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Construction and Behaviour of a Miniature Drift Chamber

H. Wirth, W. Eyrich, A. Hofmann, B. Mühldorfer,
H.-W. Ortner and H. Schlösser
(Physikalisches Institut der Universität Erlangen)

A miniature drift chamber (MDC) with an active area of 25 mm x 16 mm and a thickness of 6 mm has been constructed, using a simple design and low cost materials. The MDC is working without additional field wires or electrodes. It is operated with isobutane at low pressure (140 mbar). The spatial resolution is $\lesssim$ 300 µm.
The MDC has been used as a spatial sensitive transmission detector, together with a solid state E/ΔE telescope to study the angular distribution of the reaction ^{90}Zr (Li, Li'). Thereby a region of ca. 4.5° could be measured simultaneously, allowing an angular resulotion better than 0.2°.

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Test of a full scale sector for a 1 m long high resolution vertex chamber

V. Commichau, M. Deutschmann, K.J. Draheim, U. Geßner,
K. Hangarter, P. Hawelka, U. Herten, B. Krause, S. Masson,
J. Schug, M. Tonutti
(III. Physikalisches Institut der RWTH Aachen)

We have tested a 1 m long prototype sector consisting of 170 rectangular drift cells. The sector is arranged in 25 radial layers, of which the 13 inner ones have cell sizes of 10 x 15 mm² and the 12 outer ones of 14 x 21 mm². To measure the coordinates of a track along the wire the 13 axial layers are interleaved with 12 stereo layers. Special care was taken to keep cell sizes as homogeneous as possible to obtain the same space vs. drift-time relation for all layers of the same cell size.

A low diffusion gas mixture of 85% CO_2 plus 15% isobutane was used in a closed loop gas system, including a purifier, run at an absolute pressure of 1 and of 2 bar and stabilized within a few mbars by a microprocessor system.

The chamber signals were read-out, alternatively, with TDC's and with flash ADC's. We acchieved space resolutions of 35 µm per cell at atmospheric pressure and of 25 µm per cell at 2 bar pressure within the central part of the drift length. These figures correspond to axial resolutions of .5 to 1 mm per stereo layer.

The influence of an axial magnetic field on the space resolution will be discussed as well as the problem of absolute calibration of a chamber of this given size.