

Comparison of Pool/Loop Configurations in the JAEA feasibility study 1999-2006

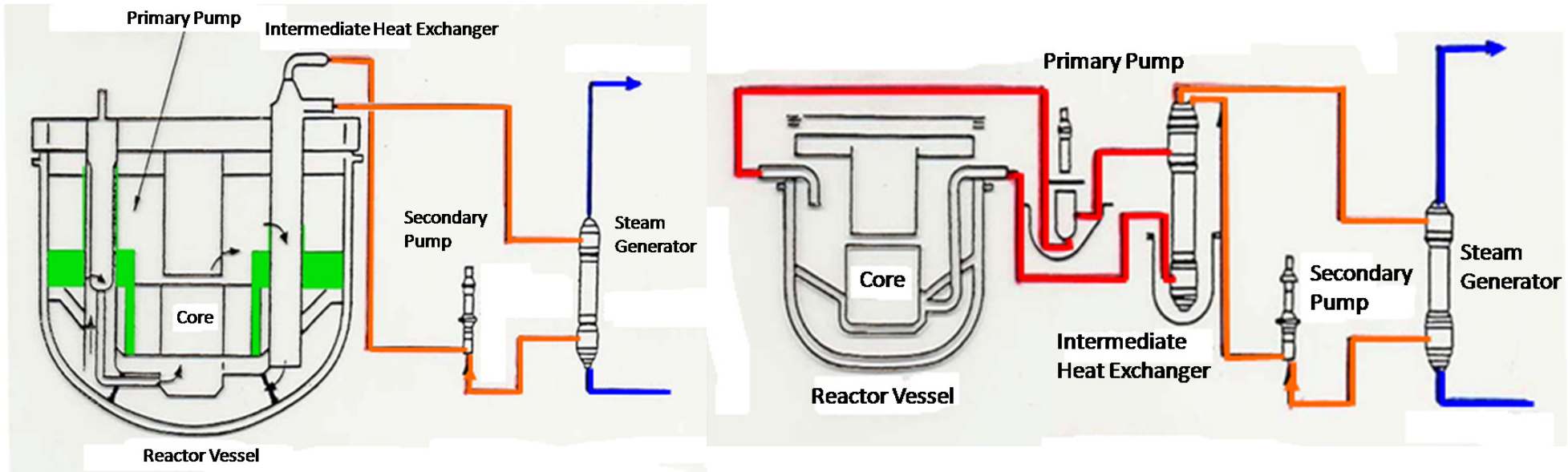
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FR09 December 7 and 11, 2009, Kyoto, Japan

Introduction



Pool

EBR-II (USA)
 PFR (UK)
 Phenix, Superphenix (France)
 BN-600 (Russia)
 PFBR (India)

Loop

EBR-I, Fermi, SEFOR, CRBR, FFTF (USA)
 DFR (UK)
 Rapsodie (France)
 KNK-II, SNR-300 (Germany)
 BOR-60, BN-350 (Russia)
 FBTR (India)
 CEFR (China)
 JOYO, Monju (Japan)

Conventional Comparison

Item	Pool	Loop
Transient	Large thermal inertia	Small thermal inertia
Coolant leak	Primary coolant contained in a vessel	Primary piping covered with guard pipe
Inspection	Difficult inspection due to complex reactor inner structure	Inspection to safety related parts could be secured
Cost	-	Slightly larger
Simplified Secondary System	Not matched	Matched

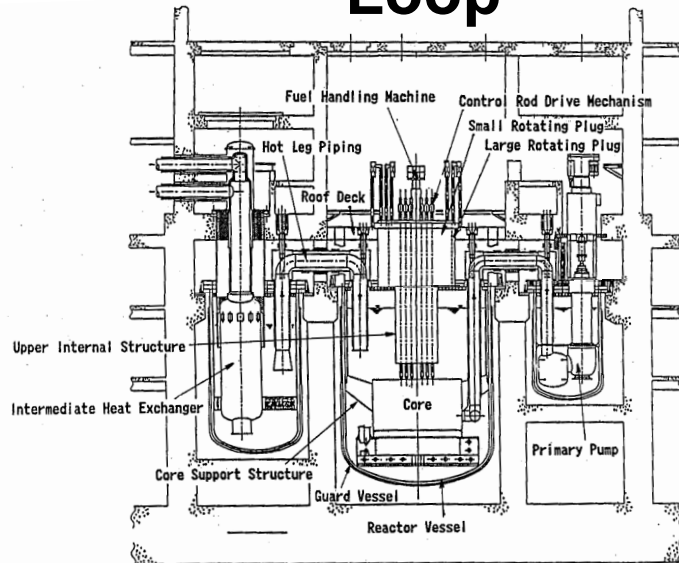
Pool/Loop Commercial Concept

Country	Prototype	Commercial
USA	Loop (CRBR)	Pool (IFR)
UK	Pool (PFR)	Pool (CDFR)
France	Pool (Phenix)	Pool (SPX-2, EFR)
Germany	Loop (SNR-300)	Pool (SNR-2)
Russia	Loop (BN-350)	Pool (BN-600, BN-800)
Japan	Loop (Monju)	Loop (JSFR)

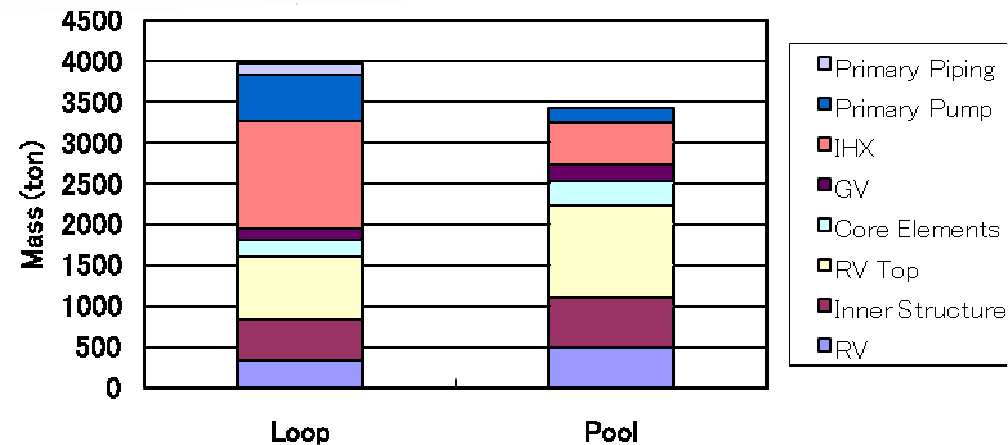
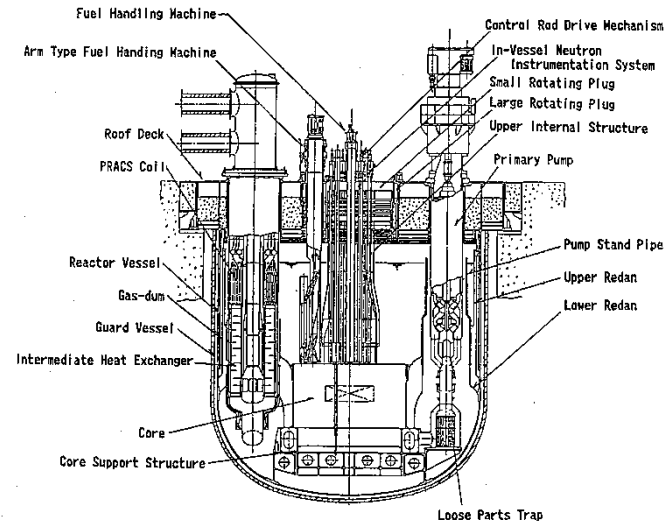
Pool/Loop in JAPC DFBR study in 1989

DFBR (JAPC)

Loop



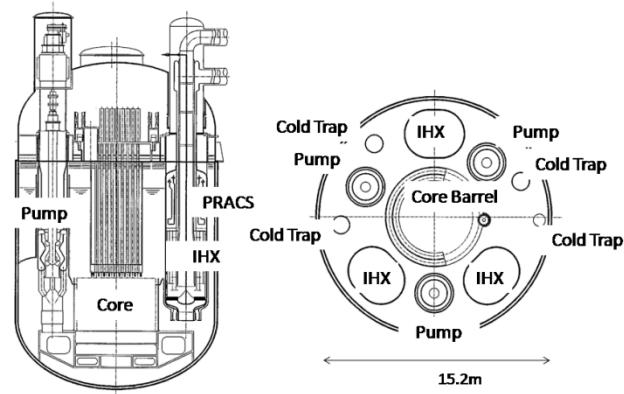
Pool



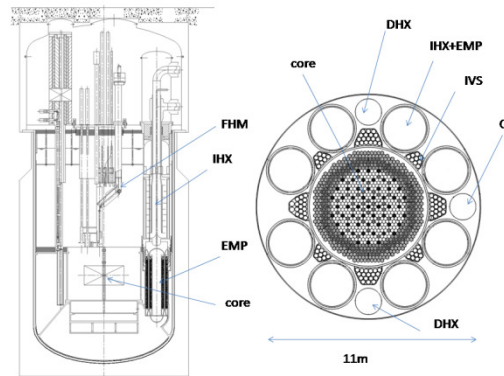
H. Nakagawa, M. Yoshimura, T. Inagaki, M. Hamada, M. Ichimiya, H. Shiraishi, H. Shibata, Y. Kumaoka, N. Nakao, T. Meshii, "Design Studies and R&D Activities for DFBR evaluation", Proceedings of International Conference on Fast Reactors and Related Fuel Cycles, Kyoto Japan, November 1991.

FS Pools (1999-2000)

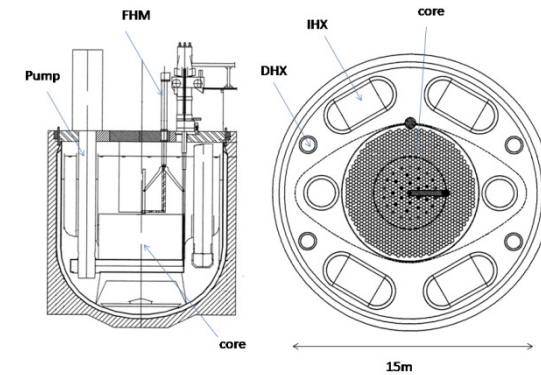
<Pool-1>



<Pool-2>



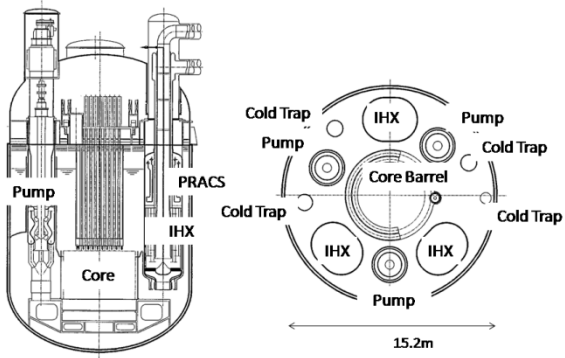
<Pool-3>



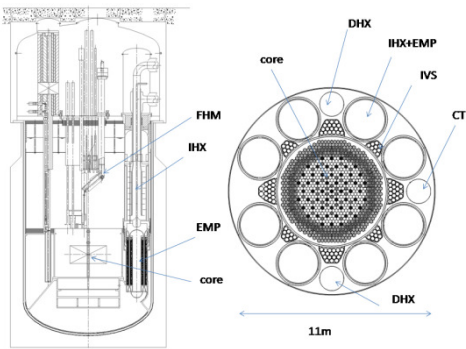
Item	Pool-1	Pool-2	Pool-3
Electric Power	1500	1600	1500
Thermal Power	3660	3800	3600
Sodium Temp. (deg-C)	550	550	545

T. Mihara et. al., "Feasibility Study on Fast Breeder Reactor Plant Systems –Result in 2000", JNC TY9400 2001-012

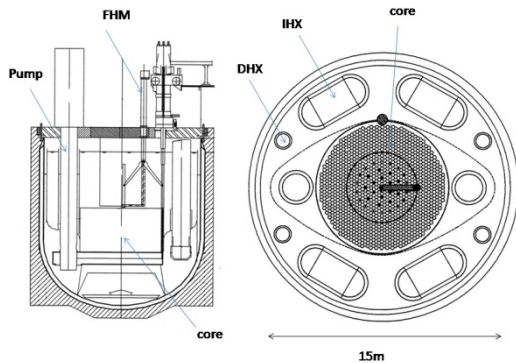
FS Pool (2001)



<Pool-1> → FS-Pool(2000)

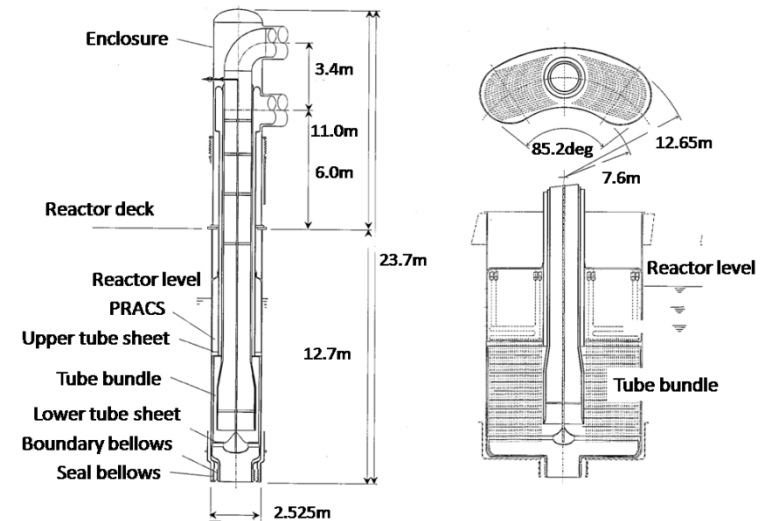
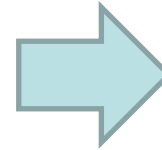
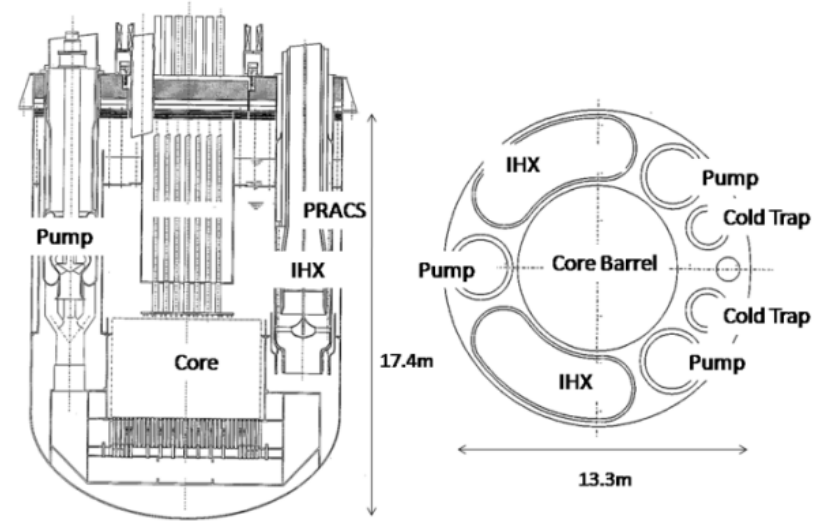


<Pool-2>



<Pool-3>

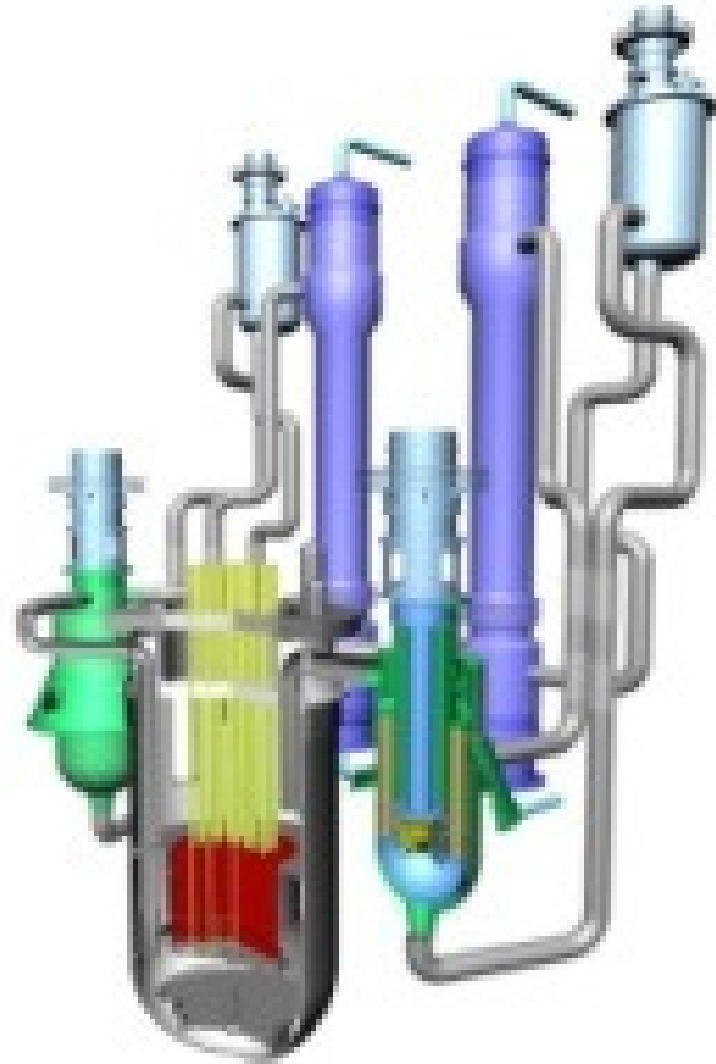
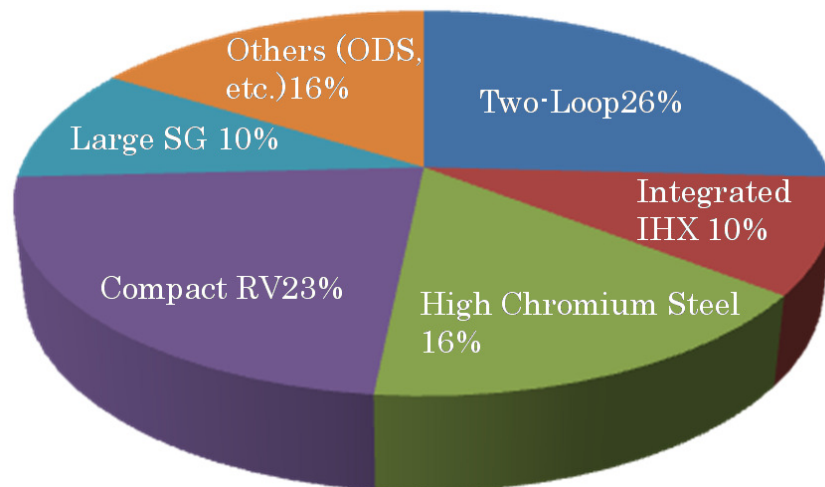
FS-Pool(2001)



FS Loop Concept (JSFR)

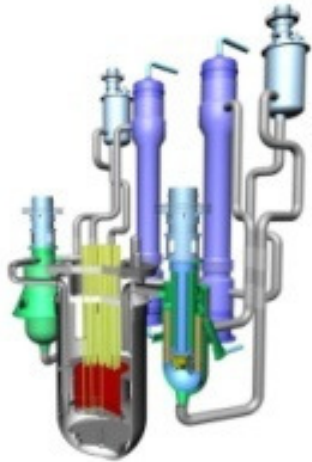
■ Innovative technologies

- *Advanced Cladding Material*
- *Two Loop Cooling System*
- *Compact Reactor Vessel*
- *High Chromium Steel Piping*
- *Integrated Pump-IHX Component*
- *Simplified Fuel Handling System*

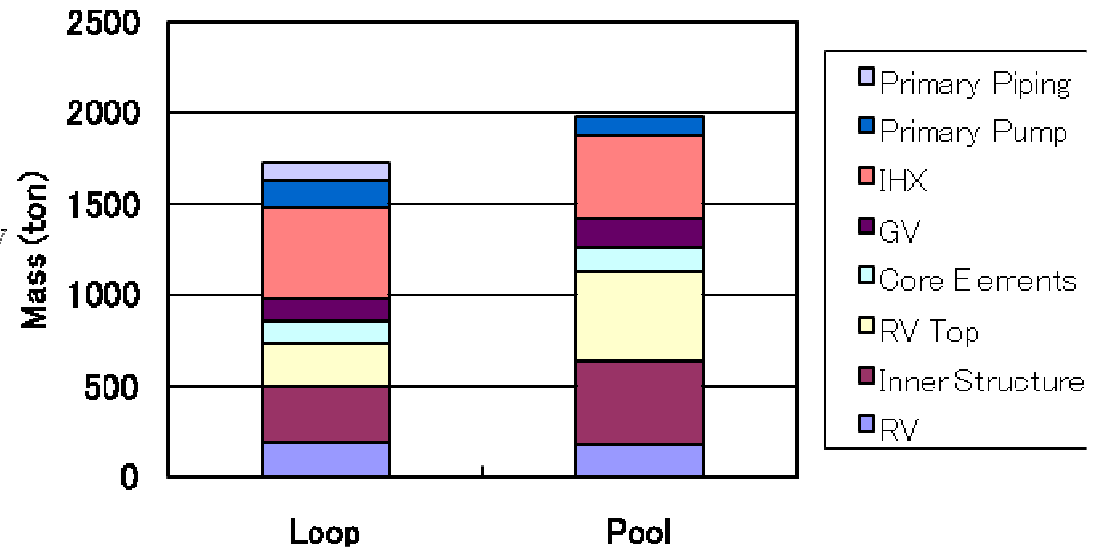
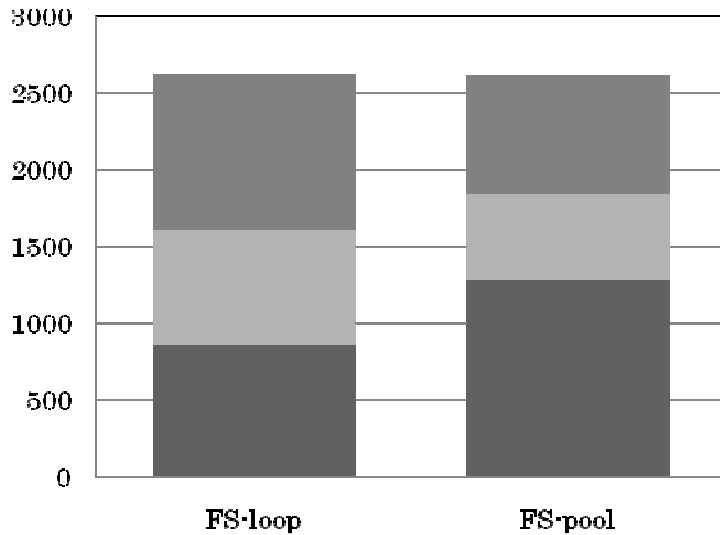
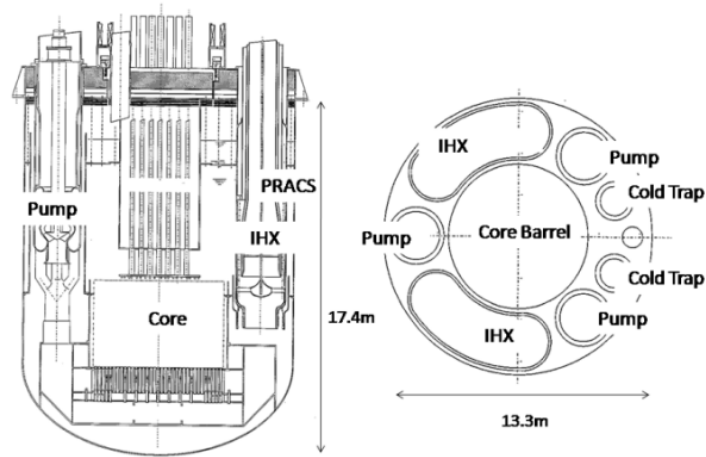


FS Pool/Loop Comparison

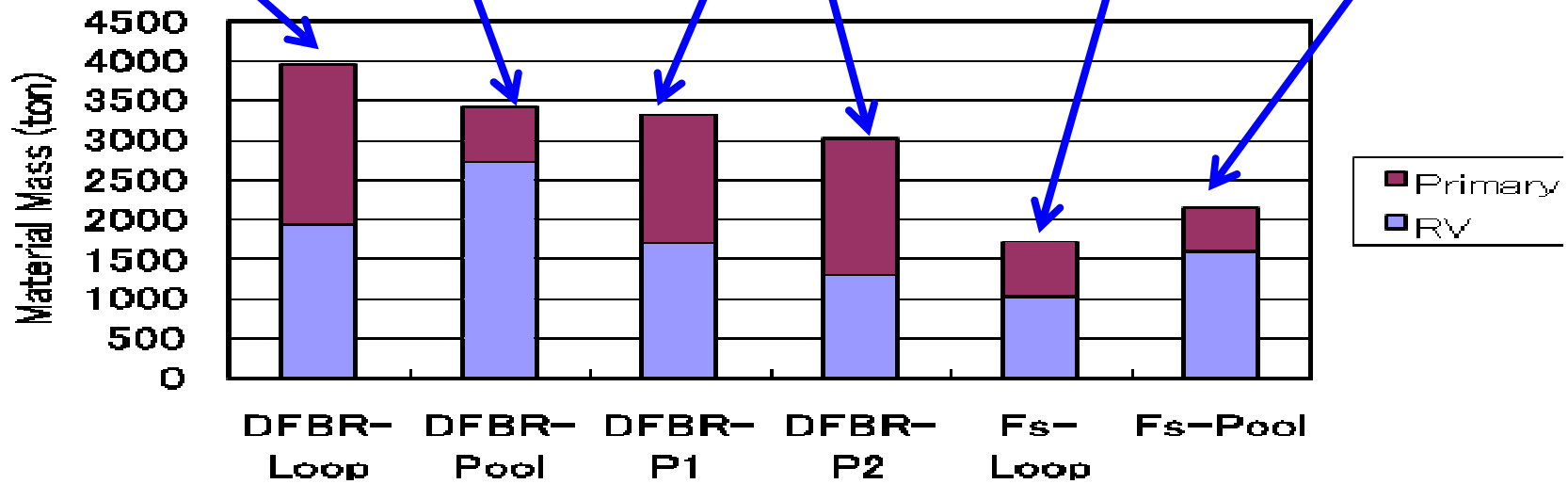
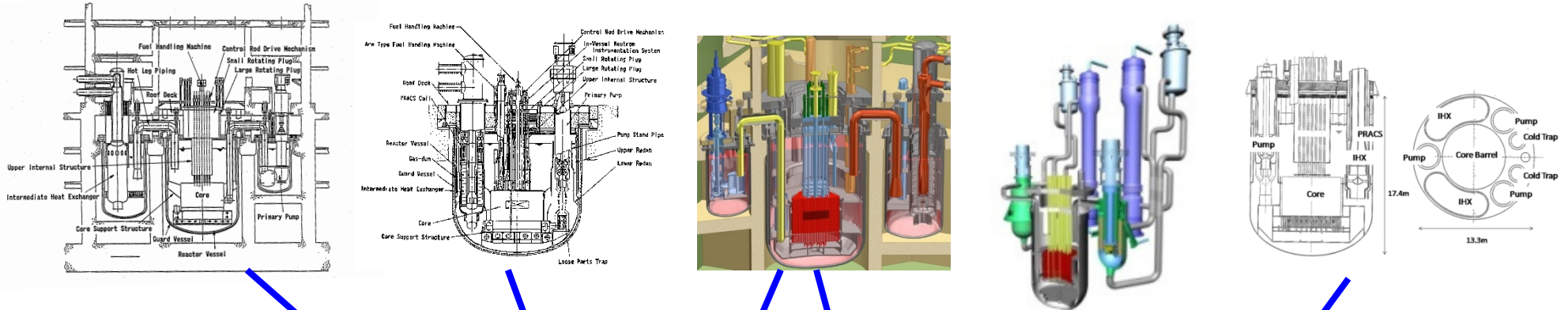
FS-Loop(2001)



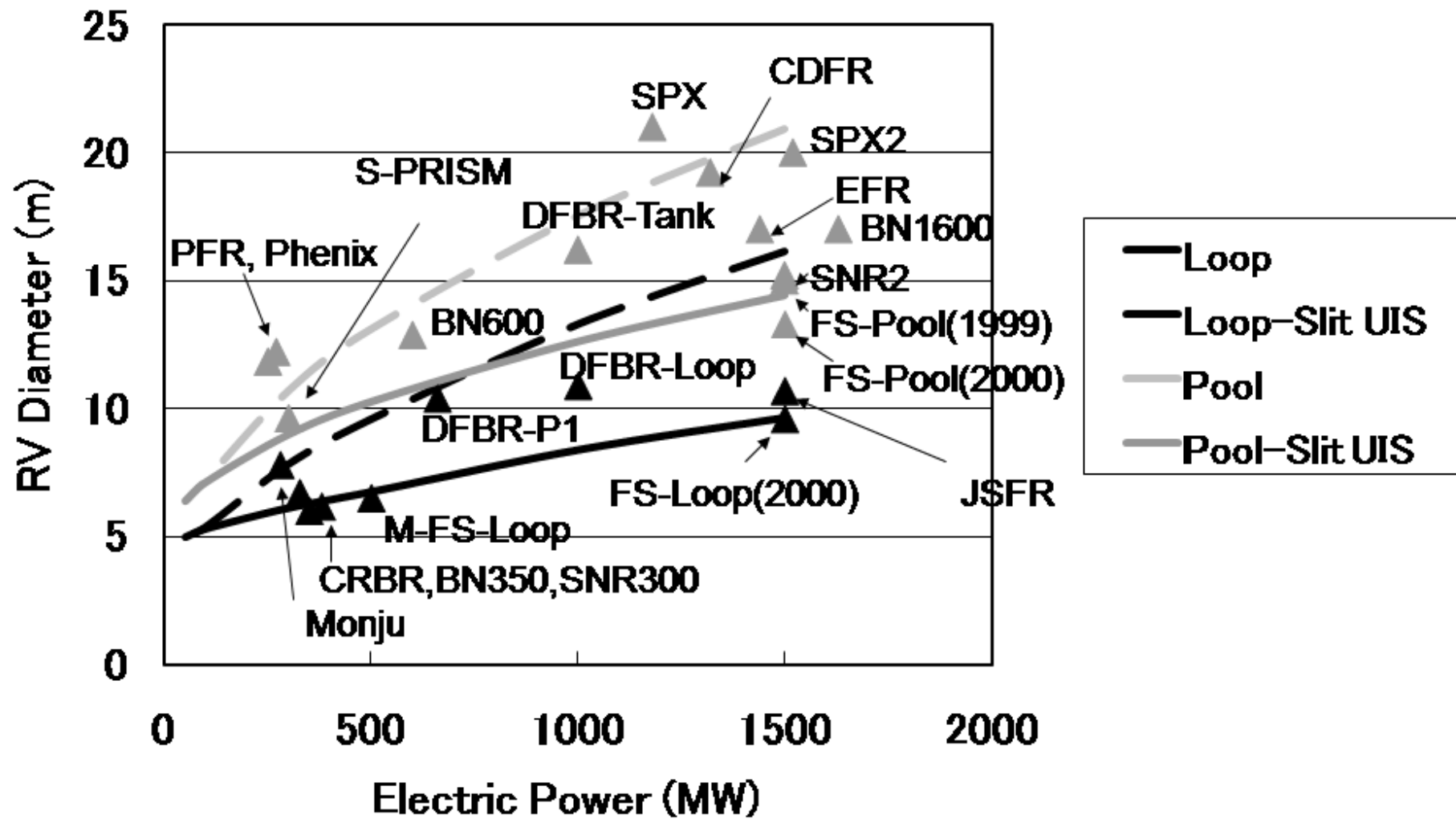
FS-Pool(2001)



Mass Comparison Change from DFBR to JSFR



Pool or Loop (Advanced cont.)



Conclusions

- ❑ FS-pool concept is one of the most compact pool concept ever.
- ❑ FS-loop concept (JSFR) reduces NSSS mass dramatically.
- ❑ We have provided a new pool/loop comparison matrix.

New Pool/Loop Comparison Matrix

Item	Pool	Loop
Transient	Large thermal inertia	Small thermal inertia
Coolant leak	Primary coolant contained in a vessel	Primary piping covered with guard pipe
Inspection	Difficult inspection due to complex reactor inner structure	Inspection to safety related parts could be secured
Construction cost	-	Slightly disadvantage → Slightly advantage
Simplified Secondary System	Not matched	Matched