



The Industry Steering Committee on Wellbore  
Survey Accuracy (ISCWSA)

# IMPROVING LATERAL SURVEYS USING MEMORY MWD DATA



Wellbore Positioning  
Technical Section

# Speaker Information



The Industry Steering Committee on Wellbore  
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- Marc Willerth
- Product Line Engineer – MWD Surveying
- March 4<sup>th</sup>, 2016
- Scientific Drilling International – Applied Technologies Center



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Technical Section**

# Speaker Bio

- Marc Willerth
  - Scientific Drilling International; Survey Support (2013-Present)
  - Schlumberger; M/LWD (2009-2013)
  - ADM & DowAgrosciences; Analytical methods (2007-2009)
  - Purdue University / Chemical Engineering & Chemistry
  - Based in Paso Robles, California, US
  - Specialized in wellbore positioning solutions
    - Particularly using measurement while drilling technologies

# Scientific Drilling International

- Precision wellbore positioning & drilling solutions
  - High-accuracy gyro survey
  - Active and passive ranging
  - Measurements and logging while drilling
  - Drilling motors and directional drilling
  - Cased hole logging
- >25 offices and 3 tech centers across 6 continents

# Common Themes

- **Conflicting Priorities**
  - Drilling vs. Geology vs. Wellbore Positioning
- **Doing More With Less**
  - “Deeper, Faster, Cheaper”
- **Moving from Paper to Practice**
  - Technically Solved vs. Widely Deployed

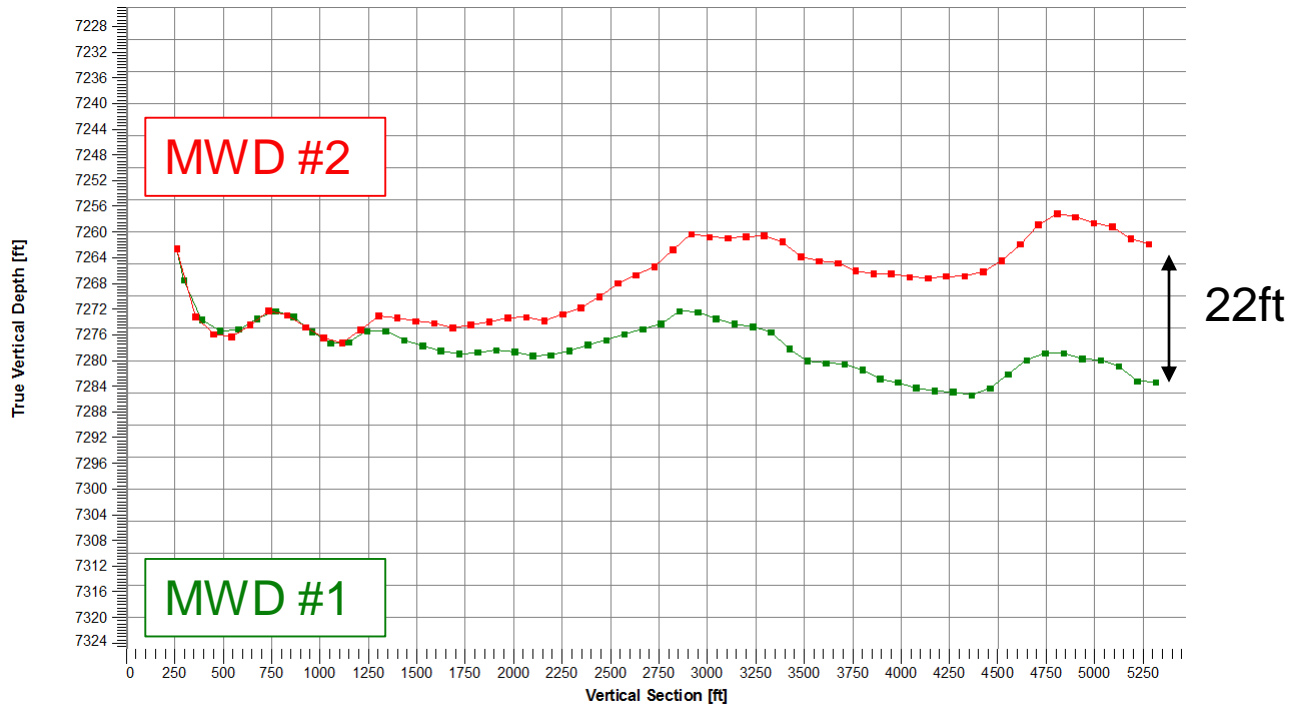


# Example Scenario

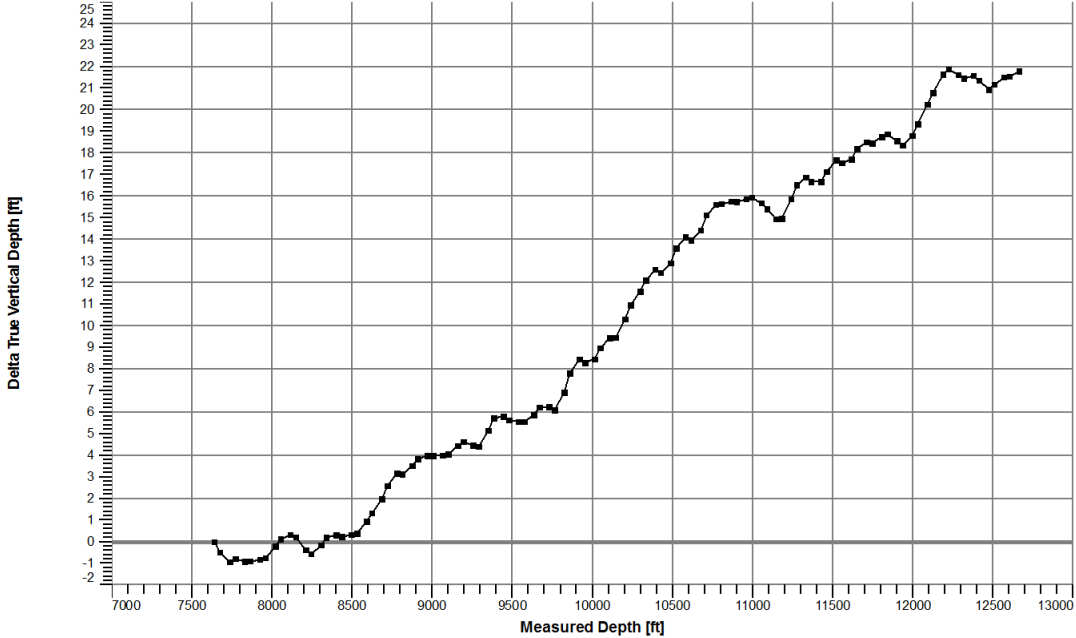
- US Land
  - Highly optimized workflow
  - Sensitivity to incremental cost
- One run curve and lateral – Motor BHA
- Concerns about survey accuracy on multiple wells
- Well surveyed with 2 MWD systems



# Two Lateral Surveys



# Steady Divergence



Growth at  
5ft TVD per  
1000ft MD

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# SPE 67616 On Survey Intervals

*The method presented in this paper relies on the assumption that an error-free measurement vector  $\mathbf{p}$  will lead to an error-free wellbore position vector  $\mathbf{r}$ ...*

*...The resulting error may be significant for sparse data, but may probably be neglected so long as the station interval does not exceed 100 ft.*



# What Else Could Affect The Survey?

- Extra non-magnetic drill collar
- Changing slide pattern
- Altering BHA order

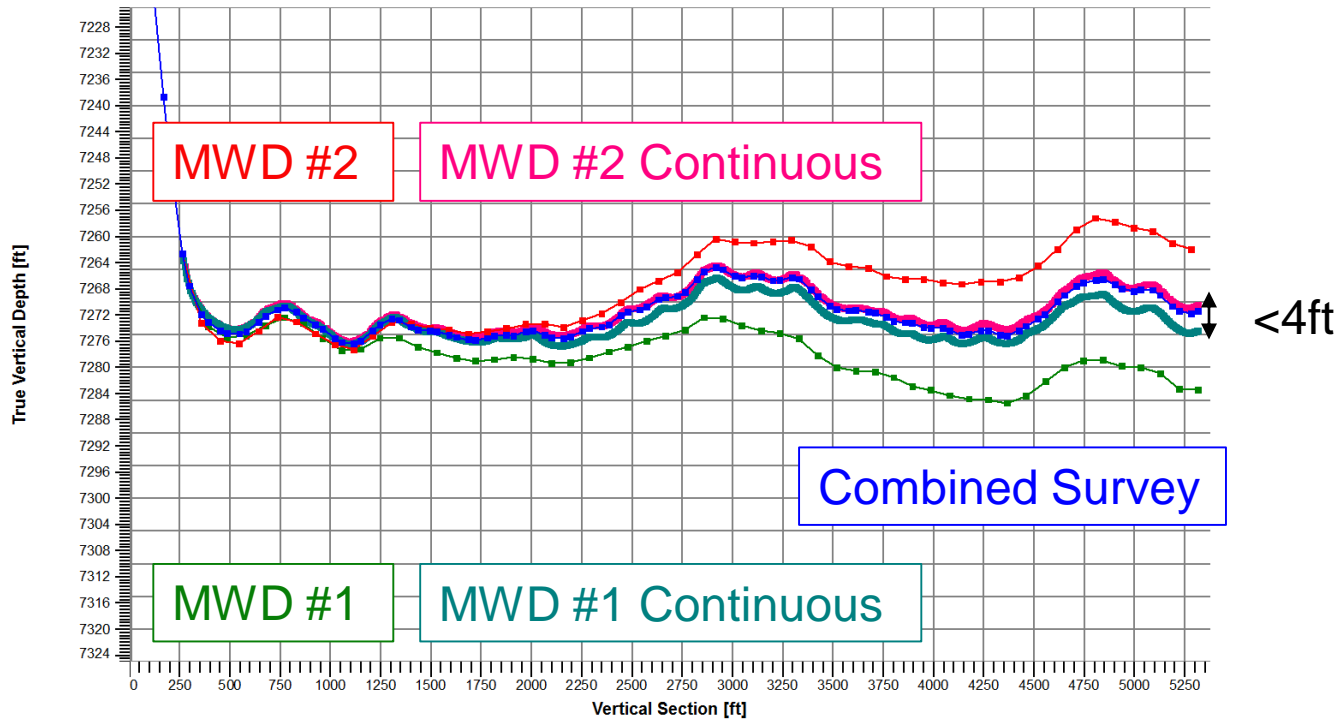


# Ways To Fix It

- Stop for additional surveys
- Dual sensor (Combined survey)
- Utilize continuous survey measurements



# New Survey Comparison



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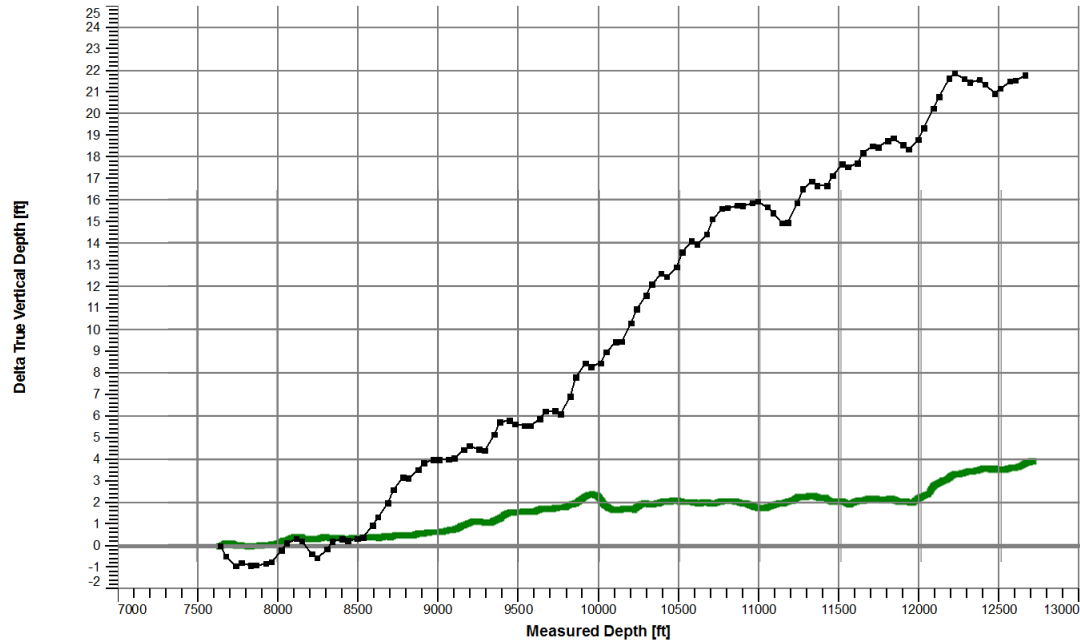


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# Dramatic Improvement



Rate drops to  
<1ft TVD/1000ft

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# Still Some Shortcomings

- Additional equipment
- Additional complications for definitive survey
- Workflow concerns: QC? Error Model? MSA?



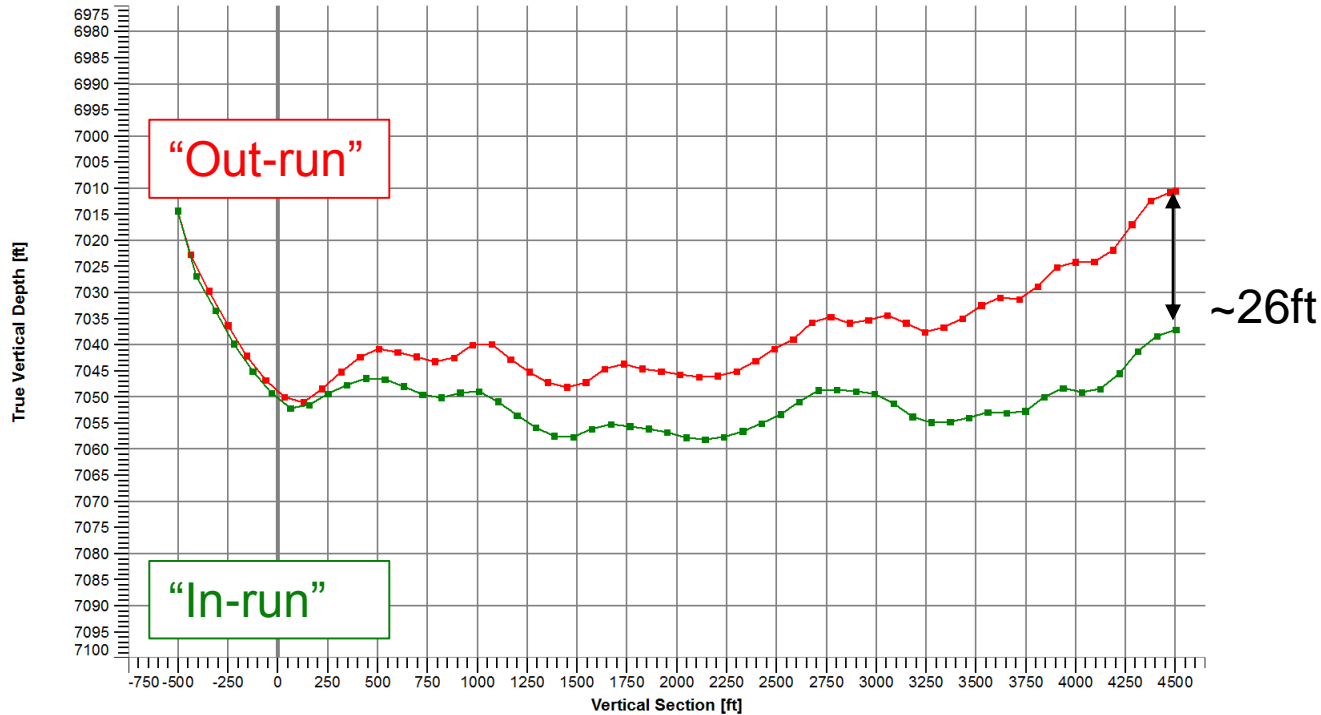
# A Simple Solution

- Leverage memory data: Multi-shot out of hole
- Workflow: Lay out a single at total depth
- Full second survey set – reduce TVD uncertainty
- Use continuous data to validate

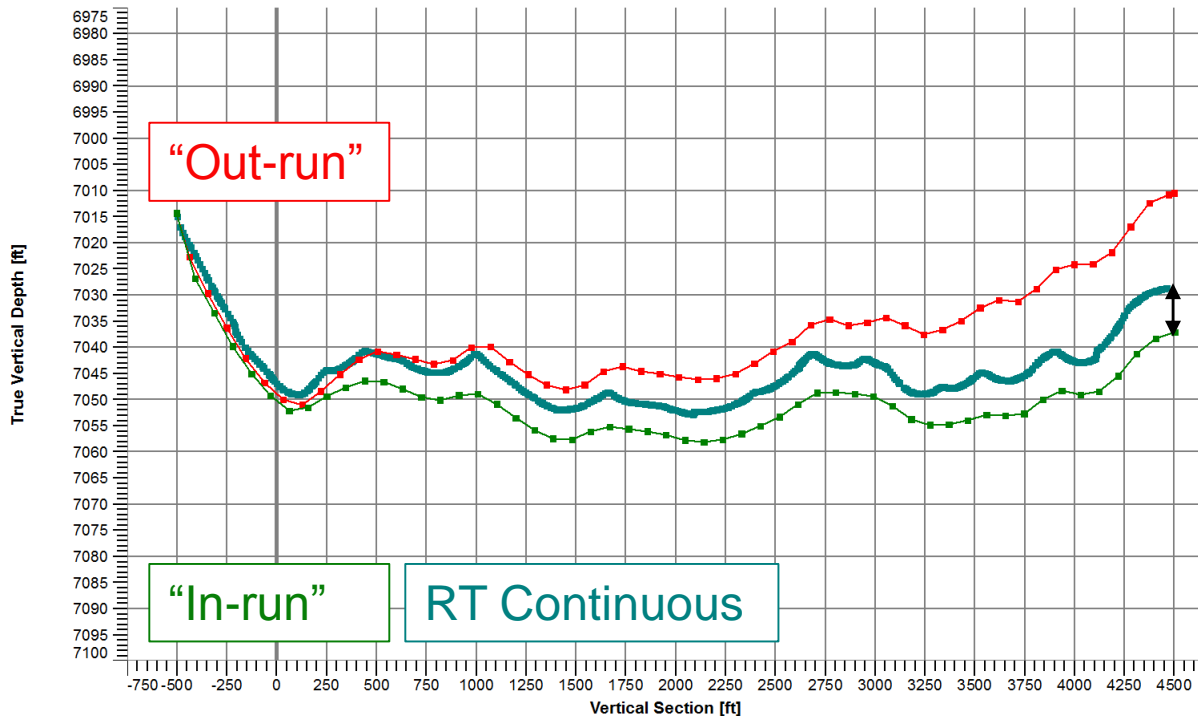




# New Well: Same Effect

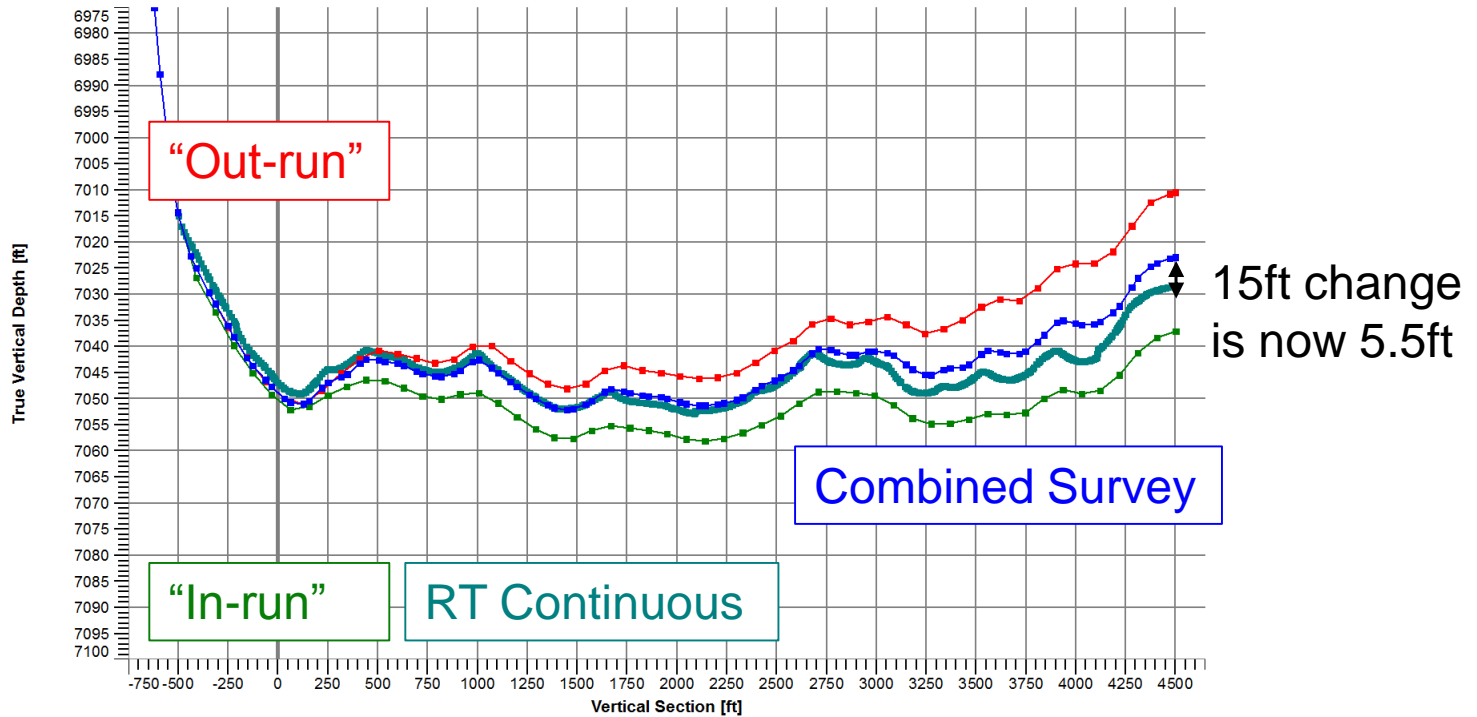


# Real-time Continuous Survey



~8.5ft shift is an early warning sign

# Memory Surveys For Definitive



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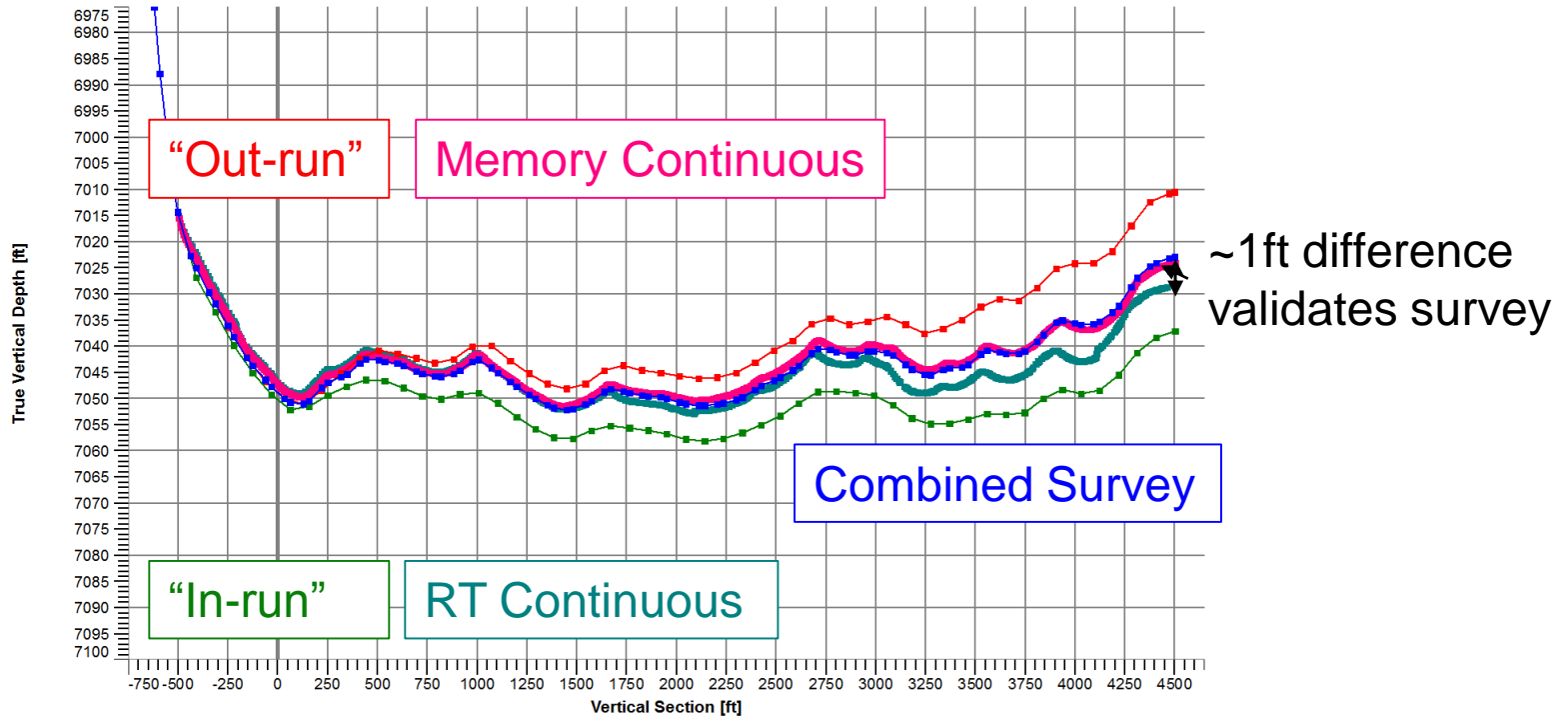


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# Final Check for Gross Errors



# Conclusion

- Systematic error can rapidly accumulate in laterals
- Can be detected by leveraging additional data
- Can be eliminated with minimal additional cost
- Modular workflow allows for varying levels of QC



# Questions?

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