Deadhorse Magnetic Observatory (DED)

SPE WPTS - ISCWSA

March 4, 2011

Benny Poedjono, Schlumberger
Carol A.K. Finn, USGS
Bill Worthington, USGS

USGS science for a changing world

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Schlumberger

DED Observatory

Schlumberger

USGS
science for a changing world

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

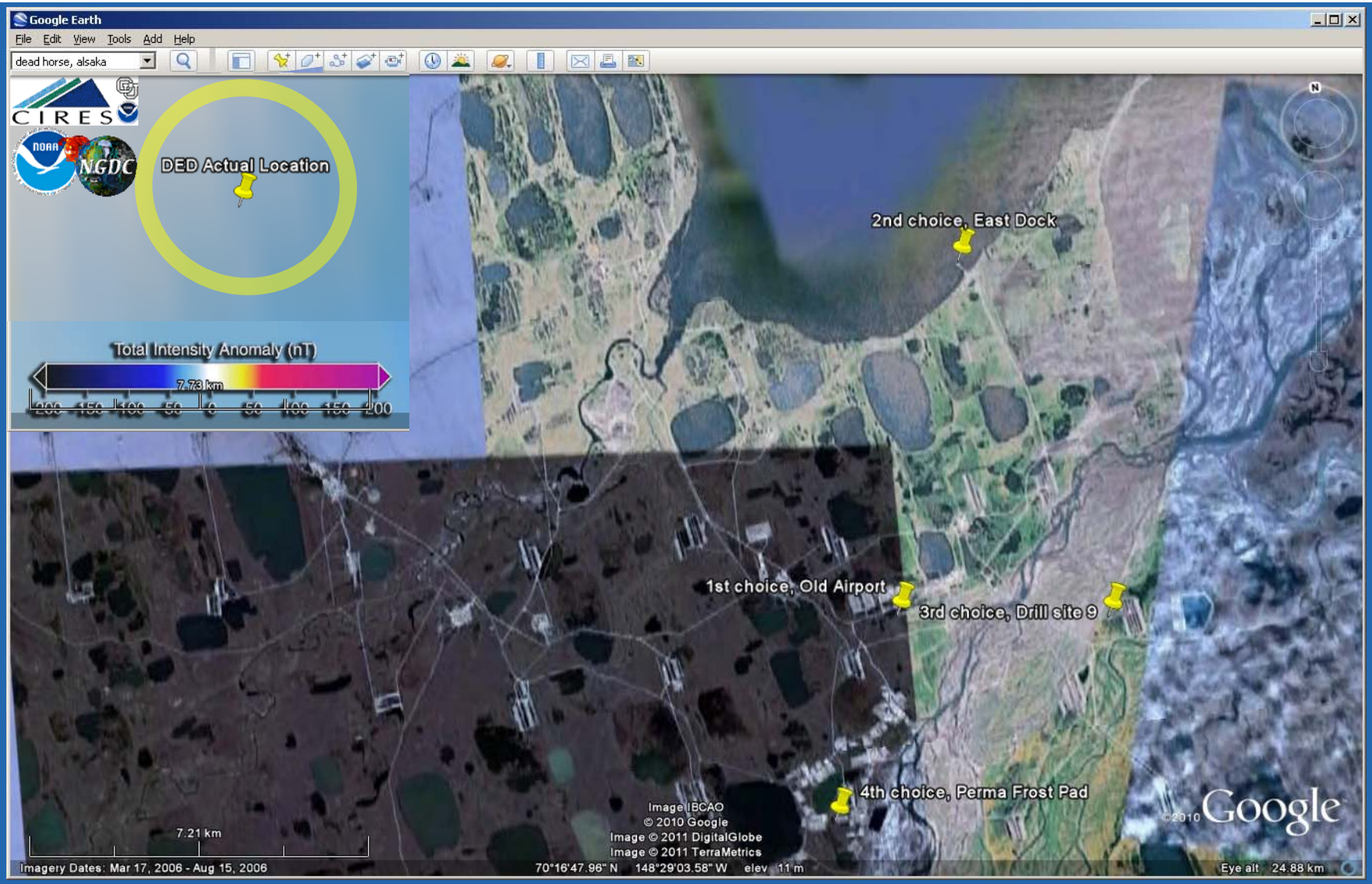
- **Vector Magnetometer**

  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

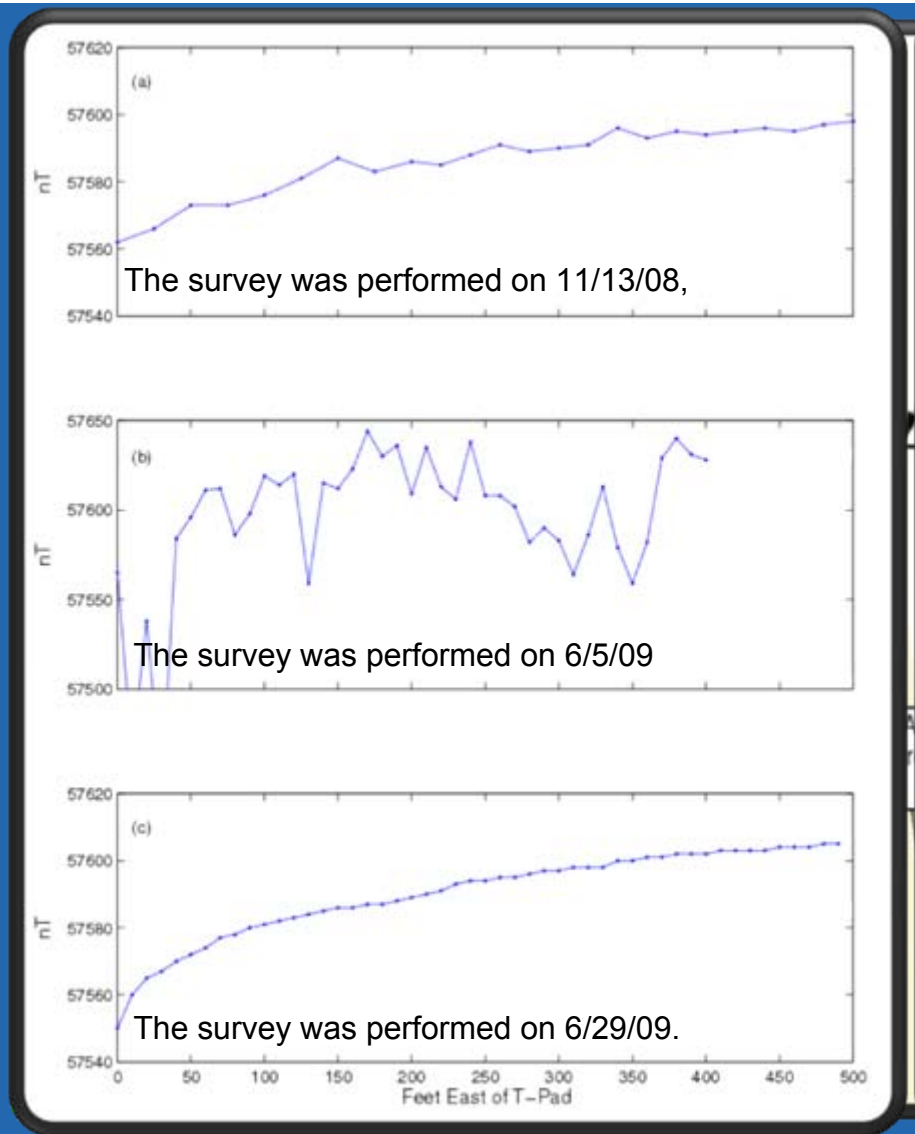
- **Scalar Magnetometer**

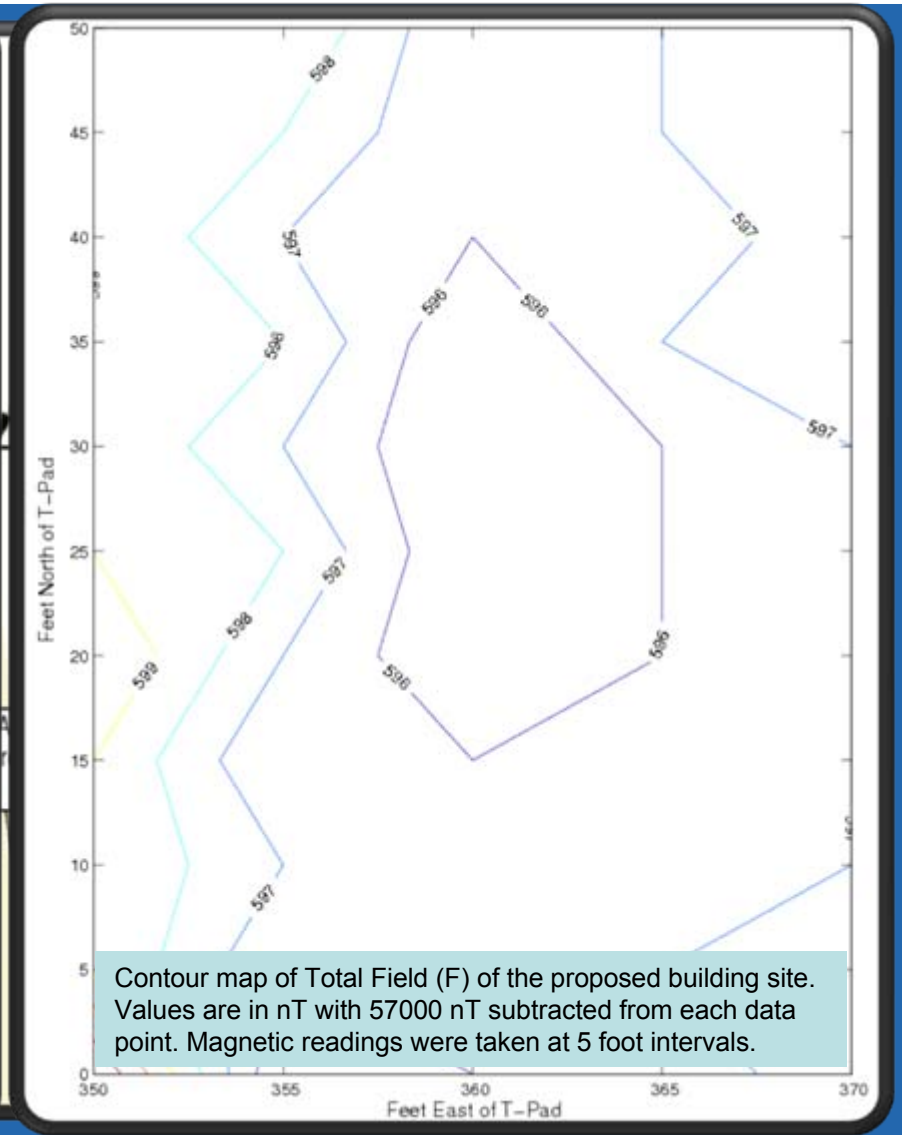
  Resolution: 0.1 nT
  Sampling Rate: 0.033 Hz (30 sec)
  Accuracy: 1 nT

Site Location Options

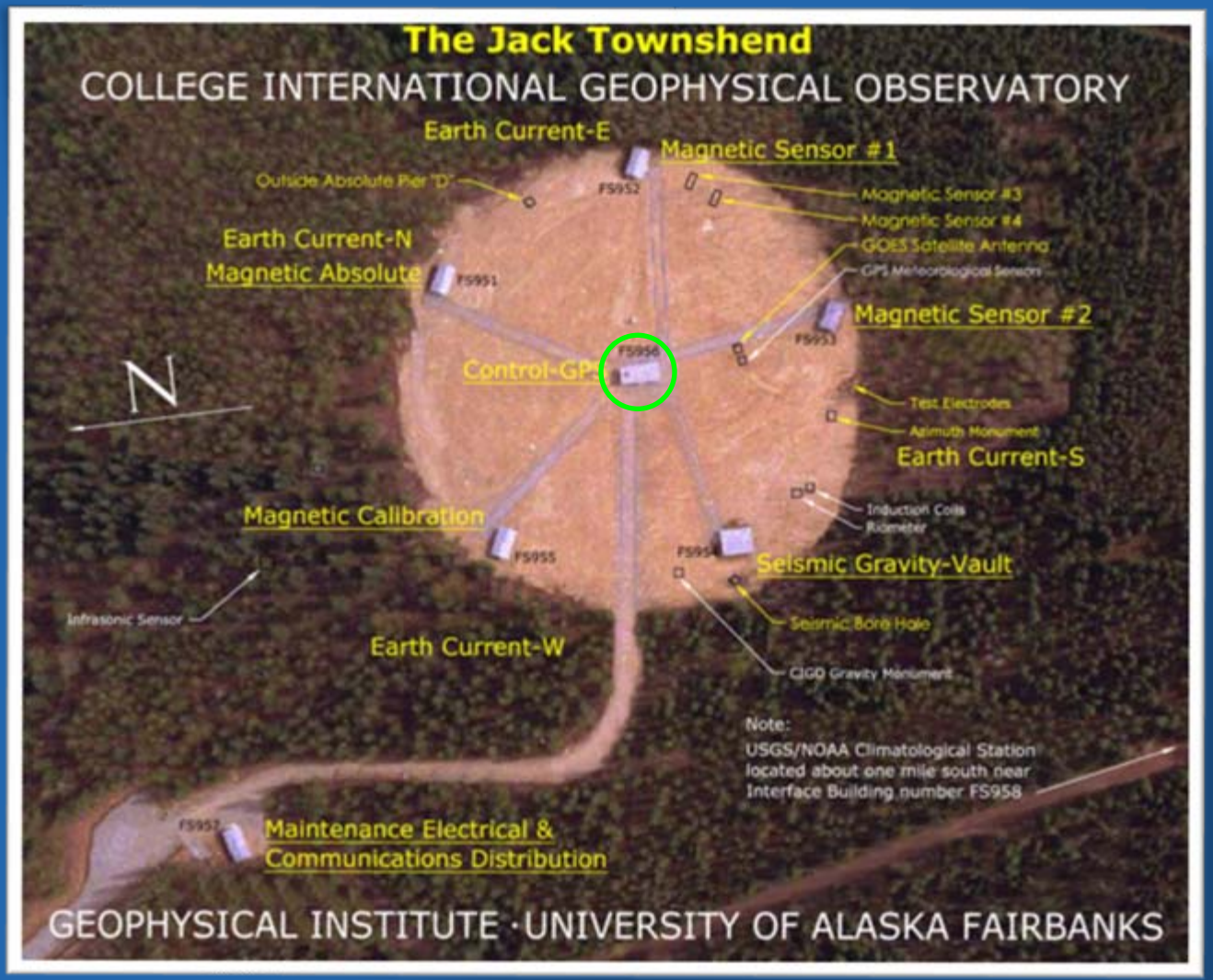


Site Surveys

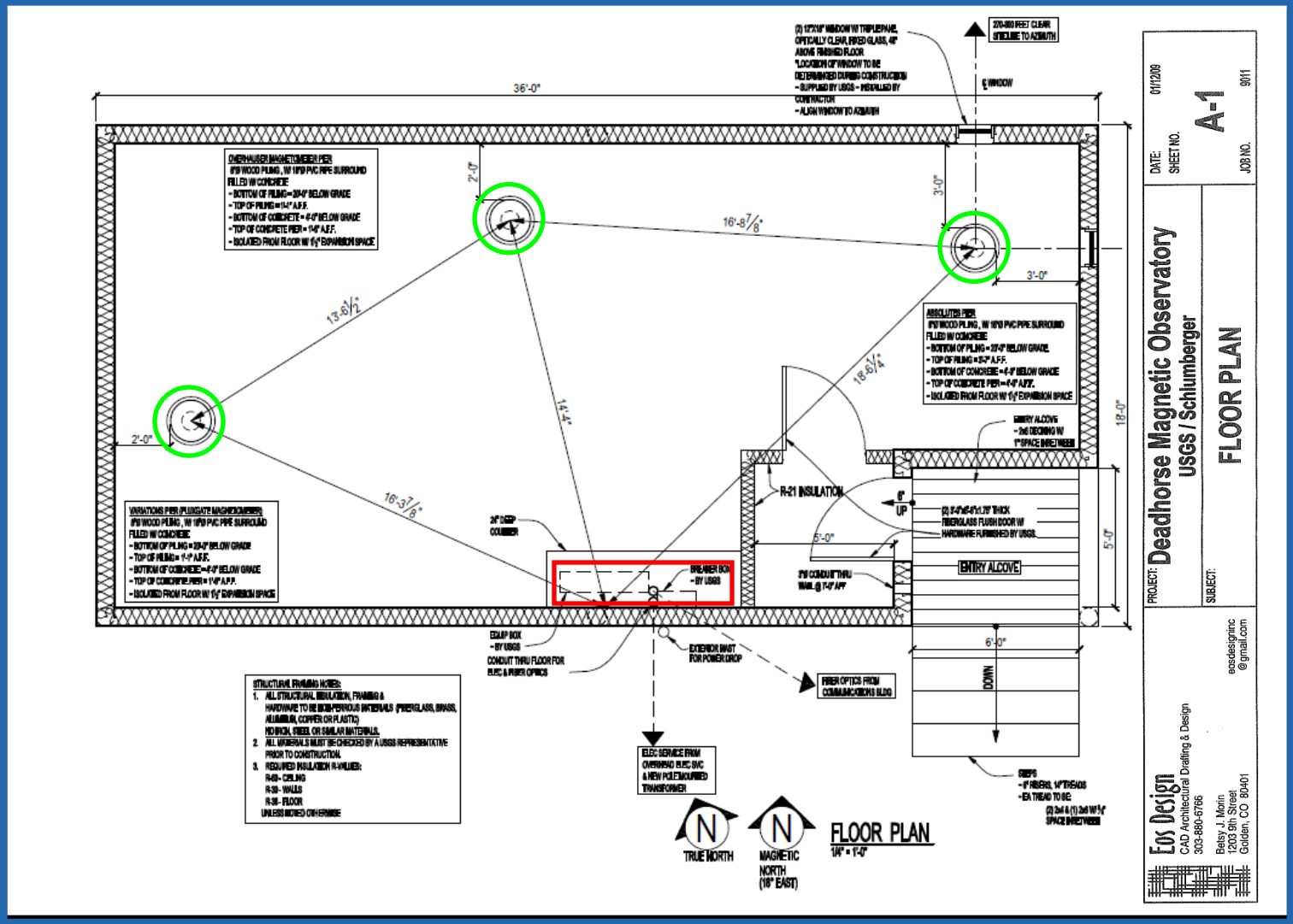




CMO Design


The Jack Townshend
COLLEGE INTERNATIONAL GEOPHYSICAL OBSERVATORY
Earth Current-E
Magnetic Sensor #1
Outside Absolute Pier "D"
FS952
Magnetic Sensor #3
Magnetic Sensor #4
GOES Satellite Antenna
GPS Meteorological Sensors
Earth Current-N
Magnetic Absolute
FS951
Magnetic Sensor #2
FS953
FS956
Control-GPS
N
Test Electrodes
Azimuth Monument
Earth Current-S
Magnetic Calibration
Induction Coils
Rotameter
FS955
FS954
Seismic Gravity-Vault
Infrasonic Sensor
Seismic Bore Hole
Earth Current-W
CIGO Gravity Monument
Note:
USGS/NOAA Climatological Station
located about one mile south near
Interface Building number FS958
FS957
Maintenance Electrical &
Communications Distribution
GEOPHYSICAL INSTITUTE · UNIVERSITY OF ALASKA FAIRBANKS

Standardization 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

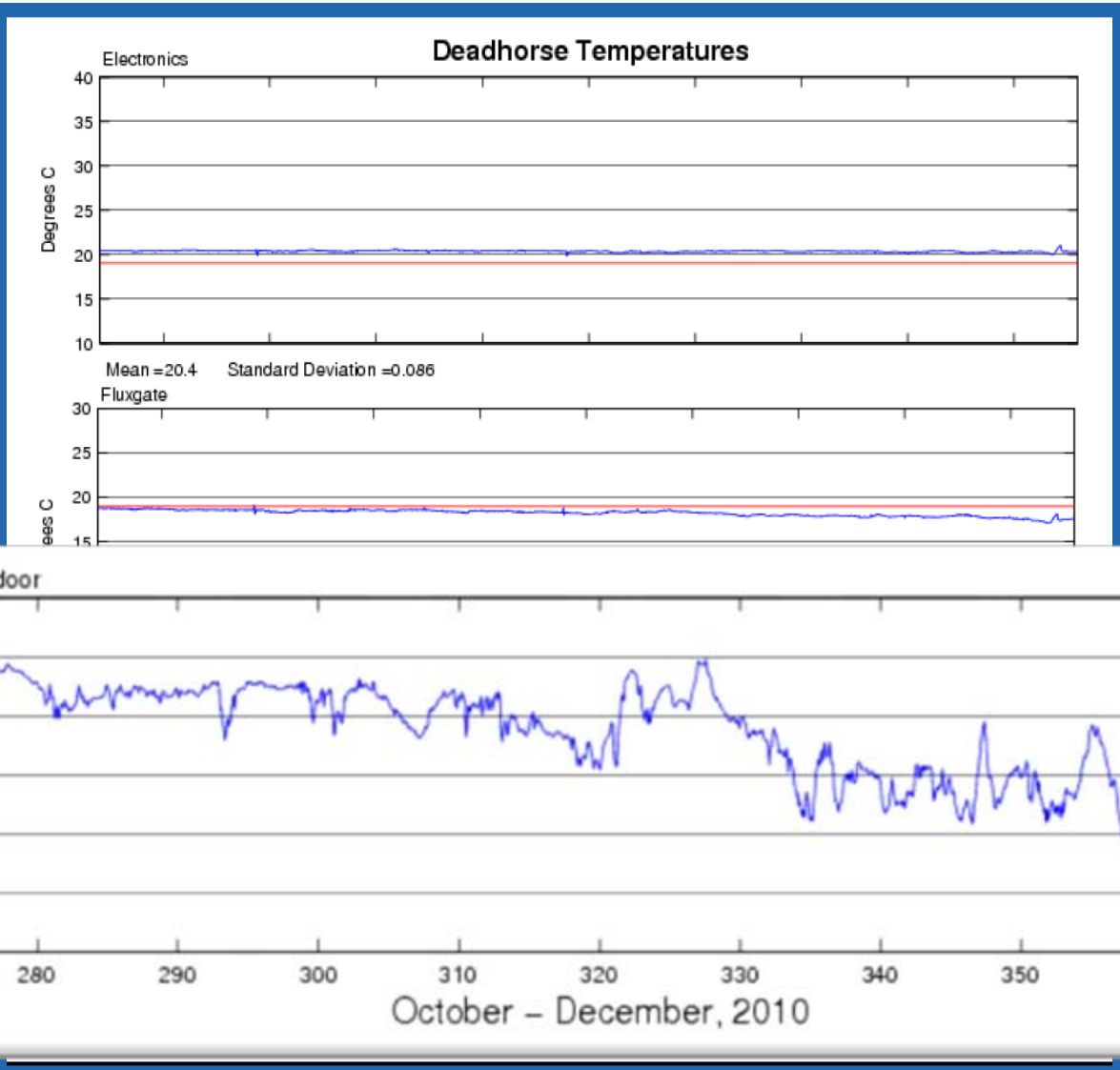
Pier Construction

- 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

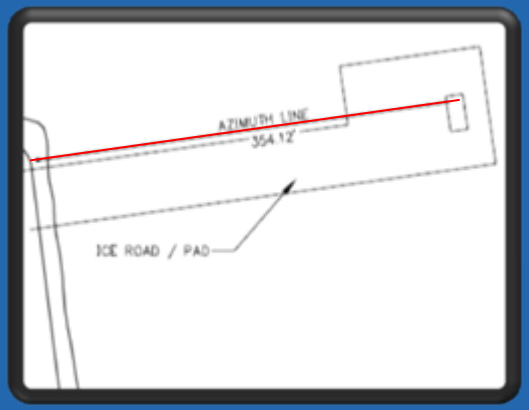
Instrument Mounting

- Fluxgates installed in suspension system

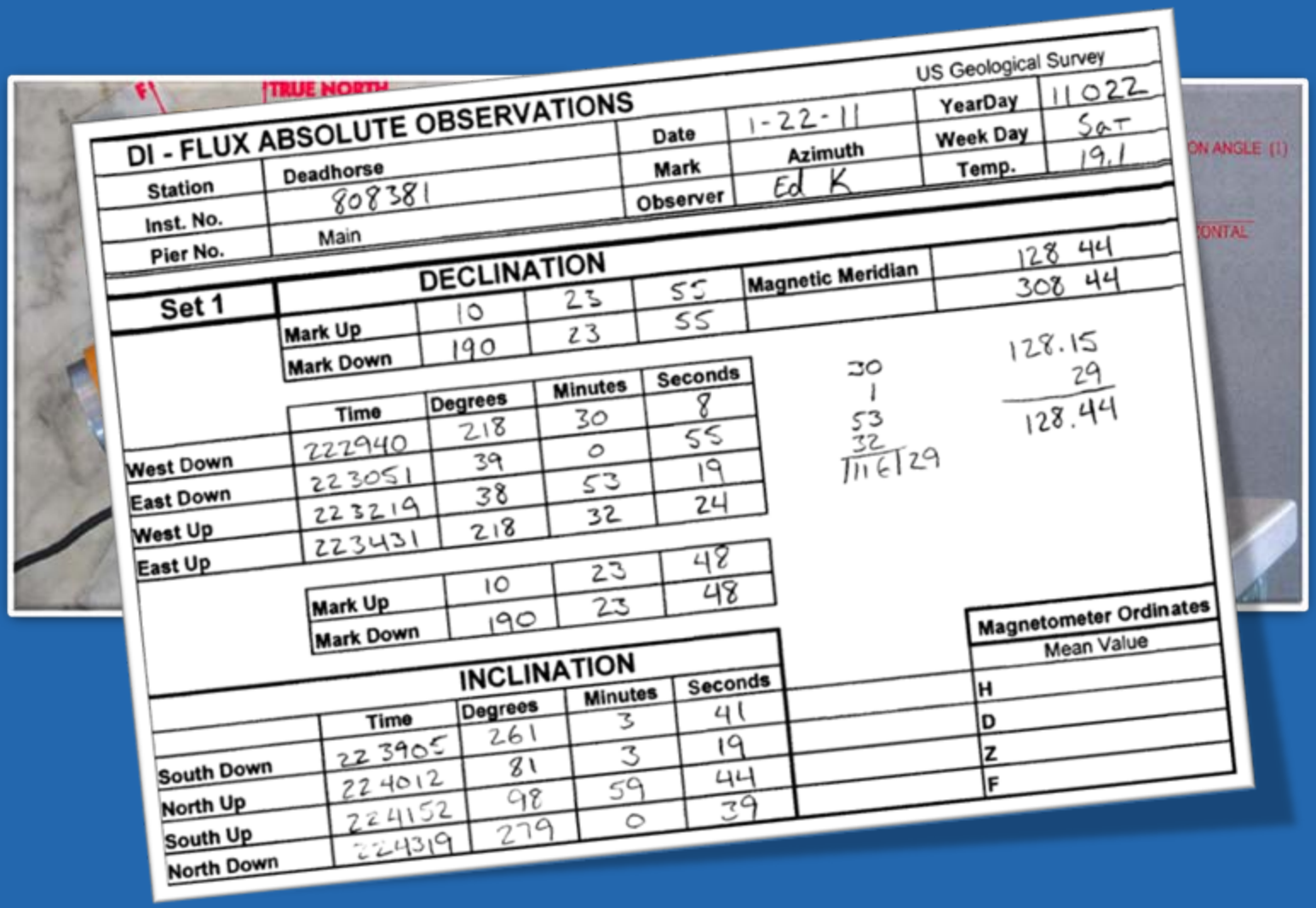
Temperature Control



Absolute Measurement



Absolute Measurement



DI - FLUX ABSOLUTE OBSERVATIONS

US Geological Survey

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

Set 1

DECLINATION

				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

30
1
53
32
116 29

128.15
29
128.44

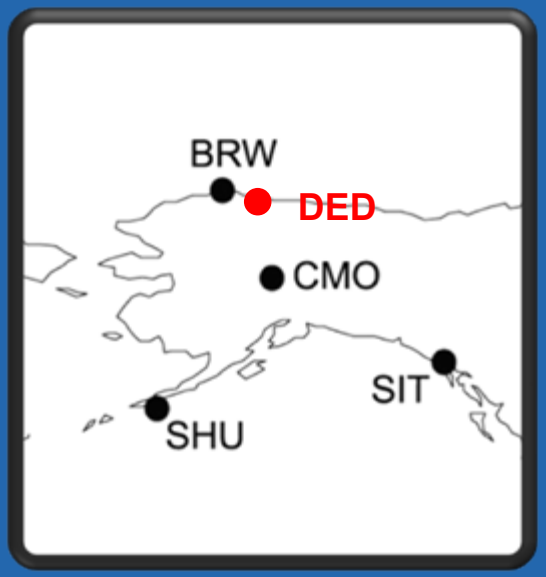
Mark Up	10	23	48
Mark Down	190	23	48

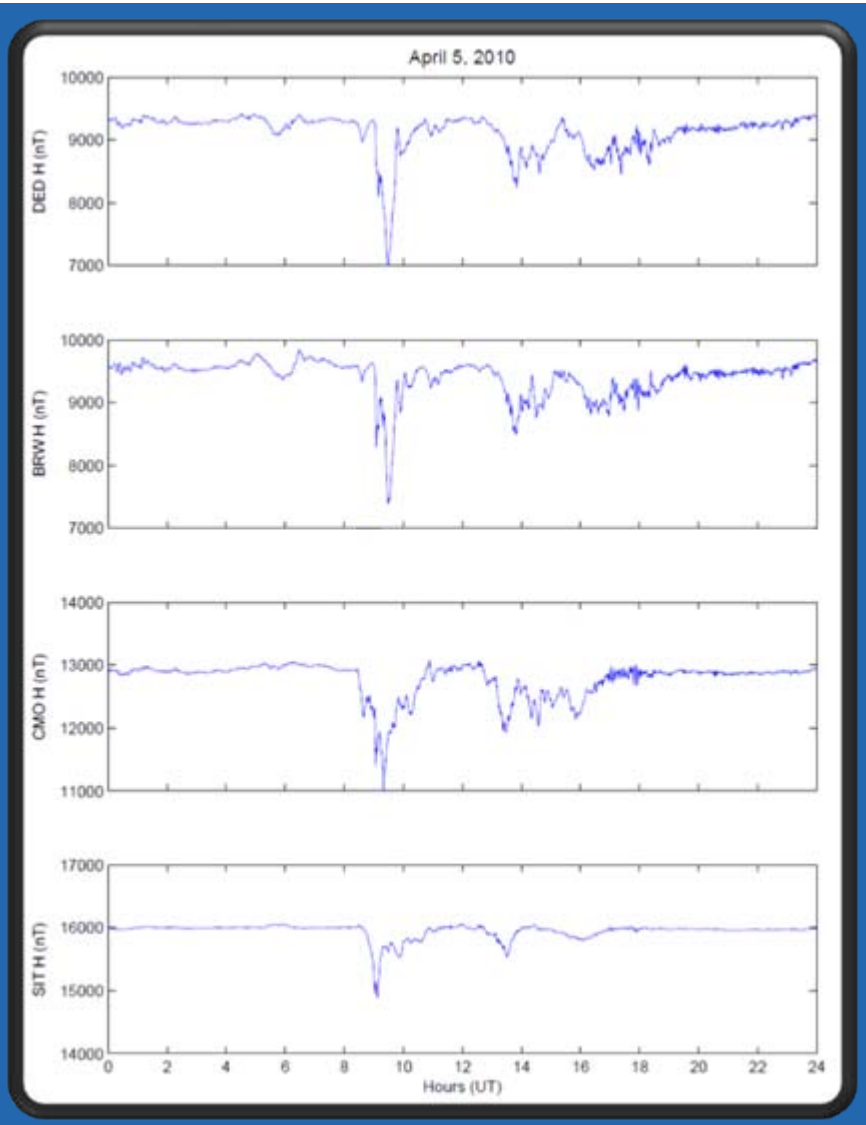
INCLINATION

	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

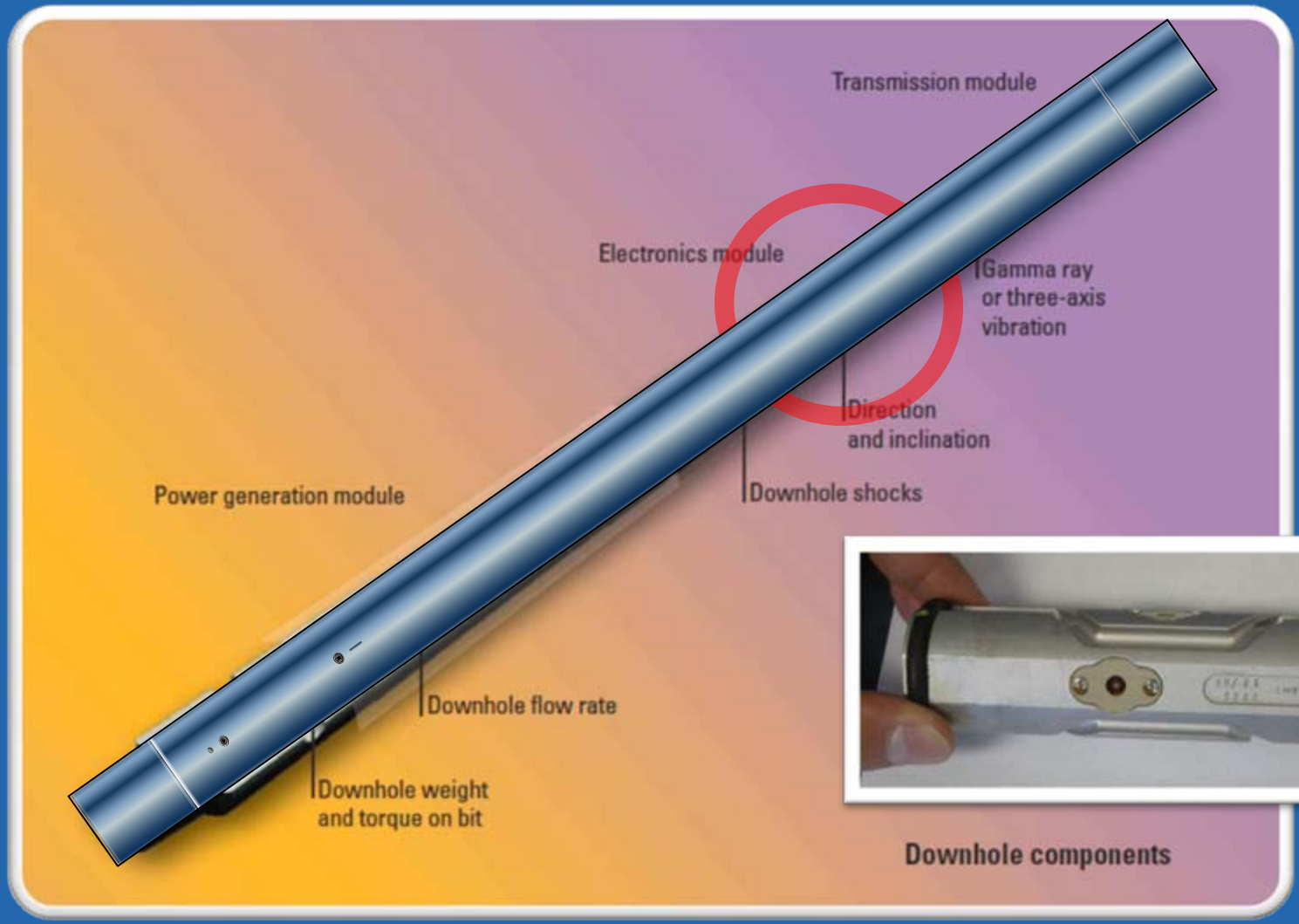
Magnetometer Ordinates	
	Mean Value
H	
D	
Z	
F	

QC/QA Performance

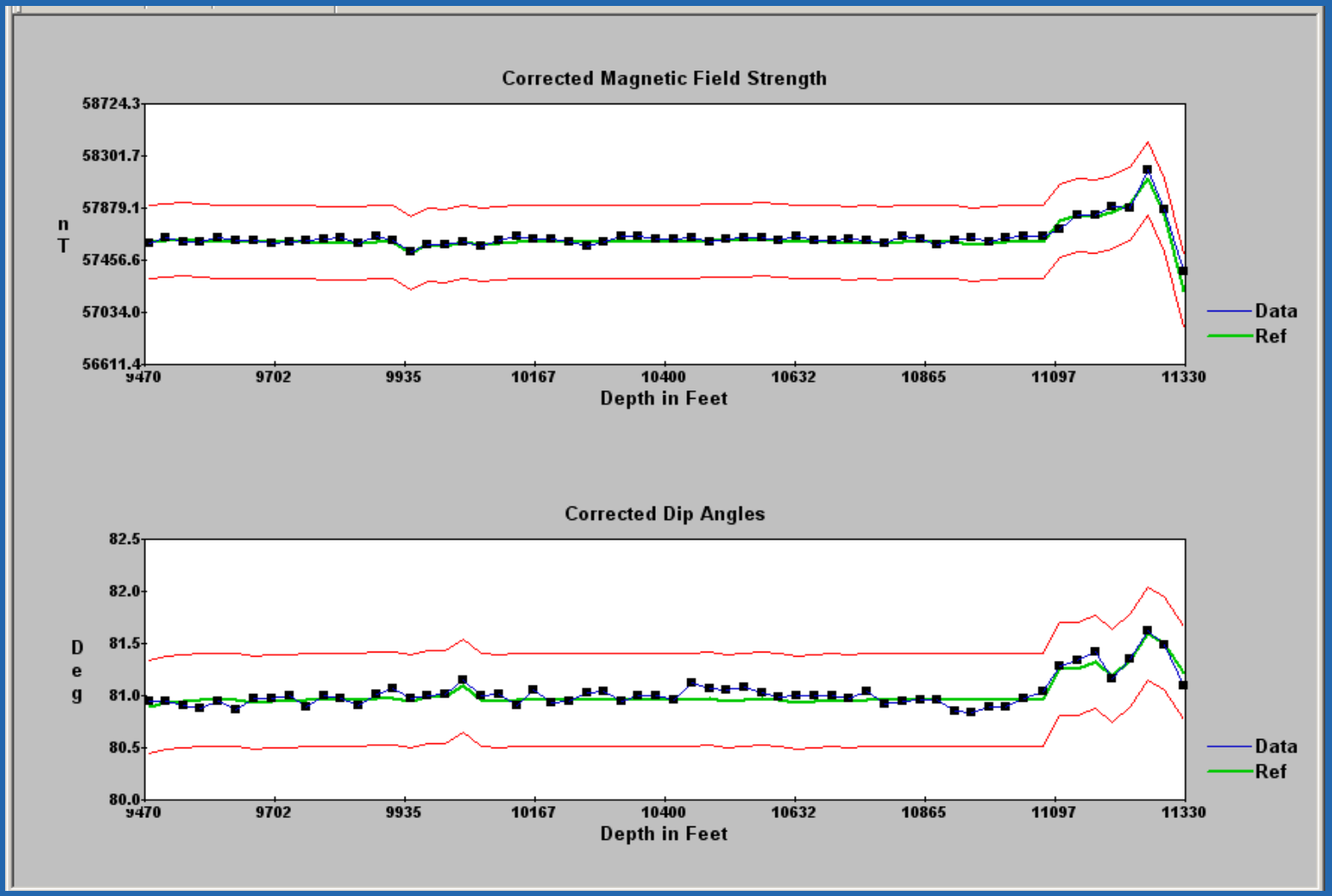




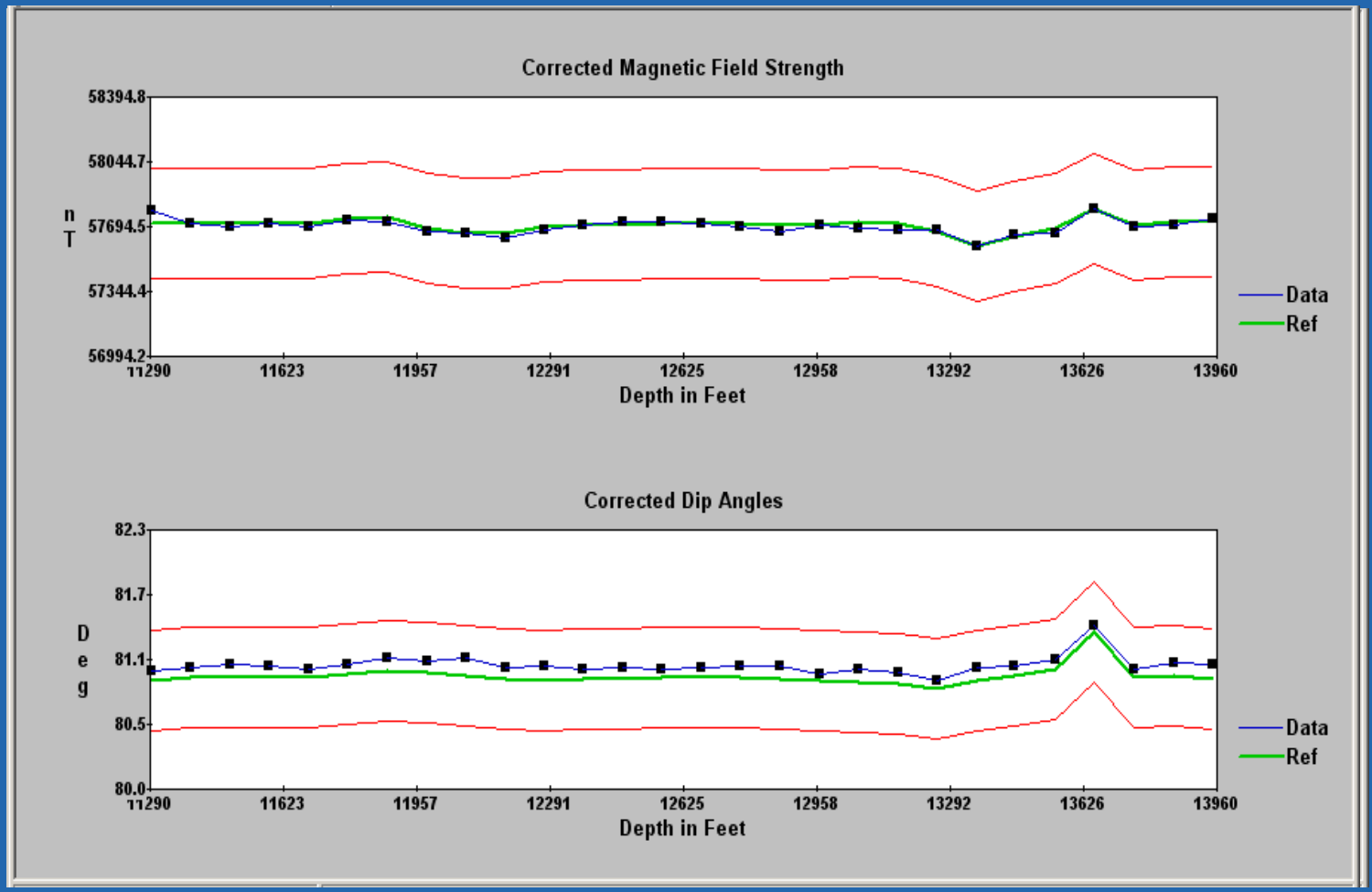
Measurement While Drilling



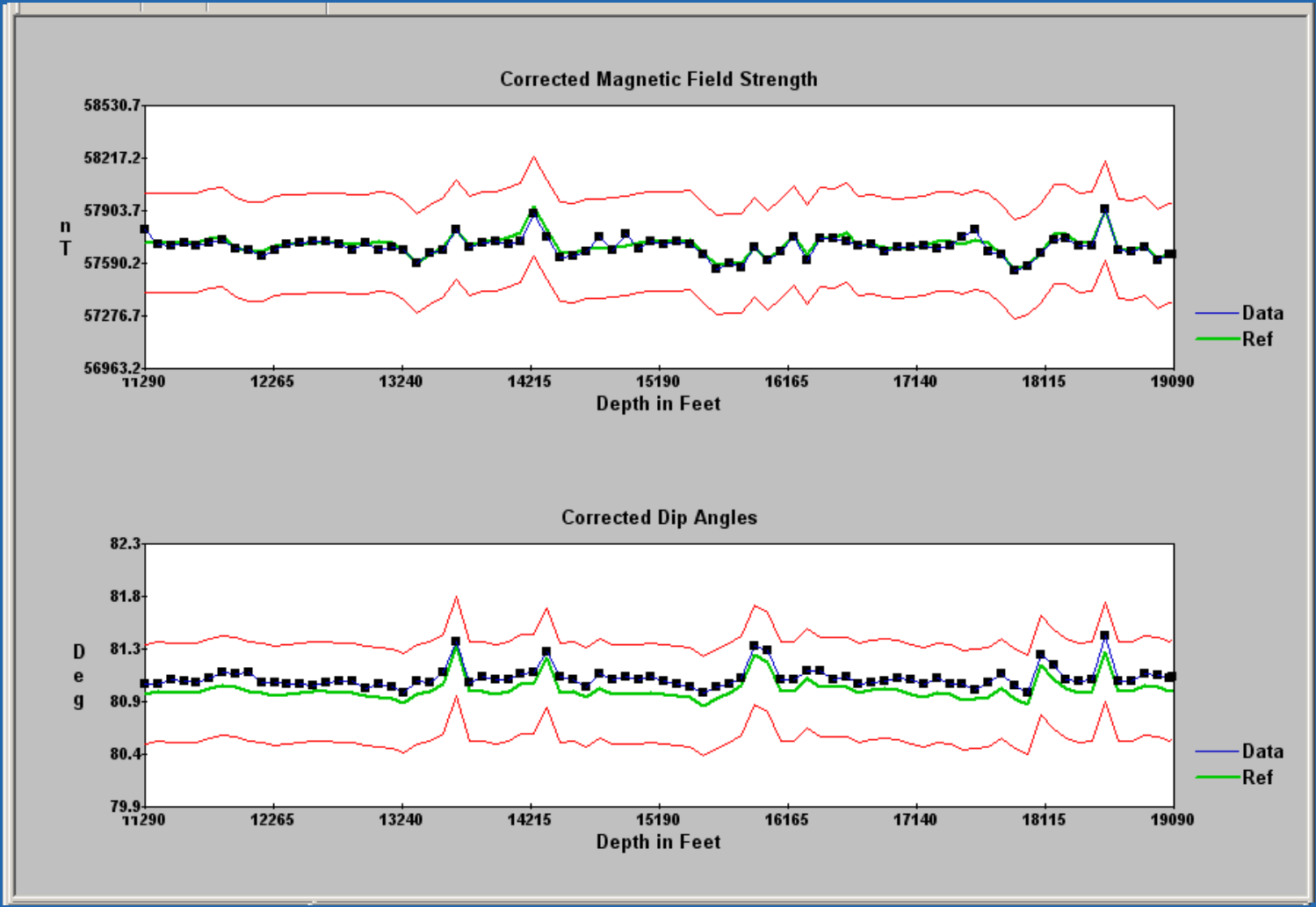
DED vs MWD Readings



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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