Desafios da fusão nuclear na produção de energia

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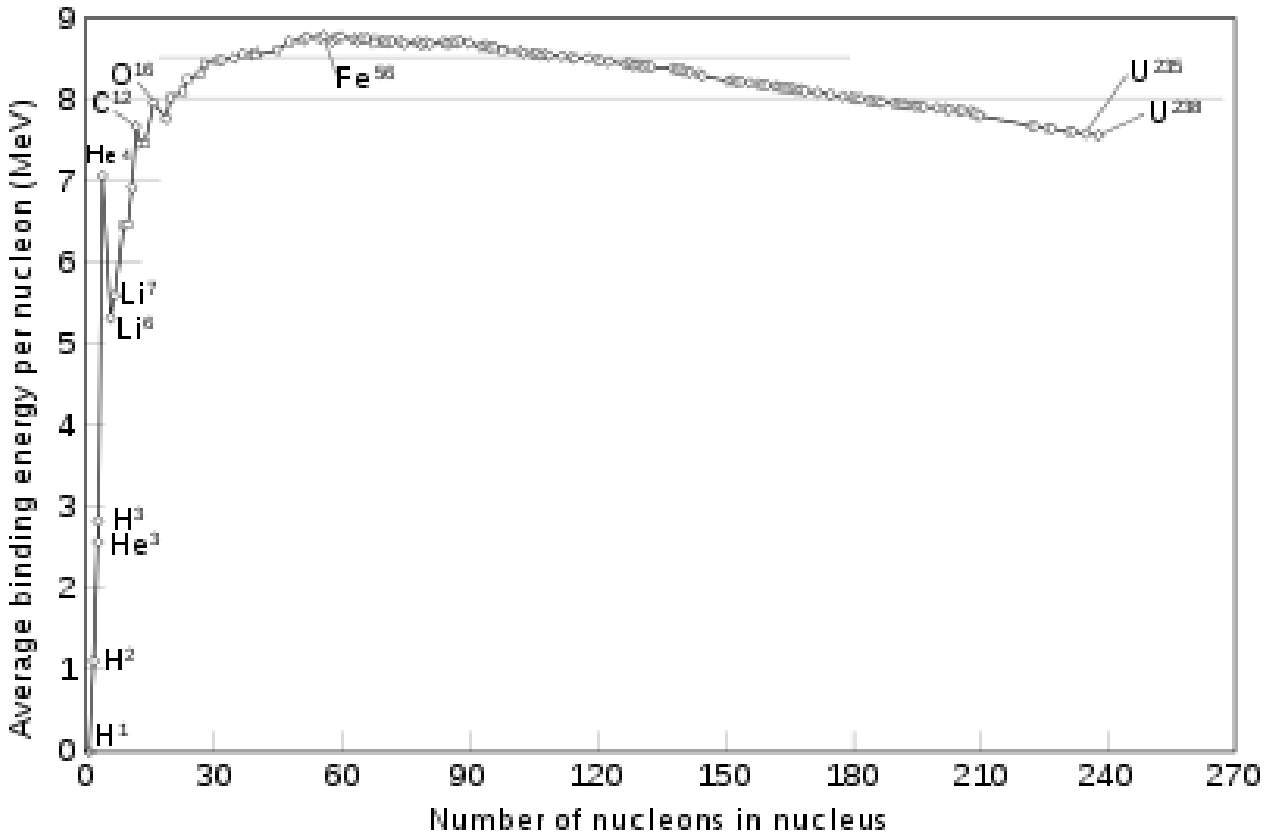
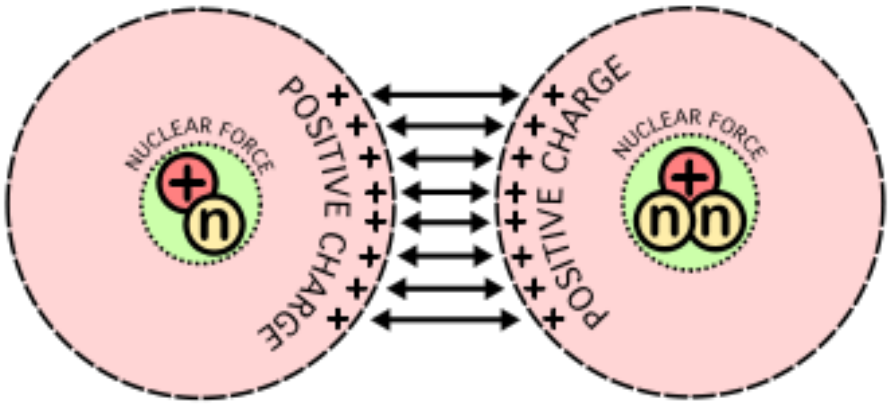
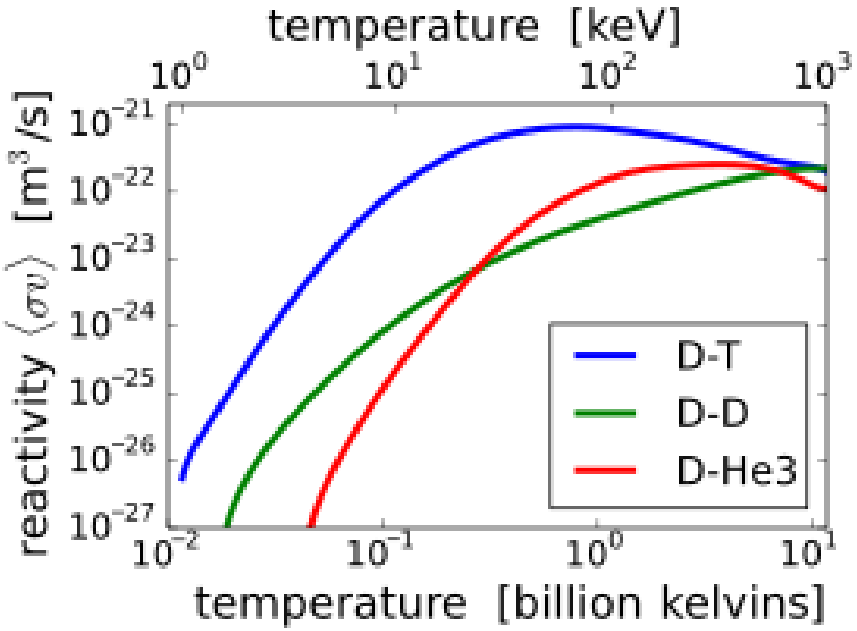
A energia de ligação dos núcleos



Reação de fusão



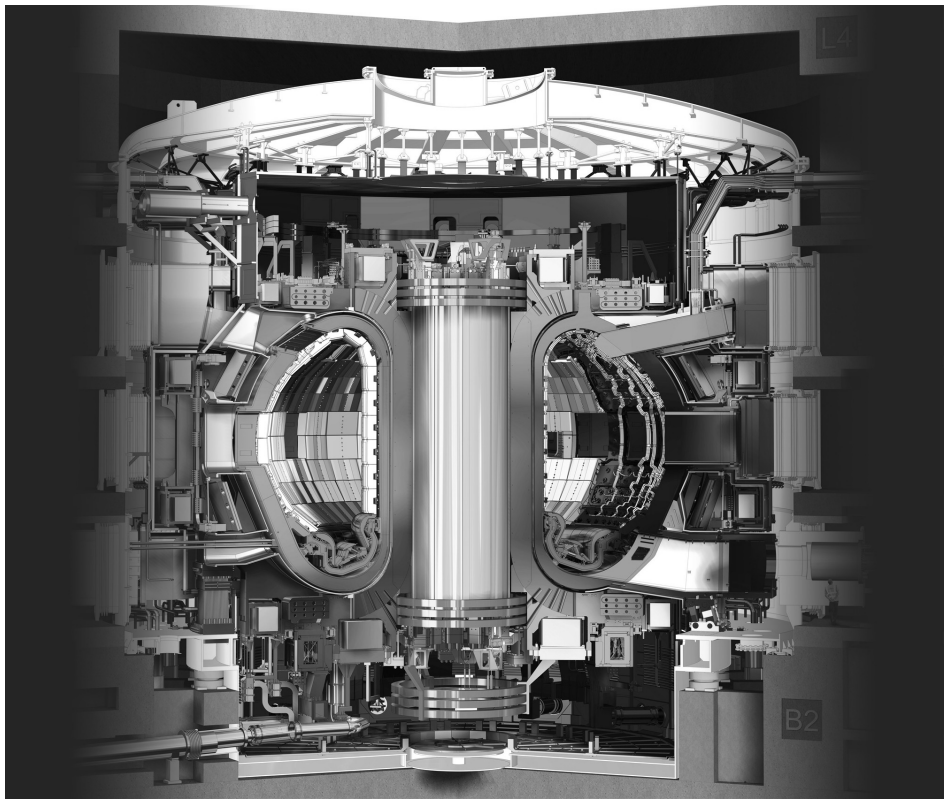


Reações mais importantes

$$
\begin{aligned}
{}^{2}_{1}\mathrm{D} + {}^{3}_{1}\mathrm{T} &\rightarrow {}^{4}_{2}\mathrm{He}\ (3{,}52\ \mathrm{MeV}) + \mathrm{n}^{0}\ (14{,}06\ \mathrm{MeV}) \\
{}^{2}_{1}\mathrm{D} + {}^{2}_{1}\mathrm{D} &\rightarrow {}^{3}_{1}\mathrm{T}\ (1{,}01\ \mathrm{MeV}) + \mathrm{p}^{+}\ (3{,}02\ \mathrm{MeV}) \quad 50\% \\
&\rightarrow {}^{3}_{2}\mathrm{He}\ (0{,}82\ \mathrm{MeV}) + \mathrm{n}^{0}\ (2{,}54\ \mathrm{MeV}) \quad 50\% \\
\mathrm{n}^{0} + {}^{6}_{3}\mathrm{Li} &\rightarrow {}^{3}_{1}\mathrm{T} + {}^{4}_{2}\mathrm{He} + 4{,}784\ \mathrm{MeV}
\end{aligned}
$$

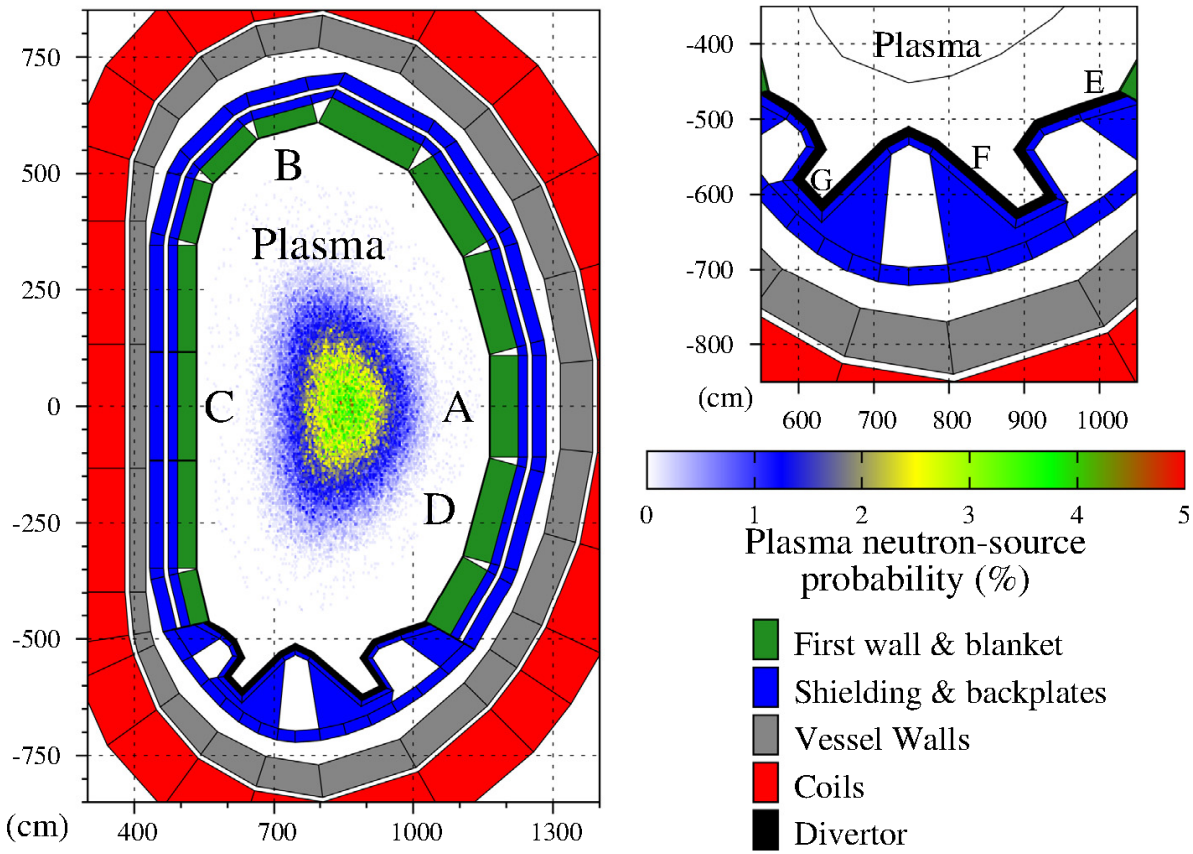
International Thermonuclear Experimental Reactor

ITER



Fonte: `https://www.iter.org`, acesso em 27/06/2021.

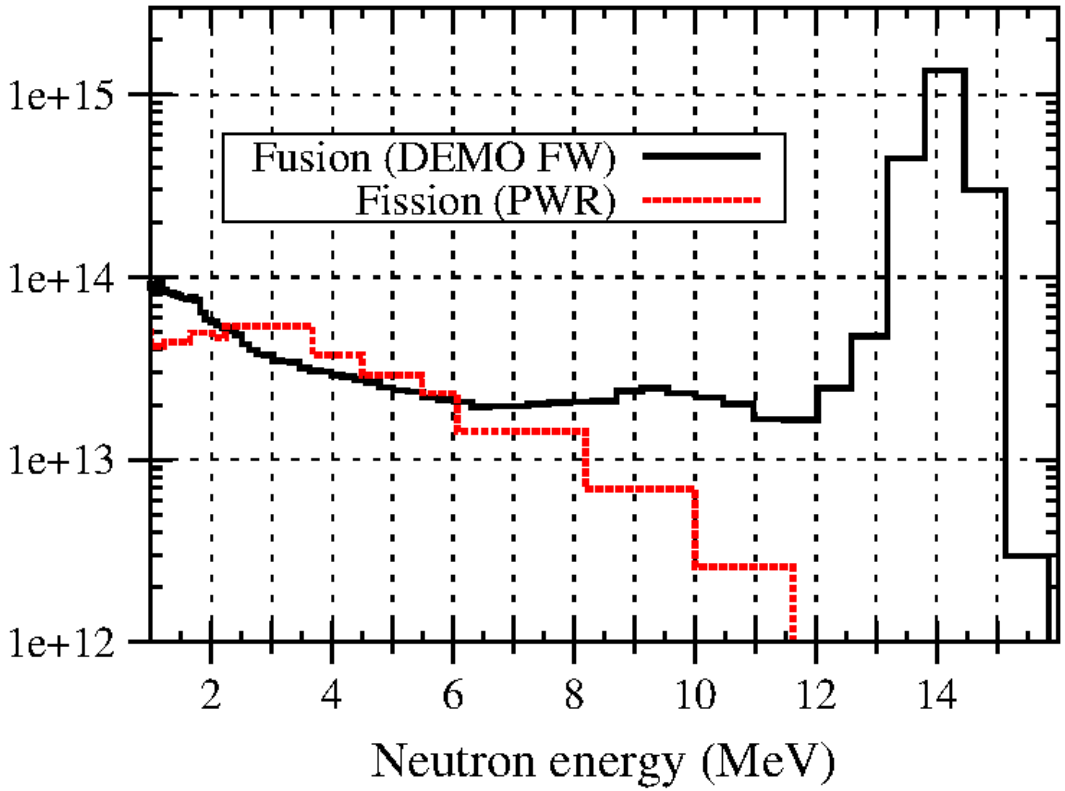
O reator de fusão



M. R. Gilbert *et al.* “Neutron-induced dpa, transmutations, gas production, and Heliun embrittlement in fusion materials” *J. Nuclear Mater.* **442** (2013) S755 – S760

Espectro de energia dos nêutrons

fluxo



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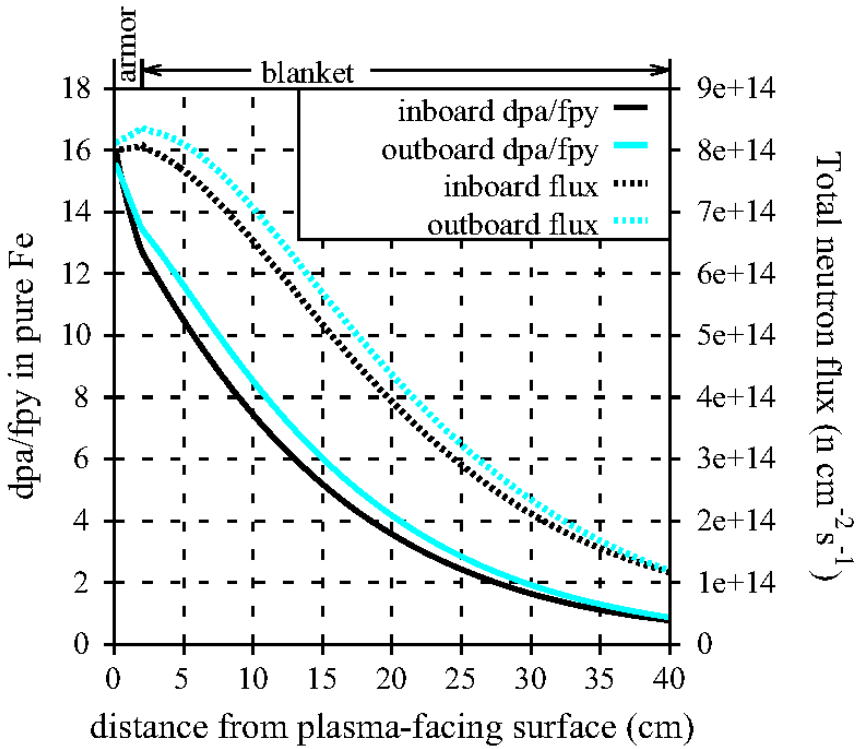
Dano por irradiação

dpa = *displacements per atom*



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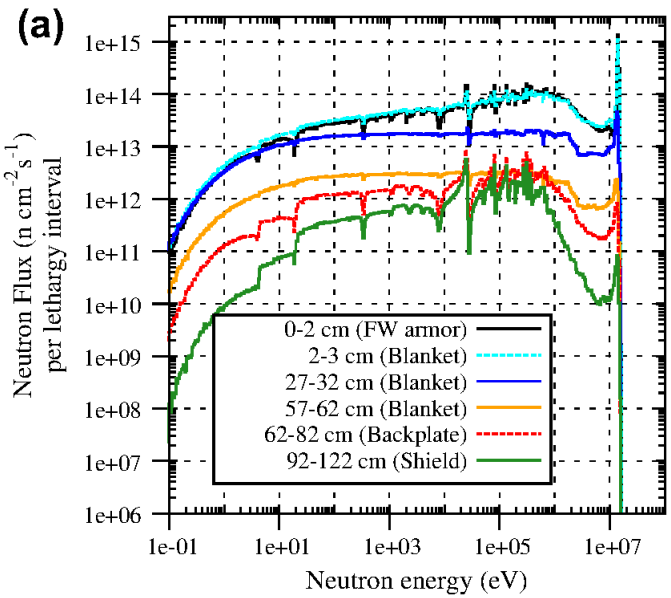
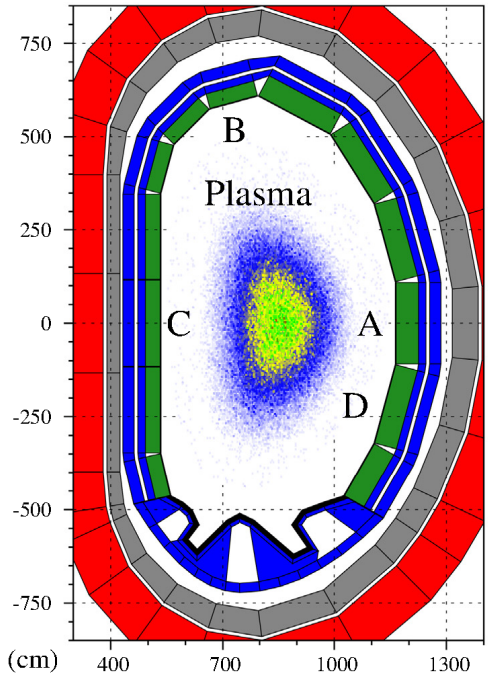
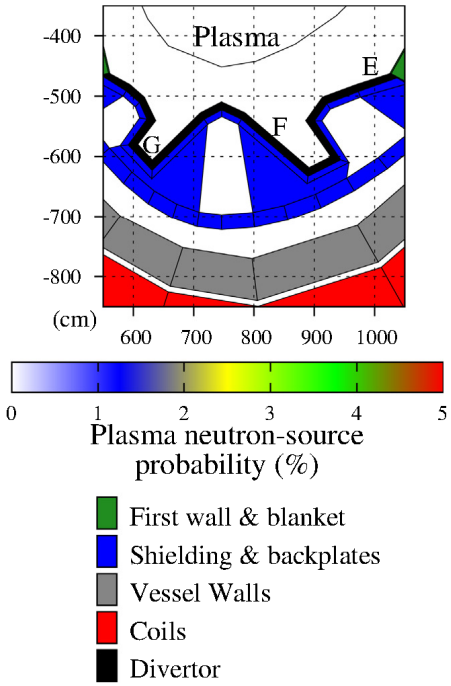
Fluxo de nêutrons em diferentes posições

distância







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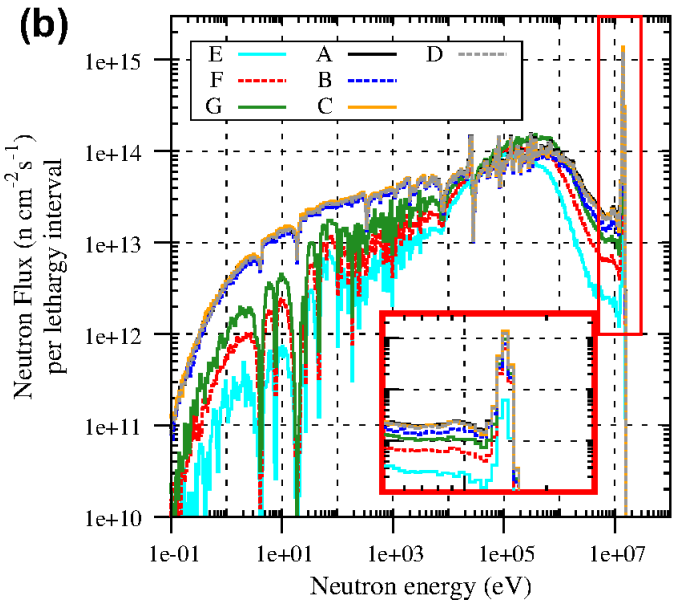
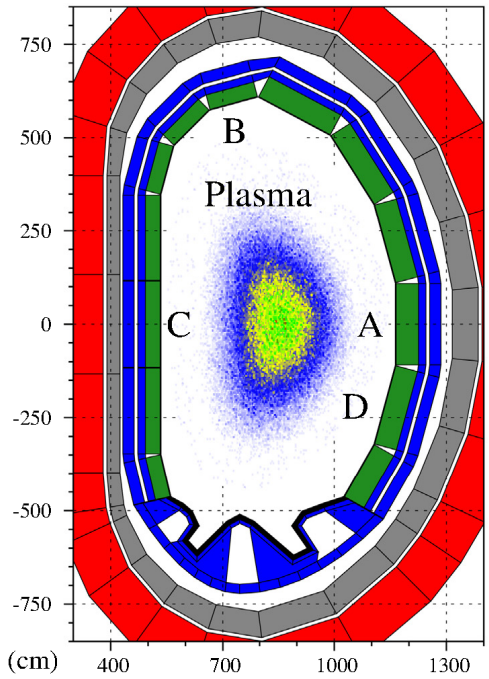
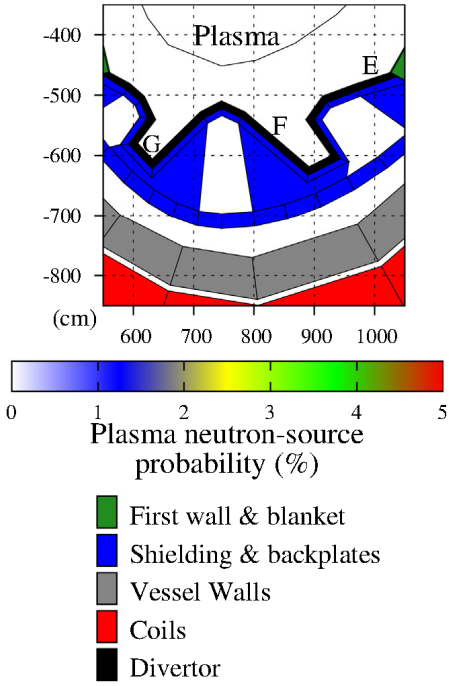
Fluxo de nêutrons em diferentes posições

posição

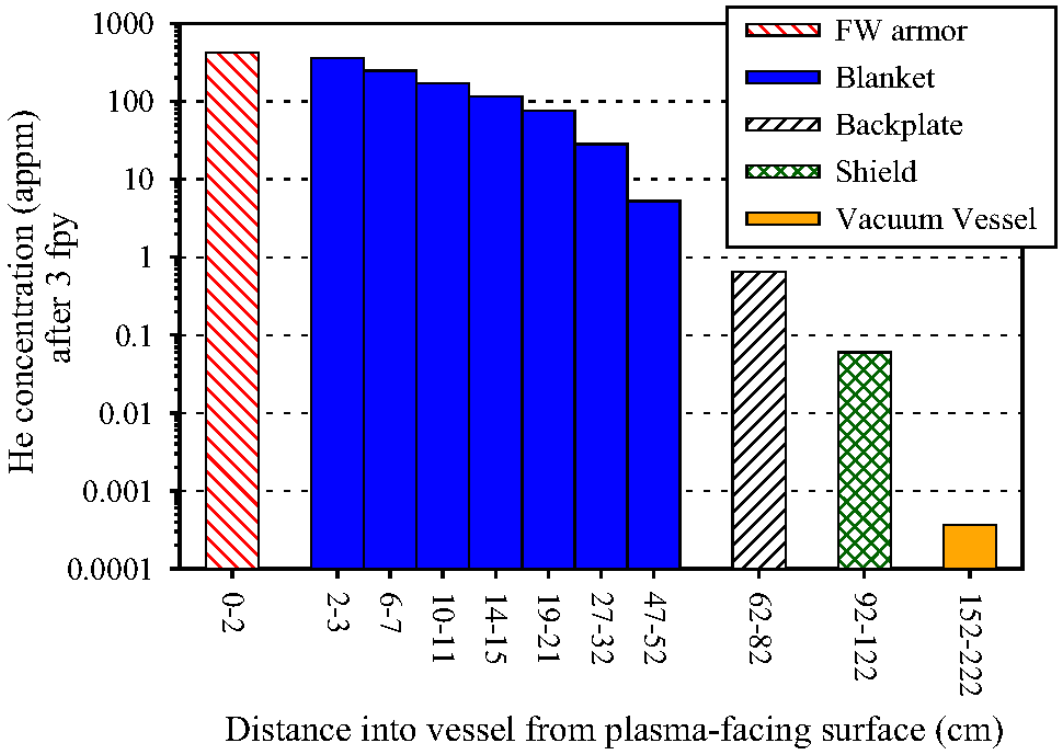






M. R. Gilbert *et al.* “Neutron-induced dpa, transmutations, gas production, and Heliun embrittlement in fusion materials” *J. Nuclear Mater.* **442** (2013) S755 – S760

Produção de He por transmutação



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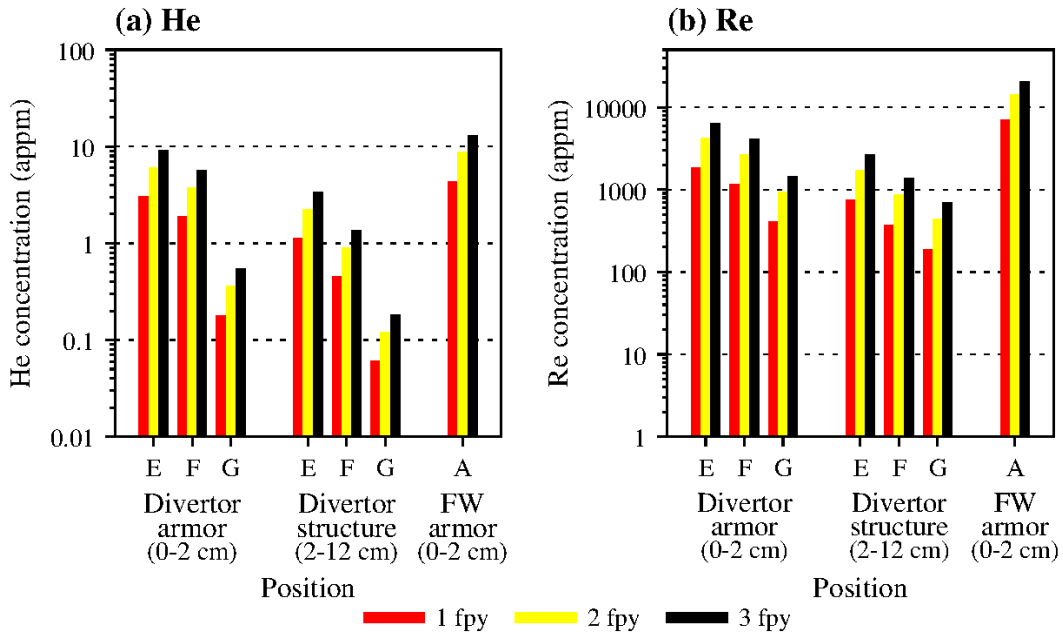
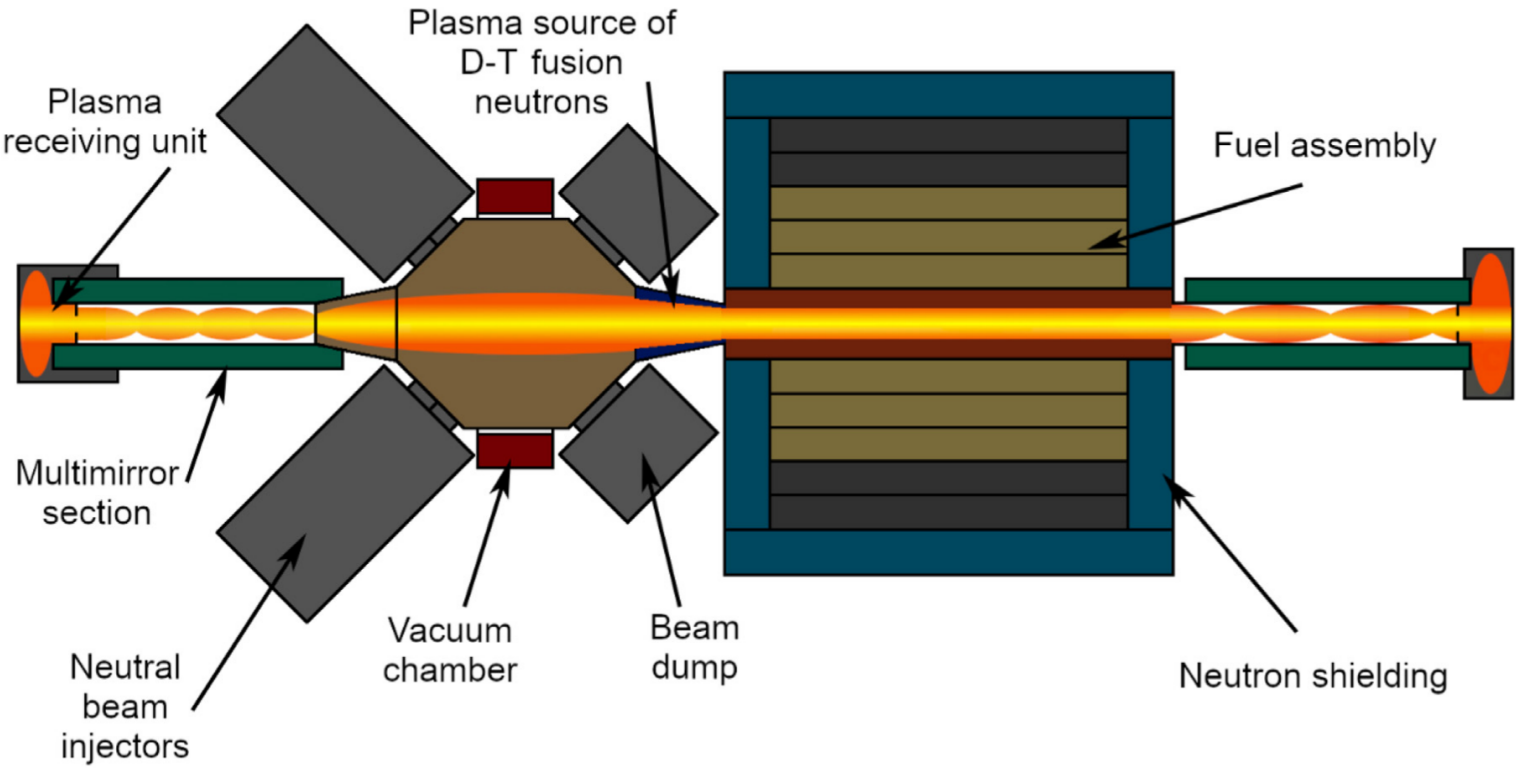


M. R. Gilbert *et al.* “Neutron-induced dpa, transmutations, gas production, and Heliun embrittlement in fusion materials” *J. Nuclear Mater.* **442** (2013) S755 – S760

Reator hibrido fusão - fissão



S. V. Bedenko *et al.* “Maintaining the close-to-critical state of thorium fuel core of hybrid reactor operated under control by D - T netrun flux” *Nuclear Eng. Tech.* **53** (2021) 1736 – 1746.