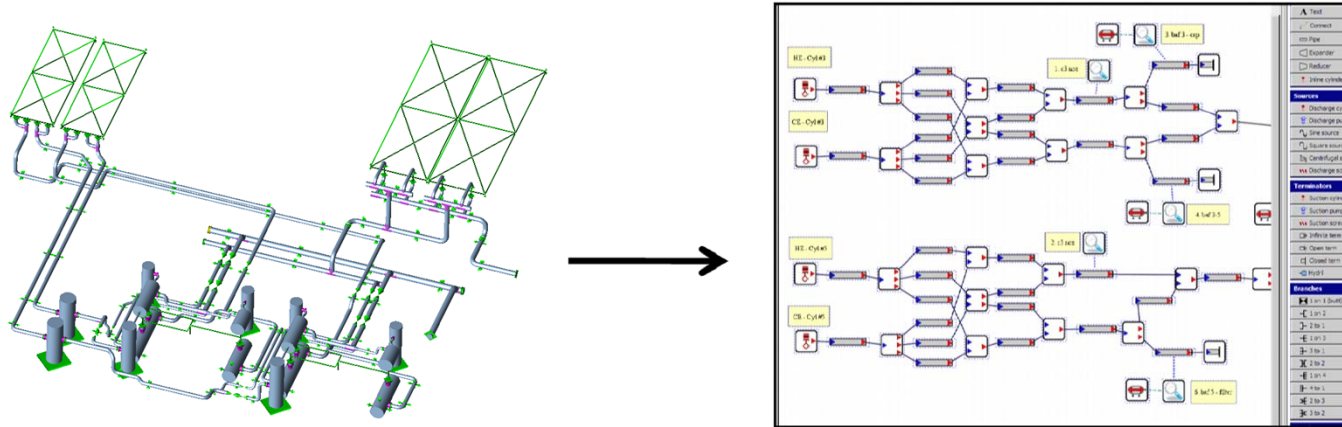


# SwRI Advanced Pulsation Analysis and Design Technology



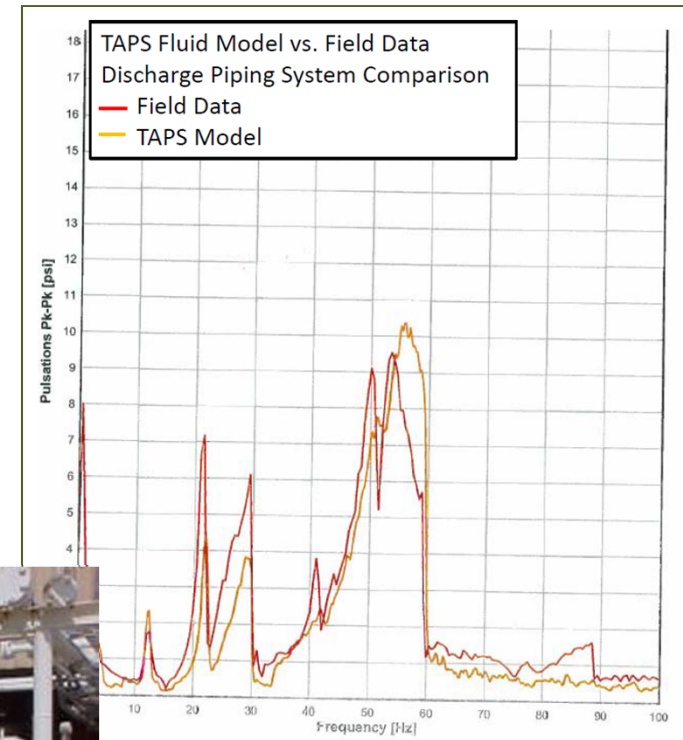
- SwRI introduces a new state of the art tool, TAPS, for designing pulsation filter systems for reciprocating compressor manifolds, screw compressor silencers and PD pump systems.
- The new design technology covers detailed gas passage and manifold analysis to complete station studies with multiple unit interactions.
- Optimizer for lowest pressure drop.
- Incorporates SwRI advanced pulsation controls and experienced design evaluation.
- API 618 5<sup>th</sup> Edition compliant.



# Validation through testing at the SwRI natural gas laboratory and multiple field sites



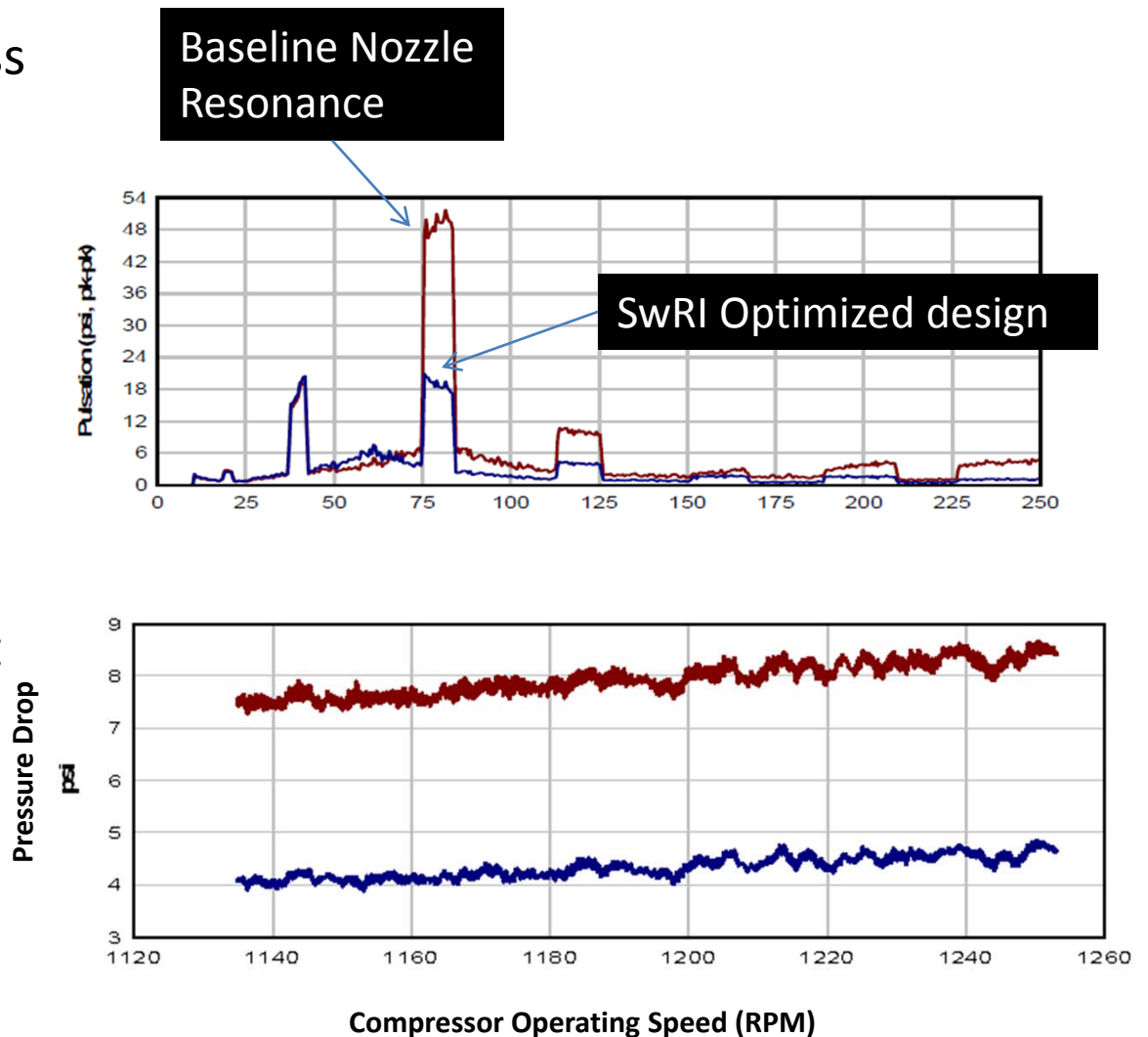
- Numerous validation tests performed to refine pressure loss models, passive response characterization and prediction of system combined responses.
- Field data matched pulsation characteristics to forecast reduction in pulsation and vibration levels through SwRI design study.



# Capabilities to Evaluate Problematic Resonances and Gas Passage Design for Improved Performance



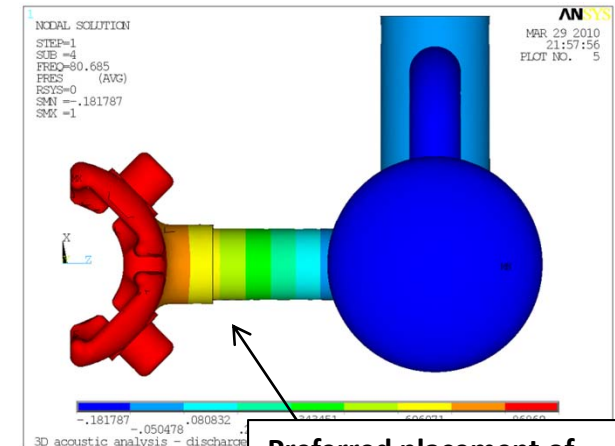
- Evaluate benefits of low loss controls.
- Study gas passage design changes to reduce dynamic losses.
- Evaluate pressure drop effects of high loss elements as a function of compressor speed.
- Optimize filter selection to meet flow demand at lowest attainable horsepower cost.



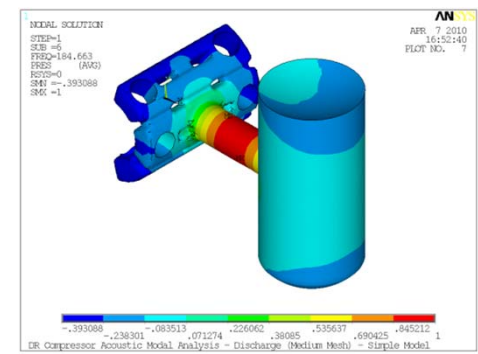
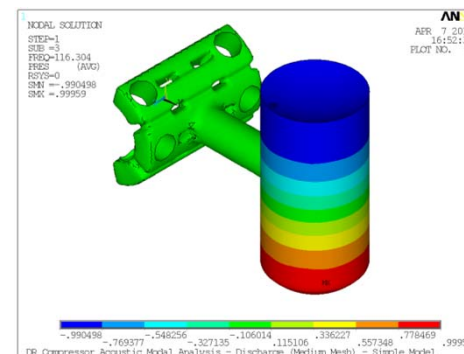
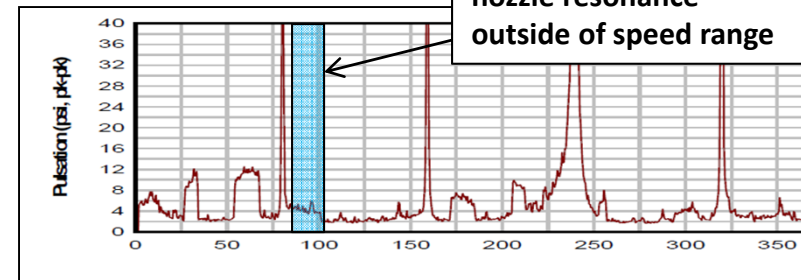
# Incorporation of 3D Acoustic Modal Responses for Higher Accuracy Cylinder Pulsation Models



- Refined gas passage, nozzle and bottle geometries through 3D acoustic modal analysis using SwRI in-house developed 3D acoustic modeling methods
- Used routinely for placement of nozzle resonance for low cylinder nozzle pulsations – without the use of orifice plates.
- Applied to higher frequency gas passage / valve responses for improved valve life.
- Used for silencer designs on high frequency screw compressors.



Preferred placement of nozzle resonance – outside of speed range





# Modeling of Innovative, Customized Designs for Low-Loss Pulsation Control

- SwRI pulsation control designs rely on innovation and advancement using new methods of attenuating and absorbing pressure waves.
- Customized controls for each application.
- New TAPS code incorporates SwRI advanced design modules to evaluate benefits of advanced controls compared to conventional orifice plates and filter bottles.

