# An Improved Gas Mixture for the Side-Detector Wire Chambers at ANKE

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In an attempt to make the operation of wire chambers of the ANKE side detector more stable we have made investigations which aim at the improvement of the gas mixture. Multiwire proportional chambers have to be filled with a proper gas mixture which guarantees sufficient gas amplification, fast response of the chamber and stability against high-voltage break downs. Furthermore, possible ageing effect define additional boundary conditions for chambers operated in an high-rate environment.

For the ANKE side detector large multi-wire proportional chambers have been built at Forschungszentrum Rossendorf. Usually they are continously flushed with the standard gas mixture of 70% Ar and 30% $CO_2$ at a total flow rate of 200 ml/minute. The advantage of this gas is that there are no ageing effects. However, in particular at instantaneous high counting rates under beam conditions there is a strong tendency for high-voltage break downs during which sometimes wires break resulting in a short curcuit and failure of the chamber.

We have added to the standard gas mixture in various quantities isobutane or let a fraction of the gas flow through liquid pentane or hexane in order to investigate their quenching properties. When the chamber is irradiated with Sr-90 β-particles the total current increases to a good approximation exponentially due the increase of the gas multiplication. In Fig. 1. the current is normalized to the current measured with the standard gas mixture and it is presented as a function of the operating voltage. When allowing part of the gas to flow through liquid hexane then the current increases already at low concentrations. This increase in the gas amplification is probably due to the Penning effect in which excited Ar atoms deexcite in collisions with Hexane molecules thereby releasing electrons. Hexane in larger concentrations absorbs photons more efficiently thus reducing the current which is due to photoelectrons.

Similar but less pronounced effects are observed with pentane and i-butane admixtures to the gas. The backbending effect towards the highest voltage and the increase of the gas amplification at intermediate voltage is strongest for hexane. Both effects are desirable since they allow operation of the chamber at reduced voltage and limit the current at high ionization density. Therefore hexane is considered to be the best admixture to our standard gas. A gas mixture with 70 ml/min. out of the total gas flow of 200 ml/min. passing through liquid hexane is chosen as the optimum. This corresponds to a flow of gaseous hexane of 11 ml/min.

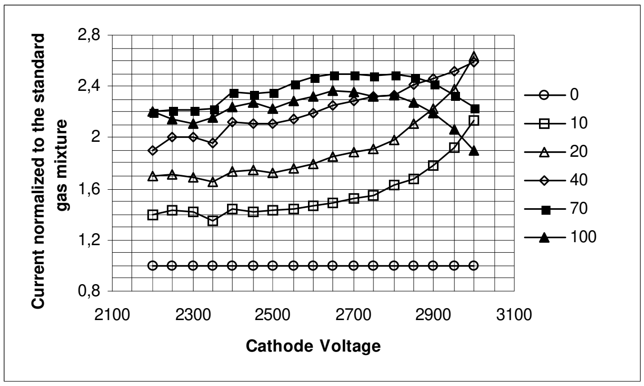
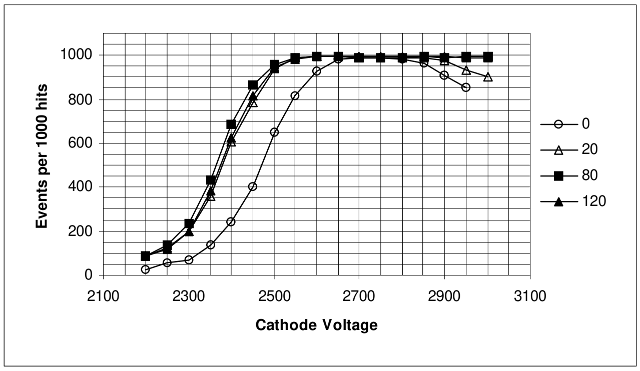



Fig. 1 : The current flowing through the wire chamber under irradiation with a Sr-90 source. The base gas mixture is 140 ml/min. Argon and 60 ml/min. $CO_2$. The gas flow which passes through liquid hexane is given in the legend. The current is given in units of the current which is measured with the standard gas mixture.

The effect of the gas composition on the detection efficiency is examined for a similar chamber, see Fig. 2. This chamber is smaller and it is equipped with 20 µm anode wires instead of 25 µm like the chamber mentioned before. Already small admixtures of hexane shift the characteristics to lower voltages. For the standard gas the efficiency decreases seemingly near the end of the plateau. This effect is due to events with several clusters of wires firing upon the passage of a single particle. The corresponding events are rejected during the data analysis since no unambigous assignment of the hit position is possible. The reason for the phenomenon are afterpulses due to electrons released by photons. Hexane reduces this




effect by absorbing photons in the ultraviolet region.

Fig. 2 : The detection efficiency of the small ANKE side-detector wire chambers. The standard gas mixture with a total flow of 200 ml/min. is used while the flow given in the legend is bypassed through liquid hexane.

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