# Bottom built in and pinned top connections

PH-DT Engineering Office, CERN

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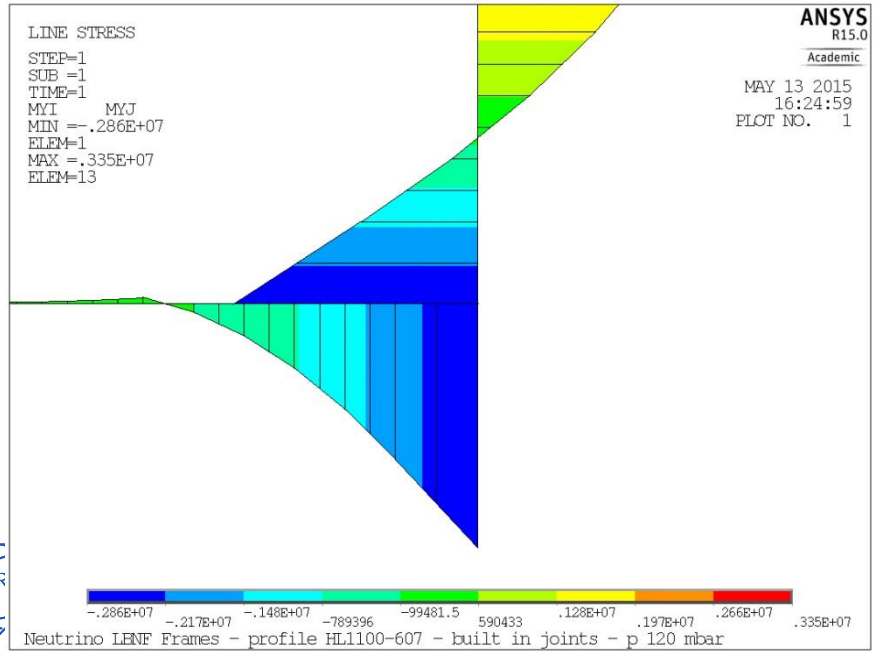
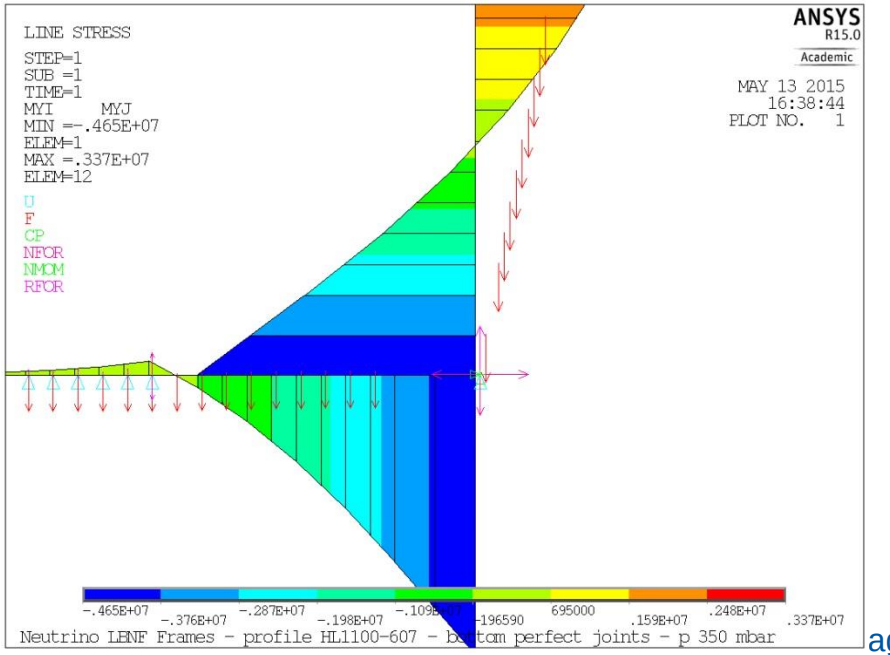
# Status today

- Baseline:
  - Solid corner pieces at bottom: splice connection at 3.4 m from bottom (shaft available envelope 3.7 m)
  - **Splice must be able to take moment of 1-2 MN m and Shear of 3 MN (this to cope with possible uncertainties in transition point)**
  - Bolted connection on top (better stability, splice calculated)
- Bolted connections all calculated (Joao will summarise results)
- Short side walls: analyses yet to be done
  - longitudinal force retaining system, bracings
  - Pinned or M connection at top → **see next slides for pinned connection**
  - M connection at bottom → verify transverse connection to floor I beams
- Behaviour of bottom elements (floor): option to be discussed for the review (Piet)
- Work ahead:
  - Final proposal short side walls design
  - Static and Buckling final results and bracings: add bracing, ignore grid
  - Full run of SCIAeng EC3 verification
  - Verification of ASME requirements Pm+Pb < 1.5 S for div 1 and div 2
  - Verification of ASME requirements for welds
  - Verification of ASME requirements for bolts
  - Seismic calculations (no time for the review)
  - Material x the review

# A note on the moment transition

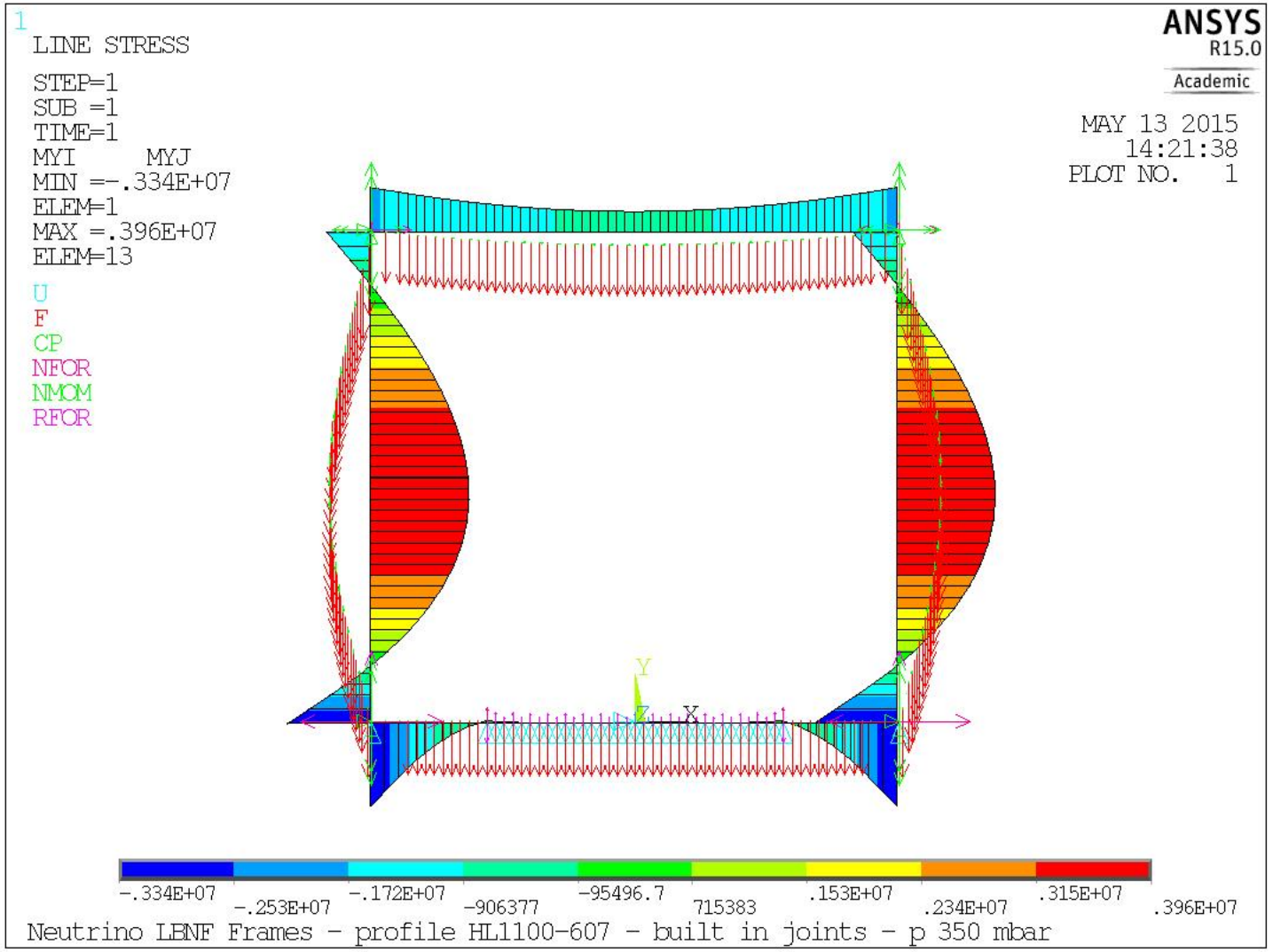
- The transition point of M along the vertical beam is highly affected by:
  - The rotational stiffness of the bottom joint
  - The position of the bottom support (or contact point)
  - (The behaviour of the floor beam)
- The top pressure 20, 120, 350 mbar does not influence the transition point
- The splice joint (seen these effects) must be capable of taking Moments and Shear with some good safety factors
- Transition at 1.9 (+0.55) for RotStiff =1250 MN m/rad and at 2.66 (+0.55) for perfect joint stiffness



# Baseline: all M connections

- **HL1100-607 :** beam – joint stiffness calculated and accounted for in FEA



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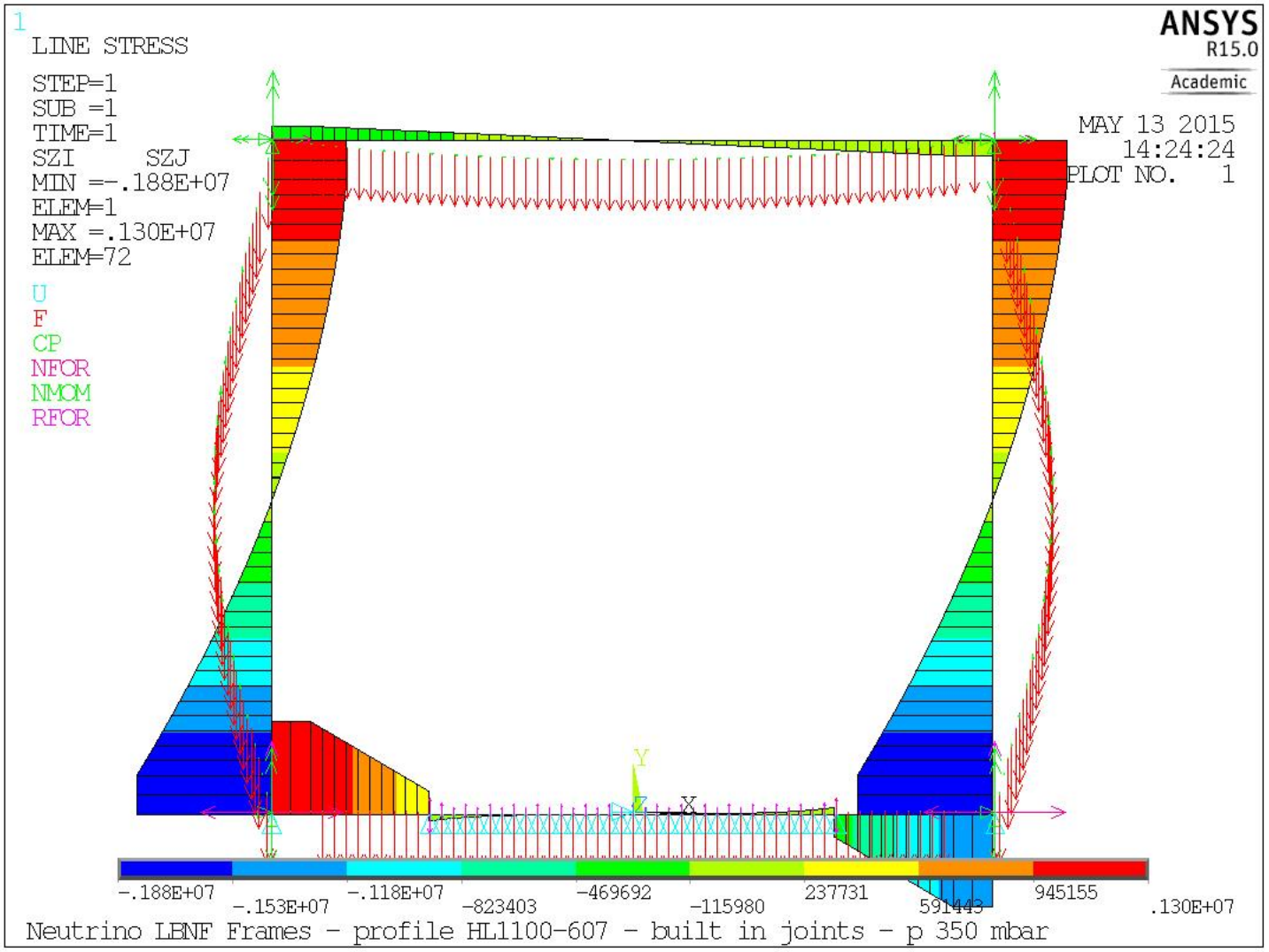

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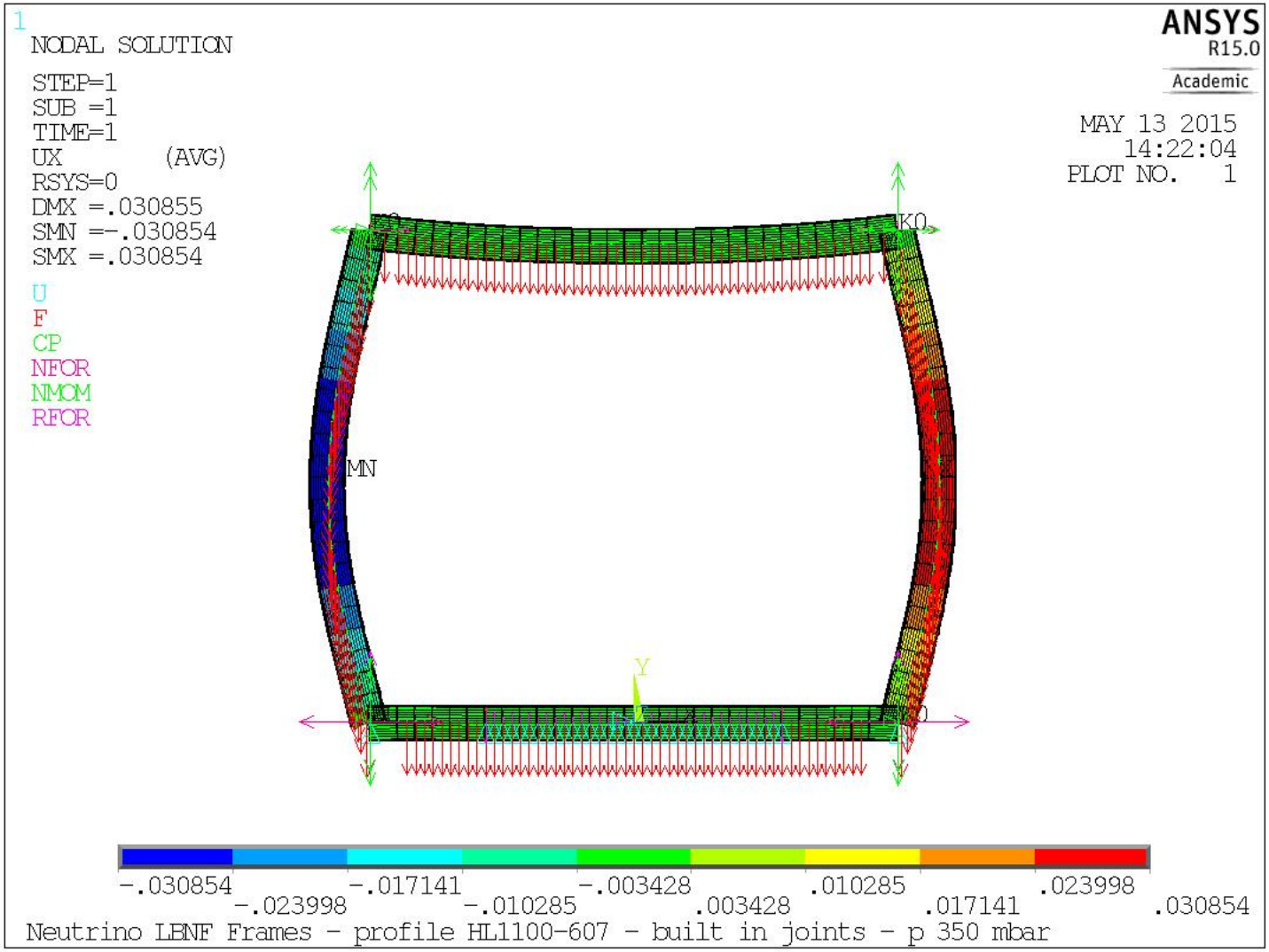

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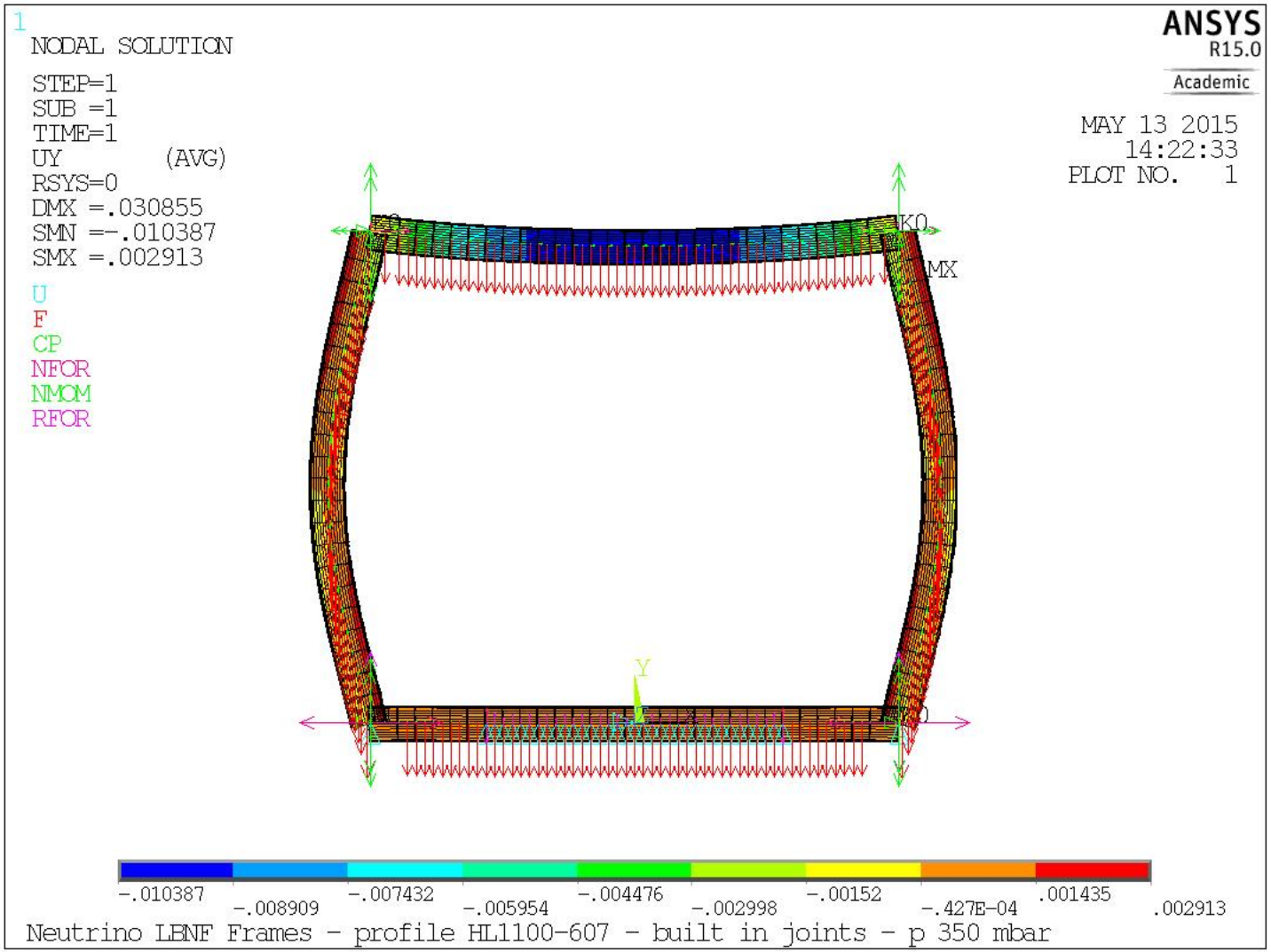

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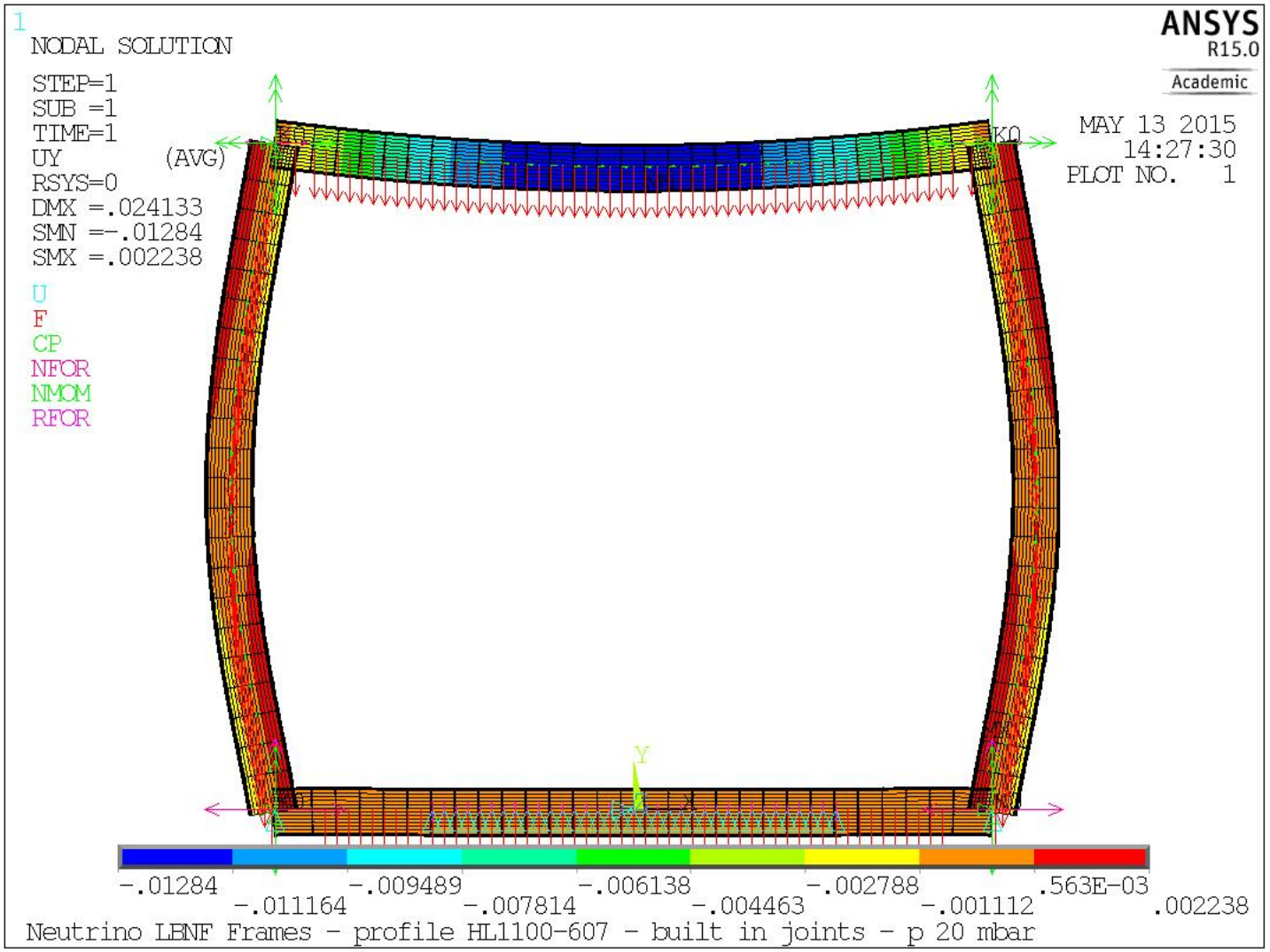

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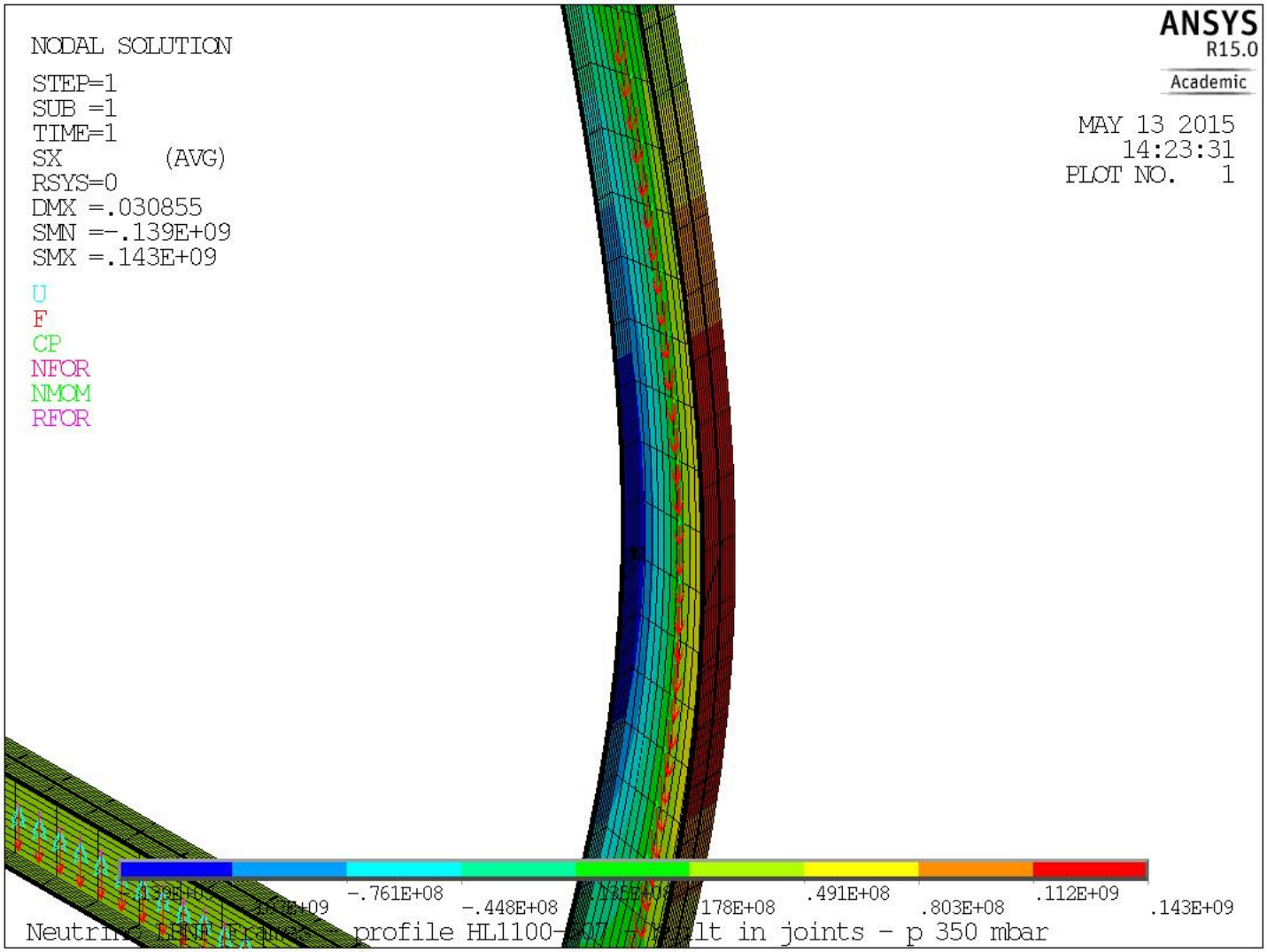

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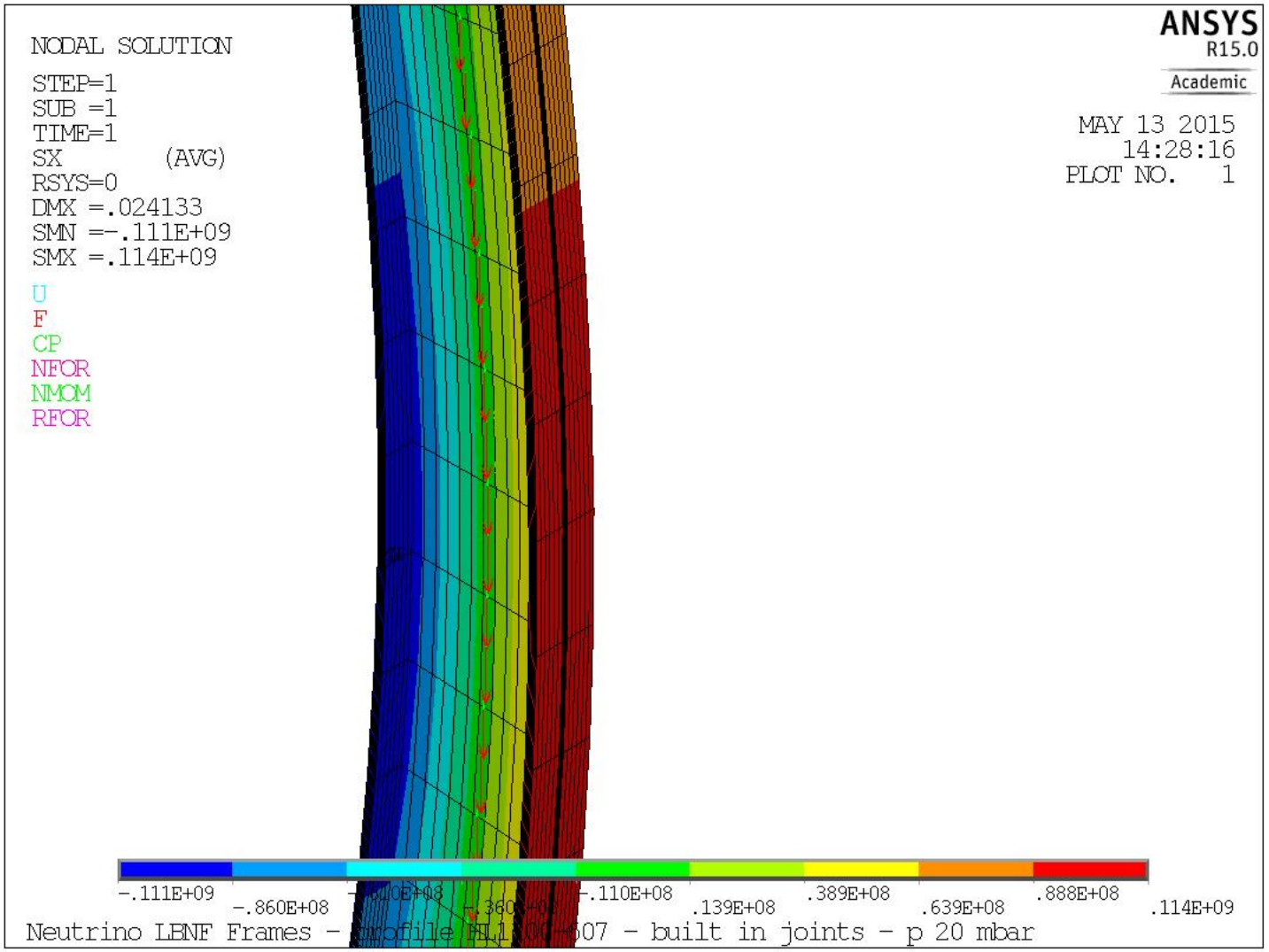

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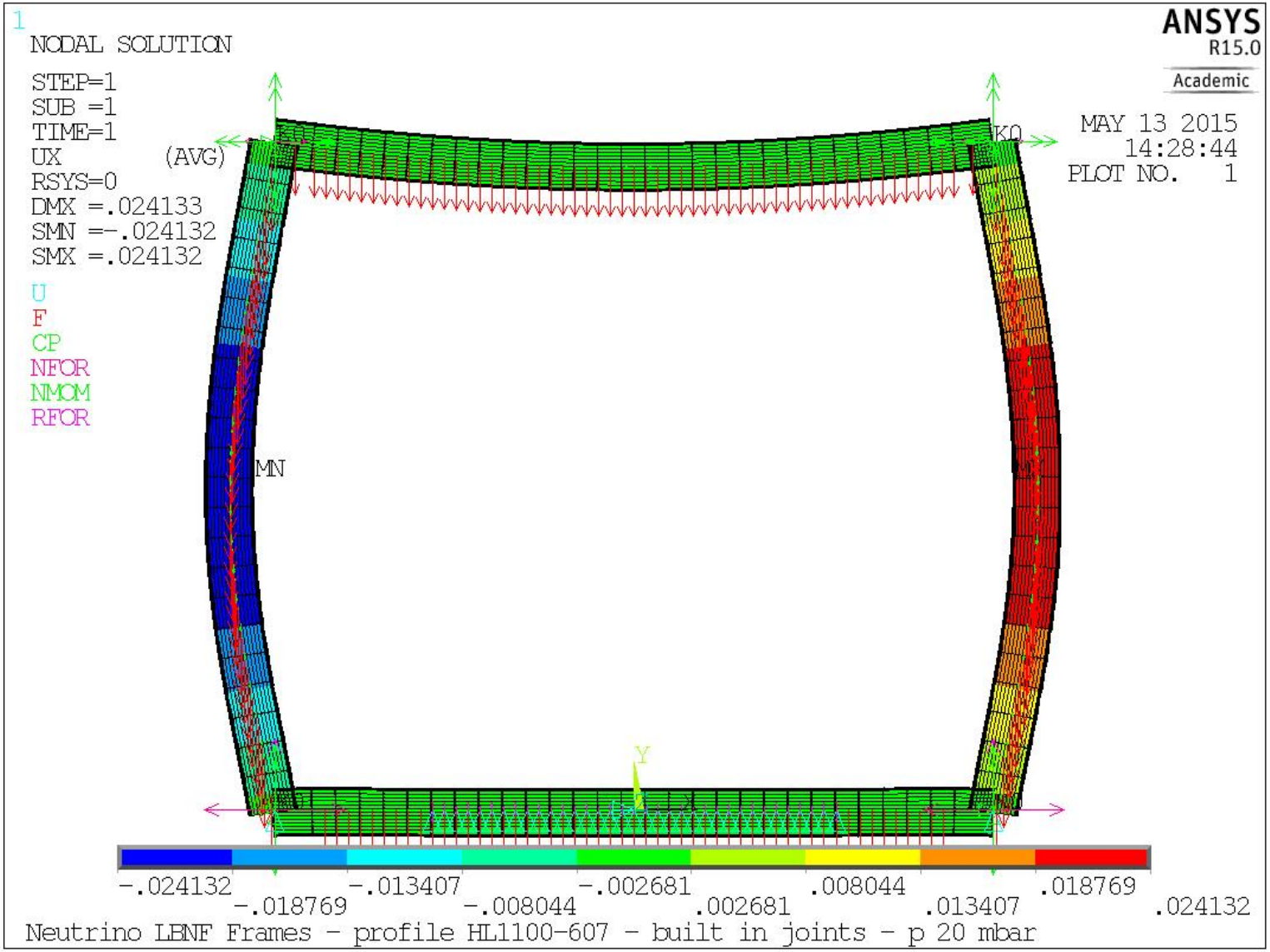
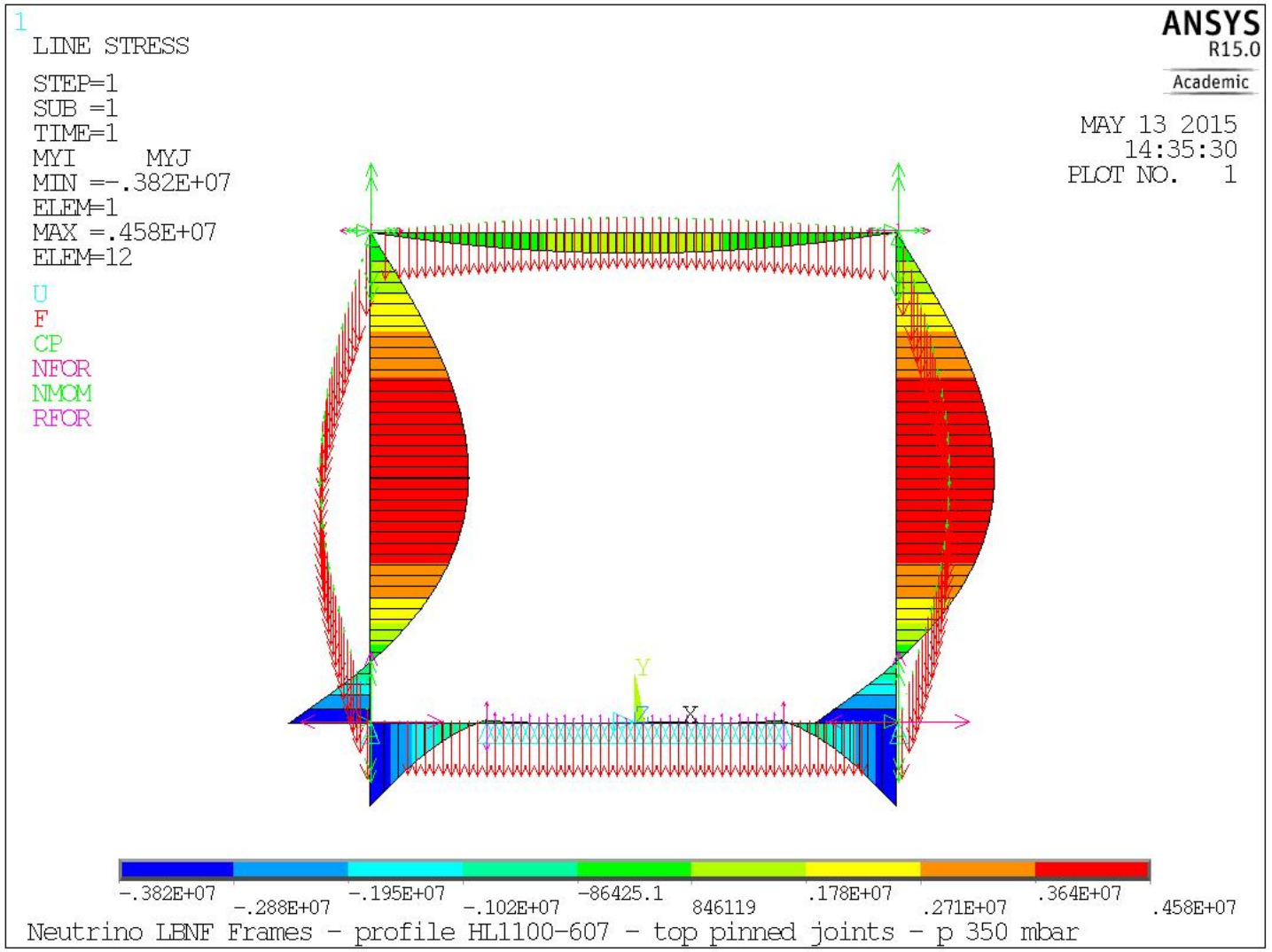


# Top connections pinned



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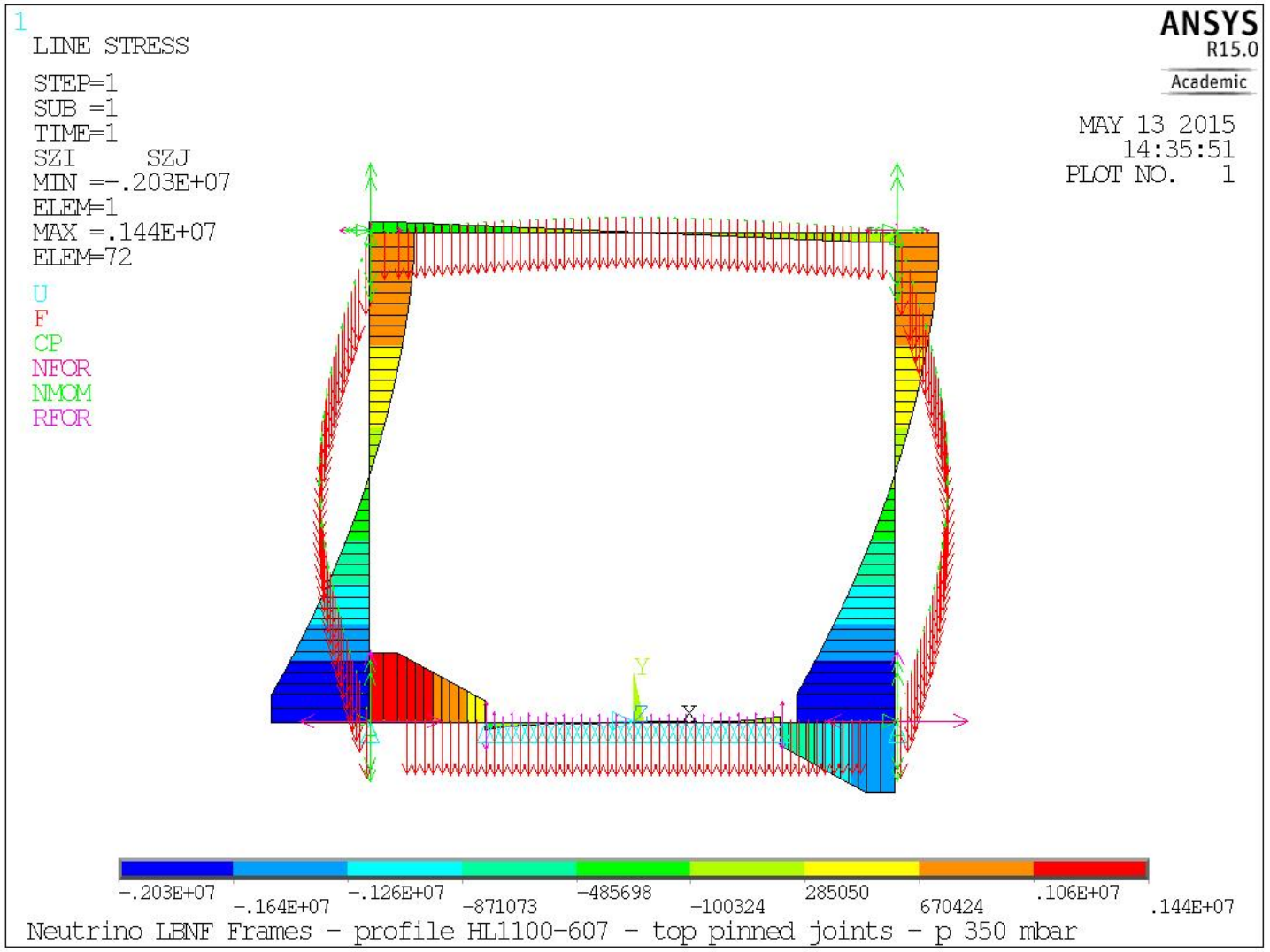

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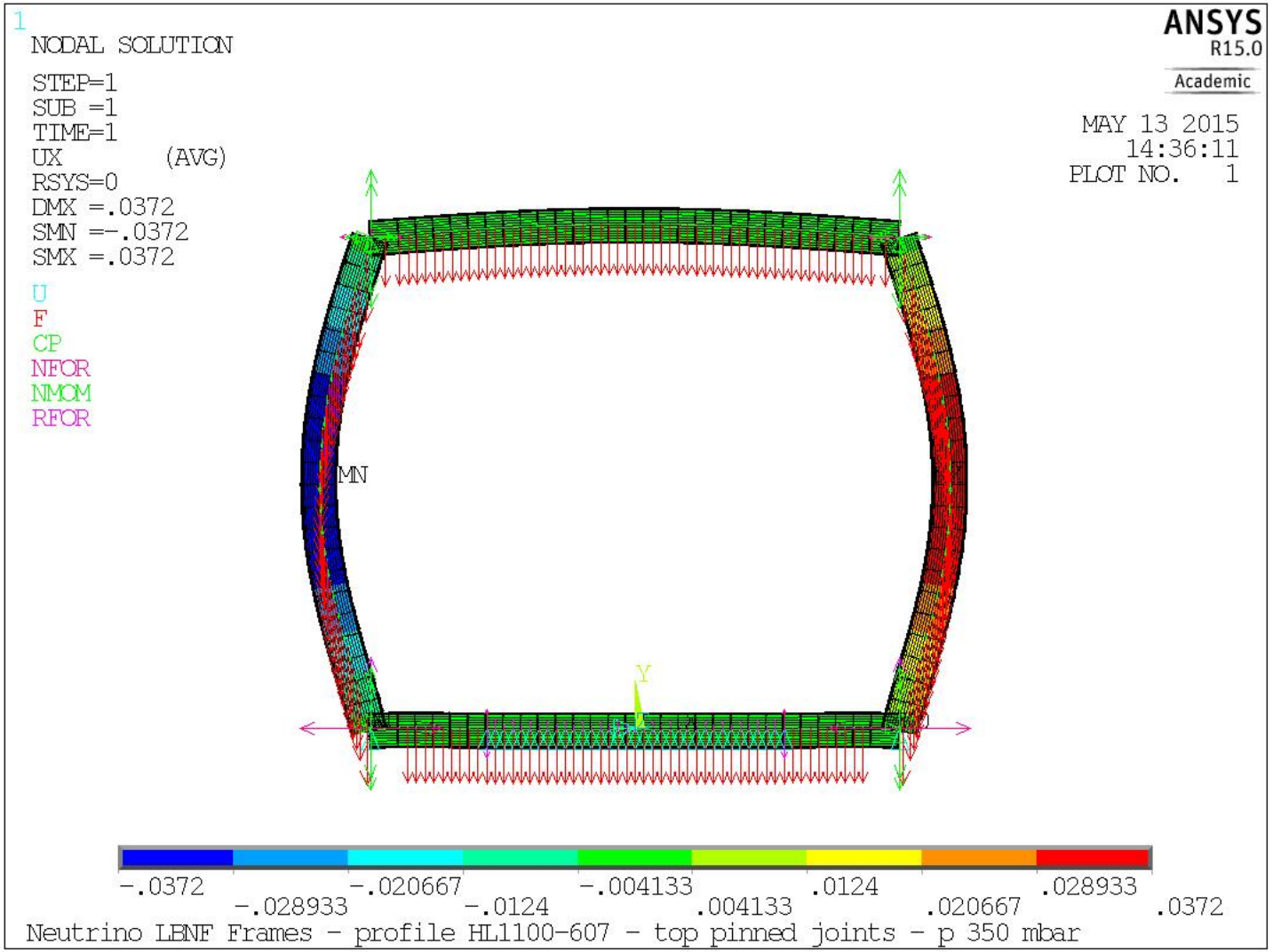

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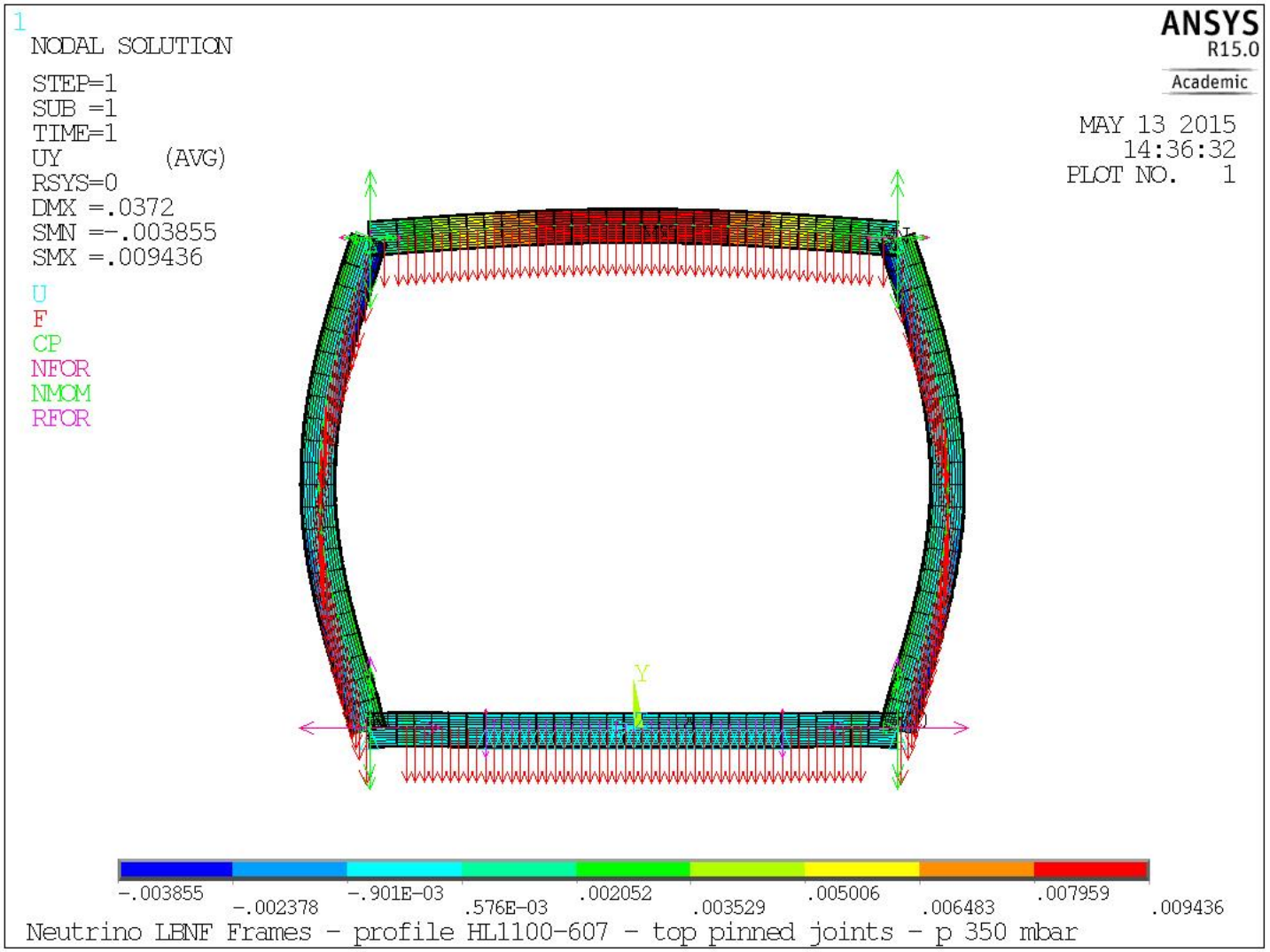

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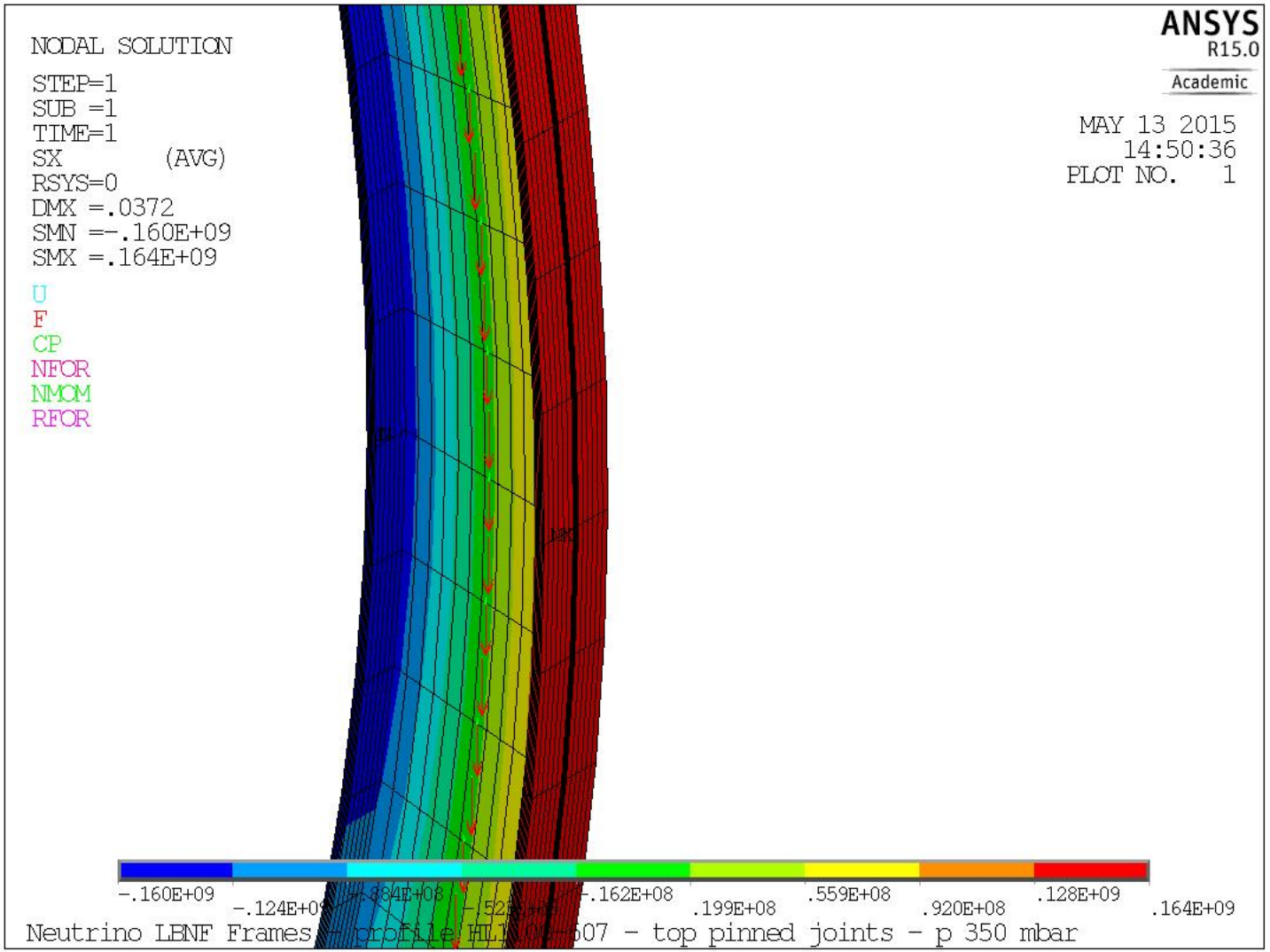

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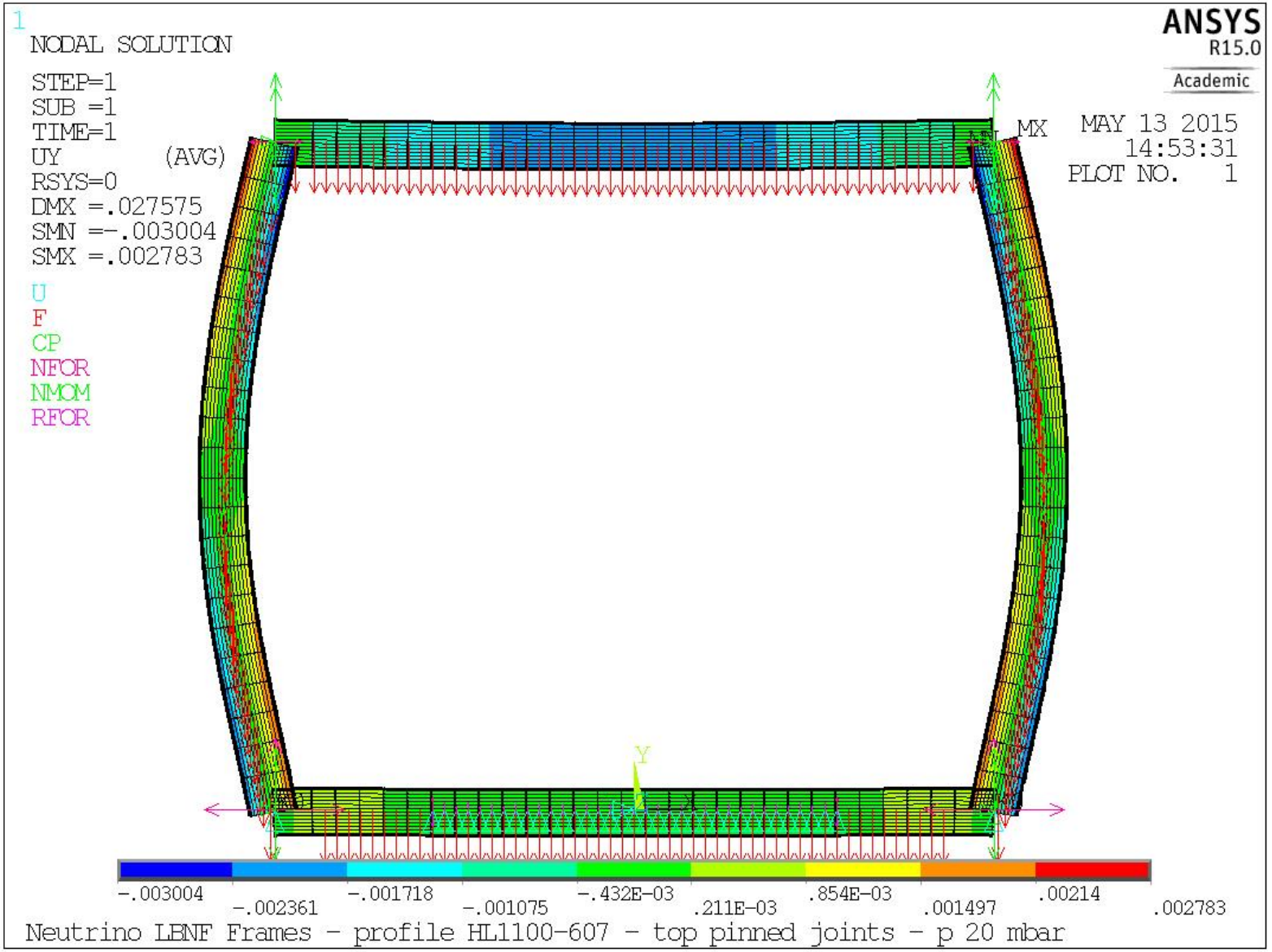

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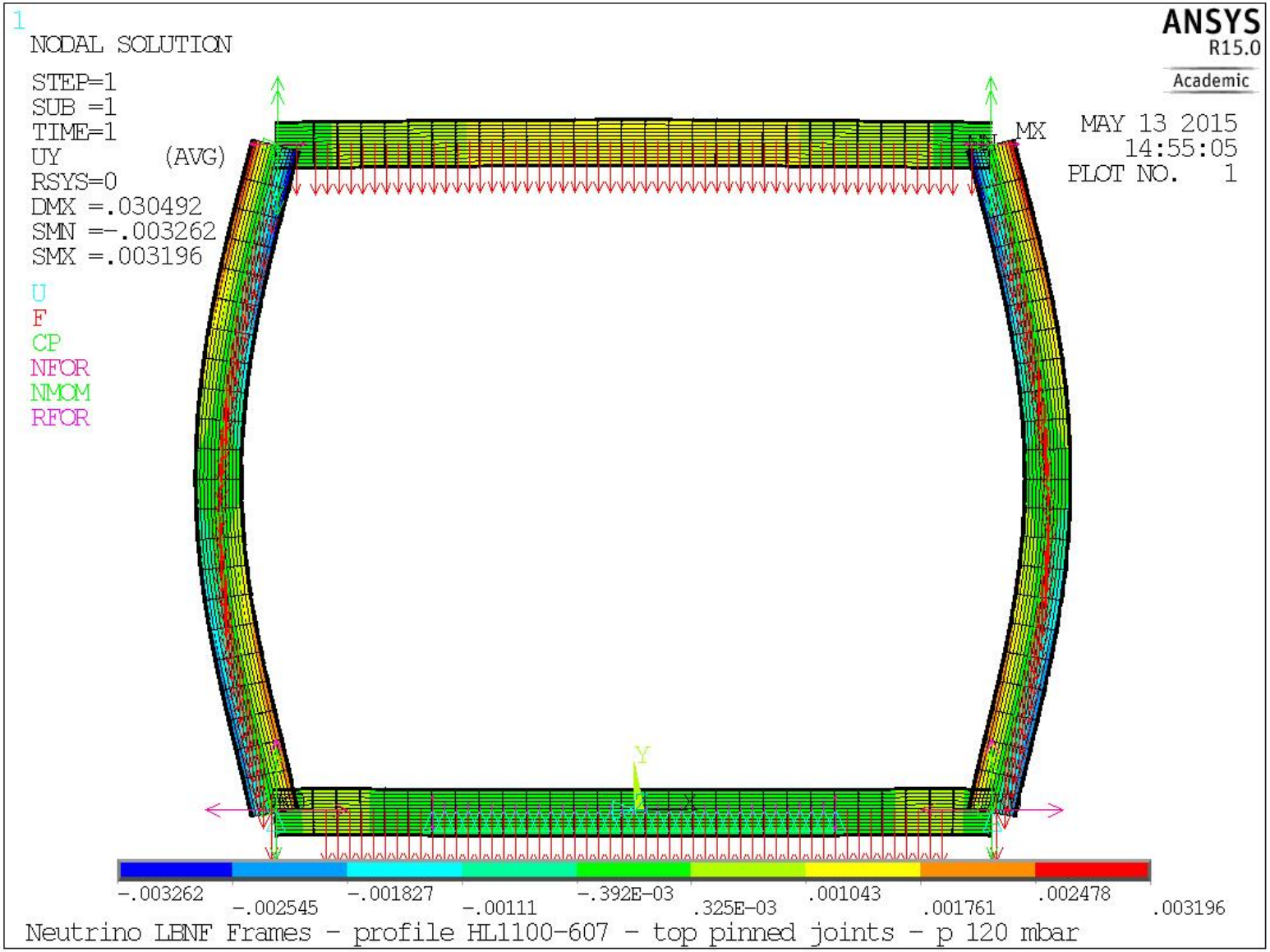

# Material

# Steel Grades

- Steel S355 (EC properties for t>40mm)
  - $\sigma_y$=335 MPa → $\sigma_y$/1.5=223 MPa
  - UTS=470 MPa → **UTS/3.5=134 MPa** → UTS/2.4=195 MPa

- Small Improvements by moving to S450 (EC properties for t>40mm):
  - $\sigma_y$=410 MPa → $\sigma_y$/1.5=273.3 MPa
  - UTS=550 MPa → **UTS/3.5=157 MPa** → UTS/2.4 =229 MPa