16.2–11 INSTRUMENTATION AND TECHNIQUES FOR EXPERIMENTAL PHASE DETERMINATION.

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Experimental procedures for the determination of invariant phases of x-ray reflections are based on the analysis of the distribution of n-beam diffraction intensities immediately adjacent to n-beam interaction maxima. One of the authors (J.L.) has recently completed construction of a novel, computer controlled, biaxial single crystal diffractometer for such diffraction experiments. The biaxial diffractometer provides for precise control and measurement of crystal settings and is used in conjunction with a highly collimated monochromatic incident x-ray optical system. The new apparatus has been used, with considerable success, for the determination of large numbers of invariant phases of perfect and mosaic crystals, including germanium, lead molybate, zinc tungstate and sulfamic acid. Examples of phases determined for each of the above will be shown and compared with the known phases of the specimen crystals. The advantages of the new instrumentation over previously described experimental arrangement will be discussed.

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16.3–1 A HIGH-COUNT RATE AREA DETECTOR WITH MULTIPLE DELAY-LINE READOUT FOR X-RAY CRYSTALLOGRAPHY.

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A fast area detector system has been designed for crystallographic and small-angle data collection at synchrotron light sources. The detector uses a multiwire proportional chamber with a 184x192 mm sensitive area. The Y-coordinate of the avalanche is determined from the anode signal by a priority encoder (Jeavons, A.P. et al., IEEE Trans. Nucl. Sci. (1976) NS-23, 1, 259), while the X-coordinate is found from the cathode signal by fifteen independent delay-line encoders. Each encoder uses a 200 ns delay line and accepts amplified signals from eight cathodes to determine the local X-coordinate by time measurement in a variable-frequency time-to-digital converter. The configuration of the delay-line encoders is such that eight encoders cover all the 64 cathodes, of which central 56 cathodes are covered doubly by other seven encoders. The adjustment of the readout electronics is fully computerized to give a uniform response over the sensitive area in a short time. The detector is followed by a high-speed data collection system using a 16K-word 4-way interleaving memory accessed by a MELCOM 70/60 computer. The digital partioning scheme is such that a memory channel corresponds to 2x2 mm on the detector surface. The whole system can collect two dimensional X-ray data at count rates higher than 1 MHz.

16.3–2 CHARGE INTEGRATING POSITION-SENSITIVE PROPORTIONAL CHAMBER.

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A position-sensitive detector system for high intensity X-ray diffraction experiments has been developed. It consists of a charge integrating type gas-filled detector, multi-channel analog multiplexers, a signal processor and memory (120 ch x 128 phases x 24 bits)(Hasegawa IEEE Trans. on Nucl. Sci. (1981) NS-28, 3660 and Mochiki Adv. in X-ray Analysis, (1981) Vol. 24, 155). The detector is 60 mm long in effective length by 5 mm x 15 mm in crossection with three 20 μm^{ϕ} anodes. The cathode consists of 120 strips with a spacing of 0.5 mm. Ions produced by gas multiplication are collected by strip cathodes and accumulated in external capacitors connected to each strip and sequentialy transferred to a charge-sensitive amplifier through analog multiplexer channels. As the output amplitude of the amplifier is proportional to the amount of the accumulated charges in each capacitor, a train of 128 pulses from the amplifier shows the X-ray intensity profile. The gas gain is adjustable according to the X-ray intensity so as not to occur gas gain shift, thus the maximum intensity more than 10^8 photons/sec/strip with low applied voltage and the minimum intensity about 100 photons/sec/strip with high applied voltage can be achieved. The time resolution of the system depends on the period of charge transfer, that is, the interval of pulse trains and can be minimized to 1 msec. The spatial resolution is almost equal to the pitch of the cathode strips.
This system was applied to time-resolved X-ray diffraction study on frog muscle using synchrotron radiation sources and we could collect diffraction patterns with time resolution of 2 msec and 30 times stimulations.

16.5–1 UPGRADE OF THE CONTROL HARDWARE AND COMPUTER SOFTWARE OF AN X-RAY POWDER DIFFRACTOMETER.

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In an industrial research laboratory such as that at AECI, where many costly instrumental techniques are used, the upgrade of an existing X-ray powder diffractometer remains an attractive alternative to the purchase of a new system. The growth path associated with such an exercise, and the flexibility to alter the scope of the instrument according to a particular research activity are some of the aspects to be covered. The simplicity of the control hardware configuration will be highlighted, as well as a novel design for computer software control routines. Basic powder diffraction requirements including diffraction pattern deconvolution are accomplished by a standard software approach.

The significance of a multi-user, multi-task computer operating system will be illustrated with respect to an inter-computer, inter-laboratory network that accesses the Johnson-Vand library search-match program on a central VAX 11/730 installation.