Description of the SG-33 work planned at NRG

D. Rochman, S.C. van der Marck and A. Hogenbirk

Nuclear Research and Consultancy Group,

NRG, Petten, The Netherlands

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Work plan

①	Goal:	*See the SG description*
②	Deliverable:	*June 2011: report of the SG activities*
③	Systems:	*GODIVA, JEZEBEL, ZPR6-6A, ZPR6-7, SEFOR, JOYO ZPPR-9*
④	Group structure:	*28, 33, 44 or any other*
⑤	Quantities:	k_{eff}*, control rod worth, void coef., Doppler reactivity, burn-up reactivity*
⑥	Isotopes:	^{10}B, ^{16}O, ^{23}Na, ^{56}Fe, ^{52}Cr, ^{235}U, $^{239,240,241}Pu$
⑦	Reactions:	*(n,f), ν-bar, (n,γ), (n,el), (n,inl)*
⑧	Methods:	*Covariances from TENDL-2009, MCNP+ perturbation method and MCNP+ Total Monte Carlo*

Description of the Method 1: MCNP+SUSD (perturbation method)

- Use of the standard option "*sensitivity profile*" in MCNP for a single isotope, in a single material and in a single energy bin.

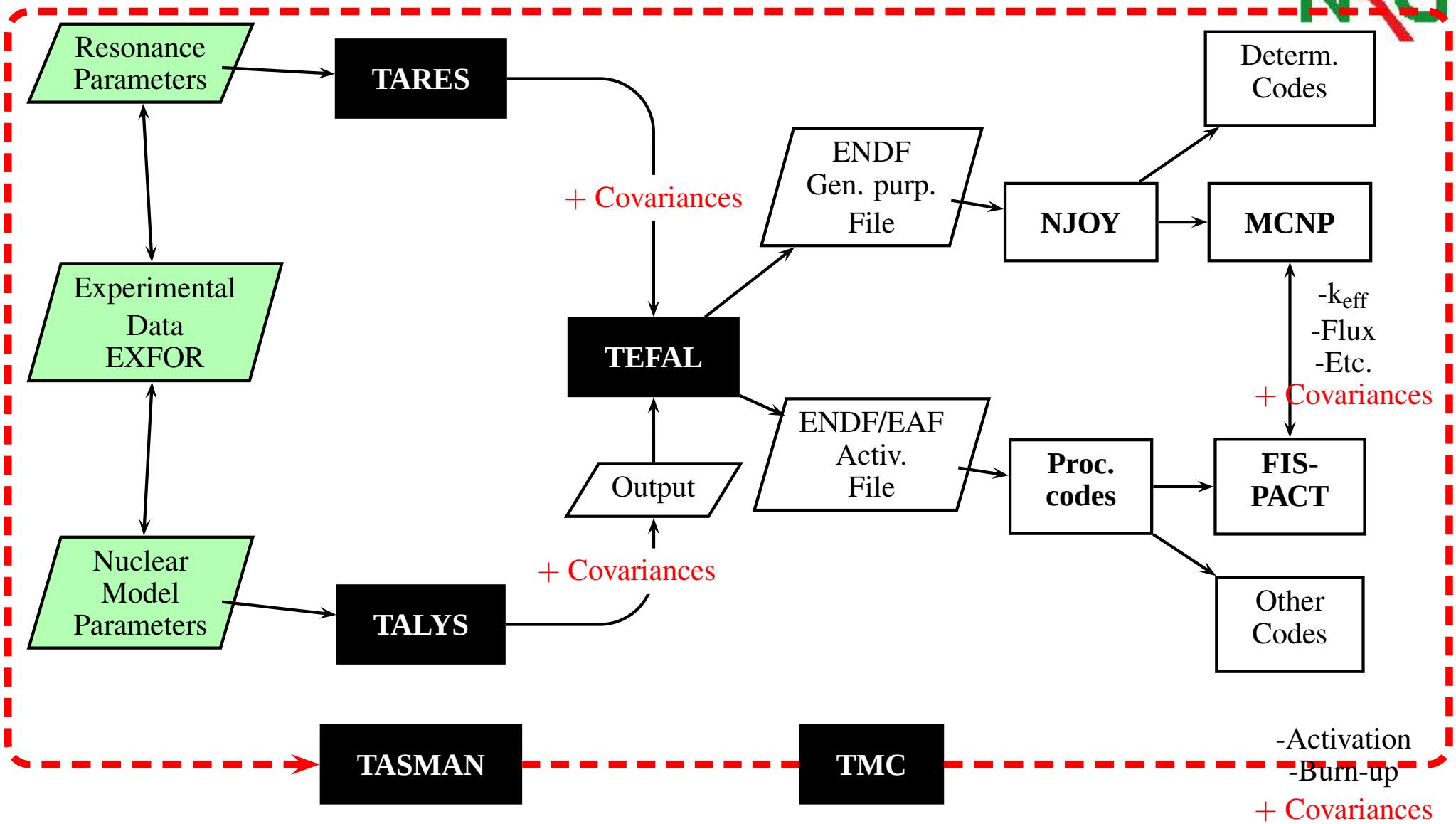
- Output directed to SUSD

- Uncertainty considered: MF31,32 and 33.

- See details in "*An easy way to carry out 3D uncertainty analysis*", A. Hogenbirk in the M&C + SNA 2007 conference, Monterey, Ca, April 15-19, 2007, ANS.

- Use of TENDL-2009: full covariances for $\simeq$ 1100 isotopes (www.talys.eu/talys2009)

Description of the Method 2: MCNP+ Total Monte Carlo



Monte Carlo: 1000 TALYS runs

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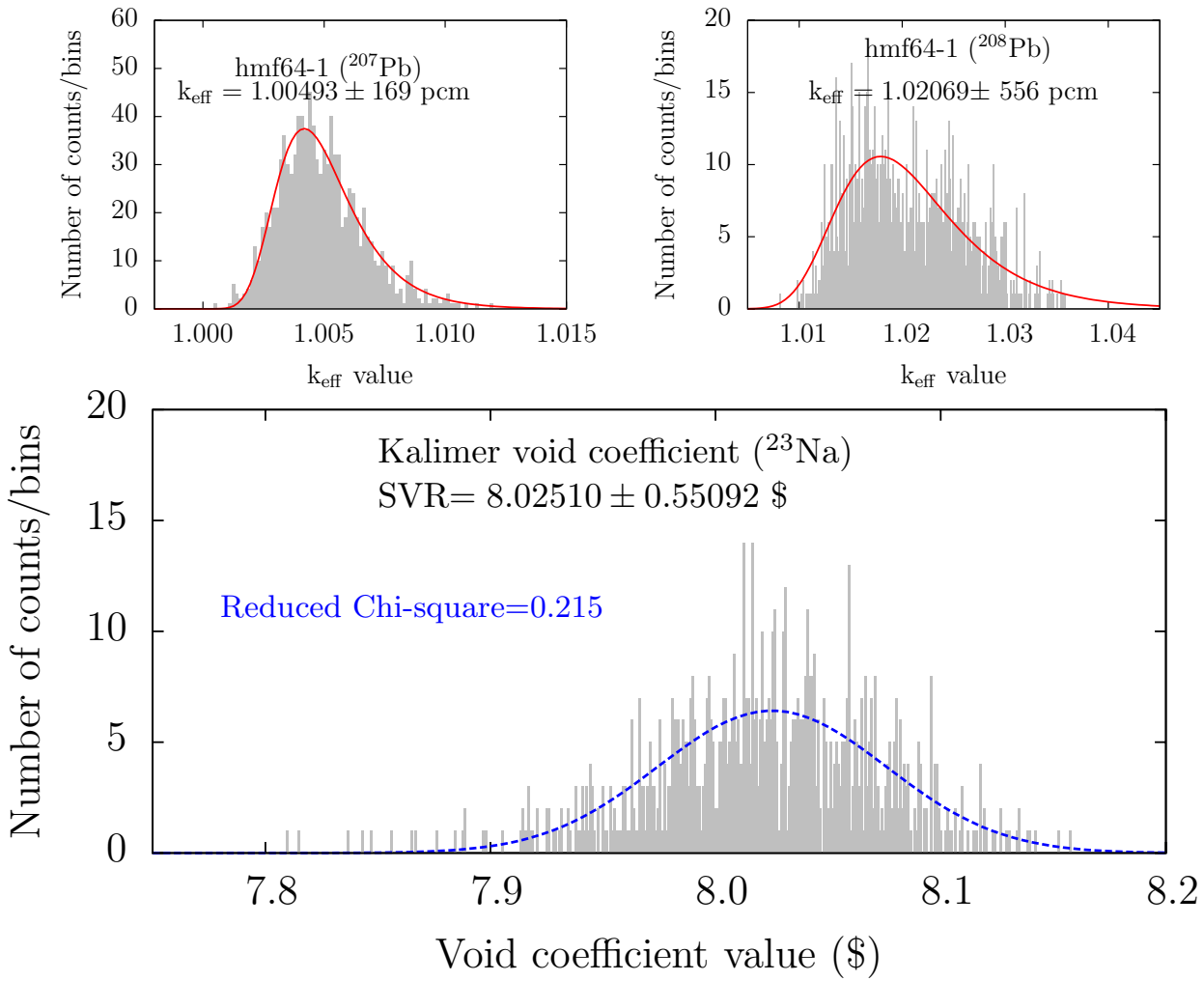

-"*Towards sustainable nuclear energy: Putting nuclear physics to work*", A.J. Koning and D. Rochman in ANE 35 (2008) 2024

-"*On the evaluation of ^{23}Na neutron-induced reactions and validations*", D. Rochman *et al.*, accepted in NIM/A

Advantages of performing both approachs

- MCNP+SUSD: Speed (but only MF31,32 and 33)

- MCNP+ Total Monte Carlo: Slow (but sensitive to MF1,2,3,4,6...)

- Consistency between covariance files and random files

		Total Monte Carlo			Pertur. method	
Benchmark	Isotopes	k_{eff}	Stat. uncert. (pcm)	Uncert. nucl. data (pcm)	k_{eff}	Uncert. nucl. data (pcm)
hmf7-34	^{19}F	1.00374	35	373	1.00323	120
hst39-6	^{19}F	1.01325	51	418	1.01315	146
hmf64-1	^{208}Pb	1.02069	35	556	1.01952	507
hmf57-1	^{208}Pb	1.01256	34	499	1.01156	452
hmi1-1	^{56}Fe	1.06582	45	1370		371
hmt13-625	^{56}Fe	1.01171	42	464	-	444

Conclusion

- - Consistent data files and covariances
- - Make use of library with the largest number of covariances
- - With the *"MCNP+perturbation"* method: sensitivity to any quantity
- - With the *"MCNP+Total Monte Carlo"* method: assessment of other uncertainties

A unique approach !

- - More work needed for fission neutron spectrum sensitivity
- - More work needed for μ-bar