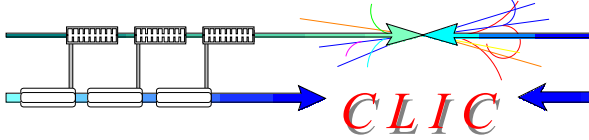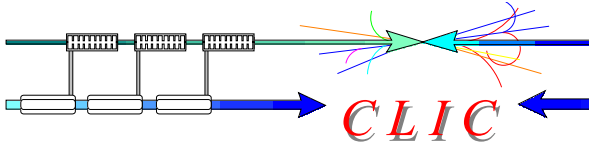# Beam Loss induced thermal deformation of the 30 GHz power extraction structure
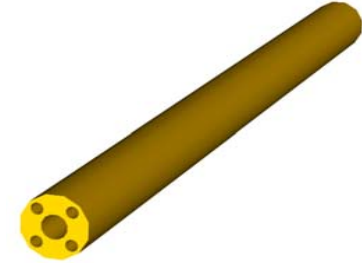
Preliminary studies of

Beam Loss induced thermal deformation of the 30 GHz power extraction structure
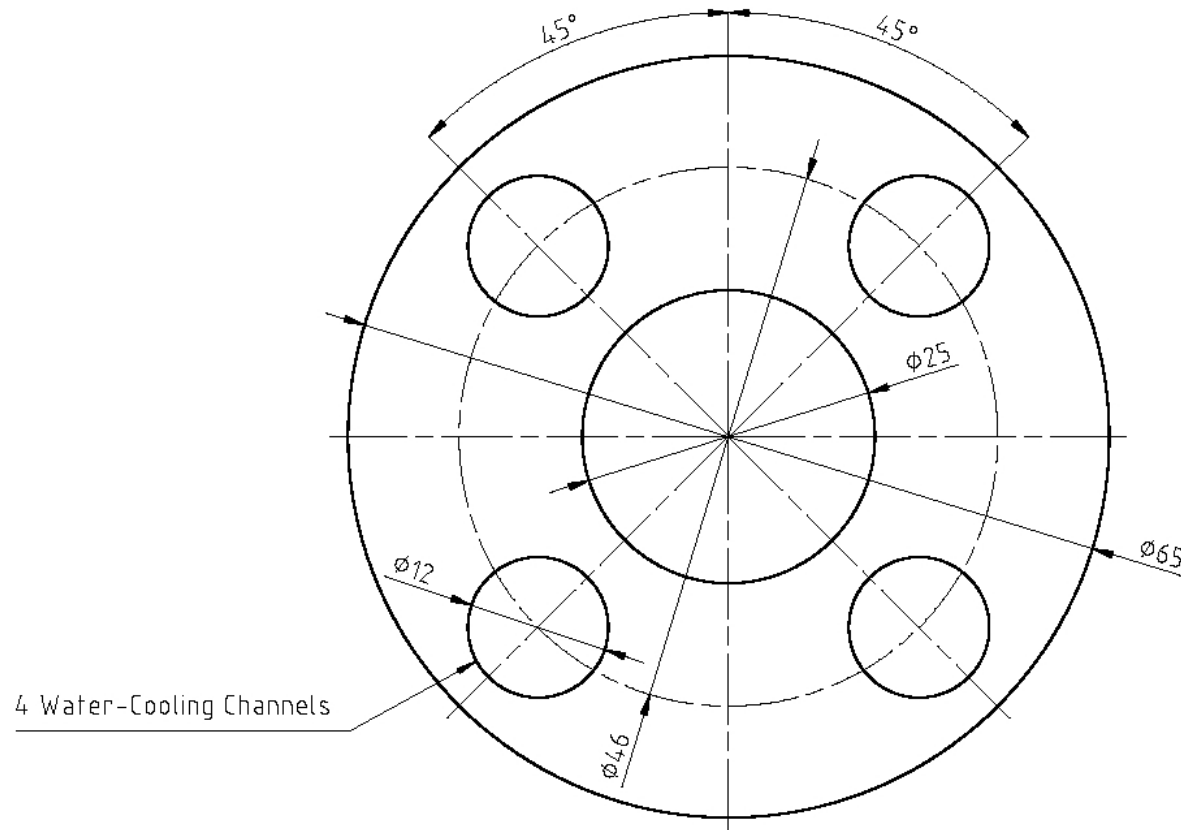
CLIC

- Average heat power from the beam losses: 10 kW
- 4 water-cooling channels, Ø12 mm
- Water temperature: 27 °C (300 °K), velocity: 200 cm/s
- Material: Cu-OFE
- Structure length: 1 m

Cross Section Dimensions

45°   45°

Ø25

Ø65

Ø12

4 Water-Cooling Channels

Ø46

CLIC
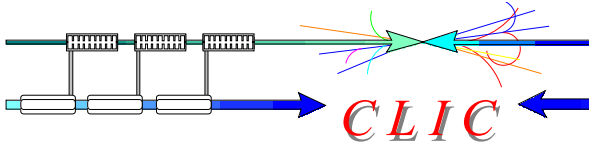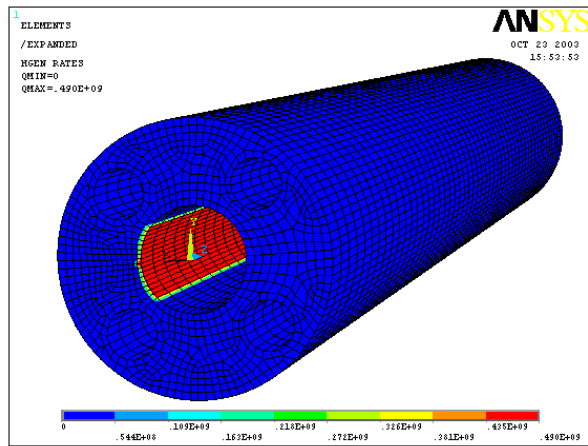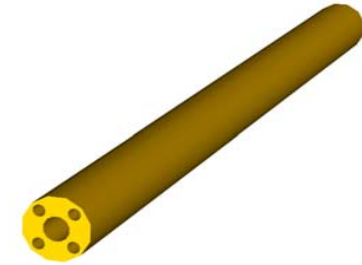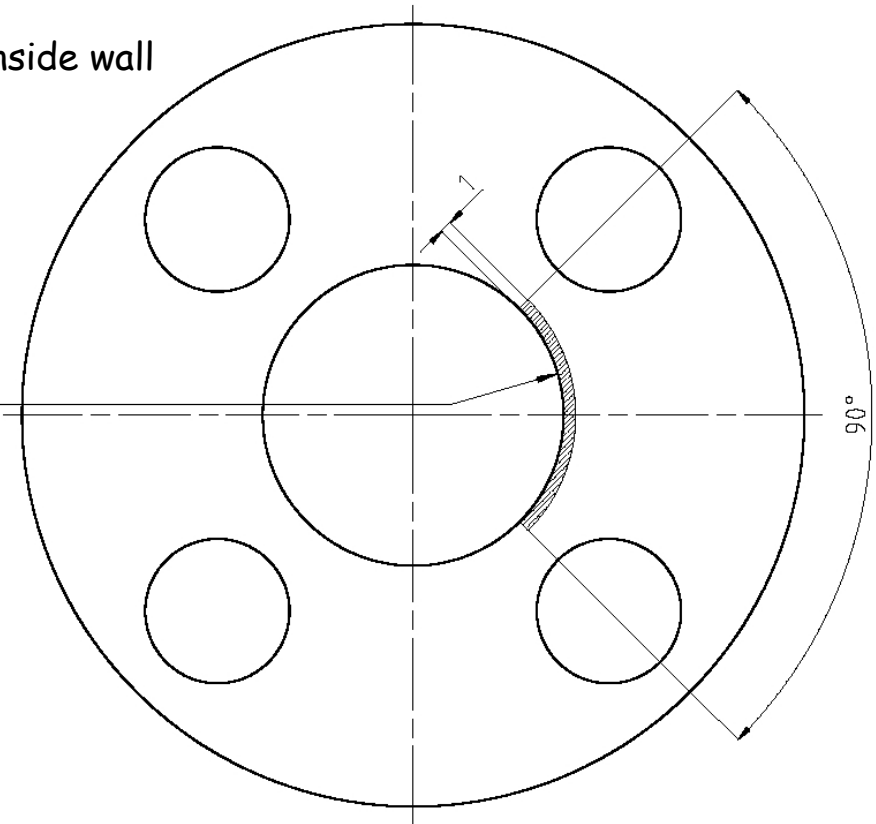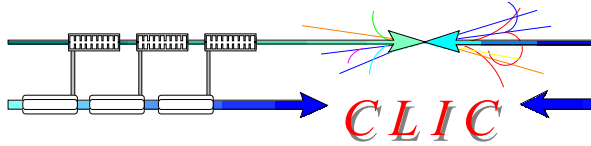
- Average heat power from the beam losses: 10 kW
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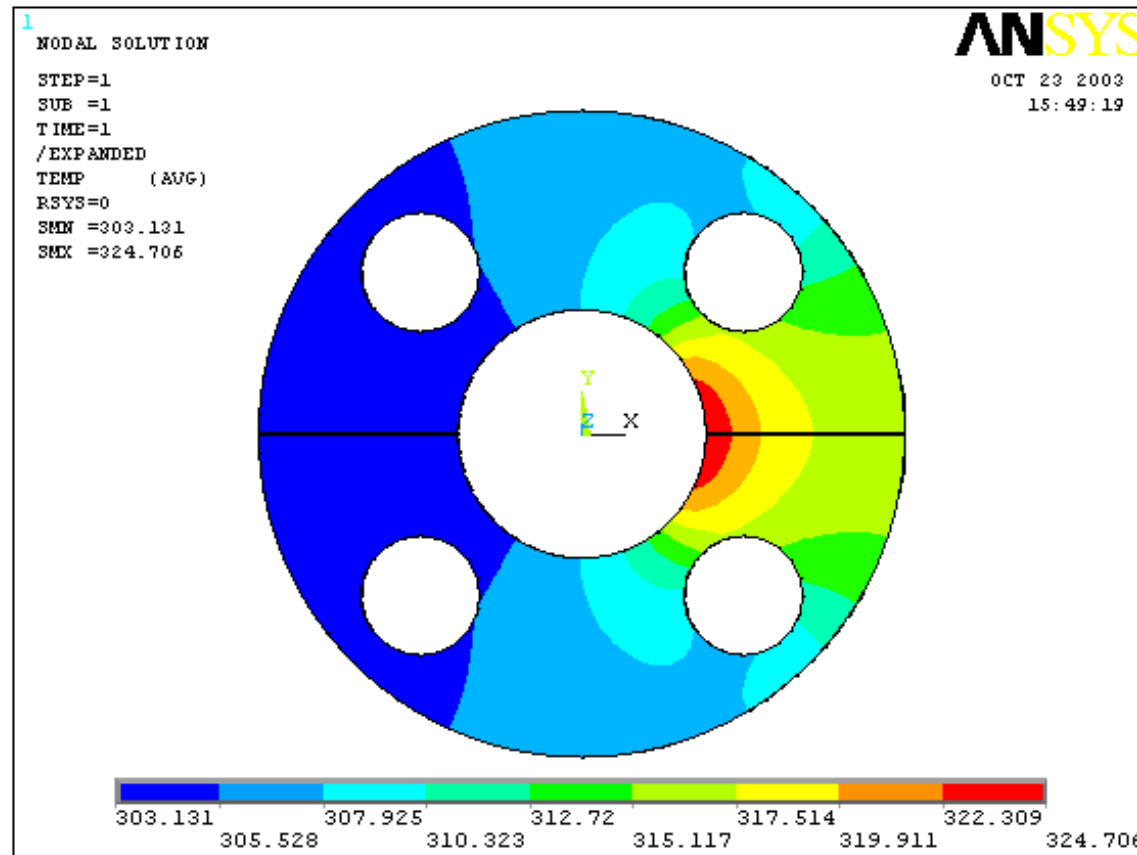- Heat power induced in 1 mm deep quarter of the inside wall
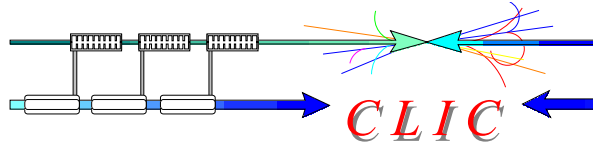

Beam losses induced
in this volume

90°

C L I C
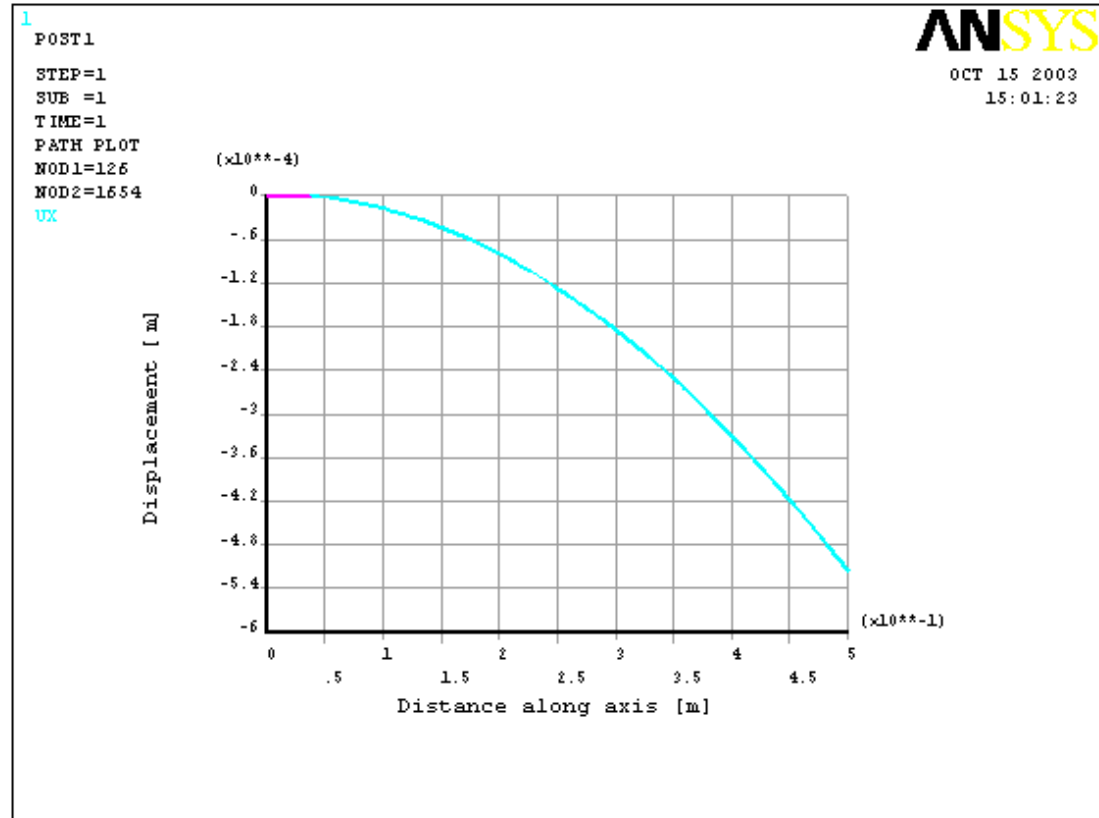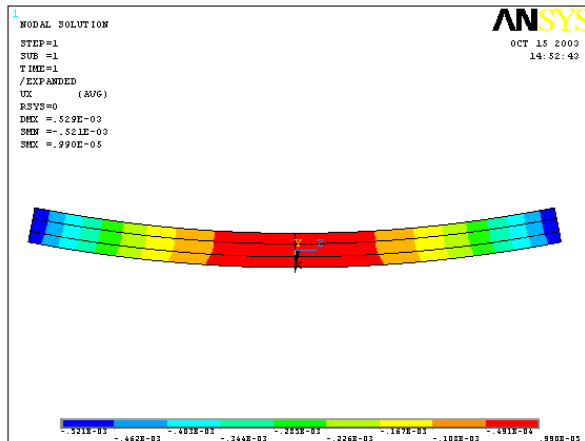

Temperature profile [°K]

ΔT = 21.5 °C
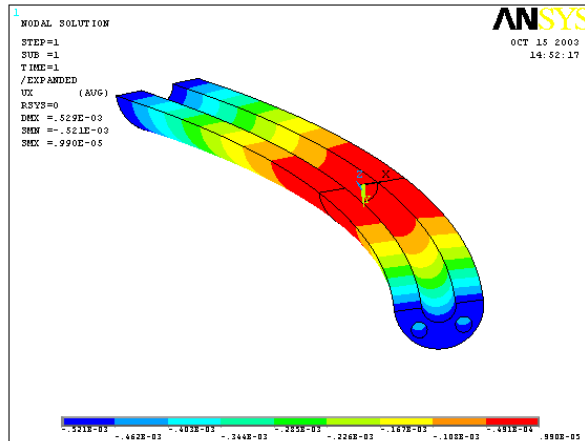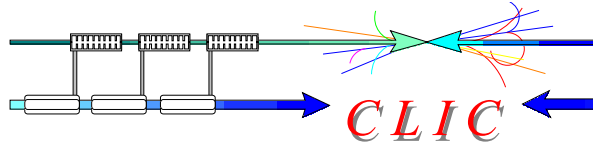
C L I C

Maximum displacement 0.5 mm
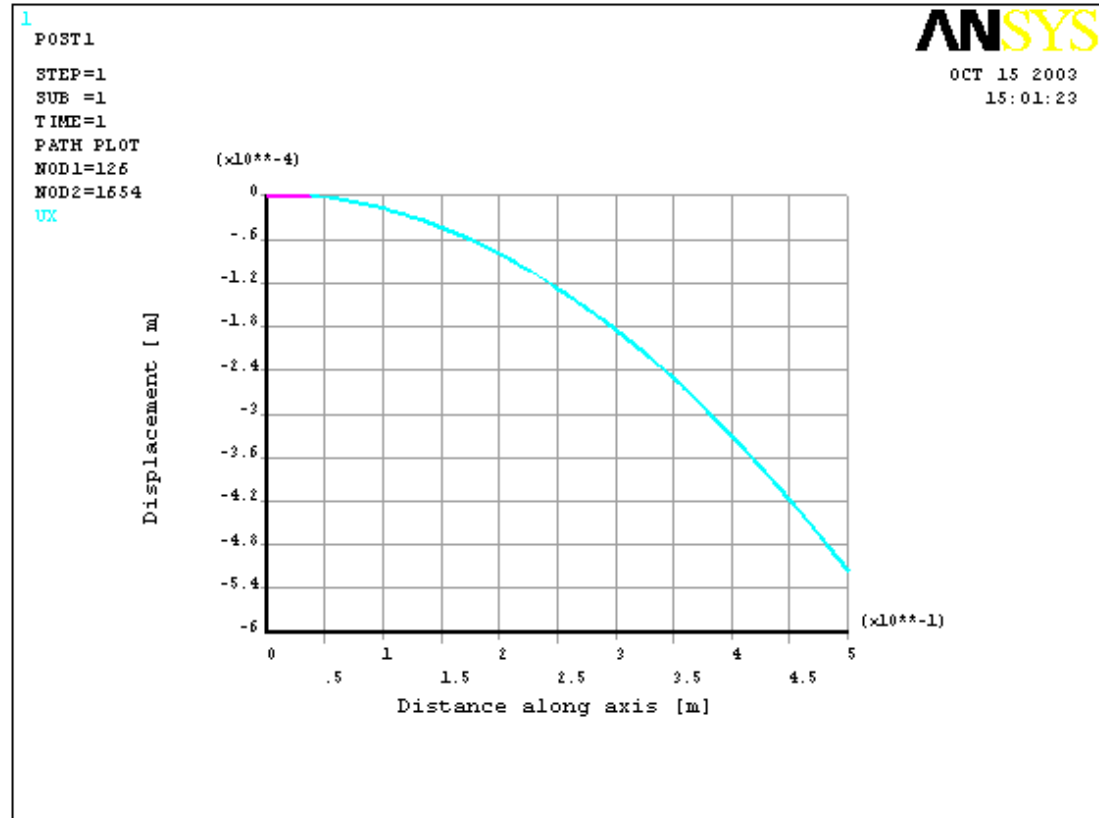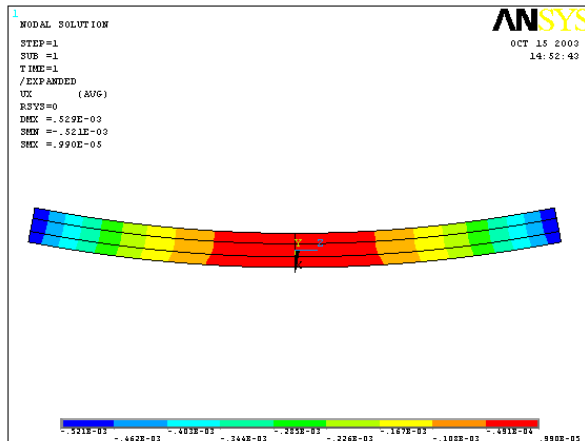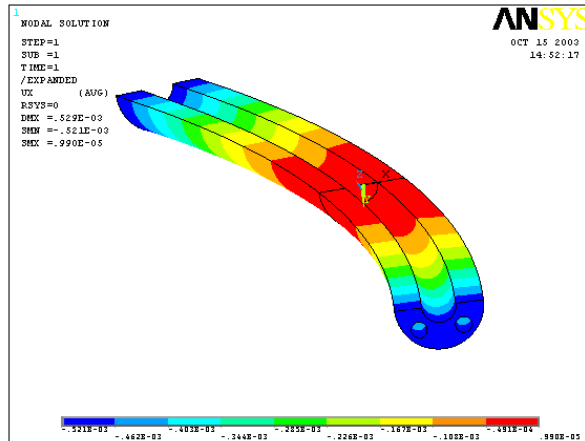
C L I C

Maximum displacement 0.5 mm

Needed straightening force = 6 kN
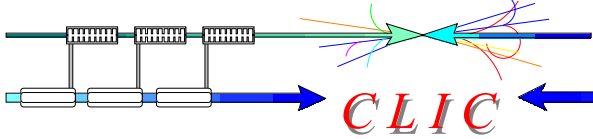
CLIC
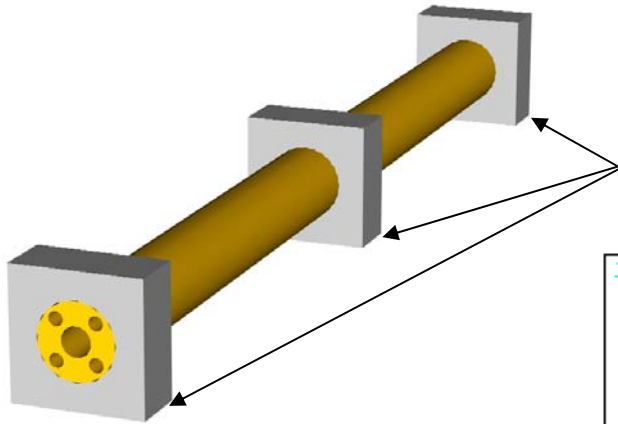
3 steel supports
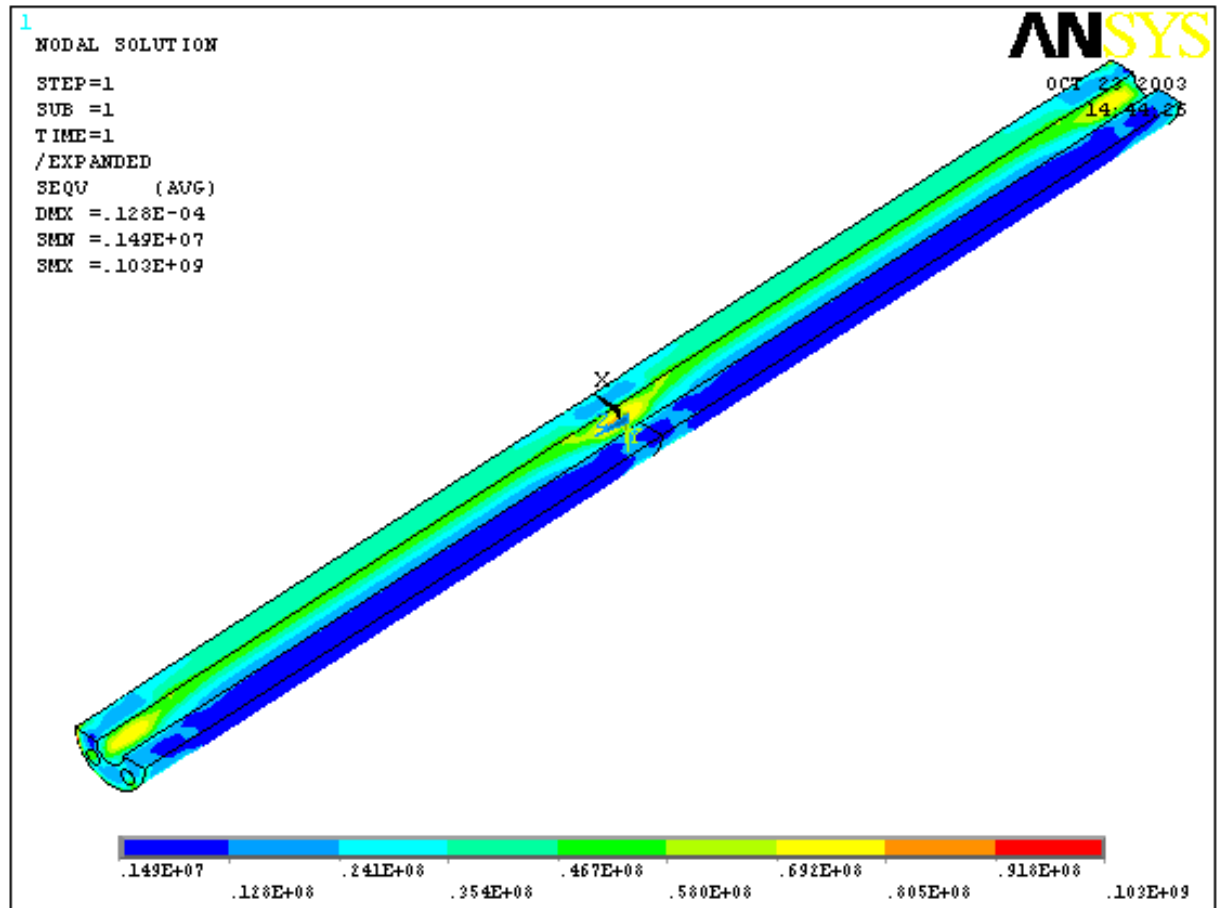
Maximum displacement
= 0.01 mm

Maximum stress in the
structure = 103 MPa
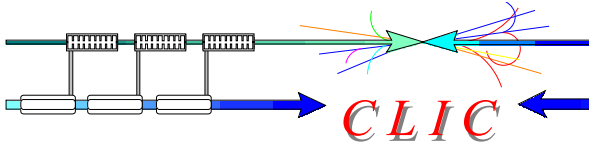

```
1
NODAL SOLUTION                                    ANSYS
STEP=1                                          OCT 23 2003
SUB =1                                          14:44:25
TIME=1
/EXPANDED
SEQV      (AVG)
DMX =.128E-04
SMN =.149E+07
SMX =.103E+09
```

```
.149E+07        .241E+08        .467E+08        .692E+08        .918E+08
       .128E+08        .354E+08        .580E+08        .805E+08        .103E+09
```

CLIC

10 kW average heat power converted to 150 ns pulses at 100 Hz: Peak power = 670 MW

Temperature profile after the 150 ns pulse. ΔT = 1.4 °C
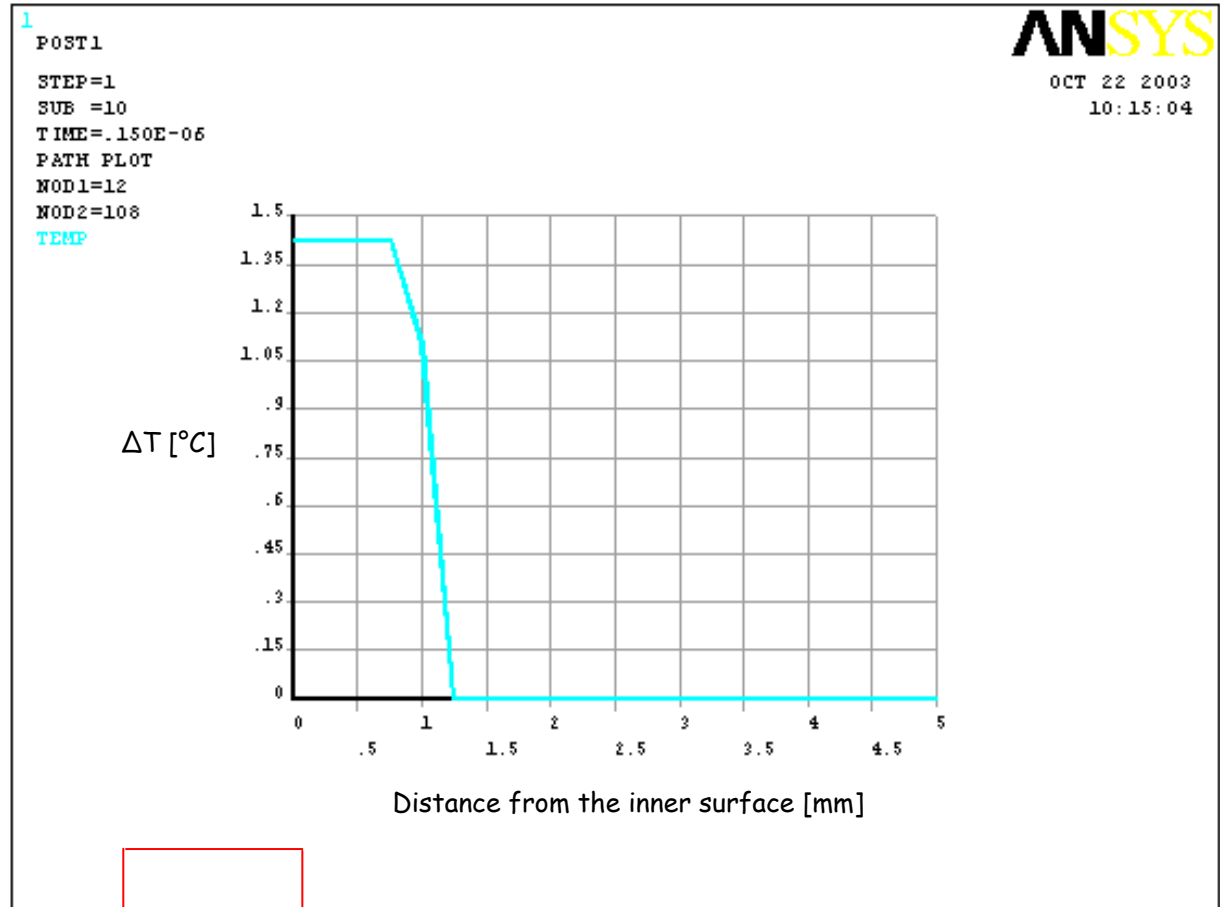
```
1
 POST1
 STEP=1                                      ANSYS
 SUB =10                                     OCT 22 2003
 TIME=.150E-06                               10:15:04
 PATH PLOT
 NOD1=12
 NOD2=108
 TEMP
```

ΔT [°C]

Distance from the inner surface [mm]

P

670 MW

150 ns   0.01 s   t
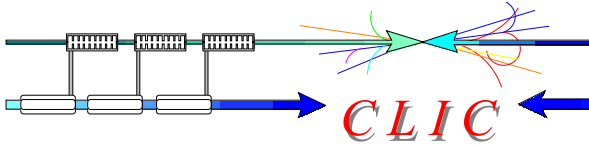
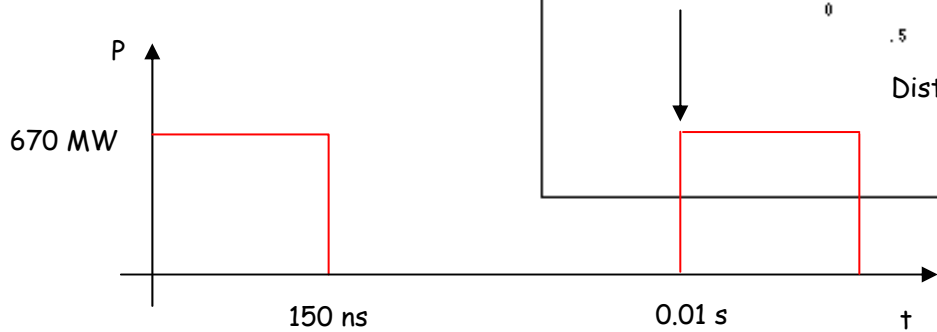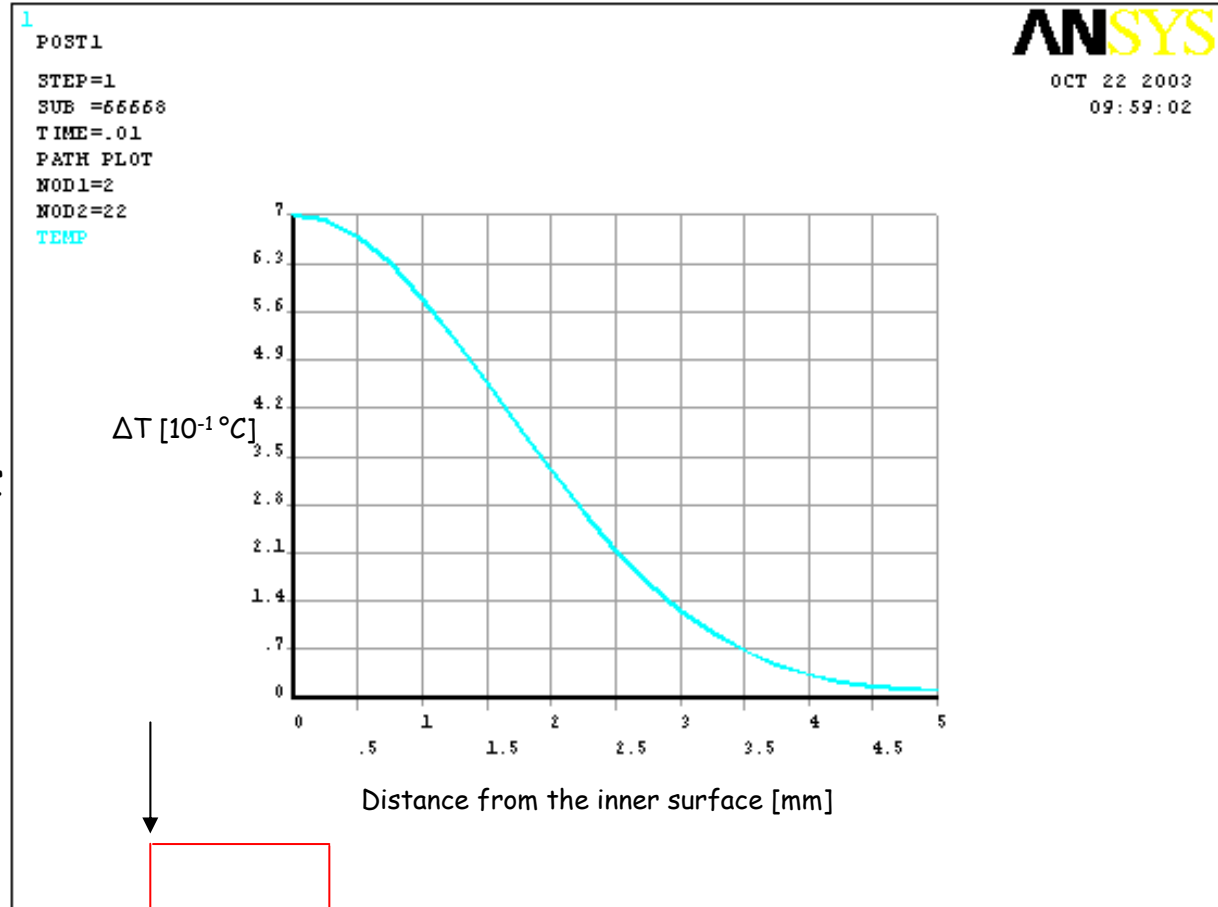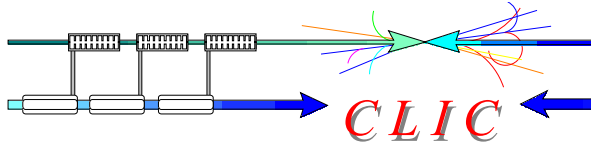CLIC

10 kW average heat power converted to 150 ns pulses at 100 Hz: Peak power = 670 MW

Temperature profile after the 0.01 s cycle. ΔT = 0.7 °C

1
POST1

STEP=1
SUB =66668
TIME=.01
PATH PLOT
NOD1=2
NOD2=22
TEMP

ANSYS

OCT 22 2003
09:59:02

ΔT [10⁻¹ °C]

Distance from the inner surface [mm]

P

670 MW

150 ns   0.01 s   t

- With the initial parameters the situation doesn't look alarming.
- The results should be checked with refined parameters.