6.6 INSTRUMENTATION FOR THE ANL 12-FT HYDROGEN BUBBLE CHAMBER*

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In most respects our approach to the instrumentation of the Argonne 12-ft bubble chamber is quite conventional. We have attempted to follow a straightforward approach wherever possible, carefully avoiding the temptations and pitfalls of doing something tricky or state-of-the-artish for the sake of our own self edification. However, we are using several techniques, which, although new in their application to bubble chambers, are in no way state-of-the-artish.

Figure 1 shows the general layout of the control room with respect to the bubble chamber area. The dimensions of the room are 30 x 40 ft, allowing adequate service space behind the racks and a small service area in one corner of the room. A network of cable troughts recessed into the concrete floor of the control room provides some flexibility in the placement of the racks and the console. This room is separated from the bubble chamber area by a blast wall designed to withstand an overpressure of 1-1/2 lbs/in^2. There are no direct access doors between the room and the chamber area. A 3-ft x 3-ft blast window will allow limited visual observation of the chamber area. Communication facilities in the control room include several closed circuit TV monitors viewing the chamber, expansion pit, and compressor room. Operation of the hydrogen and helium liquefiers is done from a separate area in the compressor building.

We intend to include a small computer in the control room to serve principally as an automatic data logging system. The machine will be in the DDP-416, PDP-8, or similar class. This system will be used mainly to provide a reliable, periodic log of significant parameters, and record alarms as indicated on the main alarm panels. It will also be used for analogue to digital conversion of the pressure pulse in the chamber and the chamber static pressure and VPT pressure for the data box presentation. No closed loop control is anticipated at this time, but, like most other groups, we do not exclude the possibility in the remote future. The system will incorporate a fast line printer to eliminate stacking problems should several alarms arrive in a short time interval. By operator request, the logger will record any subset of parameters. The purchase request has been filed for this equipment and we expect to place an order in the very near future.

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Because of the logging equipment, we have endeavored to transmit signals to the control room electrically unless other considerations require otherwise. Thus, many indicators in the control room are electrical meters following transducers in local equipment. We have chosen to use potentiometric pressure transducers for static and quasi-static pressures after evaluating several types. Excitation of these transducers fulfills "intrinsically safe" requirements for added safety.

An important responsibility of bubble chamber instrumentation is to present pertinent data on the film in formats convenient to as many users of the film as possible. Figure 2 illustrates our planned film format, identical in each of the four views with exception of a view indicator. Decimal presentations consist of the magnet shunt voltage, frame number, view number, and roll number. Data such as chamber conditions, beam counts, date-time, plus the decimal data is presented in this 12 x 16 bit matrix of BCD coded integers. During multiple pulse operation, this data box information must expose the film within 30 milliseconds, the time during which film is stationary in the magazines. We considered several methods of illumination and decided to use pulsed incandescent lamps, both in the data box and segmented readouts. Segmented readouts lend themselves well to convenient handling by automatic readers. This feature provides a redundant check on these important parameters in the BCD matrix. We have pulsed some lamps for as long as 6 million pulses without bulb failure. The actual data box measures roughly 5 x 7 inches, requiring a rather high density of bulbs. Exposure of the microfile film to be used appears possible from either the emulsion side or the base side of the film.

The square area will serve as a locating base for the data box information and as a base from which to locate the lens-registered fiducial marks.

Timing for expansion and optics sequencing is obtained from preset scales driven by a 10 KC cryostal controlled source. Interface to the ZGS is such that in event of ZGS timing pulse failure, the chamber will continue to pulse at the established rate to maintain thermal equilibrium conditions in the chamber.

Other techniques employed include: piezoelectric dynamic pressure transducers in the chamber, an ultrasonic transducer at the chamber high point to detect any large bubble there, and Ga-As diodes to measure cooldown of the supermagnet cryostat. Instruments employed in the cryogenic process systems are of the conventional pneumatic type.

In the event of power failure, a steam turbine-driven generator will automatically assume the electrical load. However, the expander and optics systems will be disabled until a manual start commend is provided.

Whenever required, cables are being run in conduits purged with dry nitrogen. Conduits entering the control room from the bubble chamber area are fed through a sealed bulkhead.

LIST OF FIGURES

1. Control Room Floor Plan

2. Calculated Poppet Position Vs. Time At Closure

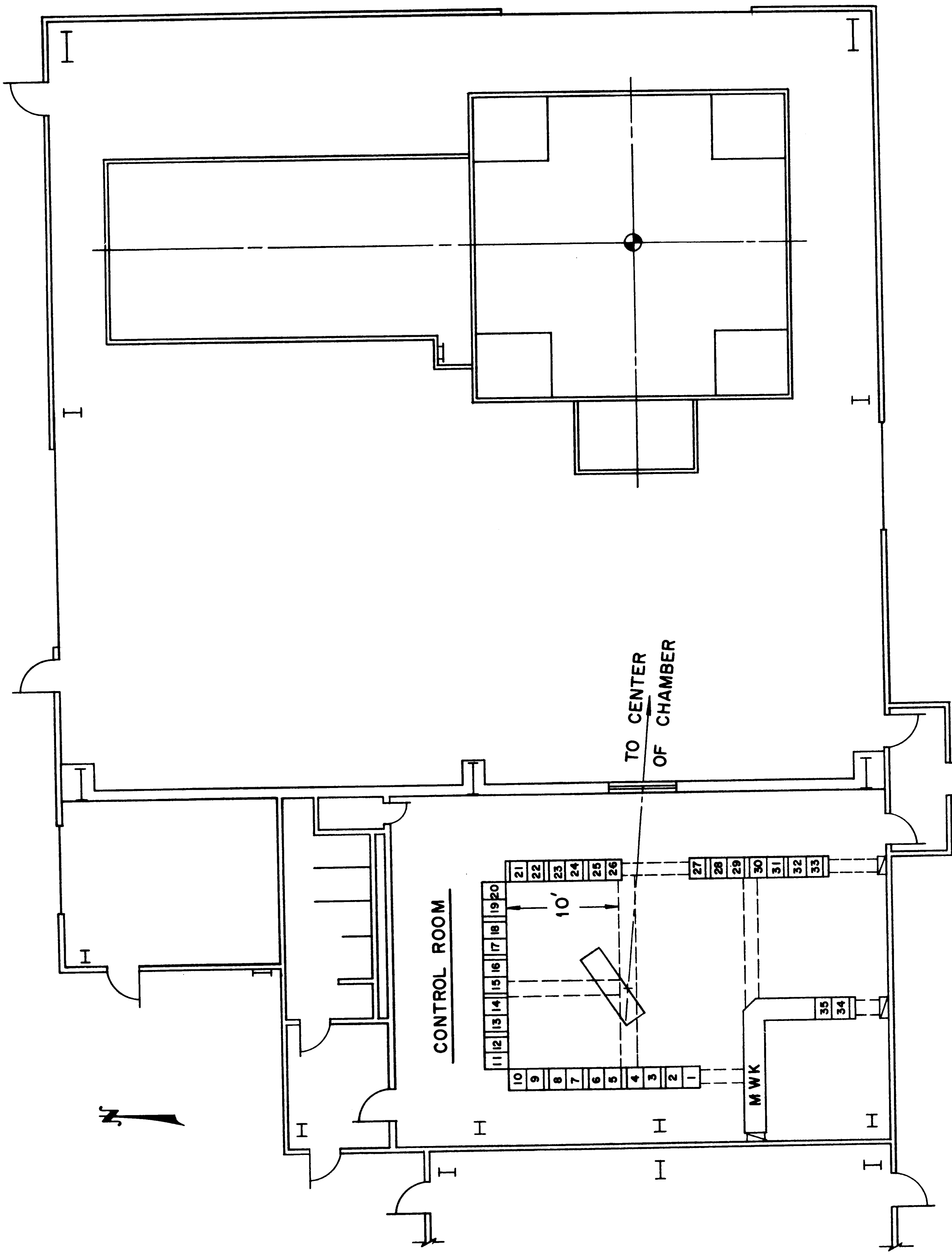
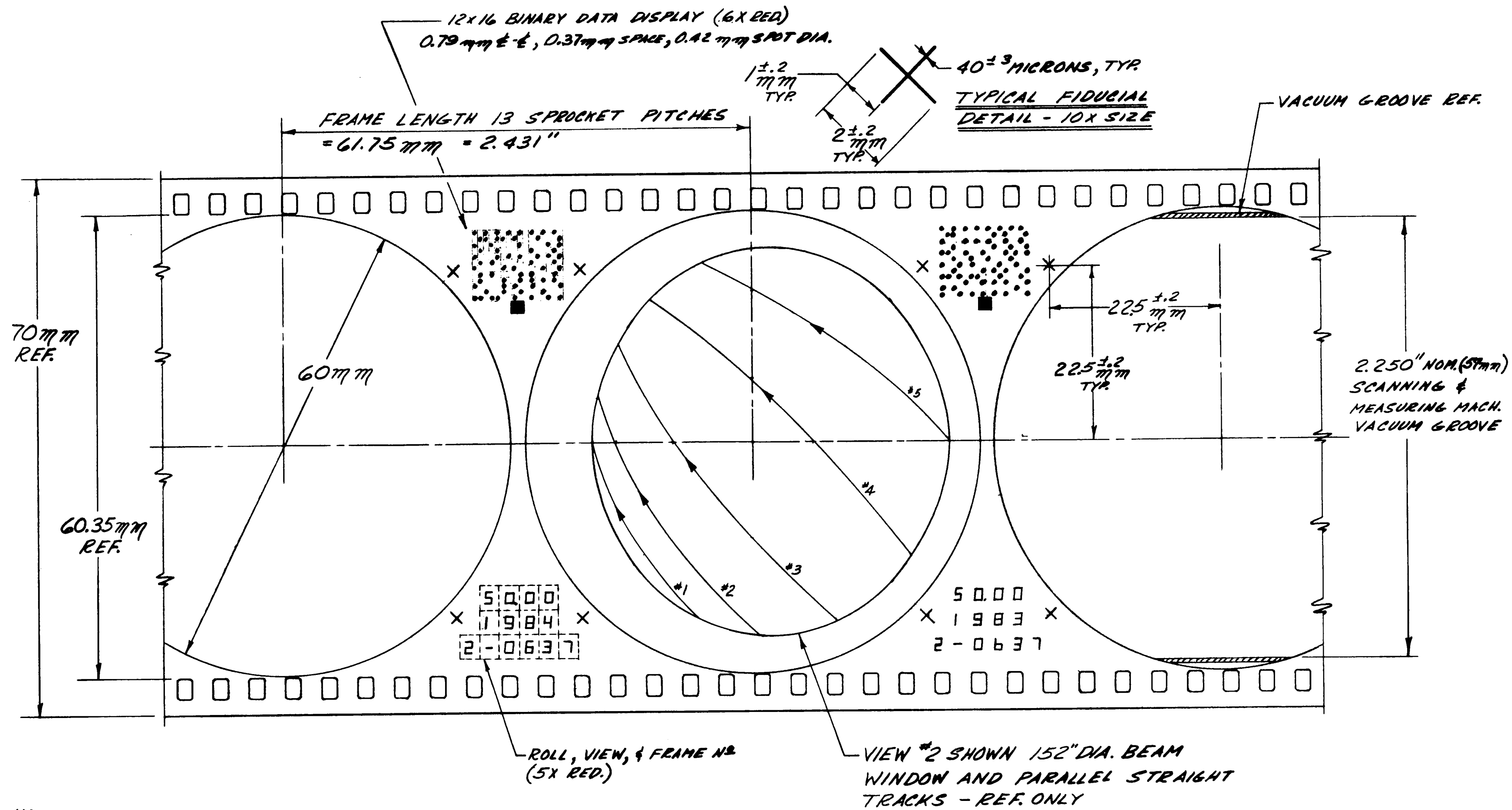


Fig. 1

CONTROL ROOM FLOOR PLAN



NOTE:

1) FILM CONFORMS TO A.S.A. STD. #PH1.20-1956 WITH TYPE II PERFORATIONS.

2) RELATIVE LONGITUDINAL LOCATION OF SPKT. HOLES AND IMAGE <u>NOT</u> FIXED. LOCATION TO REMAIN FIXED WITHIN ANY ROLL.

Fig. 2