FLATTOP PU239 Corrective Factors

The specifications of this experiment are provided on the "International Handbook of Evaluated Criticality Safety Benchmark Experiments" under the name "PU-MET-FAST-006" in the Plutonium Systems chapter.
The radius of the core, a 6060-gram Pu sphere at a density of 15.53 g/cm3, was 4.5332 cm. The sphere was reflected by 19.6088 cm of normal uranium (outer radius of 24.1420 cm).
The homogeneous compositions are in Table I (taken from the benchmark DVD).

For the deterministic spherical model the following meshing has been used with equidistant points in the same region:

Axis				
R	Point	1	25	100
	Dimens.	0.0	4.5332	24.142

The following S_4 angular data have been used. Just a reminder that directions with zero weight are used only for improving convergence on the curvilinear derivative term and should not affect the final result if not used, as it is the case of some S_n codes (e. g. ONETRAN, ONEDANT).

Direc.	Weight	μ
1	0.0000000E+00	-0.9367418E+00
2	0.1666667E+00	-0.8688903E+00
3	0.3333333E+00	-0.3500212E+00
4	0.3333333E+00	0.3500212E+00
5	0.1666667E+00	0.8688903E+00

Corrective factors have been calculated with the ENDF/B-VII cross section data. In table II we provide the corrective factors for the homogenous R model for the deterministic S_4P_1 33 group calculations. Corrective factors are calculated as the ratio between the values obtained by the detailed Monte Carlo calculation and those obtained by the corresponding approximated calculation.

Table I. Homogeneous compositions.

Isotope	Atom Densities (atoms/barn-cm)
Core	
^{239}Pu	3.6697×10^{-2}
^{240}Pu	1.8700×10^{-3}
^{241}Pu	1.1639×10^{-4}
Ga	1.4755×10^{-3}
Reflector[(a)]	
^{234}U	2.6438×10^{-6}
^{235}U	3.4610×10^{-4}
^{238}U	4.7721×10^{-2}

Table II. Corrective factors for R homogeneous **deterministic** calculations.

Parameters	MC Detailed	S_4 R.	**Corr. Fact.**	Experiment
K_{eff}	1.00097 ±18pcm	0.99962	**1.00135** ±100pcm	1.00000 ±300pcm
F28/F25	0.1767 ±0.0013	0.1715	**1.0303** ±1%	0.1799 ±1.1%
F37/F25	0.8523 ±0.0013	0.8452	**1.0084** ±1%	0.8561 ±1.4%