

Run handling

version: readout-v3.0

The DAQ server (ilcserver) fork and exec the readout program PROG_PATH which is defined in ilcserver.cxx. The exec'ed program start up three threads, in addition to the main readout. Two of these threads handle requests for on line events and playback events read from a file. The third send regularly an status update. The run commands exchanged with the run control the system are sent as text strings over the network. The command starts with *<COMMAND> followed by a number of arguments, i.e. *<COMMAND> ARG1 <value> ARG2 <value> ... <ARGn> value. It is the task of the ilcserver to interpret the commands from the remote control system and decode it into these commands as understood by the DAQ readout program. In the case of the local run control do the run control send the commands as they are given here, i.e. there is no decoding by the ilcserver, except when a run is active. When a run is active and the readout is polling for data is the readout thread not listening to the network since it is busy polling for data, instead is the server communicating with it by writing the received command to the network port and issues then a unix signal:

SIGUSR1	status requested
SIGUSR2	an action is requested

When the readout recognize the unix signal, it exits the readout loop and reads the command from the network port. After having serviced the action does it resume polling for data, unless the command was pause or end run. The protocol between the ilcserver and readout is shown in figure RO-1. The arguments of the commands are described in the document about the local run control.

Trigger(s)

The implemented hardware trigger is a NIM system which can be controlled from the parallel port of the computer. One must run the readout program as root to access the parallel port. If one is not root then the readout program will exit. There are three lines used in the parallel port:

0 - trigger reset (active low)

1 - trigger enable (active low)

2 – disable (off) or enable (on) pulser that generates a pulse to the front end card (active low)

There is one triggering in which the program handles the hardware trigger through the parallel port. There are two modes for triggering with the Distributor Box (DBOX). In one mode is a trigger expected from the DBOX through the network, and in the data packet the data from the DBOX. The second mode is data driven. i.e. the readout is waiting for data in the DRORC. After the DRORC has been read is the program waiting for data from the DBOX. After all data has been read is always an acknowledge sent to the DBOX. When using the DBOX is the parallel port not used.

The trigger configuration is read from the file dbbox.cfg at Start DAQ command.

Program logic

When the readout program starts does it search for installed DRORC and active RCUs. This scan is done only at start of the program, therefore must the RCUs to be used already be on power and running before the readout program is started. The RCU runs a linux kernel and must boot before it is ready. The readout program starts threads for monitoring and status udpates, and opens the network sockets used. The command *CLI is sent to the ilcserver when the readout task is ready and starts to listen on

the network port for receiving commands.

The commands to power on/off FEC and load the PCA settings must be received when the DAQ is stopped, since it is using the RORC-RCU link in an incompatible way from the actual data readout. *START is starting the DAQ by setting up the physical memory in the PC and DRORC-RCU links for data taking. *STOP is stopping the DAQ by closing the physical memory in the PC and the DRCOR-RCU link for data taking. At *START is also all configurations loaded into the RCU/FEC/ALTRO, e.g. active channels, pedestals, run configuration parameters. The configurations are read from configuration files as described later. For a change to become active must the *STOP - *START sequence be done. A schematic description is given in figure RO-2.

When receiving the *SOR is the event readout loop entered. If data logging is requested is the data file opened. When in this loop is the program not listening on the network port. Instead are the unix signals SIGUSR1 and SIGUSR2 used to interrupt the event loop when something has been written into the socket for run handling commands. It then exits the loop to read and execute the command. These commands can be *PAUSE, *EOR, and *STATUS. If the run is paused or ended, then the program continues to listen on the network, until a new *SOR or *CONT is received.

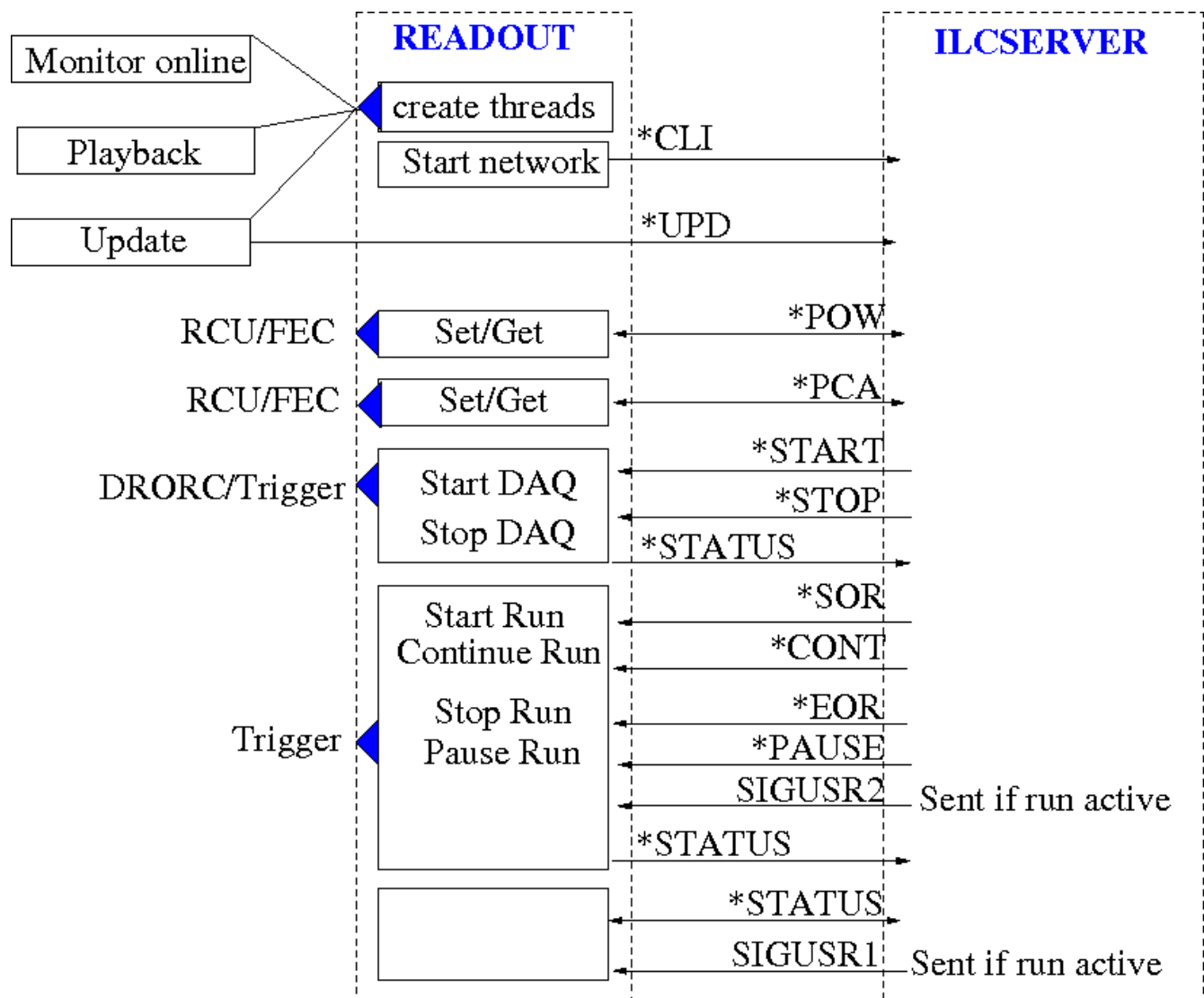


Figure RO-1: The protocol between the ilcserver and readout.

READOUT HANDLER

SIGUSR1 and SIGUSR2 are sent by ilcserver if run is active

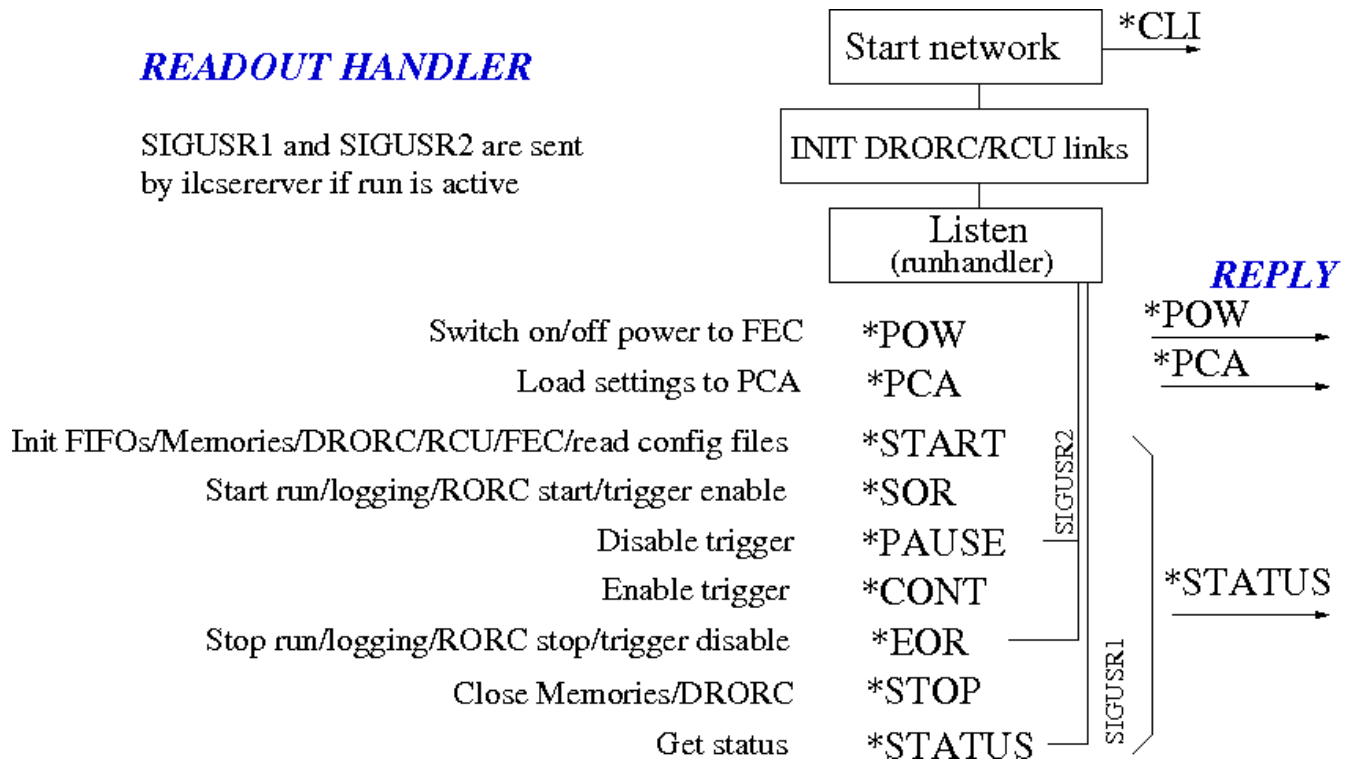


Figure RO-2: Schematic view of run handling in the readout handler.

Event loop

In the event loop is the active DRORCs polled for data. When all active DRORC are ready with new data is the readout waiting for the event buffer to be available (it may be locked by other threads using it). Since there is only one event buffer at the moment does it have be available for writing. When the event buffer is available it is locked and the data from the DRORCs is moved to the event buffer and formatted with headers. If data logging is requested then the event is a written to disk. The event buffer is unlocked. If a SIGUSRn has been received (flagged by a variable set in the signal handler) then the event loop is stopped and the request is handled. Figure RO-3 gives a view of the structure.

In the case of triggering through network by the DBOX is the readout waiting for a network connection before start polling the DRORC for data. If using the second DBOX mode is the readout waiting for data from the DBOX after the DRORC data has finished. The DBOX data is added as the same data structure as for the RCU data but with the RCUID set to 100.

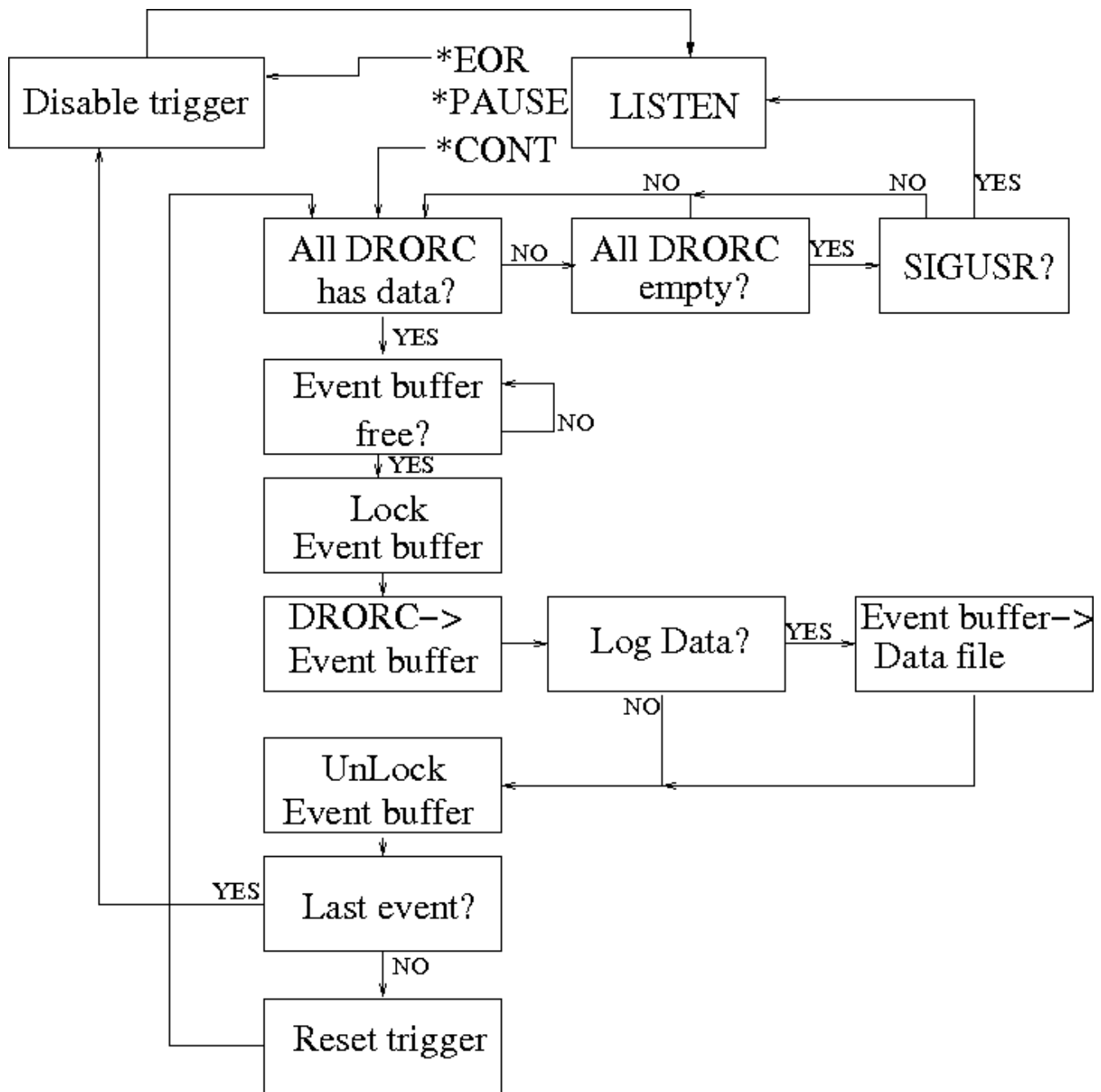


Figure RO-3: Event loop logic

DBOX emulator

in the the catalog dbxserver is a simple emulator of a DBOX. It use the parallel port to handle the hardware trigger. If TRIG_POLL is defined then an extra wait is done after the trigger to simulate the time it takes for the DBOX to send the data to the readout task.

Configuration files

The configuration of the front end is read from configuration files. The location of these files are in the location given by `CONFIG_DIR` which is defined in `readout.h`. This location can be changed with the command option `-configdir <configuration file directory>`. The first file read is `files.cfg`, which define the file locations of other files.

dbbox.cfg

```
# configuration file for trigger and the distribution box
# TRIG.SOURCE <source> 1=Parallel port, 2 = DBOX, 3 – data driven, with DBOX
# DBOX.SERVER <ip-address> address of DBOX
# DBOX.PORT <port> server port on the box
# DBOX.RND <microseconds> random trigger rate
# DBOX.BSY <microseconds> timeout of busy signal
# DBOX.ACKEN <0,1> enable ethernet event acknowledge
# DBOX.BSYTO <0,1> enable busy time out
# DBOX.SOURCE <0,1,2,3,4> trigger source of DBOX
# 0 = TLU, 1 = NIM, 2 = random, 3 = ethernet, 4 = button
#
# DBOX.POLLTO <milliseconds> timeout in waiting for data from DBOX
# -1 = infinite
#
```

files.cfg

```
#
# Definitions of where files are read from/written to
# these are also defined in readout.h
# the values here override the program default
#
# Directories
#DIR.CONFIG <configuration file directory> (default /misc/ilcdaq/config/)
#DIR.DATA <data file directory> (default misc/ilcdaq/data/)
#DIR.LOG <log file directory> (default /misc/ilcdaq/log/)
#
#Files
# Note 1. the runlog is always called FILE.RUN-<runnb>
# Note 2. the configuration file names are defined in run.cfg
#FILE.MSGLOG <name of message log file> (default msglog)
#FILE.MONLOG <name of monitor log file> (default monlog)
#FILE.RUNLOG <name of run log file> (default runlog)
```

run.cfg

```
# Run information
#RUN.TYPE <run type id> user defined identifier
#RUN.COMMENT Just a comment line
# Configuration files – note that the extension is automatically set to
# .pedestal, .physics by the program
#PED.ALTRO <file with altro settings for pedestal run> (default is global-altro)
#PHYS.ALTRO <file with altro settings for physics run> (default is global-altro)
```

```
#PED.RCU          <file with RCU settings for pedestal run> (default is global-rcu)
#PHYS.RCU         <file with RCU settings for physics run> (default is global-rcu)
# ALTRO.LOOKUP <type>
# type 0 - not used
# type 1 - straight lookup table
# type 2 - polarity = 1 invert (1023-ADC) some channels (8-15)
# type 3 - polarity = 0 invert (1023-ADC) some channels (0-7)
# The lookup table is used to invert 8 channels of the PCA16 which has opposite polarity as to what
# the ALTRO chip expects.
# LOOKUP.DEST  n – 0 = ALTRO registers, 1 = RCU PMEM
# LOOKUP.VERIFY n – 0= do not verify written, 1 = do verify
```

daq.cfg

```
# General DAQ configuration
# read and written at each start of run
# FORMAT:
#RUN.NB <nb> last run number, incremented for each run
```

drorc.cfg

```
# This file contains the mapping between
# RCU and DRORC channel
# FORMAT:
# RCU.ID          <id> id of RCU [0..3]
# DRORC.SERIAL    <serial> serial number of DRORC for this RCU
# DRORC.CHANNEL   <channel> DIU on DRORC (0,1) for this RCU
# DRORC.STATUS [0,1] channel status: 0-not used,1-used
```

The serial number must correspond to an installed DRORC, else will the RCU not be read out.

rcu-<rcuid>.cfg where rcuid is the RCU ID given in drorc.cfg

```
# This file contains information of active FEC/ALTRO
# for the RCU id as given in filename ruc_<id>.cfg
# RCU.ID id must be repeated as first statement
# then default values follows
# Each FEC ALTRO can be individually be changed from
# default ACL setting.
#FORMAT
#RCU.ID          <rcuid>      MUST BE FIRST STATEMENT!!
#RCU.POWER       <hexvalue>   Which FEC to power on (hexbit pattern)
#RCU.READOUT     <hexvalue>   Which FEC to readout (hexbit pattern)
#RCU.ACL         <hexvalue>   Default ALTRO active channel list (for each FEC to readout)
#RCU.ZSUP        <hex>        Default ALTRO zero suppression (for each FEC to readout)
#RCU.PEDSUB      <hex>        Default ALTRO pedestal subtraction (for each FEC to readout)
#FEC.ID          <fecid>      IF NOT GIVEN FEC.ID = 0 IS ASSUMED
#FEC.ZSUP        <hex>        Zero suppression pattern for this FEC
#FEC.PEDSUB      <hex>        Pedestal subtratcuon pattern for this FEC
#ALTRO.ID        <altrochip>  Altro chip- default 0 if not given
#ALTRO.ACL       <hexvalue>   Active channels int this FEC and ALTRO chip
#ALTRO.ID        <altroid>    Altro channel within ALTRO chip - default 0 if not given
```

#ALTRO.ACL	<hexvalue>	Active channels of this FEC and ALTRO chip
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global-rcu.<runmode> **runmode can be physics,pedestal,(test to be implemented)**

Settings common to all RCU

#TRCFG.TW <clock cycles from L1 until L2 is issued>

```
#TRCFG.BMD      <buffer mode>
```

```
#TRCFG.MODE      <trigger mode>
```

```
#TRCFG.OPT      <enable readout optimization>
```

```
#TRCFG.POP      <enable popped readout>
```

global-altro.<runmode> **runmode can be physics,pedestal,(test to be implemented)**

Settings common to all ALTROs in all FECs

FORMAT

All values are decimal! Might change for some settings

#Zero suppression threshold and offset

#ZSTHR.OFFSET	<value>	Offset to be added to the signal
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#ZSTHR.ZS_THR	<value>	Zero suppression threshold
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#Second baseline correction threshold

#BCTHR.THR LO	<value>	Lower threshold of the acc. window
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#BCTHR.THR _{HI}	<value>	Upper threshold of the acc. window
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#Trigger configuration

#TRCFG.ACQ START	<value>	Number of cycles to wait before start
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#TRCFG.ACQ_END	<value>	Cycles to sample
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#Data path configuration

```
#DPCFG.ZS CFG <value> bits 0-1:glitch filter
```

bits 2-4:presamples

bits 5-6:postsamples

#	b	it 7:enable zero suppression
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#DPCFG.BC2_CFG	<value>	bits 0-1:presamples excluded from 2nd baseline
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#	bits 2-5:postsamples excluded from 2nd baseline
1	1
2	1
3	1
4	1
5	1
6	1
7	1
8	1
9	1
10	1
11	1
12	1
13	1
14	1
15	1
16	1
17	1
18	1
19	1
20	1
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174	1
175	1
176	1
177	1
178	1
179	1
180	1
181	1

bit 6: enable second baseline

#DPCFG.BC1	CFG	<value>	bits 0-3: first baseline mode = 8 if lookup table used
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when bit is set. ADC value is inverted

#BFNPT.PWSV	<0,1>	when set, power save
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#BFNPT.FLT	EN	<0,1>	enable digital filter
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#BFNPT.NBUF	<0,1>	0: 4 buffers, 1: 8 buffers
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#BFNPT.PTRG	<0-15>	Pretrigger samples
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pca16.cfg

PCA16 settings

default is same for all FEC and RCU

CAN NOT YET BE SET INDIVIDUALLY

#PCA16.PREAMP ENABLE <value> 1 = enable preamp mode

#PCA16.GAIN <value> 0-3, gain setting

#PCA16.SHAPER <value> 0-7, shaping setting

#PCA16.SHUTDOWN	<value> 1 = shutdown the PCA16
-----------------	--------------------------------

```
#PCA16.POLARITY <value> 0,1 should be 1 for GEMs
```

#PCA16.DECAY BIAS <value> 0-2505, value to DAC

When loading the PCA is a delay needed in the program to allow the FEC to react to commands. This

delay may be configurable in future version.

Pedestal files

The pedestals for the ALTRO chip are read from files. The location of these files are in CONFIG_DIR which is defined in readout.h. There is one file for each RCU. The pedestal file contains the fixed decimal pedestal value for each channel. Optionally, using the standalone pedestal calculation program, are also the calculated values of pedestals and rms (using entries values) stored. These are ignored when loading the pedestals.

pedestal-<rcuid>.dat

FORMAT:

#RCUID n

<channel> <fixed pedestal - decimal> [<fixed pedestal – float> <rms – float> <entries>]

Log files

Logfiles are written to the directory LOG_DIR as defined in readout.h, or as defined in files.cfg. There are three types of logfiles; message log, run log, and monitor log.

Message log file – Information and debug output

Run log file – Status of run, started, stopped, paused, continued etc...

Monitor log file – status of the monitor server threads

These files have a very debugging content is not yet non-expert readable.

Data files

The binary data files get the name readout-<runnb>_<filenb>.dat where <runnb> is the RUN.NB taken from the file daq.cfg. The location of these files are in DATA_DIR which is defined in readout.h. When the file size exceeds the value MAX_FILE_SIZE (defined in loghandler.h), then the file is closed and a new one is opened with <filenb> incremented by one. The first file in a run has <filenb> = 0. Before the file is closed is an End Of File record written. In the beginning of the new file is a Beginning Of File record written. MAX_FILE_SIZE must be given in 32-bit words.

Files

readout.c, readout.h	all readout, event handling
runhandler.c, runhandler.h	handling the network run control
monhandler.c, monhandler.h	monitoring threads
ilc_altro.c, ilc_altro.h	ALTRO routines
ilc_rcu.c, ilc_rcu.h	RCU routines
pca16.c, pca16.h	PCA16 configuration

utility.c, utility.h	set power to FEC/load pca16 routines
loghandler.h	data format header definitions
ilc-physmem.h	physical memory definitions
fecrorc_lib.c, fecrorc_lib.h	adopted routines for FEC handling
fec2rorc_lib.c, fec2rorc_lib.h	non-adopted ALICE FEC handling (used in utility.c)
fecrorc_RCUdefines.h	RCU definitons
fec2rorc_lib_structs.h	needed by fec2rorc_lib.h
fec2rorc_version.h	needed by fec2rorc_lib.c (version number)
dbox.c, dbox.h	DBOX communication
typedefs.h	some common definitions

The utility.c need for fec2rorc_lib.c should be moved to use fecrorc_lib.c.

compile the code:

compile-readout

executable:

ilcrorc-readout