

Deadhorse Magnetic Observatory (DED)

SPE WPTS - ISCWSA

March 4, 2011

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DED Observatory



Schlumberger



DEADHORSE GEOMAGNETIC OBSERVATORY, (DED)

Schlumberger Technology Corporation
2525 Gambell St., Anchorage, AK 99503
(907) 659-2434

DED Observatory



Background

- A public-private collaboration established between USGS and Schlumberger in 2009
- Observatory building constructed following USGS design for new Barrow observatory building
- USGS responsibilities: technical guidance; observatory oversight; training; equipment installation; data management and processing

Background

- Schlumberger responsibilities: building construction; most equipment purchases; routine operations; weekly absolute measurements
- Initial operational capability in Mar 2010
- Operated as a USGS observatory following Intermagnet standards

Intermagnet Specifications

- **Vector Magnetometer**

Resolution: 0.1 nT

Dynamic Range: 8000 nT High Latitude
6000 nT Mid/Equatorial Latitude

Band pass: D.C. to 0.1 Hz

Sampling rate: 1 Hz

Thermal stability: 0.25 nT/EC

Long term stability: 5 nT/year

- **Scalar Magnetometer**

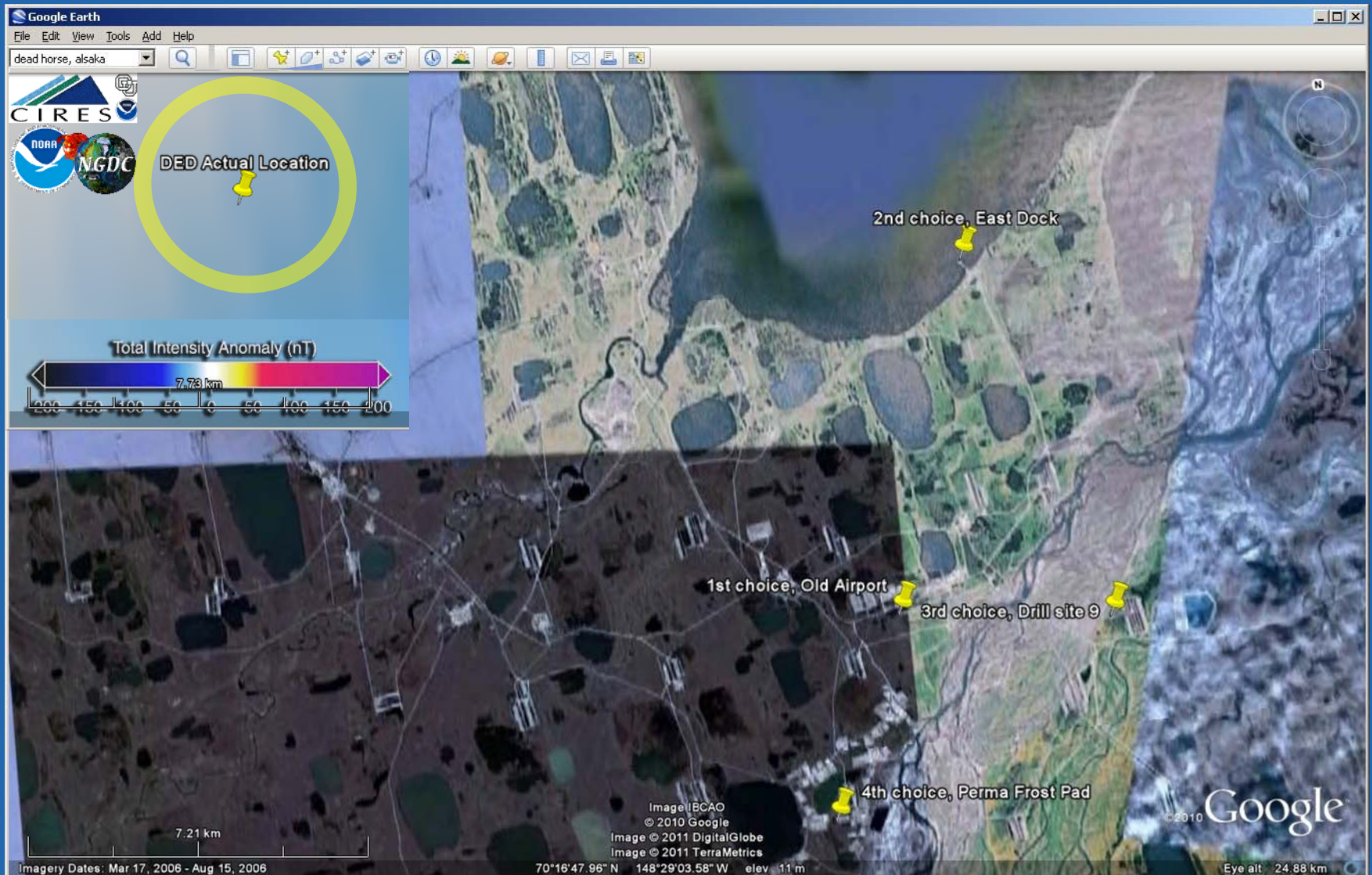
Resolution: 0.1 nT

Sampling Rate: 0.033 Hz (30 sec)

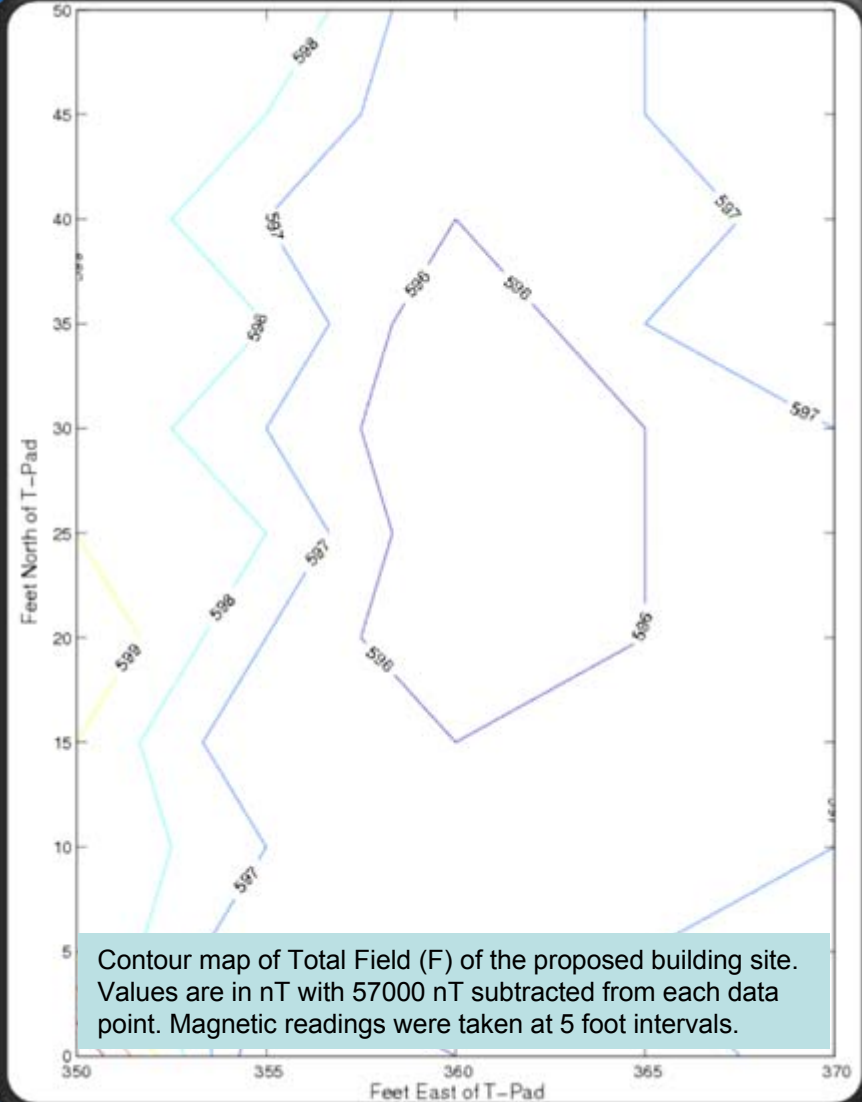
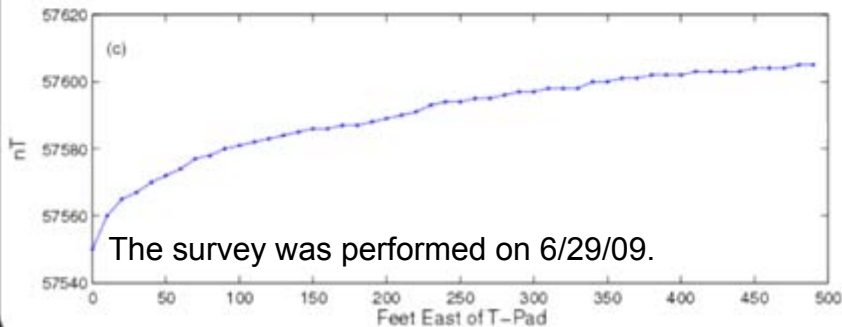
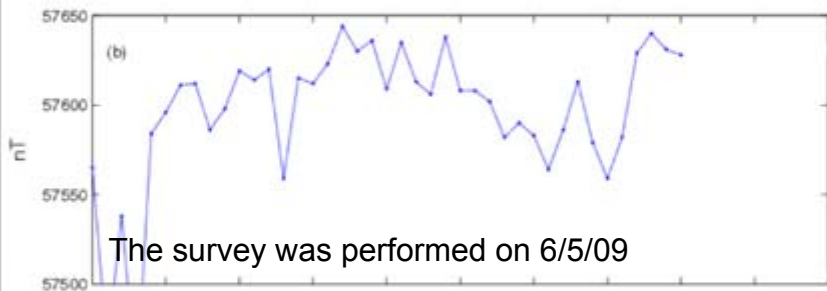
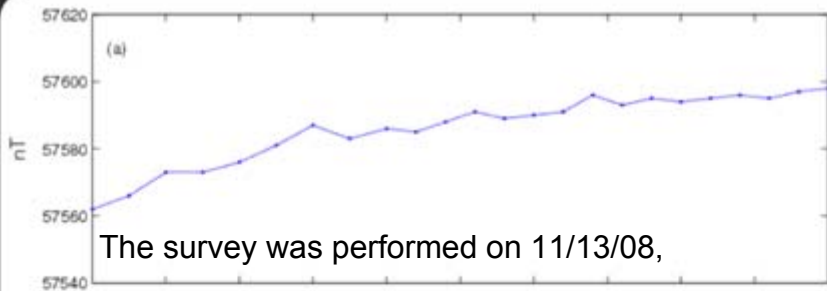
Accuracy: 1 nT



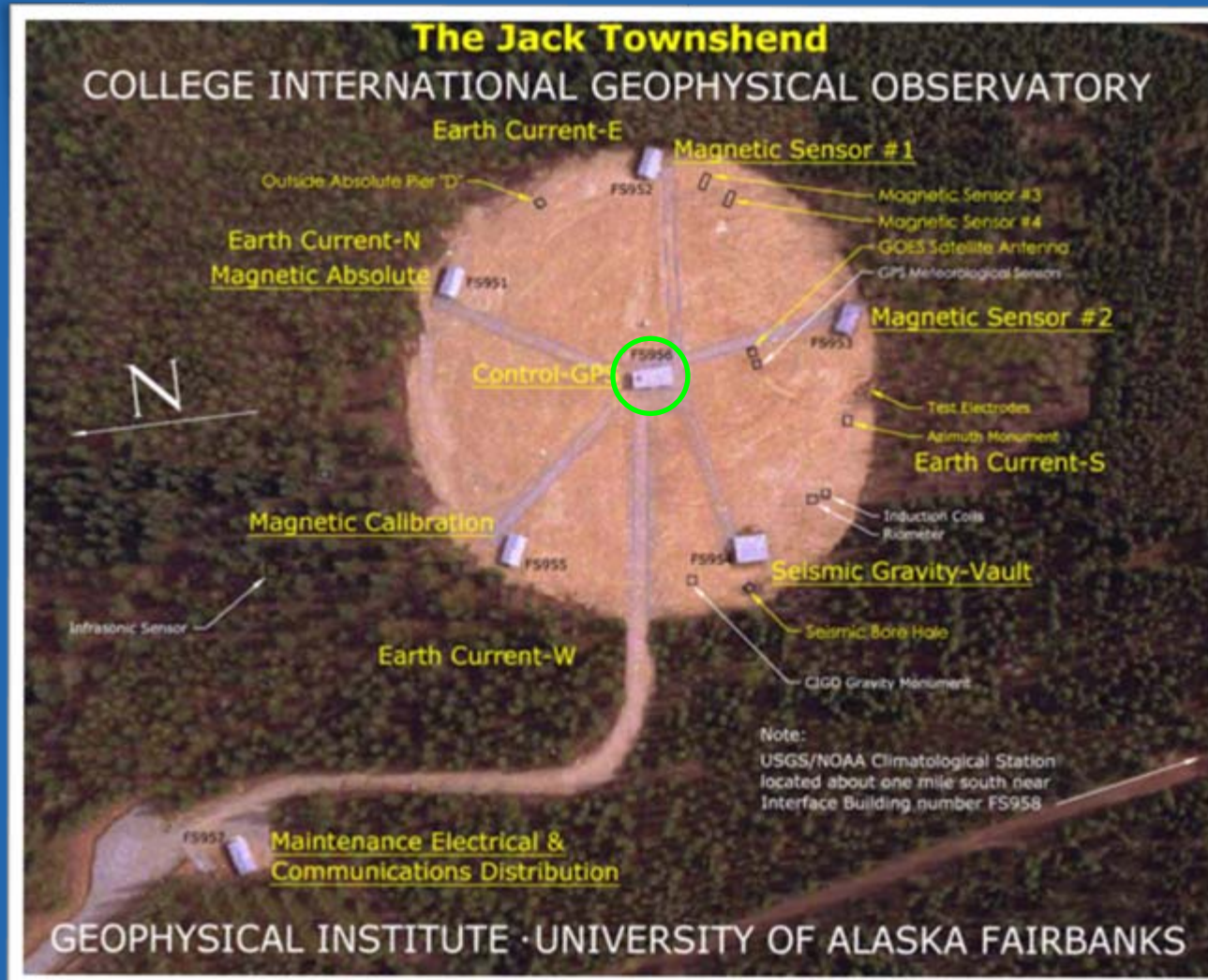
Site Location Options



Site Surveys



CMO Design



Building Characteristics

- Wood frame, non magnetic construction
- Single building is easier to heat, lower cost
- Triple pane, sealed windows with non-refractive glass
- Heated vestibule - heat buffer, place for coats, boots, etc.
- New non-magnetic heaters with low emf noise

Instrument Pier Design



Pier Construction

- Place wood pilings in the winter when the ground is frozen.
- Drill hole 6-7 meters deep
- Emplace pilings in hole with a water-gravel mix
- Pier is encased in a High Density Polyethylene Pipe, filled with concrete



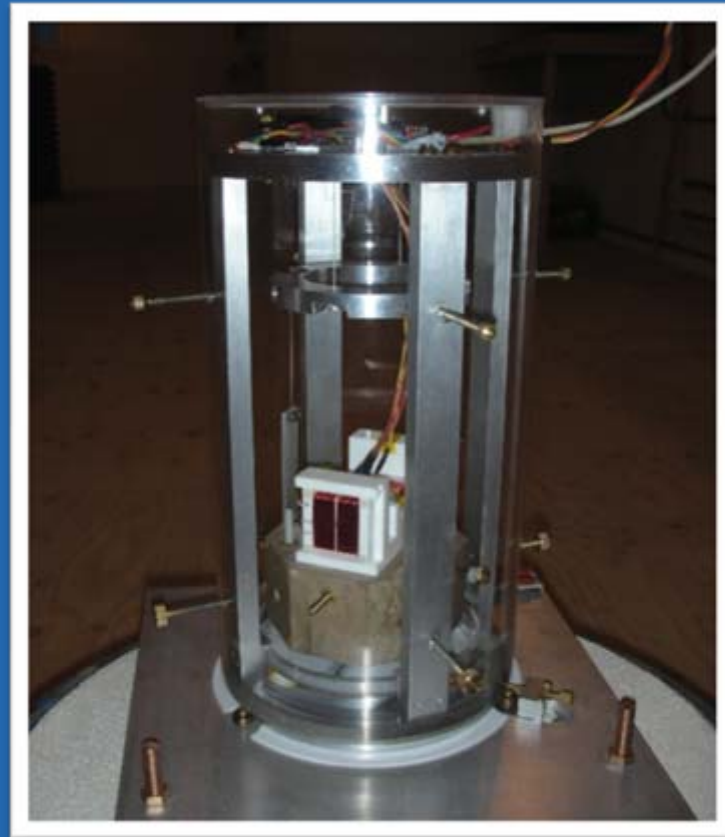
Pier Construction

- Top 15 cm is capped with cement and sand mix.
- Finished pier is insulated and heated for 4 weeks to assist the curing process
- Top surface is sealed with Epoxy

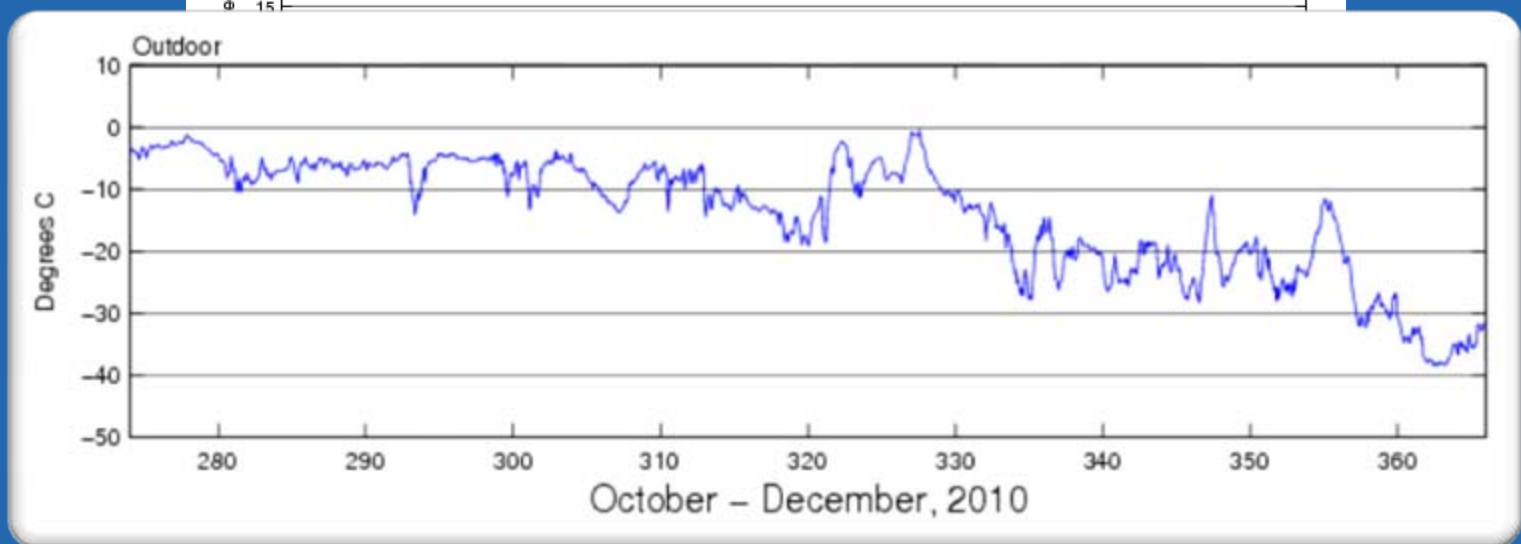
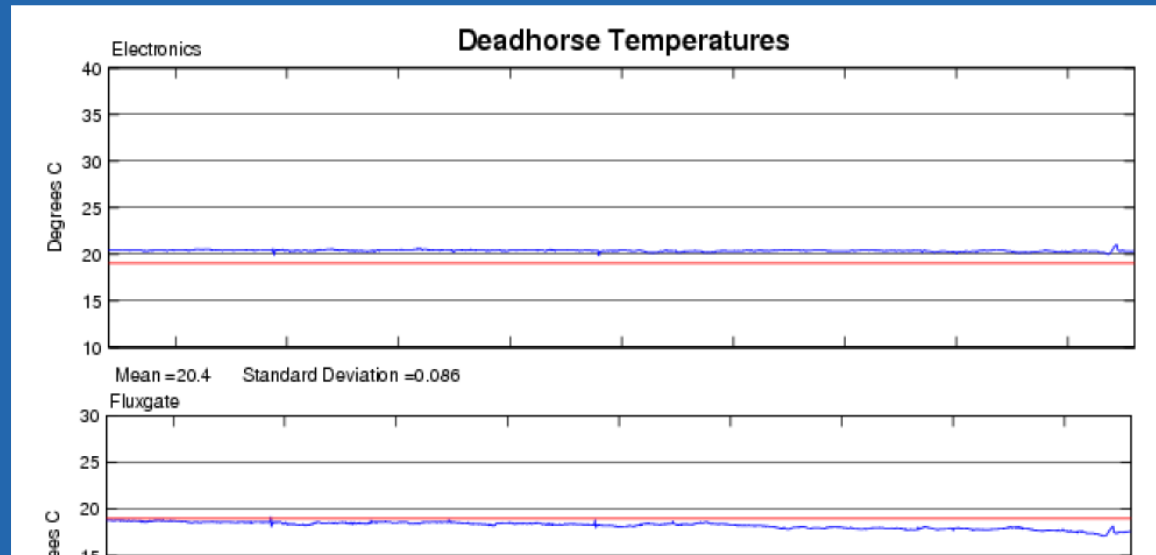


Instrument Mounting

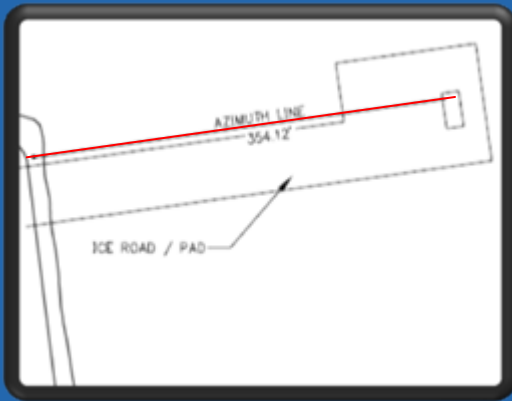
- Fluxgates installed in suspension system



Temperature Control



Absolute Measurement



Absolute Measurement

US Geological Survey

DI - FLUX ABSOLUTE OBSERVATIONS

| | | | | | |
|-----------|-----------|----------|---------|----------|-------|
| Station | Deadhorse | Date | 1-22-11 | YearDay | 11022 |
| Inst. No. | 808381 | Mark | Azimuth | Week Day | Sat |
| Pier No. | Main | Observer | Ed K | Temp. | 19.1 |

| DECLINATION | | | | | |
|-------------|-----------|-----|----|-------------------|--------|
| Set 1 | | | | Magnetic Meridian | |
| | Mark Up | 10 | 23 | 55 | 128 44 |
| | Mark Down | 190 | 23 | 55 | 308 44 |

| | Time | Degrees | Minutes | Seconds |
|-----------|--------|---------|---------|---------|
| West Down | 222940 | 218 | 30 | 8 |
| East Down | 223051 | 39 | 0 | 55 |
| West Up | 223219 | 38 | 53 | 19 |
| East Up | 223431 | 218 | 32 | 24 |

| | | | |
|-----------|-----|----|----|
| Mark Up | 10 | 23 | 48 |
| Mark Down | 190 | 23 | 48 |

| INCLINATION | | | | |
|-------------|--------|---------|---------|---------|
| | Time | Degrees | Minutes | Seconds |
| South Down | 223905 | 261 | 3 | 41 |
| North Up | 224012 | 81 | 3 | 19 |
| South Up | 224152 | 98 | 59 | 44 |
| North Down | 224319 | 279 | 0 | 39 |

30
1
53
32

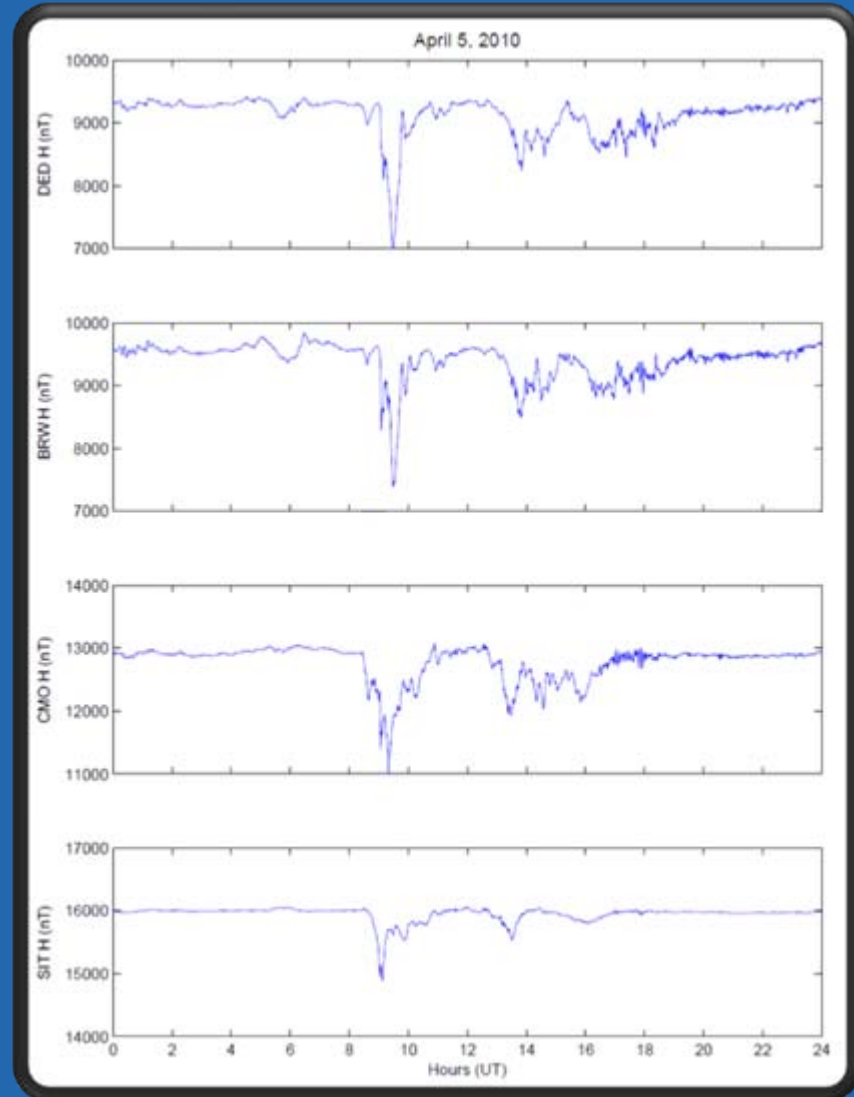
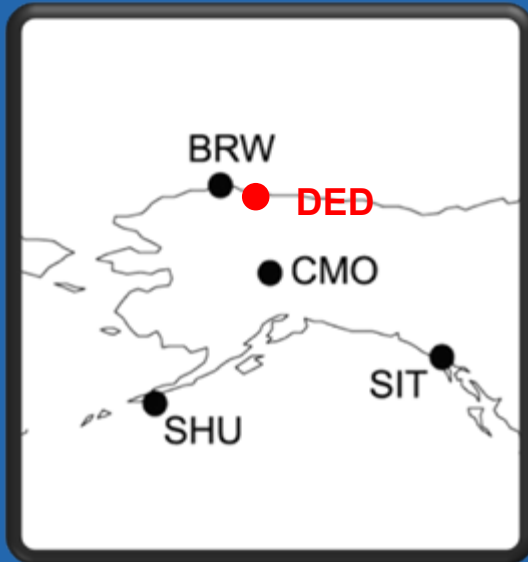
116129

128.15
29

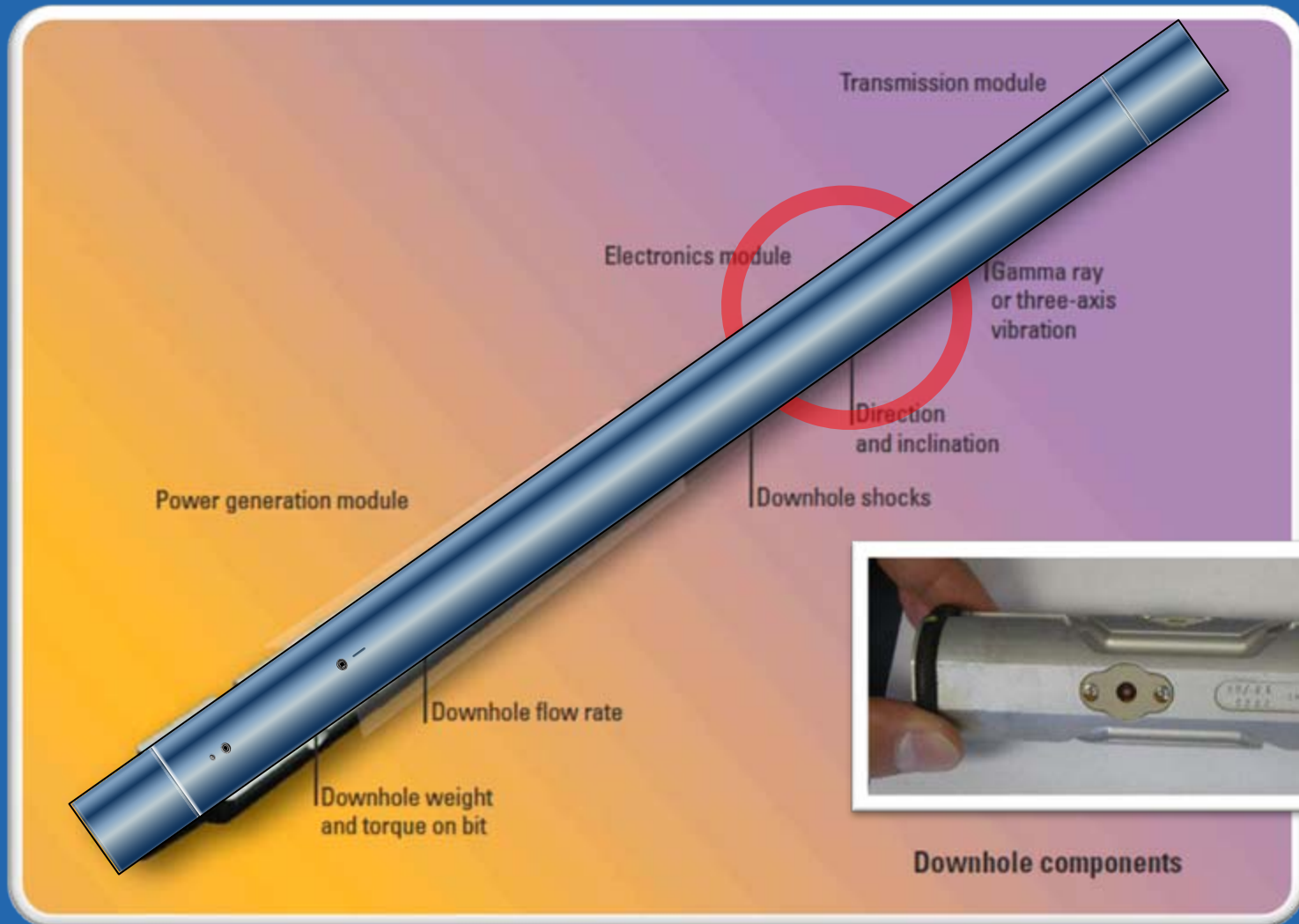
128.44

| Magnetometer Ordinates | |
|------------------------|---|
| Mean Value | |
| | H |
| | D |
| | Z |
| | F |

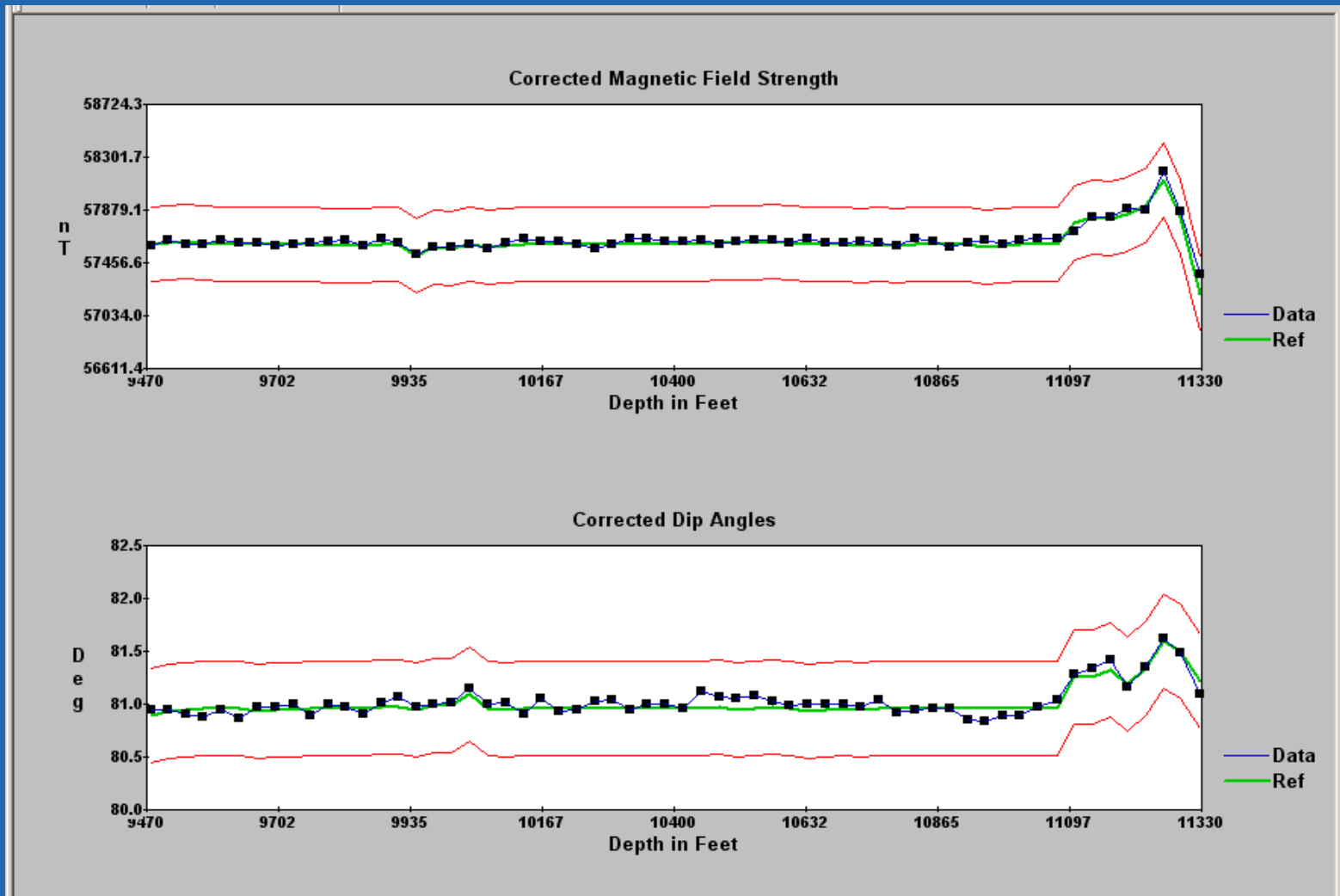
QC/QA Performance



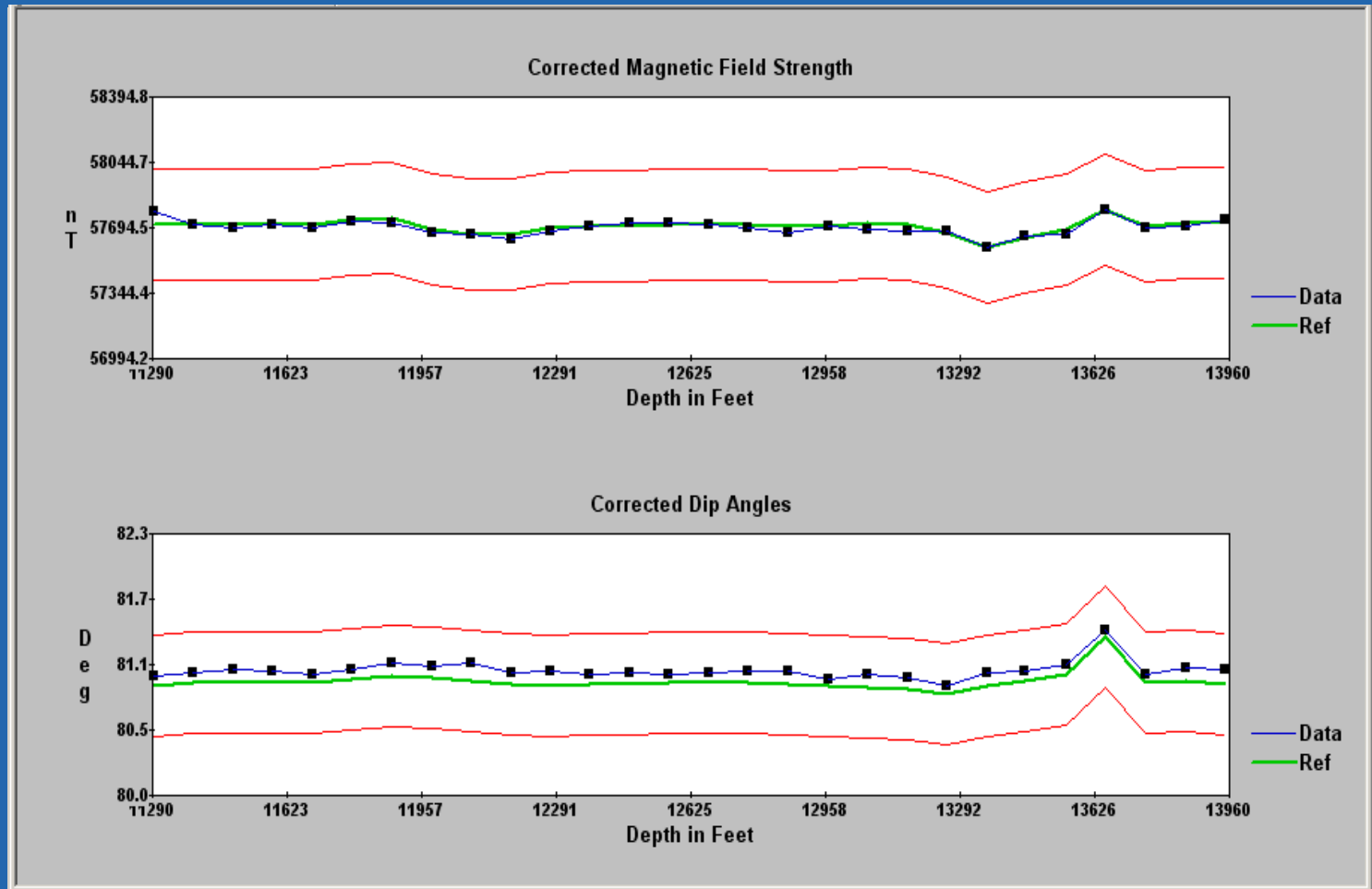
Measurement While Drilling



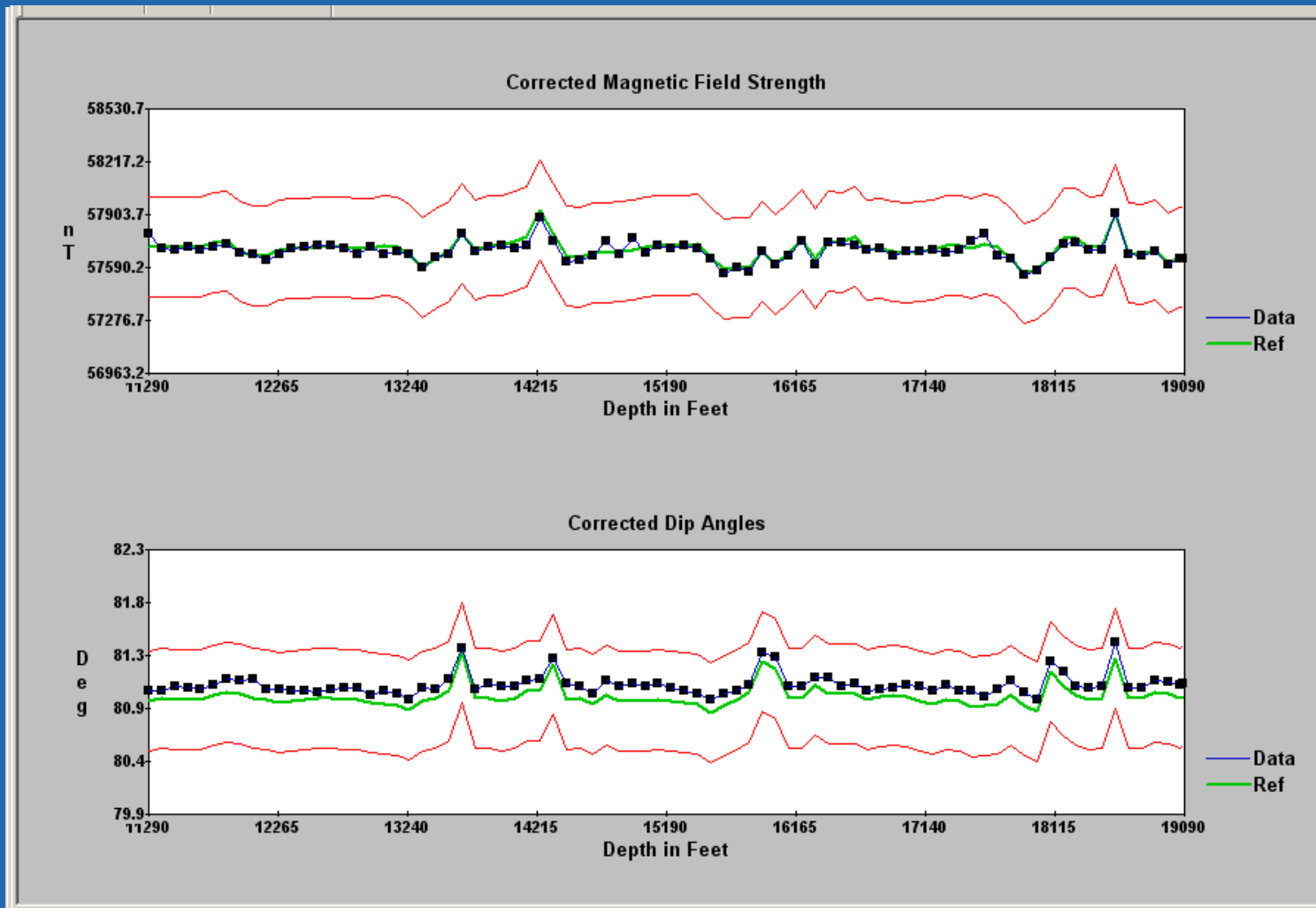
DED vs MWD Readings



DED vs MWD Readings




DED vs MWD Readings



Benefits to Scientific Community

- Auroral zone magnetic activity
- Space physics research
- Main field studies (geodynamo)
- Magnetic field mapping
- Accelerated development of adjusted data in real-time for all USGS observatories
- This will lead to higher-accuracy data available in real-time to all USGS magnetic observatory customers

Conclusions

- Data is publicly available from the USGS
- Requests for real-time data should be sent to geomagdata@usgs.gov 
- Intermagnet application will be submitted after one year of stable baselines
- Higher-accuracy data available in real-time for Geomagnetic Referencing applications in oilfield drilling

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