IAEA
International Atomic Energy Agency
Atoms for Peace and Development

TM on Nuclear Data Processing

Status of the ACE Verification Project

Andrej Trkov, IAEA

Stage 1

Objectives:

Verify that codes can assemble correctly the cross sections into an ACE file (no probability tables)

Statistics:

10 variants of ACE file assembly:

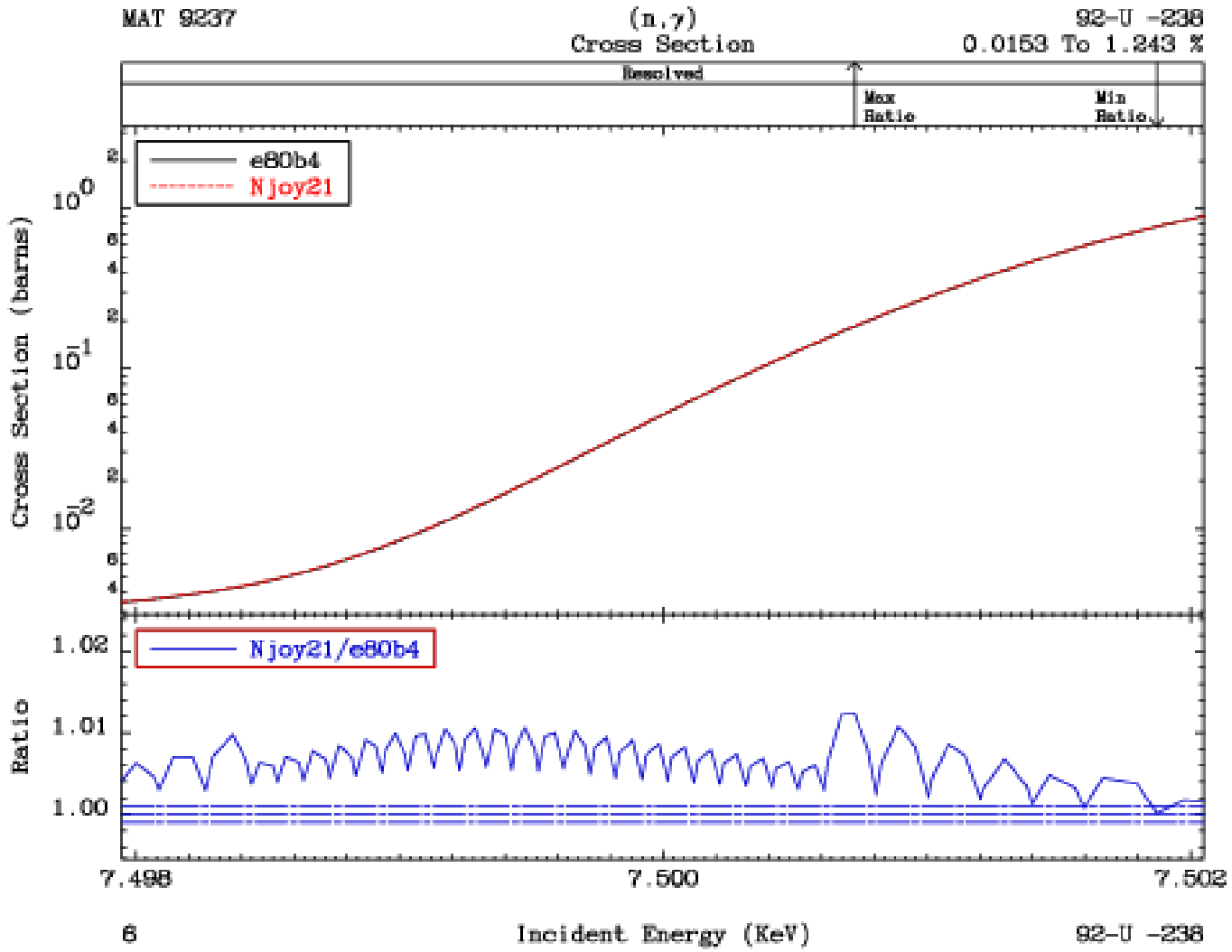
- 2 variants of processing with NJOY
- 2 codes using NJOY for the final ACE file assembly
- 5 codes independent of NJOY
- 1 additional code announced

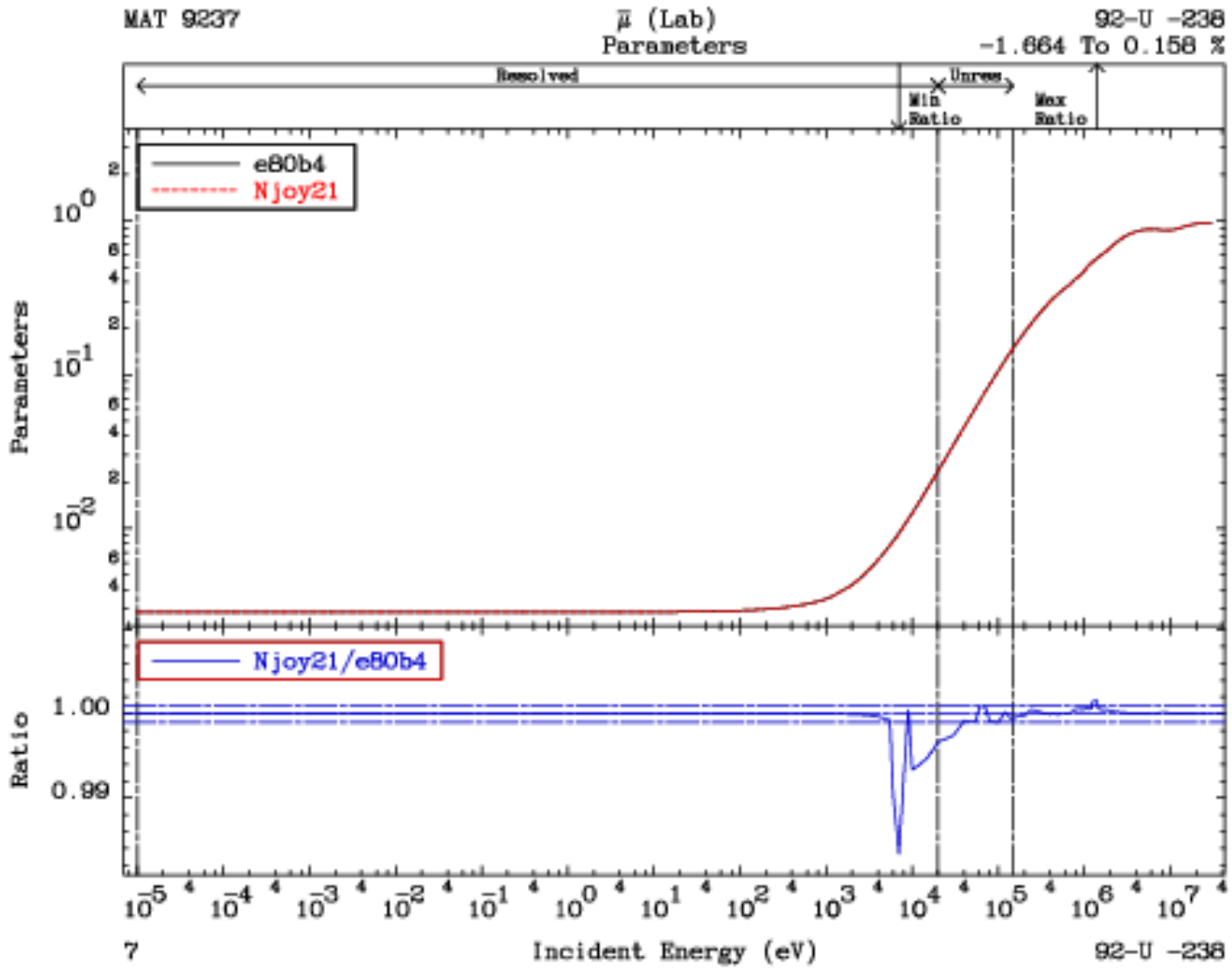
List of participating codes

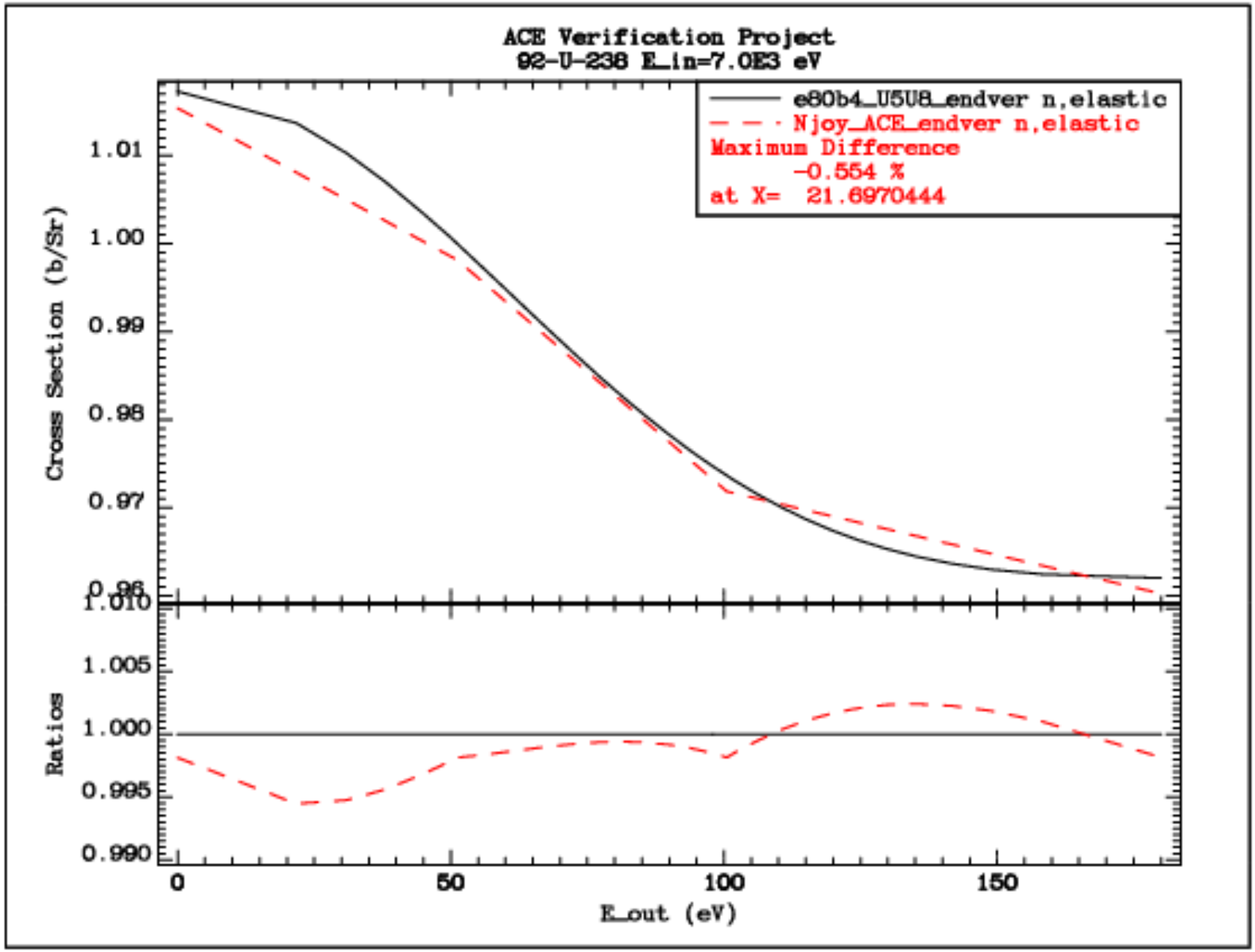
- **NJOY16/NJOY21** – conventional code for ACE file preparation (full capability, USA)
- **LEGEND/NJOY** – Angular distributions in the original ENDF file converted to tabular form with LEGEND of PREPRO (full capability, USA)
- **PREPRO/ACEMAKER** – wrap-around PREPRO to assemble the ACE file (fast neutrons only, Cuba)
- **FRENDY** (full capability, Japan)
- **FUDGE** (fast neutrons only, no self-shielding, USA)
- **GAIA/NJOY** (resonance reconstruction and Doppler broadening only, France)
- **GALILEE/NJOY** (resonance reconstruction and Doppler broadening only, France)
- **GRUCON** (full capability, Russia)
- **NECP-Atlas** (results to be submitted, China)
- **RULER** (no self-shielding, China)

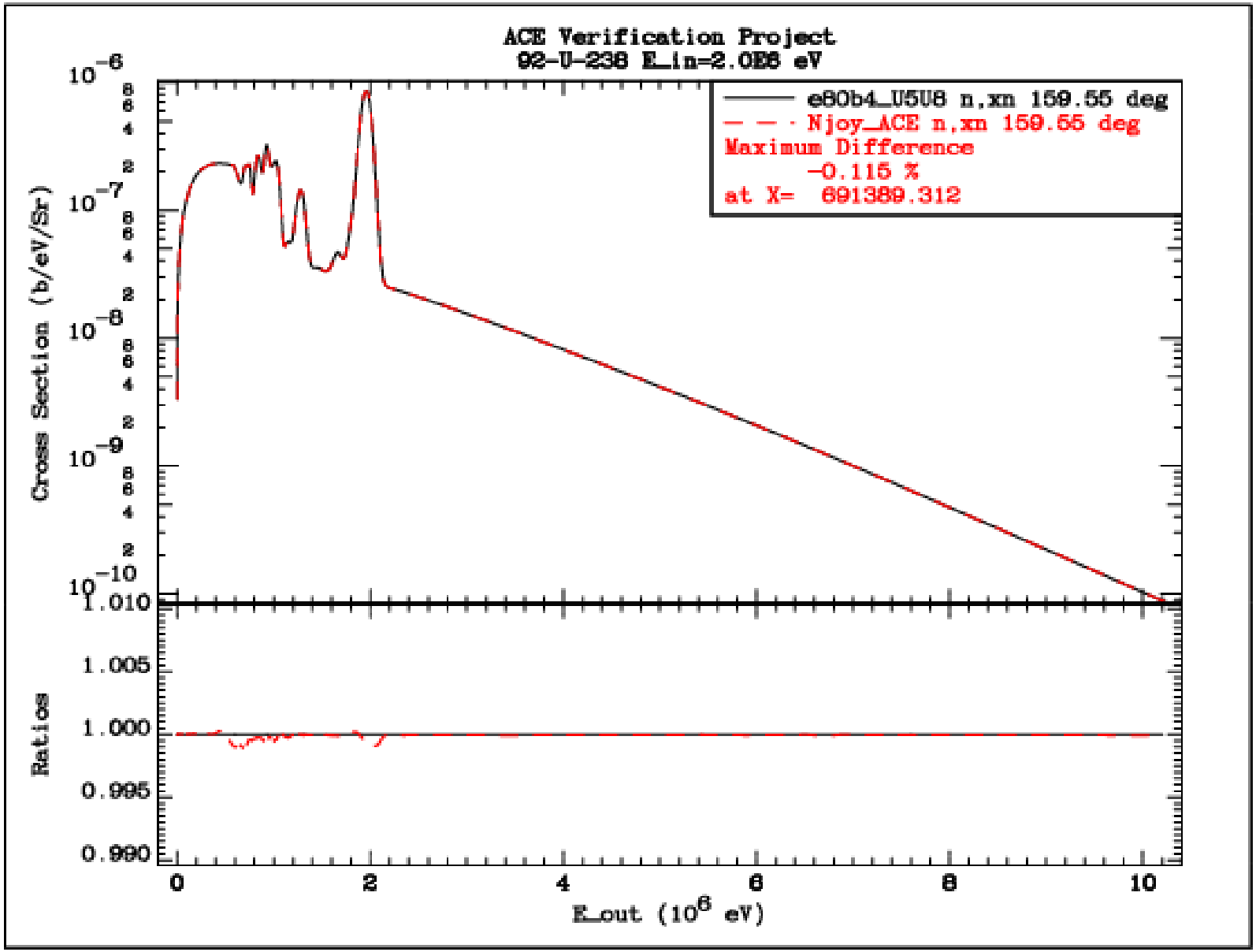
Procedures

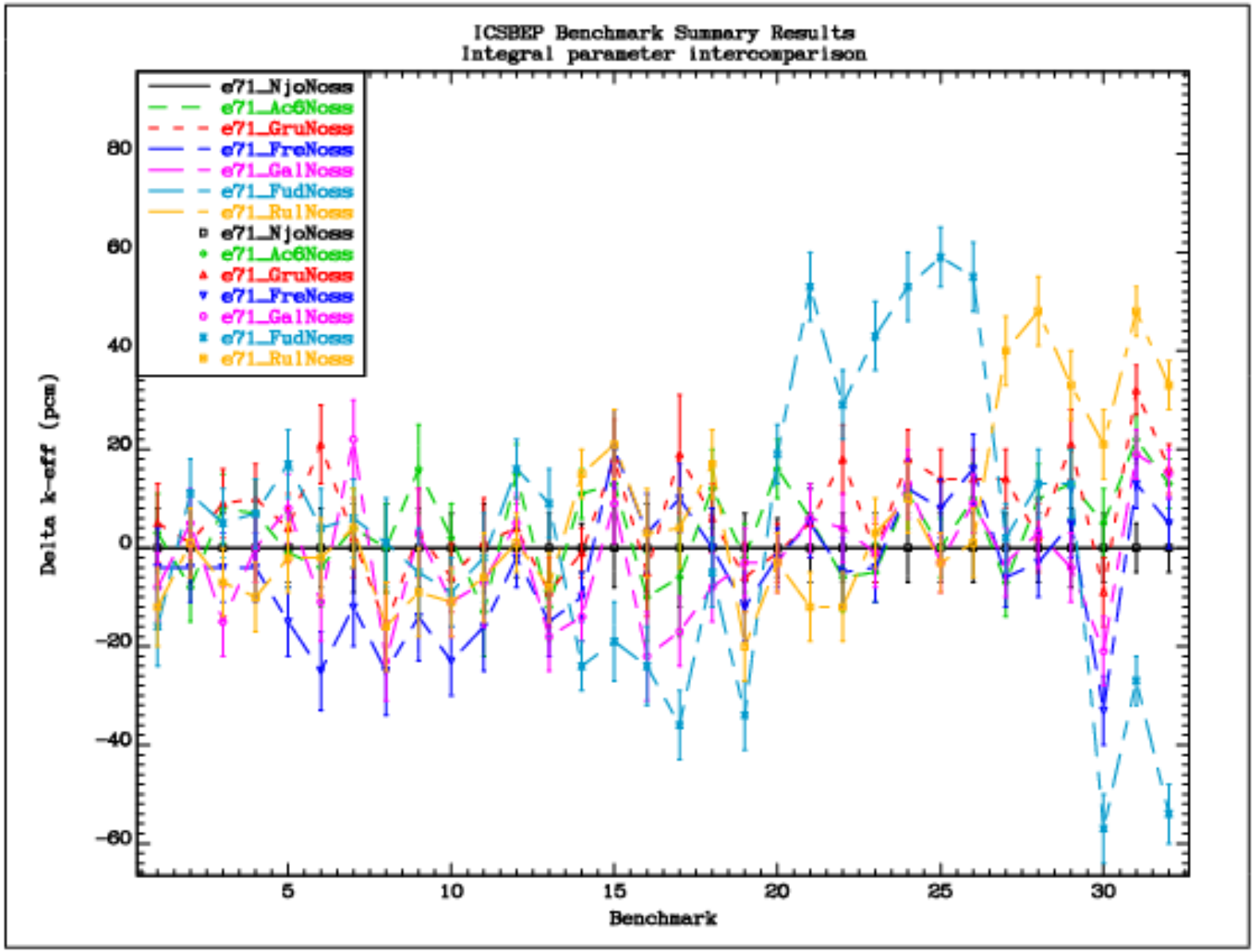
- Test cases: U-235 and U-238 from ENDF/B-VIII.b4
- Cross section comparison to PREPRO, including angular distributions and double-differential data using modules of PREPRO, ENDVER and auxiliary codes
- Examples:


MAT 9237
(n,γ)
Cross Section
92-U -238
0.0153 To 1.243 %
Resolved
Max Ratio
Min Ratio
e80b4
Njoy21
Cross Section (barns)
Njoy21/e80b4
Ratio
7.498
7.500
7.502
Incident Energy (KeV)
92-U -238


MAT 9237
μ̄ (Lab)
Parameters
92-U -238
-1.664 To 0.158 %
Resolved
Unres
Min Ratio
Max Ratio
e80b4
Njoy21
Parameters
Njoy21/e80b4
Ratio
1.00
0.99
Incident Energy (eV)
92-U -238
7


ACE Verification Project
92-U-238 E_in=7.0E3 eV
e80b4_U5U8_endver n,elastic
Njoy_ACE_endver n,elastic
Maximum Difference
-0.554 %
at X= 21.6970444
Cross Section (b/Sr)
1.01
1.00
0.99
0.98
0.97
0.96
1.010
Ratios
1.005
1.000
0.995
0.990
0
50
100
150
E_out (eV)


ACE Verification Project
92-U-238 E_in=2.0E6 eV
e80b4_U5U8 n,xn 159.55 deg
Njoy_ACE n,xn 159.55 deg
Maximum Difference
-0.115 %
at X= 691389.312
Cross Section (b/eV/Sr)
Ratios
E_out (10^6 eV)


ICSBEP Benchmark Summary Results
Integral parameter intercomparison
e71_NjoNoss
e71_Ac6Noss
e71_GruNoss
e71_FreNoss
e71_GalNoss
e71_FudNoss
e71_RulNoss
e71_NjoNoss
e71_Ac6Noss
e71_GruNoss
e71_FreNoss
e71_GalNoss
e71_FudNoss
e71_RulNoss
Delta k-eff (pcm)
80
60
40
20
0
-20
-40
-60
5
10
15
20
25
30
Benchmark

Conclusions

- Stage-1 successfully completed (some results still pending)
- Stage-2 will involve calculations with self-shielding
- Additional stages to de determined:
  - Photon production
  - Thermal scattering
  - Heating/damage …

Links

- https://www-nds.iaea.org/index_nds_meetings.htm
- https://www-nds.iaea.org/index-meeting-crp/TM-DataProc/
- https://www-nds.iaea.org/ACE_verification/
- https://www-nds.iaea.org/ACE_verification/Stage1_results/

IAEA
International Atomic Energy Agency
Atoms for Peace and Development

Thank you!