

Real-Time Optimal Error Field Correction

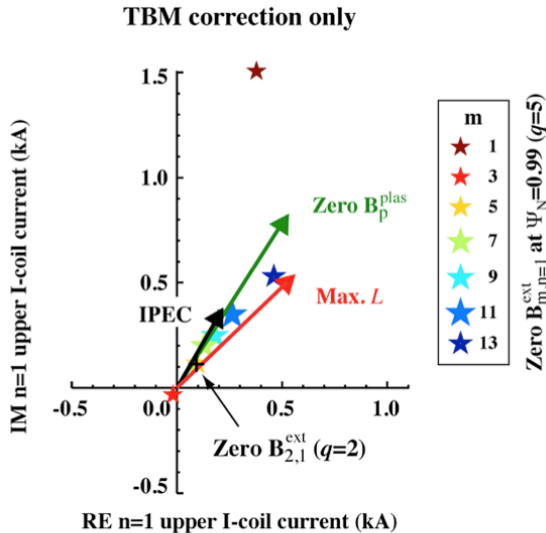
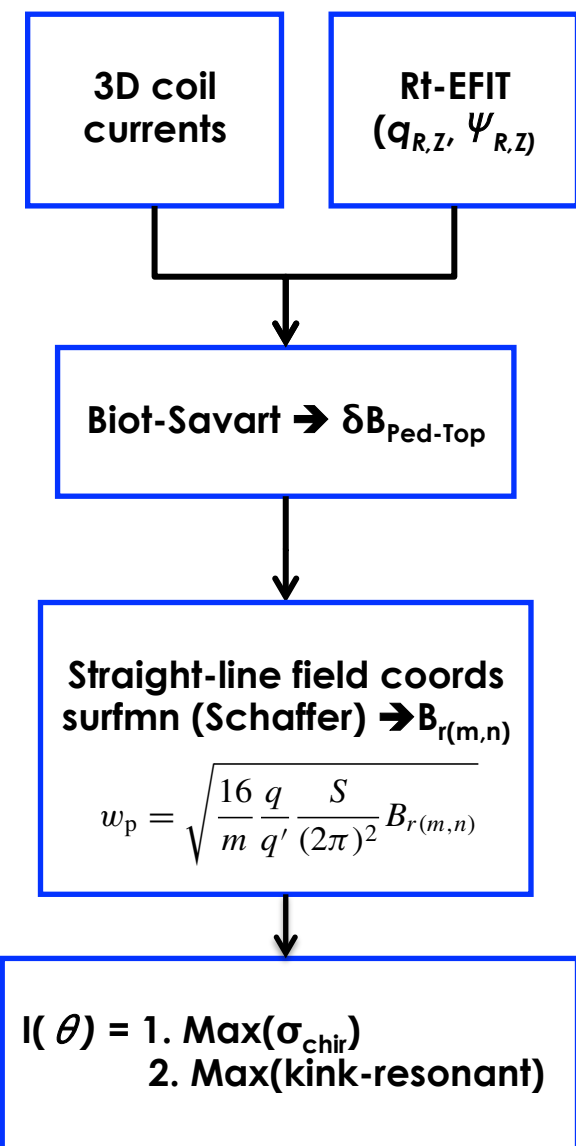


FIG. 5 Comparison of the optimal $n=1$ I-coil EFC of the TBM field obtained by maximizing the angular momentum L (red) and zeroing the magnetic plasma response B_p^{plas} (green) and an IPEC prediction (black) with I-coil currents that cancel various poloidal mode components with the same helicity as the equilibrium field.

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- $n=1$ mode error field correction is crucial for $n=1$ mode suppression
- We can in real-time change the EFC to match the optimal calculations
- Progress in the optimal EFC modeling.
 - Optimal can be calculated from the EFIT shape, boundary and the coil currents (**without perturbing the plasma**).
 - Calculation and the compass scan are indistinguishable!
- Every part (ramp up/down) of shot will have real-time optimal EFC! Great improvement over current situation.

Real-Time Optimal Error Field Correction



- In real-time calculate 3D perturbations due to 3D coils
 - Use surmnf to convert to straight-line field coordinates
 - Find the orthogonal component $B_{r(m,n)}$
 - Find the island size and σ_{chir}
 - Kink-resonance
- Control:
 - Choose phase of the coils, $I(\vartheta)$, maximize kink or σ_{chir}
- Test different EFC mechanisms
- Already implemented and tested on DIII-D
- Reproduce the same results here

3D coil NTM Interaction

- **Two effects on the island formation from 3D coils.**
 - Rotation shear
 - Edge stochastization
- **Study these two effects at NSTX-U**
 - DIII-D showed some interaction of rotation and NTMs
 - There is no study of the effect stochastization on NTM formation yet (that I know)
- **We would form shots with NTMs (not 2/1) vary the rotation profile with NBI and then scan 3D coil currents**
- **For the stochastization, we need an island close to the edge $\rho \sim 0.9$**
- **Make trying to reduce the adjust the edge q (q_{95}) to be ~ 2.1 or so**
- **Perturb the plasma for NTM formation (beta ramp?)**
- **Turn on the 3D coils at various currents**
 - Does it effect the 2/1 NTM formation
- **We can try higher mode numbers but harder to distinguish**