



Dual-Readout Calorimeter

- Dual-Readout Calorimeter(DRC) has been proposed both in FCC-ee & CEPC with the high energy resolution, which can **detect EM & hadronic particles**.
- Non-gaussian EM fluctuations make it difficult to measure energy of hadron shower.
- *f_EM* can be measured by two types of fibers with different h/e responses in the calorimeter.







Test Beam setting

Two prototypes of module

Test Beam at CERN

- Two prototypes of DRC was produced over a period of times.
- To test the performance of it, we had the **test beam at CERN**.
- It needed to construct our own **data acquisition(DAQ) system** for it.





Hardware

- Dual-Readout Calorimeter : 426 channels
- Ancillary detectors : 11 channels
- Our DAQ system should cover at least **437 channels**.
- We used 15 DAQ boards and 1 TCB board.

Software

Making all signals (from ancillary detectors and our module)
be in 400 ns time window gate.









Limit of data taking frequency

- We tested our DAQ boards to check proper frequency.
- It is concluded that **350 Hz is maximum** for data taking.
- We made data files for each DAQ board.





Time window

- We tested each sampling rate with 20 MHz sine wave.
- Sampling rate are not fixed in 0.625 and 0.3125 GHz.
- We prepared 200, 400, 800 ns time window, and used 400 ns for Test Beam.
- Setting proper time window is important for **timing resolution**.

	•	1.25 GHz / 1 s -> 1 Hz / 800 ps
		1 bin = 800 ps 800 ps X 1024 bin = 800 ns
	Wavefo	orm
3750 3700 3650 3600 3550 3450 3450 3450 3450 0	200 400	









Down	samp	ling	options
200011	oump	6	optionic

Time window

200 ns

400 ns

800 ns

1600 ns

3200 ns

Sampling rate

5 GHz

2.5 GHz

1.25 GHz

0.625 GHz

0.3125 GHz





Data mode

- Waveform mode
 - Save waveform data
 - Data size : 64 kB
 - Heavy and slow, but detail.
- We take data using both mode.
- Data size is based on 1 DAQ board (32 channels).



- Fast mode
 - Save integral and timing information.
 - Data size : 256 Byte
 - Light and fast.









Fast mode : Threshold (timing) data



DAQ Operation



Run DAQ system

- 1. **Set** every hardware equipment including ancillary detectors and module.
- 2. Turn on DAQ & TCB board.
- 3. **Operate** them on DAQ PC.
 - We set simple shell script on linux environment to operate it.
 - Shifters can easily set DAQ system just through typing configuration file name.
- 4. Promptly **monitor** the plot we need to check.

eoyun@eoy	un:~/TB/no	tice/test/TB_daq	/config\$ ls	
0ext400	43ped200	45ped400	46ext400pre1	46ext400pre32
0ped200	43ped400	46ext200	46ext400pre1024	46ext400pre4
0ped400	44ext200	46ext400	46ext400pre128	46ext400pre512
42ext200	44ext400	46ext400100gev	46ext400pre16	46ext400pre64
42ext400	44ped200	46ext400125gev	46ext400pre1fast40	46ext400pre8
42ped200	44ped400	46ext40030gev	46ext400pre1fast404095	46ped200
42ped400	45ext200	46ext40040gev	46ext400pre2	46ped400
43ext200	45ext400	46ext40060gev	46ext400pre2048	setup
43ext400	45ped200	46ext40080gev	46ext400pre256	

Configuration file lists

Total Waveform	Total Fast	Total Time
4,657,849 (evts)	23,248,704 (evts)	84h

Total amount of data for Test Beam

bash-3.2# ./run all.sh
/Users/drc dag/scratch/notice
run number is 337!!
Enter the set up config file : setup
setup
test
Info: open device: opening device Vendor ID = 0x547, Pr
Info: open device: super speed device opened (bus = 2,
mid 1 is found at ch1
mid 2 is found at ch2
DRAM is aligned, delay = 17, bitslip = 0
DRS PLL lock status = 15
DRAM is aligned, delay = 18, bitslip = 0
DRS PLL lock status = 15
Run number = 337
setting complete!
Enter the nevt : 10
1 2
processing 1 / 1 : mid num is 1
processing 2 / 1 : mid num is 2
readv!!

Data taking process



