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Geophysical Survey Logistics Report (v.2)

Regarding the Quantec SPARTAN TENSOR MAGNETOTELLURIC SURVEY over the CURNAMONA MT PROJECT, near Arkaroola, South Australia, AUSTRALIA, on behalf of TERREX SEISMIC PTY LTD, Perth, WA, Australia.

Joel Stockill, Dominic Brown
Susanna Scappin
Trent Retallick
Mehran Gharibi
October, 2009
Project AU00056S

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1. INTRODUCTION

- **QGI Project No:** AU00056S / CA00618I
- **Project Name:** **CURNAMONA MT PROJECT**
- **Survey Areas:** Lake Frome, Strezlecki Desert (SA)
- **Survey Periods:** 25th November – 16th December, 2008
  19th – 27th January, 2009
- **Survey Type**: Tensor Magnetotelluric (MT) Surveys
- **Client:** **TERREX SEISMIC PTY LTD**
- **Client Address** Unit 2
  37 Howson Way
  Bibra Lake, WA
  6163 - Australia
  Telephone: +61 (0)8 9334 4388
- **Representatives:** Mr. Stephen Tobin
- **Objectives:** Deployment and recovery of MT stations at 5 to 10 km station spacing according to the client instruction and producing edited field data in EDI standard format to help determining preferential zones for possible energy resources.
- **Report Type:** Survey logistics, describing the survey parameters and methodology, as well as presenting the survey sounding curves in digital/map forms.

  Version 2:
  Report has been updated to reflect new EDI files created after applying azimuth and spectra corrections (conversion to RH-positive down coordinate system).
  Coil Recalibrations were also applied.

2. GENERAL SURVEY DETAILS

2.1 LOCATION

- **General Location:** The Curnamona MT Project area is located approx. 250 km East of Leigh Creek, SA (see Figure 1).
- **State:** South Australia
- **Nearest Settlements:** Arkaroola, Copley and Leigh Creek
- **Nearest Highway:** Barrier Highway (A32)
- **Datum & Projection** GDA 94 / WGS 84; UTM Zone 54J
- **Latitude/Longitude:** approx. 30°54'38"S , 140°09'46"E
- **UTM position[1]:** approx.420000E, 6580000S (Figure 1)

[1] UTM coordinates (GDA 94) positioning (GPS) supplied by Terrex Seismic Pty Ltd (October, 2008).

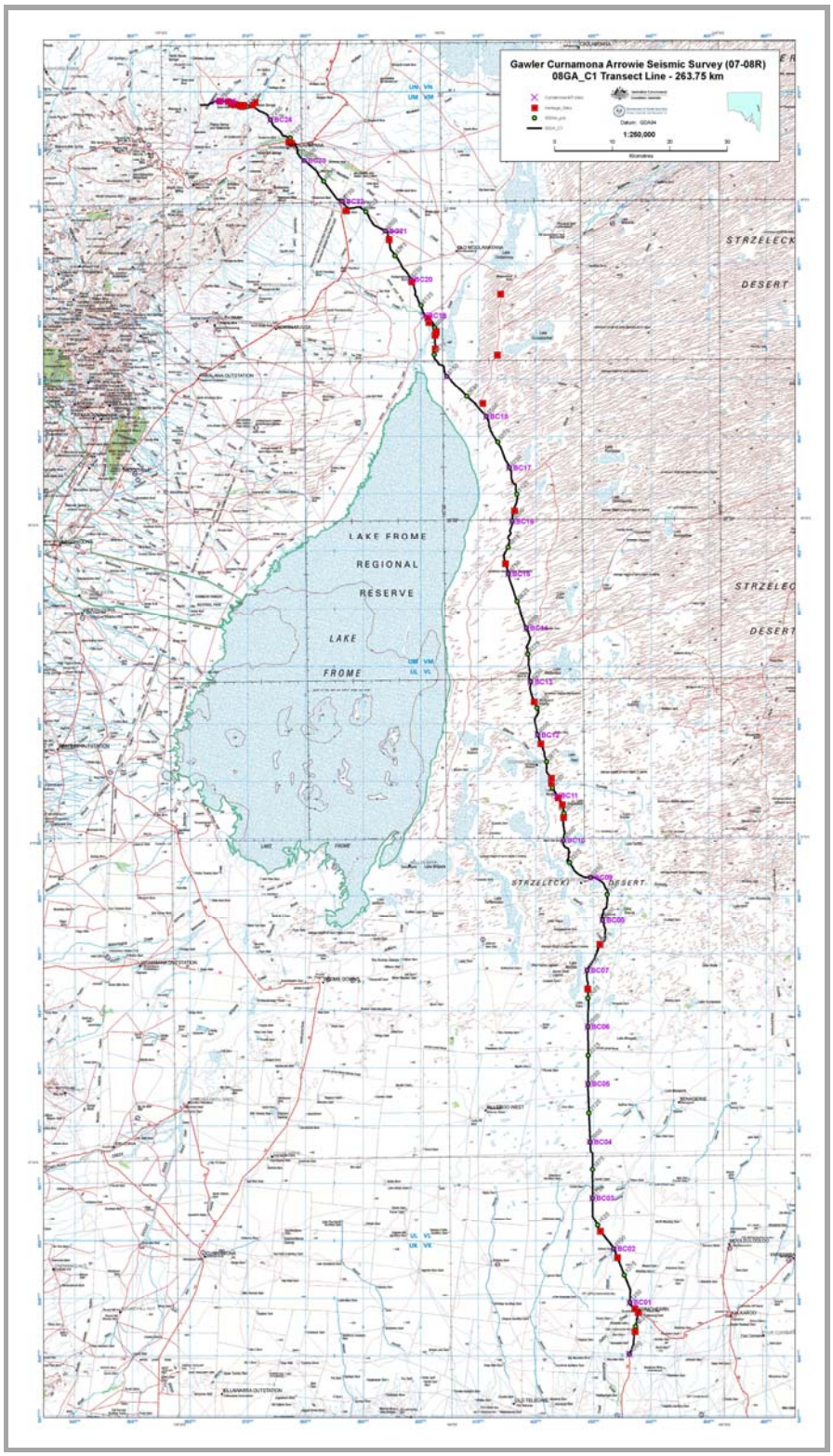


Figure 1: Curnamona MT Project: General Location Map (supplied by Geoscience Australia, 2008).

2.2 Access

- **Base of Operations:** Wooltana Station and Moolawatana Station
- **Mode of Access to Sites:** Trucks and foot

2.3 Survey Grid

- **Previously established by:** Terrex Seismic Pty Ltd (see Table I)
- **Coordinate Reference System:** Survey Grid Coordinates referenced to UTM Coordinates (see Table I).
- **Site Direction:** X-orientation at 0 deg (North), Y at 270 deg (West).
- **Site Separation:** approx. 5 to 10 km
- **Site Location:** GPS surveyed

Site	UTM Easting (GDA 94 – UTM Zone 54J)	UTM Northing (GDA 94 – UTM Zone 54J)
BC01	436320	6489301
BC02	433527	6498631
BC03	429851	6507414
BC04	429442	6517250
BC05	429086	6527235
BC06	429046	6537225
BC07	428904	6547087
BC08	431593	6555690
BC09	429527	6563192
BC10	424803	6569668
BC11	423656	6577500
BC12	420321	6588074
BC13	419115	6597299
BC14	418372	6606650
BC15	415260	6616058
BC16	415915	6625197
BC17	415437	6634517
BC18	411431	6643407
BC19	400684	6660957
BC20	398273	6667261
BC21	393914	6675675
BC22	386450	6680834
BC23	379826	6687975
BC24	373945	6695124
BC25	364310	6698304

Table I: Proposed MT Site Locations.

3. SURVEY WORK UNDERTAKEN

3.1 GENERALITIES

- **Survey Dates:** November 25th to December 16th, 2008
  January 15th to January 27th, 2009
- **Survey Period I:** 22 days
- **Survey Period II:** 8.5 days
- **Survey Days (read time):** 16.5 days
- **Weather Days:** 4
- **Number of Lines Surveyed:** 1
- **Number of Sites Surveyed:** 25

3.2 PERSONNEL

- **Project Manager:** Trent Retallick – QG Australia
- **Geophysicists/Interpreters:** Mehran Gharibi – QGL (Toronto, ON)
- **Data Processing (office):** Joel Stockill
  Dominic Brown
  Susanna Scappin
- **Field Operators:** Yatha Hoffman
  Lee Davison
- **Field Technicians:** Shaun Burnett
  Clinton Efford

3.3 SURVEY SPECIFICATIONS

- **Technique:** Tensor soundings, remote-referenced
- **Station Configuration:** "L" shaped E-field array (Figure 2)
  Ex – North(0deg)
  Ey –West (270deg)
  3 Low Frequencies coils Hx, Hy, Hz
- **Remote Configuration:** "L" shaped E-field array (Figure 2)
  Ex –North(0deg),
  Ey –West (270deg)
  3 Low Frequencies coils Hx, Hy, Hz
- **Remote Reference Measurements**
  1 Hx/Hy set
  1 Ex/Ey set (for verification/monitoring)
- **Dipole Length:** 100 metres
- **Remote Reference site:** The remote station is a site along the line reading contemporaneously (see Table II).

- **Data Acquisition:** Full-waveform time-series acquisition
  Data processing/output in frequency-domain
- **Frequency bandwidth:** 0.001 Hz to 250 Hz

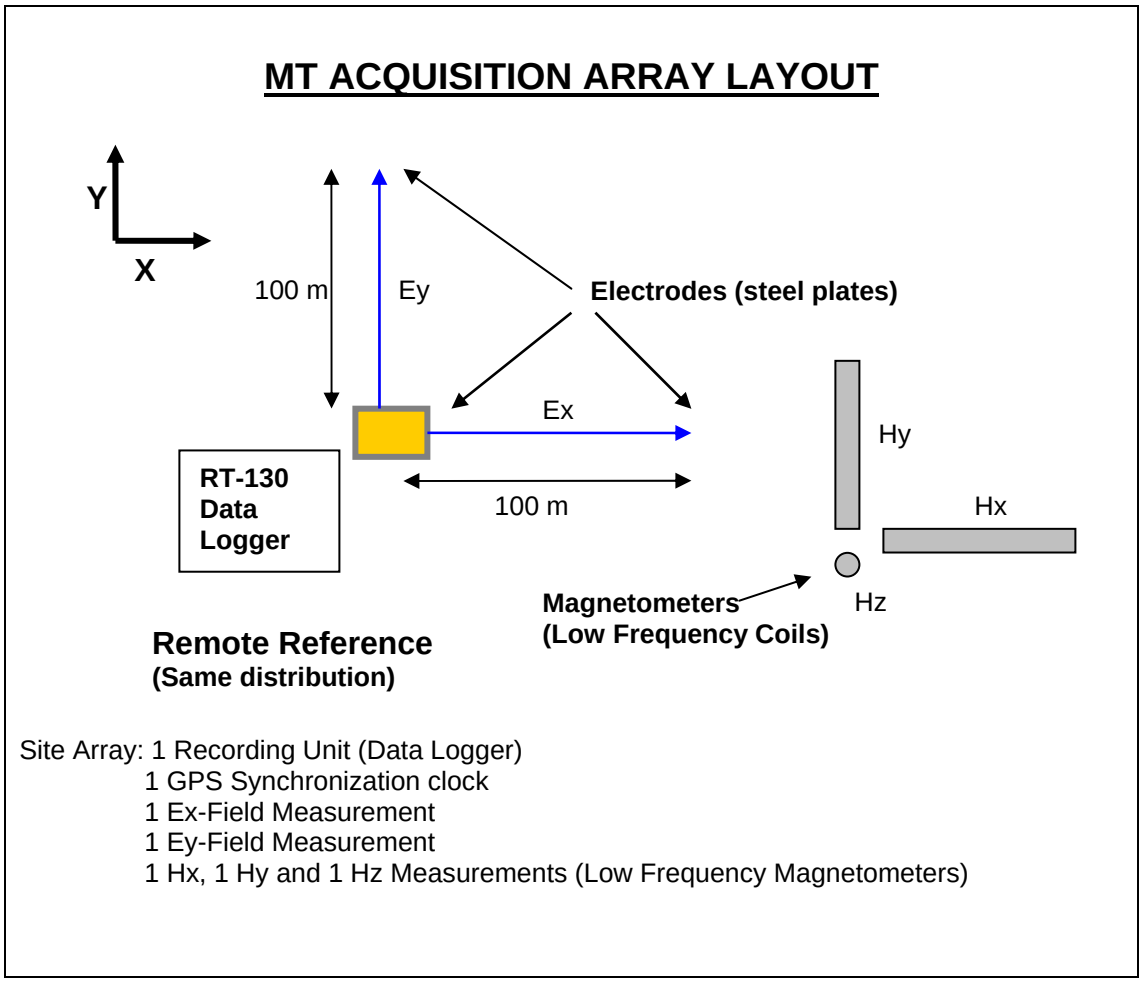


Figure 2: Magnetotelluric Station Survey Layout.

Curnamona Line					
Site	**Reference Site**	**Site**	**Reference Site**	**Site**	**Reference Site**
BC01	BC03	**BC10**	BC08	**BC19**	BC18
BC02	BC03	**BC11**	BC13	**BC20**	BC22
BC03	BC01	**BC12**	BC13	**BC21**	BC22
BC04	BC05	**BC13**	BC12	**BC22**	BC21
BC05	BC07	**BC14**	BC16	**BC23**	BC24
BC06	BC05	**BC15**	BC16	**BC24R**	BC23R
BC07	BC05	**BC16**	BC15	**BC25**	BC23
BC08	BC10	**BC17**	BC19		
BC09	BC10	**BC18**	BC19		

Table II: Sites and related reference sites.

3.4 SURVEY COVERAGE

3.4.1 Curnamona Line

Curnamona Line					
Site	**East UTM**	**North UTM**	**Elevation (m)**	**Latitude**	**Longitude**
	(WGS 84 – UTM Zone 54J)				
BC01	436332	6489273	137	31°43'48.71"S	140°19'40.49"E
BC02	433556	6498642	117	31°38'43.85"S	140°17'57.29"E
BC03	429856	6507387	98	31°33'59.04"S	140°15'39.06"E
BC04R	429446	6517229	83	31°28'39.30"S	140°15'26.04"E
BC05	429090	6527212	67	31°23'14.99"S	140°15'15.12"E
BC06	429041	6537202	47	31°17'50.51"S	140°15'15.82"E
BC07	428983	6547007	33	31°12'32.04"S	140°15'16.13"E
BC08	431576	6555697	32	31°07'50.34"S	140°16'56.26"E
BC09	429387	6563257	34	31°03'44.33"S	140°15'35.50"E
BC10	424971	6568661	23	31°00'47.81"S	140°12'50.33"E
BC11	423640	6577507	22	30°56'00.18"S	140°12'02.53"E
BC12	420314	6588043	27	30°50'17.17"S	140°10'00.17"E
BC13	419096	6597248	22	30°45'17.89"S	140°09'16.94"E
BC14	418369	6606632	37	30°40'12.90"S	140°08'52.28"E
BC15	415258	6616047	21	30°35'06.31"S	140°06'58.16"E
BC16	415877	6625188	23	30°30'09.54"S	140°07'24.06"E
BC17	415497	6634563	14	30°25'04.93"S	140°07'12.55"E
BC18	411560	6643435	19	30°20'15.72"S	140°04'47.69"E
BC19	400216	6661246	2	30°10'34.01"S	139°57'48.96"E
BC20	398284	6667262	14	30°07'18.02"S	139°56'38.82"E
BC21	393927	6675711	34	30°02'42.24"S	139°53'59.06"E
BC22	386437	6680799	46	29°59'54.55"S	139°49'21.37"E
BC23	379872	6688178	72	29°55'52.62"S	139°45'19.37"E
BC24	373994	6695141	104	29°52'04.33"S	139°41'43.12"E
BC25	363364	6697870	114	29°50'31.62"S	139°35'08.24"E

Table III: MT Site Coverage for Curnamona Line.

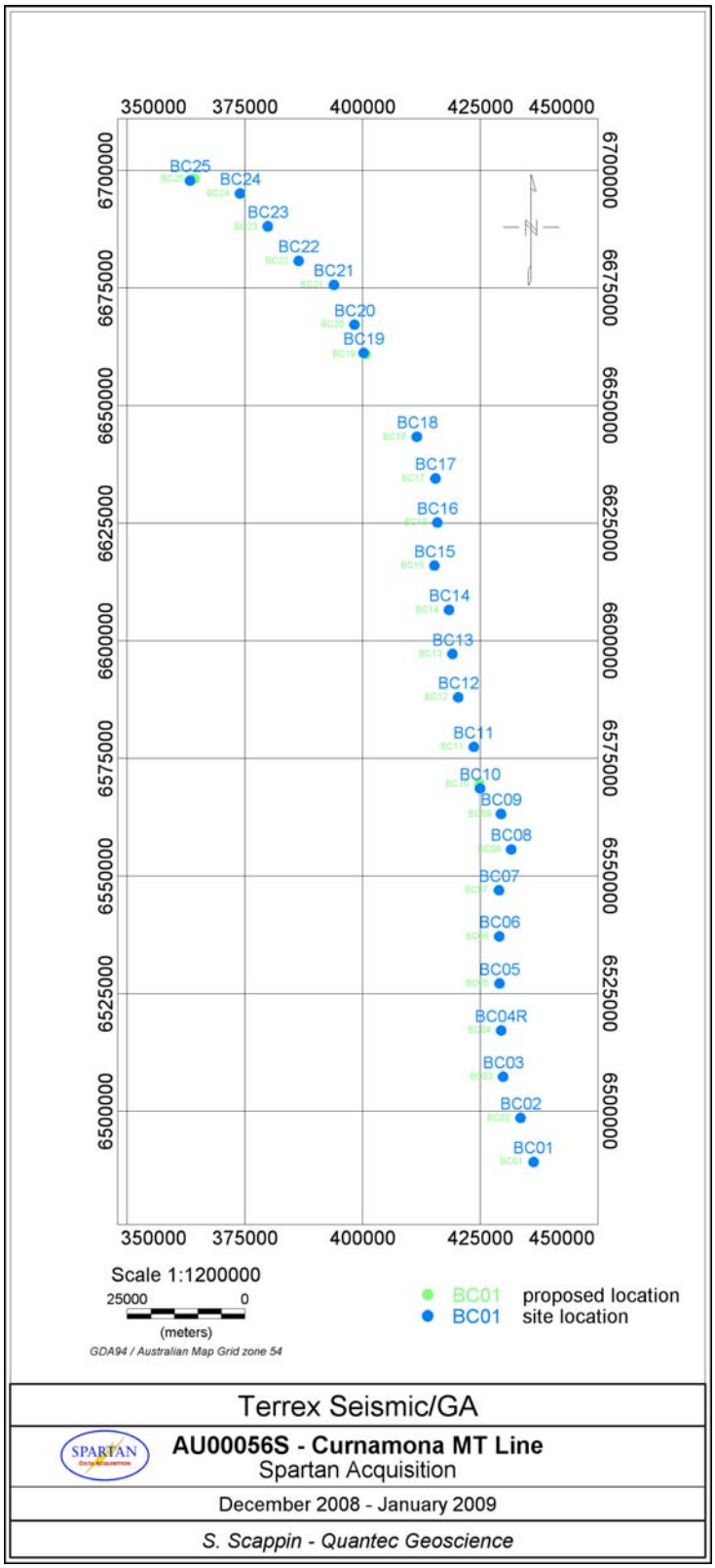


Figure 3: MT Site Location for Curnamona Line.

3.5 INSTRUMENTATION

- **Receiver System:** Quantec RT-130 Data Logger, comprising:
  - 6 channels max. per system (5 channels operationally) with internal A/D conversion (24bit @120db, and 6Mb buffer memory).
  - 9 Recording Units (loggers), deployed simultaneously for recording site and remote reference (3 units at the time)
  - 9 GPS synchronization clocks (10nsec precision /12.3MHz clock-speed)
- **Receiver Coils:** In two acquisition periods, 30 Phoenix model P50, and 13 EMI model BF4 and BF7 (10000sec to 1000Hz) Magnetometers, 3 at each site (Hx, Hy, and Hz)
- **Receiver Electrodes** Ground contacts using steel plates

3.6 PARAMETERS

- **Frequency Bandwidth:** Operating: 0.001 to 1000 Hz
  Effective: 0.001 to 250 Hz
- **Time-series Sampling:** High Range: 1000 samples/sec
  Low range: 20 samples/sec (QuickLay resampling)
- **Remote-Base Synchronization**: GPS clocks (10μsec time-accuracy)
- **Time-Series Stacking:** High Range: ~6912000 samples
  Low Range: ~3000000 samples
- **Sample/Record Time:** High Range: 4 to 17 sub-events @ 4 hrs. per event and 1 to 5 sub-events @ 12-15 hrs.
  (total recording and retrieving time approx. 19 to 72 hours)
- **Post-Processing:** Using QGI Quicklay version 3.0.Alpha_33

  1) Coherent noise rejection using remote-reference
  2) Proprietary digital filtering (scrubbing)
  3) Coherency sorting
  4) Impedance estimate stacking
- **Final Data Processing:** Edited and un-edited phase & resistivity sounding curves (0.001-250 Hz @ 8 pts. per decade) using Geotools.
- **Final Data Output:** 1) Auto and cross-power spectral estimates
  2) Unrotated (XY & YX) Tensor impedances + errors (apparent resistivities and E/H phase – Tipper Transfer Functions (Txr, Txi & Tyr, Tyi) – See Figure 4)

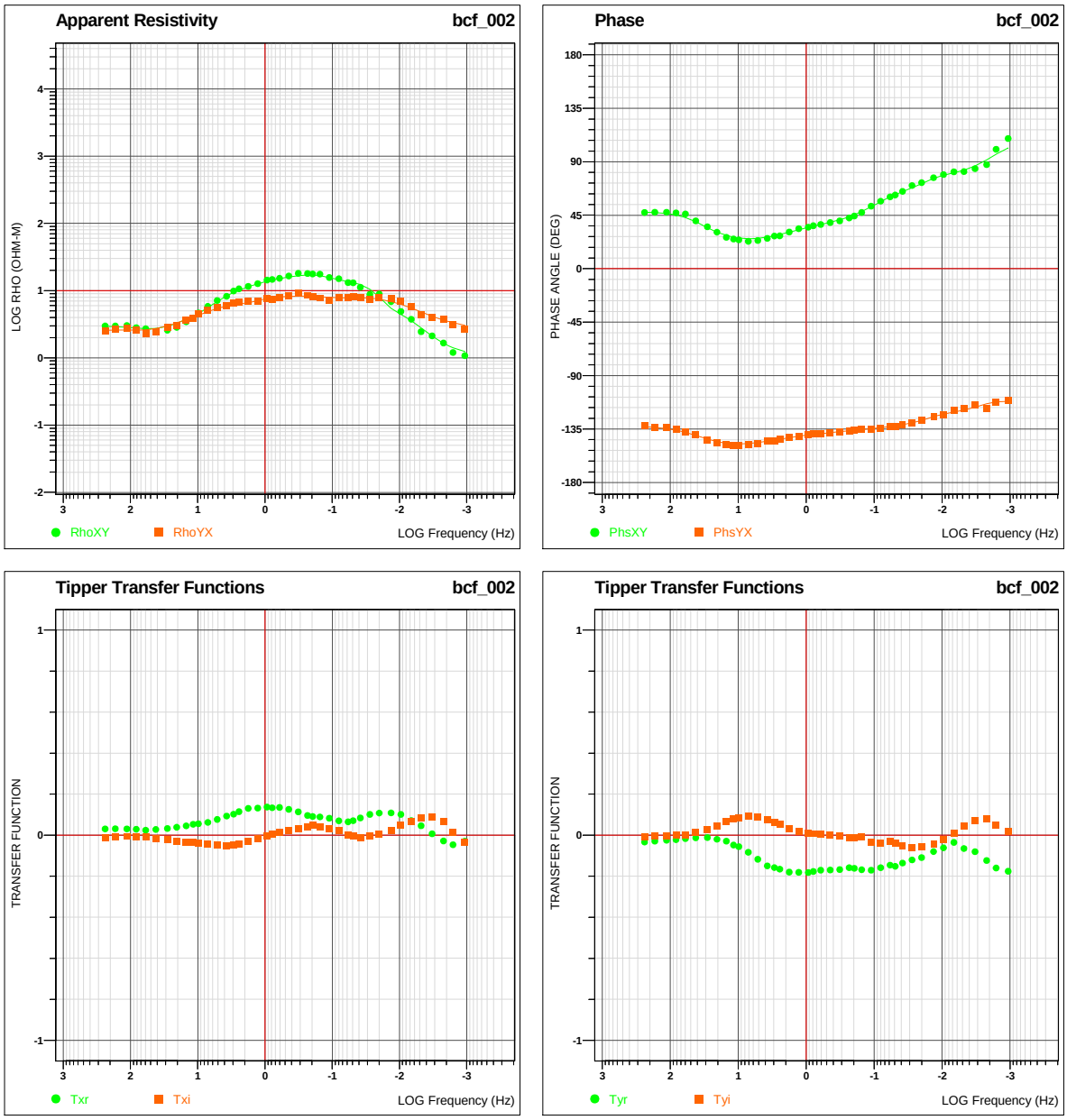


Figure 4: Example of Apparent Resistivity, Phase (XY and YX), Tipper Transfer Function (Txr, Txi & Tyr, Tyi) Sounding Curves.

3.7 Data Accuracy and Repeatability

- **Data Error:** Apparent Resistivity = <1/20TH decade avg.
  Phase = <3 degrees avg.
- **Parallel Sensor Test:** Low Freq-Range Test for Phoenix model P50 and EMI models BF4 and BF7 (see Figure 5)

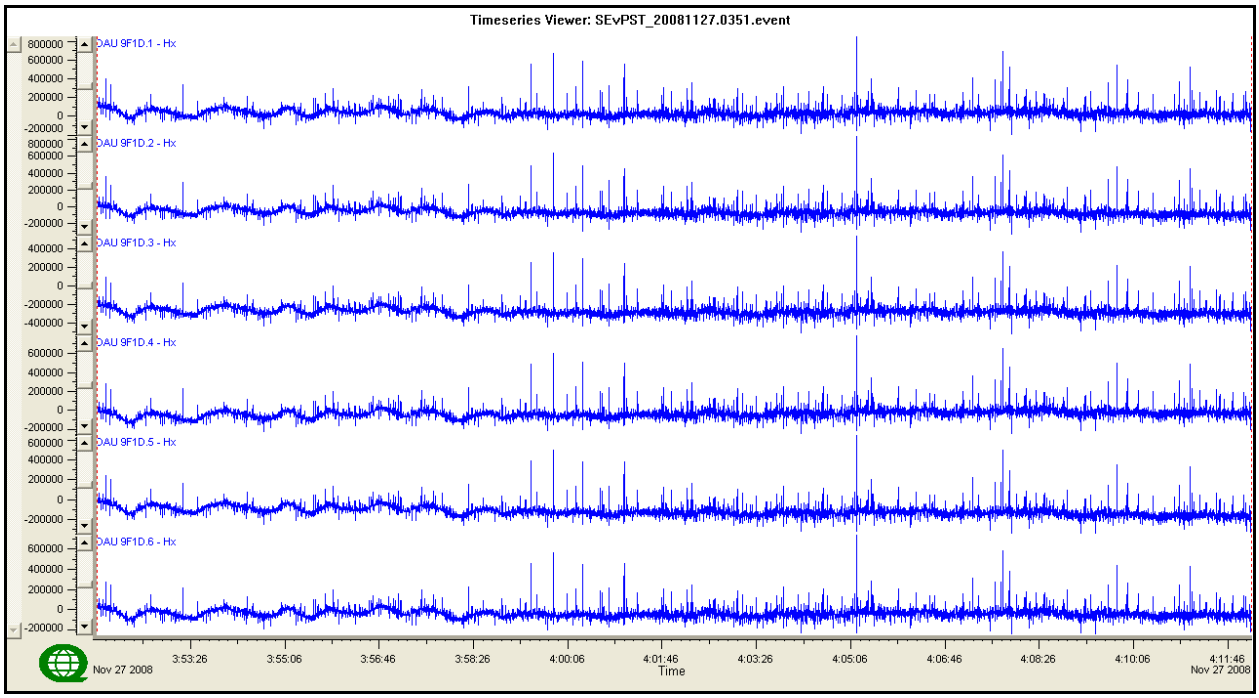


Figure 5: Time Series taken from Parallel Sensor Test[2]

[2] Parallel Sensor Test: all coils are Phoenix P50.

3.8 DATA PRESENTATION

- **Sounding Curves** — MT Apparent Resistivity and Phase (XY and YX), Tipper Transfer Function (Txr, Txi & Tyr, Tyi) (See Appendix C)
- **Digital**
  - Raw data: — Site and Remote Raw data that contains information on the location and time of the event archived onto external hard drive daily.
  - Processed data: — MT DATA, in EDI (electronic data interchange) file, created in Geotools™ containing tensor sounding data (XY & YX) for individual stations (sites) in a format conforming to SEG standard for the storage MT data.

RESPECTFULLY SUBMITTED

QUANTEC GEOSCIENCE LTD.

OCTOBER 2009

Joel Stockill, B.Sc.
Data Processor – QG Australia

Trent Retallick, B.Sc.
Project Manager – QG Australia

Dominic Brown, B.Sc.
Data Processor – QG Australia

Susanna Scappin, B.Sc.
Data Processor - QG Australia

Mehran Gharibi, Ph.D.
Interpretation – QGL

APPENDIX A: STATEMENT OF QUALIFICATIONS

MEHRAN GHARIBI

I, Mehran Gharibi, declare that

- I am a consultant with residence in Toronto, Ontario and am presently employed in this capacity with Quantec Geoscience Ltd., Toronto, Ontario.
- I obtained a Bachelor of Science Degree (B.Sc.), Nuclear Physics, from the University of Shiraz, Iran in 1986, a Master of Science Degree (M.Sc.), Geophysics, Seismic Methods, from Tehran University, Iran in 1991, and a Doctor of Philosophy Degree (Ph.D.), Geophysics, Electromagnetic Methods, from the University of Uppsala, Sweden in 2000.
- I have practiced my profession continuously since 1991 in Middle- East, Europe, and Canada.
- I have no interest, nor do I expect to receive any interest in the properties or securities of **Terrex Seismic Pty Ltd.**, its subsidiaries or its joint-venture partners.
- I was in charge of data acquisition quality control, and have reviewed the logistic report.
- The statements made in this report represent my professional opinion in consideration of the information available to me at the time of writing this report.

Toronto, Ontario

October, 2009

Mehran Gharibi, Ph.D.

Quantec Geoscience Ltd.

APPENDIX A: STATEMENT OF QUALIFICATIONS

TRENT RETALLICK

I, Trent Retallick, declare that

- I am a geoscientist with residence in Brisbane, Queensland, Australia and am presently employed as the general manager of the Australian office with Quantec Geoscience Ltd., Toronto, Ontario.
- I obtained a Bachelor of Science Degree (B.Sc.), Geology major, from the University of Queensland in Brisbane, Queensland (Australia) in 1995.
- I have practiced my profession continuously since October 1996, in Australia, North America, South America, Africa, Asia and Europe.
- I have no interest, nor do I expect to receive any interest in the properties or securities of **Terrex Seismic Pty Ltd.**, its subsidiaries or its joint-venture partners.
- I am the office manager responsible for this project. I have reviewed the survey results and oversaw the preparation and reviewed this logistics report and can attest that these accurately and faithfully reflect the data acquired on site. The statements made in this report represent my professional opinion based on my consideration of the information available to me at the time of writing this report.

Brisbane, Queensland

October 2009

Trent Retallick, B.Sc.

Quantec Geoscience Pty Ltd.

APPENDIX A: APPENDIX A: STATEMENT OF QUALIFICATIONS

SUSANNA SCAPPIN

I, Susanna Scappin, declare that

- I am a data processor with residence in Brisbane, Queensland (Australia) and am presently employed in this capacity with Quantec Geoscience Ltd., Brisbane, Australia.
- I obtained a Bachelor's Degree with Honours (B.Sc. Hons.) in Geology from the University of Padua (Università degli Studi di Padova), Italy, in October 1998.
- I have practiced my profession continuously since February 2002 in North and South America, Africa, Australia, Mongolia and Europe.
- I have no interest, nor do I expect to receive any interest in the properties or securities of **Terrex Seismic Pty Ltd**, its subsidiaries or its joint-venture partners.
- I was the data processor on site for the second part of the project responsible for the quality control of data acquired. I have reviewed the data processing of the data acquired throughout the survey. I compiled and edited the logistics report. The statements made in this report represent my professional opinion based on my consideration of the information available to me at the time of writing this report.

Brisbane, Queensland

October 2009

Susanna Scappin, B.Sc.

Quantec Geoscience Pty Ltd

APPENDIX A: STATEMENT OF QUALIFICATIONS

JOEL STOCKILL

I, Joel Stockill, declare that

- I am a geophysicist (in training) with residence in Brisbane, Queensland, Australia and am presently employed as a processor with Quantec Geoscience Ltd., Brisbane, Australia.
- I obtained a Bachelor of Science Degree (B.Sc.), Geophysics major, from the University of Queensland in Brisbane, Queensland (Australia) in 2007.
- I am commencing a Master of Mineral Resources in the field of Exploration in February 2008 at the University of Queensland in Brisbane, Queensland (Australia).
- I have practiced my profession continuously since November 2005, in Australia and North America.
- I have no interest, nor do I expect to receive any interest in the properties or securities of **Terrex Seismic Pty Ltd**, its subsidiaries or its joint-venture partners.
- I was one of the main data processors on site, responsible for quality control of the data acquired for the survey during the time I was there. The statements made in this report represent my professional opinion based on my consideration of the information available to me at the time of writing this report.

Brisbane, Queensland

October 2009

Joel Stockill, B.Sc.

Quantec Geoscience Pty Ltd

APPENDIX A: STATEMENT OF QUALIFICATIONS

DOMINIC BROWN

I, Dominic Brown, declare that

- I am a data processor with residence in Brisbane, Queensland (Australia) and am presently employed in this capacity with Quantec Geoscience Ltd., Brisbane, Australia.
- I obtained a Bachelor's Degree (B.AppSc.) in Geology from the Queensland University of Technology, Australia, in October 2004.
- I have practiced my profession continuously since October 2004 in Australia.
- I am a member of the Geological Society of Australia (GSA).
- I have no interest, nor do I expect to receive any interest in the properties or securities of **Terrex Seismic Pty Ltd**, its subsidiaries or its joint-venture partners.
- I was one of the data processor on site at the beginning of the project, responsible for the quality control of data acquired. The statements made in this report represent my professional opinion based on my consideration of the information available to me at the time of writing this report.

Brisbane, Queensland

October 2009

Dominic Brown, B.App.Sc.

Quantec Geoscience Pty Ltd

APPENDIX B: PRODUCTION SUMMARY

CURNAMONA MT PROJECT										
11-25-08	Mob Adelaide–Hawker									
11-26-08	Mob Hawker – Wooltana station									
11-27-08	Parallel sensor test									
DATE	**DESCRIPTION**	**SITES – Part I**							**Total Sites Day**	**Total Sites**
11-28-08	Setup	BC20	BC21	BC22					0	0
11-29-08	Setup	BC17	BC18	BC19					0	0
11-30-08	Setup	BC14	BC15	BC16					0	0
12-1-08	Setup	BC11	BC12	BC13						
	Read	**BC20**	**BC21**	**BC22**					3	3
12-2-08	Setup	BC08	BC09	BC10						
	Read	**BC17**	**BC18**	**BC19**					3	6
12-3-08	Setup	BC23	BC24	BC25						
	Read	**BC14**	**BC15**	**BC16**					3	9
12-4-08	Setup	BC04	BC05	BC06	BC07					
	Read	**BC11**	**BC12**	**BC13**					3	12
12-5-08	Setup	BC01	BC02	BC03						
	Read	**BC08**	**BC09**	**BC10**					3	15
12-6-08	Read	**BC23**	**BC24**	**BC25**					3	18
12-7-08	Stand by day (Weather)								0	18
12-8-08	Read	**BC07**	**BC06**	**BC05**	**BC04**	**BC03**	**BC02**	**BC01**	6	24
12-9-08	Setup	BC04R	BC05						0	24
12-10-08	Stand by day (Weather)								0	24
12-11-08	Stand by day (Weather)								0	24
12-12-08	Stand by day (Weather)								0	24
		TOTAL SITES RECORDED (partial)							24	
		STAND BY DAY – weather (partial)							4	
		MOBILIZATION DAYS (Partial)							2	
		SURVEY DAYS (Partial)							12	

CURNAMONA MT PROJECT										
DATE	**DESCRIPTION**	**SITES – Part I**							**Total Sites Day**	**Total Sites**
12-13-08	Read	**BC04R**	BC05						1	25
12-14-08	Clean/Pack gear/Mob Wooltana (SA) – Broken Hill (NSW)								0	25
12-15-08	Mob Broken Hill (NSW) – Coonabarabran (NSW)								0	25
12-16-08	Mob Coonabarabran (NSW) – Brisbane (QLD)								0	25
DATE	**DESCRIPTION**	**SITES – Part II**							**Total Sites Day**	**Total Sites**
01-19-09	Mob Brisbane (QLD) – Gilgandra (NSW)									
01-20-09	Mob Gilgandra (NSW) – Peterborough (SA)									
01-21-09	Mob Peterborough (SA) – Moolawatana station (SA) and Parallel Sensor Test 2									
01-22-09	Setup	BC23R	BC24R	BC25R					0	25
01-23-09	Acquisition								0	25
01-24-09	Read	**BC23R**	**BC24R**	**BC25R**					3	25
01-25-09	Mob Moolawatana Station (SA) – Cobar (NSW)								0	25
01-26-09	Mob Cobar (NSW) – Oman Ama (QLD)								0	25
01-27-09	Mob Oman Ama (QLD) – Brisbane (QLD)								0	25
		TOTAL SITES RECORDED							25	
		STAND BY DAY - weather							4	
		MOBILIZATION DAYS							5 + 5	
		SURVEY DAYS							16.5	

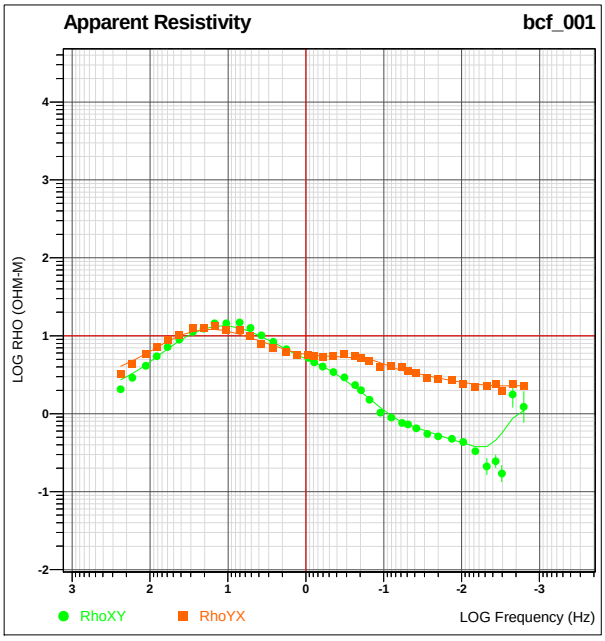
Legend:

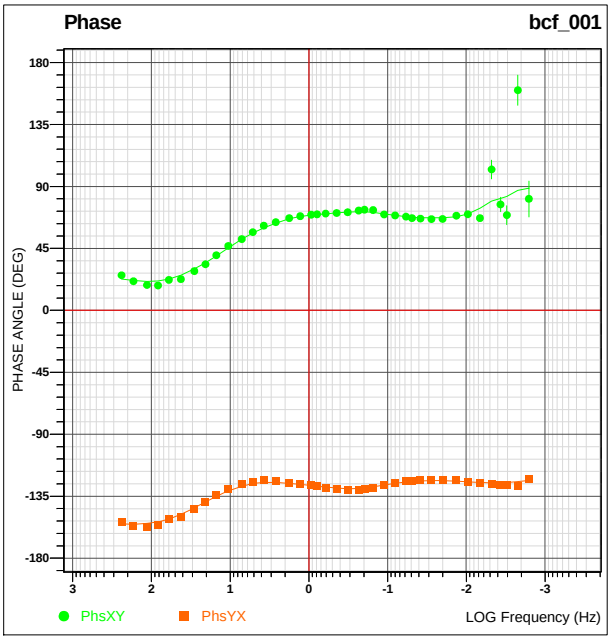
BC12	Site read
BC4	Site to be reacquired due to equipment
BC23	Site to be reacquired to confirm results

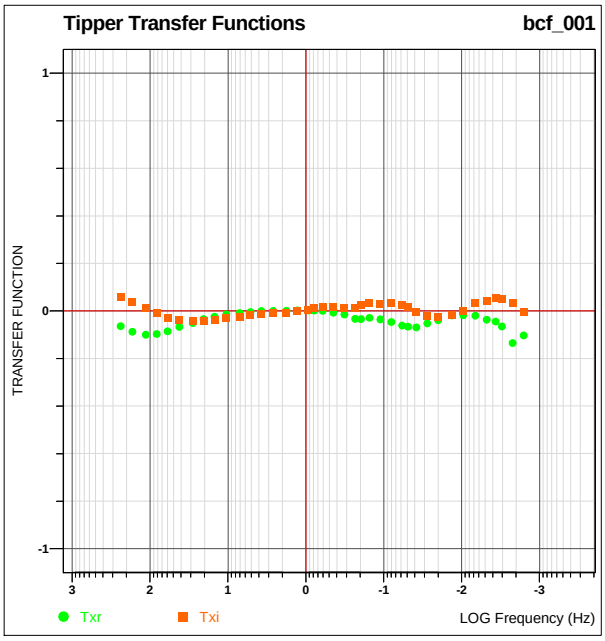
APPENDIX C: SOUNDING CURVES

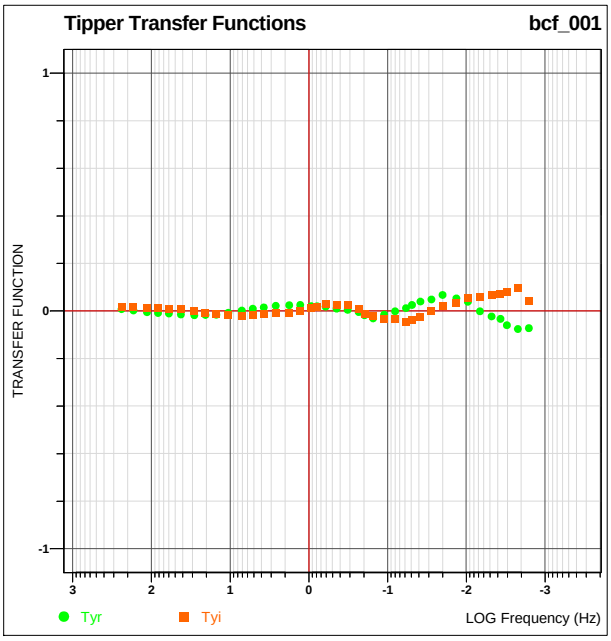
Apparent Resistivity – Phase (XY & YX) – Tipper Function (XrXi & YrYi) Sounding Curves

SITE BC01 **CURNAMONA LINE**



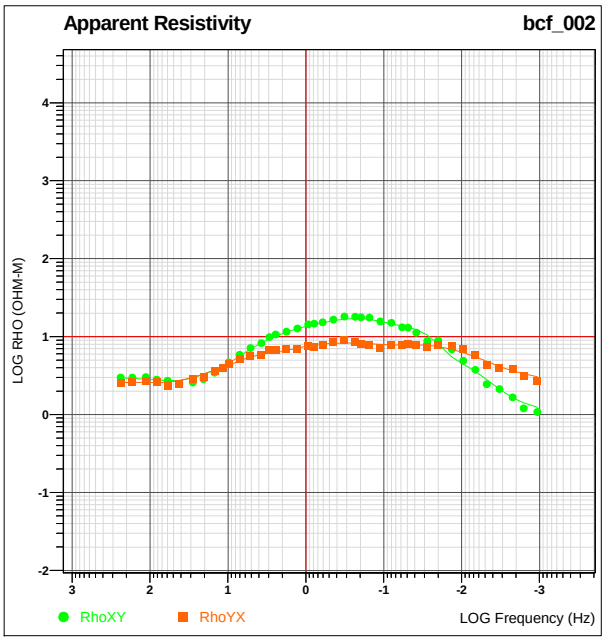


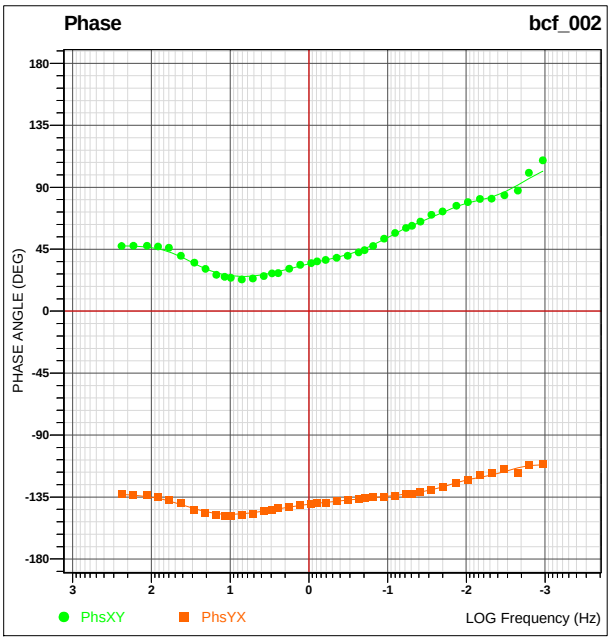


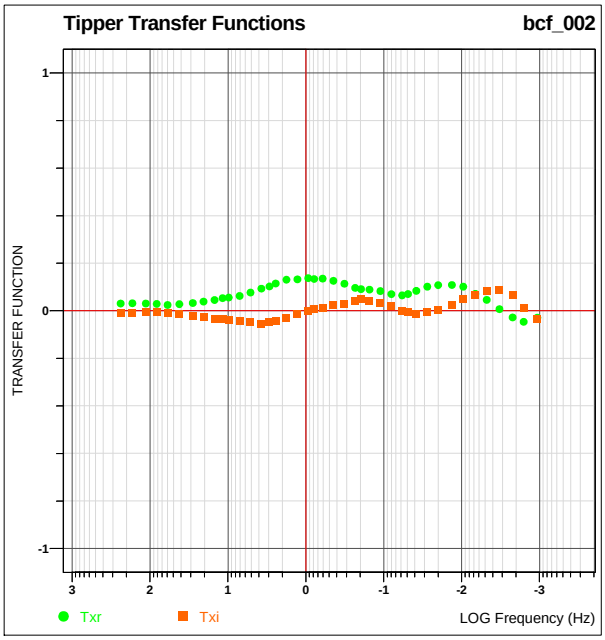


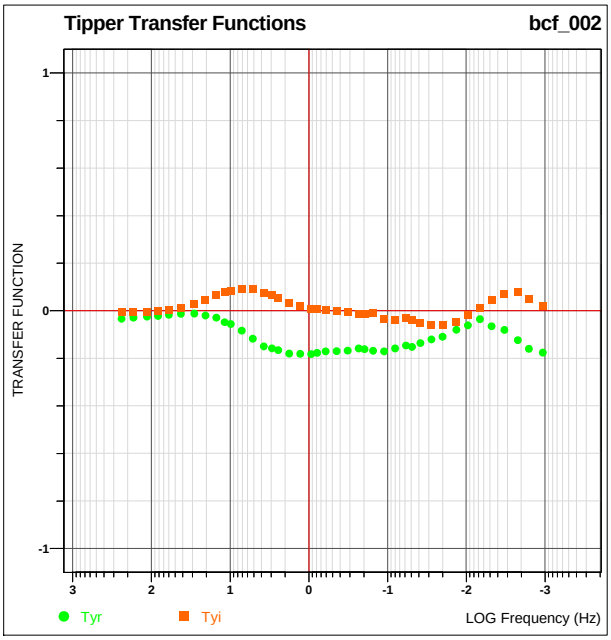
SITE BC02

CURNAMONA LINE









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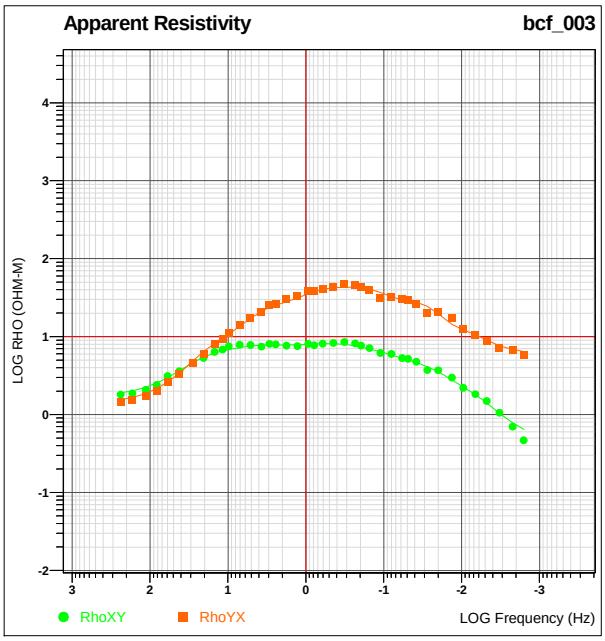

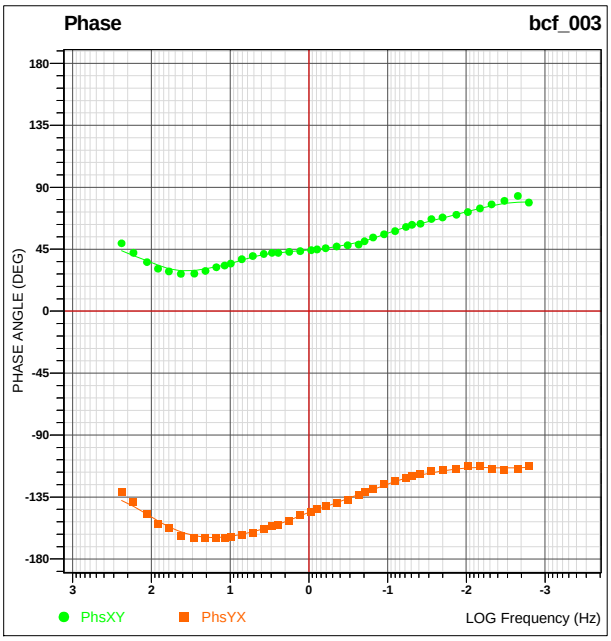

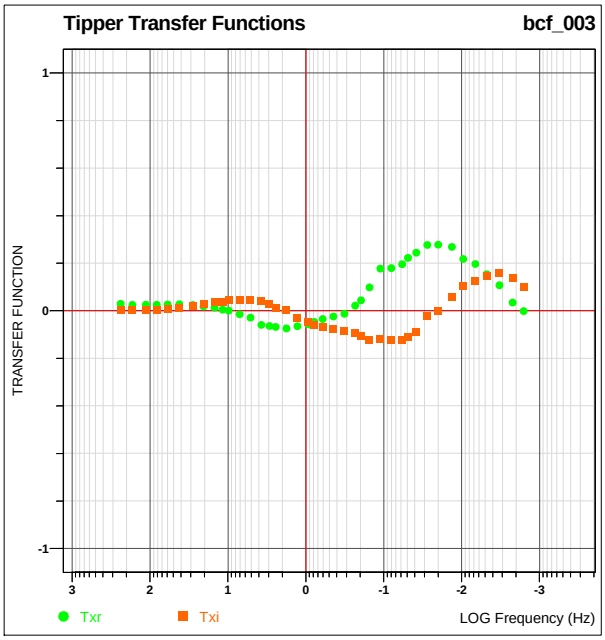

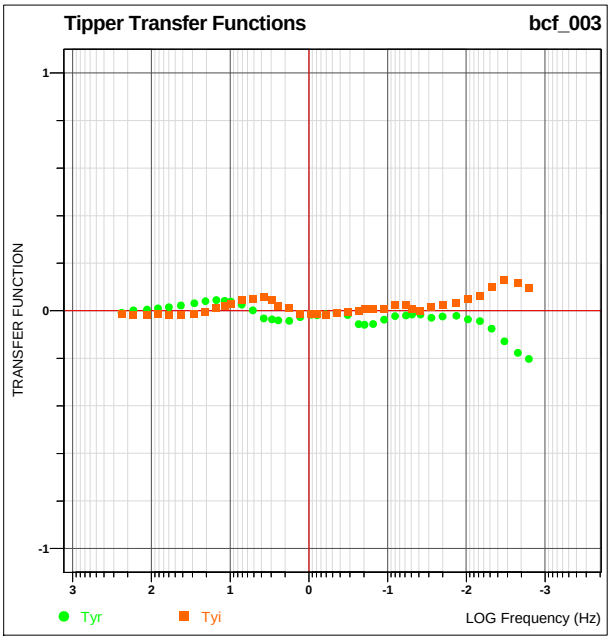

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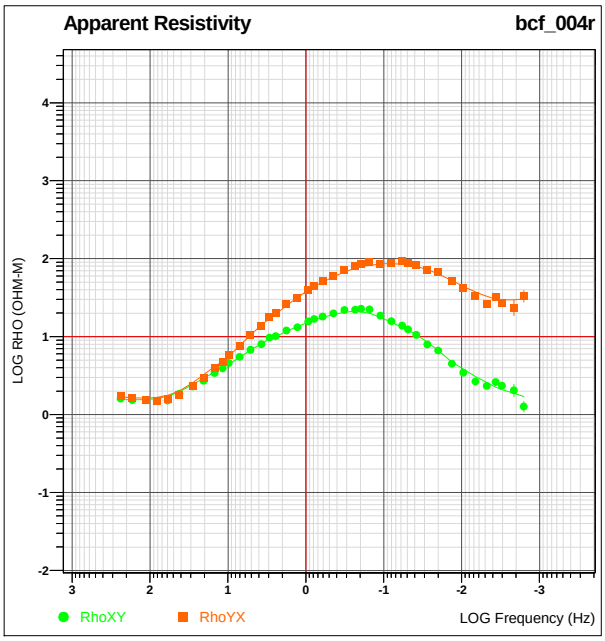

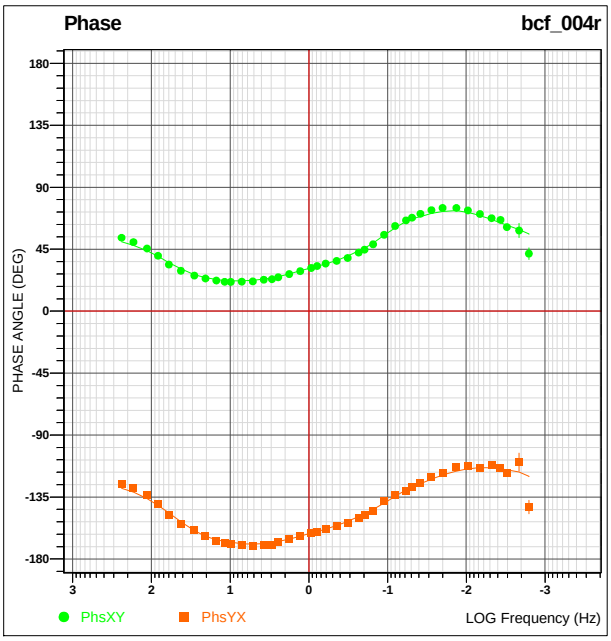

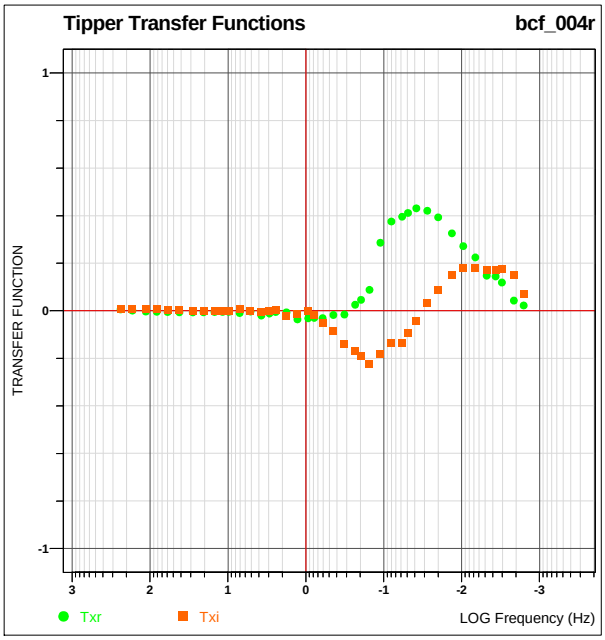

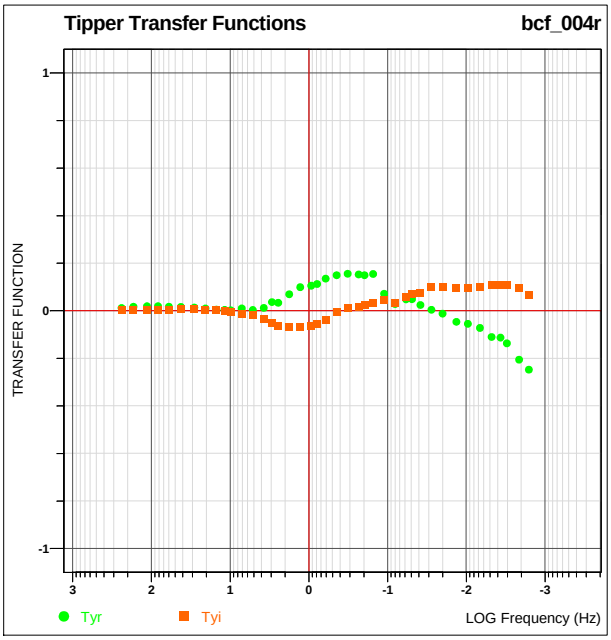

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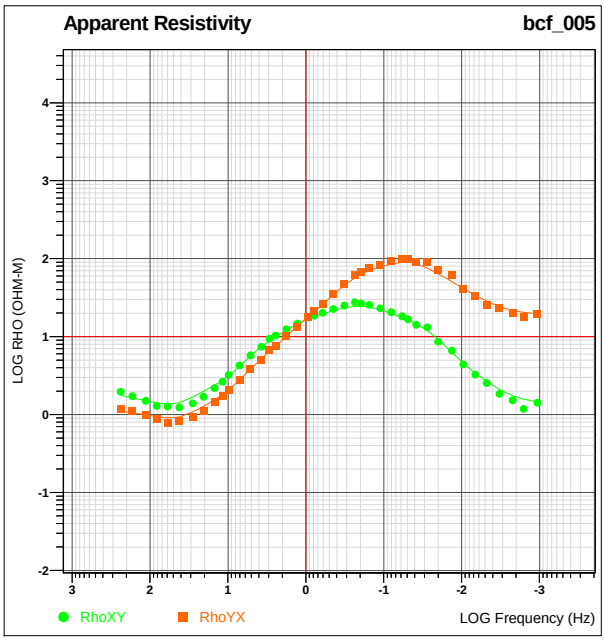

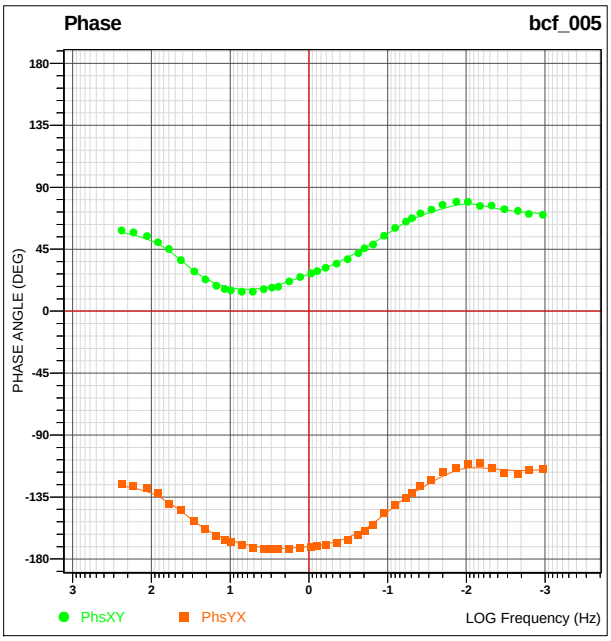

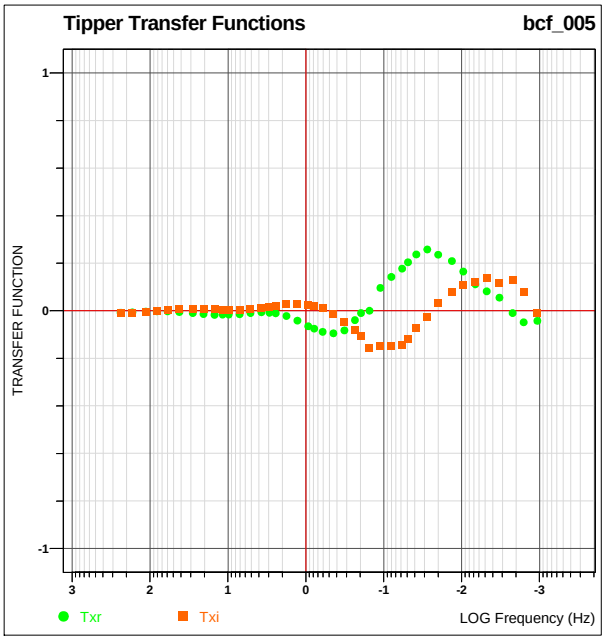

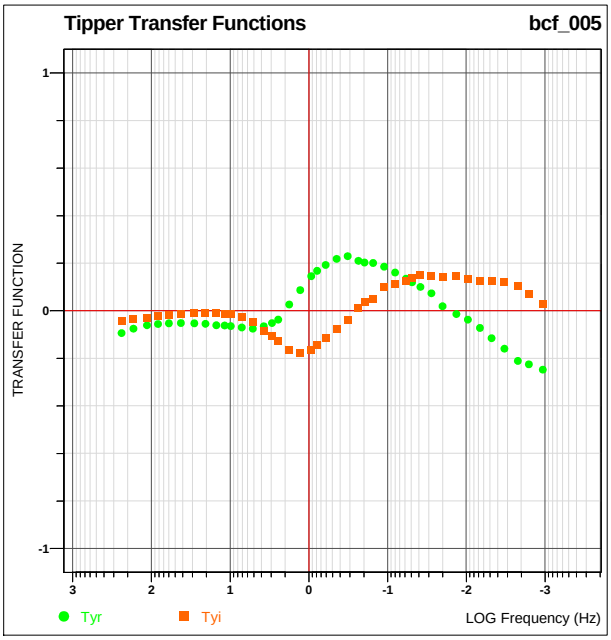

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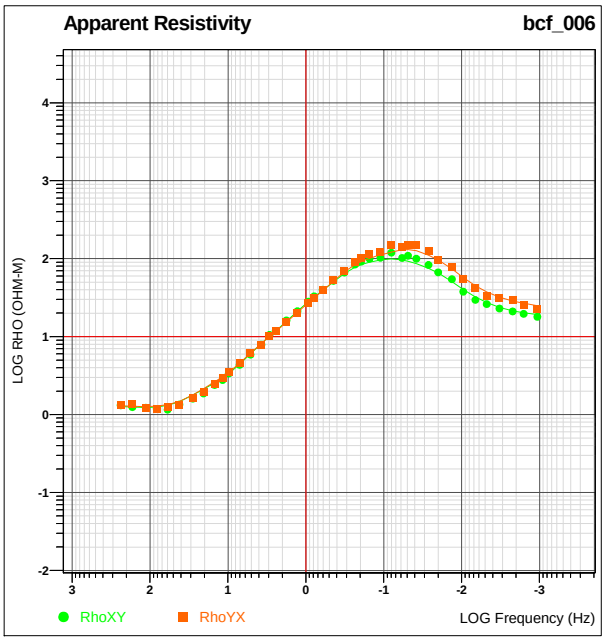

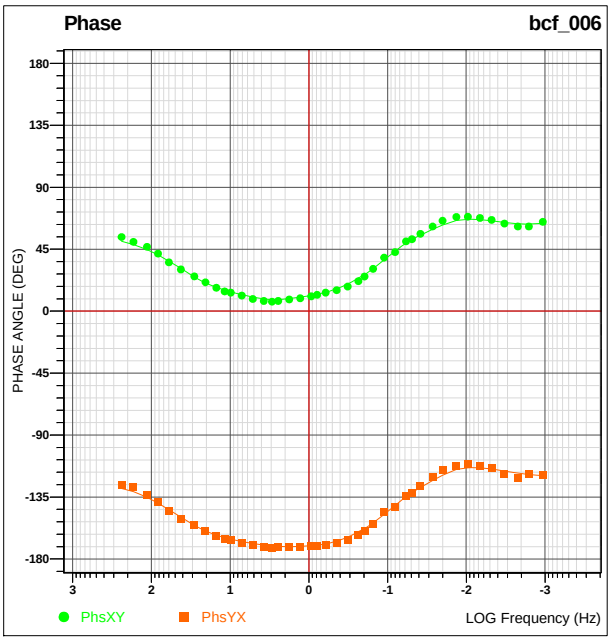

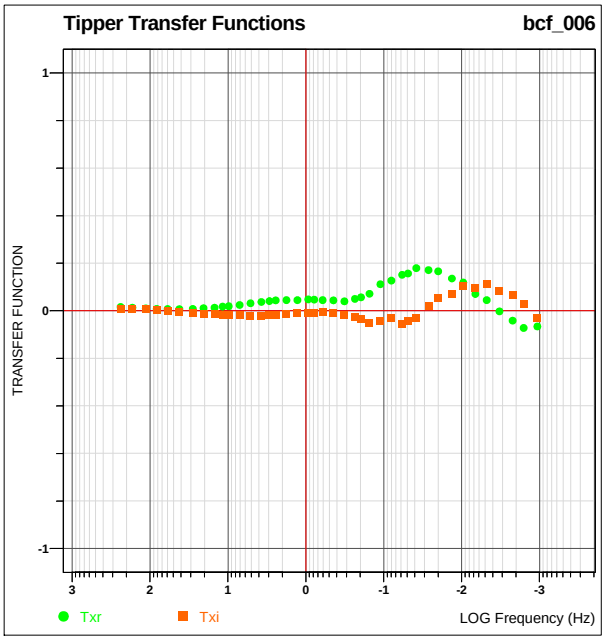

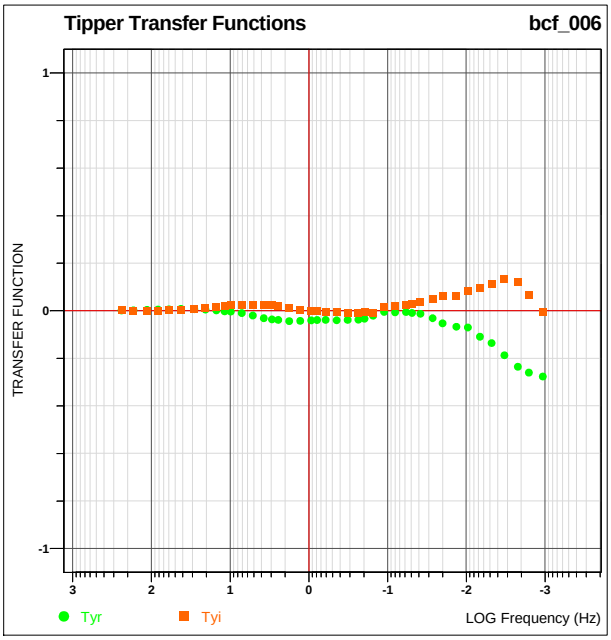

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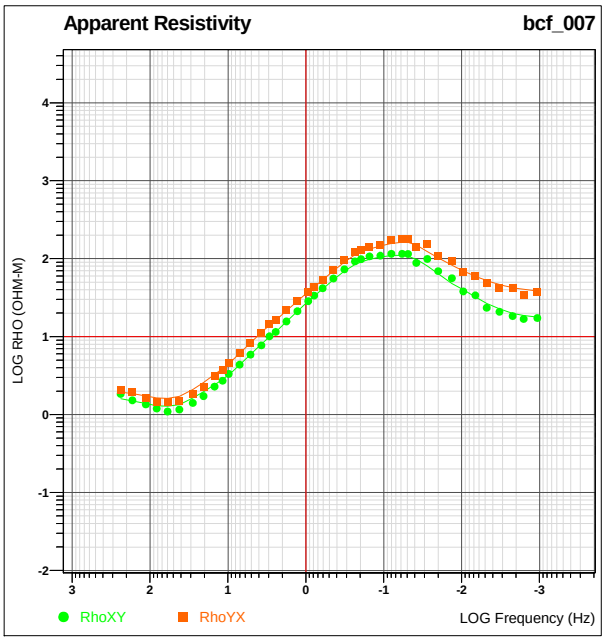

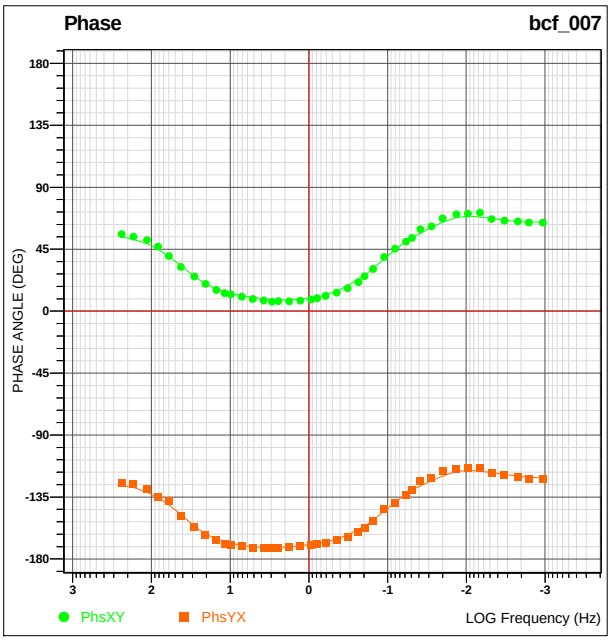

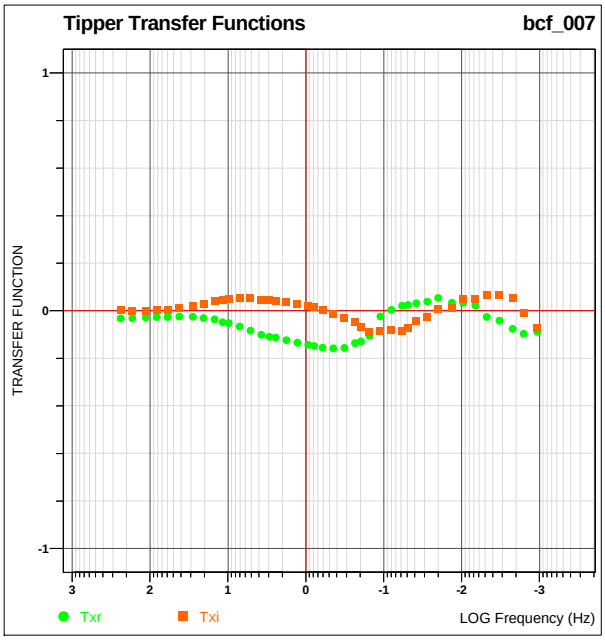

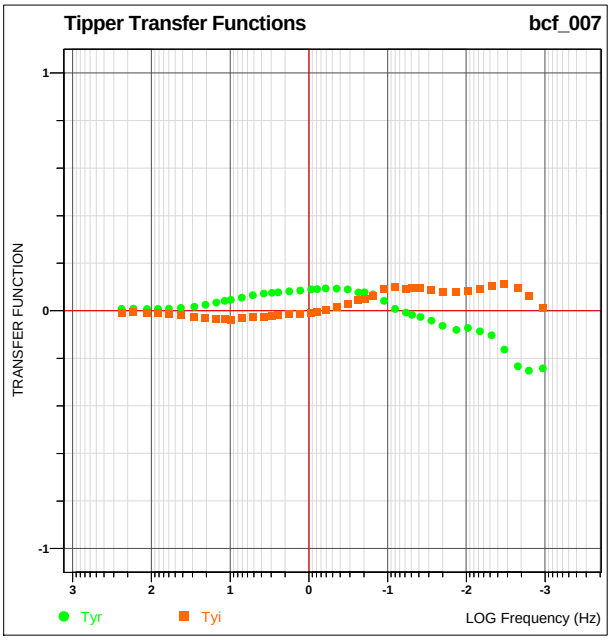

SITE BC08

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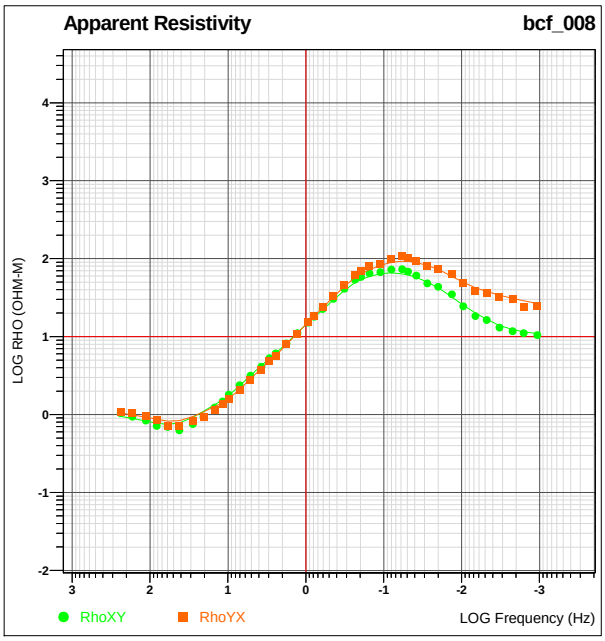

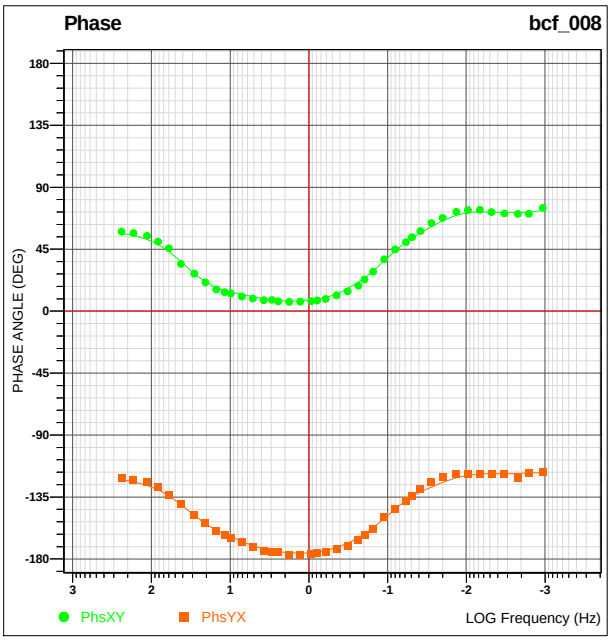

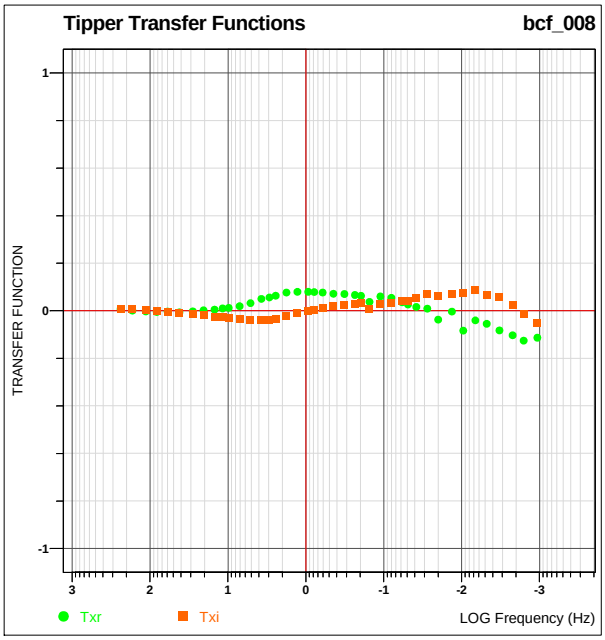

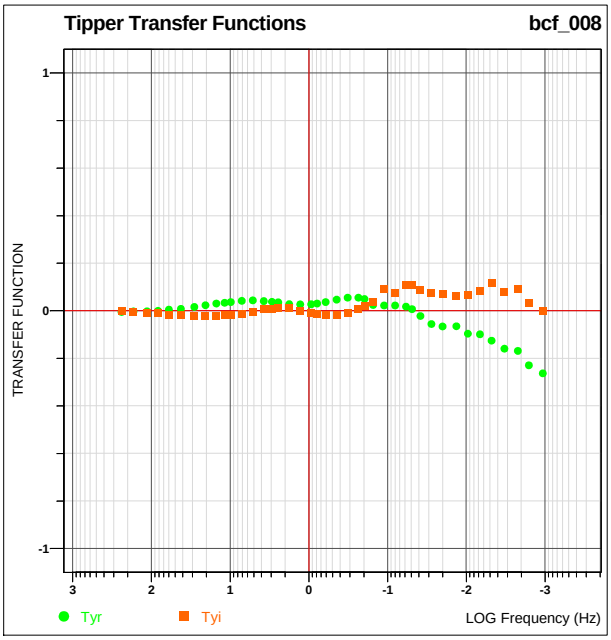

SITE BC09

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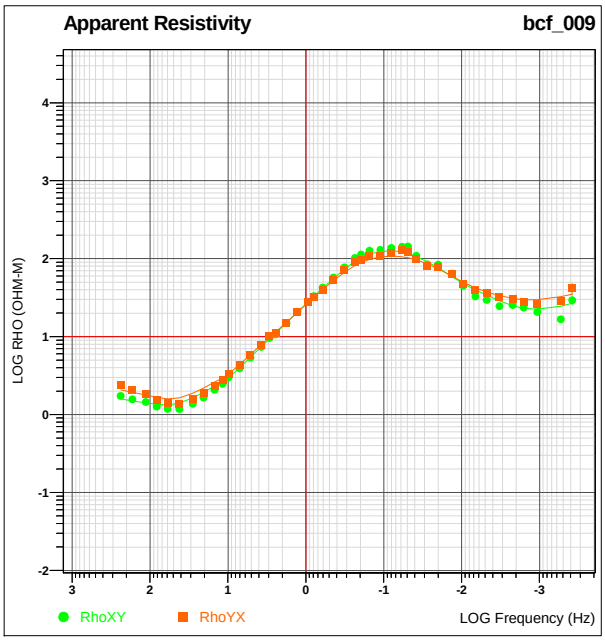

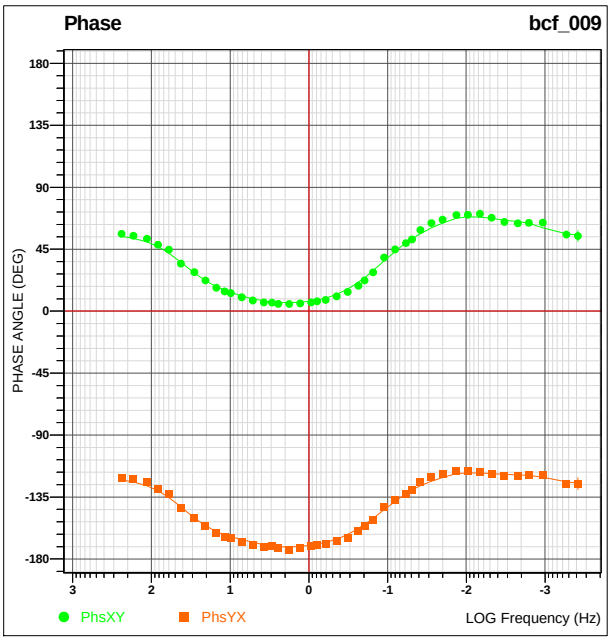

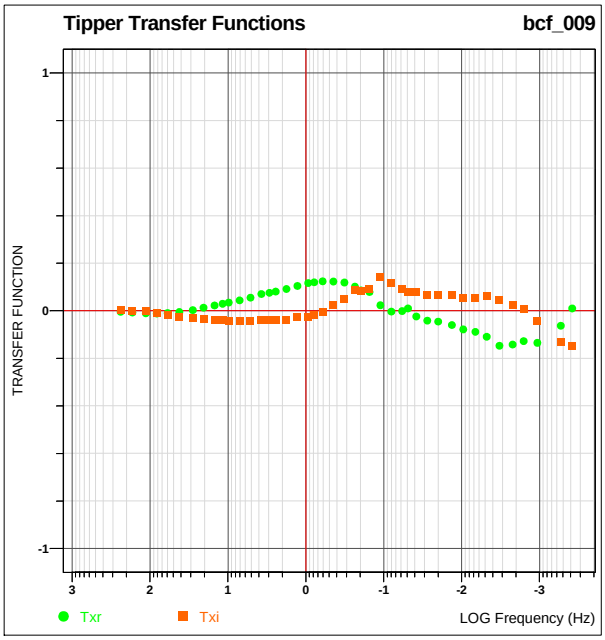

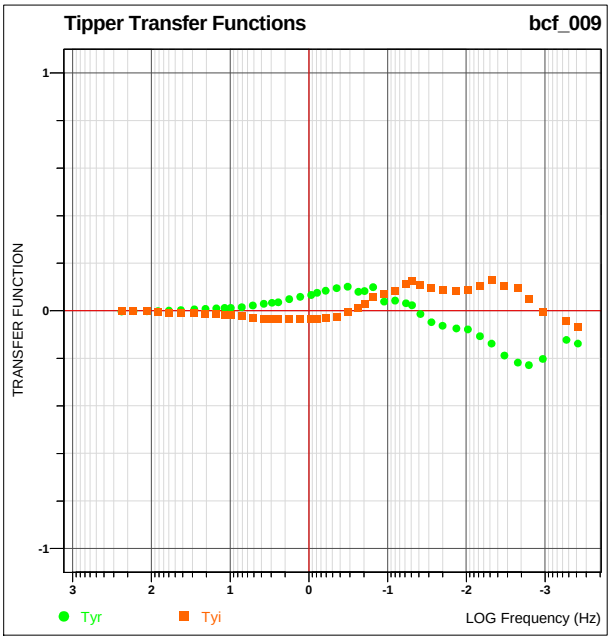

SITE BC10

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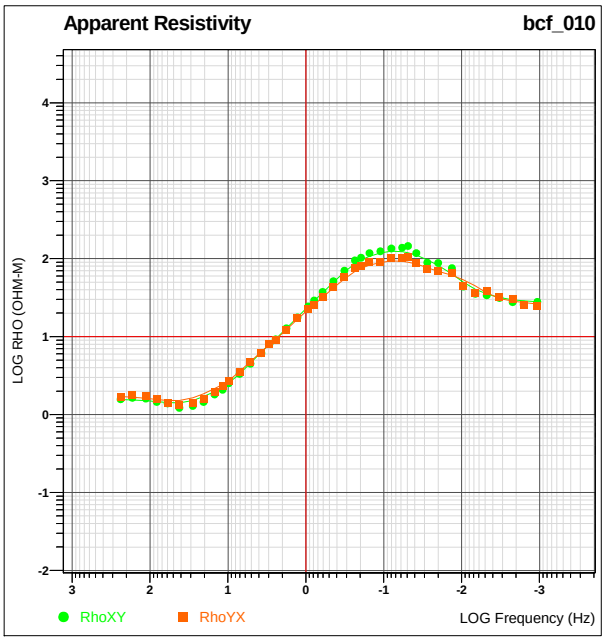

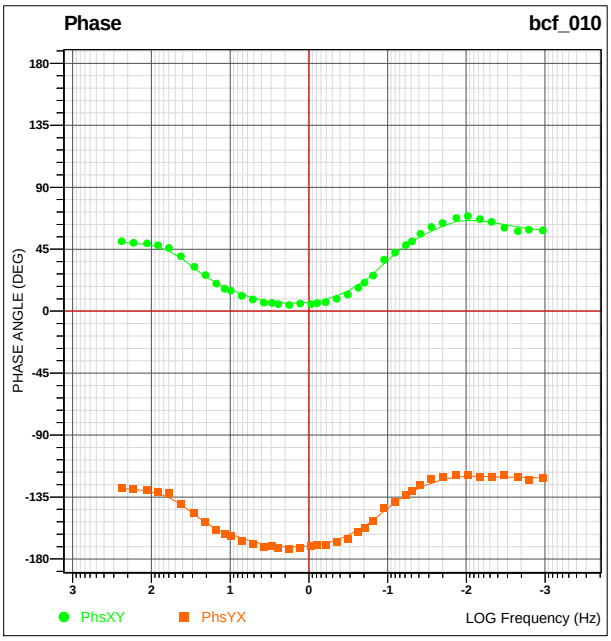

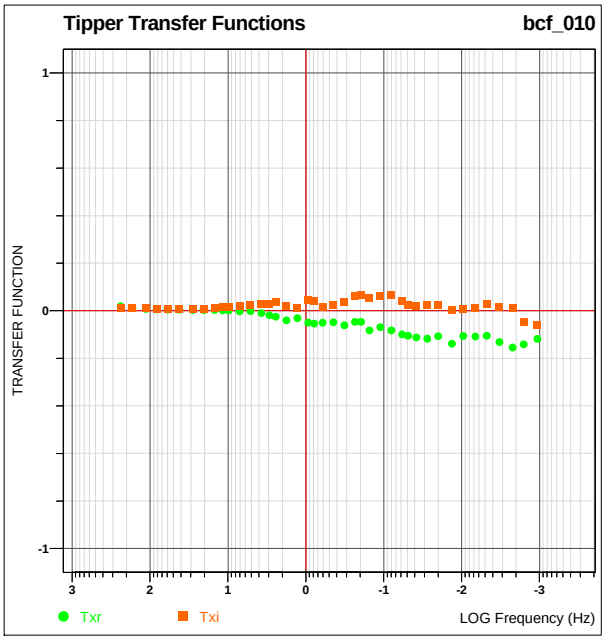

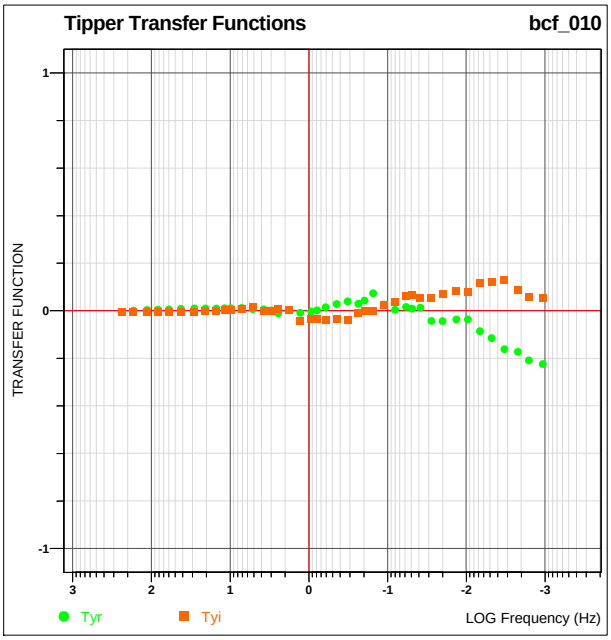

SITE BC11

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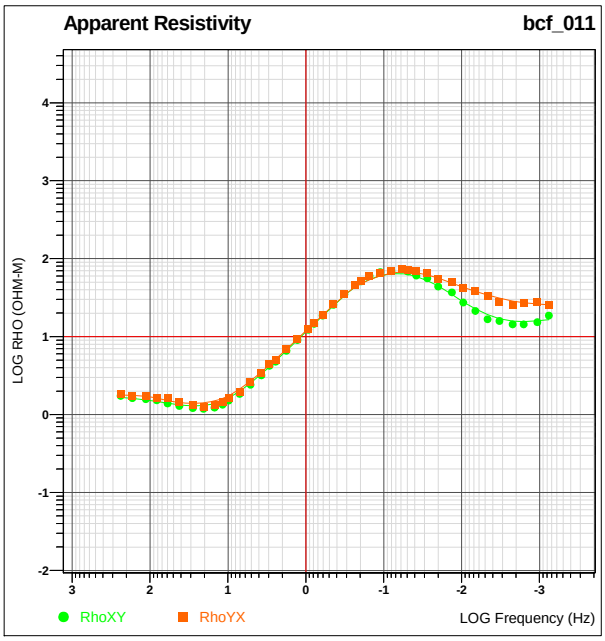

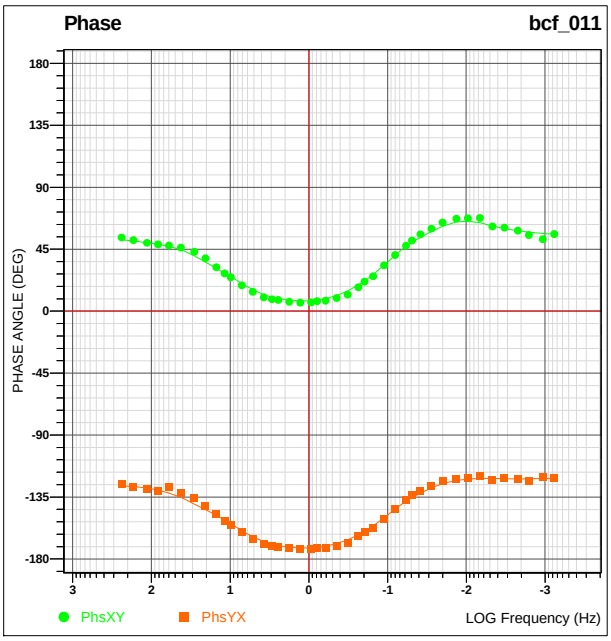

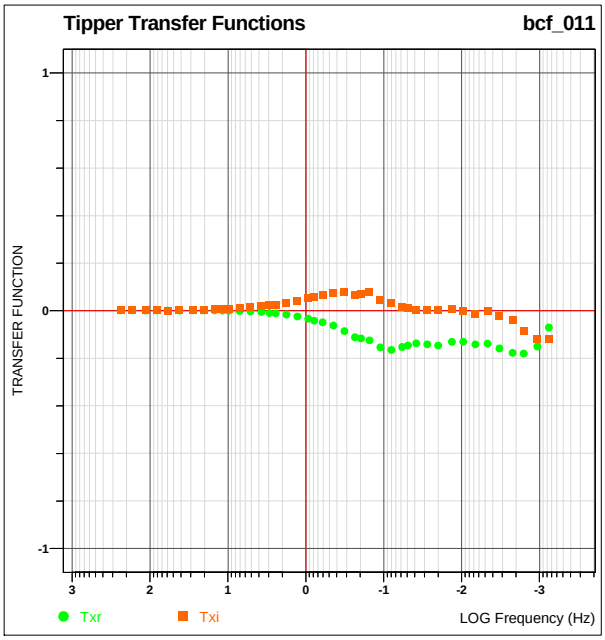

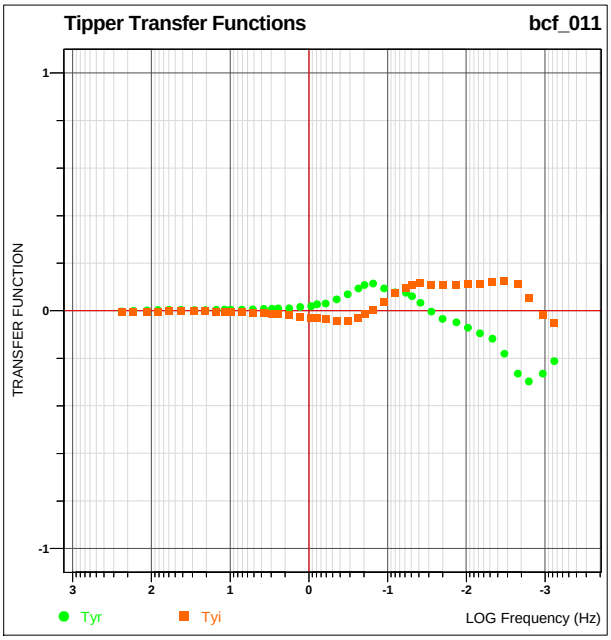

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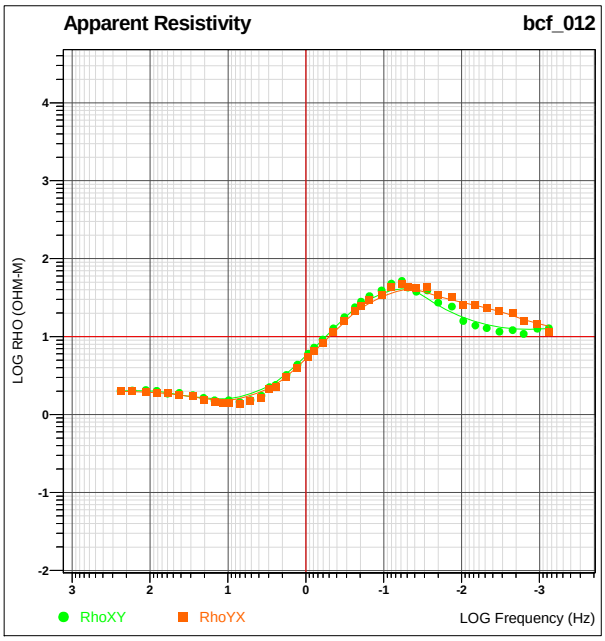

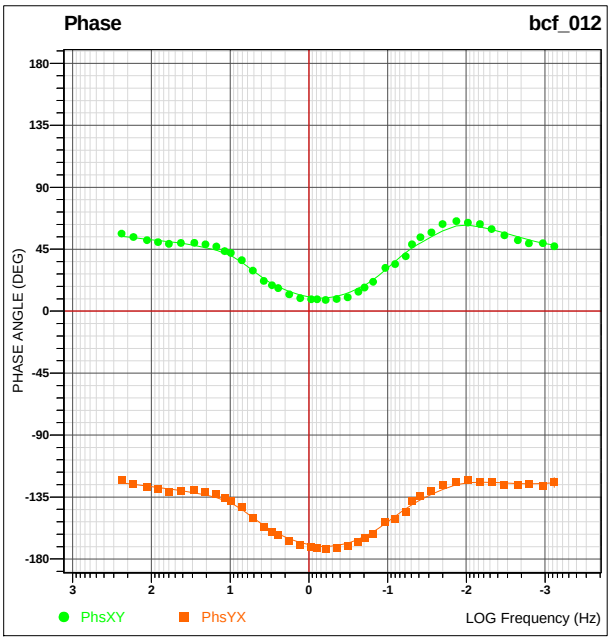

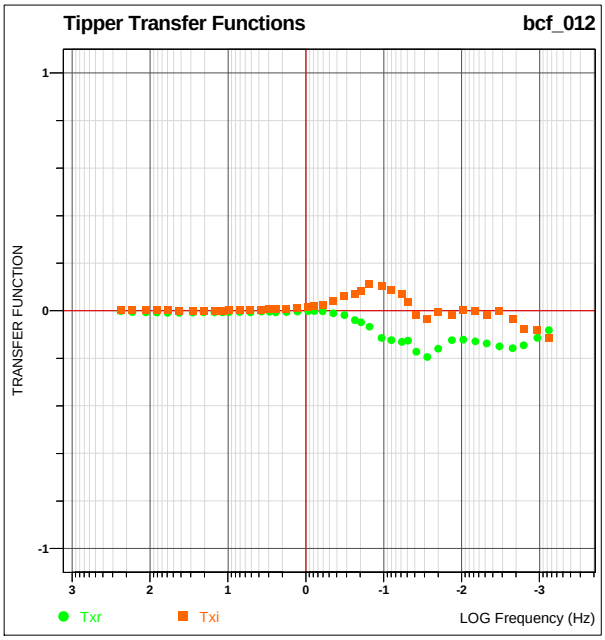

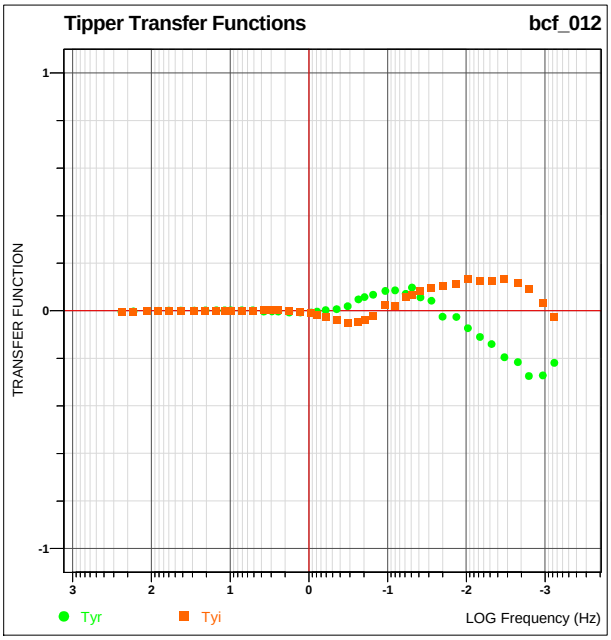

SITE BC13

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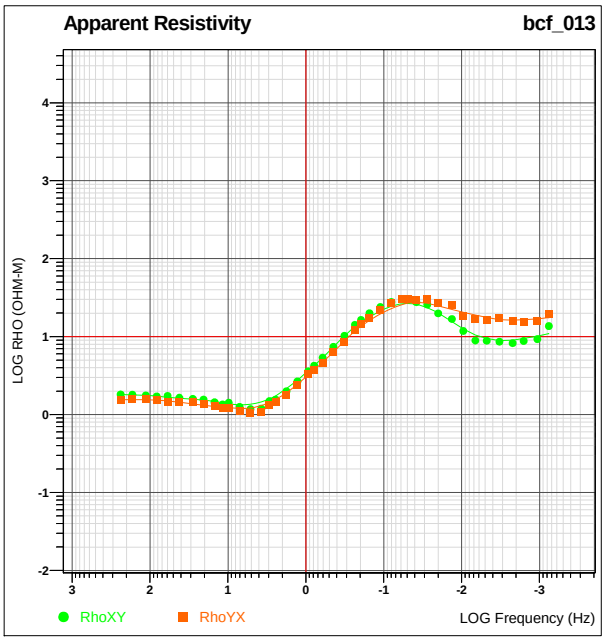

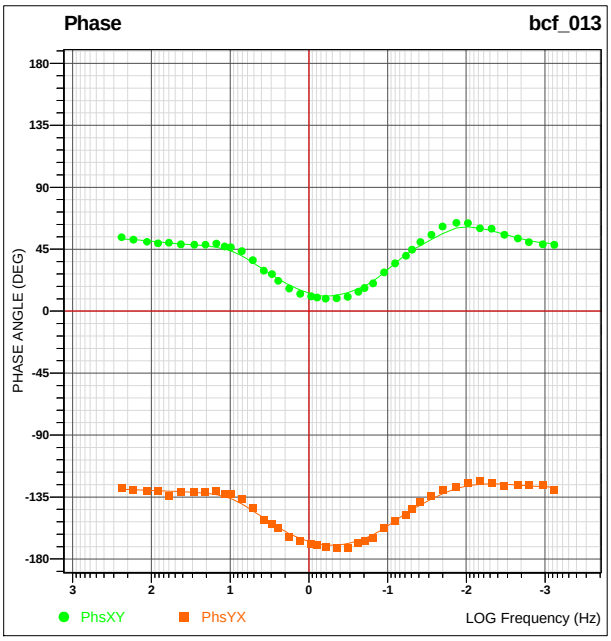

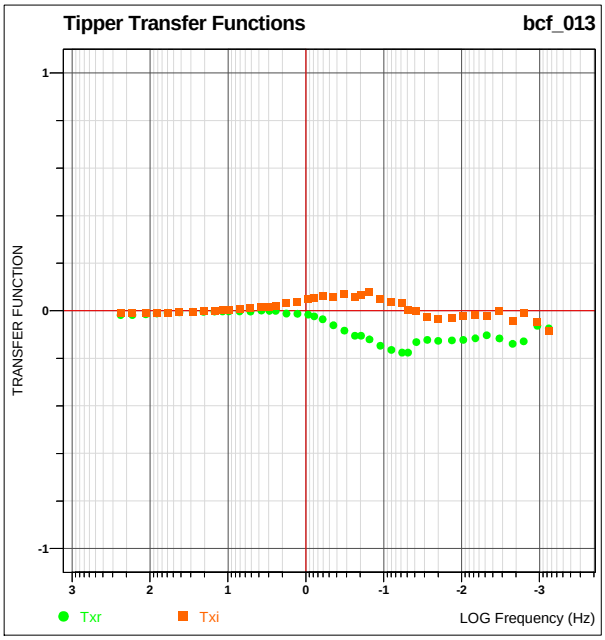

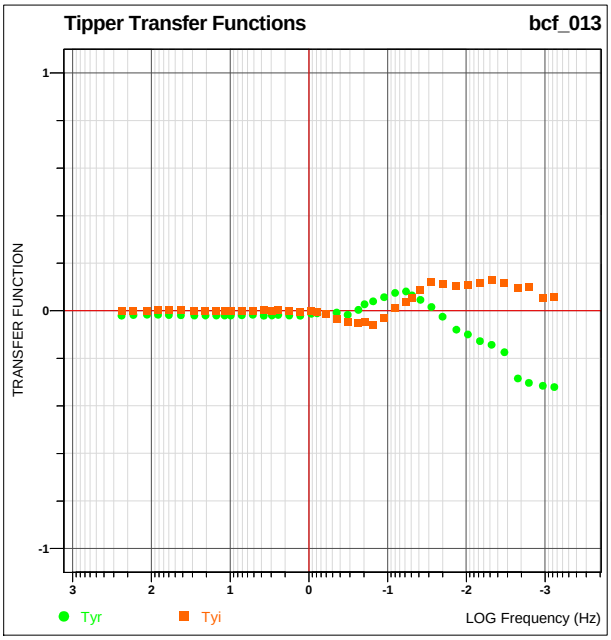

SITE BC14

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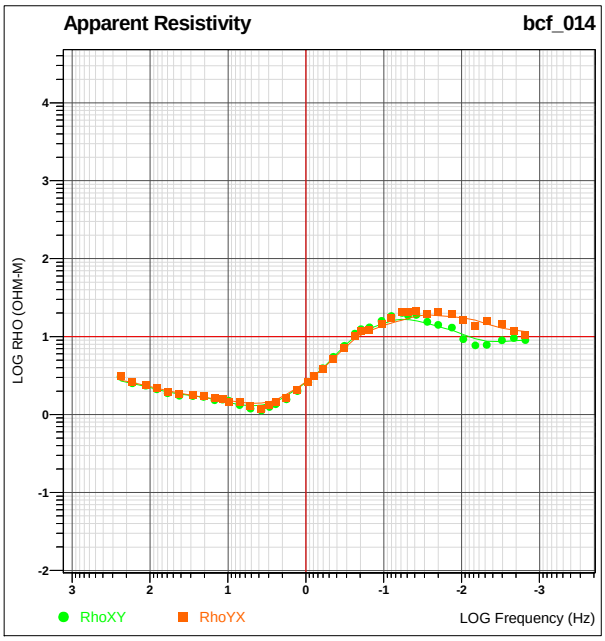

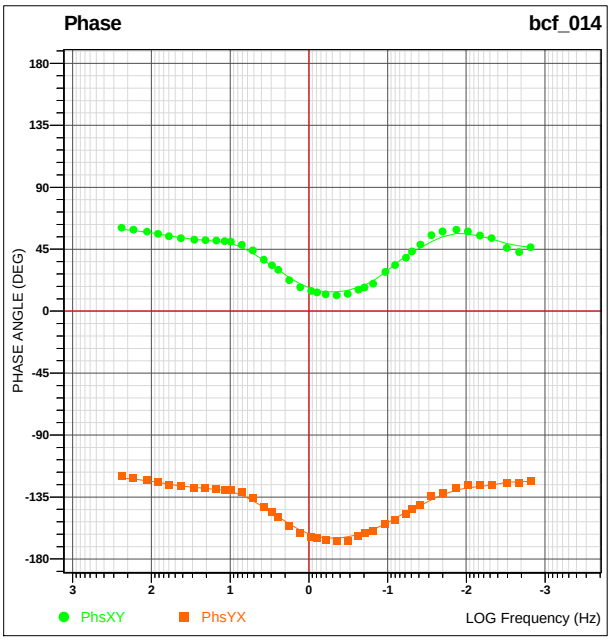

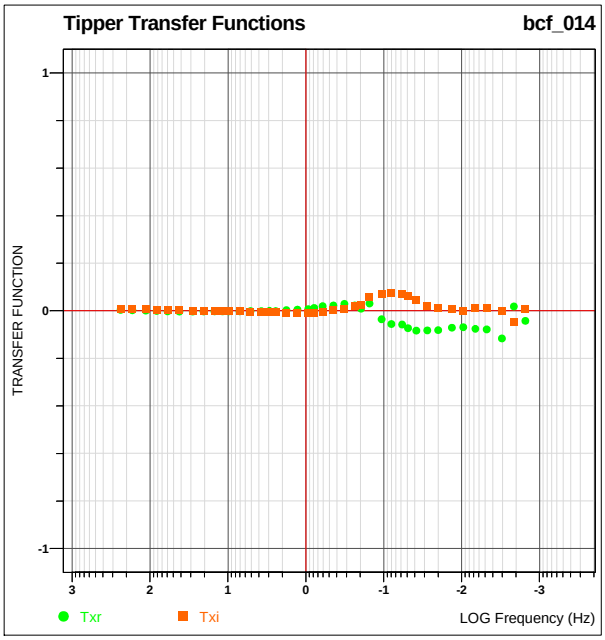

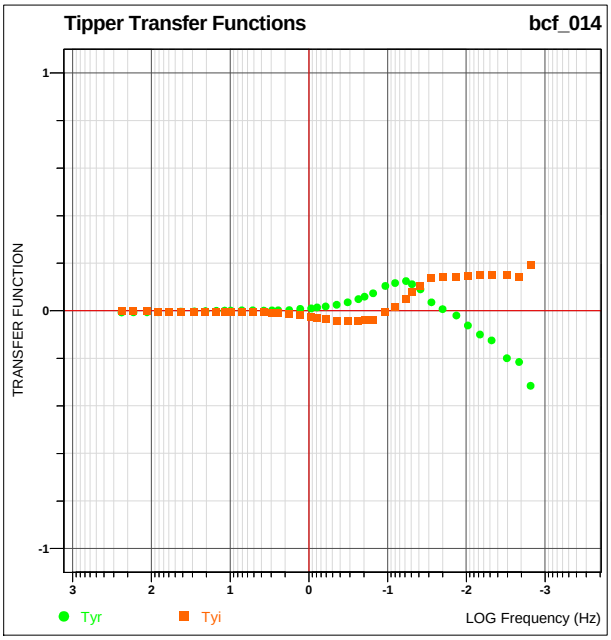

SITE BC15

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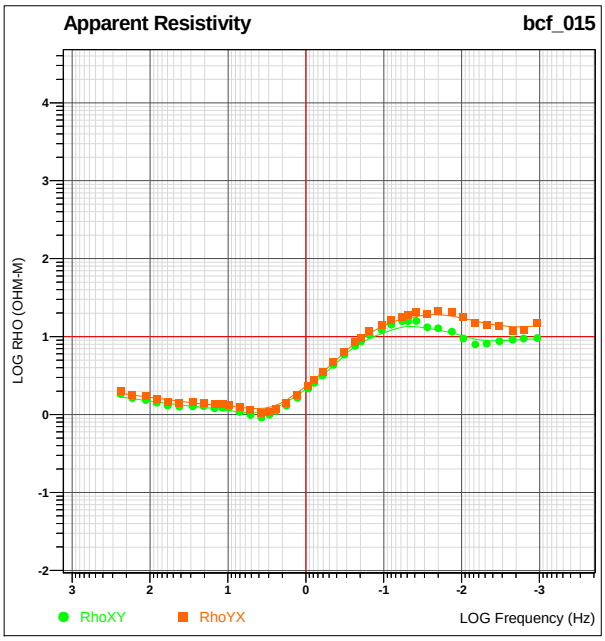

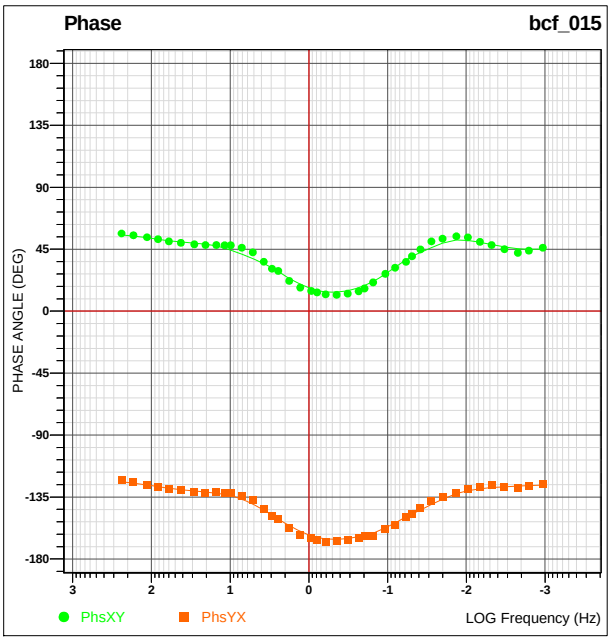

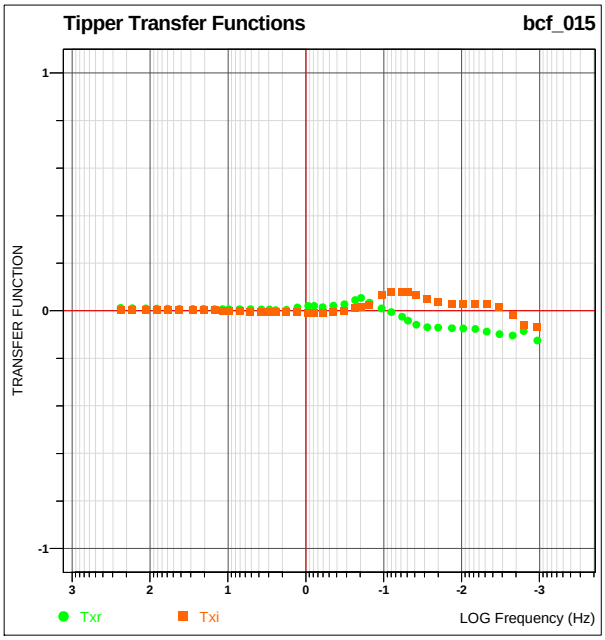

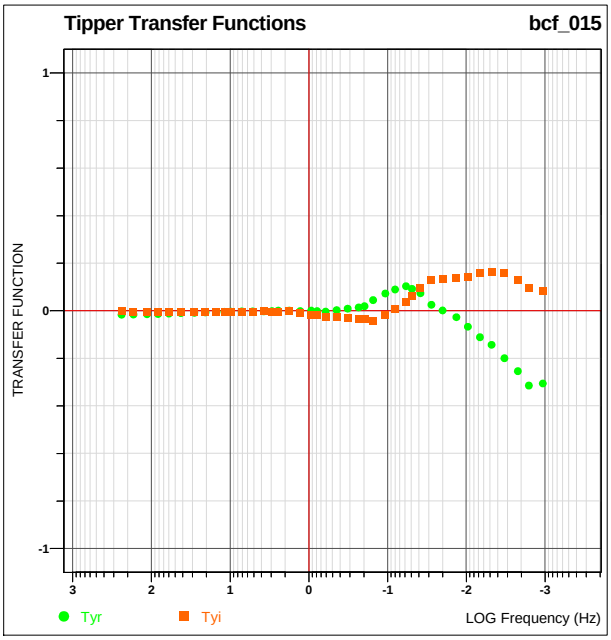

SITE BC16

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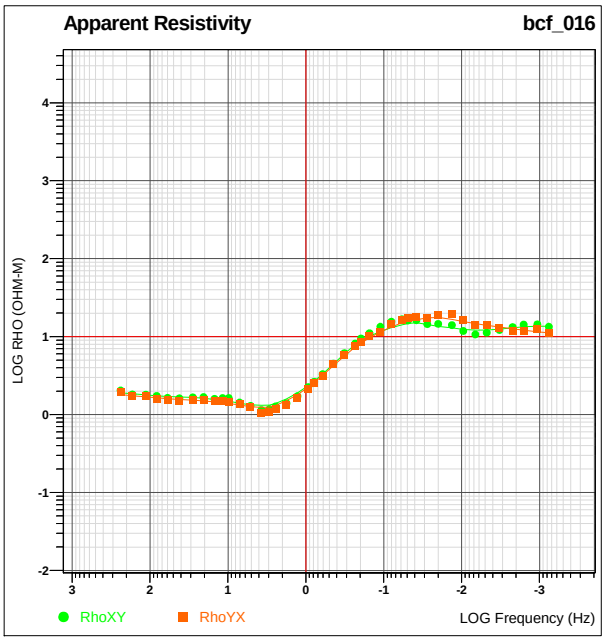

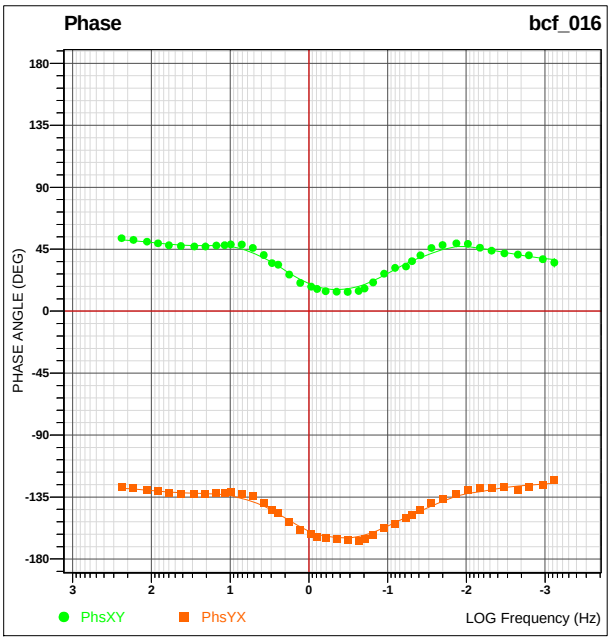

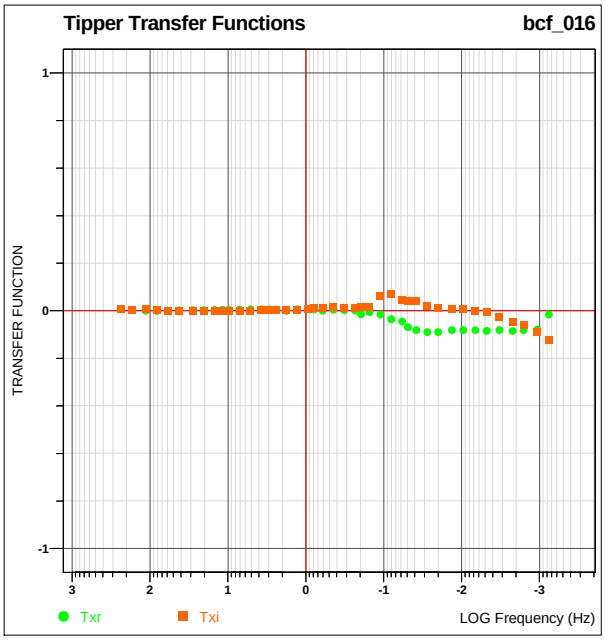

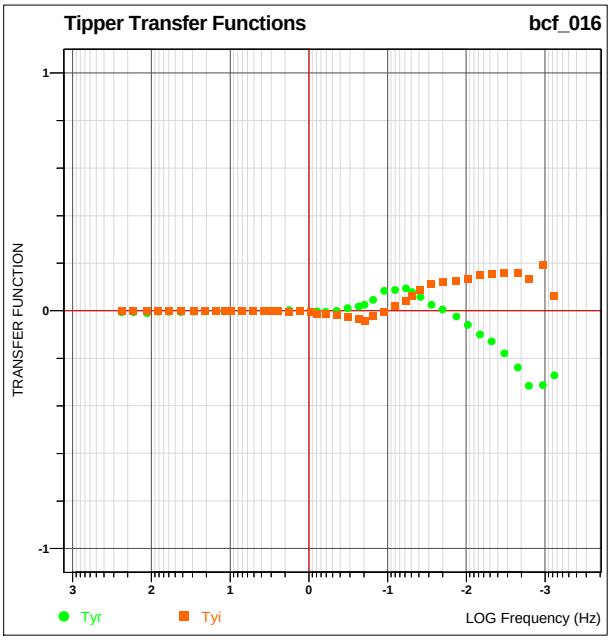

SITE BC17

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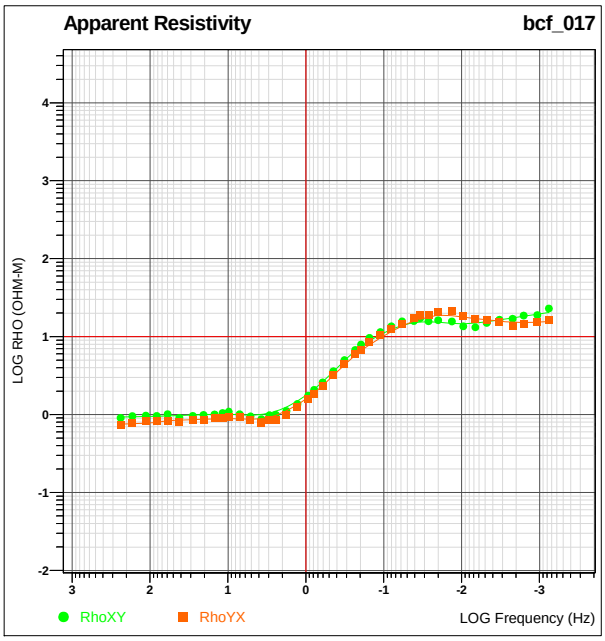

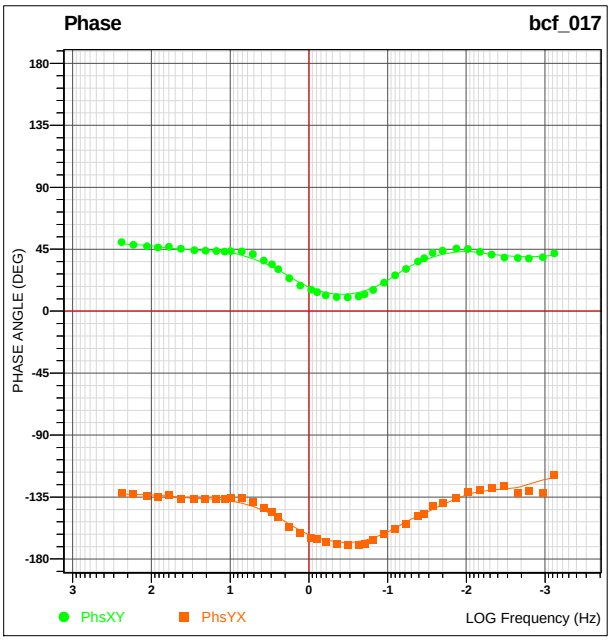

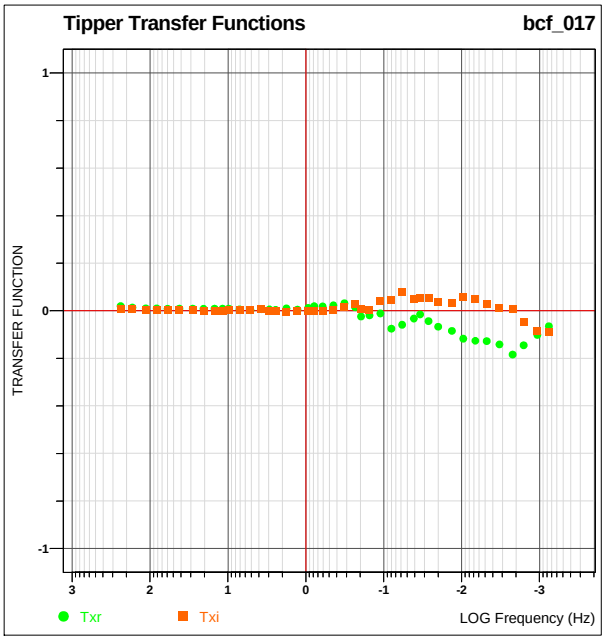

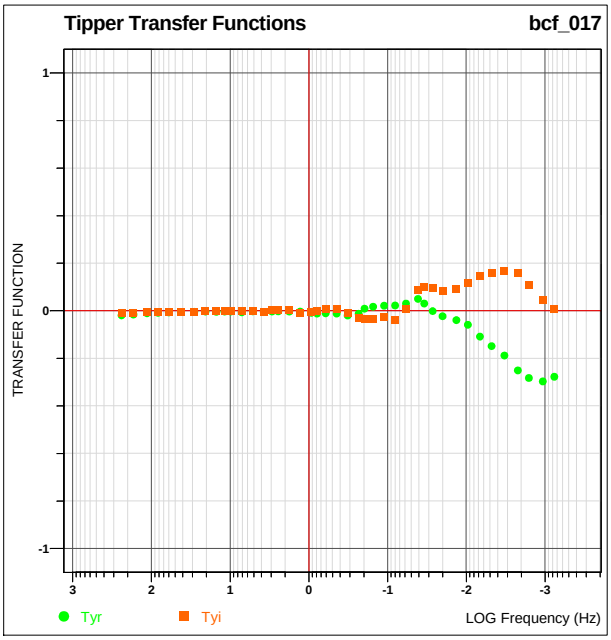

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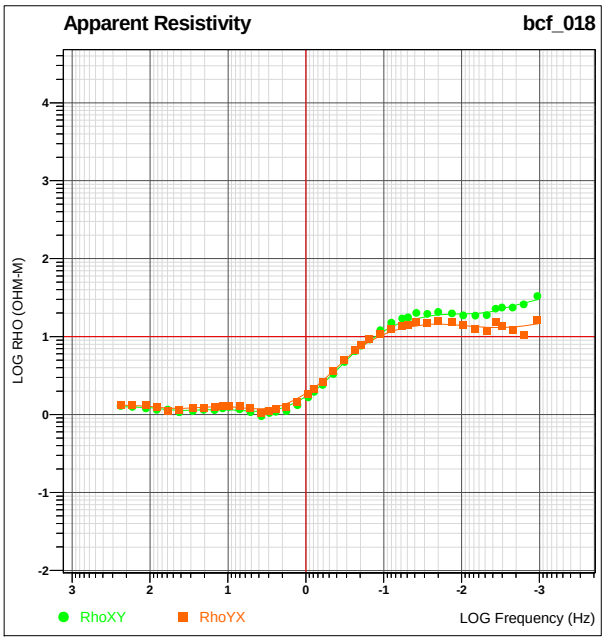

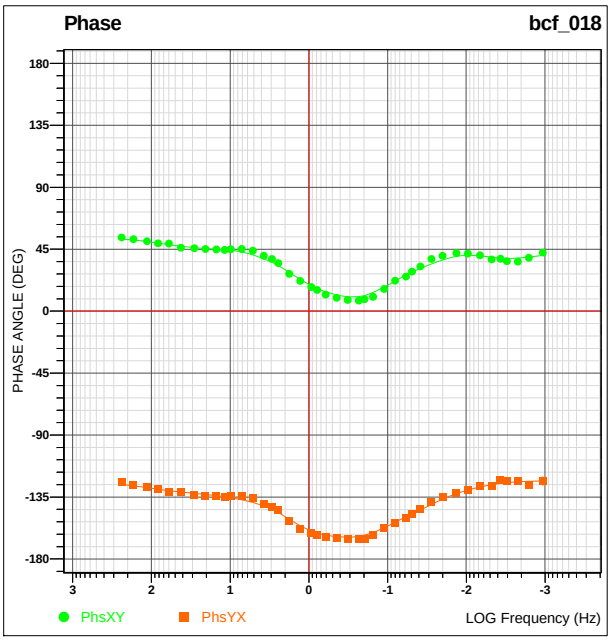

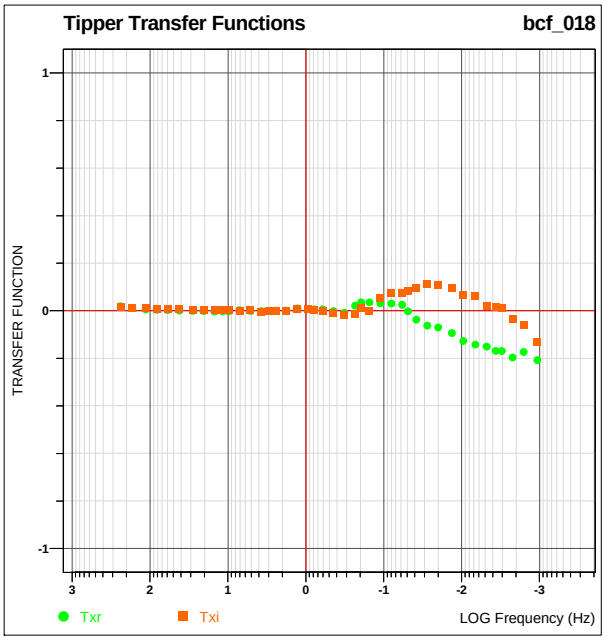

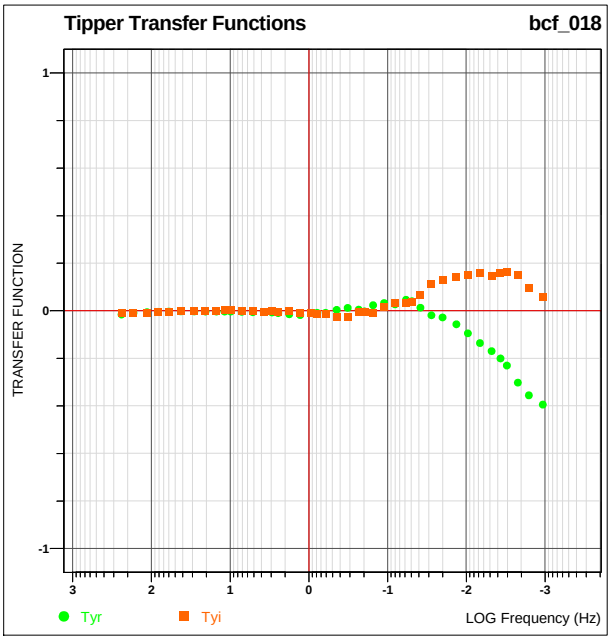

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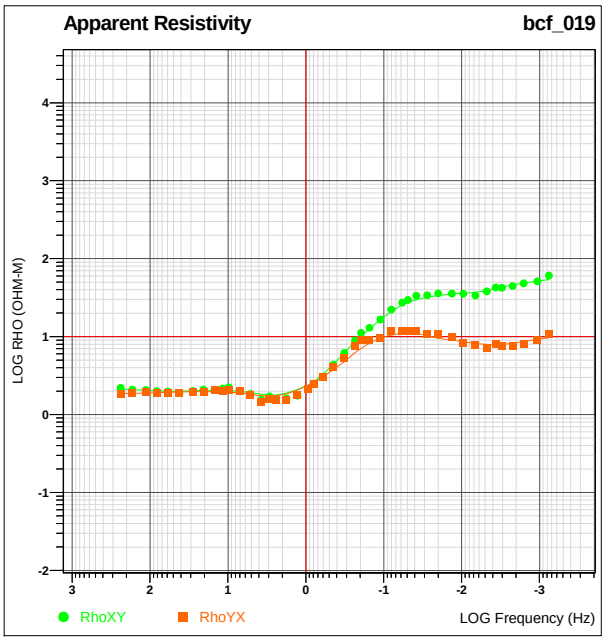

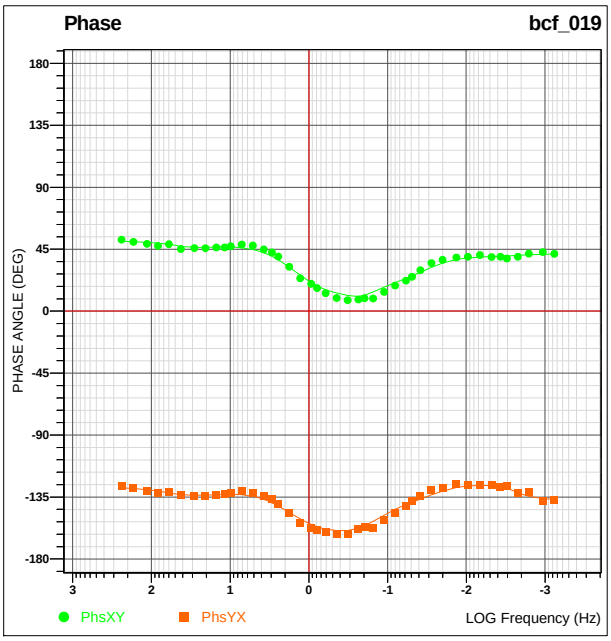

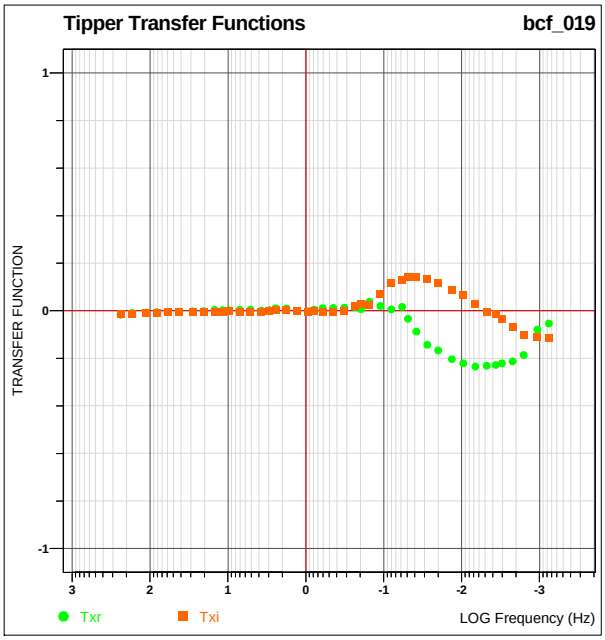

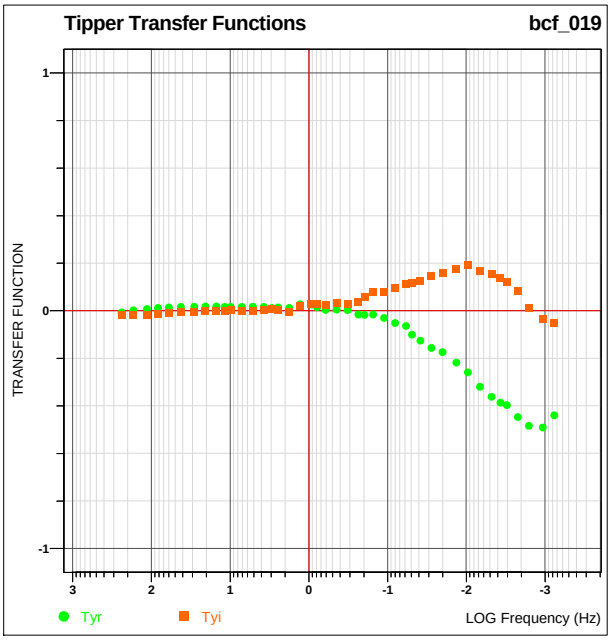

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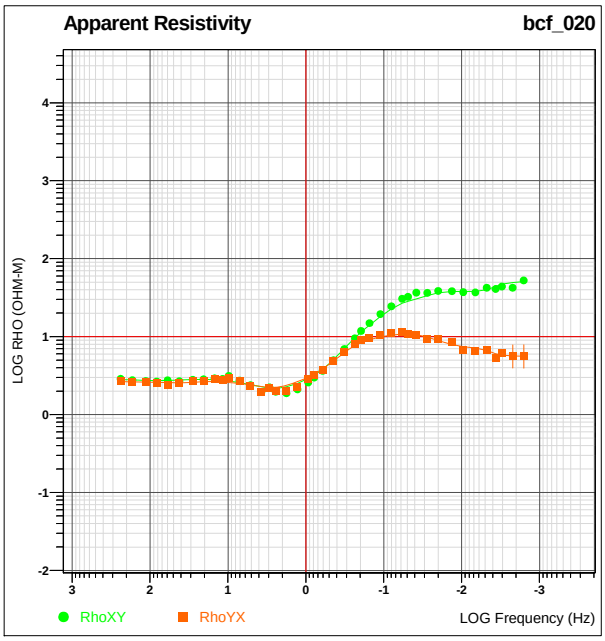

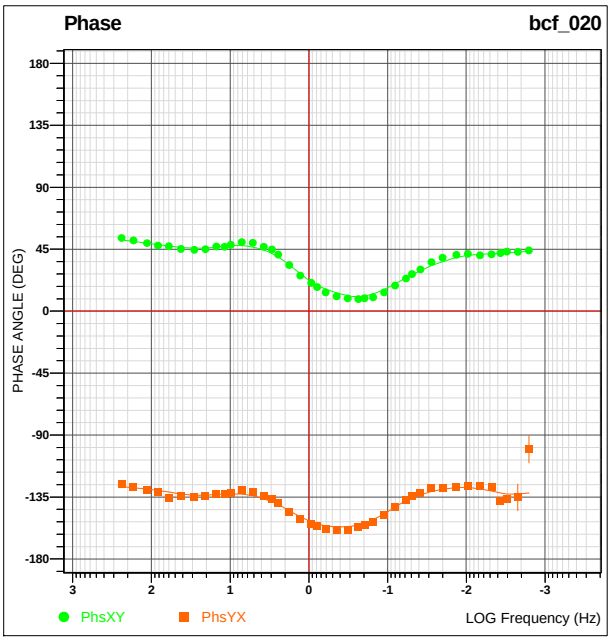

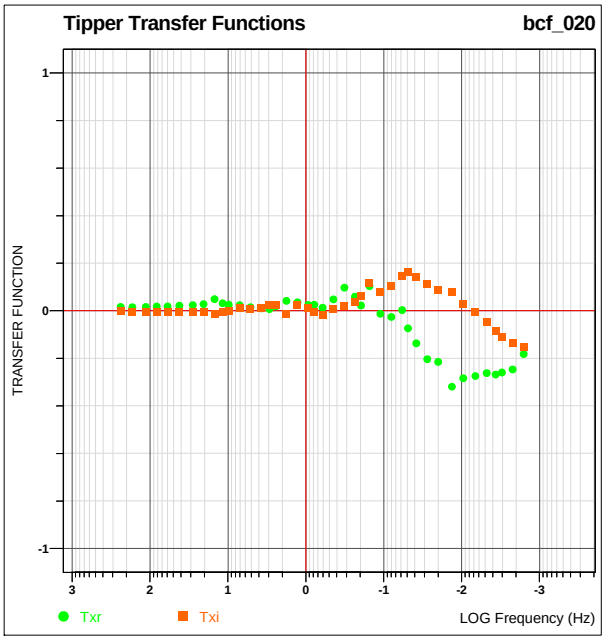

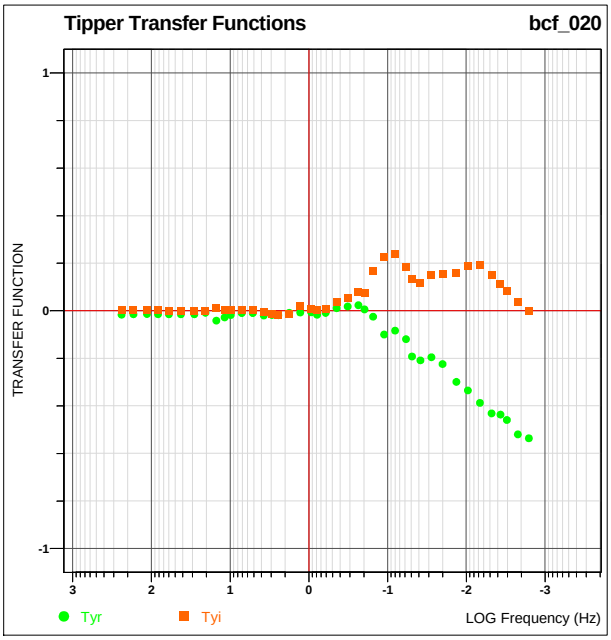

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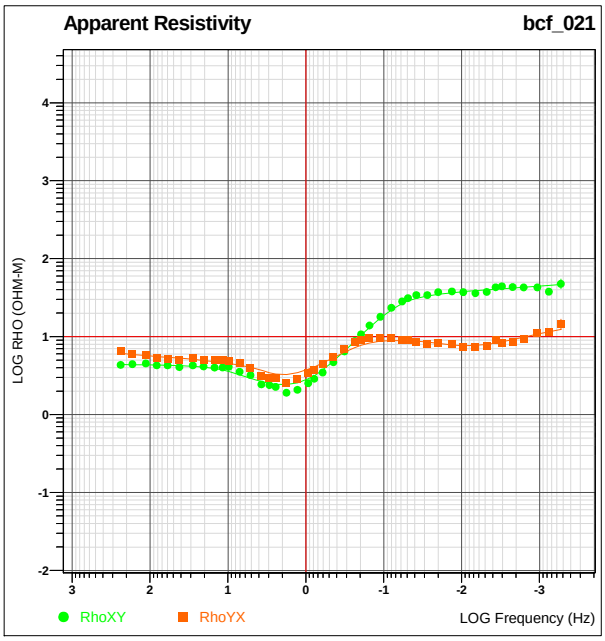

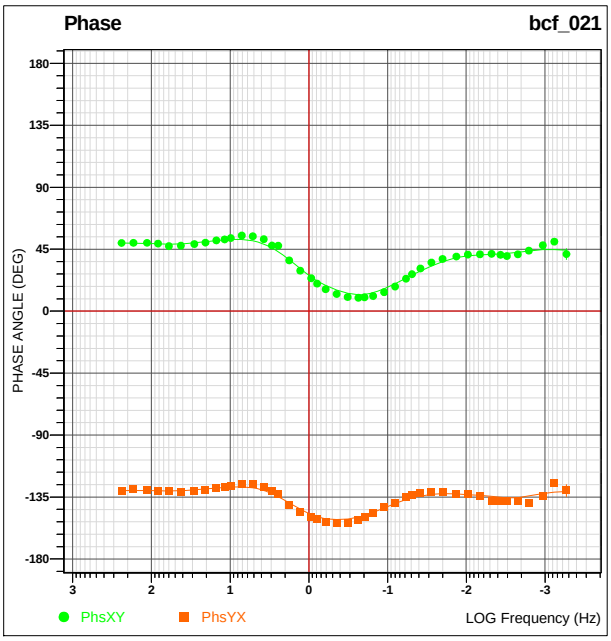

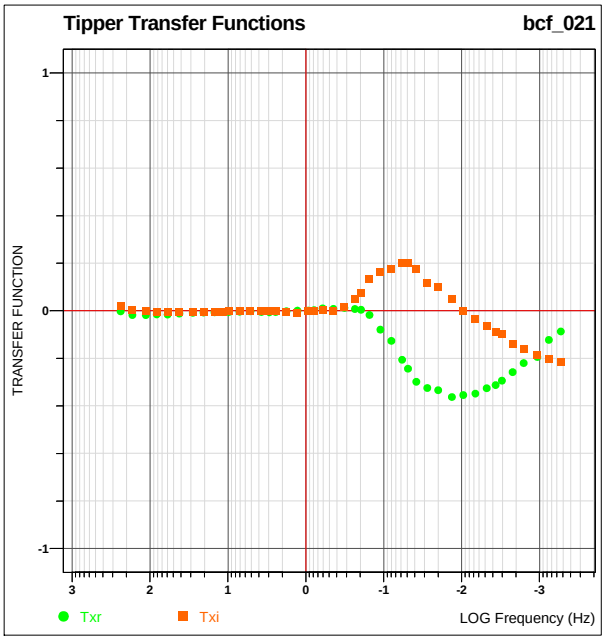

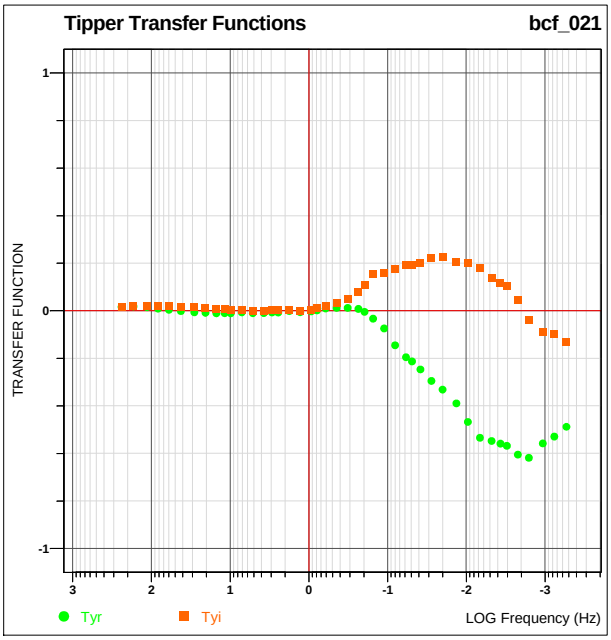

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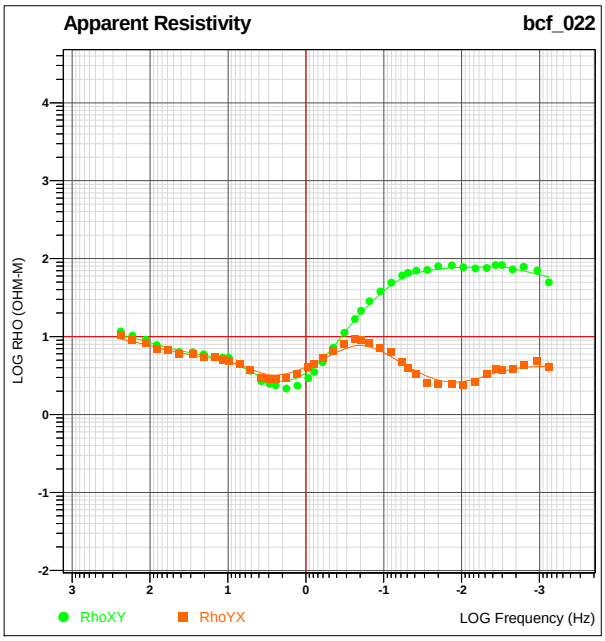

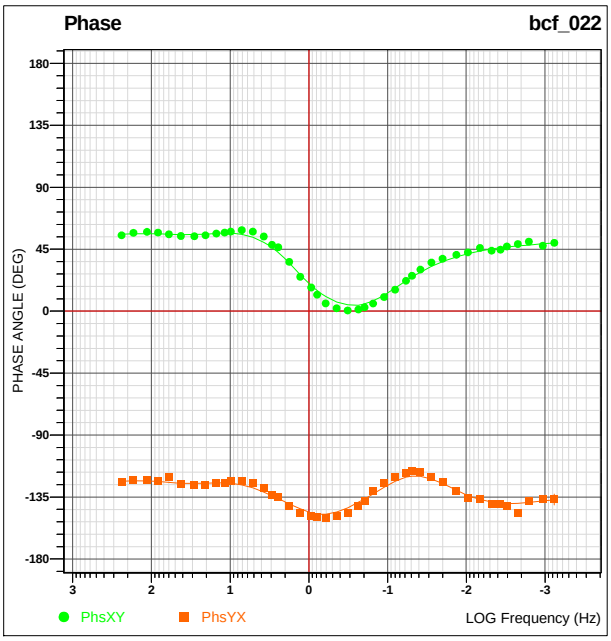

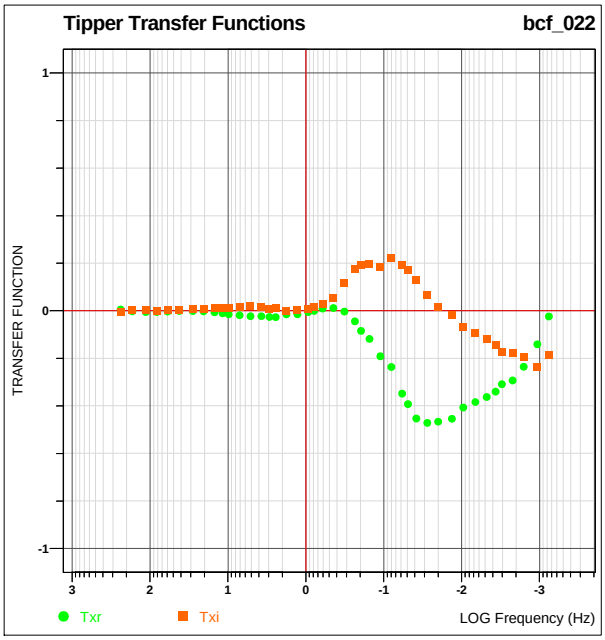

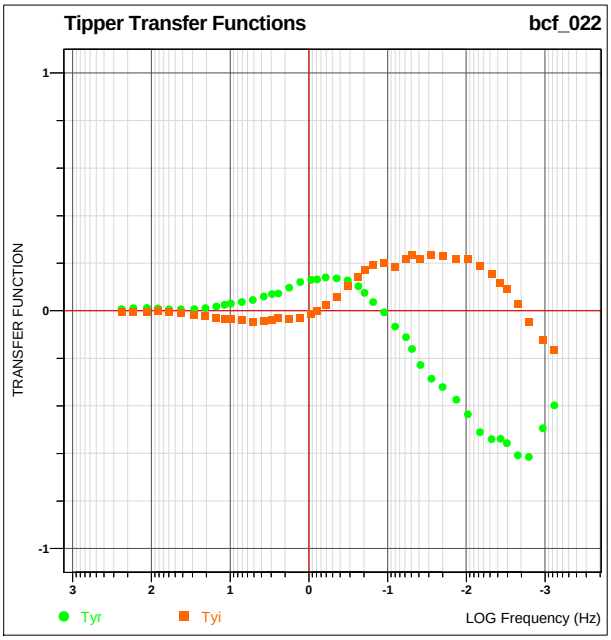

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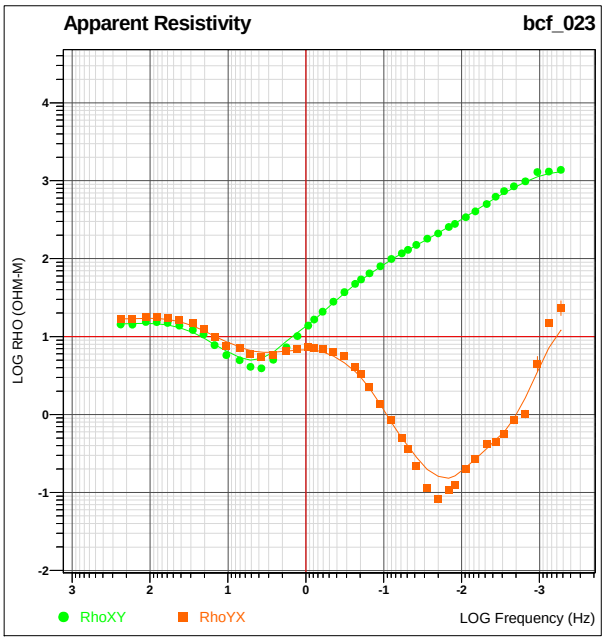

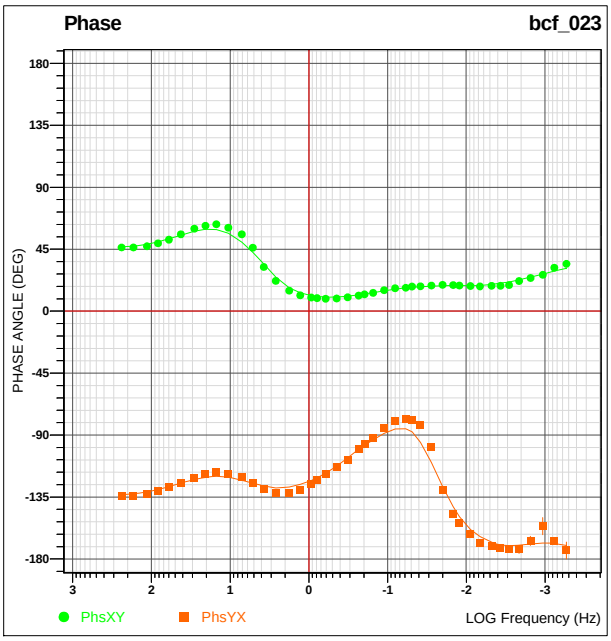

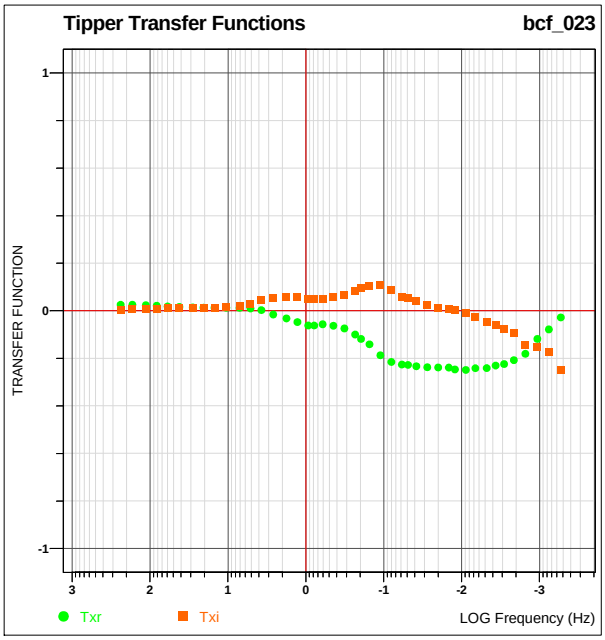

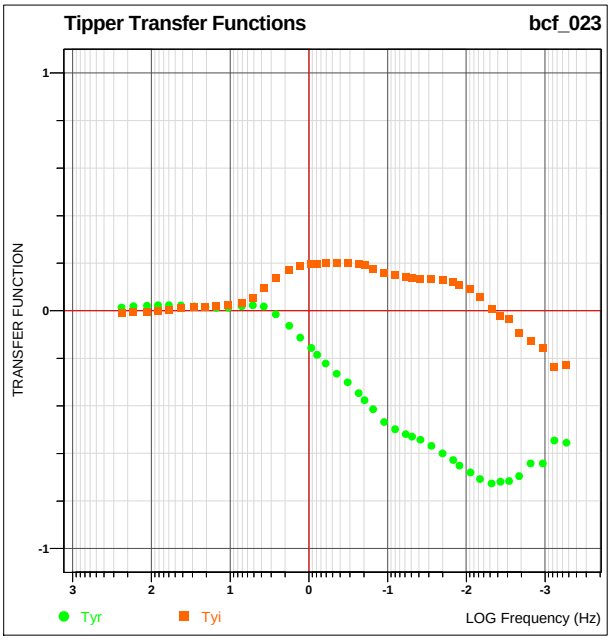

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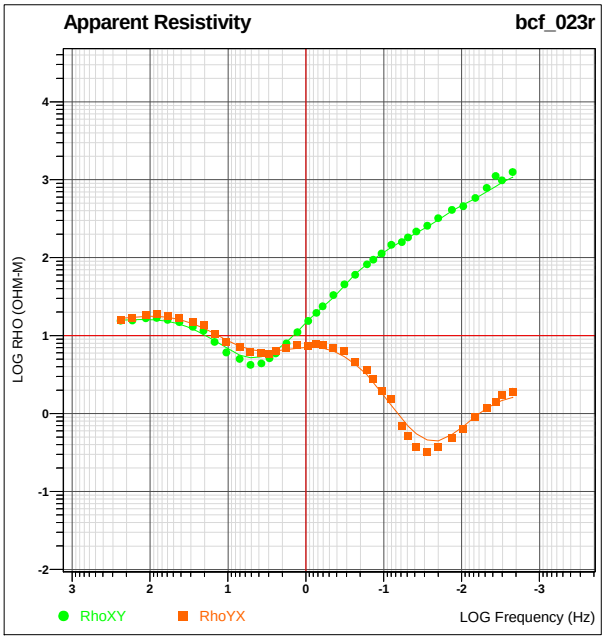

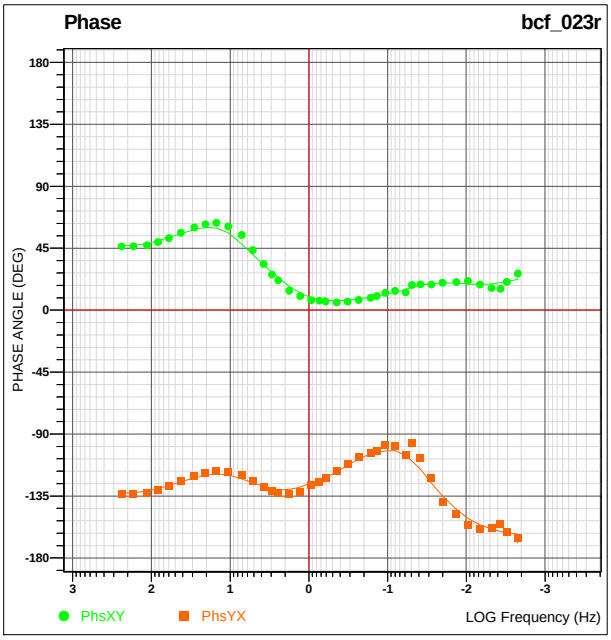

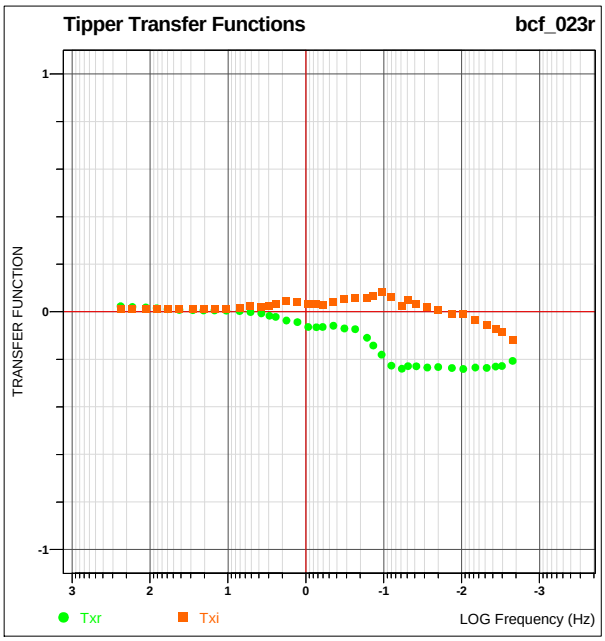

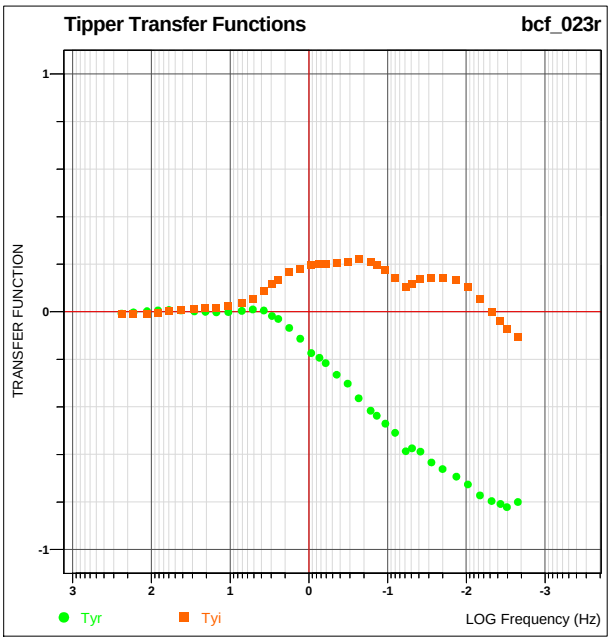

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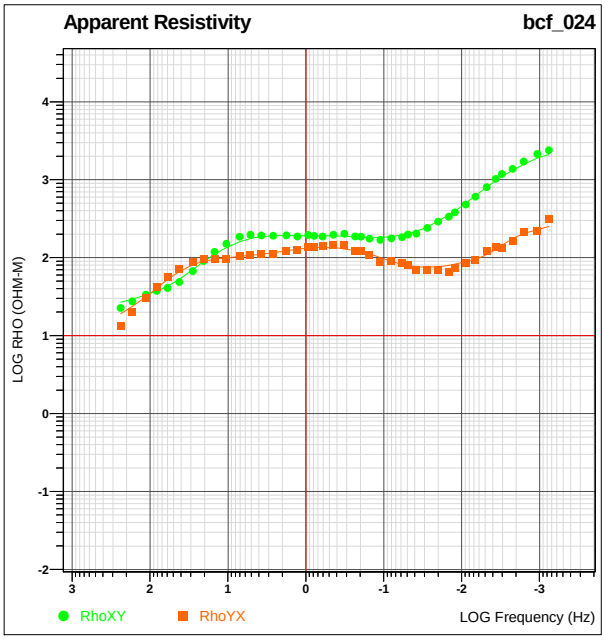

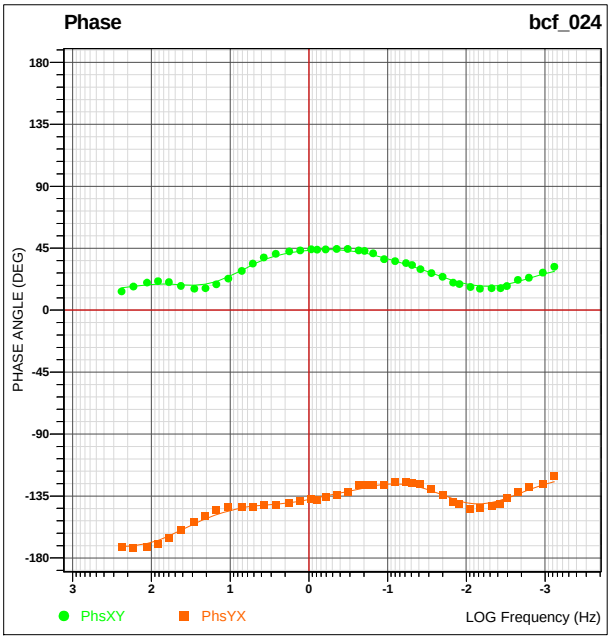

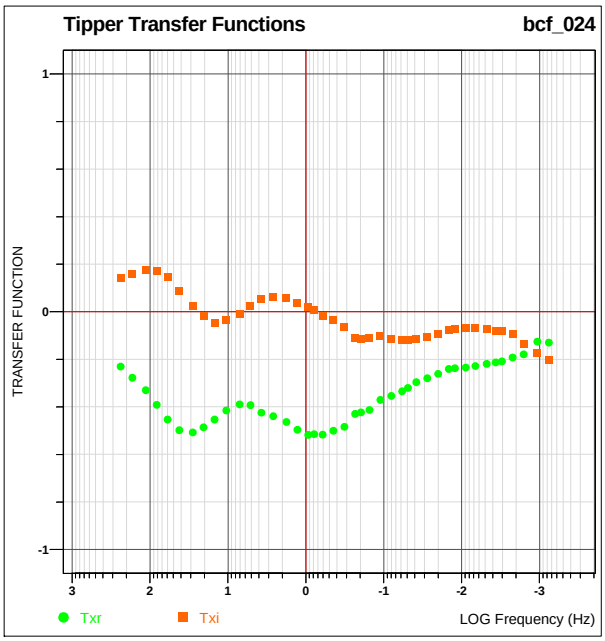

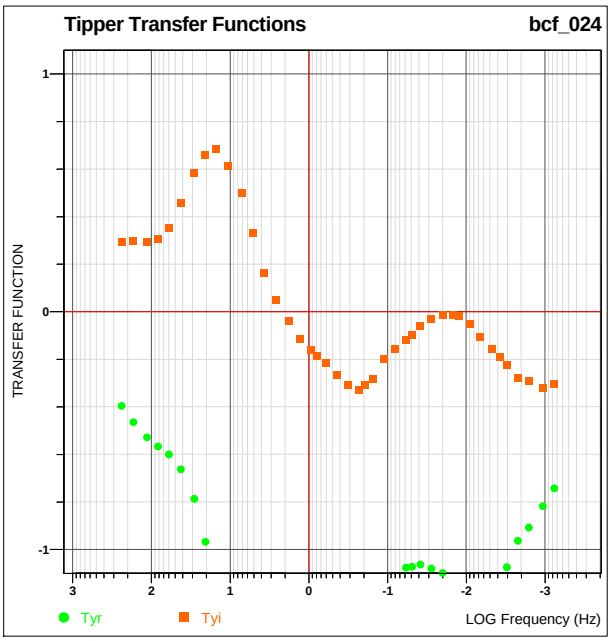

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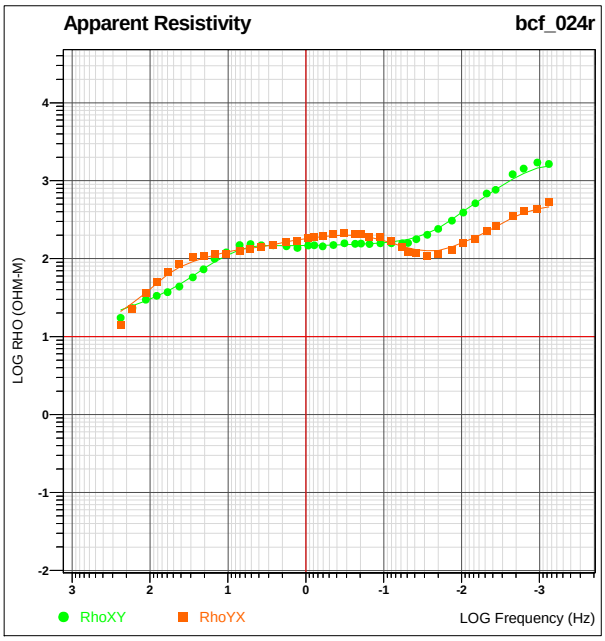

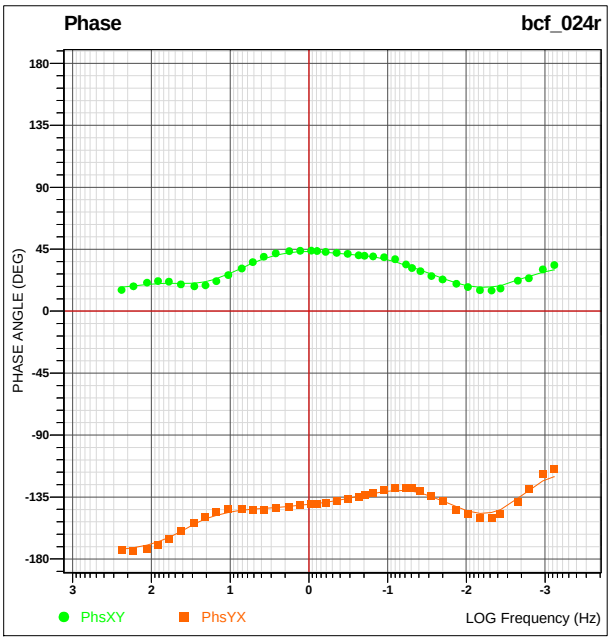

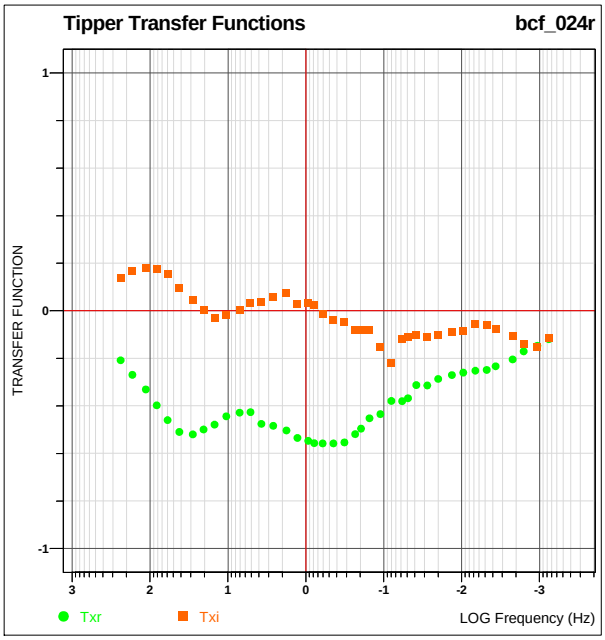

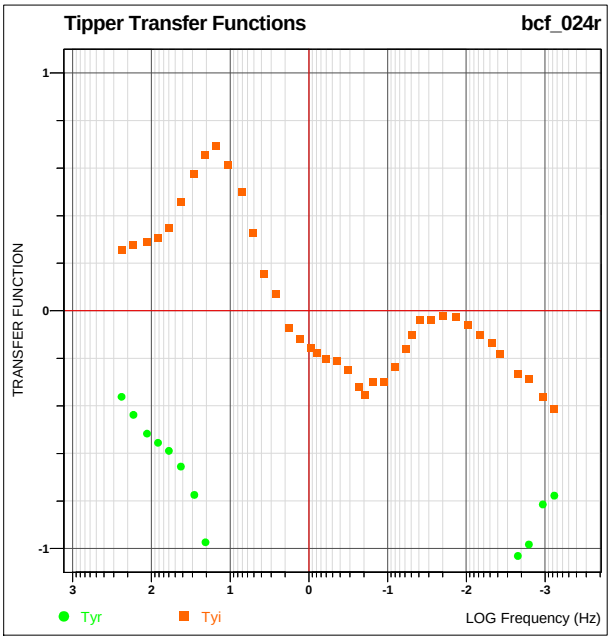

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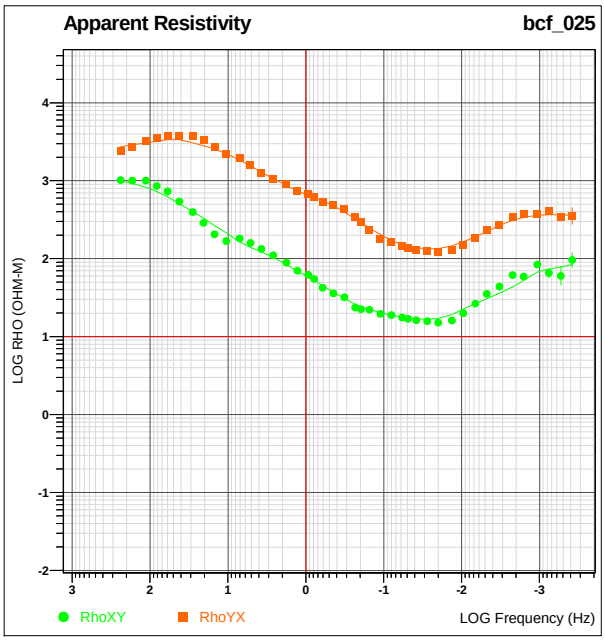

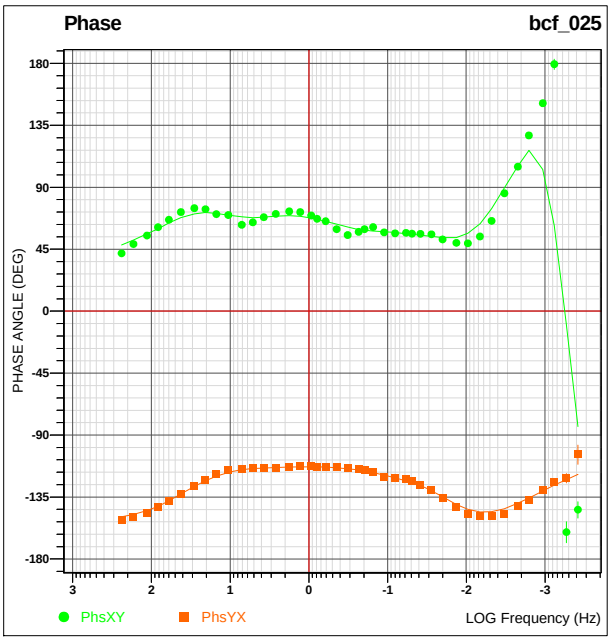

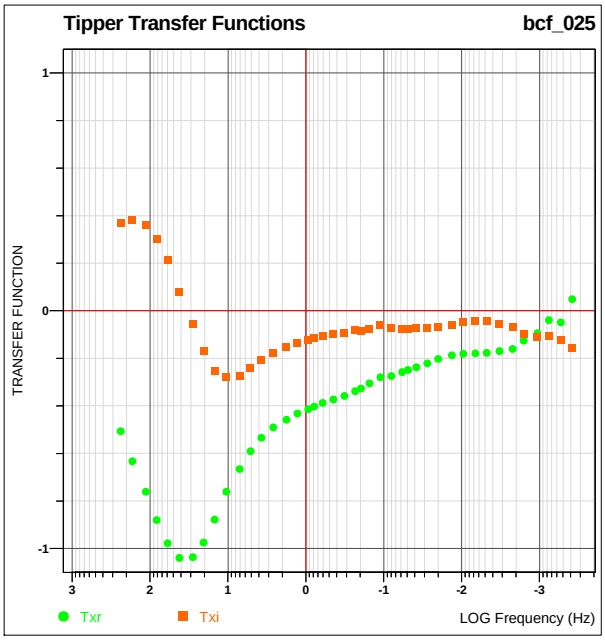

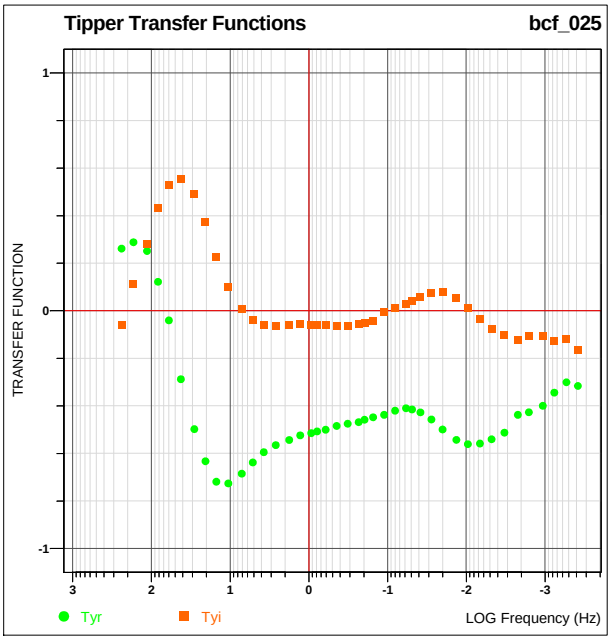

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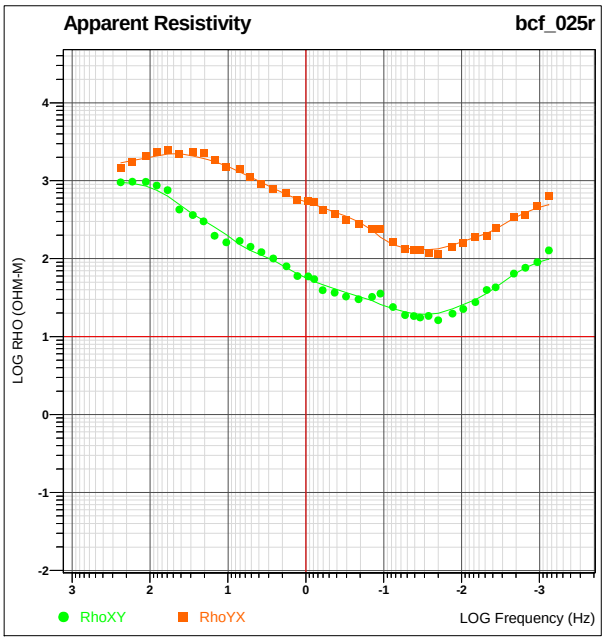
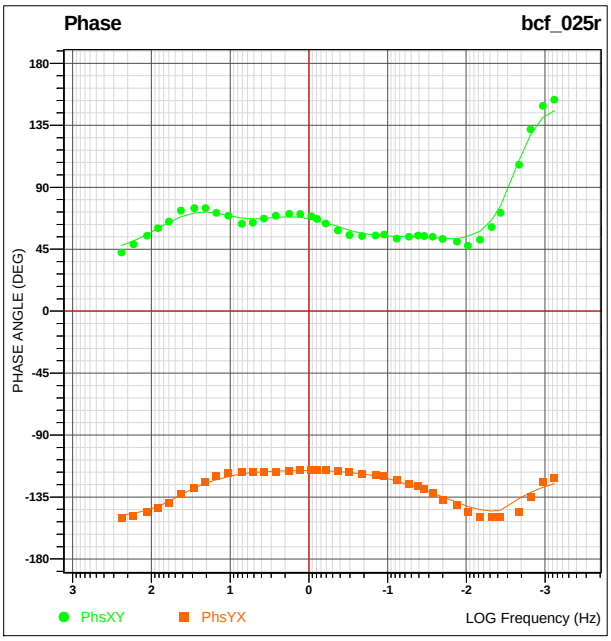
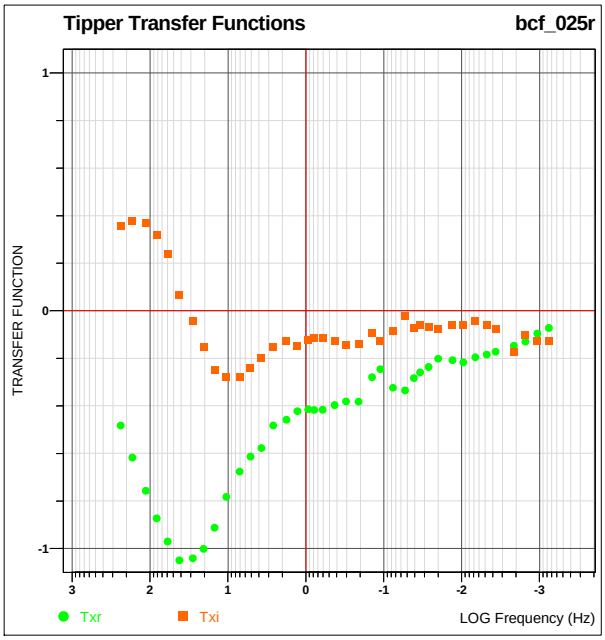
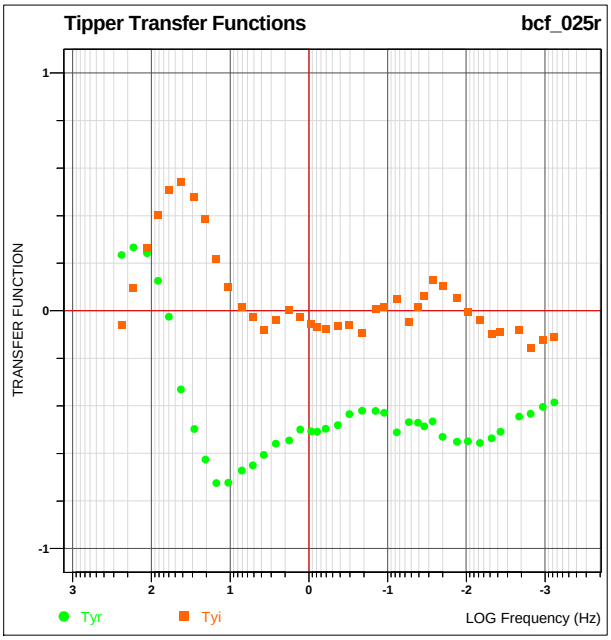




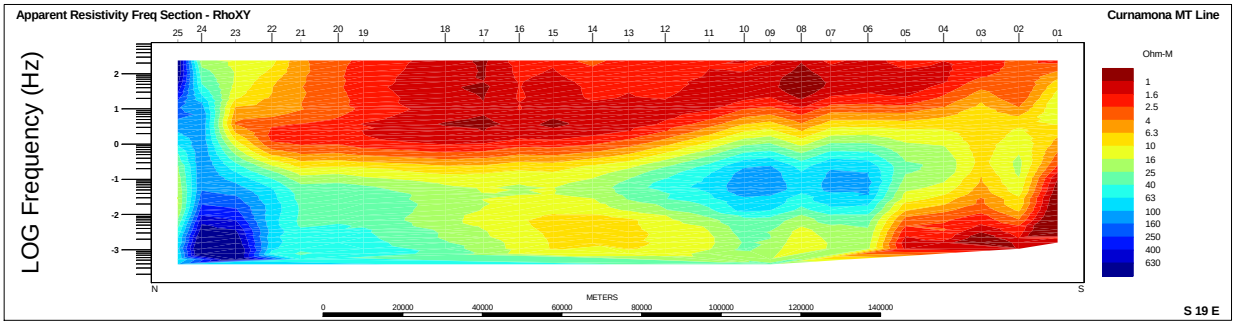


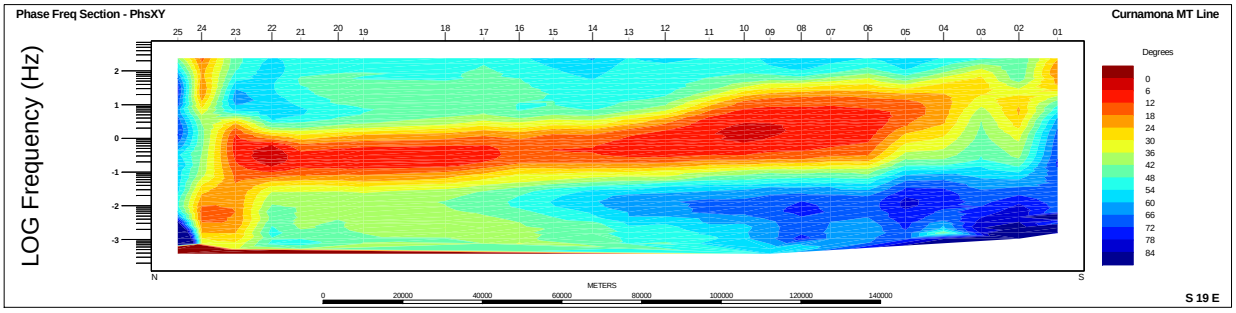


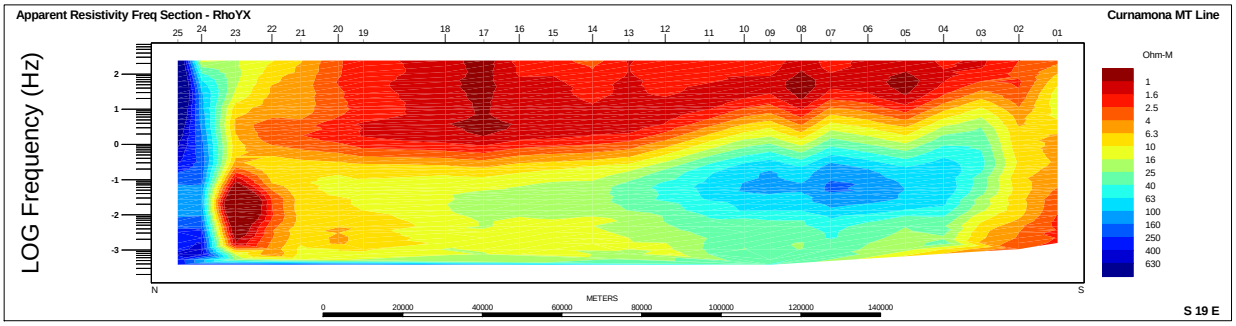
APPENDIX D: MT APPARENT RESISTIVITY AND PHASE PSEUDO-SECTIONS

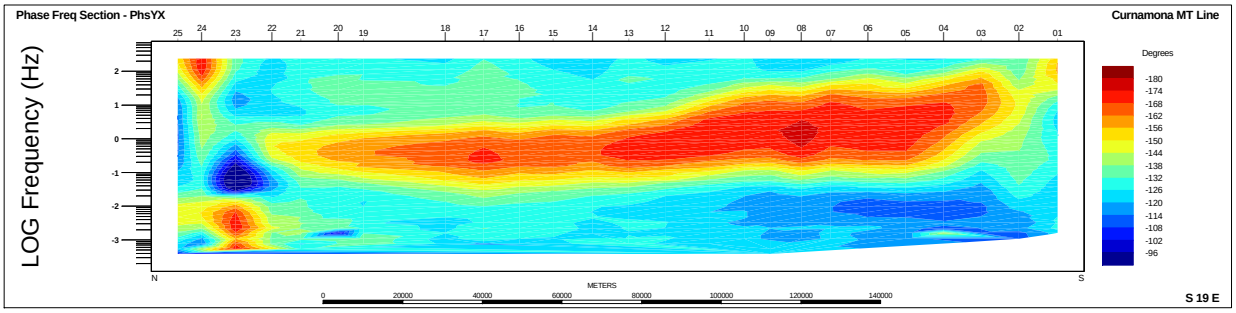
Note: XY denotes in-line electrical (E) field and orthogonal magnetic (H) field (Ex/Hy).
YX denotes in-line H field and orthogonal E-field (Ey/Hx).

CURNAMONA LINE – APPARENT RESISTIVITY AND PHASE (XY & YX) PSEUDO-SECTIONS









XY: Inline
- Rho: From 1 to 1000ohm-m
- Phs: From 0 to 90 deg

YX: Crossline
- Rho: From 1 to 1000ohm-m
- Phs: From -180 to -90 deg

APPENDIX E: PARALLEL SENSOR TEST 1

Date: November 27th, 2007

Report: Dominic Brown

Staff: Yatha Hoffman
Lee Davison
Joel Stockill
Shaun Burnett

1. Introduction

Location:

Station	Location: UTM WGS 84 / Zone 54J	
	Easting	Northing
BC 24	373994	6695141

Coil Azimuth: 90° true N (declination approx. 7˚ E)

Results:
BF7: BF7-9103 failed, ok the rest
P50: All good
BF4: All good

Tested a total of 32 coils:
18 Phoenix MTC-50 (P50)
10 BF7 EMI
4 BF4 EMI

BF7-9103 was put aside after decent coherency results could not be achieved.
Signal increased towards the end of testing due to approaching storm.

Test 2 yielded poor results due to connection problems to the spider unit (not included).

Coil #	Coil Type	Result		Role	Comments
		Pass	Fail		
BF7-7001	EMI	Test 1		Hx,Hy,Hz	
BF7-7004	EMI	Test 3		Hx,Hy,Hz	
BF7-7006	EMI	Test 1		Hx,Hy,Hz	
BF7-7007	EMI	Test 3		Hx,Hy,Hz	
BF7-9103	EMI		Test 1,3,4, 5,10		Changed cables, ports and cleaned connections
BF7-9104	EMI	Test 1		Hx,Hy,Hz	
BF7-9306	EMI	Test 3		Hx,Hy,Hz	
BF7-9307	EMI	Test 1		Hx,Hy,Hz	
BF7-9602	EMI	Test 1		Hx,Hy,Hz	
BF7-9802	EMI	Test 3		Hx,Hy,Hz	
BF4-9016	EMI	Test 5,10	Test 4	Hx,Hy,Hz	
BF4-9122	EMI	Test 4	Test 5,10	Spare	
BF4-9622	EMI	Test 4,5,10		Hx,Hy,Hz	
BF4-9623	EMI	Test 4,5,10		Hx,Hy,Hz	
P50-2010	Phoenix	Test 6		Hx,Hy,Hz	
P50-2017	Phoenix	Test 6		Hx,Hy,Hz	
P50-2114	Phoenix	Test 7	Test 6	Hx,Hy,Hz	Changed cable
P50-2117	Phoenix	Test 6		Hx,Hy,Hz	
P50-2126	Phoenix	Test 6		Hx,Hy,Hz	
P50-2202	Phoenix	Test 6		Hx,Hy,Hz	
P50-2236	Phoenix	Test 7		Hx,Hy,Hz	
P50-2237	Phoenix	Test 7		Hx,Hy,Hz	
P50-2436	Phoenix	Test 7		Hx,Hy,Hz	
P50-2445	Phoenix	Test 7		Hx,Hy,Hz	
P50-2447	Phoenix	Test 7		Hx,Hy,Hz	
P50-2448	Phoenix	Test 8,9		Hx,Hy,Hz	
P50-2451	Phoenix	Test 8		Hx,Hy,Hz	
P50-2455	Phoenix	Test 8,9		Hx,Hy,Hz	
P50-2456	Phoenix	Test 8,9		Hx,Hy,Hz	
P50-2457	Phoenix	Test 8,9		Hx,Hy,Hz	
P50-2459	Phoenix	Test 8,9		Hx,Hy,Hz	
P50-2461	Phoenix	Test 9		Hx,Hy,Hz	

2. Low Frequency Coils – Test 1

Available Coils:

TS Strip	Manufacturer	Serial #	Tasked To
1	EMI	BF7-9104	Logger Site
2	EMI	BF7-9103	Logger Site
3	EMI	BF7-9602	Logger Site
4	EMI	BF7-9307	Logger Site
5	EMI	BF7-7006	Logger Site
6	EMI	BF7-7001	Logger Site

Processing Parameters:

Parameter	Value
QuickLay Version	3_Alpha.33
PSD Method	Welch
Window	Hanning
Window length	8196
Segment Overlap	50%

2.1 Test Results: 1000sps

NetEvent: PST_20081126.2249.net
Sample Rate: 1000sps
TS Length: 650000 samples (~11min)

Results:
BF7-9103: Bad coherency, F<10Hz connections cleaned and retested

Time Series

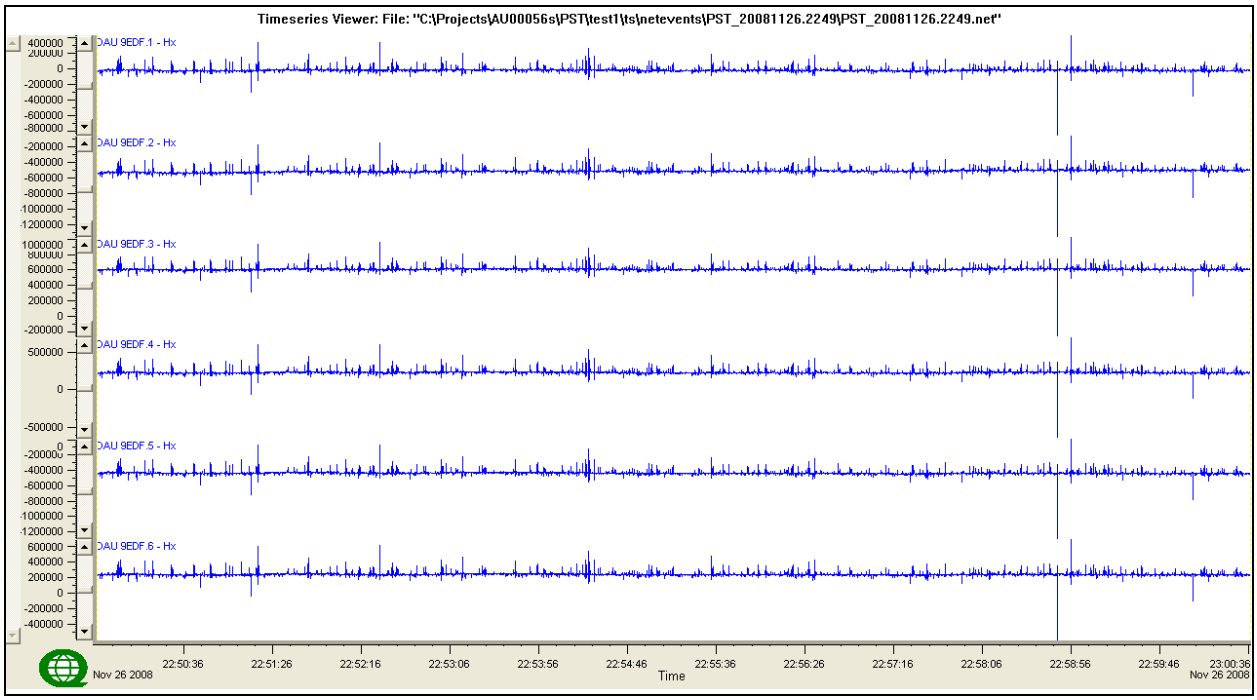


Figure 2-1: Complete time series @ 1000sps

Low Frequency Coil Results: 1000sps
Coherency to BF7-9104

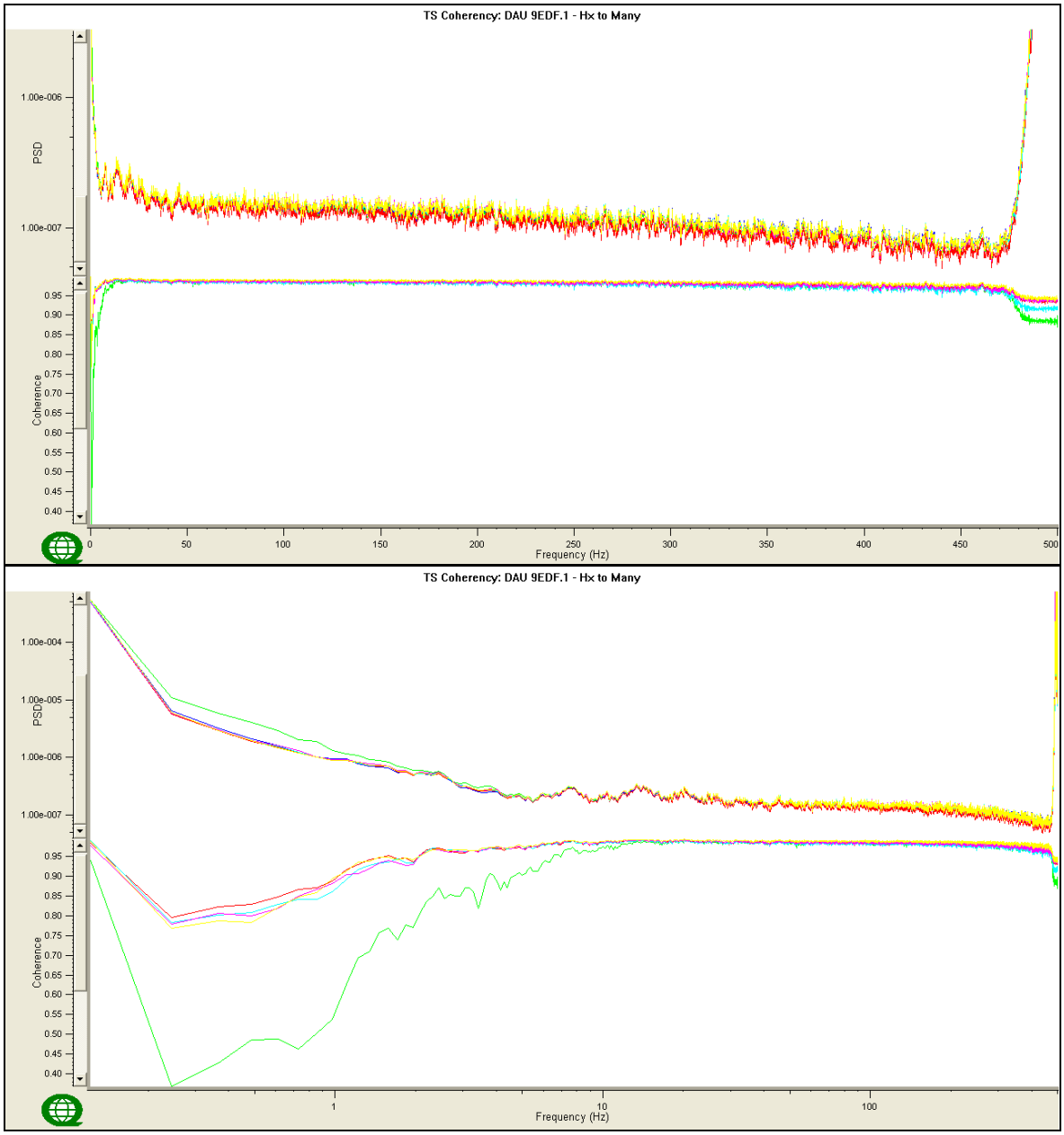


Figure 2-2: Coherencies are to BF7-9104 (blue). Upper linear, lower logarithmic frequency scales.

Colour	Channel	Notes
Blue	BF7-9104	
Green	BF7-9103	
Red	BF7-9602	
Cyan	BF7-9307	
Magenta	BF7-7006	
Yellow	BF7-7001	

3. Low Frequency Coils – Test 3

Available Coils:

TS Strip	Manufacturer	Serial #	Tasked To
1	EMI	BF7-9306	Logger Site
2	EMI	BF7-9802	Logger Site
3	EMI	BF7-7007	Logger Site
4	EMI	BF7-9103	Logger Site
5	EMI	BF7-7004	Logger Site

Processing Parameters:

Parameter	Value
QuickLay Version	3_Alpha.33
PSD Method	Welch
Window	Hanning
Window length	8196
Segment Overlap	50%

3.1 Test Results: 1000sps

NetEvent: PST_20081127.0024.net
Sample Rate: 1000sps
TS Length: 650000 samples (~11min)

Results:
All good, except coil BF7-9103.

Time Series

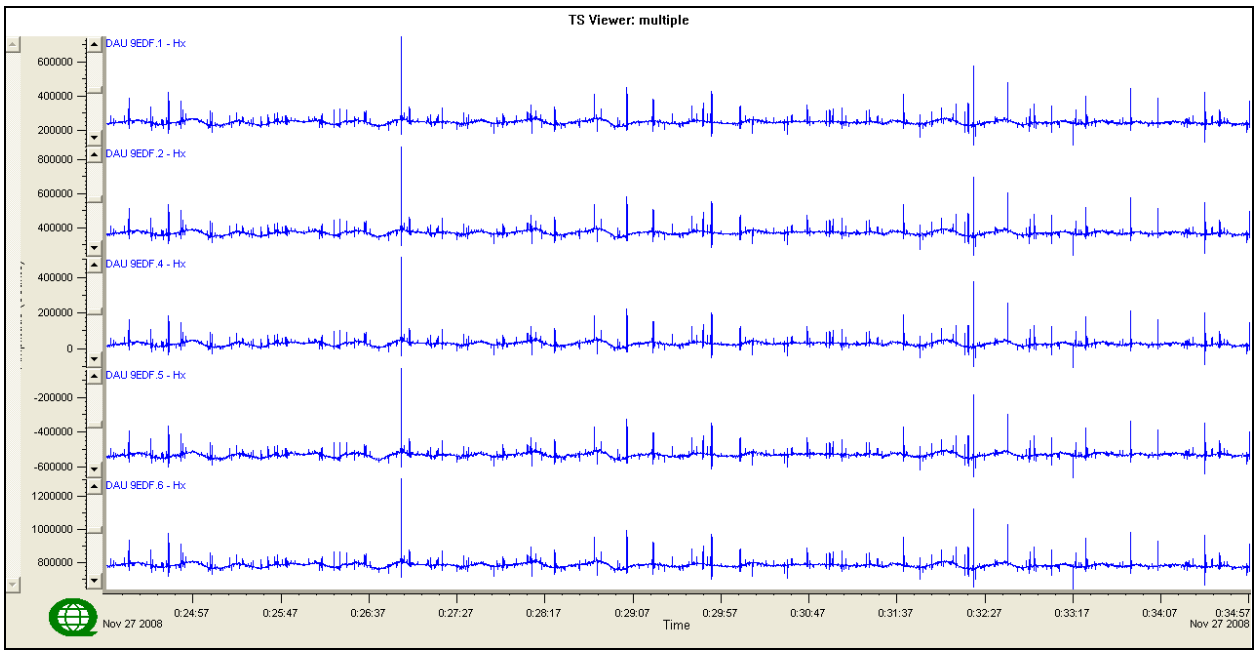


Figure 3-1: Complete time series @ 1000sps

Low Frequency Coil Results: 1000sps
Coherency to BF7-9306

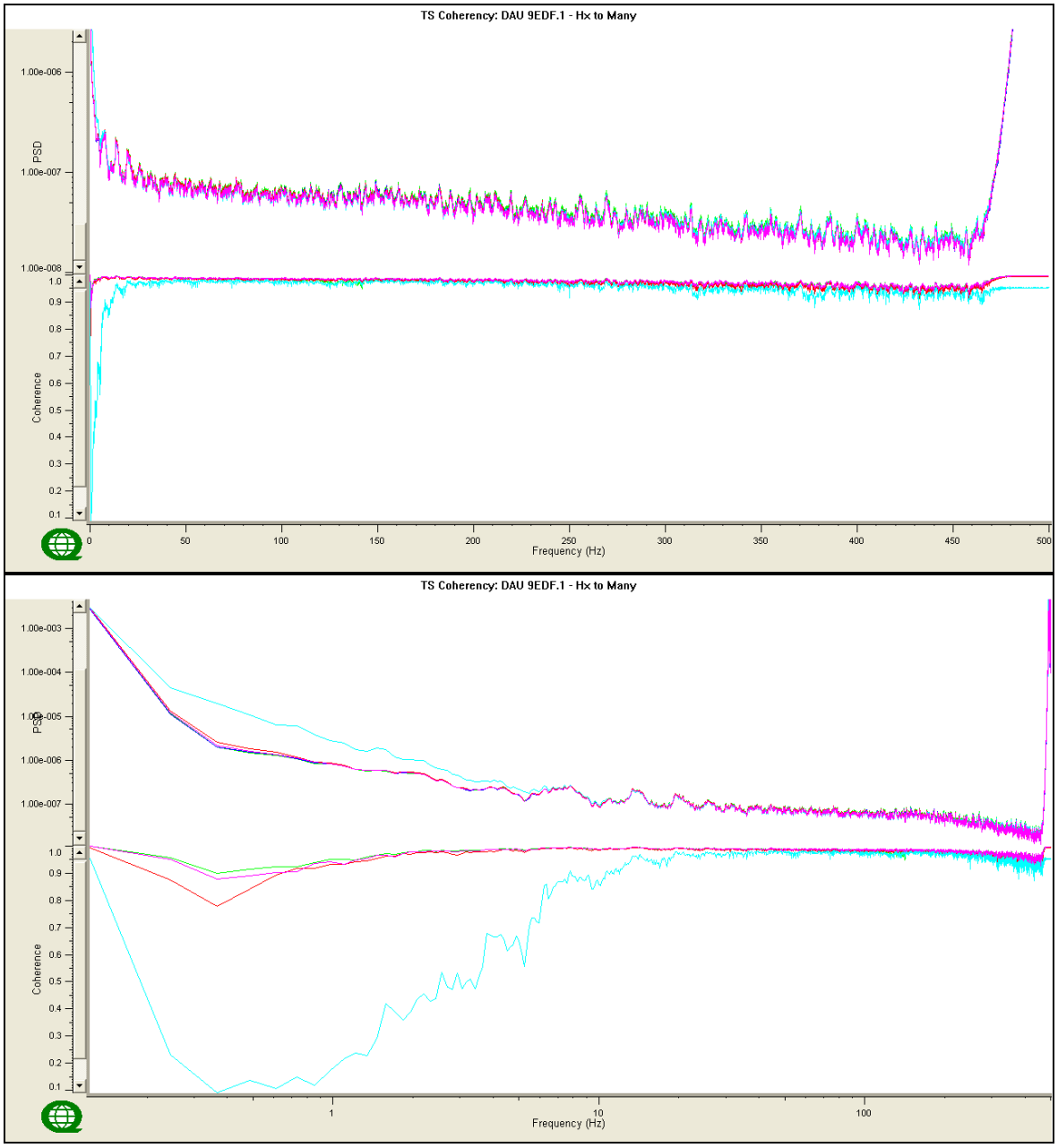


Figure 3-2: Coherencies are to BF7-9306 (blue). Upper linear, lower logarithmic frequency scales.

Colour	Channel	Notes
Blue	BF7-9306	
Green	BF7-9802	
Red	BF7-7007	
Cyan	BF7-9103	to be retested with another coil cable
Magenta	BF7-7004	

4. Low Frequency Coils – Test 4

Available Coils:

TS Strip	Manufacturer	Serial #	Tasked To
1	EMI	BF4-9016	Logger Site
2	EMI	BF7-9103	Logger Site
3	EMI	BF4-9122	Logger Site
4	EMI	BF4-9622	Logger Site
5	EMI	BF4-9623	Logger Site

Processing Parameters:

Parameter	Value
QuickLay Version	3_Alpha.33
PSD Method	Welch
Window	Hanning
Window length	8196
Segment Overlap	50%

Results:

BF4-9016 & BF7-9103 failed due to low coherency and poor PSD.

4.1 Test Results: 1000sps

NetEvent: PST_20081127.0109.net
Sample Rate: 1000sps
TS Length: 650000 samples (~11min)

Time Series

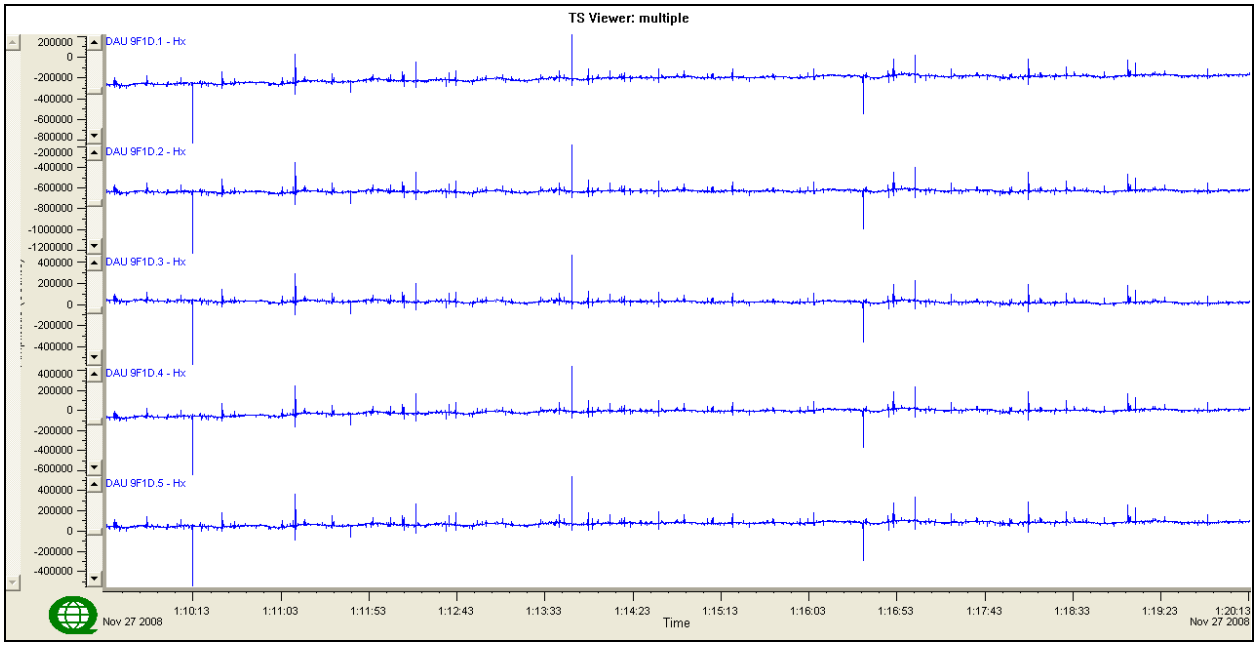


Figure 4-1: Complete time series at 1000sps

Low Frequency Coil Results: 1000sps
Coherency to BF4-9122

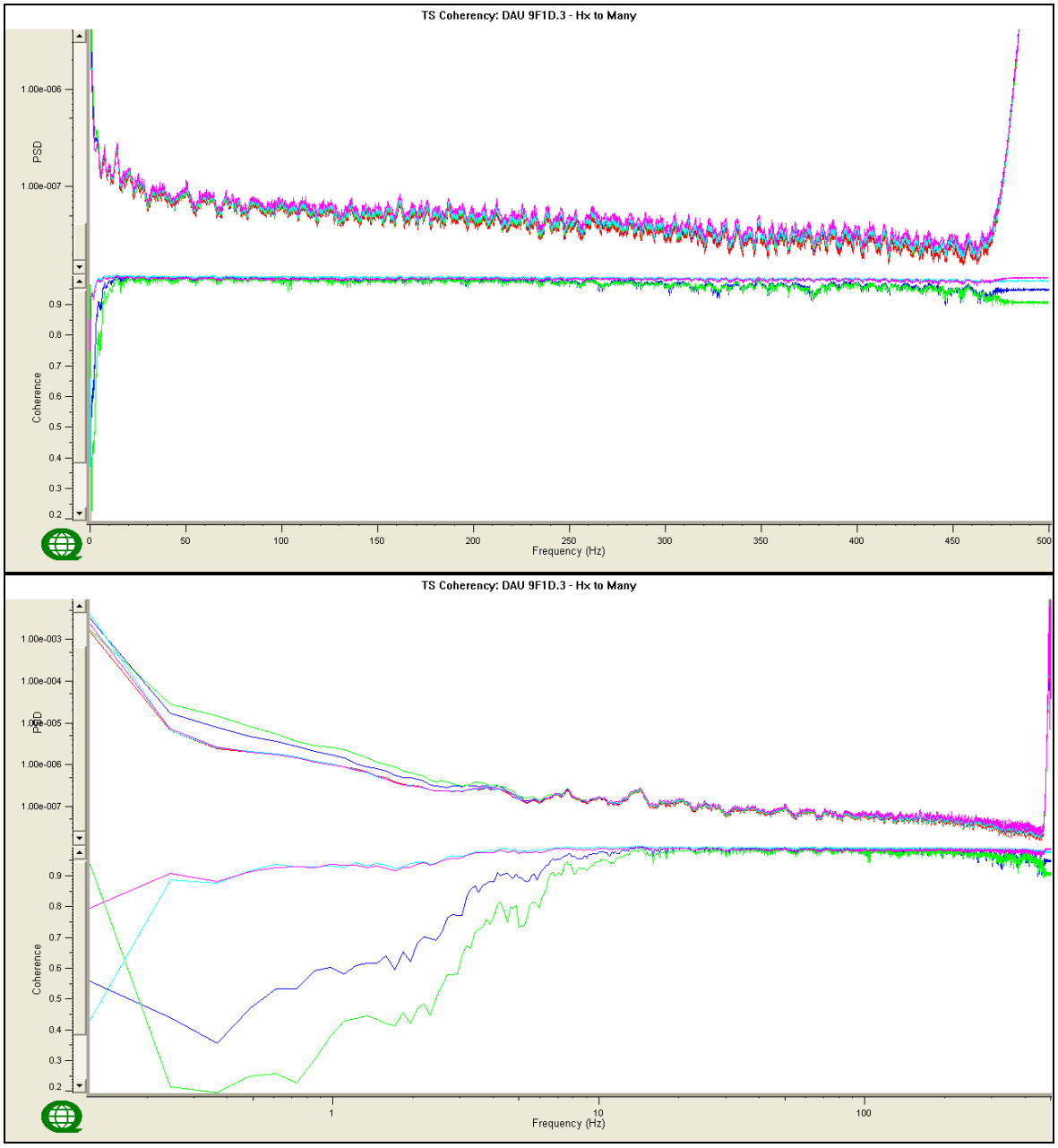


Figure 4-2: Coherencies are to BF4-9122 (Red).Upper linear, lower logarithmic frequency scales.

Colour	Channel	Notes
Blue	BF4-9016	to be retested
Green	BF7-9103	to be retested
Red	BF4-9122	
Cyan	BF4-9622	
Magenta	BF4-9623	

5. Low Frequency Coils – Test 5

Available Coils:

TS Strip	Manufacturer	Serial #	Tasked To
1	EMI	BF4-9623	Logger Site
2	EMI	BF4-9622	Logger Site
3	EMI	BF4-9016	Logger Site
4	EMI	BF7-9103	Logger Site
5	EMI	BF4-9122	Logger Site

Processing Parameters:

Parameter	Value
QuickLay Version	3_Alpha.33
PSD Method	Welch
Window	Hanning
Window length	8196
Segment Overlap	50%

5.1 Test Results: 1000sps

NetEvent: PST_20081127.0148.net
Sample Rate: 1000sps
TS Length: 650000 samples (~11min)

Results:
Ok, BF7-9103 & BF4-9122 failed due to low coherency

Time Series

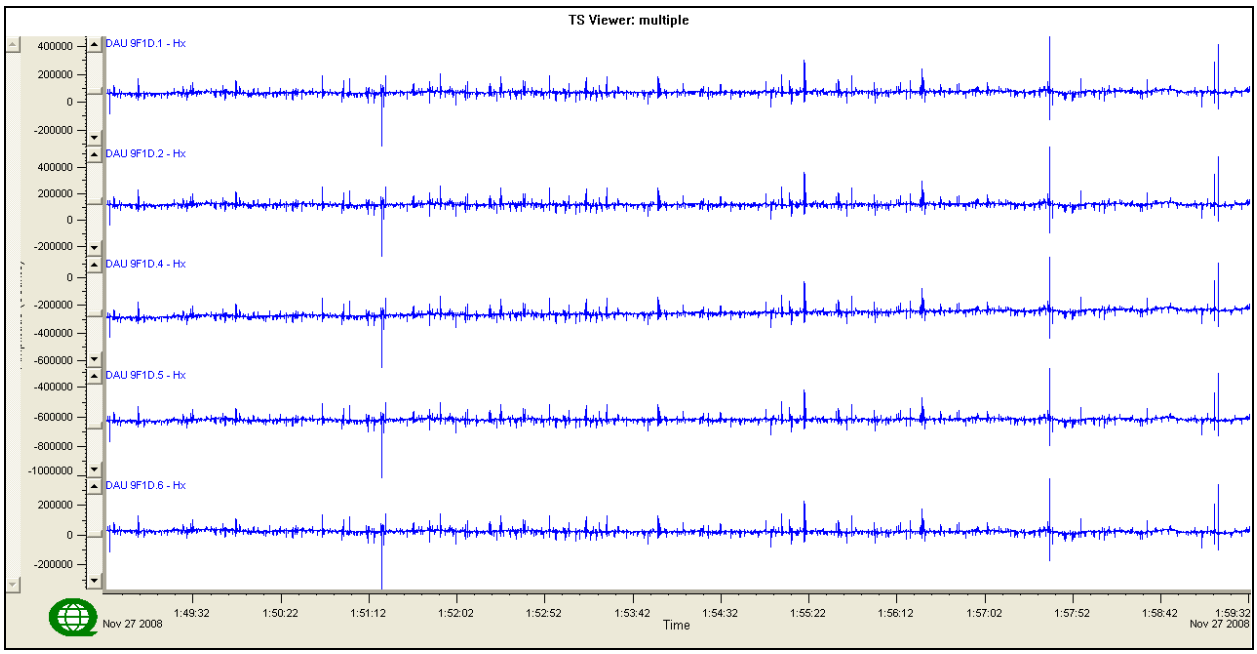


Figure 5-1: Complete time series @ 1000sps

Low Frequency Coil Results: 1000sps
Coherency to BF4-9623

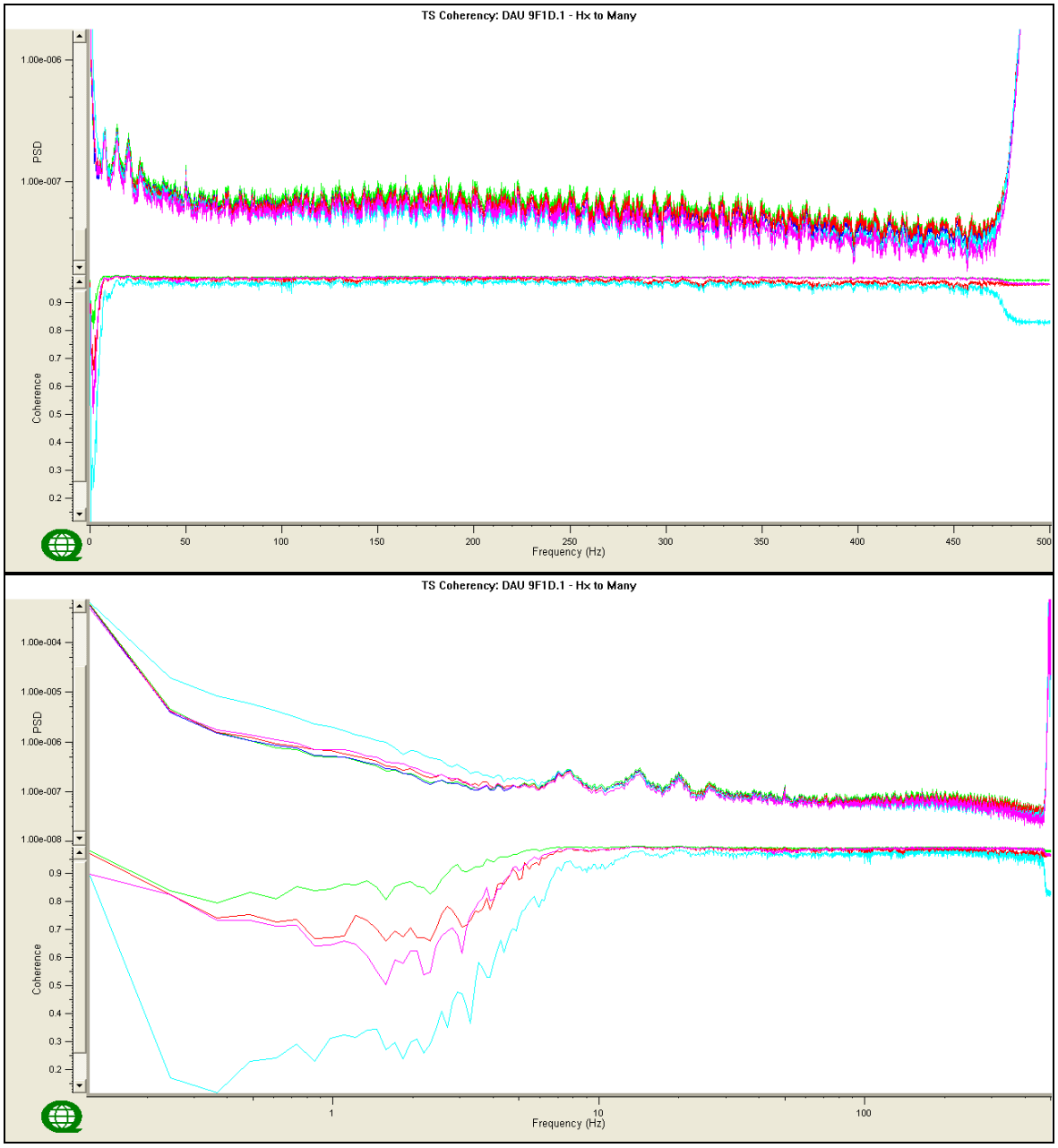


Figure 5-2: Coherencies are to BF4-9623 (blue). Upper linear, lower logarithmic frequency scales.

Colour	Channel	Notes
Blue	BF4-9623	
Green	BF4-9622	
Red	BF4-9016	
Cyan	BF7-9103	poor coherency and PSD
Magenta	BF4-9122	weak performance

6. Low Frequency Coils – Test 6

Available Coils:

TS Strip	Manufacturer	Serial #	Tasked To
1	PHOENIX	P50-2010	Logger Site
2	PHOENIX	P50-2017	Logger Site
3	PHOENIX	P50-2202	Logger Site
4	PHOENIX	P50-2126	Logger Site
5	PHOENIX	P50-2114	Logger Site
6	PHOENIX	P50-2117	Logger Site

Processing Parameters:

Parameter	Value
QuickLay Version	3_Alpha.33
PSD Method	Welch
Window	Hanning
Window length	8196
Segment Overlap	50%

6.1 Test Results: 1000sps

NetEvent: PST_20081127.0314.net
Sample Rate: 1000sps
TS Length: 650000samples (~11min)

Results:
Weak performance for P50-2114 on coherency.

Time Series

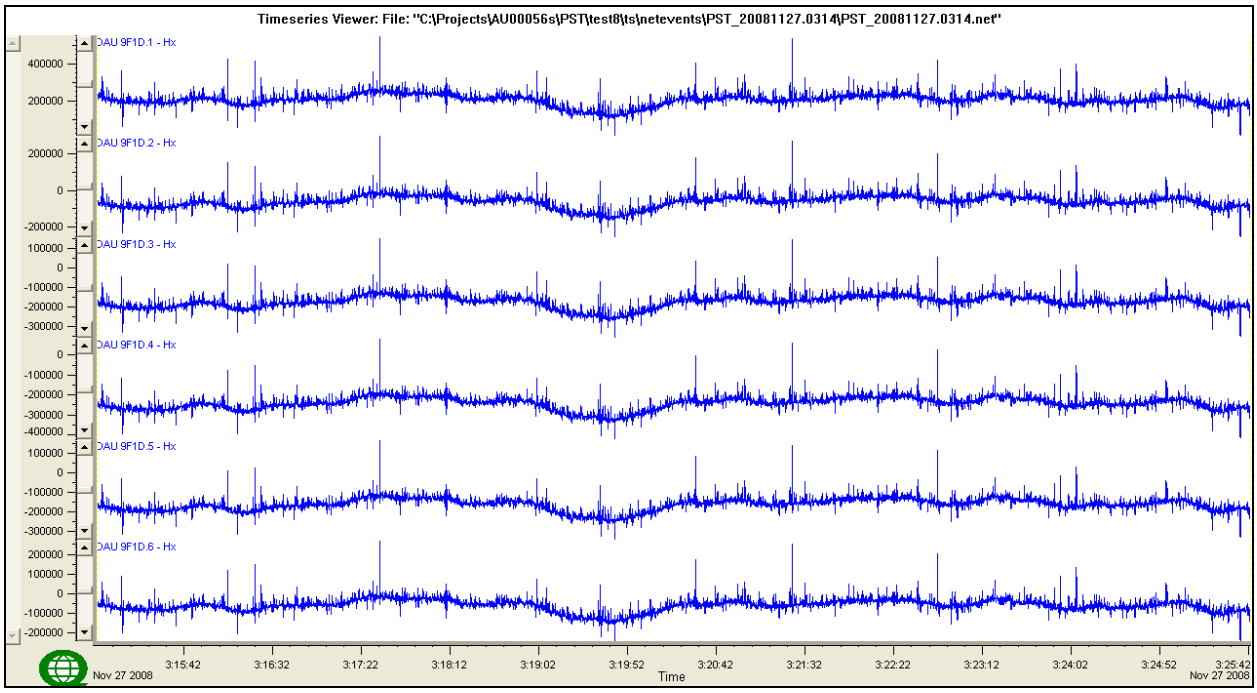


Figure 6-1: Complete time series @ 1000sps

Low Frequency Coil Results: 1000sps
Coherency to P50-2010

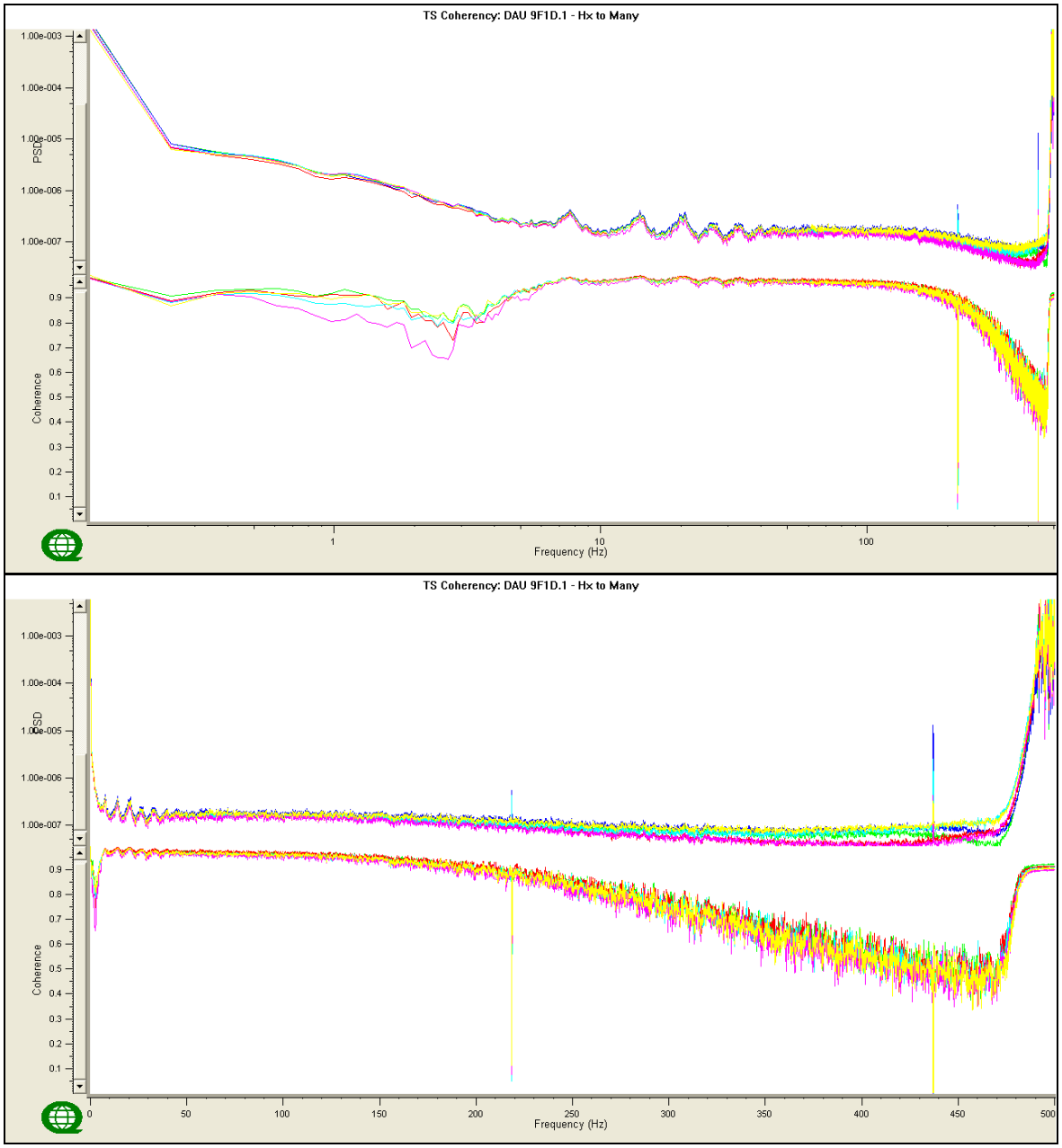


Figure 6-2: Coherencies are to P50-2010 (blue). Upper linear, lower logarithmic frequency scales.

Colour	Channel	Notes
Blue	P50-2010	
Green	P50-2017	
Red	P50-2202	
Cyan	P50-2126	
Magenta	P50-2114	to be retested
Yellow	P50-2117	

7. Low Frequency Coils – Test 7

Available Coils:

TS Strip	Manufacturer	Serial #	Tasked To
1	PHOENIX	P50-2236	Logger Site
2	PHOENIX	P50-2237	Logger Site
3	PHOENIX	P50-2436	Logger Site
4	PHOENIX	P50-2445	Logger Site
5	PHOENIX	P50-2114	Logger Site
6	PHOENIX	P50-2447	Logger Site

Processing Parameters:

Parameter	Value
QuickLay Version	3_Alpha.33
PSD Method	Welch
Window	Hanning
Window length	8196
Segment Overlap	50%

7.1 Test Results: 1000sps

NetEvent: PST_20081127.0351.net
Sample Rate: 1000sps
TS Length: 650000 samples (~11min)

Results:
All good

Time Series

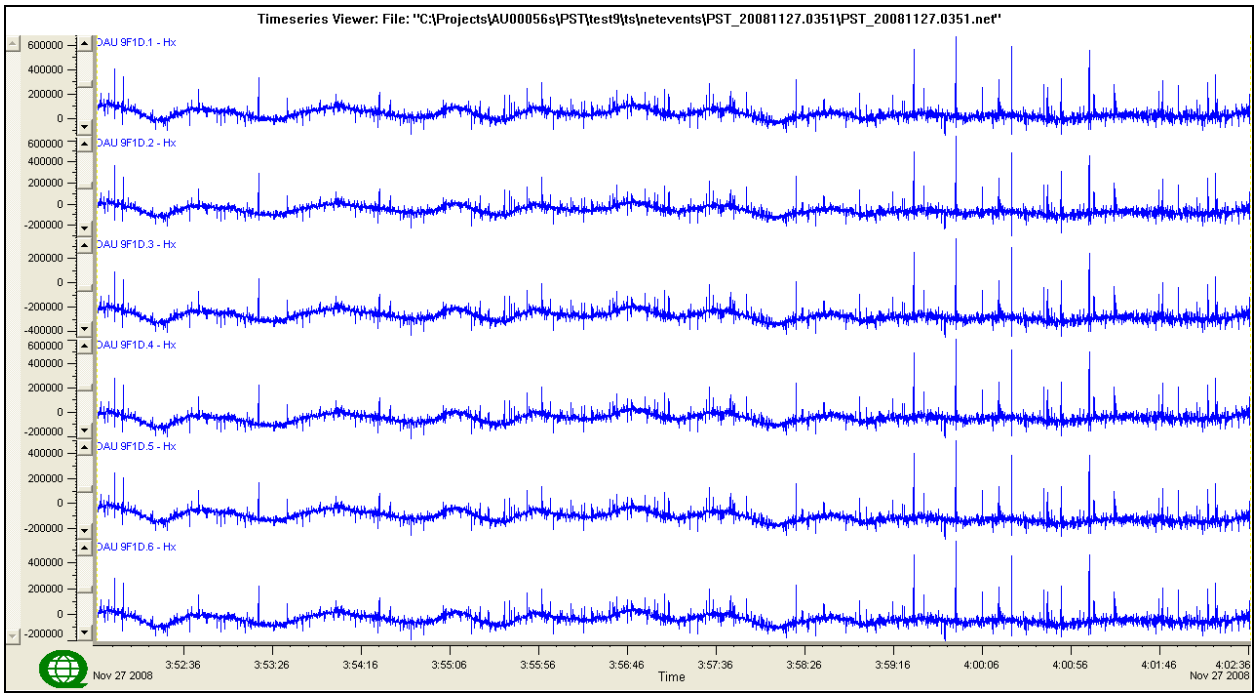


Figure 7-1: Complete time series @ 1000sps

Low Frequency Coil Results: 1000sps
Coherency to P50-2236

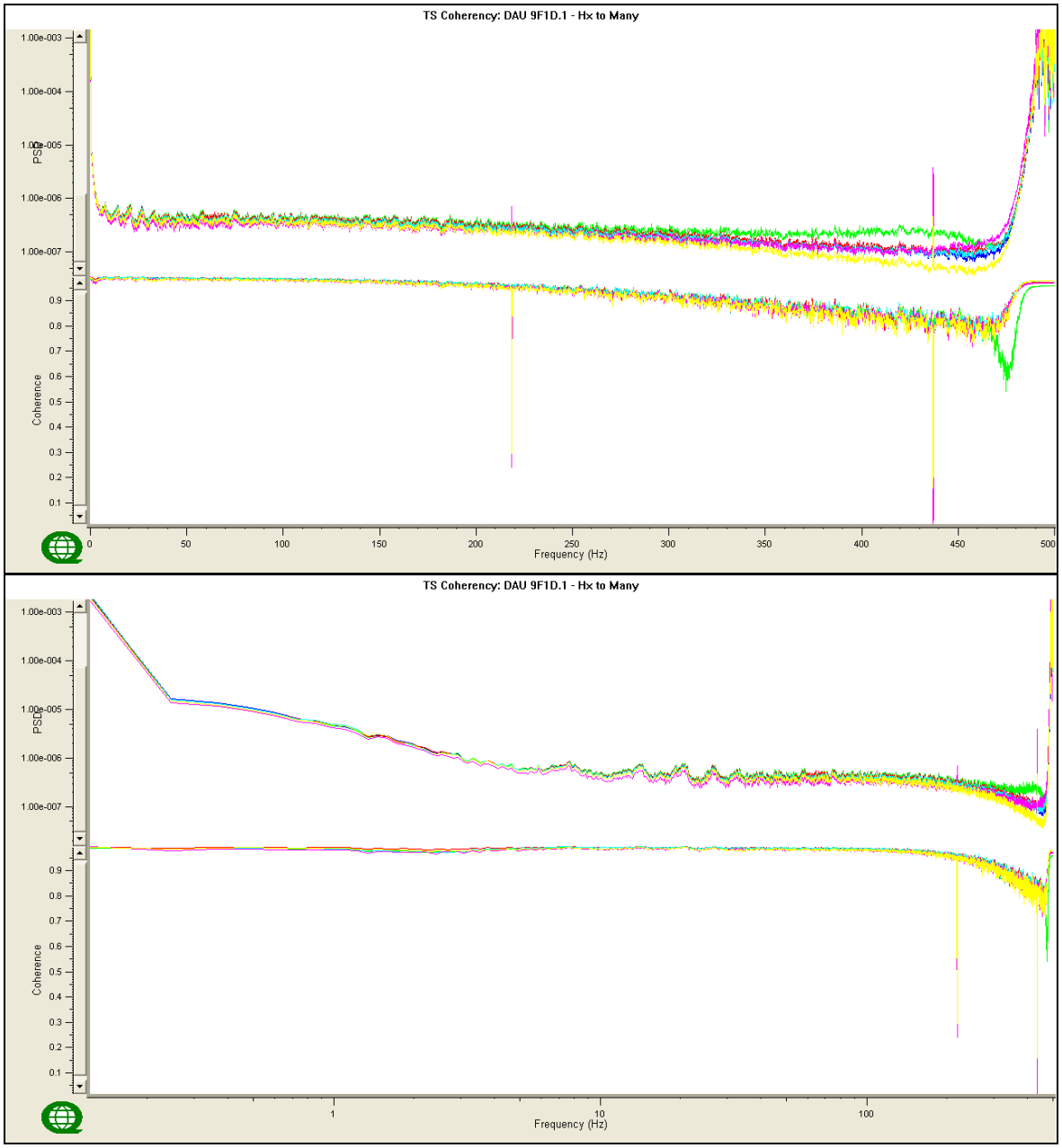


Figure 7-2: Coherencies are to P50-2236 (blue). Upper linear, lower logarithmic frequency scales.

Colour	Channel	Notes
Blue	P50-2236	
Green	P50-2237	
Red	P50-2436	
Cyan	P50-2445	
Magenta	P50-2114	
Yellow	P50-2447	

8. Low Frequency Coils – Test 8

Available Coils:

TS Strip	Manufacturer	Serial #	Tasked To
1	PHOENIX	P50-2451	Logger Site
2	PHOENIX	P50-2448	Logger Site
3	PHOENIX	P50-2456	Logger Site
4	PHOENIX	P50-2455	Logger Site
5	PHOENIX	P50-2459	Logger Site
6	PHOENIX	P50-2457	Logger Site

Processing Parameters:

Parameter	Value
QuickLay Version	3_Alpha.33
PSD Method	Welch
Window	Hanning
Window length	8196
Segment Overlap	50%

8.1 Test Results: 1000sps

NetEvent: PST_20081127.0435.net
Sample Rate: 1000sps
TS Length: 650000 samples (~11min)

Results:
All good

Time Series

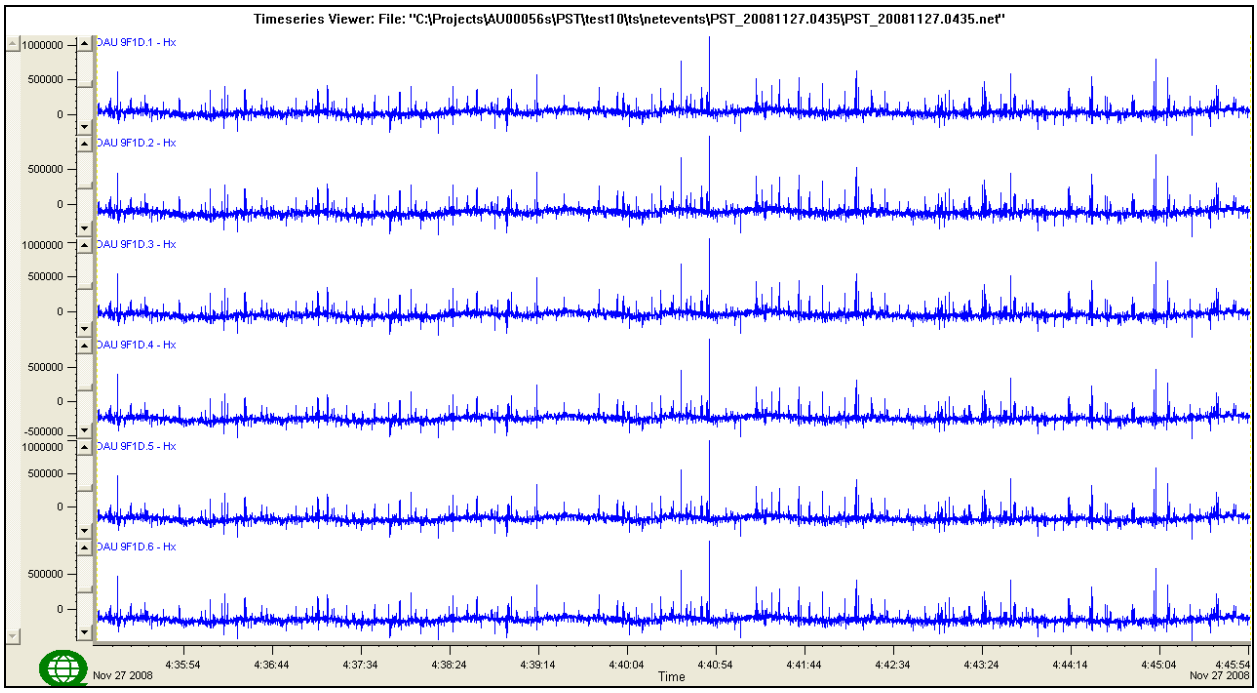


Figure 8-1: Complete time series @ 1000sps

Low Frequency Coil Results: 1000sps
Coherency to P50-2451

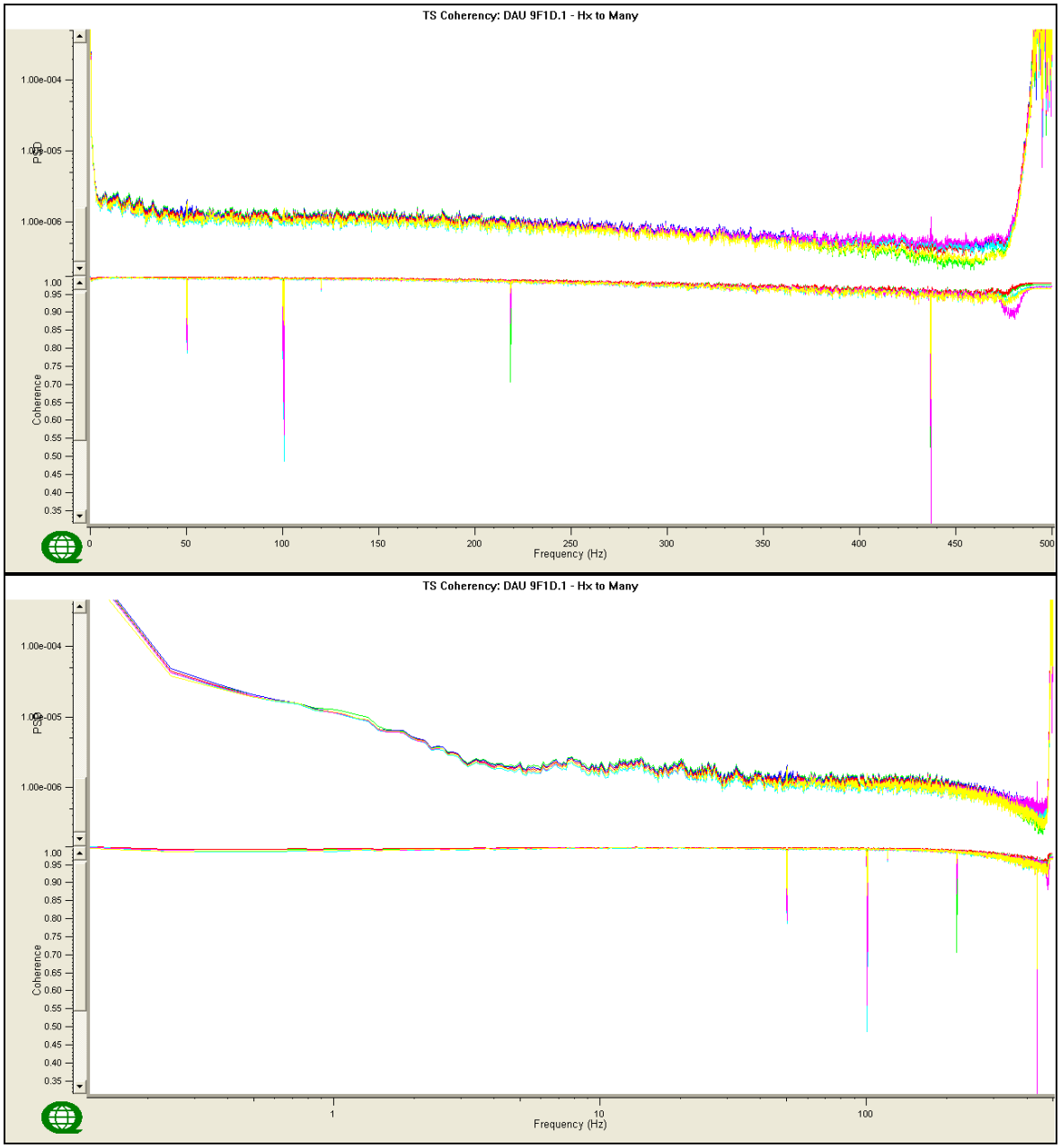


Figure 8-2: Coherencies are to P50-2451 (blue). Upper linear, lower logarithmic frequency scales.

Colour	Channel	Notes
Blue	P50-2451	
Green	P50-2448	
Red	P50-2456	
Cyan	P50-2455	
Magenta	P50-2459	
Yellow	P50-2457	

9. Low Frequency Coils – Test 9

Available Coils:

TS Strip	Manufacturer	Serial #	Tasked To
1	PHOENIX	P50-2451	Logger Site
2	PHOENIX	P50-2448	Logger Site
3	PHOENIX	P50-2456	Logger Site
4	PHOENIX	P50-2455	Logger Site
5	PHOENIX	P50-2459	Logger Site
6	PHOENIX	P50-2457	Logger Site

Processing Parameters:

Parameter	Value
QuickLay Version	3_Alpha.33
PSD Method	Welch
Window	Hanning
Window length	8196
Segment Overlap	50%

9.1 Test Results: 1000sps

NetEvent: PST_20081127.0504.net
Sample Rate: 1000sps
TS Length: 650000 samples (~11min)

Results:
All Good

Time Series

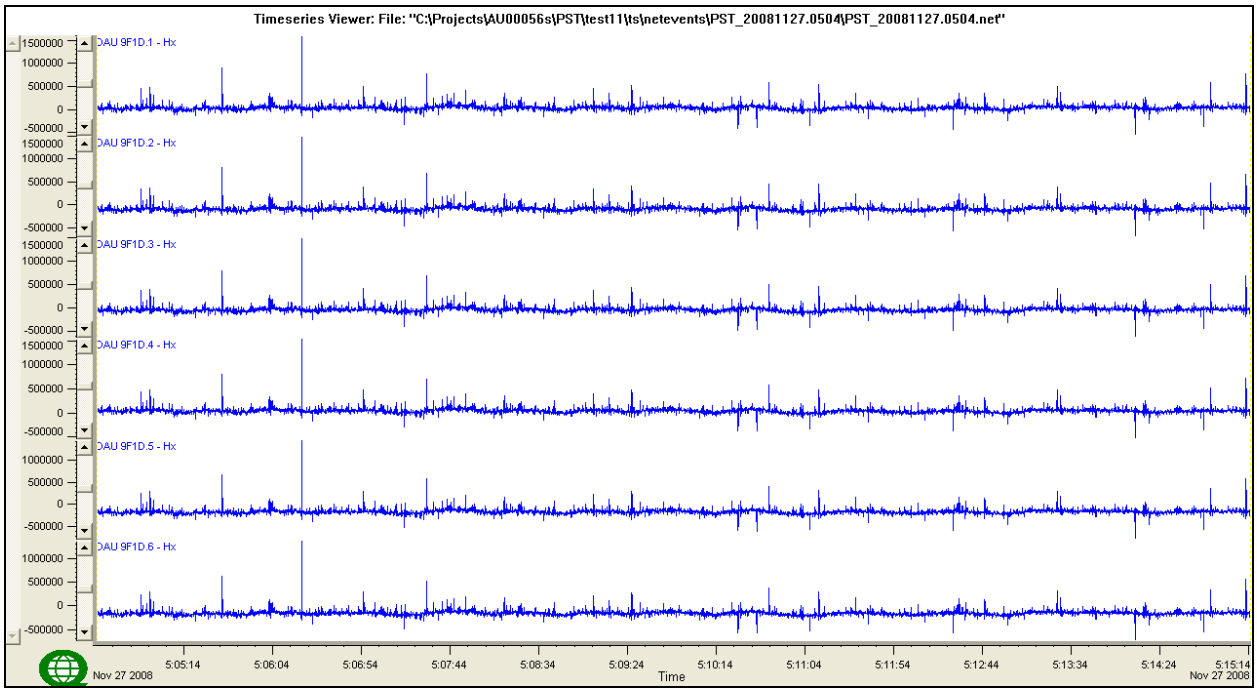


Figure 9-1: Complete time series @ 1000sps

Low Frequency Coil Results: 1000sps
Coherency to P50-2461

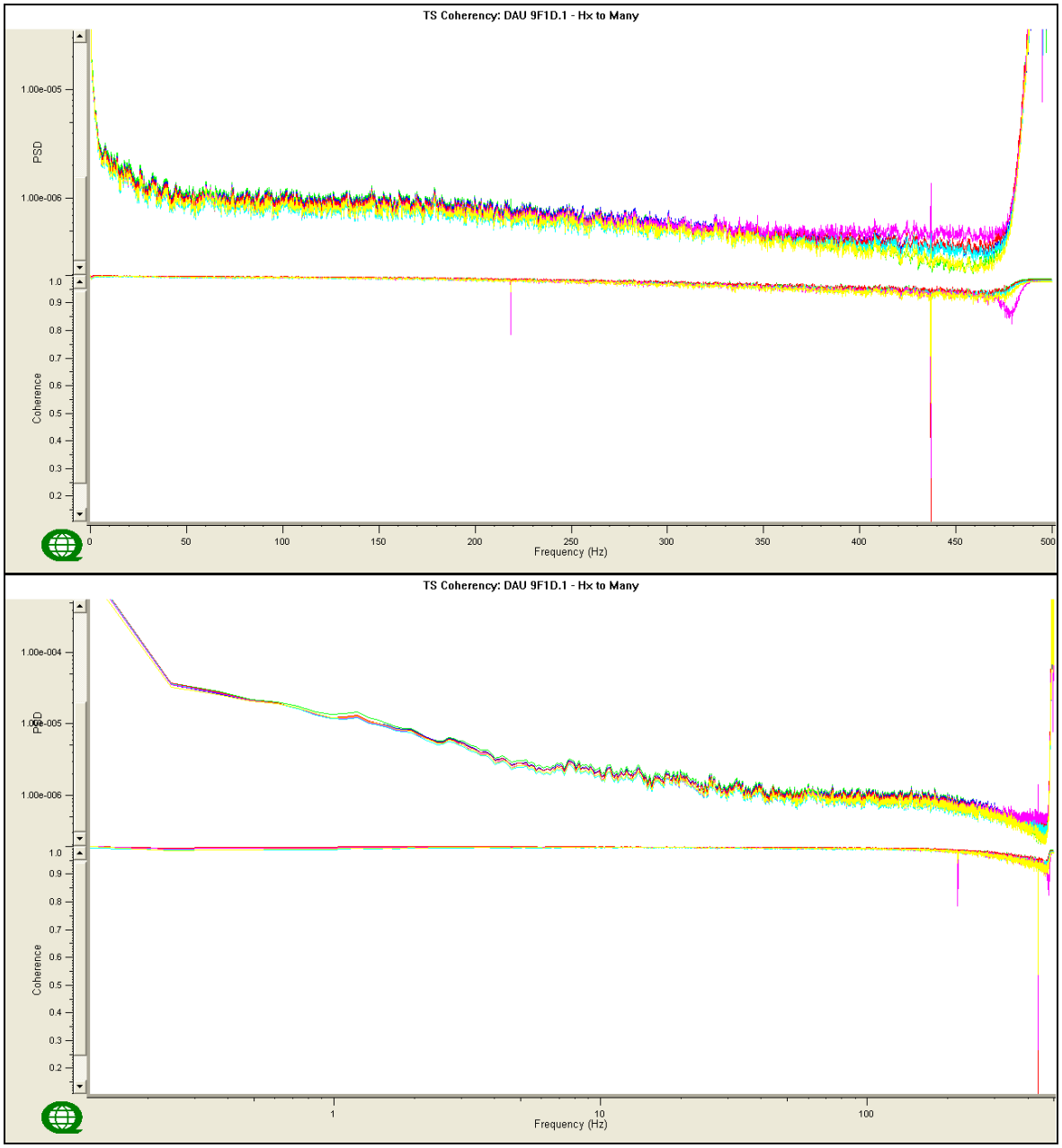


Figure 9-2: Coherencies are toP50-2461 (blue). Upper linear, lower logarithmic frequency scales.

Colour	Channel	Notes
Blue	P50-2461	
Green	P50-2448	
Red	P50-2456	
Cyan	P50-2455	
Magenta	P50-2459	
Yellow	P50-2457	

10. Low Frequency Coils – Test 10

Available Coils:

TS Strip	Manufacturer	Serial #	Tasked To
1	EMI	BF4-9622	Logger Site
2	EMI	BF4-9623	Logger Site
3	EMI	BF4-9016	Logger Site
4	EMI	BF4-9122	Logger Site
5	EMI	BF7-9103	Logger Site

Processing Parameters:

Parameter	Value
QuickLay Version	3_Alpha.33
PSD Method	Welch
Window	Hanning
Window length	8196
Segment Overlap	50%

10.1 Test Results: 1000sps

NetEvent: PST_20081129.0431.net
Sample Rate: 1000sps
TS Length: 650000 samples (~11min)

Results:
BF4-9122 & BF7-9103 failed due to low coherency

Time Series

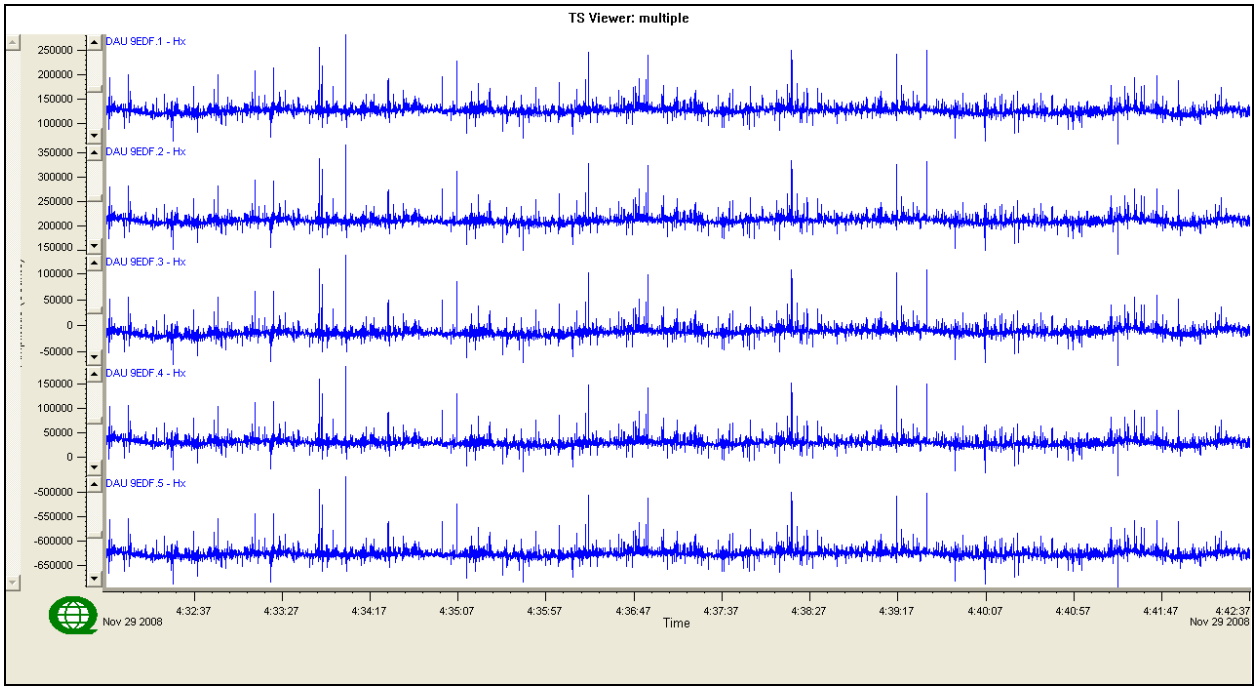


Figure 10-1: Complete time series @ 1000sps

Low Frequency Coil Results: 1000sps
Coherency to BF4-9623

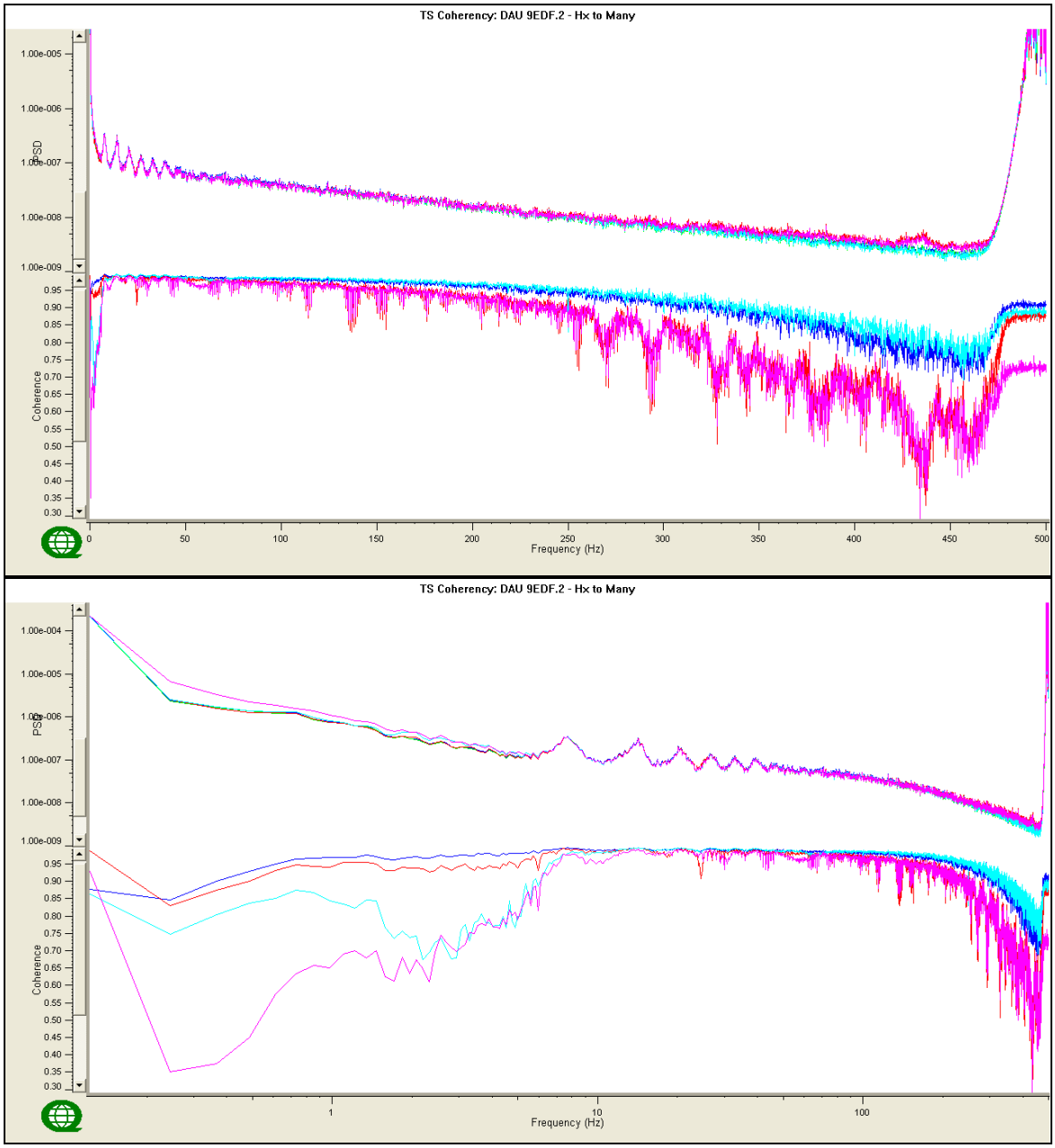


Figure 10-2: Coherencies are to BF4-9623 (green). Upper linear, lower logarithmic frequency scales.

Colour	Channel	Notes
Blue	BF4-9622	
Green	BF4-9623	
Red	BF4-9016	
Cyan	BF4-9122	poor performance
Magenta	BF7-9103	poor performance

APPENDIX F: PARALLEL SENSOR TEST 2

Date: January 21st, 2009

Report: Susanna Scappin

Staff: Susanna Scappin
Clinton Efford

1. Introduction

Location:

Site	Location: UTM WGS 84 Zone 54J	
	Easting	Northing
BC23	379872	6688178

Coil Azimuth: 360° true N (declination approx. 7˚ E)

Results:
P50: All good except P50-2444 that failed

Tested a total of 12 coils:
12 Phoenix MTC-50 (P50)

P50-2444 was put aside after decent coherency results could not be achieved (failed test 2, 3 and 4).
Test 3 and 4 didn't yield better results for coil P50-2444, therefore were not included in the document.

Coil #	Coil Type	Result		Role	Comments
		Pass	Fail		
P50-1964	Phoenix	Test 1		Hx	
P50-1996	Phoenix	Test 1		Hy	
P50-2012	Phoenix	Test 1		Hz	
P50-2113	Phoenix	Test 1		Hx	
P50-2115	Phoenix	Test 1		Hy	
P50-2127	Phoenix	Test 1		Spare	
P50-2387	Phoenix	Test 2		Hx	
P50-2388	Phoenix	Test 2		Hy	
P50-2389	Phoenix	Test 2		Hz	
P50-2390	Phoenix	Test 2		Hz	
P50-2444	Phoenix		Test 2,3 & 4		Changed cable and port
P50-2458	Phoenix	Test 2		Spare	

2. Low Frequency Coils – Test 1

Available Coils:

TS Strip	Manufacturer	Serial #	Tasked To
1	Phoenix	P50-1964	Logger Site - Hx
2	Phoenix	P50-1996	Logger Site - Hy
3	Phoenix	P50-2012	Logger Site - Hz
4	Phoenix	P50-2113	Logger Site - Hx
5	Phoenix	P50-2115	Logger Site - Hy
6	Phoenix	P50-2127	Logger Site - Spare

Processing Parameters:

Parameter	Value
QuickLay Version	3_Alpha.33
PSD Method	Welch
Window	Hanning
Window length	8196
Segment Overlap	50%

2.1 Test Results: 1000sps

NetEvent: PST_AU00056S_20090121.0756.net
Sample Rate: 1000sps
TS Length: 700000 samples (~12min)

Results:
All good

Time Series

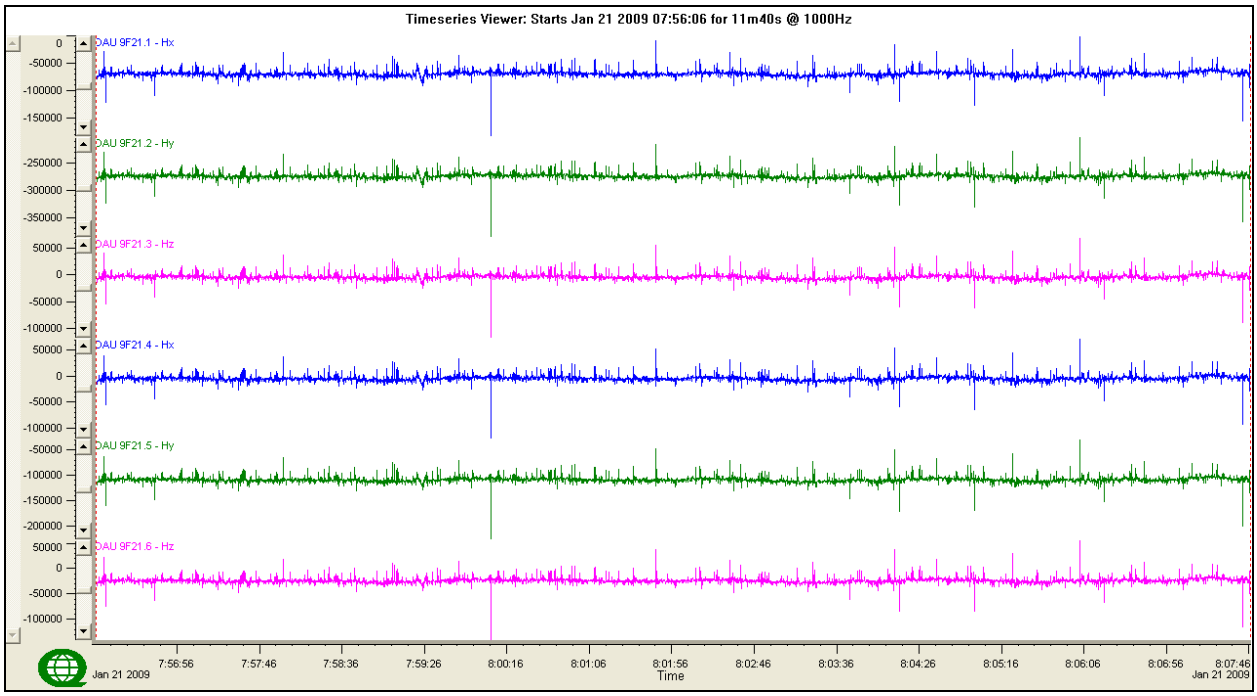


Figure 2-1: Complete time series @ 1000sps

Low Frequency Coil Results: 1000sps
Coherency to P50-1964

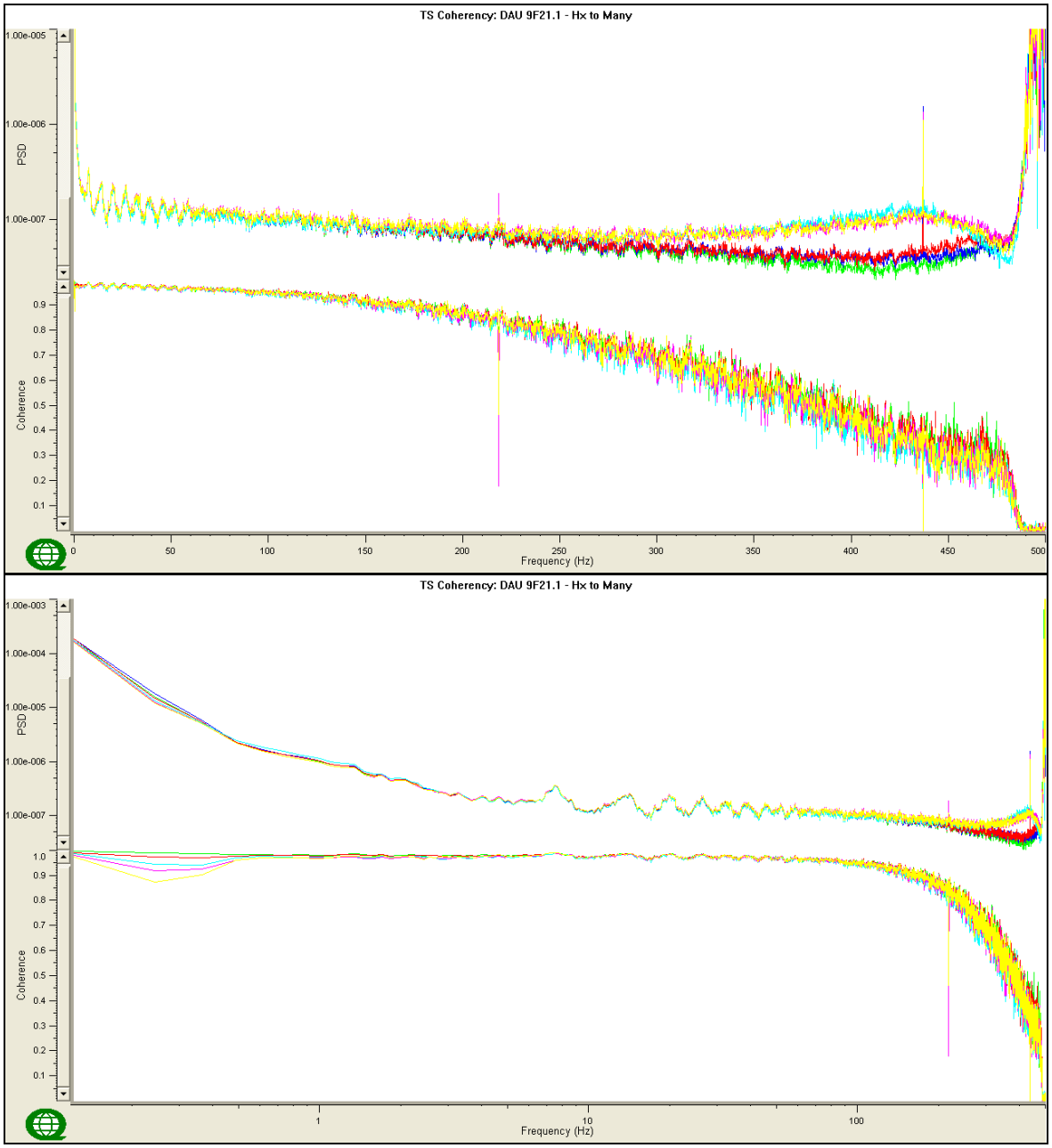


Figure 2-2: Coherencies are to P50-1964 (blue). Upper linear, lower logarithmic frequency scales.

Colour	Channel	Notes
Blue	P50-1964	
Green	P50-1996	
Red	P50-2012	
Cyan	P50-2113	
Magenta	P50-2115	
Yellow	P50-2127	

3. Low Frequency Coils – Test 2

Available Coils:

TS Strip	Manufacturer	Serial #	Tasked To
1	Phoenix	P50-2387	Logger Site – Hx
2	Phoenix	P50-2388	Logger Site – Hy
3	Phoenix	P50-2389	Logger Site – Hz
4	Phoenix	P50-2390	Logger Site – Hz
5	Phoenix	P50-2444	Logger Site – failed
6	Phoenix	P50-2458	Logger Site – spare

Processing Parameters:

Parameter	Value
QuickLay Version	3_Alpha.33
PSD Method	Welch
Window	Hanning
Window length	8196
Segment Overlap	50%

3.1 Test Results: 1000sps

NetEvent: PST_AU00056S_20090121.0756.net
Sample Rate: 1000sps
TS Length: 700000 samples (~12min)

Results:
All good, except P50-2444 changed port, then cable in next 2 tests but still same results.

Time Series

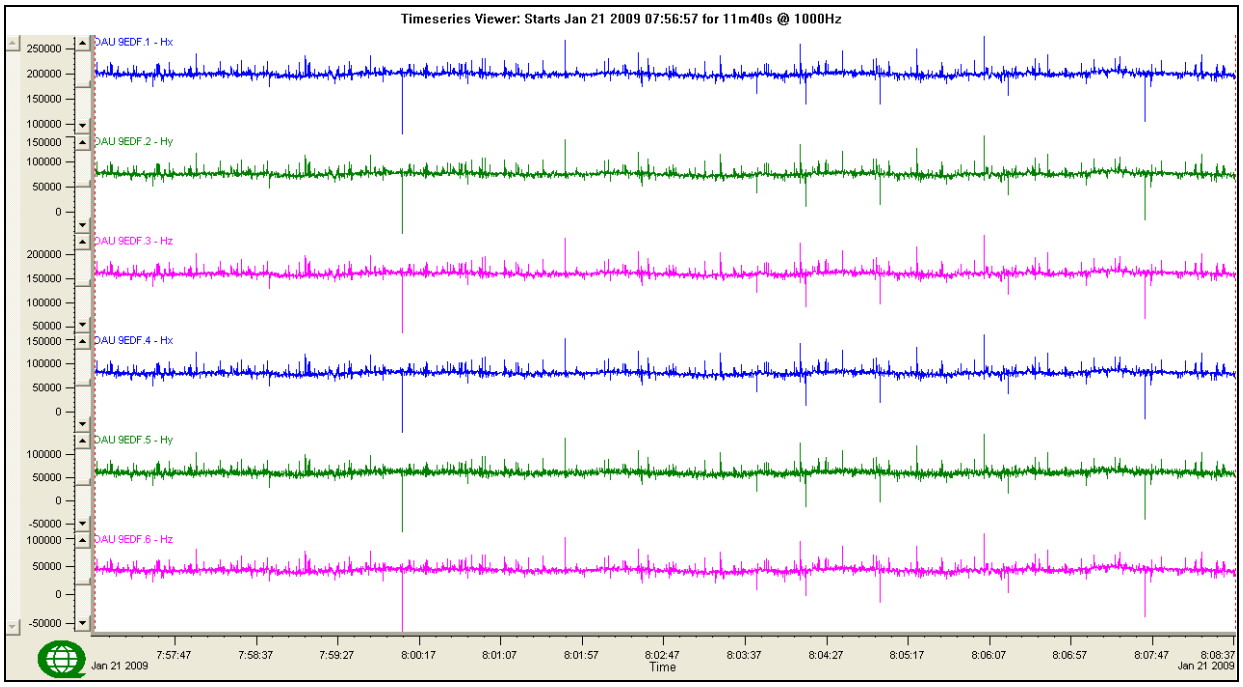


Figure 3-1: Complete time series @ 1000sps

Time Series

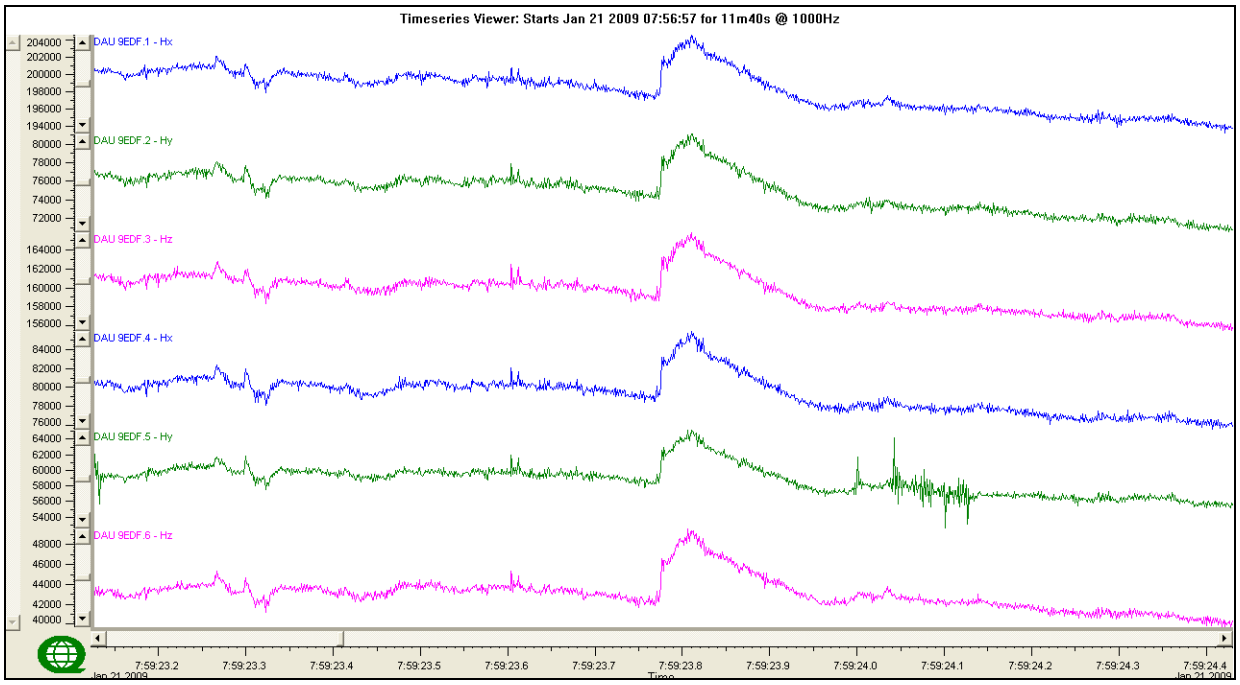


Figure 3-2: Zoom in time series @ 1000sps to show extra noise recorded by channel 5 (P50-2444)

Low Frequency Coil Results: 1000sps
Coherency to P50-2387

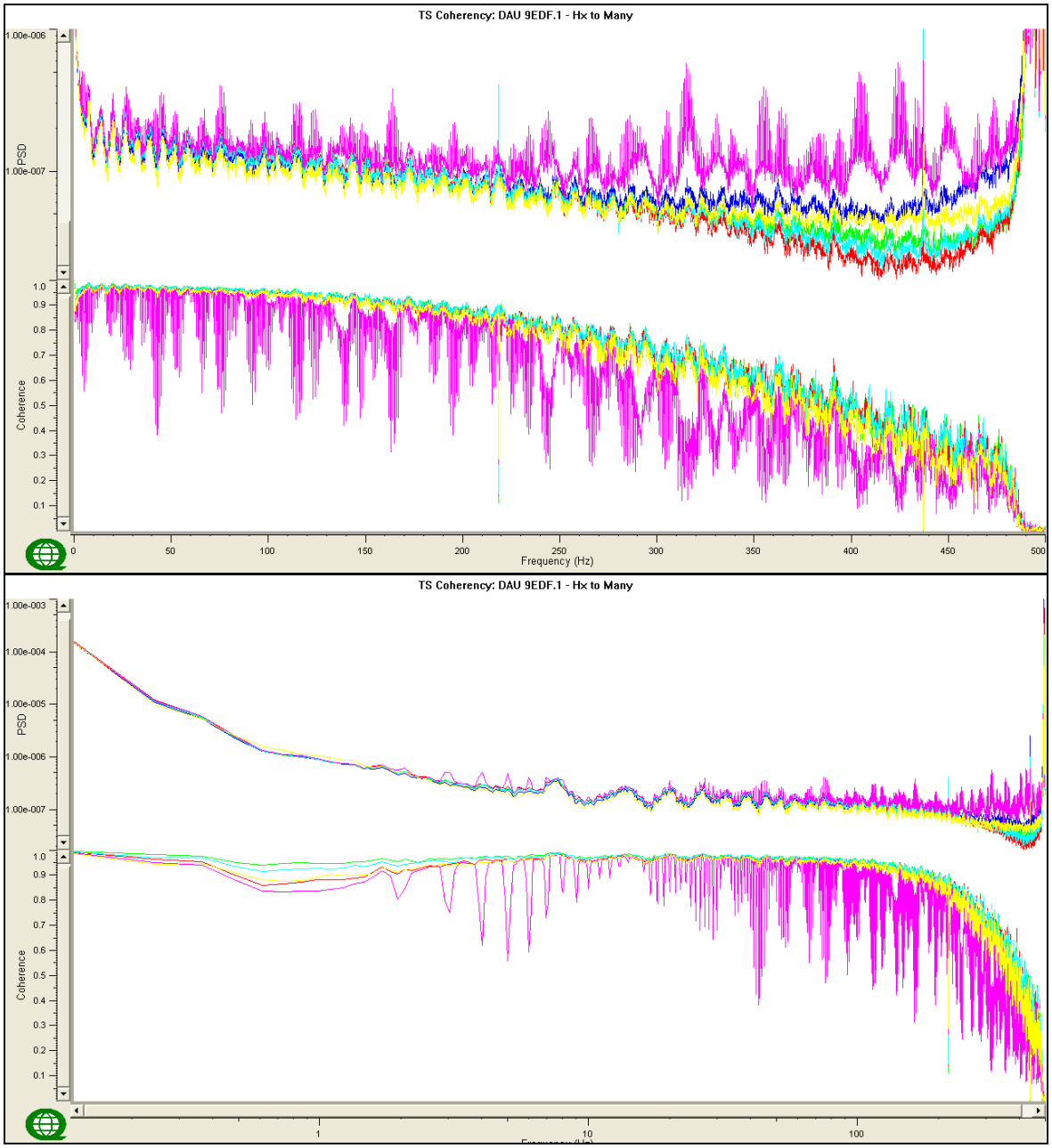


Figure 3-3: Coherencies are to P50-2387 (blue). Upper linear, lower logarithmic frequency scales.

Colour	Channel	Notes
Blue	P50-2387	
Green	P50-2388	
Red	P50-2389	
Cyan	P50-2390	
Magenta	P50-2444	Poor performance
Yellow	P50-2458	

APPENDIX G: INSTRUMENT SPECIFICATIONS

REF TEK – 130 QUANTEC REV 2 DATA ACQUISITION SYSTEM

SPECIFICATIONS:

REVISION: QUANTEC REV. 2

Specification	Description
Mechanical - DAS	
Size:	5.3" (135mm) high x 7.3" (185mm) wide x 13.5" (343mm) long
Weight:	4.5 lbs (2 kg)
Watertight Integrity:	IP 67
Shock:	Survives a 1 meter drop on any axis
Operating Temperature:	-20°C to +60°C
Connectors	
Channel Input:	PTO7A14-19S (2 each for 6-Channel DAS)
Power:	PTO7A12-4S
NET:	PTO7A14-19P
Serial:	PTO7A12-10P
GPS Antenna:	PTO7A12-8S
Power	
Input Voltage:	10 to 16 VDC
Average Power:	~3 W (3 ch., no communications)
	~3.4 W (3 ch., with communications)
	~4 W (6 ch., no communications)
	~4.4 W (6 ch., with communications)
Communications	
NET Connector:	

Specification	Description
Ethernet:	10-BaseT, TCP/IP, UDP/IP, FTP, RTP
Serial:	Asynchronous, RS-232 , PPP, TCP/IP, UDP/IP, FTP, RTP
Serial Connector:	
Terminal:	Asynchronous, RS-232 , 130 Command
A/D Converter	
Type:	Δ–Σ modulation, 256 KHz base rate, 24-bit output resolution
Channels:	6
Input Impedance:	Filter A: 100 Mohms, 0.002 μFd, differential B: 100 Mohms, 0.002 μFd, differential C: 100 Mohms, 0.002 μFd, differential D: 100 Mohms, 0.002 μFd, differential
Common Mode Rejection:	Greater than 70 dB within +/-2.5VDC
Sensor Input Signal Range:	Gain / Input Full Scale (volts) / Bit Weight (Actual / Reported) 1 / +/- 10 V / 1.907μV / 62.50mV 4 / +/- 2.5 V / 476.8nV / 15.63mV 16 / +/- 625 mV / 119.2nV / 3.906mV 64 / +/- 156 mV / 29.80nV / 976.6μV 256 / +/- 39 mV / 7.45nV / 244.1μV
Noise Level:	~1 count RMS at 50 sps @x1
Sample Rates:	1000, 500, 250, 200, 125, 100, 50, 40, 25, 20, 10, 5, 1 sps
Time Base	
Type:	GPS Receiver/Clock plus a disciplined oscillator
Accuracy with GPS:	+/- 100 μsec after validated 3-D fix and locked
Free-Running Accuracy:	0.1 ppm over the temperature range of 0°C to 40°C, and 0.2 ppm from -20°C to 0°C
Recording Modes	
Continuous:	Record length
Recording Capacity	
Battery Backed SRAM:	5 Mbytes
Removable Storage:	up to 8 GB with two CF type II cards
Recording Format	
Format:	PASSCAL Recording Format
Compliance	CE

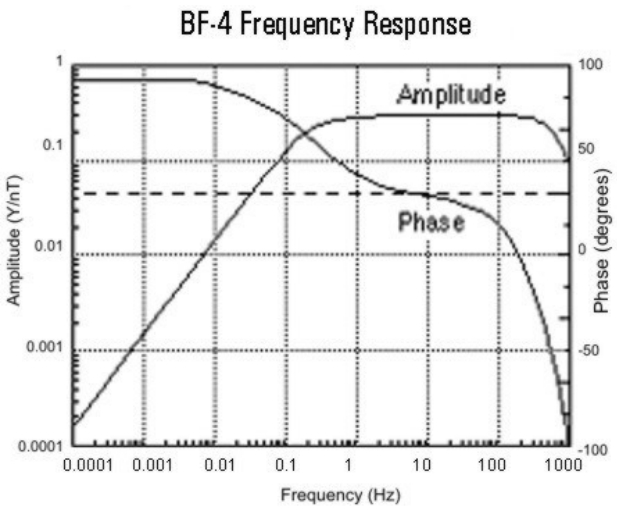
EMI – ELECTROMAGNETIC INSTRUMENTS INC

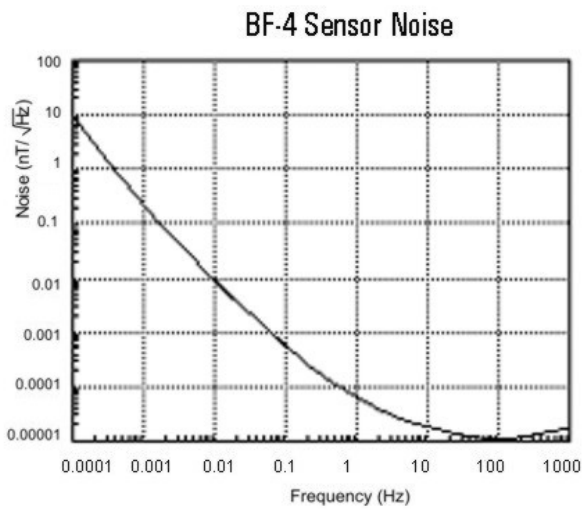
BF-4 Series Magnetic Sensors

SPECIFICATIONS:

BF-4 Magnetic Field Induction Sensor

The BF-4 sensor utilizes a magnetic feedback design to provide a stable flat response over several decades of frequency. The sensors respond as a B field detector over the flat band regions. Both the amplitude and phase responses are highly stable with variations of less than 0.1dB in amplitude and +/- one degree in phase between sensors. For the frequencies below the flat response region, the sensor response is proportional to signal frequency so that the sensor acts as a dB/dt detector. The coil is potted with epoxy and housed inside a rugged impact-resistant Nema G-10 fiberglass tube. A matched low noise preamplifier is connected to the coil in a waterproof case and powered by an external +/- 12V power supply.





Features

- High sensitivity
- Very low noise
- Magnetic feedback design
- Chopper stabilized amplifier for best low frequency performance
- Ruggedized and waterproof
- Light weight and compact
- Low power consumption
- Stable phase response

Applications

- Magnetotellurics
- Audiomagnetotellurics
- Controlled-source electromagnetics
- Magnetometric resistivity

Technical Specifications

Performance

- Frequency Range: 0.0001 to 1000 Hz
- 3 dB frequency corners: 0.2 Hz, 500 kHz
- Sensitivity (flat region): 0.3 V/nT (standard)
- Power consumption: 12mA at +/-12V

Physical

- Housing: Nema G-10 straight tube
- Length: 142 cm (56 inches)
- Diameter: 6 cm (2.4 inches)
- Weight: 7 kg (15 lbs)
- Connector: 8-pin Tajimi

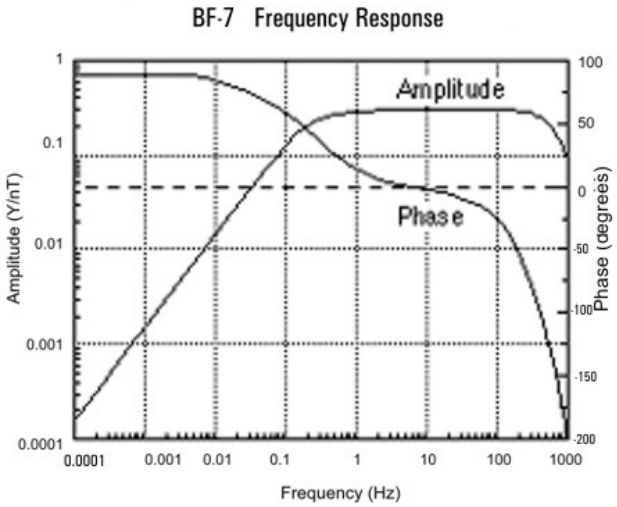
EMI – ELECTROMAGNETIC INSTRUMENTS INC

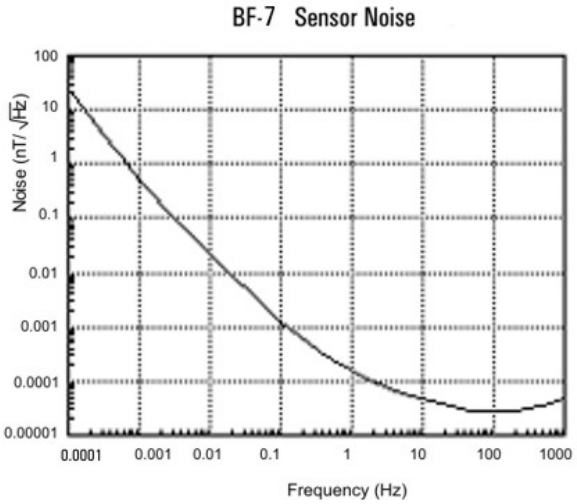
BF-7 Series Magnetic Sensors

SPECIFICATIONS:

BF-7 Magnetic Field Induction Sensor

The BF-7 sensor utilizes a magnetic feedback design to provide a stable flat response over several decades of frequency. The sensors respond as a B field detector over the flat band regions. Both the amplitude and phase responses are highly stable with variations of less than 0.1dB in amplitude and +/- one degree in phase between sensors. For the frequencies below the flat response region, the sensor response is proportional to signal frequency so that the sensor acts as a dB/dt detector. The coil is potted with epoxy and housed inside a rugged impact-resistant Nema G-10 fiberglass tube. A matched low noise preamplifier is connected to the coil in a waterproof case and powered by an external +/- 12V power supply. The BF-7 sensor is designed for monitoring vertical field applications.





Features

- High sensitivity
- Very low noise
- Magnetic feedback design
- Chopper stabilized amplifier for best low frequency performance
- Ruggedized and waterproof
- Light weight and compact
- Low power consumption (290 mW)
- Stable phase response

Applications

- Magnetotellurics
- Audiomagnetotellurics
- Controlled-source electromagnetics
- Magnetometric resistivity

Technical Specifications

Performance

- Frequency Range: 0.0001 to 1000Hz
- 3 dB frequency corners: 0.2 Hz, 500kHz
- Sensitivity (flat region): 0.3 V/nT (standard)
- Power consumption: 12mA at +/-12V

Physical

- Housing: Nema G-10
- Length: 104 cm (41 inches)
- Diameter: 6 cm (2.4 inches)
- Weight: 7 kg (15 lbs)
- Connector: 8-pin Tajimi

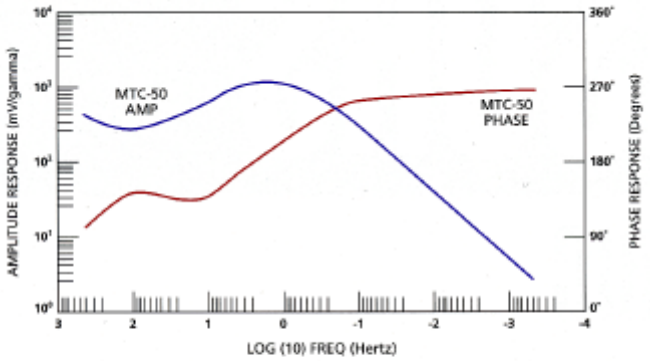
PHOENIX GEOPHYSICS LTD

MTC 50 (P50) Serie Magnetic Sensors

SPECIFICATIONS:

MTC-50 magnetic sensor coils weigh just over 10 kg, and measure only 141 cm. They provide magnetotelluric data at frequencies between 400 Hz to 0.0002 Hz.

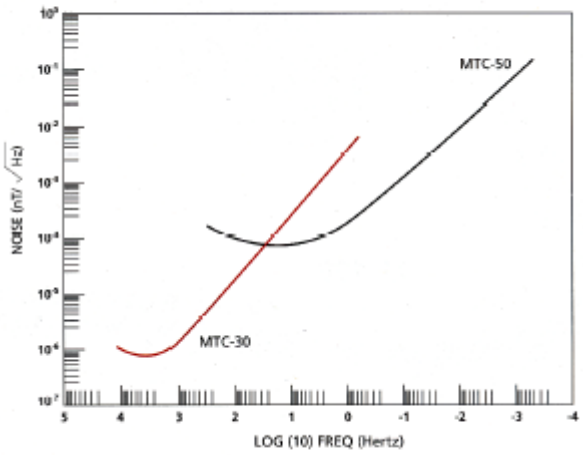
AMPLITUDE AND PHASE RESPONSE MTC-50 SENSOR



Coil model MTC-50

Overall Length	141 cm
Outside Diameter	6.0 cm
Weight	10.5 kg
Frequency Range (for MT)	400 Hz to 0.00002 Hz

TYPICAL SPECTRAL PLOT OF SENSOR NOISE



Technical Specifications

- Overall Length : 141 cm
- Outside Diameter : 6.0 cm
- Weight : 10.5 kg
- Frequency Range (for MT) : 400 Hz to 0.00002 Hz