A High Energy Physics Scanner Describes the Experience

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In a galaxy far, far away, or so it seems, I was involved in a small way in the research studies into high energy particle physics. As a lowly sophomore at UCLA in 1962 struggling to cover my tuition expenses, I managed to find a part-time job -- 20 hours per week -- working in the High Energy Physics lab as a “scanner,” for the princely hourly wage of $1.75! In that alternate universe, there were esteemed scientists who devised a way to capture the existence of subatomic particles, by trapping the trails these particles left behind after being excited in a cyclotron (or later, a bevatron) and sent through hydrogen bubble chambers. These experiments took place up north in our big sister UCB's Lawrence Berkeley Laboratory.

The role of the unknown scanner was a minor one, but perhaps deserving of some recognition. The head of the department was Prof. Harold K. Ticho. At the time that I worked there, perhaps there were about eight of us, and over the years of this research, I presume there were less than 100 in total. It is amusing, some 47 years later, to see how far technology has developed, and I hope the reader will gain some insight on how early research was undertaken.

After the experiments were performed and the photographs captured on a continuous roll of film, these rolls were sent to UCLA for the research staff to analyze, perform calculations on, and evaluate the results. In actuality, the scanners performed the grunt work first. To start, a scanner inspected each roll of film, frame by frame to determine if anything had been captured at all by the camera. Each roll and frame of film had its unique identifiers. The rolls were about as large as a slide carousel and were mounted on a machine that projected the film downward onto a narrow, white 72” long, table-like surface in a darkened room. The intent was to project it life-size.

We scanners would review each frame of film, and per the brief instructions we had been given, looked for any “unusual activity,” -- tracks or trails left by a particle as it moved through the bubble chamber. Of course the particles did not simply move in two dimensions, and that was the limitation of the film. We compiled lists of the rolls and frames of interest that were to be mounted and viewed on the more sophisticated equipment: the *Franckenstein* or *Hermes* machines. If the name Franckenstein seems strange or misspelled, that is not so. It was developed by Berkeley lab mechanic Jack Franck. (I don’t think I ever used the less-reliable Hermes machine, so my description here is strictly about the Franckenstein.)

The Franckenstein was a huge device, about the size of one of those wooden armoires that people now have to enclose their large screen TVs. Connected to the Franckenstein and at the scanner’s right, was an IBM keypunch machine -- now another relic of the early computer age. At the scanner’s foot, was a foot-pedal, similar to an electric sewing machine pedal, linking the two pieces of equipment.

Franckenstein’s largest component was its screen, with electronics on both sides of it. There was a place to read and display the film and frame numbers, among other things. On the table surface in front of the almost vertical screen, there were two joystick-like handles. The scanner had to use both hands, a joystick in each, and turn them clockwise or anti-clockwise, to align a double crosshair cursor at several sequential positions on a track. One joystick handled the vertical alignment; the other the horizontal.

As the scanner positioned the cursor to his/her visual satisfaction, a quick but firm tap on the foot-pedal punched the coordinate values onto an IBM card that had been fed into the keypunch machine. When all the required coordinates for a particular track had been captured in this multi-limbed physical activity, the IBM card(s) would be released and added to the stack.

Figure 1 A Scanning Device from UC Berkeley Lab, with an IBM Keypunch Machine in the Foreground.

The precious stack of IBM cards were passed to the physicists, who would then process the data in the existing IBM processors, using software that would calculate the best fit for these coordinates, and thereby mathematically simulate the curvature of the track. This collection of data for analyses is what led the physicists to prove the existence of new particles. Since I was only a scanner for one year, and a Math rather than a Physics major, the details and results are beyond my knowledge. Suffice it to say, from what I have described here, the data collection process was a demanding physical activity, relying on an individual's coordination and eyesight to determine the "best" coordinate points to select. But we were working with the state of the art equipment of its time!

Figure 1, a mirror image of a photo from the Berkley Lab, shows equipment that was similar to the one I worked on. The alignment of the equipment in this aspect reflects how I used the equipment. (Note one of the joysticks—the large circular disk with the protruding handle.)

I visited the UCLA Physics Department in May 2009 and attempted to find out what happened to the ancient, original equipment. Dr. Martin Simon tried to help and directed me to people who might have known. I learned that some people of that era had passed away: Dr. Peter Schlein (who had also been one of my teachers) and then-graduate student Mojtabe "Moji" Taherzadeh. The original equipment was either dismantled or destroyed and no photos apparently exist. I did manage to contact professors still at UCLA, Niña Byers and William Slater, who were also there in the 1960s -- and they confirmed this.

It seems that no one seemed to care enough to capture that imagery since it was irrelevant to the research and the papers they wrote. Dr. Simon was kind enough to show me old 3-D ViewMaster© discs that had examples of the particle tracks. That brought back memories of tracks that haunted me for some years after I no longer worked there!

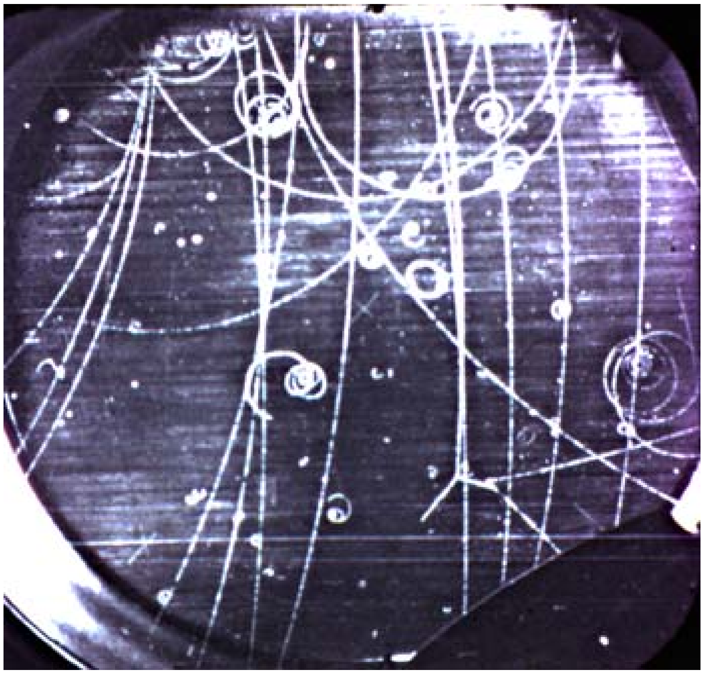

Figure 2 Bubble chamber tracks.

Perhaps readers of this experience will not only smile, but may also find it useful to their understanding of early research: the limitations of extinct technology and how many ways errors could have been introduced during the course of experimentation.