DIFFERENTIAL RECOIL RANGE MEASUREMENTS IN THE REACTION ^{4}He + ^{59}Co AT 90, 150 AND 200 MeV

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Linear momentum transfer in the $^{3,4}He$ + ^{59}Co reaction was the subject of previous investigations at IUCF.[1,2] It was found that, when the bombarding energy increases past ~30 MeV/nucleon, fairly abrupt changes in the dependence of linear momentum transfer on the bombarding energy per nucleon occur. Up to this energy, the average momentum transferred to the target residue (projected on the beam axis) increases when the bombarding energy is increased. Past the "critical point", this trend is reversed and linear momentum transfer decreases with increasing energy. This observation may be interpreted as a signature of the fundamental change in the reaction mechanism. The basic goal of the experiment described in this report was to determine the change of linear momentum transfer distribution in addition to average values obtained earlier.

It was not clear if the behaviour of the average momentum transfer reflected a gradual shift of the LMT distribution as a whole or if it was due to a change in balance between two distinct LMT components of the reaction. In other words, it was not known if the LMT distribution was uni- or bimodal. Bimodal LMT distributions are known[3,4] to occur as a result of a competition between compound and noncompound reaction mechanisms.

In order to resolve this ambiguity, linear momentum transfer in the reaction ^{4}He + ^{59}Co at 90, 150 and 200 MeV was investigated by a thin target - thin catcher method. At each energy we employed two thin (~100μg/cm^2) cobalt targets evaporated on berryllium backing, one of them facing the beam and the other facing downstream. A few 50μg/cm^2 carbon foils were placed in front of the upstream target to examine the backward recoil range distribution. Up to 38 similar catchers were stacked behind the downstream target to investigate the distribution in the forward (i.e. downstream) direction. An example of the forward recoil range distributions for several radioactive isotopes is presented in Fig. 1a - 1d for 200 MeV bombardment. Arrows point to the compound nucleus recoil range. These preliminary results strongly support conclusions of the thick target - thick catcher work,[1,2] ruling out a two component LMT distribution as a possible source of the trend reversal in the dependence of linear momentum transfer on the bombarding energy.

1) J. Jastrzebski et al., Phys. Lett. 136B (84) 153 and to be published.

2) J. Jastrzebski et al., contribution to this Annual Report and to be published.

3) E. Gadioli et al., Recoil Range distributions of residues from ^{4}He + ^{59}Co reactions, Phys. Rev. C 32, 1214 (1985).

4) M. Fatyga et al., Evolution of Nucleus-Nucleus Collision Mechanism from the Barrier to Beyond the Fermi Energy, Phys. Rev. Lett. 55, 1376 (1985).

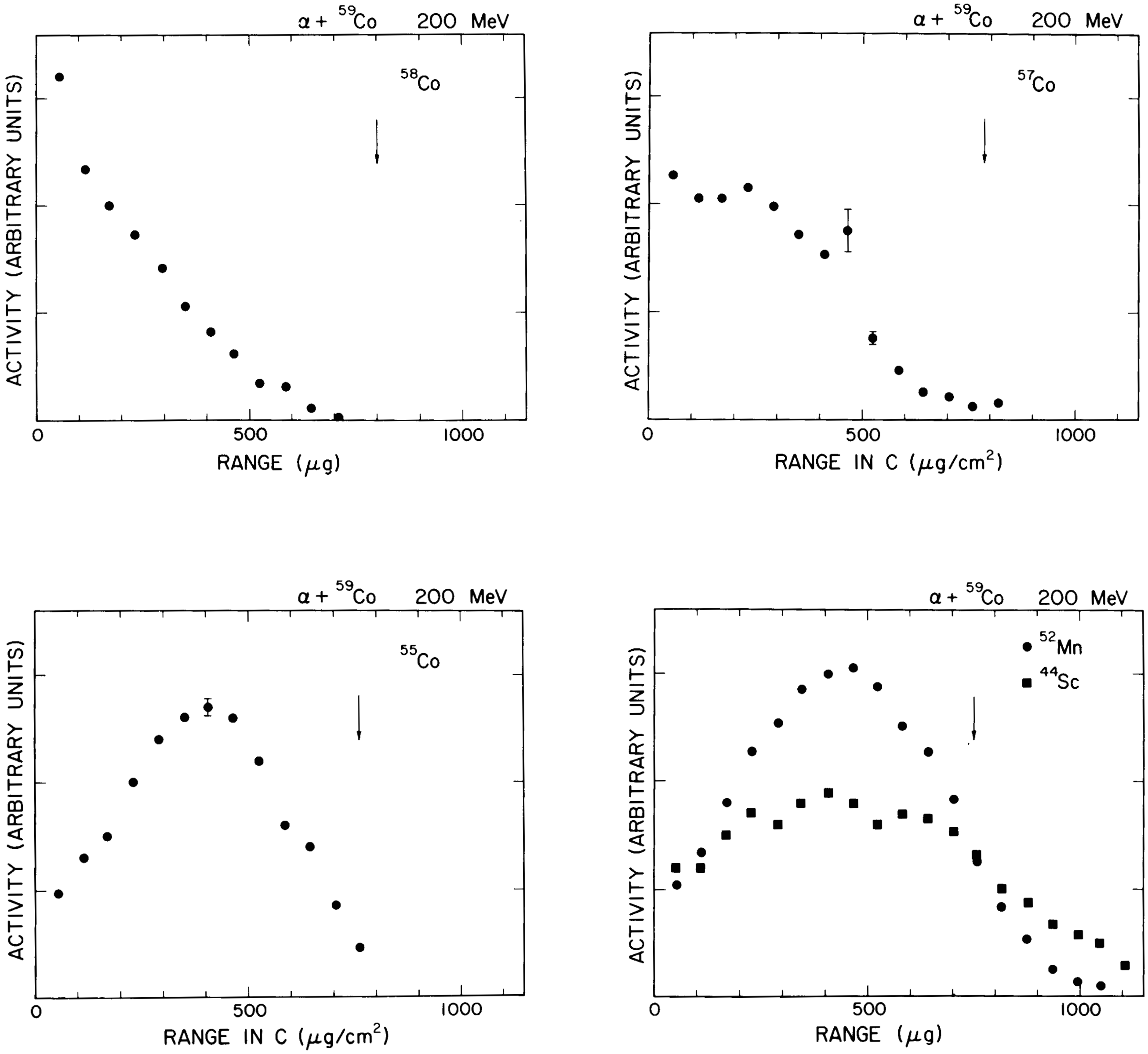

Figure 1. An example of the forward recoil range distributions of several radioactive isotopes measured in the reaction ^{4}He + ^{58}Co at 200 MeV.

a) $^{59}Co(^{4}He,2p3n)^{58}Co$
b) $^{59}Co(^{4}He,2p4n)^{57}Co$
c) $^{59}Co(^{4}He,2p6n)^{55}Co$
d) $^{59}Co(^{4}He,4p7n)^{52}Mn$; $^{59}Co(^{4}He,8p11n)^{44}C$