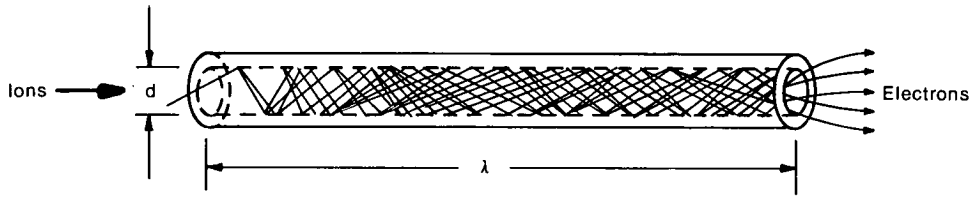
December 1975 B75-10328

NASA TECH BRIEF

NASA Pasadena Office

Electro-Optical Detector to Improve Sensitivity of a Focal-Plane Mass Spectrometer



Note: $\lambda/d \cong 40$
d = Approximately 10 μm

Figure 1. Typical Channel

A wedge-shaped microchannel electron multiplier array (MCA) has been proposed to improve the sensitivity of a focal-plane mass spectrometer. The array is to be used with the automated mass-spectrometer system described in NASA Tech Brief B75-10331. Channel electron multipliers had been thought to be inoperative when exposed to the strong magnetic fields generated by the spectrometer. This assumption has been shown to be inaccurate for small diameter channels.

A typical electron multiplier array is composed of millions of channels, one of which is illustrated in Figure 1. Ions focused by the magnetic field of the spectrometer enter the channels, striking the inner channel-wall surfaces. This releases a cascade of electrons as in a conventional electron multiplier. The

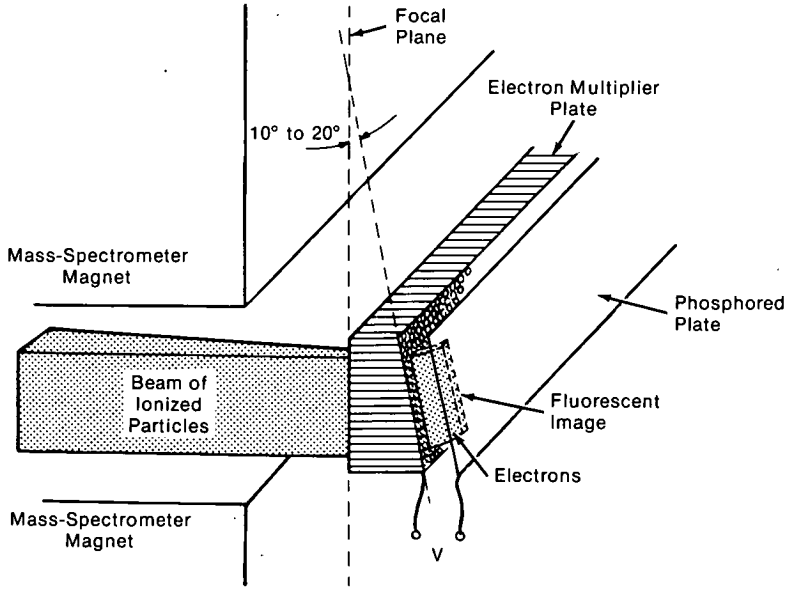


Figure 2. Wedge-Shaped Electron Multiplier Plate

(continued overleaf)

electrons leaving the channels are accelerated by an electrostatic field toward a phosphor plate for the generation of a fluorescent image and ultimate photometric measurement.

The new electron multiplier plate is set up as shown in Figure 2. The plate is wedge shaped to allow the front face of the MCA to be coplaner with the mass spectrometer focal plane and the back face to be nonparallel to the magnetic fringe field. Because of the absence of orthogonal electric and magnetic fields between the MCA and the phosphor screen, the generated electrons are able to traverse the gap and provide undistorted images of the ion beam. The result is improved spectrometer sensitivity by two to four orders of magnitude.

Note:

Requests for further information may be directed to:

Technology Utilization Officer
NASA Pasadena Office
4800 Oak Grove Drive
Pasadena, California 91103
Reference: TSP75-10328

Patent status:

Title to this invention has been waived under the provisions of the National Aeronautics and Space Act [42 U.S.C. 2457(f)] to: The California Institute of Technology, Pasadena, California 91109.

Source: Charles E. Giffin of
Caltech/JPL
(NPO-13524)