Console Access to the Flying Wires

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Summary

The Flying Wires System uses the Acnet protocol communicate with the Fermilab Control System. This paper describes how the Acnet devices are updated and which devices are created.

1. Introduction

This version is for the Main Ring/Injector system which is an update of the current Tevatron System. The Tevatron system will be updated to this version. This update also includes upgrading the timing hardware.

1.1 Console Interaction

The Flying Wires (FW) interfaces with the Acnet protocol in three ways. Firstly, the FW maintains a set a Acnet devices in which analysis results are stored. These devices are updated in the Virtual Instrument (VI) FW Acnet Update 36, after the data of a fly has been analyzed. Secondly, an Acnet console can control the operation of the FW. This is handled by the Acnet subsection of the FW Main VI in the User Interface Task. Thirdly, a console can directly set Acnet devices related to the operation of the FW, e.g. a fly specification.

1.2 Front-End Acnet Device Access Points

The locations in the front-end program that access the Acnet devices are kept to a minimum to simplify the program. The FW initializes Acnet devices in the FW Init VI and accesses devices in the Menu VIs: FW Menu FlySpec and FW Menu Flyspec in a similar way as a console can do. Two more VI's access Acnet devices: TFW Acq Tag for reading out the store number and lattice setting to update the Fly tag at the same time as the flying of the wire, and TFW Error to update the error devices at any point in the program. There are no other location in the program that refer to Acnet devices.

1.3 Legend

To easily recognize the device names related to the Main Ring/Injector Flying Wires, device names start with I:FW. For the Tevatron the devices start with T:FW.

FLYING WIRES	FW	= Flying Wires

To make up the device names the following abbreviations are used for the Tevatron:

WIRE	H	= E11 Horizontal
	V	= E11 Vertical
	E	= E17 Horizontal

and for the Main Ring:

WIRE	H	= F48 Horizontal
	V	= F47 Vertical
	E	= Spare

and for the Main Injector:

WIRE	H	= Q102 Horizontal
	V	= Q103 Vertical
	E	= Spare

for all systems:

PARTICLE	P	= Proton
	A	= Anti-Proton

To keep the front-end program compatible, the same devices are generated, even though the Main Ring/Injector system has only two wires instead of three as the Tevatron system.

3. Remote Control using Acnet

A console can issue a command to the LabVIEW program by writing a command array to the command register. A command consists of a command code and command parameters which are all part of one Acnet device. The front-end program processes the command as soon as it notices the command code is non-zero and resets the whole register to zero. Because of this you must set the parameters before you set the command code or, preferably, set both in one setting. A result register indicates the status of the command execution.

3.1 Acnet Commands

The first element of the command array represents the command to execute, the next nine are parameters for the command. The available commands are:

Value	Command	Param1	Param2	Param3
0	No Command	---	---	---
1	Save FlySpec File	FlySpec Idx	---	---
2	Restore FlySpec File	FlySpec Idx	---	---
3	Restore All	---	---	---
4	Inspect FlySpec File	---	---	---
5	Set active FlySpec	FlySpec Idx	---	---
6	Set Remote/Local	---	---	---
7	List Log files/dir	Store	Low	High
8	Load log file	Store	Id	---
9	Fly now	---	---	---
10	Wire Positions	---	---	---
11	Find Index	---	---	---
12	Set Hardware			
13	Initialize Hardware	---	---	---
14	Set State	State		
15	Save/Restore State	Save		
14	Error	---	---	---

Table 1. Acnet commands to TFW.

FWCOMM Command register

1 device of 10 elements of type I32 , 40 bytes

The commands have the following meanings:

Save FlySpec File: Save the Flyspec (from Acnet device) indicated by the FlySpec Idx to disk. When a FlySpec is saved to disk it becomes the default FlySpec for that index.

Restore FlySpec File: Retrieve the Flyspec indicated by the FlySpec Idx from disk to the Acnet device FWSPEC. The old contents of the Acnet device (for that Idx) are overwritten.

Restore All: Retrieve all Flyspecs from disk to Acnet Device FWSPEC.

Inspect FlySpec File: Retrieve all the Flyspec from disk to the inspection Acnet device FWSPEF. This command is used to inspect the default flyspecs on disk while not modifying the flyspecs in the Acnet Device FWSPEC.

Set active FlySpec: Set the current flyspec to the flyspec associated with the index given by FlySpec Idx. This will reset the hardware to adapt to the new fly specifications.

Set Remote/Local: Toggle the mode from local to remote or vice versa. In remote mode the settings for the hardware are taken from Acnet device values, in local mode local variables are used.

List Log files/dir: Update the listing of log files in FWLOGS. The parameter Store should be set to the store you want to see the log files of. The parameters Low and High specify the range (in c-time) of files to display. If Low and High are both zero then all files are displayed for specified store number.

Load log file: Use this command to load the log file that you are interested in. You can inspect the data using buffer number 9 and special position and beamloss devices, see in appropriate sections below. The log file is identified by store number and Id (in c-time, same as in log listing)

Fly now: Fly the wires immediately

Get Wire Positions: Update the device T:FWWPOS with the current wire positions.

Find Index: Reset Motor boards and find the index. N.B. this will move the wires.

Set Hardware: Use current settings to set the hardware. For use after changing Acnet devices to let the system know that it needs the read the devices and reset the hardware.

Initialize: This command will initialize the hardware and as a result fly the wires to their initial position. This command must be issued after a reboot/restart before the system can operate and must be issued by hand to avoid an uncontrolled fly.

Set State (Tev Only): This command will set the state and activate the spec associated with that state using T:FWSSA.

Save/Restore State Spec (Tev Only): Save (save = 1) the state device array T:FWSSA to disk file or restore the device from file (save=0).

Error: The Error command will replace any command issued that is not equal to the Initialize hardware command if the hardware is not initialized. The Error command will only update the command register and error message register with an appropriate message.

3.2 Acnet Command Result

The Result Acnet Command Result register has eleven elements. The first element contains the result code, the following 10 are a copy of the issued command. The following codes are used for the result register's first element:

-1 = Busy executing command
0 = No Error
1 = Error

The busy, -1, is set just after the command is being read in. Before this the register will hold the No Error/Error value of the previous command. Note that even if a the command was executed flawless, errors can occur later in the program due to the command. For example, you could have made a bad setting that will be detected later during e.g. setting of hardware or analysis of data. Such an error will not show up in the command result register but in the diagnostic message device.

FWCOMR Command Result

1 vector device of 11 elements of type I32, 44 bytes, read-only

Note: in the case that there is more than one application issuing commands, there can be a conflict. If one writes the command register as one setting, you are guaranteed that a command is matched up with the right parameters. However, another application could overwrite the command register before the front-end read the value. Therefore, read out the result register to see if your command was executed.

4. Fly Specifications

The fly specifications determine when and how the wires are flown. Through Acnet devices the flyspec can be changed. There are up to 40 different fly specifications. You can find out what the current fly spec is and what will be the next fly spec (unless you change this using the command register).

4.1 Active Fly Specification

The active or current fly spec number. This flyspec has been used to initialize the hardware.

FWSPEA Fly SPEc Active

1 device of type I16, 2 bytes , read-only

4.2 Next Fly Specification

The next fly spec number. This flyspec will be used after a fly to initialize the hardware. This value is set by the current fly spec's next flyspec value or, through the command registers, by the console application or sequencer. You cannot set this directly because it would not reset the hardware immediately but wait until a fly has been completed. Use the command register to set the new flyspec.

FWSPEN Fly SPEc Next

1 device of type I16, 2 bytes , read-only

4.3 The Fly Specifications

You can control many aspects of a fly using the fly spec, see table 2. All 40 fly specs are stored in one Acnet device. To access the fly spec in a C program use the example c structure in list 1.

FWSPEC Operational Flyspecs

*1 vector device of 40 (Flyspecs) * 100 elements of type U8, 4000 bytes*

OFFSET	SIZE	ITEM
0	32	NAME of fly spec, 32 chars, string is null terminated
32	8	HIGH VOLTAGE, 4 rows[1] by 1 column of words (2 bytes)
40	8	PATTERN array, 4 rows[1] by 1 column of words (2 bytes)
48	8	DELAY 4 rows[1] by 1 column of words
56	8	UNUSED 4 rows[1] by 1 column of bytes
64	18	APERTURE 3 rows[2] by 3 columns of words
82	2	FLY EVENT one word
84	2	NEXT SPEC, one word
86	2	REPEAT, one word (Not implemented)
88	2	TURN/TRIGGER, one word
90	2	ACTIVE ACNET DATA-BUFFER, one word
92	2	FIT one word (0=Quick 1=Full)
94	2	LOG DATA one word
96	2	MODE processing, one word
98	2	FILLER 2 bytes
100	-	Total

Table 2. Definition of the Fly Specification.

```
typedef struct flyspec {
char            name[32];
unsigned short  highvolt[4];
unsigned short  pattern[4];
unsigned short  delay[4];
unsigned short  unused[4];
unsigned short  aperture[9];
unsigned short  flyevent;
unsigned short  nextspec;
unsigned short  repeat;
unsigned short  turntrig;
unsigned short  buffer;
unsigned short  fit;
unsigned short  logdata;
unsigned short  mode;
unsigned short  filler;
} flyspec;
```

List 1. Definition of the Fly Specification as a C structure.

4.4 Flyspec Inspection

Use the Fly spec inspection device to inspect a default fly spec as stored on disk without affecting any loaded flyspec (which might have been modified). Issue a Inspect FlySpec command to update this buffer.

FWSPEF Copy of Fly Specs on disk

*1 vector device of 40 (Flyspecs) * 100 elements of type U8, 4000 bytes, read-only*

5. Tags

The analyzed and raw data is tagged to identify when and how the data was taken. The sequencer will set some of the tag values, others come from MDAT or are set by the front-end program. A Tag is saved with each fly flown. Tags are saved for each buffer (there are 10 of these, see figure 1). Each tag has 10 I32 elements defined in table 3. An equivalent C structure is given in List 2.

FWTAGS(Buffer) Tags for the results

*1 vector device of 10*10 elements of type I32, 400 bytes., read-only*

```
offset     = buf*10       offset in elements.
{0,..,90}  = {0,..,9}*10
```

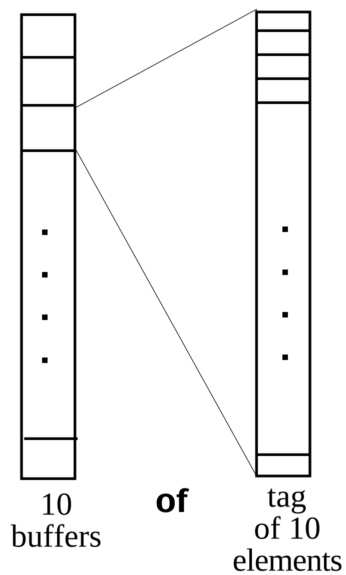

Figure 1. The organization of the tag buffer.

OFFSET	SIZE	TAG
0	4	Time of fly (c-time)
4	4	Store number (set by sequencer)
8	4	Lattice step (set by sequencer)
12	4	MDAT energy (from VUCD card)
16	4	Pass (0 or 1: currently not used)
20	4	Fly direction (forward or backward)
24	4	Fly number (sequence number by LV)
28	4	Error (Error during fly)
32	8	Filler (unused)
40	-	Total

Table 3. Definition of the Tag.

```
typedef struct tag {
long      time;
long      store;
long      lattice;
long      energy;
long      pass;
long      direction;
long      flynum;
long      error;
long      filler[2];
} tag;
```

List 2. Definition of the Tag as a C structure.

5.1 Sequencer Controlled Tag Devices

These are values that should be set by the sequencer to be used by the tag.

FWLATT Lattice DBB index

1 device of type I32, 4 bytes

FWSTOR Store number

1 device of type I32, 4 bytes

5.2 Front-End Controlled Tag Devices

These are devices that are set by the FW program and are used with the tag. The individual device allows for easy access to the current fly number.

FWFLYN Fly number

1 device of type I32, 4 bytes, read-only

6. Diagnostics

The diagnostic devices represent the state of the Flying Wire front-end. The message can include errors on VME access, aperture opening and others.

6.1 Diagnostic Message

Message string (C-style, null terminated)

FWDMSG Diagnostic MeSsaGe

1 device of 1000 elements of U8, 1000 bytes, read-only

6.2 State Of Flying Wires

Currently, the state of the flying wires is used only to indicate whether the system is initialized or not, see table 4. If the system has been fully initialized, that is, the wires have been reset and flown to initial position. The system will always reboot to an uninitialized mode to prevent an unwanted fly of the wire. While the software is running in the uninitialized mode, and preferences have been read from the disk, none of the hardware will be accessed until the system is initialized.

FWSTAT State of FW

1 device of type I32, 4 bytes, read-only

Value	**Comment**
-1	System uninitialized
0	System initialized
1	Error occurred, see message string

Table 4. Definition of status codes.

7. Data Readout

The date produced by the flying wire system is updated right after the analysis. It is possible that the analysis of one fly has not been completed while another fly has already been done. Up to 10 flies can be done before data must be analyzed and the Acnet devices updated.

7.1 Data Update Mechanism

It is possible to read out the Acnet devices while the data-acquisition program is updating the devices. This can lead to an inconsistent data set of part old data and part new data. To avoid this, a mechanism is implemented to determine if the data was updated while reading the devices. Before the program updates the devices it will write the current fly number to the first element of a two element array. After the update, the program writes the fly number to the second element, see figure 2.

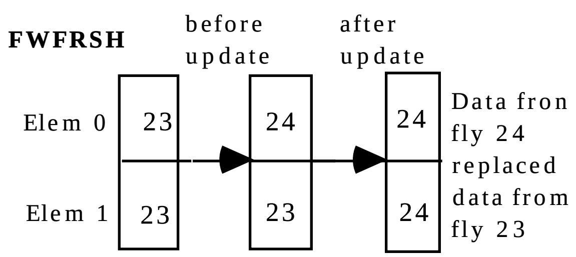

Figure 2. Marking the update of results.

Thus, a console reading out the analyzed data should do the following steps:

1) read the two elements of FWFRSH, if they are the same continue with step 2 otherwise, pause (about a second) and repeat step 1.
2) read devices containing results.
3) read the two elements of FWFRSH, if the values are equal to each other and equal to the readout in step 1, you have consistent data. Otherwise (element 0 is unequal to element 1 or doesn't match readout from step 1) data might have been partially updated and you will have to repeat the process and go back to step 1.

This method should not be used to synchronize read-outs from disk. This is synchronized by checking the status of the FWCOMR device. Also note that the data from two consecutive flies not necessarily is stored in the same locations. If the data is saved to different buffers, there will be no data mixing.

FWFRSH Data results Freshness

1 device of type I32, 4 bytes, read-only

7.2 Fit Parameters

The analyzed data is stored in separate Acnet devices for each parameter of the analysis model. The parameters are: Sigma, Center, Amplitude, Background, Slope and Chi-square for each wire and each particle (total of six devices per parameter). Each device is organized as seen in figure 3. There are 10 buffers, each buffer contains data from two passes of each single fly and each pass can hold up to 36 bunches, see figure 3. The buffer index assignments are shown in table 4.

Note: for FIXED TARGET operation there is no pbar data in the Tevatron. Occasionally, the pbar signals are replaced with test signals. Ignore any data and analysis results on pbar data.

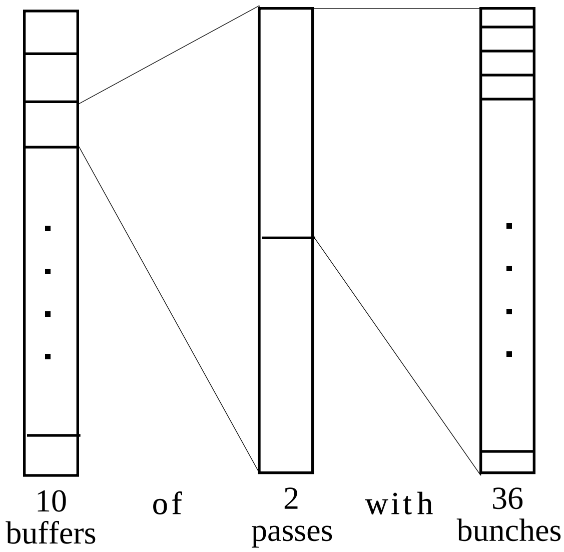

Figure 3. The organization of the analyzed data buffers.

FW[H|V|E][P|A]SG(Bun*Pass*buf) Sigma

FW[H|V|E][P|A]CE(Bun*Pass*buf) Center

FW[H|V|E][P|A]AM(Bun*Pass*buf) Amplitude

FW[H|V|E][P|A]BG(Bun*Pass*buf) Background (offset)

FW[H|V|E][P|A]DY(Bun*Pass*buf) Slope of background

FW[H|V|E][P|A]FT(Bun*Pass*buf) Chisquare of fit

*36 vector devices of 36*2*10 elements of type SGL, 7200 bytes/device , read-only*

Each device has 10 buffers for the results of 72 bunches. The first 36 results for pass1, next 36 for pass 2.

```
offset        = bunch       +  pass*bunches_total  +
  passes_fly* bunches_total *buffer
{0,..,719} ={0,..,35} + {0,1}*36     + 2*36*{0,..,9}
```

7.3 Emittance Calculation

For the Tevatron the emittance is calculated from the results of the three wires.

7.3.1 Tevatron

FW[H|V|E]EMI(Bun*Prtl*pass*buf) Emittance

*3 vector devices of 36*2*2*10 elements of type SGL, 5760 bytes, read-only*

```
  offset = bunch + 36*particle + 72*pass
+144*buf

  {0,..,5756} ={0,..,35}+ 36*{0,1}  +72*{0,1}
+144*{0,..9}
```

These devices contains the values for the horizontal (FWHEMI), vertical emittance (FWVEMI) and dp/p (FWEEMI). The update is done only for data from a fly (not for data from disk) and only if all three wires have been flown. The sigma's are averaged over the two passes. The Tevatron lattice values used in the calculation for FIXED TARGET are (numbers by J. Holt).

Location	Betah	Betav	dp/p
E11H	85.87	xxxxx	1.99
E11V	xxxxx	83.84	Xxxx
E17H	65.86	xxxxx	5.63

Table 5. Lattice values for the Tevatron.

7.3.2 Main Injector

For the Main Injector the emittance is a simple calculation done for each wire separately:

$$\varepsilon(95)= (6\pi\sigma^{\wedge 2}\beta\gamma) /\beta_{lattice}$$

The calculated emittance is stored in same named devices but also stores data for each pass:

FW[H|V|E]EMI(Bun*Prtl*Pass*Buf) Emittance

*2 vector devices of 36*2*2*10 elements of type SGL, 5760 bytes, read-only*

```
  offset = bunch + 36*particle + 72*pass
+144*buf
```

```
  {0,..,5756} ={0,..,35}+ 36*{0,1}  +72*{0,1}
+144*{0,..9}
```

7.4 Energy Measurements

The Main Injector system now digitizes the nergy as it is also sampling the beam loss. This gives us a accurate estimate for the energy when the wires were in the beam. The energy is stored in a device per wire holding one value each for each pass. Because the main Injector Ramp is so fast, the values for each pass are different, unlike the Tevatron.

FW[H|V|E]NGY (Pass)   Emittance

3 vector devices of 2 elements of type SGL, 86 bytes, read-only

```
offset      = Pass
{0,..,1}  ={0,1}
```

7.5 Position Data

The position data is now saved for each wire, each particle, and bunch. The position is organized as 12 devices (one for each wire, each particle, and each pass). The passes were made different devices due to limitations of the Acnet protocol. Each device has 36 buffers of 100 samples. A maximum of 100 samples of position can be saved per bunch. (current use is either 80 or 100). In the front-end program (LabVIEW), the position devices for each pass are combined. The position array is only available for the last fly and for retrieval from disk.

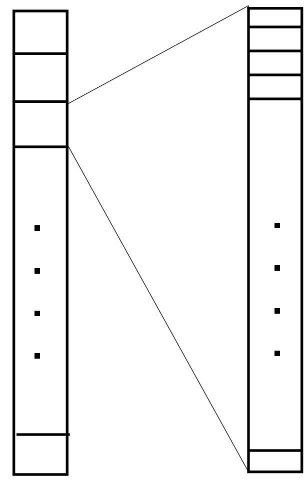

Figure 5. The organization of the position data buffer.

FW[H|V|E][P|A]P1(Sample*Bunch) Position (fly) pass1
FW[H|V|E][P|A]P2(Sample*Bunch) Position (fly) pass2
FW[H|V|E][P|A]F1(Sample*Bunch) Position (Disk) pass1
FW[H|V|E][P|A]F2(Sample*Bunch) Position (Disk) pass2

*12 vector devices of 100*36 elements of type SGL, 14400 bytes, read-only.*

```
offset      = sample   +  bunch*100 offset in
elements
{0,..,3500} ={ 0,..,99}+ {0,..,35}*100
```

7.6 Old setup for position data

Initially the assumption was made that the position data is the same for each particle and each bunch except for an offset. This generated problems when the position array used as reference came from a bunch that wasn’t present. This led to a position array that was derived from a slightly rotated position count array and thus incorrect and leading to a small mismatch in the console plots even though the results are fine. Additional problems arise when a bunch disappears from one pass to another or if the protons and pbars are on different orbits. The old method is still available but could be removed at any time.

FW[H|V|E]WP(Sample*Pass) Wire Position(fly), Sample=0-99, Pass=0,1

FW[H|V|E]WD(Sample*Pass) Wire Position(disk), Sample=0-99, Pass=0,1

*6 vector devices of 100*2 elements of type SGL, 800 bytes/device , read-only*

```
offset     = bunch    + pass*bunches + passes*
bunches *buffer
{0,..,199} ={0,..,35} + {0,1}*36   + 2*36*{0,..,9}
```

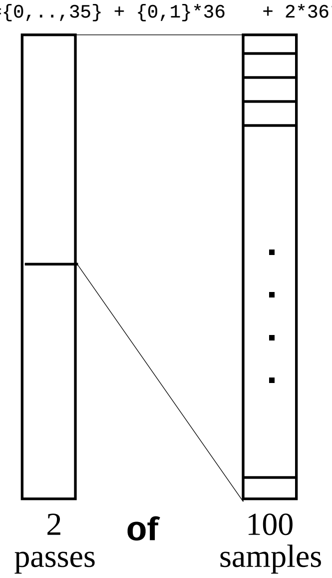

Figure 4. Organization of the beam position data.

To account for that positions aren't the same for each particle and each bunch but have an offset, two array devices, one for data from fly and one for data from disk, that give the correct value of the first position. This value must be compared to the beam position data array. the difference must be added to all elements of the array.

FWPOSF(Wire*Pass*Prt*Bunch) Wire Position(fly), Wire=0-2, Pass = 0,1, Prt =0,1, Bunch=0-35.
FWPOSD(Wire*Pass*Prt*Bunch) Wire Position(disk), Wire=0-2, Pass = 0,1, Prt =0,1, Bunch=0-35.

*2 vector devices of 3*2*2*36 elements of type SGL, 1728 bytes, read-only*

```
offset     = wire*144   +  pass*72 + prtl*36 + bunch
{0,..,431} ={0,1,2}*144 + {0,1}*72 + {0,1}*36+
  {0,..,35}
```

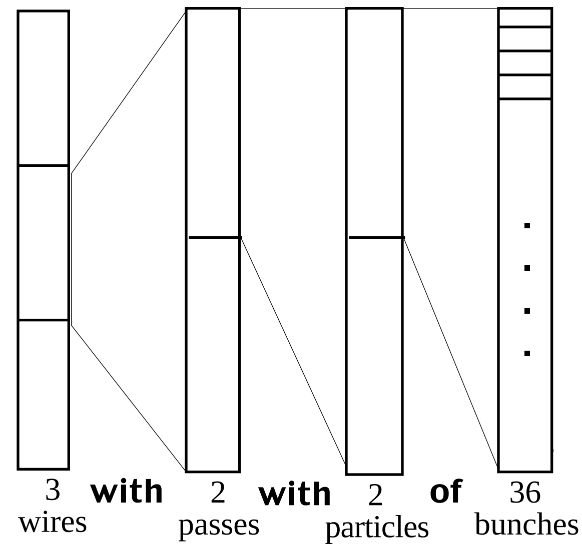

Figure 4. Initial position of wire.

The final positions for each wire, bunch, pass, and particle is calculated by taking the position value for the right bunch from FWPOSF or FWPOSD compare it to the first element of FW[H|V|E]WP or FW[H|V|E]WD. Add the difference of FWPOSF - FW[H|V|E]WP (or FWPOSD - FW[H|V|E]WD) to all position elements.

7.7 Beamloss Data

The beamloss is different for each wire, each particle, and bunch. The beamloss is organized as 12 devices (one for each wire, each particle, and each pass). The passes were made different devices due to limitations of the Acnet protocol. Each device has 36 buffers of 100 samples. A maximum of 100 samples of beamloss can be saved per bunch. (current use is either 50 or 100). In the front-end program (LabVIEW), the beamloss devices for each pass are combined.

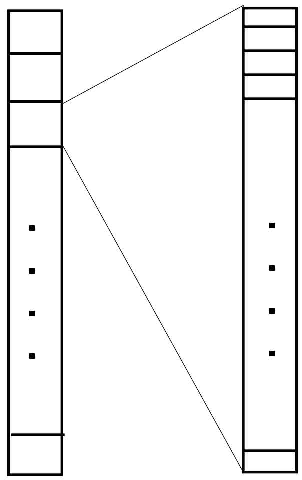

Figure 5. The organization of the beamloss data buffer.

FW[H|V|E][P|A]L1(Sample*Bunch)
BeamLoss(fly) pass1
FW[H|V|E][P|A]L2(Sample*Bunch)
BeamLoss(fly) pass2
FW[H|V|E][P|A]D1(Sample*Bunch)
BeamLoss(Disk) pass1
FW[H|V|E][P|A]D2(Sample*Bunch)
BeamLoss(Disk) pass2

*12 vector devices of 100*36 elements of type SGL, 14400 bytes, read-only.*

```
offset      = sample    +  bunch*100 offset in
elements
{0,..,3500} ={ 0,..,99}+ {0,..,35}*100
```

8. File System

A local file system on the front-end can save all data from a fly if so instructed by the flyspec. The logged data can be accessed through buffer 9 for the analyzed parameters and raw data profile devices. You can list log directories and files or load a specific fly into the Acnet devices. A listing of the directories can be made using the command List Log with the parameter store having the value -1. If the value is equal or greater then 0, a listing is returned of the files in the directory for that store. The listings are returned in the string device FWLOGS. The data from a log file is loaded into the appropriate Acnet devices by issuing the load data command and specifying the store and fly index. See Command registers. To obtain a listing of the log filenames, you must first issue the load log file command, then check to the status register to see if the command has been completed, then read the device FWLOGS.

Note: for FIXED TARGET operation, the store folder with the last 100 files is folder 0000. If already 100 files are present and a new file is written, the oldest file in 0000 will be moved to the next available (less than 100 files) folder. For FIXED TARGET the folders 0000 to 0999 are the only available. Folders 4000 and up are reserved for COLLIDER operation.

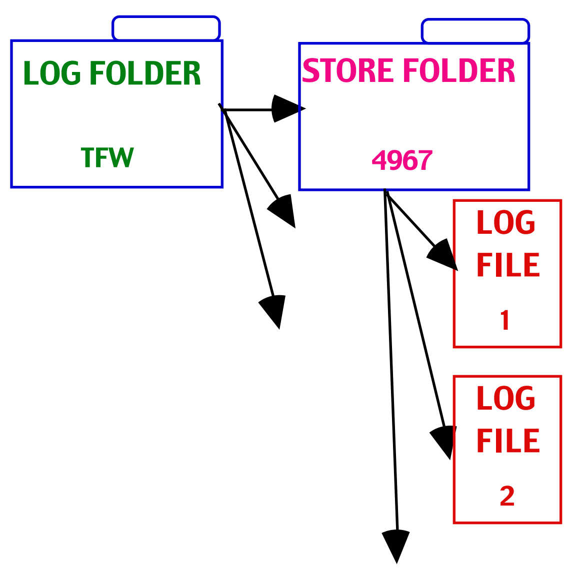

Figure 6. Layout of the Data Log System for the TFW.

8. 1 Listing Of Files And Directories

The front-end program can list all available directories and all the files in each of the directories.

FWLOGS TFW LOGs listing

1 device of 10000 elements of type U8 (currently only 2000 used), 10000 bytes, read-only.

The directory or filenames are separated by newline "\n" characters and the string is terminated by a null "\00" character. The definition of a log filename is shown in figure 6. (older versions end after the "time in seconds" field).

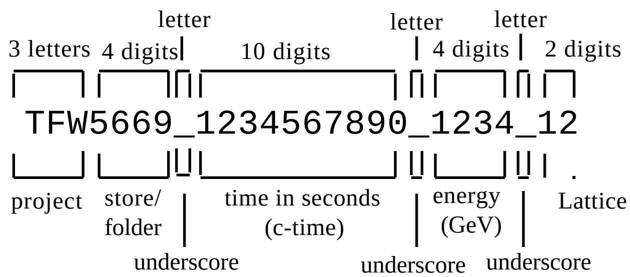

Figure 7. Definition of a log filename.

APPENDIX A

THE DEVICE TABLES

1/1/00	TFW	V 2.0										W. Blokland
Device name	SSDN #	Read/ Write	Var type	Byt es/e lem	Elem/ device	Initial value	Updat e rate	Prim Unit	Comm Unit	Long/ Short	Not atio n	Description
T:FWCOMM	100	RW	I32	4	10	0	60	unit	unit	short	dec	TFW Command Register
T:FWCOMR	101	RW	I32	4	11	0	60	unit	unit	short	dec	TFW Command Result Reg
T:FWFRSH	102	R	I32	4	2	0	60	unit	unit	short	dec	TFW Data Freshness
T:FWSPEA	200	R	I16	2	1	0	60	unit	unit	short	dec	TFW FlySpec Active Index
T:FWSPEN	201	R	I16	2	1	0	60	unit	unit	short	dec	TFW FlySpec Next Index
T:FWSPEC	202	RW	U8	1	4000	0	600	unit	unit	short	dec	TFW Operational FlySpec
T:FWSPEF	203	RW	U8	1	4000	0	600	unit	unit	short	dec	TFW Inspection FlySpec
T:FWWPOS	204	R	I32	4	5	-1	600	unit	unit	short	dec	TFW Wire Positions
T:FWTAGS	300	R	I32	4	600	0	600	unit	unit	short	dec	TFW Fly Tags
T:FWFLYN	301	R	I32	4	1	0	60	unit	unit	short	dec	TFW Current Fly Number
T:FWSTOR	302	RW	I32	4	1	0	60	unit	unit	short	dec	TFW Store Number
T:FWLATT	303	RW	I32	4	1	0	120	unit	unit	short	dec	TFW DB Lattice Step
T:FWLBUF	304	R	I32	4	1	0	600	unit	unit	short	dec	TFW Last Savebuf
T:FWSAMP	305	R	I32	4	2	0	600	unit	unit	short	dec	TFW Last Num of samples
T:FWSTAT	350	R	I32	4	10	0	60	unit	unit	short	dec	TFW State
T:FWDMSG	351	R	STR	1	1024	No Msg	240	str	str	short	dec	TFW Diagnostic Message
T:FWTIM	400	RW	U16	2	24	0	240	unit	unit	short	dec	TFW Timing array
T:FWHPSG	500	R	SGL	4	720	0	120	mm	mm	short	dec	TFW E11 Hor Prot Sigma
T:FWHASG	501	R	SGL	4	720	0	120	mm	mm	short	dec	TFW E11 Hor Pbar Sigma
T:FWVPSG	502	R	SGL	4	720	0	120	mm	mm	short	dec	TFW E11 Ver Prot Sigma
T:FWVASG	503	R	SGL	4	720	0	120	mm	mm	short	dec	TFW E11 Ver Pbar Sigma
T:FWEPSG	504	R	SGL	4	720	0	120	mm	mm	short	dec	TFW E17 Hor Prot Sigma
T:FWEASG	505	R	SGL	4	720	0	120	mm	mm	short	dec	TFW E17 Hor Pbar Sigma
T:FWHPCE	506	R	SGL	4	720	0	120	mm	mm	short	dec	TFW E11 Hor Prot Centr
T:FWHACE	507	R	SGL	4	720	0	120	mm	mm	short	dec	TFW E11 Hor Pbar Centr
T:FWVPCE	508	R	SGL	4	720	0	120	mm	mm	short	dec	TFW E11 Ver Prot Centr
T:FWVACE	509	R	SGL	4	720	0	120	mm	mm	short	dec	TFW E11 Ver Pbar Centr
T:FWEPCE	510	R	SGL	4	720	0	120	mm	mm	short	dec	TFW E17 Hor Prot Centr
T:FWEACE	511	R	SGL	4	720	0	120	mm	mm	short	dec	TFW E17 Hor Pbar Centr
T:FWHPAM	512	R	SGL	4	720	0	120	Volt	Volt	short	dec	TFW E11 Hor Prot Ampl
T:FWHAAM	513	R	SGL	4	720	0	120	Volt	Volt	short	dec	TFW E11 Hor Pbar Ampl
T:FWVPAM	514	R	SGL	4	720	0	120	Volt	Volt	short	dec	TFW E11 Ver Prot Ampl
T:FWVAAM	515	R	SGL	4	720	0	120	Volt	Volt	short	dec	TFW E11 Ver Pbar Ampl
T:FWEPAM	516	R	SGL	4	720	0	120	Volt	Volt	short	dec	TFW E17 Hor Prot Ampl
T:FWEAAM	517	R	SGL	4	720	0	120	Volt	Volt	short	dec	TFW E17 Hor Pbar Ampl
T:FWHPBG	518	R	SGL	4	720	0	120	Volt	Volt	short	dec	TFW E11 Hor Prot Back
T:FWHABG	519	R	SGL	4	720	0	120	Volt	Volt	short	dec	TFW E11 Hor Pbar Back
T:FWVPBG	520	R	SGL	4	720	0	120	Volt	Volt	short	dec	TFW E11 Ver Prot Back
T:FWVABG	521	R	SGL	4	720	0	120	Volt	Volt	short	dec	TFW E11 Ver Pbar Back
T:FWEPBG	522	R	SGL	4	720	0	120	Volt	Volt	short	dec	TFW E17 Hor Prot Back
T:FWEABG	523	R	SGL	4	720	0	120	Volt	Volt	short	dec	TFW E17 Hor Pbar Back
T:FWHPDY	524	R	SGL	4	720	0	120	V/mm	V/mm	short	dec	TFW E11 Hor Prot Back dY
T:FWHADY	525	R	SGL	4	720	0	120	V/mm	V/mm	short	dec	TFW E11 Hor Pbar Back dY
T:FWVPDY	526	R	SGL	4	720	0	120	V/mm	V/mm	short	dec	TFW E11 Ver Prot Back dY

T:FWVADY	527	R	SGL	4	720	0	120	V/mm	V/mm	short	dec	TFW E11 Ver Pbar Back dY
T:FWEPDY	528	R	SGL	4	720	0	120	V/mm	V/mm	short	dec	TFW E17 Hor Prot Back dY
T:FWEADY	529	R	SGL	4	720	0	120	V/mm	V/mm	short	dec	TFW E17 Hor Pbar Back dY
T:FWHPFT	530	R	SGL	4	720	0	120	unit	unit	short	dec	TFW E11 Hor Prot Fit
T:FWHAFT	531	R	SGL	4	720	0	120	unit	unit	short	dec	TFW E11 Hor Pbar Fit
T:FWVPFT	532	R	SGL	4	720	0	120	unit	unit	short	dec	TFW E11 Ver Prot Fit
T:FWVAFT	533	R	SGL	4	720	0	120	unit	unit	short	dec	TFW E11 Ver Pbar Fit
T:FWEPFT	534	R	SGL	4	720	0	120	unit	unit	short	dec	TFW E17 Hor Prot Fit
T:FWEAFT	535	R	SGL	4	720	0	120	unit	unit	short	dec	TFW E17 Hor Pbar Fit
T:FWHSIG	550	R	SGL	4	12	0	600	mm	mm	short	dec	TFW E11 Hor Sigma Aver
T:FWVSIG	551	R	SGL	4	12	0	600	mm	mm	short	dec	TFW E11 Ver Sigma Aver
T:FWESIG	552	R	SGL	4	12	0	600	mm	mm	short	dec	TFW E17 Hor Sigma Aver
T:FWHEMI	560	R	SGL	4	12	0	600	mmmr	mmmr	short	dec	TFW Norm Hor Emittance
T:FWVEMI	561	R	SGL	4	12	0	600	mmmr	mmmr	short	dec	TFW Norm Ver Emittance
T:FWEEMI	562	R	SGL	4	12	0	600	unit	unit	short	dec	TFW Norm dP/P
T:FWHWP	600	R	SGL	4	400	0	120	mm	mm	short	dec	TFW E17 Hor Posit Fly
T:FWVWP	601	R	SGL	4	400	0	120	mm	mm	short	dec	TFW E17 Ver Posit Fly
T:FWEWP	602	R	SGL	4	400	0	120	mm	mm	short	dec	TFW E11 Hor Posit Fly
T:FWHWD	610	R	SGL	4	400	0	120	mm	mm	short	dec	TFW E17 Hor Posit Disk
T:FWVWD	611	R	SGL	4	400	0	120	mm	mm	short	dec	TFW E17 Ver Posit Disk
T:FWEWD	612	R	SGL	4	400	0	120	mm	mm	short	dec	TFW E11 Hor Posit Disk
T:FWPOSF	620	R	SGL	4	432	0	600	mm	mm	short	dec	TFW First Position Fly
T:FWPOSD	621	R	SGL	4	432	0	600	mm	mm	short	dec	TFW First Position Disk
T:FWHPBL	700@	R	SGL	4	7200	0	120	Volt	Volt	short	dec	TFW E11 Hot Prot Los Fly
T:FWHPL1	700[0]	R	SGL	4	3600	0	120	Volt	Volt	short	dec	TFW E11 H Prot Los Fly 1
T:FWHPL2	700[3600]	R	SGL	4	3600	0	120	Volt	Volt	short	dec	TFW E11 H Prot Los Fly 1
T:FWHABL	701@	R	SGL	4	7200	0	120	Volt	Volt	short	dec	TFW E11 Hor Pbar Los Fly
T:FWHAL1	701[0]	R	SGL	4	3600	0	120	Volt	Volt	short	dec	TFW E11 H Pbar Los Fly 1
T:FWHAL2	701[3600]	R	SGL	4	3600	0	120	Volt	Volt	short	dec	TFW E11 H Pbar Los Fly 2
T:FWVPBL	702@	R	SGL	4	7200	0	120	Volt	Volt	short	dec	TFW E11 Ver Prot Los Fly
T:FWVPL1	702[0]	R	SGL	4	3600	0	120	Volt	Volt	short	dec	TFW E11 V Prot Los Fly 1
T:FWVPL2	702[3600]	R	SGL	4	3600	0	120	Volt	Volt	short	dec	TFW E11 V Prot Los Fly 2
T:FWVABL	703@	R	SGL	4	7200	0	120	Volt	Volt	short	dec	TFW E11 Ver Pbar Los Fly
T:FWVAL1	703[0]	R	SGL	4	3600	0	120	Volt	Volt	short	dec	TFW E11 V Pbar Los Fly 1
T:FWVAL2	703[3600]	R	SGL	4	3600	0	120	Volt	Volt	short	dec	TFW E11 V Pbar Los Fly 2
T:FWEPBL	704@	R	SGL	4	7200	0	120	Volt	Volt	short	dec	TFW E17 Hor Prot Los Fly
T:FWEPL1	704[0]	R	SGL	4	3600	0	120	Volt	Volt	short	dec	TFW E17 H Prot Los Fly 1
T:FWEPL2	704[3600]	R	SGL	4	3600	0	120	Volt	Volt	short	dec	TFW E17 H Prot Los Fly 2
T:FWEABL	705@	R	SGL	4	7200	0	120	Volt	Volt	short	dec	TFW E17 Hor Pbar Los Fly
T:FWEAL1	705[0]	R	SGL	4	3600	0	120	Volt	Volt	short	dec	TFW E17 H Pbar Los Fly 1
T:FWEAL2	705[3600]	R	SGL	4	3600	0	120	Volt	Volt	short	dec	TFW E17 H Pbar Los Fly 2
T:FWHPBD	706@	R	SGL	4	7200	0	120	Volt	Volt	short	dec	TFW E11 Hor Prot Los Dsk
T:FWHPD1	706[0]	R	SGL	4	3600	0	120	Volt	Volt	short	dec	TFW E11 H Prot Los Dsk 1
T:FWHPD2	706[3600]	R	SGL	4	3600	0	120	Volt	Volt	short	dec	TFW E11 H Prot Los Dsk 2
T:FWHABD	707@	R	SGL	4	7200	0	120	Volt	Volt	short	dec	TFW E11 Hor Pbar Los Dsk
T:FWHAD1	707[0]	R	SGL	4	3600	0	120	Volt	Volt	short	dec	TFW E11 H Pbar Los Dsk 1
T:FWHAD2	707[3600]	R	SGL	4	3600	0	120	Volt	Volt	short	dec	TFW E11 H Pbar Los Dsk 2
T:FWVPBD	708@	R	SGL	4	7200	0	120	Volt	Volt	short	dec	TFW E11 Ver Prot Los Dsk
T:FWVPD1	708[0]	R	SGL	4	3600	0	120	Volt	Volt	short	dec	TFW E11 V Prot Los Dsk 1
T:FWVPD2	708[3600]	R	SGL	4	3600	0	120	Volt	Volt	short	dec	TFW E11 V Prot Los Dsk 2
T:FWVABD	709@	R	SGL	4	7200	0	120	Volt	Volt	short	dec	TFW E11 Ver Pbar Los Dsk
T:FWVAD1	709[0]	R	SGL	4	3600	0	120	Volt	Volt	short	dec	TFW E11 V Pbar Los Dsk 1
T:FWVAD2	709[3600]	R	SGL	4	3600	0	120	Volt	Volt	short	dec	TFW E11 V Pbar Los Dsk 2
T:FWEPBD	710@	R	SGL	4	7200	0	120	Volt	Volt	short	dec	TFW E17 Hor Prot Los Dsk

T:FWEPD1	710[0]	R	SGL	4	3600	0	120	Volt	Volt	short	dec	TFW E17 H Prot Los Dsk 1
T:FWEPD2	710[3600]	R	SGL	4	3600	0	120	Volt	Volt	short	dec	TFW E17 H Prot Los Dsk 2
T:FWEABD	711@	R	SGL	4	7200	0	120	Volt	Volt	short	dec	TFW E17 Hor Pbar Los Dsk
T:FWEAD1	711[0]	R	SGL	4	3600	0	120	Volt	Volt	short	dec	TFW E17 H Pbar Los Dsk 1
T:FWEAD2	711[3600]	R	SGL	4	3600	0	120	Volt	Volt	short	dec	TFW E17 H Pbar Los Dsk 2
T:FWLOGS	800	R	STR	1	1000	No List	600	Str	Str	short	dec	TFW Log List

Table A1. The device table for the Tevatron Flying Wires.

7/11/97	MFW	V 1.0										W. Blokland
Device name	SSDN #	Read/ Write	Var type	Bytes/ elem	Elem/ device	Initial value	Update rate	Prim Unit	Comm Unit	Long/ Short	Notation	Description
I:FWCOMM	100	RW	I32	4	10	0	60	unit	unit	short	dec	MFW Command Register
I:FWCOMR	101	RW	I32	4	11	0	60	unit	unit	short	dec	MFW Command Result Reg
I:FWFRSH	102	R	I32	4	2	0	60	unit	unit	short	dec	MFW Data Freshness
I:FWSPEA	200	R	I16	2	1	0	60	unit	unit	short	dec	MFW FlySpec Active Index
I:FWSPEN	201	R	I16	2	1	0	60	unit	unit	short	dec	MFW FlySpec Next Index
I:FWSPEC	202	RW	U8	1	4000	0	600	unit	unit	short	dec	MFW Operational FlySpec
I:FWSPEF	203	RW	U8	1	4000	0	600	unit	unit	short	dec	MFW Inspection FlySpec
I:FWWPOS	204	R	I32	4	5	-1	600	unit	unit	short	dec	MFW Wire Positions
I:FWTAGS	300	R	I32	4	600	0	600	unit	unit	short	dec	MFW Fly Tags
I:FWFLYN	301	R	I32	4	1	0	60	unit	unit	short	dec	MFW Current Fly Number
I:FWSTOR	302	RW	I32	4	1	0	60	unit	unit	short	dec	MFW Store Number
I:FWLATT	303	RW	I32	4	1	0	120	unit	unit	short	dec	MFW DB Lattice Step
I:FWLBUF	304	R	I32	4	1	0	600	unit	unit	short	dec	MFW Last Savebuf
I:FWSAMP	305	R	I32	4	2	0	600	unit	unit	short	dec	MFW Last Num of samples
I:FWSTAT	350	R	I32	4	10	0	60	unit	unit	short	dec	MFW State
I:FWDMSG	351	R	STR	1	1024	No Msg	240	str	str	short	dec	MFW Diagnostic Message
I:FWTIM	400	RW	U16	2	24	0	240	unit	unit	short	dec	MFW Timing array
I:FWHPSG	500	R	SGL	4	720	0	120	mm	mm	short	dec	MFW Q102 Hor Prot Sigma
I:FWHASG	501	R	SGL	4	720	0	120	mm	mm	short	dec	MFW Q102 Hor Pbar Sigma
I:FWVPSG	502	R	SGL	4	720	0	120	mm	mm	short	dec	MFW Q103 Ver Prot Sigma
I:FWVASG	503	R	SGL	4	720	0	120	mm	mm	short	dec	MFW Q103 Ver Pbar Sigma
I:FWEPSG	504	R	SGL	4	720	0	120	mm	mm	short	dec	MFW Spare Prot Sigma
I:FWEASG	505	R	SGL	4	720	0	120	mm	mm	short	dec	MFW Spare Pbar Sigma
I:FWHPCE	506	R	SGL	4	720	0	120	mm	mm	short	dec	MFW Q102 Hor Prot Centr
I:FWHACE	507	R	SGL	4	720	0	120	mm	mm	short	dec	MFW Q102 Hor Pbar Centr
I:FWVPCE	508	R	SGL	4	720	0	120	mm	mm	short	dec	MFW Q103 Ver Prot Centr
I:FWVACE	509	R	SGL	4	720	0	120	mm	mm	short	dec	MFW Q103 Ver Pbar Centr
I:FWEPCE	510	R	SGL	4	720	0	120	mm	mm	short	dec	MFW Spare Prot Centr
I:FWEACE	511	R	SGL	4	720	0	120	mm	mm	short	dec	MFW Spare Pbar Centr
I:FWHPAM	512	R	SGL	4	720	0	120	Volt	Volt	short	dec	MFW Q102 Hor Prot Ampl
I:FWHAAM	513	R	SGL	4	720	0	120	Volt	Volt	short	dec	MFW Q102 Hor Pbar Ampl
I:FWVPAM	514	R	SGL	4	720	0	120	Volt	Volt	short	dec	MFW Q103 Ver Prot Ampl
I:FWVAAM	515	R	SGL	4	720	0	120	Volt	Volt	short	dec	MFW Q103 Ver Pbar Ampl
I:FWEPAM	516	R	SGL	4	720	0	120	Volt	Volt	short	dec	MFW Spare Prot Ampl
I:FWEAAM	517	R	SGL	4	720	0	120	Volt	Volt	short	dec	MFW Spare Pbar Ampl
I:FWHPBG	518	R	SGL	4	720	0	120	Volt	Volt	short	dec	MFW Q102 Hor Prot Back
I:FWHABG	519	R	SGL	4	720	0	120	Volt	Volt	short	dec	MFW Q102 Hor Pbar Back
I:FWVPBG	520	R	SGL	4	720	0	120	Volt	Volt	short	dec	MFW Q103 Ver Prot Back
I:FWVABG	521	R	SGL	4	720	0	120	Volt	Volt	short	dec	MFW Q103 Ver Pbar Back
I:FWEPBG	522	R	SGL	4	720	0	120	Volt	Volt	short	dec	MFW Spare Prot Back
I:FWEABG	523	R	SGL	4	720	0	120	Volt	Volt	short	dec	MFW Spare Pbar Back
I:FWHPDY	524	R	SGL	4	720	0	120	V/mm	V/mm	short	dec	MFW Q102H Prot Back dY
I:FWHADY	525	R	SGL	4	720	0	120	V/mm	V/mm	short	dec	MFW Q102H Pbar Back dY
I:FWVPDY	526	R	SGL	4	720	0	120	V/mm	V/mm	short	dec	MFW Q103V Prot Back dY
I:FWVADY	527	R	SGL	4	720	0	120	V/mm	V/mm	short	dec	MFW Q103V Pbar Back dY

I:FWEPDY	528	R	SGL	4	720	0	120	V/mm	V/mm	short	dec	MFW Spare Prot Back dY
I:FWEADY	529	R	SGL	4	720	0	120	V/mm	V/mm	short	dec	MFW Spare Pbar Back dY
I:FWHPFT	530	R	SGL	4	720	0	120	unit	unit	short	dec	MFW Q102 Hor Prot Fit
I:FWHAFT	531	R	SGL	4	720	0	120	unit	unit	short	dec	MFW Q102 Hor Pbar Fit
I:FWVPFT	532	R	SGL	4	720	0	120	unit	unit	short	dec	MFW Q103 Ver Prot Fit
I:FWVAFT	533	R	SGL	4	720	0	120	unit	unit	short	dec	MFW Q103 Ver Pbar Fit
I:FWEPFT	534	R	SGL	4	720	0	120	unit	unit	short	dec	MFW Spare Prot Fit
I:FWEAFT	535	R	SGL	4	720	0	120	unit	unit	short	dec	MFW Spare Pbar Fit
I:FWHSIG	550	R	SGL	4	72	0	600	mm	mm	short	dec	MFW Q102H Sigma Aver
I:FWVSIG	551	R	SGL	4	72	0	600	mm	mm	short	dec	MFW Q103V Sigma Aver
I:FWESIG	552	R	SGL	4	72	0	600	mm	mm	short	dec	MFW Spare Sigma Aver
I:FWHEMI	560	R	SGL	4	72	0	600	mm mr	mm mr	short	dec	MFW Norm Hor Emittance
I:FWVEMI	561	R	SGL	4	72	0	600	mm mr	mm mr	short	dec	MFW Norm Ver Emittance
I:FWEEMI	562	R	SGL	4	72	0	600	unit	unit	short	dec	MFW Norm dP/P
I:FWHWP	600	R	SGL	4	400	0	120	mm	mm	short	dec	MFW Q102 Hor Posit Fly
I:FWVWP	601	R	SGL	4	400	0	120	mm	mm	short	dec	MFW Q103 Ver Posit Fly
I:FWEWP	602	R	SGL	4	400	0	120	mm	mm	short	dec	MFW Spare Posit Fly
I:FWHWD	610	R	SGL	4	400	0	120	mm	mm	short	dec	MFW Q102 Hor Posit Disk
I:FWVWD	611	R	SGL	4	400	0	120	mm	mm	short	dec	MFW Q103 Ver Posit Disk
I:FWEWD	612	R	SGL	4	400	0	120	mm	mm	short	dec	MFW Spare Hor Posit Disk
I:FWPOSF	620	R	SGL	4	432	0	600	mm	mm	short	dec	MFW First Position Fly
I:FWPOSD	621	R	SGL	4	432	0	600	mm	mm	short	dec	MFW First Position Disk
I:FWHPBL	700@	R	SGL	4	7200	0	120	Volt	Volt	short	dec	MFW Q102H Prot Los Fly
I:FWHPL1	700[0]	R	SGL	4	3600	0	120	Volt	Volt	short	dec	MFW Q102H Prot Los Fly1
I:FWHPL2	700[3600]	R	SGL	4	3600	0	120	Volt	Volt	short	dec	MFW Q102H Prot Los Fly1
I:FWHABL	701@	R	SGL	4	7200	0	120	Volt	Volt	short	dec	MFW Q102H Pbar Los Fly
I:FWHAL1	701[0]	R	SGL	4	3600	0	120	Volt	Volt	short	dec	MFW Q102H Pbar Los Fly1
I:FWHAL2	701[3600]	R	SGL	4	3600	0	120	Volt	Volt	short	dec	MFW Q102H Pbar Los Fly2
I:FWVPBL	702@	R	SGL	4	7200	0	120	Volt	Volt	short	dec	MFW Q103V Prot Los Fly
I:FWVPL1	702[0]	R	SGL	4	3600	0	120	Volt	Volt	short	dec	MFW Q103V Prot Los Fly1
I:FWVPL2	702[3600]	R	SGL	4	3600	0	120	Volt	Volt	short	dec	MFW Q103V Prot Los Fly2
I:FWVABL	703@	R	SGL	4	7200	0	120	Volt	Volt	short	dec	MFW Q103V Pbar Los Fly
I:FWVAL1	703[0]	R	SGL	4	3600	0	120	Volt	Volt	short	dec	MFW Q103V Pbar Los Fly1
I:FWVAL2	703[3600]	R	SGL	4	3600	0	120	Volt	Volt	short	dec	MFW Q103V Pbar Los Fly2
I:FWEPBL	704@	R	SGL	4	7200	0	120	Volt	Volt	short	dec	MFW Spare Prot Los Fly
I:FWEPL1	704[0]	R	SGL	4	3600	0	120	Volt	Volt	short	dec	MFW Spare Prot Los Fly1
I:FWEPL2	704[3600]	R	SGL	4	3600	0	120	Volt	Volt	short	dec	MFW Spare Prot Los Fly2
I:FWEABL	705@	R	SGL	4	7200	0	120	Volt	Volt	short	dec	MFW Spare Pbar Los Fly
I:FWEAL1	705[0]	R	SGL	4	3600	0	120	Volt	Volt	short	dec	MFW Spare Pbar Los Fly1
I:FWEAL2	705[3600]	R	SGL	4	3600	0	120	Volt	Volt	short	dec	MFW Spare Pbar Los Fly2
I:FWHPBD	706@	R	SGL	4	7200	0	120	Volt	Volt	short	dec	MFW Q102H Prot Los Dsk
I:FWHPD1	706[0]	R	SGL	4	3600	0	120	Volt	Volt	short	dec	MFW Q102H Prot Los Dsk1
I:FWHPD2	706[3600]	R	SGL	4	3600	0	120	Volt	Volt	short	dec	MFW Q102H Prot Los Dsk2
I:FWHABD	707@	R	SGL	4	7200	0	120	Volt	Volt	short	dec	MFW Q102H Pbar Los Dsk
I:FWHAD1	707[0]	R	SGL	4	3600	0	120	Volt	Volt	short	dec	MFW Q102H Pbar Los Dsk1
I:FWHAD2	707[3600]	R	SGL	4	3600	0	120	Volt	Volt	short	dec	MFW Q102H Pbar Los Dsk2
I:FWVPBD	708@	R	SGL	4	7200	0	120	Volt	Volt	short	dec	MFW Q103V Prot Los Dsk
I:FWVPD1	708[0]	R	SGL	4	3600	0	120	Volt	Volt	short	dec	MFW Q103V Prot Los Dsk1
I:FWVPD2	708[3600]	R	SGL	4	3600	0	120	Volt	Volt	short	dec	MFW Q103V Prot Los Dsk2
I:FWVABD	709@	R	SGL	4	7200	0	120	Volt	Volt	short	dec	MFW Q103V Pbar Los Dsk

I:FWVAD1	709[0]	R	SGL	4	3600	0	120	Volt	Volt	short	dec	MFW Q103V Pbar Los Dsk1
I:FWVAD2	709[3600]	R	SGL	4	3600	0	120	Volt	Volt	short	dec	MFW Q103V Pbar Los Dsk2
I:FWEPBD	710@	R	SGL	4	7200	0	120	Volt	Volt	short	dec	MFW Spare Prot Los Dsk
I:FWEPD1	710[0]	R	SGL	4	3600	0	120	Volt	Volt	short	dec	MFW Spare Prot Los Dsk1
I:FWEPD2	710[3600]	R	SGL	4	3600	0	120	Volt	Volt	short	dec	MFW Spare Prot Los Dsk2
I:FWEABD	711@	R	SGL	4	7200	0	120	Volt	Volt	short	dec	MFW Spare Pbar Los Dsk
I:FWEAD1	711[0]	R	SGL	4	3600	0	120	Volt	Volt	short	dec	MFW Spare Pbar Los Dsk1
I:FWEAD2	711[3600]	R	SGL	4	3600	0	120	Volt	Volt	short	dec	MFW Spare Pbar Los Dsk2
I:FWLOGS	800	R	STR	1	10000	No List	600	Str	Str	short	dec	MFW Log List
I:FWPATC	810@	RW	U8	1	8800	0	600	None	None	short	dec	MFW Pattern buffer
I:FWPAC1	810[0]	RW	U8	1	4400	0	600	None	None	short	dec	MFW Pattern buffer 1
I:FWPAC2	810[3600]	RW	U8	1	4400	0	600	None	None	short	dec	MFW Pattern buffer 2
I:FWPATF	811@	RW	U8	1	8800	0	600	None	None	short	dec	MFW Pattern buffer file
I:FWPAF1	811[0]	RW	U8	1	4400	0	600	None	None	short	dec	MFW Pattern buffer file1
I:FWPAF2	811[3600]	RW	U8	1	4400	0	600	None	None	short	dec	MFW Pattern buffer file2

Figure A2. The device table for the Main Injector Flying Wires.

APPENDIX B

SEQUENCER COMMANDS

B1 Tevatron Flying Wires

B1.1 Command Cog

allow p-bar 7-9 --> ul_cbsaux routine cog_injection() will set cogging timers for p-bar 7-9 as though they are proton 4-6

B1.2 Command Sda

added arming of 'cases' 19-21 for PBAR_INJ_(7-9) (SDA will internally map these cases to 4-6)

B1.3 Command Inject P-Bars

added PBAR_INJ_7, PBAR_INJ_8, PBAR_INJ_9 syntax

For new Tev flying-wire system (by request: errors will be displayed, but won't halt the Sequencer).

B1.4 Command Fly_tev

sets T:FWCOM to specified fly-spec number

B1.5 Command Set_seq Tev_mode

now also sets T:FWLATT to lattice db index number. When the store-number is set, T:FWSTOR will be set to the same value.

B2 Main Injector Flying Wires

New sequencer commands must be implemented for the MFW.

APPENDIX C

GRAPHICAL REPRESENTATIONS

The front-end user-interface and console interface are made as similar as possible. This appendix documents the graphical representations of the fly specifications and data tags of the front-end software.

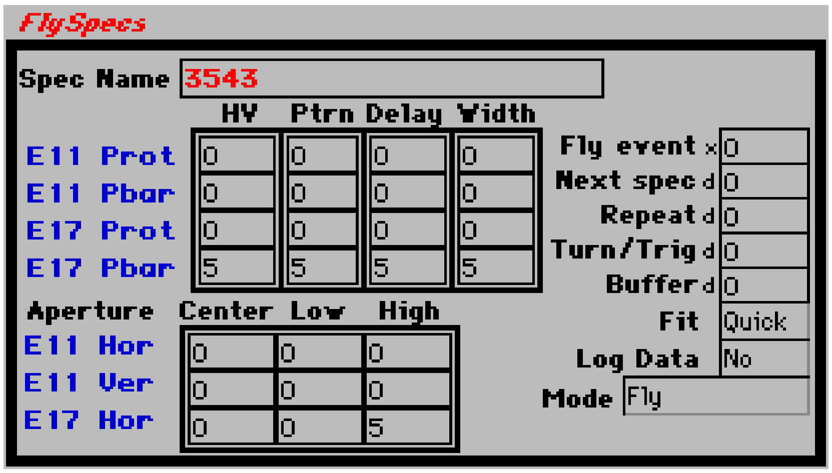

Figure C1. The Fly Specification.

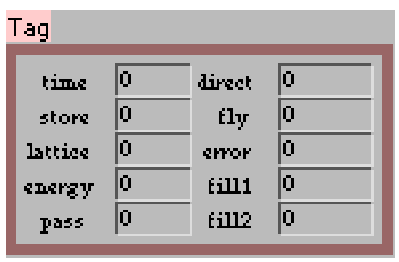

Figure C2. The Data Tag.