DAΦNE TECHNICAL NOTE

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DAΦNE CONTROL SYSTEM STATUS REPORT

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1. DANTE SYSTEM UPDATE

We have reconsidered the structure of the system trying to avoid the necessity to develop the OPLA board, which would save time and money. It is possible to use, instead of OPLA, the commercial LEXTEL LL2000 bus interconnect system. Unfortunately, since the LL2000 only carries one communication channel per VME slot, a single crate is not sufficient for the second level. However the CES VMV bus, which we had already decided to use to connect the consoles to the second level, can accomodate up to 15 VME crates on the same multimaster bus.

Figure 2 shows the new system architecture: the number of second level crates depends on the number of third level crates (divided by 18).

The CES VMV bus defines an addressing space of 256 MBytes devided in 256 1 Mbyte pages that can be mapped independently on any bus interface. The LEXTEL LL2000 interface performs a transparent translation of addresses from one crate to another. Therefore, from the consoles it is possible to access directly, without software translations, 256 Mbytes diffused throughout the third level crates. If we assume 80 crates, we can address 3 Mbytes per crate (See Fig. 1 and Tab. a).

The Real Time Data Base does not any more reside in the second level, but it is dispersed through the third level DEVILS (3 Mbyte/DEVIL). This allows to keep the data where they are generated, with advantages from the point of view of coherence and speed. The part of the RTDB that contains "Physics" data, not directly correlated with a particular piece of equipment, resides on the CARON memory, at the second level.

Although this seems like a very big revolution, actually very little of the software has been modified, since the consoles still have in the RTDB a table of addresses which correspond directly to the element records. They have no way of knowing that they are now in third level crates instead of in the second level memory.

Compared to the preceding version of the system architecture we loose speed in the readout, since the LL2000 access time is 5 µs/longword instead of the 1.7 µs/longword of the CES VMV, but we avoid a much larger software time spent in the readout from the third level to the second. The "reader" DEVILs are now useless and have been suppressed.

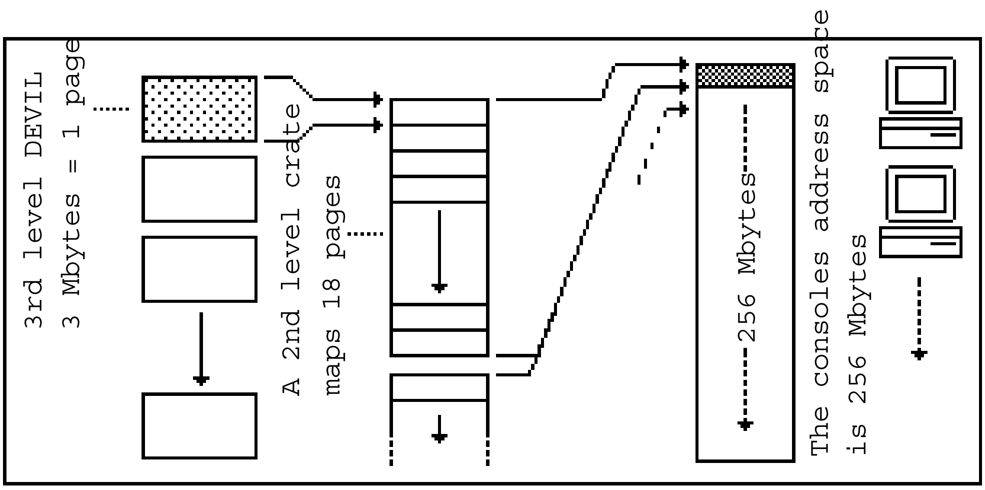


***Figure 1** - Memory mapping for the new System configuration.*
The Lextel LL2000 performs the memory link between 2nd and 3rd.
The CES VMV performs the memory link between the consoles and the 2nd level.

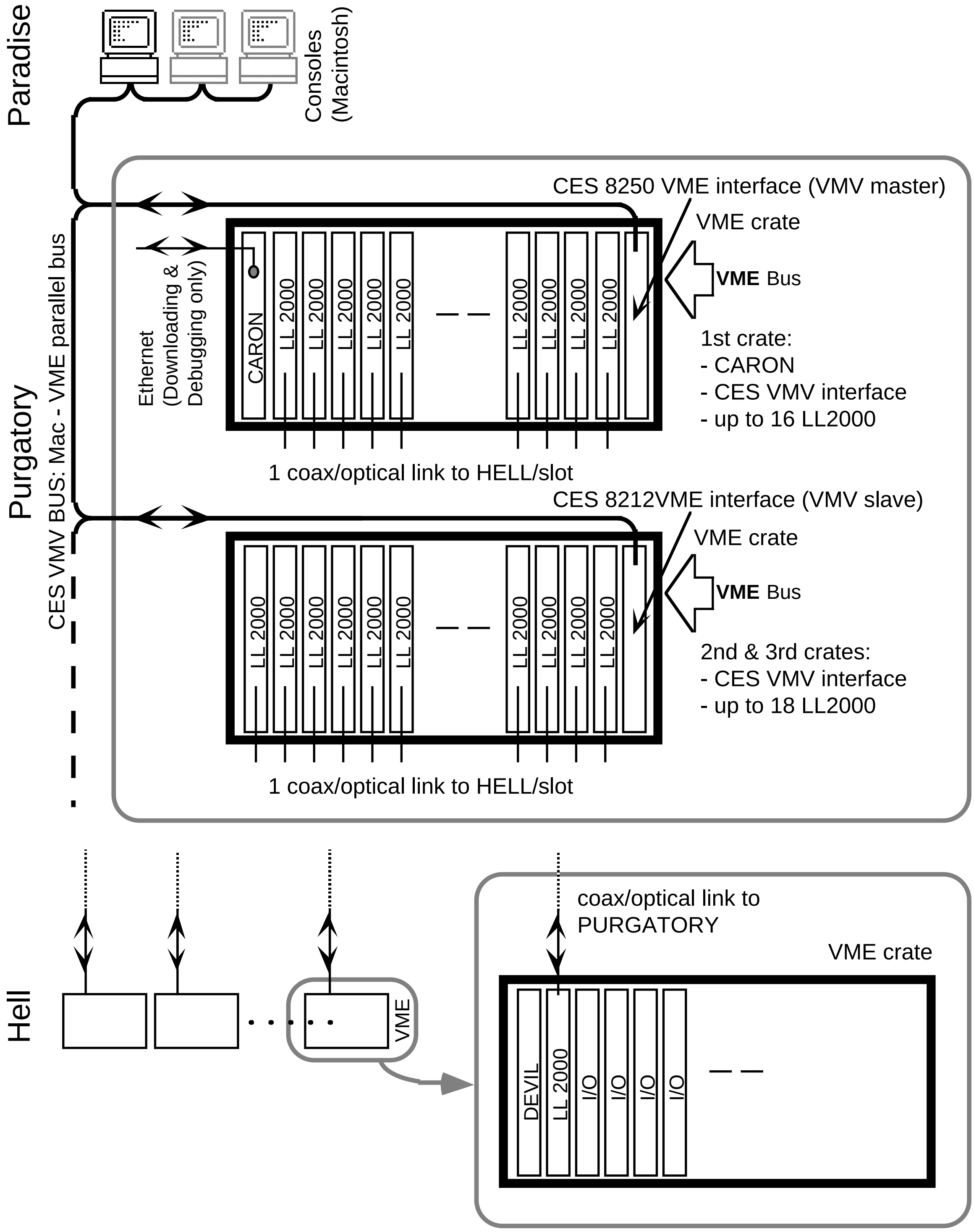


Figure 2 - *The new System architecture.*

Type	From Caron	Caron VME ADD	From Consol 1	From Consol 10	Ctl Crate	Lextel VME ADD	From Devil 1	Devil 1 VME ADD
Mail Box Caron Console1	E0000000	E0000000	S0000000					
Mail Box Console1 Caron	E0010000	E0010000	S0010000					
Mail Box Caron Console10	E0120000	E0120000		S0120000				
Mail Box Console10 Caron	E0130000	E0130000		S0130000				
Command Log	E0140000	E0140000	S0140000	S0140000				
Error Log	E0160000	E0160000	S0160000	S0160000				
Warning Log	E0180000	E0180000	S0180000	S0180000				
Start Address RTDB Caron	E0200000	E0200000	S0200000	S0200000				
Lextel 1 register	E1400000		S0400000	S0400000	1	400000		
Mail Box Caron Devil 1	E2100000				1	30100000	E0000000	E0000000
Mail Box Devil 1 Caron	E2110000				1	30110000	E0100000	E0100000
Start Address RTDB Devil 1	E2140000		S1140000	S1140000	1	30140000	E0040000	E0040000
Lextel 2 register	E1410000		S0410000	S0410000	1	410000		
Mail Box Caron Devil 2	E2400000				1	30400000		
Mail Box Devil 2 Caron	E2410000				1	30410000		
Start Address RTDB Devil 2	E2440000		S1440000	S1440000	1	30440000		
Lextel 3 register	E1420000		S0420000	S0420000	1	420000		
Mail Box Caron Devil 3	E2700000				1	30700000		
Mail Box Devil 3 Caron	E2710000				1	30710000		
Start Address RTDB Devil 3	E2740000		S1740000	S1740000	1	30740000		
Lextel 4 register	E1430000		S0430000	S0430000	1	430000		
Mail Box Caron Devil 4	E2A00000				1	30A00000		
Mail Box Devil 4 Caron	E2A10000				1	30A10000		
Start Address RTDB Devil 4	E2A40000		S1A40000	S1A40000	1	30A40000		
Lextel 5 register	E1440000		S0440000	S0440000	1	440000		
Mail Box Caron Devil 5	E2D00000				1	30D00000		
Mail Box Devil 5 Caron	E2D10000				1	30D10000		
Start Address RTDB Devil 5	E2D40000		S1D40000	S1D40000	1	30D40000		
Lextel 6 register	E1450000		S0450000	S0450000	1	450000		
Mail Box Caron Devil 6	E2100000				1	31100000		
Mail Box Devil 6 Caron	E2110000				1	31110000		
Start Address RTDB Devil 6	E2140000		S2140000	S2140000	1	31140000		

Table a (part 1) - *Memory mapping addresses.*

Type	From Caron	Caron VME ADD	From Consol 1	From Consol 10	Ctl Crate	Lextel VME ADD	From Devil 1	Devil 1 VME ADD
Lextel 10 register	E1490000		S0490000	S0490000	1	490000		
Mail Box Caron Devil 10	E2D00000				1	31D00000		
Mail Box Devil 10 Caron	E2D10000				1	31D10000		
Start Address RTDB Devil 10	E2D40000		S2D40000	S2D40000	1	31D40000		
Lextel 11 register	E14A0000		S04A0000	S04A0000	1	4A0000		
Mail Box Caron Devil 11	E2100000				1	32100000		
Mail Box Devil 11 Caron	E2110000				1	32110000		
Start Address RTDB Devil 11	E2140000		S3140000	S3140000	1	32140000		
Lextel 15 register	E14E0000		S04E0000	S04E0000	1	4EOOOO		
Mail Box Caron Devil 15	E2D00000				1	32D00000		
Mail Box Devil 15 Caron	E2D10000				1	32D10000		
Start Address RTDB Devil 15	E2D40000		S3D40000	S3D40000	1	32D40000		
Lextel 16 register	E14F0000		S04F0000	S04F0000	1	4F0000		
Mail Box Caron Devil 16	E2100000				1	33100000		
Mail Box Devil 16 Caron	E2110000				1	33110000		
Start Address RTDB Devil 16	E2140000		S4140000	S4140000	1	33140000		
Lextel 17 register	E1500000		S0500000	S0500000	2	500000		
Mail Box Caron Devil 17	E2400000				2	33400000		
Mail Box Devil 17 Caron	E2410000				2	33410000		
Start Address RTDB Devil 17	E2440000		S4440000	S4440000	2	33440000		
Lextel 20 register	E1540000		S0540000	S0540000	2	540000		
Mail Box Caron Devil 20	E2D00000				2	33D00000		
Mail Box Devil 20 Caron	E2D10000				2	33D10000		
Start Address RTDB Devil 20	E2D40000		S4D40000	S4D40000	2	33D40000		
Lextel 21 register	E1450000		S0550000	S0550000	2	450000		
Mail Box Caron Devil 21	E2100000				2	31100000		
Mail Box Devil 21 Caron	E2110000				2	31110000		
Start Address RTDB Devil 21	E2140000		S2140000	S2140000	2	31140000		
Lextel 25 register	E1490000		S0490000	S0490000	2	490000		
Mail Box Caron Devil 25	E2D00000				2	31D00000		
Mail Box Devil 25 Caron	E2D10000				2	31D10000		
Start Address RTDB Devil 25	E2D40000		S2D40000	S2D40000	2	31D40000		

Table a (part 2) - *Memory mapping addresses.*

2. TIME MEASUREMENTS

Hardware

We have measured the transfer time from a CES 8212 (MAC) to a CES 7212 (VME). This is the time for a console to access the second level crates. The transfer takes 1.7 µs per LongWord, i.e. 2.4 MBytes/s.

We have also measured the transfer time between two LEXTEL LL2000 interfaces (125 Mbit/s TAXI + memory access) between two VME crates. This is the time for a transfer from the third level to the second. The transfer takes 5 µs per LongWord, i.e. 0.8 MBytes/s.

The sum of these two times gives the access bandwidth from the consoles to the database. This is 0.6 Mbytes/s.

Software

We have assembled a system as follows:

Console (Mac Quadra 950) containing: CES 8212 interface

Purgatory (VME Crate) containing: DEVIL (CARON)

CES 7212 interface

LEXTEL LL2000 interface

HELL(VME Crate) containing: DEVIL

LEXTEL LL2000 interface.

The system differs in hardware from the final design only in that CARON sends commands directly through the LL2000 interface instead of the combination CES 8250 - LL2000. This does not seriously affect the results since the 8250 is 3 times faster than the LL2000, the bus is very little occupied and the software times are much longer than the hardware ones.

The measurement was performed by sending messages to the third level from the console and reading back from third level memory until the value was modified according to the command sent. The third level software is complete except for the actual communication with the device which was simulated. A real command routine for magnets was used .

The time diagram is shown in fig 3.

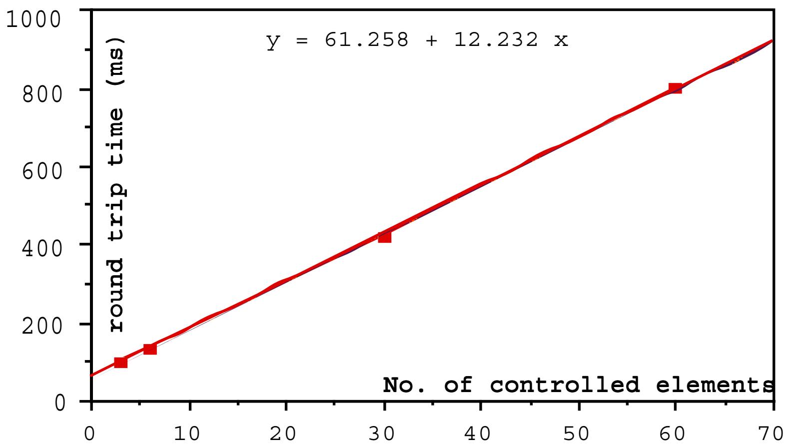


Figure 3

The measurements were performed with different system configurations: respectively with 3, 6, 30, 60 elements controlled in ON LINE status.

Maximum times were measured over 100 commands sent.

The intercept of the extrapolated curve is a measure of the "COMMAND" time (61 ms), while the slope measures the "CONTROL" time for a single element (12 ms).

A second procedure was performed to measure the time spent by CARON to process a command (check for syntactic integrity, for element existence and service availability) and to forward it to the third level. This measurement was performed using the VME METRO bus analyzer. The response time was 17 ms.

Last, the time taken by the console to forward a command to CARON was measured.

We also measured the time for a console to read the database from the third level and display it on a real window (accumulator quadrupoles). The time was 17 ms.

We summarize the results of our measurements:

<u>COMMAND DELIVERY</u>

- Time to send a command from a console to CARON	2 ms
- Time for CARON to forward to third level	17 ms
- Time to process a command at third level	42 ms

<u>ELEMENT CONTROL AND REFRESH</u>

- Time for CONTROL to examine an element	12 ms

<u>Readout</u>

- Time for CONSOLE to read and display one element	17 ms.

Note that none of these numbers are optimized. There is still space for software optimization at all levels that can result in large in time savings.

If we assume that a CPU controls 20 elements via an RS/485 multidrop link, the turnaround time will be:

$$73ms < T < 73ms + 19*12ms = 301ms$$

if a single command is present. In the worst possible case, where a command is received in the same cycle for all the 20 magnets, the time will be:

$$73ms < T < 301ms + 19*42ms = 1099\ ms.$$

Let us stress once more that these times will improve when the software will be fully optimized.

Background programs

Two kinds of "background" programs run in the system:

a) "ALIVE"; with this mechanism we check that all the third level and first level CPUs (and therefore their data connections) are operating.

b) Error and warning messages from the third level.

Both programs use the same mechanism: CARON periodically polls the third level mailboxes (one per crate, resident on the internal DEVIL memories) to check for the presence of a message, which can be either ALIVE or ERROR or WARNING.

In a test where no message was present we measured a cycle time of 800 µs per peripheral CPU, with a total bus occupancy of about 15 µs. This means that if we check every DEVIL at 1 Hz and if we assume 60 DEVILs in the system the total load on the bus will be:

$$15\mu s*60=900\mu s, \text{ or } 0.09\%.$$

Let us now consider the case when messages are present.

The error and warning messages must be at an extremely low rate, so we are left with the ALIVE messages. They consist of 20 bytes, so the time to transfer them is about 40 µs. This means, if we ask for a message every 10 s, a total occupancy of 2.4 ms, or .24 %.

Transmission of information

During an hysteresis cycle of a magnet, as in many other operation modes of the machine, no information is normally transferred on the buses. However, the power supply status (BUSY) and the current readout is still performed by the third level and the database is in the physical memory of the updated EVIL that controls that particular piece of equipment. Thus only if a console window is open and an operator is checking a particular device, the corresponding information transits on the bus. Therefore the bandwidth is limited by the number of windows that a console can keep open at the same time, and we can put restrictions on this number.

Magnets control

Let us now consider how many magnetic elements can be controlled by a DEVIL. Let us take the transfer line magnets and correctors: they are served by an addressable RS/485 line. Its protocol requires about 20 characters to read a current; at 9600 bps this means 20 ms. If we assume a refresh rate of 4 Hz we get 12 elements per RS/485 line.

Moreover the CONTROL time is12 ms/element. Assuming 4 Hz readout rate we get 20 elements per DEVIL, split on two RS/485 lines (OCEM only allows 10). Since the number of RS/485 is 2 it is possible to use the two serial ports of the DEVIL, and to put more than one DEVIL in a crate. We will put three of these DEVILs in a single half width crate.

TRANSFER LINES

We have 75 magnetic elements plus 64 corrector coils. The locations are as follows (CC = Correction Coils). We add to this list the pulsed magnets (PM).

ROOM	#mags	#CC	#PM	Tot #	#CPUs(4Hz)
20	7			7	1
3	34	40	2	76	4
33c	13	8		21	1
16	21	16	1	38	1

Assuming the same interface with the rings magnets (RM) and correction coils (RCC) we get:

ROOM	#RCC	RM	CPUs(4Hz)
33c	96		5
8		134	7

All this assumes a mechanism similar to the magnets of the accumulator for the simultaneous ramping of several Power Supplies: a TTL cable running throughout the system with a hardware trigger to start the ramp. However, it is debatable whether this setup would be any better and less expensive than connecting the magnets to the Control system through a GPIB interface, which would allow a software trigger mechanism taking advantage of the speed of this bus.

3. DANTE DATABASE

There are two different DataBases in the DANTE control system: the Real Time Database (RTDB) and the Offline Database (ODB). They serve different purposes.

RTDB

It is implemented in LabView with some C routines: remember that we can insert in LabView CINs, Code Interface Nodes written in any language. It contains:

a) Machine status, read and updated asynchronously by the peripheral DEVILs.

b) Set values: the last one is recorded in the corresponding element records, while the history is recorded in the Command Log

c) Command Log, Error Log and Warning Log, which contain all of the Commands, Errors and Warnings generated in the system. An automatic mechanism saves the content of the Logs when they are full.

d) Parameters: e. g. Max and min values, interpolation coefficients, etc.
For those parameters for which it is considered appropriate it is possible to implement new fields containing the time of the last modification and the name of the operator who modified it.

All these data are saved to the ODB periodically and/or by operator command. A set of routines will be implemented to restore the machine to a given state reading the data from the ODB.

The RTDB resides physically on the memories of the DEVIL boards (3 MBytes each). The records relative to the single elements reside on the 3rd level DEVIL that has the responsibility for the particular element, while the "physics" records (e. g. machine tune) and the Logs reside on the CARON memory, together with the records defining the position of the single elements in the system.

Although physically fractioned in different modules in different crates, the RTDB can be considered as a single unit, since from any console it is possible to access every record directly, through a simple access to a well defined memory location. There is no problem of data coherence since only one copy of each record exists.

ODB

It will be implemented in Oracle for compatibility with existing accelerator Databases. Macintosh interfaces will be implemented and/or bought when possible. It will reside on a separate machine (Macintosh if possible, otherwise VAX). It contains:

e) Status of the machine periodically saved from the RTDB.

f) Location and identification of electronic devices and cabling information. A set of "expert" interfaces for will be implemented to allow access to this information without having to go through the control system itself.

4. SYSTEM PROGRAMS

System General Facilities

The several CPUs (DEVILs) of the Control System use two different kinds of interconnection: Point To Point and LAN. We have tools for both of them to manage and to test the System itself.

All these tools have been tested and will be fully integrated in a common operating environment: the console interface. The following tables report for each task the corresponding software employed (The definition *LabVIEW System program* indicates an application developed by the Control Group and written in LV or C).

System applications which deal with Point To Point links (Direct Memory Access):

TASK	APPLICATION
Parameters downloading from the 1st level to the 2nd and 3rd	LabVIEW System programs
System commands, System messages, System data exchange	LabVIEW System programs
Run time check on the CPUs	LabVIEW System programs

System applications which deal with LAN (AppleShare on ETHERNET):

TASK	APPLICATION
Bootstrap and applications downloading	The Diskless Mac®: (Macintosh system extension)
Reports of "ERROR DURING TRANSMISSION"	LabVIEW System programs using AppleEvent library
DEVILs clocks synchronization at 1/60 sec	"5th column": MPW tool
Remote CPUs response and hardware description	"5th column": MPW tool
Remote CPUs software description	Status Profiler®: Macintosh application
Remote CPUs debugging	Timbuktu®: (Macintosh system extension)

A list of the main System programs (for 1st, 2nd and 3rd levels) is presented in chapters 3.1, 3.2, and 3.3.

System safety

Restricted access to different operations will be adopted where necessary.

In general it will be always allowed:

- to browse and click on "Standard procedures windows";
- to save the current RTDB image on disk with a particular name.

It will be allowed only to people belonging to the OPERATORS group:

- to start the System up;
- to restart a remote CPU after an eventual fault.
- to restore from disk and apply a previously saved RTDB configuration.

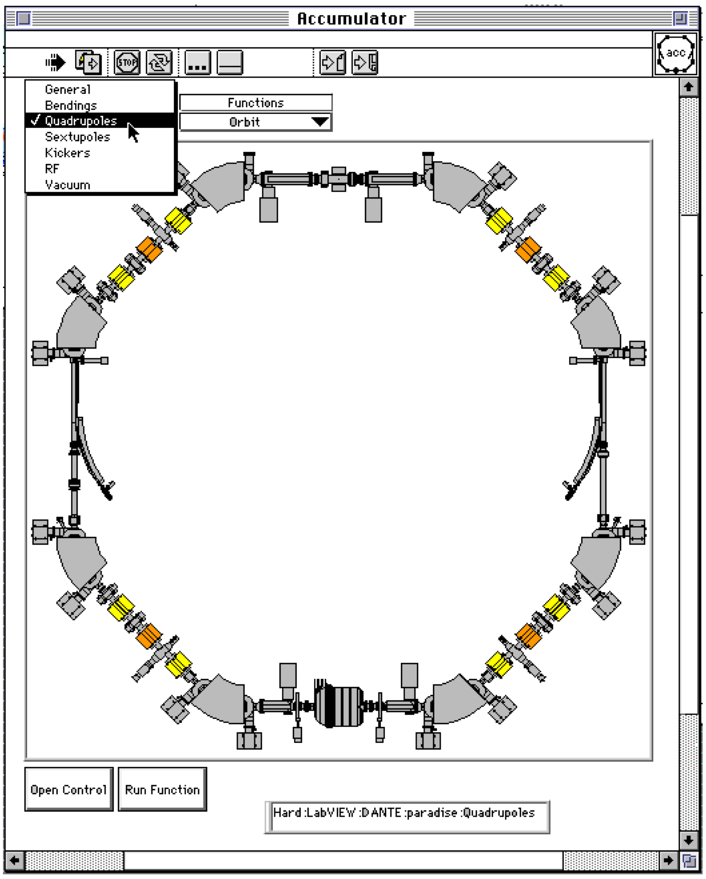
It will be allowed only to people belonging to the EXPERTS group:

- to change element's "static" parameters such as *sensitivity, min, max, etc...*;
- to access the windows for a "direct" control on the elements;

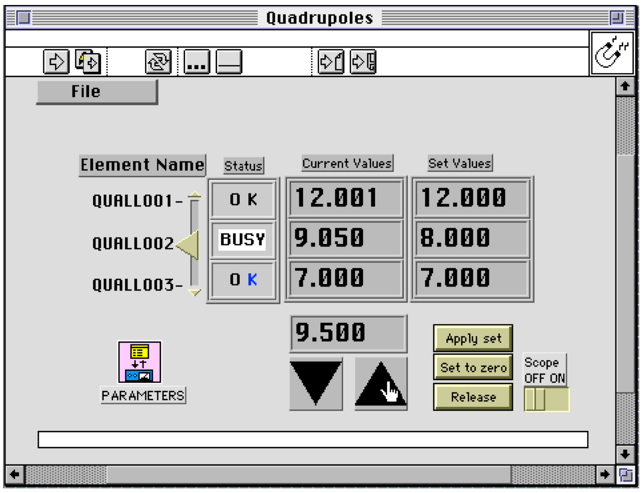
It will be allowed only to people belonging to the CONTROL group:

- to re-configure the SDB (Static Data Base);
- to access the applications debugging tools;
- to add and remove people from and to a group.

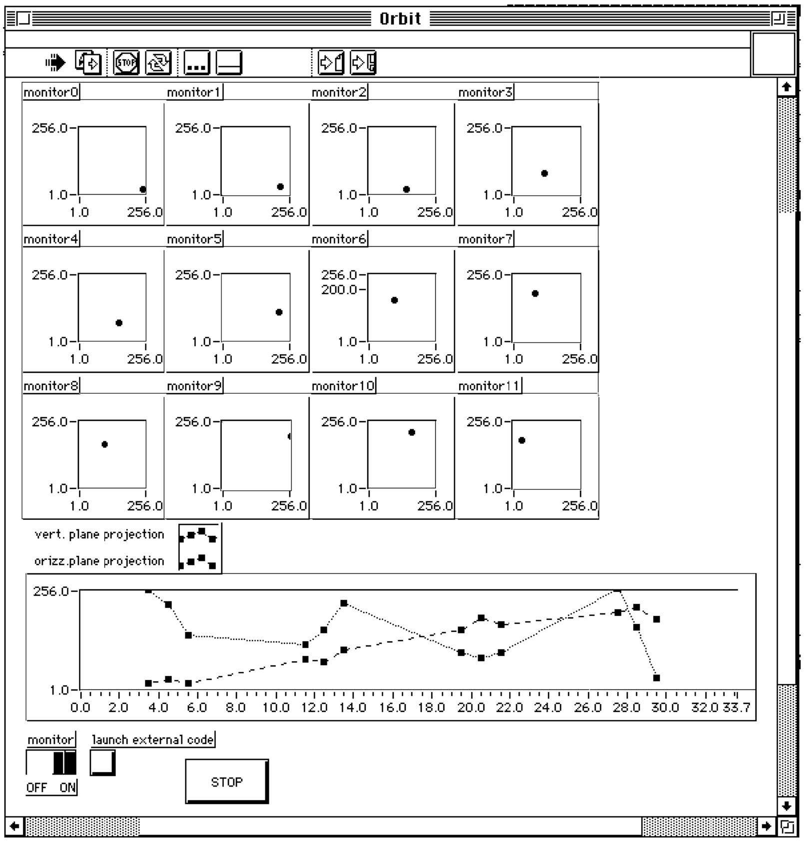
1st level System programs



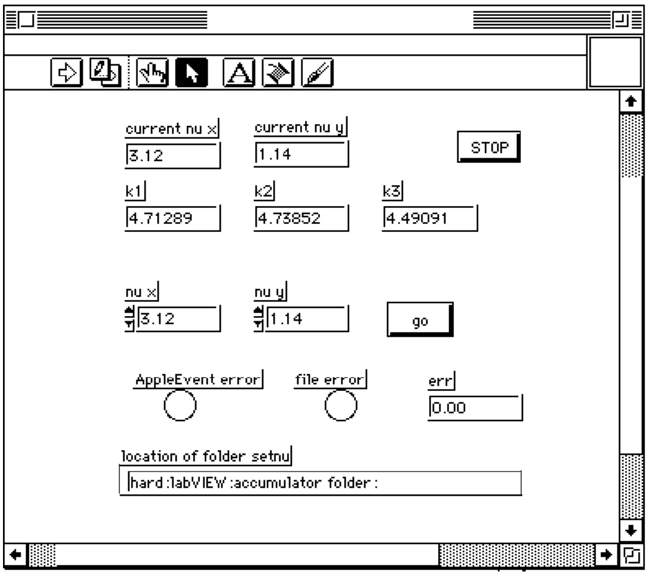
Example of Accumulator main window. From this drawing an operator can choose both the elements to control and the accelerator application to run.



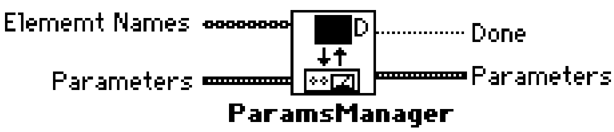
Example of quadrupoles control window. This kind of windows is used to work on the elements. We will implement these windows under the guide of the machine people.



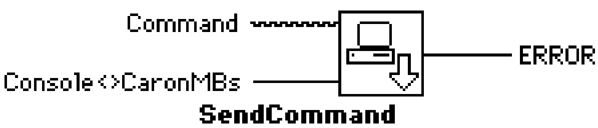
Example of window dedicated to monitor and correct (via an external application) the orbit.



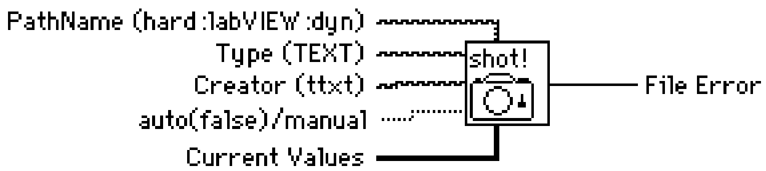
SetNu: an example of external FORTRAN application:
We have implemented a first external application in order to check the PPC exchange mechanism. SetNu performs the tuning of the DAFNE Accumulator. The FORTRAN code needs the actual values of the K^2 for the three quadrupole families and the ν_x,ν_y which the operator needs to set on the machine. The FORTRAN code returns the K^2 values corresponding to the wanted betatron wave number and an error code on its execution.



Allows an operator to change the "static" parameters of an element's record

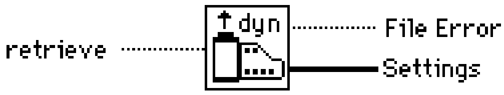


Sends a command to the specified mailbox



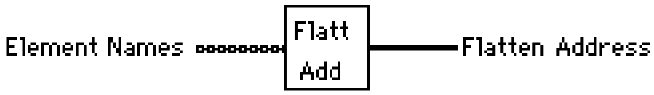
Shot Dyanamic quad

Saves the data set on file. The saving process can be both automatic and under request.



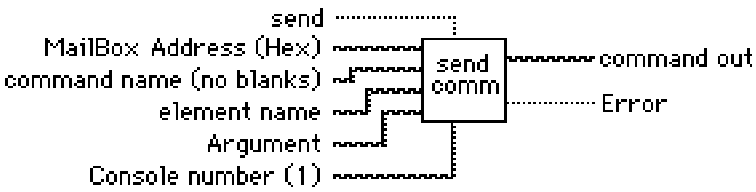
Retrieve Dyanamic quad

Retrieves the data set from a file.



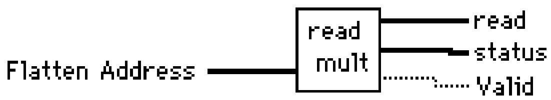
SearchFlatAddFromGWorld.vi

For a given ElementName, returns the address of the corresponding record in the RTDB.



SendComm

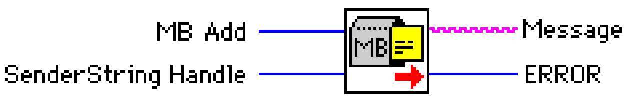
Builds and sends a command for specific element.



readmultiple.vi

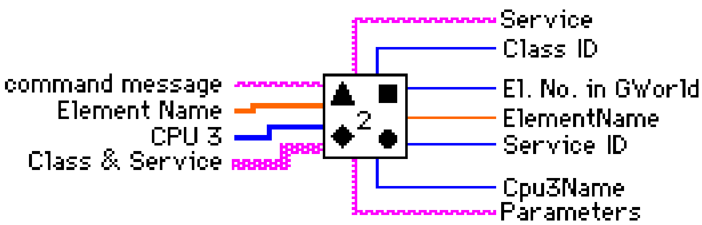
Reads from the RTDB a block of data (an element record, an acquired digital frame and so on…)

2nd level System programs



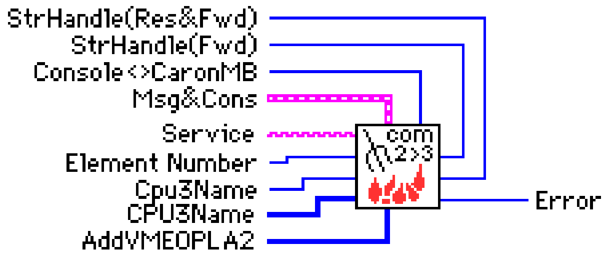
readMailbox.vi

Accesses the Mailbox and extracts the command strings (if any) from consoles and messages from 3rd level.



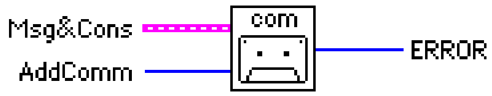
CommandDecode.vi

Analizes the command in terms of:
- element involved;
- service requested for the element;
- 3rd level CPU in charge of the element;
- list of parameters.



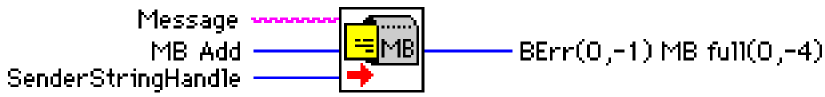
Command2.vi

Forwards the command to the proper 3rd level CPU



LogComm.vi

Logs the command into a 2nd level RAM area. This temporary buffer is saved at time-priority on disk.



WriteMailbox.vi

Accesses the Mailbox and writes the message strings.

LogErr.vi

LogWar.vi

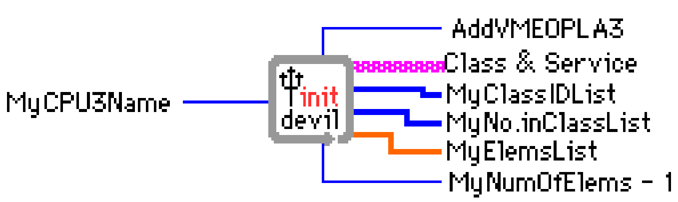
Logs the Warning and Error messages into 2nd level RAM areas These temporary buffers are saved at time-priority on disk.

Alive.vi

Updates a status array (each component corresponding to a CPU) depending on the time at which the last "ALIVE" messages (form a remote CPU) has been received.

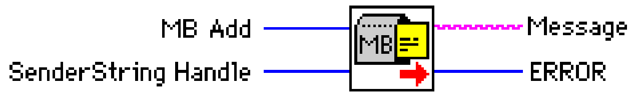
3rd level System programs

Local RTDB downloading and hardware initialization.



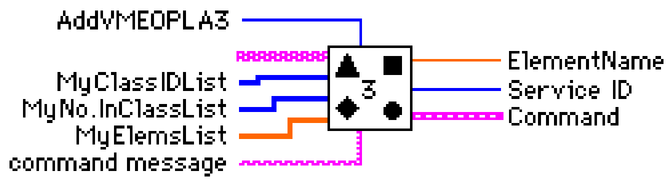
DEVILinit

Creates local tables for:
- list of element classes and services recognized by the CPU;
- list of the element names under the CPU responsibility;
- list of the hardware addresses related to the elements.



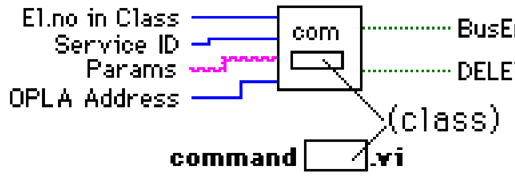
readMailbox.vi

Accesses the Mailbox and extracts the command strings (if any) from 2nd level.

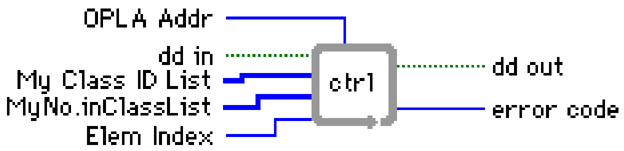


CommandDecode3

Analyzes the command string in terms of:
- element involved;
- service requested for the element;

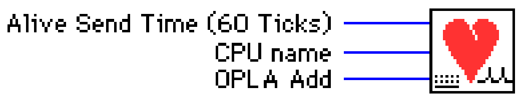


Executes the command. There is a specialized VI of this type for each element class (the box in the VI's icon and name is a general representation of the possible class).



Control.vi

Performs control on the elements under the responsibility of the CPU (one at time). Reports meaningful variations on readout values and error conditions.



AliveGenerator(Hell).vi

Generates "ALIVE" messages with the period = Alive Send Time.

5. DESCRIPTIVE RECORDS FOR MAGNETS

Magnets PS Serial Interface Transfer Lines

DHSTT01	Dipole, horizontal	1
DHRTE02,03	Dipole, horizontal	2
DHRTE01, DHRTT01	Dipole, horizontal	2
DHRTP01	Dipole, horizontal	1
DHRTP02	Dipole, horizontal	1
DHSTS01	Dipole, horizontal	1
DVR	Dipole, vertical	10
DHSTB01,02	Dipole, horizontal	2
DHYTT01	Dipole, horizontal	1
QUADRUPOLE TYPE A		9
QUADRUPOLE TYPE B		37
THIN SEPTUM	Inj. septa	4
CURVED SEPTUM	Inj. septa	4

Room 20: 7
Room 03: 34
Room 33c: 13
Room 16: 21

ElementName [DBL]	
ErrorStatus [INT32]	
ReadOutCurrent [A]	Numeric Input
ReadOutCurrentSens [A]	readouts within the range [ReadOut ± Sens] are not reported
ReadOutCurrentErr [A]	readouts out of the range [ReadOut ± Err] generate an Error
GndCurrent [A]	Ground current
ExcessiveCurrRipple [0-1]	Digital Input
SetValue [A]	Numeric Output
MinSetValue [A]	Lower limit for set value
MaxSetValue [A]	Upper limit for set value
MaxStep [A]	Max step used by the System for moving the PS from i_1 to i_2
ConversionFactor[ ]	
Status [Off, StdBy, PowerOn, Fault]	Power Supply status
Polarity [-1,0,+1]	Three state flag
Local/Remote [0=Local,1=Remote]	Digital Input
Serial Channel Nr. [0-15]	Serial Interface specifications
Serial Bus Address [?-?]	*same as above*
Serial speed [bps]	*same as above*
Serial Parity [0-1]	*same as above*
Serial Stop Bits [1-2]	*same as above*
Serial Protocol [0-2]	*same as above*

Pulsed Magnets PS Serial Interface

DHPTT01	45' linac to acc.	1
DHPTT02	45' accum. to rings	1
DHPTS01	6' spectrometer line	1

Room 03: 2
Room 16: 1

ElementName [DBL]	
ErrorStatus [INT32]	
ReadOutCurrent [A]	Numeric Input
ReadOutCurrentSens [A]	readouts within the range [ReadOut ± Sens] are not reported
ReadOutCurrentErr [A]	readouts out of the range [ReadOut ± Err] generate an Error
GndCurrent [A]	Ground current
SetValue [A]	Numeric Output
MinSetValue [A]	Lower limit for set value
MaxSetValue [A]	Upper limit for set value
ConversionFactor[ ]	
Status [Off, StdBy, PowerOn, Fault]	Power Supply status
Local/Remote[0=Local,1=Remote]	Three state flag
Serial Channel Nr. [0-15]	Serial Interface specifications
Serial speed [bps]	*same as above*
Serial Parity [0-1]	*same as above*
Serial Stop Bits [1-2]	*same as above*
Serial Protocol [0-2]	*same as above*

[*] GPIB Add (Prog. Delay Stanford)
[*] Delay1 [s]
[*] MaxDelay1 [s] (>0)
[*] Delay2 [s]
[*] MaxDelay2 [s] (>0)

[*] Note: *The two delays refer to the triggers coming from the timing system:*
For DHPTT01: Delay1=Start Pulse; Delay2=Stop Pulse
For DHPTT02, DHPTS01: Delay1=Arm; Delay2=Start Pulse

Magnets PS Serial Interface (whit RAMP capability) Accumulator

Room 20: 6

ElementName [DBL]	
ErrorStatus [INT32]	
ReadOutCurrent [A]	Numeric Input
ReadOutCurrentSens [A]	readouts within the range [ReadOut ± Sens] are not reported
ReadOutCurrentErr [A]	readouts out of the range [ReadOut ± Err] generate an Error
GndCurrent [A]	Ground current
ExcessiveCurrRipple [0-1]	Digital Input
SetValue [A]	Numeric Output
MinSetValue [A]	Lower limit for set value
MaxSetValue [A]	Upper limit for set value
MaxStep [A]	Max step used by the System for moving the PS from i_1 to i_2
RampSlope [A/s]	
MinRampSlope [A/s]	Lower limit for set value
MaxRampSlope [A/s]	Upper limit for set value
RampSet [A]	Target value of the ramp process
RampInProgress [0-1]	System flag
ConversionFactor[ ]	
Status [Off, StdBy, PowerOn, Fault]	Power Supply status
Polarity [-1,0,+1]	Three state flag
Local/Remote[0=Local,1=Remote]	Digital Input
Serial Channel Nr. [0-15]	Serial Interface specifications
Serial Bus Address [?-?]	*same as above*
Serial speed [bps]	*same as above*
Serial Parity [0-1]	*same as above*
Serial Stop Bits [1-2]	*same as above*
Serial Protocol [0-2]	*same as above*

Magnets PS GPIB Interface (whit RAMP capability [*]) DAΦNE

Room 08: 134

ElementName [DBL]	
ErrorStatus [INT32]	
ReadOutCurrent [A]	Numeric Input
ReadOutCurrentSens [A]	readouts within the range [ReadOut ± Sens] are not reported
ReadOutCurrentErr [A]	readouts out of the range [ReadOut ± Err] generate an Error
GndCurrent [A]	Ground current
ExcessiveCurrRipple [0-1]	Digital Input
SetValue [A]	Numeric Output
MinSetValue [A]	Lower limit for set value
MaxSetValue [A]	Upper limit for set value
MaxStep [A]	Max step used by the System for moving the PS from i_1 to i_2
ConversionFactor[ ]	
[*] RampSlope [A/s]	
[*] MinRampSlope [A/s]	Lower limit for set value
[*] MaxRampSlope [A/s]	Upper limit for set value
[*] RampSet [A]	Target value of the ramp process
[*] RampInProgress [0-1]	System flag
Status [Off, StdBy, PowerOn, Fault]	Power Supply status
Polarity [-1,0,+1]	Three state flag
Local/Remote[0=Local,1=Remote]	Digital Input
GPIB Address	GPIB Interface specifications

[*] NOTE: *It is not yet known whether the "RAMP" capability will be embedded in the Power Supplies of the rings or not.*

Correctors PS Transfer Lines

Room 03: 40
Room 33c: 8
Room 16: 16

Correctors PS Accumulator

Room 20: 16

Correctors PS DAΦNE

Room 33c: 96

ElementName [DBL]	
ErrorStatus [INT32]	
ReadOutCurrent [A]	Numeric Input
ReadOutCurrentSens [A]	readouts within the range [ReadOut ± Sens] are not reported
ReadOutCurrentErr [A]	readouts out of the range [ReadOut ± Err] generate an Error
SetValue [A]	Numeric Output
MinSetValue [A]	Lower limit for set value
MaxSetValue [A]	Upper limit for set value
MaxStep [A]	Max step used by the System for moving the PS from i_1 to i_2
ConversionFactor[ ]	
Status [Off, StdBy, PowerOn, Fault]	Power Supply status
Local/Remote[0=Local,1=Remote]	Digital Input
Serial Channel Nr. [0-15]	Serial Interface specifications
Serial Bus Address [?-?]	*same as above*
Serial Bus SubAddress [0-7]	*same as above*
Serial speed [bps]	*same as above*
Serial Parity [0-1]	*same as above*
Serial Stop Bits [1-2]	*same as above*
Serial Protocol [0-2]	*same as above*

Kickers

Room ?? : 1
Room ?? : 1

ElementName [DBL]	
ErrorStatus [INT32]	
setting DAC1	injection set point
Conversion factor DAC1	conversion factor [bit/Kvolt]
offset DAC1	output voltage offset
min DAC1	lowest setting value allowed
max DAC1	highest setting value allowed
setting DAC2	extraction set point
Conversion factor DAC2	*same as above*
offset DAC2	*same as above*
min DAC2	*same as above*
max DAC2	*same as above*
refValue ADC1	typ. temp. for thermocouple
out ADC1	actual readout for thermocouple
Conversion factor ADC1	conversion factor [bit/Celsius]
offset ADC1	output voltage offset of thermocouple
sensitivity ADC1	readouts within the range
	[refValue ± sens] are not reported
error range ADC1	the thermocouple readouts out of the range [refValue ± err] generate an alarm
	typical Reservoir output
refenceValue ADC2	*same as above*
out ADC2	*same as above*
Conversion factor ADC2	*same as above*
offset ADC2	*same as above*
sensitivity ADC2	*same as above*
error range ADC2	
	expected voltage for Inj. peak pulse
refenceValueInj ADC3	expected voltage for Extr. peak pulse
refenceValueExt ADC3	HV peak readout for power supply
out ADC3	conversion factor [bit/Kvolt]
Conversion factor ADC3	output voltage offset of power supply
offset ADC3	*same as above*
sensitivity ADC3	*same as above*
error range ADC3	digital scope for tyratron pulse waveform
GPIB address	Digital Input [0-1]
	Digital Input [0-1]
Main Power Status	Digital Input [0-1]
Power Status	Digital Input [0-1]
Wait	Digital Output [0-1]
HV Status	Digital Output [0-1]
Operative/StandBy	
Auto/Manual	

Magnet's PLC (Interlocks)

Room ??: 3 for 8 wigglers
Room ??: ?? for magnet interlocks

PLC StringOut [64 bytes]	Error report fromPLCs
Serial Channel Nr. [0-15]	Serial Interface specifications
Serial Bus Address [?-?]	*same as above*
Serial speed [bps]	*same as above*
Serial Parity [0-1]	*same as above*
Serial Stop Bits [1-2]	*same as above*
Serial Protocol [0-2]	*same as above*

6. DESCRIPTIVE RECORDS FOR RF

NAME: Power Amplifier Main Ring

Room 33b: 1

This apparatus are under control of a stand-alone mac from this computer we have this information:

ElementName [DBL]
ErrorStatus [INT32]

1	Input	Filament voltage
2	Input	Filament current
3	Input	Focalaizer voltage I
4	Input	Focalaizer current I
5	Input	Focalaizer voltage II
6	Input	Focalaizer current II
7	Input	Ion pump current I
8	Input	Ion pump current II
9	Input	Collector temperature inlet coils water
10	Input	Collector temperature outlet coils water
11	Input	Cattiode voltage
12	Input	Cattiode current
13	Input	Body power
14	Input	Output RF power CW [avarege]
15	Input	Inverse RF power CW [avarege]
16	Input	Body temperature inlet coils water
17	Input	Body temperature outlet coils water
18	Input	Power supply high voltage
19	Input	High voltage ON/OFF
20	Output	RF ON/OFF
21	Output	Auxiliaries ON/OFF
22	Output	Errors
23		Module hardware configuration

The command to comunicate to this Mac are under definition.

NAME: RF Cavity Ring

Room 33b: 1

ElementName [DBL]
ErrorStatus [INT32]

1	Analog Output	Center of mass feedback (phase)
2	Analog Output	Absolute phase reference (phase)
3	Analog Output	Phase feedback reference
4	Analog Output	RF Level Reference
5	Analog Output	RF Level Reference (AGC OFF)
6	Analog Output	Tuner phase shifter
7	Analog Output	GAIN RF Loop
8	Analog Output	Phase RF Loop
9	Analog Input	RF Level (cavity probe)
10	Analog Input	RF Forward(From D.C. before cavity)
11	Analog Input	Reverse(From D.C. before cavity)
12	Analog Input	AGC working point
13	Analog Input	Phase working point
14	Analog Input	Circulator
15	Analog Input	Center mass feedback
16	Digital Input	Tuner UP limit
17	Digital Input	Tuner DOWN limit
18	Digital Input	Cavity temp. alarm
19	Digital Input	Water alarm
20	Digital Input	Circulator Alarm
21	Digital Input	RF OFF alarm
22	Digital Output	Tuner man/auto
23	Digital Output	Tuner direction
24	Digital Output	Tuner ON/OFF
25	Digital Output	Tuner inhibit
26	Digital Output	IMPULSE/CW
27	Digital Output	AGC ON/OFF
28	Digital Output	Phase feedback ON/OFF
29	Digital Output	RF loop ON/OFF
30	RS485	Turner Position Gray code
31		Module hardware configuration

All analog input and output have a control on Minimum, Maximum and Sensibilty to update the database.

Power Up Status
Center of mass feedback (phase) = 0
Absolute phase reference = 0 not used?
Phase feedback reference = 0
RF Level Reference = 0
RF Level Reference (AGC OFF) = 0
Tuner phase shifter = 0
GAIN RF Loop = 0
Phase RF Loop = 0
Tuner man/auto = 0 [man]
Tuner direction = 0 [clockwise]
Tuner ON/OFF = 0 [OFF]
Tuner inhibit = 0 [inhibit]
IMP/CW = 0 [IMP]
AGC ON/OFF = 0 [OFF]
Phase feedback ON/OFF = 0 [OFF]
RF loop ON/OFF = 0 [OFF]

NAME: Power Amplifier Accumulator

Room 33b: 1

ElementName [DBL]
ErrorStatus [INT32]

1	Digital Output Power ON	
2	Digital Output Power OFF	
3	Digital Output HV ON	
4	Digital Output HV OFF	
5	Digital Output Power ON	
6	Digital Output Power OFF	
7	Digital Output HV ON	
8	Digital Output HV OFF	
9	Digital Output ALARM	
10	Digital Output Solid STATUS	
11	Analog Output	Current Anodica
12	Analog Output	Voltage Anodica
13	Analog Output	Current of Griglia cont
14	Analog Output	Potenza diretta
15	Analog Output	Potenza Riflessa
16	Analog Output	Tensione di Griglia
17	Analog Output	Tensione di griglia schermo
18	Analog Output	Corrente di griglia schermo
19		Module hardware configuration

All analog input have a control on Minimum, Maximum and Sensibilty to update the database.

NAME: RF Cavity Accumulator

Room 33b: 1

ElementName [DBL]
ErrorStatus [INT32]

1	Analog Output	Center of mass feedback
2	Analog Output	Absolute phase reference
3	Analog Output	Phase feedback reference
4	Analog Output	RF level Reference
5	Analog Output	Tuner phase shifter
6	Analog Output	RF level reference (AGC OFF)
7	Analog Input	RF Level (Cavity Probe)
8	Analog Input	RF Forward (From D.C. before cavity)
9	Analog Input	RF Reverse ((From D.C. before cavity)
10	Analog Input	AGC Working Point
11	Analog Input	Center of mass feedback
12	Analog Input	Phase Working Point
13	Analog Input	Circulator
14	Digital Input	Tuner UP Limit switch
15	Digital Input	Tuner Down Limit switch
16	Digital Input	Cavity temp. Alarm
17	Digital Input	Water Alarm
18	Digital Input	Circulator Alarm
19	Digital Input	RF OFF Alarm
20	Digital Output	Tuner man/aut
21	Digital Output	Tuner Direction
22	Digital Output	Tuner ON/OFF
23	Digital Output	Tuner inhibit
24	Digital Output	IMPULSE/CW
25	Digital Output	AGC ON/OFF
26	Digital Output	Phase feedback ON/OFF
27	RS485	Tuner position Gray Code
28		Module hardware configuration.

All analog input and output have a control on Minimum, Maximum and Sensibilty to update the database.

Power Up Status
Center of mass feedback = 0
Absolute phase reference = 0 not used?
Phase feedback reference = 0
RF level Reference = 0
Tuner phase shifter = 0
RF level reference (AGC OFF) = 0
Tuner man/aut = 0 [man]
Tuner Direction = 0 [clockwise]
Tuner ON/OFF = 0 [OFF]
Tuner inhibit = 0 [inhibit]
IMPULSE/CW = 0 [IMPULSE]
AGC ON/OFF = 0 [OFF]
Phase feedback ON/OFF = 0 [OFF]
All out channel must be drive reed rele'
no open collector.

7. DESCRIPTIVE RECORDS FOR VACUUM

NAME: Ion Pumps

Room 03: 28
Room 33c: 92

ElementName [DBL]
ErrorStatus [INT32]

1	Analog Output	Current power supply 4 pumps
2	Analog Input	Current power supply 4 pumps
3	Analog Input	Vacuum single pump.
4	Digital Output ON/OFF single pump	
5		Module hardware configuration.

All analog input and output have a control on Minimum, Maximum and Sensibilty to update the database.

NAME: Titanium Sublimator Pumps (TSP)

Room 33c: 72

ElementName [DBL]
ErrorStatus [INT32]

1	Analog Input	Current reading
2	Analog Output	Current setting
3	Digital Input	ON/OFF
4	Digital Input	ERROR
5	Digital Output ON/OFF	
6		Module hardware configuration.

All analog input and output have a control on Minimum, Maximum and Sensibilty to update the database.

NAME: Ion Gauges

Room 03: 11
Room 33c: 18

ElementName [DBL]
ErrorStatus [INT32]

1	Input	Vacuum
2	Output	ON/OFF filament
3	Output	ON/OFF degassamento
4		Module hardware configuration.

NAME: Spectrum Analyzers Residual Gas Analyzer

Room ?

ElementName [DBL]
ErrorStatus [INT32]

1	Output	ON/OFF filament
2	Output	ON/OFF degassamento
3	Output	Selection filament
4	Output	Selection sensibility
5	Output	Selection type detector
6	Output	Selection type of acquisition:
		Mass monitor default operation
		Spectrum
		Histogram
7	Input	Acquisition
8		Module hardware configuration

NAME: Ion Clearing Electrodes

Room 33c: 20

ElementName [DBL]
ErrorStatus [INT32]

1	Input	Status ON/OFF
2	Output	Voltage
3		Module hardware configuration

8. DESCRIPTIVE RECORDS FOR DIAGNOSTIC

STRIPLINES - Single Pass

ElementName	BPS T- ---
ErrorStatus	
Vout(i)	{i=1-4}
Offset(i)	{i=1-4}
Gain(i)	{i=1-4}
Kx(n)	{n=?} array of Polin. coeff.
Ky(n)	{n=?} array of Polin. coeff.
Xos	Mechanical offset on x
Yos	Mechanical offset on y
Xcoordinate [num]	
Ycoordinate [num]	
CalibCtrl [0,1]	Enable/Disable Calibration
GainCtrl [num]	Analog control (DAC) for calib. box
TrigDelay [s]	Delay on beam gate for ADC sampling

STRIPLINES

ElementName	BPS A- ---
ErrorStatus	
Vout(i)	{i=1-4}
Offset(i)	{i=1-4}
Gain(i)	{i=1-4}
Kx(n)	{n=?} array of Polin. coeff.
Ky(n)	{n=?} array of Polin. coeff.
Xos	Mechanical offset on x
Yos	Mechanical offset on y
Xcoordinate [num]	
Ycoordinate [num]	
CalibCtrl [0,1]	Enable/Disable Calibration
GainCtrl [num]	Analog control (DAC) for calib. box
TrigDelay [s]	Delay on beam gate for ADC sampling
Gated/Ungated [0,1]	For continuous or triggered sampling mode selection

SEM FOILS - Accumulator

ElementName	SEMTS001
ErrorStatus	
Vout(i)	{i=1-24}
Offset(i)	{i=1-24}
Gain(i)	{i=1-24}
(ΔE/E)/bin	there are 24 bins
ConvFactor [Q/V]	Ratio Q_{beam}/Vout
Histogram(i)	Calculated histogram
CalibCtrl [0,1]	Enable/Disable Calibration
GainCtrl [num]	ADC gain control via VME
TrigDelay [s]	Delay on beam gate for ADC sampling

BEAM POSITION MONITOR - BUTTON

ElementName	BPB -- ---
ErrorStatus	
Vout(i)	{i=1-4}
Offset(i)	{i=1-4}
Gain(i)	{i=1-4}
AverageDimension	nr. of acquisition for average
<Vout(i)>	average aquired values
PickupAddress [num]	secect 1 out of 4 sensors
Kx(n)	{n=?} array of Polin. coeff.
Ky(n)	{n=?} array of Polin. coeff.
Xos	Mechanical offset on x
Yos	Mechanical offset on y
Xcoordinate [num]	
Ycoordinate [num]	
CalibCtrl [0,1]	Enable/Disable Calibration
GainCtrl [num]	Analog control (DAC) for calib. box

SYNCHROTRON RADIATION MONITOR

ElementName	SRP -- ---
ErrorStatus	

no data available…

FARADAY CUP

ElementName	FRCTS001
ErrorStatus	
ReadOut	Measured Charge
CurrentGain	Current amplifier GPIB
ConversionFactor [V/Q]	

DCCT

ElementName	--- -- ---
ErrorStatus	
dI/dt	
SignalOut	
CalibCtrl [0,1]	Enable/Disable Calibration

TOROIDAL CURRENT MONITOR - TRANSFER LINE

ElementName	WCM T- ---
ErrorStatus	
Vout	
ConversionFactor [Ibeam/V]	
CalibOut	
CalibCtrl [0,1]	Enable/Disable Calibration
CalibCharge [num]	
GainControl [num]	
MuxAddress [num]	

TOROIDAL CURRENT MONITOR - ACCUMULATOR

ElementName	WCMA4001
ErrorStatus	
Vout	
ConversionFactor [Ibeam/V]	
TriggerDelay [s]	

WALL CURRENT MONITOR

ElementName	MIR -- ---

this element is connected to a remotized digital oscilloscope and there is no descriptive record

BEAM STOPPER

ElementName	BST T- ---
ErrorStatus	
Position	0=open, 1=closed

FLAGS (TWO-WAY)

ElementName	FL2 T- ---
ErrorStatus	
Position	Flag position: 0=out, 1=in
TV1status	0=OFF, 1=ON
TV1SelectedOnMUX	0=YES, 1=NO
Screen1Intensity [num]	screen 1 illumination intensity
Screen1HorTicks [mm/tick]	horizzontal grid scale
Screen1VerTicks [mm/tick]	vertical grid scale
IrisControl1 [num]	TV camera sensitivity control
TV2status	0=OFF, 1=ON
TV2SelectedOnMUX	0=YES, 1=NO
Screen2Intensity [num]	screen 1 illumination intensity
Screen2HorTicks [mm/tick]	horizzontal grid scale
Screen2VerTicks [mm/tick]	vertical grid scale
IrisControl2 [num]	TV camera sensitivity control
Calculated value #1 Calculated value #2 . . . . . Calculated value #N	A GPIB device acquires and displays the beam image as a stand-alone. Moreover it performs a certain number of calculations such as: center coordinates, variance, axis orientation and so on. The System can read such values but it has not yet been decided what numbers to include in the record.

FLAGS & BEAM PROFILE MONITOR

ElementName	FL1 T- --- & BPFTM001
ErrorStatus	
Position	Flag position: 0=out, 1=in
TVstatus	0=OFF, 1=ON
TVSelectedOnMUX	0=YES, 1=NO
ScreenIntensity [num]	screen 1 illumination intensity
ScreenHorTicks [mm/tick]	horizzontal grid scale
ScreenVerTicks [mm/tick]	vertical grid scale
IrisControl [num]	TV camera sensitivity control
Calculated value #1 Calculated value #2 . . . . . Calculated value #N	A GPIB device acquires and displays the beam image as a stand-alone. Moreover it performs a certain number of calculations such as: center coordinates, variance, axis orientation and so on. The System can read such values but it has not yet been decided what numbers to include in the record.

SLIT & TWO-JAWS SCRAPER

ElementName	SLT T- --- & TJS -- ---
ErrorStatus	
SwitchMask1 [num]	Stepper motor 1 switches status
SwitchMask2 [num]	Stepper motor 2 switches status
$(\Delta E/E)$/step	
StepDriver1String [CHARACTER*?]	command string for driver of motor 1
StepDriver1String [CHARACTER*?]	screen 1 illumination intensity
Encoder1Position [num]	readOut position on encoder 1
Encoder2Position [num]	readOut position on encoder 2

TARGET

ElementName	TGTTM001
ErrorStatus	
SwitchMask [num]	Stepper motor switch status
$(\Delta E/E)$/step	
StepDriverString [CHARACTER*?]	command string for driver of motor 1
EncoderPosition [num]	readOut position on encoder

9. PROTOCOL FOR ACCELERATOR APPLICATIONS

System commands generation and path

The term "command" defines any message that involves a System action. Except for a few service commands generated by the System itself, commands are issued from the first level to the second one from a Control window or from an external accelerator application.

Commands coming from windows are automatically generated when the user pushes buttons, moves knobs and so on. Commands coming from external accelerator applications are analyzed by an interface that relays them only if they are syntactically correct. This avoids the possibility of issuing "garbage" to the System.

At 2nd level a Command Decoder analyzes the commands in terms of Service type and Element involved and forwards each command to the DEVIL which is in charge of executing that service on that element.

At 3rd level a Parser analyzes again the command (this is for safety against a possible transmission error or memory corruption) and then extracts the properties and parameters.

Commands structure

The general form for a command is:

<*Service*><*ElementName*>[<*Property*>][<*Parameters*>]

where

<*descriptor*> content of the field
[*optional*] depending on the command type

<*Service*>	A Service is a generalized action that specializes depending on the property and element it refers to. For instance the Service POWER effectively switches ON or OFF a TV camera whilst enables or disables the delivery of current on the load for a magnet power supply. The Service List is still in progress and at the moment includes: POWER, MODE, BYPASS, SET, RESET.
<*ElementName*>	The name of any element of DAΦNE contains information about the class it belongs to, its location and number of order in that location: <*Class*><*Location*><*Number*>. For instance the name DHRTE003 identifies the horizontal Dipole (DHR) in the transfer line (branch TE) number 3 (003).
<*Property*>	For some elements a Service can apply to more than one property (we define a property as a control-relevant value). For instance The Service SET for the element KCKA1001 (a Kicker) can refer both to the injSetPoint and to the extrSetPoint so that we will issue SET KCKA1001 DAC1,… or SET KCKA1001 DAC2,… .
<*Parameters*>	The set points, the wanted status, in general the target of a command. In the following examples some possible parameters are typed in bold face. SET KCKA1001 DAC2,**10** POWER DHRTE001 **ON**

Readouts

It is an evidence that in the above description there is no reference to a "READ" command. This is because the 3rd level performs the readout task in background and updates automatically the RTDB. If a 1st level control window or an external accelerator application needs the current value of a variable, it has to fetch that value from the proper address.

Protocol for External Accelerator Application (FORTRAN)

An external application behaves as an "operator" and a 1st level interface has the responsibility of passing data to the application on request and relying commands to the System.

In our case the definition of a protocol involves:

a. to set a pool of descriptive records (one for each element class);
b. to set a pool of descriptive records for the machines structure;
c. to set FORTRAN subroutines for getting data from the RTDB and issuing commands to the System.
d. to set a table of Services, ElementNames, Properties and Parameters available to the developers.

a) The definition of all descriptive records (containing all the relevant information for an Accelerator Application developer) is nearly completed.

b) For what concerns the descriptive records relative to the machine structure the accelerator people are evaluating a LEDA-like format due to its wide use in the input files used up to now.

c) We have already developed a set of low level routines (LVLibrary) based on PPC for accessing to the System from a FORTRAN application. The user's subroutines for the accelerator application environment will be available in the form:

CALL fetchData(*dataIdentificator,dataContainer,result*)

dataIdentificator	An ID-code used by the interface to identify the wanted data structure with the proper format.
dataContainer	A FORTRAN variable of type RECORD where the subroutine returns the wanted descriptive record.

result A number that indicates the exitus of the exchange (OK, errorCode, TIME-OUT, …)

CALL issueCmd(*commandString,result*)

commandString A CHARACTER*64 variable containing the command that the interface must issue to the System.

result A number that indicates the exitus of the exchange (OK, errorCode, TIME-OUT, …)

We will implement another subroutine (returnData) to return processed data to LabVIEW. If an external application has to plot something it is much easier to use the LabVIEW display facilities rather than the FORTRAN code.

CALL returnData(*dataIdentificator,dataContainer,result*)

dataIdentificator An ID-code used by the interface for interpreting the data structure with the proper format.

dataContainer A FORTRAN variable of type RECORD where the subroutine gets the data to send to the interface.

result A number that indicates the exitus of the exchange (OK, errorCode, TIME-OUT, …)

d) The command table is not yet available because its compilation depends on the analysis of the state diagrams of the elements. This analysis is still in progress because most of the DAΦNE hardware is not finalized yet both in behavior and in structure.

The first step: an external application as a stand-alone on Macintosh

As a first attempt we developed an orbit correction application for the transfer line. The code has been developed on a VAXstation and then ported on Macintosh.

Macintosh vs VAXstation: benchmarks

We ran the orbit correction application for the transfer lines both on a VAXstation 3100 M76 and a Macintosh Quadra 950.

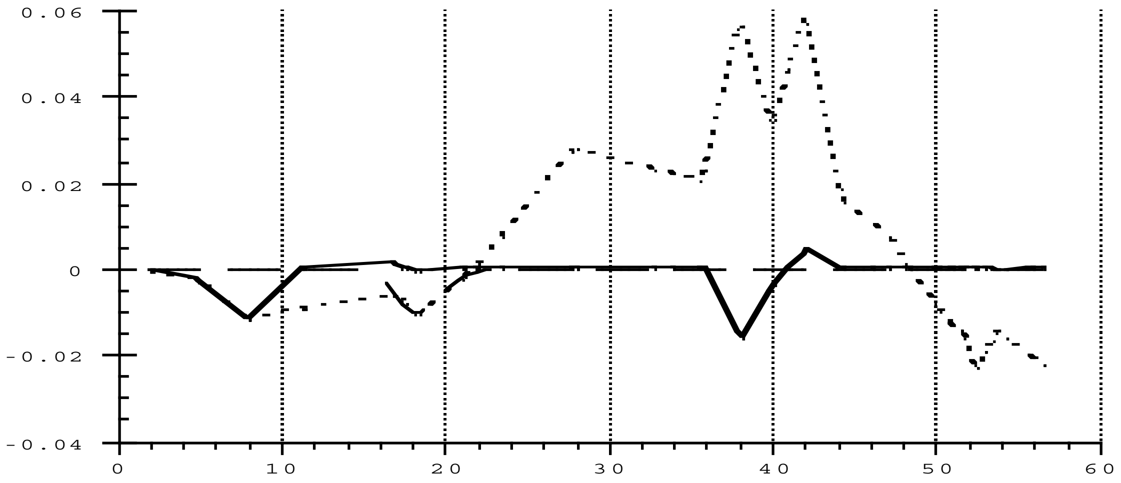
We used REAL*8 (double precision) on the VAXstation whilst 12 bytes floating point (extended: 1.7E-4932 ÷ 1.1 E+4932) on the Mac.

Due to the greater accuracy of the extended representation with respect to the double precision we have 19 digits on the Mac and 16 digits on the VAXstation.

The results coincide in the meaningful range: for instance for the orbit we got agreement within 10^{-10} mm.

Time measurements give 2 s for the run on the VAXstation and 2.5 s for the run on the Mac.

In the following graph an example of the orbit plot before and after correction (on Macintosh) is shown.



Orbit plot before (dotted) and after correction.

Conclusion

People involved in the Accelerator applications software environment and people of the Control Group have met to debate the problem of integrating any external application in the control System. A common context has been defined and the respective responsibilities are now clear. The Control Group has pointed out a few guidelines for writing FORTRAN programs in such a way that they can be easily imported in the DANTE environment. At present we are able to import and run programs written in such a way as stand alone on Macintosh and we have already developed and tested the exchange mechanism. We plan to have the interface operative in a short time.

10. INSTALLATION

The following 5 pages reports drawings for:

- racks equipped with 3 single powered crates for control hardware (control racks). For each crate a descriptive table is provided (these tables will be included in the static Database of the Control System);

- racks equipped with PS, DVM, digital oscilloscope, MUX and NIM crate (instrumentation racks);

- mechanical drawings with cooling and wiring for control racks;

- mechanical drawings with cooling and wiring for instrumentation racks;

- Forms for the racks description (these forms will be included in the static Database of the Control System).

APPENDIX A

LIST OF CRATES CPUs AND MODULES

Crate	CPU	Service	Object	Room	RS232	#	RS485	#	MacRS422	GPIB	#	adc	#	dac	#	I/O in	I/O out	#	Ethernet	#	Lextel	CES	?
1	1	RF	ampl rings	33b			2	1													1		
1	1	RF	cav rings	33b			2	0				14	1	16	1	12	16	1					
1	2	RF	ampl acc	33b								8	1			6	4	1			1		
1	2	RF	cav acc	33b			1	1				7	0	6	1	6	7	0					
2	1	VAC	ion pumps acc	3	7	1															1		34
2	1	VAC	Ion Gauges acc	3	11	1																	
3	2*	VAC	Spectrum anal	33c	2	1															1		
3	2*	VAC	ion pumps rin	33c	15	1																	92
3	2*	VAC	Ion clearing	33c	20	1																	
4	3	VAC	TSP rings	33c																	1		72
4	3	VAC	ion Gauges rin	33c	18	1																	
4	3	VAC	Spectrum anal	33c	2	1																	
5	1	Kick	acc	20						1	1	12	1	8	1	18	10	1			1		
6	2	Kick	rings	33b						1	1	12	1	8	1	18	10	1			1		
7	1	Mags	TL M	20					2												1		
8	2@	Mags	TL M+CC	3					2												1		
8	3@	Mags	TL M+CC	3					2												0		
8	4@	Mags	TL M+CC	3					2												1		
8	5@	Mags	TL M+CC	3					2												0		
9	6@	Mags	TL M+CC+RCC	33c					2												1		
9	7@	Mags	TL M+CC+RCC	33c					2												0		
9	8@	Mags	TL M+CC+RCC	33c					2												0		
9	9@	Mags	TL M+CC+RCC	33c					2												1		
9	10@	Mags	TL M+CC+RCC	33c					2												0		
9	11@	Mags	TL M+CC+RCC	33c					2												0		
10	12@	Mags	TL M+CC+PM	16					2												1		
10	13@	Mags	TL M+CC+PM	16					2												0		
11	14	Mags	Ring	8					2												1		
11	15	Mags	Ring	8					2												0		
12	16	Mags	Ring	8					2												1		
12	17	Mags	Ring	8					2												0		
13	18	Mags	Ring	8					2												1		
13	19	Mags	Ring	8					2												0		
14	20	Mags	Ring	8					2												1		
15	1	diag	SEM foil	19						2	1	24	1				2	1	1	1	1		
16	2*	diag	Targets	19										48	3		84	2	2	1	1		
16	2*	diag	ScrapersT Acc	19	14	2										42		1	1	1			
17	3	diag	Scrapers R	33b	16	2										48		1	1	1	1		
17	3	diag	SPIRICON	33b						12	1												

18	4	diag	FaradayCup	19						1	0										1		
18	4	diag	Tor IM Acc	19						1	1	1	1										
19	5	diag	Tor IM TL	19						18	0	4	0				12	1			1		
19	6	diag	DCCT Acc	19						2	1	2	1				1	1			1		
17	3	diag	DCCT R	33b						4	0	4	1				2	1			0		
20	7	diag	BPM Strip SP	19						8	1	16	1	4	1		4	1			1		
20	8	diag	BPM Strip SP	19						8	0	16	1	4	1		4	1			1		
21	9	diag	BPM Strip SP	19						8	1	16	1	4	1		4	1			1		
21	10	diag	BPM Strip SP	19						8	0	16	1	4	1		4	1			1		
22	11	diag	BPM Strip SP	19						8	1	16	1	4	1		4	1			1		
22	12	diag	BPM Strip SP	19						6	0	12	1	3	1		3	1			1		
23	13	diag	BPM Strip ACC	19						8	1	16	1	4	1		8	1			1		
23	14	diag	BPM Butt ACC	19								8	1	8	1		16	1			1		
24	15	diag	BPM Butt R	33b								38	2	38	3		76	1			1		
24	16	diag	BPM Butt R	33b								38	2	38	3		76	1			1		
25	17	diag	BPM IP R	33b								24	1	24	2		48	1			1		
26	18*	diag	Sync rad mon	19					1	1	1	1	1	1	1		1	1			1		
27	19*	diag	Sync rad mon	19					1	1	1	1	1	1	1		1	1			1		
28	20*	diag	Sync rad mon	33b					1	1	1	1	1	1	1		1	1			1		
29	21*	diag	Sync rad mon	33b					1	1	1	1	1	1	1		1	1			1		
30	22*	diag	TR Feedb A	acc						1	1	6	1	11	1						1		
31	23*	diag	TR Feedb A	acc						1	1	6	1	11	1						1		
32	24*	diag	TR Feedb R	33b															4	1	1		
33	25*	diag	Long Feedb Rel	33b																1	1		
34	26*	diag	Lum Mon	33b			·														1		?
35	27*	diag	Lum Mon	33b																	1		?
36	28*	diag	Timing	33b																	1		
7	1m	diag	Scope+DVM...	20						1	1												
17	2d	diag	Scope+DVM...	19						1	1												
2	1v	diag	Scope+DVM...	3						1	1												
14	20m	diag	Scope+DVM...	8						1	1												
1	3d	diag	Scope+DVM...	33b						1	1												
7	3v	diag	Scope+DVM...	33c						1	1												
10	12m	diag	Scope+DVM...	16						1	1												
37	1*	PLC		33b	15	2															1		
38	1*	2nd lev	CARON	32																	16	1	
39	*	2nd lev	comm	32																	15	1	
40	*	2nd lev	comm	19																	15	1	
TOT		tot			120	13	5	2	44	109	23	320	27	247	29	150	399	27	9	6	92	3	198

APPENDIX B

WBS

WBSTxT11LT 10/93 sum

R	WBS NUMBER 1	2	3	4	5	6	7	8	DESCRIPTION	UNIT	QUANTITY AT WBS LEVELS 1	2	3	4	5	6	7
	1								DAFNE PROJEC	SET	1						
	1	3							ACCUMULATOR	EA		1					
LT	1	3	6						COMPUTER CO	SET			1				
LT	1	3	6	1					HARDWARE	SET				1			
LT	1	3	6	1	1				GENERAL	SET					1		
LT	1	3	6	1	1	1			VME CRATES	EA						20	
LT	1	3	6	1	1	2			CPUS	EA						26	
LT	1	3	6	1	1	4			OPTICAL LINKS	EA						24	
LT	1	3	6	1	2				MAGNET POWE	SET					1		
LT	1	3	6	1	2	1			ADC (CHANNE	EA						86	
LT	1	3	6	1	2	2			DAC (CHANNE	EA						45	
LT	1	3	6	1	3	3			DIGITAL I/O (C	EA						51	
LT	1	3	6	1	3	4			RS485 (CHAN	EA						1	
LT	1	3	6	1	3				RF SYSTEM	SET					1		
LT	1	3	6	1	3	1			ADC (CHANNE	EA						15	
LT	1	3	6	1	3	2			DAC (CHANNE	EA						6	
LT	1	3	6	1	3	3			DIGITAL I/O (C	EA						23	
LT	1	3	6	1	4				VACUUM	SET					1		
LT	1	3	6	1	4	1			RS/232 (CHAN	EA						18	
LT	1	3	6	1	5				DIAGNOSTICS	SET					1		
LT	1	3	6	1	5	1			ADC (CHANNE	EA						161	
LT	1	3	6	1	5	2			DAC (CHANNE	EA						107	
LT	1	3	6	1	5	3			DIGITAL I/O (C	EA						200	
LT	1	3	6	1	5	4			GPIB	EA						86	
LT	1	3	6	1	5	5			RS/232 (CHAN	EA						14	
LT	1	3	6	1	5	5			ETHERNET	EA						3	
LT	1	3	6	2					SOFTWARE	SET				1			
LT	1	3	6	2	1				COMMUNICATI	EA					28		
	1	5							DAFNE STORAG	SET		1					
LT	1	5	6						COMPUTER CO	SET			1				
LT	1	5	6	1					HARDWARE	SET				1			
LT	1	5	6	1	1				GENERAL	SET					1		
LT	1	5	6	1	1	1			VME CRATES	EA						20	
LT	1	5	6	1	1	2			CPUS	EA						28	
LT	1	5	6	1	1	3			MEMORY	EA						0	
LT	1	5	6	1	1	4			OPTICAL LINKS	EA						22	
LT	1	5	6	1	2				MAGNET POWE	SET					1		
LT	1	5	6	1	2	1			ADC (CHANNE	EA						12	
LT	1	5	6	1	2	2			DAC (CHANNE	EA						8	
LT	1	5	6	1	2	3			DIGITAL I/O (C	EA						28	
LT	1	5	6	1	3				RF SYSTEM	SET					1		
LT	1	5	6	1	3	1			ADC (CHANNE	EA						14	
LT	1	5	6	1	3	2			DAC (CHANNE	EA						16	
LT	1	5	6	1	3	3			DIGITAL I/O (C	EA						28	
LT	1	5	6	1	3	4			RS485 (CHAN	EA						4	
LT	1	5	6	1	4				VACUUM	SET					1		
LT	1	5	6	1	4	1			ADC (CHANNE	EA						0	
LT	1	5	6	1	4	2			DAC (CHANNE	EA						0	
LT	1	5	6	1	4	3			DIGITAL I/O (C	EA						0	
LT	1	5	6	1	4	4			RS/232 (CHAN	EA						57	
LT	1	5	6	1	5				DIAGNOSTICS	SET					1		
LT	1	5	6	1	5	1			DVM	EA						0	
LT	1	5	6	1	5	2			ADC (CHANNE	EA						106	
LT	1	5	6	1	5	3			DAC (CHANNE	EA						102	
LT	1	5	6	1	5	4			DIGITAL I/O (C	EA						252	
LT	1	5	6	1	5	5			GPIB	EA						21	
LT	1	5	6	1	5	6			ETHERNET	EA						5	

WBSTxT11LT 10/93 sum

LT	1	5	8	2					SOFTWARE	SET				1			
LT	1	5	8	2	1				COMMUNICATI	SET					28		
LT	1	5	6	2	2				DRIVERS	SET					0		
LT	1	5	6	2	3				LOCAL CONTR	SET					0		
	1	8							GENERAL FACI	SET		1					
LT	1	6	5						CONTROL SYST	SET			1				
LT	1	6	5	1					1ST. LEVEL (P	SET				1			
LT	1	6	5	1	1				HARDWARE	SET					1		
LT	1	6	5	1	1	1			WORKSTATION	EA						5	
LT	1	6	5	1	1	2			LARGE SCREEN	EA						5	
LT	1	6	5	1	1	3			PRINTER	EA						1	
LT	1	6	5	1	1	4			FAST LINK	EA						5	
LT	1	6	5	1	1	5			ETHERNET LIN	EA						0	
LT	1	6	5	1	1	6			STORAGE (OPT	EA						2	
LT	1	6	5	1	2				SOFTWARE	SET					1		
LT	1	6	5	1	2	1			DEVELOPMENT	SET						1	
LT	1	6	5	1	2	2			HUMAN INTERF	SET						1	
LT	1	6	5	1	2	3			DATA BASE	EA						1	
LT	1	6	5	1	2	4			COMMUNICATI	SET						5	
LT	1	6	5	2					2ND. LEVEL (P	SET				1			
LT	1	6	5	2	1				HARDWARE	SET					1		
LT	1	6	5	2	1	1			VME CRATES	EA						3	
LT	1	6	5	2	1	2			CPUS	EA						1	
LT	1	6	5	2	1	3			MEMORY	EA						0	
LT	1	6	5	2	1	4			FAST LINK	EA						3	
LT	1	6	5	2	1	5			OPTICAL LINK	EA						46	
LT	1	6	5	2	1	6			MIPS	EA						1	
LT	1	6	5	2	2				SOFTWARE	SET					1		
LT	1	6	5	2	2	1			OS	EA						1	
LT	1	6	5	2	2	2			COMMUNICATI	SET						1	
LT	1	6	5	3					3RD. LEVEL (H	SET				1			
LT	1	6	5	4					TIMING SYSTEM	EA				1			

WBSTXT11LT 10/93 sum

		OUTSIDE PURCHASES		DAFNE	EFFORT	UNIT TOTAL				COMPONENT COST AT WBS LEVEL							
		(KL)		(K	L)						(KL)				NOTES		
8	COMPONENT	MFG+ASSY	MFG	LABOR	MATERIAL	(KL)	8	7	6	5	4	3	2	1			
						1,164,951								1,164,951			1
						503,588							503,588				2
						503,588						503,588					3
						492,388					492,388						4
						238,000				238,000							5
	2,500					2,500			50,000								6
	5,000					5,000			140,000						TWO PLANES		6
	2,000					2,000			48,000								6
						50,139				50,139							5
	244		30			274			23,564								6
	449		30			479			21,555								6
	60		30			90			4,590						MCR INSTRUME		6
	400		30			430			430								6
						9,054				9,054							5
	244		30			274			4,110								6
	449		30			479			2,874								6
	60		30			90			2,070						MCR INSTRUME		6
						7,740				7,740							5
	400		30			430			7,740								6
						187,455				187,455							5
	244		30			274			44,114								6
	449		30			479			51,253								6
	60		30			90			18,000								6
	743		30			773			66,478								6
	400		30			430			6,020								6
	500		30			530			1,590								6
						11,200					11,200						4
	400					400				11,200							5
						412,835							412,835				2
						412,835						412,835					3
						401,635					401,635						4
						234,000				234,000							5
	2,500					2,500			50,000								6
	5,000					5,000			140,000								6
						0			0								6
	2,000					2,000			44,000								6
						9,640				9,640							5
	244		30			274			3,288								6
	449		30			479			3,832								6
	60		30			90			2,520								6
						14,020				14,020							5
	244		30			274			3,836								6
	449		30			479			7,664								6
	60		30			90			2,520								6
	400		30			430			1,720								6
						24,510				24,510							5
	244		30			274			0								6
	449		30			479			0								6
	60		30			90			0								6
	400		30			430			24,510								6
						119,465				119,465							5
	5,000					5,000			0								6
	244		30			274			29,044								6
	449		30			479			48,858								6
	60		30			90			22,680								6
	743		30			773			16,233								6
	500		30			530			2,650								6

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						11,200					11,200					4
	400					400				11,200						5
						0				0						5
						0				0						5
						248,528							248,528			2
						248,528						248,528				3
						125,028					125,028					4
						93,028				93,028						5
	15,000					15,000			75,000							6
	4					4			20							6
	3,000					3,000			3,000							6
	3,000					3,000			15,000							6
						0			0							6
	4					4			8							6
						32,000				32,000						5
	15,000					15,000			15,000							6
	5,000					5,000			5,000							6
	10,000					10,000			10,000							6
	400					400			2,000							6
						123,500					123,500					4
						123,500				123,500						5
	2,500					2,500			7,500							6
	5,000					5,000			5,000							6
	1,000					1,000			0							6
	3,000					3,000			9,000							6
	2,000					2,000			92,000							6
	10,000					10,000			10,000							6
						0				0						5
	0					0			0							6
	0					0			0							6
						0					0					4
						0					0					4
																1
										1,164,951	1,164,951					