PAUL SCHERRER INSTITUT

PSI

HORIZON 2020

D. Rochman

SANDA task 4.1: Nuclear reaction code developments and evaluations

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SANDA – general meeting, via remote connection, 9-11 March 2022

Zertifiziertes Managementsystem STARS ISO 9001

Task 4.1

Task 4.1: Nuclear reaction code developments and evaluations
*Task coordinator: **PSI**, partners: **CEA/DAM/DIF, CEA/DEN, PSI, CNRS/IPHC, TUW, UB, UU***

Task 4.1.1: TALYS development

Task 4.1.2: Nuclear reaction evaluation

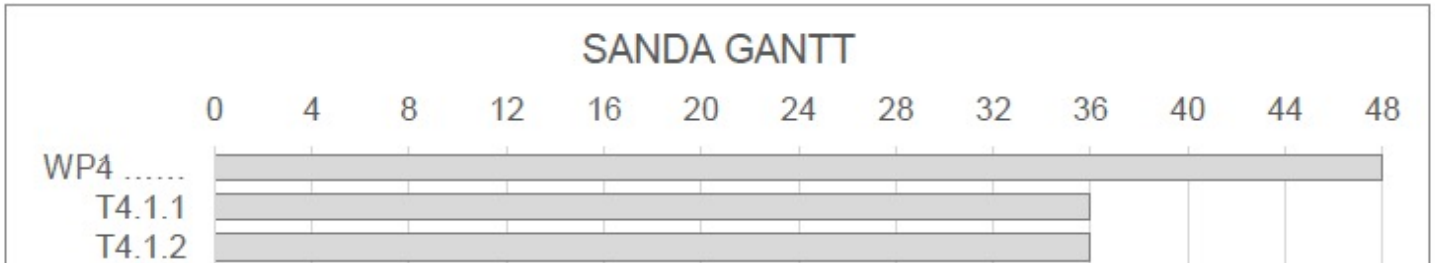

Table 3.1c: List of Deliverables[4]

4.1	Report on code development, methods	4	PSI	R	PU	40
4.2	Report on new nuclear reaction data evaluation	4	CEA	R	PU	48

T0: September 2019

T36: August 2022

T40: December 2022

T48: August 2023

Task 4.1

Task 4.1: Nuclear reaction code developments and evaluations
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Task 4.1.1: TALYS development

Task 4.1.2: Nuclear reaction evaluation

Table 3.2a: List of milestones

Milestones:

M.4.1: availability of TALYS modules (CEA/DAM/DIF): M32
M.4.2: availability of new EMPIRE modules/models (UB): M32
M.4.3: availability of evaluated files for important actinide isotopes (CEA/DEN, CNRS): M32
M.4.4: availability of evaluated files for important fission products (CEA/DEN, PSI): M36

4.1	Availability of TALYS modules	4	32	Short communication
4.2	Availability of new EMPIRE modules/models	4	32	Short communication
4.3	Availability of evaluated files for important actinide isotopes	4	32	Presentation or ENDF file

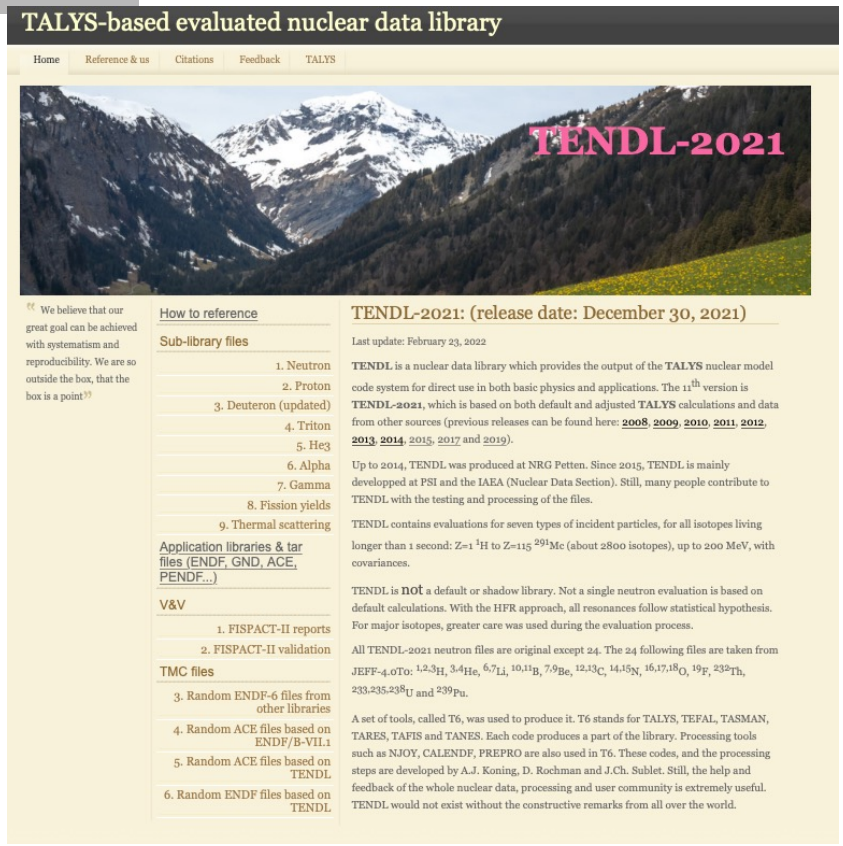
T0: September 2019

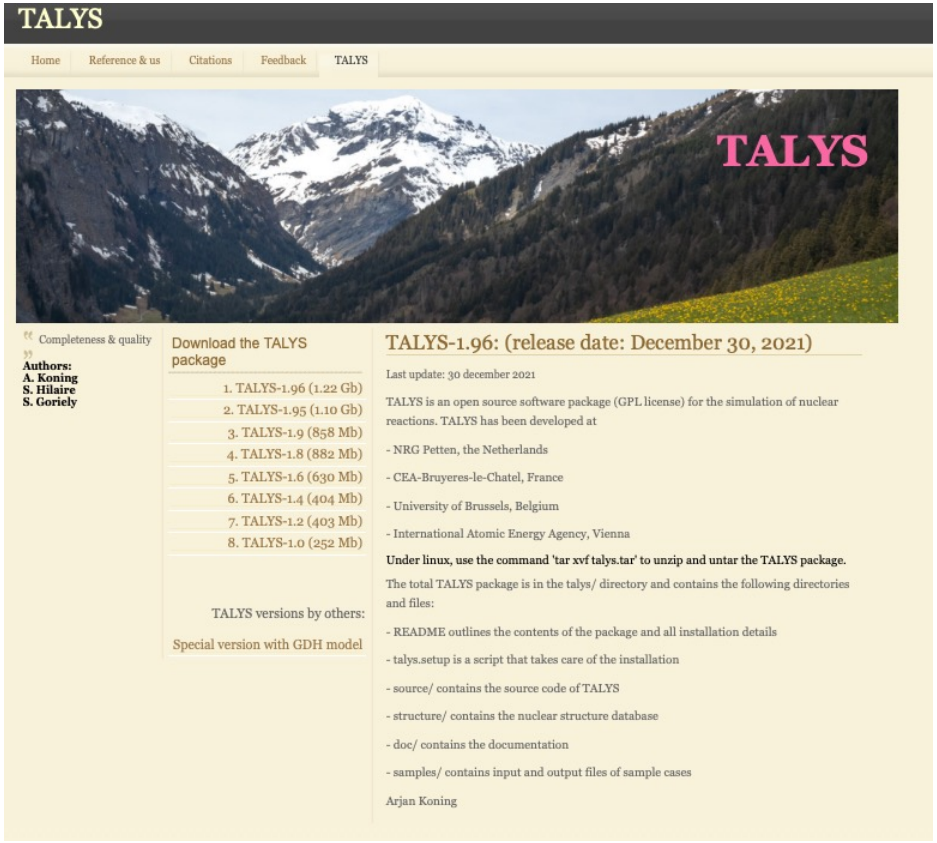
T32: May 2022

T36: August 2022

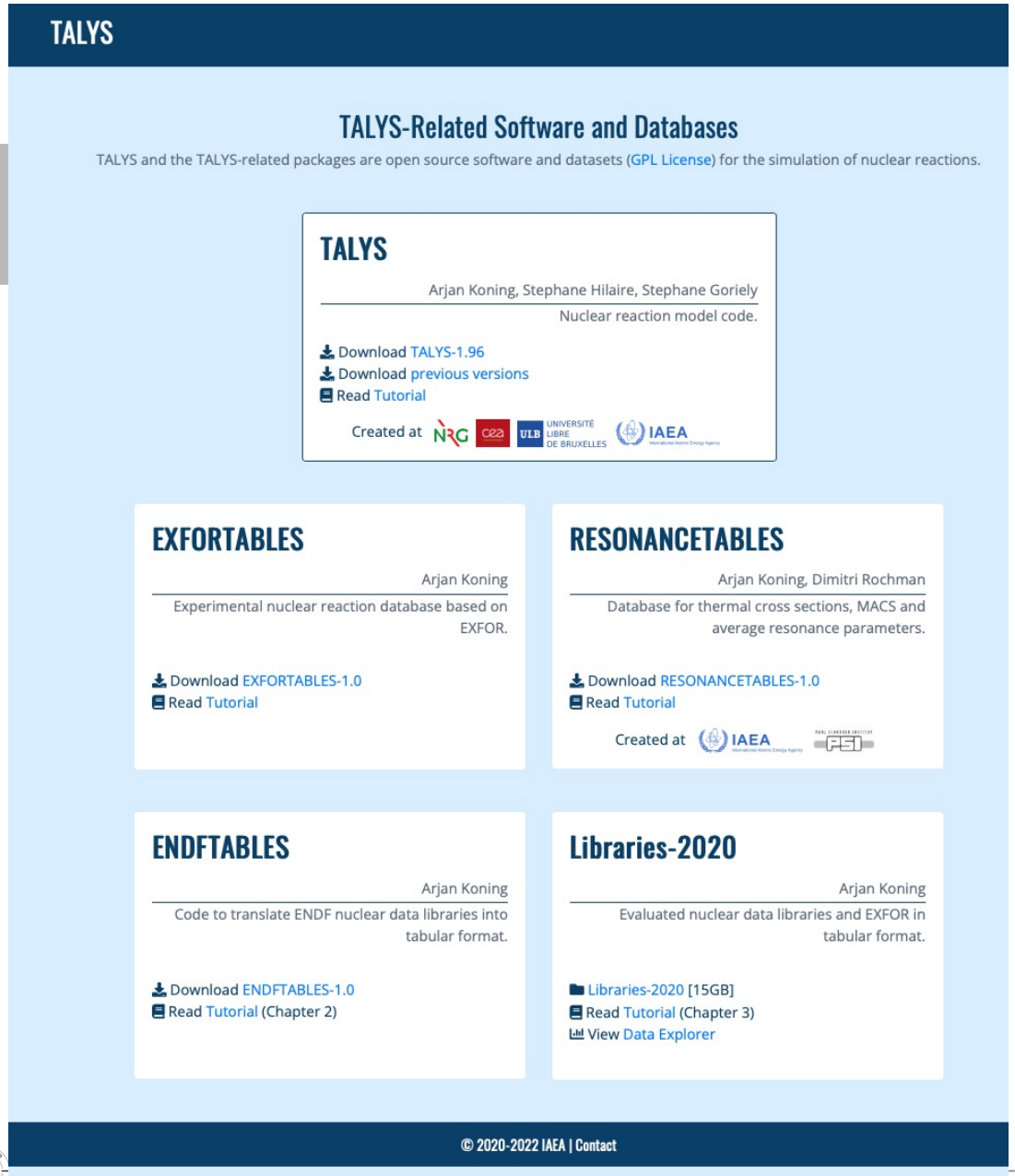
Subtask 4.1.1: "TALYS development"

- PSI/IAEA:
  - New version of TALYS released in December 2021
  - New evaluation tool (T6) developed with various partners





Subtask 4.1.1: “TALYS development”



- https://nds.iaea.org/talys/

- EXFORTABLES: formatted
- experimental data for automatic
- use (plots, fit)

- RESONANCETABLES: ready to
- use resonance tables

- ENDFTABLES: ready to use x-y cross
- sections

- Libraries-2020: systematically
- processed data libraries

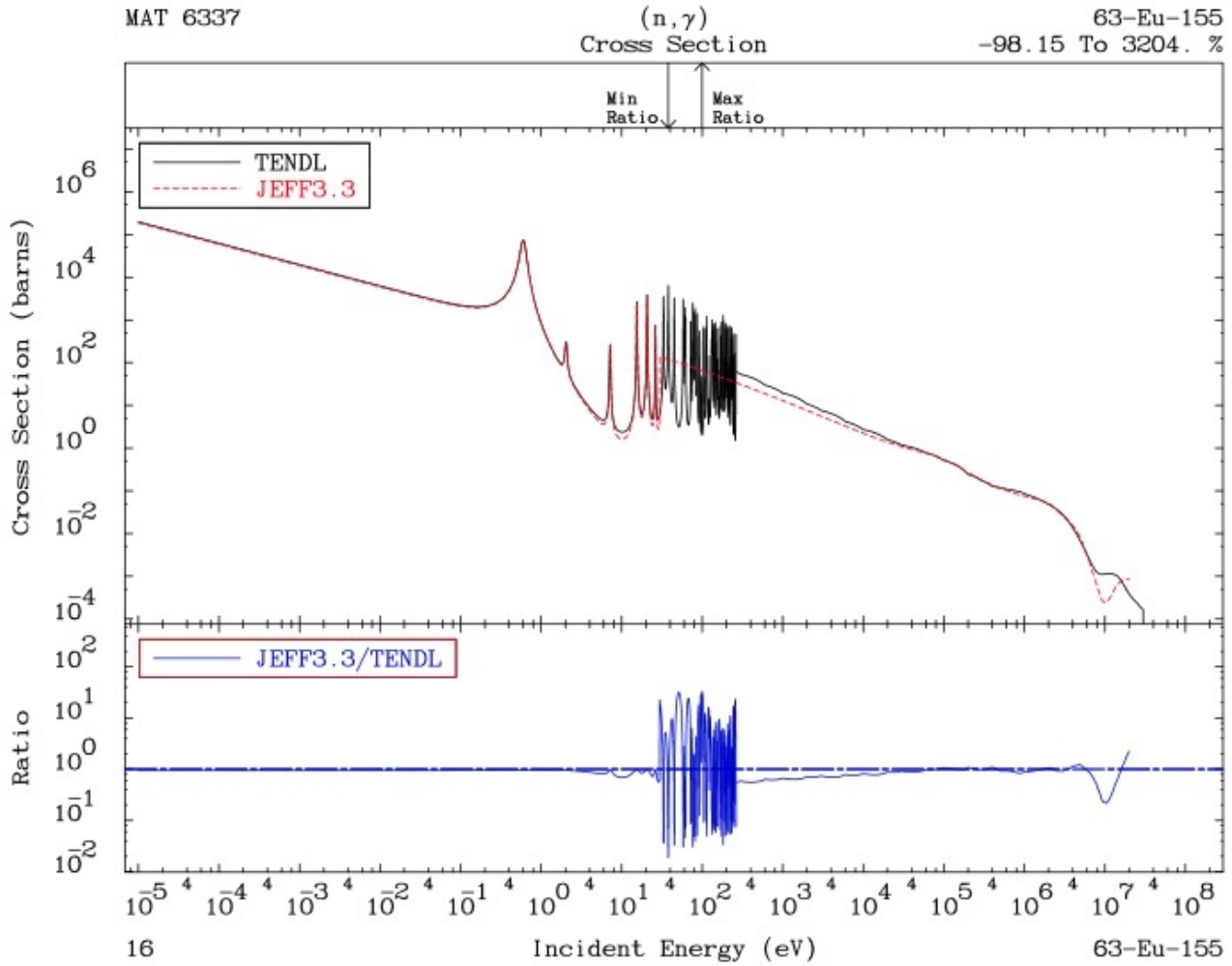
Subtask 4.1.1: “TALYS development”

- CEA DAM/CEA DEN/CNRS/IPHC
  - TALYS: Implementation of Engelbrecht-Weidenmüller transformation done .. test and validation underway
  - JLM/QRPA pre-equilibrium based spin rule + Update of QRPA tables
  - Postdoc Work on statistical decay of Fission fragments with TALYS (debugging/implementation/validation in TALYS)

  - Work on ^{238}U evaluation is scheduled for may/june (related to IPHC measurements+CEA-DEN collaboration)
  - 1st results on ^{239}Pu uncertainties with MCMC (towards a reference calculation).
  - PhD work started at IPHC and CEA DAM/DEN (measurements+evaluations)

Subtask 4.1.1: "TALYS development"

- PSI/IAEA/CEA: New evaluations for JEFF-4 and TENDL
  - Xe135, Cs133, Ag107, Ag109, Eu151, Eu153, Eu154, Eu155, Lu173, Lu175, Lu176, Pm148m and Pu238



Subtask 4.1.1: "Light elements"

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SANDA
WP4

Development of Nuclear Data Evaluation Technique for Light Nuclei

Status of Work performed by
Nuclear Data Group at TU Wien, Austria
H. Leeb, B. Raab, T. Srdinko

luation for Light Systems

TU WIEN

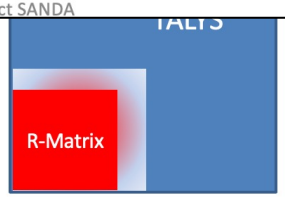
lei are not satisfactory at present
y accurate for evaluation
le, of limited use only at high energies
sonance region is still not established
ation technique for light nuclear systems

ure

Evaluation update based on observables based on modified GLS technique for large scale evaluations proposed by Schnabel&Leeb

Uncertainty information: determination of covariance matrices including model defects based on Gaussian processes for resonance and high-energy region using the prior covariance matrix of the unified Bayesian evaluation procedure

$$A_0(E,E') = f(E,E')A_0^{RMat}(E,E') + \left[1 - f(E,E')\right]A_0^{TALYS}(E,E')$$



Subtask 4.1.1: "Light elements"

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Status of work performed

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main work performed in 2020

1) Modification of moduls of GENEUS to accommodate various types of observables (integral, differential cross sections, …) considering all subchannels associated with the same compound nucleus
   - solved for integral and most angle differential data,
   - some open problems for double-differential data

2) Automatic determination of a consistent set of observables with regard to sum rules, integral relations and other dependencies
   - solved for integral and angle-differential data,
   - further work required for double differential and breakup data

3) Implementation of the Large Scale Bayesian GLS algorithm developed at TU Wien
   - a prototype of an extended module for GENEUS is under construction, but its completion requires the completion of point 2).

4) Construction of a module for the generation of the prior information based on calculations with TALYS and GECCCOS in terms of the Large Scale GLS algorithm
   - at present only preparatory analytical work has been performed
   - numerical implementation is envisaged for this year.

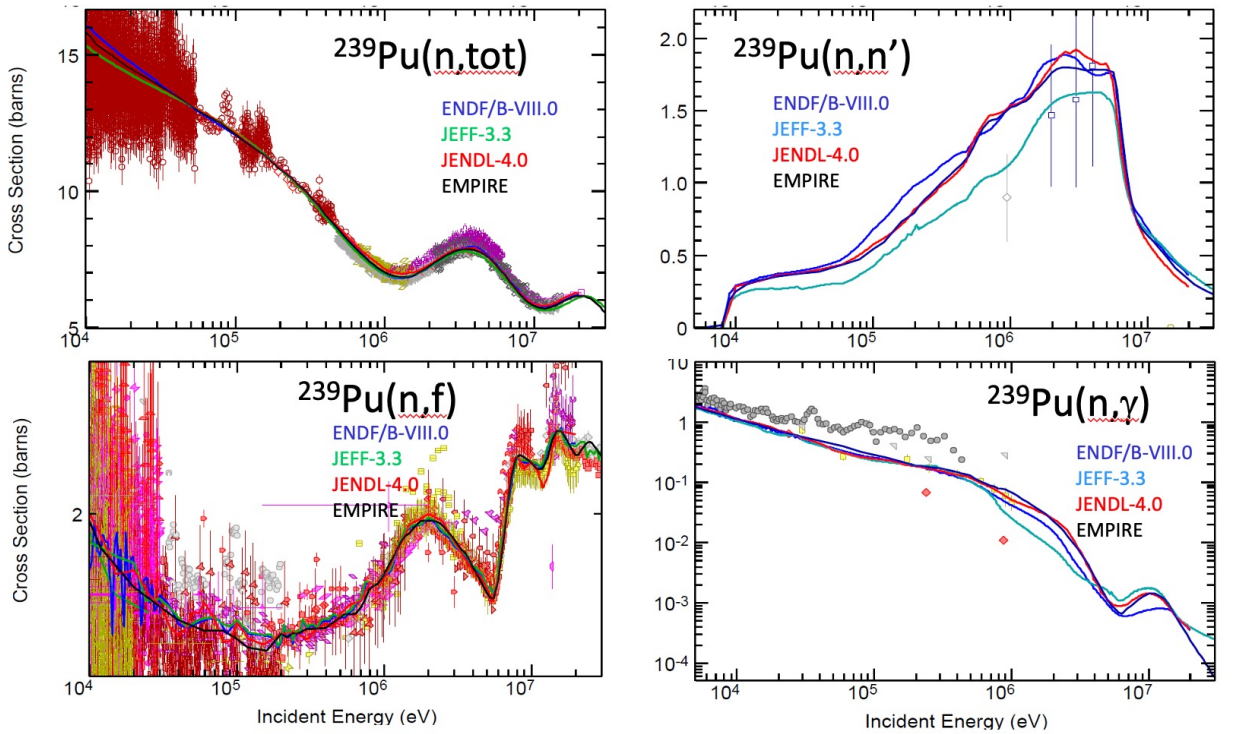
Apart from these points there are efforts to develop a proper data system allowing for efficient storage and in- and output of experimental, intermediate and evaluated data.

Subtask 4.1.1: "EMPIRE developments"

- UB:
  - Full and consistent model calculations for the neutron induced reaction data on $^{238-242}$Pu isotopes for the incident energy range 0.01-30 MeV. These model calculations will represent the starting point for new evaluations performed by an IAEA collaboration.

UB –Task 4.1

Preliminary model calculations for n+ ^{239}Pu cross sections



Plans/conclusions

- All participants have started their work, with slight delays (PhD work with experimental data)

- Very good collaboration between partners, and with outside collaborators (other evaluator communities, JEFF, TENDL, IAEA, ENDF)

- Participations to (online) meetings and support for future library releases

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Wir schaffen Wissen – heute für morgen