Wallbridge Mining Company

-2014 UTEM5 Survey-
Ermatinger Project
Sudbury

Explanation of Costs Incurred

To complete the survey, Wallbridge Mining Company incurred costs in addition to that for the services provided by Lamontagne Geophysics.

Wallbridge Mining contracted Daniel Gauthier Exploration Inc. out of Abitibi, Quebec to cut the 20 line kilometer grid.

Canadian Exploration Services Ltd. were contracted to perform DGPS surveys.

Wallbridge employees Tom Johnson and Dave Coventry were responsible for supervising the contractors. Dave Smith, Joshua Bailey, and Natalie MacLean were responsible for planning the survey, sequestering, supervising and coordinating contractors, and review of the results. Nick Wray was responsible for assembling the assessment report. Wallbridge's trucks were used for the purpose of supervision and establishing access.

-2014 UTEM5 Survey Report-
Ermatinger Grid
Sudbury District
for
Wallbridge Mining Company Ltd.

LAMONTAGNE GEOPHYSICS LTD
GEOPHYSIQUE LTEE

April, 2014

Rob Langridge, M.Sc.

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INTRODUCTION

During the period of September 4th 2014 through October 15th 2014 a UTEM5 survey (surveying days: September 9th - September 26th) was carried out by Lamontagne Geophysics Limited personnel for Wallbridge Mining Company Ltd. on the Ermatinger Grid in the Sudbury District. The location/layout of the Ermatinger survey is shown in Figures 1 and 2. The UTEM5 survey was carried out to test anomalies outlined by an airborne survey, to detect/outline new conductors and to detect/outline deeper features and potential depth continuations of shallow features.

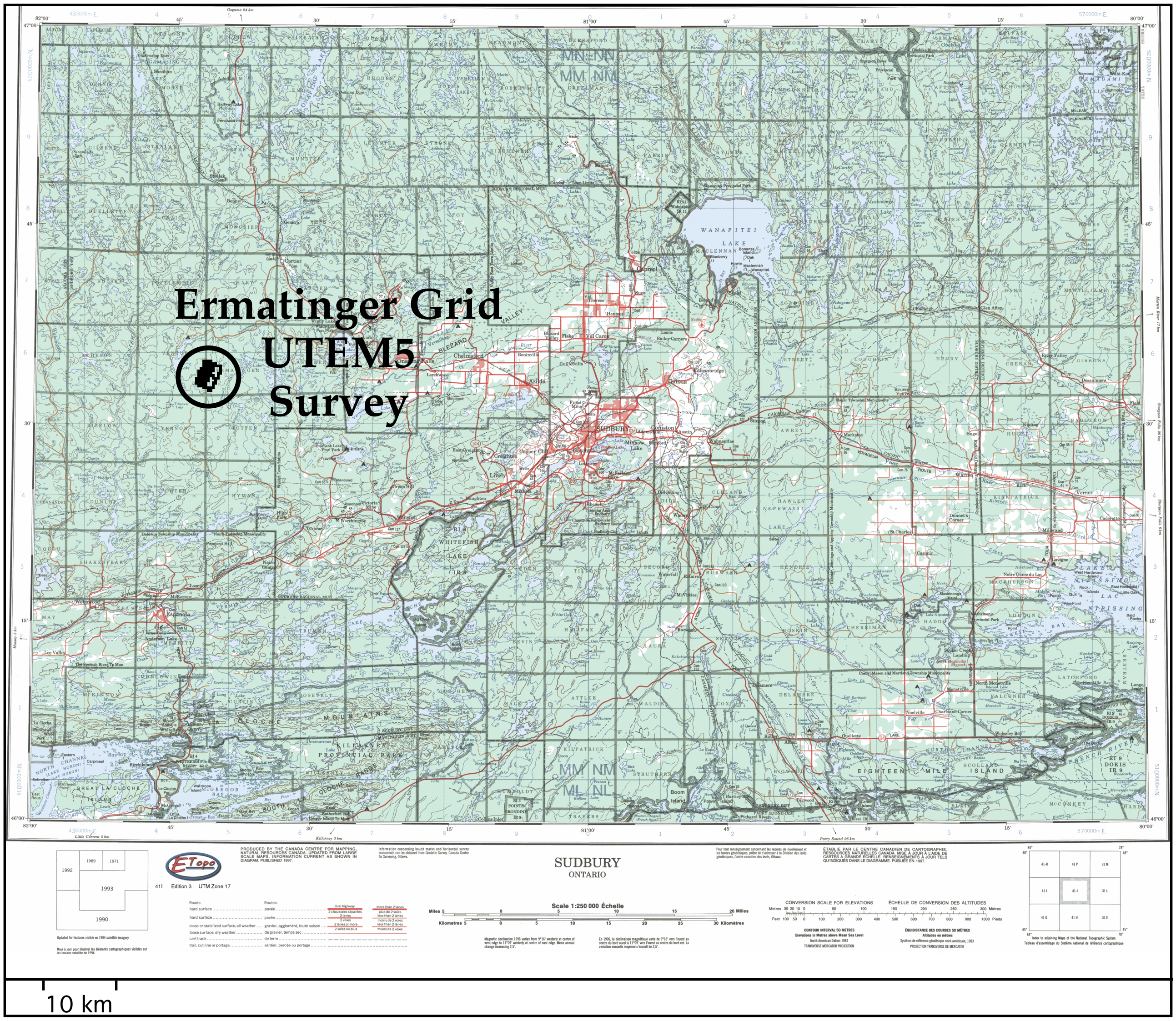
A total of 15.000 line km of Hz/Hx/Hy UTEM5 data was collected with the UTEM5 receiver using four transmitter loops (Figure 2). For all stations on the Ermatinger Grid three-component data were collected from two loops simultaneously. The survey frequencies for the Ermatinger Grid were as follows:

- 12Ch UTEM5 two loop coverage (15.000km) of the Ermatinger Grid
  actual frequencies (in the ratio of 2:1) were:
  2.045Hz (outside-the-loop - loops grideast) - Loop 1416-1415
  4.090Hz (side-loop - loops gridnorth/gridsouth) - Loop 1418-1417

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 Hz/Hx/Hy 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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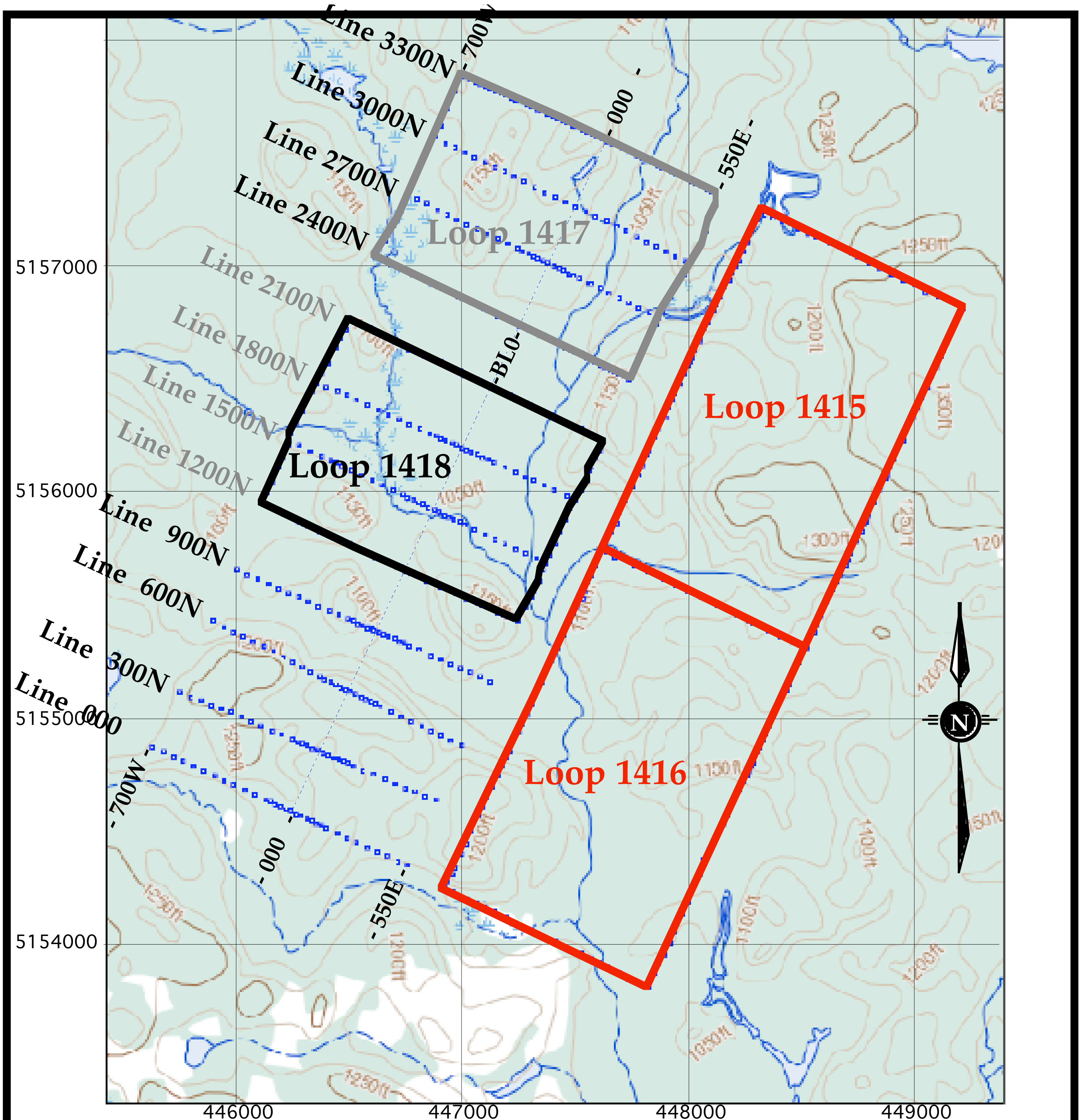
Ermatinger Grid UTEM5 survey

Location Map

Figure 1



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Ermatinger Grid UTEM5 survey

Grid Map

0 200 1000m

Figure 2

Note: 2.045Hz Transmitter Loops shown in **red.**

SURVEY DESIGN

The UTEM survey was planned and carried out to test anomalies outlined by an airborne survey, to detect/outline new conductors and to detect/outline deeper features and potential depth continuations of shallow features.

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 and to minimise .

The survey parameters employed are as follows:

- line spacing of 300m adjusted in places to detail airborne anomalies
- station interval of 50m/25m in areas of interest (Figure 2)
- a total of 4 transmitter loops
- three component measurements, collected from two Tx loops simultaneously:
  - • outside-the-loop (loops grideast) 2.045Hz coverage
  - • side-loop (loops gridnorth/gridsouth) 4.090Hz coverage
- 12 Ch/139s single stacking (with duplicate readings as required).
- frequencies for main grid coverage (in the ratio 2:1 - **S1**:**S2**) (Figure 3):
  - • **S1** - 4.090Hz (side-loop) Loops 1418-1417-
    stacking: 570 full-cycles/1140 half-cycles
  - • **S2** - 2.045Hz (outside-the-loop) Loops 1416-1415
    stacking: 285 full-cycles/ 570 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).

side-loop	frequency	4.090910 Hz	
	period	0.24444 s	
(5MHz clock)	half period	611110 0.2μs cycles	
(narrowest Ch=1unit)	XNP	**4248** /halfperiod	
	width of unit channel	2.87717e-5 s	
	width of unit channel	28.7717 μs	
(symbol) channel	peak of tapered Ch (μs)	tapered Ch begins - unit -	tapered Ch ends - unit -
timing Ch13	14.39	-0.5	1.5
12	43.16	0.5	3
11	86.32	1.5	6
10	172.63	3	12
9	345.26	6	24
8	690.52	12	48
7	1381.04	24	96
6	2762.08	48	192
5	5524.17	96	384
4	11048.33	192	768
3	22096.67	384	1536
2	44193.34	768	3072
1	88386.67	1536	4171
0	120006.77	3072	4246.5
timing Ch15	122179.04	4171	4247.5
timing Ch14	122207.81	4246.5	4248+0.5
	sub-stack time =	**1.466666** s	
	number of substacks =	**95** substacks	
	stacking time =	139.33 s	
	cycles stacked =	570 cycles	
	half-cycles stacked =	1140 half-cycles	

off-loop	frequency	2.045455 Hz	
	period	0.48889 s	
(5MHz clock)	half period	1222221 0.2μs cycles	
(narrowest Ch=1unit)	XNP	**4248** /halfperiod	
	width of unit channel	5.75434e-5 s	
	width of unit channel	57.5434 μs	
(symbol) channel	peak of tapered Ch (μs)	tapered Ch begins - unit -	tapered Ch ends - unit -
timing Ch13	28.77	-0.5	1.5
12	86.32	0.5	3
11	172.63	1.5	6
10	345.26	3	12
9	690.52	6	24
8	1381.04	12	48
7	2762.08	24	96
6	5524.17	48	192
5	11048.33	96	384
4	22096.67	192	768
3	44193.34	384	1536
2	88386.67	768	3072
1	176773.34	1536	4171
0	240013.55	3072	4246.5
timing Ch15	244358.08	4171	4247.5
timing Ch14	244415.62	4246.5	4248+0.5
	sub-stack time =	**1.466666** s	
	number of substacks =	**95** substacks	
	stacking time =	139.33 s	
	cycles stacked =	285 cycles	
	half-cycles stacked =	570 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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UTEM5 survey

12Ch base frequencies: details

Figure 3

SURVEY LOGISTICS

A Lamontagne Geophysics crew mobilized the UTEM5 survey equipment from Kingston, Ontario, to Sudbury on September 5th. 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 Gerry Lafortune (crew chief/operator), Phil Guimond (asst. crew chief/Rx operator), Bill Dingwall (Tx operator/electronics), Richard Lahaye (Rx/Tx operator) James Young (coiler) and Tyler Gallant (Tx operator).

The crew received their site orientation from Wallbridge personnel. A five-person crew headed out September 6th to check access and to begin to lay out the initial loops on the Wallbridge Ermatinger Project. Access was hampered by a large creek running north-south through the eastern part of the grid. Finding daily safe passage across the creek involved frequent detours which slowed overall production. Laying of three initial loops was completed on the morning of September 8th. The remainder of the day was spent testing and dealing with equipment issues. Surveying began on the Ermatinger Grid on September 9th using two transmitters simultaneously in an off-loop/side-loop arrangement. Over the course of the survey problems were encountered with 4.090Hz signal from the S1 side-loops "bleeding" into the 2.045Hz off-loop signal. This required the resurveying of various lines with only one transmitter running in order to isolate the problem. The surveying is detailed in Appendix B - in the Appendix B data collected but not used are indicated in **gray**.

Transportation to and from the grid was by pickup via Fox Lake Road and transport onsite was by Polaris utility vehicle as required/feasible. The southern portion of the grid was accessed via a logging road heading north from the Worthington/Inco High Falls area. This added approximately 1/2 hour to the (already lengthy) commute. The location of the Ermatinger Grid is shown in Figures 1 and 2.

The UTEM5 surveying on the Ermatinger Grid (detailed in Appendix B - the Production Diary) continued fairly smoothly, although there were several loop breaks (animal movement and a fair number of hunters in the area), which took quite long to track down and repair. An abnormal amount of equipment issues also caused delays. Coverage was completed on September 26th. The following day 3 crew members demobed back to Kingston while the others remained in Sudbury to work on other projects. Wire pick up began on September 30th but because of other work commitments was not completed until October 15th.

The survey equipment consisted of two UTEM5 receiver/coils, 2 UTEM4 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. The exception to this is the Line 2100N Loop 1417 (4.090Hz) Hy Ch0 profile. The earlier-time (Ch0 normalized profiles) are quite clean but the Ch0 profile is clearly distinctive when compared with the adjacent lines and with the Loop 1415 (2.045Hz) profile (collected on a later date). The issue was thought to be due to an error in the correction tensors applied to the data but it was later determined to be an instrumental fault primarily affecting the Hy component. Note: the latest time profiles (Ch0) should be considered in conjunction with other available information (Appendix D).

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 4-axis profiles in order of line number from south to north: Line 000 through Line 3300N. The order is as follows:

Ermatinger Grid

Loops 1416 - 1415

Hz (HZ) **continuous norm**	2.045Hz	**(blue separator)**
Hx (HL) **continuous norm**	2.045Hz	(blue separator)
Hy (HT) **continuous norm**	2.045Hz	(blue separator)

Loops 1418 - 1417

Hz (HZ) **continuous norm**	4.090Hz	**(pink separator)**
Hx (HL) **continuous norm**	4.090Hz	(pink separator)
Hy (HT) **continuous norm**	4.090Hz	(pink separator)

Note: in future reports UTEM5 data will be presented as:

- HZ the vertical component (currently Hz)
- HL the in-line horizontal component (currently Hx)
- HT the transverse horizontal component (currently Hy)

<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 Hz/Hx/Hy continuously normalized data are presented as 4-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

1409 UTEM5 Profiles

UTEM5 Survey

Ermatinger Grid
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. The exception to this is the Line 2100N Loop 1417 (4.090Hz) Hy Ch0 profile. The earlier-time (Ch0 normalized profiles) are quite clean but the Ch0 profile is clearly distinctive when compared with the adjacent lines and with the Loop 1415 (2.045Hz) profile (collected on a later date). The issue was thought to be due to an error in the correction tensors applied to the data but it was later determined to be an instrumental fault affecting the Hy component. Note: the latest time profiles (Ch0) should be considered in conjunction with other available information (Appendix D).

For each line surveyed the continuously normalized profiles have been plotted for the three components collected. Profiles are listed by Loop number and presented as 4-axis profiles in the following order:

Ermatinger Grid

Loops 1416 - 1415

Hz (HZ) **continuous norm**	2.045Hz	**(blue separator)**
Hx (HL) **continuous norm**	2.045Hz	(blue separator)
Hy (HT) **continuous norm**	2.045Hz	(blue separator)

Loops 1418 - 1417

Hz (HZ) **continuous norm**	4.090Hz	**(pink separator)**
Hx (HL) **continuous norm**	4.090Hz	(pink separator)
Hy (HT) **continuous norm**	4.090Hz	(pink separator)

Note: in future reports UTEM5 data will be presented as:

- HZ the vertical component (currently Hz)
- HL the in-line horizontal component (currently Hx)
- HT the transverse horizontal component (currently Hy)

Outline of profile type

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 Hz/Hx/Hy continuously normalized data are presented as legal size 4-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*

Note that the four-axis profiles were introduced to facilitate interpretation. A description of the standard plotting formats used and of the UTEM System is presented in Appendix C.

List of Data Collected and Plotted

Wallbridge Mining Company Ltd. (1409)
Ermatinger Grid - 12Ch @ 4.090/2.045Hz

	Line	Coverage		
Loop 1416	Line 000	700W - 550E	1250m	Hz/Hx/Hy
(@ 2.045Hz)	Line 300N	700W - 550E	1250m	Hz/Hx/Hy
	Line 600N	700W - 550E	1250m	Hz/Hx/Hy
	Line 900N	700W - 550E	1250m	Hz/Hx/Hy
	Line 1200N	700W - 550E	1250m	Hz/Hx/Hy
	Line 1500N	700W - 550E	1250m	Hz/Hx/Hy
Loop 1415	Line 1800N	700W - 550E	1250m	Hz/Hx/Hy
	Line 2100N	700W - 550E	1250m	Hz/Hx/Hy
	Line 2400N	700W - 550E	1250m	Hz/Hx/Hy
	Line 2700N	700W - 550E	1250m	Hz/Hx/Hy
	Line 3000N	700W - 550E	1250m	Hz/Hx/Hy
	Line 3300N	700W - 550E	1250m	Hz/Hx/Hy
Loop 1418	Line 000	700W - 550E	1250m	Hz/Hx/Hy
(@ 4.090Hz)	Line 300N	700W - 550E	1250m	Hz/Hx/Hy
	Line 600N	700W - 550E	1250m	Hz/Hx/Hy
	Line 900N	700W - 550E	1250m	Hz/Hx/Hy
Loop 1417	Line 1200N	700W - 550E	1250m	Hz/Hx/Hy
	Line 1500N	700W - 550E	1250m	Hz/Hx/Hy
	Line 1800N	700W - 550E	1250m	Hz/Hx/Hy
	Line 2100N	700W - 550E	1250m	Hz/Hx/Hy
Loop 1418	Line 2400N	700W - 550E	1250m	Hz/Hx/Hy
	Line 2700N	700W - 550E	1250m	Hz/Hx/Hy
	Line 3000N	700W - 550E	1250m	Hz/Hx/Hy
	Line 3300N	700W - 550E	1250m	Hz/Hx/Hy
U5 Hz/Hx/Hy 2 loop coverage: Totals			15000m	Hz/Hx/Hy
Ermatinger Grid UTEM5 coverage Total			**15000m**	**Hz/Hx/Hy**

Ermatinger Grid Survey totals:

15000m UTEM5 2 loop 6-component coverage

- •15000m UTEM5 Hz/Hx/Hy line coverage
- equalling: •30000m UTEM5 three-component coverage
- equalling: •90000m UTEM5 single component coverage

Ermatinger Grid

Loop 1416/1415

Hz

2.045Hz frequency

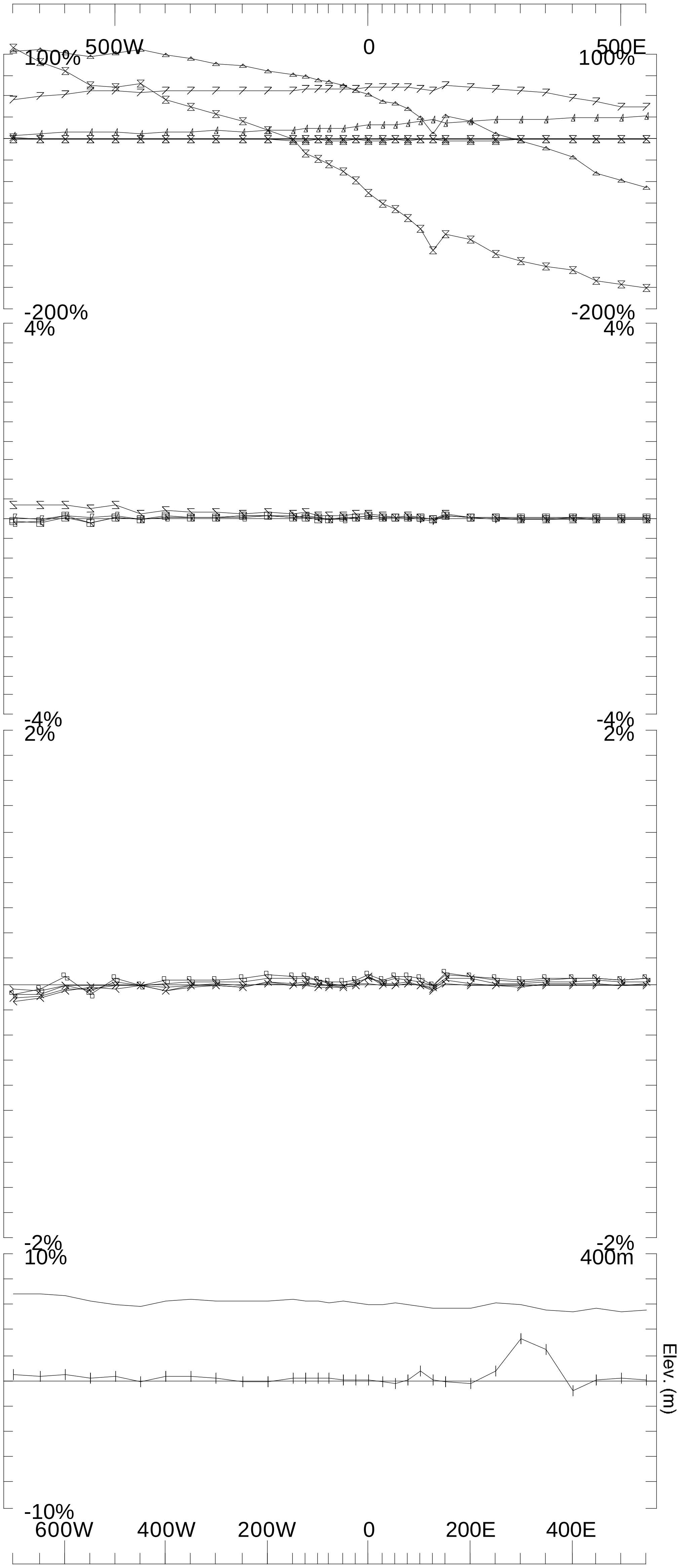
continuous norm

12Ch - Ch0 reduced

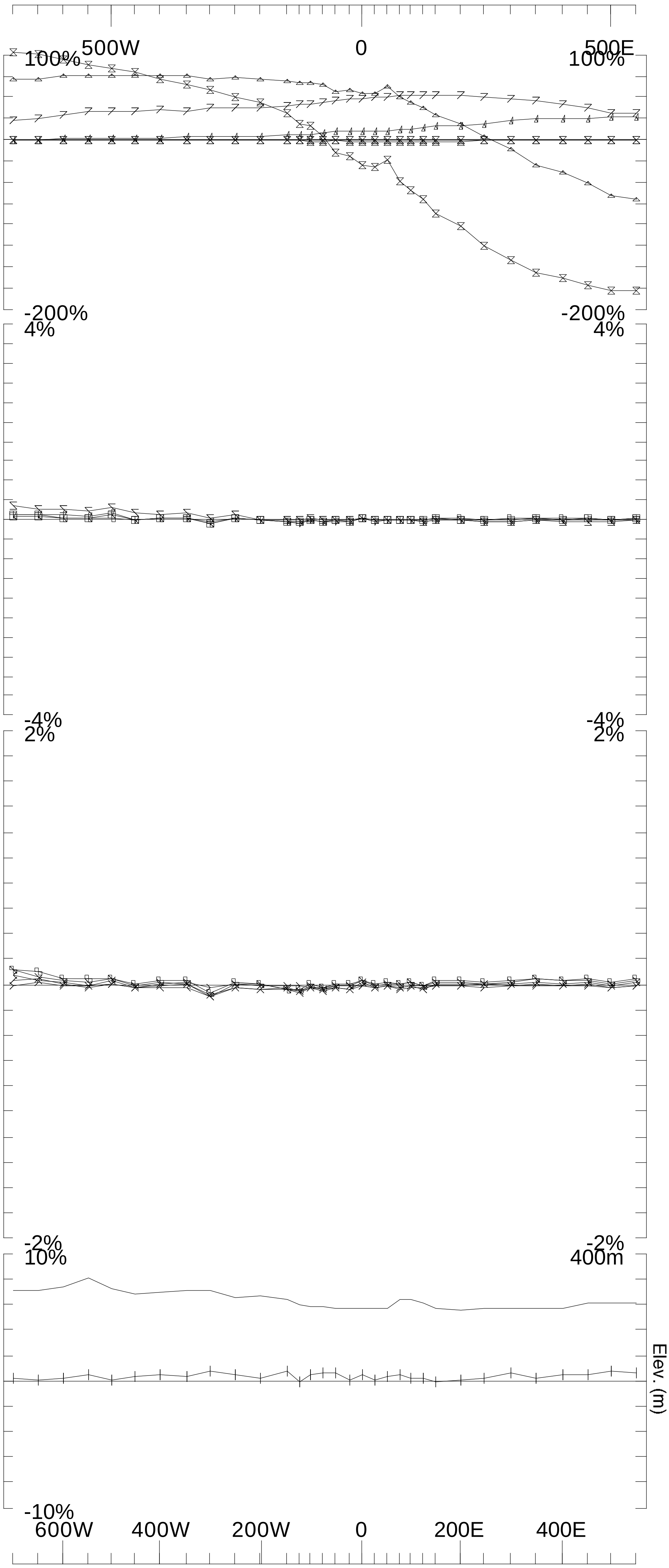
Loop 1416/1415 @2.045Hz

Loop 1416	Line 000	700W - 550E	1250m	Hz/Hx/Hy
	Line 300N	700W - 550E	1250m	Hz/Hx/Hy
	Line 600N	700W - 550E	1250m	Hz/Hx/Hy
	Line 900N	700W - 550E	1250m	Hz/Hx/Hy
	Line 1200N	700W - 550E	1250m	Hz/Hx/Hy
	Line 1500N	700W - 550E	1250m	Hz/Hx/Hy
Loop 1415	Line 1800N	700W - 550E	1250m	Hz/Hx/Hy
	Line 2100N	700W - 550E	1250m	Hz/Hx/Hy
	Line 2400N	700W - 550E	1250m	Hz/Hx/Hy
	Line 2700N	700W - 550E	1250m	Hz/Hx/Hy
	Line 3000N	700W - 550E	1250m	Hz/Hx/Hy
	Line 3300N	700W - 550E	1250m	Hz/Hx/Hy

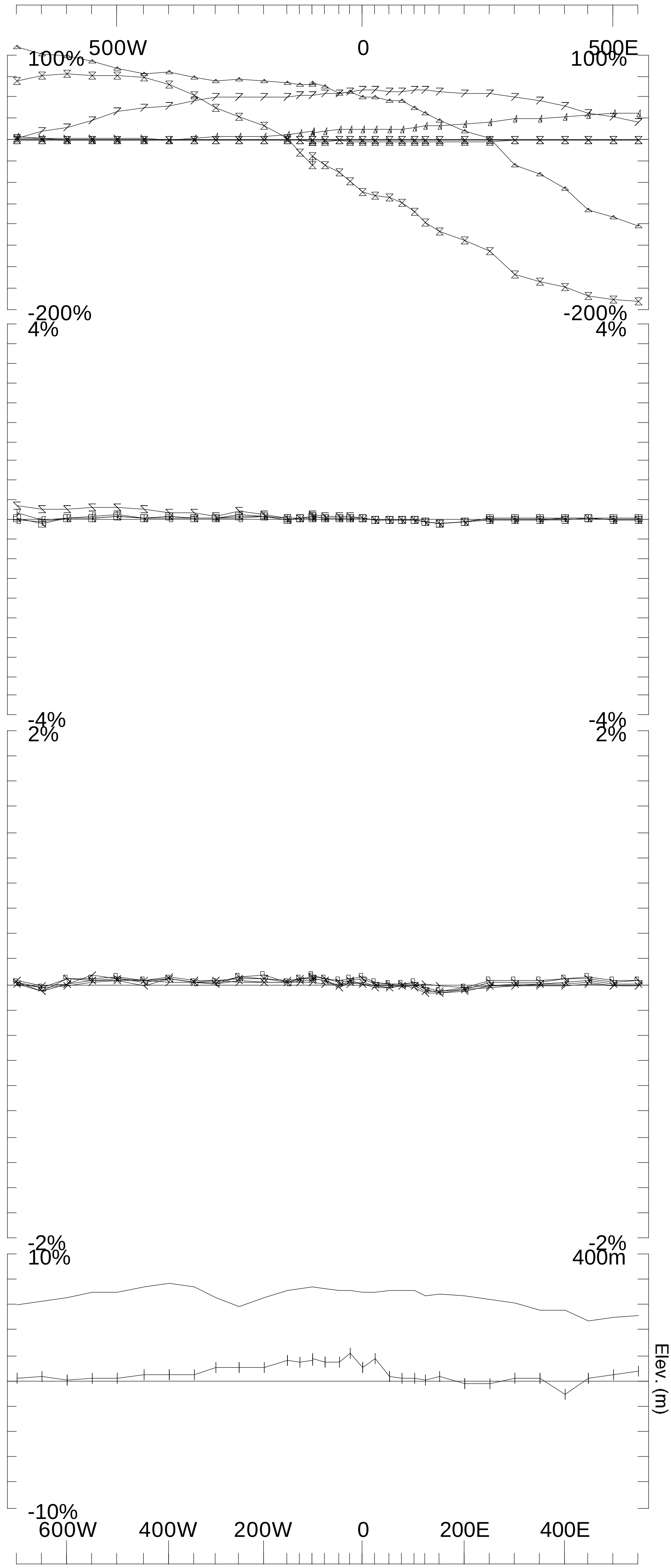
Loop 1416/1415 - Hz



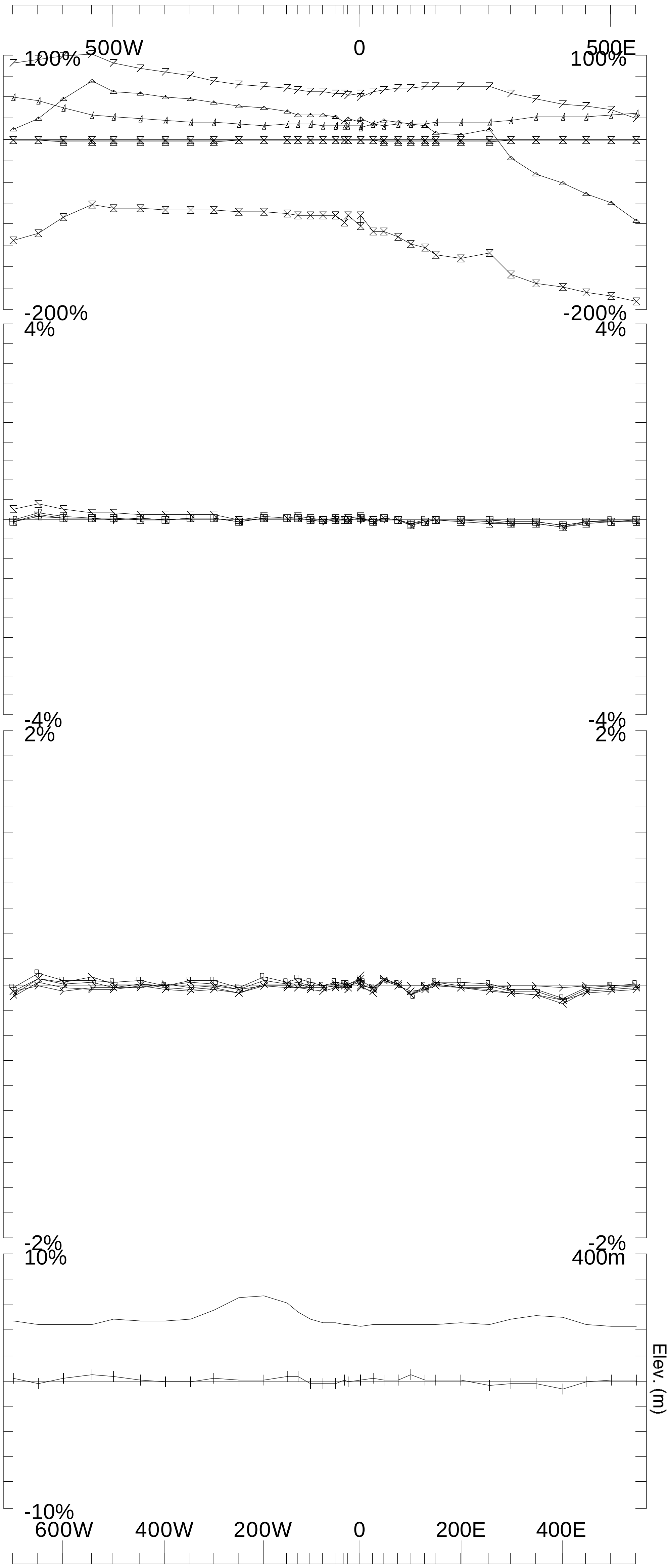
Loop: 1416S2	Secondary, (Chn - Ch0)/|Hp|	UTEM Survey at: Ermatinger
Line: 000	Contin. Norm at depth of 0 m	For: Wallbridge
Compt: Hz	Base Freq. 2.045 Hz	LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE Job 1409 Plotted : 19/11/14



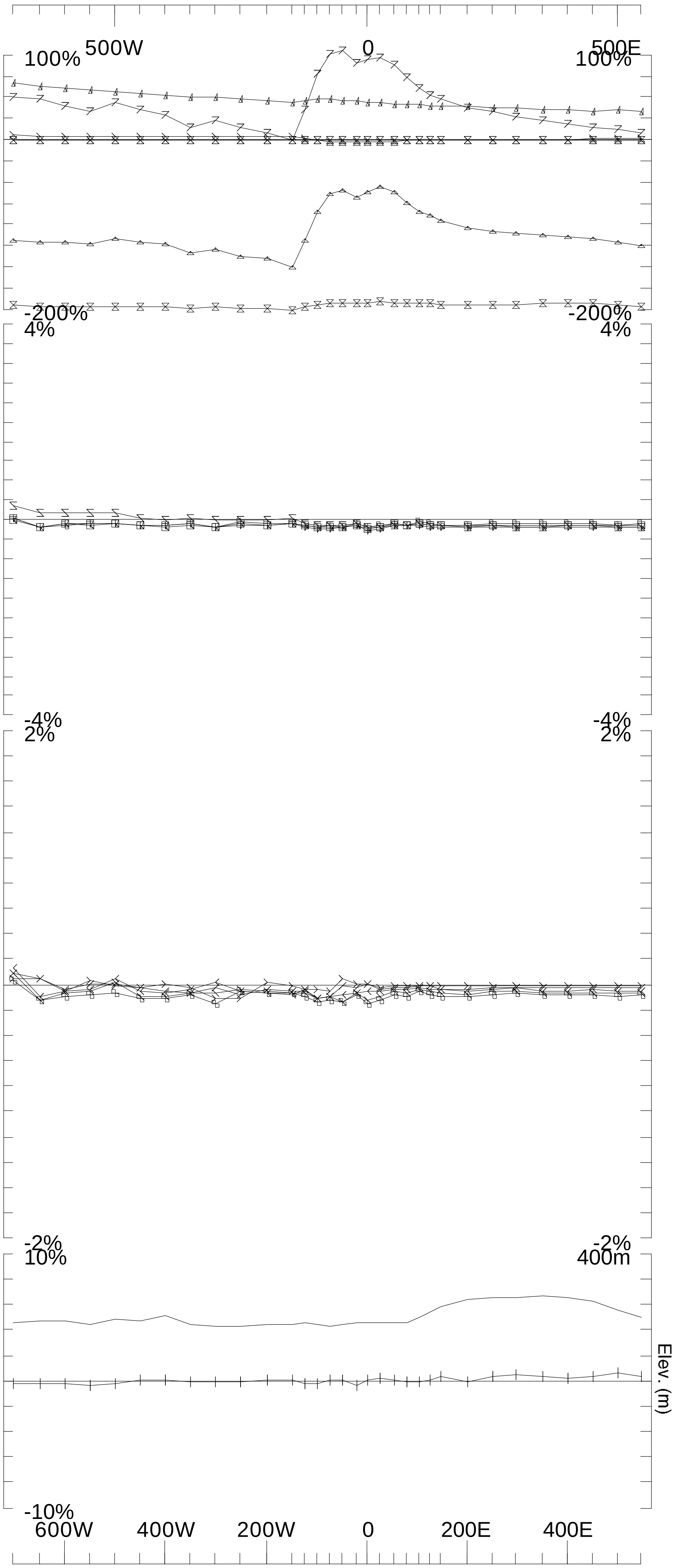
Loop: 1416S2	Secondary, (Chn - Ch0)/|Hp|	UTEM Survey at: Ermatinger
Line: 300N	Contin. Norm at depth of 0 m	For: Wallbridge
Compt: Hz	Base Freq. 2.045 Hz	LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE Job 1409 Plotted : 19/11/14



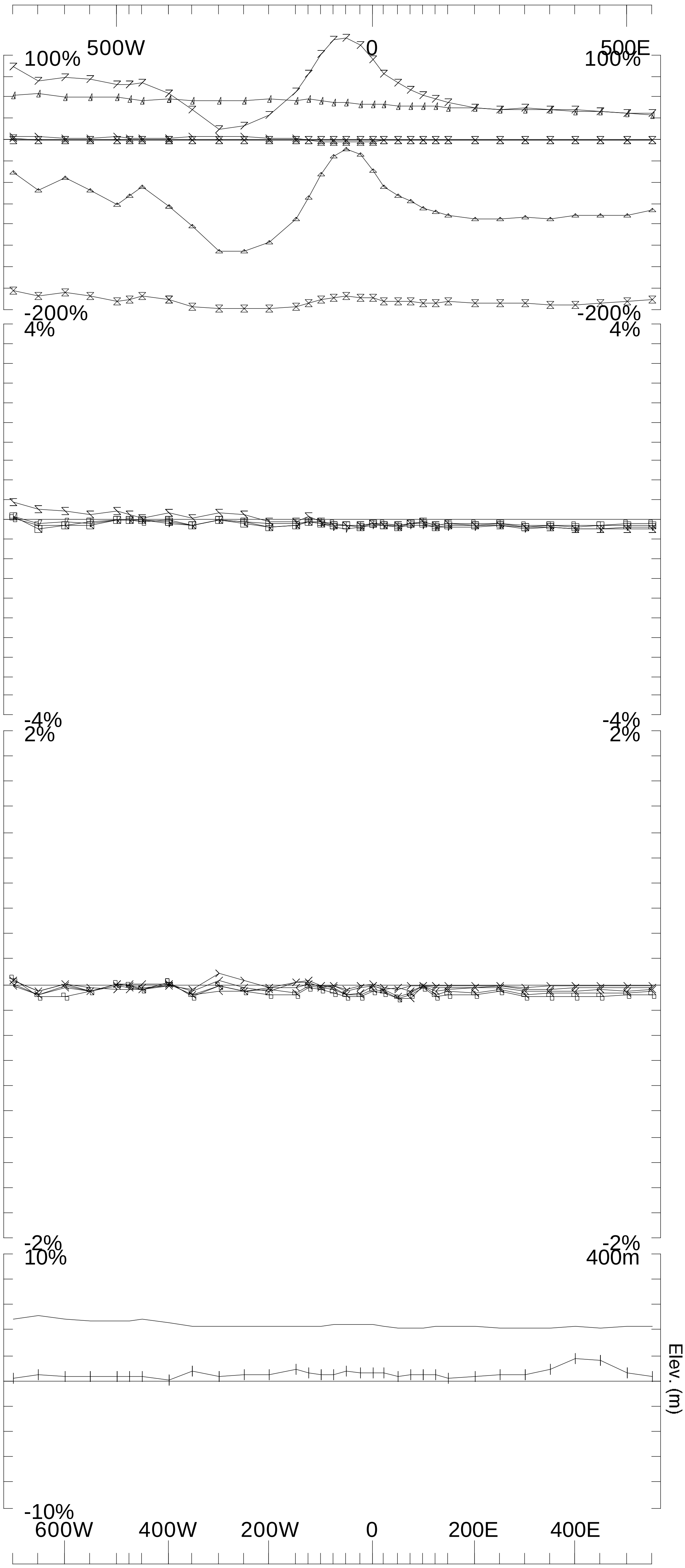
Loop: 1416S2	Secondary, (Chn - Ch0)/|Hp|	UTEM Survey at: Ermatinger
Line: 600N	Contin. Norm at depth of 0 m	For: Wallbridge
Compt: Hz	Base Freq. 2.045 Hz	LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE Job 1409 Plotted : 19/11/14



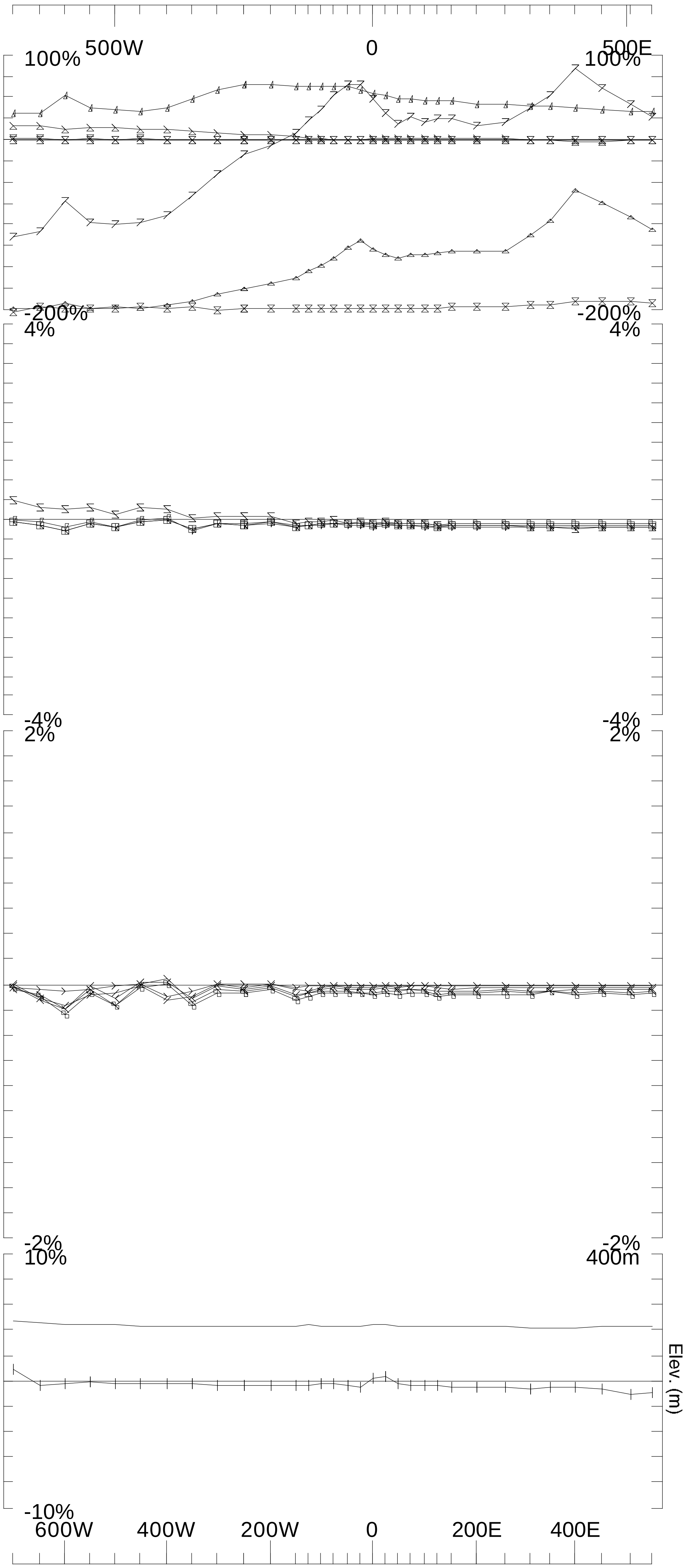
Loop: 1416S2	Secondary, (Chn - Ch0)/|Hp|	UTEM Survey at: Ermatinger
Line: 900N	Contin. Norm at depth of 0 m	For: Wallbridge
Compt: Hz	Base Freq. 2.045 Hz	LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE Job 1409 Plotted : 19/11/14



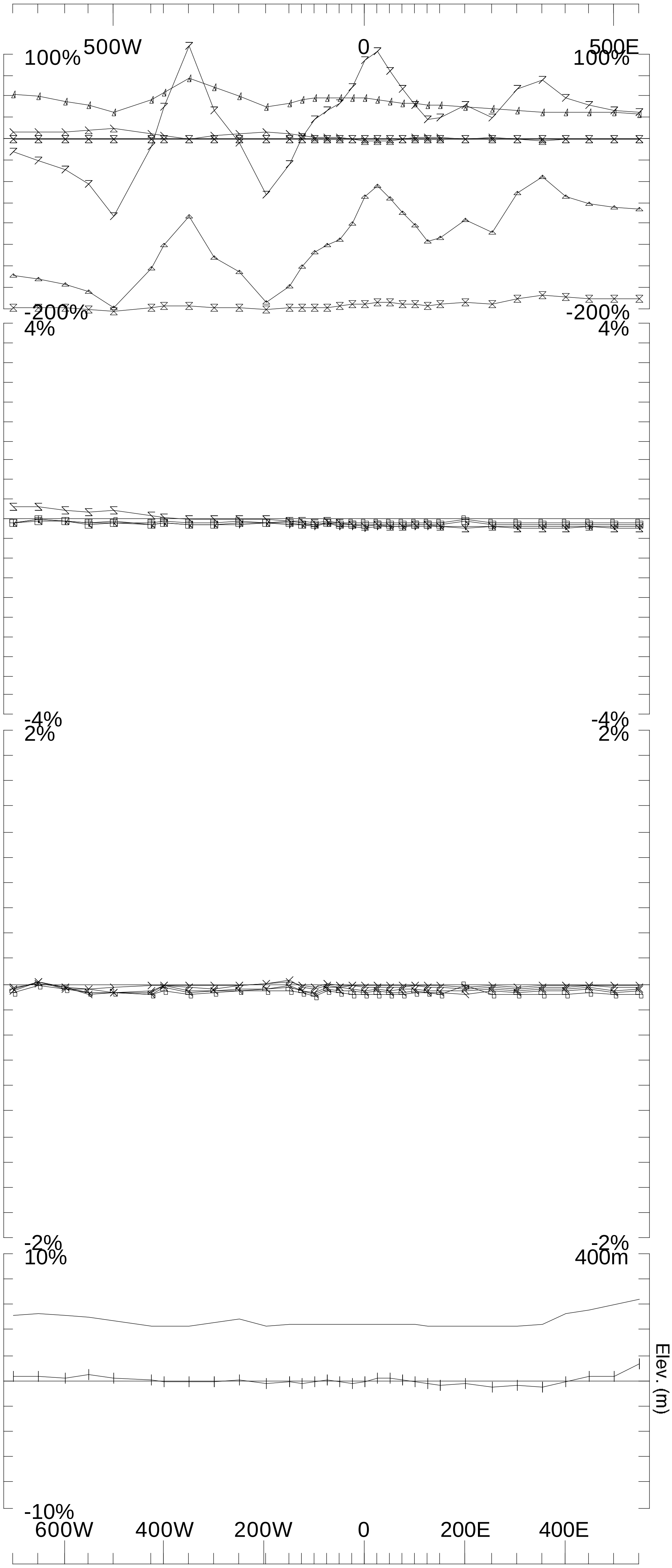
Loop: 1416S2	Secondary, (Chn - Ch0)/|Hp|	UTEM Survey at: Ermatinger
Line: 1200N	Contin. Norm at depth of 0 m	For: Wallbridge
Compt: Hz	Base Freq. 2.045 Hz	LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE Job 1409 Plotted : 19/11/14



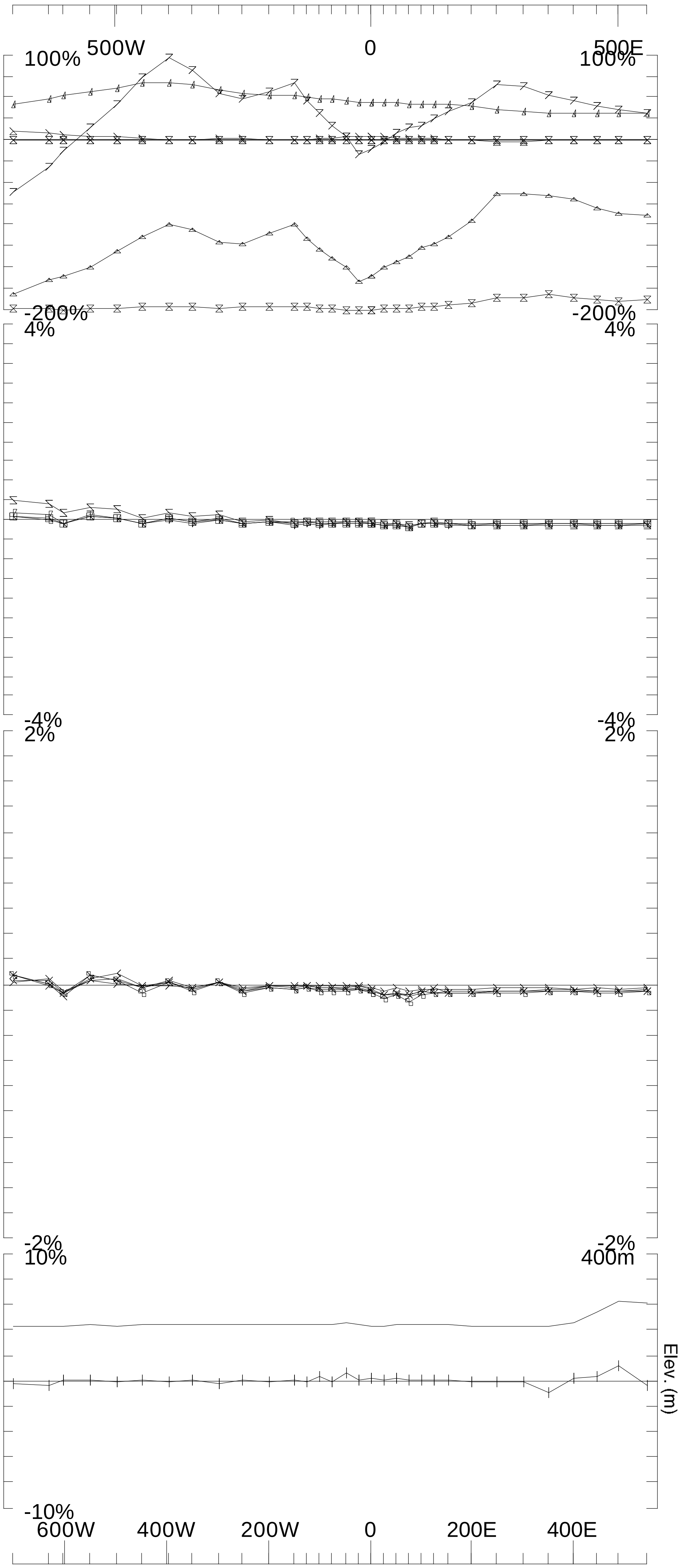
Loop: 1416S2	Secondary, (Chn - Ch0)/|Hp|	UTEM Survey at: Ermatinger
Line: 1500N	Contin. Norm at depth of 0 m	For: Wallbridge
Compt: Hz	Base Freq. 2.045 Hz	LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE Job 1409 Plotted : 19/11/14



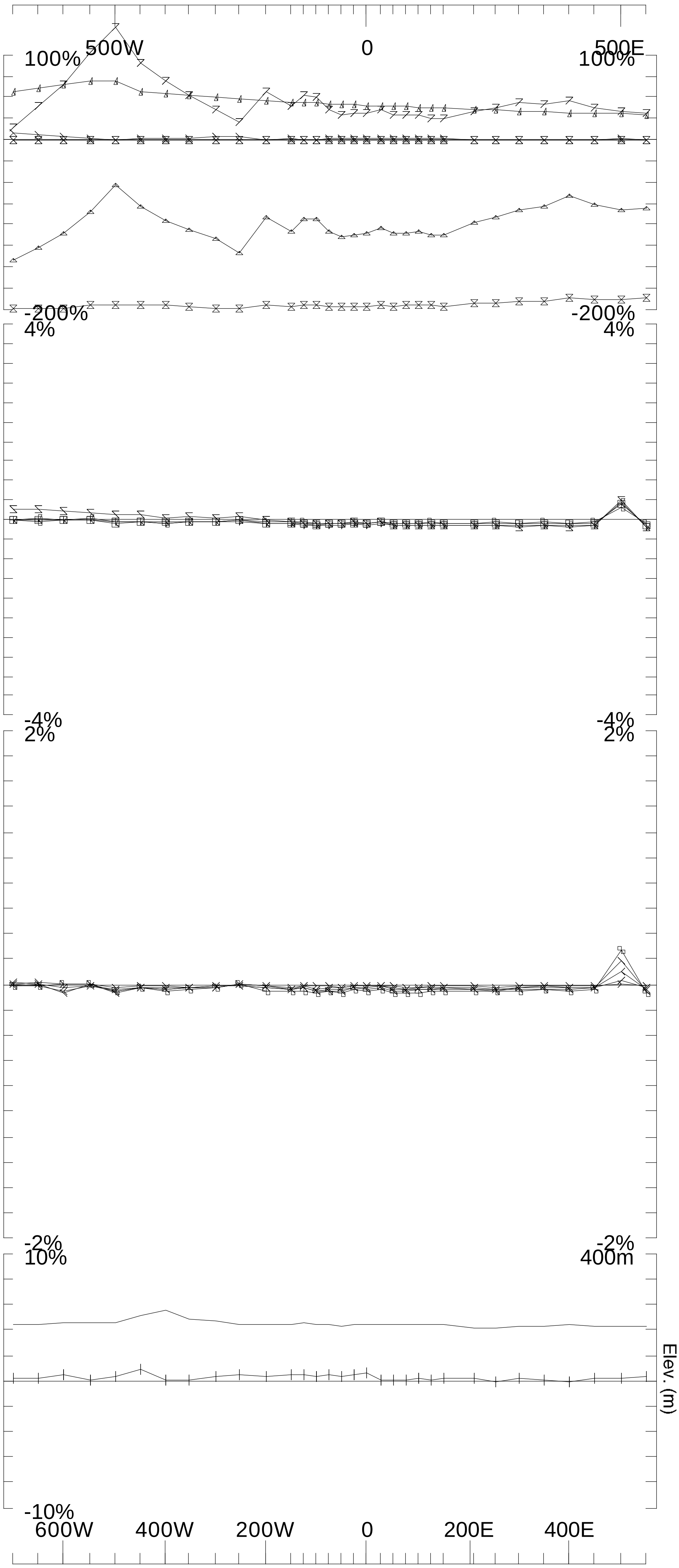
Loop: 1415S2	Secondary, (Chn - Ch0)/|Hp|	UTEM Survey at: Ermatinger
Line: 1800N	Contin. Norm at depth of 0 m	For: Wallbridge
Compt: Hz	Base Freq. 2.045 Hz	LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE Job 1409 Plotted : 19/11/14



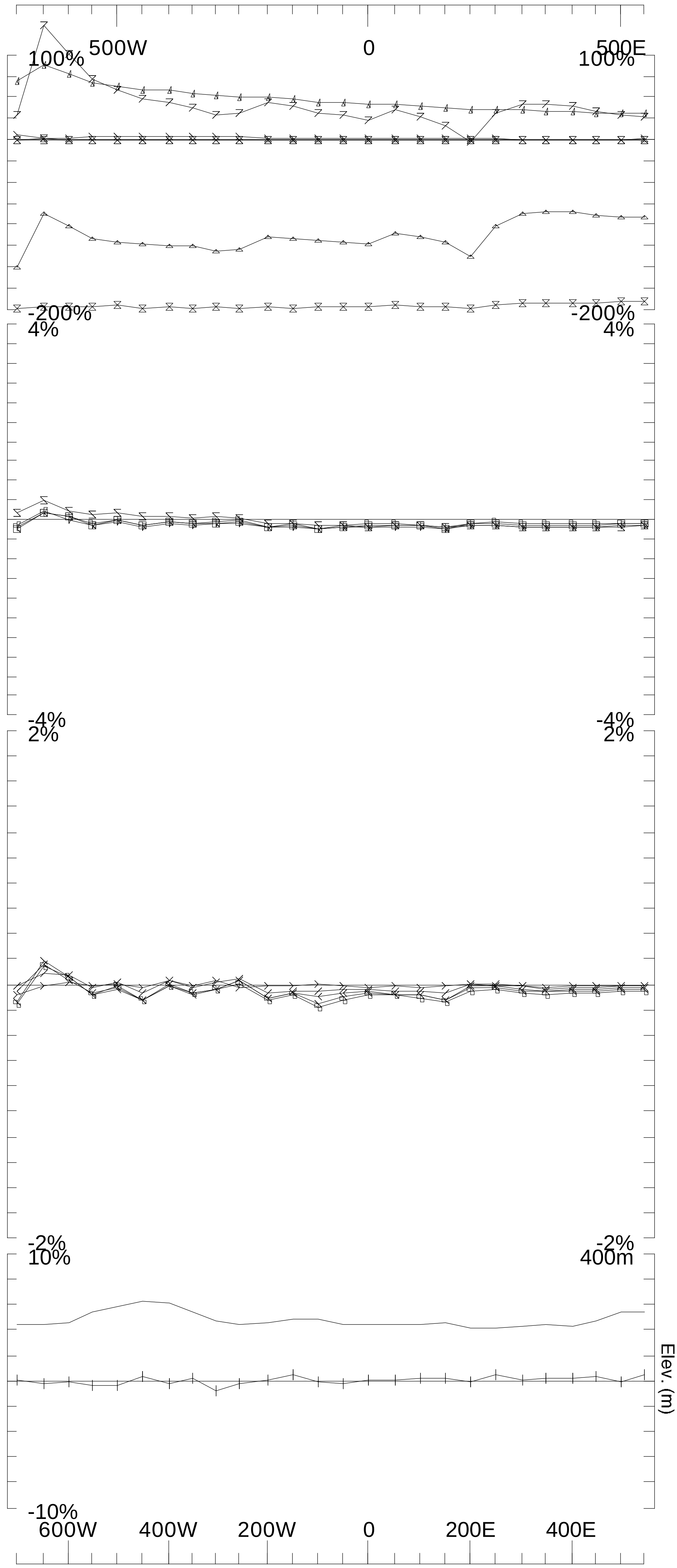
Loop: 1415S2	Secondary, (Chn - Ch0)/|Hp|	UTEM Survey at: Ermatinger
Line: 2100N	Contin. Norm at depth of 0 m	For: Wallbridge
Compt: Hz	Base Freq. 2.045 Hz	LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE Job 1409 Plotted : 19/11/14



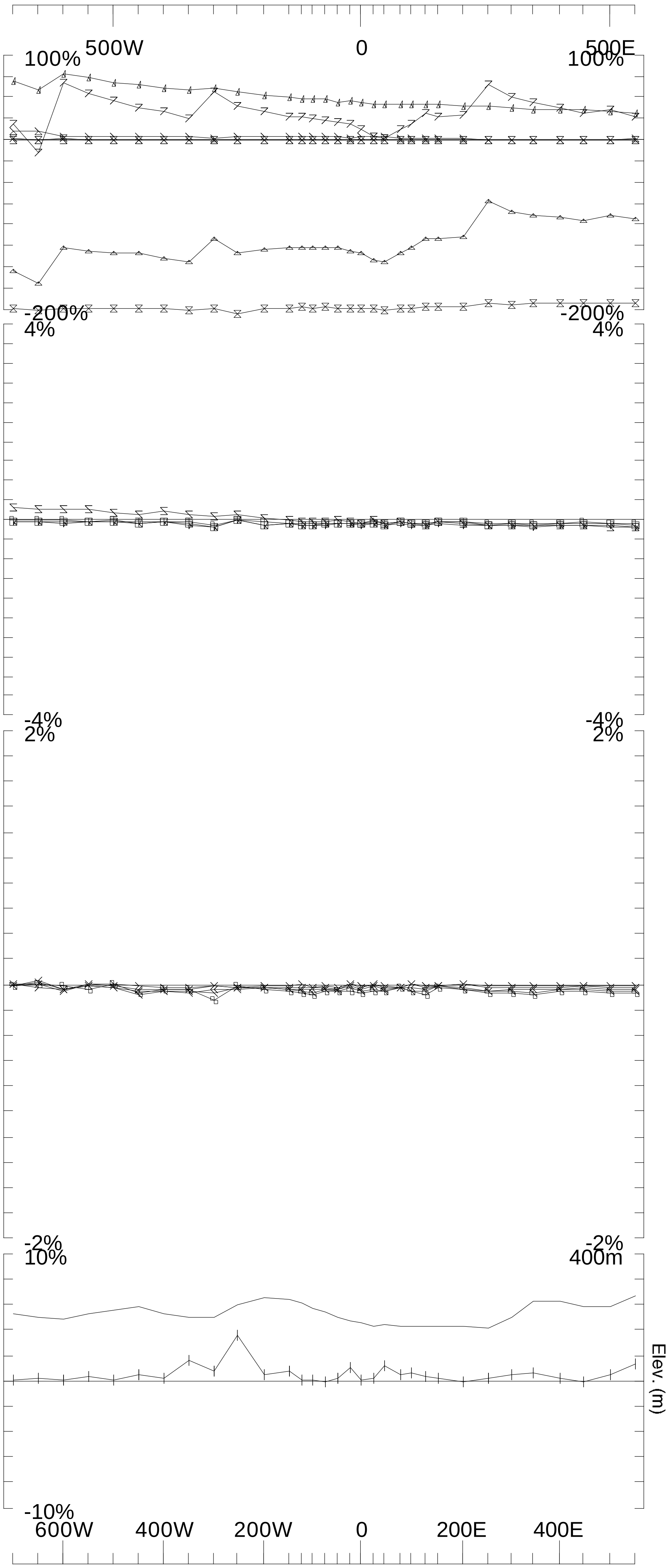
Loop: 1415S2	Secondary, (Chn - Ch0)/|Hp|	UTEM Survey at: Ermatinger
Line: 2400N	Contin. Norm at depth of 0 m	For: Wallbridge
Compt: Hz	Base Freq. 2.045 Hz	LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE Job 1409 Plotted : 19/11/14



Loop: 1415S2	Secondary, (Chn - Ch0)/|Hp|	UTEM Survey at: Ermatinger
Line: 2700N	Contin. Norm at depth of 0 m	For: Wallbridge
Compt: Hz	Base Freq. 2.045 Hz	LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE Job 1409 Plotted : 19/11/14



Loop: 1415S2	Secondary, (Chn - Ch0)/|Hp|	UTEM Survey at: Ermatinger
Line: 3000N	Contin. Norm at depth of 0 m	For: Wallbridge
Compt: Hz	Base Freq. 2.045 Hz	LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE Job 1409 Plotted : 19/11/14



Loop: 1415S2
Line: 3300N
Compt: Hz

Secondary, (Chn - Ch0)/|Hp|
Contin. Norm at depth of 0 m
Base Freq. 2.045 Hz

UTEM Survey at: Ermatinger
For: Wallbridge

LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE

Job 1409

Plotted : 19/11/14

Ermatinger Grid

Loop 1416/1415

Hx

2.045Hz frequency

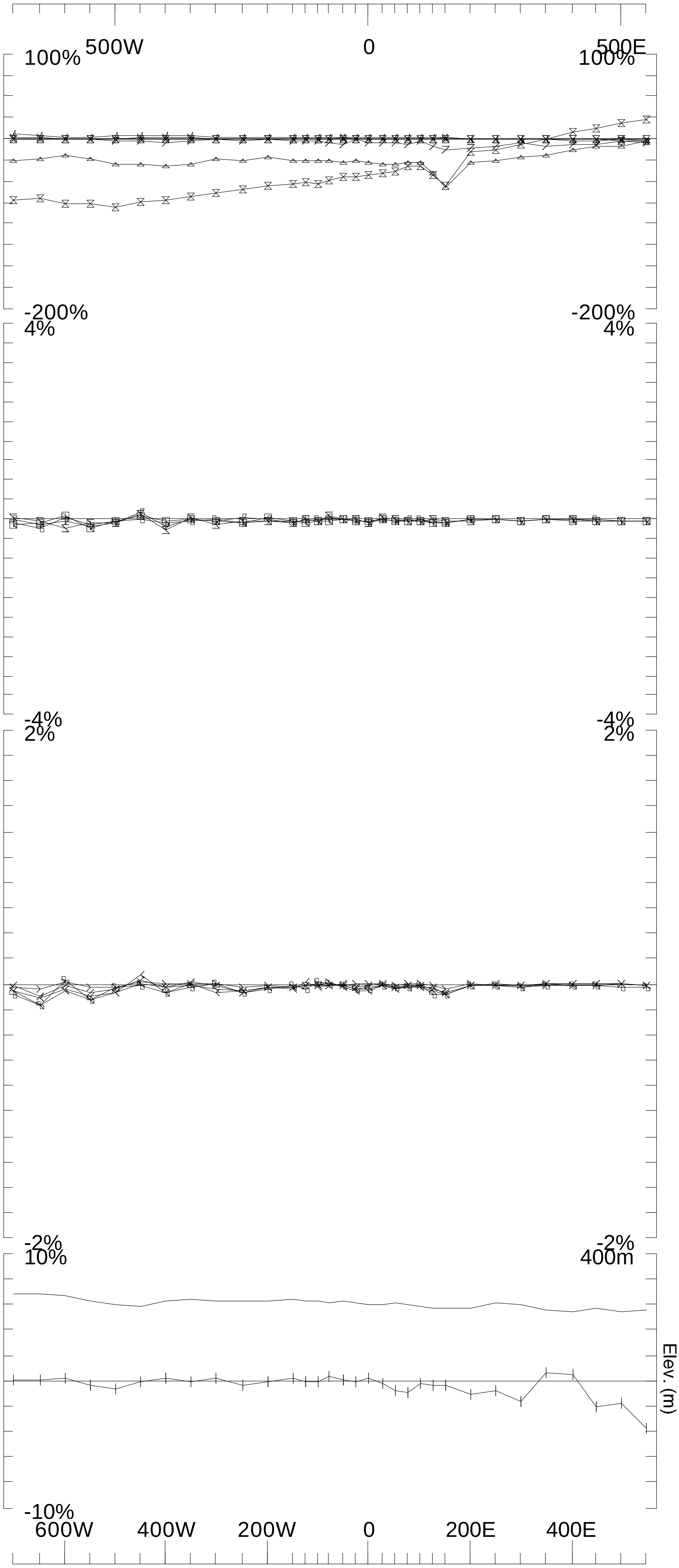
continuous norm

12Ch - Ch0 reduced

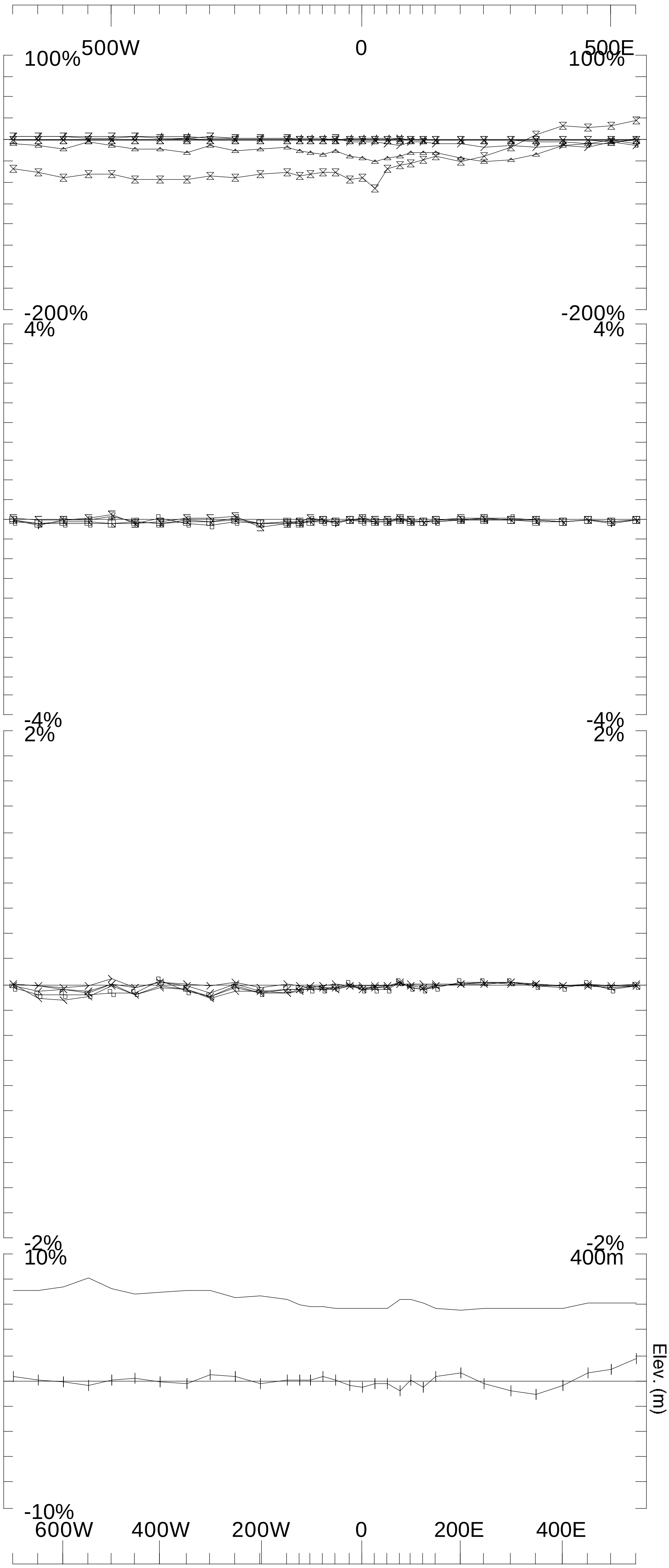
Loop 1416/1415 @2.045Hz

Loop 1416	Line 000	700W - 550E	1250m	Hz/Hx/Hy
	Line 300N	700W - 550E	1250m	Hz/Hx/Hy
	Line 600N	700W - 550E	1250m	Hz/Hx/Hy
	Line 900N	700W - 550E	1250m	Hz/Hx/Hy
	Line 1200N	700W - 550E	1250m	Hz/Hx/Hy
	Line 1500N	700W - 550E	1250m	Hz/Hx/Hy
Loop 1415	Line 1800N	700W - 550E	1250m	Hz/Hx/Hy
	Line 2100N	700W - 550E	1250m	Hz/Hx/Hy
	Line 2400N	700W - 550E	1250m	Hz/Hx/Hy
	Line 2700N	700W - 550E	1250m	Hz/Hx/Hy
	Line 3000N	700W - 550E	1250m	Hz/Hx/Hy
	Line 3300N	700W - 550E	1250m	Hz/Hx/Hy

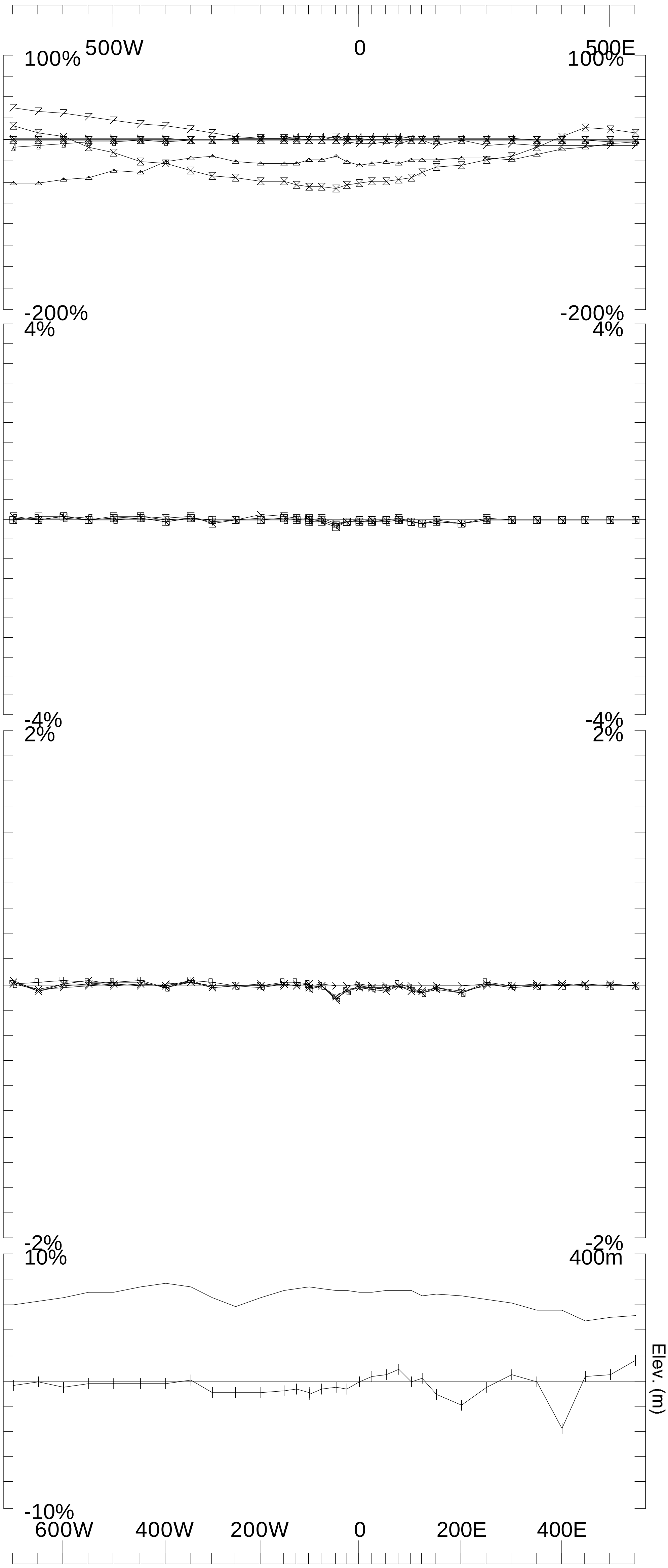
Loop 1416/1415 - Hx



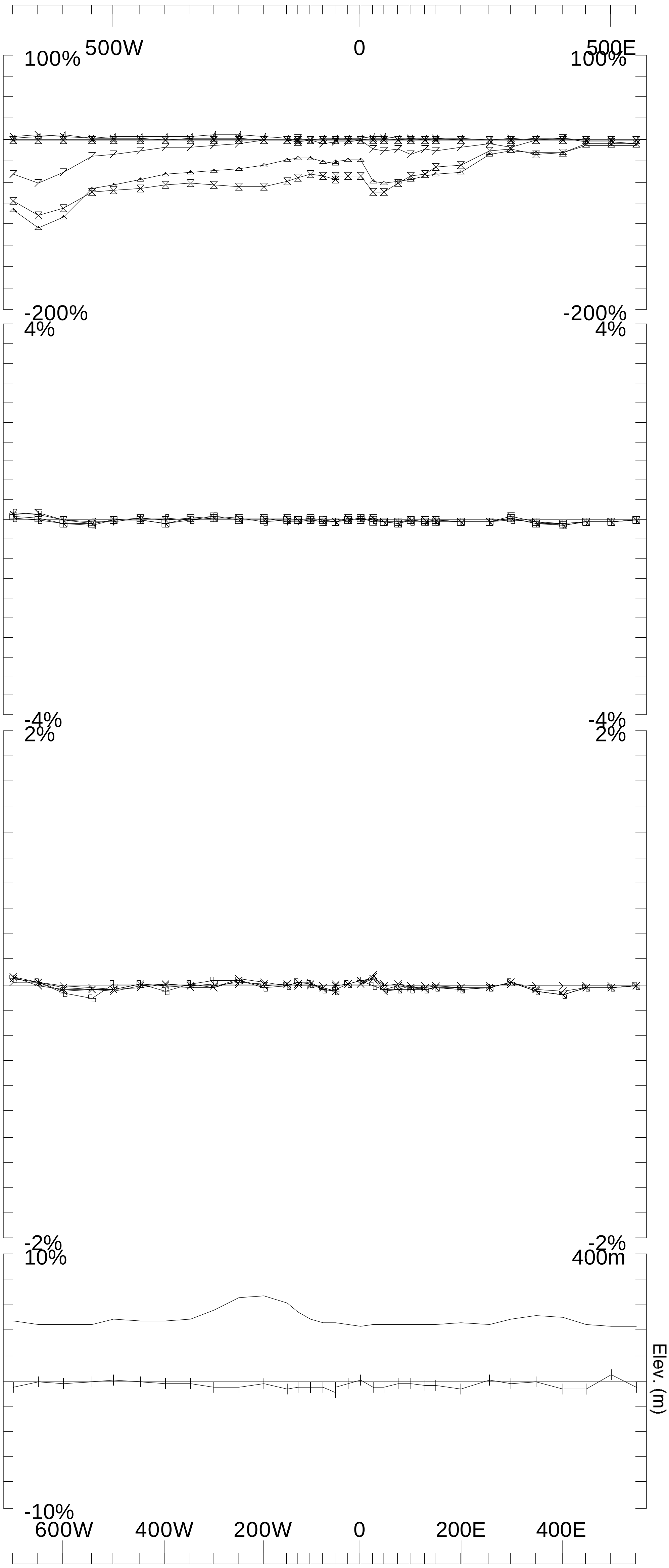
Loop: 1416S2	Secondary, (Chn - Ch0)/|Hp|	UTEM Survey at: Ermatinger
Line: 000	Contin. Norm at depth of 0 m	For: Wallbridge
Compt: Hx	Base Freq. 2.045 Hz	LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE Job 1409 Plotted : 19/11/14



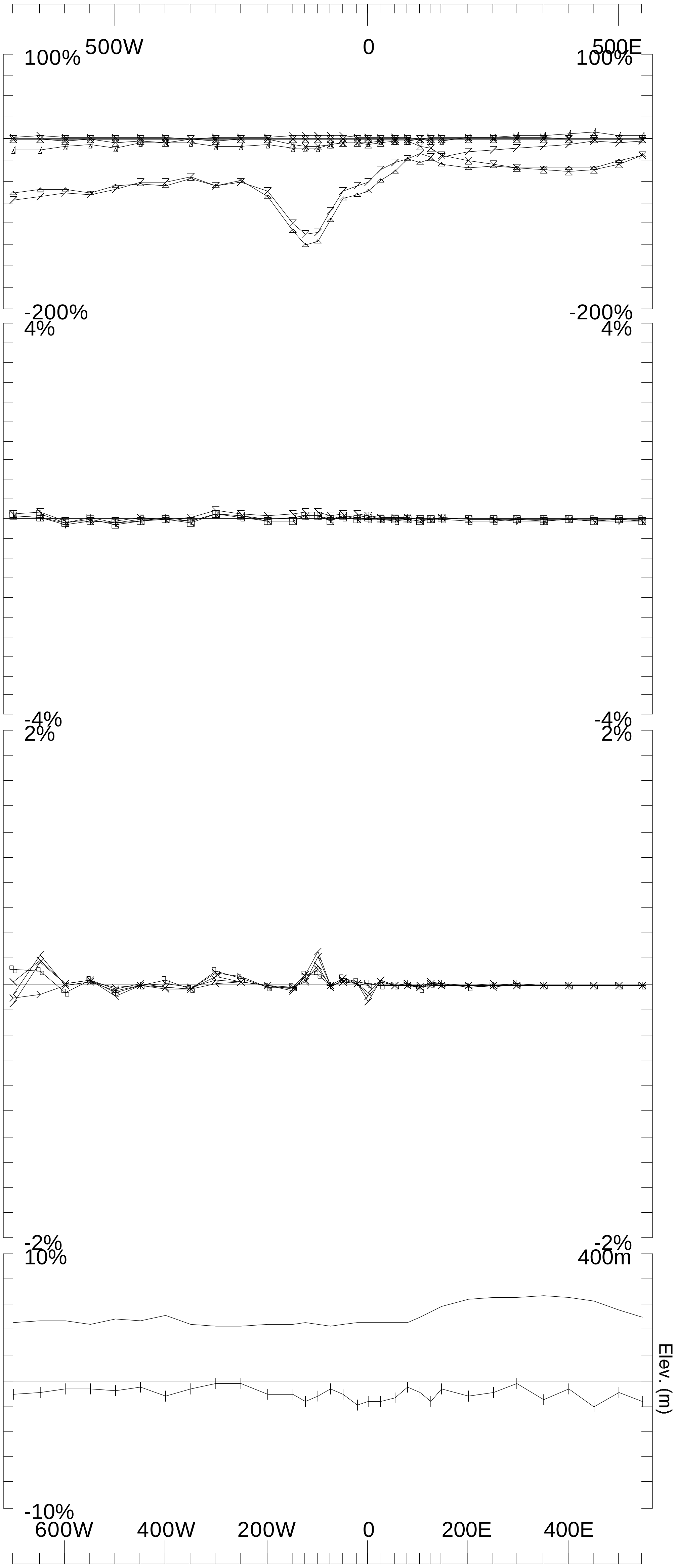
Loop: 1416S2	Secondary, (Chn - Ch0)/|Hp|	UTEM Survey at: Ermatinger
Line: 300N	Contin. Norm at depth of 0 m	For: Wallbridge
Compt: Hx	Base Freq. 2.045 Hz	LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE Job 1409 Plotted : 19/11/14



Loop: 1416S2	Secondary, (Chn - Ch0)/|Hp|	UTEM Survey at: Ermatinger
Line: 600N	Contin. Norm at depth of 0 m	For: Wallbridge
Compt: Hx	Base Freq. 2.045 Hz	LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE Job 1409 Plotted : 19/11/14



Loop: 1416S2	Secondary, (Chn - Ch0)/|Hp|	UTEM Survey at: Ermatinger
Line: 900N	Contin. Norm at depth of 0 m	For: Wallbridge
Compt: Hx	Base Freq. 2.045 Hz	LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE Job 1409 Plotted : 19/11/14



Loop: 1416S2
Line: 1200N
Compt: Hx

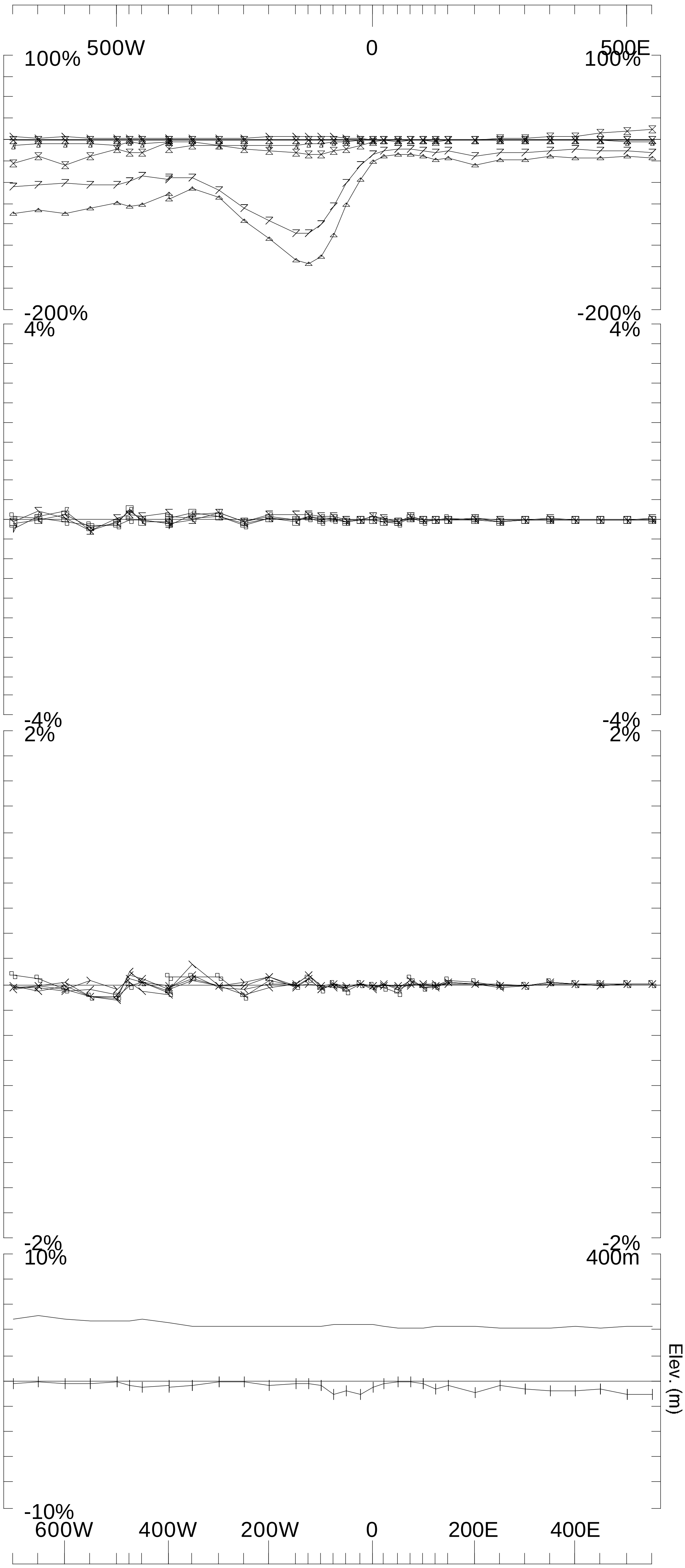
Secondary, (Chn - Ch0)/|Hp|
Contin. Norm at depth of 0 m
Base Freq. 2.045 Hz

UTEM Survey at: Ermatinger
For: Wallbridge

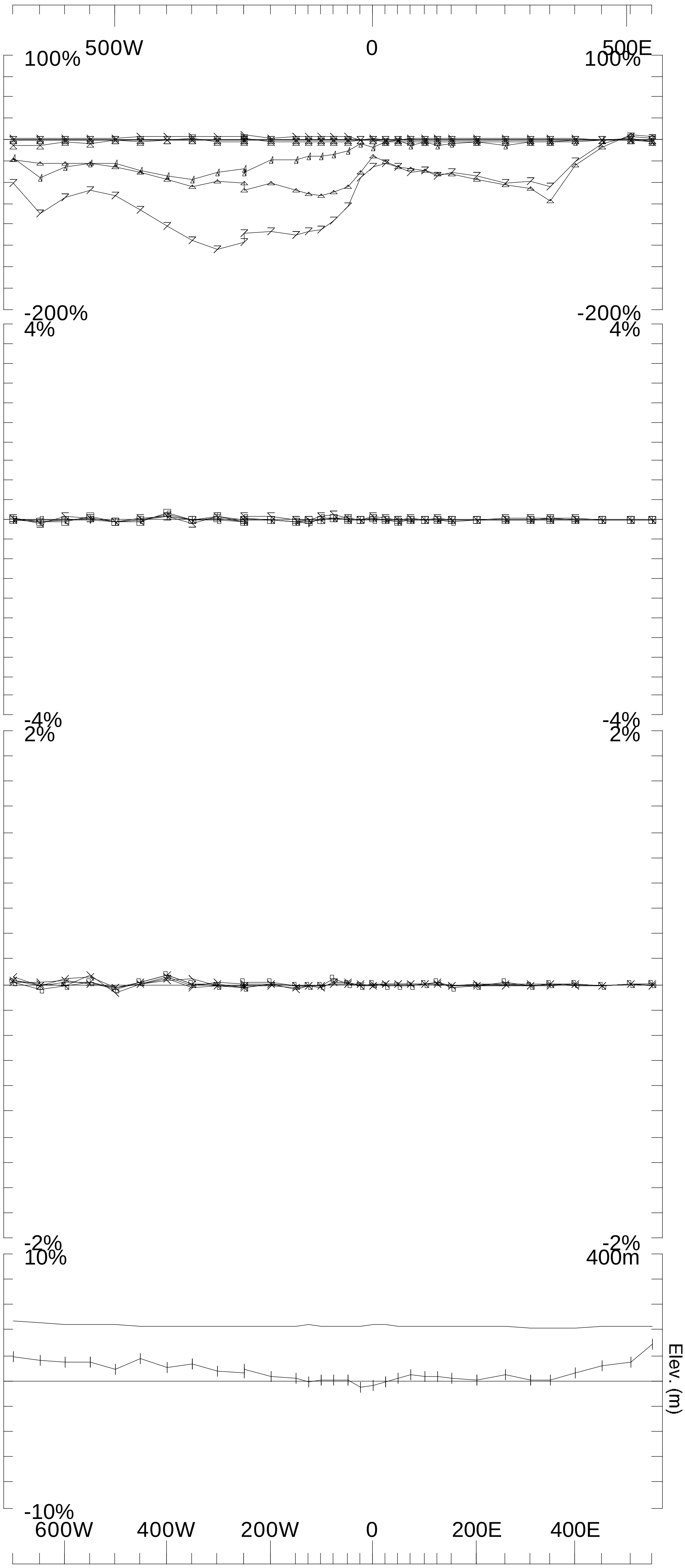
LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE

Job 1409

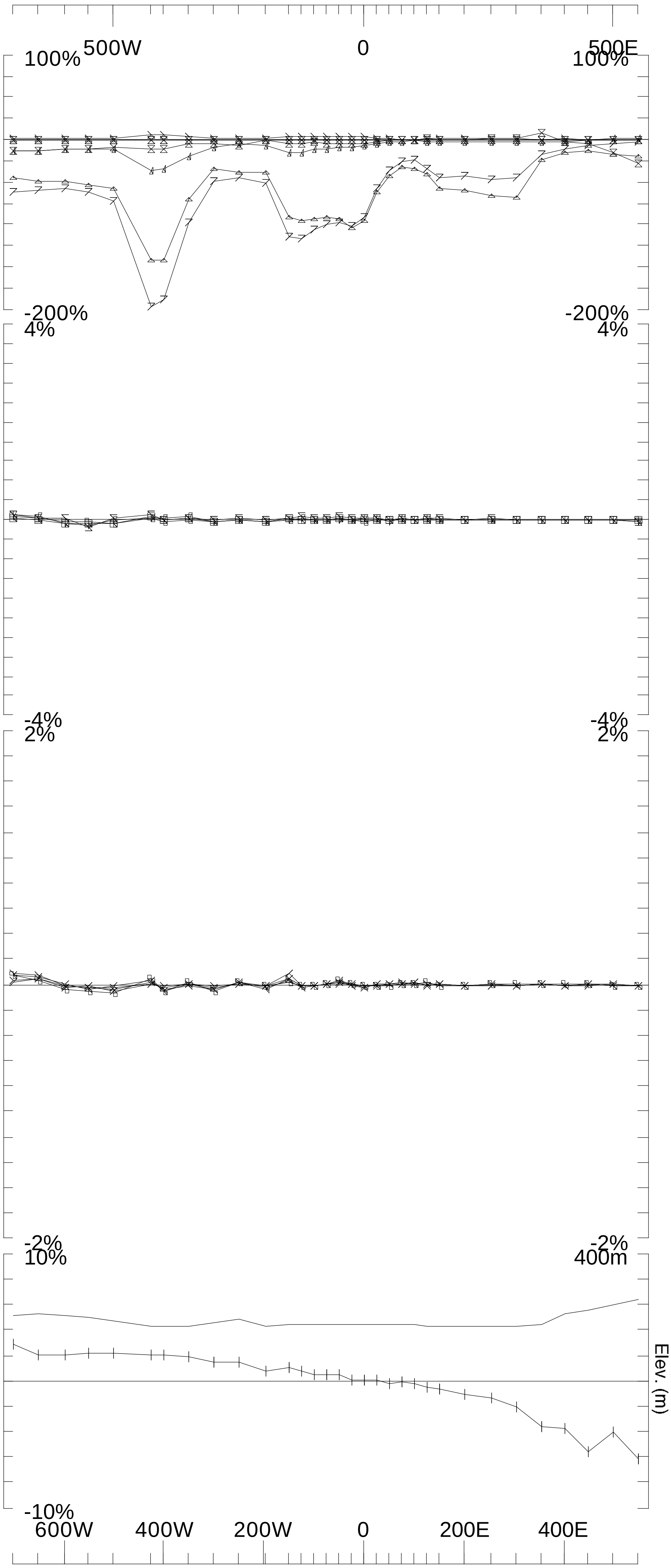
Plotted : 19/11/14



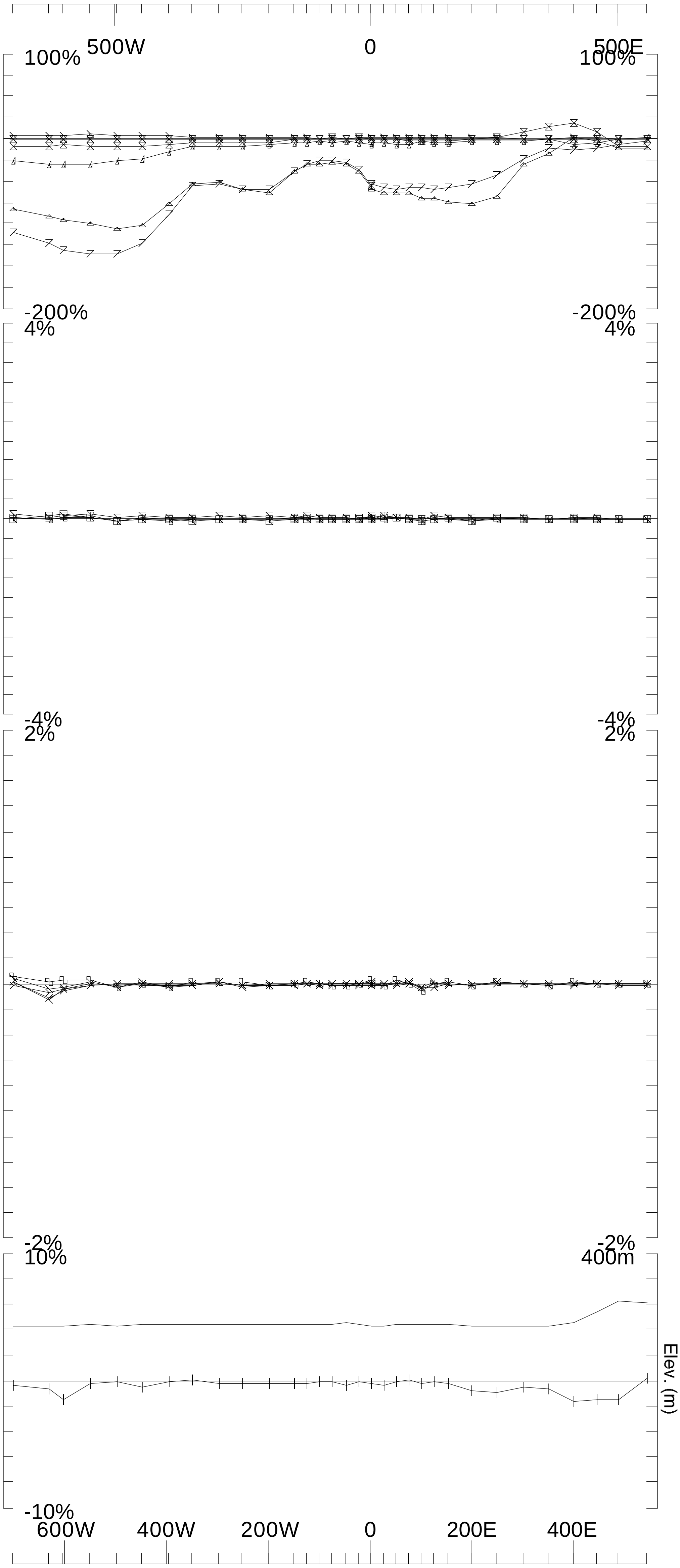
Loop: 1416S2	Secondary, (Chn - Ch0)/|Hp|	UTEM Survey at: Ermatinger
Line: 1500N	Contin. Norm at depth of 0 m	For: Wallbridge
Compt: Hx	Base Freq. 2.045 Hz	LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE Job 1409 Plotted : 19/11/14



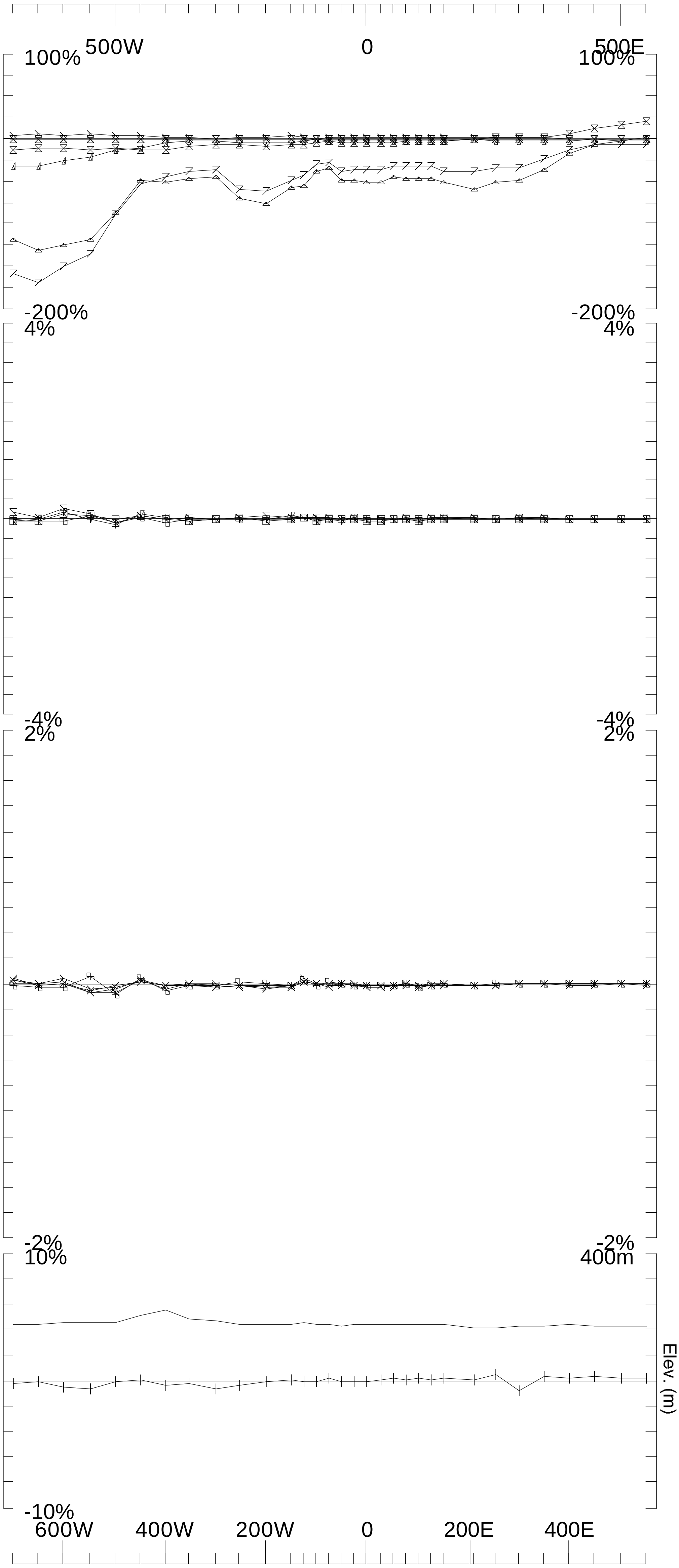
Loop: 1415S2	Secondary, (Chn - Ch0)/|Hp|	UTEM Survey at: Ermatinger
Line: 1800N	Contin. Norm at depth of 0 m	For: Wallbridge
Compt: Hx	Base Freq. 2.045 Hz	LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE Job 1409 Plotted : 19/11/14



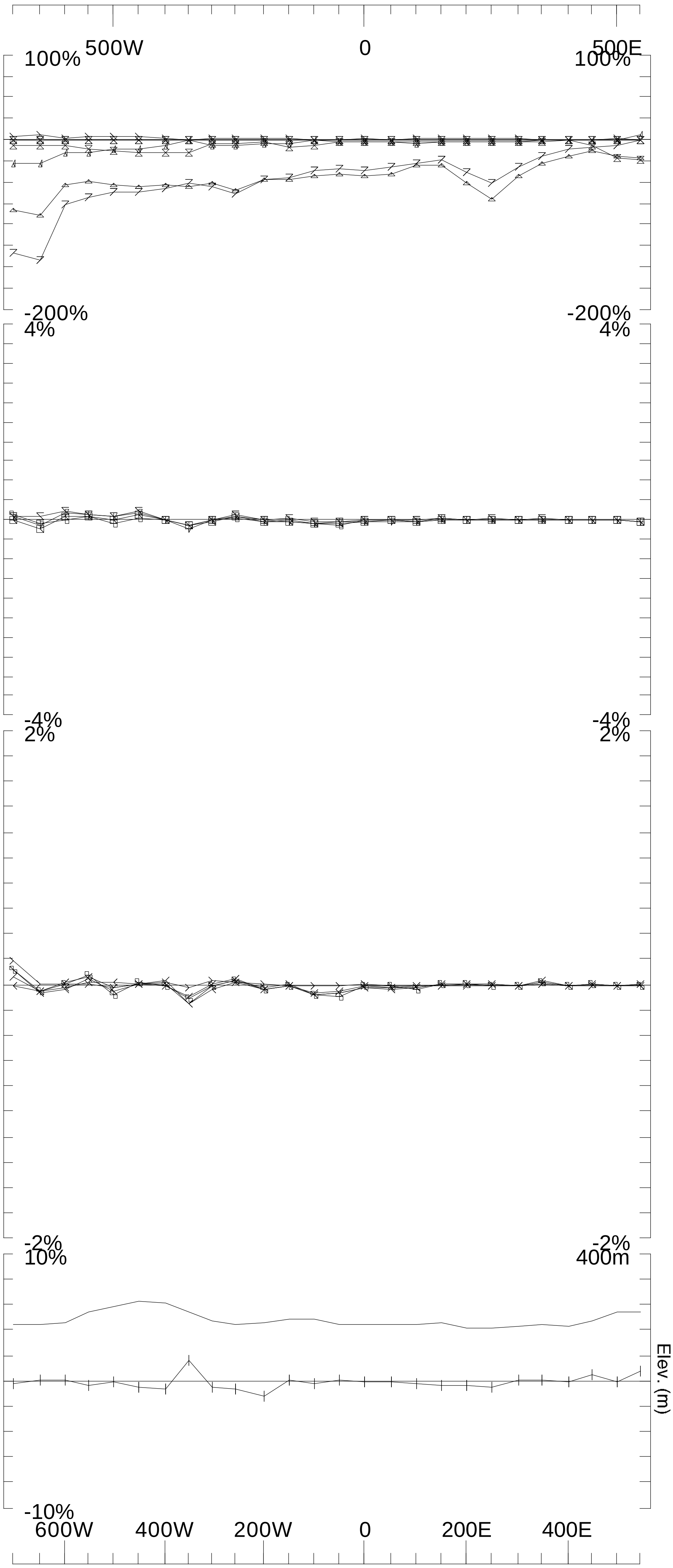
Loop: 1415S2	Secondary, (Chn - Ch0)/|Hp|	UTEM Survey at: Ermatinger
Line: 2100N	Contin. Norm at depth of 0 m	For: Wallbridge
Compt: Hx	Base Freq. 2.045 Hz	LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE Job 1409 Plotted : 19/11/14



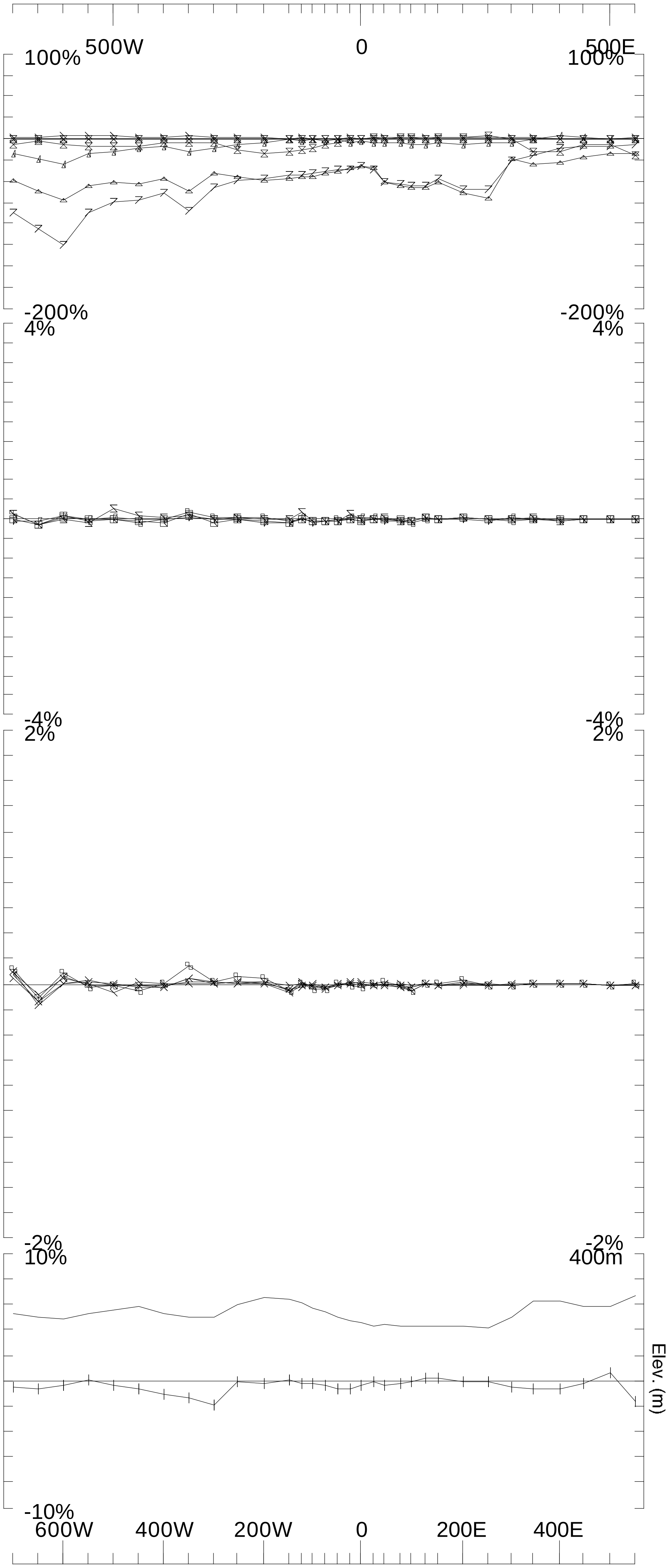
Loop: 1415S2	Secondary, (Chn - Ch0)/|Hp|	UTEM Survey at: Ermatinger
Line: 2400N	Contin. Norm at depth of 0 m	For: Wallbridge
Compt: Hx	Base Freq. 2.045 Hz	LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE Job 1409 Plotted : 19/11/14



Loop: 1415S2	Secondary, (Chn - Ch0)/|Hp|	UTEM Survey at: Ermatinger
Line: 2700N	Contin. Norm at depth of 0 m	For: Wallbridge
Compt: Hx	Base Freq. 2.045 Hz	LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE Job 1409 Plotted : 19/11/14



Loop: 1415S2	Secondary, (Chn - Ch0)/|Hp|	UTEM Survey at: Ermatinger
Line: 3000N	Contin. Norm at depth of 0 m	For: Wallbridge
Compt: Hx	Base Freq. 2.045 Hz	LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE Job 1409 Plotted : 19/11/14



Loop: 1415S2	Secondary, (Chn - Ch0)/|Hp|	UTEM Survey at: Ermatinger
Line: 3300N	Contin. Norm at depth of 0 m	For: Wallbridge
Compt: Hx	Base Freq. 2.045 Hz	LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE Job 1409 Plotted : 19/11/14

Ermatinger Grid

Loop 1416/1415

Hy

2.045Hz frequency

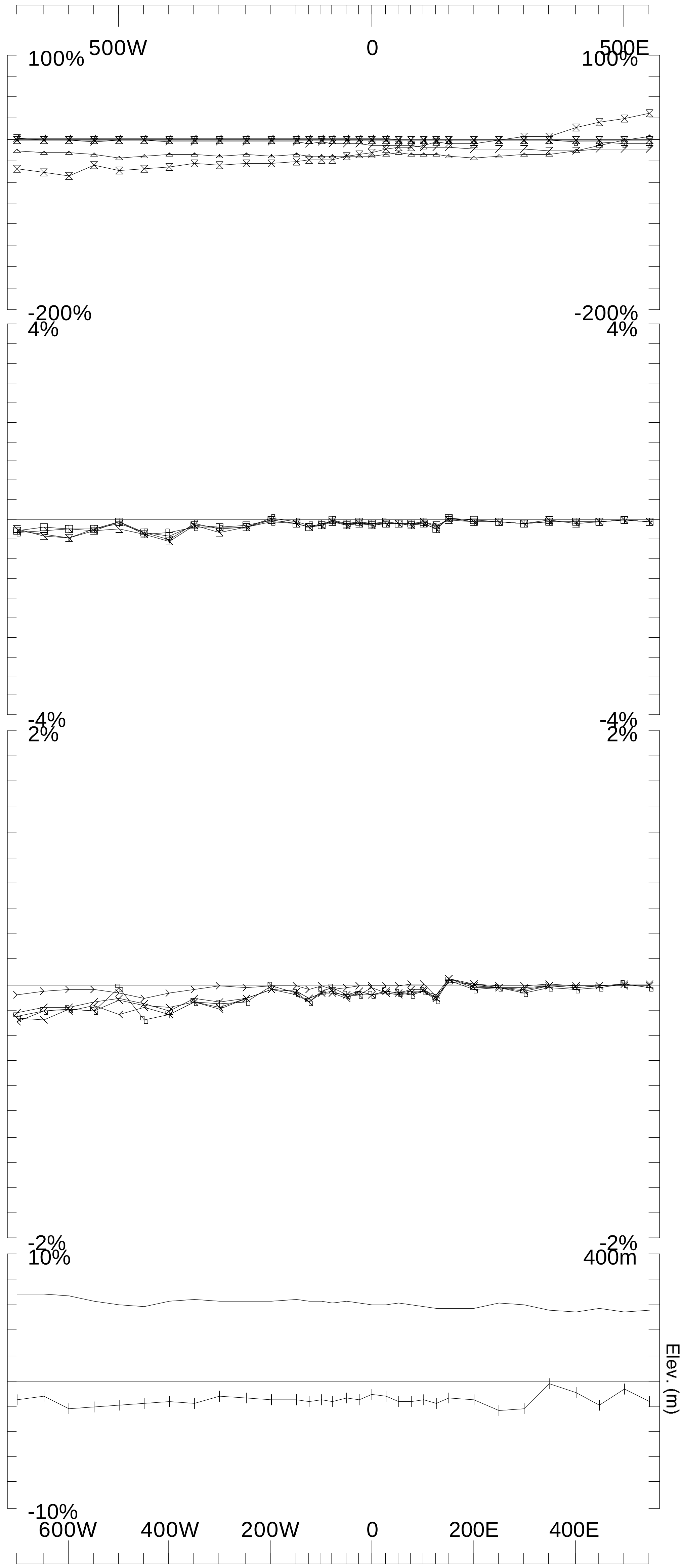
continuous norm

12Ch - Ch0 reduced

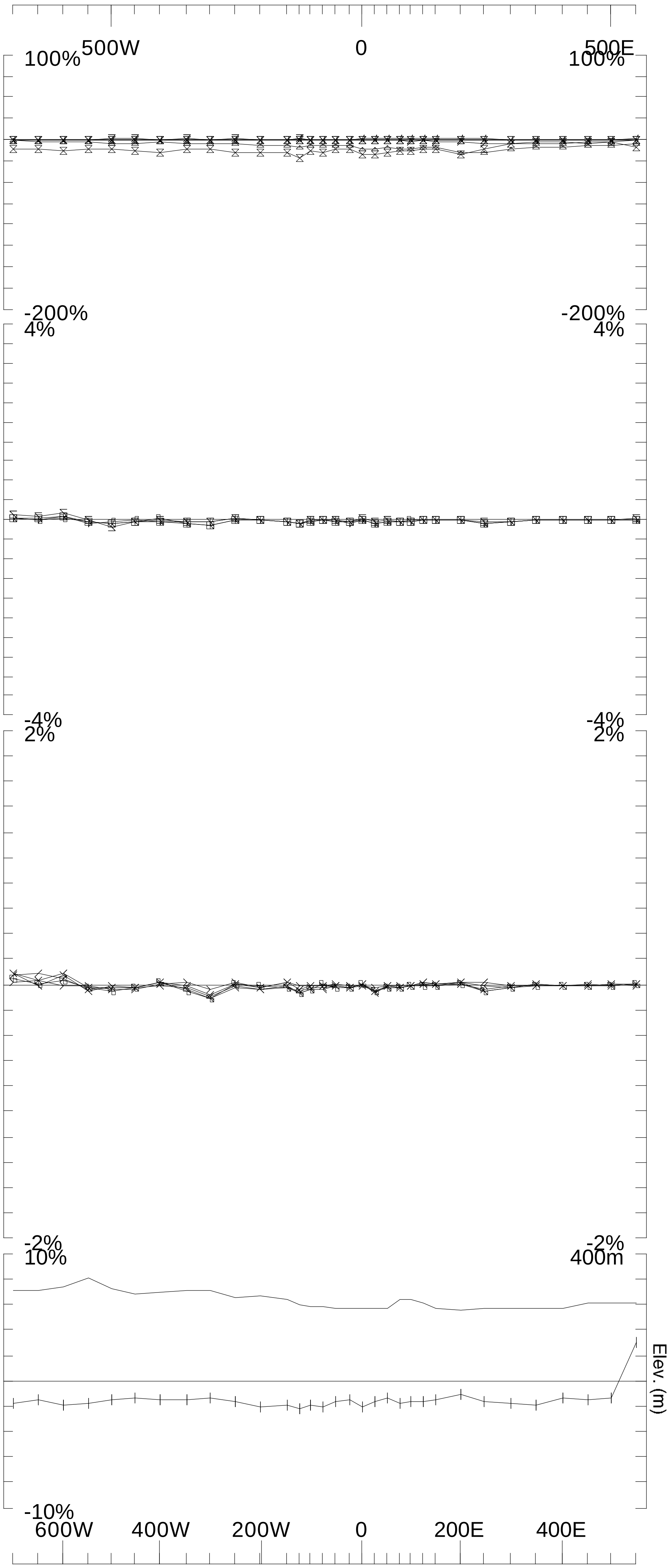
Loop 1416/1415 @2.045Hz

Loop 1416	Line 000	700W - 550E	1250m	Hz/Hx/Hy
	Line 300N	700W - 550E	1250m	Hz/Hx/Hy
	Line 600N	700W - 550E	1250m	Hz/Hx/Hy
	Line 900N	700W - 550E	1250m	Hz/Hx/Hy
	Line 1200N	700W - 550E	1250m	Hz/Hx/Hy
	Line 1500N	700W - 550E	1250m	Hz/Hx/Hy
Loop 1415	Line 1800N	700W - 550E	1250m	Hz/Hx/Hy
	Line 2100N	700W - 550E	1250m	Hz/Hx/Hy
	Line 2400N	700W - 550E	1250m	Hz/Hx/Hy
	Line 2700N	700W - 550E	1250m	Hz/Hx/Hy
	Line 3000N	700W - 550E	1250m	Hz/Hx/Hy
	Line 3300N	700W - 550E	1250m	Hz/Hx/Hy

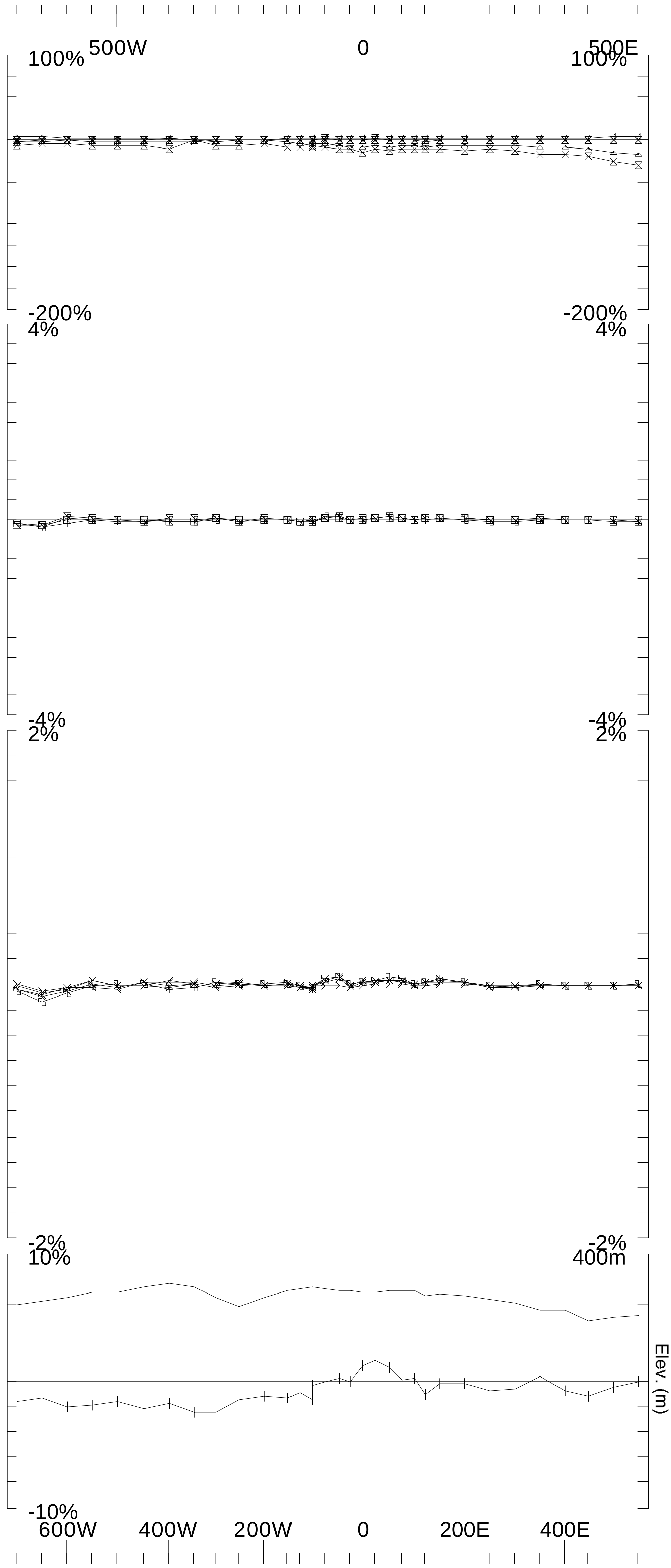
Loop 1416/1415 - Hy



Loop: 1416S2	Secondary, (Chn - Ch0)/|Hp|	UTEM Survey at: Ermatinger
Line: 000	Contin. Norm at depth of 0 m	For: Wallbridge
Compt: Hy	Base Freq. 2.045 Hz	LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE Job 1409 Plotted : 19/11/14



Loop: 1416S2	Secondary, (Chn - Ch0)/|Hp|	UTEM Survey at: Ermatinger
Line: 300N	Contin. Norm at depth of 0 m	For: Wallbridge
Compt: Hy	Base Freq. 2.045 Hz	LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE Job 1409 Plotted : 19/11/14



Loop: 1416S2
Line: 600N
Compt: Hy

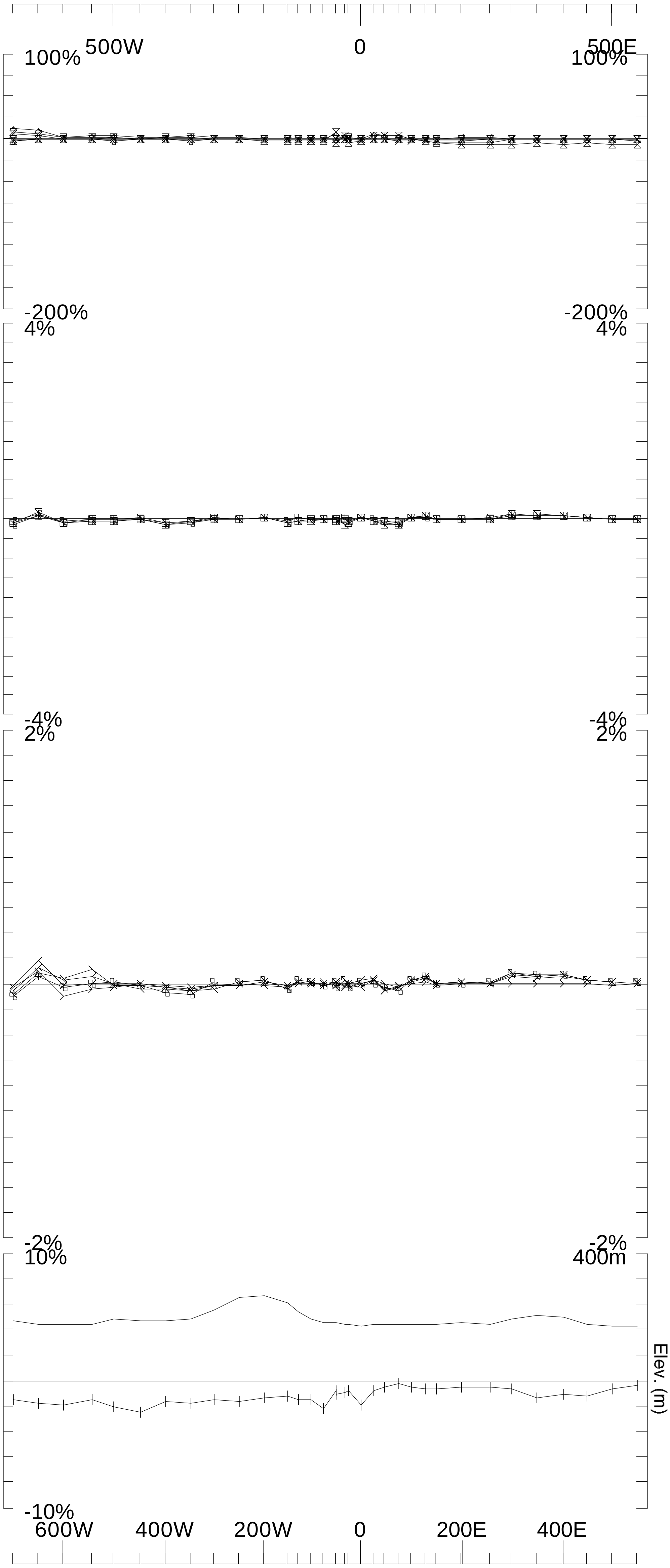
Secondary, (Chn - Ch0)/|Hp|
Contin. Norm at depth of 0 m
Base Freq. 2.045 Hz

UTEM Survey at: Ermatinger
For: Wallbridge

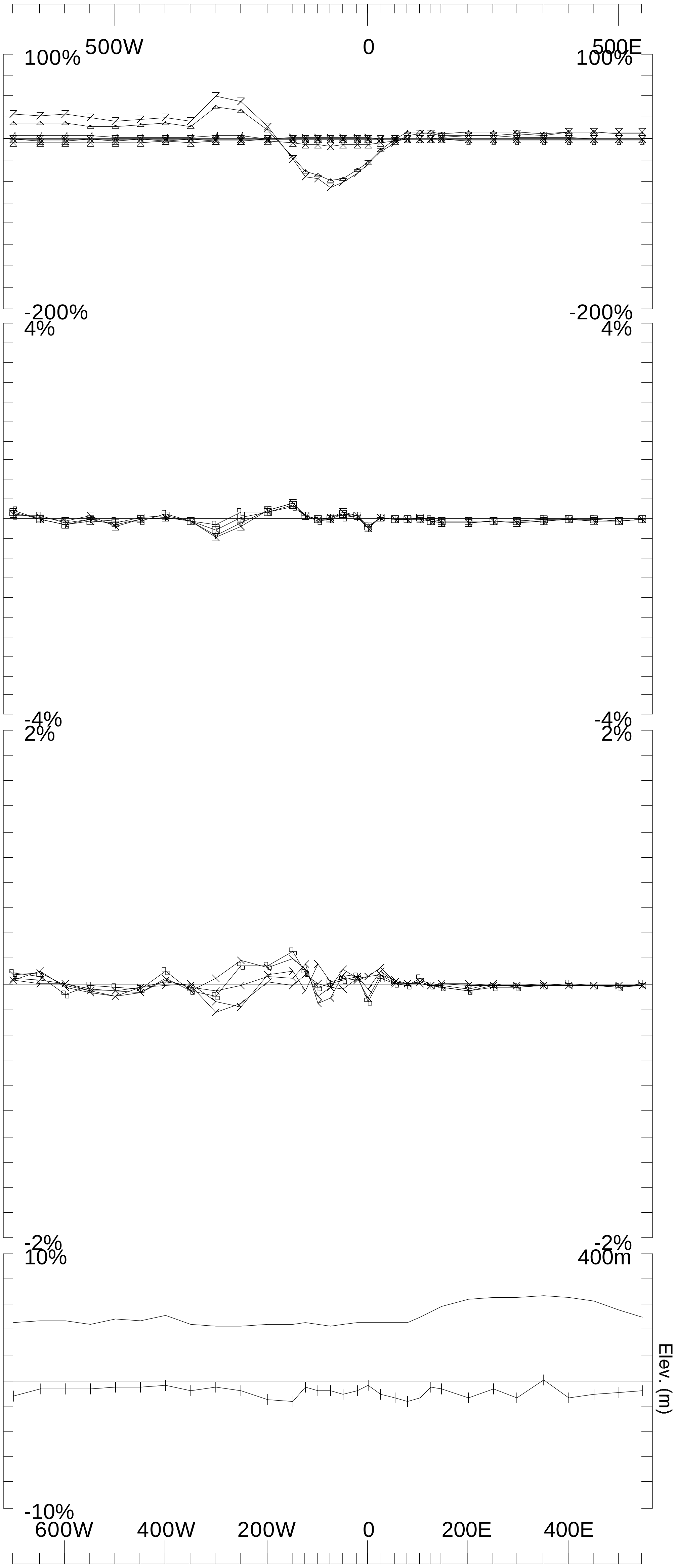
LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE

Job 1409

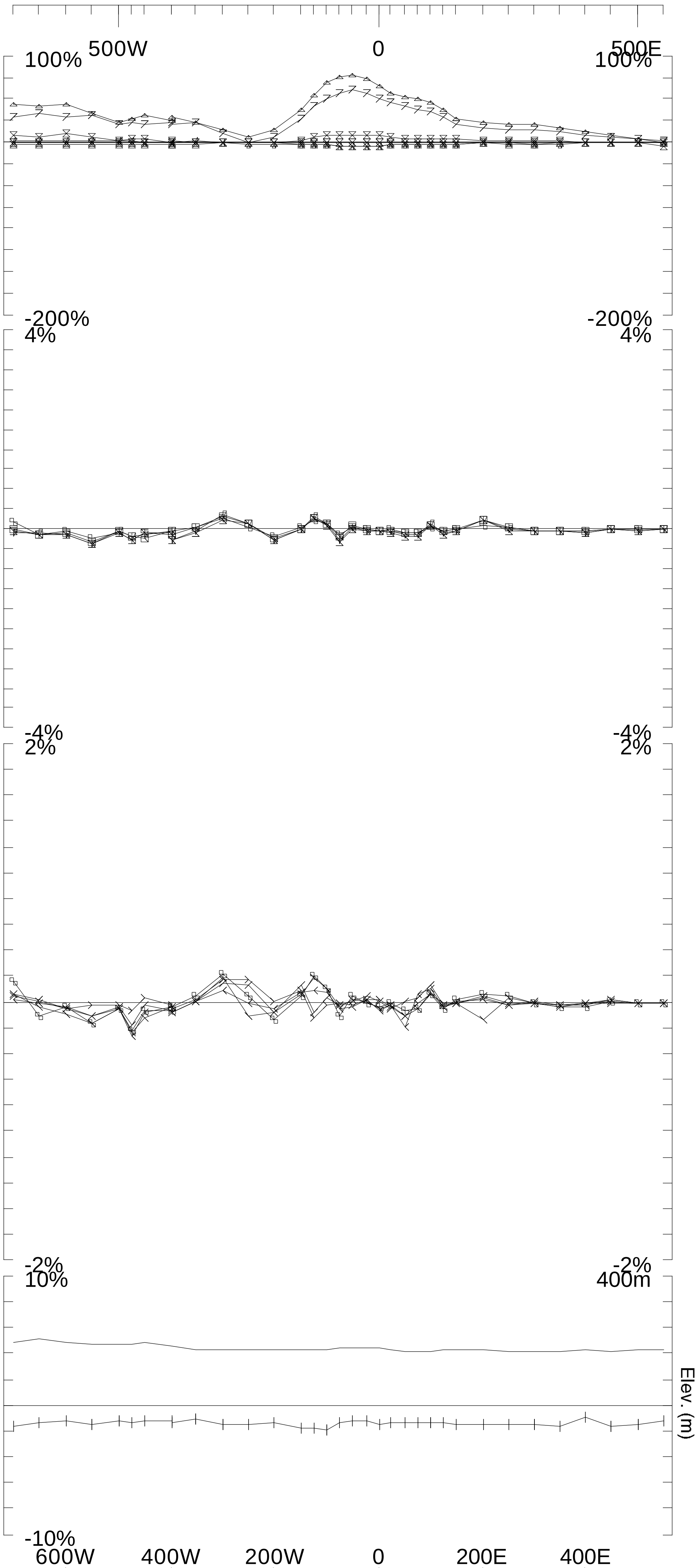
Plotted : 19/11/14



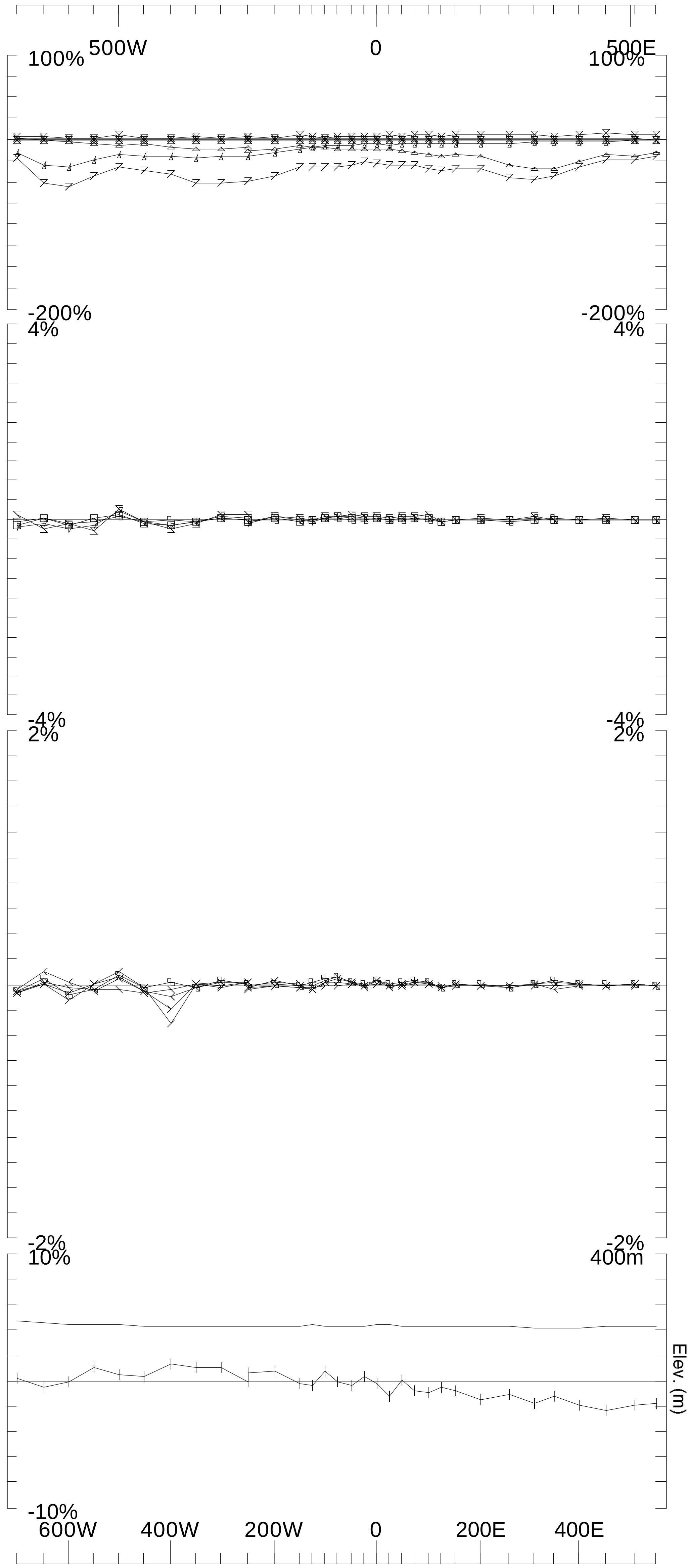
Loop: 1416S2	Secondary, (Chn - Ch0)/|Hp|	UTEM Survey at: Ermatinger
Line: 900N	Contin. Norm at depth of 0 m	For: Wallbridge
Compt: Hy	Base Freq. 2.045 Hz	LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE Job 1409 Plotted : 19/11/14



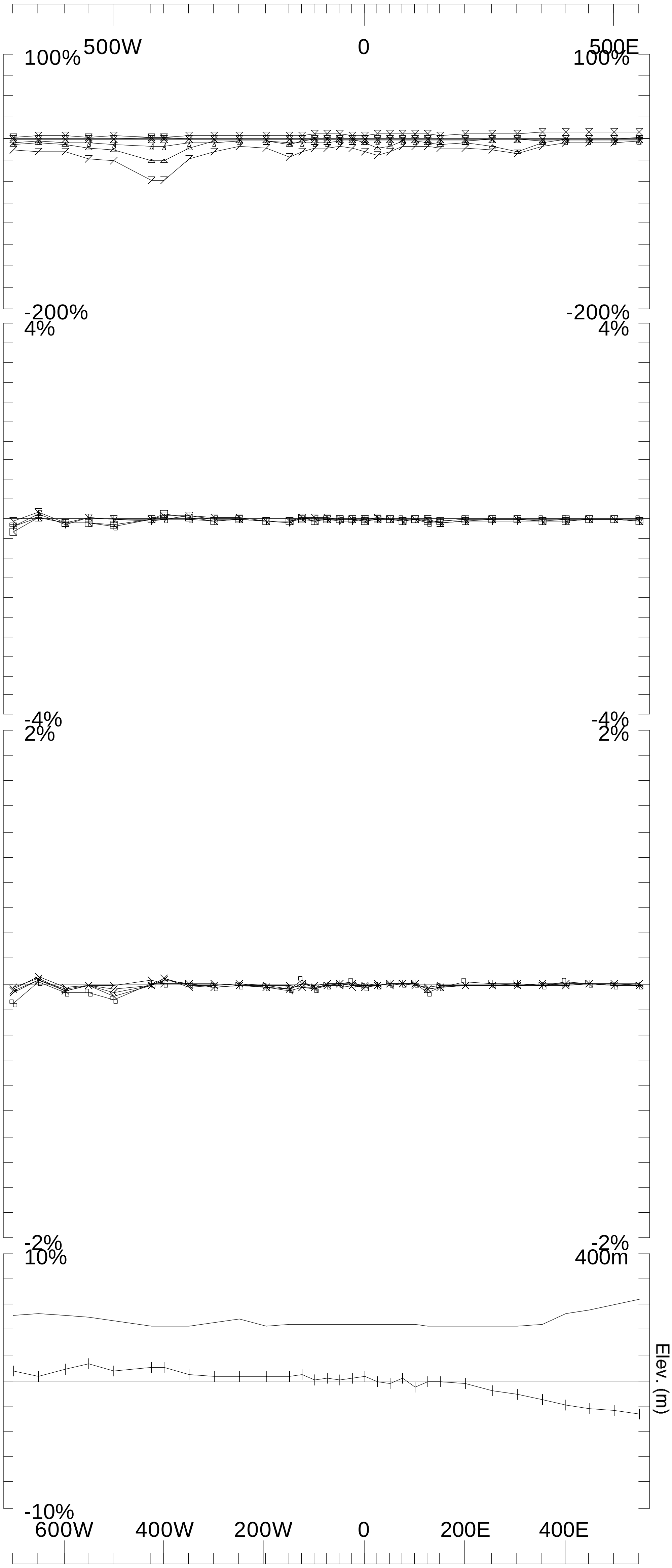
Loop: 1416S2	Secondary, (Chn - Ch0)/|Hp|	UTEM Survey at: Ermatinger
Line: 1200N	Contin. Norm at depth of 0 m	For: Wallbridge
Compt: Hy	Base Freq. 2.045 Hz	LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE Job 1409 Plotted : 19/11/14



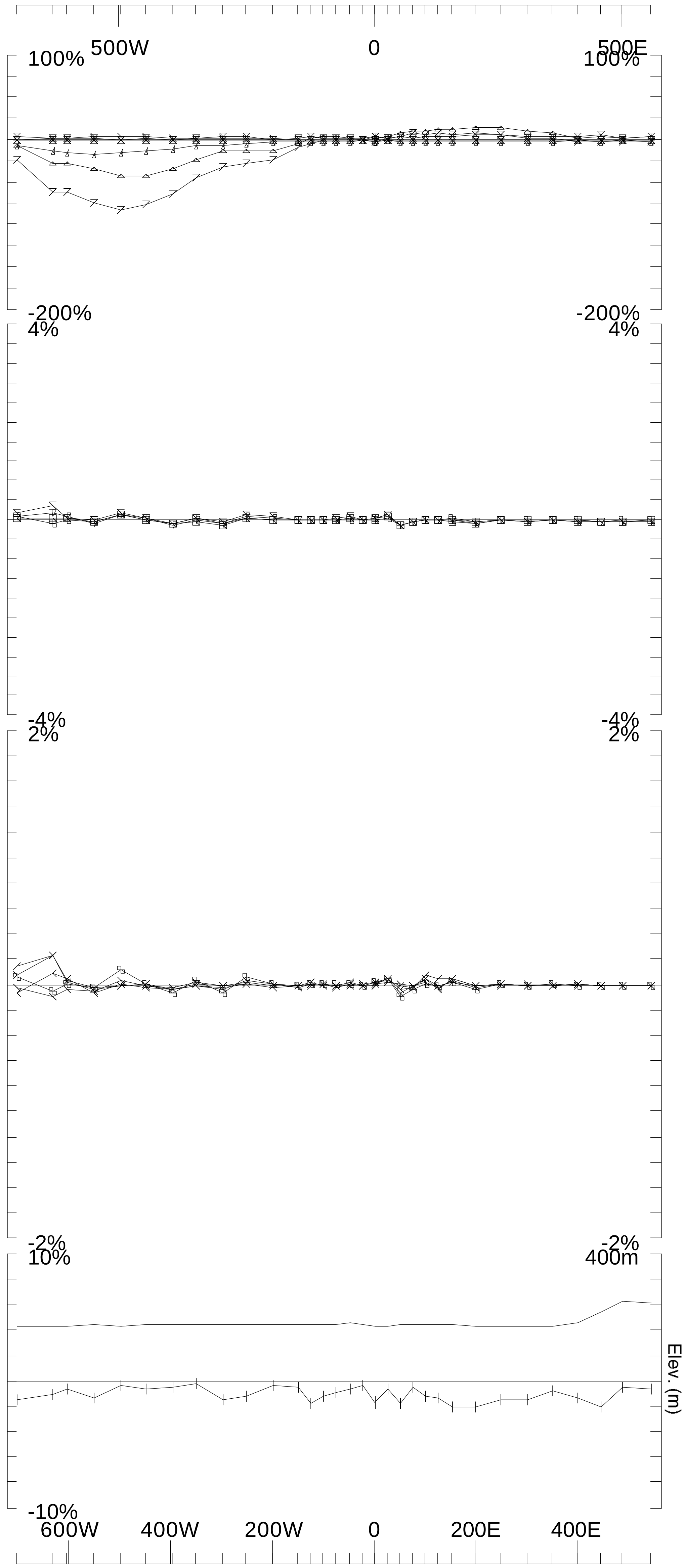
Loop: 1416S2	Secondary, (Chn - Ch0)/|Hp|	UTEM Survey at: Ermatinger
Line: 1500N	Contin. Norm at depth of 0 m	For: Wallbridge
Compt: Hy	Base Freq. 2.045 Hz	LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE Job 1409 Plotted : 19/11/14



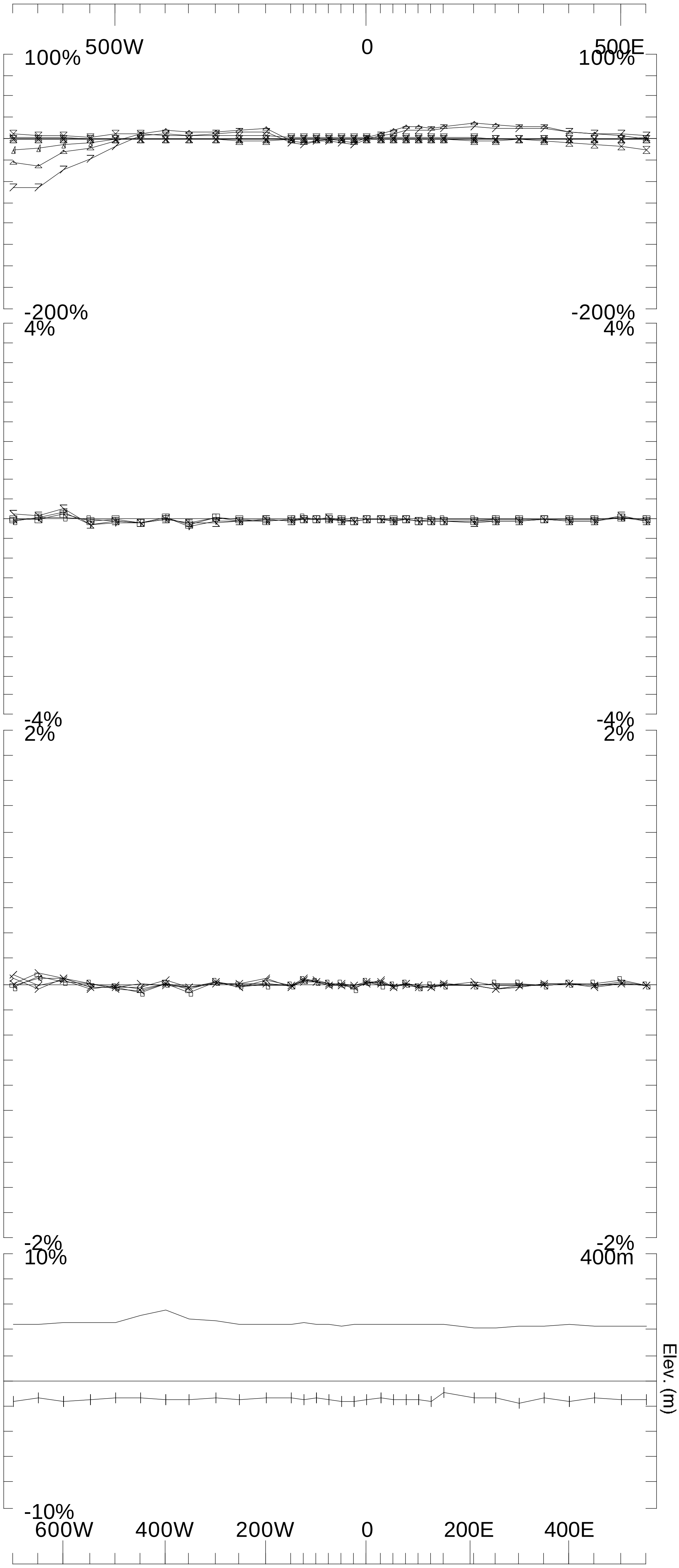
Loop: 1415S2	Secondary, (Chn - Ch0)/|Hp|	UTEM Survey at: Ermatinger
Line: 1800N	Contin. Norm at depth of 0 m	For: Wallbridge
Compt: Hy	Base Freq. 2.045 Hz	LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE Job 1409 Plotted : 19/11/14



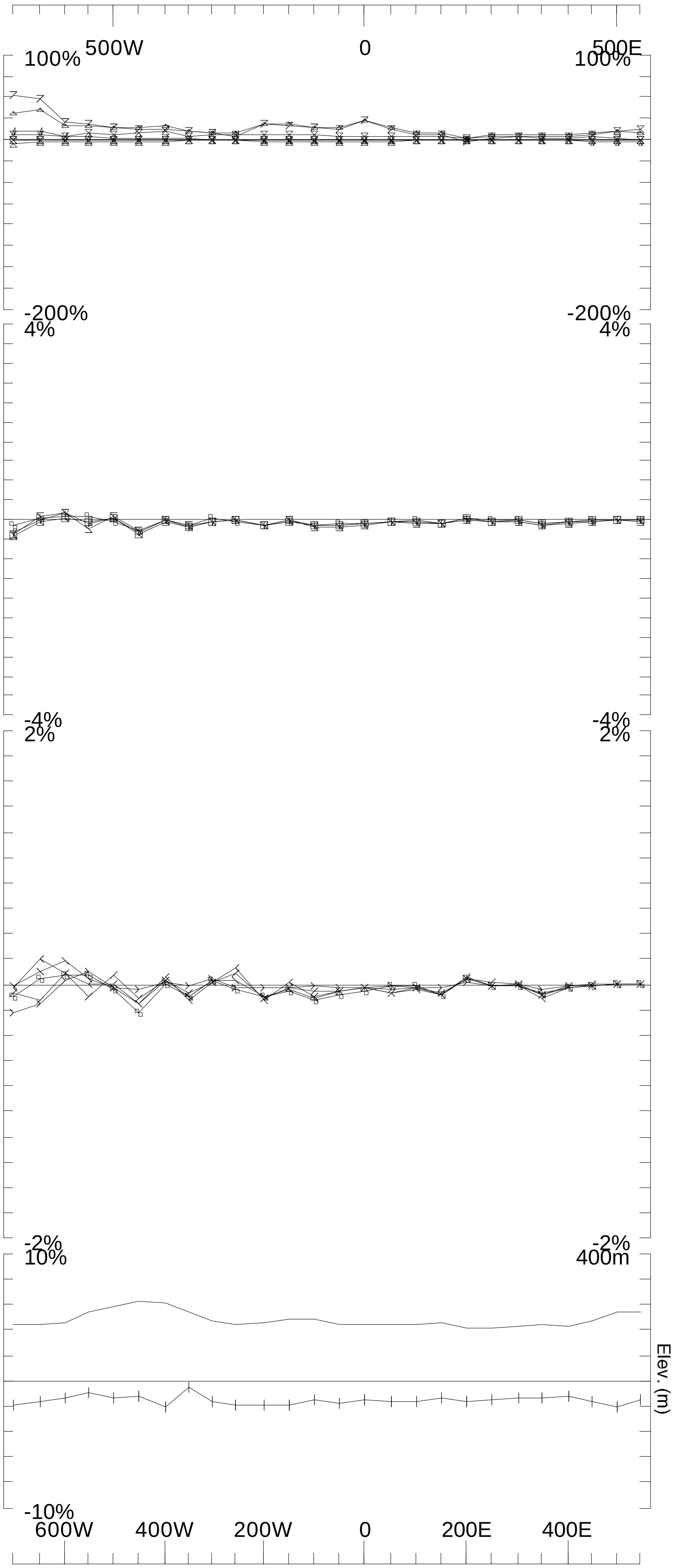
Loop: 1415S2	Secondary, (Chn - Ch0)/|Hp|	UTEM Survey at: Ermatinger
Line: 2100N	Contin. Norm at depth of 0 m	For: Wallbridge
Compt: Hy	Base Freq. 2.045 Hz	LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE Job 1409 Plotted : 19/11/14



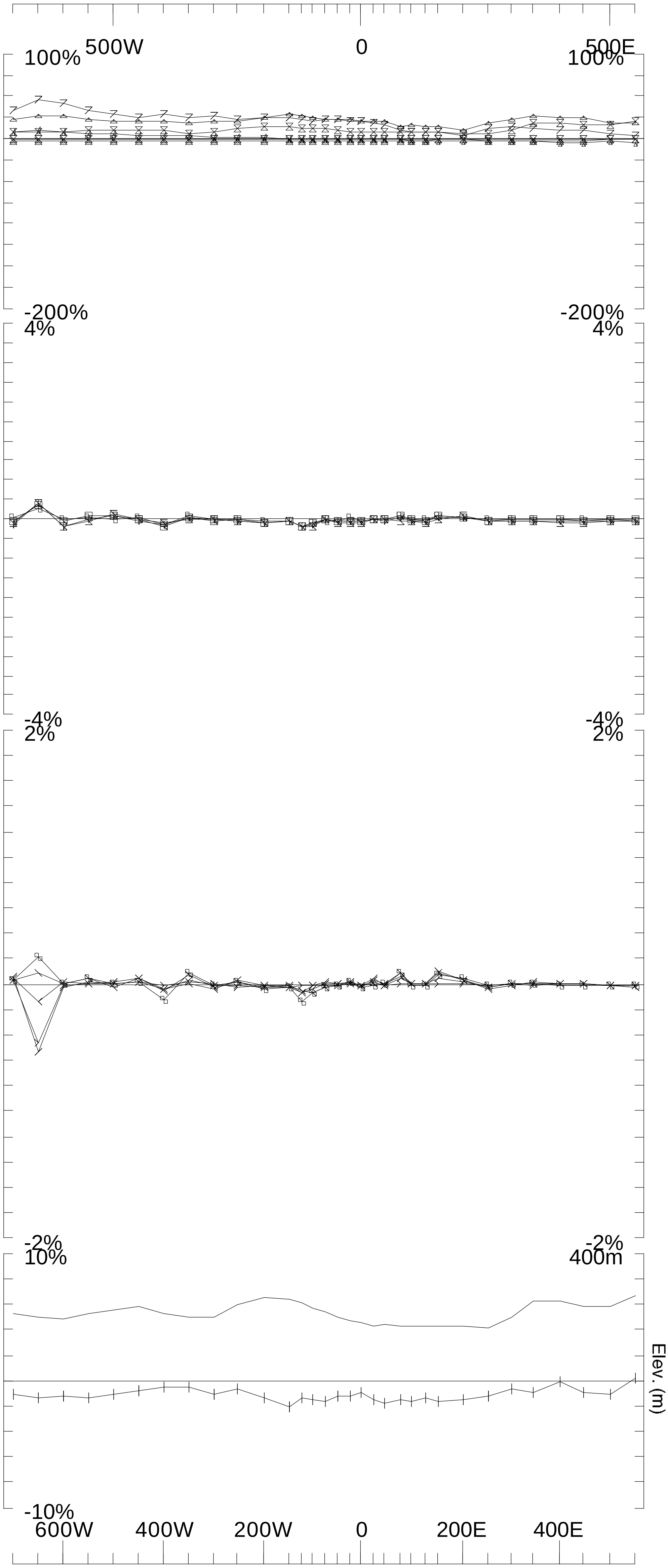
Loop: 1415S2	Secondary, (Chn - Ch0)/|Hp|	UTEM Survey at: Ermatinger
Line: 2400N	Contin. Norm at depth of 0 m	For: Wallbridge
Compt: Hy	Base Freq. 2.045 Hz	LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE Job 1409 Plotted : 19/11/14



Loop: 1415S2	Secondary, (Chn - Ch0)/|Hp|	UTEM Survey at: Ermatinger
Line: 2700N	Contin. Norm at depth of 0 m	For: Wallbridge
Compt: Hy	Base Freq. 2.045 Hz	LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE Job 1409 Plotted : 19/11/14



Loop: 1415S2	Secondary, (Chn - Ch0)/|Hp|	UTEM Survey at: Ermatinger
Line: 3000N	Contin. Norm at depth of 0 m	For: Wallbridge
Compt: Hy	Base Freq. 2.045 Hz	LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE Job 1409 Plotted : 19/11/14



Loop: 1415S2	Secondary, (Chn - Ch0)/|Hp|	UTEM Survey at: Ermatinger
Line: 3300N	Contin. Norm at depth of 0 m	For: Wallbridge
Compt: Hy	Base Freq. 2.045 Hz	LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE Job 1409 Plotted : 19/11/14

Ermatinger Grid

Loop 1418/1417/1418

Hz

4.090Hz frequency

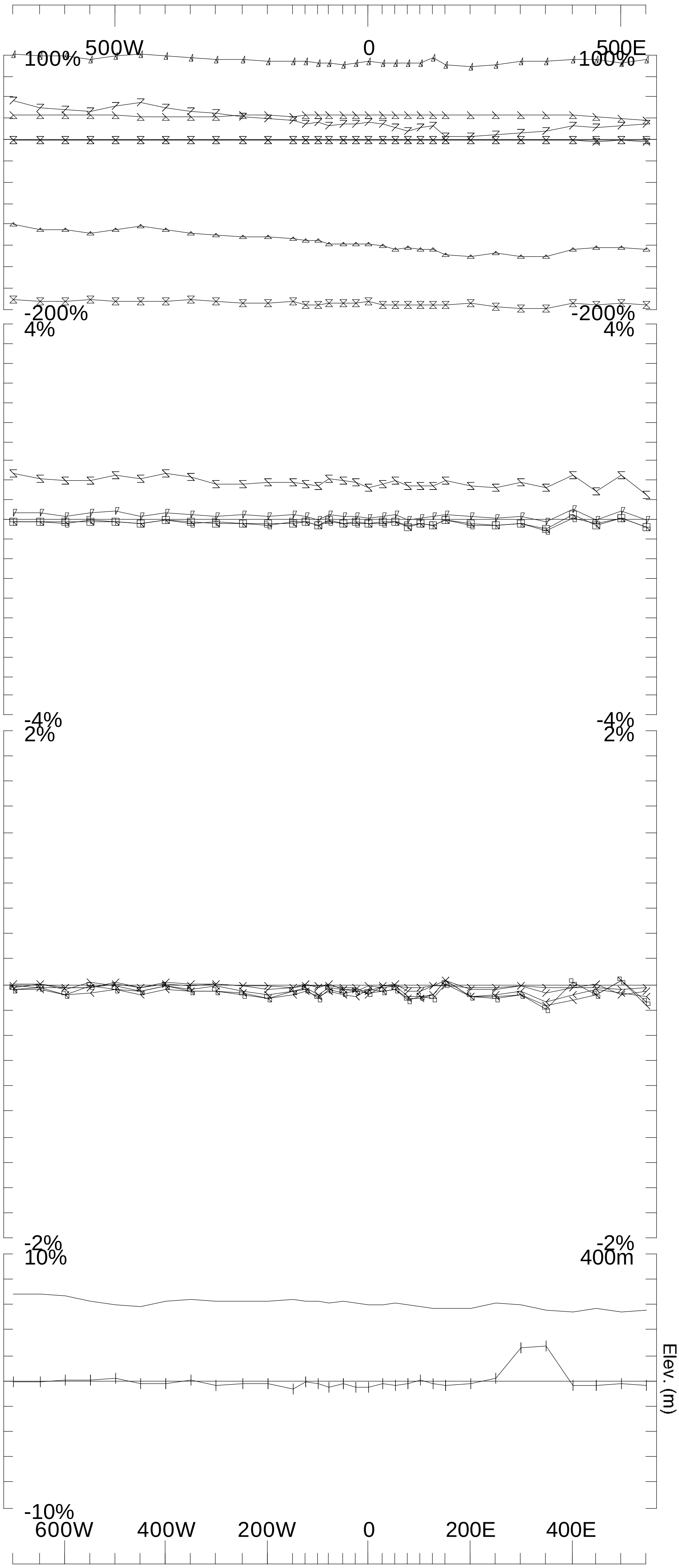
continuous norm

12Ch - Ch0 reduced

Loop 1418/1417/1418 @4.090Hz

Loop 1418	Line 000	700W - 550E	1250m	Hz/Hx/Hy
(@ 4.090Hz)	Line 300N	700W - 550E	1250m	Hz/Hx/Hy
	Line 600N	700W - 550E	1250m	Hz/Hx/Hy
	Line 900N	700W - 550E	1250m	Hz/Hx/Hy
Loop 1417	Line 1200N	700W - 550E	1250m	Hz/Hx/Hy
	Line 1500N	700W - 550E	1250m	Hz/Hx/Hy
	Line 1800N	700W - 550E	1250m	Hz/Hx/Hy
	Line 2100N	700W - 550E	1250m	Hz/Hx/Hy
Loop 1418	Line 2400N	700W - 550E	1250m	Hz/Hx/Hy
	Line 2700N	700W - 550E	1250m	Hz/Hx/Hy
	Line 3000N	700W - 550E	1250m	Hz/Hx/Hy
	Line 3300N	700W - 550E	1250m	Hz/Hx/Hy

Loop 1418/1417/1418 - Hz



Loop: 1418S1
Line: 000
Compt: Hz

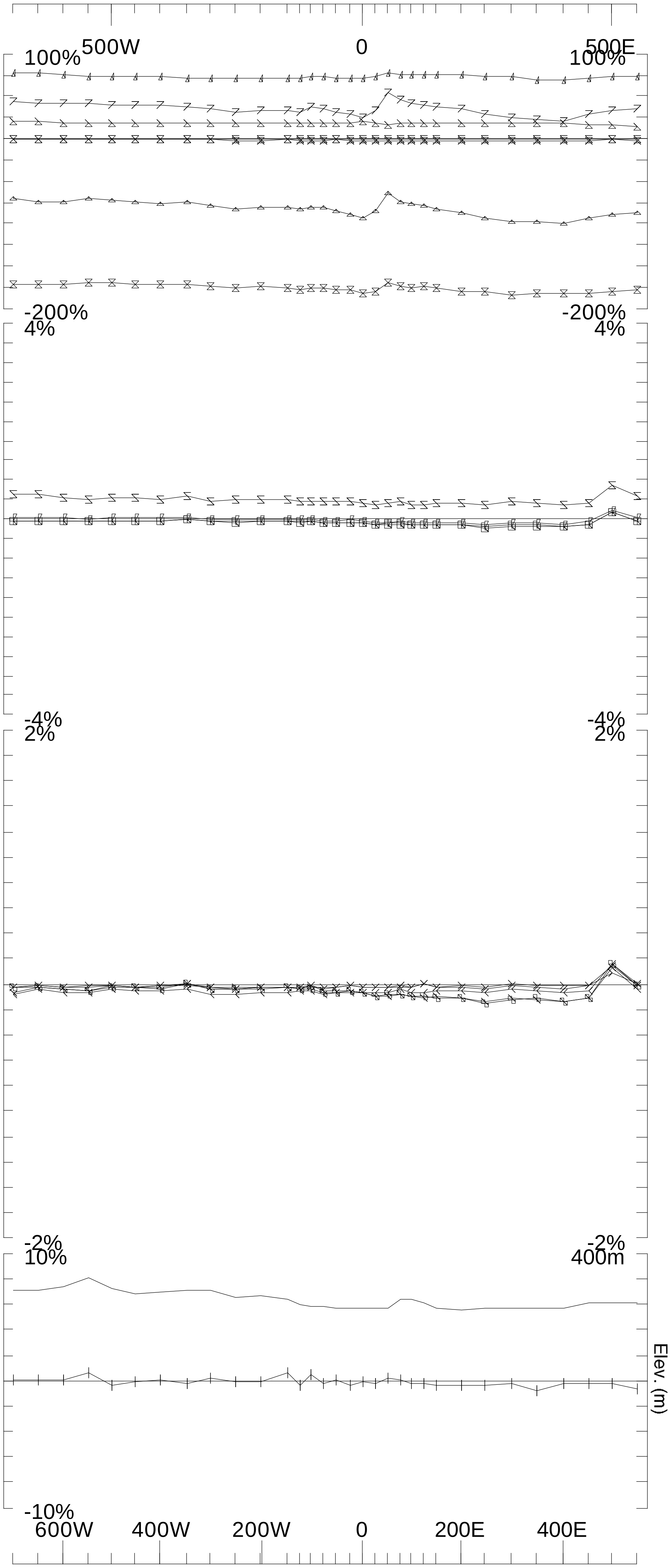
Secondary, (Chn - Ch0)/|Hp|
Contin. Norm at depth of 0 m
Base Freq. 4.090 Hz

UTEM Survey at: Ermatinger
For: Wallbridge

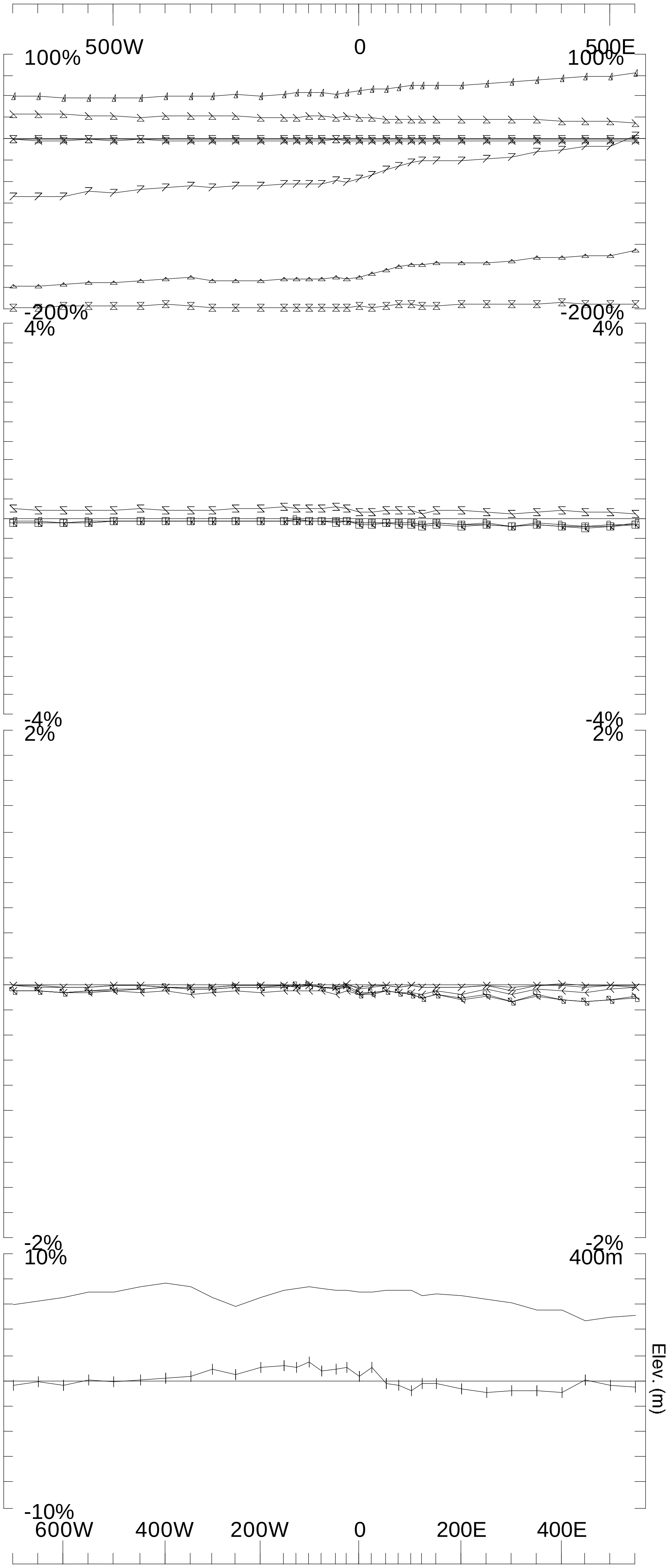
LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE

Job 1409

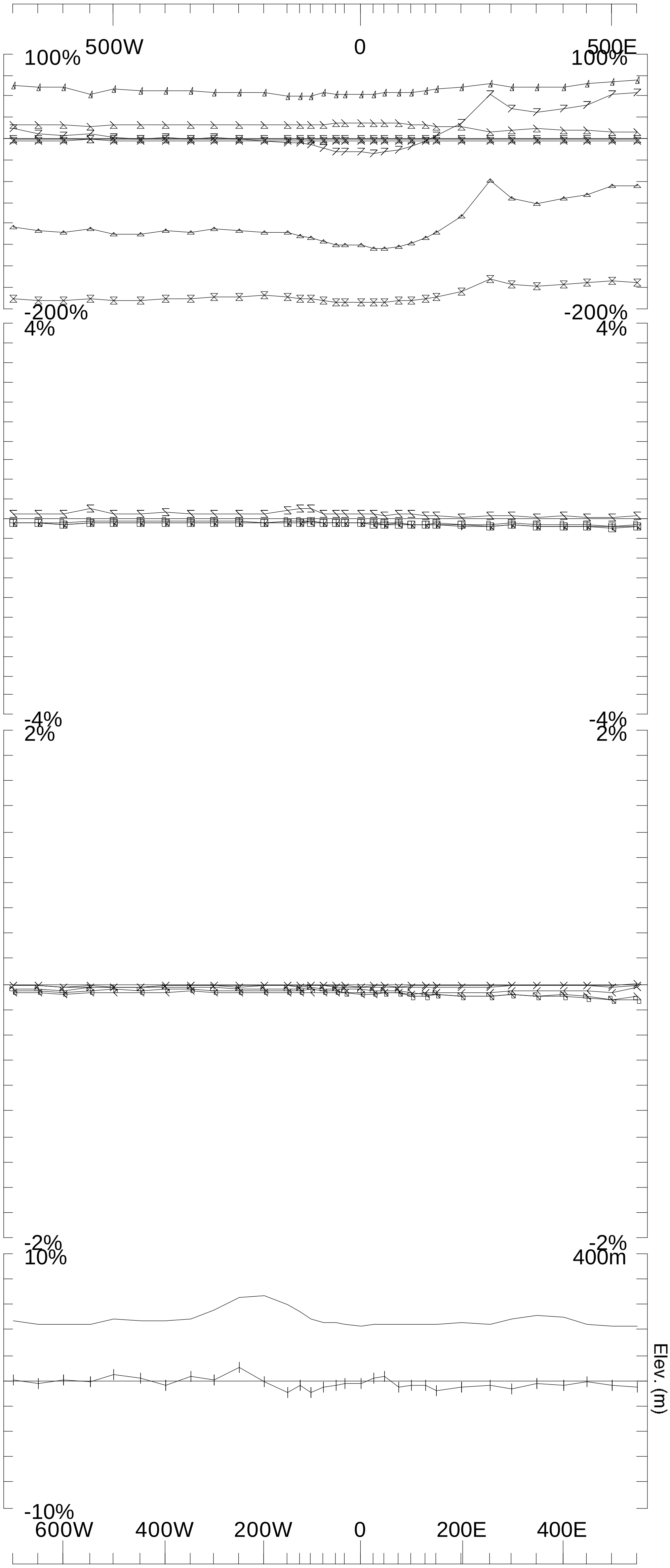
Plotted : 19/11/14



Loop: 1418S1	Secondary, (Chn - Ch0)/|Hp|	UTEM Survey at: Ermatinger
Line: 300N	Contin. Norm at depth of 0 m	For: Wallbridge
Compt: Hz	Base Freq. 4.090 Hz	LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE Job 1409 Plotted : 19/11/14



Loop: 1418S1	Secondary, (Chn - Ch0)/|Hp|	UTEM Survey at: Ermatinger
Line: 600N	Contin. Norm at depth of 0 m	For: Wallbridge
Compt: Hz	Base Freq. 4.090 Hz	LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE Job 1409 Plotted : 19/11/14



Loop: 1418S1
Line: 900N
Compt: Hz

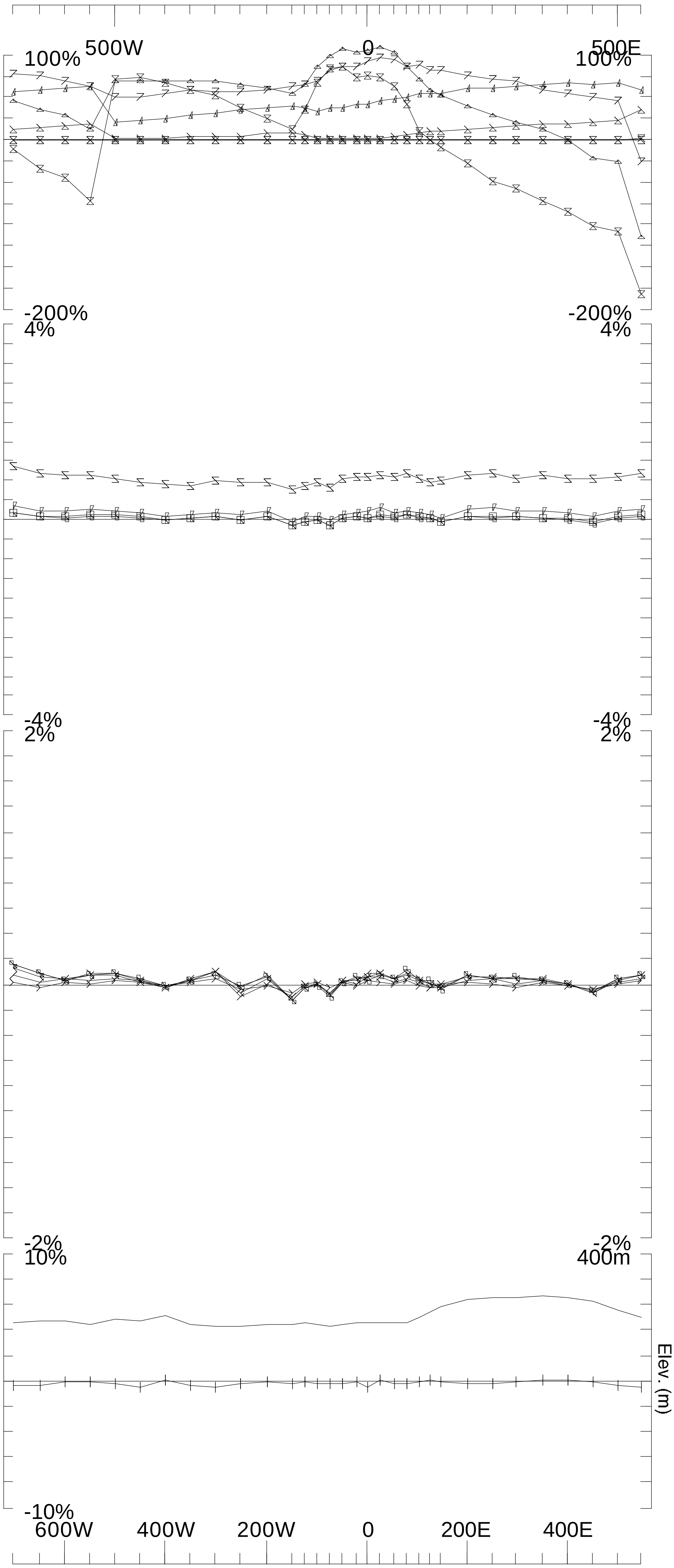
Secondary, (Chn - Ch0)/|Hp|
Contin. Norm at depth of 0 m
Base Freq. 4.090 Hz

UTEM Survey at: Ermatinger
For: Wallbridge

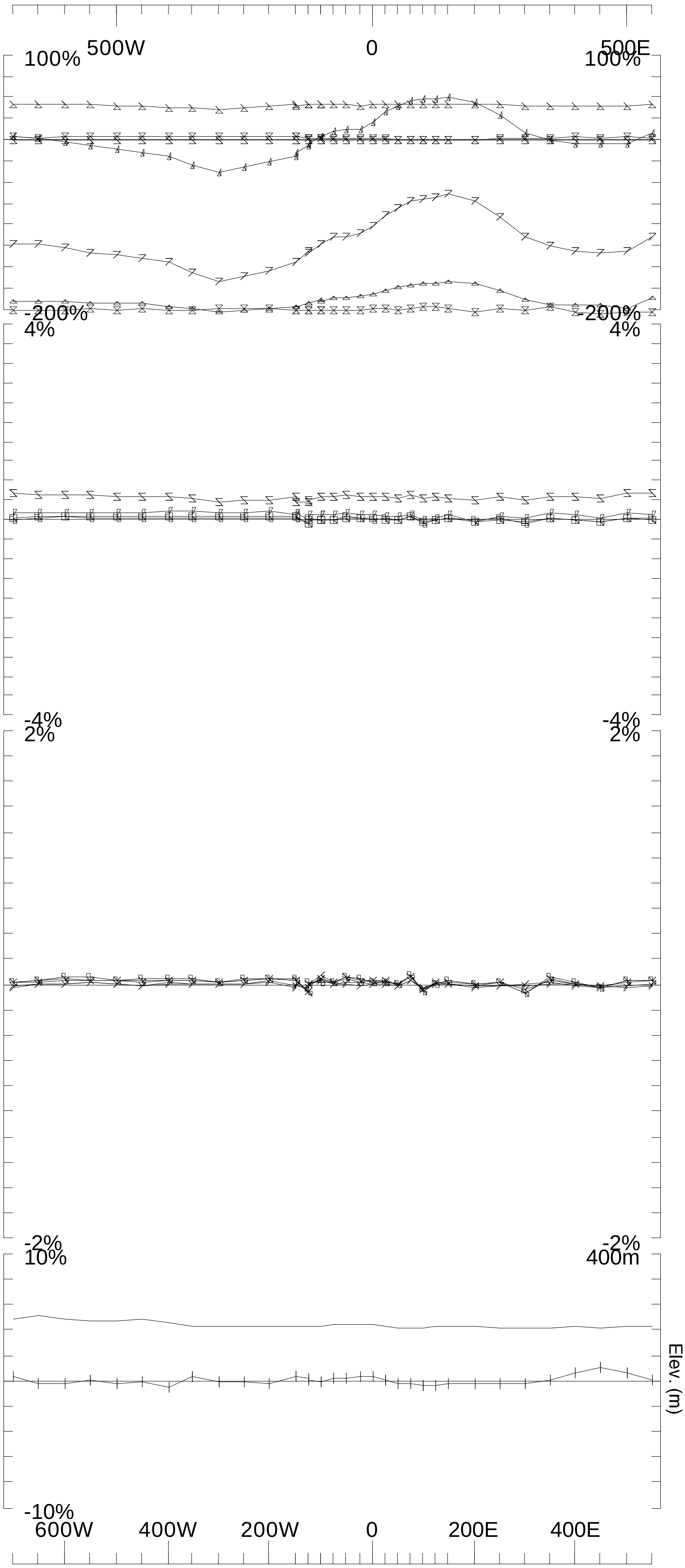
LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE

Job 1409

Plotted : 19/11/14



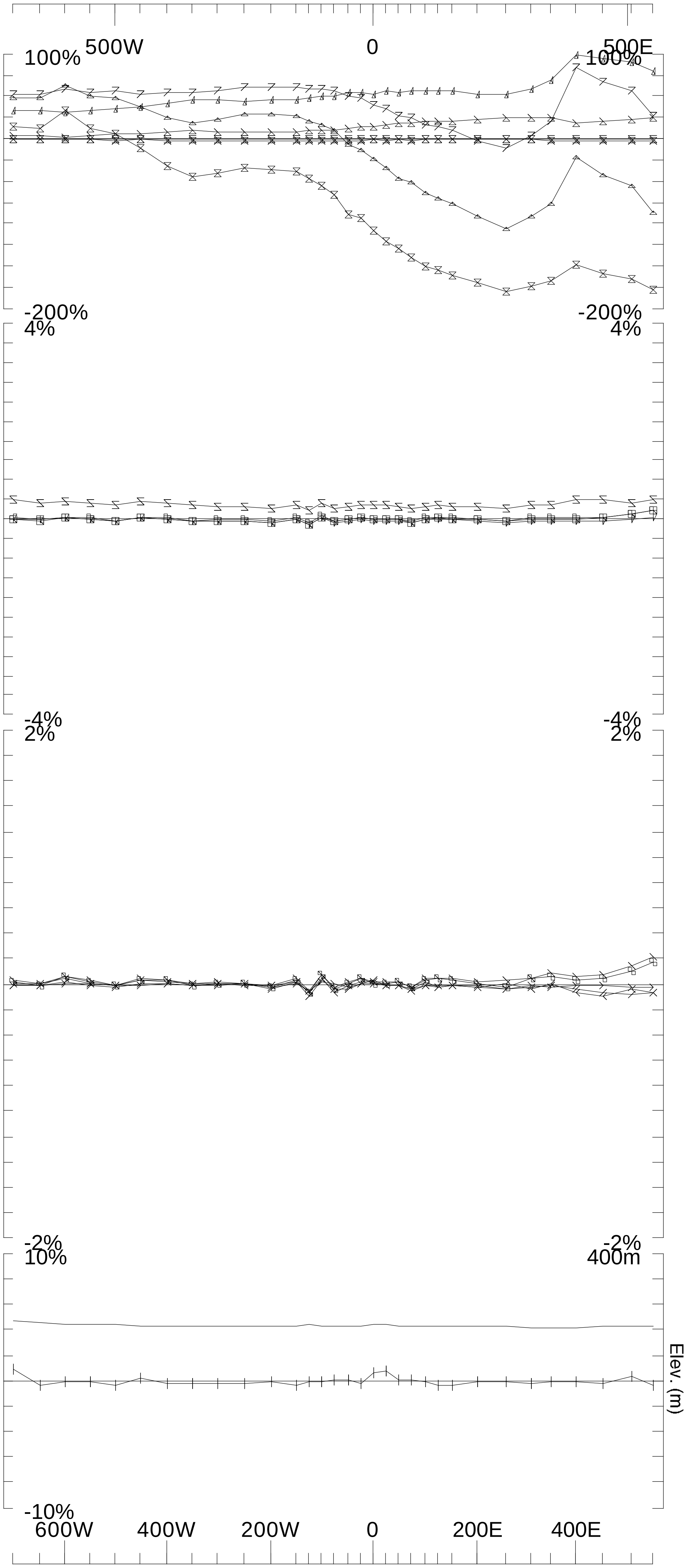
Loop: 1417S1	Secondary, (Chn - Ch0)/|Hp|	UTEM Survey at: Ermatinger
Line: 1200N	Contin. Norm at depth of 0 m	For: Wallbridge
Compt: Hz	Base Freq. 4.090 Hz	LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE Job 1409 Plotted : 19/11/14



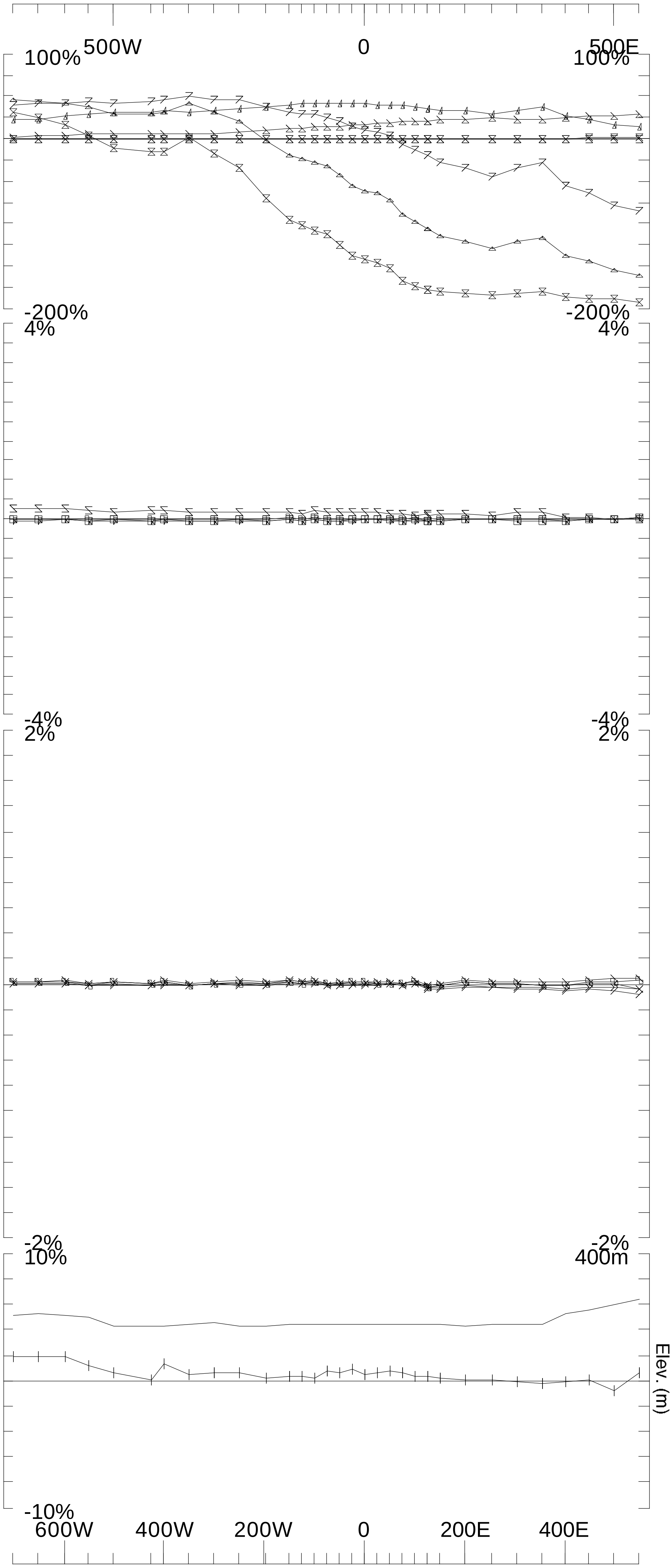
Loop: 1417S1 | Secondary, (Chn - Ch0)/|Hp| | UTEM Survey at: Ermatinger

Line: 1500N | Contin. Norm at depth of 0 m | For: Wallbridge

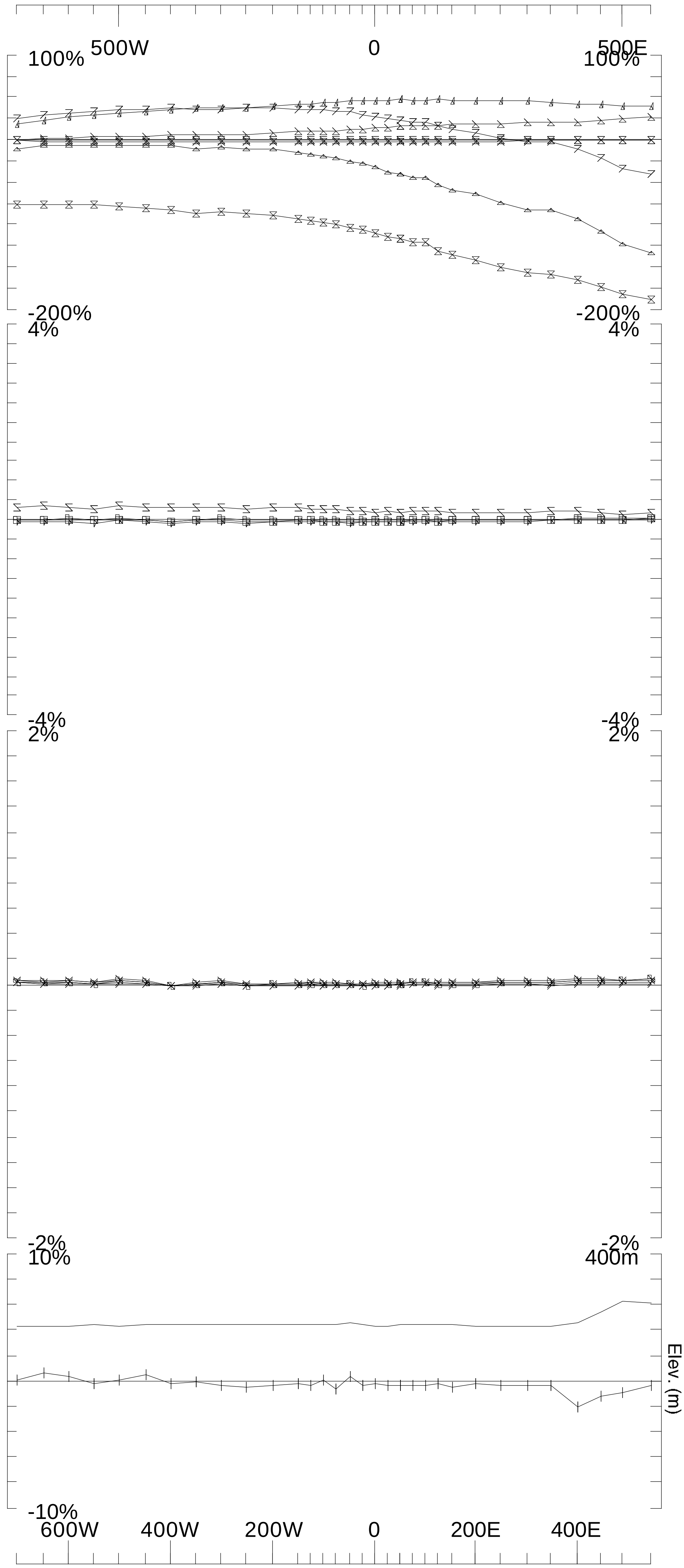
Compt: Hz | Base Freq. 4.090 Hz | LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE Job 1409 Plotted : 19/11/14



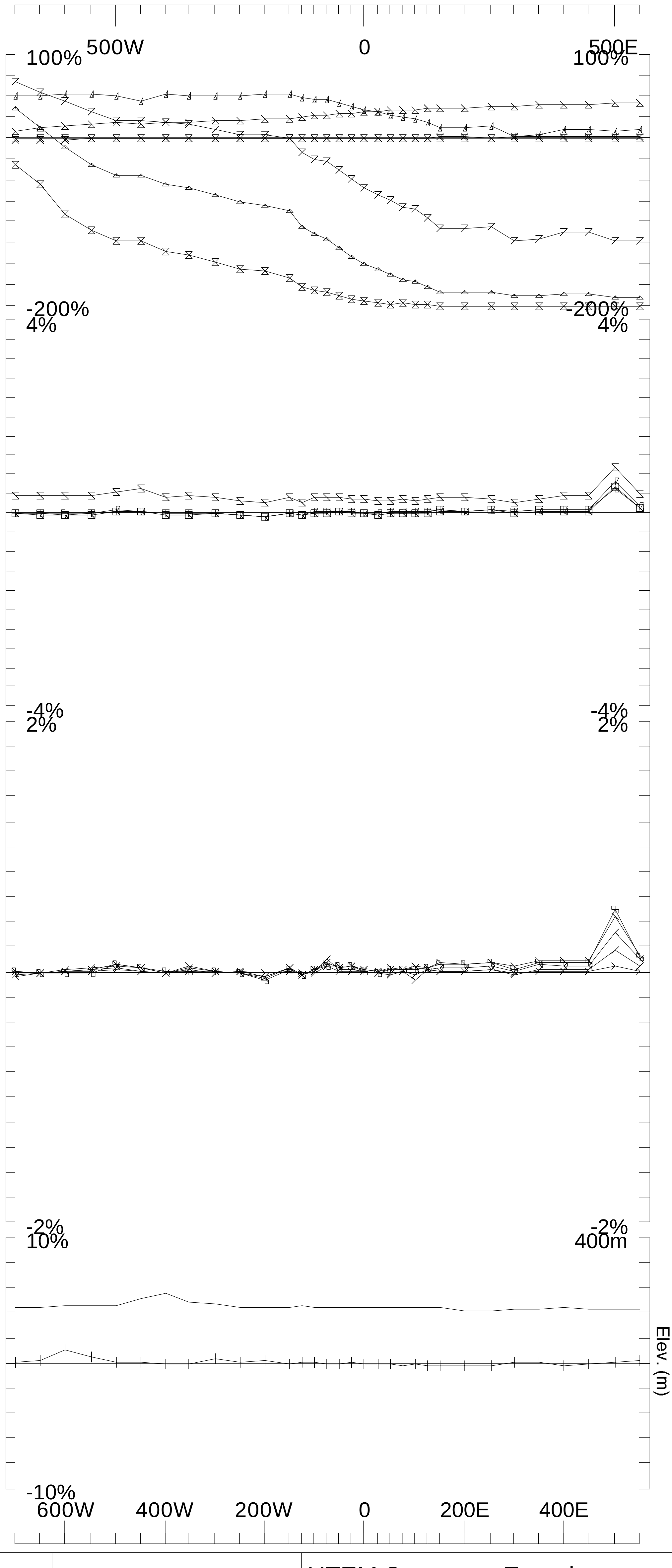
Loop: 1417S1	Secondary, (Chn - Ch0)/|Hp|	UTEM Survey at: Ermatinger
Line: 1800N	Contin. Norm at depth of 0 m	For: Wallbridge
Compt: Hz	Base Freq. 4.090 Hz	LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE Job 1409 Plotted : 19/11/14



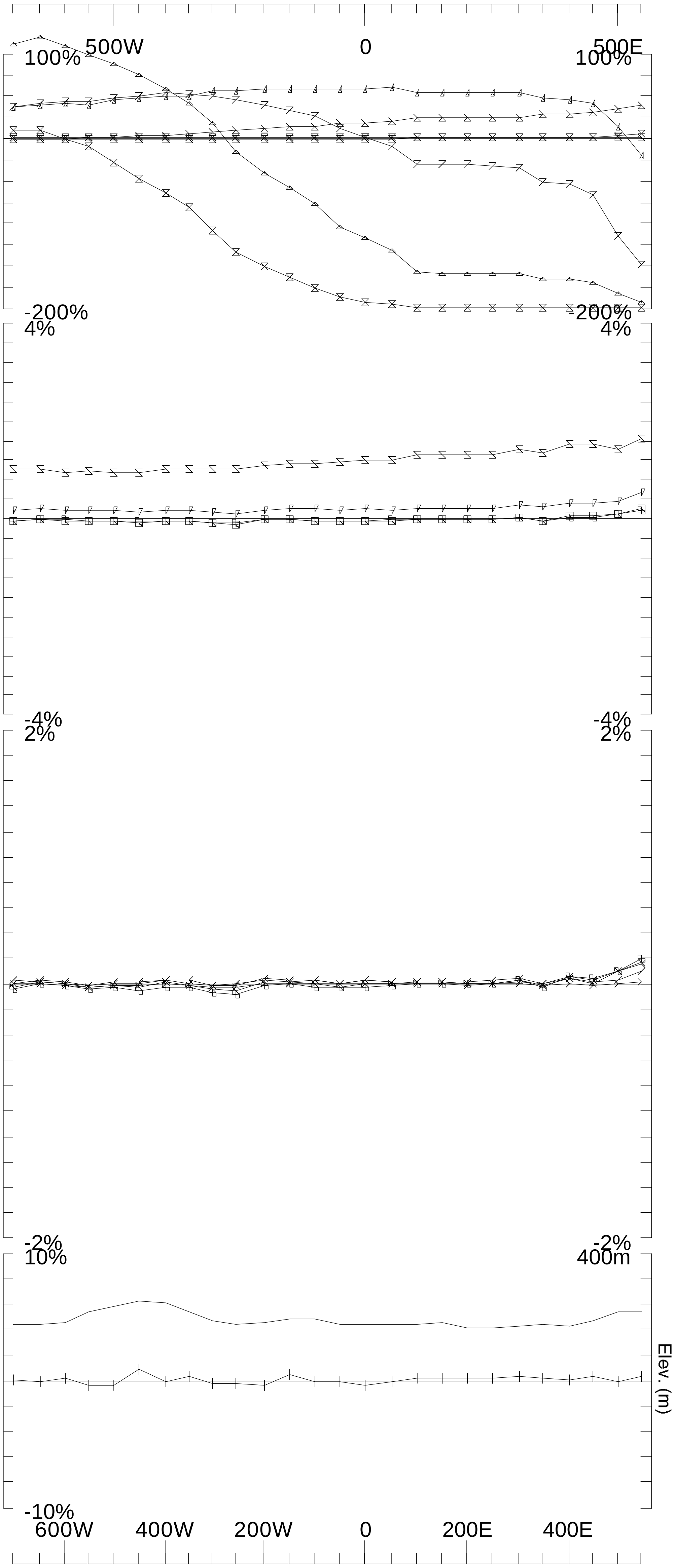
Loop: 1417S1	Secondary, (Chn - Ch0)/|Hp|	UTEM Survey at: Ermatinger
Line: 2100E	Contin. Norm at depth of 0 m	For: Wallbridge
Compt: Hz	Base Freq. 4.090 Hz	LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE Job 1409 Plotted : 26/4/15



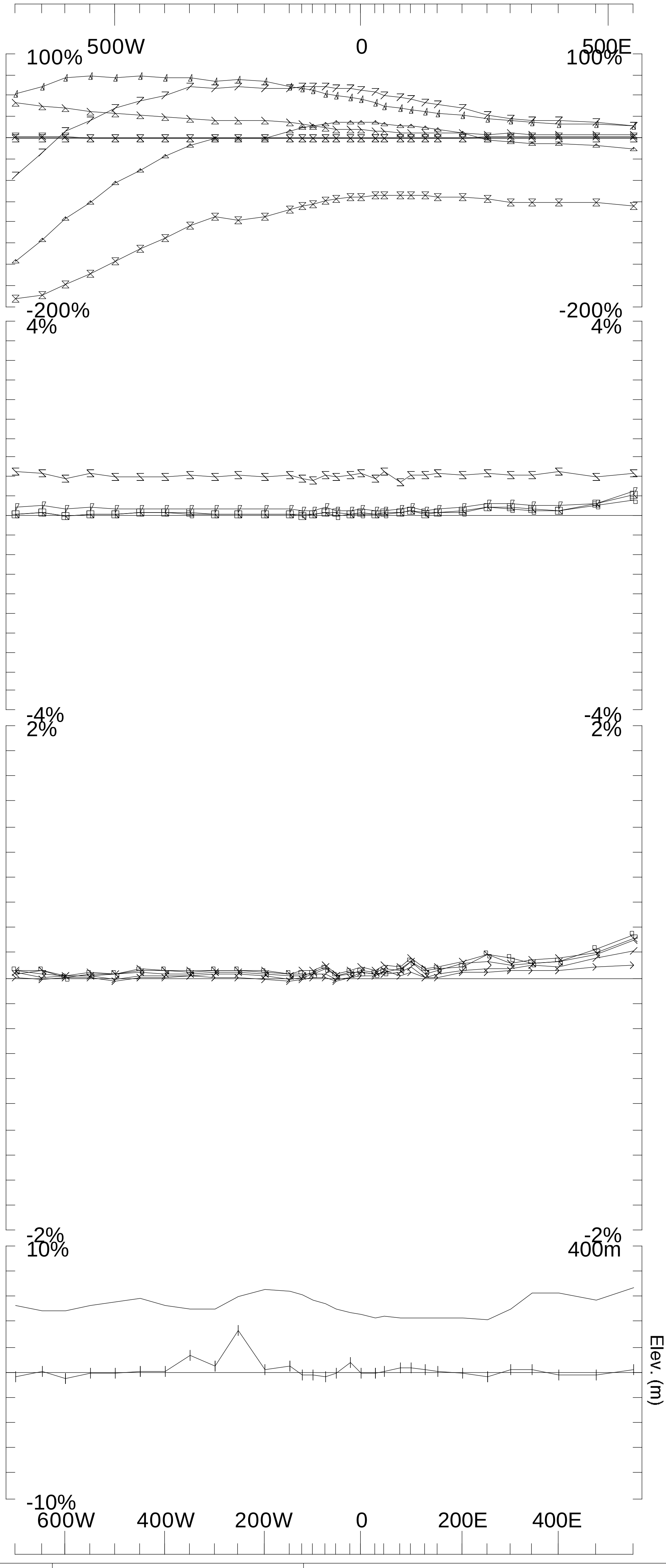
Loop: 1418S1	Secondary, (Chn - Ch0)/|Hp|	UTEM Survey at: Ermatinger
Line: 2400N	Contin. Norm at depth of 0 m	For: Wallbridge
Compt: Hz	Base Freq. 4.090 Hz	LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE Job 1409 Plotted : 19/11/14



Loop: 1418S1	Secondary, (Chn - Ch0)/|Hp|	UTEM Survey at: Ermatinger
Line: 2700N	Contin. Norm at depth of 0 m	For: Wallbridge
Compt: Hz	Base Freq. 4.090 Hz	LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE Job 1409 Plotted : 19/11/14



Loop: 1418S1	Secondary, (Chn - Ch0)/|Hp|	UTEM Survey at: Ermatinger
Line: 3000N	Contin. Norm at depth of 0 m	For: Wallbridge
Compt: Hz	Base Freq. 4.090 Hz	LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE Job 1409 Plotted : 19/11/14



Loop: 1418S1	Secondary, (Chn - Ch0)/|Hp|	UTEM Survey at: Ermatinger
Line: 3300N	Contin. Norm at depth of 0 m	For: Wallbridge
Compt: Hz	Base Freq. 4.090 Hz	LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE Job 1409 Plotted : 19/11/14

Ermatinger Grid

Loop 1418/1417/1418

Hx

4.090Hz frequency

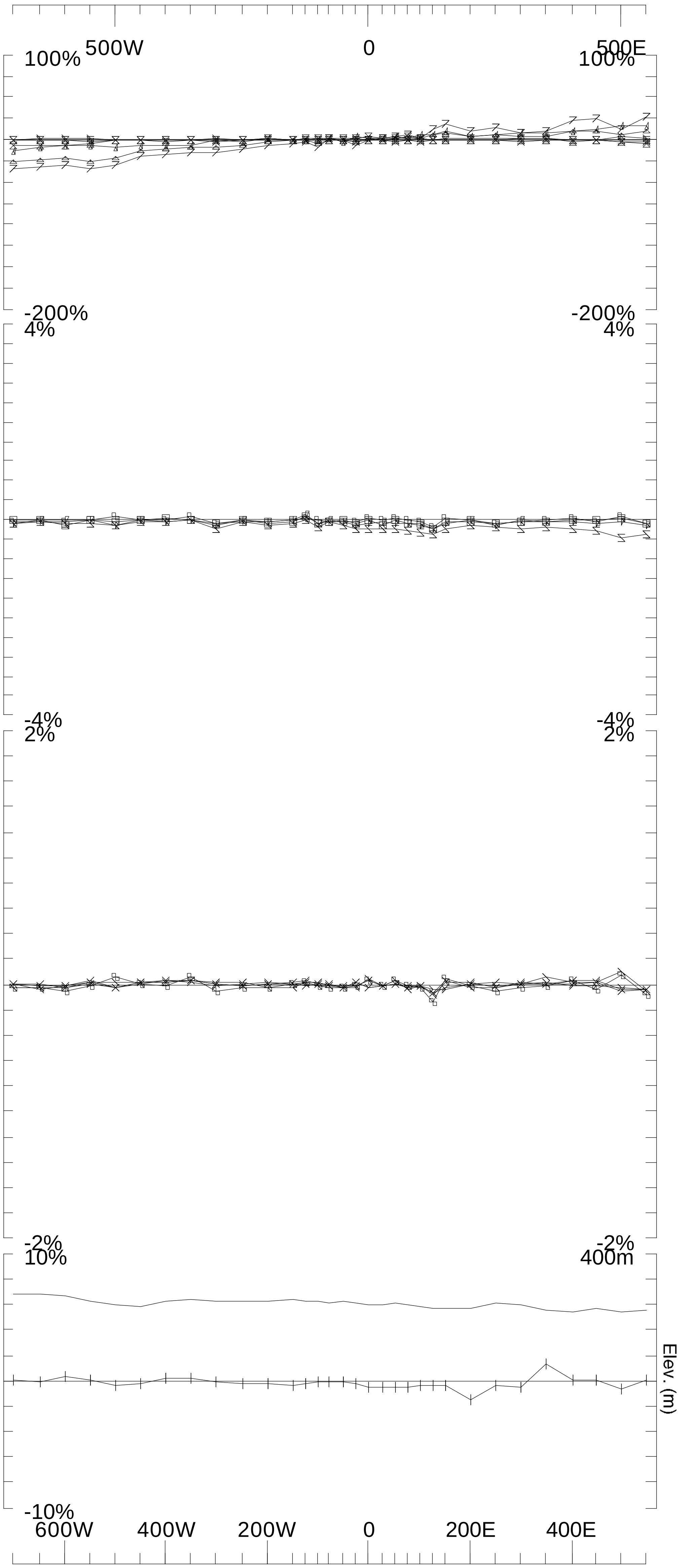
continuous norm

12Ch - Ch0 reduced

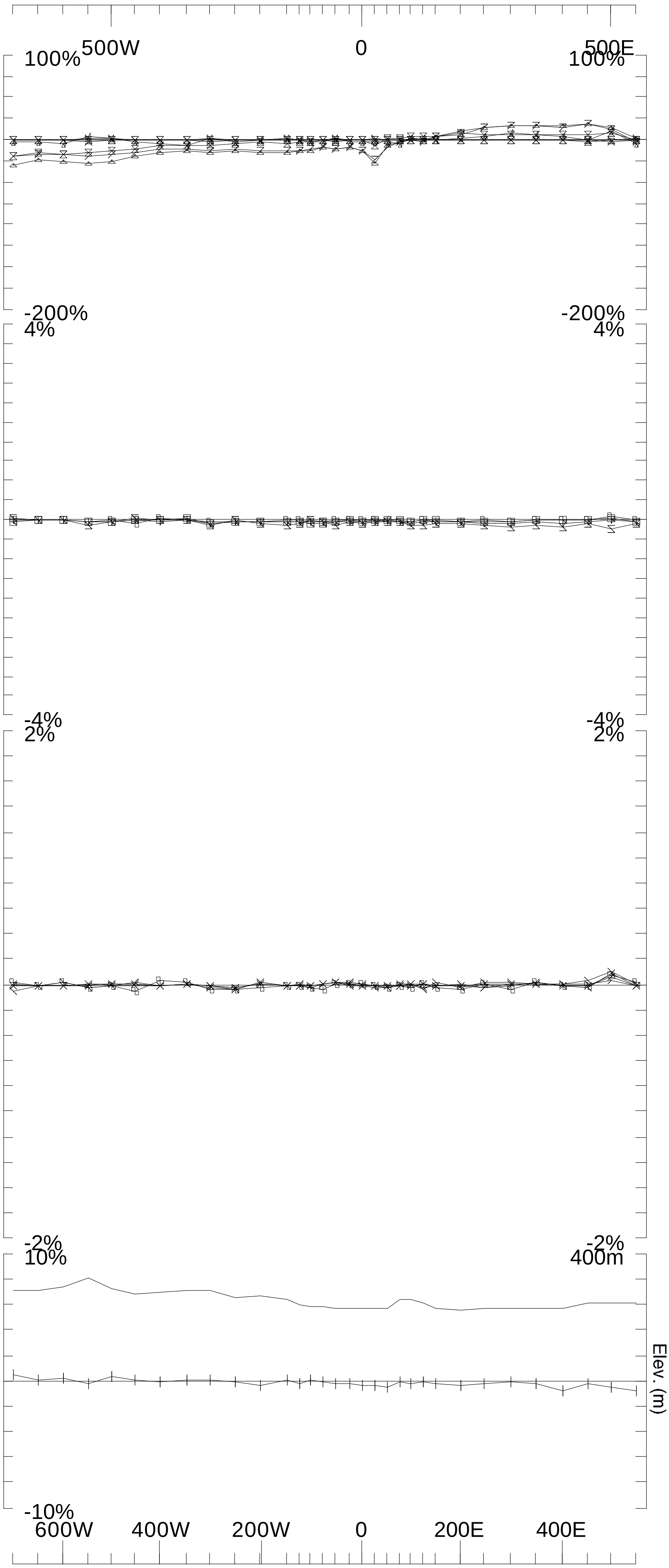
Loop 1418/1417/1418 @4.090Hz

Loop 1418	Line 000	700W - 550E	1250m	Hz/Hx/Hy
(@ 4.090Hz)	Line 300N	700W - 550E	1250m	Hz/Hx/Hy
	Line 600N	700W - 550E	1250m	Hz/Hx/Hy
	Line 900N	700W - 550E	1250m	Hz/Hx/Hy
Loop 1417	Line 1200N	700W - 550E	1250m	Hz/Hx/Hy
	Line 1500N	700W - 550E	1250m	Hz/Hx/Hy
	Line 1800N	700W - 550E	1250m	Hz/Hx/Hy
	Line 2100N	700W - 550E	1250m	Hz/Hx/Hy
Loop 1418	Line 2400N	700W - 550E	1250m	Hz/Hx/Hy
	Line 2700N	700W - 550E	1250m	Hz/Hx/Hy
	Line 3000N	700W - 550E	1250m	Hz/Hx/Hy
	Line 3300N	700W - 550E	1250m	Hz/Hx/Hy

Loop 1418/1417/1418 - Hx



Loop: 1418S1	Secondary, (Chn - Ch0)/|Hp|	UTEM Survey at: Ermatinger
Line: 000	Contin. Norm at depth of 0 m	For: Wallbridge
Compt: Hx	Base Freq. 4.090 Hz	LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE Job 1409 Plotted : 19/11/14



Loop: 1418S1
Line: 300N
Compt: Hx

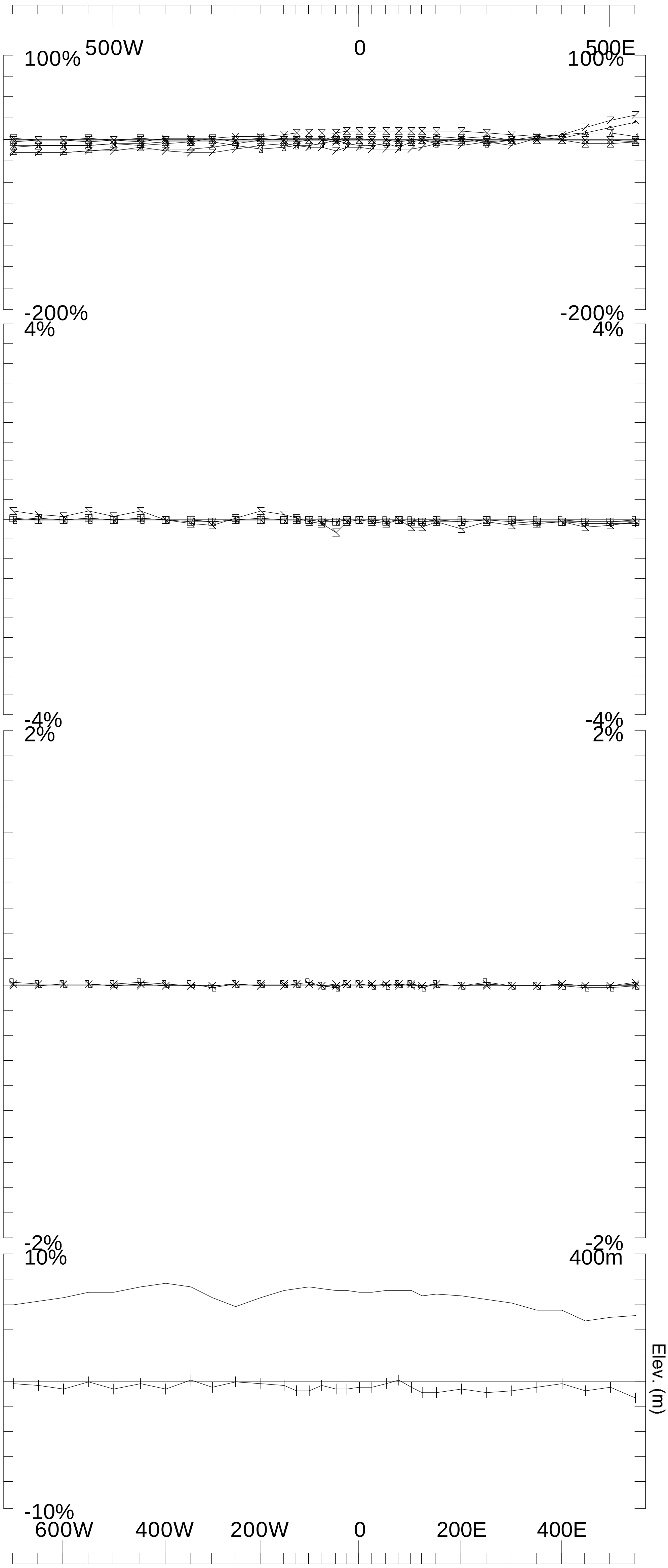
Secondary, (Chn - Ch0)/|Hp|
Contin. Norm at depth of 0 m
Base Freq. 4.090 Hz

UTEM Survey at: Ermatinger
For: Wallbridge

LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE

Job 1409

Plotted : 19/11/14



Loop: 1418S1
Line: 600N
Compt: Hx

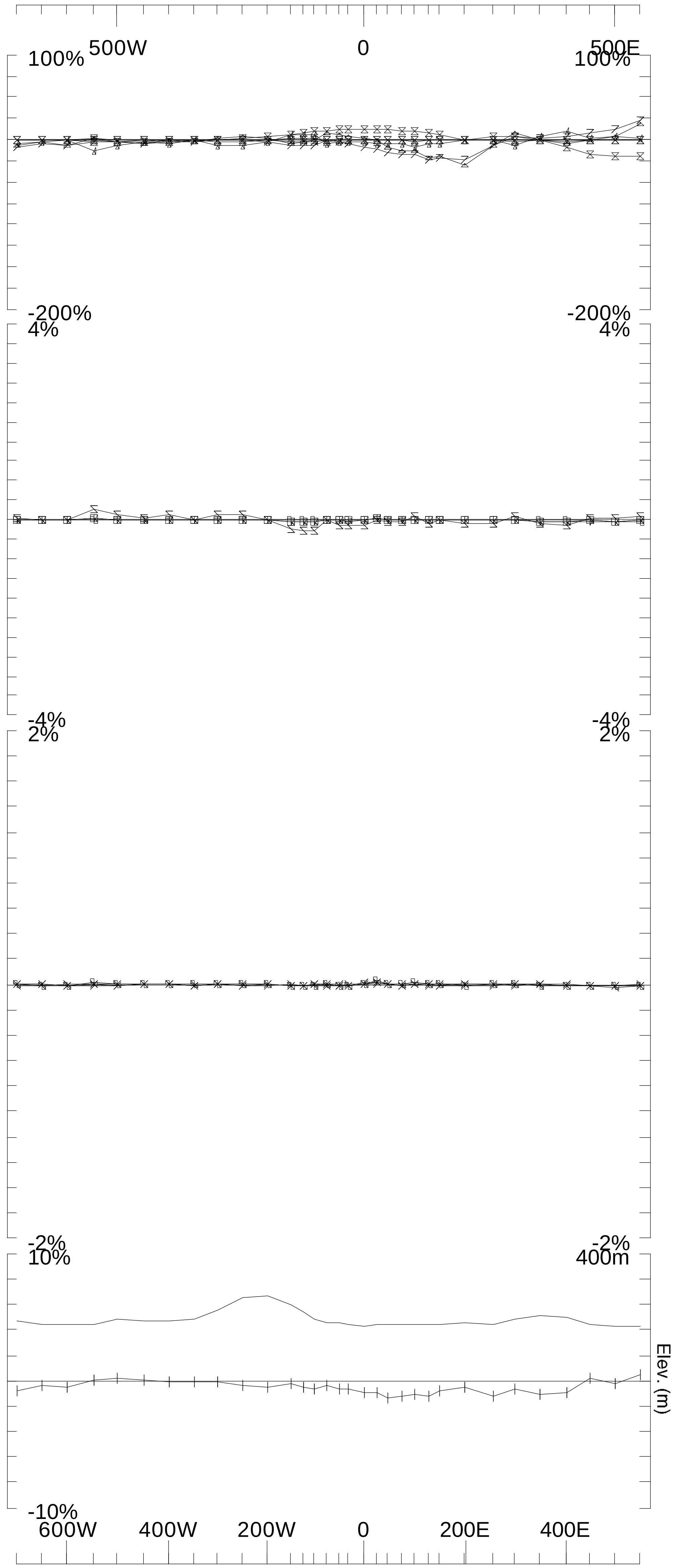
Secondary, (Chn - Ch0)/|Hp|
Contin. Norm at depth of 0 m
Base Freq. 4.090 Hz

UTEM Survey at: Ermatinger
For: Wallbridge

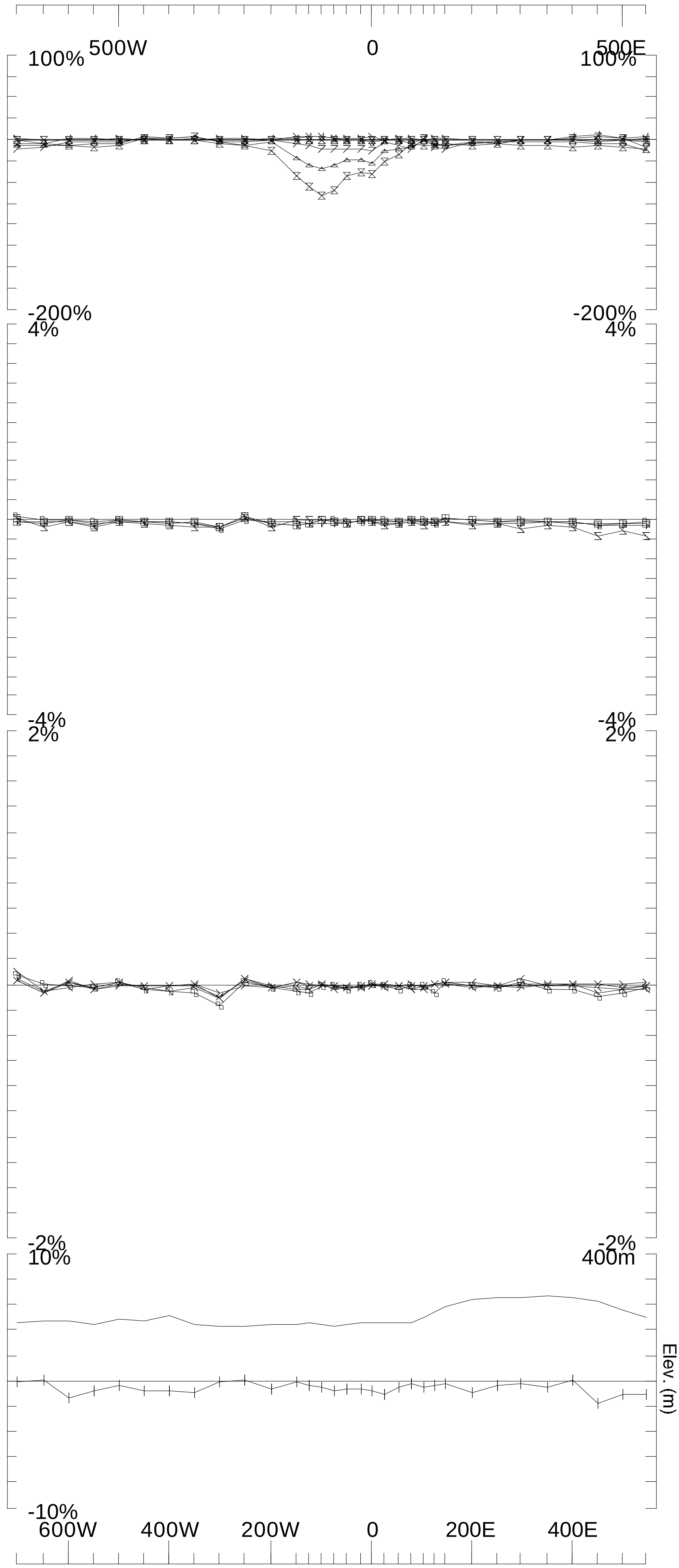
LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE

Job 1409

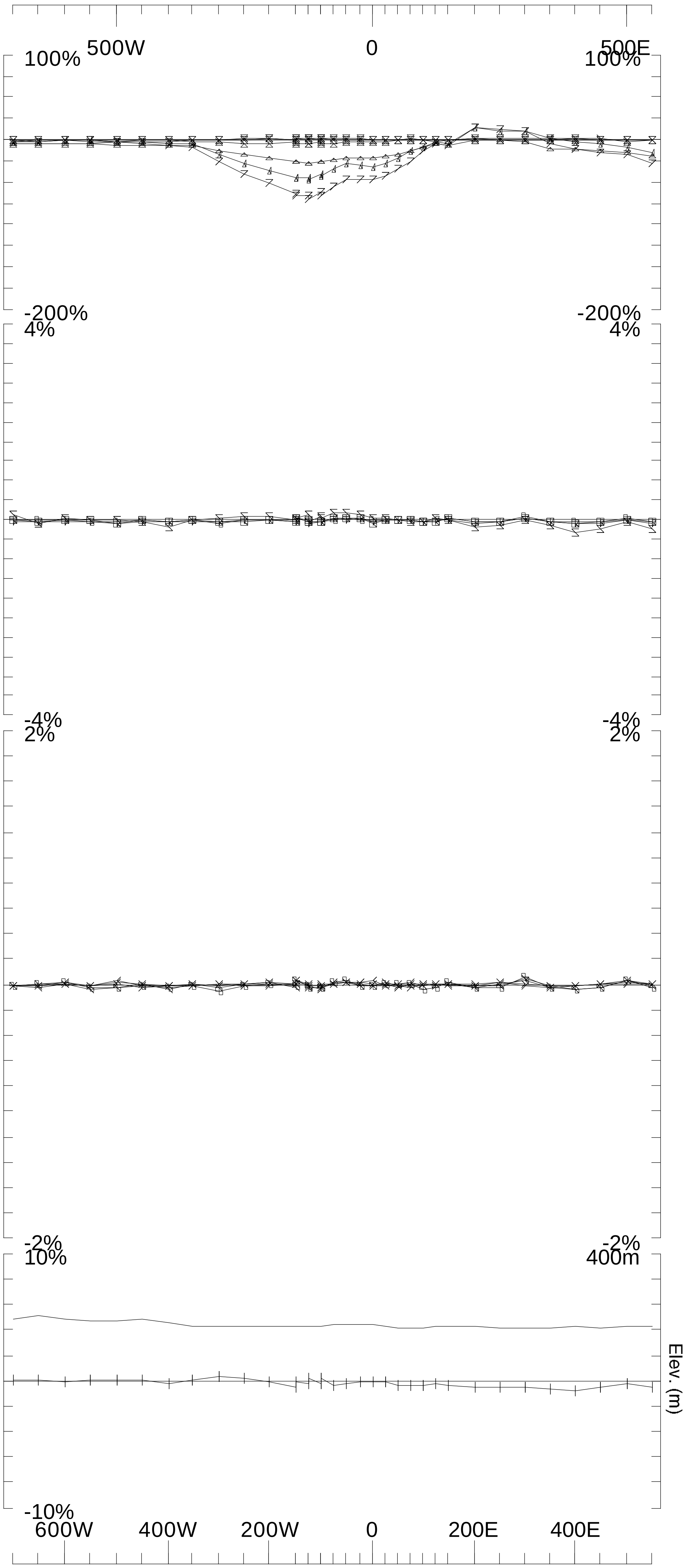
Plotted : 19/11/14



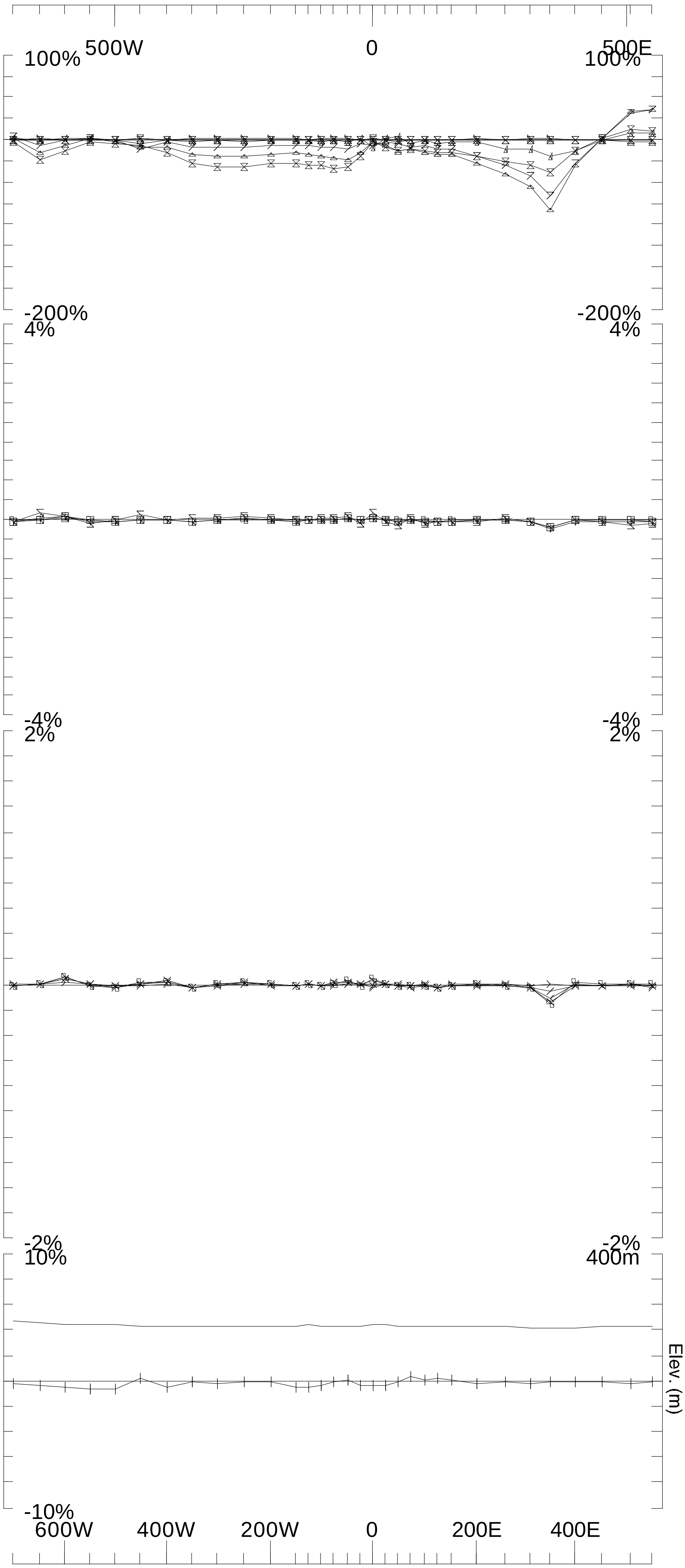
Loop: 1418S1	Secondary, (Chn - Ch0)/|Hp|	UTEM Survey at: Ermatinger
Line: 900N	Contin. Norm at depth of 0 m	For: Wallbridge
Compt: Hx	Base Freq. 4.090 Hz	LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE Job 1409 Plotted : 19/11/14



Loop: 1417S1	Secondary, (Chn - Ch0)/|Hp|	UTEM Survey at: Ermatinger
Line: 1200N	Contin. Norm at depth of 0 m	For: Wallbridge
Compt: Hx	Base Freq. 4.090 Hz	LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE Job 1409 Plotted : 19/11/14



Loop: 1417S1	Secondary, (Chn - Ch0)/|Hp|	UTEM Survey at: Ermatinger
Line: 1500N	Contin. Norm at depth of 0 m	For: Wallbridge
Compt: Hx	Base Freq. 4.090 Hz	LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE Job 1409 Plotted : 19/11/14



Loop: 1417S1
Line: 1800N
Compt: Hx

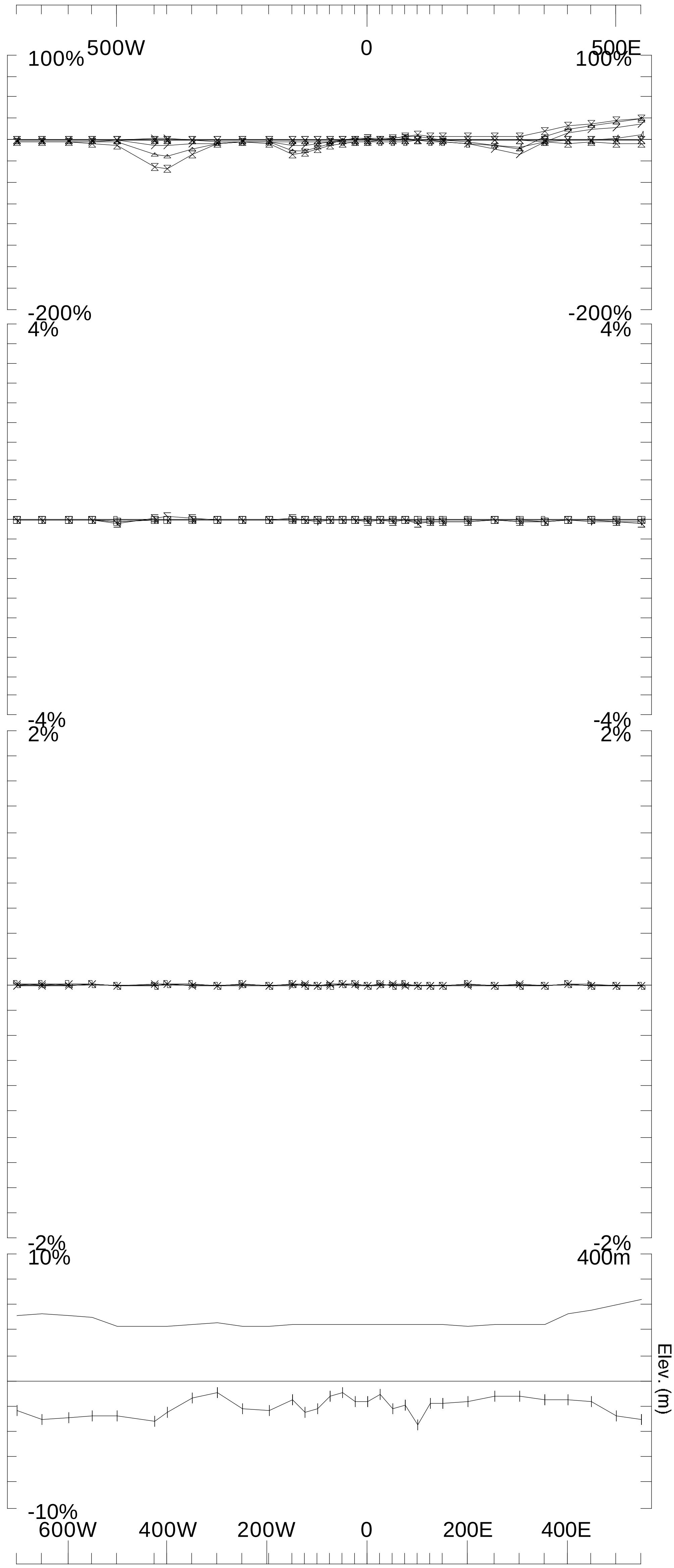
Secondary, (Chn - Ch0)/|Hp|
Contin. Norm at depth of 0 m
Base Freq. 4.090 Hz

UTEM Survey at: Ermatinger
For: Wallbridge

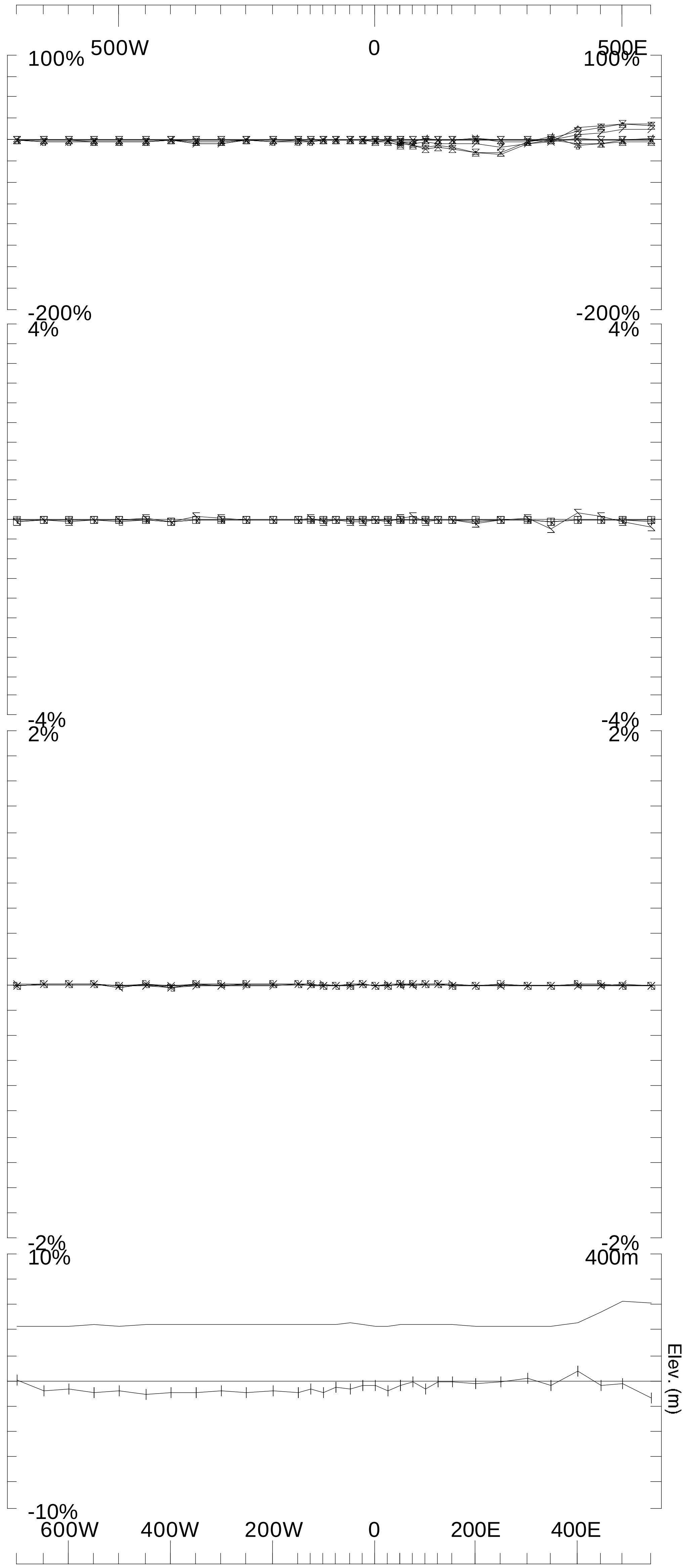
LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE

Job 1409

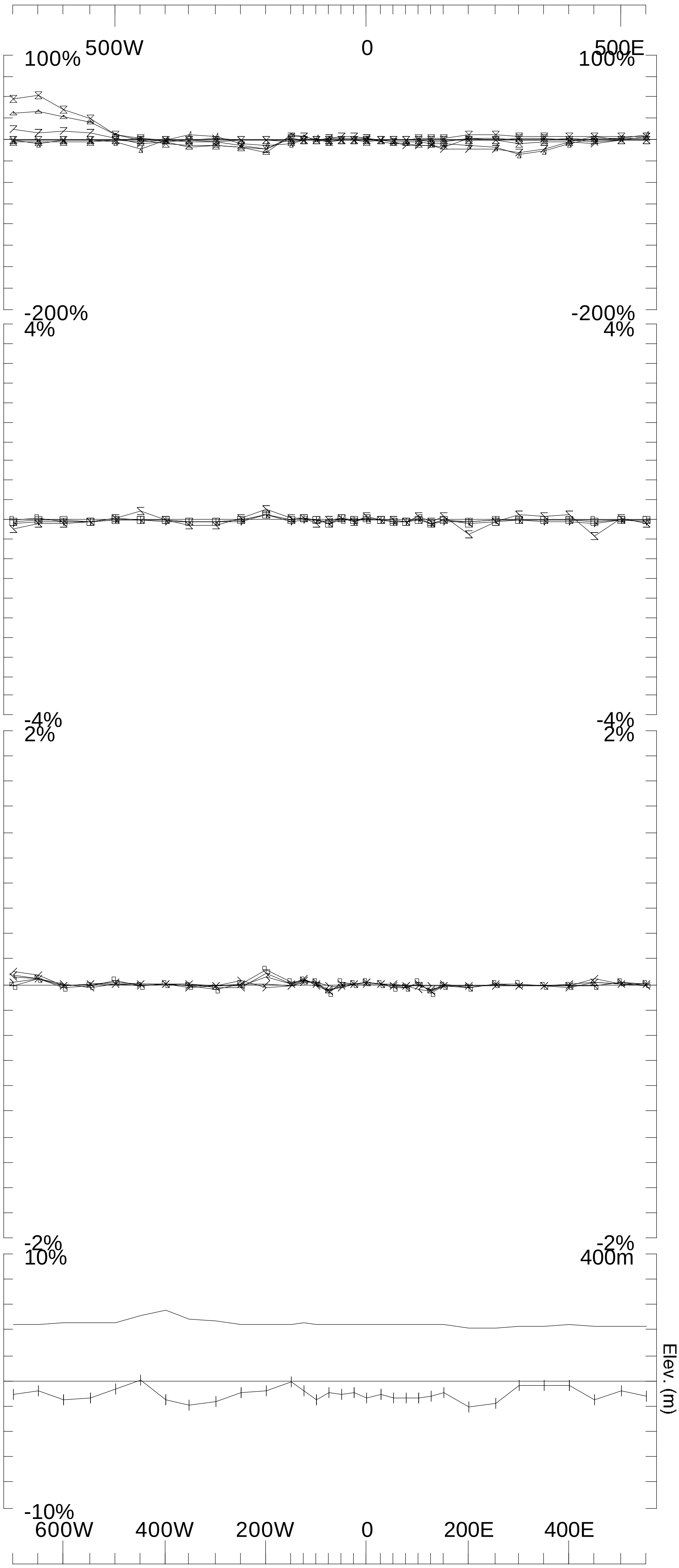
Plotted : 19/11/14



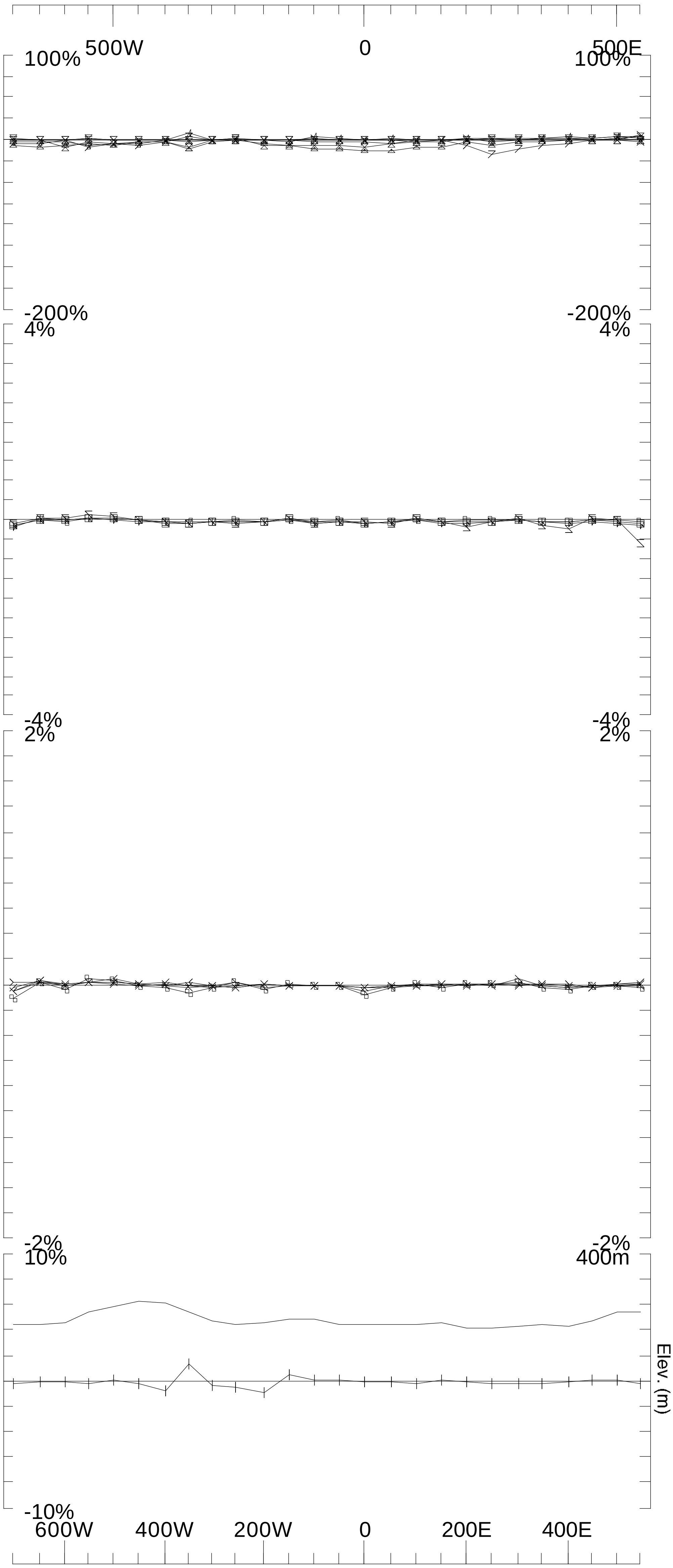
Loop: 1417S1	Secondary, (Chn - Ch0)/|Hp|	UTEM Survey at: Ermatinger
Line: 2100E	Contin. Norm at depth of 0 m	For: Wallbridge
Compt: Hx	Base Freq. 4.090 Hz	LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE Job 1409 Plotted : 26/4/15



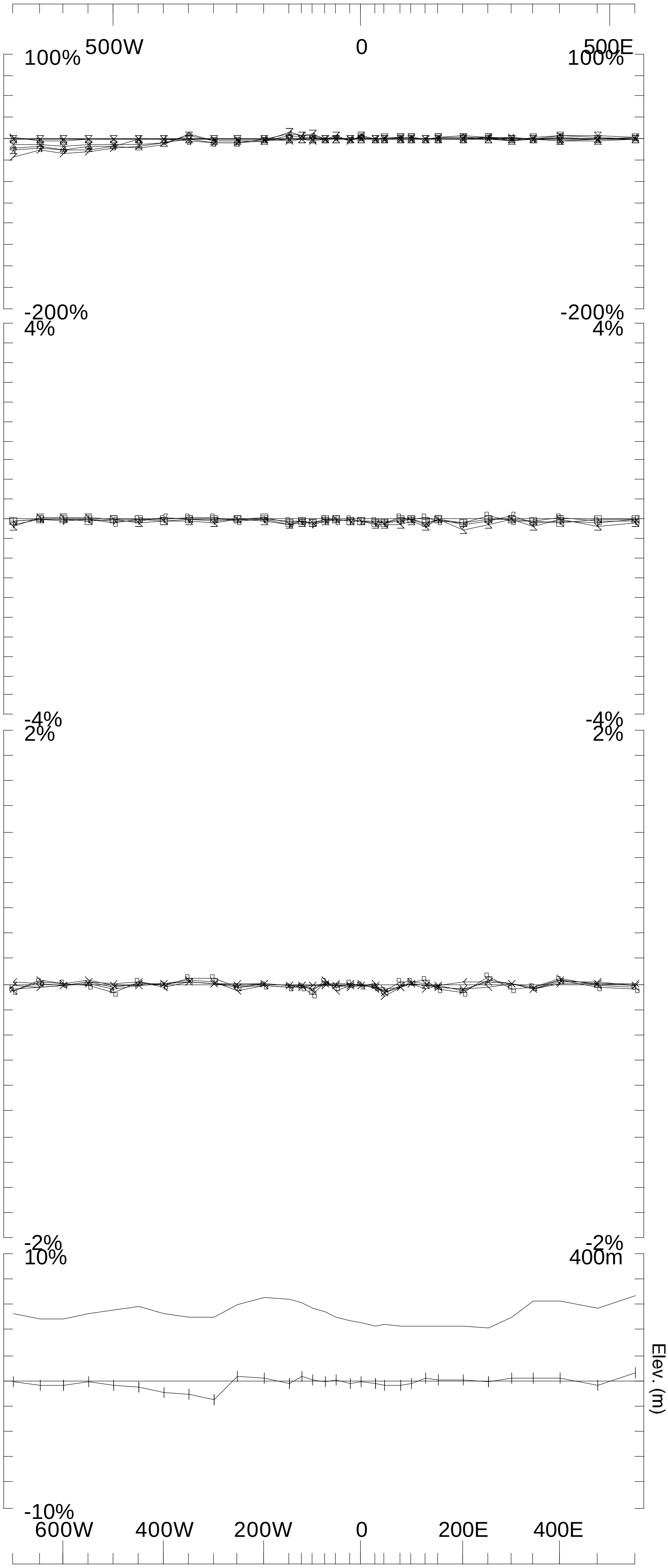
Loop: 1418S1	Secondary, (Chn - Ch0)/|Hp|	UTEM Survey at: Ermatinger
Line: 2400N	Contin. Norm at depth of 0 m	For: Wallbridge
Compt: Hx	Base Freq. 4.090 Hz	LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE Job 1409 Plotted : 19/11/14



Loop: 1418S1	Secondary, (Chn - Ch0)/|Hp|	UTEM Survey at: Ermatinger
Line: 2700N	Contin. Norm at depth of 0 m	For: Wallbridge
Compt: Hx	Base Freq. 4.090 Hz	LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE Job 1409 Plotted : 19/11/14



Loop: 1418S1	Secondary, (Chn - Ch0)/|Hp|	UTEM Survey at: Ermatinger
Line: 3000N	Contin. Norm at depth of 0 m	For: Wallbridge
Compt: Hx	Base Freq. 4.090 Hz	LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE Job 1409 Plotted : 19/11/14



Loop: 1418S1	Secondary, (Chn - Ch0)/|Hp|	UTEM Survey at: Ermatinger
Line: 3300N	Contin. Norm at depth of 0 m	For: Wallbridge
Compt: Hx	Base Freq. 4.090 Hz	LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE Job 1409 Plotted : 19/11/14

Ermatinger Grid

Loop 1418/1417/1418

Hy

4.090Hz frequency

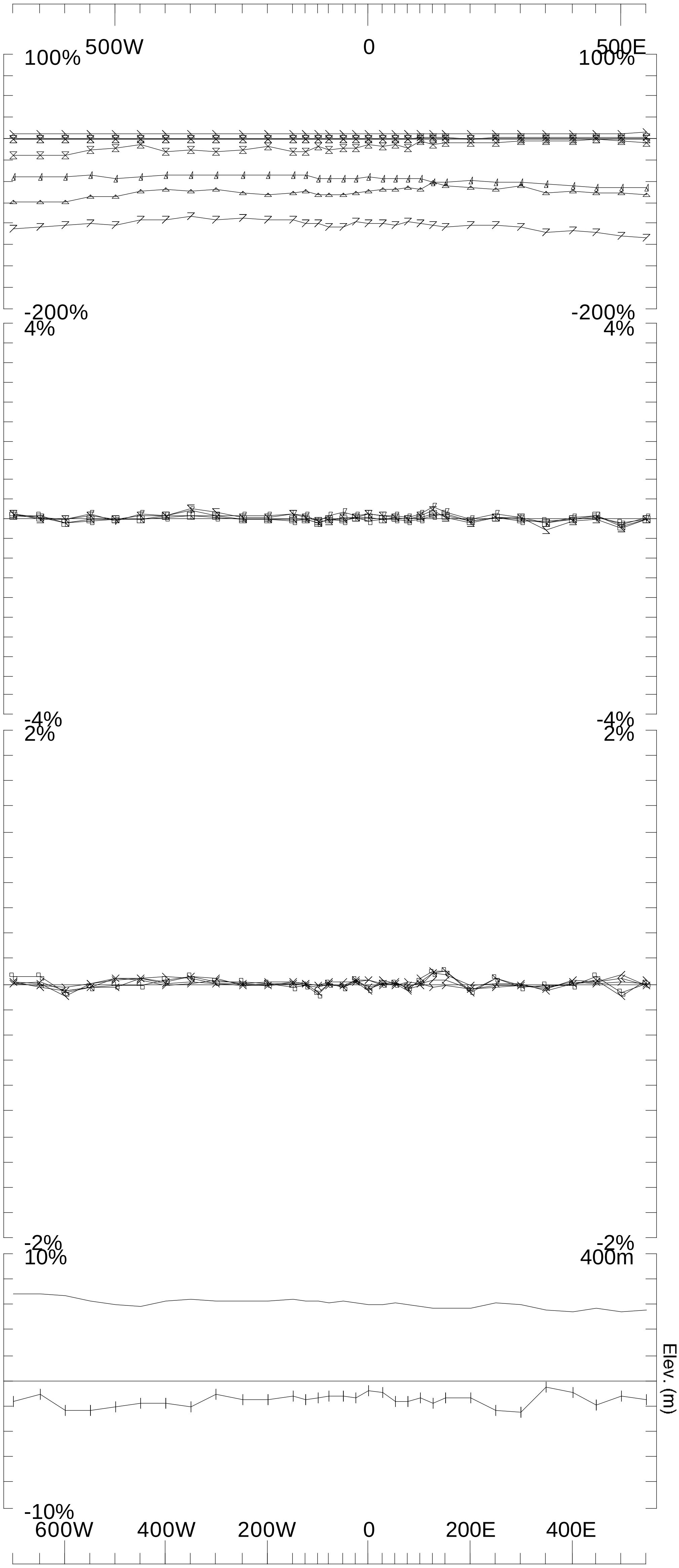
continuous norm

12Ch - Ch0 reduced

Loop 1418/1417/1418 @4.090Hz

Loop 1418	Line 000	700W - 550E	1250m	Hz/Hx/Hy
(@ 4.090Hz)	Line 300N	700W - 550E	1250m	Hz/Hx/Hy
	Line 600N	700W - 550E	1250m	Hz/Hx/Hy
	Line 900N	700W - 550E	1250m	Hz/Hx/Hy
Loop 1417	Line 1200N	700W - 550E	1250m	Hz/Hx/Hy
	Line 1500N	700W - 550E	1250m	Hz/Hx/Hy
	Line 1800N	700W - 550E	1250m	Hz/Hx/Hy
	Line 2100N	700W - 550E	1250m	Hz/Hx/Hy
Loop 1418	Line 2400N	700W - 550E	1250m	Hz/Hx/Hy
	Line 2700N	700W - 550E	1250m	Hz/Hx/Hy
	Line 3000N	700W - 550E	1250m	Hz/Hx/Hy
	Line 3300N	700W - 550E	1250m	Hz/Hx/Hy

Loop 1418/1417/1418 - Hy



Loop: 1418S1
Line: 000
Compt: Hy

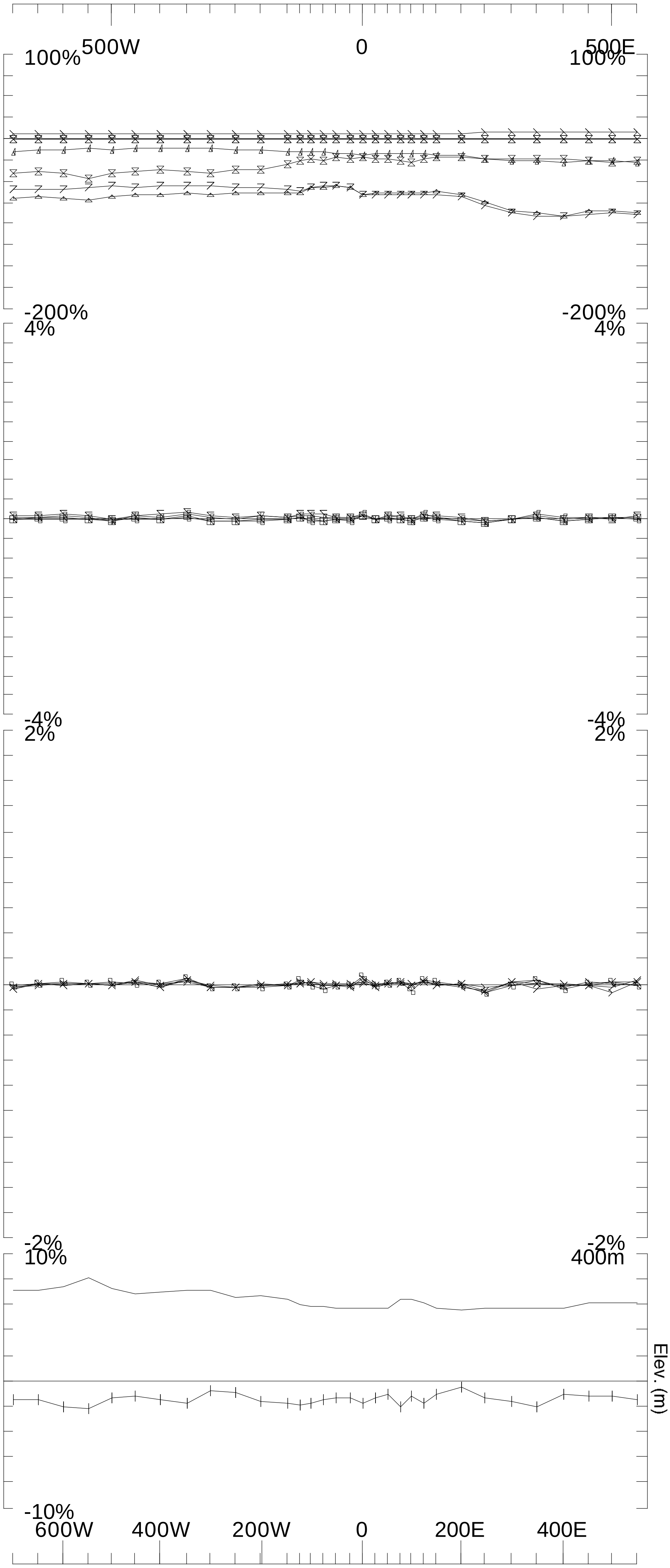
Secondary, (Chn - Ch0)/|Hp|
Contin. Norm at depth of 0 m
Base Freq. 4.090 Hz

UTEM Survey at: Ermatinger
For: Wallbridge

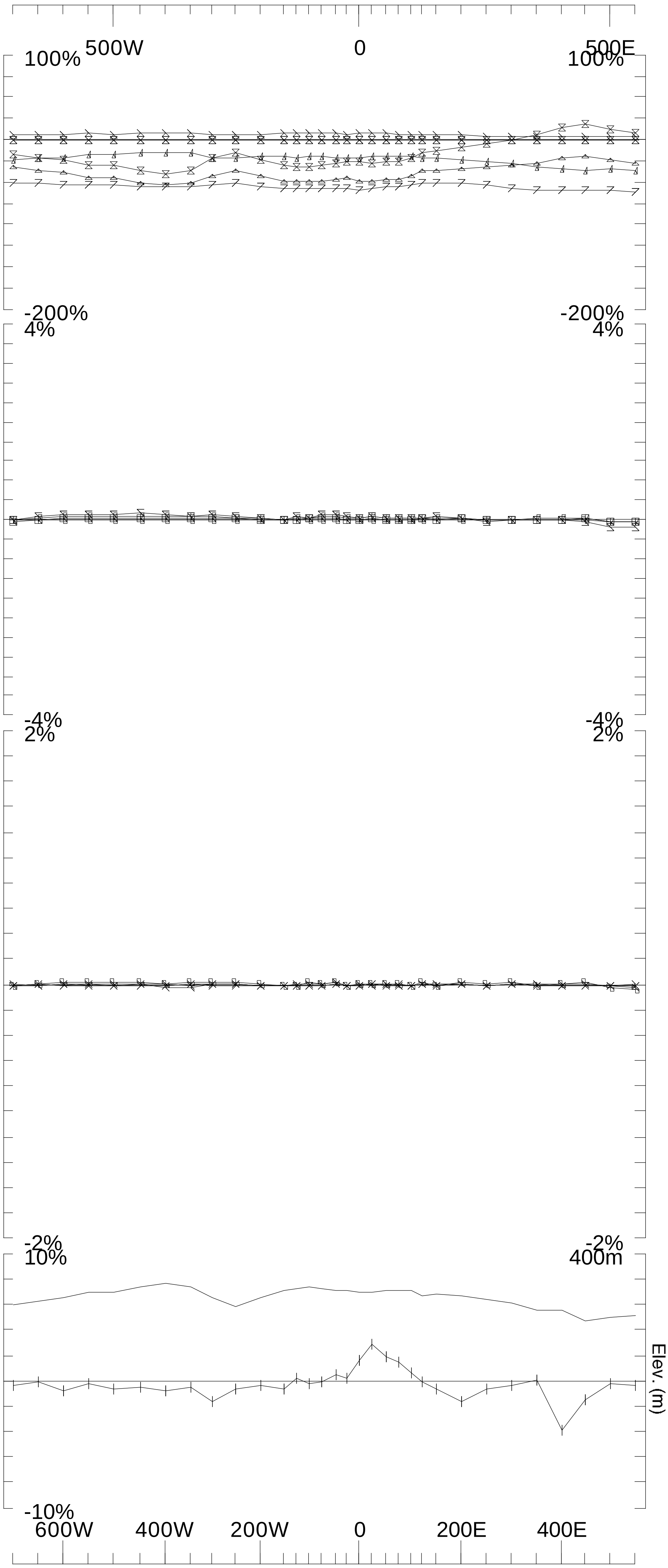
LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE

Job 1409

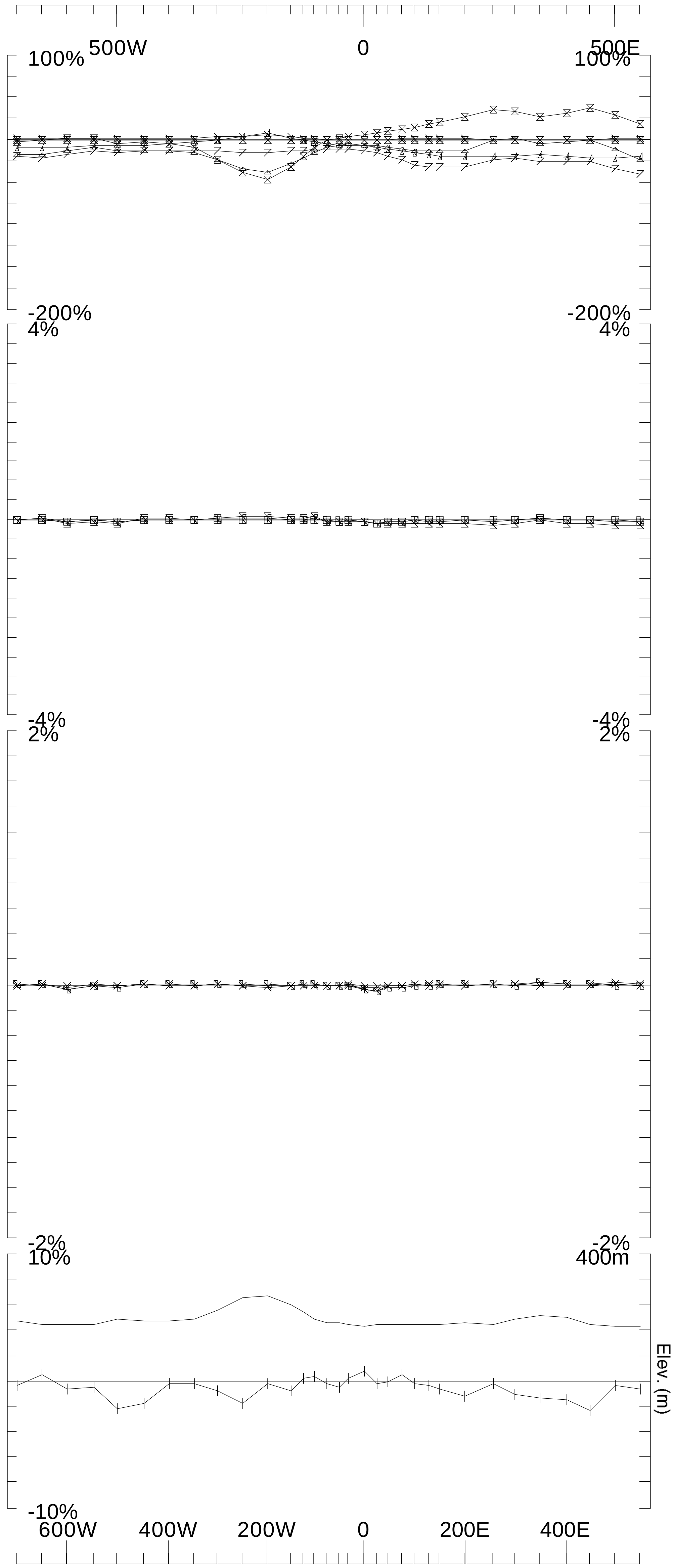
Plotted : 19/11/14



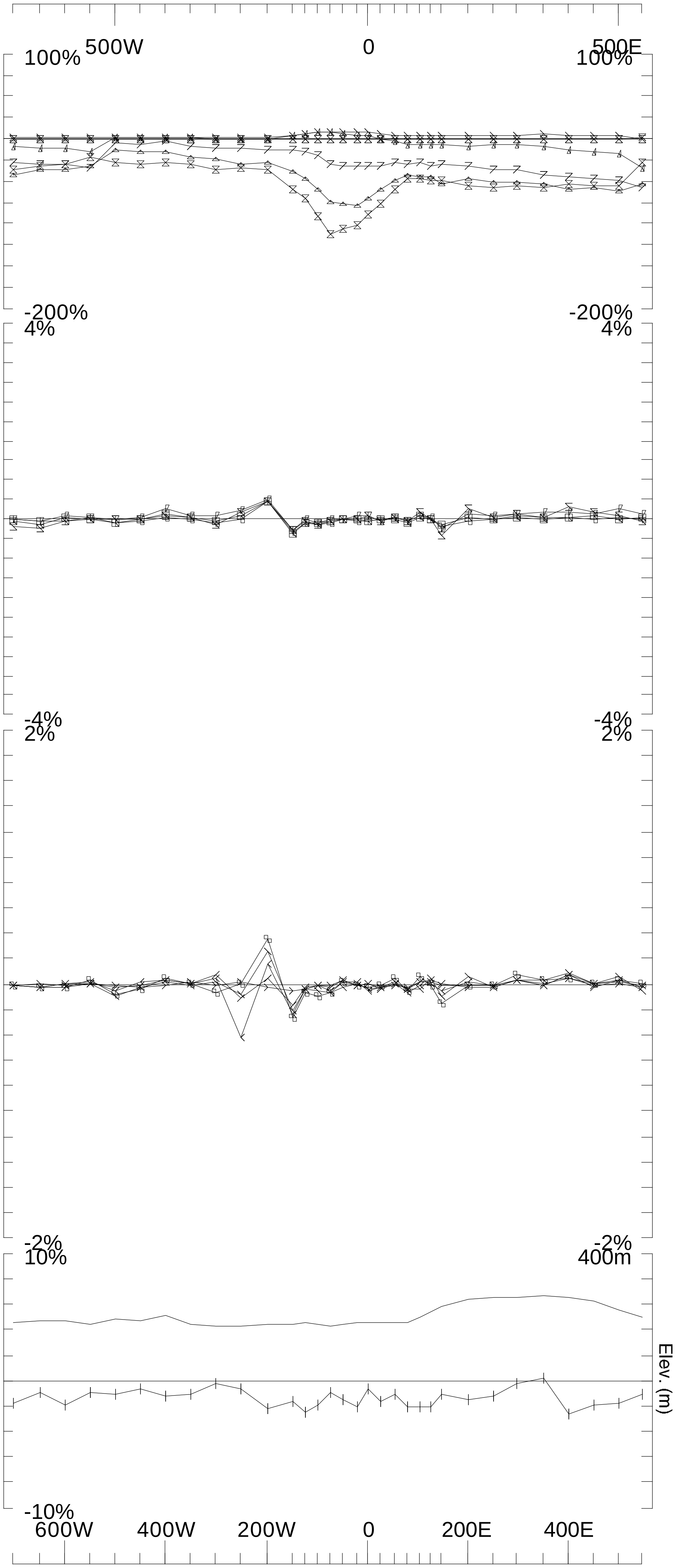
Loop: 1418S1	Secondary, (Chn - Ch0)/|Hp|	UTEM Survey at: Ermatinger
Line: 300N	Contin. Norm at depth of 0 m	For: Wallbridge
Compt: Hy	Base Freq. 4.090 Hz	LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE Job 1409 Plotted : 19/11/14



Loop: 1418S1	Secondary, (Chn - Ch0)/|Hp|	UTEM Survey at: Ermatinger
Line: 600N	Contin. Norm at depth of 0 m	For: Wallbridge
Compt: Hy	Base Freq. 4.090 Hz	LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE Job 1409 Plotted : 19/11/14



Loop: 1418S1	Secondary, (Chn - Ch0)/|Hp|	UTEM Survey at: Ermatinger
Line: 900N	Contin. Norm at depth of 0 m	For: Wallbridge
Compt: Hy	Base Freq. 4.090 Hz	LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE Job 1409 Plotted : 19/11/14



Loop: 1417S1
Line: 1200N
Compt: Hy

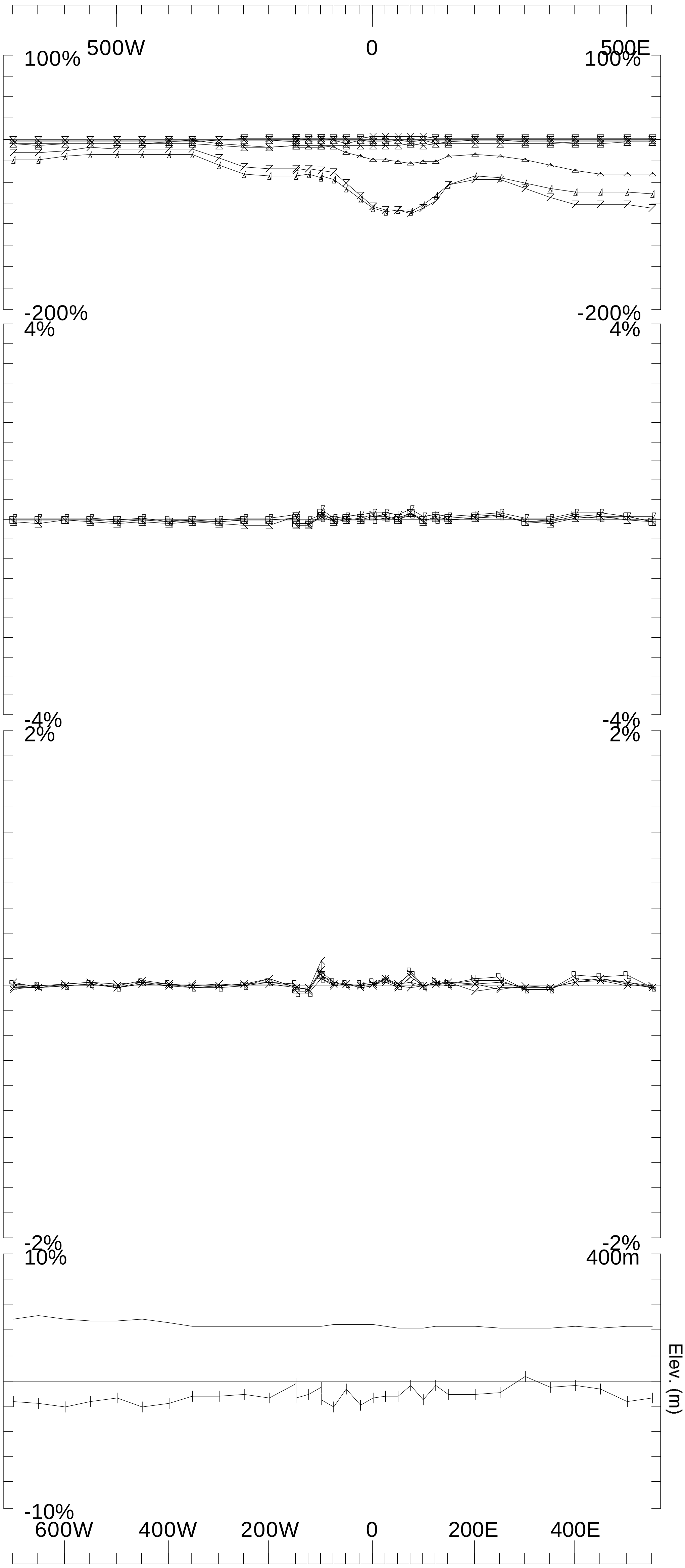
Secondary, (Chn - Ch0)/|Hp|
Contin. Norm at depth of 0 m
Base Freq. 4.090 Hz

UTEM Survey at: Ermatinger
For: Wallbridge

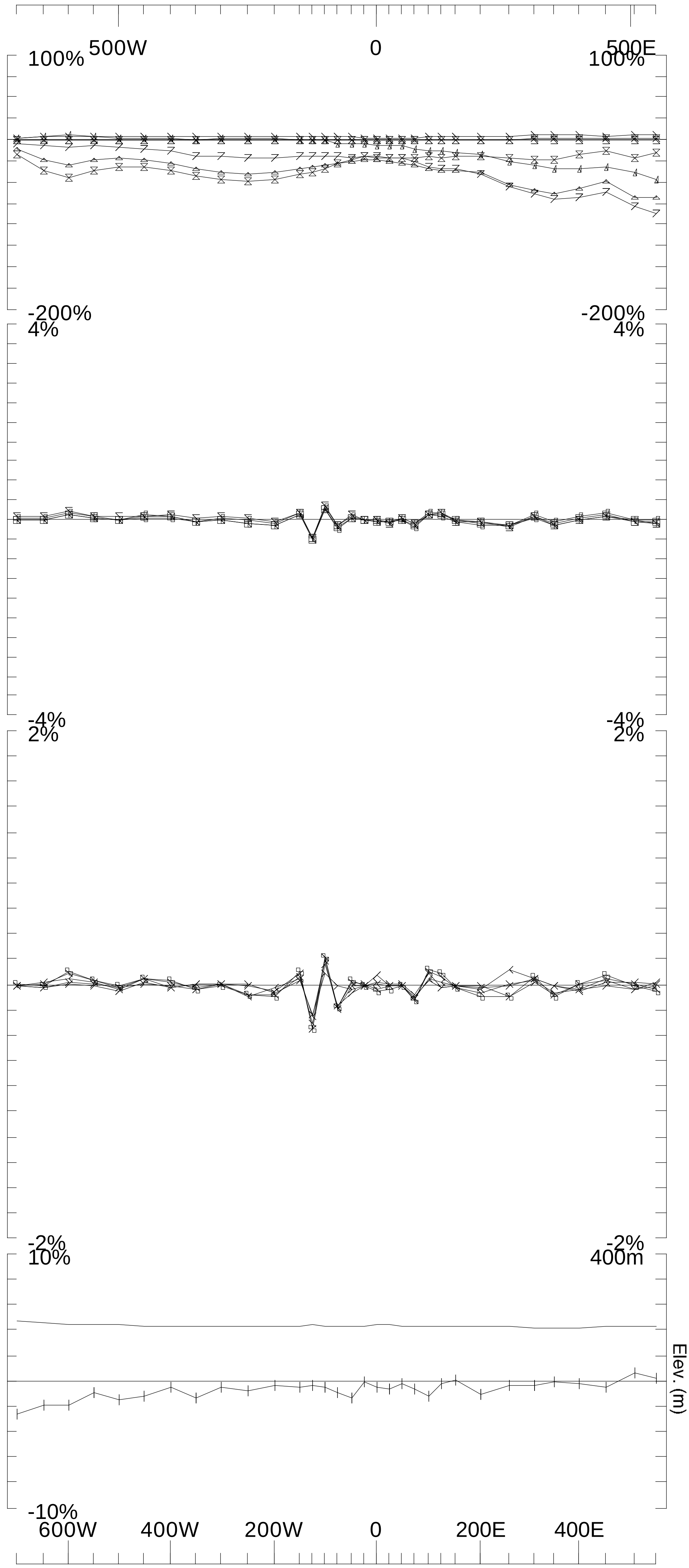
LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE

Job 1409

Plotted : 19/11/14



Loop: 1417S1	Secondary, (Chn - Ch0)/|Hp|	UTEM Survey at: Ermatinger
Line: 1500N	Contin. Norm at depth of 0 m	For: Wallbridge
Compt: Hy	Base Freq. 4.090 Hz	LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE Job 1409 Plotted : 19/11/14



Loop: 1417S1
Line: 1800N
Compt: Hy

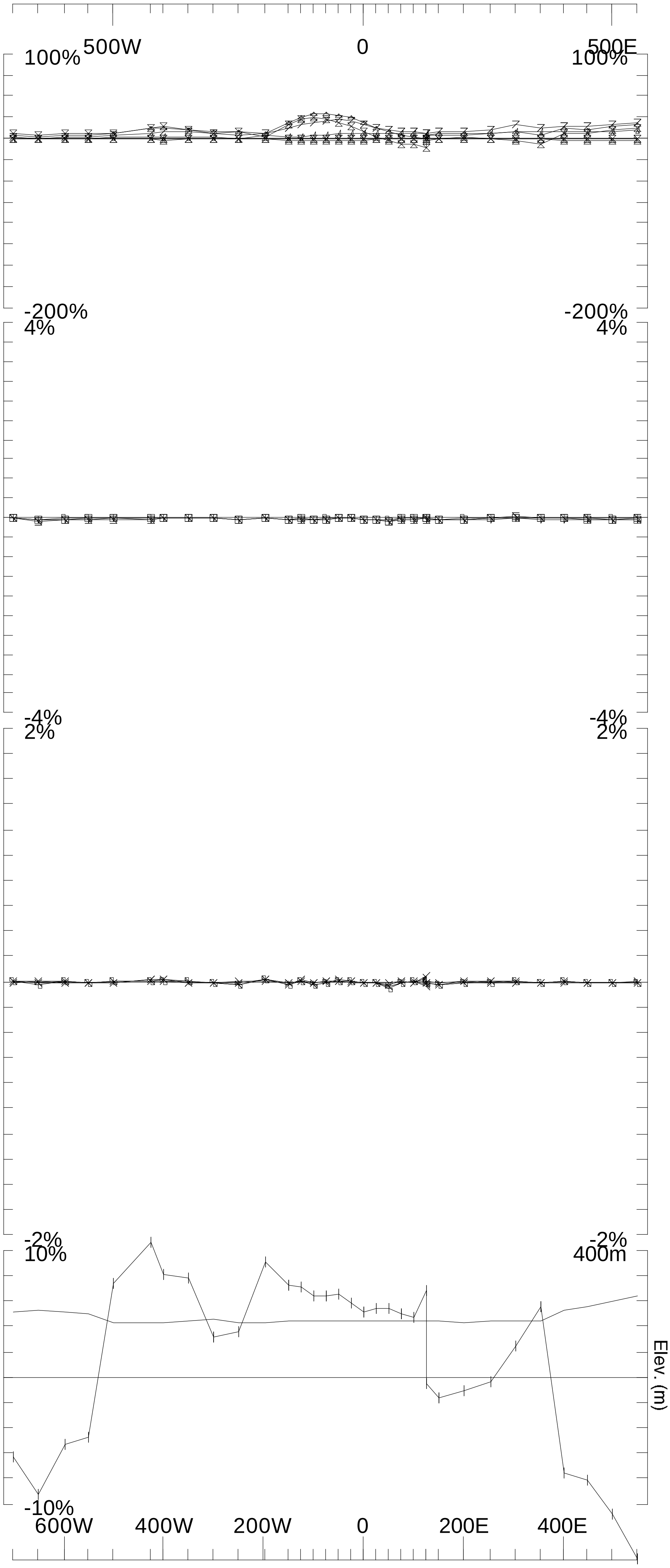
Secondary, (Chn - Ch0)/|Hp|
Contin. Norm at depth of 0 m
Base Freq. 4.090 Hz

UTEM Survey at: Ermatinger
For: Wallbridge

LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE

Job 1409

Plotted : 19/11/14



Loop: 1417S1
Line: 2100E
Compt: Hy

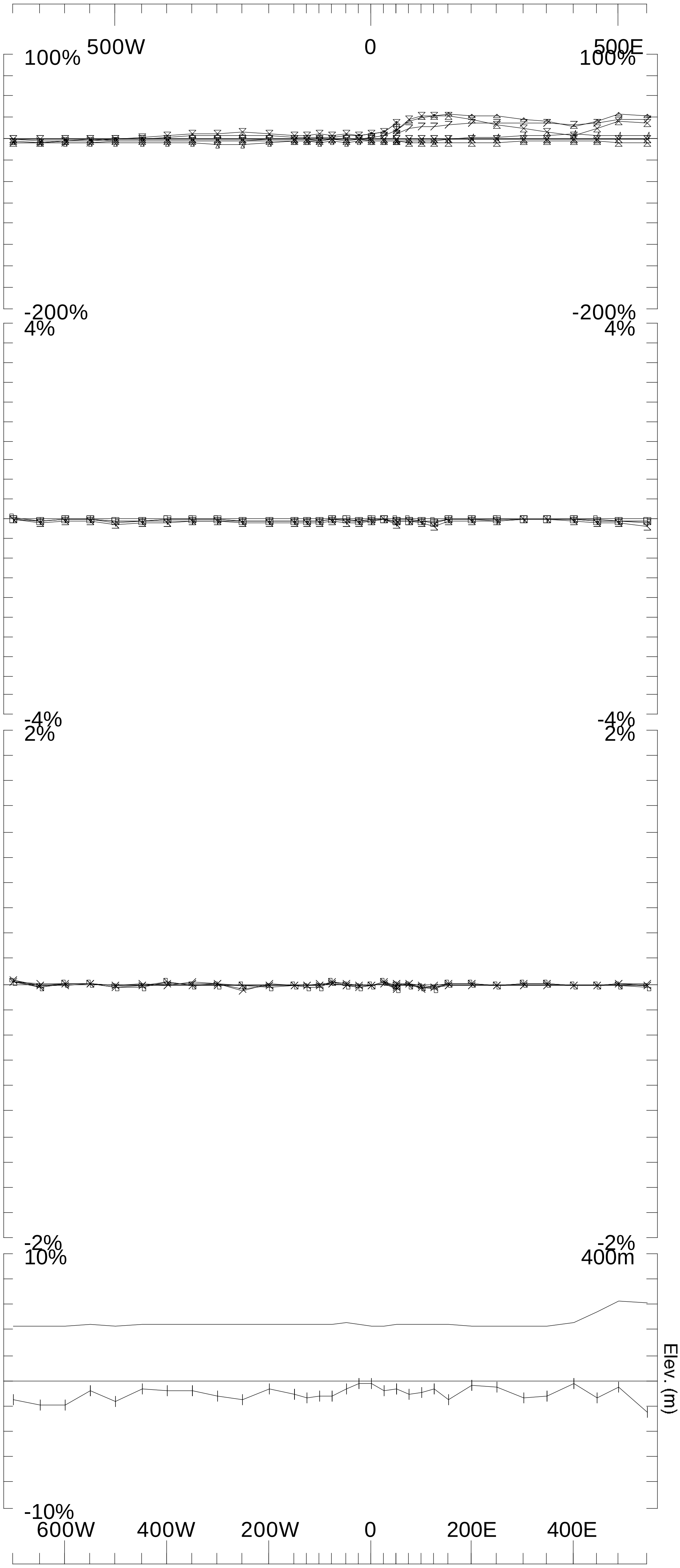
Secondary, (Chn - Ch0)/|Hp|
Contin. Norm at depth of 0 m
Base Freq. 4.090 Hz

UTEM Survey at: Ermatinger
For: Wallbridge

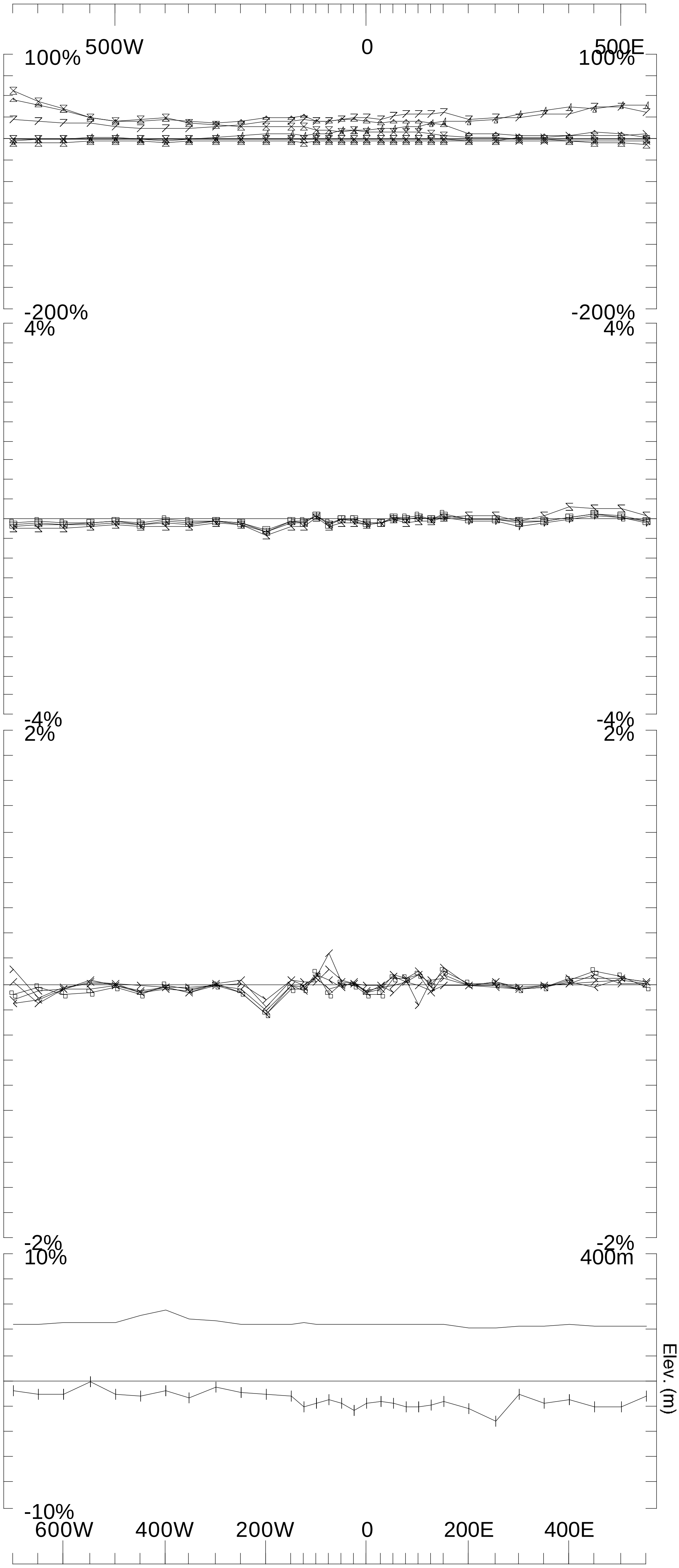
LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE

Job 1409

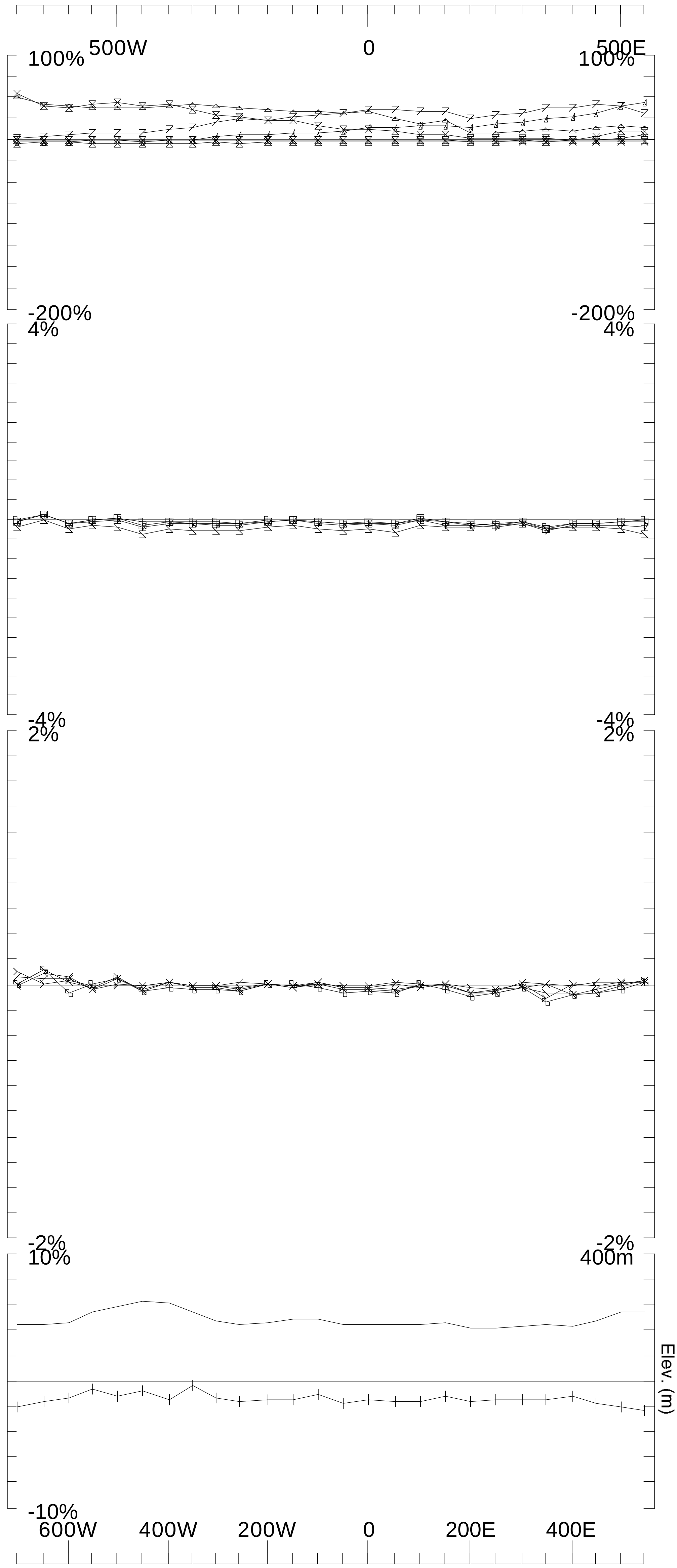
Plotted : 26/4/15



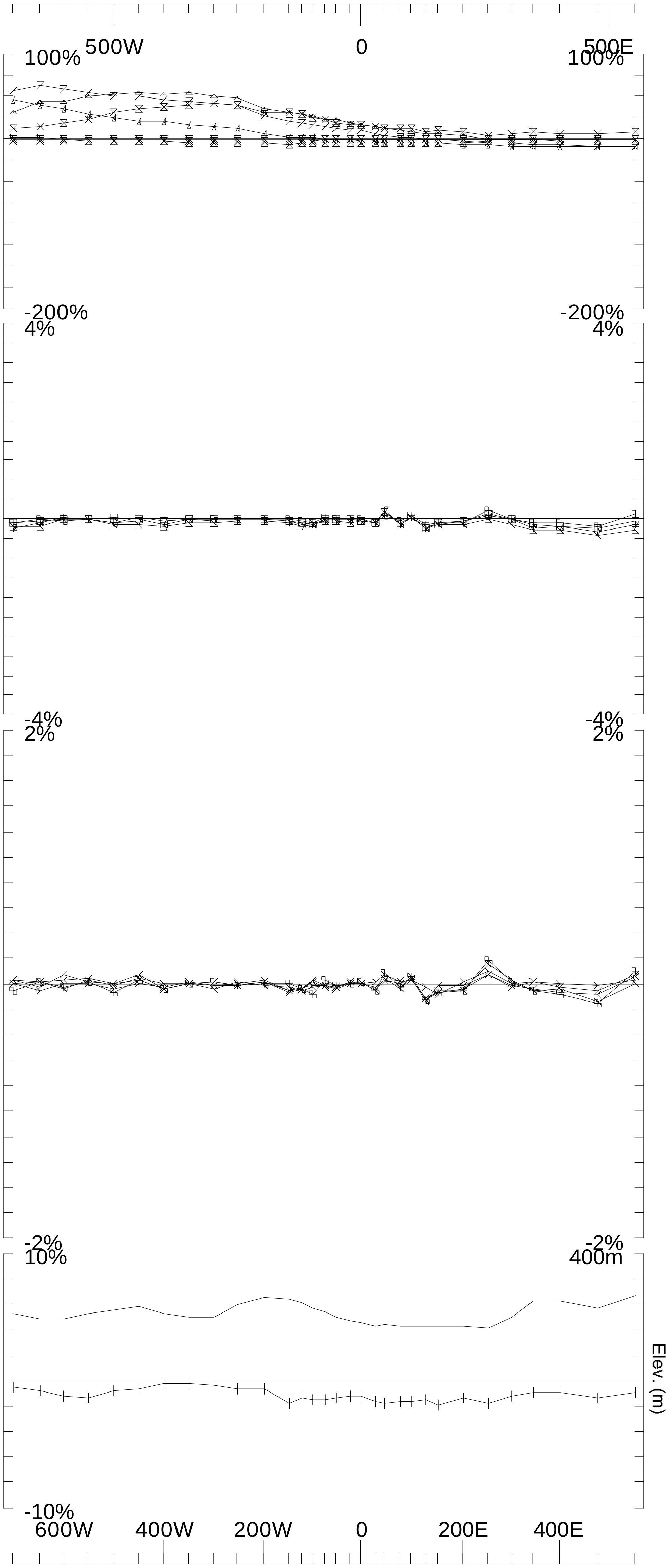
Loop: 1418S1	Secondary, (Chn - Ch0)/|Hp|	UTEM Survey at: Ermatinger
Line: 2400N	Contin. Norm at depth of 0 m	For: Wallbridge
Compt: Hy	Base Freq. 4.090 Hz	LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE Job 1409 Plotted : 19/11/14



Loop: 1418S1	Secondary, (Chn - Ch0)/|Hp|	UTEM Survey at: Ermatinger
Line: 2700N	Contin. Norm at depth of 0 m	For: Wallbridge
Compt: Hy	Base Freq. 4.090 Hz	LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE Job 1409 Plotted : 19/11/14



Loop: 1418S1	Secondary, (Chn - Ch0)/|Hp|	UTEM Survey at: Ermatinger
Line: 3000N	Contin. Norm at depth of 0 m	For: Wallbridge
Compt: Hy	Base Freq. 4.090 Hz	LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE Job 1409 Plotted : 19/11/14



Loop: 1418S1	Secondary, (Chn - Ch0)/|Hp|	UTEM Survey at: Ermatinger
Line: 3300N	Contin. Norm at depth of 0 m	For: Wallbridge
Compt: Hy	Base Freq. 4.090 Hz	LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE Job 1409 Plotted : 19/11/14

Appendix B

1409 Production Diary

UTEM 5 Survey

Ermatinger Grid
Sudbury District

for

Wallbridge Mining Company Ltd.

Production Log (1409)

UTEM5 Survey - Ermatinger Grid
Wallbridge Mining Company Ltd.

Date	Rate - Production		Comments
September 04	Mob	-	R.Lahaye travels from Montreal to Kingston Crew: G.Lafortune.
September 05	Mob	-	Crew travels to Sudbury, picking up P.Guimond in Toronto. Crew: T.Gallant, R.Lahaye, B.Dingwall, P.Guimond.
September 06	L-5		Lay 3/4 of Loop 1416 and ~5/6 of Loop 1417. Crew: G.Lafortune, T.Gallant, J.Young, R.Lahaye, P.Guimond.
September 07	L-5		Finish laying Loop 1416 and 1417 and lay Loop 1415. Crew: G.Lafortune, T.Gallant, J.Young, R.Lahaye, P.Guimond.
September 08	.25L-6 .75D		Loop break on Loop 1417 in the morning. Repair the loop, set up and start the transmitters. After ~15 minutes Tx7 goes down. It is repaired and runs for another 2 hours before it goes down again. A total of 200m surveyed - it will be resurveyed tomorrow. Coil RD2 acted up and Rx5 was found to have defective batteries. Replacement batteries were installed in the evening. Crew: G. Lafortune, T.Gallant, J.Young, R.Lahaye, P.Guimond, B.Dingwall.
September 09	1.25 P6	2500m	Read Lines 1800 and 2100. At the end of the day the replacement batteries in Rx5 were dead. **Loop 1417 S1-Tx7 4.090Hz_12Ch** **Loop 1415 S2-Tx8 2.045Hz_12Ch** **Line 21+00N 5+50E - 7+00W R2/P2** **Line 18+00N 5+50E - 7+00W R5/P1** Time in/out: 07h45/19h15, survey: 10h20/17h15 Crew: G.Lafortune, T.Gallant, J.Young, R.Lahaye, P.Guimond, B.Dingwall.
September 10	P6	650m	Rain today. At the third station the batteries in Rx5 die. Switch to Rx1 but problems were encountered turning the Rx/coil off. It was decided by the operator (G.Lafortune) to take the batteries out of Rx1 and put them into Rx5. This would require a resync which was tried by using the control unit at the transmitter site. Unfortunately this causes Rx2, being used by the other operator in the field, to go out of sync . The rain had become heavier by this time and a re-sync would require a 1.5 hour delay. Decide to call it a day. **Loop 1417 S1-Tx7 4.090Hz_12Ch** **Loop 1415 S2-Tx8 2.045Hz_12Ch** **Line 21+00N 5+50E - 1+00W R2/P2** Time in/out: 09h30/16h15, survey: 11h20/14h15 Crew: G.Lafortune, T.Gallant, J.Young, R.Lahaye, P.Guimond, B.Dingwall.

Date	Rate - Production		Comments
September 11	P6	1850m	After the survey was done the corners are flipped to Loop 1416 which is found to be broken. The entire loop is walked and 4 breaks are found/repaired. **Loop 1417 S1-Tx7 4.090Hz_12Ch** **Loop 1415 S2-Tx8 2.045Hz_12Ch** **Line 21+00N 1+00W - 7+00W R2/P2** **Line 18+00N 5+50E - 7+00W R5/P1** Time in/out: 07h20/18h00: survey: 9h15/15h00 Crew: G.Lafortune, T.Gallant, J.Young, R.Lahaye, P.Guimond, B.Dingwall.
September 12	P6	1850m	Repair Loop 1416 first thing in the morning. When Tx4 was started it is out of sync. Re-syncing procedure causes all the other equipment to go out of sync. All control units and receivers are resynced. This causes a bit of a delay because of the walking and creek-crossings involved. **Loop 1417 S1-Tx7 4.090Hz_12Ch** **Loop 1416 S2-Tx8 2.045Hz_12Ch** **Line 12+00N 5+50E - 0+75E R5/P1** **Line 15+00N 5+50E - 1+50E R2/P2** Time in/out: 08h30/18h00: survey: 14h00/16h15 Crew: G.Lafortune, T.Gallant, J.Young, R.Lahaye, P.Guimond, B.Dingwall.
September 13	1.25 P6	1850m	Wait to talk to LGL office to find out if data from the previous day was good. Slow production day as 3 reading were taken at every station. **Loop 1417 S1-Tx7 4.090Hz_12Ch** **Loop 1416 S2-Tx8 2.045Hz_12Ch** **Line 12+00N 0+75E - 7+00W R5/P1** **Line 15+00N 1+50E - 7+00W R2/P2** Time out/in: 09h30/19h40: survey: 11h30/19h30 Crew: G.Lafortune, T.Gallant, J.Young, R.Lahaye, P.Guimond, B.Dingwall.
September 14	P5	1850m	Re-survey 2 lines (initially surveyed September 12/13th) from Loop 1417 only - 1 transmitter was used to allow comparison of the readings. B.Dingwall stays back to talk to Yves about transmitter issues. **Loop 1417 S1-Tx7 4.090Hz_12Ch** **Line 12+00N 5+50E - 5+00W R5/P1** **Line 15+00N 5+50E - 2+50W R2/P2** Time out/in: 08h30/18h00: survey: 11h00/16h30 Crew: G.Lafortune, T.Gallant, J.Young, R.Lahaye, P.Guimond.
September 15	P5	1250m	One Tx - Loop 1417 - used to re-survey Line 15+00N (faulty coil the previous day. Loop 1415 reconnected and checked for the next day. B.Dingwall stayed back to work on coils. **Loop 1417 S1-Tx7 4.090Hz_12Ch** **Line 15+00N 5+50E - 1+50W R5/P1** **Line 15+00N 1+00W - 7+00W R2/RD1** Time out/in: 08h30/17h00: survey: 10h30/14h30 Crew: G.Lafortune, T.Gallant, J.Young, R.Lahaye, P.Guimond.

Date	Rate - Production		Comments
September 16	P5	2500m	Re-survey 2 lines that were initially surveyed on Sept. 12th and 13th from transmitter Loop 1416. B.Dingwall stays back to work on coils. **Loop 1416 S2-Tx6 2.045Hz_12Ch** **Line 12+00N 5+50E - 7+00W R5/P1** **Line 15+00N 5+50E - 7+00W R2/RD1** Time out/in: 07h20/19h10: survey: 10h15/17h30 Crew: G.Lafortune, T.Gallant, J.Young, R.Lahaye, P.Guimond.
September 17	P5	2500m	Raining. Loop 1415 was found to be broken in 3 places. Rain continues all day with cool temperatures. Surveying suspended when the creek is reached as all crew members are very cold and wet. One transmitter on Loop 1415 is used today. B.Dingwall works with the borehole crew. **Loop 1415 S2-Tx6 2.045Hz_12Ch** **Line 18+00N 5+50E - 3+00W R5/P1** **Line 21+00N 5+50E - 4+00W R2/RD1** Time out/in: 07h30/18h00: survey: 11h45/16h30 Crew: G.Lafortune, T.Gallant, J.Young, R.Lahaye, P.Guimond
September 18	P5	700m	Finish Lines 1800 and 2100 using one transmitter, then pick up Loop 1417 and lay 1418. **Loop 1415 S2-Tx6 2.045Hz_12Ch** **Line 18+00N 3+00W - 7+00W R5/P1** **Line 21+00N 4+00W - 7+00W R2/RD1** Time out/in: 07h30/18h00: survey: 10h30/13h00 Crew: G.Lafortune, T.Gallant, J.Young, R.Lahaye, P.Guimond
September 19	P6	2500m	Survey Lines 2400 and 3300N. **Loop 1418 S1-Tx7 4.090Hz_12Ch** **Loop 1415 S2-Tx6 2.045Hz_12Ch** **Line 24+00N 5+50E - 7+00W R5/P1** **Line 33+00N 5+50E - 7+00W R2/RD1** Time out/in: 07h30/19h30: survey: 10h30/18h00 Crew: G.Lafortune, T.Gallant, J.Young, R.Lahaye, P.Guimond, B.Dingwall.
September 20	S6		Arrive at the grid during a lightning storm. Wait several hours but more storms with heavy rain/lightning move in. Return to the office and talk to Kingston office (Yves) about the equipment. Carry out testing at the office. Time out/in: 07h30/12h30 Crew: G.Lafortune, T.Gallant, J.Young R.Lahaye, P.Guimond, B.Dingwall.
September 21	P6	2500m	Survey Lines 2700 and 3000N **Loop 1418 S1-Tx7 4.090Hz_12Ch** **Loop 1415 S2-Tx6 2.045Hz_12Ch** **Line 27+00N 5+50E - 7+00W R5/P1** **Line 30+00N 5+50E - 7+00W R2/RD1** Time out/in: 07h30/19h30: survey: 10h00/17h30 Crew: G.Lafortune, T.Gallant, J.Young R.Lahaye, P.Guimond, B.Dingwall.

Date	Rate - Production		Comments
September 22	P5	2500m	Re-survey 2 lines read on Sept. 19th using only one transmitter loop (1415). **Loop 1415 S2-Tx6 2.045Hz_12Ch** **Line 24+00N 5+50E - 0+00W R5/P1** **Line 24+00N 0+00E - 7+00W R5/P1** **Line 33+00N 5+50E - 7+00W R2/RD1** Time out/in: 07h30/19h30: survey: 10h15/17h30 Crew: G.Lafortune, T.Gallant, J.Young, R.Lahaye, P.Guimond
September 23	P5	1950m	Re-survey 1 line read on Sept. 21st and 700m of L2400 re-surveyed yesterday using only one transmitter loop (1415). Flip the corners to Loop 1416 to find it broken. Walk most of the loop repairing 3 breaks but run out of time before the loop could be completely repaired. **Loop 1415 S1-Tx6 2.045Hz_12Ch** **Line 24+00N 0+00E - 7+00W R5/P1** **Line 27+00N 5+50E - 7+00W R2/RD1** Time out/in: 07h30/18h40: survey: 10h15/16h00 Crew: G.Lafortune, T.Gallant, J.Young, R.Lahaye, P.Guimond
September 24	1.25 P6	2500m	Fix a break on Loop 1416 on a section that had not been walked the day before. The loop is still open so the loop is walked again and a new break is found and repaired. **Loop 1418 S1-Tx6 4.090Hz_12Ch** **Loop 1416 S2-Tx7 2.045Hz_12Ch** **Line 0+00N 5+50E - 7+00W R2/RD1** **Line 9+00N 5+50E - 1+00W R5/P1** **Line 9+00N 1+00W - 7+00W R5/P1** Time out/in: 07h30/19h10: survey: 10h30/17h15 Crew: G.Lafortune, T.Gallant, J.Young, R.Lahaye, P.Guimond, B.Dingwall.
September 25	1.25 P6	2500m	Access the grid from the south route because a bridge had been removed. This added half an hour to the travel time **Loop 1418 S1-Tx6 4.090Hz_12Ch** **Loop 1416 S2-Tx7 2.045Hz_12Ch** **Line 3+00N 5+50E - 7+00W R2/RD1** **Line 6+00N 5+50E - 1+00W R5/P1** **Line 6+00N 1+00W - 7+00W R5/P1** Time out/in: 07h30/20h10: survey: 10h00/18h05 Crew: G.Lafortune, T.Gallant, J.Young, R.Lahaye, P.Guimond, B.Dingwall.
September 26	1.25 P3	1200m	Access the grid from the south route again. Re-read two 600m sections on L600 and L900 from one transmitter. **Loop 1416 S2-Tx7 2.045Hz_12Ch** **Line 6+00N 1+00W - 7+00W R2/RD1** **Line 9+00N 1+00W - 7+00W R2/RD1** Time out/in: 07h30/19h30: survey: 10h00/18h05 Crew: B.Dingwall, R.Lahaye, P.Guimond.

Date	Rate - Production	Comments
September 27	demob	Part of the crew demobs back home. The other half remains in Sudbury to work on other projects. Crew: B.Dingwall, R.Lahaye, and P.Guimond.
September 30	L-2	Pick up Loop 1418. Crew: G.Lafortune and J.Young.
October 01	L-3	Pick up Loop 1415 and half of Loop 1416. Crew: G.Lafortune, T.Gallant and J.Young.
October 15	L-2	Finish picking up Loop 1416. All loops are now up. Crew: G.Lafortune and T.Gallant.

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

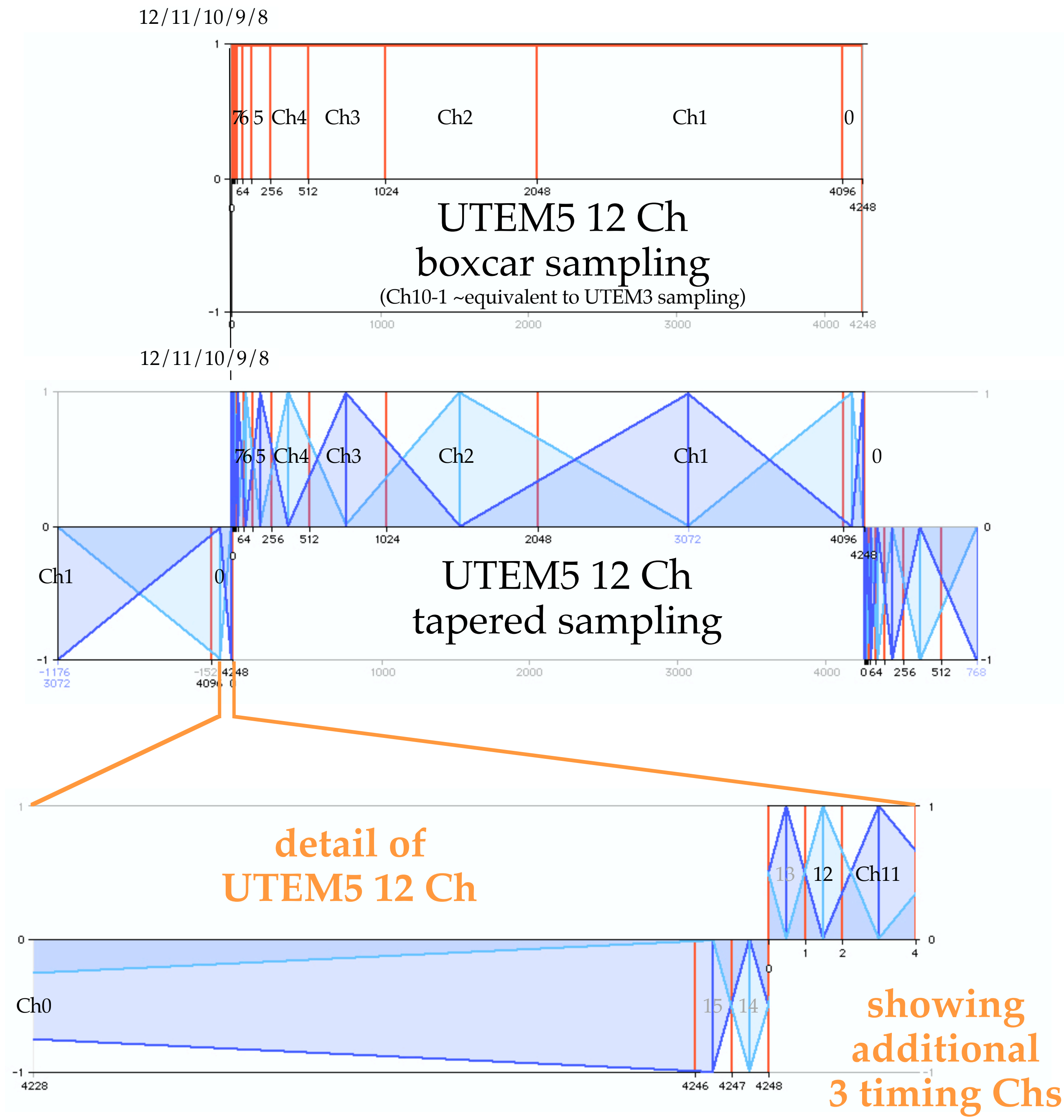
BHUTEM - the borehole version of UTEM -surveys have been carried out to depths up to 3000+ metres.

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.



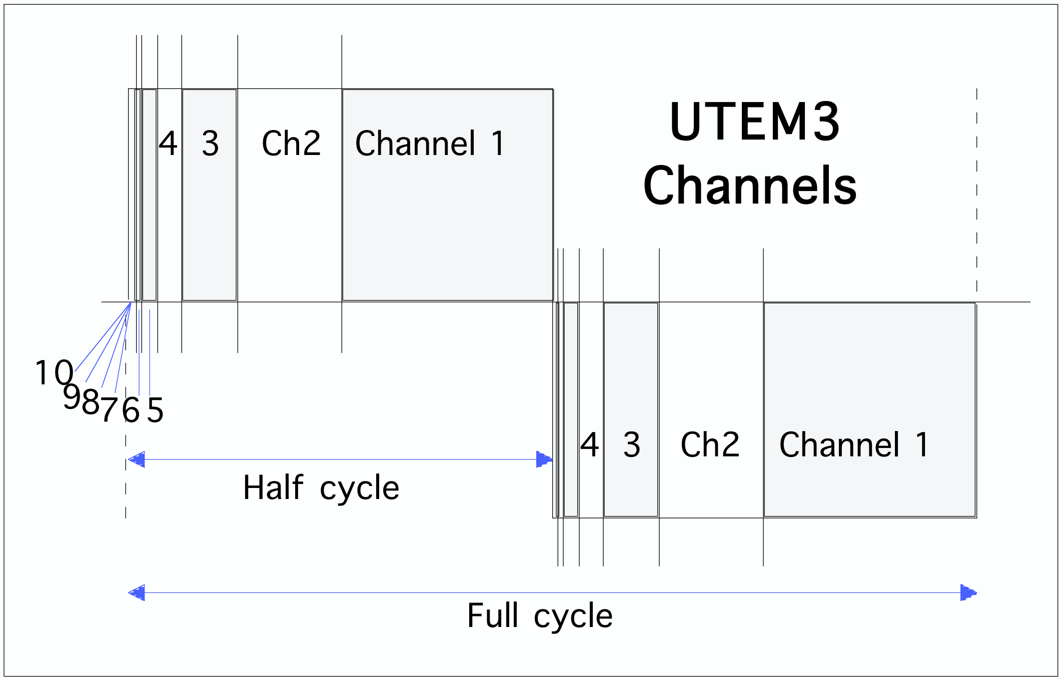
Notes:
- boxcar sampling equivalent to UTEM3 sampling
- tapered sampling: improved powerline rejection
- the use of UTEM4/5 Transmitters and UTEM5 Receivers improves syncing/timing and allows for the implementation of:
  - Ch0 - a narrow Ch after (later than) Ch1.
    - Ch0 normalization is an option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

LAMONTAGNE GEOPHYSICS LTD
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 resolve into:

- u the horizontal transverse component ~ Hy = HT(ransverse)
- v the vertical component ~ Hz = HZ
- w the horizontal in-line component ~ Hx = HL(ine)

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, continuously normalized form. In this form, the magnetic field data collected by the receiver is expressed as a % of the calculated primary magnetic field vector magnitude at the station. 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 reduced magnetic field data (as it appears in the data file) 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 plotting format is defined by the choice of the *normalization* and *field type* parameters selected for display.

NORMALIZATION

UTEM results are always 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 **point normalized** form the normalizing factor is the magnitude of the computed primary field vector at a single point in space. When data is presented in this form, the point of normalization is displayed in the title block of the plot. Point normalized profiles 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 point normalized profile. Point normalized data is often used for interpretation where an analysis of the shape of a specific anomaly is required. Point normalized 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. In these cases data is often point normalized to a fixed point near the loop centre.

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: When UTEM data is plotted in the ***Channel 0 Reduced*** form the secondary field data for Channel 0 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:

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

$\mathbf{R1_j}$ is the result plotted for the latest-time UTEM channel, Channel 0,

$\mathbf{Chn_j}$ is the raw component sensor value for the n^{th} channel at station j,

$\mathbf{Ch1_j}$ is the raw component sensor value for Channel 0 at station j,

$\mathbf{H^P_j}$ is the computed primary field component in the sensor direction

$|\mathbf{H^P}|$ 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, Channel 0 is used as an "estimate" of the primary signal and channels 2-10 are expressed as:

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

Channel 0 itself is reduced by subtracting a calculation of the primary field observed in the direction of the coil, H^P as follows:

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

Primary Field Reduced Secondary Fields **:** In this form all channels are reduced according to the equation used for Channel 0 above:

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

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, $H^P{}_j$) and where very slowly decaying responses result in significant secondary field effects remaining in Channel 0 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:

$$Rn_j = Chn_j / |H^P| \; x\ 100\%$$

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
Σ 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
ǀ 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 - rountinely 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.

Center 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 center 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.

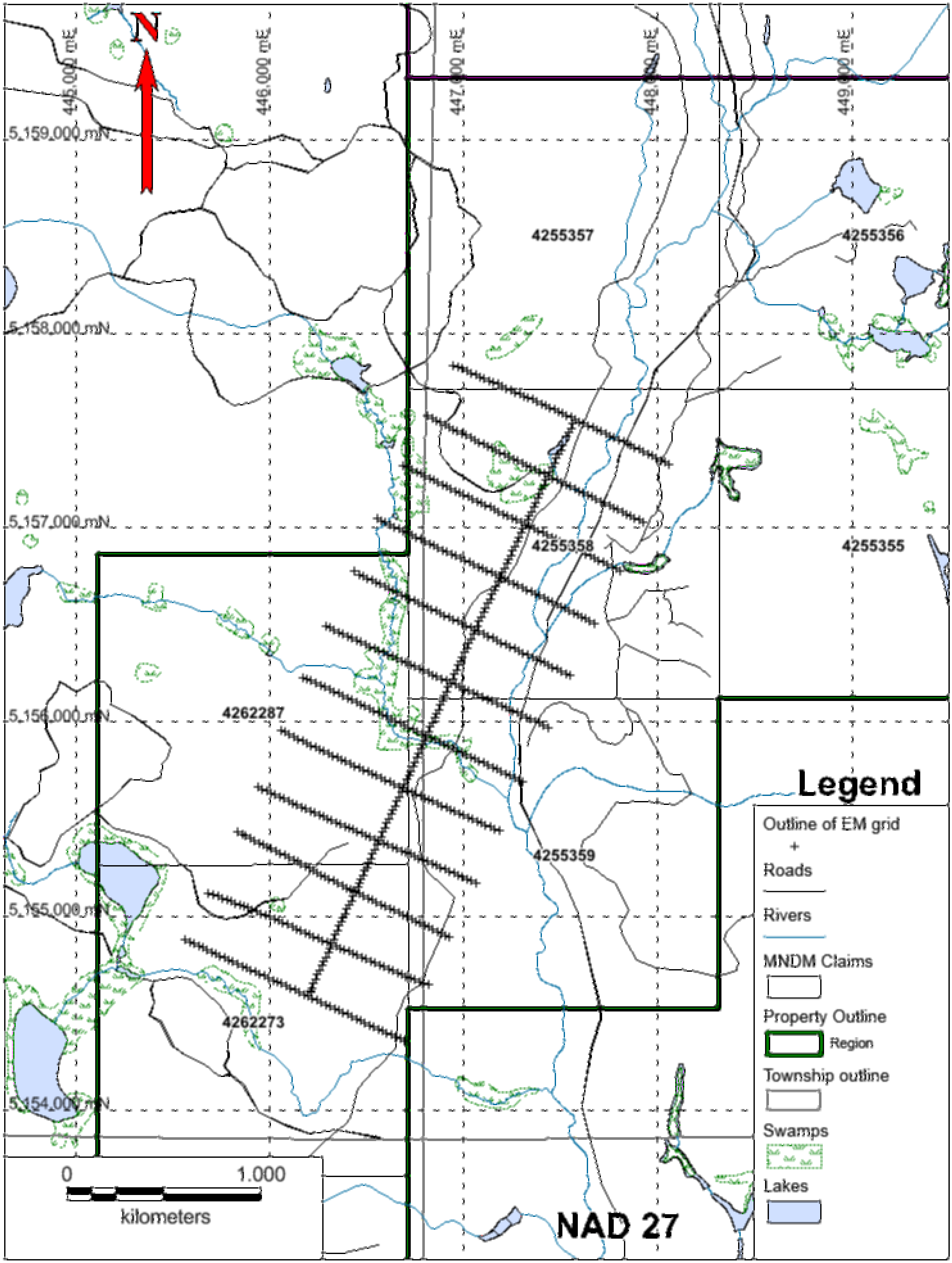
The larger amplitude of the UTEM Ch0 response is explained by the fact that the UTEM primary field is often more favourably coupled (magnetostatically speaking) to magnetic mineralization as compared to the earths field. Another factor could be the presence of a reverse remnant component to the magnetization.

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.



N
445,000 mE
446,000 mE
447,000 mE
448,000 mE
449,000 mE
5,159,000 mN
5,158,000 mN
5,157,000 mN
5,156,000 mN
5,155,000 mN
5,154,000 mN
4255357
4255356
4255358
4255355
4262287
4255359
4262273
Legend
Outline of EM grid
Roads
Rivers
MNDM Claims
Property Outline
Region
Township outline
Swamps
Lakes
0
1,000
kilometers
NAD 27