JEF/DOC-747

RECOMMENDATIONS FOR BASIC DATA EVALUATION

DEDUCED FROM

THE VALIDATION OF GAMMA-HEATING CALCULATIONS AGAINST EXPERIMENTS IN MASURCA

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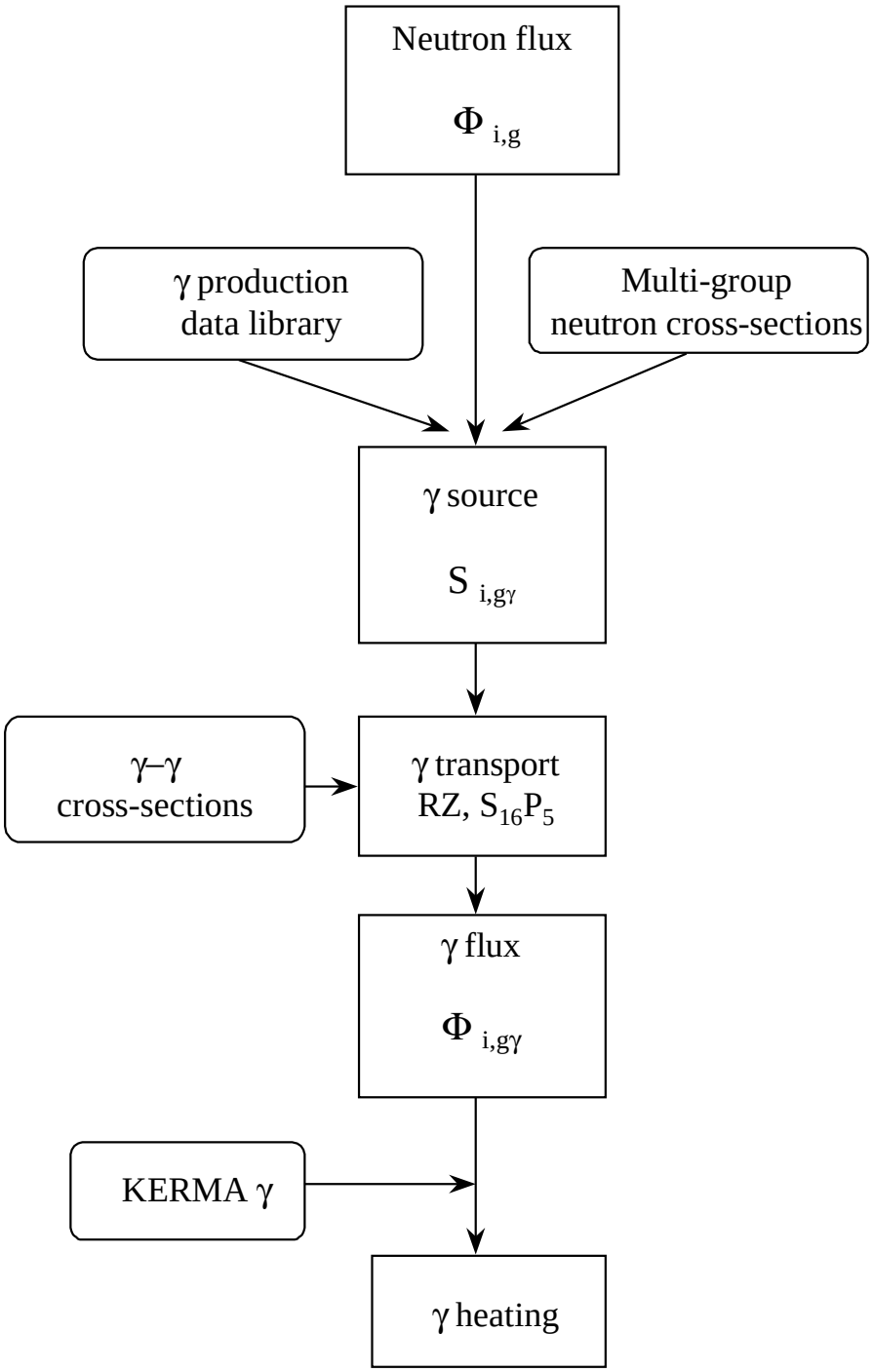
Background

- Locally, gammas can contribute up to 90 % of total heating (e.g. in diluent sub-assembles, steel reflectors).

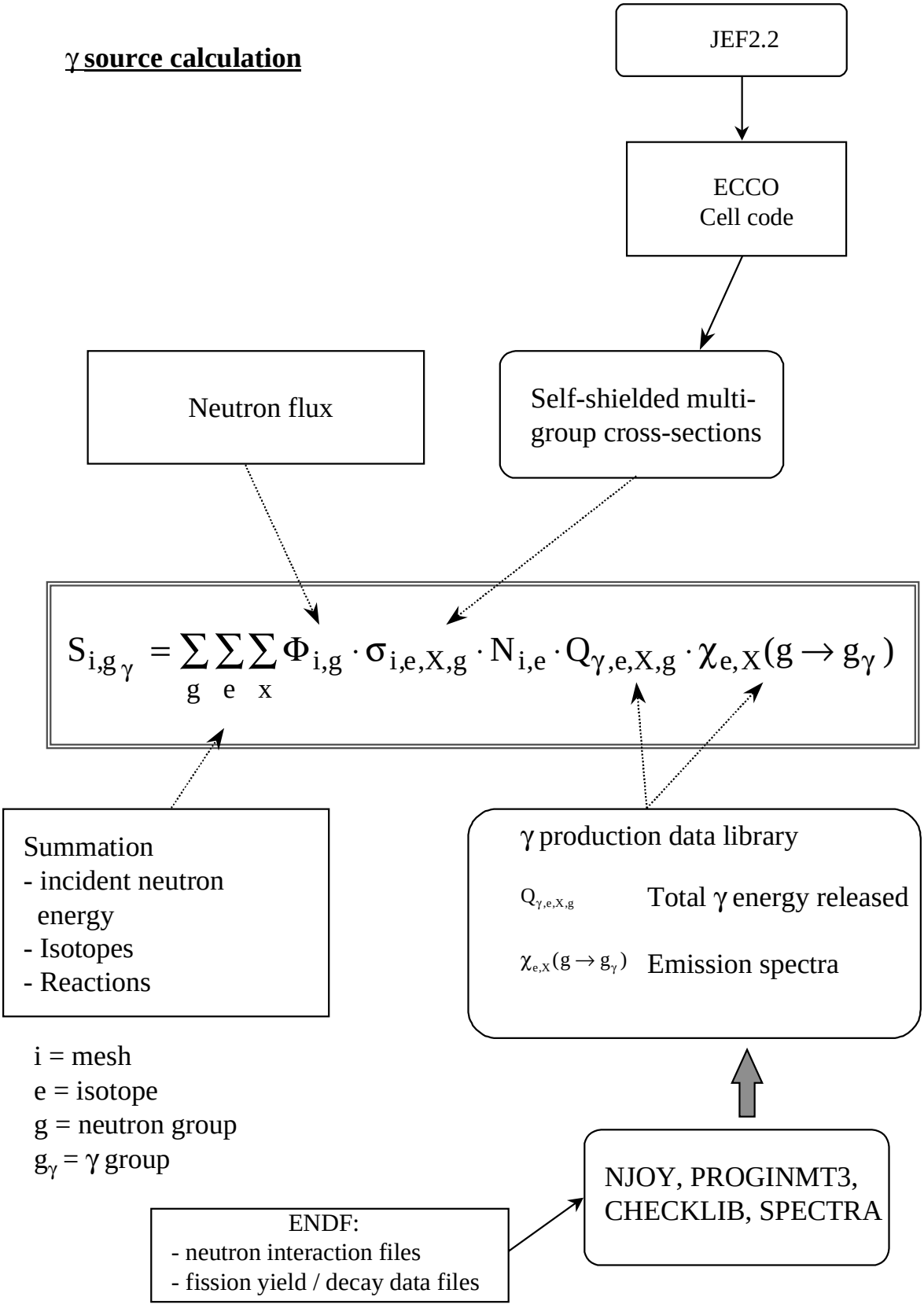
- The possibility of doing gamma-heating calculations has been implemented into ERANOS (European Reactor Analysis Optimized System).

- The calculations were tested against integral measurements.

Calculational Scheme for Gamma-Heating Calculations in ERANOS

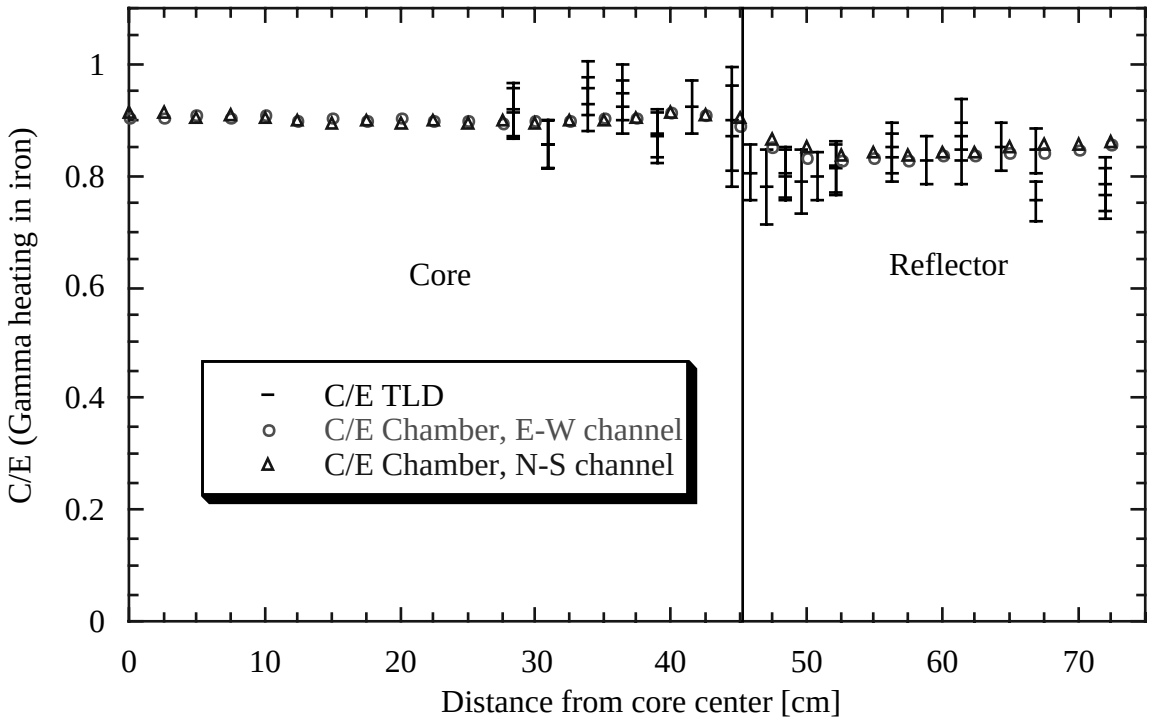


γ source calculation



Validation

- With respect to absolute gamma-heating measurements at the MASURCA facility in Cadarache
- Measuring techniques: TLD-700 (Li^7F) (absolute values) + ionization chambers (relative values)
- Main configuration studied: ZONA2B, i.e. a PuO_2/UO_2 core surrounded by a steel/sodium reflector.



C/E (core) = 0.89 **C/E reflector = 0.84**

(experimental uncertainty: 5 %)

Confirmed through reevaluated measurements by D.Calamand et al.

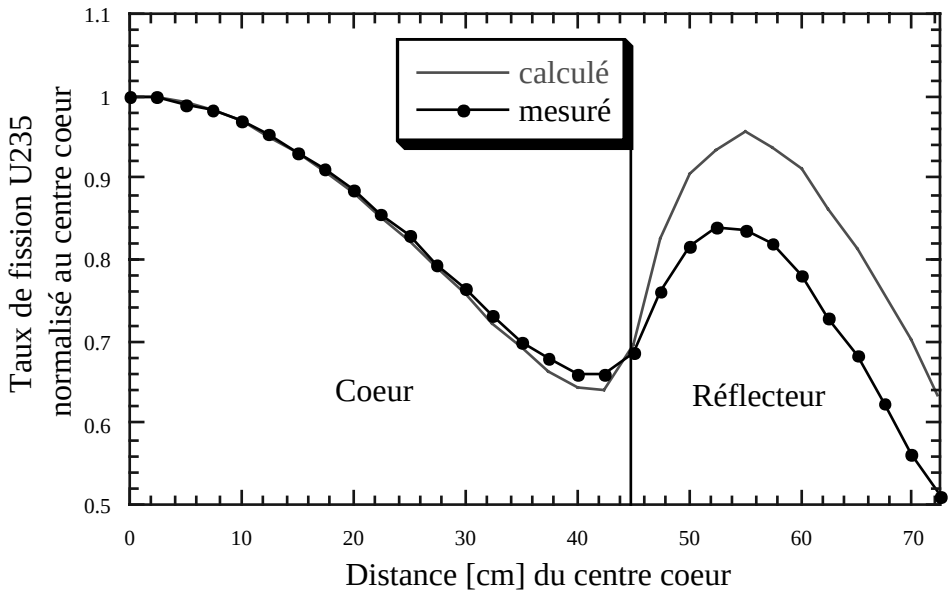
Analysis of error sources

⇨ Differences most probably due to:

- Errors in computing reaction rates
- Errors in the production data used

Core (C/E ~ 0.89):

- 66 % of gamma heating in the core is due to fission gamma
- Fission rates are thought to be well computed



=> Presently adopted data for the fission gamma production too low

Values for γ Energy release in fission (MeV) used in ERANOS

Isotope	Prompt	Source (MF 12/15)	Delayed (asymptotic)	Source	Total release
U235	6.72	JEF2.2	6.35	From JEF2.2 Fission yield and Decay data	13.07
U238	7.62	JEF2.2	7.89		15.51
Pu239	7.45	JENDL-3	5.11		12.56
Pu240	7.01	ENDF/B-VI	5.43		12.44
Pu241	7.25	ENDF/B-VI	5.95		13.20
Pu242	6.17	ENDF/B-VI	6.35		12.53
Am241	6.17	ENDF/B-VI	4.43		10.59

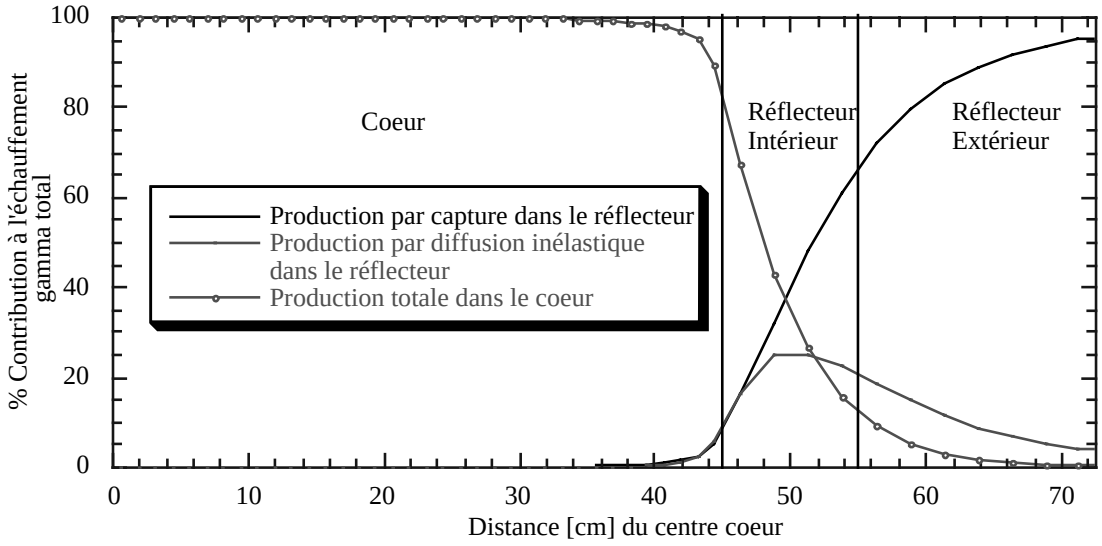
=> Recommendations

1. **Gamma production data for fissile isotopes (Pu^{239}) should be reviewed** (Gamma fission emission would have to be raised by 10 % to be consistent with experimental findings)

2. **Gamma production for fissile isotopes should be implemented into JEF (no data for Pu isotopes in JEF 2.2!)**

Reflector (C/E ~ 0.84)

- Gamma heating is principally due to gammas created by capture in structural isotopes (Fe^{56})



- The gamma energy released in a radiative capture is well known

  (~ Q+E)

=> Computed capture rates in structural isotopes are too low

Findings consistent with parallel work by JC Bosq et al.

=> tried to explain reasons for the too soft neutron flux in the reflector

=> Data adjustment studies: -> Fe^{56} capture cross-section significantly too low below ~ 10 keV

=> Capture cross-sections (Fe^{56}) should be reviewed