Bare Core Flux Shape: Peak-to-Average Ratio

Peak-to-average neutron flux (and power density) in bare slab, sphere, cylinder and rectangular cores from one-group diffusion theory, with peak power density.

Method: One-group fundamental-mode flux shapes

Input parameters

Unit system: SI

Parameter	Value	Unit
Core shape	Finite cylinder	
Core thermal power	3,000.0	MW
Core volume	30.000	m³

Calculated results

Parameter	Value	Unit
Peak-to-average flux ratio	3.6382	
Average power density	100.00	MW/m³
Peak power density	363.82	MW/m³

Notes for this case

• Fundamental-mode flux shapes: cos (slab), sin(r)/r (sphere), J_0 (cylinder); Ω = π/2, π²/3 and 2.405/[2J_1(2.405)] = 2.32, with products for finite shapes. Reflectors, fuel zoning and burnable poisons flatten real cores to Ω of about 1.5–2.5.

Formula and method

$$\Omega_{slab} = \frac{\pi}{2}, \quad \Omega_{sphere} = \frac{\pi^2}{3}, \quad \Omega_{cyl} = \frac{2.405}{2J_1(2.405)}$$

Variables

shape	Core shape	-
P	Core thermal power	W
V	Core volume	m³
Ω	Peak-to-average flux ratio	-
$\bar{q}'''$	Average power density	W/m³
q'''_{max}	Peak power density	W/m³

Method and standards

Flux shape factors.

Assumptions and limits

- Bare homogeneous core; one group.

References

One-group fundamental-mode flux shapes

Report details

Report reference	FCC-H3GM-QGJY (the same inputs always give the same reference)
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Calculator	Bare Core Flux Shape: Peak-to-Average Ratio
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Release checks	3 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/boilers-power-plant/nuclear-power/bare-core-flux-peaking-factor

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.