REMARKS ON THE USE OF BUBBLE CHAMBERS FOR STRONG-INTERACTION PHYSICS

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ABSTRACT

Some general arguments are presented on the role of bubble chambers for strong-interaction studies at NAL.

I. THE PAST

At existing accelerators, bubble chambers have been exceedingly productive. Some of the reasons for this productivity are easily understood:

1. They are self-contained:

(a) The momenta of all secondaries (except n and π^0) are determined with adequate precision for kinematic reconstruction.

(b) Decays of particles with lifetimes in the 10^{-10} sec range are easily detected.

2. They make excellent use of the accelerators:

With 1-4 expansions per machine pulse they can absorb a large fraction of the available K^+, K^-, or $\bar{p}$ flux: To study the interactions of these particles by other means one is likely to lose as much in solid angle as one can gain in flux (with some notable exceptions).

3. Their use has been economically justified:

(a) Little enough was known about strong interactions that all events were interesting.

(b) The cross sections of interest have been large enough to obtain statistically significant results with the limited fluxes available and with the high cost per event the bubble-chamber technique entails.

II. THE FUTURE

To first order all arguments presented above fail. To overcome this failure two general cures have been suggested.

1. Bigger chambers

The advantages are easy to see. Secondary interactions of the outgoing particles will complicate life,[1] however, and the overall usefulness is questionable.[2]

2. Fast-cycling chambers combined with other detectors. Such devices may work in special instances. Their impact, however, will not be anywhere close to what we have seen in the past.

III. ADDENDUM

Perceptive readers will have noticed by now that several important factors of the bubble-chamber success story have been left out of the foregoing arguments. By some curious accident these are just the factors that remain true to first order as we look into the future. We list some of these below:

1. There exists a data reduction machinery (hardware, software, and brains). This machinery has made the bubble chamber the most accessible instrument for outside user groups.
2. It renders the point of interaction and the surrounding region visible.
3. It has excellent spatial resolution.
4. It provides mass information for slow secondaries.
5. It records the unexpected and the imponderable in an unbiased way.

Doubtless the bubble chamber as such will remain a useful detector for strong-interaction studies at NAL. However, it will not be as well matched to the 200-GeV machine as it was to present-day accelerators unless startling advances take place in its technology.

REFERENCES

[1] M. Derrick, T. O'Halloran, and R. Kraemer, FAKE Studies of Some Strong and Weak Interactions In the 12-Ft and 25-Ft Bubble Chamber, National Accelerator Laboratory 1968 Summer Study Report, Vol. I, p. 47.

[2] W. D. Walker, Difficulties with Large Bubble Chambers, National Accelerator Laboratory 1969 Summer Study Report SS-10, Vol. II.