Microstrip Gas Counter for the Q3D Focal Plane ◇

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The prototype of a new focal plane detector using a microstrip structure directly evaporated on scintillating glass [1–3] was significantly improved during the last year. The main problem, the insufficient collection of the light output of the scintillating glass, which gives the energy-rest signal needed for particle identification, was solved. The use of an additional wavelength shifter was avoided by putting a 3-inch photomultiplier with a short waveguide directly behind the glass, as proposed in fig. 3 of ref. [3].

The detector was tested with the ^{128}Te(d,p)^{129}Te reaction at a deuteron energy of 24 MeV. Figure 1 shows the measured position (energy) spectrum with the ground state and the first two excited states of ^{129}Te. Due to a better alignment of the detector in the focal plane compared to the situation in the last run [3] a full width at half maximum of 9 keV was achieved.

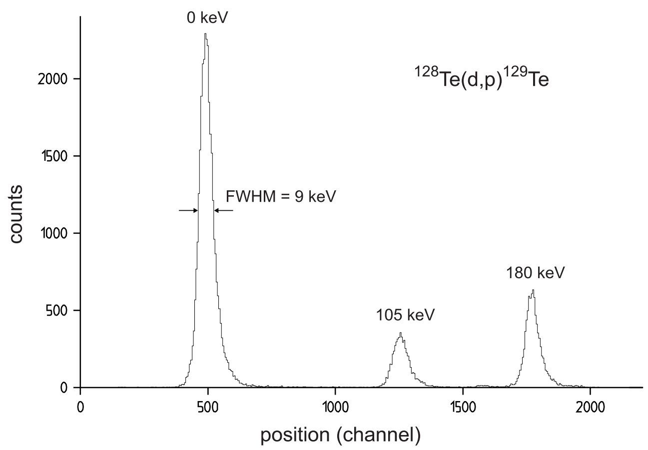

Fig. 1: Position spectrum of the ^{128}Te(d,p)^{129}Te reaction at 20° with 24 MeV deuterons and 28 MeV protons.

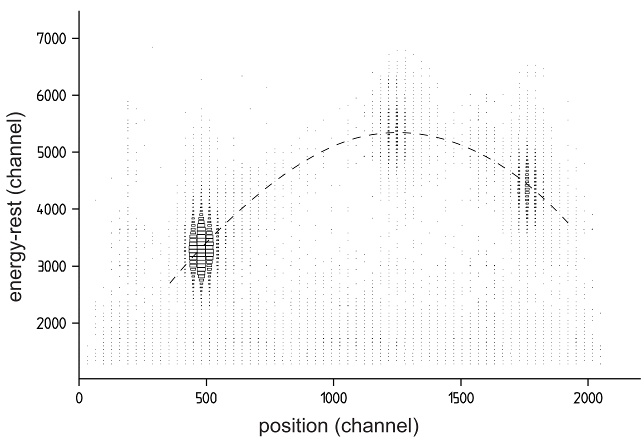

Fig. 2: Energy-rest vs. position spectrum. The dashed line is explained in the text.

Figure 2 shows, that the light or energy-rest signal is well separated from background. The dashed line follows an appropriate calibration that could be made for the signal. The shape only reflects the better collection of light created by particles stopped in the center of the glass, close to the PM, than of those stopped near the edges, which suffers from the conical shape of the waveguide. The weak line at position channel 1600, also seen in fig. 1, is the ground state of ^{131}Te.

For particle identification not only an energy-rest signal but also an energy-loss signal is needed. In this case we use the integrated charge deposit on the anodes for every single event, which is proportional to the energy-loss of the incoming particles in the gas. From the last tests we learned that the signal produced in argon-methane (90 % Ar, 10 % CH_4) was too low. So in the present run a mixture of argon and isobutane (approx. 15 % C_4H_{10}) was used. Figure 3 shows the good particle identification that was possible. In the projection of the energy-loss (left side) only one peak is seen. The three peaks in the projection of the energy-rest signal are due to the position dependence of the light collection. The dashed ellipse in Fig. 3 marks all proton events. These are collected in the position spectrum (fig. 1) which is background free.

Consequently the very important particle identification is well working. The energy resolution of 9 keV is still unsatisfactory and has to be improved.

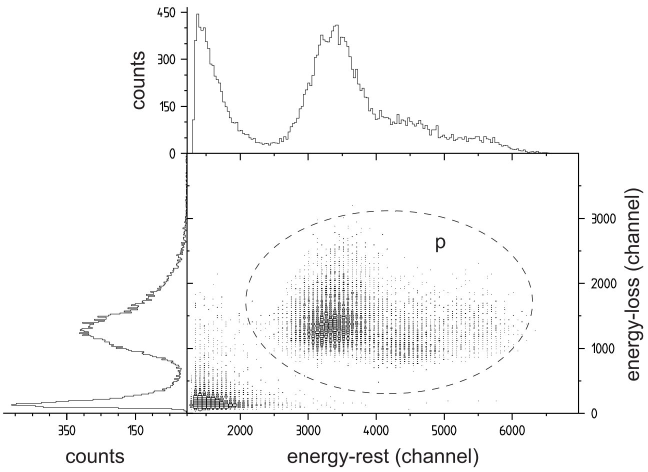

Fig. 3: Energy-loss vs. energy-rest spectrum. The dashed ellipse marks the protons from the (d,p) reaction.

References

[1] W. Schauer, Ph.D. thesis, TU München, 1997
[2] W. Schauer, T. von Egidy, R. Georgii, and J. Ott, Jahresbericht 1993, p. 209
[3] H.-F. Wirth, T. von Egidy, W. Schauer, H. Angerer, B. Ketzer, J. Ott, and R. Schmidt, Jahresbericht 1997, p. 90

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