# Influence of Cylinder Bore Volume on Pressure Pulsations in a Hermetic Reciprocating Compressor

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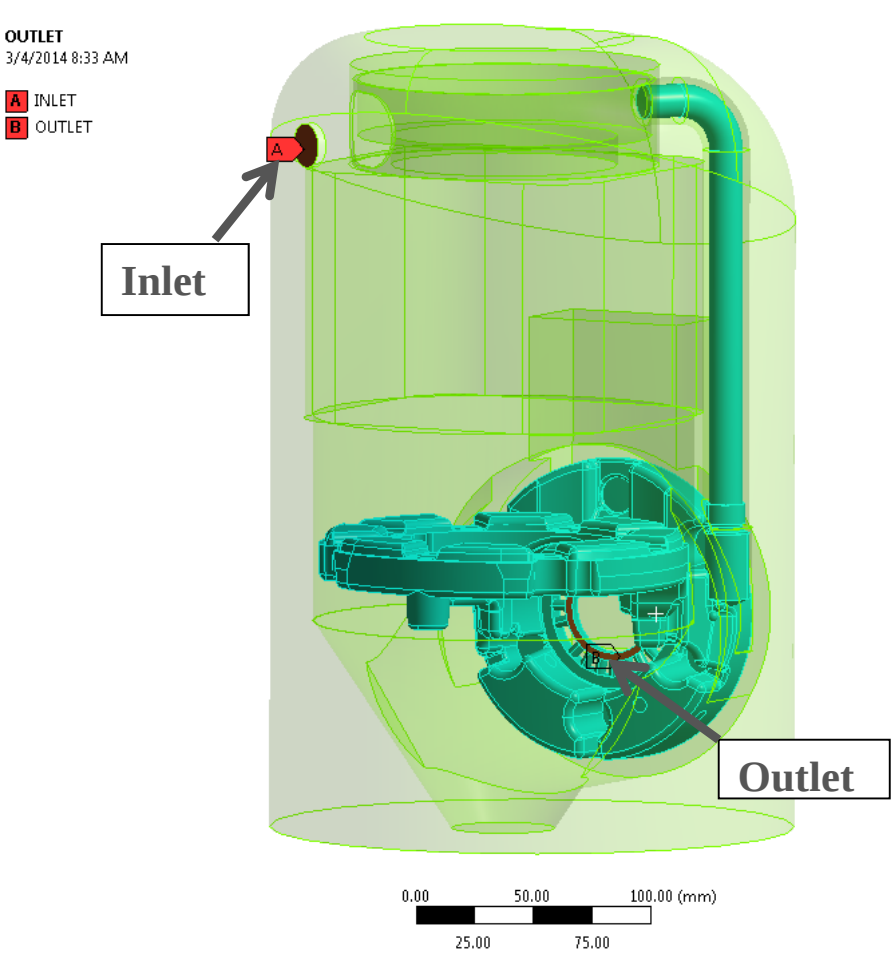
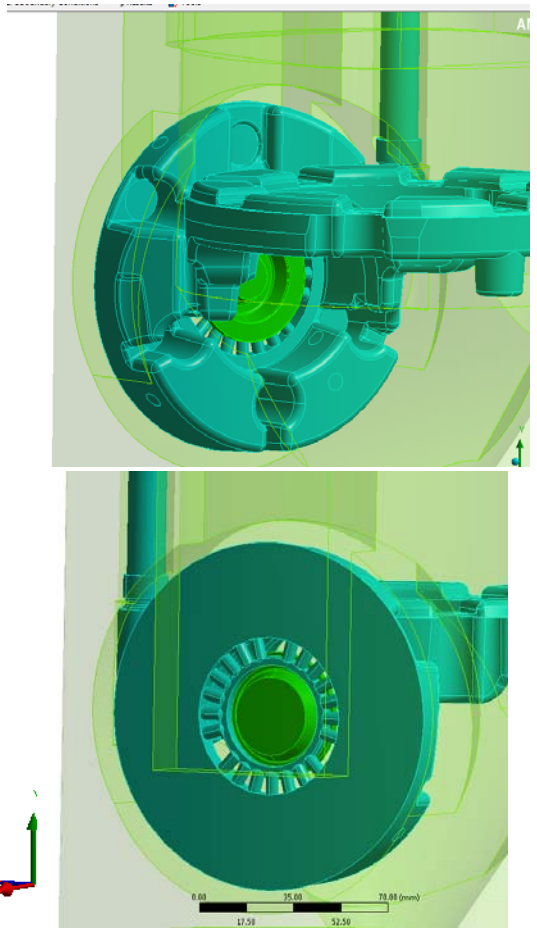
# Reciprocating Compressor



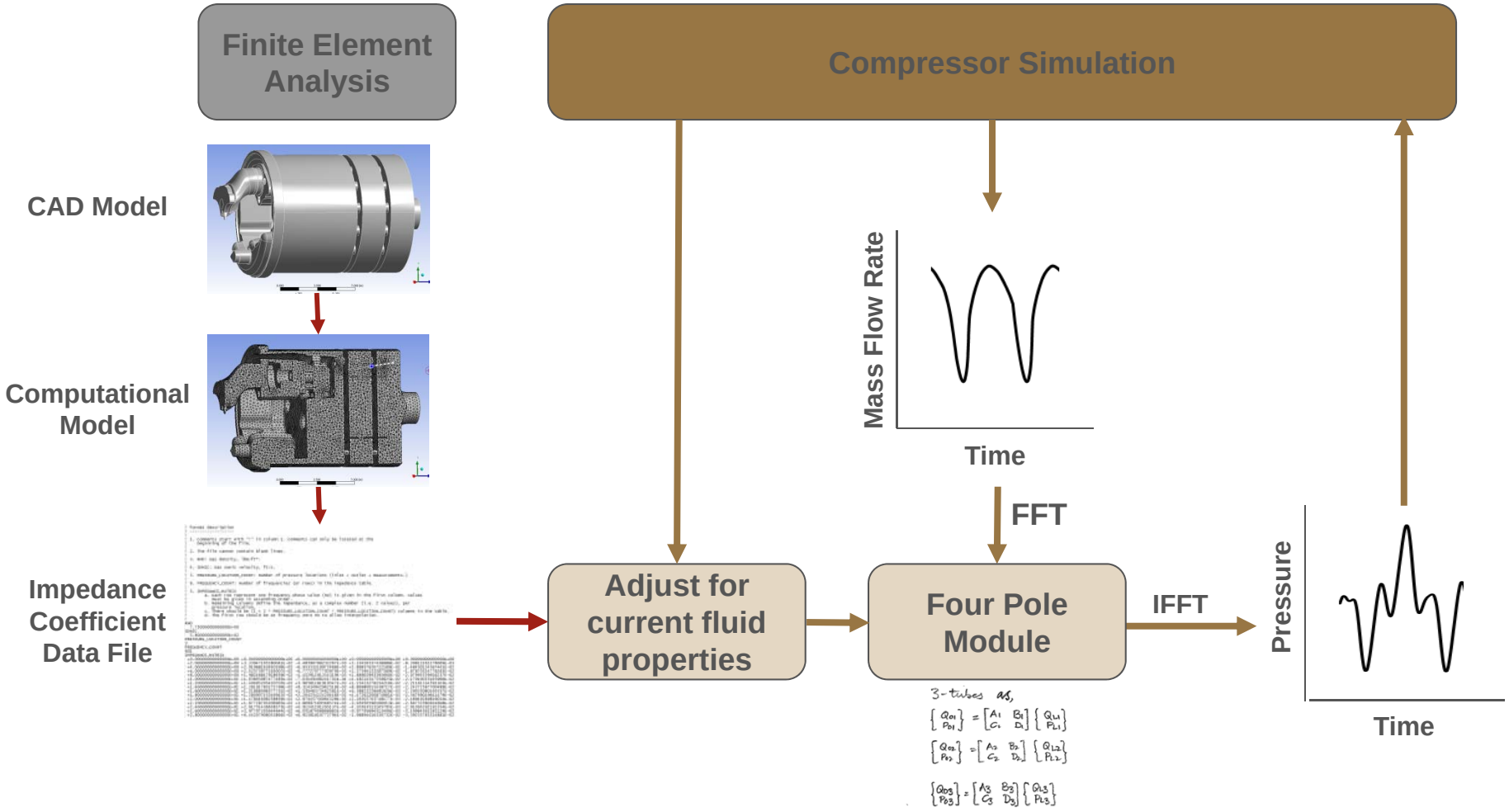



# Cite

- **10.2.11 Oscillation Effects Caused By Cylinder Volume And Valve Passage Masses** (Sound and Vibration of Positive Displacement Compressors, Soedel, W., 2007)

    1. Below 500 Hz
    2. Noise

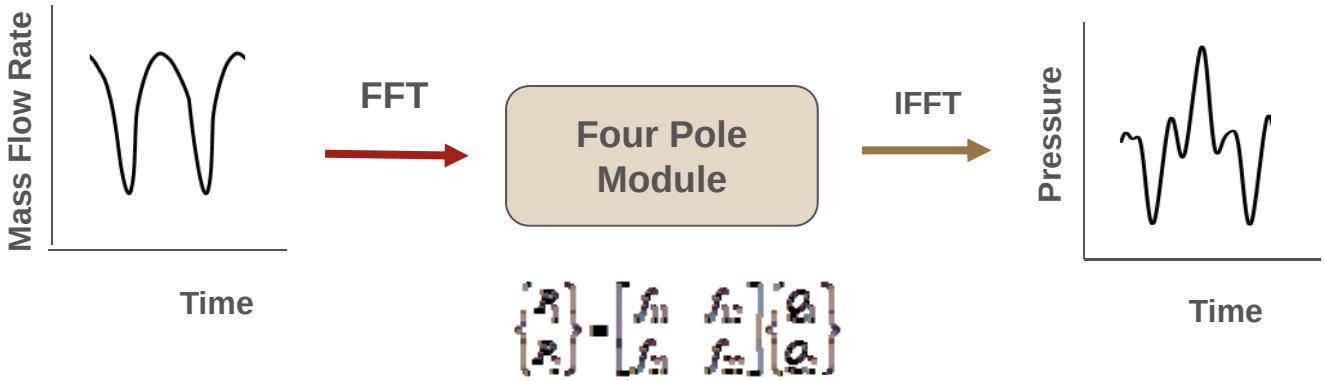
# Hybrid Simulation with Four Pole Method




**Calculate once for each flowpath geometry**

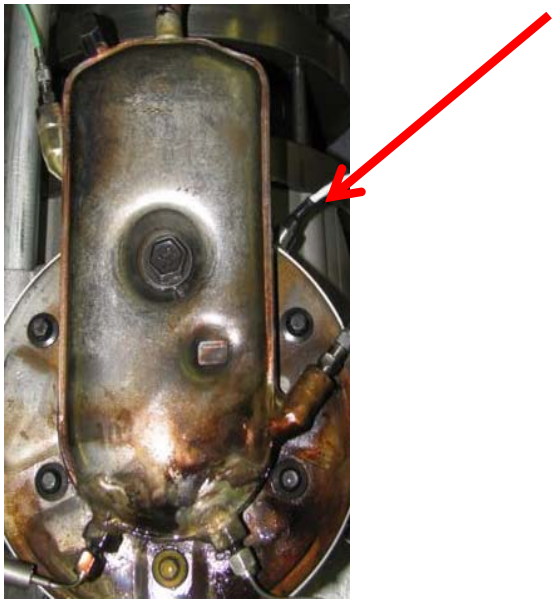
**Calculate many times with one flowpath vary operating conditions, other design features**

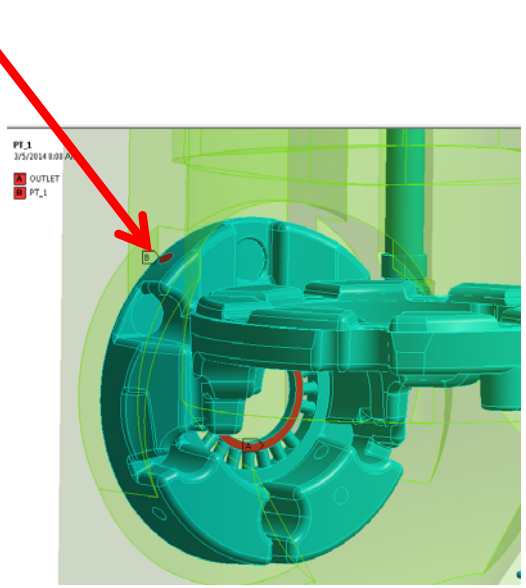
# Impedance Method



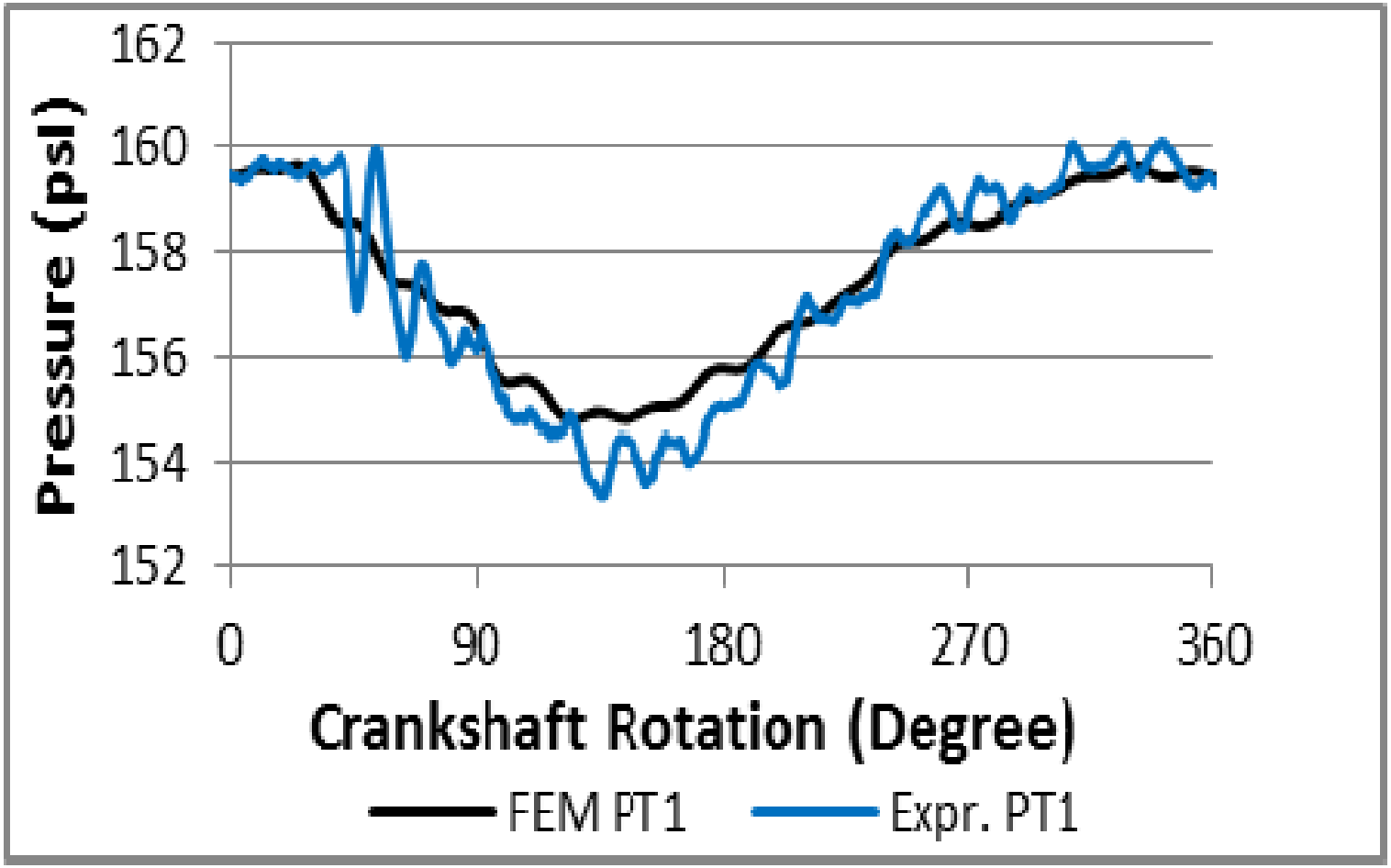

- **Remove Valve Dynamics from System**
- **Pressure Pulsation is Based on Volume Flow (mass flow) and System Impedance**

# Pressure Transducer Location

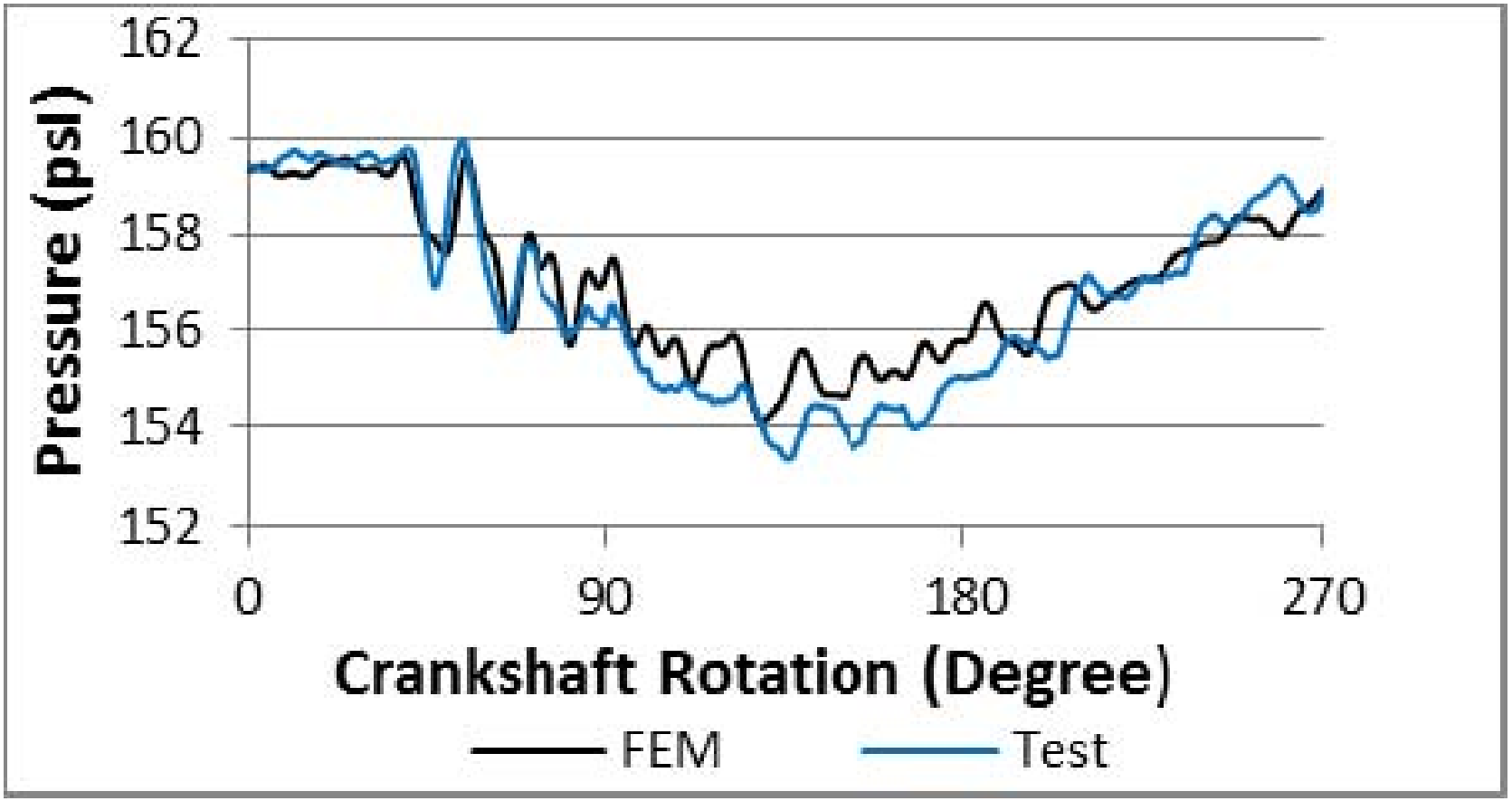




# Test vs Simulated Pressure Pulsation
## 1st Paper

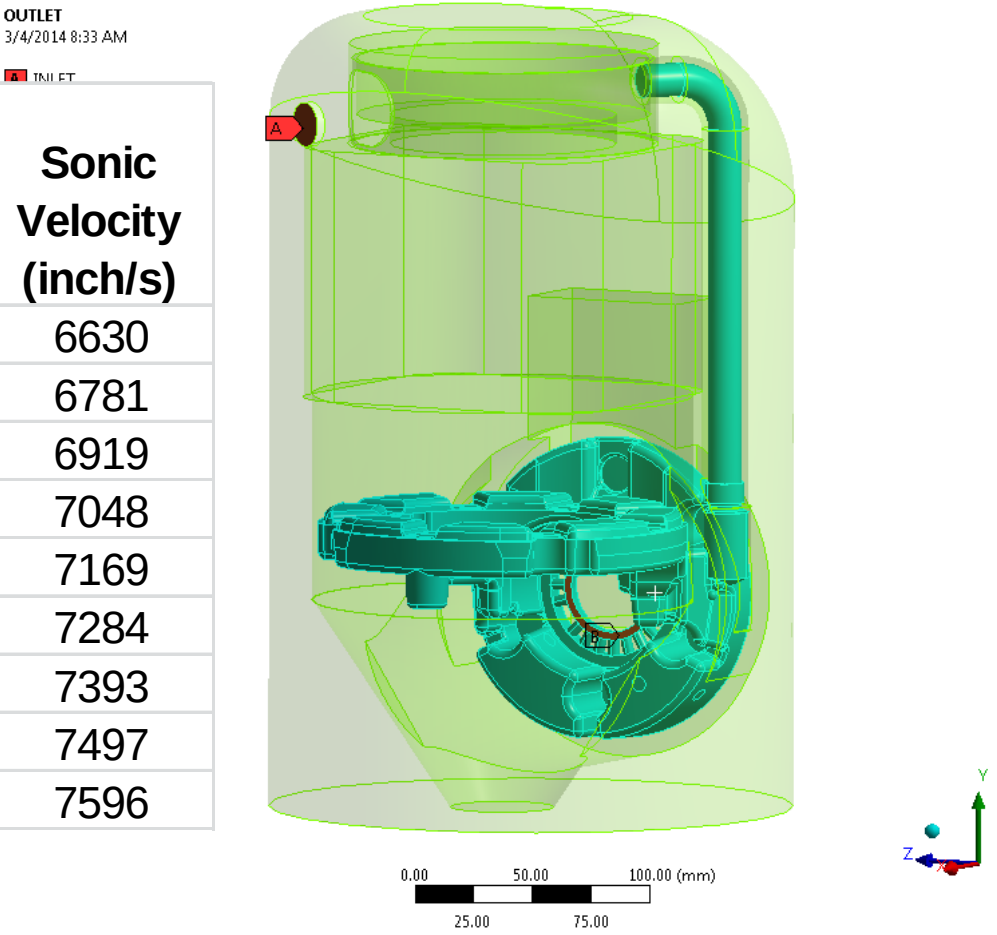


# Test vs Simulated Pressure Pulsation

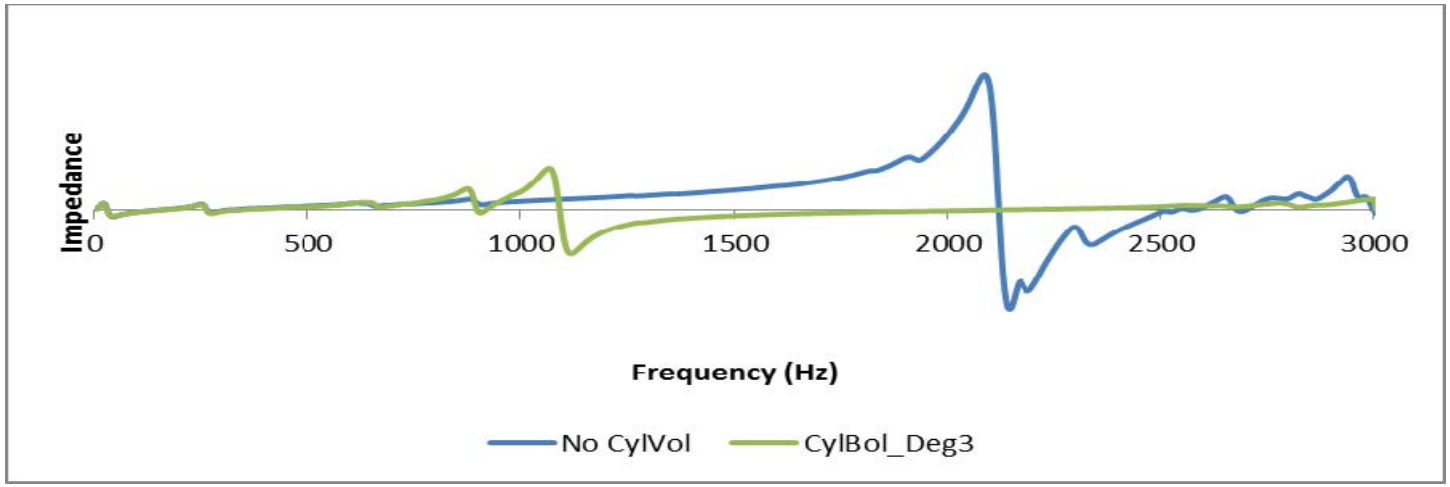


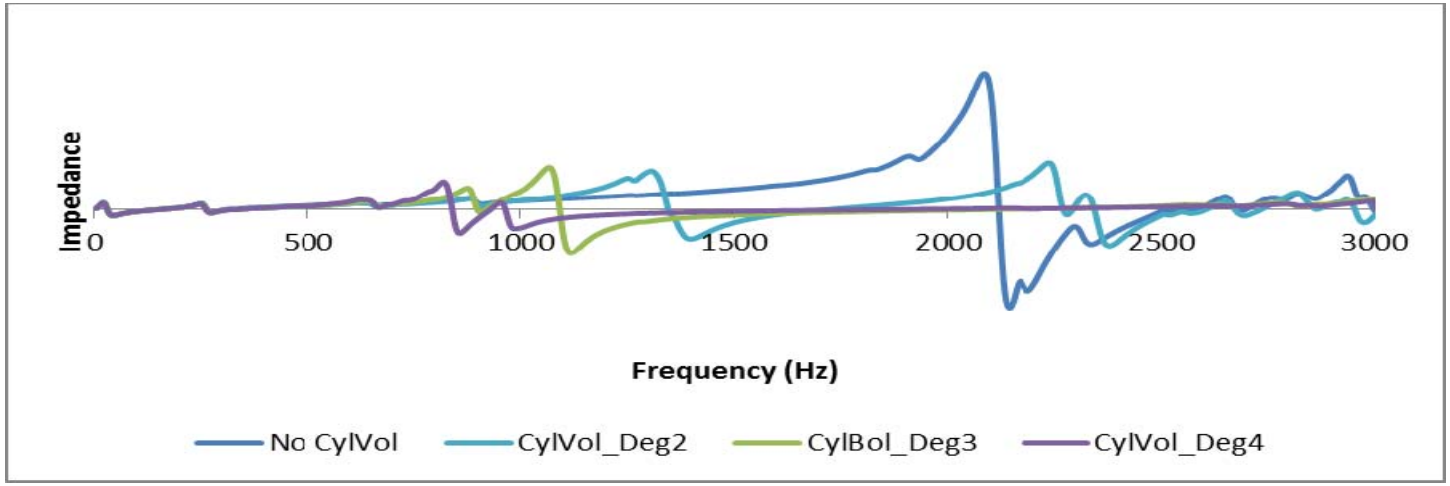
# Sonic Velocity of R410a

| Refrigerant Temperature (F) @45F Sat. | Sonic Velocity (ft/s) | Sonic Velocity (inch/s) |
|---|---|---|
| 45 | 552 | 6630 |
| 55 | 565 | 6781 |
| 65 | 577 | 6919 |
| 75 | 587 | 7048 |
| 85 | 597 | 7169 |
| 95 | 607 | 7284 |
| 105 | 616 | 7393 |
| 115 | 625 | 7497 |
| 125 | 633 | 7596 |

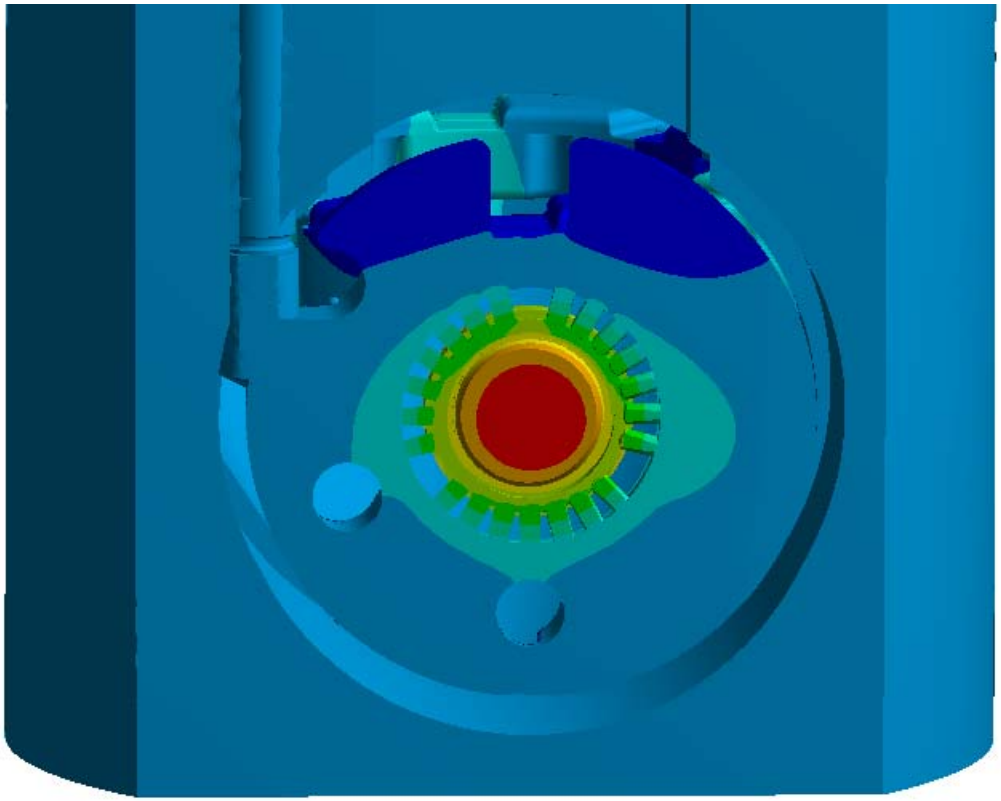


# Input Impedance at Valve

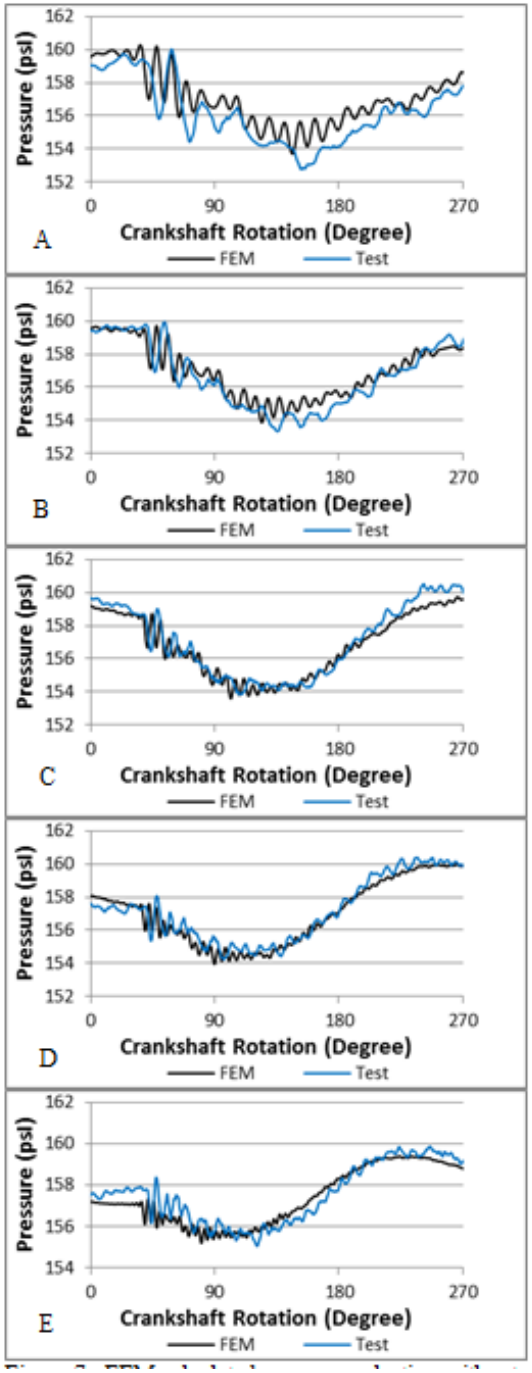


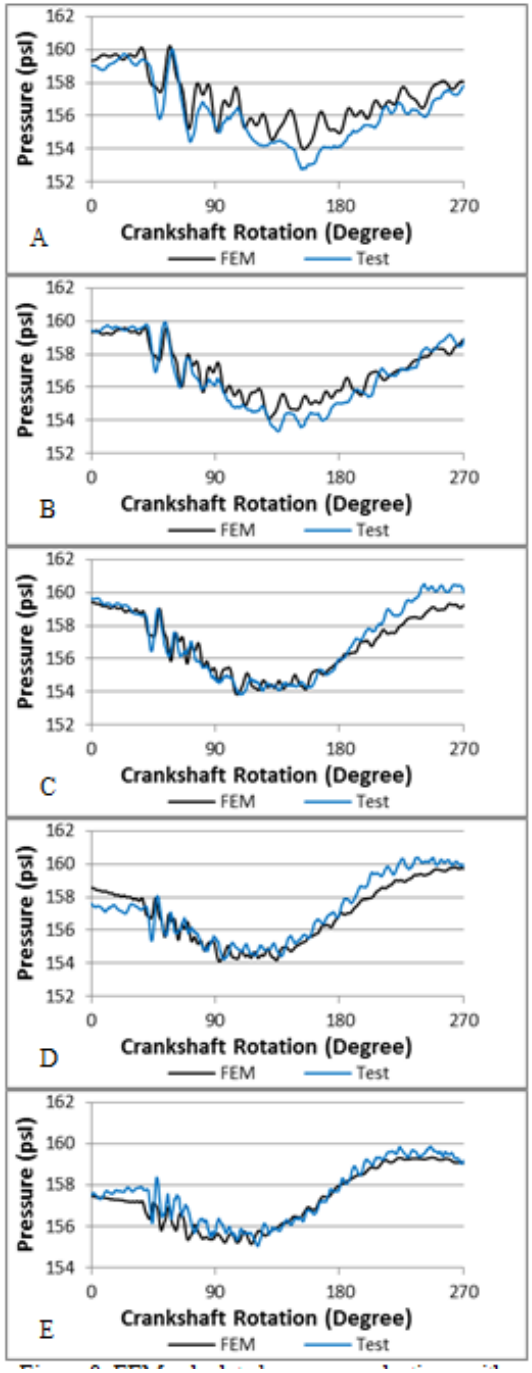



# Impedance Plot near 1100 Hz



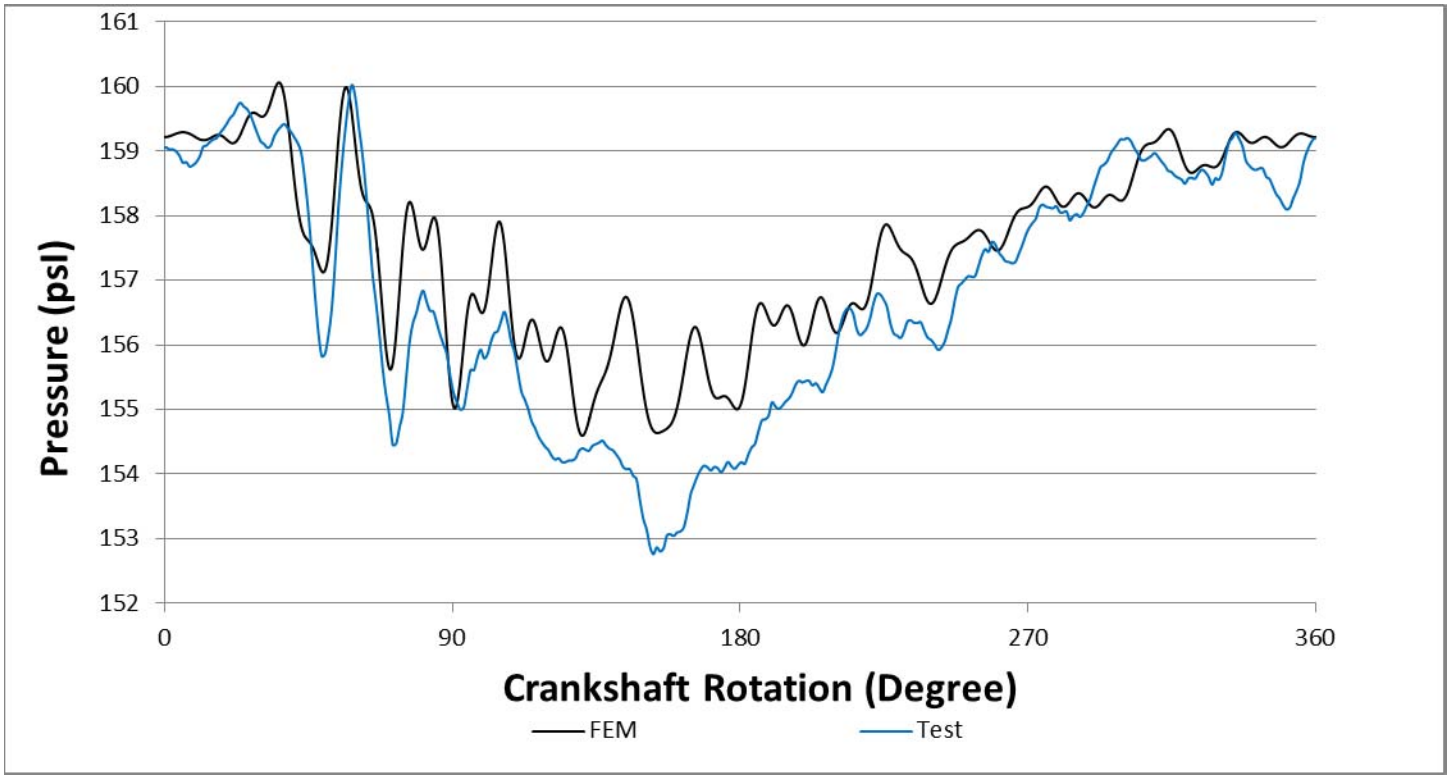
**No Cylinder Volume**




**With Cylinder Volume**

# Optimized Sonic to Match Test Data



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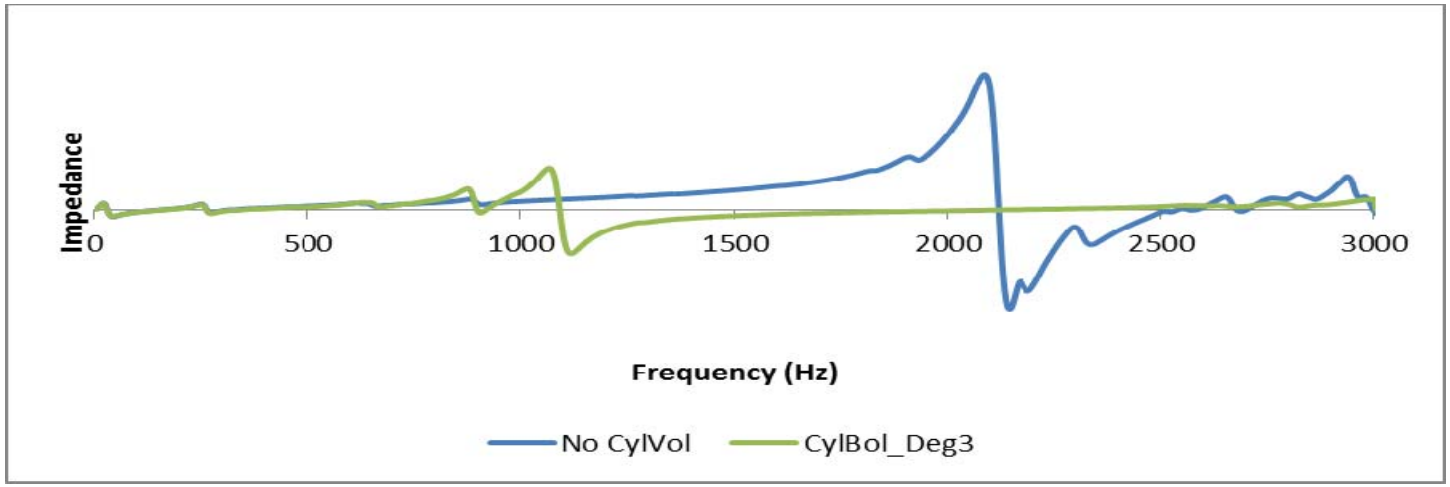


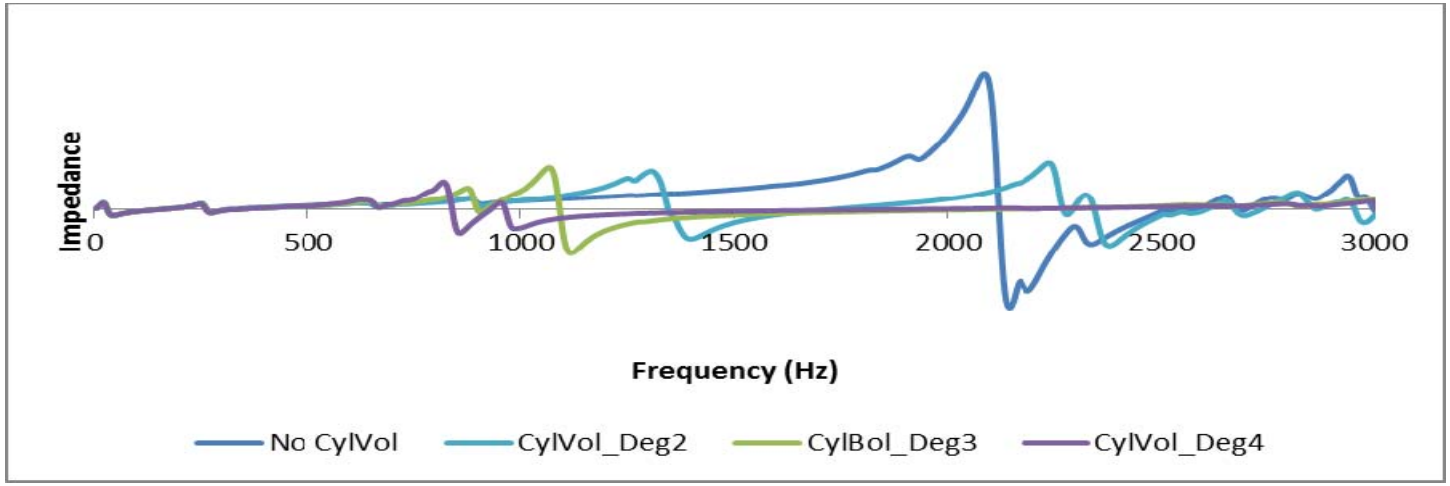

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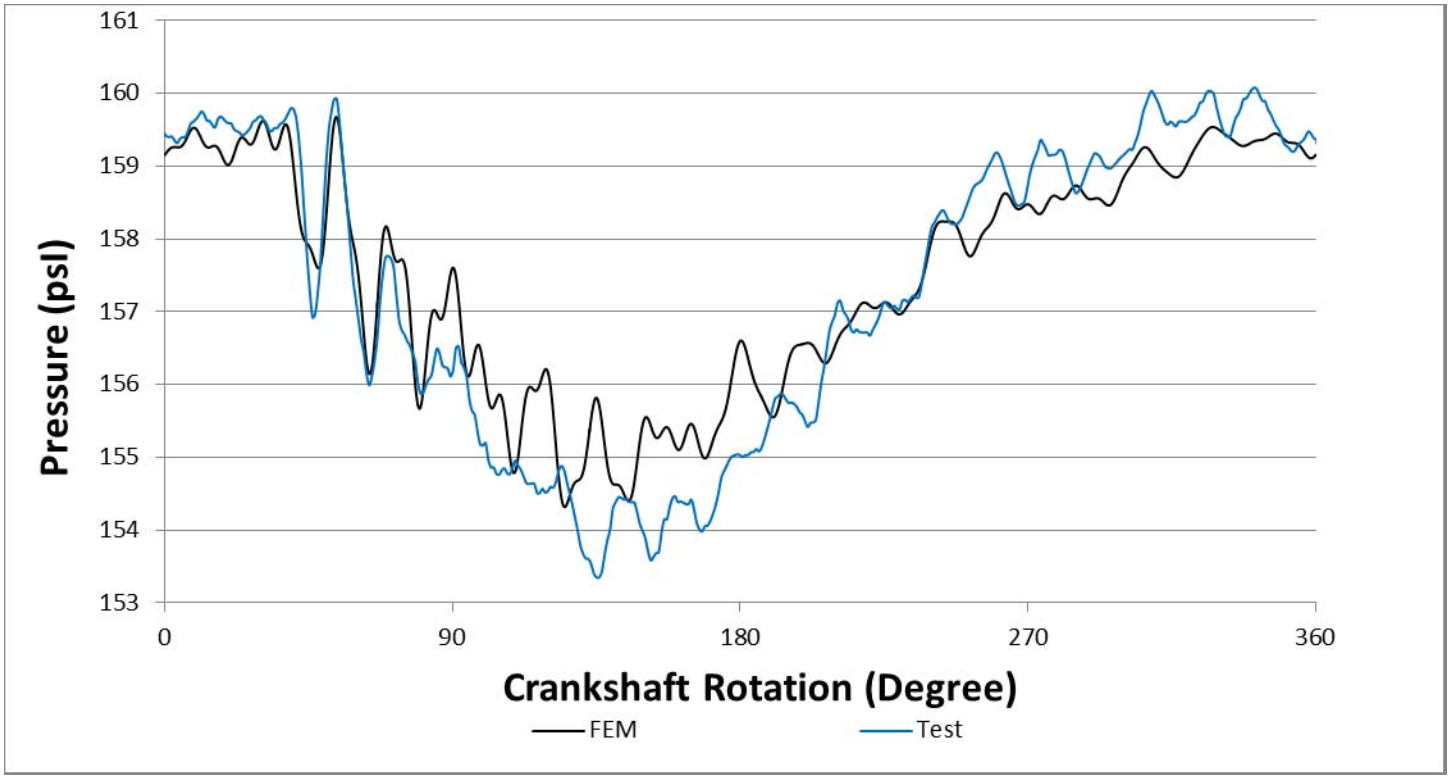

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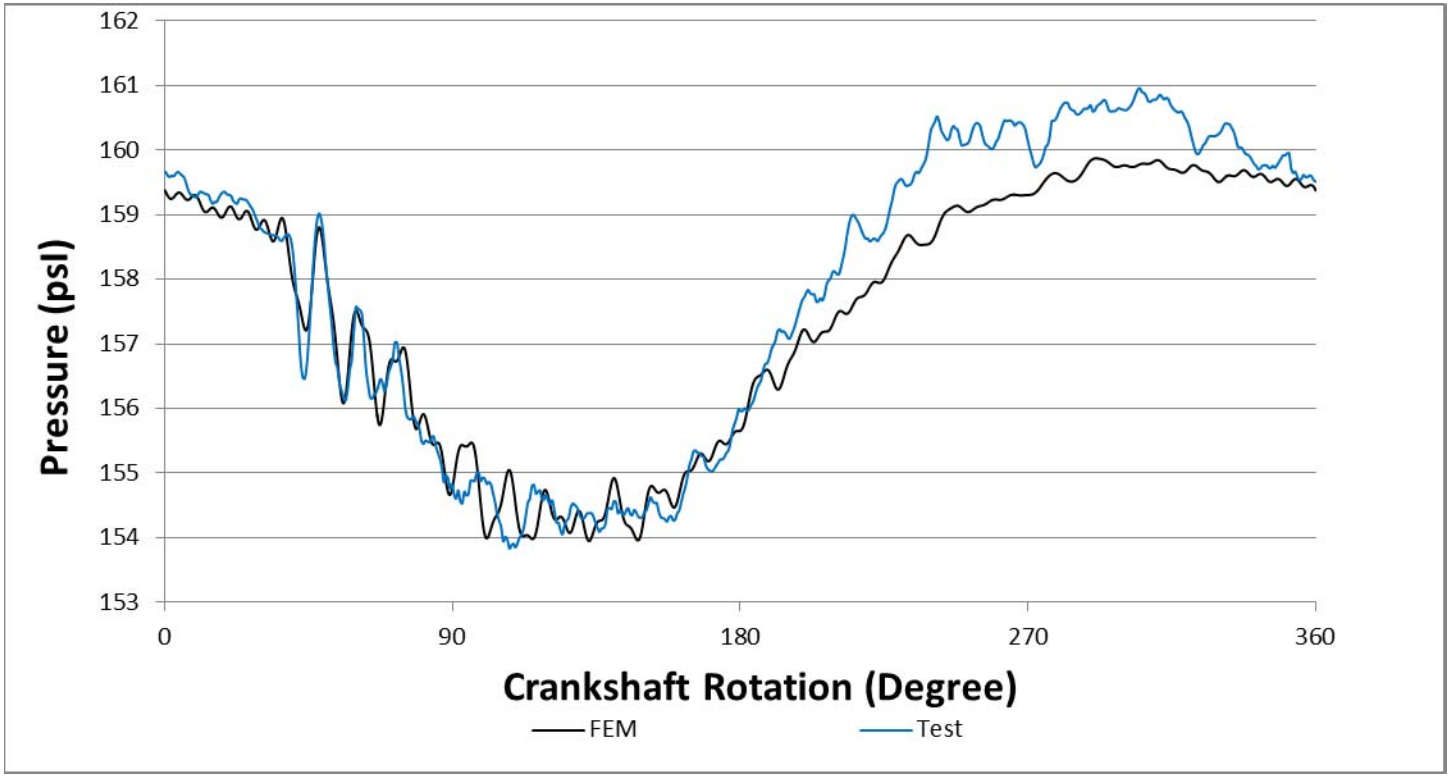

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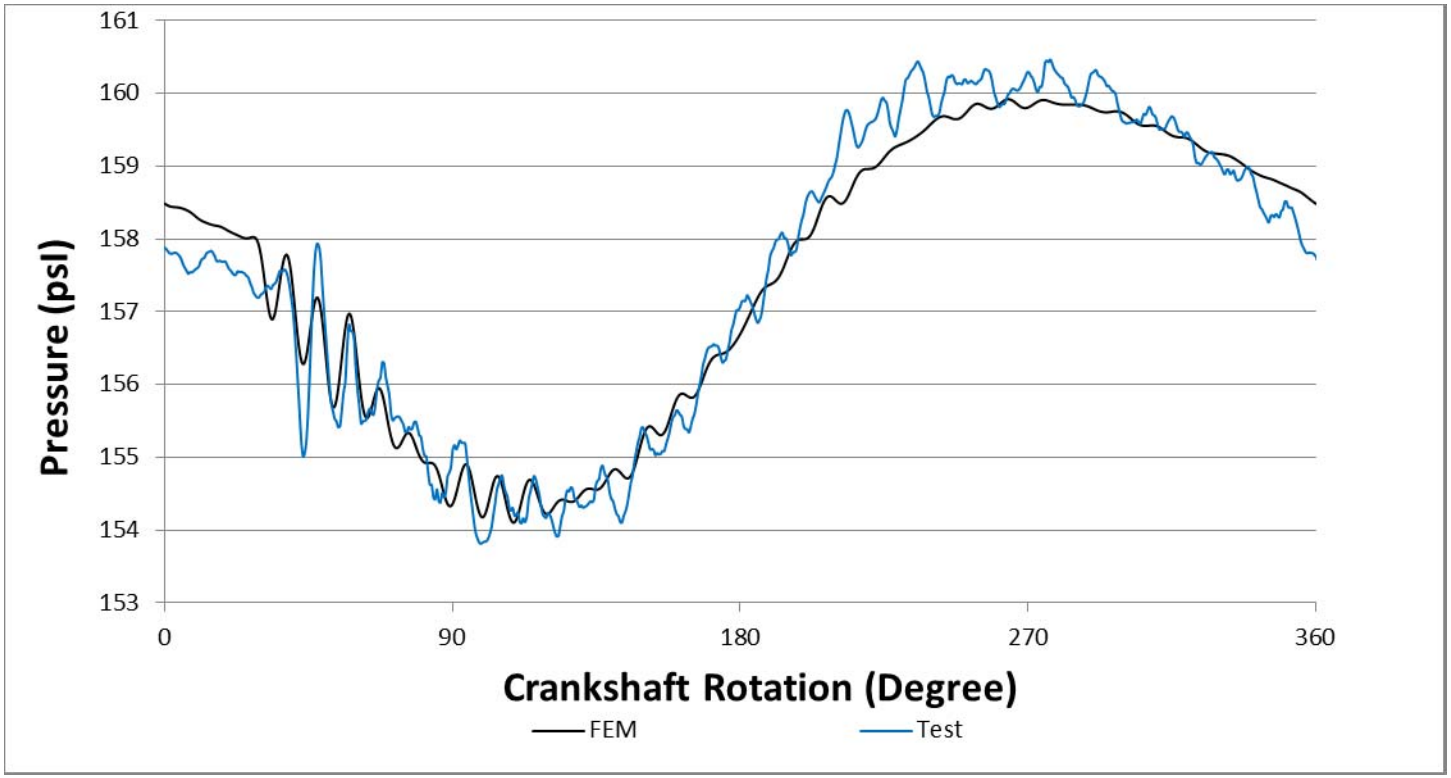

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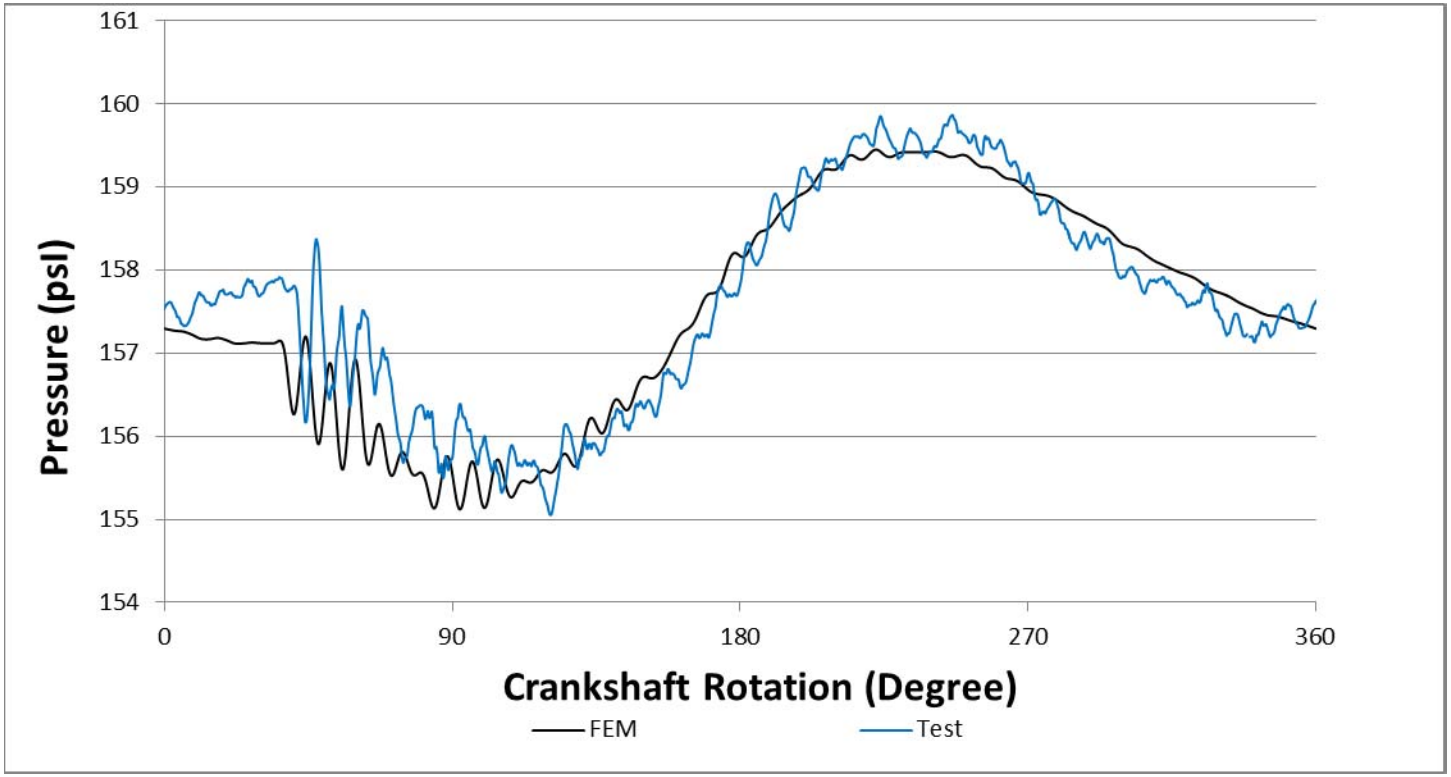

# Conclusion

- Shell Volume Influence Low Frequency
- Anechoic Ratios – Good Way to Determine Model Size
- Half Wavelength– Alternative Way to Determine Model Size
- Mass flow, Acoustic Half Wavelength and Acoustic Resonance Lengths Influence Pressure Waves
- Close Geometry Influence Higher Frequency
- High Frequency Fluctuations after Suction Valve Opens are due to Acoustic Resonances with Cylinder Volume

# Thank You


Ingersoll Rand