TITLE

300,400 MeV 陽子ー原子核反応からの陽子、重陽子生成

包括的な原子核反応機構の理解

工学等応用のための原子核反応データ

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魚住裕介

New accelerator-driven technologies

- accelerator transmutation of waste (ATW)
- transmuting long-lived radioactive waste into shorter-lived products
- converting excess plutonium
- producing energy

These technologies make use of spallation neutron sources.

Medical treatments

Cosmic ray dose evaluation

New nuclear cross section data are needed from 20 MeV to 3 GeV to improve theoretical predictions of

neutron production,

shielding requirements,

activation,

radiation heating,

material damage,

production rate of nuclide

Such predictions can guide the design of the target/blanket configurations and can reduce engineering overdesign costs.

Evaluation of High Energy Nuclear Data

Development of code for evaluation

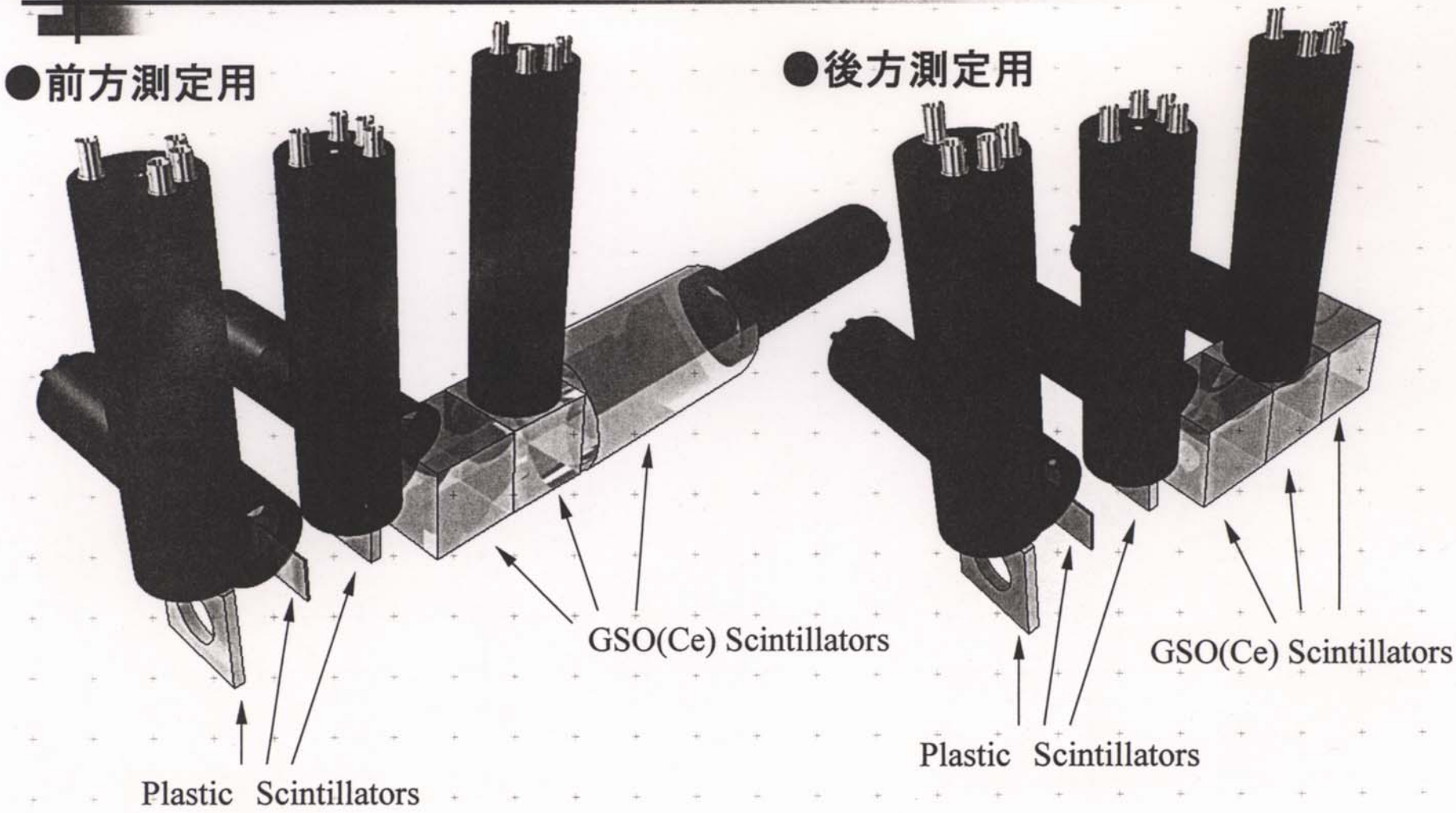
- Intranuclear Cascade Model

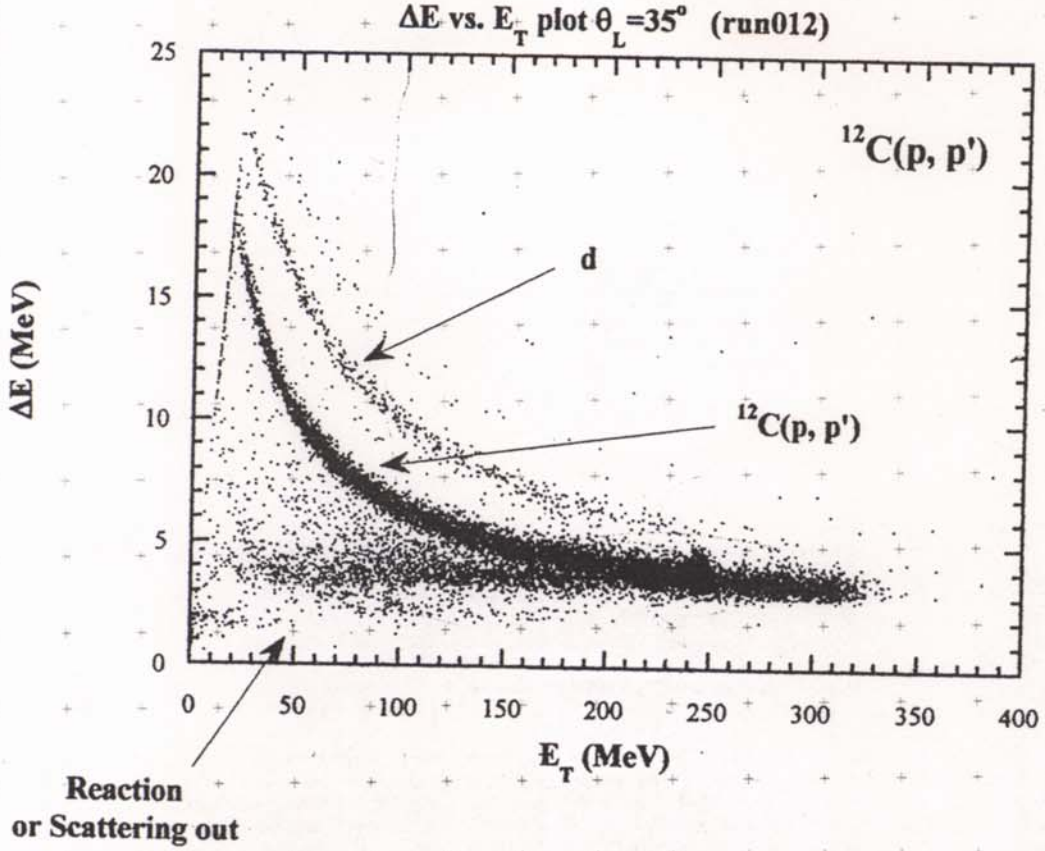
  (HETC/3-step)

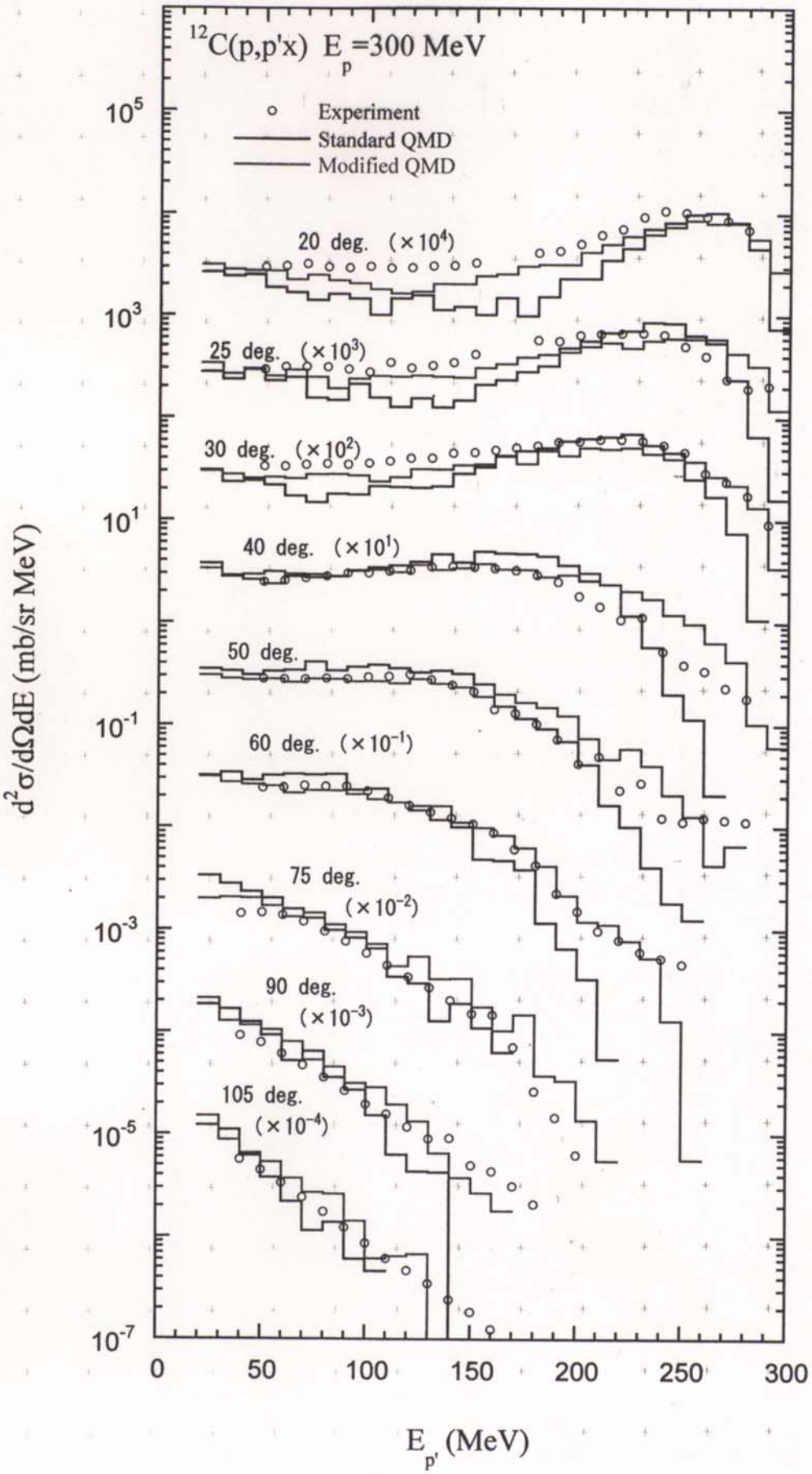
- Quantum Molecular Dynamics Model

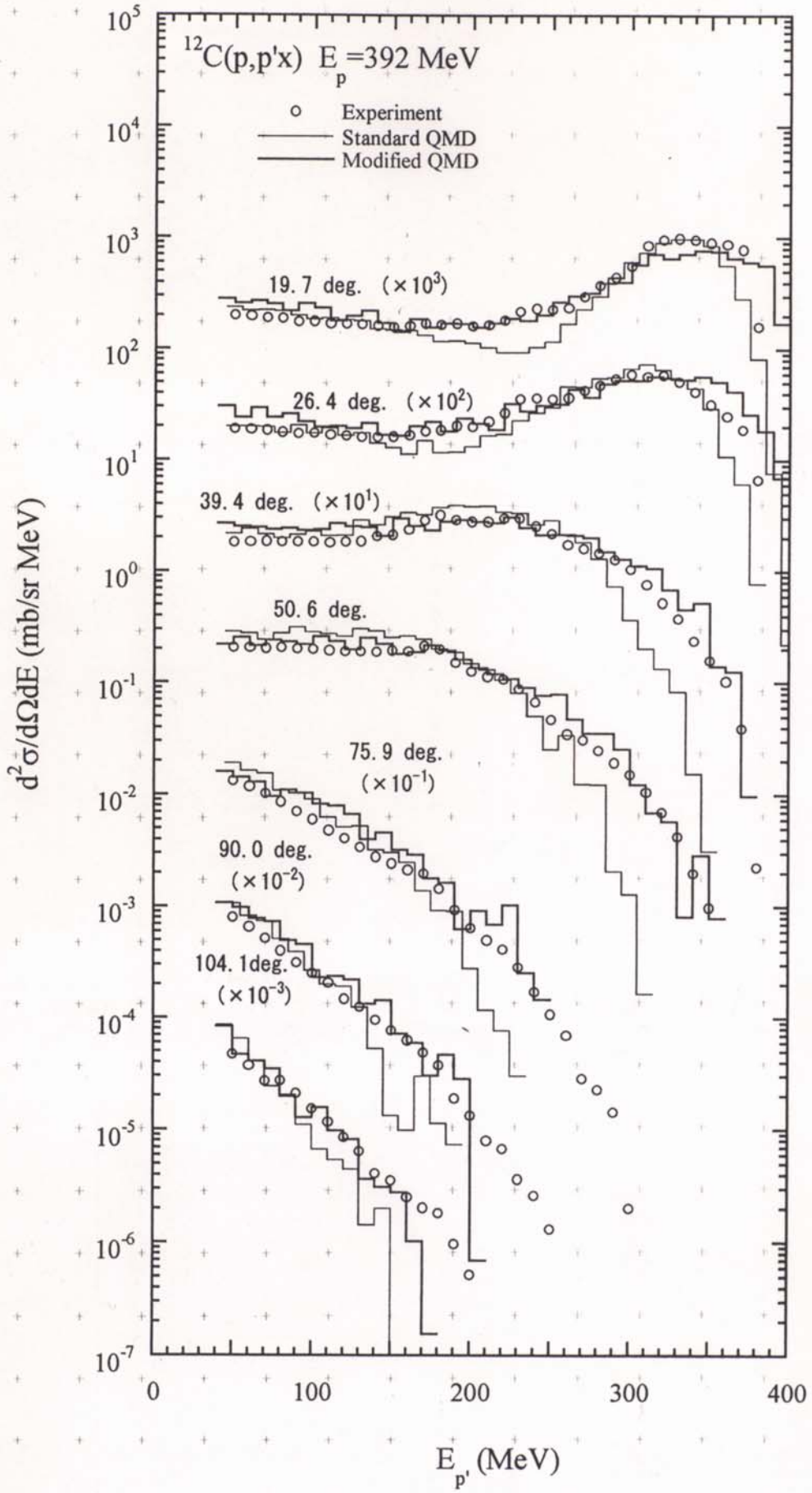
  (JQMD)

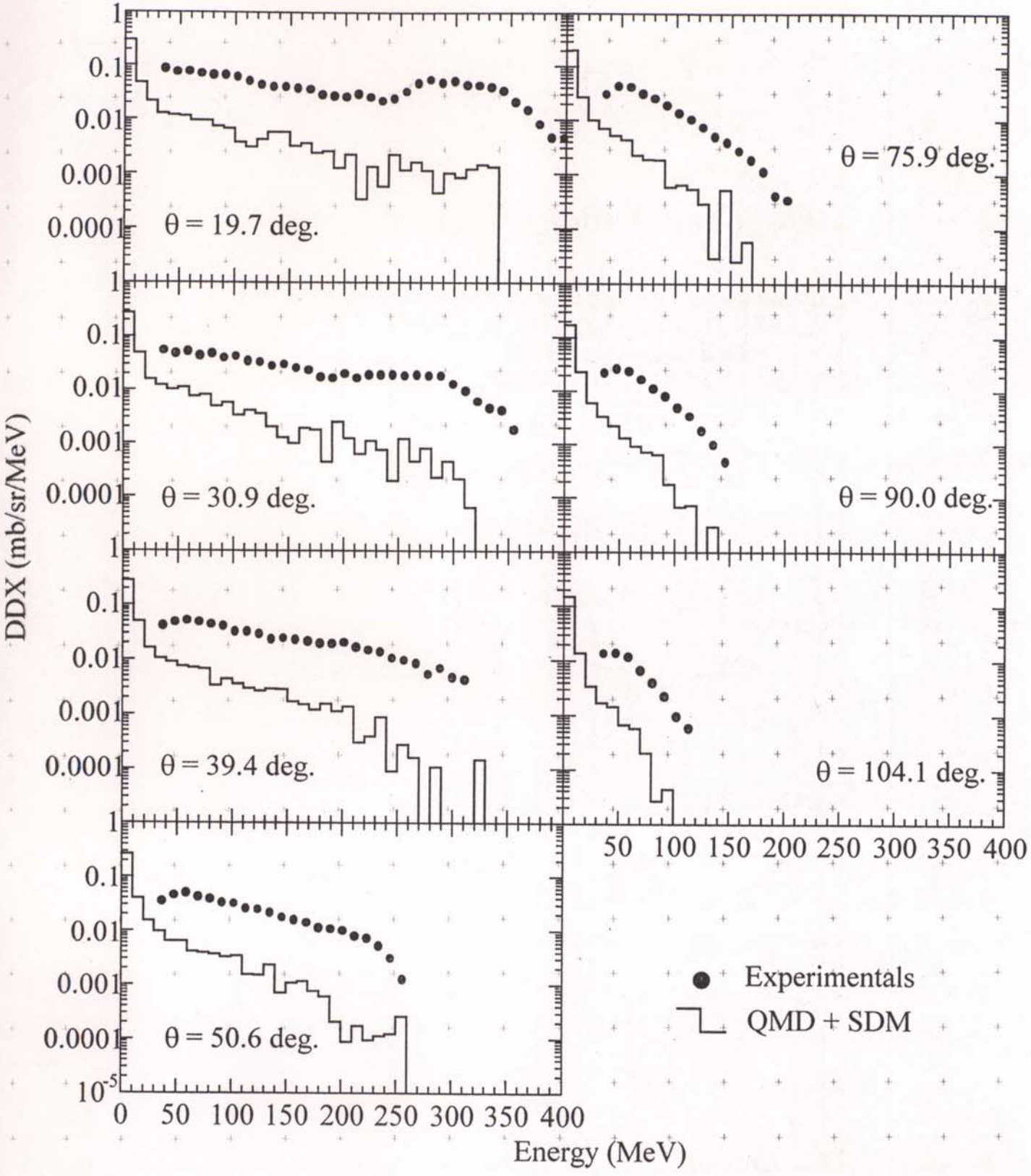
積層型GSO(Ce)スペクトロメータ




ΔE vs. E_T plot θ_L=35° (run012)
ΔE (MeV)
E_T (MeV)
12C(p, p')
d
12C(p, p')
Reaction
or Scattering out
0
5
10
15
20
25
0
50
100
150
200
250
300
350
400

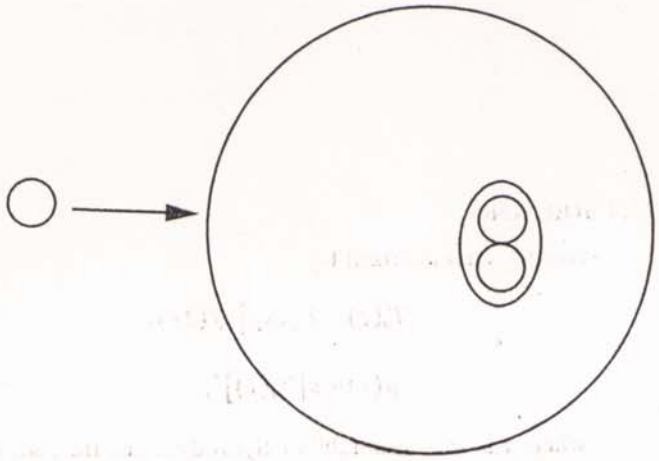

^{12}C(p,p'x) E_p =300 MeV
Experiment
Standard QMD
Modified QMD
20 deg. (×10^4)
25 deg. (×10^3)
30 deg. (×10^2)
40 deg. (×10^1)
50 deg.
60 deg. (×10^{-1})
75 deg. (×10^{-2})
90 deg. (×10^{-3})
105 deg. (×10^{-4})
d^{2}σ/dΩdE (mb/sr MeV)
$E_{p'}$ (MeV)
10^5
10^3
10^1
10^{-1}
10^{-3}
10^{-5}
10^{-7}
0
50
100
150
200
250
300


^{12}C(p,p'x) E$_p$=392 MeV
Experiment
Standard QMD
Modified QMD
19.7 deg. (×10^3)
26.4 deg. (×10^2)
39.4 deg. (×10^1)
50.6 deg.
75.9 deg. (×10^{-1})
90.0 deg. (×10^{-2})
104.1deg. (×10^{-3})
d^{2}σ/dΩdE (mb/sr MeV)
E$_{p'}$ (MeV)



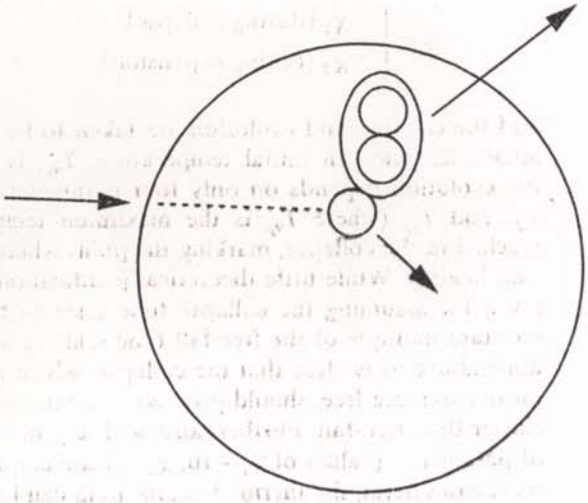
The experimental deuteron DDX for 392 MeV proton incidence on ^{12}C is compared with the one calculated by the QMD code.

Knock out of preformed deuteron

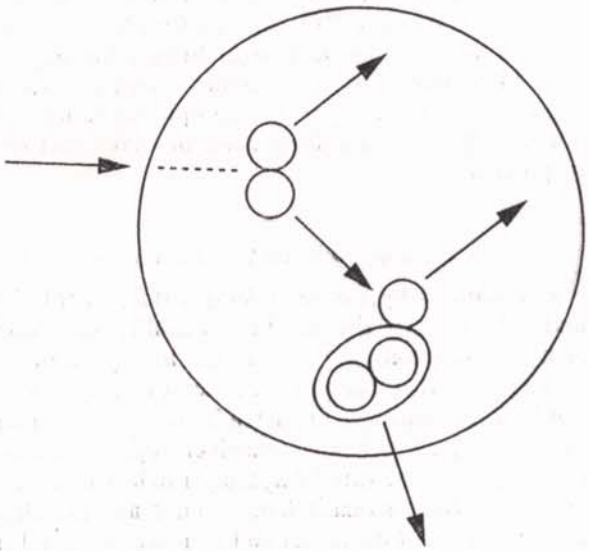


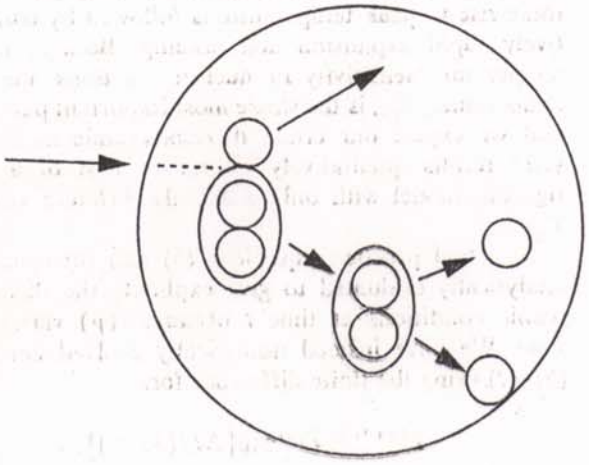
One preformed deuteron within ten ^{12}C nuclei

One step knockout



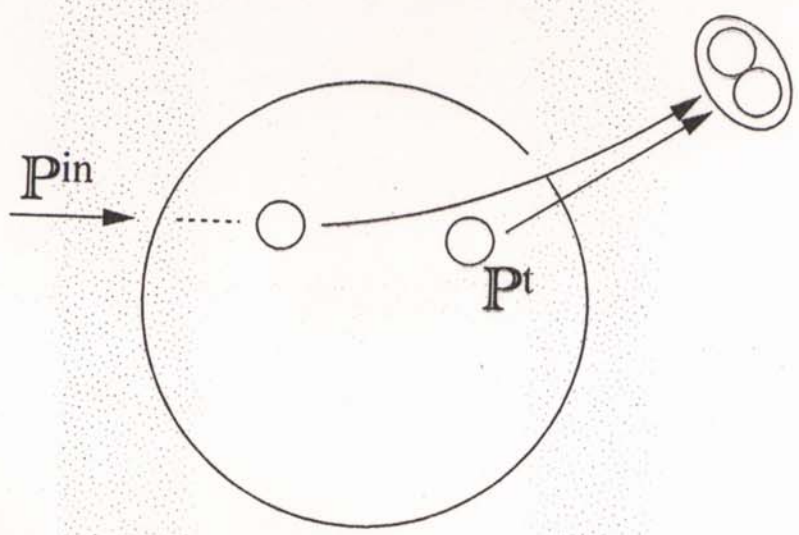
multistep step knockout



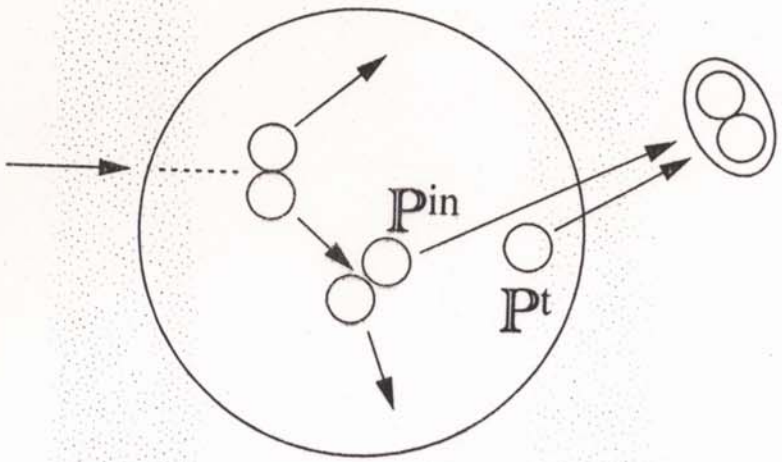


Deuteron breakup

Pickup process to form deuteron



one step

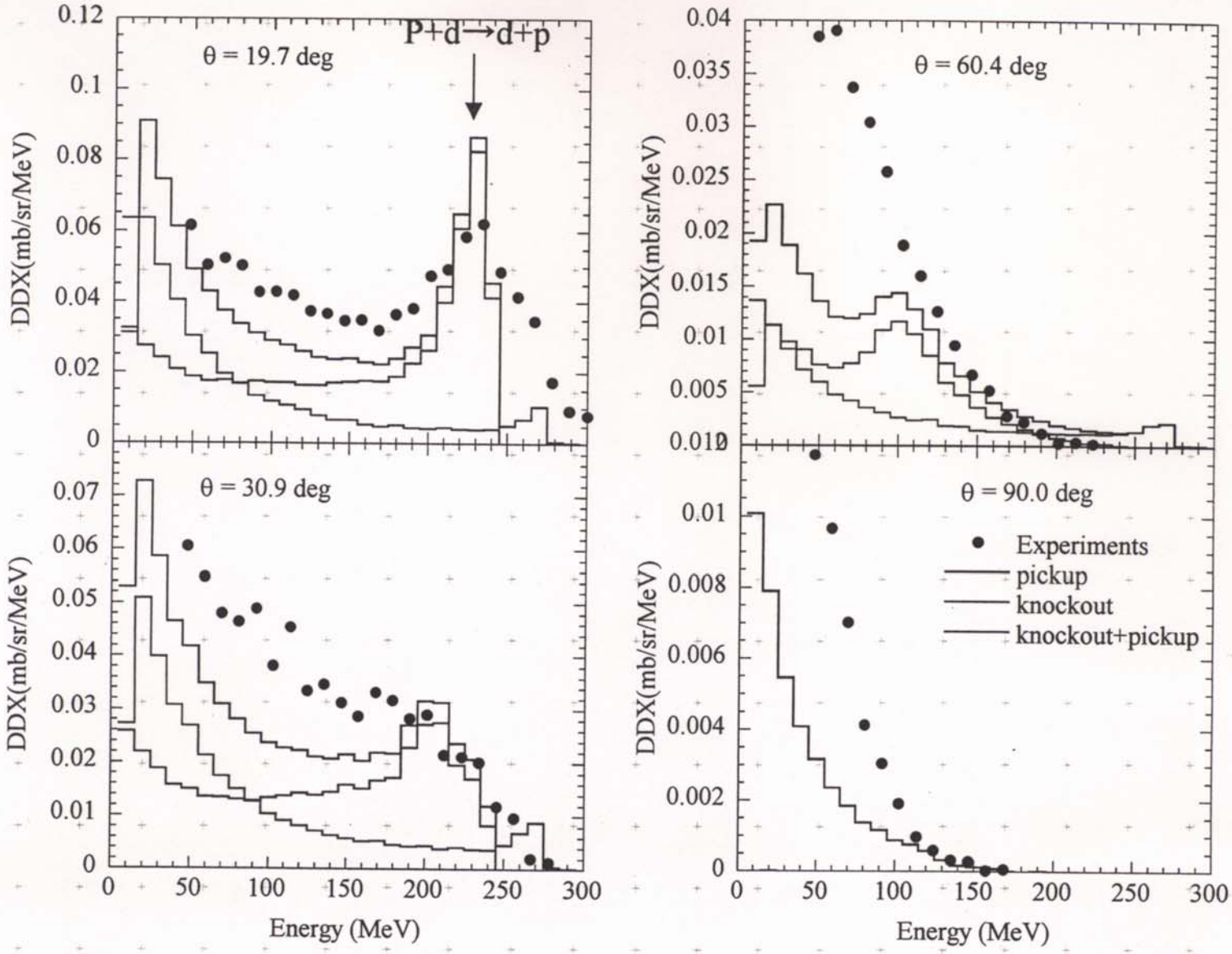


multi step

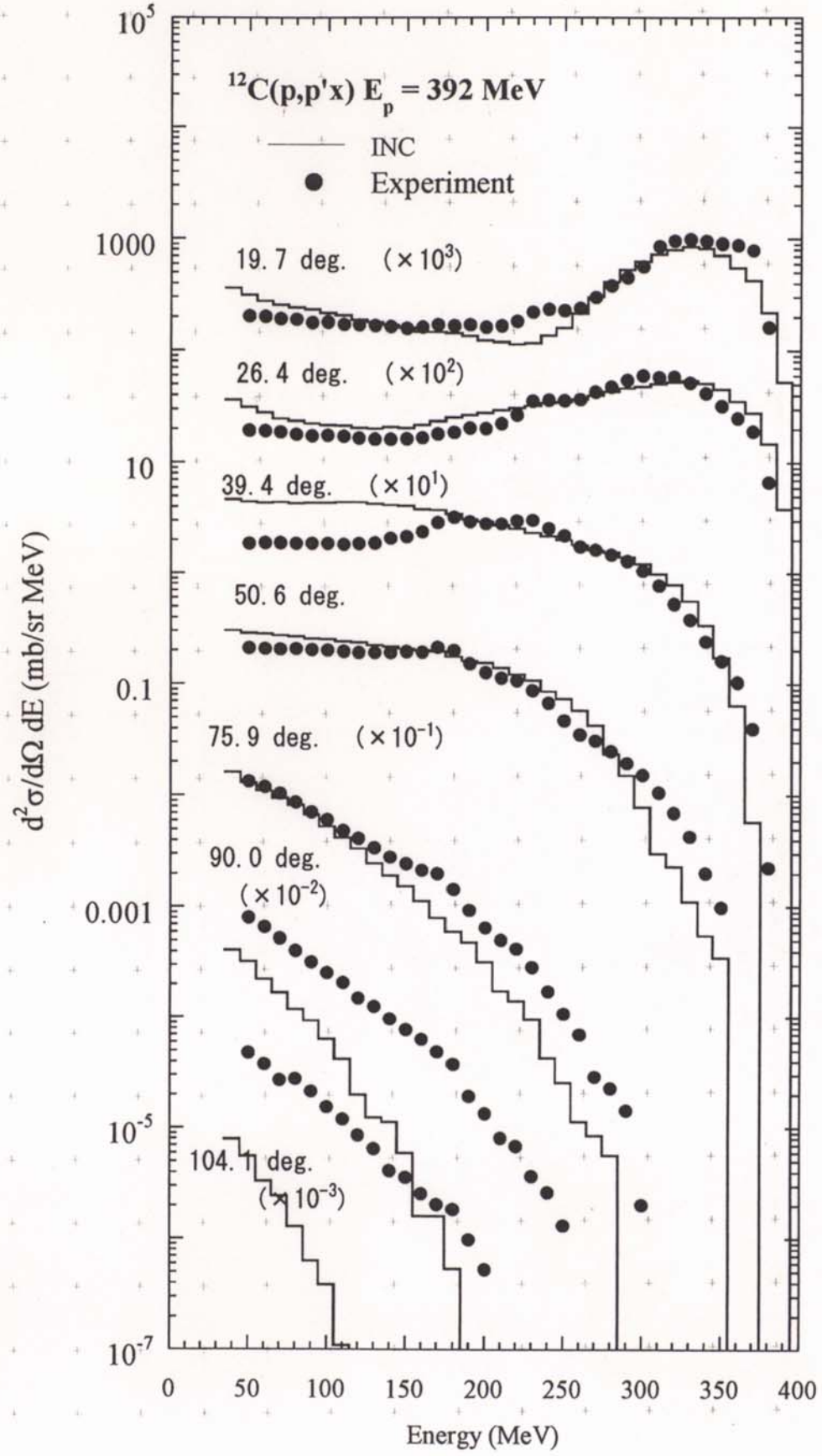
Condition

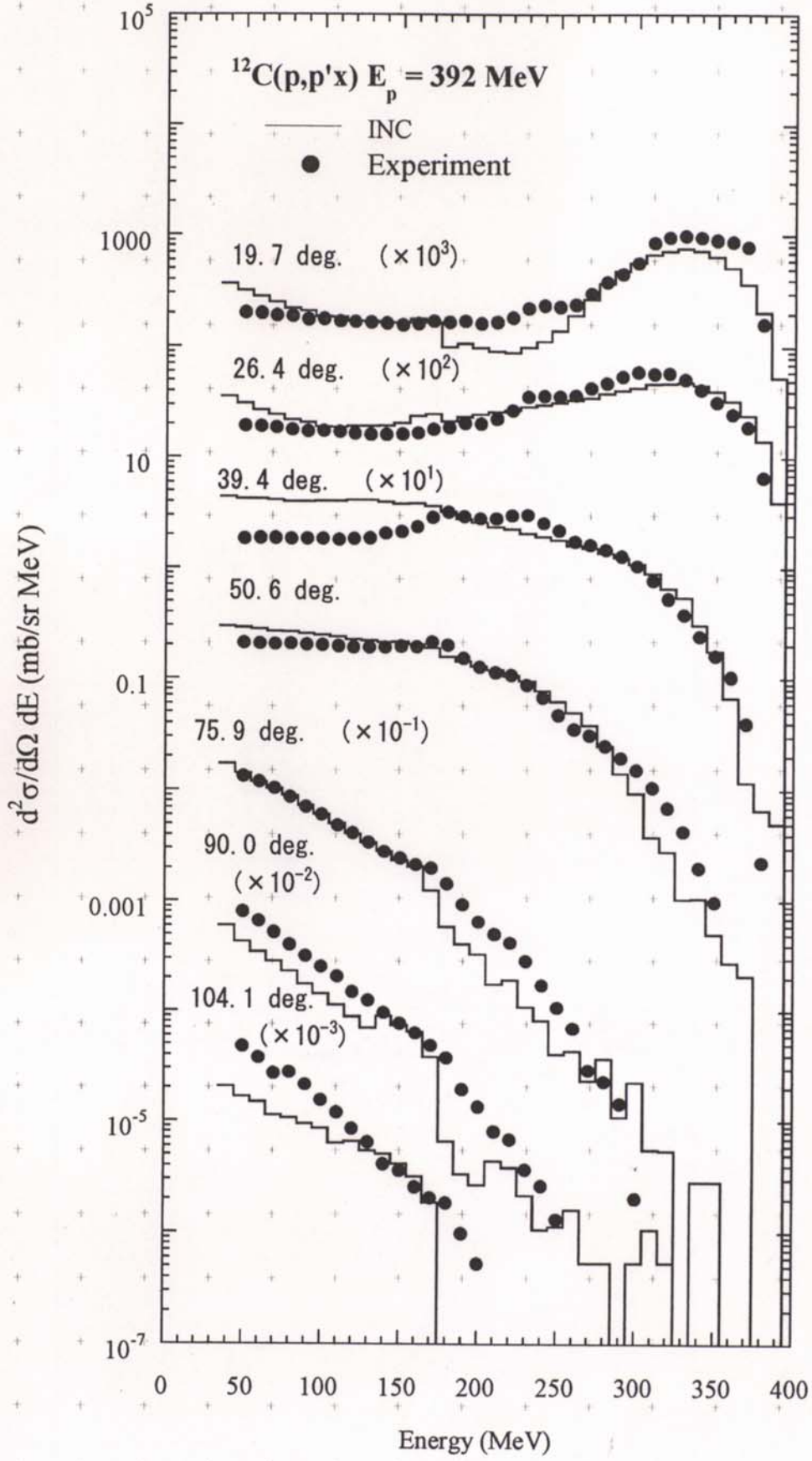
$\mathbb{P}^t$ is distributed uniformly under $\mathbb{P}_F$.

$$0.8\ \mathbb{P}^{in}_x < \mathbb{P}^t_x < 1.2\ \mathbb{P}^{in}_x$$
$$0.8\ \mathbb{P}^{in}_y < \mathbb{P}^t_y < 1.2\ \mathbb{P}^{in}_y$$
$$0.8\ \mathbb{P}^{in}_z < \mathbb{P}^t_z < 1.2\ \mathbb{P}^{in}_z$$



The experimental deuteron DDX for 300 MeV proton incidence on ^{12}C is compared with the one calculated by the INC code.


^{12}C(p,p'x) E_p = 392 MeV
INC
Experiment
19.7 deg. (×10^3)
26.4 deg. (×10^2)
39.4 deg. (×10^1)
50.6 deg.
75.9 deg. (×10^{-1})
90.0 deg. (×10^{-2})
104.1 deg. (×10^{-3})
$d^2\sigma/d\Omega\, dE$ (mb/sr MeV)
Energy (MeV)
10^5
1000
10
0.1
0.001
10^{-5}
10^{-7}
0
50
100
150
200
250
300
350
400


^{12}C(p,p'x) E_p = 392 MeV
INC
Experiment
19.7 deg. (×10^3)
26.4 deg. (×10^2)
39.4 deg. (×10^1)
50.6 deg.
75.9 deg. (×10^{-1})
90.0 deg. (×10^{-2})
104.1 deg. (×10^{-3})
$d^2\sigma/d\Omega\, dE$ (mb/sr MeV)
Energy (MeV)
10^5
1000
10
0.1
0.001
10^{-5}
10^{-7}
0
50
100
150
200
250
300
350
400