

NCSX Fueling and Vacuum Pumping Systems

W. Blanchard
WBS 21 and 22 Manager

VACUUM PUMPING SYSTEM

Requirements

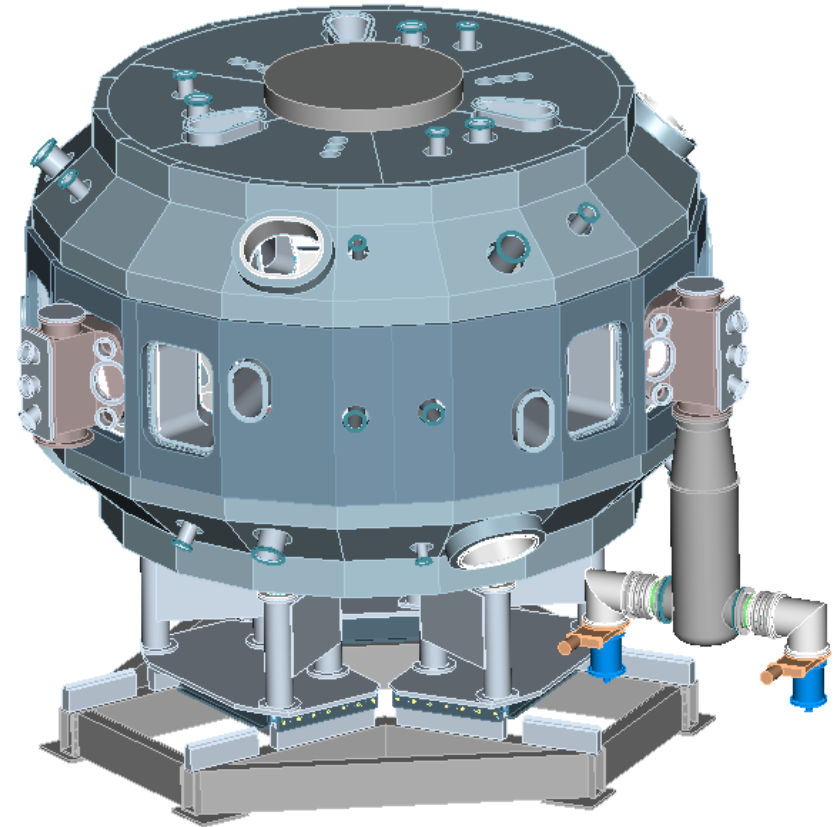
- Minimum effective pumping speed of 1300 l/s

Interfaces

- Design consists of one pumping duct off of one NB transition piece and a vertical 24” duct

Design Features

- Two legacy 1500 l/s TMPs
- System monitored, controlled and interlocked using a PLC
- Differentially pumped RGA



VACUUM PUMPING SYSTEM



Task ID	M&S	Hours										
		EMEM	EMSM	EMSB	EMTB	EAEM	EASB	EEEM	EESM	EESB	EETB	
Title I and II Design												
Preliminary Design / Management / Admin												
	Engr Work Planning & Design	180										
	Design Hardware			80								
	Design PLC Controls							336				
	Testing Equipment			88								
	Drafting Support (Electrical)					160						
	Drafting Support (Mechanical)					20						
Final Design / Management / Admin												
	Engr Work Planning & Design	220										
	Mechanical Design			88								
	Design PLC Controls							336				
	Electrical Design							64				
	Electrical Design/Drafting						272					
	Drafting Support (Mechanical)						60					
Subtotal Title I & II Design		400	0	256	0	180	332	736	0	0	0	
Title III												
	Engr Work Planning & Design	120										
	Maint/Repair Mech Pumps			80								
	Repair/Cal. Instrumentation			80								
	Electrical Installation					668						
	Fabricate/Install Hardware			120	520							
	Fabricate/Install PLC Controls							352				
	Integrated System Testing	40						80				
	Materials and Supplies	\$ 118,000										
Subtotal Title III		\$ 118,000	160	0	280	1188	0	0	432	0	0	0

Cost Estimate

- * Based on NSTX costs for system which is similar to the proposed NCSX design
- * Input from engineers and personnel familiar with various parts of the project



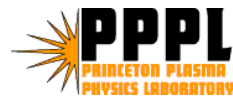
VACUUM PUMPING SYSTEM



Activity ID	MILESTONE LEVEL	Activity Description	Duration (work days)	SHIFTS	Forecast Start	Forecast Finish	Total Float	Cost to Complete					
									FY08	FY09	FY10	FY11	FY12
22 - Torus Vacuum Pumping Systems													
Job: 2201 - Vacuum Pumping Systems-BLANCHARD													
220-101		Preliminary Design	83		01OCT08*	05FEB09	361	126,871.80					
220-105		PDR VPS	1		06FEB09	06FEB09	361	0.00					
220-109		Final Design	80		09FEB09	01JUN09	361	147,786.60					
220-113		FDR VPS	1		02JUN09	02JUN09	361	0.00					
220-117		Procure PLC,Values,Hardware	87		01OCT09*	12FEB10	277	157,766.00					
220-133		Fabrication and Assemble	154		01SEP10*	15APR11	50	205,043.31					
220-137		Test VPS Hardware	3		05JUL11	07JUL11	1	21,609.20					
220-116		Title III	463		03JUN09	13APR11	893	20,285.49					

Project Schedule

- Design in FY09, procurements in FY10 and fabrication/installation in FY11



VACUUM PUMPING SYSTEM



<u>Uncertainty of the Estimate</u>																			
			<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Uncertainty Range (%)</u>	<u>Comments/Other Considerations</u>												
Design Maturity					X		There have been no design reviews therefore the design is not fixed.												
						-15%/+25%													
Design Complexity					X		Anticipated to only require standard components												
Other Comments:																			

Risk Assessment: Low

Risk:

- * Equipment or component failure

Mitigation:

- * All components outside of coils and cryostat and easily accessible
- * Standard equipment and hardware
- * Replacement parts for major components in-house



FUELING SYSTEM

Requirements

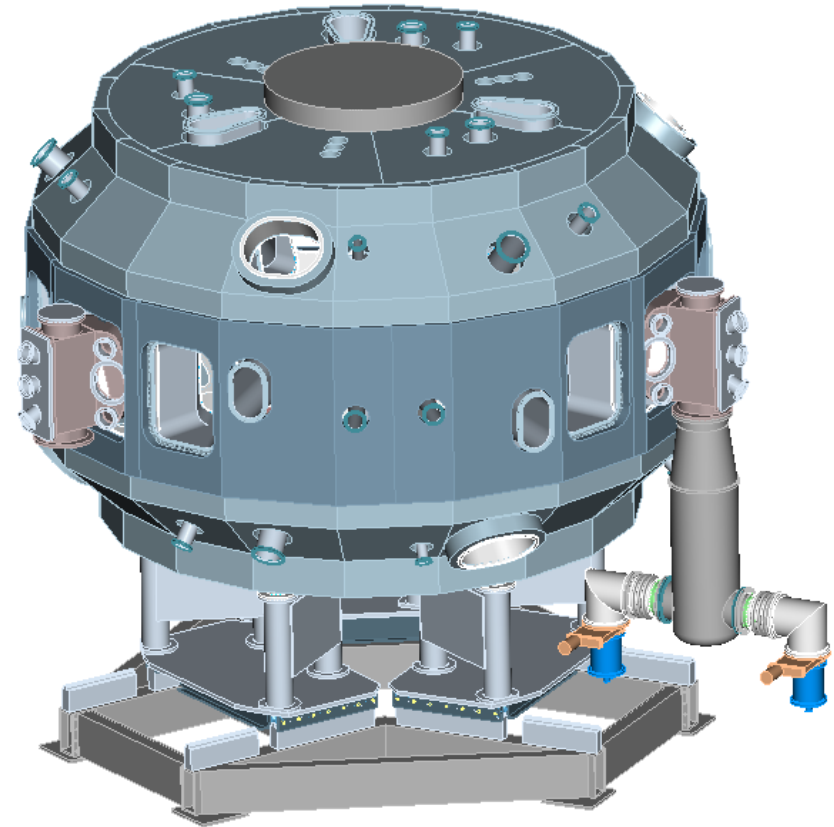
- Three gas injection systems with each injector having a maximum flow rate >50 T-l/s

Interfaces

- Injectors located at the three upper P12 port covers

Design Features

- Includes gas delivery manifold, pumpout system and gauging
- System monitored, controlled and interlocked using a PLC
- Pulse valve controlled from central computing



FUELING SYSTEM



Task ID	M\$	Hours									
		EVEM	EVSM	EVSB	EMTB	EASB	EEEM	EEEM	EEESB	EEETB	
Title I and II Design											
Preliminary Design / Management / Admin											
Engr Work Planning & Design		48									
Design Gas handling Hardware				96							
Design PLC Controls								112			
Drafting Support						24					
Final Design / Management / Admin											
Engr Work Planning & Design		88									
Design Gas handling Hardware				48							
Design PLC Controls								448			
Drafting Support (Electrical)						144					
Drafting Support (Mechanical)						68					
Subtotal Title I & II Design		136	0	144	0	236	560		0	0	
Title III											
Engr Work Planning & Design		40									
Fabricate & Install Hardware				120	240						
Fabricate & Install Hardware (Electrical)					288						
Install PLC Controls								192			
Integrated System Testing		40						80			
Materials and Supplies	\$	38,000									
Subtotal Title III	\$	38,000	80	0	120	528	0	272	0	0	

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- * Based on NSTX costs for system which is similar to the proposed NCSX design
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FUELING SYSTEM



21 - Fueling Systems						
Job: 2101 - Fueling Systems-BLANCHARD						
211-101	Preliminary Design	42	03MAR09*	29APR09	318	40,631.36
211-105	PDR Fueling Systems	0		29APR09	318	0.00
211-109	Final Design	42	30APR09	29JUN09	318	120,756.40
211-113	FDR Fueling Systems	0		29JUN09	318	0.00
211-117	Title III	431	30JUN09	25MAR11	906	6,764.55
211-121	Procure Material and Supplies	65	01OCT09*	13JAN10	253	50,806.00
211-125	Fabricate and Assemble	115	01OCT10*	22MAR11	70	97,654.80
211-126	Test	5	23MAR11	29MAR11	70	21,609.20

em/em=48; em/sb=96
ea/sb=24; ee/em=112

em/em=38; ea/sb=212
ee/em=448; em/sb=48

EM/EM = 40hr;

41=38\$K;

em/sb=120; em/tb=528
em/em=40; ee/em=192

em/em=40; ee/em=80

Project Schedule

Design in FY09, procurements in FY10 and fabrication/installation in FY11



FUELING SYSTEM



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