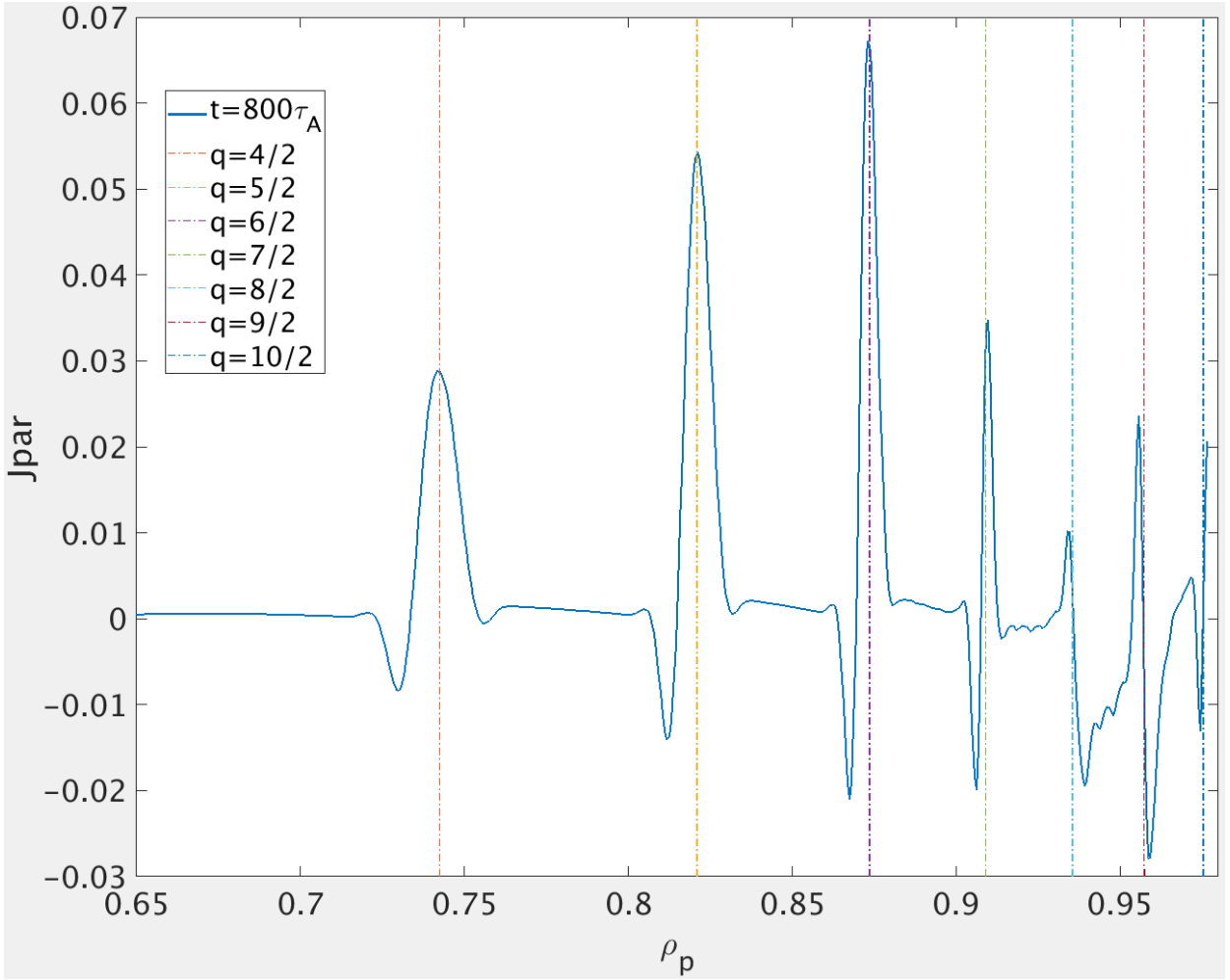
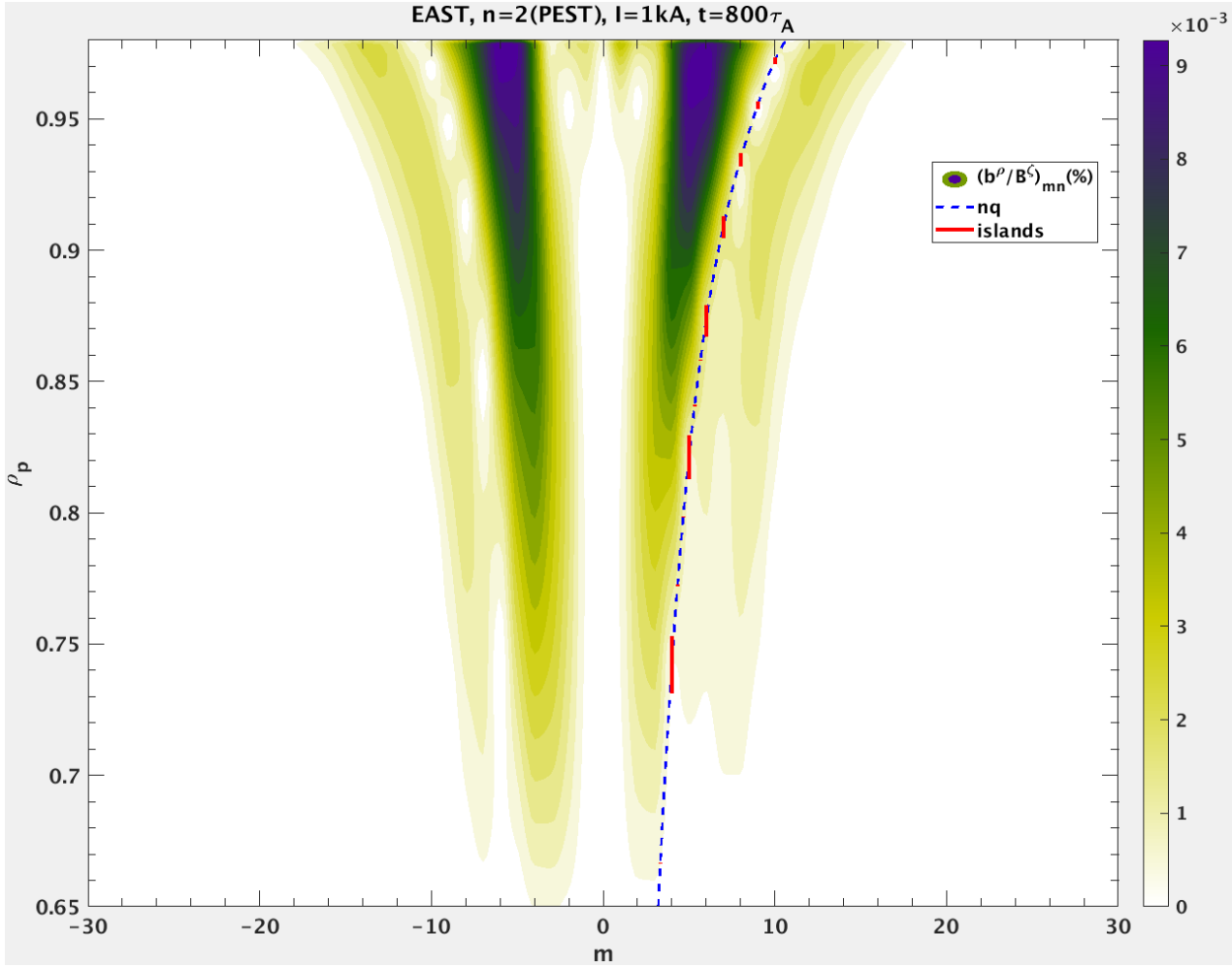
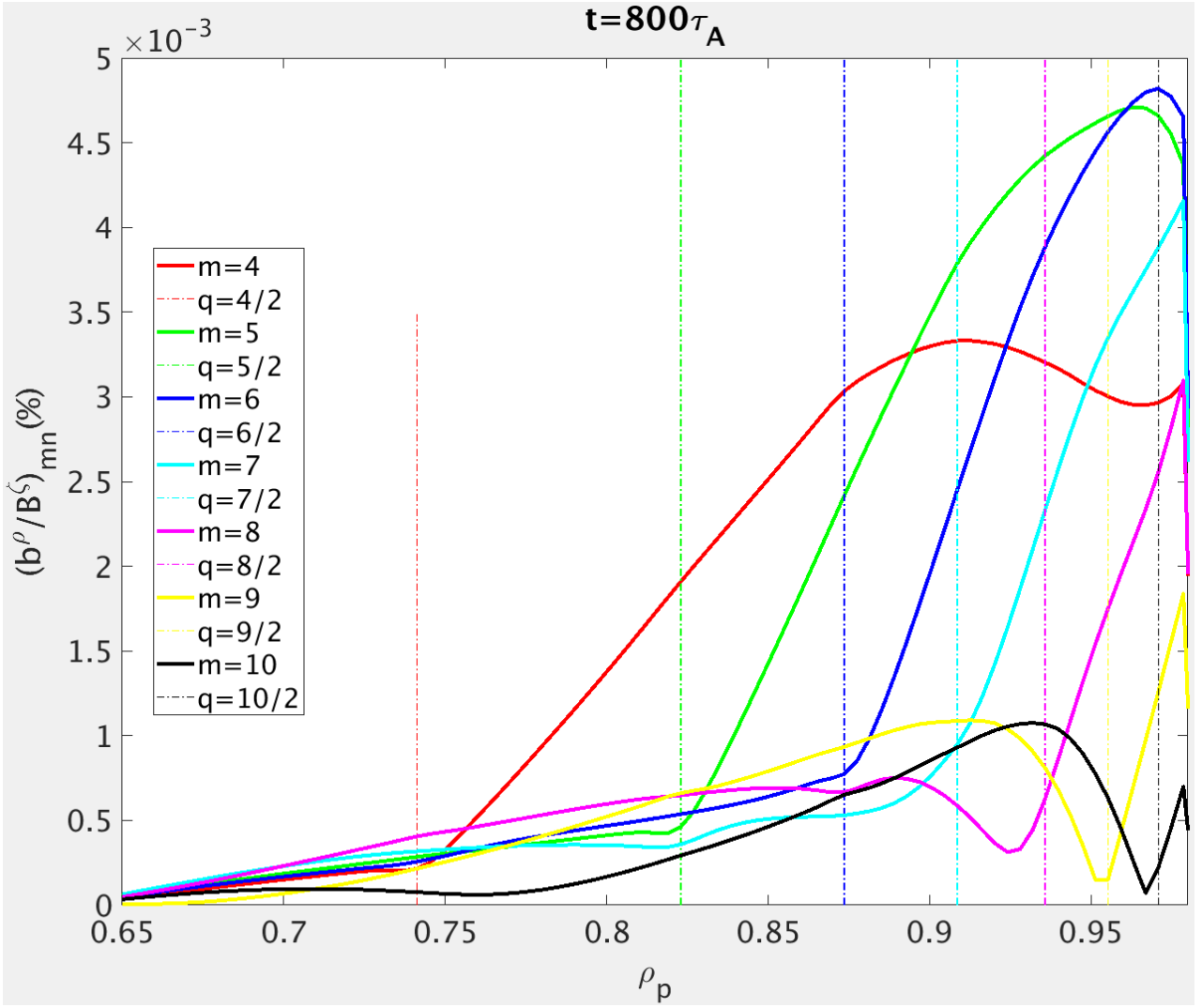




The resonance components of B_r are suppressed at the rational surface



Thank you!