

**PrincetonUniversity Plasma Physics Laboratory  
PPPL COST PERFORMANCE REPORT WORKBREAKDOWN STRUCTURE**

**8/11/05**

**NCSX**

\*\*\*\* Cumulative to date FY03, FY04 & FY05\*\*\*\*

**JUNE FY05**

	CUMULATIVE TO DATE (from 4/1/03) (k)								ECP36		EAC	FY05	Variance Explanation	
	Budgeted Cost			VARIANCES					Budget	ETC	Thru FY05	UNDER	Schedule	Cost
	BCWS	BCWP	ACWP	Sch Var	SPI	Cst Var	CPI	Thru FY05	Thru FY05	Thru FY05	(OVER)			
<b>1 - Stellarator Core Systems</b>	<b>27,294</b>	<b>25,915</b>	<b>26,521</b>	<b>-1,378</b>	<b>.95</b>	<b>-606</b>	<b>.98</b>	<b>30,390</b>	<b>3,785</b>	<b>30,324</b>	<b>101</b>			
<b>12 Vacuum Vessel Systems</b>	<b>6,149</b>	<b>5,669</b>	<b>5,678</b>	<b>-480</b>	<b>.92</b>	<b>-9</b>	<b>1.00</b>	<b>7,340</b>	<b>1,711</b>	<b>7,389</b>	<b>(49)</b>			
CLOSED 1201 - Vacuum Vessel Prelim Dsn	424	424	424	0	1.00	0	1.00	424		424				
CLOSED 1202 - Vacuum Vessel R&D	1,791	1,791	1,771	0	1.00	21	1.01	1,791		1,771	21			
1203 - Vacuum Vessel Final Dsn	944	873	915	-71	.93	-42	.95	944	40	955	(11)	Final FDR slipped from August 8th to September 16 due to lack of designer manpower.		
1204-VV Sys Procurements (non VVS)	9			-9				257	14	14	243			
CLOSED 1206 - VV Field Weld Joint R&D	18	18	16	0	1.00	1	1.08	18		16	1			
1250 - Vacuum Vessel Fabrication	2,963	2,563	2,552 (1)	-400	.86	11	1.00	3,906	1,657	4,209	(302)	Panel production has delayed final assy. MTM is still forecasting 1st field period 120 deg segment welded together by 8/25 and delivery by Nov 05		
<b>13 Conventional Coils</b>	<b>1,292</b>	<b>1,032</b>	<b>1,239</b>	<b>-260</b>	<b>.80</b>	<b>-207</b>	<b>.83</b>	<b>1,677</b>	<b>230</b>	<b>1,469</b>	<b>209</b>			
1301 - TF Design	837	812	932	-26	.97	-121	.87	837	30	962	(125)	Successful conductor FDR held in May. Wedge casting FDR completed in July. Comprehensive FDR being held Friday August 12th.	Underestimated Rushinski by factor of 3 due to redesign of leads.	
1302 - PF and CS Design		20		20		20		-	30	30	(30)			
1350 - TF Coil Fabr Prep	218	201	289	-17	.92	-89	.69	381	150	439	(58)	Behind on taping machine and TF mold. Forecast facility availability slip from end September to mid October	Electrician time for setting up fabr facility underestimated.	
1351 - TF Coil Fabrication	237		17	-237		-17		459	20	37	421	TF procurements and fabrication startup slipped due to 3 month delay in the final design.		
<b>14 Modular Coils</b>	<b>16,988</b>	<b>16,347</b>	<b>16,736</b>	<b>-641</b>	<b>.96</b>	<b>-388</b>	<b>.98</b>	<b>18,098</b>	<b>1,567</b>	<b>18,320</b>	<b>(188)</b>			
CLOSED 1401 - Mod Coil Prel.Dsn	303	303	304	0	1.00	-1	1.00	303		304	(1)			
CLOSED 1402 - Mod.Coil Analyses	239	239	239	0	1.00		1.00	239		239	(0)			
1403 - Modular Coil Final Design	2,989	2,700	2,928	-289	.90	-227	.92	3,141	190	3,118	23	FDR held in June. Completion of all fabrication dwgs will not be completed until early September. Status of individual drawings and procurements being tracked via separate bill of material list..	Manpower under estimated. Preliminary estimates for Type A design 3x greater than planned. Type B 2x greater. Potential impact of \$450k. Estimate being developed by ORNL.	
CLOSED 1404-MCWF R&D & 1st Prod Casting	2,534	2,534	2,552	0	1.00	-18	.99	2,534		2,552	(18)			
CLOSED 1405-Mod Coil Winding R&D Prep	168	168	168		1.00	0	1.00	168		168	0			
CLOSED 1406 - Mod. Coil Winding Facility	2,214	2,214	2,250	0	1.00	-36	.98	2,214		2,250	(36)			
CLOSED 1410 MC Twisted Racetrack Fabr	1,080	1,080	1,066	0	1.00	14	1.01	1,080		1,066	14			
CLOSED 1407 -Mod Coil Winding Facility	2,523	2,523	2,546	0	1.00	-23	.99	2,523		2,546	(23)			
CLOSED 1412 - Complete Winding Facilities	540	540	540	0	1.00	1	1.00	540		540	1			
1419 - Winding Facility Modification			25			-25			5	30			Misc unplanned modifications to the winding facility.	
1414 - Coil Testing	49	2	2	-46	.05	0	1.08	77	64	66		Testing of TRC behind due to cryostat re configuration.		
1415 - Dimensional Control Testing	15	7	15	-7	.50	-7	.50	15	15	30				

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		Budgeted Cost			VARIANCES				Budget	ETC	Thru FY05	UNDER	Schedule	Cost
		BCWS	BCWP	ACWP	Sch Var	SPI	Cst Var	CPI	Thru FY05	Thru FY05	Thru FY05	(OVER)		
	1408-Mod Coil Winding Supplies	472	357	393	-115	.76	-36	.91	594	103	496	98	Lead hardware and cladding. Also, add'l copper not yet received although not schedule critical.	Tom Meighan support (CC orders ?) not estimated.
CLOSED	1409 - Mod. Coil Test Stand	854	854	837	0	1.00	17	1.02	854		854			
	1411-MCWF Fabrication S005242	2,820	2,802	2,840 (2)	-17	.99	-38	.99	3,430	1,190	4,030	(600)	B pattern behind, C-1 and A-1 machining behind, C3, C-4, C-5 castings ahead of schedule. <b>NOTE: SPI &amp; SV NOT INDICATIVE OF SCHEDULE IMPACT. SEE SPECIAL CRITICAL PATH ANALYSIS ATTACHED.</b>	
CLOSED	1413 - Mod Coil Fracture Analysis	23	23	28	0	1.00	-5	.83	23		28	(5)		
	1451 - Mod Coil Winding	166		3	-166		-3		364		3	361	Prep for winding operations delayed due to late casting delivery.	
	<b>15 Structures</b>	<b>35</b>	<b>66</b>	<b>39</b>	<b>32</b>	<b>1.92</b>	<b>28</b>	<b>1.72</b>	<b>35</b>	<b>10</b>	<b>49</b>	<b>(14)</b>		
	1501 - Structures Design	35	66	39	32	1.92	28	1.72	35	10	49	(14)		
	<b>16 - Coil Services</b>								-		-			
	<b>17 Cryostat and Base</b>	<b>217</b>	<b>194</b>	<b>331</b>	<b>-23</b>	<b>.89</b>	<b>-137</b>	<b>.59</b>	<b>241</b>	<b>40</b>	<b>371</b>	<b>(130)</b>		
	1701-Cryostat&Base Sprt Strct Dsn	217	194	331	-23	.89	-137	.59	241	40	371	(130)	PDR for Base support structure slipped again to August 25. Gettelfinger being diverted to resolve coil test stand cryostat design.	Designer support underestimated by factor of 2. 1 1/2 MM of analysis (Dahlgren) req'd but not estimated.
	1751 - Cryostat Procurement								-		-			
	1752 - Base Support Structure Procure								-		-			
	<b>18 Field Period Assembly</b>	<b>1,260</b>	<b>1,218</b>	<b>1,138</b>	<b>-41</b>	<b>.97</b>	<b>80</b>	<b>1.07</b>	<b>1,512</b>	<b>147</b>	<b>1,285</b>	<b>227</b>		
CLOSED	1801-Field Period Assly	61	61	61	0	1.00	0	.99	61		61	(0)		
	1802 - FP Assy Oversight&Support	285	285	335	0	1.00	-51	.85	311	35	370	(60)		HP higher than planned charges and rates plus OT to support the TRC fabrication.
	1803- FP Assy Toolg/Constructability	561	523	367	-38	.93	156	1.42	758	70	437	321		
	1804-FP Assy Measurement	353	350	374	-3	.99	-25	.93	382	42	416	(34)		Raftopulous charge rate 50% compared to 40% budgeted.
	<b>19 1901 - Stellarator Core Mngtt&amp;Inl</b>	<b>1,353</b>	<b>1,389</b>	<b>1,362</b>	<b>35</b>	<b>1.03</b>	<b>26</b>	<b>1.02</b>	<b>1,488</b>	<b>80</b>	<b>1,442</b>	<b>46</b>		
	<b>2 - Plasma Heating,Fueling &amp; Vac</b>	<b>348</b>	<b>348</b>	<b>347</b>	<b>0</b>	<b>1.00</b>	<b>1</b>	<b>1.00</b>	<b>348</b>	<b>-</b>	<b>347</b>	<b>1</b>		
CLOSED	2001-VPS Gas& Cond Sys Oversight	64	64	63	0	1.00	1	1.01	64		63	1		
CLOSED	2501 - Neutral Beam Refurbishment	284	284	284	0	1.00	0	1.00	284		284	0		
	<b>3 - Diagnostics</b>	<b>368</b>	<b>346</b>	<b>347</b>	<b>-22</b>	<b>.94</b>	<b>-1</b>	<b>1.00</b>	<b>493</b>	<b>50</b>	<b>397</b>	<b>96</b>		
31	3101 Magnetic Diagnostics	93	71	82	-22	.76	-11	.86	206	40	122	84	Fabrication of MC co-wound loops not yet started.	Engr ytd (Labik) 50% higher than estimated.
36	36 - Edge and Divertor Diagnosti								-		-			
38	38 - Electron Beam (EB) Mapping								-		-			
39	3901 - Diagnostics sys Integratic	275	275	265	0	1.00	10	1.04	287	10	275	12		
	<b>4 - Electrical Power Systems</b>	<b>571</b>	<b>445</b>	<b>426</b>	<b>-125</b>	<b>.78</b>	<b>19</b>	<b>1.04</b>	<b>614</b>	<b>55</b>	<b>481</b>	<b>133</b>		
41	4101 - AC Power	81	107	81	25	1.31	26	1.33	81		81	1		

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		Budgeted Cost			VARIANCES				Budget	ETC	Thru FY05	UNDER	Schedule	Cost
		BCWS	BCWP	ACWP	Sch Var	SPI	Cst Var	CPI	Thru FY05	Thru FY05	Thru FY05	(OVER)		
43	4301 - DC Systems	203	152	176	-52	.75	-24	.86	233	44	220	13	Power loop simulation and design documentation. Fabrication of bus components not yet started.	
44	4401 - Control & Protection	1	4	30	3	3.85	-26	.13	1	11	41	(40)		Mainly a FY04 variance for overload protection design.
45	4501 - Power Sys Dsn & Integr	284	181	138	-102	.64	43	1.31	298	-	138	160	Power systems design 2 months behind. FDR for c-site cabling planned for September 05. RAKI ONLY CHARGED 26% IN JULY COMPARED TO 70% REQUESTED.	
46	4601 - FCPC Bldg Mods	1	1	1		1.00	0	.98	1		1	(0)		
<b>5 - Central I&amp;C Systems</b>		<b>38</b>	<b>38</b>	<b>33</b>	<b>0</b>	<b>1.00</b>	<b>5</b>	<b>1.15</b>	<b>40</b>	<b>4</b>	<b>37</b>	<b>3</b>		
58	5801 -Central I&C Integr	38	38	33	0	1.00	5	1.15	40	4	37	3		
<b>6 - Facility Systems</b>		<b>24</b>	<b>24</b>	<b>24</b>		<b>1.00</b>	<b>0</b>	<b>1.01</b>	<b>24</b>	<b>-</b>	<b>24</b>	<b>0</b>		
61 - Water Systems														
	6163 - Facility Systems Support FY04	15	15	15		1.00	0	1.01	15		15	0		
62 - Cryogenic Systems														
63 - Utility Systems														
CLOSED	6501 - Facility Systems Integrati	9	9	9		1.00	0	1.00	9		9			
<b>7 - Test Cell Prep &amp; Machine Assy</b>		<b>638</b>	<b>639</b>	<b>642</b>	<b>1</b>	<b>1.00</b>	<b>-3</b>	<b>1.00</b>	<b>685</b>	<b>90</b>	<b>732</b>	<b>(46)</b>		
CLOSED	7101 - Shield Wall Modif	32	32	32	0	1.00		1.00	32		32	(0)		
	7201 - Control Room Walls&Floc	8			-8				8	-	-	8	On hold awaiting FED to install walls (under a GPP project)	
	7301 - Platform Design &	42	86	4	44	2.06	81	19.84	70	-	4	66	Work on platform fabrication started ahead of plan.	
	7401 - TC Prep & Mach Assy Pla	556	521	605	-35	.94	-84	.86	575	90	695	(120)		
75 Machine Assembly														
76 7601 - Tooling Design & Fabricat														
<b>8 - Project Oversight &amp; Support</b>		<b>5,925</b>	<b>5,926</b>	<b>5,935</b>	<b>0</b>	<b>1.00</b>	<b>-9</b>	<b>1.00</b>	<b>6,348</b>	<b>412</b>	<b>6,348</b>			
81	Project Management and Control	2,722	2,722	2,751	0	1.00	-29	.99	2,934	183	2,934			
	8101 - Project Management & Control	1,837	1,837	1,862		1.00	-26	.99	1,969	106	1,969			
	8102 - NCSX MIE Management ORNL	225	225	224		1.00	1	1.01	242	18	242			
	8998 - Allocations	661	661	665	0	1.00	-4	.99	724	58	724			
82	Project Engineering	2,733	2,734	2,714	0	1.00	19	1.01	2,943	229	2,943			
	8202 - Engr Mgmt & Sys Eng Support	1,523	1,523	1,523	0	1.00	1	1.00	1,634	112	1,634			
	8203 - Design Integration	695	695	670	0	1.00	24	1.04	722	52	722			
	8204 - Systems Analysis	444	444	447	0	1.00	-3	.99	490	43	490			
	8205 - Dimensional Control Coord.	71	71	74	0	1.00	-3	.96	97	23	97			
84	Project Physics	470	470	470		1.00	0	1.00	470	(0)	470			
CLOSED	8401 - Project Physcis	324	324	324		1.00	1	1.00	324	1	324			
CLOSED	8402 - Project Physics MIE ORNL	146	146	146		1.00	-1	1.00	146	(1)	146			
	85 - Integrated Systems Testing													

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	Budgeted Cost			VARIANCES					Budget	ETC	Thru FY05	UNDER	Schedule	Cost		
	BCWS	BCWP	ACWP	Sch Var	SPI	Cst Var	CPI	Thru FY05	Thru FY05	Thru FY05	(OVER)					
<b>Subtotal</b>	<b>35,206</b>	<b>33,682</b>	<b>34,276</b>	<b>-1,524</b>	<b>.96</b>	<b>-594</b>	<b>.98</b>	<b>38,944</b>	<b>4,396</b>	<b>38,690</b>	<b>288</b>			Note: PPPL overhead rates changed in June to reflect severance cost and current estimate forecast. Net impact shows an increase of \$162k to the NCSX MIE project.		
<b>Contingency/Management Reserve</b>								<b>2,299</b>								
<b>DCMA QA Inspection services</b>								<b>75</b>								
<b>TOTAL PROJECT</b>								<b>41,318</b>	<b>4,396</b>	<b>38,690</b>	<b>2,628</b>					
(1) Reflects accrual reduction of \$306k based on MTM's June earned value report																
(2) Reflects accrual reduction of \$39k based on EIO's June earned value report																
Thru FY2004	20,640	19,652	19,744	-988	0.95	-92	1.00	<b>FORECAST PROJECT UNDRERUN FY05</b>								
Thru Oct	20,637	20,832	20,917	195	1.01	-85	1.00									
Thru NOVEMBER	21,812	21,906	22,158	94	1.00	-252	0.99									
Thru DECEMBER	23,813	23,042	23,434	-771	0.97	-392	0.98									
Thru JANUARY (ecp-21)	25,866	24,310	24,639	-1556	0.94	-329	0.99									
Thru Feb (ecp-24)	26,637	25,856	26,285	-781	0.97	-429	0.98									
Thru Mar (ecp-29)	28,440	27,282	28,004	-1158	0.96	-722	0.97									
Thru Apr (ecp-30)	29,588	28,736	29,416	-852	0.97	-680	0.98									
Thru May (ecp-30)	31,301	29,903	30,889	-1398	0.96	-986	0.97									
Thru June (ecp-30)	32,740	31,362	32,719	-1378	0.96	-1357	0.96									

## **Schedule Impact**

### **The baseline schedule (including the underlying planning assumptions) is being impacted by the following:**

1) The late delivery of the modular coil winding forms.

coil #	Baseline	Latest Forecast	Slip (weeks)
1	06/23/05	10/17/05	16.6
2	09/30/05	11/15/05	6.6
3	10/18/05	11/29/05	6.0
4	11/29/05	12/13/05	2.0

2) The completion of final design for the type A and B design drawings necessary to fabricate the winding hardware.

	Baseline	Guesstimate	Slip (weeks)
Type A	7/29/05	1/23/06	25.4
Type B	9/30/05	4/24/06	29.4

Note that the guesstimate for completion of the FDR for type A and B is based upon a preliminary estimate from ORNL of 18 mm and 12 mm remaining work on the Type A and B design respectively along with the assumption that 4 people will be dedicated to these designs.

3) to a lesser degree, the sequence of delivery has been changed which affects the down stream assy process.

### **The forecast schedule being presented factors in the following workaround plans.**

1) Two winding lines will work two shifts each for the first 13 coils

(double shift for the last 5 coils will remain as further schedule contingency)

(The baseline plan assumed only one winding line on second shift for the first 10 coils)

2) Increased estimates for winding to cover; a) lacing process, b)holes in casting for cooling lines, c)ad'l time for winding block fit up and installation.

3) Learning curves for the first two coils in each winding line of 50% and 10%.

No reduction in time on the balance of coils.

4) ORNL to develop detailed schedule and manpower plan to support the following FDR's

Preliminary analysis indicates that this can be achieved by assigning approx 4 engr/dsn personnel during this period

Type A 1/23/2006

Type B 4/24/2006

5) 5 months of overall project schedule contingency restored.