

Initial search for acceptable coils for QOS configurations

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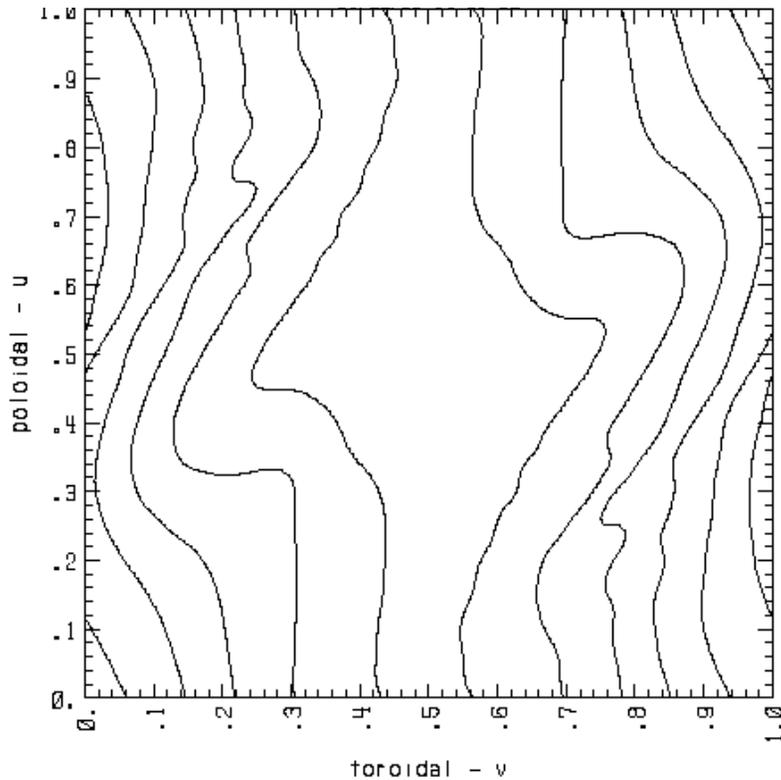
Tasks

- Find acceptable svd-optimized surface current solutions for the new QOS configurations
- Compare solutions to decide which to use for coils
 - Optimize coil choice with Genetic Algorithm and/or
 - Optimize coil surface with Coilopt
- Based on generally observed correlation between the complexity for Nescoil surface current and Coilopt coils

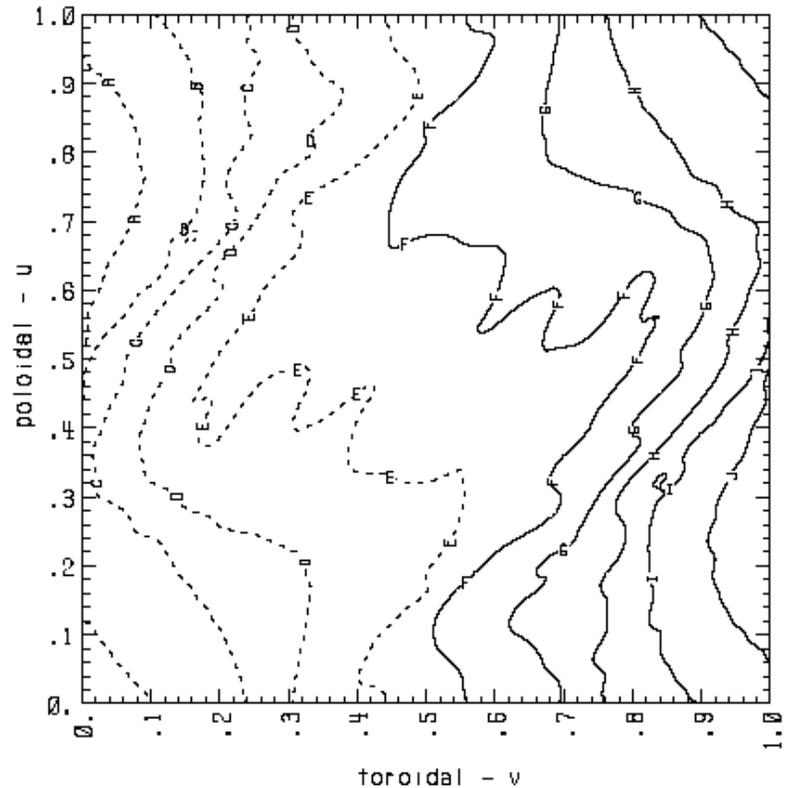
QOS configurations studied in this round

- QO2: (m2a2.5b1.5): 2 fp, A=2.5, beta=1.5 and
- QO3: (m3a3b2r4): 3 fp, A=3, beta=2
 - Conformal 10 cm surface
 - Number of fourier modes = 8x8,10x10,12x12,20x20
 - Number of u,v current surface points = 64x128, 128x128
- Issues:
 - Can we find better svd solution starting from many more modes and smoothing with fewer svd weights?
 - Is spatial resolution on current surface adequate?
 - Can GA help reduce number of coils needed?
 - Will we need non-conformal coil surface (coilopt)?

QO2 nesvd solutions look better than QO3 for same Berr

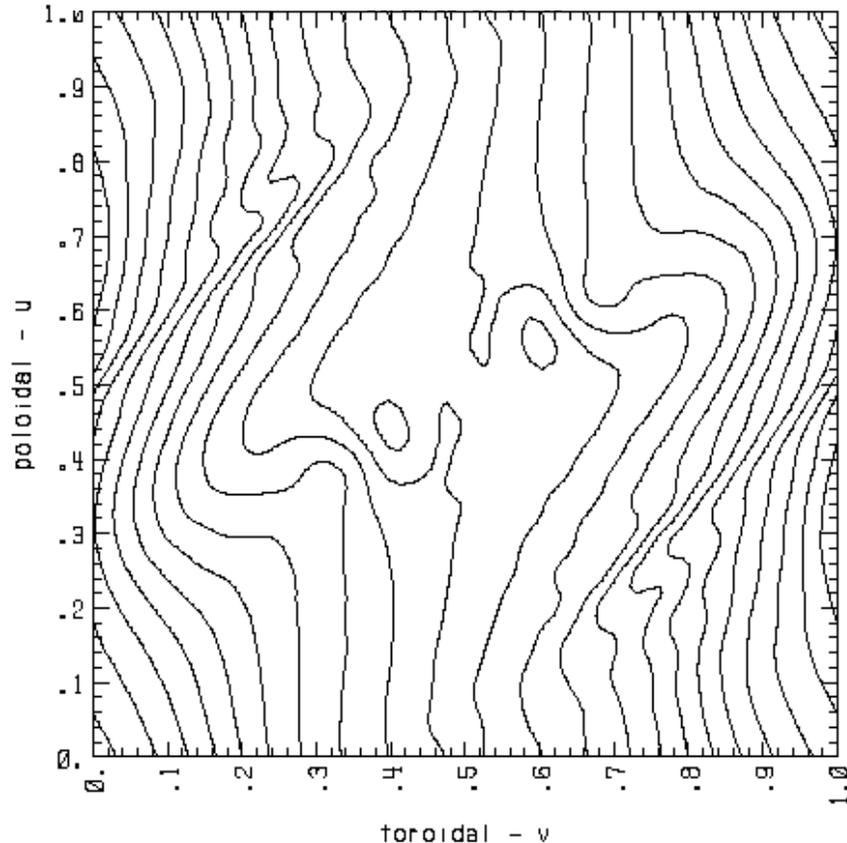


QO 2 @ 302 svd, mf,nf=12x12
Nesvd $\langle \text{Berr} \rangle = 0.2\%$, $\text{MaxBerr} = 2.4\%$
10 coils per period
 $\langle \text{Berr} \rangle = 8\%$, $\text{MaxBerr} = 31\%$
Error too high, but coils look ok

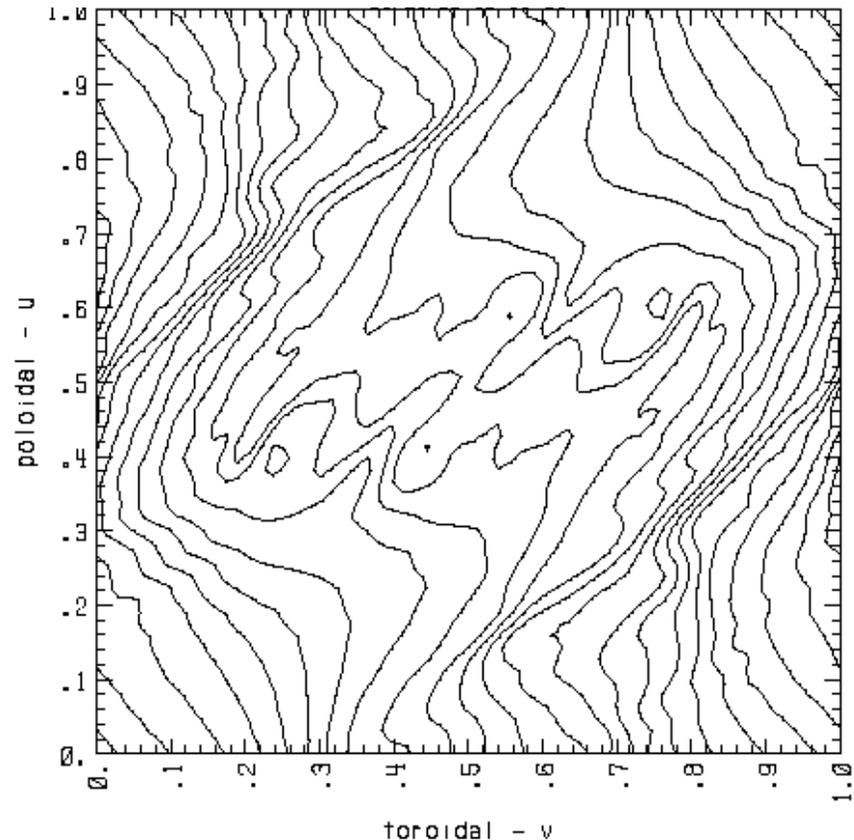


QO 3 @ 439 svd, mf,nf= 20x20
Nesvd $\langle \text{Berr} \rangle = 0.35\%$, $\text{MaxBerr} = 4.8\%$
10 coils per period
 $\langle \text{Berr} \rangle = 7.2\%$, $\text{MaxBerr} = 30\%$
Error too high and coils look bad

Both need too many coils (> 20) for acceptable error

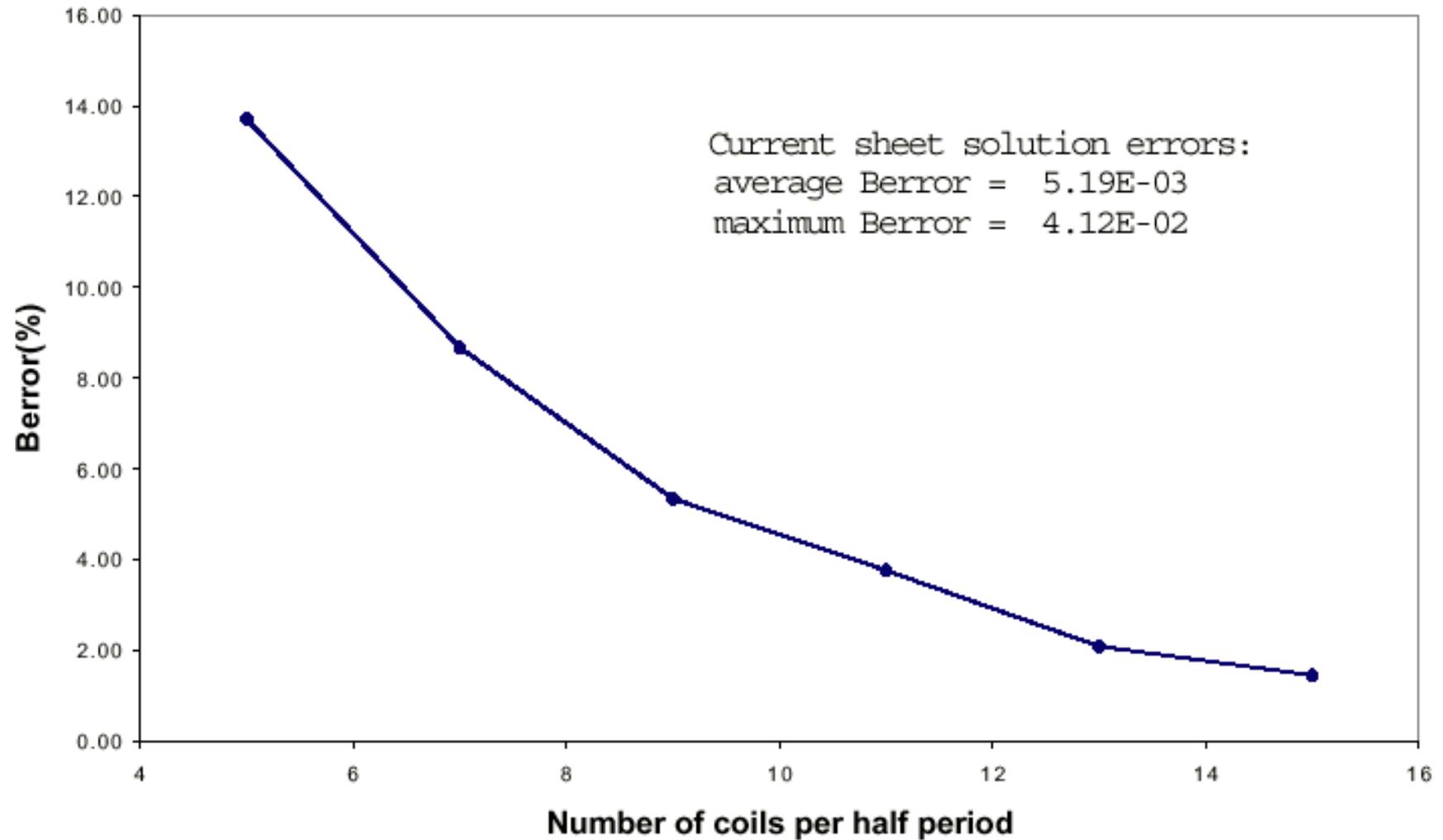


QO 2 @ 302 svd, mf,nf=12x12
Nesvd \langle Berr $\rangle=0.2\%$, MaxBerr=2.4%
20 coils per period
 \langle Berr $\rangle=1\%$, MaxBerr=13%
Error ok but coils bad => try GA



QO 3 @ 439 svd, mf,nf= 20x20
Nesvd \langle Berr $\rangle=0.35\%$, MaxBerr=4.8%
20 coils per period
 \langle Berr $\rangle=1.5\%$, MaxBerr=11%
Error ok but coils very bad

GA Run (by Miner) for QO2: Need 15 coils/period



Summary of results of QOS nesvd study

- QO2: (m2a2.5b1.5): 2 fp, A=2.5, beta=1.5
 - *Acceptable* solutions with 12x12 fourier and 302 svd (out of 312).
 - Nesvd: 0.2% ave, 2.4% max Berr, 2.7 Jmax, 1.7 Complexity.
 - 8x8 solutions *not acceptable* even with all 144 svd kept.
 - 20x20 fourier modes gives no improvement on 12x12.
 - Solutions qualitatively similar to Coilopt - except a few switchbacks.
 - Even GA needs *15 coils/period* for $\langle \text{Berr} \rangle \sim 1.5\%$
 - Need Coilopt surface optimization- and it has good chance to work.
- QO3: (m3a3b2r4): 3 fp, A=3, beta=2
 - *No* solutions with 8x8, and 10x10 on 10 or 15 cm conformals.
 - Best compromise at 439 svd for 20x20 - *but complexity not acceptable*.
 - Nesvd: 0.36% ave, 4.76% max Berr, 3.9 Jmax, 2.4 Complexity.

Conclusion: Proceed with QO2 Coilopt : Dennis' talk