Status of the CBM-TOF readout chain

J. Frühauf[1], N. Herrmann[2], I. Deppner[2], P.-A. Loizeau[2], C. Xiang[2,3], K. Wisniewski[2], M. Ciobanu[1], H. Flemming[1], H. Deppe[1], K. Koch[1], and S. Manz[4]

[1]GSI, Darmstadt, Germany; [2]Physikalisches Institut, Universität Heidelberg, Germany; [3]Institute of Particle Physics, Huazhong Normal University, China; [4]Kirchhoff-Institut für Physik, Heidelberg, Germany

The current CBM-TOF readout chain consists out of six different modules. A board with two preamplifier and discriminator ASICs [1] (FEET-PADI) with four channels each and a digitizer board with two event-driven TDC ASICs [2] (FEET-GET4) are used as front-end electronic. These ASICs are specially developed for the CBM-ToF detector. An adapter board (R2F-Board) is used as an interface between the readout controller and the front-end cards, and an FPGA based readout controller (ROC) transfers then the data to the data acquisition (DAQ) hosted on a computer. A very precise clock-generator [3] (CLOSY2) provides the two used system frequencies. There is a 250 MHz frequency for the ROC and in addition a phase-coupled 156.25 MHz frequency, which is needed by the TDC. A third signal is send out by the CLOSY2 for synchronization of the two provided clocks and to create epoch markers. A clock distribution is needed to spread out these three signals in a tree. This is realized by a 1:10 splitter for each CLOSY2 signal.

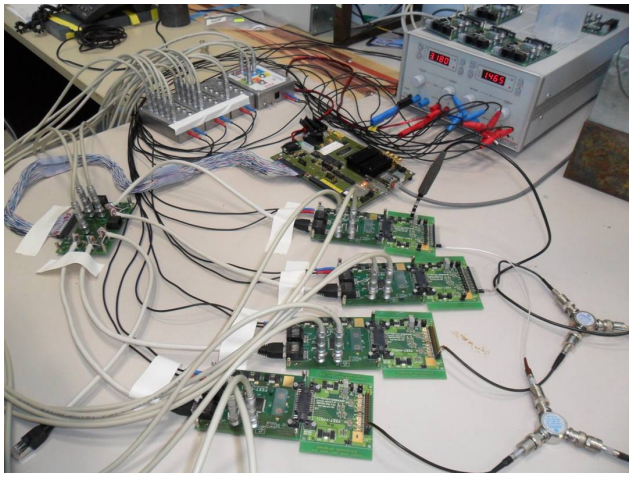

Figure 1: Readout Chain

The test setup in the laboratory is shown in Fig. 1. There are four FEET-PADI directly connected to the FEET-GET4. The same input pulse is used for all 32 channels. The signal is split into four and injected into the parallel input of the FEET-PADI board. There they are getting amplified and discriminated and are afterwards led into the FEET-GET4 to mark each rising and falling edge with a timestamp. With this setup it is possible to measure the time resolution of the complete readout chain. In order to characterize the system, the combined resolution of two channels is measured when they belong: a) to the same chip (chip-level) b) to 2 chips on the same pcb (pcb-level) and c) to 2 different pcbs (pcb-pcb-level). In Fig. 2 the resolution plot for the chip-level is shown. The results of the different time resolutions obtained by a Gaussian fit are listed in Table 1.

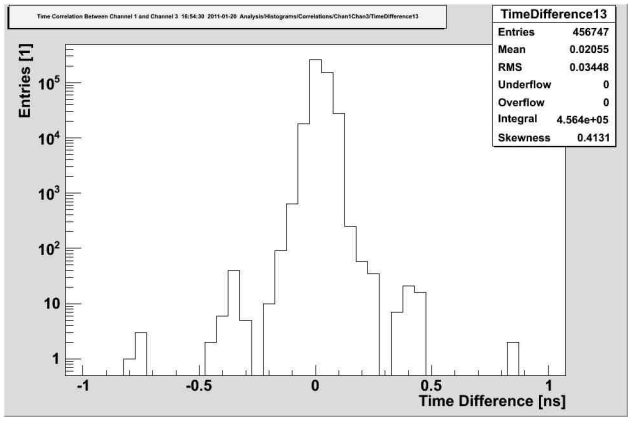

Figure 2: Resolution of the chip-level

Table 1: Resolution of the readout chain

	σ [ps]
chip level	36.94
PCB level	38.94
PCB-PCB level	40.22

This setup was used in a beam time to read out an RPC [4] with 16 strips (32 channels) and a reference system which consists of 8 photomultipliers. Preliminary results of the achieved data as well as the ongoing work on the analyzing tool for this system are presented in [5].

References

[1] M. Ciobanu *et al.*, IEEE-NSS, Dresden (2008), 2018

[2] H. Flemming and H. Deppe, IEEE-NSS, Orlando (2009), 1082

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[4] I. Deppner *et al.*, *Performance of a differential CBM-TOF-Demonstrator*, this report

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