Status of Measurements in Peking University

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The 2nd Asian Nuclear Reaction Database Development Workshop
2011-09-07

Nuclear Data Works at PKU

4.5 MV Van de Graaff + Neutron hall (20×12×10 m^3)

- Double-differential neutron emission cross-section measurement using TOF technique (Prof. **Chen Jinxiang**)
  ^{9}Be(n, 2n), 5.9 and 6.4 MeV, 10 angles (15~150º)
- Cross section measurement by activation technique (Prof. **Shi Zhaomin**)
  ^{71}Ga, ^{159}Tb, ^{169}Tm, ^{180}Hf, ^{94}Zr, ^{186}W, ^{75}As, ^{141}Pr (n, γ) (En=0.3~1.6 MeV)
  ^{58}Ni, ^{60}Ni, ^{64}Zn(n, p); ^{62}Ni(n, α); ^{59}Co (n, p), (n, α), (n, 2n);
  ^{88}Y, ^{187}Re, ^{69}Ga(n, 2n) (En=15~20 MeV)
- Nuclear data evaluations for CENDL library (Prof. **Tang Guoyou**)
  ^{0}Si, ^{0}Ca, ^{0}Mg, ^{237}Np, ^{235}U, ^{238}U, ^{241}Am, $^{236,\ 237,\ 239\text{-}245}$U, $^{240,\ 242,\ 242m}$Am
- Measurement of (n,α) reactions in the MeV neutron energy region (Will be explained in detail)

Measurement of (n,α) reactions in the MeV neutron energy region

Guohui Zhang[1], Jiaming Liu[1], Xiang Liu[1], Jinxiang Chen[1], Guoyou Tang[1]
Yu. M. Gledenov[2], M. V. Sedysheva[2] , V. A. Stolupin[2]
G. Khuukhenkhuu[3]
P. J. Szalanski[4]
P. E. Koehler[5]

1 *State Key Laboratory of Nuclear Physics and Technology, Institute of Heavy Ion Physics, Peking University, Beijing 100871, China*

2 *Frank Laboratory of Neutron Physics, JINR, Dubna 141980, Russia*

3 *Nuclear research Centre, National University of Mongolia, Ulaanbaatar, Mongolia*

4 *University of Lodz, Institute of Physics, Lodz, Poland*

5 *Physics Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831, USA*

China-Russia Cooperation

FLNP, Dubna

- Charged particle detector (GIC): 2
- Highly enriched isotopes: ~15

IHIP, Peking Univ.

- 4.5-MV Van de Graaff
  Monoenergetic neutron source (1-7 MeV)
  Neutron hall
- Electronics (NIM DAQ, WDF)
- Graduate students: 7 (5 graduated already)

北京大学
PEKING UNIVERSITY

Memorandum between

the Joint Institute for Nuclear Research and Peking University

Protocol

of the collaboration on carrying out joint studies on the mechanism of interaction of neutrons with nuclei and on the properties of high excited nuclear states between the Joint Institute for Nuclear Research, Dubna, Russia and Peking University, Beijing, China.

As of 15.03.2005

The collaboration between the two institutions has been fruitful and successful for nearly four years, and both sides have agreed to continue the collaboration. Accordingly, the period of validity of the above Protocol is extended for another four years until December 31, 2012.

Director of the Joint Institute
for Nuclear Research

Prof. A.N. Sissakian

16.10.2008

President of
Peking University

Prof. Xu Zhihong

2008

(n,α) Reaction Data

- **Nuclear engineering applications**

  Structural material of reactors (Fast reactors & Fusion reactors)

  Helium embrittlement & Nuclear heating

  Radiochemistry for reactors & Control of reaction rate for reactors

  Neutron flux determination

  Neutron dose determination & Biomedicine

- **Determination of nuclear model parameters**

  Optical model parameters

  Level density parameters

- **Nuclear reaction mechanism analysis**

  "Effect of particle leaking"

  Compound/Pre-equilibrium/Direct processes

  Isotopic effect

Difficulties for measurement

- Small reaction cross sections
- Limitation of neutron source intensity in MeV region
- Limitation of sample thickness
- Background from materials and working gas

  Background from thermal neutron induced events
- Identification of different charged particles
- Oxidation of some samples (^{10}B)
- Kinematics effect for light nuclei
- Neutron flux determination

Groups of (n,α) measurement in the world

- FLNP, Dubna, Russia: **Yu. Gledenov**
  Thermal + resonance neutron energies
- IPPE, Obninsk, Russia: **V. A. Khryachkov**
  Gas samples: ^{14}N, ^{16}O …
- Tohoku Univ., Japan: **M. Baba**
  Move to high neutron energy
- Oak Ridge, USA: **P. E. Koehler**
  ORELA neutron source
- IRMM, Geel, Belgium: **G. Giorginis** and **F.-J. Hambsch**
  $^{10}B(n,\alpha)$, "effect of particle leaking" 2006

Setup of our experiment

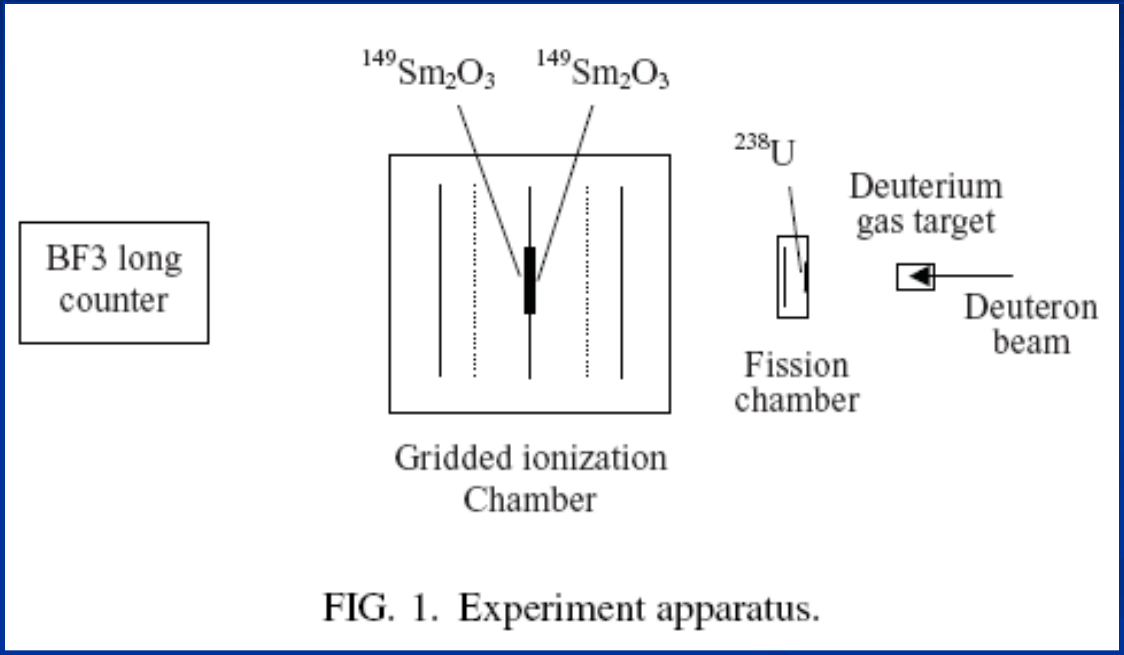


FIG. 1. Experiment apparatus.

- 3 parts:

neutron source, particle detector, neutron flux monitor and determination

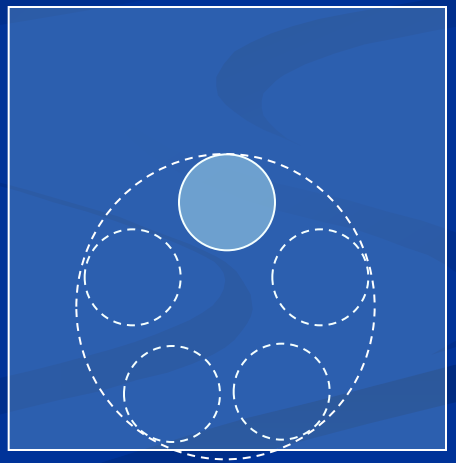
p-^{7}Li **d-d** 2 GICs BF_3 + 2 ^{238}U samples

solid+gas target small+big samples

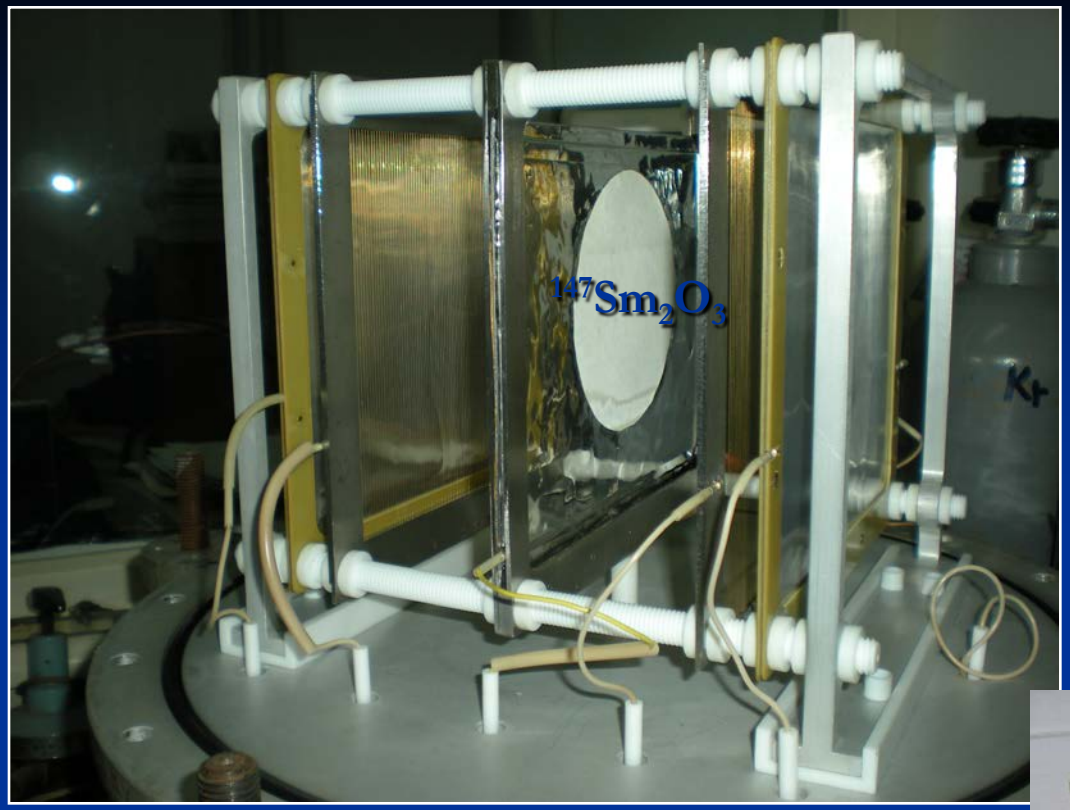
4π solid angle

Stainless steel chamber

Small samples:
ϕ 40mm



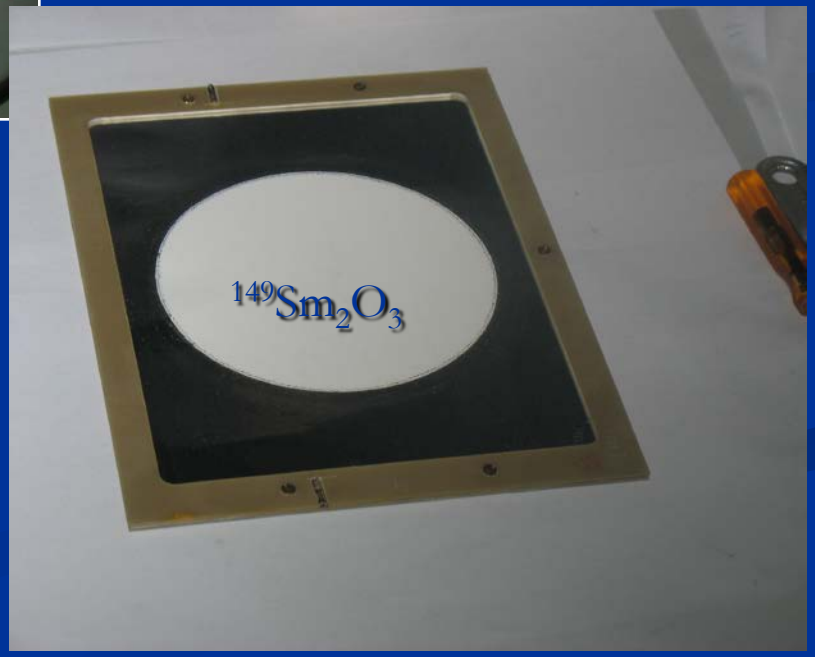
Sample changer



Aluminum Chamber

big sample

ϕ 110mm

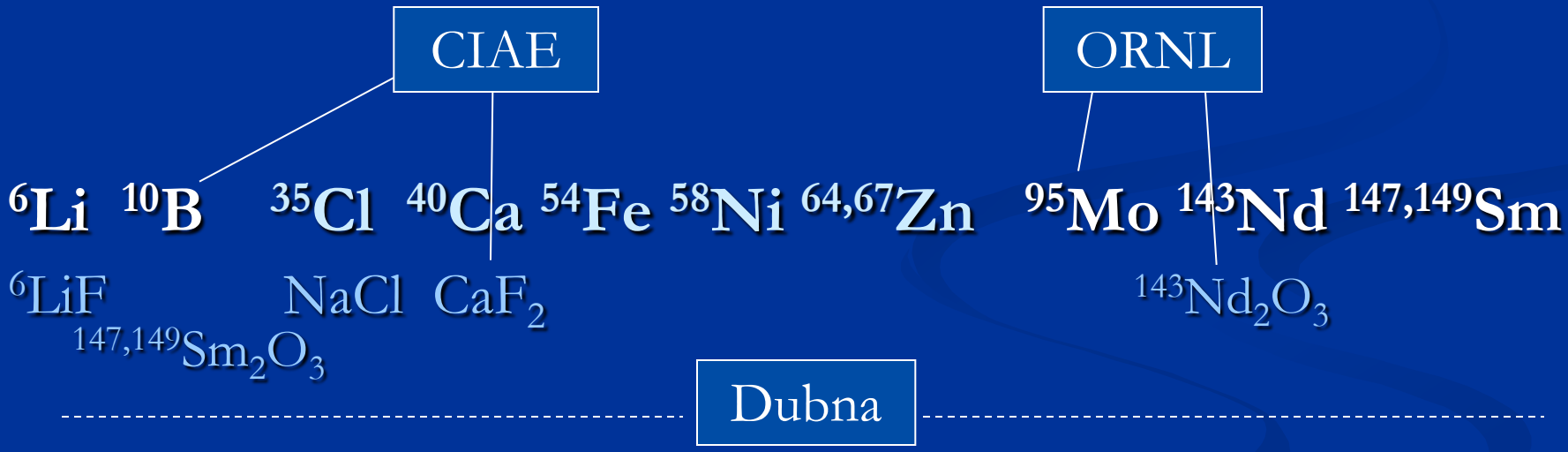


Progresses

- Single side→Double side
- 1 GIC → 2 GICs
- Big σ → Small σ
- Argon→Krypton
- Flux determination
  Separate runs + Simultaneously
- Alpha→Triton→Proton
- Experiment→Thoretical analysis
- NIM+DAQ → WFDs+Software
- China+Russia→ China+Russia+ Mongolia+Poland+USA

Reactions measured

- 12 (n, α) reactions measured



small samples, ϕ40mm

big samples, ϕ110mm

Measurement results

- ✓ Measured cross sections: from ~ 100 mb to 50 μb
- ✓ Theoretical analysis also performed with code TALYS
- ✓ Reliable and repeatable results obtained
- ✓ The only data for the ^{67}Zn,^{147,149}Sm(n,α) reactions in the MeV range were measured by our group
- ✓ Took part in international ND- and ISINN-series meetings
- ✓ Published 20 papers in PRC, EPJA, NIM, NSE, ARI, CPL, NST…
- ✓ Results were collected in EXFOR data bank:
  20 reactions, 46 datasets, Institute="CPRBJG"

Publications

1. ^{64}ZN AND ^{67}ZN (n, a) REACTIONS IN THE MEV NEUTRON ENERGY REGION, **Journal of the Korean Physical Society**, 59 (2011) 1705-1708.
2. Measurement of cross sections for the ^{10}B(n, a)^{7}Li reaction at 4.0 and 5.0 MeV using asymmetrical twin gridded ionization chamber, **Chinese Physical Letter**, Vol. 28, No. 8 (2011) 082801.
3. Measurement of ^{10}B content in thin-film ^{10}B samples, **Applied Radiation and Isotopes,** 69 (2011) 858–861**.**
4. Cross sections of the ^{67}Zn(n, a)^{64}Ni reaction at 4.0, 5.0, and 6.0 MeV, **Physical Review C 82**, 054619 (2010).
5. Cross-section measurement and analysis for the ^{149}Sm(n, a)^{146}Nd reaction at 6.0 MeV, **Physical Review C 82**, 014601 (2010).
6. Cross-section measurement for the ^{67}Zn(n, a)^{64}Ni reaction at 6.0MeV, **Eur. Phys. J. A** 43 (2010) 1–4.
7. Cross section measurement for the ^{95}Mo(n, a)^{92}Zr reaction at 4.0, 5.0 and 6.0 MeV, **Applied Radiation and Isotopes**, 68 (2010) 180–183.
8. A thin film ^{10}B sample for measuring the atom number, **Nuclear Science and Techniques,** 21 (2010) 114-117.
9. Cross sections of the ^{143}Nd(n, a)^{140}Ce and ^{147}Sm(n, a)^{144}Nd reactions in the MeV neutron energy region, **Physical Review C 80**, 044602 (2009).
10. Measurement of cross sections for the ^{147}Sm(n, a)^{144}Nd reaction at 5.0 and 6.0 MeV, **Applied Radiation and Isotopes**, 67 (2009) 46–49.
11. 12. Measurement of Electron-Drift Velocity in Ar+CH_4 Mixtures Using Double-Grid Method, **Chinese Physical Letter**, Vol. 26, No. 11 (2009) 112901.
12. Measurement of Differential Cross Section for the ^{64}Zn(n, a)^{61}Ni Reaction at 2.54, 4.00 and 5.50 MeV, **Nuclear Science and Engineering**, 160 (2008) 123–128.

Publications (cont.)

13. Cross-section measurement for the $^{10}B(n, a)^{7}Li$ reaction at 4.0 and 5.0 MeV, **Applied Radiation and Isotopes**, 66 (2008) 1427–1430.
14. Differential Cross-Section Measurement for the $^{64}Zn(n, a)^{61}Ni$ Reaction at 5.03 and 5.95 MeV, **Nuclear Science and Engineering**, 156 (2007) 115-119.
15. Differential Cross-Section Measurement for the $^{64}Zn(n, a)^{61}Ni$ Reaction at 5.03 and 5.95 MeV, **Nuclear Science and Engineering**, 156 (2007) 115-119.
16. Differential and Angle Integrated Cross-Section Measurement for the 6Li(n,t)4He Reaction at En = 1.05, 1.54 and 2.25 MeV， **Nuclear Science and Engineering**, 153 (2006) 41-45.
17. Measurement of Differential Cross-Sections of the 6Li(n,t)4He Reaction, , Neutron spectroscopy, Nuclear structure, Related topics, XIII International Seminar on Interaction of Neutrons with Nuclei (**ISINN-13**), Dubna, JINR, May 25-28, 2005. pp.217-221.
18. Measurement of Differential Cross-Sections of the 6Li(n,t)4He Reaction at 1.85 and 2.67 MeV， **Nuclear Science and Engineering**, 143 (2003) 86-89.
19. Angular Distribution and Cross Section Measurement for 64Zn(n,a)61Ni Reaction at 5.0, 5.7 and 6.5 MeV, **Nuclear Science and Engineering ,** 144 (2003) 108-112.
20. Differential Cross Section Measurement for the 10B(n,a)7Li Reaction, **Nuclear Science and Engineering,** 142 (2002) 203-206.
21. Measurement of the 64Zn(n,a)61Ni Cross Section at En=5.0-6.75 MeV, **Journal of Nuclear Science and Technology,** Supplement 2, August, 2002, pp.342-345.

Experimental Nuclear Reaction Data (EXFOR)

Database Version of August 03, 2011

Software Version of 2011.06.17 Old interface is [here]

News

2011/06 Software development:
1) Constructing a covariance matrix from EXFOR uncertainties (Options/View: extended) [doc]
2011/05 Improvements and extensions:
1) Search by DOI and NSR-KeyNo (Extended mode)
2) Search by Keyword MONITOR
3) Search by DatasetID (SubentPointer)
2011/01 Improvements and extensions:
1) Search for recently updated data (Extended mode: Last modified)
2) Display titles of original articles (imported from NSR) when data "Sorted by Publications"

[History]

The EXFOR library contains an extensive compilation of experimental nuclear reaction data. Neutron reactions have been compiled systematically since the discovery of the neutron, while charged particle and photon reactions have been covered less extensively.
The library contains data from 19065 experiments (see statistics and recent updates).

Request

Examples: 1 2 3 4 5 6 7

Submit Reset Help

Target
Reaction
Quantity
Product
Energy from to eV
Author(s) Guohui Zhang
Publication year
Accession #

Extended
Keywords
Expert

Submit Reset

Options

- Exclude superseded data
- No reaction combinations (ratios,..)
- Enhanced search of Products
- Retrieve listing only
- Disable Prompt-Help

Sort by: reaction publication
View: basic extended

Ranges (Z,A)
Reaction Sub-Fields
Feedback and User's Input

Clone Request: CINDA ENDF

Tip of the day: video-guide

Note:
- all criteria are optional (selected by checking)
- selected criteria are combined for search with logical AND
- criteria separated in a field by ";" are combined with logical OR
- criteria starting with "^" will be used as logical NOT
- wildcards (*) and intervals (..) are available

Request #14533
Results: Reactions: 20 Datasets: 46

Data Selection

Retrieve | Selected | Unselected | All | Reset

Output: EXFOR | EXFOR+ | Bibliography | TAB | C4 | PlotC4

Plot: Quick-plot (cross-sections only) | Advanced plot [how-to] | Convert ratios (if any) to cross sections using [IAEA-standards,2006]

Narrow Energy (optional), eV: Min: Max:

Data re-normalization (for advanced users, results in: C4, TAB and Plots)

n	Display	Year	Author-1	Energy range,eV		Points	Reference	Accession#	P	NSR-Key	
1)	3-LI-6(N,T)2-HE-4,,DA C4: MF4 MT105										
Quantity: [DA] Differential c/s with respect to angle											
1	Info X4 X4+ X4± T4	2006	Guohui Zhang+	1.05e6		14	+ J,NSE,153,41,2006	32651003		2006ZH07	An=20:159
2	Info X4 X4+ X4± T4			1.54e6		14		004		2006ZH07	An=21:158
3	Info X4 X4+ X4± T4			2.25e6		14		005		2006ZH07	An=21:158
4	Info X4 X4+ X4± T4	2003	Guohui Zhang+	1.85e6		14	+ J,NSE,143,(1),86,200301	32646003		2003ZH40	An=21:158
5	Info X4 X4+ X4± T4			2.67e6		14		004		2003ZH40	An=21:158
6	Info X4 X4+ X4± T4	2000	Guohui Zhang+	3.67e6	4.42e6	54	+ J,NSE,134,312,2000	32544003		2000ZH05	An=15:164
2)	3-LI-6(N,T)2-HE-4,,DA,,LEG C4: MF=4 MT=?										
Quantity: [DA] Legendre coef. d/dA=a(0)+Sum(a(L)*p(L))											
7	Info X4 X4+ X4± T4	2006	Guohui Zhang+	1.05e6	2.25e6	15	+ J,NSE,153,41,2006	32651006		2006ZH07	
3)	3-LI-6(N,T)2-HE-4,,SIG C4: MF3 MT105										
Quantity: [CS] Cross section											
8	Info X4 X4+ X4± T4	2006	Guohui Zhang+	1.05e6	2.25e6	3	+ J,NSE,153,41,2006	32651002		2006ZH07	
9	Info X4 X4+ X4± T4	2003	Guohui Zhang+	1.85e6	2.67e6	2	+ J,NSE,143,(1),86,200301	32646002		2003ZH40	
10	Info X4 X4+ X4± T4	2000	Guohui Zhang+	3.67e6	4.42e6	2	+ J,NSE,134,312,2000	32544002		2000ZH05	
4)	5-B-10(N,A)3-LI-7,,DA C4: MF4 MT107										
Quantity: [DA] Differential c/s with respect to angle											
11	Info X4 X4+ X4± T4	2002	Guohui Zhang+	4.17e6		13	+ J,NSE,142,(2),203,200210	32650003		2002ZH35	An=30:159
12	Info X4 X4+ X4± T4			5.02e6		15		004		2002ZH35	An=30:159
13	Info X4 X4+ X4± T4			5.74e6		14		005		2002ZH35	An=30:159
14	Info X4 X4+ X4± T4			6.52e6		15		006		2002ZH35	An=30:160
5)	5-B-10(N,A)3-LI-7,,SIG C4: MF3 MT107										
Quantity: [CS] Cross section											
15	Info X4 X4+ X4± T4	2008	Guohui Zhang+	4.00e6	5.00e6	2	+ J,ARI,66,1427,2008	31617002			
16	Info X4 X4+ X4± T4	2002	Guohui Zhang+	4.17e6	6.52e6	4	+ J,NSE,142,(2),203,200210	32650002		2002ZH35	
6)	28-NI-58(N,P)27-CO-58,,SIG C4: MF3 MT103										
Quantity: [CS] Cross section											
17	Info X4 X4+ X4± T4	1999	Xiaolong Huang+	4.00e6	1.90e7	7	+ J,NSE,131,267,1999	31500003			
7)	30-ZN-64(N,A)28-NI-61,,DA C4: MF4 MT107										
Quantity: [DA] Differential c/s with respect to angle											
18	Info X4 X4+ X4± T4	2007	Yu.M.Gledenov+	5.00e6	6.00e6	28	+ S,ISINN-14,223,2007	31636002			An=32:150

8) 30-ZN-64(N,A)28-NI-61,,DA,,REL C4: MF=4 MT=?

Quantity: [DA] Differential c/s with respect to angle

*	19		Info	X4	X4+	X4±	T4	2003 Jing Yuan+	5.00e6		19	+ J,NSE,144,108,2003	32657002 2003YU09 An=27:155
	20		Info	X4	X4+	X4±	T4		5.70e6		18		003 2003YU09 An=-2:156
	21		Info	X4	X4+	X4±	T4		6.50e6		19		004 2003YU09 An=7:155

9) 30-ZN-64(N,A)28-NI-61,,SIG C4: MF3 MT107

Quantity: [CS] Cross section

	22		Info	X4	X4+	X4±	T4	2008 Guohui Zhang+	2.54e6	5.50e6	3	+ J,NSE,160,123,2008	31620003 2008ZH15
	23		Info	X4	X4+	X4±	T4	2007 Guohui Zhang+	5.03e6	5.95e6	2	+ J,NSE,156,115,2007	31614003 2007ZH12
	24		Info	X4	X4+	X4±	T4	2007 Yu.M.Gledenov+	5.00e6	6.00e6	2	+ S,ISINN-14,223,2007	31636003
	25		Info	X4	X4+	X4±	T4	2003 Jing Yuan+	5.03e6	6.50e6	3	+ J,NSE,144,108,2003	32657005 2003YU09

10) 30-ZN-64(N,A)28-NI-61,PAR,DA C4: MF4 MT801

Quantity: [DAP] Partial differential cross section d/dA

	26		Info	X4	X4+	X4±	T4	2008 Guohui Zhang+	2.54e6		8	+ J,NSE,160,123,2008	31620004 2008ZH15 An=26:155 LV
	27		Info	X4	X4+	X4±	T4		4.00e6		32		005 2008ZH15 An=18:163 LV
	28		Info	X4	X4+	X4±	T4		5.50e6		32		006 2008ZH15 An=18:163 LV
	29		Info	X4	X4+	X4±	T4	2007 Guohui Zhang+	5.03e6		32	+ J,NSE,156,115,2007	31614004 2007ZH12 An=18:163 LV
	30		Info	X4	X4+	X4±	T4		5.95e6		32		005 2007ZH12 An=18:163 LV

11) 30-ZN-64(N,A)28-NI-61,PAR,DA,,REL C4: MF=4 MT=?

Quantity: [DAP] Partial differential cross section d/dA

	31		Info	X4	X4+	X4±	T4	2003 Jing Yuan+	5.00e6		20	+ J,NSE,144,108,2003	32657006 2003YU09 An=1:180 LVI
	32		Info	X4	X4+	X4±	T4		5.00e6		20		007 2003YU09 An=0:180 LVI
	33		Info	X4	X4+	X4±	T4		5.70e6		20		008 2003YU09 An=0:174 LVI
	34		Info	X4	X4+	X4±	T4		5.70e6		20		009 2003YU09 An=4:176 LVI
	35		Info	X4	X4+	X4±	T4		6.50e6		20		010 2003YU09 An=1:172 LVI
	36		Info	X4	X4+	X4±	T4		6.50e6		20		011 2003YU09 An=0:170 LVI

12) 30-ZN-64(N,A)28-NI-61,PAR,SIG C4: MF=? MT=?

Quantity: [CSP] Partial cross section

	37		Info	X4	X4+	X4±	T4	2008 Guohui Zhang+	2.54e6	5.50e6	6	+ J,NSE,160,123,2008	31620002 2008ZH15 LVL=0:2.8e5
	38		Info	X4	X4+	X4±	T4	2007 Guohui Zhang+	5.03e6	5.95e6	4	+ J,NSE,156,115,2007	31614002 2007ZH12 LVL=0:2.8e5

13) 30-ZN-64(N,P)29-CU-64,,SIG C4: MF3 MT103

Quantity: [CS] Cross section

	39		Info	X4	X4+	X4±	T4	1999 Xiaolong Huang+	4.00e6	1.90e7	13	+ J,NSE,131,267,1999	31500002

14) 30-ZN-67(N,A)28-NI-64,,SIG C4: MF3 MT107

Quantity: [CS] Cross section

	40		Info	X4	X4+	X4±	T4	2010 Guohui Zhang+	4.00e6	6.00e6	3	+ J,PR/C,82,054619,2010	32689003 2010ZH47

15) 30-ZN-67(N,A)28-NI-64,PAR,SIG C4: MF=? MT=?

Quantity: [CSP] Partial cross section

	41		Info	X4	X4+	X4±	T4	2010 Guohui Zhang+	4.00e6	6.00e6	3	+ J,PR/C,82,054619,2010	32689002 2010ZH47 LVL=0

16) 42-MO-95(N,A)40-ZR-92,,SIG C4: MF3 MT107

Quantity: [CS] Cross section

	42		Info	X4	X4+	X4±	T4	2010 Guohui Zhang+	4.00e6	6.00e6	3	+ J,ARI,68,180,2010	32676002

17) 60-ND-143(N,A)58-CE-140,,SIG C4: MF3 MT107

Quantity: [CS] Cross section

	43		Info	X4	X4+	X4±	T4	2010 Yu.M.Gledenov+	4.00e6	6.00e6	3	+ S,ISINN-17,323,2010	32681002

18) 62-SM-147(N,A)60-ND-144,,SIG C4: MF3 MT107

Quantity: [CS] Cross section

	44		Info	X4	X4+	X4±	T4	2009 Guohui Zhang+	5.00e6	6.00e6	2	+ J,ARI,67,(1),46,200901	31648002

19) 62-SM-149(N,A)60-ND-146,,SIG C4: MF3 MT107

Quantity: [CS] Cross section

	45		Info	X4	X4+	X4±	T4	2010 Yu.M.Gledenov+	6.00e6		1	+ J,PR/C,82,(1),014601,2010	32679002 2010GL03

20) 74-W-186(N,G)74-W-187,,SIG,,,EXP C4: MF3 MT102

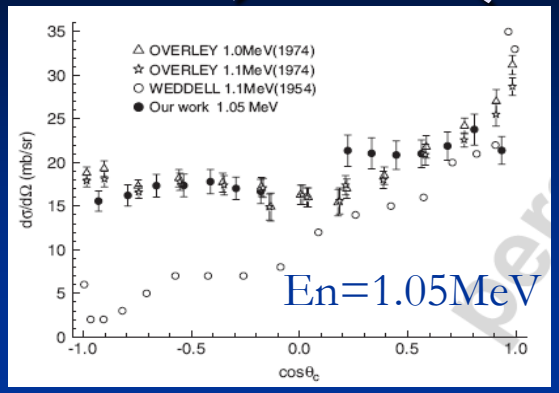
Quantity: [CS] Cross section

	46		Info	X4	X4+	X4±	T4	2001 Guohui Zhang+	5.00e5	1.50e6	3	+ J,NSE,137,107,2001	32550002 2001ZH11

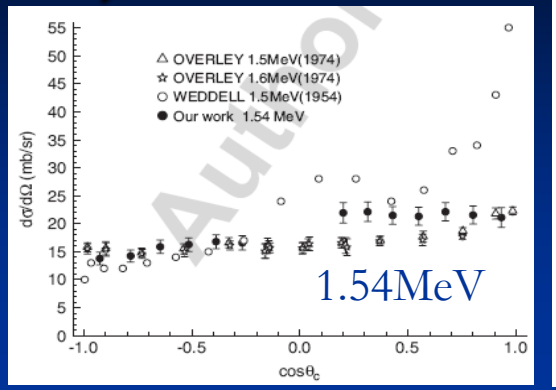
Examples

1) $^{6}Li(n, t)^{4}He$

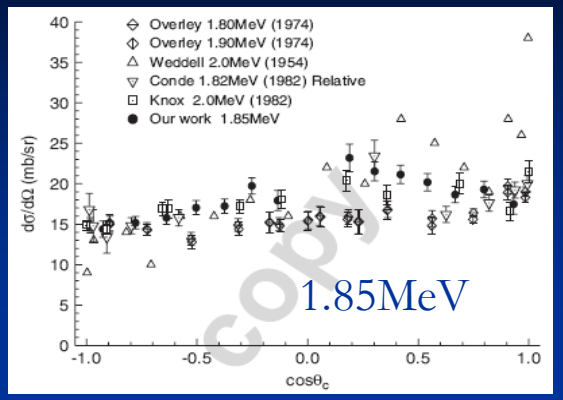
Forward-α + forward-triton



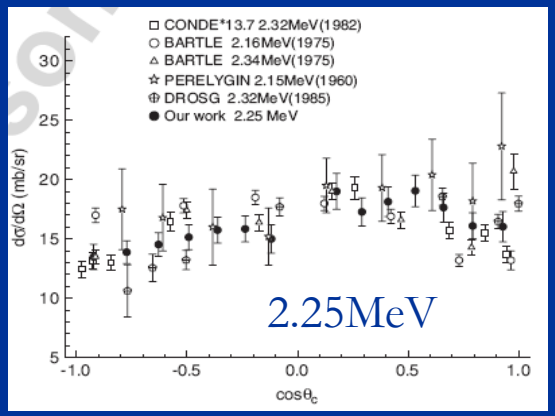
En=1.05MeV



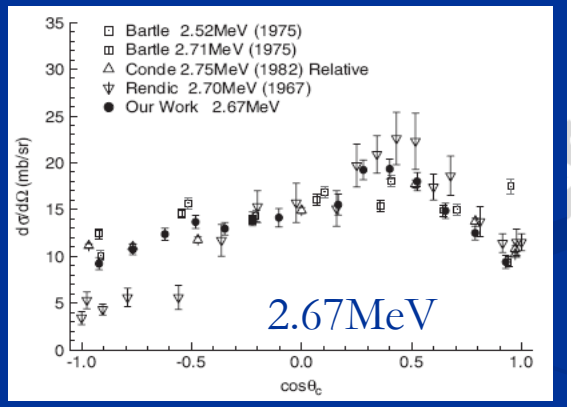
1.54MeV



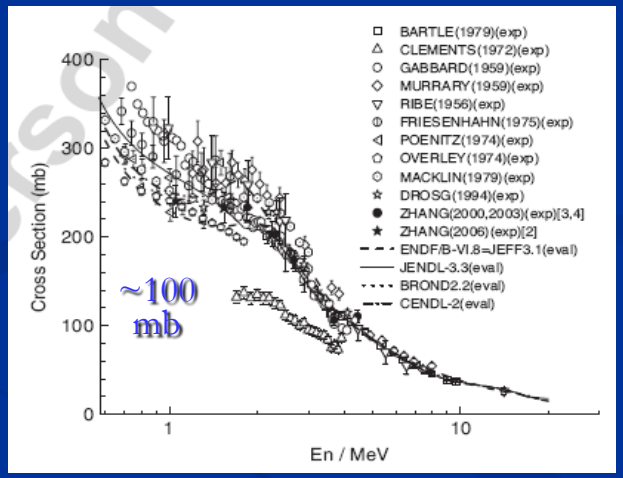
1.85MeV

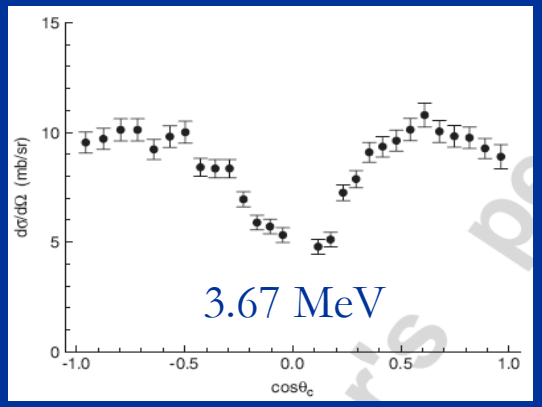


2.25MeV

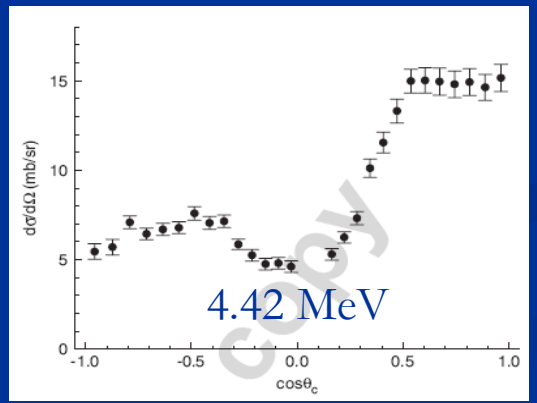


2.67MeV





3.67 MeV



4.42 MeV

NIM A **566** (2006) 615
NSE **153** (2006) 41
NSE **143** (2003) 86

2) $^{10}B(n,\alpha)^{7}Li$

Asymmetry chamber

Leaking cross section obtained

ARI 66(2008)1427

CPL 28 (2011) 082801

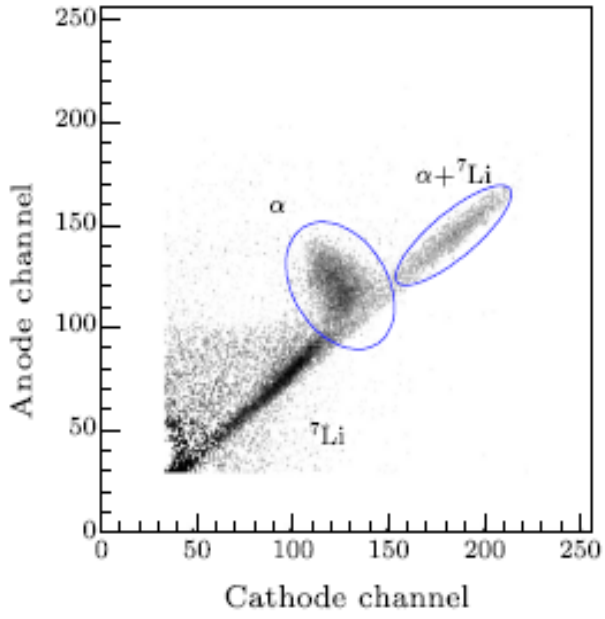


Fig. 3. Cathode-anode two dimensional spectrum for forward event measurements at $E_n = 4.0$ MeV after background subtraction.

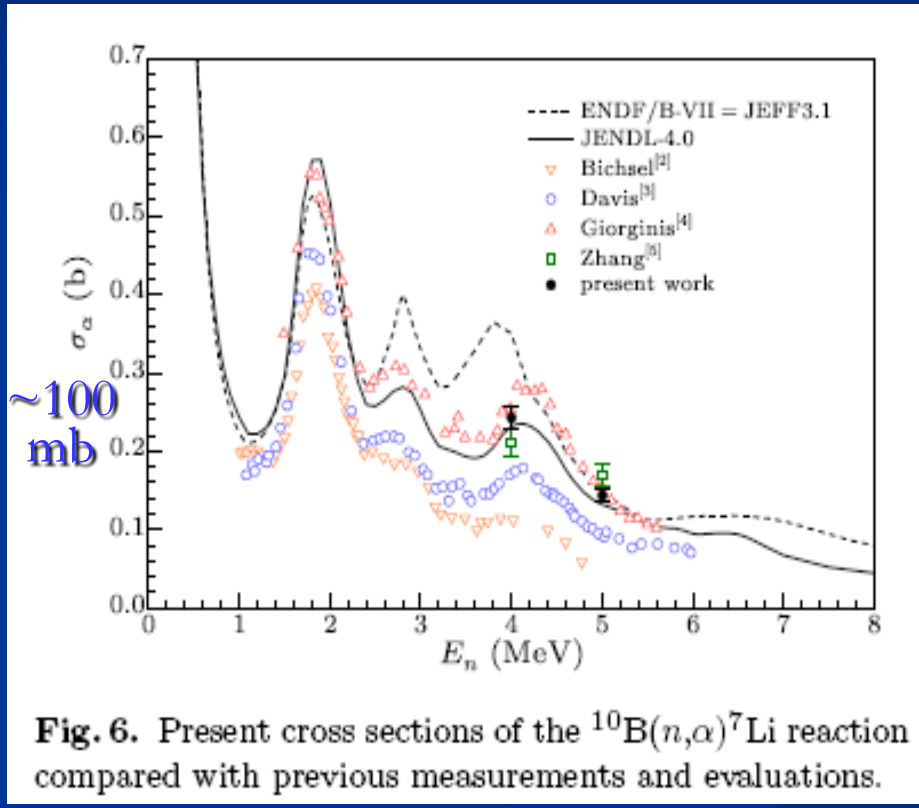


Fig. 6. Present cross sections of the $^{10}B(n,\alpha)^{7}Li$ reaction compared with previous measurements and evaluations.

- 1~7MeV systematic measurement is planed

3) $^{64}Zn(n,\alpha)^{61}Ni$

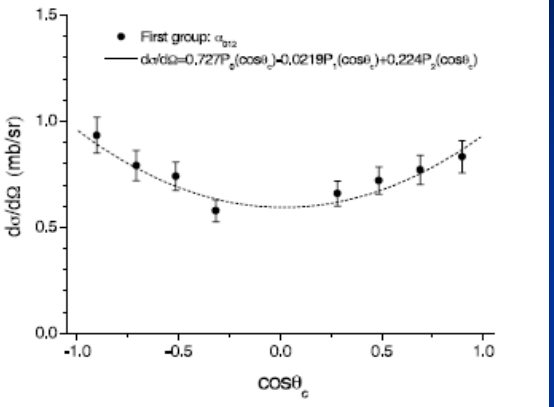


Fig. 4. Differential cross sections of the first group of alpha particles in the c.m. system at En = 2.54 MeV.

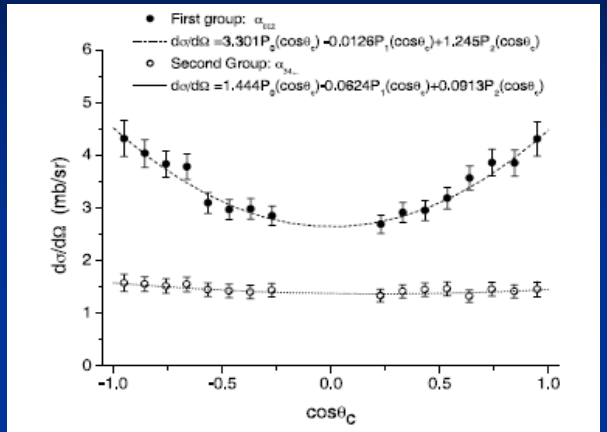


Fig. 5. Differential cross sections of the first and second groups of alpha particles in the c.m. system at En = 4.00 MeV.

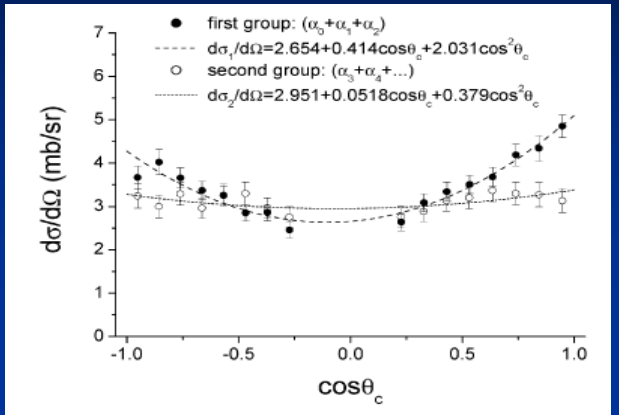


Fig. 6. The differential cross sections of the $^{64}Zn(n,\alpha_{012})^{61}Ni$ and $^{64}Zn(n,\alpha_{34...})^{61}Ni$ reactions in the c.m. system at E_n = 5.03 MeV.

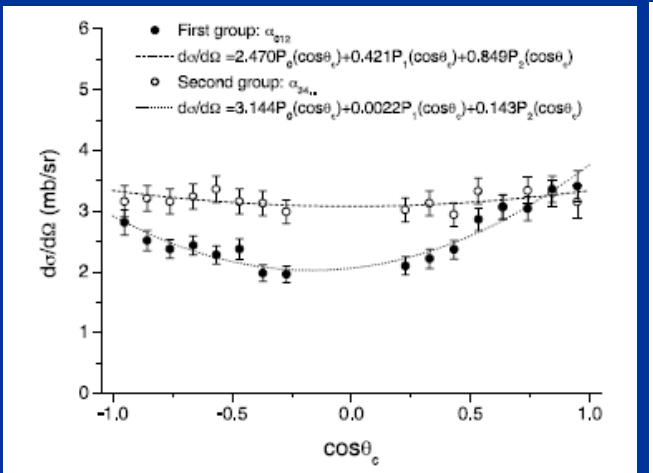


Fig. 6. Differential cross sections of the first and second groups of alpha particles in the c.m. system at En = 5.50 MeV.

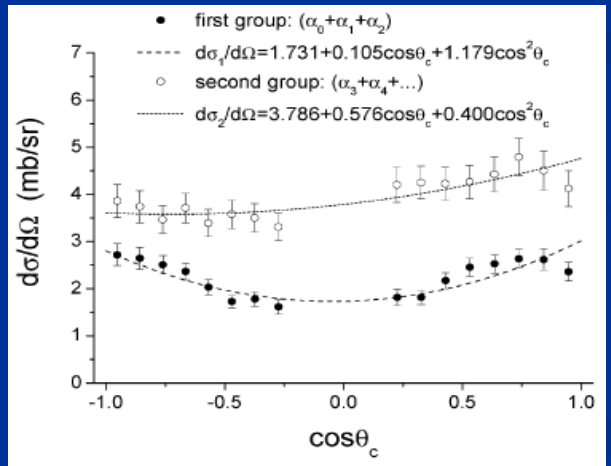


Fig. 7. The differential cross sections of the $^{64}Zn(n,\alpha_{012})^{61}Ni$ and $^{64}Zn(n,\alpha_{34...})^{61}Ni$ reactions in the c.m. system at E_n = 5.95 MeV.

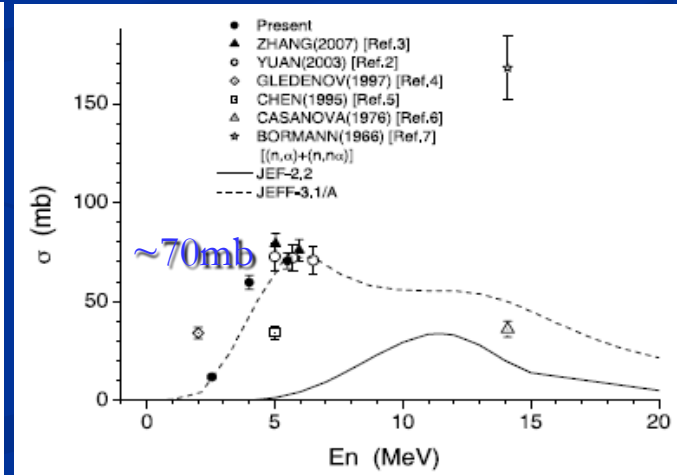


Fig. 7. Present cross sections of the $^{64}Zn(n,\alpha)^{61}Ni$ reaction compared with existing data.

NSE **160** (2008) 123 NSE **156** (2007) 115

4) $^{67}Zn(n,\alpha)^{64}Ni$

PRC **82** (2010) 054619

EPJA **43** (2010) 1

6 MeV, 101 h (54 + 47 h)

$^{64,67}Zn(n,\alpha)$ isotopic effect

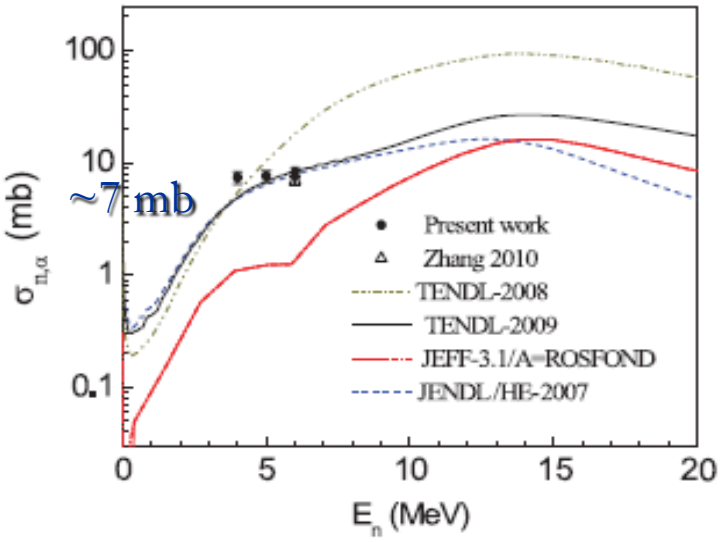


FIG. 5. (Color online) Measured cross-section data of the total $^{67}Zn(n,\alpha)^{64}Ni$ reaction compared with existing measurement and evaluations.

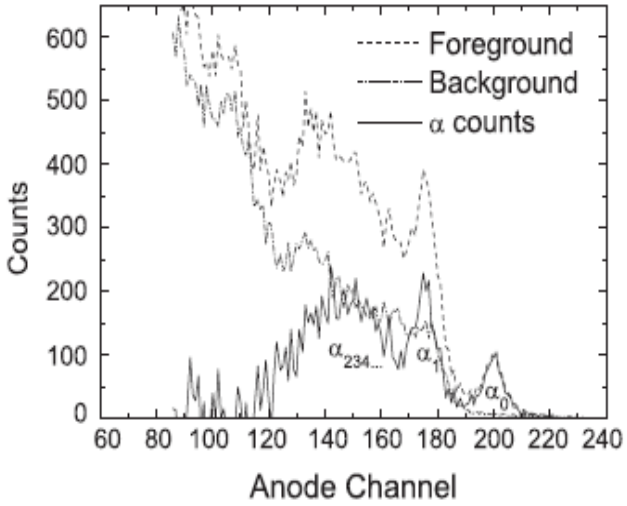


Fig. 4. The anode spectrum for forward $^{67}Zn(n,\alpha)^{64}Ni$ reaction measurement.

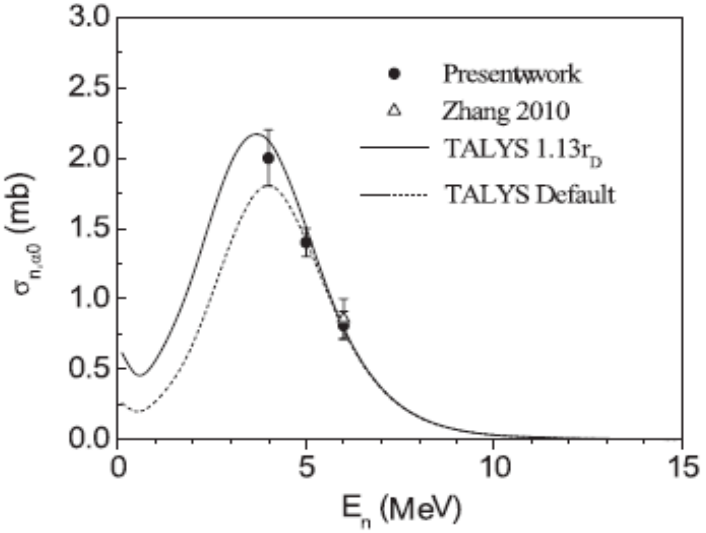


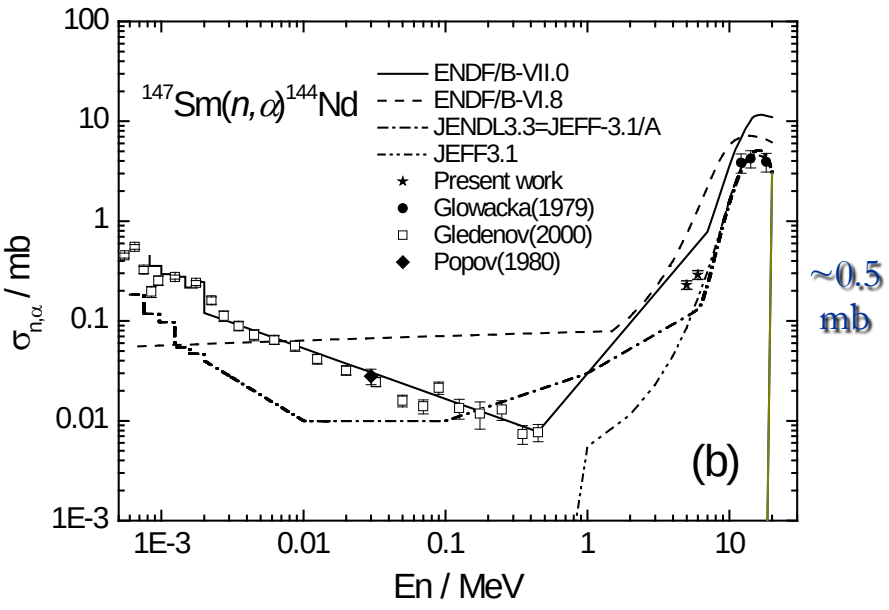
FIG. 6. Present $^{67}Zn(n,\alpha_0)^{64}Ni$ cross section compared with previous measurement and TALYS-1.2 code calculations.

5) $^{147}Sm(n,\alpha)^{144}Nd$

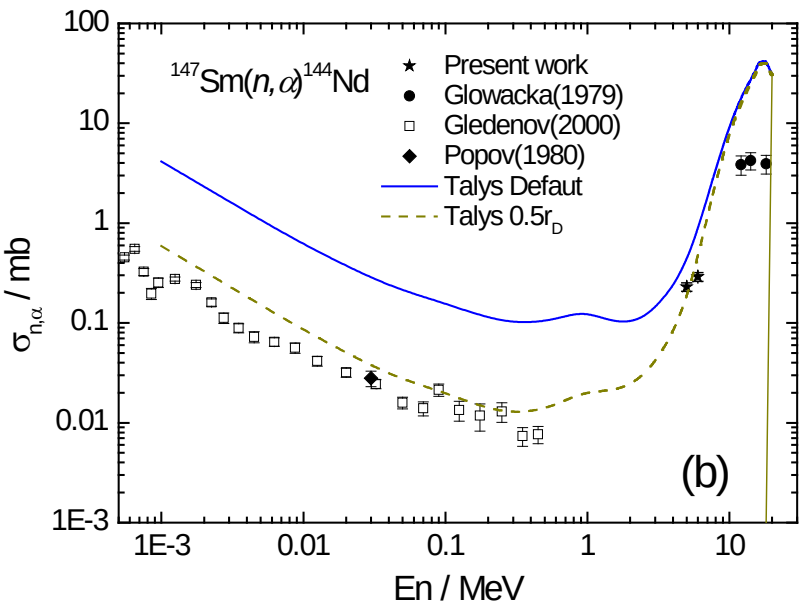
PRC 80 (2009) 044602

Big Q value

5, 6 MeV: 28, 22 h



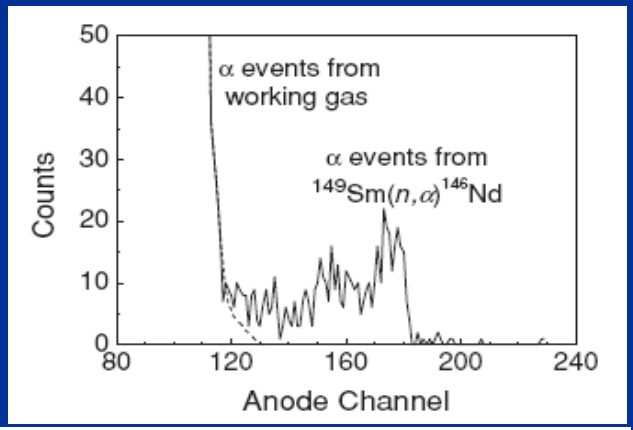
~0.5 mb

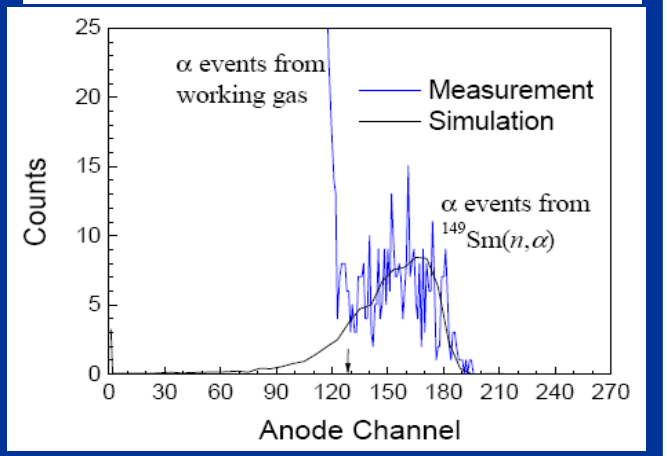


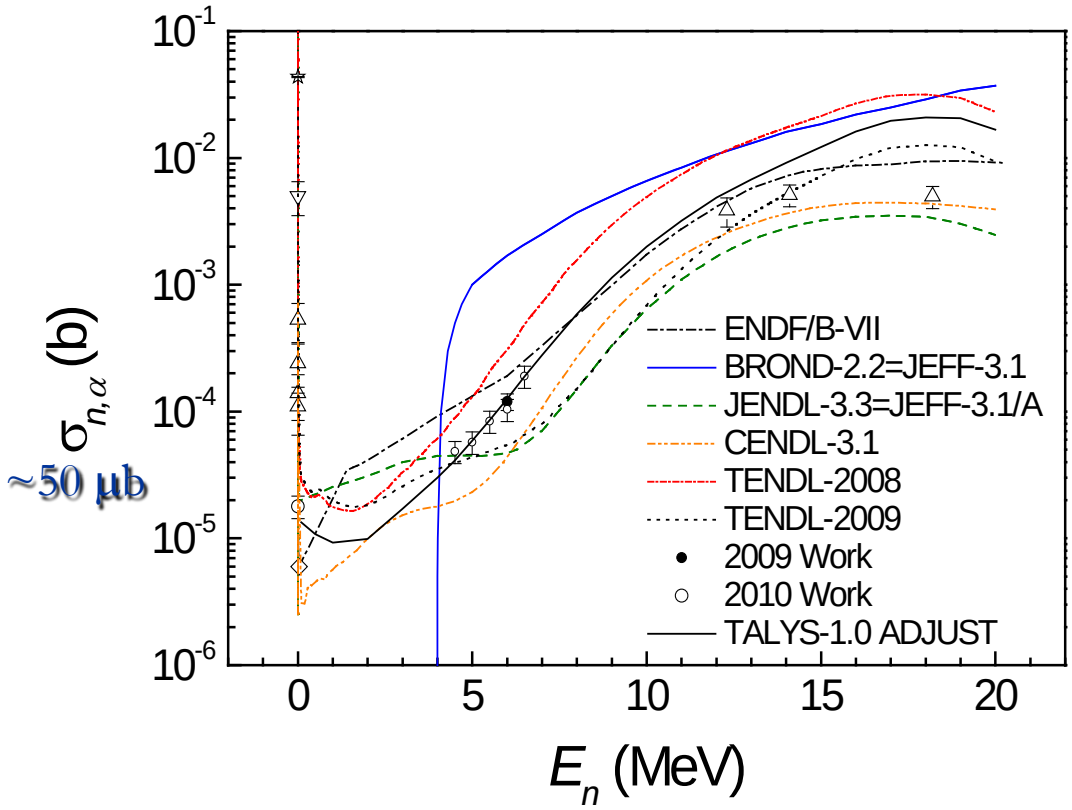
6) $^{149}Sm(n,\alpha)^{146}Nd$ PRC 82 (2010) 014601

6.0 MeV, 63 h

ϕ= 11.0 cm thin + thick samples
(α self absorption)







Future works

Measurements

- $^{10}B(n,\alpha)$ 1-7 MeV cross sections (esp. Leaking part)
- $^{56,57,54}Fe(n,\alpha)$
- ^{24}Mg, ^{28}Si (n,α) ?
- ^{238}U,^{232}Th (n,α) ??
- $^{10}B(n,t+\alpha)^{4}He$
- 8-13 MeV & 14-20 MeV

Theoretics

- (n,α) systematics
- Isotopic effect analysis
- Reaction mechanism (light→heavy)

Summary

- Nuclear Data Works at PKU were introduced briefly
- Measurement of (n,α) reactions in the MeV neutron energy region explained in some detail
- 12 (n,α) reactions were (re-)measured

  Cross sections: from ~ 100 mb to 50 μb

  Reliable & repeatable results obtained

Acknowledgements

- National Natural Science Foundation of China
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- China Nuclear Data Center
- State Key Laboratory of Nuclear Physics and Technology
- Institute of Heavy Ion Physics, PKU
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Thank you for your attention !