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Ontario

-2015 UTEM5 Survey Report-
Wisner Grid
Sudbury District
for
Wallbridge Mining Company Ltd.

LAMONTAGNE GEOPHYSICS LTD
GEOPHYSIQUE LTEE

March, 2015

Rob Langridge, M.Sc.
Phil Guimond, B.Sc.

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INTRODUCTION

During the period of January 31th 2015 through February 14th 2015 a UTEM5 survey (surveying days: February 3rd, 11th -12th) was carried out by Lamontagne Geophysics Limited personnel for Wallbridge Mining Company Ltd. on the Wisner Grid in the Sudbury District. The location/layout of the Wisner survey is shown in Figures 1 and 2. The survey was carried out as a follow-up to a previous UTEM5 survey completed in March, 2014.

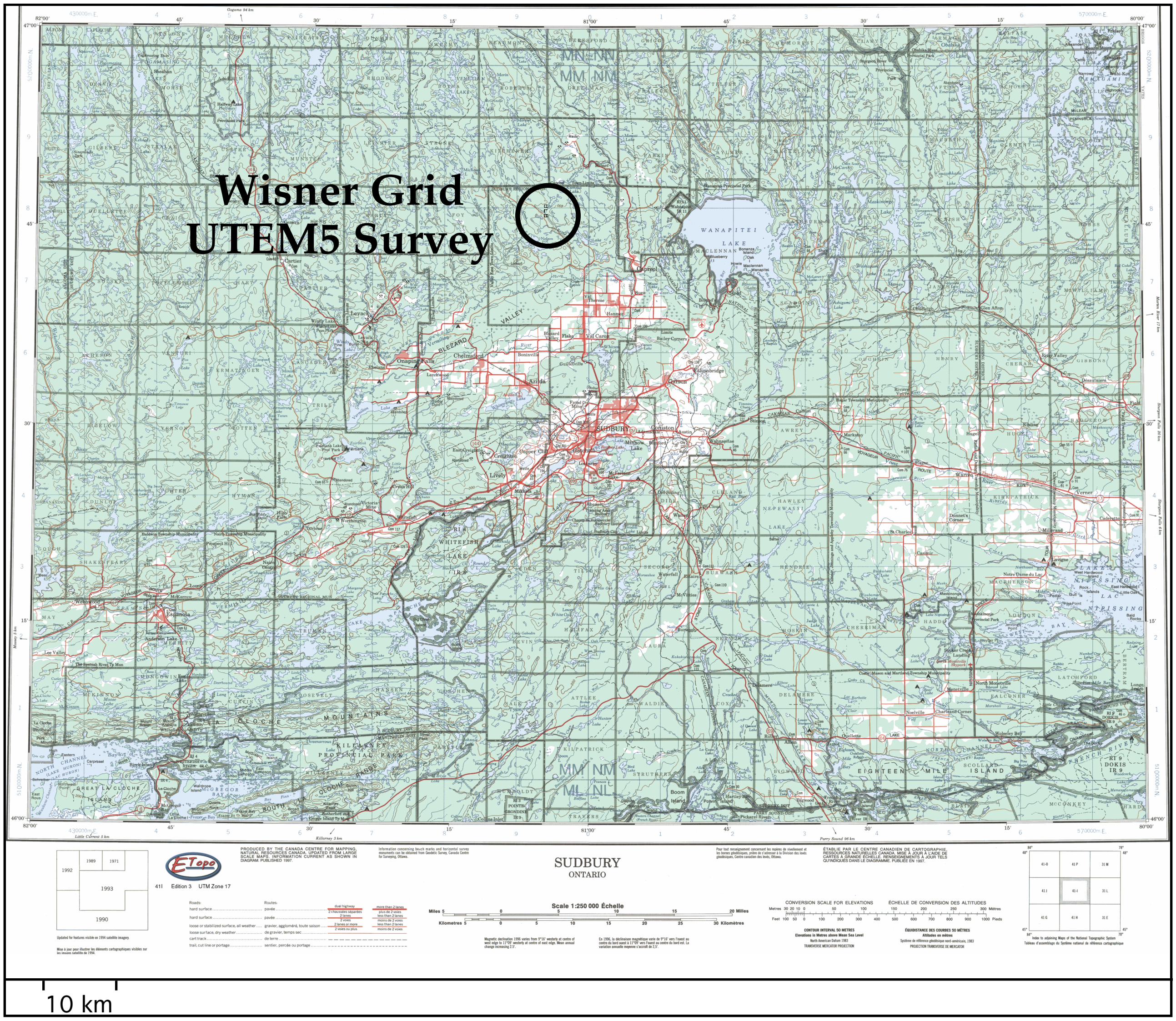
A total of 1.625 line km of Bz/BL/BT UTEM5 data was collected with the UTEM5 receiver using two transmitter loops (Figure 2). For all stations on the Wisner Grid three-component data were collected from two loops simultaneously. The survey frequencies for the survey were as follows:

- 12Ch UTEM5 two loop coverage (1.625 line km) of the Wisner Grid
  actual frequencies (in the ratio of 2:1) were:
  4.090Hz (outside-the-loop - grid-south) - Loop 1551 (S1)
  2.045Hz (outside-the-loop - grid-north) - Loop 1552 (S2)

This report documents the UTEM5 survey in terms of logistics, survey parameters and field personnel, outlines the data processing and discusses the results. Appendix A contains the data presented as Bz/BL/BT profiles.

Other appendices contain:

- List of Personnel/Production Diary (Appendix B)
- an outline of the UTEM5 System (Appendix C)
- Note on sources of anomalous Ch0 (Appendix D)



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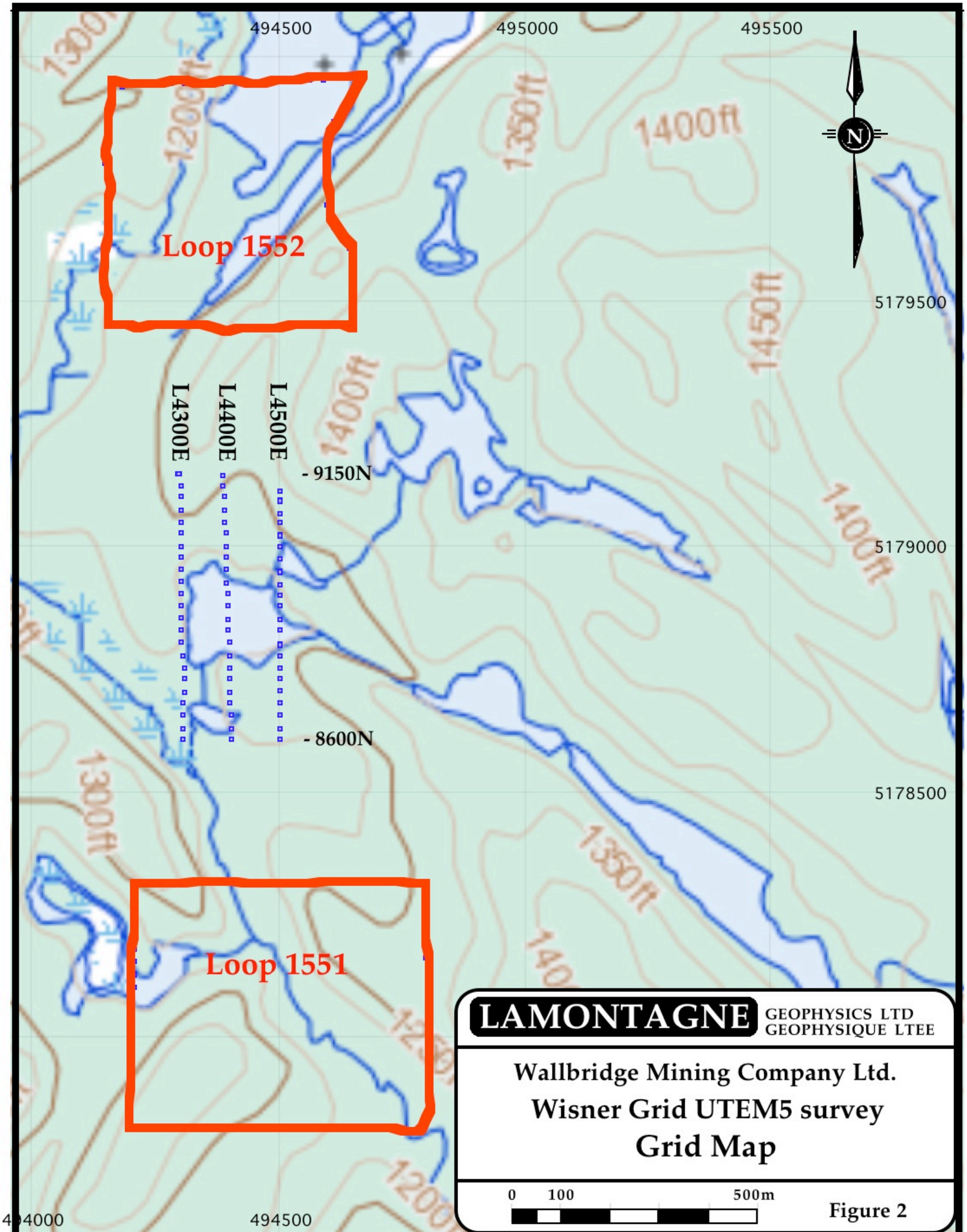
Wallbridge Mining Company Ltd.

Wisner Grid UTEM5 survey

Location Map

Figure 1


494500
495000
495500
5179500
5179000
5178500
494000
494500
1300ft
1200ft
1350ft
1400ft
1450ft
1400ft
1400ft
1300ft
1350ft
1200
Loop 1552
Loop 1551
L4300E
L4400E
L4500E
- 9150N
- 8600N
N
LAMONTAGNE
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GEOPHYSIQUE LTEE
Wallbridge Mining Company Ltd.
Wisner Grid UTEM5 survey
Grid Map
0 100 500m
Figure 2

SURVEY DESIGN

The UTEM survey was planned and carried out as an extension to a previous UTEM5 survey completed in March, 2014, the purpose being to test and detail anomalies outlined during that survey and to detect/outline new conductors.

The grid and loop layout was designed by Wallbridge Mining Company Ltd. personnel in consultation with Lamontagne Geophysics. Loop size and location were selected to provide good coupling with the expected targets, to allow efficient coverage of the area of interest.

The survey parameters employed are as follows:

- line spacing of 100m
- station interval of 25m
- a total of 2 transmitter loops
- three component measurements, collected from two Tx loops simultaneously:
  - • outside-the-loop (loop grid-south) 4.090Hz coverage
  - • outside-the-loop (loop grid-north) 2.045Hz coverage
- 12 Ch/120s minimum double stacking
- frequencies for main grid coverage (in the ratio 2:1) (Figure 3):
  - •4.090Hz (outside-the-loop) Loop 1551
    stacking: 492 full-cycles/ 984 half-cycles
  - •2.045Hz (outside-the-loop) Loop 1552-
    stacking: 256 full-cycles/492 half-cycles

Wallbridge Mining Company Ltd. provided GPS (NAD 27) locations for all survey stations and the transmitter loops. The LGL crews routinely collect handheld-GPS (Garmin eTrex) data for all transmitter loops for the purpose of control.

Note: Geometric control should be considered a mandatory part of the interpretation of any UTEM survey where the target is potentially non-decaying. Poor geometric control has the potential to both mask and invent Ch0 (latest time) conductors (Appendix D).

south loop	frequency	4.090910 Hz	
	period	0.24444	s
(5MHz clock)	half period		0.2μs cycles
(narrowest Ch=1unit)	XNP	**4444**	/halfperiod
	width of unit channel	2.75027e-5	s
	width of unit channel	27.5027	μs

(symbol) channel		peak of tapered Ch (μs)	tapered Ch begins - unit -	tapered Ch - unit -
timing Ch13		13.75	-0.5	1.5
Z	12	41.25	0.5	3
◿	11	82.51	1.5	6
⊵	10	165.02	3	12
X	9	330.03	6	24
Σ	8	660.07	12	48
⊽	7	1320.13	24	96
□	6	2640.26	48	192
ꟸ	5	5280.53	96	384
\	4	10561.05	192	768
<	3	21122.11	384	1536
/	2	42244.22	768	3072
>	1	84488.43	1536	4269
|	0	117409.21	3072	4442.5
timing Ch15		122180.94	4269	4443.5
timing Ch14		122208.44	4442.5	4444+0.5

sub-stack time =	**1.466666**	s
number of substacks =	**82**	substacks
stacking time =	120.27	s
cycles stacked =	492	cycles
half-cycles stacked =	984	half-cycles

north loop	frequency	2.045455 Hz	
	period	0.48889	s
(5MHz clock)	half period	1222221	0.2μs cycles
(narrowest Ch=1unit)	XNP	**4444**	/halfperiod
	width of unit channel	5.50055e-5	s
	width of unit channel	55.0055	μs

(symbol) channel		peak of tapered Ch (μs)	tapered Ch begins - unit -	tapered Ch ends - unit -
timing Ch13		27.50	-0.5	1.5
Z	12	82.51	0.5	3
◿	11	165.02	1.5	6
⊵	10	330.03	3	12
X	9	660.07	6	24
Σ	8	1320.13	12	48
⊽	7	2640.26	24	96
□	6	5280.53	48	192
ꟸ	5	10561.05	96	384
\	4	21122.11	192	768
<	3	42244.22	384	1536
/	2	84488.43	768	3072
>	1	168976.86	1536	4269
|	0	234818.43	3072	4442.5
timing Ch15		244361.88	4269	4443.5
timing Ch14		244416.89	4442.5	4444+0.5

sub-stack time =	**1.466666**	s
number of substacks =	**82**	substacks
stacking time =	120.27	s
cycles stacked =	246	cycles
half-cycles stacked =	492	half-cycles

A target frequency is entered for each UTEM transmitter and the local powerline frequency are entered in the UTEM receiver. The actual frequencies used are selected by the receiver sofware to be as close to the entered target frequencies as possible while optimizing rejection of the other transmitters and powerline noise. In this instance the two frequencies are in the ratio **2:1**.

The minimum substack time is set by the receiver software to the shortest time that will include an integer number of cycles of each frequency used and 30Hz (the first harmonic of the 60 Hz powerline frequency).

Allowable stacking times are required to be a multiple of the minimum substack time.

Where responses extend to the latest time-channel measured (Ch0) the survey frequency can be lowered. Reducing the number of channels from 12 to 10 allows for a wider anti-aliasing filter bandwidth. This can help improve S/N (signal-to-noise ratio) when dealing with high-frequency noise - eg. wind “whistling”.

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Wallbridge Mining Company Ltd.

UTEM5 survey

12Ch base frequencies: details

Figure 3

SURVEY LOGISTICS

The Lamontagne base of operations in the Sudbury District is in Chelmsford and the crew was housed in the Northland Motel. The crew consisted of Phil Guimond (crew chief/operator), Gerry Lafortune (asst. crew chief/Rx operator), Bill Dingwall (Tx operator/electronics), Kevin Arsenault (Tx operator), Richard Lahaye (looper/coiler), James Young (looper/coiler), and John Savage (looper).

A Lamontagne Geophysics crew were in the Sudbury area working for another client when the project began. During a break in that contract the crew was able to begin work on the Wisner project. A two-person crew headed out January 31st to check access and to begin to lay out the initial loops on the Wisner grid. The southern loop (Loop 1551) was completed by the end of the day. A three-man crew returned the following day to scout access and begin breaking a trail to the northern loop. A suitable route was found to the SW corner and two sides of Loop 1552 were laid. On February 3rd a seven-man crew returned to complete the remaining two sides of Loop 1552 and to begin surveying. Transportation of all the gear into the two transmitter sites took longer than expected and surveying did not begin until 14:30.

Work on the Wisner grid was postponed while the Lamontagne crew finished another contract in the Sudbury area. The crew was able to return to the grid on February 11th to complete the coverage. Examination of the collected data in the evening indicated that portions of two lines would have to be re-surveyed. All surveying was completed on February 12th, the loops picked up the following day, and demob back to Kingston occurred on February 14th. Transportation to and from the grid was by pickup and transport onsite was by snowmobile along an OFSC marked snowmobile trail. The location of the Wisner Grid is shown in Figures 1 and 2. Details of the UTEM5 survey can be found in Appendix B - the Production Diary.

The survey equipment consisted of two UTEM5 receiver/coils, two UTEM5 transmitters as well as all necessary accessories, support equipment and backup equipment. Data was reduced on a field computer (PowerBook) and UTEM profiles and digital data were made available/emailed to the client's personnel as the data became available.

SURVEY RESULTS

The results of the survey are summarized and presented as UTEM profiles in Appendix A. The final grid and loop locations are presented in Figure 2. The data presented in Appendix A are reduced with a UTM grid (NAD27) produced from DGPS points provided by the client. Overall the UTEM data quality is considered good. Note: the latest time profiles (Ch0) should be considered in conjunction with other available information (Appendix D).

Profiles are listed by Loop number on the following pages. For each line surveyed the continuously normalized profiles have been plotted for the three components collected. Profile are presented as 3-axis profiles in order of line number: Line 4300E through Line 4500E. The order is as follows:

Wisner Grid

Loop 1551

Bz continuous norm	4.090Hz	**(pink separator)**
BL continuous norm	4.090Hz	(pink separator)
BT continuous norm	4.090Hz	(pink separator)

Loops 1552

Bz continuous norm	2.045Hz	**(blue separator)**
BL continuous norm	2.045Hz	(blue separator)
BT continuous norm	2.045Hz	(blue separator)

Note: in past reports UTEM5 data was presented as:

- Hz the vertical component (currently Bz)
- Hx the in-line horizontal component (currently BL
- Hy the transverse horizontal component (currently BT)

<u>Outline of profile type</u>

Hz Hx Hy continuous norm ***Ch0 reduced***

Continuous normalization is useful for detection of the presence of anomalies at any position on a profile. The anomaly shape is distorted by normalization to the local field. Near the wire (large field) the continuously normalized Ch0 tends towards zero.

Note: Ch0 is later in time and narrower than Ch1 (Appendix C).

The Bz/BL/BT continuously normalized data are presented as 3-axis profiles:

for the 12Ch @ 4.090/2.045Hz data:

top axis - Ch8-12 + timing Ch13/14	*Ch0 Reduced*
upper middle axis - Ch5-8	*Ch0 Reduced*
lower middle axis - Ch1-5	*Ch0 Reduced*
bottom axis - Ch0	*Primary Field Reduced*
bottom axis - topo	*some vertical exaggeration*

A description of the standard plotting formats used and of the UTEM System is presented in Appendix C.

Appendix A

1508 UTEM5 Profiles

UTEM5 Survey
Wisner
Sudbury District

for

Wallbridge Mining Company Ltd.

Presentation

The results of the survey are summarized and presented as UTEM profiles in Appendix A. The final grid and loop locations are presented in Figure 2. The data presented in Appendix A are reduced with a UTM grid (NAD27) produced from DGPS points provided by the client. Overall the UTEM data quality is considered good. Note: the latest time profiles (Ch0) should be considered in conjunction with other available information (Appendix D).

Profiles are listed by Loop number on the following pages but it was felt that presentation by line number would be more appropriate. For each line surveyed the continuously normalized profiles have been plotted for the three components collected. Profile are presented as 3-axis profiles in order of line number from west-to-east: Line 4300E through Line 4500E. The order is as follows:

Wisner Grid

Loop 1551

Bz continuous norm	4.090Hz	**(pink separator)**
BL continuous norm	4.090Hz	(pink separator)
BT continuous norm	4.090Hz	(pink separator)

Loops 1552

Bz continuous norm	2.045Hz	**(blue separator)**
BL continuous norm	2.045Hz	(blue separator)
BT continuous norm	2.045Hz	(blue separator)

Note: in past reports UTEM5 data was presented as:

- Hz the vertical component (currently Bz)
- Hx the in-line horizontal component (currently BL
- Hy the transverse horizontal component (currently BT)

Outline of profile type

Bz BL BT continuous norm ***Ch0 reduced***

Continuous normalization is useful for detection of the presence of anomalies at any position on a profile. The anomaly shape is distorted by normalization to the local field. Near the wire (large field) the continuously normalized Ch0 tends towards zero.

Note: Ch0 is later in time and narrower than Ch1 (Appendix C).

The Bz/BL/BT continuously normalized data are presented as 3-axis profiles:

for the 12Ch @ 4.090/2.045Hz data:

top axis - Ch8-12 + timing Ch13/14	*Ch0 Reduced*
upper middle axis - Ch5-8	*Ch0 Reduced*
lower middle axis - Ch1-5	*Ch0 Reduced*
bottom axis - Ch0	*Primary Field Reduced*
bottom axis - topo	*some vertical exaggeration*

A description of the standard plotting formats used and of the UTEM System is presented in Appendix C.

<u>List of Data Collected by Loop</u>

Wallbridge Mining Company Ltd. (1508)
Wisner Grid - 12Ch @ 4.090/2.045Hz

	Line	Coverage		
Loop 1551	Line 4300E	8600N - 9150N	550m	Bz/BL/BT
(@ 4.090Hz)	Line 4400E	8600N - 9150N	550m	Bz/BL/BT
	Line 4500E	8600N - 9125N	525m	Bz/BL/BT
Loop 1552	Line 4300E	8600N - 9150N	550m	Bz/BL/BT
(@ 2.045Hz))	Line 4400E	8600N - 9150N	550m	Bz/BL/BT
	Line 4500E	8600N - 9125N	525m	Bz/BL/BT

<u>Wisner Survey totals:</u>

1625m UTEM5 2 loop 6-component coverage

- 1625m UTEM5 Bz/BL/BT line coverage
- 3250m UTEM5 three-component coverage
- 9750m UTEM5 single-component coverage

- 1625m UTEM5 4.090Hz coverage
- 1625m UTEM5 2.045Hz coverage

Wisner Grid
plotted by line number
4.090Hz

Loop 1551	Line 4300E	8600N - 9150N	550m	Bz/BL/BT
(@ 4.090Hz)	Line 4400E	8600N - 9150N	550m	Bz/BL/BT
	Line 4500E	8600N - 9125N	525m	Bz/BL/BT

Wisner Grid
plotted by line number

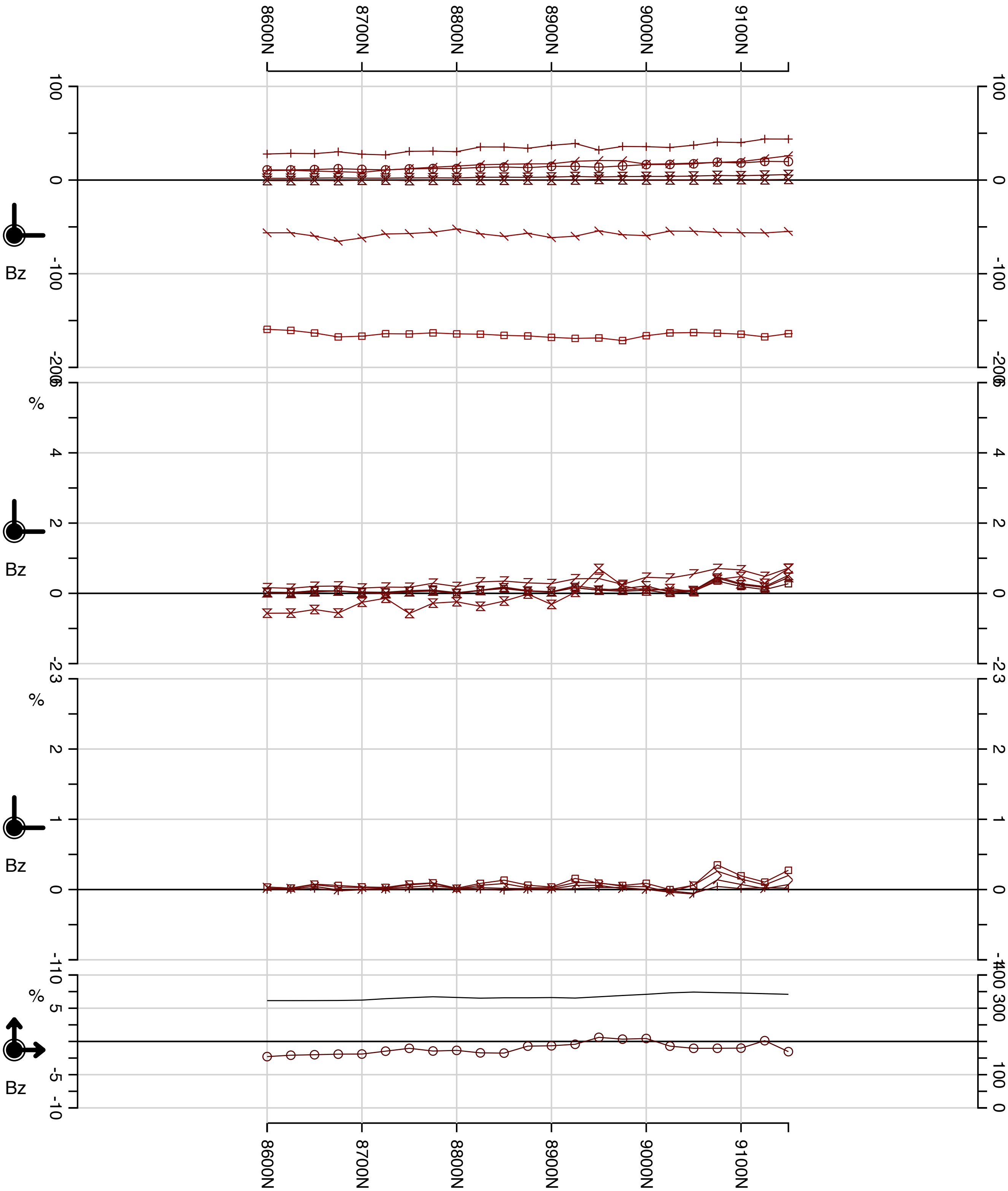
Bz

4.090Hz frequency

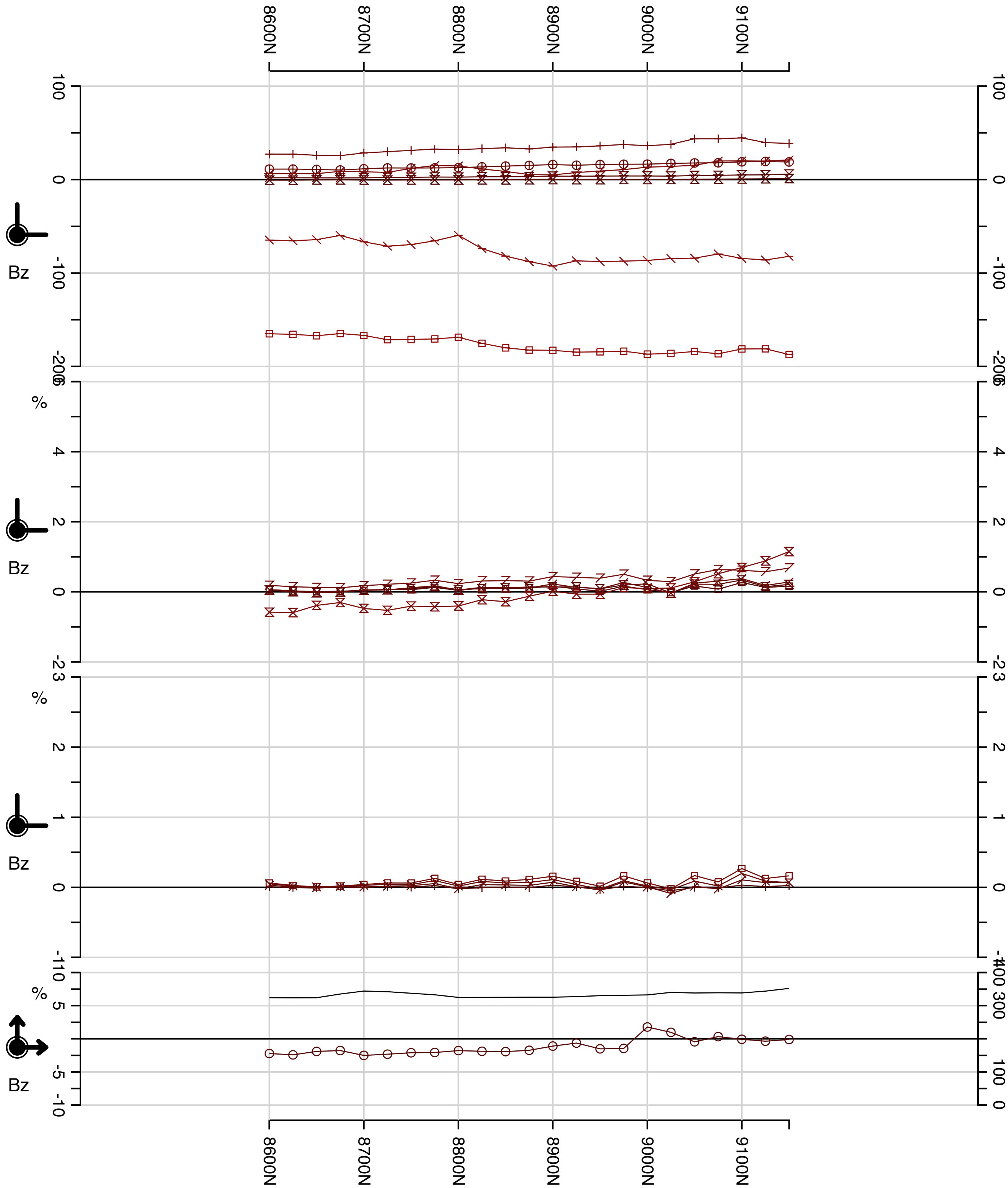
continuous norm

12Ch - Ch0 reduced

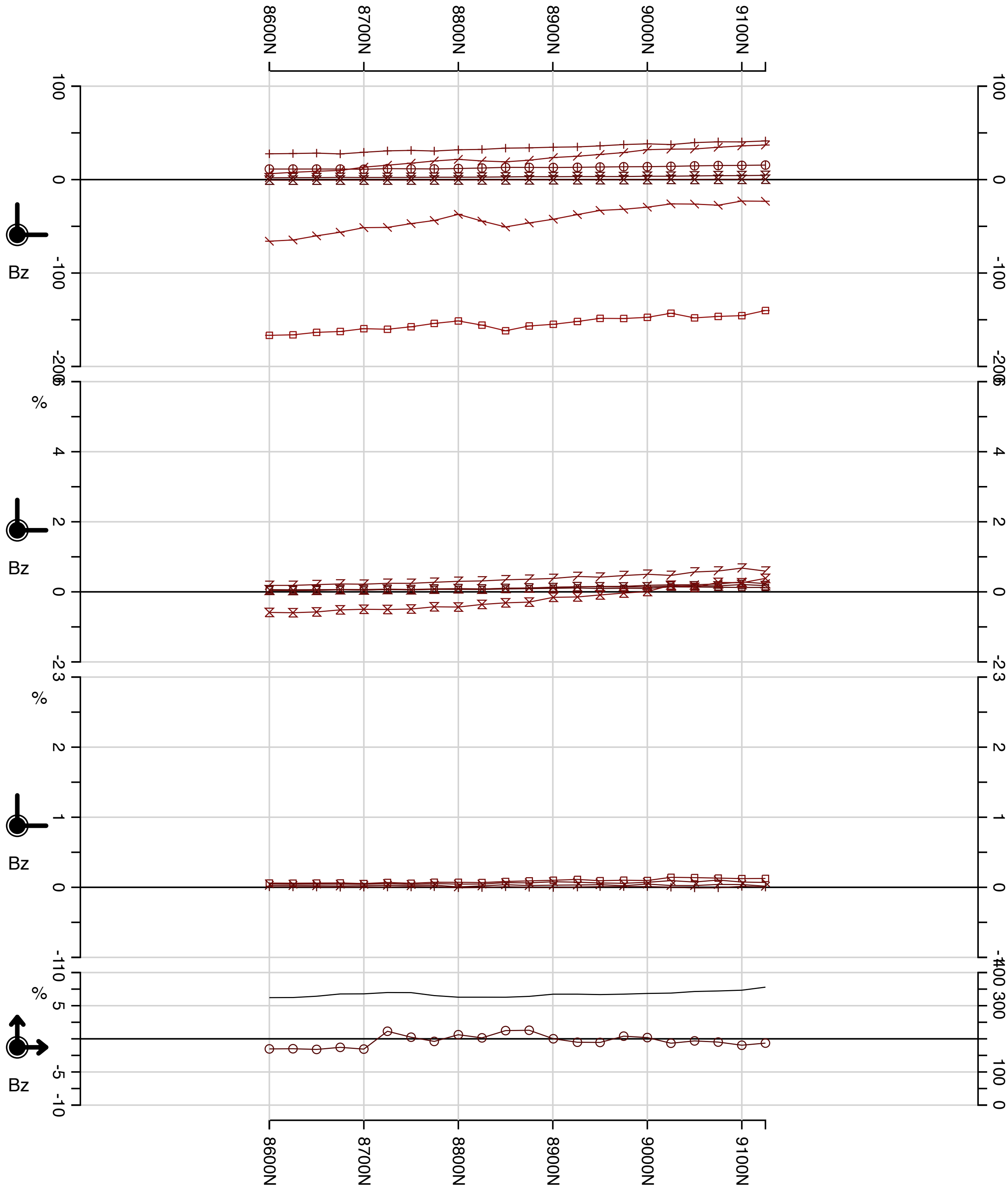
Loop 1551	Line 4300E	8600N - 9150N	550m	Bz/BL/BT
(@ 4.090Hz)	Line 4400E	8600N - 9150N	550m	Bz/BL/BT
	Line 4500E	8600N - 9125N	525m	Bz/BL/BT



Line: L4300E Loop: 1551S1 Cpt: Bz L 0.0°	(Chn - Ch0) / |Bp| (%) Cont norm @ Δz: 0m Base Freq: 4.09091Hz aLp1551S1_L4300EA.3cH5 / Wall wisner settings*	UTEM-5 Survey at: Wisner For: Wallbridge LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTÉE Job 1508 Surv: 11/2/15 Red: 20/8/15 Plot: 20/8/15



Line: L4400E Loop: 1551S1 Cpt: Bz L 0.0°	(Chn - Ch0) / |Bp| (%) Cont norm @ Δz: 0m Base Freq: 4.09091Hz aLp1551S1_L4400EA.3cH5 / Wall wisner settings*	UTEM-5 Survey at: Wisner For: Wallbridge LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTÉE Job 1508 Surv: 11/2/15 Red: 20/8/15 Plot: 20/8/15



Line: L4500E Loop: 1551S1 Cpt: Bz L 0.0°	(Chn - Ch0) / |Bp| (%) Cont norm @ Δz: 0m Base Freq: 4.09091Hz aLp1551S1_L4500EA.3cH5 / Wall wisner settings*	UTEM-5 Survey at: Wisner For: Wallbridge LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTÉE Job 1508 Surv: 11/2/15 Red: 20/8/15 Plot: 20/8/15

Wisner Grid
plotted by line number

BL

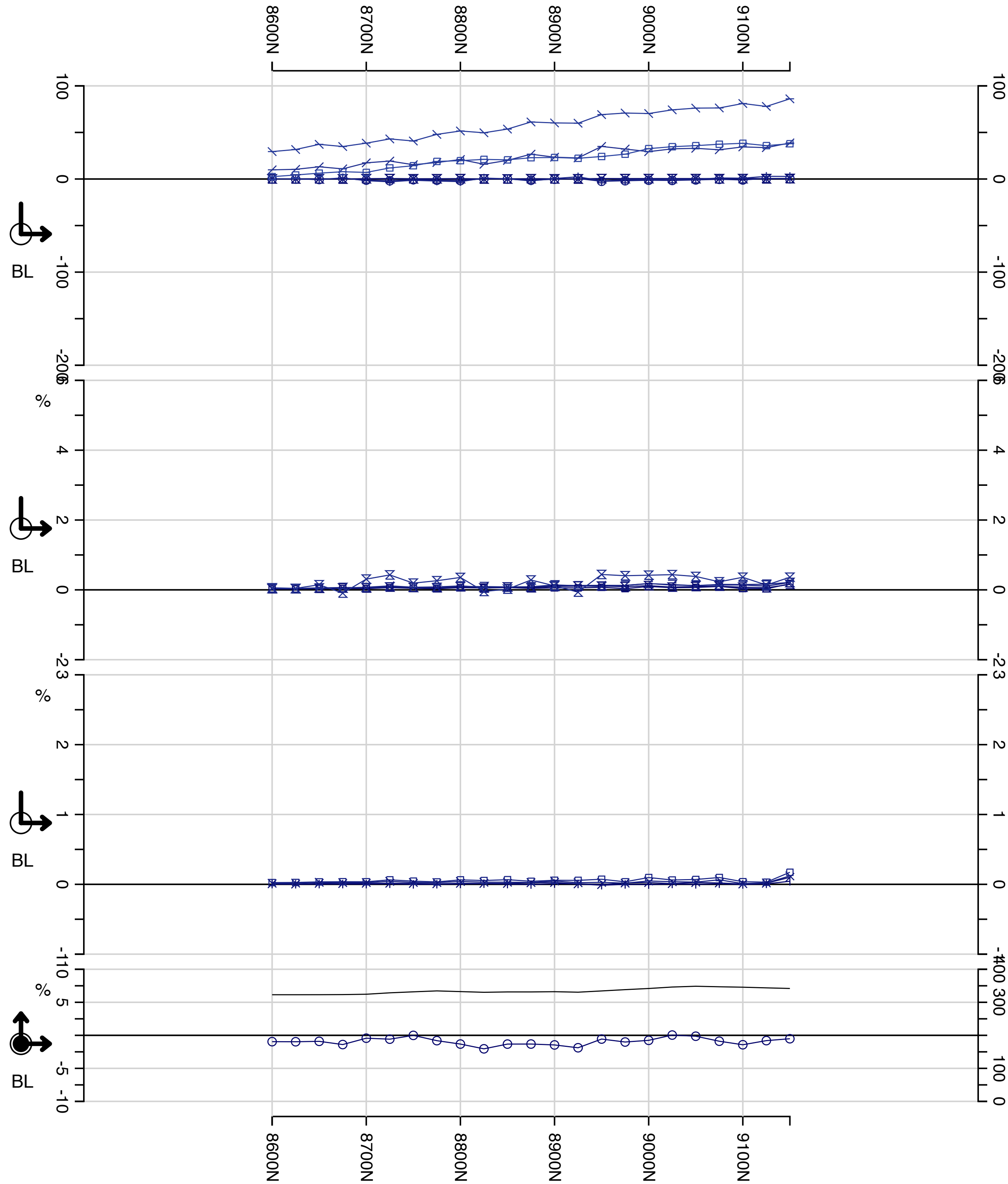
4.090Hz frequency

continuous norm

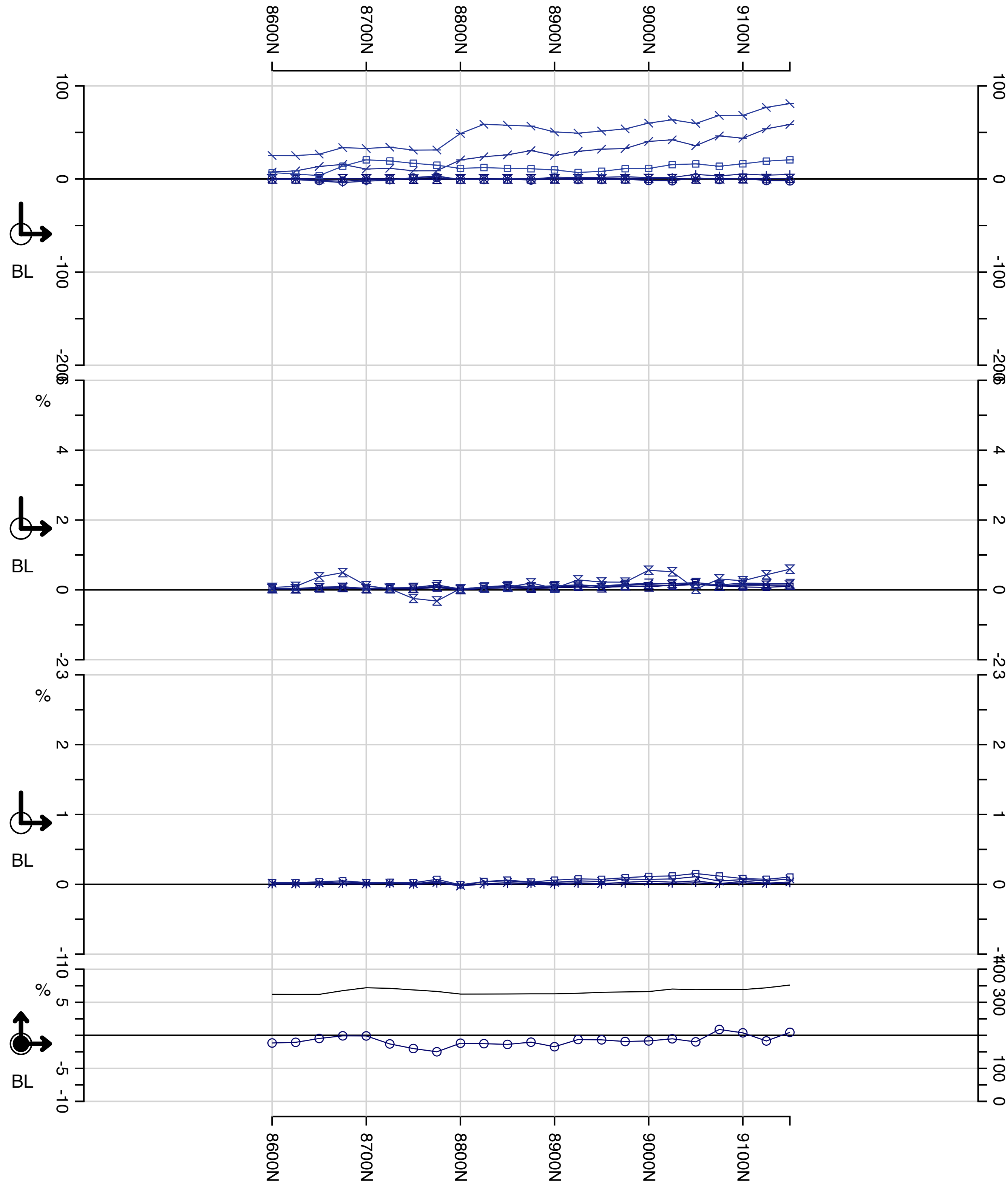
12Ch - Ch0 reduced

Loop 1551	Line 4300E	8600N - 9150N	550m	Bz/BL/BT
(@ 4.090Hz)	Line 4400E	8600N - 9150N	550m	Bz/BL/BT
	Line 4500E	8600N - 9125N	525m	Bz/BL/BT

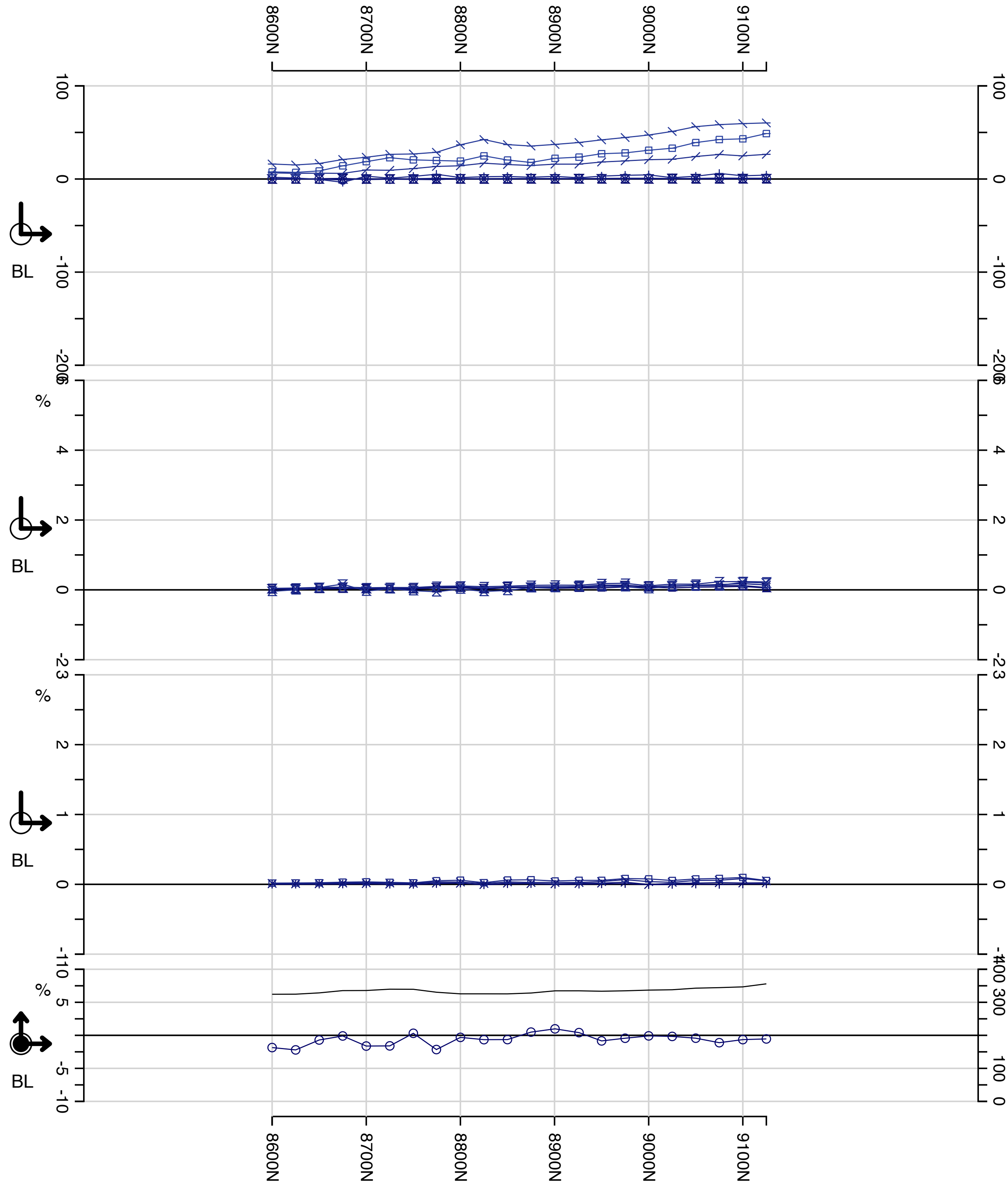
4.090Hz by line number - BL



Line: L4300E Loop: 1551S1 Cpt: BL L 0.0°	(Chn - Ch0) / |Bp| (%) Cont norm @ Δz: 0m Base Freq: 4.09091Hz aLp1551S1_L4300EA.3cH5 / Wall wisner settings*	UTEM-5 Survey at: Wisner For: Wallbridge LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTÉE Job 1508 Surv: 11/2/15 Red: 20/8/15 Plot: 20/8/15



Line: L4400E Loop: 1551S1 Cpt: BL L 0.0°	(Chn - Ch0) / |Bp| (%) Cont norm @ Δz: 0m Base Freq: 4.09091Hz aLp1551S1_L4400EA.3cH5 / Wall wisner settings*	UTEM-5 Survey at: Wisner For: Wallbridge LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTÉE Job 1508 Surv: 11/2/15 Red: 20/8/15 Plot: 20/8/15



Line: L4500E Loop: 1551S1 Cpt: BL L 0.0°	(Chn - Ch0) / |Bp| (%) Cont norm @ Δz: 0m Base Freq: 4.09091Hz aLp1551S1_L4500EA.3cH5 / Wall wisner settings*	UTEM-5 Survey at: Wisner For: Wallbridge LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTÉE Job 1508 Surv: 11/2/15 Red: 20/8/15 Plot: 20/8/15

Wisner Grid
plotted by line number

BT

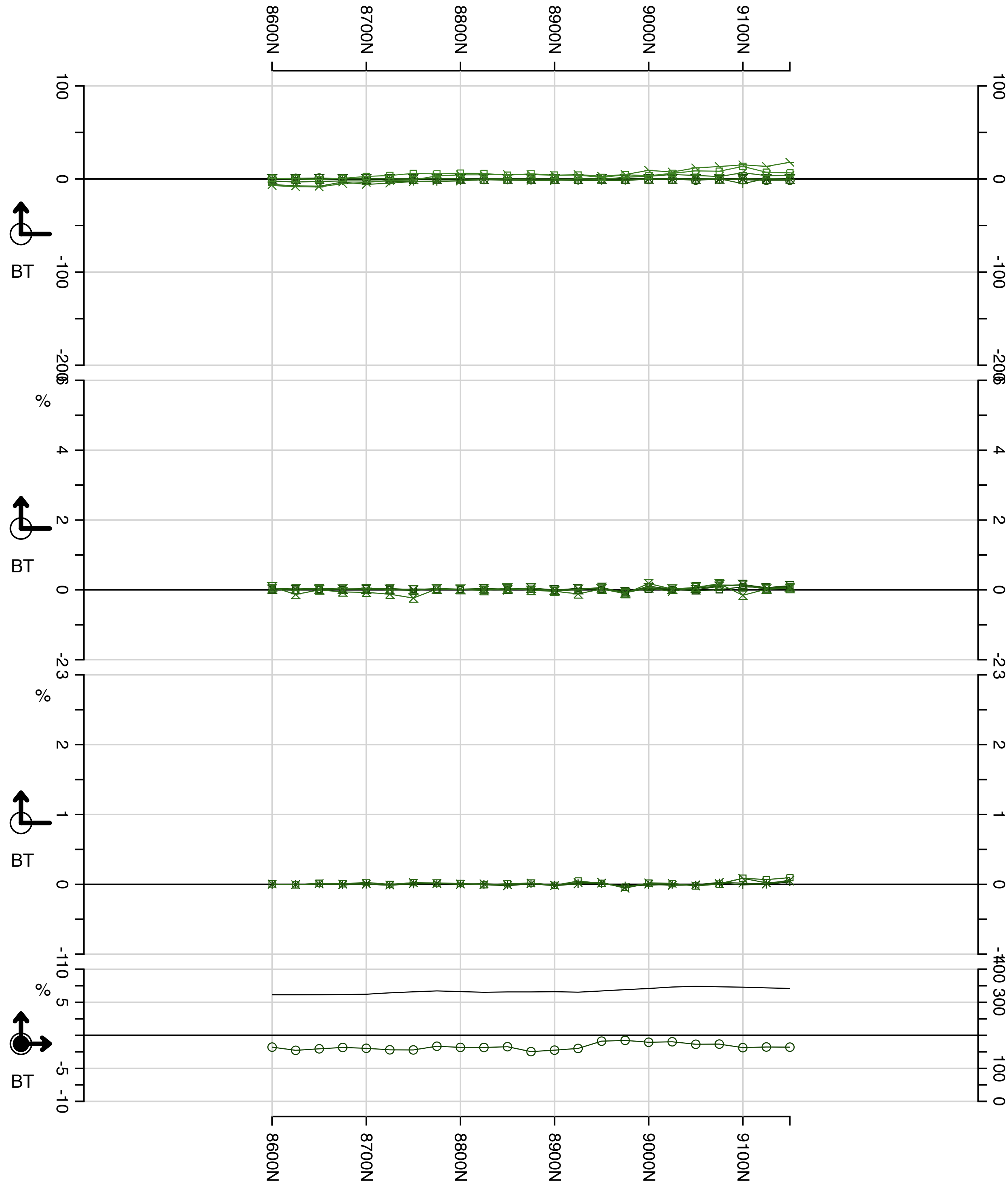
4.090Hz frequency

continuous norm

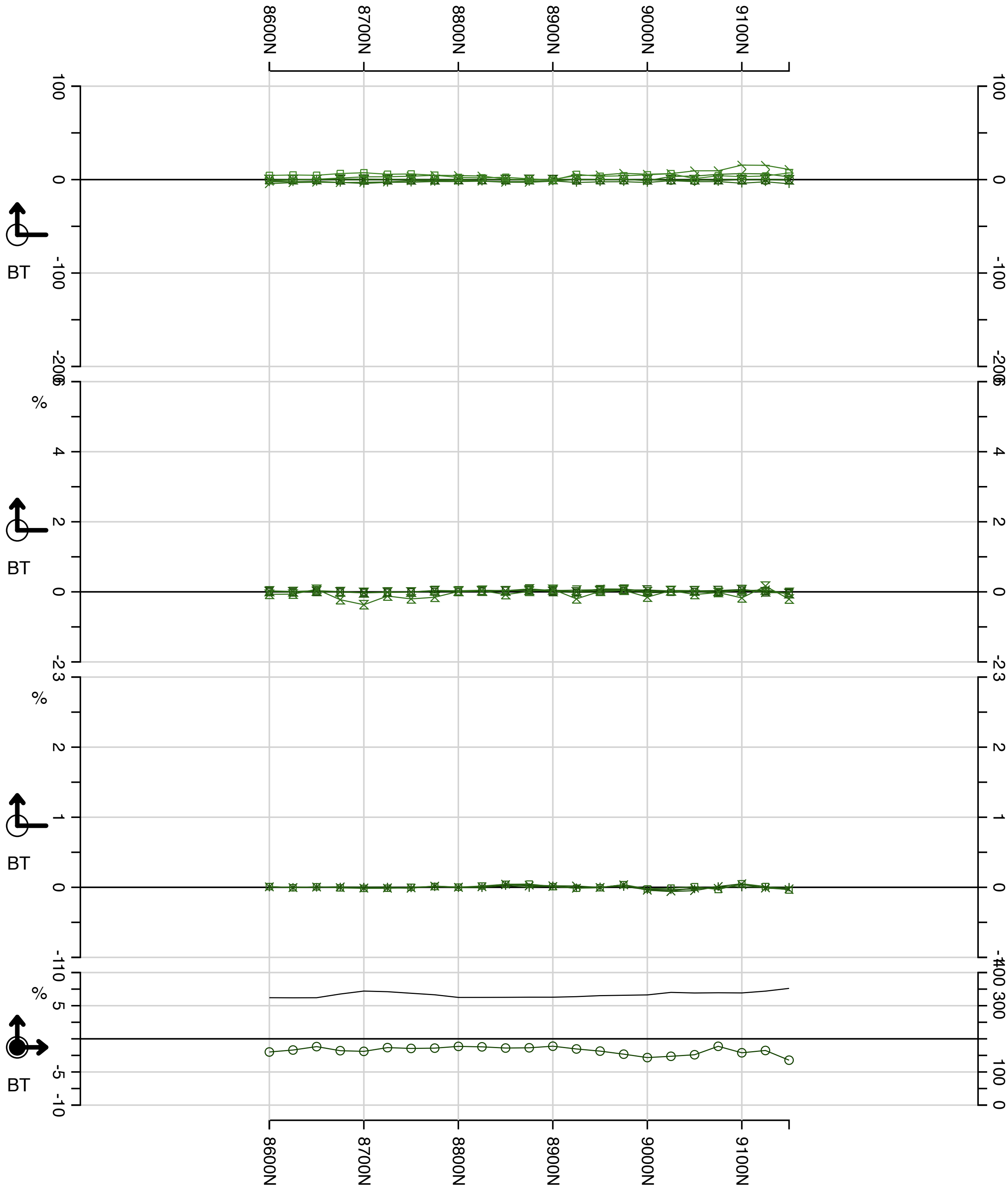
12Ch - Ch0 reduced

Loop 1551	Line 4300E	8600N - 9150N	550m	Bz/BL/BT
(@ 4.090Hz)	Line 4400E	8600N - 9150N	550m	Bz/BL/BT
	Line 4500E	8600N - 9125N	525m	Bz/BL/BT

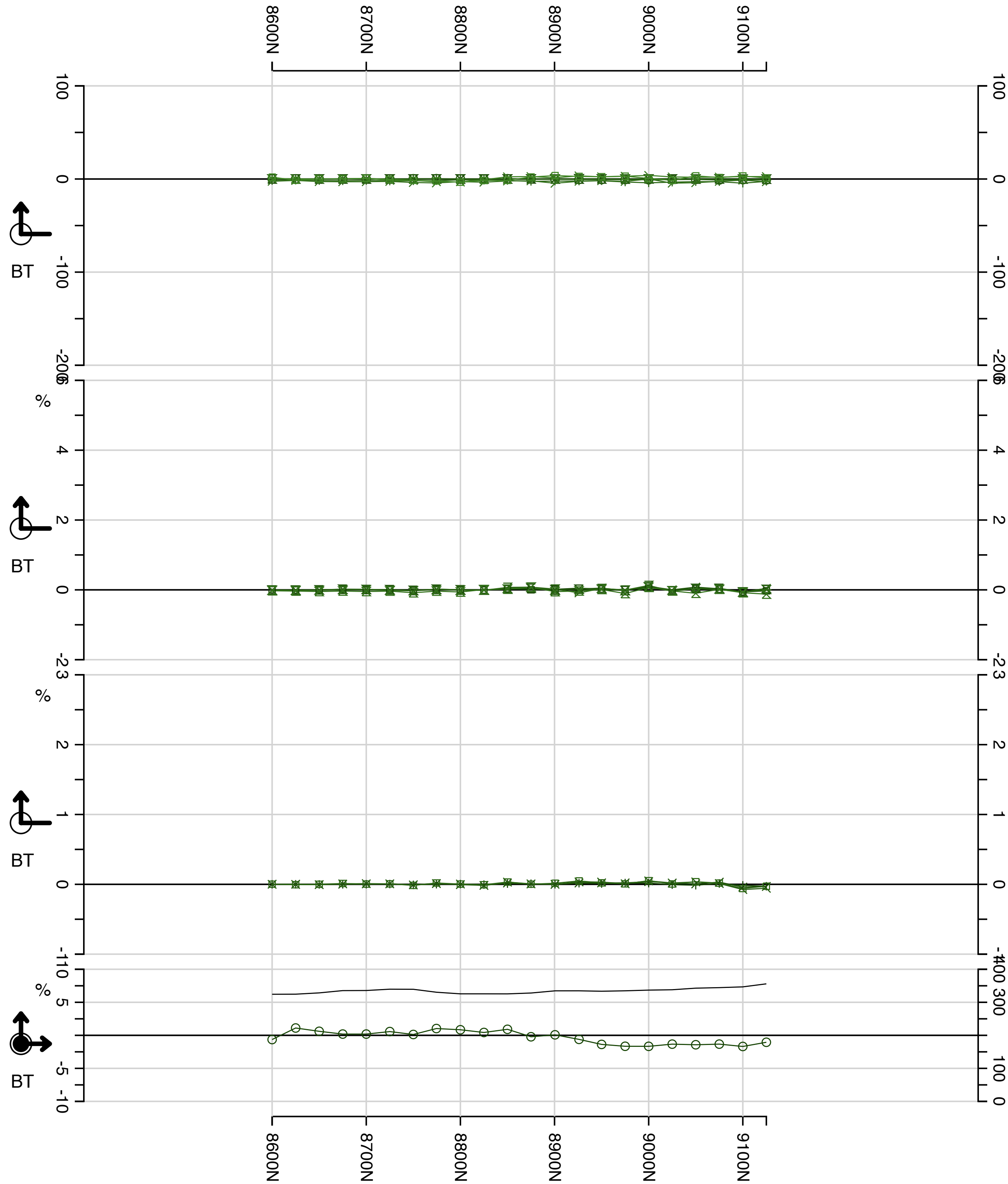
4.090Hz by line number - BT



Line: L4300E Loop: 1551S1 Cpt: BT L 0.0°	(Chn - Ch0) / |Bp| (%) Cont norm @ Δz: 0m Base Freq: 4.09091Hz aLp1551S1_L4300EA.3cH5 / Wall wisner settings*	UTEM-5 Survey at: Wisner For: Wallbridge LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTÉE Job 1508 Surv: 11/2/15 Red: 20/8/15 Plot: 20/8/15



Line: L4400E Loop: 1551S1 Cpt: BT L 0.0°	(Chn - Ch0) / |Bp| (%) Cont norm @ Δz: 0m Base Freq: 4.09091Hz aLp1551S1_L4400EA.3cH5 / Wall wisner settings*	UTEM-5 Survey at: Wisner For: Wallbridge LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTÉE Job 1508 Surv: 11/2/15 Red: 20/8/15 Plot: 20/8/15



Line: L4500E Loop: 1551S1 Cpt: BT L 0.0°	(Chn - Ch0) / |Bp| (%) Cont norm @ Δz: 0m Base Freq: 4.09091Hz aLp1551S1_L4500EA.3cH5 / Wall wisner settings*	UTEM-5 Survey at: Wisner For: Wallbridge LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTÉE Job 1508 Surv: 11/2/15 Red: 20/8/15 Plot: 20/8/15

Wisner Grid
plotted by line number
2.045Hz

Loop 1552	Line 4300E	8600N - 9150N	550m	Bz/BL/BT
(@ 2.045Hz))	Line 4400E	8600N - 9150N	550m	Bz/BL/BT
	Line 4500E	8600N - 9125N	525m	Bz/BL/BT

Wisner Grid
plotted by line number

Bz

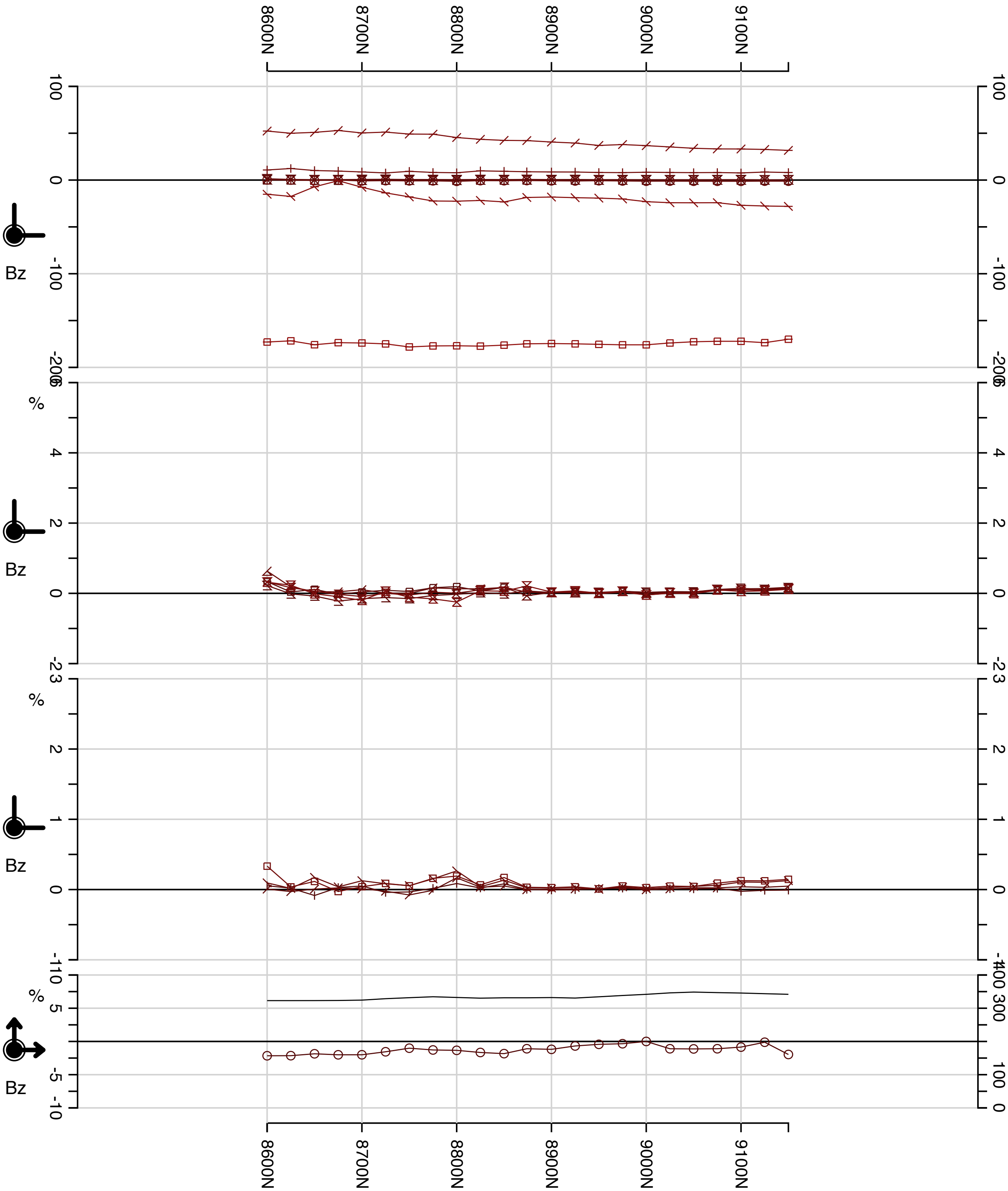
2.045Hz frequency

continuous norm

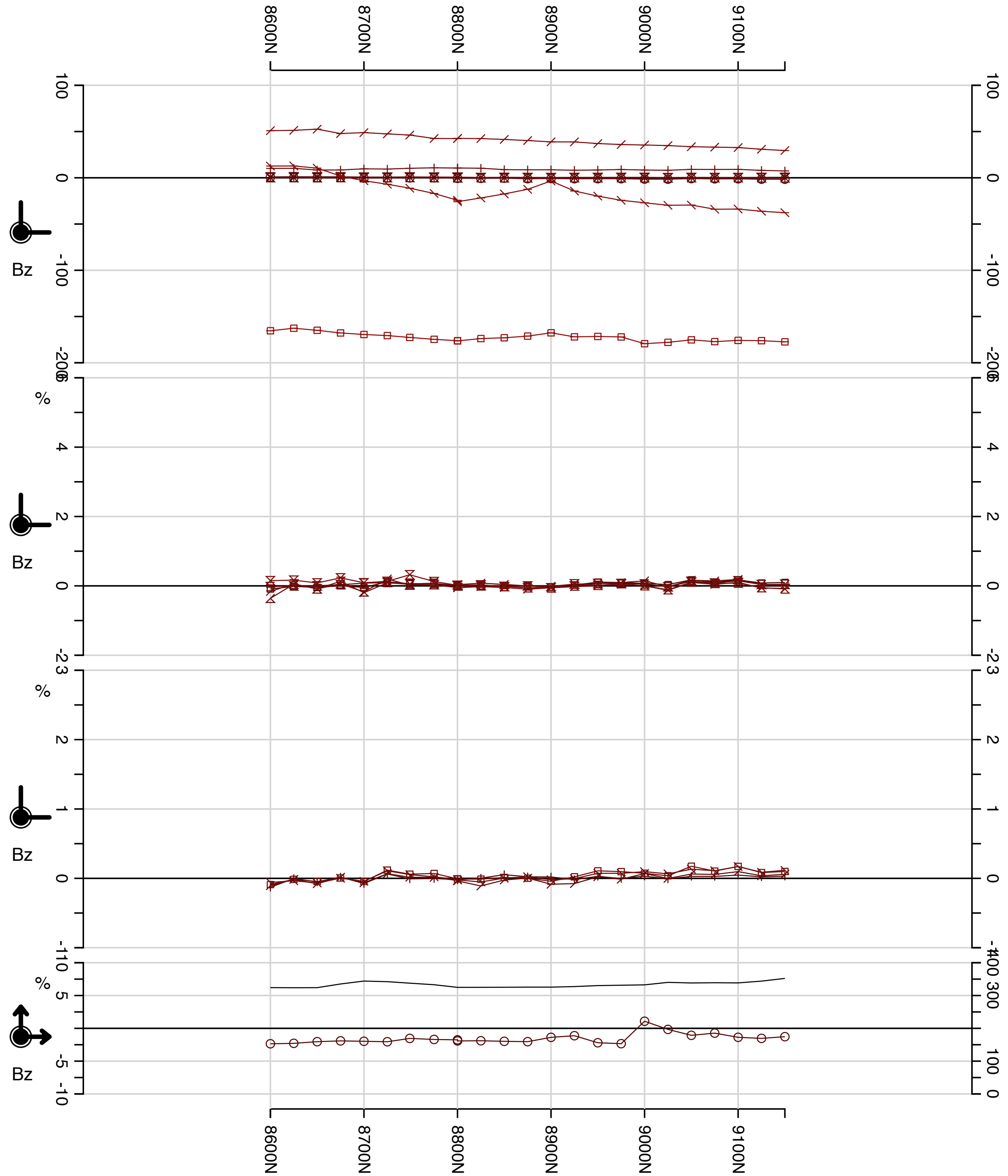
12Ch - Ch0 reduced

Loop 1552	Line 4300E	8600N - 9150N	550m	Bz/BL/BT
(@ 2.045Hz))	Line 4400E	8600N - 9150N	550m	Bz/BL/BT
	Line 4500E	8600N - 9125N	525m	Bz/BL/BT

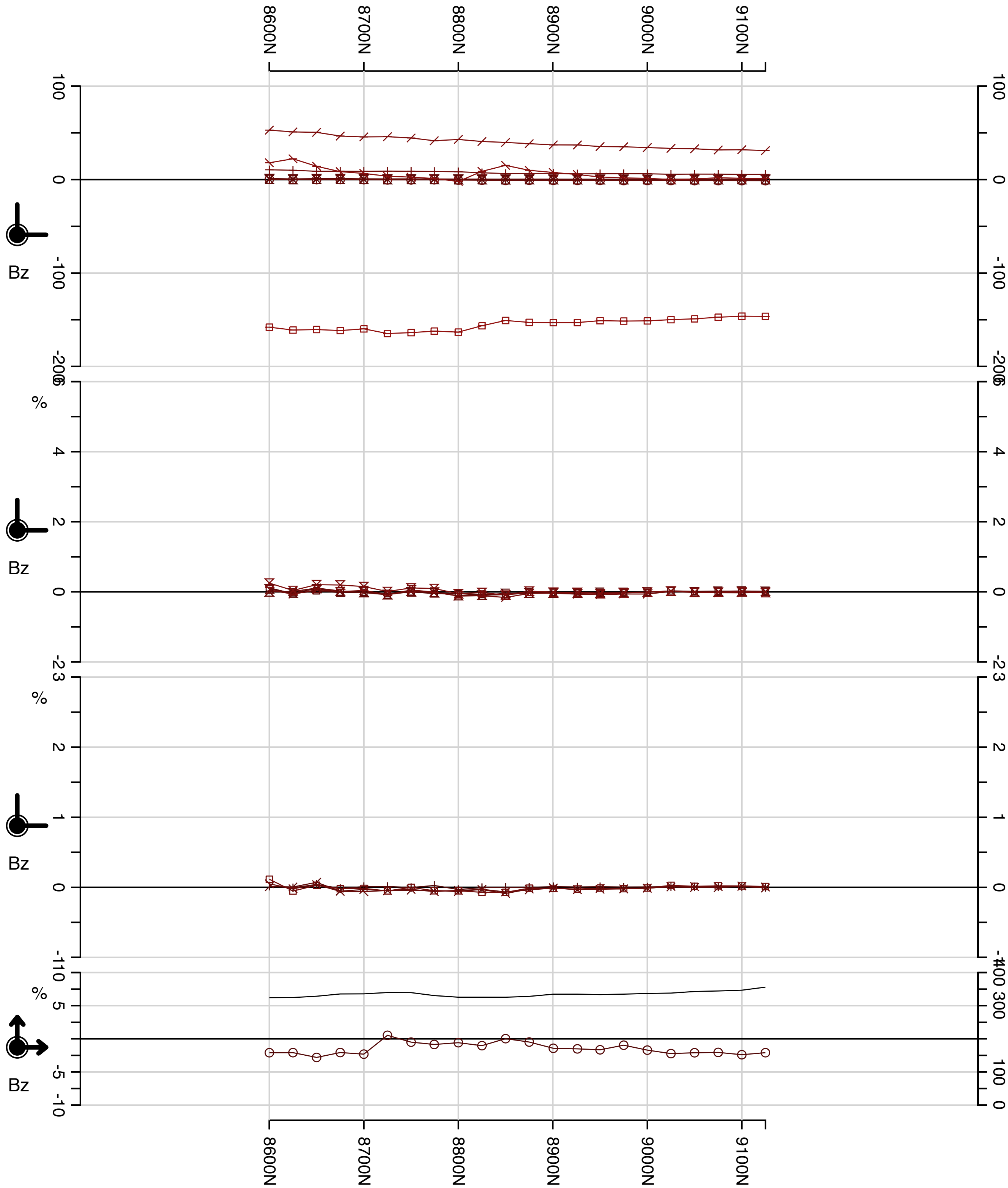
2.045Hz by line number - Bz



Line: L4300E	(Chn - Ch0) / |Bp| (%)	UTEM-5 Survey at: Wisner
Loop: 1552S2	Cont norm @ Δz: 0m	For: Wallbridge
Cpt: Bz	Base Freq: 2.04545Hz	LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTÉE
L 0.0°	aLp1552S2_L4300EB.3cH5 / Wall wisner settings*	Job 1508 Surv: 12/2/15 Red: 20/8/15 Plot: 20/8/15



Line: L4400E Loop: 1552S2 Cpt: Bz L 0.0°	(Chn - Ch0) / lBpl (%) Cont norm @ Δz: 0m Base Freq: 2.04545Hz aLp1552S2_L4400EB.3cH5 / Wall wisner settings*	UTEM-5 Survey at: Wisner For: Wallbridge LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTÉE Job 1508 Surv: 12/2/15 Red: 20/8/15 Plot: 20/8/15



Line: L4500E Loop: 1552S2 Cpt: Bz L 0.0°	(Chn - Ch0) / |Bp| (%) Cont norm @ Δz: 0m Base Freq: 2.04545Hz aLp1552S2_L4500EB.3cH5 / Wall wisner settings*	UTEM-5 Survey at: Wisner For: Wallbridge LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTÉE Job 1508 Surv: 11/2/15 Red: 20/8/15 Plot: 20/8/15

Wisner Grid
plotted by line number

BL

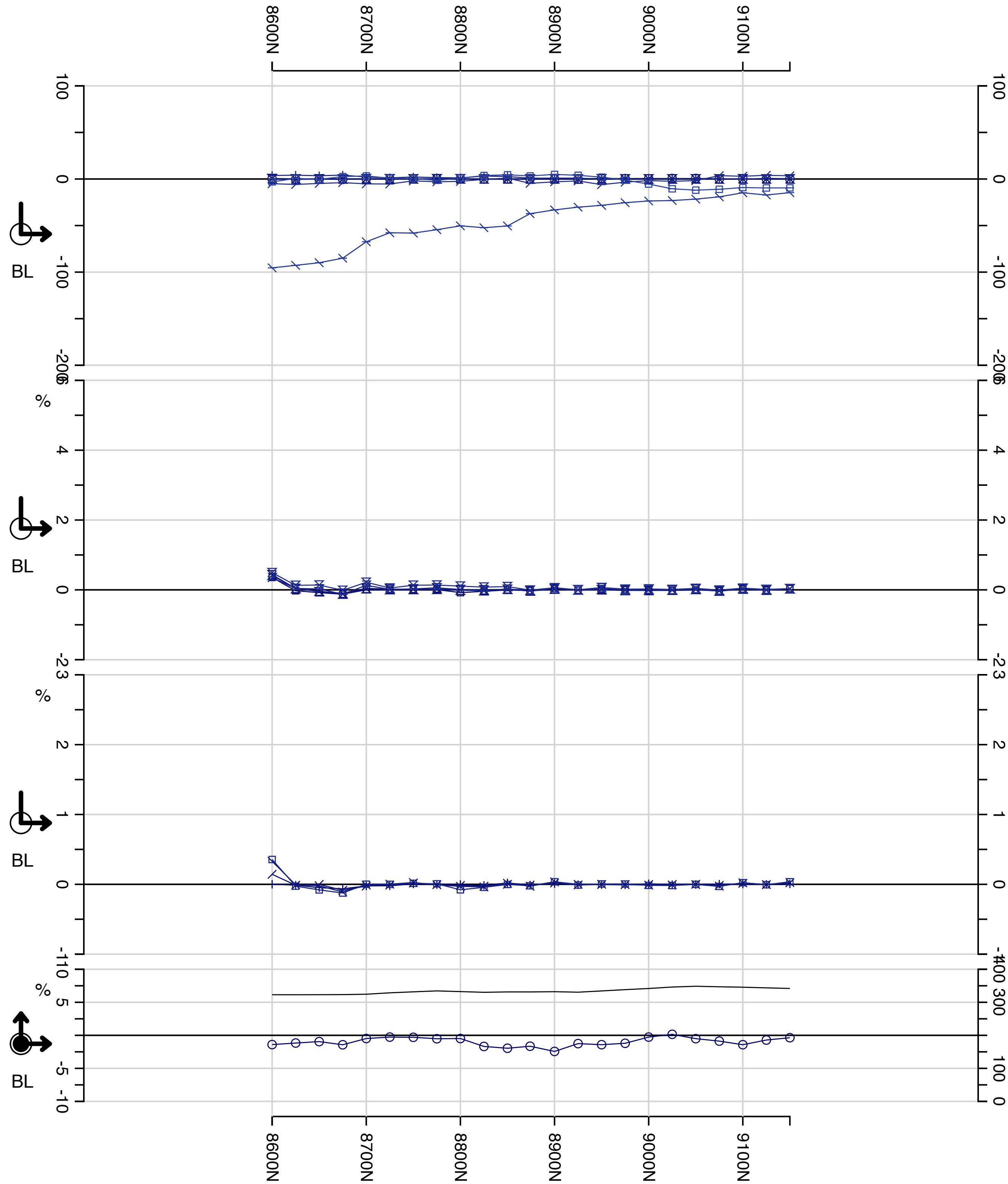
2.045Hz frequency

continuous norm

12Ch - Ch0 reduced

Loop 1552	Line 4300E	8600N - 9150N	550m	Bz/BL/BT
(@ 2.045Hz))	Line 4400E	8600N - 9150N	550m	Bz/BL/BT
	Line 4500E	8600N - 9125N	525m	Bz/BL/BT

2.045Hz by line number - BL



Line: L4300E
Loop: 1552S2
Cpt: BL
L 0.0°

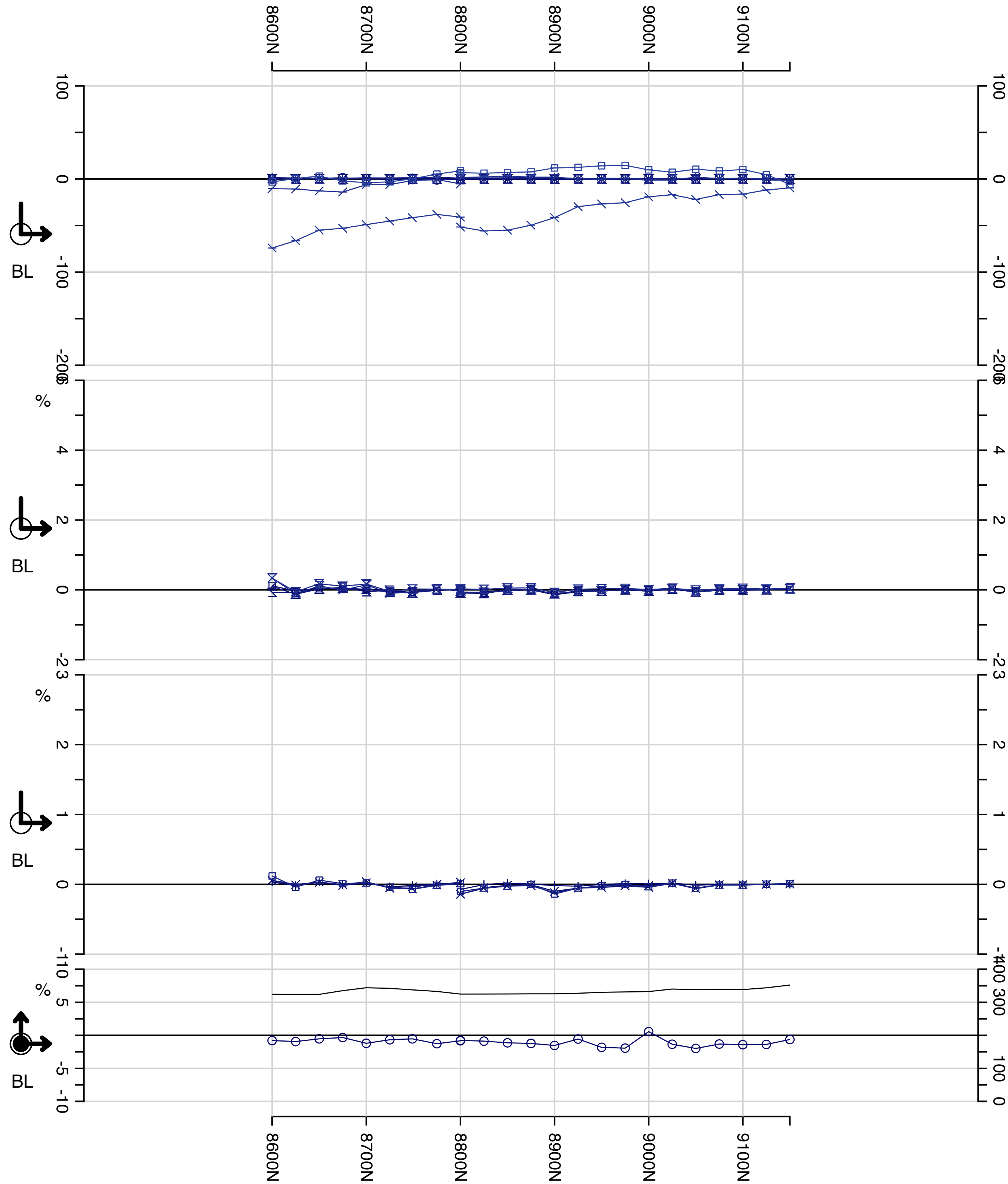
(Chn - Ch0) / |Bp| (%)
Cont norm @ Δz: 0m
Base Freq: 2.04545Hz
aLp1552S2_L4300EB.3cH5 / Wall wisner settings*

UTEM-5 Survey at: Wisner
For: Wallbridge

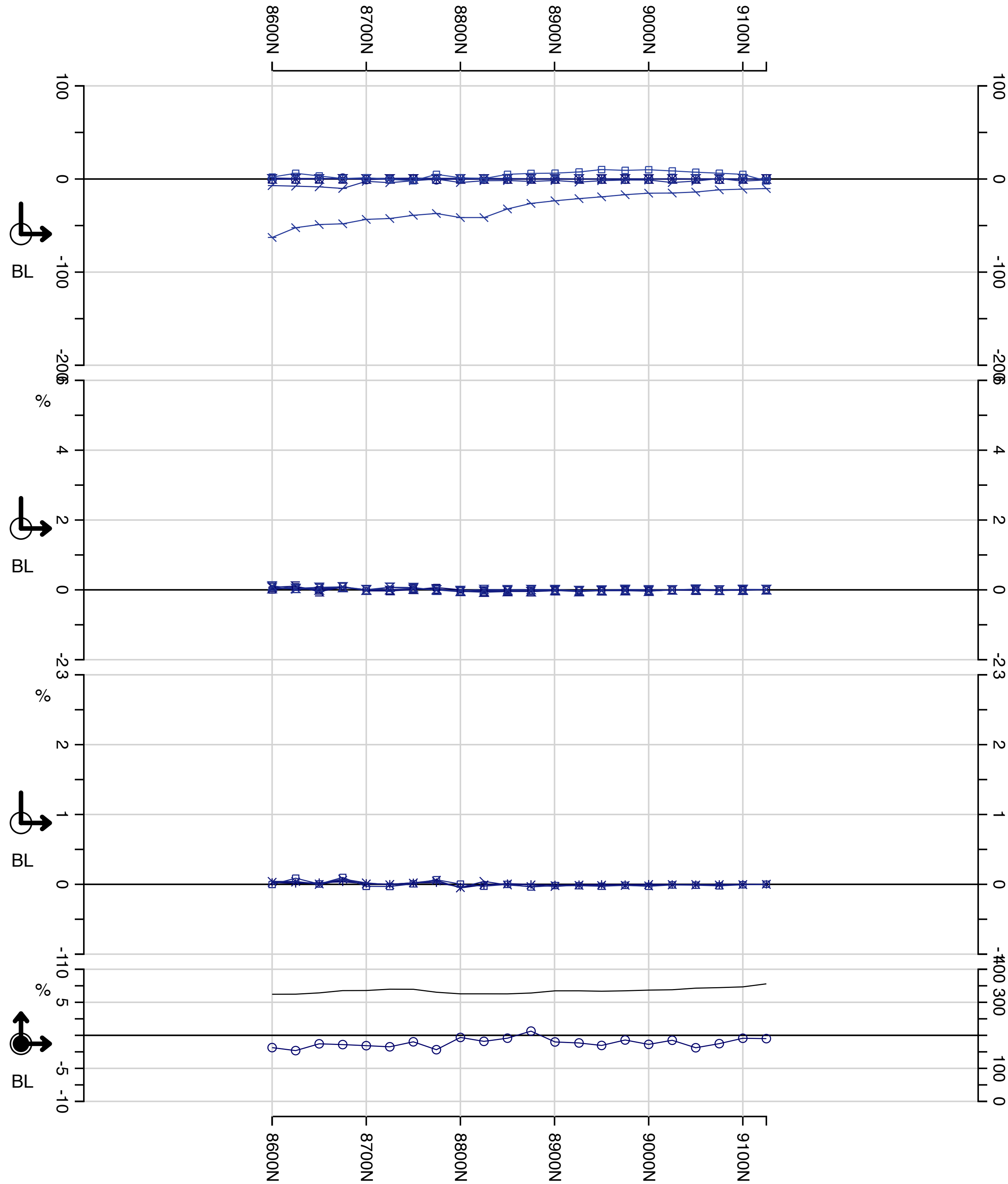
LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTÉE

Job 1508

Surv: 12/2/15
Red: 20/8/15
Plot: 20/8/15



Line: L4400E Loop: 1552S2 Cpt: BL L 0.0°	(Chn - Ch0) / |Bp| (%) Cont norm @ Δz: 0m Base Freq: 2.04545Hz aLp1552S2_L4400EB.3cH5 / Wall wisner settings*	UTEM-5 Survey at: Wisner For: Wallbridge LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTÉE Job 1508 Surv: 12/2/15 Red: 20/8/15 Plot: 20/8/15



Line: L4500E Loop: 1552S2 Cpt: BL L 0.0°	(Chn - Ch0) / |Bp| (%) Cont norm @ Δz: 0m Base Freq: 2.04545Hz aLp1552S2_L4500EB.3cH5 / Wall wisner settings*	UTEM-5 Survey at: Wisner For: Wallbridge LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTÉE Job 1508 Surv: 11/2/15 Red: 20/8/15 Plot: 20/8/15

Wisner Grid
plotted by line number

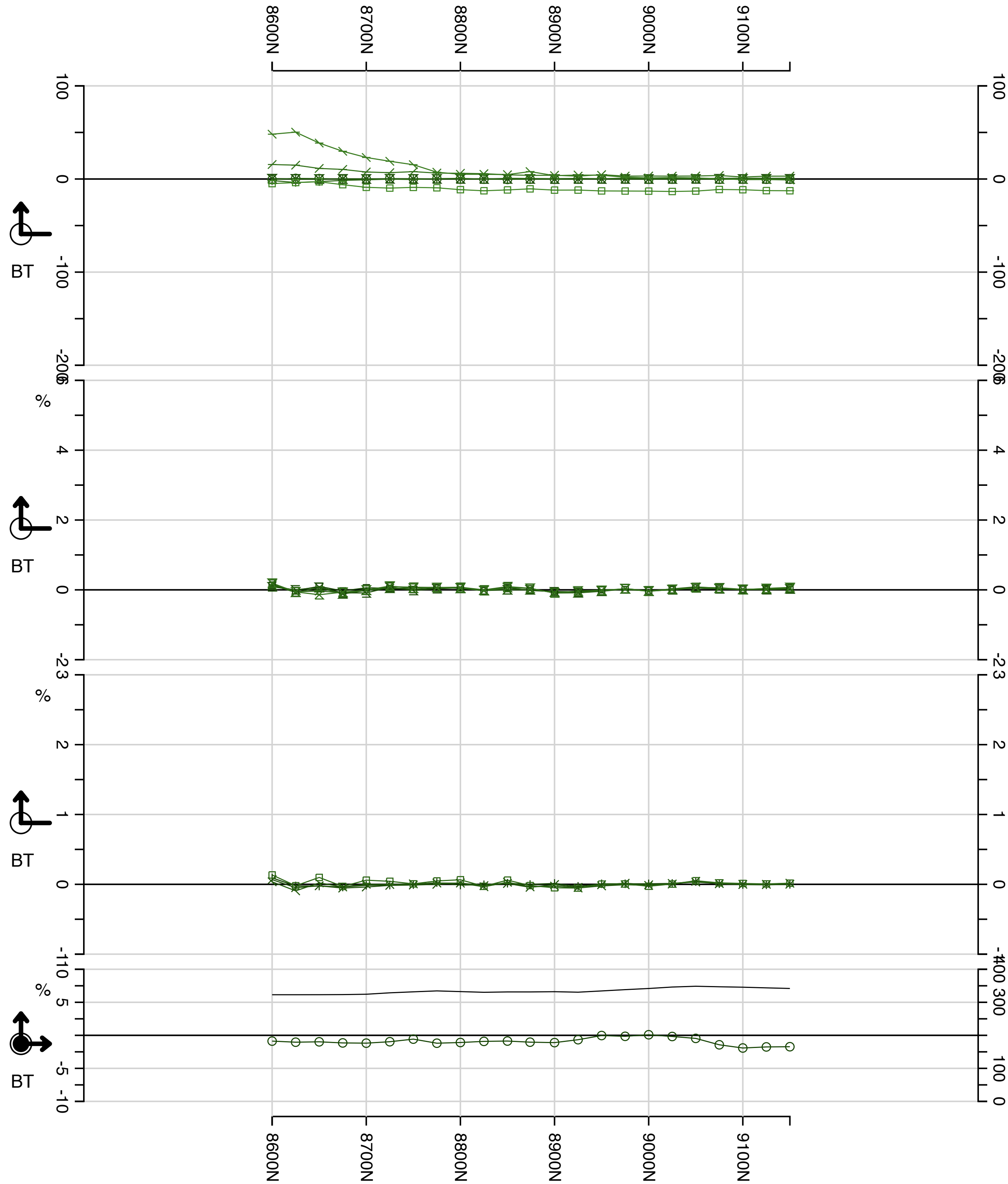
BT

2.045Hz frequency

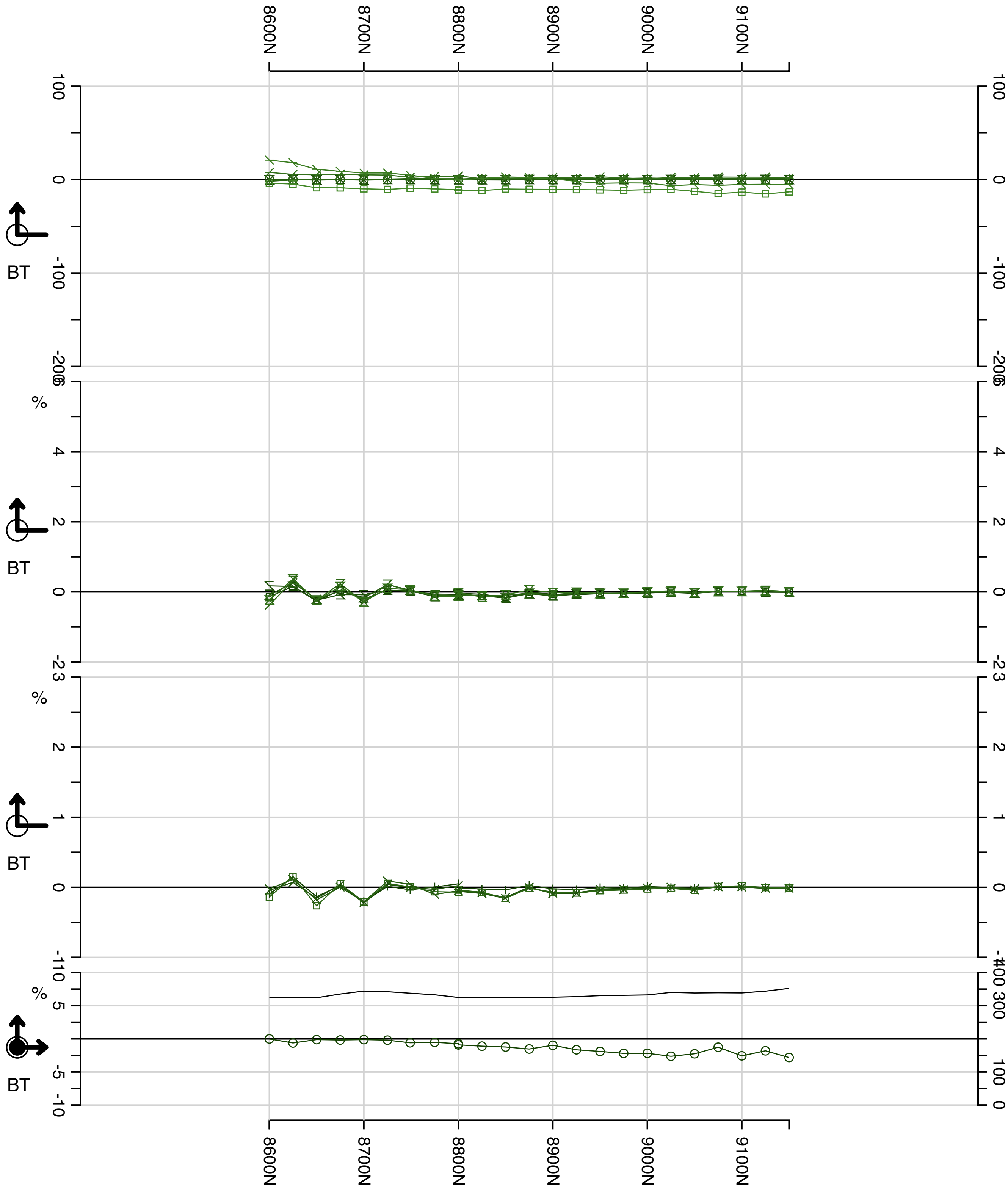
continuous norm

12Ch - Ch0 reduced

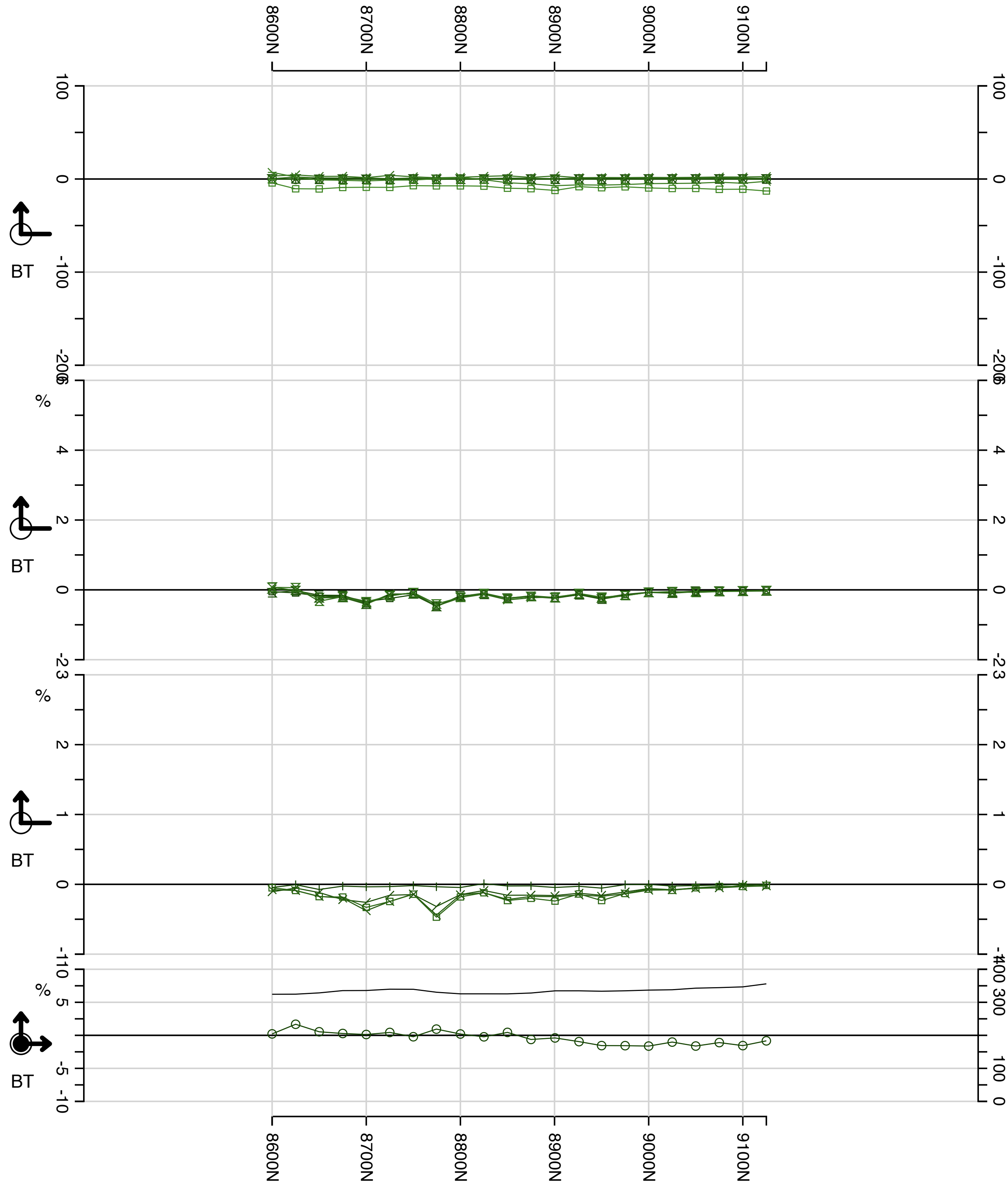
Loop 1552	Line 4300E	8600N - 9150N	550m	Bz/BL/BT
(@ 2.045Hz))	Line 4400E	8600N - 9150N	550m	Bz/BL/BT
	Line 4500E	8600N - 9125N	525m	Bz/BL/BT



Line: L4300E	(Chn - Ch0) / |Bp| (%)	UTEM-5 Survey at: Wisner
Loop: 1552S2	Cont norm @ Δz: 0m	For: Wallbridge
Cpt: BT	Base Freq: 2.04545Hz	LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTÉE Job 1508 Surv: 12/2/15 Red: 20/8/15 Plot: 20/8/15
L 0.0°	aLp1552S2_L4300EB.3cH5 / Wall wisner settings*	



Line: L4400E Loop: 1552S2 Cpt: BT L 0.0°	(Chn - Ch0) / |Bp| (%) Cont norm @ Δz: 0m Base Freq: 2.04545Hz aLp1552S2_L4400EB.3cH5 / Wall wisner settings*	UTEM-5 Survey at: Wisner For: Wallbridge LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTÉE Job 1508 Surv: 12/2/15 Red: 20/8/15 Plot: 20/8/15



Line: L4500E Loop: 1552S2 Cpt: BT L 0.0°	(Chn - Ch0) / |Bp| (%) Cont norm @ Δz: 0m Base Freq: 2.04545Hz aLp1552S2_L4500EB.3cH5 / Wall wisner settings*	UTEM-5 Survey at: Wisner For: Wallbridge LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTÉE Job 1508 Surv: 11/2/15 Red: 20/8/15 Plot: 20/8/15

Appendix B

1508 Production Diary

UTEM5 Survey

Wisner Grid
Sudbury District

for

Wallbridge Mining Company Ltd.

Production Log (1508)

UTEM 5 Survey - Wisner Grid
Wallbridge Mining Company Ltd.

Date	Rate - Production		Comments
January 31	L-2	-	Two men lay all of the southern loop. The western side is moved to Line 4200E and the eastern side is moved to Line 4800E, to take advantage of a previously DGPSed cut line

Crew: P.Guimond,R.Lahaye.

Date	Rate - Production		Comments
February 01	L-3		Three men check out the access to the northern loop. A trail is broken to within 50m of the SW corner and two sides of the loop are laid.

Crew: P.Guimond,R.Lahaye,J.Young.

Date	Rate - Production		Comments
February 03	P-7	350m	Three men extend the trail to the NE corner of the northern loop and lay the remaining 2 sides, finishing by 13h00. The remaining crew members begin transporting gear to the two transmitter sites (3 trips). Survey underway by 14h30 until 15h45. Back at the office by 18h00.

Loop 1551		**S1-Tx09**	**4.090Hz_12Ch**
Loop 1552		**S2-Tx10**	**2.045Hz_12Ch**
Line 43+00E	**89+50N - 91+50N**		**R6/RD2**
Line 44+00E	**90+00N - 91+50N**		**R3/RD1**

Crew: P.Guimond,G.Lafortune,R.Lahaye,J.Young,B.Dingwall,,K.Arsenault, J.Savage

Date	Rate - Production		Comments
February 010	L-2		Two men check out the status of the two loops. The southern loop was found to be broken in two places. The lake crossing on the northern loop is re-deployed.

Crew: R.Lahaye,J.Young.

Date	Rate - Production		Comments
February 011	P-6	1425m	Move the gear in on one trip (3 sleds and 3 sleighs). Survey underway by 10h30 until 15h30. Back at the office by 18h00.

Loop 1551		**S1-Tx09**	**4.090Hz_12Ch**
Loop 1552		**S2-Tx10**	**2.045Hz_12Ch**
Line 43+00E	**86+00N - 89+50N**		**R6/RD2**
Line 44+00E	**86+00N - 91+50N**		**R6/RD2**
Line 45+00E	**86+00N - 91+25N**		**R1/RD1**

Crew: P.Guimond,G.Lafortune,R.Lahaye,J.Young,B.Dingwall,K.Arsenault

Date	Rate - Production		Comments
February 12	P-5	650m	A late start in the morning waiting for instructions from Kingston. Re-read portions of 2 lines from one loop (S2). Survey underway by 13h30 until 17h15. Back at the office by 19h00.

Loop 1552 **S2-Tx10** **2.045Hz_12Ch**

Line 43+00E	**86+00N - 88+50N**		**R6/RD2**
Line 43+00E	**88+50N - 90+50N**		**R1/RD1**
Line 44+00E	**86+00N - 88+00N**		**R1/RD1**

Crew: P.Guimond,G.Lafortune,R.Lahaye,J.Young, B.Dingwall

February 13	L-4	Four men pick up Loops 1508S1 and 1508S2 to complete the project.

Crew: P.Guimond, R.Lahaye,J.Young,J.Savage.

February 14	demob	Three men demob back to Toronto (Guimond), Kingston (Dingwall) and Montréal (Lahaye).

Crew: P.Guimond,R.Lahaye,B.Dingwall

LEGEND

P(n)-x	Surface Production (# of receivers) - # of personnel
D(n)-x	Down (# of receivers) - # of personnel
L(n)-x	Looping (# of receivers) - # of personnel
S(n)-x	Standby (# of receivers) - # of personnel

Appendix C

The UTEM SYSTEM
- UTEM5 -

- Introduction to UTEM5 -

The UTEM System

UTEM Data Reduction and Plotting Conventions

Data Presentation

UTEM5

The UTEM5 system collects 3-component data from up to 3 transmitter loops - three coupling angles - simultaneously - translating to superior target definition and improved detection of all targets. In addition:

- UTEM5 precision is at least an order of magnitude better than the UTEM3 surface system. Our current estimate is that the UTEM5 surface coil precision will prove to be better by a factor of 10-40 times. Improved sensitivity equals better depth penetration. It also translates to significantly shorter stacking times or alternatively, better precision for the same stacking time. The improvement in precision is greater at lower frequencies (<4Hz).
- UTEM5 surface equipment has a greater advantage at low frequency - <4Hz. The UTEM5 technical advantage is greatest in the search for targets that are deeper and more highly-conductive when (very) large-loops (geometry of the applied field is simpler). UTEM5, however, will be found to be extremely useful in numerous other applications.
- Figure C1 shows the UTEM5 channels when 12Ch sampling is selected. Channels are spaced in a binary, geometric progression across each half-cycle of the received waveform - giving just over 3 channels per decade. Ch**12**, the earliest channel, is (~)$1/2^{12}$ of the half-cycle wide. Ch**1**, the latest channel, is (~)$1/2^{1}$ of the half-cycle wide. The use of UTEM4/5 Transmitters and UTEM5 Receivers allows for the implementation of:
  - Ch0 - a narrow Ch later than Ch1. Making Ch0 normalization an option.
  - 3 timing channels - Ch13/14/15 (Figure C1) for 12Ch UTEM5 The timing Chs improve the operator's ability to monitor Rx/Tx(s) synchronisation and allow for more precise phase correction/improved deconvolution.
- the UTEM5 rejection of non-survey frequencies including powerline noise is far superior to previous UTEM systems. One of the many features of the UTEM5 system that add up to the improved rejection is the option of tapered channel sampling (Figure C1).

The ability to simultaneously collect higher-precision, 3-component data from multiple transmitters (coupling angles) at low frequency is really what the UTEM5 system is designed for - to be efficient and precise. To date UTEM5 surveys using multiple transmitters operating at base frequencies as low as 0.25Hz have confirmed that both the sensitivity of the system and the rejection of non-survey frequencies (powerline noise etc.) is far superior to previous UTEM systems.

In terms of BH operations, UTEM5 Rx coupled with our existing BHUTEM system allows for the collection of 3-component data from multiple transmitters simultaneously. The precision improvement may not be that noticeable near surface - in high field strengths. But at depth - low field strength - we estimate up to a factor of 5 improvement in precision. That improvement, and the multiple transmitter option, will add up to a considerable increase in the ability to resolve deep, highly-conductive targets - allowing for the detection of smaller targets and targets more distant from the hole.

The UTEM SYSTEM

UTEM uses a large, fixed, horizontal transmitter loop as its source. Loops range in size from 300x300m to 4000x4000m and larger. Smaller loops are generally used over conductive terrain or for shallow sounding work. Larger loops are used over resistive terrain or where the ability of the system to resolve a response can be aided by the simpler geometry of the applied field. The UTEM receiver(s)/transmitter(s) are typically synchronised at the beginning of a survey day and the Rx(s) operates remotely after that point. The Rx/Tx clocks are sufficiently accurate to maintain synchronisation.

Measurements are routinely taken to a distance of twice the loop dimensions and can be continued further depending on the local noise levels. Lines are typically surveyed:

- off-loop: out from an edge of the loop when the target is steeply dipping.
- inside-the-loop: when the target is ~flat-lying

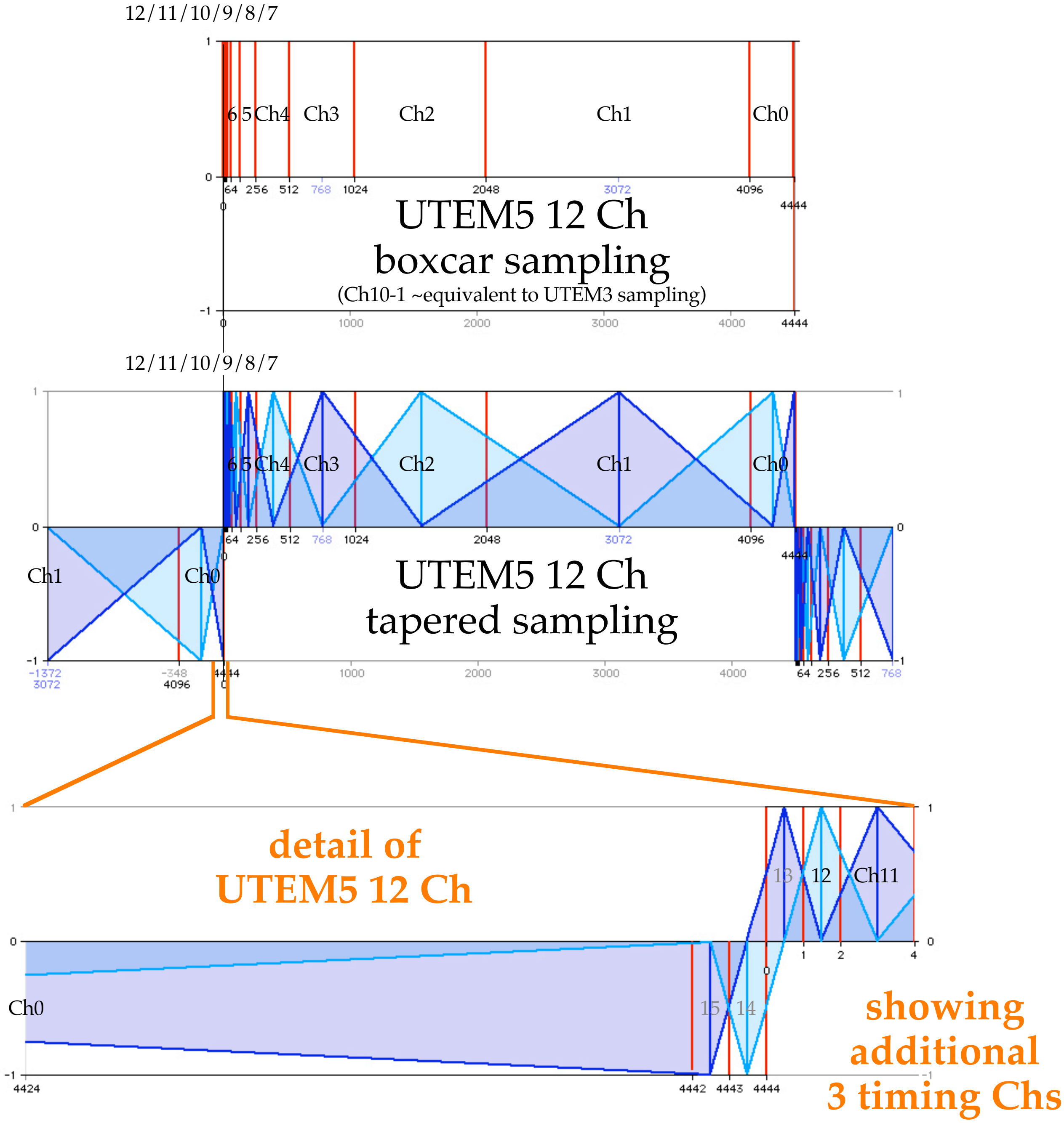
BHUTEM - the borehole version of UTEM -surveys have been carried out to depths up to 3000+ metres.

System Waveform

A UTEM transmitter passes a low-frequency current of a precisely regulated triangular waveform through the transmitter loop. The frequency can be set to any value within the operating range of the transmitter. A target frequency for each UTEM transmitter and the local powerline frequency are entered. The actual frequencies used are selected to be as close to the target frequencies as possible while optimising rejection of the other transmitters and powerline noise (60 Hz in North America/generally 50Hz elsewhere). Since the receiver coils responds to the time derivative of the magnetic field, the UTEM system really "sees" the step response of the ground. UTEM is the only time domain system which measures the step response of the ground. All other TDEM systems to date transmit a modified step current and "see" the (im)pulse response of the ground at the receiver. In practice, the UTEM waveform is filtered - pre-whitened - to optimize signal-to-noise. Deconvolution techniques produce the equivalent to the conceptual “step response” at the receiver.

System Sampling

The UTEM receiver measures the time variation of the magnetic field in the direction of the receiver coil at (typically) channels or delay times. UTEM channels are spaced in a binary, geometric progression across each half-cycle of the received waveform. Channel **12 (or Ch10)** is the earliest channel and it is $1/2^{12}$ of the half-cycle wide. Channel **1**, the latest channel, is $1/2^{1}$ of the half-cycle wide (see UTEM3 10Ch figure below and Figure C1). The measurements obtained for each of channels are accumulated over many half-cycles. The final channel value stored is the average of the measurements. The number of half-cycles averaged depends on the signal strength and the ambient noise.



Notes:
- boxcar sampling equivalent to UTEM3 sampling
- tapered sampling: improved powerline rejection
- the use of UTEM4/5 Transmitters and UTEM5 Receivers improves syncing/timing and allows for the implementation of:
  - Ch0 - a narrow Ch after (later than) Ch1.
    - Ch0 normalization is an option
  - 3 timing channels - Ch13/14/15 shown for 12Ch UTEM5
    - improved ability to monitor Rx/Tx(s) synchronisation.
    - improved deconvolution/phase correction.

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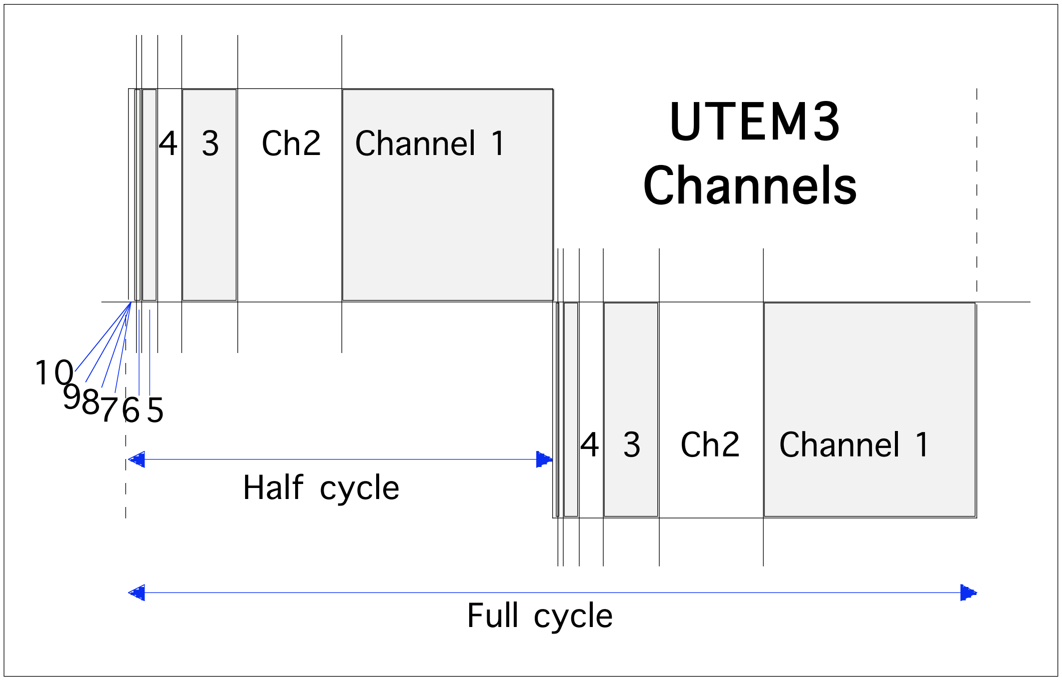
GEOPHYSIQUE LTEE

UTEM5 12Ch Sampling
boxcar/tapered options

Figure C1



System Configurations

During a surface UTEM5 survey the 3-component receiver coil is oriented along the survey line and the coil orientation is determined from the data from a set of three orthogonal accelerometers in the coil in combination with the GPS coordinates of the line. The 3 measured (raw) components of the magnetic field - uvw - are oriented and resolved into:

- u the horizontal transverse component BT(ransverse) ~UTEM3 Hy
- v the vertical component Bz ~UTEM3 Hz
- w the horizontal in-line component BL(ine) ~UTEM3 Hx

Note that the UTEM System is also capable of measuring the electric field, The two horizontal components,Ex and Ey can be measured using a dipole sensor comprised of two electrodes. E-field measurements are generally used for outlining resistive features to which the magnetic field is not very sensitive.

BHUTEM4 surveys employ a 3-component receiver coil - longer and smaller in diameter than the surface coil. The borehole receiver coil forms part of a down-hole receiver package used to measure the axial (along-borehole) and the two transverse components of the magnetic field. Due to the distance between coil and receiver in borehole surveys the signal must be transmitted up to the receiver. In BHUTEM the signal is transmitted to surface digitally using a kevlar-reinforced fibre-optic cable as a data link. Using a fibre-optic link avoids signal degradation problems and allows surveying of boreholes to 3000+m. The cable is also very light - the specific gravity is ~1.0 - making the cable handling hardware quite portable.

The EM Induction Process

Any time-varying transmitted ("primary") field induces current flow in conductive regions of the ground below and around the transmitter loop (i.e. in the earth or "half-space"). This current flow produces a measurable EM field, the secondary field, which has an inherent "inertia" that resists the change in primary field direction. This “inertial” effect is called self-inductance; it limits the rate at which current can change and is only dependent on the shape and size of a conductive path.

It takes a certain amount of time for the transmitted current flow to be redirected (reversed) and re-established to full amplitude after the rate-of-change of the primary field reverses direction. This measurable reversal time is characteristic for a given conductor. In general, for a good conductor this time is greater than that of a poor conductor. This is because in a good conductor the terminal current level is greater, whereas its rate of change is limited by the inductance of the current path. The time-varying current causes an EMF in the sensor proportional to the time derivative of the current. This EMF decays with time - it vanishes when the reversal is complete - and the characteristic time of the EMF decay as measured by the sensor is referred to as the **decay time** of the conductor.

The large-scale current which is induced in the half-space by the primary field produces the half-space response as seen in typical UTEM profiles. This background response is influenced by the finite conductivity of the surrounding rock. Other currents may be induced in locally more conductive zones (conductors) that have longer decay times than the half-space response. The responses of these conductors are superimposed upon the background response. The result is that the UTEM receiver detects:

- the primary field waveform, a square-wave
- the half-space (background) response of the surrounding rock
- a slight-to-large response due to any conductors present.

The result is that in the presence of conductors the primary field waveform is substantially (and anomalously) distorted.

UTEM DATA REDUCTION and PLOTTING CONVENTIONS

The UTEM data as it appears in the data files is in total field form in nanoTesla (nT). These are total field values - the UTEM system measures during the "on-time" and as such samples both the primary and secondary fields.

For plotting purposes, the magnetic field data are transformed to other formats as required. The following is provided as a description of the various plotting formats used for the display of UTEM data. A plot format is defined by choices of choice of the *normalization* and *field type* parameters selected for display.

PLOT FORMATS

UTEM results can be expressed as a % of a normalizing field at some point in space. In **continuously normalized** form the normalizing factor (the denominator) is the magnitude of the computed local primary field vector. As the primary exciting field magnitude diminishes with increasing distance from the transmitter loop the response is continuously amplified as a function of offset from the loop. Although this type of normalization considerably distorts the response shape, it permits anomalies to be easily identified at a wide range of distances from the loop.

Note: An optional form of continuous normalization permits the interpreter to normalize the response to the magnitude of the primary field vector at a fixed depth below each station. This is useful for surface profiles which come very close to the loop. Without this adjustment option, the normalizing field is so strong near the loop that the secondary effects become too small in the presence of such a large primary component. In such circumstances interpretation is difficult, however; by "normalizing at some depth" the size of the normalizing field, near the loop in particular, is reduced and the resulting profile can be more effectively interpreted to a very close distance from the transmitter wire. The usual choice for the depth is the estimated target depth.

In **Absolute** profiles the data is presented in picoTesla (pT). Data presented in this format show the non-distorted shape of the field profiles. Unfortunately, the very large range in magnitude of anomalies both near and far from the loop means that small anomalies, particularly those far from the loop, may be overlooked on this type of plot in favour of presenting larger amplitude anomalies.
Note: Selecting the correct plot scales is critical to the recognition of conductors over the entire length of a Absolute profile. This presentation is often used for interpretation where an analysis of the shape of a specific anomaly is required. Absolute profiles are therefore plotted selectively as required during interpretation. An exception to this procedure occurs where surface data has been collected entirely inside a transmitter loop. The primary field does not vary greatly inside the loop, therefore, the benefits of continuous normalization are not required in the display of such results.

FIELD TYPE

The type of field may be either the **Total field** or the **Secondary field.** In general, it is the secondary field that is most useful for the recognition and interpretation of discrete conductors.

UTEM Results as Secondary Fields

Because the UTEM system measures during the transmitter on-time the determination of the secondary field requires that an estimate of the primary signal be subtracted from the observations. Two estimates of the primary signal are available:

1) UTEM Channel 0

One estimate of the primary signal is the value of the latest time channel observed by the UTEM System, Channel 0. When Channel 0 is subtracted from the UTEM data the resulting data display is termed ***Channel 0 Reduced***. This reduction formula is used in situations where it can be assumed that all responses from any target bodies have decayed away by the latest time channel sampled. The Channel 0 value is then a reasonable estimate of the primary signal present during Channels 1....10/12.

In practice the ***Channel 0 Reduced*** form is most useful when the secondary response is very small at the latest delay time. In these cases Channel 0 is indeed a good estimate of the primary field and using it avoids problems due to geometric errors or transmitter loop current/system sensitivity errors.

2) Calculated primary field

An alternate estimate of the primary field is obtained by computing the primary field from the known locations of the transmitter loop and the receiver stations. When the computed primary field is subtracted from the UTEM data the resulting data display is termed ***Primary Field Reduced***.

The calculated primary field will be in error if the geometry is in error - mislocation of the survey stations or the loop vertices - or if the transmitter loop current/system sensitivity is in error. Mislocation errors from loop/station geometry may give rise to very large secondary field errors depending on the accuracy of the loop and station location method used. Transmitter loop current/system sensitivity error is rarely greater than 2%. ***Primary Field Reduced*** is plotted in situations where a large Channel 0 response is observed. In this case the assumption that the Channel 0 value is a reasonable estimate of the primary field effect is not valid.

Note: for UTEM data profiles plotted in ***Channel 0 Reduced*** form the secondary field data for Ch0 itself are always presented in ***Primary Field Reduced*** form and are plotted on a separate axis. This plotting format serves to show any long time-constant responses, magnetostatic anomalies and/or geometric errors present in the data.

Mathematical Formulations

In the following expressions:

Rn_j is the result plotted for the n^{th} UTEM channel,

$R1_j$ is the result plotted for the latest-time UTEM channel, Channel 0,

Chn_j is the raw component sensor value for the n^{th} channel at station j,
$Ch1_j$ is the raw component sensor value for Channel 0 at station j,

$B^P{}_j$ is the computed primary field component in the sensor direction

$|B^P|$ is the magnitude of the computed primary field at:
- a fixed station for the entire line (point normalized data)
- the local station of observation (continuously normalized data)
- a fixed depth below the station (continuously normalized at a depth).

Channel 0 Reduced Secondary Fields : Here, the latest time channel, Ch0 is used as an "estimate" of the primary signal and other channels are expressed as:

$$Rn_j = (Chn_j - Ch1_j) / |B^P| \quad x\ 100\%$$

Ch0 itself is reduced by subtracting a calculation of the primary field observed in the direction of the coil, **H^P** as follows:

$$R1_j = (Ch1_j - H^P{}_j) / |B^P| \quad x\ 100\%$$

Primary Field Reduced Secondary Fields **:** In this form all channels are reduced according to the equation used for Ch0 above:

$$Rn_j = (Chn_j - B^P{}_j) / |B^P| \quad x\ 100\%$$

This type of reduction is most often used in cases where very good geometric control is available (leading to low error in the calculated primary field, **$B^P{}_j$**) and where very slowly decaying responses result in significant secondary field effects remaining in Ch0 observations.

UTEM Results as a Total Field

In certain cases results are presented as a % of the **Total Field**. This display is particularly useful, in borehole surveys where the probe may actually pass through a very good conductor. In these cases the shielding effect of the conductor will cause the observed (total) field to become very small below the intersection point. This nullification due to shielding effects on the total field is much easier to see on a separate ***Total Field*** plot. In cases where the amplitude of the anomalies relative to the primary field is small, suggesting the presence of poorly conductive bodies, the ***Total Field*** plot is less useful.

The data contained in the UTEM reduced data files is in ***Total Field***, continuously normalized form if:

$$\mathbf{Rn_j = Chn_j \,/\, |B^P| \times 100\%}$$

DATA PRESENTATION

All UTEM5 survey results are presented as profiles in an appendix of this report. For BHUTEM surveys the requisite Vectorplots, presented as plan and section views showing the direction and magnitude of the calculated primary field vectors for each transmitter loop, are presented in a separate appendix.

The symbols used to identify the channels on all plots (Appendix A) as well as the mean delay time for each channel (3.750Hz/10Ch) is shown in the following table (for details of frequencies used in this survey see figures in the report):

outside	frequency	3.750000	Hz
	period	0.26667	s
(5MHz clock)	half period	666666	0.2μs cycles
(narrowest Ch=1unit)	XNP	**1062**	half-period
	width of unit channel	1.255493e-4	s
	width of unit channel	125.5493	μs
(symbol) channel	midpoint of ch (microseconds)	tapered Ch begins - unit -	tapered Ch ends - unit -
timing Ch11	62.77	-0.5	1.5
10	188.32	0.5	3
9	376.65	1.5	6
8	753.30	3	12
7	1506.59	6	24
6	3013.18	12	48
5	6026.37	24	96
4	12052.73	48	192
3	24105.47	96	384
2	48210.93	192	768
1	96421.86	384	1042
0	130822.37	768	1060.5
timing Ch13	133145.03	1042	1061.5
timing Ch12	133270.58	1060.5	1062+0.5

Note: With UTEM5 there is the option of expanding the 10Ch (+Ch0) sampling to earlier time Chs - routinely to 12Chs. There are tradeoffs involved in measuring additional earlier-time Chs - stacking time can be greatly increased by adding too many narrow(er) Chs. That said, when operating at a frequency of ~4Hz or lower, 2 Chs can be added without incurring significant penalty. 12Ch (+Ch0) sampling @4Hz brings the earliest delay time (Ch12) to 47.08μs - the equivalent of the earliest delay time when operating @15Hz with 10Ch sampling.

Notes on Standard plotting formats:

Channel 0 Reduced form - The data are typically displayed on three separate axes. This permits scale expansion and allows for the accurate determination of signal decay rates. The standard configuration is:

Top axis - early time channels and a repeat of the latest channel from the centre axis for comparison are plotted at a reduced scale.

Centre axis - intermediate-to-late-time channels are plotted on the centre axis using a suitable scale.

Bottom axis - the latest time channel (Ch0) is plotted alone in ***Primary Field Reduced*** form using the same scale as the centre axis.

UTEM data in ***Primary Field Reduced*** form:

All channels are displayed on a single axis. Typically they are plotted using peak-to-peak scale values of up to -200% - 200%.

BHUTEM4 data plotted as total field profiles:

The 3 components are expressed directly as a percentage of the ***Total Field***. Each three-axis data plot shows peak values of up to 100%.
Note: the measured total field value is plotted as a polarity-reference tool.

BHUTEM data plotted as secondary field profiles:

Check the title block of the plot to determine if the data is in:
Channel 0 Reduced form or in ***Primary Field Reduced*** form.
Note: the measured total field value is plotted as a polarity-reference tool.

Appendix D

Note on sources of anomalous Ch0

Note: The data presented in this report are *channel 0 normalized* - the latest time chanel plotted is Ch0. Traditionally in UTEM data the latest time channel plotted has been Ch1.

Note on sources of anomalous Ch0

This section outlines the possible sources of anomalous channel 0 which is not correlated to the Ch1-10/12 profiles on the upper axes of a *channel 0 normalized* plot.

1) **Mislocation of the transmitter loop and/or survey stations**

Mislocating the transmitter loop and/or the survey stations results in an error in the calculated primary field at the station and appears as an anomalous Ch0 value not correlated to *channel 0 normalized* Ch1-10/12. The effect is amplified near the loop front. This can be seen in the profiles - the error in Ch0 generally increases approaching the loop. As a rule a 1% error in measurement of the distance from the loop will result in, for outside-the-loop surveys, an error in the Hz (vertical component) Ch0 of:

- 1% near the loop front (long-wire field varies as $1/r$)
- 3% at a distance from the loop front (dipolar field varies as $1/r^3$)
- 2% at intermediate distances (intermediate field varies as $\sim 1/r^2$)

The in-loop survey configuration generally diminishes geometric error since the field gradients are considerably lower. At the centre of the loop the gradient in the vertical field is essentially zero so it is difficult to introduce geometric anomalies near the loop centre. Near the loop sides and at the closest approach of the lines to the wire mislocation of the loop and the station becomes more critical. Typically loop sides are designed to be >200m from any survey stations.

Errors in elevation result in smaller errors in Hz but they can affect the chainage and accumulate along the line. Erroors in elevation have a stronger affect on the two horizontal components, Hx and Hy.

2) **Magnetostatic UTEM responses**

Magnetostatic UTEM responses arise over rocks which generate magnetic anomalies. Such magnetic materials will amplify the total (primary + secondary) field of the UTEM transmitter which is sensed by the receiver coil. The secondary field is generated by subtracting a computed primary which does not include magnetic effects. This can give rise to strong and abrupt channel 0 anomalies when the source of the magnetics is at or near surface. This is the case in a number of places on these grids. UTEM magnetostatic anomalies differ from DC magnetic anomalies in the following three major ways:

1) In the case of DC magnetics the field is dipping N and is very uniform over the scale of the survey area while the UTEM field in-loop is vertical and it is stronger near the loop edges.
2) Most aeromagnetics are collected as total field while with UTEM we measure components - HZ, Hx and Hy..
3)DC magnetic instruments observe the total magnetization of the causative body which is due to its susceptibility as well as any remnant magnetization. An AC method such as UTEM will not respond to the remnant portion of the magnetization.

The larger amplitude of the UTEM Ch0 response is explained by the fact that the UTEM primary field is often more favourably coupled (magnetostatically speaking) to magnetic mineralization as compared to the earths field. Another factor could be the presence of a reverse remnant component to the magnetization.

Note that positive (*negative*) magnetic anomalies will cause:

- positive (*negative*) Ch0 anomalies in data collected outside the loop
- negative (*positive*) Ch0 anomalies in data collected inside the loop

3) **Extremely good conductors**

An extremely good conductor will be characterized by a time constant much longer than the half-period (@ 30Hz >>16ms). This will give rise to an anomalous Ch0 which is not correlated to the Ch1-10/12 data plotted on the upper axes of a *channel 0 normalized* plot.