

# The Cloud Chamber as a Field Diagnostic Tool

A. Clark

RECEIVED  
DEC 20 1996  
OSTI

October 19, 1967

MASTER

 Lawrence  
Livermore  
National  
Laboratory

This is an informal report intended primarily for internal or limited external distribution. The opinions and conclusions stated are those of the author and may or may not be those of the Laboratory.

Work performed under the auspices of the U.S. Department of Energy by the Lawrence Livermore National Laboratory under Contract W-7405-ENG-48.

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED HH

**DISCLAIMER**

**Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.**

### **DISCLAIMER**

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

~~SECRET~~

Classification (Declassification/Review Date) Changed to:  
3/21/95 UNCLASSIFIED  
(Insert an example of field routing slip or other document)  
Authority of R2D2-COL-67-400  
R. June Barrow 3/22/95  
ified by Spb/Al 3-29-95 (date)  
(Signature of person certifying this is the correct document or model)

DOCUMENT NUMBER COL 67-400

This document consists of 3 pages  
No. 8 of 12 Copies, Series A.

October 19, 1967

COL-67-400 8A

19 NOV-90 12:42 ARCH BROTHERS JAMES E

TO: Distribution

FROM: A. Clark

SUBJECT: The Cloud Chamber as a Field Diagnostic Tool

### I. Pros and Cons

Off hand, a cloud chamber sounds like a most unlikely detector for field use.

1. It has never been so used before and almost no one uses such a detector even in the laboratory any more.
2. It has very poor time resolution (about 0.1 sec.) so late backgrounds can be very bad.
3. Since it is so different, a whole new body of field and laboratory know-how must be developed. One cannot borrow from existing field techniques: fluors, P.D.'s, oscilloscopes, etc.
4. Its use requires a L.O.S. pipe to the surface, a scatterer and a further horizontal L.O.S. pipe and about ten feet of earth protection for the equipment from sky shine backgrounds.

However, a cloud chamber is so completely different from other field techniques that it can provide a much more independent check on the other experiments which generally share some systematic errors. The cloud chamber is really quite a simple device, flexible as to pressure, gas and geometry. Each complete electron track, photo electron or Compton knock-on electron, is identified and measured and understood in detail so that one has high confidence that one understands the physics of the phenomena and the detector.

~~SECRET~~

~~RESTRICTED DATA~~

This document contains restricted data as defined in the Atomic Energy Act of 1954. Its transmittal or disclosure of its contents in any manner to an unauthorized person is prohibited.

GROUP I: Excluded from Automatic Downgrading And Declassification

Backgrounds are easily identified and accounted for: they are not bothersome. Knock-on protons from neutrons and high energy electrons from gamma rays make very different tracks in the chamber and cause trouble only if there are so many as to confuse the rest of the picture.

An obvious drawback is the difficulty in getting good statistics. Many tracks must be analyzed to obtain much accuracy. Actually, this is not a great difficulty, and it is worth while belaboring this point:

Good statistics are not really necessary: 10% answers are much sought after and rarely obtained in the field. So, 100 tracks provide a statistic; and analyzing 100 tracks takes less than a man week of effort. Actually, a 20% number is about all one can expect from field experiments. Furthermore, the source is commonly not known to 10% and is probably not reproducible either. In addition, the effects one is interested in are in even much worse shape as far as being quantitative; a piece of material with an incipient crack is much more vulnerable and much more likely to spall. So the vulnerability of a particular R/V is unknown since it has a large number of pieces, any one of which may have an incipient crack. And, finally if one talks of the enemy's materials one must be still less quantitative because of lack of knowledge of his R/V's.

Another comment on the general pros and cons. One must be very careful not to introduce a subjective bias into the measurements. However, if one reads and accounts for essentially every track in the cloud chamber it is difficult to have much bias left.

## II. History

The history of cloud chambers is older than the century. The history on nuclear shots is about one year old. Just one year ago, we obtained our first track in a resurrected chamber from Berkeley. A year ago last June, Montgomery Johnson suggested using a much attenuated beam so that one could look at individual quantum events. Paul Ebert suggested a cloud chamber. We looked into the possibilities and started work last fall. Ref: COL 66-440

### III. Midi Mist

The cloud chamber experiment on Midi Mist was designed to check our theories, calculations, the experimental gear, and the people. A check out of the personnel was as important as anything. Actually, we did unbelievably well: we got actual data. Not only did we verify that the x-rays other people were measuring are the same as those seen in cloud chambers 30 and 40 years ago, but we got fairly quantitative results!! Ref: COL 67-101 Cloud Chamber Calculations and Qualitative Comments. Pre-Op for Midi Mist.

COL 67-315 Midi Mist Cloud Chamber Direct Flux Measurements


We quote a derived flux number for Midi Mist with a 25% error. This error will become smaller when we understand our energy calibration better.

### IV. Hupmobile

We are in the process of working out an experiment to be fielded on Hupmobile. We will use 12 cloud chambers and expect to measure 100 to 200 tracks in each chamber and thus get flux and spectrum numbers from about 10 to 100 Kev.

AFC:jb

#### Distribution:

- 1A A. Biehl
- 2A J. E. Carothers/J. N. Shearer
- 3A A. F. Clark
- 4A D. Hall
- 5A N. Hansen
- 6A Maj. Loren Logie (SPAS) DASA
- 7A M. Johnson
- 8A W. H. McMaster 
- 9A H. L. Reynolds
- 10A J. C. Watson
- 11A File
- 12A File