MICROSTRIP GAS DETECTORS

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The LLB is currently developing micro-strip gas counters (MSGC) based on the charge division principle. These detectors are suitable for small area 200x100mm², good spatial resolution (< 2mm) neutron detection. They allow to avoid the possible mechanical problems related to wire grid detectors by replacing the wires with anode and cathode metal stripes deposited on a glass substrate.

A MSGC consist of a gap filled with high pressure ^{3}He gas (up to 10 bars) to capture the neutrons and create an electrical charge. A high electrical field (~1000 V/m) The charge amplification is performed by a high electrical field between anodes and cathodes amplifies the charge (gain of 10^4). This electrical charge is split in two by a resistive line. The position of the neutron is determined by measuring the charge ratio between the two ends of the resistive line (see figure 1). The charge division design has been chosen because of the very low cost of the associated electronics (the number of charge amplifiers is limited to 3.)

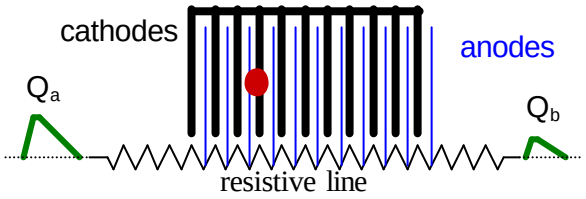

Figure 1 : charge division principle. The electrical charge created by the neutron are amplified and collected on both sides of a resistive line Q_a and Q_b. The neutron position is calculated by $Q_a/(Q_a+Q_b)$.

The gamma discrimination is performed by measuring the total electrical charge collected on the cathodes.

At the moment, the larger size available is 200x100mm². It is limited by the fabrication and the capacitance of the micro-strip glass plate itself. A 2D position detection can be achieved by using two perpendicular sets of stripes (on the front and on the back of the glass substrates).

Ultra High Vacuum techniques have been used for the design of the detectors casings (see fig. 2) in order to maintain the purity of the detection gas. This is essential to prevent any deterioration of the metallic anodes stripes and to avoid parasitic signals.

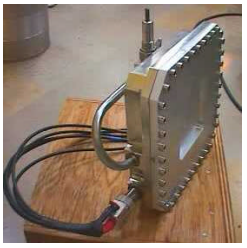

Figure 2 : 100x100 mm² MSGC detector

The electronics is composed of a compact electronic chain including the charge amplification and the charge division calculation, a conversion board with two 12 bits ADC converters, an interface board to communicate with the standard LLB EuroPSD and EuroScaler counting boards.

The speed of the electronics counting rate is limited at 5MHz, but the actual limitation is given by the detector itself (due to the resistance of the charge division line.)

These MSGC can achieve a 1.5-2 mm spatial resolution (see Figure 3). The background noise is 30 counts/min on a 100x200mm² detector.

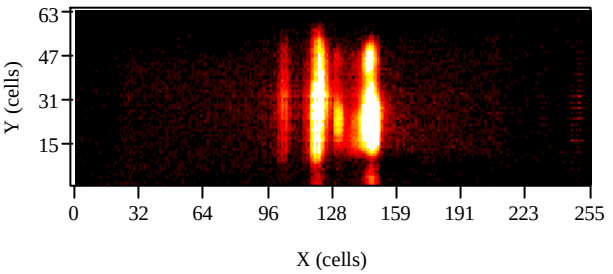

Figure 3 : picture of the reflectivity measured on a grating (right, direct beam ; left reflected beams).

This year, the spectrometer 7C2 (designed for the study of liquids and disordered systems) will be equipped with a set of 10 new MSGC (200x100mm²). The resolution of each individual detector is 2 mm in the horizontal direction and 5 mm in the vertical direction. The wavelength of this spectrometer is 0.05 nm. The ^{3}He pressure in each detector is 15 bars and allows a detection efficiency of 85%.

Acknowledgement
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