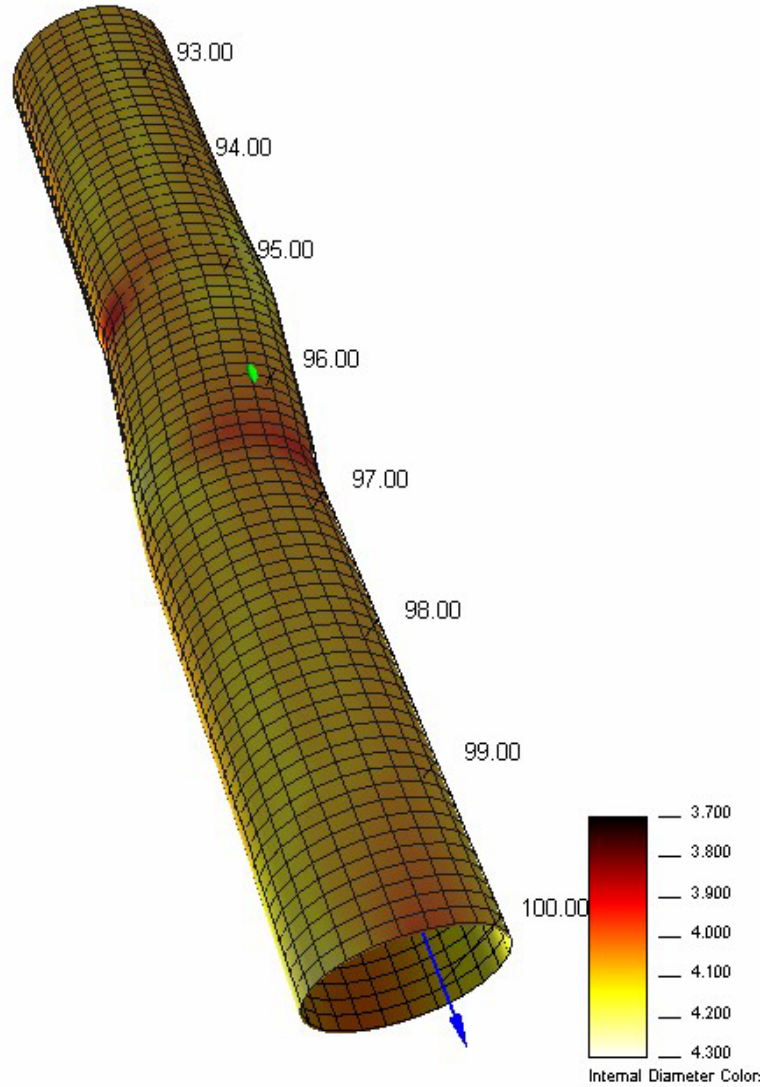

EV
Epidote

# Pipe Deformation Analysis (PDA)

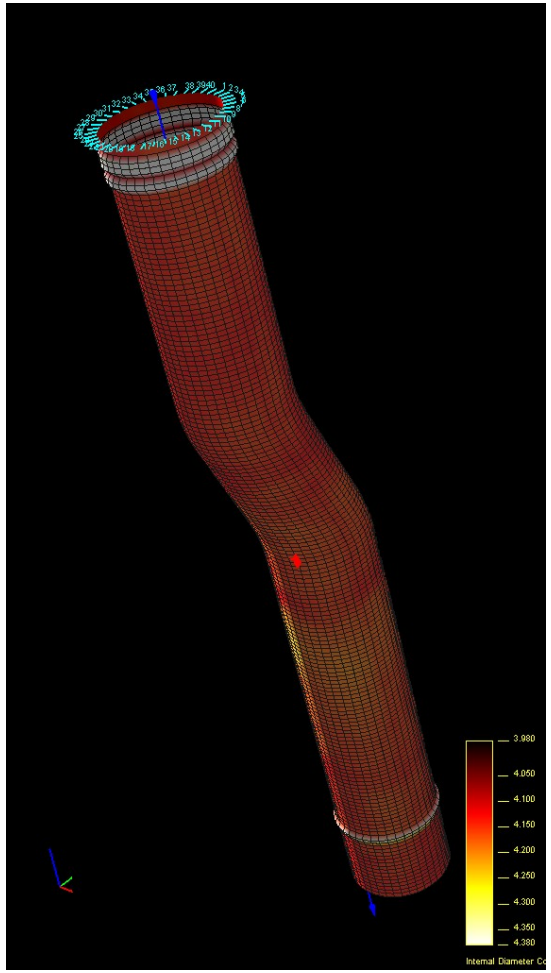
Determination of deformed pipe 3D geometry from multi-finger caliper data

Proprietary inversion scheme based on anomalous caliper eccentricity and caliper tool geometry

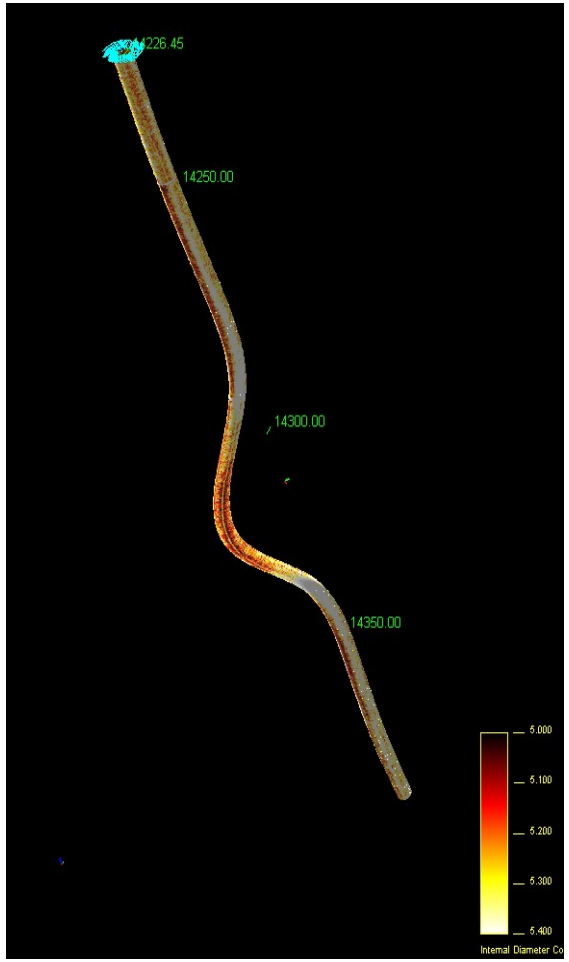
Allows analysis of well access limitations and insight into deformation mechanism



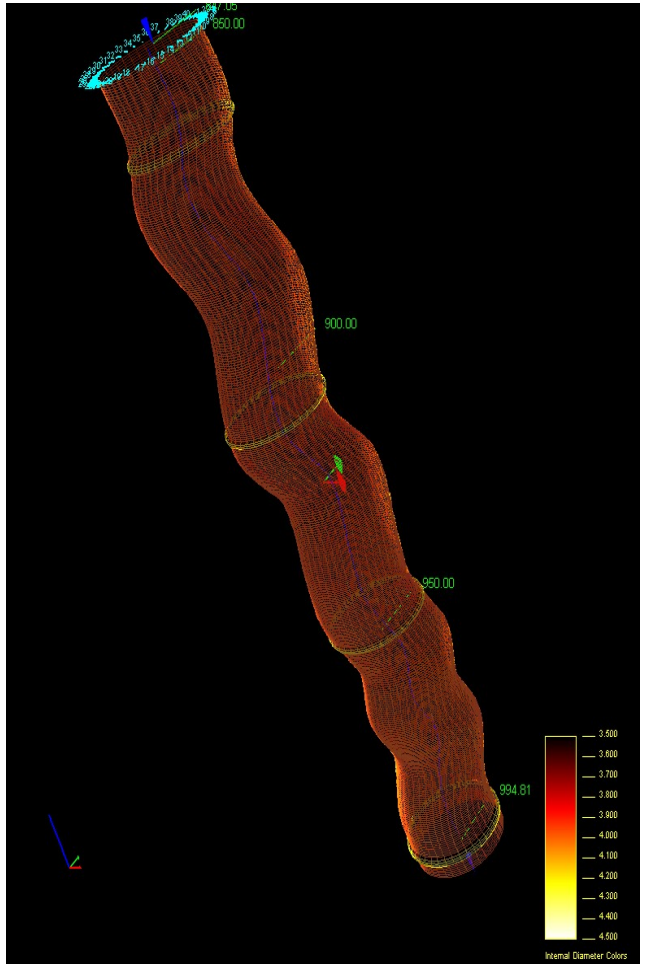
# Deformation Types



Shear Buckling

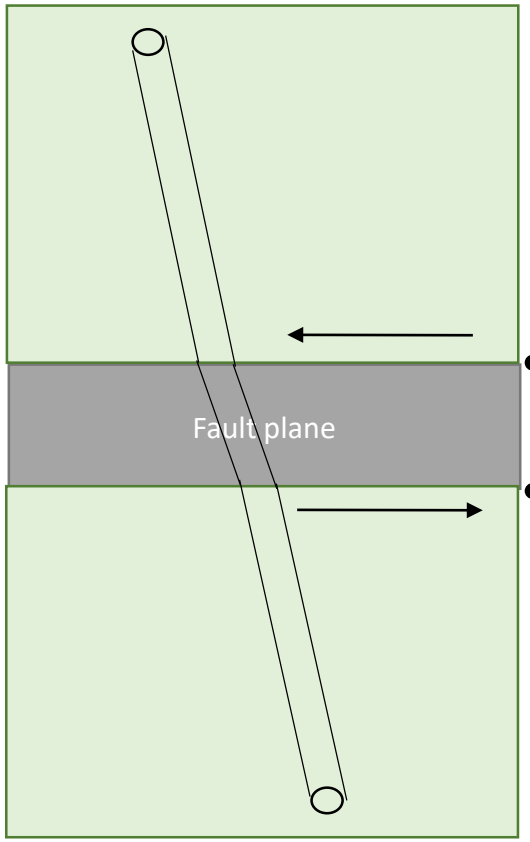


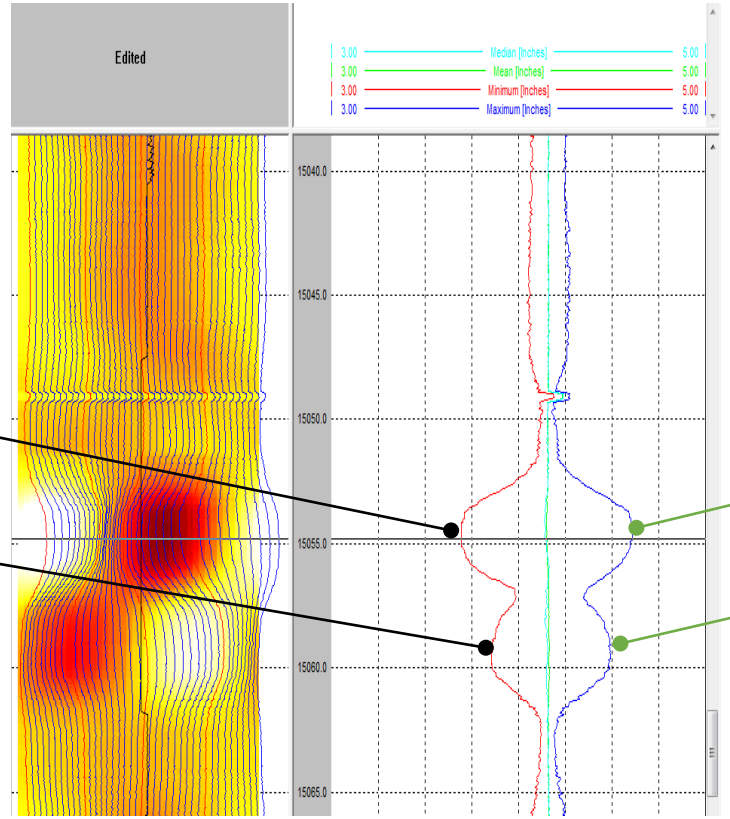

Bending



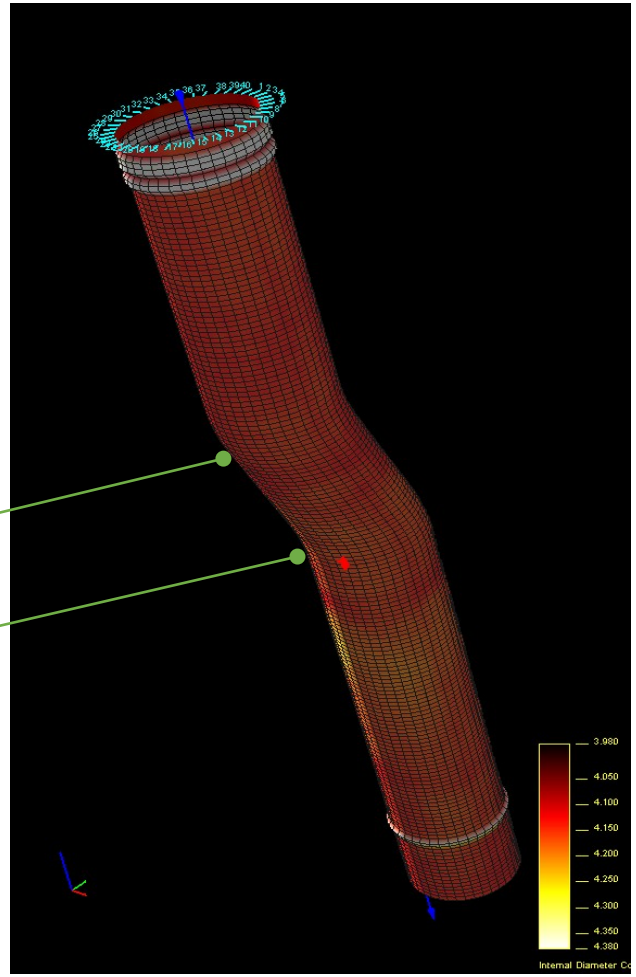

Helical buckling

# Shear Deformation ‘Signature’ in Raw MFC data




Raw MFC data with max, min and mean curves

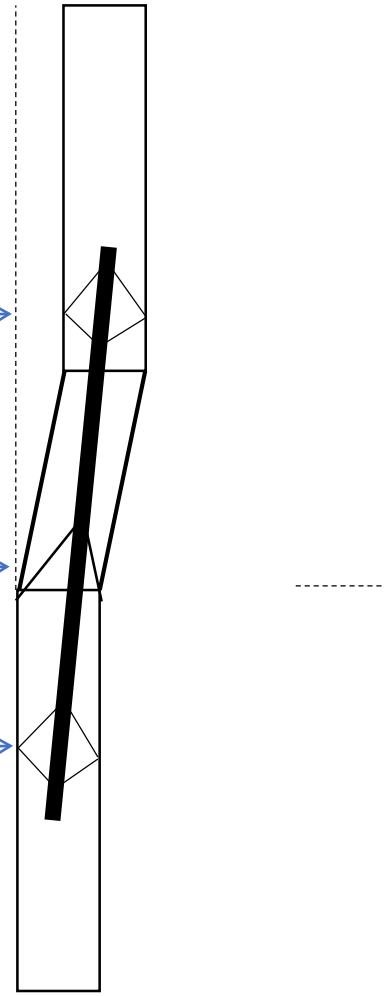


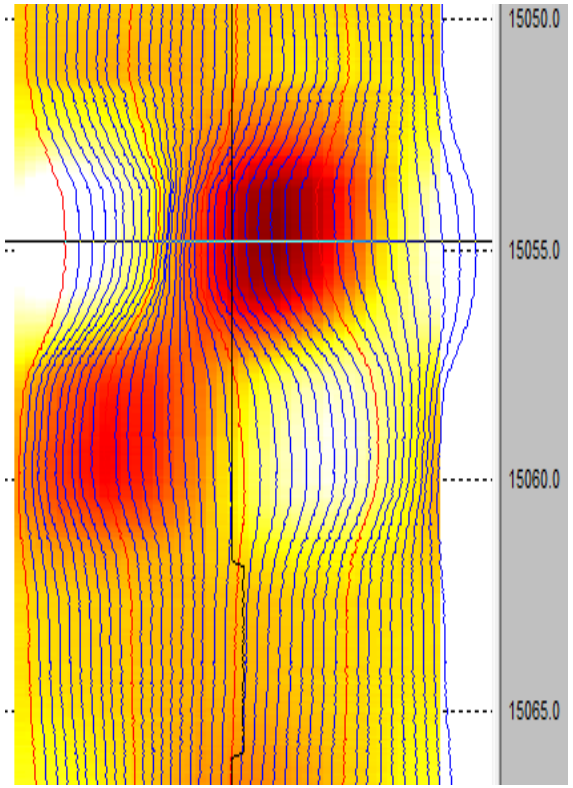
# MFC Tool – Response in Deformed Tubular

Tool centralised here

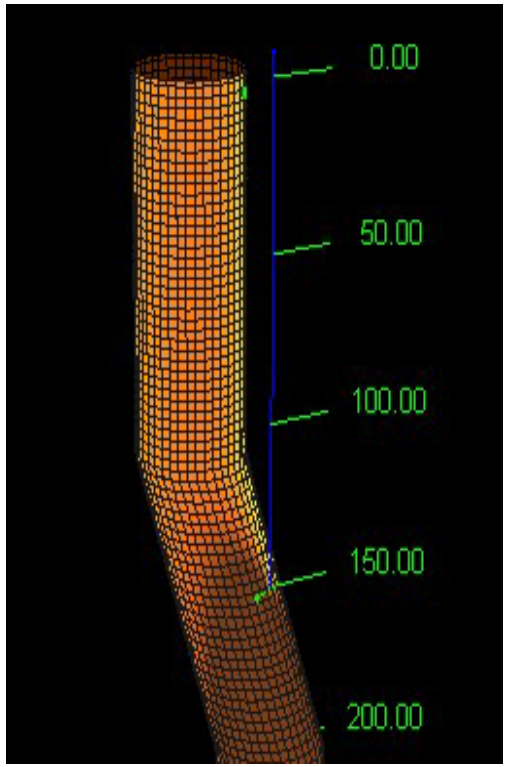
Feelers pressed in on inside of bend

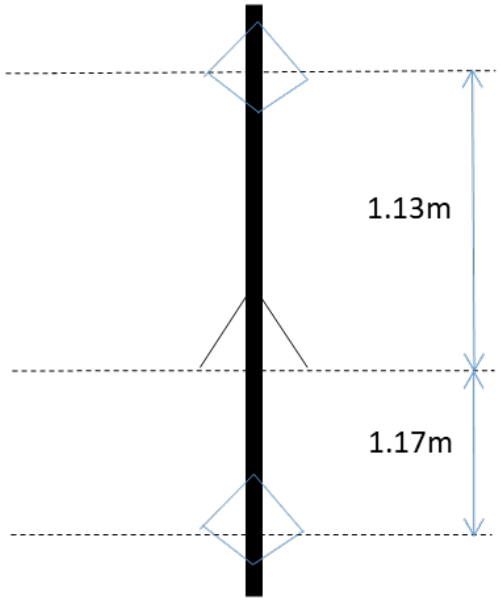
Tool centralised here



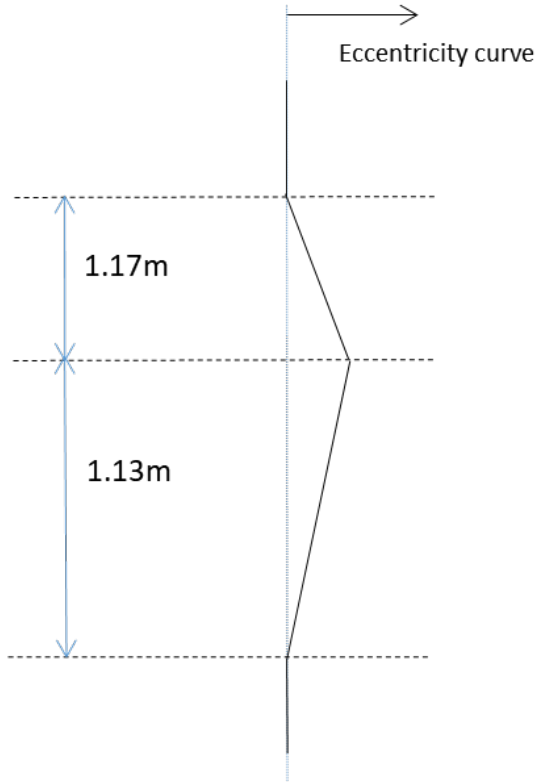


# MFC Tool Response - Continued



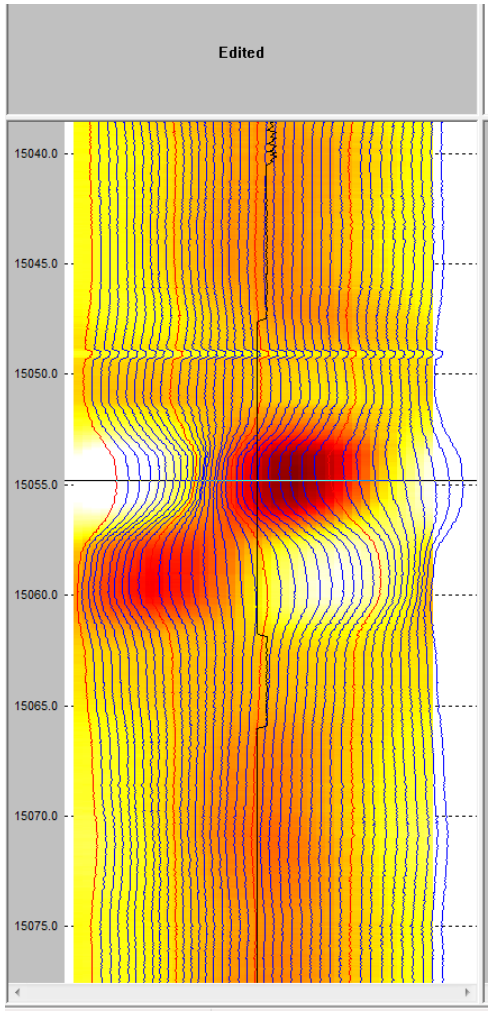

MFC tool string dimensions

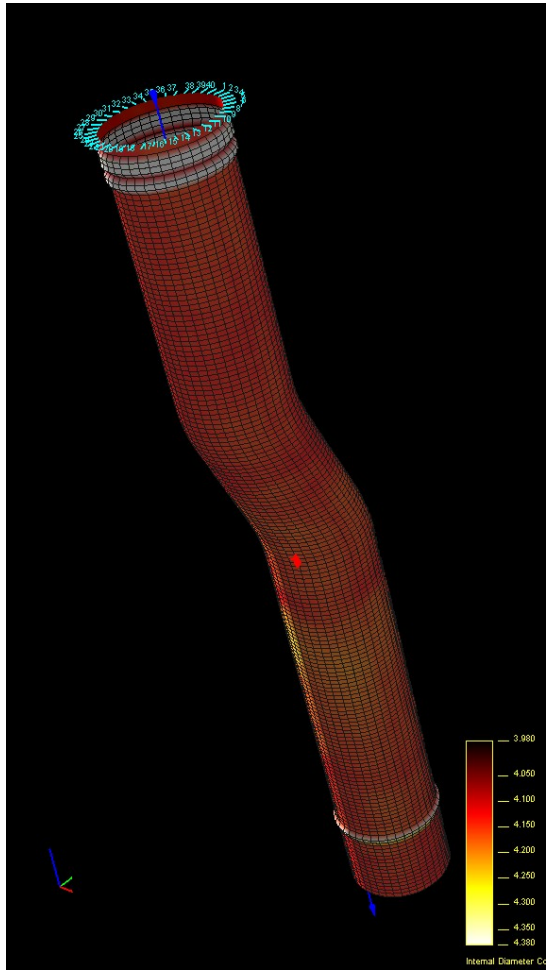


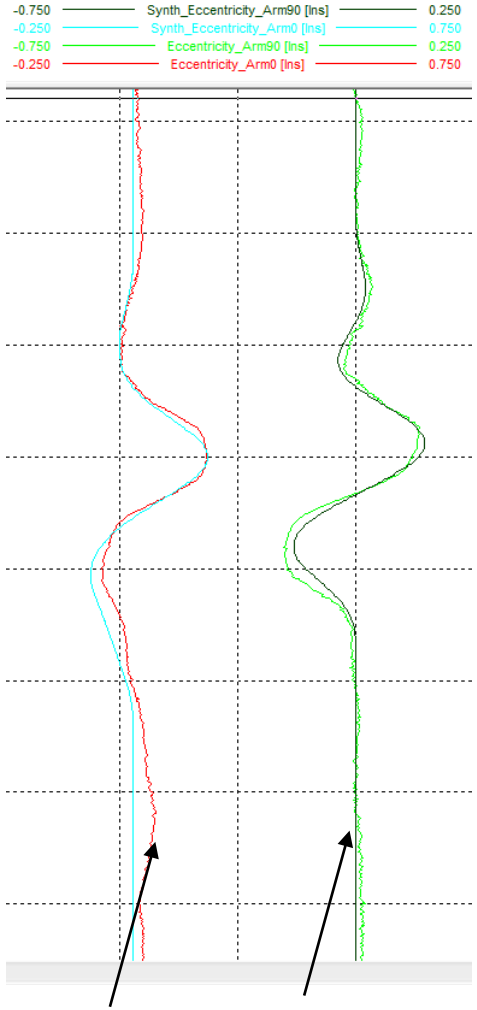

Tool response to abrupt change in well angle

- Geometry of caliper tool string results in a predictable response to rapid changes in pipe centreline direction
- N.B. Bandwidth limitations due to tool geometry and sampling

# Reduce 3D problem to 2 x 2D problems






Inline and Crosswell eccentricity

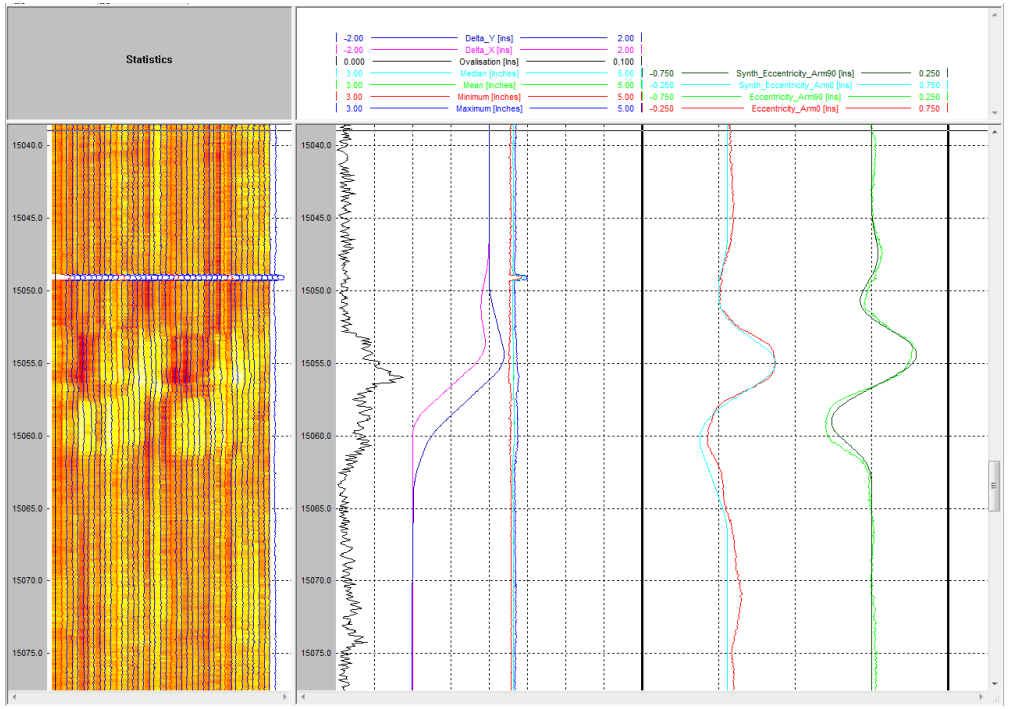
# Model Constrained Inversion for Shear Offset Deformations

**Model based Inversion to determine Shear offset**

→

**Direct Inversion**

→




**Check: Forward model synthetic caliper log set and compare to field data**

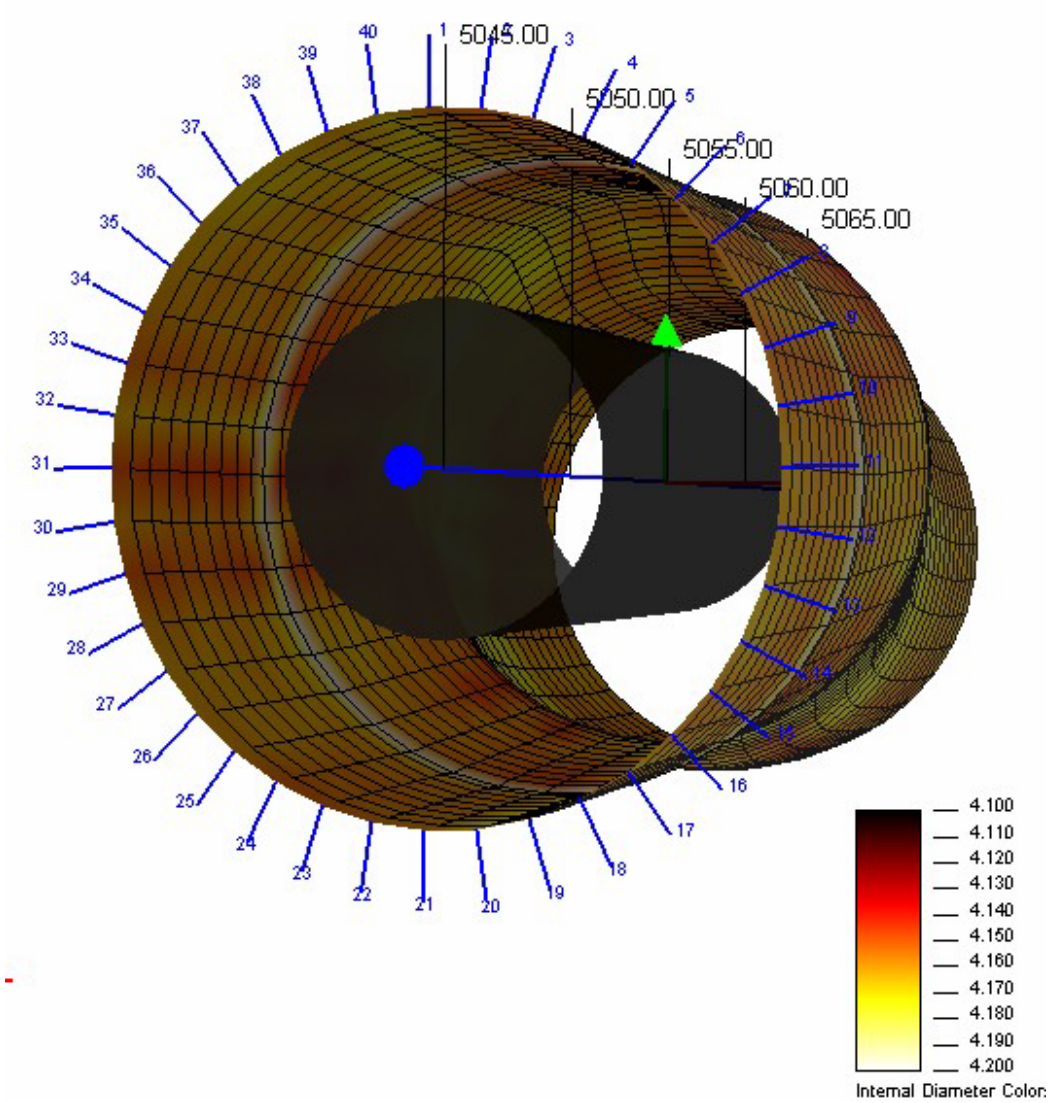
Build simple model to set constraints on angle and displacement above and below deformation

# Well Access (Drift) analysis

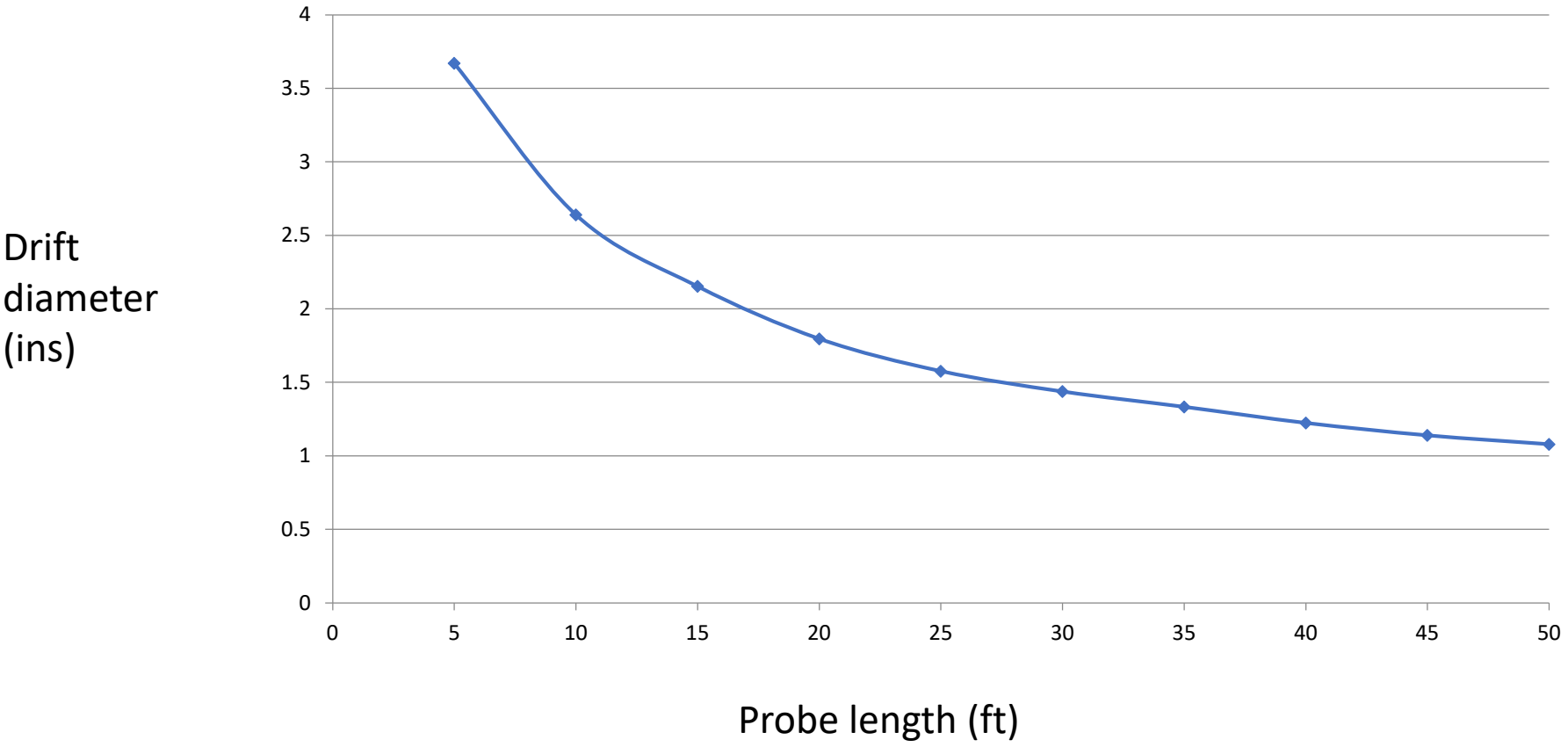
MIPS ™ drift analysis runs tool simulations through the 3D deformed pipe model

Well access analysis:

- Maximum clearance circle
- Cylinder Length / Diameter charts
- Simulations of specified toolstrings

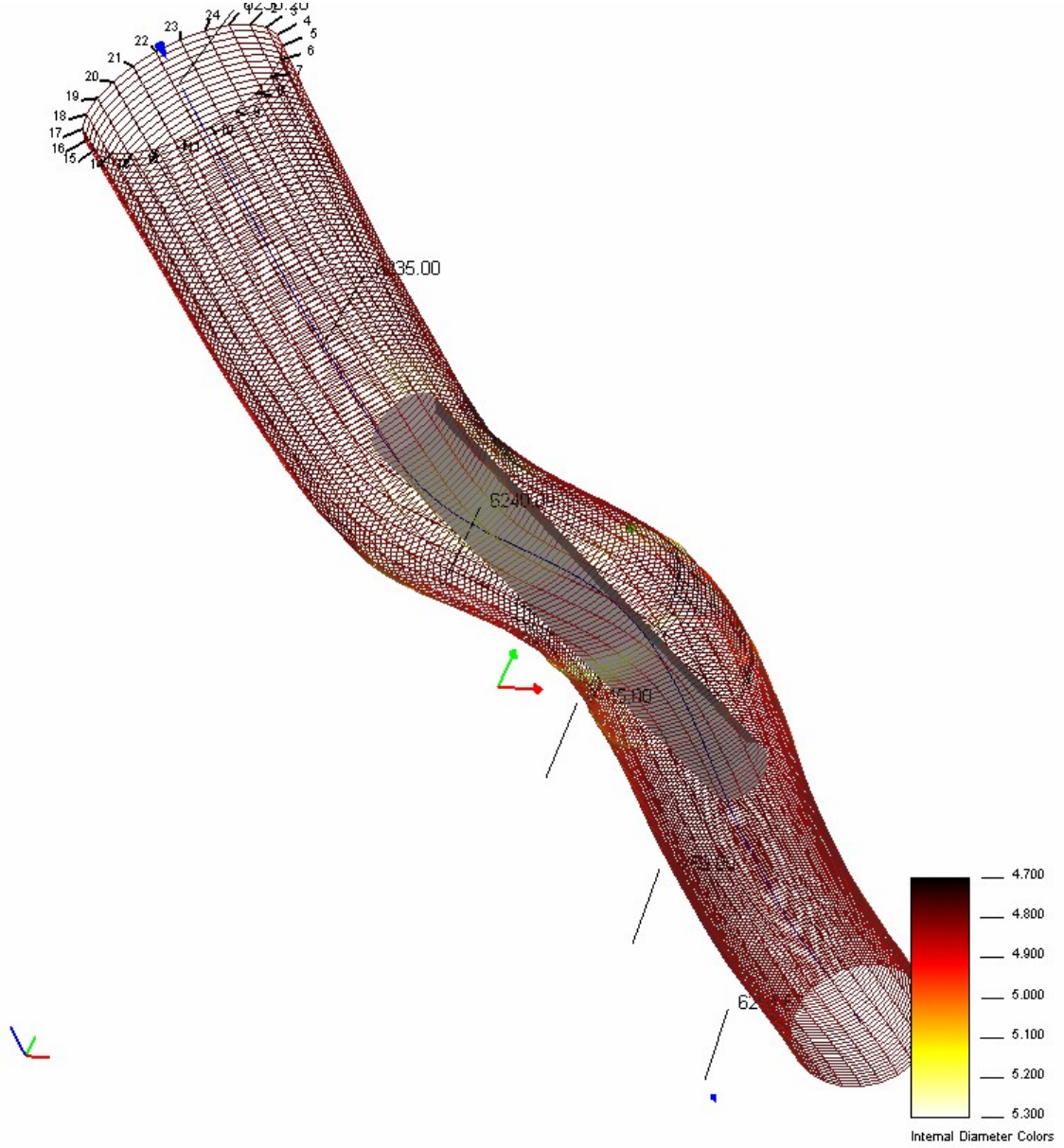


# Drift Analysis – Example

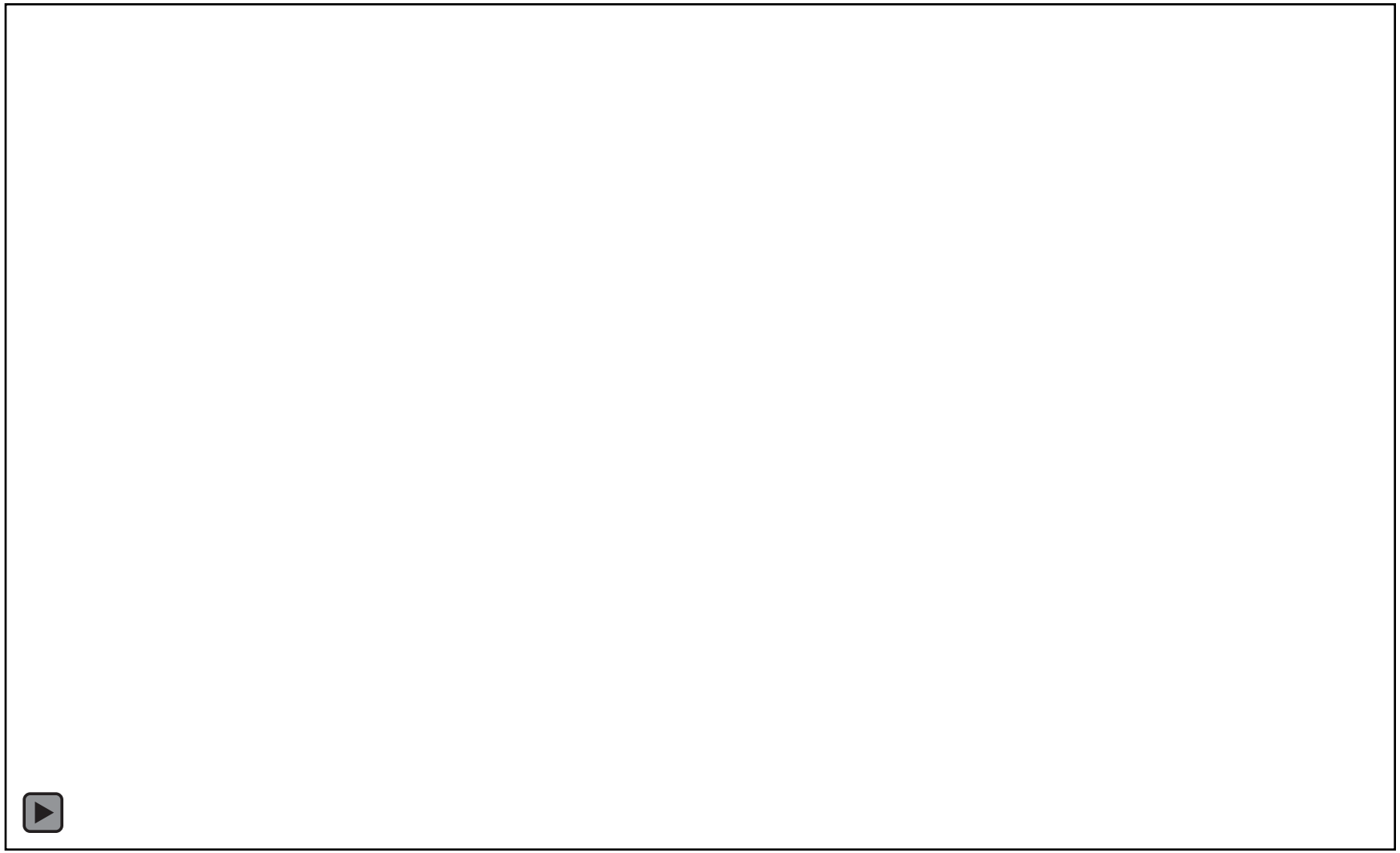


# PDA Drift Analysis Example

**3D Simulation of drift probe**



# Extrapolation of Model to External Casing



# Questions?