

Test of the new preamplifier for the ALICE TRD

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One of the major components of the ALICE TRD front-end electronics is a charge sensitive preamplifier/shaper with differential outputs. A general description of this circuit can be found in [1]. In this report we briefly review results from the test of the new prototype chip and the method for measuring the input-output characteristics of this type of amplifiers. The outputs of the preamplifier are designed for high impedance load ($R=170\text{ k}\Omega$ and $C=7\text{ pF}$). Therefore we have used a test circuit, shown in Fig. 1. With this setup it is possible to measure directly output signals. Another advantage is that on the output of the buffer we measure only the differential noise of the preamplifier.

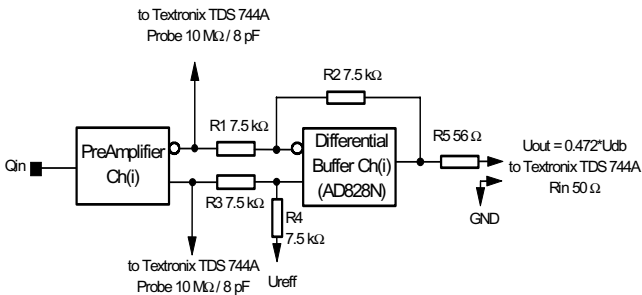


Figure 1: Test circuit

The layout requirement. The first requirement is a good solid ground plane. The length of the wire between GND-pin and ground plane should be kept as short as possible. This will minimize crosstalk and noise. The power supply pins should be bypassed close to the device to the nearby ground plane, therefore ground plane should cover as much of the board area around the preamplifier as possible. On the test-board the bypassing is done with a capacitance value of $1\text{ }\mu\text{F}$ and $0.1\text{ }\mu\text{F}$. Another requirement concerns to the routing of the input signals. The wires should be short with a minimum spacing between them of about $200\text{ }\mu\text{m}$ because each 1 pF parasitic capacitance between input wires gives $20\text{-}30\text{ mV}$ in amplitude of crosstalk signal.

For the test of the TRD preamplifier we use a PCB layout with two layers. The board includes 16-differential buffers (one per channel) and power supply sources with the possibility to change values. The operating voltage range is from 3.0 to 3.6 V . The *charges-generating circuit* is outside of the test board. The reason to use separate *charges-generating circuit* is to remove back-current of the pulse generator. The rise time of input pulses is 12 ns and the amplitude ranges 35 mV to 160 mV .

Measured characteristics. Fig. 2 shows the typical input-

output characteristic of the preamplifier. The typical conversion gain is 11.5 mV/fC with integral non-linearity of 1.39% . Dispersion of the gain between channels is about 5% , which depends on the type of common-bias circuit. Therefore in a new version of the preamplifier we will use a separate-bias network for each channel. Another advantage of changing the bias circuit is a decrease in the feedthrough between channels.

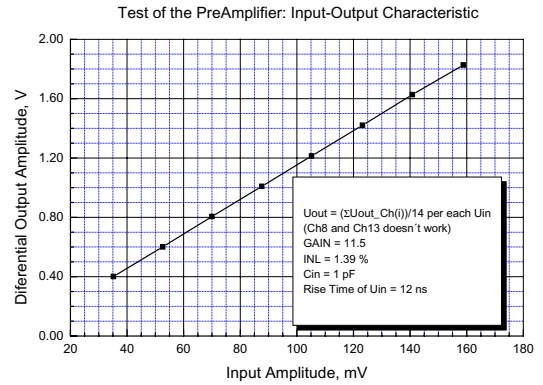


Figure 2: Input-Output Characteristic

One of the main characteristics of the preamplifier is noise. For its measurement we used a digital scope Tektronix TDS 744A. The noise is $1100e$ for 25 pF capacitance to GND (Fig. 3). The shaping time is 95 ns , the total power consumption is 10 mW per channel.

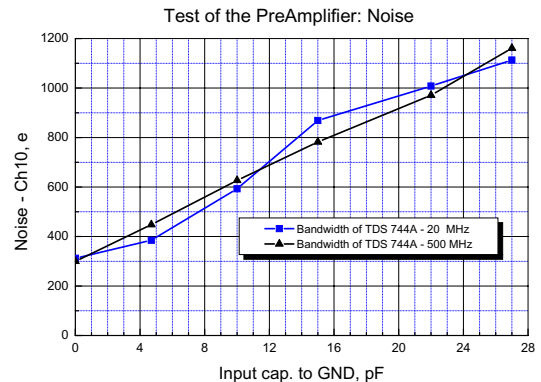


Figure 3: Noise

References

- [1] ALICE TRD Technical Design Report, CERN/LHCC, October 2001.