USNDP LANL Report

T. Kawano, HY. Lee, M. Jandel
Los Alamos National Laboratory

Personnel Changes and National / International Activities

- **Staff Members and Post-Docs**
  - R.C. Haight retired, HyeYoung Lee succeeded
  - M. Jandel left LANL
  - M.R. Mumpower, a new post-doc hired by T-2 in Aug. 2015
  - A.M. Long, a new postdoc, hired by P-27 in Aug. 2016

- **Conference Organized and Plans**
  - Int. Workshop on Compound Nuclear Reaction
    CNR15, Tokyo, Japan, Oct. 2015
    - 86 participants from 15 countries
    - LANL was in charge of proceedings editing
  - Workshop on Neutron Nuclear Data Directions into the Next Half Century, Santa Fe, Aug. 2016
  - Int. Workshop on Fission Experiments and Theoretical Advance
    FIESTA 2017

- **IAEA CPRs**
  - Cross section standards (G. Hale, D. Neudecker, T. Kawano)
  - Strength function and photo-nuclear data (T. Kawano)
  - Model code comparison under RIPL-4 CRP, to be started (T. Kawano)

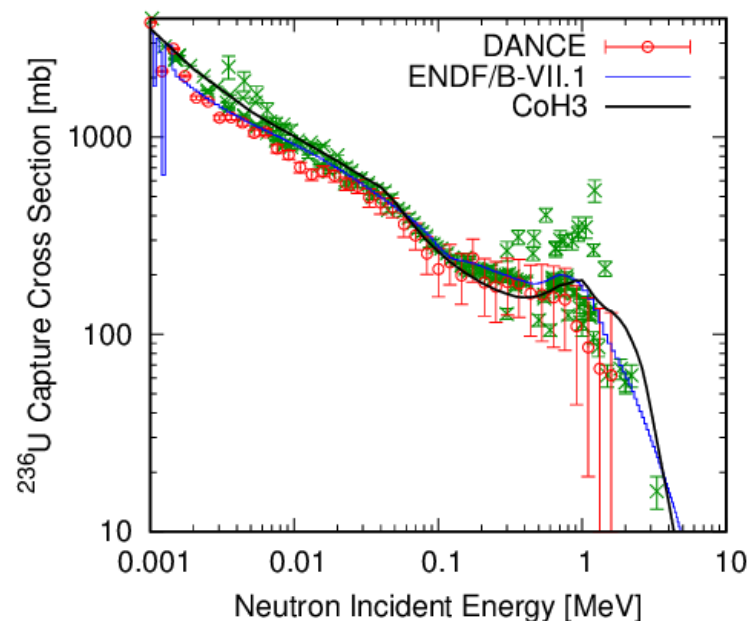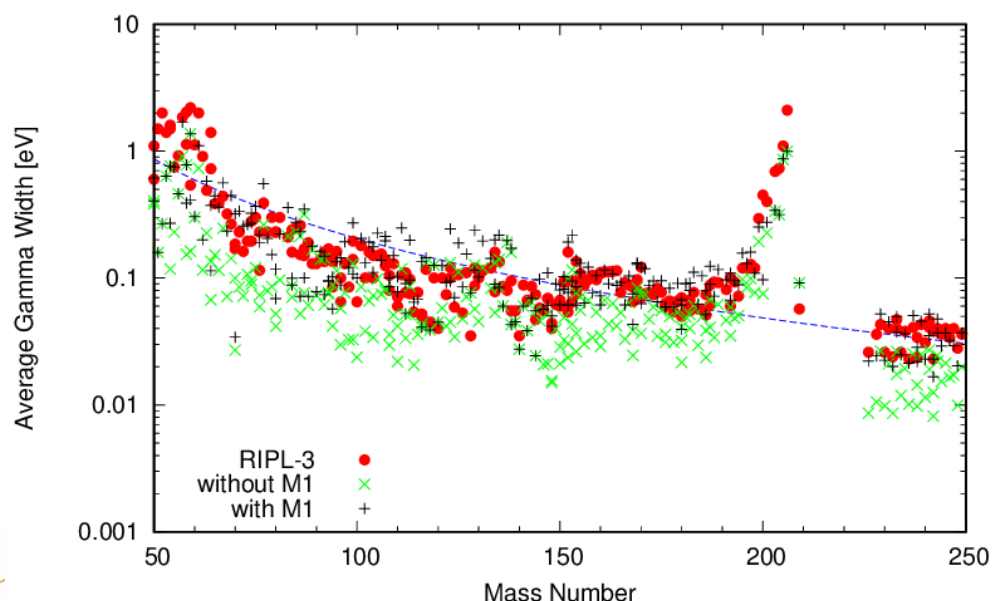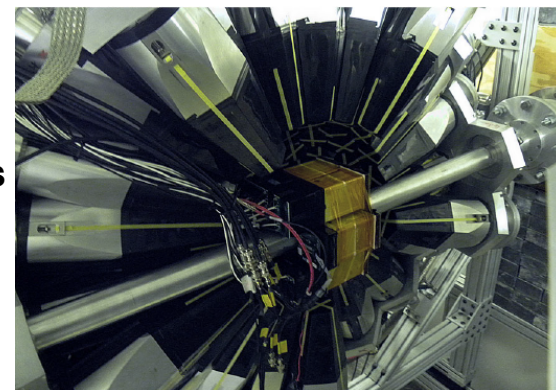- **FIRE (Fission In R-process Elements) topical collaboration**
  - Funded by DOE/SC and NNSA
  - LLNL (leading), LANL, BNL, University of Notre Dame, North Carolina State University

Neutron Nuclear Data Directions Into the Next Half Century
In Celebration of Bob Haight's Contributions to Science

August 5th 2016
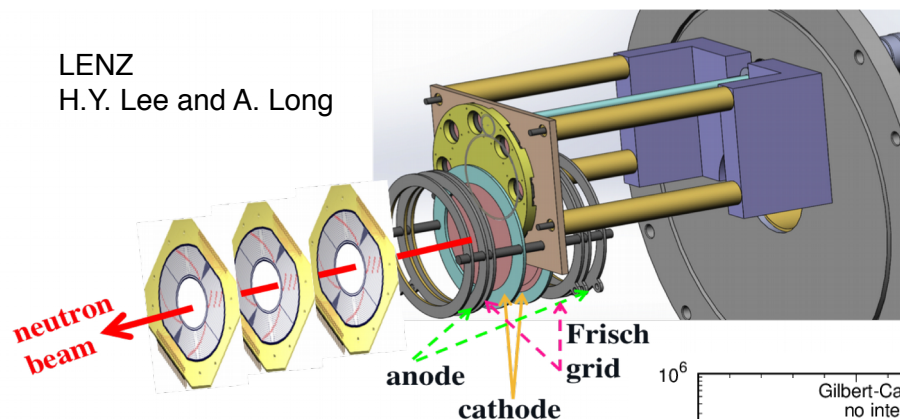The Inn and Spa at Loretto, Santa Fe, New Mexico

Photon Strength Function and DANCE Data

- **DANCE detector at LANSCE suggested M1 scissors mode for actinides**
  - Neutron capture cross section strongly enhanced

- **Estimation of M1 photon strength from evaluated capture cross sections**
  - Capture cross section calculations for more than 100 nuclei in the FP region performed
  - M1 strength and nuclear deformation studied
  - DANCE data can be reproduced without artificial STR re-scaling

LENZ Upgrade for Improvement of Reaction Modeling at LANL
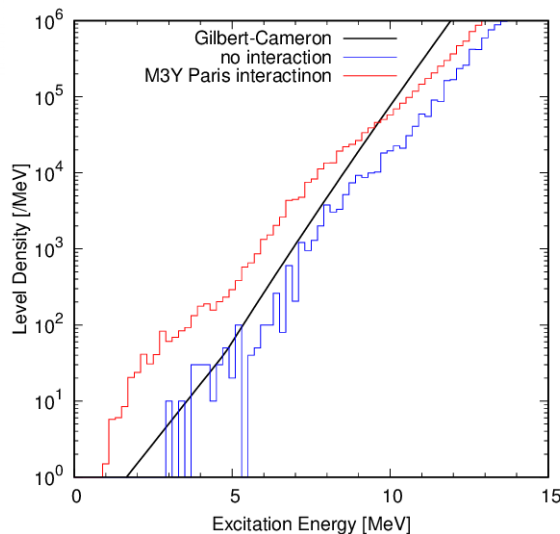
LENZ
H.Y. Lee and A. Long

neutron beam

anode **Frisch grid**

cathode

Cross Sections (n,p), (n,alpha)
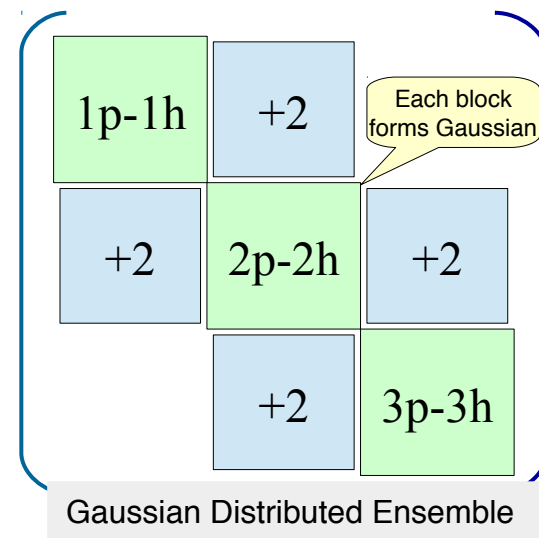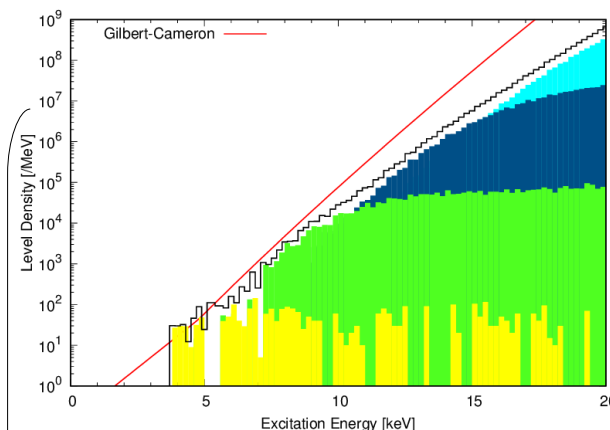Fe, Cr, Mo will be provided

⬇

Hauser-Feshbach model calculation

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Microscopic Level Density Calculation
can be tested against LENZ/DANCE

CoH,BeoH, CGMF
T. Kawano and M. Mumpower
P. Talou and I. Stetcu

Gilbert-Cameron

Level Density [/MeV]

Excitation Energy [keV]

Gilbert-Cameron
no interaction
M3Y Paris interactinon

Level Density [/MeV]

Excitation Energy [MeV]

1p-1h	+2
+2	2p-2h

Each block forms Gaussian
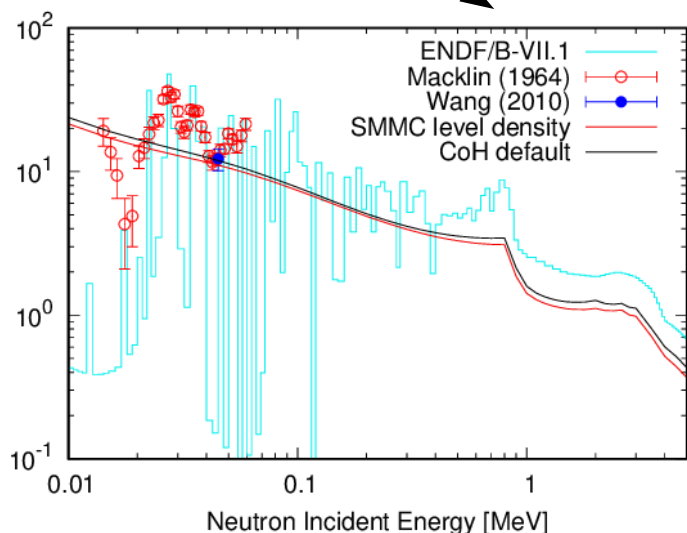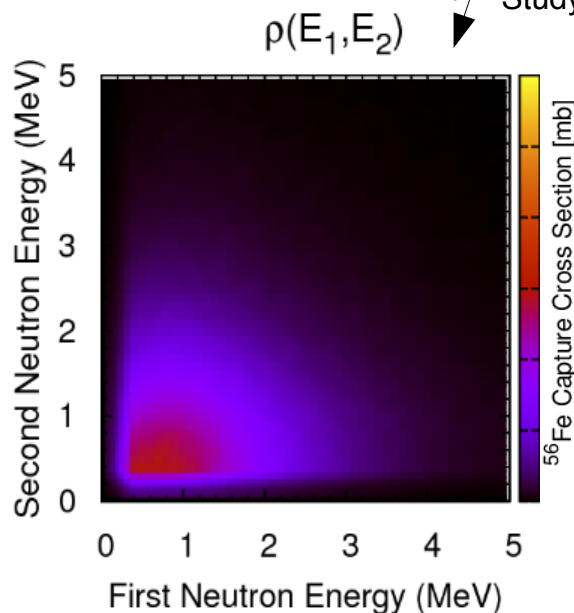
+2

+2

3p-3h

Gaussian Distributed Ensemble

USNDP Effort Impacts on Other Programs

- **The LANL Statistical Hauser-Feshbach code CoH$_3$ and its subset CGM have been employed extensively to calculate nuclear reactions**
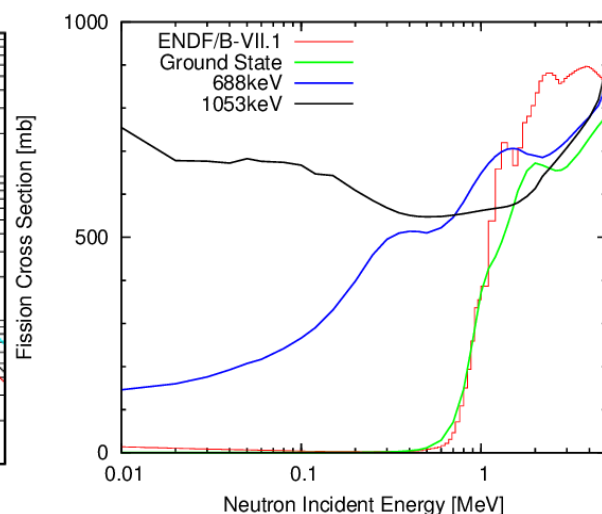
  - ^{55,56}Fe ^{59}Co, ^{56,57}Ni, ^{68}Ga, ^{89}Y, ^{103}Rh, ^{109}Ag, ^{132}Ba, ^{152,153,154,155,156,157,158}Gd, ^{132}Sn, ^{147,148}Sm, ^{176}Lu, ^{181}Ta, ^{182,184,186}W, ^{208}Pb, ^{234,235,236,238}U, ^{237}Np, ^{239}Pu, … in FY16

    for other internal / external programs

    - Isometric state production, and reaction on the produced isomers
    - Correlated emission of neutrons and gammas from fission
    - Study on cosmogenic origin of ^{60}Fe

$\rho(E_1, E_2)$

SMMC level density for reaction calculation
(in collaboration with Y. Alhassid)

Fission cross sections on U236 isomers

DeCE: ENDF-6 Format Manipulation Code

```
read 3 51 "inelastic.dat"
make4
calc 3 = 2 + 4
calc 1 = 2 - 3
delete 3 3
quit
```

- **Finally, we made it an open source!**
  - https://github.com/toshihikokawano/DeCE

- **C++ code to edit ENDF files interactively**
  - Extensively used to create ENDF files at LANL
  - DeCE is a by-product of reaction data evaluation
  - General ENDF Class provided

- **Examples:**
  - Convert ENDF files into human readable X-Y table format
  - Read another library or data and merge
  - Delete/add/subtract/re-scale each section
  - Automatic generation of index (dictionary)

```
example(ifstream *fp, const int mt){
  ENDF lib(M);
  ENDFReadMF3(fp,&lib,mt);
  ENDFWriteMF3(&lib);
}
```