IRE Model Paper

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WIRE CHAMBER--COMPUTER SYSTEM

MASTER

J. Bounin, R. Miller, M. Neumann, J. Sarma and H. Sherrard
The University of Chicago
Chicago, Illinois

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M. Neumann and H. Sherrard¹ reported the development of a wire spark chamber experiment toward receiving digitized spark information. Since late 1962 our effort has been directed toward a wire-chamber with a core memory, using standard ferrite cores, and toward an on-line operation between spark chamber and computer.

Figure 1 shows the wire chamber-core memory unit, which a read current drive-board gets plugged into. The parameters of the chamber are: 24 wires/inch; 256 wires per chamber-plane; gap-width 1/4 inch; 4 mil aluminum or stainless steel wire. Each wire is threaded through a memory core; a core gets "set" by the spark current in that wire and during the scanning procedure all cores get "reset".

A more detailed view of the core memory is given in Figure 2. The 256 cores are organized into 8 groups of 32, constituting eight 32-bit words. Word address and bit pattern together will then give the wire location. The 32 cores of a word get read out at a time, hence 32 parallel sense lines. The sense lines of different spark chamber boards are connected in parallel by means of diode buffering.

is about 500 feet long.

The spark will write into the core memory and initialize the read out through the scanning system, during which time further sparking is inhibited. After each transmission of a data word to the computer the scanning system waits for a "ready" signal before transmitting the next word. Together with the information a control bit gets sent. The scanning system will enable the spark chamber and release the computer after completing the read out. Figure 5 shows more details of the scanning system.³ A nine-bit binary counter addresses the memory words. The lower three bits are used to select and trigger the 8 current drivers of a memory board. The next five bits determine the gated board, and the last bit is for detecting the end of scanning. The 32-bit of a word gets read into a register.

In order to reduce the incoming data as much as possible the scanning system does not transmit "zero-words" to the computer, this means words that do not contain any information. Assuming that there are one or two sparks in the gap, it is likely that seven or six words yield no data. The data reduction may therefore be as high as 1:8. The 32-input-as-gate detects the

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The read current for each word comes from an attached Shockley driver, see Figure 3. Eight such drivers are needed per memory-board; the common bus connects to a gating transistor. Only the trigger pulse to a gate-selected driver will result in a read current.

The block diagram of a scanning system, capable of handling 32 memory boards, i. e. 32 chamber decks, is shown in Figure 4. The computer and the scanning system remain two rather independent machines; the computer deals with the scanning system as with other peripheral equipment; the scanning system handles the computer as multiple storage device which may do some computation with the received information or just transfer the data onto tapes or drums.

A 60 coax-cable link² was installed between the proton and meson rooms of the Chicago cyclotron and the Maniac III computer of the Institute for Computer Research. The cable run

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Because the computer does not keep track of the data addresses, one has to give the address of all transmitted words, requiring another eight data channels. The extra 8 bits of the 48 channels are not used under the present arrangement. The scanning system has a 10 MC cyclor. Eight steps are needed to read and transmit one word. The total scanning time for the maximum capacity of 32 gaps is about 256 microsec. This will allow the spark chamber to run at frequencies up to 3 or 4 KC.

Performance data will be published elsewhere.

At present, we are starting production on chambers for physics experiments. Test chambers have been run with cosmic rays and with mesons at the cyclotron.

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Decision-Making Chambers: A special wire and core chamber has been built and tested by Sherwood Parker and Charles Rey. It will be part of the decision-making counter system for controlling the firing of a conventional spark chamber.

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References

1. Mr. Neumann and H. Sherrard, IRE Transactions on Nuclear Science, NS-9-5, 51-54 (1962); NS-9-3, 295-300 (1962).

2. J. Bounin and R. Miller, Nuclear Instruments and Methods 24, 408 (1963).

3. The scanning system was assembled by the Digital Equipment Corporation.

WIRE CHAMBER FOR VERY FAST DECISIONS

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