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Development of Codes for Nuclear Data Evaluation at JAEA

Tokio Fukahori, Akira Ichihara, Osamu Iwamoto, Satoshi Kunieda
Nuclear Data Evaluation Group, Japan Atomic Energy Agency
fukahori.tokio@jaea.go.jp



Introduction

Codes being developed at JAEA for nuclear data evaluation

POD

FORTRAN

mainly for **FP** nuclides

COCOON (tentative)

C++ & Object-oriented Architecture

R IPL database

mainly for **MA** nuclides

Optical Model

spherical

charged particle : p, d, t, h, α

partial wave ($l_{\max}=40$) \rightarrow < 50 MeV

built-in potential : Koning-Delaroche

Direct Process

DWBA : only for neutron

Knock-out (α) : empirical formula

Pick-up + Stripping (d, t, h, α) : empirical formula

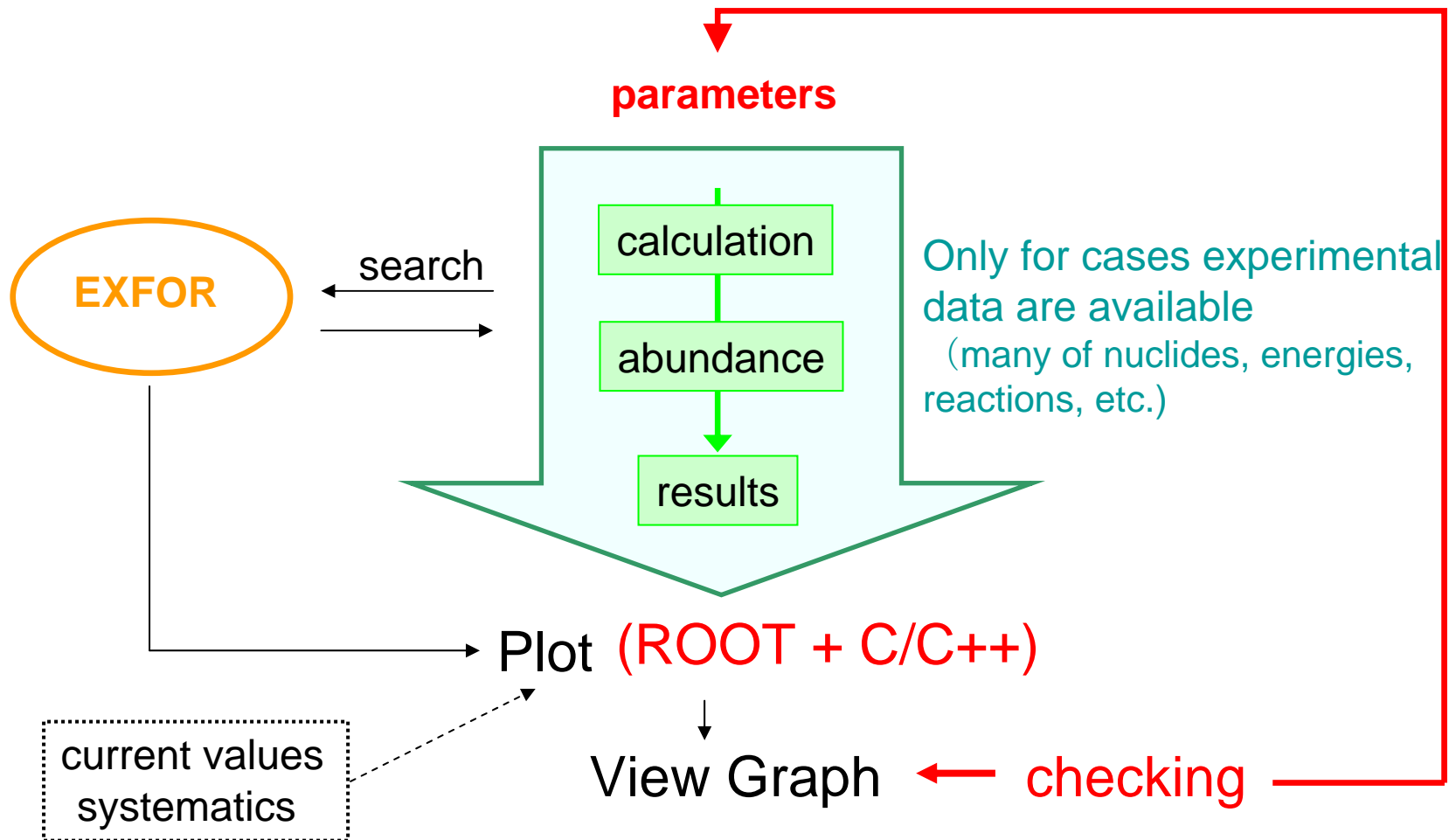
Pre-equilibrium Process

one component exciton model (n, p, d, t, h, α)
master equation or closed form (option)
Karbach systematics

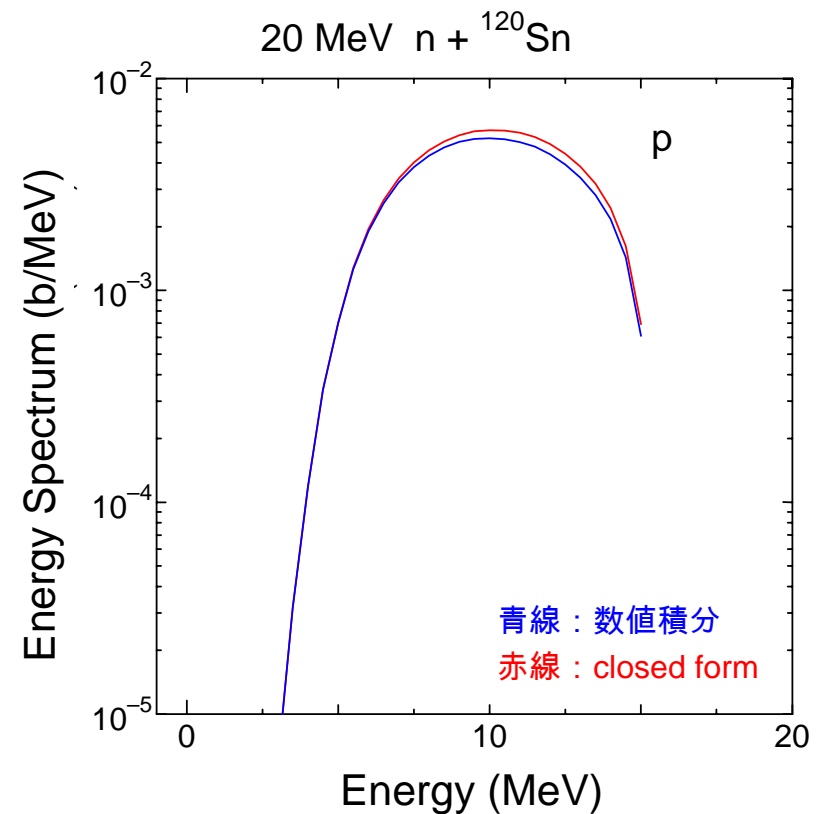
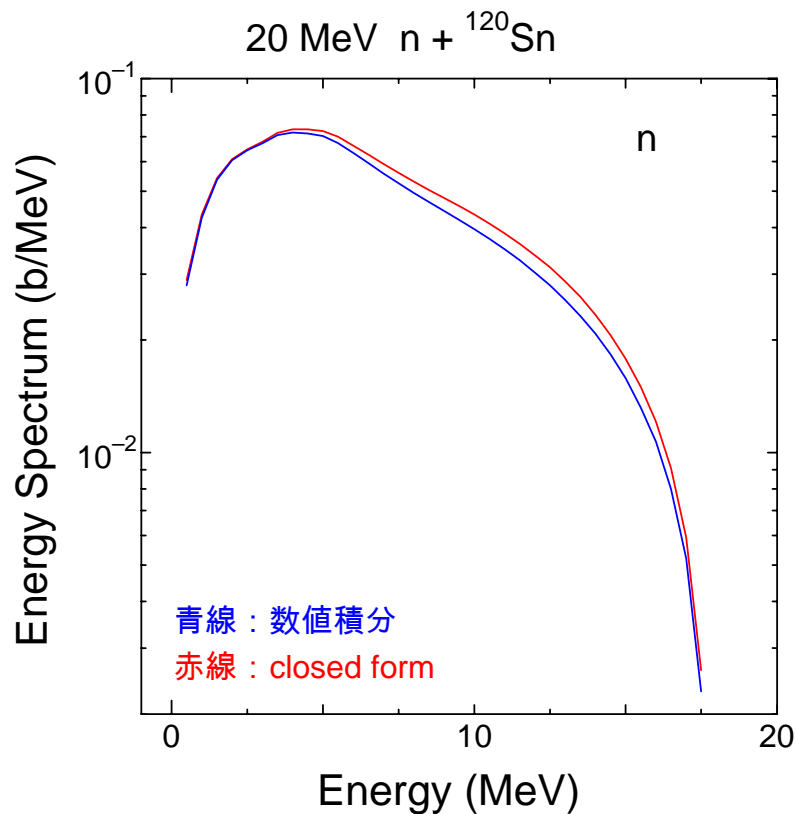
Compound Process

Hauser-Feshbach
width fluctuation
level density with shell correction

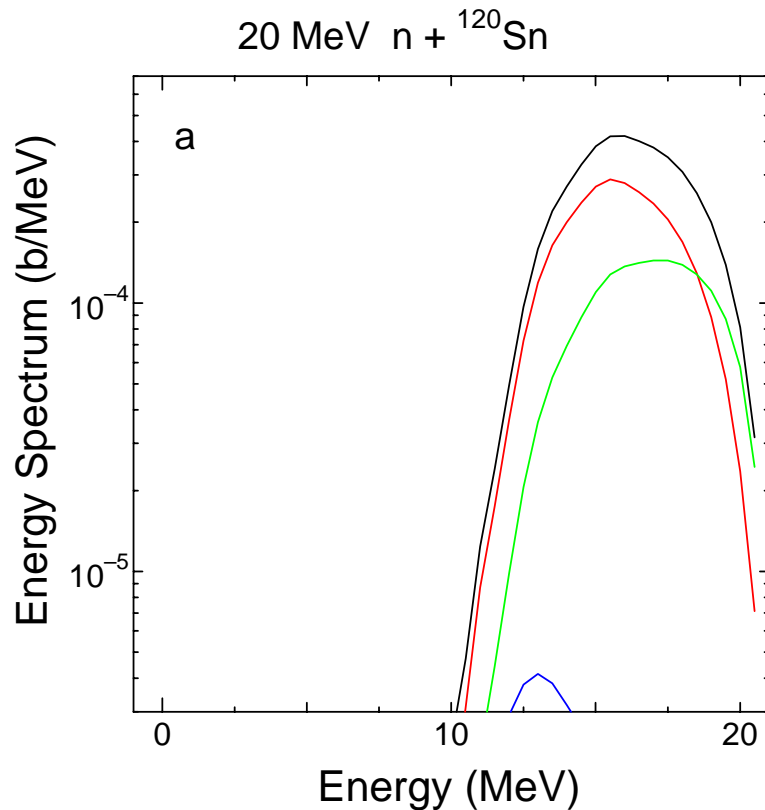
Post Calculation



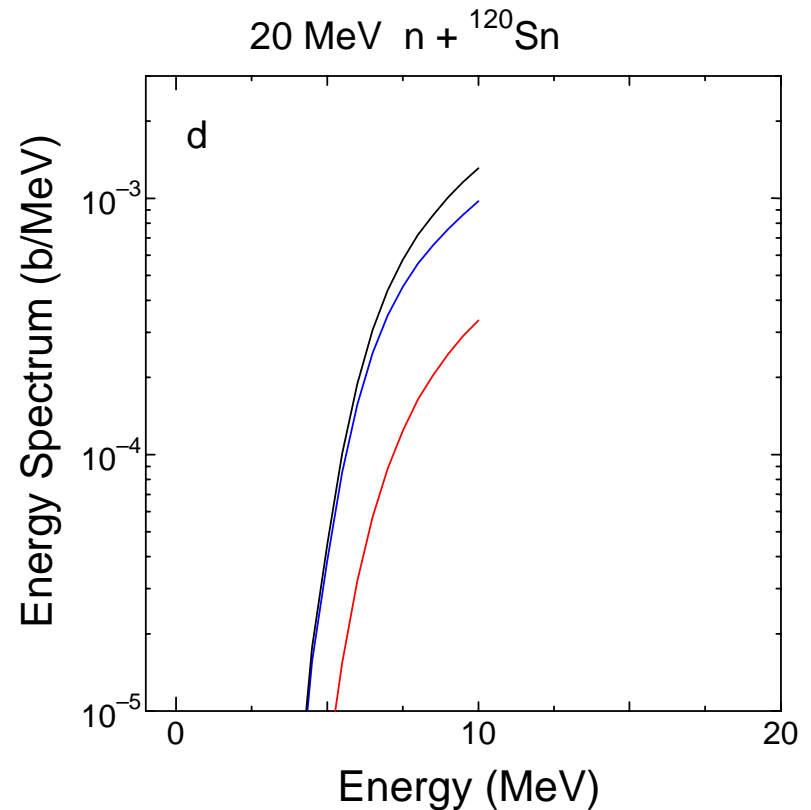
Examples of Calculated Results



Examples of Calculated Results



total
 Direct Pickup-Stripping
 Direct Knockout
 exciton



total
 Direct Pickup-Stripping
 exciton

Models and Codes

Direct Process (CCOM,CCDM)

- Coupled-channel optical model (ground state rotational band)
- Distorted wave born approximation (vibrational collective state)
- Optical model parameter search (CCOM)

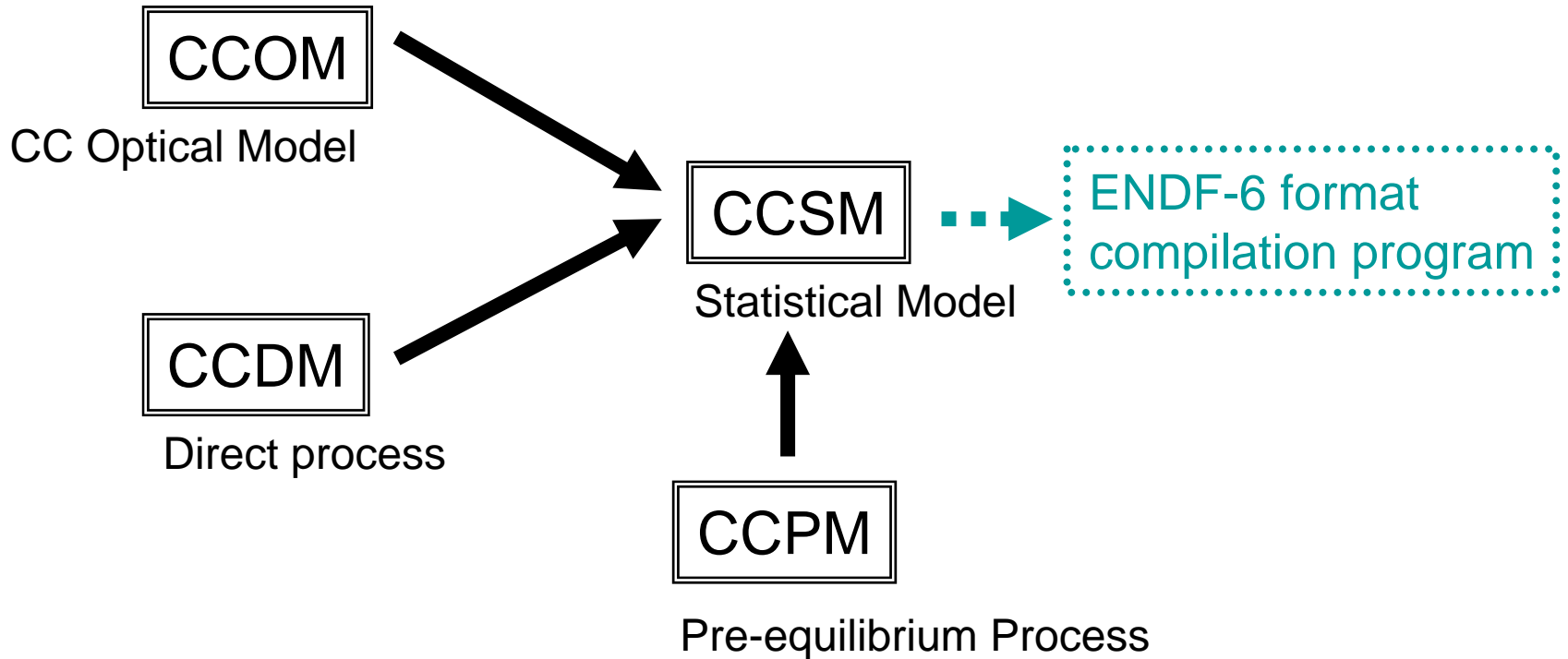
Pre-equilibrium Process (CCPM)

- 2 component exciton model

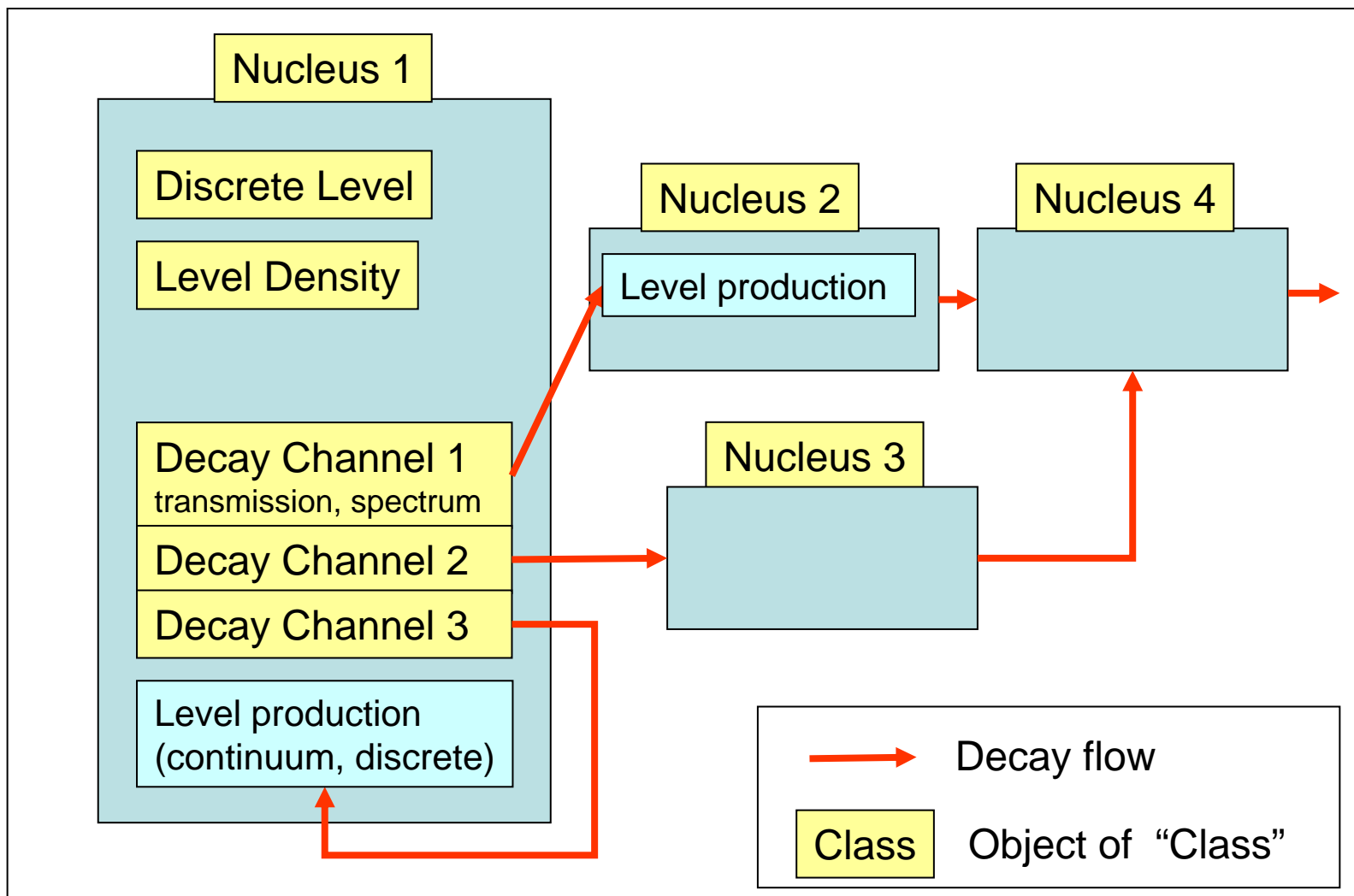
Compound Process (CCSM)

- Hauser-Feshbach (spin-parity conservation, Moldauer width fluctuation correction)
- Gilbert-Cameron & Ignatyuk level density (Mengoni-Nakajima)
- Fission (Hill-Wheeler)

System Structure



Structure of CCSM



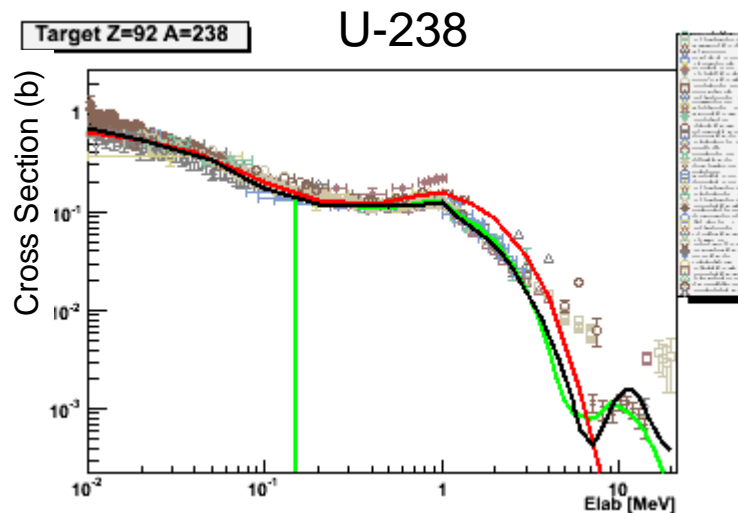
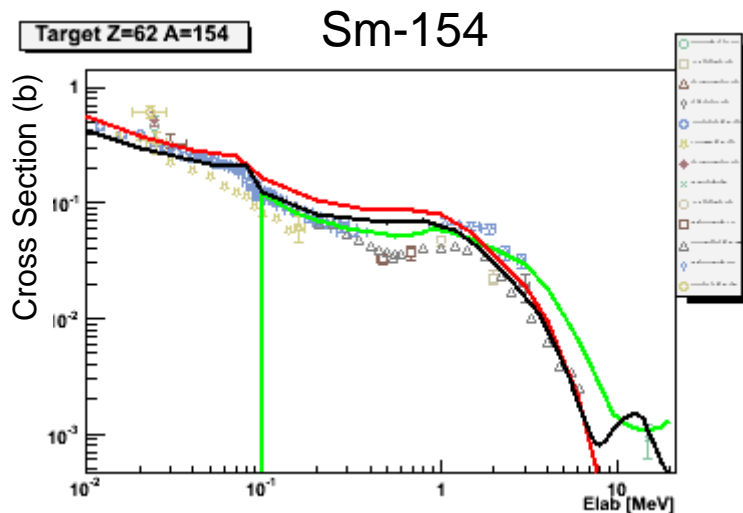
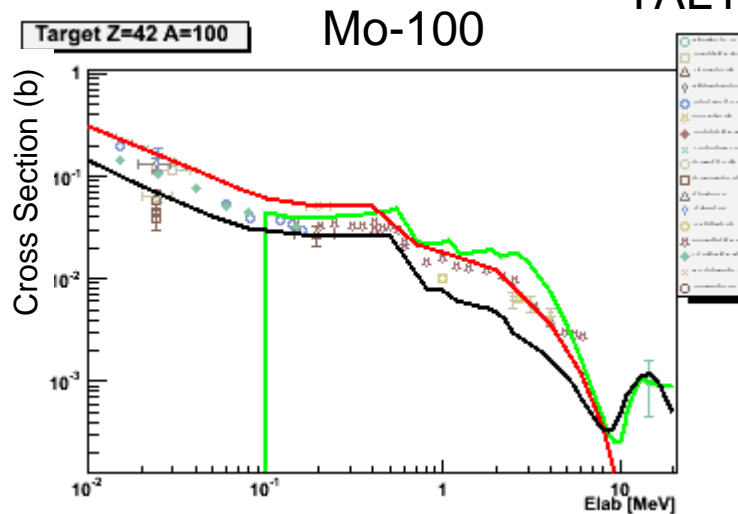
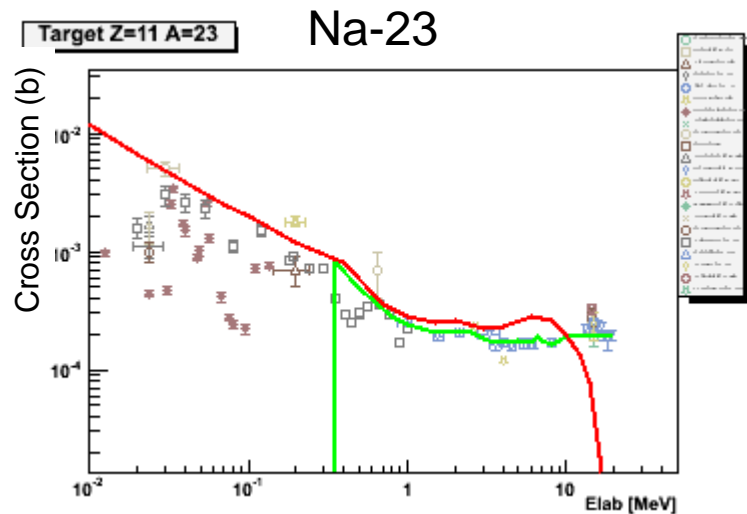
Global calculation

(verification of code)

- Parameters
 - OMP: Koning-Delaroche(2003)
 - LDP: Mengoni-Nakajima(1994)
 - GSF: E1,M1,E2 (rolentz type, GR systematics)
- Stable isotopes ($Z > 10$, $E_n = 10\text{keV} - 20\text{MeV}$)
- EXFOR, JENDL-3.3, TALYS

Capture cross section

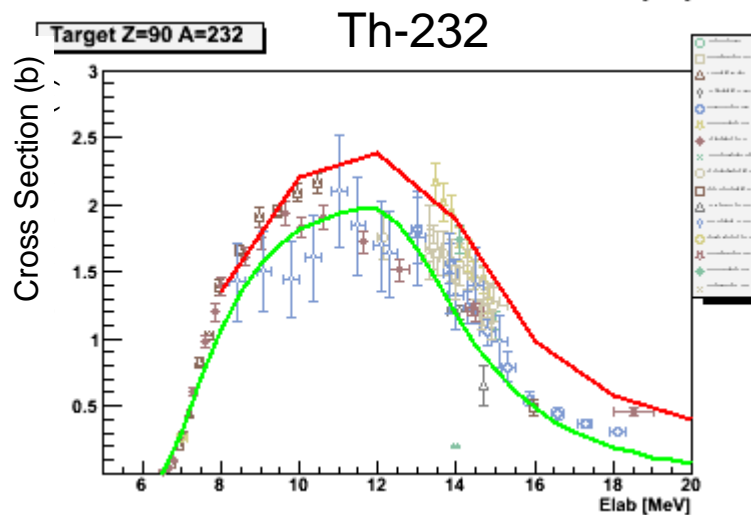
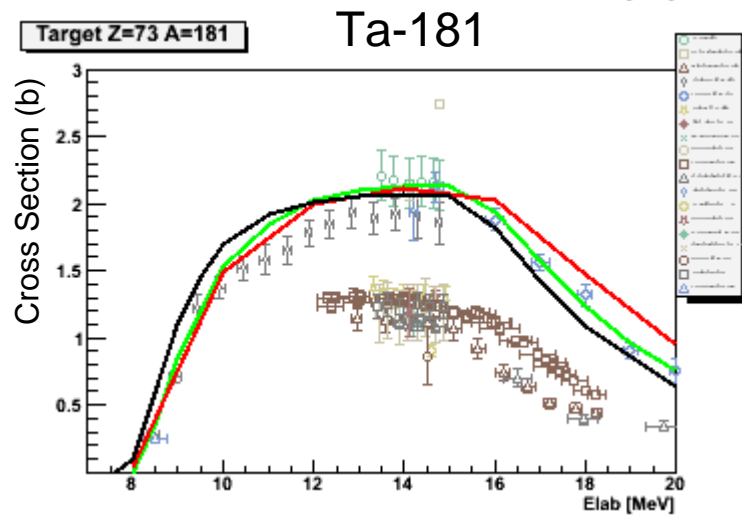
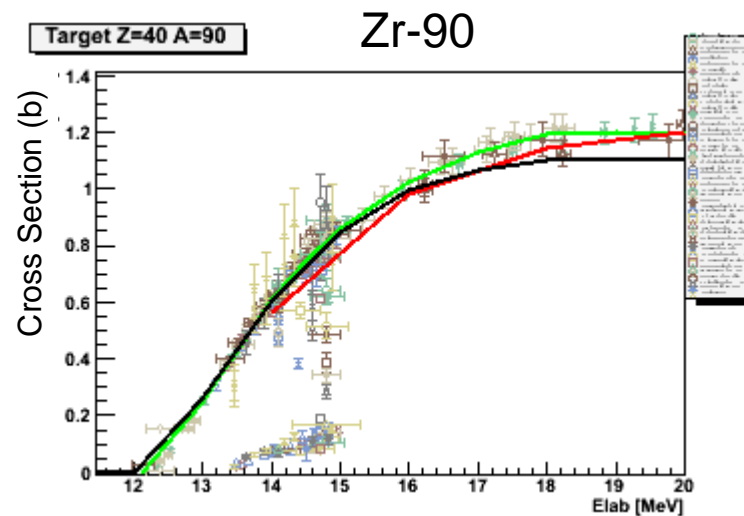
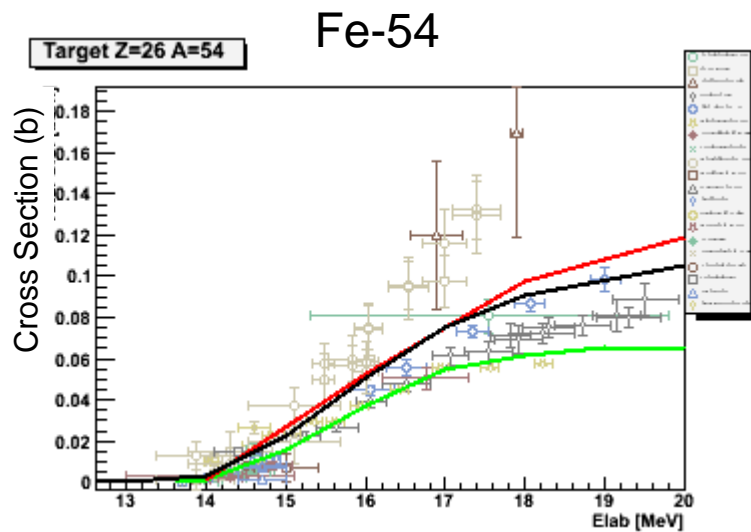
CCSM
JENDL-3.3
TALYS



COCOON

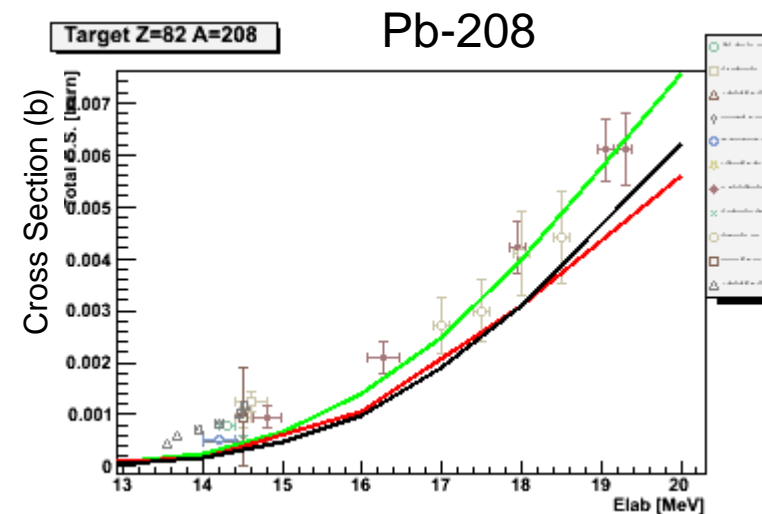
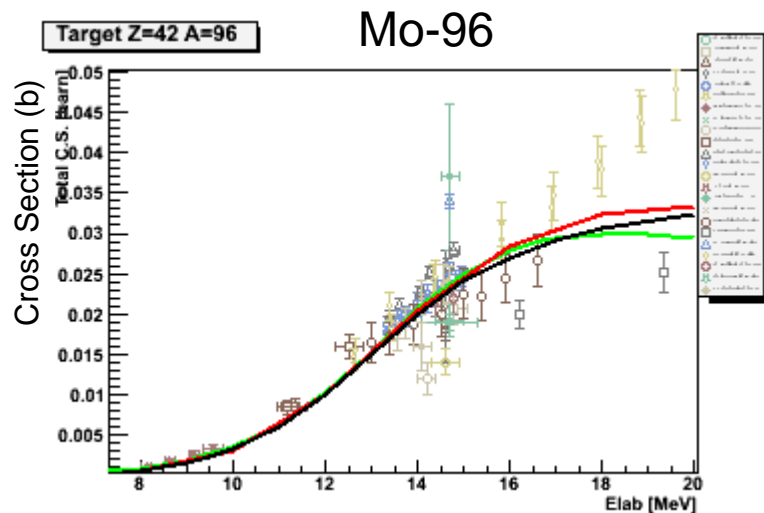
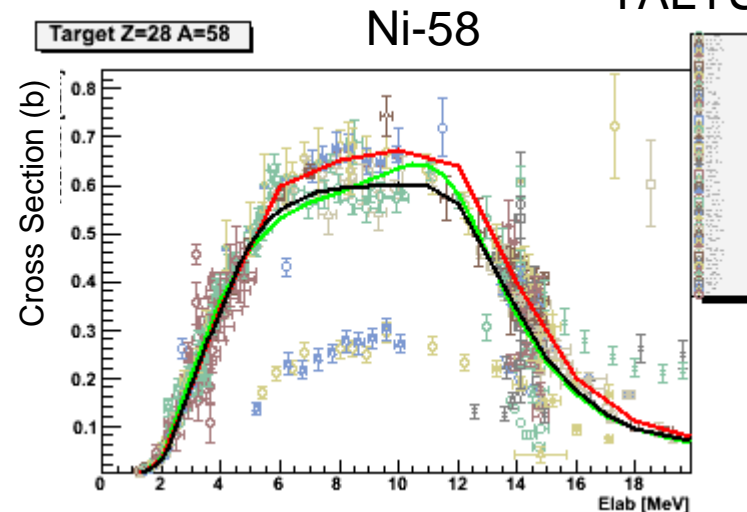
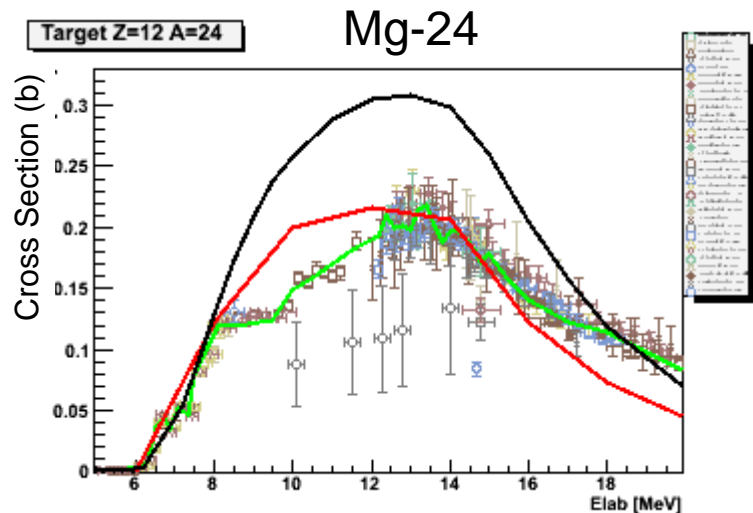
(n,2n)Cross section

CCSM
JENDL-3.3
TALYS



(n,p) Cross section

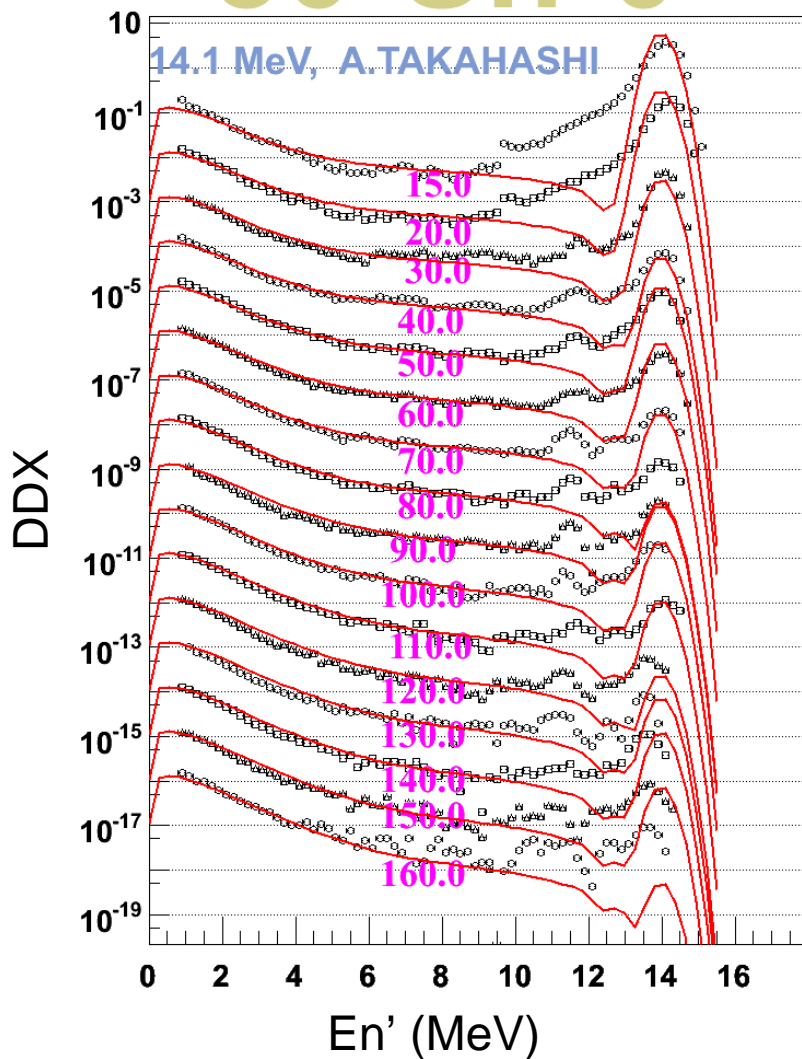
CCSM
JENDL-3.3
TALYS



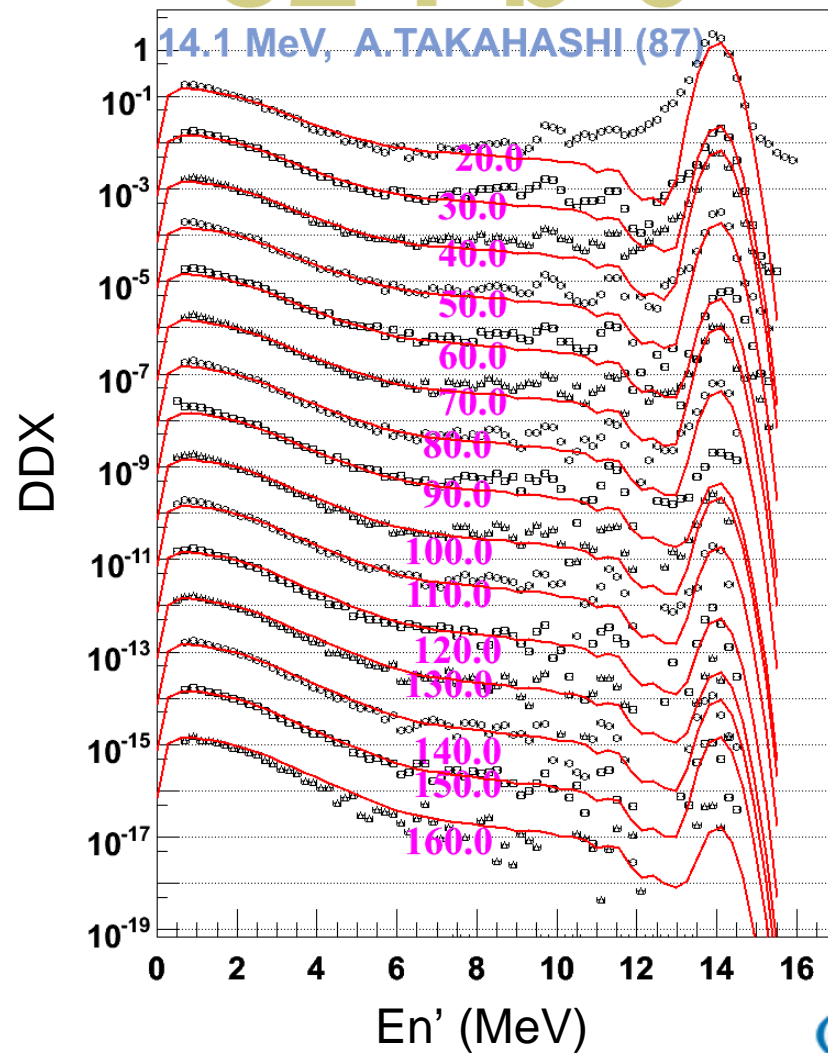
COCOON

(n,xn) DDX

50-Sn-0



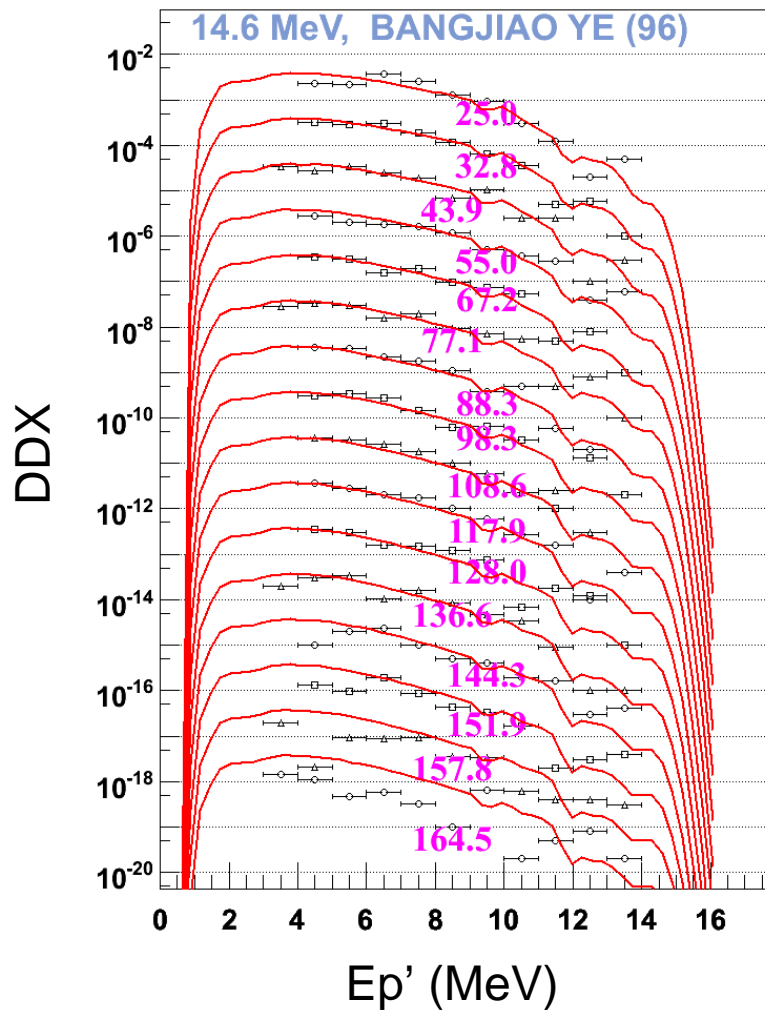
82-Pb-0



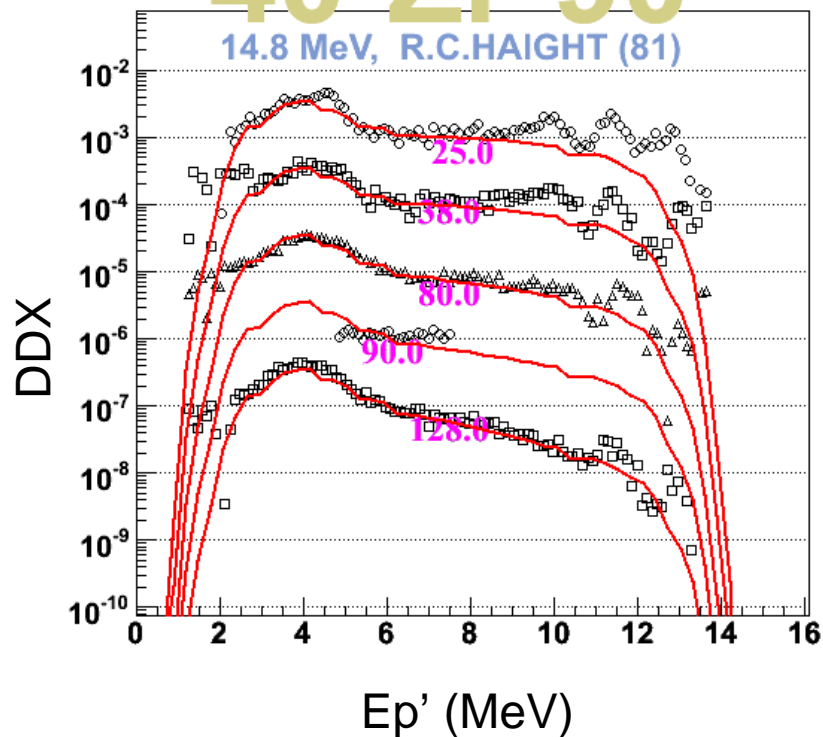
COCOON

(n,xp) DDX

26-Fe-0

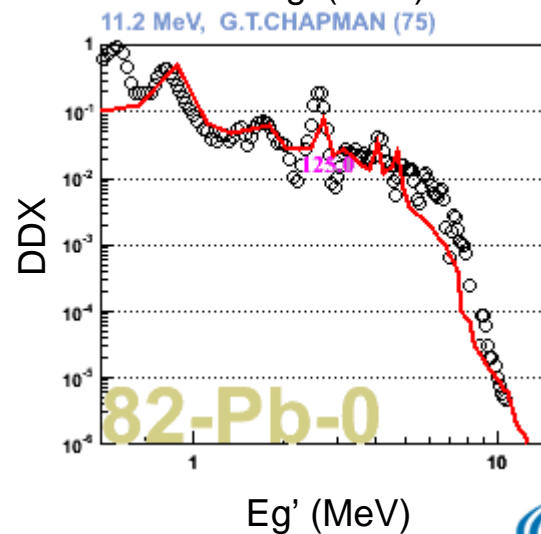
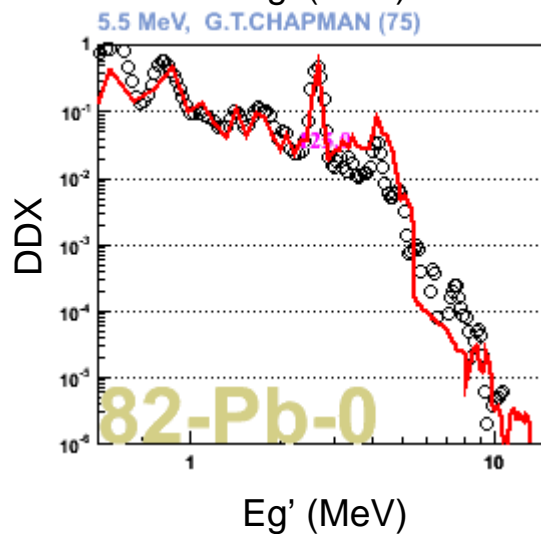
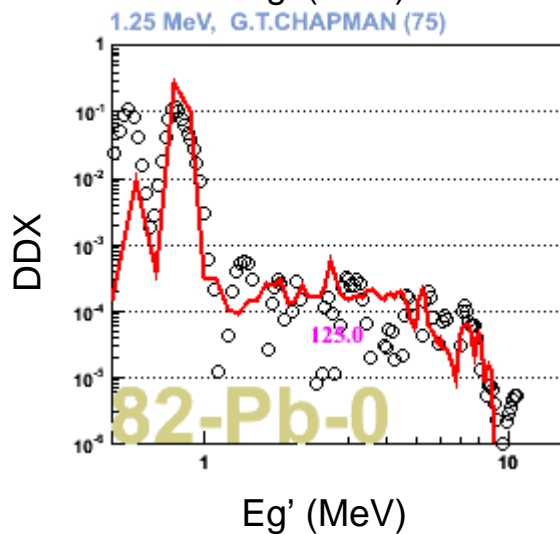
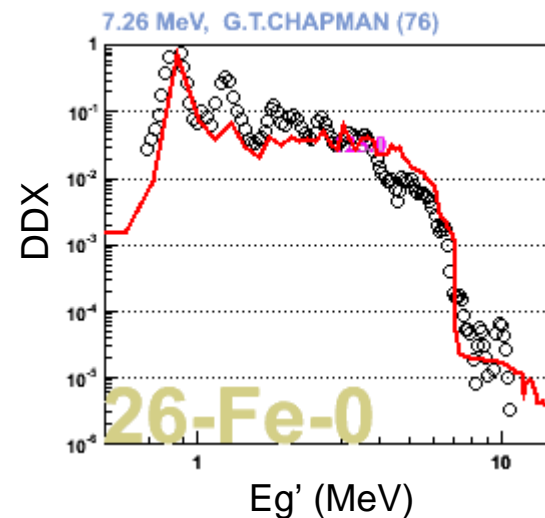
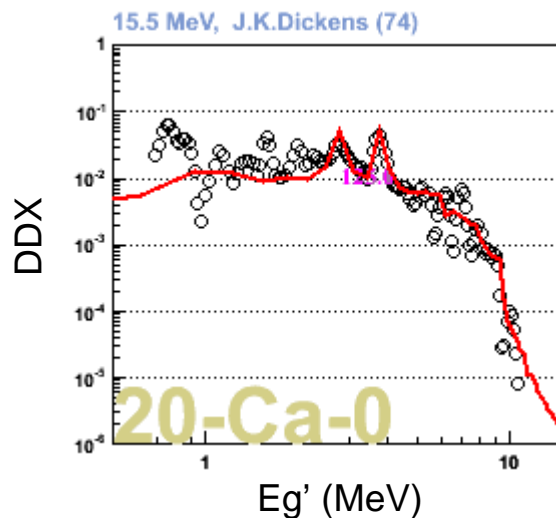
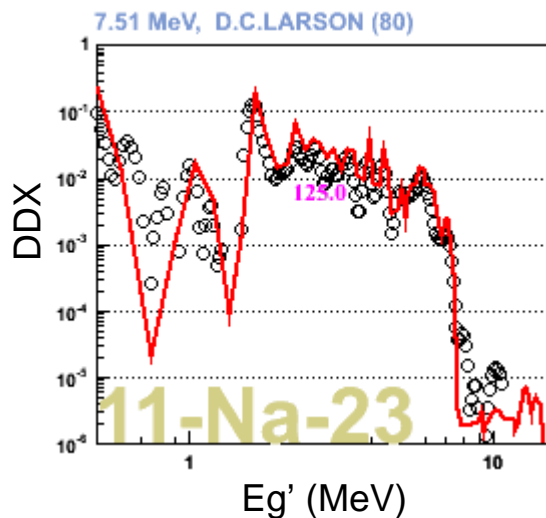


40-Zr-90



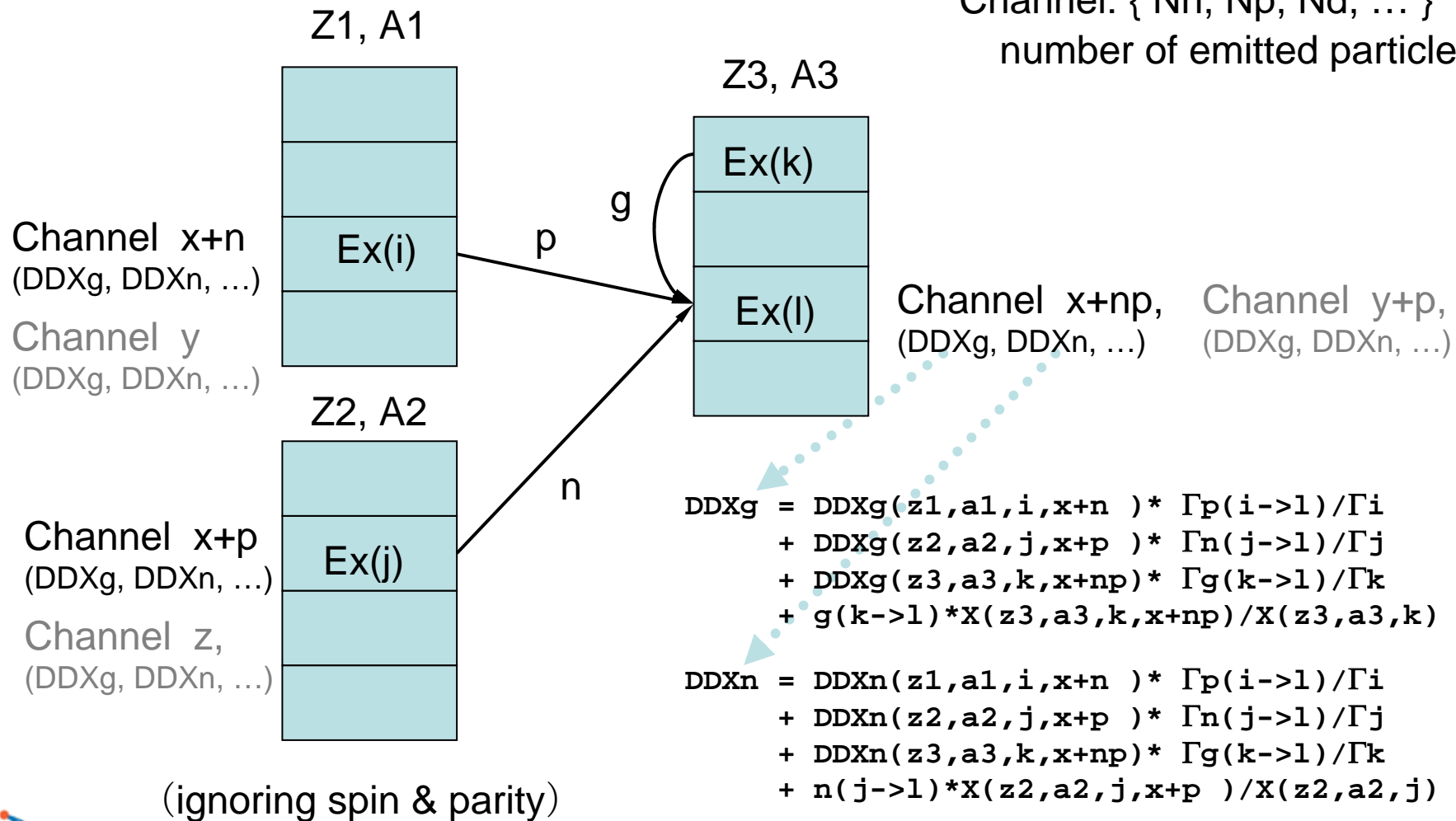
COCOON

(n, x γ) DDX



Exclusive DDX Compilation

Channel: { N_n, N_p, N_d, \dots }
 number of emitted particle



Summary

- Reported are current status of codes under developing at JAEA, **POD** and **COCOON** (tentative).
- They are developed as evaluation tools for JENDL-4.
- It is necessary to improve them more and to obtain experiences to use the codes.