

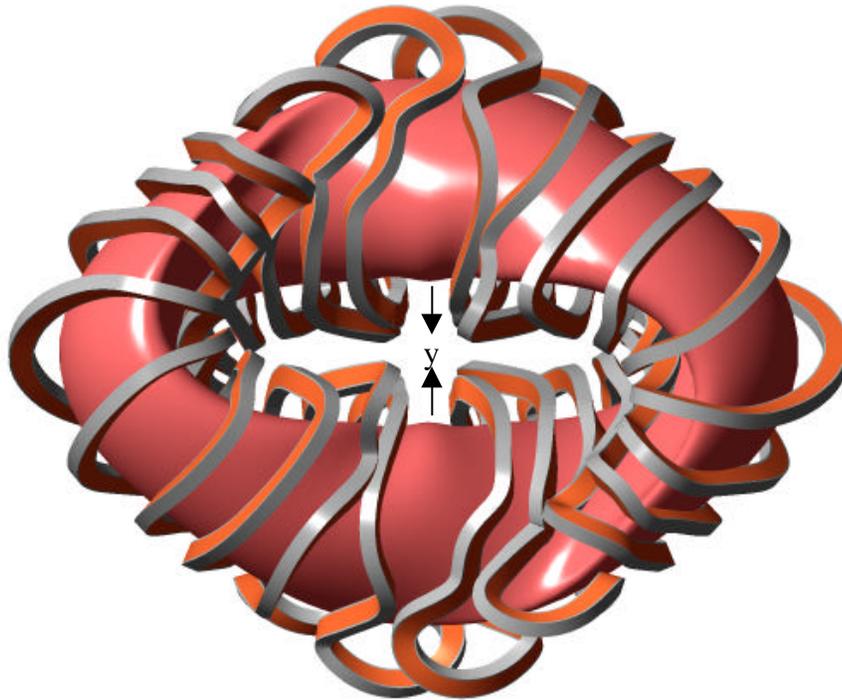
Modular Coils for QOS

D. Strickler, L. Berry, S. Hirshman

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Result from previous project meeting

Reference Coils - 0829b1



Issues

- 22 modular coils
- Field error / plasma reconstruction
- Coil separation
- Coil radius of curvature
- Space for TF, OH coils

Coil Targets Added to STELLOPT Improve Coil Design and Reconstruction

- Minimum δ for inboard plasma boundary (at $v = 1/2$)
- NESCOIL field error, coil complexity, current density parameters
- Modular coils based on recent plasma configuration gb4
 - 2 field-period, $A = 2.6$, $\langle R \rangle = 0.95$ m
 - $\delta = 2.0\%$, $I_p = 57$ kA, $\langle B \rangle = 1.0$ T
 - $\delta(0) = 0.26$, $\delta(1) < 0.4$
- Plasma free-boundary reconstruction properties meet physics and engineering design goals

COILOPT Targets for Modular Coil Optimization

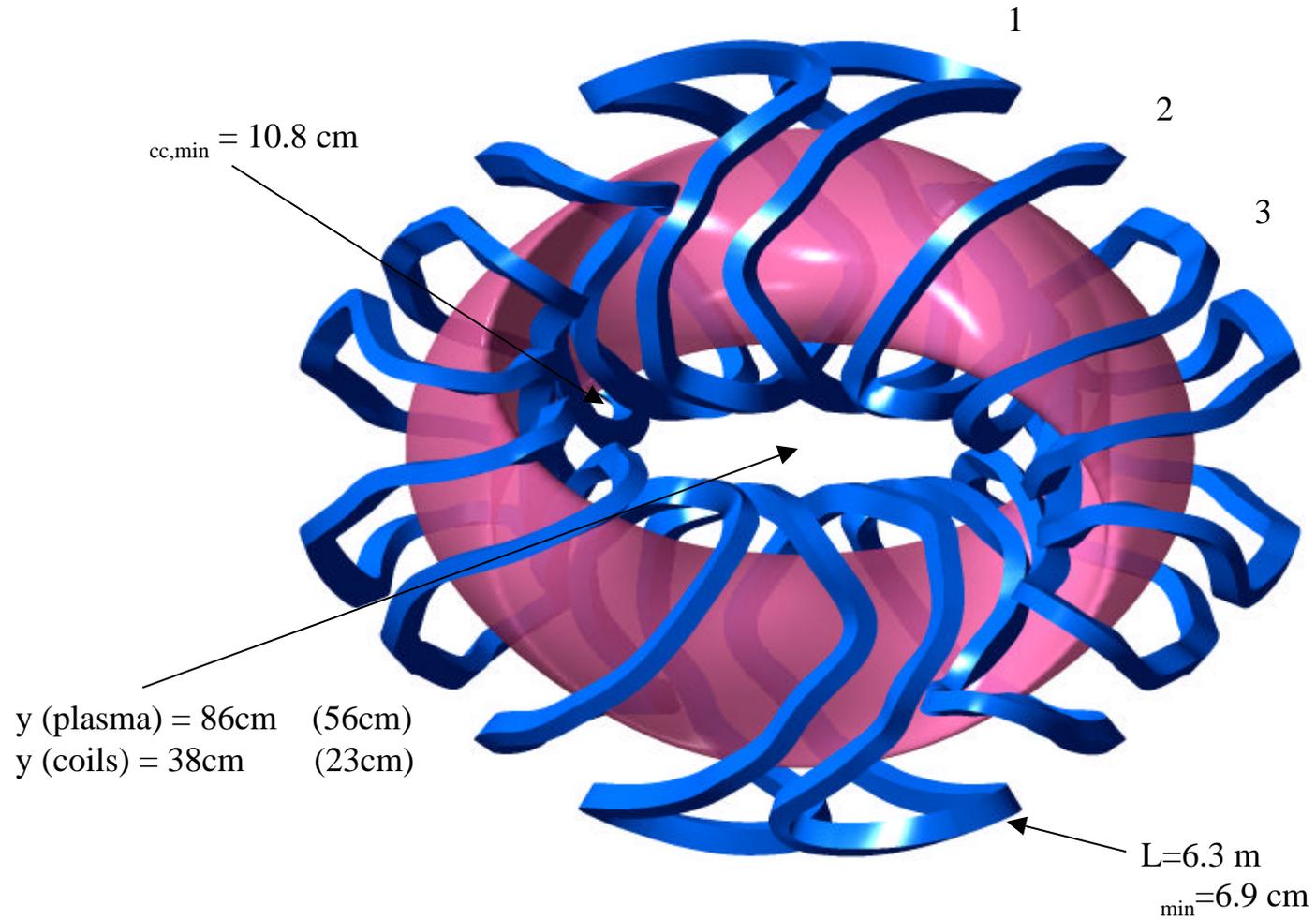
- Normal component of \mathbf{B} at plasma edge - B_{rms}
- Penalty functions for:
 - Min. y-coordinate (for coils near $v = 1/2$)
 - Min. coil-coil separation - cc_{min}
 - Min. coil-plasma separation - cp_{min}
 - Min. coil radius of curvature - min

Improvements in QOS Modular Design

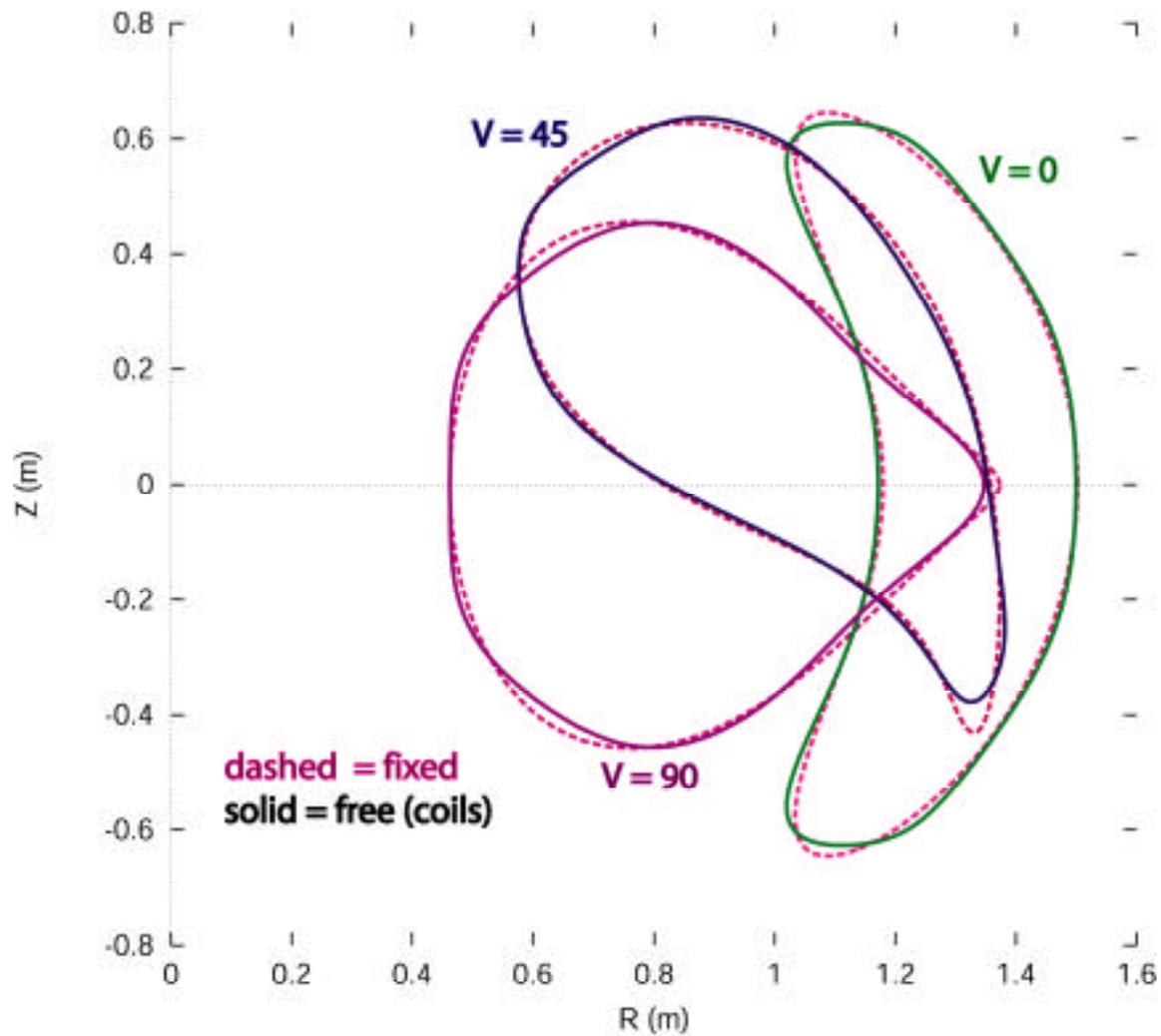
- Reduced number of modular coils from 22 to 16
- Reduced number of coil types from 6 to 4
- Targeted space in center of torus for TF, OH coils
- Included TF and VF coils in modular optimization

ID #	I_{TF}/I_{pol}	$I_{mod}(kA)$	$I_{VF}(kA)$	B_{avg} (%)	B_{max} (%)	cc,min (cm)	cp,min (cm)	min (cm)
0829b1	0.0	268	0	1.93	12.69	6.7	8.2	5.9
0213b2	-0.121	374	-205	1.43	8.66	10.8	12.7	6.9

QOS Modular Coils – solution 0213b2



Free-boundary reconstruction – 0213b2



$A = 2.61$
 $\langle R \rangle = 0.95 \text{ m}$
 $= 2.0\%$
 $(0) = .25$
 $(1) = .38$

Summary

- Modular coil configurations have been found with 16 coils (4 coil types) for improved plasma physics properties
- Targeted parameters related to coil current density, access for TF, OH, imply engineering feasibility (Williamson, Nelson)
- Free-boundary reconstruction meets physics goals (Ware, Spong, Hirshman)