

# The TENDL evaluation project

**D. Rochman and A.J. Koning**

*Nuclear Research and Consultancy Group,*

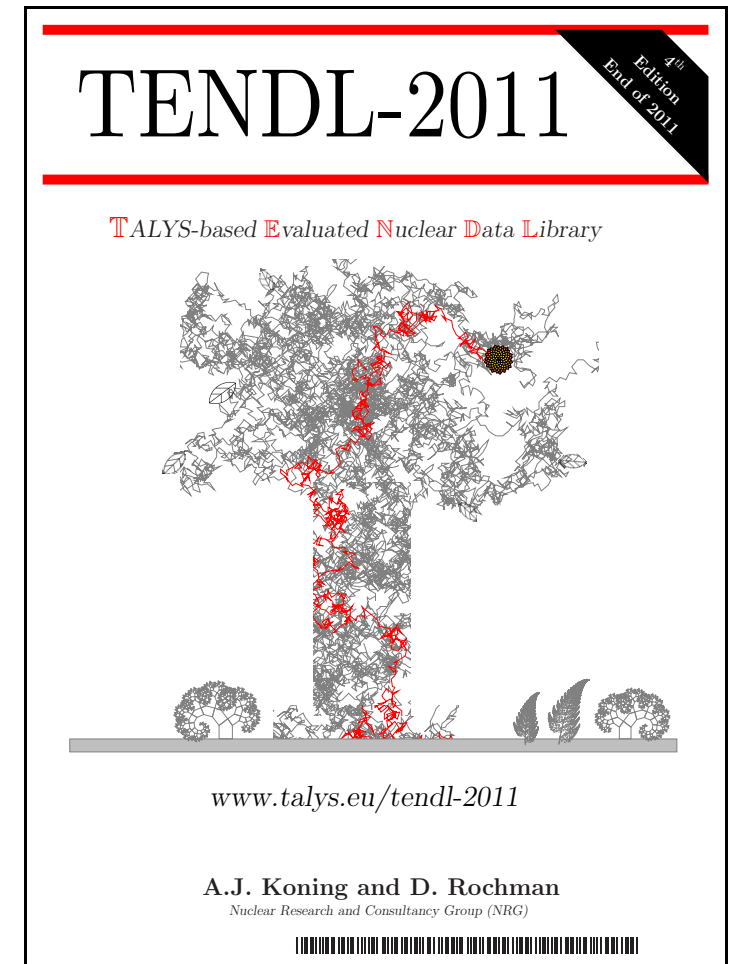
*NRG, Petten, The Netherlands*

WPEC Meeting, Paris, France, May 2012

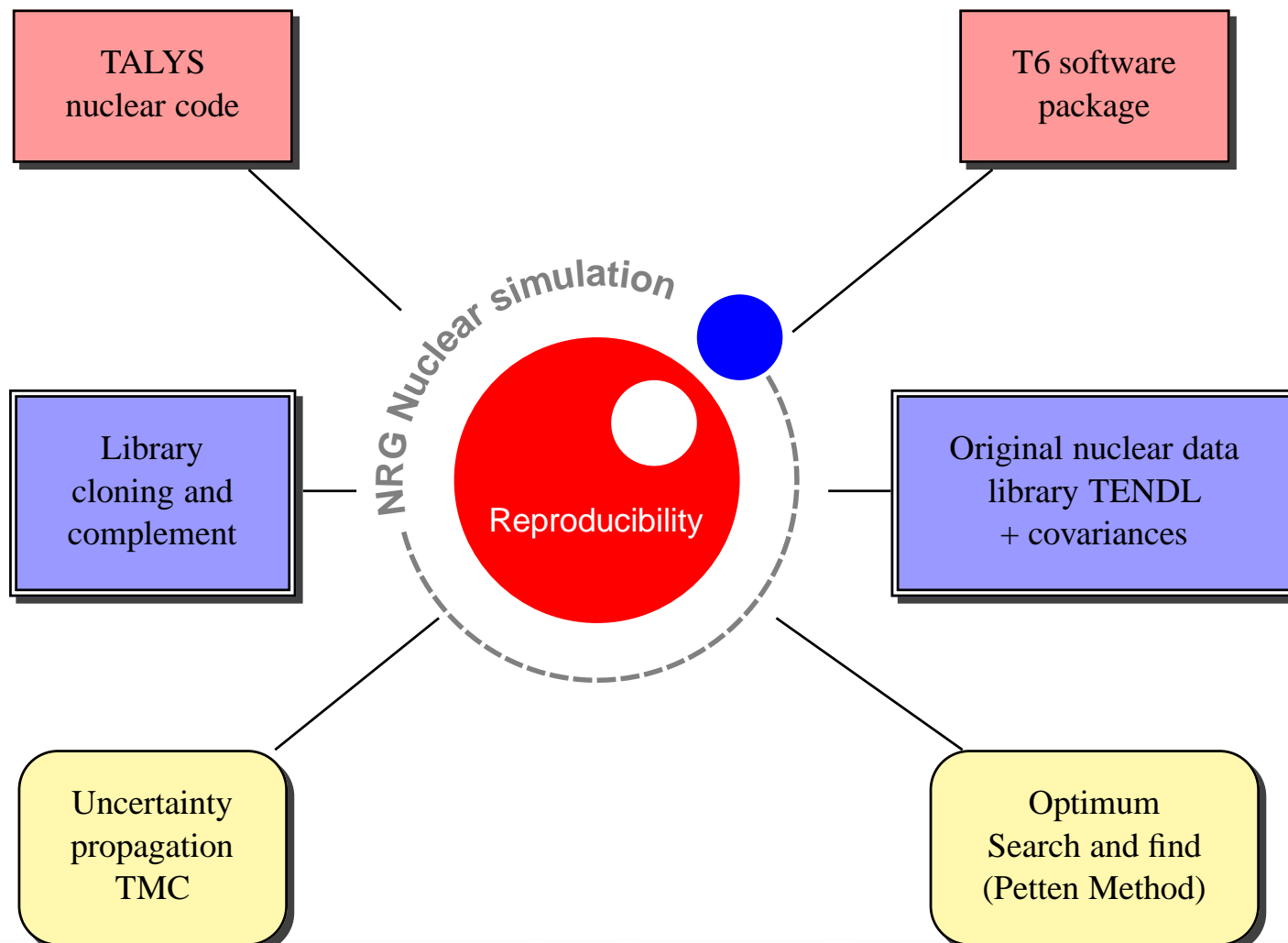
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## Our mission: improve nuclear simulation



## Mission and objective

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One of objectives: improve nuclear data with the TENDL library

One of objectives: improve nuclear data with the TENDL library

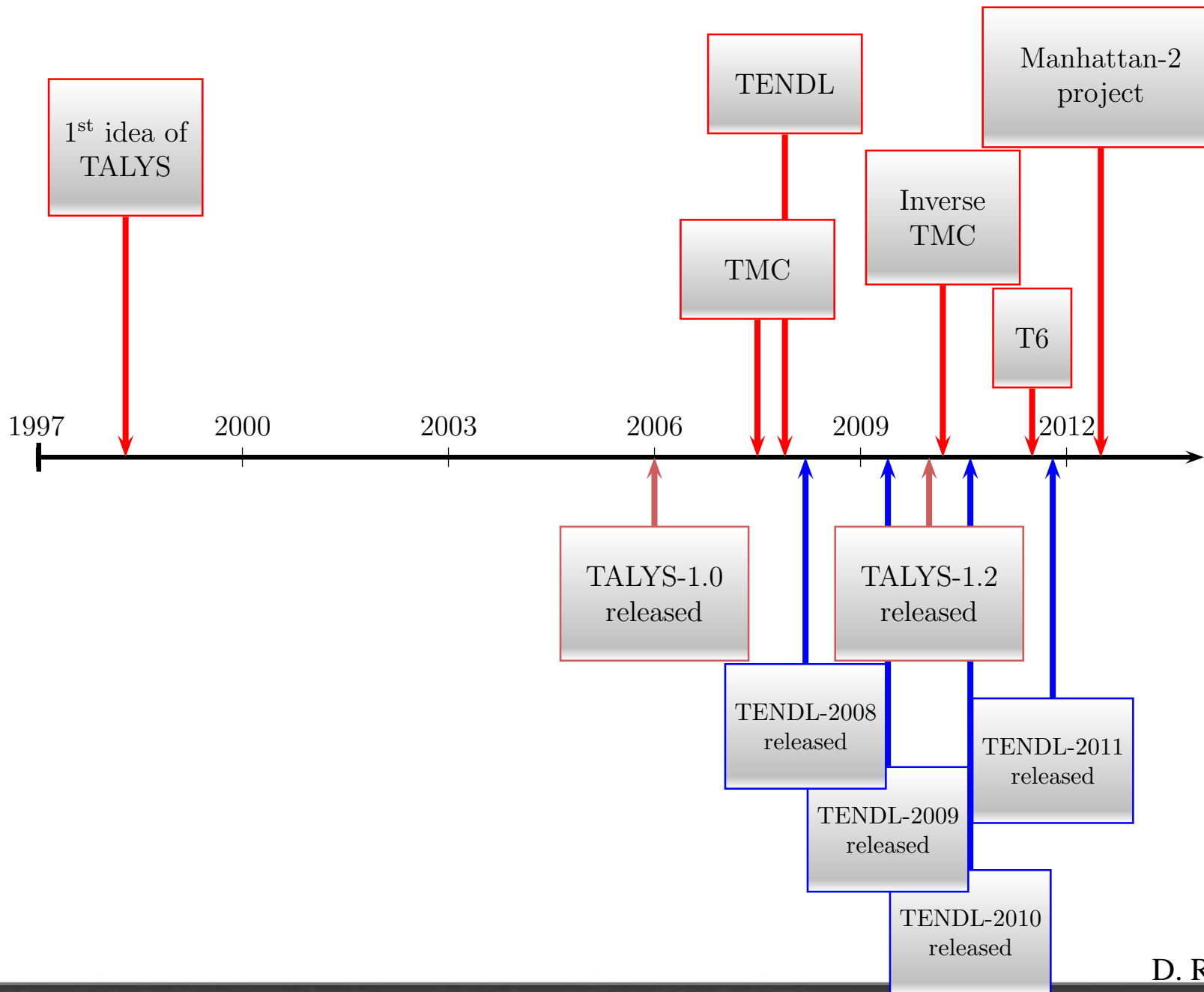
We need a **consistent and complete** nuclear data library to be integrated in reactor calculations, including realistic covariance data.

*(None of the existing libraries fulfill these requirements.)*

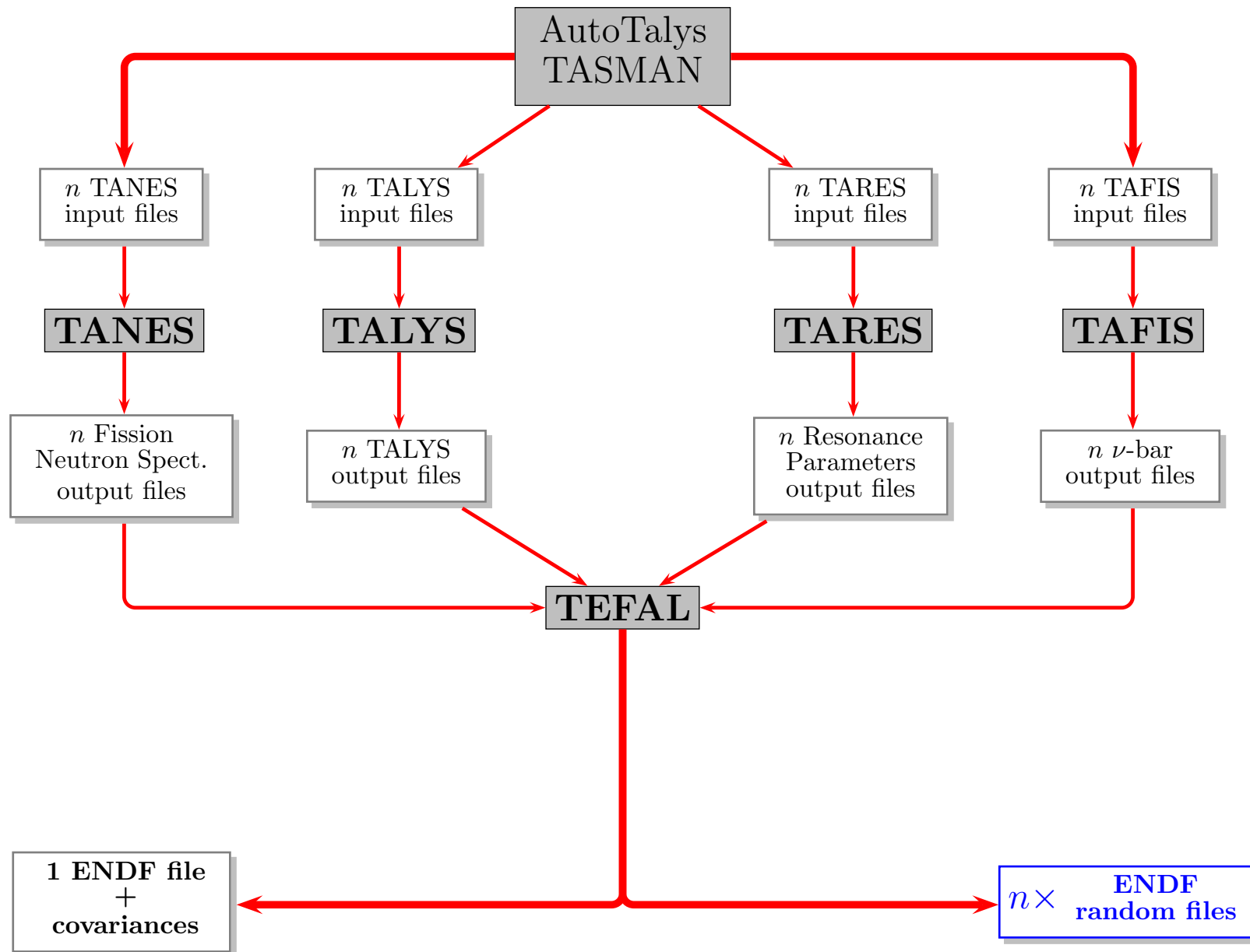
- ⊗ Use the latest developments (TALYS, resonance range, format, processing, EXFOR),
- ⊗ Use global, robust TALYS method for the bulk of nuclides,
- ⊗ Use in-depth evaluation, adjustment... for important nuclides (e.g.  $^{56}\text{Fe}$ ,  $^{239}\text{Pu}$ ),
- ⊗ "Clever" import of high-quality reaction channels from other library,
- ⊗ **Reproducible** library

Produce TENDL-2008, -2009, -2010... with an increasing quality with regard to:  
**differential data, model development, integral validation, completeness and covariance data**

# A (very) brief and recent history of nuclear data in NRG



# Method of work (1): reproducibility



## Method of work (2): consistency, completeness and validations



- ⊗ Available at [www.talys.eu/tendl-20xx](http://www.talys.eu/tendl-20xx) (-2008 to -2011),
- ⊗ Neutrons: ENDF files (MF1 to 35), plots, ACE, EAF, processed files,
- ⊗ Neutrons RRR: MF2 and 32 from other libraries, Atlas, HFR,
- ⊗ Protons, deuterons, tritons, alphas, gammas: ENDF, ACE, EAF files,
- ⊗ Fission yields: neutron and charged particles induced (+ random files),
- ⊗ Based on TALYS + **automatic normalization**: to adopt from other libraries,
- ⊗ S. van der Marck benchmarks' list: 1800 crit-safety, shielding...
- ⊗ Activation benchmarks: 600 reactions (from SAFEPAQ),
- ⊗ Extensive format and processing tests (CALENDF, PREPRO, NJOY) by J.C. Sublet
- ⊗ TALYS global adjustment.



# TENDL content:



- \*  $^{19}\text{F}$  to  $^{281}\text{Ds}$  ( $t_{1/2} > 1$  sec),
- \* 200 MeV

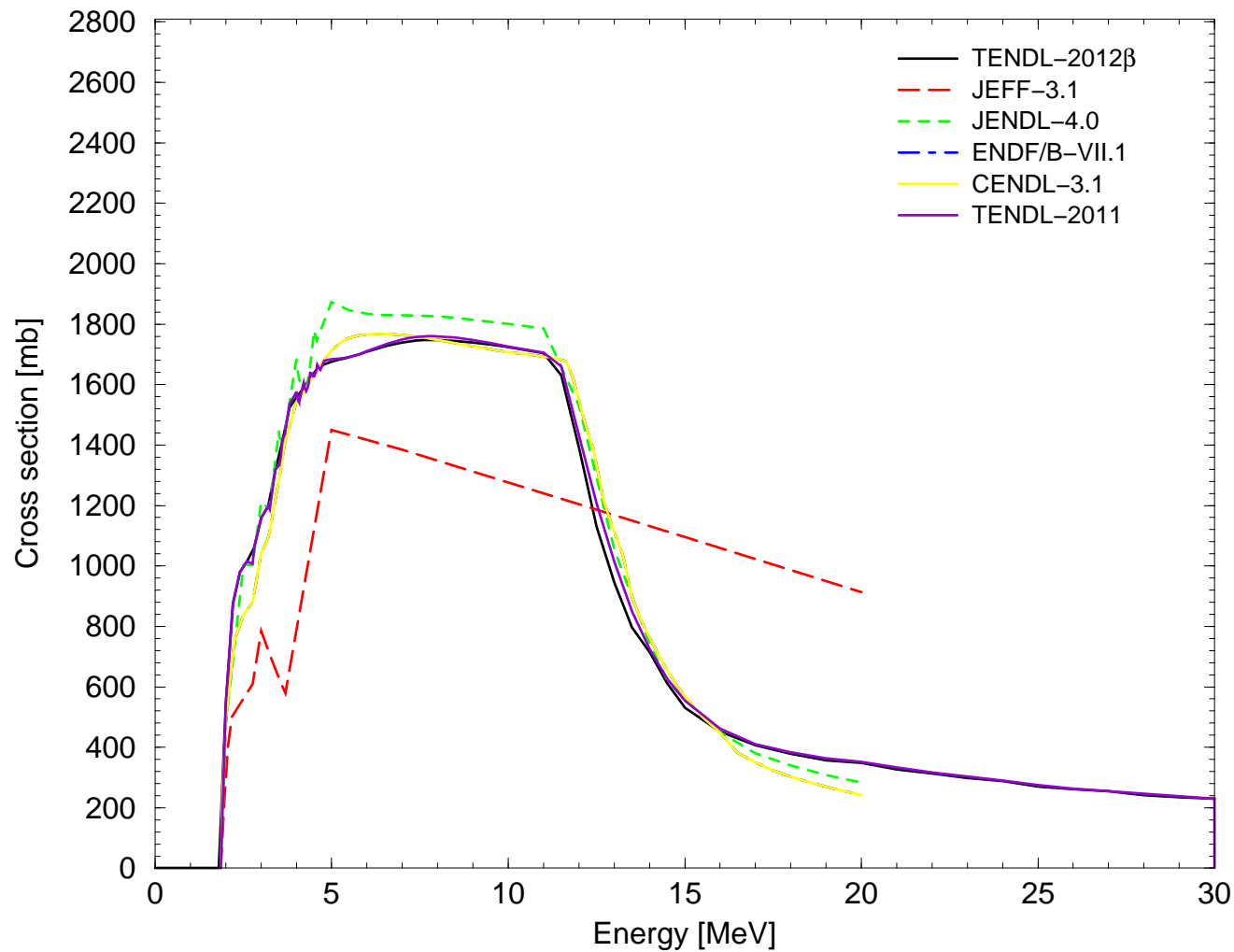
	Neutron	Proton	Deuteron	Triton	Alpha	Helium3	Photon	Fi. Yields	Covariances
TENDL-2011	2425	2429	2419	2431	2429	2428	2428	574	2416
TENDL-2010	2394	1157	1159	1156	1159	1140	1152	529	1086
TENDL-2009	2375	1163	1164	1116	1163	1127	1165	509	1141
TENDL-2008	348	344	336	339	342	338	327		342
(JEFF-3.1.2)	381	26						44	32
(ENDF/B-VII.1)	423	47	5	3		2	163	80	146
(JENDL-4.0)	406								90

# TENDL examples: latest developments

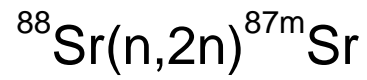


⊛ in-depth fitting from Co to Sr,

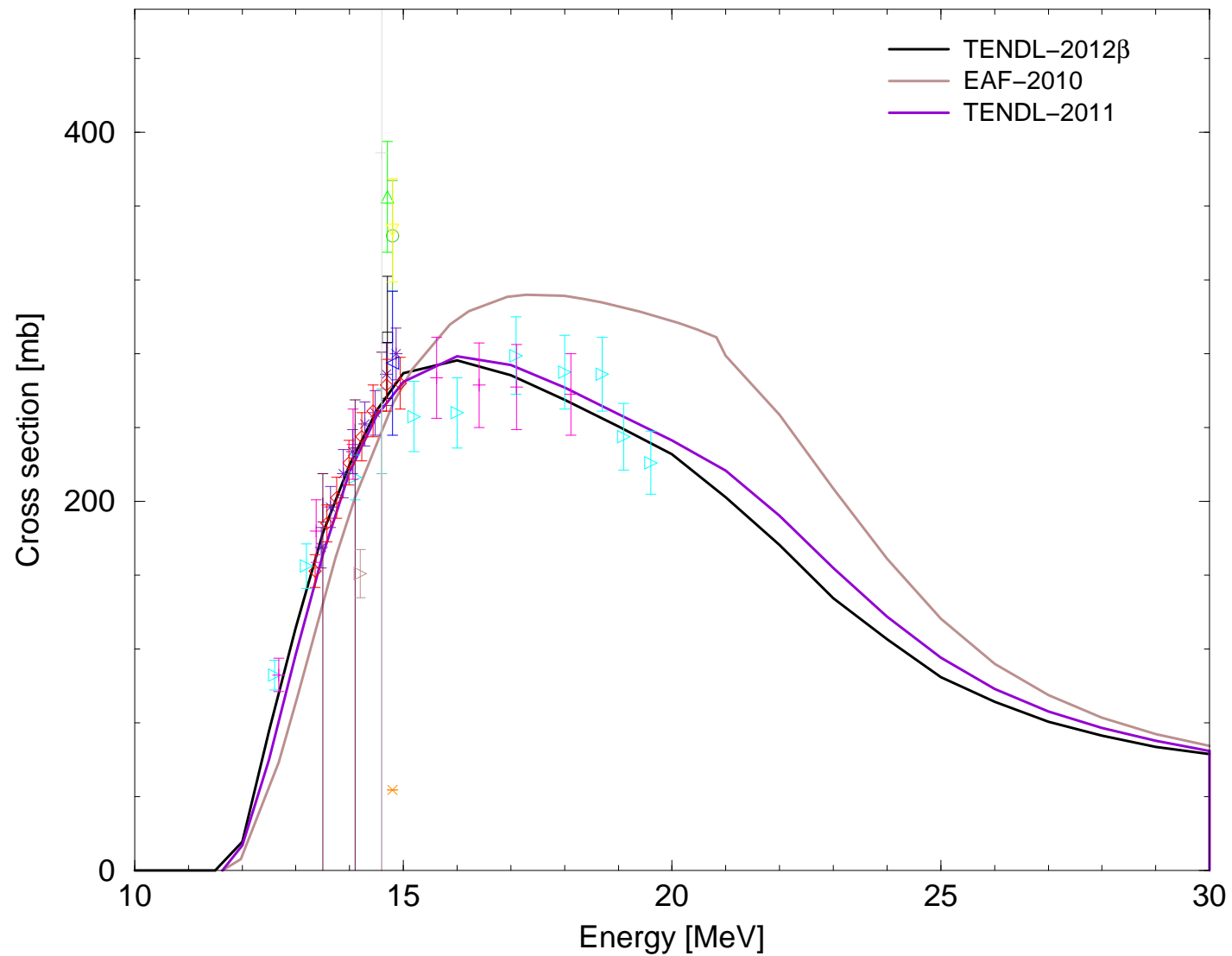
$^{88}\text{Sr}(n,\text{inel})$



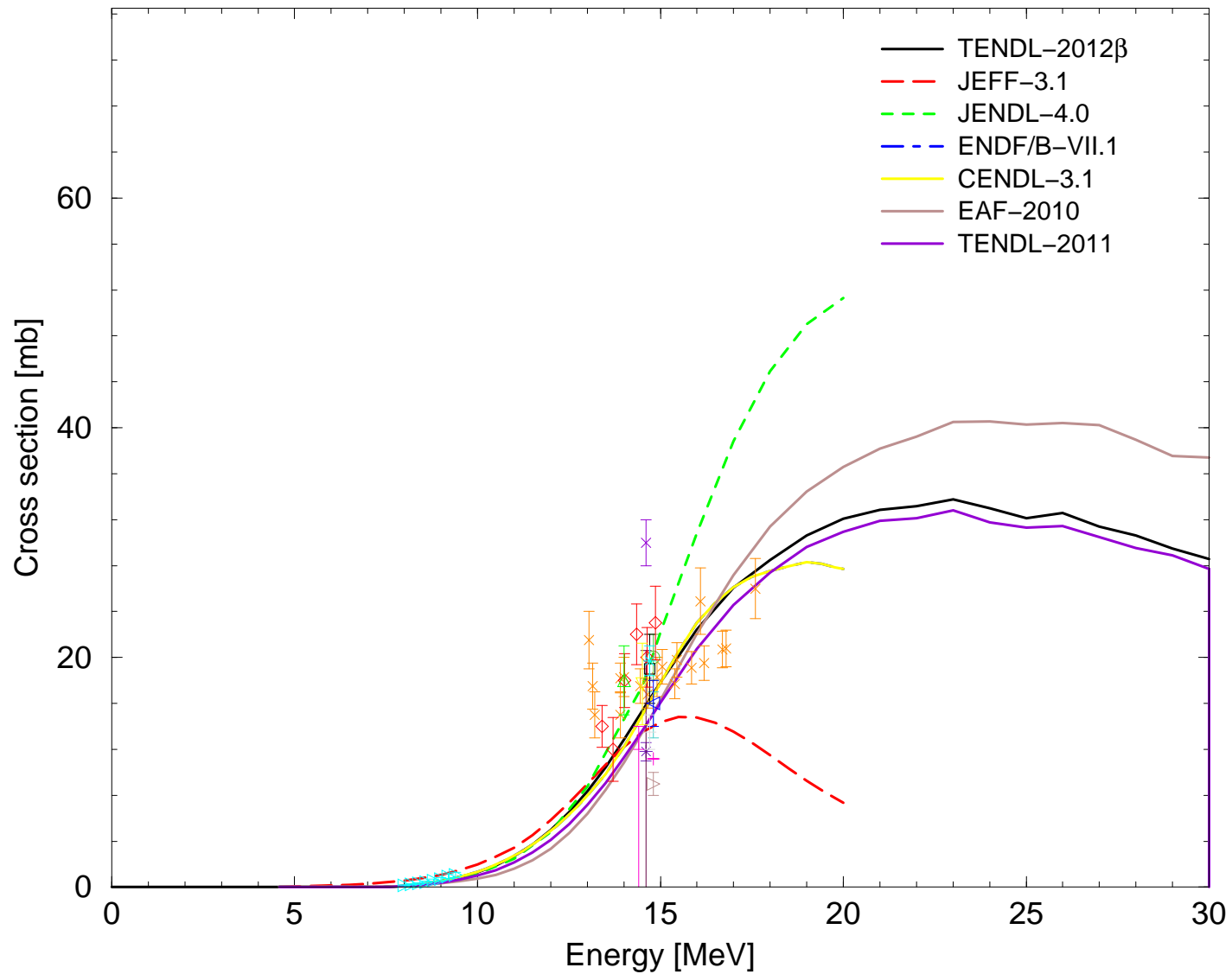
# TENDL examples: latest developments



(nothing in other libraries)



$^{88}\text{Sr}(n,p)$



## Main partners:

- NRG Petten: A.J. Koning, D. Rochman (development, production...),
- CCFE: J.C. Sublet (processing),
- JUKO: J. Kopecky (benchmarking),
- CEA Bruyeres le Chatel: coming in 2012,

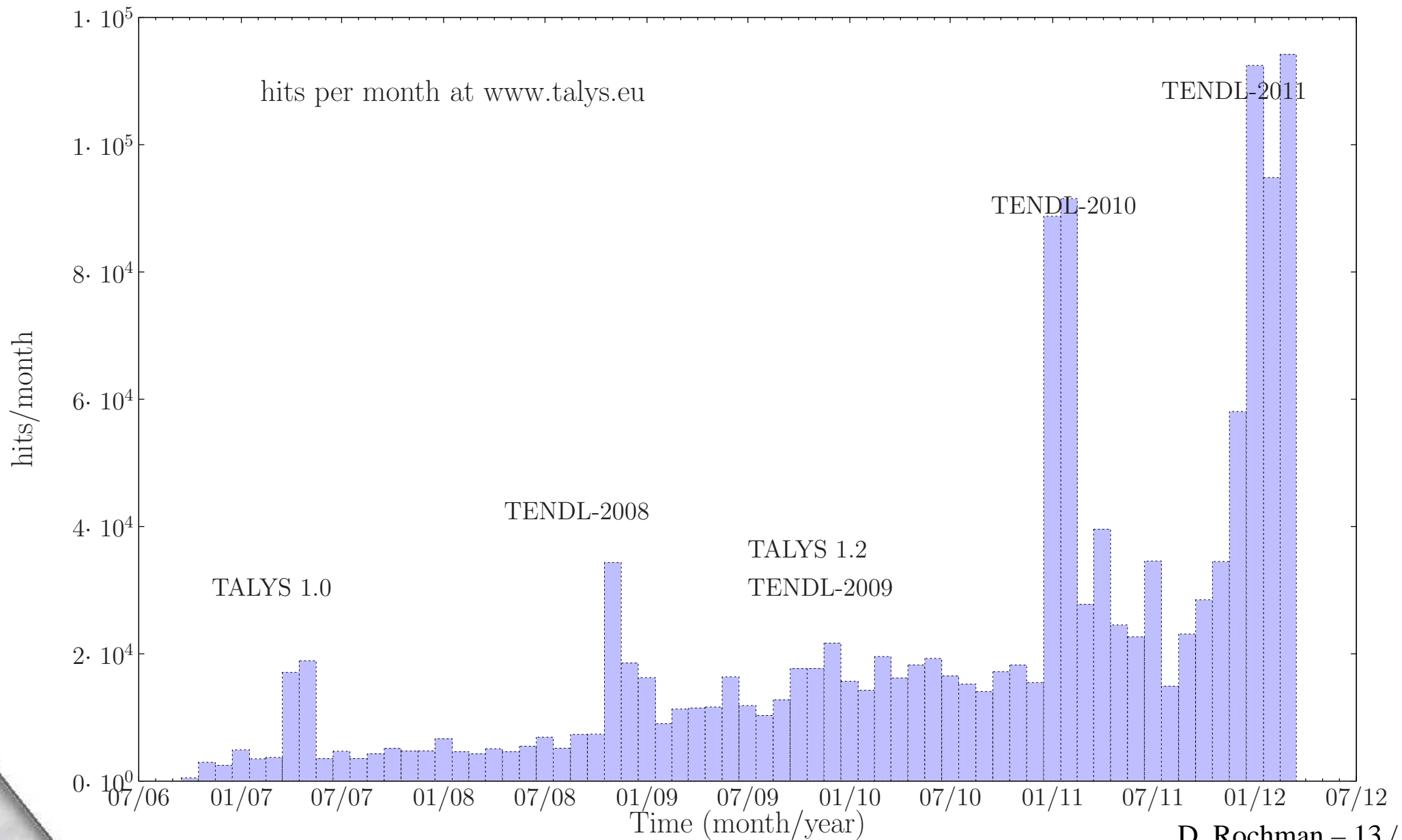
## Indirect and partial contributors

- ANDES ( $^{239}\text{Pu}$  evaluation and covariance methodology),
- F4E (some structural materials),

## TENDL files in



- SAFEPAQ,
- FENDL-3,
- JEFF-3.2,
- GEANT, FLUKA,
- TENDL reference in  $\simeq 170$  publications


# TENDL "clicks" on www.talys.eu



# Future perspectives and Possibilities



 TENDL has now 4 releases, with defined status and objectives,  
 complete, validated and with original contents,

 In the future:

- continue with new yearly releases,
- increase collaborations with other institutes (better models, input files, validations),
- share our evaluation tools to include more contributions (better evaluations),
- disseminate our working method, and
- gain status and influence.

 Different opportunities:

- becoming an independent evaluation project (in the NEA terms) ?
- a source of evaluations for the JEFF project ?
- a world library ?