

## ECP-04-009 and ECP-04-009 Details

| Work Breakdown Structure (WBS)                              | ECP 8 Baseline<br>(K\$) | Delta<br>(K\$)    | ECP 9 Baseline<br>(K\$) |
|---|-------------------------|-------------------|-------------------------|
| <b>WBS 11 - Plasma Facing Components</b>                    |                         |                   |                         |
| 111 - Limiters  | \$0.1K                  | \$0.0K            | \$0.1K                  |
| <i>Subtotal WBS 11</i>                                      | <i>\$0.1K</i>           | <i>\$0.0K</i>     | <i>\$0.1K</i>           |
| <b>WBS 12 - Vacuum Vessel</b>                               |                         |                   |                         |
| 121 - Vacuum Vessel Assembly                                | \$6,648.1K              | \$0.0K            | \$6,648.1K              |
| 122 - Vacuum Vessel Thermal Insulation                      | \$174.9K                | \$0.0K            | \$174.9K                |
| 123 - Vacuum Vessel Heating and Cooling Distrib             | \$375.8K                | \$0.0K            | \$375.8K                |
| 124 - Vacuum Vessel Supports                                | \$62.6K                 | \$0.0K            | \$62.6K                 |
| 125 - Vacuum Vessel Local I&C                               | \$26.7K                 | \$0.0K            | \$26.7K                 |
| <i>Subtotal WBS 12</i>                                      | <i>\$7,288.1K</i>       | <i>\$0.0K</i>     | <i>\$7,288.1K</i>       |
| <b>WBS 13 - Conventional Coils</b>                          |                         |                   |                         |
| 130 - Conventional Coils                                    | \$462.1K                | \$0.0K            | \$462.1K                |
| 131 - TF Coils  | \$1,546.3K              | \$0.0K            | \$1,546.3K              |
| 132 - PF Coils  | \$1,747.4K              | \$0.0K            | \$1,747.4K              |
| 133 - External Trim Coils                                   | \$372.0K                | \$0.0K            | \$372.0K                |
| 134 - Conventional Coil Local                               | \$85.5K                 | \$0.0K            | \$85.5K                 |
| <i>Subtotal WBS 13</i>                                      | <i>\$4,213.3K</i>       | <i>\$0.0K</i>     | <i>\$4,213.3K</i>       |
| <b>WBS 14 - Modular Coils</b>                               |                         |                   |                         |
| 141 - Modular Coil Winding Form                             | \$9,291.0K              | \$77.2K           | \$9,368.2K              |
| 142 - Modular Coil Windings and Assembly                    | \$8,680.0K              | \$89.3K           | \$8,769.3K              |
| 143 - Modular Coil Local I&C                                | \$121.2K                | \$0.0K            | \$121.2K                |
| 144 - Modular Coil Winding Facility & Fixtures              | \$2,501.7K              | \$0.0K            | \$2,501.7K              |
| <i>Subtotal WBS 14</i>                                      | <i>\$20,593.9K</i>      | <i>\$166.5K</i>   | <i>\$20,760.4K</i>      |
| <b>WBS 15 - Coil Support Structure</b>                      |                         |                   |                         |
| 151 - Structures and Base                                   | \$1,441.1K              | \$0.0K            | \$1,441.1K              |
| <i>Subtotal WBS 15</i>                                      | <i>\$1,441.1K</i>       | <i>\$0.0K</i>     | <i>\$1,441.1K</i>       |
| <b>WBS 16 - Coil Services</b>                               |                         |                   |                         |
| 161 - LN2 Distribution                                      | \$337.5K                | \$0.0K            | \$337.5K                |
| 162 - Electrical Leads                                      | \$621.3K                | \$0.0K            | \$621.3K                |
| 163 - Coil Protection System                                | \$78.1K                 | \$0.0K            | \$78.1K                 |
| <i>Subtotal WBS 16</i>                                      | <i>\$1,036.9K</i>       | <i>\$0.0K</i>     | <i>\$1,036.9K</i>       |
| <b>WBS 17 - Cryostat and Base Support Structure</b>         |                         |                   |                         |
| 171 -Cryostat   | \$858.5K                | \$0.0K            | \$858.5K                |
| 172 - Base Support Structure                                | \$438.2K                | \$0.0K            | \$438.2K                |
| <i>Subtotal WBS 17</i>                                      | <i>\$1,296.7K</i>       | <i>\$0.0K</i>     | <i>\$1,296.7K</i>       |
| <b>WBS 18 - Field Period Assembly</b>                       |                         |                   |                         |
| 181 - Field Period Assembly Planning/Oversight              | \$1,379.3K              | \$0.0K            | \$1,379.3K              |
| 182 - TFTR Test Cell Area preparations                      | \$92.9K                 | \$0.0K            | \$92.9K                 |
| 183 - Receive Inspect and Test Coils                        | \$77.4K                 | \$0.0K            | \$77.4K                 |
| 184 - Receive Inspect and Test VV                           | \$326.3K                | \$0.0K            | \$326.3K                |
| 185 - Assemble Field Periods                                | \$1,433.8K              | \$0.0K            | \$1,433.8K              |
| 186 - Tooling Design and Fabrication                        | \$1,342.5K              | (\$166.6K)        | \$1,175.9K              |
| 187 - Measurement Systems                                   | \$591.6K                | \$0.0K            | \$591.6K                |
| <i>Subtotal WBS 18</i>                                      | <i>\$5,243.8K</i>       | <i>(\$166.6K)</i> | <i>\$5,077.2K</i>       |
| <b>WBS 19 - Stellarator Core Management and Integration</b> |                         |                   |                         |
| 191 - Stellarator Core Management & Oversight               | \$1,083.0K              | \$0.0K            | \$1,083.0K              |
| 192 - Stellarator Core Integration & Analysis               | \$1,579.0K              | \$0.0K            | \$1,579.0K              |
| <i>Subtotal WBS 19</i>                                      | <i>\$2,662.0K</i>       | <i>\$0.0K</i>     | <i>\$2,662.0K</i>       |
| <b>WBS 21 - Fueling Systems</b>                             |                         |                   |                         |
| 210 - Fueling Systems                                       | \$140.0K                | \$0.0K            | \$140.0K                |
| <i>Subtotal WBS 21</i>                                      | <i>\$140.0K</i>         | <i>\$0.0K</i>     | <i>\$140.0K</i>         |
| <b>WBS 22 - Torus Vacuum Pumping Systems</b>                |                         |                   |                         |
| 220 - Torus Vacuum Pumping Systems                          | \$384.2K                | \$0.0K            | \$384.2K                |
| <i>Subtotal WBS 22</i>                                      | <i>\$384.2K</i>         | <i>\$0.0K</i>     | <i>\$384.2K</i>         |
| <b>WBS 25 - Neutral Beam Injection systems</b>              |                         |                   |                         |
| 250 - Neutral Beam Injection System                         | \$1,169.1K              | \$0.0K            | \$1,169.1K              |
| <i>Subtotal WBS 25</i>                                      | <i>\$1,169.1K</i>       | <i>\$0.0K</i>     | <i>\$1,169.1K</i>       |

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| <b>WBS 31 - Magnetic Diagnostic Systems</b>               |                         |                |                         |
| 310 - Magnetic Diagnostics                                | \$454.1K                | \$0.0K         | \$454.1K                |
| <i>Subtotal WBS 31</i>                                    | <i>\$454.1K</i>         | <i>\$0.0K</i>  | <i>\$454.1K</i>         |
| <b>WBS 36 - Edge and Divertor Diagnostics Systems</b>     |                         |                |                         |
| 360 - Edge and Divertor Diagnostics                       | \$99.3K                 | \$0.0K         | \$99.3K                 |
| <i>Subtotal WBS 36</i>                                    | <i>\$99.3K</i>          | <i>\$0.0K</i>  | <i>\$99.3K</i>          |
| <b>WBS 38 - Electron Beam Mapping Systems</b>             |                         |                |                         |
| 380 - Electron Beam (EB) Mapping                          | \$292.1K                | \$0.0K         | \$292.1K                |
| <i>Subtotal WBS 38</i>                                    | <i>\$292.1K</i>         | <i>\$0.0K</i>  | <i>\$292.1K</i>         |
| <b>WBS 39 - Diagnostic Integration</b>                    |                         |                |                         |
| 390 - Diagnostics Integration                             | \$847.2K                | \$0.0K         | \$847.2K                |
| <i>Subtotal WBS 39</i>                                    | <i>\$847.2K</i>         | <i>\$0.0K</i>  | <i>\$847.2K</i>         |
| <b>WBS 41 - AC Power Systems</b>                          |                         |                |                         |
| 411 - Auxiliary AC Power Systems                          | \$569.3K                | \$0.0K         | \$569.3K                |
| 412 - Experimental AC Power Systems                       | \$42.8K                 | \$0.0K         | \$42.8K                 |
| <i>Subtotal WBS 41</i>                                    | <i>\$612.1K</i>         | <i>\$0.0K</i>  | <i>\$612.1K</i>         |
| <b>WBS 42 - AC/DC Convertors</b>                          |                         |                |                         |
| 422 - D-Site AC/DC Convertors                             | \$23.5K                 | \$0.0K         | \$23.5K                 |
| <i>Subtotal WBS 42</i>                                    | <i>\$23.5K</i>          | <i>\$0.0K</i>  | <i>\$23.5K</i>          |
| <b>WBS 43 - DC Systemrs</b>                               |                         |                |                         |
| 431 - C-Site DC Systems                                   | \$326.7K                | \$0.0K         | \$326.7K                |
| 432 - D-to-C Site DC Systems                              | \$1,328.7K              | \$0.0K         | \$1,328.7K              |
| 433 - D-Site DC Systems                                   | \$487.9K                | \$0.0K         | \$487.9K                |
| <i>Subtotal WBS 43</i>                                    | <i>\$2,143.3K</i>       | <i>\$0.0K</i>  | <i>\$2,143.3K</i>       |
| <b>WBS 44 - Control and Protection Systems</b>            |                         |                |                         |
| 441 - Electrical Interlocks                               | \$578.6K                | \$0.0K         | \$578.6K                |
| 442 - Kirk Key Interlocks                                 | \$98.0K                 | \$0.0K         | \$98.0K                 |
| 443 - Real Time Control Systems                           | \$38.4K                 | \$0.0K         | \$38.4K                 |
| 444 - Instrument Systems                                  | \$433.2K                | \$0.0K         | \$433.2K                |
| 445 - Coil protection Systems                             | \$283.4K                | \$0.0K         | \$283.4K                |
| 446 - Ground Fault Monitoring                             | \$167.0K                | \$0.0K         | \$167.0K                |
| <i>Subtotal WBS 44</i>                                    | <i>\$1,598.6K</i>       | <i>\$0.0K</i>  | <i>\$1,598.6K</i>       |
| <b>WBS 45 - Power Systems Design and Integration</b>      |                         |                |                         |
| 451 - System Design and Interfaces                        | \$591.4K                | \$0.0K         | \$591.4K                |
| 452 - Electrical Systems Support                          | \$91.4K                 | \$0.0K         | \$91.4K                 |
| 453 - System Testing (PTP's)                              | \$192.0K                | \$0.0K         | \$192.0K                |
| <i>Subtotal WBS 45</i>                                    | <i>\$874.8K</i>         | <i>\$0.0K</i>  | <i>\$874.8K</i>         |
| <b>WBS 46 - FCPC Building Modifications</b>               |                         |                |                         |
| 460 - FCPC Building Modifications                         | \$78.6K                 | \$0.0K         | \$78.6K                 |
| <i>Subtotal WBS 46</i>                                    | <i>\$78.6K</i>          | <i>\$0.0K</i>  | <i>\$78.6K</i>          |
| <b>WBS 51 - TCP/IP Infrastructure Systems</b>             |                         |                |                         |
| 510 - TCP/IP Infrastructure Systems                       | \$429.0K                | \$0.0K         | \$429.0K                |
| <i>Subtotal WBS 51</i>                                    | <i>\$429.0K</i>         | <i>\$0.0K</i>  | <i>\$429.0K</i>         |
| <b>WBS 52 - Central Instrumentation &amp; Control</b>     |                         |                |                         |
| 520 - Central Instrumentation & Control                   | \$578.0K                | \$0.0K         | \$578.0K                |
| <i>Subtotal WBS 52</i>                                    | <i>\$578.0K</i>         | <i>\$0.0K</i>  | <i>\$578.0K</i>         |
| <b>WBS 53 - Data Acquisition &amp; Facility Computing</b> |                         |                |                         |
| 530 - Data Acquisition & Facility Computing               | \$407.8K                | \$0.0K         | \$407.8K                |
| <i>Subtotal WBS 53</i>                                    | <i>\$407.8K</i>         | <i>\$0.0K</i>  | <i>\$407.8K</i>         |
| <b>WBS 54 - Facility Timing &amp; Synchronization</b>     |                         |                |                         |
| 540 - Facility Timing & Synchronization                   | \$352.0K                | \$0.0K         | \$352.0K                |
| <i>Subtotal WBS 54</i>                                    | <i>\$352.0K</i>         | <i>\$0.0K</i>  | <i>\$352.0K</i>         |

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|---|-------------------------|----------------|-------------------------|
| <b>WBS 55 - Real Time Plasma &amp; Power Supply Control Systems</b> |                         |                |                         |
| 550 - Real Time Plasma & Power Supply Control Systems               | \$293.3K                | \$0.0K         | \$293.3K                |
| <i>Subtotal WBS 55</i>  | <i>\$293.3K</i>         | <i>\$0.0K</i>  | <i>\$293.3K</i>         |
| <b>WBS 56 - Central Safety Interlock Systems</b>                    |                         |                |                         |
| 560 - Central Safety Interlock Systems                              | \$399.9K                | \$0.0K         | \$399.9K                |
| <i>Subtotal WBS 56</i>  | <i>\$399.9K</i>         | <i>\$0.0K</i>  | <i>\$399.9K</i>         |
| <b>WBS 57 - Control Room Facility</b>                               |                         |                |                         |
| 570 - Control Room Facility   | \$119.7K                | \$0.0K         | \$119.7K                |
| <i>Subtotal WBS 57</i>  | <i>\$119.7K</i>         | <i>\$0.0K</i>  | <i>\$119.7K</i>         |
| <b>WBS 61 - Water Cooling Systems</b>                               |                         |                |                         |
| 611 - C-Site Cooling System   | \$153.3K                | \$0.0K         | \$153.3K                |
| 612 - NB Water Cooling Systems                                      | \$239.9K                | \$0.0K         | \$239.9K                |
| 613 - Vacuum Pumping System   | \$100.0K                | \$0.0K         | \$100.0K                |
| 614 - Bakeout Water System  | \$38.5K                 | \$0.0K         | \$38.5K                 |
| <i>Subtotal WBS 61</i>  | <i>\$531.7K</i>         | <i>\$0.0K</i>  | <i>\$531.7K</i>         |
| <b>WBS 62 - Cryogenic Systems</b>                                   |                         |                |                         |
| 621 - LN2-LHe Supply System   | \$252.9K                | \$0.0K         | \$252.9K                |
| 622 - LN2 Coil Cooling Supply                                       | \$274.4K                | \$0.0K         | \$274.4K                |
| 623 - GN2 Cryostat Cooling System                                   | \$220.2K                | \$0.0K         | \$220.2K                |
| <i>Subtotal WBS 62</i>  | <i>\$747.5K</i>         | <i>\$0.0K</i>  | <i>\$747.5K</i>         |
| <b>WBS 63 - Utility Systems</b>                                     |                         |                |                         |
| 630 - Utility Systems   | \$120.9K                | \$0.0K         | \$120.9K                |
| <i>Subtotal WBS 63</i>  | <i>\$120.9K</i>         | <i>\$0.0K</i>  | <i>\$120.9K</i>         |
| <b>WBS 64 - PFC/VV Heating &amp; Cooling Systems</b>                |                         |                |                         |
| 640 - PFC/VV Heating & Cooling                                      | \$628.9K                | \$0.0K         | \$628.9K                |
| <i>Subtotal WBS 64</i>  | <i>\$628.9K</i>         | <i>\$0.0K</i>  | <i>\$628.9K</i>         |
| <b>WBS 65 - Facility Systems Integration</b>                        |                         |                |                         |
| 650 - Facility Systems Integration                                  | \$41.6K                 | \$0.0K         | \$41.6K                 |
| <i>Subtotal WBS 65</i>  | <i>\$41.6K</i>          | <i>\$0.0K</i>  | <i>\$41.6K</i>          |
| <b>WBS 71 - Shield Wall Modifications</b>                           |                         |                |                         |
| 710 - Shield Wall Seismic Modifications                             | \$32.2K                 | \$0.0K         | \$32.2K                 |
| <i>Subtotal WBS 71</i>  | <i>\$32.2K</i>          | <i>\$0.0K</i>  | <i>\$32.2K</i>          |
| <b>WBS 72 - Control Room Refurbishment</b>                          |                         |                |                         |
| 720 - Control Room Refurbishment                                    | \$47.6K                 | \$0.0K         | \$47.6K                 |
| <i>Subtotal WBS 72</i>  | <i>\$47.6K</i>          | <i>\$0.0K</i>  | <i>\$47.6K</i>          |
| <b>WBS 73 - Platform Design &amp; Fabrication</b>                   |                         |                |                         |
| 730 - Platform Design & Fabrication                                 | \$70.0K                 | \$0.0K         | \$70.0K                 |
| 731 - Platform Design & Fabrication                                 | \$89.6K                 | \$0.0K         | \$89.6K                 |
| <i>Subtotal WBS 73</i>  | <i>\$159.6K</i>         | <i>\$0.0K</i>  | <i>\$159.6K</i>         |
| <b>WBS 74 - Machine Assembly Planning &amp; Oversight</b>           |                         |                |                         |
| 740 - Machine Assembly Planning and Oversight                       | \$147.8K                | \$0.0K         | \$147.8K                |
| 741 - Planning Prior to Machine Assembly                            | \$281.6K                | \$0.0K         | \$281.6K                |
| 742 - Construction Management                                       | \$1,184.8K              | \$0.0K         | \$1,184.8K              |
| <i>Subtotal WBS 74</i>  | <i>\$1,614.2K</i>       | <i>\$0.0K</i>  | <i>\$1,614.2K</i>       |
| <b>WBS 75 - Test Cell &amp; Basement Assembly Operations</b>        |                         |                |                         |
| 750 - Test Cell & Basement Assembly Operations                      | \$2,160.0K              | \$0.0K         | \$2,160.0K              |
| <i>Subtotal WBS 75</i>  | <i>\$2,160.0K</i>       | <i>\$0.0K</i>  | <i>\$2,160.0K</i>       |
| <b>WBS 76 - Tooling Design &amp; Fabrication</b>                    |                         |                |                         |
| 76 - 76 - Tooling Design & Fabrication                              | \$223.7K                | \$0.0K         | \$223.7K                |
| <i>Subtotal WBS 76</i>  | <i>\$223.7K</i>         | <i>\$0.0K</i>  | <i>\$223.7K</i>         |
| <b>WBS 81 - Project Management &amp; Control</b>                    |                         |                |                         |
| 810 - Project Management & Control                                  | \$3,354.3K              | \$0.0K         | \$3,354.3K              |
| <i>Subtotal WBS 81</i>  | <i>\$3,354.3K</i>       | <i>\$0.0K</i>  | <i>\$3,354.3K</i>       |

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|--|-------------------------|-----------------|-------------------------|
| <b>WBS 82 - Project Engineering</b>        |                         |                 |                         |
| 820 - Project Engineering                  | \$4,723.1K              | \$0.0K          | \$4,723.1K              |
| <i>Subtotal WBS 82</i>                     | <i>\$4,723.1K</i>       | <i>\$0.0K</i>   | <i>\$4,723.1K</i>       |
| <b>WBS 84 - Project Physics</b>            |                         |                 |                         |
| 840 - Project Physics                      | \$507.7K                | \$0.0K          | \$507.7K                |
| <i>Subtotal WBS 84</i>                     | <i>\$507.7K</i>         | <i>\$0.0K</i>   | <i>\$507.7K</i>         |
| <b>WBS 85 - Integrated Systems Testing</b> |                         |                 |                         |
| 850 - Integrated Systems Testing           | \$1,225.0K              | \$0.0K          | \$1,225.0K              |
| <i>Subtotal WBS 85</i>                     | <i>\$1,225.0K</i>       | <i>\$0.0K</i>   | <i>\$1,225.0K</i>       |
| <b>AA - PPPL Allocations</b>               |                         |                 |                         |
| AA - PPPL Allocations                      | \$983.3K                | \$0.0K          | \$983.3K                |
| <i>Subtotal PPPL Allocations</i>           | <i>\$983.3K</i>         | <i>\$0.0K</i>   | <i>\$983.3K</i>         |
| <b>NCSX Performance Baseline</b>           | <b>\$72,173.8K</b>      | <b>(\$0.1K)</b> | <b>\$72,173.7K</b>      |
| <b>CC - Contingency</b>                    |                         |                 |                         |
| <b>NCSX TEC</b>                            | <b>\$86.3M</b>          |                 | <b>\$86.3M</b>          |