General Description of the Ames Laboratory POLLY

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ABSTRACT

A general description of the POLLY system (called "HOLLY" for various obscure reasons) is given, including reasons for some of our choices. The present status of the hardware is that one bay is operating well enough to test the software. Plans for the future are also discussed.

DESCRIPTION

In general, our apparatus is modelled after the "DOLLY" built at Urbana, Illinois. We decided to use four bays each with its own precision CRT, lens, film drive, photomultiplier, etc. The spot is moved on the CRT face exclusively by a digital to analog converter, including the fast sweeps. (There is one DAC for each bay.) All corrections for distortions, pincushion, etc., are done by software from the main computer which, in our case is an EMR 6050 (formerly ASI 6050). The principle reasons for our choice were that it was certainly necessary to have provision for 4-view film, each film on a separate reel. Although a mechanical scheme for interchanging platens was certainly a possibility, we felt that we could not spare the time (and we were not sure we had the ability) for a good mechanical design that would accurately register each of the platens and without damage to the film. Also, although it will be, at least for the foreseeable future, impossible to measure simultaneously on more than one bay, it is possible to go back and forth between bays, keeping the film registered on each bay, and hopefully, if the computer can handle it, use this feature to help match up tracks in different views, even with track shapes like those for the 12 foot chamber. In any case, it is possible to project to move film in other bays while measurements are being made in any desired bay.

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A general block diagram of the equipment is shown in Fig. 1.

The cables in the figure have EMR drivers and/or receivers at both ends. The rest of the "interface" consists of EMR logic boards to recognize the various HOLLY addresses and to connect data line between the computer and HOLLY. The level shifters are necessary because the 6050 used negative logic (True = -4, False = 0 volts) while the "digital electronics used positive logic (+5 volts and 0). (I have to be careful here not to encroach on Bill Thomas, who will describe the digital electronics.)

The mechanical arrangement of each bay is shown in Fig. 2. (I have taken liberties in this drawing: The pellicle is actually rotated 90° about the optic axis of the system so that the reference photomultiplier is behind, and the projected image comes out forward. This image is again reflected to be imaged on the screen.) Four shutters are used on each bay, one for each photomultiplier, one in front of the projected light source, and the fourth to shut off light reflected into the system at the pellicle when the bay is not projecting. Microswitches on the photomultipliers are used to interlock them so that the projector shutters cannot open unless the photomultiplier shutters are closed. The shutters are driven by air cylinders energized by 110 AC solenoids. These, in turn, are energized by 24 volt dc relays driven by relay drivers from logic signals. With the air on and no ac available for solenoids, all shutters are closed. If the ac for the solenoids is on, the "default" condition is to have the photomultiplier shutters open and the projection shutters closed.

Only a minimum of power interlocking is used. (Actually, I think it is less than the minimum necessary for reliable operation with inexperienced personnel). A row of 10 circuit breakers control power to various parts of the machine. Any of these may be on without any of the others. A pair of push buttons is used to turn on and off a 3-phase solenoid which energizes these circuit breakers. A time delay, started by the 6.3 volt CRT filament circuit, holds off the CRT (and photomultiplier) high voltages for about three minutes. The same circuit prevents the control grid from being positive with respect to the cathode. After the high voltage on the first anode is on, a self-bias circuit protects the cathode from excessive current. Also, focus power cannot be turned on until the power to the digital to analog converter is on. When the "off" button is pushed, the high voltages are turned off immediately but a time delay keeps everything else going for another 2 or 3 minutes. An "emergency off" button is also available (in case of smoke or something), but it cannot be reset except from behind a panel which will be locked. Power for the interface is part of the power turned on and off by the push buttons, and it has been found that strange signals go down the cables to the 6050 computer when this power is turned on or off, so that it is necessary to halt the computer at these times.

A logical interlock is provided so that if, for some reason, the computer calls for film movement on a bay which is in the process of measuring, the measurement will be completed before the film is released. Another logical interlock does not allow the operator to move the film manually unless that bay is projecting. We plan to

Fig. 1 General Arrangement of HOLLY

Fig. 2 Precision CRT and Arrangement of Optics for One Bay

have four controls, one for each bay, for manual movement of the film.

The circuits used are mostly copies of either POLLY II or DOLLY circuits. The discriminator is from POLLY II; the film drive and reticle drive are from old versions from DOLLY, etc.

PRESENT STATUS

At present only one bay is operating. Essentially all parts for the other three bays are on hand and most of the mechanical work has been done. We have been spending some time measuring a precision grid and have found some peculiar difference between the x and y calibrations. The statistical errors in y (North-South direction) seem to be considerably larger than those in x and take several hours to settle down to reasonable values. At the same time there is a drift in y which also seems to settle down after a few hours. Whether these are connected or not we have not yet determined. In order to keep at least one bay operating while trying to locate the source (or sources) or this difference, a second bay is being assembled. Since the principle part of our effort lately has been with the software, I will leave that up to Bill Higby.

PLANS FOR THE FUTURE

So far we are using a pellicle to sample the light through the lens in to the reference photomultiplier and also to reflect the projector light out. For the first purpose, this seems to be reasonably satisfactory, although it does lose some light and also is very expensive, but the material which we have is not a very satisfactory mirror. It requires a low humidity (less than about 50%) in order to keep taut. We are planning to install a moving mirror for the projected image and have not yet decided what to do for the reflected light to the reference photomultiplier. We are also starting the design of a new discriminator. We plan to use some kind of operational amplifier to take the ratio of the signal/reference and use this for the discrimination. At the same time, we plan to design the circuit so that it can be used both for dark tracks on light film and light tracks on dark film.

We also plan to connect more microswitches to the photomultiplier shutters to signal that they are open and we also plan to interlock the room lights so that they can only be turned on when the photomultiplier shutters are closed. Also, the combination of 24 volt relay drivers and 110 volt ac solenoids produced a considerable amount of electrical noise in the system, particularly in the reticle registers. So far, this has been "fixed" by software, that is, by reading the reticle registers into the computer before operating the shutters and reading these values back to the registers after the shutters are moved.

Of course our most important improvement is to get all four bays working, and I am sure that this will give rise to many other problems.