Energy calibration of the COSY–11 spectator detector.

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In order to measure the production of mesons in quasi-free proton-neutron reactions, the COSY–11 facility has been extended by both a neutron– and a spectator detector. The scheme of the whole detection system can be found eg. in reference [1]. The energy calibration of the neutron calorimeter have been performed [2, 3] and here we report on the calibration of the spectator detector. A schematic view of the spectator detector arrangement is presented in figure 1. This arrangement consists of four double–layered detector elements, each one containing eighteen silicon pads in the front layer (which is the plane closer to the beam) and six pads in the back layer. The active area of each single pad in the front layer amounts to 20 $mm * 5\ mm$, whereas those in the back layers are equal to 20 $mm * 18\ mm$. The tickness of each of the silicon detectors is 300 μm.

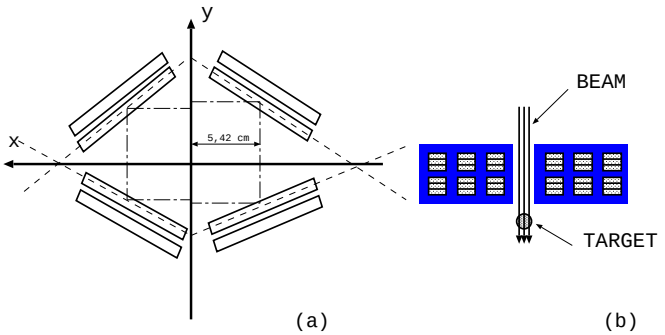

Fig. 1: Spectator detector– a schematic view.

During the experiment we measure the charge of the signal induced in the detector by the traversing particles. This charge is proportional to the energy deposited by the particle in the detection unit.

The aim of the work reported here was to established the proportionality constants for each of the 96 detection modules. For this purpose we compare the experimentally determined dependence between the energy loss in the two detection layers with the values of energy loss tables [4]. Protons, having a kinetic energy smaller than 6 MeV are absorbed in the first layer and for those with higher energies we expect a dependence between the energy deposited in the first (dE_1) and the second layer (dE_2) as shown in figure 2. Denoting by α and β the calibration constants of the two adjacent modules in the first and the second layer, respectively, we may write that $dE_1 = \alpha * ADC_1$ and $dE_2 = \beta * ADC_2$, where ADC is the charge of the measured signal and dE denotes the real energy loss. The data points on the $dE_1(dE_2)$ plot (see figure 3) were fitted to the expected $dE_1(dE_2)$ function with α and β as free parameters for each considered detection pair.

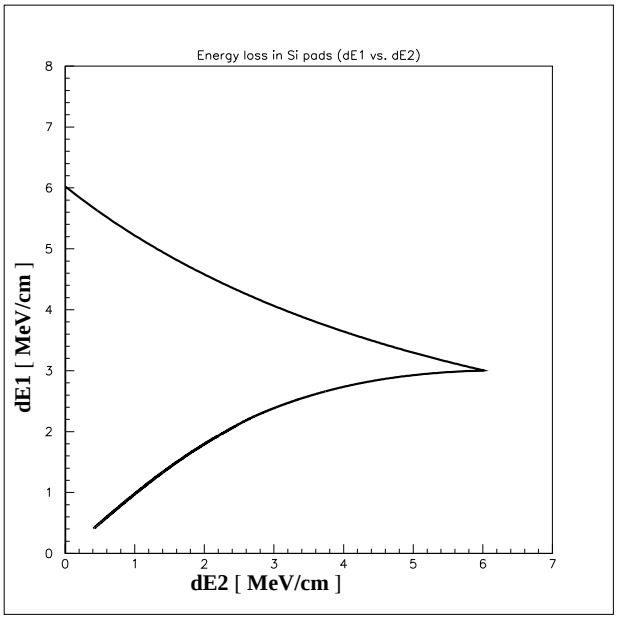

Fig. 2: Energy losses in the first– versus the one in the second layer according to energy loss tables [4].

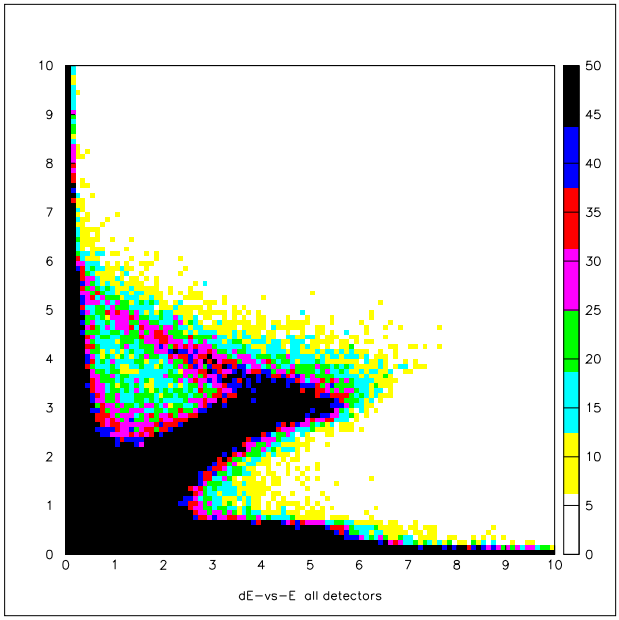

Fig. 3: Energy losses in the first layer versus the second layer as measured at COSY–11 with a deuteron target and a proton beam with momentum of 2.075 GeV/c

References:

[1] P. Moskal, e-Print Archive: nucl-ex **0110001.**
[2] M. Janusz et al., IKP, FZ-Jülich, Ann. Rep. 2002.
[3] T. Rożek et al., IKP, FZ-Jülich, Ann. Rep. 2002.
[4] Atomic data and Nuclear Data Tables **27** (1982) 147-339.

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