Proton Production Cross Sections for Reactions Induced by 392 MeV Protons.

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Recently, nuclear datas which are measured by using intermediate energy accelerators are needed in many fields of engineering, medicine, science and so on. In particular, they are requied to estimate exposed dose of human in the space craft and cancer therapy. However only few studies have so far been made at the region above 200 MeV on (p,p$'x$) reaction.

There are many simulation code for nuclear reaction : for example INC, QMD [1, 2], AMD etc. Especially, QMD model code is widely-applied for not only simulation but also evaluation of nuclear datas. But because of short of data, we don't confirm its accracy well. Therefore we measured the ^{12}C(p,p$'x$) reaction DDX and compared it with QMD model calculation.

Measurments of proton production reactions were carried out at RCNP. Proton beam was accelerated to 392 MeV by the ringcyclotron. The target of ^{12}C located at the center of a one-meter-diameter chamber. Energy spectra of emitted protons were measured by using stacked scintillator detectors (**Fig.1**) [3] placed out of the chamber.

The measured energy spectra were compared with the QMD model. **Fig.2** shows energy spectra for ^{12}C(p,p$'x$). With the standard QMD which is shown by the solid line, the reproducibility of experiment value is not very good. We paid notice to the ground state in QMD. **Fig.3** shows distributions for ^{12}C ground state. With the standard QMD, both of momentum and density distribute within narrower regions than that of measured one.

To enlarge the distibutions, we changed parameters of the density dependent potential for nucleon interactions. The code uses the local Skyrme type potential:

$$U_{Sky}(r) = A\frac{\rho(r)}{\rho_0} + \frac{B}{1+\tau}\left(\frac{\rho(r)}{\rho_0}\right)^{\tau}$$

We adjusted the parameters A and B. The resultant distributions are shown by doted line in **Fig.3**. It is found that the modified QMD reproduce the mesured values reasonably.

And energy spactra with modified QMD is shown by doted line in **Fig.2**. At backward angles, cross sections with standard QMD godown rapidly with increasing proton emission energy. But with modified QMD, it is more reproducible than standard QMD.

It is found that the theoretical spectra are sensitive to ground state parameters of the target nucleus.

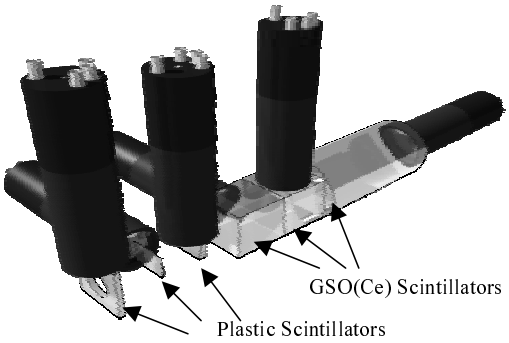

Fig.1 A sketch of the detector

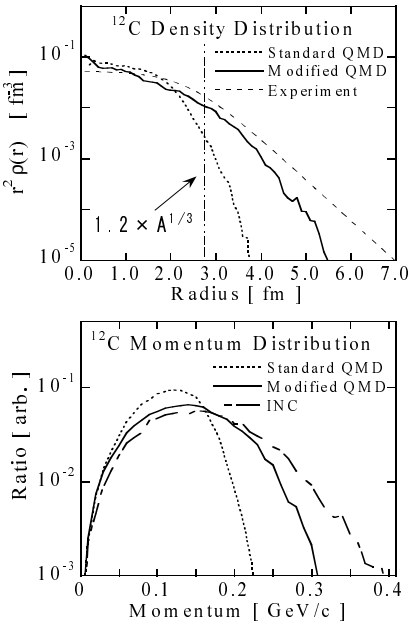

Fig.3 Distributions of nucleon density (top) and momentum (bottom) for ^{12}C ground state

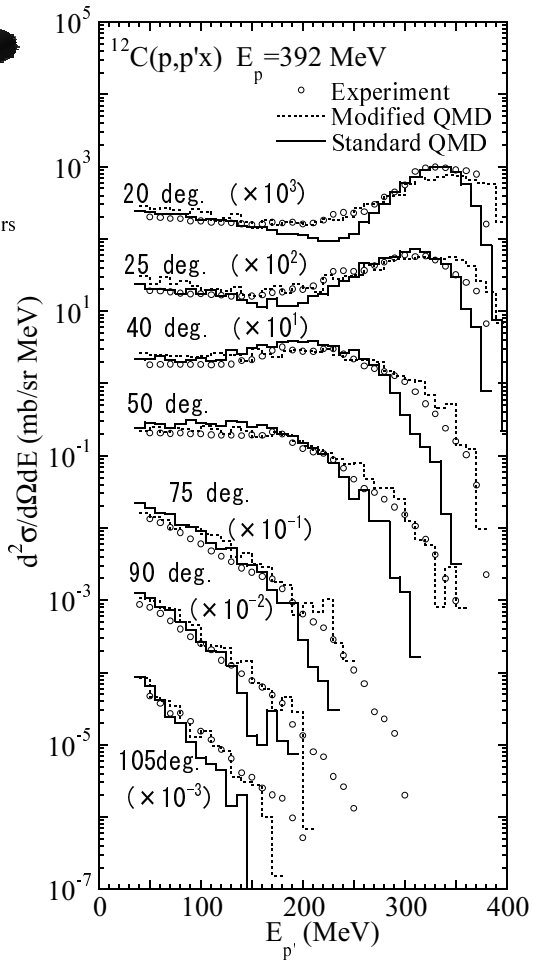

Fig.2 Proton production reaction DDX for ^{12}C at 392 MeV

References

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