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Topography Experiment (TOPEX) Software Document Series

Volume 3

WFF TOPEX Software Documentation Altimeter Instrument File (AIF) Processing

October 1998

Jeffrey Lee, Dennis Lockwood

TOPEX Contact:
David W. Hancock III

July 2003

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July 2003

About the Series

The TOPEX Radar Altimeter Technical Memorandum Series is a collection of performance assessment documents produced by the NASA Goddard Space Flight Center Wallops Flight Facility over a period starting before the TOPEX launch in 1992 and continuing over greater than the 10 year TOPEX lifetime. Because of the mission's success over this long period and because the data are being used internationally to redefine many aspects of ocean knowledge, it is important to make a permanent record of the TOPEX radar altimeter performance assessments which were originally provided to the TOPEX project in a series of internal reports over the life of the mission. The original reports are being printed in this series without change in order to make the information more publicly available as the original investigators become less available to explain the altimeter operation and details of the various data anomalies that have been resolved.

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Foreword

This document is a compendium of the WFF TOPEX Software Development Team's knowledge regarding Altimeter Instrument File (AIF) Processing. It includes many elements of a Requirements Document, a Software Specification Document, a Software Design Document, and a User's Manual. In the more technical sections, this document assumes the reader is familiar with TOPEX and Instrument files.

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- Larry Rossi (NASA GSFC/WFF)
  TOPEX Altimeter Manager
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Section 1
Introduction

1.1 Purpose

This document provides a detailed description of TOPEX Altimeter Instrument File (AIF) Processing at NASA Goddard Space Flight Center's Wallops Flight Facility (WFF). AIF Processing is work-in-progress and this document will be updated to reflect changes in the documented software or procedures.

1.2 Scope

This document is Volume 3 in a series of publications generated by the TOPEX Software Development Team (SWDT) at WFF. Volume 1 is an overview of the project and its processes. Volume 2 documents pre-launch Radar Altimeter System Evaluator (RASE) processing. Volumes 4 and 5 document Sensor Data Record (SDR) and Geophysical Data Record (GDR) processing, respectively. Volume 6 covers Special Processing which does not fall into any of the other categories. The series is an attempt to document SWDT software and procedures used in support of TOPEX at WFF.

1.3 Organization of Document

Section 2 lists other documents related to this document. Section 3 describes Altimeter Instrument Files. Sections 4, 5 and 6 document Daily, Weekly, and Special Processing, respectively. Section 7 details the components of AIF processing. Appendix A contains samples of AIF Standard Products. Appendix B lists programs and software used and developed. Appendix C describes the contents of AIF output files and databases. Appendix D has plots of reference values used in AIF Processing. Appendix E is the change history of AIF processing software. Appendix F contains significant documents and memos related to AIF Processing.

Section 2

Related Documentation

- *TOPEX/POSEIDON Joint Verification Plan*, June 15, 1992, JPL92-9.
- *TOPEX Mission Radar Altimeter Engineering Support Plan*, May 1992, NASA GSFC WFF.
- *TOPEX Project Radar Altimeter Development Requirements and Specifications*, August 1988, NASA GSFC WFF 672-85-004.
- *TOPEX Ground System Algorithm Specification Document*, September 1990, JPL D-7075 (Rev. A), TOPEX 633-708.
- *TOPEX Ground System Software Interface Specification (SIS-2) Instrument File*, October 8, 1991, JPL D-7925 (Rev. A), TOPEX 633-731-23-007, Rev. A.
- *Interface Control Document between the TOPEX Ground System and the Goddard Space Flight Center/Wallops Flight Facility Oceans Laboratory,* (Rev. 2.0), July 1990, TOPEX 633-712J.
- *Wallops Flight Facility TOPEX Project Software Products Specification for Engineering Assessment Software,* January 1991.
- Applied Physics Laboratory, *TOPEX Radar Altimeter System Specification*, APL Document 7301-9028.
- Hancock, D. W., III, 1989, *Studies in Support of The NASA Ocean Topography Experiment (Report 1),* NASA TM-100766.
- Zieger, Alfred R., David W. Hancock, III, George S. Hayne, and Craig L. Purdy, June 1991, *NASA Radar Altimeter for The TOPEX/POSEIDON Project,* Proceedings of The IEEE, Vol. 79, No. 6, pp. 810-826.
- Marth, P. C., J. R. Jensen, C.C.Kilgus, J. A. Perschy, and J. L. MacArthur of The Johns Hopkins University Applied Physics Laboratory; D. W. Hancock, III, G. S. Hayne, C. L. Purdy, and L. C. Rossi of NASA GSFC WFF; and C.J. Koblinsky of NASA GSFC, *Pre-Launch Performance of the NASA TOPEX/POSEIDON Altimeter,* IEEE Transactions on Geoscience and Remote Sensing, 31(2), pp. 315-332, 1993.
- Hancock, D. W., III, R. L. Brooks and H. A. Goldberg, June 1992, *Performance Parameters for The TOPEX Radar Altimeter from Bench Testing through Spacecraft Thermal Vacuum Testing,* NASA GSFC WFF.

Selected documents and memos are also included in Appendix F-Attachments for completeness.

Section 3

Altimeter Instrument Files

3.1 Definition

Altimeter Instrument Files (AIFs) are created daily by the TOPEX Ground System (TGS) at the Jet Propulsion Laboratory (JPL). These files provide WFF with the most immediate look at the health and status of the TOPEX altimeter. The flow of altimeter data is depicted in Figure 3-1 "TOPEX ALT Dataflow (AIF Emphasized)", where emphasis is placed on the AIF data flow.

The TOPEX Ground System extracts altimeter science and engineering minor frames from the spacecraft telemetry. Common frames are merged and time-sorted to create AIFs. AIFs are created in eight-hour segments usually corresponding to a play-back period. WFF users may request that segments of less than eight hours be created and made available on a special by-request basis.

At the end of a UTC day, the three eight-hour segments are merged into one twenty-four hour file and placed in a shared storage area on TGSC. For a complete description of the AIF formats, see JPL D-7925 TOPEX Ground System Software Interface Specification (SIS-2) Instrument File.

3.2 Distribution

Altimeter Instrument Files are made accessible to WFF via the NASA Science Internet (NSI) using either DECNET or FTP protocols. WFF does not redistribute AIFs.

3.3 Storage

A full set of twenty-four hour AIF science and engineering files consumes approximately 105 megabytes of disk space. A week of instrument files is kept in the working area at WFF. Instrument files over a week old are rolled off onto 2.2GB Exabyte tape for archive. Every AIF generated has been archived and is available for use at WFF.

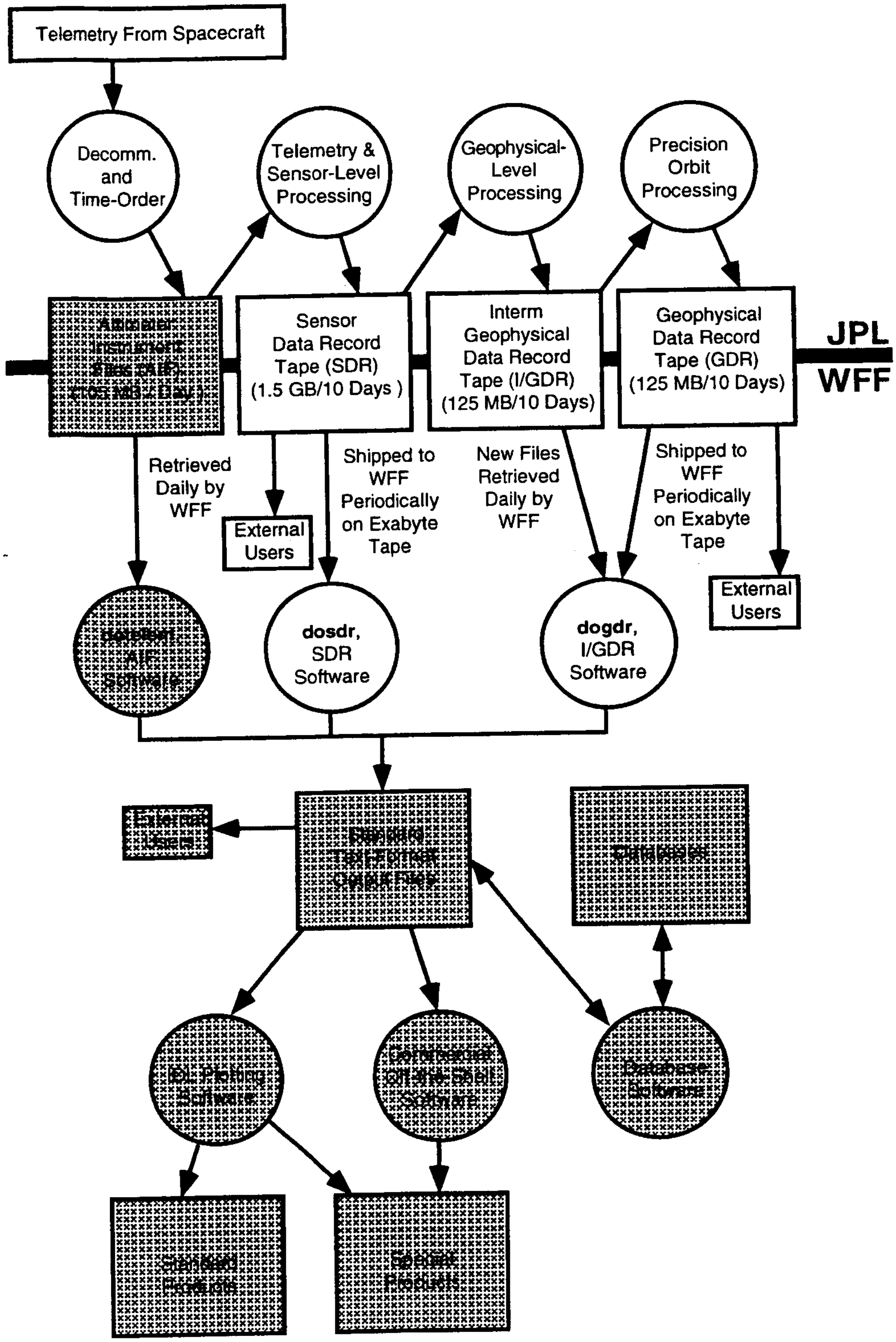


Figure 3-1 TOPEX ALT Dataflow (AIF Emphasized)

Section 4

AIF Daily Processing

AIFs are automatically retrieved from JPL and processed by WFF. The daily processing script, **autoaif**, is executed each day at 0800 UTC by the UNIX crontab facility. The timing is set up such that when WFF personnel arrive to work, all daily processing is complete and the standard products are available for inspection. See Figure 4-1 "TOPEX AIF Daily Processing" for diagram of daily processing. Appendix A contains samples of the daily products produced by **autoaif. autoaif** performs the following functions (in order).

- Runs **ftpjplbin**, which uses FTP to transfer Science, Engineering, and Selected Telemetry Record (STR) AIF files from JPL via NSI/SPAN. If the transfer is not successful, the program will retry the copy 300 times with a 180 second timeout between copies. A log is kept of the processing; upon completion, this log is electronically mailed to the user who invoked the process. See Figure A-1 "AIF Processing Log Produced as Part of Daily Processing".
- Runs **dotelem**, the primary data reduction program. It creates 15-second Science Averages, Event Listings, 5-minute Engineering Averages, and CAL, Engineering, Waveform, and Header database import files.
- Runs **aifhdr**, a UNIX script that runs the IDL program **aifhdr.pro** to read the **dotelem** Event Listing and generate a Processing Summary report. See Figure A-2 "AIF Processing Summary Produced as Part of Daily Processing".
- Runs **aifcal**, a UNIX script that runs the IDL program aifcal.pro to read the **dotelem** database CAL file and create Daily AIF CAL plots. See Figure A-3 "AIF CAL Plot Produced as Part of Daily Processing".
- Runs **dailyeng**, a UNIX script that runs the IDL program **dailyeng.pro** to read the **dotelem** Engineering Averages file and create Daily AIF Engineering plots. See Figure A-4 "AIF Engineering Plot Produced as Part of Daily Processing".
- Runs **aifsci**, a UNIX script that runs the IDL program **aifsci.pro** to read the **dotelem** Science Averages file and create Daily AIF Engineering plots. See Figure A-5 "AIF Science Plots Produced as Part of Daily Processing".
- Runs **dailywf**, a UNIX script that runs the IDL program **wfdiff.pro** to read the **dotelem** database Waveform files and create Daily AIF Waveform Difference plots. See Figure A-6 "AIF Waveforms Difference Plot Produced as Part of Daily Processing".
- Prints the **dotelem** Events Listing. See Figure A-7 "AIF Events Report Produced as Part of Daily Processing".
- Concatenates the **dotelem** database files into the corresponding merged AIF database file in /gen/topex2/dbase.
- Moves the AIF files into /gen/flight/aif, the AIF Storage area.

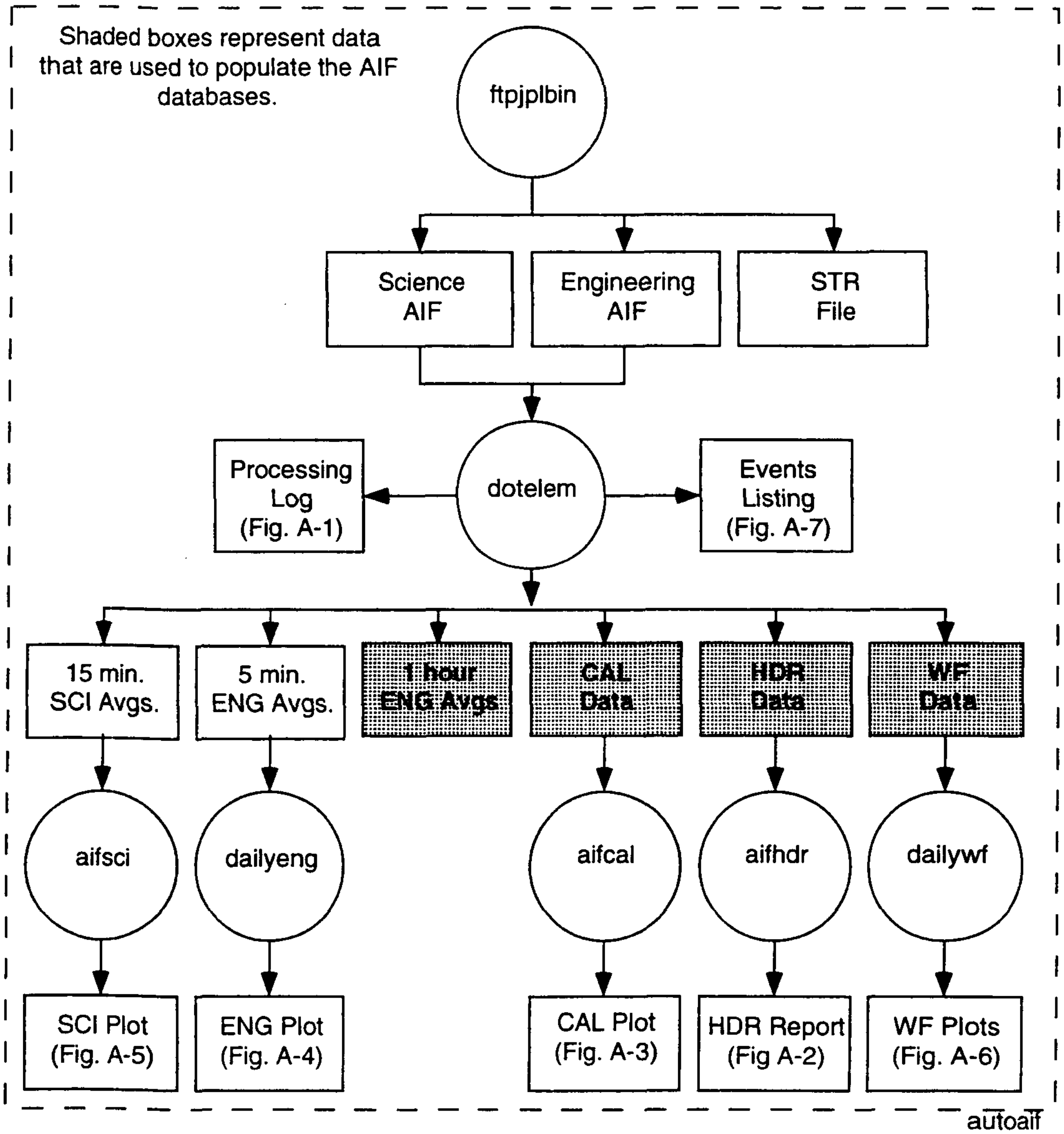


Figure 4-1 TOPEX AIF Daily Processing

Section 5

AIF Weekly Processing

Each week, the merged AIF database files are copied to the TOPEX Macintosh Quadra 900 and imported into the AIF Databases. After this is done, all data in the databases are exported to create Launch-to-Date files. The Launch-to-Date files are copied back to osb3 and the UNIX script **launchtodate** is run. **launchtodat**e runs IDL programs that create the standard Launch-to-Date plots. The diagram for weekly AIF processing is shown in Figure 5-1 "TOPEX AIF Weekly Processing". Appendix A contains samples of the weekly products. **launchtodate** performs the following functions (in order).

- Runs **dbcal**, a UNIX script that runs the IDL program **aifcal.pro** to read the database extraction CAL file and create Launch-to-Date AIF CAL plots. See Appendix A, Figure A-8 "Launch-to-Date CAL Plot Produced as Part of Weekly Processing".
- Runs **dbeng**, a UNIX script that runs the IDL program **aifeng.pro** to read the database extraction Engineering file and create Launch-to-Date AIF Engineering plots. See Appendix A, Figure A-9 "Launch-to-Date ENG Plot Produced as Part of Weekly Processing".
- Runs **dbwf**, a UNIX script that runs the IDL program wfdiff.pro to read the database extraction Waveform files and create Launch-to-Date AIF Waveform Difference plots. See Appendix A, Figure A-10 "Launch-to-Date WF Difference Plot Produced as Part of Weekly Processing.

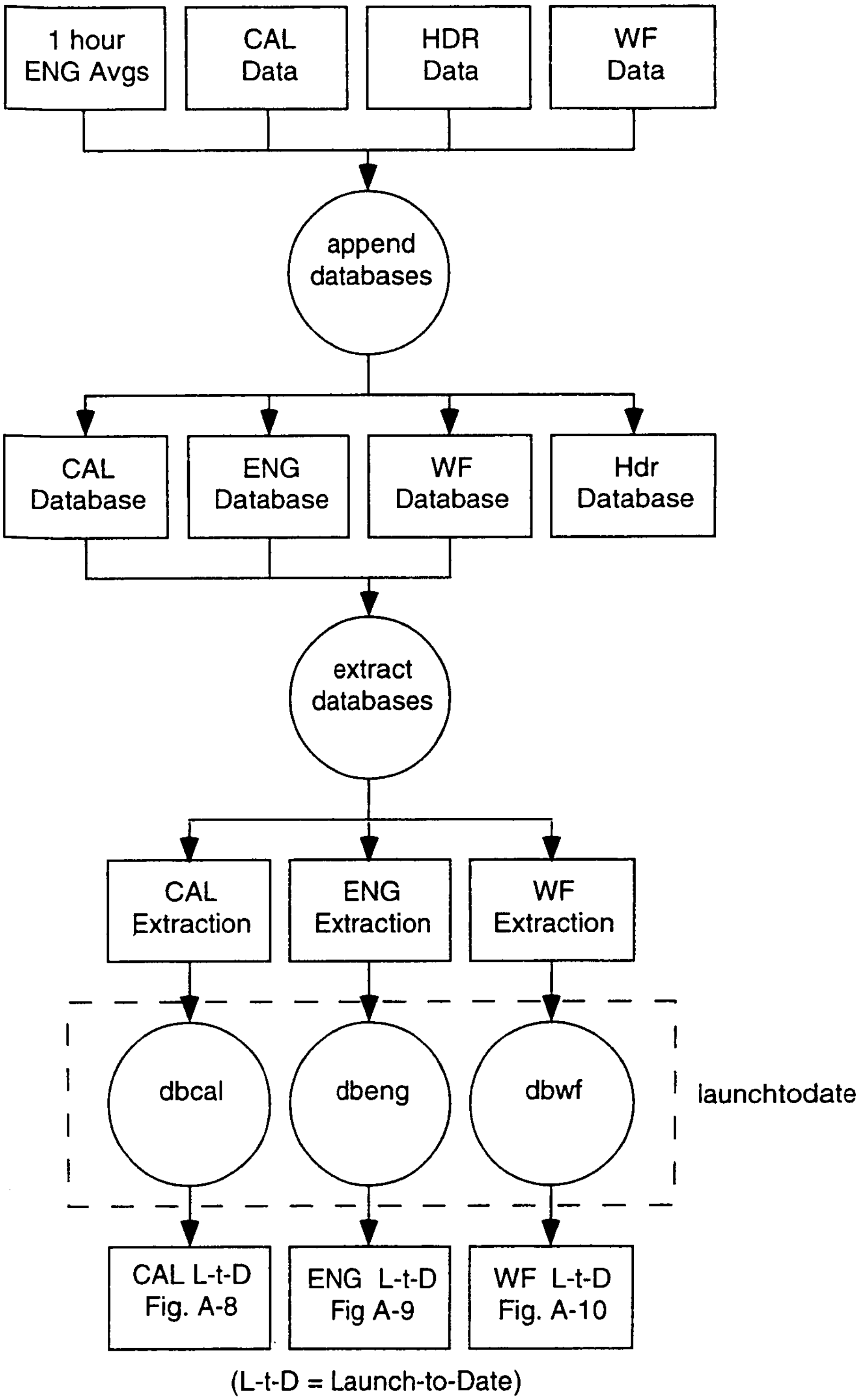


Figure 5-1 TOPEX AIF Weekly Processing

Section 6

AIF Special Processing

Special processing is defined as that processing which is not done on a regular chronological basis. Many **dotelem** products can be used for special processing along with commercial-off-the-shelf (COTS) software. Special processing can also be performed using IDL and Database Software. There are many other forms of special processing performed on TOPEX data; this section explains the general methods by which special processing is performed.

6.1 dotelem Special Processing

In general, AIF Special Processing is performed by using **dotelem** to create one or more special output files. The resulting files are then copied to a user for analysis or one of the TOPEX SWDT members uses custom IDL or COTS software to create the desired product. Any **dotelem** option can be used for special processing, but one of the more common ones is Waveform Averages.

6.2 IDL Special Processing

Another way to perform special processing is to create special IDL plot programs. This has been done on occasion to create special plots for papers and/or presentations. Many of the standard IDL programs can also be run using non-standard arguments to produce plots according to custom specifications.

6.3 Database Special Processing

Custom database programs have been written to perform special processing. Some examples of these include routines to apply experimental temperature corrections, extract corresponding CAL and ENG data, and create other types of special output files.

6.4 Examples of Special Processing

Two examples of special processing include: (1) plotting AIF waveforms using both IDL and WingZ; and (2) plotting engineering data over the last 60 days.

6.4.1 Plotting Waveforms

To plot waveforms, **dotelem** is run to create averages of the data over a user-specified time interval. The resulting waveform average files are processed with topexwf (for fixed scales) or **topexautowf** (for automatic scales). This is the first-level waveform product. A sample waveform average plot is shown in Figure A-11 "Waveform Average Plot Produced as Part of Special Processing".

If a more detailed look is required, the waveform average file can be processed using the **WingZ plot3d** program on a Macintosh. The waveform average file is copied to the Macintosh hard disk and transformed into a WingZ file. The program **unix2wingz** translates the waveform average file into the correct format. **WingZ** is launched and the **plot3d** script opened. The waveform wingz file is opened and the header row and columns B through M of the spreadsheet deleted. Finally, the plot3d script is run. The rest of the processing is interactive using the controls shown in Figure 6-1 "WingZ plot3d Interface".

6.4.2 Plotting Last 60 Days of ENG Data

To plot the last 60 days of engineering parameters, data must be extracted from the AIF Engineering Database. The user would run the database program and extract engineering data, selecting the range of dates he wishes to extract. See Figure 6-2 "Database Extraction Screen" for a picture of the data extraction screen. Once the data are extracted, the database extraction file is copied to the Sun, and the IDL **aifeng** program is run to create the desired plots.

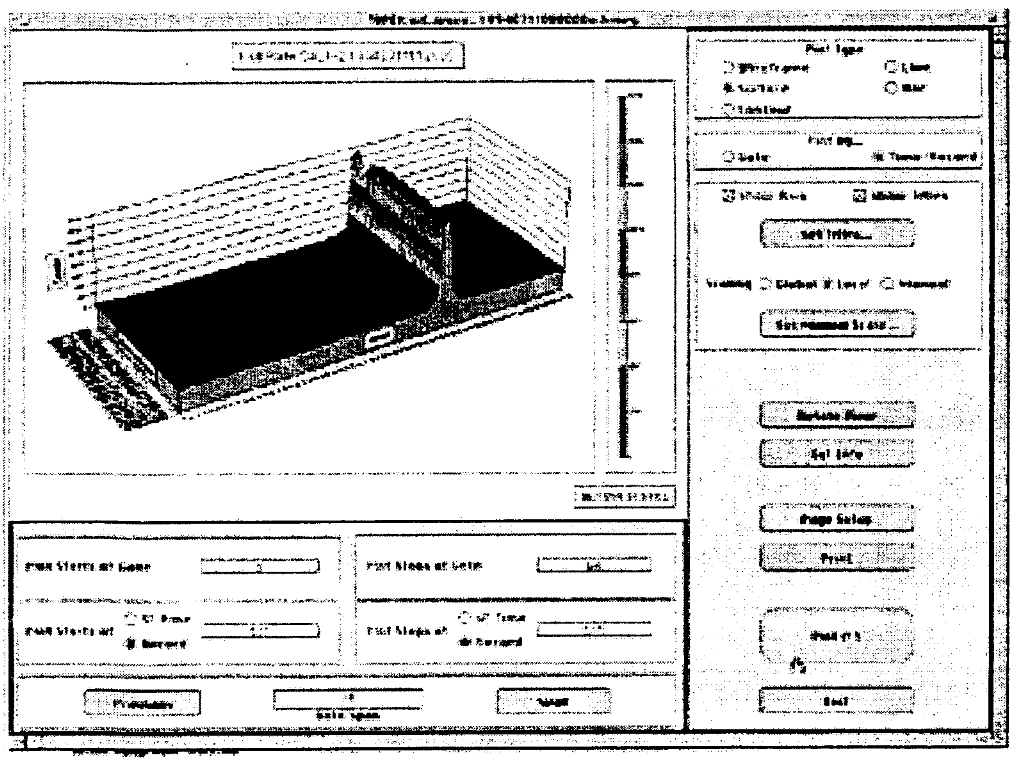


Figure 6-1 WingZ plot3d Interface

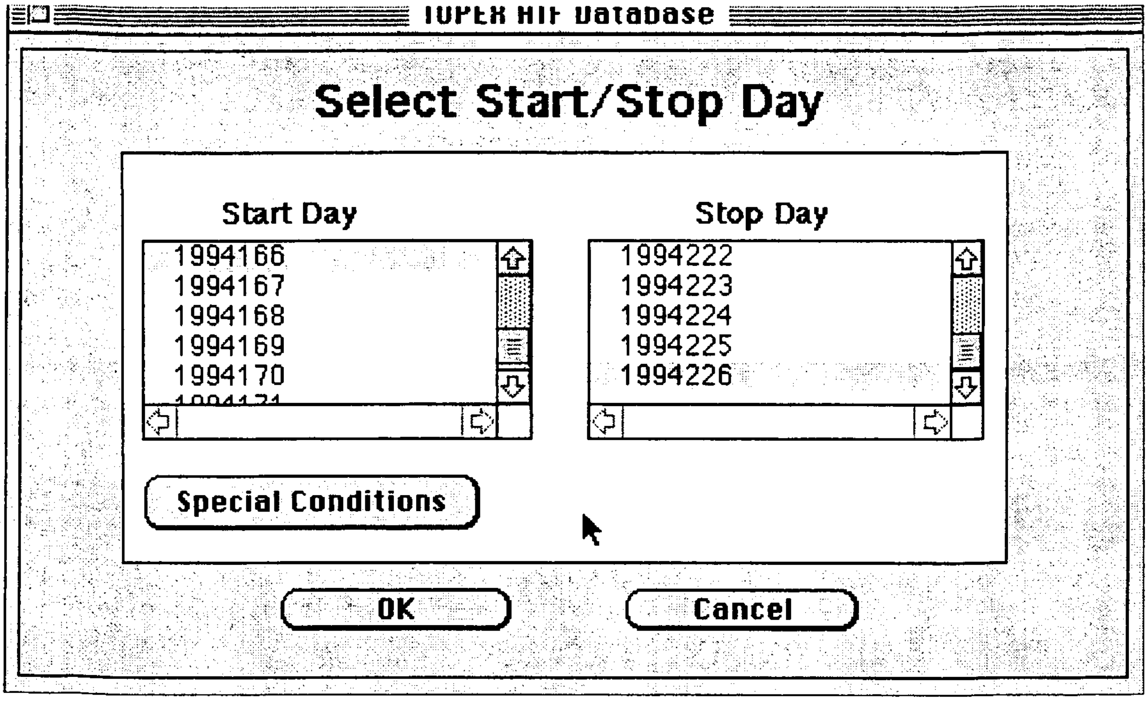


Figure 6-2 Database Extraction Screen

Section 7
Components of AIF Processing

Figure 7-1 depicts the flow of AIF data during processing. There are four major components of AIF processing software: **dotelem**, the FORTRAN which performs initial data processing; AIF databases, which handle data storage, retrieval, and secondary processing; IDL programs, which handle most of the plotting duties; and UNIX scripts, which automate much of the processing. These components comprise a system that is sufficiently automated to handle standard processing tasks and yet flexible enough to assist in highly-detailed engineering assessment investigations.

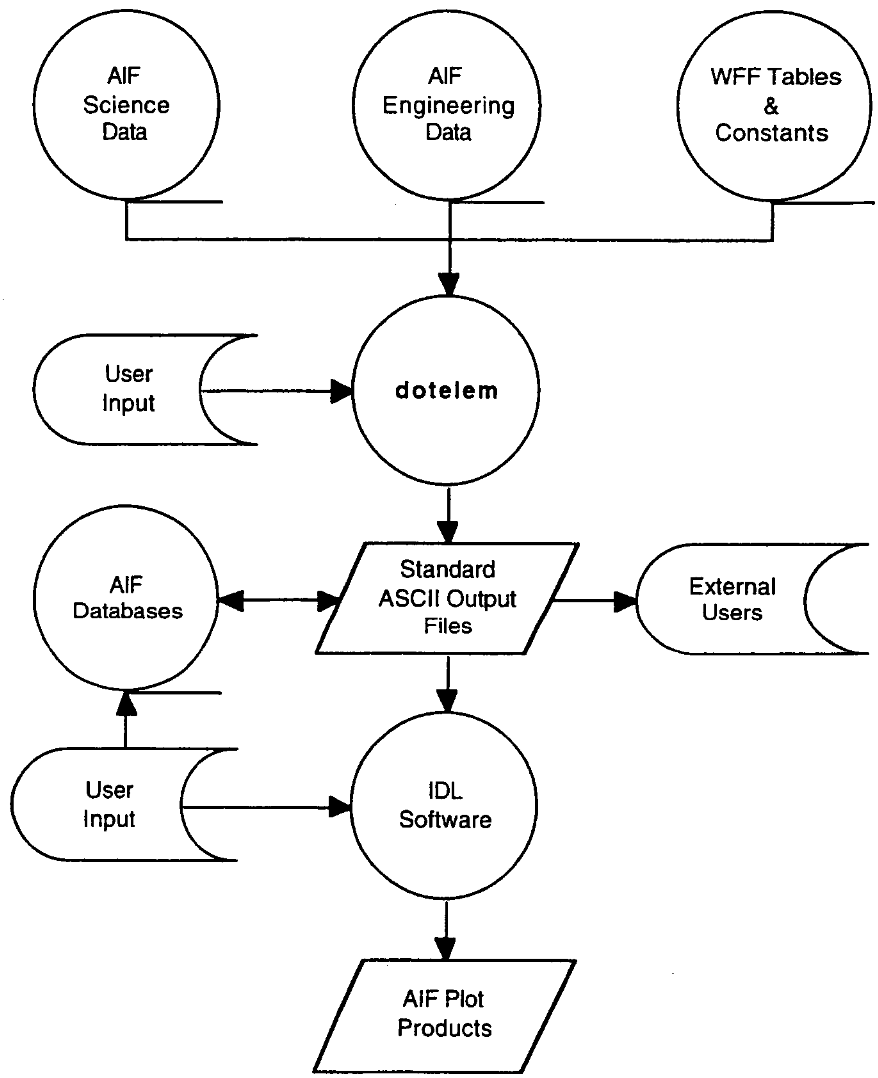


Figure 7-1 AIF Processing Dataflow

7.1 dotelem

dotelem is the FORTRAN program responsible for all AIF data processing. It is highly interactive, allowing the user to choose what process to run and to specify customized parameters for the chosen process. .Figure 7-2 "dotelem Startup Screen"

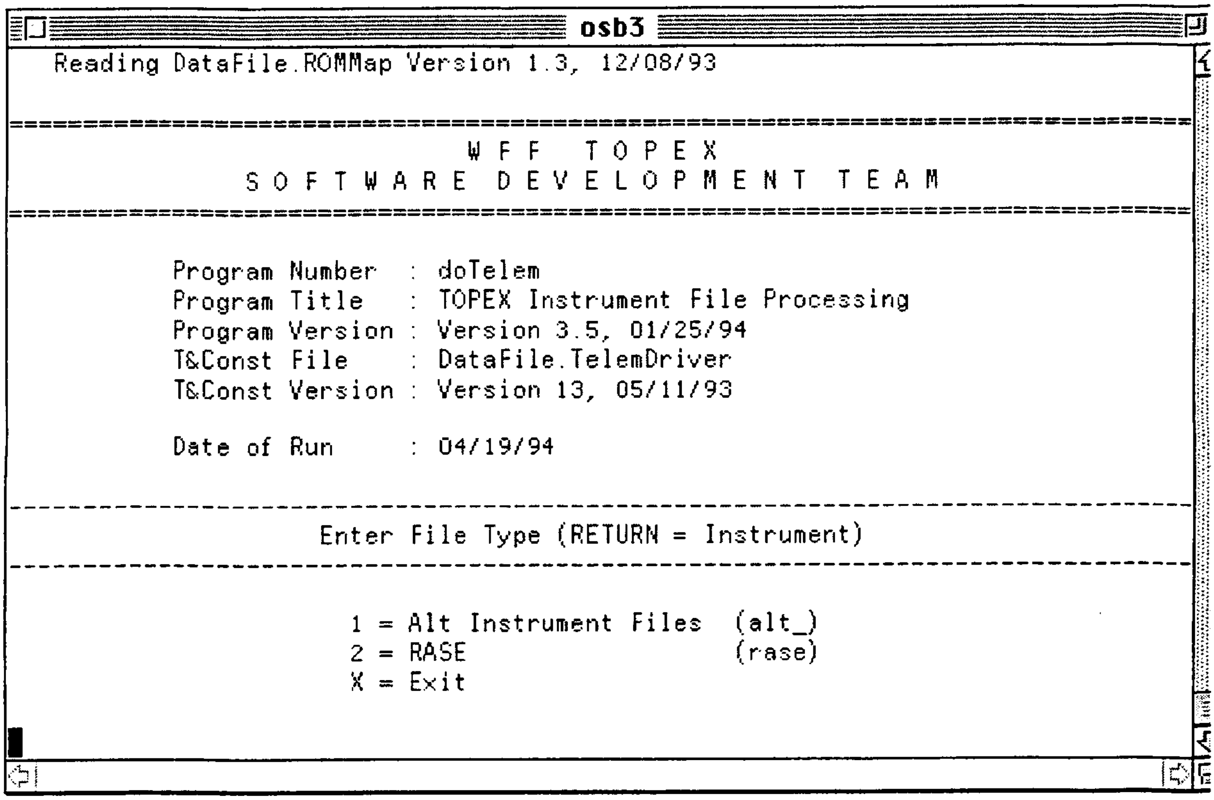


Figure 7-2 dotelem Startup Screen

depicts the **dotelem** startup screen. **dotelem** has three main components: the Initialization Module, the User Input Module, and the Data Processing Loop. Figure 7-3 "dotelem Main Processing" on page 7-3 diagrams the highest-level **dotelem** processing.

The software currently runs on **osb3**, a Sun Microsystems SparcStation 10 UNIX workstation. However, since **dotelem** was originally coded on the Apple Macintosh platform, and then ported to the Sun environment, the code has been designed to be highly portable.

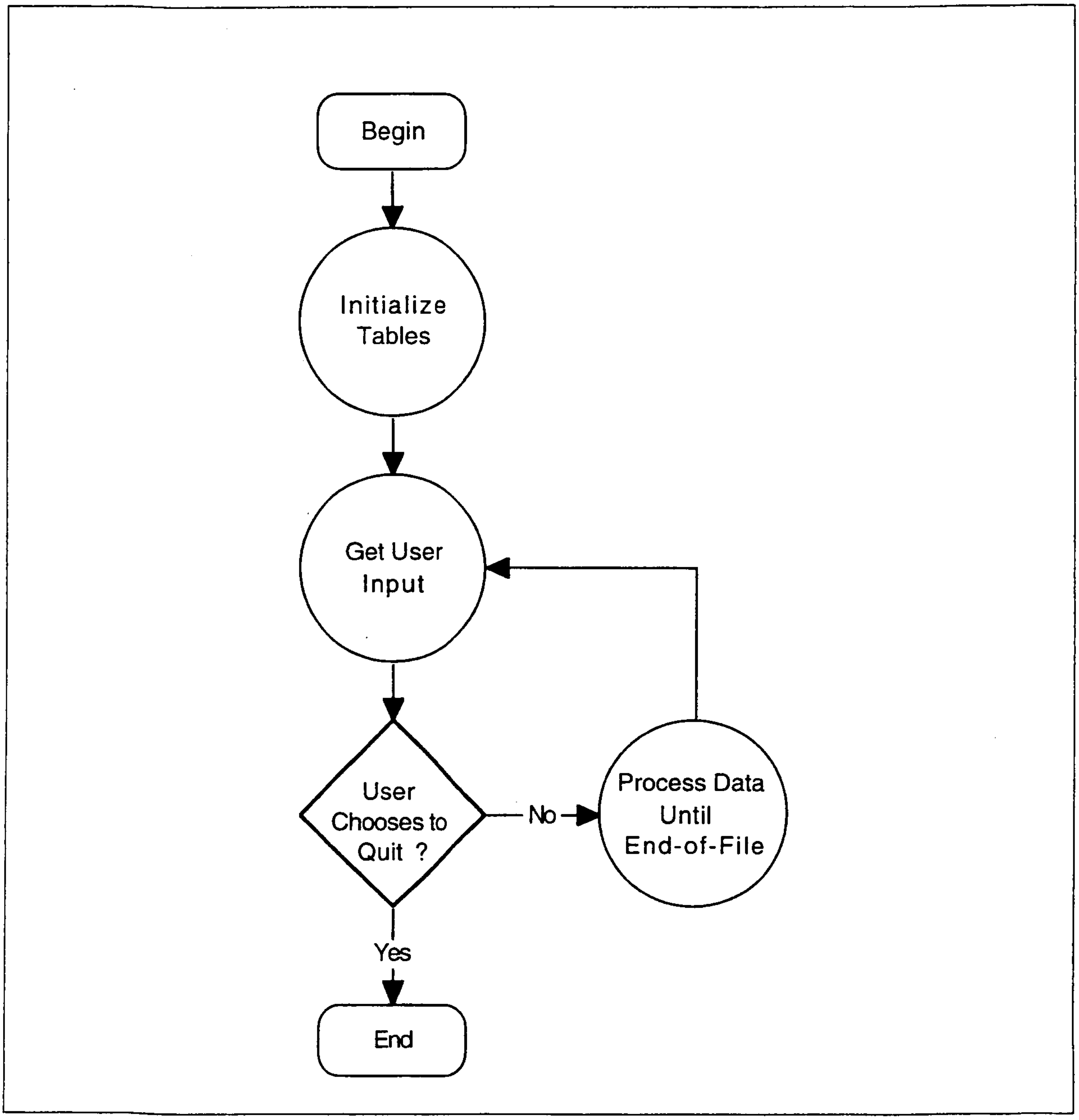


Figure 7-3 dotelem Main Processing

7.1.1 dotelem Initialization Module

Upon startup, **dotelem** initializes several data structures needed to decode and process data. There are basically three types of data structures used: byte maps, constants tables, and look-up tables. Byte maps are used for easily referencing which bytes in the raw telemetry data correspond to which converted engineering units. Constants tables contain constants used by various processing routines and are initialized by reading values from appropriate external files. Lookup tables are used for such things as integer to mnemonic conversion, memory maps, and labeling. Table 7-1 lists the data structures initialized by **dotelem**.

Table 7-1 Data Structures Initialized by dotelem

Structure	Description
TelemEngDef	Byte map of data contained in the AIF engineering record.
TelemSciDef	Byte map of data contained in the AIF science record.
TelemConstDef	Constants table used by telemetry processing.; Read from DataFile. TelemDriver.
SensorConstDef	Constants table for SDR creation. Read from DataFile.SensorDriver.
CMDTableDef	ASCII codes for converting integer commands to mnemonics. Read from DataFile.CMD.
EngLabel	Table of labels for identifying engineering parameters.
EALimitsDef	Constants table for Engineering Assessment. Contains reference values for CAL and Waveform data, as well as other engineering assessment constants. Read from DataFile.EALimits.
ROMMapDef	Table of reference addresses and 32-bit hex dumps for determining that altimeter ROM has not been corrupted. Read from DataFile. ROMMap.

7.1.2 dotelem User Input

. **dotelem** is designed to be highly interactive and offer the user a variety of processing options. The user must enter the UTC time of the file to process and must select a processing method; the processing selection screen is shown in Figure 7-4 "dotelem Primary User Input Screen" on page 7-5. The user may optionally set custom parameters such as averaging time, mode selection, and parameters to report. Defaults are provided in all cases. Table 7-2 "dotelem Processing Options" on page 7-5 lists processing types, options, and defaults. Time selection is available as an option for all processes.

7.1.3 dotelem Processing Loop

After a user has chosen what process(es) to run and what options to use, **dotelem** runs in a processing loop until either all data have been read from both science and

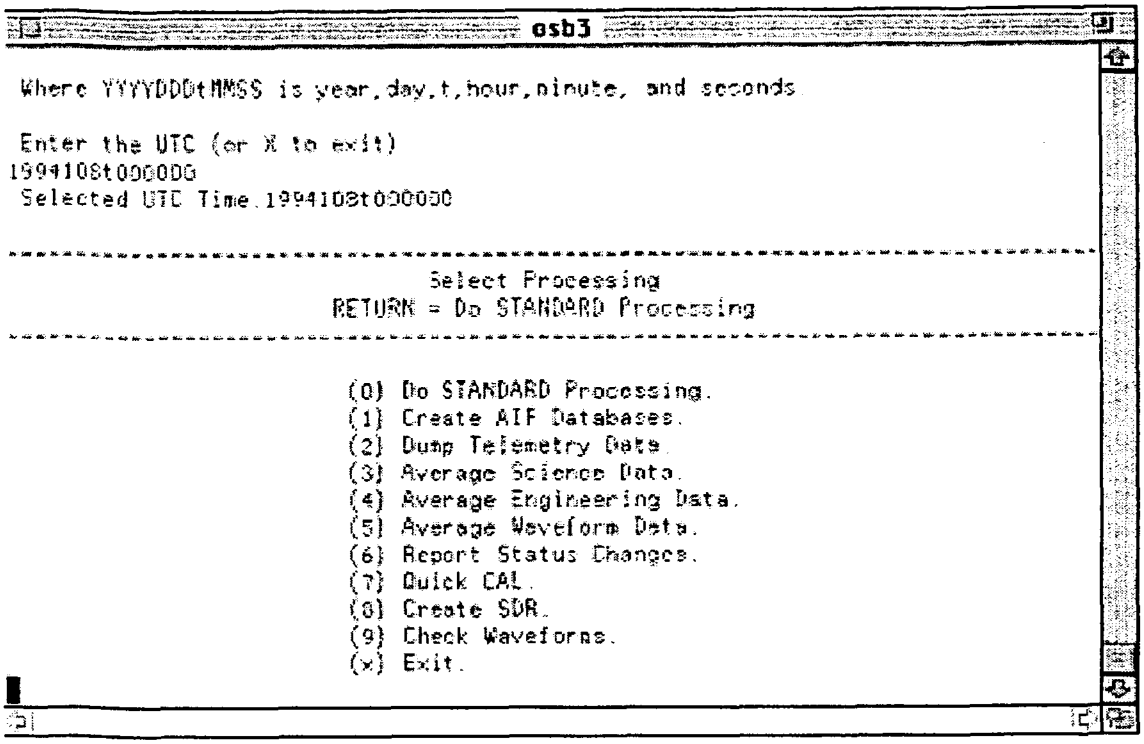


Figure 7-4 dotelem Primary User Input Screen

Table 7-2 dotelem Processing Options

Parameter	Options	Defaults
STANDARD Processing (default process)	None	Create AIF Datgabases 15 sec Science3 Avgs. 5 min Engineering Avgs.
Create AIF Databases	None	1 Hour Engineering Avgs. CAL Mode Processing Check Waveforms Check Commands Check Science Check Engineereing
Dump Telemetry Data	Dump What Data Dump Full Rate Time Selection	Science and Engineering No Process All Data
Average Science Data	Seconds to Average What Modes Time Selection	60 Seconds Track Modes Process All Data
Average Engineering Data	Seconds to Average What Modes Time Selection	60 Seconds Track Modes Process All Data

Table 7-2 dotelem Processing Options (Continued)

Parameter	Options	Defaults
Average Waveform Data	Seconds to Average What Modes Time Seletion	60 Seconds Track Modes Process All Data
Report Status Changes	Check What Data Check What Params Time Selection	S cience and Engineering All Parameters Process All Data
QuickCAL	None	None
Create SDR	Debug Algorithms	No
Check Waveforms	None	None

engineering files, or a time is detected that is later than a user-specified stop time. **dotelem** branches off the main loop to run those processes the user has specified.

7.1.4 dotelem Time Synchronization

Since AIF science and engineering data are sampled at different rates, the data must be time-synchronized during processing. The synchronization must take into account such factors as the lack of science data during the IDLE mode, data dropouts, and corrupted records. Thus, it is important to validate the data used for time synchronization so that a non-valid record has as little an impact as possible on the synchronization routines.

When processing is started, time synchronization is initialized by reading the first valid engineering and science frames. The engineering time is stored in both EngTime and NextEngTime, and the science time is stored in SciTime. The record pointer is then reset to the beginning of each file.

SciTime, the time of the current science record, is compared to NextEngTime, the time of the next engineering record, to see if a new science record should be read. If there are more science data and SciTime is less than or equal to the NextEngTime, or there are no more engineering data, then a new valid science record is read. The time of the newly-read science record is stored into SciTime.

NextEngTime is then compared with SciTime. If there are more engineering data, and NextEngTime is less than or equal to SciTime, or there are no more science data, then a new valid engineering record is read. The time of the newly read engineering record is stored into EngTime. The next valid engineering record is read and the pointer reset to the previous valid engineering record. The time of the next valid engineering record is stored into NextEngTime.

The synchronization process is robust and does correctly synchronize science and engineering data. The key to the success of synchronization is the careful validation process through which newly-read AIF records must pass. Figure 7-5 "AIF Time Synchronization" details the AIF Time Synchronization Process.

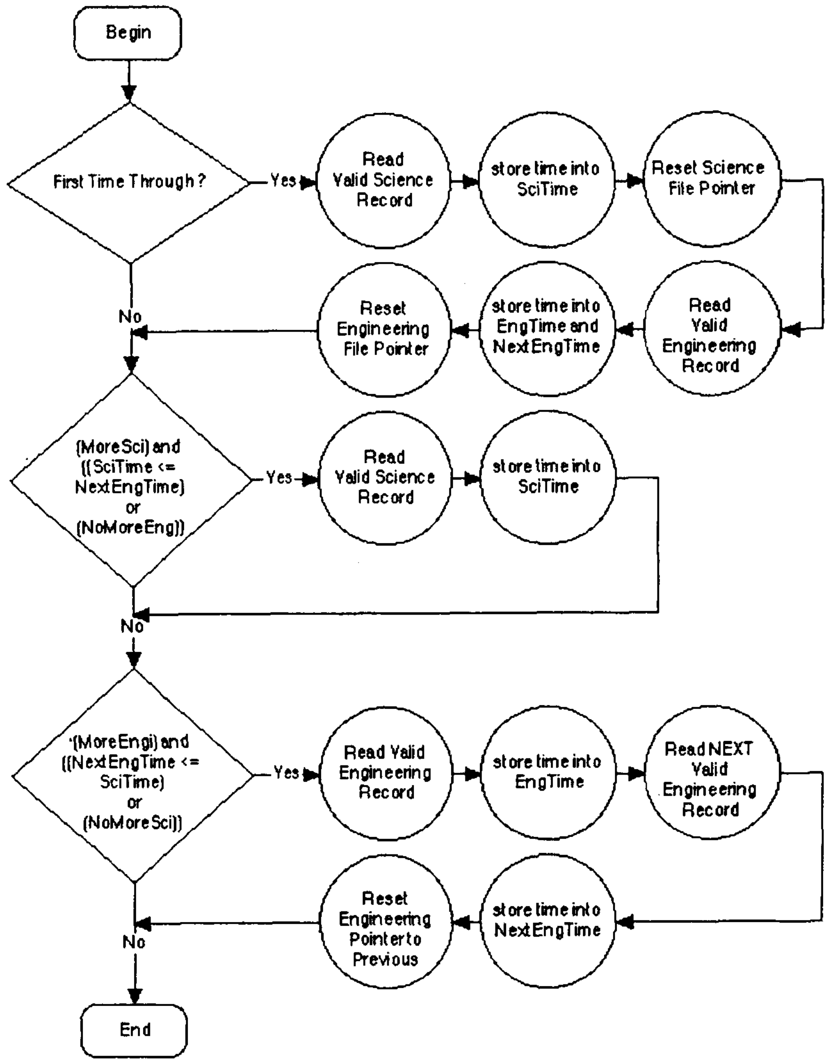


Figure 7-5 AIF Time Synchronization

7.1.5 dotelem Record Validation

AIF Science and Engineering data must be time-synchronized; it is critical that records are carefully checked during the data-input process. Since AIF data are assumed to be time-ordered, a corrupt time may cause the synchronization process to delete a great deal of valid data in the attempt to synchronize with an invalid time. **dotelem** performs extensive checking to ensure the validity of AIF records. There are three levels of error-checking performed. If the record passes all three levels, it is assumed to contain valid data.

The first level of error-checking uses the appropriate T4108 Preliminary Flags algorithm to check the Science or Engineering Frame Checksum. T4108 sets FlgEC4108 if it detects a bad checksum in the engineering record and sets FlgSC4108 if it detects a bad checksum in the science record. T4108 also sets FlgER4108 if it detects a reset. If any of these flags are set, the appropriate record is considered non-valid and is deleted.

The second level of error-checking examines the contents of the AIF record header. The important fields in the header are the Continuity Map and Data Quality Map. The Continuity Map field verifies the presence of each major and minor frame necessary to complete the record. The Data Quality Map field verifies the checksum of each major and minor frame necessary to complete the record. If any Continuity or Data Quality flags are set, the record is considered non-valid and is deleted.

The third and final level of error-checking tests the science or engineering Sync Byte. This step was necessary because a record containing all zeros would checksum correctly, but would not be valid for use in processing. If the Sync Byte does not match the appropriate science or engineering reference value, the record is considered non-valid and is discarded.

If an AIF record passes all tests, it is considered valid for use in time synchronization and further processing. The AIF Record Validation process is time-tested and has been proven to prevent non-valid data from being used during further processing. Furthermore, it has also been proven to delete only non-valid records. Figure 7-6 provides a diagram of how this process works.

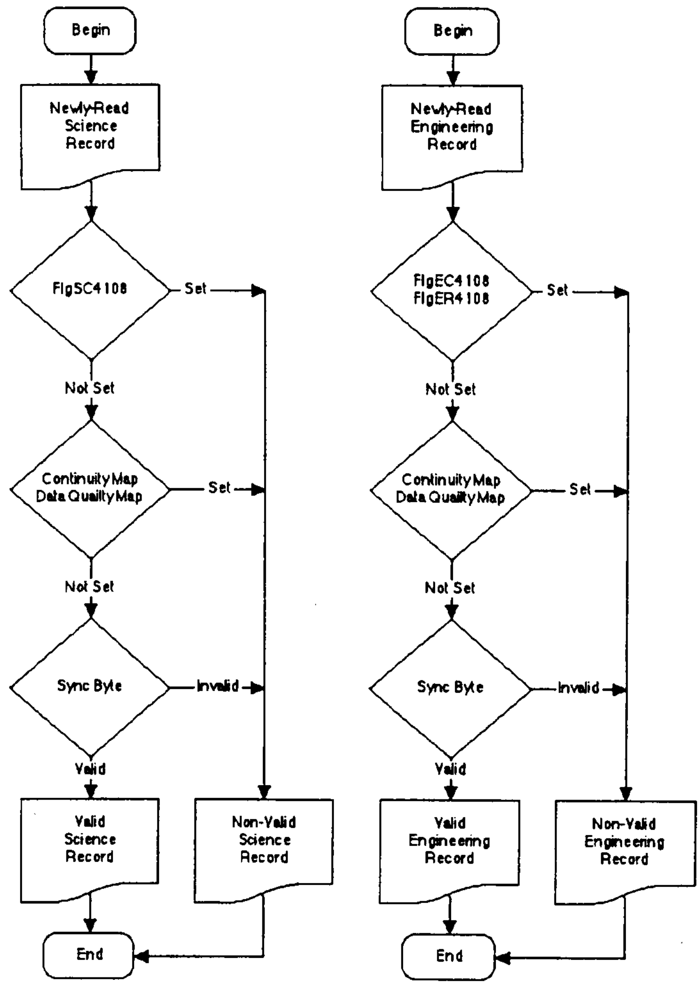


Figure 7-6 AIF Record Validation

7.1.6 dotelem Science Unit Conversion

AIF Science data must be converted from raw telemetry data into engineering units to be used during processing. The process that performs this conversion is **scieuconv**. Algorithm T3117 Science Data EU Conversion is used for most of the conversion.. However, some additional parameters need to be decoded for further AIF processing; Table 7-3 "Other Converted AIF Science Parameters" on page 7-11 lists the parameters that are needed, but not decoded by T3117.

7.1.7 dotelem Engineering Unit Conversion

AIF Engineering data must be converted from raw telemetry data into engineering units to be used during processing. The process that performs this conversion is **engeuconv**. Algorithm T3107 Engineering Data EU Conversion is used for most of the conversion. However, some parameters not included in T3107 need to be decoded for further AIF processing. Figure 7-4 "dotelem Primary User Input Screen" on page 7-5 lists the parameters that are needed, but not decoded by T3107.

7.1.8 dotelem Standard Processing

Standard Processing is the default process for **dotelem**. Standard Processing calls several of the other processing modules with specific parameters. Table 7-5 "Standard Processing Modules & Parameters" on page 7-12 lists the modules called and corresponding parameters supplied. See Appendix C for output file formats.

Table 7-3 Other Converted AIF Science Parameters

Parameter	Description
Last_ICA_Command Last_ATA_Command	Converted into appropriate text mnemonic by table lookup using Dta-File.CMD. Other parameters converted include command type, status, and command count (if appropriate).
Sync_Mode_Byte	Converted into integer representation.
Calib_Atten_Ku Calib_Atten_C	Converted into Ku and C band integer representations. Further decoded into Cal Mode Step.
Limit_Byte	Converted into integer representation.
Current_Mode	Converted into integer representation.
Mode_Change	
Test_Mode	Converted into integer representation.
Operation_Mode_Byte	Converted into integer representation.

Table 7-4 Other Converted AIF Science Parameters

Parameter	Description
Last_ICA_Command Last_ATA_Command	Converted into appropriate text mnemonic by table lookup using Dta-File.CMD. Other parameters converted include command type, status, and command count (if appropriate).
Sync_Mode_Byte	Converted into integer representation.
Calib_Atten_Ku Calib_Atten_C	Converted into Ku and C band integer representations. Further decoded into Cal Mode Step.
Limit_Byte	Converted into integer representation.
Current_Mode	Converted into integer representation.
Mode_Change	
Test_Mode	Converted into integer representation.
Operation_Mode_Byte	Converted into integer representation.

Table 7-5 Standard Processing Modules & Parameters

Module	Parameters
Average Science	15 Second Averages, Track Modes Only
Average Engineering	5 Minute Averages, All Modes
Average Engineering	1 Hour Averages, All Modes
Average Cal1 Waveforms	Average by step, Cal1 Mode Only
Check Status	Check Science & Engineering, Check Standard Parameters
QuickCAL	- no options available-
Check Waveforms	- no options available-

7.1.9 dotelem Create AIF Databases

Create AIF Databases calls several of the other processing modules with specific parameters. Table 7-6 lists the modules called and corresponding parameters supplied. See Appendix C for output file contents and formats.

Table 7-6 Create AIF Databases Modules & Parameters

Module	Parameters
Average Engineering	1 Hour Averages, All Modes
Check Status	Check Science & Engineering, Check Standard Parameters
QuickCAL	- no options available-
Check Waveforms	- no options available-

7.1.10 dotelem Dump Telemetry

The telemetry dumping routine, **dumptelem**, simply dumps all decoded parameters in each science and/or engineering record to output files. The user may specify if all data are to be dumped or just the first entry of each parameter array. See Appendix C for output file contents and formats.

7.1.11 dotelem: Average Science Data

The science data averaging routine, **sciavg**, runs on a record-to-record basis and performs two similar but distinct functions: the creation of science averages files and the creation of daily science plot files. The basic algorithm is the same for both processes, but the creation of daily science plot files requires special handling to insure that land data are not used during computations. Processing the AIF science data are complicated by the lack of latitude/longitude and land/water flags. This deficiency reduces the usefulness of AIF science data and eliminates the requirement for WFF to keep AIF science databases.

The **sciavg** processing begins with checking the mode of the current science record. The worse mode of the two modes is assigned to the variable **WorseMode**. This variable is checked against the modes that the user has selected for processing. If **Worse-Mode** is not one of the user-selected modes, the record is marked as bad by setting the variable **GoodRec** to FALSE.

A special-case routine for checking the modes of the current science record against previous modes is performed for the creation of daily science plot files. The purpose of this routine is to use only the best data in the averaging interval. This is done by comparing the better mode of the current record with the best mode yet seen in the interval. If the better mode of the current record is worse than the best mode yet seen, then the record is marked as bad by setting the variable **GoodRec** to FALSE. If the better mode of the current record is better than the best mode yet seen, the statistics for the interval are cleared and processing continues. Figure 7-7 "AIF Mode Comparison" shows the order by which modes are compared.

Best ——————————→ Worst

FTRK	FACQ	CTRK	CACQ	CAL1	CAL2	STBY

Figure 7-7 AIF Mode Comparison

If a record is not a **GoodRec**, and there are no data in the current averaging interval, the module returns. Otherwise, elapsed time is checked to see if it exceeds the user-specified averaging interval. If so, the **WriteData** flag is set. Other conditions which would set the **WriteData** flag include a CAL step change, an End-of-File condition, or a difference between the worst mode of the averaging interval and the worst mode of the current record.

If the **WriteData** flag has been set, averages are computed for the current interval. RMS statistics are also computed using the Hayne method (see memo in Appendix F) of scaling the RMS of the height differences to compute Ku and C-band RMS. The **UseFlag** parameter is set to false if any of the following conditions are true:

- If the worst mode of the interval is not FTRK.
- the number of records used in the interval is less that one-half the total number of records in the averaging interval.
- the number of T1016 Data Quality Flags (**FlgAGC1016Ku** and **FlgAGC1016C** and **FlgSWH1016Ku** and **FlgSWH1016C** and **FlgHgt1016C** and **FlgHgt1016Ku** and **FlgHgtRate1016**) is greater than zero.
- the number of T5110 Waveform Flags (**FlgHi5110** and **FlgLo5110**) is greater than zero.

If the **GoodRec** flag is set to FALSE, the process returns. Otherwise, several parameters of interest are computed using WFF Algorithms T1068 and T1016. A number of flags returned by these algorithms are checked and counters are incremented if certain flags are set.

A special case check of T1016 Data Quality flags (**FlgAGC1016Ku** and **FlgAGC1016C** and **FlgSWH1016Ku** and **FlgSWH1016C** and **FlgHgt1016C** and **FlgHgt1016Ku** and **FlgHgtRate1016**) is performed for the creation of daily science plot files. If any one of these flags is set, the **GoodRec** flag is set to FALSE and the process returns.

Next, values of the primary science parameters are added to the statistics for the current interval, and WFF Algorithms T5110, T5135, and S5134 are run to compute several parameters of interest. Several flags generated by these algorithms are also checked and counted. At this point, **sciavg** is complete and returns. See Figure 7-8 "AIF sciavg Processing" for a processing overview. See Appendix C for output file contents and formats.

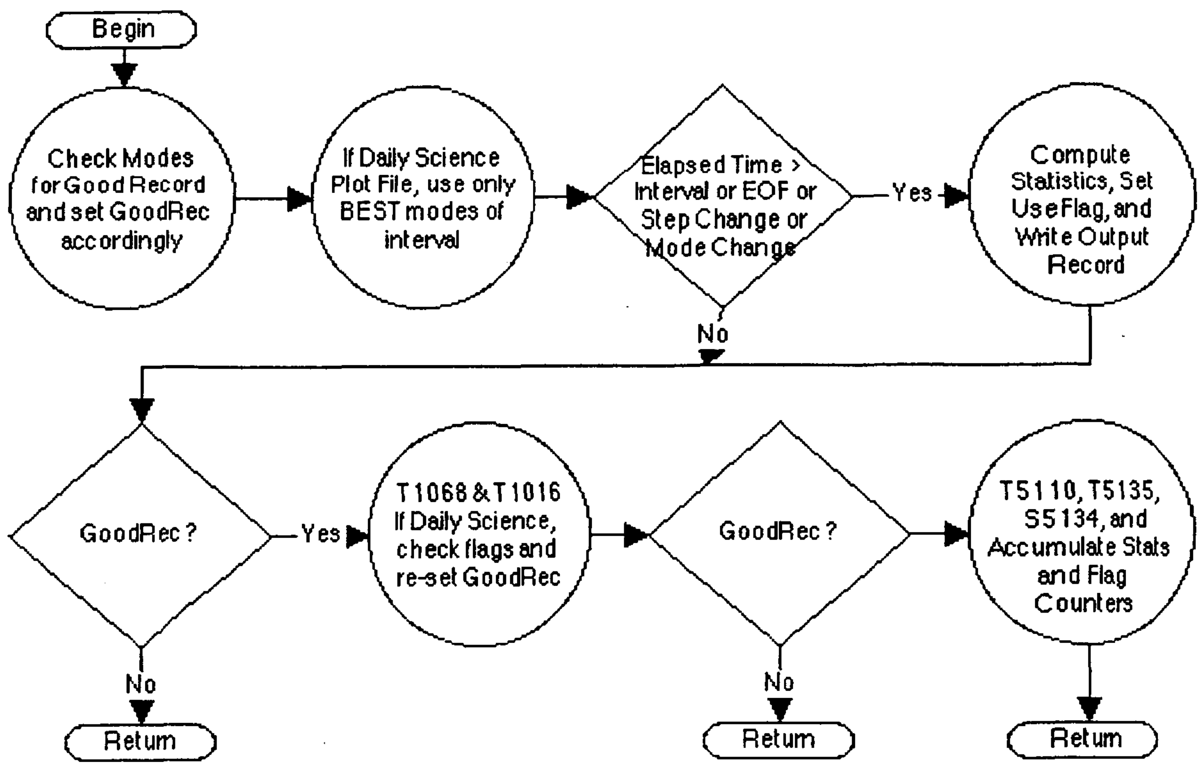


Figure 7-8 AIF sciavg Processing

7.1.12 dotelem:Average Engineering Data

The engineering data averaging routine, **engavg**, runs on a record-to-record basis and creates engineering average and database files. The module produces output records of the full-rate minimum, full-rate maximum, and interval average of engineering parameters.

The **engavg** processing begins with checking the mode of the current engineering record. The mode is checked against the modes that the user has selected for processing. If the mode is not one of the user-selected modes, the record is marked as bad by setting the variable **GoodRec** to FALSE.

If this record is not a GoodRec, and there are no data in the current averaging interval, the module returns. Otherwise, elapsed time is checked to see if it exceeds the user-specified averaging interval; if so, the **WriteData** flag is set. Other conditions which would set the **WriteData** flag include an End-of-File condition, or a mode change to/from CAL or IDLE.

If the **WriteData** flag has been set, averages are computed for the current interval and data are then written to the output file.

If the **GoodRec** flag is set to FALSE, the process returns. Otherwise, the values of the primary engineering parameters are accumulated. Full-rate minimum and maximum values are checked and saved if necessary. At this point, **engavg** is complete and returns. See Figure 7-9 "AIF engavg Processing" for a processing overview. See Appendix C for output file contents and formats.

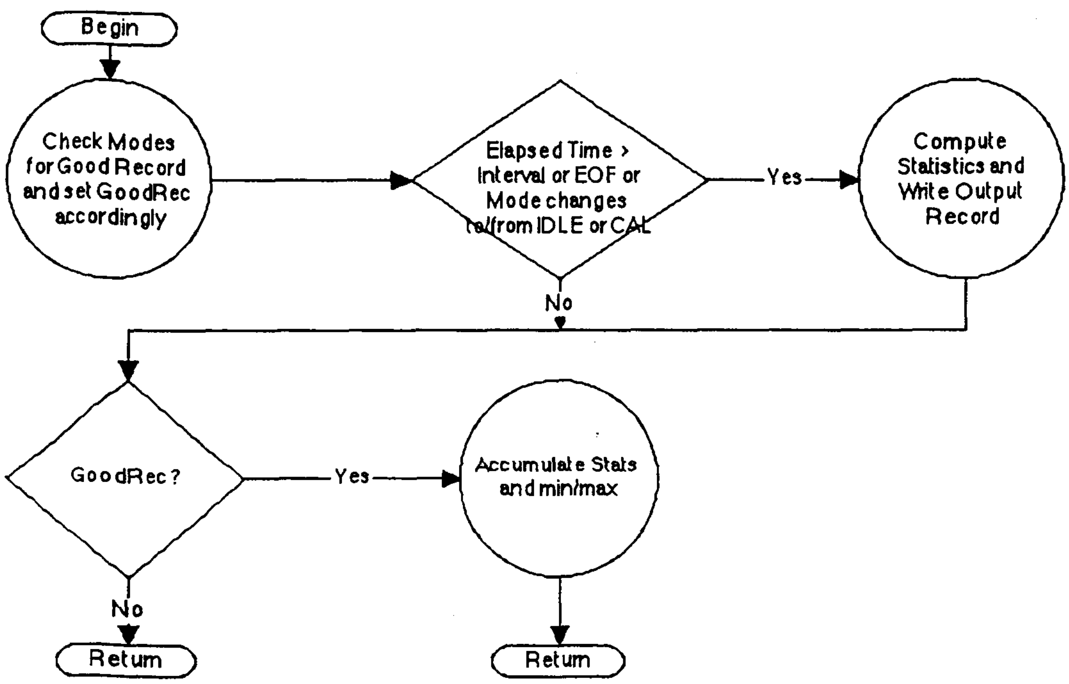


Figure 7-9 AIF engavg Processing

7.1.13 dotelem Waveform Averaging

The waveform averaging routine, **wfavg**, runs on a record-to-record basis and creates high and low rate waveform average files.

The **wfavg** processing begins with checking the mode of the current science record. The mode is checked against the modes that the user has selected for processing. If the mode is not one of the user-selected modes, the record is marked as bad by setting the variable **GoodRec** to FALSE.

If this record is not a GoodRec, and there are no data in the current averaging interval, the module returns. Otherwise, elapsed time is checked to see if it exceeds the user-specified averaging interval. If so, the **WriteData** flag is set. Other conditions which would set the **WriteData** flag include an End-of-File condition, a CAL step change, or a mode change.

If the **WriteData** flag has been set, averages are computed for the current interval and data are then written to the output files.

If the **GoodRec** flag is set to FALSE, the process returns. Otherwise, the values of the standard waveform parameters are accumulated. At this point, **wfavg** is complete and returns. See Figure 7-10 "AIF wfavg Processing" for a processing overview. See Appendix C for output file contents and formats.

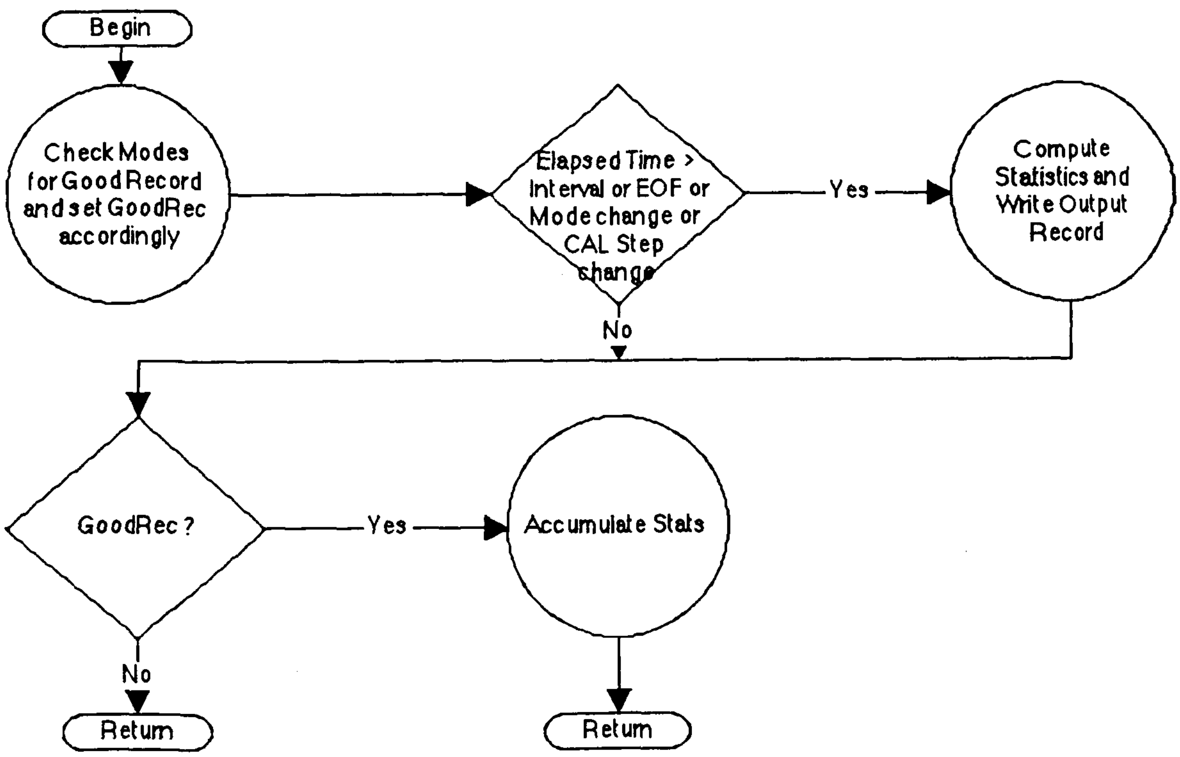


Figure 7-10 AIF wfavg Processing

7.1.14 dotelem Report Status Changes

The Report Status Changes routines, **scistatus** and **engstatus**, check for record-to-record differences in user-specified parameters and optionally compares memory dumps to **DataFile.ROMMap**, the reference memory map. Table 7-7 "Parameters Checked by Report Status Changes Options" on page 7-17 lists the parameters checked for each user-specified option.

Table 7-7 Parameters Checked by Report Status Changes Options

Option	Source	Parameters Checked
All Parameters	Science	**Status, Flags, Times, Commands, Memory,**
All Parameters	Engineering	**Status, Flags, Times, Commands, Memory,**
Status Bytes	Science	CALAttenKu, CALAttenC, SynchModeByte, ModeChangeByte, CurrModeByte, TestMode-Byte, OperModeByte, LimitByte, Mode, Track, AGCType, KuOn, COn, AltOper, WFFreqHi, WFFreqLo
Status Bytes	Engineering	EngMode, BiLevels, EngAltOper
Times	Science	Elapsed clock time, elapsed UTC time
Times	Engineering	Elapsed clock time, elapsed UTC time, Last Reset time.
Commands	Science	LastICACMD, LastATACMD
Commands	Engineering	LastCMDType, LastCMD, LastCMDStatus
Memory	Engineering	MemDumpAddr, MemDump, EngMemChkSum, Compare Memory
Database	Science	**Times, Commands,** KuOn, COn, AltOper, WFFreqHi, WFFreqLo
Database	Engineering	**Times, Commands,** Compare Memory, Mem-DumpAddr, EngMemChkSum, BiLevels
(Boldface parameters signify a group of individual parameters)		

7.1.15 dotelem calavg

The CAL mode processing routine, **calavg**, runs on a record-to-record basis and creates CAL average and database files. Reference CAL values are subtracted from the averages to compute deltas. **calavg** skips data at the beginning of each CAL mode and each CAL1 step to allow for settling, and temperature-corrects AGC data.

The **calavg** processing begins by checking the mode of the current science record. If the mode is not one of the CAL modes, the record is marked as bad by setting the variable **GoodRec** to FALSE.

If this record is not a **GoodRec**, and there are no data in the current averaging interval, the module returns. Otherwise, elapsed time is checked to see if it exceeds the user-specified averaging interval, or more likely, if the CAL mode or Step has changed. If so, the **WriteData** flag is set.

If the **WriteData** flag has been set, averages are computed for the current interval and references subtracted from the averages. Data are then written to the output file. See Appendix D for the current CAL mode references.

If the **GoodRec** flag is set to FALSE, the process returns. Otherwise, at the start of CAL1 or a Step change, one CAL record is skipped. At the start of CAL2, 9 records are skipped. If enough records have not been skipped, the process returns.

If sufficient records have been skipped, CAL1 AGC is CAL-Attenuator temperature-corrected and the values of the CAL parameters are accumulated. At this point, **calavg** is complete and returns. See Figure 7-11 "AIF calavg Processing" for a processing overview. See Appendix C for output file contents and formats.

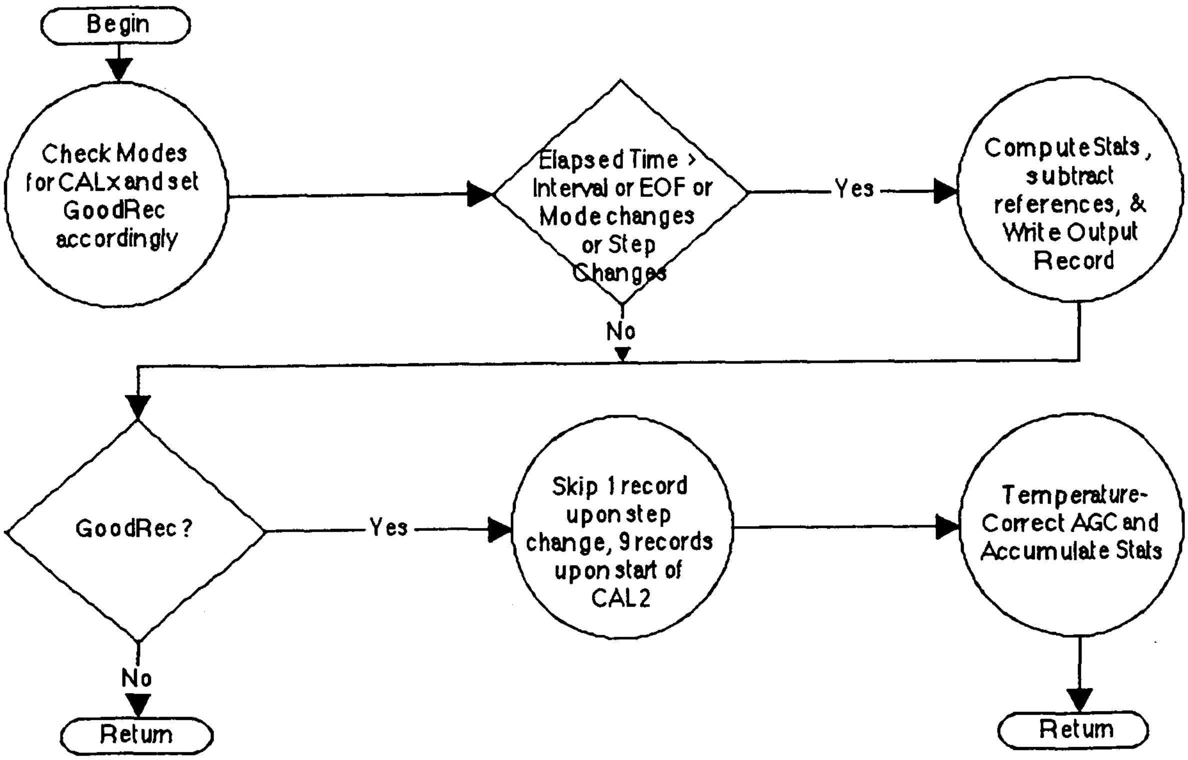


Figure 7-11 AIF calavg Processing

7.1.16 dotelem Create SDR

createsdr, the SDR creation routine, uses WFF Algorithms and some WFF-coded JPL Algorithms to create a pseudo-SDR. This is primarily used for algorithm testing and debugging purposes and is not an attempt to create an exact replica of an "official" JPL SDR. Table 7-8 "Algorithms Used in createsdr" on page 7-19 lists the algorithms used in the SDR creation process.

7.1.17 dotelem Check Waveforms

checkwf, the waveform checking routine, is used to determine if waveform shapes in CAL2 and STBY modes are changing. It does this by averaging waveforms in CAL2 and STBY, and subtracting a reference waveform from each average. The resulting deltas are then checked to see if there are values that exceed pre-set limits.

Table 7-8 Algorithms Used in createsdr

Algorithm	Developer	Implementation Notes
T4108	WFF	Complete Implementation.
T3107	WFF	Complete Implementation.
T3117	WFF	Complete Implementation.
T4109	JPL	Uses only WFF-Generated Variables.
T1068	WFF	Complete Implementation.
T1016	WFF	Complete Implementation.
T5110	WFF	Complete Implementation.
T5135	WFF	Complete Implementation.
T1165	WFF	Complete Implementation.
T1145	WFF	Complete Implementation.
T1155	WFF	Complete Implementation.

The **checkwf** processing begins by checking the mode of the current science record. If the mode is not CAL2 or STBY, the record is marked as bad by setting the variable **GoodRec** to FALSE.

If this record is not a **GoodRec**, and there are no data in the current averaging interval, the module returns. Otherwise, if the mode has changed, the **WriteData** flag is set.

If the **WriteData** flag has been set, averages are computed for the current interval and references subtracted from the averages. The averages are checked against limits and alarm messages written if a limit is exceeded. Data are then written to the output file. See Appendix D for the current waveform reference and limits.

If the **GoodRec** flag is set to FALSE, the process returns. Otherwise at the start of CAL2, 9 records are skipped. If enough records have not been skipped, the process returns. One waveform (waveform, not record) is skipped if the Mode is STBY.

If sufficient records or waveforms have been skipped, the values of the waveform parameters are accumulated. If the mode is STBY, one-record averages are used. If the mode is CAL2, an average of the whole CAL2 interval is used. At this point, **checkwf** is complete and returns. See Appendix C for output file contents and formats.

7.1.18 dotelem Average CAL1 Waveforms

The CAL1 mode waveform averaging routine, **calwfmon**, runs on a record-to-record basis and creates CAL1 high and low rate waveform averages files. **Calwfmon** skips data at the beginning of each CAL1 step to allow for settling, and temperature-corrects AGC data.

The **calwfmon** processing begins by checking the mode of the current science record. If the mode is not one of the CAL modes, the record is marked as bad by setting the variable **GoodRec** to FALSE.

If this record is not a **GoodRec**, and there are no data in the current averaging interval, the module returns. Otherwise, elapsed time is checked to see if it exceeds the user-specified averaging interval, or more likely, if the CAL mode or Step has changed. If so, the **WriteData** flag is set, and averages are computed for the current interval.

If the **GoodRec** flag is set to FALSE, the process returns. Otherwise, at the start of CAL1 or a Step change, one CAL record is skipped.

If sufficient records have been skipped, CAL1 AGC is CAL-Attenuator temperature-corrected and the values of the CAL parameters are accumulated. At this point, **calwfmon** is complete and returns. See Figure 7-12 "Cal1 Waveform Averaging" for a processing overview. See Appendix C for output file contents and formats.

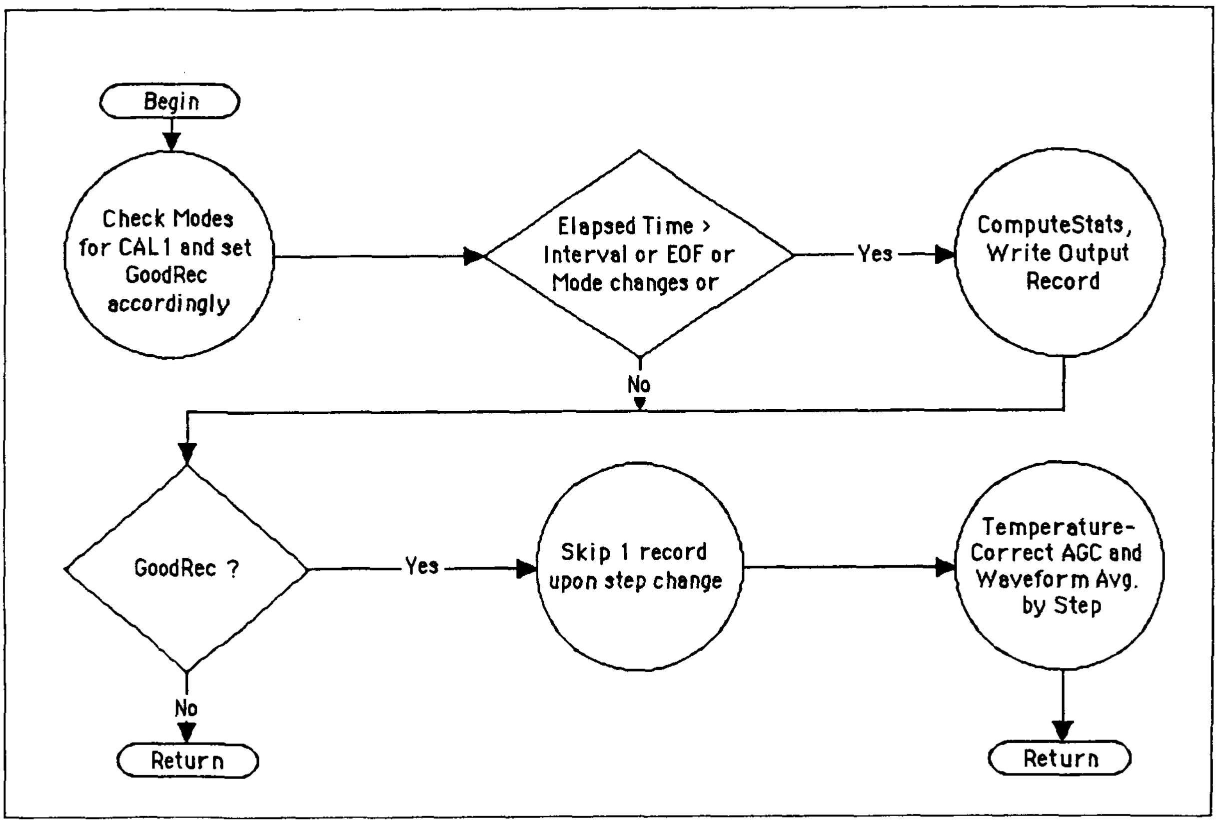


Figure 7-12 Cal1 Waveform Averaging

7.2 AIF Databases

FoxBase/Mac is used as the TOPEX AIF Database management system. The database Main Menu is depicted in Figure 7-13 "TOPEX AIF Database Main Menu" on page 7-21. Using this system, AIF data can be imported, exported, sorted, and searched. Spe-

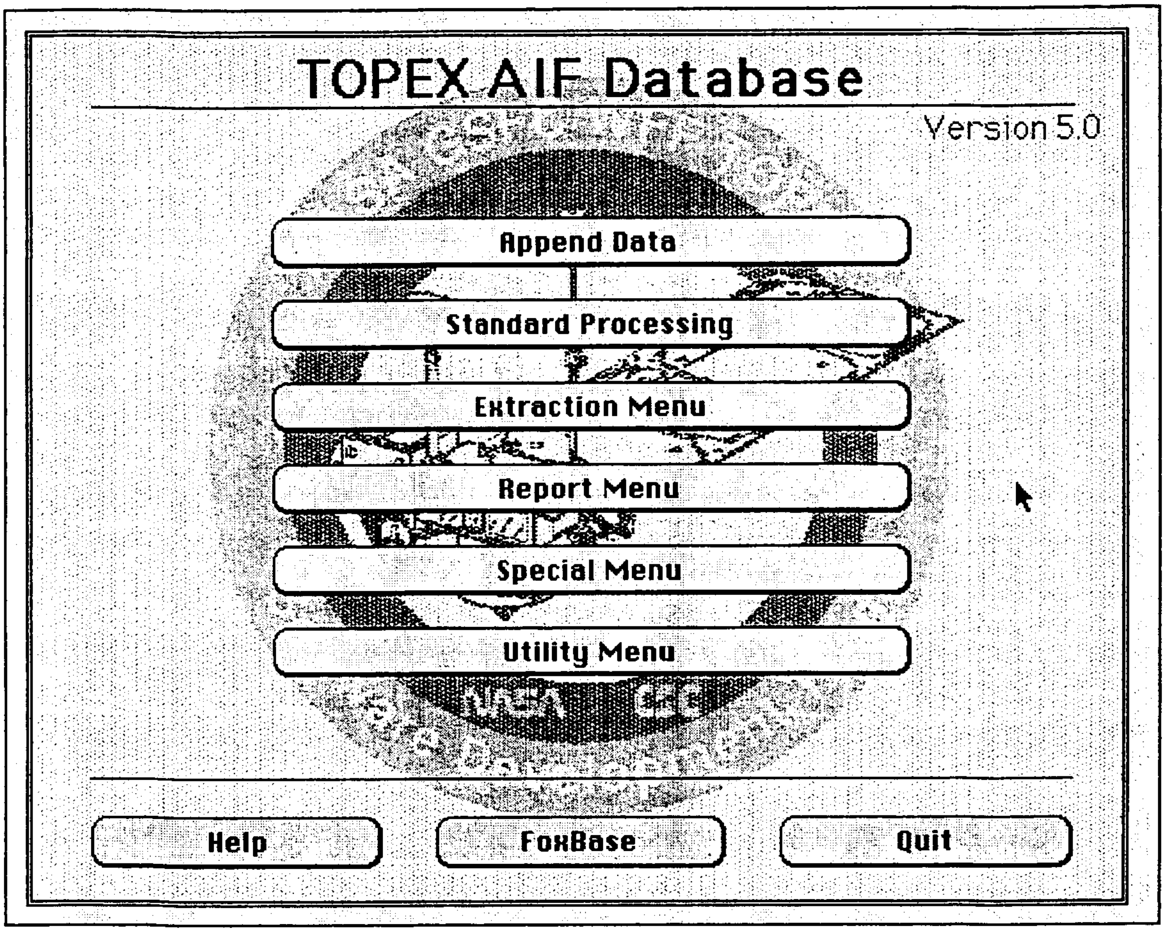


Figure 7-13 TOPEX AIF Database Main Menu

cial-purpose programs can be created to perform specific processing on the AIF data prior to exporting. Database structures are documented in Appendix C.

7.2.1 AIF Databases Append Data

Files created by the **dotelem** database processing routines are imported into and appended to the AIF databases. The Append Menu is shown in Figure 7-14 "AIF Database Append Menu" on page 7-22. Due to standard naming conventions, the user is prompted to pick one of the five import files. The database program then computes the other four filenames and checks for the existence of those files. If any of the five files are missing or misnamed, the import process is canceled. If all files exist, then the program imports the data from each file into the appropriate database. Table 7-9 "AIF Database Import Files" on page 7-22 lists the files required to import data.

7.2.2 AIF Databases Export Data

The AIF database system allows a user to extract data according to specified criteria. There are currently three extraction files available: Waveforms, CAL, and Engineering. The user may select from a range of dates and specific conditions to restrict the data extraction. The extraction files are written in the same format as the corresponding databases. See Appendix C for the database export file formats.

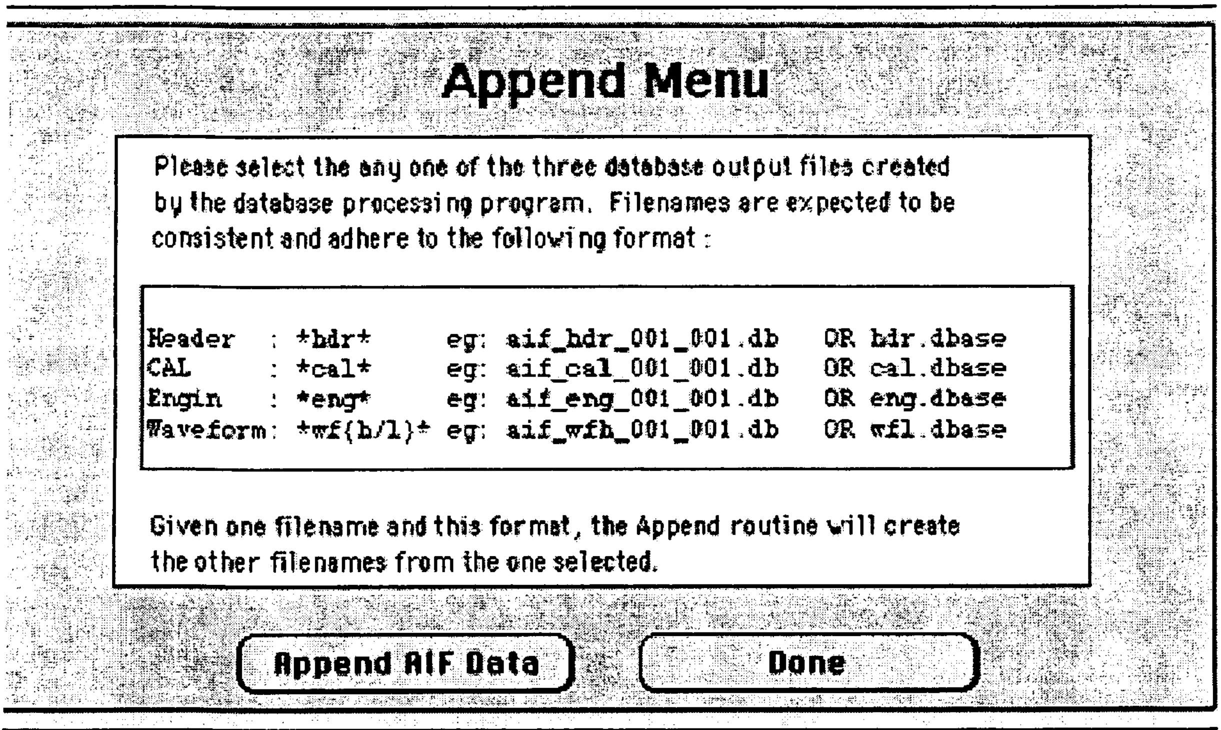


Figure 7-14 AIF Database Append Menu

Table 7-9 AIF Database Import Files

Std. Filename	Database	Description
cal.dbase	cal	Concatenated files of **dotelem** cal output.
hdr. dbase	header	Concatenated files of **dotelem** headers output.
eng. dbase	engin	Concatenated files of **dotelem** 1-hour engineering output
wfh.dbase	wfhi	Concatenated files of **dotelem** high rate checkwf output.
wfl.dbase	wflo	Concatenated files of **dotelem** low rate checkwf output.

7.2.3 AIF Cal1 Waveform Database

Files created by the **dotelem** standard processing routines are appended to the AIF Cal1 waveform database. See table for file content and format.Table C-11 “AIF Cal Waveform Monitor Database” Table 7-10 "AIF Cal Waveform Monitor Database Files" lists the files required to import data.

Table 7-10 AIF Cal Waveform Monitor Database Files

Std. Filename	Database	Description
calwfmonhi.dbase	calwfmonhi	Concatenated files of **dotelem** high rate Cal1 wf output.
calwfmonlo.dbase	calwfmonlo	Concatenated files of **dotelem** low rate Cal1 wf output.

7.3 AIF IDL Software

IDL, Interactive Data Language, is a software package written by Research Systems, Inc. It is an array-based scientific visualization package that enables a programmer to quickly and easily write code to generate highly customized plots and analyses. IDL has allowed the TOPEX SWDT to automatically generate products that were difficult and time-consuming to produce using COTS software.

TOPEX IDL programs generally can read **dotelem** average files or database export files and produce standardized plots on a PostScript printer. These programs are coded with a set of parameters which may be modified to customize features of the final output without changing the IDL code. Table 7-11 "IDL Parameters" lists the standard parameters that may be modified by the user. Appendix B lists the UNIX scripts which run TOPEX IDL programs.

Table 7-11 IDL Parameters

Parameter	Default	Description
InputFile	n/a	Text file from which data to be processed is read.
XPlots	varies	Number of plots stacked horizontally per page.
YPlots	varies	Number of plots stacked vertically per page.
Printer	topex2	Printer where output will be printed.
AutoScale	FALSE	Switch to automatically set axis scales by min & max of data, rather than by standard scale values.
LandScape	varies	Switch to print in landscape rather than portrait mode.
DeviceType	'ps'	Type of device driver to use (ps=PostScript).
PlotTitle	*InputFile*	Title to place on plot. May be overridden by program.
Color	TRUE	Switch to define that color should be used for output.
Scale	1.0	Factor by which to scale whole page. Useful for incorporating output in presentations or publications.
Manual	FALSE	Switch to define that printer should be set to Manual Feed mode. Highly printer-dependent.
All	FALSE	Switch to define that all output products should be printed rather than the standard subset. Used by only some programs.
SinceLast	TRUE	Switch to define that output data should be subsetted by a pre-defined interval. Useful for restricting Launch-to-Date output.

7.4 UNIX Scripts

UNIX scripts are used to automate common tasks and supply standard parameters to TOPEX AIF software. Some shell scripts are invoked by the **crontab** facility to perform daily processing. Other shell scripts are used for automatically retrieving and processing special data from JPL, automatically running IDL programs, and miscellaneous utility functions. Appendix B contains a list of UNIX scripts which are available for use.

Appendix A
Standard Products

This appendix contains samples of the standard products produced by the TOPEX AIF software. A note is made, where appropriate, detailing the frequency of production of the product.

```
csh /gen/topex2/bin/autoaif

produced the following output:

Tue May 3 03:00:11 EDT 1994 -- starting JPL automatic copying..
wffdev:[wffuser.wff_data]tcc_alteng_1994122t000000.bin copied.  Retrys : 1
wffdev:[wffuser.wff_data]tcc_altsci_1994122t000000.bin copied.  Retrys : 1
wffdev:[wffuser.wff_data]tcc_wff1_1994122t000000.bin copied.  Retrys : 1

Tue May 3 03:44:59 EDT 1994 -- running dotelem...

Tue May 3 03:59:01 EDT 1994 -- moving tcc_wff1_1994122t000000.bin to /gen/flight/aif

Tue May 3 03:59:04 EDT 1994 -- Printing IDL Hdr Page...

Tue May 3 03:59:18 EDT 1994 -- Printing IDL CAL plots...

Tue May 3 03:59:21 EDT 1994 -- Printing IDL Science plots...
Tue May 3 04:00:01 EDT 1994 -- Printing IDL Engineering plots...
Tue May 3 04:00:13 EDT 1994 -- Printing IDL Waveform plots...

Tue May 3 04:00:20 EDT 1994 -- Printing events...
request id is topex-115 (1 file(s))
Tue May 3 04:01:29 EDT 1994 -- Automatic Processing Complete.

-- See jplauto_1994122t000000.log for more details. --
```

Figure A-1 AIF Processing Log Produced as Part of Daily Processing

TOPEX Daily AIF Summary Information

Header ID:	0
Day Number:	1994121
Alt:	A
KuOn:	ON
COn:	C32
Date Processed:	05/02/94
WFF Program:	doTelem
WFF Version:	3.5,01/25/94
TelemConst Version:	13,05/11/93
EALimits Version:	07,01/26/94
ROMMap Version:	1.3,12/08/93
Bad Eng Records:	7
Bad Sci Records:	27
Hours in TRACK:	23.84
Sci Data Lost (sec):	26.8
Eng Data Lost (sec):	49.1
Last RST, # RSTs:	31D99295124E,0
STBYWF Alarms(Hi,Lo):	3,0
CAL2WF Alarms(Hi,Lo):	4,3

Figure A-2 AIF Processing Summary Produced as Part of Daily Processing

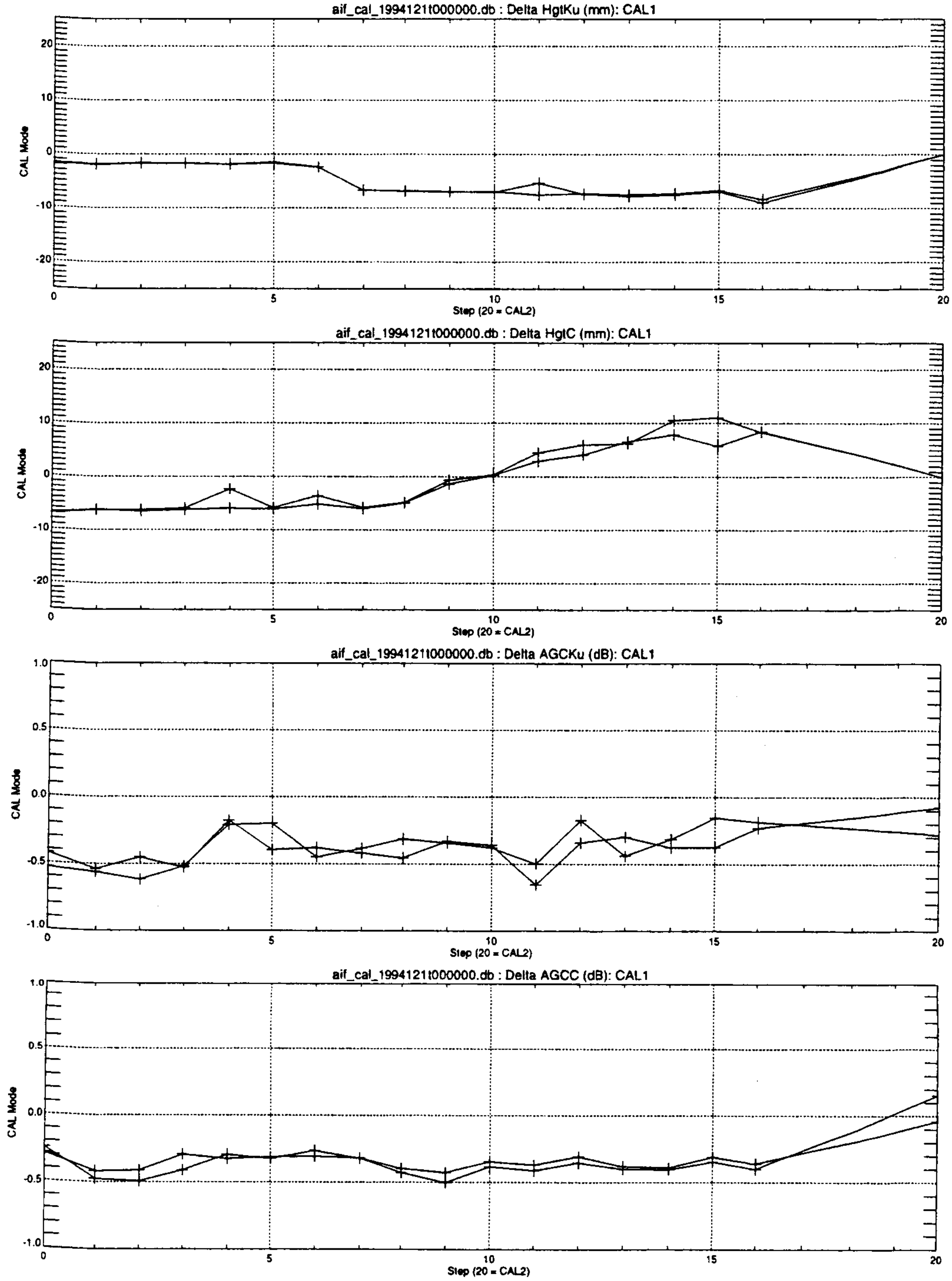


Figure A-3 AIF CAL Plot Produced as Part of Daily Processing

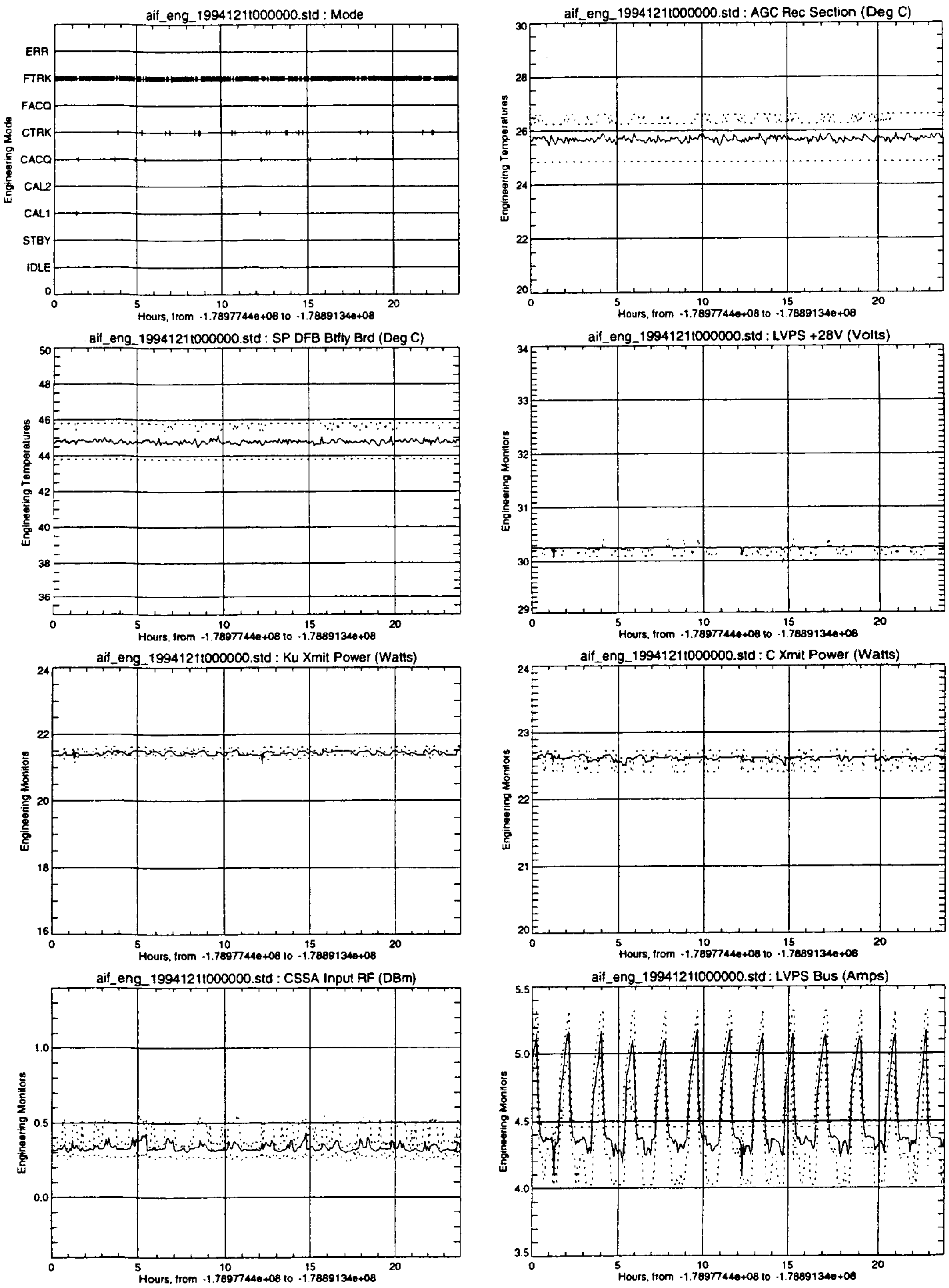


Figure A-4 AIF Engineering Plot Produced as Part of Daily Processing

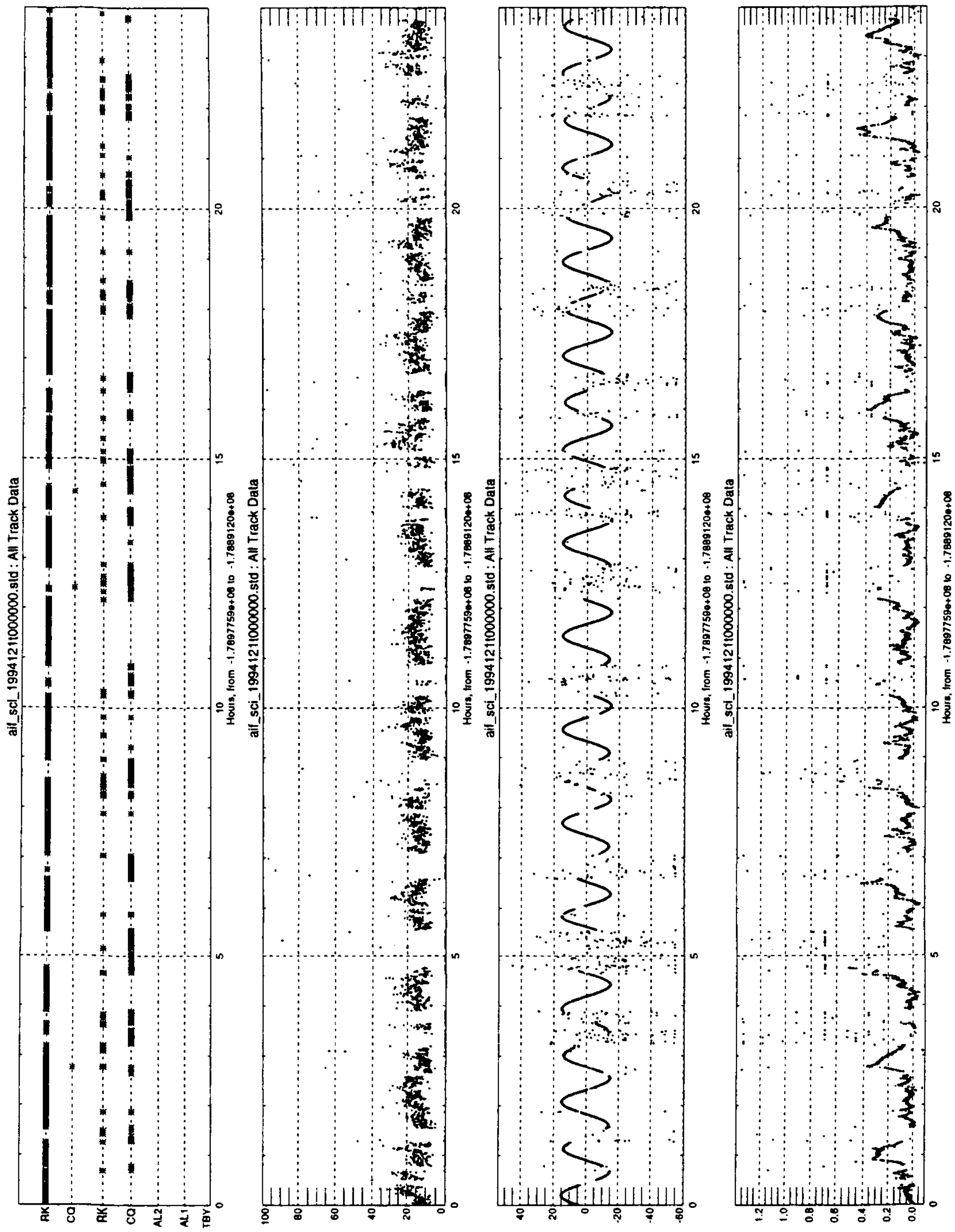


Figure A-5 AIF Science Plots Produced as Part of Daily Processing

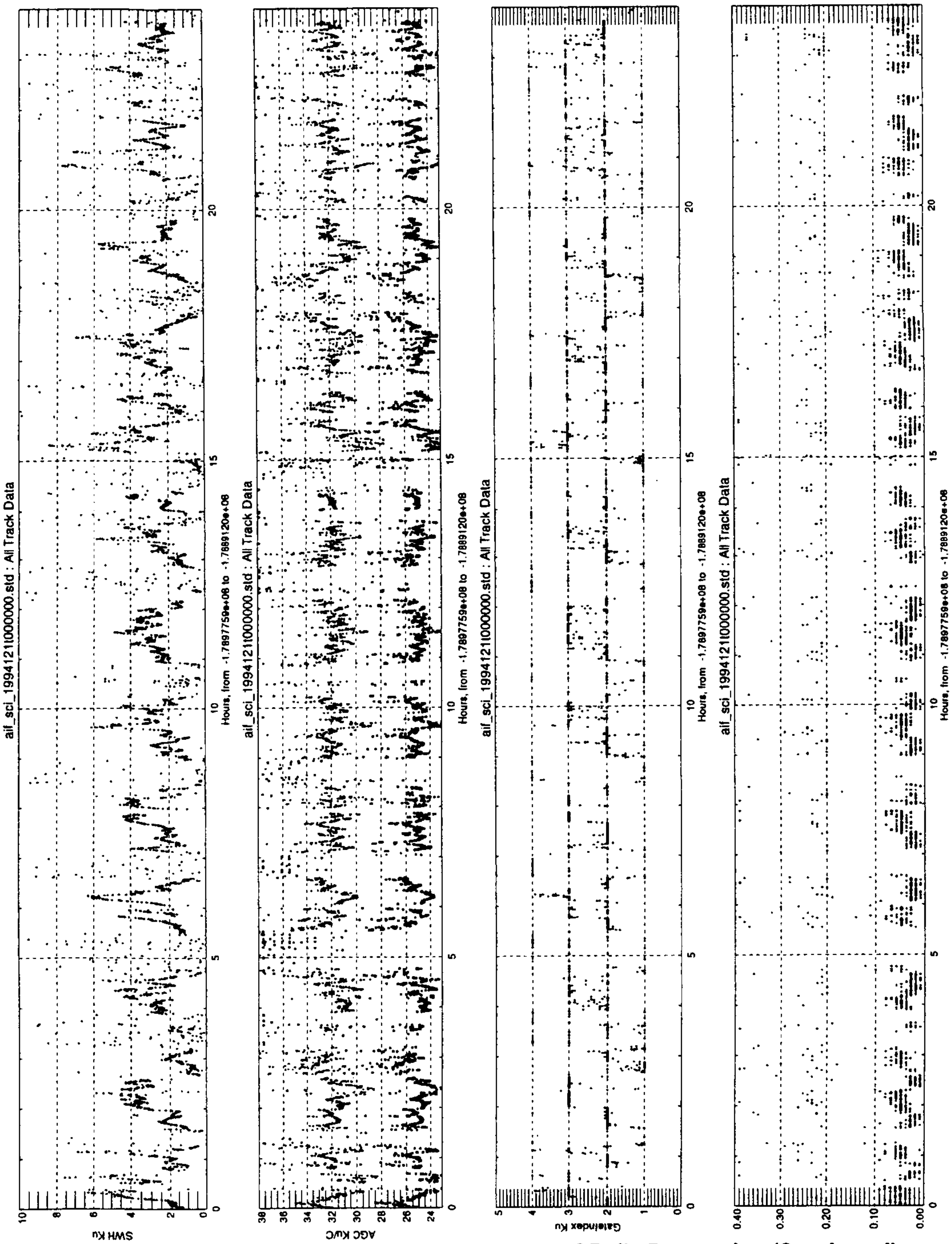


Figure A-5 AIF Science Plots Produced as Part of Daily Processing (Continued)

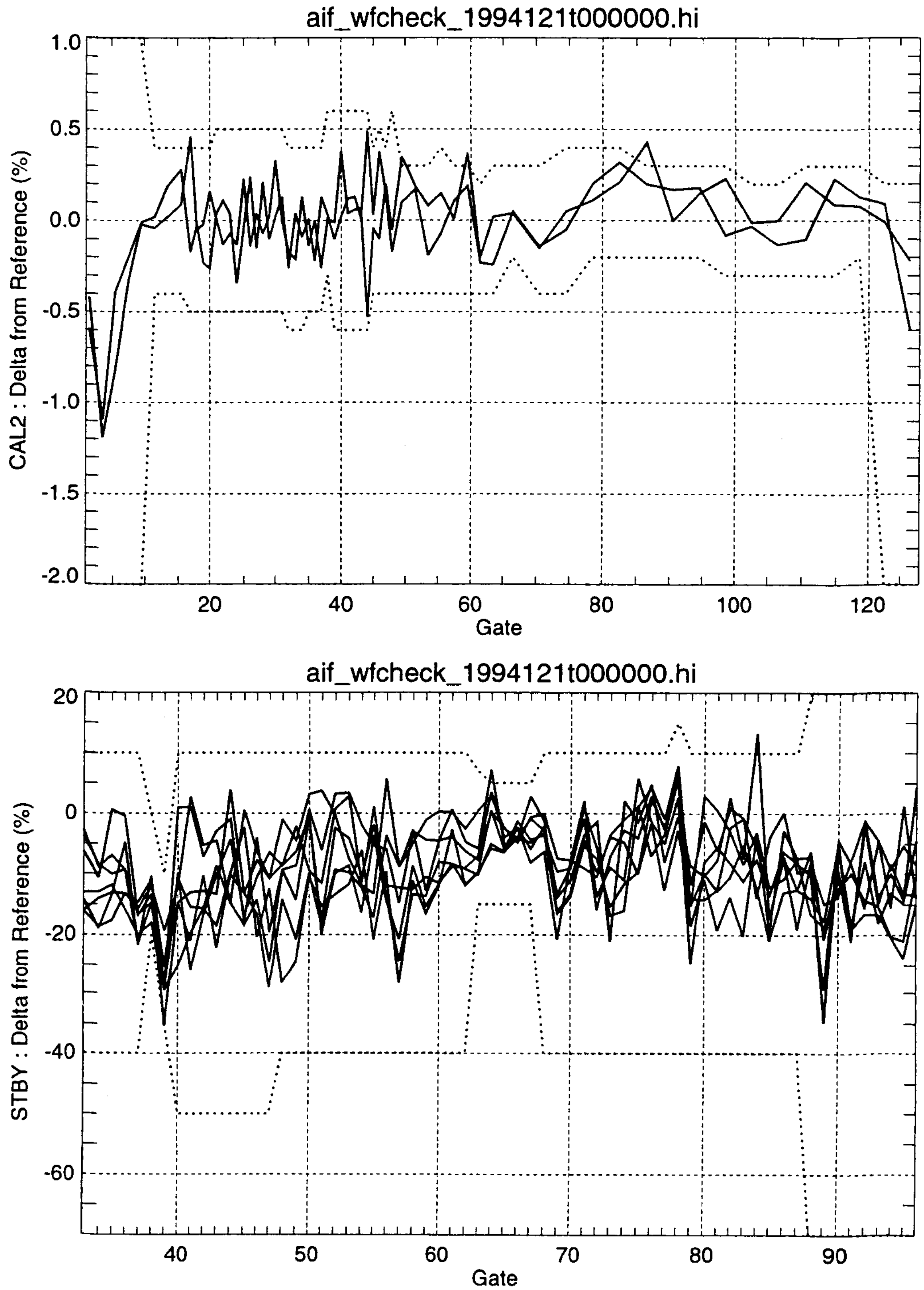
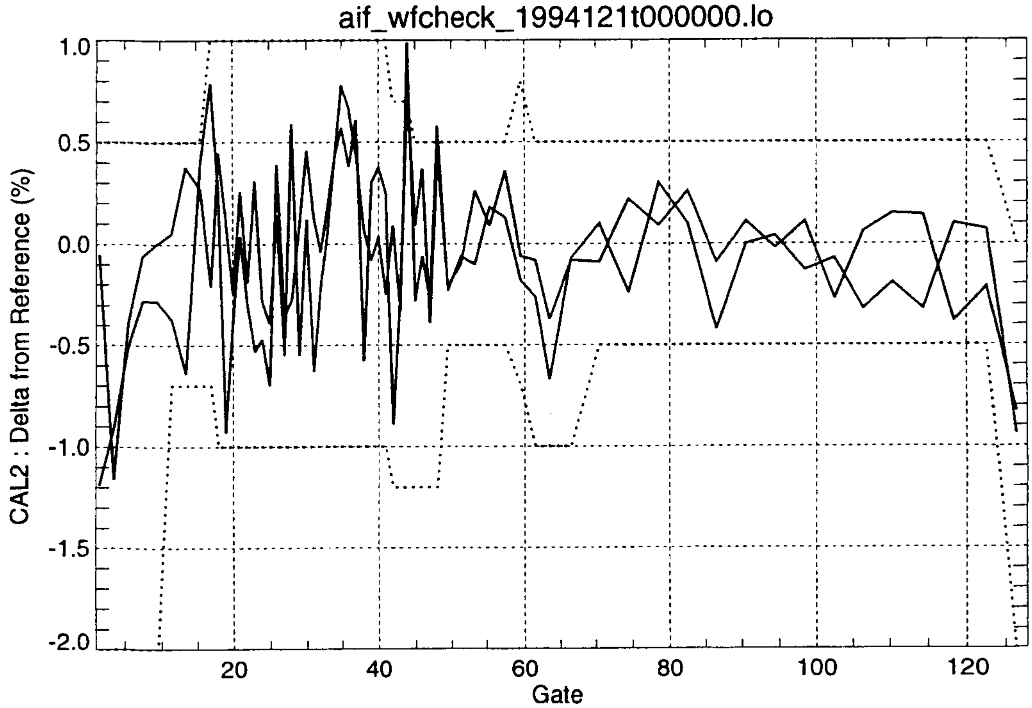


Figure A-6 AIF Waveforms Difference Plot Produced as Part of Daily Processing



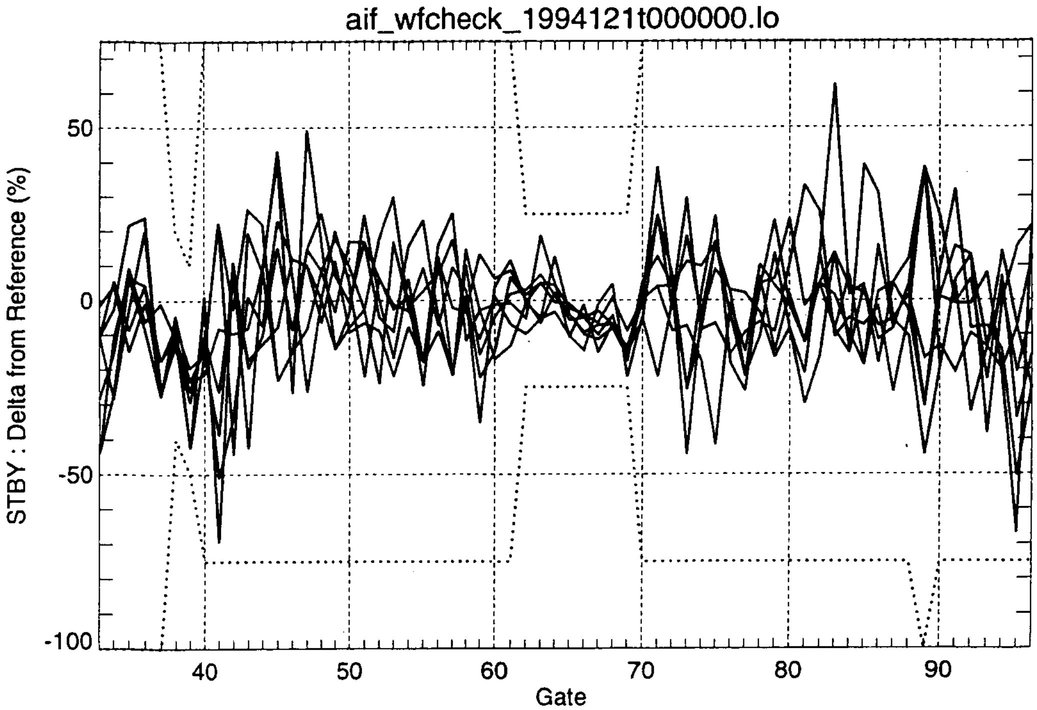


Figure A-6 AIF Waveforms Difference Plot Produced as Part of Daily Processing (Continued)

Figure A-7 AIF Events Report Produced as Part of Daily Processing

```
-----------------------------------------------------------------------
1994121 -178977599.55 1994-121T00:00:00 SCI  Mode     Mode(1,2) FTRK,FTRK
-----------------------------------------------------------------------
1994121 -178977586.17 1994-121T00:00:14 ENG  dTime    Time_Last_Reset  53525914.95
1994121 -178977586.17 1994-121T00:00:14 ENG  dTime    Time_Last_Reset_Hex 31D99295124E
-----------------------------------------------------------------------
1994121 -178977553.40 1994-121T00:00:47 ENG  Status   BadEngRecs        1
-----------------------------------------------------------------------
1994121 -178977539.52 1994-121T00:01:00 SCI  Status   BadSciRecs        1
1994121 -178977539.52 1994-121T00:01:00 SCI  dTime    Sci_Time_SDF      2.15
1994121 -178977539.52 1994-121T00:01:00 SCI  dTime    Sci_Time_UTC      2.11
-----------------------------------------------------------------------
1994121 -178977537.02 1994-121T00:01:03 ENG  dTime    Eng_Time_EDF      17.16
1994121 -178977537.02 1994-121T00:01:03 ENG  dTime    Eng_Time_UTC      16.38
-----------------------------------------------------------------------
1994121 -178972859.39 1994-121T01:19:01 ENG  CMD      Last_Command(1) ICA  AWENBLK1 OK
1994121 -178972859.39 1994-121T01:19:01 ENG  CMD      Last_Command(4) ATAs STANDBY  OK
1994121 -178972859.39 1994-121T01:19:01 ENG  CMD      Last_Command(5) ATAs CAL      OK
1994121 -178972859.39 1994-121T01:19:01 ENG  CMD      Last_Command(7) ICA  AFULLON  OK
1994121 -178972859.39 1994-121T01:19:01 ENG  Memory   ENG_Memory_CheckSum BDD5
-----------------------------------------------------------------------
1994121 -178972855.80 1994-121T01:19:04 SCI  Mode     Mode(1,2) STBY,STBY
-----------------------------------------------------------------------
1994121 -178972854.78 1994-121T01:19:05 SCI  Mode     Mode(1,2) CAL1,CAL1
-----------------------------------------------------------------------
1994121 -178972851.20 1994-121T01:19:09 ENG  Memory   ENG_Memory_CheckSum 5CE9
-----------------------------------------------------------------------
1994121 -178972678.08 1994-121T01:22:02 SCI  Mode     Mode(1,2) CAL2,CAL2
-----------------------------------------------------------------------
1994121 -178972613.63 1994-121T01:23:06 ENG  CMD      Last_Command(1) ICA  AWENBLK1 OK
1994121 -178972613.63 1994-121T01:23:06 ENG  CMD      Last_Command(4) ATAs STANDBY  OK
1994121 -178972613.63 1994-121T01:23:06 ENG  CMD      Last_Command(6) ATAs TRACK    OK
1994121 -178972613.63 1994-121T01:23:06 ENG  CMD      Last_Command(7) ICA  AFULLON  OK
1994121 -178972613.63 1994-121T01:23:06 ENG  Memory   ENG_Memory_CheckSum 5CF5
-----------------------------------------------------------------------
1994121 -178972610.94 1994-121T01:23:09 SCI  Mode     Mode(1,2) STBY,STBY
1994121 -178972640.37 1994-121T01:22:40 WF   CAL2LO Gate  44 Upper  0.7   0.99
1994121 -178972640.37 1994-121T01:22:40 WF   CAL2LO Gate  48 Upper  0.5   0.58
-----------------------------------------------------------------------
1994121 -178972608.83 1994-121T01:23:11 SCI  Mode     Mode(1,2) CACQ,CACQ
-----------------------------------------------------------------------
1994121 -178948750.33 1994-121T08:00:50 ENG  Status   BadEngRecs        1
-----------------------------------------------------------------------
1994121 -178948739.83 1994-121T08:01:00 SCI  Status   BadSciRecs        1
1994121 -178948739.83 1994-121T08:01:00 SCI  dTime    Sci_Time_SDF      2.17
1994121 -178948739.83 1994-121T08:01:00 SCI  dTime    Sci_Time_UTC      2.18
-----------------------------------------------------------------------
1994121 -178948733.95 1994-121T08:01:06 ENG  dTime    Eng_Time_EDF      16.27
1994121 -178948733.95 1994-121T08:01:06 ENG  dTime    Eng_Time_UTC      16.38
-----------------------------------------------------------------------
1994121 -178937723.90 1994-121T11:04:36 ENG  Status   BadEngRecs        1
-----------------------------------------------------------------------
1994121 -178937707.64 1994-121T11:04:52 SCI  Status   BadSciRecs        1
1994121 -178937707.64 1994-121T11:04:52 SCI  dTime    Sci_Time_SDF      2.15
1994121 -178937707.64 1994-121T11:04:52 SCI  dTime    Sci_Time_UTC      2.18
-----------------------------------------------------------------------
1994121 -178937707.51 1994-121T11:04:52 ENG  dTime    Eng_Time_EDF      16.12
1994121 -178937707.51 1994-121T11:04:52 ENG  dTime    Eng_Time_UTC      16.38
```

Figure A-7 AIF Events Report Produced as Part of Daily Processing (Continued)

```
1994121 -178933562.36 1994-121T12:13:58 ENG   CMD    Last_Command(4) ICA  AWENBLK1 OK
1994121 -178933562.36 1994-121T12:13:58 ENG   CMD    Last_Command(6) ATAs STANDBY  OK
1994121 -178933562.36 1994-121T12:13:58 ENG   CMD    Last_Command(8) ATAs CAL      OK
1994121 -178933562.36 1994-121T12:13:58 ENG Memory  ENG_Memory_CheckSum BDD5
--------------------------------------------------------------------------------
1994121 -178933556.67 1994-121T12:14:03 SCI  Mode        Mode(1,2) STBY,STBY
1994121 -178933556.67 1994-121T12:14:03 WF  STBYHI Gate  84 Upper 10.0   13.22
1994121 -178933555.64 1994-121T12:14:04 WF  STBYHI Gate  64 Upper  5.0    7.21
--------------------------------------------------------------------------------
1994121 -178933554.62 1994-121T12:14:05 SCI  Mode        Mode(1,2) CAL1,CAL1
--------------------------------------------------------------------------------
1994121 -178933554.17 1994-121T12:14:06 ENG   CMD    Last_Command(2) ICA  AFULLON  OK
1994121 -178933554.17 1994-121T12:14:06 ENG Memory  ENG_Memory_CheckSum 5CE9
--------------------------------------------------------------------------------
1994121 -178933377.98 1994-121T12:17:02 SCI  Mode        Mode(1,2) CAL2,CAL2
--------------------------------------------------------------------------------
1994121 -178933316.60 1994-121T12:18:03 ENG   CMD    Last_Command(4) ICA  AWENBLK1 OK
1994121 -178933316.60 1994-121T12:18:03 ENG   CMD    Last_Command(7) ATAs STANDBY  OK
1994121 -178933316.60 1994-121T12:18:03 ENG Memory  ENG_Memory_CheckSum BDD5
--------------------------------------------------------------------------------
1994121 -178933310.78 1994-121T12:18:09 SCI  Mode        Mode(1,2) STBY,STBY
1994121 -178933340.24 1994-121T12:17:40 WF  CAL2HI Gate  17 Upper  0.4    0.46
1994121 -178933340.24 1994-121T12:17:40 WF  CAL2LO Gate  44 Upper  0.7    0.75
1994121 -178933340.24 1994-121T12:17:40 WF  CAL2HI Gate  49 Upper  0.3    0.35
1994121 -178933340.24 1994-121T12:17:40 WF  CAL2HI Gate  59 Upper  0.3    0.37
1994121 -178933340.24 1994-121T12:17:40 WF  CAL2HI Gate  85 Upper  0.3    0.43
1994121 -178933310.78 1994-121T12:18:09 WF  STBYHI Gate  39 Lower -35.0  -35.18
--------------------------------------------------------------------------------
1994121 -178933308.73 1994-121T12:18:11 SCI  Mode        Mode(1,2) CACQ,CACQ
--------------------------------------------------------------------------------
1994121 -178933308.41 1994-121T12:18:12 ENG   CMD    Last_Command(1) ATAs TRACK    OK
1994121 -178933308.41 1994-121T12:18:12 ENG   CMD    Last_Command(2) ATAs $ C00F7B OK
1994121 -178933308.41 1994-121T12:18:12 ENG   CMD    Last_Command(3) ICA  AFULLON  OK
1994121 -178933308.41 1994-121T12:18:12 ENG Memory  ENG_Memory_CheckSum 5CF5
--------------------------------------------------------------------------------
1994121 -178931809.27 1994-121T12:43:11 ENG Status      BadEngRecs       1
--------------------------------------------------------------------------------
1994121 -178931793.34 1994-121T12:43:27 SCI Status     BadSciRecs       1
1994121 -178931793.34 1994-121T12:43:27 SCI  dTime     Sci_Time_SDF     2.17
1994121 -178931793.34 1994-121T12:43:27 SCI  dTime     Sci_Time_UTC     2.18
--------------------------------------------------------------------------------

--------------------------------
1994121 -178931792.89 1994-121T12:43:27 ENG  dTime      Eng_Time_EDF     16.24
1994121 -178931792.89 1994-121T12:43:27 ENG  dTime      Eng_Time_UTC     16.38
--------------------------------------------------------------------------------
1994121 -178924770.81 1994-121T14:40:29 SCI Status     BadSciRecs       9
1994121 -178924770.81 1994-121T14:40:29 SCI  dTime     Sci_Time_SDF     10.02
1994121 -178924770.81 1994-121T14:40:29 SCI  dTime     Sci_Time_UTC     10.05
--------------------------------------------------------------------------------
1994121 -178924766.78 1994-121T14:40:33 SCI Status     BadSciRecs       3
1994121 -178924766.78 1994-121T14:40:33 SCI  dTime     Sci_Time_SDF     3.95
1994121 -178924766.78 1994-121T14:40:33 SCI  dTime     Sci_Time_UTC     4.03
--------------------------------------------------------------------------------
1994121 -178924759.67 1994-121T14:40:40 SCI Status     BadSciRecs       6
1994121 -178924759.67 1994-121T14:40:40 SCI  dTime     Sci_Time_SDF     6.90
1994121 -178924759.67 1994-121T14:40:40 SCI  dTime     Sci_Time_UTC     7.10
```

Figure A-7 AIF Events Report Produced as Part of Daily Processing (Continued)

```
-----------------------------------------------------------------
1994121 -178924758.71 1994-121T14:40:41 SCI dTime     Sci_Time_UTC     0.96
---------------------------------------------------------------------------------
1994121 -178924755.64 1994-121T14:40:44 SCI Status     BadSciRecs      2
1994121 -178924755.64 1994-121T14:40:44 SCI dTime     Sci_Time_SDF     3.23
1994121 -178924755.64 1994-121T14:40:44 SCI dTime     Sci_Time_UTC     3.07
---------------------------------------------------------------------------------
1994121 -178919955.45 1994-121T16:00:45 ENG Status      BadEngRecs       1
---------------------------------------------------------------------------------
1994121 -178919939.83 1994-121T16:01:00 SCI Status     BadSciRecs      1
1994121 -178919939.83 1994-121T16:01:00 SCI dTime     Sci_Time_SDF     2.15
1994121 -178919939.83 1994-121T16:01:00 SCI dTime     Sci_Time_UTC     2.18
---------------------------------------------------------------------------------
1994121 -178919939.07 1994-121T16:01:01 ENG dTime     Eng_Time_EDF     16.11
1994121 -178919939.07 1994-121T16:01:01 ENG dTime     Eng_Time_UTC     16.38
---------------------------------------------------------------------------------
1994121 -178910755.83 1994-121T18:34:04 ENG Status      BadEngRecs       1
---------------------------------------------------------------------------------
1994121 -178910747.13 1994-121T18:34:13 SCI Status     BadSciRecs      1
1994121 -178910747.13 1994-121T18:34:13 SCI dTime     Sci_Time_SDF     2.15
1994121 -178910747.13 1994-121T18:34:13 SCI dTime     Sci_Time_UTC     2.11
---------------------------------------------------------------------------------
1994121 -178910739.45 1994-121T18:34:2
--------------------1 ENG dTime     Eng_Time_EDF     16.12
1994121 -178910739.45 1994-121T18:34:21 ENG dTime     Eng_Time_UTC     16.38
---------------------------------------------------------------------------------
1994121 -178891209.72 1994-121T23:59:50 ENG Status      BadEngRecs       1
---------------------------------------------------------------------------------
1994121 -178891200.38 1994-122T00:00:00 SCI TOTAL      BadSciRecs      27
---------------------------------------------------------------------------------
1994121 -178891209.72 1994-121T23:59:50 ENG TOTAL       BadEngRecs       7
```

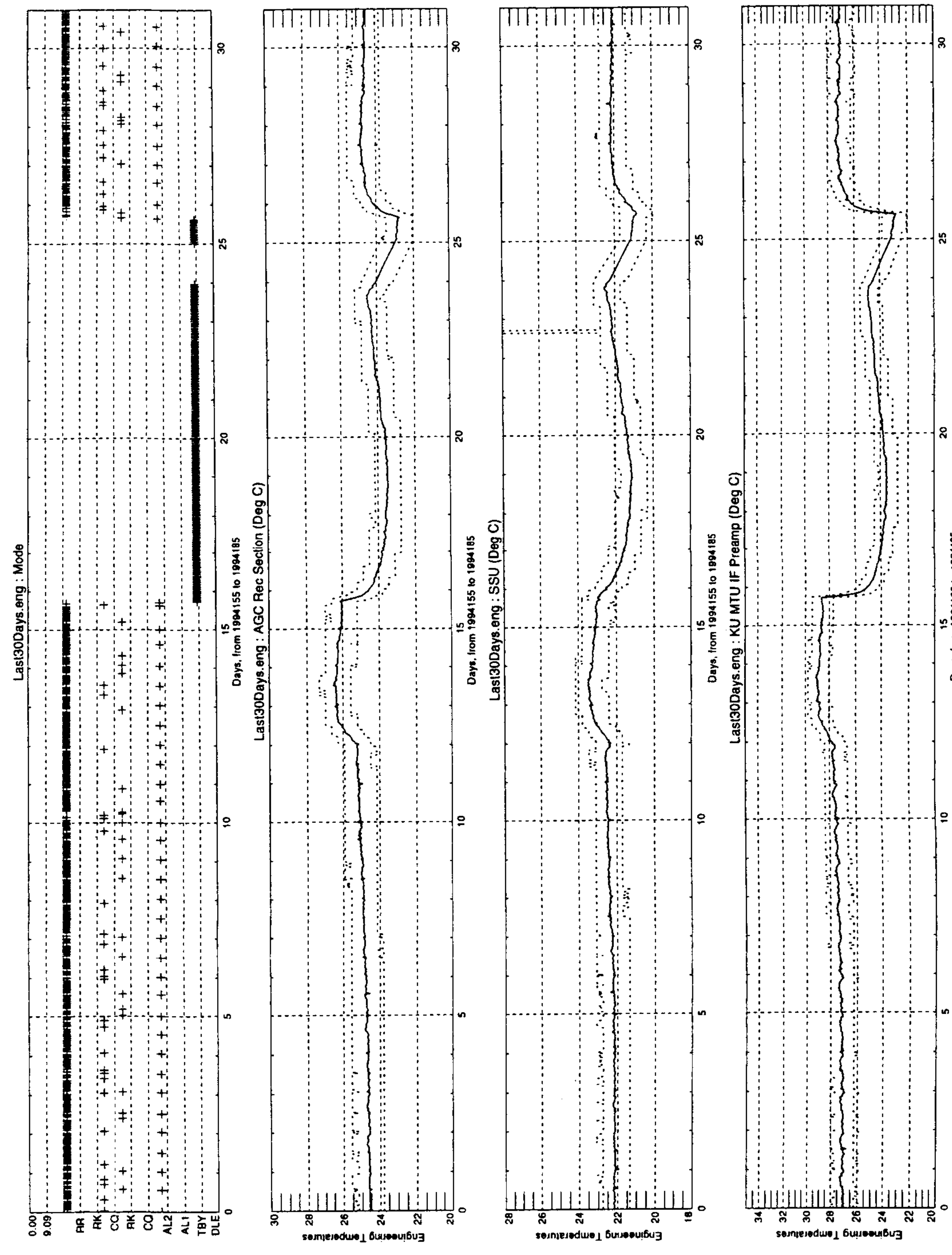


Figure A-8 Launch-to-Date CAL Plot Produced as Part of Weekly Processing

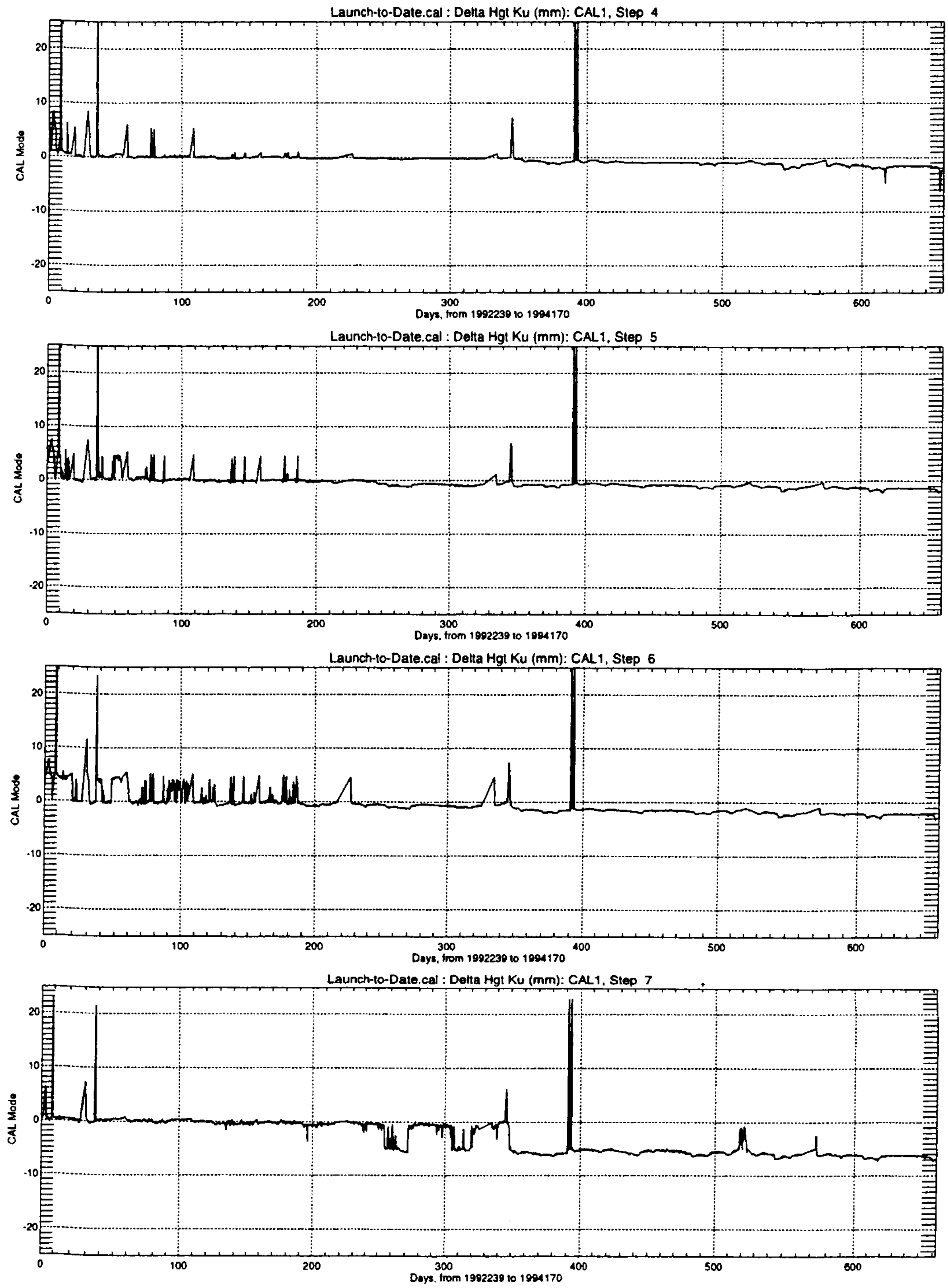


Figure A-8 Launch-to-Date CAL Plot Produced as Part of Weekly Processing (Continued)

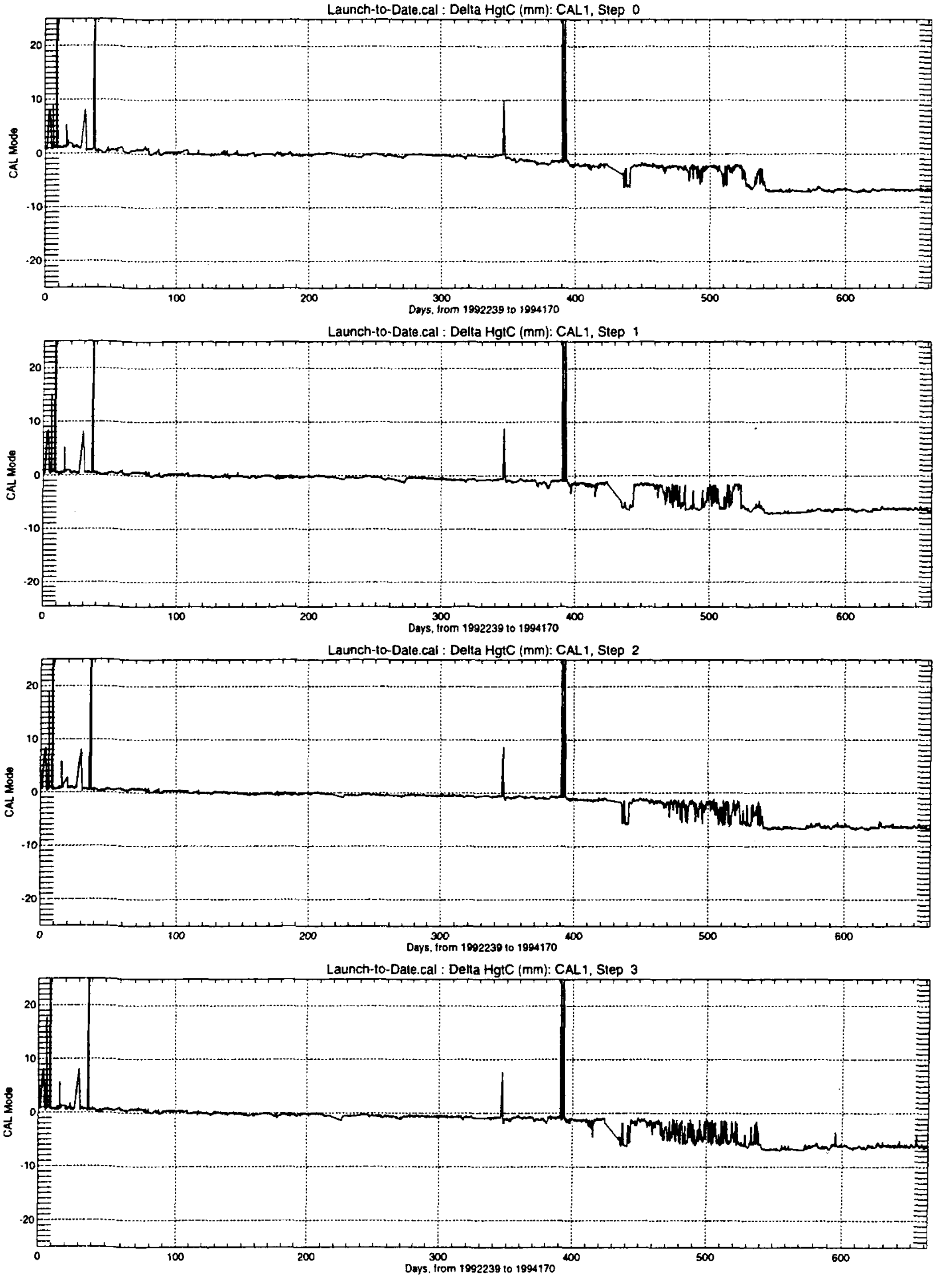


Figure A-8 Launch-to-Date CAL Plot Produced as Part of Weekly Processing (Continued)

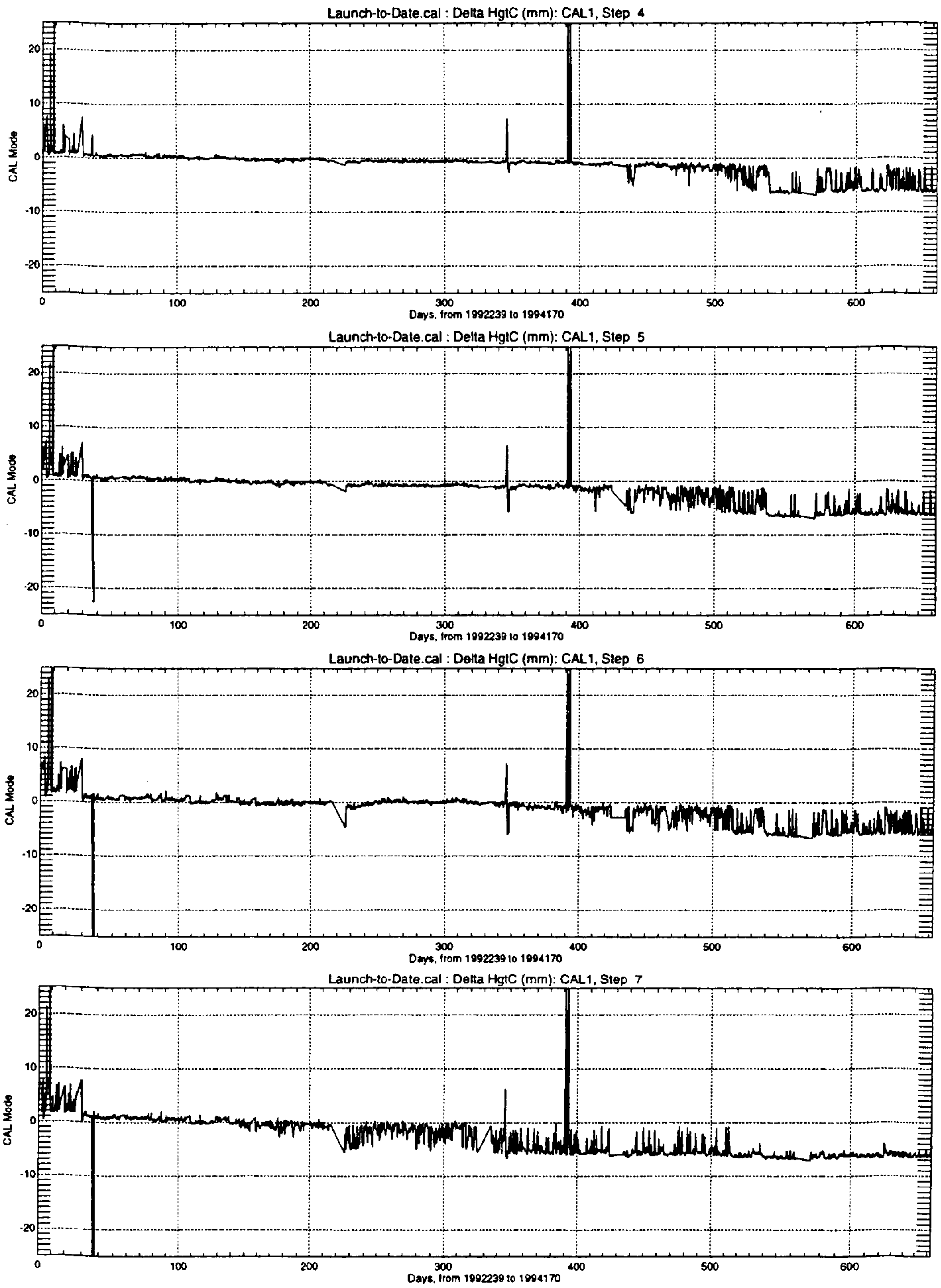


Figure A-8 Launch-to-Date CAL Plot Produced as Part of Weekly Processing (Continued)

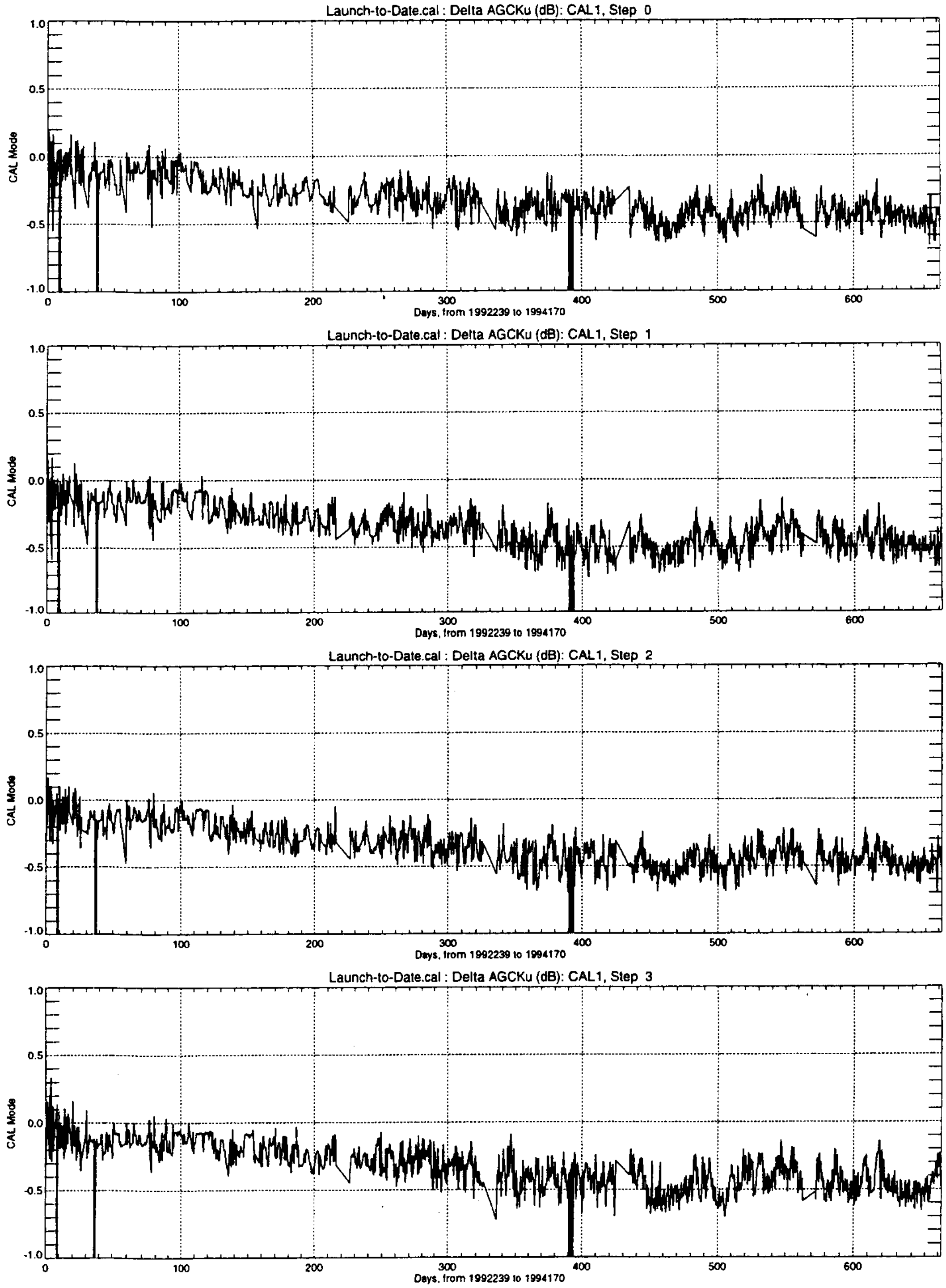


Figure A-8 Launch-to-Date CAL Plot Produced as Part of Weekly Processing (Continued)

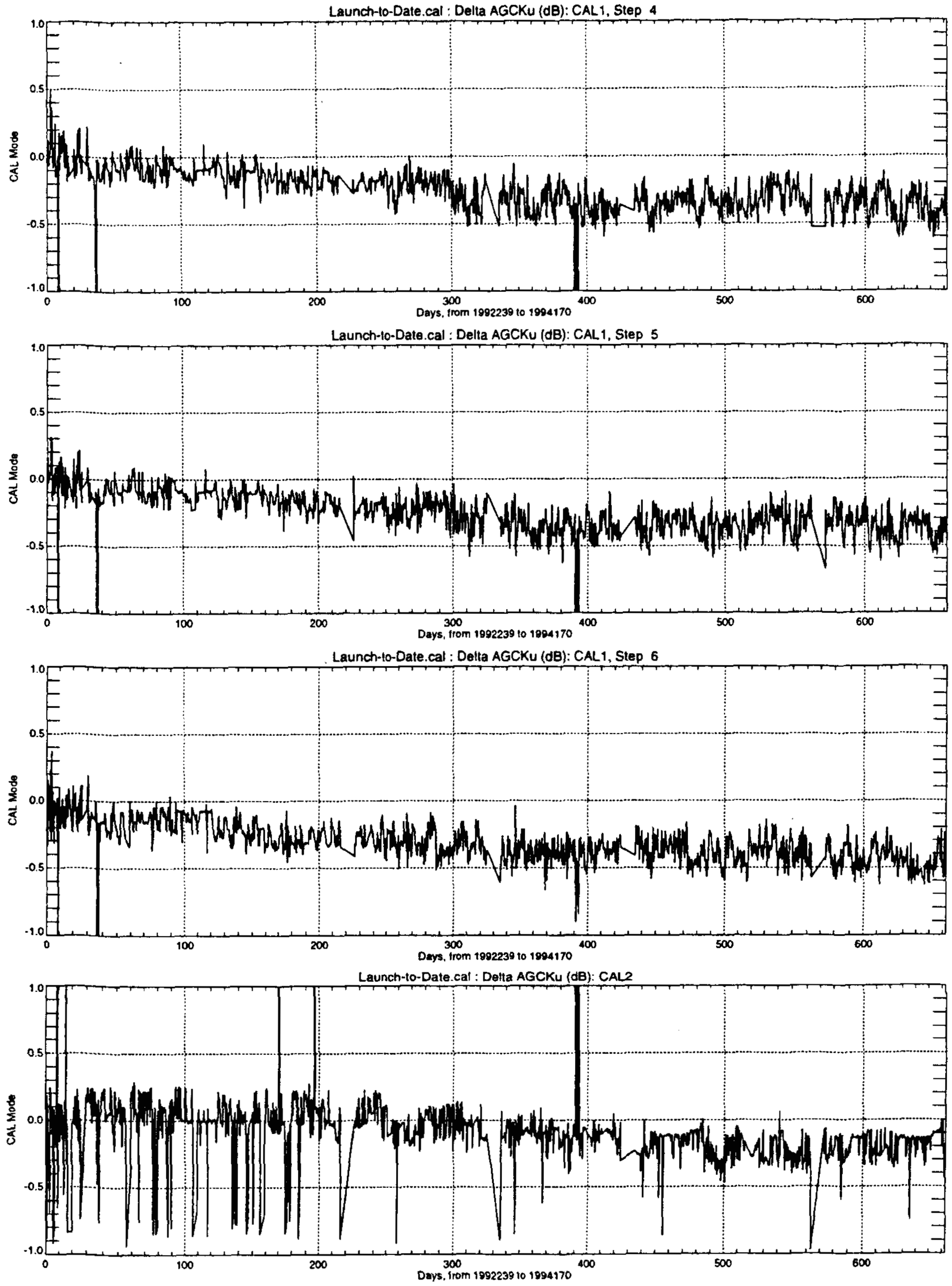


Figure A-8 Launch-to-Date CAL Plot Produced as Part of Weekly Processing (Continued)

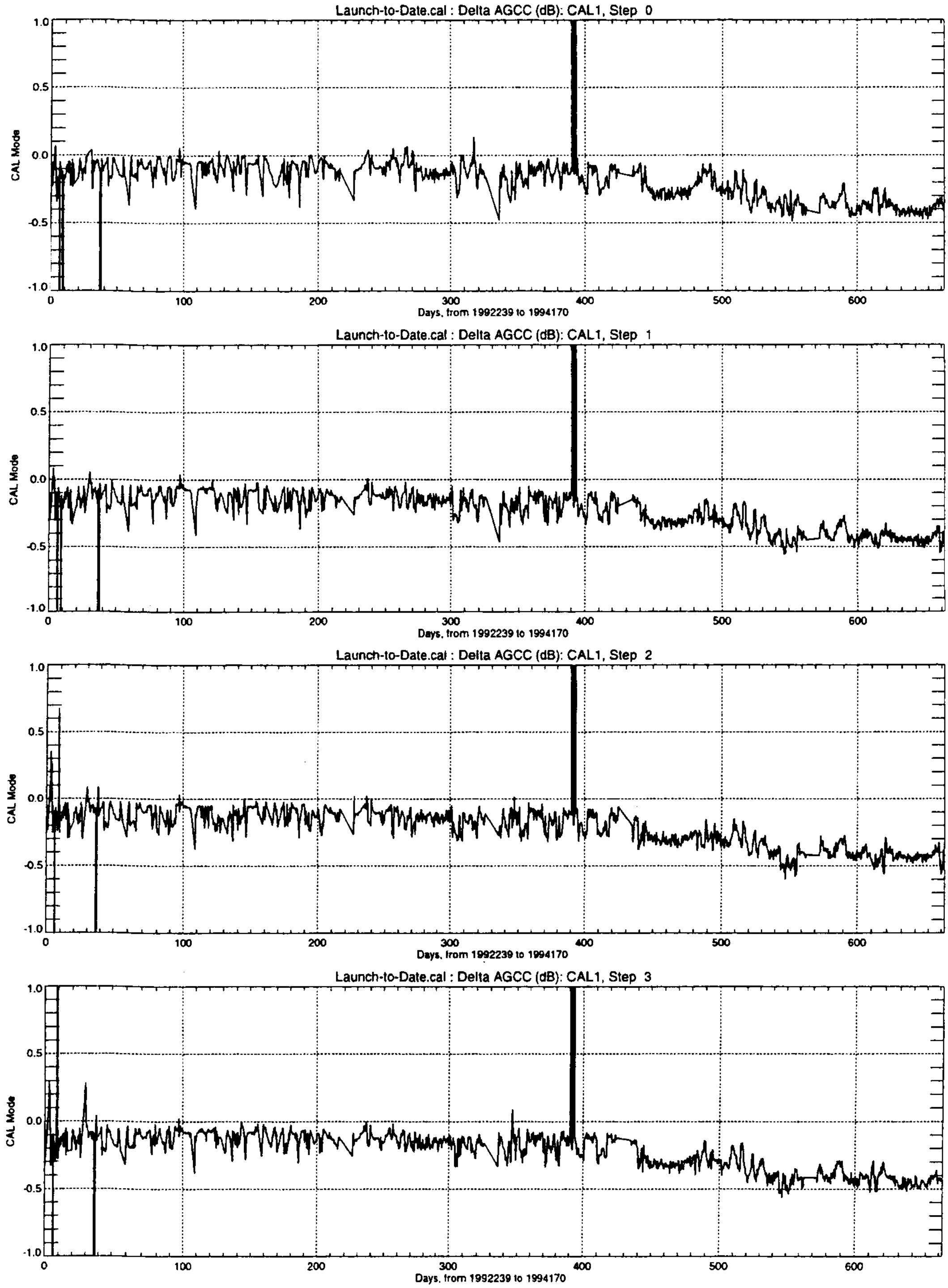


Figure A-8 Launch-to-Date CAL Plot Produced as Part of Weekly Processing (Continued)

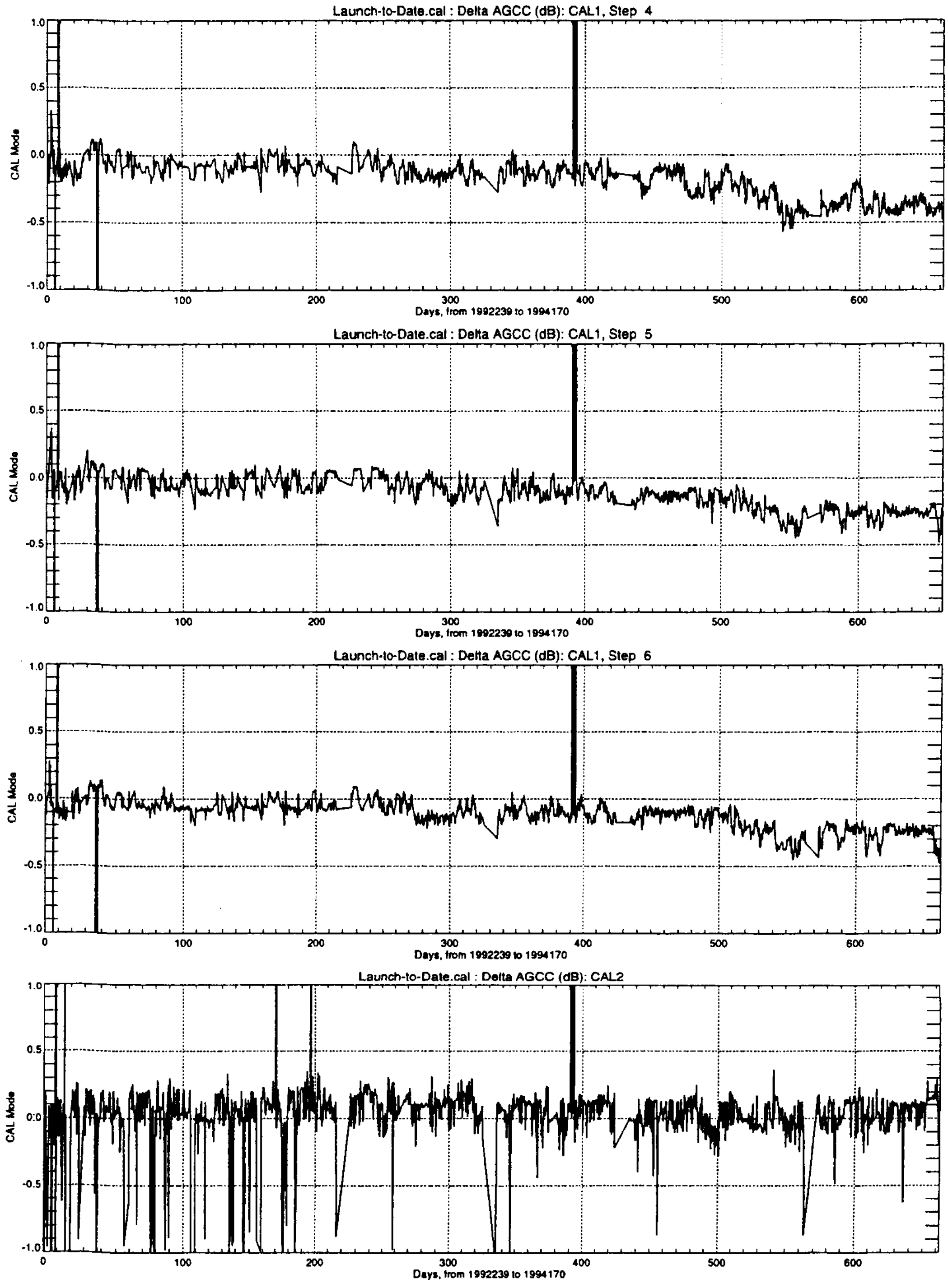


Figure A-8 Launch-to-Date CAL Plot Produced as Part of Weekly Processing (Continued)

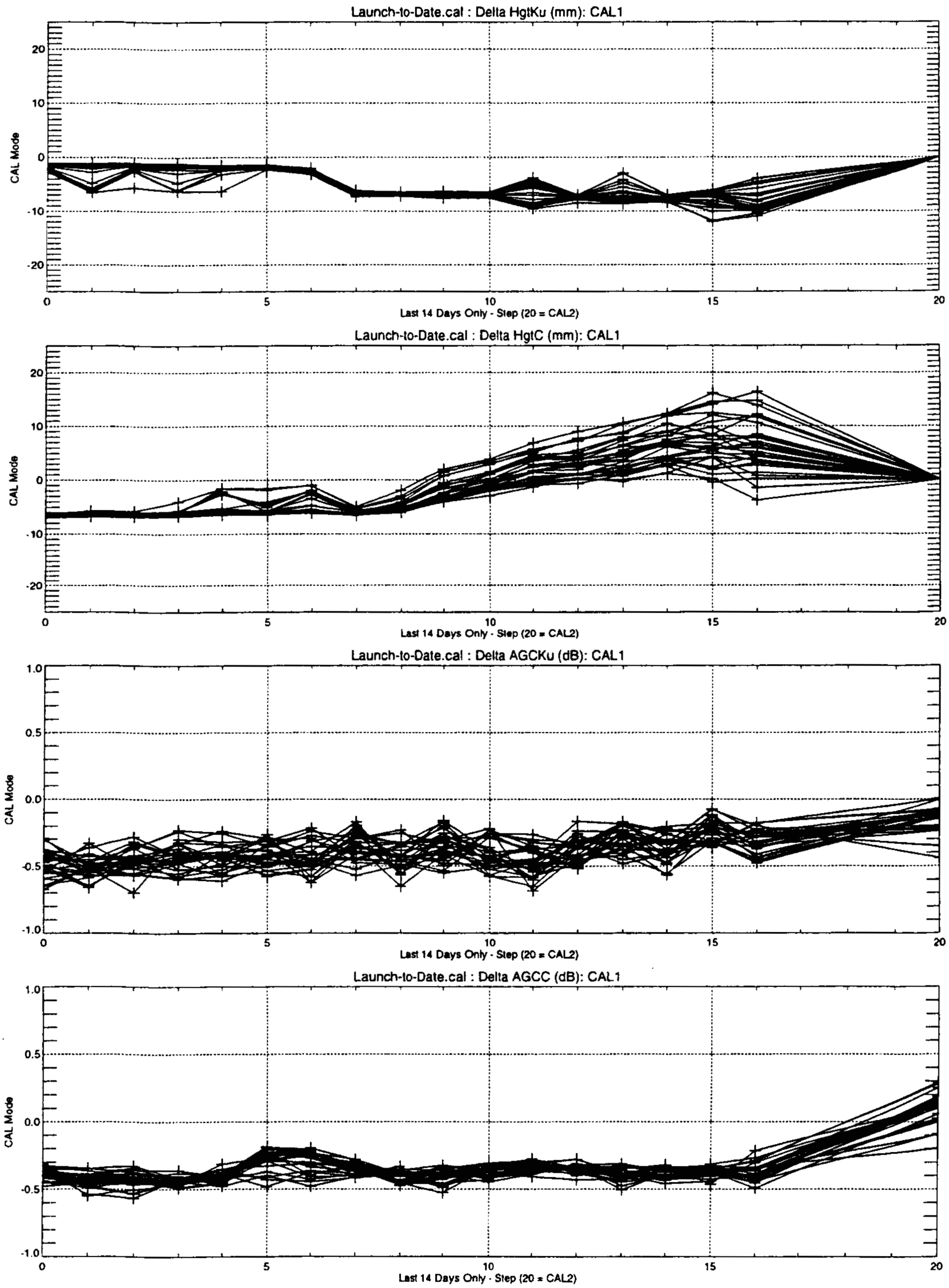


Figure A-8 Launch-to-Date CAL Plot Produced as Part of Weekly Processing (Continued)

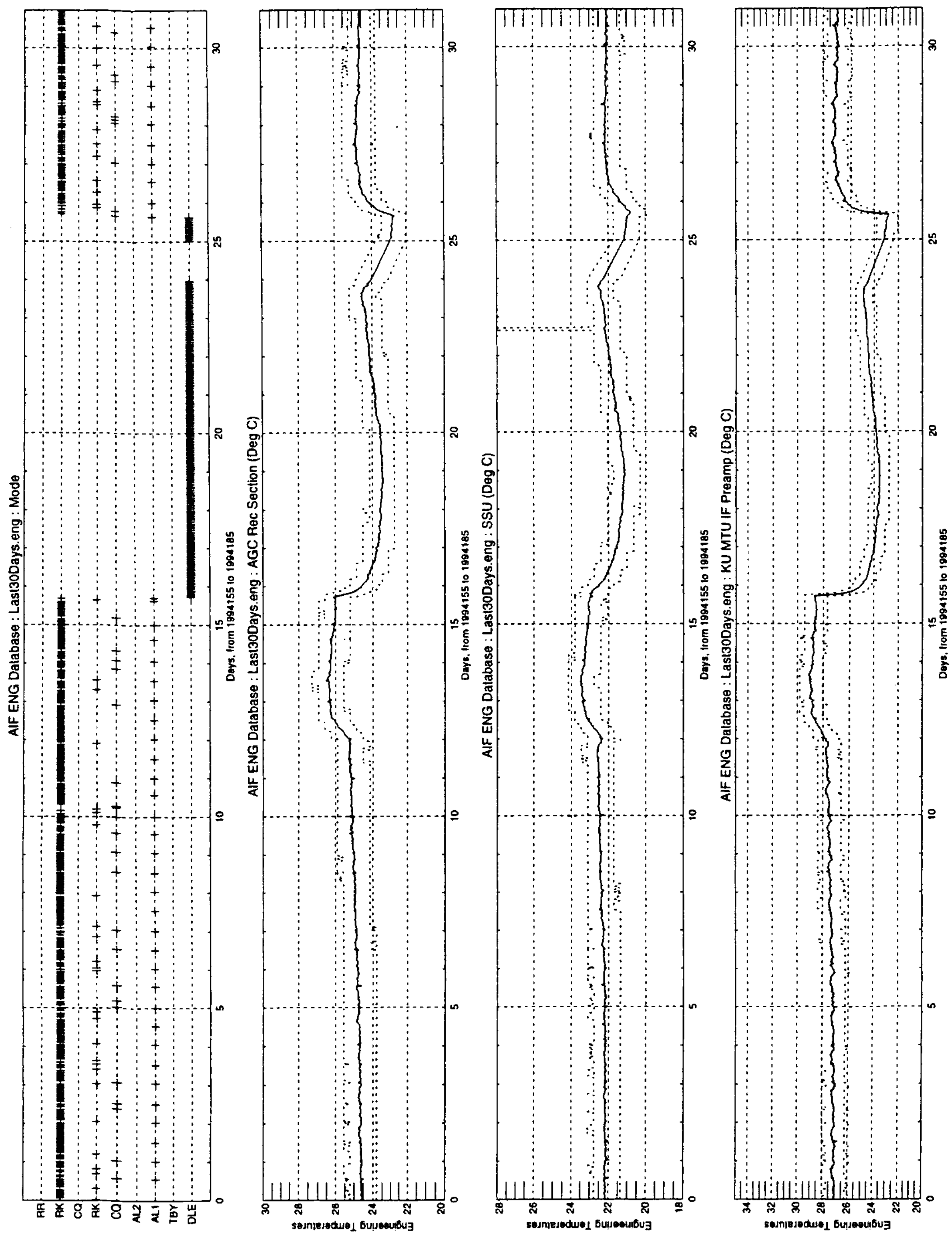


Figure A-9 Launch-toDate ENG Plot Produced as Part of Weekly Processing

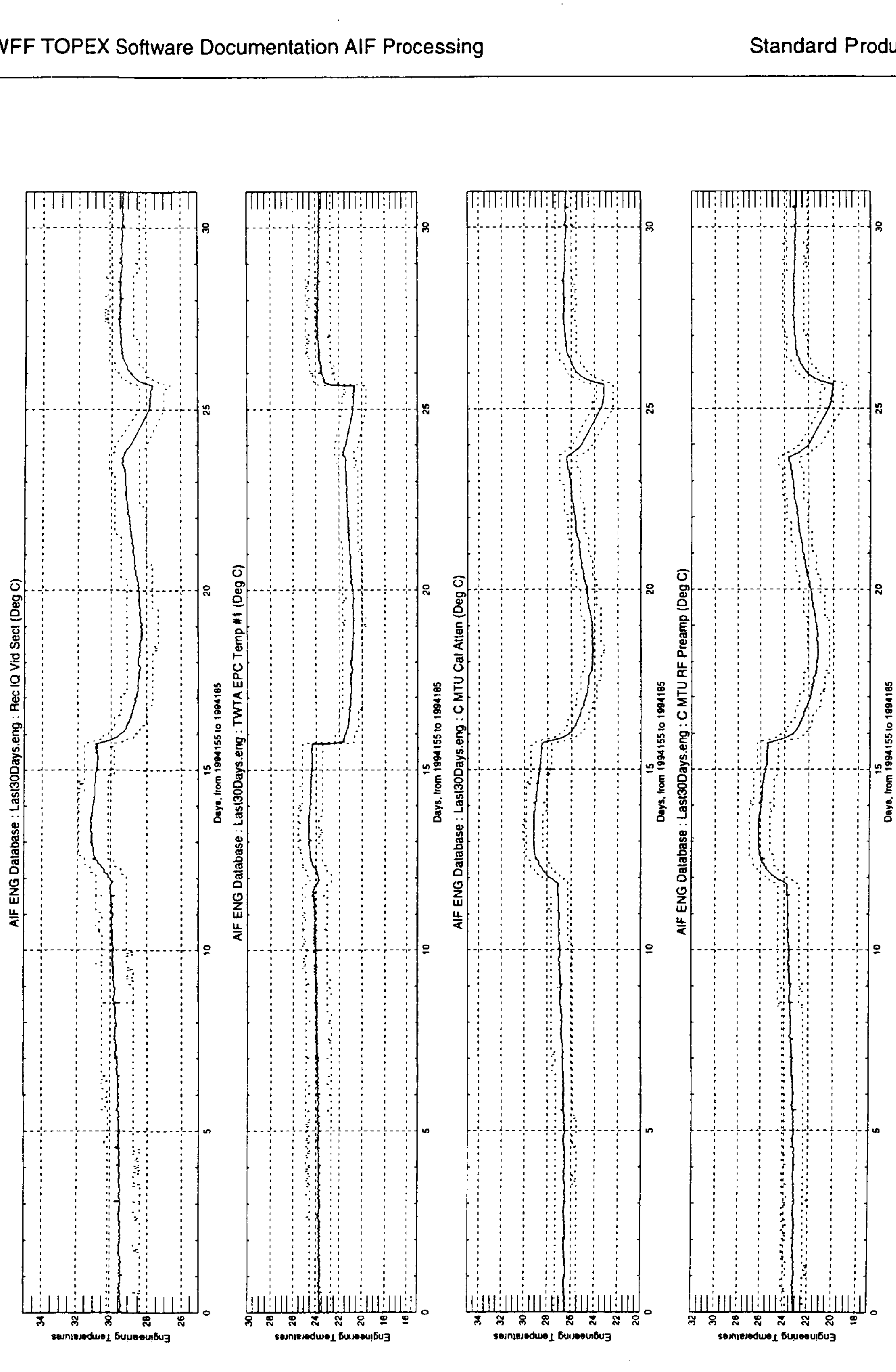


Figure A-9 Launch-toDate ENG Plot Produced as Part of Weekly Processing (Continued)

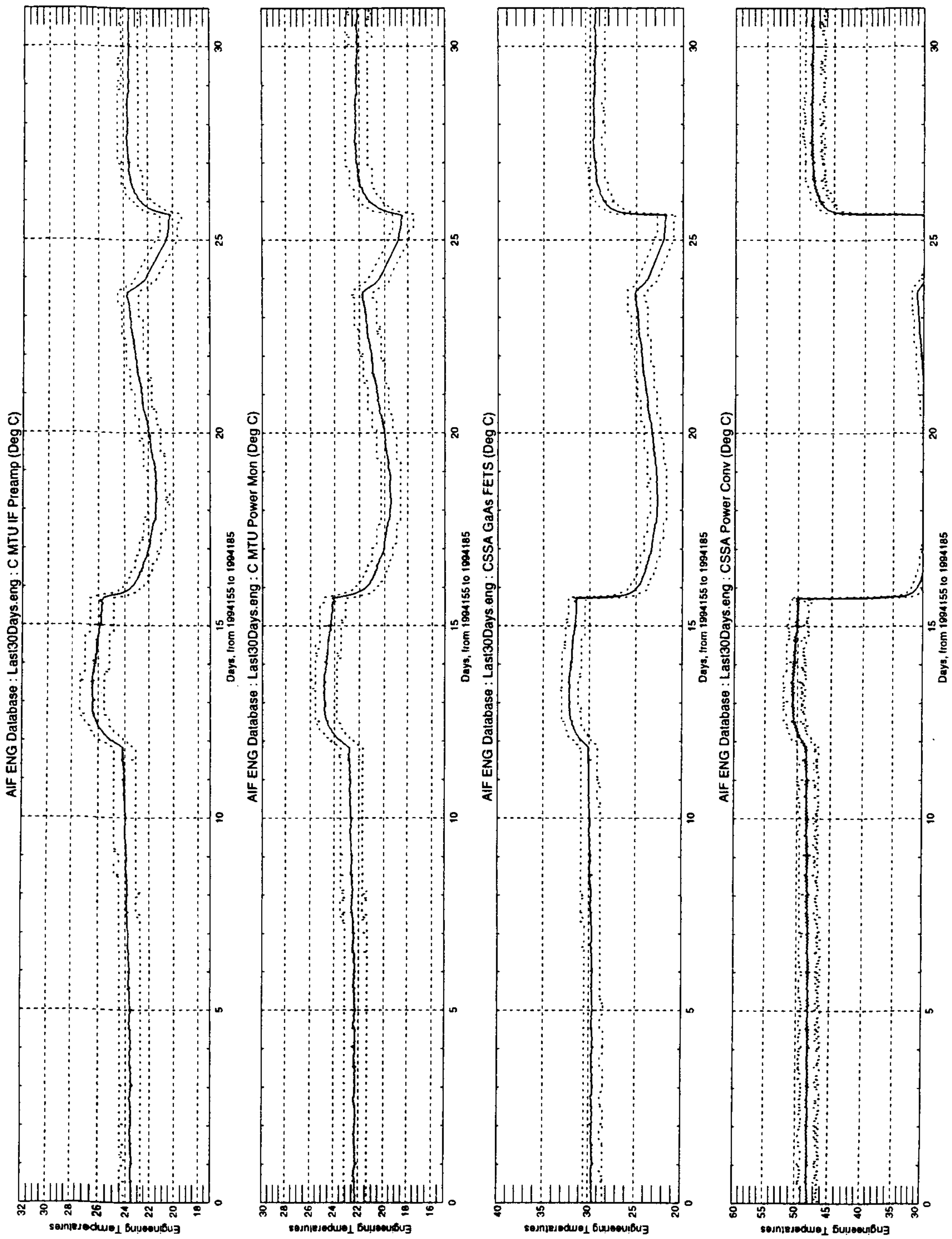


Figure A-9 Launch-toDate ENG Plot Produced as Part of Weekly Processing (Continued)

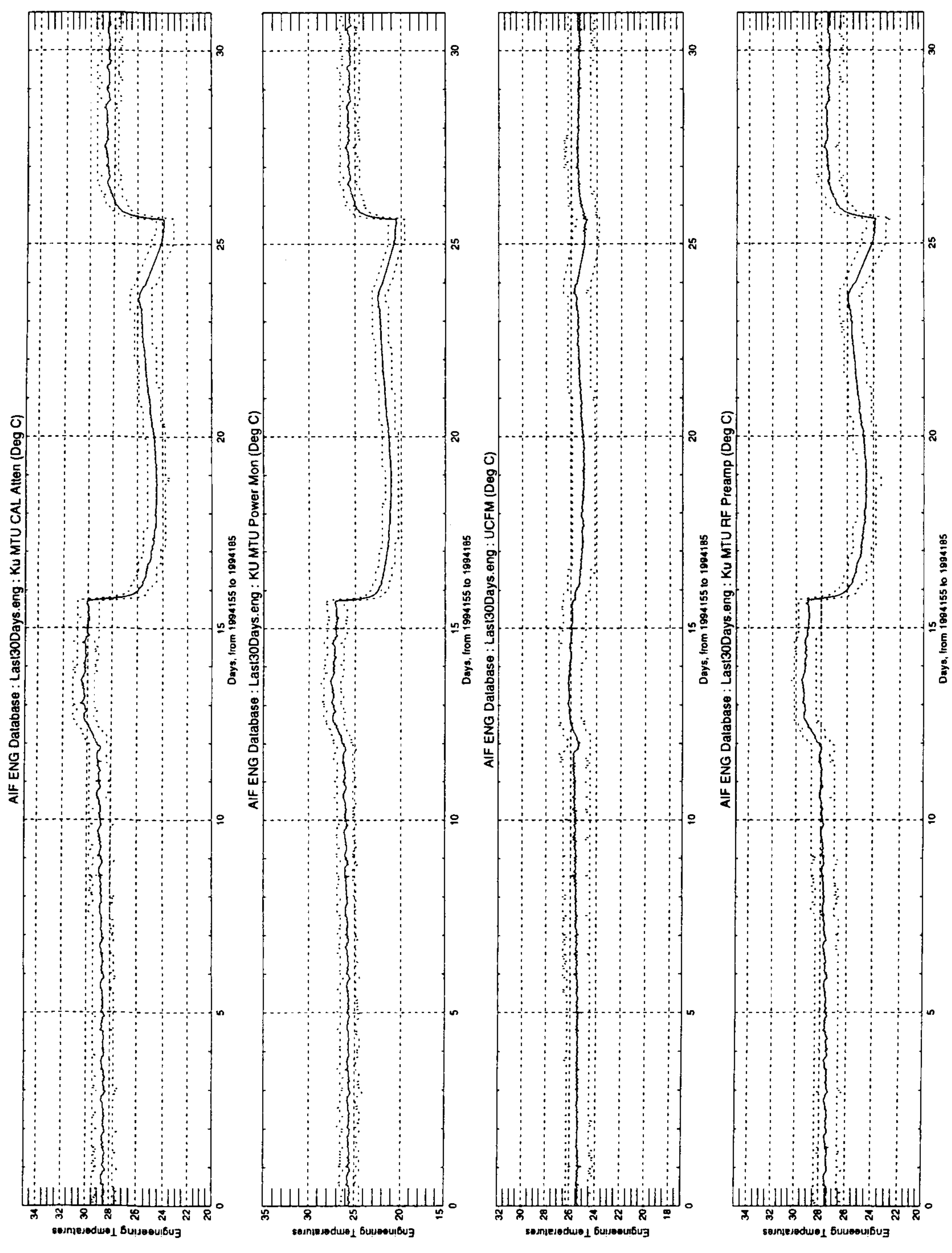


Figure A-9 Launch-toDate ENG Plot Produced as Part of Weekly Processing (Continued)

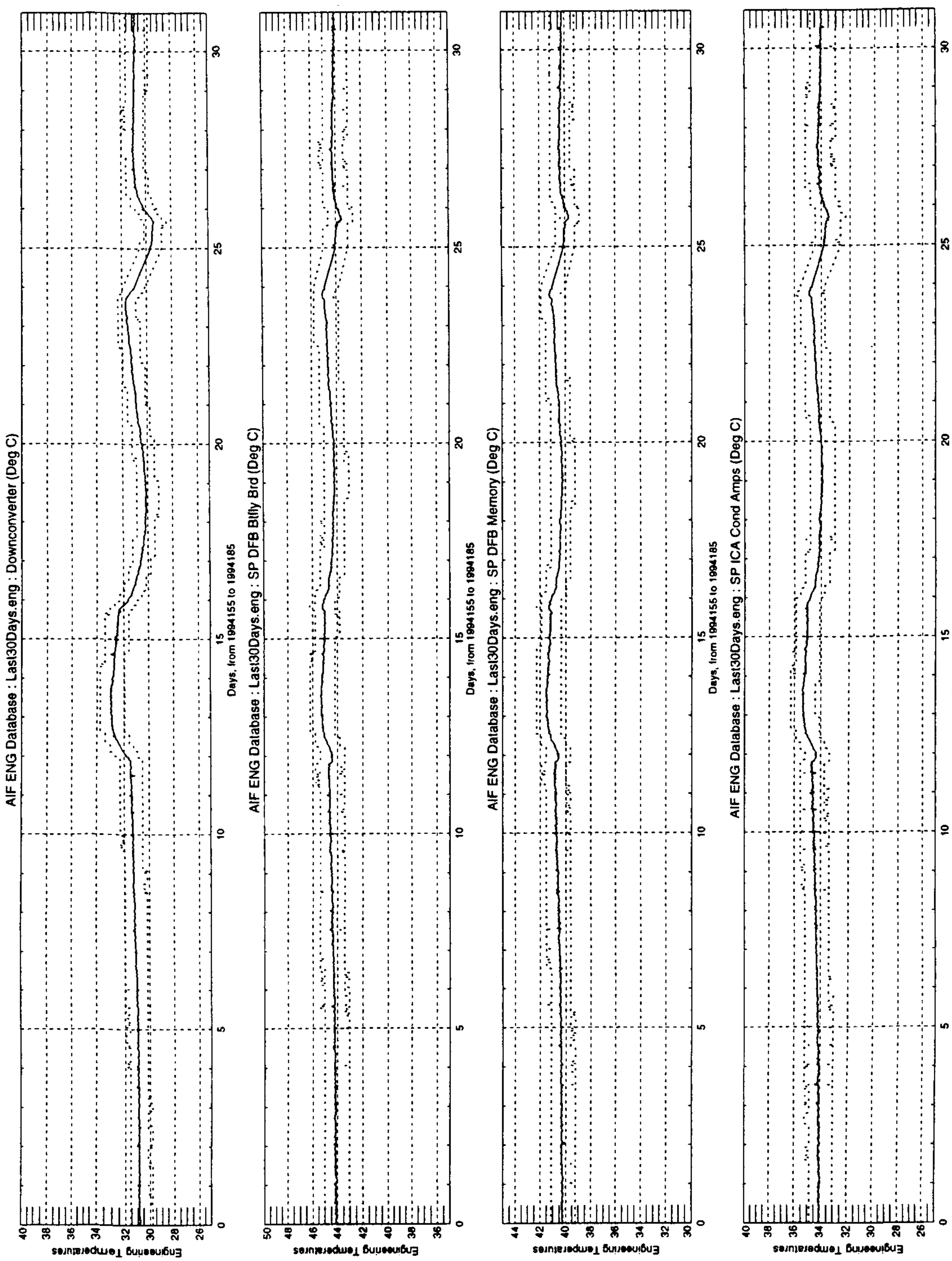


Figure A-9 Launch-toDate ENG Plot Produced as Part of Weekly Processing (Continued)

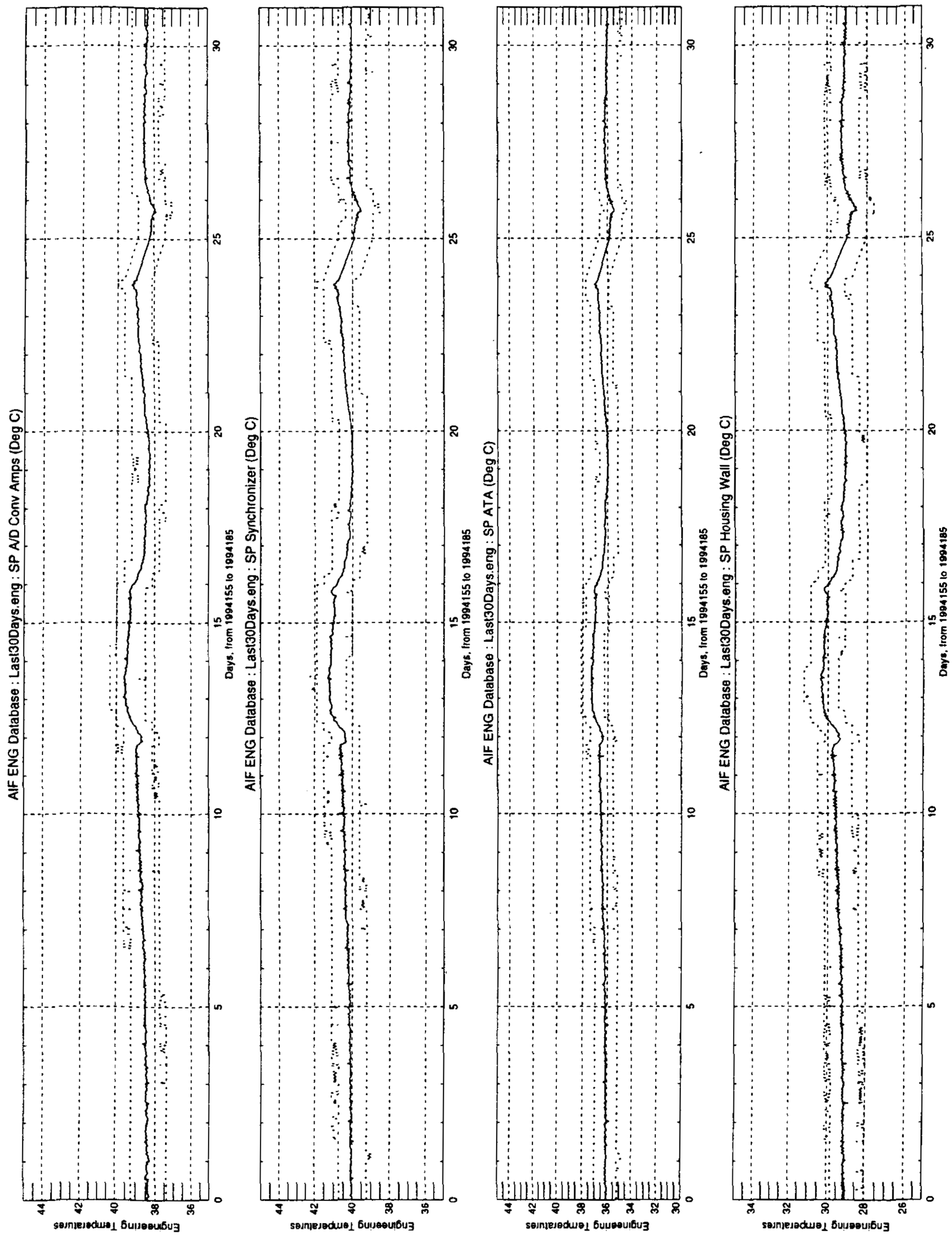


Figure A-9 Launch-toDate ENG Plot Produced as Part of Weekly Processing (Continued)

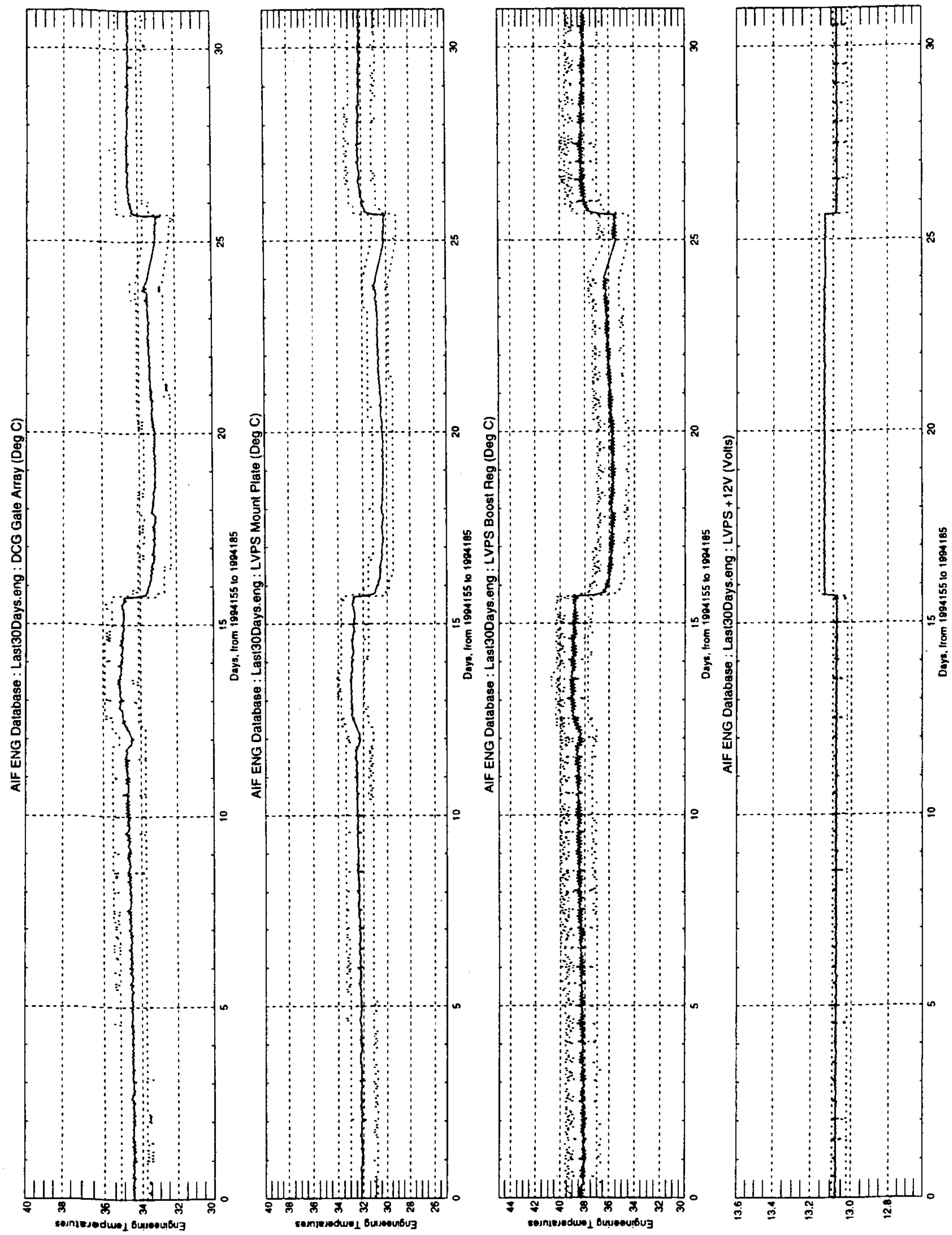


Figure A-9 Launch-toDate ENG Plot Produced as Part of Weekly Processing (Continued)

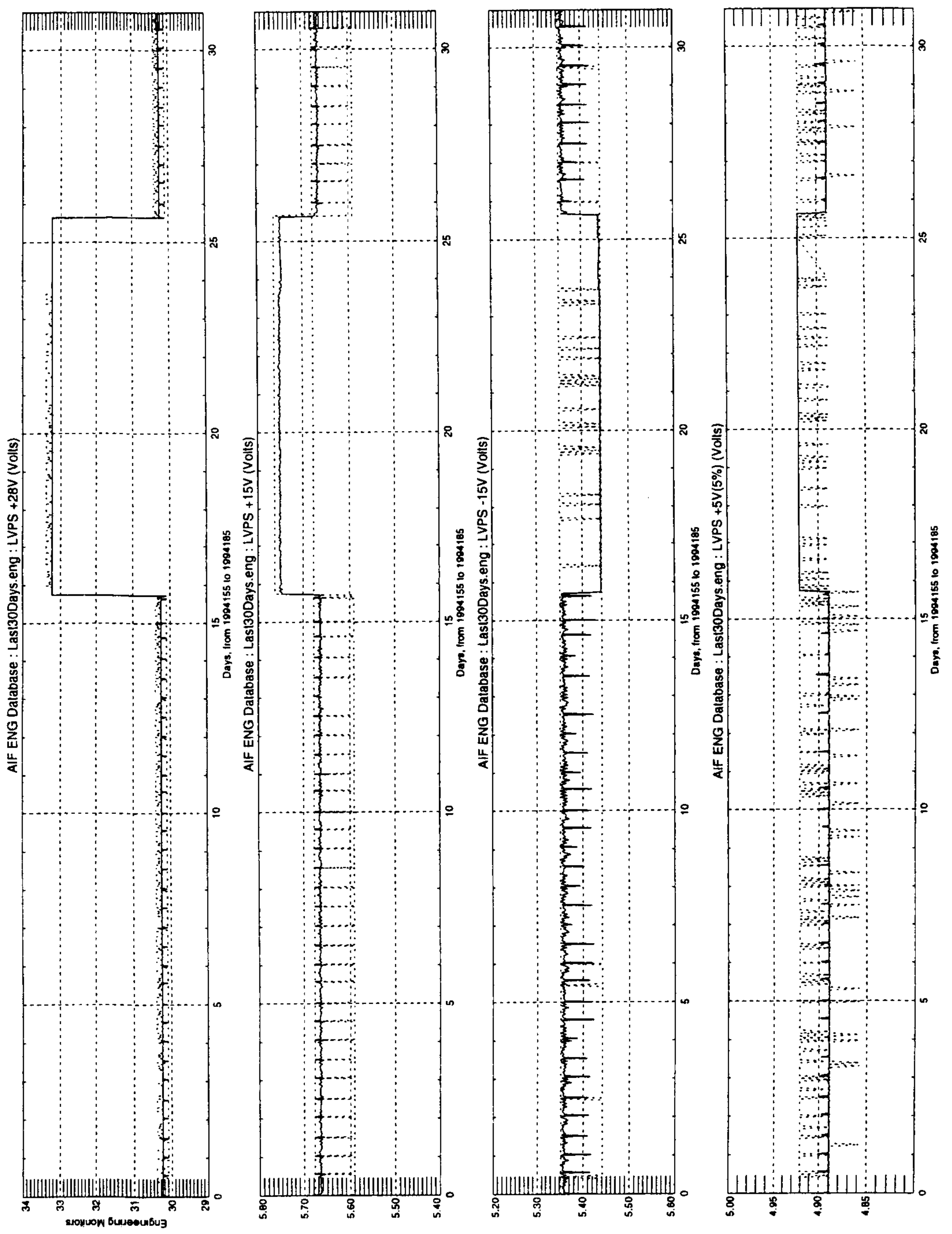


Figure A-9 Launch-toDate ENG Plot Produced as Part of Weekly Processing (Continued)

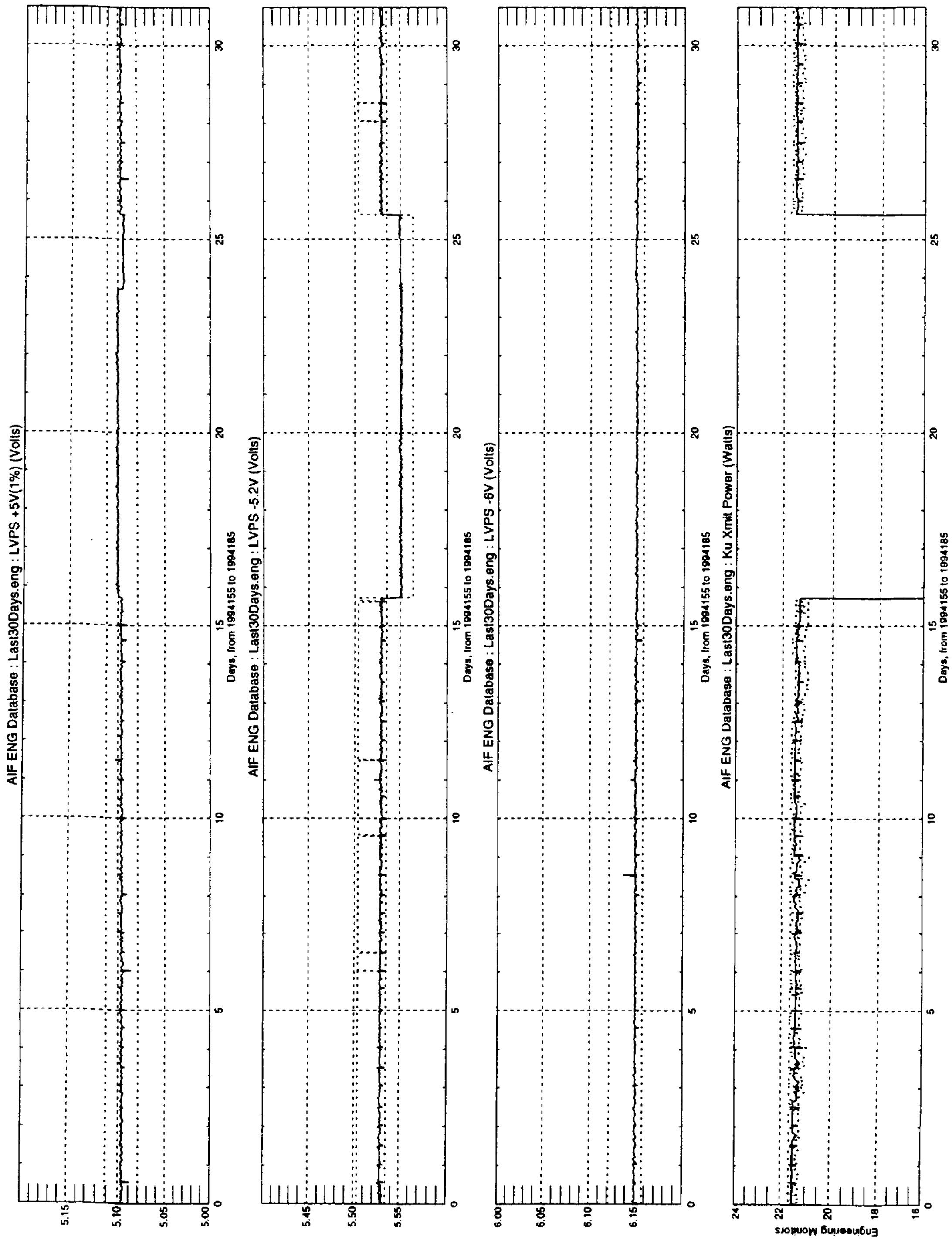


Figure A-9 Launch-toDate ENG Plot Produced as Part of Weekly Processing (Continued)

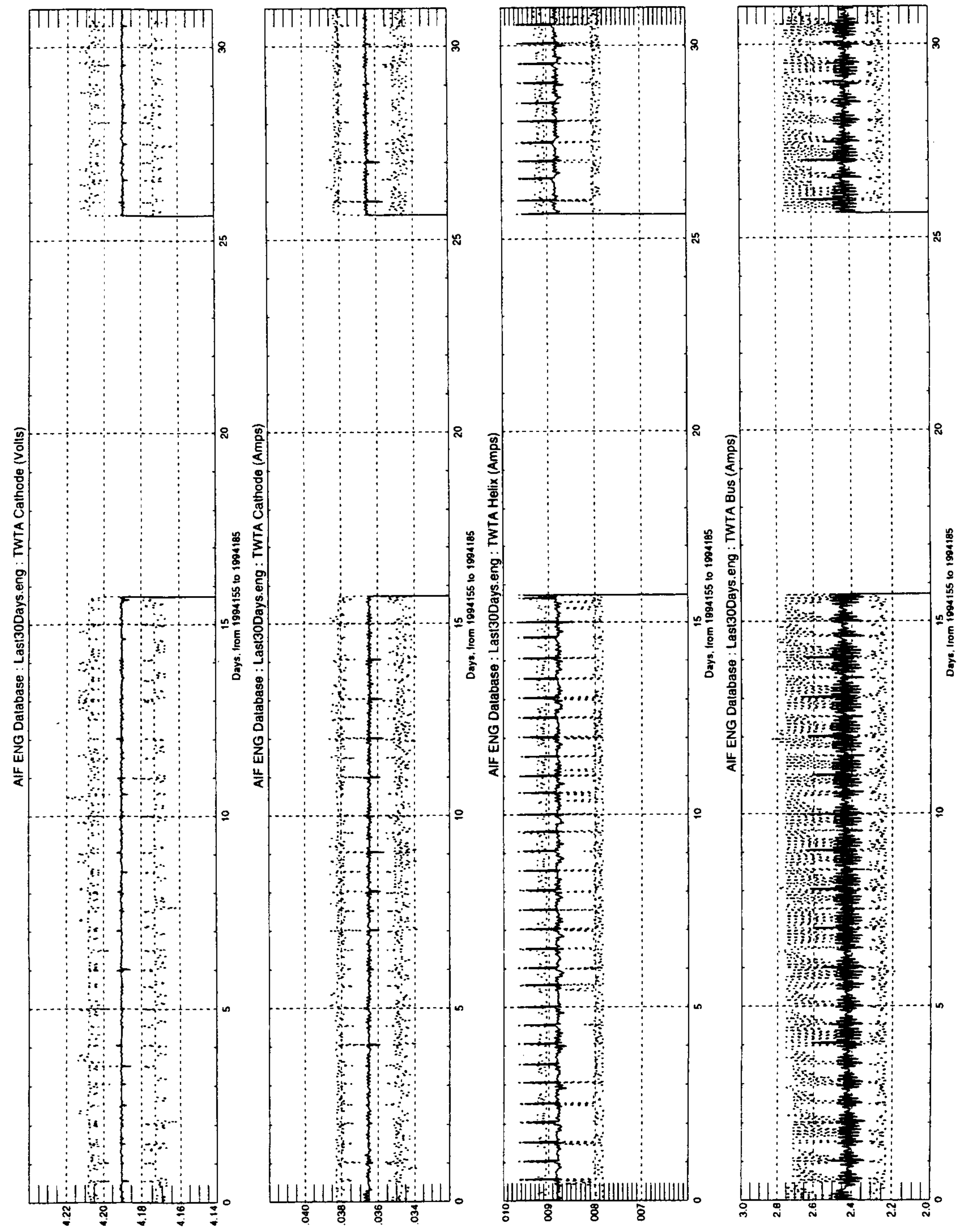


Figure A-9 Launch-toDate ENG Plot Produced as Part of Weekly Processing (Continued)

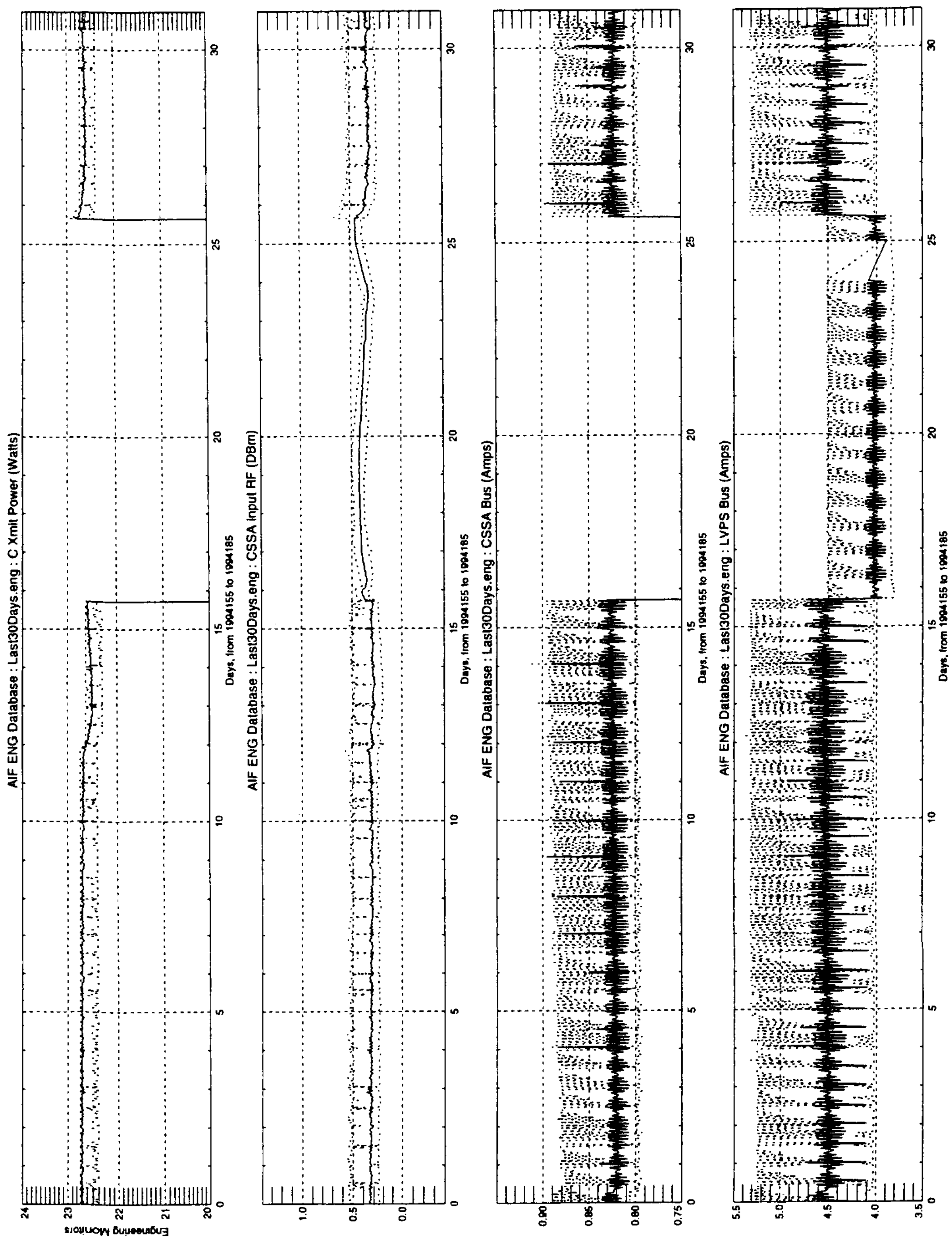
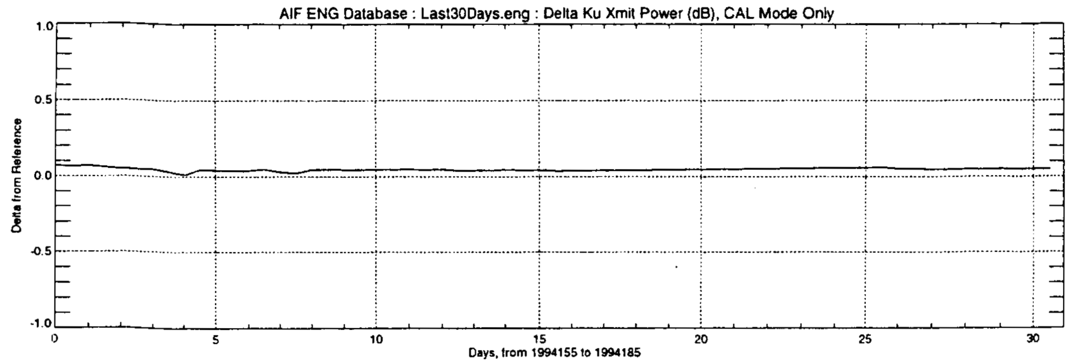


Figure A-9 Launch-toDate ENG Plot Produced as Part of Weekly Processing (Continued)



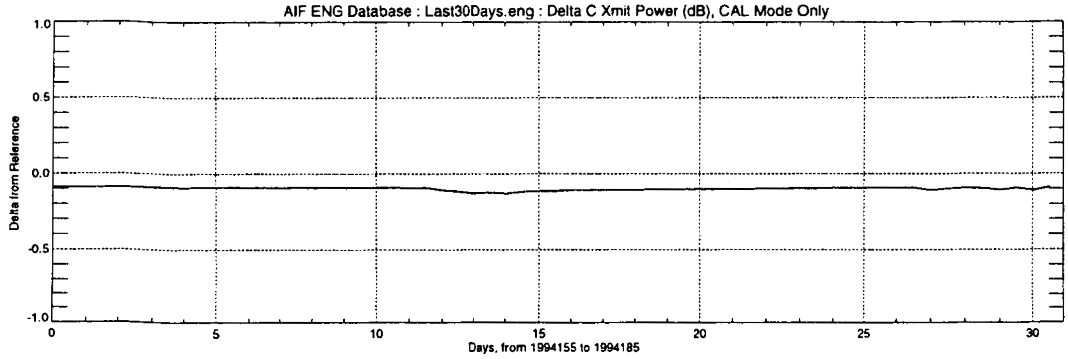


Figure A-9 Launch-toDate ENG Plot Produced as Part of Weekly Processing (Continued)

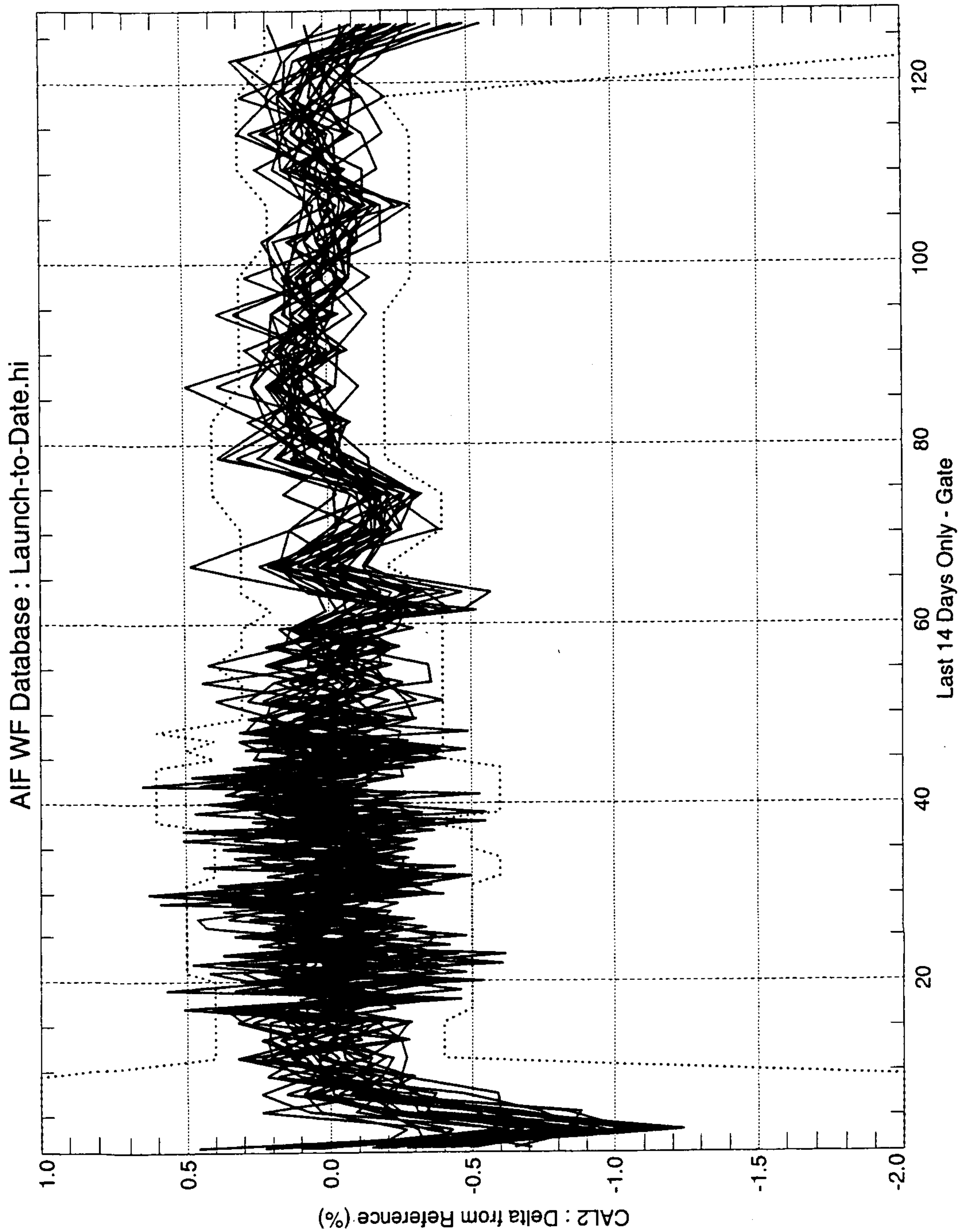


Figure A-10 Launch-to-Date WF Difference Plot Produced as Part of Weekly Processing

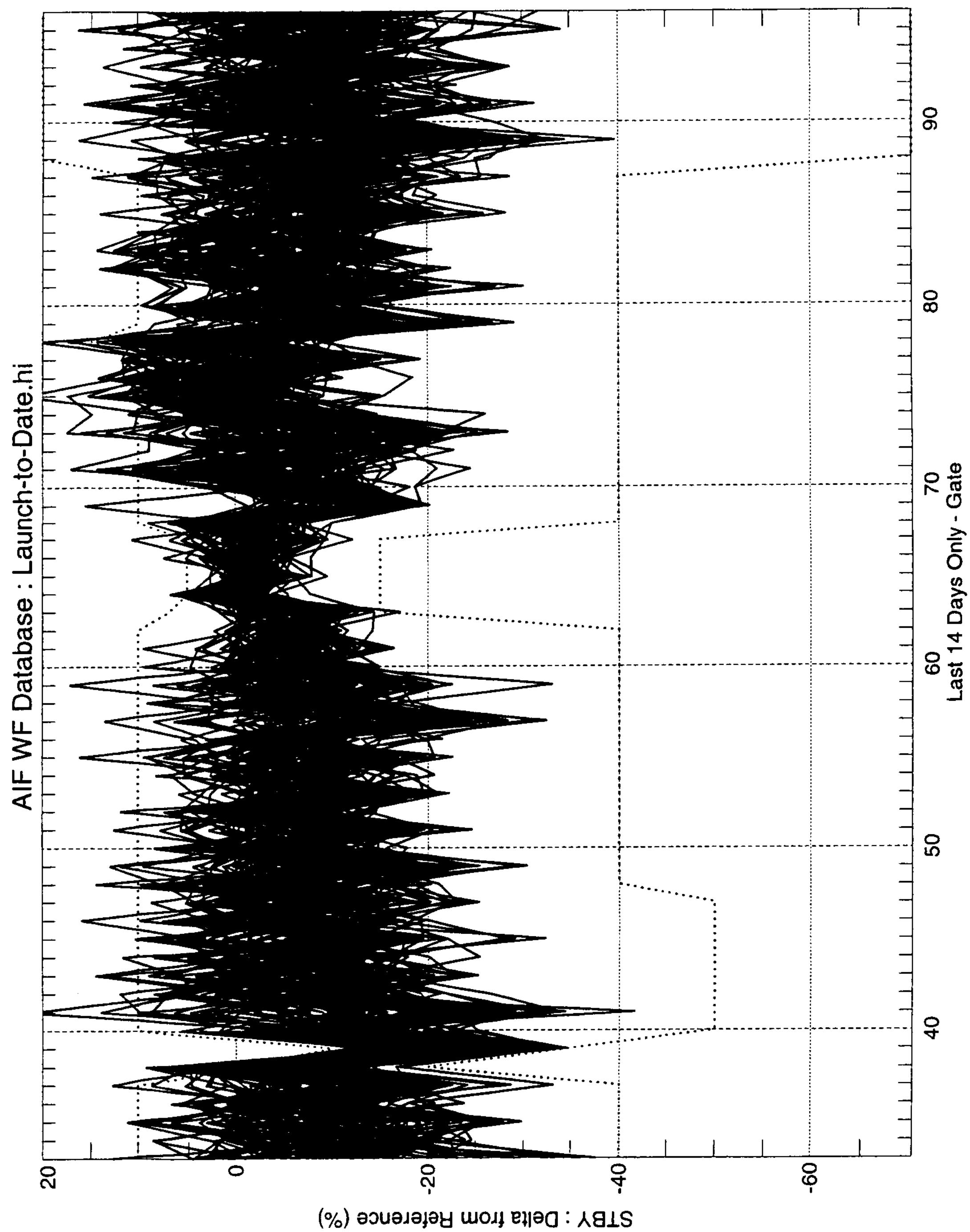


Figure A-10 Launch-to-Date WF Difference Plot Produced as Part of Weekly Processing

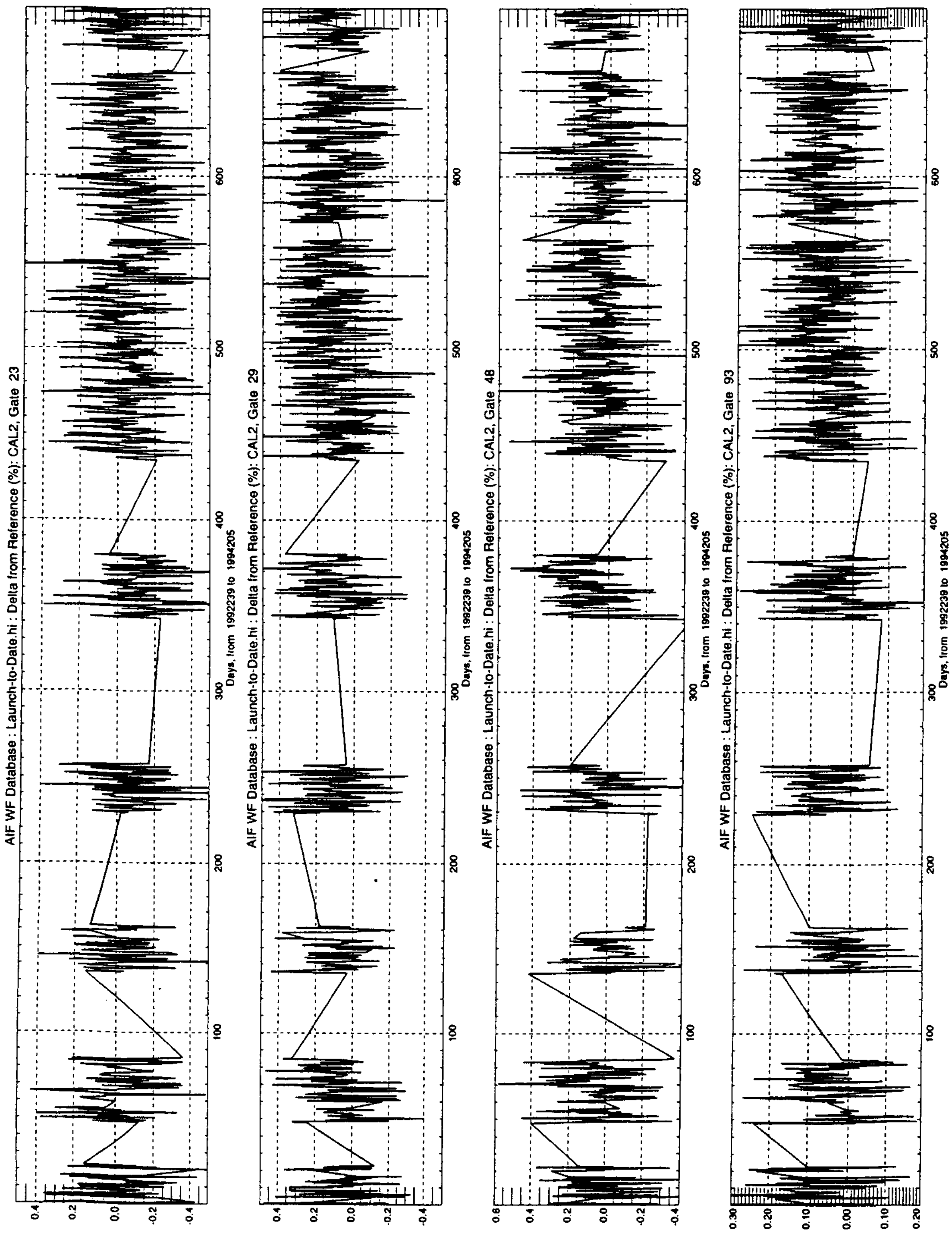


Figure A-10 Launch-to-Date WF Difference Plot Produced as Part of Weekly Processing

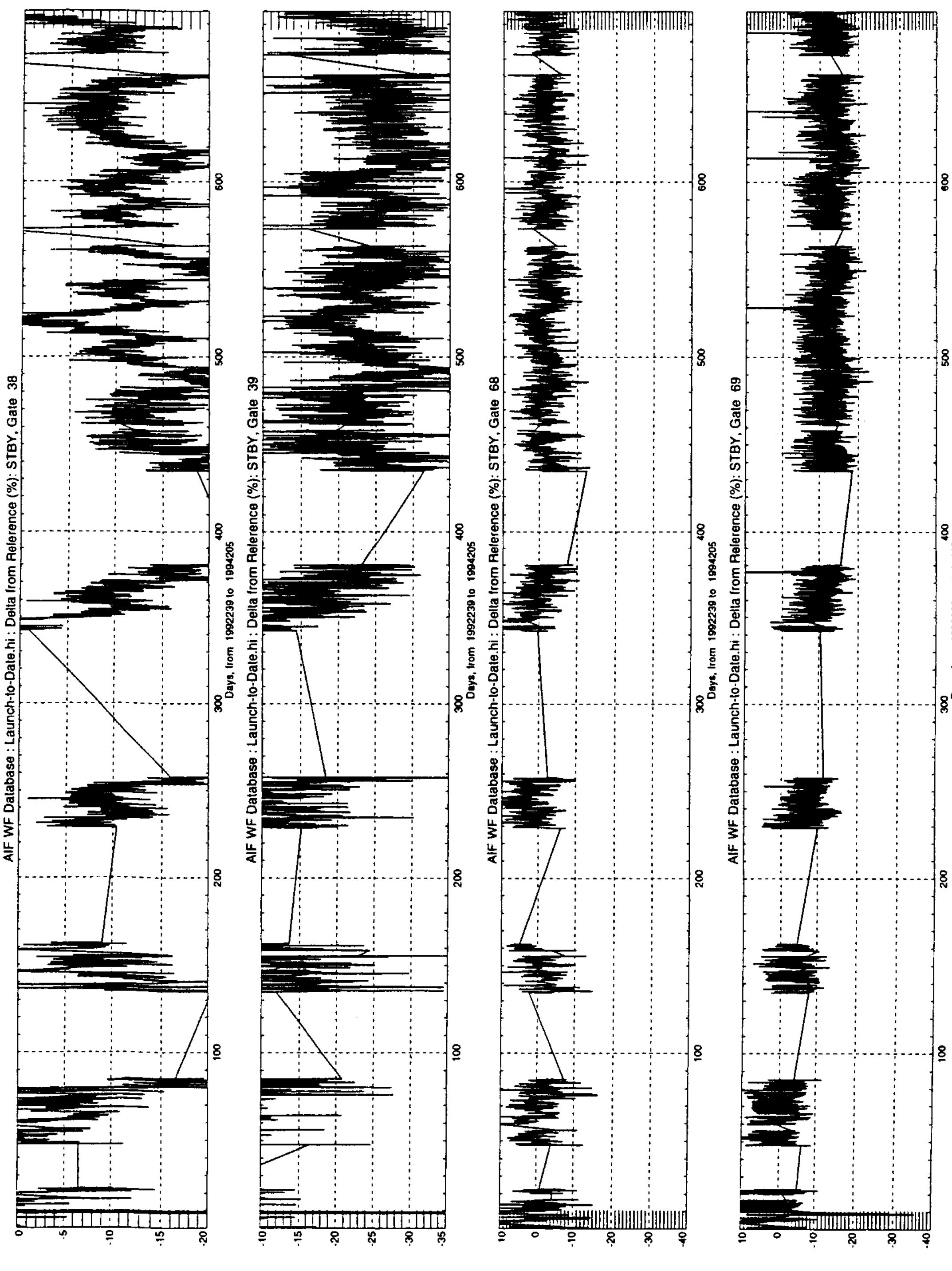


Figure A-10 Launch-to-Date WF Difference Plot Produced as Part of Weekly Processing

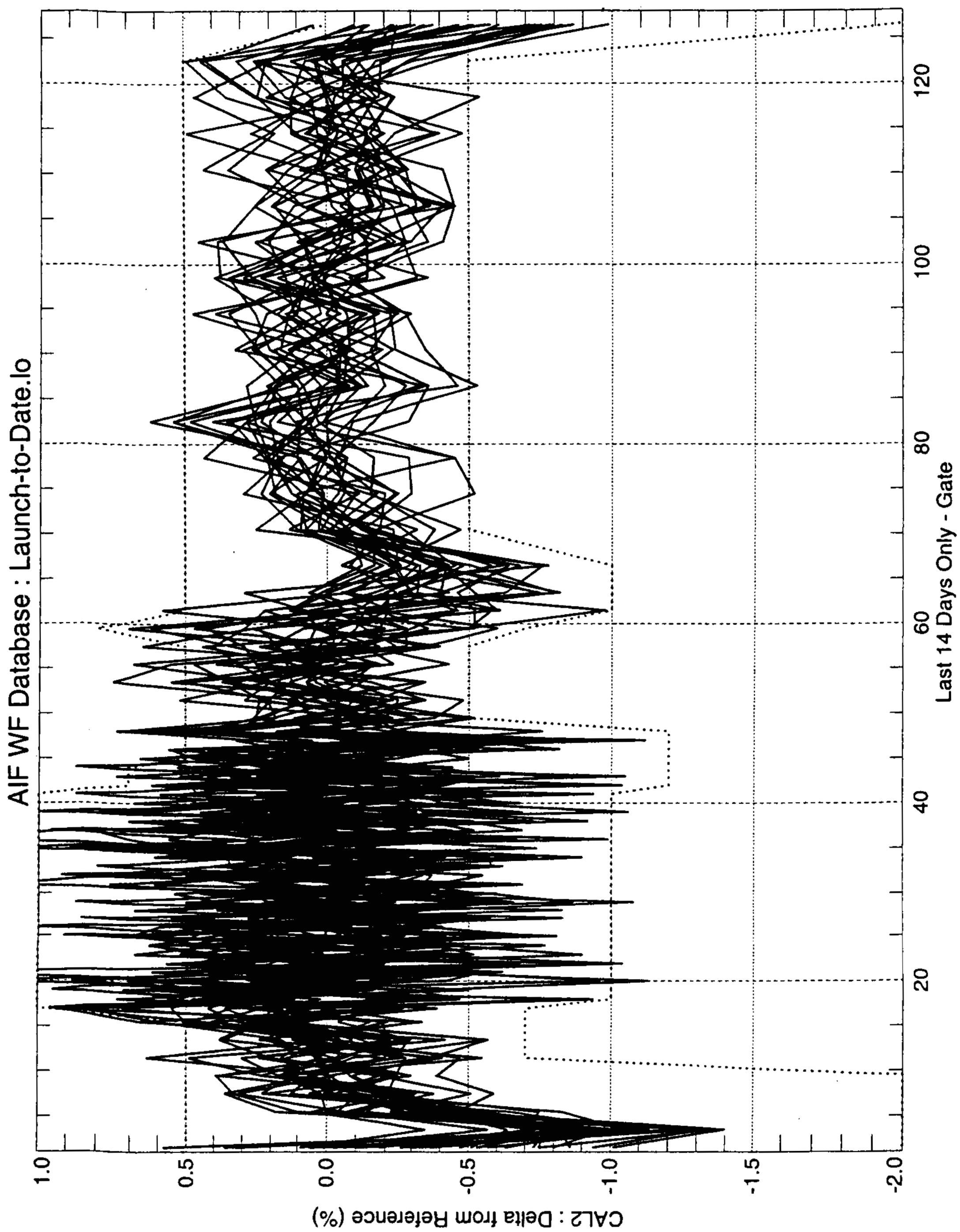


Figure A-10 Launch-to-Date WF Difference Plot Produced as Part of Weekly Processing

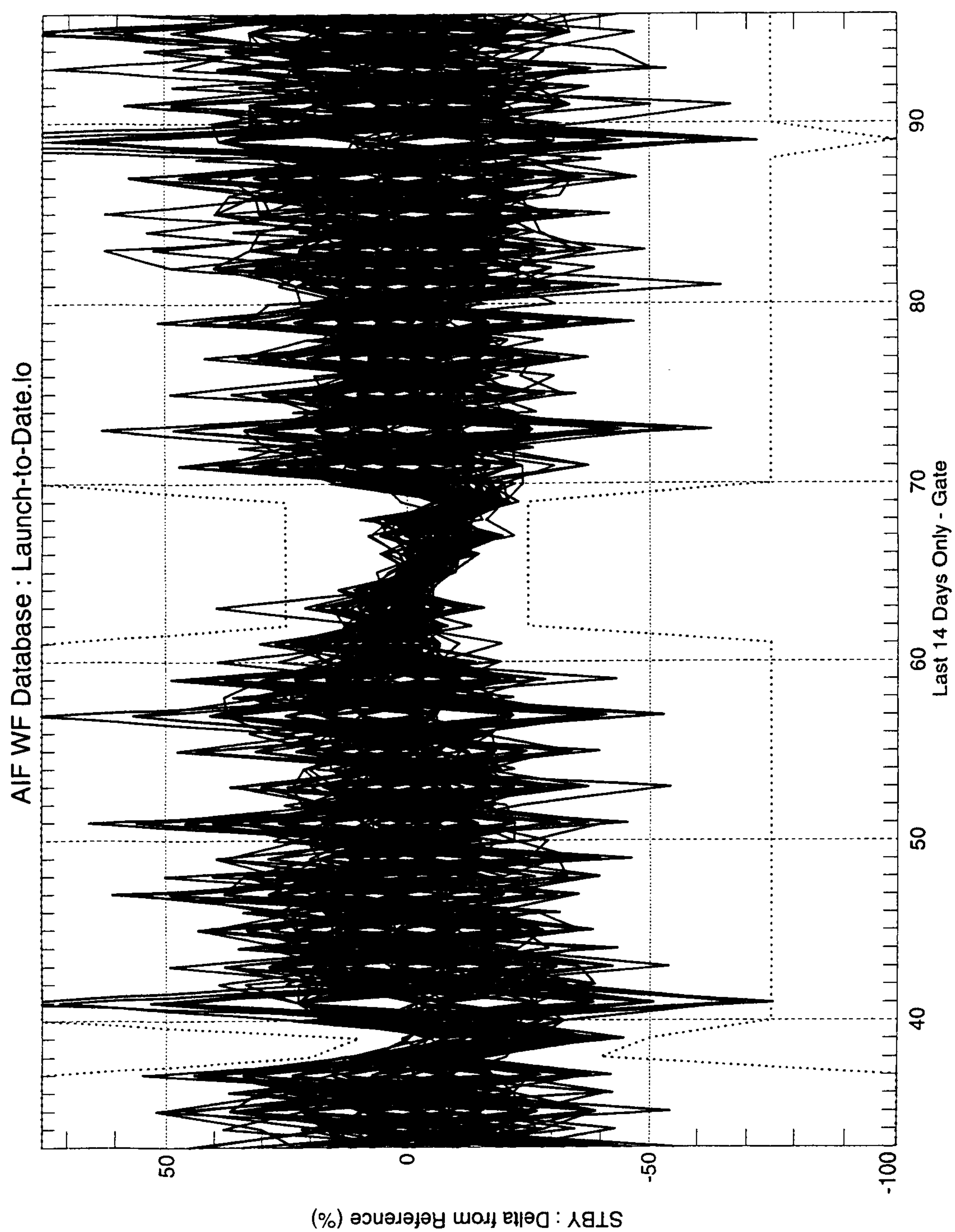


Figure A-10 Launch-to-Date WF Difference Plot Produced as Part of Weekly Processing

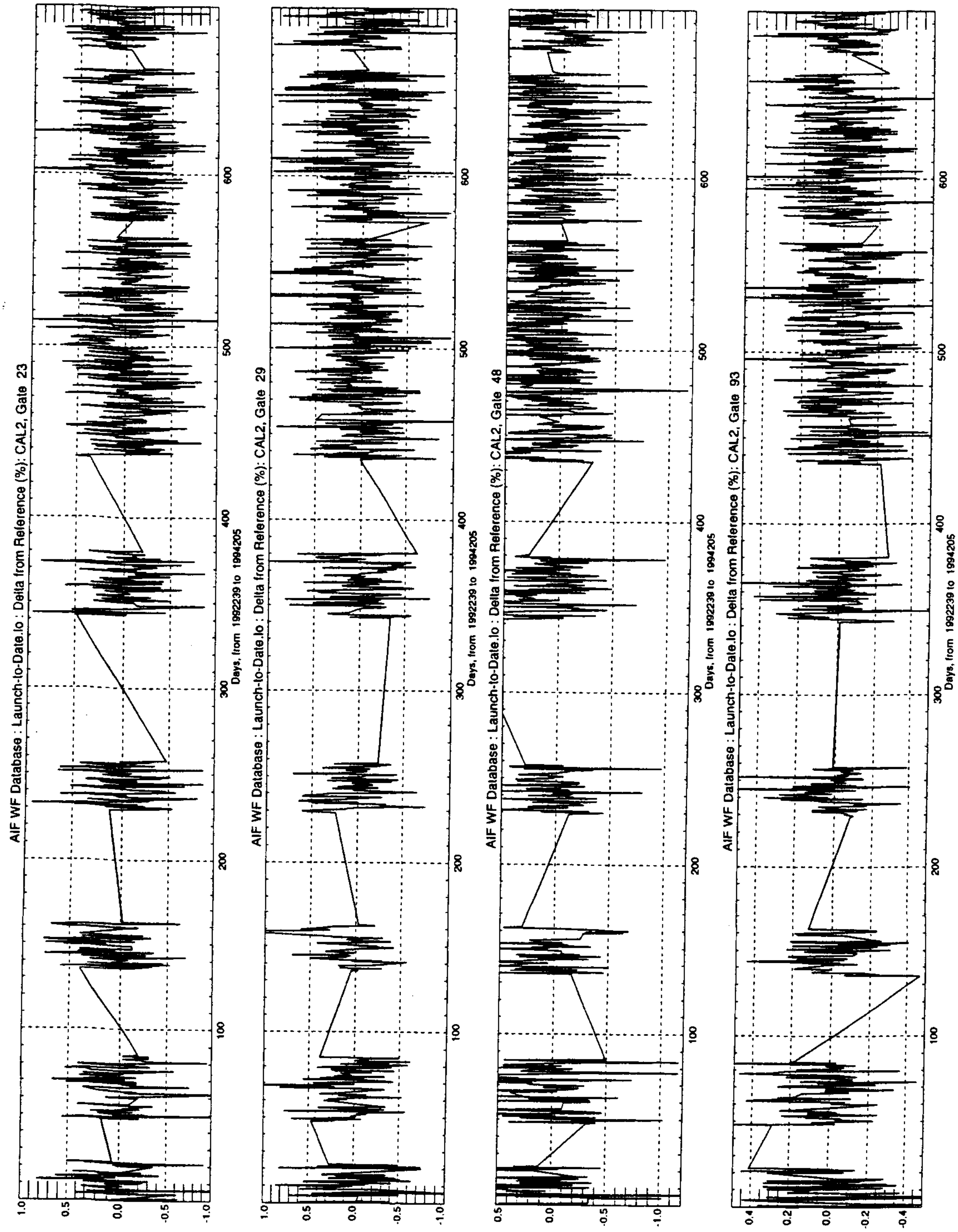


Figure A-10 Launch-to-Date WF Difference Plot Produced as Part of Weekly Processing

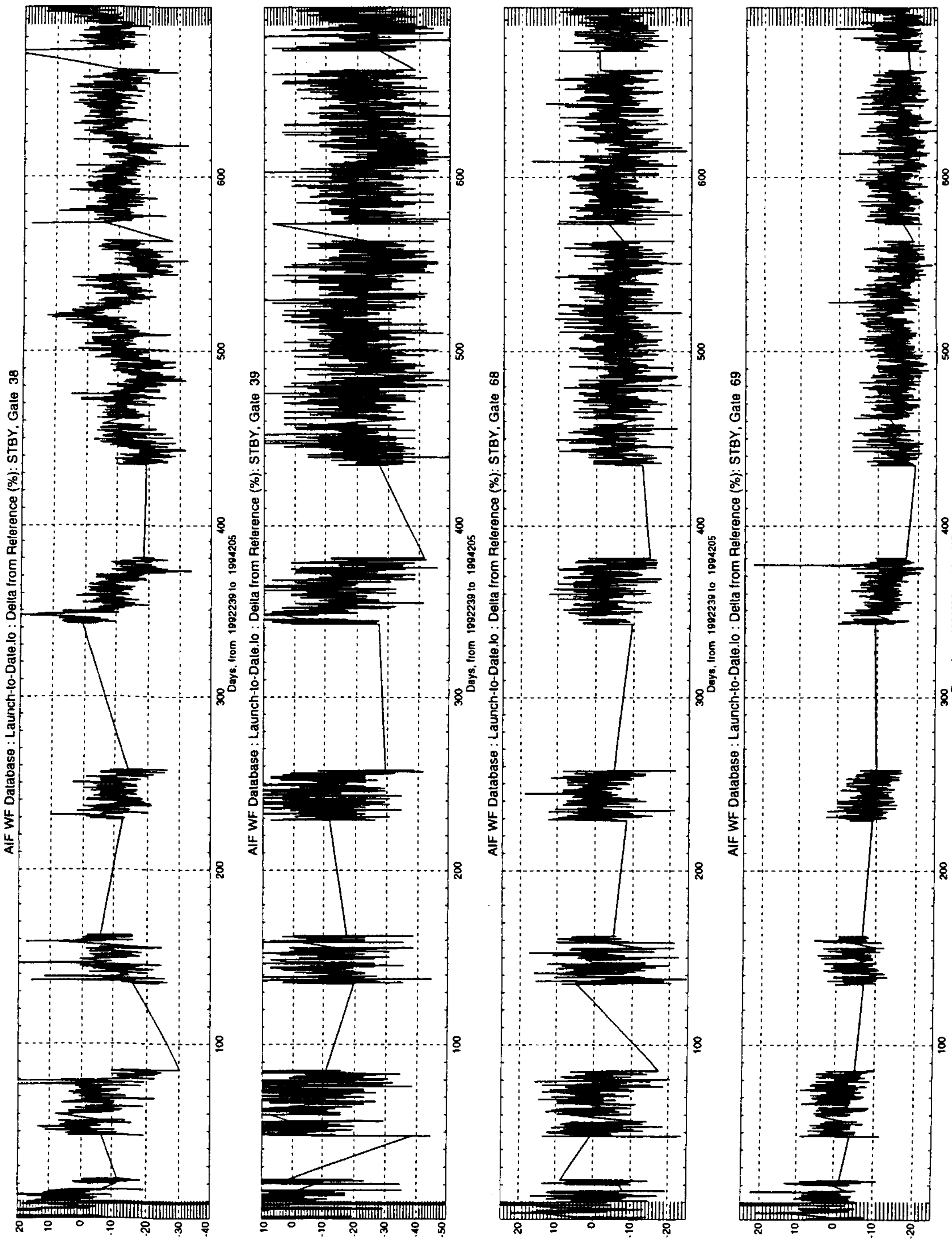


Figure A-10 Launch-to-Date WF Difference Plot Produced as Part of Weekly Processing

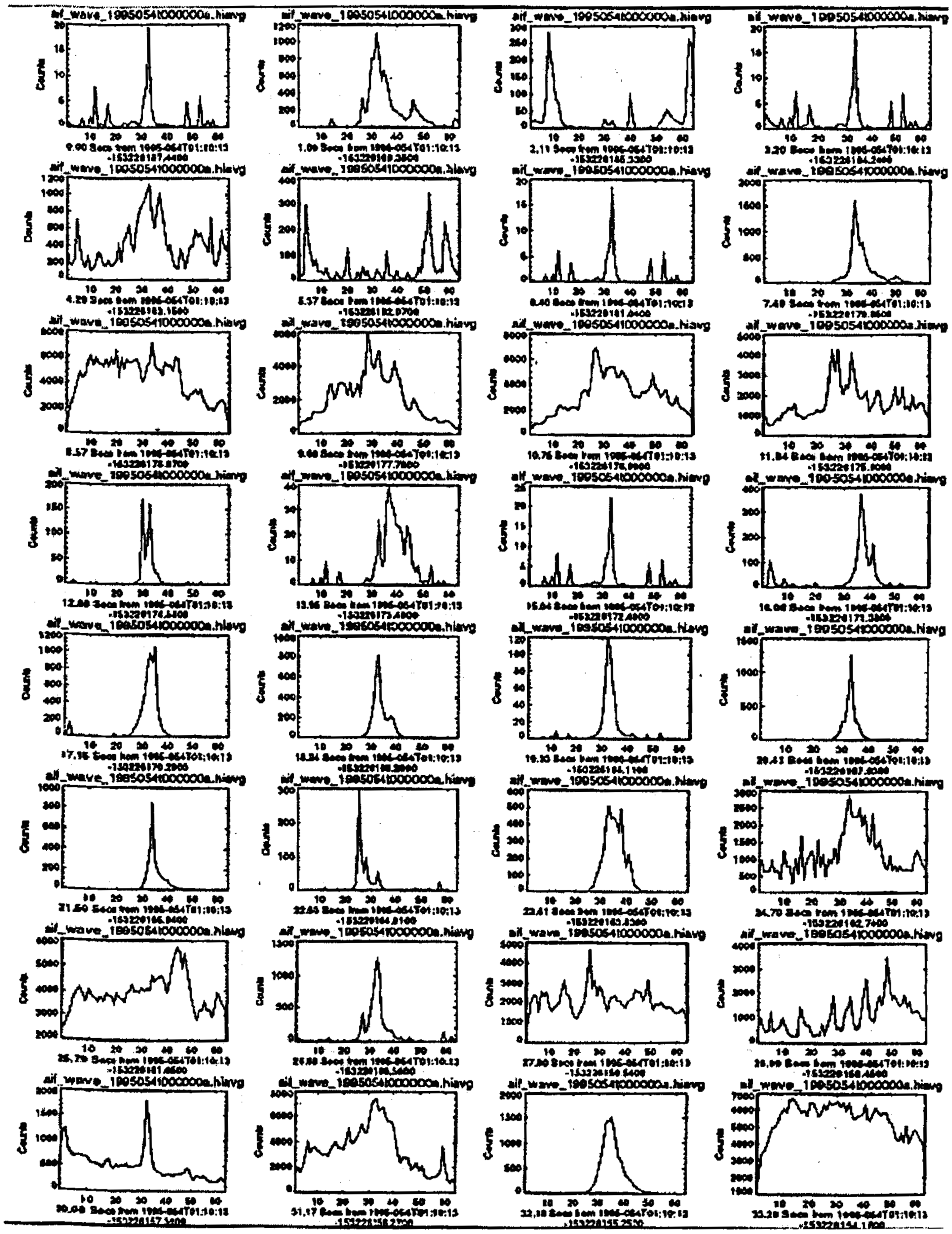


Figure A-11 Waveform Average Plot Produced as Part of Special Processing

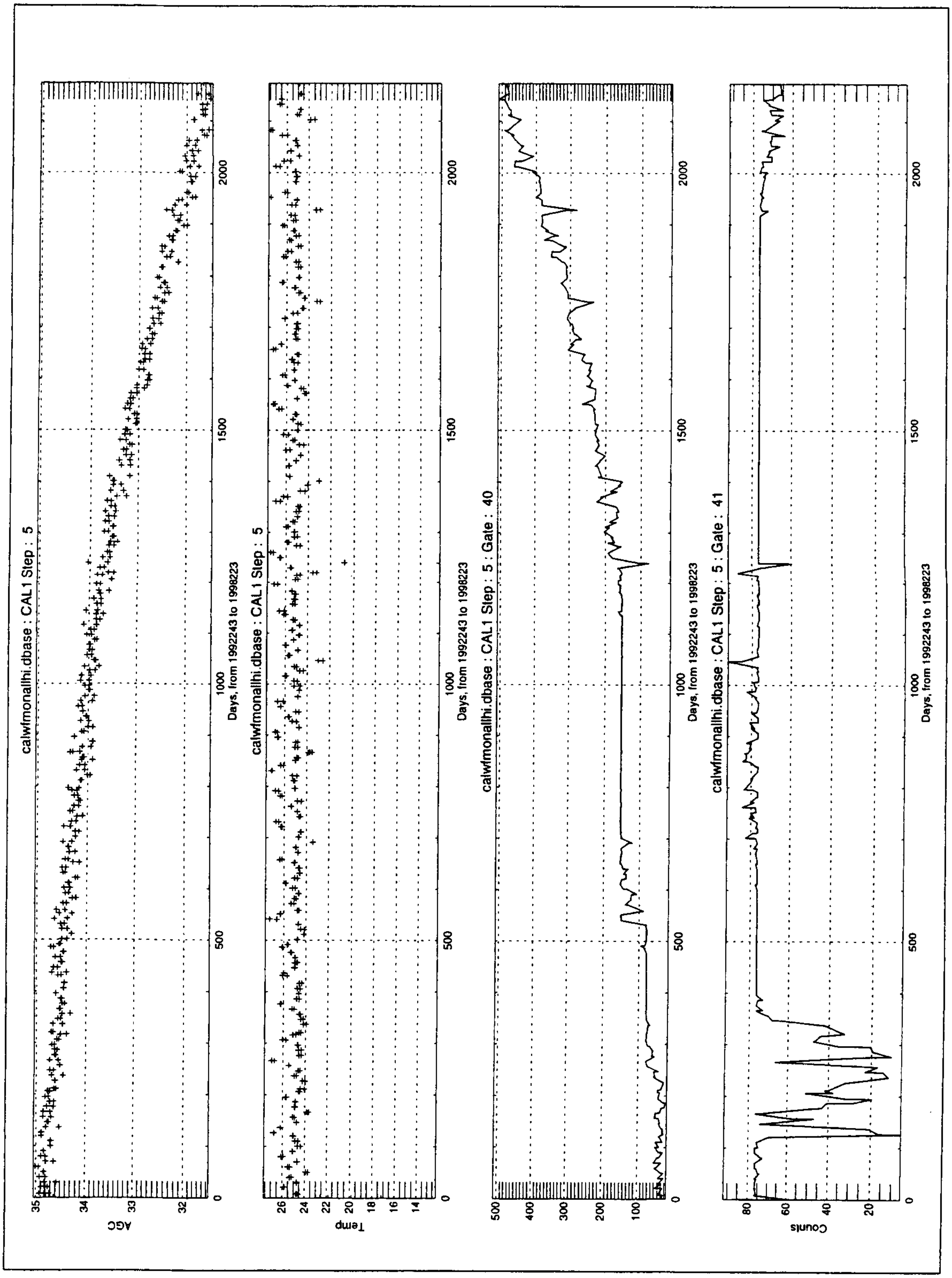


Figure A-12 Cal1 Step Waveform Trend Plot (Pg. 1 of 5)

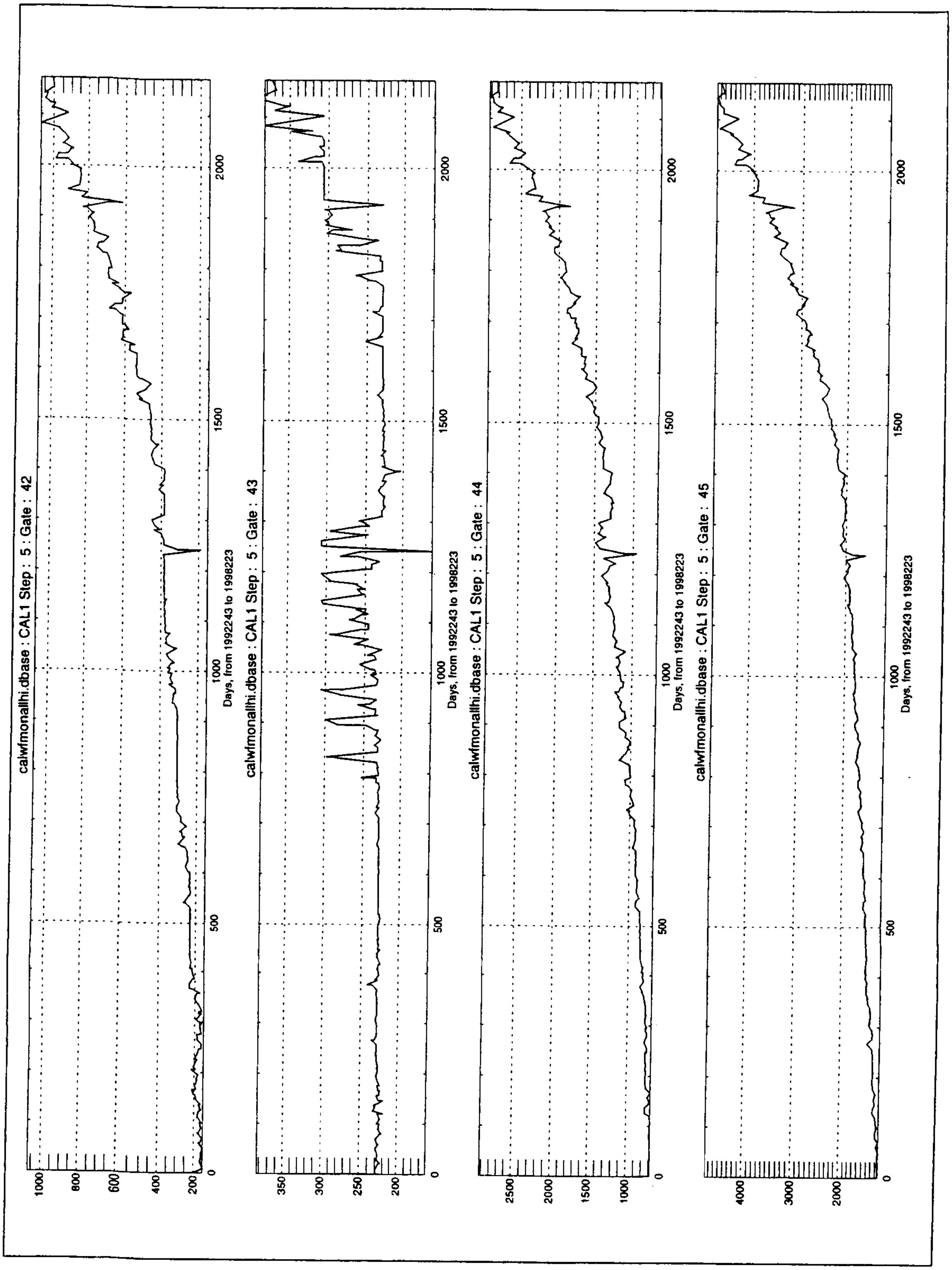


Figure A-13 Cal1 Step Waveform Trend Plot (Pg. 2 of 5)

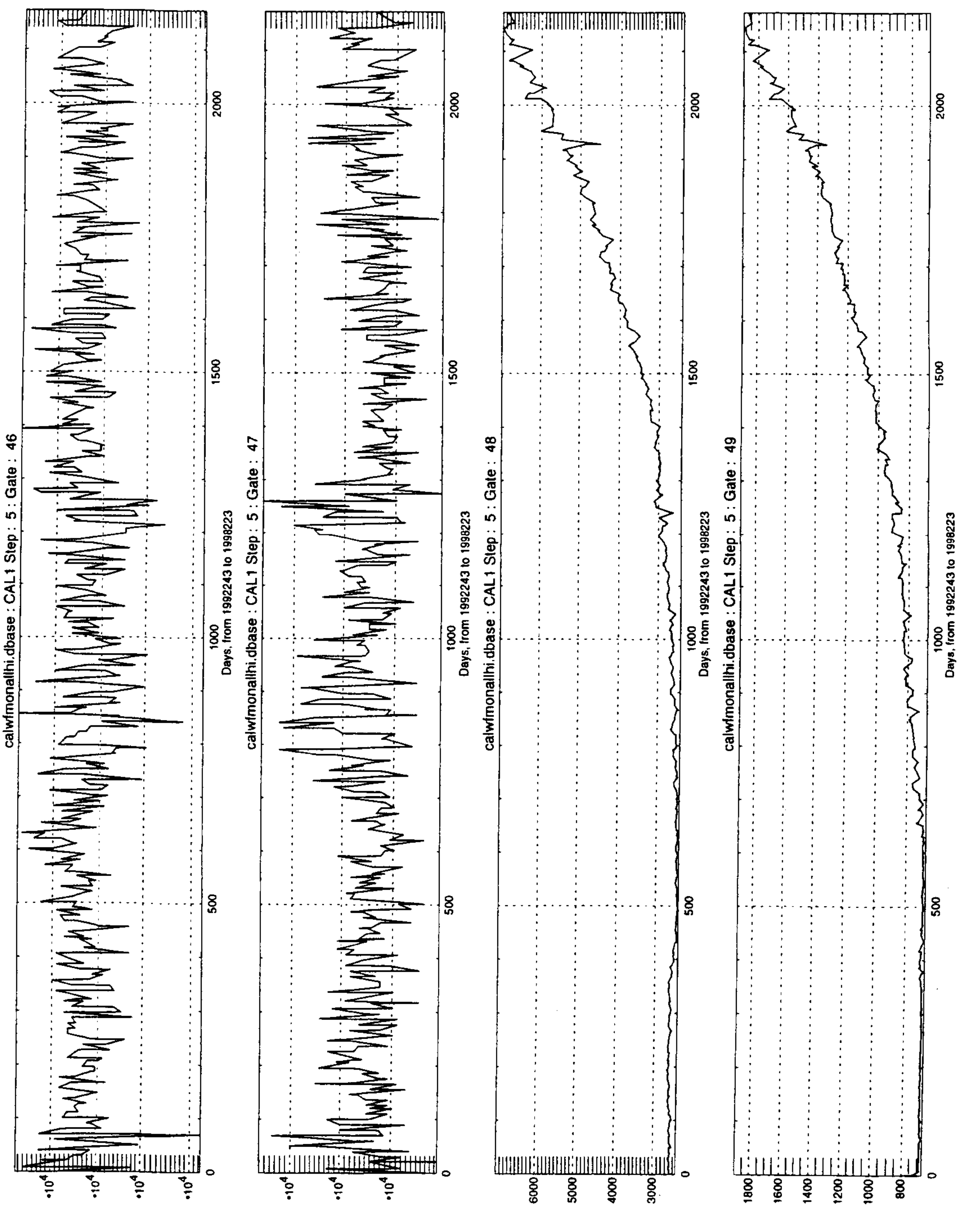


Figure A-14 Cal1 Step Waveform Trend Plot (Pg. 3 of 5)

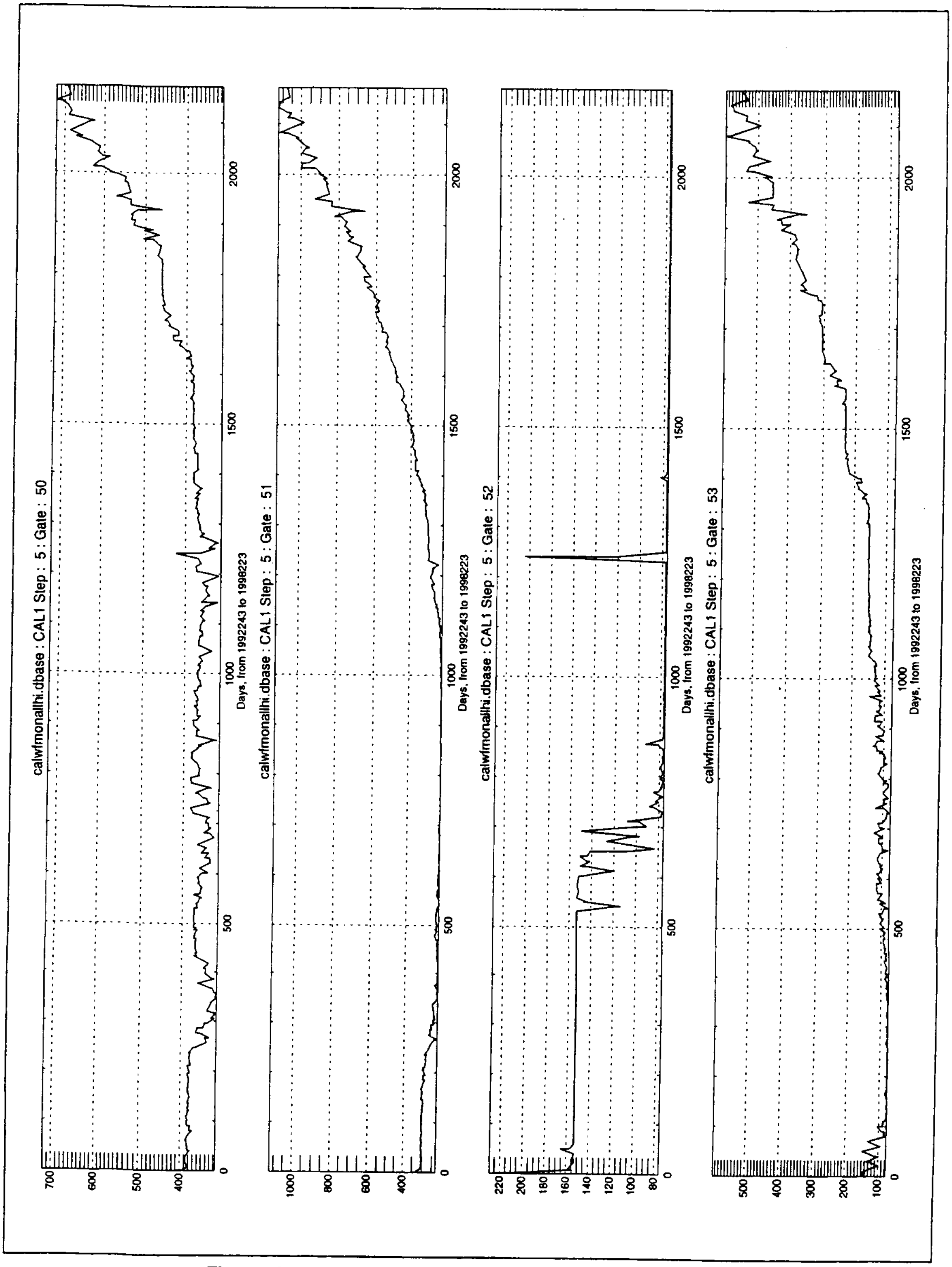


Figure A-15 Cal1 Step Waveform Trend Plot (Pg. 4 of 5)

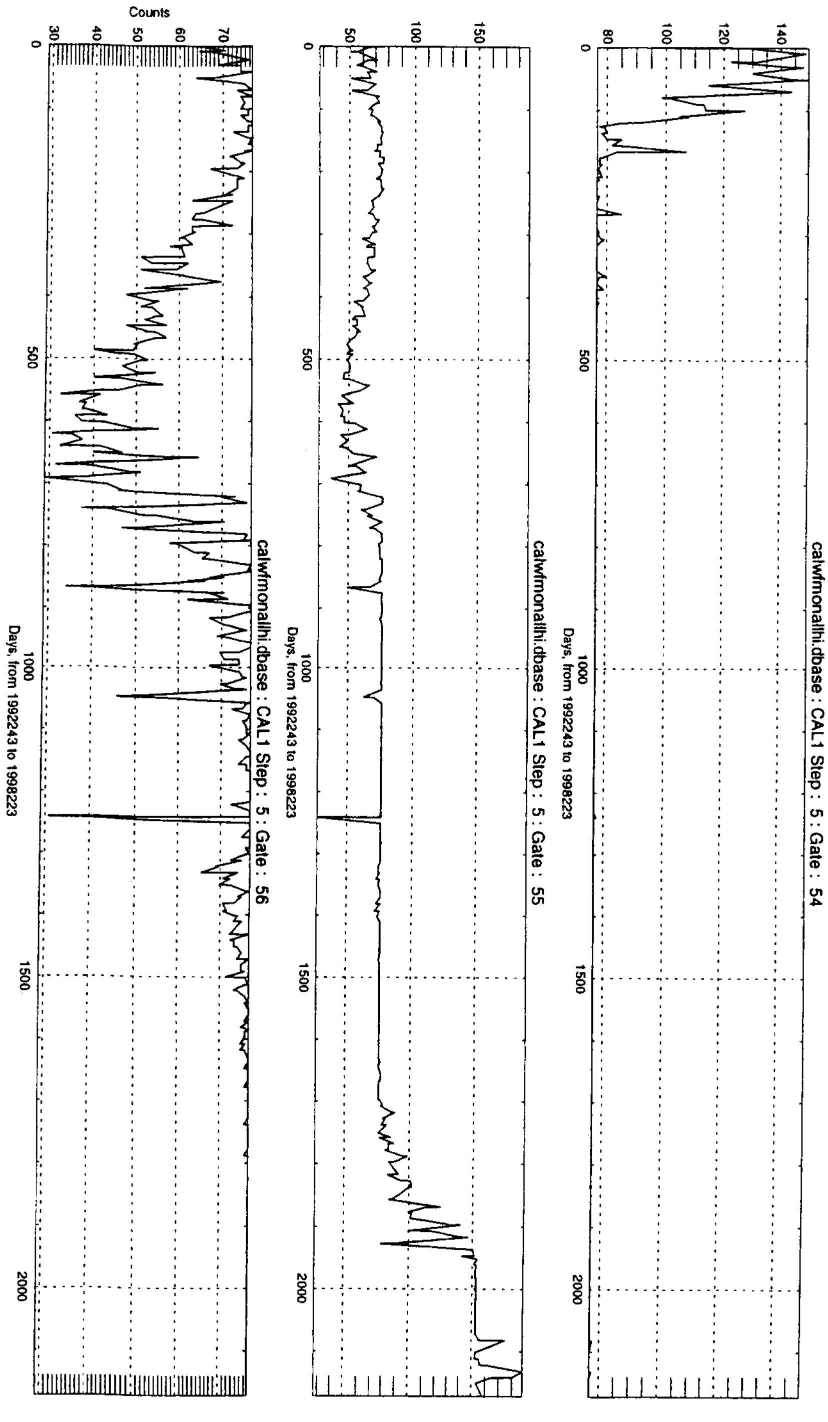


Figure A-16 Cal1 Step Waveform Trend Plot (Pg. 5 of 5)

Appendix B
Software Matrix

Table B-1 AIF Software Matrix

Software	Data Source	Products	Description
aifcal	CAL (Avg or DB)	Daily CAL Plot (Figure A-3)	UNIX script that runs IDL aif-cal.pro. Creates Daily CAL plots.
aifeng	ENG (Avg or DB)	ENG Plot (Special)	UNIX script that runs IDL aifeng.pro. Creates special ENG plots displaying ALL parameters.
aifhdr	DB Header & Events	Process Summary (Figure A-2)	UNIX script that runs IDL aif-hdr.pro
aifsci	SCI Avg	Science Plot (Figure A-5)	UNIX script that runs IDL aif-sci.pro
alldbcal	CAL DB	CAL Plot (Special)	UNIX script that runs IDL allaif-cal.pro. Creates special CAL plots displaying ALL steps.
autoaif	Current Date or User-Specified Date	Daily Products (Figure A-1 through A-7)	UNIX script automatically invoked by the crontab facility that performs all AIF daily pro-cessing. (FTP)
autoaifdni	Current Date	Daily Products (Figure A-1 through A-7)	Old version of autoaif that used DECNET to copy AIFs rather than FTP.
clkconvert	User Input	Converted Time (Displayed Only)	FORTRAN program that con-verts hexadecimal spacecraft clock time into seconds.
dailyeng	ENG Avg	Daily ENG Plot (Figure A-4)	UNIX script that runs IDL daily-eng.pro. Creates Daily ENG plots.
dailywf	WFDiff	Daily WFDiff Plot (Figure A-6)	UNIX script that runs IDL wfdiff.pro. Creates Daily WFDIFF plots.
dbcal	CAL DB	DB CAL Plot (Figure A-8)	UNIX script that runs IDL aif-cal.pro. Creates Launch-to-Date CAL plots.
dbeng	ENG DB	DB ENG Plot	UNIX script that runs IDL aifeng.pro. Creates Launch-to-Date ENG Plots.

Table B-1 AIF Software Matrix (Continued)

Software	Data Source	Products	Description
dbwf	WF DB	DB WF Plot (Figure A-10)	UNIX script that runs IDL wfdiff.pro. Creates Launch-to-Date WFDIFF plots
dotelem	AIF SCI & ENG Files	DB Header Events DB/QuickCAL DB/Avg ENG DB/Avg WFDiff Avg Waveforms Avg Science Science Dump ENG Dump	Main TOPEX WFF AIF processing program. Coded in FORTRAN.
finishaif	Current Date or User-Specified Date	Daily Products (Figure A-1 through A-7)	UNIX script that performs the same functions as autoaif, with the exception of copying the AIF files from JPL.
fittpx3	WF Avgs	See Attached Memo GSH 7/21/93.	See Attached Memo GSH 7/21/93.
launchtodate	Launch-to-Date DBs	Launch-to-Date Database Plots (Figures A-8 through A-11)	UNIX script that runs IDL dbcal, dbeng, & dbwf.
lsjplaif	none	List of AIF files (Display Only)	UNIX script that automatically runs an FTP session to list AIF files available at JPL.
mtopexautowf	WF Avgs	Modified WF Plots (Special)	UNIX script that runs IDL mtopexautowf.pro. Creates autoscaled waveform plots modified as requested by GSH.
mtopexwf	WF Avgs	Modified WF Plots (Special)	UNIX script that runs IDL mtopexwf.pro. Creates fix-scaled waveform plots modified as requested by GSH.
stdaif	Current Date or User-Specified Date	Daily Products (Figure A-1 through A-7)	UNIX script that performs the same functions as autoaif, with the exception of creating and concatenating database files. Useful for automatically processing special data from JPL.
topexautowf	WF Avgs	WF Plots (Figure A-11)	UNIX script that runs IDL mtopexwf.pro. Creates autoscaled waveform plots.

Table B-1 AIF Software Matrix (Continued)

Software	Data Source	Products	Description
topexseu	DataFile.SEU	SEU Plot (Figure A-13)	UNIX script that runs IDL topex-seu.pro. Creates SEU plots.
topexwf	WF Avgs	WF Plots (Special)	UNIX script that runs IDL topexwf.pro. Creates fix-scaled waveform plots.
wfdiff	WF Diffs	WFDiff Plots (Figure A-6)	UNIX script that runs IDL wfdiff.pro. Creates WFDIFF plots.
wfdiffall	WF Diffs	WFDiff Plots (Special)	UNIX script that runs IDL wfdiff.pro. Creates WFDIFF plots with ALL steps.

Appendix C
File & Database Contents

This appendix documents file and database formats used in AIF processing. By definition, database files will be SPACE-delimited, while average files are TAB delimited.

Table C-1 AIF Header Database Format

Field	Fmt	Units	Description
hdrid	I4	n/a	
day	I7	YYYYDDD	Year and Julian Day
altoper	A1	n/a	Altimeter Operating (A/B)
kuon	A3	n/a	Operating Status of Ku-Band (ON/OFF)
con	A3	n/a	Operating Status of C-Band (C32/C10/OFF)
dateproc	A9	n/a	Date Data was Processed at WFF
wffprg	A15	n/a	WFF Software Used to Process Data
wffvers	A15	n/a	Version of WFF Software Used to Process Data
telemvers	A15	n/a	Version of DataFile.TelemDriver Used to Process Data
eavers	A15	n/a	Version of DataFile.EALimits Used to Process Data
romvers	A15	n/a	Version of DataFile.ROMMap Used to Process Data
badeng	I4	records	Number of Bad Engineering Records Detected
badsci	I4	records	Number of Bad Science Records Detected
trackhrs	F5.2	Hours	Number of Track-Mode Hours
scilost	F8.1		
englost	F8.1		

Table C-2 AIF CAL Database/QuickCAL Format

Field	Fmt	Units	Description
utcsec	F13.2	seconds	Average UTC Seconds
day	I7	YYYYDDD	Year and Julian Day
wffid	I2	n/a	Database Link
hdrid	I2	n/a	Database Link
step	I2	n/a	CAL Step (~16, 20 = CAL2)
mode	A4	n/a	Mode (CAL1/CAL2)
numrec	I4	records	Number of Records Used to Compute Averages
deltahgtku	F8.4	Δmm	Computed Average HgtKu - Reference (TempCorr)
deltahgtc	F8.4	Δmm	Computed Average HgtC - Reference (TempCorr)
deltaagcku	F8.4	ΔdB	Computed Average AGCKu - Reference (TempCorr)
deltaagcc	F8.4	ΔdB	Computed Average AGCC - Reference (TempCorr)
useflag	L1	n/a	Settable Flag Used for Ignoring Bad Data

Table C-3 AIF Events Report Format

Field	Fmt	Units	Description
day	I7	YYYYDDD	Year and Julian Day
utcsec	F13.2	n/a	UTC Seconds
ATB	A17	n/a	Full UTC ASCII Time
EventSource	A3	n/a	Source of Event (SCI/ENG)
EventClass	A6	n/a	Level of Event Severity (Danger/Warn/Status, etc)
Description	A??	n/a	Description of Event

Table C-4 AIF ENG Database/Eng Averages Format

Field	Fmt	Units	Description
utcsec	F13.2	seconds	Average UTC Seconds
day	I7	YYYYDDD	Year and Julian Day
wffid	I2	n/a	Database Link
hdrid	I2	n/a	Database Link
mode	A4	n/a	Mode
numrec	I4	records	Number of Records Used to Compute Averages
value	A4	n/a	Type of Statistic (Min/Max/Mean)
temp01	F6.2	DegC	Statistic for Temp Monitor - spare
temp02	F6.2	DegC	Statistic for AGC Receiver Section Temp
temp03	F6.2	DegC	Statistic for SSU Temp
temp04	F6.2	DegC	Statistic for Ku MTU IF Preamp Temp
temp05	F6.2	DegC	Statistic for Receiver IQ Video Section Temp
temp06	F6.2	DegC	Statistic for TWTA EPC Temp #1
temp07	F6.2	DegC	Statistic for Temp Monitor - spare
temp08	F6.2	DegC	Statistic for C MTU Cal Attenuator Temp
temp09	F6.2	DegC	Statistic for C MTU RF Preamp Temp
temp10	F6.2	DegC	Statistic for C MTU IF Preamp Temp
temp11	F6.2	DegC	Statistic for C MTU Power Monitor Temp
temp12	F6.2	DegC	Statistic for C-SSA GaAs FETS Temp
temp13	F6.2	DegC	Statistic for C-SSA Power Converter Temp
temp14	F6.2	DegC	Statistic for Ku MTU Cal Attenuator Temp
temp15	F6.2	DegC	Statistic for Ku MTU Power Monitor Temp
temp16	F6.2	DegC	Statistic for UCFM Temp
temp17	F6.2	DegC	Statistic for Ku MTU RF Preamp Temp
temp18	F6.2	DegC	Statistic for Downconverter Temp
temp19	F6.2	DegC	Statistic for Signal Proc DFB Butterfly Brd Temp
temp20	F6.2	DegC	Statistic for Signal Proc DFB Memory Temp
temp21	F6.2	DegC	Statistic for Signal Proc ICA Condition Amps Temp
temp22	F6.2	DegC	Statistic for Signal Proc A/D Converter Temp
temp23	F6.2	DegC	Statistic for Signal Proc Synchronizer Temp

Table C-4 AIF ENG Database/Eng Averages Format (Continued)

Field	Fmt	Units	Description
temp24	F6.2	DegC	Statistic for Signal Proc ATA Temp
temp25	F6.2	DegC	Statistic for Signal Proc Housing Wall Temp
temp26	F6.2	DegC	Statistic for Digital Chip Generator Gate Array Temp
temp27	F6.2	DegC	Statistic for LVPS Mounting Plate Temp
temp28	F6.2	DegC	Statistic for LVPS Boost Regulator Assembly Temp
mon01	F10.6	Volts	Statistic for LVPS +12V
mon02	F10.6	Volts	Statistic for LVPS +28V
mon03	F10.6	Volts	Statistic for LVPS +15V
mon04	F10.6	Volts	Statistic for LVPS -15V
mon05	F10.6	Volts	Statistic for LVPS +5V (5%)
mon06	F10.6	Volts	Statistic for LVPS +5V (1%)
mon07	F10.6	Volts	Statistic for LVPS -5.2V
mon08	F10.6	Volts	Statistic for LVPS -6V
mon09	F10.6	Watts	Statistic for Ku Xmit Power (TempCorr)
mon10	F10.6	Volts	Statistic for TWTA Cathode Voltage
mon11	F10.6	Amps	Statistic for TWTA Cathode Current (TempCorr)
mon12	F10.6	Amps	Statistic for TWTA Helix Current
mon13	F10.6	Amps	Statistic for TWTA Bus Current
mon14	F10.6	Watts	Statistic for C Xmit Power
mon15	F10.6	dBm	Statistic for C-SSA Input RF Power (TempCorr)
mon16	F10.6	Amps	Statistic for C-SSA Bus Current (TempCorr)
mon17	F10.6	Amps	Statistic for LVPS Bus Current
useflag	L1	n/a	Settable Flag Used for Ignoring Bad Data

Table C-5 AIF Waveform Differences Database/Check WF Format

Field	Fmt	Units	Description
utcsec	F16.2	seconds	Average UTC Seconds
day	I7	YYYYDDD	Year and Julian Day
mode	A4	n/a	Mode
numrec	I4	rewcords	Number of Records Used to Compute Averages
gate01	F7.2	Δcounts	Computed WF Gate #1 Average - Reference
gate02	F7.2	Δcounts	Computed WF Gate #2 Average - Reference
gate03	F7.2	Δcounts	Computed WF Gate #3 Average - Reference
gate04	F7.2	Δcounts	Computed WF Gate #4 Average - Reference
. . .	. . .	. . .	. . .
gate61	F7.2	Δcounts	Computed WF Gate #61 Average - Reference
gate62	F7.2	Δcounts	Computed WF Gate #62 Average - Reference
gate63	F7.2	Δcounts	Computed WF Gate #63 Average - Reference
gate64	F7.2	Δcounts	Computed WF Gate #64 Average - Reference
temp01	F7.2	degC	Mean of AGC Receiver Section Temperature

Table C-6 DataFile.SEU Format

Field	Fmt	Units	Description
ATB	A17	n/a	Full UTC ASCII Time of SEU
Latitude	F6.2	degrees	Latitude of SEU
Longitude	F6.2	degrees	Longitude of SEU
TypeRST	A1	n/a	Type of Reset (A=Automatic, M=Manual)
ATB-MAN	A17	n/a	Time of Manual Reset
HoursLost	F6.2	Hours	Number of Track Hours Lost due to Reset
Mode	A4	n/a	Altimeter Mode Prior to Reset
Description	n/a	n/a	Description of Reset

Table C-7 AIF Waveform Averages Format

Field	Fmt	Units	Description
utcsec	F16.2	seconds	Average UTCSeconds
ATB	A17	n/a	Full UTC ASCII Time
year	A3	n/a	Last 3 Digits of Year
day	A3	n/a	Julian Day of Year
step	I4	n/a	CAL Mode Step (Valid only if Mode=CAL1)
mode	A4	n/a	Mode
numrec	I4	records	Number of Records Used to Compute Averages
gateindex	I4	n/a	Computer Gate Index Average
vswh	F14.2	counts	Computed VSWH Average
finehgt	F14.2	mm	Computed Fine Height Average
gate01	F14.2	counts	Computed WF Gate #1 Average
gate02	F14.2	counts	Computed WF Gate #2 Average
gate03	F14.2	counts	Computed WF Gate #3 Average
gate04	F14.2	counts	Computed WF Gate #4 Average
⋮	⋮	⋮	⋮
gate61	F14.2	counts	Computed WF Gate #61 Average
gate62	F14.2	counts	Computed WF Gate #62 Average
gate63	F14.2	counts	Computed WF Gate #63 Average
gate64	F14.2	counts	Computed WF Gate #64 Average

Table C-8 AIF Sci Averages Format

Field	Fmt	Units	Description
time	F13.2	seconds	Average UTC Seconds
UTC	A17	YYYYDDD	Year and Julian Day
Day	A7	n/a	Database Link
numrec	I4	records	Number of Records Used to Compute Averages
worstmode	A4	n/a	Worst Mode Detected in Interval
bestmode	A4	n/a	Best Mode Detectewd in Interval
Landwater	F6.4	n/a	unused
Latitude	F7.3	n/a	unused
Longitude	F7.3	n/a	unused
HgtKuRMS	F9.2	mm	RTMS of AltHgtKu, computed with Hayne Method
HgtDiffRMS	F9.2	mm	RMS of AltHgtKu-C, computed with Hayne Method
AltHgtKu	F9.2	meters	Average of AltHgtKu
HgtDiff	F6.2	meters	Average of AltHgtC-AltHgtKu
SWHKu	F6.2	meters	Average of SWHKu
SWHC	F6.2	meters	Average of SWHC
VSWHKu	F6.2	counts	Average of VSWHKu
VSWHC	F6.2	counts	Average of VSWHC
AGCKu	F5.2	dB	Average of AGCKu (TempCorr)
AGCC	F5.2	dB	Average of AGCC (TempCorr)
HgtRate	F6.2	meters/sec	Average of AltHgtRate
GateIndexKu	F6.2	n/a	Average of GateIndexKu
GateIndexC	F6.2	n/a	Average of GateIndexC
AttEstWF	F6.2	n/a	Average of AttEstWF
SciQuality	I4	flags	Number of ALL recs with T1016 AGC, SWH, or Hgt Flags
IntertQuality	I4	n/a	unused
LimitByte	I4	flags	Number of ALL Records with LimitByte ≠ 0
ModeFlag	I4	flags	Number of ALL Recs with FlgMode1068 or FlgTrack1068
OOEFlag	I4	flags	unused
OrderFlag	I4	flags	unused
FlgBln1016C	I4	flags	Number of ALL Heights with FlgBln1016C

Table C-8 AIF Sci Averages Format (Continued)

Field	Fmt	Units	Description
FlgBln1016K	I4	flags	Number of ALL Heights with FlgBln1016Ku
FlgEaHgtC	I4	flags	Number of ALL Heights with FlgEaHgt1016C
FlgEaHgtK	I4	flags	Number of ALL Heights with FlgEaHgt1016Ku
FlgVAttKu	I4	flags	Number of GOOD Raecords with FlgVAttKu
FlgVAttC	I4	flags	Number of GOOD Records with FlgVAttC
UTCConv	I4	n/a	unused
FlgHi5110	I4	flags	Number of GOOD Waveforms with FlgHi5110
FlgLo5110	I4	flags	Number of GOOD Waveforms with FlgLo5110
useflag	L1	n/a	Settable Flag Used for Ignoring Bad Data

Table C-9 AIF ENG Dump Format

Field	Fmt	Units	Description
engrec	I4	n/a	Engineering Record Number
ATB	A17	n/a	Full UTC ASCII time
clktime	F16.4	seconds	Time of Spacecraft On-Board Clock
utctime	F16.4	seconds	UTC Seconds
timerst	F16A	seconds	Time of Last Reset
EngAltOper	A1	n/a	Altimeter Currently operating (A/B)
ChkSum	2A2	n/a	Engineering Memory Checksum (in hex)
EngMode	A4	n/a	Current Mode
BiLevels	2A2	n/a	BiLevel Words (in Hex)
LastCMD1	A17	n/a	Last command #1, Type, Command, Status
LastCMD2	A17	n/a	Last Command #2, Type,Command, Status
LastCMD3	A17	n/a	Last Command #3, Type, Command, Status
LastCMD4	A17	n/a	Last Command #4, Type, Command, Status
LastCMD5	A17	n/a	Last Command #5, Type, Command, Status
LastCMD6	A17	n/a	Last Command #6, Type, Command, Status
LastCMD7	A17	n/a	Last Command #7, Type, Command, Status
LastCMD8	A17	n/a	Last Command #8, Type, Command, Status
MemAddr	2A2	n/a	Memory Dump Address (in Hex)

Table C-9 AIF ENG Dump Format (Continued)

Field	Fmt	Units	Description
MemDump	32A2	n/a	Memory Dump (in Hex)
temp01	F6.2	DegC	Average of Temp Monitor - spare
temp02	F6.2	DegC	Average of AGC Receiver Section Temp
temp03	F6.2	DegC	Average of SSU Temp
temp04	F6.2	DegC	Average of Ku MTU IF Preamp Temp
temp05	F6.2	DegC	Average of Receiver IQ Video Section Temp
temp06	F6.2	DegC	Average of TWTA EPC Temp #1
temp07	F6.2	DegC	Average of Temp Monitor - spare
temp08	F6.2	DegC	Average of C MTU Cal Attenuator Temp
temp09	F6.2	DegC	Average of C MTU RF Preamp Temp
temp10	F6.2	DegC	Average of C MTU IF Preamp Temp
temp11	F6.2	DegC	Average of C MTU Power Monitor Temp
temp12	F6.2	DegC	Average of C-SSA GaAs FETs Temp
temp13	F6.2	DegC	Average of C-SSA Power Converter Temp
temp14	F6.2	DegC	Average of Ku MTU Cal Attenuator Temp
temp15	F6.2	DegC	Average of Ku MTU Power Monitor Temp
temp16	F6.2	DegC	Average of UCFM Temp
temp17	F6.2	DegC	Average of Ku MTU RF Preamp Temp
temp18	F6.2	DegC	Average of Downconverter Temp
temp19	F6.2	DegC	Average of Signal Proc DFB Butterfly Brd Temp
temp20	F6.2	DegC	Average of Signal Proc DFB Memory Temp
temp21	F6.2	DegC	Average of Signal Proc ICA Condition Amps Temp
temp22	F6.2	DegC	Average of Signal Proc A/D Converter Temp
temp23	F6.2	DegC	Average of Signal Proc Synchronizer Temp
temp24	F6.2	DegC	Average of Signal Proc ATA Temp
temp25	F6.2	DegC	Average of Signal Proc Housing Wall Temp
temp26	F6.2	DegC	Average of Digital Chip Generator Gate Array Temp
temp27	F6.2	DegC	Average of LVPS Mounting Plate Temp
temp28	F6.2	DegC	Average of LVPS Boost Regulator Assembly Temp
mon01	F10.6	Volts	Average of LVPS +12V

Table C-9 AIF ENG Dump Format (Continued)

Field	Fmt	Units	Description
mon02	F10.6	Volts	Average of LVPS +28V
mon03	F10.6	Volts	Average of LVPS +15V
mon04	F10.6	Volts	Average of LVPS -15V
mon05	F10.6	Volts	Average of LVPS +5V (5%)
mon06	F10.6	Volts	Average of LVPS +5V (1%)
mon07	F10.6	Volts	Average of LVPS -5.2V
mon08	F10.6	Volts	Average of LVPS -6V
mon09	F10.6	Watts	Average of Ku Xmit Power (TempCorr)
mon10	F10.6	Volts	Average of TWTA Cathode Voltage
mon11	F10.6	Amps	Average of TWTA Cathode Current (TempCorr)
mon12	F10.6	Amps	Average of TWTA Helix Current
mon13	F10.6	Amps	Average of TWTA Bus Current
mon14	F10.6	Watts	Average of C Xmit Power
mon15	F10.6	dBm	Average of C-SSA Input RF Power (TempCorr)
mon16	F10.6	Amps	Average of C-SSA Bus Current (TempCorr)
mon17	F10.6	Amps	Average of LVPS Bus Current
useflag	L1	n/a	Settable Flag used For Ignoring Bad Data

Table C-10 AIF SCI Dump Format

Field	Fmt	Units	Description
scirec	F8.2	n/a	Science Record Number
synctime	F16.4	seconds	Time used by Science/Engineering Synchronization
sciclk	F16.4	seconds	time of Spacecraft On-Board Clock
sciutc	F16.4	records	UTC seconds
ATB	A17	n/a	Full UTC ASCII Time
AltOper	A1	n/a	Current Altimeter Operating (A/B)
KuOn	A3	n/a	State of Ku-Band (ON/OFF)
COn	A3	n/a	State of C-Band (C10/C32/OFF)
WFFreqHi	A2	n/a	High Rate Frequency (Ku/C)
WFFreqLo	A2	n/a	Low Rate Frequency (Ku/C)

Table C-10 AIF SCI Dump Format

Field	Fmt	Units	Description
Mode	A4	n/a	Current Mode
Track	A4	n/a	Current Track Type
AGCType	A4	n/a	Current AGC Type
Step	I4	n/a	Current CAL Step (Only Valid if Mode=CAL1)
GateIndexKu	I4	n/a	GateIndexKu
GateIndexC	I4	n/a	GateIndexC
CALAttenK	I4	n/a	CAL Attenuator Setting Ku
CALAttenC	I4	n/a	CAL Attenuator Setting C
CurrMode	I8	n/a	Interger Value of Current Mode Byte
ModeChg	I8	n/a	Integer Value of Mode Change Byte
SynchMode	I8	n/a	Integer Value of Sync Mode Byte
LimitByte	I8	n/a	Integer Value of Limit Byte
TestMode	I8	n/a	Integer Value of Test Mode Byte
OperMode	I8	n/a	Integer Value of Operation Mode Byte
LastATA	A8	n/a	Last ATA Command Received
LastICA	A8	n/a	Last ICA Command Received
AltHgtKu	F16.4	mm	AltHgtKu
AltHgtC	F16.4	mm	AltHgtC
AGCKu	F16.4	dB	Average of AGCKu (TempCorr)
AGCC	F16.4	dB	Average of AGCC (TempCorr)
HgtRate	F16.4	meters/sec	Average of AltHgtRate
SWHKu	F16.4	meters	SWHKu
SWHC	F16.4	meters	SWHC
VSWHKu	F16.4	counts	VSWHKu
VSWHC	F16.4	counts	VSWHC
HgtRate	F16.4	meters/sec	AltHgtRate

Table C-11 AIF Cal Waveform Monitor Database

Field	Fmt	Units	Description
utcsec	F13.2	seconds	Average UTC Seconds
fileid	A7	YYYYDDD	Year and Julian Day
wffid	I2	n/a	
hdrid	I2	n/a	
step	I2	n/a	CAL1 Step (16)
mode	A4	n/a	Mode CAL1 only
reccount	F4.0	records	Number of Records Used to Compute Averages
Height	F16.4	mm	Altimeter Height
AGC	F8.4	db	Average of AGC
Temp	F8.4	degC	Mean of AGC Receiver Section Temperature
gate01	F14.3	Scaled	WF Gate #1 Step Average
gate02	F14.3	Scaled	WF Gate #2 Step Average
gate03	F14.3	Scaled	WF Gate #3 Step Average
gate04	F14.3	Scaled	WF Gate #4 Step Average
. . .	. . .	. . .	. . .
gate61	F14.3	Scaled	WF Gate #61 Step Average
gate62	F14.3	Scaled	WF Gate #62 Step Average
gate63	F14.3	Scaled	WF Gate #63 Step Average
gate64	F14.3	Scaled	WF Gate #64 Step Average

Appendix D
Plots of Reference Values

This appendix contains plots of the reference values used during AIF processing. These plots were generated by an IDL program that reads DataFile.EALimits and extracts from it the CAL and Waveform references.

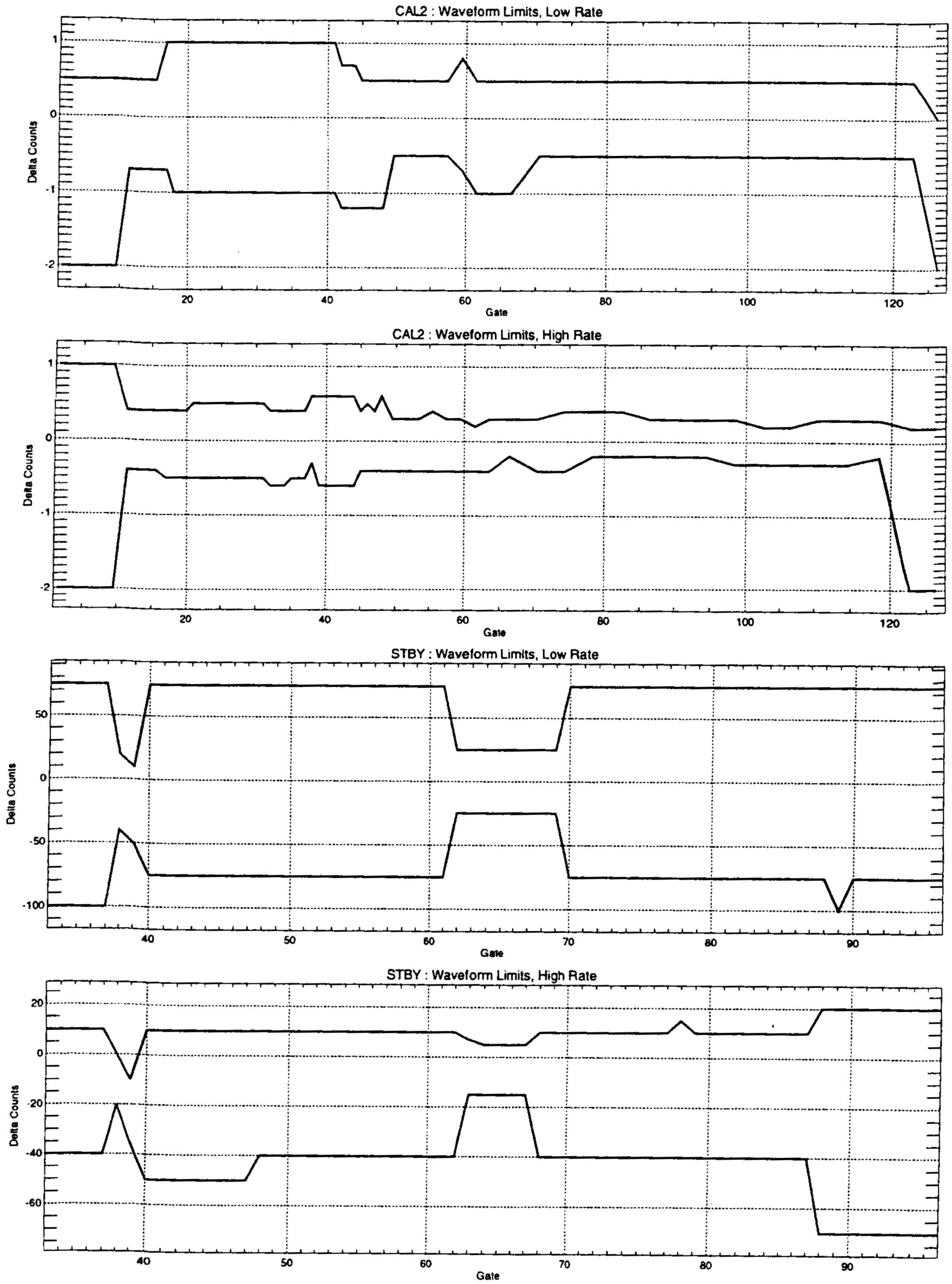


Figure D-1 CheckWF Waveform Limits

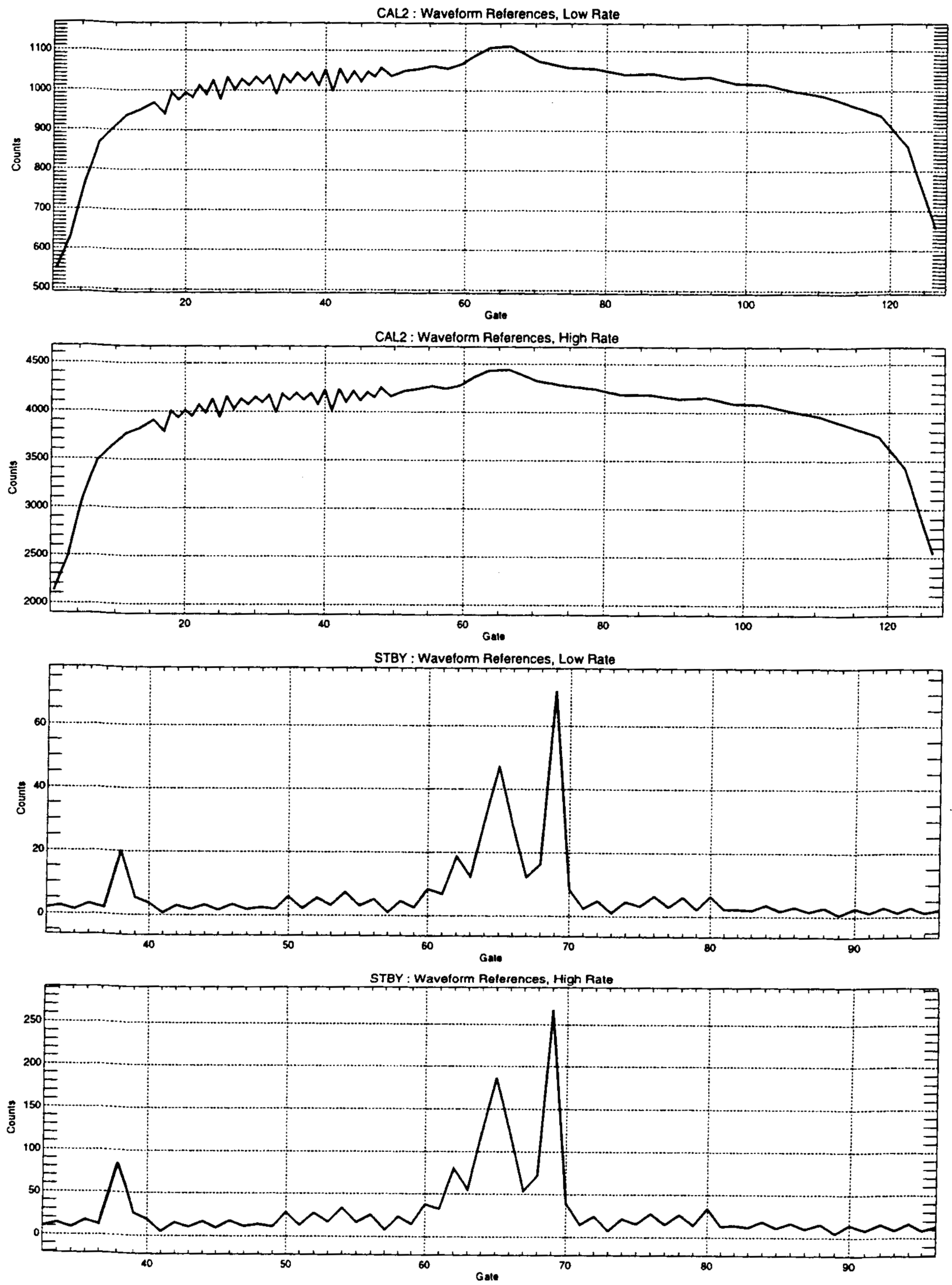


Figure D-2 CheckWF Waveform References

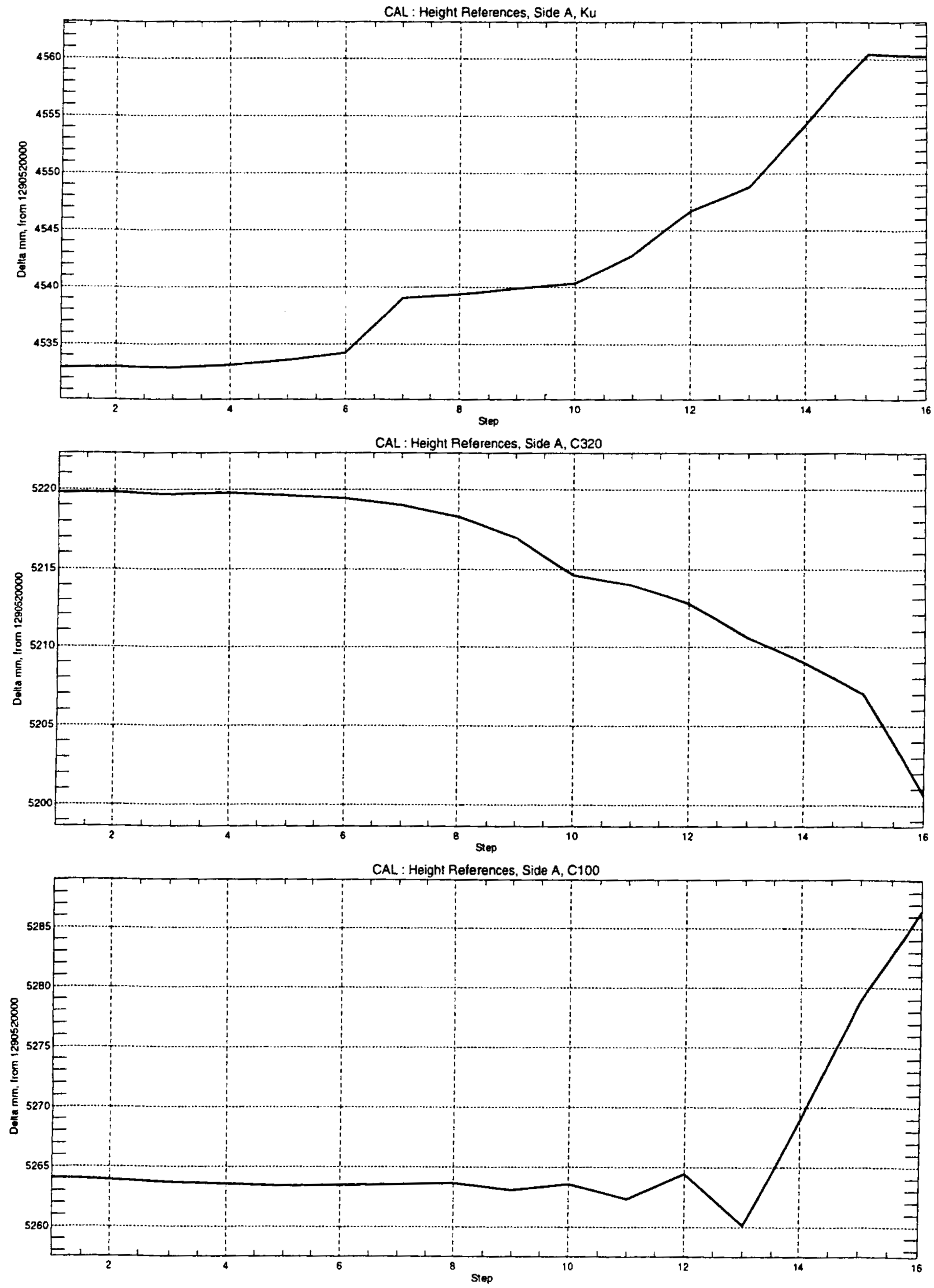


Figure D-3 QuickCAL Height References, Side A

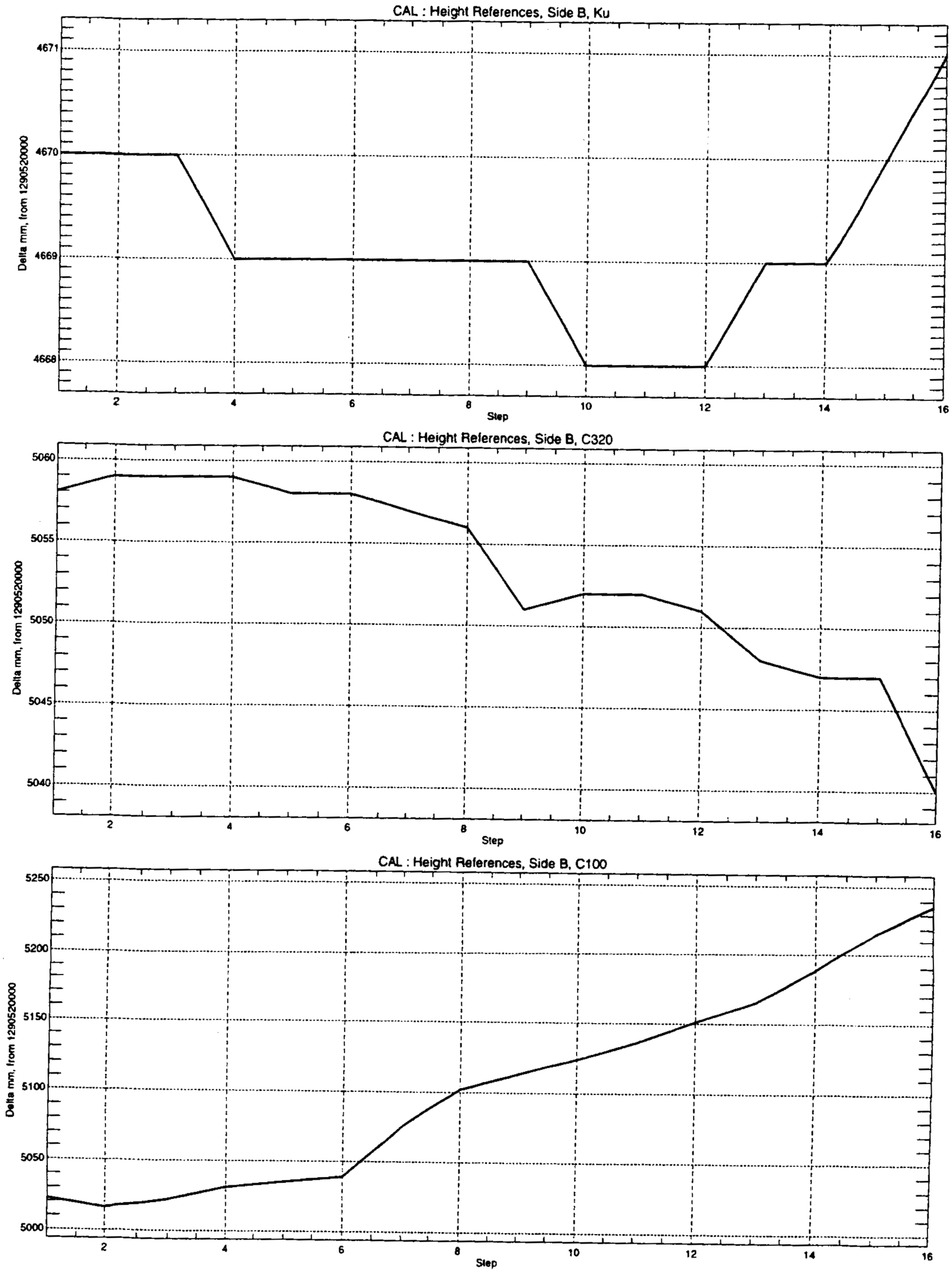


Figure D-4 QuickCAL Height References, Side B

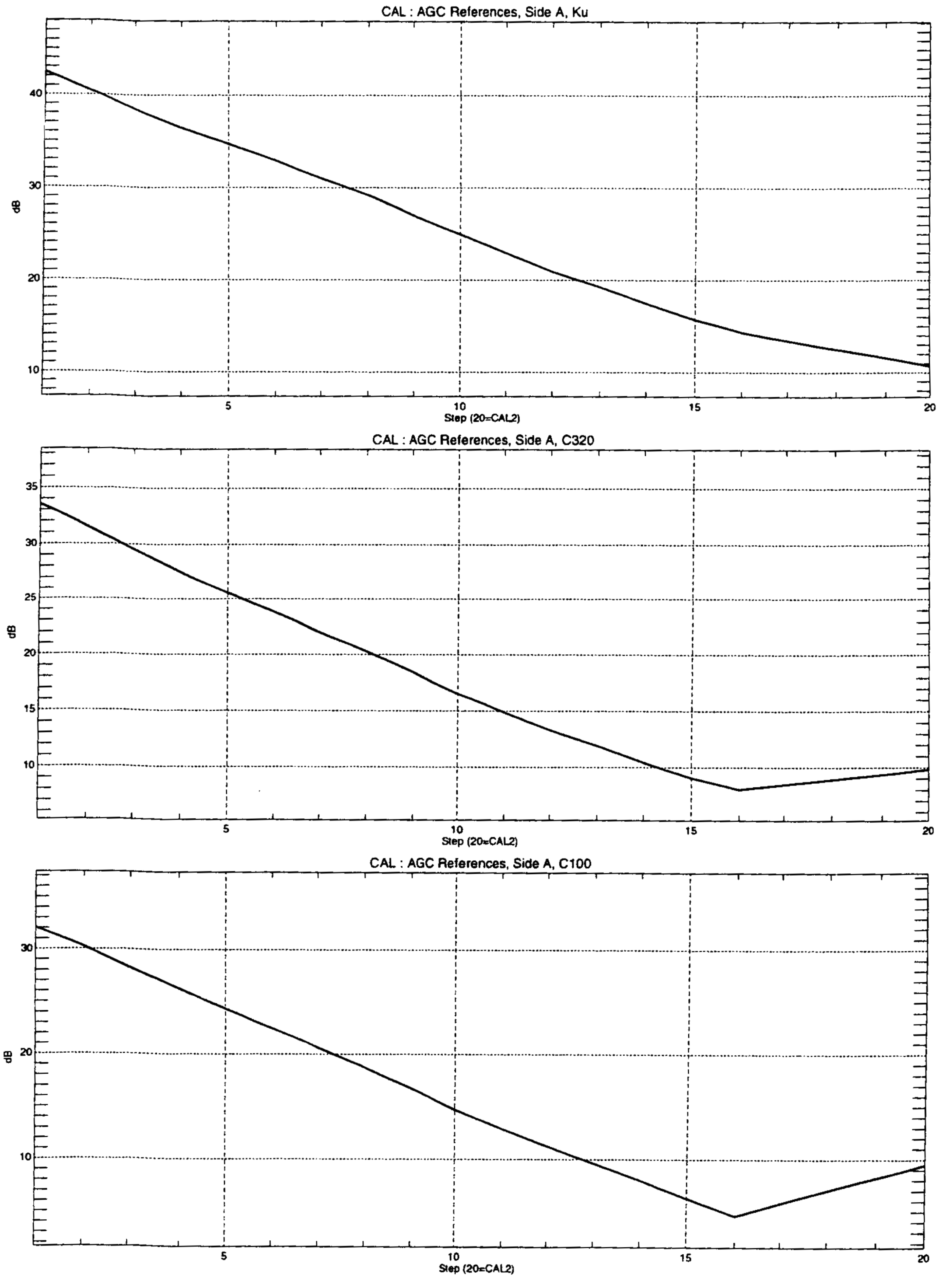


Figure D-5 QuickCAL AGC References, Side A

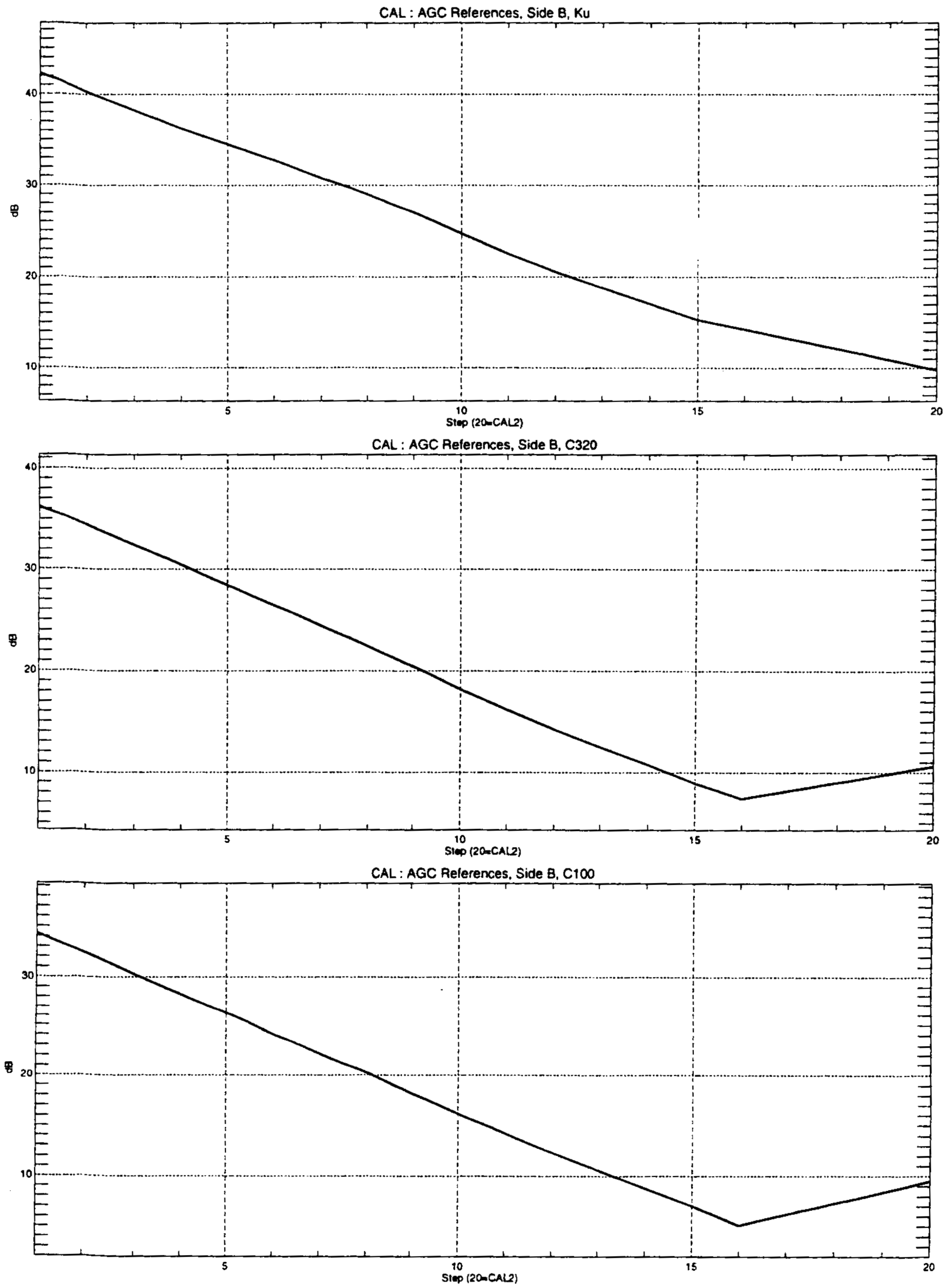


Figure D-6 QuickCAL AGC References, Side B

Appendix E
AIF Software

Table E-1 AIF Software Change History

Date	First Data Affected	Related Requests	Software Component(s)	New Version	Description of Changes
06/07/93	1992234		dotelem	3.0, 03/01/93	Baseline Version. Includes CAL1 Attenuator temperature correction.
			DataFile.TelemDriver	13.0 ,05/11/93	Baseline version.
			DataFile.EALimits	6.0, 05/25/93	Baseline version.
			DataFile.ROMMap	1.2, 11/30/92	Baseline version.
06/09/93	1993120		dotelem	3.2 ,05/18/93	New Height RMS method implemented (see Hayne/Brooks memos). Some previous data were reprocessed with the new version of dotelem.
08/03/93	1993214	93/233	dotelem	3.3, 07/20/93	Fix T3117 AGC Temperature corrections problem.
			aifcal.pro	n/a	Reduced number of daily CAL plots.
			DataFile.EALimits	6.0, 08/17/93	Fix AGC CAL Reference values to match new data to previous uncorrected AGCs.
08/10/93	n/a	93/234	aifeng.pro	n/a	Add delta transmit power plots to Launch-to-Date engineering package.
09/08/93	n/a	93/260	aifeng.pro aifcal.pro	n/a	Change labeling on Launch-to-Date plots.
10/01/93	AIF Processing Officially Placed Under Change Control, Memo 10/01/93, H. Gordon				
12/09/93	1993342	93/280	dotelem	3.4, 12/08/93	Fix memory check logic.
		93/279	DataFile.ROMMap	1.3, 12/08/93	Add Pulse Count Refresh patch to Memory Map.
		93/299	getjplbin	n/a	Switched from DECNET to FTP protocols for data transfer from JPL.

Table E-1 AIF Software Change History (Continued)

Date	First Data Affected	Related Requests	Software Component(s)	New Version	Description of Changes
01/27/94	1994026	94/007 94/010	dotelem	3.5 ,01/25/94	Add waveform monitoring and report time_last_reset in hex.
			aifhdr.pro readevents.pro	n/a	Print time_last_reset in hex..and number of resets per day.
			aifcal.pro	n/a	Plot only last 14 days of CAL steps by gate.
			DataFile.EALimits	07 ,01/26/94	Add waveform monitoring parameters.
			dailywf,wfdiff,wfdif-fall,wfdiff.pro,reade-vents.pro,aifhdr.pro	n/a	Created idl code and unix script to plot waveform differences.
			dailyaif, finishaif, stdaif	n/a	Modified unix script to support standard waveform difference processing.
			topexigdr.prg, wfhi.dbase, wflo. dbase	n/a	Waveform databases created & database code modified to support same.
03/31/94	1994025	94/009	DataFile.CMD	n/a	Added new mnemonics.
09/16/94	1994264	94/115	dotelem	3.6, 9/16/94	Corrected full-rate waveform averages problem. Implemented new Hayne CAL processing. ALL DATA WAS PREPROCESSED.
		94/134	DataFile.EALimits	8.0, 09/16/94	Added Side B AGC temperature correction coeffi-cients
02/15/95	1995046	94/045	dotelem	4.0, 02/10/95	Added CACQ processing, PassCount processing, and improved memory comparison.
			DataFile.EALimits	10.0, 02/10/95	Added constants for CACQ processing & memory comparison.
			DataFile.ROMMap	2.0, 02/10/95	Added new memory locations to map.

Appendix F
Attachments

Table F-1 List of Attachments

Date	Author(s)	Subject
October 1998	J.Lee/D. Lockwood	JPL SPAT Display Instructions (Revised)
October 1998	J.Lee/D. Lockwood	AIF Retrieval & STANDARD Processing Instructions (Revised)
October 1998	J.Lee/D. Lockwood	SPECIAL Processing Instructions (Revised)
March 4, 1993	G.S. Hayne	Estimating Ku Range Noise
June 21, 1993	G.S. Hayne	TOPEX Waveform Fitting Program fittpx
September 29., 1993	G.S. Hayne	Needed Corrections to TOPEX Waveform Fitting Program fittpx
October 1, 1993	H. Gordon	Change Control Status ffor AIF Processing Module
October 1, 1993	J. Lee, D. Lockwood	AIF Processing
October 6, 1993	J. Lee	Suggested Correction to AIF Processing
December 9, 1993	H. Gordon	EA S/W Change 4: Memory map
December 9, 1993	H. Gordon	EA S/W Change 5: Memory Dump Address
December 9, 1993	J. Lee, D. Lockwood	Emergency TOPEX AIF Processing change request
December 9, 1993	H. Gordon	EA S/W Change 6: JPL/WFF File Transfer
December 9, 1993	J. Lee, D. Lockwood	Final JPL SPAT Displays and Instrument File Retrieval & Processing Instructions
January 20, 1994	J. Lee, D. Lockwood	RE: Change Request for AIF Processing Module: CAL Plot Change
January 24, 1994	J. Lee, D. Lockwood	RE: Change Request for AIF Output of Last Time Reset - Revisited
January 25, 1994	J. Lee, D. Lockwood	RE: Request 94/010
January 25, 1994	J. Lee, D. Lockwood	RE: Request 94/007
January 25, 1994	J. Lee, D. Lockwood	RE: Request 94/008
January 25, 1994	J. Lee, D. Lockwood	RE: Request 94/011
February 1, 1994	H. Gordon	EA S/W Change 10: Last Reset Time of Day

Table F-1 List of Attachments (Continued)

Date	Author(s)	Subject
February 1, 1994	H. Gordon	EA S/W Change7: Waveform Monitoring
February 1, 1994	H. Gordon	EA S/W Change 8: SEU Monitoring
February 1, 1994	H. Gordon	EA S/W Change 11: CAL Plot Change
March 21, 1994	H. Gordon	EA S/W Change 9: Error Reset Mnemonics
May 26, 1994	R. Brooks, J. Lee	Temperature Corrections for Side-B CA-1 Ku and C AGC
May 27, 1994	J. Lee, D. Lockwood	Suggested Corrections to AIF Processing: Full Rate Waveforms
June 3, 1994	R. Brooks	Implementation of Temperature Correction Coefficients for Side-B CAL-1 Ku and C AGC
June 28, 1994	G.S. Hayne	Corrections to Range Bias Determined in TOPEX Calibration Mode 1
July 7, 1994	G.S. Hayne	Replacement Figure 3 for DRAFT Memo "Corrections to Range Bias Determined in TOPEX Calibration Mode 1" of 28 June 1994
September 21, 1994	H. Gordon	EA S/W Change 15: AIF Waveform Processing Correction
September 21, 1994	H. Gordon	EA S/W Change 20: Side B Temperature Correction Coeffs.
September 21, 1994	H. Gordon	EA S/W Change 19: New CAL Processor
January 17, 1995	J. Lee	RE: Request 94/193
February 24, 1995	J. Lee	Change Request 95/045

JPL SPAT Display Instructions

Note: Requests for ALT Science and Engineering instrument files should be directed to the TOPEX Data Analyst Office at 818/393-0701.

1. **Launch the TCP/Connect II** - click on its icon.
2. For EACH display you wish to view, perform steps 3 through 11.
3. Under **Terminal** on the menu bar at the top of the screen, select **Connect**.
4. In the **Session Name** text field, **type 128.149.96.13** and click the "**OK**" button.
5. Press the [return] key once to get TGSA's attention.

   User Name : (opssys) and press the **[return]** key at the Username: prompt.

   Password: (*?) and press the **[return]** key at the Password: prompt.
   (*Password cannot be published but must be obtained from a cognizant TOPEX team member.)

   Note: If there are errors made in entering username/password attempts, the jpl system will temporarily lockout user for a period of time. After an undetermined amount of time, the system will accept another attempt.

TCP/Connect II VT102 Emulation Keys	
VT102 Key	**Mac Keyboard**
enter	[enter] on numeric keypad
PF1	[clear] on numeric keypad
PF2	[=] on numeric keypad
PF3	[/] on numeric keypad
PF4	[*] on numeric keypad
KP0	[0] on numeric keypad
KP1	[1] on numeric keypad
KP2	[2] on numeric keypad
KP3	[3] on numeric keypad
KP4	[4] on numeric keypad
KP5	[5] on numeric keypad
KP6	[6] on numeric keypad
KP7	[7] on numeric keypad
KP8	[8] on numeric keypad
KP9	[9] on numeric keypad
KP.	[.] on numeric keypad

TCP/Connect II VT102 Emulation Keys	
VT102 Key	**Mac Keyboard**
Up	[ ] on cursor keypad
Down	[ ] on cursor keypad
Left	[ ] on cursor Keypad
Right	[ ] on cursor Keypad

6. Follow on-screen instructions until you get to the **TCCS MAIN MENU.**
7. Press the [**enter**] key on the **numeric keypad** to access the **TELEMETRY** menu.
8. Follow Step 9 to choose from a list of displays, or Step 10 to view a "standard" display.
9. Press the [**Down**] key three times to hilight **TLM3 VIEW CHANNEL DATA (LIST OF DISPLAYS).**

   Press the [**enter**] key on the numeric keyboard to select this choice.

   Press the [**KP.**] key.

   Type **SPAT*** in response to **Where DISPLAY_NAME is.**

   Press the [**PF3**] key to execute the query.

   Use the [**Up**] and [**Down**] keys to hilight the desired screen. Note: using the [Up] key to scroll backwards may produce strange results.

   Press the [**PF1**] then [**KP4**] keys to select your choice. The selected display should now be viewable on screen.
10. Press the [**Down**] key two times to hilight **TML2_1 VIEW CHANNEL DATA - DUAL COLUMN.**

    Press the [**enter**] key to select this choice.

    Press the [**KP.**] key. Type one of the following choices in response to **DISPLAY_NAME is**. For example, **SPAT-ALTAC**.

"Standard" Displays	
Name	**Description**
SPAT-ALTAC	ALT-A Command Words
SPAT-ALTAD	ALT-A Memory Dump
SPAT-ALTAP	ALT-A Powers
SPAT-ALTRS	S/C & RESET Times & SCI Word

Press the **PF1** and **KP4** keys to confirm your choice. The selected display should now be viewable on-screen.

11. You may move the display screen windows around by clicking on the title bar and dragging the mouse. The title bar is the area at the top of the window that contains "128.149.96.13" surrounded by faint lines.

12. To exit, for each window, "back-out" of TGS system by pressing subsequent [**PF1**] then [**KP0**] keys.

    Note: at screen bottom : At HOME level, now exiting. Are you sure (y/n):___[return].

13. Under **File** on the menu bar at the top of the screen, select **QUIT** to exit TCP/Connect II.

AIF Retrieval & STANDARD Processing Instructions

Note: Requests for ALT Science and Engineering instrument files should be directed to the TOPEX Data Analyst Office at 818/393-0701.

Definitions

UTC: Coordinated Universal Time. Time is represented in the format "YYYYDDDtHHMMSS", where YYYY represents year, DDD represents the Julian day of the year, and HHMMSS represents hours, minutes, and seconds. Eastern Standard Time = UTC Time - 5 hours. For example: 1993285t060203 represents October 12, 1993 at 01:02:03 EST.

fileutc: The UTC portion of a filename. JPL creates their AIF filenames by using the UTC of the start of the data.

filename: The name of a file. Standard filenames consist of a prefix, a ***fileutc***, and a suffix, where the prefix and suffix identify the file type.

Instructions

14. Log on to osb3 by doing the following:

    Select **TCP/Connect** - click on its icon

    Under **Terminal** on the menu bar at the top of the screen, select **Connect** .

    Session Name: **osb3** [select "**okay**"] (Note: It is not necessary to enter information for Window Name:)

    Login: (**user name**) [return]
    Pswd: (**user password**) [return]

15. Your path must be able to access several binaries and the IDL_PATH.

    Type: **setenv PATH /gen/topex2/bin:/opt/bin:$PATH** [return]
    Type: **source /opt/idl/bin/idl_setup** [return]

16. Change to the AIF processing directory.

    Type: **cd /gen/topex2/aif** [return]

17. To see what files are available at JPL.

    Type: **lsjplaif** [return]

18. Run the automated daily processing system. This will take approximately 1.5 hours for a full 24-hour AIF.

    Type: **stdaif** ***fileutc*** [return]
    (note: fileutc would be in the format as YYYYDDDtHHMMSS.)

The automated daily processing will print the following products:
aifsci, the daily science product
dailyeng, the daily single-page engineering product
aifcal, the daily CAL mode product
aifhdr, the processing summary
aifevents, the events listing

It will also create the following output files for any additional processing:
aif_eng_*fileutc*.std, 5-minute engineering averages.
aif_sci_*fileut*c.std, 10-second science averages.
aif_event_*fileutc*.std, an event report.
aif_eng_*fileutc*.db, 1-hour engineering averages.
aif_cal_*fileutc*.db, CAL mode averages.
aif_hdr_*fileutc*.db, a header report

19. If more engineering parameters need to be examined, run the idl program that plots all engineering parameters.

    Type: **aifeng*filename***, where filename is of the form **aif_eng_*fileut*c.std**.

20. If other types of processing is required, see **SPECIAL Processing Instructions**.
21. If task is completed, type: **exit**. Then, under File on menu bar, select **Quit.**

SPECIAL Processing Instructions

Note: Requests for ALT Science and Engineering instrument files should be directed to the TOPEX Data Analyst Office at 818/393-0701.

Definitions

UTC: Coordinated Universal Time. Time is represented in the format "YYYYDDDtH-HMMSS", where YYYY represents year, DDD represents the Julian day of the year, and HHMMSS represents hours, minutes, and seconds. Eastern Standard Time = UTC Time - 5 hours. For example: 1993285t060203 represents hours, minutes, and seconds. Eastern Standard Time = UTC Time - 5 hours. For example: 1993285t060203 represents October 12, 1993 at 01:02:03 EST.

fileutc: The UTC portion of a filename. JPL creates their AIF filenames by using the UTC of the start of the data.

filename: The name of a file. Standard filenames consist of a prefix, a ***fileutc***, and a suffix, where the prefix and suffix identify the file type.

Instructions

1. Log on to osb3.

2. Your path must be able to access several binaries and the IDL_PATH.
   Type: **setenv PATH /gen/topex2/bin:/opt/bin:$PATH[return]**
   Type: **source /opt/idl/bin/idl_setup**

3. Change to the AIF processing directory.
   Type: **cd /gen/topex2/aif [return]**

4. You can check to see what files are available at JPL.
   type: **lsjplaif**

5. If you haven't already retrieved the data, retrieve the Engineering Instrument File.
   Type: **getjplbin '14.429::WFFDEV:[WFFUSER.WFF_DATA]*filename*[return]**
   Where ***filename*** is of the format **tcc_alteng_*fileutc*bin**
   (24 hours of data takes approximately 5 minutes to retrieve)

6. If you haven't already retrieved the data, retrieve the Science Instrument File.
   Type: **getjplbin '14.429::WFFDEV:[WFFUSER.WFF_DATA]*filename*[return]**
   Where ***filename*** is of the format **tcc_altsci_*fileutc*bin**
   (24 hours of data takes approximately 45 minutes to retrieve)

7. dotelem requires UTC Seconds for time selections. If you wish to do a time selection and don't know UTC Seconds, run utcconvert to convert from UTC Clock Time to UTC Seconds. Remember, Eastern Standard Time = UTC Time - 5 hours.

Convert the start time.
Type: **utcconvert**
Type: **2 [return]** in response to **Select UTC Time to Enter**
Type: ***UTC*** in response to **Enter UTC in the format YYYYDDDtHHMMSS**
Write down the time in seconds. You won't be able to remember it.
Type: **[return]** in response to **Press RETURN to Continue**

Convert the stop time.
Type: **2 [return]** in response to **Select UTC Time to Enter**
Type: ***UTC*** in response to **Enter UTC in the format YYYYDDDtHHMMSS**
Write down the time in seconds. You won't be able to remember it.
Type: **[return]** in response to **Press RETURN to Continue**
Type: **x [return]** in response to **Select UTC Time to Enter** in order to exit.

8. Run dotelem. Follow the on-screen menus to select what processing you wish to perform. Note that selecting by Latitude/Longitude does not work. The names of the output files will be printed on the screen after your processing selections are complete. They will also be written into an aif_???.log file. Write down the output filenames and wait until procesing is complete.
   Type: **dotelem** and follow on-screen instructions.
   Type: **x[return]** in response to **Enter File Type** to exit.

9. Use the following table to choose what output command corresponds to your processing selection. Run that command by typing it.

Table of Processing Selections & Output Commands		
Processing Selection	Output Command	Description/Comment
0. Do Standard Processing	n/a	Previously documented.
1. Create AIF Databases	n/a	No output commands available.
2. Dump Telemetry	n/a	Load into spreadsheet of view on-screen.
3. Average Science Data	aifsci *filename*	Plot science data.
4. Average Engineering Data	aifeng *filename* dailyeng *filename*	Plot single-page selected engineering data.
5. Average Waveform Data	topexautowf *filename* topexwf *filename*	Plot auto-scaled waveforms. Plot fixed-scale waveforms.
6. Report Status Changes	n/a	Print or view on-screen.
7. Create SDR	n/a	No output commands available.

WFF TOPEX INFORMAL MEMORANDUM

Date: March 4, 1993

From: G. S. Hayne

To: R. L. Brooks, D. W. Hancock, & C. W. Purdy

Subject: Estimating Ku Range Noise

Introduction

David Hancock suggested that we might be able to assess the range noise of the TOPEX Ku altimeter by using noise estimates of the Ku ionospheric correction, *i.e.*, the term which is subtracted from the Ku range to remove the effects of ionospheric propagation delay. First I'll review what everybody knows about the two-frequency altimeter, and then I will show that the noise of the Ku ionospheric correction can be simply scaled to estimate the Ku-only range noise if one knows the ratio of the C320-only range noise to the Ku-only range noise.

General Review

The radar propagation to/from the ocean surface is retarded by an amount proportional to the free electron content of the propagation path and inversely proportional to the radar frequency. In general, the Ku altimeter's range can be written as

$$r_K = r_0 + Q/(f_K^2) + n_K, \text{ where}$$

r_0 is the true range, Q is proportional to total electron content (TEC), f_K is the Ku altimeter's frequency, and n_K is a zero-mean noise term with the expectation values $\langle n_K \rangle = 0$, and $\langle n_K^2 \rangle = \sigma_K^2$. A similar equation describes the C altimeter range as

$$r_C = r_0 + (Q/(f_C^2)) + n_C,$$

with similar noise properties $\langle n_C \rangle = 0$, and $\langle n_C^2 \rangle = \sigma_C^2$.

These two equations can be solved for the true range r_0 with the result

$$r_0 = (K/(K-1))r_K - (1/(K-1))r_C, \text{ where } K = (f_K/f_C)^2.$$

It can also be shown that the standard deviation of r_0, denoted σ_0, is given by

$$\sigma_0 = (K^2\sigma_K^2 + \sigma_C^2)^{1/2} /(K-1).$$

Finally, the Ku ionospheric bias term Q/f_K^2 can be expressed as

$$Q/f_K^2 = (r_C - r_K)/(K - 1),$$

and the C320 ionospheric bias term as

$$Q/f_C^2 = (r_C - r_K)K/(K - 1).$$

Since it is easy to show that the standard deviation of $(r_C - r_K)$ is $(\sigma_K^2 + \sigma_C^2)^{1/2}$, then the standard deviation of the Ku ionospheric bias term is

$$\sigma_{i,K} = [(\sigma_K^2 + \sigma_C^2)^{1/2}/(K-1)],$$

and the standard deviation of the C320 ionospheric bias term is

$$\sigma_{i,C} = [(\sigma_K^2 + \sigma_C^2)^{1/2}\, K/(K-1)].$$

Practical Range Noise Estimates

We can invert the Ku ionospheric term's standard deviation to find that the Ku-only range standard deviation σ_K can be written as

$$\sigma_K = A\ \sigma_{i,K}\text{ , where}$$

$$A = (K - 1)/(1 + (\sigma_C/\sigma_K)^2)^{1/2}.$$

Then the combined (or ionosphere-corrected) range standard deviation σ_0 can be written as

$$\sigma_0 = B\ \sigma_{i,K}\text{ , where}$$

$$B = [\ (K^2 + (\sigma_C/\sigma_K)^2)\ ]^{1/2} /\ \ [\ (1 + (\sigma_C/\sigma_K)^2)\ ]^{1/2}$$

In most of the Topex data, we expect σ_C to somewhere in the range of one to two times σ_K. Table 1 gives values of the multipliers A and B for several values of the ratio σ_C/σ_K, with the frequency ratio factor K evaluated with frequencies of 13.6 GHz for Ku and 5.3 GHz for C320.

Table 1. Factors A and B for different σ_C/σ_K values

σ_C/σ_K	1	1.2	1.4	1.6	1.8	2
A	3.95	3.58	3.25	2.96	2.71	2.50
B	4.71	4.28	3.91	3.59	3.32	3.08

Example

Figure 1 plots the 1-second standard deviation of the Ku ionospheric correction, $\sigma_{i,K}$, from a series of 30-second averages of data from TOPEX pass 21 of cycle 8. Figure 2 is the

SDR summary plot for the same pass. Several large outliers have been eliminated from the Figure 1 data. It is possible to argue that the quietest regions of Figure 1 showed $\sigma_{i,K}$ values of 0.005 meters. If we assume $\sigma_C/\sigma_K = 1.0$, then A = 3.95 so that σ_K is 3.95 times 0.005 meters or 1.98 cm; likewise B = 4.71 so that σ_0 is 4.71 times .005 m or 2.35 cm.

Conclusion

This memo has shown a simple way of estimating Topex Ku-only range noise or combined Ku-C range noise to noise estimates of the Ku ionospheric correction. This method would be a good candidate for producing range noise estimates for the next version of the Topex data base here at WFF.

Figure 1. Results from 30-Frame Averages in Pass 008_021

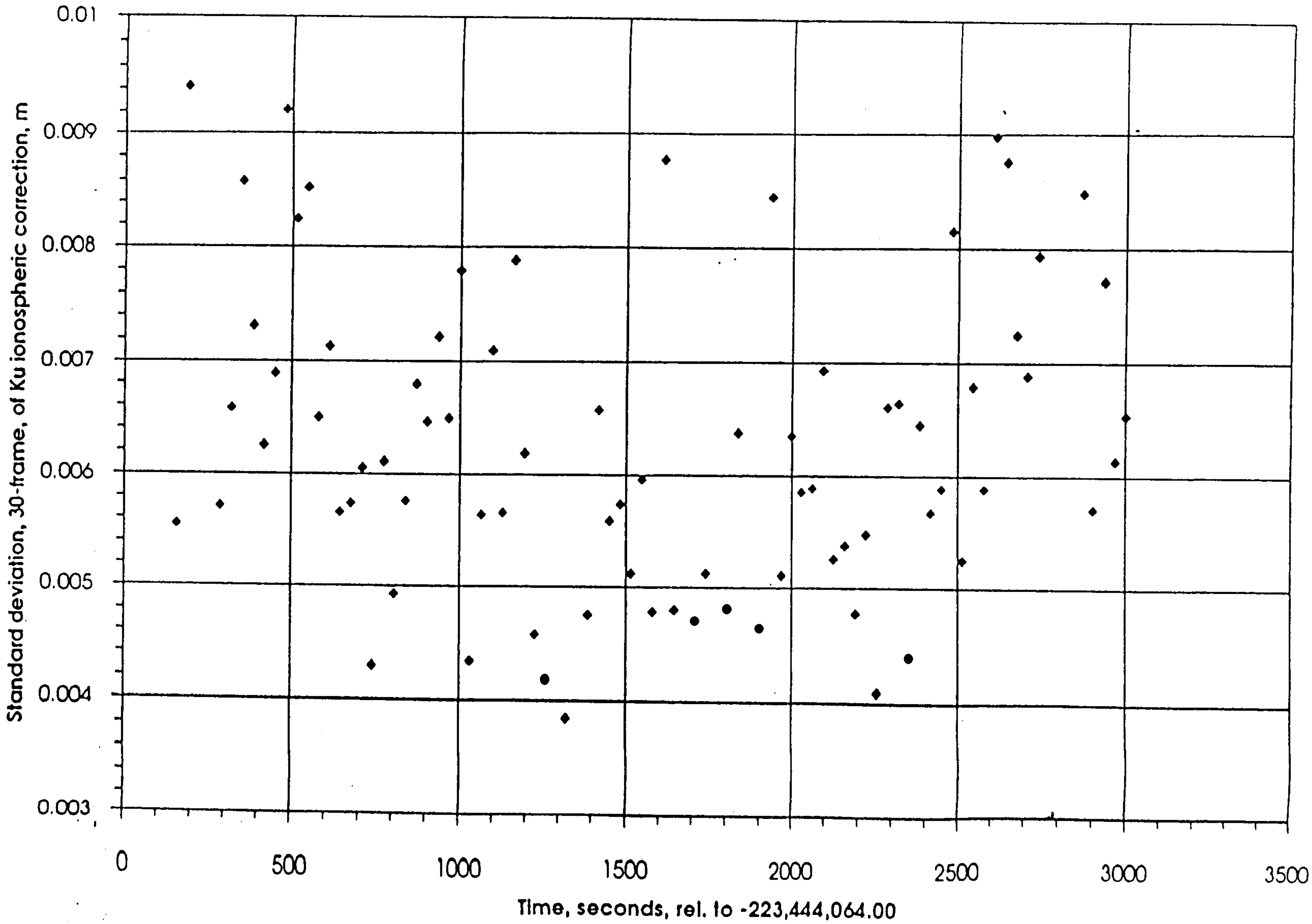
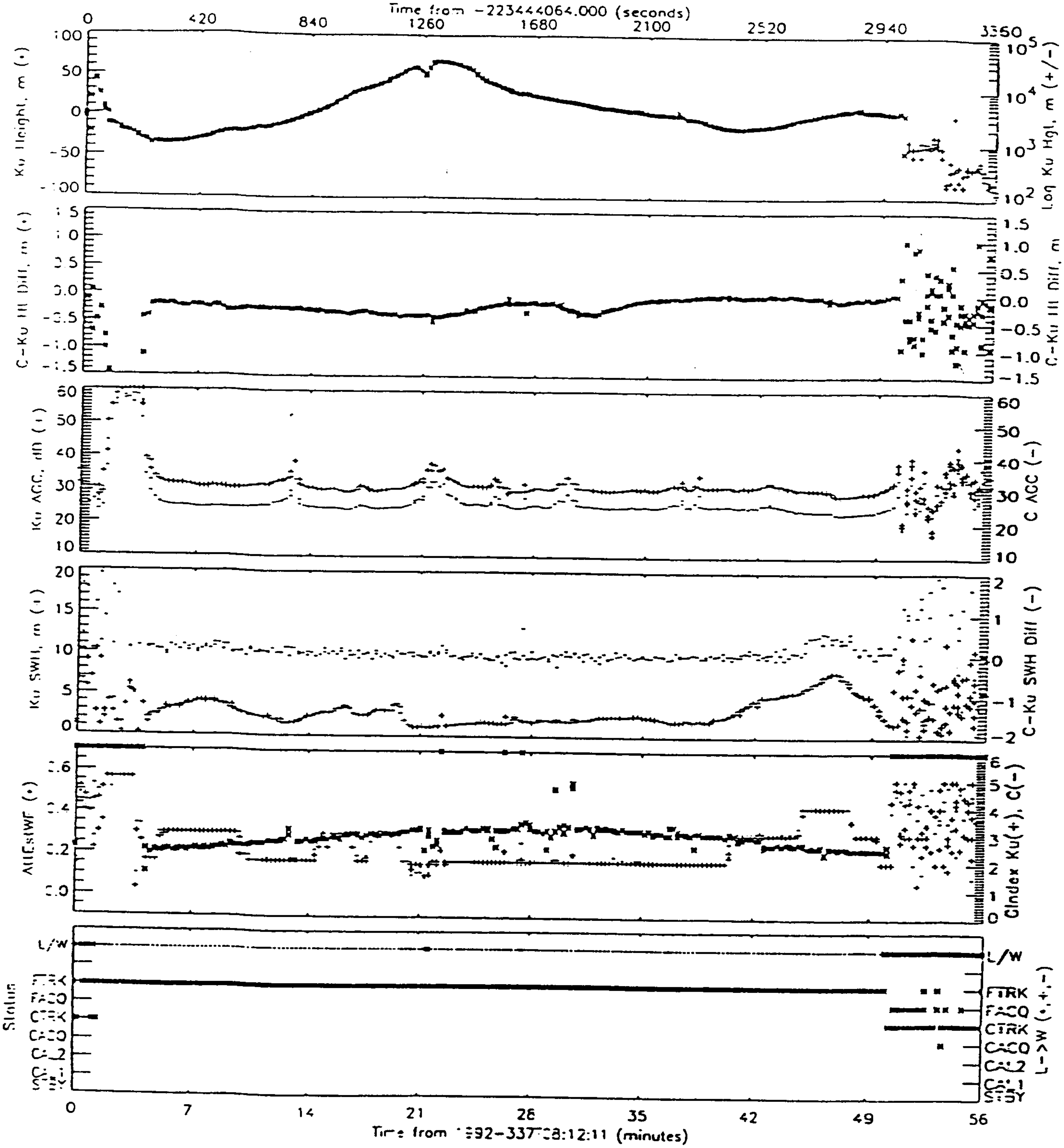
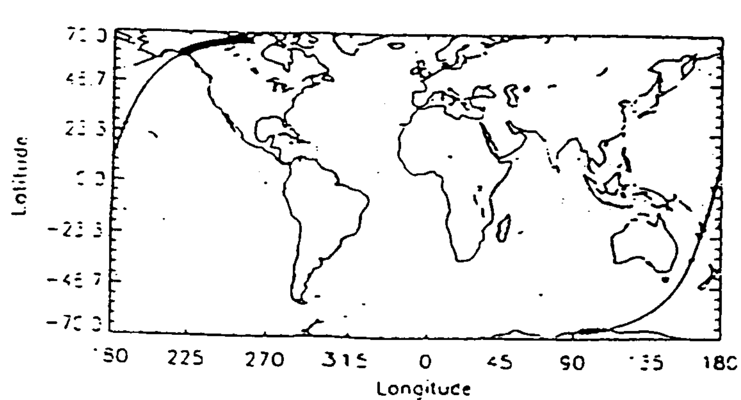


Figure 2





CYCLE 8, PASS 21

Input File: sdr_sci_008_021.std
NumRec =348, Interval = 10
Summary created Wed Jan 20 20:29:56 1993
SDR Software = Version 3.0, 01/14/93
SensorVersion = Version 10, 10/27/92
EALimVersion = Version 05, 01/19/93
ROMMapVersion = Version 1.2, 11/30/92
SIS_ID = 633-751-23-001/1992-05-15 ;
ALT_SDR_SW_PED= 633-755/1992-11-25 ;

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WFF TOPEX INFORMAL MEMORANDUM

Date: June 21, 1993

From: George Hayne

To: Dennis Lockwood
cc: Ron Brooks, Ron Forsythe, Hayden Gordon, David Hancock

Subject: TOPEX Waveform Fitting Program fittpx3

This memo is a brief description of the current TOPEX waveform fitting program which is called fittpx3. Among the several significant changes and improvements in fittpx3 compared to earlier versions are:

- all three possible altimeters (Ku, C-320, and C-100) are now handled within the single program,
- the waveform data to be fitted are from the output of the current version of Jeff Lee's TOPEX program dosdr
- the waveform fit control file now includes the antenna beamwidth (which was hard-coded in the older fit program versions)
- a substantially improved first guess is now provided for the parameter values which are to be fitted.

You have somewhere an older version of a TOPEX waveform fitting program and I would suggest that you replace it with the fittpx3 described here.

You will find in directory /osbnet/hayne/public/fitstuff all of the necessary files to compile, load, and execute fittpx3 on the osb1 computer. Here is a list of the files I have provided:

```
Various files in directory fitstuff, 06/21/93
-------------------------------------------------------------
-rw-rw-rw-  1 hayne      7445 Jun 21 10:14 aguess3.f
-rw-rw-rw-  1 hayne       562 Jun 21 10:14 c027045a.job
-rw-rw-rw-  1 hayne      1356 Jun 21 10:14 c027045a.out
-rw-rw-rw-  1 hayne       566 Jun 21 10:14 c027045a.prm
-rw-rw-rw-  1 hayne      8358 Jun 21 10:14 c027045a.prt
-rw-rw-rw-  1 hayne       995 Jun 21 10:14 cfp13f10.d
-rw-rw-rw-  1 hayne      5886 Jun 21 10:14 drvxxtpx.f
-rw-rw-rw-  1 hayne      2313 Jun 21 10:14 dsyinv.f
-rw-rw-rw-  1 hayne     12255 Jun 21 10:14 fitprm3.f
-rwxrwxrwx  1 hayne    307725 Jun 21 10:14 fittpx3
-rw-rw-rw-  1 hayne     25797 Jun 21 10:14 fittpx3.f
-rw-rw-rw-  1 hayne      1276 Jun 21 10:14 fittpx3.makefile
-rw-rw-rw-  1 hayne      8710 Jun 21 10:14 genwavxx.f
-rw-rw-rw-  1 hayne      8780 Jun 21 10:14 gfsrt.f
-rw-rw-rw-  1 hayne      3534 Jun 21 10:14 gseat.f
-rw-rw-rw-  1 hayne      3862 Jun 21 10:14 gsysxx.f
-rw-rw-rw-  1 hayne      3234 Jun 21 10:14 gtdata2.f
-rw-rw-rw-  1 hayne       210 Jun 21 10:14 inwtxx.d
-rw-rw-rw-  1 hayne       558 Jun 21 10:14 k027045a.job
-rw-rw-rw-  1 hayne      1356 Jun 21 10:14 k027045a.out
```

```
-rw-rw-rw-   1 hayne          566 Jun 21 10:14 k027045a.prm
-rw-rw-rw-   1 hayne         8358 Jun 21 10:14 k027045a.prt
-rw-rw-rw-   1 hayne         1133 Jun 21 10:14 kfp13f10.d
-rw-rw-rw-   1 hayne         3182 Jun 21 10:14 pickt4.f
-rw-rw-rw-   1 hayne          824 Jun 21 10:14 rlout2.f
-rw-rw-rw-   1 hayne         4725 Jun 21 10:14 sdr_wave_027_045a.hiavg
-rw-rw-rw-   1 hayne         4725 Jun 21 10:14 sdr_wave_027_045a.loavg
-rw-rw-rw-   1 hayne         9233 Jun 21 10:14 topwavxx.f
-rw-rw-rw-   1 hayne         2744 Jun 21 10:14 txat5134.f
-rw-rw-rw-   1 hayne         1349 Jun 21 10:14 txsw1051.f
-rw-rw-rw-   1 hayne         2981 Jun 21 10:14 wavtrp4.f
-rw-rw-rw-   1 hayne         5543 Jun 21 10:14 wv100tpx.f
-rw-rw-rw-   1 hayne         5909 Jun 21 10:14 wv320tpx.f
```

You can compile and load the program by executing the Unix system command "make -f fittpx3.makefile", and the executable module fittpx3 will be produced in whatever directory you choose to move this stuff to. I have also provided two short sample waveform data files for checking program operation, sdr_wave_027_045a.hiavg and sdr_wave_027_045a.loavg, for the TOPEX Ku and the C-320 altimeters respectively. Each of these sample files contains three 10-second waveform averages of over-ocean fine-track data.

Program fittpx3 has a variety of console dialog for job specification. It is generally easier to operate with job scripts, the set of user responses to the input details asked by fittpx3. I have provided job scripts k027045a.job and c027045a.job for running fittpx3 with the sample data files, and the output files from these sample jobs are k027045a.prt, k027045a.prm, c027045a.prt, and c027045a.prm. These sample jobs were run in background on osb1 by

fittpx3 <k027045a.job >k027045a.out &

fittpx3 <c027045a.job >c027045a.out &

and the output files k027045a.out and c027045a.out are also provided. (Normally I discard any *.out files after the background job is completed.) These examples have been for 10-second waveform averages. Here is one of the *.job files, the one for the Ku altimeter:

```
k027045a.prt
kfp13f10.d
1        ;;1st lin =outprintfile; 2nd=setupfile; YES, wts filename:
inwtxx.d
0        ;;NO, accept default Version 13 gains & additions
1        ;;Output parameters to following filename:
k027045a.prm
sdr_wave_027_045a.hiavg
0, 0     ;;selected all records for above input filename
0        ;;select all indgt values

 File k027045a.job, a script control file for Ku job in fittopex.

   This file is for 10-second averages with new additive
   waveform factors from v13.0 final (delivered 05/12/93)

```

17 revised 06/21/93

The bold italic line numbers are not in the *.job file itself, but I have inserted the numbers for this discussion.

Except for those jobfile lines providing file names, the lines supply one or two numbers for a free-format read operation by the fittpx3 program. The numbers-only lines can have comments anytime after the last number to be specified, and in the example above the comments are preceded by ";;". Line ***1*** above specifies the output file for eventual off-line printout if desired. Line ***2*** specifies waveform fit control file, to be discussed later. Line ***3*** specifies whether another input file is to be consulted for data-weighting, and the following line specifies that filename (the answer in this example was 1 = yes, that the data-weighting file to be used was named inwtxx.d). Line ***5*** allows specifying different waveform gains and additions than the default set, but in the example the default set was used.

Line ***6*** specifies additional output files: 0 = no other output files; 1 = output a file of fitted parameters to the filename on the next line; 2 = output a file of input and fitted waveform values to the filename on the next line; and 3 = output both fitted parameter and waveform files to the filenames on the next two lines.. In the example above, just the fitted parameter output file was requested. Line ***8*** specifies the input waveform data filename. Then line ***9*** indicates range of data to be fitted (by record number). For line ***9***, either actual numbers can be specified (1,4 to process records 1 through 4), or 0,0 can be entered to denote all available waveform data. Finally, line ***10*** allows restricting the gate index values to be fitted. The 0 signals that all gate index values are to be fitted; otherwise line ***10*** would indicate the number of separate gate index values to be fitted and a following line would indicate those gate index values (for example, 2 on line ***10*** followed and 1 and 3 on line ***11*** would allow only data with gate index values of 1 or 3 to be fitted). After the gate index values or range are specified, there is no more reading of the job script file, so the remainder of that file can be filled with file-identification comments. The source file fittpx3.f contains the code specifying what form the terminal (or redirected job script file) responses should have.

The waveform fit control file used in the Ku sample fit is given below:

```
5                           ;; # parameters to be fitted
5   60                      ;;low, high limit on fitted TLM samples
1  2  3  4  6               ;;Jordr(.) for the parameters to be fitted
200   0.05   0.5  20  0.1  0.025 .1     ;;the fit constraints
0     .10    .20   0  .05   .025  0.    ;;finite-step sizes for derivatives
9200. 0.00   3.0  95.  0.1  0.05  0.0   ;;first guess at parameter values
10                           ;;min NumRec required (10-sec avg's)
5,6      12,37      57,60          ;;lo,hi indices for Early, AGC, ATT gates
1        32.5               ;;nnnalt( =1 for Ku) & track-point
```

```
1334.     1.08           ;;altitude (km) & beamwidth (degrees)
75.       200.           ;;RMSlim & BSlim, for weight calc...

file kfp13f10.d                revised 05/13/93
   This is a file of settings for the Topex fitting routine
   fittpx3 doing 10-second averages.  The early gate for Att
   has been changed to match the simulation for Ku, about
   03/15/93.  The fit is for 5-parameters, at 0.1 skewness.
THE BEAMWIDTH IS 1.08 degrees (about 2.85% above nominal 1.05 degrees)
```

The seventh line of this file gives the minimum NumRec required. For the 10-second fit, this requires that 10 frames (TOPEX nominal 1 second/frame) were used in forming the waveform average. If 5-second waveform averages are to be fitted, this minimum value should be changed to 5. For full-rate data or 1-second averages, the value would be 1.

This memo obviously doesn't provide a complete fittpx3 description, but it should at least allow you to set up an operating version in your own work area. Please don't hesitate to come to me with questions or comments.

George Hayne

WFF TOPEX INFORMAL MEMORANDUM

Date: September 29, 1993

From: G. Hayne

To: Dennis Lockwood
cc: R. Brooks, R. Forsythe, H. Gordon, D. Hancock, J. Lee

Subject: Needed Corrections to TOPEX Waveform Fitting Program fittpx3

In an earlier memo "TOPEX Waveform Fitting Program fittpx3", G.S. Hayne, June 21, 1993, I described briefly the program, its subroutines, where to find them, and how to load and run the program. I had developed and used it exclusively on osb1, but Dennis Lockwood installed and ran it on osb4. Later, in analyzing data from ABCAL #21 on 09/14/93, we found that the results from osb1 and osb4 differed significantly in the fitted value of the range correction.

I have found the error which was in the subroutine wv320tpx. It is a simple parameter-setting statement which was badly written, with the original error being made years ago. The osb1 compiler interpreted the ambiguous statement in the way that had been intended, but osb4 treated it differently. The subroutine has been fixed, as has subroutine wv100tpx which had the same error. (Subroutine wv100tpx is called only if the C-100 waveform is being fitted, and we have never looked at any C-100 waveforms to date.)

I have also made minor cosmetic changes in the main program and in the subroutines topwavxx and drvxxtpx. Copies of the five revised files (fittpx3.f, drvxxtpx.f, wv100tpx.f, wv320tpx.f and topwavxx.f) have been put into the area /osbnet/lockwood/public. Please use these files to replace the earlier versions which were the subject of the June 1993 memo, and then recompile and reload the fittpx3 program into the same place where the current malfunctioning version resides. After this, there should be no further problems with the waveform-fitting program.

There are some very slight numerical differences for ABCAL #21 results from the osb1 and the (corrected) osb4 versions, but these are not a problem. The maximum range correction difference was 0.5 mm, the maximum SWH difference was 0.002 meters, the maximum amplitude difference was 9 (out of about 9000), and the maximum baseline difference was 0.6 (out of about 100). I consider these acceptable for the complicated fitting procedure, run on real data. For general information, I have attached a copy of a diagram showing the relationship of the various subroutines in program fittpx3; see me if you want a larger copy of this eye test figure.

For fittpx3, the Topex waveform-fitting-to-data program, the files are listed below:

source file name	relationship of various modules of fittpx3	type	arguments in calling list
fittpx3.f	fittpx3	main program	
.. in libwff	gtflg & banner	WFF library routines	
rlout2.f	rlout2	subroutine	(device #, outpt array, # output points)
gtdata2.f	gtdata2		modegd, 7, fnamid, 6, ierr, iend, iostat, tj2in, utctime, icycle, ipass, istep, trkmode, numreci, avindgt, vswh, fineht, yin
fitprm3.f	fitprm3	subroutine	nlo, nhi, yin, wty, ixdbg, ier, indgt, vswh, vatt, ztrk0, altkm, bwdeg, nnnalt ... also common /fitparms/Aprms, Astep, NA, jordr, guess, cnstr, ITER, SERSO
aguess3.f	aguess3	subroutine	la, indgt, vswh, vatt, swhcff, swh, iflags
txsw1051.f	txsw1051	subroutine	la, indgt, vswh, vatt, atcff, att, iflaga
txat5134.f	txat5134	subroutine	yin, nnnalt, vswh, vatt, indgt
drvxxtpx.f	drvxxtpx	subroutine	Aparm, Astep, Tims, drvMode, ztrk0, altkm, bwdeg, nnnalt
wv320tpx or wv100tpx	wv320tpx or wv100tpx	subroutine	Aparm, Wavs, Tims, ztrk0, altkm, bwdeg, nnnalt
dsyinv.f	dsyinv	subroutine	xmat, Na, Ifail, ndim, psym, qsym, rmsym
topwavxx.f	topwavxx	subroutine	PI, C, dgrd, rekm, NDIV, qtime, qdist, altkm, bwdeg, IFATT, NFLAT, Aold, Aspc, Agen, Atrp, NNP, NP2, NC2, nlobe, NCSYS, NSYS, NCSEA, NFSR, NTOP, NTRK, ztrk0, SYS, SEA, FSR, RES, CTSYS, CTSEA, CTFSR, CTRES, WV, WVgen, WVint, WVold, iuse, IFLAG, nnalt
genwavxx.f	genwavxx	subroutine	PI, C, dgrd, rekm, NDIV, qtime, qdist, altkm, bwdeg, IFATT, NFLAT, Agen, NNP, NP2, NC2, nlobe, NCSYS, NSYS, NCSEA, NFSR, NTOP, NTRK, ztrk0, SYS, SEA, FSR, RES, CTSYS, CTSEA, CTFSR, CTRES, WVgen, nnnalt
gsysxx.f	gsysxx	subroutine	PI, NNP, NP2, NDIV, nlobe, NCSYS, NSYS, SYS, SMSYS, nnnalt
in libwff ...	FFA	WFF library subroutine; also library r2tr, r4tr, r8tr, ord1, & ord2	
gseat.f	gseat	subroutine	qtime, Agen, NNP, NP2, NCSEA, SEA,
gfsrt.f	gfsrt	subroutine	C, dgrd, rekm, altkm, bwdeg, qtime, IFATT, NFLAT, Agen, NNP, NP2, NFSR, FSR,
in libwff ...	FFS	WFF library subroutine; also library r2tr, r4syn, r8syn, ord1, & ord2	
pickt4.f	pickt	subroutine	NNP, NDIV, NTRK, ztrk0, RES, WVgen
wavtrp4.f	wavtrp	subroutine	qtime, qdist, NDIV, Aspc, Agen, Atrp, WVint, NP2, NFSR, NTOP, NTRK, ztrk0, RES, IFLAG
–	drvxxtpx ... as called from fitprm3 above		

TOPEX InterOffice Memo

To: Ron Brooks, Ron Forsythe, George Hayne, David Hancock

From: Hayden Gordon

Date: October 1, 1993

Subject: Change Control Status for AIF Processing Module

By this memo, the NASA Radar Altimeter Instrument File processing module is considered baselined and is placed under change control; changes to any of its routines will be handled according to the TOPEX Software Development Team (SWDT) change control policy (stated below).

Attached is a summary of the functions performed by the module, the database structures, a sample of the standard products generated, and a list of the source code and data files affected.

SWDT Change Control Policy

Any changes to SWDT baselined software, under change control, will be handled according to the following process:

1. A memo describing the requested change will be generated and circulated to all members of the TOPEX Algorithm Development Team (ADT), and to the SWDT (for implementation comments).
2. The memo will be discussed at a meeting (regular or special) of the ADT, at which time any special implementation comments (from the SWDT) will be considered. If the change is approved by the ADT, a priority will be assigned. The process will not proceed beyond this step until ADT approval is secured
3. An SWDT Work Request will be generated, signed by the NASA SWDT manager, and attached as a cover to the original memo.
4. The SWDT request will be given a title, EA S/W Chg #, and processed in the normal manner.
5. When the request is completed, a brief memo will be generated by the SWDT to summarize the change, to date the change (the date when implemented and the date when the change will appear in the data), and to list the affected routines and data files. Any new or modified products will be attached, if applicable. The implementation memo will be delivered to all members of the ADT, and the process will be complete.

CC: Jeff Lee, Dennis Lockwood, Carol Purdy

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Software Development Team
TOPEX Project
NASA GSFC/WFF

To : CSC/Hayden Gordon
From: CSC/Dennis Lockwood, CSC/Jeff Lee
Date: October 01, 1993
Subject: AIF Processing.

Attached are listing of the database structures and sample output products from the Altimeter Instrument File daily processing. The processing methodology, database structure, processing software, and plotting software is hereby under change control. No modifications, additions, or deletions will be made to this system without the proper (TBD) authorization.

Processing Methodology.

1. Daily, data is retrieved automatically from JPL starting at 3AM Eastern Time.

2. Daily, **doTelem** is automatically run on the retrieved data and produces the following output files :

    a. Event file listing.
    b. 5-min Engineering Averages for daily plotting.
    c. 1-min Science Averages for daily plotting.
    d. Average CAL Mode differences for plotting & database.
    e. 1-Hour Engineering Averages for database.
    f. Header (Processing summary) listing for printing & database.

3. Daily, various programs are automatically run in IDL to produce the following output products :

    a. Event listing.
    b. Daily Engineering plot.
    c. Daily Science plot.
    d. Daily CAL plot.
    e. Daily Processing Summary plot.

4. At the beginning of each week, database files are loaded into the master database and the following output products are generated :

    a. Launch-to-Date Engineering.
    b. Launch-to-Date CAL.

Attached are listing of the database structures and sample output products. Attachment A contains the structure of the databases. Attachment B contains sample of the daily products. Attachment C contains samples of the Weekly products. Appendix D is a list of software and datafile titles put under change control by this (or some previous) memo.

Software Development Team
TOPEX Project
NASA GSFC/WFF

To : CSC/Hayden Gordon, CSC/Dennis Lockwood
From: CSC/Jeff Lee
Date: October 06, 1993
Subject: Suggested Correction to AIF Processing.

In running a memory dump requested by D. Hancock on the day 278 partial Instrument File, I noticed that the memory was changing. This threw me into a panic and I started debugging a COPY of dotelem. This debugging has uncovered a potential problem, but it was not the problem I had originally attempted to trace.

There was/is no problem with the memory dump. The memory dump was not changing because the altimeter was dumping a portion of memory that did not change. However, in debugging, I noticed that if memory did not change, memory did not get compared with the ROMMap reference. This design goal was to speed processing by reducing redundant memory comparisons, but the implemention is wrong because it checks the Memory Dump and not the Memory Dump <u>Address</u> for a change. This has the effect of bypassing the memory comparison when consecutive memory dump locations contain the same memory pattern. The implementation should check the Memory Dump <u>Address</u>, not the actual memory dump for changes. This correction is the recommended change.

In practice, this should not present a problem because the memory that is compared rarely, if ever, contains the same bit patterns. However, whereever there is potential for a problem, a problem usually occurs. Since dotelem is change-controlled software, this memo is to advise the team of a potential problem and offer a suggested correction. A software change notice will be required in order to fix the problem.

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TOPEX InterOffice Memo

To: Ron Brooks, Ron Forsythe, George Hayne, David Hancock

From: Hayden Gordon

Date: December 9, 1993

Subject: EA S/W Chg 4: Memory Map

Attached is a memo from David Hancock requesting a change in the baselined AIF processing module to account for a revision in the on-board memory map (Pulse Count Refresh standard patch). This change, designated Engineering Assessment Software Change Request 4, has been completed. The modification was made on December 8, 1993, with the release of Version 1.3 of the datafile containing the on-board memory map, Datafile.ROMMap. The change became effective with data processed beginning December 9 (1993343). No routines within the program 'dotelem' were affected. The change in the memory map was tested in conjunction with EA S/W Chg 5 (correction of Memory Dump verification logic) using Altimeter Instrument File data from Day 341; as anticipated, no changes were detected. A further test was run using older data (1992323), and the absence of the Pulse Count Refresh patch was properly detected. No standard output products were modified by the change.

CC: Jeff Lee, Dennis Lockwood, Carol Purdy

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TOPEX InterOffice Memo

To: Ron Brooks, Ron Forsythe, George Hayne, David Hancock

From: Hayden Gordon

Date: December 9, 1993

Subject: EA S/W Chg 5: Memory Dump Address

Attached is a memo from Jeff Lee requesting a change in the baselined AIF processing module to account for an improper implementation of the Memory Dump processing logic. This change, designated Engineering Assessment Software Change Request 5, has been completed. The modification was made on December 8, 1993, with the release of Version 3.4 of the AIF processing module. The change became effective with data processed beginning December 9 (1993343). The routine, CheckEng.f, within the program 'dotelem' was affected. The change was tested in conjunction with EA S/W Chg 4: Memory Map Modification. No standard output products were modified by the change.

Thanks,

CC: Jeff Lee, Dennis Lockwood, Carol Purdy

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Software Development Team
TOPEX Project
NASA GSFC/WFF

To: CSC/Hayden Gordon
From: CSC/Dennis Lockwood, CSC/Jeff Lee
Date: December 09, 1993
Subject: **Emergency** TOPEX AIF Processing change request.

I request emergency authorization to switch from DECNET to FTP software for copying Altimeter Instrument Files from JPL. We have been having problems for a couple of weeks with the transfer process.

We cannot reliably transfer the Science data (100MB) and this causes our automated processing to fail. We are having to do this process by hand and we have generally been 1-4 hours late getting the data out. The recent power outages (and we are going to have another this weekend !!!) are only compounding the problem.

D. Hancock has been in contact with personnel at JPL and NSI and the suggestion is to use FTP rather than DECNET since FTP is generally assumed to be "more reliable."

The software to implement the FTP procedure has been written and tested. It only needs to be renamed in order to put it into production.

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TOPEX InterOffice Memo

To: Ron Brooks, Ron Forsythe, George Hayne, David Hancock

From: Hayden Gordon

Date: December 9, 1993

Subject: EA S/W Chg 6: JPL/WFF File Transfer

Attached is a memo from Jeff Lee and Dennis Lockwood requesting an emergency change in the baselined AIF processing. This change, designated Engineering Assessment Software Change Request 6, has been completed. The modification was made on December 9, 1993, with a revision to the UNIX script file, 'autoaif'. The change will become effective with data processed beginning December 10 (1993344). No standard output products were modified by the change.

Thanks,

CC: Jeff Lee, Dennis Lockwood, Carol Purdy

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Software Development Team
TOPEX Project
NASA GSFC/WFF

To: CSC/Hayden Gordon
From: CSC/Dennis Lockwood, CSC/Jeff Lee
Date: December 09, 1993
Subject: **FINAL JPL SPAT Displays and Instrument File Retrieval & Processing Instructions.**

Requested JPL SPAT Display and AIF File Retrieval & Processing Instructions have been revised and are attached.

User testing with the JPL SPAT Display Instructions has shown that the user needs to pay close attention to the keypresses required. Pay particular attention to the difference between [return] and [enter] and the [PFxx] and [KPx] keys. Also note that sometimes the JPL machines and/or the network is slow and keypresses do not immediately illicit a response. When in doubt, read the screen.

User testing with the Standard and Special Processing Instructions has shown the need to clarify the difference between the **fileutc** and **utctime** variables used in the Instructions. **fileutc** is the time used in the creation of the filename at JPL. It is used primarily to build filenames. **utctime** is used for selecting portions of data to work with from within **dotelem**.

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JPL SPAT Display Instructions

1. Launch the TCP/Connect II application by **double-clicking** on its icon.

2. For EACH display you wish to view, perform steps 3 through 11.

3. Under the **Terminal** menu at the top of the screen, select **Connect.**

4. In the **Session Name** text field, type `128.149.96.13` and either press the **[return]** key or click the **OK** button.

5. Press the **[return]** key once to get TGSA's attention.
   Enter a ***username*** and press the **[return]** key at the `Username:` prompt.
   Enter a ***password*** and press the **[return]** key at the `Password:` prompt.

TCP/Connect II VT102 Emulation Keys	
VT102 Key	**Mac Keyboard**
enter	[enter] on numeric keypad
PF1	[clear] on numeric keypad
PF2	[=] on numeric keypad
PF3	[/] on numeric keypad
PF4	[*] on numeric keypad
KP0	[0] on numeric keypad
KP1	[1] on numeric keypad
KP2	[2] on numeric keypad
KP3	[3] on numeric keypad
KP4	[4] on numeric keypad
KP5	[5] on numeric keypad
KP6	[6] on numeric keypad
KP7	[7] on numeric keypad
KP8	[8] on numeric keypad
KP9	[9] on numeric keypad
KP.	[.] on numeric keypad
Up	[↑] on cursor keypad
Down	[↓] on cursor keypad
Left	[←] on cursor keypad
Right	[→] on cursor keypad

8. Follow on-screen instructions until you get to the `TCCS MAIN MENU`.

9. Press the [enter] key on the **numeric keypad** to access the `TELEMETRY` menu.

10. Follow Step 10a to choose from a list of displays, or Step 10b to view a "standard" display.

10a Press the [Down] key three times to hilight `TLM3 VIEW CHANNEL DATA (LIST OF DISPLAYS)`.

Press the [enter] key to select this choice.

Press the [KP.] key.
Type `SPAT*` in response to `Where DISPLAY_NAME is`.

Press the [PF3] key to execute the query.

Use the [Up] and [Down] keys to hilight the desired screen. Note : using the [Up] key to scroll backwards may product strange results.

Press the [PF1] then [KP4] keys to select your choice. The selected display should now be viewable on-screen.

10b Press the [Down] key two times to hilight `TML2_1 VIEW CHANNEL DATA - DUAL COLUMN`.

Press the [enter] key to select this choice.

Press the [KP.] key. Type one of the following choices in response to `DISPLAY_NAME is`. For example,`SPAT-ALTAC`.

"Standard" Displays

Name	Description
SPAT-ALTAC	ALT-A Command Words
SPAT-ALTAD	ALT-A Memory Dump
SPAT-ALTAP	ALT-A Powers
SPAT-ALTRS	S/C & RESET Times & SCI word

Press the **PF1** and **KP4** keys to confirm your choice. The selected display should now be viewable on-screen.

11. You may move the display screen windows around by clicking on the title bar and dragging the mouse. The title bar is the area at the top of the window that contains "`128.149.96.13`" surrounded by faint lines.

12. To exit, <u>for each window,</u> "back-out" of TGS system by pressing subsequent **[PF1]** then **[KP0]** keys.

13. Choose the **Quit** menu item under the **File** menu to exit TCP/Connect II.

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AIF Retrieval & STANDARD Processing Instructions

Definitions

UTC: Coordinated Universal Time. Time is represented in the format "YYYYDDDtHHMMSS", where YYYY represents year, DDD represents the Julian day of the year, and HHMMSS represents hours, minutes, and seconds. Eastern Standard Time = UTC Time - 5 hours. For example : 1993285t060203 represents October 12, 1993 at 01:02:03 EST.

fileutc: The UTC portion of a filename. JPL creates their AIF filenames by using the UTC of the start of the data.

filename: The name of a file. Standard filenames consist of a prefix, a *fileutc*, and a suffix, where the prefix and suffix identify the file type.

Instructions

1. Log on to osb3.

2. Your path must be able to access several binaries and the IDL_PATH.
   For csh, Type: `setenv PATH /gen/topex2/bin:/opt/bin:$PATH` [return]
   For csh, Type: `source /opt/IDL/idl_setup`

3. Change to the AIF processing directory.
   Type: `cd /gen/topex2/aif [return]`

4. You can check to see what files are available at JPL.
   Type: `lsjplaif`

5. Run the automated daily processing system. This will take approximately 1.5 hours for a full 24-hour AIF.
   Type: `stdaif` *fileutc*

   The automated daily processing will print the following products :

   aifsci, the daily science product
   dailyeng, the daily single-page engineering product
   aifcal, the daily CAL mode product
   aifhdr, the processing summary
   aifevents, the events listing

It will also create the following output files for any additional processing:

aif_eng_*fileutc*.std, 5-minute engineering averages.
aif_sci_*fileutc*.std, 10-second science averages.
aif_event_*fileutc*.std, an event report.
aif_eng_*fileutc*.db, 1-hour engineering averages.
aif_cal_*fileutc*.db, CAL mode averages.
aif_hdr_*fileutc*.db, a header report.

6. If more engineering parameters need to be examined, run the idl program that plots all engineering parameters.
Type: `aifeng` *filename*, where filename is of the form `aif_eng_`*fileutc*`.std`.

7. If other types of processing is required, see **SPECIAL Processing Instructions**.

SPECIAL Processing Instructions

Definitions

UTC: Coordinated Universal Time. Time is represented in the format "YYYYDDDtHHMMSS", where YYYY represents year, DDD represents the Julian day of the year, and HHMMSS represents hours, minutes, and seconds. Eastern Standard Time = UTC Time - 5 hours. For example : 1993285t060203 represents October 12, 1993 at 01:02:03 EST.

fileutc: The UTC portion of a filename. JPL creates their AIF filenames by using the UTC of the start of the data.

filename: The name of a file. Standard filenames consist of a prefix, a *fileutc*, and a suffix, where the prefix and suffix identify the file type.

Instructions

1. Log on to osb3.

2. Your path must be able to access several binaries and the IDL_PATH.
For csh, Type: `setenv PATH /gen/topex2/bin:/opt/bin:$PATH` [return]
For csh, Type: `source /opt/IDL/idl_setup`

3. Change to the AIF processing directory.
Type: `cd /gen/topex2/aif` [return]

4. You can check to see what files are available at JPL.
Type: `lsjplaif`

5. If you haven't already retrieved the data, retrieve the Engineering Instrument File.
Type: `getjplbin '14.429::WFFDEV:[WFFUSER.WFF_DATA]`*filename*[return]
Where *filename* is of the format `tcc_alteng_`*fileutc*`.bin`
(24 hours of data takes approximately 5 minutes to retrieve)

6. If you haven't already retrieved the data, retrieve the Science Instrument File.
Type: `getjplbin '14.429::WFFDEV:[WFFUSER.WFF_DATA]`*filename*[return]
Where *filename* is of the format `tcc_altsci_`*fileutc*`.bin`
(24 hours of data takes approximately 45 minutes to retrieve)

7. dotelem requires UTC Seconds for time selections. If you wish to do a time selection and don't know UTC Seconds, run utcconvert to convert from UTC Clock Time to UTC Seconds. Remember, Eastern Standard Time = UTC Time - 5 hours.

Convert the start time.
Type: **utcconvert**
Type: **2 [return]** in response to **Select UTC Time to Enter**
Type: *UTC* in response to **Enter UTC in the format YYYYDDDtHHMMSS**
Write down the time in seconds. You won't be able to remember it.
Type: [return] in response to Press RETURN to Continue

Convert the stop time.
Type: **2 [return]** in response to **Select UTC Time to Enter**
Type: *UTC* in response to **Enter UTC in the format YYYYDDDtHHMMSS**
Write down the time in seconds. You won't be able to remember it.
Type: [return] in response to **Press RETURN to Continue**
Type: **x** [return] in response to **Select UTC Time to Enter** in order to exit.

8. Run dotelem. Follow the on-screen menus to select what processing you wish to perform. Note that selecting by Latitude/Longitude does not work. The names of the output files will be printed on the screen after your processing selections are complete. They will also be written into an aif_???.log file. Write down the output filenames and wait until processing is complete.
   Type: **dotelem** and follow on-screen instructions.
   Type: **x** [return] in response to **Enter File Type** to exit.

9. Use the following table to choose what output command corresponds to your processing selection. Run that command by typing it.

Table of Processing Selections & Output Commands		
Processing Selection	**Output Command**	**Description/Comment**
0. Do Standard Processing	`n/a`	Previously documented.
1. Create AIF Databases	`n/a`	No output commands available.
2. Dump Telemetry	`n/a`	Load into spreadsheet of view on-screen.
3. Average Science Data	`aifsci` *filename*	Plot science data.
4. Average Engineering Data	`aifeng` *filename* `dailyeng` *filename*	Plot all engineering data. Plot single-page selected engineering data.
5. Average Waveform Data	`topexautowf` *filename* `topexwf` *filename*	Plot auto-scaled waveforms. Plot fixed-scale waveforms.
6. Report Status Changes	`n/a`	Print or view on-screen.
7. Create SDR	`n/a`	No output commands available.

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Software Development Team
TOPEX Project
NASA GSFC/WFF

To: CSC/Hayden Gordon
From: CSC/Dennis Lockwood, CSC/Jeff Lee
Date: January 20, 1994
Subject: RE: Change Request for AIF Processing Module: Cal Plot Change.

I recommend we modify the request to state that only the last 7 (or 14) days of cal data be plotted. It is too hard to keep track of the last date the plot was printed.

This change will require the <u>modification</u> of the following change-controlled software:
topexcal.pro (IDL software)

This change will require the <u>recompilation</u> of the following change-controlled software:
-none-

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Software Development Team
TOPEX Project
NASA GSFC/WFF

To: CSC/Hayden Gordon
From: CSC/Dennis Lockwood, CSC/Jeff Lee
Date: January 24, 1994
Subject: RE: Change Request for AIF Output of Last Reset Time - Revisited.

In prototyping methods for displaying the Hex values of the Time_Last_Reset, I will propose another method of making this change. I have already written code to read the event file and count the number of occurrences of a certain event (due to another request). I can also detect the occurrence of a Time_Last_Reset event. There is a problem in converting from the Time in seconds (which is currently displayed) to the Time in Hex. Thus, I propose the following:

The doTelem module EngStatus will be modified to print out the Time_Last_Reset in hexidecimal as well as seconds. IDL software, ReadEvents, will be modified to read the time in hex and dbheader will be modified to display the results.

This change will require the modification of the following change-controlled software:
  dbheader (IDL software)
  readevents (NEW IDL software)

This change will require the recompilation of the following change-controlled software:
  EngStatus (doTelem)

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Software Development Team
TOPEX Project
NASA GSFC/WFF

To: CSC/Hayden Gordon
From: CSC/Dennis Lockwood, CSC/Jeff Lee
Date: January 25, 1994
Subject: RE: Request #94/010.

Per request number 94/010 change-controlled software and/or procedures have been modified.

Effective Date: 1/25/94

Version Numbers

1. doTelem 3.5, 01/24/94

Modifications to Procedures.

none

Modification to FORTRAN source code

1. EngStatus.f modified(doTelem)

Modification to Datafiles

none

Modifications to IDL code

1. aifhdr.pro modified
2. readevents.pro modified

Modifications to UNIX script files

none

Modifications to Databases

none

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Software Development Team
TOPEX Project
NASA GSFC/WFF

To : CSC/Hayden Gordon
From: CSC/Dennis Lockwood, CSC/Jeff Lee
Date: January 25, 1994
Subject: RE: Request #94/007.

Per request number 94/007 change-controlled software and/or procedures have been modified.

Effective Date: 1/25/94

Version Numbers

1.	doTelem	3.5, 01/24/94
2.	DataFile.EALimits	07, 01/26/94

Modifications to Procedures.

1. Waveform plots are generated daily.
2. Waveform differences are stored in databases.
3. Launch-to-Date Waveform plots are generated weekly.

Modification to FORTRAN source code

1.	CALWFAvg.f	created (doTelem)
2.	STBYWFAvg.f	created(doTelem)
3.	doTelem.f	modified(doTelem)
4.	doTelemIO.f	modified(doTelem)
5.	EALimitsInit.f	modified (TOPEXGeneral.lib)
6.	EALimitsDef.incl	modified (Include file)

Modification to Datafiles

1.	DataFile.EALimits	modified

Modifications to IDL code

1.	wfdiff.pro	created
2.	readevents.pro	created
3.	aifhdr.pro	modified

Modifications to UNIX script files

1.	dailyaif.pro	modified
2.	finishaif.pro	modified
3.	stdaif.pro	modified
4.	dailywf	created

5.	wfdiff	created
6.	wfdiffall	created

Modifications to Databases

1.	wfhi.dbase	created
2.	wflo.dbase	created

Software Development Team
TOPEX Project
NASA GSFC/WFF

To : CSC/Hayden Gordon
From: CSC/Dennis Lockwood, CSC/Jeff Lee
Date: January 25, 1994
Subject: RE: Request #94/008.

Per request number 94/008 change-controlled software and/or procedures have been modified.

Effective Date: 1/25/94

Version Numbers
none

Modifications to Procedures.
1. **Information must be received from Hancock or Purdy.**
2. Lockwood wil keep log up-to-date.

Modifications to FORTRAN source code
none

Modification to Datafiles
none

Modifications to IDL code

1.	readseu.pro	modified
2.	topexseu.pro	modified

Modifications to UNIX script files
none

Modifications to Databases
none

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Software Development Team
TOPEX Project
NASA GSFC/WFF

To: CSC/Hayden Gordon
From: CSC/Dennis Lockwood, CSC/Jeff Lee
Date: January 25, 1994
Subject: RE: Request #94/011.

Per request number 94/011 change-controlled software and/or procedures have been modified.

Effective Date: 1/25/94

Version Numbers
none

Modifications to Procedures.
none

Modifications to FORTRAN source code
none

Modification to Datafiles
none

Modifications to IDL code
1. aifcal.pro modified

Modifications to UNIX script files
1. dbcal modified

Modifications to Databases
none

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TOPEX InterOffice Memo

To: Ron Brooks, Ron Forsythe, George Hayne, David Hancock, Craig Purdy

From: Hayden Gordon

Date: February 1, 1994

Subject: EA S/W Chg 10: Last Reset Time of Day

Attached is a memo from David Hancock requesting a change in the baselined AIF processing module, with a modification to the standard output products to include the last Reset Time encountered during a single day. This change, designated Engineering Assessment Software Change Request 10, has been completed. The modification was made on January 25, 1994, with the release of Version 3.5 of the AIF processing module, and became effective with data processed January 26, 1994. The changes are summarized in the attached memo from Dennis Lockwood and Jeff Lee.

Thanks,

CC: Jeff Lee, Dennis Lockwood, Carol Purdy

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TOPEX InterOffice Memo

To: Ron Brooks, Ron Forsythe, George Hayne, David Hancock, Craig Purdy

From: Hayden Gordon

Date: February 1, 1994

Subject: EA S/W Chg 7: Waveform Monitoring

Attached are two memos from David Hancock requesting a change in the baselined AIF processing module. This change, designated Engineering Assessment Software Change Request 7, has been completed. The modification was made on January 25, 1994, with the release of Version 3.5 of the AIF processing module, and Version 7 of the file DataFile.EALimits. The change became effective with data processed beginning January 26, 1994. The routines affected and the new data products being generated are summarized in the attached memo from Dennis Lockwood and Jeff Lee..

Thanks,

CC: Jeff Lee, Dennis Lockwood, Carol Purdy

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TOPEX InterOffice Memo

To: Ron Brooks, Ron Forsythe, George Hayne, David Hancock, Craig Purdy

From: Hayden Gordon

Date: February 1, 1994

Subject: EA S/W Chg 8: SEU Monitoring

Attached is a memo from David Hancock requesting a change in the production processing. This change, designated Engineering Assessment Software Change Request 8, has been completed. There was no modification to any baselined software, but a new procedure has been established and put under change control. The new procedure became effective January 25, 1994, and is summarized in the attached memo from Dennis Lockwood and Jeff Lee. Please note that the source of data for this process is David Hancock or Craig Purdy.

Thanks,

CC: Jeff Lee, Dennis Lockwood, Carol Purdy

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TOPEX InterOffice Memo

To: Ron Brooks, Ron Forsythe, George Hayne, David Hancock, Craig Purdy

From: Hayden Gordon

Date: February 1, 1994

Subject: EA S/W Chg 11: Cal Plot Change

Attached is a memo from David Hancock requesting a change in the baselined AIF processing module, with a modification to the standard output products to include only data since the last plot on the standard Cal plot. Since there is no way to know when the last plot was produced, the request was modified by the ADT to include only the last 14 days of Cal data. This change, designated Engineering Assessment Software Change Request 11, has been completed. The modification was made on January 25, 1994, and became effective with data processed January 26, 1994. The changes are summarized in the attached memo from Dennis Lockwood and Jeff Lee.

Thanks,

CC: Jeff Lee, Dennis Lockwood, Carol Purdy

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TOPEX InterOffice Memo

To: Ron Brooks, Ron Forsythe, David Hancock, George Hayne, Craig Purdy

From: Hayden Gordon

Date: March 21, 1994

Subject: EA S/W Chg 9: Error Reset Mnemonics

Attached is a memo from David Hancock requesting two additional mnemonics be added to the mnemonic look-up file, DataFile.CMD. This change, designated Engineering Assessment Software Change Request 9, has been completed. The modification was made on March 11, 1994, with an addition to the look-up file, and became effective with data processed March 11, 1994.

CC: Jeff Lee, Dennis Lockwood, Carol Purdy

We have had two new commands added to the TOPEX library at JPL. It is requested that the following mnemonics be added to the WFF Altimeter Command Mnemonic file:

0F7F	AERRORST	Error reset; side A
0B7F	BERRORST	Error reset; side B

David Hancock hancock@osb1.wff.nasa.gov

To: David Hancock and Craig Purdy
From: Ron Brooks and Jeff Lee
Date: May 26, 1994
Subject: Temperature Corrections for Side-B CAL-1 Ku and C AGC

OVERVIEW

Temperature corrections have been derived for Side-B CAL-1 Ku and C AGC values, based on pre-launch test data. The form of the additive AGC temperature correction for each band is [a + bT], where a and b are coefficients and T is temperature. This correction is for a fixed attenuator in the calibration path; this attenuator is not in the normal AGC operation path.

For Ku-band, a = -3.620 dB, b = +0.127 dB/deg, and T is the Ku MTU Calibration Attenuator Temperature. The value of "a" is based on an anticipated on-orbit nominal temperature of 28.5 degrees, the same as for the on-orbit Side A.

For C-band, a = -2.133 dB, b = +0.079 dB/deg, and T is the C MTU Calibration Attenuator Temperature. The value of "a" is based on an anticipated on-orbit nominal temperature of 27.0 degrees, the same as for the on-orbit Side A.

These temperature corrections do not apply to CAL-2 data.

PROCEDURES

The procedures to derive these coefficients were as follows.

RASE tapes for April 1992 were loaded and processed using standard AIF processing software. This software performs T3117 temperature corrections and subtracts references from processed CAL data; however, a special override file was used to disable the standard CAL attenuator temperature corrections.

The processed RASE data were entered into a temporary database, and Ku and C CAL data for Step 5 were extracted. The Step 5 data were separated into Side A and Side B, and suspect data were deleted. The remaining Ku and C AGC data were linearly fit to the respective Ku and C Calibration Attenuator Temperatures. The plots depicting these linear fits are attached.

To assess the technique described above, the Side A Ku and C CAL-1 RASE data were linearly fit to the Calibration Attenuator Temperatures. The derived temperature corrections for Side A agreed with those in current use to within 0.01 dB per degree.

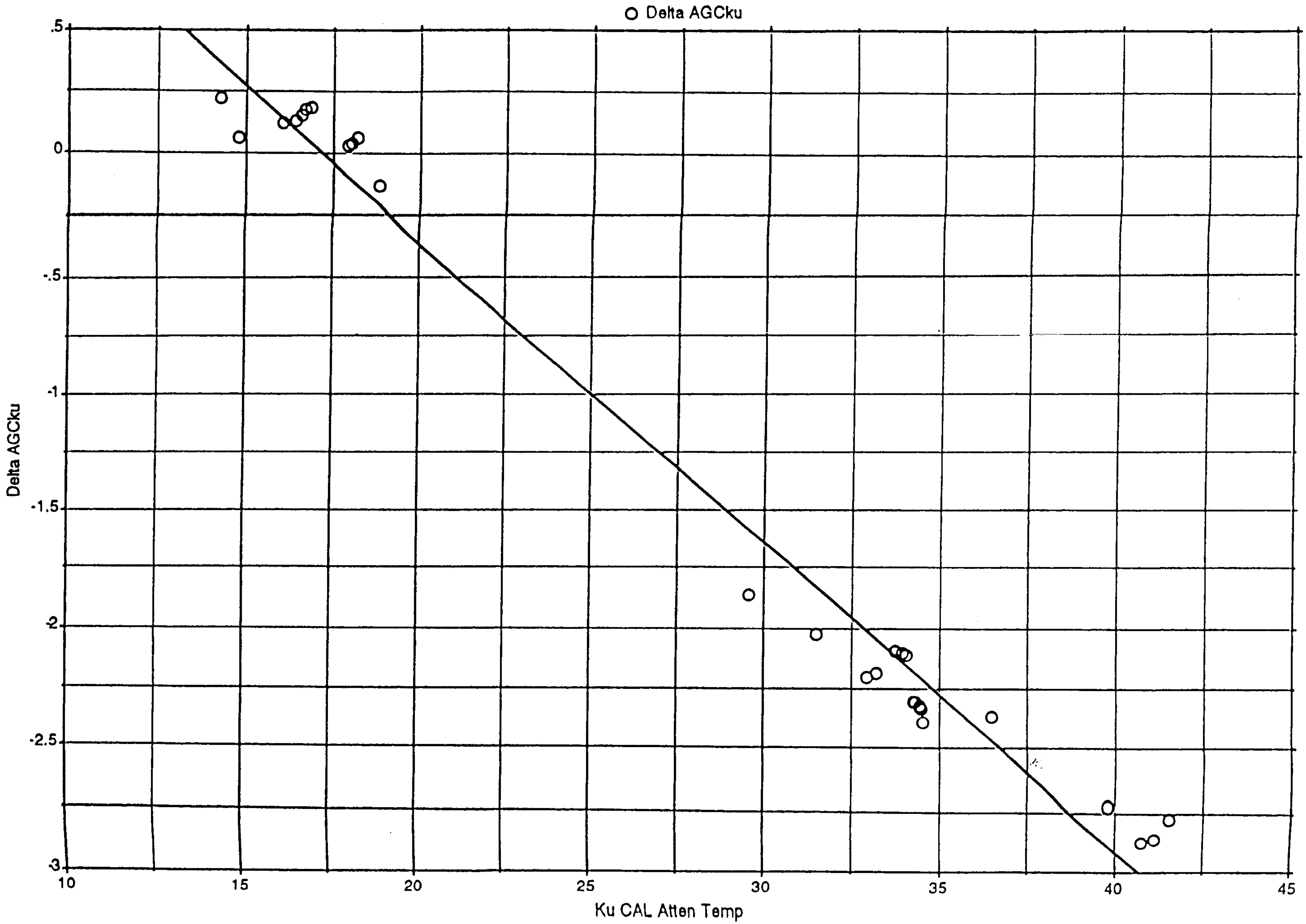
RECOMMENDATIONS

It is recommended that these CAL-1 AGC temperature-correction coefficients for Side B be implemented in the WFF AIF processing software. Minor coefficient tweaking may be required after Side B becomes operational and on-orbit Side B CAL data are analyzed.

cc:
George Hayne
Ron Forsythe
Larry Rossi
Hayden Gordon
Jeff Lee
Dennis Lockwood
Carol Purdy

[redacted] SFC [redacted] TV [redacted] Att[redacted]ator [redacted]np [redacted] Co[redacted]ent [redacted]

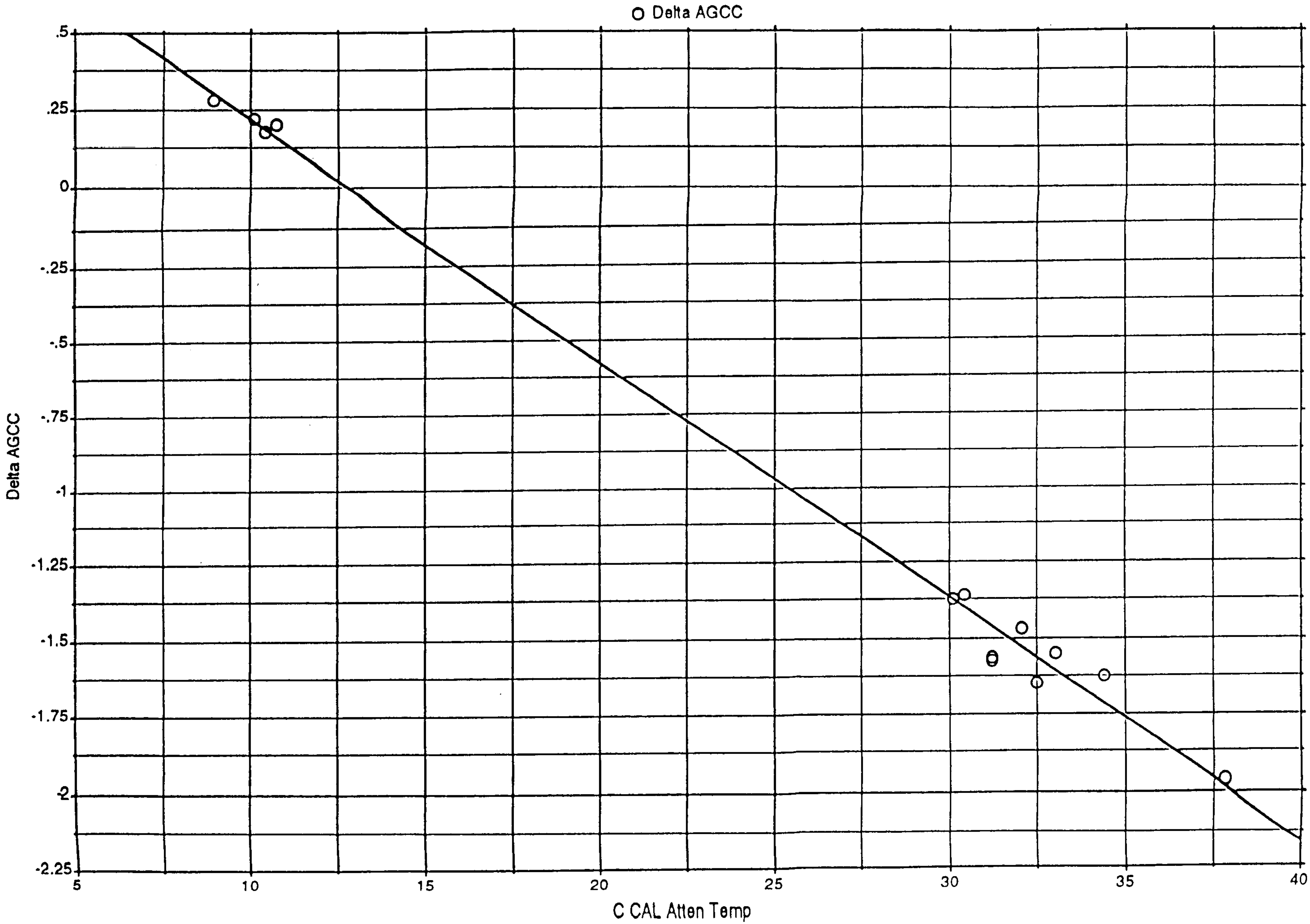
$y = -.127251x + 2.179132,\ r^2 = .983403$



Side B, Ku ON, CAL Mode Step 5

GSFC SCTV CAL Attenuator Temp Corr Coefficients

$y = -.079251x + 1.011985, r^2 = .994572$



Side B, C320, CAL Mode Step 5

Software Development Team
TOPEX Project
NASA GSFC/WFF

To: CSC/Hayden Gordon
From: CSC/Dennis Lockwood/CSC/Jeff Lee
Date: May 27, 1994
Subject: Suggested Correction to AIF Processing.

George Hayne has discovered an error in the full-rate waveform routine of **dotelem**. When writing full-rate waveforms, the incorrect value of CAL Step is output.

We recommend that the AIF processing module, **dogtelem** be modified to write out the correct CAL Step during full-rate waveform processing. The fix is a very simple one and only requires changing a variable name in the write statement. No products will be modified.

Since **dotelem** is change-controlled software, this memo is to advise the team of a problem and offer a suggested correction. A software change notice will be required in order to fix the problem.

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TO: Hayden Gordon
FROM: Ron Brooks
DATE: June 3, 1994
SUBJECT: Implementation of Temperature Correction Coefficients for Side-B CAL-1 Ku and C AGC

REFERENCE: 5/26/94 Memorandum from R. Brooks and J. Lee, Temperature Corrections for Side-B CAL-1 Ku and C AGC

I recommend that the coefficients for Side-B CAL-1 Ku and C AGC temperature corrections be implemented in the WFF AIF processing software. The derivation of the coefficients is described in the referenced memorandum.

The form of the additive AGC temperature correction for each band is [a + bT], where a and b are coefficients and T is temperature. This correction is for a fixed attenuator in the calibration path; this attenuator is not in the normal AGC operation path.

For Side B Ku-band, a = -3.620 dB, b = +0.127 dB/deg, and T is the Ku MTU Calibration Attenuator Temperature. For Side-B C-band, a = -2.133 dB, b = +0.079 dB/deg, and T is the C MTU Calibration Attenuator Temperature.

cc:
David Hancock
Craig Purdy
George Hayne
Ron Forsythe
Larry Rossi
Jeff Lee
Dennis Lockwood
Carol Purdy

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Draft TOPEX INFORMAL MEMORANDUM

28 June 1994

SUBJ: Corrections to Range Bias Determined in TOPEX Calibration Mode 1

FROM: G.S. Hayne

TO: R.L. Brooks, R.G. Forsythe, H.H. Gordon, D.W. Hancock III, J.E. Lee, D.W. Lockwood, C.L. Purdy, L.C. Rossi

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The TOPEX altimeter's Calibration Mode 1 ("Cal-1") gives data on possible range drift in the altimeter. The Cal-1 measurements are contaminated by the finite size of the least significant bit (l.s.b.) for the word positioning the altimeter's Digital Filter Bank (DFB). In this memo I discuss how to correct the TOPEX Cal-1 range bias estimates for the 7.32 mm l.s.b. effects. This is a brief memo, to be expanded soon into a more complete document addressing both the range and the σ^0 corrections indicated by the TOPEX altimeter's Calibration Modes.

Cal-1 has a number of individual steps, each having different AGC levels, and there is a range estimate for the ~10 seconds spent in each step. In general, a Calibration Mode is executed approximately every half day. Figure 1 shows the launch-to-date Calibration database results for the Ku-band range estimates from Cal-1 Step 5, the step which probably best represents typical AGC levels for normal ocean fine-track operation.

Figure 2 shows the full-rate range data for a portion of the Cal-1 on 1992 day 348. Notice the regular sawtooth oscillation of these data. The average of all of the Step 5 data in Figure 2 is a single point plotted on Figure 1. The Cal-1 pulseshape being tracked is almost a completely deterministic signal, having none of the speckle noise which is so typical of a normal, over-ocean radar return. The regular sawtooth oscillation occurs because the deterministic signal is tracked by a loop in which the DFB is positioned by 7.32 mm increments, the l.s.b. of the fine height word within the altimeter. Figure 3 sketches the range tracking loop for Cal-1. The range accumulator R can be regarded as a continuous variable, unlike the position Q of the DFB with its position l.s.b. of 7.32 mm.

The Cal-1 range tracking is easily simulated, using the Cal-1 recursion relation

$$R_n = R_{n-1} + \alpha \cdot \Delta R_{n-2}\text{, where}$$

$$\Delta R_n = T_n - Q_n,$$

in which T_n is the true range, and Q_n is the value of R_n as quantized by the 7.32 mm l.s.b. For the nearly noise-free transmitted pulseshape being tracked, we can assume zero error in the waveform-based estimate of the ΔR_n. Figure 4 shows simulation results for Cal-1 tracking of a range which decreases linearly with time, and Figure 5 shows just a part of Figure 4. In Figures 4 and 5, the quantity Raccum or Racc is the altimeter's range R as described by the recursion relationship above. Notice the behavior of Figure 5 as the Rtrue crosses the quantization levels 21.96, 14.64, and 7.32 . The Cal-1 data of Figure 1 from the start of Cycle 009 to the present correspond to data between two of the quantization levels. The small change of about -1.5 mm over 540 days in Figure 1 is an underestimate of the true drift, just as the R for updates 120 to 330 in Figure 5 would produce an underestimate of the change in Rtrue.

Notice in Figure 5 that the appearance of the R sawtooth changes as a function of the distance of Rtrue from the next lower quantization level. I have extended the simulation work, replacing the continuously changing Rtrue of Figures 4 and 5 with a set of different constant Rtrue values. For each Rtrue, the simulation is run for a large number of tracker update cycles, and I form average values for R and for a ratio $Q_r = N_{up} / N_{down}$; N_{up} is the number of range updates for which R_n is greater than R_{n-1}, and N_{down} is the number of range updates for which R_n is less than R_{n-1}. Then I defined an additive range correction dR' = Average(Rtrue - R + 3.66) mm. This dR' will be zero when Rtrue is about halfway between one quantization level and the next. The extended simulation results allow dR' to be expressed as a fitted function of Q_r by

$$dR' = 0.02910 - 1.34369 \cdot \mathrm{ATAN}[1.03325 \cdot \mathrm{Ln}(Q_r) - 0.01174]\ \mathrm{mm},$$

and the simulation input points and fitted curve are shown on Figure 6.

As a rough check on what the effect of the dR' correction will be, I selected portions of four different Cal-1 Modes, each separated by about 180 days. Figure 7 shows the average Cal-1 ranges before the quantization correction, and Figure 8 shows the results after the quantization correction dR'. The Figure 8 ranges decrease more rapidly with time than do the Figure 7 ranges. The same procedure was used to correct the C-band Cal-1 ranges which also decrease with time. Finally, Figure 9 shows the combined Ku- & C-band ranges from the several Cal-1 steps. Figure 9 suggests that the TOPEX ionosphere-corrected range measurement has drifted downward by about 5 mm in the past year and a half.

Figures 7 - 9 are based on only four parts of Cal-1 Modes, analyzed by hand. We are going to add more data to the set analyzed in this way, perhaps one Cal-1 per month as a start. The added data will allow some assessment of how linear the TOPEX range measurement drift is with time. But we already have a useful tool to remove some of the quantization-caused error in the range drift results, and it is now time to consider what range updates should be added to the JPL Cal Table and when.

Attachment 1 is a one-page summary of the algorithm to correct Cal-1 ranges for the DFB positioning quantization.

ATTACHMENT 1. Algorithm for quantization effects additive correction to Cal-1 ranges

To be done for each step and each frequency (Ku and C) in TOPEX Cal-1:

1. Skip first frame of data
2. Initialize variables:
   a. set counter $N_{up} = 0$
   b. set counter $N_{down} = 0$
   c set counter $N_{ranges} = 0$
   d. set $R_{avg} = 0$
3. For first range value, r_1, after the initial skipped frame
   a. set $R_{avg} = r_1$
   b. set counter $N_{ranges} = 1$
4. For each successive value, r_n, after the initial value r_1 (no special action is needed in case of a missing frame)
   a. set $R_{avg} = R_{avg} + r_n$
   b. set counter $N_{ranges} = N_{ranges} + 1$
   c. if $r_n > r_{n-1}$, set counter $N_{up} = N_{up} + 1$
   d. if $r_n < r_{n-1}$, set counter $N_{down} = N_{down} + 1$
5. At the end of this step in Cal-1
   a. form the average range by $R_{avg} = R_{avg} / N_{ranges}$
   b. if $N_{down} = 0$, set $N_{down} = 1$
   c. form a ratio quantity $Q_R = N_{up} / N_{down}$
   d. the additive range correction for quantization effects, dR', is given by:
      $$dR' = C_1 + C_2 \cdot \mathrm{ATAN}[C_3 \cdot \mathrm{Ln}(Q_R) + C_4].$$
   e. the latest values for the four coefficients in this expression are:
      $C_1 = +0.02910$
      $C_2 = -1.34369$
      $C_3 = +1.03325$
      $C_4 = -0.01174$

Comment: Note that this algorithm includes the formation of the average range. The average range is already being formed in the existing Cal data processing at WFF, and is included here only for completeness.

Figure 1. TOPEX Cal-1 Step 5 Ku Height Data from Launch-to-Date Calibration Database (11-point moving average trend line).

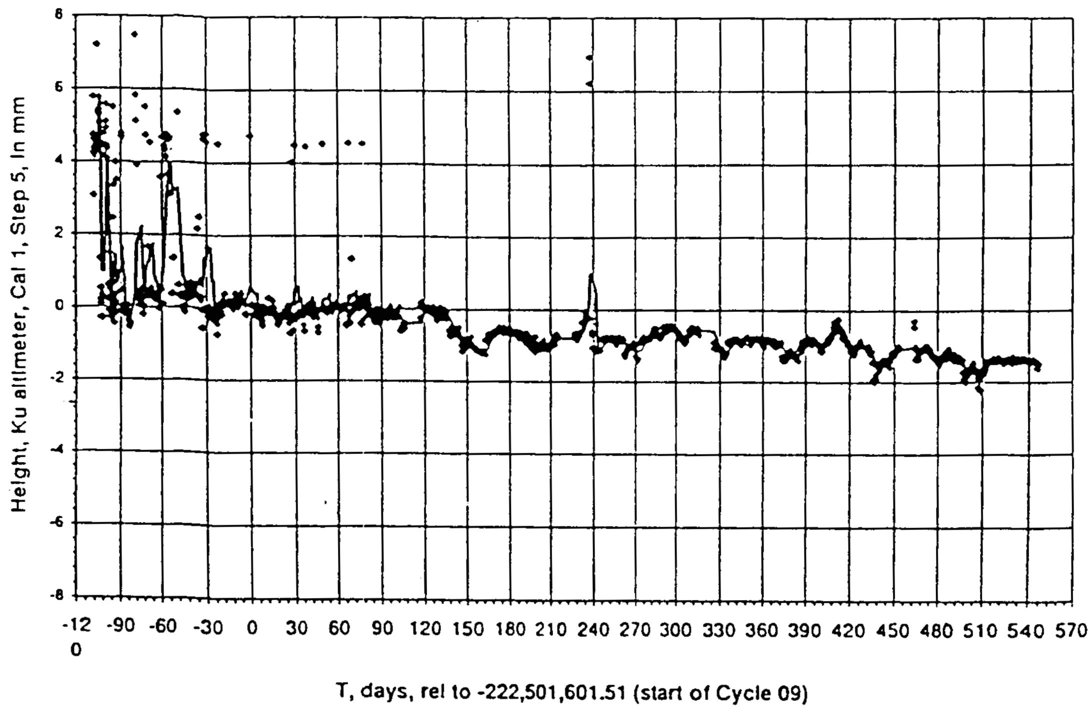


Figure 2. Part of TOPEX Ku Cal-1 Range Data for 1992 Day 348.

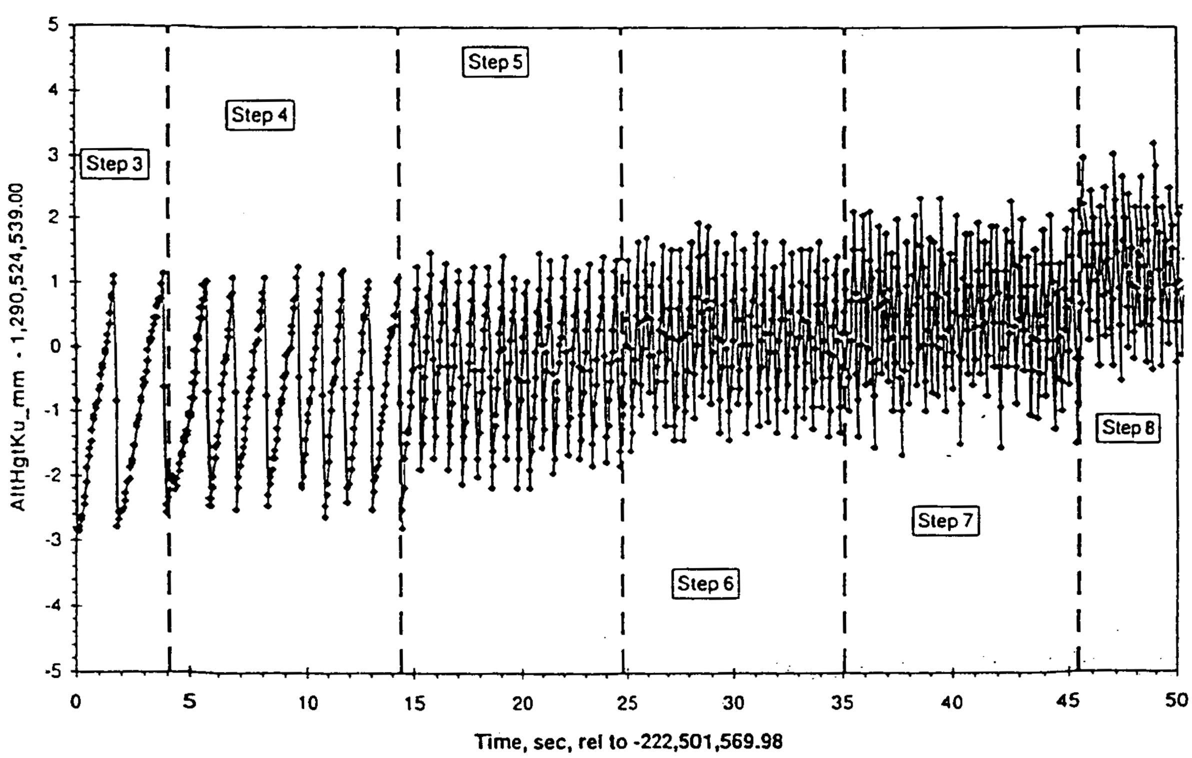


Figure 3. Sketch of TOPEX Range Measurement in Cal-1.

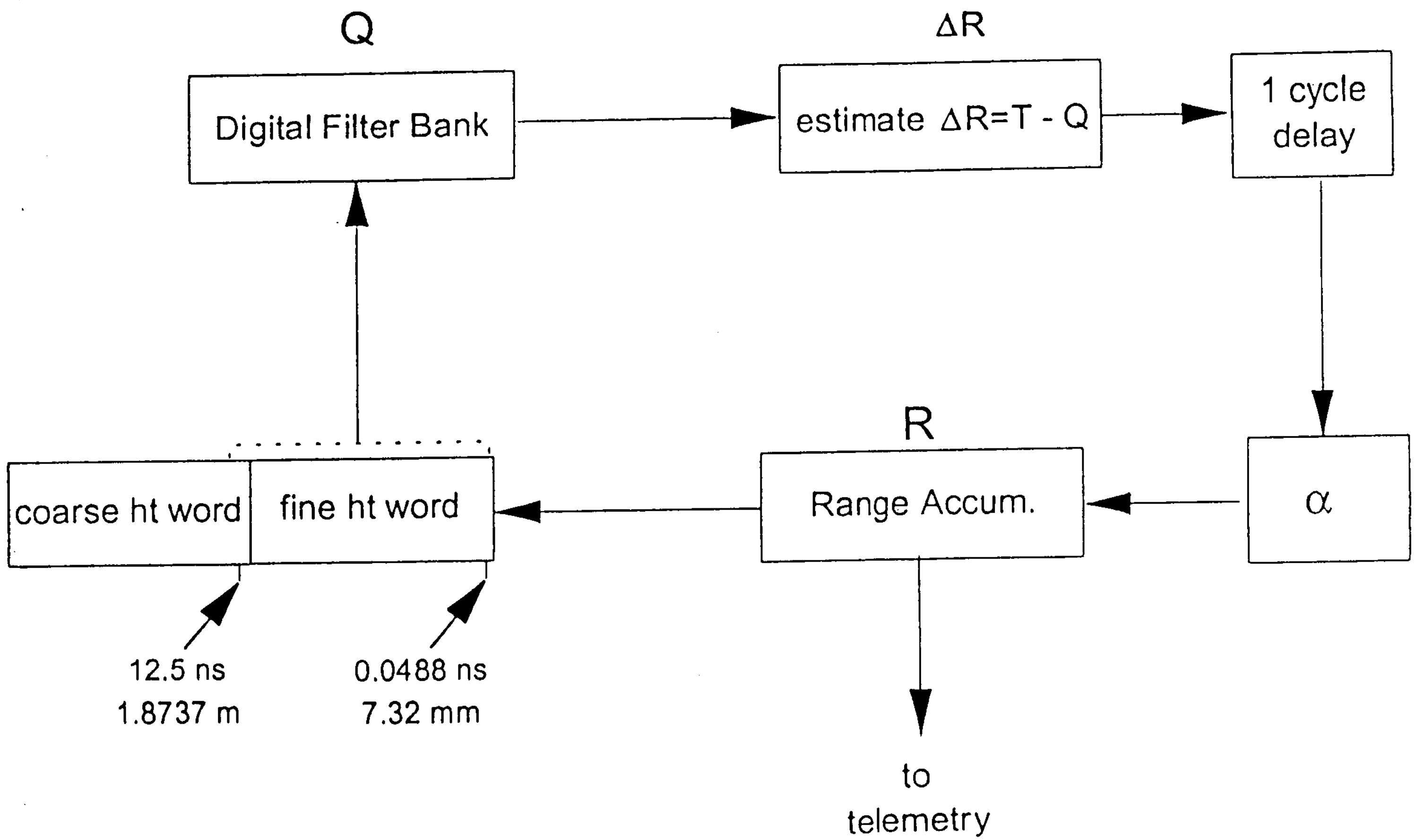


Figure 4. Simulation Study of Cal-1 Range Tracking, for 7.32 mm Quantization in DFB Positioning.

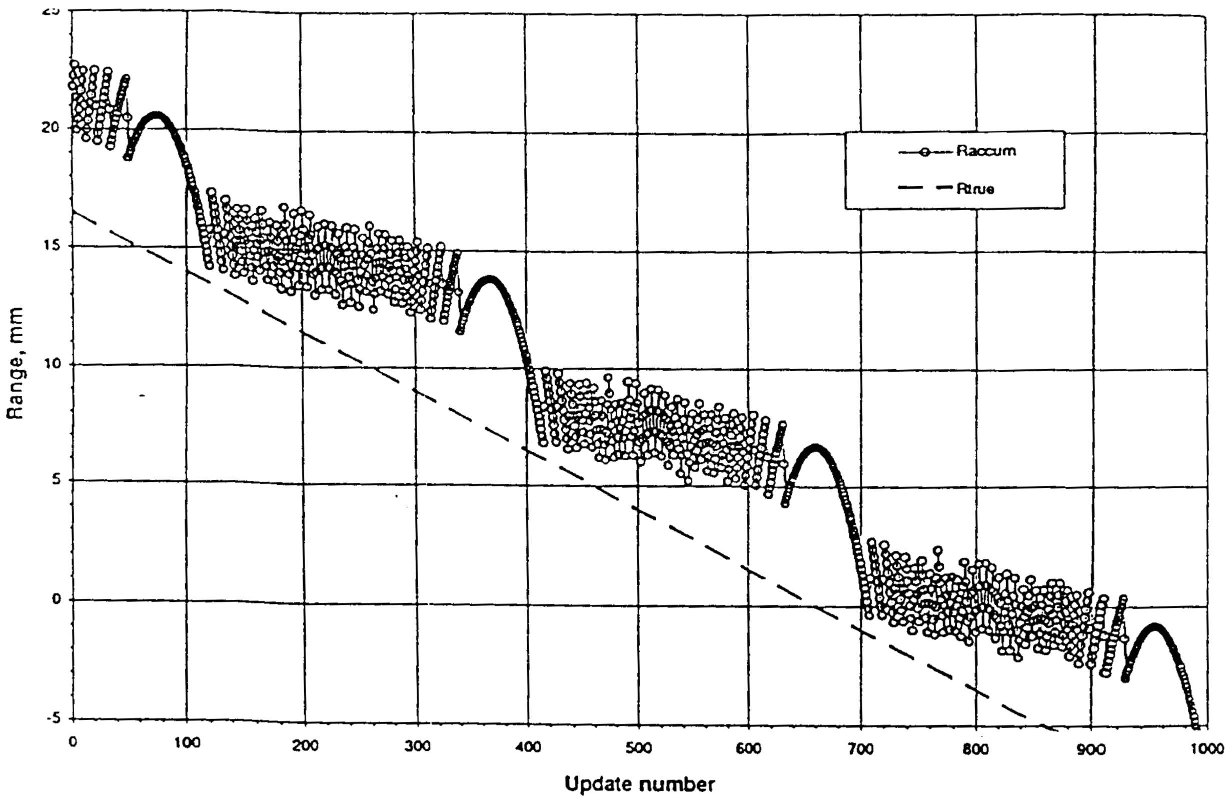


Figure 5. Simulation Study of Cal-1 Range Tracking, for 7.32 mm Quantization in DFB Positioning (Expanded Horizontal Scale from Figure 4).

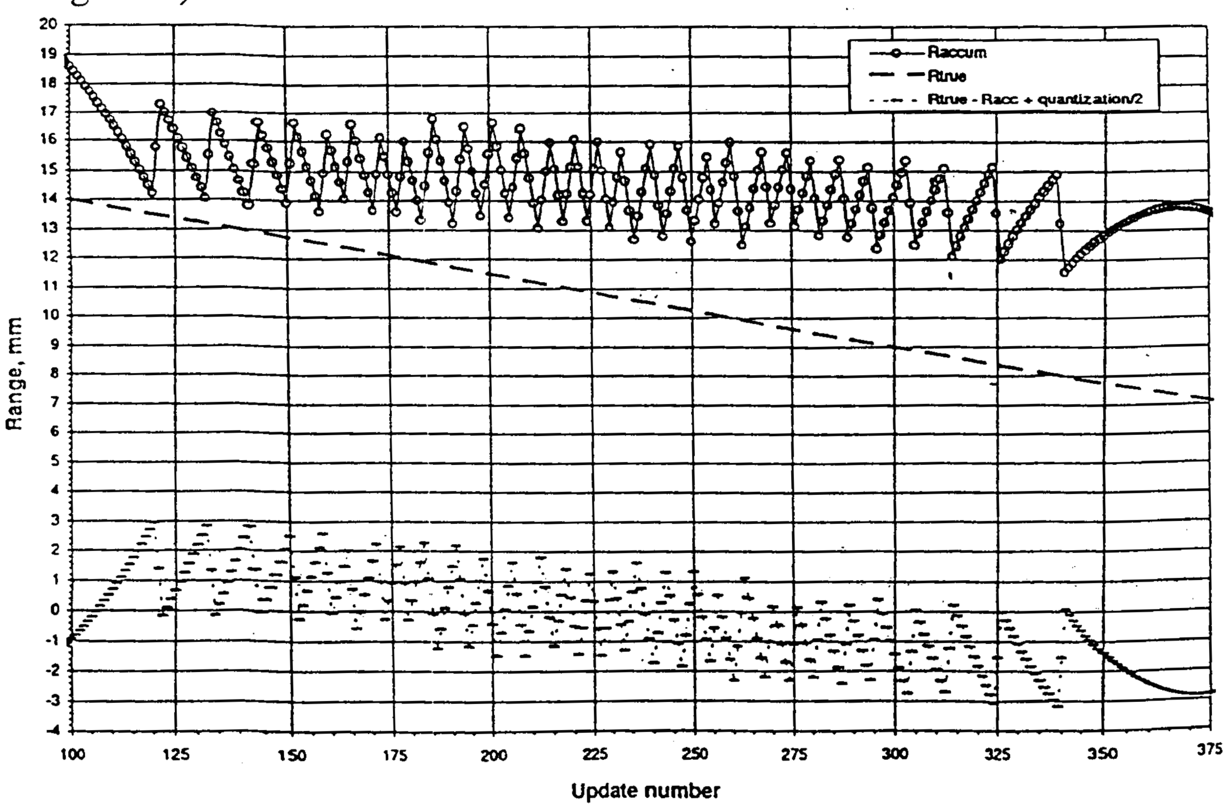


Figure 6. TOPEX Cal-1 Additive Range Correction for 7.32 mm DFB Positioning l.s.b. (solid line is fitted curve, diamonds are from the simulation).

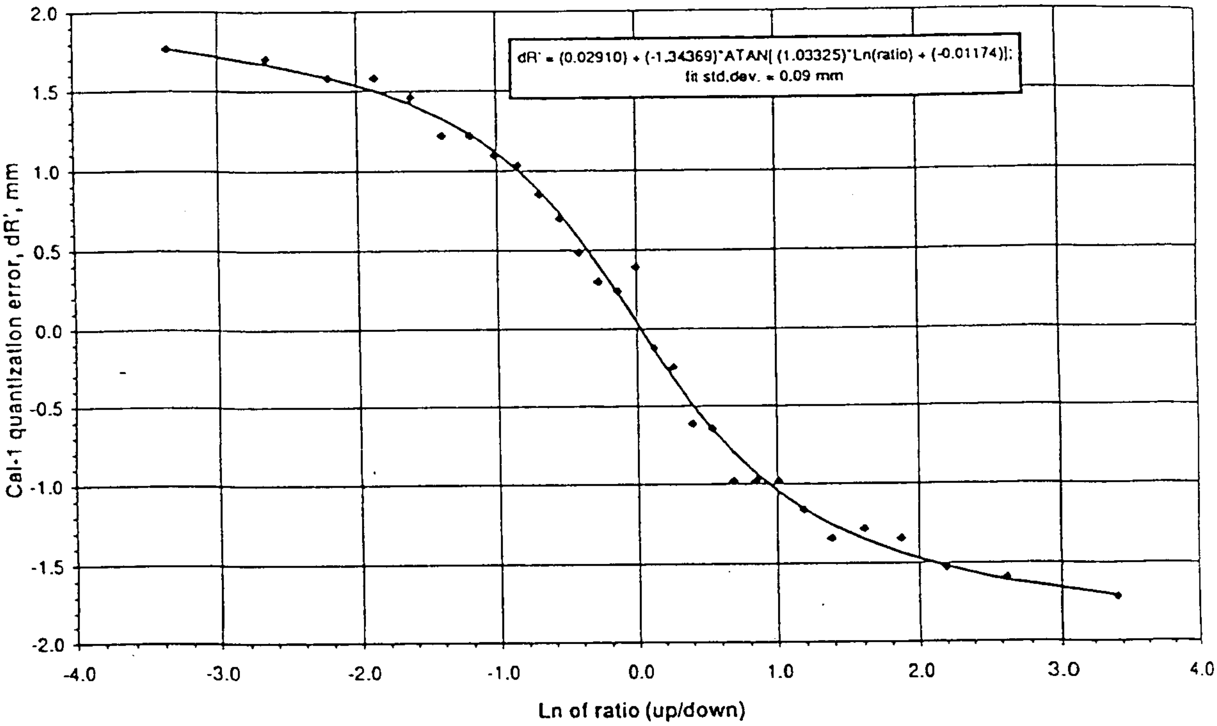


Figure 7. TOPEX Ku Cal-1 Range Drift from Cal Database Before Correcting for DFB Positioning Quantization.

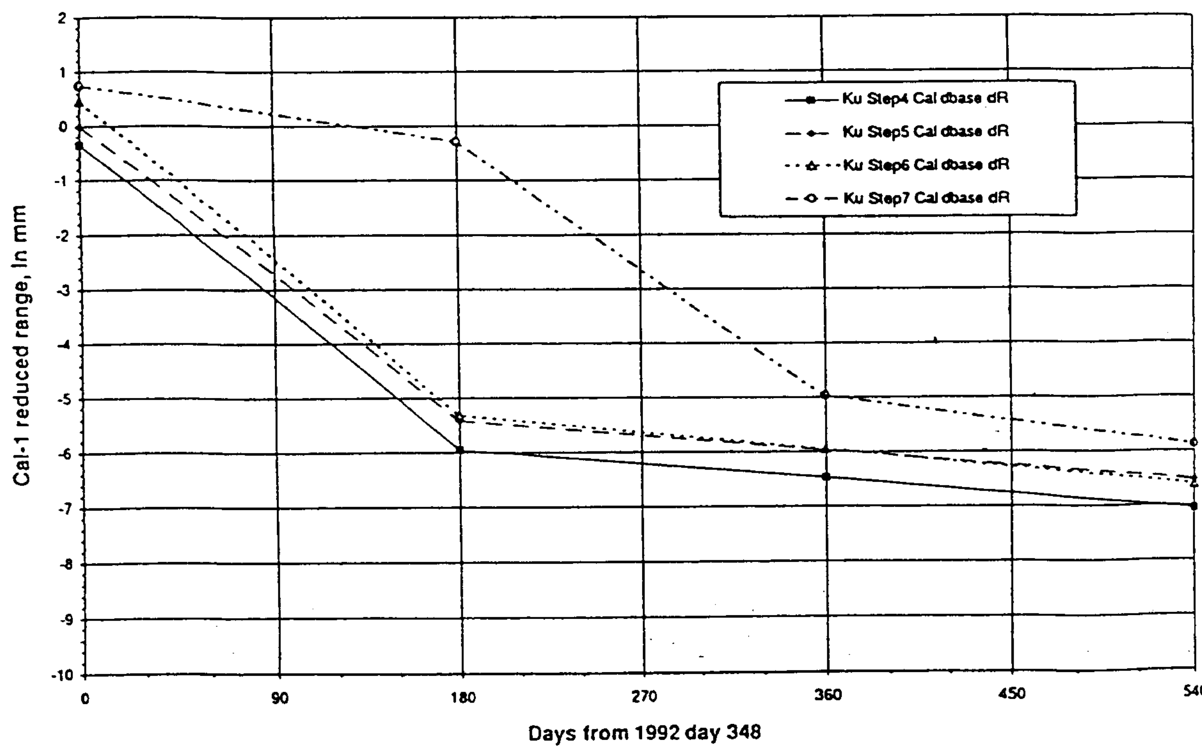


Figure 8. TOPEX Ku Cal-1 Range Drift from Cal Database After Correction for 7.32 mm l.s.b. of DFB Position.

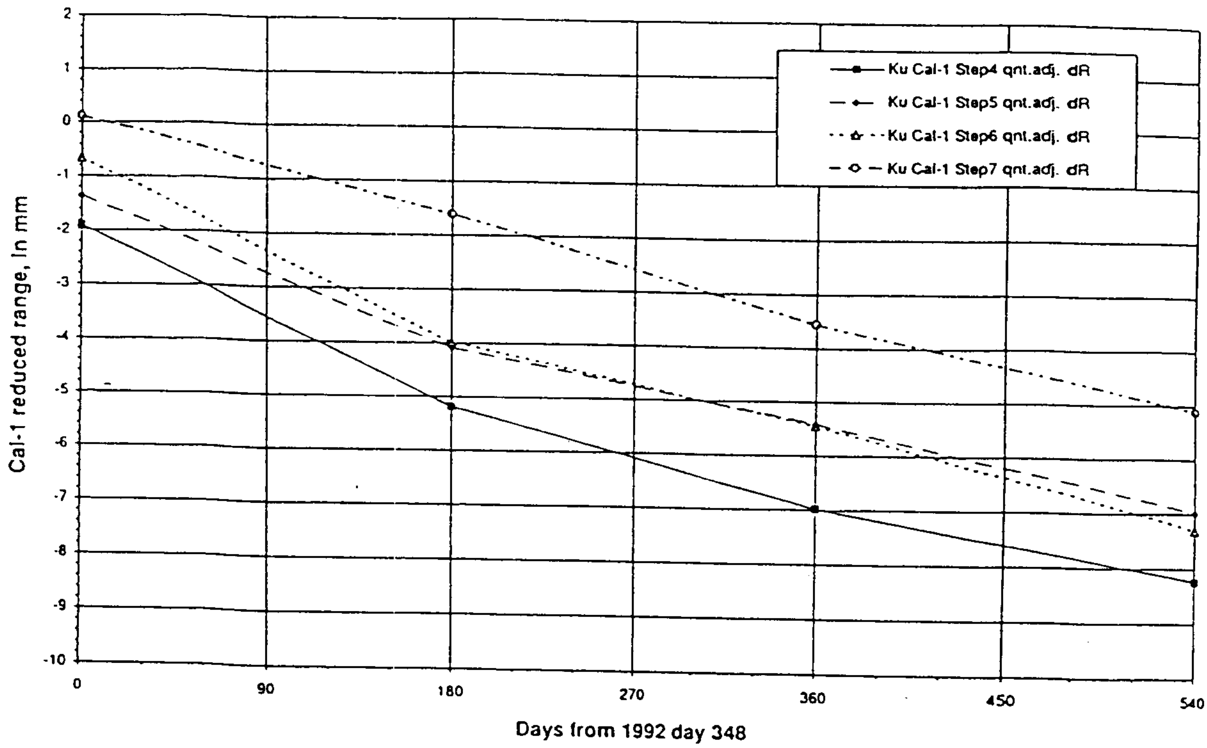
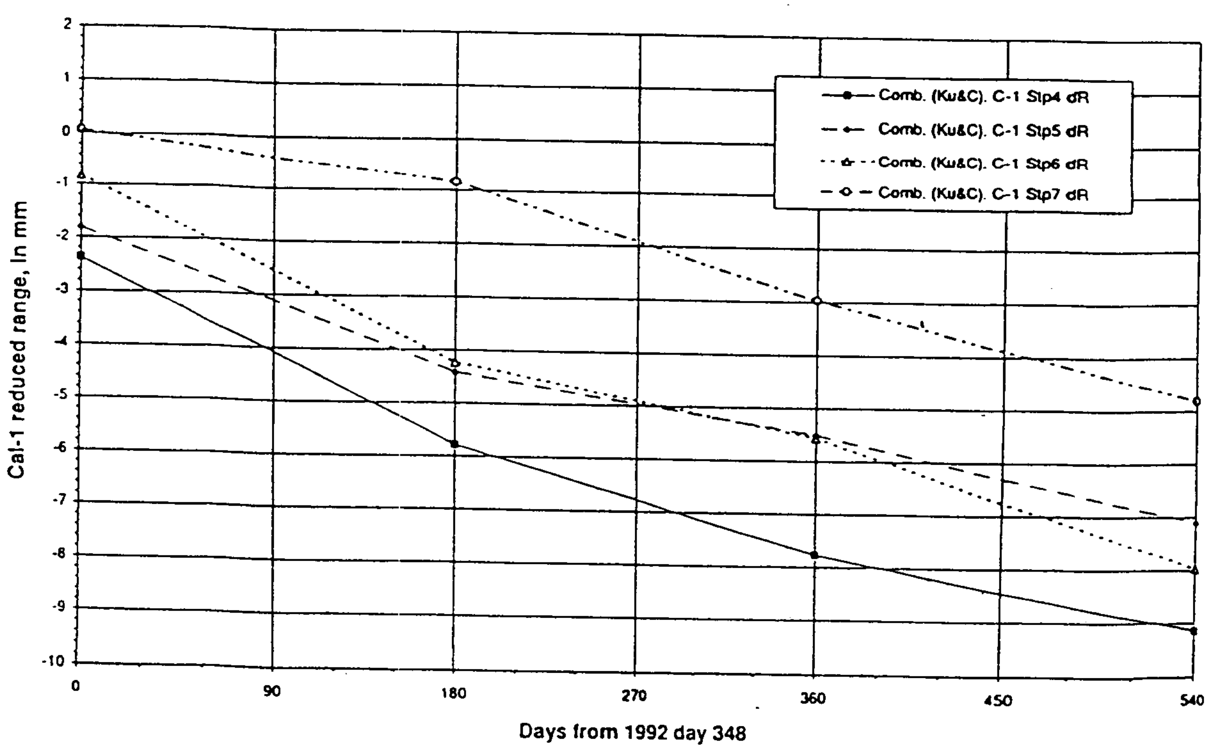


Figure 9. TOPEX Combined Ku & C Cal-1 Range Drift After Including Correction for 7.32 mm l.s.b. of DFB Position.



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07 July 1994

SUBJ: Replacement Figure 3, for DRAFT Memo "Corrections to Range Bias Determined in TOPEX Calibration Mode 1" of 28 June 1994

FROM: G.S. Hayne

TO: R.L. Brooks, R.G. Forsythe, H.H. Gordon, D.W. Hancock III, J.E. Lee, D.W. Lockwood, C.L. Purdy, L.C. Rossi

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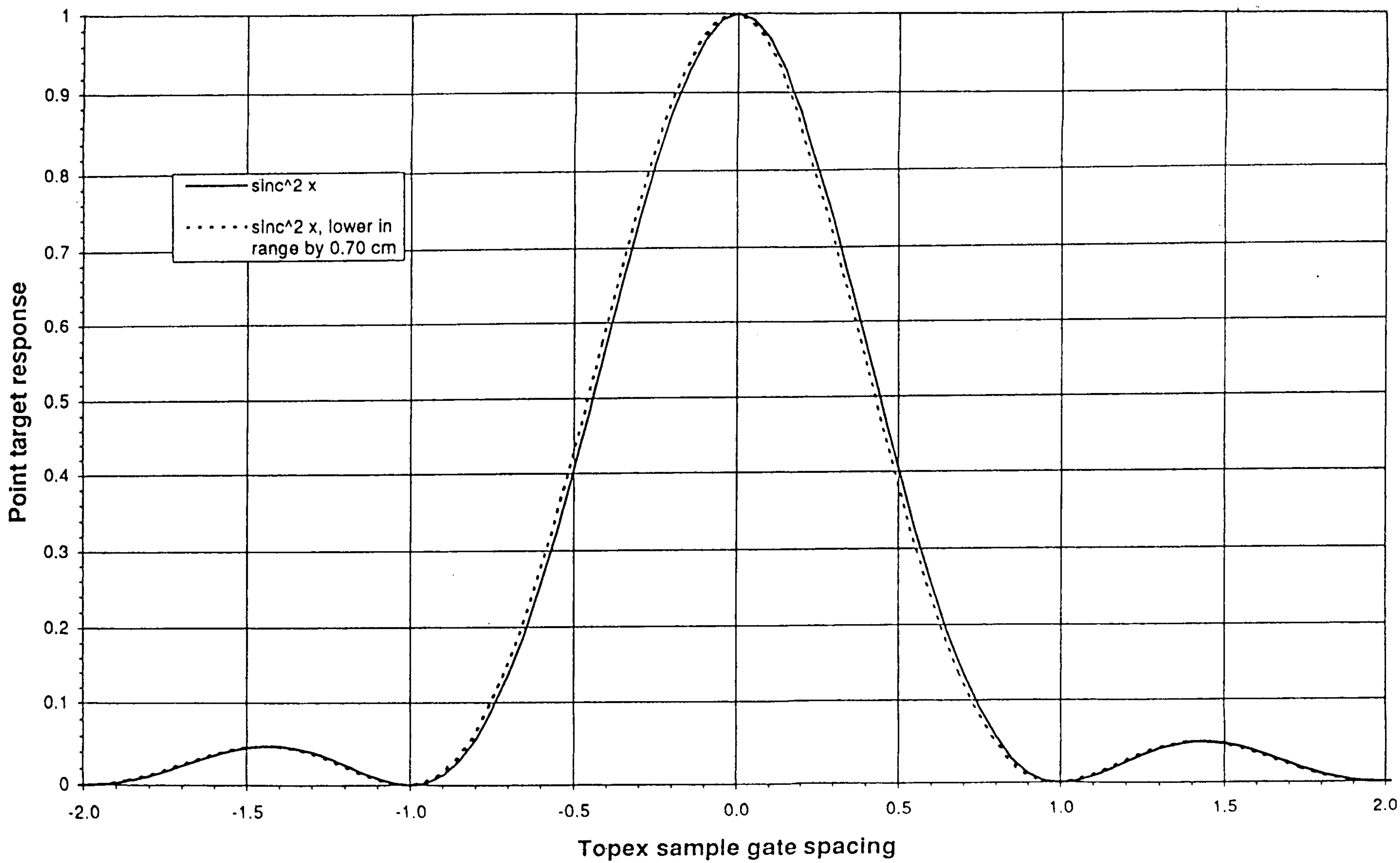
There was an error on Figure 3 of the indicated memo. The original Figure 3 misidentified the fine height word's least significant bit as 0.732 mm, but the correct value is 7.32 mm. The attached replacement Figure 3 corrects this error.

I have also attached a figure showing the TOPEX ideal point target response and replica of that response displaced 7.0 mm lower in range. Recall that our estimate of Ku Cal-1 range drift was about 6 mm, so this figure shows something like the maximum Cal-1 track point difference over the mission to date. Because the horizontal axis of the figure is in units of sample gate spacing, the TOPEX waveform samplers in Cal-1 tracking will be at positions ±0.5, ±1.5, ±2.5, and so forth. The actual point-target response is very nearly identical to the ideal response shown on this figure.

Comparison of TOPEX Ideal Point Target Response and Its Shifted Replica



TOPEX InterOffice Memo

To: Ron Brooks, Ron Forsythe, George Hayne, David Hancock, Craig Purdy

From: Hayden Gordon

Date: September 21, 1994

Subject: EA S/W Chg 15: AIF Waveform Processing Correction

Attached is a memo from Dennis Lockwood & Jeff Lee which addresses an error in the implemented full-rate waveform routine of 'dotelem' within the baselined AIF processing module. This change, designated Engineering Assessment Software Change Request 15, has been completed. The AIF processing module, dotelem, was modified to write out the correct CAL step during full-rate waveform processing. The change was made and implemented on 9/16/94; the new version of dotelem is 3.6. No output products were changed, and none are attached.

Thanks,

CC: Jeff Lee, Dennis Lockwood, Carol Purdy

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TOPEX InterOffice Memo

To: Ron Brooks, Ron Forsythe, George Hayne, David Hancock, Craig Purdy

From: Hayden Gordon

Date: September 21, 1994

Subject: EA S/W Chg 20: Side B Temp Corr Coeffs

Attached is a memo from Ron Brooks which addresses the implementation of Side B, CAL-1, Ku & C AGC temperature corrections in the baselined AIF software. This change, designated Engineering Assessment Software Change Request 20, has been completed. The change was made by revising the Engineering Limits file, DataFile.EALimits, which was completed on 9/16/94; the new version of the file is 8. No output products were changed, and none are attached.

Thanks,

CC: Jeff Lee, Dennis Lockwood, Carol Purdy

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TOPEX InterOffice Memo

To: Ron Brooks, Ron Forsythe, George Hayne, David Hancock, Craig Purdy

From: Hayden Gordon

Date: September 21, 1994

Subject: EA S/W Chg 19: New CAL Processor

George Hayne has developed a better method for processing CAL mode data (reference Hayne memo, "Corrections to Range Bias Determined in TOPEX Calibration Mode 1", dated June 28, 1994). The algorithm has been implemented and tested by the SWDT (SWDT Request #94/086). It is requested that the algorithm be made a permanent part of the AIF processing. This change, designated Engineering Assessment Software Change Request 19, has been completed. The change was made and implemented on 9/16/94; the new version of dotelem is 3.6. No output products were changed, and none are attached.

Thanks,

CC: Jeff Lee, Dennis Lockwood, Carol Purdy

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To: CSC/Dennis Lockwood
From: CSC/Jeff Lee
Date: January 17, 1995
Subject: RE> Request 94/193

Software Development Team
TOPEX Project
NASA GSFC/WFF

In response to Request#94/143, changes have been made to the following components of the AIF processing system:

DataFile.EALimits	Version 9.0, 01/17/95	Changed WF Limits per Memo
aifcal	no version number	Changed AGC Scales

All changes are completed and new software is in place as of 01/17/95.

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To :	CSC/Hayden Gordon
From:	CSC/Jeff Lee
Date:	February 24, 1995
Subject:	Change Request 95/045

Software Development Team
TOPEX Project
NASA GSFC/WFF

In response to Change Request 94/045 modified components of the AIF processing software have be placed into service. These modifications may be broken down into three distinct areas of functionality: Pass Count; Memory Map; and CACQ Waveform Processing. Changes made in each area are detailed below. A summary of version information is included at the end.

Pass Count : Study Request 95/004
Pass Count processing is a change implemented in the event processing of dotelem. New PassCount processing follows:

> Write error message to event log if last PassCount ≠ current PassCount

Memory Map: Study Request 95/019
A large part of RAM has been added to the memory which is checked during dotelem processing. Memory checking code was also modified to only check memory when the EngMemChksum matches the current reference value (FC55). The new memory references were added to DataFile.ROMMap and the EngMemChksum reference value was added to DataFile.EALimits.

CACQ Processing : Study Request 95/003
A new process was added to dotelem to perform CACQ waveform checking. Implemenation of this process necessitated a change to the format of the waveform databases and, additionally, changes to the STBY and CAL2 waveform processors. Constants for AGCKu limits were added to DataFile.EALimits. Additional code was added to the dotelem events processor to alarm if initial CACQ AGCKu value was out of limits. CACQ waveform processing follows:

> Until end of science data,
>
> Each science record is checked for validity. A record is considered valid if Mode1 = Mode2 = CACQ. If not valid, another science record is read.
>
> AGCKu is checked to be within the required range. (Currently 36-42 dB). If AGCKu is not within range, another science record is read.

- values for waveforms 3,4, and 5 are added to accumulated high rate data
- values for waveform 2 are added to accumulated low rate data
- temperature from AGC Receiver Section Monitor is added to temperature data

Upon end of science data, accumulated data is averaged and written to appropriate Hi & Lo waveform files.

Version Information

The following versions of each changed software component follow:

dotelem	4.0, 2/10/95
DataFile.ROMMap	2.0, 2/10/95
DataFile.EALimits	10.0, 2/10/95

Date effective is	**2/15/95**
First Data affected is	**1995046**

Abbreviations & Acronyms

AIF	Altimeter Instrument File
ADP	Algorithm Development Plan
ADT	Algorithm Development Team
AGC	Automatic Gain Control
APL	Applied Physics Laboratory
CAL	Calibration Mode or Calibration Mode data
CSC	Computer Sciences Corporation
CNES	Centre National d'Etudes Spatiales
COTS	Commercial Off-The-Shelf
EM	Electromagnetic
ENG	Engineering Data
EU	Engineering Unit
FTP	File Transfer Protocol
GDR	Geophysical Data Record
GSFC	Goddard Space Flight Center
HDR	Header data
IGDR	Intermediate Geophysical Data Record
IDL	Interactive Data Language
JPL	Jet Propulsion Laboratory
NASA	National Aeronautics and Space Administration
NSI	NASA Science Internet
RASE	Radar Altimeter System Evaluator
SCI	Science Data
SDR	Sensor Data Record
SDS	Science Data System
SIS	Software Interface Specification
SDT	Science Definition Team
SEU	Single Event Upset
STR	Selected Telemetry Record

SWDT	Software Development Team
SWH	Significant Wave Height
TGS	TOPEX Ground System (TGSA, TGSB, & TGSC VAX Cluster)
TMR	TOPEX Microwave Radiometer
TOPEX	Ocean Topography Experiment
UTC	Universal Time Coordinated
WFF	Wallops Flight Facility

Other Documents in this Series

Volume 1	TOPEX Radar Altimeter Development Requirements and Specifications, Version 6.0, August 1988 (Published May 2003)
Volume 2	WFF Topex Software Documentation Overview, May 1999 (Published May 2003)
Volume 3	WFF TOPEX Software Documentation Altimeter Instrument File (AIF) Processing, October 1998 (Published July 2003)

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13. ABSTRACT *(Maximum 200 words)*

This document is a compendium of the WFF TOPEX Software Development Team's knowledge regarding Sensor Data Record (SDR) Processing. It includes many elements of a requirements document, a software specification document, a software design document, and a user's manual. In the more technical sections, this document assumes the reader is familiar with TOPEX and instrument files.

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