State of the EMPIRE

M. Herman

National Nuclear Data Center

Brookhaven National Laboratory

Nuclear Data Week, Nov. 14-18, 2011

BROOKHAVEN
NATIONAL LABORATORY

a passion for discovery

U.S. DEPARTMENT OF **ENERGY** | Office of Science

Wednesday, November 16, 11

EMPIRE developer team

- Developers
  - M. Herman (BNL, Upton)
  - R. Capote (IAEA, Vienna)
  - B. Carlson (ITA, Sao Jose dos Campos)
  - Young-Sik Cho (KAERI, Daejeon)
  - C. Mattoon (LLNL, Livermore)
  - P. Oblozinsky (Bratislava)
  - M. Sin (University of Bucharest)
  - A. Trkov (JSI, Lubljana)
  - H. Wienke (decesead)
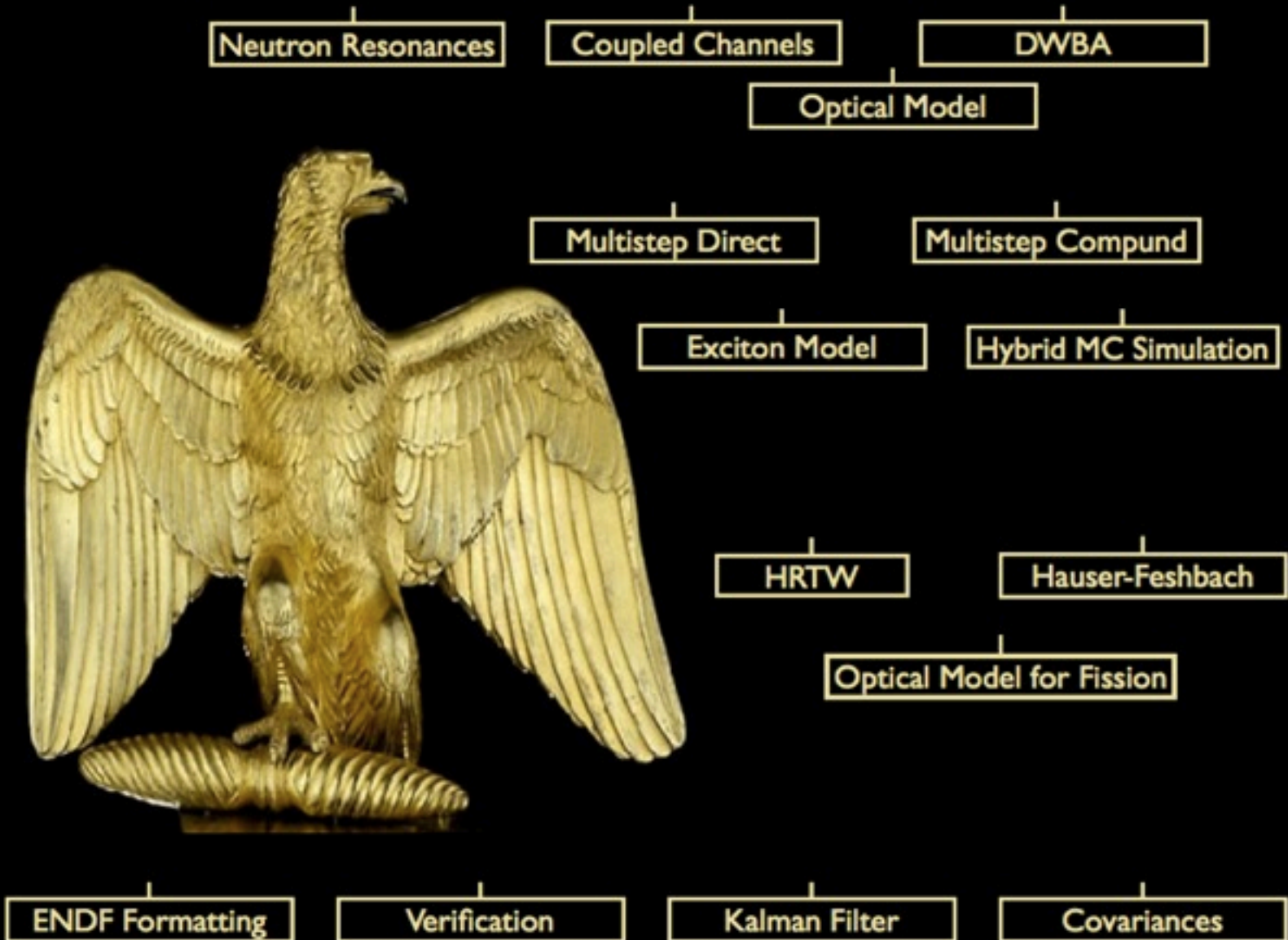 - V. Zerkin (IAEA, Vienna)

- Contributors
  - E. Betak (SAS, Bratislava)
  - M. Pigni (ORNL, Oak Ridge)
  - V. Plujko (University of Kiev)
  - S. Mughabghab (BNL, Upton)
  - T. Kawano (LANL, Los Alamos)
  - A. Ventura (ENEA, Bologna)

BROOKHAVEN
NATIONAL LABORATORY

Wednesday, November 16, 11

Major new features in EMPIRE-3.1 (Rivoli)

- Covariance capabilities using Kalman filter and Monte Carlo
- Resonance module to produce MF2 and MF32 from the Atlas of Neutron Resonances
- RIPL-3 library of input parameters
- New version of Coupled Channel code ECIS-2006
- Coupled Channel code OPTMAN for soft-rotor calculations
- Improved treatment of fission
- Parity dependent level densities
- New parametrization of EGSM level densities
- Three additional ejectiles (d, t, ^{3}He)
- Platform independent retrieval of EXFOR data
- Fully operational on Mac OS X

BROOKHAVEN
NATIONAL LABORATORY

Wednesday, November 16, 11

EMPIRE-3.1 (Rivoli)
Nuclear Reaction Model Code

Neutron Resonances

Coupled Channels

DWBA

Optical Model

Multistep Direct

Multistep Compund

Exciton Model

Hybrid MC Simulation

HRTW

Hauser-Feshbach

Optical Model for Fission

ENDF Formatting

Verification

Kalman Filter

Covariances

EMPIRE-3.1 Rivoli

- New release is being prepared
- Web site updated
- Manual mostly updated
- All planned changes to the source in place
- Test cases to be prepared
- Expected release date December 2011/ January 2012

Battle of Rivoli, 14–15 January 1797

In a two-days battle of Rivoli fought in January 14-15, 1797 close to the lake Garda Napoleon Bonaparte defeated final Austrian attempt to relieve siege of Mantua and secured French control of northern Italy. Subsequent French offensive into Austrian Tirol ended the first Italian campaign.

5

Parallel calculations

- System of scripts written by Caleb Mattoon
  - split original multi-energy input into many single-energy inputs
  - run each incident energy on a different node
  - collect single-energy outputs and reconstruct a standard multi-energy output
- With 72-nodes NNDC Linux cluster calculation time is given by the time needed to calculate the highest energy
- Intensively used for sensitivity calculations (covariances)

BROOKHAVEN
NATIONAL LABORATORY

Wednesday, November 16, 11

Major changes since CSEWG-2010 (278 Svn commits)

- Full OPTMAN capabilities implemented

- Upgrade of checking codes

- Reorganization done flying over Tropic of Capricorn, Equator and Tropic of Cancer.

- Direct access to C4 file with exp data instead of fancy but unstable MySql retrieval

- KERCEN code included in the source (not linked through the GUI)

- Input controlled adjustment of the level density shift

- Thorough work on tightening cross section balance

- Refitting EGSM level densities

Wednesday, November 16, 11

"...the state of our Empire is the strongest it has ever been."

Bill Clinton, state of the Union 2000

BROOKHAVEN
NATIONAL LABORATORY