VIA UNIVERSITY COLLEGE

Elasto-Plastic Analysis of an Offshore Construction

Made by

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Finite Element Method Final Project 2009

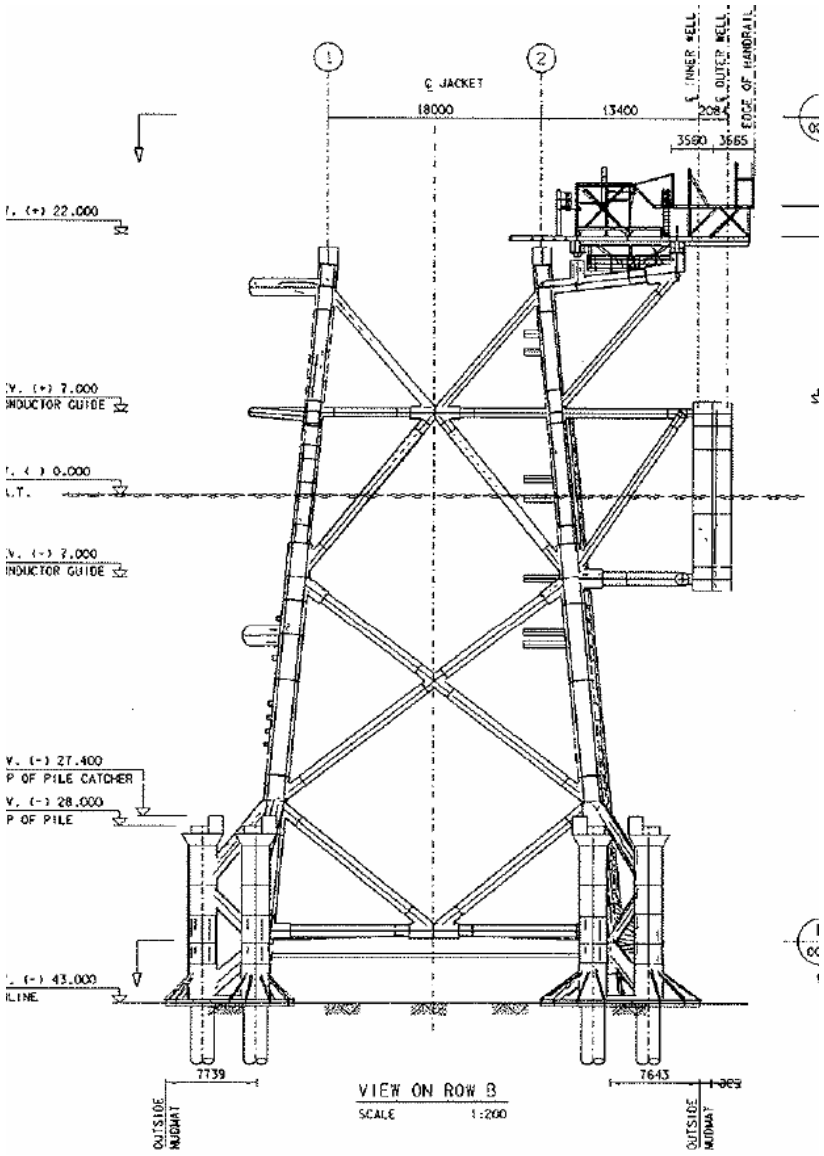

DUC HD B
DUC HD C


SAIPEM 7000
SAIPEM 7000

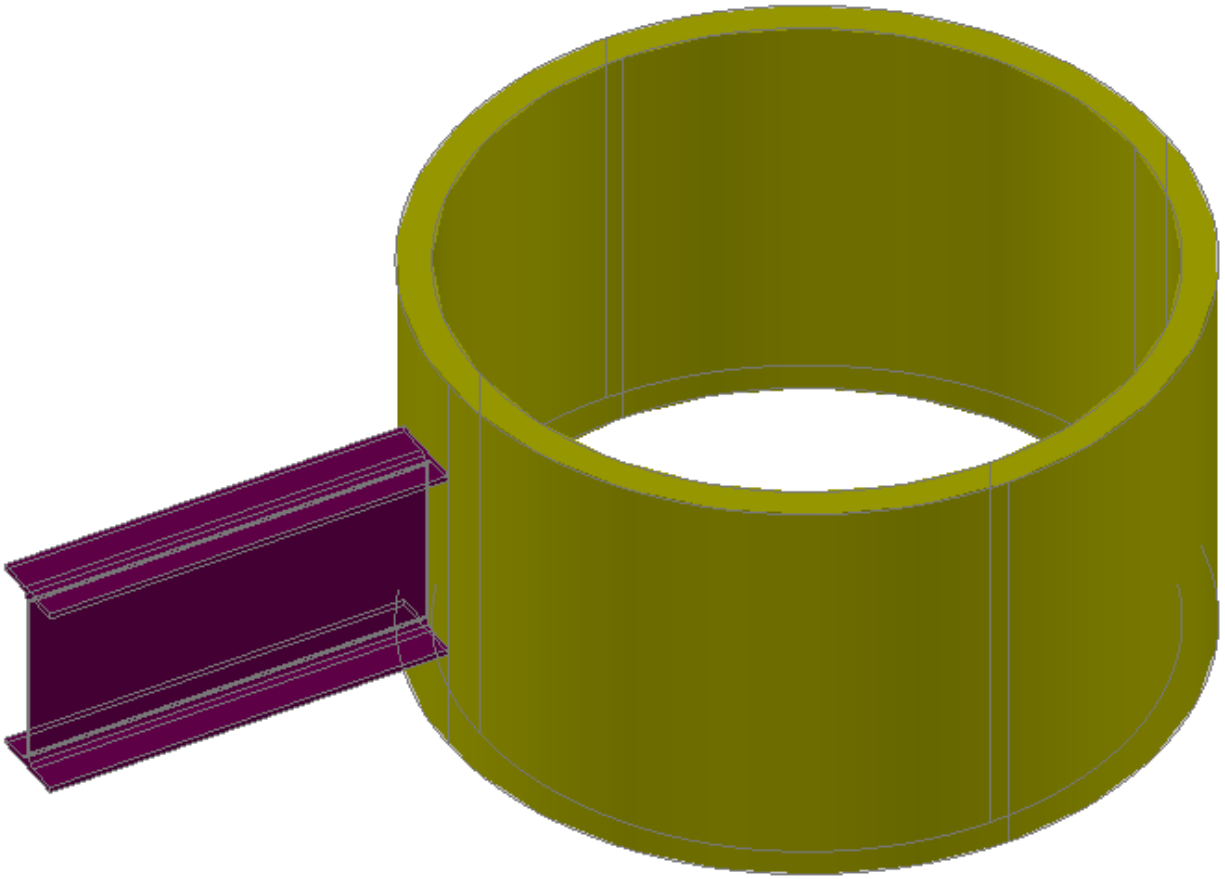
Seipem 7000

General characteristics	
Class and type:	Semi-submersible crane vessel
Displacement:	172,000 t (heavy lift)
Length:	198 m (overall)
Beam:	87 m
Height:	43.5 m (keel to deck)
Draft:	10.5 metres (34 ft) (transit) 18.0 metres (59 ft) (survival) 27.5 metres (90 ft) (heavy lift)
Installed power:	70,000 kW
Propulsion:	12 thrusters
Speed:	9.5 knots (18 km/h)
Crew:	Up to 700 persons

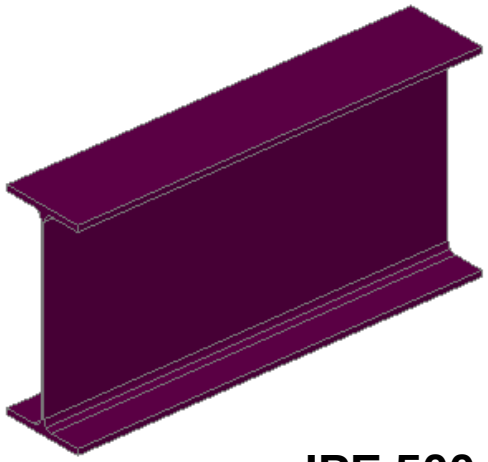
Analyzed elements



Analyzed elements

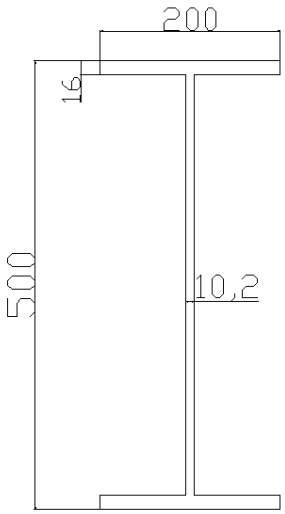


Analyzed elements



IPE 500

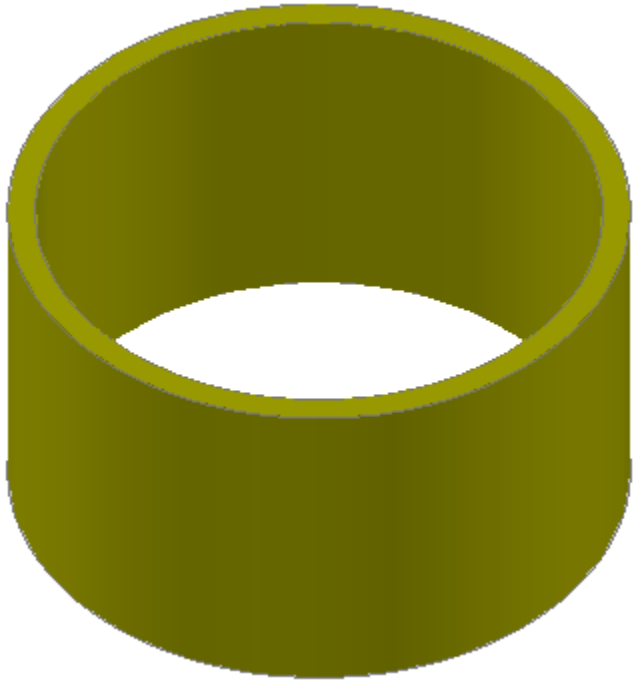
L = 1m



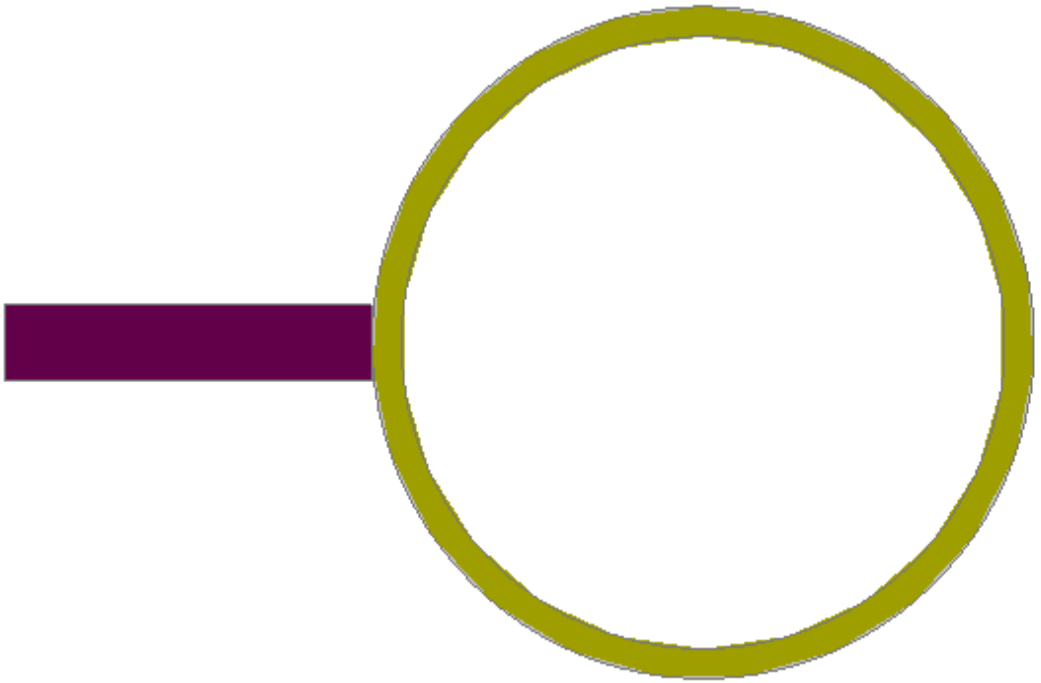
D = 1.8m

h = 1m

b = 0.08m



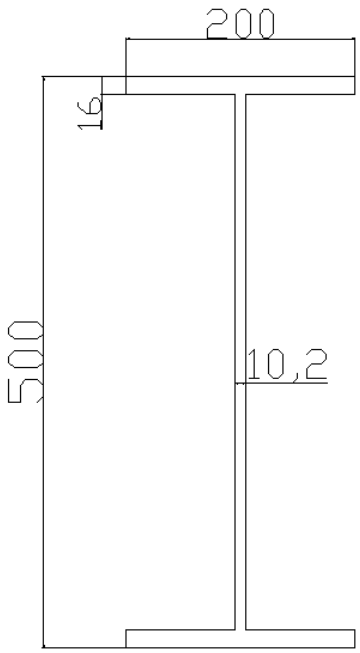
From 3D to 2D

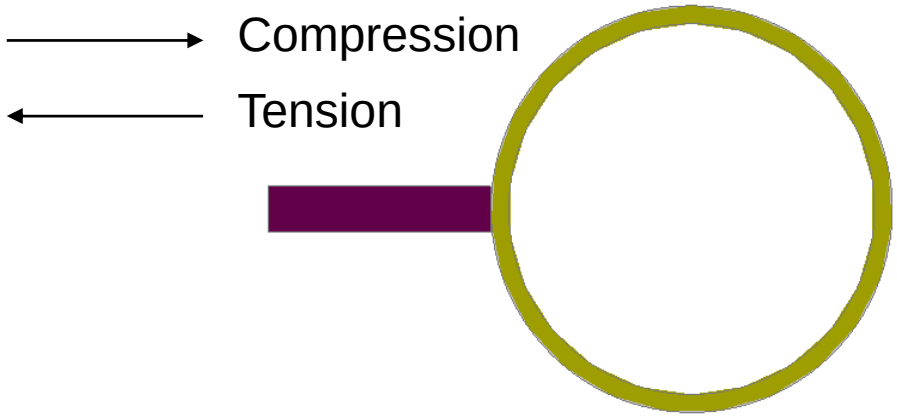


The view of the top

The view of the front

Tension - Compression





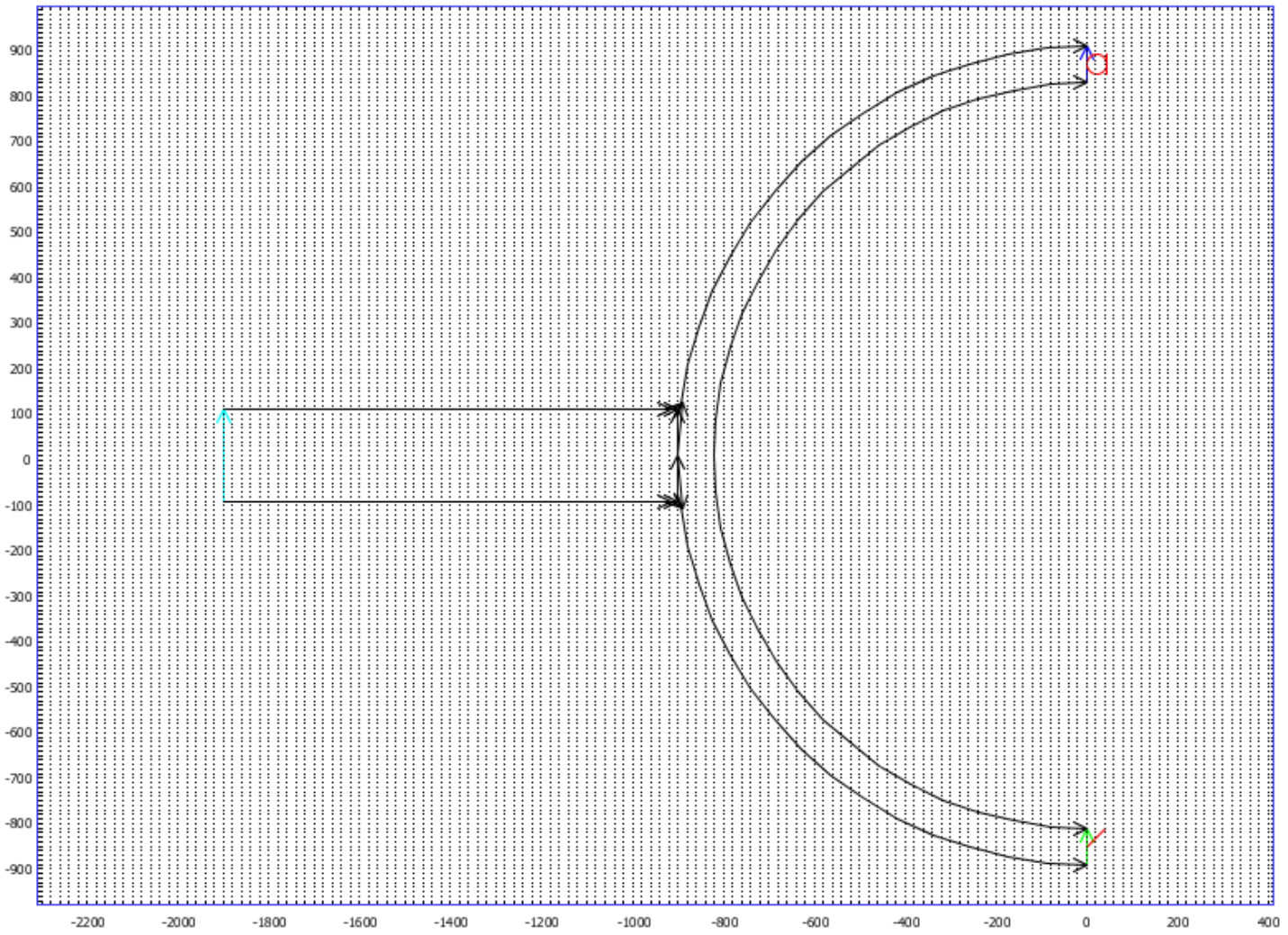
We calculated the thickness to have the same area for the section.

(IPEarea)/200 = 58mm

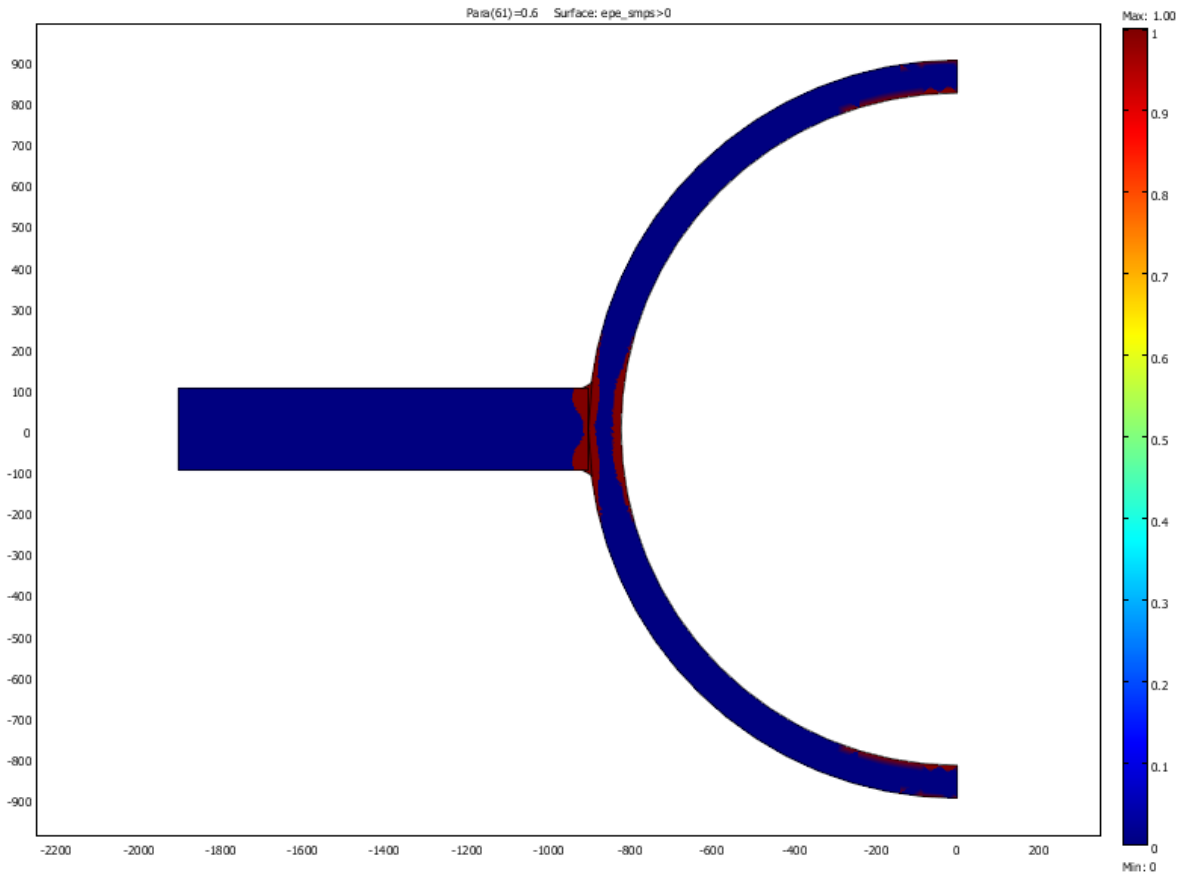
We calculated also the thickness of the weld.

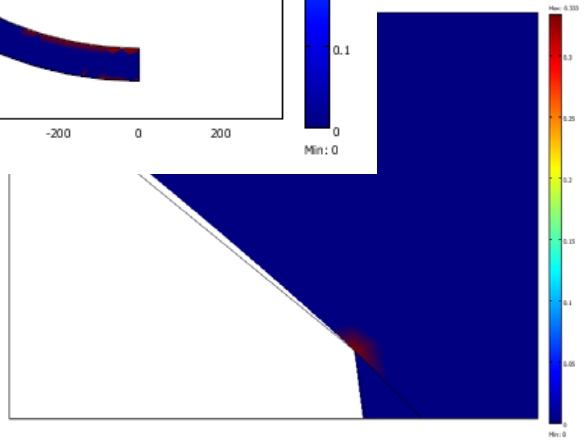
(IPEarea+Weldarea)/230=52,8mm

Tension - Compression



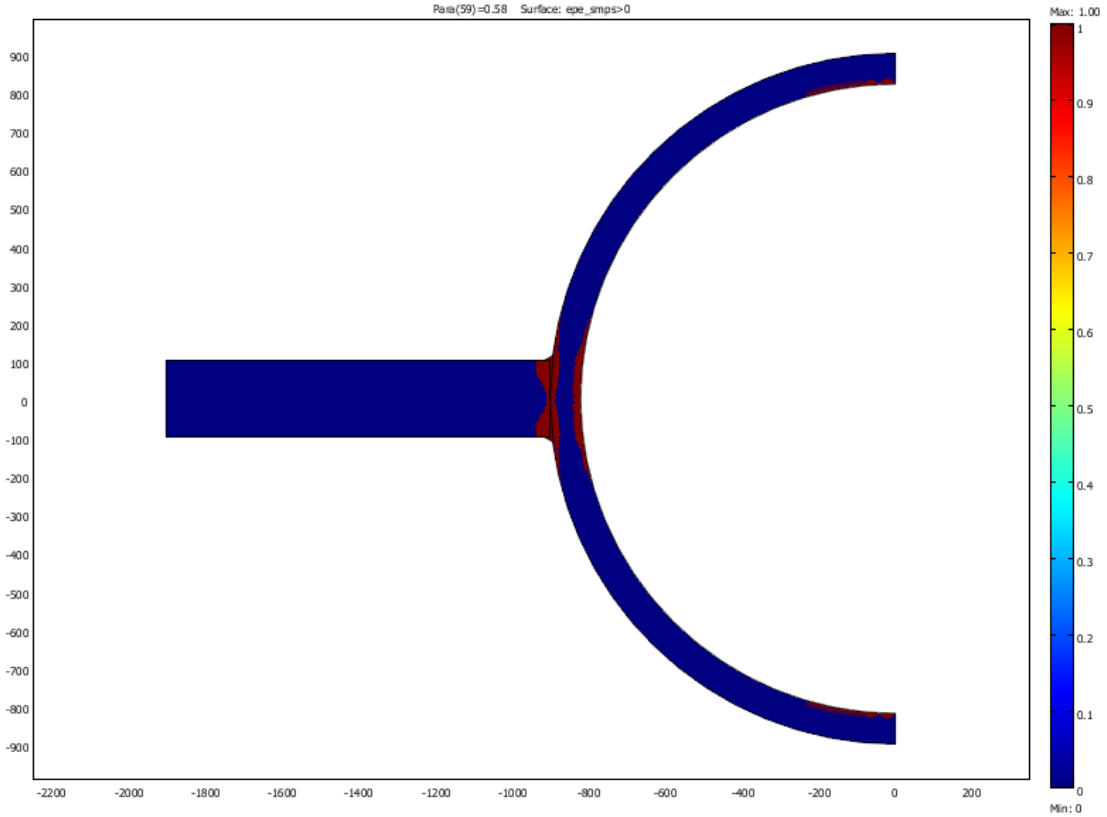
Tension

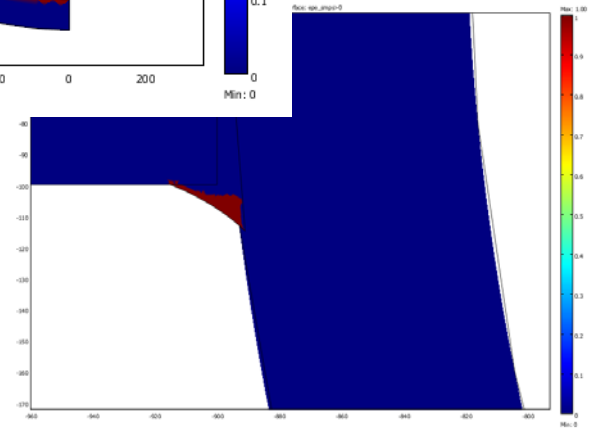




Plastification starts at 55 kN

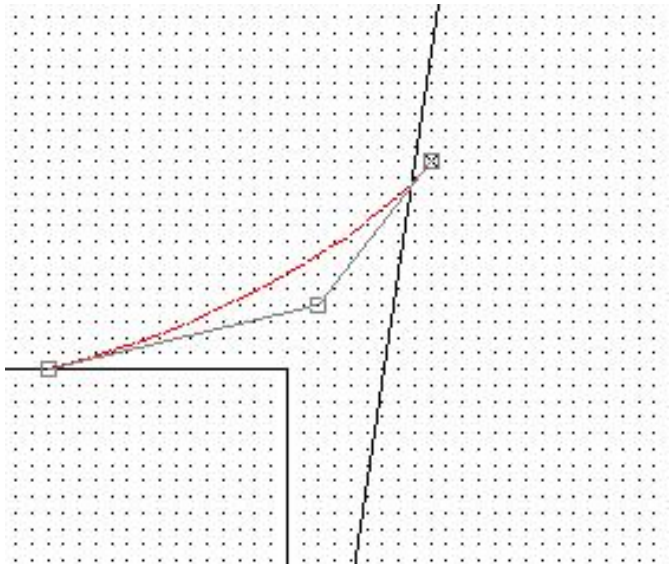
Compression

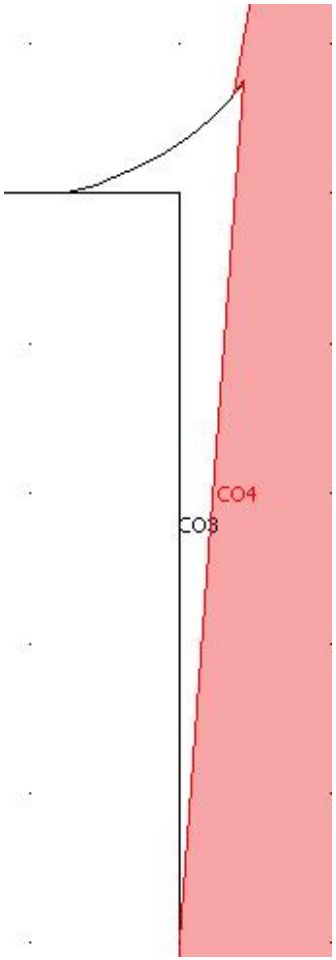




Plastification starts at 82,5 kN

Drawing





Because of the grid in Comsol, we had to make an approximation in the drawing.

$$I_x = \frac{\pi(d_o^4 - d_i^4)}{64}$$

$$\Downarrow$$

$$I_x = \frac{\pi(180^4 - 164^4)}{64}$$

$$\Updownarrow$$

$$I_x = 1600 \cdot 10^4 [cm^4]$$

$$J_x = \frac{bh^3}{12}$$

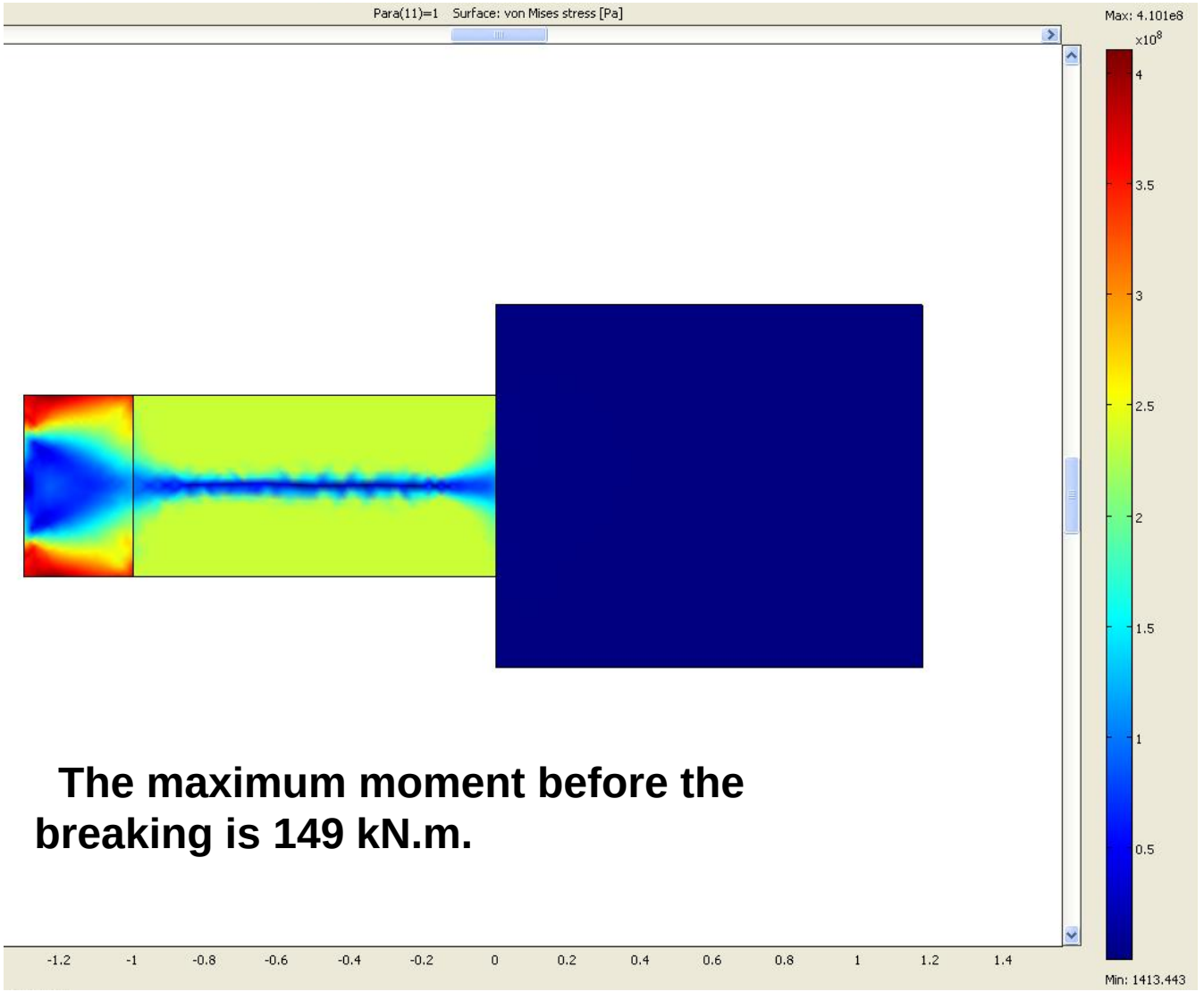
$$\Downarrow$$

$$h = (12 \cdot 160 \cdot 10^4)^{\frac{1}{4}}$$

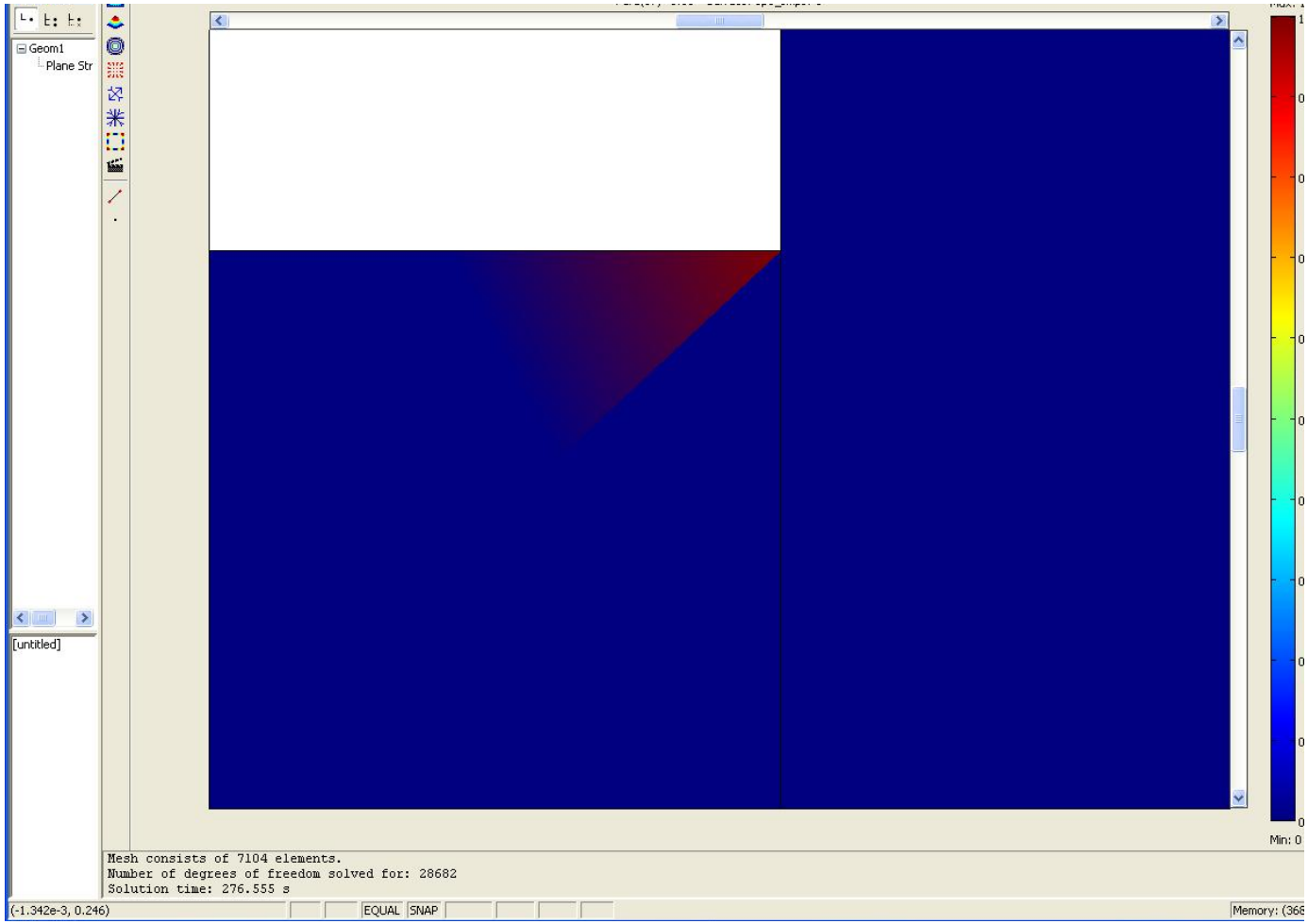
$$\Updownarrow$$

$$h = 117.7 [cm]$$

First calculation with a moment involved by two horizontal forces

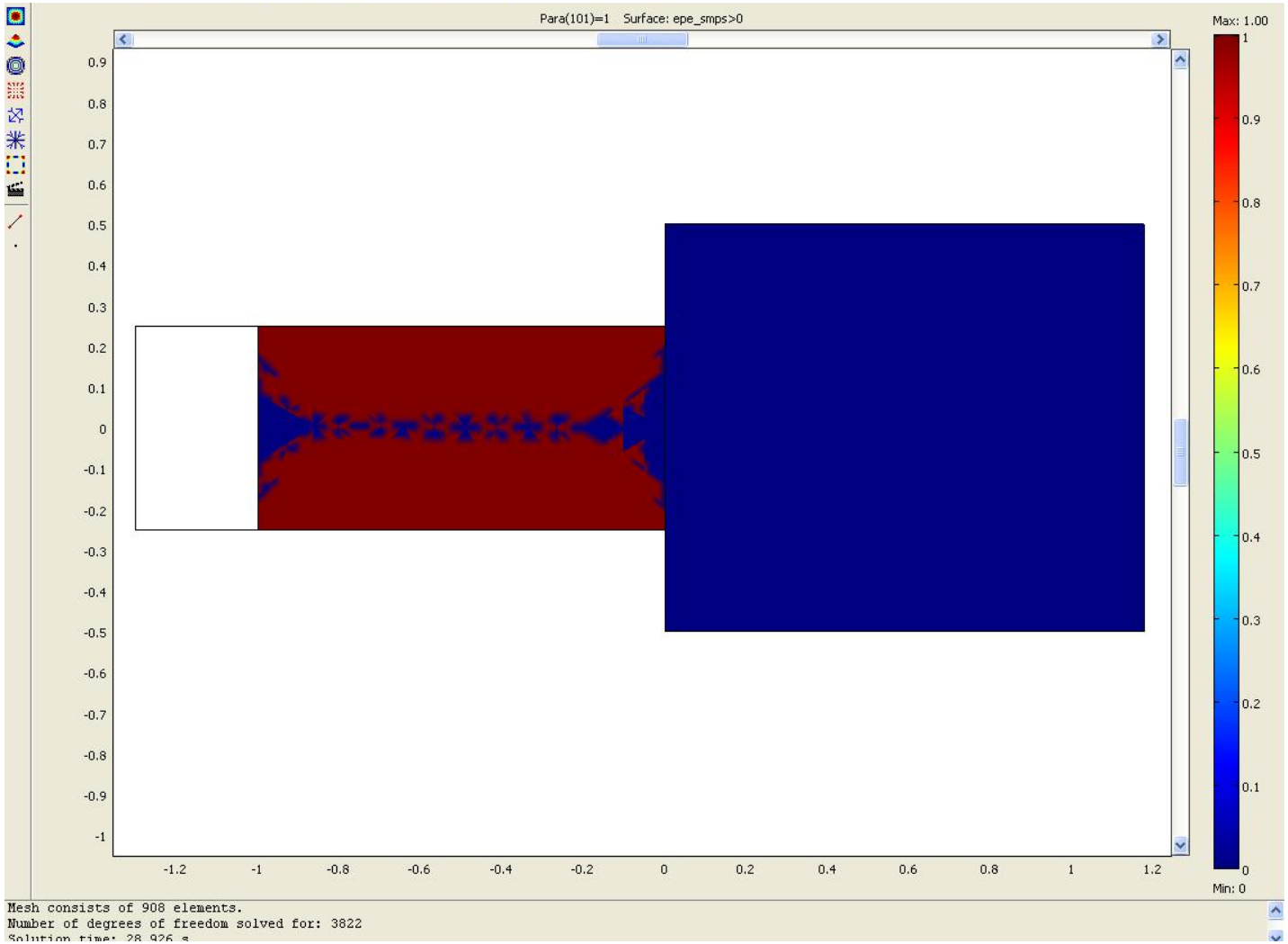


The maximum moment before the breaking is 149 kN.m.



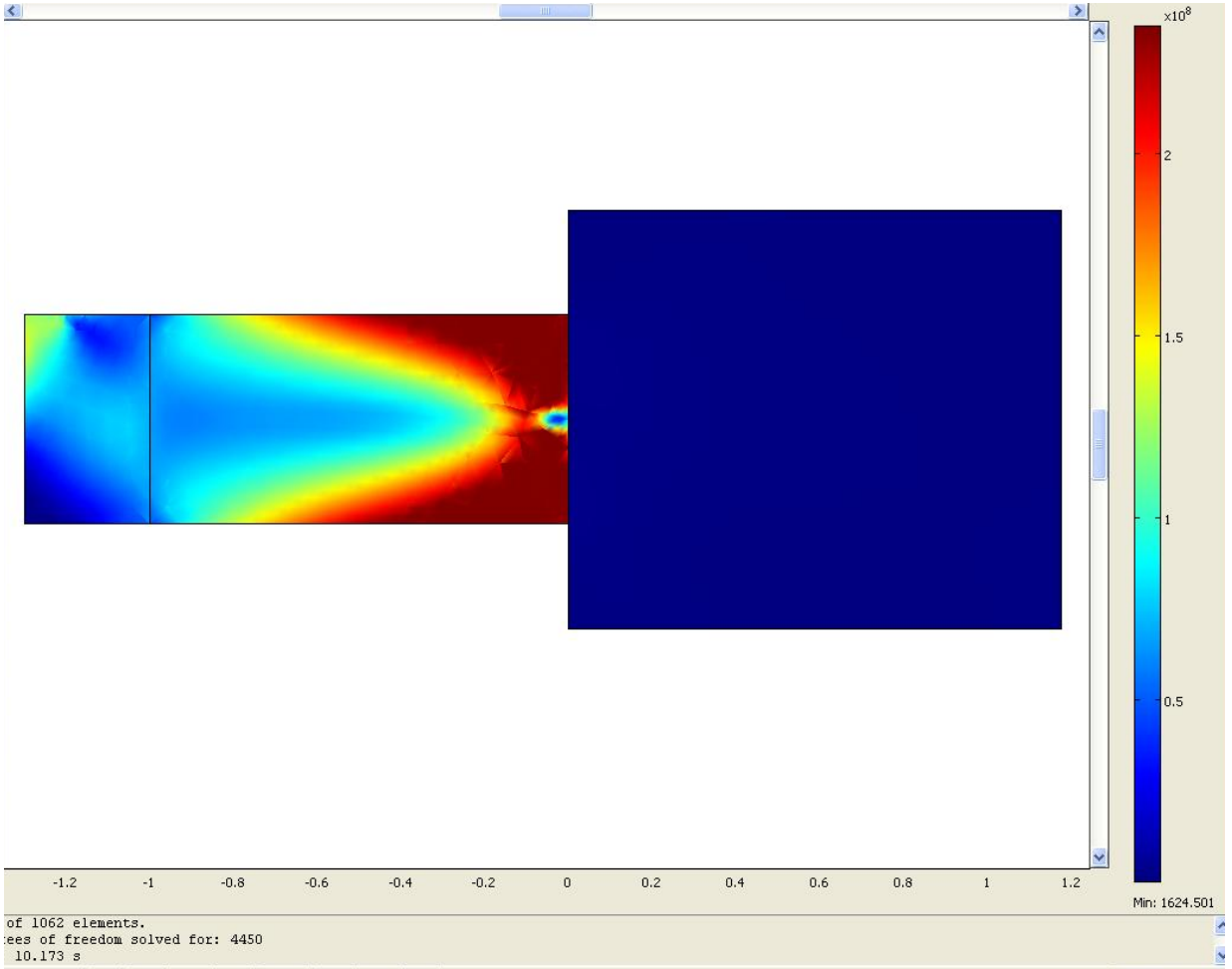
Plastification starts for a bending moment of 53,64 kN.m.

It starts at the connection between the tube and the IPE profile.

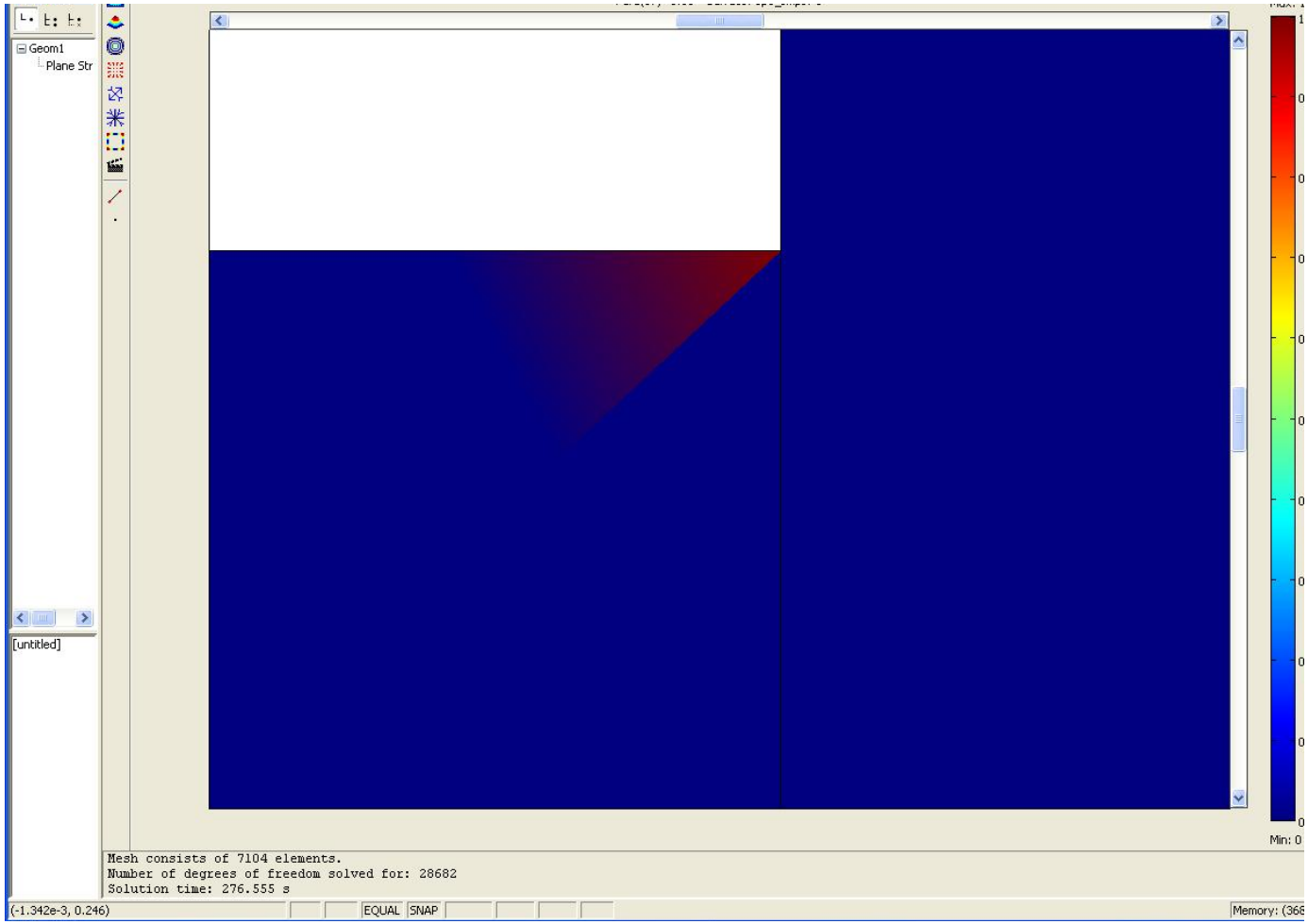


The structure totally plastifies in the middle of the beam.

Second calculation with a moment involved by a vertical force

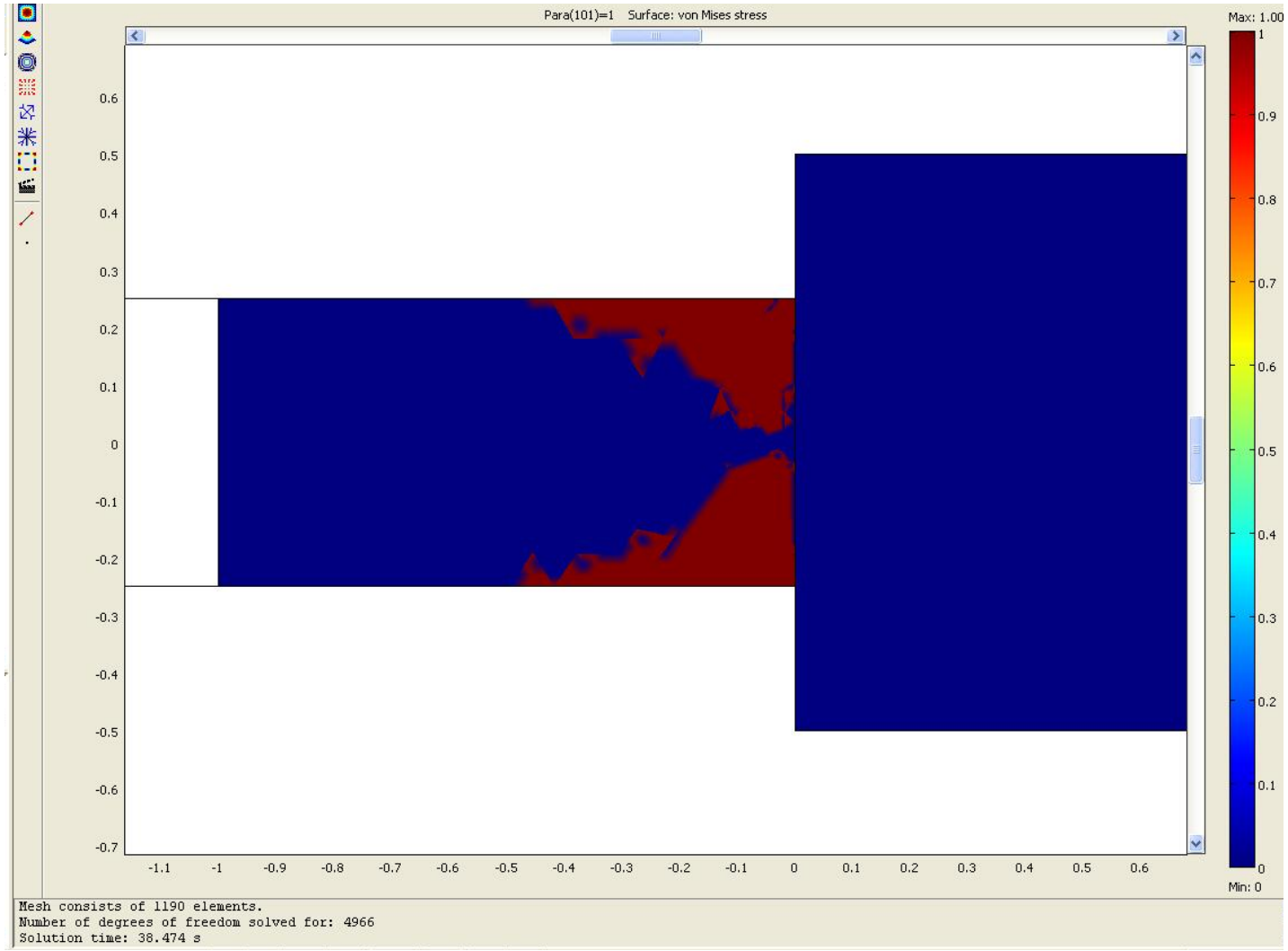


The maximum moment before the breaking is 149 kN.m.



Plastification starts for a bending moment of 64,4 kN.m.

It starts at the connection between the tube and the IPE profile.



The structure totally plastifies at the level of the joint.

Thank you for your attention!