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A NEW METHOD TO CONTROL THE ON TARGET BEAM POSITION

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A New Method to Control the on Target Beam Position*

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ABSTRACT

This work presents a new method for controlling the beam position on the target, which utilizes the secondary electrons emitted by the target upon the passage of the beam.

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In the fusion cross section measurements for systems such as $^{16}O+Cu$[1], where the evaporation residues are detected by time of flight methods, the measurements for the forward angles ($2^{o} \leq \theta_{lab} \leq 15^{o}$) were extremely difficult to make owing to the preponderance of beam particles scattered into these angles by the slit and collimators which define the main beam path. This degraded beam which reaches the detection system causes a high number of accidental coincidences which consequently constitute a high background to the E vs ToF spectra and perturbs the identification of the evaporation residues.

The solution which we adopted for this problem entailed the removal of the slits and collimator and the installation of an automatic control of the on-target beam position which defines the direction of the incident beam axis with good precision. The control system (Fig.1) senses the secondary electrons emitted by the target as the incident beam passes through. These electrons are collected by two identical copper plates (areas indicated in fig. 1) positioned symmetrically with respect to the incident beam axis. These collectors were prepared by etching plates of the impressed circuit type.

The electrons generate currents I_1 and I_2 which, after amplification, are fed to an electronic circuit which generates a signal proportional to $(I_1-I_2)/(I_1+I_2)$. This ratio signal actuates a steering magnet positioned approximately 1.5 meters upstream from the target at the entrance to the scattering chamber which corrects any drift in the incident on-target beam position. The performance of the control system is quite satisfactory; the slow drifts in the on-target beam position, which occur during measurements of long duration, are entirely eliminated.

The sensitivity of the experimental arrangement indicated by the variation in the normalized difference of the electric currents, $(I_1-I_2)/(I_1+I_2)$, as a function of the position of the incident beam on the target is shown in figure 2.

In conclusion, we have presented here a simple method for controlling the incident on-target beam position which eliminates the need for beam defining slits and collimators near the scattering chamber. The method reduces by several orders of magnitude the number of accidental coincidences which enter the detection system thus allowing easy identification of the fusion products.

References

1 - D. Pereira, J.C. Acquadro and O. Sala in proceedings the International Conference on Nuclear Structure with Heavy Ions - Legnaro, 1985, edited by R.A. Ricci and C. Villi, p.355.

Figure Captions

Figure 1 - Schematic view (not to scale) of the target holder and the secondary electron collectors.

Figure 2 - Variation of the normalized electrical current difference $(I_1-I_2)/(I_1+I_2)$ as function of the beam position on the target. The curves drawn in the figure serve only as a guide to the eye.

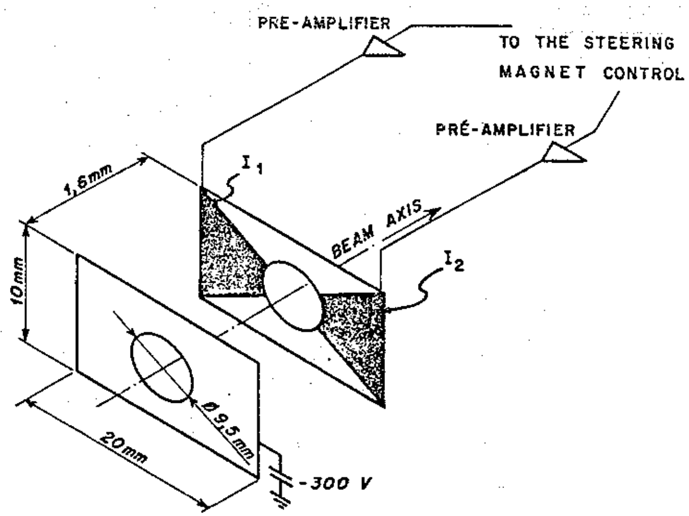

Fig. 1.

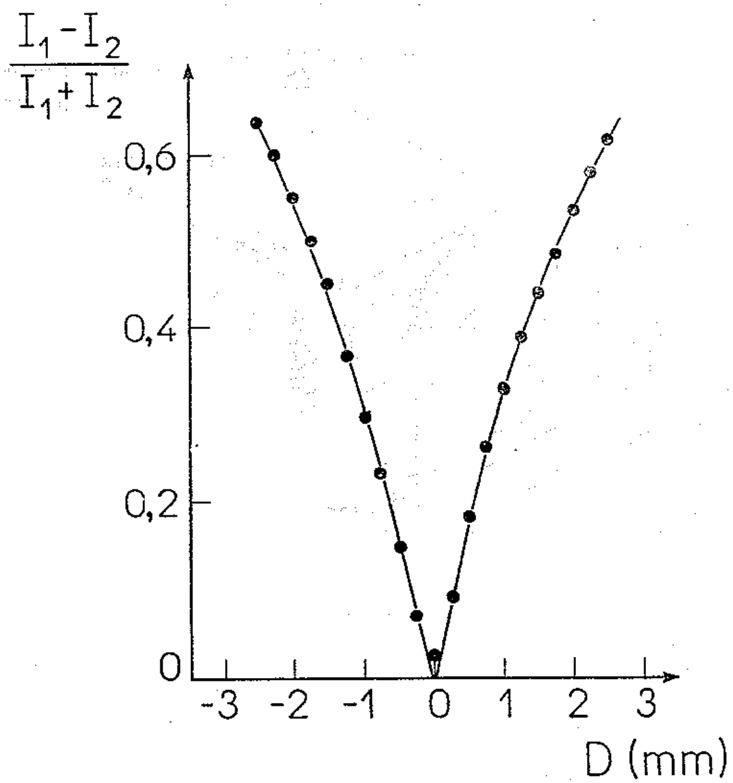

Fig. 2.