LIGHT PARTICLE EMISSION IN $^{14}N + ^{12}C$

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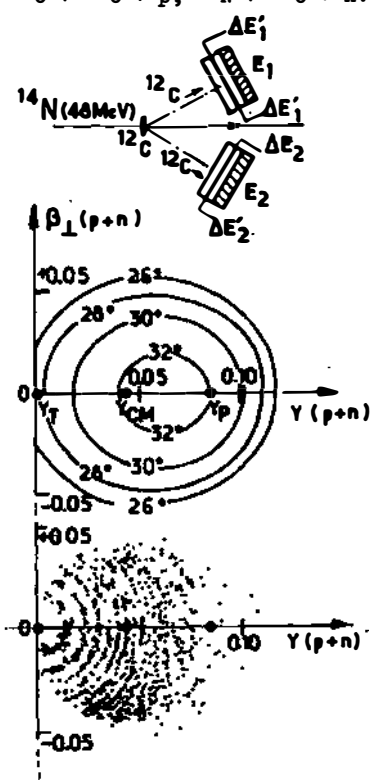
Light particles accompanying heavy ion collisions may give some insight into the dynamical properties of the interacting system or the sequence of emission after fusion.

The emission of p, n, d in $^{14}N + ^{12}C$ at 48 MeV has been analysed in this way by using a kinematically complete correlation between two heavy fragments in the channels : $^{14}N + ^{12}C \rightarrow ^{12}C + ^{12}C + p + n$, $^{12}C + ^{12}C + d$, $^{12}C + ^{13}C + p$, $^{13}N + ^{12}C + n$. In such correlations, the light particles are considered as missing masses. We avoid using three-body diagrams but adopt the classification which is used in relativistic collisions, i.e. the coincidence events are plotted versus transverse velocity and rapidity of the missing mass.



To cover a large area in the rapidity plot, two position sensitive counters[1] have been used in coincidence, giving a total of 225 combinations of angular correlations from slit to slit (steps of about 0.7 degrees). The events are then expected on loci which are partly shown in the figure for the first channel afore mentioned. This four-body decay is analysed by considering the (p + n) system as a virtual deuteron to compute the kinematics.

The impressive result, after adding all coincidence events, is a clear source pattern

which seems centered at the target rapidity. The lack of more results around $Y = Y_{Projectile}$ does not allow to conclude to a symmetry of this pattern relative to the normal at $Y = Y_{CM}$.

The clear propagating circle pattern is unexplanable by usual sequential decays or a break-up process. For example, a decay of $^{14}N^{**}$ in $^{12}C + p + n$ following a deep inelastic process should give a source (rough circle) centered out of the beam path (the average velocity defining the centre is given by the kinematics of the first step $^{12}C + ^{14}N^{**}$) ; a decay from fusion fragments like $^{24}Mg^{**} \rightarrow ^{12}C + ^{12}C$ should result in a scattering of events on circles centered around $Y \approx Y_{CM}$. Finally, a break-up of ^{14}N is comparable to the first case (however, at threshold the radius of the source is zero).

A complete analysis involving coulomb distortions[2,3] is in progress.

References

1) B. Berthier, E. Chamaux, J.P. Fouan, CEA-N-1861 (1975), p. 57
2) J.L. Québert et al, Extreme states in Nuclear Physics, Dresden, 1980 (vol. 1)
3) K.G. Libbrecht and S.E. Koonin, Phys. Rev. Lett. 43 (1979) 158