Cosmic-ray and in-beam tests of 100 Ohm transmission line MGMSRPC prototype developed for the inner zone of CBM-TOF *

M. Petriş[1], *V. Aprodu*[1], *D. Bartoş*[1], *A. Bercuci*[1], *G. Caragheorgheopol*[1], *F. Constantin*[1], *V. Duţă*[1], *M. Petrovici*[1], *L. Prodan*[1], *A. Radu*[1], *L. Rădulescu*[1], *and V. Simion*[1]

[1]NIPNE, Bucharest, Romania

As a solution for the high granularity required for the most inner zones of the CBM-TOF, a new MGMSRPC prototype (called RPC2013), was designed and built. Constructive details of the tested prototype are presented in [1]. The strip structure of the readout and high voltage electrodes, (4.19 mm strip pitch with 2.16 mm width and 200 mm strip length) was decided based on APLAC simulations. The aim was to obtain a differential readout impedance as close as possible to 100 Ω in order to match the input impedance of the front-end electronics. The prototype is based on low resistivity ($\sim 10^{10}$ Ω·cm) glass plates in order to cope with the high values of the counting rate anticipated for the inner zone of the CBM-TOF wall. High counting rate tests performed with MGMSRPCs using low resistivity glass electrodes were already reported [2, 3].

The response of the new prototype was first tested with cosmic rays and radioactive sources in the detector laboratory of Hadron Physics Department from IFIN-HH. The prototype was operated at 2 x 5.5 kV high voltage with 95%$C_2F_4H_2$ + 5%SF_6 gas mixture. For this measurements the strip signals were processed by fast amplifiers/discriminators NINO chips [4], their differential output being converted by CAEN V1290A TDCs.

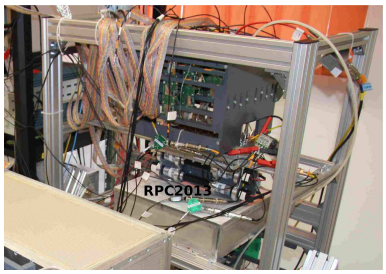

Figure 1: Cosmic ray experimental set-up.

The experimental setup used in the cosmic ray test is presented in Fig. 1. The position along the strips, triggered by the plastic scintillators positioned above the detector across the strips, is presented in the left side of Fig. 2 as a function of strip number. The right part of Fig. 2 shows the correlation between the position along the strip and position along the 10 cm length plastic scintillator, readout at both ends.

The in-beam tests of this prototype were performed in an in-beam test campaign of CBM-TOF Collaboration in October 2014 at GSI Darmstadt and at CERN-PS accelerator in November 2014, in an in-beam test campaign of different subsystems of CBM Collaboration. In the CERN in-beam

* Work supported by EU-FP7/HP3 Grant No 283286 and Romanian NASR/CAPACITATI-Modul III contract RO-FAIR F02 and NASR/NUCLEU Project PN09370103

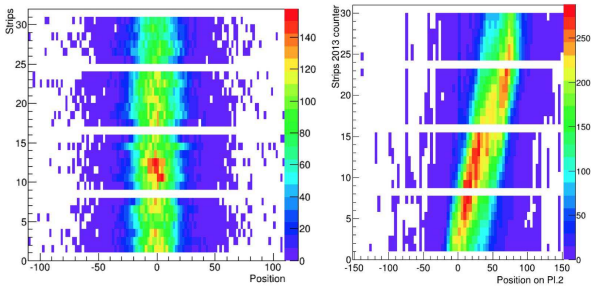

Figure 2: Cosmic-ray test: left side - position along the strip as a function of strip number; right side - correlation between position along the strips and position in the platic scintillator.

test the MGMSRPC signals were processed by the same electronic chain as in the cosmic ray test. As reference for time resolution estimation was used a plastic scintilator readout at both ends. Preliminary results show a time resolution of 52 ps using pure $C_2F_4H_2$ and of 61 ps using a gas mixture of 95%$C_2F_4H_2$ + 5%SF_6, after performing walk corrections and subtraction of the contribution of the reference counter. The October 2014 in-beam test was focused

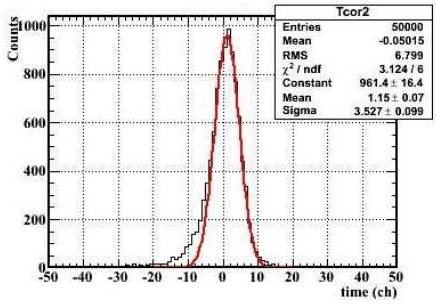

Figure 3: CERN in-beam test time spectrum using a gas mixture of 95%$C_2F_4H_2$ + 5%SF_6.

on the compatibility with the PADI8 new FEE, aiming to be used in the CBM-TOF wall. The MGMSRPC signals were converted by FPGA TDCs [5]. Data analysis is in progress.

References

[1] V. Aprodu et al., CBM Progress Report 2013, p.79

[2] M. Petrovici et al., JINST 7 (2012) P11003

[3] A. Bălăceanu et al., CBM Progress Report 2013, p. 78

[4] F. Anghinolfi et al., Nucl.Instr.and Meth. A533(2004)183

[5] J. Frühauf et al. CBM Progress Report 2012, p.71

DOI:10.15120/GR-2015-1-MU-NQM-CBM-50