# Near threshold study of the $pd \to {}^3\mathrm{He}\,\eta$ reaction

K. P. Khemchandani, N. G. Kelkar and B. K. Jain

*Nuclear Physics Division, Bhabha Atomic Research Centre, Mumbai 400 085, India*

Experimentally [1,2], a spectacular fall by a factor of about 4 from threshold to 75 MeV/c above threshold, in the amplitude for the $pd \to {}^3\mathrm{He}\,\eta$ reaction has been observed. It is believed to arise due to the strong $\eta\,{}^3$He interaction in the final state. We have investigated these FSI effects using a T-matrix, $T_{\eta^3He}$, which includes the off-shell and binding effects in $\eta^3$He scattering. Starting with the four particle equations for the $\eta$(3N) system, we evaluate $T_{\eta^3He}$ within a Finite Rank Approximation (FRA) approach. We model the $\eta$ production to proceed in two steps, thus allowing the large momentum transfer in this reaction to be shared by three nucleons. In the figure we present our results including the FSI for 3 different models of the elementary t-matrix, $t_{\eta N \to \eta N}$, which enters the calculation of $T_{\eta^3He}$. These t-matrices fit the experimental data on $\pi N$ elastic scattering and $\pi^- n \to \eta p$ reaction, but lead to different values of the $\eta N$ scattering length. Our results reproduce the observed rapid fall of the amplitude. We find that the off shell and binding effects in the FSI are significant. We also find that the three body mechanism leads to an isotropic angular distribution of the $\eta$ mesons near threshold which slowly changes to a backward peak at higher energies.

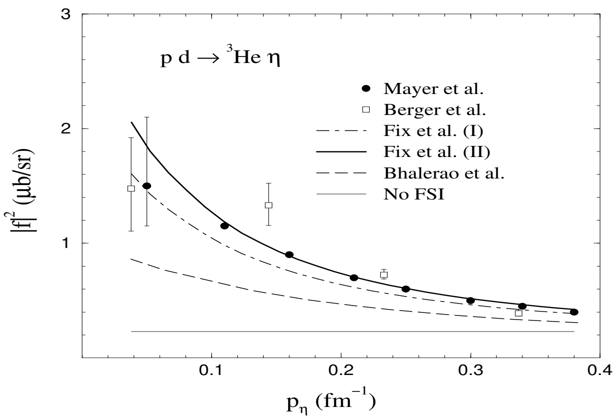


Figure 1: The square of the $p\,d \to {}^3\mathrm{He}\,\eta$ amplitude ($|f|^2 = \frac{p_\eta}{p_p}\frac{d\sigma}{d\Omega}$) as a function of the $\eta$ momentum in the centre of mass. The thin solid line is our calculation without FSI. The solid, dash-dotted and dashed lines include FSI with different prescriptions of the elementary t-matrix, $t_{\eta N \to \eta N}$ from Refs [3,4].

## References

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