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ON SECONDARY PARTICLE PRODUCTION FROM AN EPB TARGET

The properties of secondary particle beams from EPB targets are characterized by dependence on various parameters in ways different from beams from an internal target. Since single-traversal targets must be used, targets relatively thick along the beam direction are indicated to produce a sufficiently high flux of secondaries. Reabsorption effects then enter strongly. The shape of the target is a factor in two ways. Beyond some length, which is a function of the absorption cross-section of the target material for the secondary particle in question, the production falls off due to reabsorption in the target. If the cross-section of the target is of the order of the beam size lower-energy particles, which might be absorbed in the forward direction, will escape through the sides of the target. These two effects imply that the flux of low-energy particles from an EPB target may be higher at some finite angle than at 0°. In addition the absorption cross-section for K mesons and π mesons differ, which might give rise to a K/π ratio at a given angle that is better than production kinematics would indicate.

While the production process from single nucleons, groups of nucleons, or whole nuclei is dominated by statistical considerations, the upper end of the momentum spectrum will be dominated by single processes, e.g. in H_2 the highest energy π^+ will probably come from $p+p \rightarrow d+\pi^+$. The largest flux of high energy $K^{\pm}$ particles should come from neutron-rich targets, then, based on charge conservation in single processes, e.g. $p+n \rightarrow K^+ \Lambda\ n$ or $p+n \rightarrow K^+ \Sigma^-\ p$. From these considerations a high-A target would be indicated for K beams. The effect could be checked by a comparison of $K^{\pm}$ production of a given momentum from H_2 and D_2 targets of the same relative lengths. Within the limitations of the optics of the channel, variation of the material and geometry of the EPB target may thus be used to vary the absolute and relative fluxes of secondary particles in a given secondary beam channel from the EPB. The optics of the secondary beam channel may become a limiting factor, because the length of EPB targets tends to be long to obtain adequate flux. For a dc separated or enriched beam the limitations by secondary beam optics can be minimized by doing both the momentum and mass analysis in the vertical plane.

In considering the usual parameterization of particle production data for EPB target stations the relevant quantity, both from the production viewpoint and from an operations viewpoint is the transverse 3-momentum P_t (or P_t^2). An accumulation of data from many sources indicates that P_t is, on the average, an invariant of the particle production process considered at the statistical level. From the operations viewpoint the strengths of bending magnets which must be used for momentum selection for secondary beams, are also specified by a P_t maximum. Flux-angle curves parameterized in terms of secondary momentum are relevant however for selecting the optimum angle at which to construct a beam of a given momentum.

For efficient exploitation of EPB target stations it would be useful to obtain particle production data with H_2 and D_2 targets to test particle production models. These targets should be "disc" targets relative to the incident beam cross-section. The (Z,A) dependence should be determined from a series of thin "disc" targets ranging over Z. Reabsorption effects should be demonstrated by a set of measurements with "disc" targets of varying thickness for at least one target material. The material should be of reasonably short interaction length to avoid being limited by the acceptance of the transport system. Finally, the effect of the escape of particles through the sides of the target for various target cross-sections should be determined.

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