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piping engineering
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FEPipe Capabilities

- License holder for the FEPipe software suite (Paulin Research Group).
- Typical piping and pressure vessel geometries can be modelled and analysed using FE Pipe – from beam models for evaluating piping systems (to B31.1 or B31.3) to advanced shell models when design by analysis to ASME VIII-2 or Level 3 FFS to API 579 is necessary.
- Components can be analysed individually or combined with other models (beam or shell)

Element Type	Application
Beam	➢ Conventional Pipe Stress Analysis required by B31.1 and B31.3 ➢ Evaluation of Loads on Static and Rotating Equipment Nozzles ➢ Calculation of Loads Imposed by Piping onto Structural Supports ➢ Flange Leakage Assessment ➢ Dynamic Analysis: Natural Frequencies and Harmonic Analysis ➢ Structural Supports – e.g. Pipe support brackets
Shell	➢ Advanced (Stress Analysis using Design by Analysis (VIII-2) Methods ➢ Vessel and Nozzle Stress Evaluation due to Piping Loads ➢ Level 3 Fitness for Service to API 579 (e.g. dents, thinning) ➢ Buckling Analysis ➢ Detailed component analysis and qualification ➢ Piping systems with large (>100) D/t ratios ➢ Dynamic Analysis (e.g. Shell Modes for Acoustic Induced Vibration) ➢ Qualify B31.3 components using VIII-2 methods
Plate	➢ Pipe Shoes ➢ Vessel Saddles ➢ Structural Attachments to Piping and Vessels ➢ General structural sections (e.g. channels, tees) used for pipe supports
Brick	➢ Flanges ➢ Orifice Plates ➢ “Olet” type branch connections ➢ Generally restricted to Axisymmetric geometries

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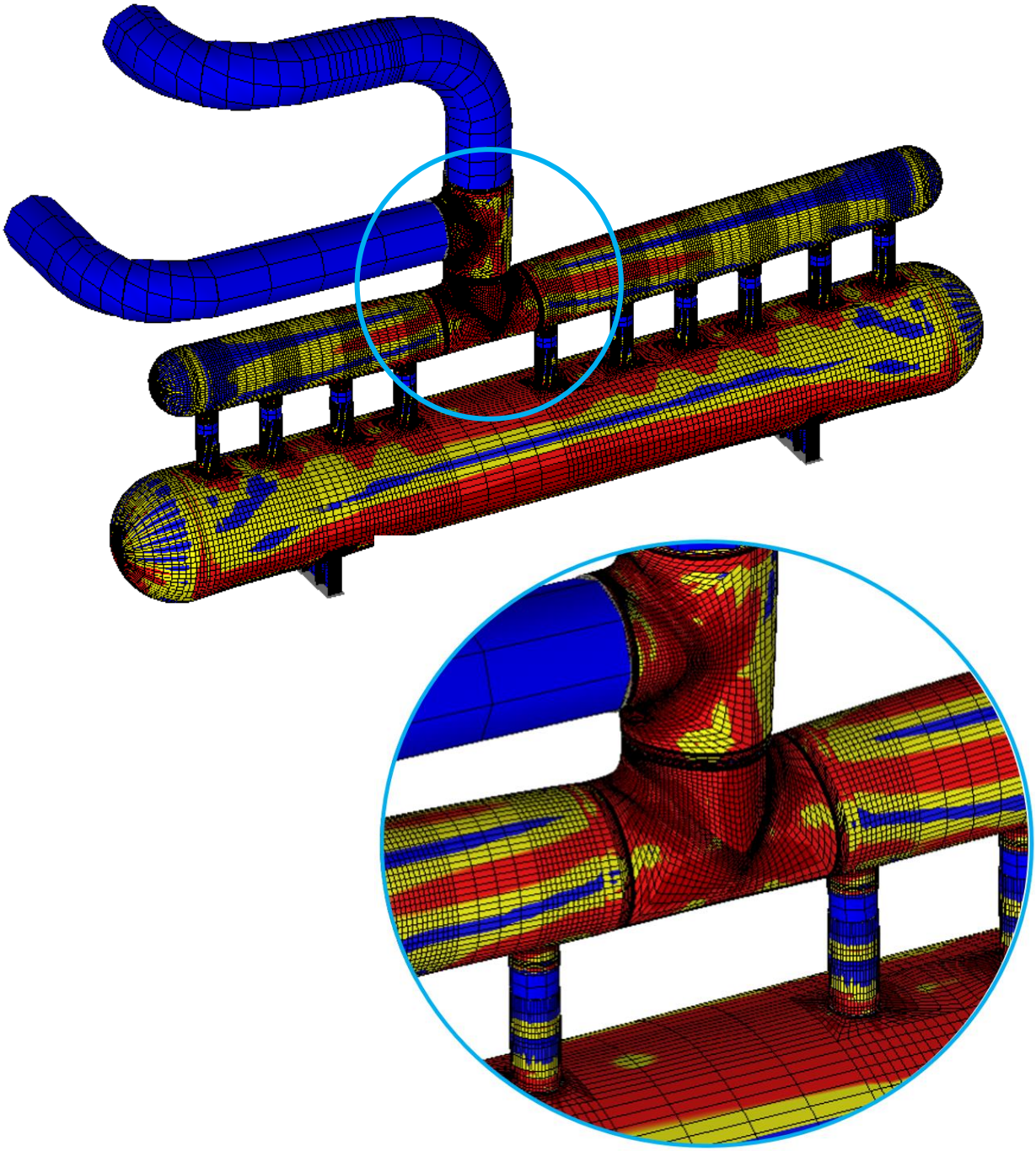

Comprehensive model of a large bore piping manifold connected to a horizontal vessel on saddles. Shell elements are used for all components except for the connected pipe runs which are beam elements (dark blue).

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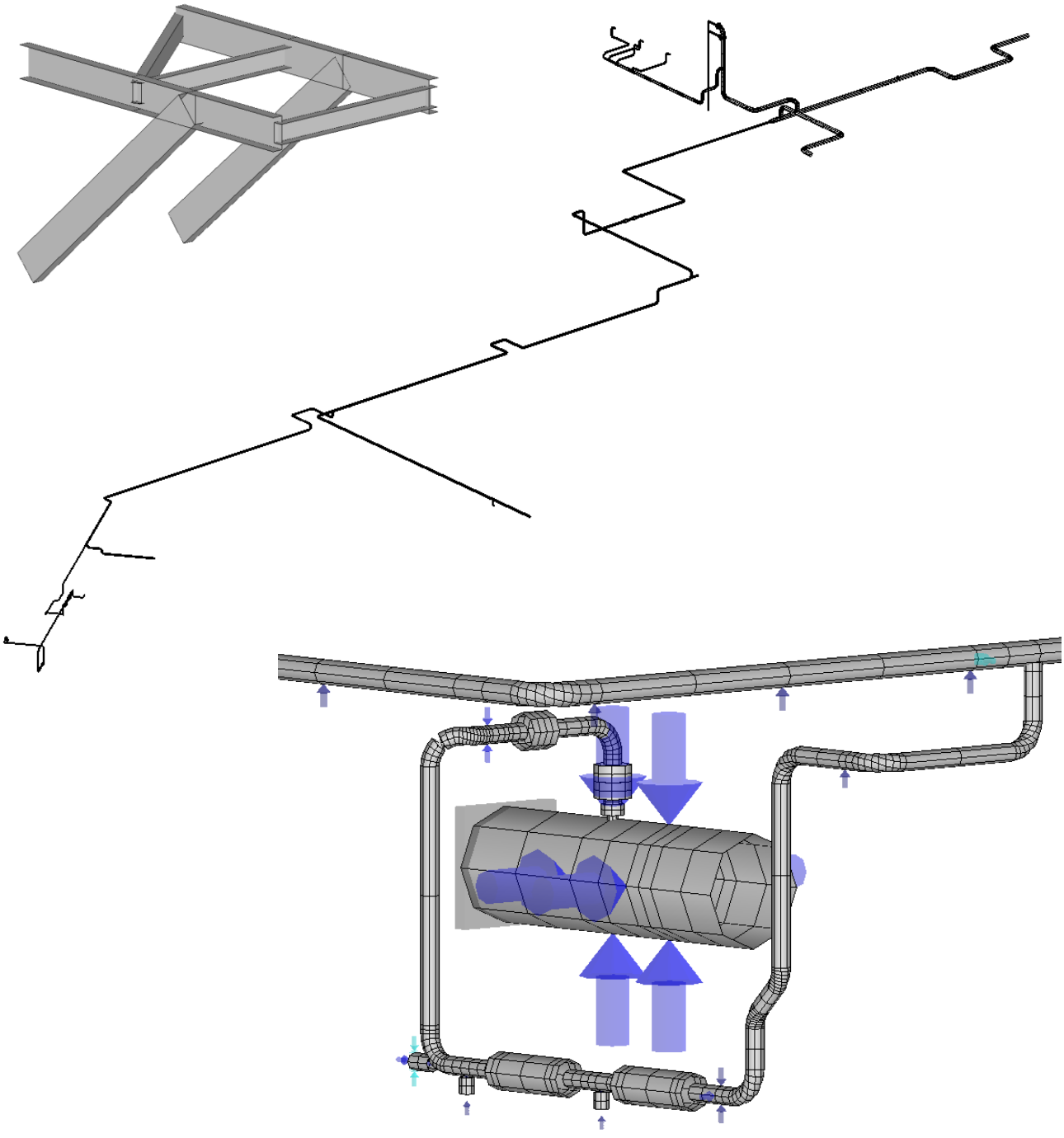

Beam modelling is normally used to evaluate code compliance for piping codes but can also be used to analyse structural components.

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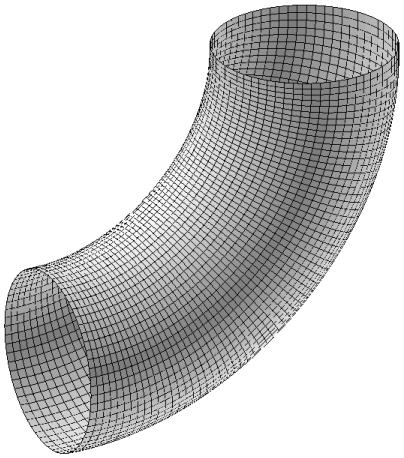

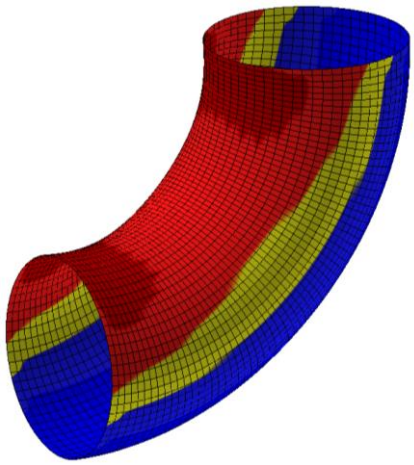

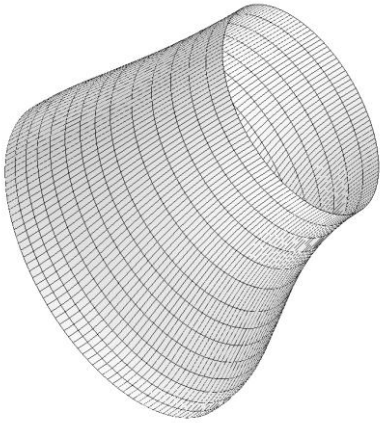

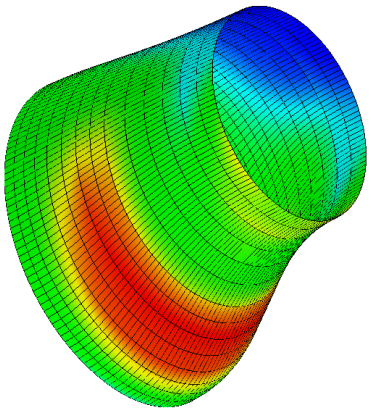

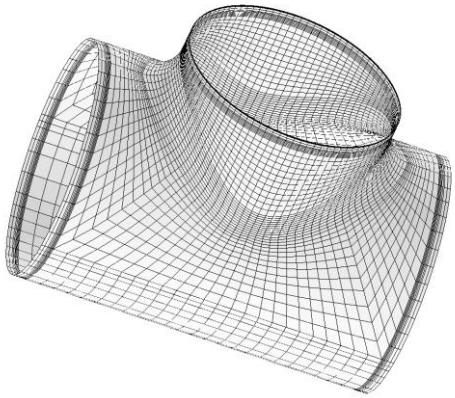

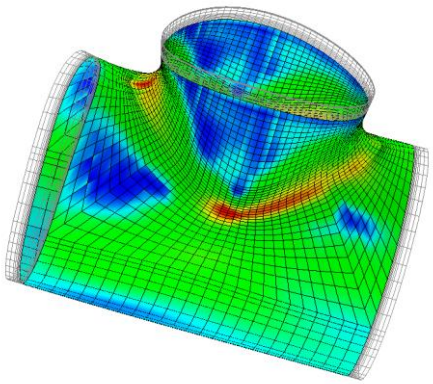

Typical piping components modelled using shell elements.

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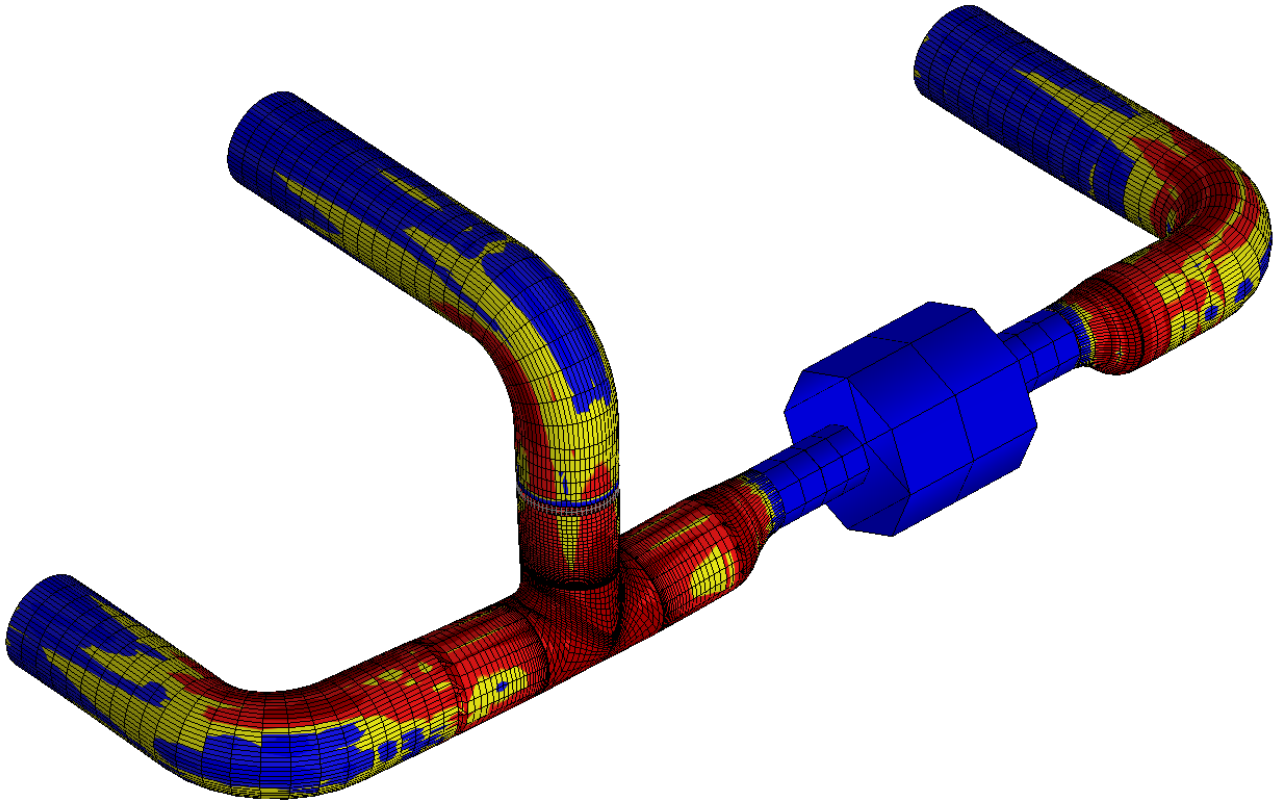

Components modelled from shell elements can be connected to each other or to beam elements.

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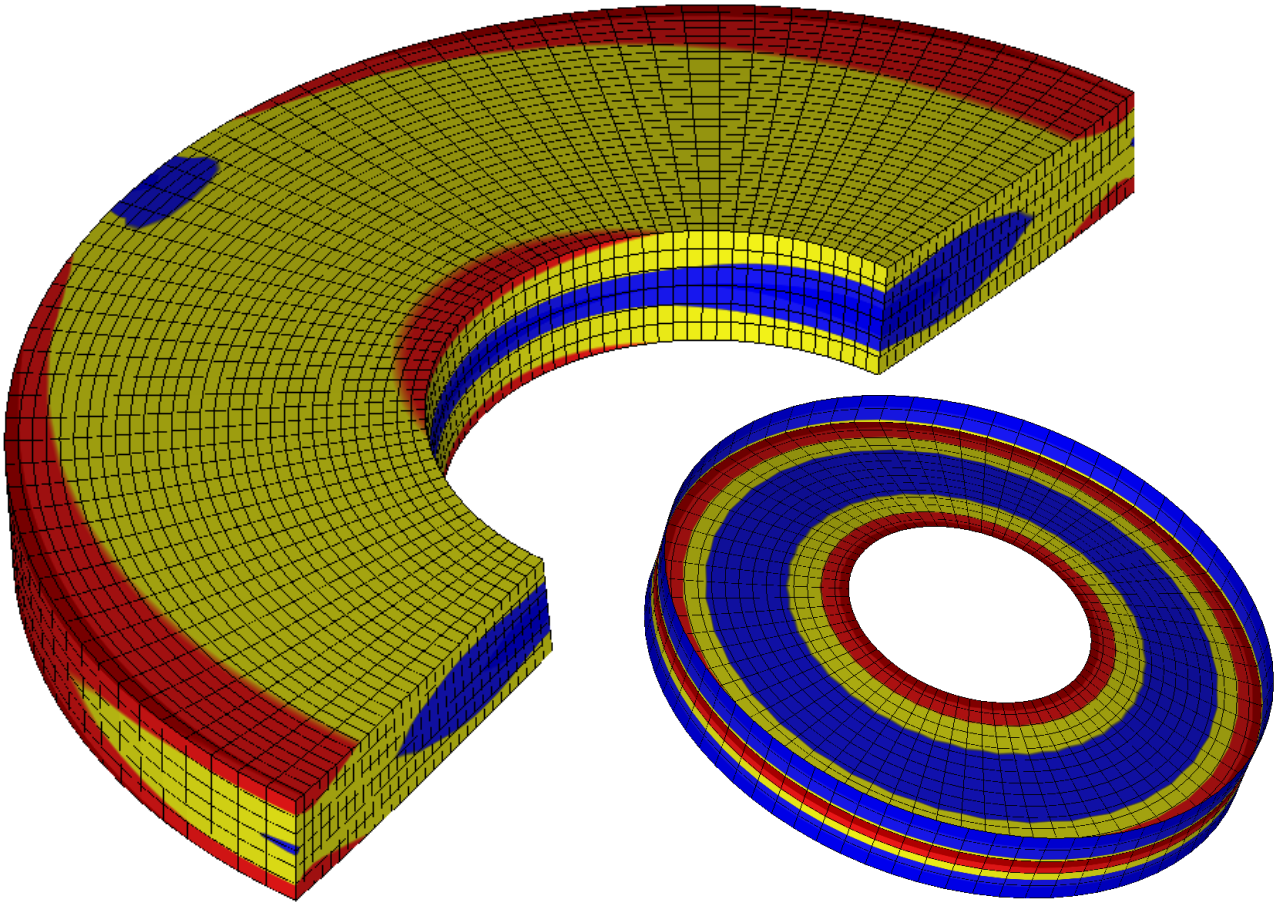

Model of an orifice plate using 3D brick elements (main) and the same orifice plate modelled using plate elements (insert)

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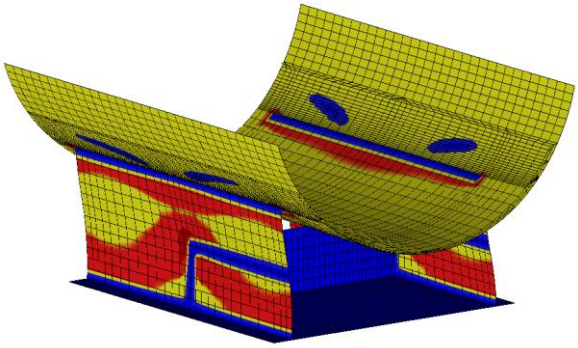

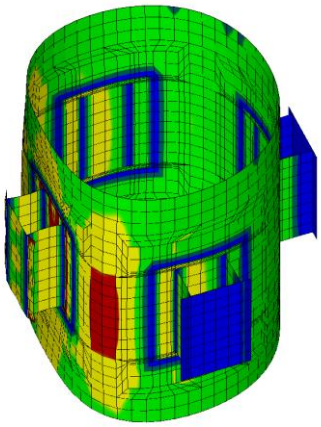

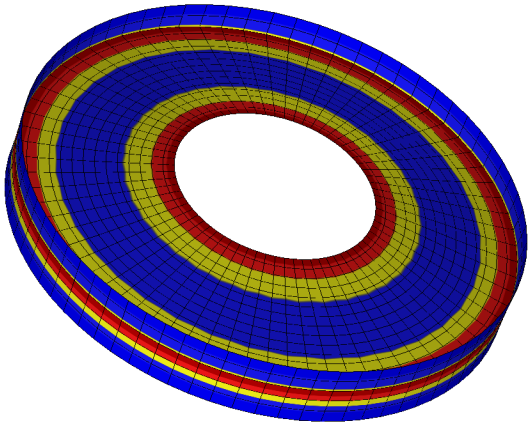

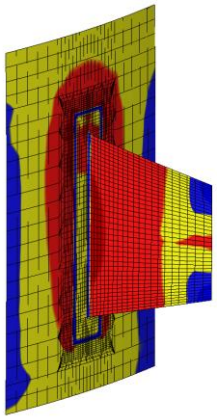

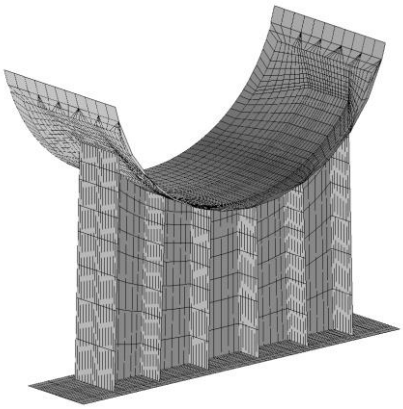

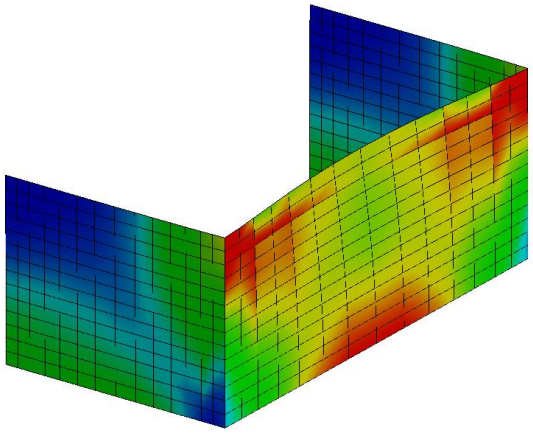

Plate elements can be used on their own or with shell elements to create pipe supports and saddles.

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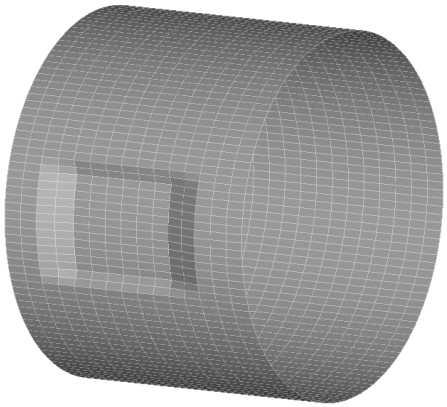

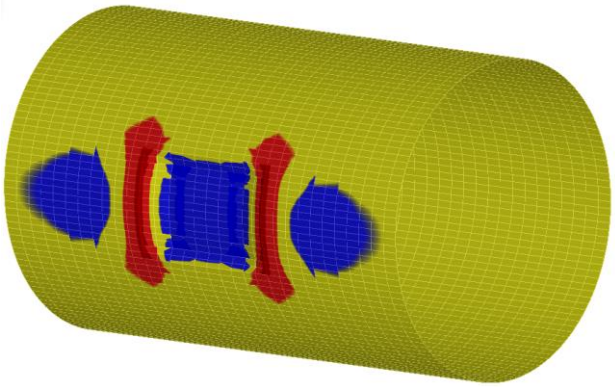

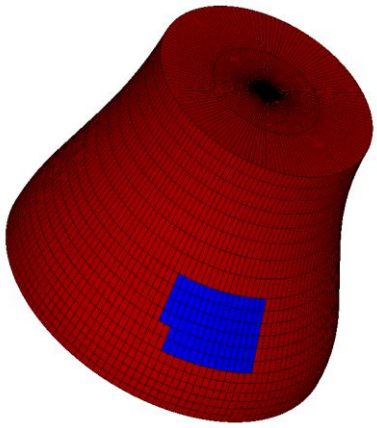

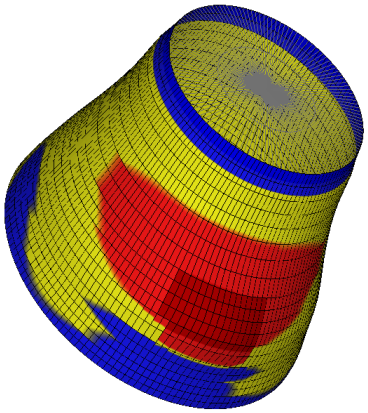

Shell models can be used for Level 3 Fitness for Service assessments for dented or thinned components.

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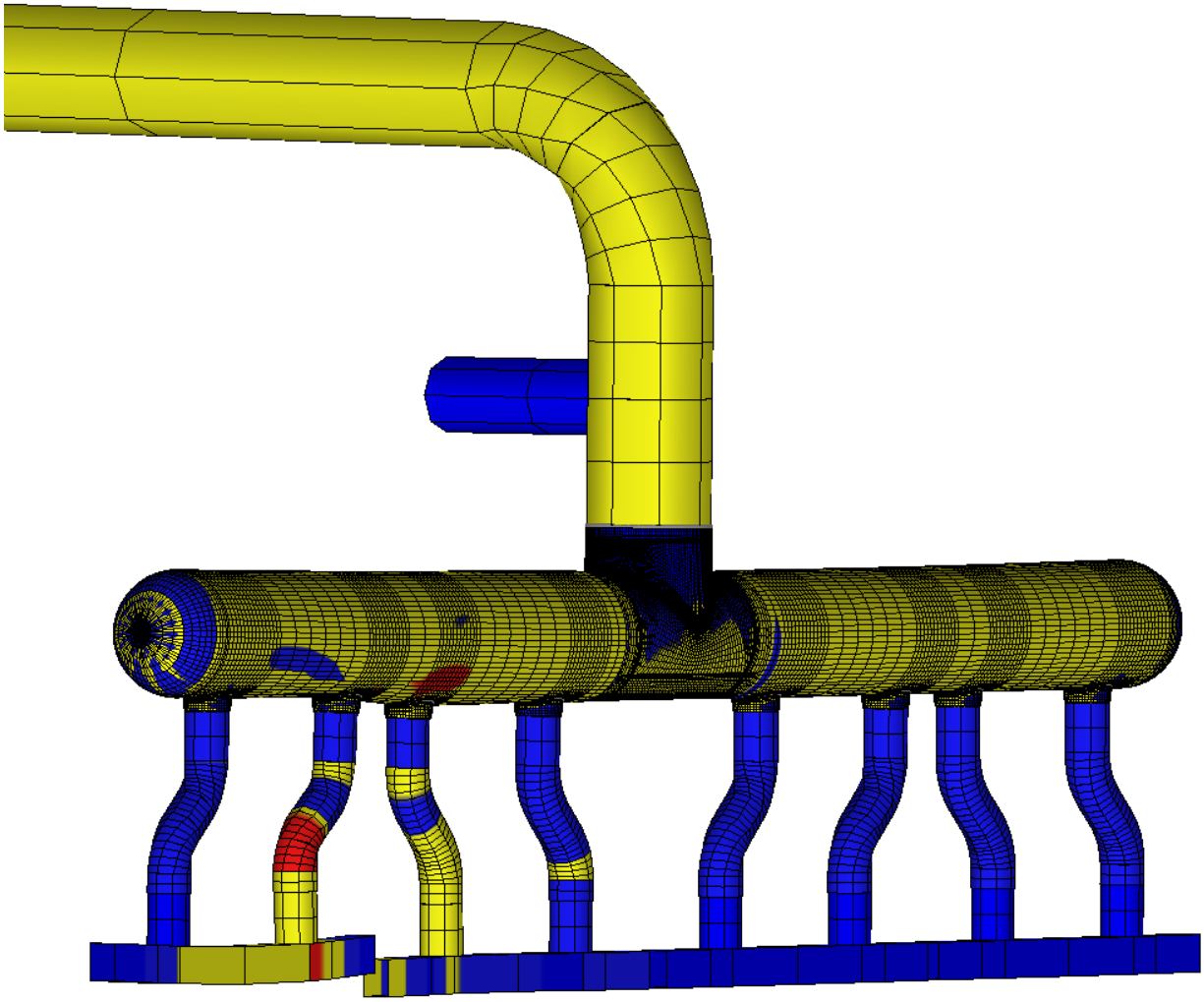

Large bore manifold connecting to header box nozzles

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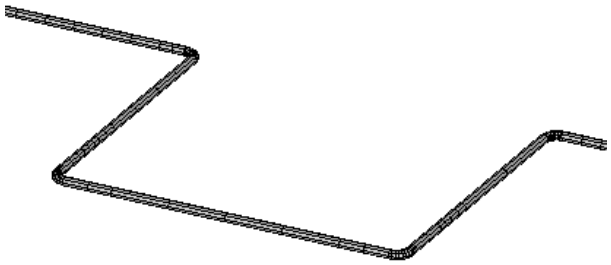

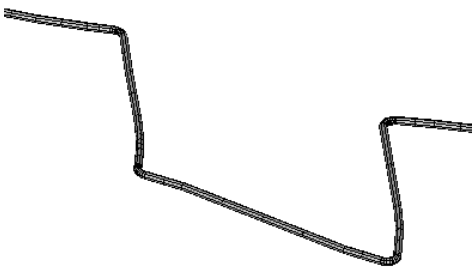

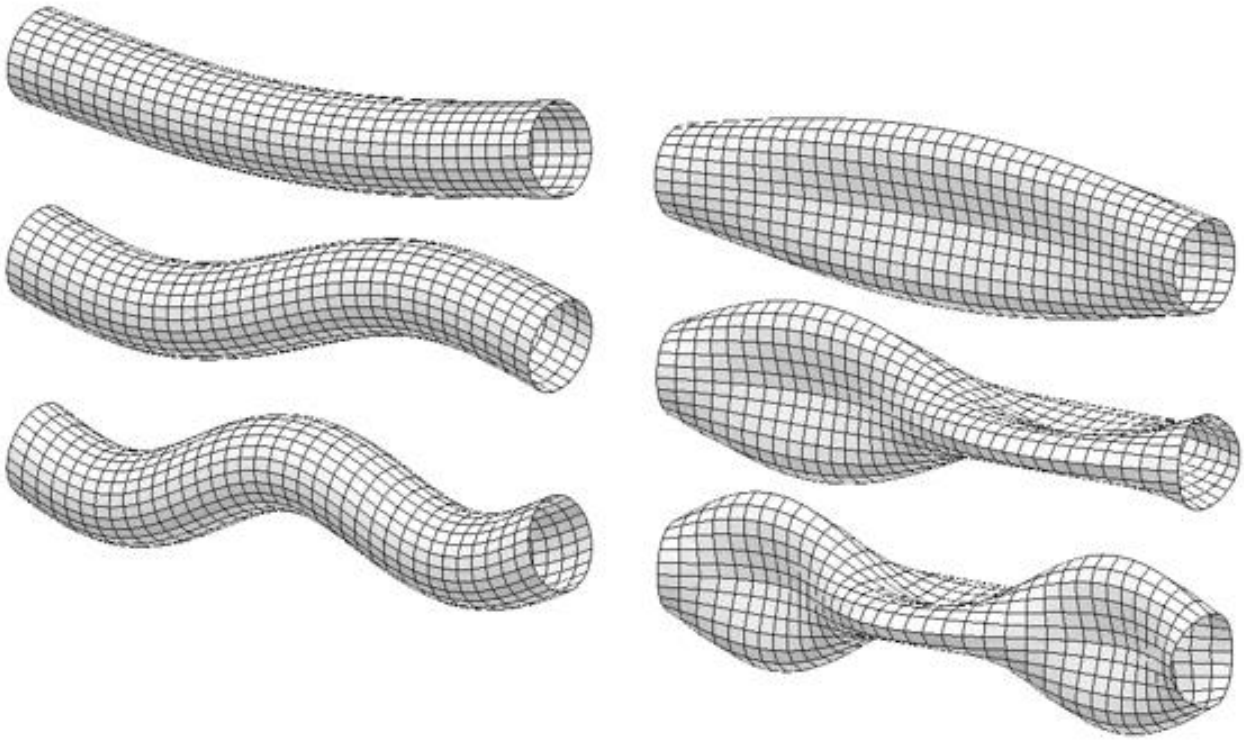

Natural Frequencies and mode shapes can be calculated for both beam and shell models. At large D/t ratios shell modes may be lower than the beam modes of vibration. Shell models can provide both beam and shell vibration modes.