Argonne NATIONAL LABORATORY

Performance of the β2 Data for a Series of Diverse ZPR/ZPPR Assemblies

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List of "As-Built" Benchmark Models

ZPR-6/6A	IEU-COMP-FAST-001	UO2 LMFBR - HEU/DU/Na/Steel/Fe2O3/U3O8 core - Du reflector
ZPR-6/7	MIX-COMP-FAST-001	Mixed oxide LMFBR - Pu/DU/Na/Steel/Fe2O3/U3O8 core - DU reflector
ZPPR-21A	PU-MET-FAST-033	IFR fuel casting - 12.5 v/o Pu-U-Mo/25 v/o Pu-Al/12.5 v/o Zr/6.25 v/o DU/18.75 v/o SST/25 v/o void unit cell - graphite reflector
ZPPR-21B	MIX-MET-FAST-011	IFR fuel casting - 12.5 v/o Pu-U-Mo/18.75 v/o Pu-Al/12.5 v/o Zr/6.25 v/o DU/25 v/o void/21.875 v/o SST/3.125 v/o HEU unit cell - graphite reflector
ZPPR-21C	MIX-MET-FAST-011	IFR fuel casting - 12.5 v/o Pu-U-Mo/12.5 v/o Pu-Al/12.5 v/o Zr/6.25 v/o DU/25 v/o void/21.875 v/o SST/9.375 v/o HEU unit cell - graphite reflector
ZPPR-21D	MIX-MET-FAST-011	IFR fuel casting - 12.5 v/o Pu-U-Mo/6.25 v/o Pu-Al/12.5 v/o Zr/6.25 v/o DU/25 v/o void/25 v/o SST/12.5 v/o HEU unit cell - graphite reflector
ZPPR-21E	MIX-MET-FAST-011	IFR fuel casting - 12.5 v/o Pu-U-Mo/12.5 v/o Zr/6.25 v/o DU/25 v/o void/25 v/o SST/18.75 v/o HEU unit cell - graphite reflector
ZPPR-21F	HEU-MET-FAST-061	IFR fuel casting - 25 v/o HEU/12.5 v/o Zr/12.5 v/o DU/18.75 v/o SST/31.25 v/o void unit cell - graphite reflector

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ZPR-9/1	IEU-MET-FAST-013	HEU/DU core - Al reflector - ~11% enrichment - 12.5 v/o HEU/87.5 v/o DU unit cell
ZPR-9/2	IEU-MET-FAST-014	HEU/DU/W core - Al reflector - ~16% enrichment - 12.5 v/o HEU/62.5 v/o DU/25 v/o W unit cell
ZPR-9/3	IEU-MET-FAST-014	HEU/DU/W core - Al reflector - ~21% enrichment - 12.5 v/o HEU/43.75 v/o DU/43.75 v/o W unit cell
ZPR-9/4	HEU-MET-FAST-060	HEU/W core - Al reflector - 18.75 v/o HEU/81.25 v/o W unit cell
ZPR-9/5	HEU-MET-FAST-067	HEU/W/C core - Al reflector - 12.5 v/o HEU/43.75 v/o W/43.75 v/o C unit cell
ZPR-9/6	HEU-MET-FAST-067	HEU/W/Al (perforated) core - Al reflector - 12.5 v/o HEU/43.75 v/o W/43.75 v/o Al (45% Al,55% void) unit cell
ZPR-9/7	HEU-MET-FAST-070	HEU/W/Al (perforated) core - Al2O3 reflector - 12.5 v/o HEU/43.75 v/o W/43.75 v/o Al (45% Al,55% void) unit cell
ZPR-9/8	HEU-MET-FAST-070	HEU/W/Al2O3/Al (perforated) core - Al ax ref, BeO rad, Al outer rad ref-12.5 v/o HEU/43.75 v/o W/25 v/o Al2O3-18.75 v/o Al (45% al,55% void) unit cell
ZPR-9/9	HEU-MET-FAST-070	HEU/W/Al2O3/Al (perforated) core - Al2O3 reflector, Al outer reflector - 12.5 v/o HEU/43.75 v/o W/25 v/o Al2O3/18.75 v/o Al (45% Al,55% void) unit cell

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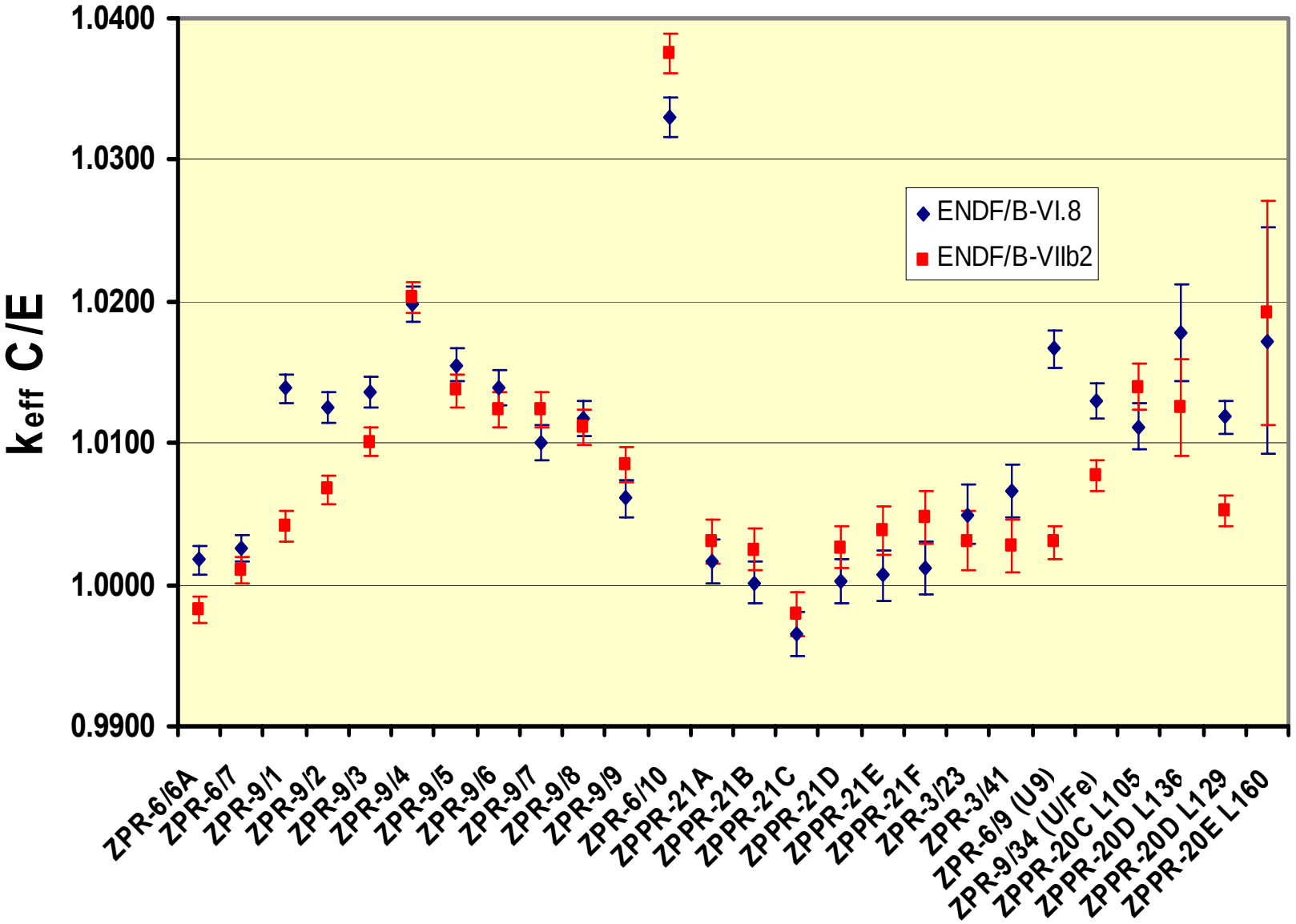
ZPR-6/10	PU-MET-INTER-002	Pu/C/Steel core - Steel reflector, Iron radial reflector - 6.25 v/o Pu/37.5 v/o C/56.25 v/o steel unit cell
ZPR-3/23	HEU-MET-FAST-055	HEU/Al (perforated) core - DU reflector -12.5 v/o HEU/87.5 v/o Al (63% Al/37% void) unit cell
ZPR-3/41	IEU-MET-FAST-012	HEU/DU/Steel/Al (perforated) core - DU reflector - ~16% enrichment - 7.8125 v/o HEU/35.9375 v/o DU/6.25 v/o SST/50 v/o Al (45% Al,55% void) unit cell
ZPR-6/9 (U9)	IEU-MET-FAST-010	HEU/DU core - DU reflector - ~9% enrichment - 9.375 v/o HEU/90.625 v/o DU unit cell
ZPR-9/34 (U/Fe)	HEU-MET-INTER-001	HEU/Fe/Stainless steel core - Stainless steel reflector - 3.125 v/o HEU/87.5 v/o Fe/9.375 v/o stainless steel unit cell
ZPPR-20C L105	HEU-MET-FAST-075	HEU/Li/Nb/Re core-BeO rad ref-Be ax ref-SP-100 mockup
ZPPR-20D L136	SUB-HEU-MET-MIXED-001	HEU/poly/Nb/Re core-BeO rad refl-Poly rad, axial refl-SP-100 mockup with flooding-subcritical
ZPPR-20D L129	HEU-MET-MIXED-012	HEU/poly/Nb/Re core-BeO rad refl-Poly rad, axial refl-SP-100 mockup with flooding-critical reference
ZPPR-20E L160	SUB-HEU-MET-FAST-001	HEU/Li/Nb/Re core-BeO rad refl-Sand rad, axial refl-SP-100 mockup with earth burial-subcritical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ZPPR-21A
ZPPR-21B
ZPPR-21C
ZPPR-21D
ZPPR-21E
ZPPR-21F
ZPR-3/23
ZPR-3/41
ZPR-6/9 (U9)
ZPR-9/34 (U/Fe)
ZPPR-20C L105
ZPPR-20D L136
ZPPR-20D L129
ZPPR-20E L160

Observations

- Comparison of 6/6A and 6/7 shows small bias (^{239}Pu more reactive than ^{235}U) – not observed for Godiva and Jezebel
- ZPR-9 Assemblies 1-4 shows degradation of performance as Tungsten replaces ^{238}U
- ZPR-6/10 (Pu/C/SST) very bad (+3.8% delta-k)
- ZPR-6/9 (U9) shows same dramatic improvements with β2 as Big Ten
- Large biases for Space Nuclear criticals (ZPPR-20 Phases C, D, and E)