

ARCOPLAST

12 ft Free Standing Double Sided 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%

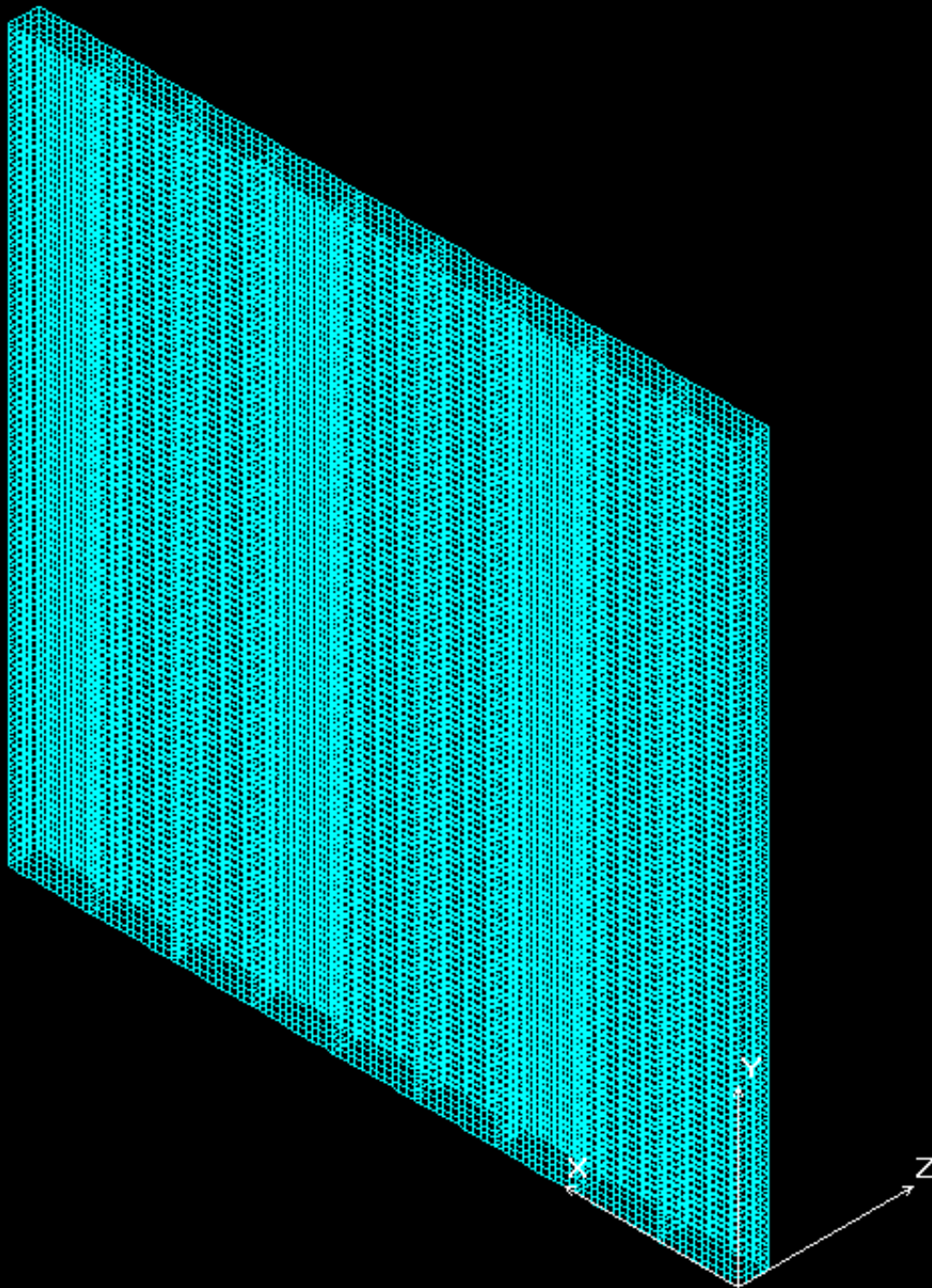
Wall Model Constraints

- 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

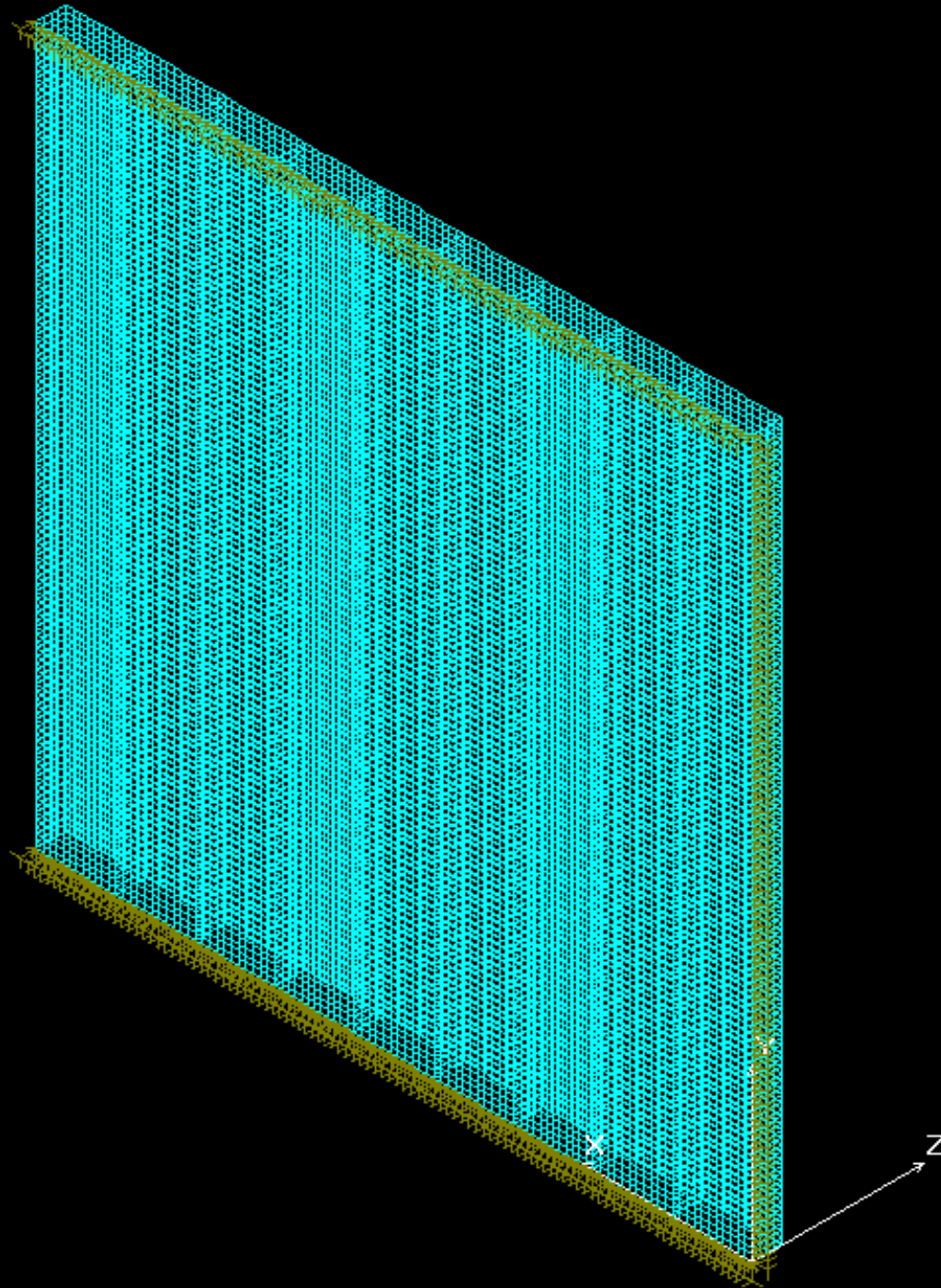
Load Cases

- 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

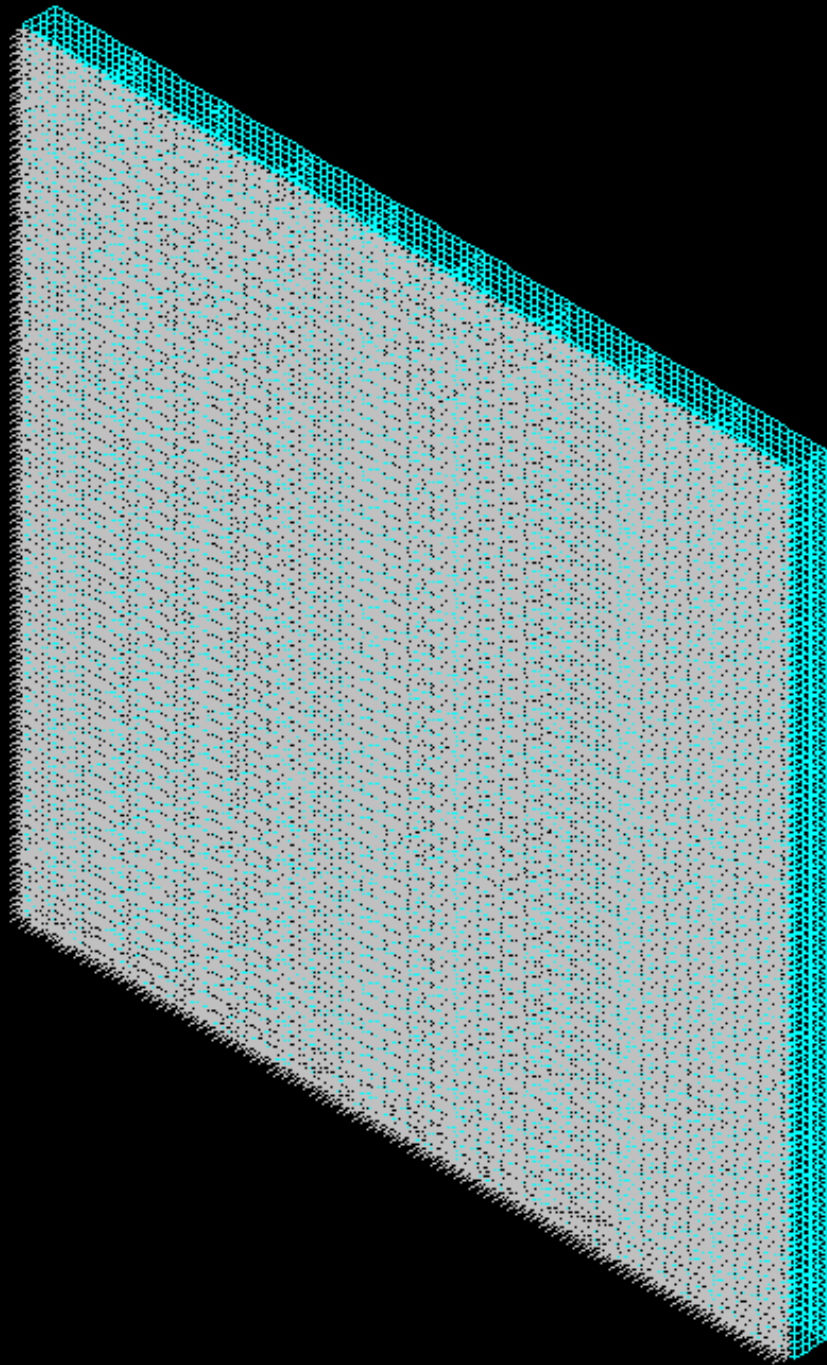


Constraints



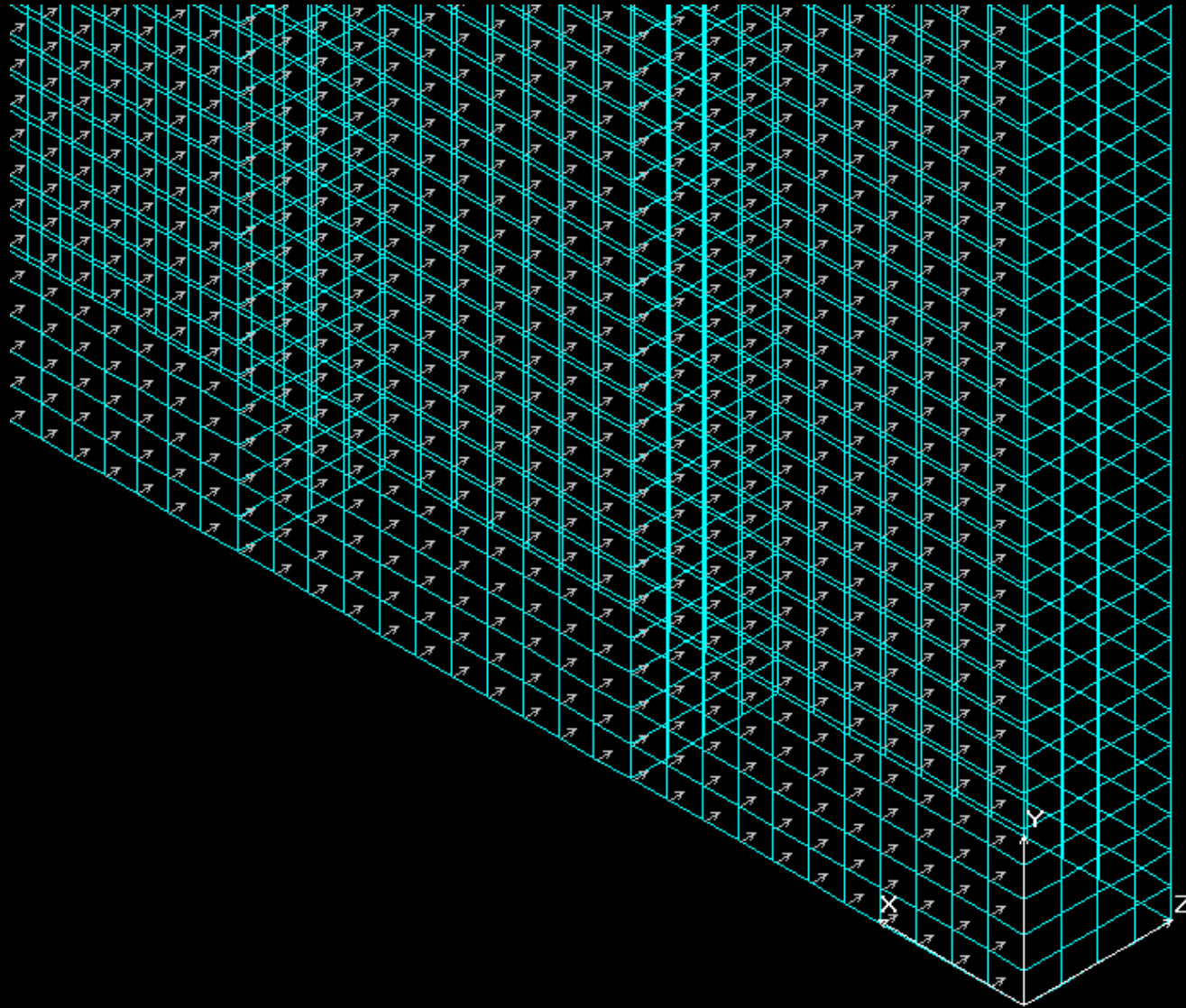
Pressure Load Only

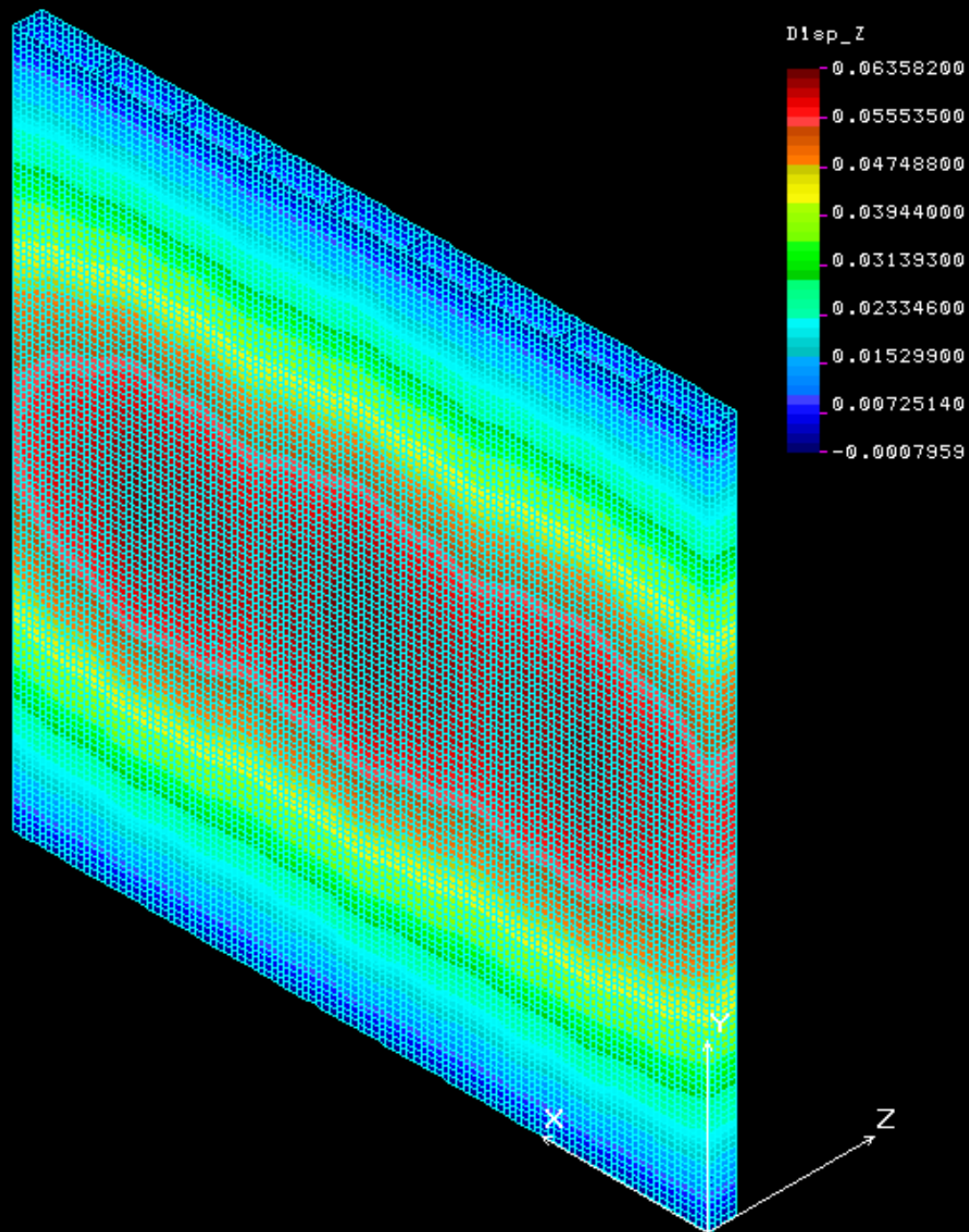
- 0.287 psi on wall panels



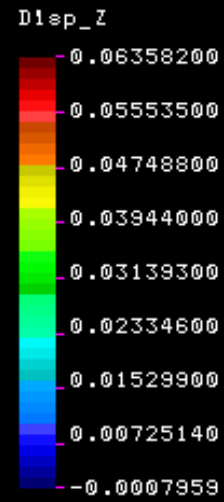
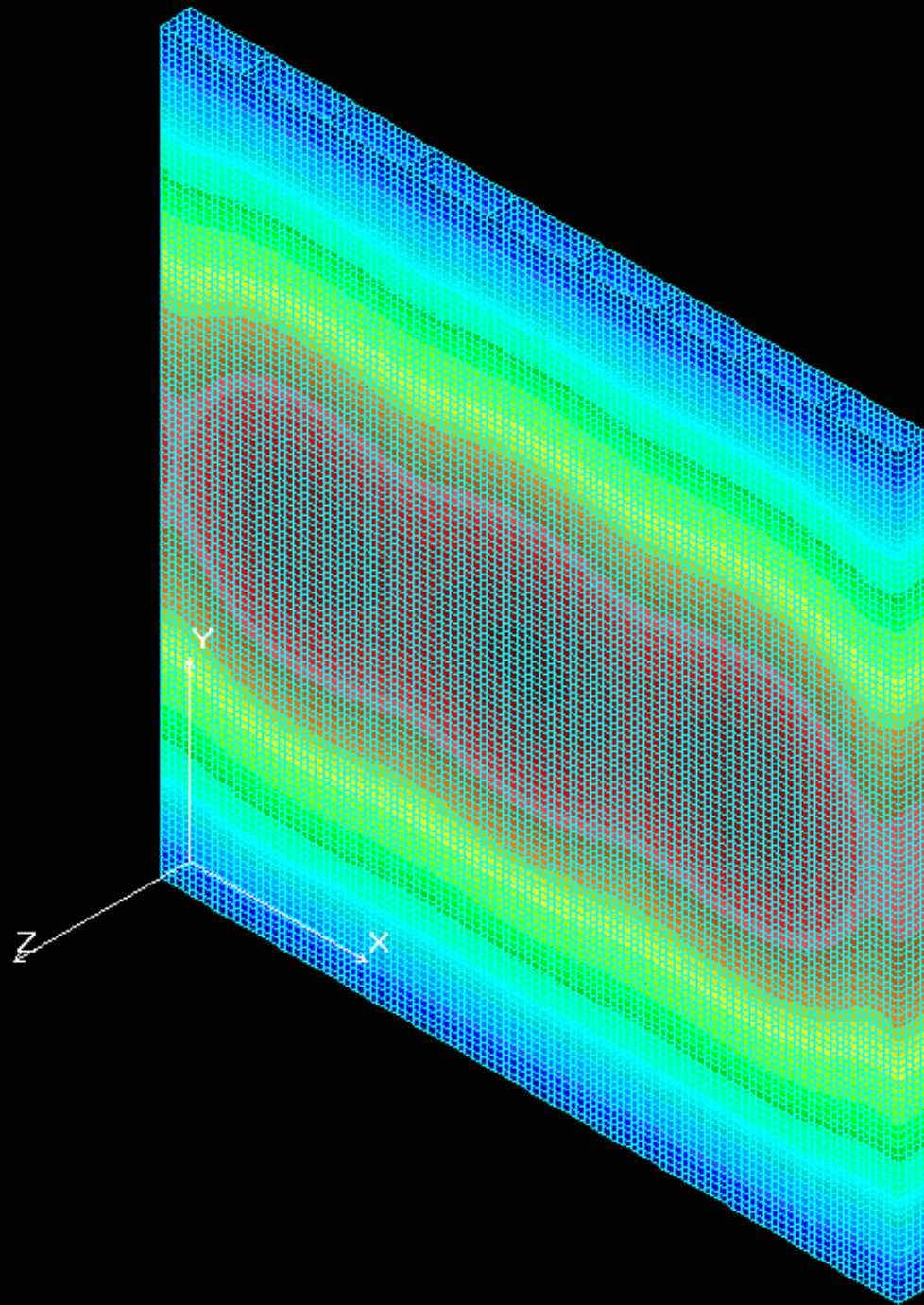
Pressure
Load

Pressure Load Closeup



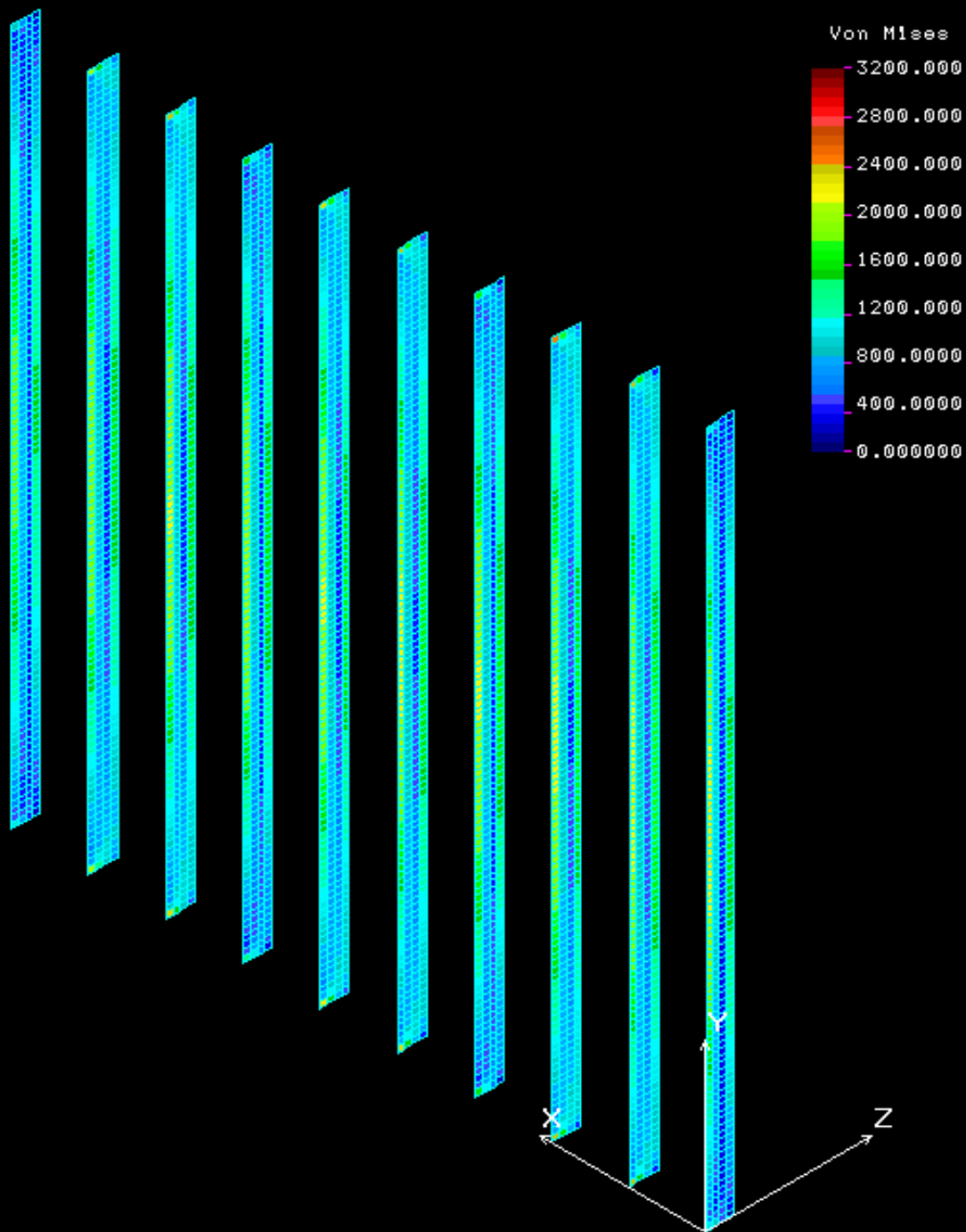


Pressure
Load Only
Front Face
Z Deflection
(in)

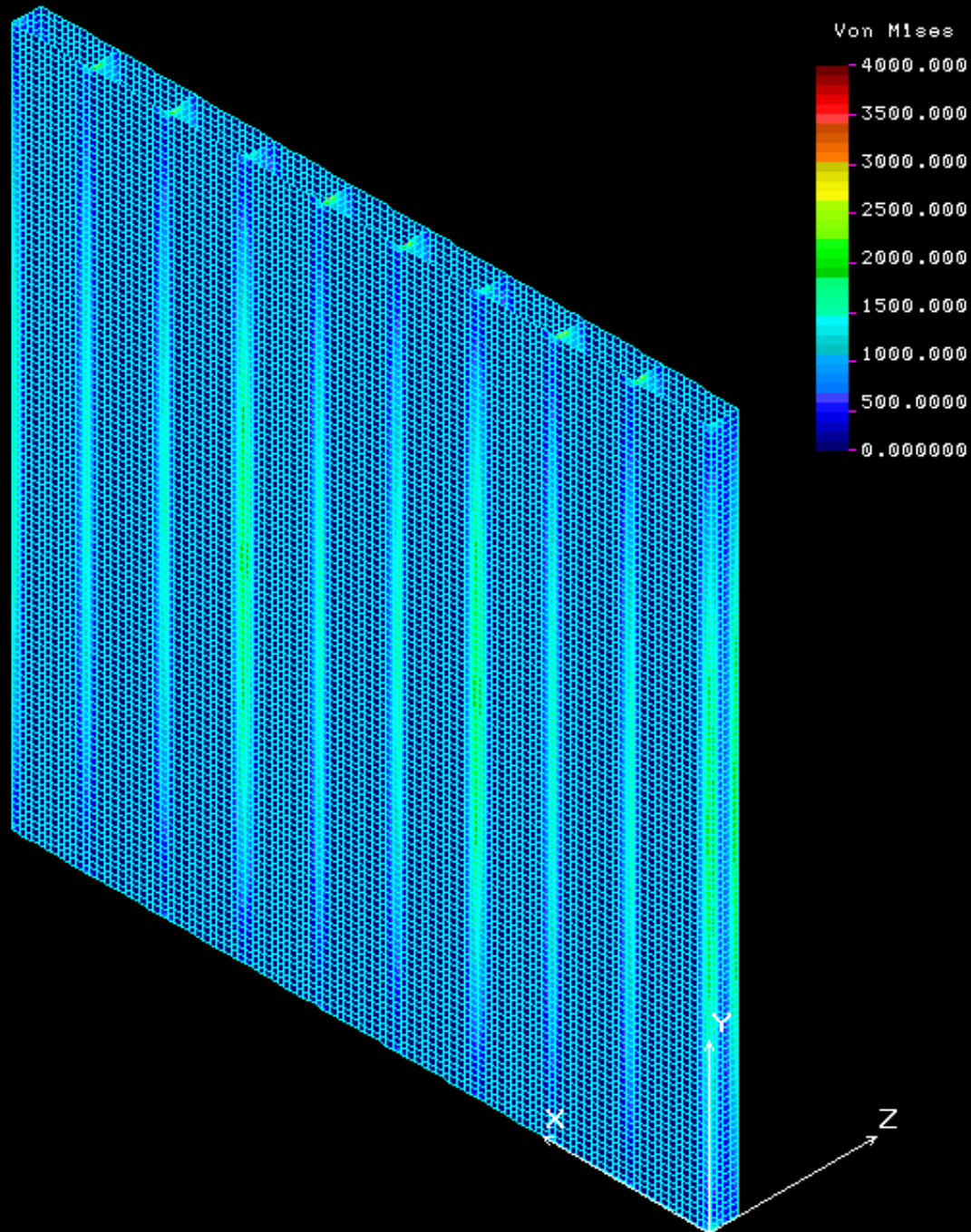


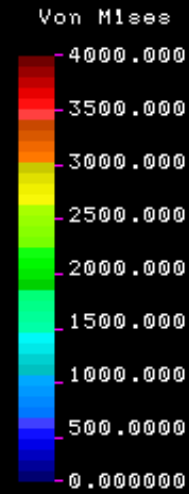
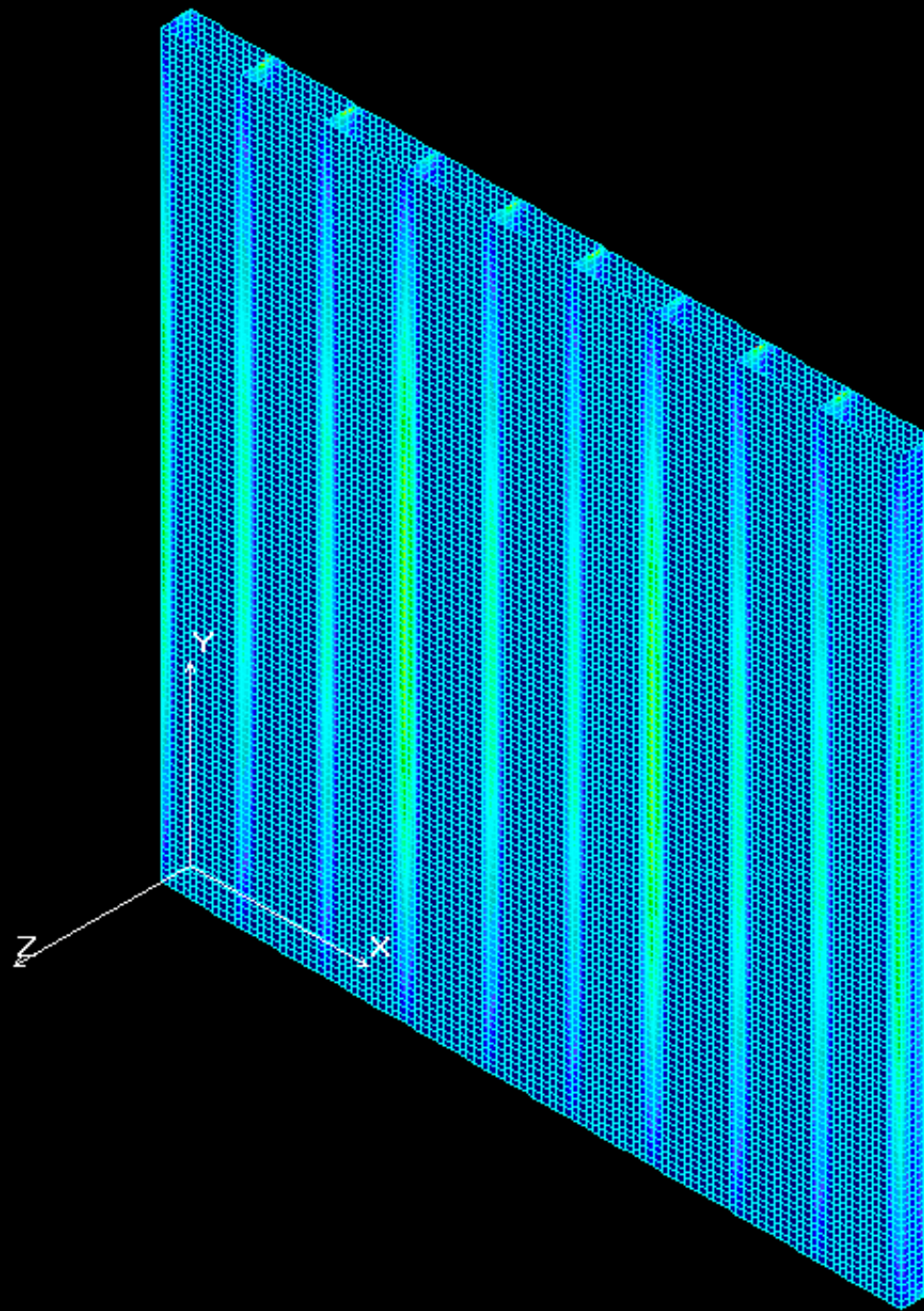
Pressure
Load Only
Back Face
Z Deflection
(in)

Pressure Load Only Frame Stress (psi)



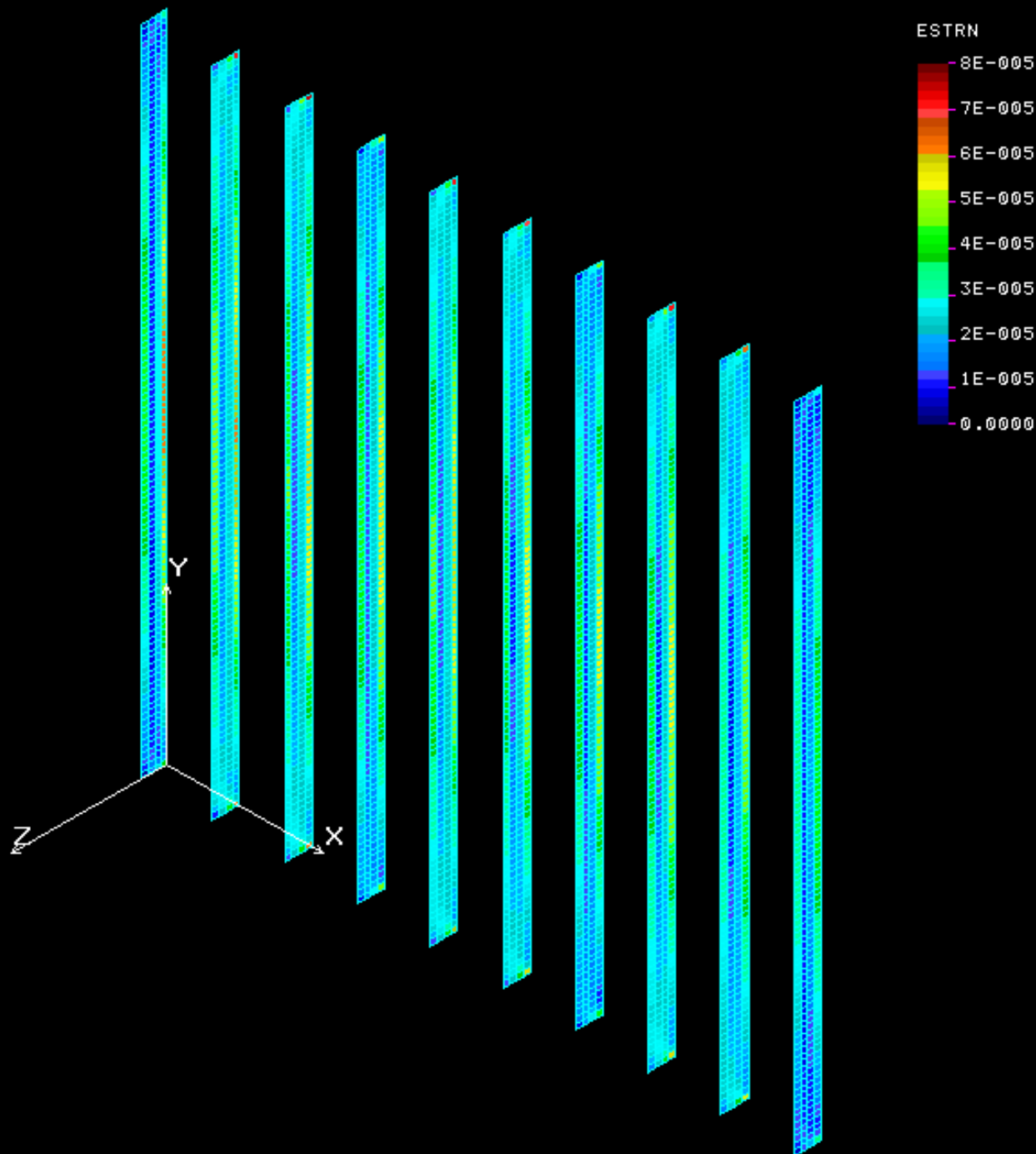
Pressure Load Only Front Panel Stress (psi)



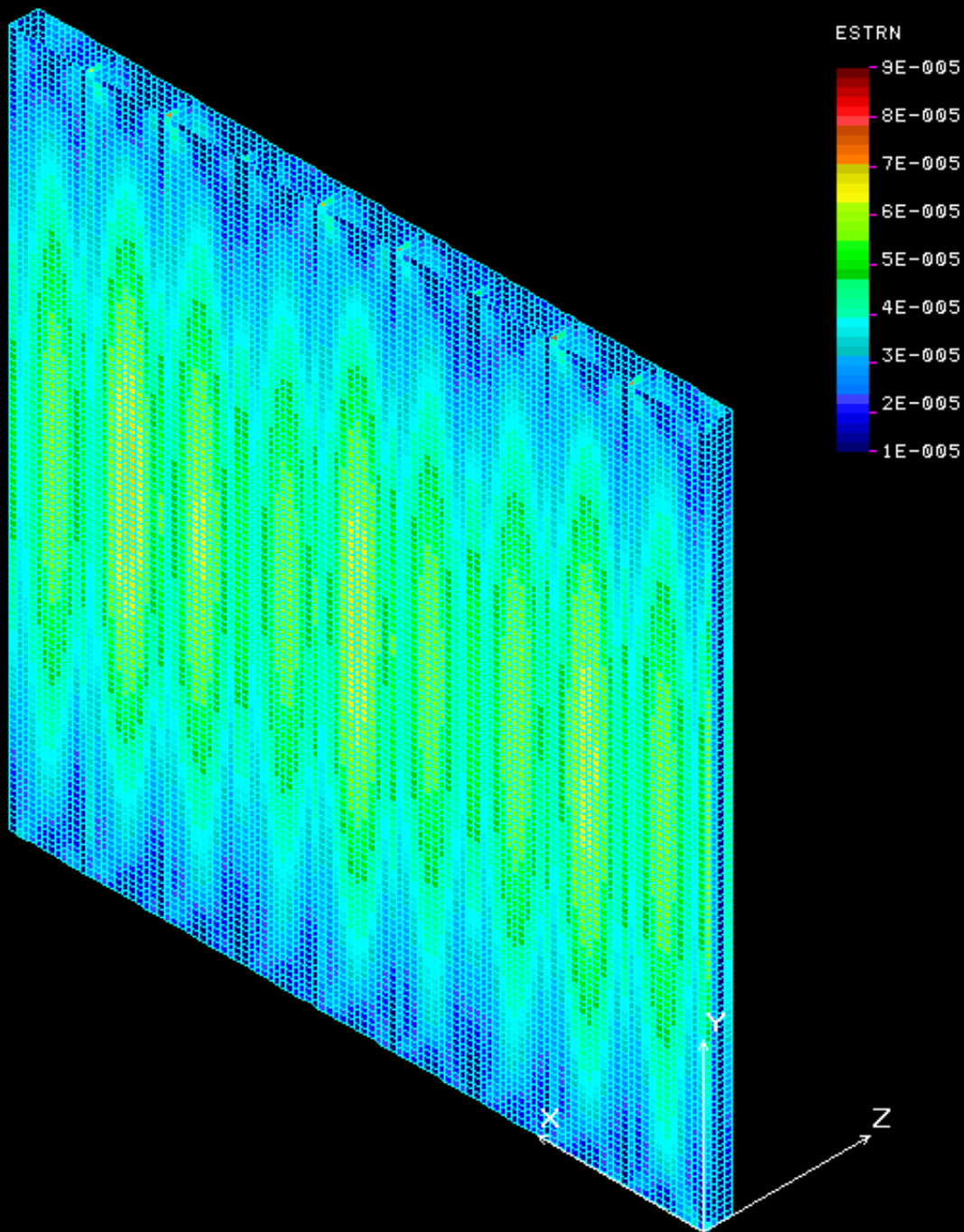


Pressure
Load Only
Back Panel
Stress (psi)

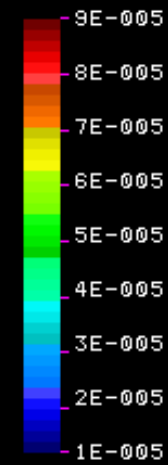
Pressure Load Only Frame Strain



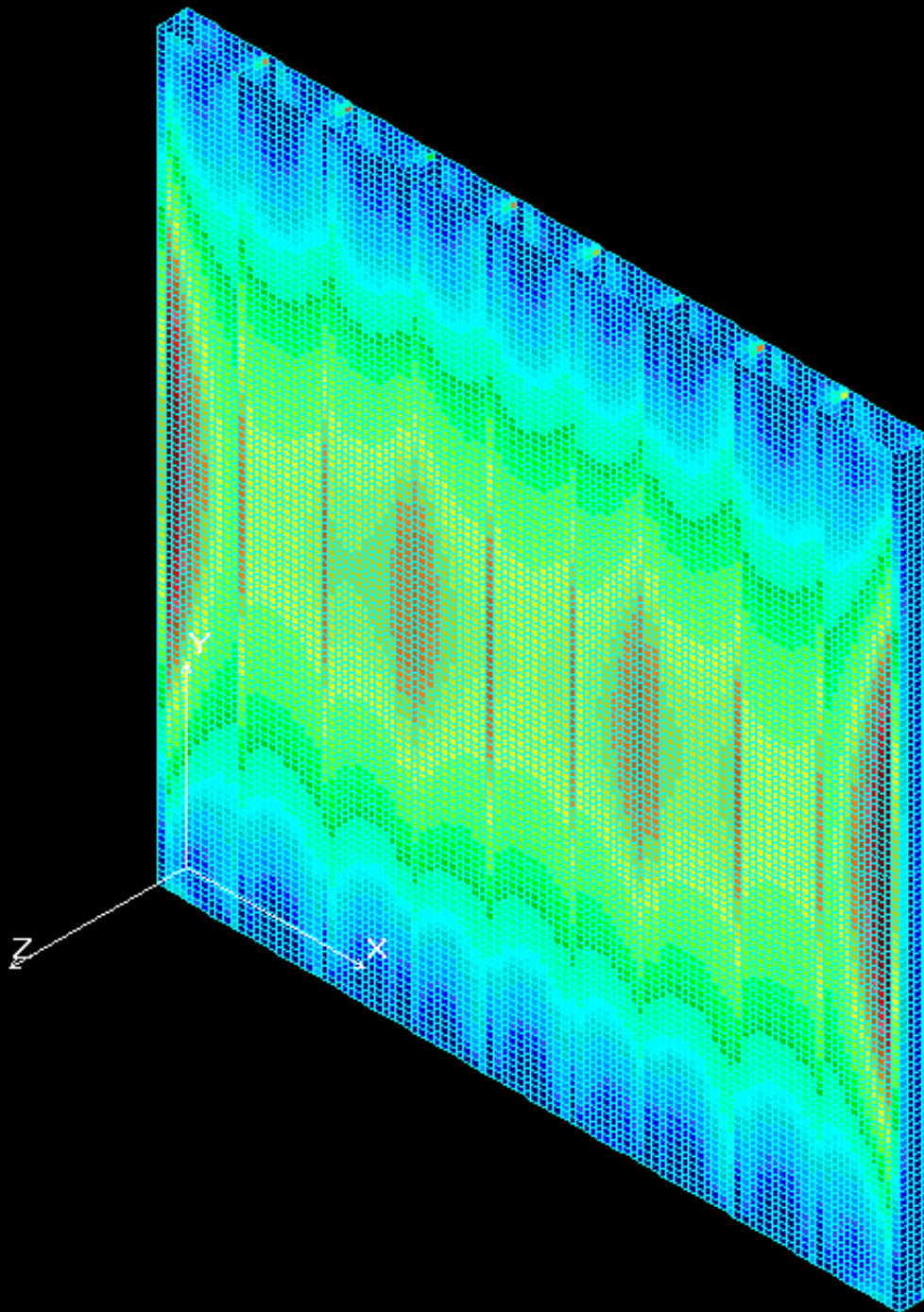
Pressure Load Only Front Panel Strain



ESTRN



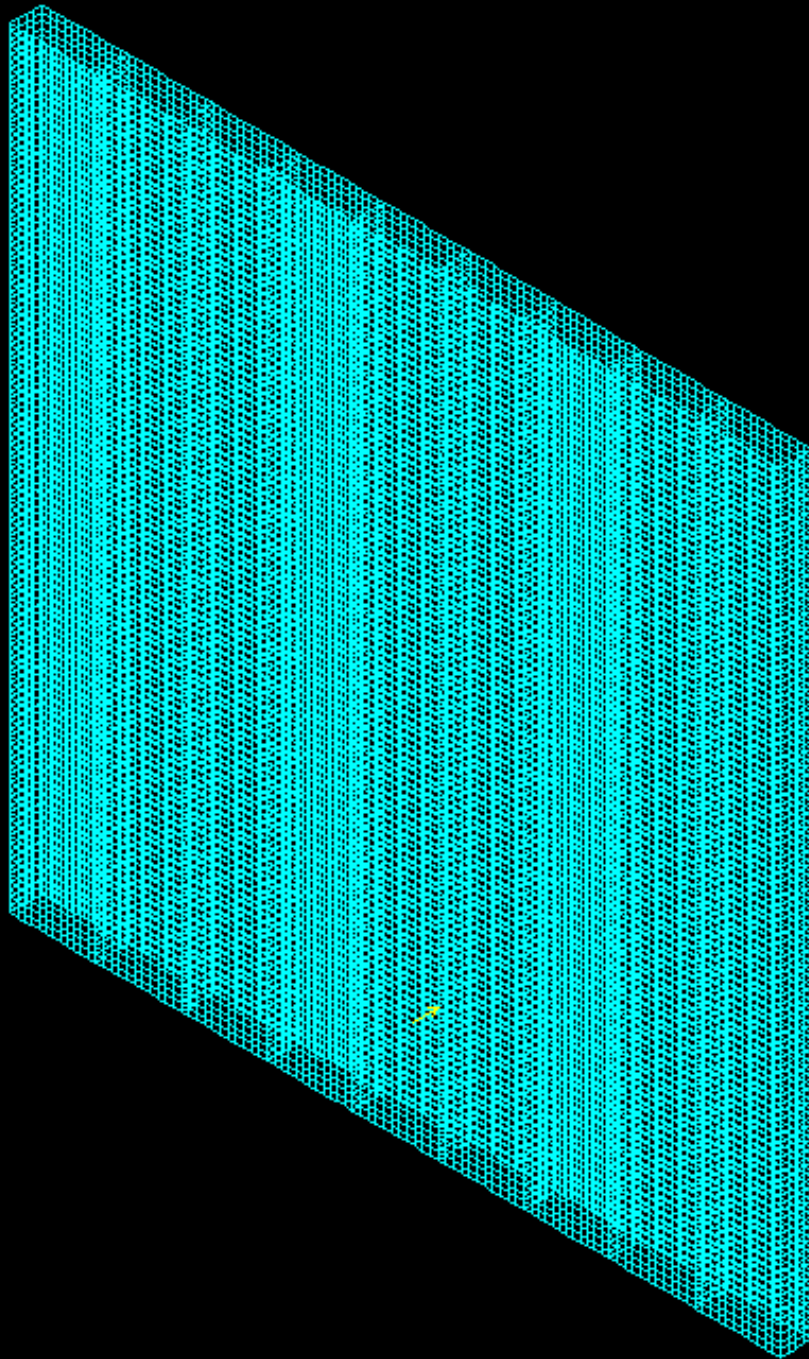
Pressure
Load Only
Back Panel
Strain

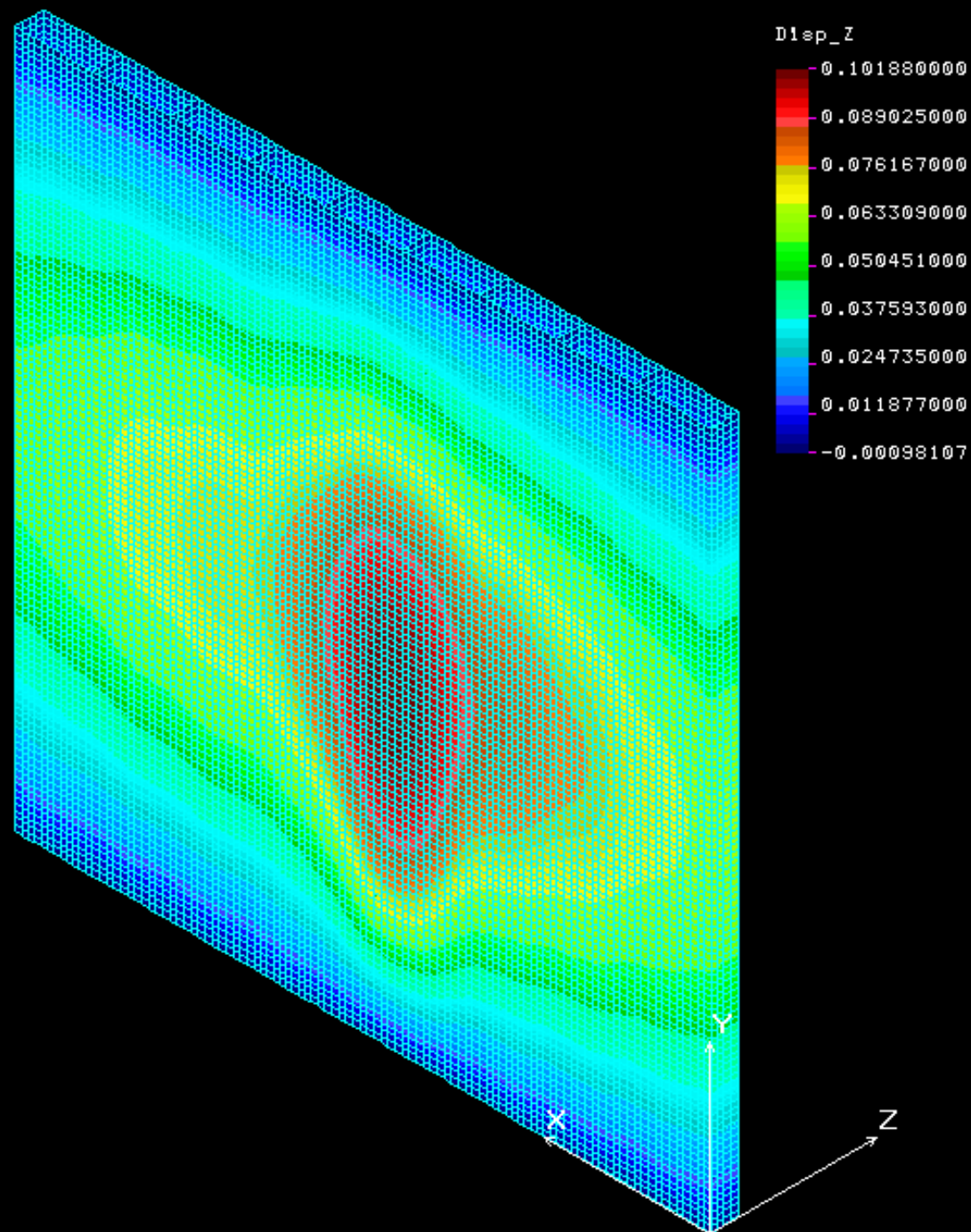


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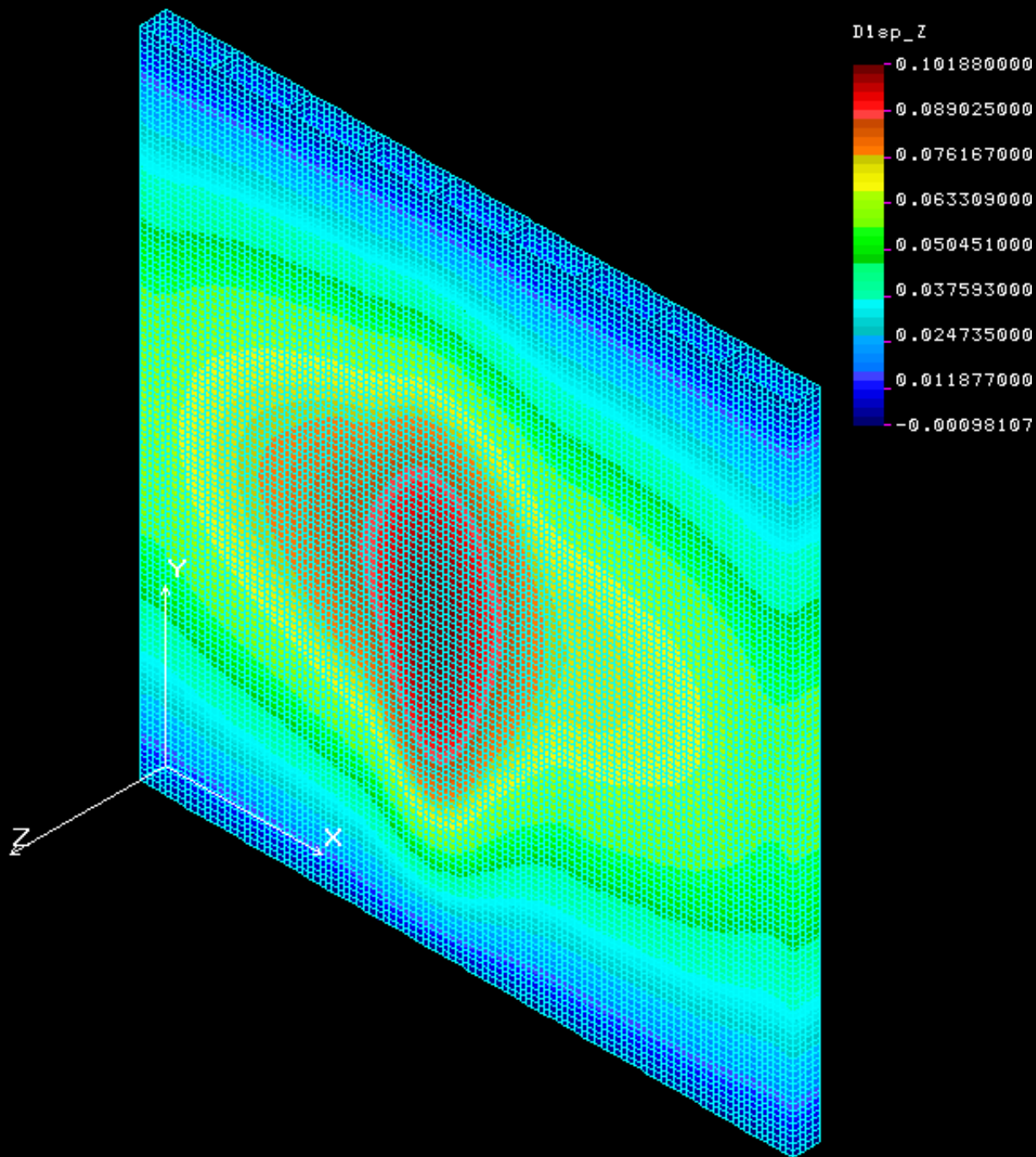
- Pressure load of 0.287 psi on wall panels
- 2000 lb point load on frame 2 ft above floor

2000 lb point
force on frame
2 ft above floor



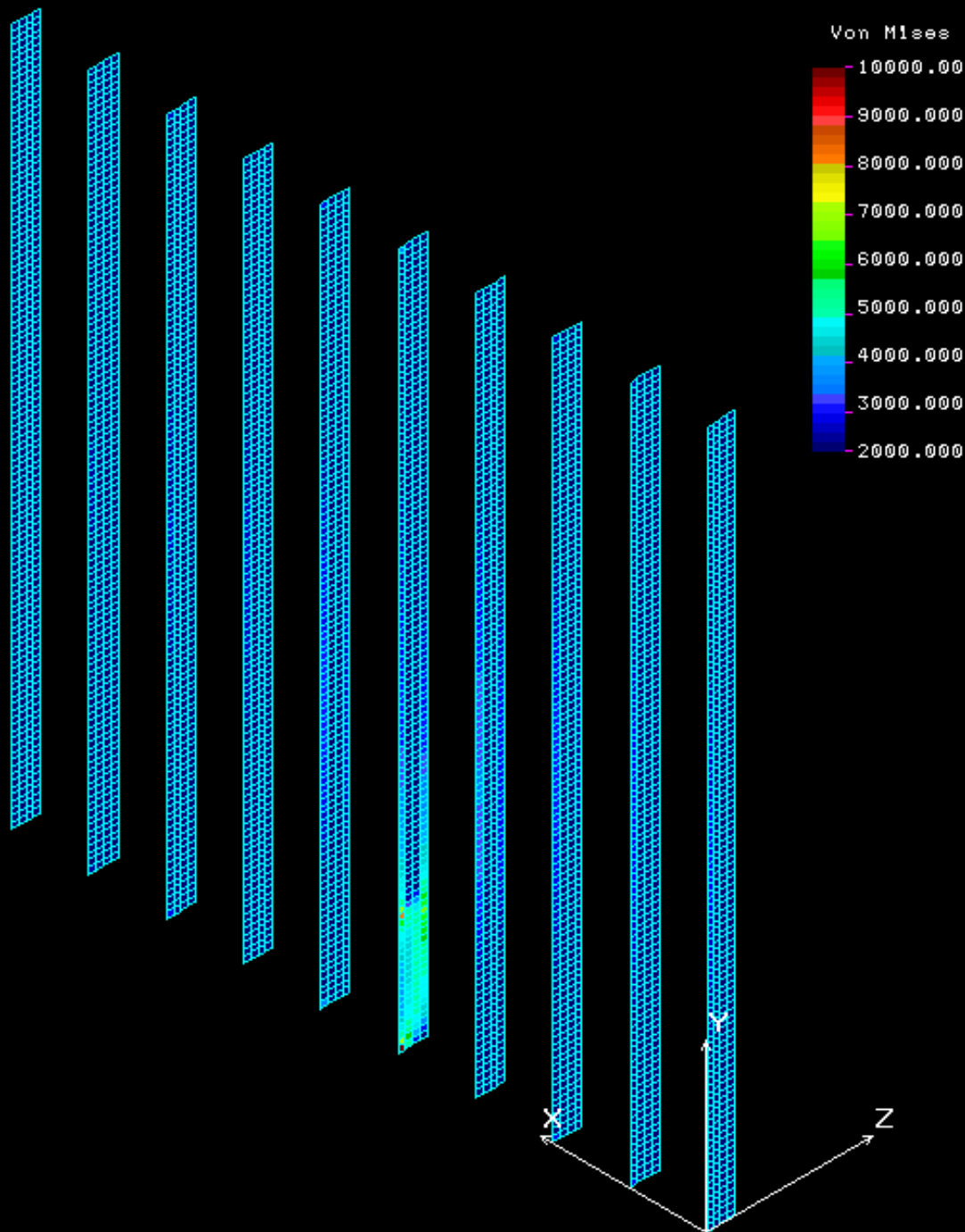


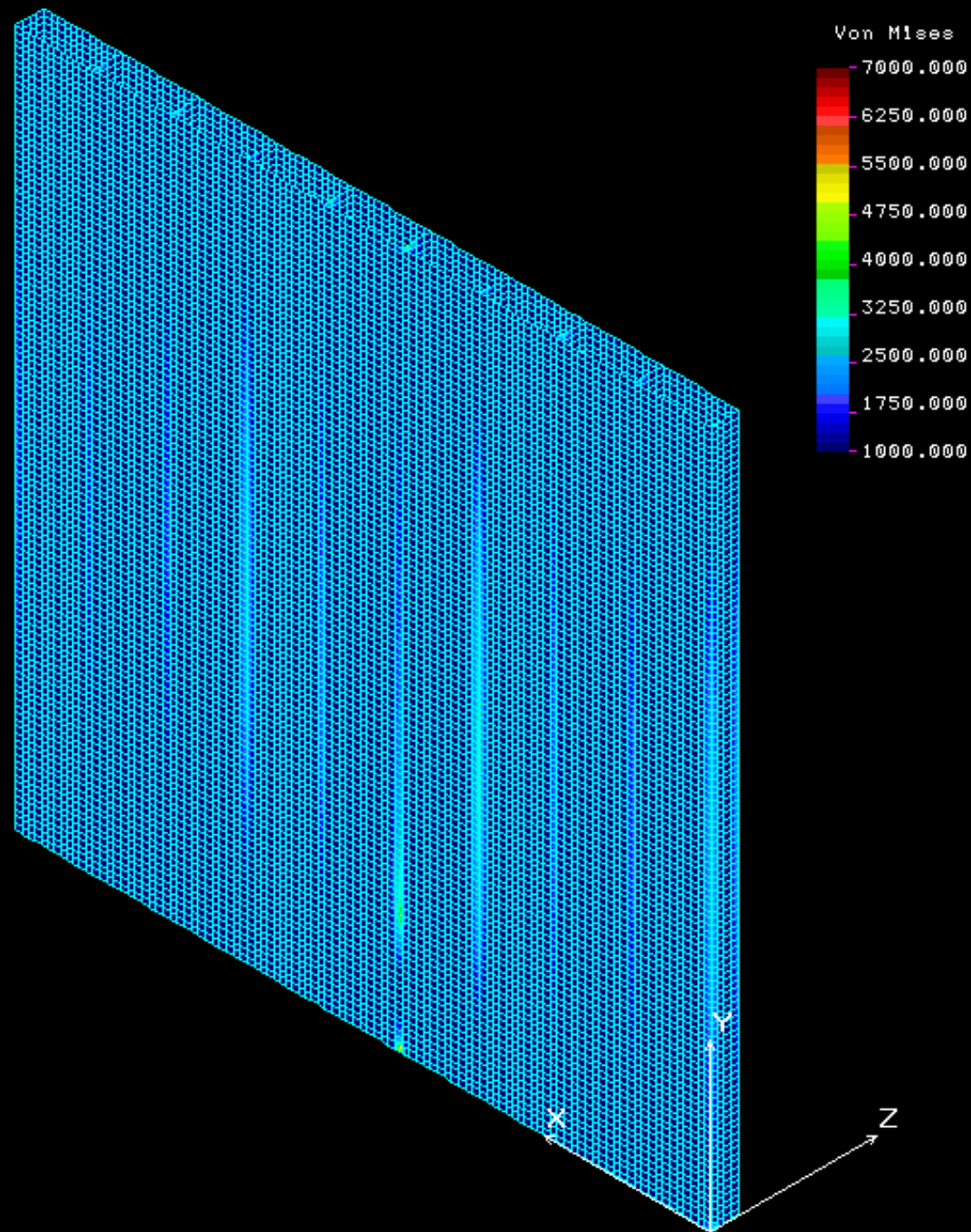
Load "A"
Front Face
Z Deflection
(in)



Load "A"
Back Face
Z Deflection
(in)

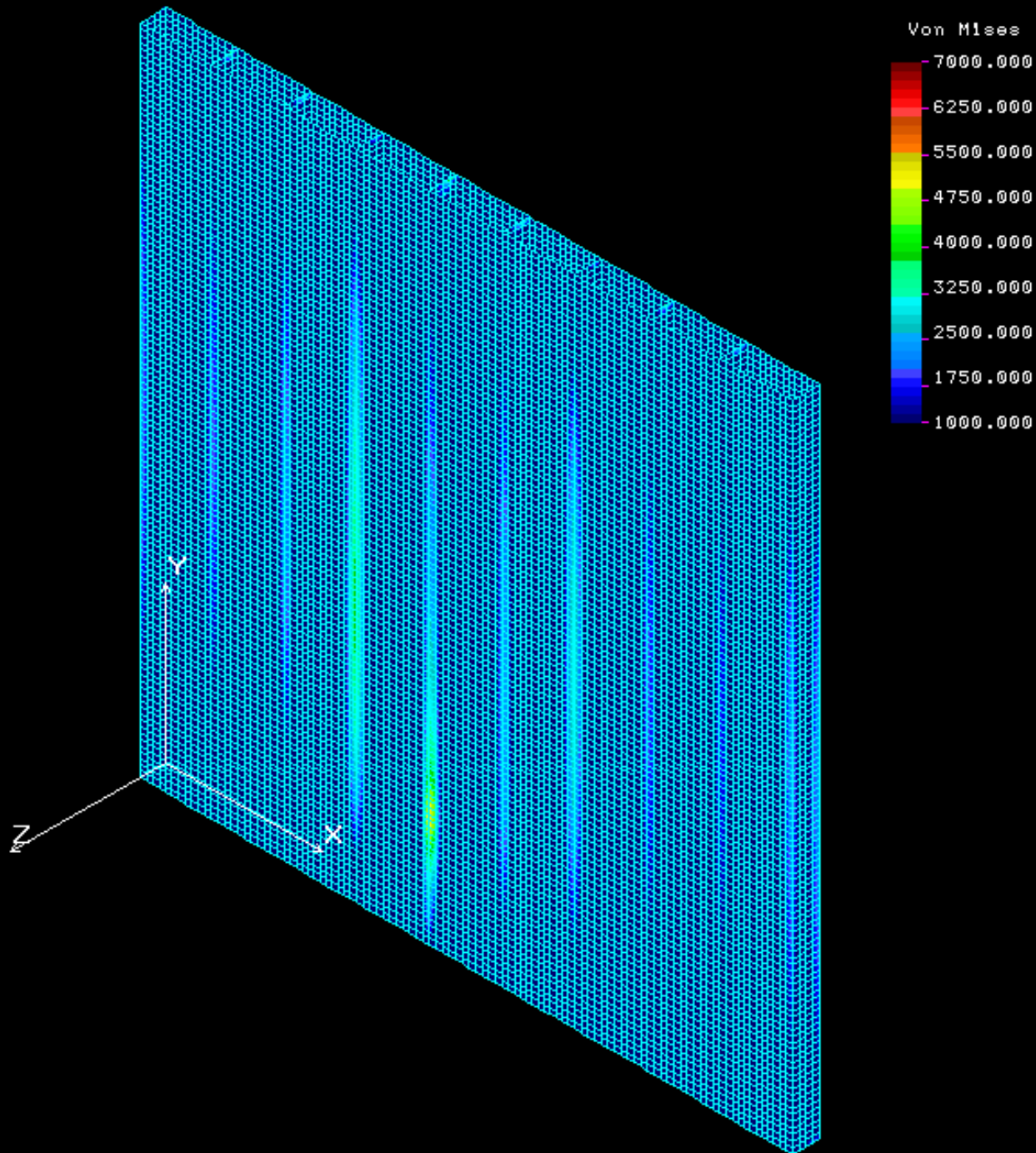
Load "A" Frame Stress (psi)



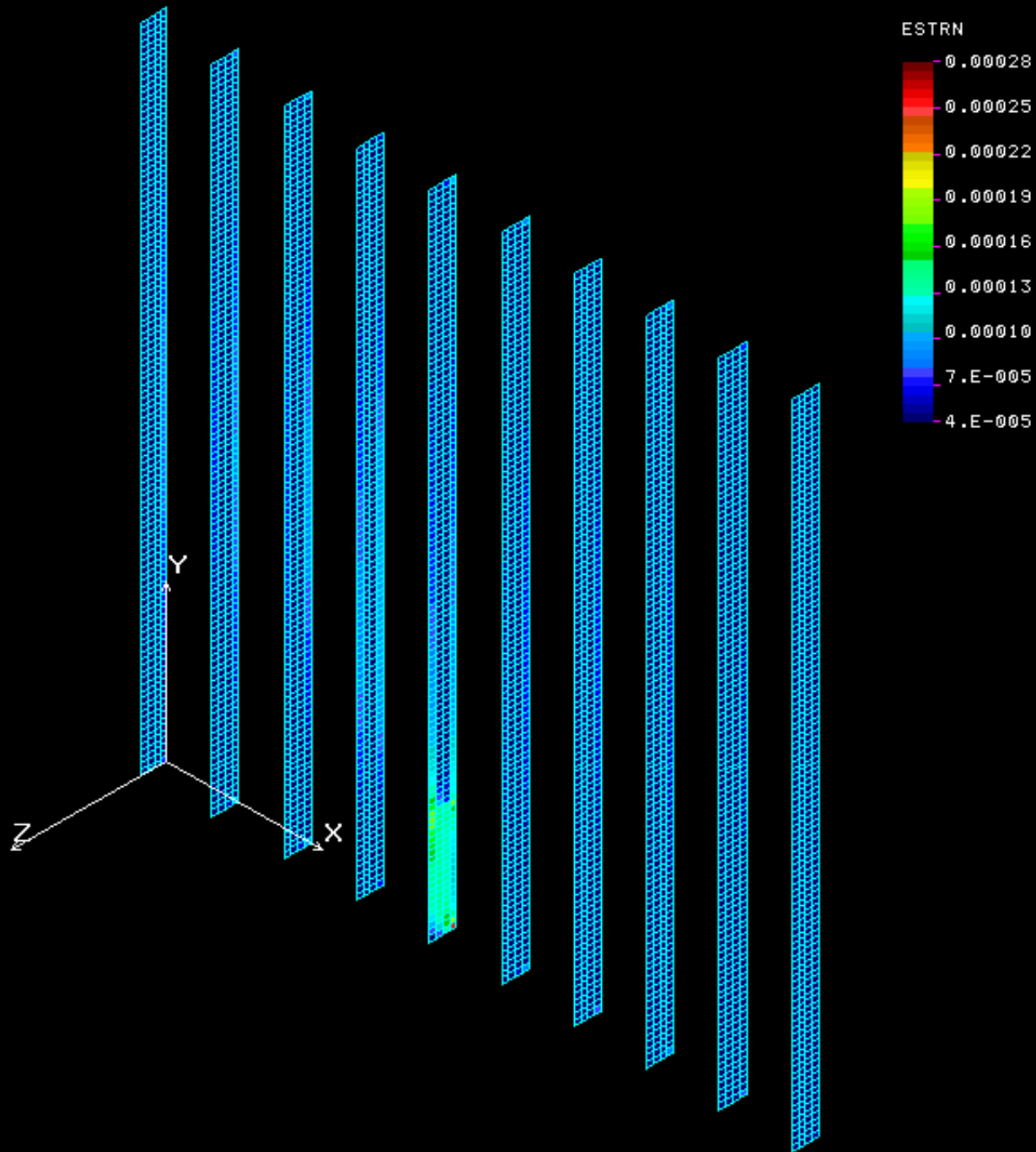


Load "A"
Front Panel
Stress (psi)

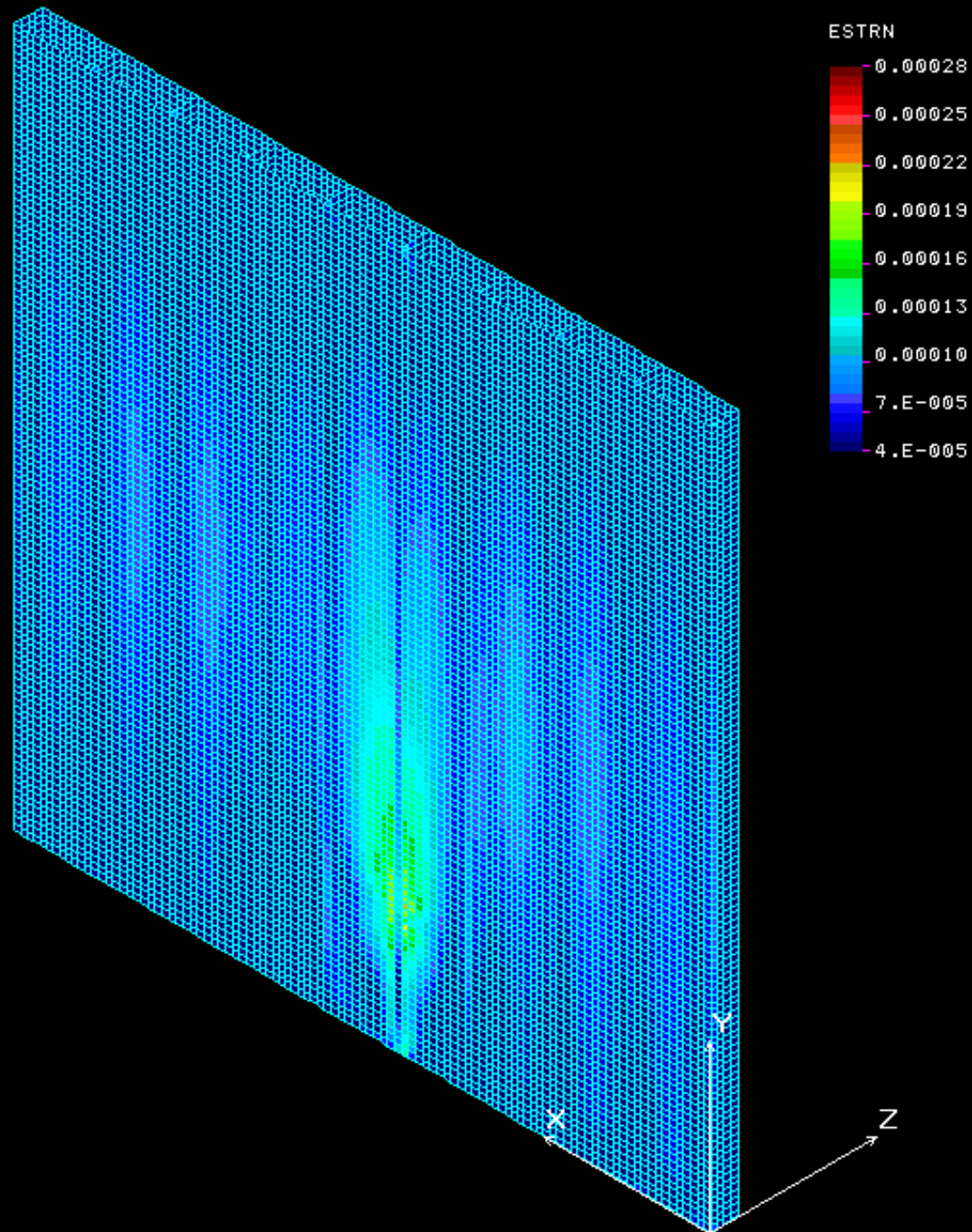
Load "A" Back Panel Stress (psi)

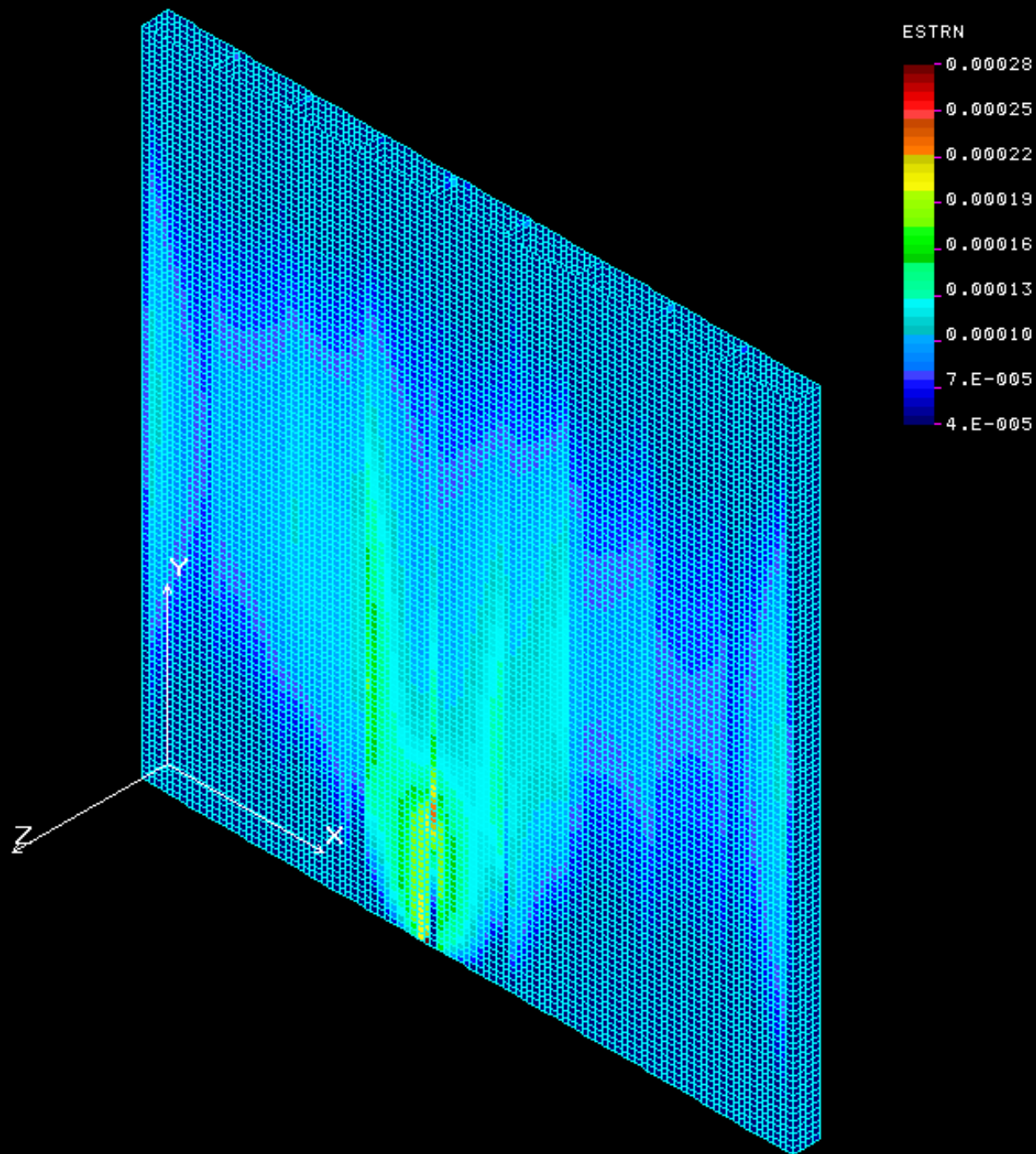


Load "A" Frame Strain



Load "A" Front Panel Strain



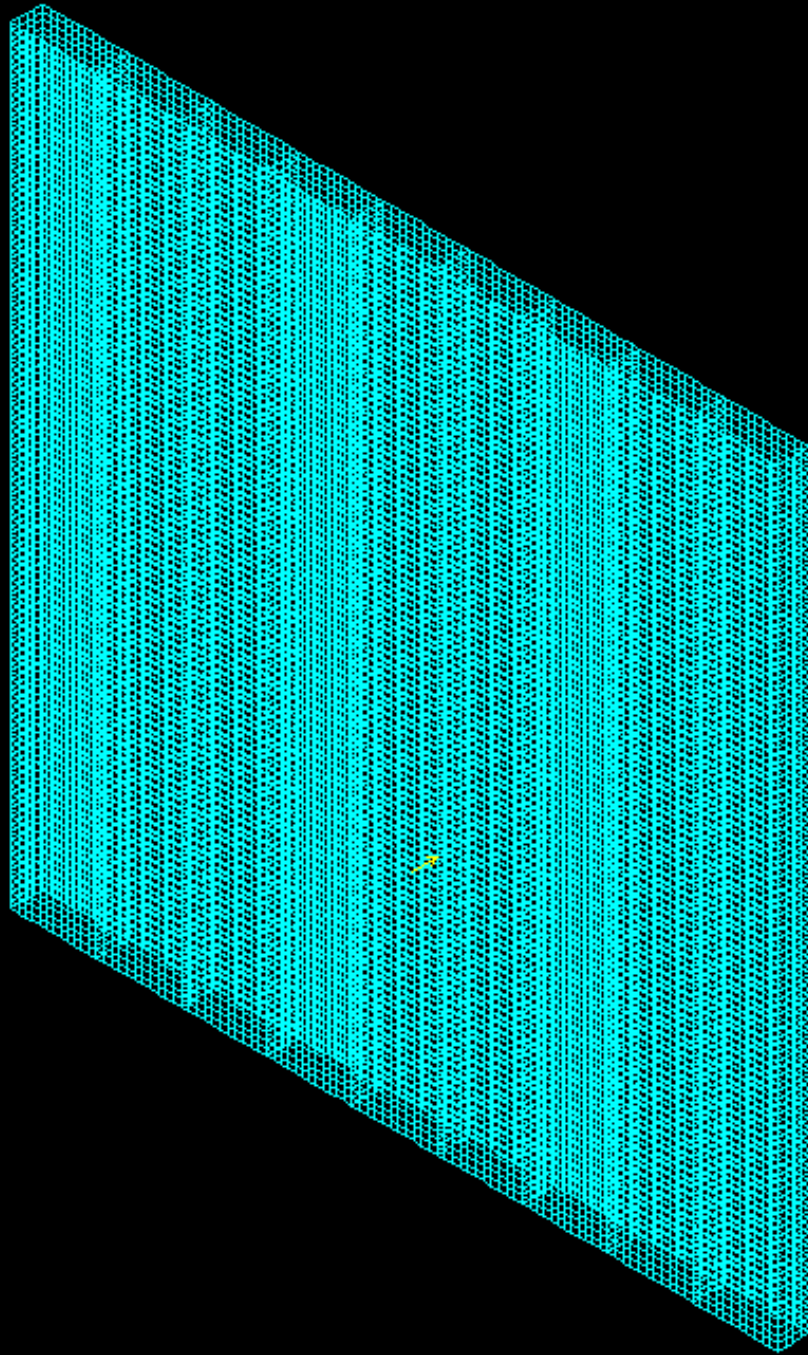


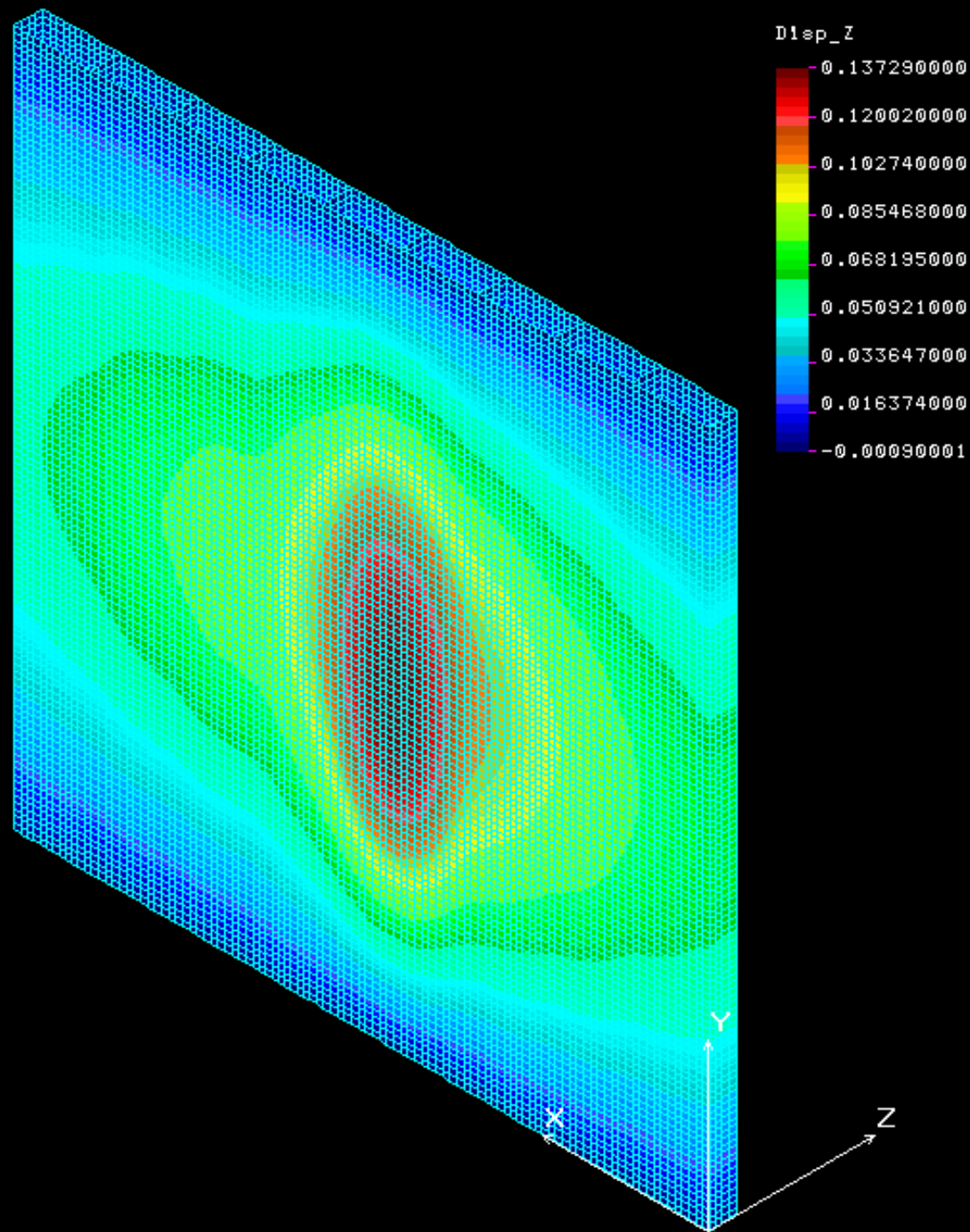
Load "A"
Back Panel
Strain

Loading “B”

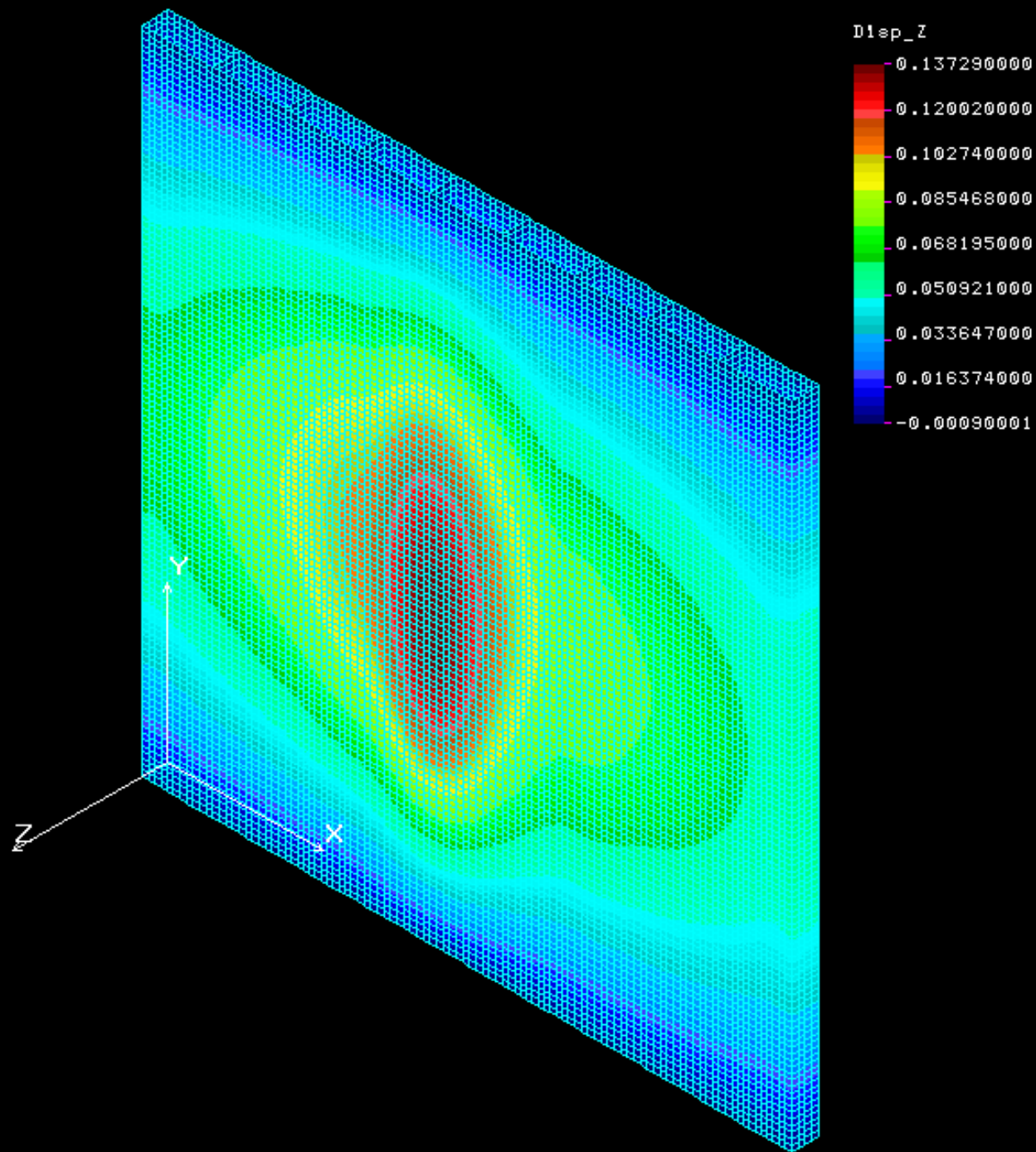
- Pressure load of 0.287 psi on wall panels
- 2000 lb point load on frame 4 ft above floor

2000 lb point
force on frame
4 ft above floor



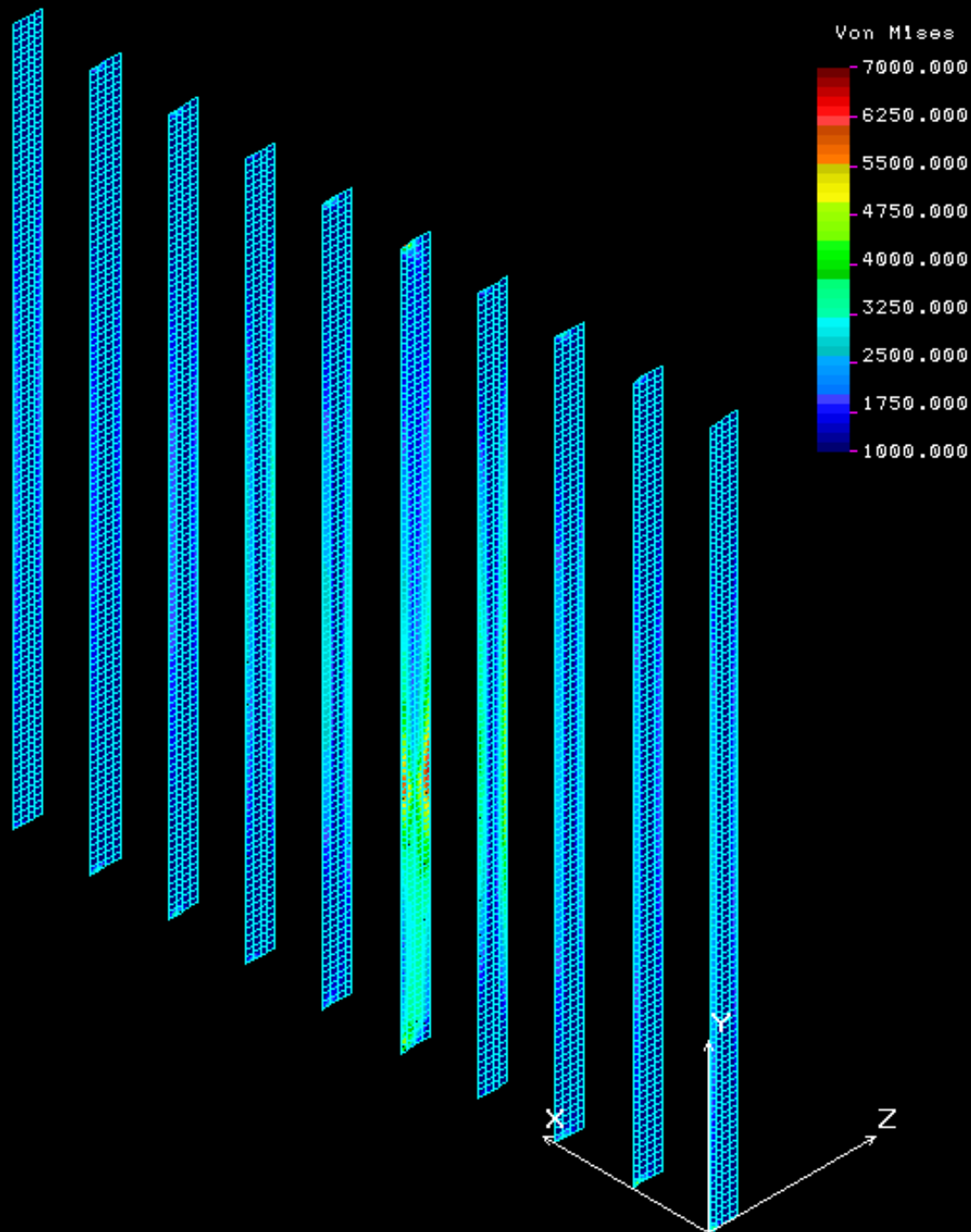


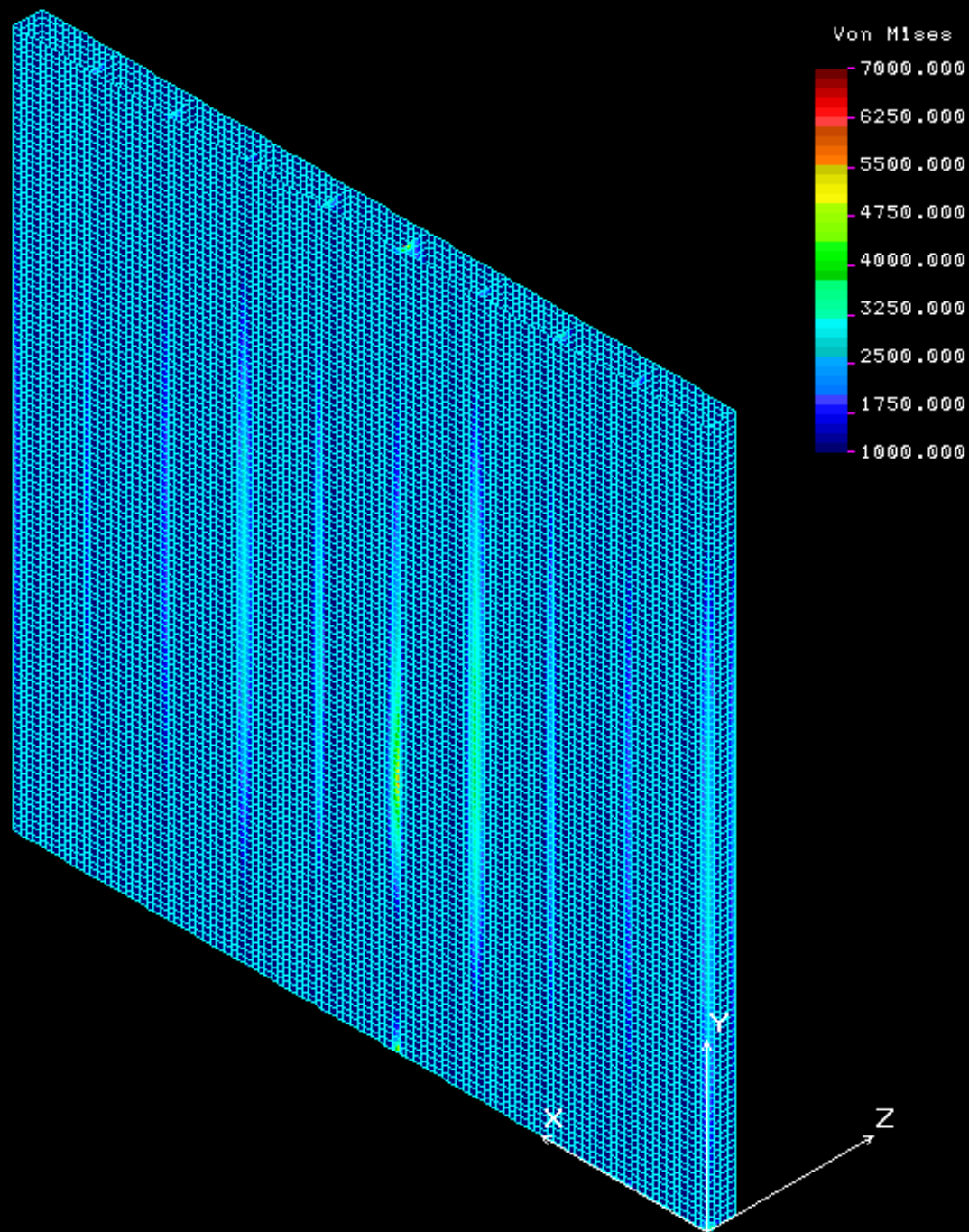
Load "B"
Front Face
Z Deflection
(in)



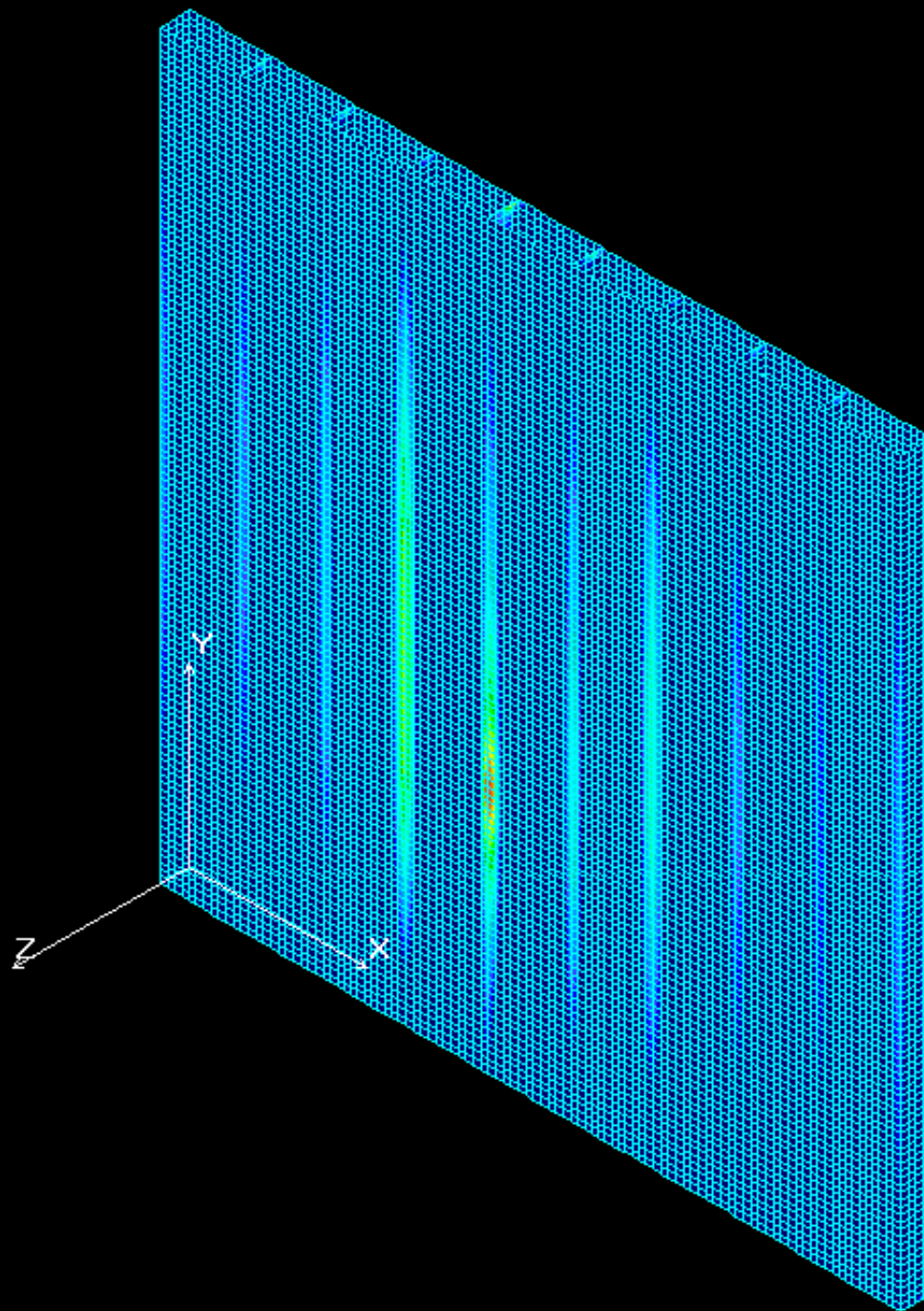
Load "B"
Back Face
Z Deflection
(in)

Load "B" Frame Stress (psi)

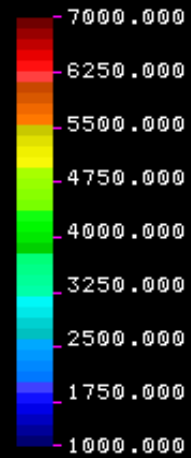




Load "B"
Front Panel
Stress (psi)

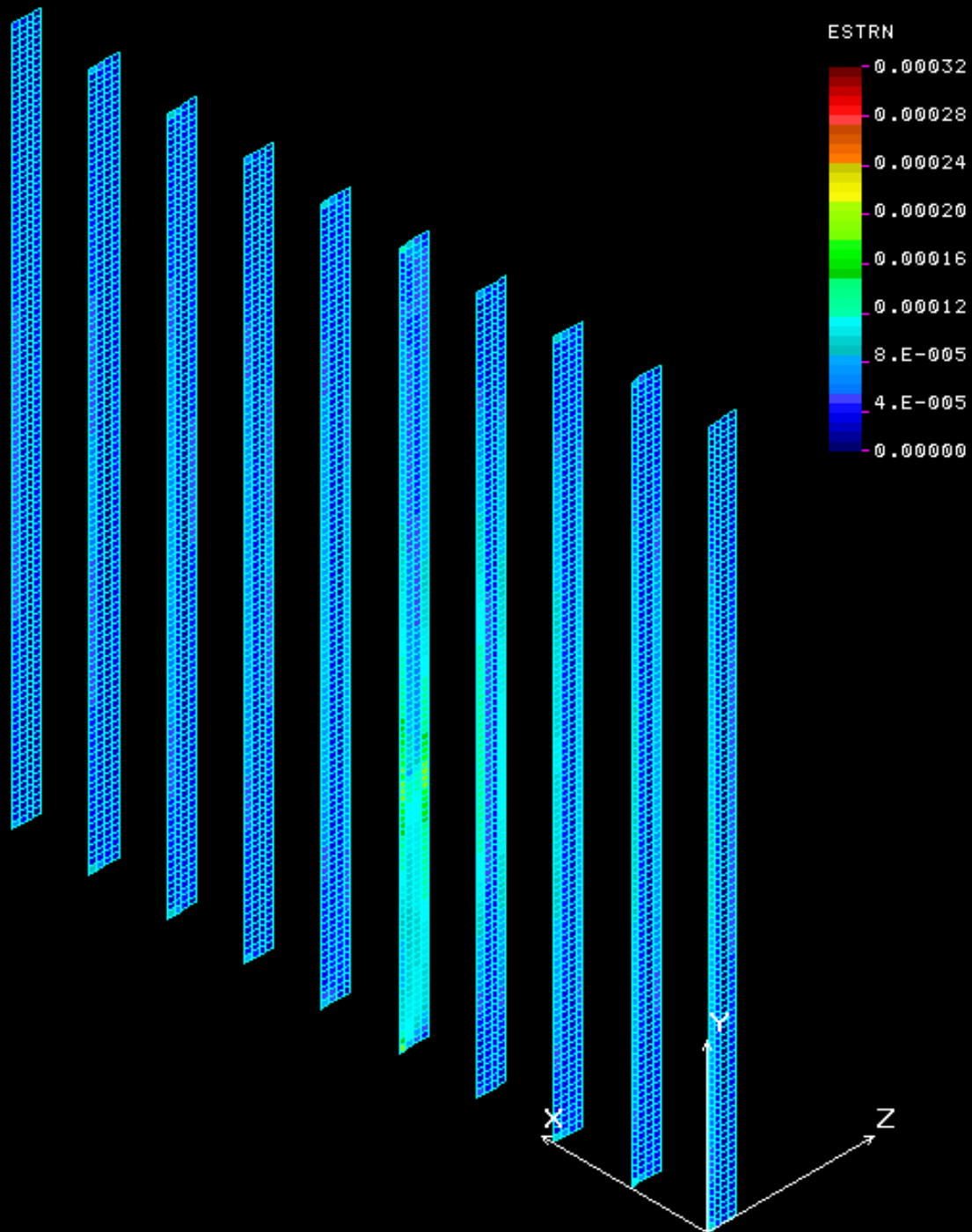


Von Mises

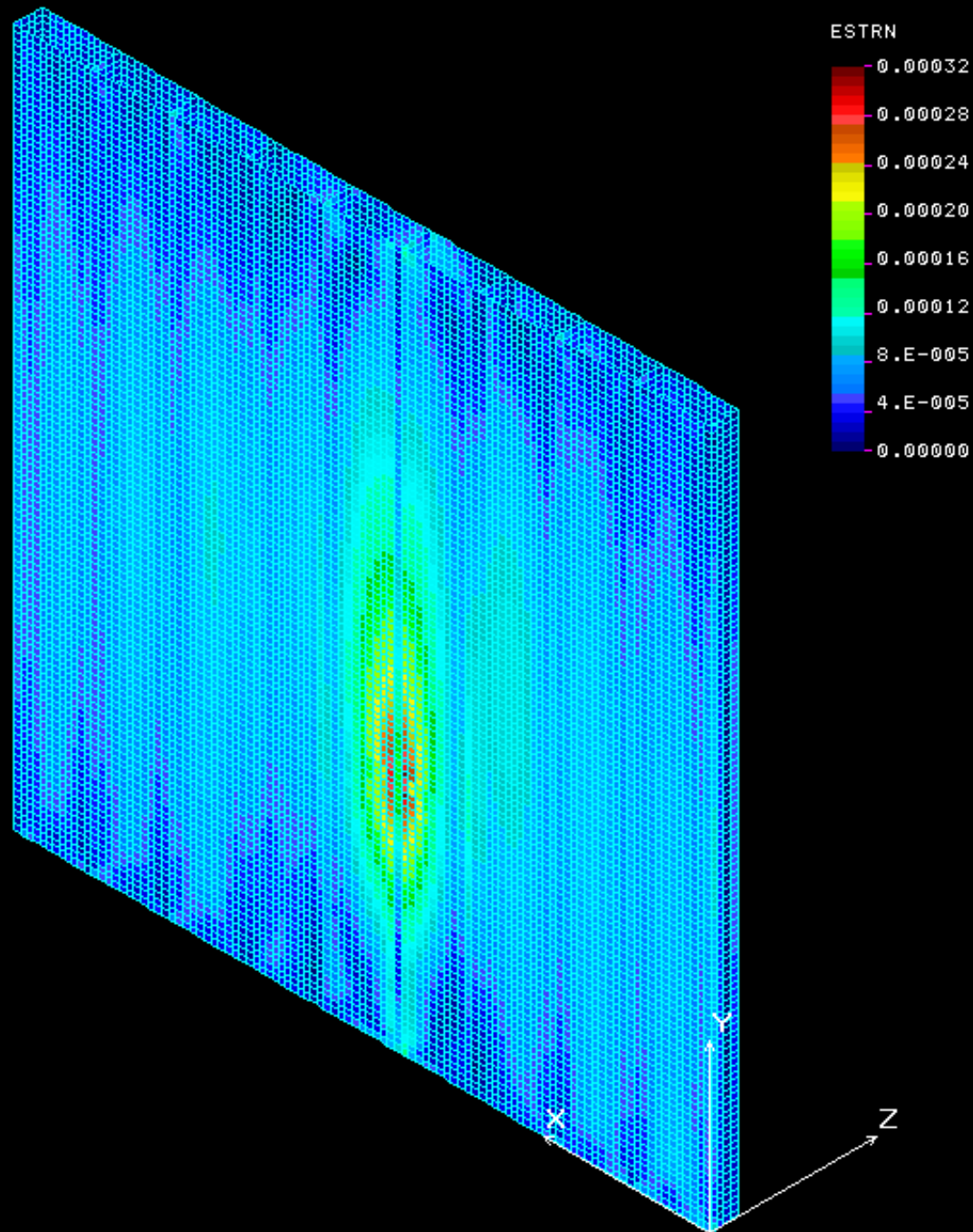


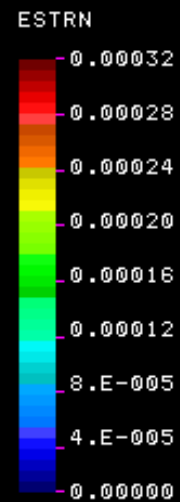
Load "B"
Back Panel
Stress (psi)

Load "B" Frame Strain

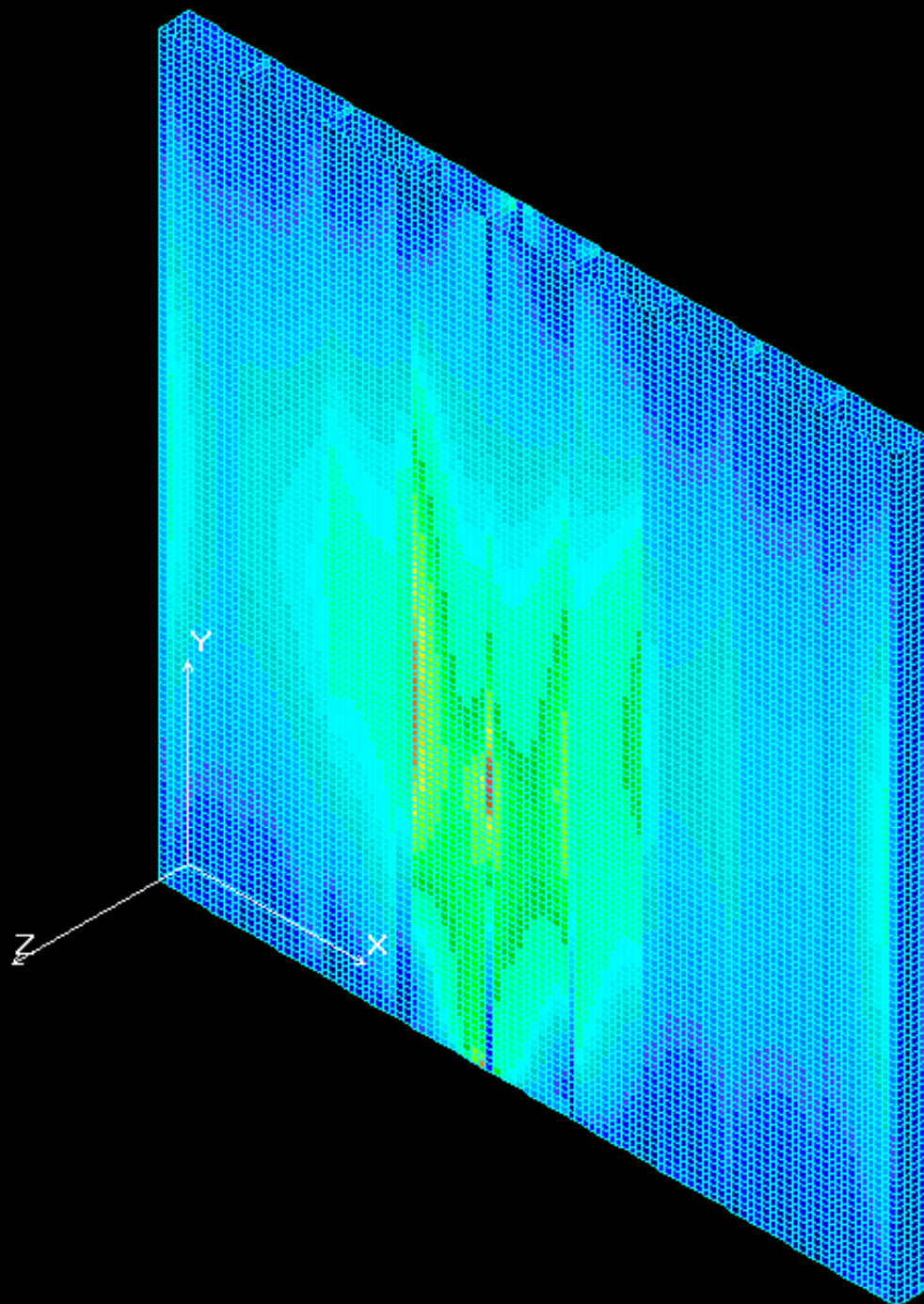


Load "B" Front Panel Strain





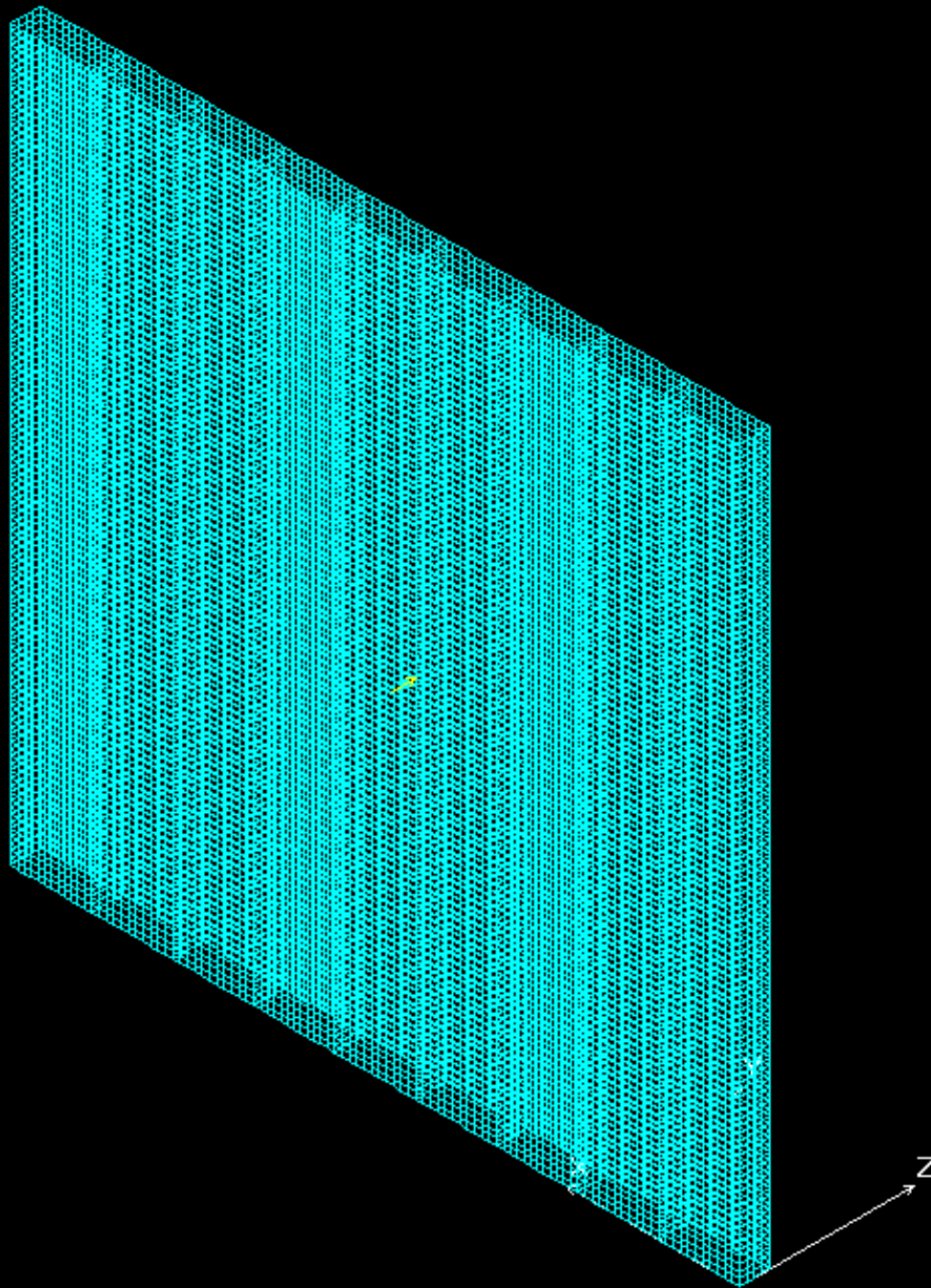
Load "B"
Back Panel
Strain

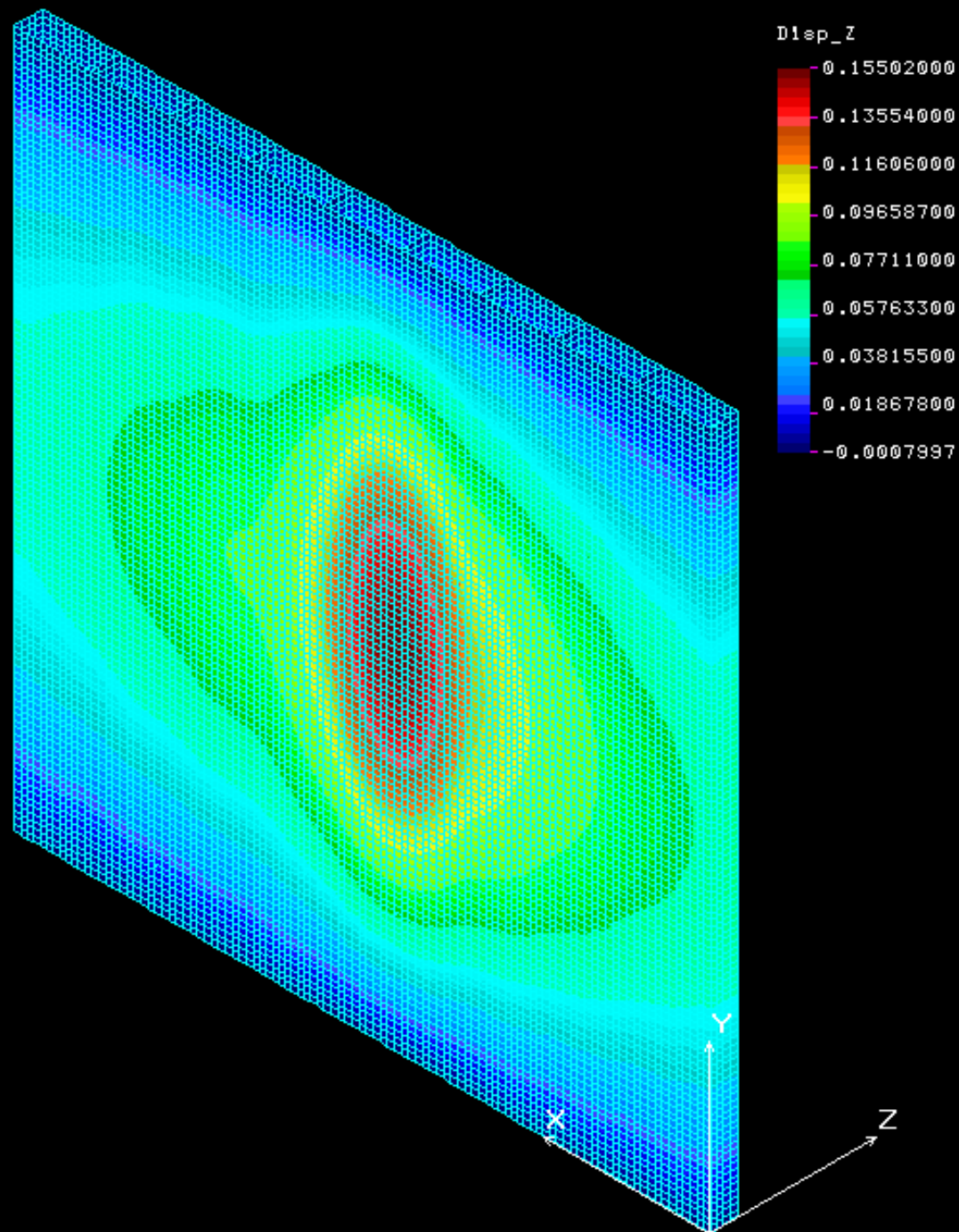


Loading “C”

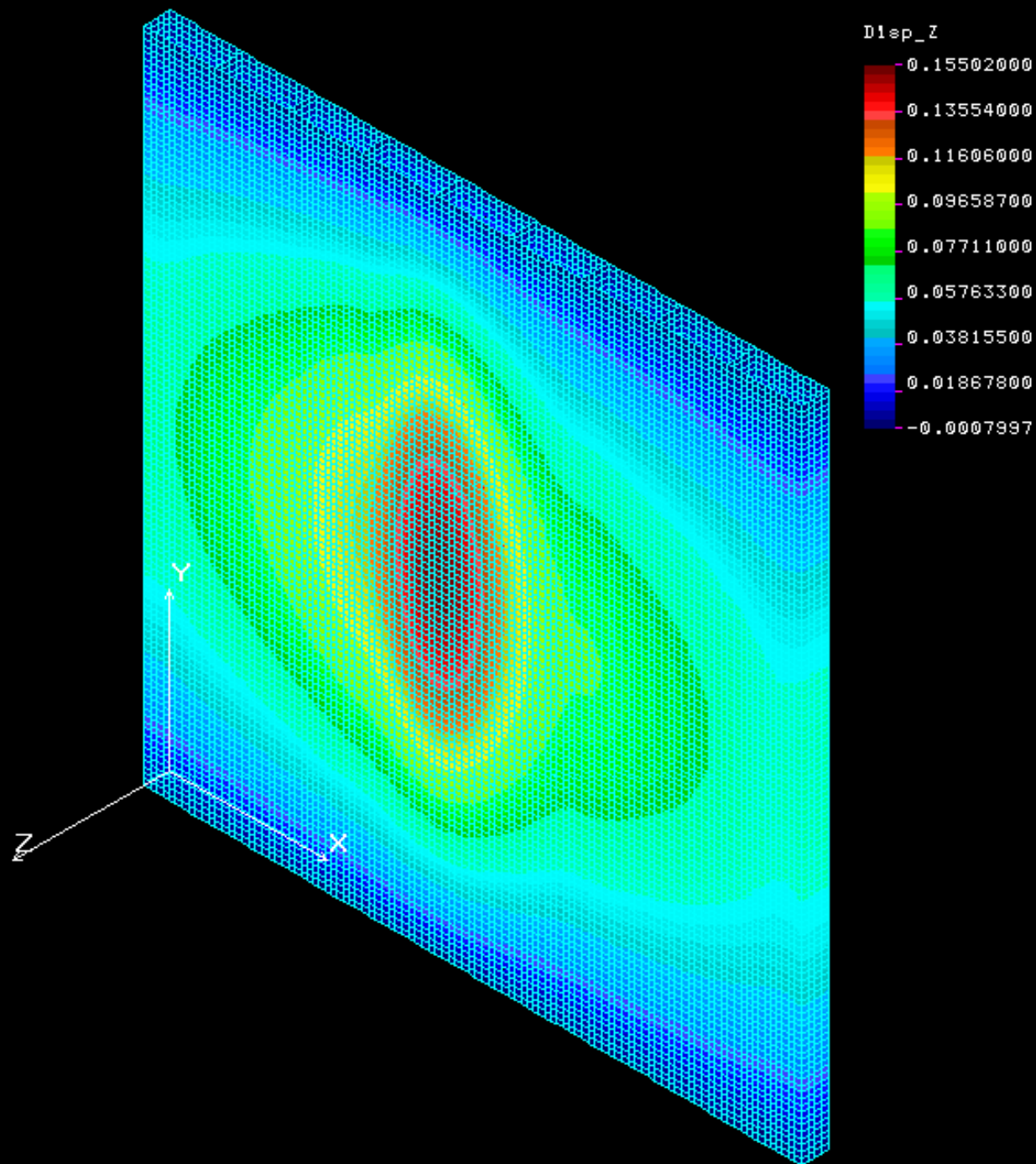
- Pressure load of 0.287 psi on wall panels
- 2000 lb point load on frame 6 ft above floor

2000 lb point
force on frame
6 ft above floor



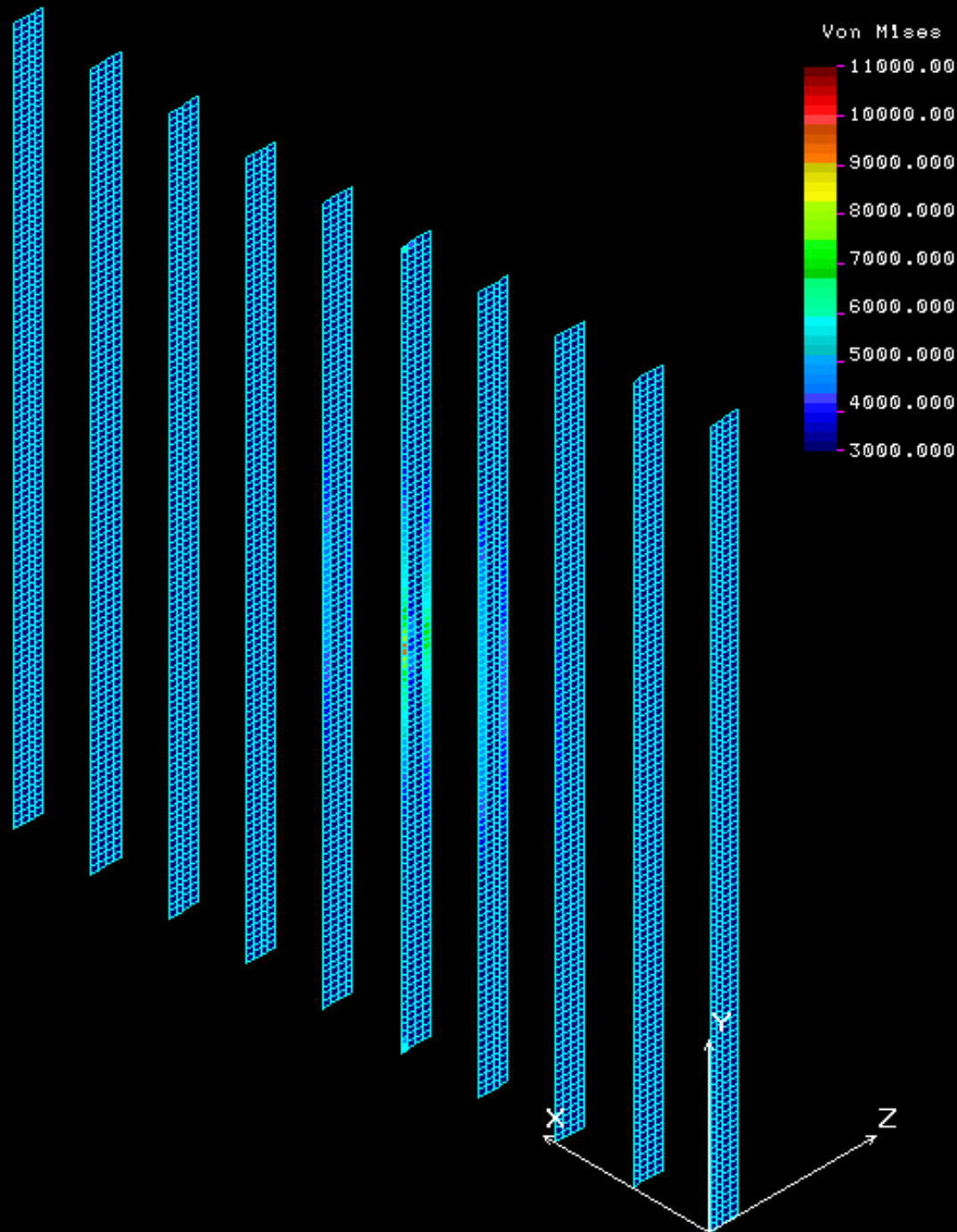


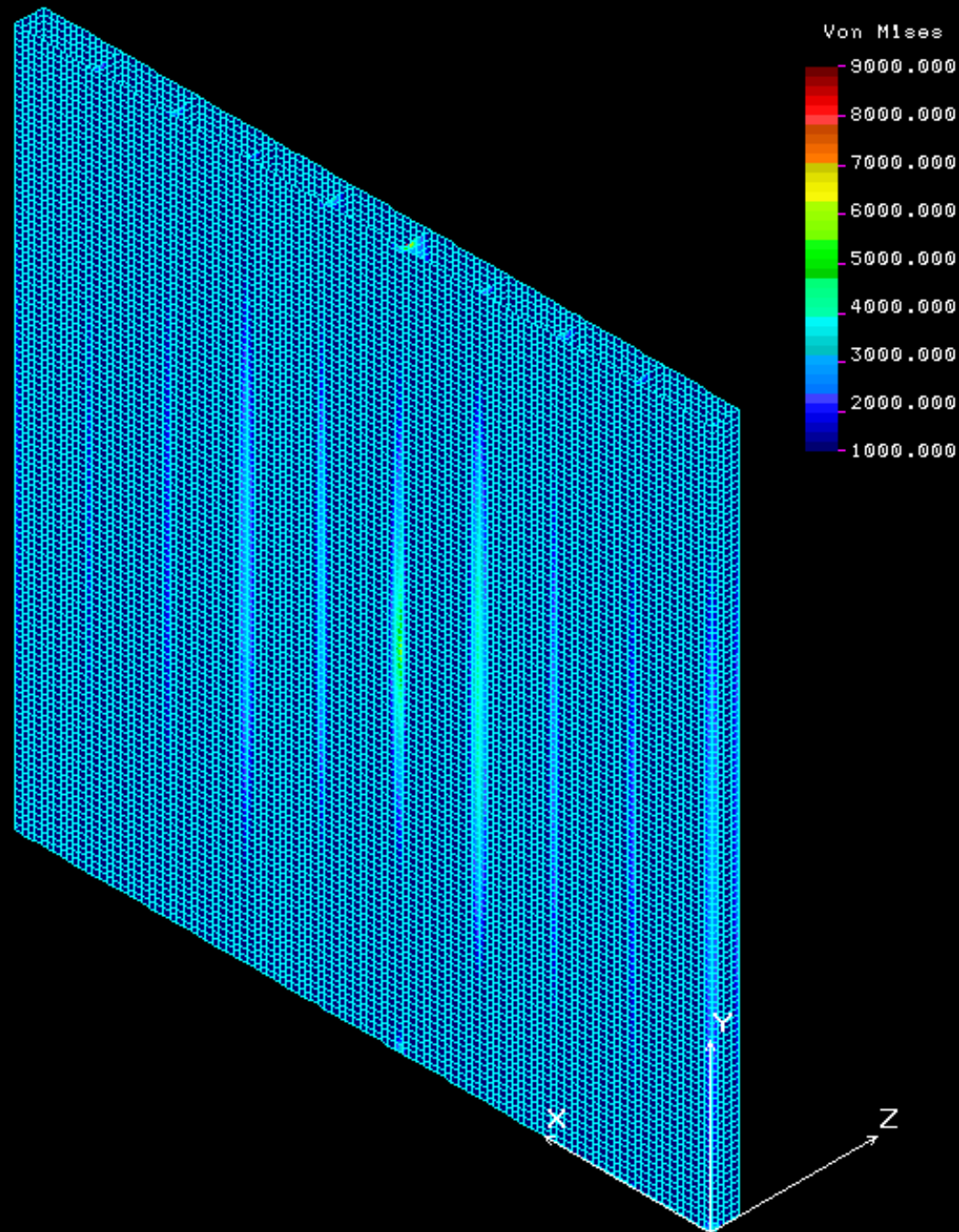
Load "C"
Front Face
Z Deflection
(in)



Load "C"
Back Face
Z Deflection
(in)

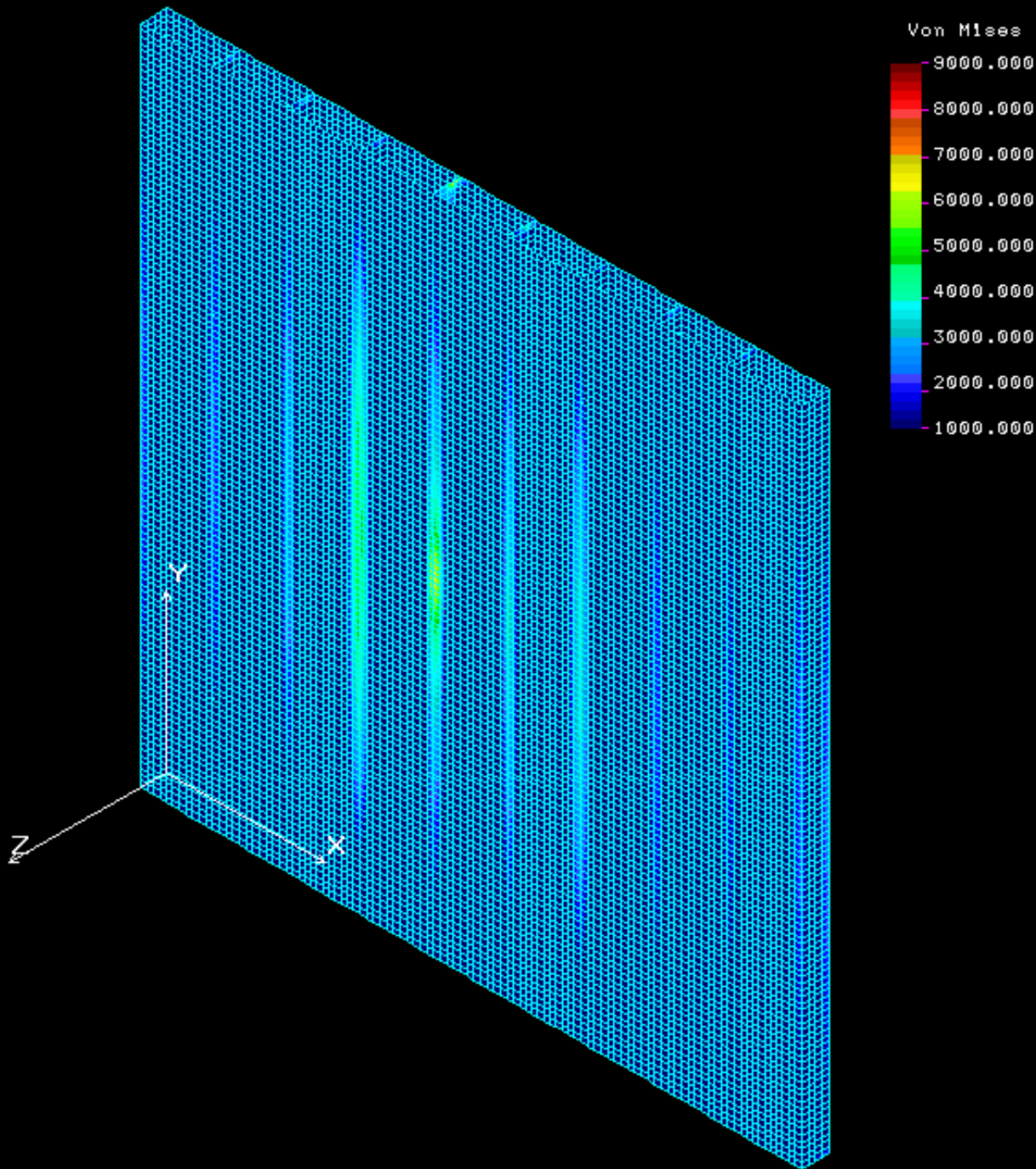
Load "C" Frame Stress (psi)



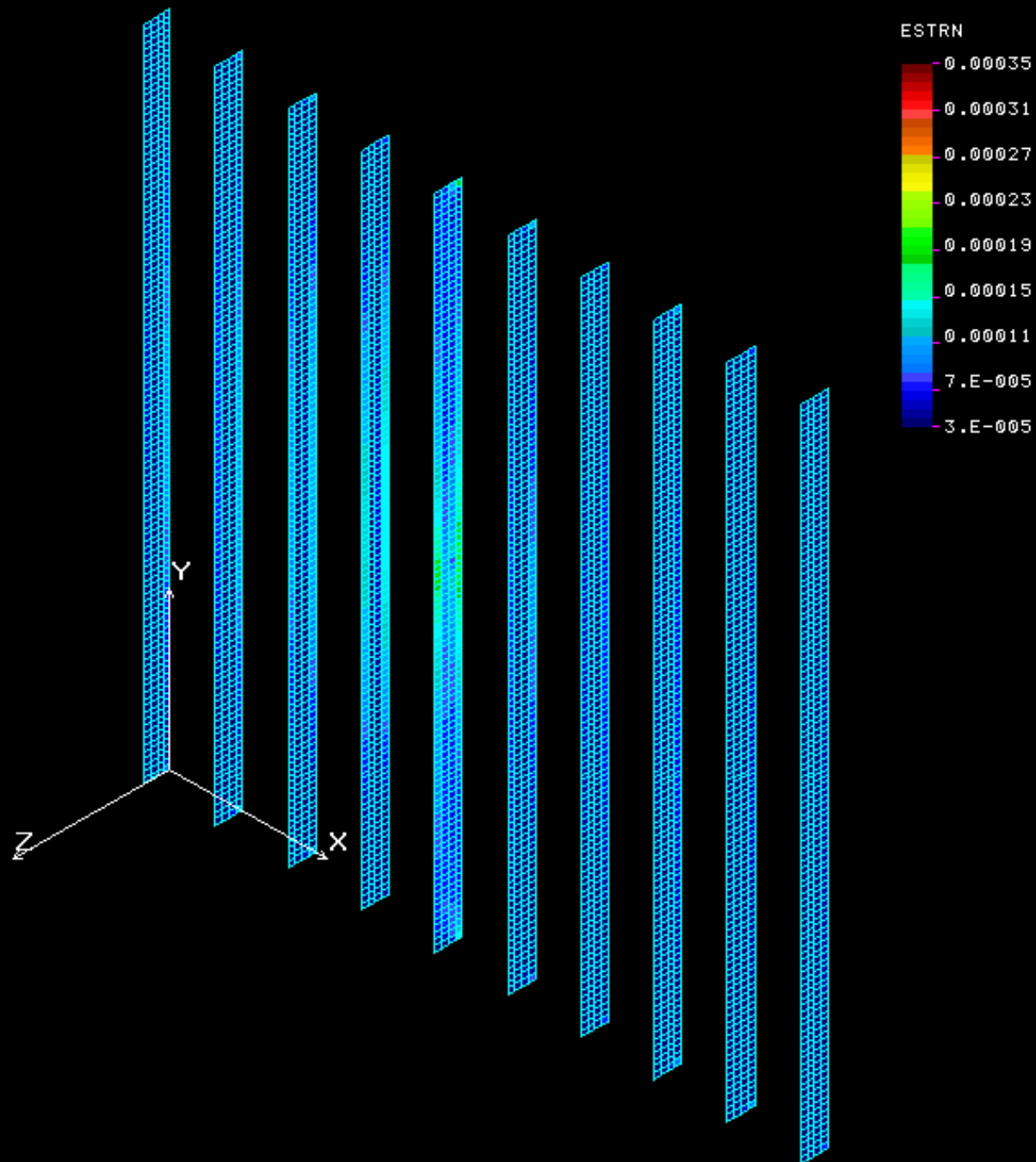


Load "C"
Front Panel
Stress (psi)

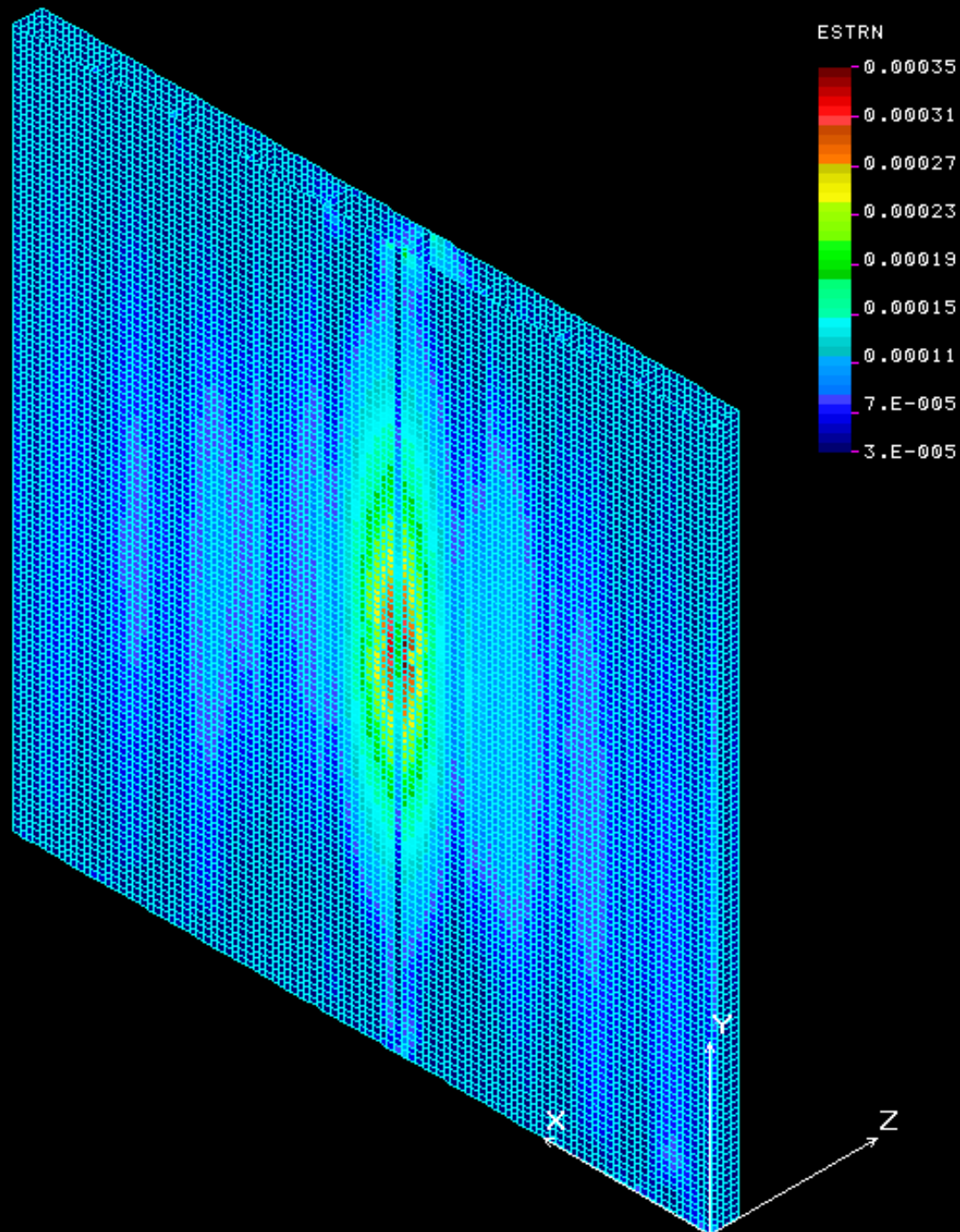
Load "C" Back Panel Stress (psi)



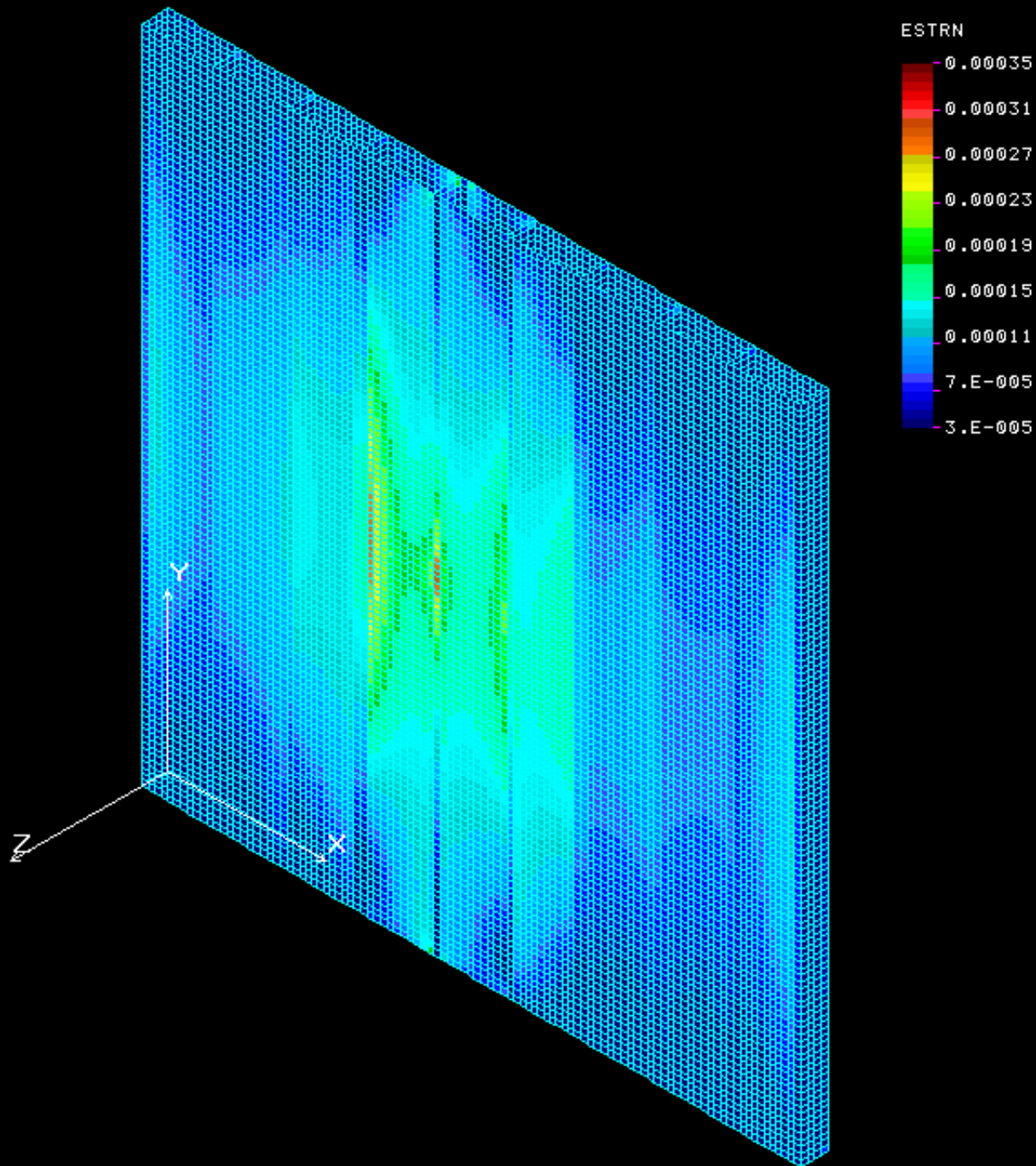
Load "C" Frame Strain



Load "C" Front Panel Strain



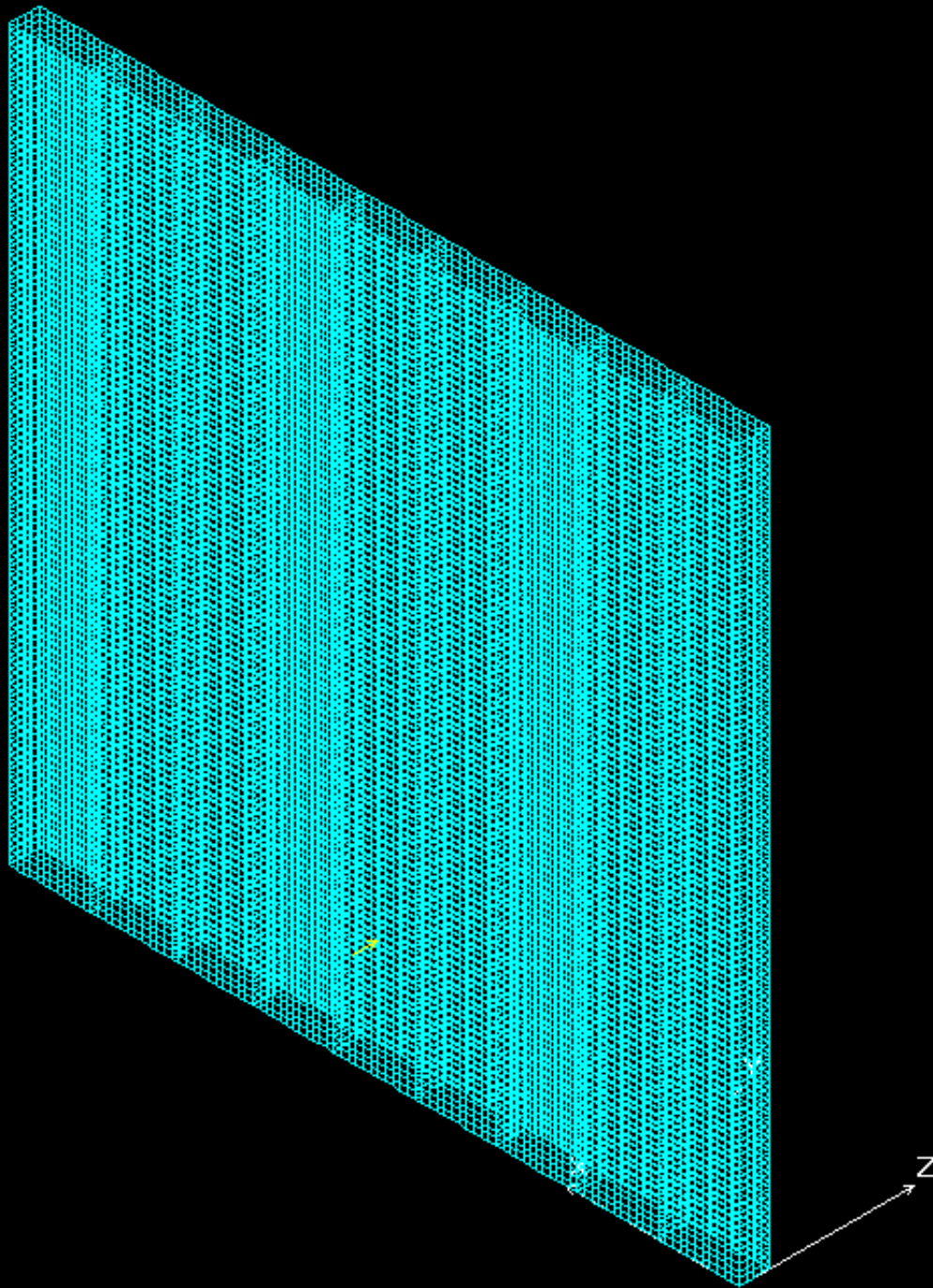
Load "C" Back Panel Strain

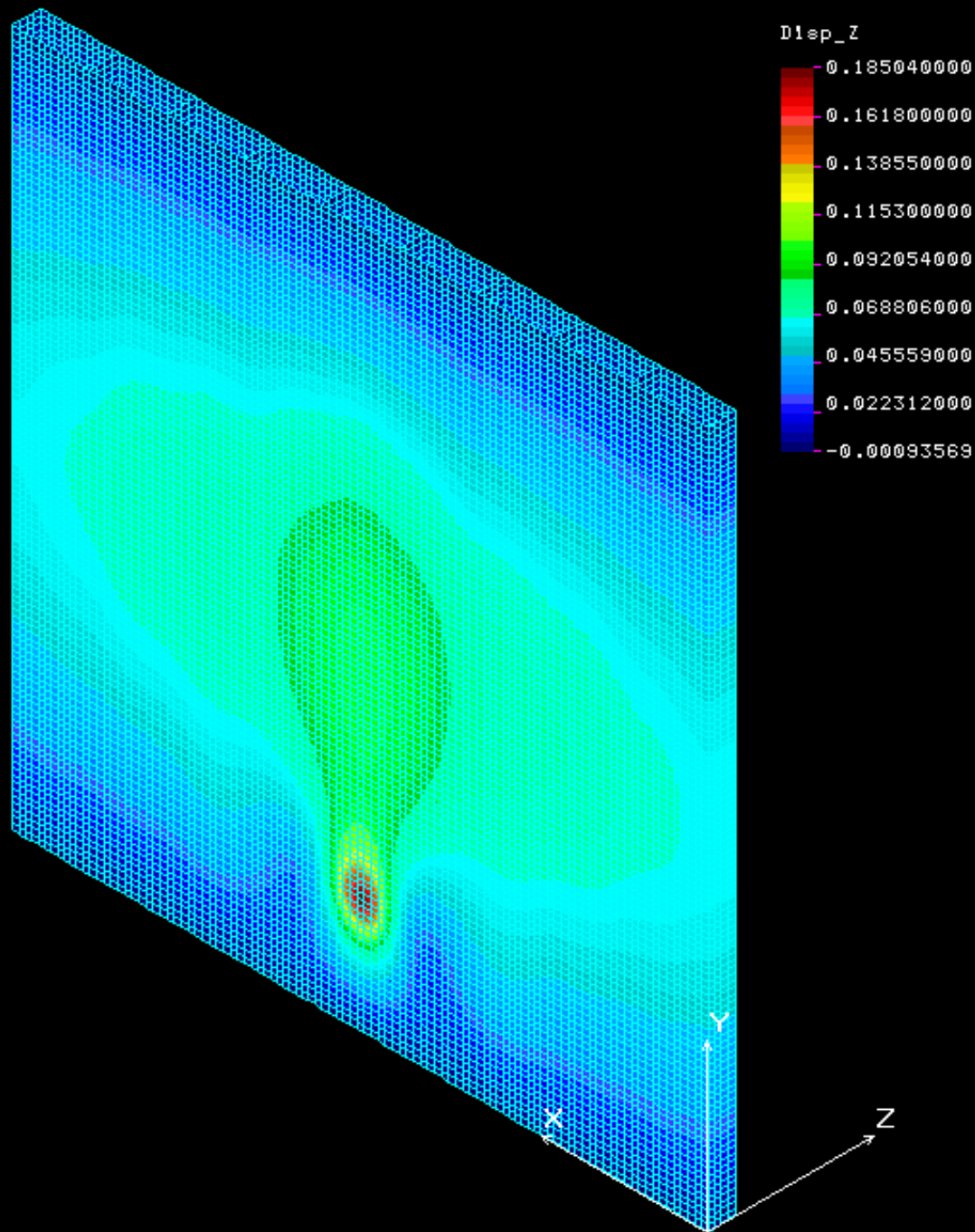


Loading “D”

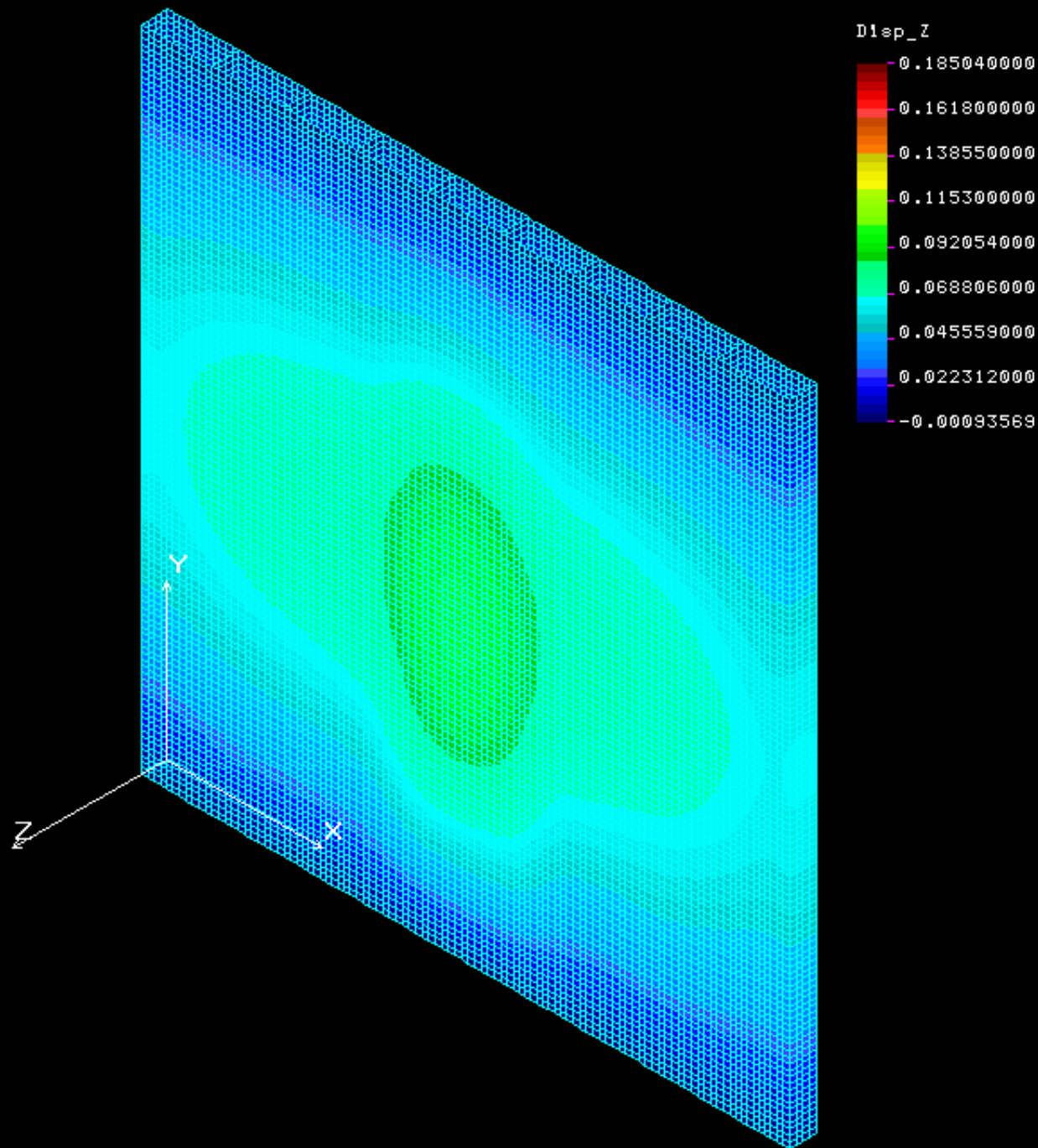
- Pressure load of 0.287 psi on wall panels
- 2000 lb point load between frames 2 ft above floor

2000 lb point
force on panel
2 ft above floor



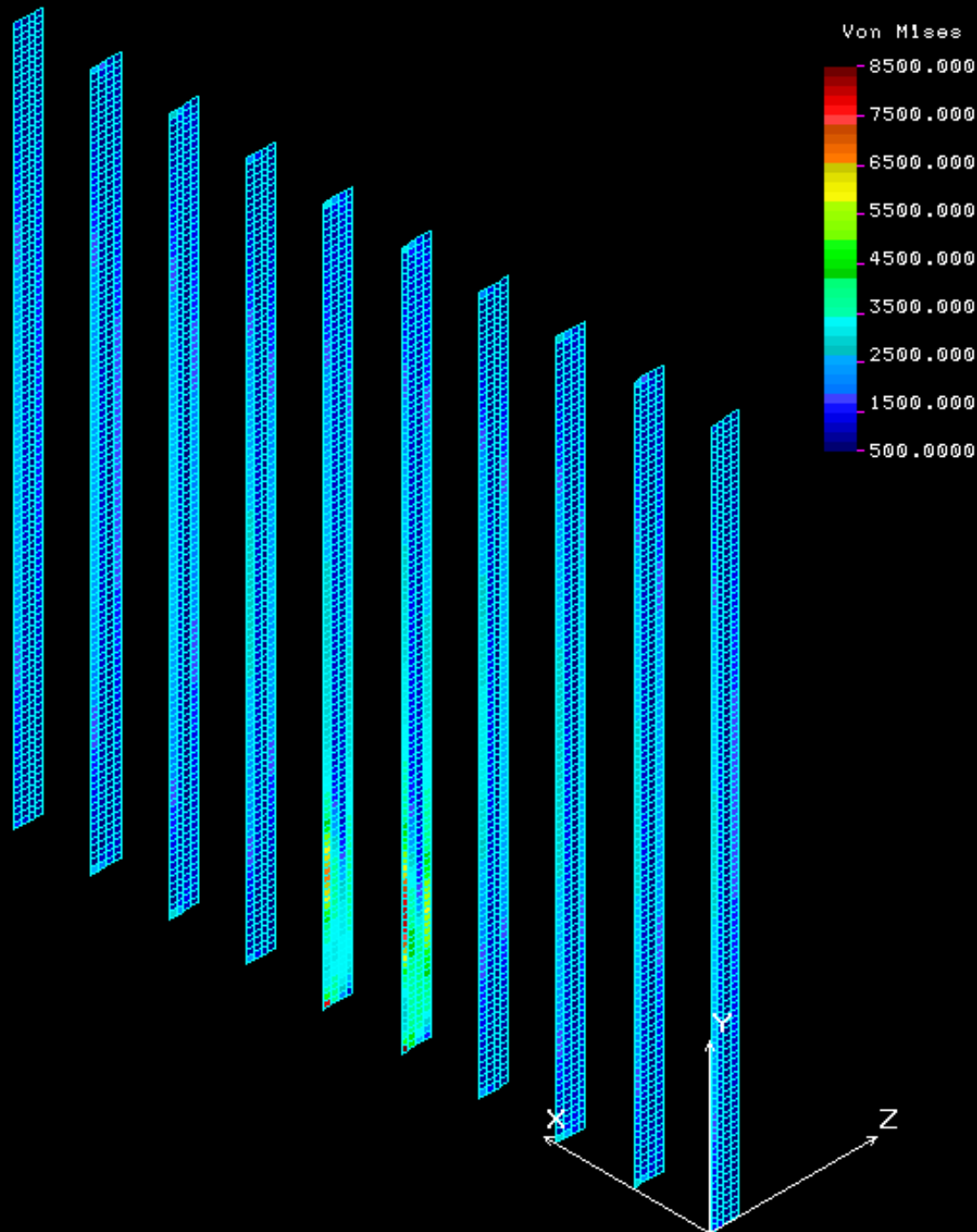


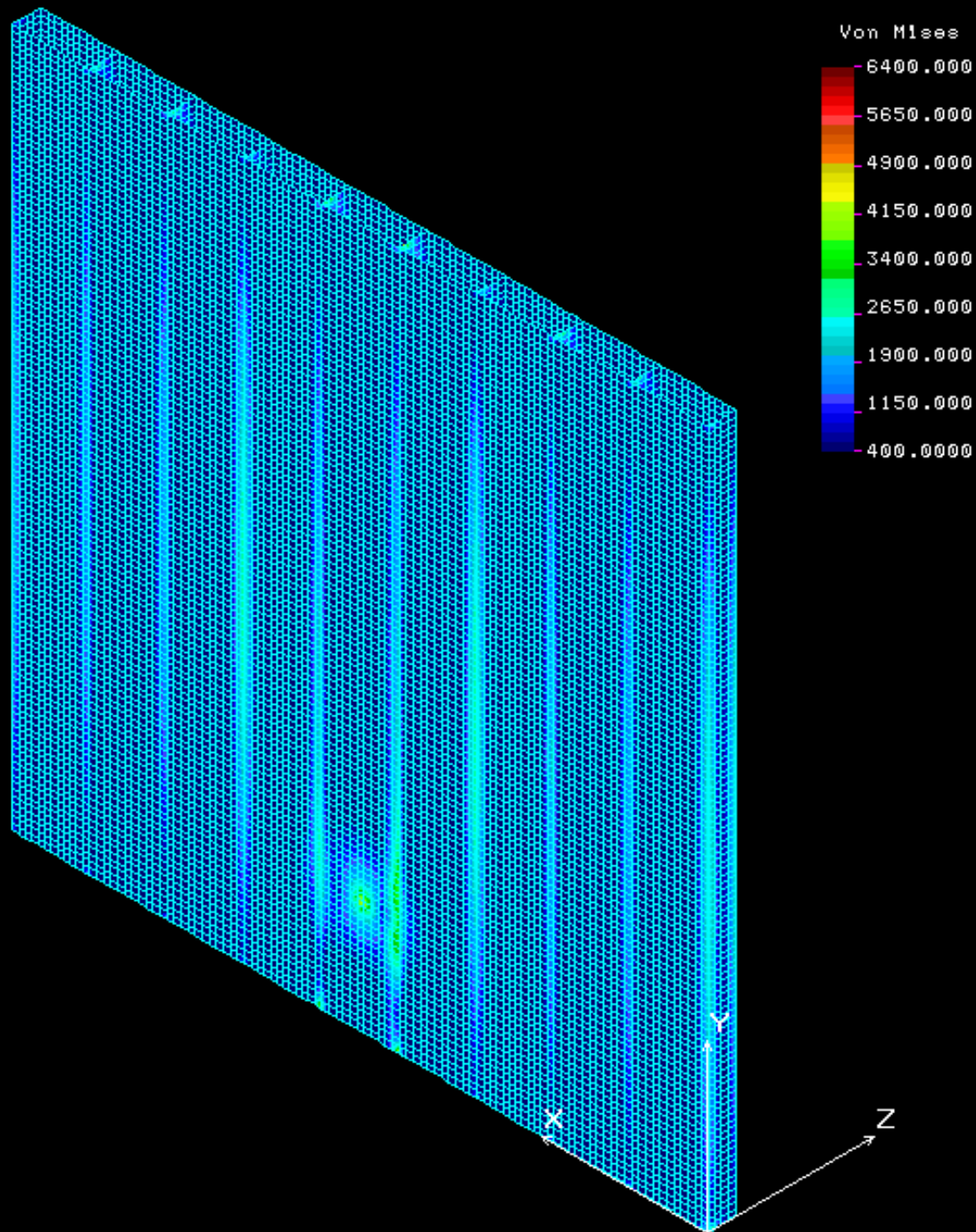
Load "D"
Front Face
Z Deflection
(in)



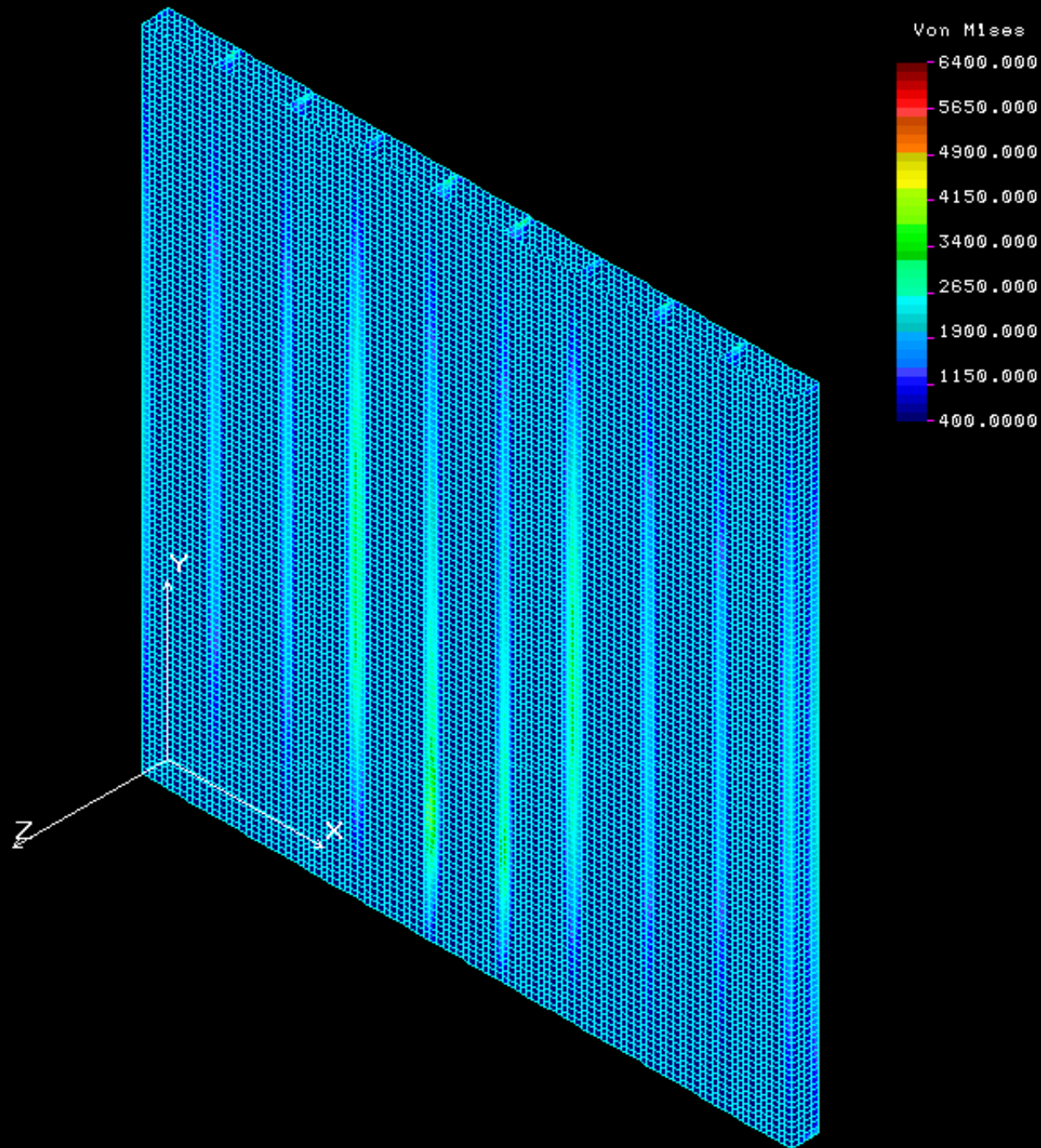
Load "D"
Back Face
Z Deflection
(in)

Load "D" Frame Stress (psi)



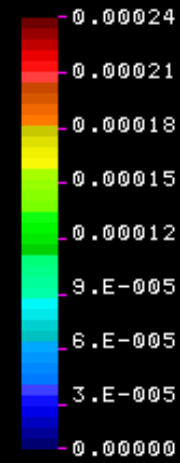


Load "D"
Front Panel
Stress (psi)

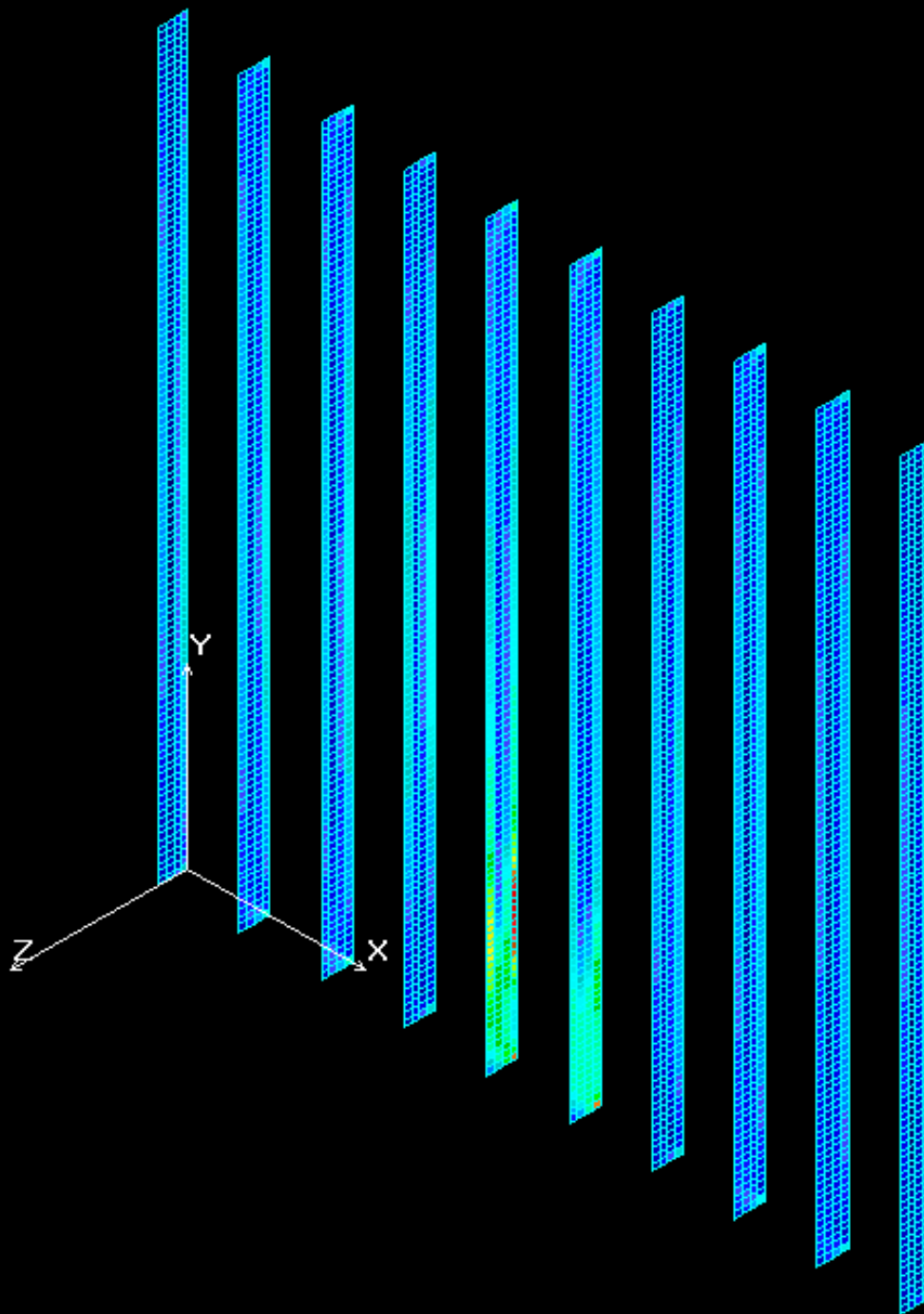


Load "D"
Back Panel
Stress (psi)

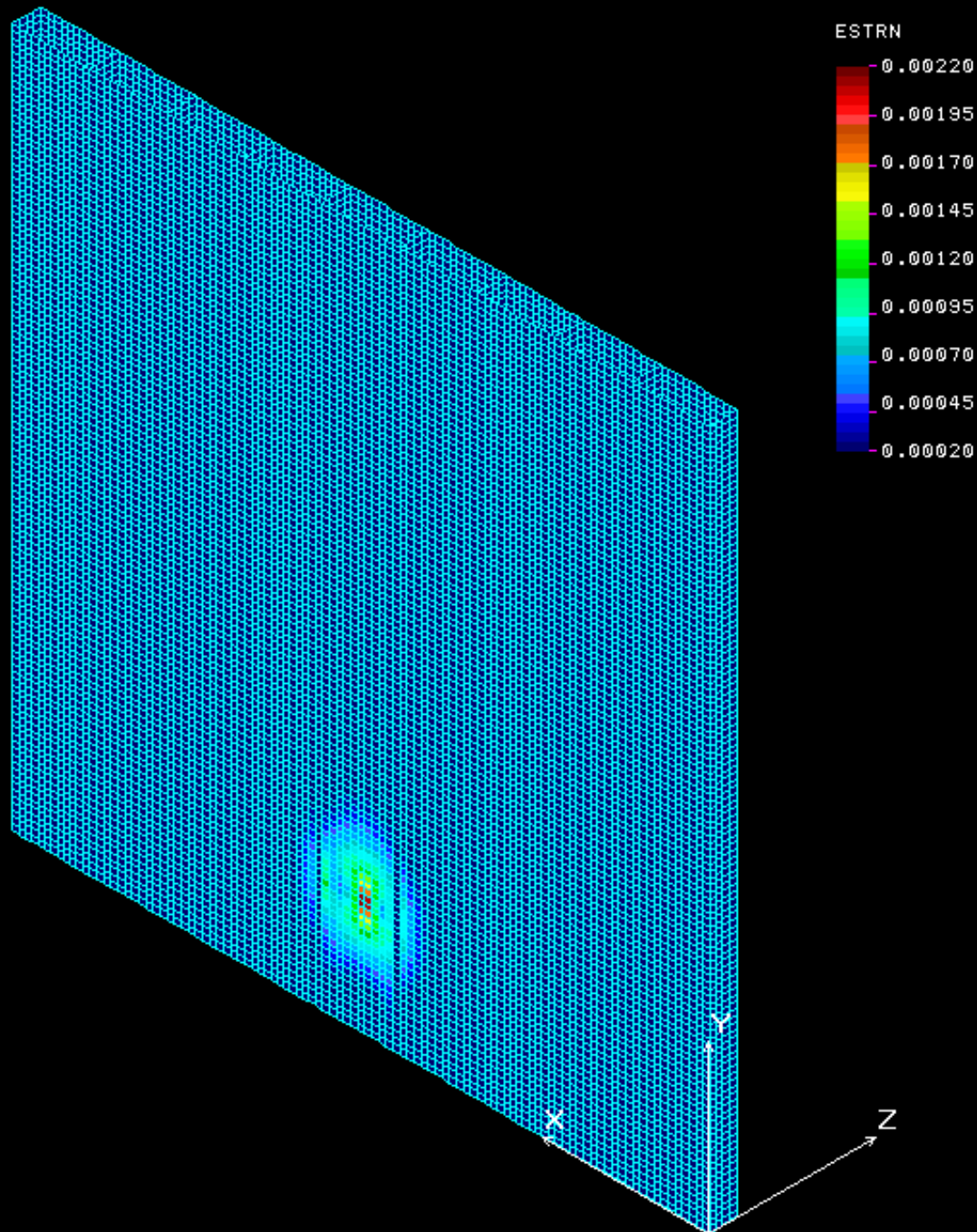
ESTRN

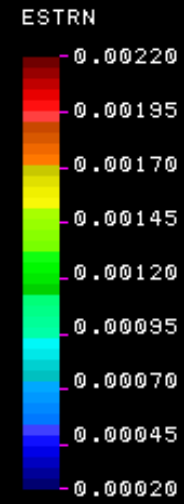
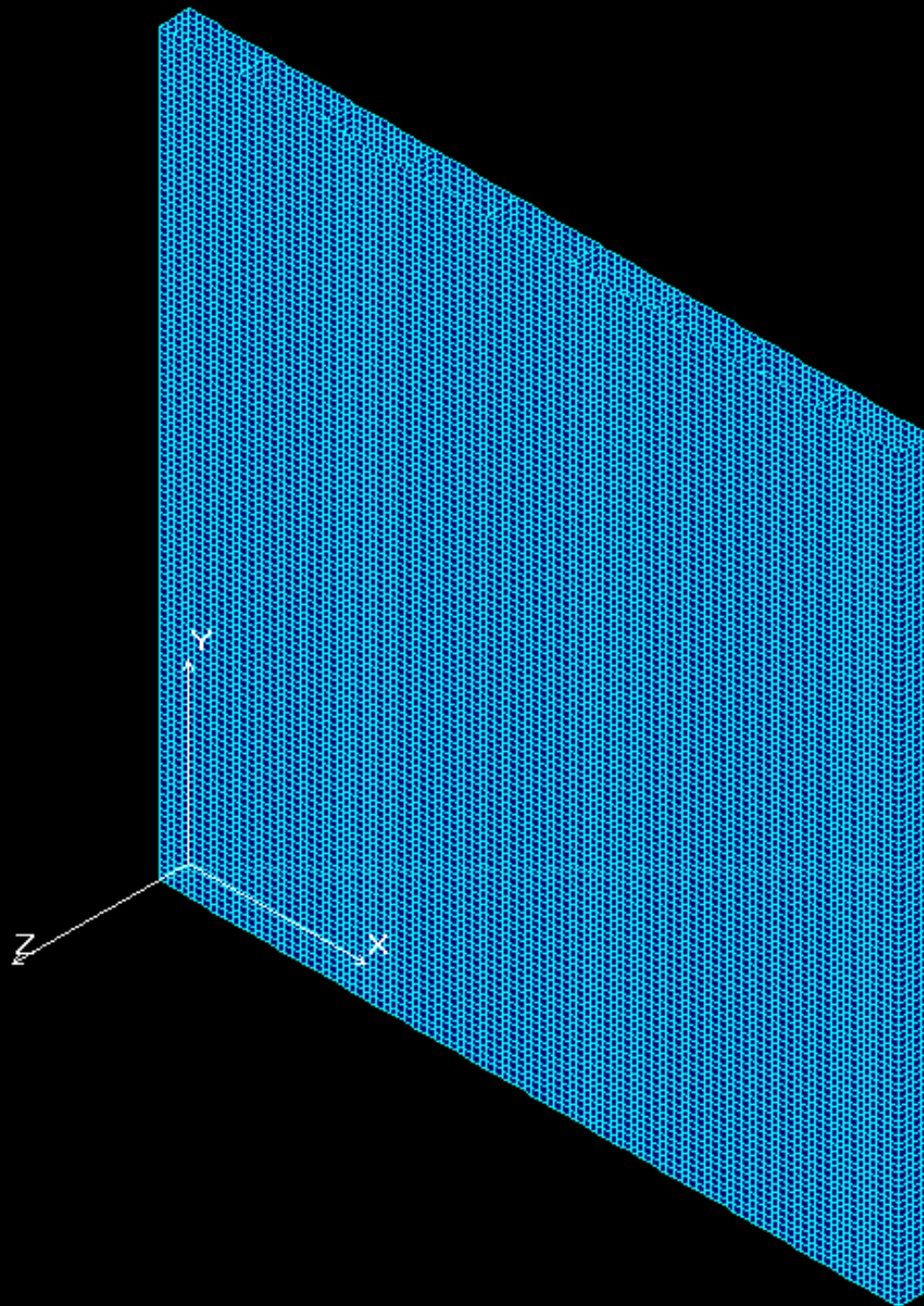


Load “D” Frame Strain



Load "D" Front Panel Strain



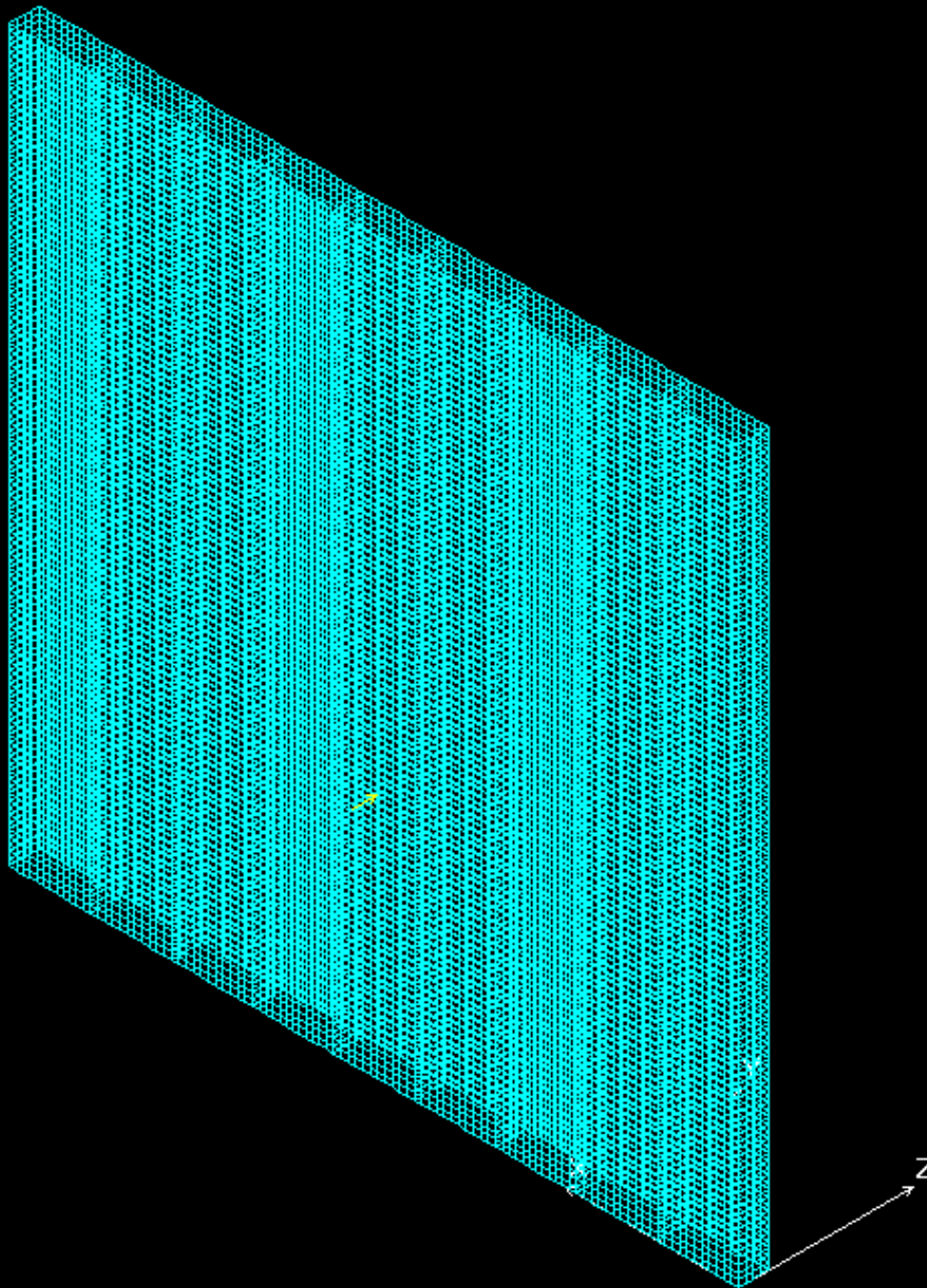


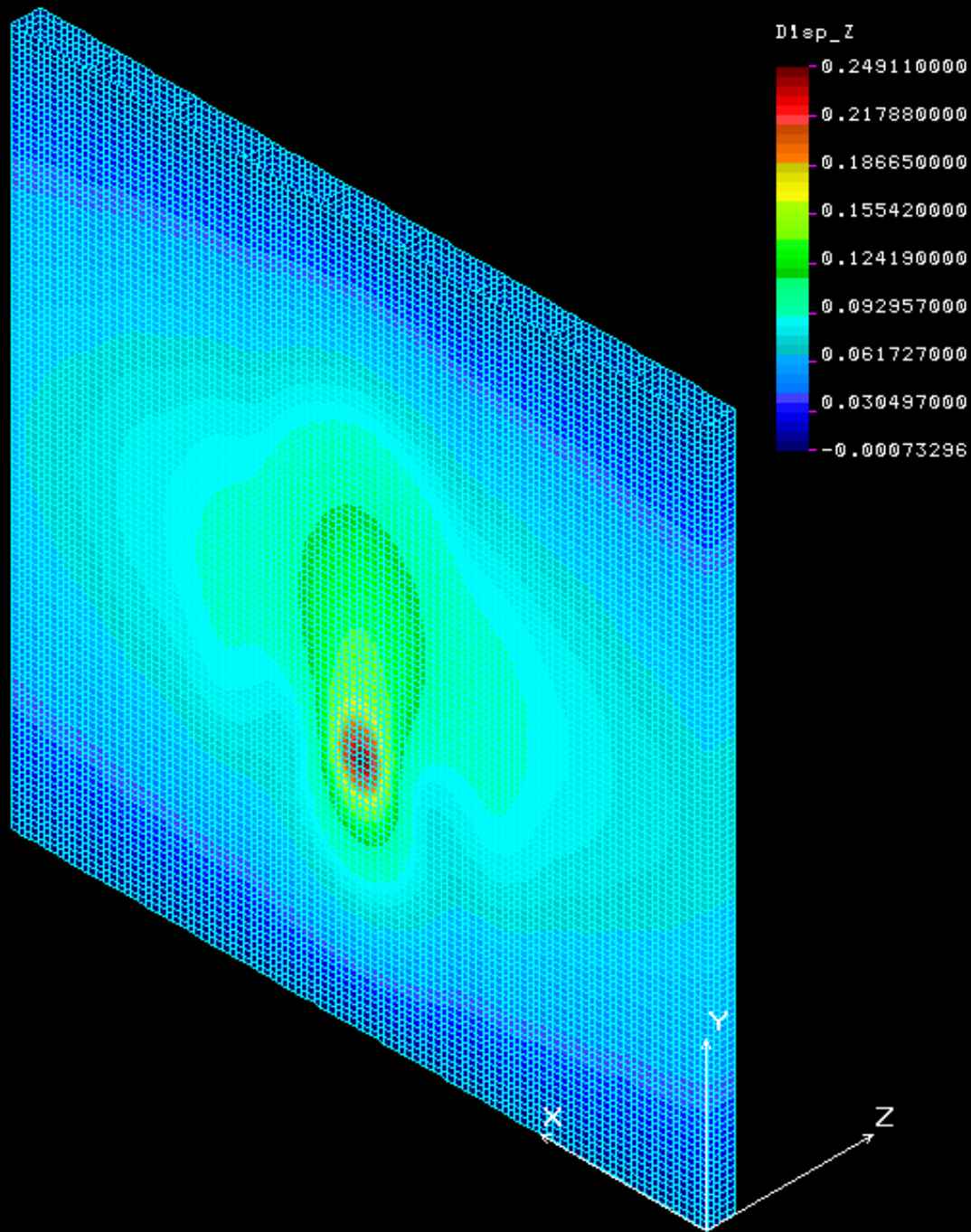
Load "D"
Back Panel
Strain

Loading “E”

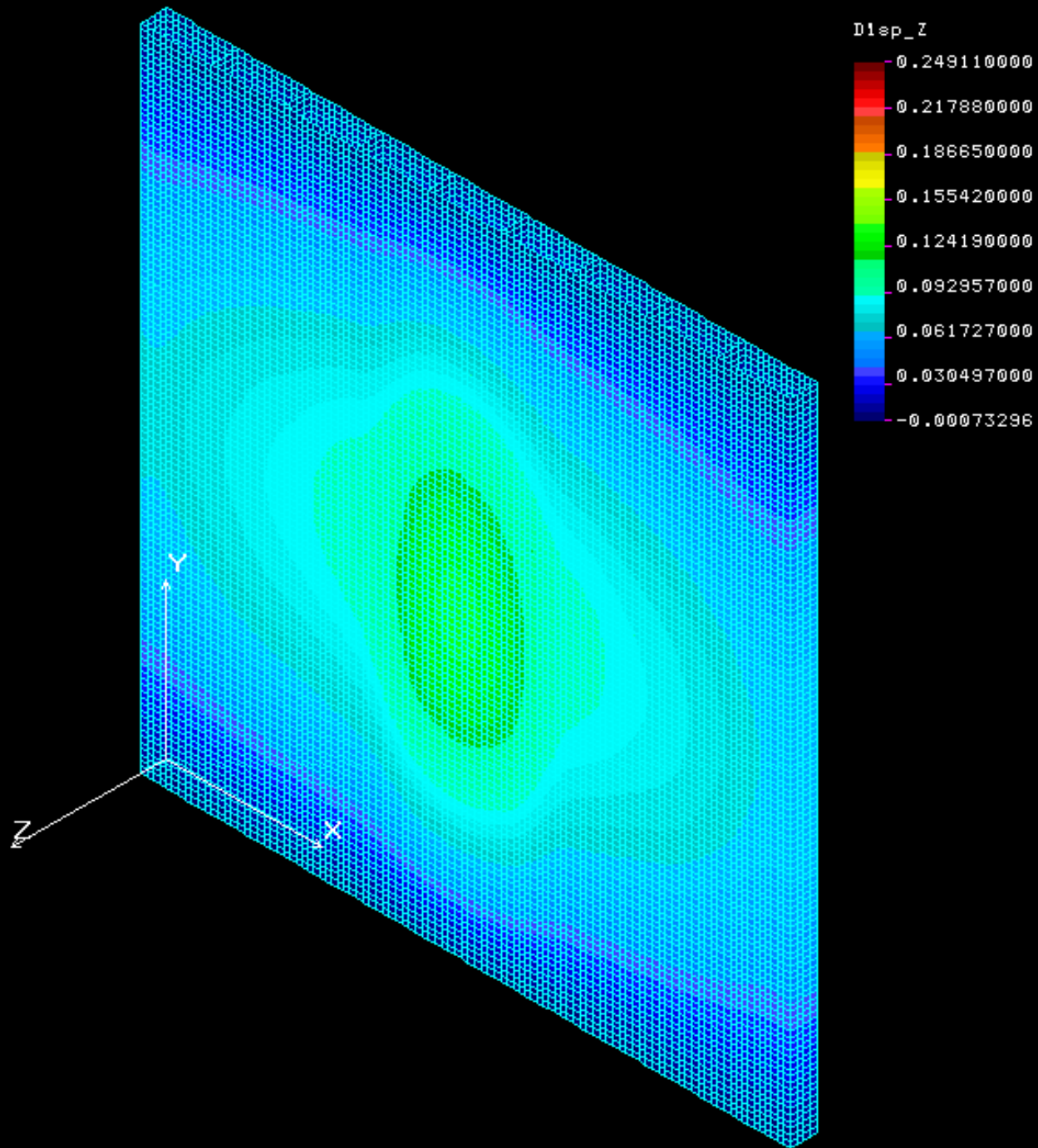
- Pressure load of 0.287 psi on wall panels
- 2000 lb point load on frame 4 ft above floor

2000 lb point
force on frame
4 ft above floor

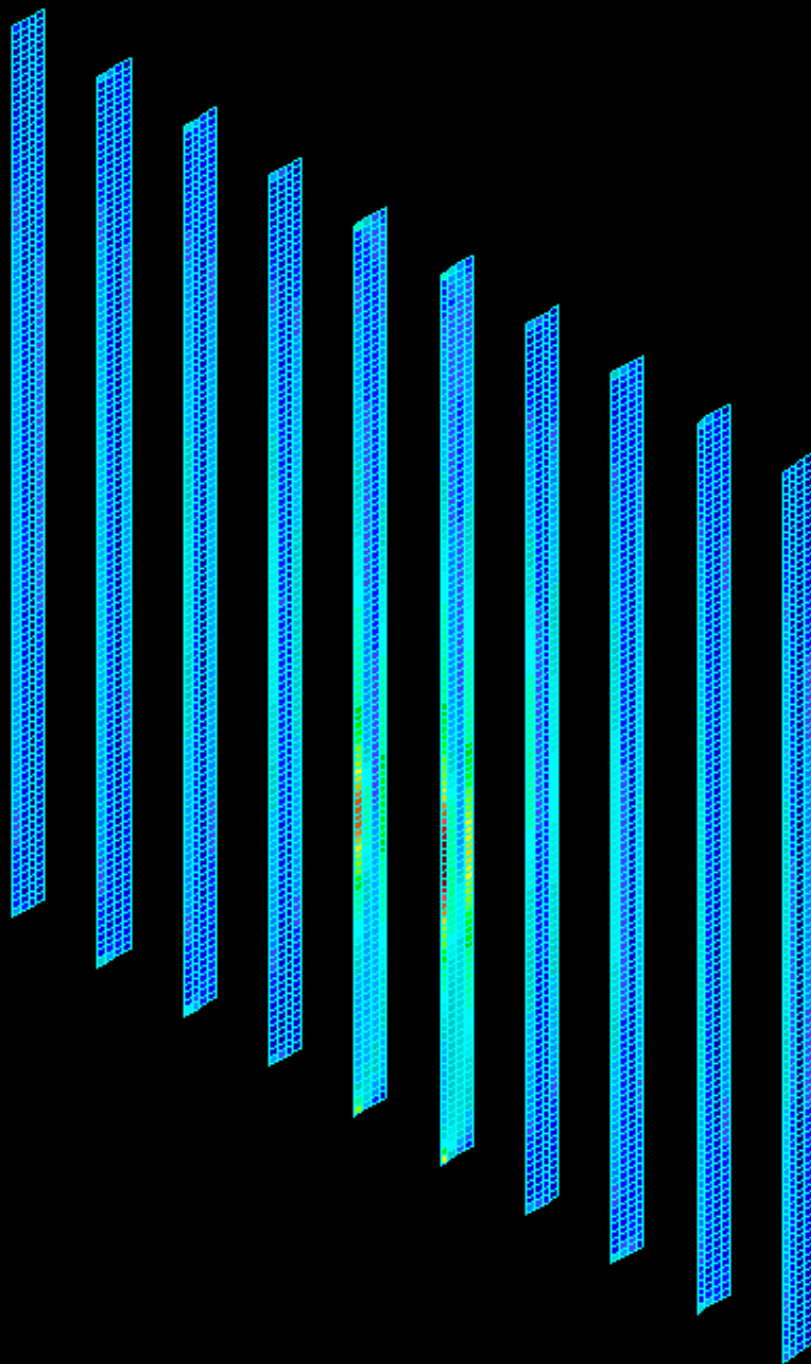




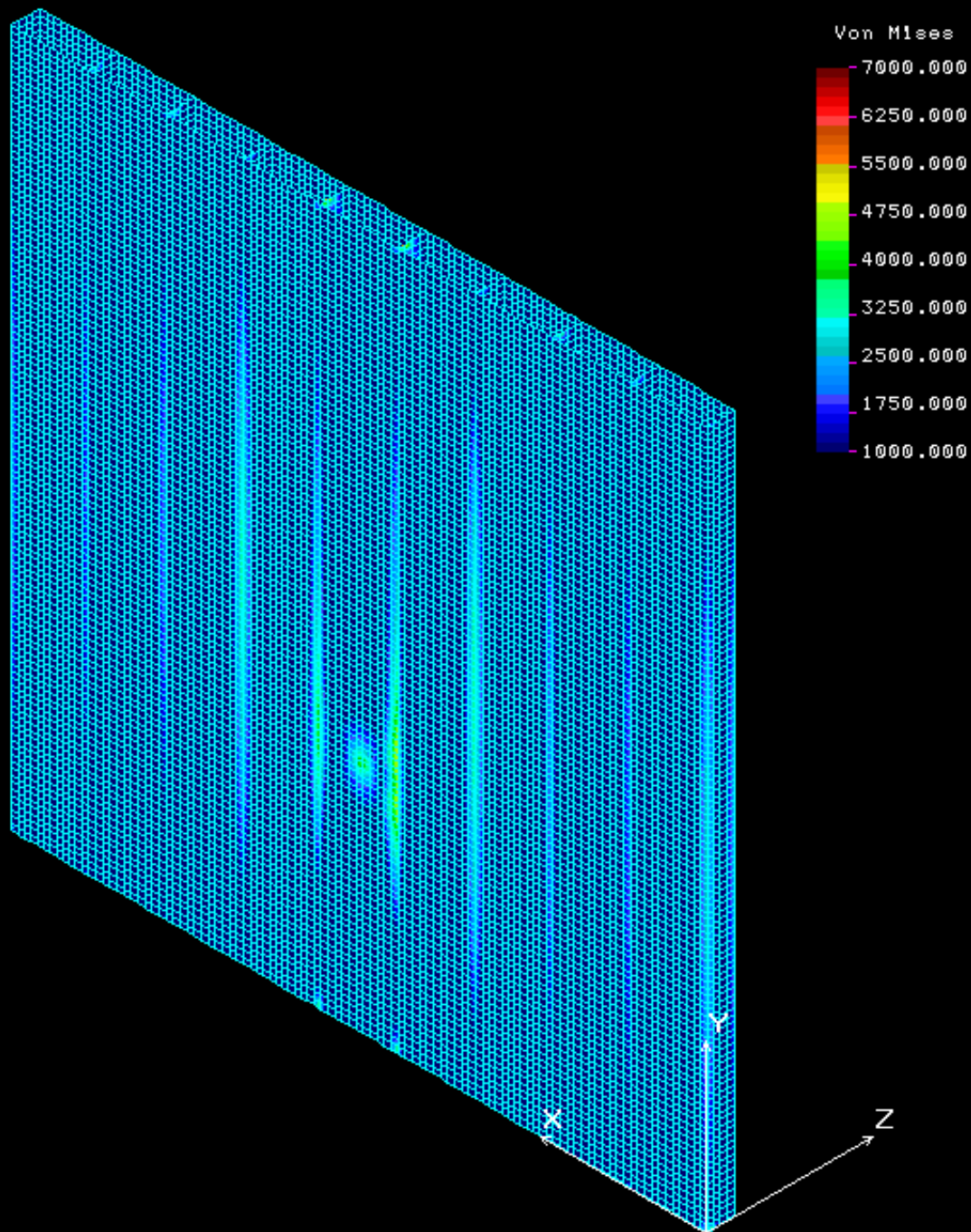
Load "E"
Front Face
Z Deflection
(in)



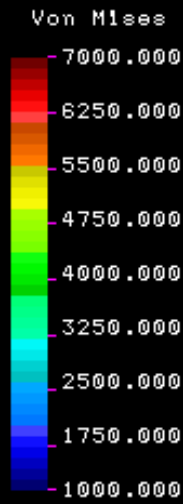
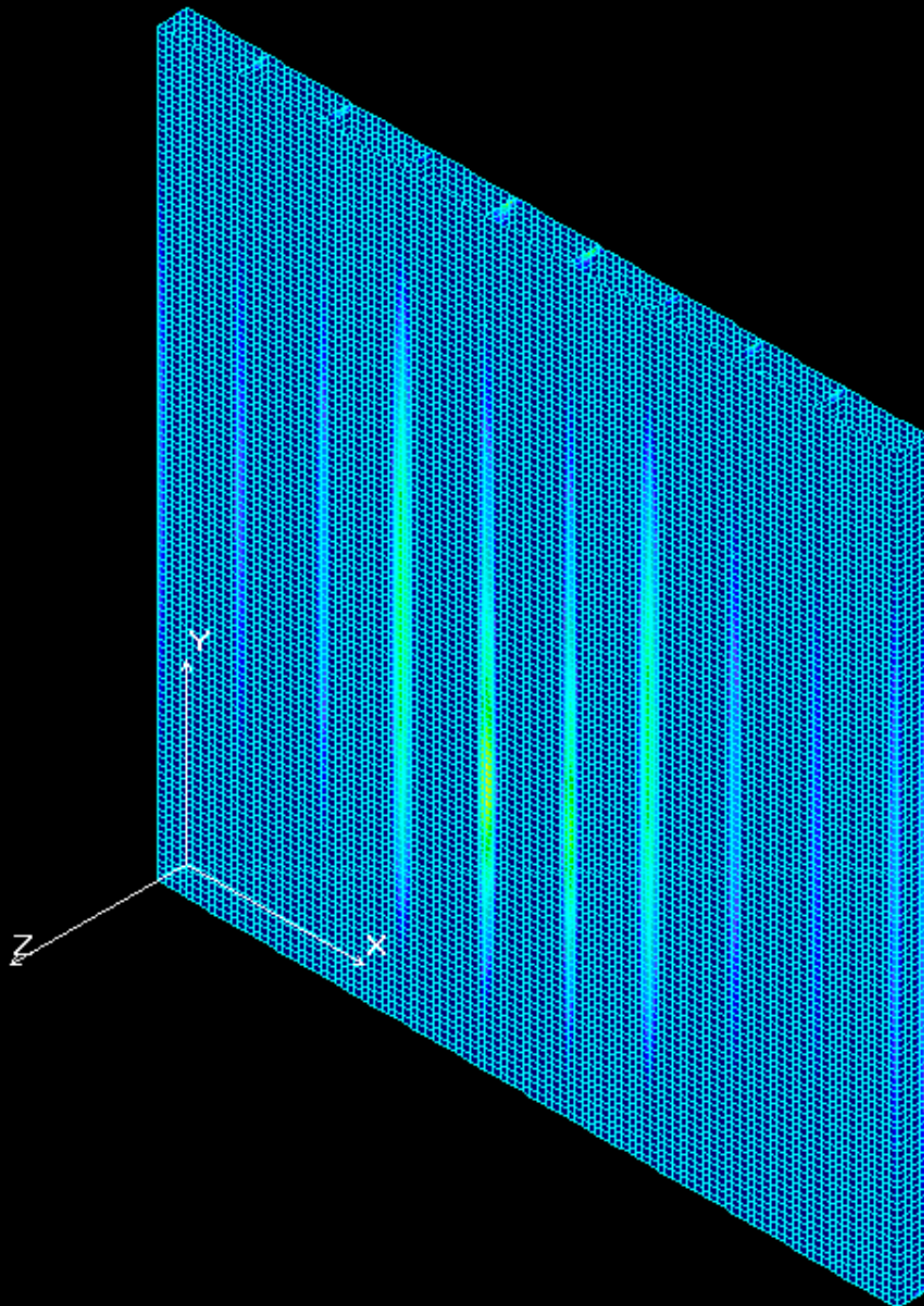
Load "E"
Back Face
Z Deflection
(in)



Load "E"
Frame
Stress (psi)

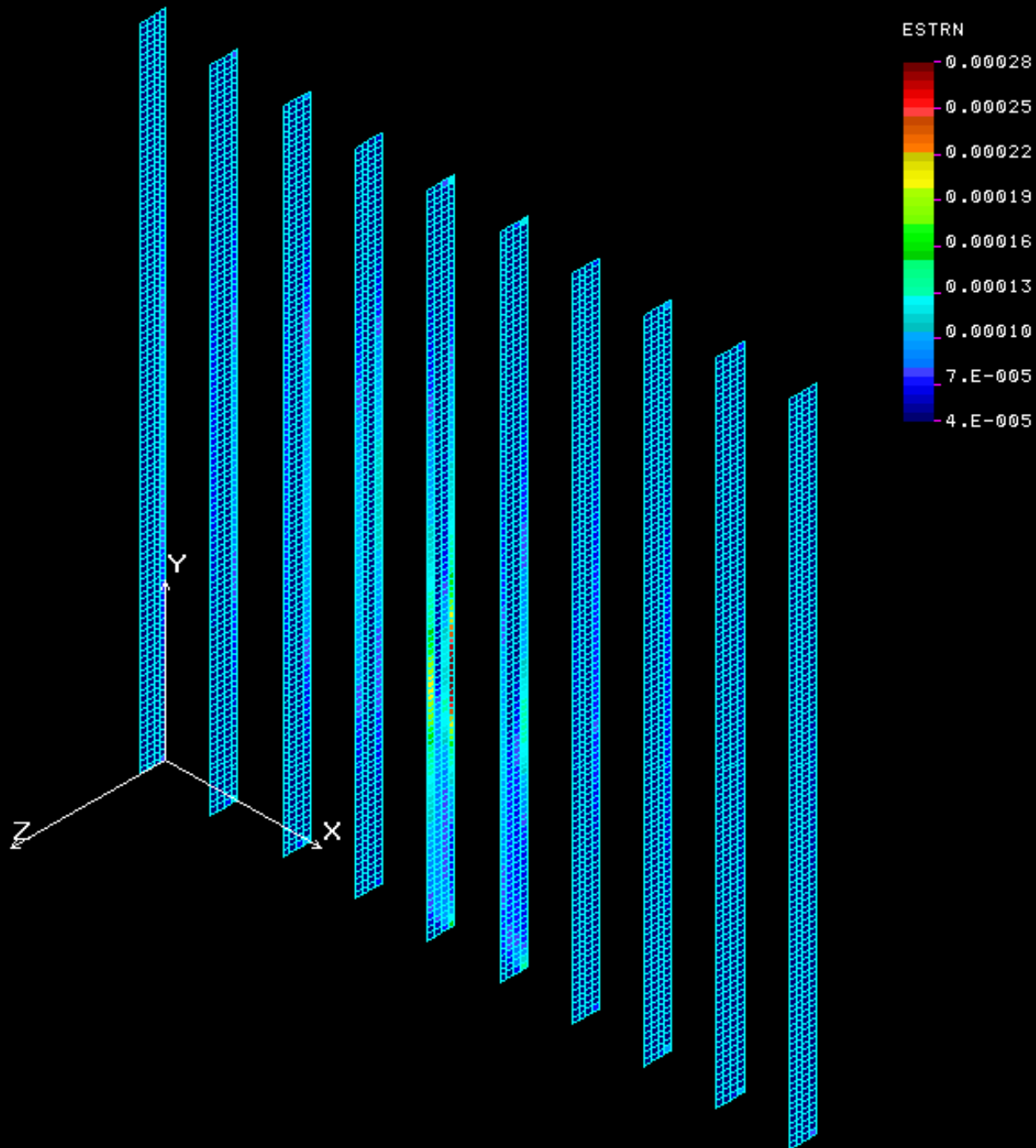


Load "E"
Front Panel
Stress (psi)

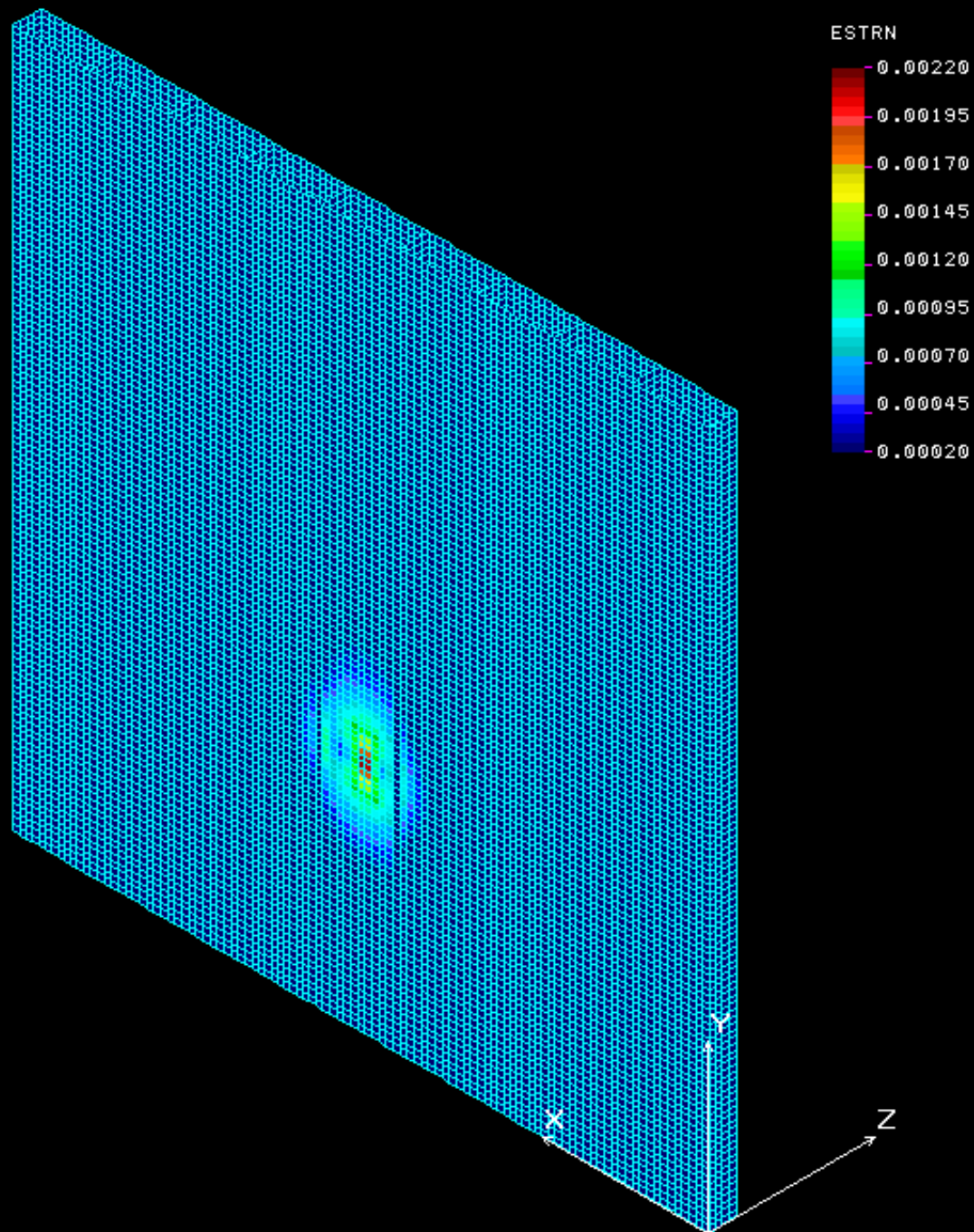


Load "E"
Back Panel
Stress (psi)

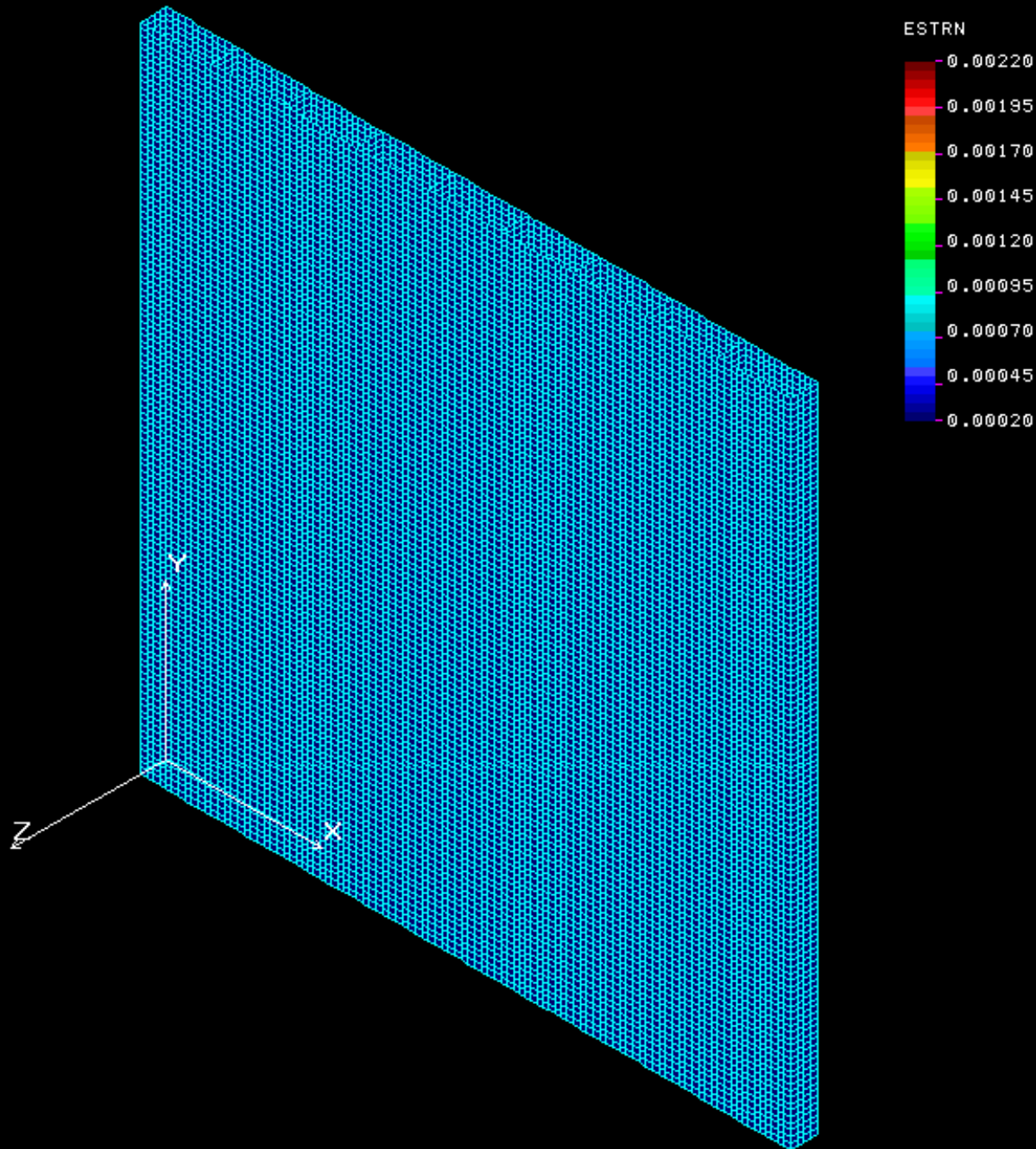
Load "E" Frame Strain



Load "E" Front Panel Strain



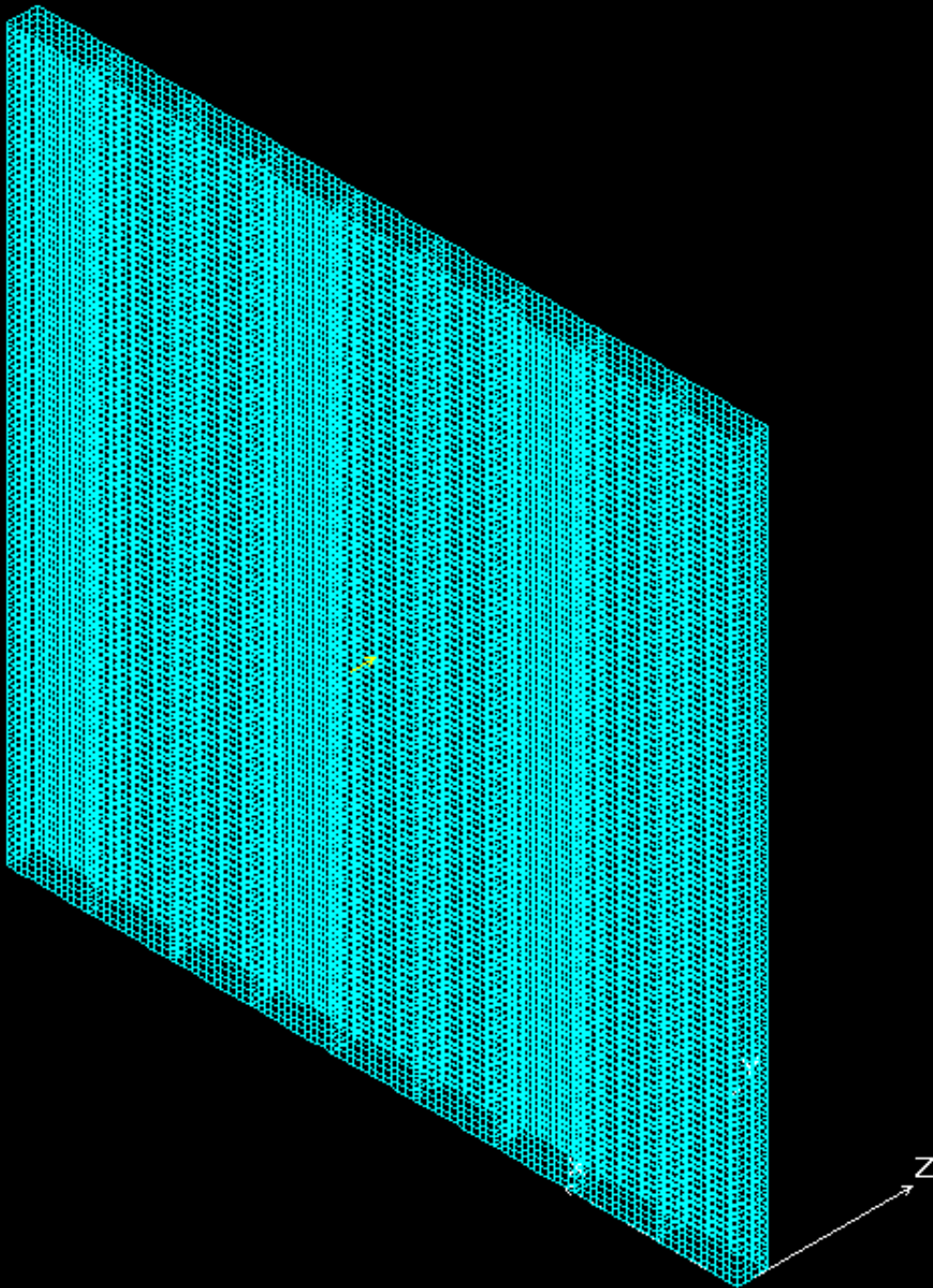
Load "E" Back Panel Strain

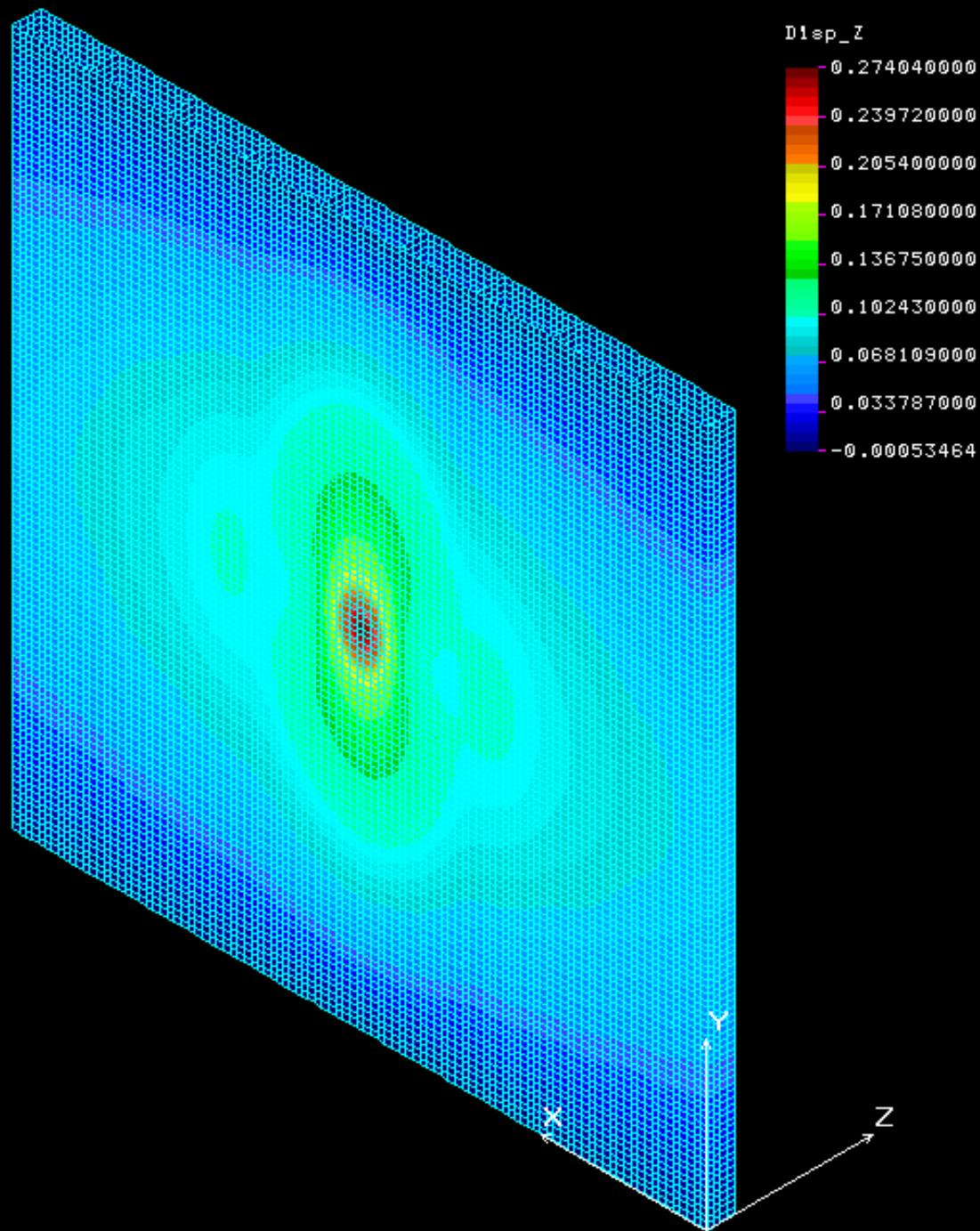


Loading “F”

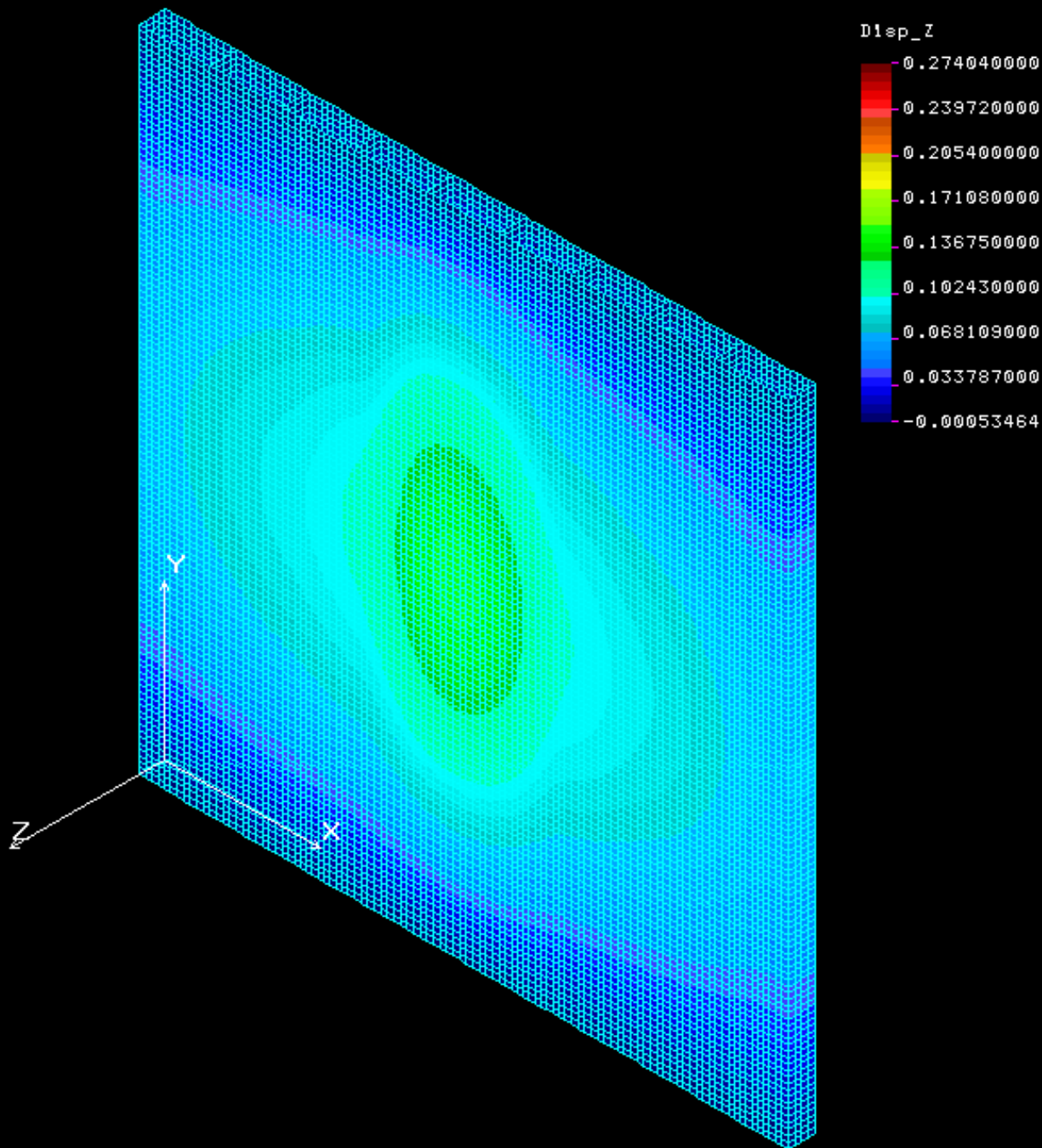
- Pressure load of 0.287 psi on wall panels
- 2000 lb point load on frame 2 ft above floor

2000 lb point
force on frame
6 ft above floor

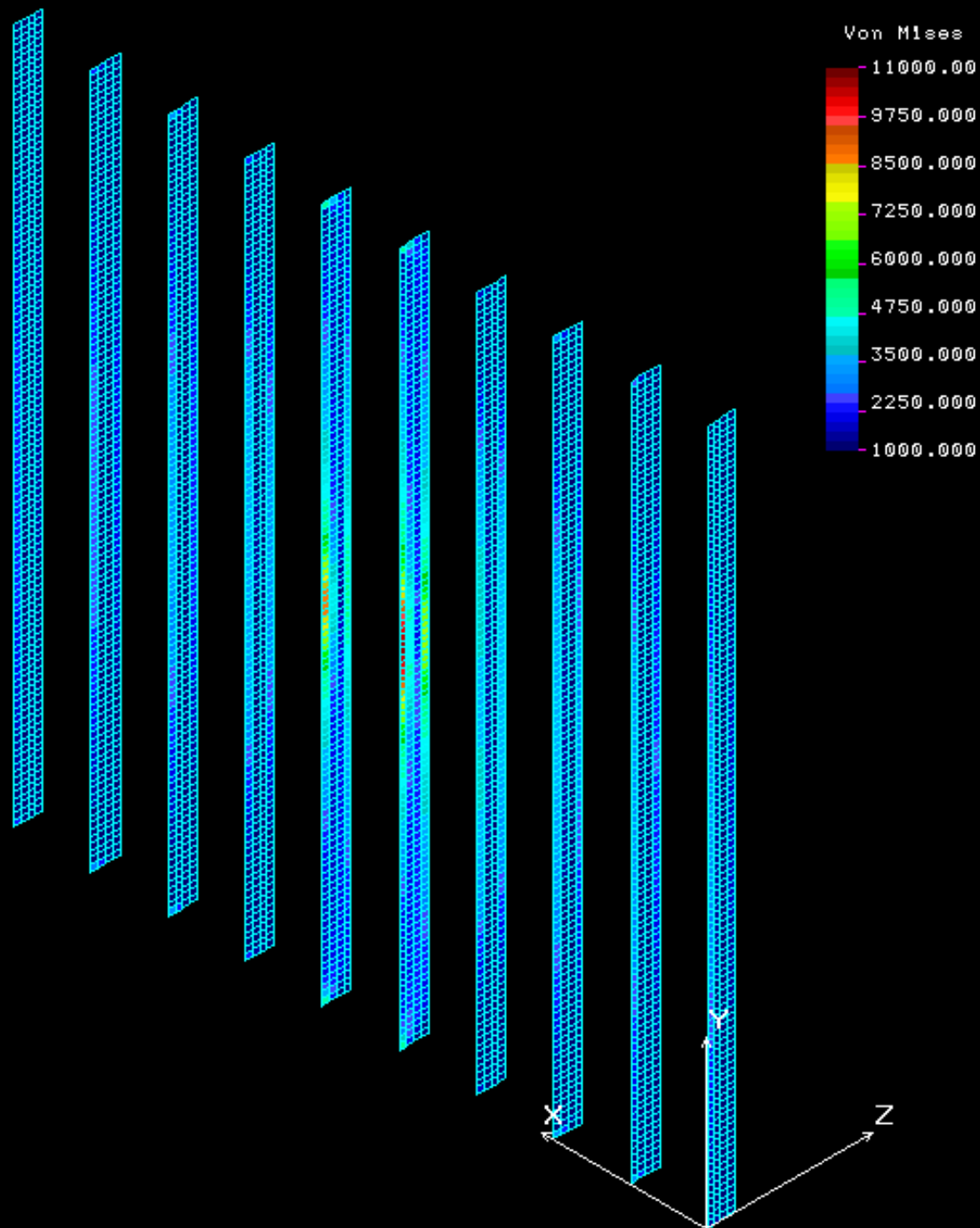




Load "F"
Front Face
Z Deflection
(in)

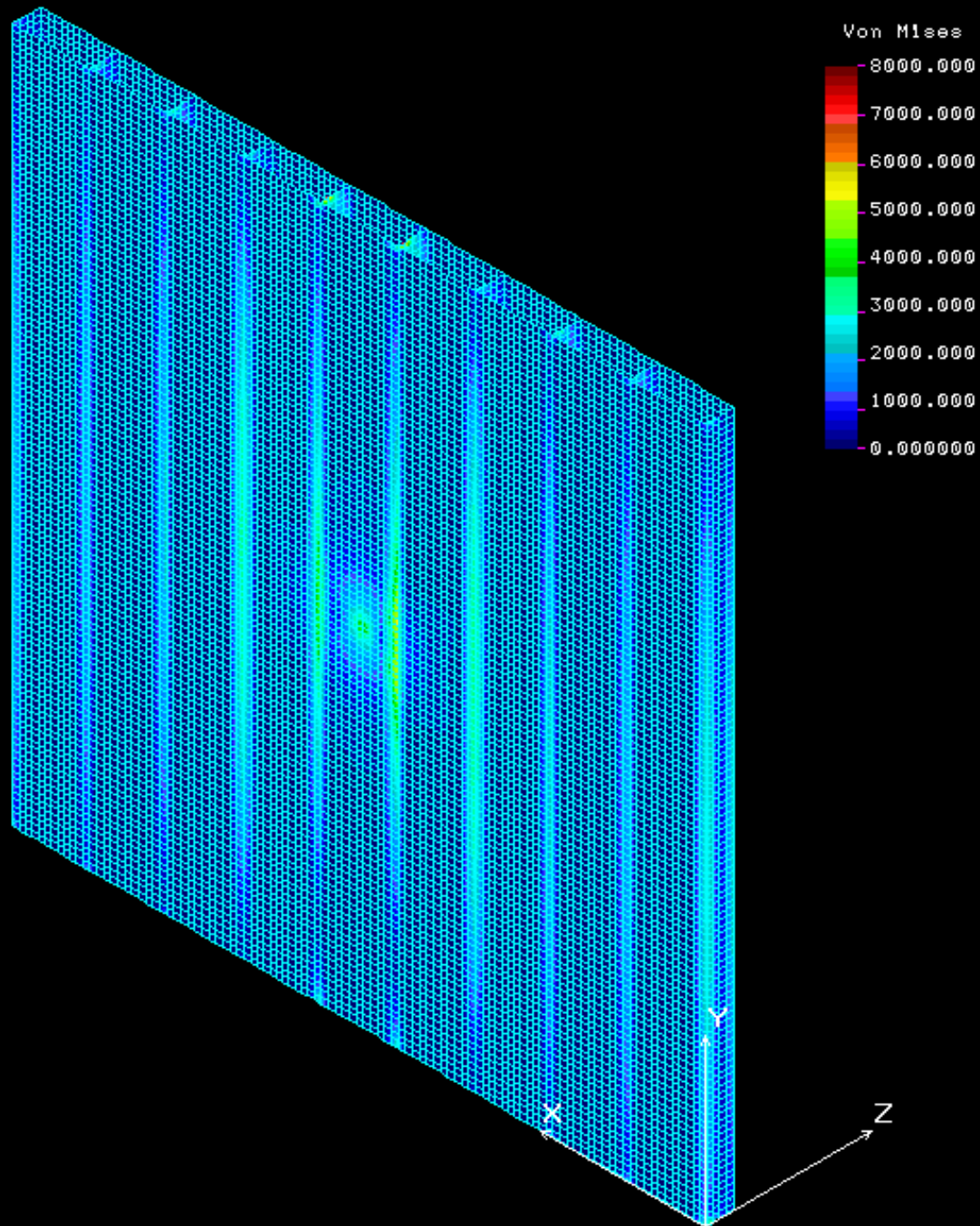


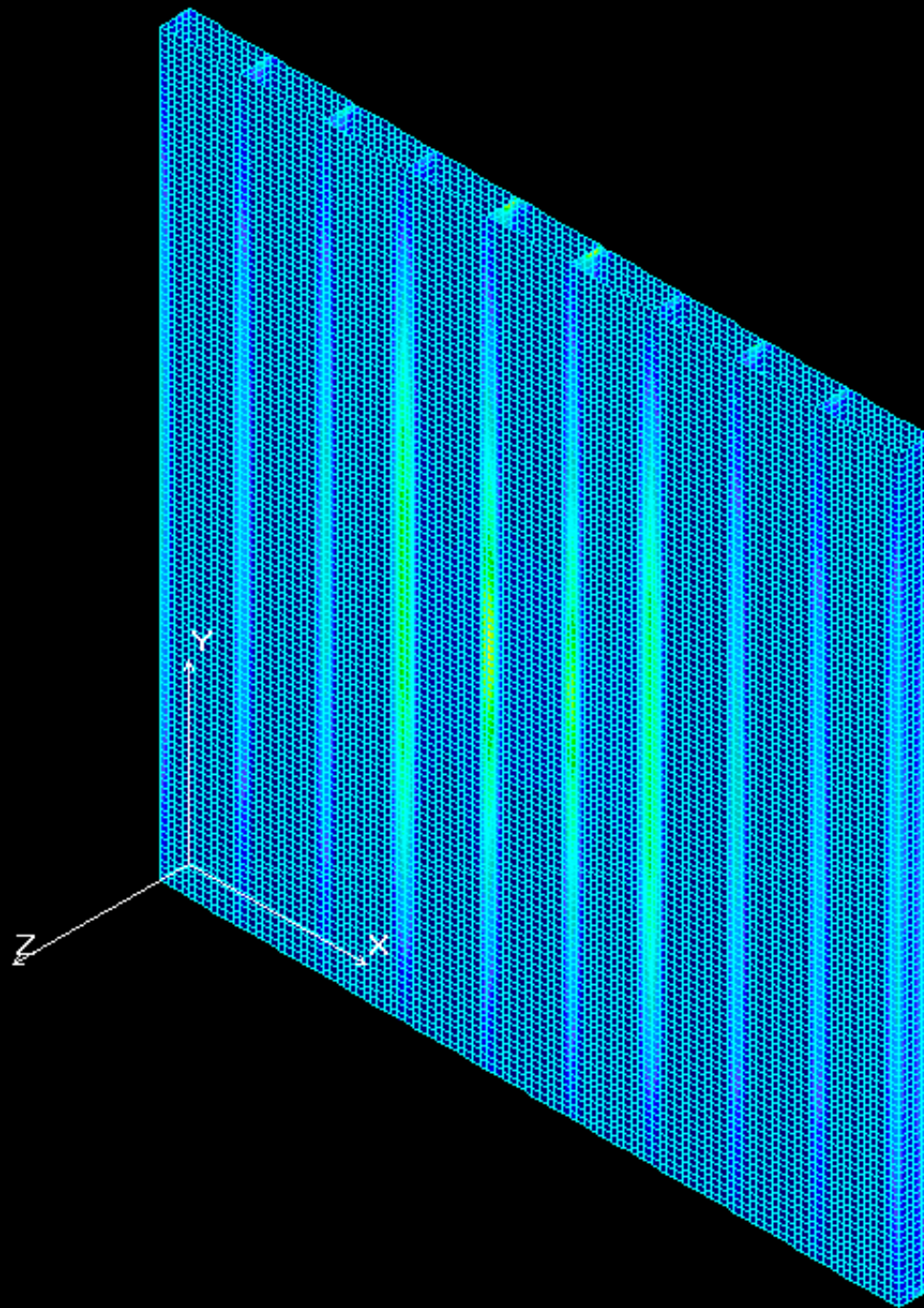
Load "F"
Back Face
Z Deflection
(in)



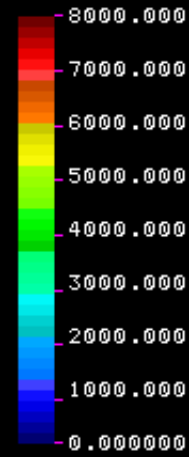
Load "F"
Frame
Stress (psi)

Load "F" Front Panel Stress (psi)



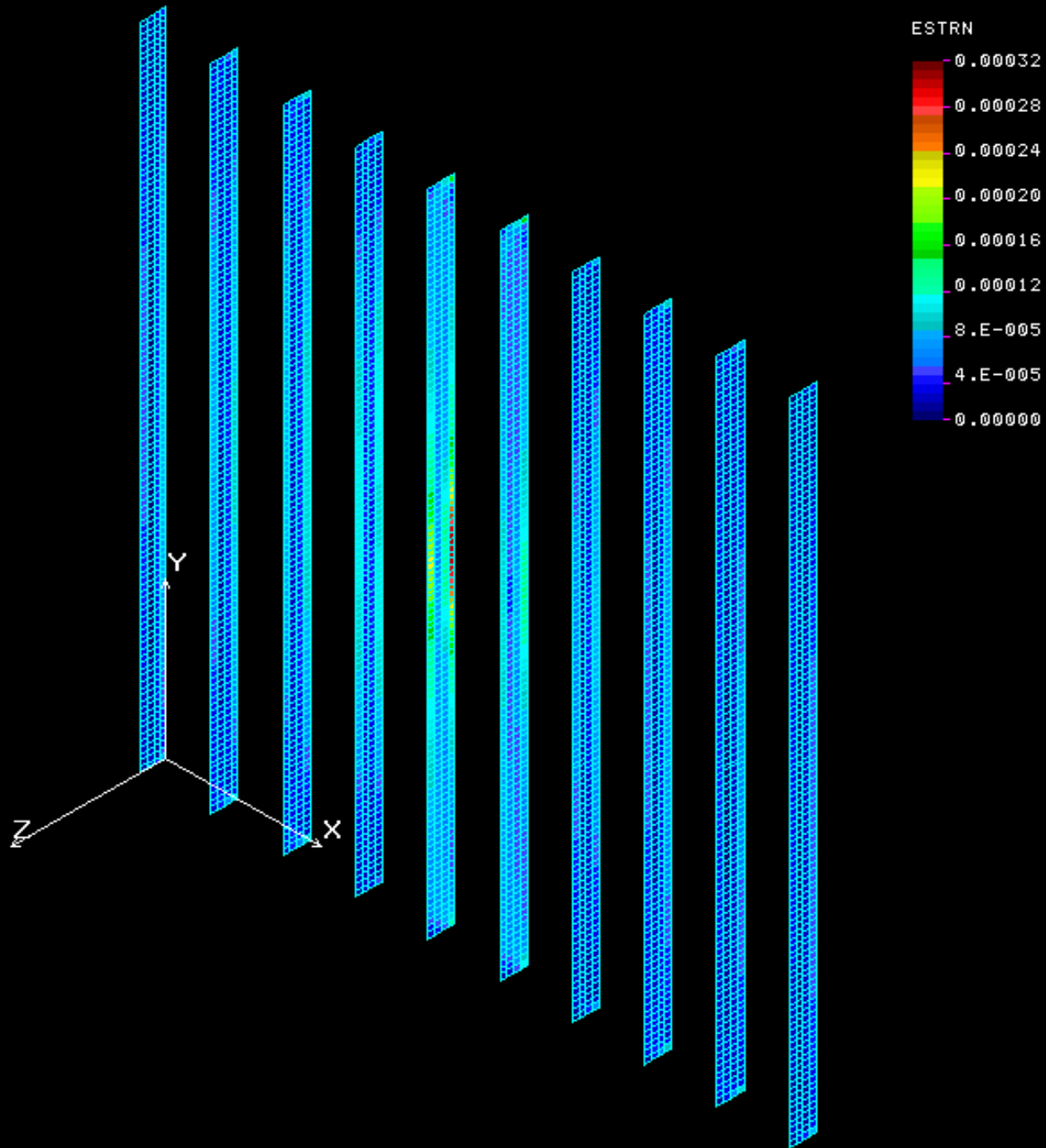


Von Mises

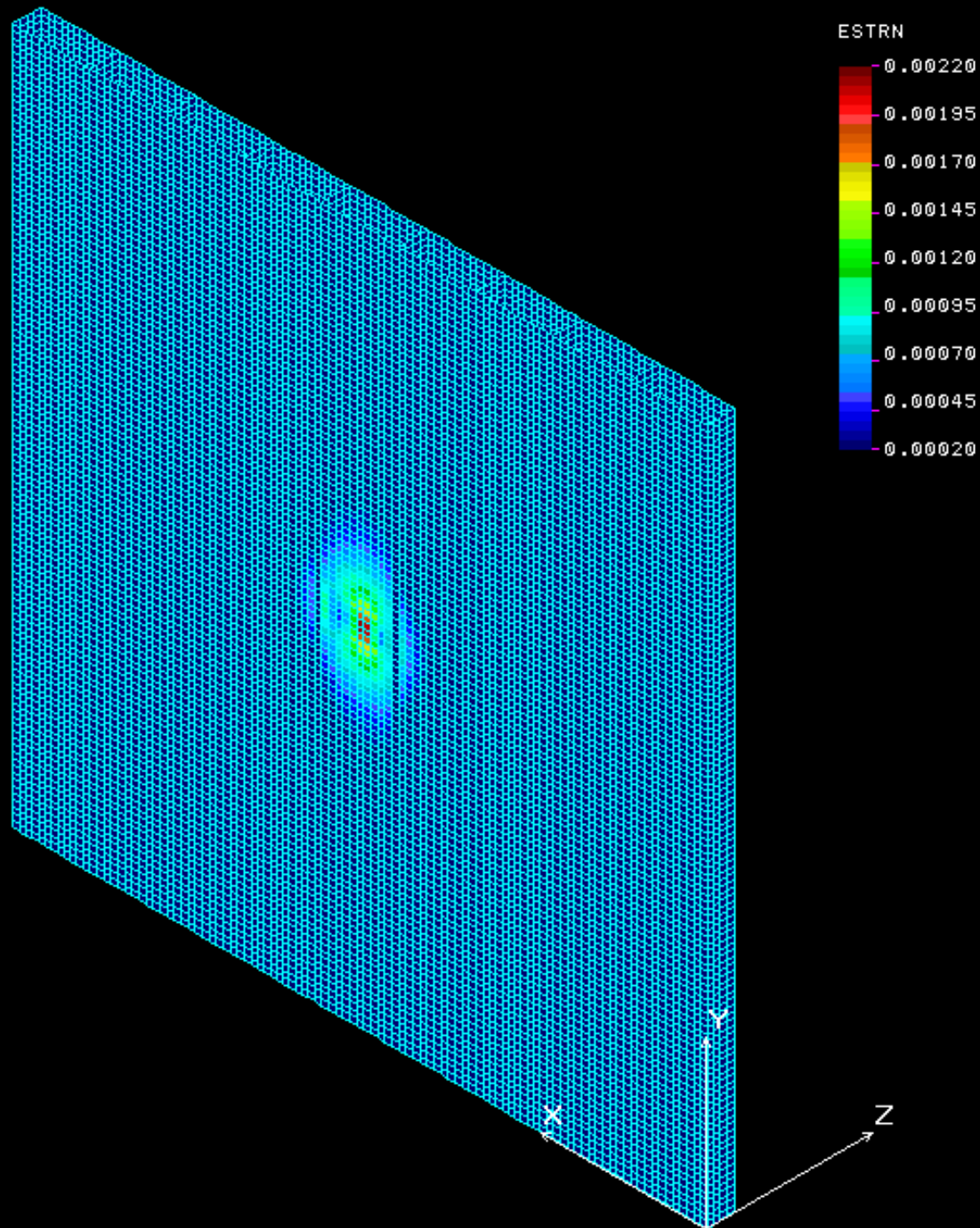


Load "F"
Back Panel
Stress (psi)

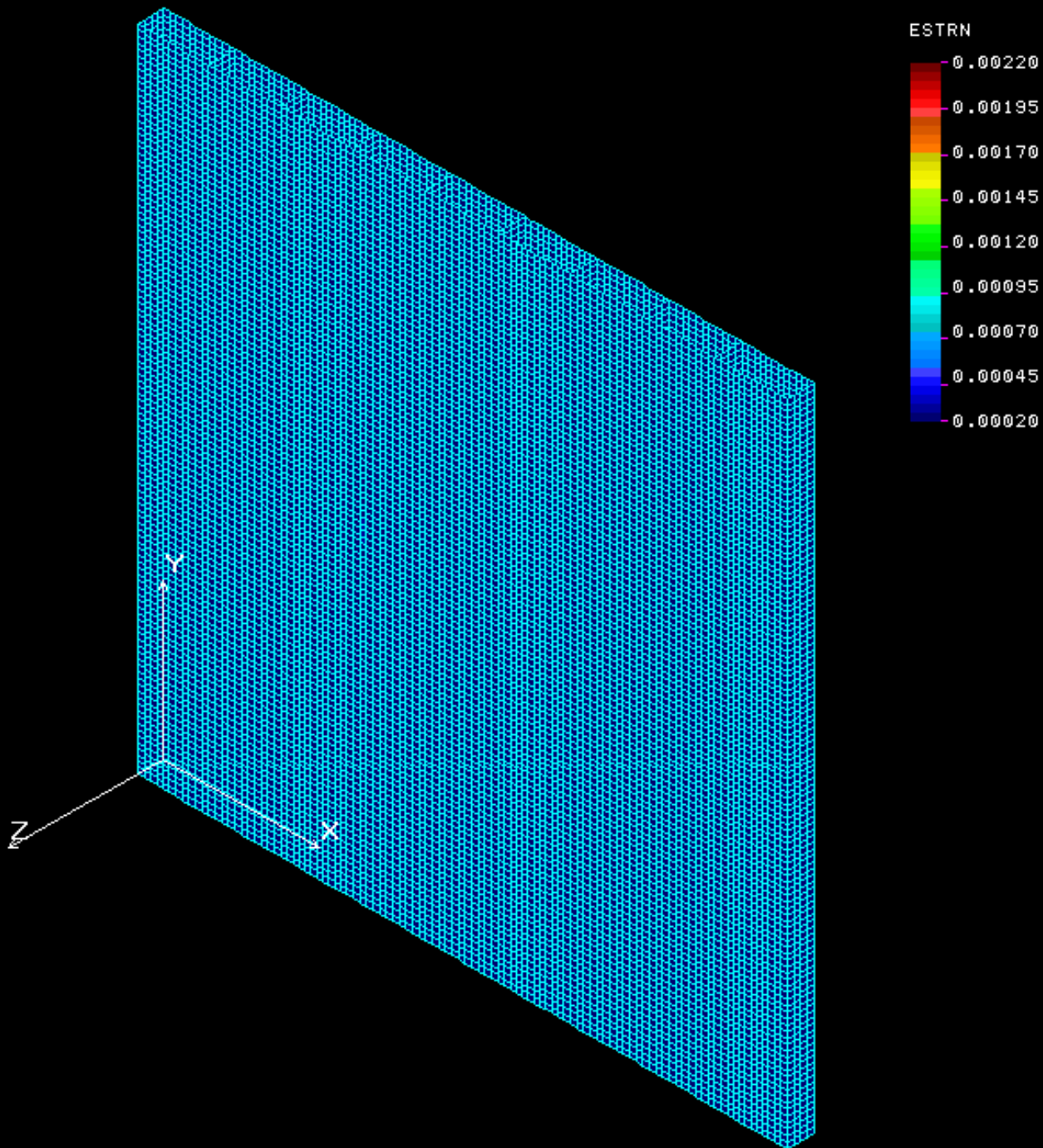
Load "F" Frame Strain



Load "F" Front Panel Strain



Load "F" Back Panel Strain



Summary

- The lowest safety factor for the steel frames is 4.8, for load case “C”.
- The lowest safety factor for the GRP panels is 1.8, 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 thicker panels.