FUSION-DRIVEN TRANSMUTATION OF SELECTED LONG-LIVED FISSION PRODUCTS

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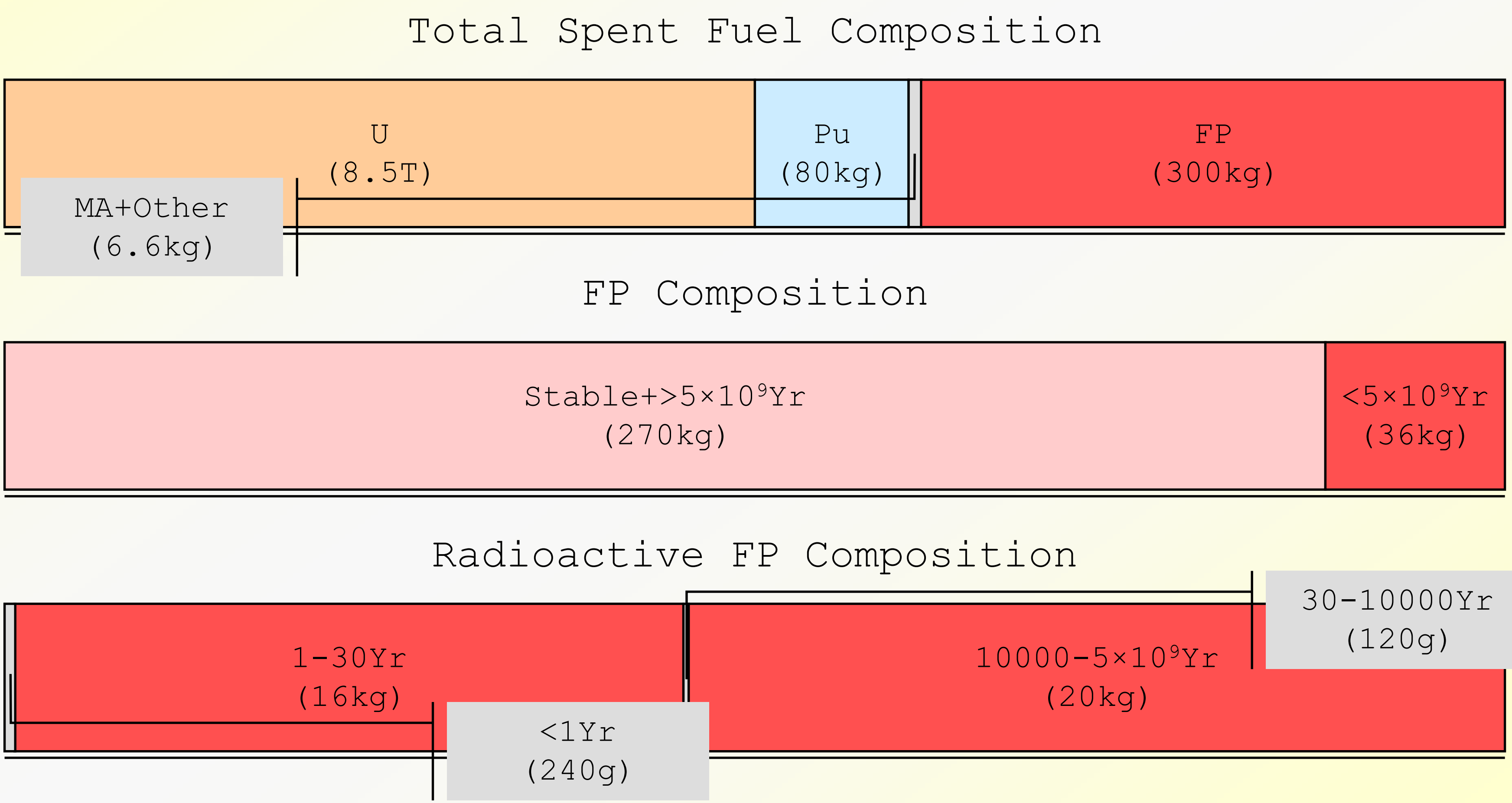
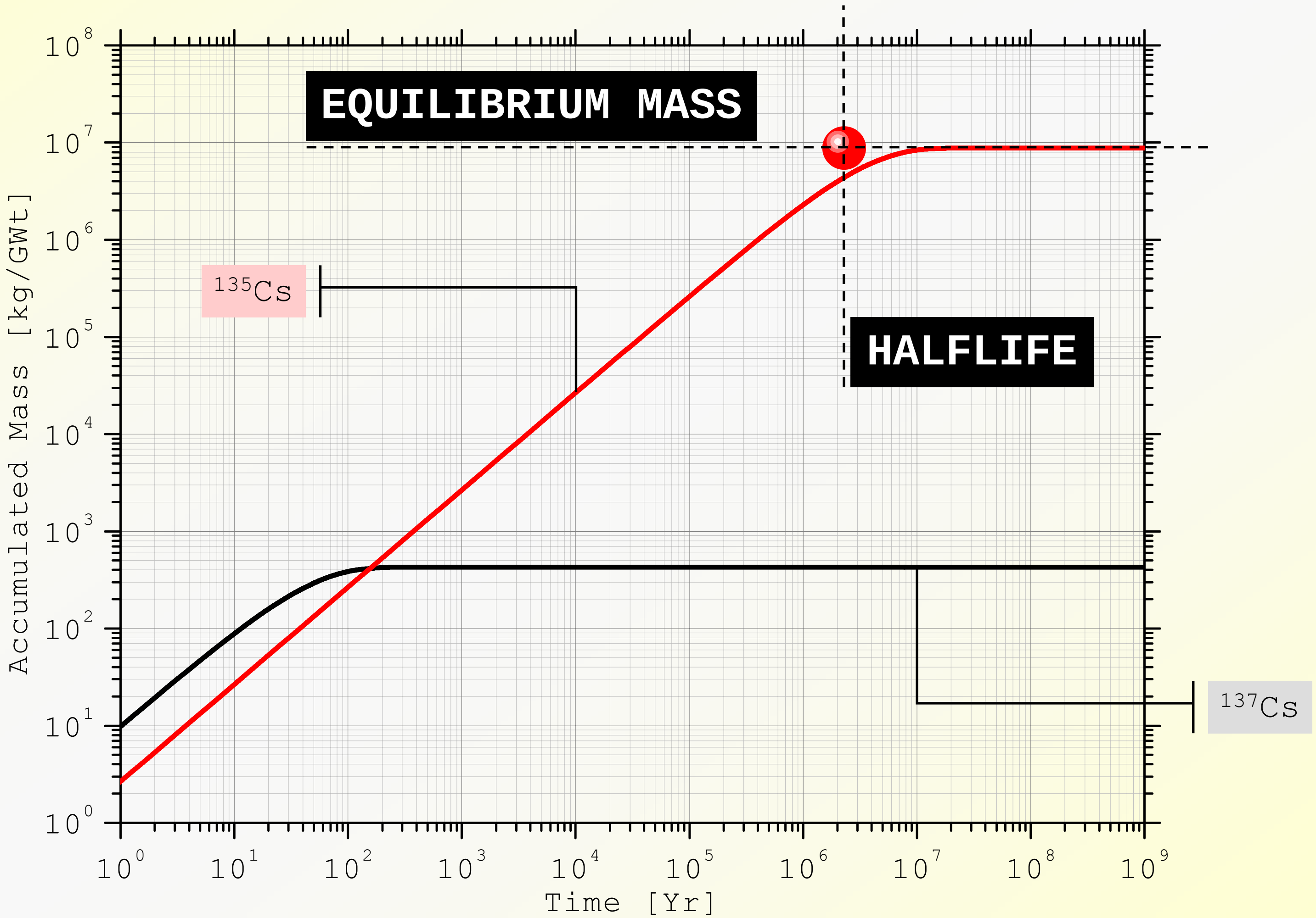
SPENT FUEL COMPOSITION

MASS OUTPUT NORMALIZED PER 1GWTYR OF FISSION ENERGY



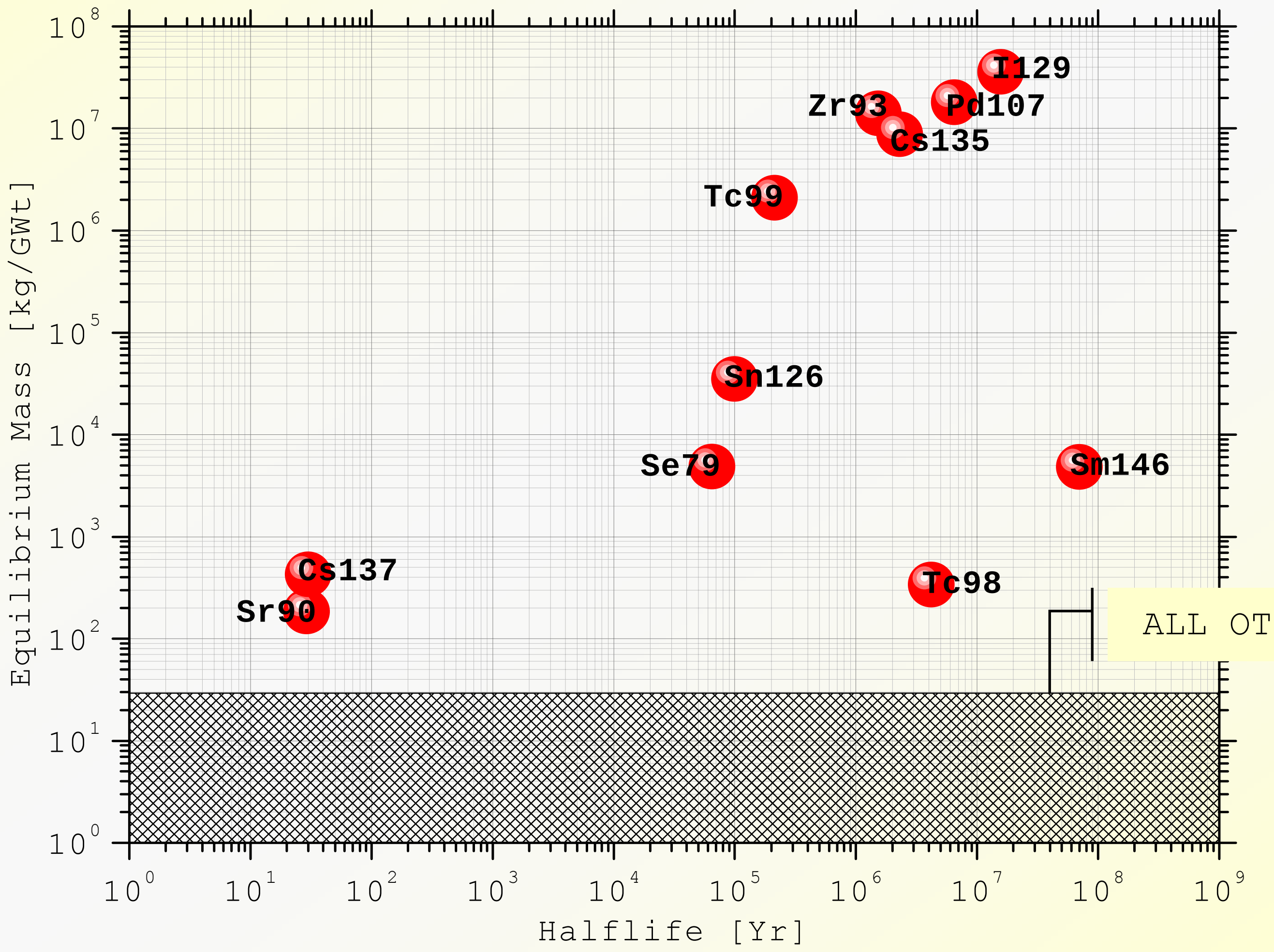
Footnote: PWR 33GWtd·THM^{-1} burnup and 3Yr cooling spent fuel

MASS BUILDUP OF RADIOACTIVE SPECIES



Footnote: ------------------------

ACCUMULATION OF FISSION PRODUCTS



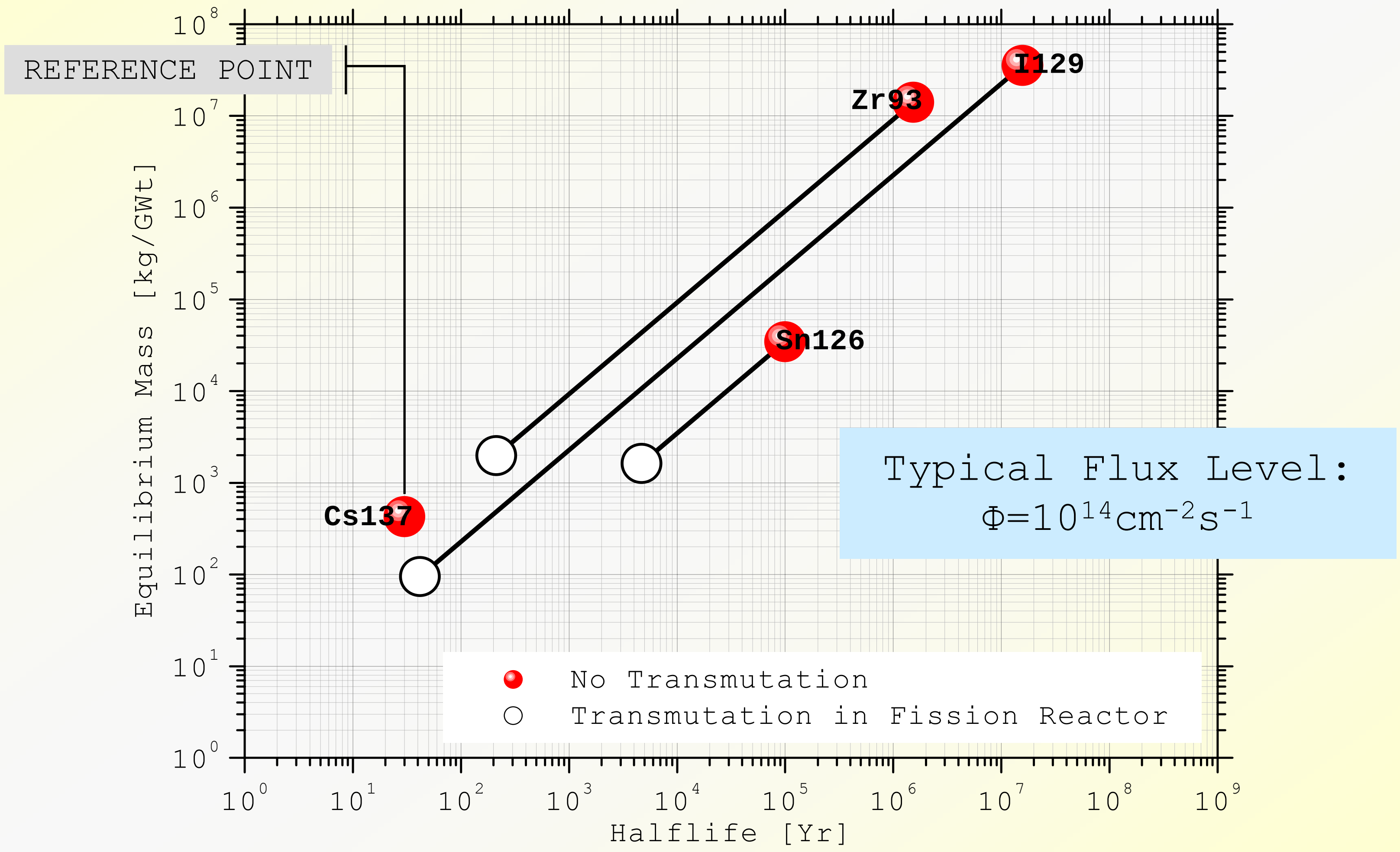
Footnote: PWR 33GWtd·THM^{-1} burnup and 3Yr cooling spent fuel

LLFP NUCLEAR REACTION DATA

Nuclide	Capture Thermal Point [barn]	Resonance Integral [barn]	(n,2n) Threshold [MeV]	(n,3n) Threshold [MeV]
^{79}Se	50	61	7.1	18
^{126}Sn	0.090	0.15	8.3	14
^{99}Tc	20	310	9.1	16
^{93}Zr	2.2	18	6.8	16
^{135}Cs	8.7	63	8.9	16
^{98}Tc	N/A	N/A	N/A	N/A
^{107}Pd	2.0	110	6.6	16
^{129}I	27	29	8.9	16
^{146}Sm	N/A	N/A	N/A	N/A

Footnote: Taken from JENDL3.2 nuclear data library

LLFP TRANSMUTATION IN THERMAL REACTOR



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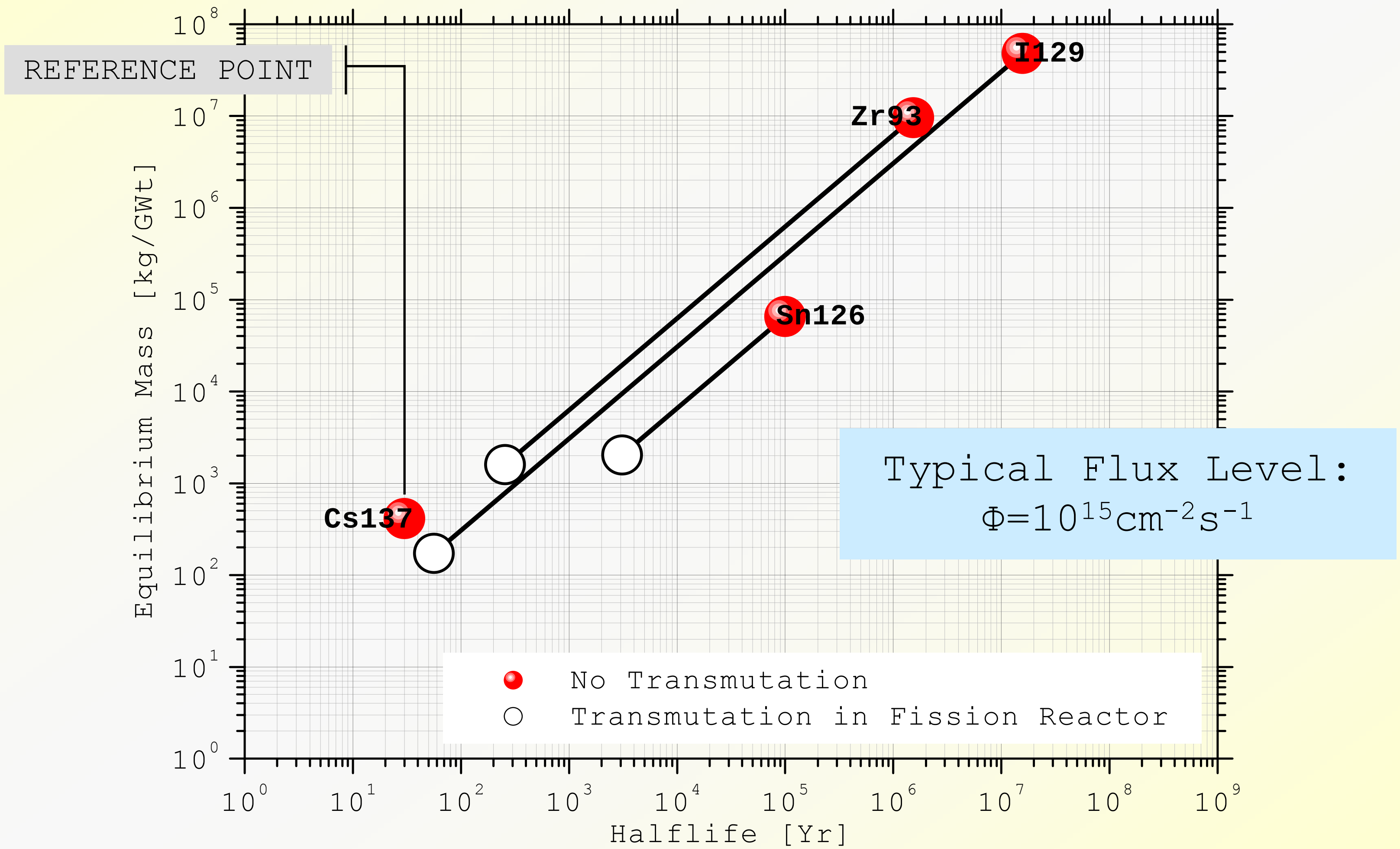
LLFP TRANSMUTATION IN FAST REACTOR



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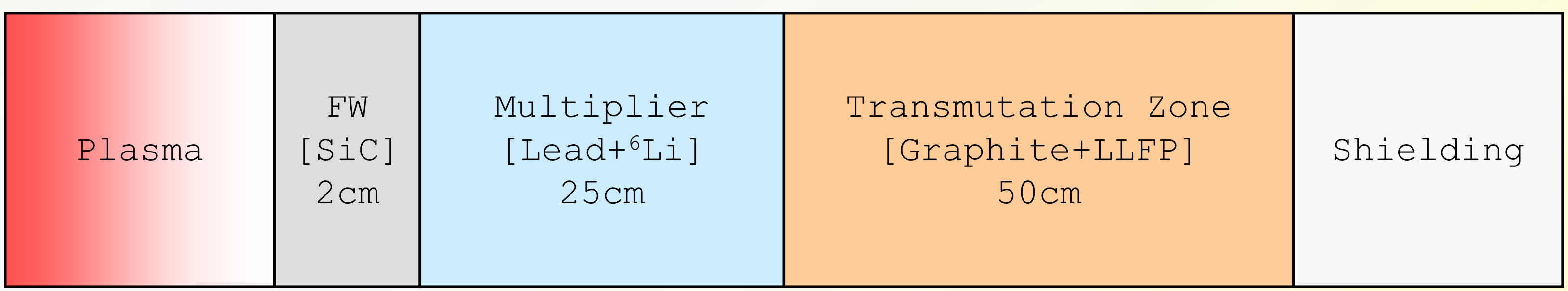
FUSION NEUTRON SOURCE

Neutron Availability → Flux is mostly governed by FWL value

Neutron Quality → Great FLEXIBILITY to create neutron spectrum desired

THERMAL FLUX BLANKET BASIC CONCEPT



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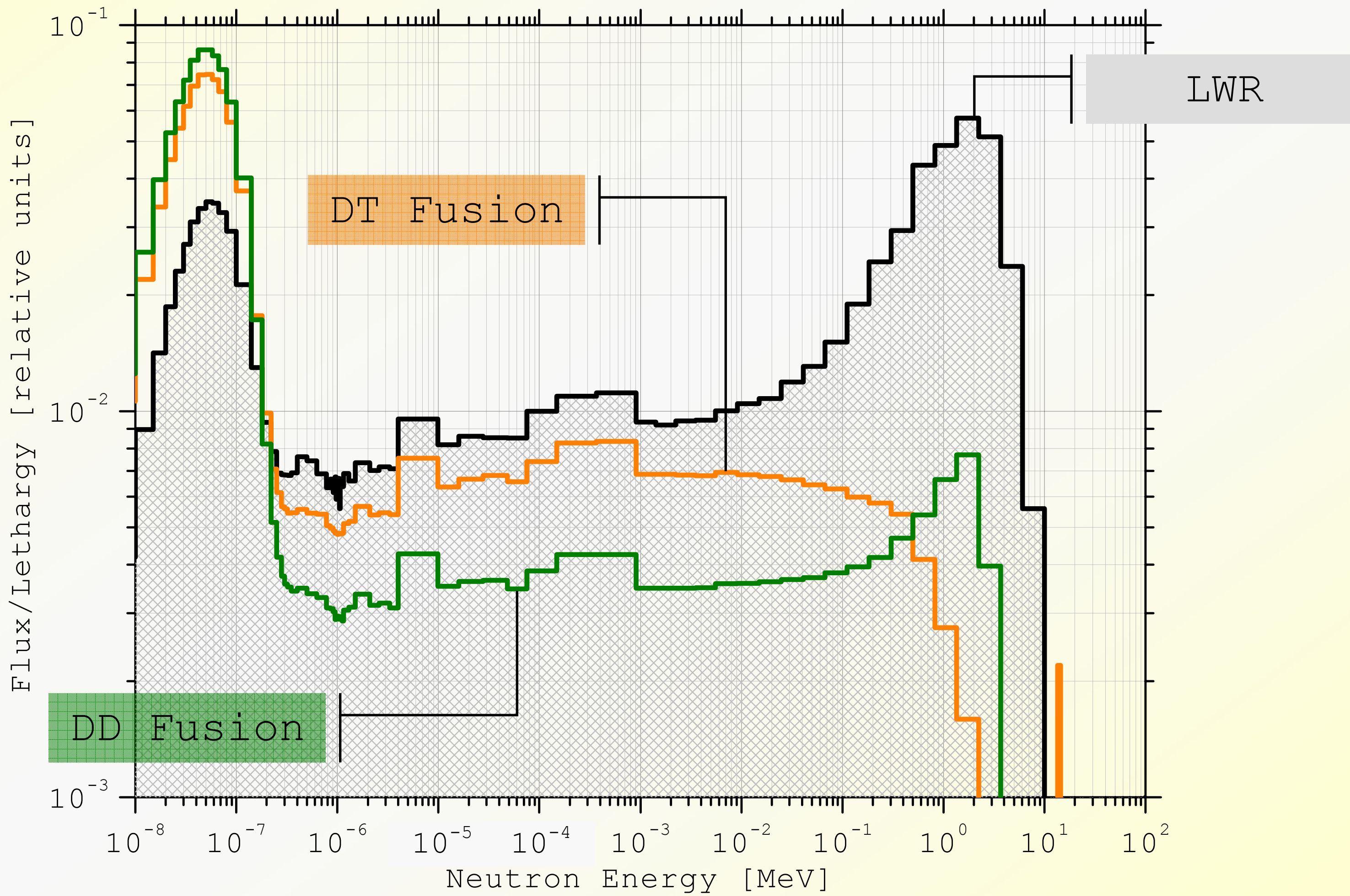
SPECTRA OVER TRANSMUTATION ZONE



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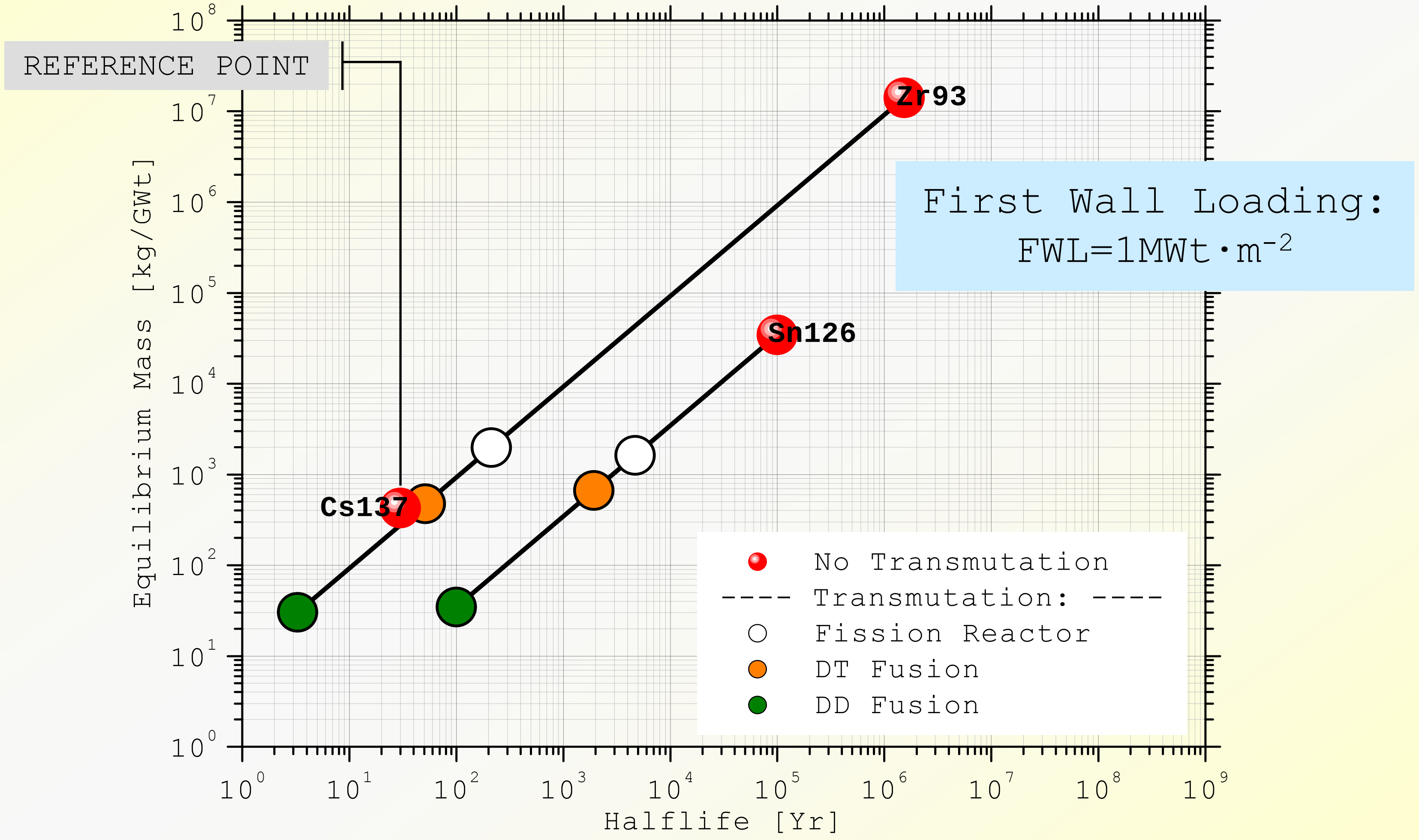
LLFP TRANSMUTATION IN FUSION FACILITY



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LLFP TRANSMUTATION EFFICIENCY

Facility	^{93}Zr		^{126}Sn	
	Effective Halflife [Yr]	Equilibrium Mass [$kg \cdot GWt^{-1}$]	Effective Halflife [Yr]	Equilibrium Mass [$kg \cdot GWt^{-1}$]
Thermal Reactor	210	2000	4700	1600
Fast Reactor	260	1400	3000	1700
DT Fusion	51	470	1900	670
DD Fusion	3.3	30	100	34

Footnote: ------------------------

CONCLUSION

LLFP transmutation by means of fission facilities is not efficient enough to drastically reduce the burden associated with LLFP

Given its neutron environment FNS is appearing to be the candidate No.1 for LLFP transmutation

In the study presented the potential of thermal flux blanket of FNS has been analyzed on ^{93}Zr and ^{126}Sn the most difficult LLFP to transmute

Footnote: ------------------------