CERN/PSCC/8031
PSCC/M 58
May 10, 1980

STATUS REPORT ON THE EXPERIMENT SC 86

STUDY OF NUCLEAR COLLISIONS OF 86 MeV/a.m.u. ^{12}C WITH HEAVY TARGETS BY COLLECTIONS OF THE HEAVY RECOIL NUCLEUS

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A first 9 shifts experiment has been completed on January 1980 to test the possibility of measuring the recoil properties of α radioactive heavy partner produced in interactions of ^{12}C at 86 MeV/a.m.u. on medium and heavy targets. The heavy recoils are first thermalized in a gas and then collected on the surface of a solid state detector with an electric field. At the end of thermalization the lines of the electric field are prependicular to the beam and allow measurements of recoil ranges along the beam axis. We have seen first that the background in the energy range of the detected α radioactivities, although higher than with less energetic heavy ions, is low enough to allow precise measurements of the α desintegrations. To test the validity of the on line collection measurements of ^{150}Dy and ^{149}Tb have been compared with the off-line results of thick targets thin catchers experiments on the same isotopes. The results obtained are very similar, except for the first two centimeters, where the collection efficiency decreases for in beam measurements due to inhomogeneity of the electric field or to an excess of electrons near the target in the gas. Thus a correction curve has been obtained.

α radioactive products have been detected for numerous targets ranging from Dy to U. The pattern of relative cross sections have been obtained for α radioactive isotones N = 84 and 85 for Ho, Er, Tm, Yb. We have shown a logarithmic decrease of the cross sections as a function of ΔZ (charge difference between the target and the detected isotope) between Ta and Th. The associated ranges are of the order of 10 to 15 MeV and then much smaller than the ranges corresponding to compound nucleus or fission mechanisms. One has here to explain a process in which for instance 80 nucleons are removed from the target in a collision where 1/4 to 1/3 ot the total linear momentum is transfered to it and therefore where a maximum of 400 MeV is deposited in the nucleus : these results are certainly a signature of some kind of collective process.

Another striking feature is the production of isotopes of 1 to 3 charges heavier than the target. These kind of products have never been seen in interactions of relativistic heavy ions with heavy targets at GeV/a.m.u. energies. For instance in off line detection some At isotopes have been produced on lead targets with very small recoil energies (∿ 2 MeV). Interactions with a net exchange of three protons and three neutrons in the target have been measured. It seems that this kind of nuclei should be produced by peripheral collisions where nucleon-nucleon collisions are predominant.

This first overview of these kind of interaction should be improved using thinner targets (∿ 200 $\mu g/cm^2$) to get the distributions of ranges and with a device in which a two dimensional distribution of ranges might be obtained. The measurements could be essentially focused on two very different kind of reactions in which a nucleus of Z higher than the target is formed or for residual nuclei very far away of the target.

<u>Beam time requirement</u> :

For studies of two dimensional differential ranges of residual nuclei on selected targets in the region of Z = 62 to 70 and in the region of Z = 82 we would require a run of 30 shifts. 24 shifts of ^{12}C at 86 MeV/a.m.u. and 6 for some explorative experiments with ^{14}N.