A Comparison of Unit Costs for FIRE and ITER

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http://fire.pppl.gov

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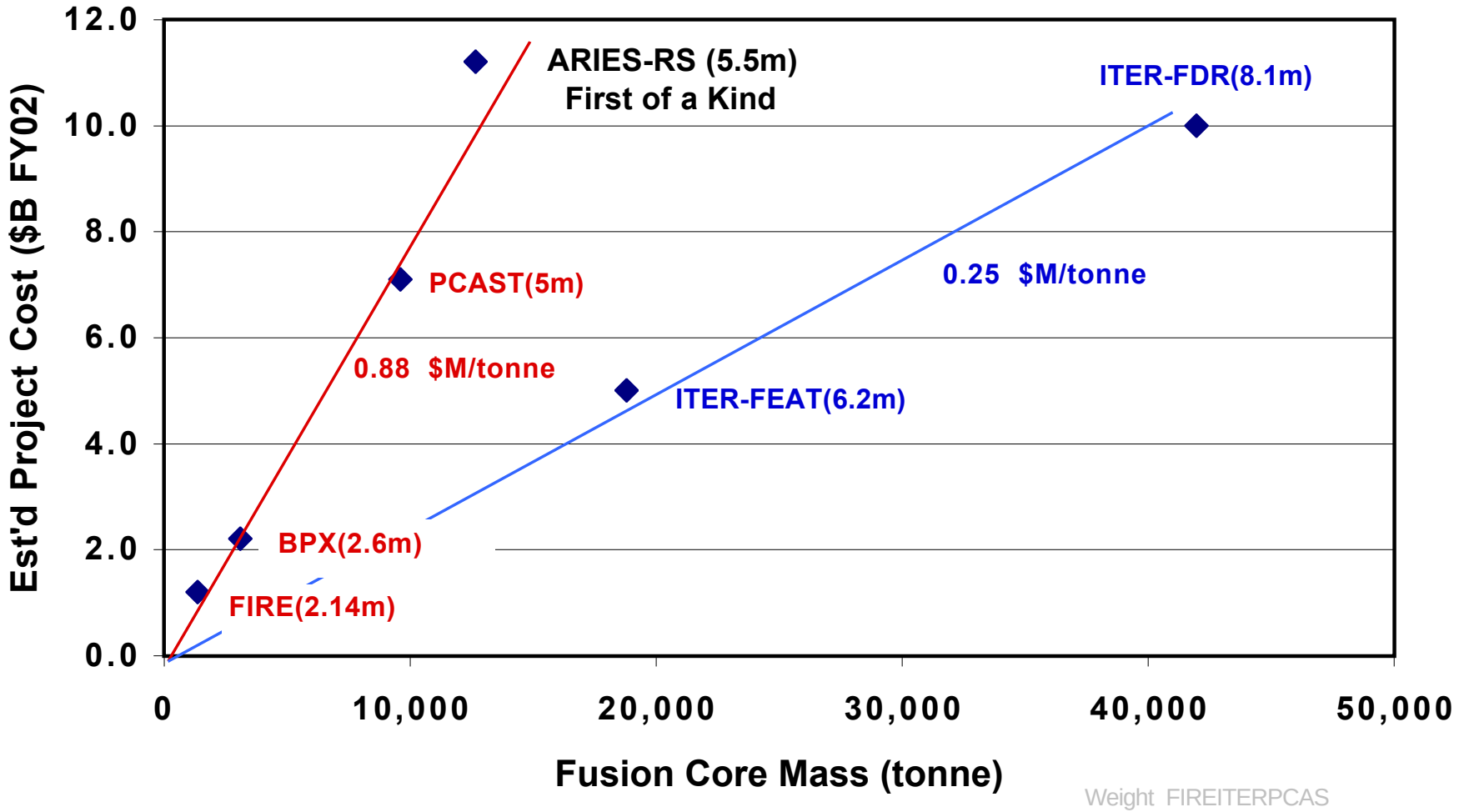
- A simple rule of thumb for comparing costs of similar devices/projects is to compare the cost/weight or $/lb.
- The estimated total project cost of several proposed burning plasma experiments was compared with the weight of the fusion power core (cryostat and everything inside).

	FIRE	BPX	PCAST5	ARIES-RS	ITER-FEAT	ITER-EDA
Major Radius (m)	2.14	2.59	5.0	5.5	6.2	8.1
Weight (tonne)	1,371	3,099	9,607	12,678	18,812	41,968
$B (FY02)	1.2	2.2	7.1	11.2	5	10
$M / tonne	0.88	0.71	0.74	0.88	0.27	0.25

- References

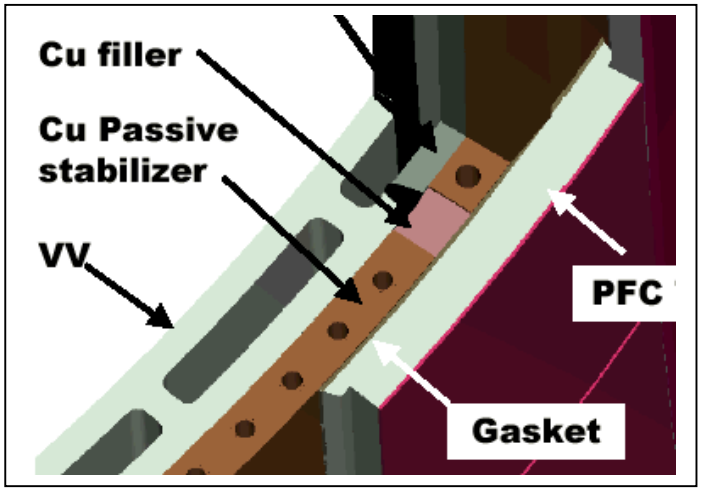
FIRE – Snowmass 2002 Report
BPX – Symposium of Fusion Engineering Proceedings (IEEE), September 1991
PCAST5 – PCAST Design Report, December 1995 (http://fire.pppl.gov)
ARIES-RS – ARIES-RS Final (8/30/96), (http://aries.ucsd.edu/ARIES/wdocs/)
ITER-FEAT – ITER Technical Basis, IAEA 2002, G A0SP 2 01-06-01 R2.0
ITER-EDA – Technical Basis for ITER-FDR, IAEA no. 16,1998,

Correlation of Estimated Total Project Cost and Fusion Core Mass

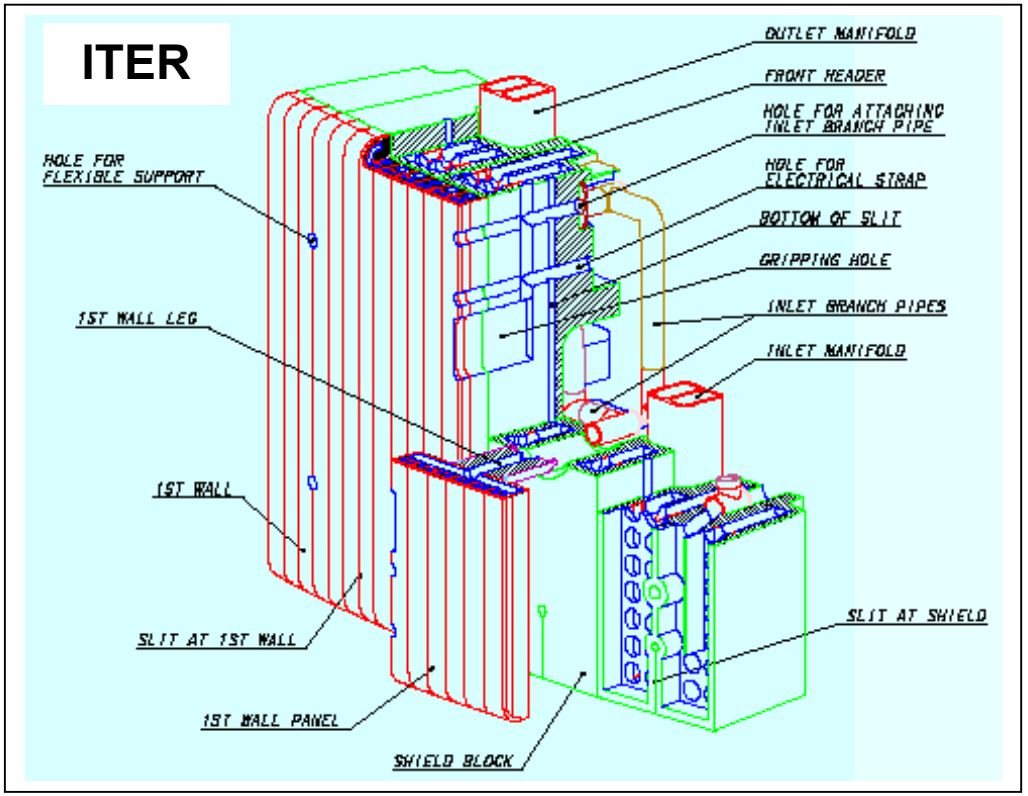


Comparison of FIRE First Wall Tiles with ITER First Wall and Blanket Cost

FIRE



ITER



	FIRE	ITER
Weight (tonne)	28.6	1530
Surface Area (m^2)	88	939
Cost ($M,FY02)	21	237
Cost/Area ($M/$m^2$)	0.24	0.25
Cost/tonne ($M/tonne)	0.73	0.15

Comparison made as a result of Snowmass discussions

Comments on the Unit Cost Comparison of FIRE and ITER

- FIRE costs are in line with the cost estimates for other low tech (LN cooled BeCu plate coils, inertial first wall cooling, low nuclear requirements) facilities (BPX and PCAST5.

- The similarity of FIRE and ARIES-RS (advanced tokamak power plant) unit costs of $0.88M/tonne could be due to economy of scale counteracting the increased costs due to high tech requirements.

- The ITER costs appear to scale with fusion core mass, but the unit cost is ≈ 1/3 the unit cost of FIRE, PCAST5 and ARIES-RS. The lower unit cost of ITER-FEAT, (superconducting, near steady state cooling with near power plant regulatory requirements) does not seem reasonable when compared to the simpler low tech burning plasma experiments like FIRE.