GL01281

June 25, 1985

MEMORANDUM

TO: Mike

FROM: Duncan D.F.

RE: Hazards meeting in Logan

The following comments are taken from my notes of the meeting. Temp also took notes, and has the attendance list. I talked about the UURI programs, and gave a brief synopsis of Kim McCarter's work this year. I did not talk about UUGG. Frank Brown said no one would be at the meeting, and I did not find Bill Nash to compile material. Merrill Ridd talked about CRSC and Geography Department efforts. He and I were the only two UU representatives at the meeting.

USU

Several major philosophical points became clear during the meeting. These were expounded by various USU speakers as:

Bruce Bishop stressed the need to not duplicate activities or set up a competitive organization to what is going on. He sees the need for better formal and informal

coordination.

They are planning to establish a natural resources and environmental hazards center in policy analysis. This would look at the policy side of such issues as pumping the Great Salt Lake (which has had no policy studies).

USU is set up for cooperative research with both private and public sector organizations. The geotechnical group presently is working with Dames and Moore (Jeff Keaton, who is also and adjunct professor at USU), CH2M Hill, and BYU. They say that the possibilities for cooperative research have been in place. They are willing to share data they have, such as digitized quadrangles, soils data, air photos, etc.

The list I gave you summarizes their overall projects. In a bit more detail on some:

Forest Science

USU is working at INEL on wind and water erosion, specifically in regards to the integrity of low-level wastes. Next year they will be looking at nutirent cycles at INEL.

They are working on slope failure of spoil heaps and phosphate run-off in phosphate mining in Idaho.

They have projects in acid rain, working on changes in hydrologic pathways, and developing a model to simulate weathering in high mountain terrains.

The group is also developing a video disk for training

forest fire fighters, and working with the interagency fire group in Boise to study the effects of wildfires on urban and suburban areas (e.g. Cedar City).

Another area of research is in what to do with the pine bark beetle, since the traditional methods for dealing with it do not exist in a depressed lumber market.

Sociological studies include the impacts of natural hazards on the perceptions of land and tourism. Does nuclear waste make a site less attractive? Work for the Park Service is showing that some people don't mind hazards, but some, typically those who travel in motor homes and spend lots of money, do mind. The Park Service is now starting to use hazards as a mechanism to control crowds.

Range Science:

Most of their studies are concerened with the effects of overgrazing, fires, and erosion. They are looking for constructive methods to encourage rapid revegatation of desirable species after a fire.

Institute for Land Rehabilitation:

Fifty faculty members are associated with this institute at USU. I have given you one of their brocures. They organize workshops in mine spoils, soil microflora, etc.

One research project centers on the disturbance characteristics of a major coal mine. This is being funded by

NSF, USDA, and coal companies. The goal is to revegetate mined areas. Step one is to identify the rules for vegetation, including such aspects as the architectural rules for planting (clumps, not rows). The second phase is to develop mathematical descriptions of the processes, in order to develop general theories. They are finding that by observing natural processes at Mount St. Helens, some lessons important to mined lands are becoming understood.

Dean of Natural Resources:

They have a fish group, some people working on marshes (especially along the Great Salt Lake), animal behavior, and mammalian hazards. The National Preditor Ecology Lab is on campus. USU now has funding from insurance companies to study the problem of auto-deer impacts, especially as the range for deer becomes restricted.

Geotechnical Engineering - Loren Anderson

The main four areas of emphasis are earthquakes, landslides, dam safety, and waste embankments. They are very successful at getting money.

In earthquake studies, they have $350K from the USGS to do liquefaction mapping from Utah County north along the Wasatch Front. The maps for Salt Lake County are finished. They have had $150K from the USGS to do seismic slope stability mapping in Salt Lake and Davis counties, and will have new USGS monies to

finish the northern Wasatch Front. Jeff Keaton has $16K in new USGS monies to study tectonic subsidence during an earthquake. Jim McCalpin has $50K from the USGS to study the Hansel Valley fault scarp, and anticipates new monies to study young movement on the East Cache Fault. Jim also has mineral lease funds in this project.

Landslide research:

USU is working on getting downlinks from the GOES satellite as a mechanism for remote telemetry of data. They are now monitoring a landslide, which includes some of Kim McCarters equipment, but they are relying on a Campbell Scientific telemetry system, which is apparently working very well. The have $50K to study the link between debris slides and snow melt. They have mineral lease funds ($25K) and some USFS funds (?) to do a multivariate analysis of landslide susceptability in Davis County. This has just been published as a PhD. The Forest Service has contributed $36K to document the 1983 slides in Utah. USU has 19 topo maps on tape to look at these hazards. Other landslide studies include the modeling of sediment transport and an attempt to do an age classification.

Dam Safety

Risk and probabilistic analyses form the basis of this effort. They are now using $45K in mineral lease funds.

Waste Embankments

Probabilistic stability modeling is part of what they are doing, with $213K from the Bureau of Mines and $25K from the USFS.

David Bowles talked about the hydrologic and climate aspects of USU research. These studies are of floods, soils and erosion, the Great Salt Lake, weather modification, and droughts.

Floods

The primary emphasis is along the Wasatch Front. They are developing analytic techniques suitable for steep canyons, cluverts, sediment and debris generation, and other applicable aspects of local hydrology. They are planning to use GOES telemetry for real-time application. USU is also working on changes that will be required as the field of floods gets swamped with data in the next few years, and evolves from and area with just a few historical records to one with continuous monitoring.

Soil and Erosion

Using the rainfall simulator, they do a lot of highway and other structure engineering work. They also are developing erosivity maps.

Great Salt Lake

USU is working on the problem of forecasting lake levels, with some success (they claim). They are also working on lake level probability estimations, and have developed a model that is used by the state to predict financial costs of various lake levels. They are now contributing to the EIS on west desert pumping. USU is working on lake level circulation and salinity models. Another project is dealing with the hydrology and climatology of the west desert, which could also be important if

an accellerator is built. Salinity studies of the lake and also the Colorado River Basin include personnel from the water lab, soil scientists, economists, etc.

Droughts

USU is involved in a review of 1977 drought policies, as the vulnerability of water supply to drought remains, and we live in a desert.

Weather modification

This is cloud seeding research, trying to understand the process of formation of precipitation in clouds.

Another major effort of USU is in toxic and hazardous waste management. Ron Sims talked about these. They are getting private company funding from engineering companies and the American Petroleum Institute, and federal funding from EPA in Cincinnati, Washington, D.C., Research Triangle Park, N.C., Corvallis, Denver, and Kerr (?), Ok., and funding from the USGS. They have state funding from Utah. The current funding level is $1.4 million.

In the Salt Lake Valley, USU is working on both the Portland Cement and Sharon Smelter superfund sites. They are trying to figure out what should be done.

They are writing the final EPA rules for RCRA, evaluating what can safely be put in the ground. This is multidisciplinary work, involving biologists, chemists, etc.

Other projects include work on underground storage tanks,

mine drainage, and, with mineral lease funds (up to $75K), household toxics and the legacy of KCC in western Salt Lake Valley.

The chem lab at USU has about $2 million in hardware, 12 full time technicians, and 8 chemists and professors who use it. They exercise great care in sample handling, even going so far as to keep separate glassware for different wet chemical elemental analyses. All toxic waste material is handled in a separate room, except for the small amounts actually needed for analyses.

BYU

BYU was represented at the meeting by two speakers. Delbert talked about environmental chemistry. Their main effort is on sulphur in the atmosphere. They are doing work on the chemical processes that occur in clouds, by studying power plant emissions in fog banks. They have also found that the plume from the LA basin can be traced into Utah. Along the Wasatch Front, work on inversions is continuing. These may be more severe than previously thought. In Utah Valley, respiratory admissions to the hospital rise a few days after the start of an inversion episode. The chemistry of inversions is not understood, except that the air stagnates, which is demonstrated by the drop off in pollution with distance from the steel mill.

Les Youd, who is a geotechnical engineer in Civil Engineering, talked about his liquefaction program. He also mentioned work in fractures in rocks around nuclear waste, and

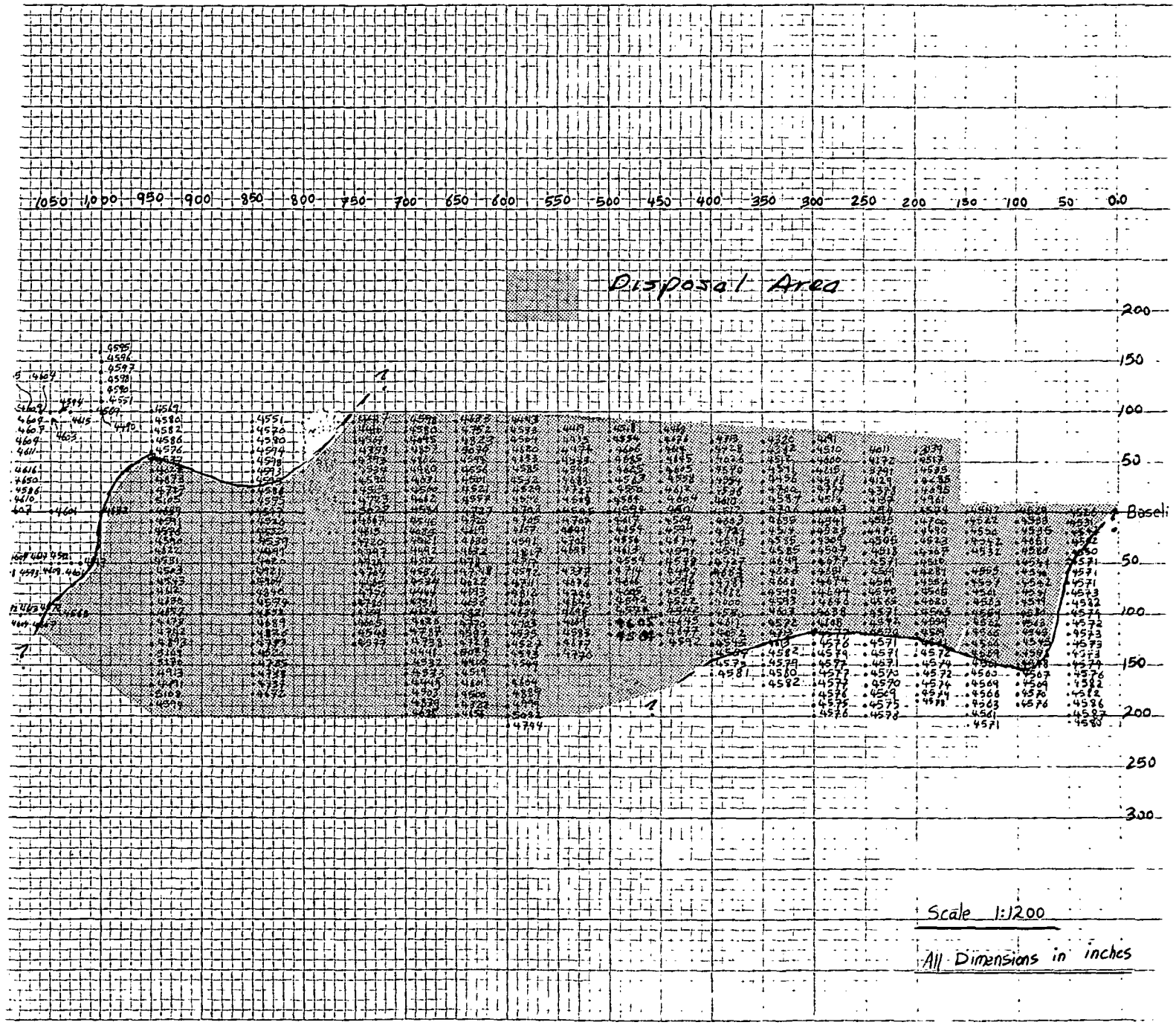
work on the structural response of buildings to earthquakes.

Les is new at BYU this year, after 17 years with the USGS in Menlo Park. His background is in liquefaction. He has written five proposals; two are funded, two are promised, and one has not yet had a response. He has USGS monies to make a liquefaction map of the US, and will be studying liquefaction at Borah Peak. He also has Army Corps funding for this. He will be working some in the area of the Parkfield earthquake prediction.

SUMMARY

My impression is that USU has a very strong, diversified, and fairly comprehensive program. Our strengths in geology and geophysics might compliment their efforts, however, and provide them with data they are not able to gather. BYU seems like a possible area for cooperation, but Youd is already working with USU, and the atmospheric cooperation would have to be through environmental studies (in a raising of their profile). No one who spoke is doing Dennis' kind of Rn work.

I will be happy to provide you with more comments if you would like.


Disposal Area
Baseline
Scale 1:1200
All Dimensions in inches


826 ft

OGDEN NATURE CENTER

GROUND MAGNETIC SURVEY

by

Phillip M. Wright
Earth Science Laboratory
University of Utah Research Institute (UURI)

and

Mike Long
Utah Division of Environmental Health (UDEH)
Solid and Hazardous Waste Management

Introduction

On 1 October 1987, a ground magnetic survey was conducted on land currently owned by the Ogden Nature Center. The objective of the survey was to determine the lateral extent of a waste dump. The land had previously been deeded to the City of Ogden by the Army's Defense Depot Ogden (DDO), and had been used by DDO partly for storage of military equipment and partly for dumping. Evidence for the existence of a dump site can be seen on the surface over much of the property, and DDO had furnished the information that outdated military equipment and phosphorous incendiary devices had been destroyed and buried at the site. However, there are no records of the exact location or nature of the disposal area(s). It is presumed that disposal was made in shallow trenches, mostly above the level of ground water, which in the area is 6 to 10 feet below ground level. Trenches were apparently covered with a thin layer of soil after use.

There is some limited evidence, furnished by a number of dead trees, that leachate from the disposal trenches could be affecting the flora in the area. It is, thus, the goal of the UDEH to drill several appropriately placed, shallow monitoring wells to determine if chemical species are, indeed, leaching and migrating from the disposal site. For reasons of safety, it is desirable to place any monitoring wells outside of disposal trenches because the exact nature of the material disposed is unknown and there is the possibility that ordnance or incendiary devices which were undestroyed could be in the dumps.

Survey Description

The Magnetic Method. In magnetic prospecting, variations in the magnitude of the earth's magnetic field are measured using

instrumentation specifically designed for the purpose. These variations are then related to the extent and type of material in the subsurface. The method has been most fully developed for use in petroleum and mining exploration, where variations in the distribution of magnetic minerals, caused by variations in subsurface geology, are detected. The primary natural magnetic mineral is magnetite (Fe_3O_4). In environmental applications, the magnetic method is primarily used in detecting metallic material in the subsurface. Many metals containing iron are magnetic, although some types of stainless steel are not. Aluminum and brass are essentially non-magnetic for our purposes. Other common materials found in waste dumps are generally non-magnetic or weakly magnetic. Thus, variations in the magnitude of the earth's field over a disposal site will generally reflect presence or absence of iron or steel in the subsurface, and indicate areas where iron and steel has been dumped. In dump areas that contain no iron or steel, no magnetic anomalies are generally to be expected.

there corrections have been made in hard copy

Equipment. The survey was carried out using a Scintrex Model MP2 proton-precession magnetometer. This type of magnetometer measures the magnitude of the earth's total magnetic field in units of gammas, where 1 gamma equals 1.0 E-9 tesla (1 tesla equals 1 weber per square meter). The instrument has a resolution of about 1 gamma and is relatively insensitive to orientation of the sensing head in the earth's field.

Expected Magnetic Anomaly Pattern. Typically, a dump filled with various material, some of which contains iron, will yield a jumbled magnetic pattern. Each iron body will act like a magnetic dipole (for three-dimensional objects such as barrels, old wheels, etc) or a line of dipoles (pipes, re-bar, etc). One would anticipate no ordering to orientation of the metal objects and a range in sizes between very small (< 1 in.) to objects 1 to 2 feet on a side and pipes or re-bar 5 to 15 feet long. Each magnetic body will yield an anomaly such that there will be a magnetic high over the southern portion of the body and a magnetic low directly north of the body. The amplitude of the northern low will be about ten percent of the amplitude of the high. In east-west profile across the body, the high will be centered on the southern portion of the body and there will be weak lows directly outside the body on both the east and west sides. The lows in these cases are due to polarization effects of the body in the earth's field, and the low to the north will be larger than the lows to the east and west due to the northern dip of the earth's field. This anomaly pattern varies with magnetic latitude, and our discussion here is pertinent to the magnetic latitude of Utah, which is about 60 degrees north (i.e., the earth's magnetic field dips 60 degrees to the north at our magnetic latitude). With such anomaly patterns over a jumble of material in the shallow subsurface, a very chaotic magnetic pattern will result. Some profiles will pass directly over magnetic bodies while others will pass to the north or south of magnetic bodies. Further, the amplitude of individual anomalies

will depend on the amount of magnetic material in the body and its distance from the magnetometer. Anomaly amplitudes ranging from a few gammas to one thousand gammas or more can be expected. The anomalies due to individual bodies will be additive at the observation point. Thus, the value of the earth's field at each measuring point will be a combination of positive and negative effects from all nearby magnetic bodies.

It would not be possible to resolve the shape and location of each magnetic source without extremely detailed and more costly surveying than was undertaken in this effort. Since we are simply interested in the boundaries of disposal, and not so much in identifying individual magnetic bodies, the profile and station spacings were selected to give reasonable detail on boundaries without providing the detail necessary to resolve individual dump components.

Field Data Acquisition. Field data were read at stations along profiles. The profiles were spaced usually every 50 feet and the station spacing along the profiles was 10 feet. A base line was established as shown on Figures 1 and 2. The base was oriented N09^{o}W, and was marked off each 50 feet using a heavy plastic surveyor's tape. The profiles were oriented normal to the base line, and readings extended both to the west and to the east from the base line. Measurement along the profiles was done with a plastic surveyor's tape of the same kind as used for the base line measurement. All directions were determined with a Brunton compass.

The magnetometer was carried on straps that suspended it in front of the operator, on his chest, whereas the magnetic sensor was held on a 6-foot non-magnetic staff built for that purpose. The staff was held away from the operator in such a fashion that the sensor was appropriately oriented in the earth's magnetic field. All unnecessary magnetic material was removed from the operator's person before surveying began. Repeat measurements were made using the instrument in an empty field near the offices of UURI on the morning of the survey, and the repeatability of measurements was about one gamma. Since variations in the magnetic field in the survey area were found to be several hundred gammas, as discussed further below, the repeatability of the instrument is deemed to be satisfactory for this survey.

Magnetometer surveying proceeded in order along 18 profiles as noted on the accompanying figures. In general, stations were first occupied westward from the baseline at 10-foot intervals until either the Old Plain City Canal was reached or vegetation became too thick to penetrate without brushing the line. Most profiles extended to the Canal. Next, the east end of the profile was surveyed at 10-foot intervals to a position some 20 to 30 feet from a high wire-mesh fence that surrounds the Juvenile Detention Center, whose property borders the Nature Center for some distance north of the beginning point of the survey. Wright carried and read the magnetometer and Long

recorded the data. A copy of the plotted field data accompanies this report (Figure 2), and all originals are being transmitted to the UDEH offices.

Results. The survey results are shown on maps and profiles. Figure 1 is a copy of an air photo of the survey area at a scale of 1 in = 200 ft., and Figure 2 is a map of the magnetometer readings at the same scale. Because the earth's magnetic field in this area is about 54,000 gammas, 50,000 gammas was subtracted from each field reading before plotting in order to simplify the map work. This, of course, has no affect of the results or interpretations. The scale of the air photo was verified in the field by measurement prior to the magnetic survey.

Figures 3 through 19 are profile plots of the data for the first 17 of the 18 profiles surveyed. Profile 18 was not plotted because it has a rather complex shape, as shown on Figure 2. Minor probable errors in recording the position of the magnetometer in the field were found on Profiles 3, 10, 11, and 12, but if these errors are real they would have essentially no effect on the results as interpreted herein.

The area of dumping is much larger than was anticipated on the basis of simple field examination before the survey began. Figure 2 illustrates the area that the magnetic survey indicates to be underlain by magnetic material. Within the dump area, the magnetic field varied from about 53,200 gammas to more that 55,000 gammas, a range of nearly 2000 gammas. In areas outside the dump, the field varied within about 15 gammas of 54,570 gammas in the clear area on the southwest side of the survey and within about 15 gammas of 54,600 in the non-dump area on the northeast side of the survey. On a few of the profiles, the dump boundary was a little ambiguous, as detailed examination of the individual values will show. This could be due to stations over portions of the dump where there was no magnetic material. However, on the whole, the boundaries of the dump are believed to be reasonably well resolved from the present work.

The disposal site extends over most of the area between the Canal and the Detention Center fence, and it is apparent that the dump continues onto Detention Center property. In the areas marked "A" and "B" on Figure 2, it is believed to be reasonably safe to drill monitor wells. Drilling is not recommended in the remainder of the area covered by this magnetic survey.

Shown on Figure 1 is an area marked "C", which is the site of a planned pond. As part of this survey, we walked around this area with the magnetometer, taking readings at miscellaneous sites. The values without exception indicated no evidence for disposal sites in this area, and it is believed to be safe to proceed with cat work to make the pond.

At the conclusion of the survey, two metal stakes were left along the base line. Also, pink flagging was used to mark the

locations of each of the profiles along the baseline. Using these markers, it should be reasonably straightforward to locate any of the magnetometer stations with sufficient accuracy. It may be desirable to replace the rather temporary markers left in the field with more permanent ones.

Figure 1
Ogden Nature Center

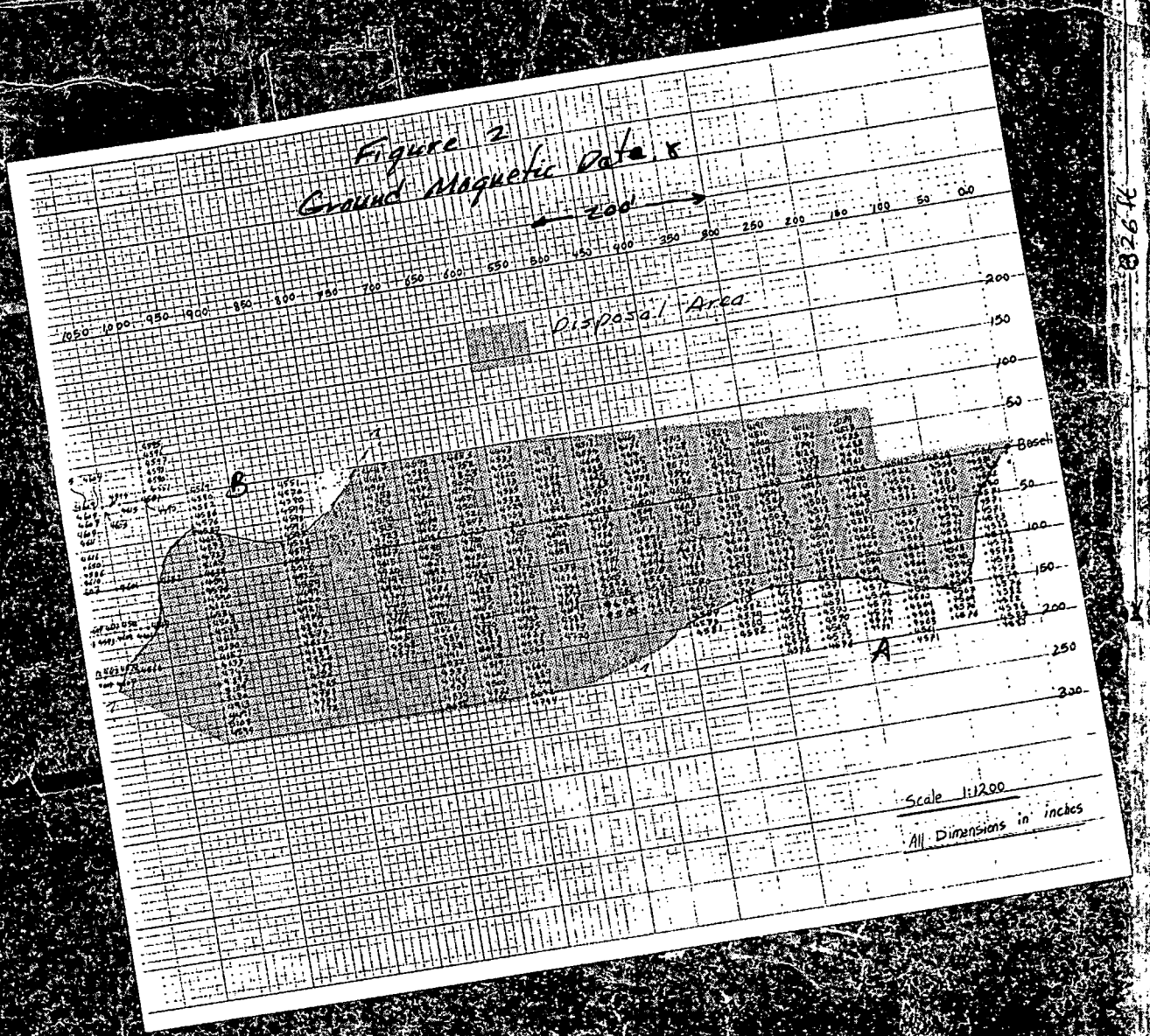


Figure 3

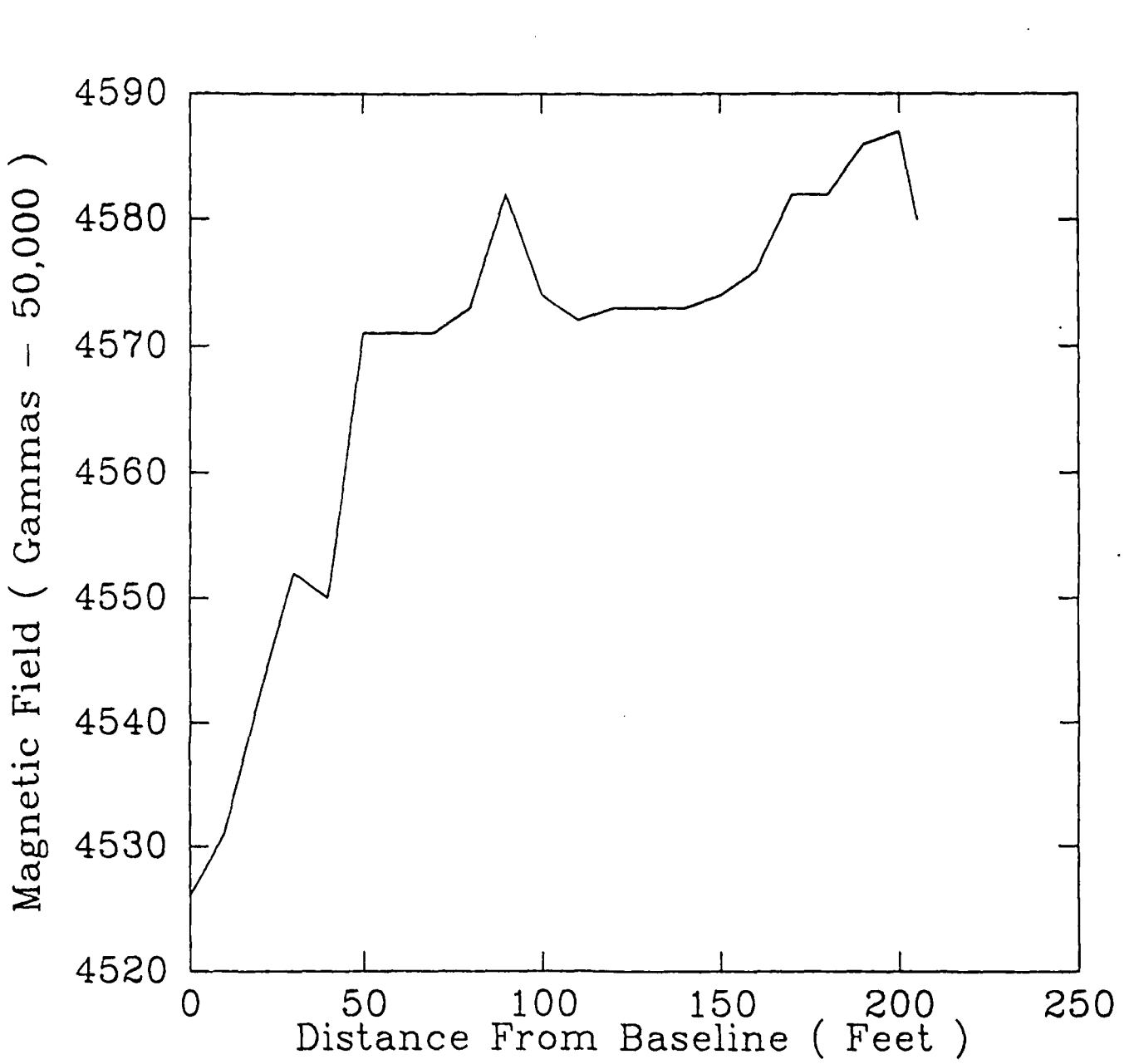

Profile 1
Magnetic Field (Gammas - 50,000)
4590
4580
4570
4560
4550
4540
4530
4520
0
50
100
150
200
250
Distance From Baseline (Feet)

Figure 4

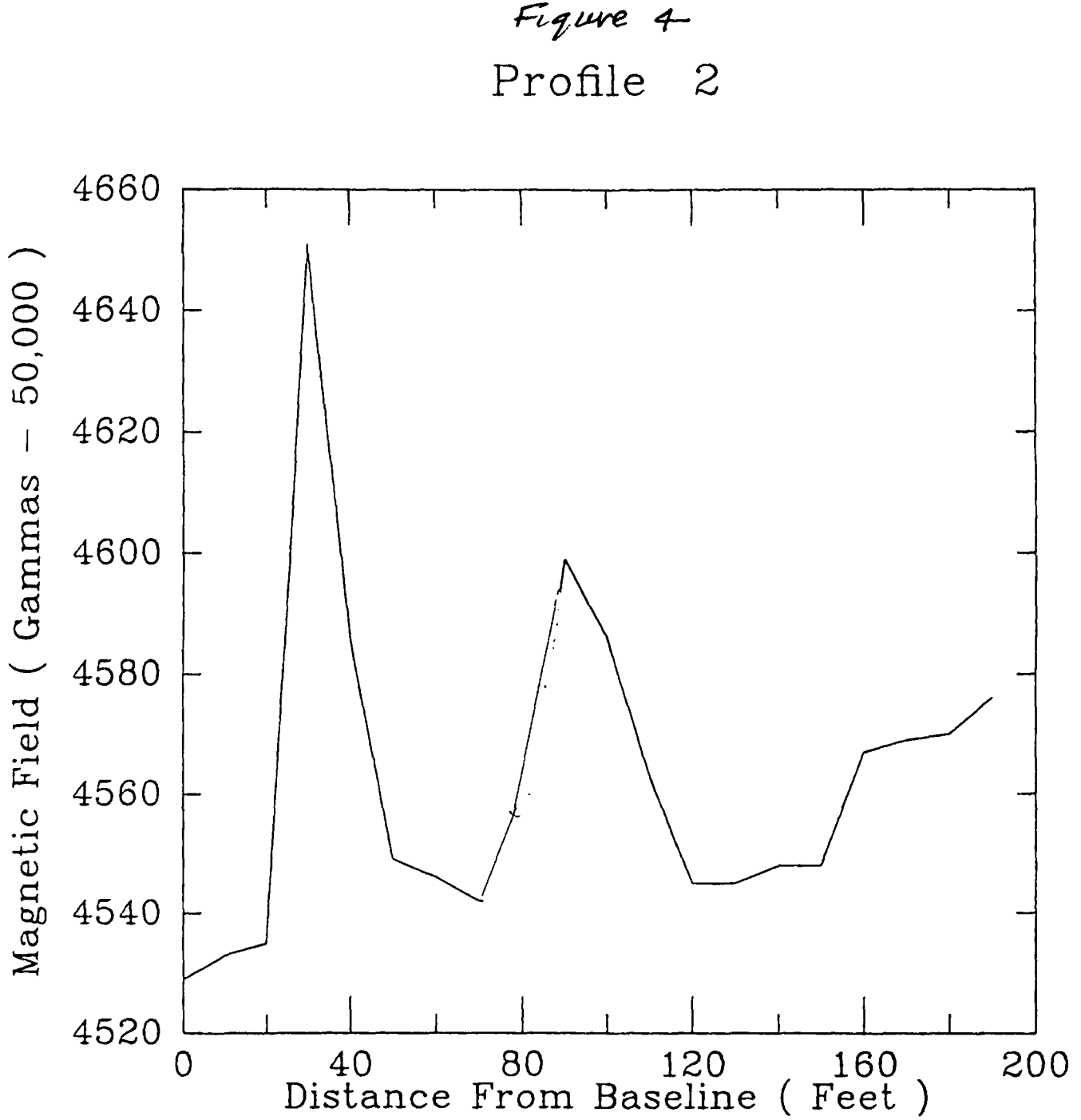

Profile 2
Magnetic Field (Gammas - 50,000)
4660
4640
4620
4600
4580
4560
4540
4520
0
40
80
120
160
200
Distance From Baseline (Feet)

Figure 5

Profile 3

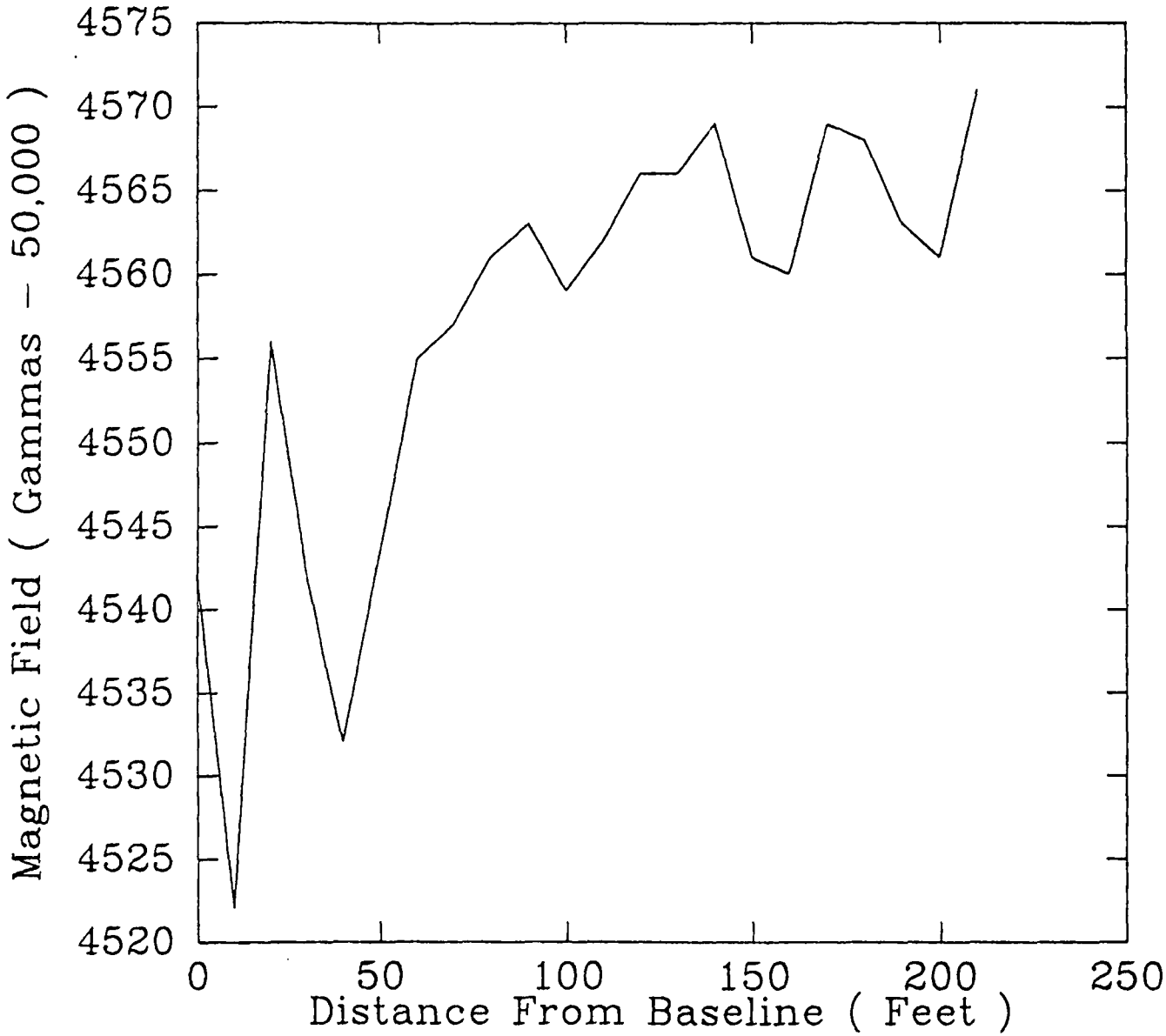


Figure 6

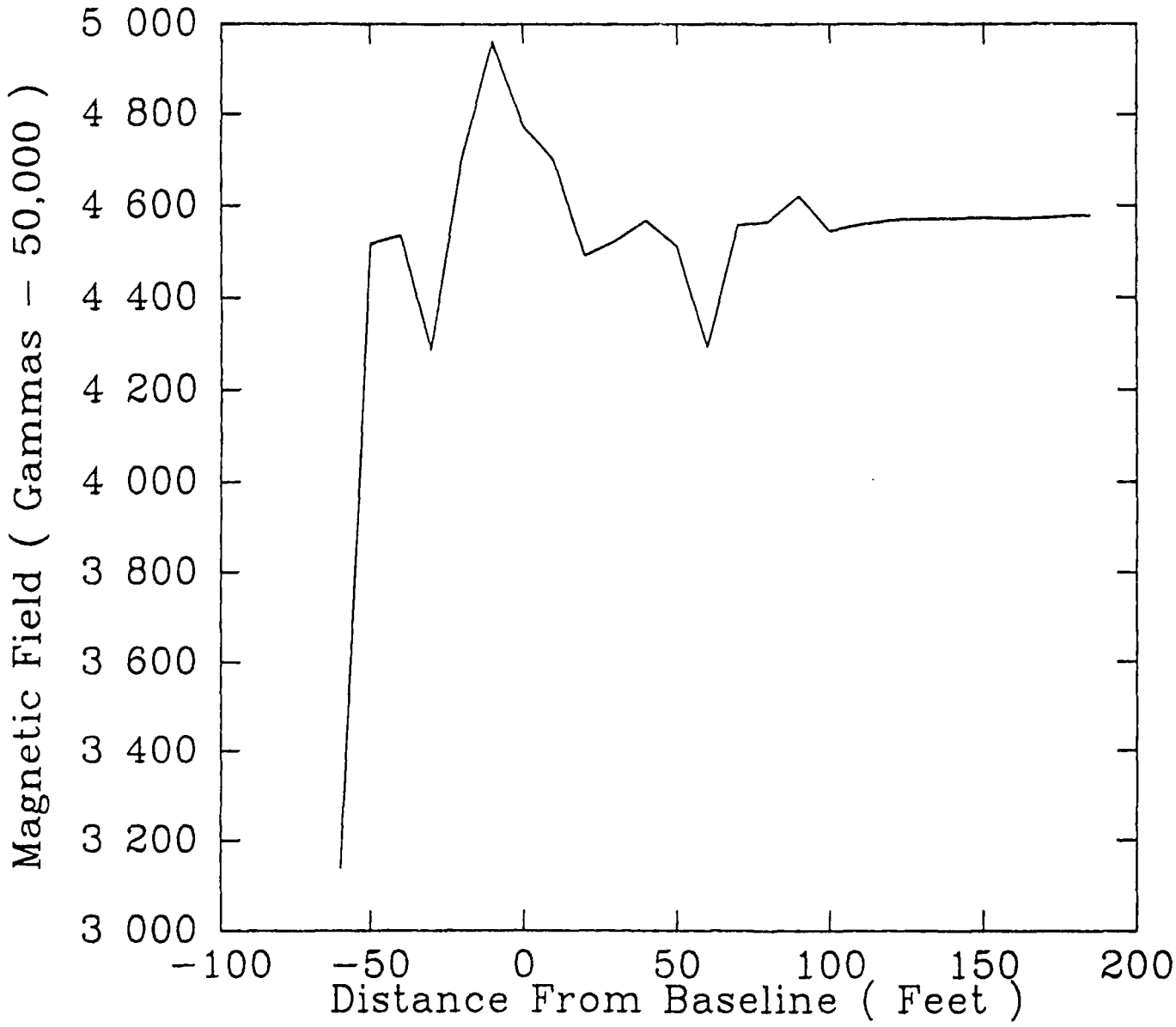


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Figure 7

Profile 5

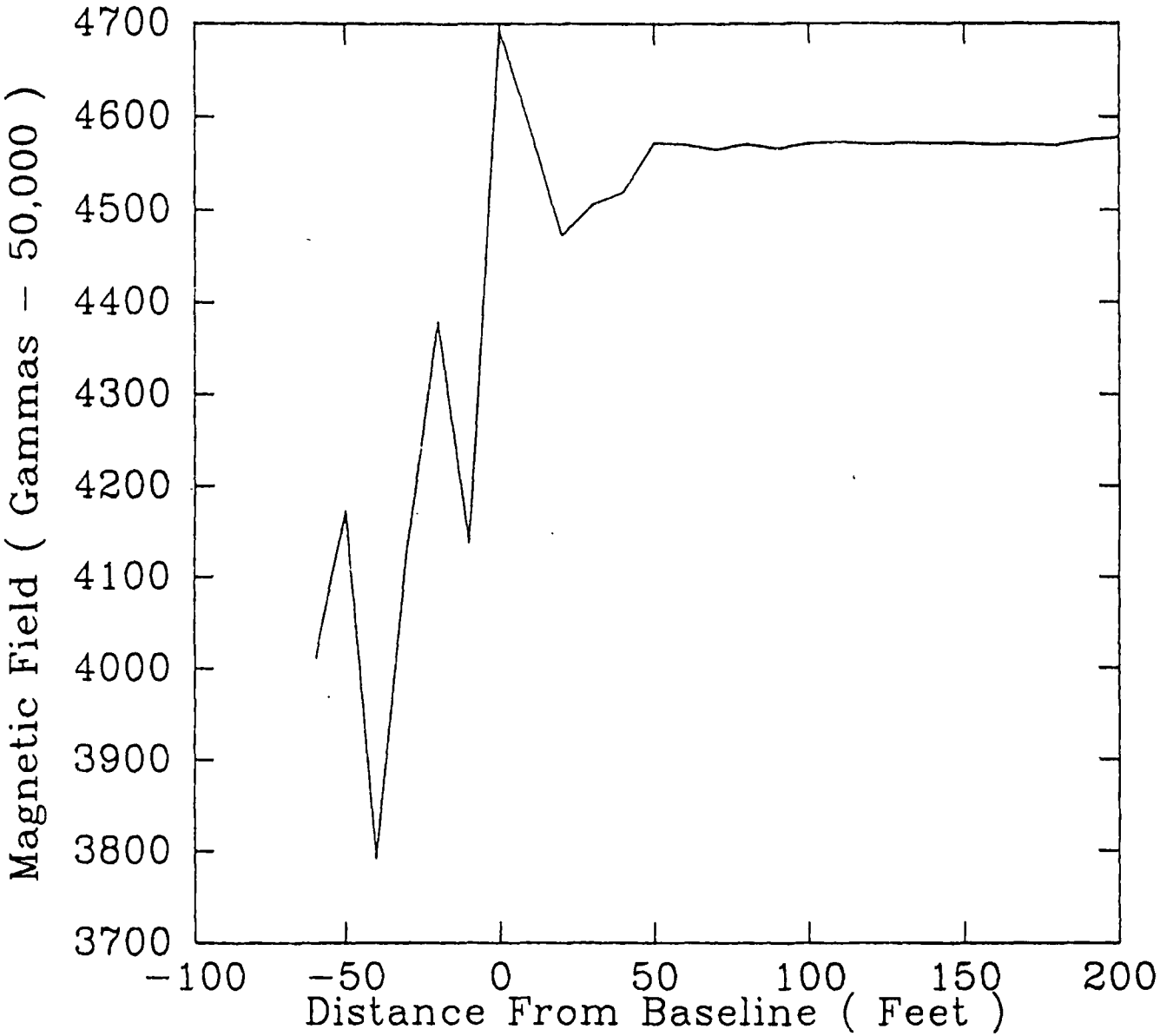

Figure 8

Profile 6

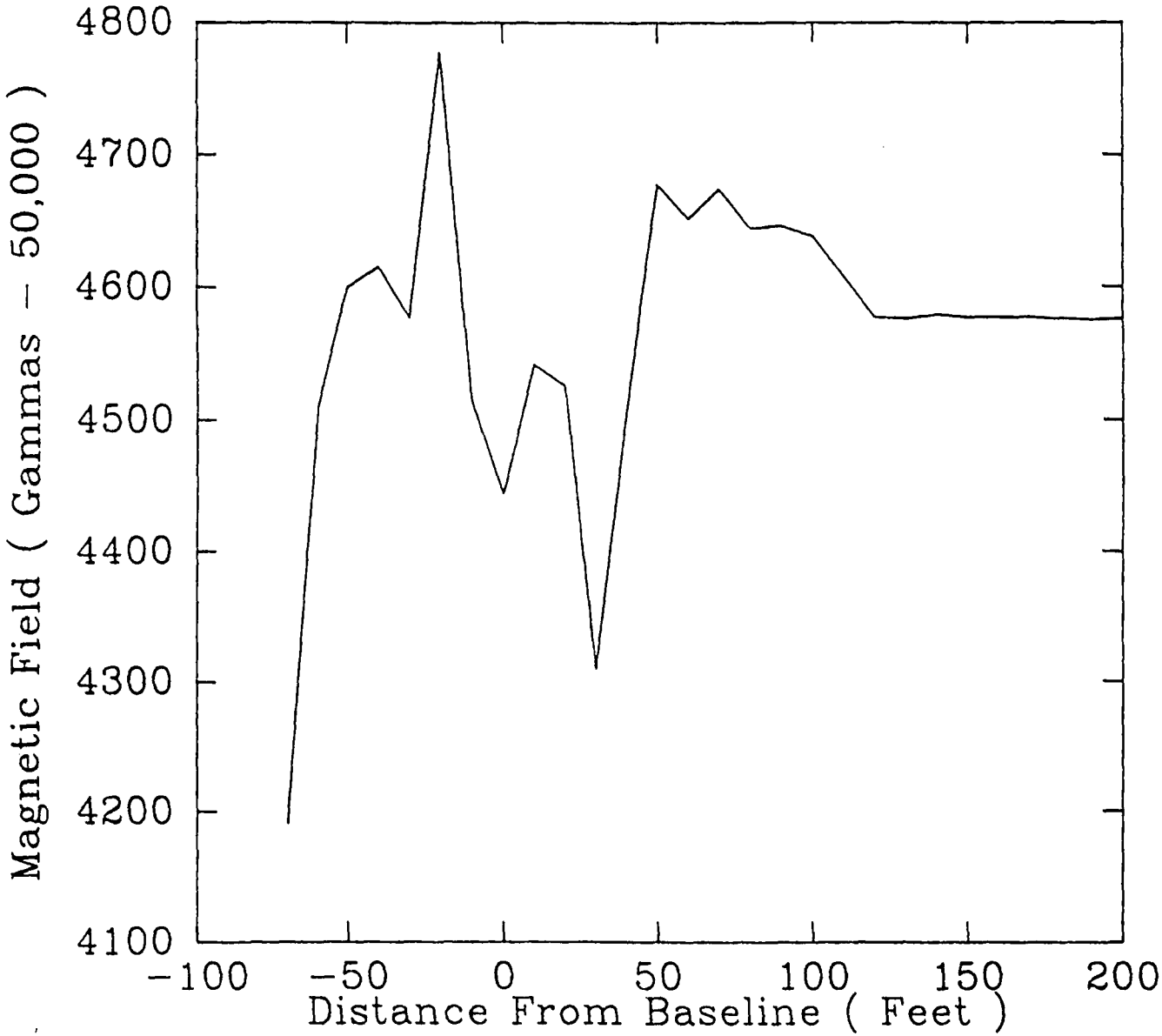

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Figure 9

Profile 7

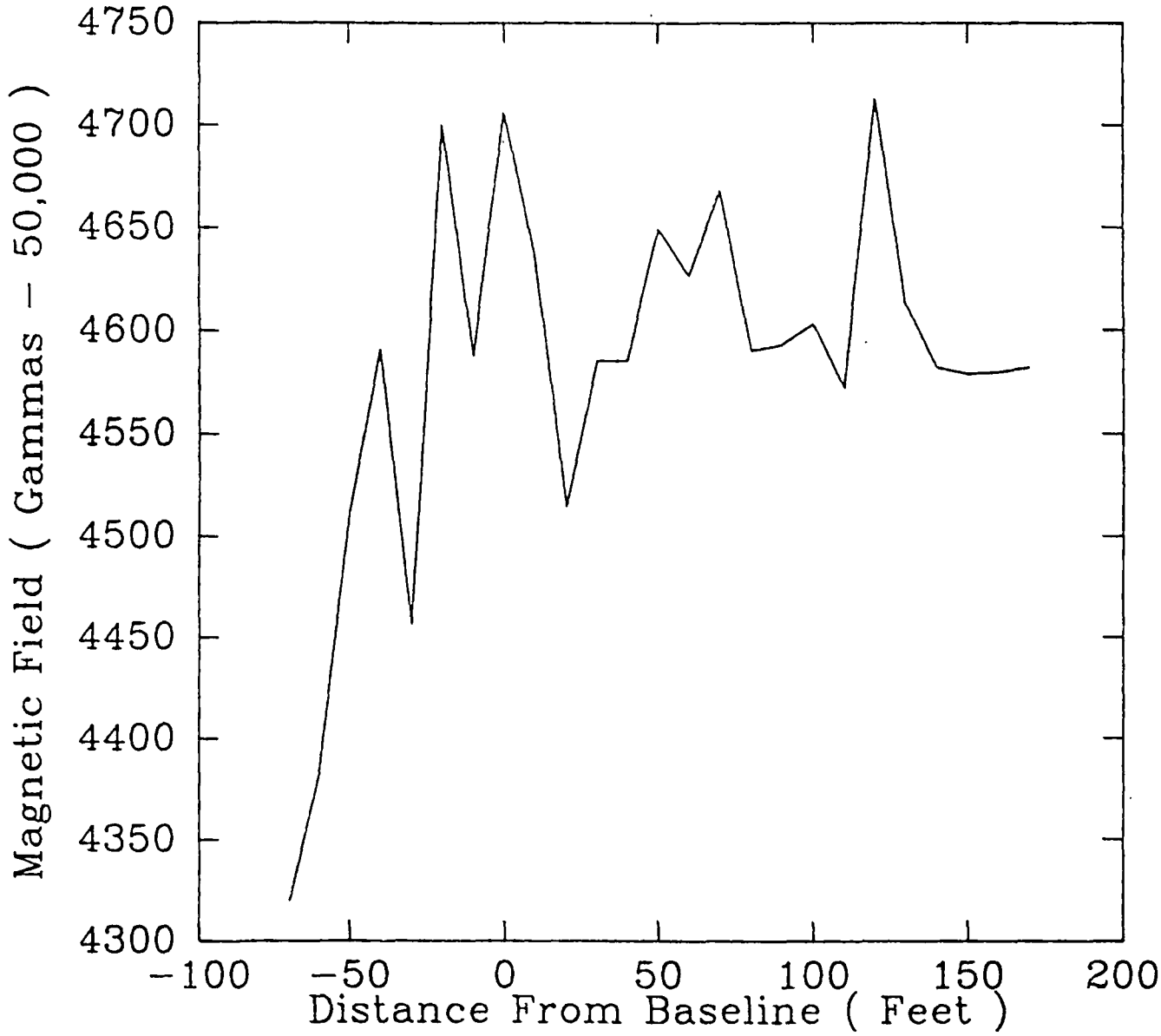

Figure 10

Profile 8

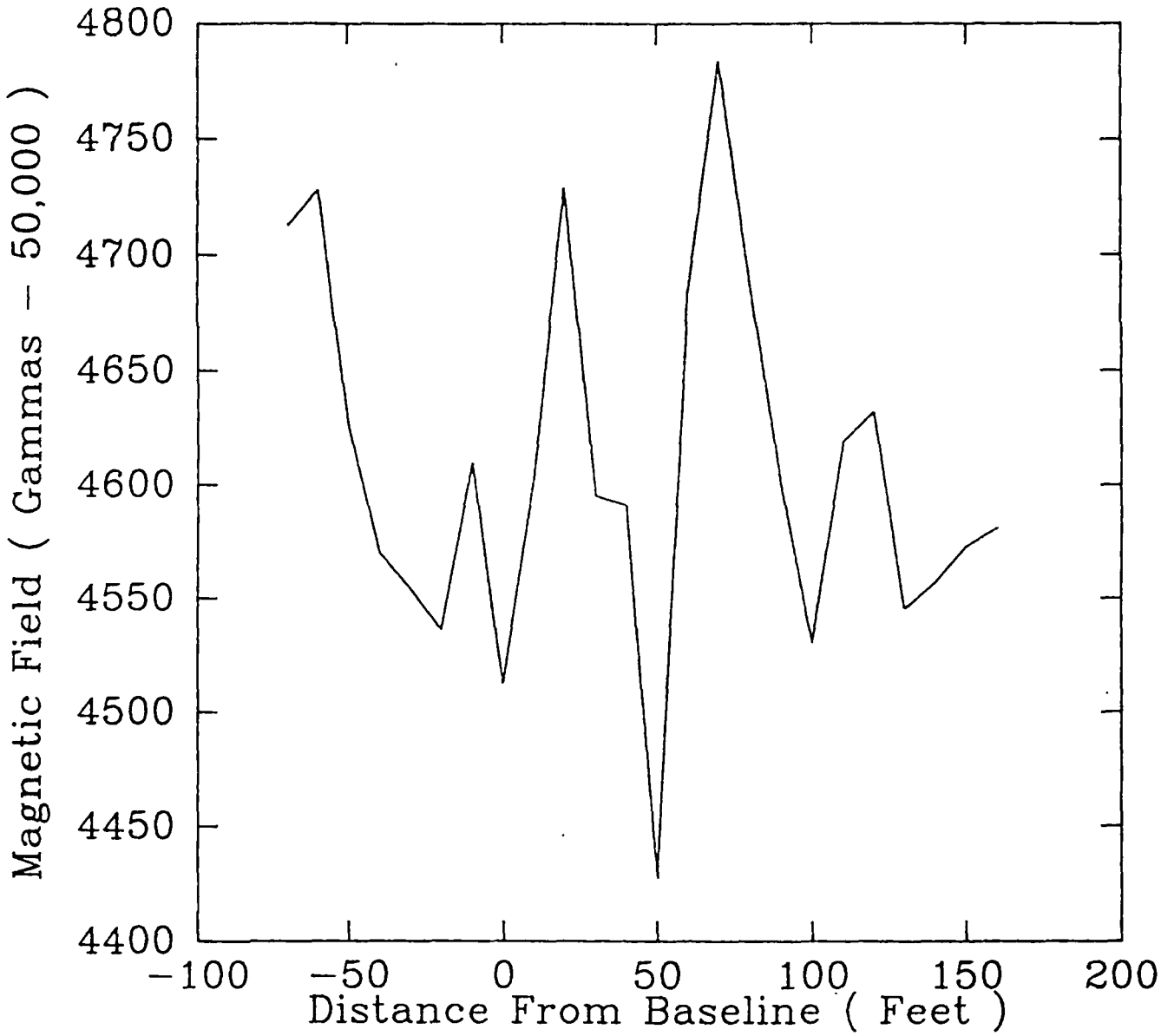

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Figure 11

Profile 9

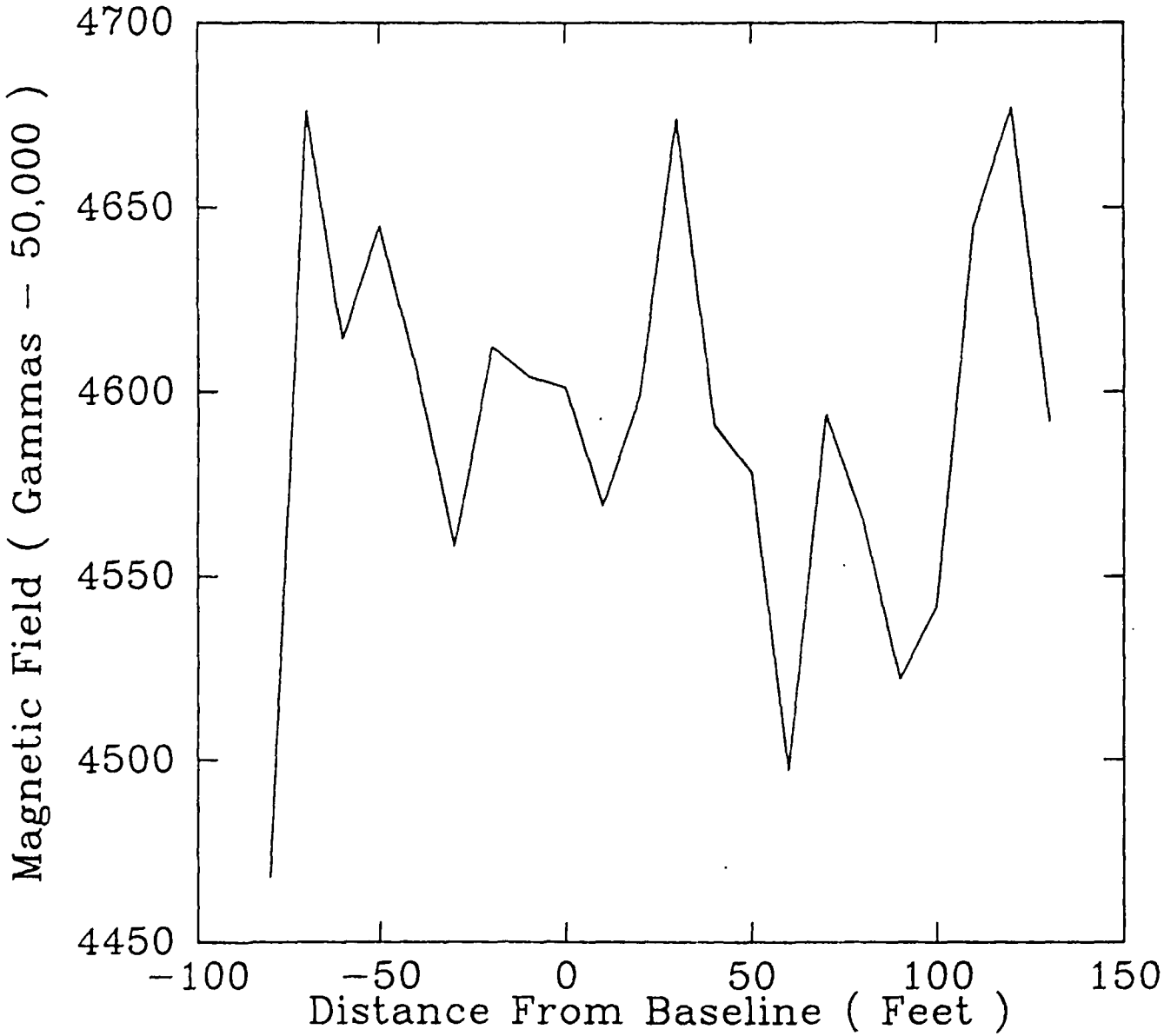

Figure 12

Profile 10

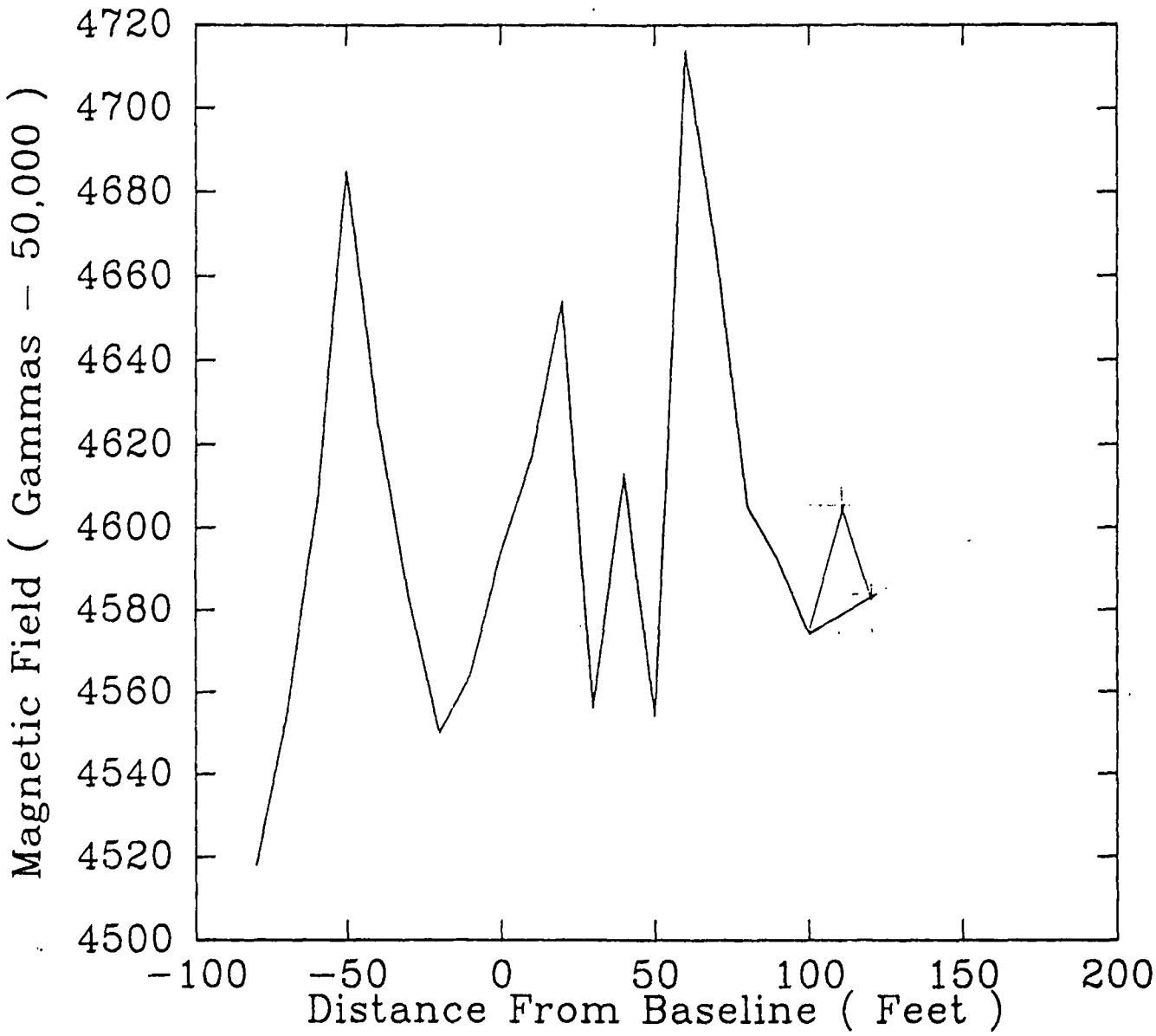

Figure 13

Profile 11

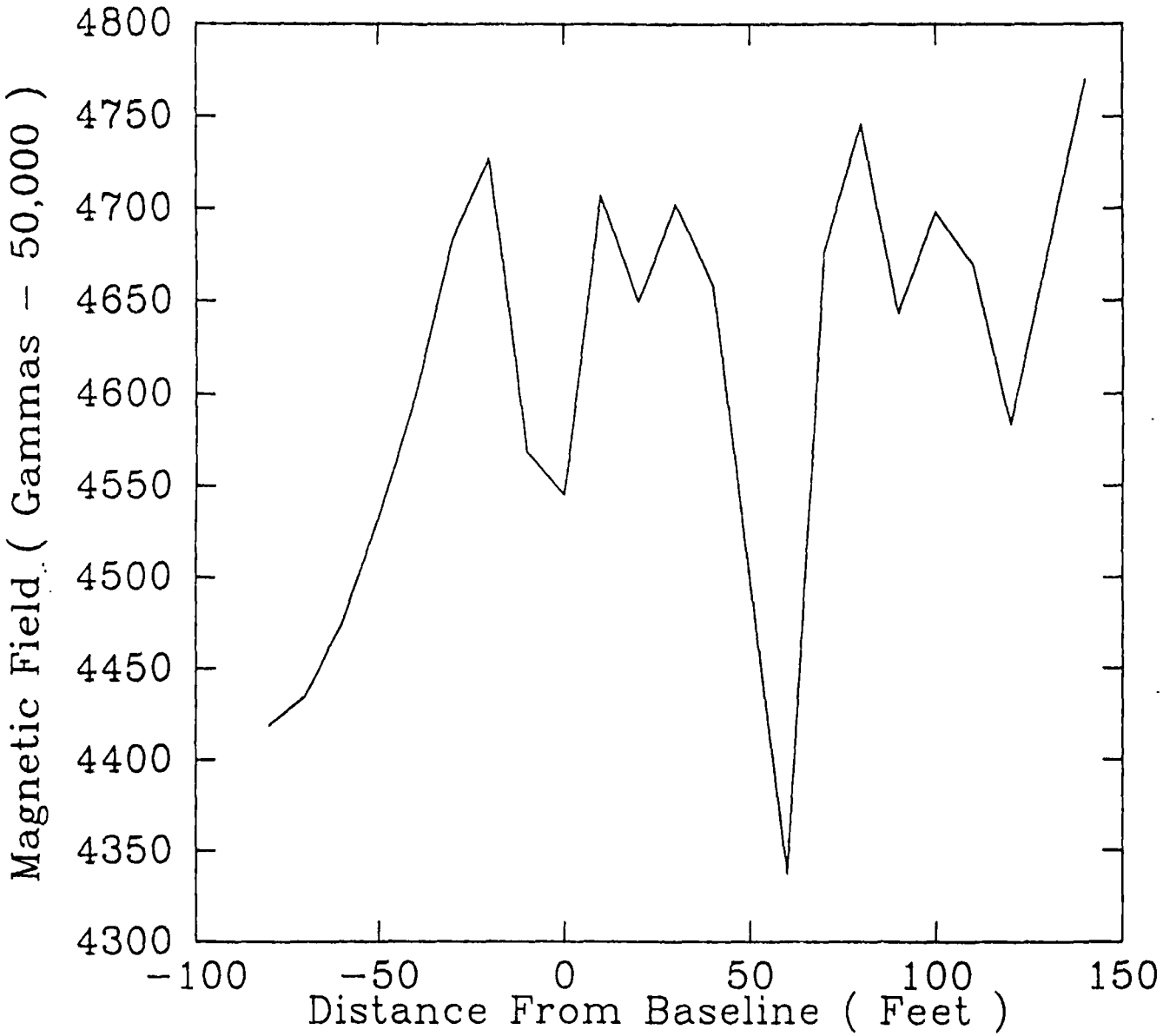

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Figure 14

Profile 12

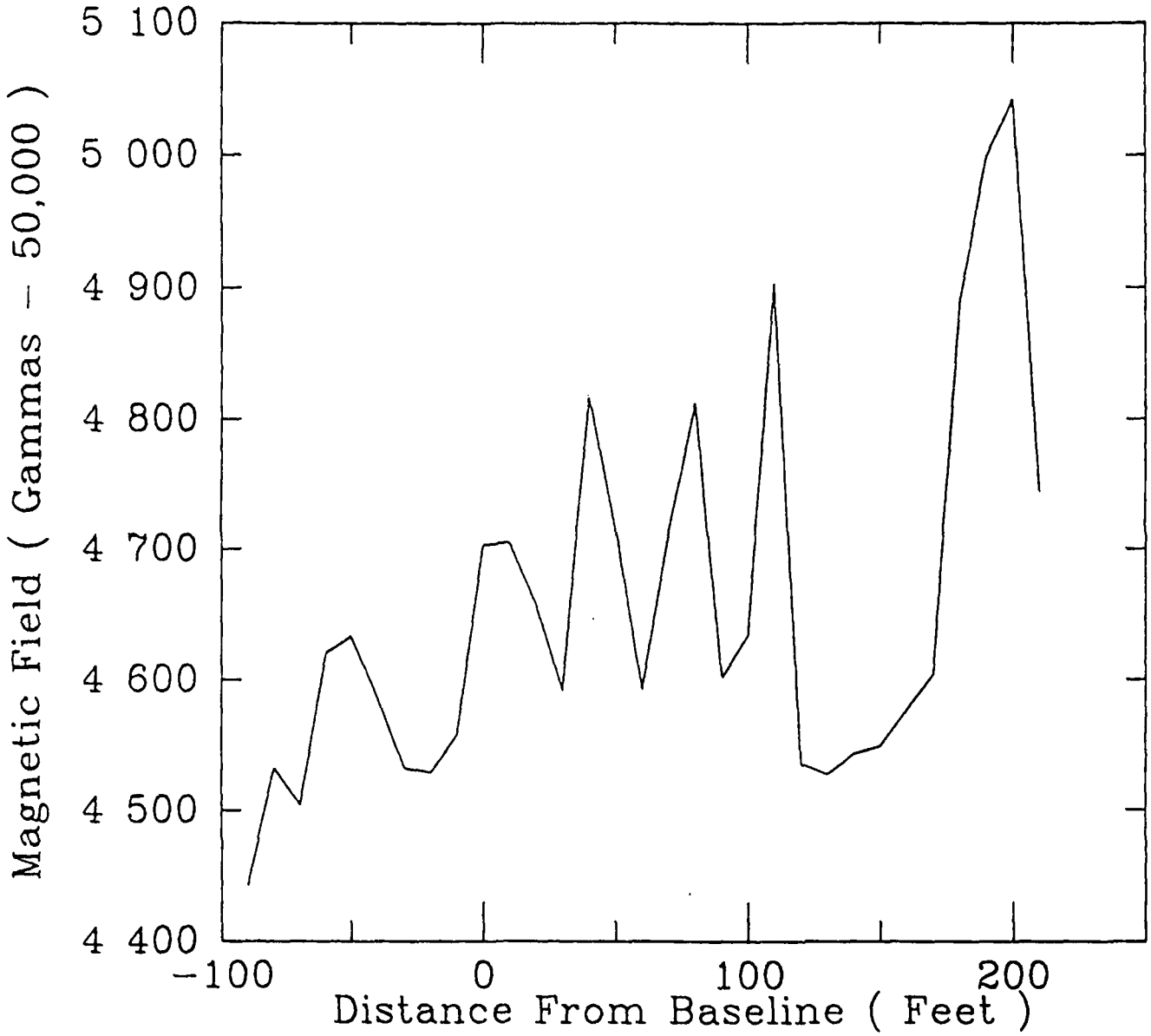

Figure 15

Profile 13

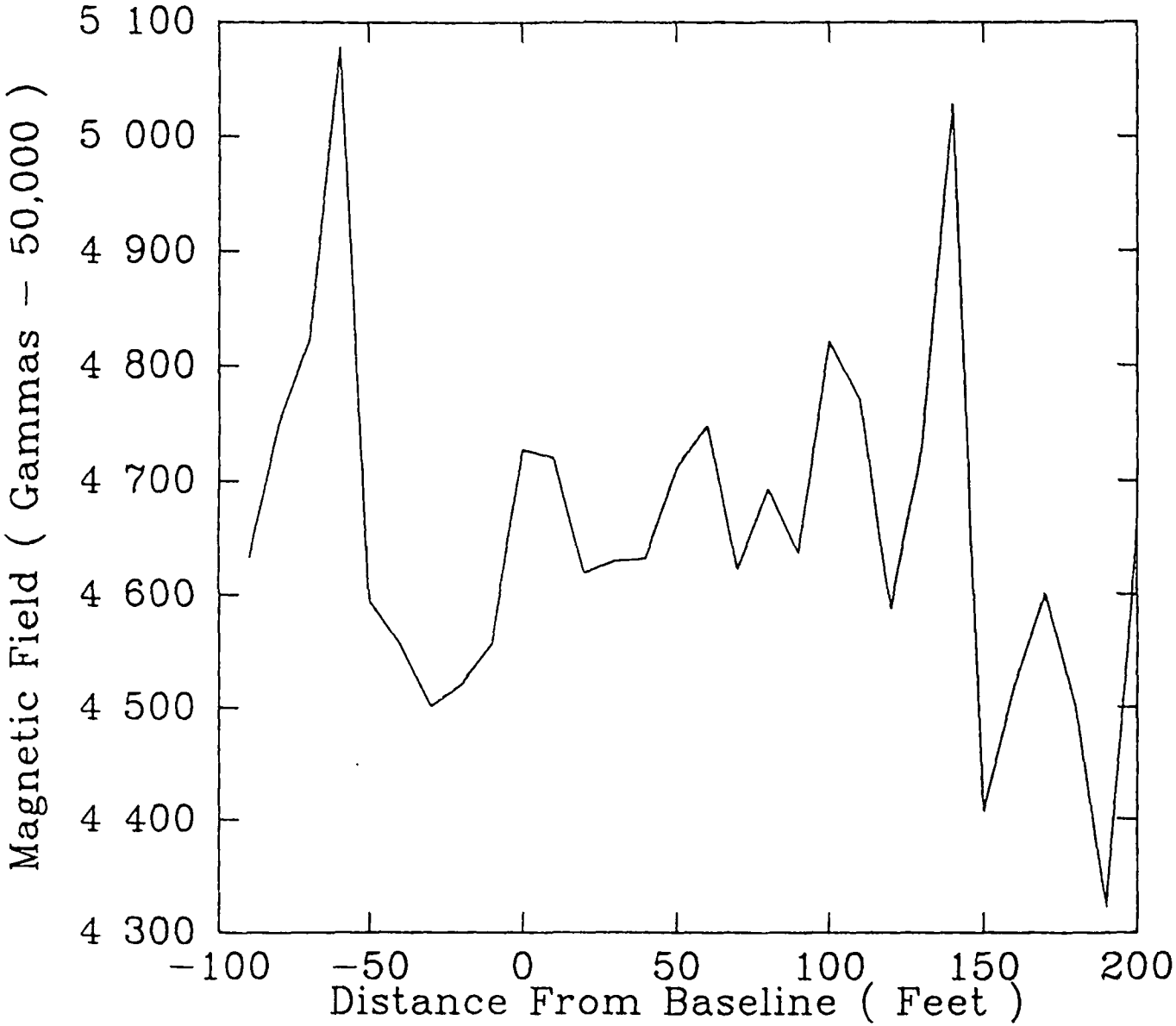

Figure 16

Profile 14

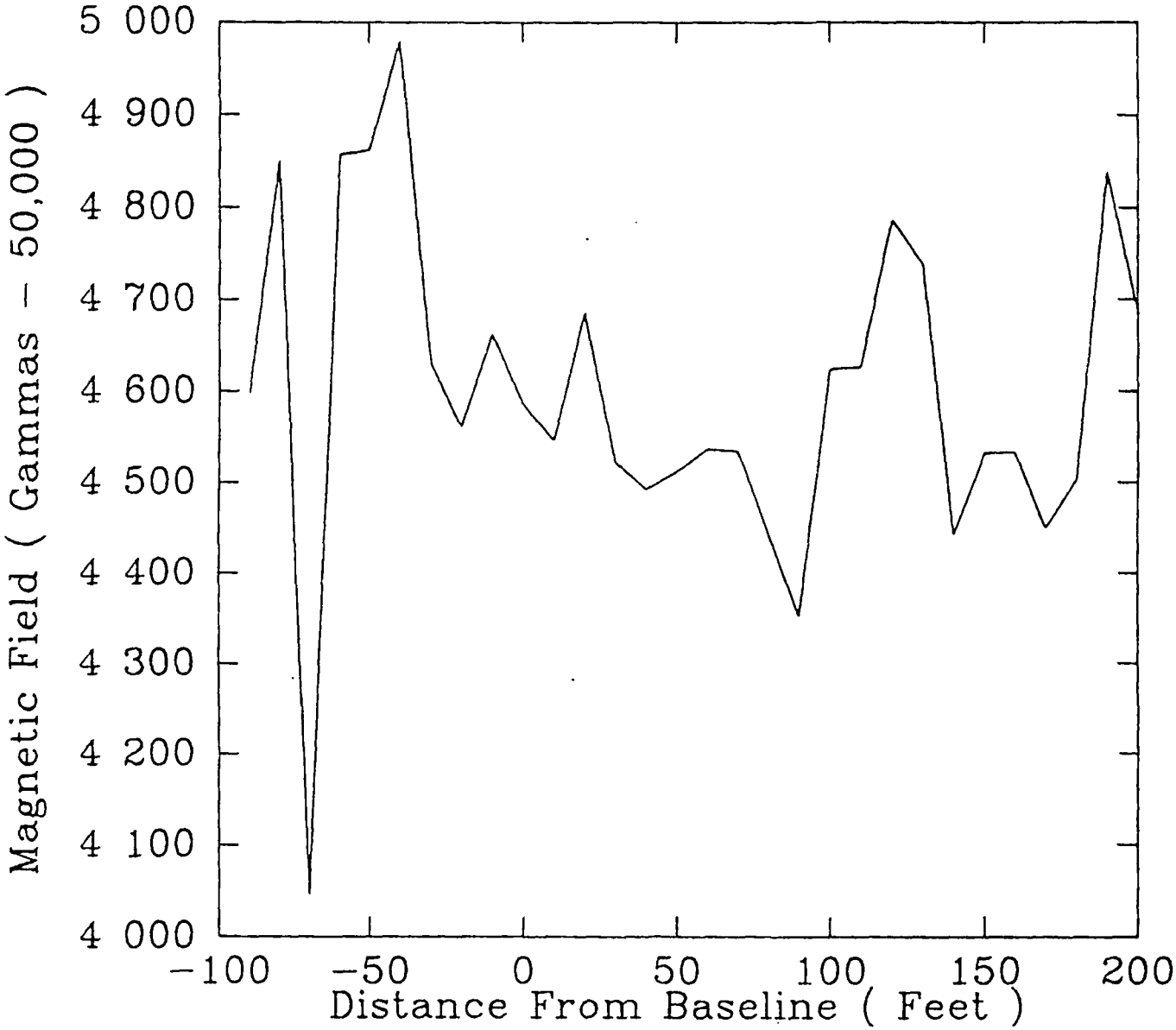

Figure 17

Profile 15

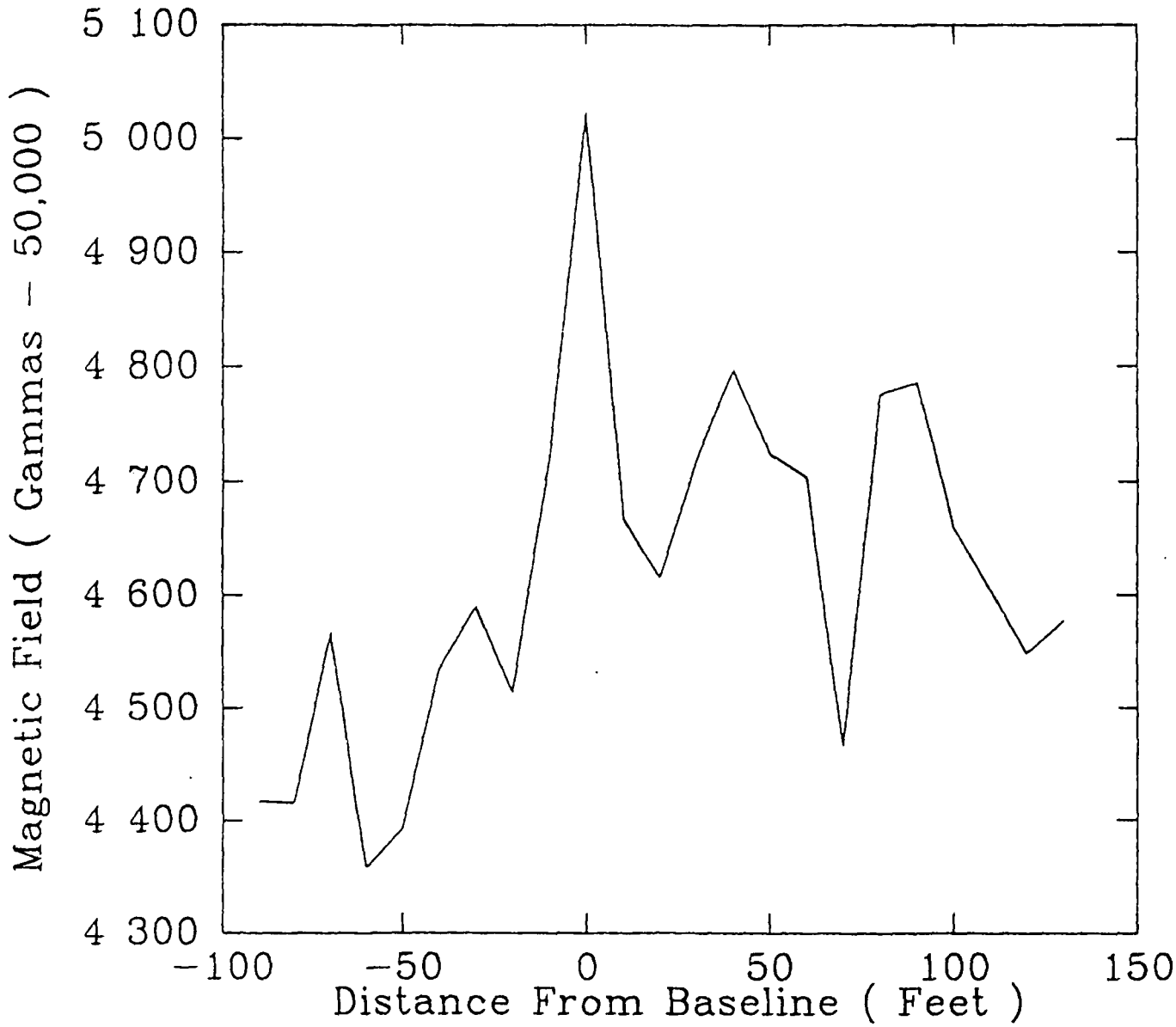

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Figure 18

Profile 16

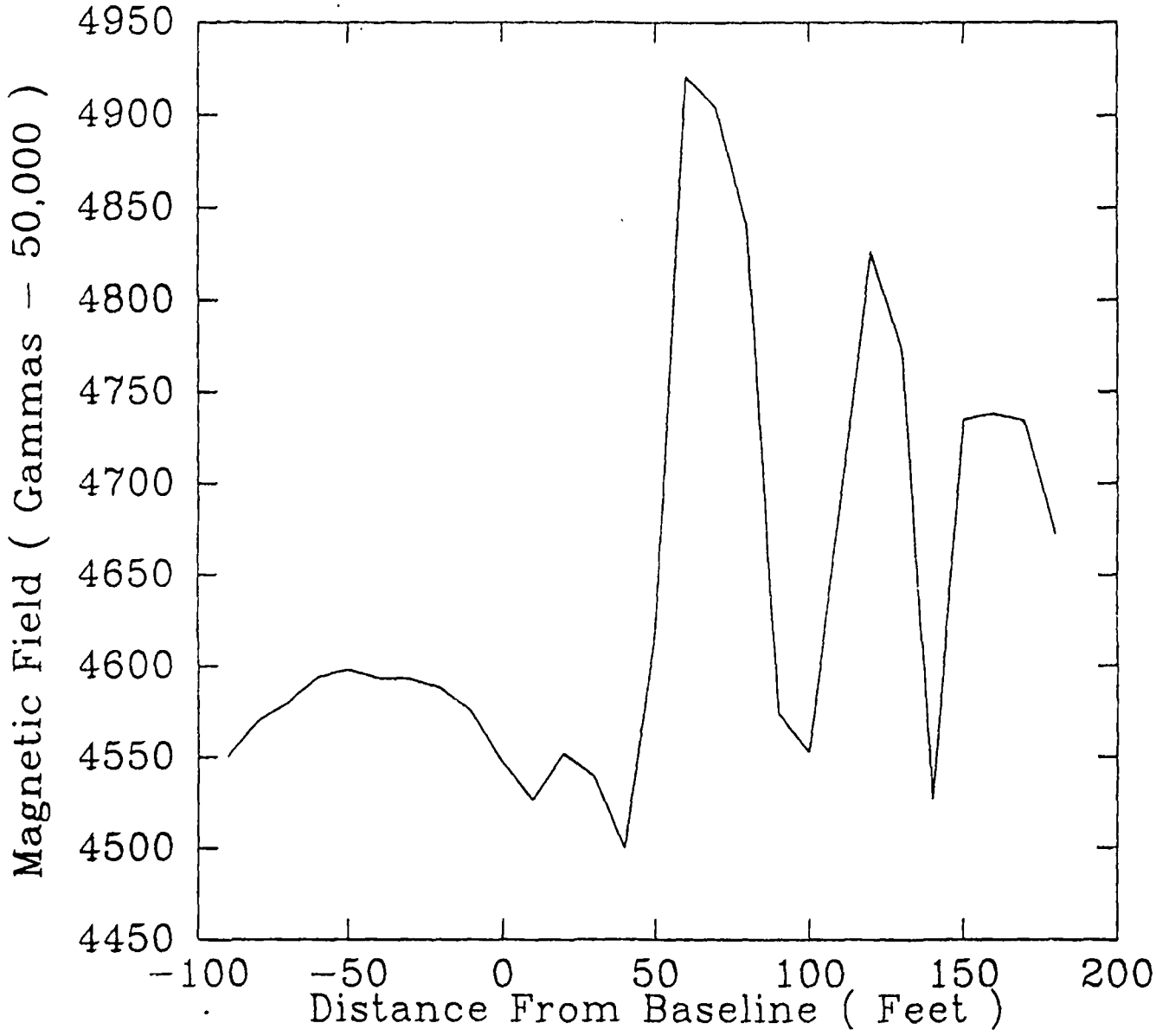

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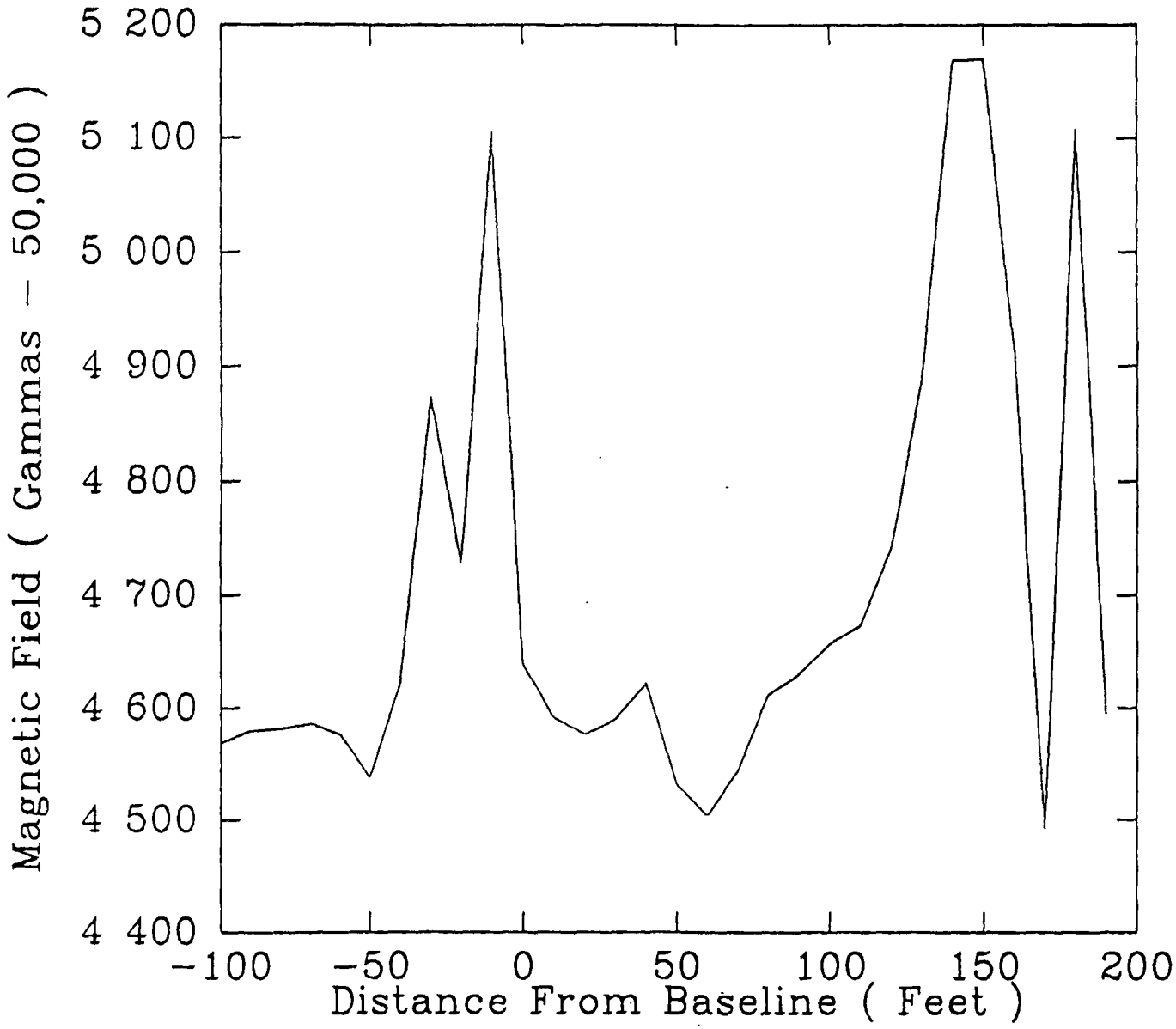
Figure 19

Profile 17



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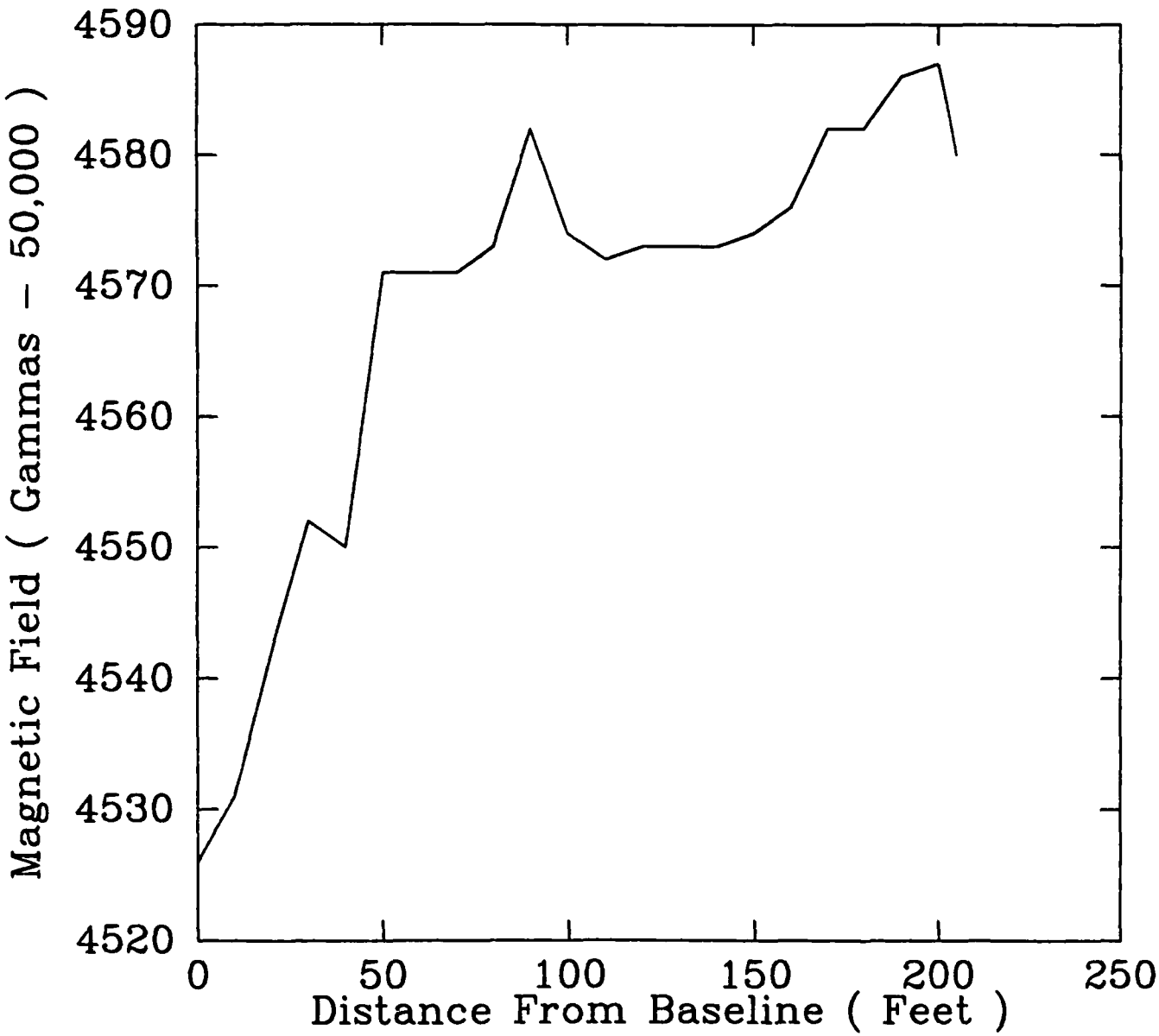
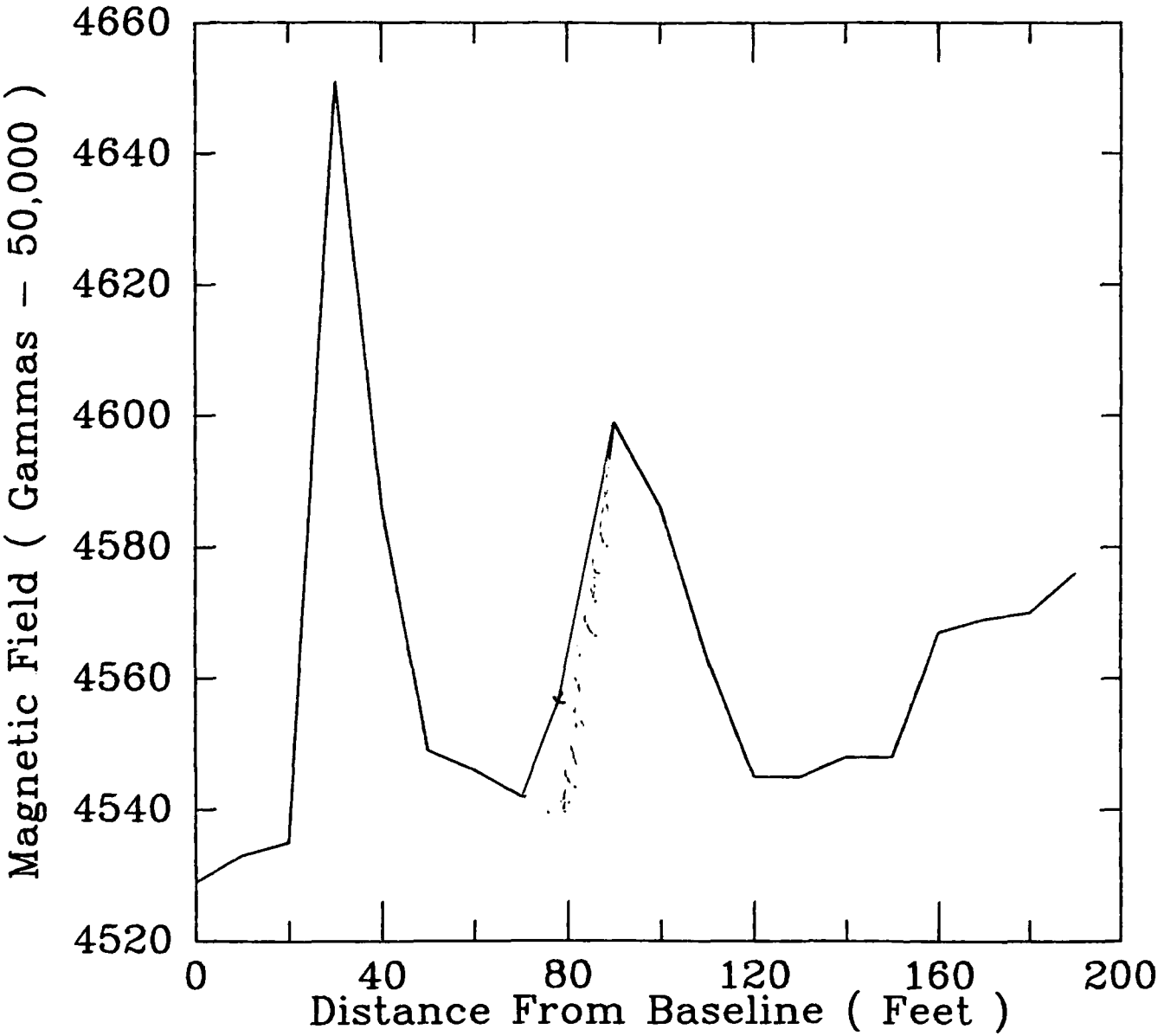
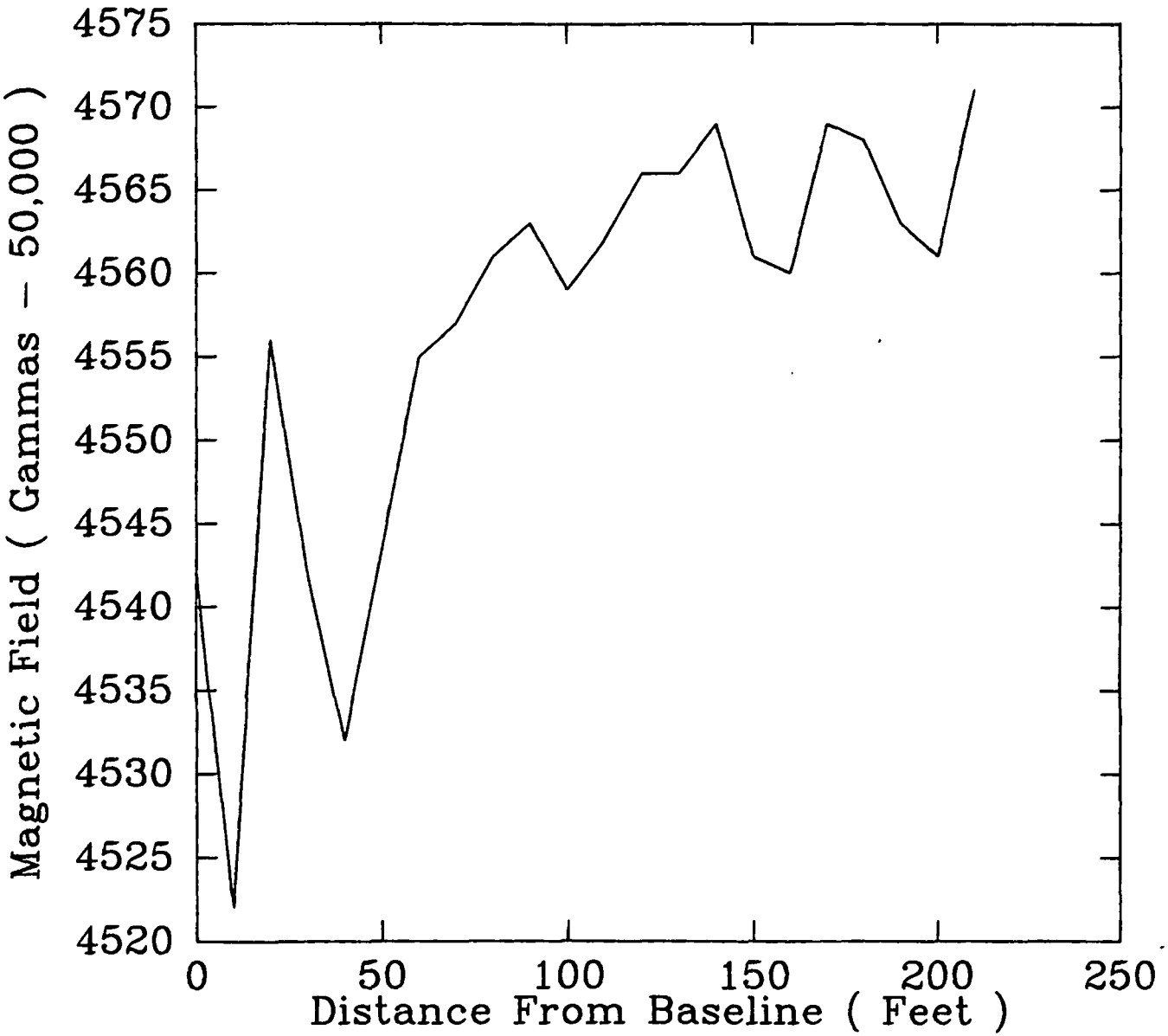


NEJATIFAR [205,101] TXB6: DUA0:[PROGRAMS.][PLOT79OLD]PLOT79.EXE;52 <PLOT79 V2.0> 13-OCT-87 15:26:28

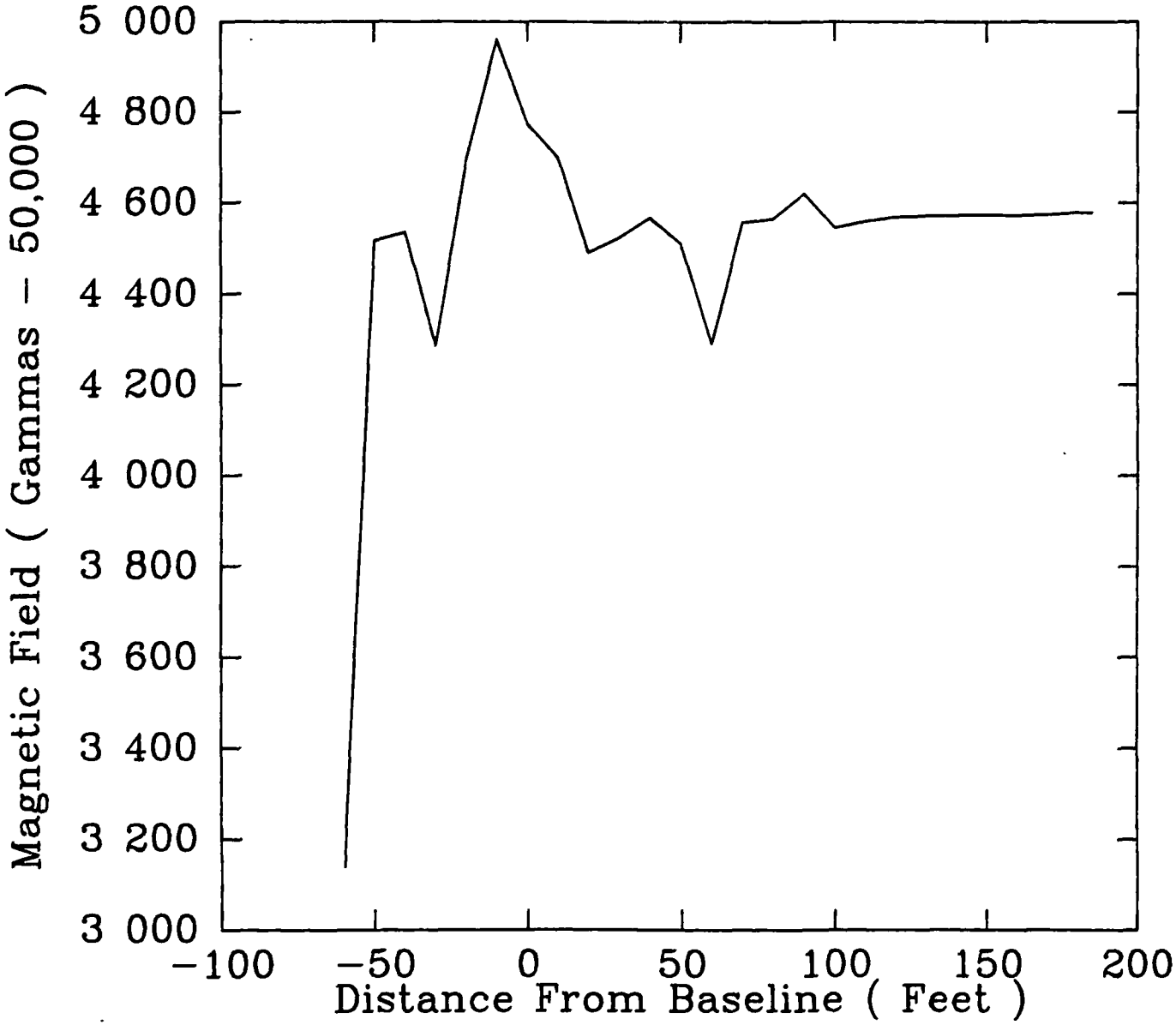
Profile 2


4660
4640
4620
4600
4580
4560
4540
4520
Magnetic Field (Gammas - 50,000)
0
40
80
120
160
200
Distance From Baseline (Feet)

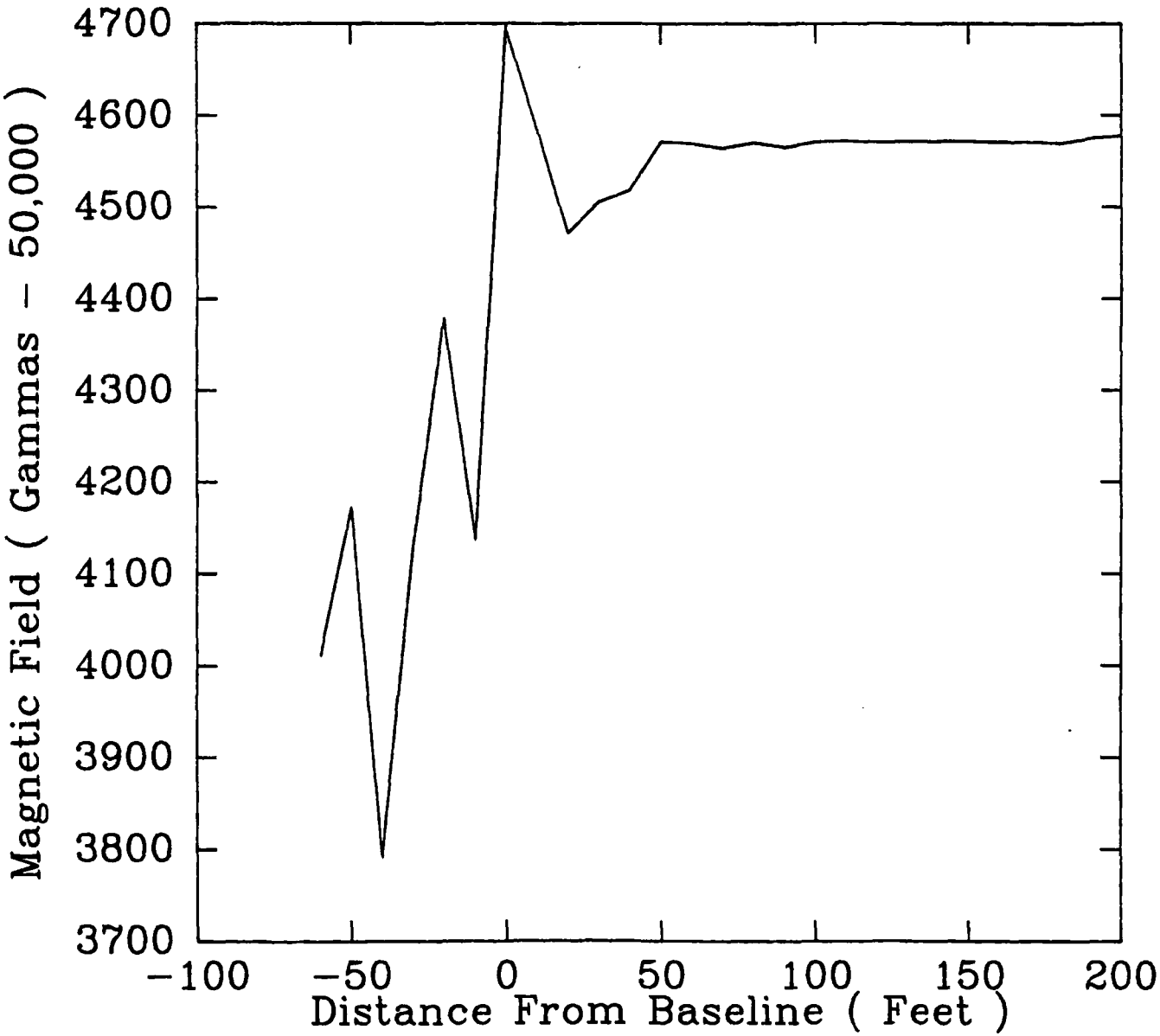
Profile 3


4575
4570
4565
4560
4555
4550
4545
4540
4535
4530
4525
4520
Magnetic Field (Gammas - 50,000)
0
50
100
150
200
250
Distance From Baseline (Feet)

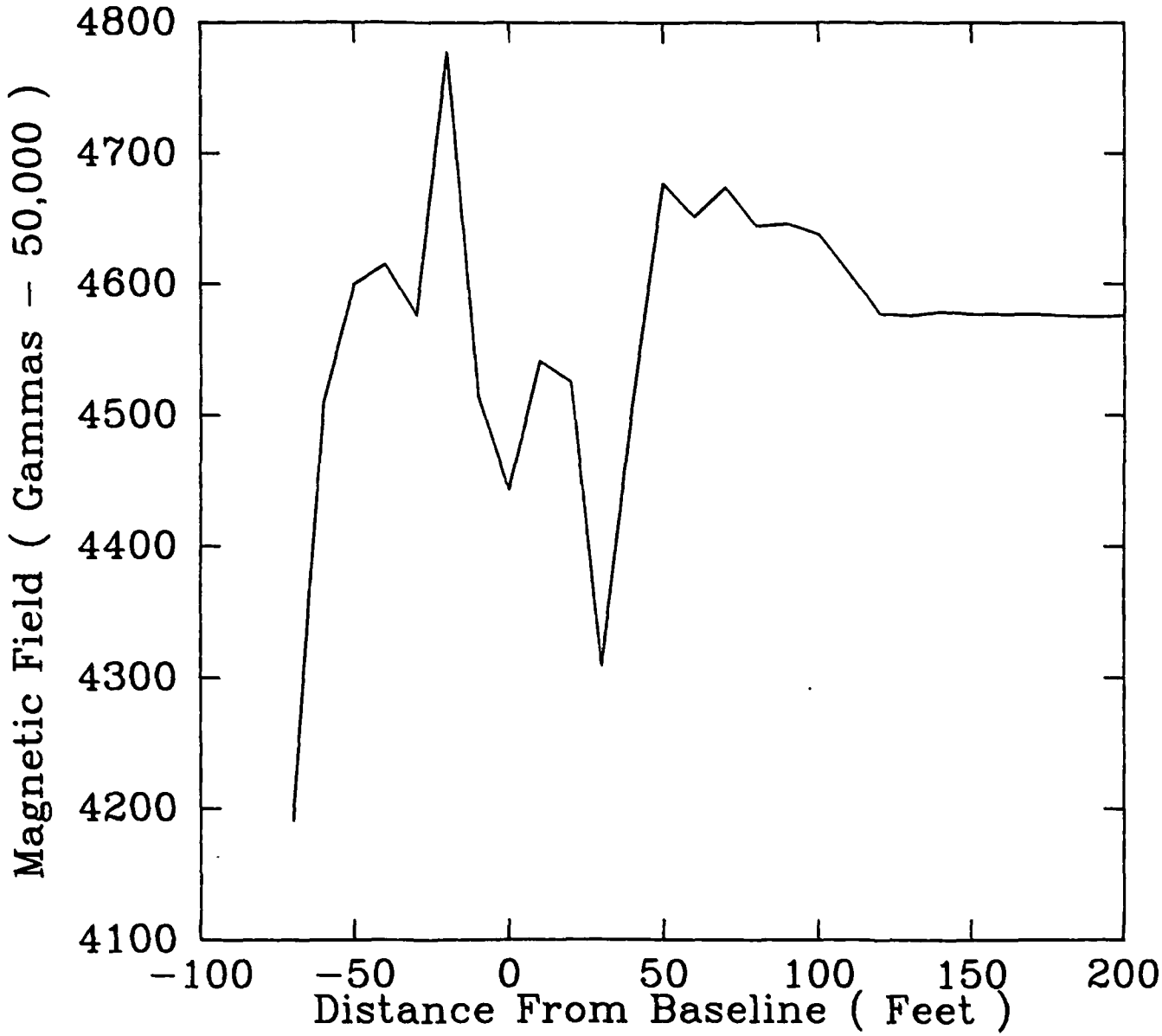
Profile 4


5 000
4 800
4 600
4 400
4 200
4 000
3 800
3 600
3 400
3 200
3 000
Magnetic Field (Gammas - 50,000)
−100
−50
0
50
100
150
200
Distance From Baseline (Feet)

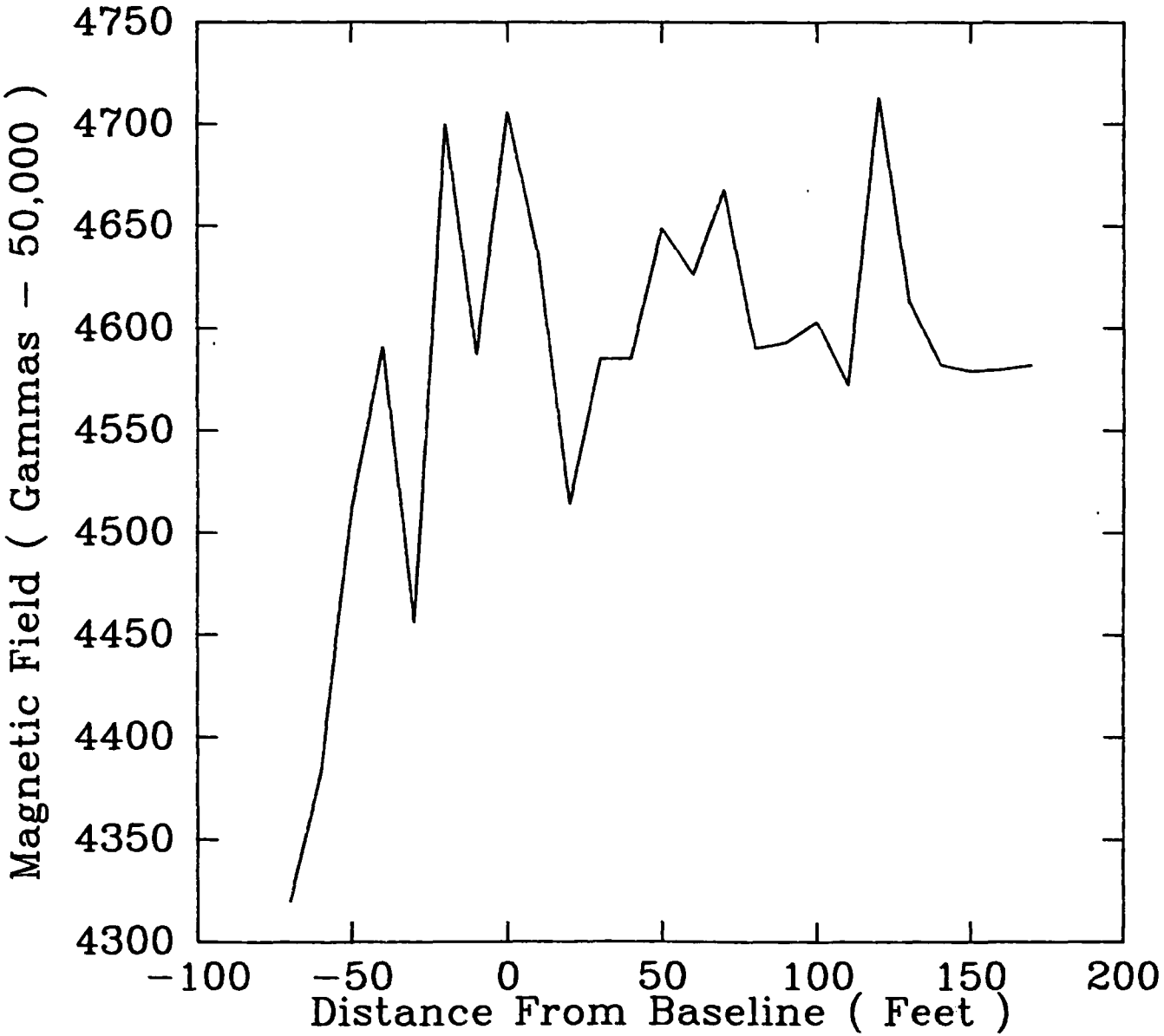
Profile 5


4700
4600
4500
4400
4300
4200
4100
4000
3900
3800
3700
Magnetic Field (Gammas - 50,000)
-100
-50
0
50
100
150
200
Distance From Baseline (Feet)

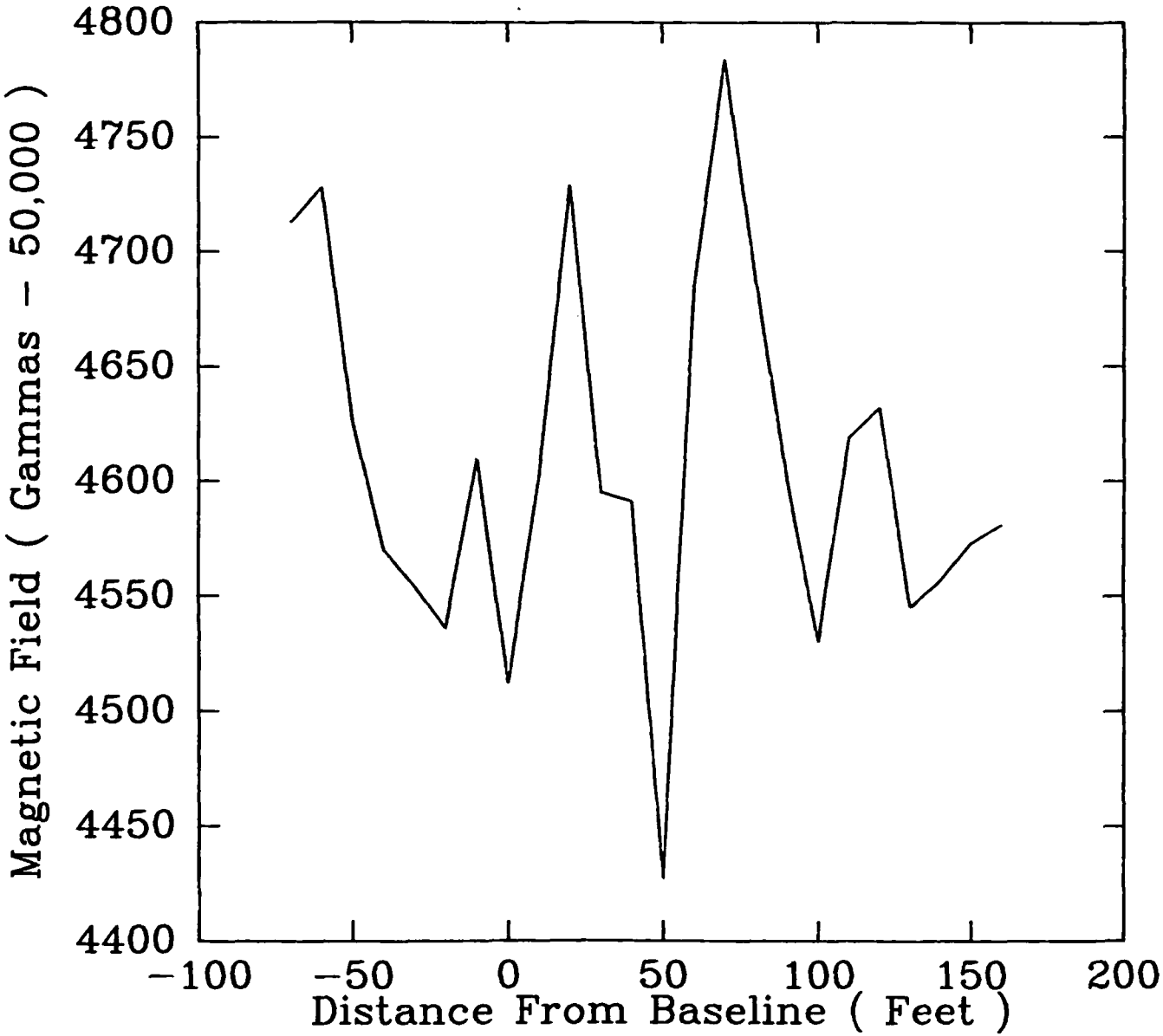
Profile 6


4800
4700
4600
4500
4400
4300
4200
4100
Magnetic Field (Gammas - 50,000)
-100
-50
0
50
100
150
200
Distance From Baseline (Feet)

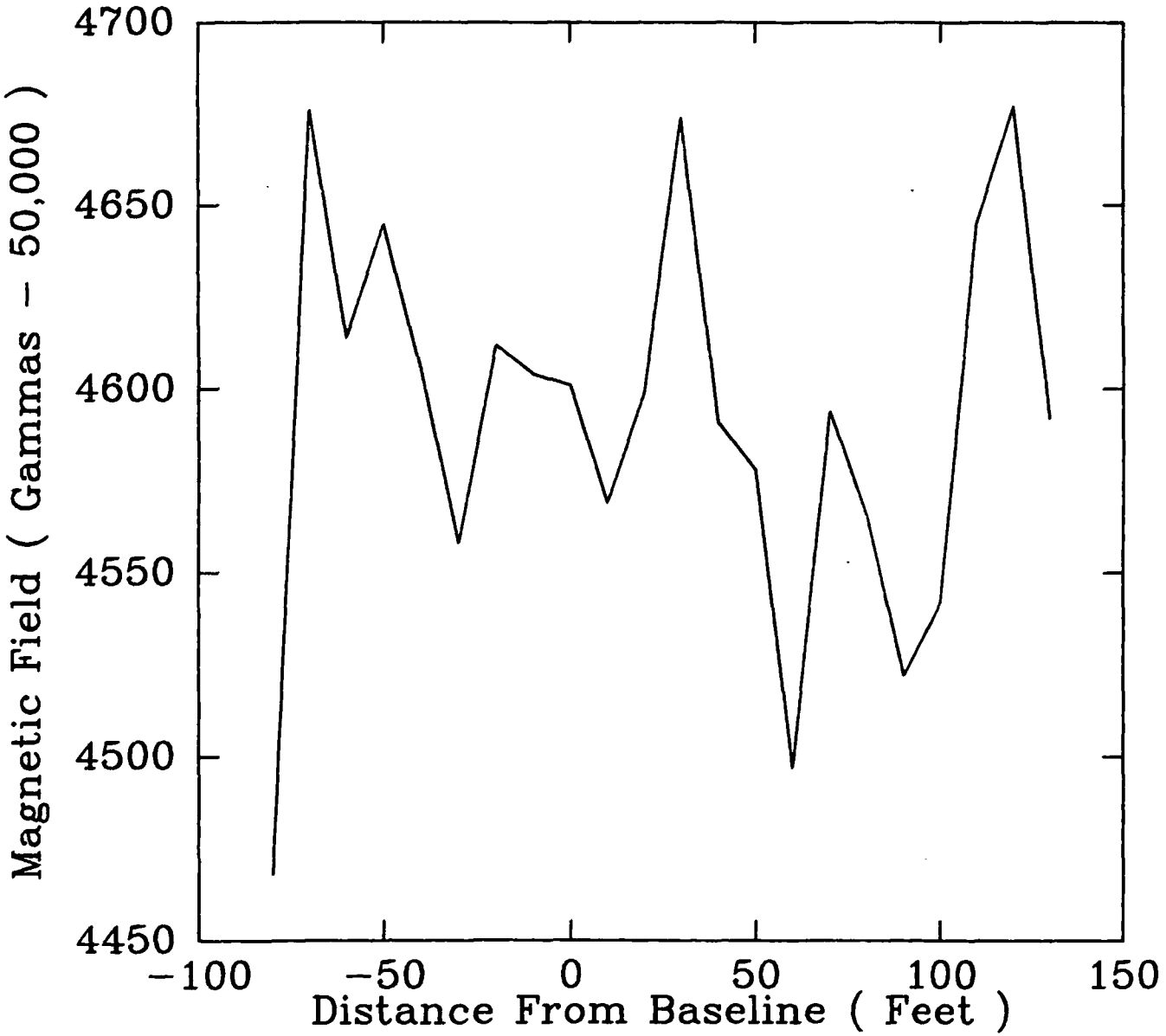
Profile 7


4750
4700
4650
4600
4550
4500
4450
4400
4350
4300
Magnetic Field (Gammas - 50,000)
-100
-50
0
50
100
150
200
Distance From Baseline (Feet)

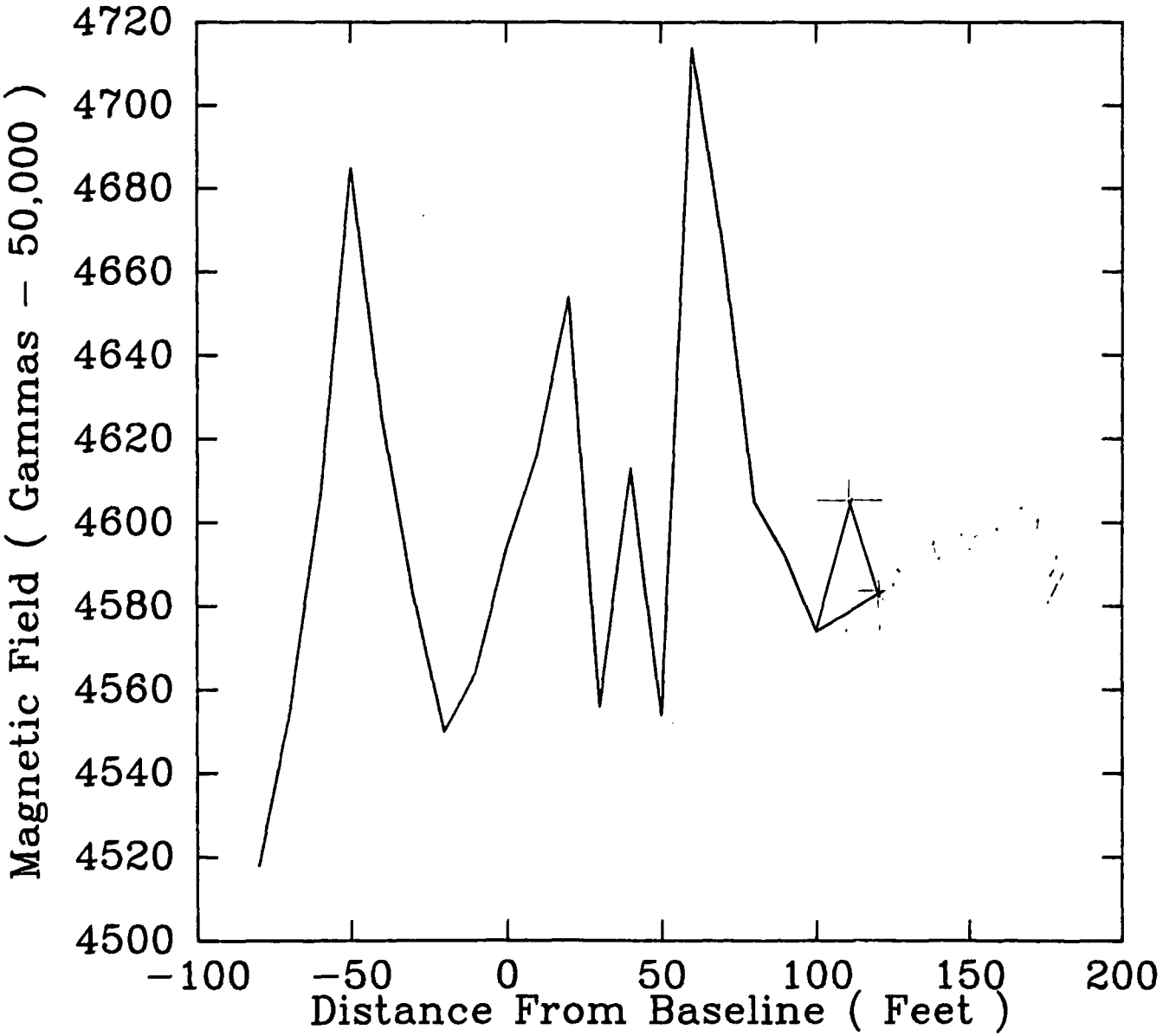
Profile 8


4800
4750
4700
4650
4600
4550
4500
4450
4400
Magnetic Field (Gammas - 50,000)
-100
-50
0
50
100
150
200
Distance From Baseline (Feet)

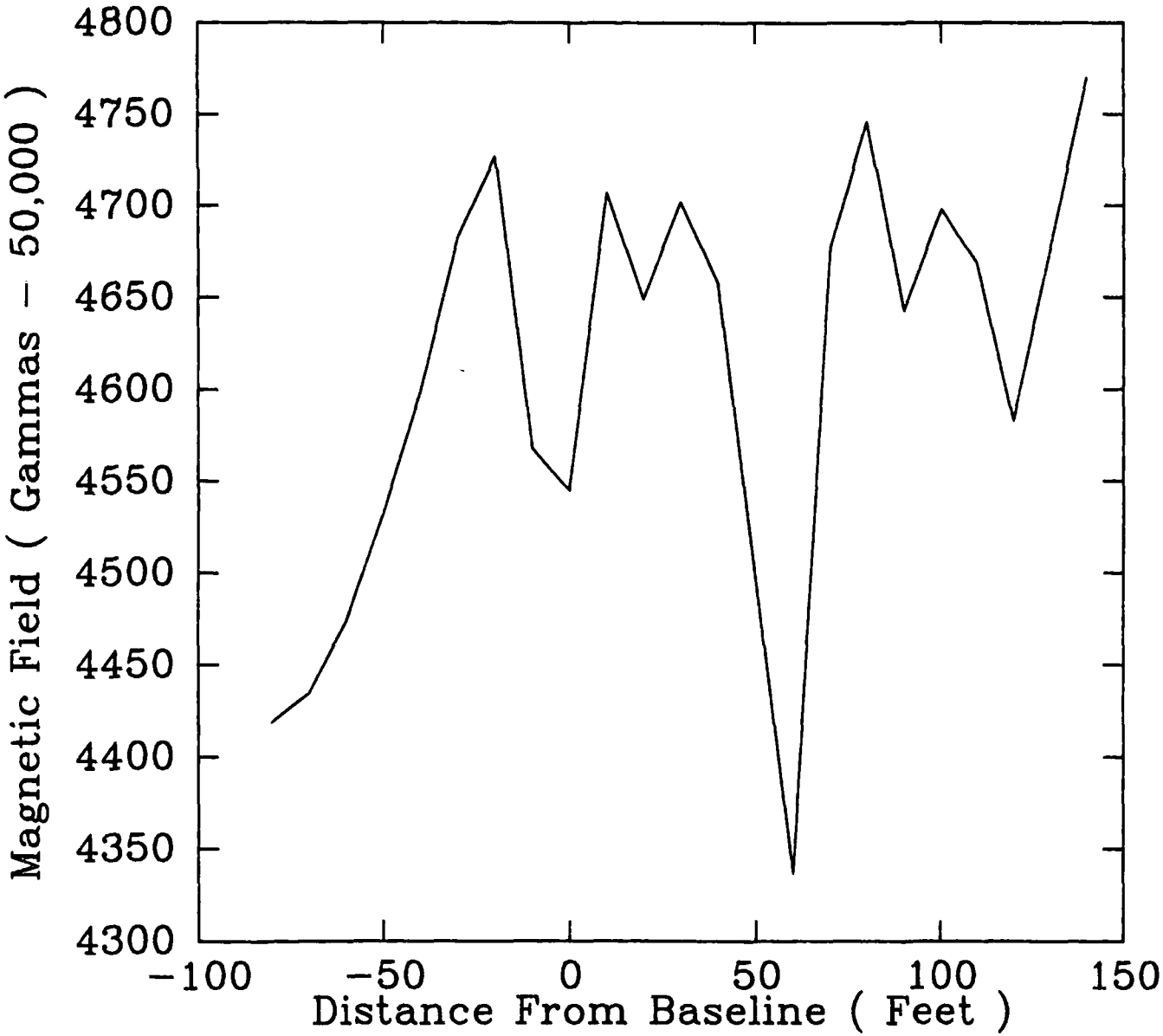
Profile 9


4700
4650
4600
4550
4500
4450
Magnetic Field (Gammas - 50,000)
-100
-50
0
50
100
150
Distance From Baseline (Feet)

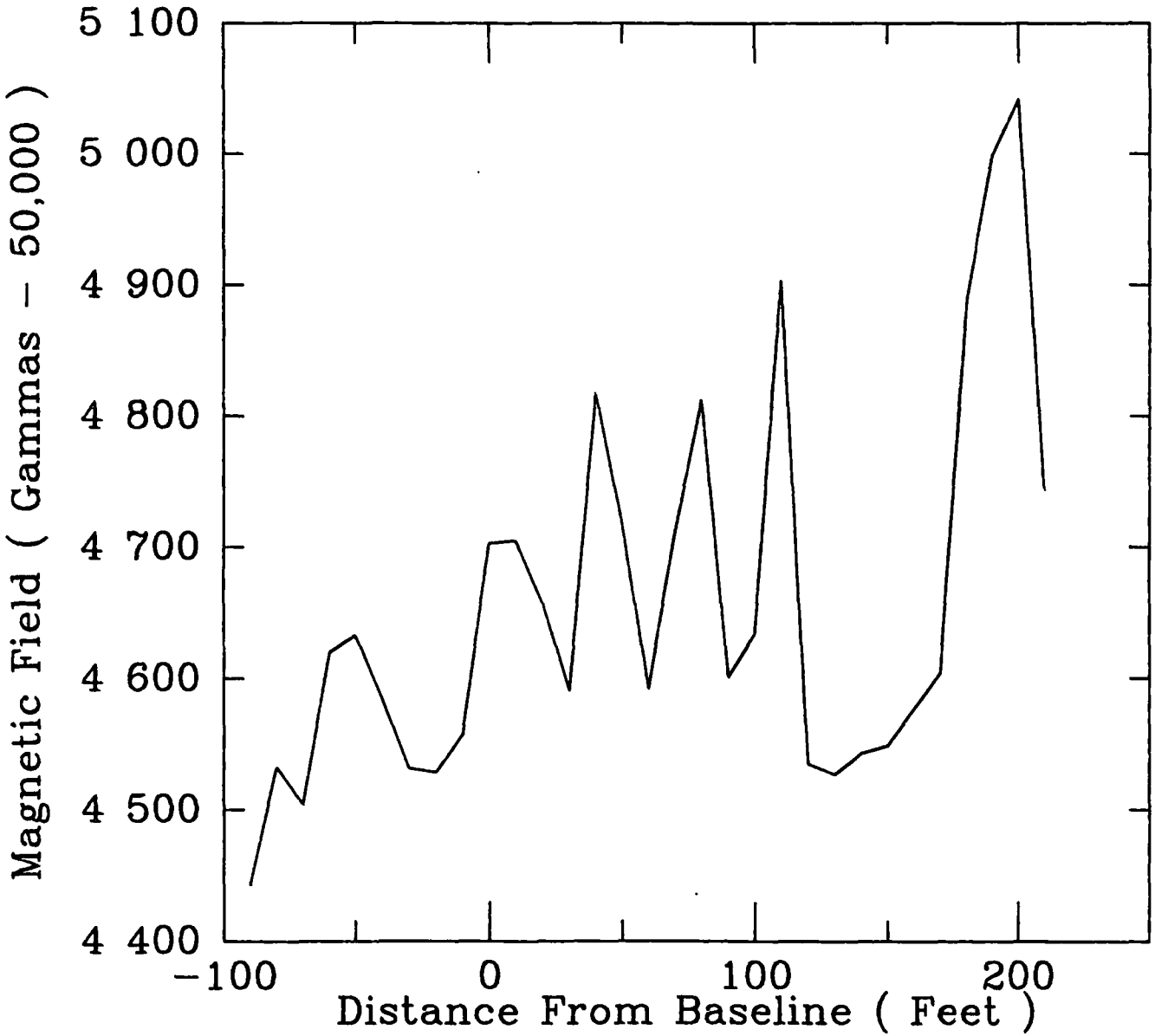
Profile 10


Magnetic Field (Gammas – 50,000)
4720
4700
4680
4660
4640
4620
4600
4580
4560
4540
4520
4500
−100
−50
0
50
100
150
200
Distance From Baseline (Feet)

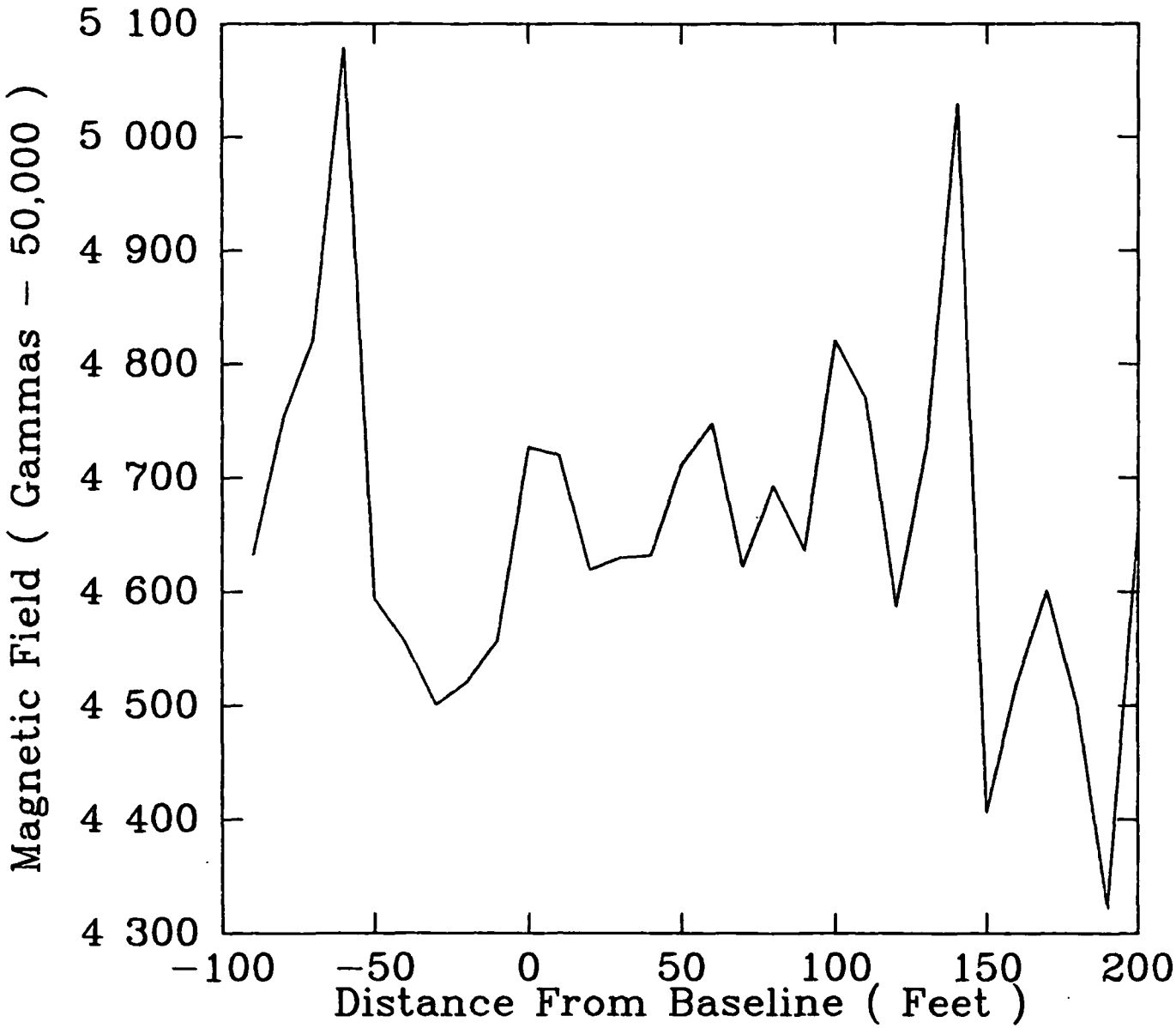
Profile 11


4800
4750
4700
4650
4600
4550
4500
4450
4400
4350
4300
Magnetic Field (Gammas - 50,000)
-100
-50
0
50
100
150
Distance From Baseline (Feet)

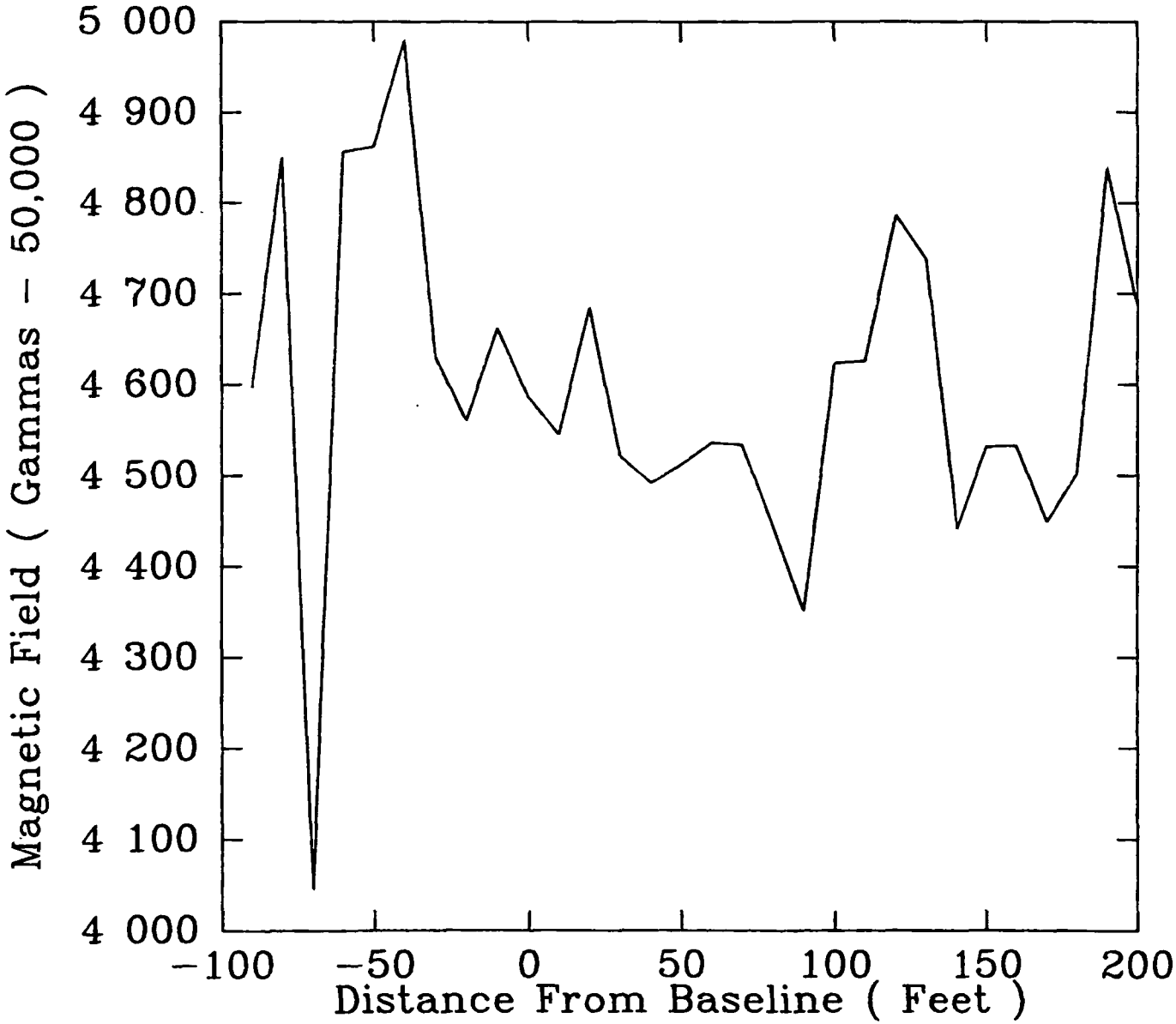
Profile 12


5 100
5 000
4 900
4 800
4 700
4 600
4 500
4 400
Magnetic Field (Gammas - 50,000)
-100
0
100
200
Distance From Baseline (Feet)

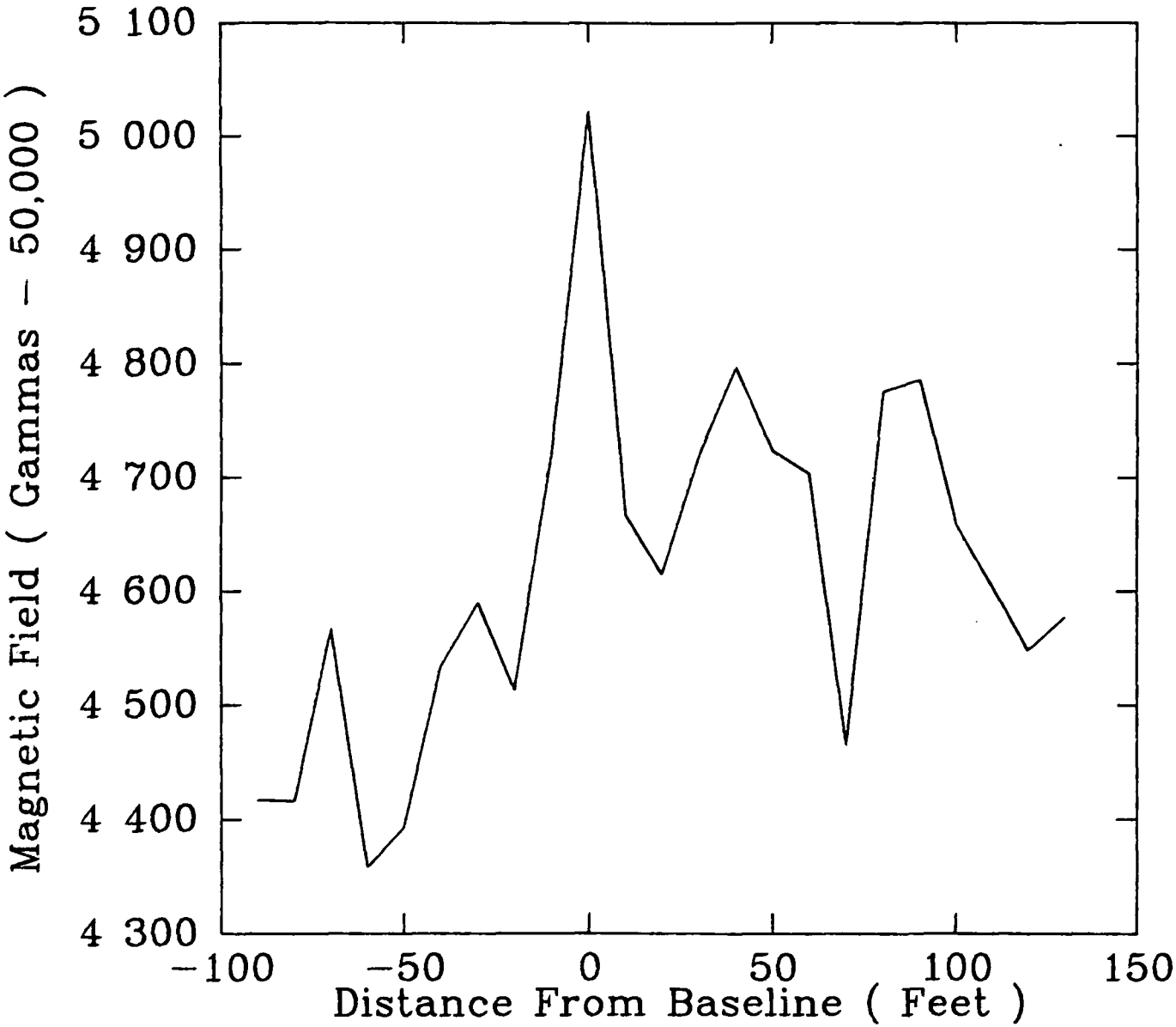
Profile 13


5 100
5 000
4 900
4 800
4 700
4 600
4 500
4 400
4 300
Magnetic Field (Gammas - 50,000)
−100
−50
0
50
100
150
200
Distance From Baseline (Feet)

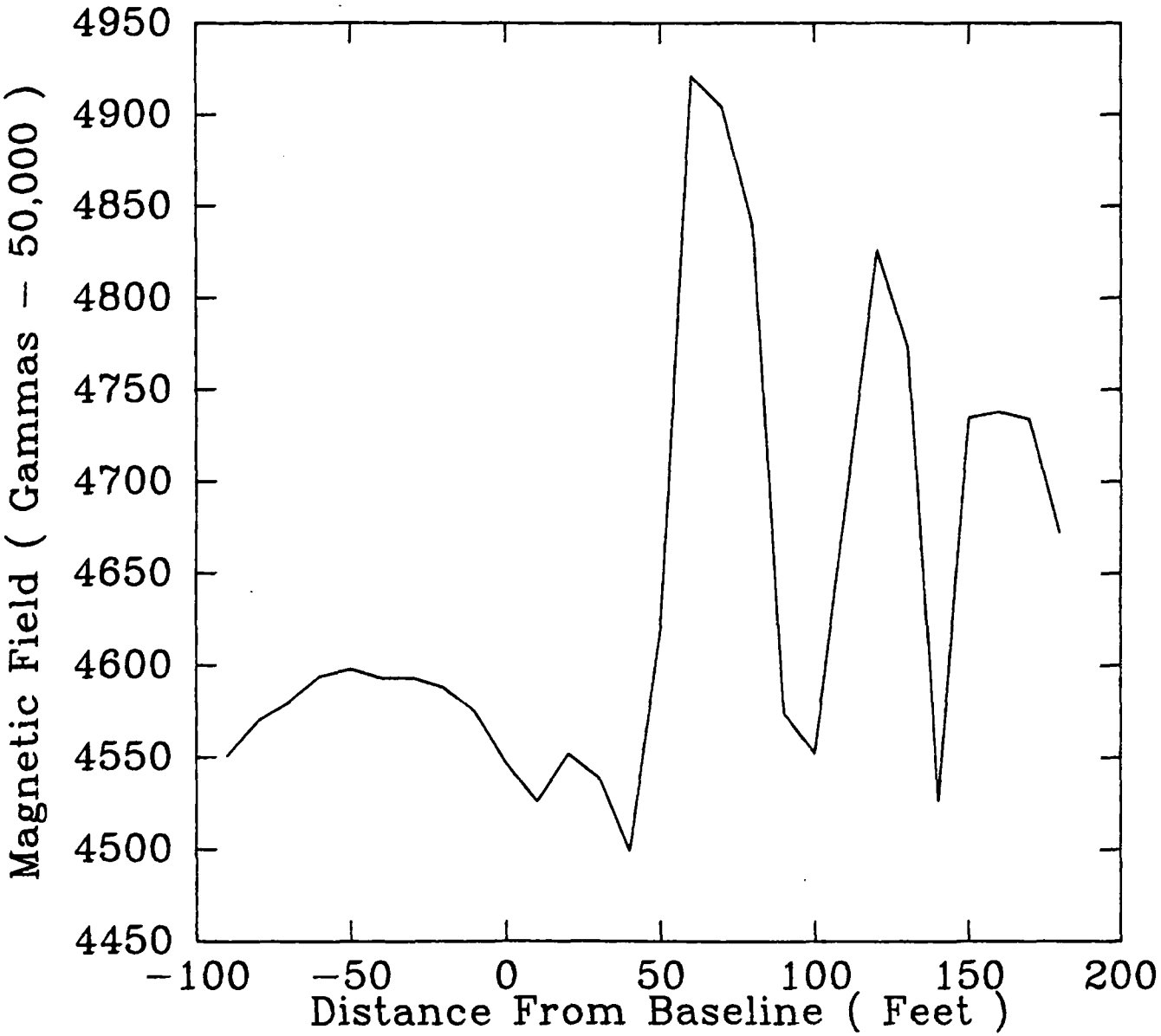
Profile 14


5 000
4 900
4 800
4 700
4 600
4 500
4 400
4 300
4 200
4 100
4 000
Magnetic Field (Gammas - 50,000)
−100
−50
0
50
100
150
200
Distance From Baseline (Feet)

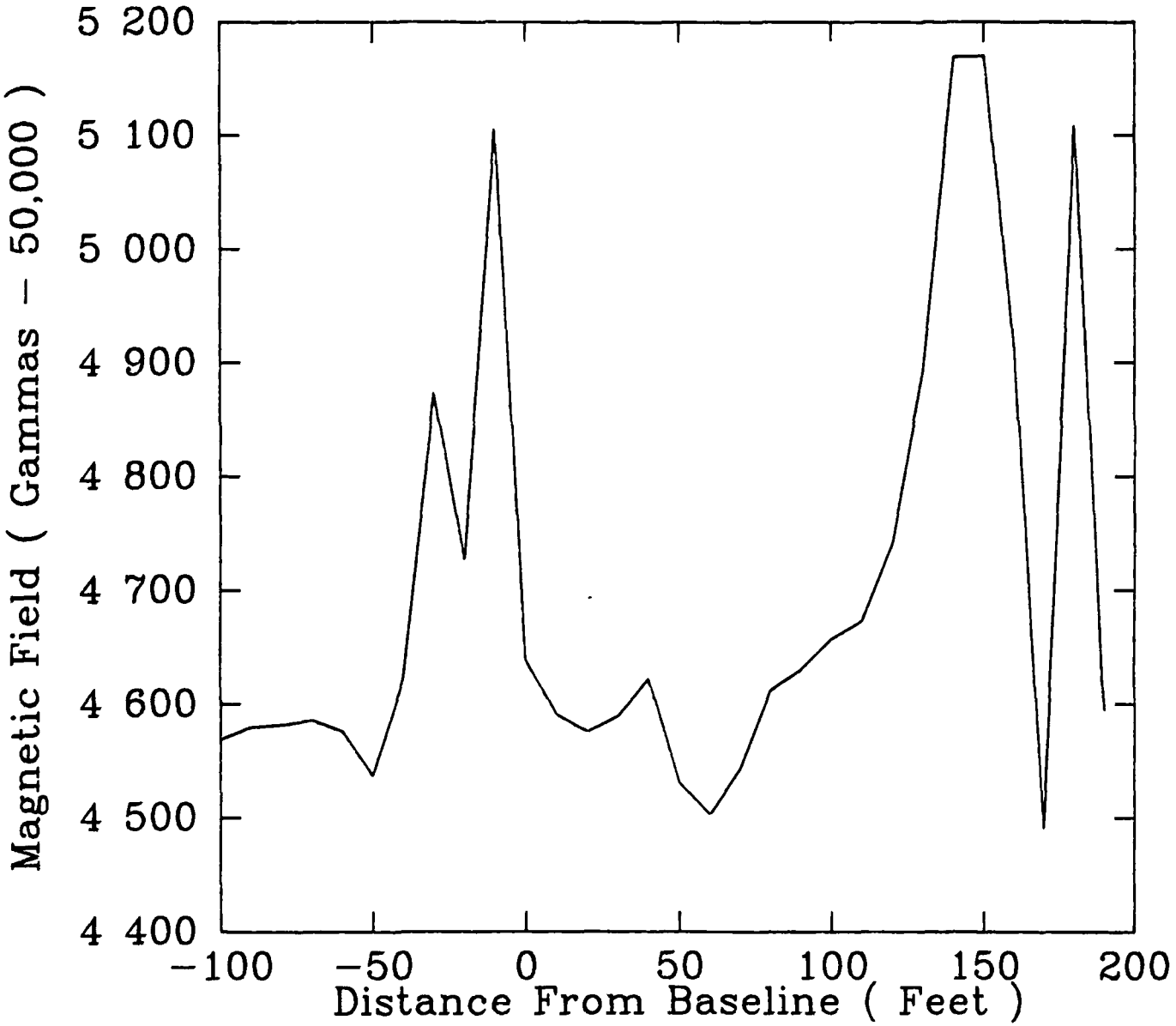
Profile 15


5 100
5 000
4 900
4 800
4 700
4 600
4 500
4 400
4 300
Magnetic Field (Gammas - 50,000)
−100
−50
0
50
100
150
Distance From Baseline (Feet)

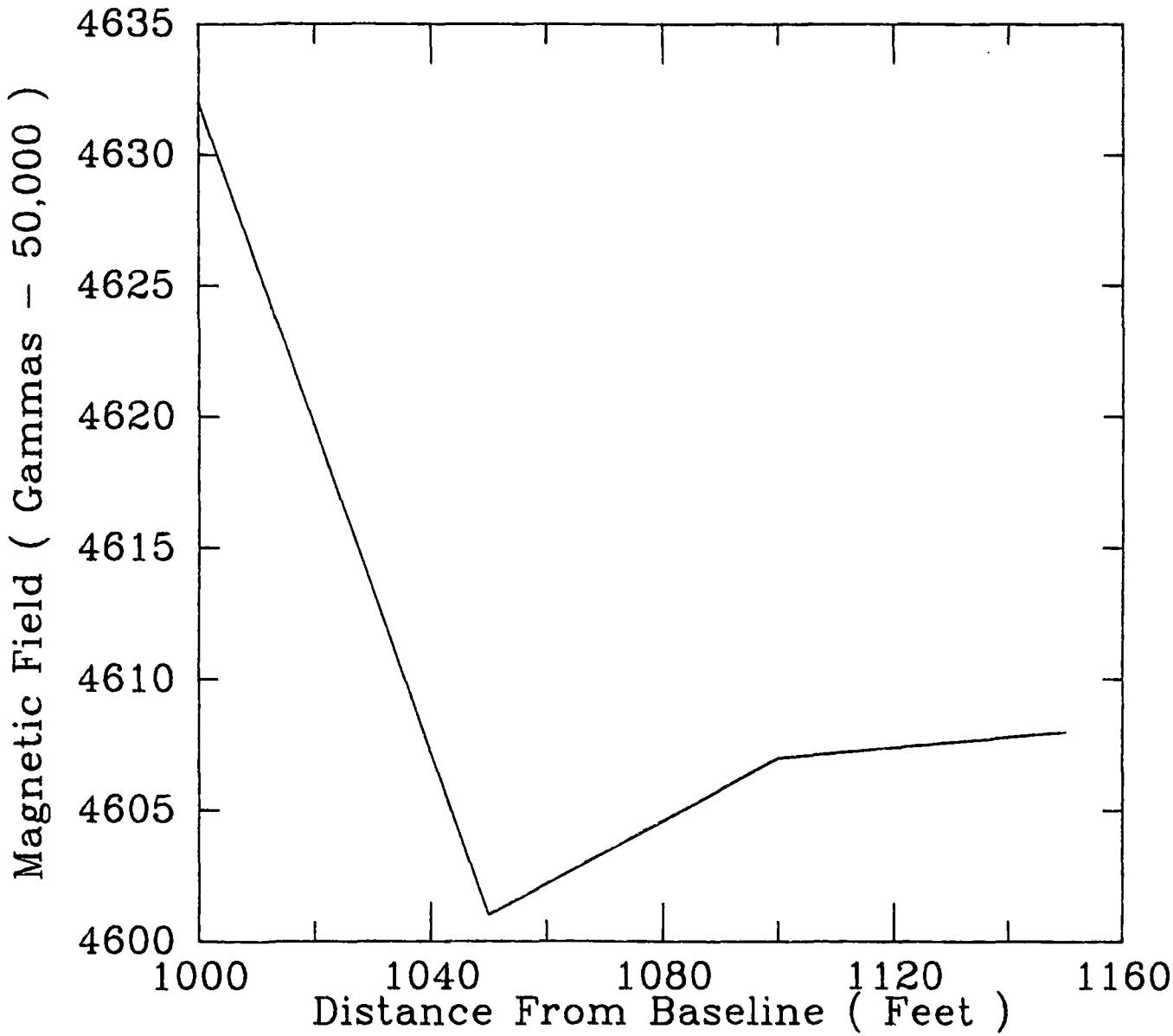
Profile 16


Magnetic Field (Gammas - 50,000)
4950
4900
4850
4800
4750
4700
4650
4600
4550
4500
4450
-100
-50
0
50
100
150
200
Distance From Baseline (Feet)

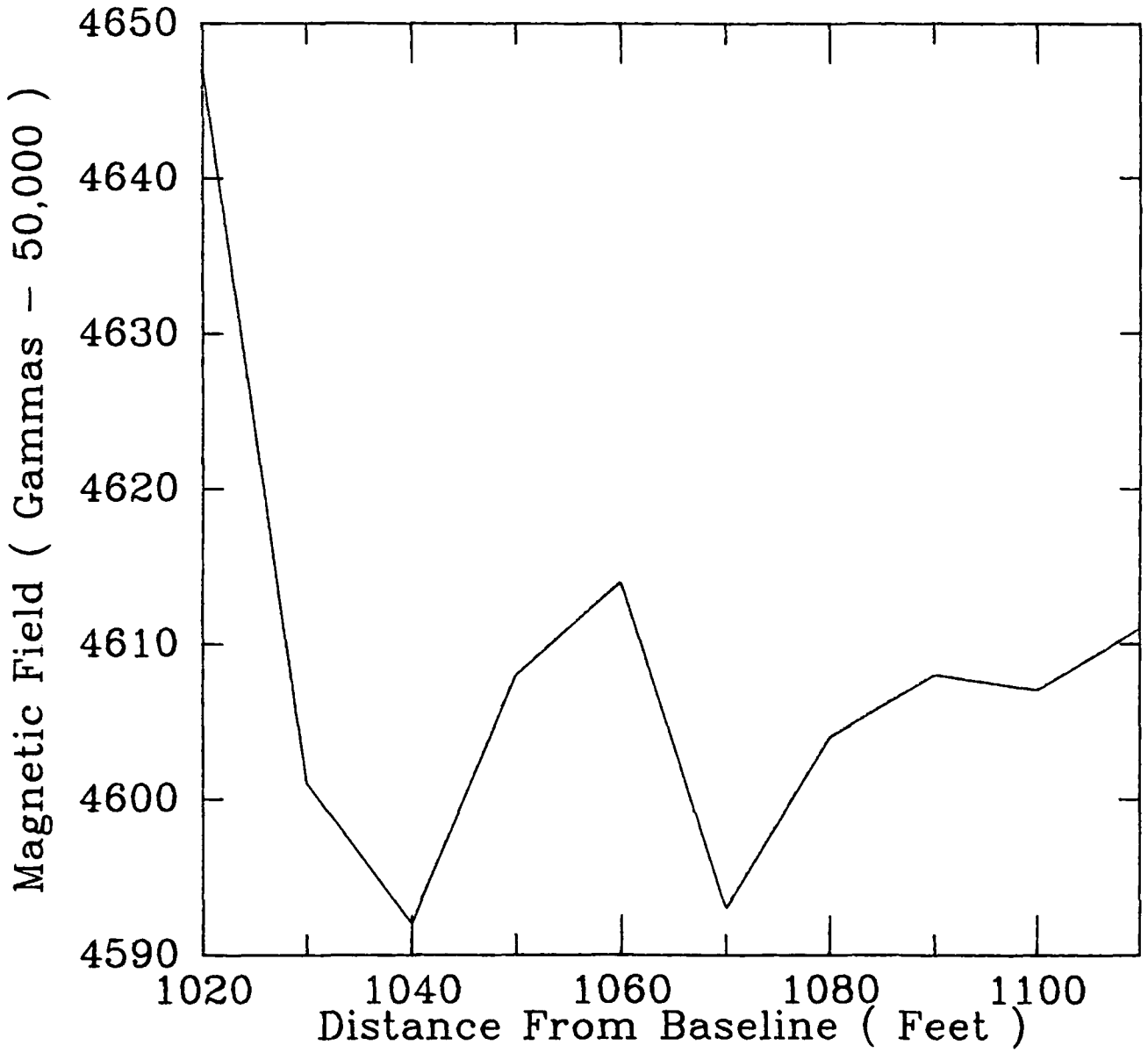
Profile 17


5 200
5 100
5 000
4 900
4 800
4 700
4 600
4 500
4 400
Magnetic Field (Gammas - 50,000)
-100
-50
0
50
100
150
200
Distance From Baseline (Feet)

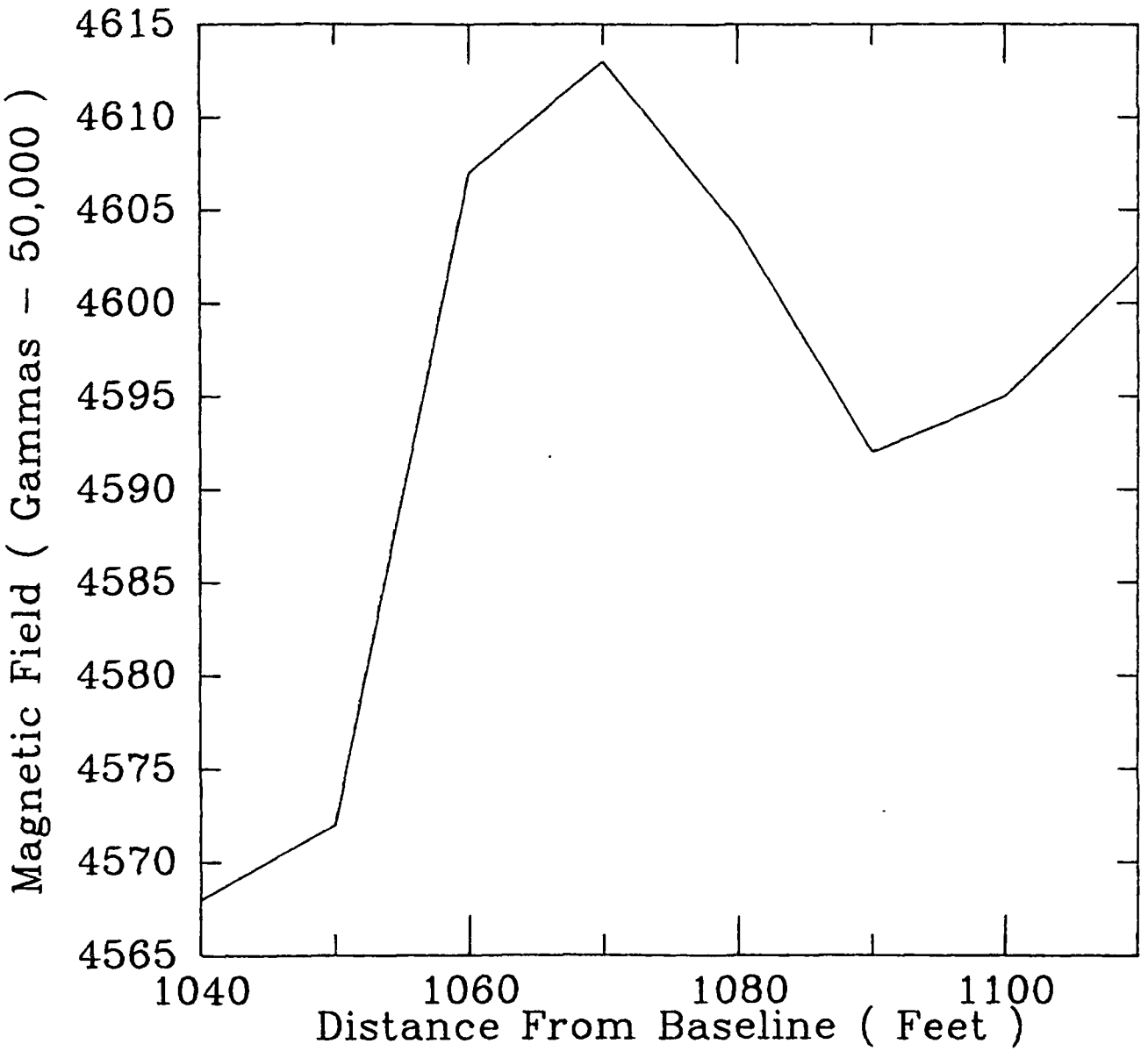
Profile 18 (1)


4635
4630
4625
4620
4615
4610
4605
4600
Magnetic Field (Gammas - 50,000)
1000
1040
1080
1120
1160
Distance From Baseline (Feet)

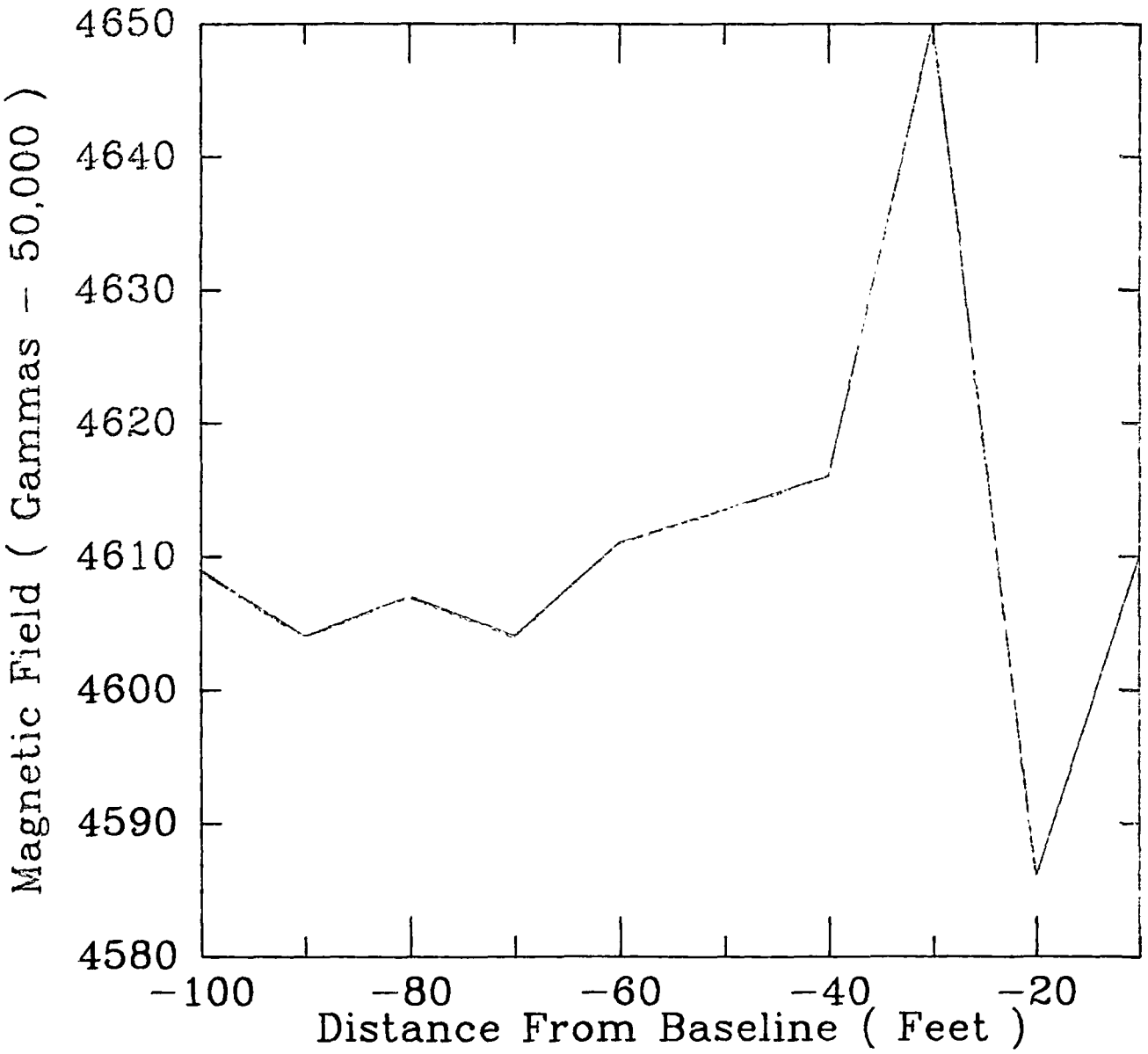
Profile 18 (2)


4650
4640
4630
4620
4610
4600
4590
Magnetic Field (Gammas - 50,000)
1020
1040
1060
1080
1100
Distance From Baseline (Feet)

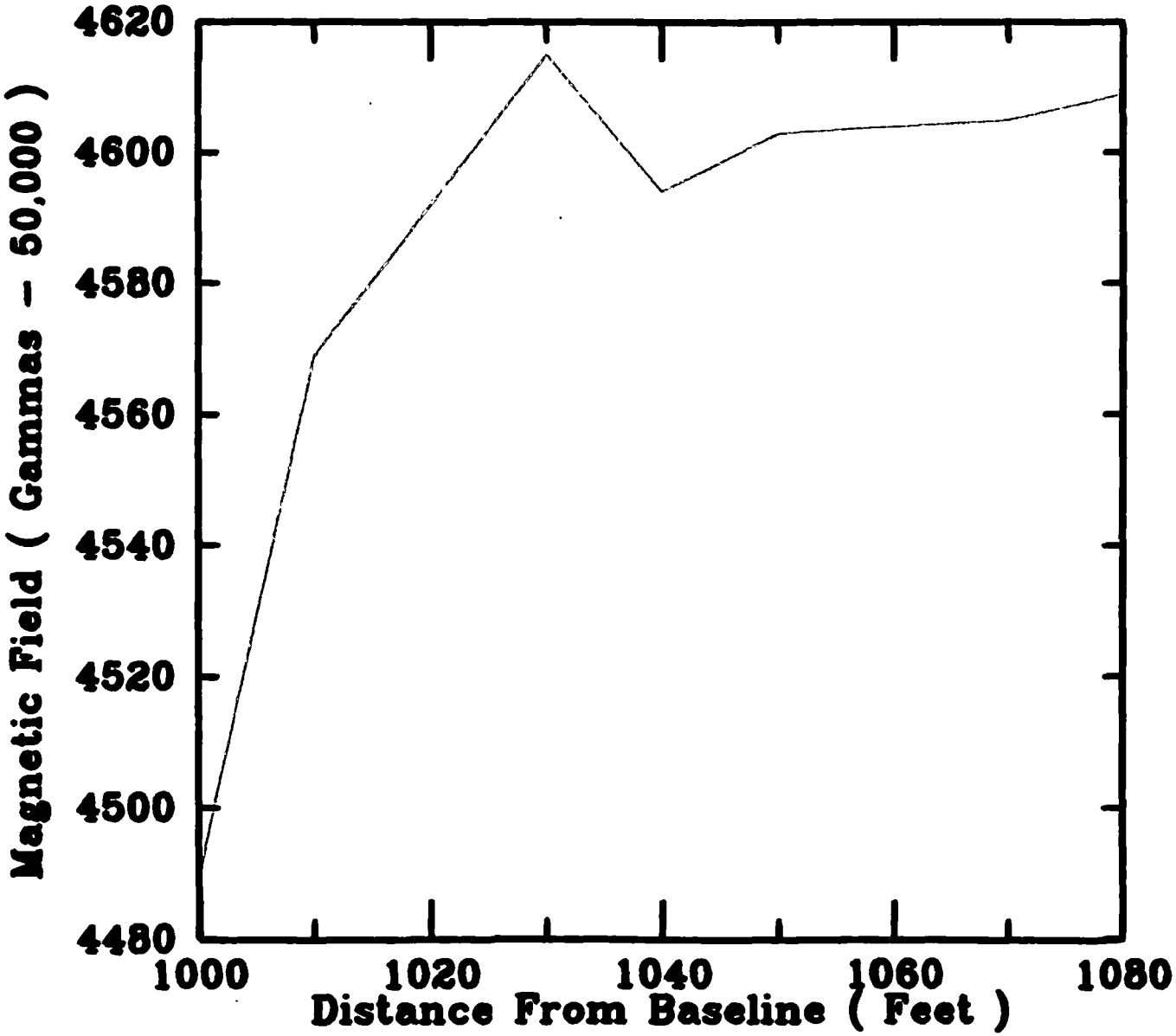
Profile 18 (3)


4615
4610
4605
4600
4595
4590
4585
4580
4575
4570
4565
Magnetic Field (Gammas - 50,000)
1040
1060
1080
1100
Distance From Baseline (Feet)

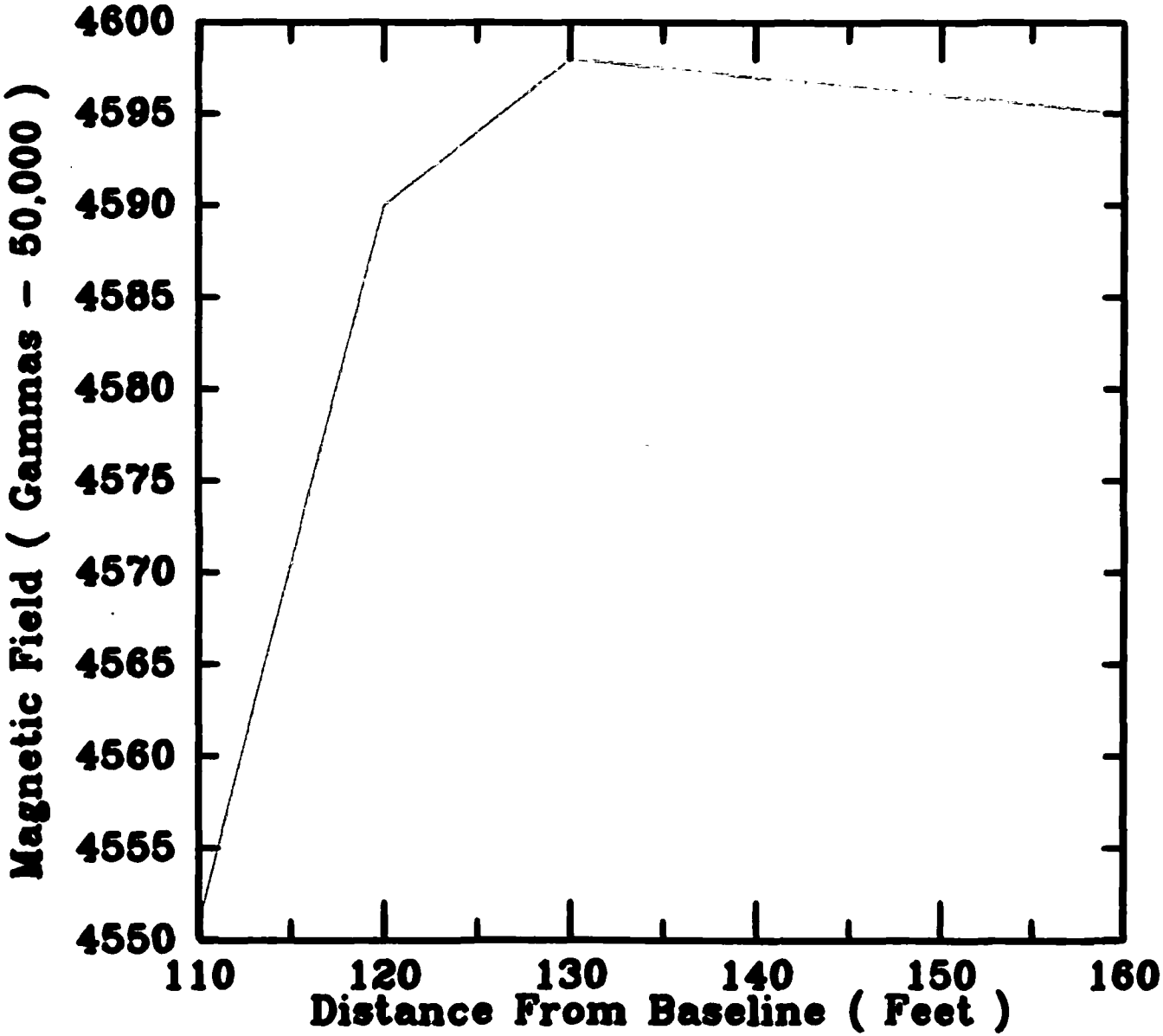
Profile 18 (4)


4650
4640
4630
4620
4610
4600
4590
4580
Magnetic Field (Gammas - 50,000)
-100
-80
-60
-40
-20
Distance From Baseline (Feet)

Profile 18 (5)


4620
4600
4580
4560
4540
4520
4500
4480
Magnetic Field (Gammas - 50,000)
1000
1020
1040
1060
1080
Distance From Baseline (Feet)

Profile 18 (6)


4600
4595
4590
4585
4580
4575
4570
4565
4560
4555
4550
Magnetic Field (Gammas - 50,000)
110
120
130
140
150
160
Distance From Baseline (Feet)

PROFILE 1

0	4526
10	4531
20	4542
30	4552
40	4550
50	4571
60	4571
70	4571
80	4573
90	4582
100	4574
110	4572
120	4573
130	4573
140	4573
150	4574
160	4576
170	4582
180	4582
190	4586
200	4587
205	4580

PROFILE 2

0	4529
10	4533
20	4535
30	4651
40	4586
50	4549
60	4546
70	4542
80	4541
90	4599
100	4586
110	4563
120	4545
130	4545
140	4548
150	4548
160	4567
170	4569
180	4570
190	4576

PROFILE 3

0	4542
10	4522
20	4556
30	4542
40	4532
60	4555
70	4557

80	4561
90	4563
100	4559
110	4562
120	4566
130	4566
140	4569
150	4561
160	4560
170	4569
180	4568
190	4563
200	4561
210	4571

PROFILE 4

-60	3139
-50	4517
-40	4535
-30	4285
-20	4695
-10	4961
0	4774
10	4700
20	4490
30	4523
40	4567
50	4510
60	4289
70	4557
80	4565
90	4620
100	4545
110	4559
120	4569
130	4571
140	4572
150	4574
160	4572
170	4574
180	4579
185	4578

PROFILE 5

-60	4011
-50	4172
-40	3791
-30	4129
-20	4378
-10	4137
0	4694
10	4585
20	4471
30	4505
40	4516

50	4571
60	4569
70	4564
80	4570
90	4565
100	4571
110	4572
120	4570
130	4571
140	4571
150	4571
160	4570
170	4570
180	4569
190	4575
200	4578

PROFILE 6

-70	4191
-60	4510
-50	4600
-40	4615
-30	4576
-20	4777
-10	4514
0	4443
10	4541
20	4525
30	4309
40	4507
50	4677
60	4651
70	4674
80	4644
90	4646
100	4638
110	4608
120	4577
130	4576
140	4579
150	4577
160	4577
170	4577
180	4576
190	4575
200	4576

PROFILE 7

-70	4320
-60	4382
-50	4512
-40	4591
-30	4456
-20	4700
-10	4587
0	4706

10	4635
20	4514
30	4585
40	4585
50	4649
60	4626
70	4668
80	4590
90	4593
100	4603
110	4572
120	4713
130	4613
140	4582
150	4579
160	4580
170	4582

PROFILE 8

-70	4713
-60	4728
-50	4626
-40	4570
-30	4554
-20	4536
-10	4610
0	4512
10	4603
20	4729
30	4595
40	4591
50	4427
60	4683
70	4784
80	4688
90	4600
100	4530
110	4619
120	4632
130	4545
140	4557
150	4573
160	4581

PROFILE 9

-80	4468
-70	4676
-60	4614
-50	4645
-40	4605
-30	4558
-20	4612
-10	4604
0	4601
10	4569
20	4599

30	4674
40	4591
50	4578
60	4497
70	4594
80	4565
90	4522
100	4542
110	4645
120	4677
130	4592

PROFILE 10

-80	4518
-70	4554
-60	4606
-50	4685
-40	4625
-30	4583
-20	4550
-10	4564
0	4594
10	4617
20	4654
30	4556
40	4613
50	4554
60	4714
70	4666
80	4605
90	4592
100	4574
170	4605
180	4584

PROFILE 11

-80	4419
-70	4435
-60	4474
-50	4533
-40	4599
-30	4683
-20	4727
-10	4568
0	4545
10	4707
20	4649
30	4702
40	4658
60	4337
70	4676
80	4746
90	4643
100	4698
110	4669
120	4583

130	4677
140	4770

PROFILE 12

-90	4443
-80	4533
-70	4504
-60	4620
-50	4633
-40	4585
-30	4532
-20	4529
-10	4558
0	4703
10	4705
20	4657
30	4591
40	4817
50	4717
60	4592
70	4711
80	4812
90	4601
100	4634
110	4903
120	4535
130	4527
140	4343
150	4549
170	4604
180	4889
190	4999
200	5042
210	4744

PROFILE 13

-90	4633
-80	4752
-70	4823
-60	5079
-50	4594
-40	4556
-30	4501
-20	4521
-10	4557
0	4727
10	4720
20	4619
30	4630
40	4632
50	4711
60	4748
70	4622
80	4693
90	4636
100	4821

110	4770
120	4587
130	4728
140	5029
150	4406
160	4519
170	4601
180	4500
190	4322
200	4656

PROFILE 14

-90	4598
-80	4850
-70	4045
-60	4857
-50	4862
-40	4980
-30	4631
-20	4560
-10	4662
0	4586
10	4545
20	4685
30	4521
40	4492
50	4512
60	4536
70	4534
80	4444
90	4351
100	4624
110	4626
120	4787
130	4738
140	4441
150	4532
160	4533
170	4449
180	4303
190	4839
200	4688

PROFILE 15

-90	4417
-80	4416
-70	4567
-60	4358
-50	4393
-40	4534
-30	4590
-20	4513
-10	4723
0	5022
10	4667
20	4615

30	4720
40	4797
50	4724
60	4704
70	4465
80	4776
90	4786
100	4659
110	4605
120	4548
130	4577

PROFILE 16

-90	4551
-80	4570
-70	4580
-60	4594
-50	4598
-40	4593
-30	4593
-20	4588
-10	4575
0	4547
10	4526
20	4552
30	4539
40	4499
50	4620
60	4921
70	4904
80	4840
90	4574
100	4552
110	4689
120	4826
130	4773
140	4526
150	4735
160	4738
170	4734
180	4672

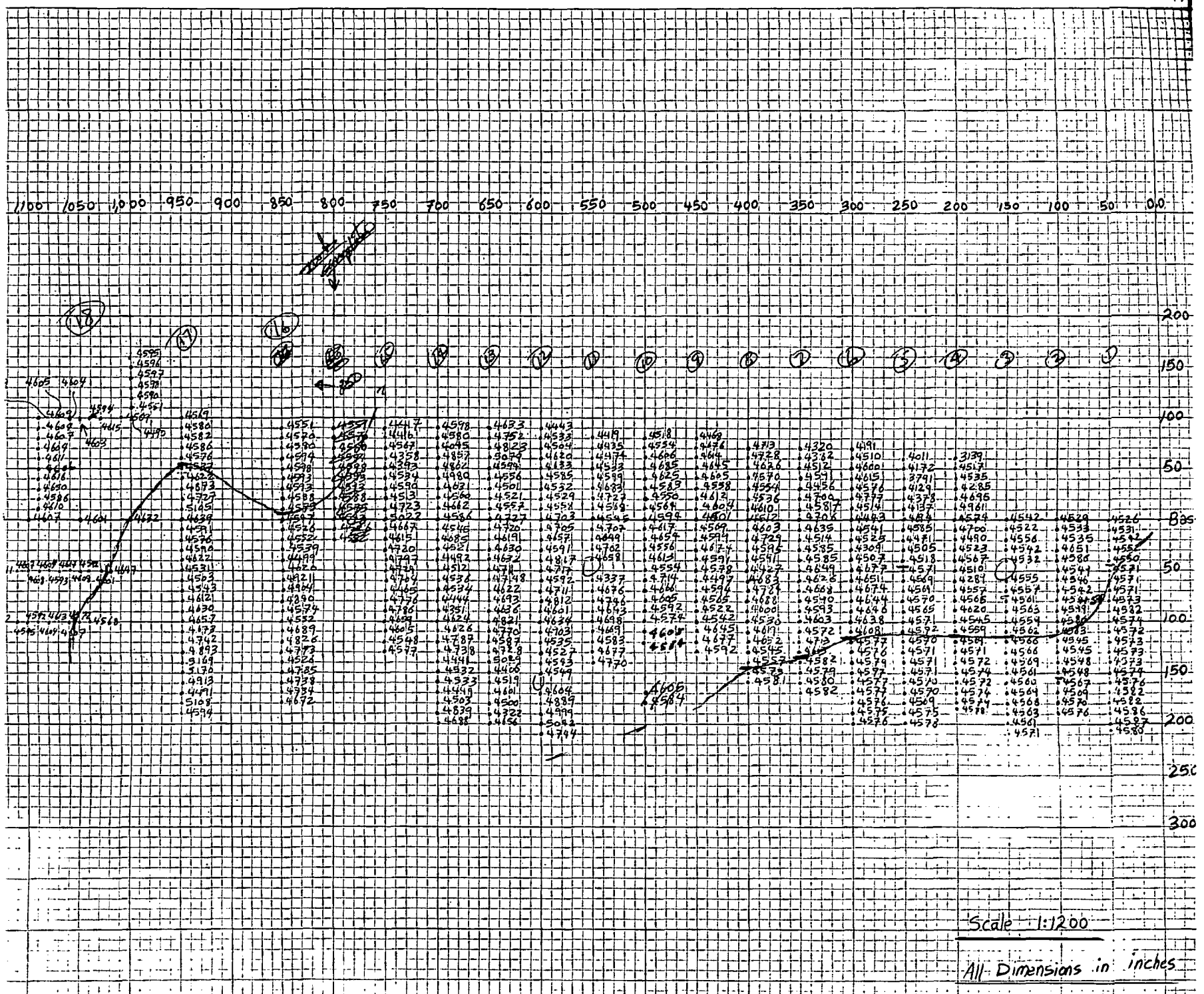
PROFILE 17

-100	4569
-90	4580
-80	4582
-70	4586
-60	4576
-50	4537
-40	4622
-30	4873
-20	4727
-10	5105
0	4639
10	4591
20	4576

30	4590
40	4622
50	4531
60	4503
70	4543
80	4612
90	4630
100	4657
110	4673
120	4742
130	4893
140	5169
150	5170
160	4913
170	4491
180	5108
190	4594

PROFILE 18

(1)		(2)		(3)		(4)		(5)		(6)	
1000	4632	1020	4647	1040	4568	-100	4609	1010	4569	100	4490
1050	4601	1030	4601	1050	4572	-90	4604	1030	4615	110	4551
1100	4607	1040	4592	1060	4607	-80	4607	1040	4594	120	4590
1150	4608	1050	4608	1070	4613	-70	4604	1050	4603	130	4598
		1060	4614	1080	4604	-60	4611	1060	4604	140	4597
		1070	4593	1090	4592	-40	4616	1070	4605	150	4596
		1080	4604	1100	4595	-30	4650	1080	4609	160	4595
		1090	4608	1110	4602	-20	4586				
		1100	4607			-10	4610				
		1110	4611								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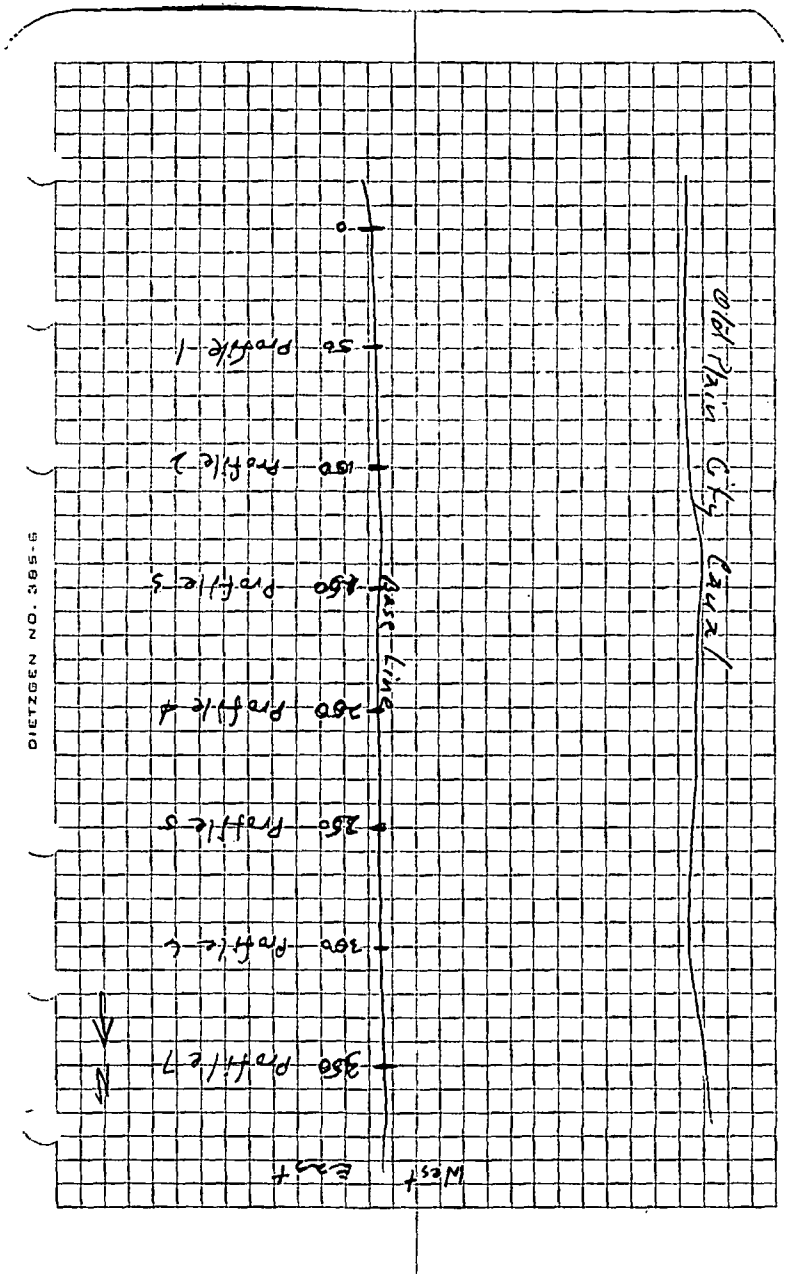
Scale 1:1200
All Dimensions in inches



Magnetic Survey - Ogden Nature Center - Weber County Date: Oct. 1, 1987

Magnetometer: Scintrex Model MP2 Total Field Proton Precession

Operator: Mike Wright, UURI

Notes: Mike Long, UBSHW

Profile 1

Station	Mag	Station	Mag	Station	Mag
50-00	54526	50-160	54576	100-90	54599
50-10	54531	50-170	54582	100-100	54586
50-20	54542	50-180	54582	100-110	54563
50-30	54552	50-190	54586	100-120	54545
50-40	54550	50-200	54587	100-130	54545
50-50	54571	50-205	54580	100-140	54548
50-60	54571	Profile 2		100-150	54548
50-70	54571	Station	Mag	100-160	54567
50-80	54573	100-00	54529	100-170	54569
50-90	54582	100-10	54533	100-180	54570
50-100	54574	100-20	54535	100-190	54576
50-110	54572	100-30	54651		
50-120	54573	100-40	54586		
50-130	54573	100-50	54549		
50-140	54573	100-60	54546		
50-150	54574	100-70	54542		
		100-80	5454		

Profile 3	
station	Mag
150-00	54542
150-10	54522
150-20	54556
150-30	54542
150-40	54532
150-60	54555
150-70	54557
150-80	54561
150-90	54563
150-100	54559
150-110	54562
150-120	54566
150-130	54566
150-140	54569
150-150	54561
150-160	54560
150-170	54569
150-180	54568
150-190	54563
150-200	54561
150-210	54571

Profile 4	
station	Mag
200-00	54994
200-10	54700
200-20	54490
200-30	54523
200-40	54567
200-50	54510
200-60	54289
200-70	54557
200-80	54565
200-90	54620
200-100	54545
200-110	54559
200-120	54569
200-130	54571
200-140	54572
200-150	54574
200-160	54572
200-170	54574
200-180	54579
200-185	54578

Going east from 0

-10	54961
-20	54695
-30	54285

-40	54535
-50	54517
-60	53139

Profile from fence

station	Mag
200-10	53709
200-19	54396

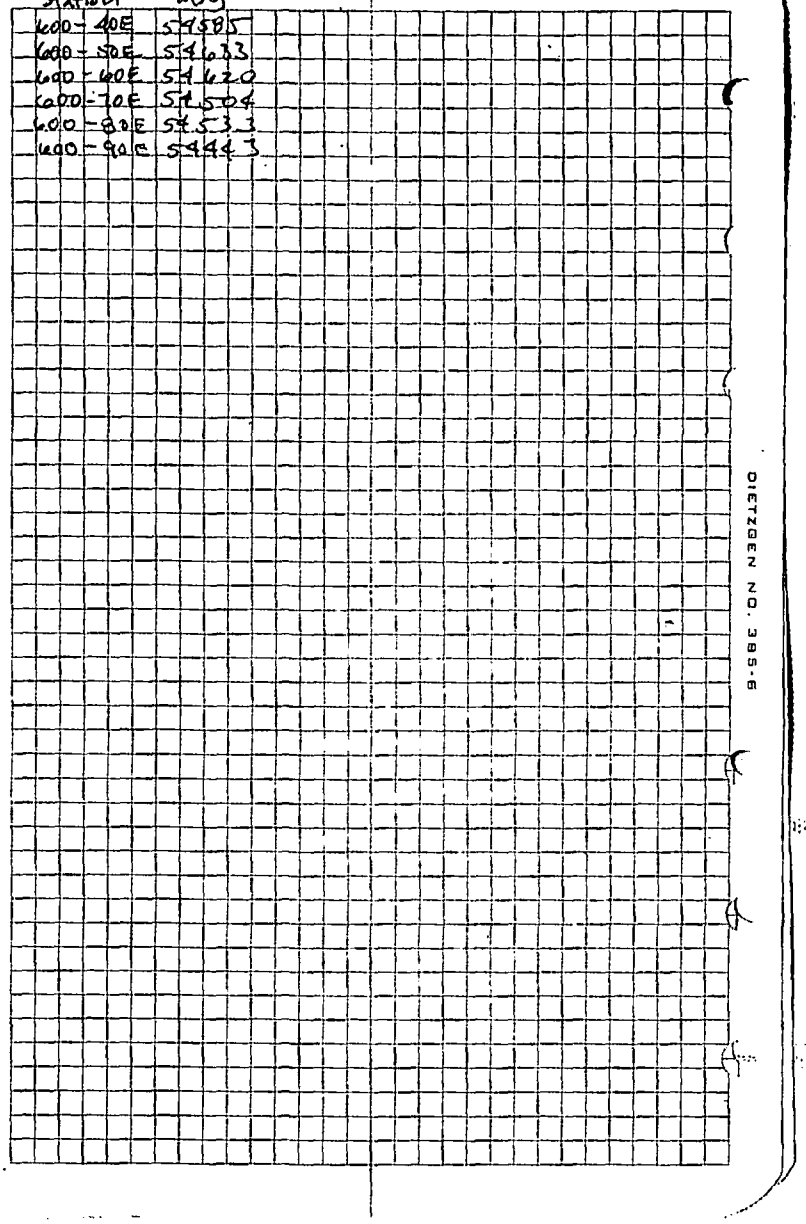
Profile 5				300-10E	54514
station	Mag	station	Mag	300-20E	54777
250-00	54694	250-50E	54172	300-30E	54576
250-10	54585	250-60E	54011	300-40E	54615
250-20	54471	Profile 6		300-50E	54600
250-30	54505	station	Mag	300-60E	54510
250-40	54518	300-00	54443	300-70E	54191
250-50	54571	300-10	54541		
250-60	54569	300-20	54525		
250-70	54564	300-30	54309		
250-80	54570	300-40	54507		
250-90	54565	300-50	54677		
250-100	54571	300-60	54651		
250-110	54572	300-70	54674		
250-120	54570	300-80	54644		
250-130	54571	300-90	54646		
250-140	54571	300-100	54638		
250-150	54571	300-110	54608		
250-160	54570	300-120	54577		
250-170	54570	300-130	54576		
250-180	54569	300-140	54579		
250-190	54575	300-150	54577		
250-200	54578	300-160	54577		
250-10E	54137	300-170	54577		
250-20E	54379	300-180	54576		
250-30E	54129	300-190	54575		
250-40E	53791	300-200	54576		

Profile 7		Profile 8		Profile 9	
Station	Mag	Station	Mag	Station	Mag
350-00	54706	400-00	57512	450-00	54601
350-10	54635	400-10	54603	450-10	54569
350-20	54574	400-20	54729	450-20	54599
350-30	54585	400-30	54595	450-30	54674
350-40	54585	400-40	54591	450-40	54591
350-50	54619	400-50	54427	450-50	54578
350-60	54696	400-60	54683	450-60	54497
350-70	54668	400-70	54784	450-70	54594
350-80	54590	400-80	54688	450-80	54585
350-90	54593	400-90	54600	450-90	54572
350-100	54603	400-100	54530	450-100	54542
350-110	54572	400-110	54619	450-110	54645
350-120	54713	400-120	54632	450-120	54677
350-130	54613	400-130	54645	450-130	54592
350-140	54582	400-140	54557	450-140E	54597
350-150	54579	400-150	54573	450-10E	54609
350-160	54580	400-160	54581	450-20E	54612
350-170	54582	400-170	54466	450-30E	54553
350-10E	54587	400-10E	54610	450-40E	54605
350-20E	54700	400-20E	54534	450-50E	54695
350-30E	54456	400-30E	54554	450-60E	54614
350-40E	54591	400-40E	54570	450-70E	54672
350-50E	54512	400-50E	54626	450-80E	54468
350-60E	54382	400-60E	54728	450-	
350-70E	54320	400-70E	54713		

Profile 10		Profile 11		Profile 12	
Station	Mag	Station	Mag	Station	Mag
500-00	54594	550-00	54565	600-00	54703
500-10	54617	550-10	54707	600-10	54705
500-20	54654	550-20	54649	600-20	54657
500-30	54556	550-30	54702	600-30	54591
500-40	54653	550-40	54697	600-40	54811
500-50	54554	550-50	54357	600-50	54717
500-60	54614	550-60	54610	600-60	54592
500-70	54711	550-70	54646	600-70	54711
500-80	54605	550-80	54643	600-80	54812
500-90	54592	550-90	54698	600-90	54601
500-100	54574	550-100	54677	600-100	54634
500-110	54605	550-110	54683	600-110	54903
500-120	54705	550-120	54677	600-120	54535
500-130	54584	550-130	54677	600-130	54527
500-140	54578	550-140	54730	600-140	54543
500-150	54550	550-150	54568	600-150	54549
500-160	54583	550-160	54727	600-160	54604
500-170	54625	550-170	54683	600-170	54889
500-180	54685	550-180	54599	600-180	54999
500-190	54554	550-190	54414	600-190	54744
500-200	54518	550-200	54735	600-200	54621
500-210E		550-210E	54419	600-210E	54559
500-220E		550-220E		600-220E	54529
500-230E		550-230E		600-230E	54532

Profile 12 (cont.)

Station	Mag
600 - 40E	54585
600 - 50E	54633
600 - 60E	54620
600 - 70E	54504
600 - 80E	54533
600 - 90E	54443



Profile 15		Profile 16			
station	Mag	station	Mag	850-70E	54580
750-00W	55022	850-00	54547	850-80E	54570
750-10	54667	850-10	54526	850-90E	64551
750-20	54615	850-20	54552	Profile 17	
750-30	54720	850-30	54539	station	Mag
750-40	54797	850-40	54499	950-00	54772
750-50	54724	850-50	54620	950-10E	54705
750-60	54704	850-60	54921	950-20E	54727
750-70	54765	850-70	54904	950-30E	54873
750-80	54776	850-80	54840	950-40E	54622
750-90	54786	850-90	54574	950-50E	54537
750-100	54659	850-100	54552	950-60E	54526
750-110	54605	850-110	54609	950-70E	54586
750-120	54548	850-120	54826	950-80E	54582
750-130	54577	850-130	54773	950-90E	54580
750-00E	55230	850-140	54526	950-100E	54569
750-10E	54723	850-150	54735	950-00	54689
750-20E	54513	850-160	54738	950-10	54591
750-30E	54590	850-170	54734	950-20	54576
750-40E	54534	850-180	54672	950-30	54590
750-50E	54393	850-10E	54575	950-40	54622
750-60E	54358	850-20E	54508	950-50	54531
750-70E	54517	850-30E	54593	950-60	54503
750-80E	54417	850-40E	54593	950-70	54543
750-90E	54417	850-50E	54598	950-80	54612
MK	MW	850-60E	54594	950-90	54630

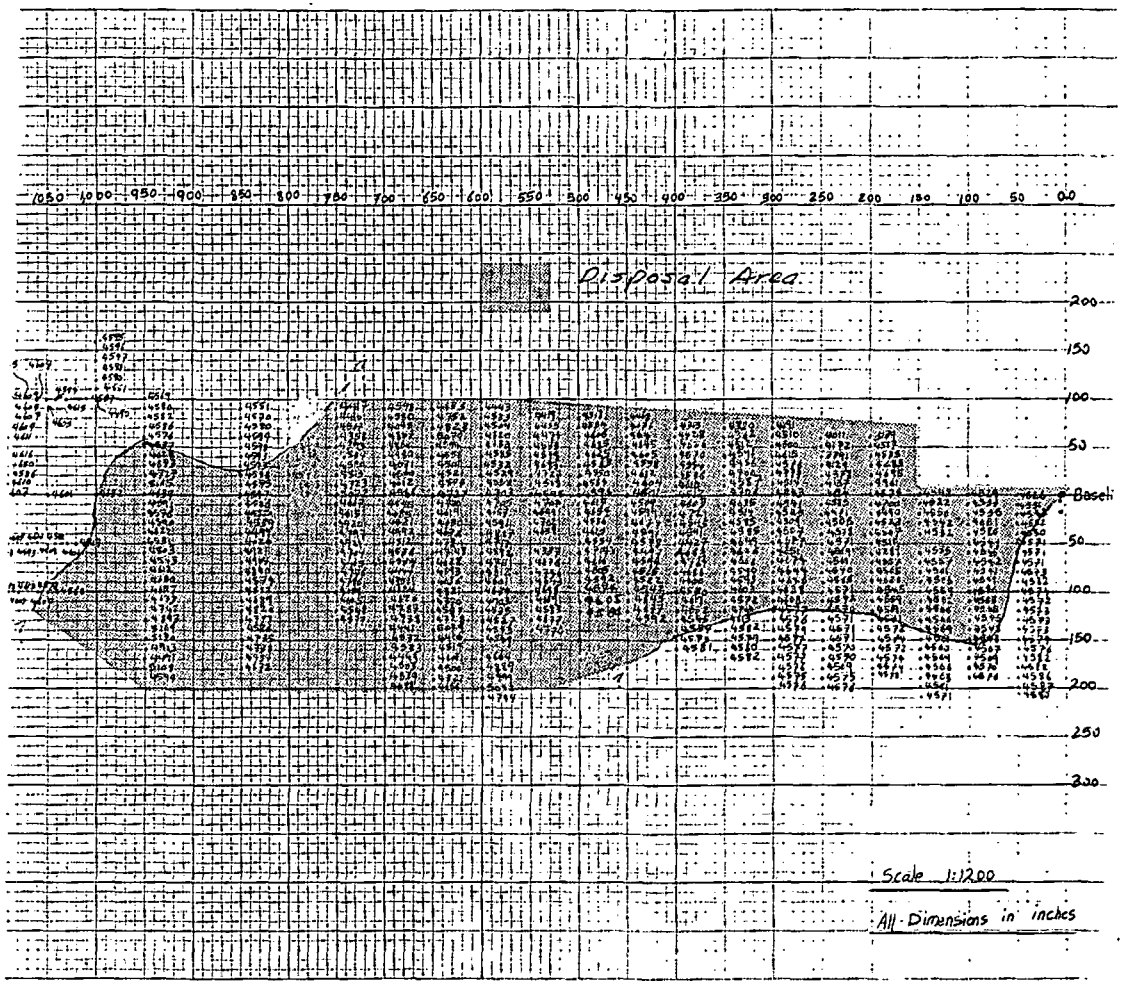
Profile 13					
station	Mag				
650-00	54727	650-40E	54556	700-170	54449
650-10	54720	650-50E	54554	700-180	54503
650-20	54614	650-60E	54079	700-190	54839
650-30	54630	650-70E	54823	700-200	54698
650-40	54632	650-80E	54752	700-00	54502
650-50	54711	650-90E	54633	700-10E	54662
650-60	54748	Profile 14		700-20E	54500
650-70	54622	station	Mag	700-30E	54631
650-80	54693	700-00	54586	700-40E	54980
650-90	54634	700-10	54545	700-50E	54862
650100	54821	700-20	54665	700-60E	54857
650-110	54720	700-30	54521	700-70E	54045
650-120	54581	700-40	54492	700-80E	54850
650-130	54738	700-50	54502	700-70E	54598
650-140	54029	700-60	54536	MW	
650-150	54606	700-70	54934		
650-160	54519	700-80	54444	MK	
650-170	54514	700-90	54351		
650-180	54520	700-100	54624		
650-190	54324	700-110	54624		
650-100	54654	700-120	54387		
650-10E	54521	700-130	54738		
650-20E	54527	700-140	54441		
650-30E	54581	700-150	54532		
650-40E	54553	700-160	54533		

Profile 17 (cont'd)	
Station	Mag
950-100	54657
950-110	54673
950-120	54742
950-130	54893
950-140	55169
950-150	55170
950-160	54913
950-170	54891
950-180	55108
950-190	54594
~~950 200~~	~~54~~

Profile 18	
Station	Mag
1000 B	54632
1050 B	54601
1100 B	54607
1150 B	54608
1160-50	54611
1100-50	54607
1090-50	54608
1080-50	54604
1070-50	54593
1060-50	54614
1050-50	54608
1040-50	54592
1030-50	54601
1020-50	54647
1110-100	54602
1100-100	54595
1090-100	54592
1080-100	54604
1070-100	54613
1060-100	54607
1050-100	54572
1040-100	54568
1090-10E	54610
1090-20E	54586
1090-30E	54650

Profile 18	
Station	Mag
1090-40E	54614
1090-50E	54606
1090-60E	54611
1090-70E	54604
1090-80E	54607
1090-90E	54604
1090-100E	54609
1080-100E	54609
1070-100E	54605
1060-100E	54604
1050-100E	54603
1040-100E	54594
1030-100E	54615
1010-100E	54563
1000-100E	54490
1000-110E	54531
1000-120E	54590
1000-130E	54598
1000-140E	54597
1000-150E	54596
1000-160E	54595

MK MW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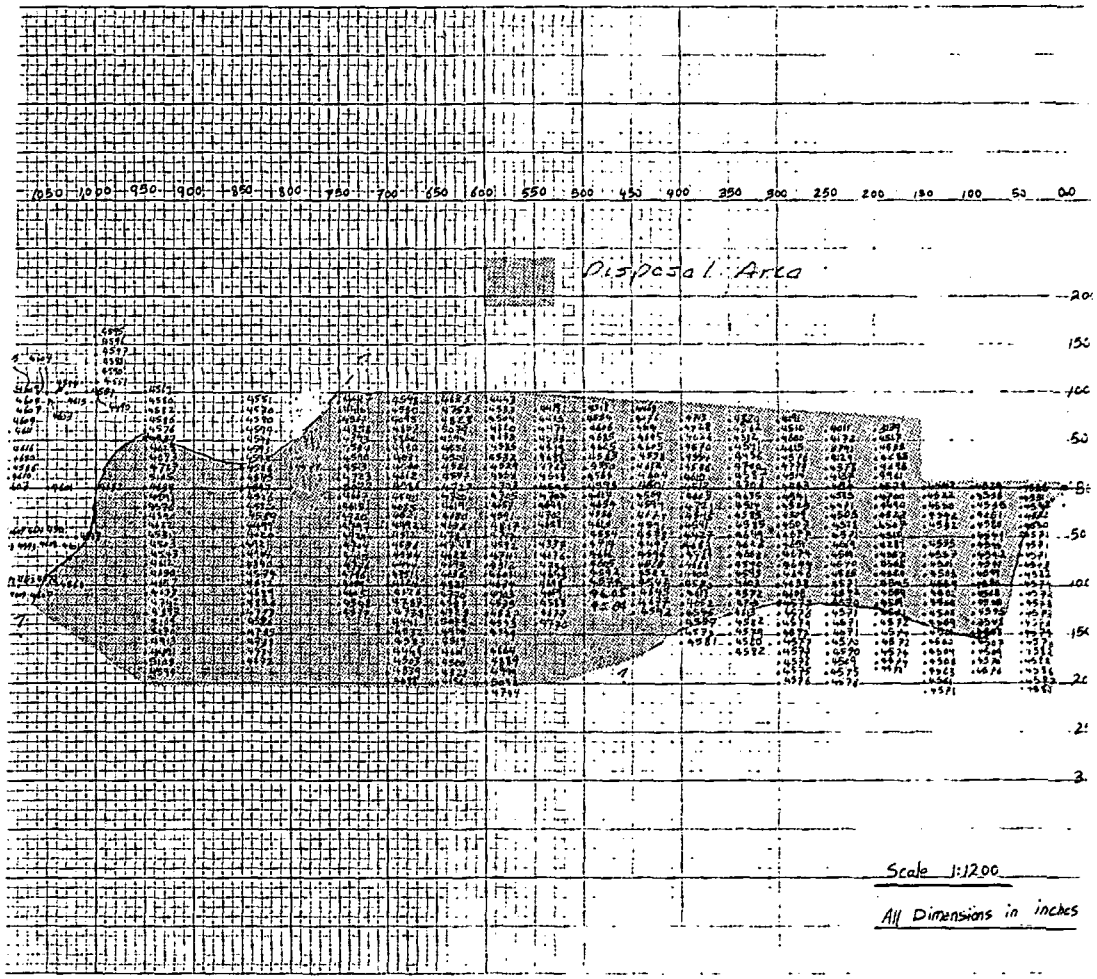
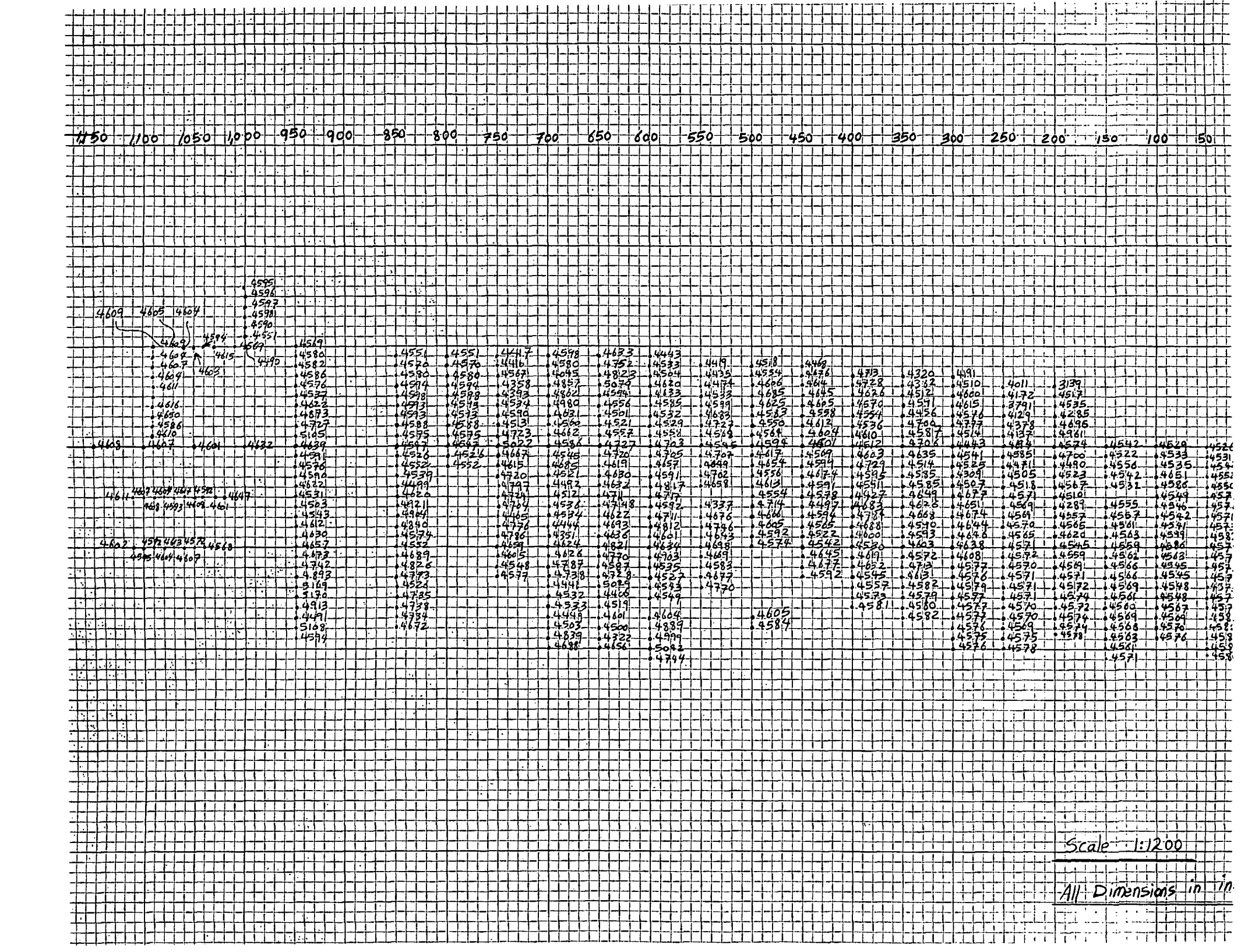
250
300
Scale 1:1200
All Dimensions in inches


Disposal Area
Scale 1:1200
All Dimensions in inches


826 ft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SCINTREX INSTRUMENT RENTAL CONTRACT

Parties

The parties to this contract are:

Scintrex, Inc.
4088 West 1820 South, Unit B
Salt Lake City, Utah 84104

hereinafter called Scintrex, and

University of Utah
391 Chipeta Way #C
Salt Lake City, Utah 84108
(801) 524-3439

hereinafter called the "lessee".

Equipment

Scintrex hereby leases to the lessee and the latter rents from Scintrex, the following equipment:

Scintrex MP-2 Proton Magnetometer s/n 8005610

hereinafter called "The Equipment". The equipment shall also include any item substituted or added by the parties during the validity of this contract to the equipment originally furnished.

Territory

The lessee undertakes that The Equipment will not be removed from the territory of the USA.

Rent

The lessee agrees to make the following rental payments to Scintrex:

A Preparation Fee of $50.00 to cover outgoing and incoming testing and quality control inspection, packing, documentation, and delivery to the Salt Lake City, Utah airport. From the first to the thirtieth day of the Rental Period inclusive, the rental rate shall be $25.00 per day. Thereafter, for the duration of the Rental Period, the rental rate shall be $20.00 per day.

:::::::

The currency for all amounts expressed in this contract is U.S. dollars.

The Rental Period for which the above charges apply commences on the date of shipment from the Scintrex plant and terminates on the day The Equipment is received at the Scintrex plant or on the Conversion Date as described under "Option to Purchase" below.

Payment Terms

Rentals payable in advance.

All invoices will be for payment net 30 days and any outstanding payments will bear interest at the compound rate of 1.5% per month or part thereof. If Scintrex shall be obliged to bring and action to collect unpaid rentals or other sums due under this contract, the lessee agrees to bear all costs, including a reasonable attorney's fee.

Deposit

A deposit equal to the preparation fee, (plus insurance, plus 10 days rental the total of which is $310.00 is required prior to delivery of the equipment.

Date of Shipment

It is agreed by the lessee that Scintrex may make delivery of The Equipment from its plant on or about 30 October 1987.

The Lessee agrees, in good time prior to the shipping date, to provide Scintrex with full shipping instructions.

Option to Purchase

The Lessee shall have the option during the period prior to returning The Equipment to Scintrex, to purchase The Equipment from Scintrex at a price of $4,985.00 plus sales tax and in the event of the exercise of such option to purchase, a sum equal to 50% of rentals incurred to the Conversion Date or 50% of six months rent, whichever is the lesser sum, shall be applied in reduction of the purchase price. Evidence of such purchase shall be by payment of the total amount owing to Scintrex. The Conversion Date is defined as the mutually agreed upon date when the Rental Period ceases and Scintrex receives the full and final payment.

Other Terms

Insurance

Scintrex is prepared to provide fire and theft insurance at a daily premium of $1.00, subject to the terms of item 9 of the "Appendix to Scintrex Rental Contract". To accept or decline this insurance, the Lessee should sign this contract in one of the two places provided.

Accepted _____ Declined _____

Acceptance

This agreement made 30 October 1987 is valid for acceptance by the Lessee for a period of 60 days.

In entering into this contract, the Lessee agrees to all of the above terms as well as those given on the attached "Appendix to Scintrex Rental Contract" and in witness of this agreement has cause one copy of this contract to be signed by an authorized signing officer and to be returned to Scintrex.

Scintrex Limited:

Authorized Signature: David J. Morris

Name: David J. Morris

Title: Agent

Lessee: _____

Authorized Signature: David R. Langston

Name: David R. Langston

Title: Tech

APPENDIX TO SCINTREX RENTAL CONTRACT

The following terms form an integral part of the Rental Contract.

1. WARRANTY.. Scintrex warrants that the Equipment will be in good operating condition when delivered to the Lessee.

2. CONTROL OF EQUIPMENT.. The Lessee agrees to maintain absolute control and possession of The Equipment at all times during the Rental Period and shall not cause The Equipment to be moved outside of the Territory except for the purpose of returning it to Scintrex. The Lessee shall cause The Equipment to be handled by competent, trained personnel only, with due respect to safety procedures. The Lessee shall pay all expenses of operating The Equipment.

3. TRANSPORTATION.. The Lessee shall pay all shipping charges and insurance on The Equipment when in transit to or from Scintrex' plant. The Lessee further agrees that packaging and packing shall be in accordance with the same standards employed by Scintrex. Any freight charges, if paid by Scintrex, will be invoiced to the Lessee at cost plus ten percent.

4. CONFORMANCE TO LAW.. The Lessee shall comply with and conform to all laws, ordinances and regulations, present or future, in any way relating to the ownership, possession, use or maintenance of The Equipment throughout the term of the Rental Period.

5. LIABILITY.. Scintrex shall in no way be bound by any representations, expressed or implied, or by agreements not embodied in this contract. Neither Scintrex, nor its officers, employees or agents shall be liable in any manner to the Lessee, its employees, agents or anyone else from any damage whatsoever resulting from The Equipment or the use of The Equipment, including results or lack of results obtained by the use of The Equipment.

6. TAXES.. The Lessee shall keep The Equipment free of levies, liens and encumbrances and shall pay all license fees, registration fees, assessments, charges, duties and taxes (municipal, provincial and federal), which may be levied or assessed directly or indirectly against or on account of The Equipment or any interest therein or use thereof, including any applicable sales or use taxes imposed on this contract.

7. RETURN OF EQUIPMENT.. Scintrex has the right to demand the return of The Equipment at any time and the Lessee agrees to return The Equipment promptly upon demand by Scintrex.

8 REPAIR AND REPLACEMENT.. The Lessee shall keep and maintain The Equipment in a good state of repair and condition

(reasonable wear and tear excepted) and shall at the termination of the Rental Period pay to Scintrex compensation in respect of any of The Equipment which may be broken or damaged or lost. The amount of such compensation shall be the retail value of the article according to the then current Scintrex price list, less a reasonable allowance for the damaged article as may be determined by and allowed by Scintrex in its absolute discretion. The Lessee assumes complete responsibility for any damage to equipment, including wear and tear, while it is in any way attached to the exterior of an aircraft or towed by an aircraft or used in drill holes.

The Lessee agrees to report to Scintrex any faulty mechanism or damages in transit immediately upon receipt of The Equipment. The Equipment shall be deemed to have been received in perfect working order unless faulty mechanism is reported immediately upon receipt of the Equipment.

Scintrex agrees to repair or replace at its own expense any defects in workmanship and manufacture in The Equipment or any effects of reasonable wear and tear. However, the liability of Scintrex in such event does not extend to transportation charges for The Equipment to or from the area in which it is being used nor to any lose of time or other costs which may be incurred by the Lessee.

If any defect occurs which impedes the proper operation of The Equipment during the time it is in the Lessee's possession, the Lessee undertakes to report such defect to Scintrex by the quickest possible means. If, in the sole discretion of Scintrex, the defect has not occurred due to any fault of the Lessee, then Scintrex may agree to a hiatus in the Rental Period, during which time: 1) The Equipment will be repaired and 2) rental charges will not be applied. Such a hiatus will begin on the say that Scintrex is notified of the defect and terminate on the day that the repaired Equipment is received by the Lessee. Depending upon availability, Scintrex may agree to supplying substitute equipment. If this occurs, the hiatus will be adjusted accordingly.

9. INSURANCE FOR FIRE AND THEFT.. Subject to acceptance by the Lessee, Scintrex shall during the term of the Rental Period, keep The Equipment insured against fire and theft only, and a premium of 3.5 percent of the rental rates shall be charged for such insurance. This insurance shall be kept in force from the time The Equipment is first shipped by Scintrex until it is returned to Scintrex or delivered to another Lessee of Scintrex.

In the event of loss of part or all of The Equipment by fire, the Lessee will report said loss within 3 days to Scintrex, and the residue of The Equipment shall be held for

inspection by a representative of the insurance company or of Scintrex, for a period of at least 30 days. Failure to comply with this provision will void this insurance and the Lessee will then become responsible for replacement of The Equipment.

In the event of loss of part or all of The Equipment by theft, the Lessee will report said loss immediately to Scintrex and to the law enforcement agency having jurisdiction in the area in which the loss occurred. Failure to report said loss to the proper law enforcement agency within 48 hours after the loss is discovered will void this insurance and Lessee will then become responsible for replacement of The Equipment.

10. INSPECTION AND REMOVAL OF THE EQUIPMENT.. Scintrex or its Agent may at all reasonable times, enter the land or premises of the Lessee for the purpose of viewing the state and condition of The Equipment.

Upon breach of this contract by the Lessee, Scintrex may enter the land or premises of the Lessee, and remove and carry away therefrom The Equipment and for that purpose do all things reasonable and necessary for such removal without being liable for any damage caused thereby and without prejudice to Scintrex' rights in respect of any rent or sums of money due or to become due from the Lessee under this contract.

11. ASSIGNMENT.. The Lessee agrees that the Lessee will not assign this lease or any interest herein, or mortgage or hypothecate this lease or any interest therein, or sublet or make any alterations or additions or improvements to The Equipment, or permit the use thereof by any person other than Scintrex having been first obtained. Consent to any of the foregoing prohibited acts shall apply only in the given instance and a further like act by the Lessee or by the Lessee's assignee or sublessee shall require a further written consent. The Lessee agrees that neither this lease nor any interest herein shall be assignable or transferable by operation of law.

12. TERMINATION.. Should The Equipment become lost, destroyed or so damage that it becomes the subject of an insurance claim or is incapable of repair, the Rental Period shall cease on the date that the Lessee notifies Scintrex of such event.

It is hereby mutually agreed, covenanted and understood by and between the parties hereto that in the event any proceedings under the Bankruptcy Act or any amendment thereto be commenced by or against the Lessee or in the event the Lessee be adjudged insolvent or makes an assignment for the benefit of the Lessee's creditors, or if a writ of attachment or execution be levied on The Equipment

and be not released or satisfied within 10 (ten) days thereafter, or if a receiver be appointed in any proceeding or action to which the Lessee is a party with authority to take possession or control of The Equipment, this contract, at the option of Scintrex, shall immediately end and terminate and shall in no way be treated as an asset of the Lessee after the exercise of the aforesaid option.

13. INTERPRETATION.. Scintrex' failure to enforce any or all of the above terms and conditions in a particular instance or instances shall not constitute a waiver or preclude subsequent enforcement.

This contract shall be interpreted under and in accordance with the laws of the Province of Ontario.

DMW GEOPHYSICS
4088 West 1820 South, Suite B
Salt Lake City, Utah 84104
(801) 972-4004 • (801) 972-4087 FAX

☒ Shipping Memo
☐ Receiving Memo

NO.

DATE 30 September 1987

SHIP OR DELIVER TO	CUSTOMER P.O. OR CONTRACT NO.	DATED
University of Utah 391 Chipeta Way #C Salt Lake City, Utah 84108 (801) 524-3439	PO#200-2347	
	JOB NO.	RENTAL CONTRACT NO.
	SHIP VIA to be picked up	SHIP ☐COLLECT ☐PREPAY CHARGE ☐PREPAY
CUSTOMER	CARRIER to be picked up	WAYBILL NO. DATED
	INSURANCE VALUE $	
	AUTHORIZED SIGNATURE	

ITEM	QTY.	DESCRIPTION
1	1	MP-2 s/n 8005610
2	1	Sensor
3	1	leather holster
4	1	staff
5	1	back pack
6	1	manual
7	16	batteries

Customer, White; Accounting, Canary; File Copy, Pink; Packing Slip, Goldenrod.

March 13 1786

Debbie

DMW GEOPHYSICAL SERVICES, INC.
EQUIPMENT RENTAL LIST

	Daily Rates	P & D Charges
Gravity Meters		
LaCoste & Romberg Model G	$ 90.00	$ 200.00
Magnetometers	$25.00	$50.00
Scintrex MP-2	$ ~~22.00~~	$ 50.00
Scintrex MP-3 Recording Proton Magnetometer (2)	$ 35.00	$ 50.00
Scintrex MP-3 Recording Base Station (2)	$ 36.00	$ 50.00
Scintrex MP-3 Gradiometer Option	$ 6.00	
Scintrex MF-2/100 Fluxgate	$ 24.00	$ 50.00
Scintrex MFD-4 Digital Fluxgate	$ 30.00	$ 50.00
VLF & EM		
Scintrex VLF-3 Recording VLF Receiver (2)	$ 42.00	$ 50.00
Scintrex VLF-3 E field sensor	$ 4.00	
Scintrex SE-88	$ 109.00	$ 120.00
Scintrex SE-81	$ 18.00	$ 50.00
Scintrex EM-4	$ 114.00	$ 120.00
Geonics EM-31D	$ 57.00	$ 70.00
Geonics EM-34-3	$ 80.00	$ 140.00
Geonics EM-34-36 (Large coil)	$ 95.00	$ 140.00
Radiometrics		
Scintrex BGS ISL Analog Scintillation Counter	$ 11.00	$ 30.00
Scintrex BGS-3 Analog Scintillation Counter	$ 14.00	$ 30.00
Scintrex BGS-4 Digital Scintillation Counter	$ 15.00	$ 30.00
Scintrex GAD-6 4 Channel Gamma-ray Spectrometer	$ 37.00	$ 40.00
Scintrex GSP-4 Portable Gamma-ray Sensor	$ 22.00	$ 40.00
Resistivity		
Scintrex RSP-6 DC Resistivity & Self Potential System	$ 24.00	$ 110.00

4088 W 1820 So.

1979 West North Temple Salt Lake City, Utah 84116 (801) 539-8471 Graphnet Telex 3789503

972-4004

GREAT BASIN GEOSERVICE

Instrumentation for exploration. P.O. Box 8094, Salt Lake City, Utah 84108 (801) 467-2811

September 30, 1983

Dr. Stan Ward
Earth Science Laboratory
University of Utah Research Institute
420 Chipeta Way, Suite 120
Salt Lake City, UT 84108

Dear Dr. Ward:

It was nice to meet you at the SEG Convention, and I have enclosed some information about my company. Not shown is the fact that I have just made an agreement with Huntec ('70) Ltd. to act as their regional representative and distribute their IP transmitters and receivers. Mark Halliday used this equipment in the Philippines and found it to be very reliable.

I understand that you contract for most of your geophysical surveys, and Mark and I would appreciate the opportunity to bid on any ground geophysical programs that you may plan in the near future. We expect to provide personally supervised geophysical surveys at reasonable costs. Just call if we can be of service to you.

Sincerely,

Neville Shea

Neville Shea

GREAT BASIN GEOSERVICE

Instrumentation for exploration., P.O. Box 8094, Salt Lake City, Utah 84108 (801) 467-2811

September 11, 1983

To: Exploration Geophysicists

Subject: New developments and background of Great Basin Geoservice

Gentlemen:

Great Basin Geoservice is pleased to announce that Mr. Mark E. Halliday has joined the firm and will direct the geophysical contracting operations. Mr. Halliday graduated from the University of Utah with a M.S. in geophysics, and has extensive field experience in the U.S., Australia, Japan, and the Philippines leading surveys in the search for minerals and geothermal resources. We expect that his combination of skills and experience will allow us to offer more services so we can better meet the needs of our clients.

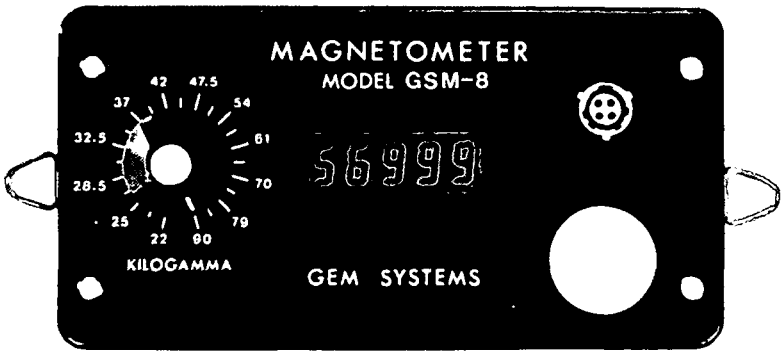
Great Basin Geoservice (GBG) was founded in 1979 and has been primarily involved with the sales, rentals, and repairs of geophysical instruments. GBG is the exclusive U.S. distributor for GEM Systems, who manufactures the GSM-8 magnetometer. which is the world's lightest and most compact 1 gamma proton precession magnetometer. GEM Systems also makes a solar powered portable magnetometer, a high sensitivity overhauser airborne magnetometer, and has just introduced the GSM-18 advanced portable memory magnetometer. GBG acts as regional representative for OYO U.S.A., who distributes the OYO Corp. line of geophysical and geotechnical instruments including portable borehole logging systems, engineering and signal enhancement seismographs, geoelectric instruments, recording systems, and instruments for soil and rock mechanics. GBG also represents: Canadian Mining Geophysics, makers of the MR-10 digital magnetometer base station and MM-10 data logger: Instrumentation GDD, whose Electronic Level and Chain+Level have proved very valuable for reducing surveying costs for gravity and seismic surveys, because they measure the elevation difference between two points without a line of sight thus allowing fast and easy profiling; and W. Sodin, who builds a prospector and geodetic gravity meter which are available with or without a solid state electronically controlled internal heating element.

Our goal is to provide a diverse selection of the highest quality instruments and field surveys, with the accent on personalized service and reasonable prices. We look forward to having the opportunity of being of service to you.

GEM SYSTEMS

GSM-8

PROTON MAGNETOMETER



FEATURES

- 1 gamma resolution and accuracy, 0.5 gamma optional
- Worldwide range
- High gradient tolerance
- Excellent visibility of the display in any ambient light
- Display stays active between readings
- WORLD'S LIGHTEST AND MOST COMPACT 1 GAMMA PROTON PRECESSION MAGNETOMETER
- External trigger and digital output standard, analog output optional
- Rugged, all-metal package
- No-lock indication
- Polarize indication

The GSM-8 is a lightweight one gamma proton precession magnetometer designed primarily for hand held and base station operations, but adaptable for other Earth's magnetic field measurements like airborne/marine surveys, pipe and cable detection and tracking, treasure hunting etc.

The instruments power consumption, size and weight have been minimized to make it the World's lightest and most compact one gamma proton precession magnetometer.

Ruggedized Liquid Crystal Display allows for easy reading in bright sunlight and an all-metal package ensures lasting use in rough field conditions.

Flexible design of electronics enables a wide selection of cycling speeds and other necessary features for almost universal Earth's field measurements, and complete selftest feature ensures reliable operation and early warning of instrument malfunction due to interferences like excessive field gradient, power line or other electromagnetic radiation, or internal breakdown.

- Shoulder and/or belt strap for easy carrying
- Sensor back-pack for hand-free operation optional
- Nonmagnetic battery pack optional
- Custom modifications available

GEM SYSTEMS, INC.
58 Ravenscroft Circle
Willowdale (Metro Toronto) Ontario
Canada, M2K 1W9
Telephone: (416) 221-5778

Neville Shea
GREAT BASIN GEOSERVICE
P.O. BOX 8094
SALT LAKE CITY, UTAH 84108
467-2811

S P E C I F I C A T I O N S

RESOLUTION:	1 gamma or 0.5 gamma optional
ACCURACY:	$\pm$ 1 gamma over operating range
RANGE:	20,000 - 100,000 gamma in 23 overlapping steps
GRADIENT TOLERANCE:	Up to 5000 gamma/meter
OPERATING MODES:	MANUAL PUSHBUTTON, new reading ever 1.85 sec., display active between readings
	CYCLING, pushbutton initiated, 1.85 sec. period.
	SELFTEST cycle, pushbutton controlled, 7 sec. period.
OUTPUT:	VISUAL: 5 digit 1 cm (0.4") high Liquid Crystal Display, visible in any ambient light
	DIGITAL: Multiplied precession frequency and gating pulse
	ANALOG: 0 - 99 gamma (optional)
EXTERNAL TRIGGER:	Permits externally triggered cycling with periods longer than 1.85 sec. (cycling faster than once per sec. optional)
POWER REQUIREMENTS:	10-28V DC 8Ws per reading
POWER SOURCE:	INTERNAL: 12 V 0.75 Ah NiCd rechargeable battery, 3,000 readings between chargings
	EXTERNAL: 12-28 V
BATTERY CHARGER:	Input: 120/220 V 50/60 Hz, Output 75 mA DC constant current
OPERATING TEMPERATURE:	- 35 to + 55 C
DIMENSIONS:	CONSOLE: 15 x 8 X 15 cm (6 x 3¼ x 6") SENSOR: 14 x 7 cm dia (5¾ x 2¾" dia) STAFF: 175 cm (70") extended, 53 cm (21") collapsed
WEIGHT:	2.7 kg (6 lb) complete, 2.3 kg (5 lb) in back-pack mode
STANDARD PACKAGE:	CONSOLE, with batteries, carrying harness SENSOR, with cable STAFF, collapsible
STANDARD ACCESSORIES:	BATTERY CHARGER, MANUAL, CARRYING CASE
GUARANTEE:	15 Months from the date of shipping

GREAT BASIN GEOSERVICE

Instrumentation for exploration. P.O. Box 8094, Salt Lake City, Utah 84108 (801) 467-2811

PRICE LIST

GEM SYSTEMS	
GSM-8 proton precession magnetometer	$ 3,675
GSM-9 solar powered magnetometer	4,025
GSM-11 high sensitivity airborne magnetometer	43,000
Accessories: Back pack adapter for sensor	30
Extra section of staff	35
Sensor cable	75
Belt pack for "D" cell battery supply	105
CANADIAN MINING GEOPHYSICS	
MR-10 base station	4,300
MR-10/2 base station for automatic diurnal corrections	5,300
MM-10 memory module	2,875
MM-10 with analog to digital converter	3,350
Accessories for MR-10:	
Basic language programming	400
8K RAM non-volatile memory	470
100 foot long sensor cable	300
Power cable	45
Cable to connect mag to MR-10	85
Accessories for MM-10:	
RS 232 interface	440
4K RAM	375

RENTAL RATES

GSM-8	550/month
GSM-9	600/month
MR-10	625/month
MR-10/2	775/month
MM-10	430/month

Weekly rates available upon request.
Purchase option: 60% of first ten months rentals will be credited toward purchase price.

All prices and rental rates F.O.B. Salt Lake City, Utah and are subject to change without notice. Effective October 1, 1982.