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Brief 71-10283

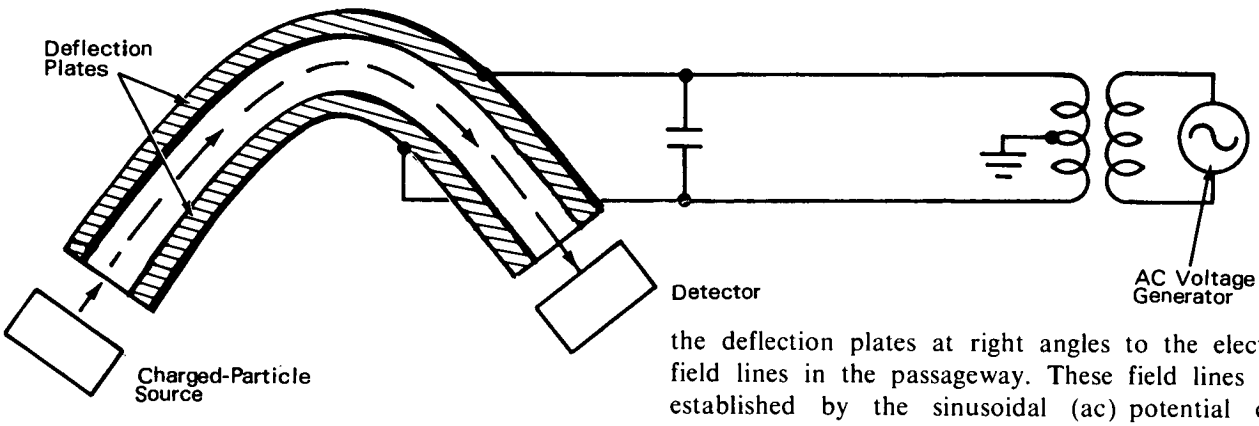
NASA TECH BRIEF

Ames Research Center

Improved Charged-Particle Analyzer: A Concept

The electrostatic charged-particle analyzer illustrated in the schematic is designed, in principle, to provide the following advantages in making simultaneous measurements of both the energy-to-charge ratio and the velocity of the particles: (1) high resolution due to the close constraints on the particle trajectory; (2) application of moderate voltages to effect particle analysis; (3) elimination of excessive weight and power associated with magnetic-field devices; and (4) elimination of stray magnetic fields and stray (fringing) electric fields associated with conventional electrostatic separators. The device is based on the concept that charged-particle analysis may be achieved by applying a sinusoidal voltage across two conductive deflection plates which have a predetermined curvature and constant spacing to define a selective passageway for the charged particles to be analyzed.

The deflection plates are machined to a curvature (calculated from equations describing the motion of a charged particle) which establishes the direction of the electric field perpendicular to the trajectory of the particles through the entire length of the passageway. A source of charged particles (e.g., positive ions from a substance being studied) directs the charged particles into the passageway between the deflection plates at right angles to the electric field lines in the passageway. These field lines are established by the sinusoidal (ac) potential difference applied by the generator across the plates. Because the deflection plates have a shape conforming to the equations relating the parameters of the analyzer, the particle trajectory between the plates approximates half a sinusoid. Under this condition, only those particles simultaneously characterized by a given velocity and a given energy-to-charge ratio pass between the deflection plates and are collected by a suitable particle detector. The particle spectrum is scanned with respect to energy-to-charge ratio by varying the peak amplitude of the generator, and with respect to velocity by varying the frequency of the generator.



Notes:

1. The deflection members may be thin plates opposing parallel surfaces of metal blocks, or may have shapes formed by the rotation of the plate cross-sections about an axis of symmetry.

(continued overleaf)

2. The deflection resolution of the analyzer could be enhanced by the addition of multiple sections in series along the particle stream. The analyzer may also be combined with apparatus to provide additional information on the properties of the particles.
3. This invention is in the conceptual stage only, and as of the date of publication of this document, neither a model nor a prototype has been constructed.
4. Requests for further information may be directed to:

   Technology Utilization Officer
   Ames Research Center
   Moffett Field, California 94035
   Reference: TSP71-10283

Patent status:

This invention has been patented by NASA (U.S. Patent Number 3,532,880), and royalty-free license rights will be granted for its commercial development. Inquiries about obtaining a license should be addressed to:

Patent Counsel
Mail Code 200-11A
Ames Research Center
Moffett Field, California 94035

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(XAC-05506)