Last updates of the TDR DSP code (v. AB06_R16/20101108)

1. Reduction code

Main code properties:

- Due to data format constraints a cluster is limited to 128 channels, which means that if a cluster is composed of more than 128 channels, it is split into sub-clusters with a maximum size of 128 channels.
- But the user has the possibility to define a maximum cluster size < 128 channels (parameter 0x10). The algorithm makes sure that new limits always contain the channel (tagged as good) with highest charge. Default setting: no size limit (i.e. parameter 0x10 = 0). Even if activated, this function does not affect the TAS reduction mode.
- A channel with status bit 15 represents an absolute cluster limit: it will be the last channel included in the cluster. This allows to define “forbidden areas”: a group of contiguous channels with bit 15 flag on will never produce clusters.
- There is the possibility to define a maximum cluster number per event: parameter 0x14 for S-side and parameter 0x15 for K-side. The default value is 0, i.e. no limit.
- Cluster signal/noise ratio: thanks to the changes in the calibration procedure, the real s/n ratio is now computed, and is expressed in 1/4 ADC units. This value is stored on bits 7 to 15 of the cluster length word. The overflow s/n value is 0x1FF, i.e. 127.75 .
- The CN status bits of the cluster second word now are set to one if the number of channels used to compute the CN is less than a minimum value stored in parameter 0x1A (default value is 8).
- For the cluster seed selection, a flag mask has been introduced (parameter 0x1B). This enables to accept channels with particular flag bits to be cluster seeds. Default value is 0xFFFF, i.e. only channels with flag=0 are accepted for cluster seed. The flag test is the following: if (flag AND mask != 0) then channel cannot be a seed.
- The possibility to exclude single channel clusters (technically, they are composed of three channels, the central one which triggered the clusterization, and the usual neighbour channels) with low charge has been added to the code. Parameter 0x1C describes the exclusion threshold: the 8 LSB describe the S-threshold (in 1/8 ADC units), and the 8 MSB the K-threshold (in 1/8 ADC units). If the channel charge is lower than the threshold, the cluster is not written in output. If the threshold is set to 0, no cut is applied. Default value of parameter is 0x1C is 0 i.e. the cut is not active.
- The dynamic pedestals algorithm uses a two-steps correction: for fluctuations > sigma_high the correction corresponds to the 8 MSB of parameter 0xB, for fluctuations in the range [sigma, sigma_high], the correction corresponds to the 8 LSB of parameter 0xB. Default configuration is 1 (i.e. 0.125 ADC) for small corrections, and 4 (i.e. 0.5 ADC) for large corrections.
- The reduction algorithm now includes an occupancy histogram building for the first N events (N is defined by parameter 0x1D). The histogram is built using the highest charged channel with status=0 of a cluster. Once N events have been acquired the channels for which the occupancy is larger than a threshold defined in parameter 0x1E are flagged with bit 7 in their status word. The histogram and event counter are reset during the calibration process. Note that any change on parameter 0x1D will be only validated through a calibration process, or through the command 54 6.
- The occupancy histogram building is renewed every N seconds, where N corresponds to variable 0x20.

2. Parameters

Table 1 describes the parameters implemented as of now in the TDR:

index	*parameter description*	*default value*
1	Cluster seed factor S1, multiplied by 8	0x1C
2	Cluster lower threshold S1, multiplied by 8	8
3	Cluster seed factor S2, multiplied by 8	0x1C
4	Cluster lower threshold S2, multiplied by 8	8
5	Cluster seed factor K, multiplied by 8	0x1C
6	Cluster lower threshold K, multiplied by 8	8
7	Sigma raw factor for channel exclusion in CN calculation	0x1E
8	TAS ladder type (8 LSB) and column (8 MSB)	0
9	Reduction mode: TAS mode	0
0xA	Reduction mode: S/N ratio mode	1
0xB	Reduction mode: dynamic pedestals steps: 8 LSB step for small correction, 8 MSB step for large correction. (0=off)	0x0401
0xC	Reduction mode: CN output	0
0xD	cTDR_AVRG_SEED (calibration step 3)	3
0xE	cTDR_AVRG_THRE (calibration step 3)	1
0xF	Threshold value for high occupancy channels (calib. step 4). See description at section 3.1.	0x20
0x10	Maximum cluster size (0=off)	0
0x11	Threshold value for “double trigger” calibration	0x14
0x12	Number of events for “double trigger” calibration	0x801
0x13	Flag for “get calibration” command	0xDF
0x14	Maximum cluster number per event, S-side (0=off)	0
0x15	Maximum cluster number per event, K-side (0=off)	0
0x16	Number of events for calibration pass 1	0x400
0x17	Number of events for calibration pass 2	0x400
0x18	Number of events for calibration pass 3	0x400
0x19	Number of events for calibration pass 4	0x800

Table 1: Description of the parameters implemented in the TDR.

index	*parameter description*	*default value*
0x1A	Minimum channel number to have a reliable CN computation. Must be in the 2 ... 32 limit.	8
0x1B	Flag mask for cluster seed rejection	0xFFFF
0x1C	Single channel cluster exclusion threshold: 8 LSB for S-side, 8 MSB for K-side. (0=off)	0
0x1D	Number of events to build the occupancy histogram during data reduction (0xFFFF = off).	0x1000
0x1E	Occupancy threshold to exclude a channel during data reduction.	0x100
0x1F	Calibration writing in flash period.	4
0x20	Occupancy repetition time in data reduction mode (in seconds)	300

Table 1: Description of the parameters implemented in the TDR (continued).

The parameter values are accessible using the AMSwire command 9, and can be modified with the command 49. Those commands foresee a protection in the case the parameters are sent to the wrong sub-detector: the last 4 bits of the word containing the number of parameters indicate the sub-detector ID (1 for the tracker). For example:

```
2E09 1004 1 2 5 8
```

asks to the TDR to return the values of four parameters: #1, #2, #5 and #8. While:

```
2E49 1004 1 0 2 3 5 2 8 6
```

changes the values of four parameters: it sets parameter 1 to 0, parameter 2 to 3, parameter 5 to 2, and parameter 8 to 6.

Configuration from flash file

The parameter managing allows one to store the parameters in a flash file (see A. Kounine's document at page 34 for detailed description). Once the command 46 is issued, the parameter list is stored in the data memory, at address 0x1000 of overlay 4. The load flash file command automatically executes the configuration procedures, and if a parameter list is present at DM(0x1000) of overlay 4, the parameters are set according to the list, provided it is valid.

To have a configuration file automatically loaded at initialization, the file must have the 'default file' attribute. Every time the program will be loaded (via a 46 or 40 command) the configuration file will be also loaded, and the parameters updated.

A simple program to build the configuration files is available at following link:

http://ams.pg.infn.it/~azzarel/work/tdr/configuration/configuration.tar.bz2

It is possible to save the parameters into a flash file, using command `2E54 5`: see section 5 for details.

3. Calibration

3.1 Non-gaussian channel identification

The non-gaussian channel identification algorithm has been simplified and is now similar to the one used in the double-trigger calibration. The occupancy histogram is built according to the channels which would trigger a cluster building (i.e. the content after pedestal and common-noise subtraction is larger than the cluster seed threshold). If the occupancy is larger than the value of parameter 0xF, then bit 4 of the corresponding status word is set to 1. It is possible to get the occupancy histogram through command `2E13 1` described in section 3.5.

3.2 Calibration flash file

Note: Starting with version R08, the sigma table is kept in memory, and thus is also saved into the flash file. This implies some changes: the flash calibration file has now one more sector, thus the file names change. To allow a better cohabitation between the old and new code version, the new file names are: ***7e06***, ***7e16*** and ***7e26***.

At the end of every calibration phase (including the double-trigger calibration), the calibration results are saved in a flash file. The files are alternatively named 7E16 or 7E26. At the program initialization, the DSP looks for one of those files and loads it. If none of those files are present, the code looks for a "reference calibration" file, named 7E06.
To create the reference file, the user has to issue a write calibration file command: `2E53 2 7E06`. This command writes the present calibration tables into the flash file 7E06. To replace a reference file with a newer version, you will first have to delete a possible pre-existing file, with command `2E47 7E06`.

Starting with version R15/20101004, a calibration is saved to flash only every N calibration, where N is controlled by parameter 0x1F. Note that if you modify the flag bits using command 54 1 or command 54 2, the next calibration is systematically saved into flash.

3.3 Front-end power failure counter

During the calibration, the DSP counts the number of events for which a front-end power failure has been observed (bits 0 and 1 of channel 1023 value). The content of the counters is then accessible through the get calibration command.

3.4 Calibration summary data

Once the calibration is finished the DSP also computes the average and standard deviation for the sigmas and pedestals, for S- and K-sides. Those values provide fast diagnostics about the ladder quality, and are available through command `2E14 1` (see section 4).

3.5 Get calibration results

The get calibration data command (13) behaves as described in A. Kounine's document (pages 36 and 37), for the standard calibration as well as for the "double-trigger" calibration:

The command `2E13 0` provides the following words:

1. Trigger frequency (parameter of a `2E53 0` command);
2. Status/failure code;
3. Number of triggers requested;

4. Number of triggers received;
5. Number of events processed;
6. Calibration start time (in 10 ms ticks);
7. Calibration stop time (in 10 ms ticks), note that it is the time at which the user sends a stop calibration (`2E53 1`) command, not the time at which the calibration actually completed.

The command `2E13 1` provides sub-detector dependent information. At the moment the TDR replies as follows, if the calibration completed:

1. Output content (corresponds to parameter 0x13, see table 1);
2. If bit 0 of parameter 0x13 is set, the list of 1024 pedestals (expressed in 1/8 ADC units);
3. If bit 1 of parameter 0x13 is set, the list of 1024 flags;
4. If bit 2 of parameter 0x13 is set , the list of 1024 low threshold ("sigma low") values (in 1/8 ADC units);
5. If bit 3 of parameter 0x13 is set, the list of 1024 sigma raw multiplied by parameter 7 (see table 1) and expressed in 1/8 ADC;
6. If bit 4 of parameter 0x13 is set, the list of 1024 cluster seed values ("sigma high") values (in 1/8 ADC units);
7. If bit 5 of parameter 0x13 is set, the list of 1024 values of the double-trigger occupancy table;
8. If bit 6 of parameter 0x13 is set, the list of 16 common noise standard deviation values (one per VA, in 1/8 ADC units);
9. If bit 7 of parameter 0x13 is set, the list of 16 common noise average values (one per VA, in 1/8 ADC units);
10. ***If bit 8 of parameter 0x13 is set, the occupancy histogram built at calibration step 4 (1024 words).*** *Note that the occupancy table of the calibration step 4 is temporary, as the memory space used by this table is also used by the reduction process. The purpose of this table is for debugging only, and if you want to use it reliably, make sure that the DSP is in NO ACQUISITION mode (52 0 command) before starting an acquisition.*
11. ***If bit 9 of parameter 0x13 is set, the list of 1024 values of the sigma values (1/8 ADC units);***
12. ***If bit 10 of parameter 0x13 is set, the occupancy histogram built during the data reduction (1024 words).*** For internal purposes most of those values will have bit 15 set to 1 (i.e. 0x8000). To get the real occupancy value, you will have to mask the value with 0x7FFF.
13. DSP program version;
14. The values of parameters 1 to 7 (see table 1);
15. The number of events with front-end power failure, S-side;
16. The number of events with front-end power failure, K-side;
17. The number of events used for the calibration;
18. The internal calibration status word.

If the calibration is not finished, only words 14 and 15 are provided by the DSP.

Note: *as of now, parameter 0x13 is set to 0xDF, for compatibility and debugging reasons. Nevertheless, for final and routine operations, it should be changed into 0x2CB, as low and high sigma and DT tables are not necessary.*

3.6 Calibration result conversions

The TDR treats the ADC values in 1/8 units. For this reason, to interpret the calibration results correctly, the user needs to convert them:

1. The pedestals need to be divided by 8.0;
2. The sigmas need to be divided by 8.0;
3. The low and high thresholds have to be divided by 8.0;
4. The raw sigma values need to be divided by 8.0 *and* by parameter 7;
5. The common noise standard deviation and average values need to be divided by 8.0 .

4. Double-trigger calibration

Due to particular hardware conditions, a calibration step using close trigger events is implemented. The procedure consists in ignoring every even event. For every odd event, the pedestals are subtracted, the common noise computed and subtracted. If a channel content is larger than the cluster high threshold, the its corresponding bin of an occupancy histogram is incremented by 1. At the end of the calibration procedure, every channel for which the occupancy is larger than the threshold defined by parameter 0x11 will be flagged, setting bit 9 to 1.

A typical command sequence is the following:

1. `2E49 1001 11 x` : sets the occupancy threshold
2. `2E53 0 8008` : double-trigger calibration
3. Switch on trigger, and wait for calibration end
4. `2E49 1001 13 20` : output format of "get calibration" command
5. `2E13 1` : get calibration
6. `2E49 1001 13 DF` : sets standard output

5. Sub-detector-dependent procedures (command 54)

Command 54 allows each sub-detector to implement specific operations. For the TDR, the following operations have been implemented:

- ***Gain calibration - parameter 0***. This operation is done using command `2E54 0 x`, where x is a number from 0 to 7, and is the signal amplitude sent to the VA channels.
- ***Channel permanent flag bit set/unset - parameters 1 and 2***. This command sets to 1 (or 0) the bits of the calibration flags described in a mask given as parameter. Flag bits in the range 8 to 15 are not reset at the beginning of a new calibration, and thus a channel tagged as "bad" with bits 8-15 will remain so permanently. Command `2E54 1` sets bits to 1, command `2E54 2` resets bits to 0. Commands `2E54 1` and `2E54 2` are followed by the mask to apply, then a list of value pairs: each pair indicates a channel range for which the flags must be changed, the first value indicates the first channel, the second one the range length. For example:
  - `2E54 1 8000 10 2 100 5 200 40` : sets bit 15 to 1 for channels 16 and 17, 256 to 260 and from 512 to 575.
  - `2E54 2 8000 280 180` : resets bit 15 to 0 for all K-side channels.
- **Parameter 3 has been de-activated:** a complete flag reset is now obtained though a `2E54 2 FFFF 0 400` command.
- ***Internal trigger for reduction debugging - parameter 4***. This command allows one to have the TDR generate an internal trigger, and take events. This function is useful for debugging and/or diagnoses purposes, as one does not need to have an external trigger to get events. The syntax is `2E54 4 x`, where x is the trigger period in 10ms units. If x is 0, the internal trigger is switched off.
- ***Save parameters in a configuration file - parameter 5***. The whole parameter list, with the parameter actual values, is saved into the flash memory. If the file already exists, it is erased, then written again. Due to possible long flash access times, in some cases the command might reply with a failure code (the DSP tried writing while the file delete was not completed). In that case, just send the command a second time. Syntax: `2E54 5 abc1` where abc1 is the file name. Digit 'a' is either 6 or 7, while digits 'b' and 'c' have no constraint.
- ***Update pedestal values for S1 - parameter 6***. This command is *mandatory* after having loaded a calibration file from the flash memory. It updates the S1 pedestal values for the reduction procedure. This command also resets to 0 the occupancy counter and histogram used in data reduction.
- ***Check calibration table integrity - parameter 7***. This command computes for each calibration table (CRC included) the CRC: it should be 0. If not, it sets to 1 the corresponding bit of dmSTATUS_TABLES, according to following list:
  - bit 8: pedestals
  - bit 9: raw sigma
  - bit 10: sigma low
  - bit 11: sigma high
  - bit 12: flags
  - bit 13: sigma

  dmSTATUS_TABLES is the last word sent by the housekeeping info command. Note that in the case of active dynamic pedestals, bit 8 will necessarily be set to 1.

6. Results of the sub-detector dependent procedures (command 14)

The parameters implemented for now are the following:

- `2E14 0` : to get the 1024 values of the gain calibration.
- `2E14 1` : the DSP gives a short calibration summary, composed of 8 words:
  1. S-side pedestals average (in ADC units);
  2. S-side pedestals RMS (in ADC units);
  3. K-side pedestal average (in ADC units);
  4. K-side pedestal RMS (in ADC units);
  5. S-side σ average (in 1/8 ADC units);
  6. S-side σ RMS (in 1/8 ADC units);
  7. K-side σ average (in 1/8 ADC units);
  8. K-side σ RMS (in 1/8 ADC units).
- `2E14 2`: to get the 1024 values of the occupancy histogram built during data reduction. For internal purposes most of those values will have bit 15 set to 1 (i.e. 0x8000). To get the real occupancy value, you will have to mask the value with 0x7FFF.
- `2E14 3`: gives a compact list of all TDR parameters (i.e. without the parameter number as it would be with command 2E09).

Note: to be consistent with the changes of Jinf's command 14 in the AA1E version of the DAQ program, the first word of TDR's command 14 reply is the parameter itself.

7. TAS data reduction mode

For the TAS calibration, a dedicated reduction mode has been implemented. The TDR subtracts the pedestals from the raw event, and isolates the values of predefined ranges. The data are then sent using the cluster format. If the cluster size is larger than 128 channels, the original cluster is split into clusters of maximum size of 128, as for the standard reduction code.

Depending on the ladder position on the tracker layers, the TAS signal will be located on various channel ranges. Also, a particular laser diode illuminates only specific ladder columns, thus not all TAS ladders received a laser signal. For this reason a selection on the only "relevant" ladders has to be done, to limit the data flow.

For this purpose, parameter 8 describes if a ladder needs to produce data - and for which channel ranges - when set in TAS reduction mode:

- bits 0 to 7 describe the ladder type:

Ladder type (bits 0 to 7)	***Channel ranges***
0	None
1	64-255, 640-703, 960-1023
2	64-255, 704-831
3	384-575, 704-831
4	384-575, 640-703, 960-1023

- bits 8 to 15 describe the ladder column position:

Value (bits 8 to 15)	***Column***
0	None
0x100	1
0x200	2
0x400	3
0x800	4
0x1000	5

As an example, if a ladder is located in column 5, and is illuminated in the channel ranges 384-575 and 704-831, parameter 8 must be set to 0x1003.

The TAS reduction mode is activated when parameter 9 is different from 0. Parameter 9 actually describes the ladder columns to be readout, according to following table:

bit	***Column***
0	1
1	2
2	3
3	4
4	5

As an example, to readout columns 2 and 5, parameter 9 has to be set to 0x12. The parameter 8 must be set according to the ladder position and type, using the configuration file.

A typical TAS acquisition could be as follows:

1. Reset buffers of all Jinf-T and TDRs.
2. Select the laser diode(s) to activate.
3. Send to all TDRs the column configuration, e.g.: `4000 2e49 1001 9 5` (here we would read columns 1 and 3: 1+4 = 5).
4. Take data...
5. Repeat sequence 1-2-3-4 for other diode/column configurations.
6. End of TAS mode: `4000 2e49 1001 9 0`
7. Reset Jinf-T and TDR buffers.

It is important to note that in the TAS configuration, all TDRs take data, but only those with a ladder type and column number different from 0 will transmit data to the JINF. ***The busy and slave masks must remain the same as for a normal data acquisition configuration***.

8. Housekeeping information

The “read housekeeping info” command (2E03) gives some TDR status information. It is composed of two data groups: the first one has structure common to every AMSWire node. The second one (starts at word 7) is composed of sub-detector specific information. Here is the output format of such a command:

Position	***Content***
0	DAQ version
1	Subd DAQ version
2	Node status
3	Last event number
4	Average processing time
5	Calibration type
6	Calibration status
7	Mean cluster event length, S-side ***(*)***
8	Mean cluster event length, K-side ***(*)***
9	Total number of S-clusters for 1024 events
10	Total number of K-clusters for 1024 events
11	Number of hybrid power failures, S-side
12	Number of hybrid power failures, K-side
13	Reduction mode description
14	Status of the calibration tables
15	Occupancy counter

(*)*The “cluster event length” corresponds to the number of words used by a cluster data: 2 words for the cluster header and the words for the cluster data. So its minimum value is 4.*

For word 13, the reduction mode description, for now we have:

- bit 0: dynamic pedestals mode (1=on)
- bit 1: common noise output (1=on)
- bit 2: laser mode (1=on)
- bit 3: cluster size limitation (1=on)
- bit 4: cluster number/event limitation, S-side (1=on)
- bit 5: cluster number/event limitation, K-side (1=on)
- bit 6: small charge-single channel exclusion (1=on)

For word 14, a bit set to 1 means that the table content changed since the calibration was done. The check is not done automatically, you need to execute a `54 7` command first. The bit table is the following:

- bit 8: pedestals
- bit 9: raw sigma
- bit 10: sigma low
- bit 11: sigma high
- bit 12: flags
- bit 13: sigma

If the dynamic pedestals algorithm is active, bit 8 will necessarily be set to 1, as pedestals change during the data acquisition.

For word 15:

- bits 0 to 13 describe the counter value.
- bit 14 indicates that the occupancy and flag bit 7 are being reset to 0.
- bit 15 indicates that the occupancy algorithm during data reduction is suspended.

9. Bug fixes / Updates

Version R16/20101108:

- To be consistent with the new DAQ version AB06, the first word of TDR's command 14 reply is the parameter itself.

Version R16/20101105:

- Bug fix: the reduction code sequence called the dynamic pedestals also when the TAS reduction was active (as no CN was generated, this induced wrong offsets from the avg CN correction).

Version R16/20101027:

- Some code cleaning in the double-trigger calibration step (the management of the test parameters 8010 and 8020 is now suppressed, this frees memory for about 30 more instructions).
- Simplification of the L register initializations. This enables to free memory for more instructions.
- Introduction of a periodic occupancy algorithm during data reduction. Parameter 0x20 controls the time period (in seconds).
- One more word has been added in the housekeeping command: status of the occupancy counter.

Version R15/20101004:

- Commands 54 1 and 54 2 have been updated, now they not only control bit 15, but all 16 bits of the flags. The user has to give a mask as additional parameter.
- Command 54 3 has been deactivated. This gives more memory space.
- Now calibration is saved only every N calibration. N is controlled by parameter 0x1F. Calibration done after modification of the flag bits with commands 54 1 or 54 2 is systematically saved.

Version R15/20100920:

- Bug fix: cluster size limitation now works correctly.

Version R15/20100910:

- Bug fixes: cluster s/n in case of high charge (overflow management) is correctly managed.
- Cluster s/n for large clusters (s/n copy in subclusters) is now correct.
- Bug: clusters of exactly 128 channels were not split into two clusters (one of 127 channels + one 1 channel).

Version R15/20100902:

- Low and high sigma table: final right shift division was done only on the 16 LSB. Now fixed.
- Introduction of the occupancy table in the reduction code: Introduction of 2 new parameters and histogram initialization procedure (included update of the 54 6 command).
- Introduction of command 14 2, to get the reduction occupancy table. Command 13, through bit 8 of parameter 0x13, also produces this table.
- Introduction of command 14 3, to get a compact list of all TDR parameters.
- Calibration cleaning: remnants of old internal trigger code removed.
- Cluster s/n: introduction of an overflow value control. Max. possible value is 0x1FF, i.e. 127.75.
- *NOTE: code size is close to the maximum of 0x1FFF 24-bit words.*

Version R15/20100816:

- Correct temporary memory initialization for raw sigma computing.
- Permanent bit on channel 1023 induced a complete flag reset for all channels during the next calibration initialization. Fixed.

Version R15/20100806:

- Dyn. ped. algorithm rewriting. Now operates on a 2-thresholds base: enables fast corrections when there are large fluctuations, and small corrections in normal conditions.
- HKinfo gives more information about reduction conditions.

Version R15/20100802:

- Bug fixed in the dyn. ped. algorithm for negative fluctuations.
- Call to dyn. ped. has been put back to its original place (previous call position was “illegal”).
- Default dyn. ped. parameter is now set to 1 i.e. 0.125 ADC.

Version R15/20100730:

- The dyn. ped. max correction amplitude is now controlled through parameter 0xB.
- Introduction of an optional cut on low signal, single-channel clusters, controlled with parameter 0x1C.
- Dynamic pedestal algorithm is now applied after cluster identification (no significant changes on the code behavior, but it is a more logical approach).

Version R15/20100722:

- In some cases the permanent calibration flags could be still erased during the first calibration step. This problem is fixed.
- A minimum channel number threshold has been introduced to warn on the CN quality (with the dedicated bits of the 2nd cluster word).
- The initial values of the clusters statistic given by HKInfo are now set to 0xFFFF, at initialization and after each calibration.
- Cluster S/N ratio not always selected the channel with highest charge. Fixed.
- Introduction of a flag status mask for the cluster seed selection.

Version R14/20100629:

- Faster reduction algorithm (30 µs average time diminution).

Version R12/20100507:

- New dynamic pedestal algorithm (with faster convergence) implemented. Now the threshold used is sigma, and the pedestal change step is variable, from 0.125 to 0.5 ADCs.

Version R11/20100503:

- Added parameter 7 to command 54: this allows to check the calibration table integrity in memory.

Version R11/20100427:

- Added parameter 6 to command 54: this command updates the S1 pedestal values, command to execute after having loaded a calibration file from flash, else the S1 pedestals are updates in memory.

Version R10/20100326:

- Introduction of a correct flag initialization to 0 when no calibration file is loaded by init.asm

Version R10/20100318:

- A bug in the mean cluster length computation, introduced with the new reduction code, has been fixed.
- The precision for the sigma average and rms has been changed to 1/8 ADC, for the 2E14 1 command.

- In case of front-end power failure, now the dmBUILD_STAT variable reflects this information.

Version R08/20100129:

- The sigma table is now written in DM(0x2000). It is included in the flash calibration file (one more segment).
- Cluster S/N is now computed using the sigma table, and the precision of the S/N is now of 0.25 .
- Non-gaussian calibration step has been changed, for a selection criteria similar to the one used in the “double-trigger” calibration (occupancy).
- TAS reduction mode has been updated to include the “ladder column” information.
- Sub-detector procedures: internal trigger for DAQ mode (debugging/test procedure), save configuration file into flash memory.
- New reduction code algorithm, with the introduction of three parameters: maximum cluster size, maximum number of clusters S, K, and bit 15 of status word stops cluster building.

Version 20100107:

- A bug in the project file definition prevented the new TAS window settings to be active. Now they are.
- The memory segment sizes have been updated in boot.h, allowing a correct result of the “program test” command (2E55).

Version 20091228:

- The TAS window dimensions have been extended to fit with VA coordinates, to ease the offline common noise calculation.
- The output format of 2E09 command has been changed to be compatible with the mainframe standard.

Version 20091214:

- A bug found in the CN calculation, when less than 32 channels are available, has been fixed. Codes for data reduction and calibration have been fixed.

Version 20091201:

- Bit sequence of dmCALIBR_STATUS during calibration was not compliant with the official requests. Now it is the following:
  - calibration running R=1 D=0 C=0
  - calibration running, enough data collected (and actually data are already ready), ok to receive a stop calibration: R=1 D=0 C=1
  - calibration stopped, calibration data available: R=0 D=1 C=0

  This sequence is not very intuitive for our way of calibrating, but complies with the main DAQ

requests.

Version 20091128:

- The permanent bit erase (2E54 3) command has been changed: now it needs a parameter which is the mask of the bits to KEEP.
- The permanent bit set (2E54 1) and unset (2E54 2) commands now control bit 15 instead of bit 8.

Version 20091127:

- A second flag initialization in the code canceled the so-called “permanent” status bits. Bug fixed, now bits >7 are really permanent.

Version 20091124:

- The write flash procedure is also executed at the end of the double-trigger calibration.
- The write flash procedure has been slightly improved: in case of write failure, the DSP tries once (and only once) again.
- When a calibration file is loaded from flash, it is now possible to get the calibration values loaded into the memory through a `2E13 1` command.
- At the initialization, if the calibration files 7F15 or 7F25 are not found, the DSP looks for the reference calibration file 7F05.

Version 20091122:

- The double-trigger calibration status bit changed from position 6 to 9. In this way, the double-trigger bit is permanent as it was foreseen.
- A feature in the load calibration file codes (in calibr.asm and init.asm) prevented files in sector 7 to be loaded.

Version 20091116:

- Fixes a bug in the power bits management code which induced the systematic production of a cluster with seed at channel 1023.