Survey Comparison

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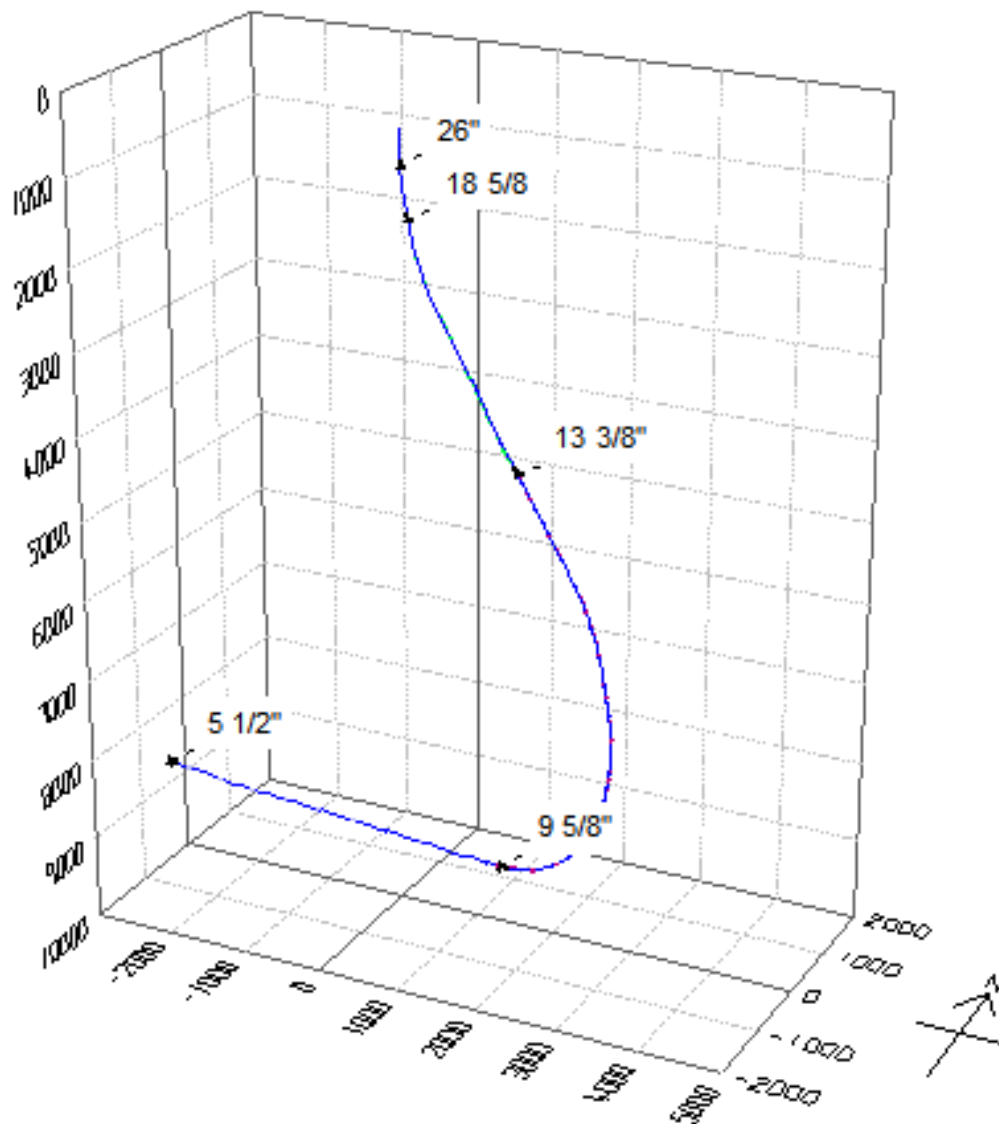
Why compare surveys?

- Validation: Independent surveys check each other for gross errors
- Post Well, QA, Data Transfers, Relief Wells

- Surveys must be completely independent
- Gyro vs. Magnetic
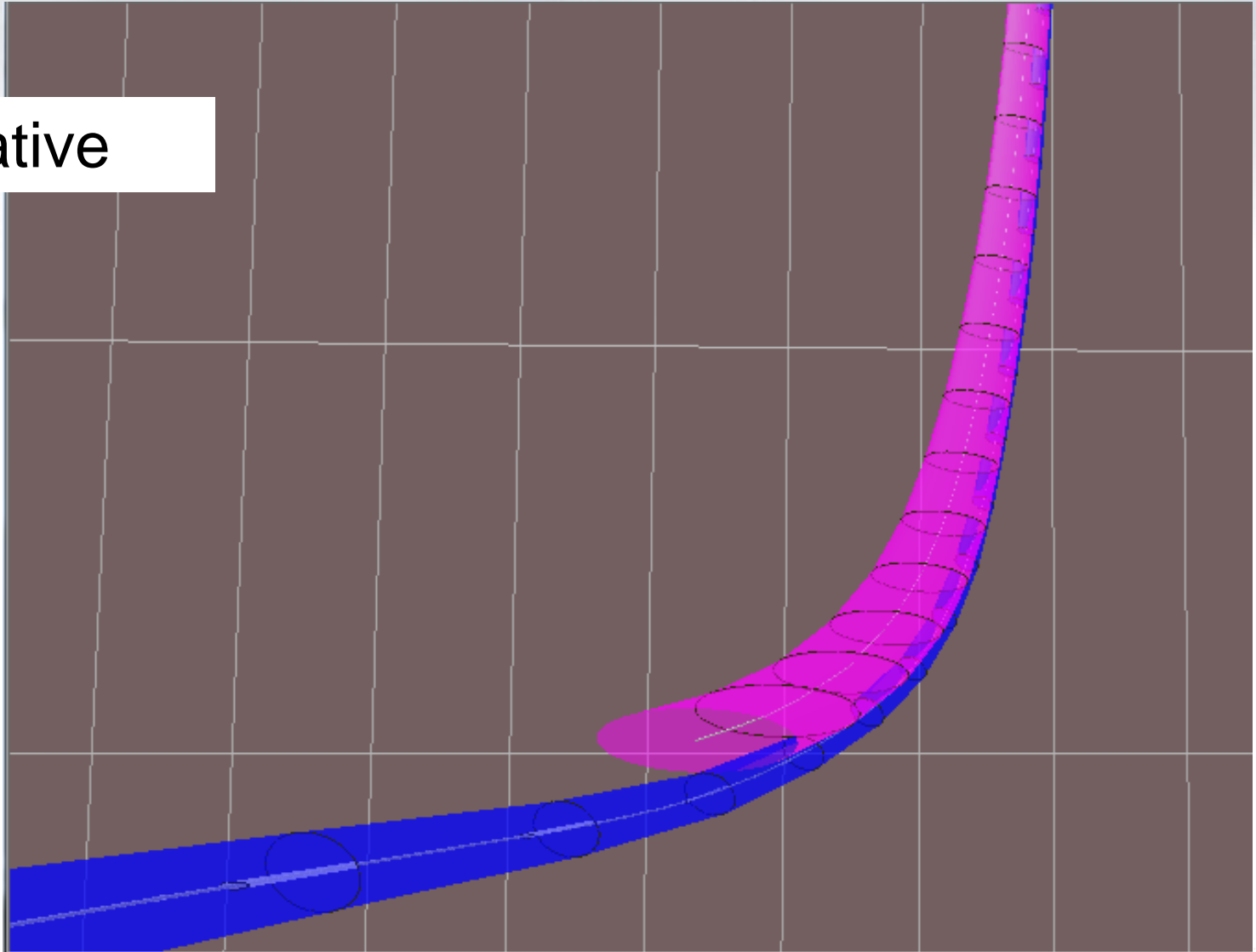- MWD vs. ESS
- Gyro vs. Gyro (different types).

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Example Well

- Recumbent
- Gyro to 9 5/8" with Depth Correction
- MWD in 16" & 12 ¼" Hole
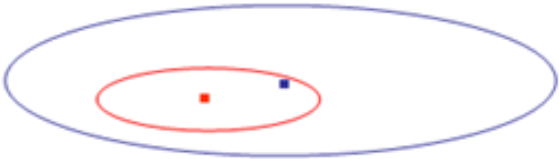
3D Solids View

- Qualitative

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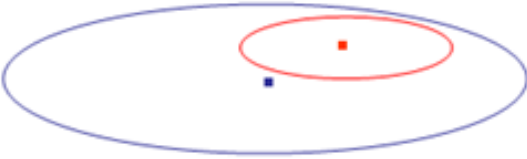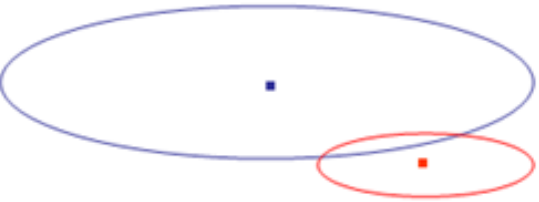**HALLIBURTON** | Landmark Software & Services
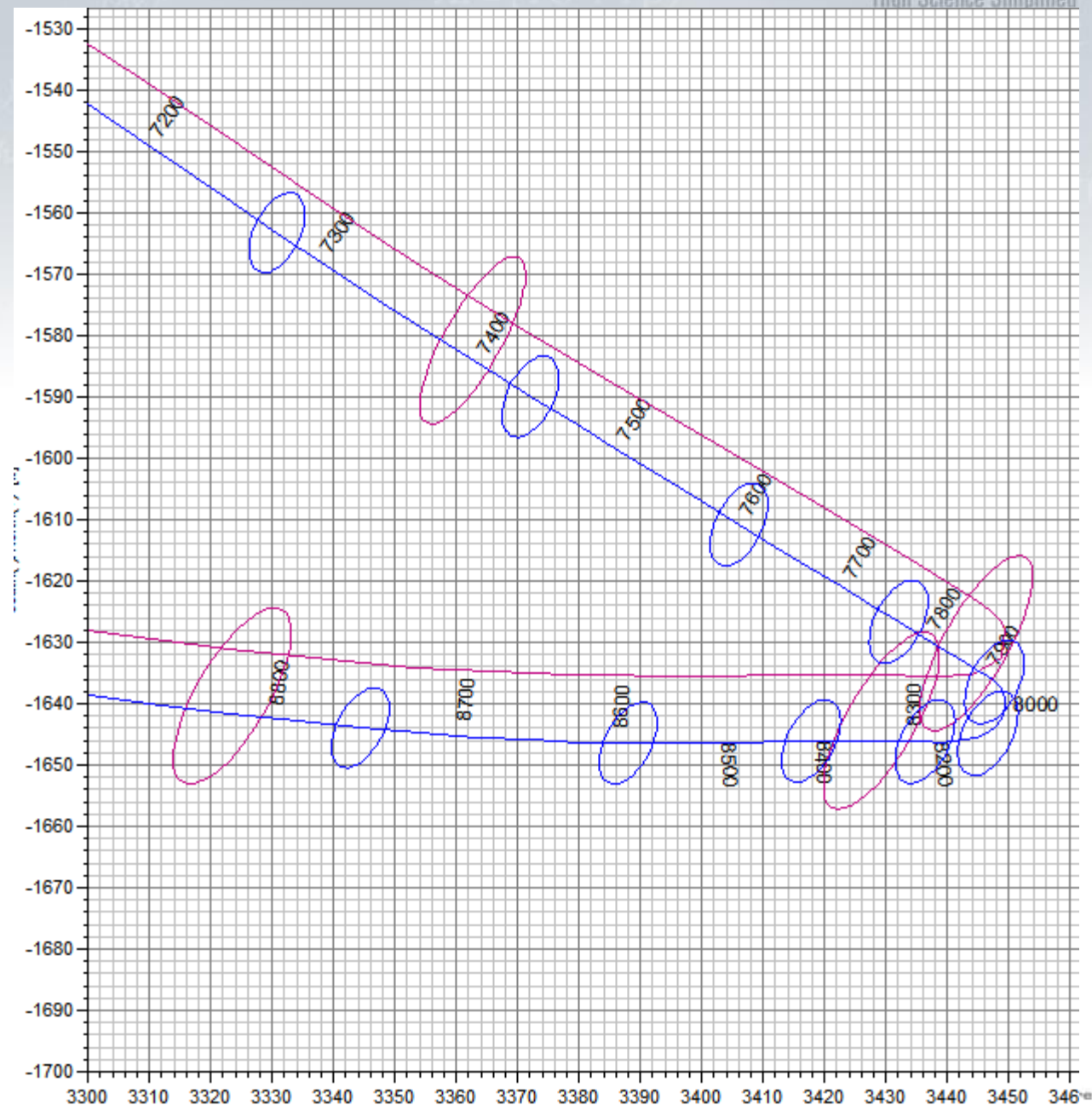
Plotted Ellipse Checks

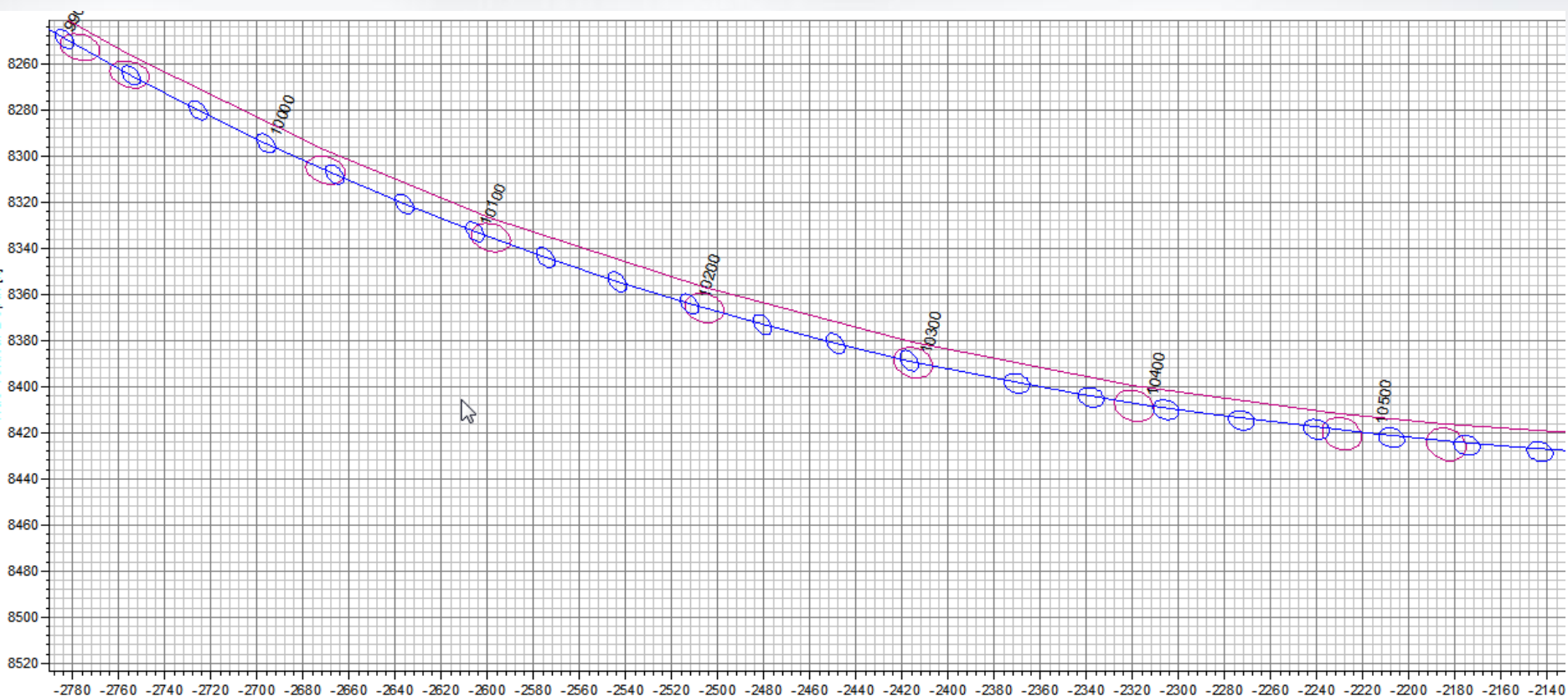| Level of Agreement	Description of Agreement Level	Pictorial Description of Agreement Level	Action
Very Good	MWD ellipse fully encompasses gyro ellipse and gyro ellipse encompasses centre of MWD ellipse		No further investigation needed
Good	MWD ellipse fully encompasses gyro ellipse but gyro ellipse does not encompass centre of MWD ellipse		No further investigation needed
Average	MWD ellipse does not fully encompass gyro ellipse but overlaps with it. The centre of the gyro ellipse lies inside the MWD ellipse		No further investigation needed
Poor	MWD ellipse does not fully encompass gyro ellipse but overlaps with it. The centre of the gyro ellipse lies outside the MWD ellipse		Investigate – if unresolved consider re-survey
Unacceptable	Ellipses do not overlap		Re-survey immediately and investigate

Plan View Ellipse Test

- 2 sigma + bias

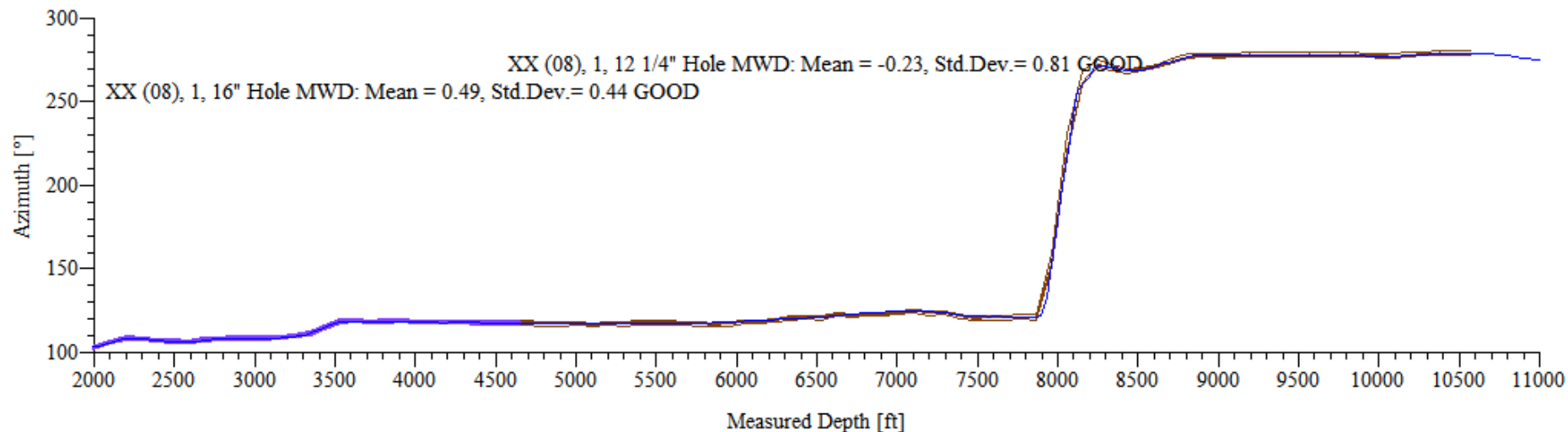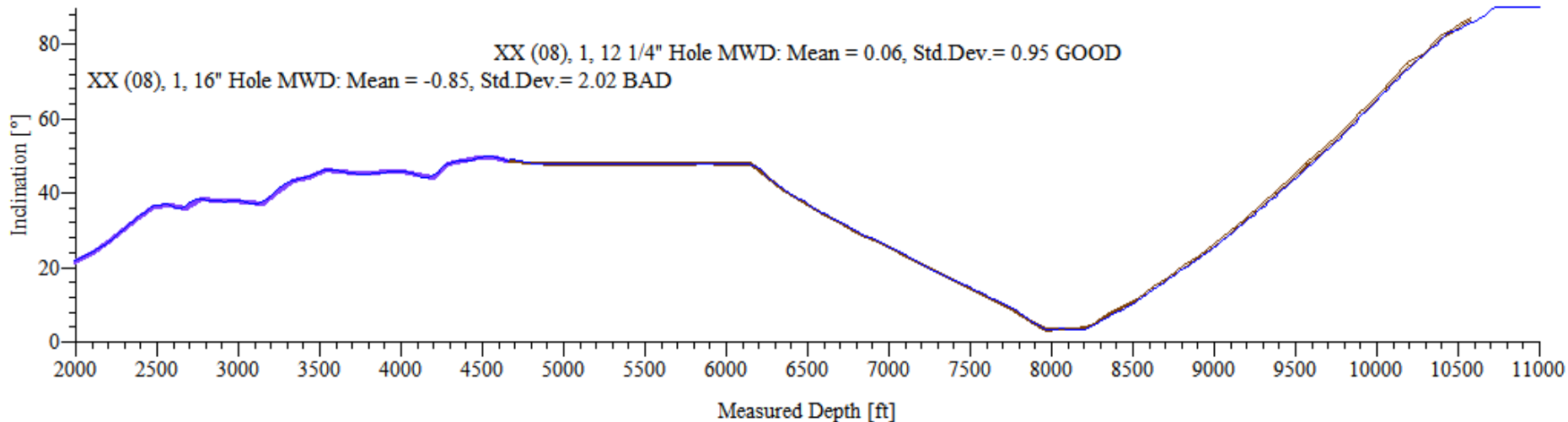# Section View – Ellipse Test

- MWD Error shows Depth Bias

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T Plots

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T – Plots Scaled in

XX (08), 1, 16" Hole MWD: Mean = -0.85, Std.Dev.= 2.02 BAD

XX (08), 1, 16" Hole MWD: Mean = 0.49, Std.Dev.= 0.44 GOOD

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Delta Plots

- ## Bias + 2 sigma

XX (08), 1, 12 1/4" Hole MWD: Mean = 0.06, Std.Dev.= 0.95 GOOD
XX (08), 1, 16" Hole MWD: Mean = -0.85, Std.Dev.= 2.02 BAD

XX (08), 1, 12 1/4" Hole MWD: Mean = -0.23, Std.Dev.= 0.81 GOOD
XX (08), 1, 16" Hole MWD: Mean = 0.49, Std.Dev.= 0.44 GOOD
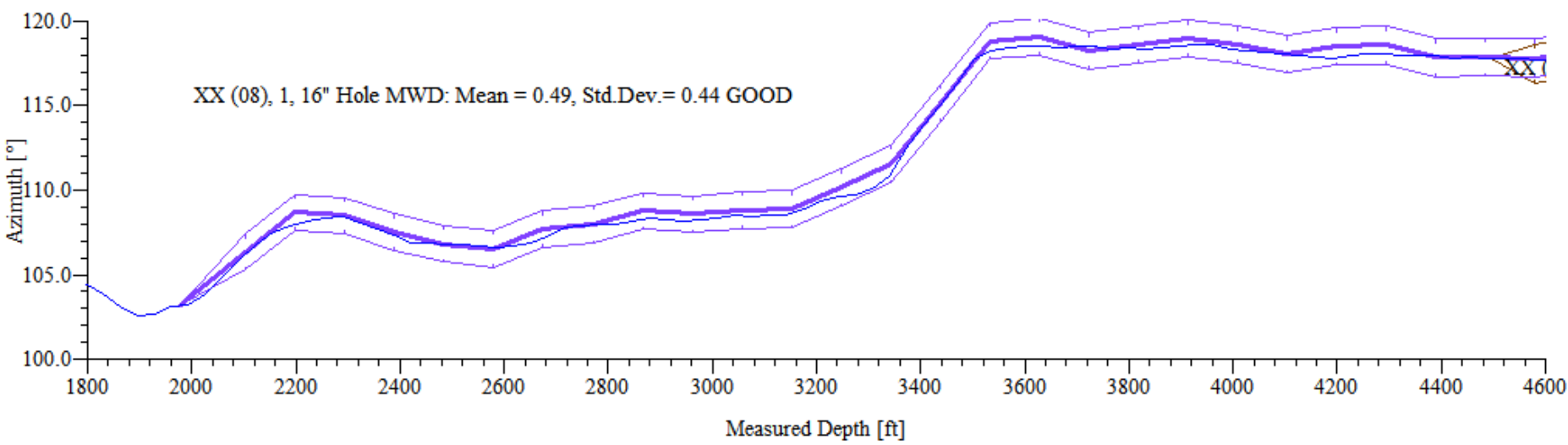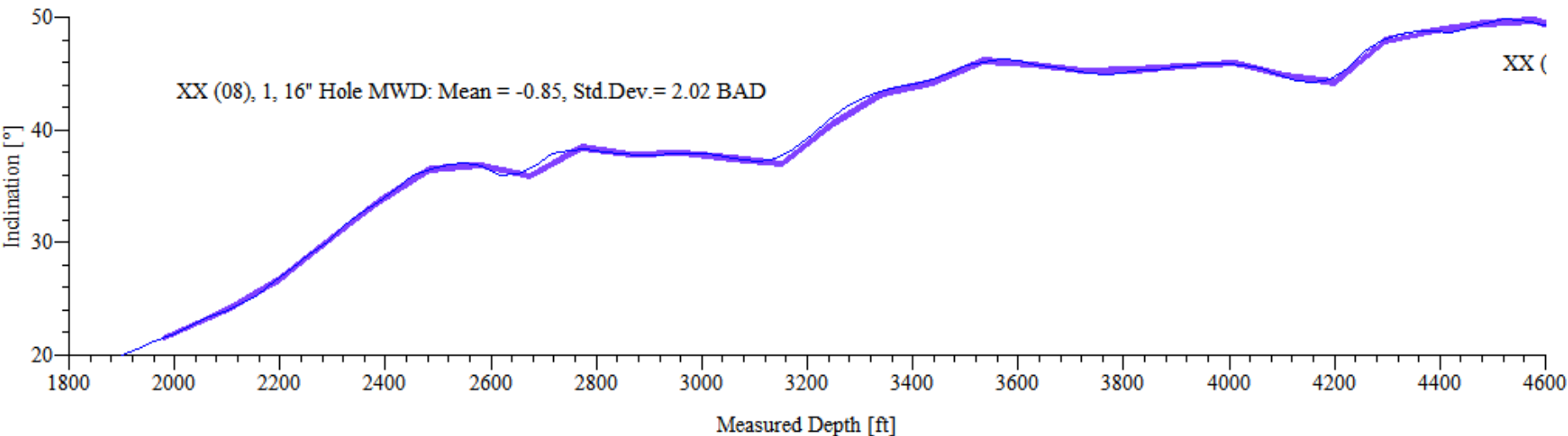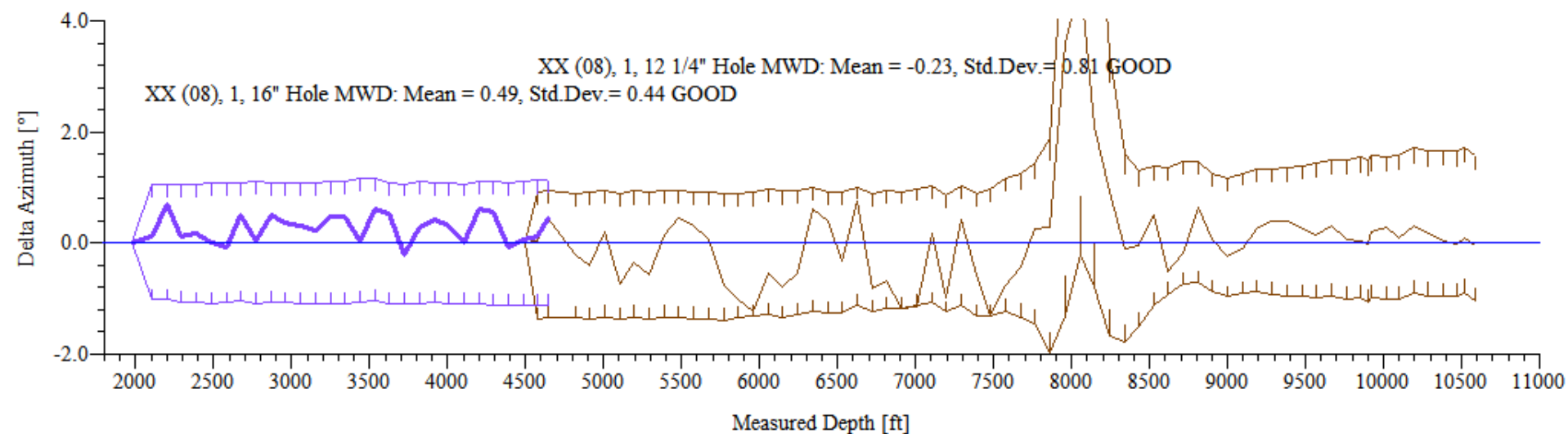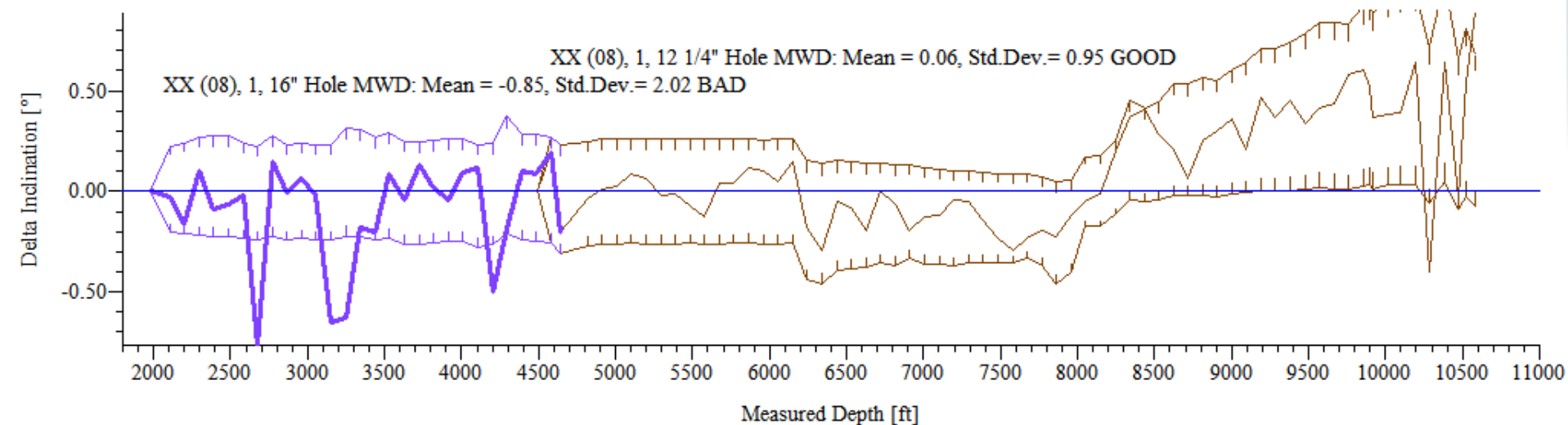
Combining Errors Method

- Calculate Inclination & Azimuth error at station
- Combined inclination errors and azimuth errors as if they are independent surveys tied on
- Using RSS for R & S type terms
- Removing W & G errors if term names are common, like...
  - Declination Magnetic Reference
  - Depth Stretch Errors

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Relative Instrument Performance Method

- Calculate Inclination & Azimuth differences & combined error at station & interpolated offset

- Calculate Mean & Standard deviation of Delta Azimuth / Combined Standard Deviation (error)

- Assess total against level criteria. (good/acceptable/poor)

- Mean difference = systematic error (bias/gross error)

- Standard deviation = random differences

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Conclusions

- A valuable tool in the right hands, but currently only run by experts

- What are acceptable differences?

- Bias really works here – otherwise its hard to understand systematic differences.

- Random Errors affect inclination & azimuth error band and standard deviation but are under represented in error model

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