

# Appendix A

## Data Management

A very large amount of data was collected from the Basil experiment and it was necessary to have some plan to keep it organised and have easy access and viewing of the data. To this end a data base management system (DBMS) was implemented to organise the data. For viewing the data a set of Windows based graphical user interface (GUI) programs were written utilising the widget capabilities of the data language IDL.

The reason for going to this amount of trouble can be illustrated by the steps involved in collecting a single set of data - for example, the azimuthal wave fields as a function of longitudinal position. To obtain the data a VMS IDL program (see figure A.1) was run and azimuthal scan selected. Information about the operational parameters are input to the program, such as gas, type of antenna, probe starting position, and step distance. The probe is moved to the starting position, five “shots” of data are taken, and then the probe is moved to the next position. Once the set of data is finished a log file is written to disk. For a 10 position scan, 50 “shot” files will be created each containing data from 18 digitised channels. Due to finite disk space these files are archived regularly on the large storage

**Data Collection**

Field (amps)	0	0.000000 gauss		MDF file name	
Pressure (mTorr)	0	0.000000 Pa		NO_INCREM.MDF	
Gas	Argon	Antenna	Double Loop	AZIMUTHAL1.MDF;1 AZIMUTHAL2.MDF;1 DAS.MDF;1 FAST1.MDF;1 FAST2.MDF;1 LANGMUIR.MDF;1 LONGB1.MDF;1	
Frequency	7 MHz			AZ.LOG;2 AZ001.LOG;1 AZ002.LOG;1 AZ003.LOG;1 AZ004.LOG;1 AZ005.LOG;1 AZ006.LOG;1	
Comments					
Langmuir probe voltage <div style="border: 1px solid black; width: 100px; height: 20px; margin: 5px auto; text-align: center;">0</div>			ABORT		

Log File Name

Starting Position

Step Distance

Number of Steps

0

0

0

0

Radial B Scan

Radial n & Te Scan

Azimuthal Probe

Longitudinal n, Te & B Scan

Power Measurements

Single Shot

View Log File

Quit

Figure A.1: Data collection program.

	Directory	Description of files
VMS		
	[.ANALYSIS]	Data collection and analysis programs
	[.SHOTS]	Shot data
	[.LOG]	Log Files
	[.BASDATA]	Analysed data
Unix		
	./	Basil GUI and analysis
	./Log	Log Files
	./Basdata	Analysed data
	./Dendata	Analysed Langmuir probe data
	./Shots12	IDL versions of shot data 120 000 to 129 999
	./Shots13	IDL versions of shot data 130 000 to 139 999
	./Shots14	IDL versions of shot data 140 000 to 149 999
	./Shots15	IDL versions of shot data 150 000 to 159 999

Table A.1: *Data file structure.*

device and backed up on Exabyte Tapes. An IDL analysis program can then be used to average the data for the 5 shots and create wave field amplitude and phase variables in appropriate units. The analysed data was then saved as IDL variables. More recently all shot data was converted to IDL variables which were then transferred to a Unix platform for more flexible analysis. In total 430 sets of data comprising 53 000 data shots were taken on Basil.

The log and analysed data filenames consist of a prefix and a number. The prefix indicates what type of probe data it is (AZ - azimuthal, LBN - longitudinal Langmuir and magnetic, PWR - power and antenna current, RB - radial magnetic, RL - radial Langmuir) and the number identifies it as part of a set of data taken under the same operating conditions. Thus the files PWR078.LOG, PWR078.DAT, LBN078.LOG, LBN078.DAT, AZ078.LOG, AZ078.DAT, RL078.LOG, RB078.LOG, and RB078.DAT are all taken

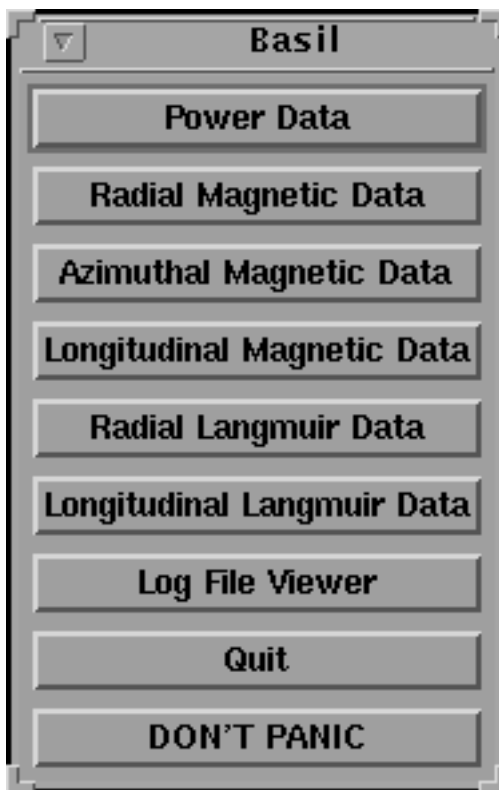


Figure A.2: *The main menu of the Basil GUI.*

with the conditions - double saddle coil antenna, argon, 896 Gauss, 30mTorr. Langmuir probe data is analysed for single times within the pulse, as it is necessary to manually identify the region of electron collection in the most negatively biased region as possible. Because of this the filename structure of analysed Langmuir probe data has the time added (the filenames were shortened as the original programs were written on a DOS platform which limits filenames to 8 letters). Thus the radial analysed Langmuir probe data for the above conditions at 30ms into the pulse (digitisation rate 5kHz, therefore 30msec is the  $5 \times 30 = 150$ th data point) is R78150.DAT, and for the longitudinal Langmuir probe is L78150.DAT. The file LBN078.DAT contains only the axial magnetic wave field data and no Langmuir probe data.

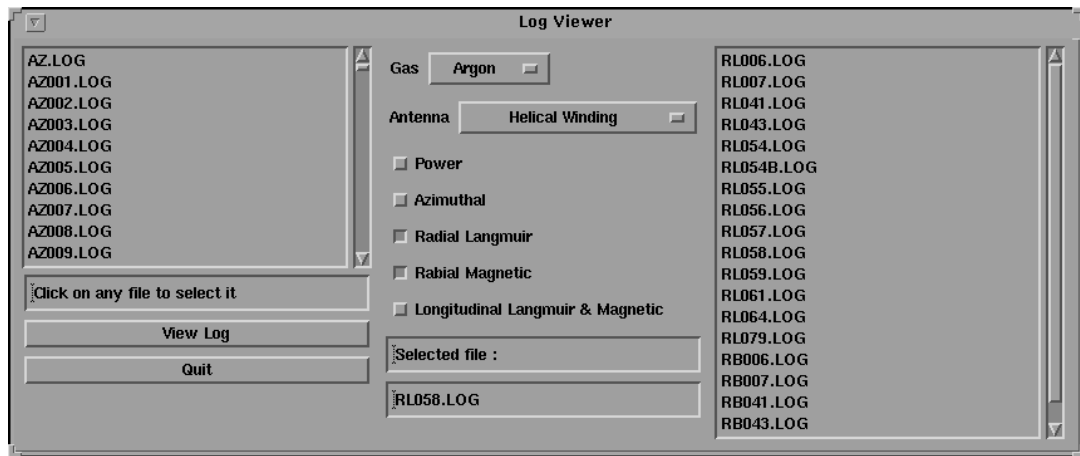


Figure A.3: *Log file search and viewer.*

To help sort through the large amount of data and to enable quick viewing of results a graphical user interface was written in IDL. The individual programs are called by the main program *Basil* (see figure A.2). To locate data taken under specific conditions the program *Log File Viewer* (figure A.3) is used. Once a gas and antenna type are chosen it will locate and list log files for different probes. Then to find the desired data it is a matter of selecting and viewing the log files. Once the data is located it can be viewed with the appropriate program. Other features include the *Azimuthal Magnetic Data* program (see figure A.4) which calculate and plot an azimuthal spectra for specified time and location (see figure A.6), and the *Azimuthal Magnetic Data* and *Longitudinal Magnetic Data* programs which calculates  $k_{||}$  spectra.



PWR032A.DAT

PWR033.DAT

PWR034.DAT

PWR035.DAT

PWR036.DAT

PWR037.DAT

PWR038.DAT

PWR038A.DAT

PWR038B.DAT

PWR039.DAT

10000

Time of average (usec)

200

Average over (usec)

Plot

Quit

Power Plotter

PWR033.DAT

Magnetic Field

70 amps

896.000 gauss

Gas Pressure

5.0 mTorr

0.666667 Pa

Antenna : Two Phased Double Loops

Gas : Argon

No of Pos : 10

Start Pos : 0cm

Step Dis : 0cm

Antenna Number 1

Pwr(for) 0.239825 Kw

Pwr(ref) 0.00246898 Kw

Pwr(tot) 0.237356 Kw

Ant current 22.8749 Amps

Ant phase -73.1663 Deg

Loading 0.453604 ohms

Antenna Number 2

Pwr(for) 0.213218 Kw

Pwr(ref) 0.00167936 Kw

Pwr(tot) 0.211539 Kw

Ant current 21.3570 Amps

Ant phase -37.9918 Deg

Loading 0.463786 ohms

Phase Difference -35.1745 Deg

Figure A.5: Power, antenna current and radiation resistance data viewer.

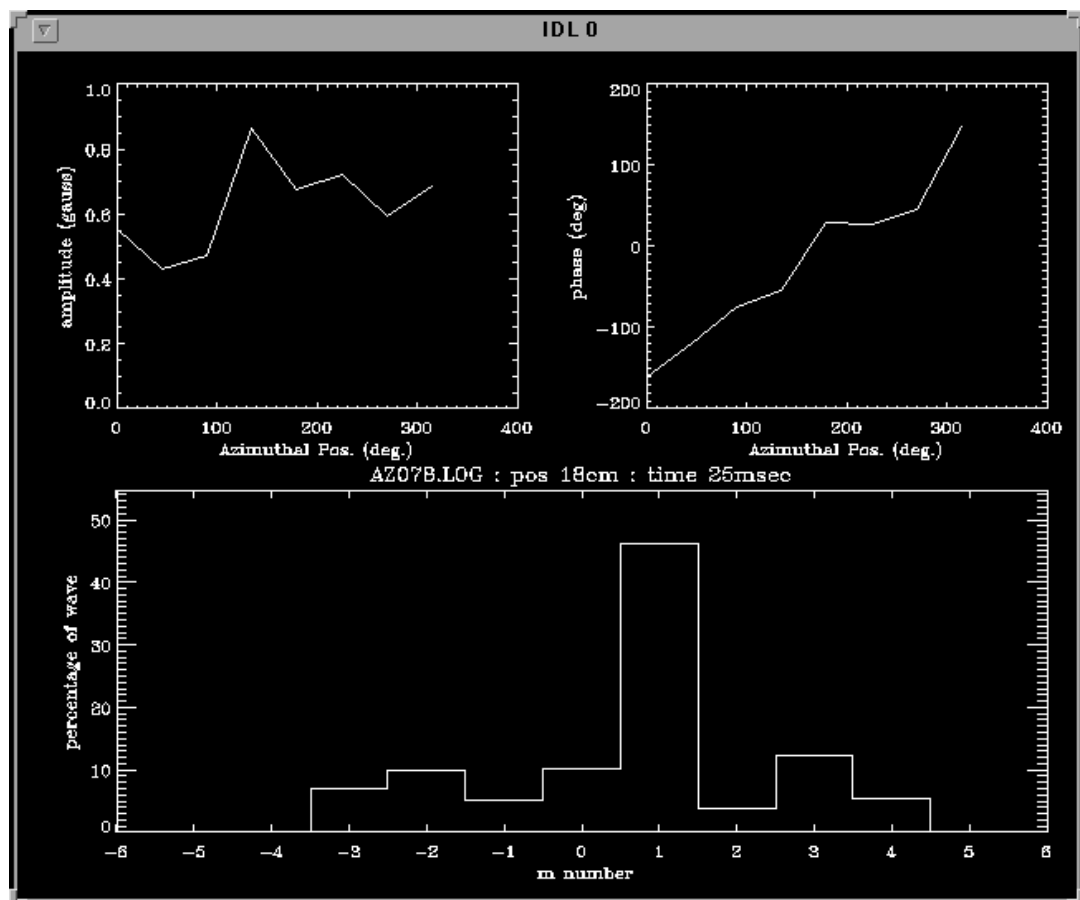


Figure A.6: Output from the azimuthal spectra program.