Co-op Summer 2012

Student: Jie Zhou

Mentor: Jim Fochtman

Content

1. Magnetic Field Surface
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Magnetic Field Data

- R (0~1400 cm)
- Z (-1100~1500cm)
- Br (0~39880 Gauss)

Data Range

R (cm)	Z (cm)	B (G)	X (mm)	Y (mm)	Z (mm)
20	-330	51	0	200	-3300
40	-330	51	0	400	-3300
60	-330	49	0	600	-3300
…	…	…	0	…	…
280	-10	51	0	2800	-100
280	0	51	0	2800	0
280	10	51	0	2800	100
…	…	…	0	…	…
240	180	50	0	2400	1800
230	190	51	0	2300	1900
220	290	50	0	2200	2900
…	…	…	0	…	…
100	690	49	0	1000	6900
70	700	49	0	700	7000
20	710	49	0	200	7100

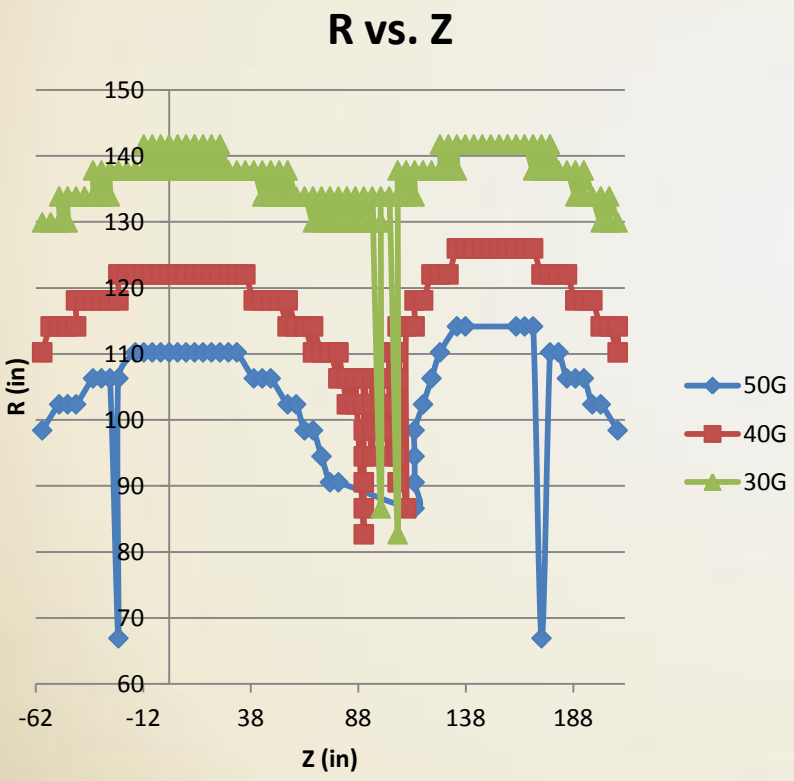
Procedure

- Filter the data (50±1G)
- Fix the data

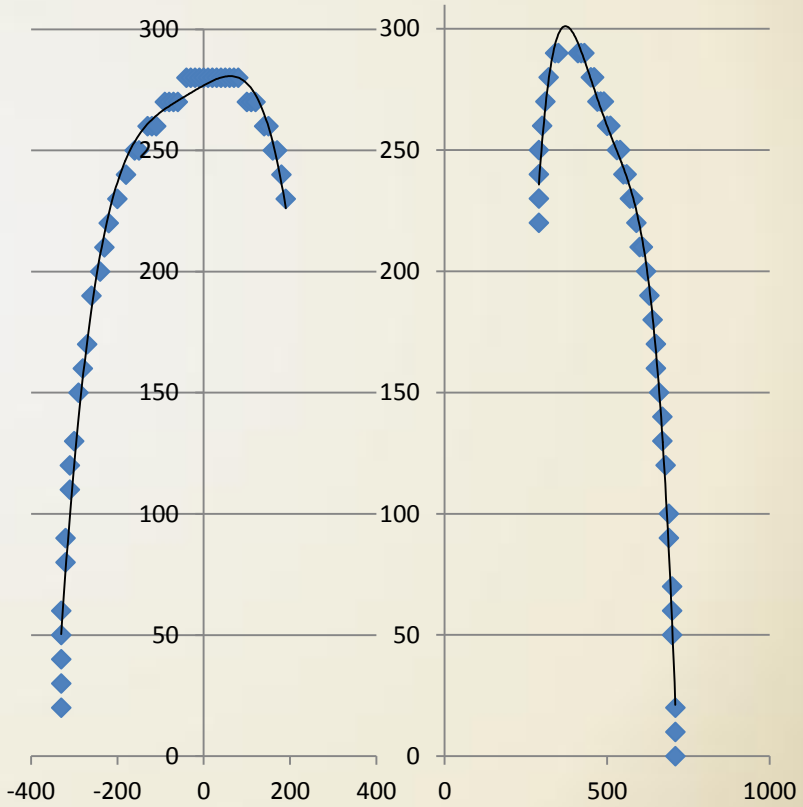
  (3 axes and units)
- Plot the curve
- Separate the curve
- Fit the curve
- Copy the data in NX
- Revolve the curve

For The Chillers

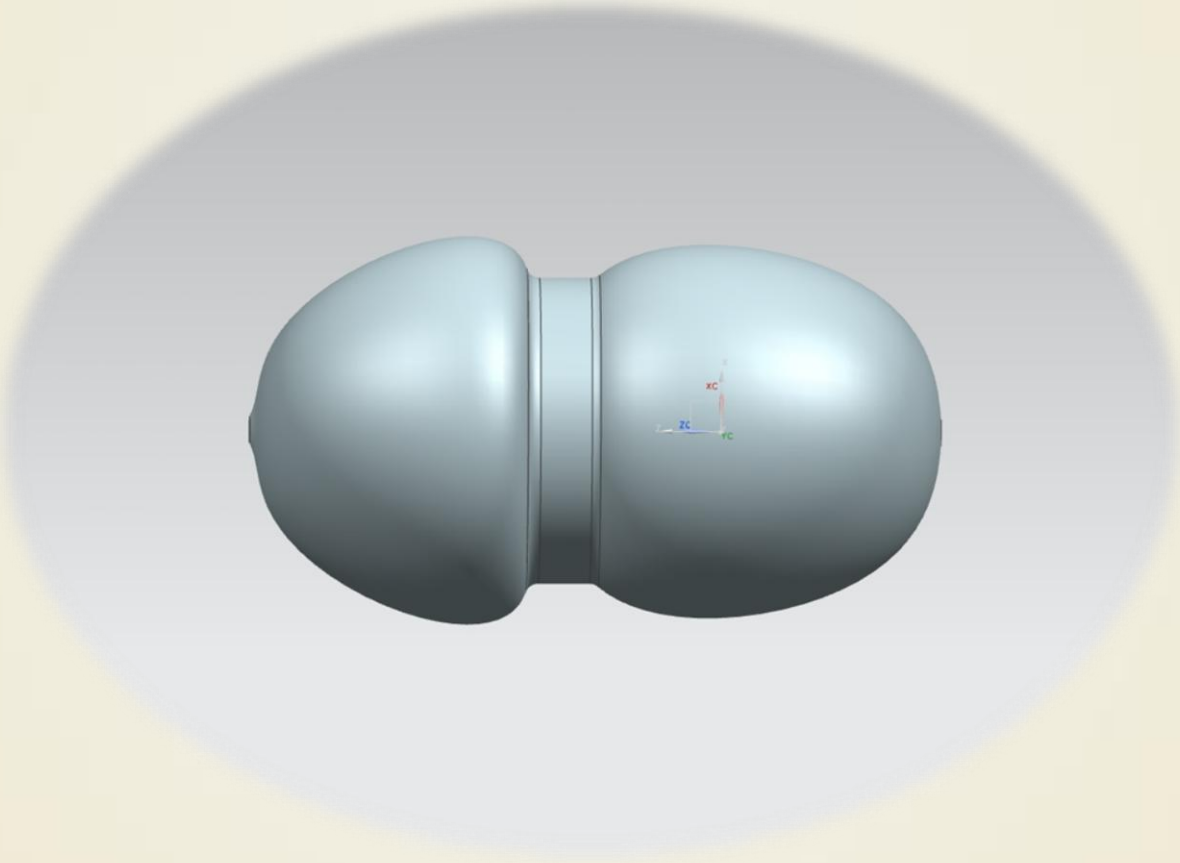
50, 40, 30 Gauss



50 Gauss Field



50 Gauss Surface



Constructing surfaces for 5G, 400G, 500G, 8000G, 10000G are similar.

BCAL Readout Cooling System

- Working Pressure: 60 psi (designed)
- Working Temperature: 104°F (max)
- Material: Stainless Steel ASTM S30400
- Stress Value in Tension: 16.0 ksi (max)
- Maximum Flow: 8 GPM
- Flow Velocity: 2.72 ft/sec (designed)
- Pipe Size: NPS 1, Schedule No. 10s (1.315”(OD), 0.109”(wall))

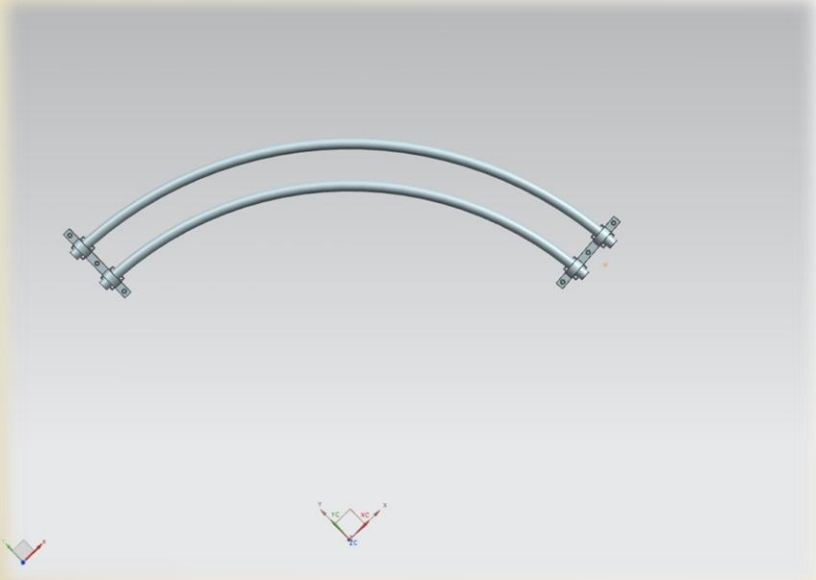
Supports and Spacing

ASME B31.9-2011, "Building Service Piping" (921)

- Allowable stresses=0.2*tensile stress (min)
- Allowable overstress=1.8*yield strength (min)
- Stress due to support spacing shall "not exceed the basic allowable stress on the basis of a support span twice as great as the actual span"
- The deflection based on "the allowable deflection of the pipe between supports shall not exceed the smaller of 0.25 in. or 15% of the outside diameter of the pipe"

Curved Pipe (1)

$$\sigma_{max} = \frac{Ma}{I}\frac{1-\beta}{K}$$



- Where **M** is the bending moment applied to the pipe; **α** is the outer radius of the pipe section; **R** is the radius of curvature of the beam axis

$$K = 1 - \frac{9}{10 + 12(tR/a^2)^2}$$

$$\beta = \frac{6}{5 + 6(tR/a^2)^2}$$

- To calculate the actual stress in extreme fiber,
- Concave side

$$\sigma_i = k_i \times \sigma$$

- Convex side

$$\sigma_o = k_o \times \sigma$$

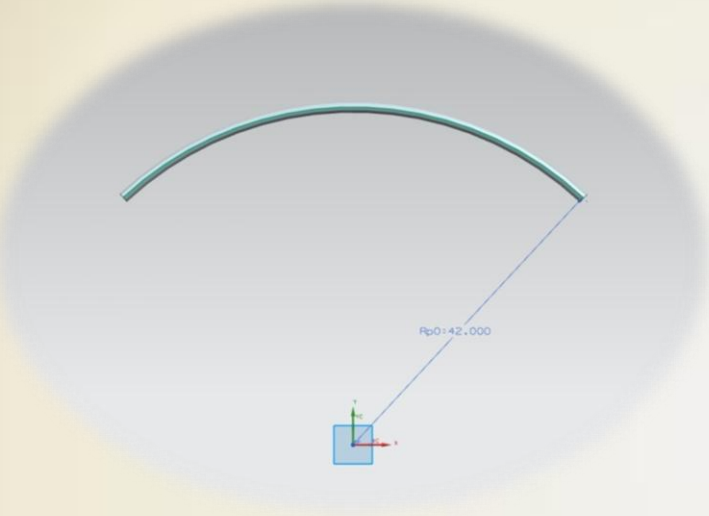
where the σ is the fictitious unit stress in corresponding fiber as computer by ordinary flexure formula for a straight beam.

$$\sigma = \frac{Mc}{I}$$

$$k_i = \frac{1}{4e/c}\frac{1 - e/c}{R/c - 1}\left[1 + \left(\frac{c_1}{c}\right)^2\right]$$

$$k_o = \frac{1}{4e/c}\frac{1 + e/c}{R/c + 1}\left[1 + \left(\frac{c_1}{c}\right)^2\right]$$

Curved Pipe (2)



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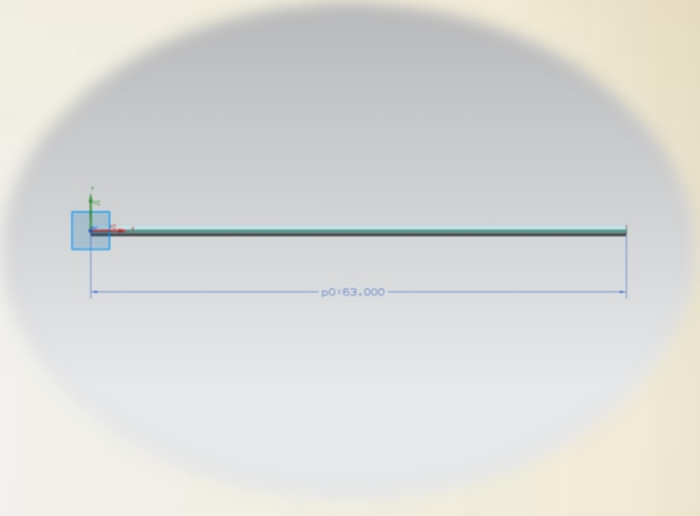

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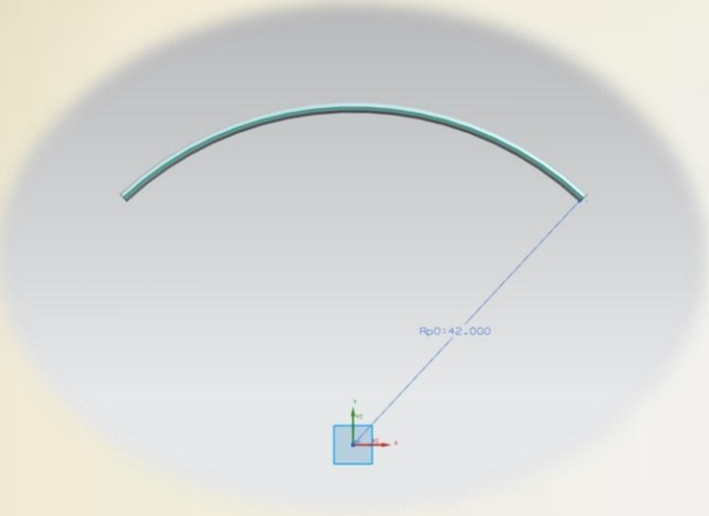

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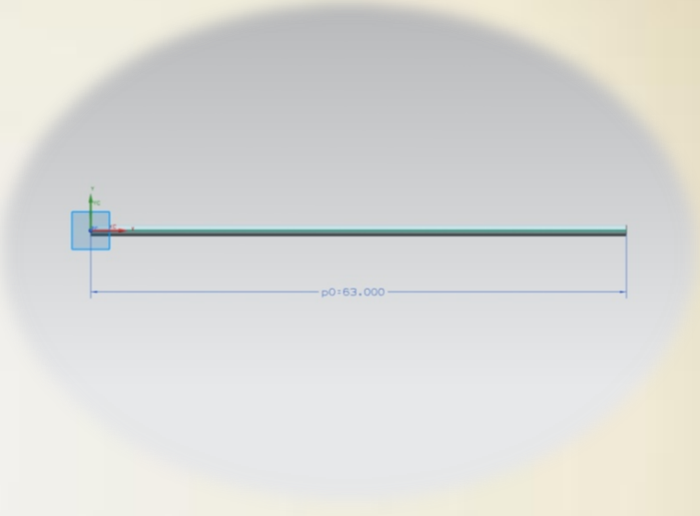

$$\delta_{max} = \frac{pL^3}{48EI}$$

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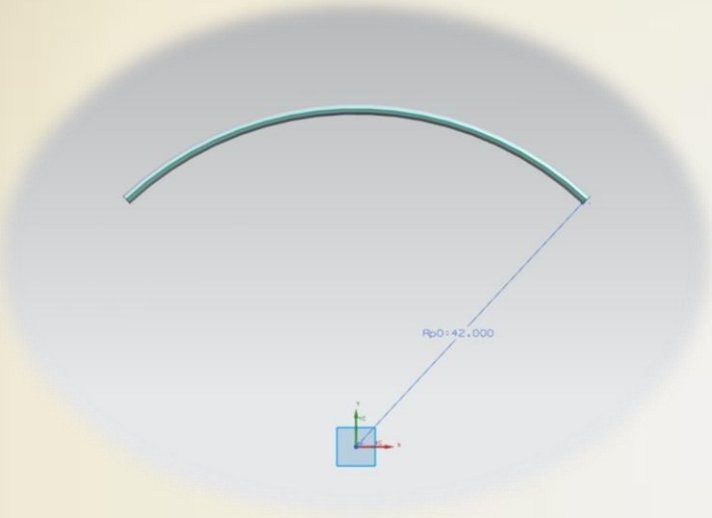

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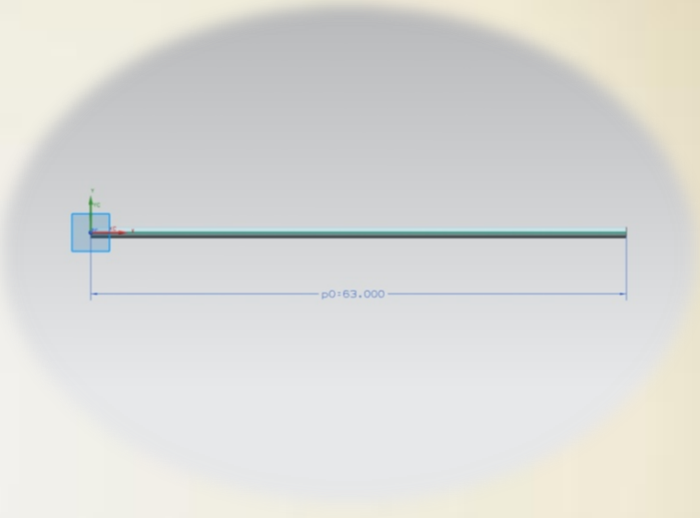

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3.5×12/1.315=32

greater than 10

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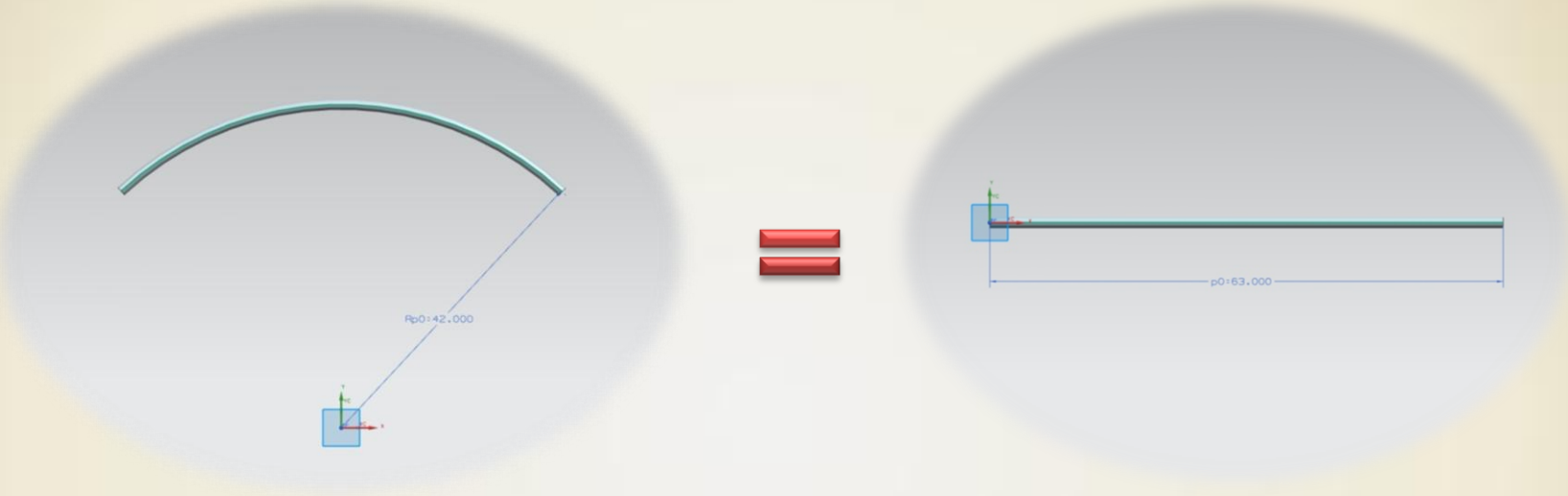

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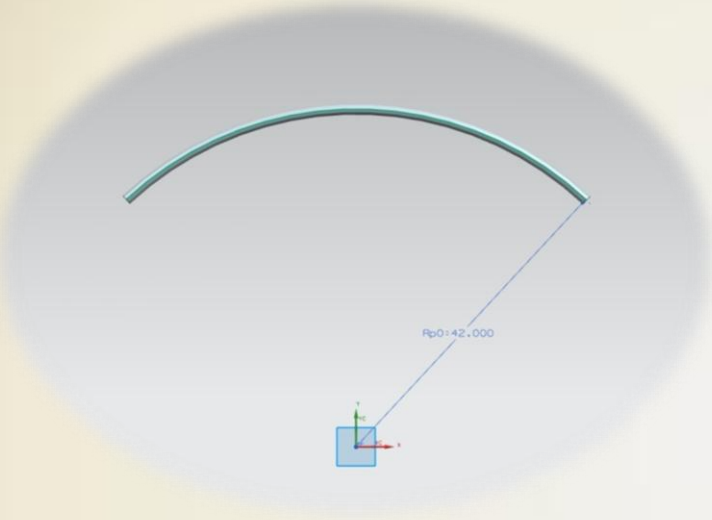
E is Young's modulus, which is equal to 28,000 ksi.

P is the concentrated load of the pipe and water with the valves.

L the original length of the pipe.

I is the minimum of the moment of inertia.

Curved Pipe (2)



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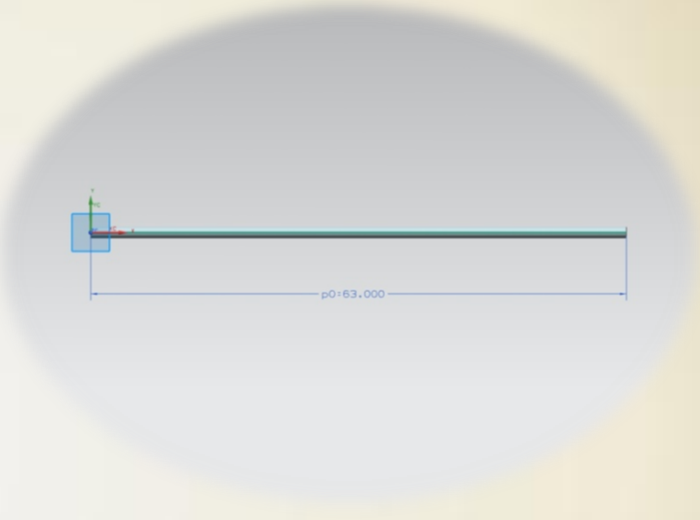

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VERIFIED!!!

Straight Pipe

Horizontal

- 80(upper),60(lower) Inches
- 2 supports (upper) hangers
  1 support (lower) U-bolt

Vertical

- 140 inches
- 2 supports (U-bolt)

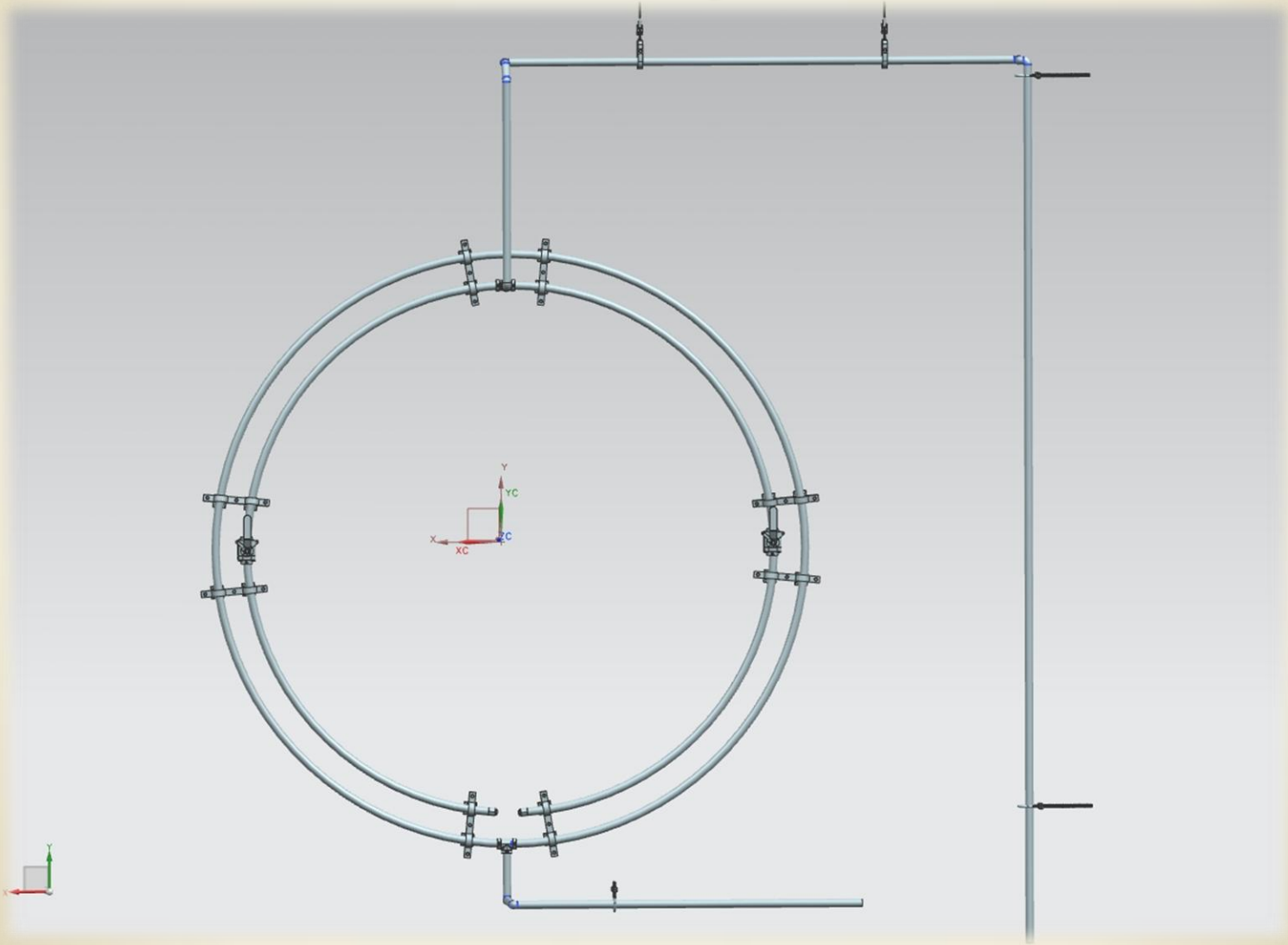
Stress $\sigma_{max} = \frac{Mc}{I}$

Deflection $\delta = \frac{Pl^3}{48EI}$

} satisfy 2 verifications

Longitudinal Stress $\sigma = \frac{PD}{2t}$ satisfies para. 902.3.2(d)

Whole System



Thank you very much!