Offline tests of the AstroBoxII with 128 μm and 64 μm Micromegas

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Proton capture reactions X(p, γ)Y play an important role in stellar environments like X-ray bursts or novae [1-3]. Reactions like ^{22}Na(p, γ)^{23}Mg, ^{12}C(p,γ)^{13}N(β^+)^{13}C, ^{16}O(p, γ)^{17}F(β^+)^{17}O are particularly important in the novae explosions [1-3]. These reactions are characterized by the location and the strength of the resonances. Many of the important resonances lie just above proton separation threshold S_p these resonances can be studied by indirect methods such as β-decay. In this case, we populate the important states by means of β-decay. This will necessarily bring up the problem of dealing with β-background. The AstroBoxII was specially designed for this purpose and it allows a dramatic reduction of the β-background and opens up an opportunity to measure proton energies of just few keV [4] [6]. It is a newly build detector that is an improvement over the original AstroBox[5]. One of the key elements of the AstroBoxII is a Micromegas anode plate that has 29 pads located symmetrically along the beam direction. Above the Micromegas plate there is a set of wires, the gating grid (GG), that allows control of the transparency of the gas gap between the GG and the Micromegas. The wires themselves are split into two sets that can be biased independently. This gives a greater flexibility when controlling transparency of the GG. Also a big part of the upgrade of the detecting system was acquiring special switch that could be programmed to control gating grid (GG) voltage automatically. That would allow us to remotely control transparency of GG in certain intervals of time.

We have received two Micromegas detectors with β-mesh for testing purposes. First, we have installed a Micromegas with 128 μm amplification gap. Fig. 1 shows the results of one of our test which

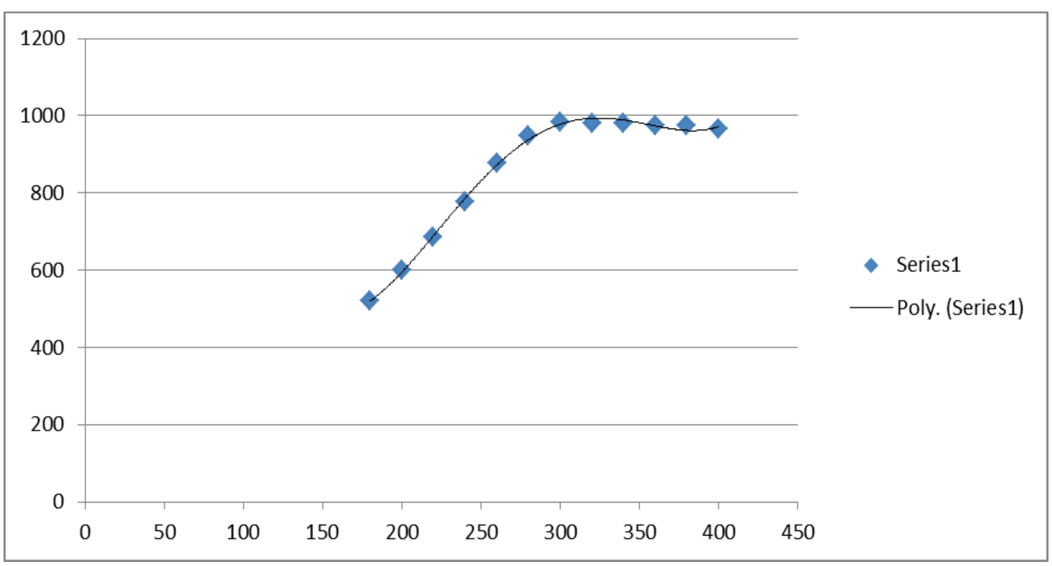

FIG. 1. This figure presents the position of the main peak (y-axis) vs the voltage on the GG (Gating Grid) in volts (x-axis). Experimental points (blue dots) approximated by polynomial fit.

we used for the optimization of the GG voltage. Also, we scanned all the pads to see the energy resolution which was in the order of 17-20% for different pads. For testing purposes, we placed the source of Fe-55 right below the C3 pad which corresponds to the center of the Micromegas where we normally want particles to be stopped. Energy spectrum in the C3 pad from a Fe-55 source can be seen in Fig. 2. This pad had a resolution 20%.

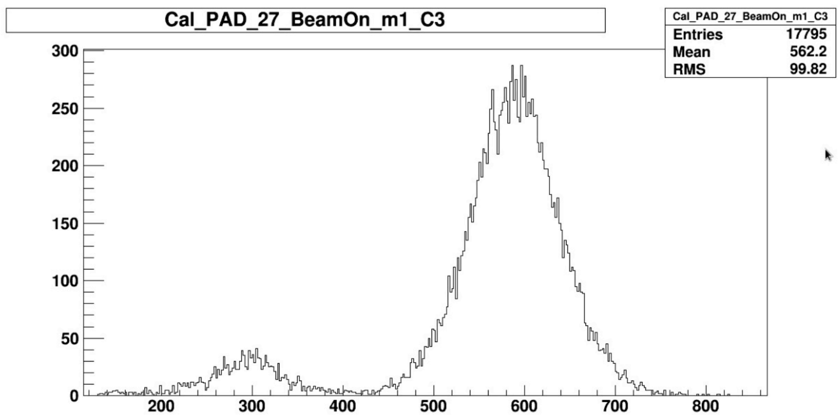

FIG. 2. Calibrated energy spectrum from the C3 pad of a Micromegas with 128 μm amplification gap. Calibrated energy on the x-axis (should be multiplied by factor of 10 to get "eV" units) vs number of counts on the y-axis. The peak from Fe-55 X-ray source (5899 keV) can be seen in the spectrum.

After that we ran a series of similar tests with a 64 μm Micromegas. It proved to be a little worse in terms of resolution. Fig. 3. shows the energy spectrum of the Fe-55 source recorded in the C3 central

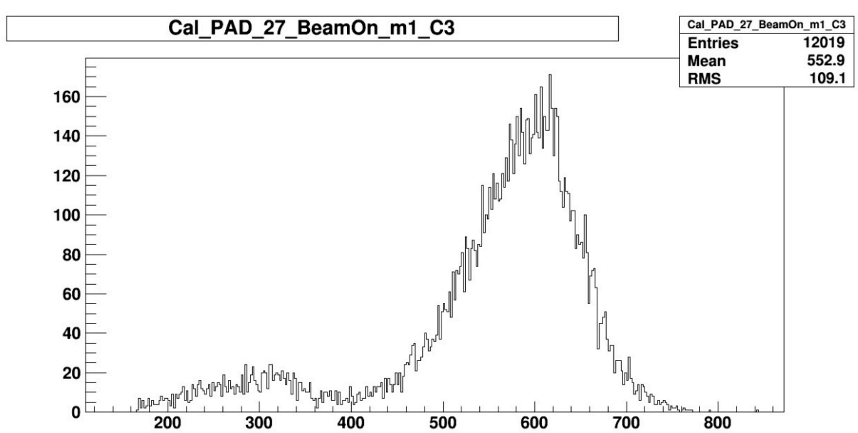

FIG. 3. Calibrated energy spectrum from the C3 pad of a Micromegas with 64 μm amplification gap. The same X-ray source Fe-55 was used. The shape of the main peak (5899 eV) is significantly deviated from a normal Gaussian distribution.

pad for the 64 μm Micromegas. This particular pad had a resolution roughly 23%. The shape of the main peak (5899 eV) is slightly deviated from a normal Gaussian.

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