## Labor

	Manhours	FY2003 \$\$	l abor Type	Start Date Month/Yr	End Date Month/Yr	Commonts
	mannouro					Comments
Preliminary Design (Title I)						
( 62% of design schedule)	230		EAEM	Jun-05	Aug-05	PPPL Engineer
	186		EADM	Jun-05	Aug-05	PPPL Designer
	51		ORNL Eng	Jun-05	Aug-05	Composite of ORNL Engineer / Designer
	0		ORNL Phys.	Jun-05	Aug-05	Composite of ORNL Physics / scientific
	0		PPPL Phys.	Jun-05	Aug-05	PPPL Physics/scientific
Final Design (Title II)						
(38% of design schedule)	141		EAEM	Aua-05	Oct-05	PPPL Engineer
(	114		EADM	Aug-05	Oct-05	PPPL Designer
	31		ORNL Eng	Aug-05	Oct-05	Composite of ORNL Engineer / Designer
	0		ORNL Phys.	Aug-05	Oct-05	Composite of ORNL Physicist
	0		PPPL Phys.	Aug-05	Oct-05	PPPL Physics/scientific
Lab R&D labor						
	0		FAFM	Jun-05	Aug-05	PPPI Engineer
	0		EADM	Jun-05	Aug-05	PPPI Designer
	0		ORNL Eng	Jun-05	Aug-05	Composite of ORNL Engineer / Designer
	0		EASM	Jun-05	Aug-05	PPPL monthly support
	0		EMTB	Jun-05	Aug-05	PPPL Technician
Lab Fab/Assembly/Installation (Title III)						
	232		EAEM	Oct-05	Jan-06	PPPI Engineer
	64		EADM	Oct-05	Jan-06	PPPL Designer
	30		ORNL Eng	Oct-05	Jan-06	Composite of ORNL Engineer / Designer
	0		EASM	Oct-05	Jan-06	PPPL monthly support
	0		EMTB	Oct-05	Jan-06	PPPL Technician

## Labor

		Manhours per fiscal year by labor category						
Level of Effort		FY2003	FY2004	FY2005	FY2006	FY2007	FY2008	TOTAL
PPPL Engineer	EAEM	0	0	365	238	0	0	603
PPPL Designer	EADM	0	0	295	69	0	0	364
Composite of ORNL Engineer / Designer	ORNL Eng	0	0	80	31	0	0	112
PPPL monthly support	EASM	0	0	0	0	0	0	0
PPPL Technician	EMTB	0	0	0	0	0	0	0
Composite of ORNL Physics / scientific	ORNL Phy	0	0	0	0	0	0	0
PPPL Physics/scientific	PPPL Phy	0	0	0	0	0	0	0

## M&S Costs

Activity Title	FY2003 \$\$	Comment
Manufacturing Development (R&D)		
Purchased Design Services	\$0	
Procured Hardware/Material	\$0	
Profit	<u>\$0</u>	included in hardware estimate
total, manf/dev (R&D)	\$0	w/o G&A
Procured Hardware/Material		
set of external error field correction coils	\$210,738	
Profit	<u>\$0</u>	included in hardware estimate
total, procured hdwe/matl.	\$210,738	w/o G&A
Purchased Design Services	\$0	no purchased services anticipated
Procured Installation/Assembly Costs	\$0	All installation and assembly costs are included in WBS 7

## **Other Costs**

Activity Title	FY2003 \$\$	Comment	
Travel	\$4,0	0 two trips are ar	nticipated for this WBS

## Summary Costs

Activity Title	Manhours	FY2003 \$\$	Comment
Labor PPPL Effort ORNL effort subtotal, labor	967 112 1,079	\$128,651 \$14,526 \$143,177	Assumed rates: EASM 100 \$/hr EAEM 153 \$/hr EMTB 73 \$/hr EADM 100 \$/hr PPPL Phys 141 \$/hr ORNL Eng 130 \$/br ORNL Phys 160 \$/br
M&S, Other Manufacturing Development (R&D) Procured Hardware/Material Purchased Design Services Procured Installation/Assembly Costs Travel subtotal, M&S		\$0 \$210,738 \$0 \$0 \$4,000 \$214,738	
G&A		\$53,684	25% on all purchased materials, subcontracts, travel
Subtotal without contingency		\$411,599 \$164,640	40% Overall on this WBS
Contingency		φ104,040	
Total cost		\$576,239	

1

Description:				
This effort covers the manufacturing costs for include Tophothem colls and the o	the external err	or field correct	on colls (EF	CC), which distributions
All installation oversight will be performed as p	art of WBS 7.	ous are proces		o prese constant.
Doubles of an deal				
External Error Correct, Coll windings	\$210,738	see notes be	low.	
subtotal, purchased parts	\$210,738			
outside engritate = outside fab cete #	130	S per hour		
outside inspection/technician rate =	80	\$ per hour		
Worksheets:				
External EFCC winding geometry				
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bundle dz	mm	42.08	42.08	
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kore wide	1	2.00	200	
current per turn	Α	10000.00	10000.00	
narian fraction		0.76	476.075	
andh ner turn	 m	0.40	5.11	
initial learnin of ou ner coll	-	67 67	41.00	
turn height	mm	9.00	9.00	
contact hole dia		6.00 6.00	6.00	
comar nadi	-	0.00	0.00	
conductor area	mm*0	64.37	64.17	
Initial relationce of coll relationships coll set	onms kn	2206-03	1.336-03	
Co-density	# 58E-14	Linime*1		
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External EFCC which goest details 1 Tooling regimening infly. Plans Tooling regimening infly. Tooling design Tooling design Tooling design Tooling design forum Total tooling cet # Monotain # Monotain	Raf. P. Halto hrs. 5 hrs. 5 t hrs. 5	0 0 0 4075 0 1273	0 0 767 767	(half engineer; half designer)
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total

Labor category

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30

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## **WBS 133 External Error Correction Coils**

### Engineering, Title I, II and III

#### **Description:**

This effort covers all Title I, II, and III engineering for the external error field correction coils, which includes the top and bottom coils and the outer perimeter coils. The windings are procured via a fixed price contract. All installation oversight will be performed as part of WBS 7.

P					fraction	EAI	EM	EAI	DM	ORNL	_ Eng	ORNL	Physics	PPPL F	Physics
	multiplier	unit	no.	hours		fract.	hrs	fract.	hrs	fract.	hrs	fract.	hrs	fract.	hrs
Title I, II design	-														
Pro-E models (avg)	16	hrs/model	8	128	1.00	0.25	32	0.50	64	0.25	32	0.00	0	0.00	0
assy dwgs	40	hrs/dwg	2	80	1.00	0.00	0	1.00	80	0.00	0	0.00	0	0.00	0
Detail drawings	16	hrs/dwg	6	96	1.00	0.00	0	1.00	96	0.00	0	0.00	0	0.00	0
installation dwg	40	hrs/dwg	0	0	1.00	0.00	0	1.00	0	0.00	0	0.00	0	0.00	0
cooling schematic	20	hrs/dwg	2	40	1.00	0.00	0	1.00	40	0.00	0	0.00	0	0.00	0
electrical schematic	20	hrs/dwg	1	20	1.00	0.00	0	1.00	20	0.00	0	0.00	0	0.00	0
I&C schematic	20	hrs/dwg	0	0	1.00	0.00	0	1.00	0	0.00	0	0.00	0	0.00	0
stress analysis	40	hrs/calc	2	80	1.00	1.00	80	0.00	0	0.00	0	0.00	0	0.00	0
thermal analysis	40	hrs/calc	2	80	1.00	1.00	80	0.00	0	0.00	0	0.00	0	0.00	0
special analysis (electromagnetics)	40	hrs/calc	1	40	1.00	0.50	20	0.00	0	0.50	20	0.00	0	0.00	0
procurement/fab specifications	40	hrs/spec	1	40	1.00	1.00	40	0.00	0	0.00	0	0.00	0	0.00	0
preliminary and final design reviews	40	hrs/rev	2	80	1.00	0.80	64	0.00	0	0.20	16	0.00	0	0.00	0
meetings/reporting/presentations	10%	% of tot	684	68	1.00	0.80	55	0.00	0	0.20	14	0.00	0	0.00	0
subtotal				752			371		300		82		0		0
					total										
					fraction	EAI	EM	EAS	SM	EAI	DM	ORN	L Eng		
Title III						fract.	hrs	fract.	hrs	fract.	hrs	fract.	hrs		
vendor oversight, inspection Disposition of deviation requests and	8	hrs/wk	12	96	1.00	1.00	96	0.00	0	0.00	0	0.00	0		

Disposition of deviation requests and												
non-conformances	4	hrs/wk	38	150	1.00	0.80	120	0.00	0	0.00	0	0.20
As-built drawings	8	hrs/dwg	10	80	1.00	0.20	16	0.00	0	0.80	64	0.00
subtotal				326			232		0		64	

### Engineering, Title I, II and III

		duration	
Schedule assumptions	start	(weeks)	end
Title I Design	Jun-05	11	Aug-05
Title II Design	Aug-05	7	Oct-05
Procurement	Oct-05	12	Dec-05
In-house fab / sub-assy	Dec-05	0	Dec-05
Installation / final assembly	Jul-05	26	Jan-06

#### Notes and worksheets

#### External error field correction coils

		3, Outer coils
	total	T&E per.
Pro-E models	8	8
assy dwgs	2	2
Detail drawings	6	6
installation dwg	0	
cooling schematic	2	2
electrical schematic	1	2
I&C schematic	0	
stress analysis	2	2
thermal analysis	2	2
special analysis	1	
procurement specifications	1	
preliminary and final design reviews	2	
meetings/reporting/presentations	10%	

models of all parts windings, winding form windings, winding form, lead blocks

covered in WBS 184

global and local analysis of winding pack and lead regions global and local analysis of winding pack and lead regions em analysis of lead area, general analysis in WBS 171 one procurement specification for external error field correction coils standard reviews