CALICE CERN Test Beam: Shift Manual

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1 Shift guide in short

Summary of the main commands to start a run. Please read the detailed instruction first.

if HCAL is off
turn on HCAL LV: click "LV ON, HV INI" on the slow control PC
start the DAQ (communication with VME): type `startUp` on the DAQ PC
ramp HCAL modules to default HV: click "ramp HV" on SC PC
otherwise
set beam optics
move detector to given position and angle
start a beam run: runStart -t Beam -e 100000

repeat last 3 steps for all new runs according to run plan

2 The shift duties

This is the first time we organize shifts for the CALICE group, please keep this in mind when reading this guide, which might be incomplete and subject to often changes. Please always use common sense to judge if the instructions you receive are meaningful and appropriate. It is your responsibility to ensure we are doing a good job. Do not hesitate to ask, point out mistakes, or call for clarification AT ANY TIME!

Shifts for the CALICE test beam are subject to often changes in program, rules, requirements. Please make sure you are aware of the latest agreements on run plan and detector operation policy before starting your first shift.
It is duty of the shift leader to inform you but it is also your duty to facilitate the information transfer.
Try to be in th control room 15 minutes before the official starting of your shifts and stay 15 minutes longer to ensure good communication between

shift crews.
Always inform the shift leader in case of problems, changes in beam schedule, major problems with the machine.

The shift crew is composed of three people. Their responsibility is to ensure good data taking and good detector performance. The shift crew controls the status of and operate the detectors (ECAL / HCAL / TCMT) according to the following guide. Furthermore, it is duty of the shift crew to set the beam optics according to instruction, start and stop runs and ensure the tracking detectors and the Cherenkov detector are performing according to specs.
The shift crew should also keep good record of all data collected using the online log-book and the local paper log-book.
At the beginning of one shift it is advisable to decide upon task sharing. It is suggested to have:
one ECAL person who
- checks ECAL voltage settings and currents on the ECAL slow control PC
- checks ECAL performance from the online monitoring plots
- records in the log-books all relevant info for the ECAL analysis one HCAL/TCMT person who
- checks HCAL/TCMT voltage settings and currents from the HCAL slow control PC
- checks the relevant online monitoring plots
- records in the log-books all relevant info for the HCAL/TCMT analysis - performs rotation of the system one beam/data taking person who
- loads the appropriate beam optics
- starts new runs
- records in the log-books run information
- checks the status on drift chambers and Cherenkov
- makes sure the data transfer to DESY dCache is properly ongoing.

This task sharing is not strictive and duties can be shared. But some level of coordination helps to minimize mistakes.
Responsibility of the whole shift crew is to look at the physics plots from the online monitoring and judge if the “physics” being collected makes sense.

3 Taking data

In normal operation mode all detectors should be on and the shift crew should follow the run program of data collection.

When you enter your shift check with the previous crew
is the ECAL on? (if not why) is the HCAL on? (if not why) is the TCMT on? (if not why) are the DC and Ch detector on? is the DAQ running? (if not why?) is a run ongoing? (which? what is the next?)

If all the above answers are yes and you know how to proceed in the data taking then continue reading, if not follow the "turn on" instructions.

when a run is over (the number of required events is reached)

start a new run

load the beam optics according to the *beam orbit guide*
choose the detector position and angle (see paragraph *Position and angle change*
check the status of the detectors (currents and voltages)
from the DAQ PC start a new run, the type being: emcBeam (ECAL only), ahcBeam (HCAL only), or Beam (combined run). Specify the number of events to 100000, and make sure to be writing data to disk (see paragraph *DAQ operation.*
record in the log-books the run info and proceed to check the online monitor plots.

If required perform special calibrations in between beam runs and in general when the beam is not delivered due to machine problems. See paragraph *special calibrations.*

3.1 Position and angle change

3.2 DAQ operation

The DAQ can be operated from the two PC (icalice00, for combined or ECAL stand alone data taking, or ??? icalice03, for HCAL stand alone data taking). The correctly used PC can be recognized by the orange optical fiber connected to the back of the PC. This is the optical connection to the VME crate(s). **is this the final config? Paul?**

The login to all machines in the control room is via the caliceon login.
On the DAQ PC go to the /online/ directory.
Check if the DAQ is running
search for the running DAQ executable: runner
type ps -u caliceon — grep runner

if a runner exist the DAQ is on
if not start the DAQ by typing `startUp`

in an extra xterm start `runMonitor`, which allowes to see the DAQ acquisition rate and the run status since last “startUp”. At the “startUp” a log file is created in the directory data/log/ with the time stamp of the startUp. Watching the tail of this file allows to see the actions made by the DAQ. If no run is started after a startUp the DAQ stays in a monitoring mode in which the communication with the VME is checked and recorded every minute or so. In this case the event rate would be 0 Hz and the tail of the log file would show:

.... insert cut of log file

A new run can be started at any time when the DAQ is on using the command
`runStart` (-h will give the full option of flags). To start a run requires to give a runType with the option -t. The list of available runs is available in the local directory in the file knownRunTypes.txt.
As soon as a run is properly started the rate should increase (average beam rates are between ... and ...) and the tail of the log file should display the sequence of operations being carried out.
A runStart will interrupt any ongoing run including the DAQ default (VME communication check) in a clean way, i.e. ending the last acquisition and properly closing all files. If no trigger is received by the DAQ a clean end cannot be performed and the DAQ will hang waiting for triggers. At present in such case the DAQ has to be killed by hand by killing the job, runner.
As long as triggers are received a run can be stopped either by the next `runStart` or be a `runEnd`, which brings the DAQ in its default state.

Multiple runs can be taken while the DAQ is on and will be stored in the same log file.
The DAQ can be stopped by the command `shutDown`. After this the communication with the VME will be interrupted and at the next startUp a new log file will be opened.

DAQ trouble shooting

A normal beam run consists of 3 types of data being collected in a repetitive loop. First 500 pedestals events, then 500 LED events for HCAL calibration are collected (at the rate of about ... Hz). The third (and all multiples of 3) configuration is collecting 20000 beam events, triggered by an external trigger specified by the subtype or version number of the run (i.e. at DESY the finger cross coincidence is trigger 13, and external pulser trigger for de-

bugging is give as trigger 12). Keeping in mind the data taking structure helps debugging in case of problems.
If the rate remains 0 Hz after a Beam runStart, check the numberOfConfigurations given by the runMonitor.

If the numberOfConfigurations = 3 (or multiple of 3) the run has properly started but got stacked because of no beam triggers received. Check if the beam is on and if the beam counter in the control room is increasing. If so, try to stop and restart the DAQ by executing `shutDown`, kill the runner job, and `startUp`. If the problem persists call the DAQ expert on-call.

If the numberOfConfigurations = 1 the run sequence is stacked at the pedestal (random) trigger which is generated on the VME board. There can be a problem with the VME. Execute a `shutDown`, if the runner is still running kill the process. Execute `alive` (a program that checks the communication to the VME crates). If the VMEs are fine the program returns:

.... include a dump of alive

If the message returned is different one VME (or VME card) requires booting. For this action access to the experimental area is needed. See paragraph *Access to beam area.*

3.3 Special calibrations

Twice per day (morning and evening) and at any time in which the beam is not delivered a special calibration run sequence for the HCAL should be started by executing `?`??. The sequence runs over various settings configurations for the VFE electronics and various amplitude of LED monitoring light. The whole sequence requires approximately ??? minutes. In case of a longer break (if daytime) enquire on which additional calibrations could be performed. If night time repeat 3 times the same sequence for reproducibility studies.

During the HCAL calibration run, follow the increase of signal amplitude on the LED monitoring plots on the online monitor PC.
Make an entry in the log-book to comment the runs taken.

4 Turn on the HCAL

The HCAL requires for its operation low voltage (LV) to power the very front end electronics and bias voltage (HV) for depleting the SiPM.
Each 1/2 of an HCAL module is independently powered, so there are 2*N HV and LV lines (channels) for N HCAL modules.
The setting and controlling of this channels is performed by the HCAL slow control PC (???).
On this PC a multi-function GUI is running which controls not only high and low voltage but also the operation of the LED boards and the HCAL movable stage.
In the upper-most command bar select the HV panel.
If the HCAL is OFF (i.e. all HV to zero, LV off) then click on “LV ON, HV INI”. The execution of this command may take few seconds. It sets the LV on to all VFE electronics and sets all bias voltages to 10 for safety.
Next the SiPM individual bias has to be set. This is done at the “startUp” of the DAQ, or, if the DAQ is already on, by executing the special run `r`unStart -t ahcDacScan
Do not ramp the SiPM HV to full value without having loaded the (DAC) settings.
The loading of the settings can be seen in the log file. After loading the settings all HV channels can be ramped to nominal values by pressing “HV ON”.
All channels are set to different nominal voltages according to the needs if the HCAL modules. It is normal that the HV spread between channels is between 30 and 70 V.
The currents for each half module should be below 100 uA, for “healthy” modules. A change of 30-40 uA from nominal value indicates a loss in DAC settings (i.e. wrong bias voltage to the SiPM). Check the latest list of currents in the log-book for a comparison. Each day the HCAL currents should be written down. Some noisy modules are known and marked, which have currents above 100 uA.
If at any time during a run a current ¿30 uA above reference is observed reload immediately the DAC settings by executing: `r`unStart -t ahcDacScan
This will interrupt the current ongoing run which has then to be restarted.

It is very dangerous for SiPM to be for long time over-biased, therefore the currents should be often checked. Check also the time dependence of the current value on the slow control PC. Jumps to higher currents indicate losses of DAC setting and require immediate action (`r`unStart -t ahcDacScan).

If the current of one half module persists in being higher than reference also after reload try to identify the cause. Look in the online plot for the FE connected to this HV channel (see paragraph *Online display*). Check if the RMS of all channels is within specs. If only one or few channels exceed specs make a clear note in the log-book and continue to run. If more channels have RMS exceeding specs this can be an indication of VFE electronics problems. Each FE is divided into two halves corresponding to the two module halves powered by separate lines. Identify the half which has high current (HV channel #A = first half, HV channel #B = second half). If all 108 channels connected to this HV line are noisy (RMS above specs) there can be a problem on the HV line (check the loaded HV value is the correct one. Maybe try to decrease it by 0.1 or 0.2 V) The problem can also be in the VFE board. In this case you need an expert. If only 18 subsequent channels are noisy the problem is in one of the VFE chips which can be exchanged. This operation requires an access to the experimental area. See paragraph *Access to beam area*.

5 The HCAL slow control trouble shoot

6 Turn on the ECAL

7 Online display

8 In case of power glitch

9 Access to beam area