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# Proposal on the Study on Fragmentation Particles created in Plastic Detector by 300 Gev Protons

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## Introduction

Plastic detectors such as cellulose nitrate have been successufully used for the identification of charge as well as mass of stopping light particles (1)(2). This method was applied to the study of the isotopic components of cosmic ray particles (3), but due to the fact that some of stopping particles are caused by fragmentations from the collision between cosmic ray protons and the nuclei of the detector accurate flux measurement of light particles is difficult. Unlike nuclear emulsion proton tracks are not visible in plastic detector; thus primary light particles and secondary particles in the detecotr are indistingulishable from the appearences.

One way of solving this problem is to study the nature and behavier of secondary particles by direct exposrue of plastic detector to high energy proton beam from an accelerator. As a result of evaporation and spallation processes, number of secondary particles are ejected from the target nuclei in various directions. It is apparent that such ejection occurs after the target nucleus starts moving in the direction of the protons and the distribution of the secondary tracks will be non-isotropic, but rather forwardly oriented. The angular distribution of fragmentation particles especially, Li, Be and B due to relativistic protons in plastic detector is not known. Once the flux of secondary particles as a function of angule is established, an accurate evaluationof primary component will be possible, and an exposure of plastic detecotrs to high energy proton beam is only the way to aolve this problem with sufficient

accuracy.

The case of Be is especially of interest, since the ratio between Be-10 and Be-9 in the primary cosmic ray may give an important clue to the age of the cosmic radiations.

Outline of Experiment

1) Exposure: Eight stacks of plastic detectors (surface area, 5 cm X 5 cm, thickness 2 cm for 4 stacks, 3 cm for 4 stacks) consisting of Daicel cellulose nitrate, Kodak cellulose nitrate and Lexan polycarbonate will be exposed to 300 Gev proton beams.* In order to observe spherical angular distribution, two stacks will be exposed perpendicular each other in the same run---one parallel to the beam and the other normal to the beam.

2) Etching and Scanning: Etching will be done by the standard procedure i.e., 4-6 hours etching at 40°C in an NaOH solution of 6 n. Scanning will be done with a stereo microscope with about X 50 magnification. Single cones associated with light nuclei (Li, Be, B) particles are easily recognizable because of their unique shapes (the so called Gothic Window shape), and corresponding stopping enders may be also found.

3) Charge and Mass Identification, Angle Measurement: Cone lengthes, residual ranges as well as angle measurements will be do e with amicroscope equipted with a digital reading unit on the coordinates, which is also connected with a computer (University of Kiel). Charge and mass of each fragmentation tracks may be identified with sufficient accuracy.

Analysis and Application

Angular distribution of light fragmentationparticles will be studied for each element. Also study will be made on what kind of target nucleus

* desirable proton density: $10^7$-$10^9$ protons/cm$^2$, but not less than $10^6$ protons/cm$^2$

was hit by the proton and what kind of secondary components were created, and the result will be compared with the evaporation theory applied to heavier target in nuclear emulsion. Once this is established the result will be applied to the light tracks observed in plastic dtectors exposed to cosmic radiations. Proper correction on the flux obsered will be made in order to evaluate the real flux of the isotopic component of the cosmic rays.

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