

---

# Korea Nuclear Data Center Progress Report for 2023-2024



Do Heon KIM & Sung-Chul YANG

Korea Nuclear Data Center  
Korea Atomic Energy Research Institute

May 14 – 17, 2024  
NRDC 2024, IAEA Headquarter, Vienna

# CONTENTS



**01** Introduction >

**02** Measurement Facility >

**03** Nuclear Data Activity >

**04** EXFOR Activity >

# 01 Introduction

## » KNDC

- Established in 1997 to start research on nuclear data in Korea (formerly, 'Nuclear Data Evaluation Lab.')
- Joined the International Network of NRDC in 2000

## » Main tasks

- **Evaluation** and method development for nuclear reaction data
- Establishment of **processing and validation** system of nuclear reaction/covariance data
- **Measurement** of nuclear reaction data and establishment of measurement facility
- Production and validation of **atomic/molecular** collision data

# 01 Introduction

## » Staff

- 15 staff members: 8 regular staffs, 2 post-retirement researchers, 2 post-doctoral researchers, and 3 Ph.D. students

### Korea Nuclear Data Center (Head: D.H. Kim)

#### Evaluation

Y.-S. Cho  
H.I. Kim

#### Measurement

T.-Y. Song  
S.C. Yang  
Y.-O. Lee  
➔ D.H. Moon

#### Processing/ Validation

D.H. Kim  
J.H. Lee  
C.-S. Gil  
H.L. Hyun

#### Atomic/ Molecular

D.-H. Kwon  
K.-B. Chai  
H.W. Shin  
➔ D.W. Kim  
➔ S. Patwal

# 02 Measurement Facility

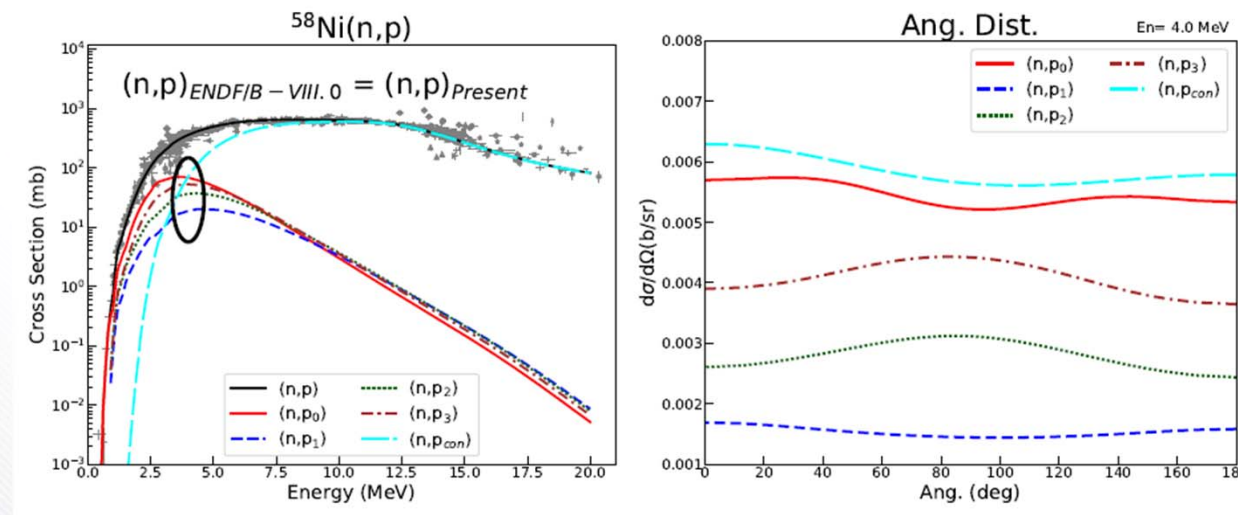
## » Existing facilities

Facility	Characteristics	Measurements
Cyclotron (KIRAMS)	<ul style="list-style-type: none"><li>• p : 20- 50 MeV / 40 <math>\mu</math>A</li><li>• d : 10- 25 MeV / 20 <math>\mu</math>A</li><li>• <math>\alpha</math> : 20- 50 MeV / 1 <math>\mu</math>A</li></ul>	<ul style="list-style-type: none"><li>• Activation cross section</li></ul>
Proton Linear Accelerator (KOMAC, KAERI)	<ul style="list-style-type: none"><li>• p : 20 &amp; 100 MeV (linac)</li></ul>	<ul style="list-style-type: none"><li>• Activation cross section</li></ul>
Cyclotron (Jeongeup, KAERI)	<ul style="list-style-type: none"><li>• p : 30 MeV / 100 <math>\mu</math>A</li></ul>	<ul style="list-style-type: none"><li>• Activation cross section</li></ul>
Heavy-Ion Accelerator (NDPS, IBS)	<ul style="list-style-type: none"><li>• Cyclotron (70 MeV proton)</li><li>• SC linac (H ~ U, 200 MeV/u(U) )</li><li>• SC linac (d (49 MeV/u), p (83 MeV))</li></ul>	<ul style="list-style-type: none"><li>• Installed all components in 2021</li><li>• Performance tests in 2024</li><li>• Scheduled to operate in 2025</li></ul>

# 03 Nuclear Data Activity

## » Neutron-induced charged particle data update

- To complete missing angular distributions and energy spectra of secondary particles in ENDF/B-VIII.0 through a collaborative project with LANL
- Angular distributions and energy spectra for neutron-induced CP reactions including (n,p), (n,a), (n,d), (n,t), and (n,<sup>3</sup>He)
- New evaluations for 52 nuclides have been submitted to NNDC for upcoming ENDF/B-VIII.1.

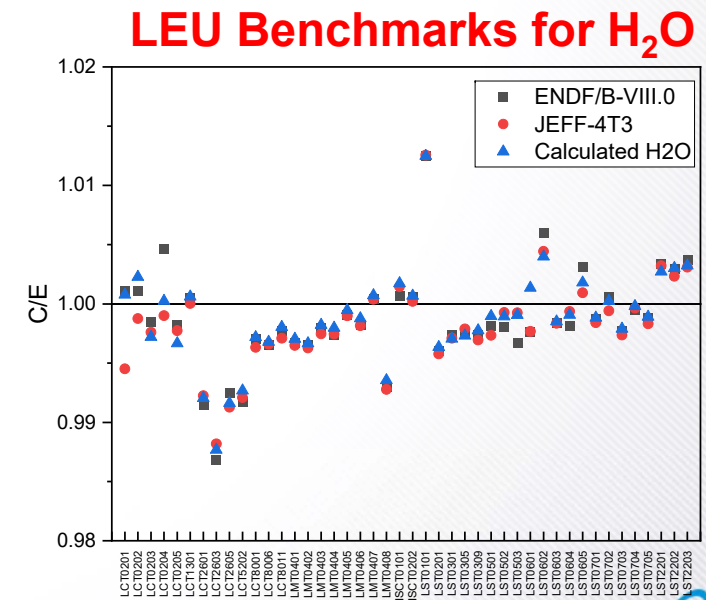
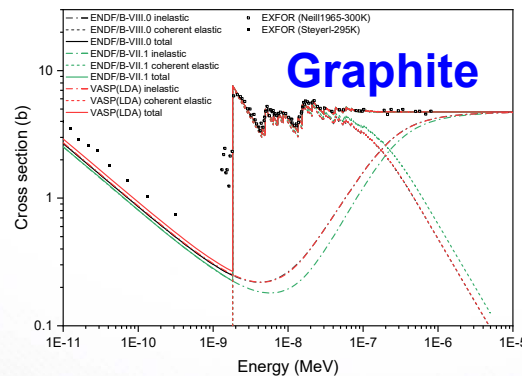
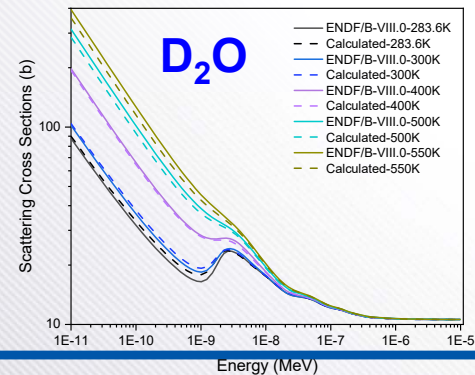
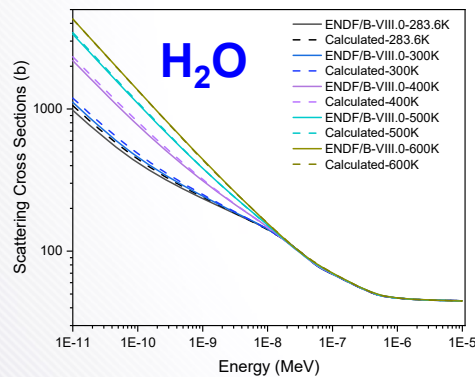


$^{58}\text{Ni}(n,p)$  cross sections and angular distributions

# 03 Nuclear Data Activity

## » TSL data production

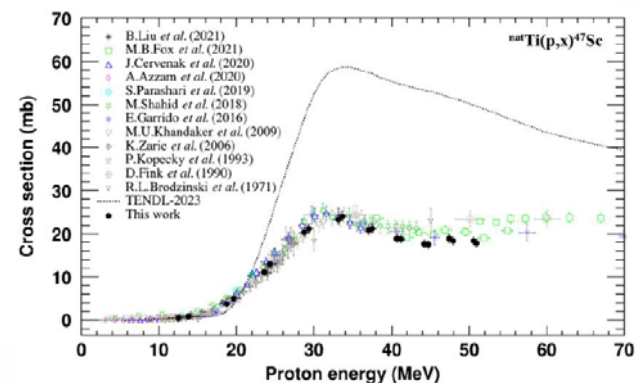
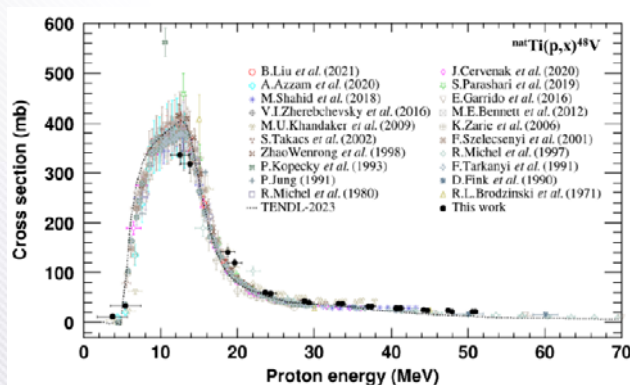
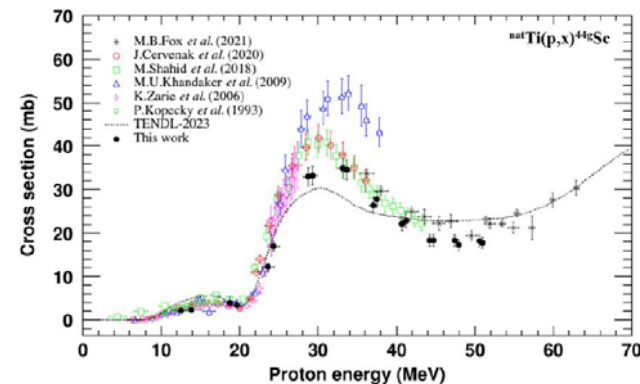
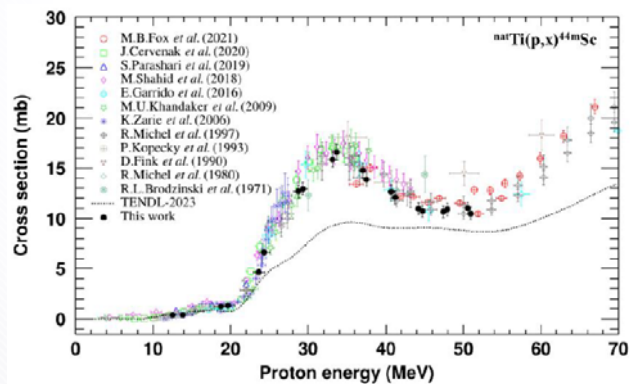
- To produce, validate, and support TSL data of coolant/moderator materials for future advanced nuclear reactor R&Ds in Korea
- TSL data of H<sub>2</sub>O, D<sub>2</sub>O, and crystalline graphite
  - ✓ GROMACS MD code simulations with TIP4P/2005f water model
  - ✓ VASP ab-initio code simulations (crystalline graphite)



# 03 Nuclear Data Activity

## » Proton induced C.S. data measurement

- Experiment on proton induced reactions of Ti
- 57 MeV at KOMAC facility
- Cross section data for 8 radionuclides ( $^{43}\text{K}$ ,  $^{43,44\text{m},44\text{g},46\text{g},47,48}\text{Sc}$ ,  $^{48}\text{V}$ )





# 03 Nuclear Data Activity

## » Event

- 4<sup>th</sup> Reactor Physics Asia Conference (RPHA 2023)
  - ✓ Oct. 24~26, 2023 (Gyeongju, Korea)
  - ✓ Hosted by Reactor Physics and Computational Science Division of KNS
  - ✓ Cosponsored by Chinese Nuclear Society (CNS) and Atomic Energy Society of Japan (AESJ)
  - ✓ Two ND sessions: 14 papers



**4<sup>th</sup> Reactor Physics Asia Conference(RPHA 2023)**

2023. 10.24(Tue)-26(Thu)  
Gyeongju Hwabaek International Convention Center (HICO),  
Gyeongju, Korea

Session Schedule				Session Schedule			
1 <sup>st</sup> Day(24 <sup>th</sup> )				2 <sup>nd</sup> Day(25 <sup>th</sup> )			
schedule	begin	end	Detail	schedule	begin	end	Detail
08:30-09:10	8:30	9:10	Registration	09:20-09:40	9:20	9:40	(C-1) Reactor Analysis Methods (Room 201)
09:10-09:20	9:10	9:20	Opening Remarks (or Welcome Address)	09:40-10:00	9:40	10:00	(A-3) Nuclear Data & Experiment (Lounge meeting room)
09:20-09:50	9:20	9:50	Chinese Plenary Session Presentation	10:00-10:20	10:00	10:20	
09:50-10:20	9:50	10:20	Japanese Plenary Session Presentation	10:20-10:40	10:20	10:40	
10:20-10:50	10:20	10:50	Korean Plenary Session Presentation	10:40-11:00	10:40	11:00	Break Time
10:50-11:00	10:50	11:00	Break Time	11:00-11:20	11:00	11:20	(C-1) Reactor Analysis Methods (Room 201)
11:00-11:20	11:00	11:20	(A-1) Nuclear Data & Multi-group Cross Section (Room201)	11:20-11:40	11:20	11:40	(A-3) Nuclear Data & Experiment (Lounge meeting room)
11:20-11:40	11:20	11:40	(B-1) Radiation Shielding (Lounge meeting room)	11:40-12:00	11:40	12:00	
11:40-12:00	11:40	12:00		12:00-12:40	12:20	12:40	
12:00-12:20	12:00	12:20		12:40-14:00	12:40	14:00	Lunch Time
12:20-12:40	12:20	12:40		14:00-14:20	14:00	14:20	
12:40-14:00	12:40	14:00	Lunch Time	14:20-14:40	14:20	14:40	(C-2) Computational Methods & Reactor Analysis (Room201)
14:00-14:20	14:00	14:20	(A-2) Monte Carlo Method & Codes (Room201)	14:40-15:00	14:40	15:00	(A-4) Advanced Reactor Core Design (Lounge meeting room)
14:20-14:40	14:20	14:40	(B-2) Data Measurement & Reactor Analysis (Lounge meeting room)	15:00-15:20	15:00	15:20	
14:40-15:00	14:40	15:00		15:20-15:40	15:20	15:40	
15:00-15:20	15:00	15:20		15:40-16:00	15:40	16:00	Break Time
15:20-15:40	15:20	15:40	Break Time	16:00-16:20	16:00	16:20	
15:40-16:00	15:40	16:00	(A-2) Monte Carlo Method & Codes (Room201)	16:20-16:40	16:20	16:40	(C-2) Computational Methods & Reactor Analysis (Room201)
16:00-16:20	16:00	16:20	(B-2) Data Measurement & Reactor Analysis (Lounge meeting room)	16:40-17:00	16:40	17:00	(A-4) Advanced Reactor Core Design (Lounge meeting room)
16:20-16:40	16:20	16:40		17:00-17:20	17:00	17:20	
16:40-17:00	16:40	17:00		17:20-17:40	17:20	17:40	
17:00-17:20	17:00	17:20					
17:20-17:40	17:20	17:40					
Meal place							
2023.10.24 (Tue) Lunch				300C			
2023.10.24 (Tue) Dinner				300C			
2023.10.25(Wed) Lunch				4th floor Cafeteria			

# 04 EXFOR Activity

## » Responsibility

- Begin in 2009
- Compile nuclear reaction data in Korea under the guidance of IAEA/NDS
- Measurement data induced by neutron, charged particle, and photon

## » Compilation status

- Number of entries in EXFOR: 10
- Compiled and transmitted: 2
- Checking tool: [www.jcprg.org/exfor/tool](http://www.jcprg.org/exfor/tool)

# 04 EXFOR Activity

## » Status

No.	TRANS	ENTRY	SUBENTRIES	SUBJECT	STATUS
1	D138	D7039	4	Proton	EXFOR
2	D138	D7040	11	Proton	EXFOR
3	D138	D7041	7	Proton	EXFOR
4	D138	D7042	15	Proton	EXFOR
5	D138	D7043	14	Proton	EXFOR
6	3210	30851	2	Neutron	EXFOR
7	3210	30852	2	Neutron	EXFOR
8	3210	30853	3	Neutron	EXFOR
9	3210	30854	2	Neutron	EXFOR
10	3210	30855	7	Neutron	EXFOR
11		30856	4	Neutron	Compiled
12		30857	2	Neutron	Compiled

# 04 EXFOR Activity

## » 30856 Entry

- Article: Cross-sections of Zr-isotopes with the fast neutrons (J,EPJ/A,57,2674,2021)
- Proposal of Memo CP-D/1100
- Subject: Dictionary 236 (Quantities) – M+,SIG,,RAB and question on RAB

Quantity	Reaction Type	Dimension	Subentry
M+, SIG,, RAB	CS	CS	30856.003

- Simplification of REACTION

```
REACTION ((40-ZR-90 (N, 2N) 40-ZR-89-G, M+, SIG,, SPA) +  
          (40-ZR-91 (N, 3N) 40-ZR-89-G, M+, SIG,, RAB/SPA) +  
          (40-ZR-92 (N, 4N) 40-ZR-89-G, M+, SIG,, RAB/SPA) )
```



```
REACTION ((40-ZR-90 (N, 2N) 40-ZR-89-G, M+, SIG,, OTH/SPA)
```

- OTH : presence of contribution from target isotopes

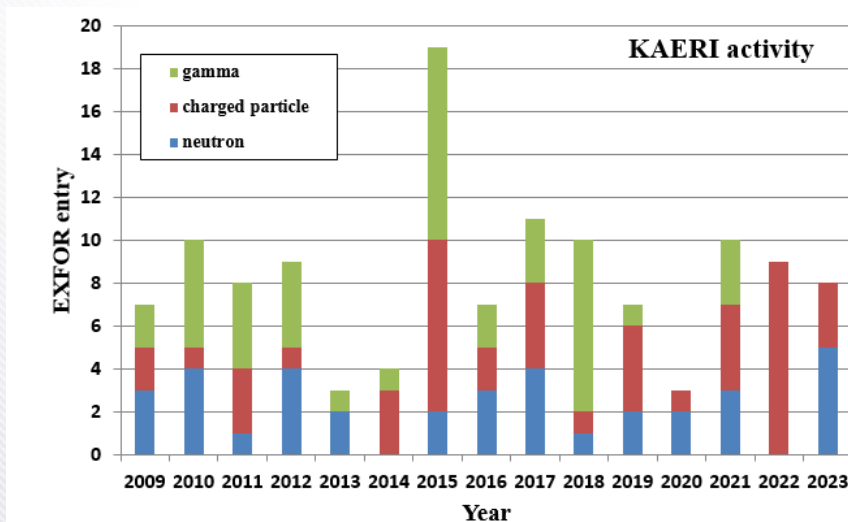
# 04 EXFOR Activity

## » EXFOR DB

### ➤ KAERI/NDC activity to EXFOR

- As of 2024, 125 entries production
- Compilation: ~8.9 per year

#### ● Incident particle



#### ● Facility (for experimental work)

