

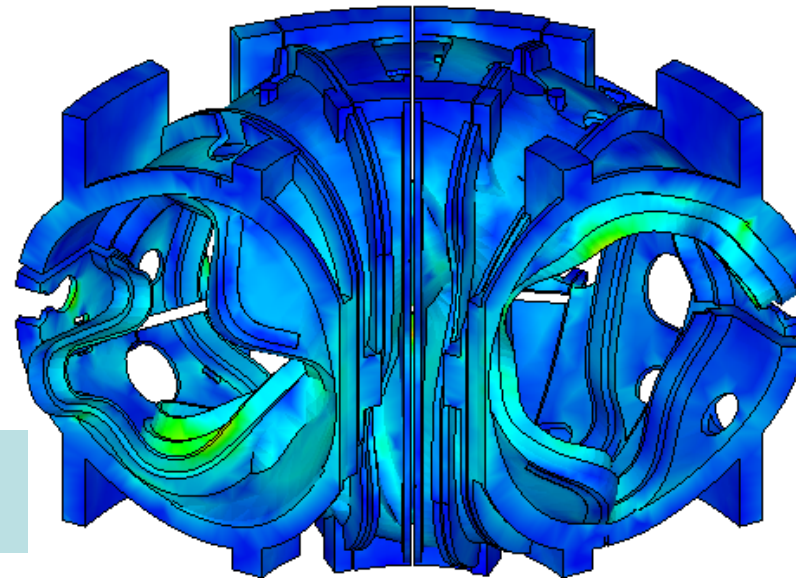
# Effects of Young Modulus E on the Stress and Displacement for the Load Case of Dead Load Plus EM Load

- ❑ All runs have wing bag E equal to 2,908 MPa
- ❑ Three (3) runs were carried out:
  - A) Flange shim E = 150,000 MPa and Shell E = 145,000 MPa
  - B) Flange shim E = 75,000 MPa and Shell E = 145,000 MPa
  - C) Flange shim E = 75,000 MPa and Shell E = 100,000 MPa

# Modular Coil Winding Form Stress

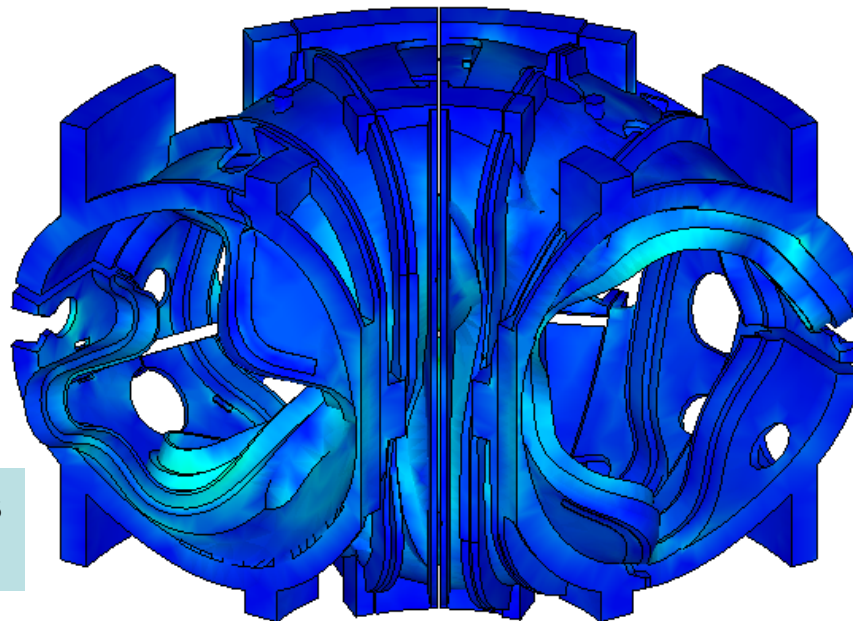
- ❑ Dead Load + EM Load
- ❑ Wing Bags E = 2,908 MPa
- ❑ Flange shim E = 150,000 MPa
- ❑ Shell E = 145,000 MPa

Full graphics  
option



SEQV (AVG)	
DMX	= .002831
SMN	= 205221
SMX	= .219E+09
	205221
	.245E+08
	.487E+08
	.730E+08
	.973E+08
	.122E+09
	.146E+09
	.170E+09
	.194E+09
	.219E+09

PowerGraphics  
option

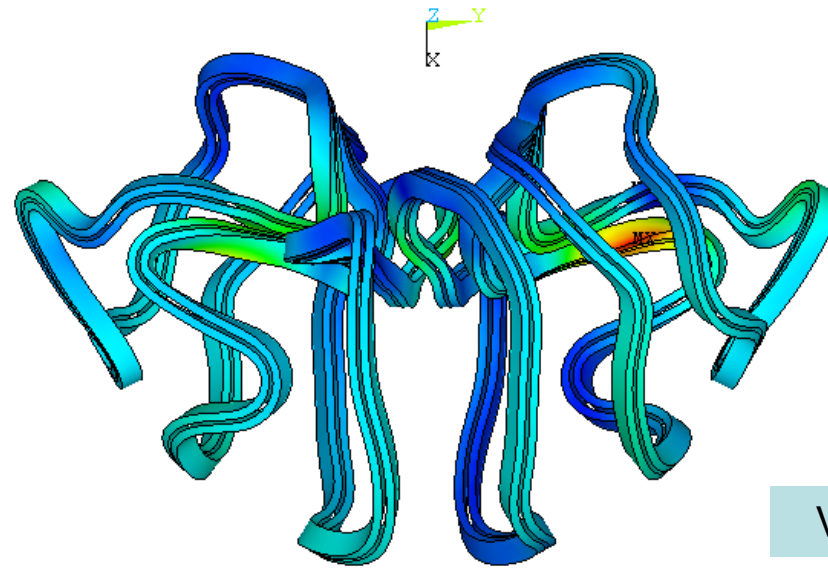


SEQV (AVG)	
PowerGraphics	
EFACET=1	
AVRES=Mat	
DMX	= .002598
SMN	= 143332
SMX	= .441E+09
	143332
	.491E+08
	.981E+08
	.147E+09
	.196E+09
	.245E+09
	.294E+09
	.343E+09
	.392E+09
	.441E+09

# Modular Coil

## Displacements

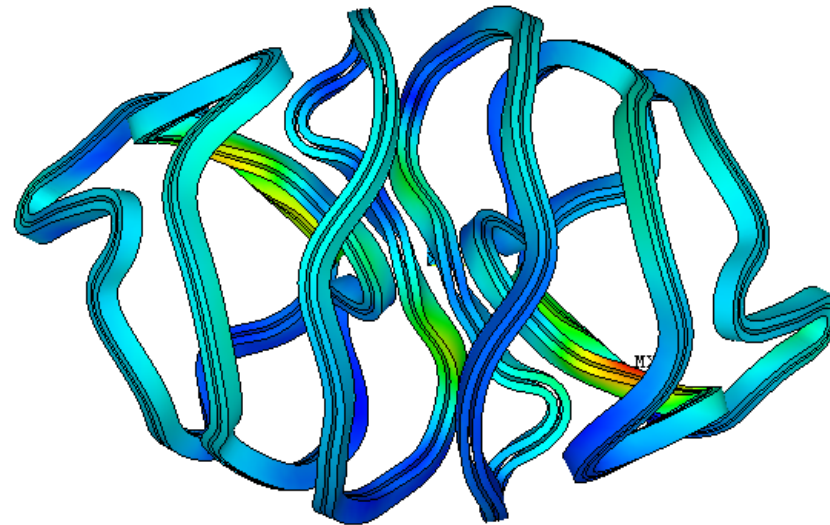
- ❑ Dead Load + EM Load
- ❑ Wing Bags E = 2,908 MPa
- ❑ Flange shim E = 150,000 MPa
- ❑ Shell E = 145,000 MPa



View from top

```
USUM      (AVG)
RSYS=0
PowerGraphics
EFACET=1
AVRES=Mat
DMX  =.002831
SMN  =.384E-04
SMX  =.002831
.384E-04
.349E-03
.659E-03
.969E-03
.00128
.00159
.0019
.002211
.002521
.002831
```

Unit in meter

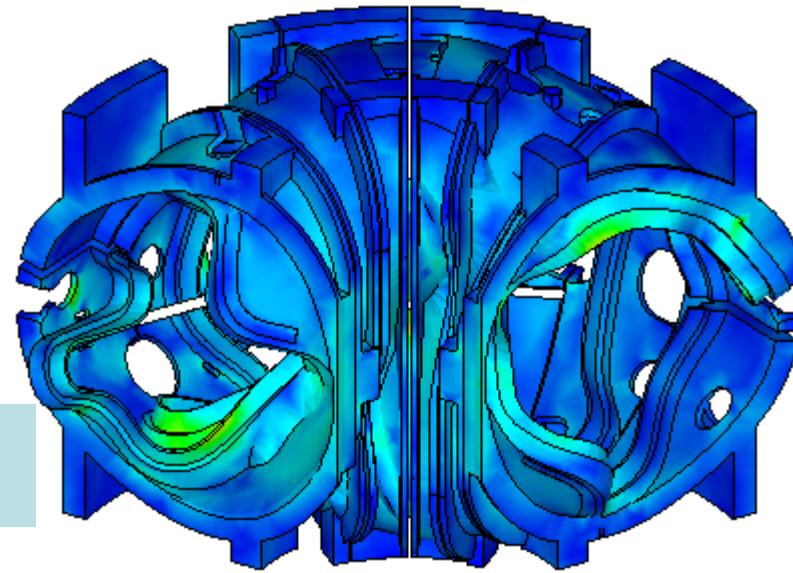


View from outboard side

# Modular Coil Winding Form Stress

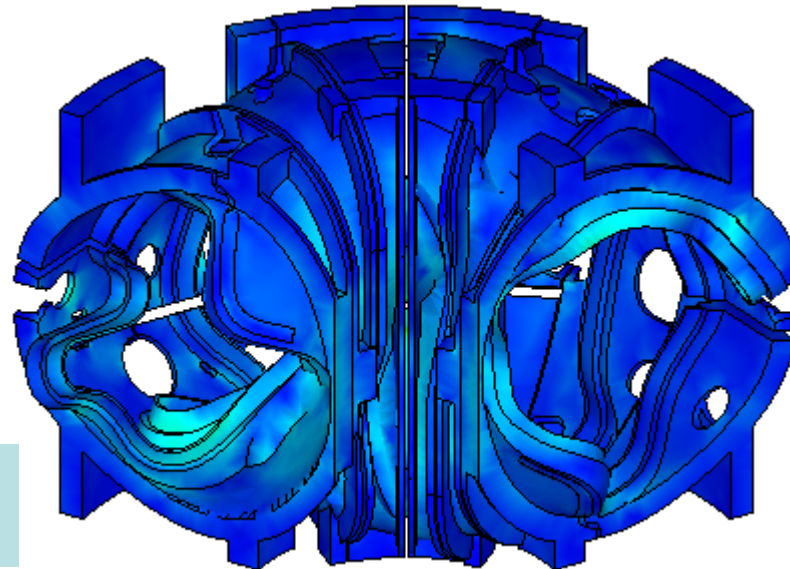
- Dead Load + EM Load
- Wing Bags E = 2,908 MPa
- Flange shim E = 75,000 MPa
- Shell E = 145,000 MPa

Full graphics  
option



SEQV (AVG)	
DMX	= .002845
SMN	= 172155
SMX	= .219E+09
	172155
	.245E+08
	.487E+08
	.730E+08
	.973E+08
	.122E+09
	.146E+09
	.170E+09
	.194E+09
	.219E+09

PowerGraphics  
option













SEQV (AVG)	
PowerGraphics	
EFACET=1	
AVRES=Mat	
DMX	= .00261
SMN	= 132749
SMX	= .409E+09
	132749
	.456E+08
	.911E+08
	.137E+09
	.182E+09
	.227E+09
	.273E+09
	.318E+09
	.364E+09
	.409E+09

# Modular Coil

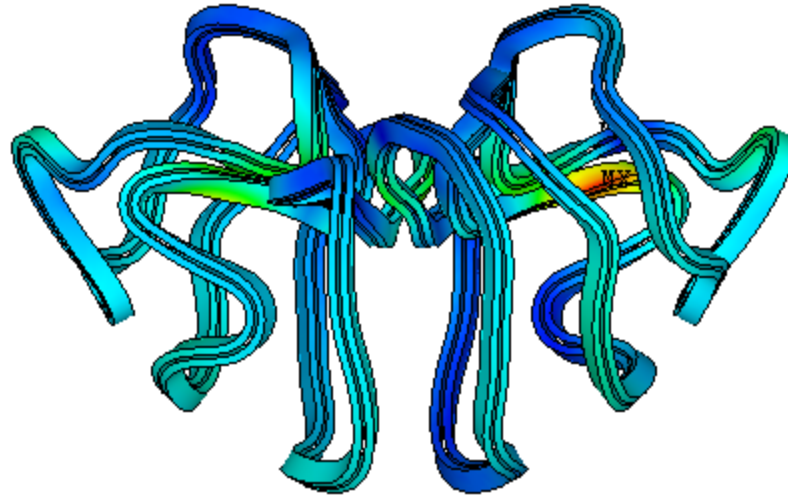
## Displacements

- ❑ Dead Load + EM Load
- ❑ Wing Bags E = 2,908 MPa
- ❑ Flange shim E = 75,000 MPa
- ❑ Shell E = 145,000 MPa

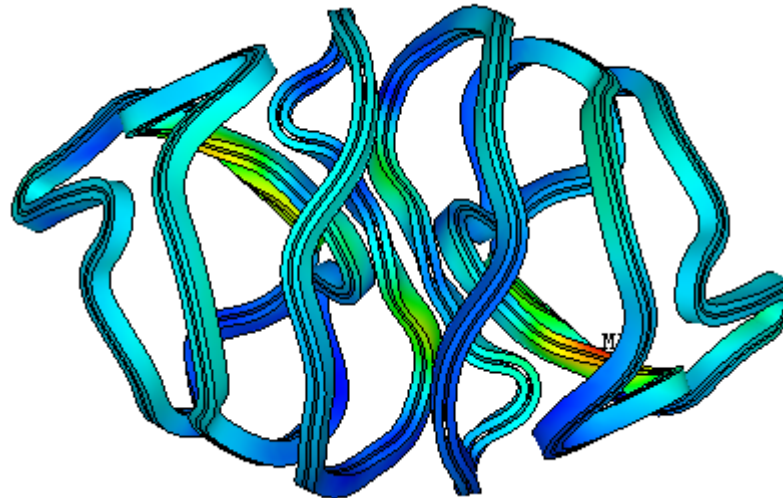
```
USUM      (AVG)
RSYS=0
PowerGraphics
EFACET=1
AVRES=Mat
DMX  =.002845
SMN  =.433E-04
SMX  =.002845
```

	.433E-04
	.355E-03
	.666E-03
	.977E-03
	.001288
	.0016
	.001911
	.002222
	.002533
	.002845

Unit in meter



View from top

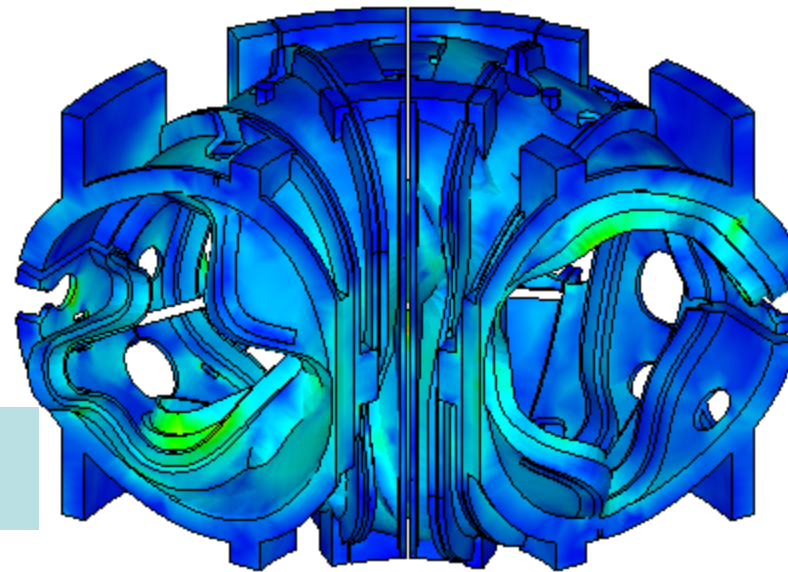


View from  
outboard side

# Modular Coil Winding Form Stress

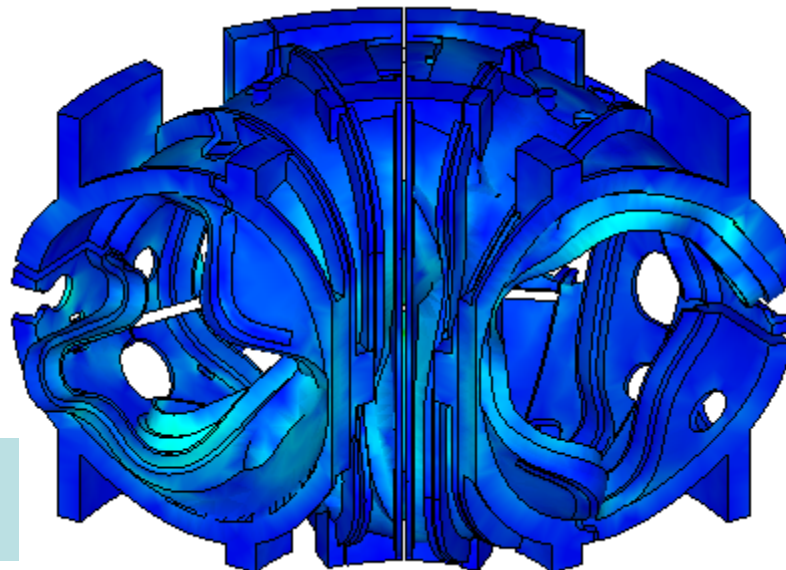
- ❑ Dead Load + EM Load
- ❑ Wing Bags E = 2,908 MPa
- ❑ Flange shim E = 75,000 MPa
- ❑ Shell E = 100,000 MPa

Full graphics  
option



SEQV	(AVG)
DMX	= .003709
SMN	= 197984
SMX	= .200E+09
	197984
	.224E+08
	.446E+08
	.669E+08
	.891E+08
	.111E+09
	.134E+09
	.156E+09
	.178E+09
	.200E+09

PowerGraphics  
option













SEQV	(AVG)
DMX	= .003406
SMN	= 157927
SMX	= .405E+09
	157927
	.451E+08
	.901E+08
	.135E+09
	.180E+09
	.225E+09
	.270E+09
	.315E+09
	.360E+09
	.405E+09

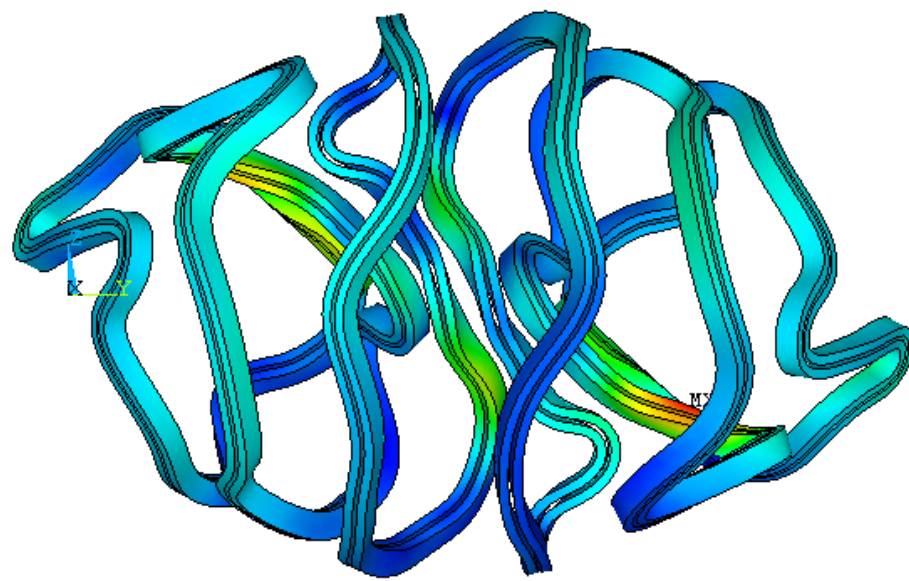
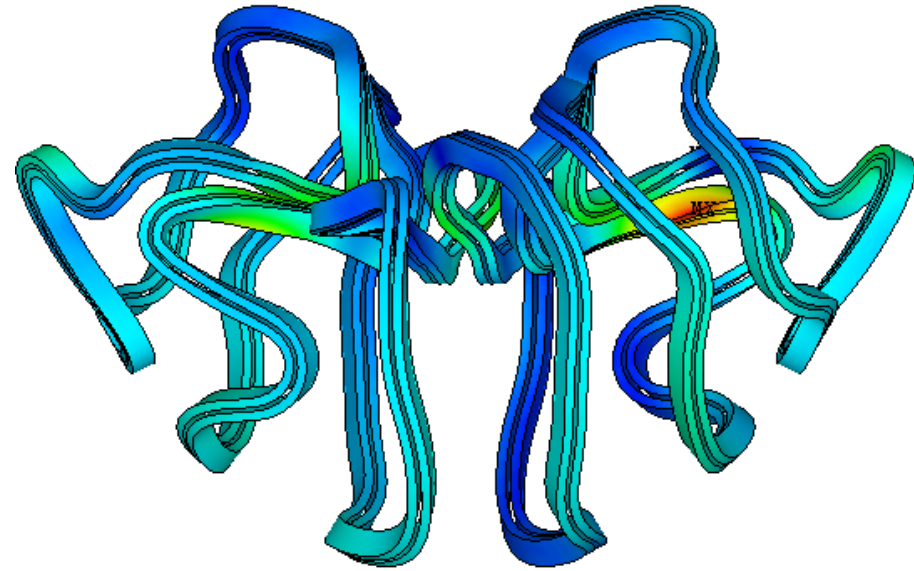
# Modular Coil

## Displacements

- ❑ Dead Load + EM Load
- ❑ Wing Bags E = 2,908 MPa
- ❑ Flange shim E = 75,000 MPa
- ❑ Shell E = 100,000 MPa

USUM (AVG)  
RSYS=0  
PowerGraphics  
EFACET=1  
AVRES=Mat  
DMX =.003709  
SMN =.528E-04  
SMX =.003709

	.528E-04
	.459E-03
	.865E-03
	.001272
	.001678
	.002084
	.00249
	.002897
	.003303
	.003709



## Summary

	E of Flange Shim	E of MCWF	Max. MC Displacement	Max. MCWF Stress - Full	Max. MCWF Stress - PowerGraphics
Unit	MPa	MPa	mm	MPa	MPa
Case A	150,000	145,000	2.831	219	441
Case B	75,000	145,000	2.845	219	409
Case C	75,000	100,000	3.709	200	405

- The results are due to dead load + EM load.
- Base on the maximum stress location, the maximum stress defined by the full graphic option is more reliable.
- Reducing the E of flange shim by half has small effects on the maximum stress and maximum displacement
- Reducing the E of MCWF to 100,000MPa increases the maximum displacement by 30.4%
- The results are based on the assumption that all bolting joints are bonded without sliding which may be unconservative if the design can not match the requirement of the assumption.