

**NCSX Fueling and Vacuum**

|  |  |  |
| --- | --- | --- |
|  | SC Project Review of NCSX, April 8-10, 2008 |  |

**Pumping Systems**

W. Blanchard

***WBS 21 and 22 Manager***

* **Differentially pumped RGA**

**Design Features**

* **Two legacy 1500 l/s TMPs**
* **System monitored, controlled**

**and interlocked using a PLC**

**Requirements**

* **Minimum effective pumping**

**speed of 1300 l/s**

**Interfaces**

* **Design consists of one**

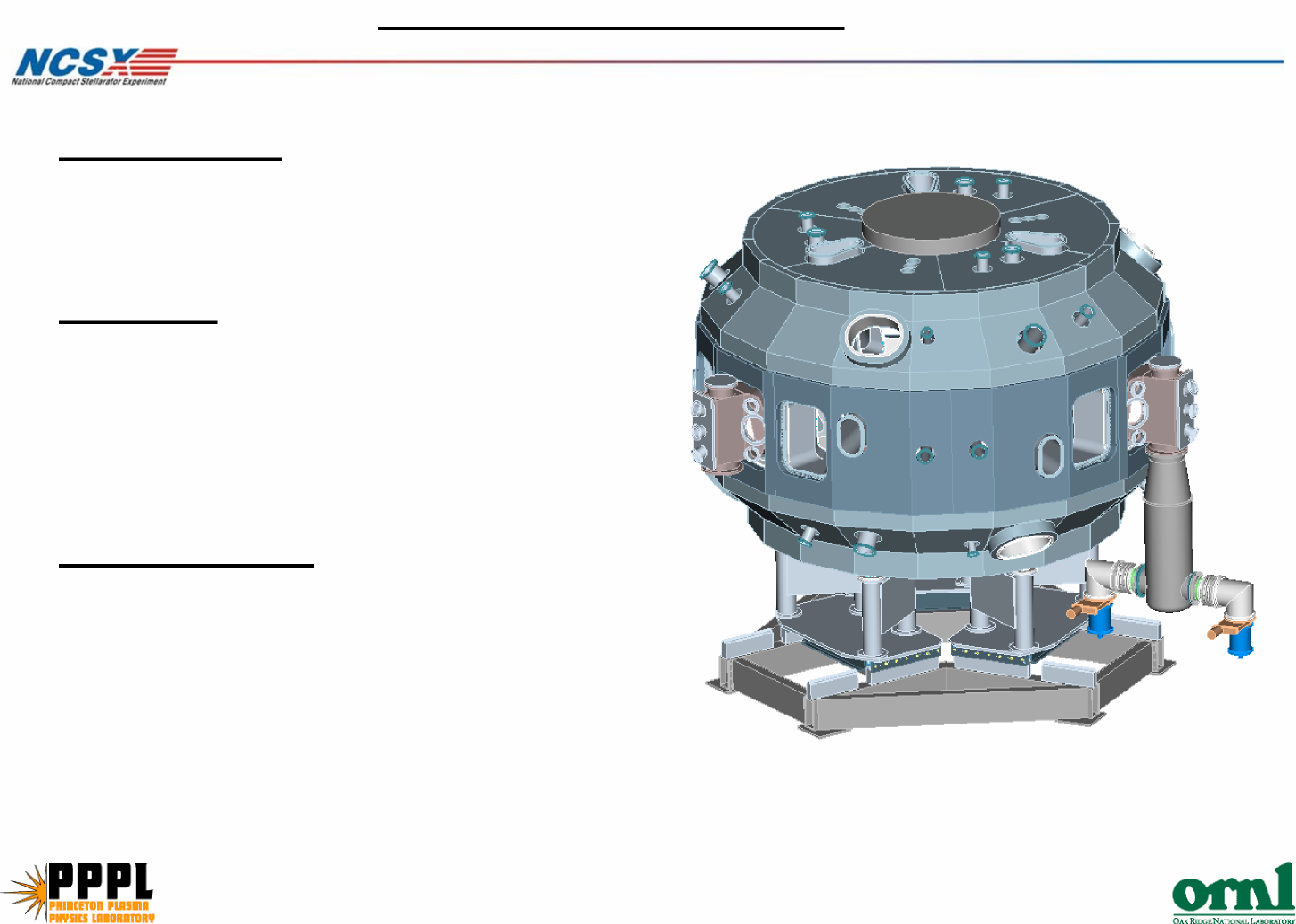
**pumping duct off of one NB**

**transition piece and a vertical**

**24” duct**

**VACUUM PUMPING SYSTEM**

SC Project Review of NCSX, April 8-10, 2008
  
W. Blanchard - page 2



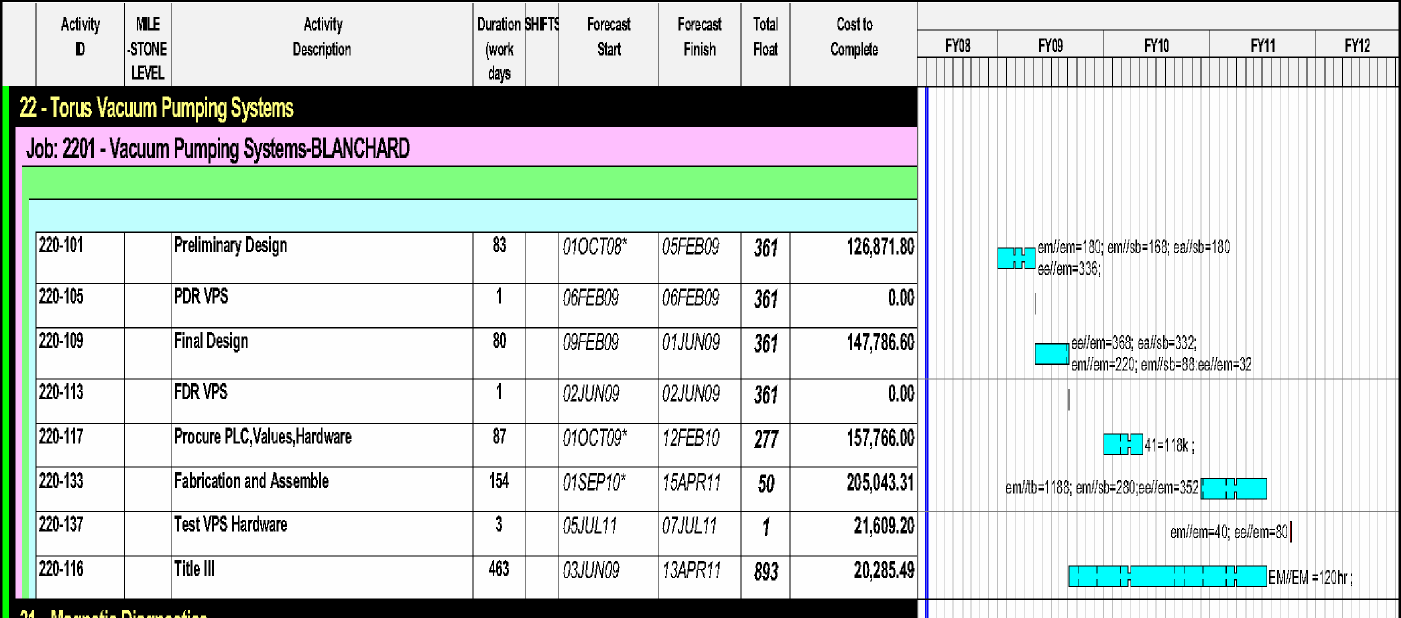


|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **$** |  | |  | | | | **Hours** | |  | | |  | |  |  |  |
| **Task ID** | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **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**

|  |  |  |
| --- | --- | --- |
|  | SC Project Review of NCSX, April 8-10, 2008  W. Blanchard - page 3 |  |

**\* 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**



**Project Schedule**

|  |  |  |
| --- | --- | --- |
|  | SC Project Review of NCSX, April 8-10, 2008  W. Blanchard - page 4 |  |



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



|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Uncertainty of the Estimate** | | | |  |  |  |  | | | | | | | |
|  |  |  | **High** | **Medium** | **Low** | **Uncertainty** | **Comments/Other Considerations** | | | | | | | |
| **Range (%)** |
|  | **Design Maturity** | |  |  | **X** |  | **There have been no design reviews therefore the design is not fixed.** | | | | | | | |
|  |  |  |  |  |  | **-1 5%/+25%** |  | | |  |  | |  |  |
|  | **Design Complexity** | |  |  | **X** |  | **Anticipated to only require standard components** | | | | | |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | **Other Comments:** | |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

**Risk Assessment: Low**

|  |  |  |
| --- | --- | --- |
|  | SC Project Review of NCSX, April 8-10, 2008  W. Blanchard - page 5 |  |

**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**

* **Pulse valve controlled from central computing**
* **System monitored, controlled and interlocked using a PLC**

**Interfaces**

* **Injectors located at the three upper P12 port covers**

**Design Features**

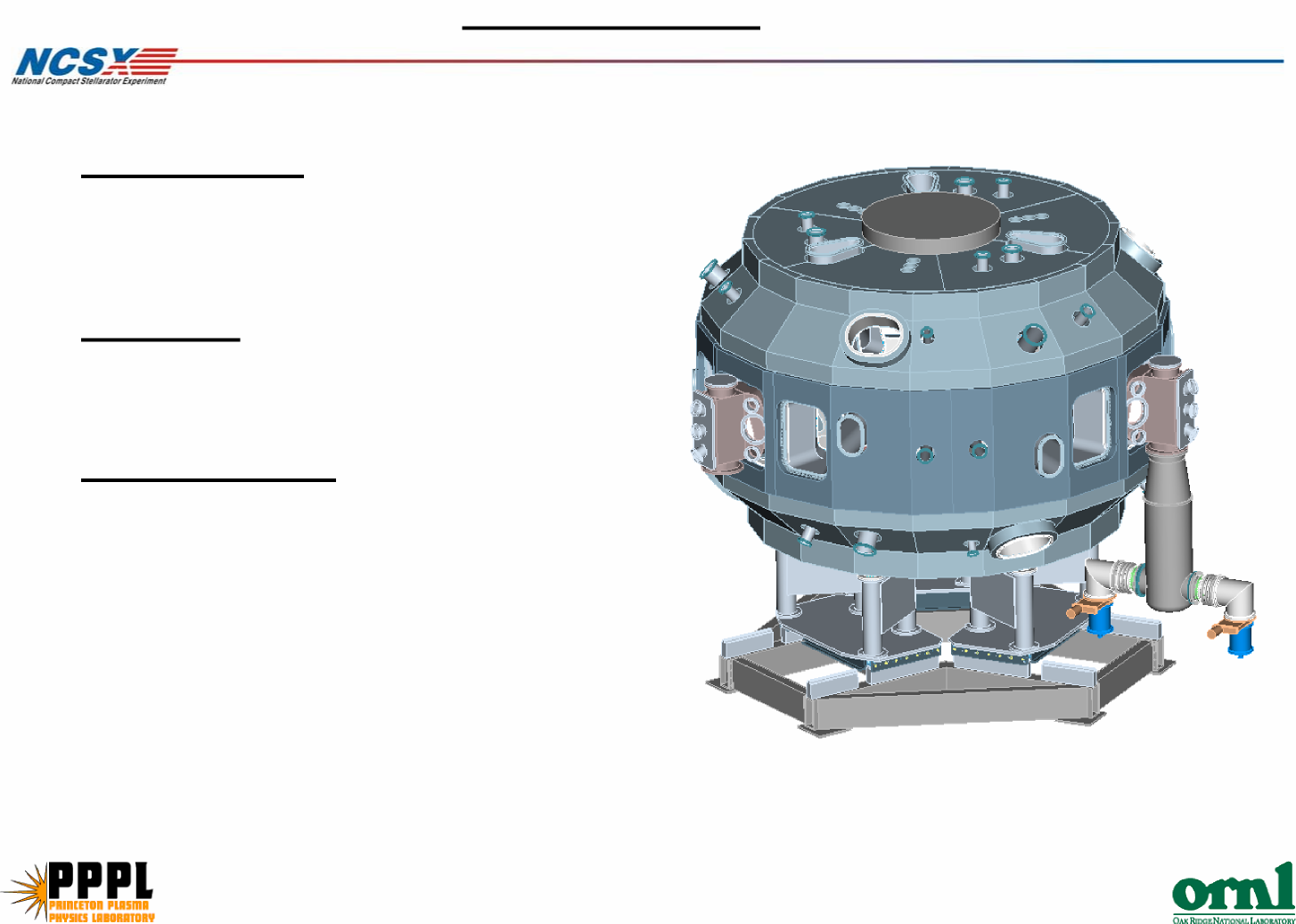
* **Includes gas delivery manifold, pumpout system and gauging**

**Requirements**

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

**FUELING SYSTEM**

SC Project Review of NCSX, April 8-10, 2008
  
W. Blanchard - page 6



**$**

**Task ID**

**Hours**

**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**

***80 0 120 528 0 272 0 0***

40 80

192

288

120 240

40

***136 0 144 0 236 560 0 0***

68

144

Materials and Supplies $ 38,000

***Subtotal Title III $ 38,000***

Integrated System Testing

Install PLC Controls

Fabricate & Install Hardware (Electrical)

Fabricate & Install Hardware

Engr Work Planning & Design

**Title III**

***Subtotal Title I & II Design***

Drafting Support (Mechanical)

Drafting Support (Electrical)

Design PLC Controls

Design Gas handling Hardware

Final Design / Management / Admin Engr Work Planning & Design

Drafting Support

Design PLC Controls

Design Gas handling Hardware

**Title I and II Design**

Preliminary Design / Management / Admin
  
Engr Work Planning & Design

**FUELING SYSTEM**

SC Project Review of NCSX, April 8-10, 2008
  
W. Blanchard - page 7

48

88

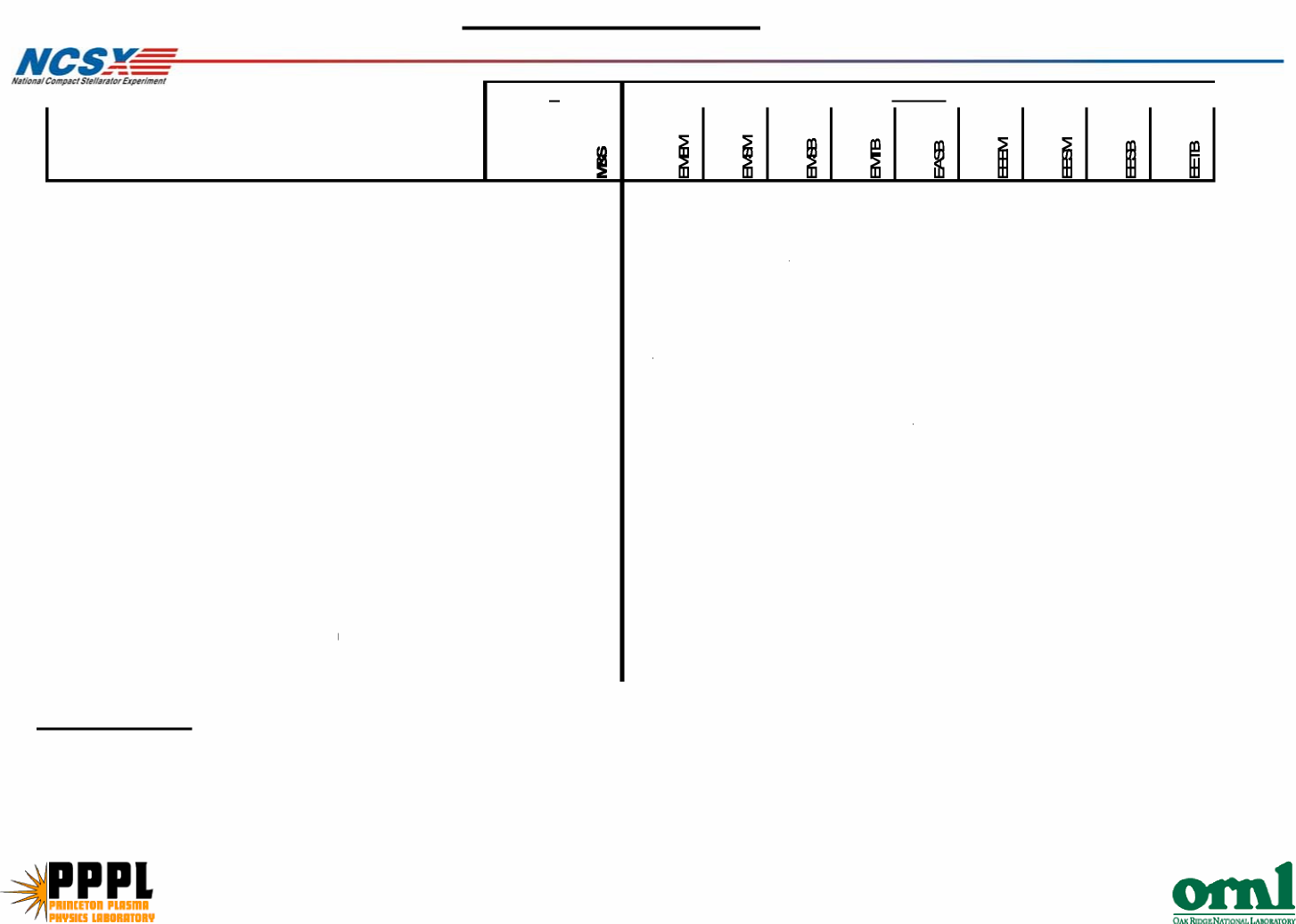
24

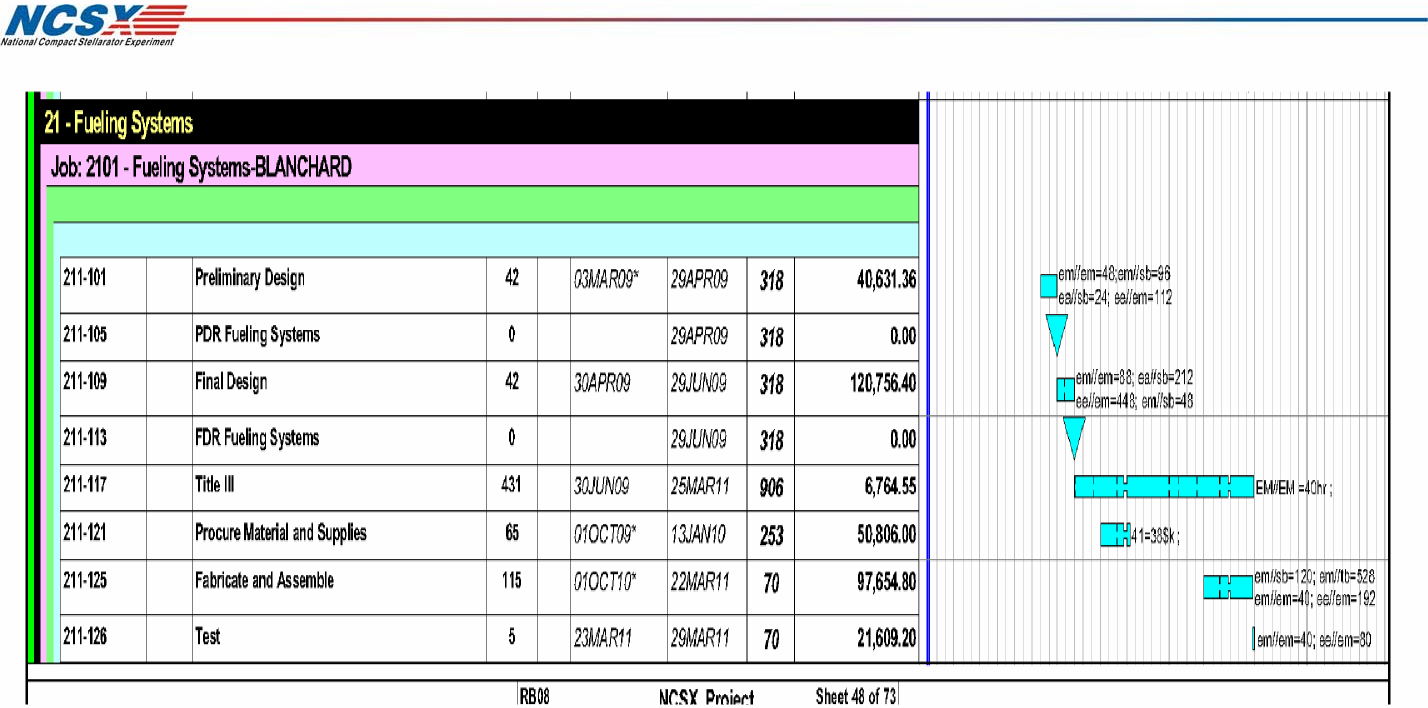
96

48

448

112





**Project Schedule**

|  |  |  |
| --- | --- | --- |
|  | SC Project Review of NCSX, April 8-10, 2008  W. Blanchard - page 8 |  |

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



|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Uncertainty of the Estimate** | | | |  |  |  |  | | | | | | | |
|  |  |  | **High** | **Medium** | **Low** | **Uncertainty** | **Comments/Other Considerations** | | | | | | | |
| **Range (%)** |
|  | **Design Maturity** | |  |  | **X** |  | **There have been no design reviews therefore the design is not fixed.** | | | | | | | |
|  |  | |  |  |  | **-1 5%/+25%** |  | |  | |  | |  |  |
|  | **Design Complexity** | |  |  | **X** |  | **Anticipated to only require standard components** | | | | | |  |  |
|  |  | |  |  |  |  |  |  |  |  |  |  |  |  |
|  | **Other Comments:** | |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

**Risk Assessment: Low**

|  |  |  |
| --- | --- | --- |
|  | SC Project Review of NCSX, April 8-10, 2008  W. Blanchard - page 9 |  |

**Risk:**

**\* Equipment or component failure**

**Mitigation:**

**\* All components outside of coils and cryostat and easily replaceable \* Standard equipment and hardware**