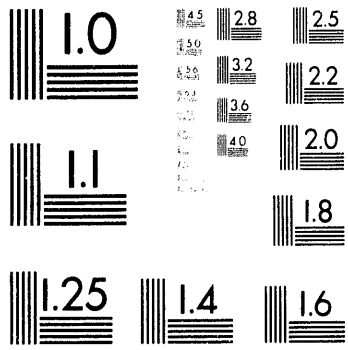
1.0
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Conf-9307179-1

ANL-HEP-CP-93-79

AUTOMATIC SCANNING AND MEASURING USING POLLY

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Effects of incorporating a human operator as part of the POLLY scanning and measuring system are briefly described.

1. INTRODUCTION

The HPD and PEPR automatic measuring systems [1,2], which have been described by B. Powell and I. Pless at this conference, were developed in the 1960's to be used for what we would now call "batch processing". That is, an entire reel of bubble chamber film containing interesting events whose tracks had been rough-digitized would be processed in an extended run by a dedicated computer/precision digitizer hardware system, with no human intervention. Then, at a later time, events for which the precision measurement did not appear to be successful would be handled with some type of "fixup" station or process.

By contrast, the POLLY system [3] included from the start, not only a computer and a precision CRT measuring device, but also a human operator who could have convenient two-way interactions with the computer and could also view the picture directly. Inclusion of a human as a key part of the system had some important beneficial effects, as has been described in the original papers [3,4]. In this note I shall summarize those effects, and also point out connections between the POLLY system philosophy and subsequent developments in both high energy physics data analysis and computing systems.

2. EFFECTS OF INCLUDING A HUMAN OPERATOR

As the POLLY system was being brought into operation, it became apparent to the development team that inclusion of a human operator brought important capabilities to the system, even beyond what was originally foreseen. Key capabilities which were recognized and exploited by the team included:

- The ability to promptly produce useful physics measurements with early versions of the software which were simple and fast.
- Feedback from operator experience as an accurate guide to the priority for various software improvements.
- The elaborate human/computer interface was of great value for program debugging.
- The accessibility of all parts of the film image to both the computer and the operator minimized the amount of data which needed to be stored in RAM.
- Together with the above capabilities, the ability of the human operator to assist in difficult pattern recognition tasks led to early physics use of POLLY for automatic scanning (event-finding) [4] as well for event measurement.
- Because this was a one-pass system, book-keeping, film-handling, and communication problems were reduced.

As described in the original papers, the above features were used to make a steady rapid series of improvements in the physics capabilities of the POLLY system. Through these improvements, the system was able to scan (find) and measure events for high

To appear in the Proceedings of the Conference on the Bubble Chamber and its Contributions to Particle Physics, CERN, Geneva, Switzerland, 1993.

statistics bubble chamber experiments while achieving high event rate (70-100 events/hour), low systematic error, and low cost.

3. COMPARISON TO A FIXUP STATION

In a logical sense, POLLY could be considered to include an online interactive fixup station. However, as can be seen from the features described above, the very fact of being online and interactive was found to have major beneficial impacts upon the simplicity and productivity of the overall hardware system, as well as upon the effectiveness of the programming/physicist team in making improvements to the software. All of this is not surprising today, 25 years later, in view of what has been learned through the revolutionary impacts of personal computers and workstations.

4. SUBSEQUENT DEVELOPMENTS

The POLLY philosophy of incorporating a human operator into the system of computer and random access precision measuring engine was recognized as one which yielded a large throughput of high energy physics events in a cost-effective manner. This philosophy was therefore incorporated at other laboratories in the early 1970's into machines such as DOLLY [5], MOLLY [6], ERASME[7], and others.

However, rapid developments in high energy physics detectors and colliding beam accelerators as well as in VLSI circuits and computer hardware soon led to major decreases in the use of both photographs for data recording and the bubble chamber technique. Ten years later, in the early 1980's, the detector frontier for the study of complex events was represented by the UA1 system of electronic detectors which was used to discover the W and Z intermediate bosons. Effective human/computer interactions in UA1 data analysis were facilitated by the Megatek device. This commercially produced device had a fast precision display as well as what would today be called a GUI - a graphical user interface - offering convenient two-way interaction between the user (physicist) and the computer.

Now, another ten years later, these same technologies - electronic detectors, computerized data acquisition, and the use of personal workstations for interactive data analysis - have reached levels of performance and cost effectiveness which are greater by perhaps two orders of magnitude than in the early 1980's.

Seen from a present-day perspective, then, POLLY offered a very early and successful demonstration of the power of a strongly interactive human/computer system for data acquisition, pattern recognition, and data analysis.

This work was supported by the U.S. Department of Energy, High Energy Physics Division, under Contract No. W-31-109-ENG-38.

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