

Modular Coil Optimization

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- Recent COILOPT developments
- Reference modular coil design
- Alternative modular configurations

Recent COILOPT Developments

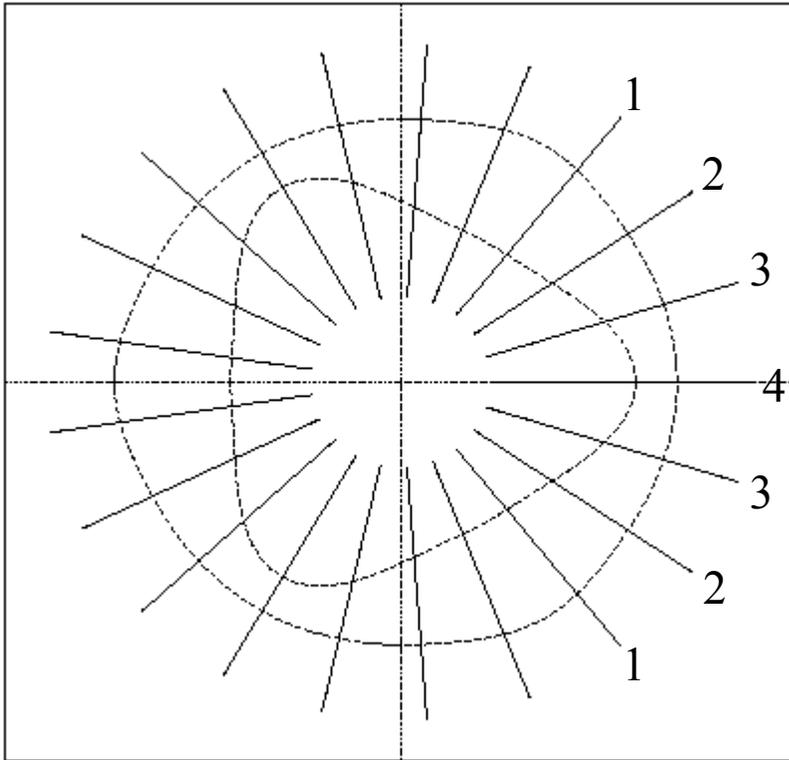
- Driven largely by NBI access considerations
- Added option for symmetry coil on $v = _$ for odd number of coils per field period
- Symmetry coils on $v = 0$ and $v = _$ for even number of coils per field period
- Modular coil model is being used in free-boundary PIES calculations to eliminate islands (S. Hudson, D. Monticello)

Modular Configuration Options for NCSX

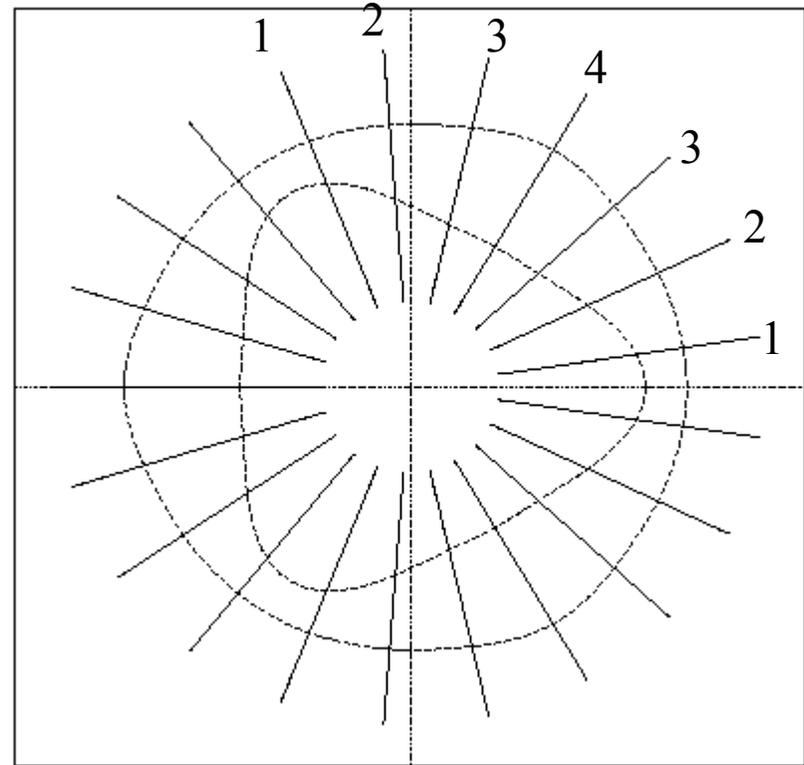
- 7 coils per field period
 - Symmetry coil on $v = 0$ (Reference)
 - Symmetry coil on $v = _$
- 6 coils per field period
 - Symmetry coils on both $v = 0$ and $v = _$
 - 4 independent coil currents

7 modular coils per field period

A

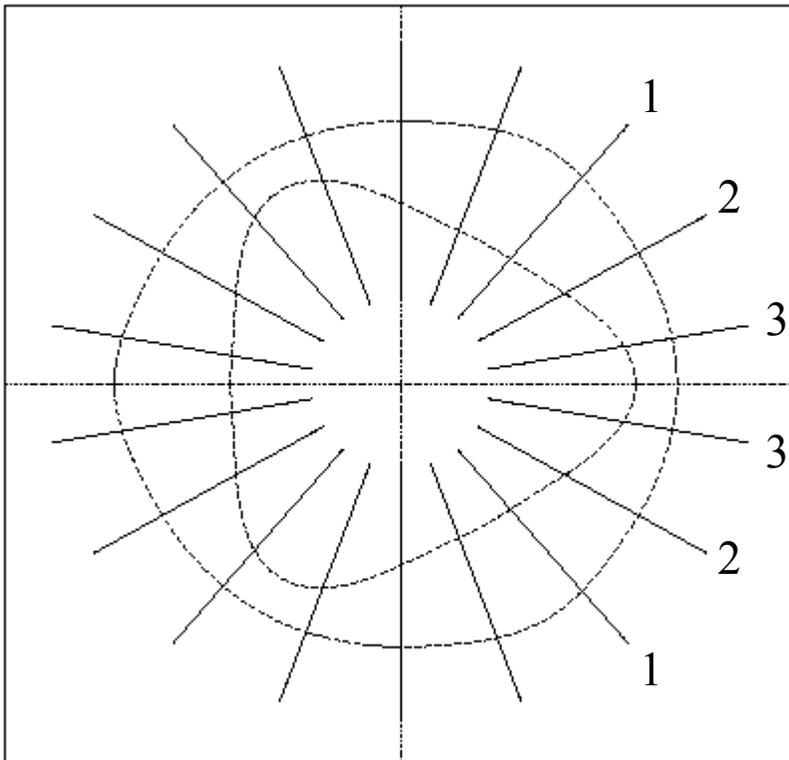


B

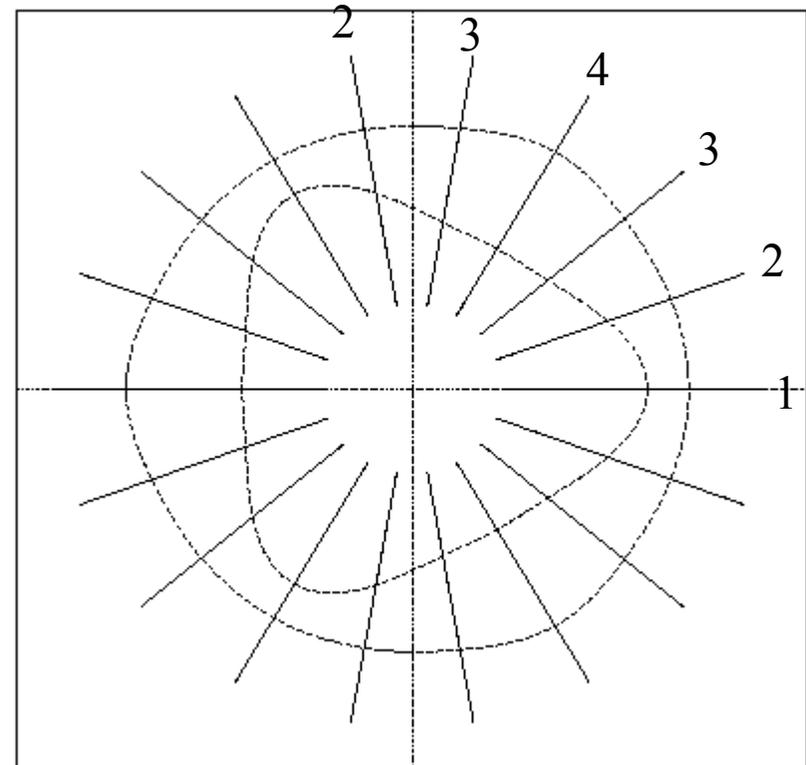


6 modular coils per field period

C



D



COILOPT Modular Solutions for LI383

ID#	N_c , Symm. coils	δB_{avg} (%)	δB_{max} (%)	$\Delta_{cc,min}$ (cm)	$\Delta_{cp,min}$ (cm)	ρ_{min} (cm)
0907 ⁽¹⁾	7, v=0	0.57	2.67	13.6	23.2	11.1
1017 ⁽²⁾	7, v=0	0.61	2.61	14.8	23.3	12.5
1115 ⁽³⁾	7, v=_	0.79	3.08	14.5	23.2	11.0
1207 ⁽¹⁾	6, v=0,_	1.12	4.79	12.4	22.3	11.5
1215a ⁽³⁾	6, v=0,_	1.08	4.56	12.2	23.3	11.7
1215b ⁽⁴⁾	6, v=0,_	0.98	4.01	12.4	23.9	11.7

(1) Uniform currents, $I_i = -488.1$ kA ($B_t = 1.2$ T)

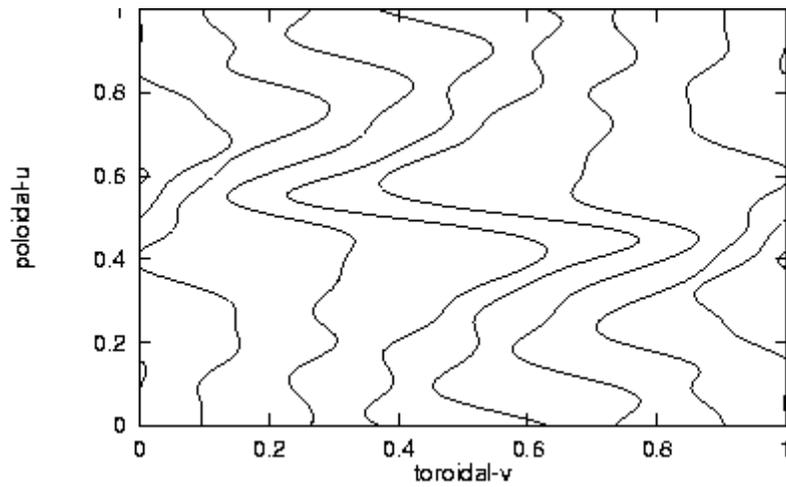
(2) Uniform currents, coils 3 and 4 extended for NBI access (Reference)

(3) Non-uniform currents

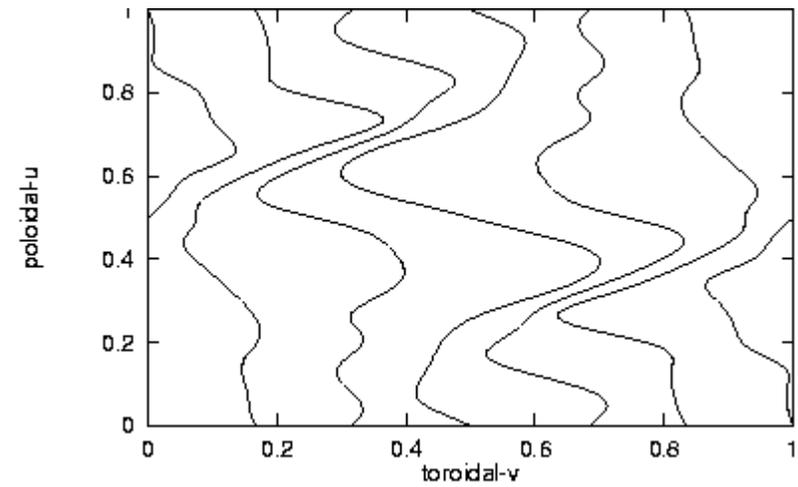
(4) Variable currents, includes 5 PF coil currents in opt.

Symmetry of 7 and 6 Modular Coil Configurations

1017



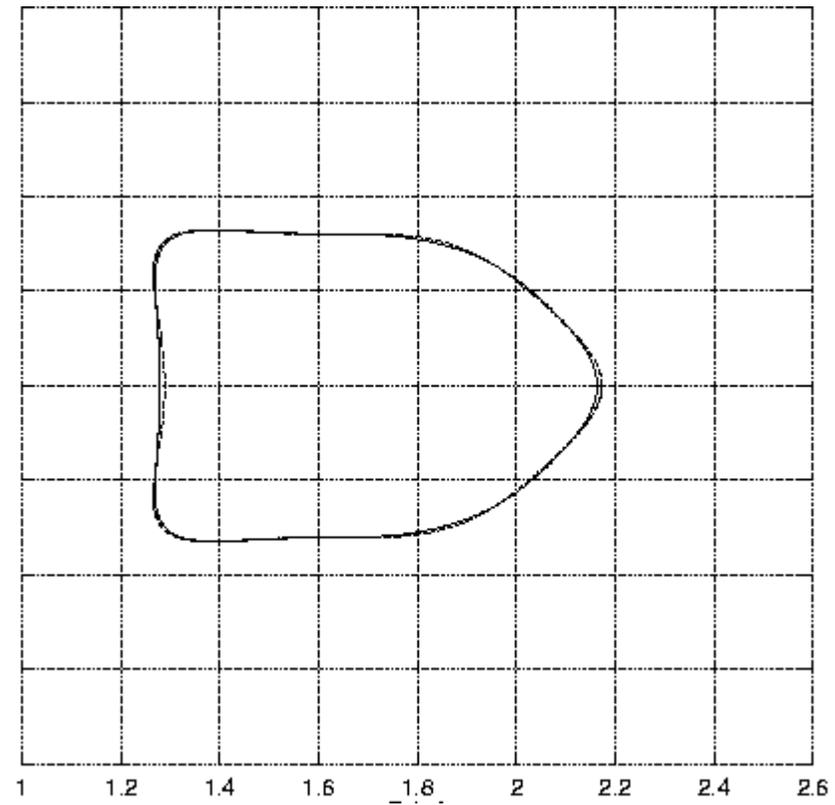
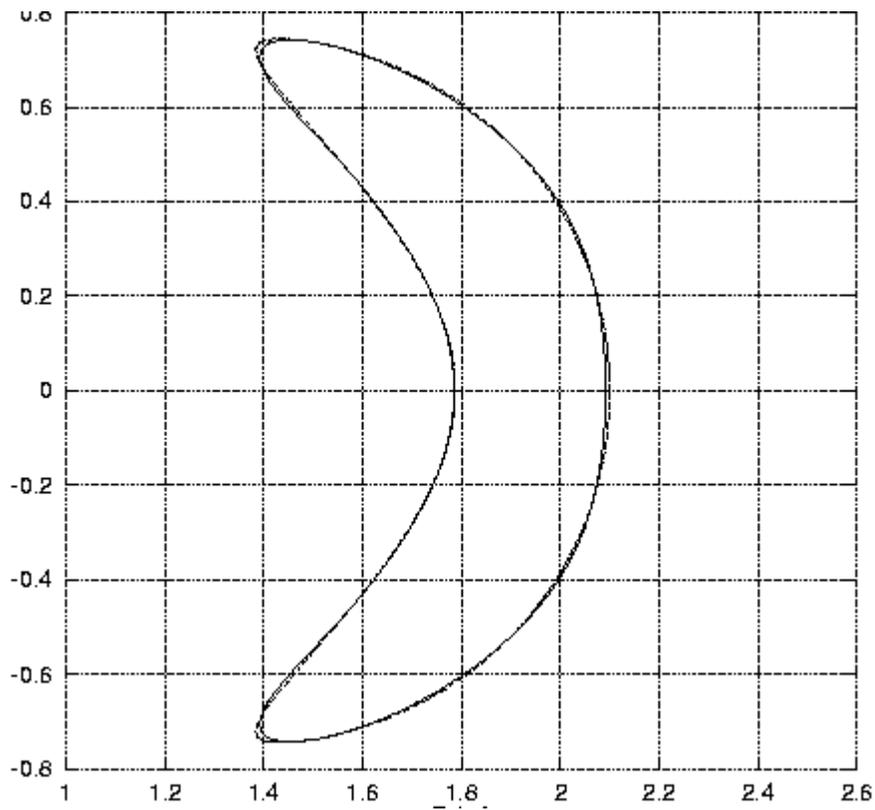
1215b



Free-boundary reconstruction in the symmetry planes - modular coil solution 1215b

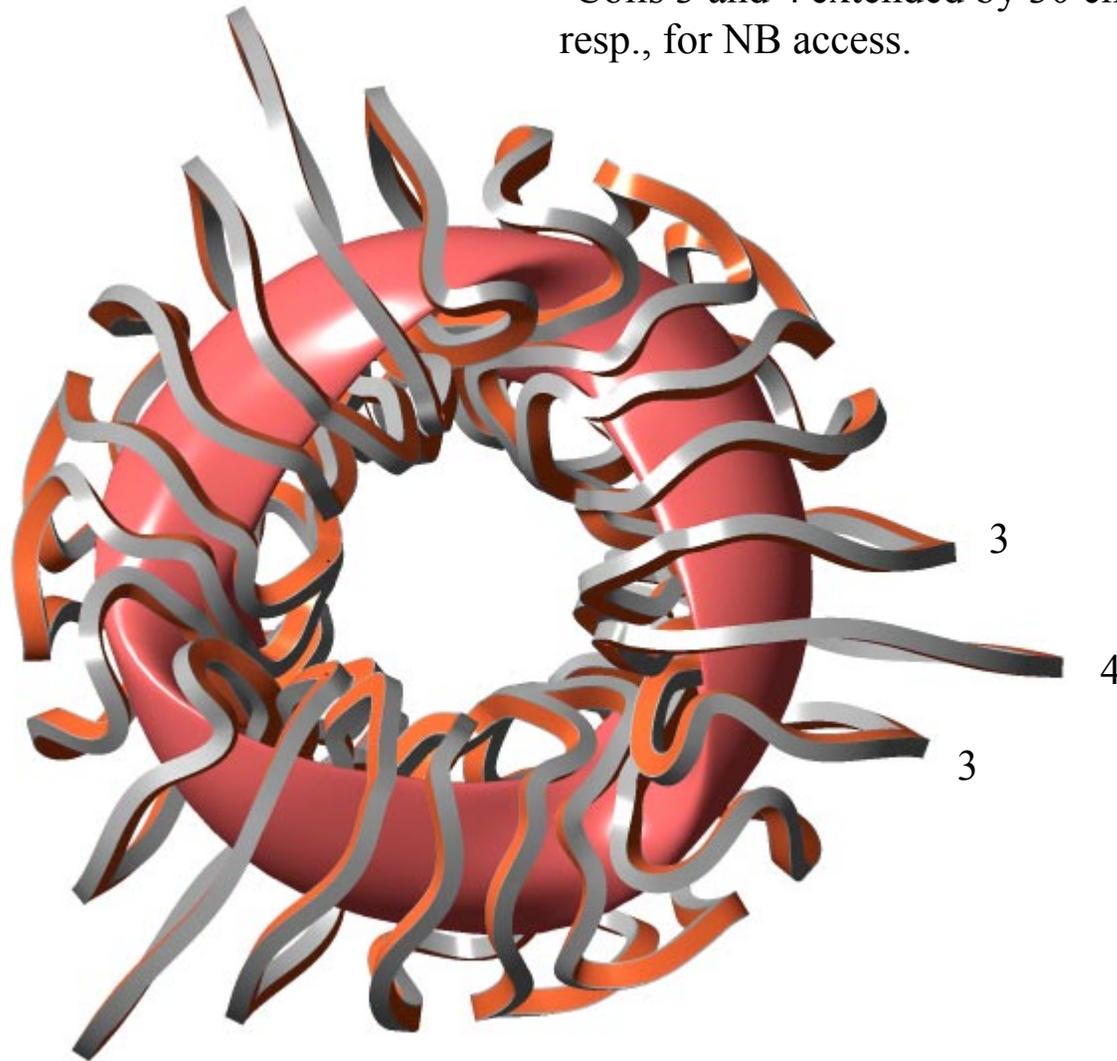
$v = 0$

$v = _$

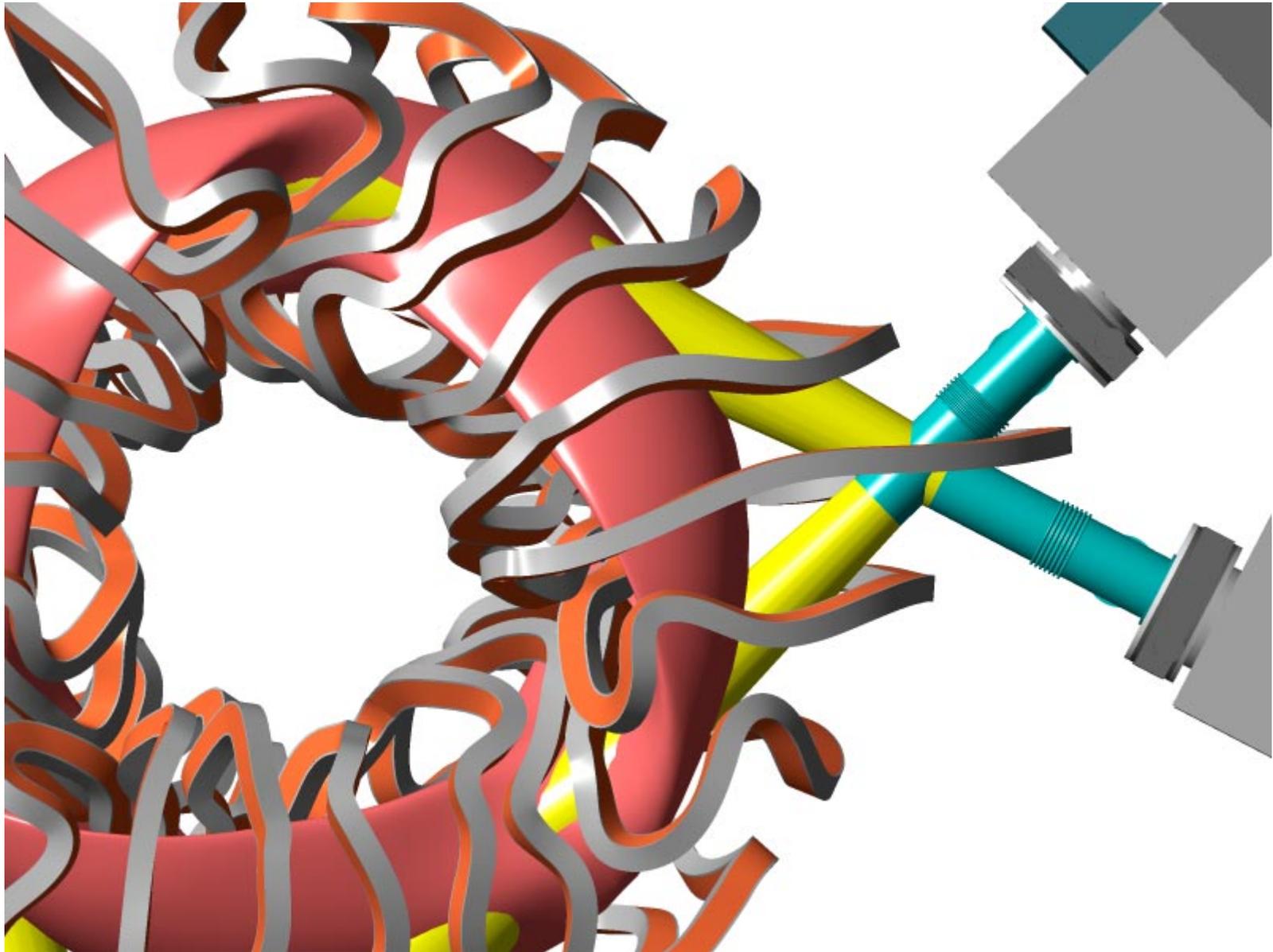


Case 1017 (Reference) – Symmetry Coil on V=0 Planes

- Coils 3 and 4 extended by 30 cm and 90 cm, resp., for NB access.



Case 1017 – NB Access



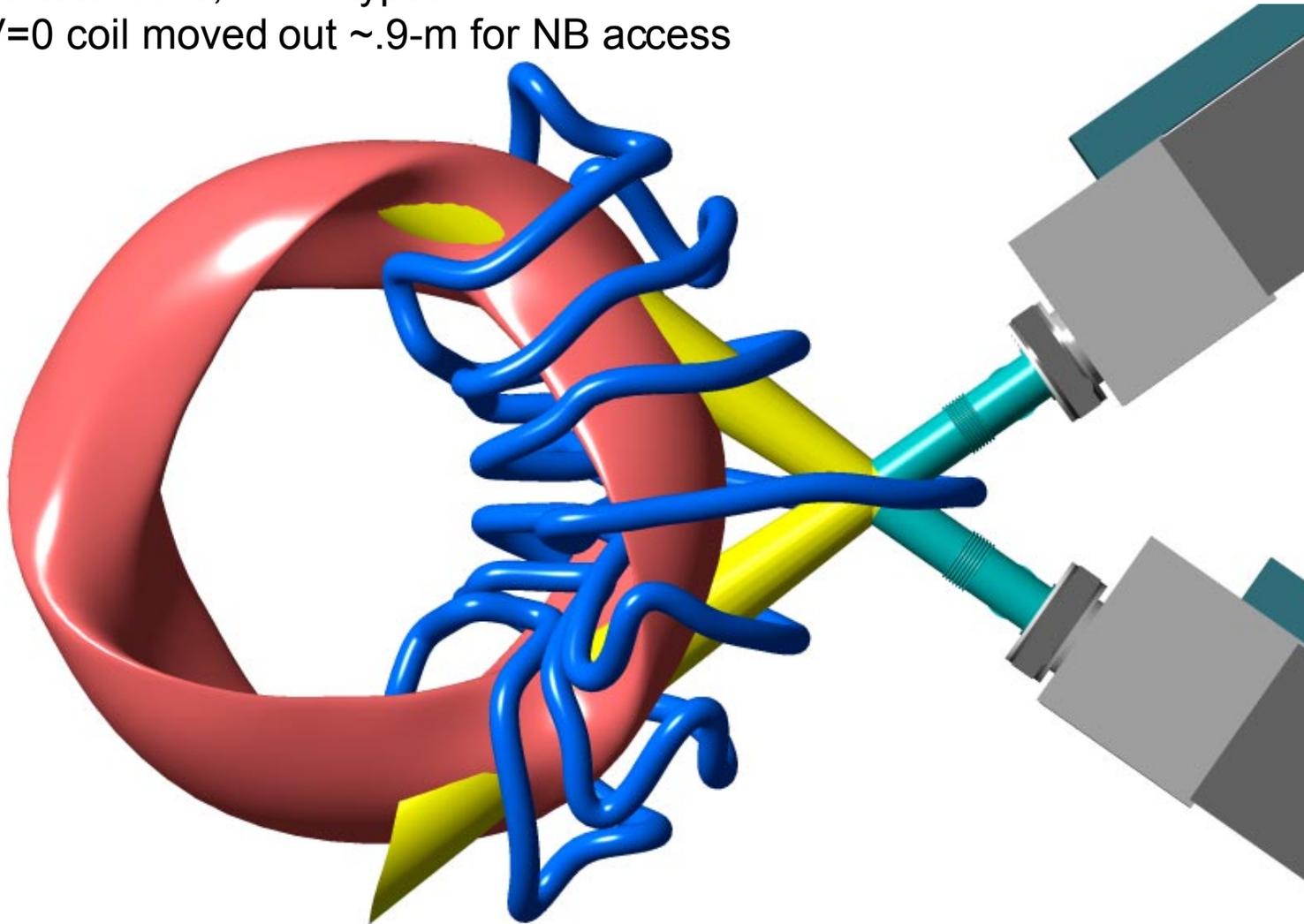
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Case 1207 – Symmetry Coil on V=0, 1/2 Planes

- 18 total coils, 4 coil types
- V=0 coil moved out ~.9-m for NB access



Summary

- New modular coil configuration options have been added to COILOPT
- Alternative modular option with 6 coils per field period, including coils on both symmetry planes, is being explored