Studying the entrance channel effect by populating compound nucleus ^{225}Pa

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In recent years, studying the fusion-fission dynamics has been an important topic of research in heavy element formation. The formation of heavy elements around capture barrier strongly depends upon formation of compound nucleus (CN) and its survival, which is hindered by other non-equlilibrium processes , viz. quassi-fission and fast fission [1, 2]. A large angular anisotropy distribution [3] and wider mass width mass distributuions [4, 5] confirms the presence of these processes around capture barrier. It has been found that entrance channel variables such as mass asymmetry ($\alpha = \frac{A_T - A_P}{A_T + A_P}$), product of atomic charges of the colliding partners ($Z_P{*}Z_T$), and static deformation (β_2) of colliding partners play a crucial role in the formation of a true CN. From earlier measurements, it was sugested that non equlilibrium process dominated at $Z_P{*}Z_T > 1600$, but in recent measurements, these processes are found to exist with $Z_P{*}Z_T < 1000$. Similarly, mass asymmetry (α) with respect to Businaro Gallone point [6] provide significant information about the fission dynamics. Signature of the non compound process has been observed with the help of probe like mass distribution and angular anisotropy of the fission fragments. In present work, mass distributions measurement of ^{19}F+^{206}Pb have been performed around barrier energies and its mass width has been compared with existing data for ^{16}O+^{209}Bi reaction. The quadrouple static deformation (β_2) of target in both cases is 0.0 [8]. Different entrance channel variables has been shown in Table 1.

TABLE I: Entrance channel variables for ^{225}Pa are tabulated. α_{bg} is Businaro Gallone point, α is mass asymmetry, and χ is CN fissility [7].

Reaction	CN	$Z_T Z_P$	α_{bg}	α	χ	Ref.
^{16}O + ^{209}Bi	^{225}Pa	664	0.87	0.858	0.773	[9]
^{19}F + ^{206}Pb	^{225}Pa	738	0.87	0.831	0.773	

The experiments were performed using Pelletron accelerator facility at IUAC, New Delhi. Pulsed beam of ^{19}F was bombarded on ^{206}Pb target with beam energy in the range of 80 to 120 MeV. ^{206}Pb targets with thickness of 110 μg/cm^{-2} were prepared by evaporation technique at IUAC target laboratory. Two large area multiwire proportional counters (MWPCs) with an active area of 20 cm × 10 cm [10] were used for detection of fission fragments. Forward detector was placed at polar angle (θ) = 40 degrees, azimuth angle (ϕ) = 90 degrees and backward detectors were placed at θ = 120 degree, ϕ = 270 degree with respect to beam direction. Forward and backward detector was placed at a distance of 35 cm and 27 cm from target center, respectively. Two silicon surface barrier detectors were placed at ±10 degree, with respect to beam direction, for monitoring the beam. Mass Distribution for ^{19}F + ^{206}Pb has been extacted from MW-

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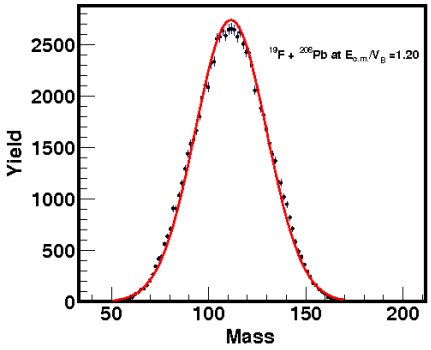

FIG. 1: Experimental mass distribution of fission fragments for ^{19}F + ^{206}Pb reaction above barrier energy. Circles represent experimental data and solid line is the Guassian fitting of mass distribution.

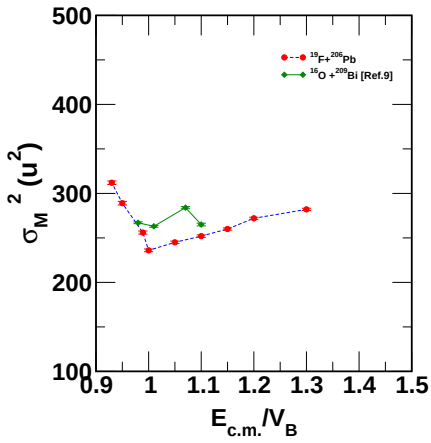

FIG. 2: Mass variance of fission fragments for ^{19}F + ^{206}Pb, ^{16}O + ^{209}Bi reactions as a function of reduced centre of mass energy. Experimental mass variance were extracted by Guassian fitting of mass distribution data.

PCs positions signal and is shown in Fig. 1.

^{19}F + ^{206}Pb and ^{16}O + ^{209}Bi reactions are forming same compound nucleus and their mass asymmetry (α) is lying below Businaro Gallone point. Both reactions exhibit symmetric fission around capture barrier energies. Existing mass width data of ^{16}O + ^{209}Bi [9] is compared to measured mass width of ^{19}F + ^{206}Pb reaction. Mass width for ^{19}F + ^{206}Pb is more compared to mass width for ^{16}O + ^{209}Bi at below barrier energies as shown in Fig.2. The above results are preliminary and further analysis is in progress.

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