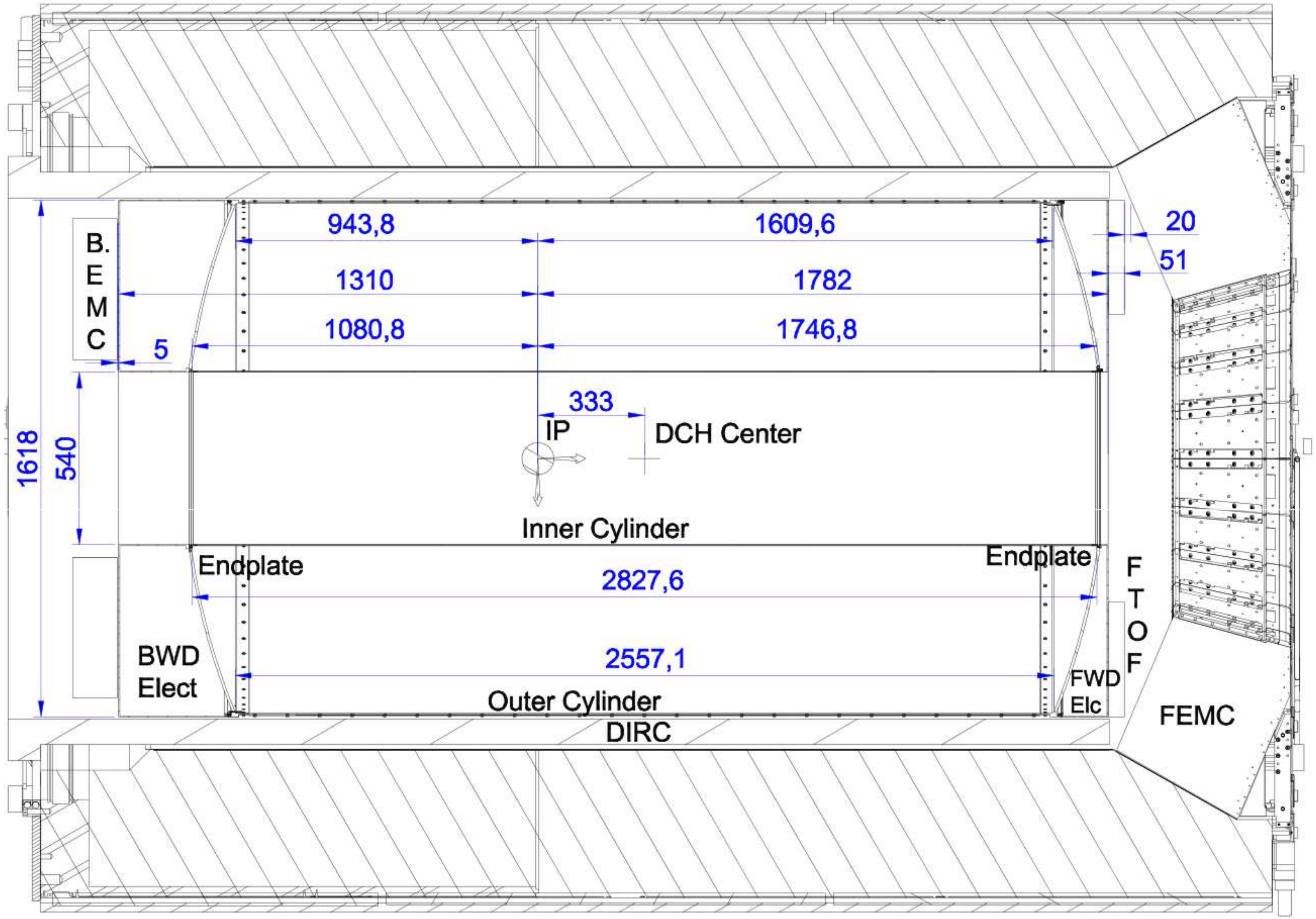
DCH mechanics

- **DCH final configuration**

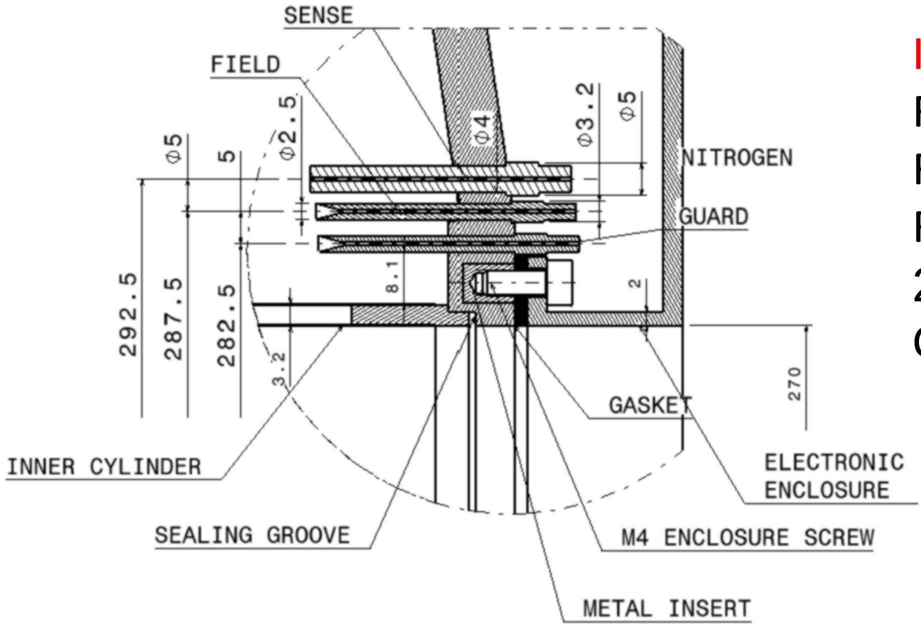
- **Safety factor analysis**
  - Endplate
  - Outer cylinder
  - Inner Cylinder

DCH Final Configuration



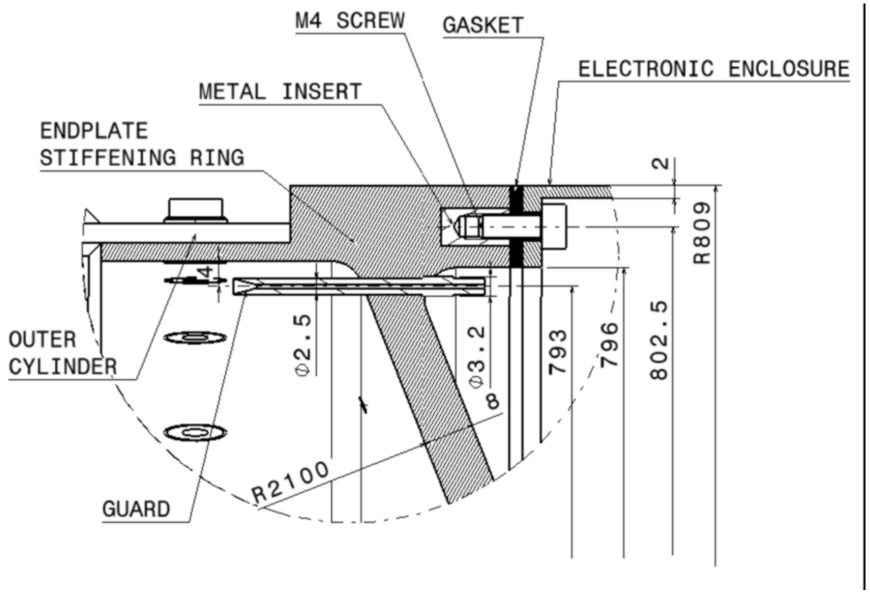
- +100mm BWD side
- -11mm FWD side
- 5mm cleareance BEMC
- 20mm clearance FEMC

Endplate



Inner radius

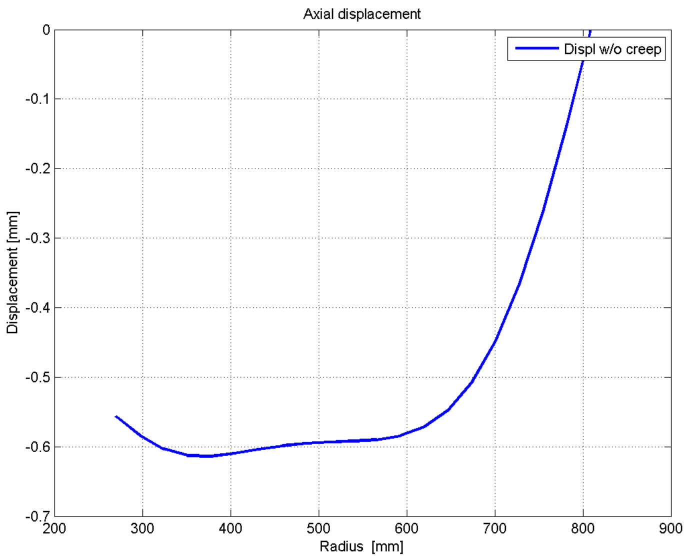
First guard layer: 282.5mm
First field layer: 287.5mm
Firse sense layer: 292.5mm
22.5 -> from outer radius (270mm)
CF-sandwich inner cylinder



Outer radius

Last guard layer: 793mm
Last field layer: 788.1mm
Last sense layer: 781.7mm
27.3 -> from outer radius (809mm)

DCH Configurations

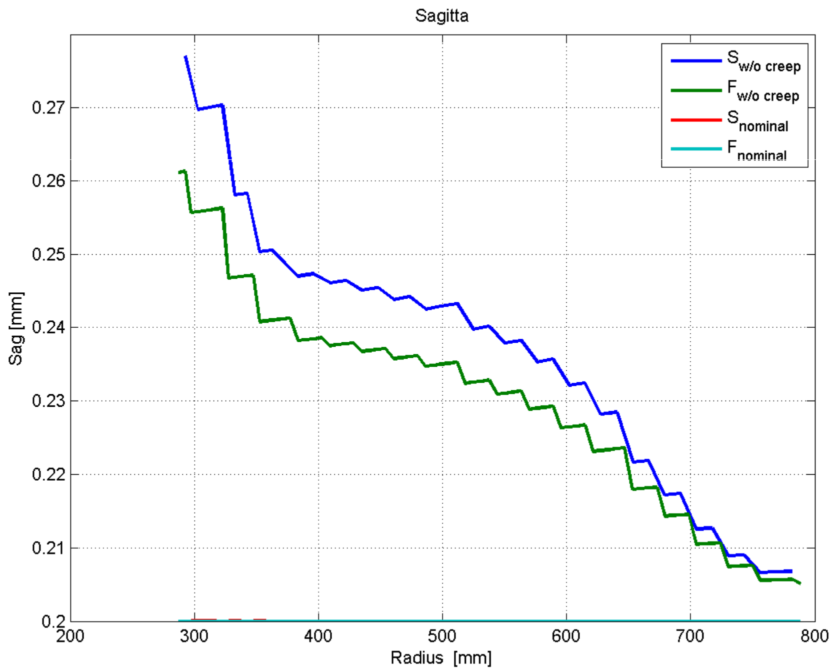


Inner and outer stiffening ring have an important effect on endplate behaviour (stiffness of whole structure)

Load
Before stringing: 21400 N
After stringing: 18900 N

Max displ: 0.61 mm
Max Sagitta w/o creep: 0.28mm

Max sagitta difference: 0.02mm



Safety factor

All the main elements are subjected to compression loads
An instability analisys is needed

- ENDPLATE
- INNER CYLINDER
- OUTER CYLINDER

Important:
Instability values provided by analitical and FEM analisys are qualitative results

Instability is really sensitive to imperfection in geometry, load and materials expecially for thin cylindrical shell

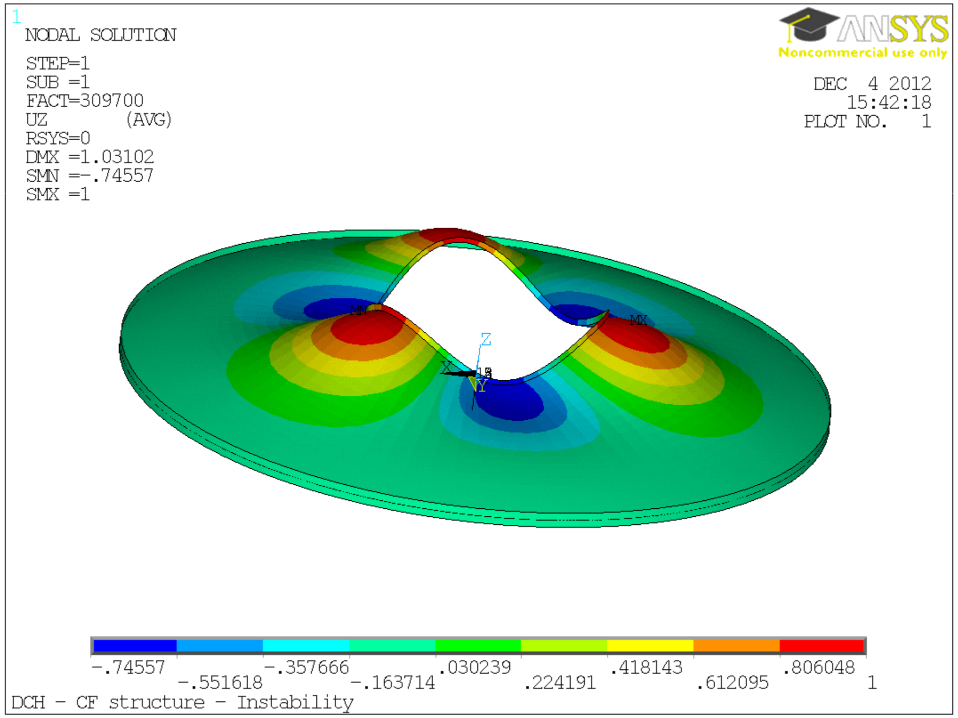
ASME and UNI standards suggest to use a SF > 4 for pressure vessel (steel, aluminum)

Uncertainty in carbon fiber material propertis lead to chose SF > 10

Endplate SF*

R_ep	Thickness (mm)	Max displ (mm)	Buckling SF
2100	8	0.614	16
3000	8	1.15	8
4000	8	1.77	4.8

8mm CF – quasi isotropic layup
[0°/45°/45°/0°]_8]_8 - 0.25mm
Plain weave

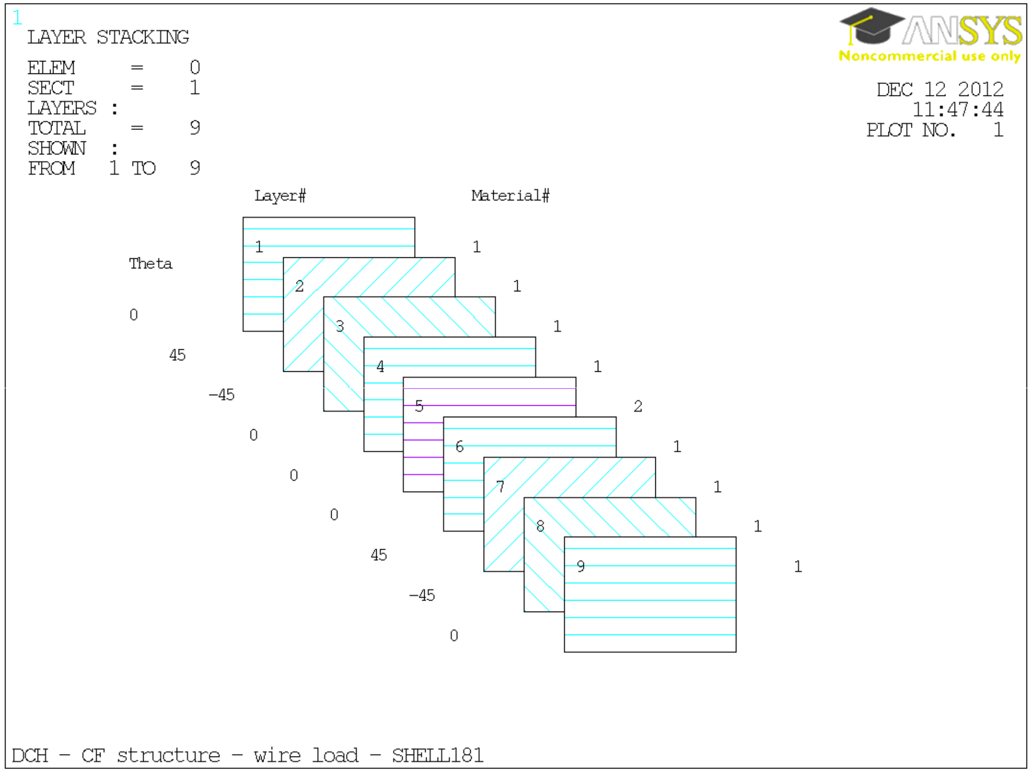


2100 Conf :
Small displ -> small sagitta (>0.3) -> probably no need to consider overtension

Higher Safety factor

*21 KN load

Outer Cylinder - structure



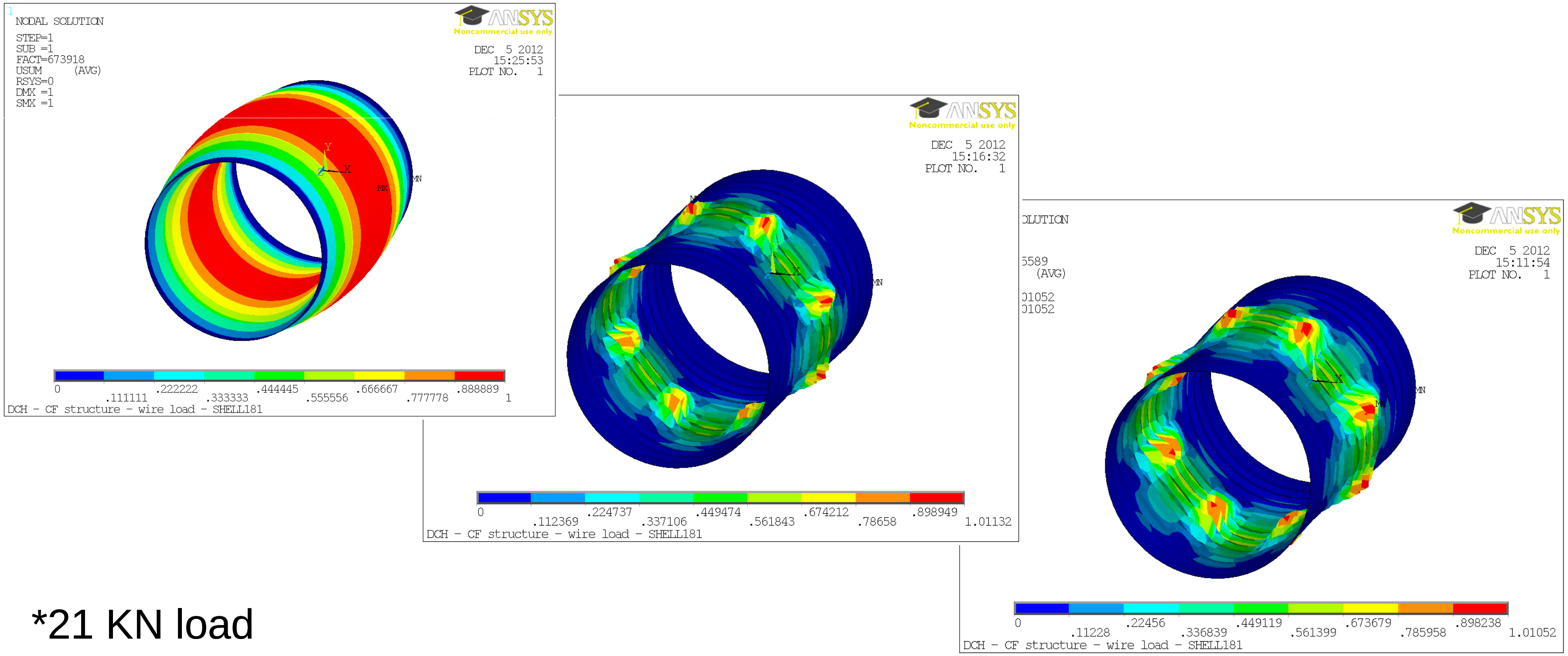
1mm CF – quasi isotropic layup
0°/45°/45°/0° - 0.25mm
Plain weave

6mm Honeycomb

1mm CF – quasi isotropic layup
0°/45°/45°/0° - 0.25mm
Plain weave

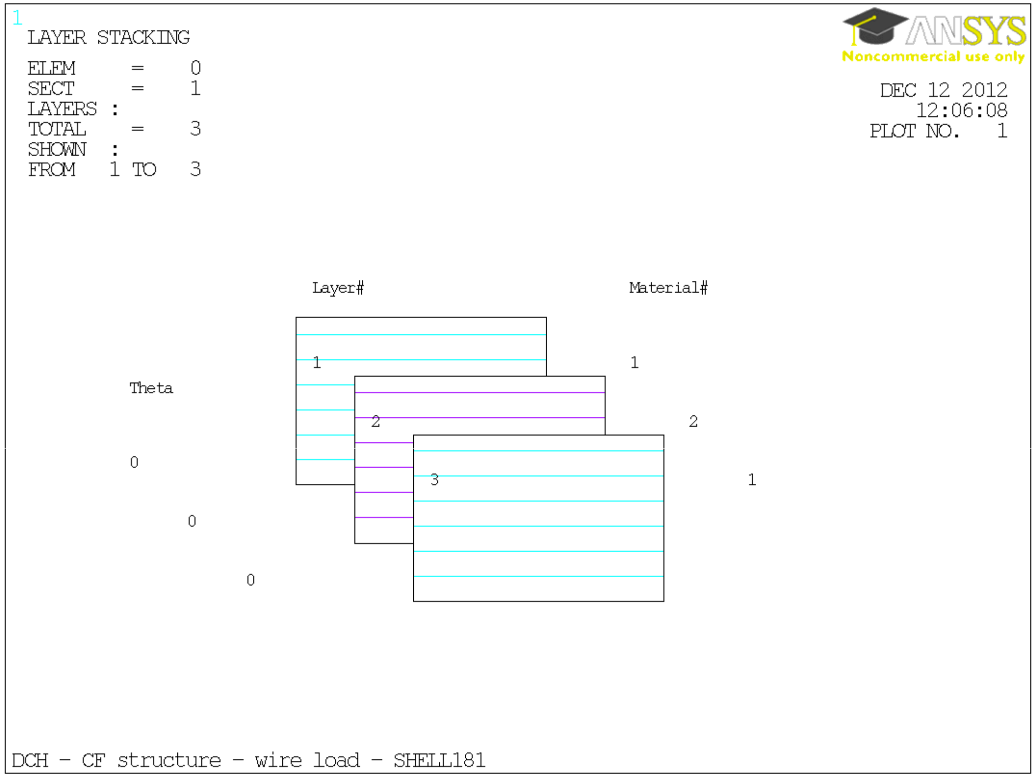
Outer Cylinder SF*

Conf	Nom. Geometry	Imp 2mm	Imp 4mm
1_1	24	10.8	8
1_3_1	22	12.8	8.3
1_4_1	25.71	13.5	9
1_6_1	33.6	22.8	18.6



*21 KN load

Inner Cylinder - structure



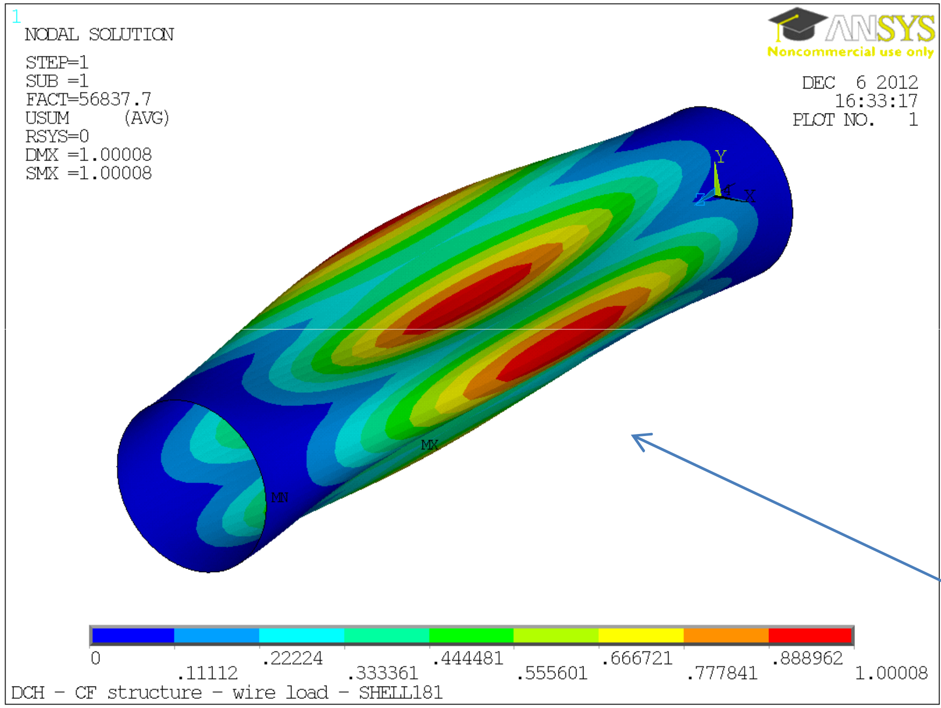
0.09mm CF – 0°
Plain weave

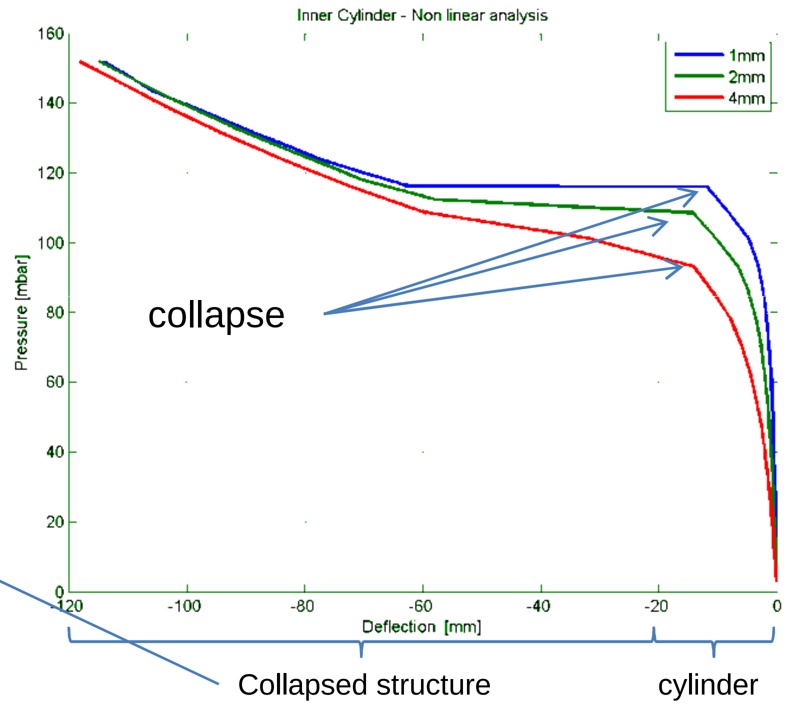
3mm Honey comb

0.09mm CF – 0°
Plain weave

Inner Cylinder

Conf	Nom. Geometry	Imp 1mm	Imp 2mm	Imp 4mm
0.09_3_0.09	120mbar	108mbar	99mbar	86mbar
0.09_0.09	0.84mbar	0.74mbar	0.68mbar	0.56mbar





CF plies thinner than 0.09mn are difficult to handle and are full of microholes (effects on material properties, gas tightening)

Conclusions

DCH design is almost completed (80%):
To do:

- Enclosure (depend on electronic and supports)
- Fastening DCH-Enclosure Cyl-EP (Number, material and typolgies of screw)
- Mechanical drawings

Parametric FEM model (90%):
To do:

- Effects of creep
- Tests (carbon fiber, sandwiches)
- Investigate Kapton-sandwich for inner cylinder (used in KLOE2 CGEM-cathode structure)
- Model can be quite easily adapted to differents geometry and materials