Report on Vectorization Application Review

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Present NERSC Configuration

	Number of Processors	Memory per processor (MW)	Time Relative to C-90
T3E	120	32(D)	1-11[+]
C-90	16	16(S)	1
J90-K	32	32(S)	3-4
J90-F	32	32(S)	3-4
J90-B	32	32(S)	3-4
T932[*]	32	32(S)	.5

[*] Not presently planned for NERSC

[+] No penalty assumed for distributive memory

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Results of PPPL Codes Survey

	Present Run mem(MW) time(hr)	Parameters Needed mem(MW) time(hr)	Runtime Factor DEC-alpha / C-90
small codes[0]	1 -- 0.1	1 -- 0.5	2
2D MHD[1]	20 -- 5	80 -- 40	6
3D MHD[2]	40 -- 16	320 -- 350	11
3D PIC[3]	40 -- 40	400 -- 400	11
Monte-Carlo[4]	1 -- 1	1 -- 60	1
Linear Eigenvalue[5]	40 -- 0.1	400 -- 1	1

E.g.:
[0]FULL
[1]TSC
[2]MH3D, GYROFLUID
[3]ORBIT, MH3D-K, Gyrokinetic
[4]DEGAS2

[5]PEST, SPARK
(All of these categories are of comparable importance)

Possible Solutions
2D + time MHD Codes: 80MW x 40 Hours

platform	#P	computation	hours	fraction of machine	hours x fraction
C-90	5	(40x1/5)	8	0.31	2.48
J-90	3	(40x3/3)	40	0.10	4.00
T3E	3	(40x6/3)	80[*]	0.025	2.00[*]
T932	3	(40x.5/3)	6	0.10	0.60

[*]assumes linear speedup

3D + time MHD Codes: 320 MW x 350 Hours

platform	#P	computation	hours	fraction of machine	hours x fraction
C-90	20[1]	(350)x1/20)	17	1.25	21
J-90	10	(350x3/10)	100	0.31	31
T3E	10	(350)x11/10)	385[*]	0.083	32[*]
T932	10	(350x.5/10)	17	0.31	5.3

[*]assumes linear speedup
[1]not possible

3D + time PIC CODES: 400 MW x 400 Hours

platform	#P	computation	hours	fraction of machine	hours x fraction
C-90	25[1]	(400x1/25)	16	1.56	25
J-90	13	(400x3/13)	92	0.40	37
T3E	13	(400x11/13)	340[*]	0.108	37[*]
T932	13	(400x.5/13)	15	0.40	6

[*]assumes linear speedup
[1]not possible

3D Monte-Carlo: 1 MW x 60 Hours

platform	#P	computation	hours	fraction of machine	hours x fraction
C-90	1	(60x1)	60	.0625	3.75
J-90	1	(60x3)	180	.03125	5.62
T3E	1	(60x1)	60	.0083	0.50
T932	1	(60x.5)	30	.0312	0.94

Summary

Equivalent whole machine hours/run for desired parameters

	C90	J90	T3E	T932
2D + time MHD	2.5	4	2	0.6
3D + time MHD	-	30	30	5
3D + time PIC	-	40	40	6
Monte Carlo	4	6	0.5	1

- linear eigenvalue codes need large memory (400MW) for short times
- small codes could run anywhere
- should now fold in cost of purchase and maintenance, and amount of work required to convert complex codes to parallel architecture