Wistell group summary

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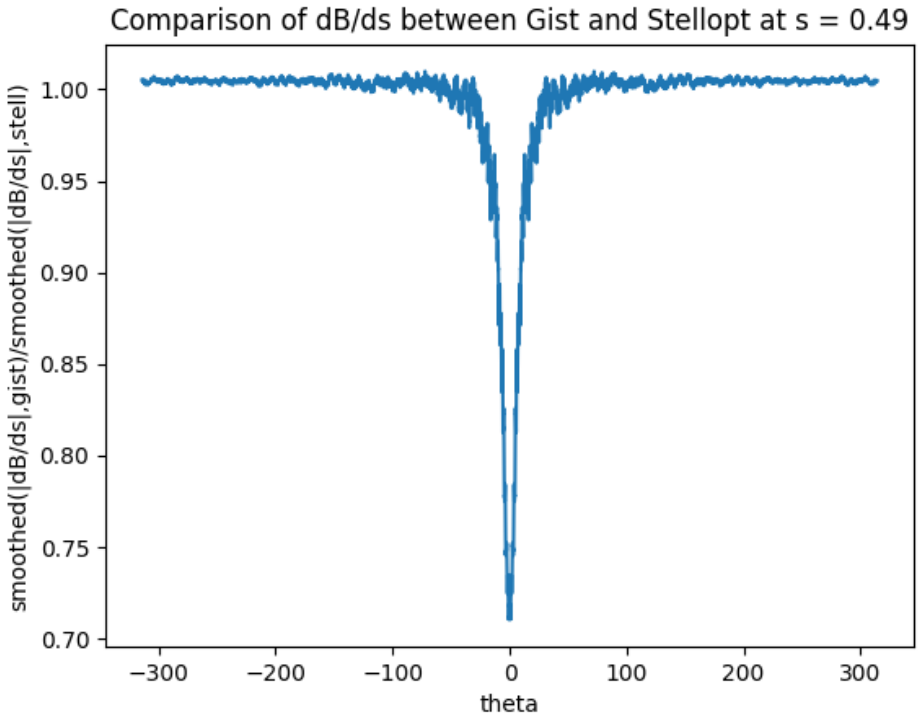
Wistell Meeting, May 18, 2018

Current focused activities for optimization

- Turbulence optimization (Ben, John, Aaron, Chris, Paul)
- Improving coil design (John, Thomas, Aaron, with tools from Matt L. and Caoxiang Z.)
- Divertor/Edge (Heinke, Aaron, Oliver)
- Energetic particles (Evan, Aaron)
- Improving optimization algorithms (John, Aaron)

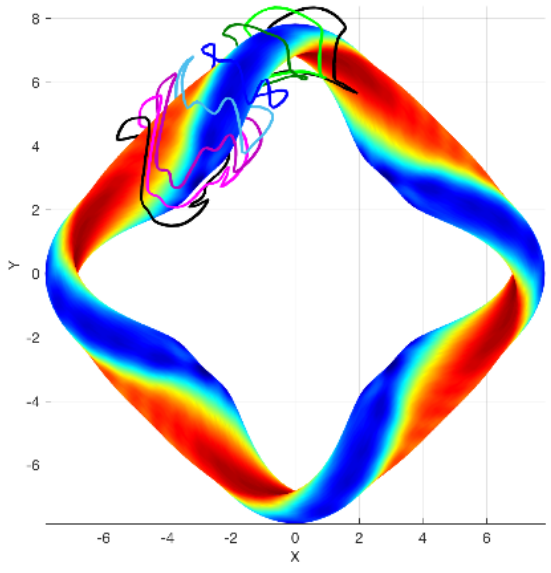
Turbulence optimization

- PTSM3D algorithm to calculate energy transfer from stable to unstable modes is implemented in STELLOPT
- However, STELLOPT calculations of geometric quantities differs from GIST calculations of geometric quantities



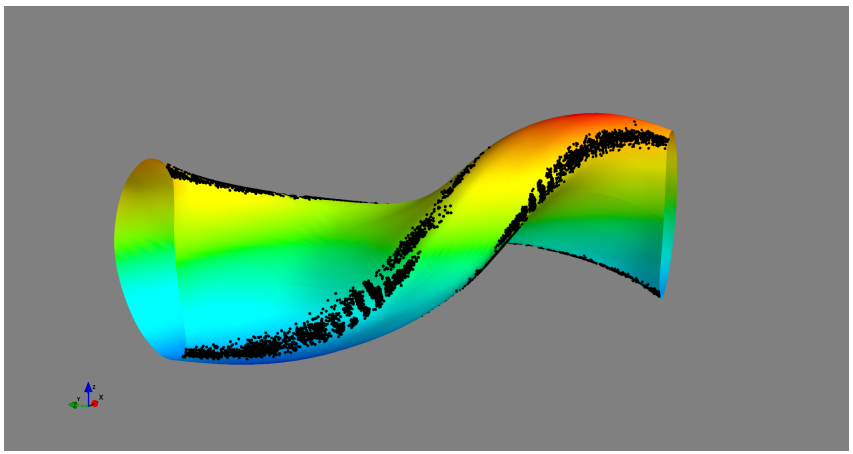
Coil design

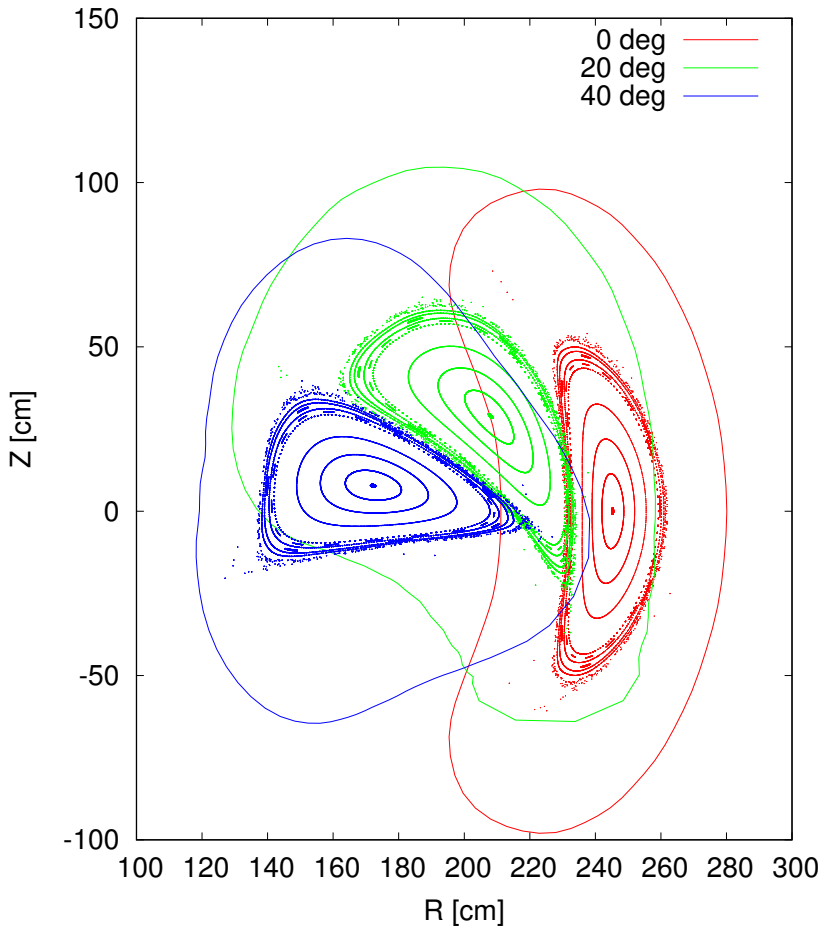
- Regcoil in stellopt allows for winding surface modification
- Standalone winding surface modification also available
- Principle curvature metric implemented in Stellopt
- FOCUS regularly used, and currently being implemented in Stellopt



Divertor/Edge

- Available divertor designs determined by coil positions
- Current algorithms indicate that it will be possible to extend coils away from plasma in regions desirable for divertors



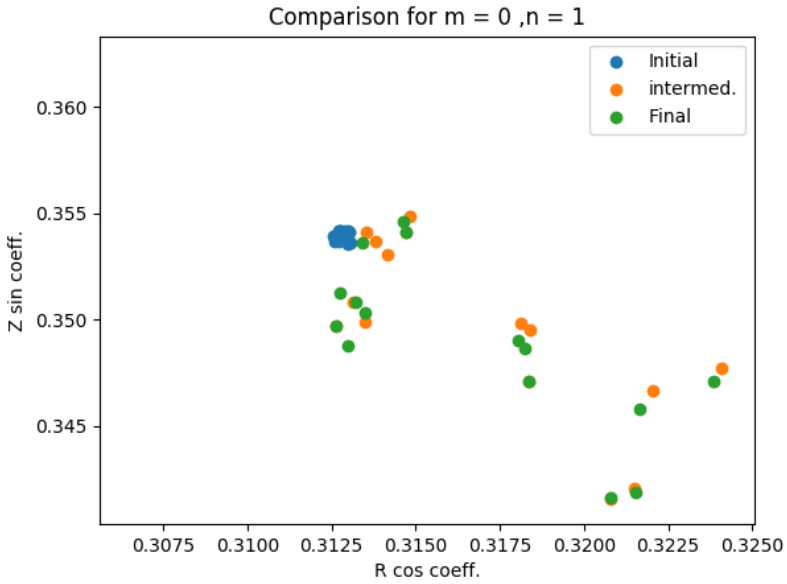


Energetic Particles

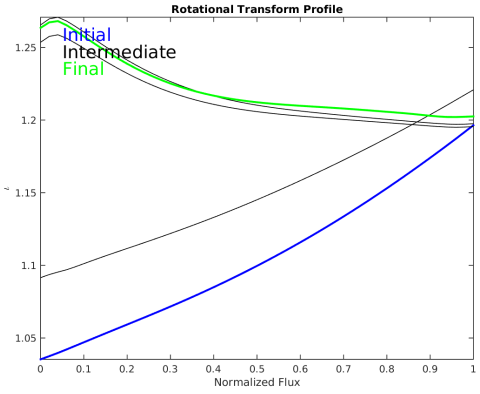
- BEAMS3D
  - STELLOPT tool BEAMS3D - Monte-Carlo beam solver
  - Works standalone for particle following (local machine)
  - Beam deposition tuning still in progress
  - Task: Begin simulations with Monte-Carlo EP solver from BEAMS3D
- Nemov Gamma metrics
  - Not in STELLOPT, although implemented in Drevlak's ROSE code
  - Verbal communication from Drevlak implies that he has seen little success for QHS equilibria
  - More detailed testing probably required, and if useful, may need implementation in STELLOPT

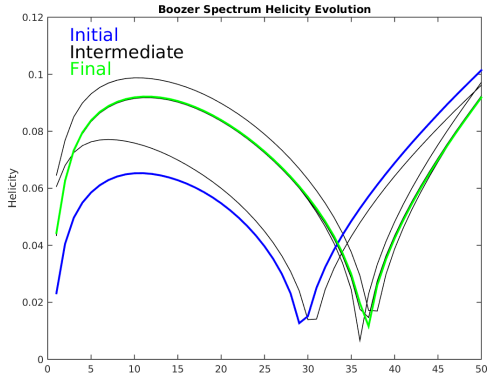
Improving optimization algorithms

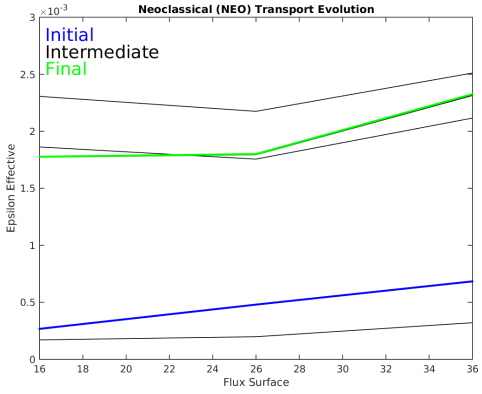
- Search space appears to be non-convex
- Levenberg-Marquardt optimization, while it usually finds improvements, may not be the best algorithm
- Task 1: Implement Quasi-Newton optimization algorithm
- Task 2: Benchmark on ROSE, and possibly repeat important optimization runs there

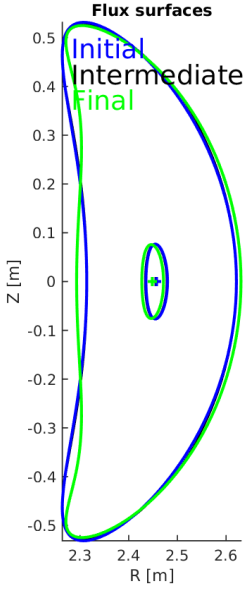


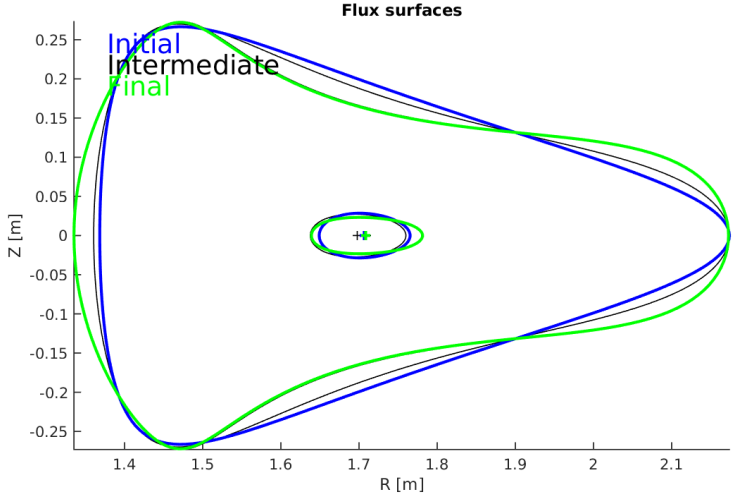
Forcing a decreasing iota profile above 1



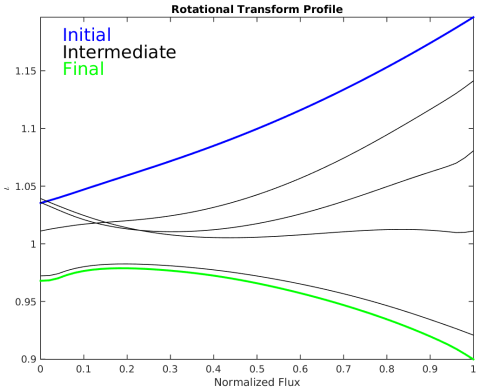


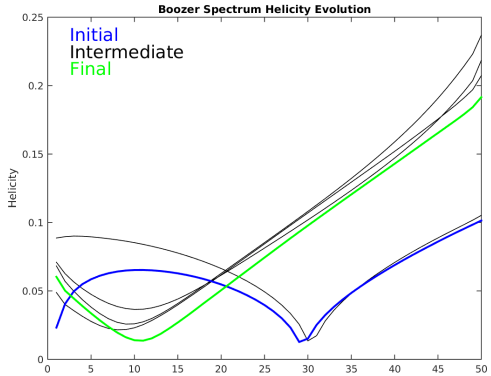


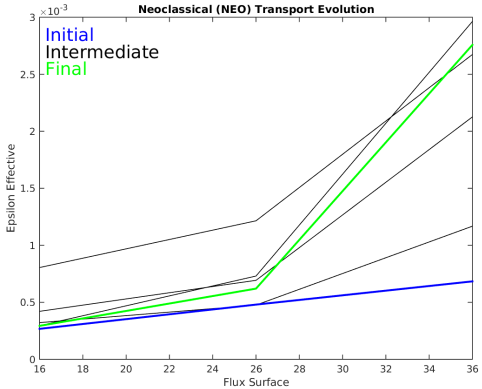


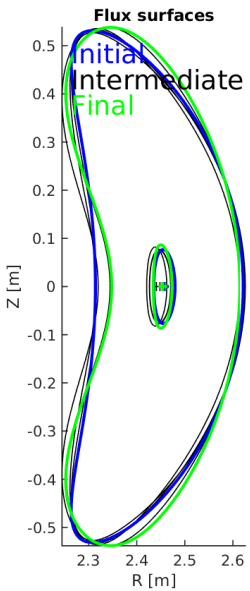


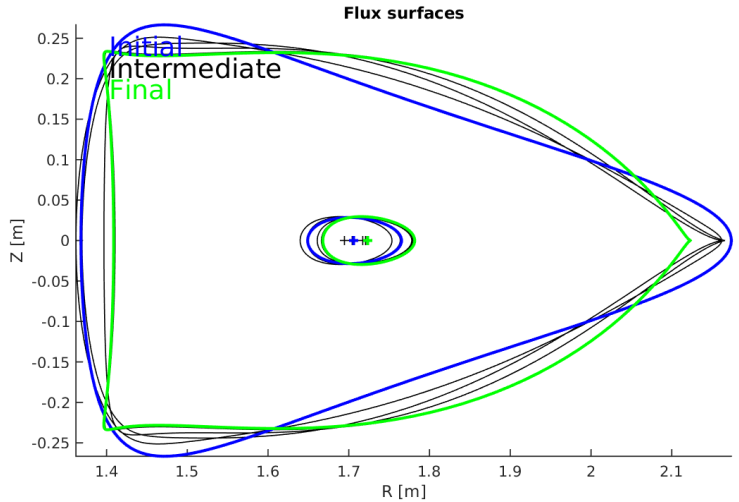
Forcing a decreasing iota profile below 1











Forcing a decreasing iota profile below 1, include curvature