



HOKKAIDO
UNIVERSITY

Current Status and Future Plans of JCPRG

Beijing, September 6, 2011

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Nuclear Reaction Data Centre (JCPRG)

Hokkaido University

JAPAN

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- Research/Collaboration
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Introduction

- Brief history
- Organization and domestic collaboration
- Main tasks



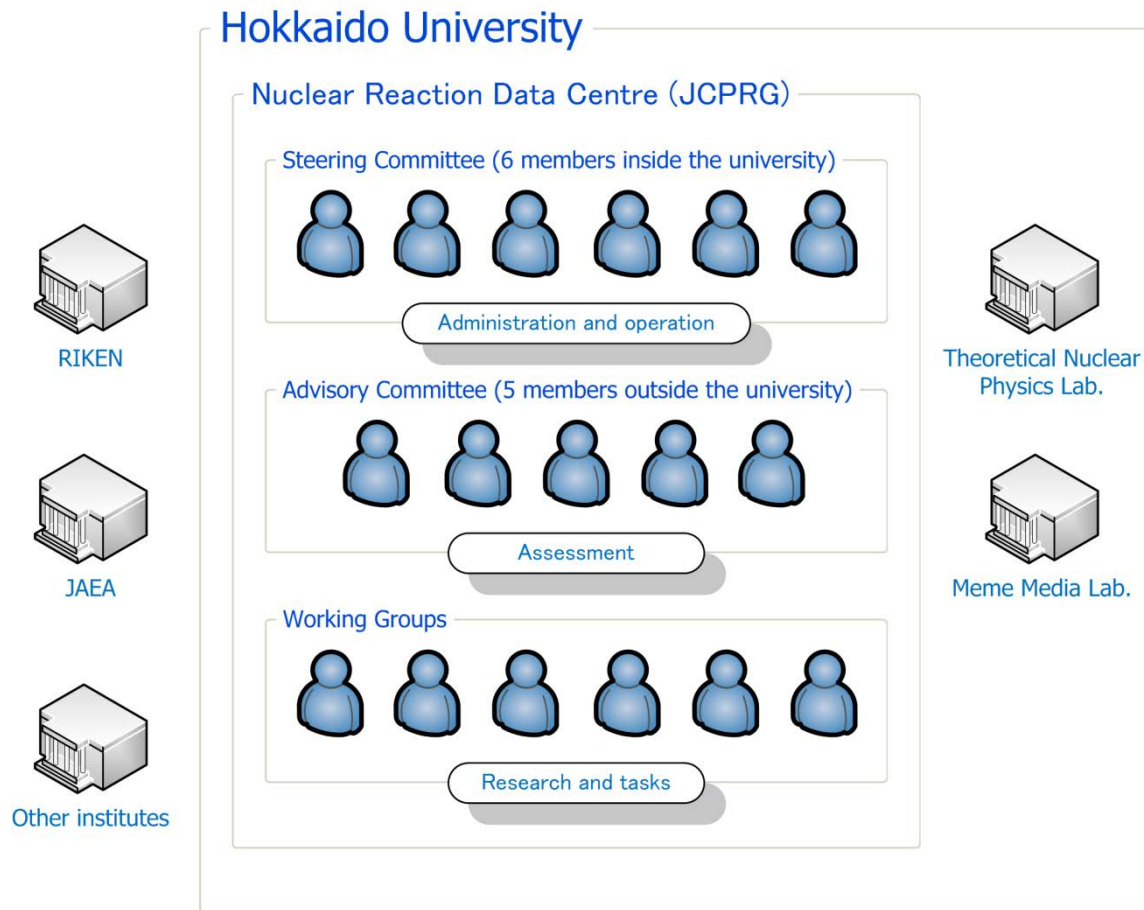
Brief history

- Nuclear Reaction Data Centre in Hokkaido University has been launched in May 2011.
- The centre is the successor of Japan Charged-Particle Reaction Data Group (JCPRG), which was founded in 1974.



Organization and domestic collaboration

- 1 staff and 1 postdoc, and many collaborators



Main Tasks

- Compilation of nuclear reaction data, except neutron-induced reactions, in Japan
- Management of the original database, Nuclear Reaction Data File (NRDF)
- Conversion of the compiled data into the EXFOR format and distribution through the international network
- Evaluation of nuclear reaction data
- Collaboration among Asian nuclear data centres



Compilation

- Nuclear Reaction Data File (NRDF)
- Original software for compilation
- Contribution to EXFOR



Nuclear Reaction Data File (NRDF)

- NRDF is the database of the original format in JCPORG.
- It includes data of about 2,000 articles.
- Some data can not be converted into EXFOR.

```

¥¥BIB.1;
D#=D2141;
TITLE=/ Direct proton decay of the isoscalar giant dipole resonance
      in 208Pb /;
ATH=(B. K. NAYAK' 1', U. GARG' 1', M. KOSS' 1', T. LI' 1', E. MARTIS' 1',
      H. FUJIMURA' 2', M. FUJIWARA' 2', K. HARA' 2', K. KAWASE' 2',
      K. NAKANISHI' 2', E. OBAYASHI' 2', H. P. YOSHIDA' 2', M. ITOH' 3',
      S. KISHI' 3', H. SAKAGUCHI' 3', H. TAKEDA' 3', M. UCHIDA' 3', Y. YASUDA' 3',
      M. YOSOI' 3', R. G. T. ZERGER'S' 4', H. AKIMUNE' 5', M. N. HARAKEH' 6',
      M. HUNYADI' 6');
INST-ATH=(1USANOT' 1', 2JPNRCN' 2', 2JPNKTO' 3', 1USAMSU' 4', 2JPNKON' 5',
          2NEDKVI' 6');
/* '1' Department of Physics */
/* '3' Department of Physics */
/* '4' National Superconducting Cyclotron Laboratory and
      Department of Physics and Astronomy, */
/* '5' Department of Physics */
REF=PL/B;
VLP=674 (2009) 281;
RCTS=208PB (ALPHA, INL, P) 207TL;
PHQS=GIA-RESN;

```

Example of NRDF format: D2141

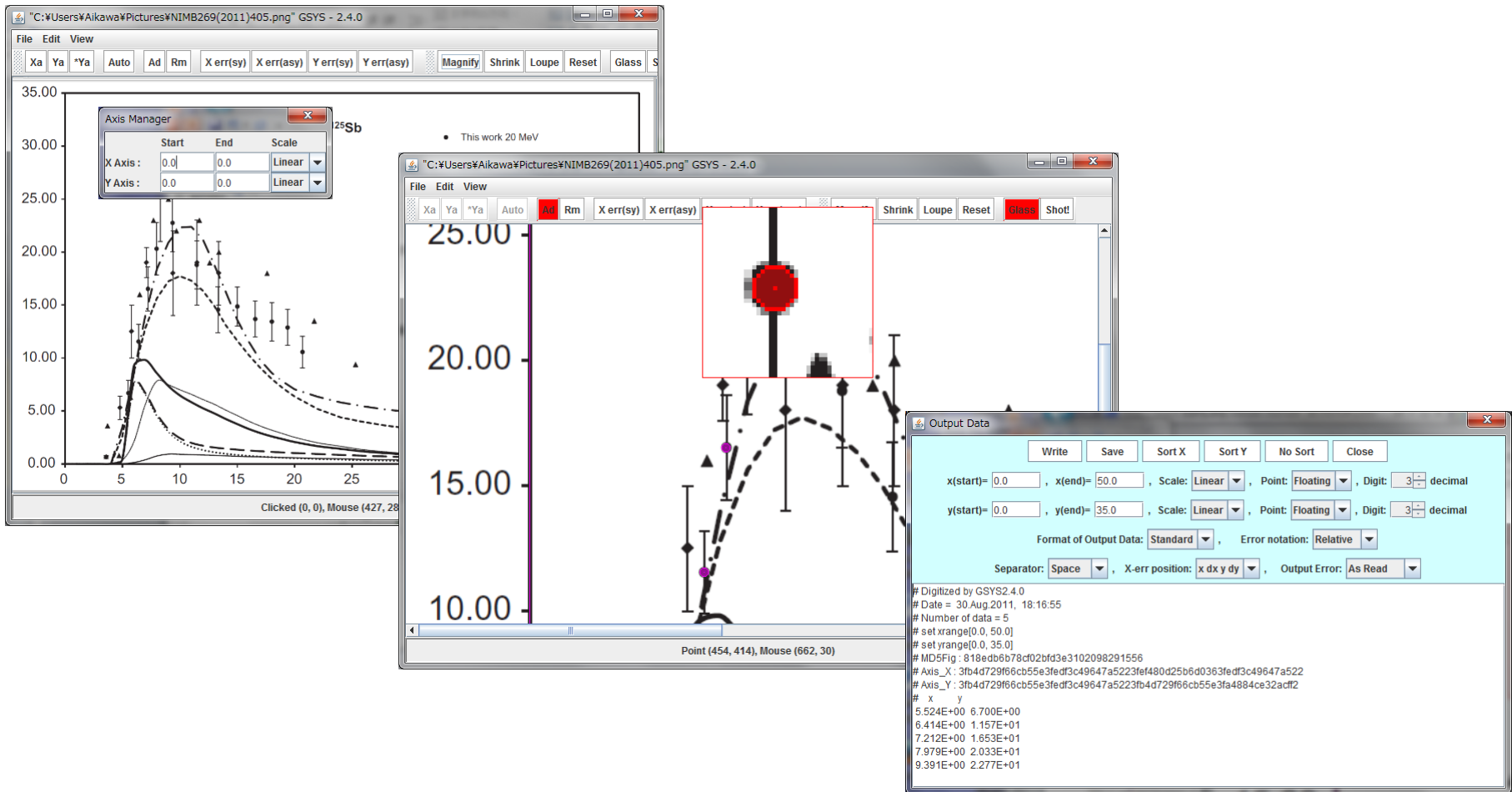


Original Software for compilation

- Web-based Editor for Nuclear Data (HENDEL)
- Digitizing Software (GSYS)
- Search and Plot System



Digitizing Software (GSYS)



Search and Plot System

The image displays three overlapping browser windows from the Hokkaido University Nuclear Reaction Data Centre (JCPRG) website, illustrating the search and plot system.

Left Window: Search Criteria Form
 The search form includes the following fields and options:
 - Target: selector (fe)
 - Projectile: selector (n)
 - Emission: selector (el)
 - Residual: selector (fe)
 - Quantity: selector (C)
 - Energy (eV): (1.)
 - Data No.: (10)
 - Plot axis: Horizontal (1) selector (E), Horizontal (2) selector (A), Vertical selector (D)
 - Bibliography: Pub. Year selector (19), Journal selector (N), 1st Author selector (K), Author selector (S)
 - Buttons: Search, Example(1), Example(2), Example(3)

Middle Window: Search Results Table
 The search results table lists the following data points (selected rows):

| Plot | Author | Year | Inc. energy (eV) | Work | Type | Ref |
|-------------------------------------|-----------------------|------|------------------|---------|------|--|
| <input type="checkbox"/> | 3-LI-6(N,EL)3-LI-6,DA | | | | | (Differential c/s with respect to angle) |
| <input type="checkbox"/> | S.Chiba | 2010 | 1.0e-05 | 2.0e+07 | Eval | Data JENDL-4.0.1 |
| <input type="checkbox"/> | D.L.Zhou | 2009 | 1.0e-05 | 2.0e+07 | Eval | Data CENDL-3.10 |
| <input type="checkbox"/> | G.M.Hale | 2006 | 1.0e-05 | 2.0e+07 | Eval | Data ENDFB-VII |
| <input type="checkbox"/> | G.M.Hale | 2005 | 1.0e-05 | 2.0e+07 | Eval | Data JEFF-31.10.3 |
| <input type="checkbox"/> | S.Chiba | 2002 | 1.0e-05 | 2.0e+07 | Eval | Data JENDL-3.3.1 |
| <input type="checkbox"/> | G.M.Hale | 2002 | 1.0e-05 | 2.0e+07 | Eval | Data JEFF-30.10.3 |
| <input type="checkbox"/> | Zhou Delin | 1995 | 1.0e-05 | 2.0e+07 | Eval | Data CENDL-2.10 |
| <input type="checkbox"/> | G.M.Hale | 1991 | 1.0e-05 | 2.0e+07 | Eval | Data ENDFB-VI |
| <input type="checkbox"/> | Nikolaev M.N. | 1989 | 1.0e-05 | 2.0e+07 | Eval | Data BROND-2.10 |
| <input type="checkbox"/> | S.Chiba | 1989 | 1.0e-05 | 2.0e+07 | Eval | Data JENDL-3.2.1 |
| <input checked="" type="checkbox"/> | A.Takahashi et al. | 1992 | 1.4e+07 | 1.4e+07 | Expt | Rept OKTAV-A-9 |
| <input checked="" type="checkbox"/> | P.W.Lisowski et al. | 1980 | 6.0e+06 | 9.8e+06 | Expt | Rept LA-8342.198 |
| <input checked="" type="checkbox"/> | H.H.Knitter et al. | 1977 | 2.2e+05 | 3.0e+06 | Expt | Rept EUR-5726E |
| <input checked="" type="checkbox"/> | J.A.Cookson et al. | 1967 | 1.0e+07 | 1.0e+07 | Expt | Jour Nucl.Phys.A9 |
| <input checked="" type="checkbox"/> | J.A.Cookson et al. | 1967 | 1.0e+07 | 1.0e+07 | Expt | Jour Nucl.Phys.A9 |
| <input checked="" type="checkbox"/> | C.Wong et al. | 1962 | 1.4e+07 | 1.4e+07 | Expt | Jour Nucl.Phys.33 |

Right Window: 3D Plot
 The plot shows the differential cross-section $d^2\sigma/d\Omega d\Omega$ [b/sr] as a function of incident energy [eV] and laboratory angle θ [deg]. The plot is titled "Hokkaido University Nuclear Reaction Data Centre (JCPRG) EXFOR / ENDF - Plots". The plot shows a complex, multi-lobed structure of data points, with a legend on the right listing the authors and their corresponding symbols and colors.



Contribution to EXFOR

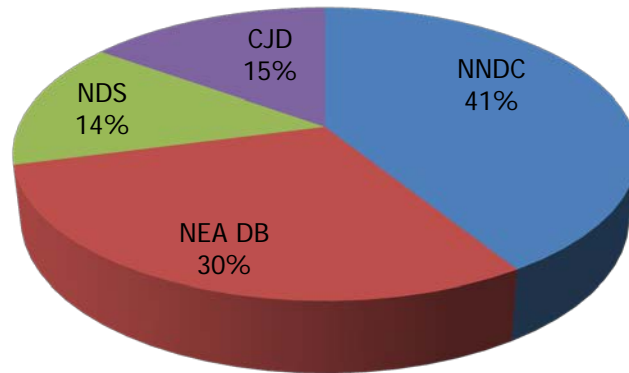
- EXFOR, a compilation of experimental nuclear reaction data, is supported by the NRDC network.

| Country | Centre | Joined | |
|---------|--|--------|--------------|
| U.S.A | US National Nuclear Data Center | 1966 | Core centres |
| France | OECD NEA Data Bank | 1966 | |
| Austria | IAEA Nuclear Data Section | 1966 | |
| Russia | Russian Nuclear Data Center | 1966 | |
| China | Chinese Nuclear Data Center (CNDC) | 1987 | |
| Hungary | Nuclear Data Group | 1992 | |
| India | Nuclear data physics center of India (NDPCI) | 2008 | |
| Japan | Japan Nuclear Reaction Data Centre (JCPRG) | 1975 | |
| Japan | Nuclear Data Center | 1991 | |
| Korea | Nuclear Data Evaluation Laboratory | 2000 | |
| Russia | Nuclear Structure and Nuclear Reaction Data Centre (CAJaD) | 1974 | |
| Russia | Centre for Experimental Photonuclear Data (CDFE) | 1982 | |
| Russia | Center for Nuclear Physics Data (CNPD) | 1997 | |
| Ukraine | Ukrainian Nuclear Data Center (UkrNDC) | 1998 | |

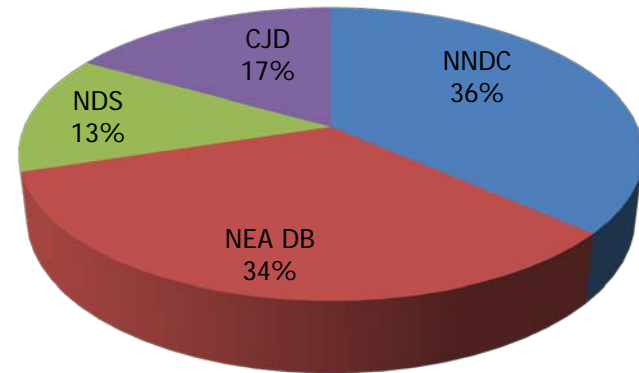


EXFOR Statistics for Neutron Data

Entries



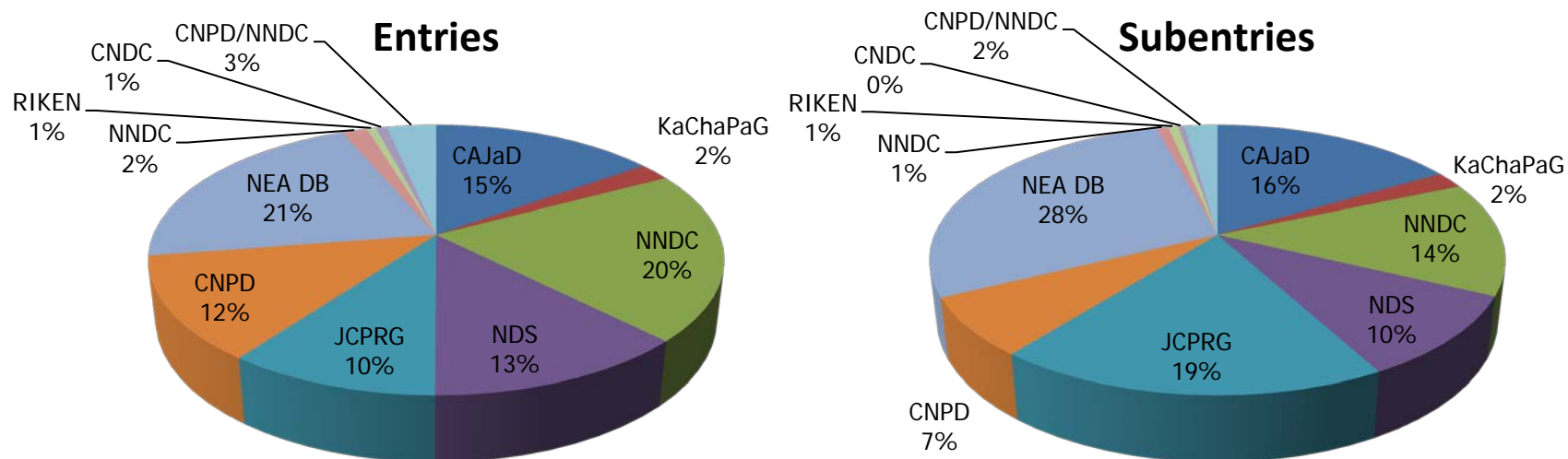
Subentries



| ID | Centre | Entries | Subentries | S/E |
|----|--------|---------|------------|------|
| 1 | NNDC | 4232 | 25042 | 5.92 |
| 2 | NEA DB | 3051 | 23003 | 7.54 |
| 3 | NDS | 1448 | 8940 | 6.17 |
| 4 | CJD | 1546 | 11528 | 7.46 |



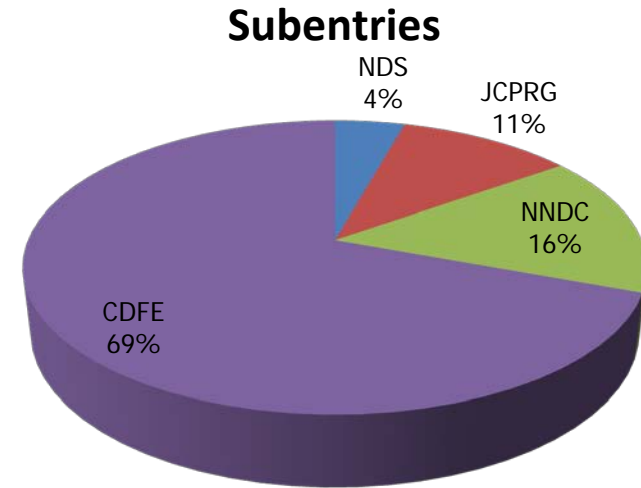
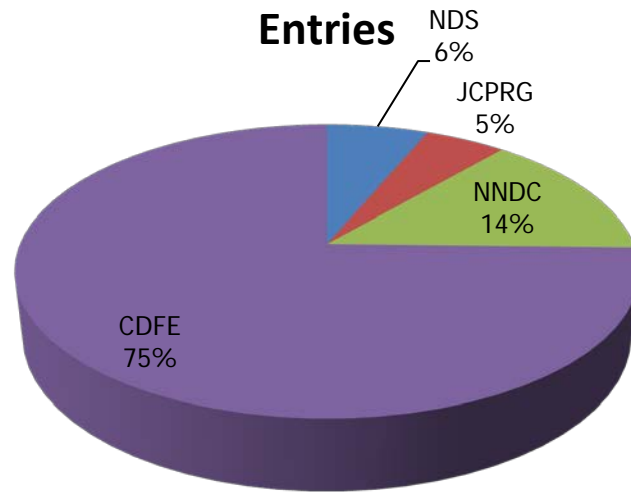
EXFOR Statistics for Charged-particle Data



| ID | Centre | Entries | Subentries | S/E |
|----|-------------------------|---------|------------|-------|
| A | CAJaD | 1271 | 12149 | 9.56 |
| B | KaChaPaG | 180 | 1470 | 8.17 |
| C | NNDC | 1719 | 10048 | 5.85 |
| D | NDS | 1053 | 7309 | 6.94 |
| E | JCPRG | 846 | 13663 | 16.15 |
| F | CNPD | 1050 | 5169 | 4.92 |
| O | NEA DB | 1779 | 20759 | 11.67 |
| P | NNDC from MacGowen file | 144 | 586 | 4.07 |
| R | RIKEN | 52 | 491 | 9.44 |
| S | CNDC | 63 | 301 | 4.78 |
| T | CNPD/NNDC | 280 | 1645 | 5.88 |



EXFOR Statistics for Photonuclear Data



| ID | Centre | Entries | Subentries | S/E |
|----|--------|---------|------------|-------|
| G | NDS | 68 | 343 | 5.04 |
| K | JCPRG | 54 | 860 | 15.93 |
| L | NNDC | 152 | 1228 | 8.08 |
| M | CDFE | 806 | 5496 | 6.82 |



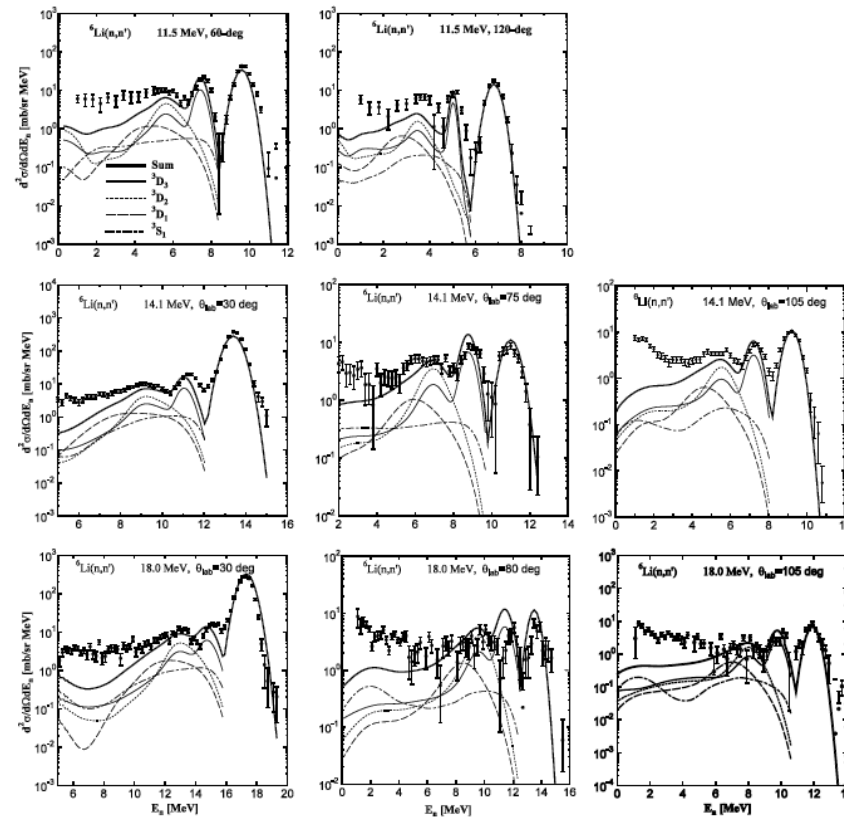
Research/Collaboration

- Evaluation
- Experiment under the AASPP program
- Asian collaboration



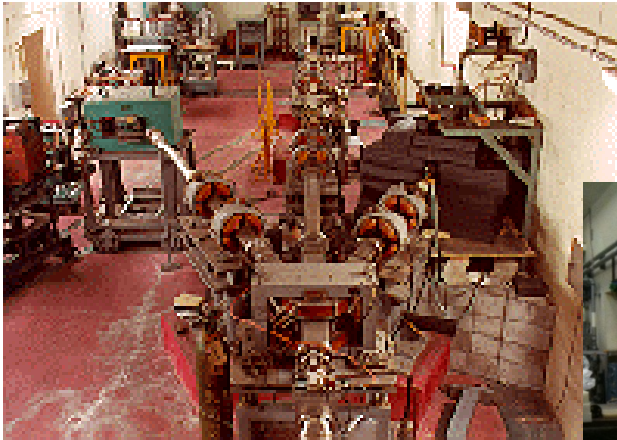
Evaluation

- Ex.: CDCC calculations for ${}^6\text{Li}+n$ reactions by D. Ichinkhorloo, et al.



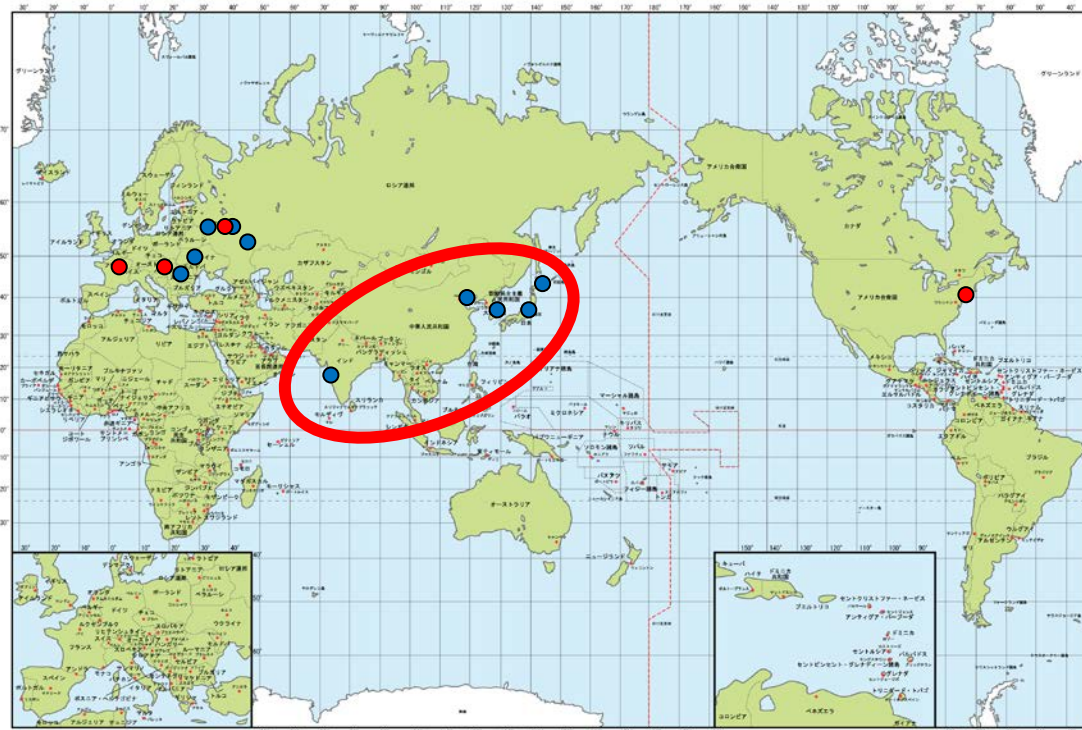
Experiment under the AASPP program

- In Aug. 19-21, 2001, an experiment has been done with Prof. Kim from Korea.



Asian collaboration

- The collaboration of Asian centres in the NRDC network is very important.



Future Plans

- Extension of compilation/research/collaboration
- Construction of a new/unified database
- Measurements of radiation dose rates



Extension of compilation/research/collaboration

- Software
 - Compilation Editor (Java)
 - GSYS
- Research
 - Evaluation for specific fields, such as astrophysics, medicine, or engineering
- Collaboration
 - Domestic institutes
 - Asian centres and other institutes abroad



Construction of a new/unified database

- The new database has to be:
 - Understandable not only for compilers but also for users in astrophysics, medicine and so on
 - Easy to develop the database application
 - Extensible in terms of data out of the EXFOR scope



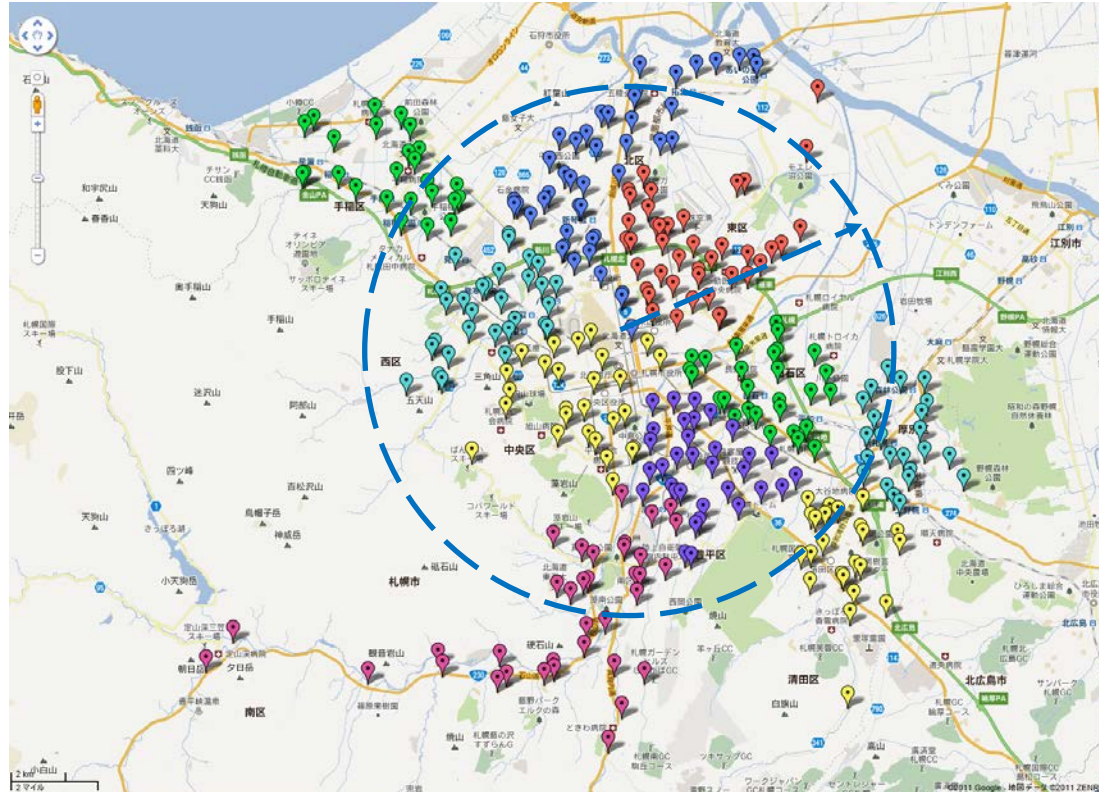
Measurement of radiation dose rates

- We measure radiation dose rates in Sapporo.
- The results, less than $0.11 \mu\text{Sv/h}$, are available on our website.
- During Aug. 23-25, over 300 points, where Sapporo municipal schools are, have been measured.



Radiation Dose Rate of Sapporo municipal schools

- The dose rates are 0.03~0.07 $\mu\text{Sv}/\text{h}$.



Circle: 10km from Sapporo station



Summary

- We contribute to:
 - NRDF and EXFOR compilation
 - Software development
 - Evaluation of nuclear data
 - Collaboration among Asian centres and others
 - Construction of a new database
 - Measurement of radiation dose rates
 - Provision of information on the web

