EXPERIMENTAL REACTION PARAMETERS OF THE REACTION (14.0 MeV/u) $^{208}Pb + ^{197}Au$ USING TWO THRESHOLD DETECTORS.

FALAK NAZ KHATTAK*, EHSAN ULLAH KHAN, TABASSUM NASIR*, JAVID JEHAN BALUCH*** AND FAIZULLAH KHAN***

**Department of Physics, Gomal University, Dera Ismail Khan (NWFP) Pakistan.*
***Radiation Physics Dvision, PINSTECH, Nilore, Islamabad, Pakistan*
****Department of Environmental Science, CIIT,Abbottabad,Pakistan.*

ABSTRACT

Experimental reaction parameters for the reaction of ^{208}Pb projectiles with ^{197}Au targets have been reported in this paper. Thin layers of ^{197}Au were vacuum deposited on three sheets of mica and three sheets of CN-85 and exposed to a normal bunched beam of (14.0 MeV/u) ^{208}Pb at GSI, Darmstadt, Germany. The reaction products, moving in the forward hemisphere, were recorded in the detectors as tracks. After removing the target material, from the detectors, the tracks were revealed by proper chemical etching. Lengths and angles of the tracks were measured. Binary events were bifurcated into elastic and in-elastic events. Quarter point angle $\theta_{1/4}$ was determined from elastic binary events. From the analysis of elastic data the reaction cross-section σ_R^{exp}(el.), maximum angular momentum L_{max}, radius of interaction R_{int}, and Coulomb potential V_c were deduced. From inelastic events of different multiplicities the partial and total reaction cross-sections σ_R^{exp} (inel) were determined. Values of L_{max}, θ_{gr}, R_{int} and V_c have also been determined indirectly, from the inelastic reaction cross-section. The average values of the above parameters are comparable to their theoretically predicted values.

Key words: Reaction parameters, Heavy Ion Interaction, elastic events, in-elastic multi pronged events, Cross-section

INTRODUCTION

Solid State Nuclear Track Detectors (SSNTDs) have been extensively used for the heavy ion (A>4) interaction studies (Baluch,1996; Khan *et al.*, 1988; Shahzad *et al.*,1999) which provide opportunities to study a number of phenomenon displaying properties of many-body nuclear system, not prone to light-ion induced reactions. The developed accelerator technologies (Klabunde *et al.*, 2001; Blasche, 2001; Steck *et al.*, 2001) and ion separation facilities have broadened the scope of SSNTDs and heavy ion interactions and have lead to the possibility of experimentation with virtually all ionic species in the periodic table at collision energies from below Coulomb barrier up to hundreds of GeV/u. The remarkable progress in the particle detection systems (Stelzer, 1976) generates an extensive amount of accurate data which is a rich source for theoretical modeling of the underlying nuclear processes (Cavallaro, 1998; Tsang, 1997; Williams ,1997). However, the collision of complex nuclei with each other continues to defy a unified microscopic description. In the light mass region at low energies (Elab<10 MeV/u) the major part of the total reaction cross-section is accounted for by the fusion-evaporation process with a single heavy residual nucleus. However, a binary process of fusion-fission type has also been observed together with quasi-elastic and deep inelastic scattering (Beck , 1998).These data are well explained on the basis of statistical model (Matsuse ,1997). At the higher projectile energies the collision with heavy targets gives rise to conditions favourable for the production of quark-gluon plasma with specific effects on the nature and yield of observed particles. However, many of the results on particle production can also be explained reasonably well by using Monte-Carlo event generators without invoking plasma formation (Drabrowski ,1998).The intermediate energy region is rather broad, scattering from ~10 MeV/u to several hundred MeV/u. The reaction mechanism at energies below 20 MeV/u is dominated by mean field effects and changes gradually to single particle