POSITION SENSITIVE GAS COUNTERS FOR X-RAY DETECTION

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Position sensitive gas counters for X-ray detection under development at our laboratory include : (1) a one-dimensional multiwire detector with a delay-line readout employing commercial lines ; (2) a drift-chamber coupled to a single-wire proportional counter with a helical delay-line readout; (3) a two-dimensional multiwire detector with commercial delay-line readout; and (4) a one-dimensional multiwire detector employing the centre-of-gravity readout method .

Position sensing by the delay-line method or by the centre-of-gravity method should allow for a high position accuracy and for the possibility of operation at high counting rates[1,2] . With the delay-line method it should be possible to operate at counting rates of up to 10^5 counts per second, using conventional time-measuring electronics[3]. With the centre-of-gravity method better position resolution at higher counting rates should be feasible, but appropriate electronics and data acquisition systems are necessary. For this purpose, a CAMAC-based data acquisition system appropriate for high counting rate experiments and for two-coordinate determination has been setup.

Tests with a 15cm long multiwire delay-line detector (type 1 above) operating with a mixture of Ar (90%) and CH_4 (10%) at 710 Torr, resulted in an energy resolution of 17% for the 5.9 keV line from ^{55}Fe,as shown in Fig. 1.

Fig. 2 shows position spectra obtained in the measurement of the point spread function and the linear response function of the detector. A resolution of 270μm for a slit image of 185μm width at the anode plane, with an integral non-linearity of 0.08% was obtained. Also, the homogeneity was measured by

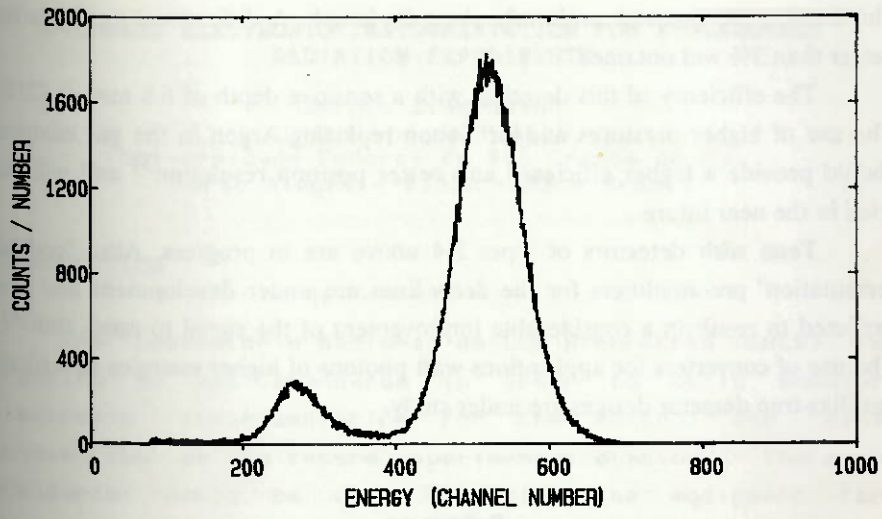

Fig. 1. Energy spectrum for the 5,9 keV X-ray line from ^{55}Fe showing an energy resolution of 17%. The small peak corresponds to the escape peak of Argon.

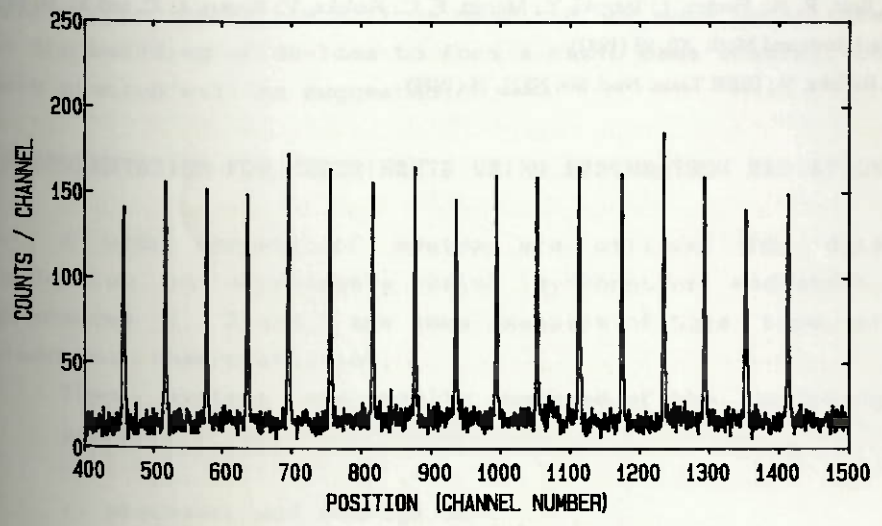

Fig. 2. Position spectra obtained moving a collimated X-ray source along the detector. The distance between peaks is 5mm.

illuminating the detector uniformly along its length. A differential nonlinearity better than 3% was obtained.

The efficiency of this detector, with a sensitive depth of 6.8 mm, is 22%. The use of higher pressures and/or Xenon replacing Argon in the gas mixture should provide a higher efficiency and better position resolution[3] and will be tried in the near future .

Tests with detectors of types 2-4 above are in progress. Also, "cooled termination" pre-amplifiers for the delay-lines are under development and are expected to result in a considerable improvement of the signal to noise ratio[4]. The use of converters for applications with photons of higher energies as well as parallax-free detector designs are under study.

References

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STANDARD ELECTRONIC INSTRUMENTATION FOR SYNCHROTRON RADIATION EXPERIMENTS

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INTRODUCTION

The Laboratório Nacional de Luz Síncrotron (LNLS) is planning to set standards in order to build modular electronic instrumentation for the control and data acquisition of its future experimental stations. The same standards could be used to build the equipment for controlling the synchrotron machine. The LNLS plans to develop these devices in order to facilitate the configuration of the different experiments. The instrumentation commonly employed in data acquisition using synchrotron radiation will be examined and some guidelines to the building of devices to form a basic data acquisition work station will be suggested.

INSTRUMENTATION FOR EXPERIMENTS USING SYNCHROTRON RADIATION

A wide variety of systems are utilized for data collection in experiments using synchrotron radiation. References 1, 2 and 3 are some examples of this type of electronic instrumentation.

These systems are usually composed of the following units:

- processor and storage unit
- data system bus
- link to main computer