

# Proposal for an Alternative MWD Magnetic QC-test

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# AGENDA

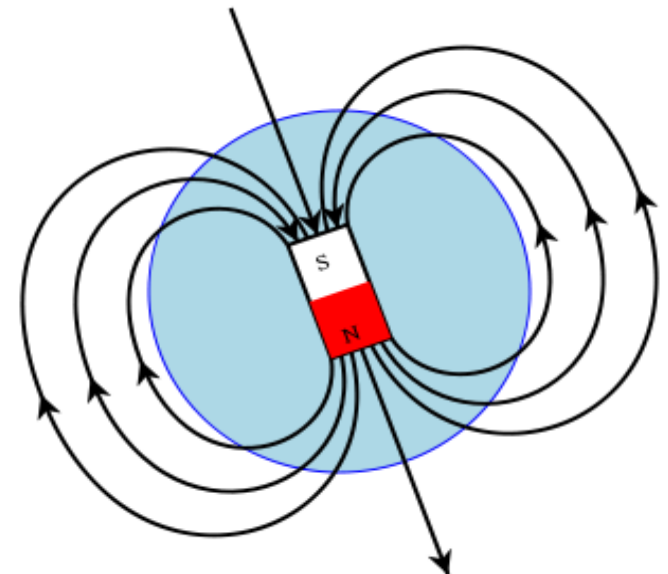
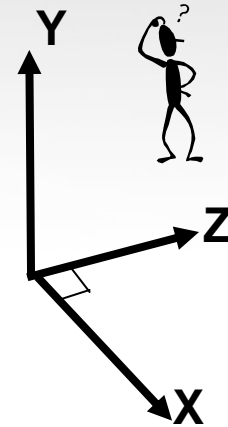
- Definition of Magnetic Total Field and Dip Angle tests
- The 90/90 QC case
- Examples
- Considerations

# Total Magnetic Field/Dip Test

- Earth's magnetic field strength and dip angle calculated from tool's magnetometer and accelerometer outputs
- Compared with the Reference Field values
- Error model estimations for the directional sensors and the reference field define how well the two should agree

# Drilling at 90/90

- Azimuth is sensitive to axial interference, Bt and Dip are not
- Standard QC tests are insensitive to excessive axial interference
  - SPE 133417 (ISCWSA)
- Stimulus for finding new QC test



# Alternative QC Tests

- $B_h$ - Horizontal component of the Earth's magnetic field
- $B_v$ - Vertical component of the Earth's magnetic field
- $B_z$ - Magnetic field along the axial direction

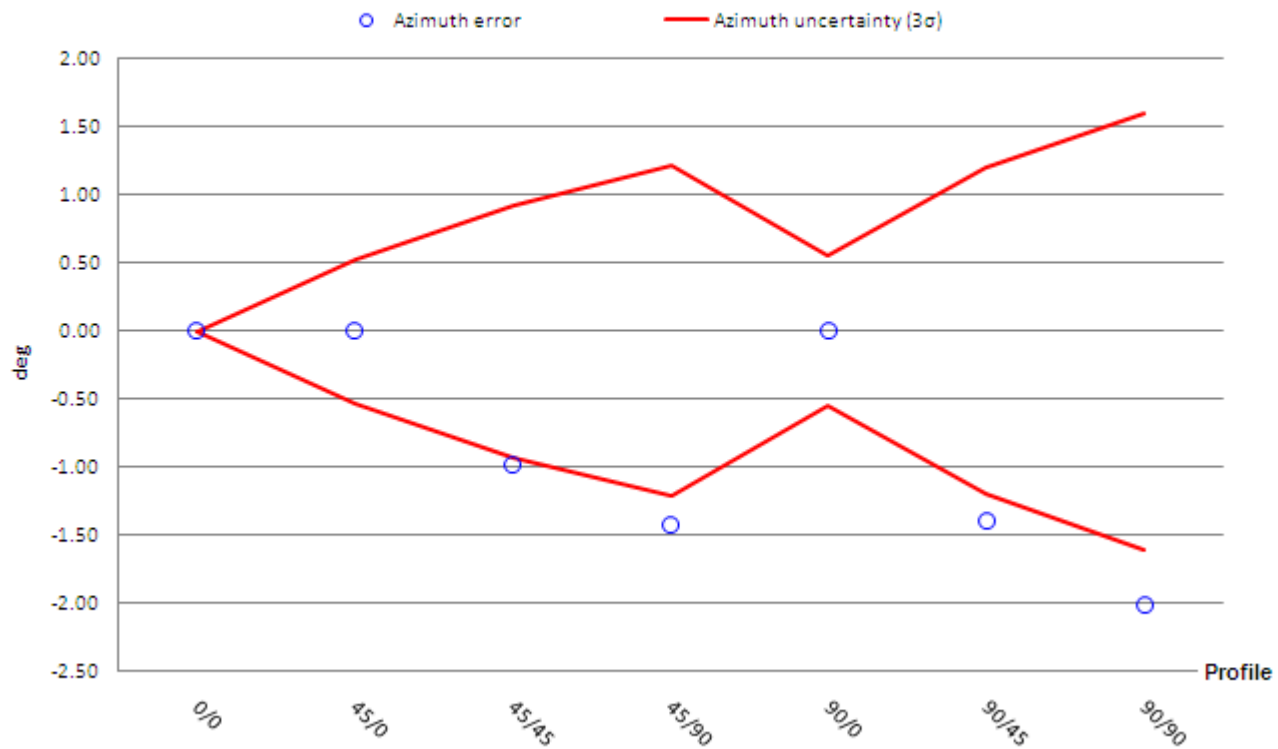
# Examples

- QC test limit values
  - BH and Statoil method (presented at ISCWSA 12 and 13)
  - BH error models used
    - Axial Interference: 150nT ( $1\sigma$ ) everywhere
- Error assumptions
  - All error sources assumed to be zero
  - One out of spec condition introduced at a time

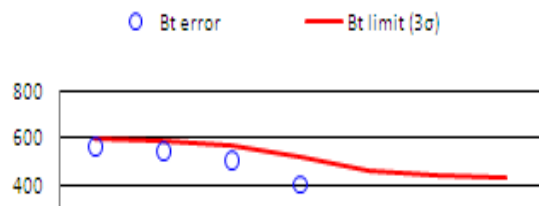
## Example 1:

- Btotal 50000 nT
- DIP 70 Deg
- Bz-bias 600 nT

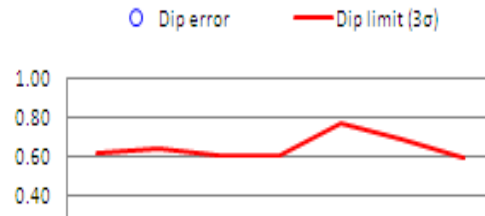
### Azimuth error



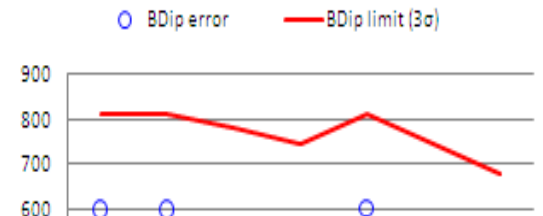
### B-total test



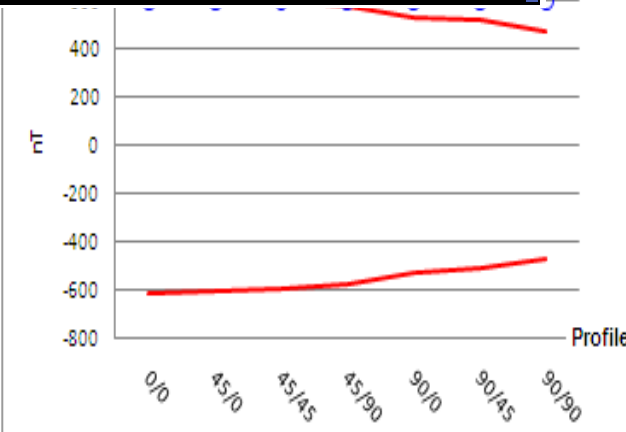
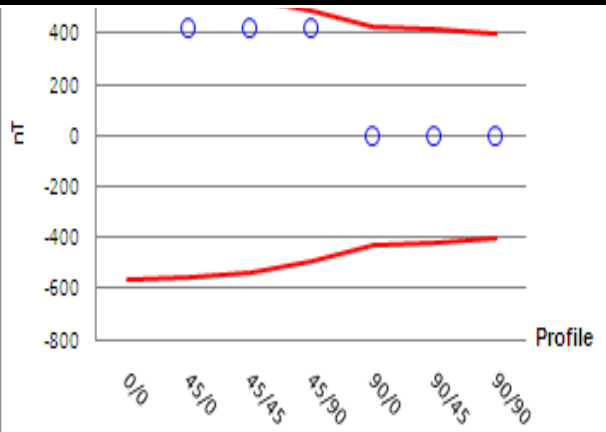
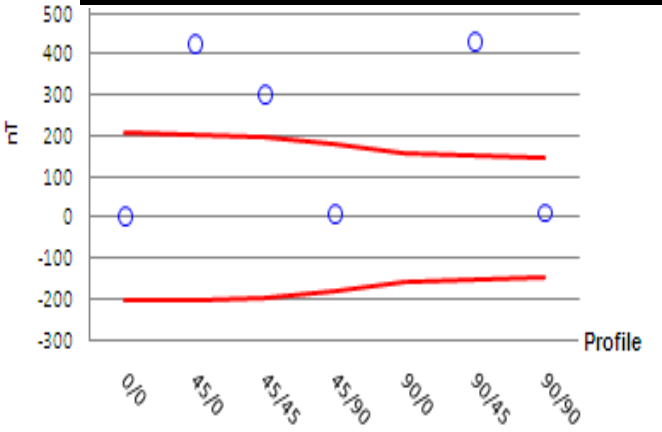
### Dip-test



### BDip-test



	0/0	45/0	45/45	45/90	90/0	90/45	90/90
<b>B-total</b>	X	X	X	X	X	X	X
<b>Dip</b>	X	X	X	X	X	X	X
<b>Bdip</b>	X	X	X	X	X	X	X
<b>B<sub>H</sub></b>	X	✓	✓	X	✓	✓	X
<b>B<sub>V</sub></b>	✓	X	X	X	X	X	X
<b>B<sub>Z</sub></b>	X	X	X	✓	✓	✓	✓

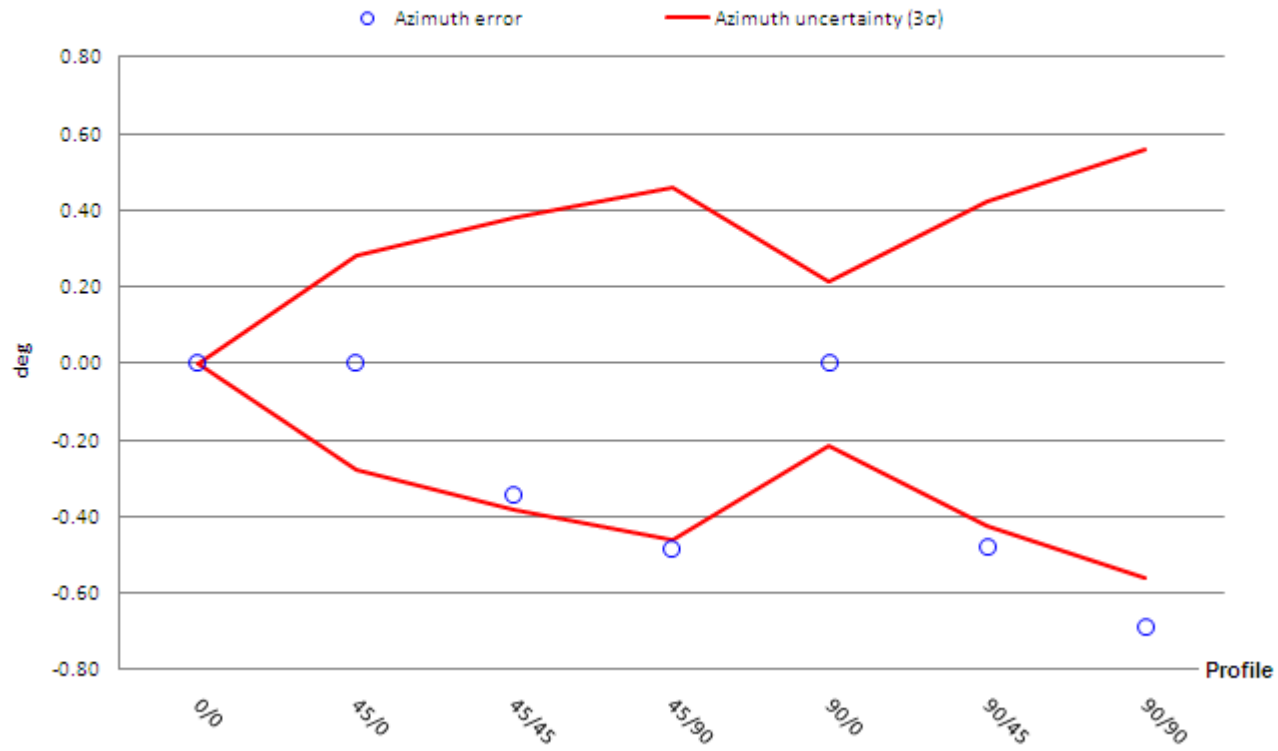




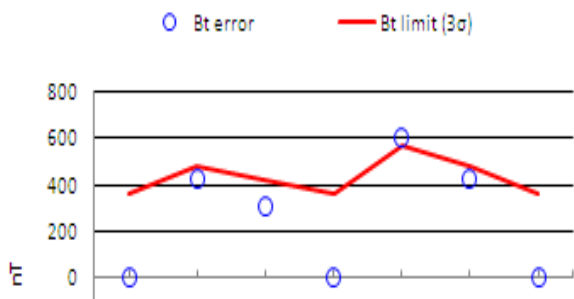
## Example 2:

Btotal 50000 nT  
DIP 0.00Deg  
Bz-bias 600nT

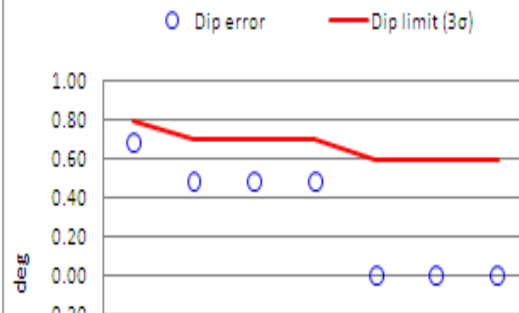
### Azimuth error



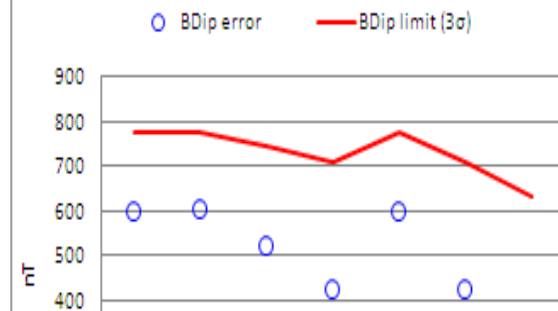
### B-total test



### Dip-test

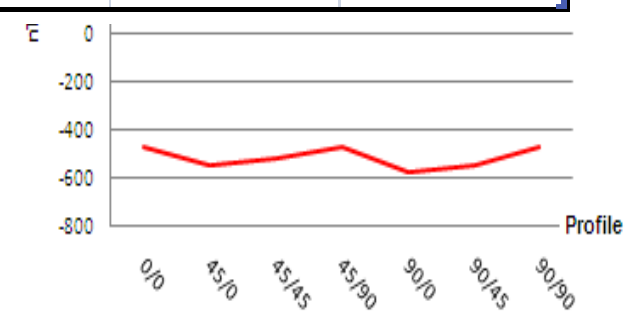
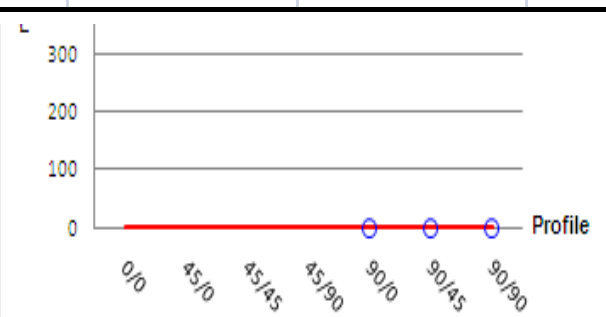
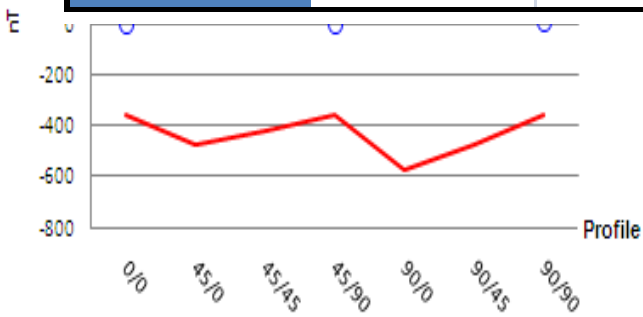


### BDip-test



	0/0	45/0	45/45	45/90	90/0	90/45	90/90
B-total	X	X	X	X	✓	X	X
Dip	X	X	X	X	X	X	X
Bdip	X	X	X	X	X	X	X
B <sub>H</sub>	X	X	X	X	✓	X	X
B <sub>V</sub>	✓	✓	✓	✓	X	X	X
B <sub>Z</sub>	✓	✓	✓	✓	✓	✓	✓

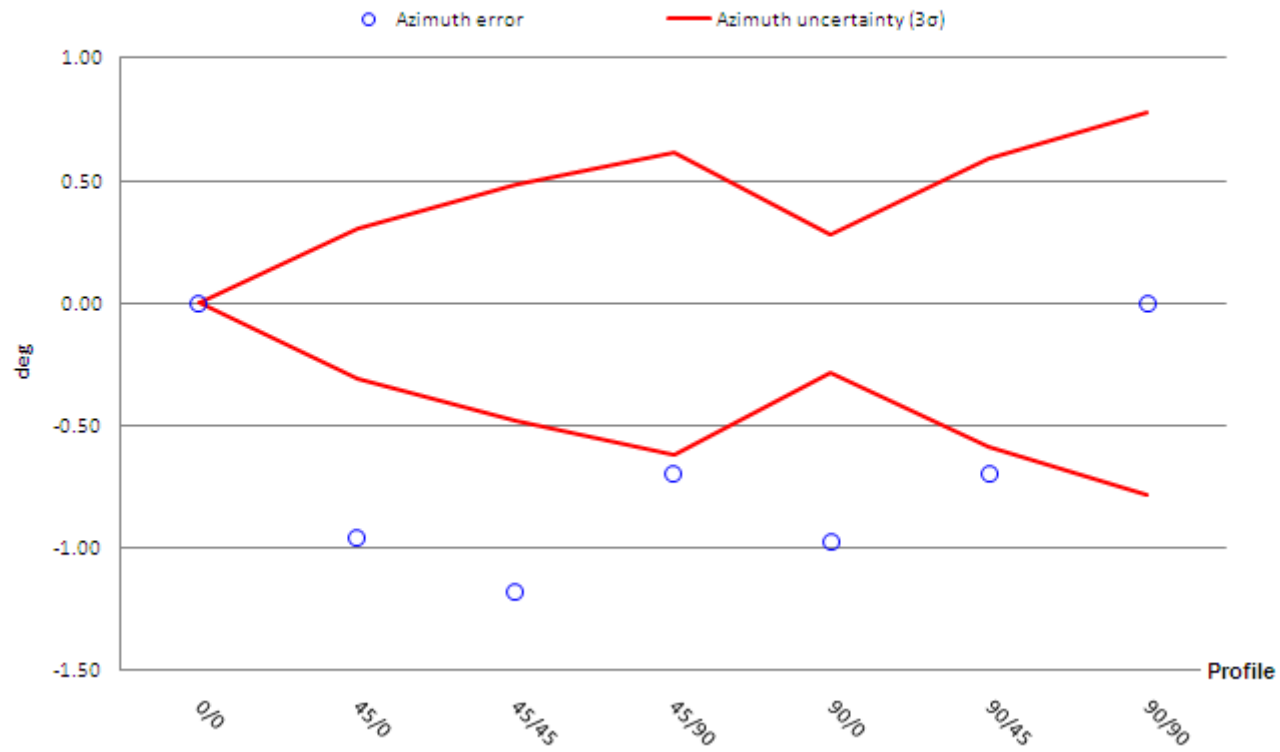
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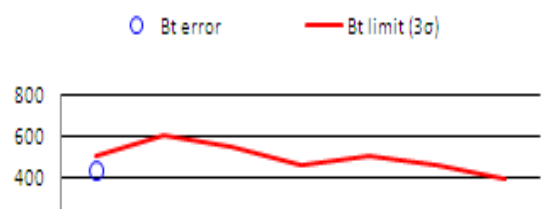
## Example 3:

Btotal 50000 nT  
DIP 45 Deg  
Bxy-bias 600nT

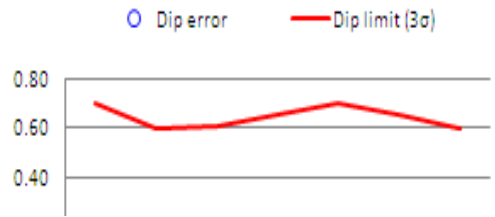
### Azimuth error



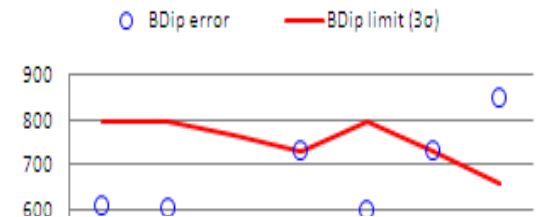
### B-total test



### Dip-test

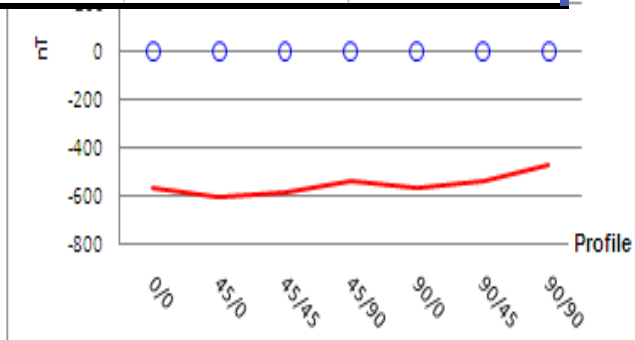
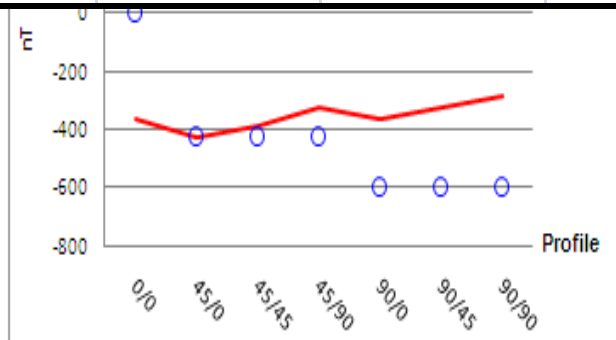
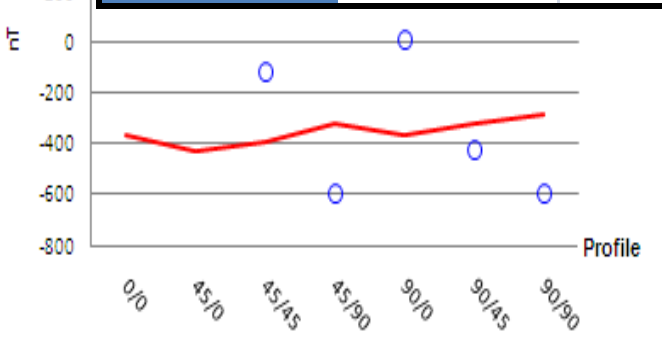


### BDip-test



	0/0	45/0	45/45	45/90	90/0	90/45	90/90
<b>B-total</b>	X	X	X	✓	X	✓	✓
<b>Dip</b>	X	✓	X	X	X	X	X
<b>Bdip</b>	X	X	X	✓	X	✓	✓
<b>B<sub>H</sub></b>	✓	✓	X	✓	X	✓	✓
<b>B<sub>V</sub></b>	X	X	✓	✓	✓	✓	✓
<b>B<sub>Z</sub></b>	X	X	X	X	X	X	X

Profile



# Considerations

- Add the Bz test to the standard set of QC tests for non-axial interference corrected surveys.
- Evaluate the Bh & Bv QC tests
- ISCWSA peer review welcomed

# Proposal for an Alternative MWD Magnetic QC-test

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