

LA-UR- 90-2221

LA-UR--90-2221 /

DE90 015103

Los Alamos National Laboratory is operated by the University of California for the United States Department of Energy under contract W-7405-ENG-36

Received by USH

DATE 0 6 1990

TITLE MISERS GOLD DUST COLLECTION AND CLOUD CHARACTERIZATION

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SUBMITTED TO FOURTH AIRBORNE GEOSCIENCE WORKSHOP  
LA JOLLA, CALIFORNIA  
JANUARY 29-FEBRUARY 1, 1991

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Los Alamos, New Mexico 87545

FORM NO. 834-114  
57 MAR 1979 5/81

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## MISERS GOLD DUST COLLECTION AND CLOUD CHARACTERIZATION

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MISERS GOLD was a surface detonation of 2445 tons of ammonium nitrate-fuel oil blasting agent conducted by the Defense Nuclear Agency for a variety of research purposes. This report presents the results of an experiment designed to study the dust cloud over the 24-hour period following the detonation.

The cloud was sampled by aircraft to obtain material needed to characterize the quantity of dust lofted, the source regions of the cloud, and the size, shape, and mineralogical characteristics of the particles. Elemental tracers and organic dyes were emplaced in the charge and in surrounding areas. Analyses were done by instrumental neutron activation analysis (INAA), fluorimetry, scanning electron microscopy (SEM), and energy-dispersive spectrometry (EDS). Tracer data define the source regions of the dust cloud. Extensive particle size distribution data were obtained.

The major emphases placed on the dust cloud study were determination of the total mass lofted, its density and distribution with altitude, tracking of the cloud, characterization of the source regions and size, shape, and mineralogy of the dust particles in various portions of the cloud. These objectives were addressed by the emplacement of one elemental tracer within the charge and five buried in the surrounding terrain, and by collecting airborne dust samples. Samples were collected by a well-characterized filter sampler carried by the WB-57F aircraft shown in figure 1.

The amount of dust collected on each pass through the cloud was determined by weighing of the filters. Figure 2 shows the dust density vs. height. The estimated dust inventory at sampling time was calculated by assuming that the cloud is composed of cylindrically symmetrical layers, that the aircraft flew the diameters of the cylinders, and that each sample was representative of the height range between the half-distances to the adjacent samples. The uncorrected estimate of total dust aloft

at sampling time is  $3.08 \times 10^9$  g. However, the indium tracer results discussed below indicate that the cloud geometry used overestimated the extent of the cloud, and a more plausible estimate would be  $1.8 \times 10^9$  g.

The indium tracer density was determined by INAA, and is shown as a function of height in figure 3. The tracer was inventoried by the same approach used for the dust in the preceding paragraph after the local soil background and filter blank were subtracted. The percentage recovered was calculated from the known amount emplaced. The indium, which is relatively volatile, was located toward the upper portion of the cloud but was recovered to the extent of 172%. This is attributed to the errors in cloud geometry as discussed above, and this value has been used to correct the dust lofting estimate.

Figure 4 shows an overview of the diagnostic cloud trajectory and sampling flights conducted at 5 and 24 hours following the detonation. Indium tracer and location data from those flights are presented in figures 5 and 6.

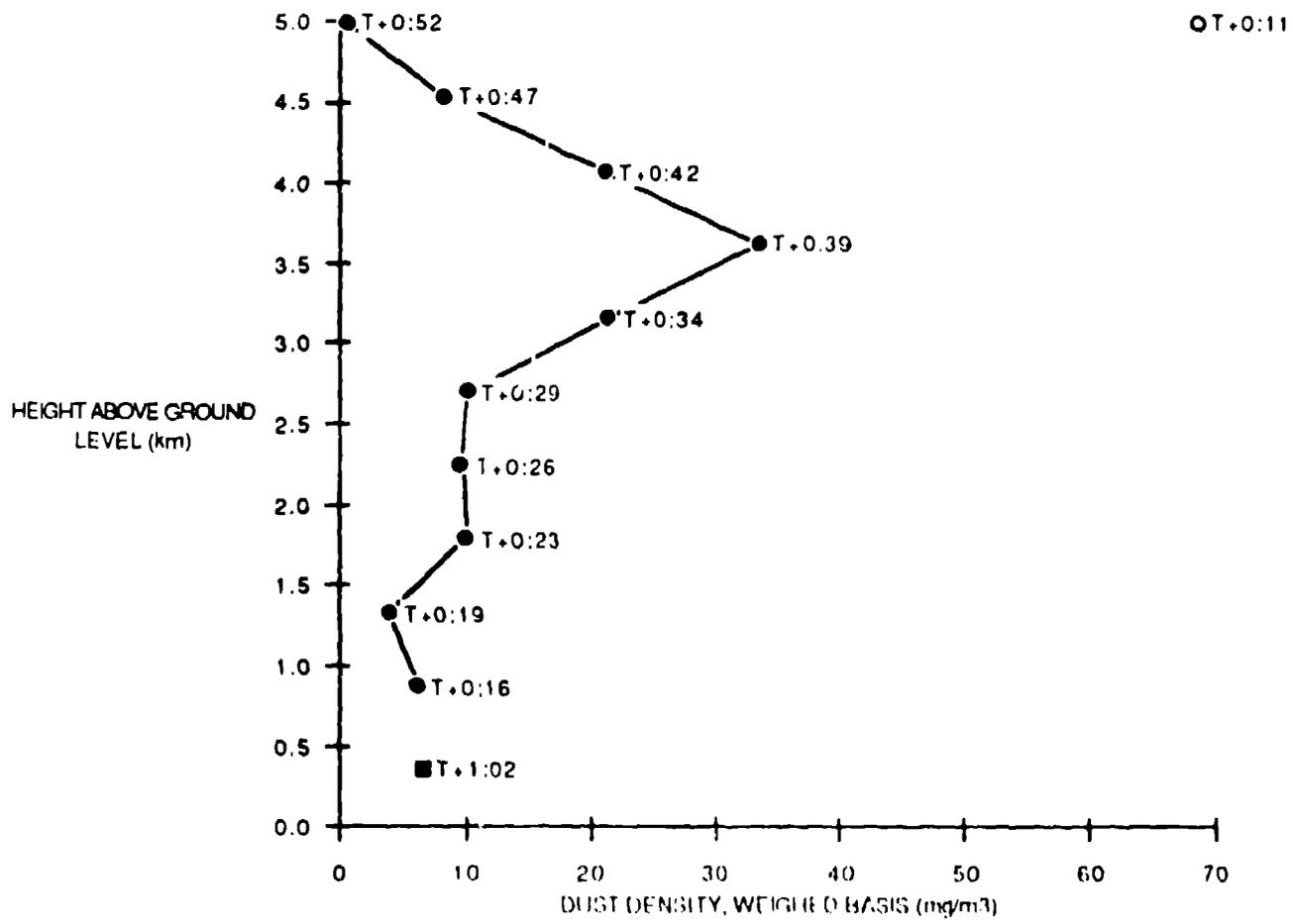
Particles were removed from the filters by destroying the cellulose filter material and the organic ester with which it was impregnated in a low temperature asher. This procedure, done directly on the SEM slide, has been shown to have negligible losses or effects on particle characteristics. The particles were then embedded in epoxy directly on the slide and the preparation polished for examination. The SEM-EDS analysis is automated such that particle sizes, shapes, and semi-quantitative compositions are determined in a single scan of a section. Particle mass distributions from shortly after detonation and from 5 and 24 hours later are shown in figures 7 through 9. Corresponding mineralogy is shown in figures 10 through 12.

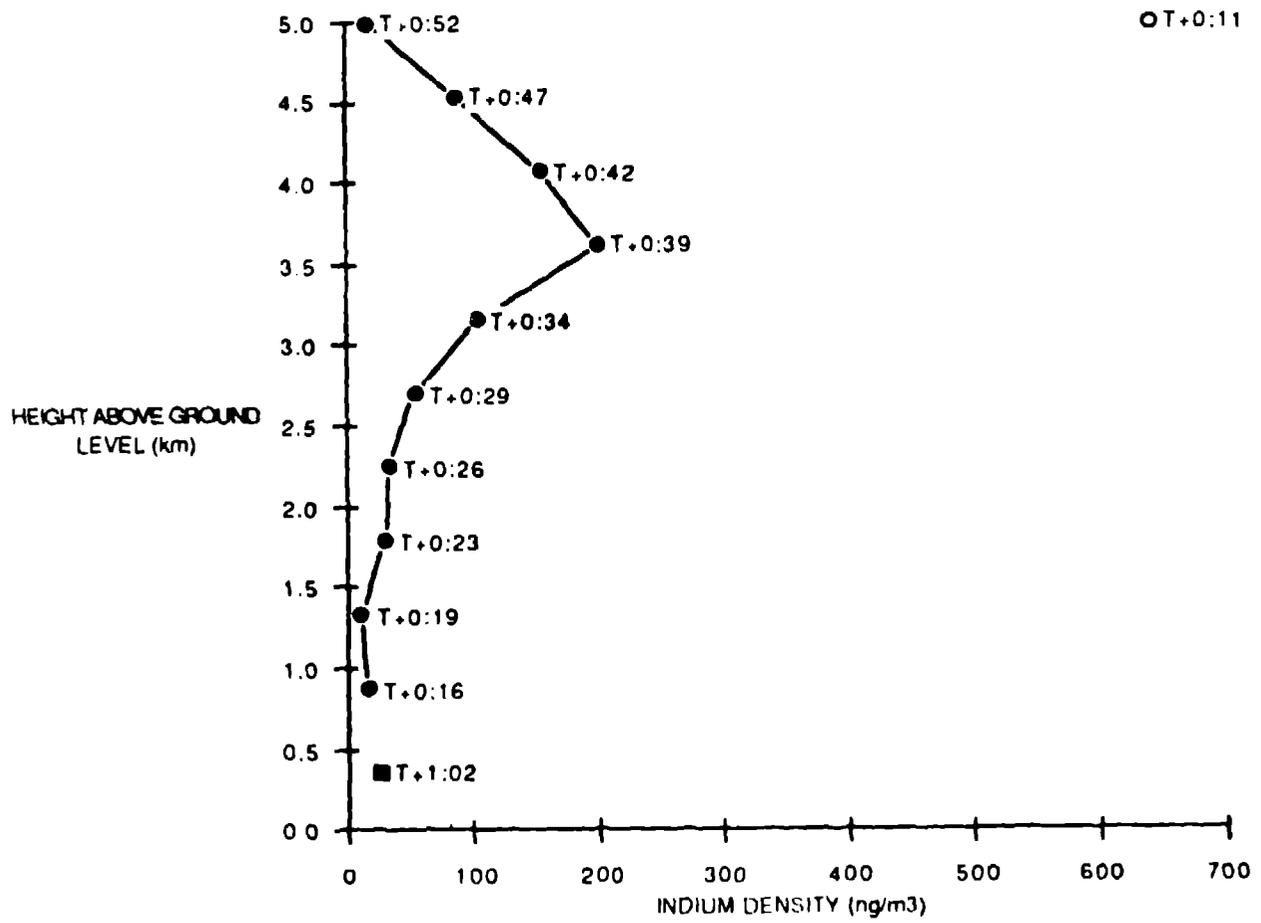
This work was sponsored by the Defense Nuclear Agency under IACRO 89-830, task code and title: RA/RV, Aerospace Systems V&H Above Ground Testing, work unit code and title: 00014, Dust Collection and Cloud Characterization MISERS GOLD, work unit manager: Maj D. Wade, USAF.

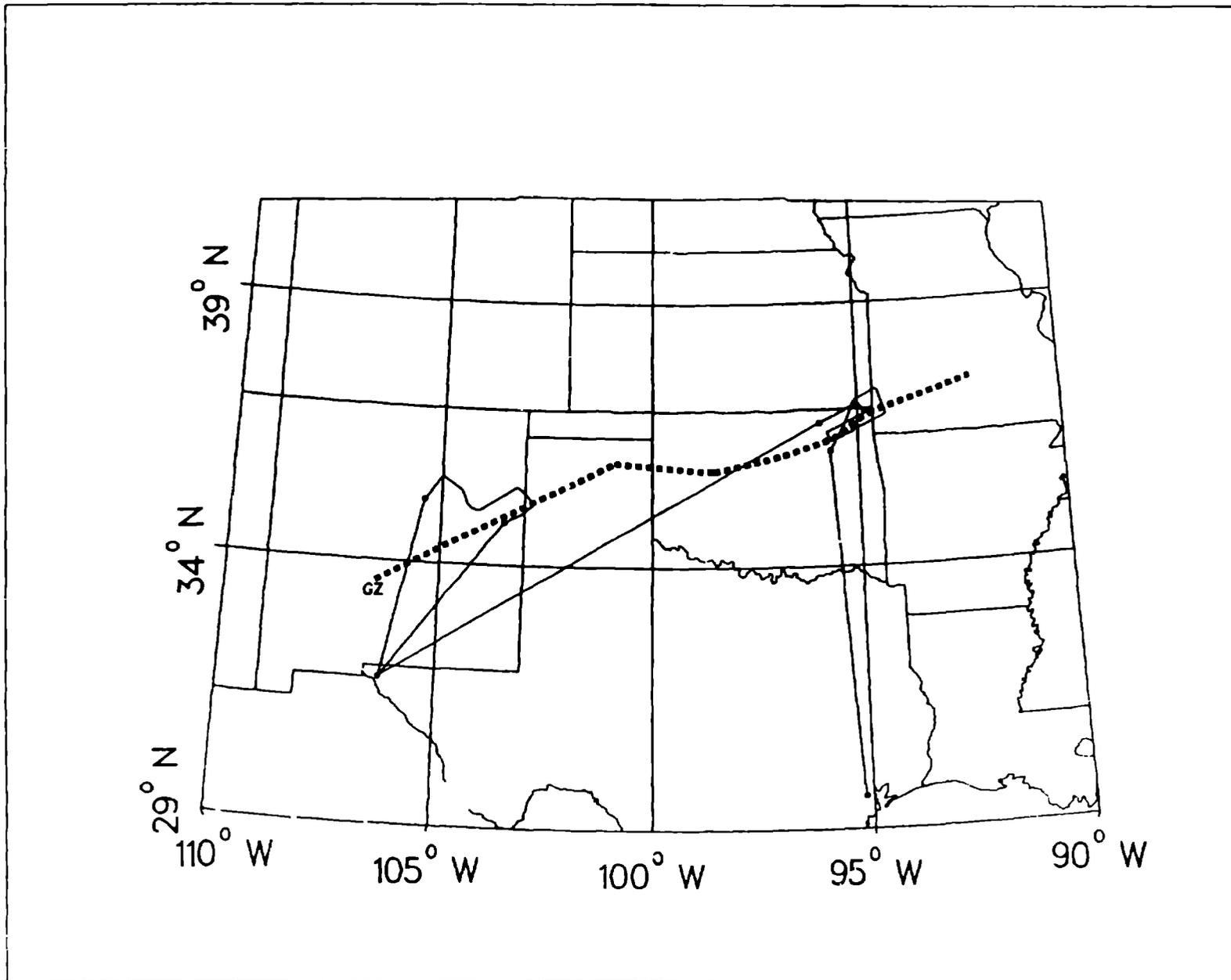
THE FOLLOWING CAPTIONS AND FIGURES WILL NOT BE PRINTED IN THE PROCEEDINGS, BUT WILL CONSTITUTE THE POSTER PRESENTATION:

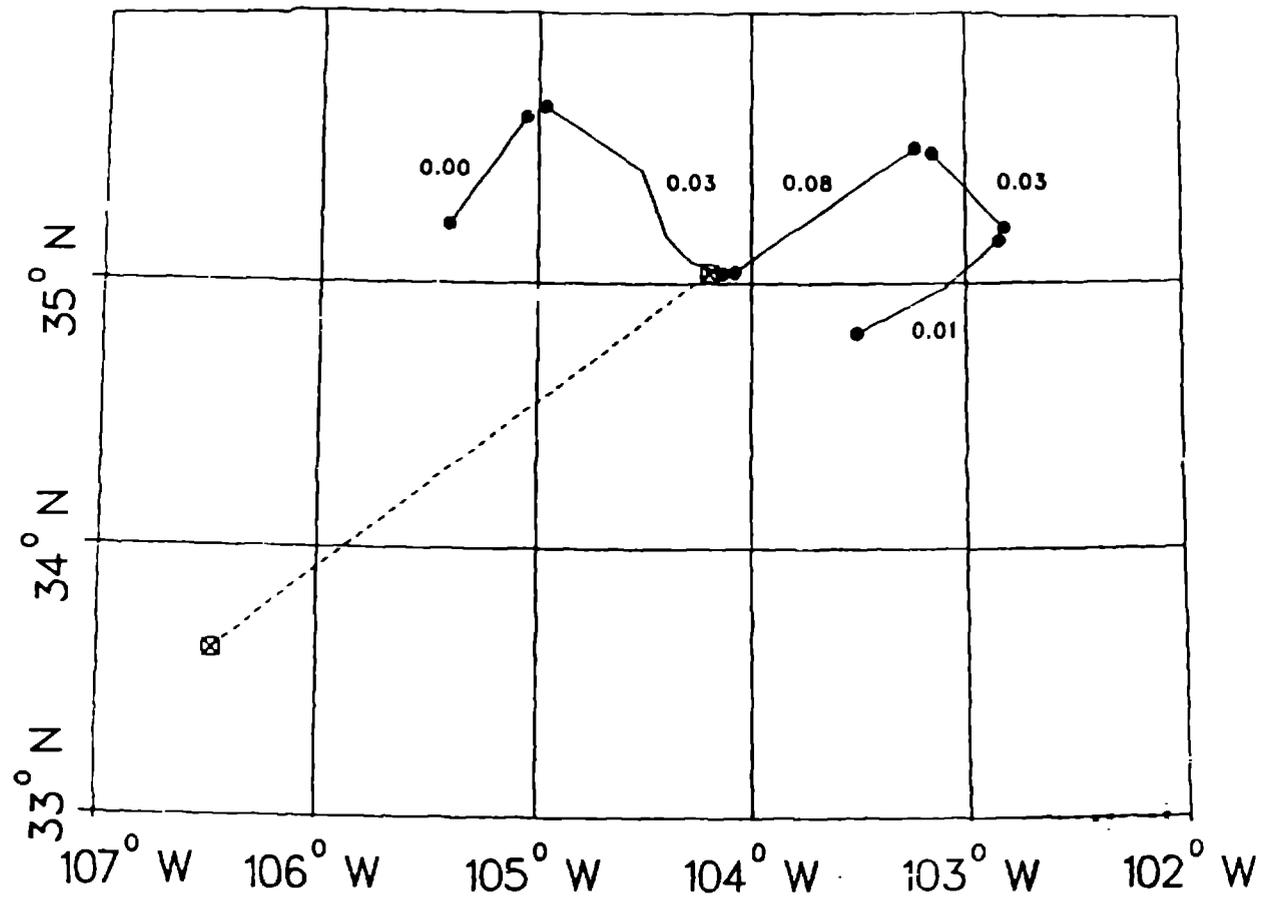
FIGURE	CAPTION
1	WB-57F atmospheric research aircraft
2	Dust density vs. height
3	Indium density vs. height
4	Cloud trajectory and sampling flight paths
5	Sample locations and indium densities (ng/m <sup>3</sup> ) at 5 hours
6	Sample locations and indium densities (ng/m <sup>3</sup> ) at 24 hours
7	Particle mass distribution by diameter at 42 minutes
8	Particle mass distribution by diameter at 5 hours
9	Particle mass distribution by diameter at 24 hours
10	Mineralogy at 42 minutes
11	Mineralogy at 5 hours
12	Mineralogy at 24 hours

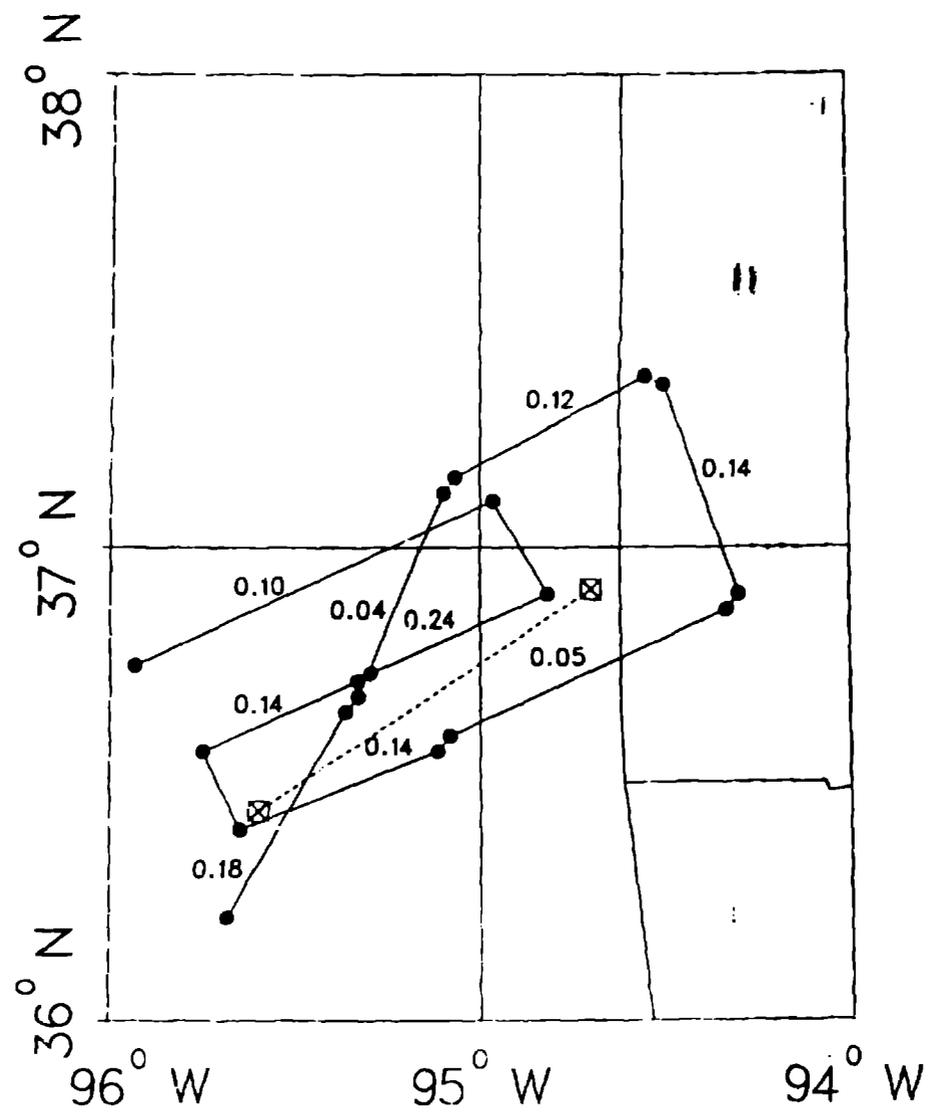




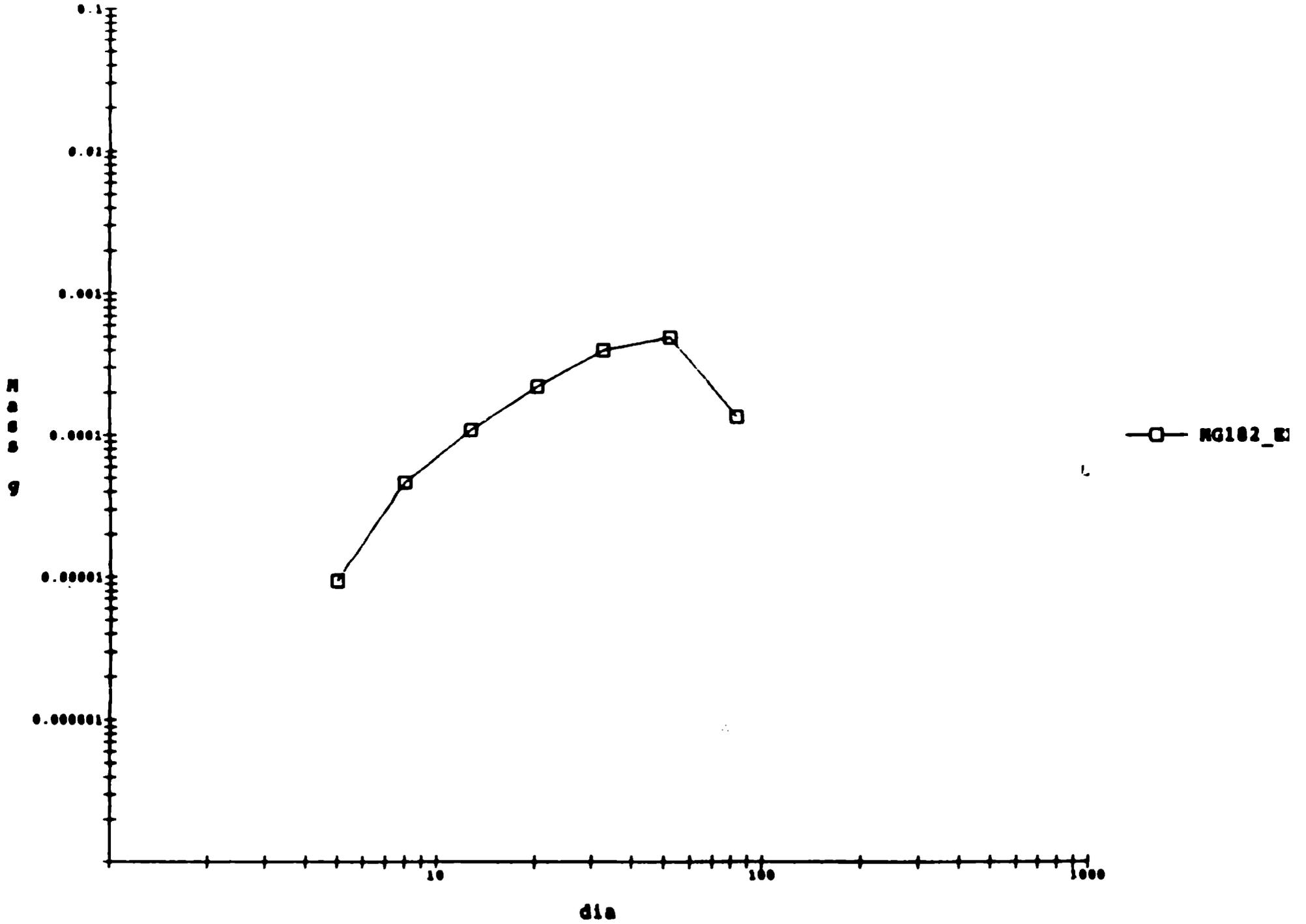


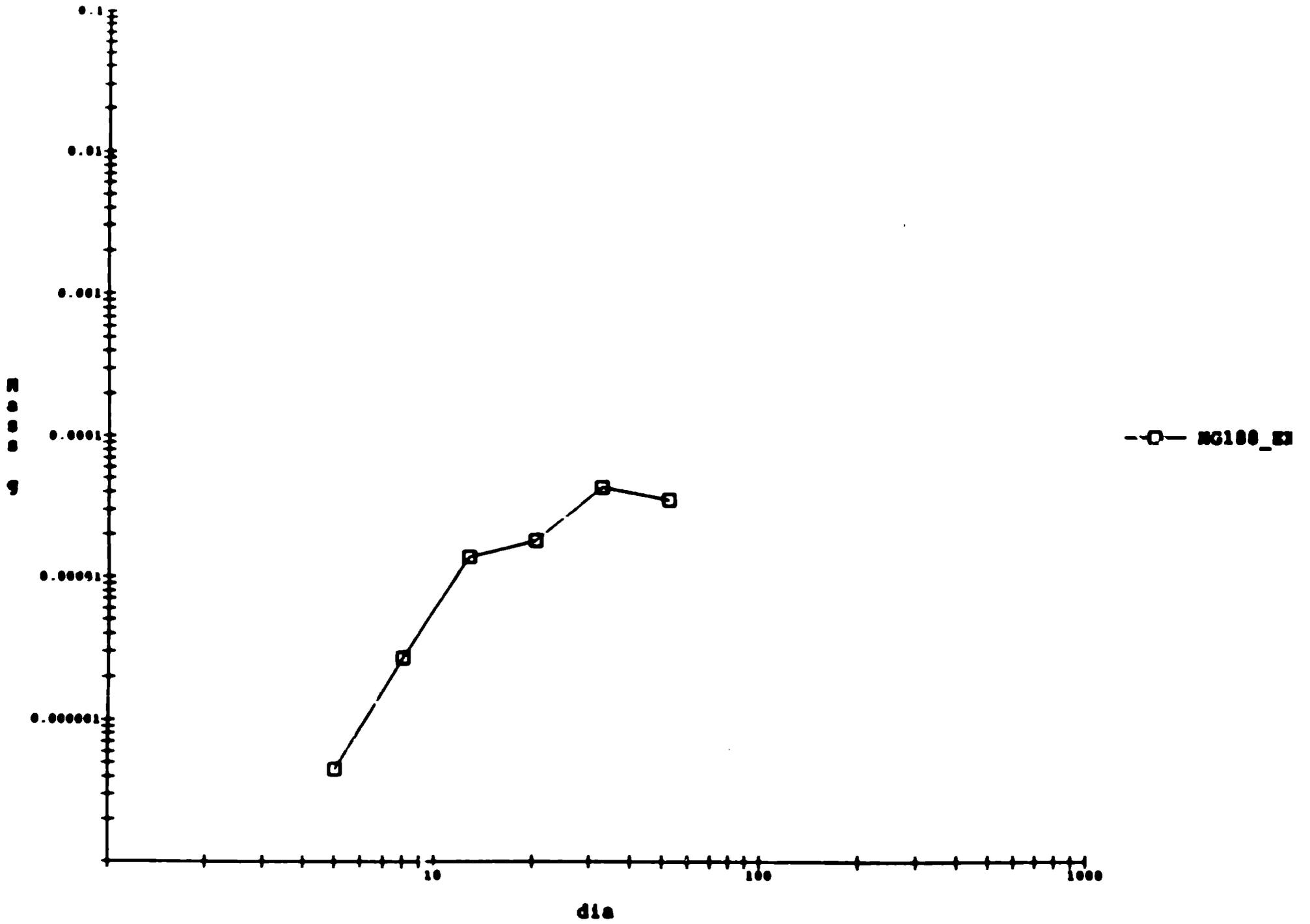




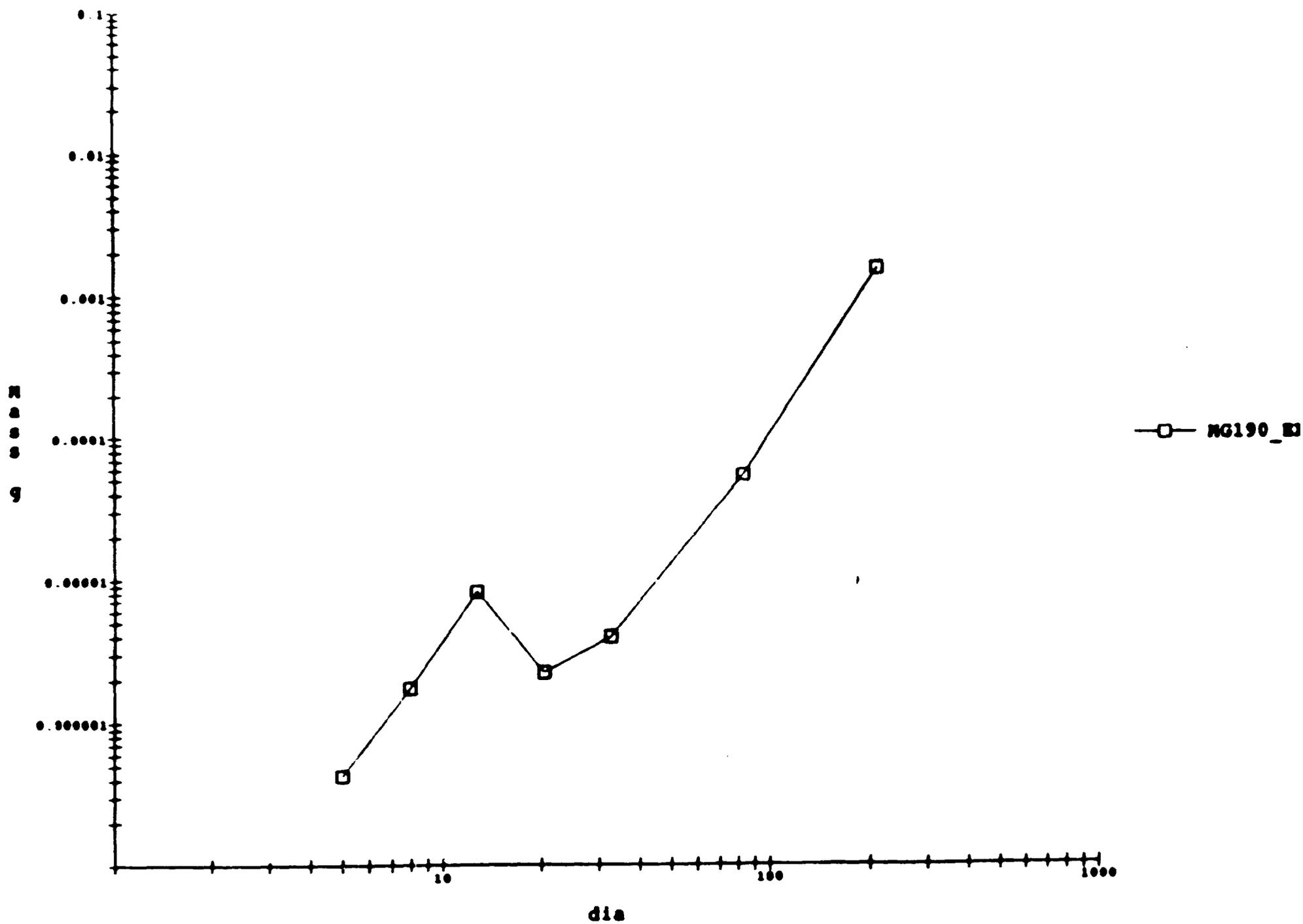


Flight 1 filter 10

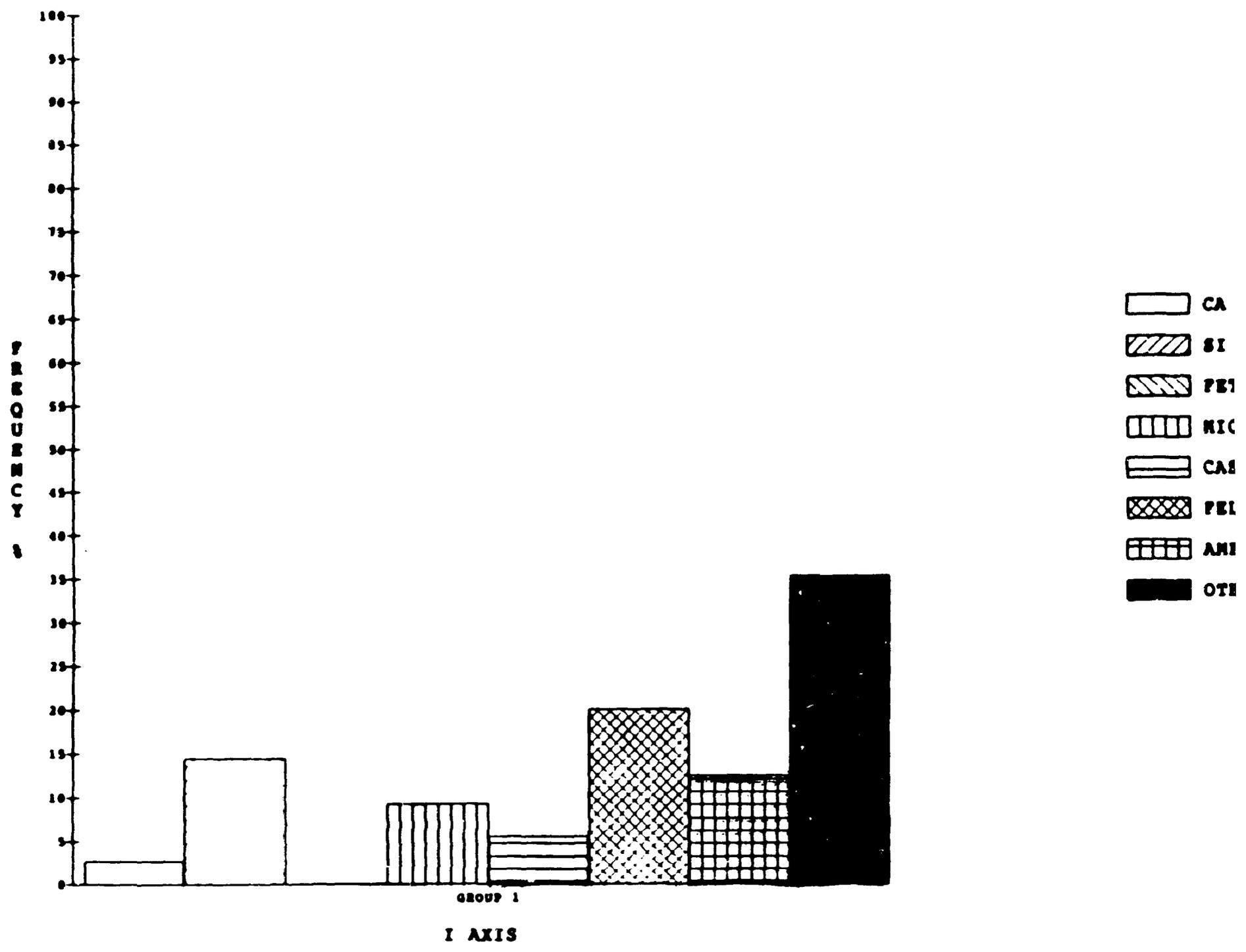




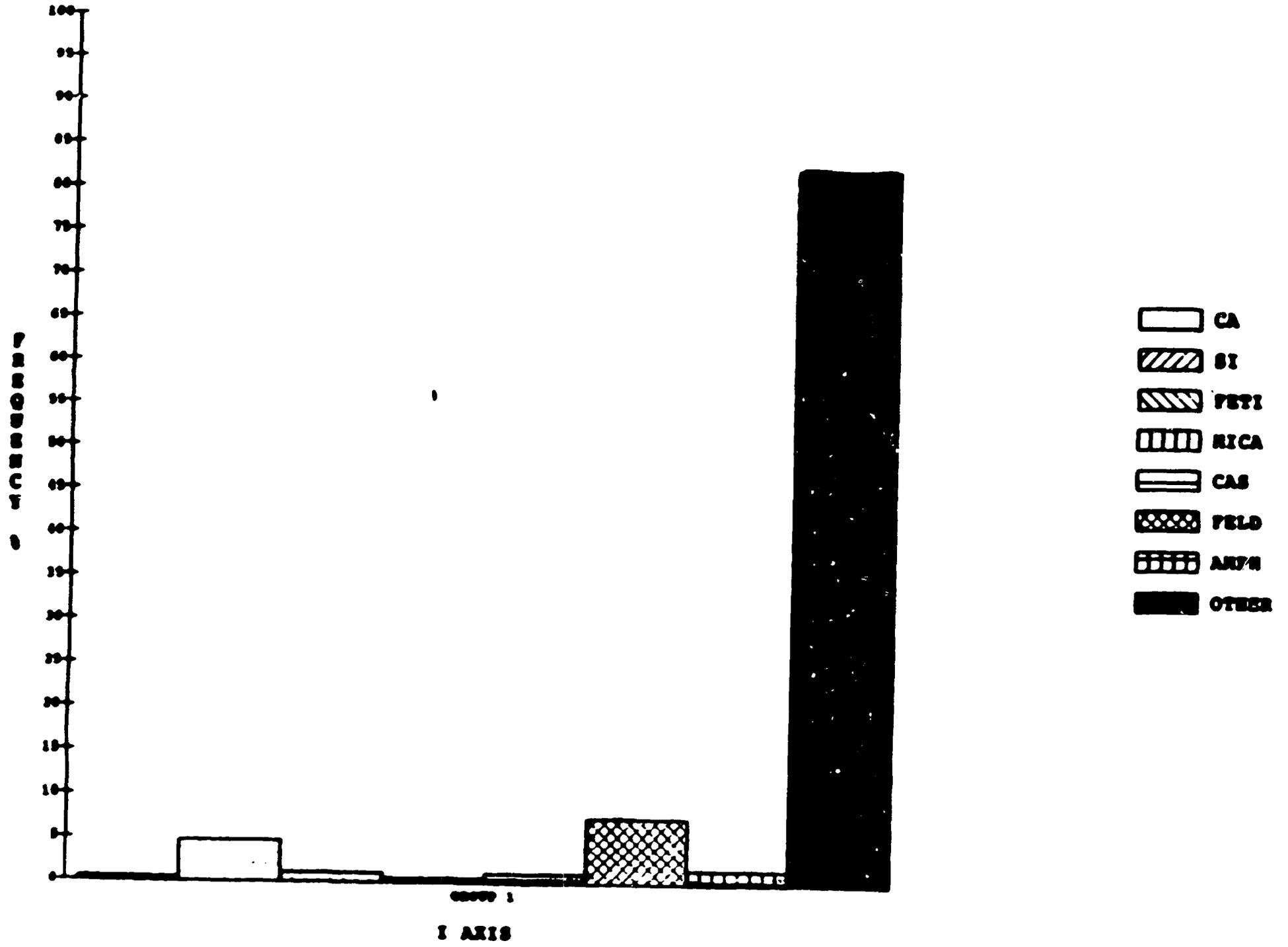
Flight 3 filter 3



Flight 1 filter 10



Flight 2 filter 4



Flight 3 filter 3

