

ARCOPLAST

12 ft Free Standing Wall

Finite Element Model

By

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Wall Model

- Three 4' x 12' wall panels
- 3/4" total panel thickness
- Chopped strand mat in MODAR resin
- Steel purloins 6" high with 1.5" flanges, 0.1" thick
16" centers, back to back at panel seams (48")

Material Properties

- Chopped Strand Mat
 - Elastic Modulus $E_x = E_y = 1 \times 10^6$ psi
 - Strength $\sigma_x = \sigma_y = 1 \times 10^4$ psi
 - Strain to Failure = $\varepsilon = 0.01$ or 1%
- Steel $E_x = E_y = 3 \times 10^7$ psi
 - Elastic Modulus $E_x = E_y = 3 \times 10^7$ psi
 - Yield Strength $\sigma_x = \sigma_y = 5.3 \times 10^4$ psi
 - Strain to Failure = $\varepsilon = 0.0017$ or 0.17%

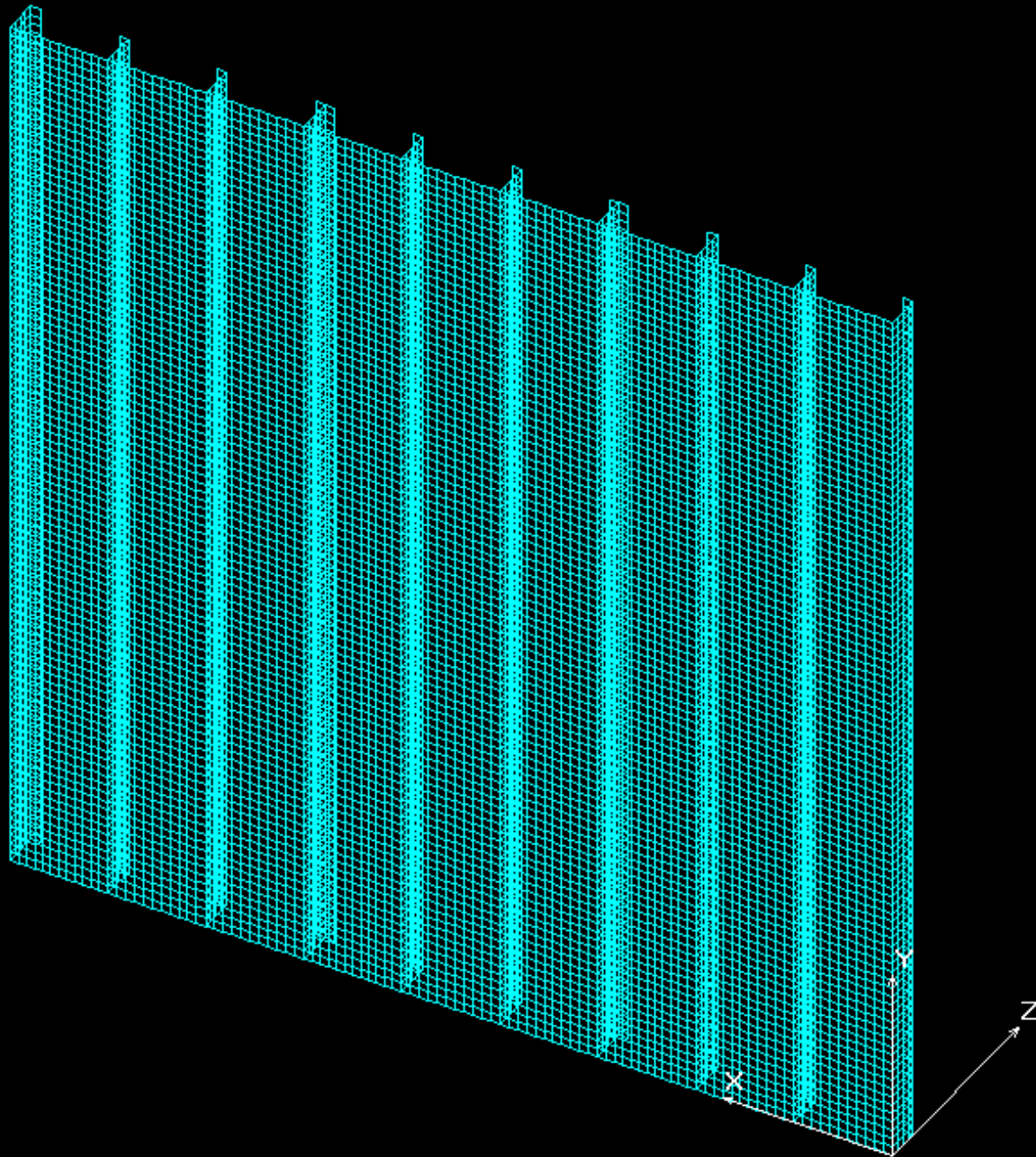
Wall Model Constraints

- Z displacement constrained to zero at top and bottom ends
- Y displacement constrained to zero at bottom end
- X displacement constrained to zero at one vertical edge

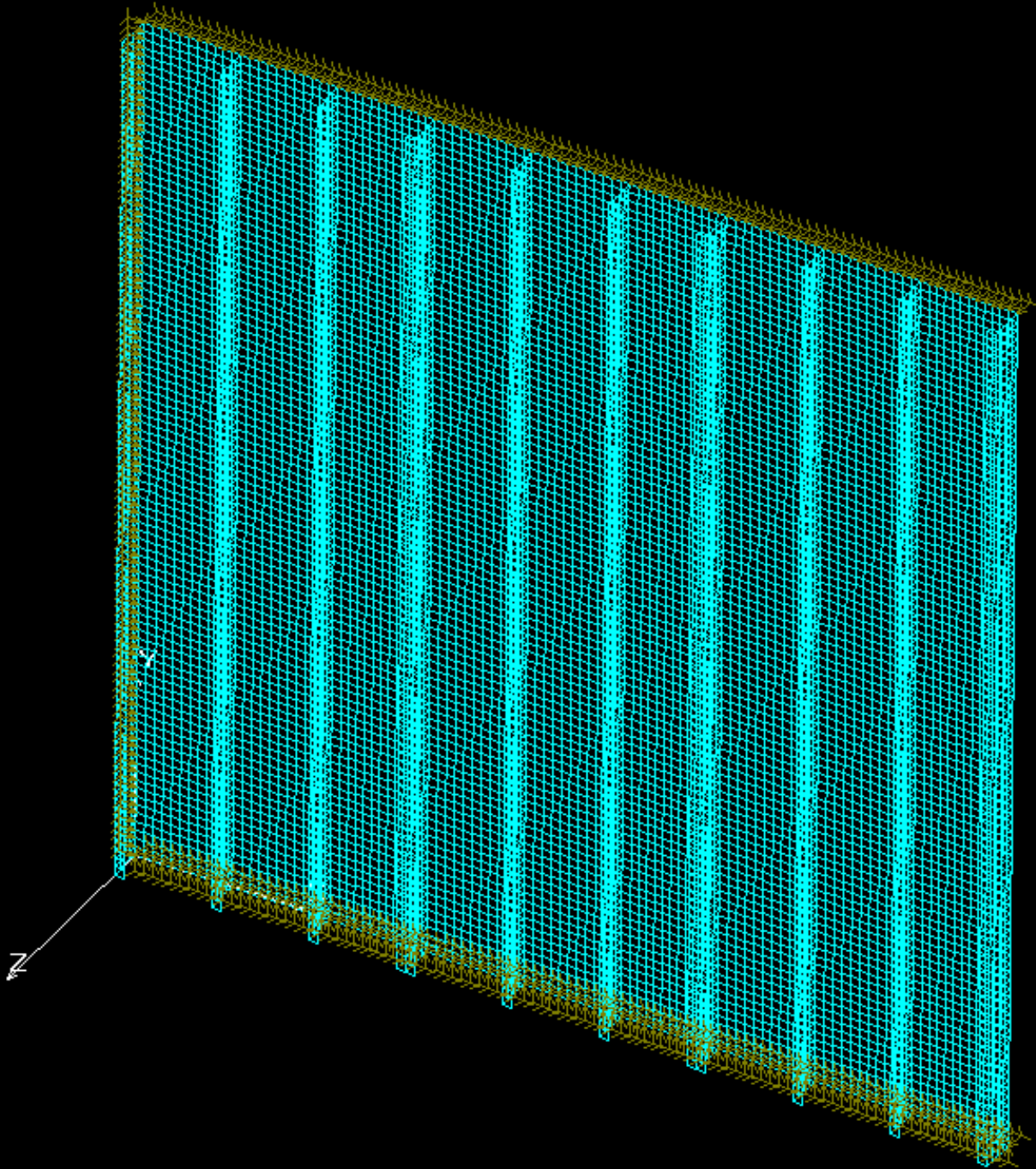
Load Cases

- Pressure load of 0.287 psi on panels for all load cases
- 2000 lb point load on frame 2 ft above floor (A)
- 2000 lb point load on frame 4 ft above floor (B)
- 2000 lb point load on frame 6 ft above floor (C)
- 2000 lb point load at panel middle 2 ft above floor (D)
- 2000 lb point load at panel middle 4 ft above floor (E)
- 2000 lb point load at panel middle 6 ft above floor (F)

Finite Element Grid

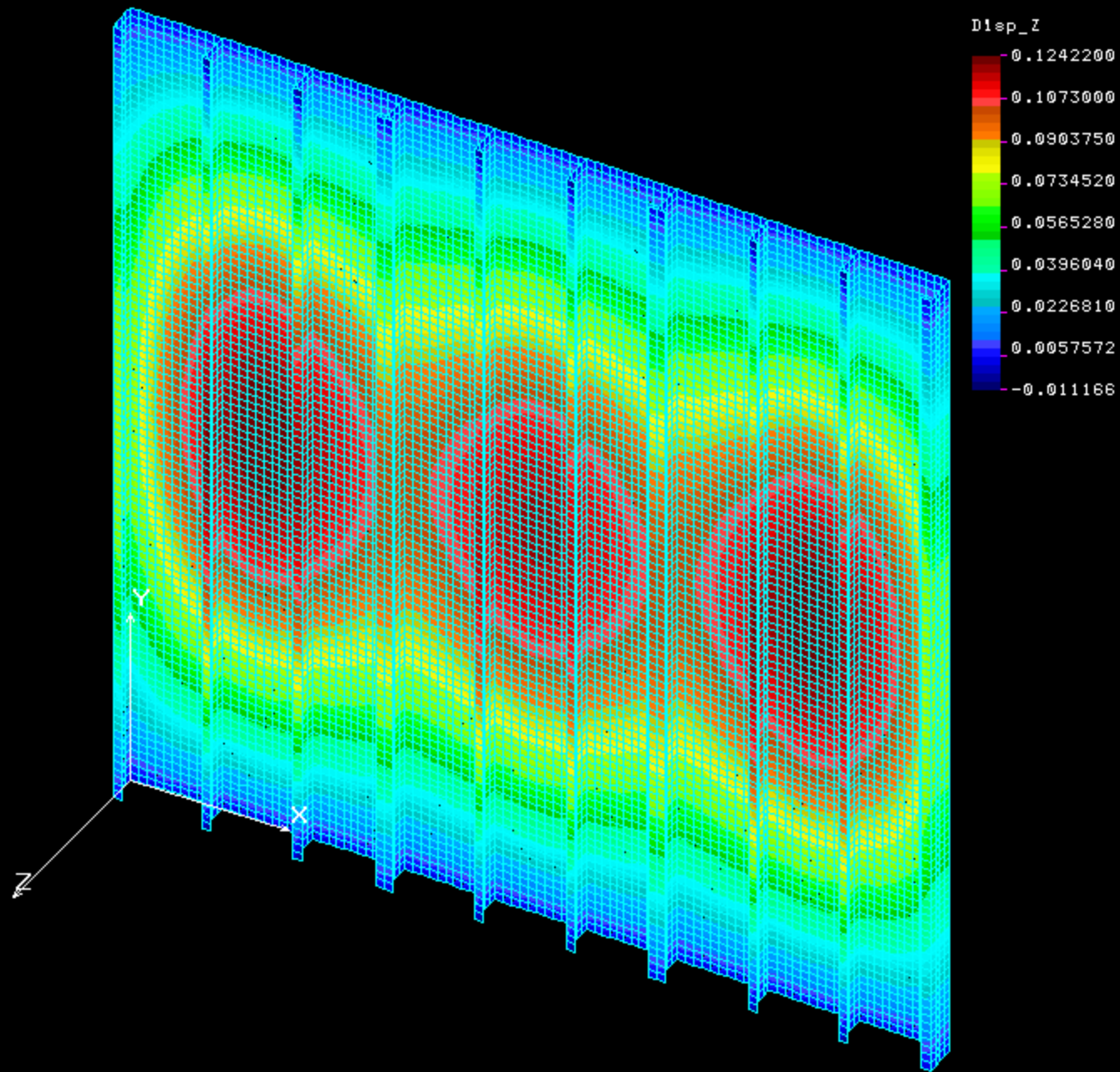


Constraints

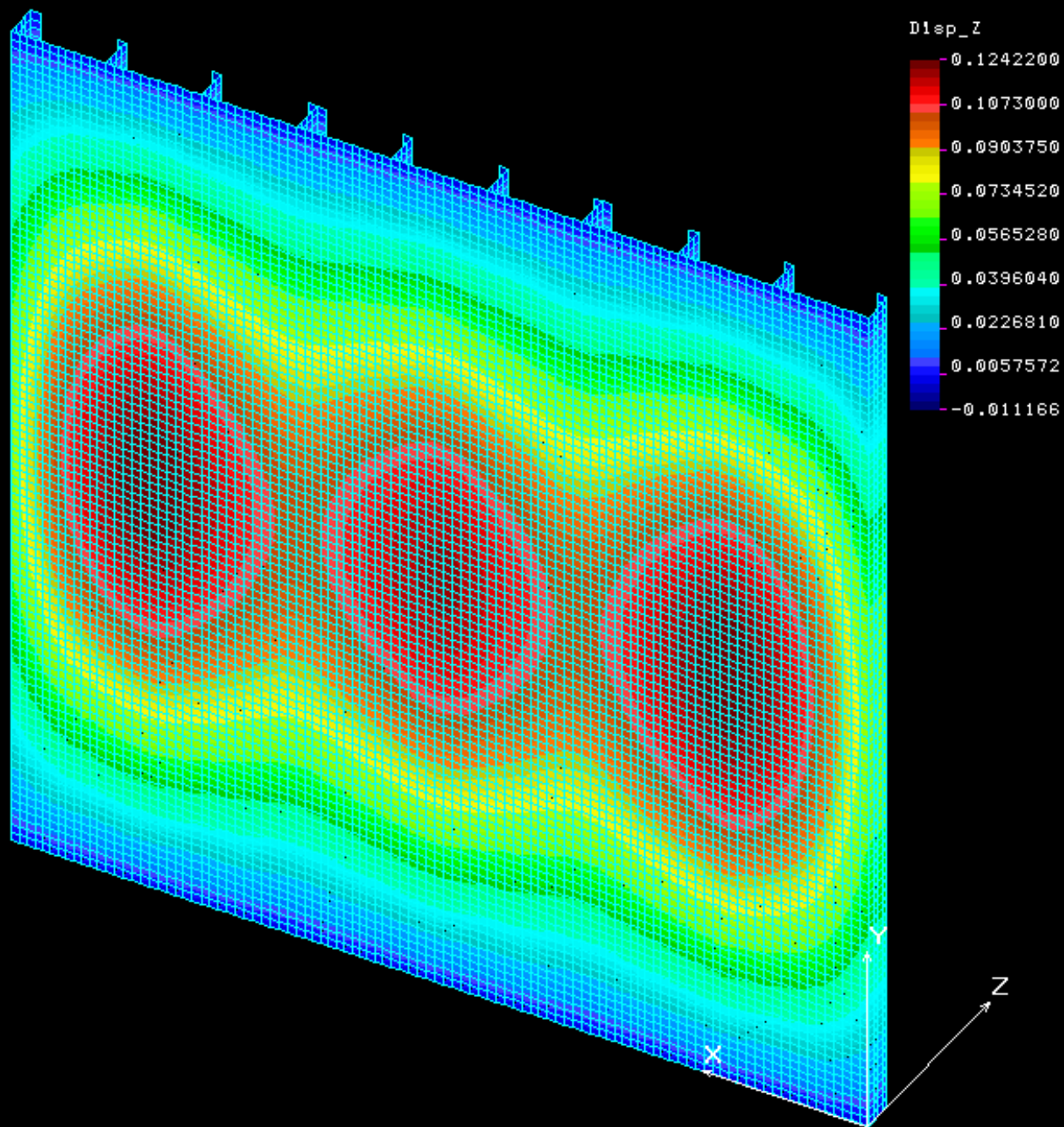


Pressure Load Only

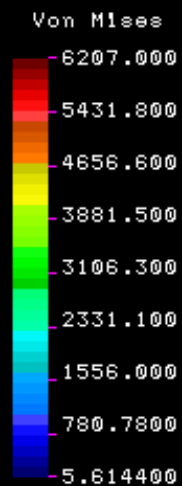
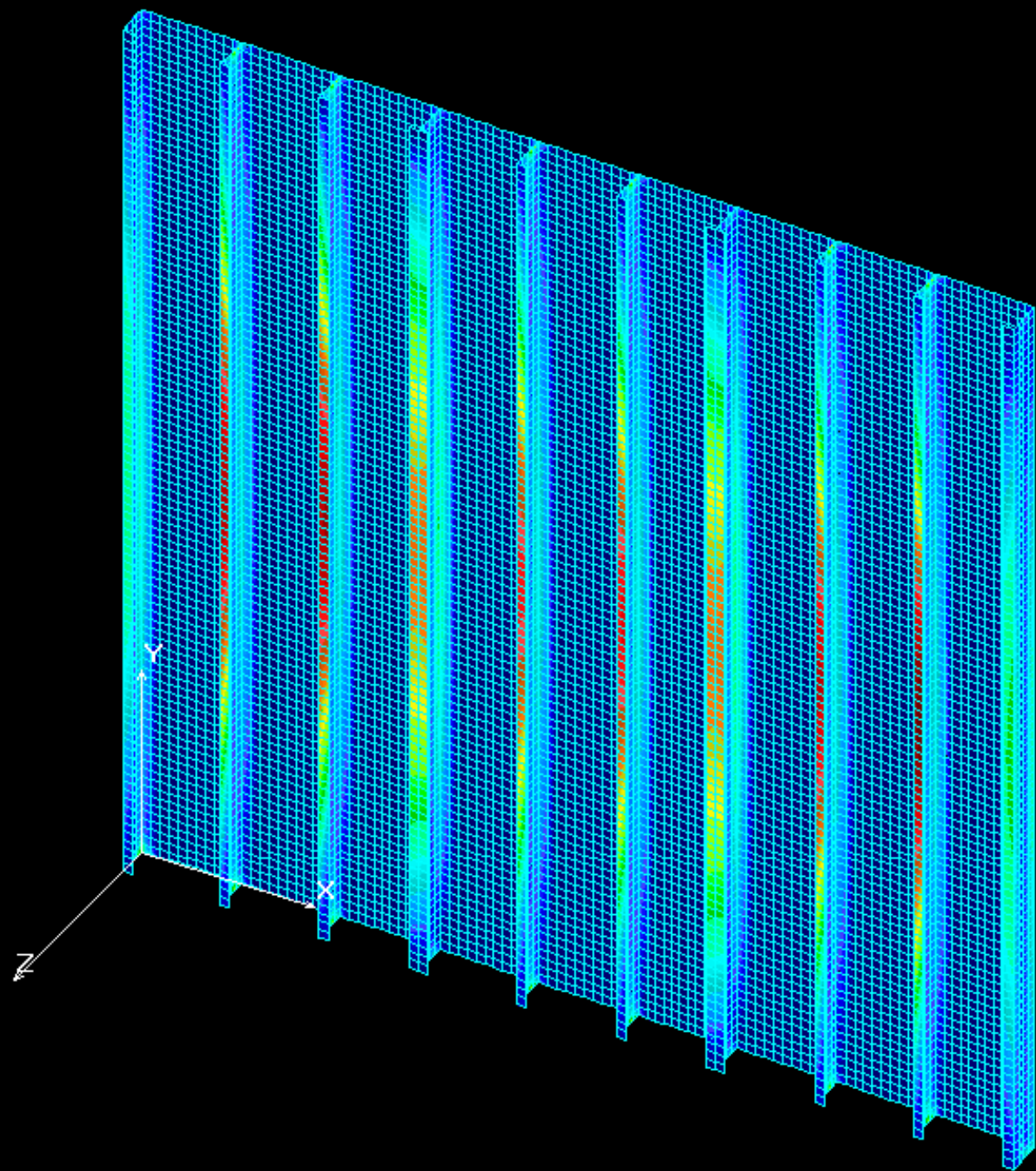
- 0.287 psi on wall panels



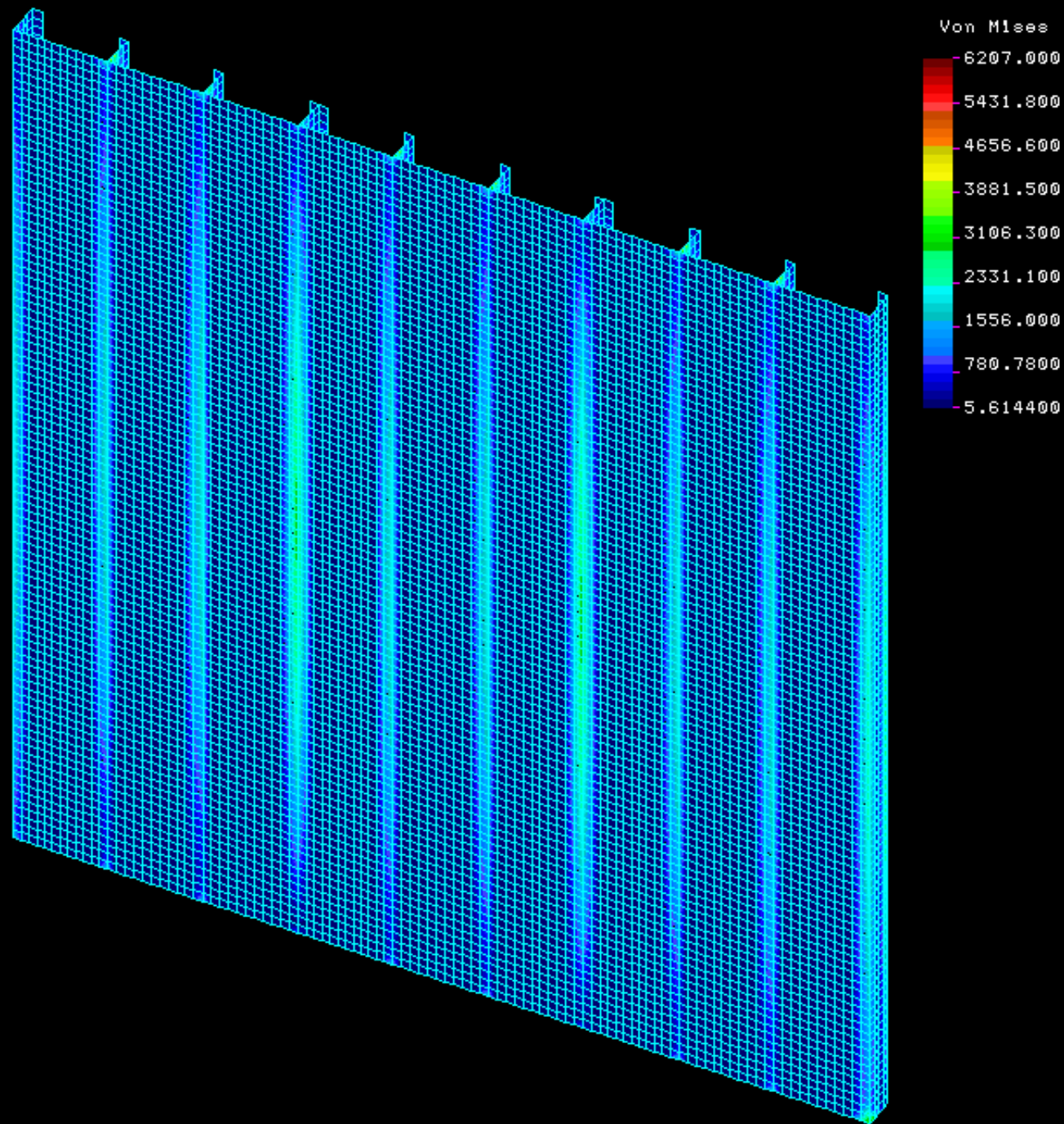
Pressure
Load Only
Z Deflection
(in)



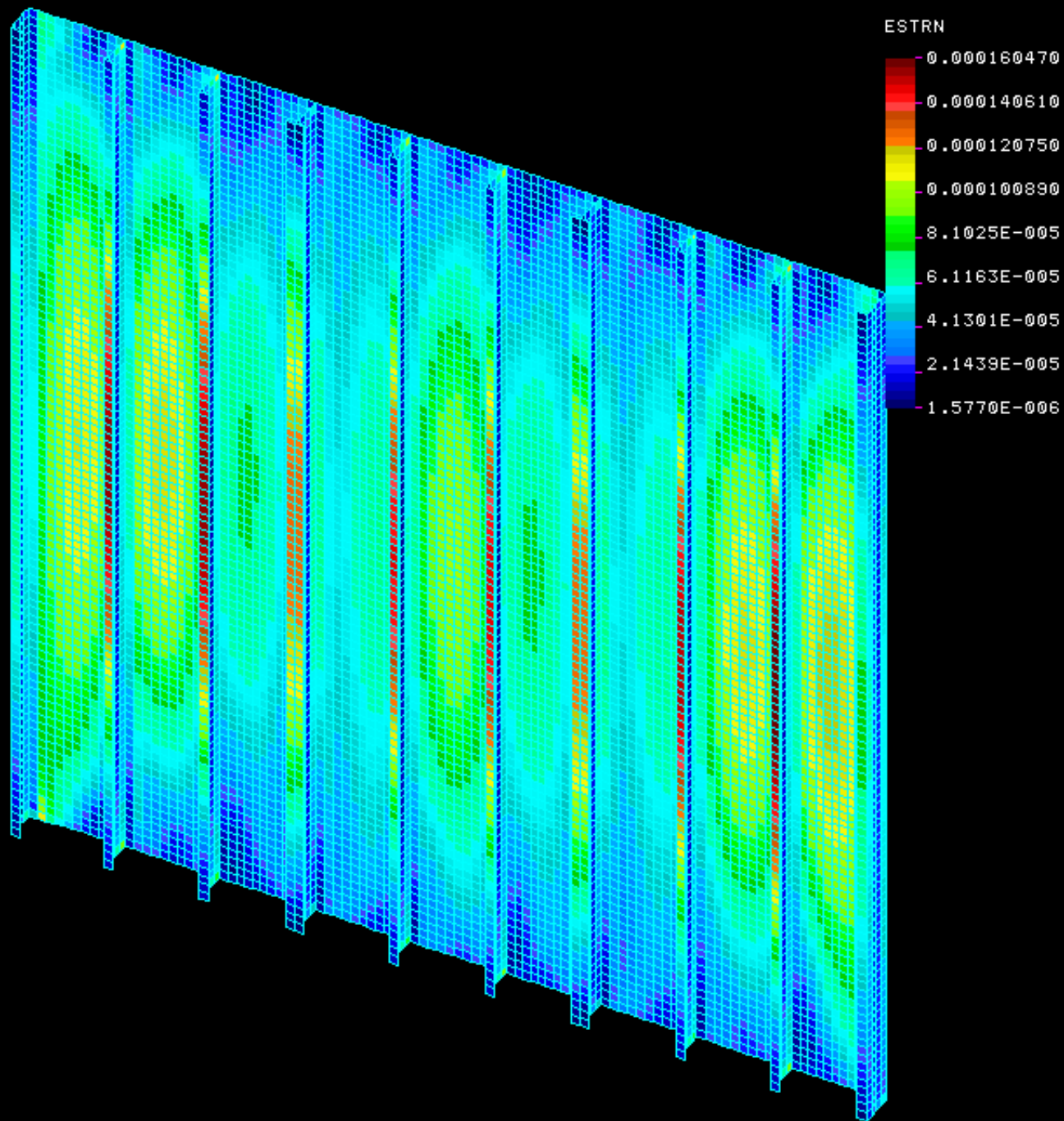
Pressure
Load Only
Z Deflection
(in)



Pressure
Load Only
Frame
Stress (psi)

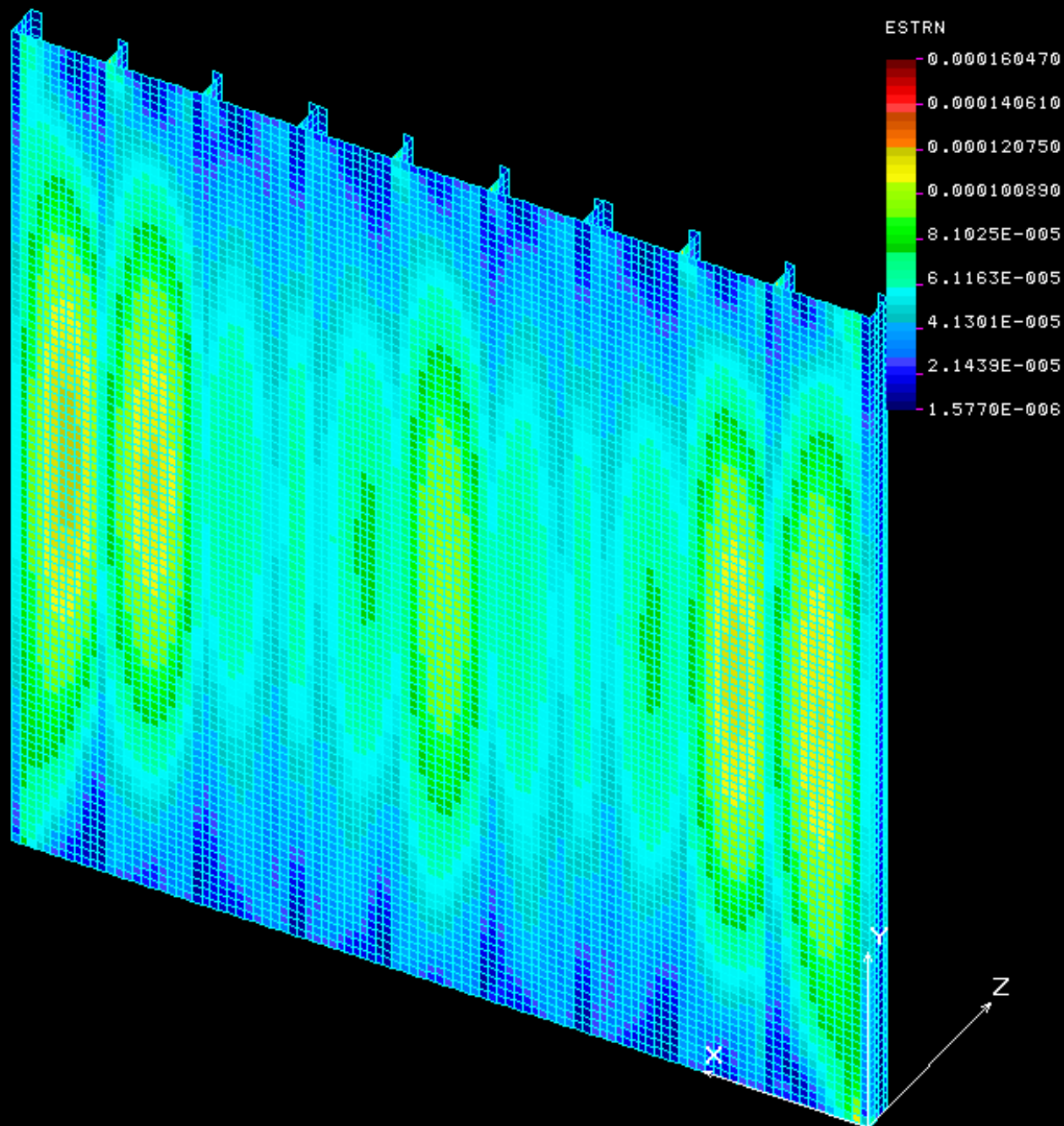


Pressure
Load Only
Panel
Stress (psi)



Pressure
Load Only
Frame
Strain

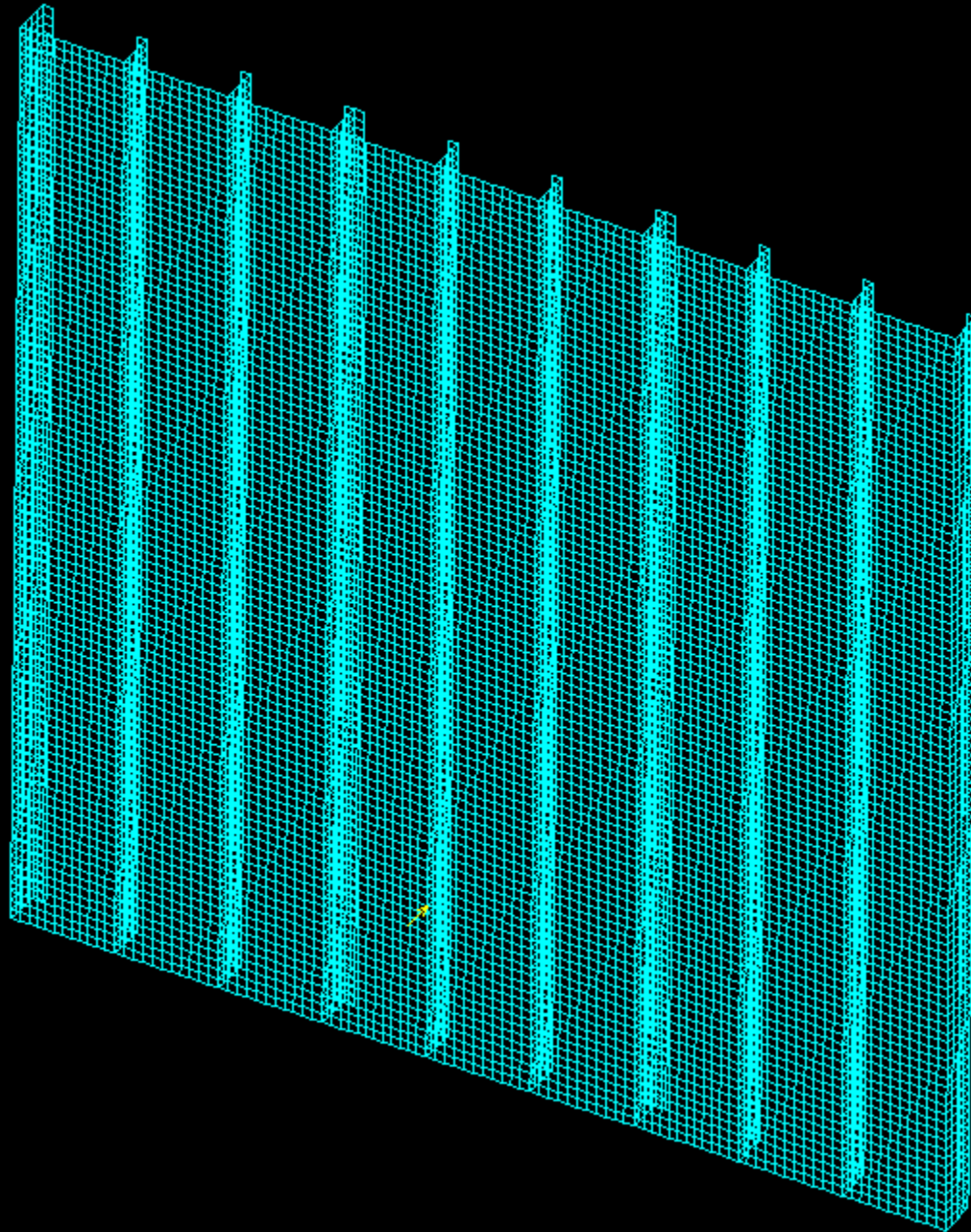
Pressure Load Only Panel Strain

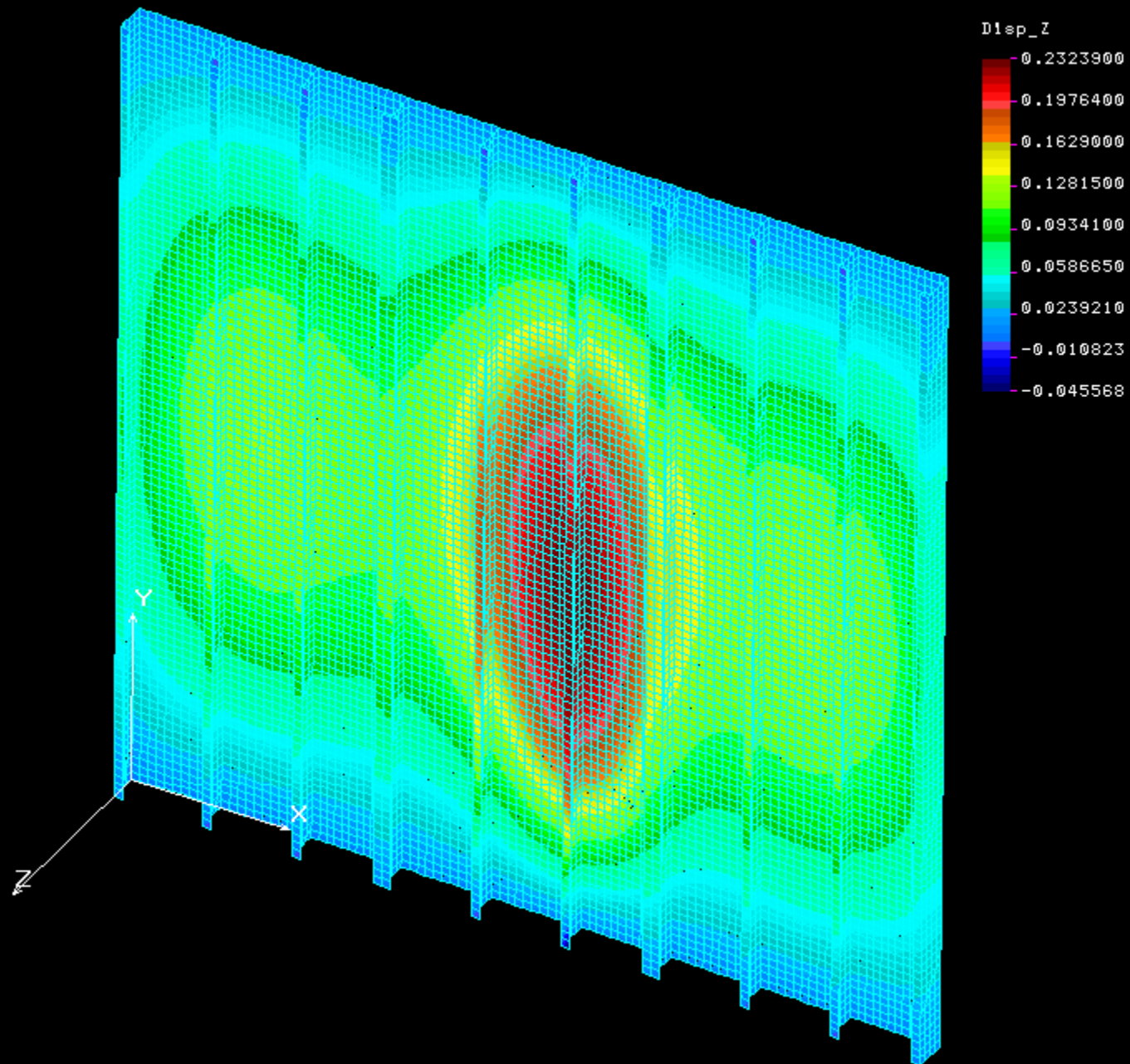


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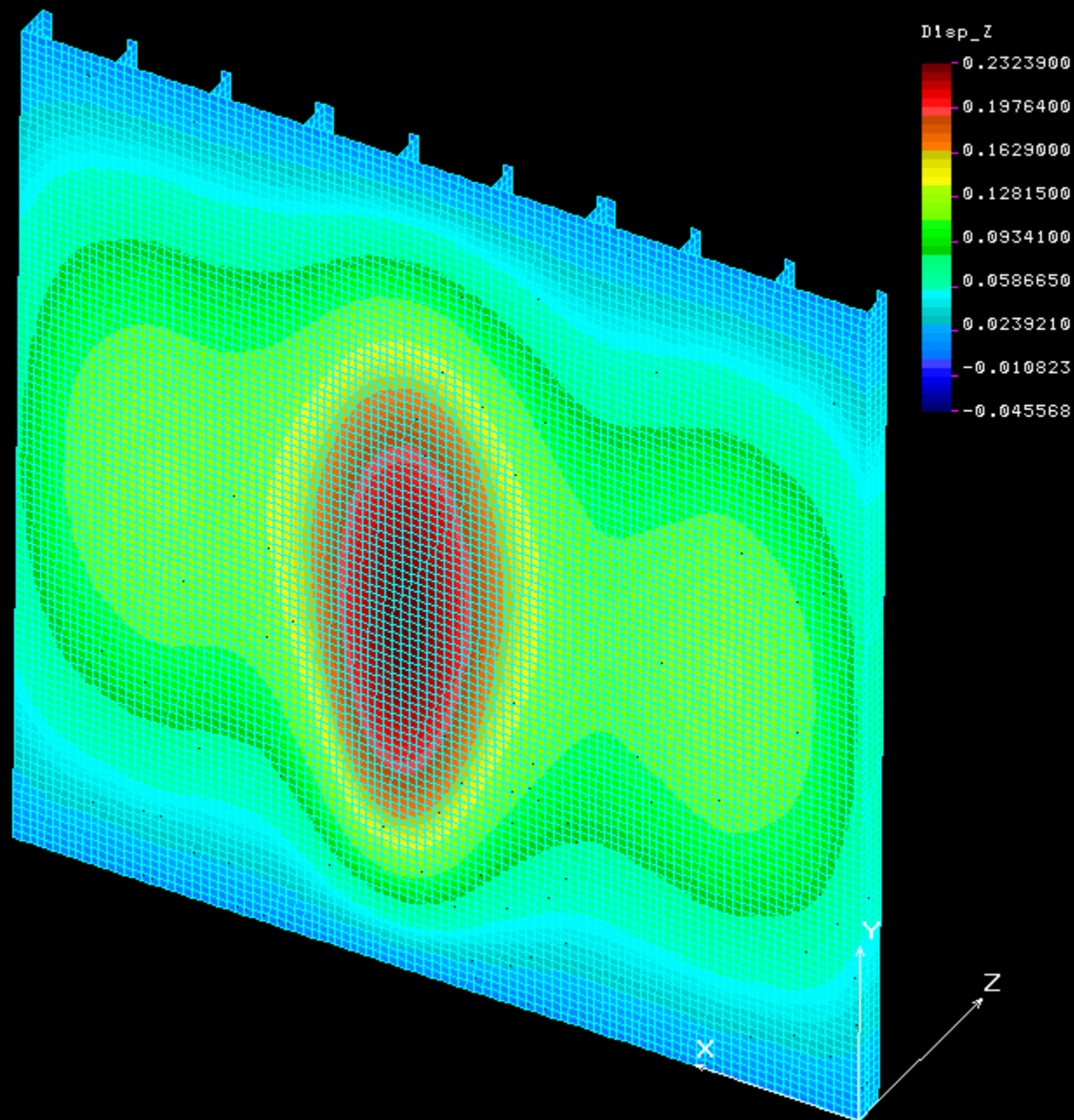
- Pressure load of 0.287 psi on wall panels
- 2000 lb point load on frame 2 ft above floor

2000 lb point
force on frame
2 ft above floor

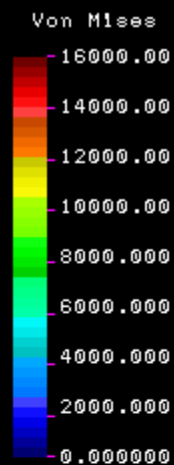
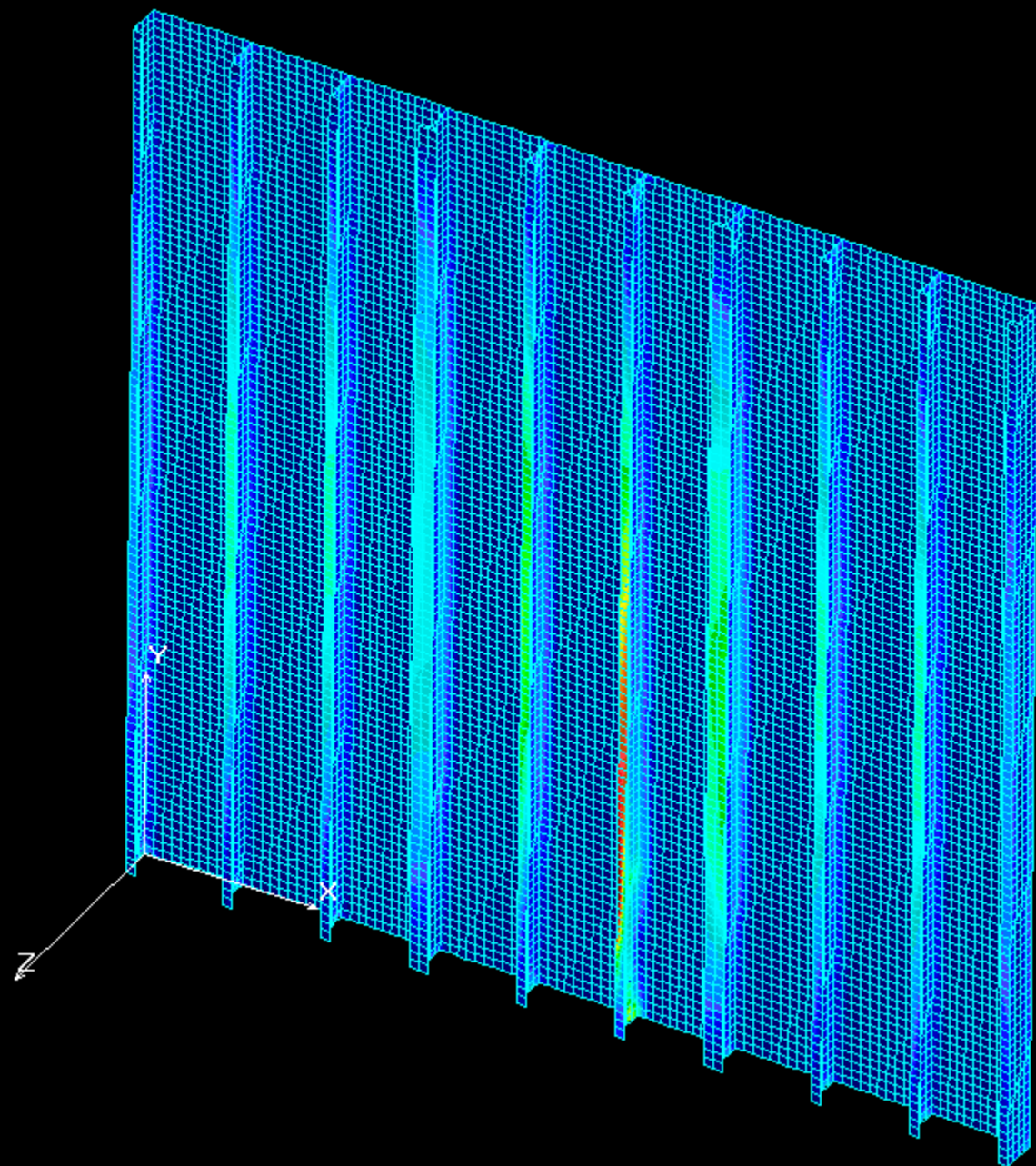




Load "A"
Frame Side
Z Deflection
(in)

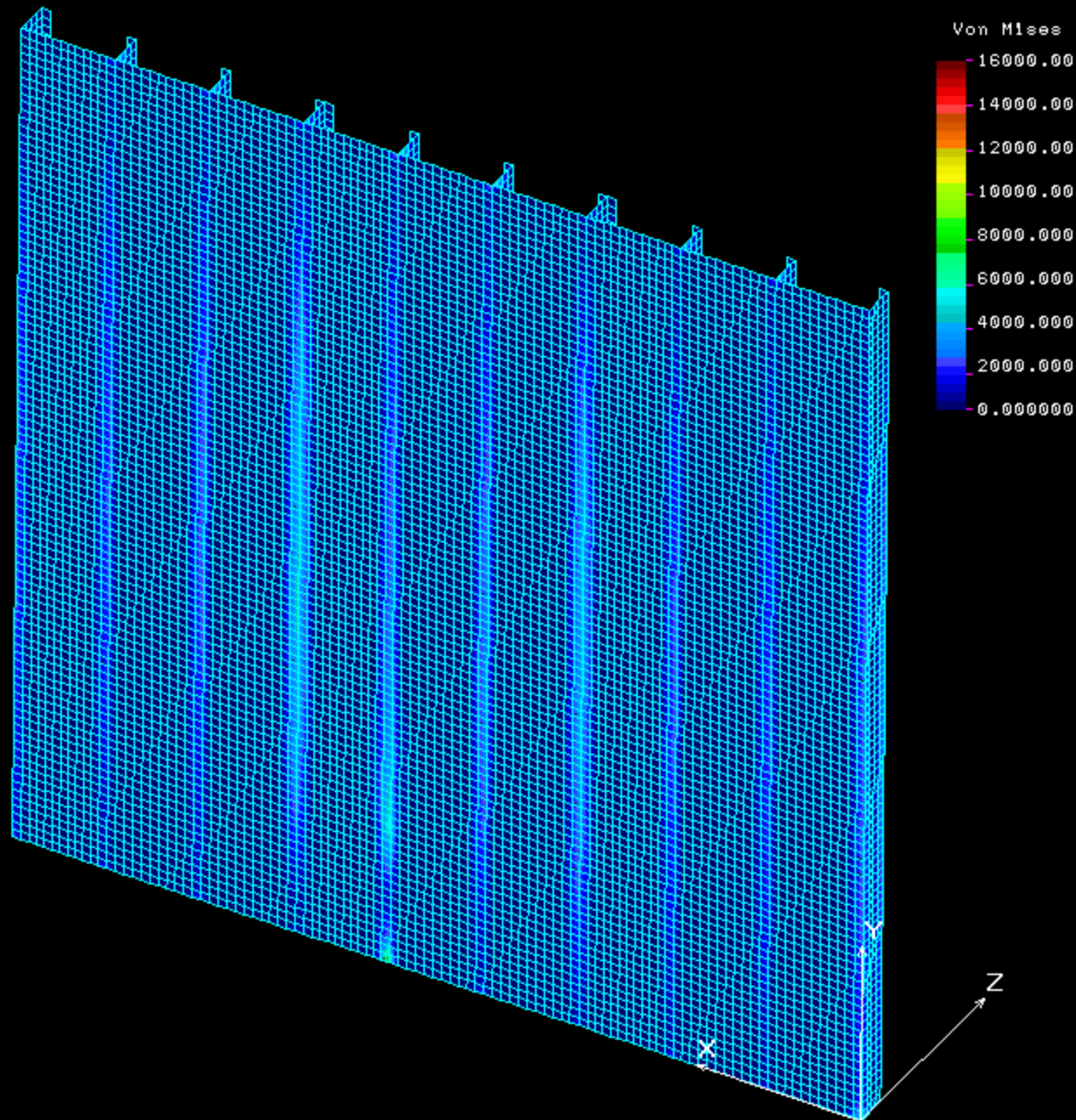


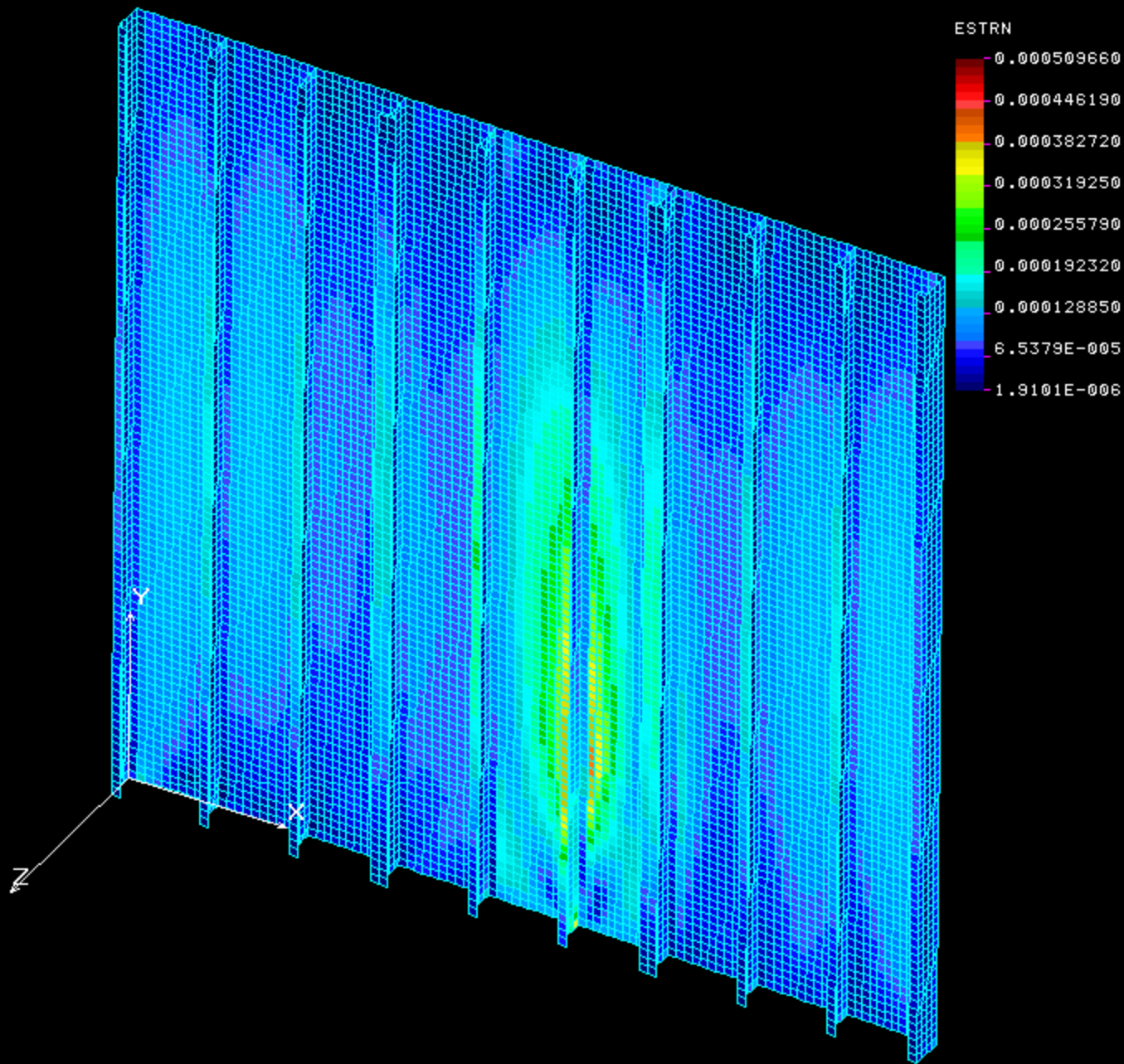
Load "A"
Front Face
Z Deflection
(in)



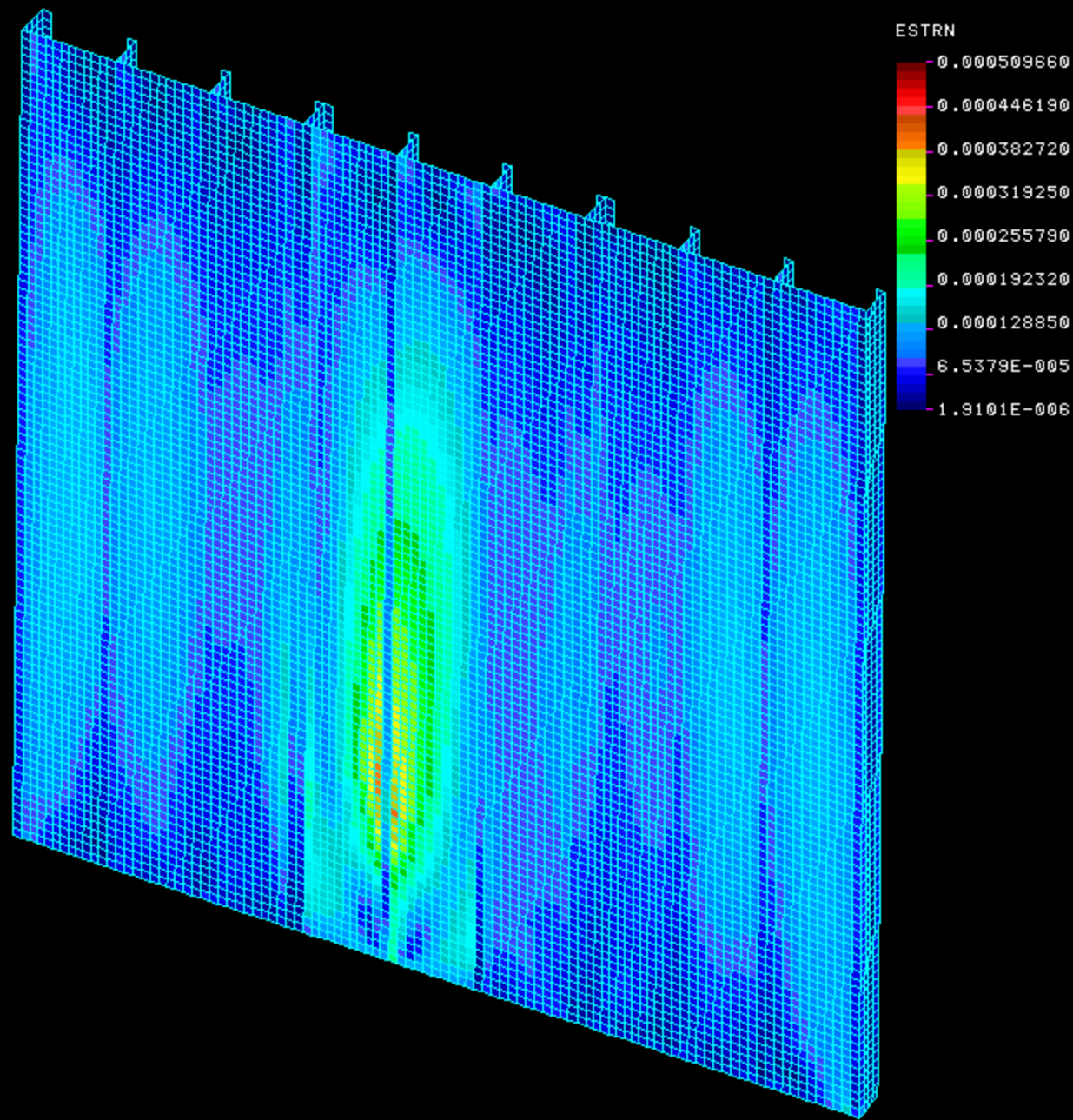
Load "A"
Frame
Stress (psi)

Load "A" Panel Stress (psi)





Load "A"
Frame
Strain

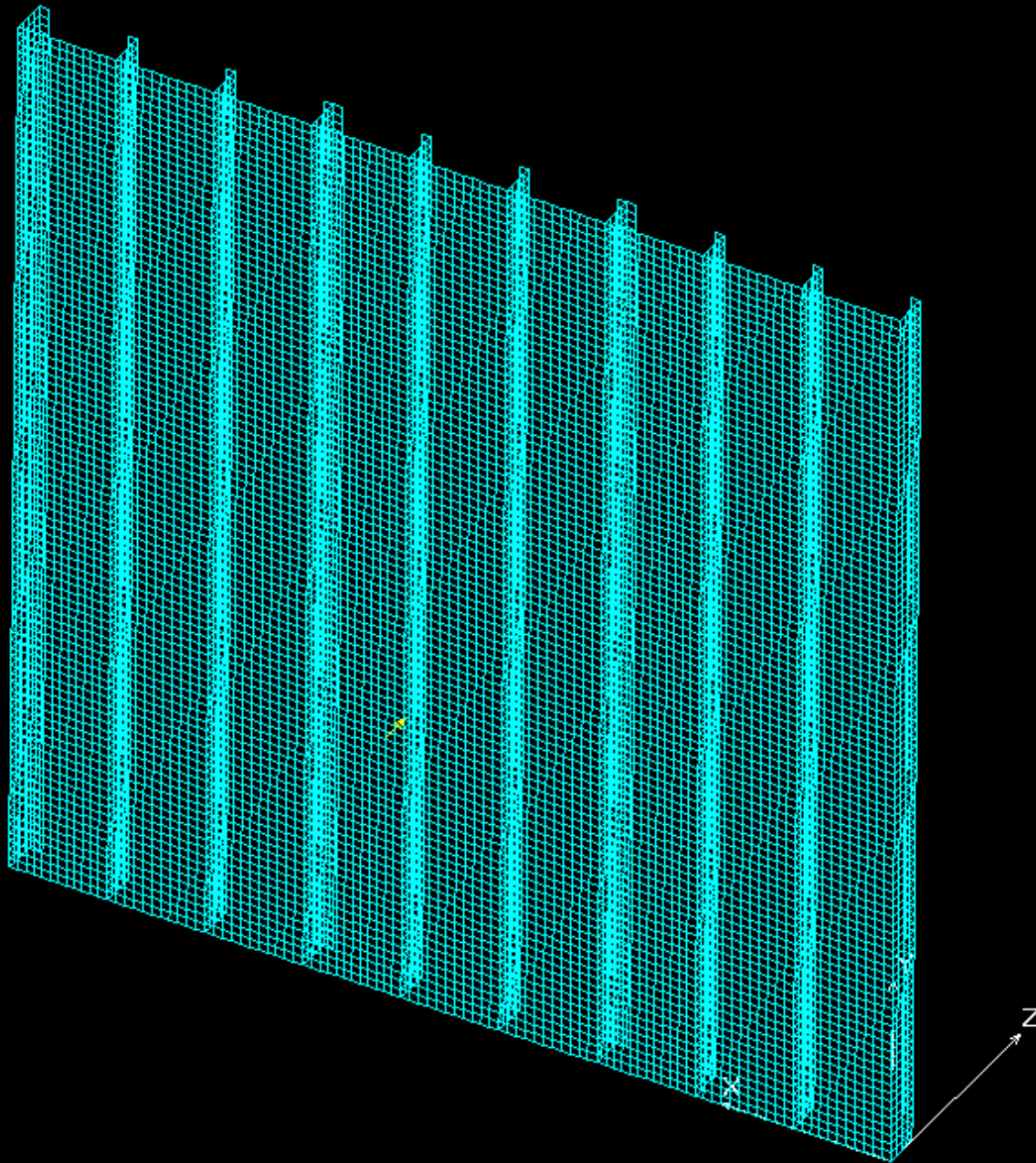


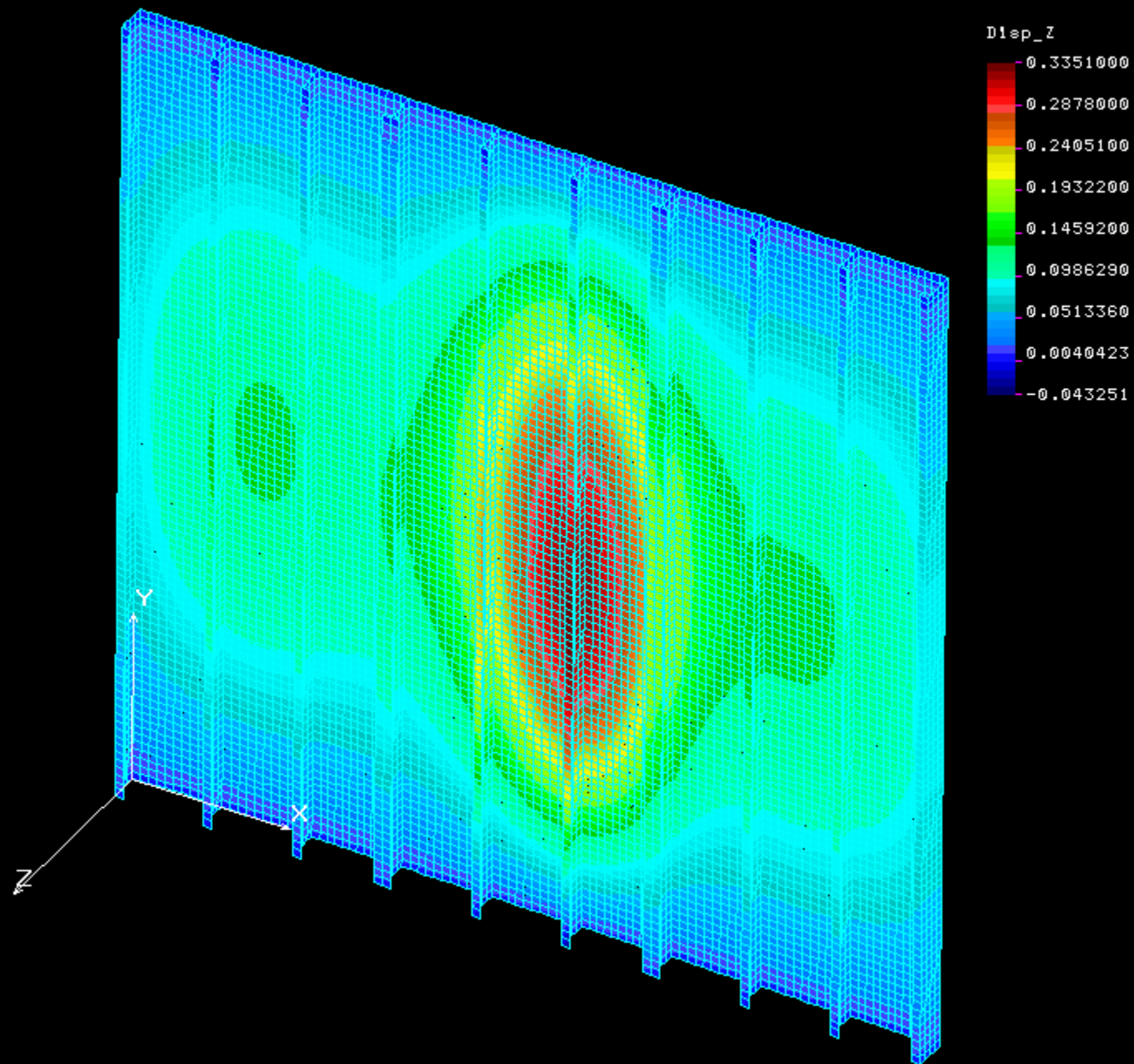
Load "A"
Panel
Strain

Loading “B”

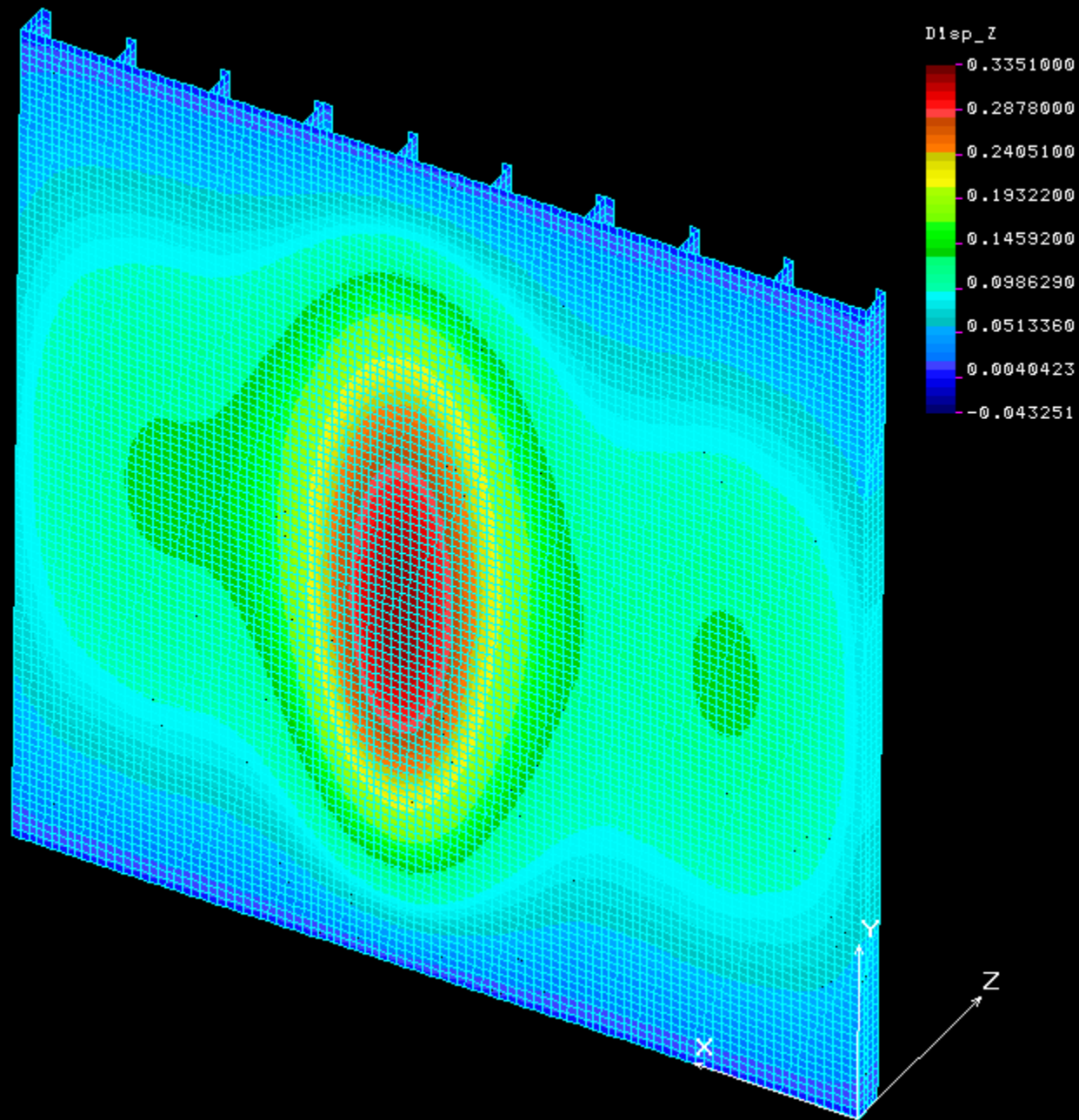
- Pressure load of 0.287 psi on wall panels
- 2000 lb point load on frame 4 ft above floor

2000 lb point
force on frame
4 ft above floor

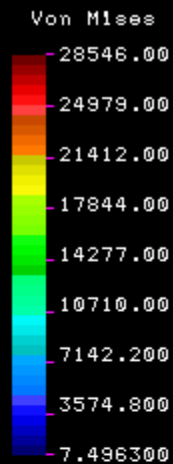
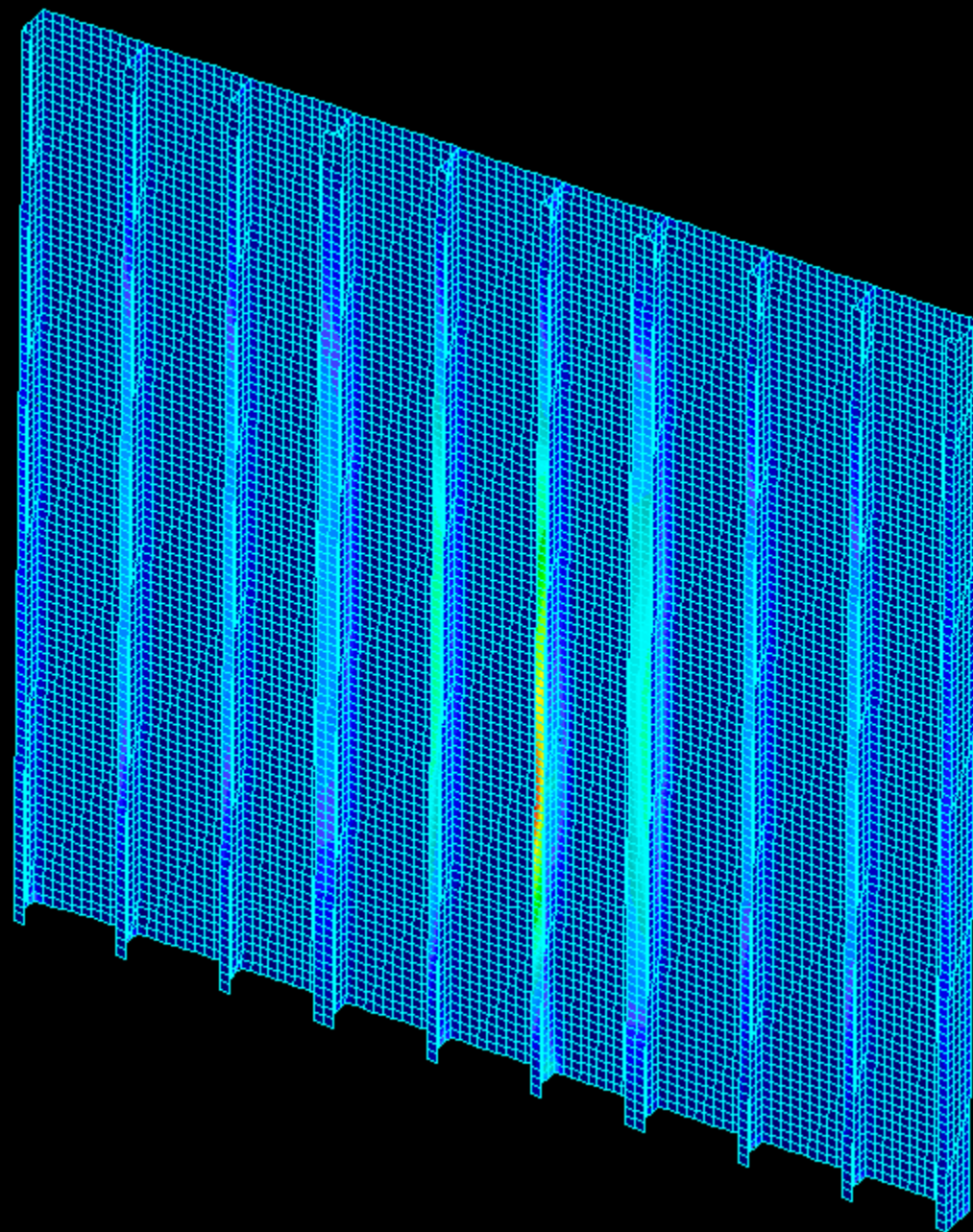




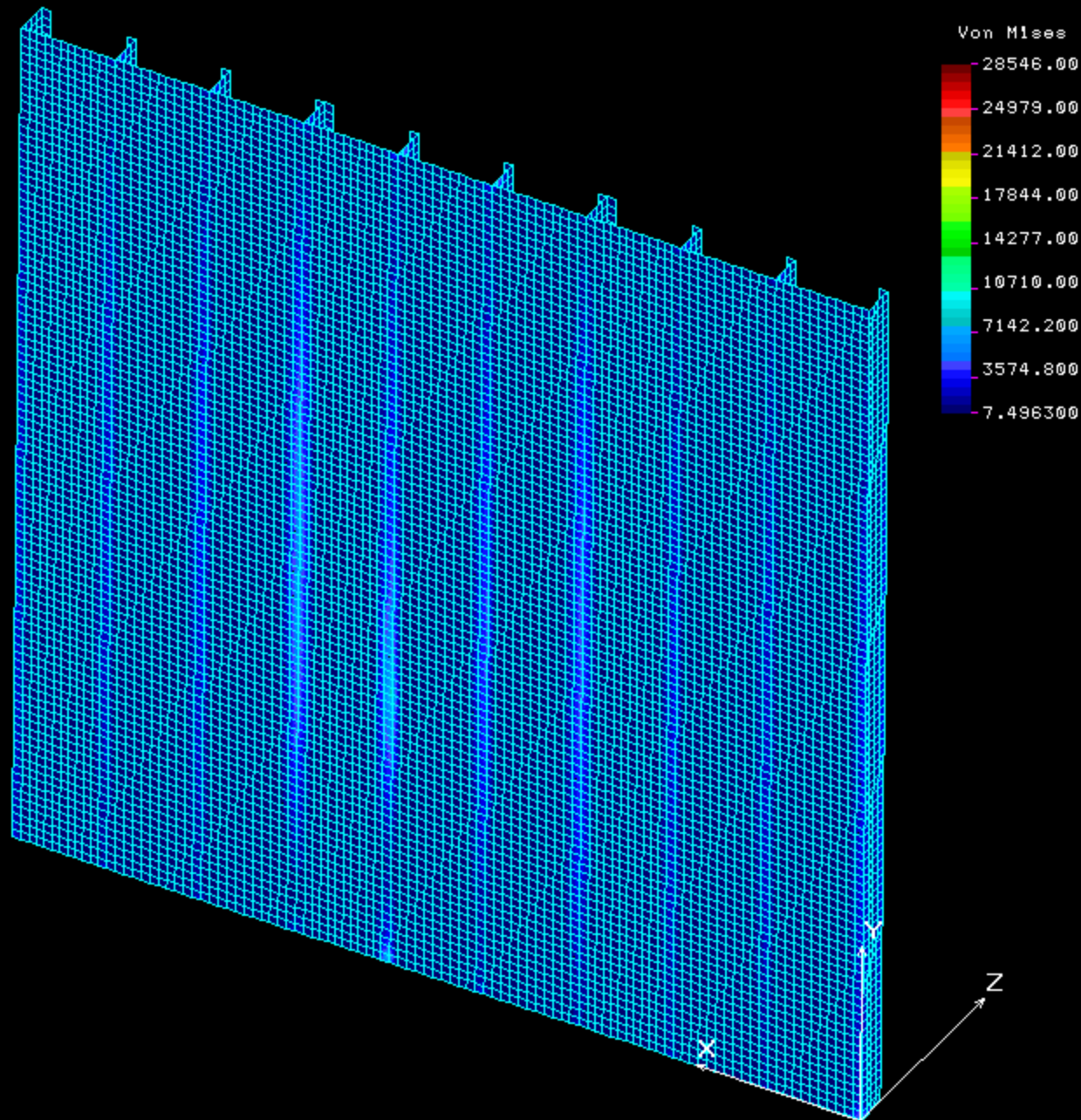
Load "B"
Frame Side
Z Deflection
(in)



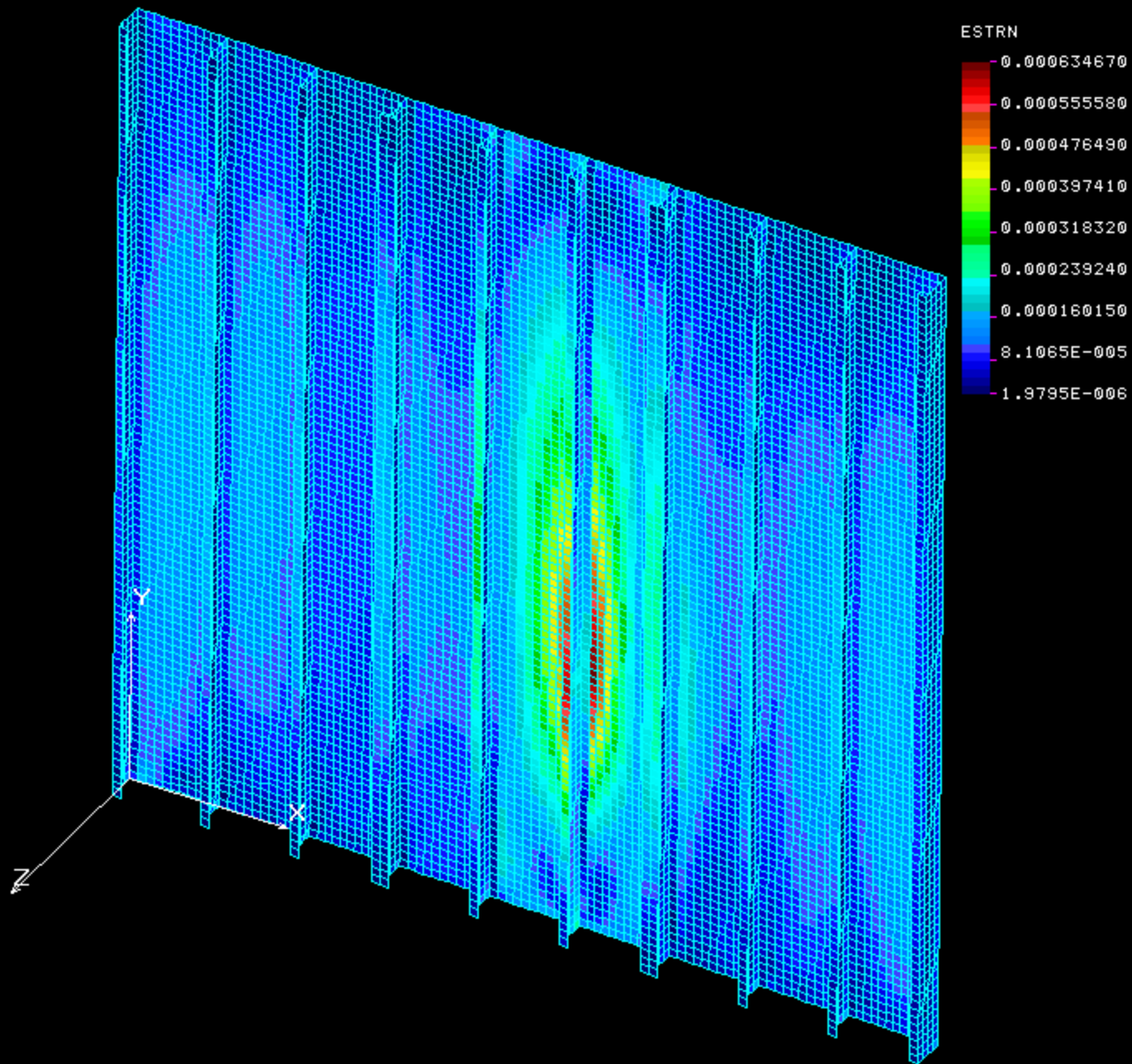
Load "B"
Front Face
Z Deflection
(in)



Load "B"
Frame
Stress (psi)

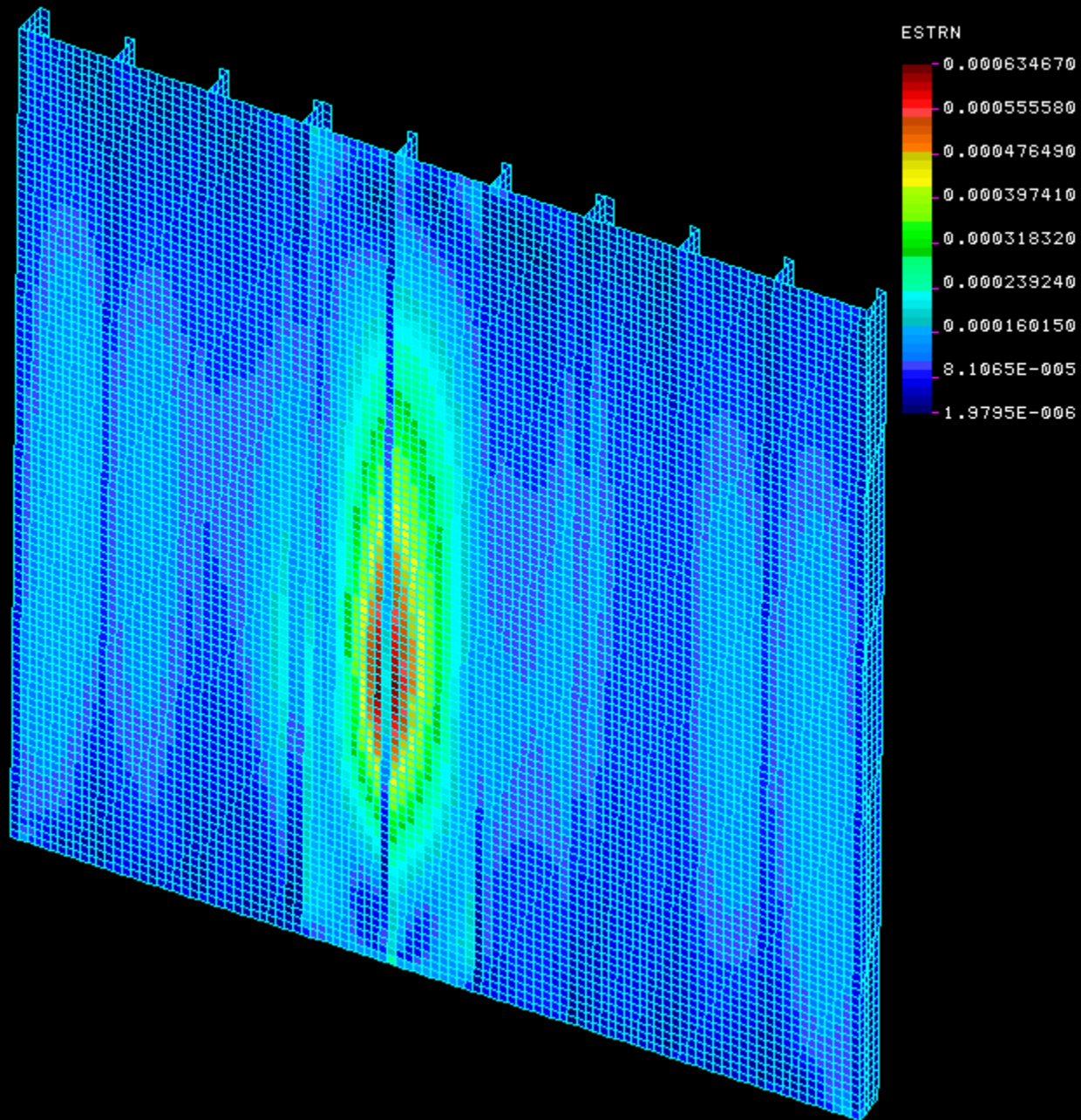


Load "B"
Panel
Stress (psi)



Load "B"
Frame
Strain

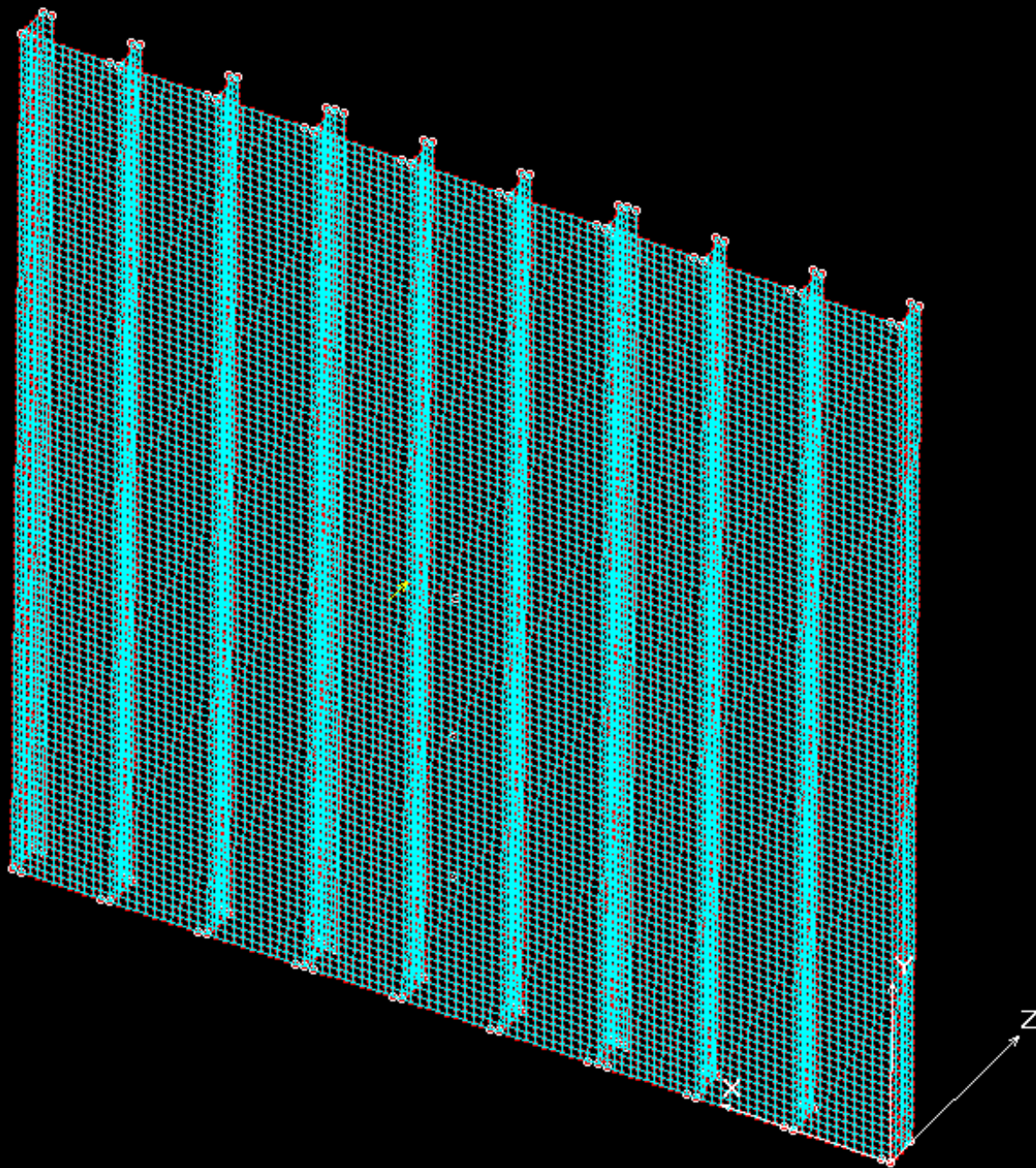
Load "B" Panel Strain

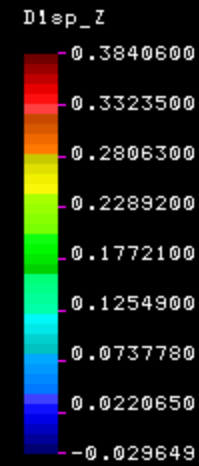
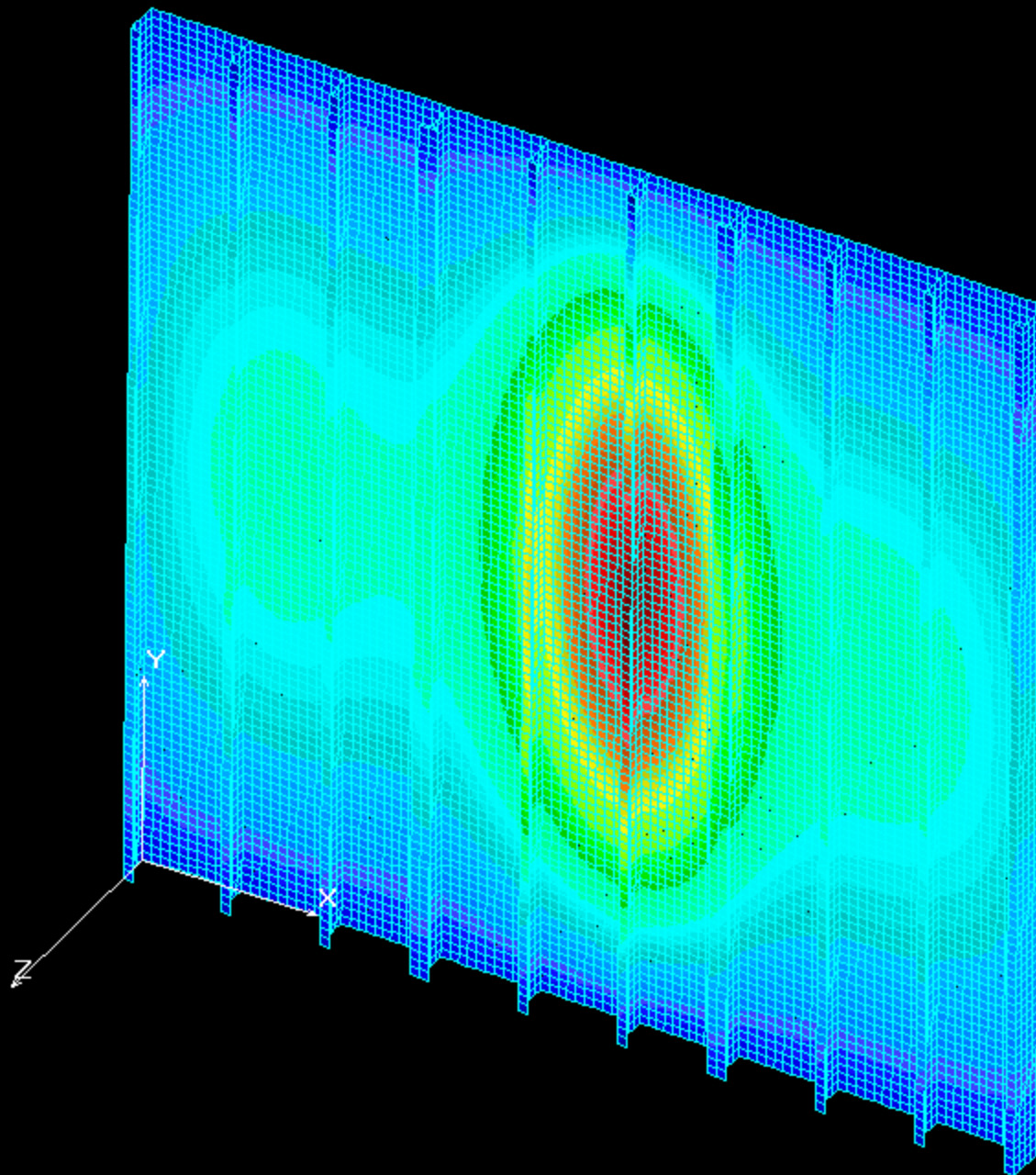


Loading “C”

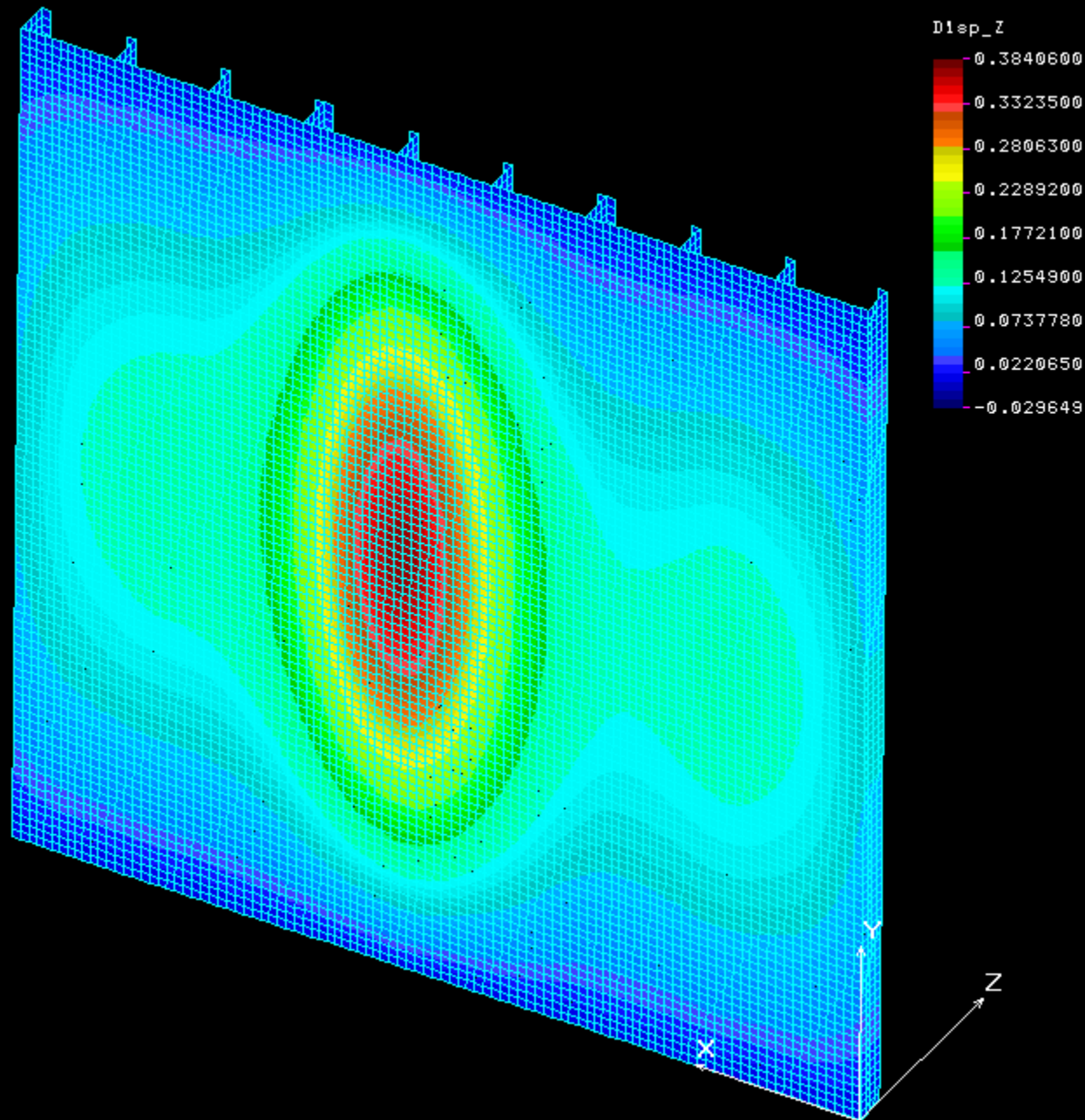
- Pressure load of 0.287 psi on wall panels
- 2000 lb point load on frame 6 ft above floor

2000 lb point
force on frame
6 ft above floor

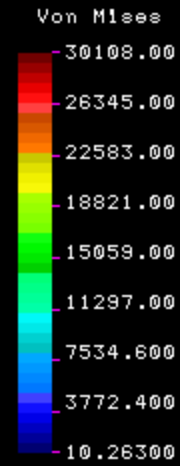
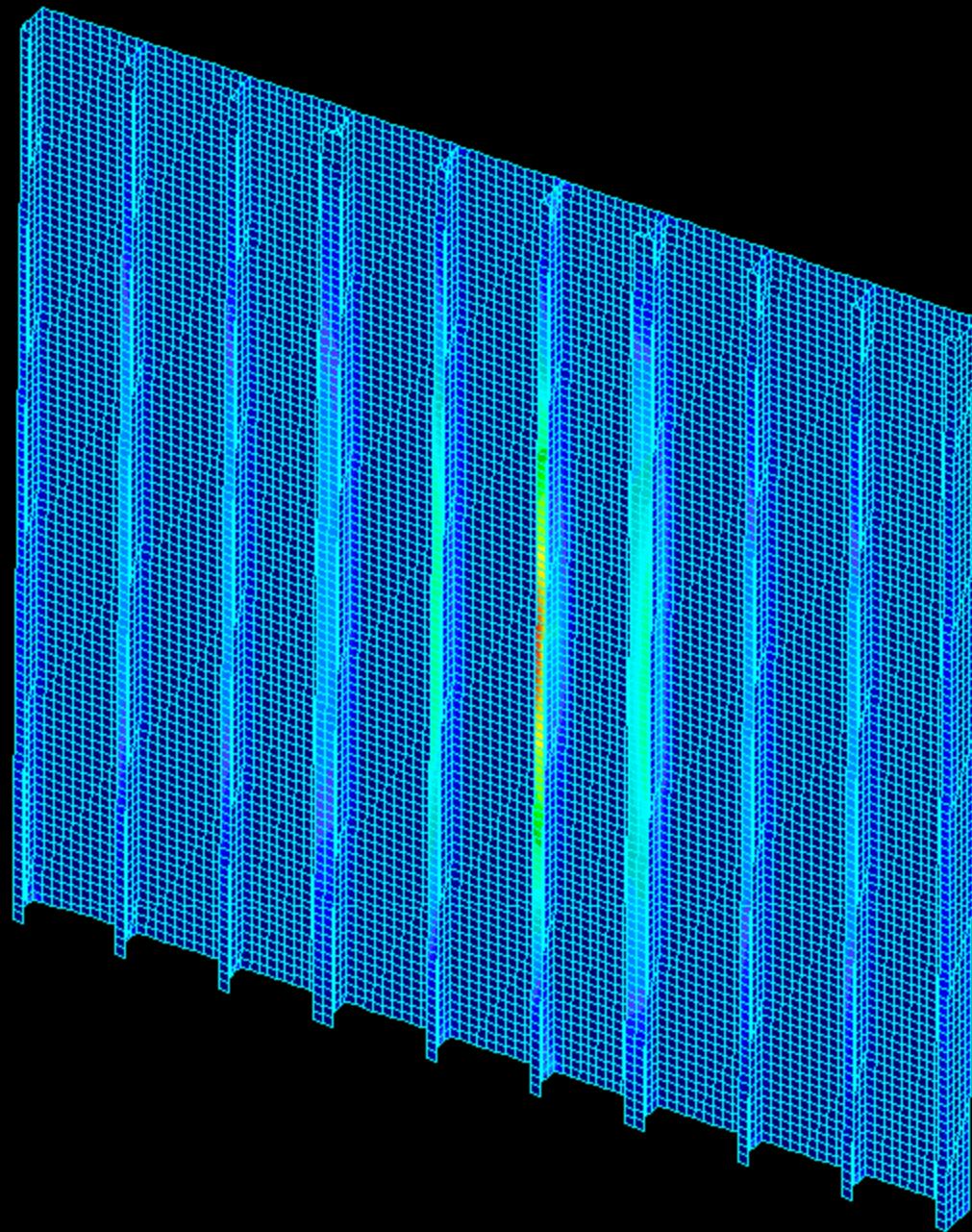




Load "C"
Frame Side
Z Deflection
(in)

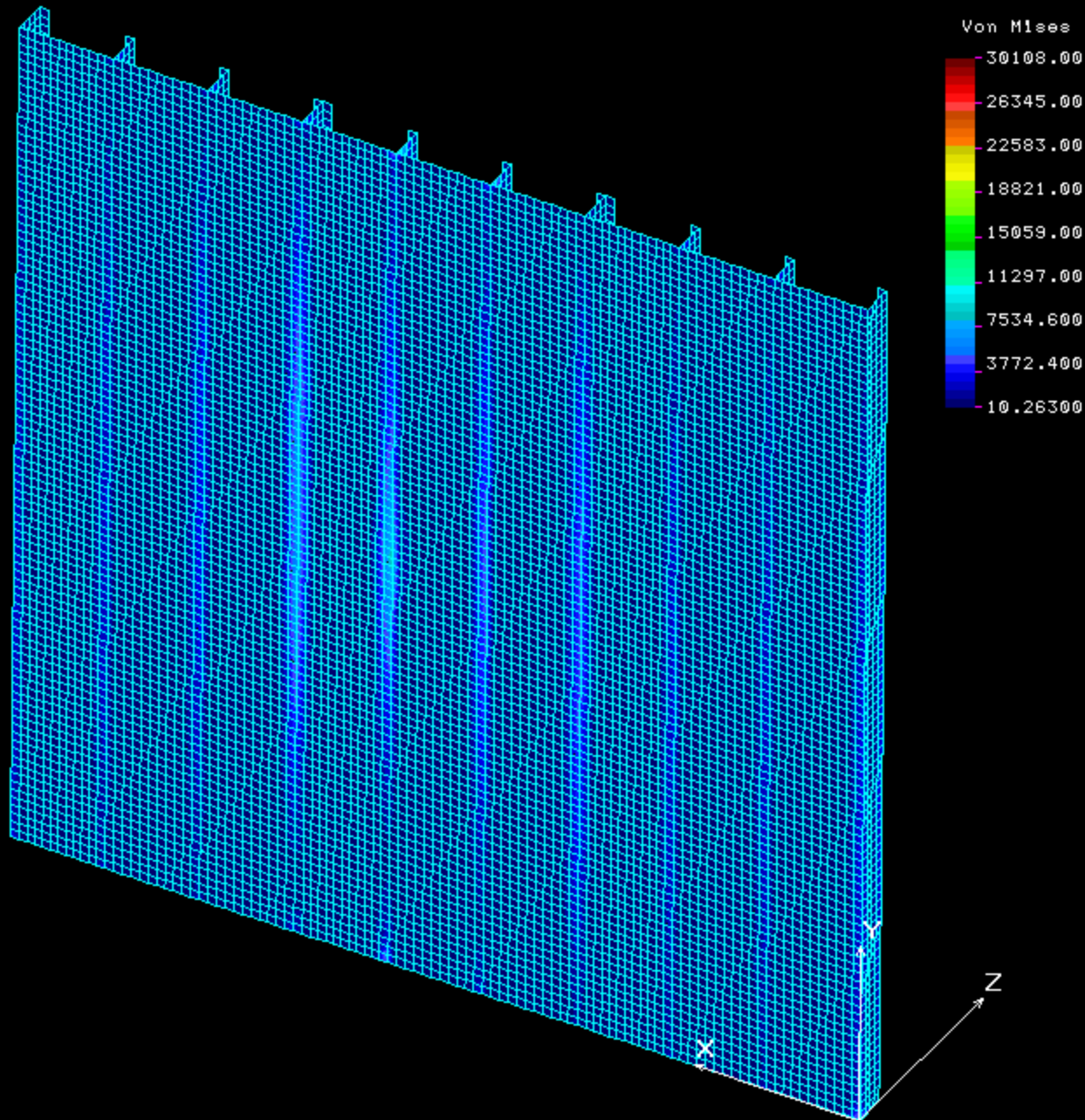


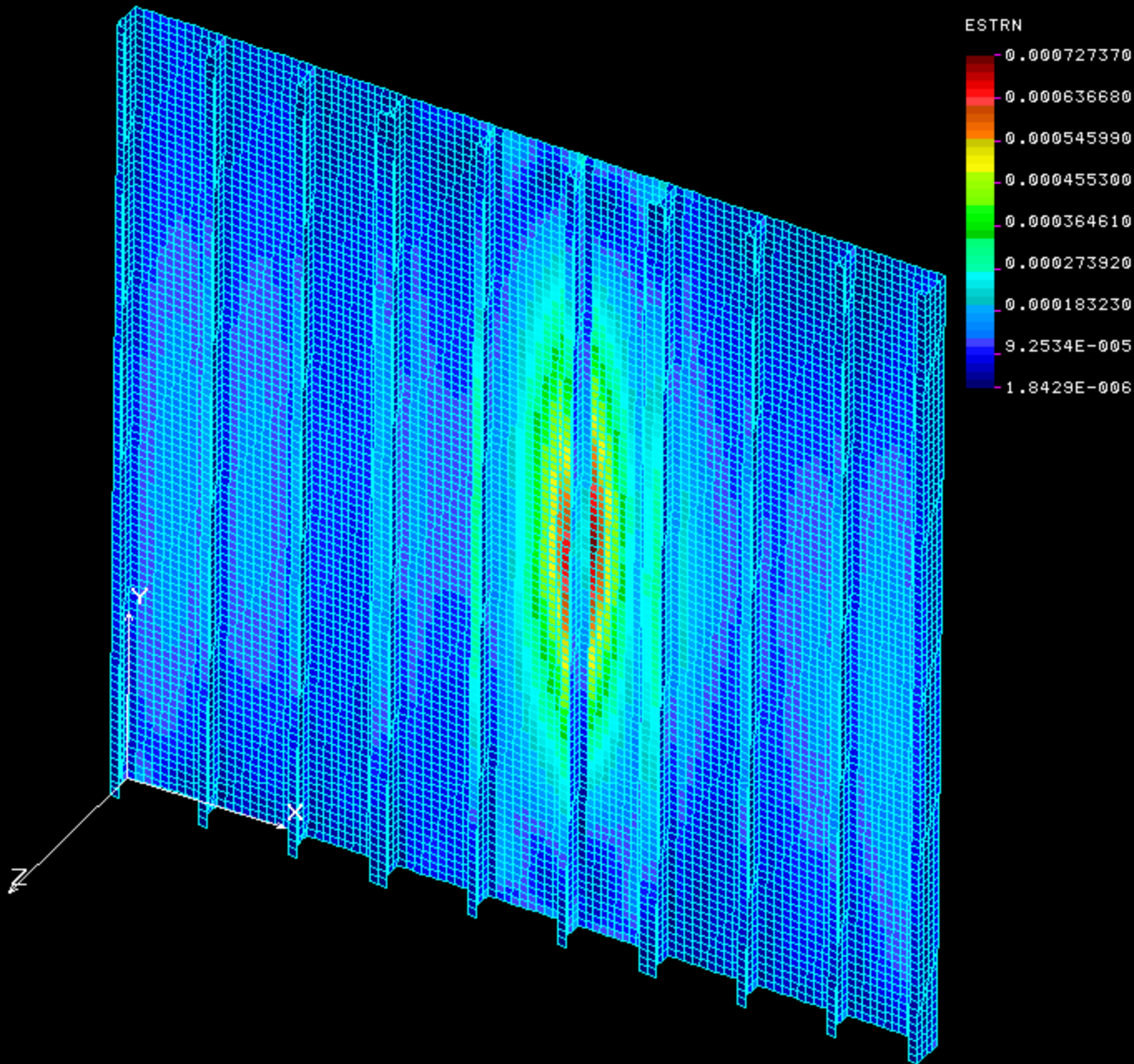
Load "C"
Front Face
Z Deflection
(in)



Load "C"
Frame
Stress (psi)

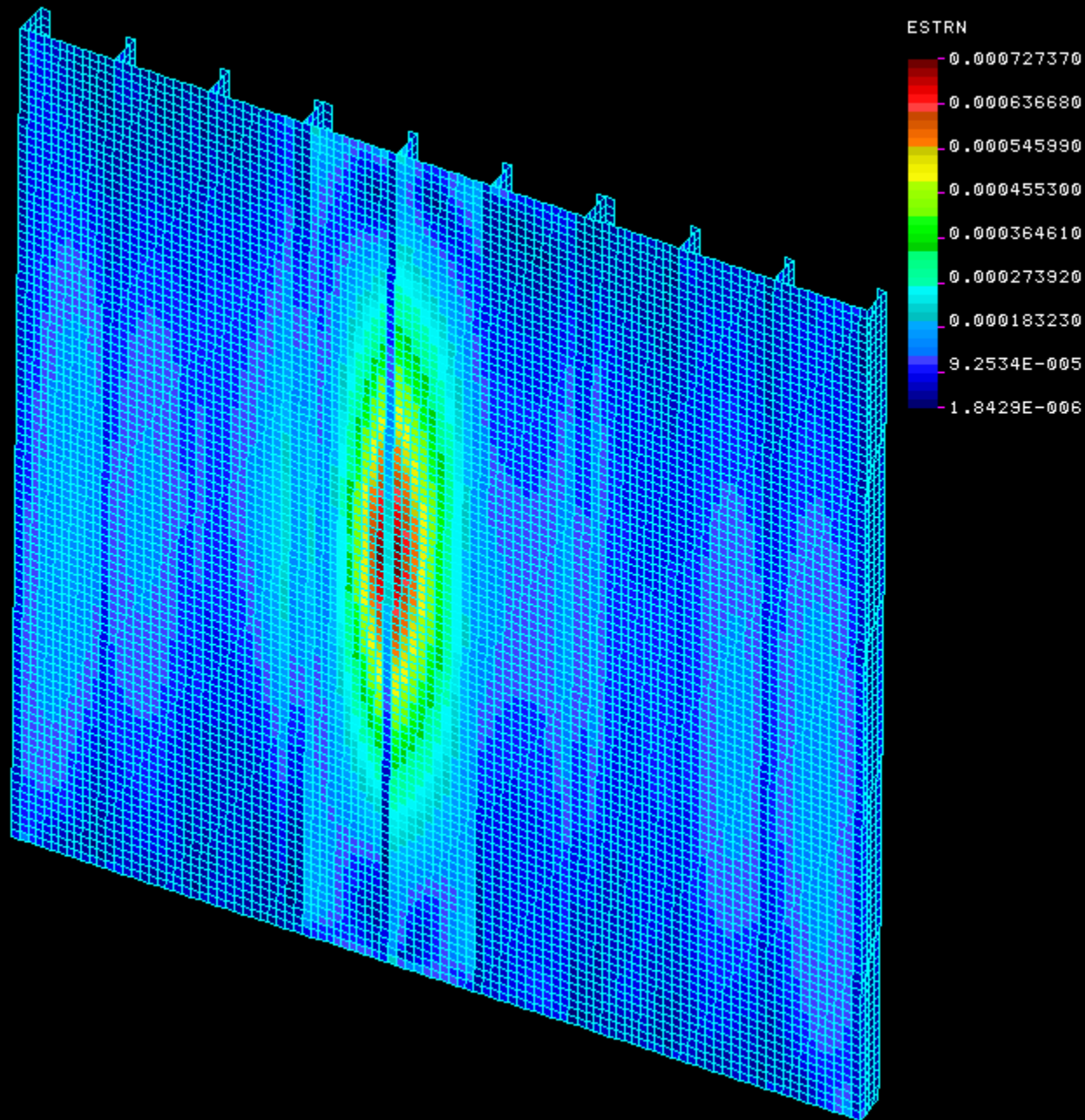
Load "C" Panel Stress (psi)





Load "C"
Frame
Strain

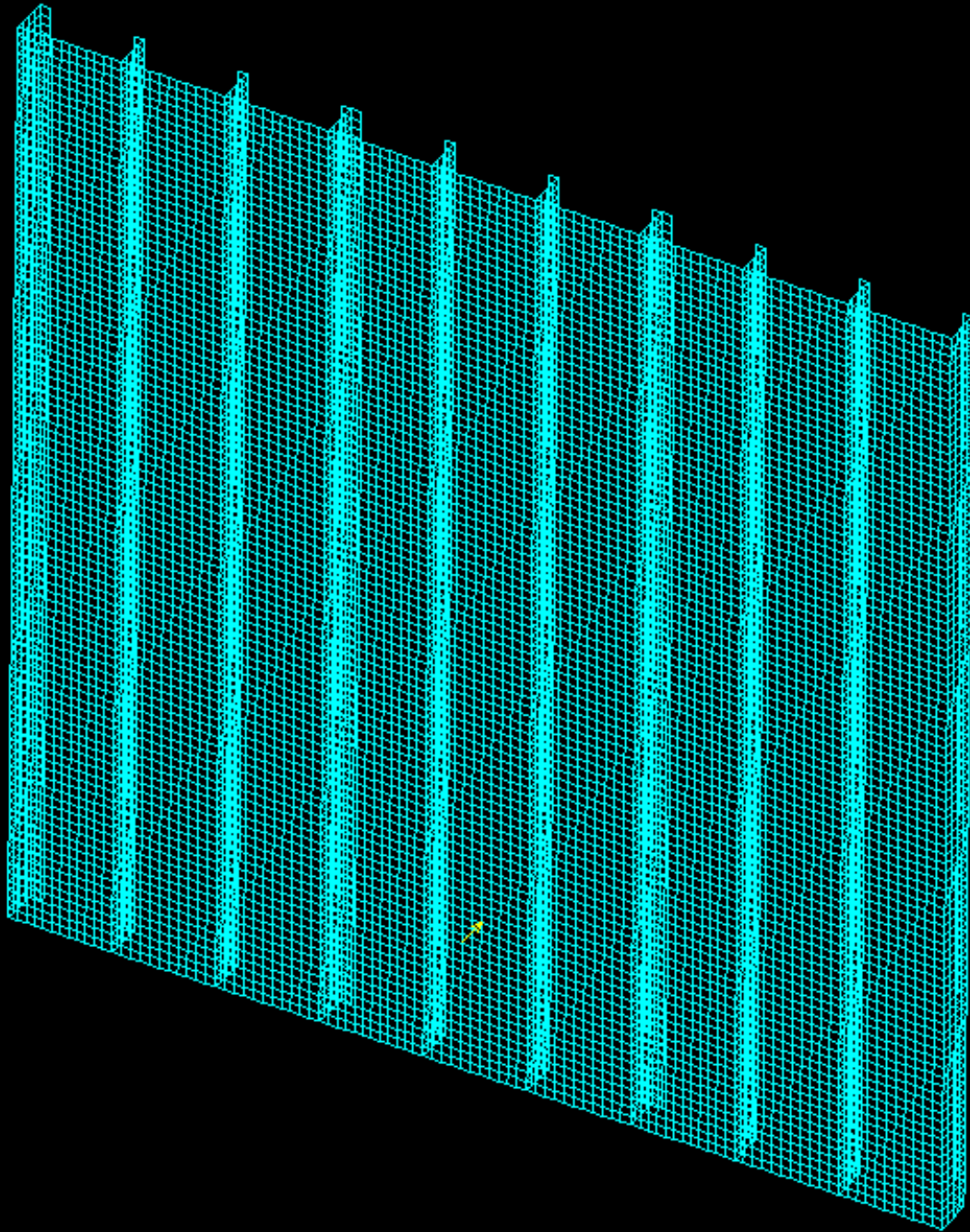
Load "C" Panel Strain

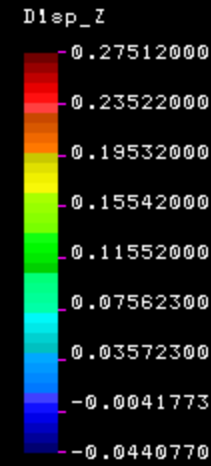
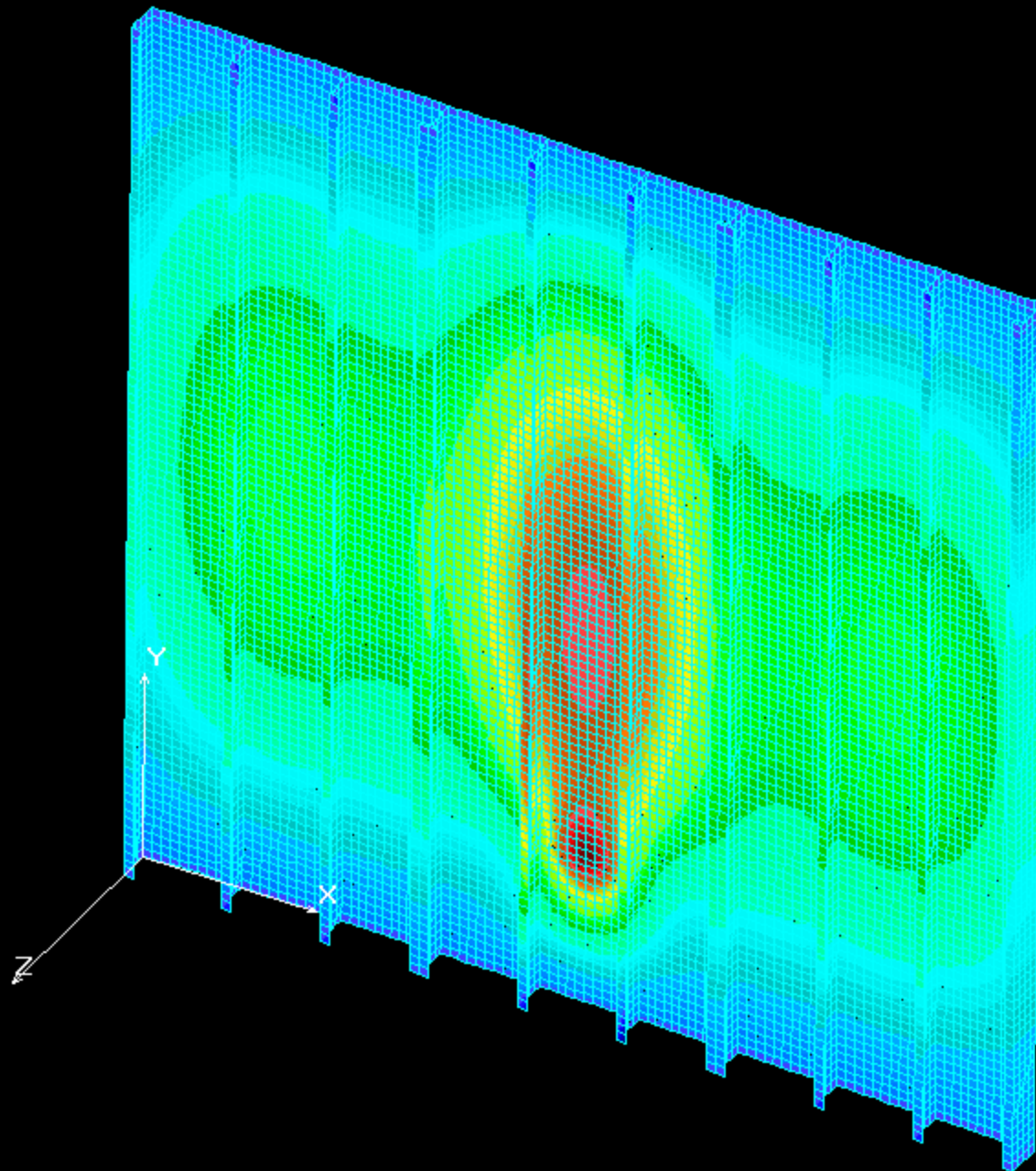


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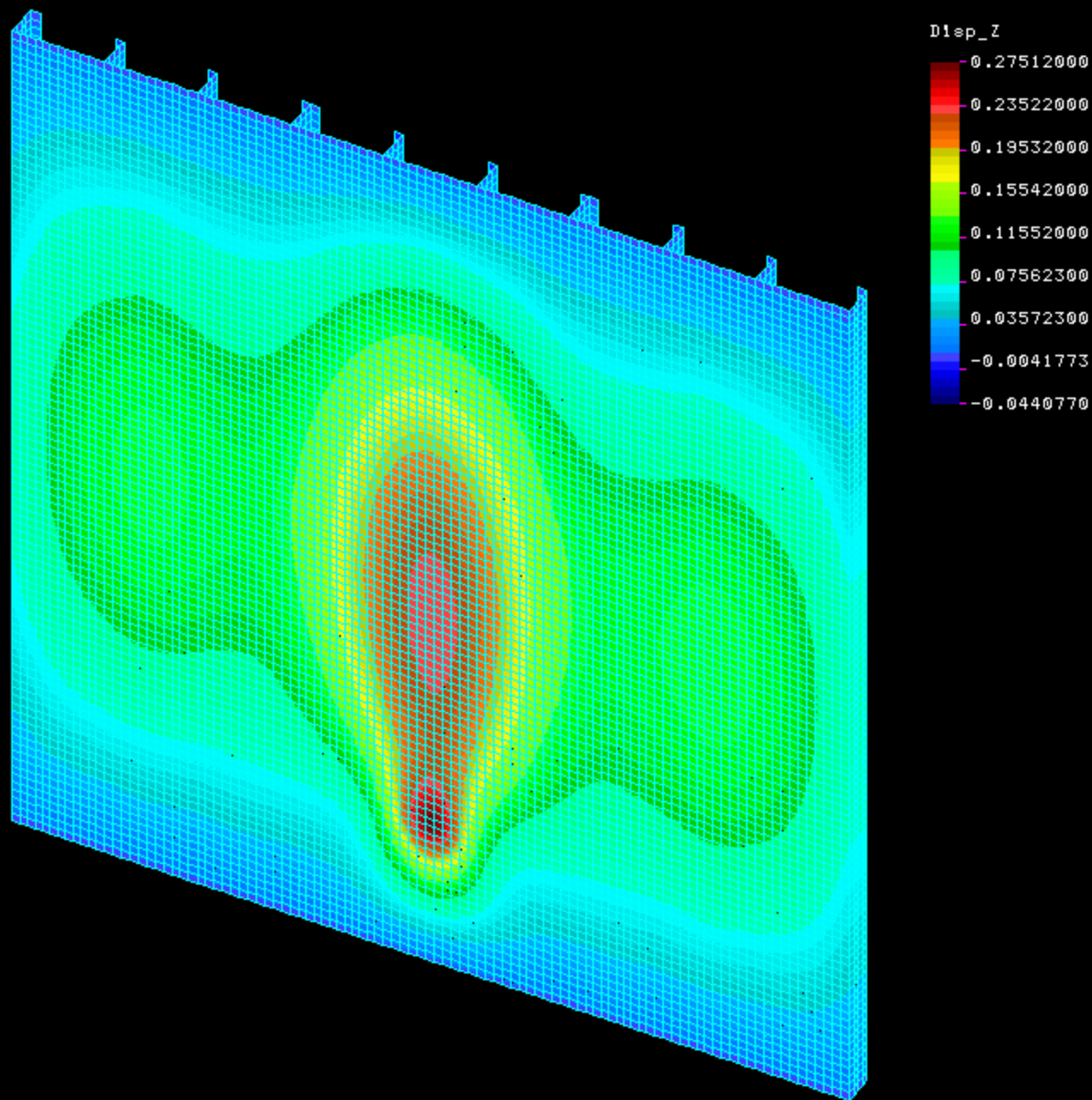
- Pressure load of 0.287 psi on wall panels
- 2000 lb point load between frames 2 ft above floor

2000 lb point
force on panel
2 ft above floor

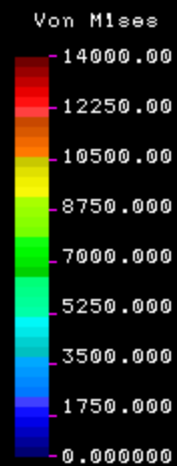
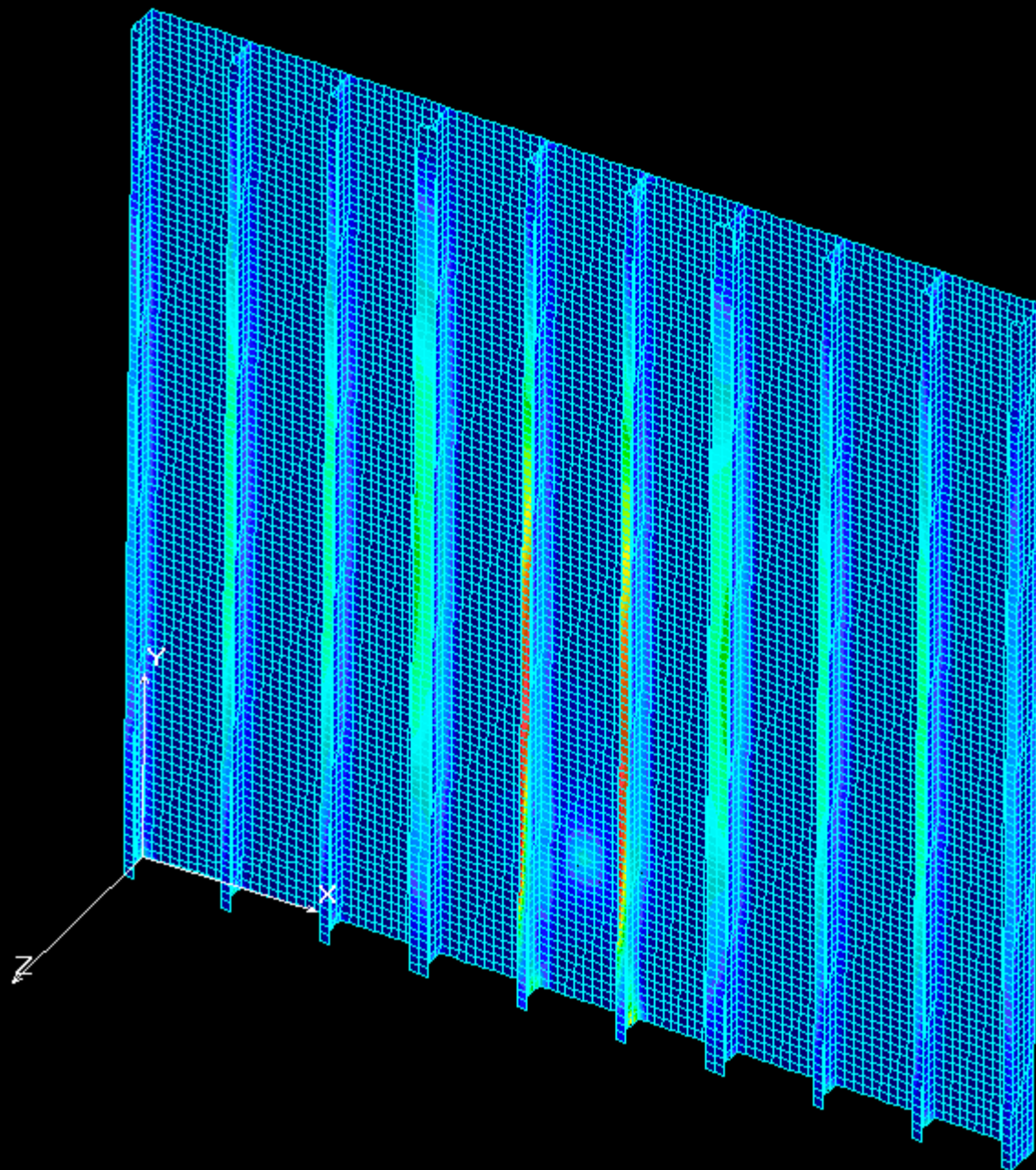




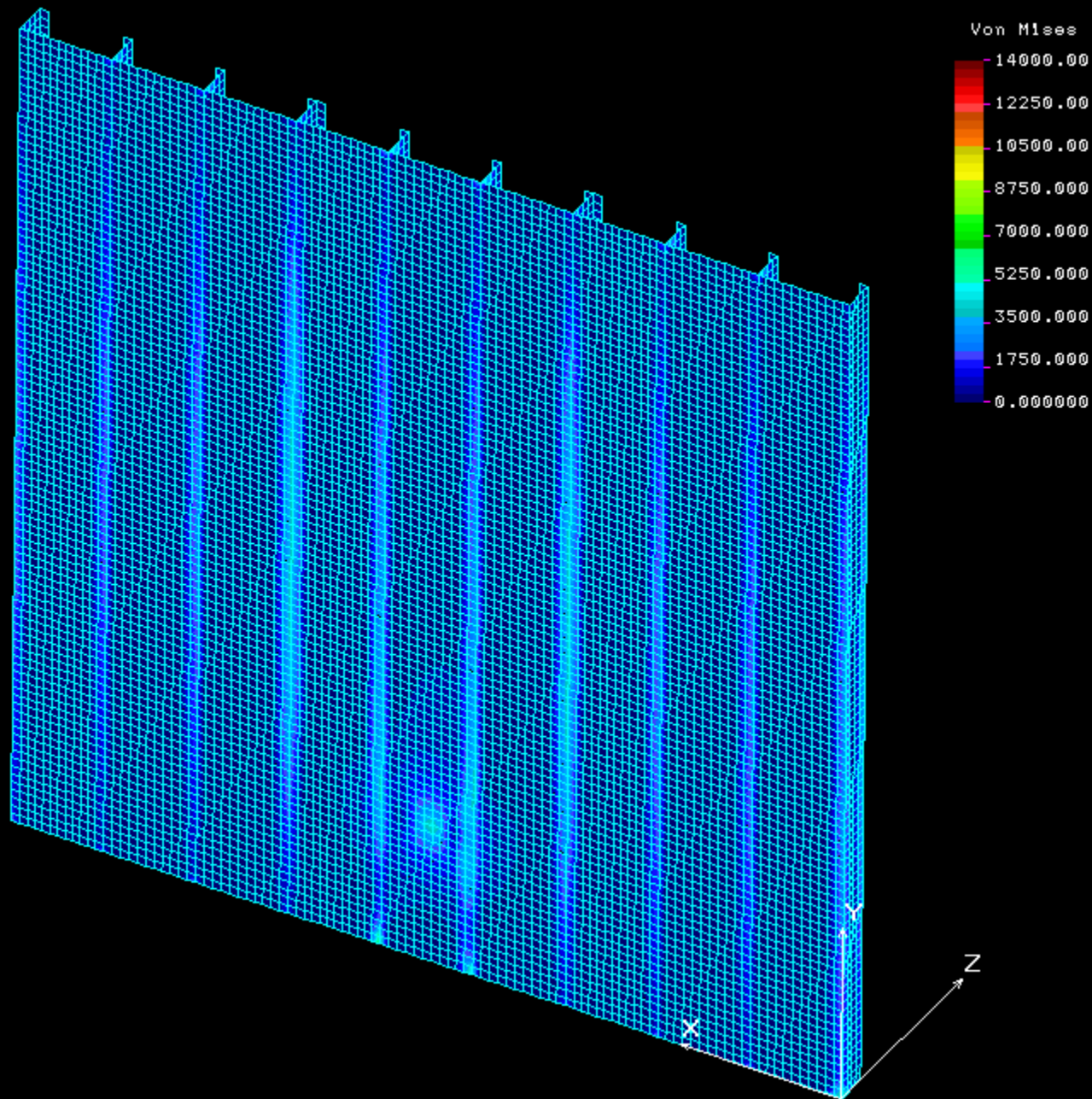
Load "D"
Frame Side
Z Deflection
(in)



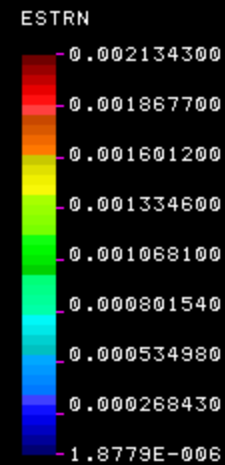
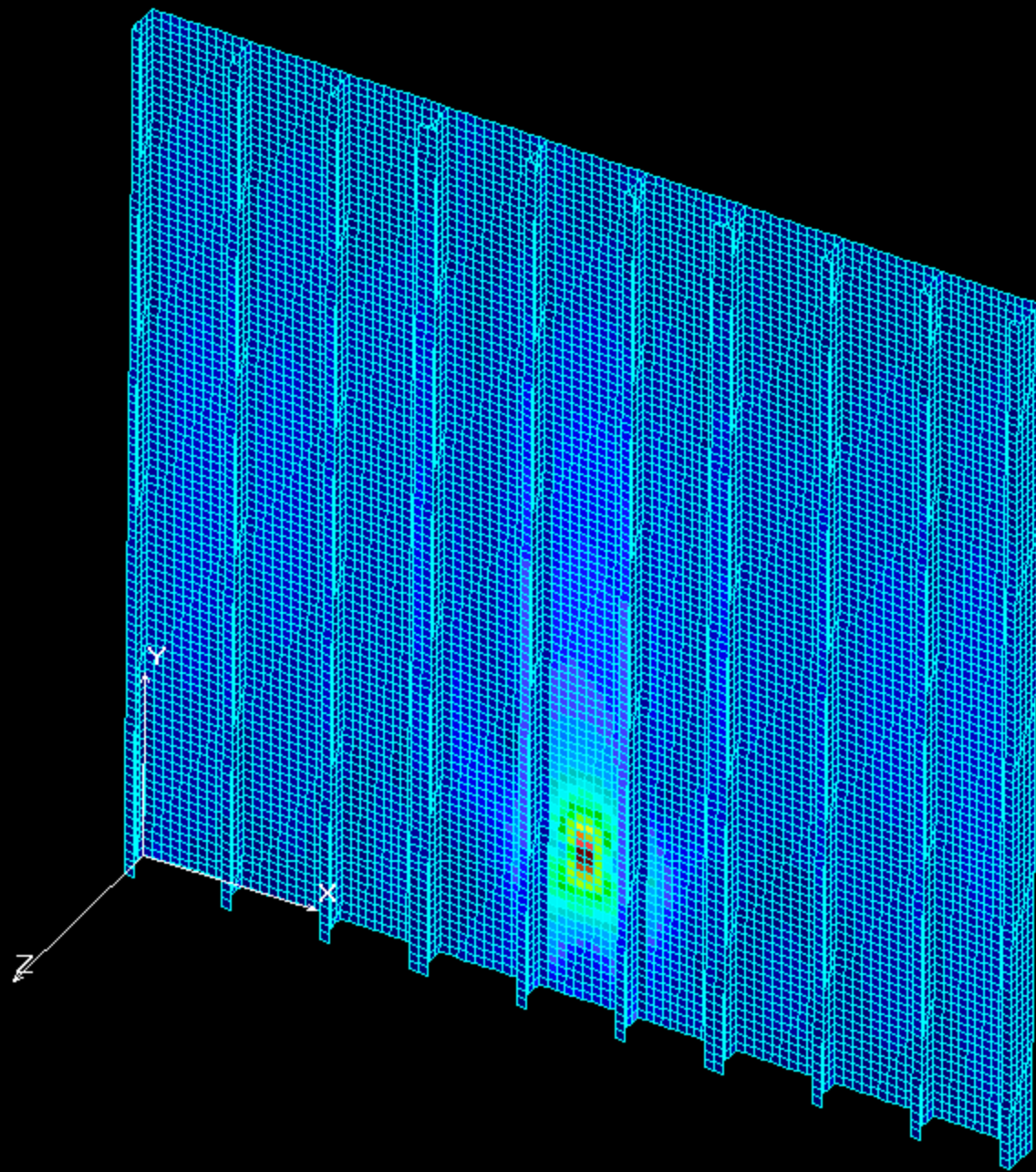
Load "D"
Front Face
Z Deflection
(in)



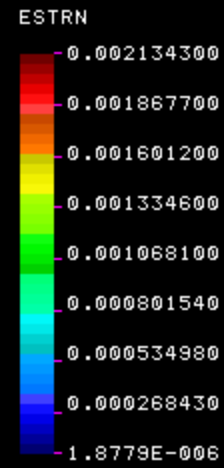
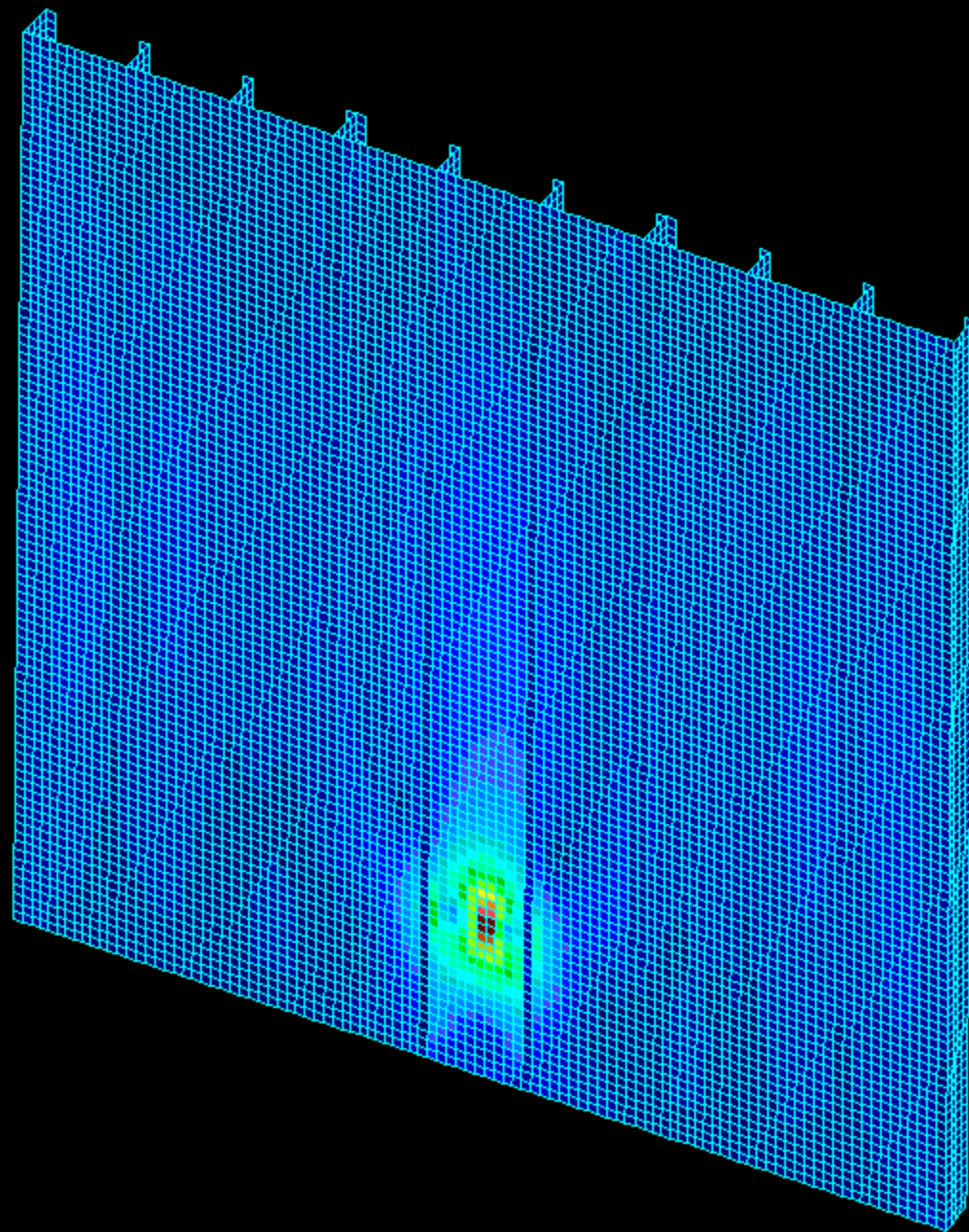
Load "D"
Frame
Stress (psi)



Load "D"
Panel
Stress (psi)



Load "D"
Frame
Strain

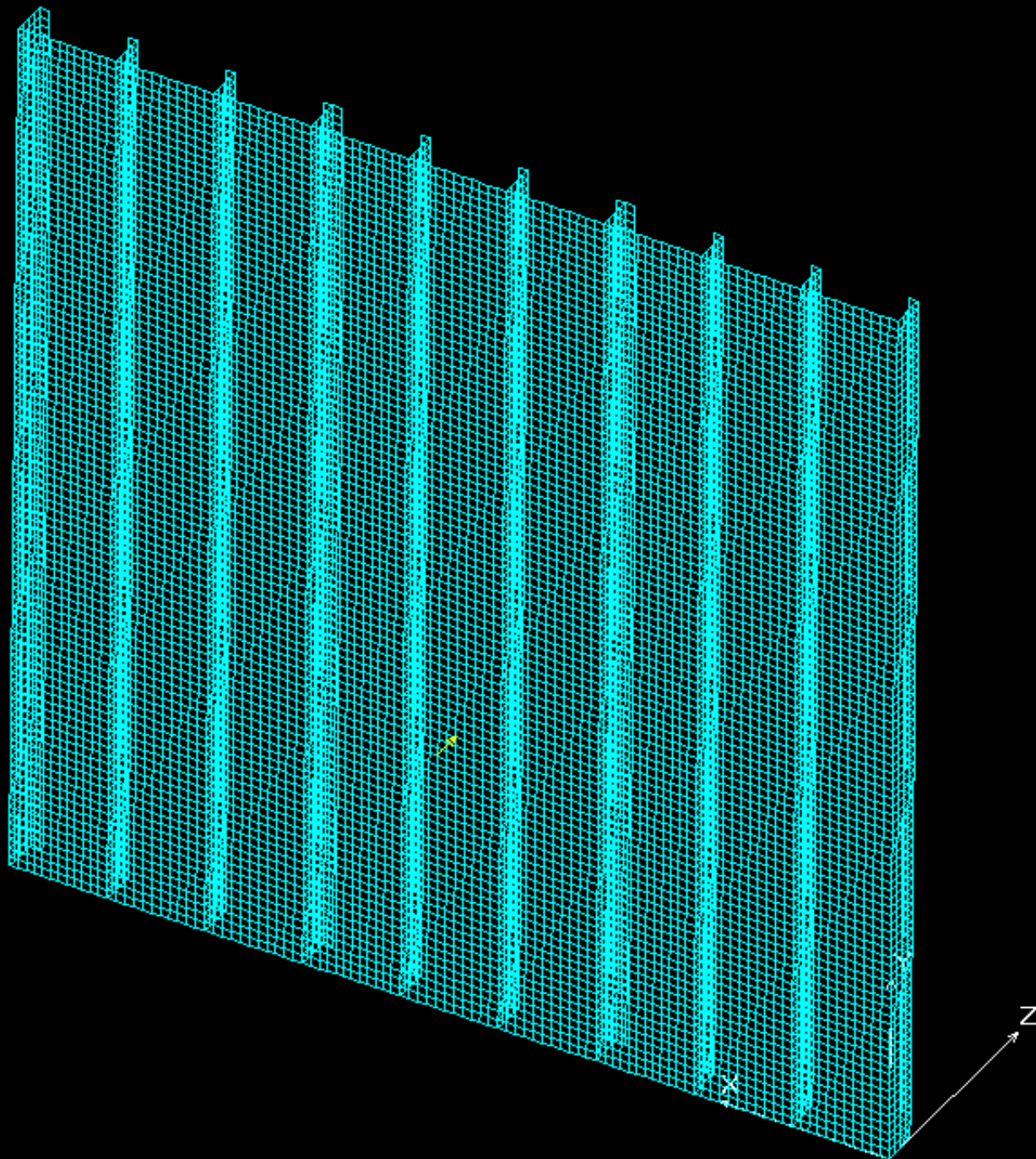


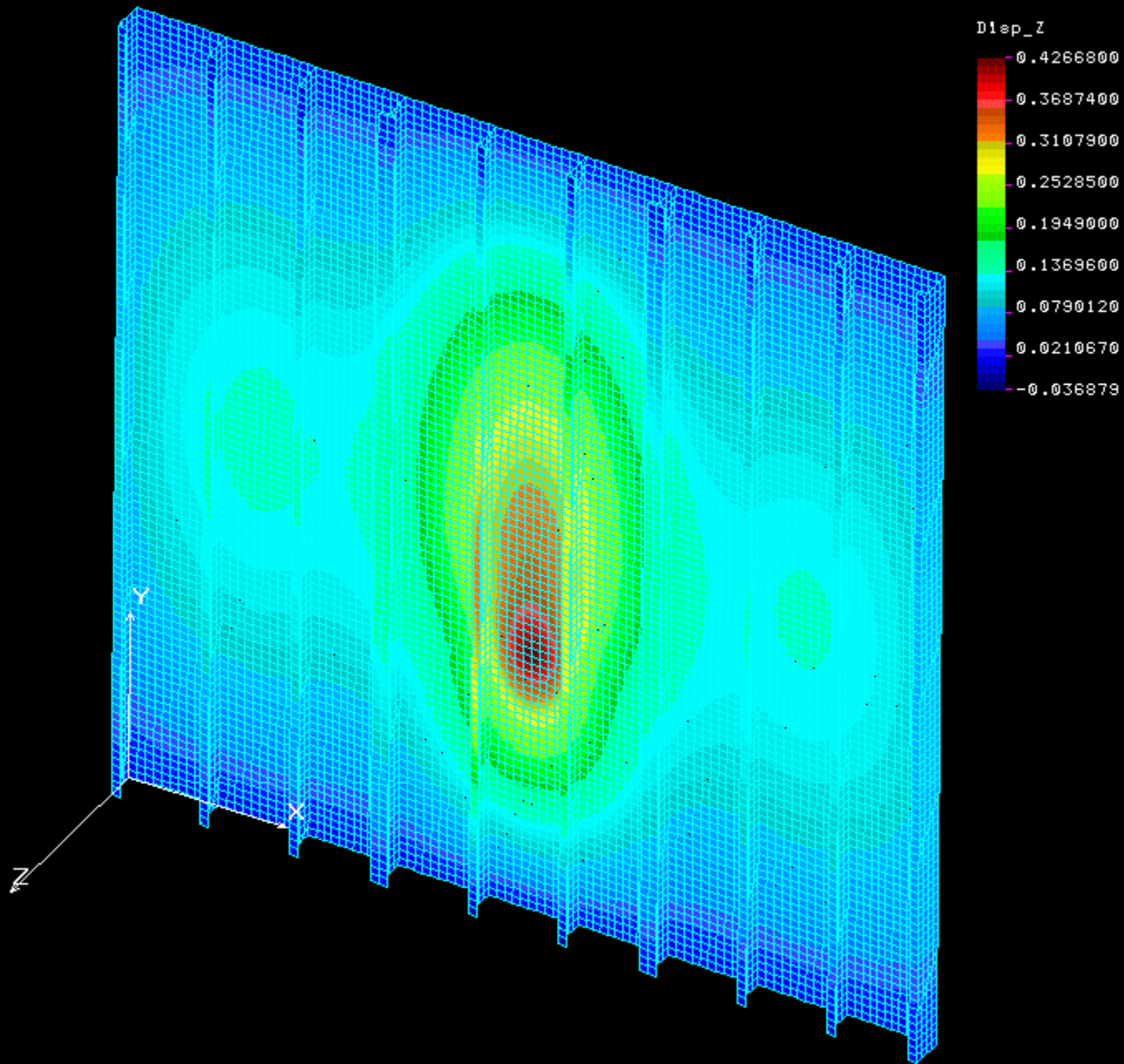
Load "D"
Panel
Strain

Loading “E”

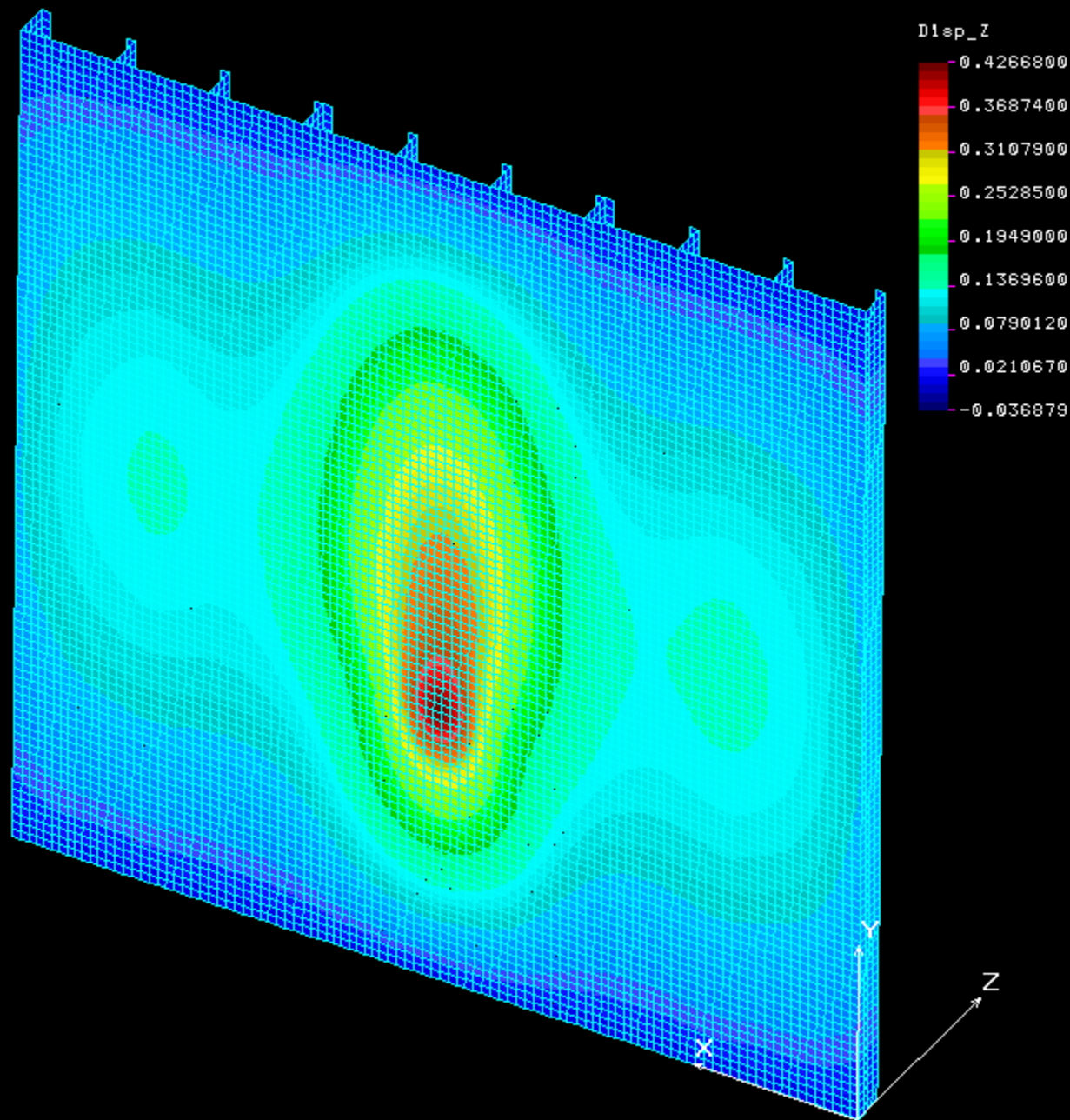
- Pressure load of 0.287 psi on wall panels
- 2000 lb point load on frame 4 ft above floor

2000 lb point
force on frame
4 ft above floor

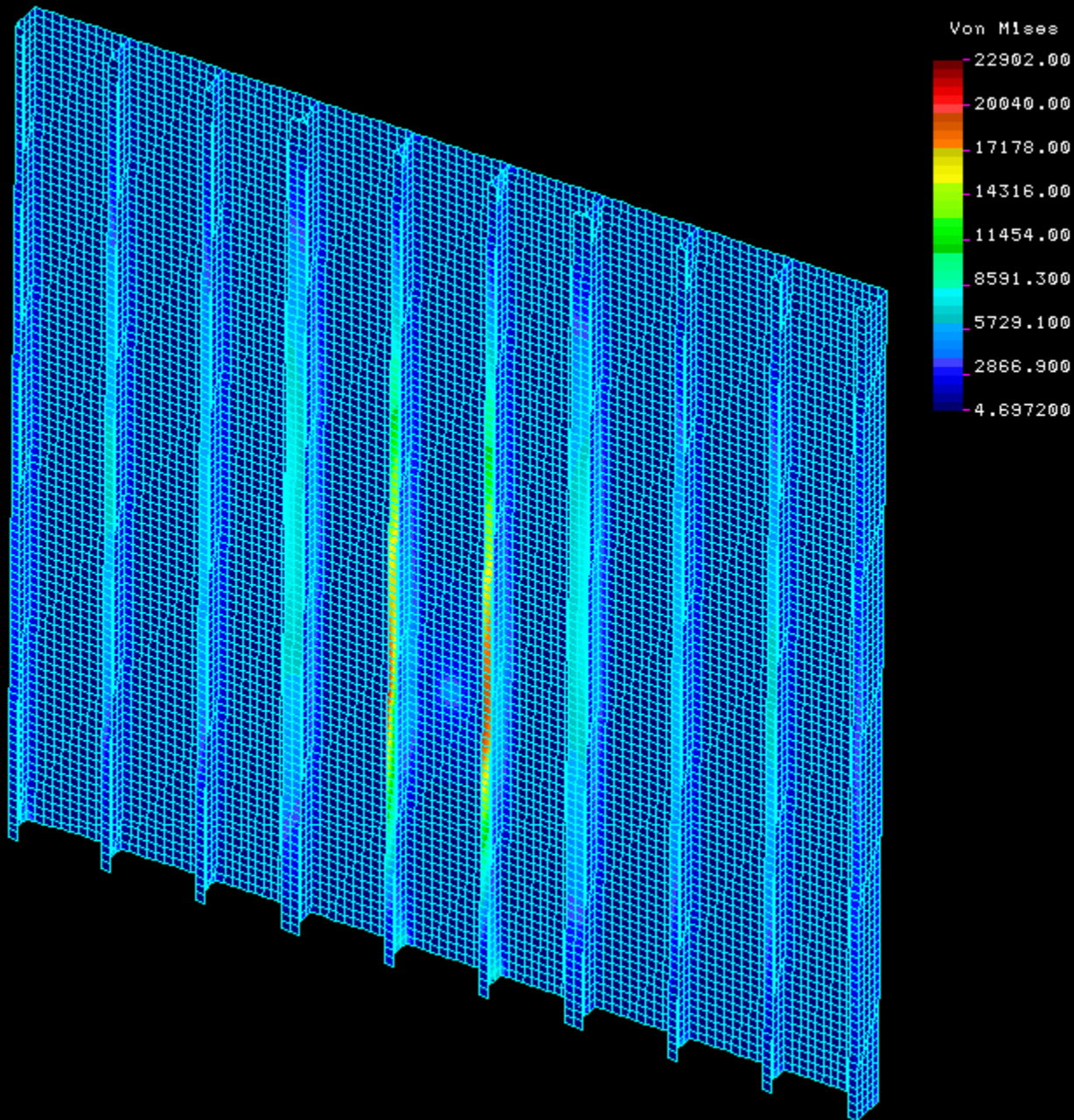




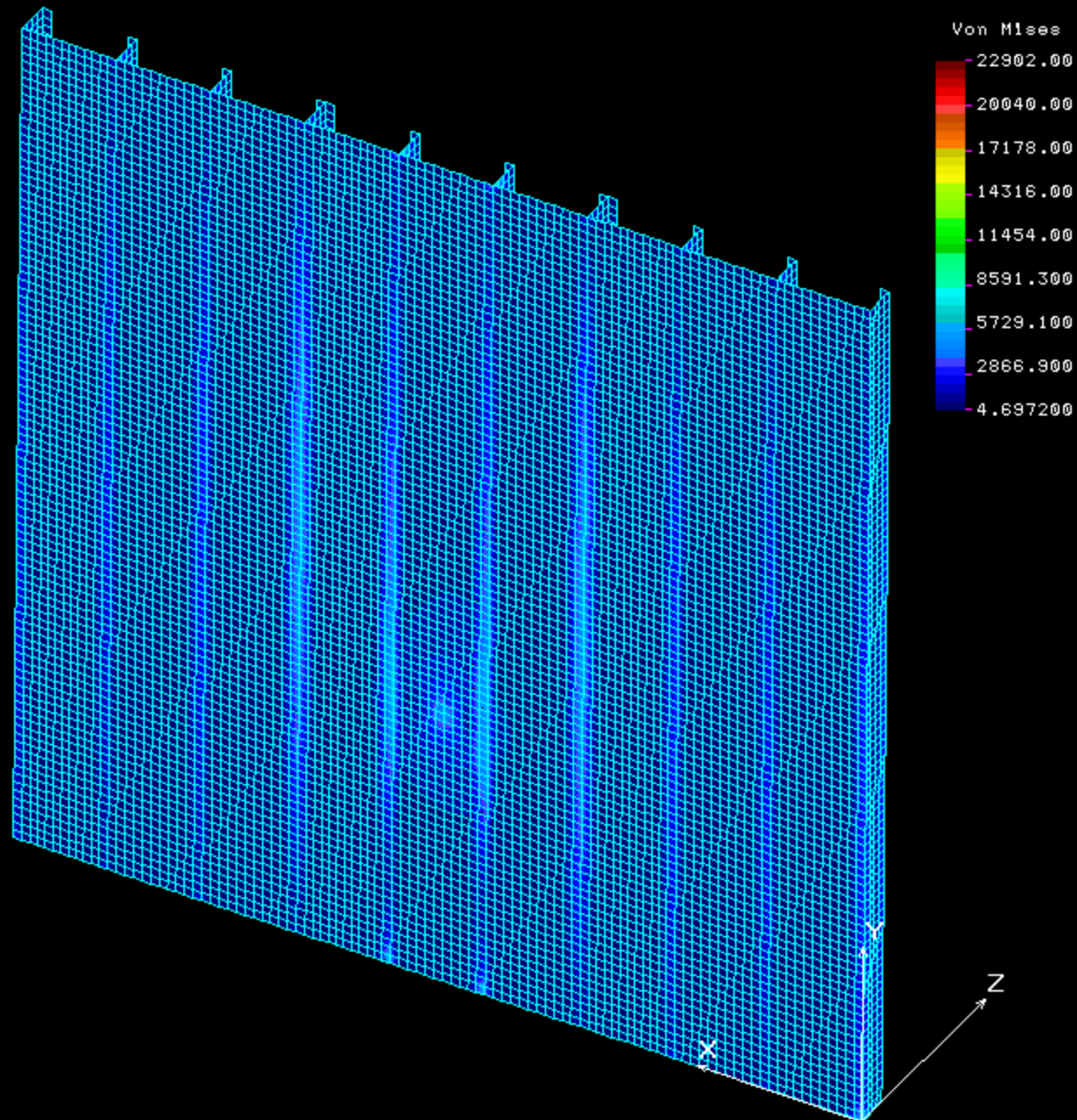
Load "E"
Frame Side
Z Deflection
(in)



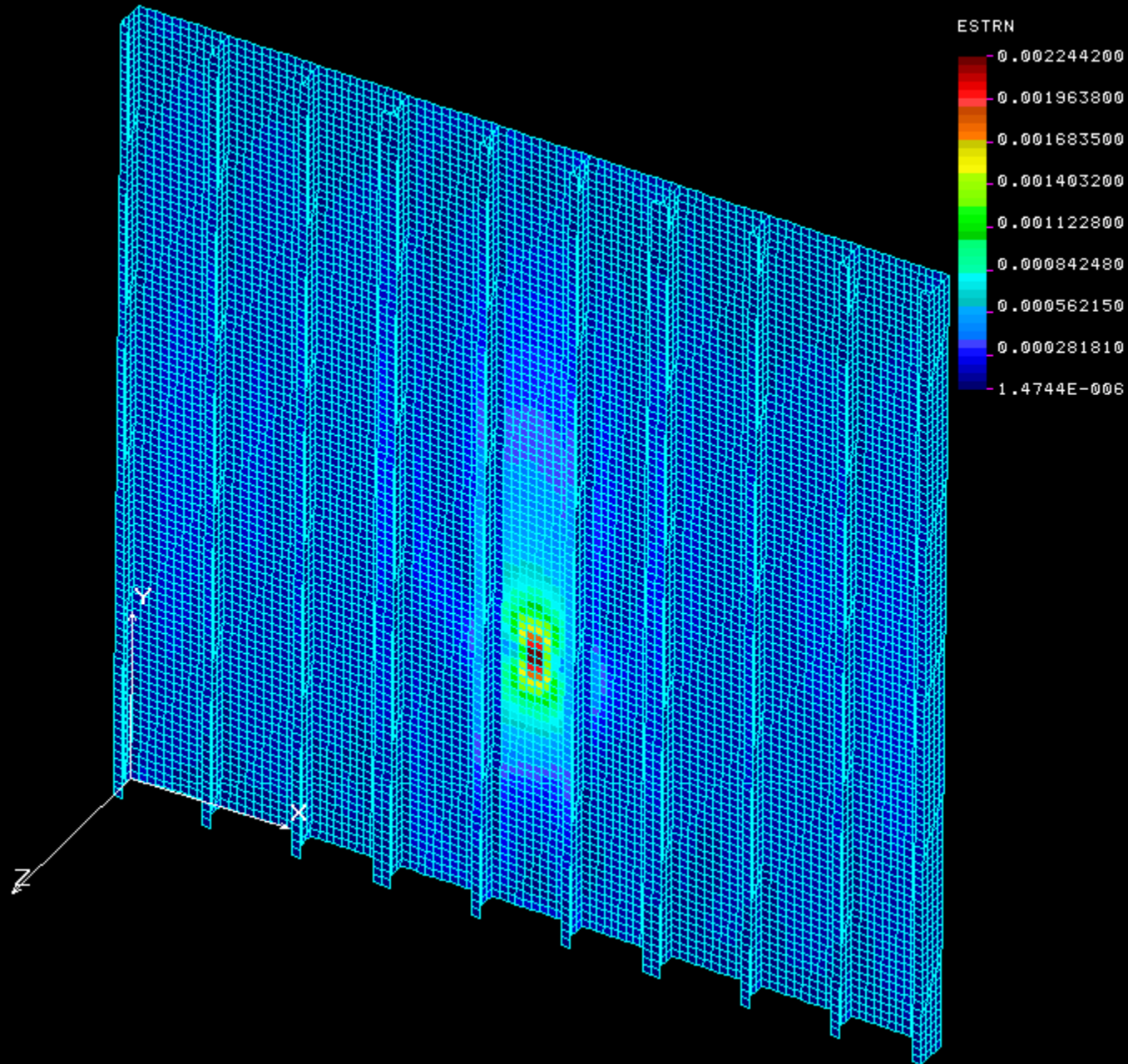
Load "E"
Front Face
Z Deflection
(in)



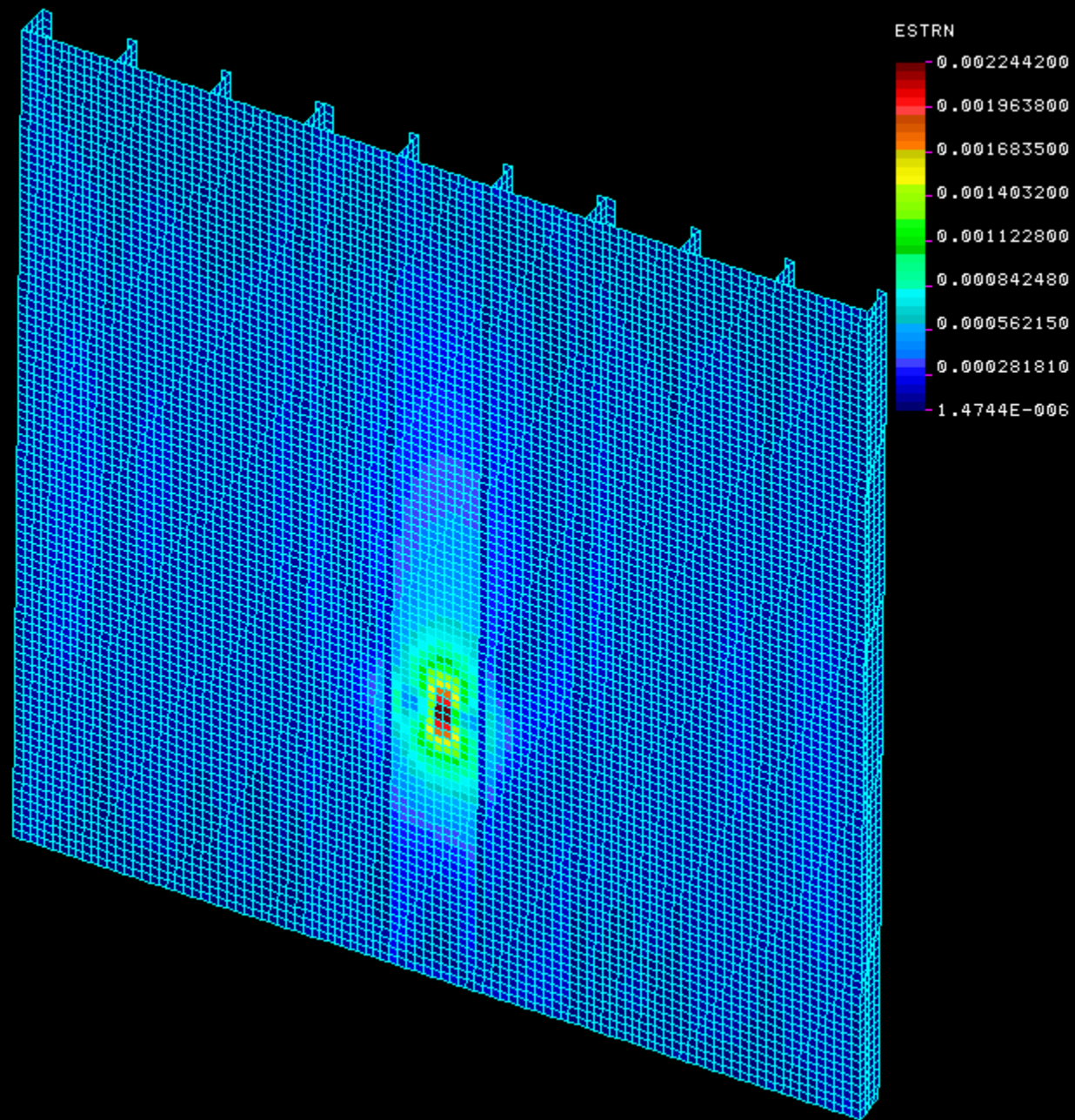
Load "E"
Frame
Stress (psi)



Load "E"
Panel
Stress (psi)



Load "E"
Frame
Strain

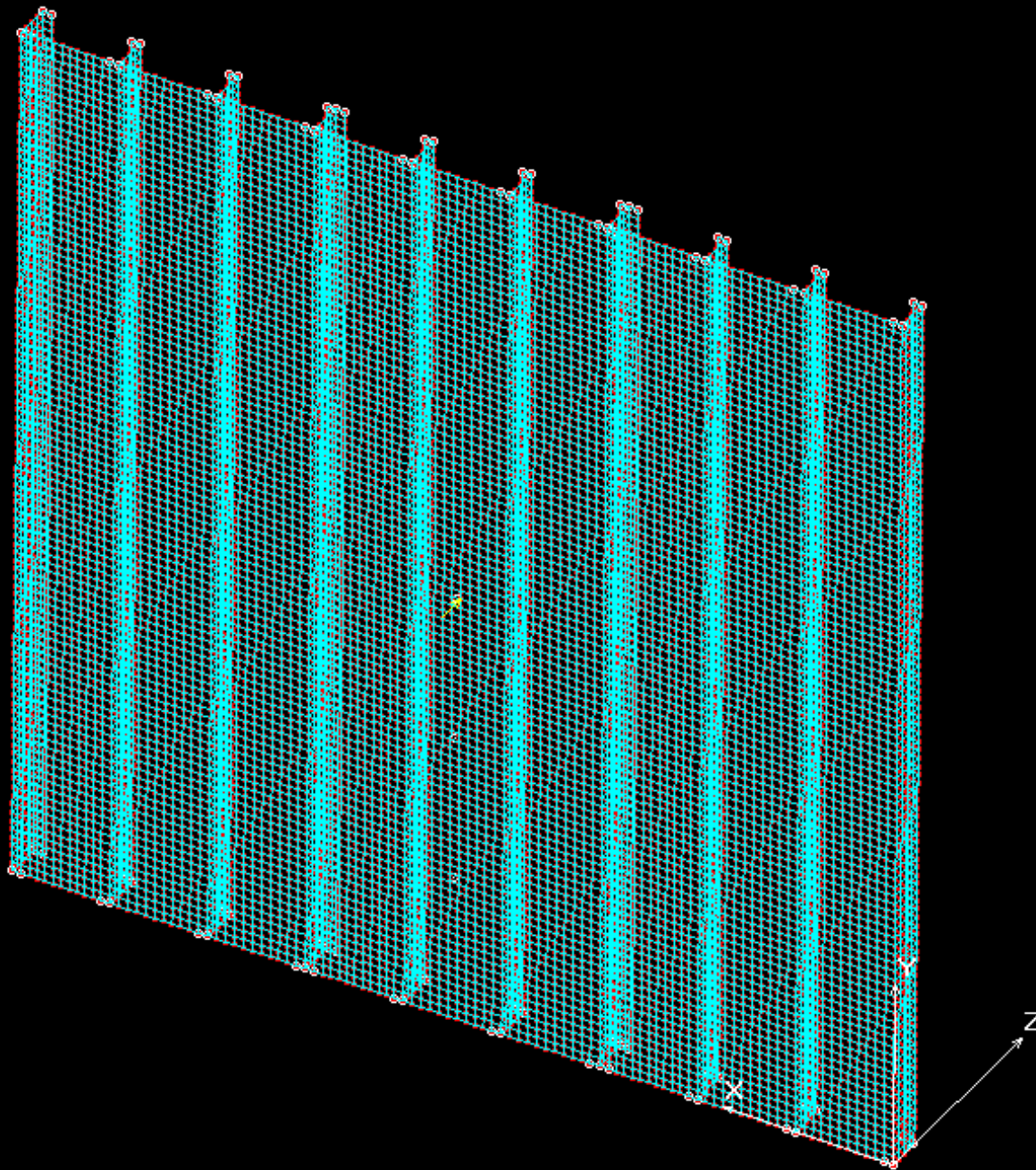


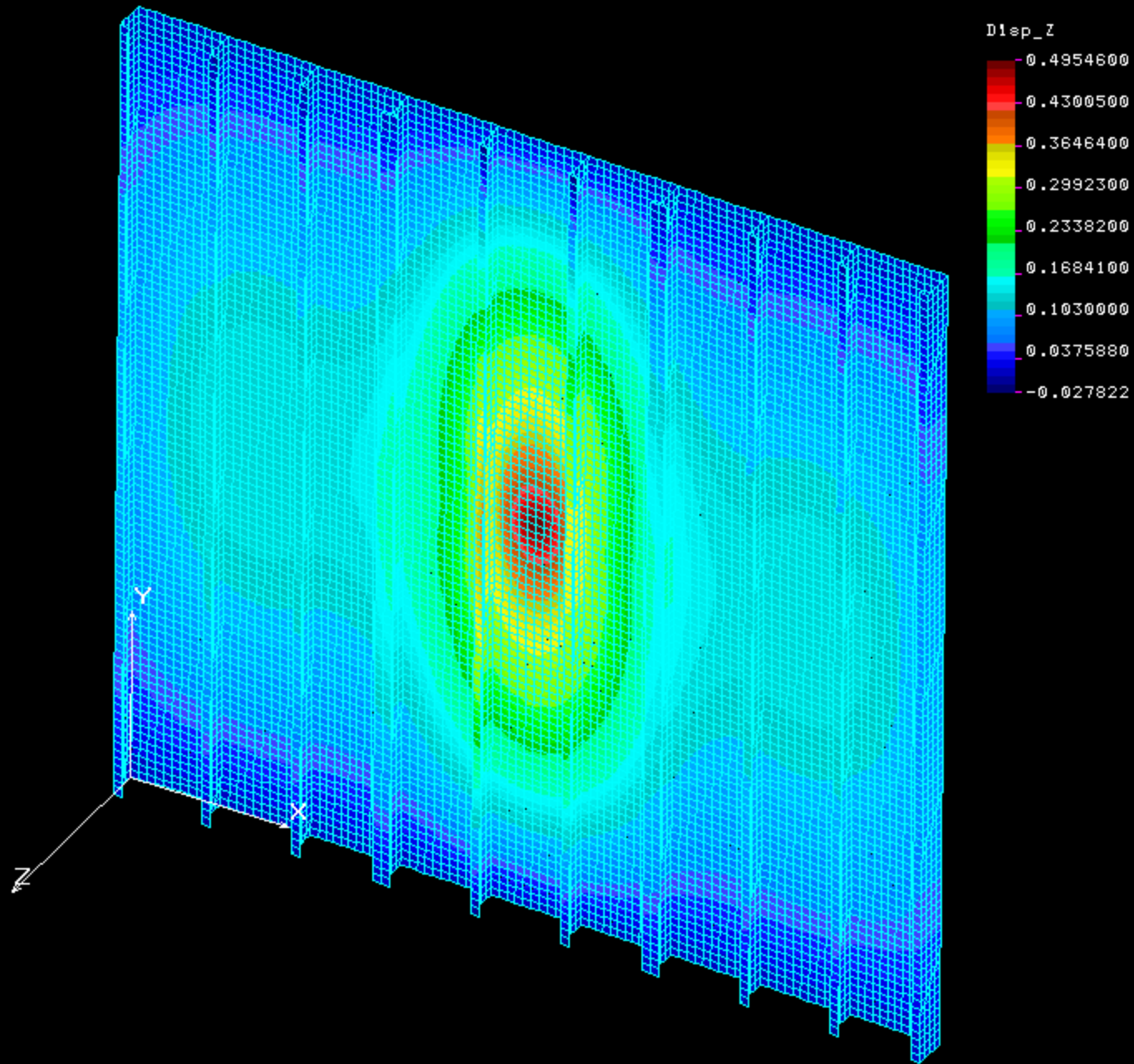
Load "E"
Panel
Strain

Loading “F”

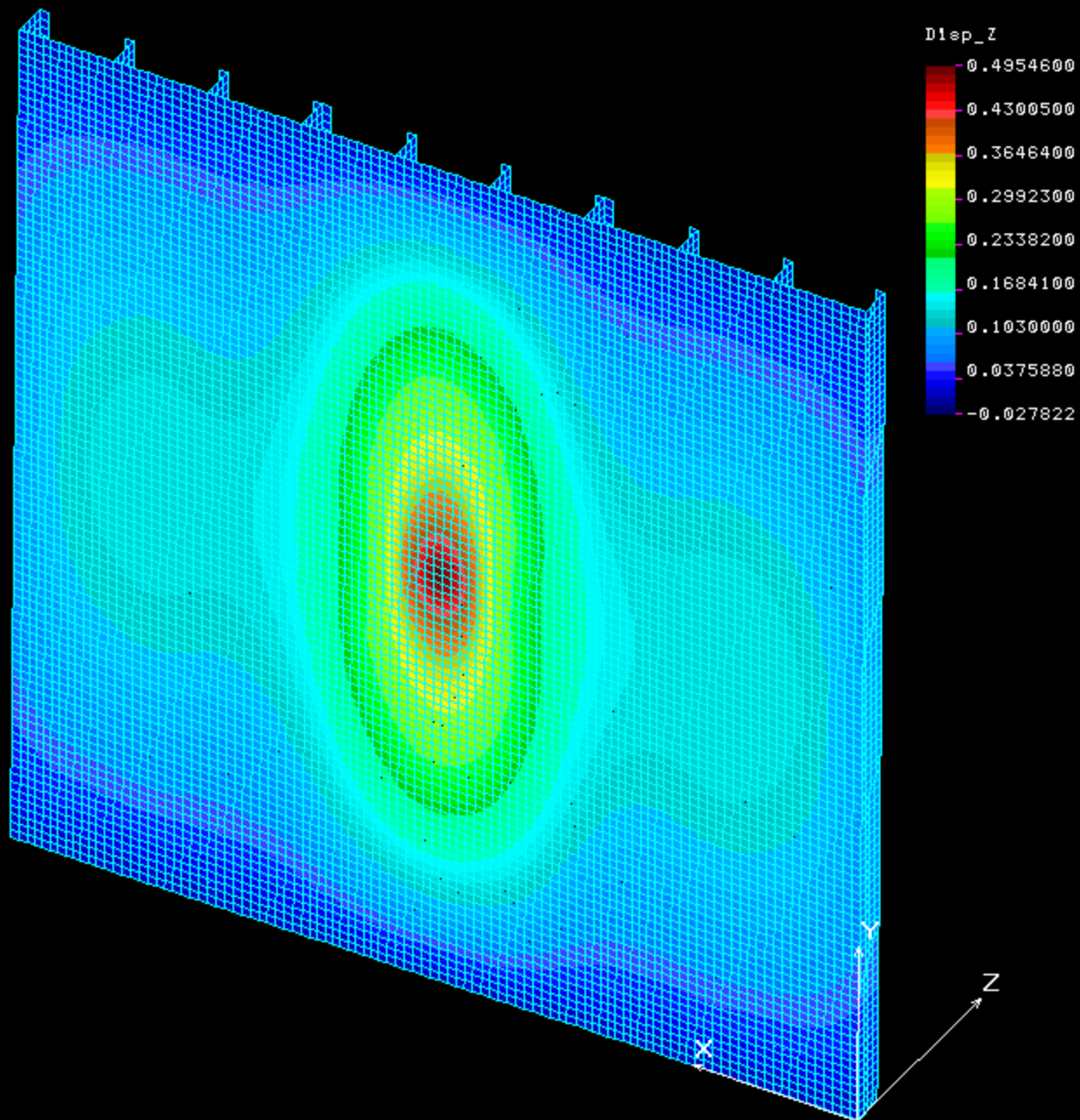
- Pressure load of 0.287 psi on wall panels
- 2000 lb point load on frame 2 ft above floor

2000 lb point
force on frame
6 ft above floor



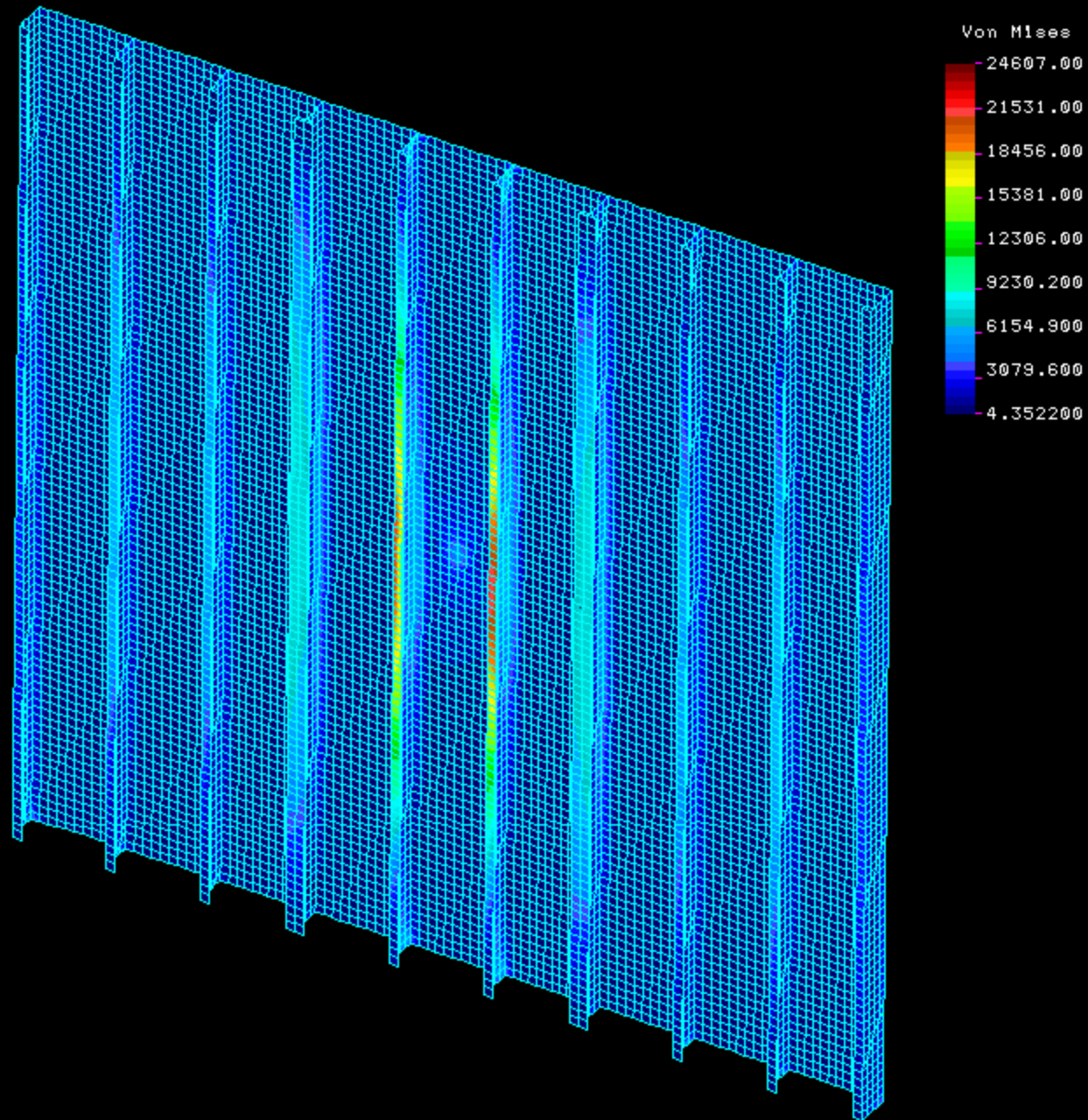


Load "F"
Frame Side
Z Deflection
(in)

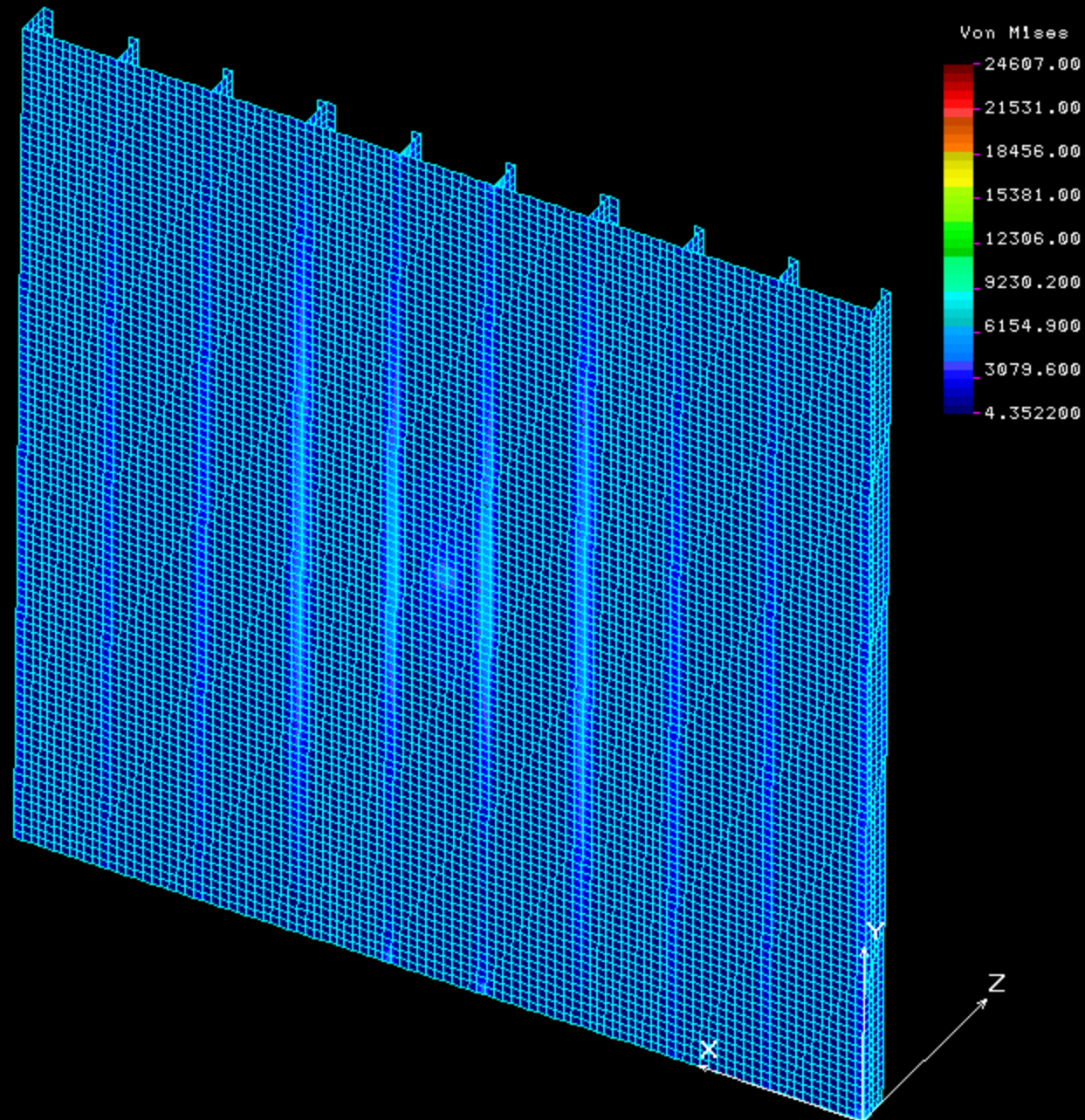


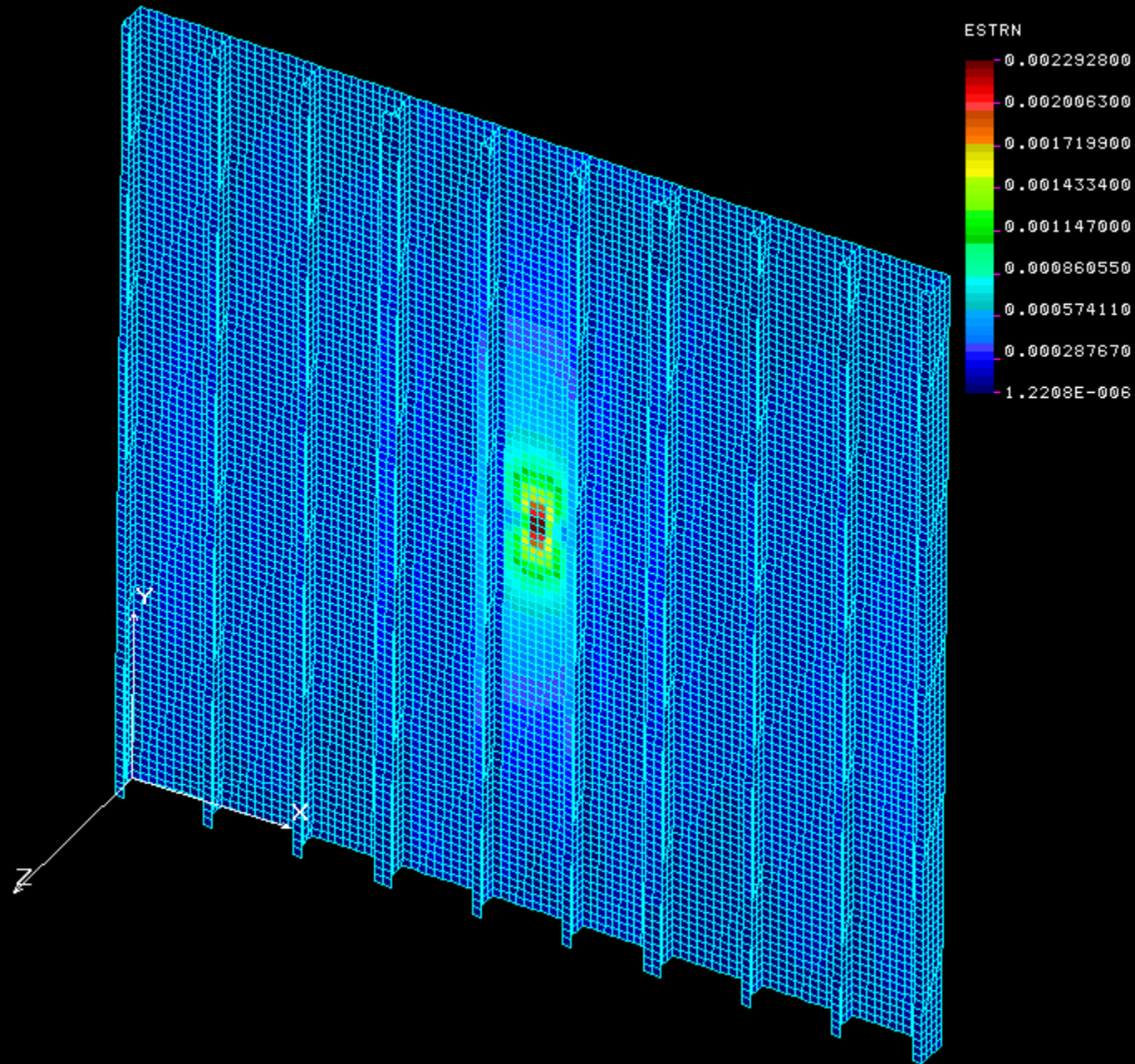
Load "F"
Front Face
Z Deflection
(in)

Load "F" Frame Stress (psi)



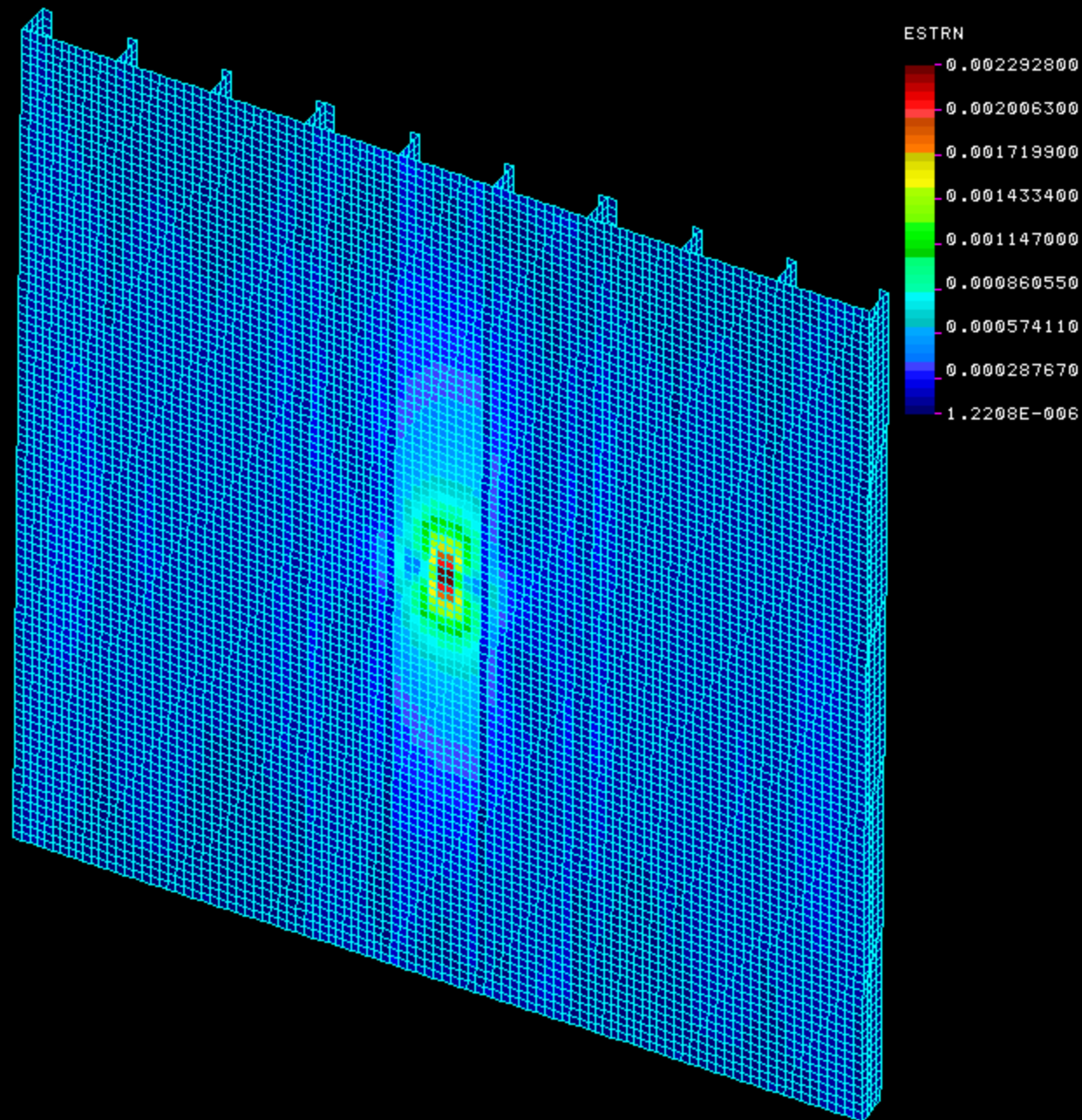
Load "F" Panel Stress (psi)





Load "F"
Frame
Strain

Load "F" Panel Strain



Summary

- The lowest safety factor for the steel frames is 2, for load case “C”.
- The lowest safety factor for the GRP panels is 4.5, for load case “F”.
- The current design is adequate for up to a 2000 lb point load for 12 ft high walls
- Higher loading will require higher/thicker frames and may require thicker panels.