IRSN
INSTITUT
DE RADIOPROTECTION
ET DE SÛRETÉ NUCLÉAIRE

Faire avancer la sûreté nucléaire

Use of Integral Data in Differential Data Evaluation

Nuclear Data Week SG39 and SG46

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OUTLINE

1. Issue with Gd evaluations
2. Evaluations Performed at IRSN for Gd
3. Concluding remarks

^{155}Gd and ^{157}Gd Resonance Evaluation

Motivation:

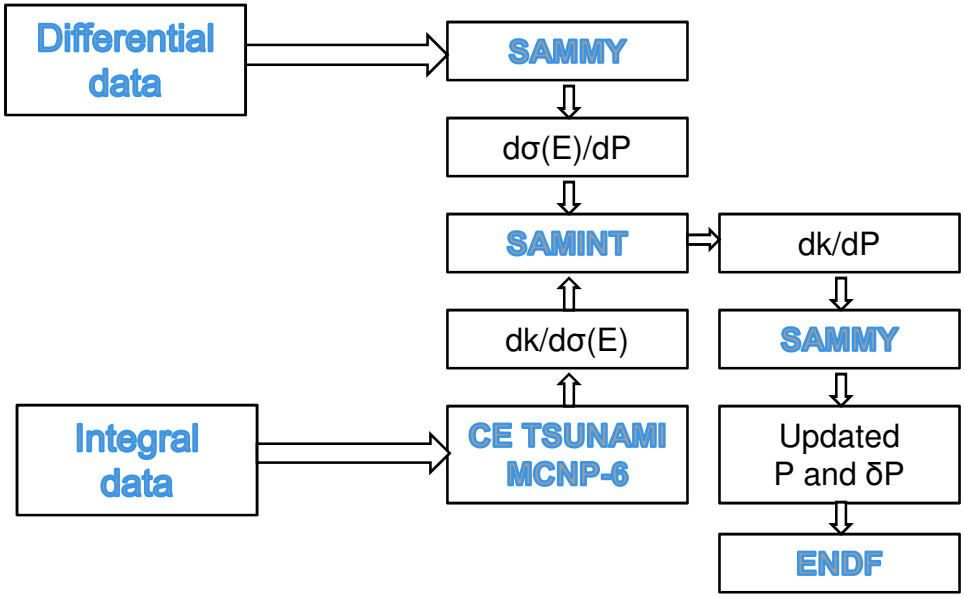
- Issues with benchmark calculations with Gd concentration;
- Extension of the resonance region from 300 eV to 500 eV;
- SAMMY R-matrix analysis;
- Transmission, capture data from RPI;
- Improve benchmark integral representation;
- Uncertainty information and resonance parameter;
- Covariance generation;

General Information

Atlas of Neutron Resonances (ANR)			
	Thermal Cross Section (barns)	Capture Resonance Integral (barns)	Westcott's Factor
^{155}Gd	60900 ± 500	1537 ± 100	0.83899
^{157}Gd	254000 ± 815	754 ± 20	0.84715

SAMINT methodology for differential and integral data treatment

SAMINT flowchart



P = all resonance parameters:

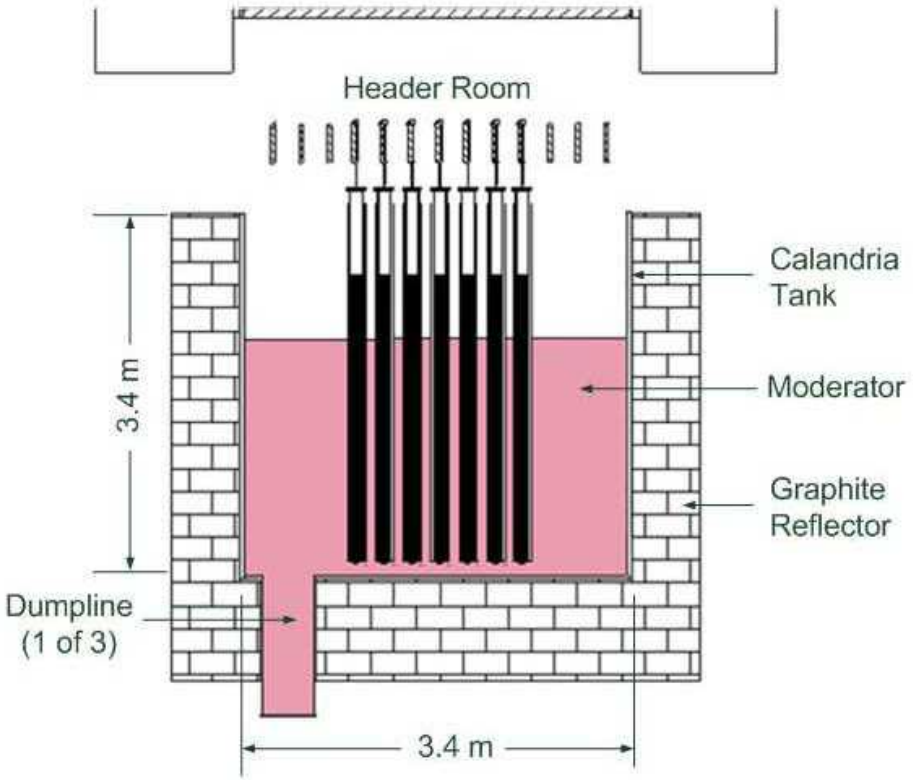
E_λ, Γ_γ , Γ_n , Γ_f , etc.

Benchmark Results: Issues

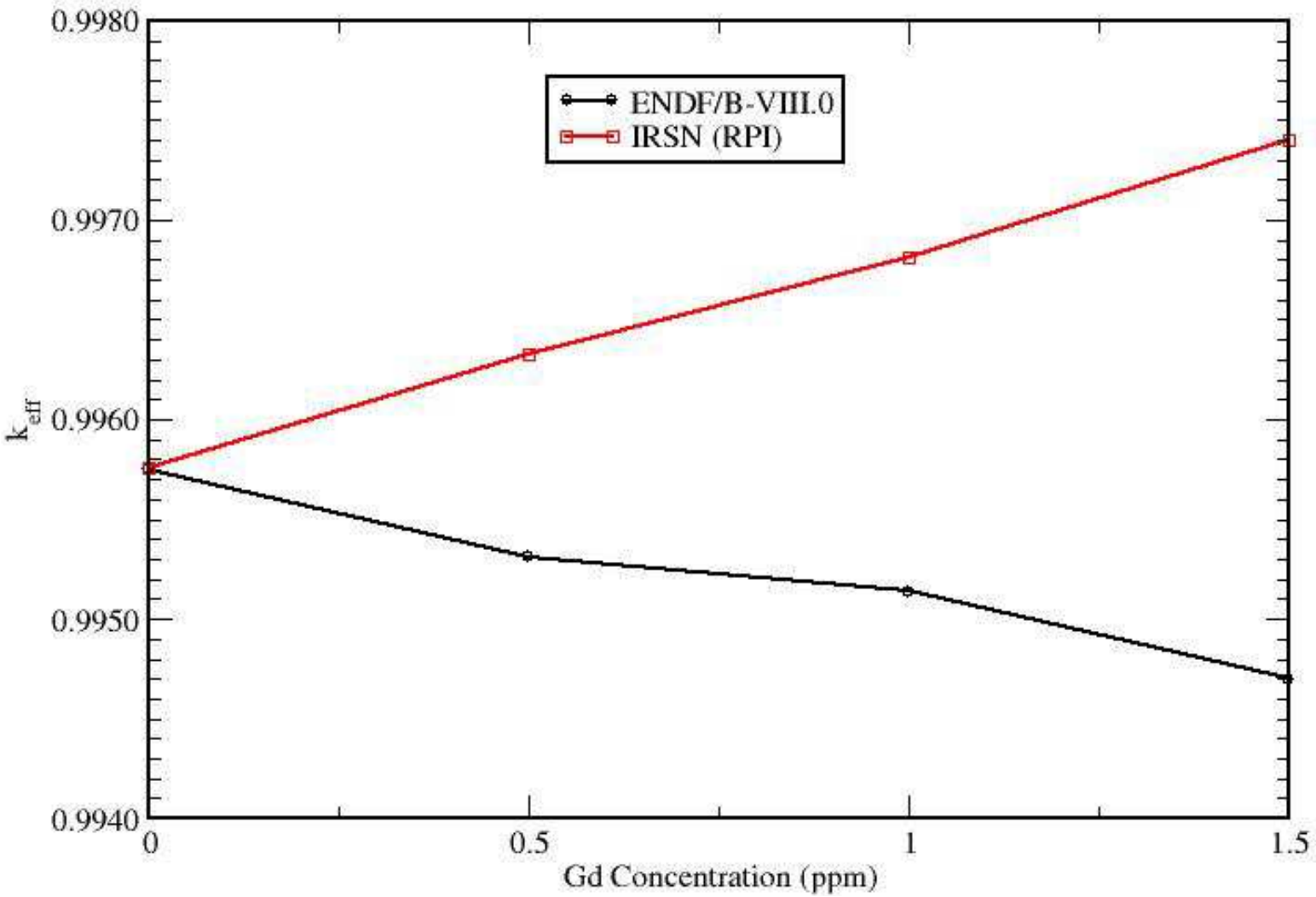
- ZED-II (Zero Energy Deuterium) Research Reactor

- Issues with benchmark calculations with Gd concentration

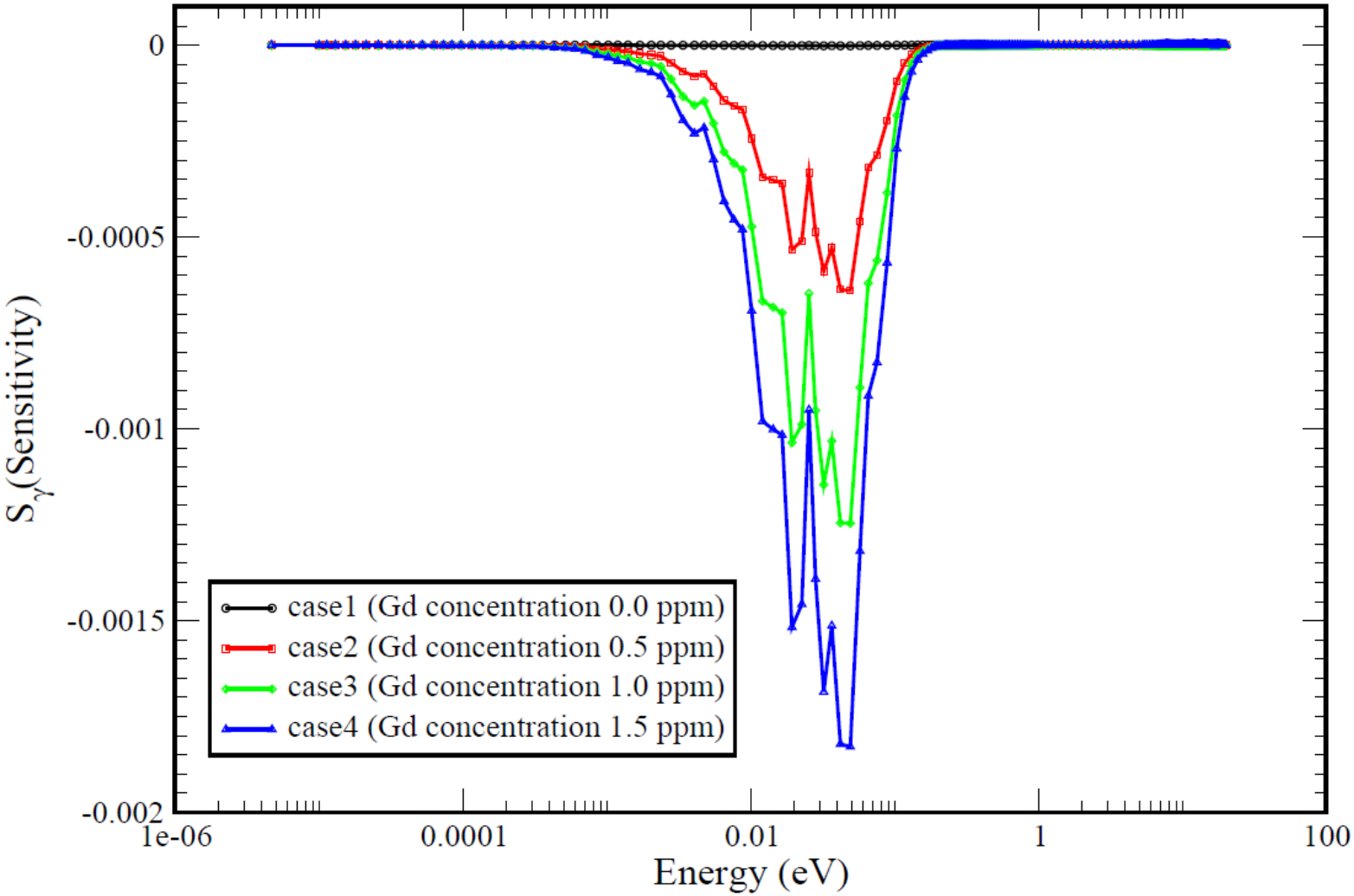
Note: Dan Roubtsov kindly shared his MCNP input decks



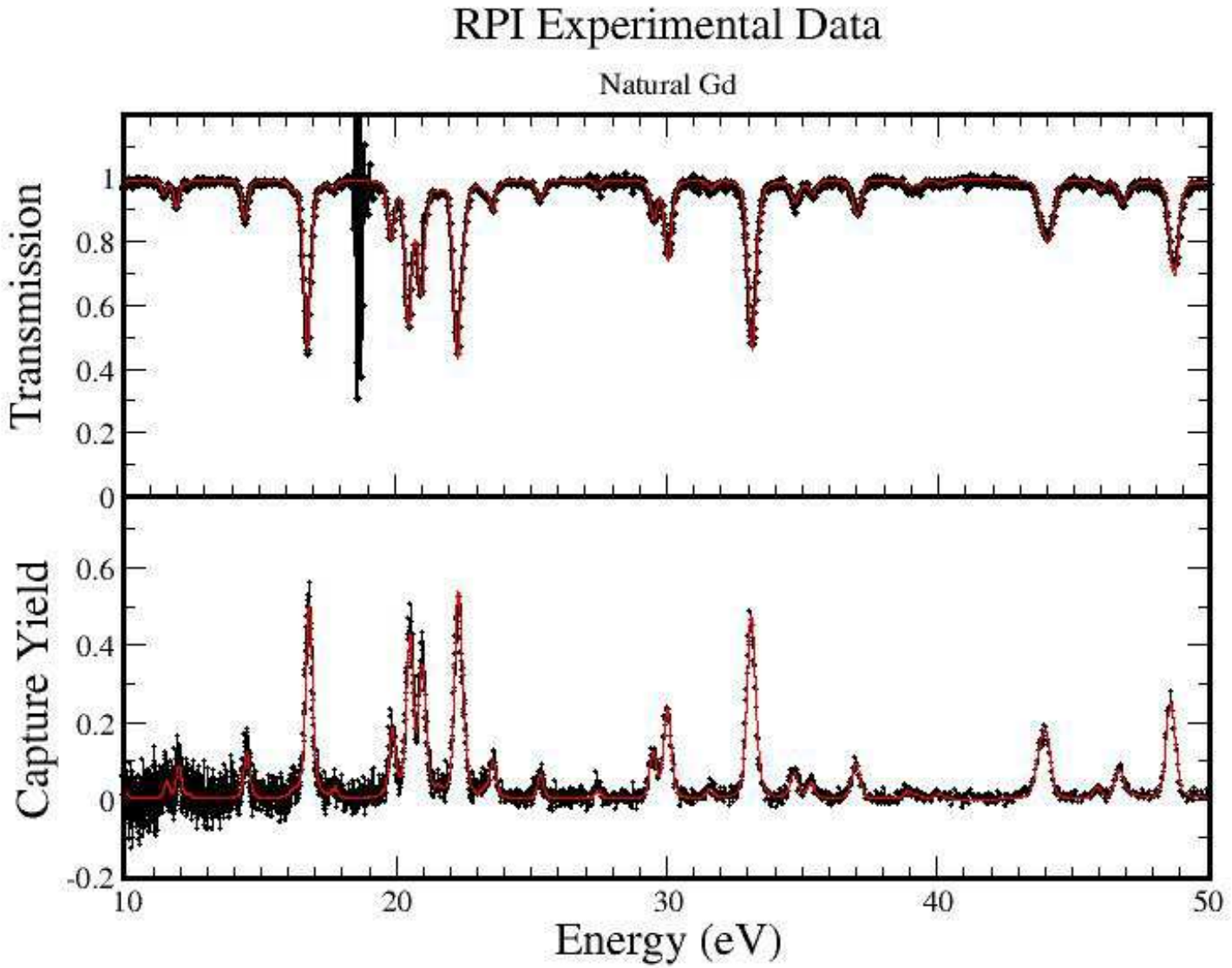
Issue:


0.9980
0.9970
0.9960
0.9950
0.9940
k_{eff}
ENDF/B-VIII.0
IRSN (RPI)
0
0.5
1
1.5
Gd Concentration (ppm)

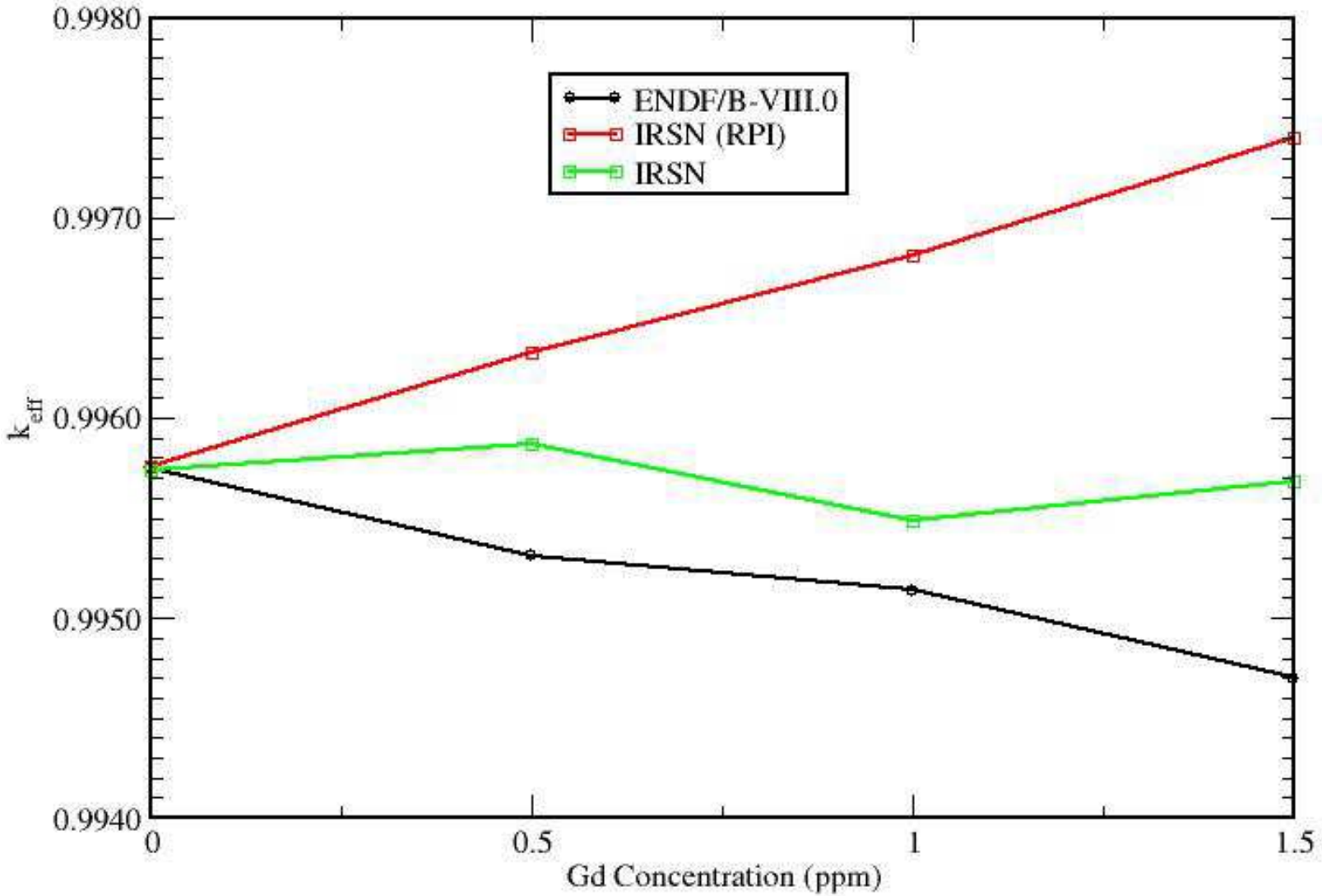
K_{eff} Sensitivity to the Capture Cross Section



SAMMY Fitting (RPI)



Resolution: use of SAMMY and SAMINT



^{157}Gd Results

Evaluation	Thermal Cross Section (barns)	Capture Resonance Integral (barns)	Westcott's Factor
ENDF/B-VIII.0	252892.2	759.26	0.85305
IRSN (RPI)	225629.8	778.32	0.76287
IRSN	244071.5	806.62	0.82467
ANR	254000 ± 815	754 ± 20	0.84715

Moving Forward:

- Include new cross-section measurements performed at n_TOF;
- Include new thermal cross-section measurements (work underway in Hungary);
- Verify contribution of other Gd isotopes, mainly ^{155}Gd;
- Include IRSN Gd benchmark in the integral fitting;
- Covariance generation;