

## NLC Control System Software WBS and Cost Estimate

WBS	ELEMENT	EFFORT ESTIMATE (Person-Years)		
		TOTAL	Needed by Commiss.	Needed Later
1	PROJECT			
13	Global Control System			
136	Global Control System Software			
1361	<b>CONTROL SOFTWARE</b>	<b>474</b>	<b>335</b>	<b>139</b>
13611	<b>Systems Architecture</b>	<b>30</b>	<b>28</b>	<b>2</b>
	Overall System Design	6	6	
	High Level Networks and Communication	5	5	
	Low Level Networks	5	5	
	Computer & Networks Security	2	2	
	High-Level Software Architecture (Device Abstraction)	6	4	2
	Digital Audio and Video Infrastructure	2	2	
	Supervision	4	4	
13612	<b>Software Infrastructure</b>	<b>102</b>	<b>52</b>	<b>50</b>
	Development Environment	39	20	19
	<b>EPICS Development Facility</b>	<b>2</b>	<b>1</b>	<b>1</b>
	<b>EPICS Setup and Maintenance</b>	<b>10</b>	<b>5</b>	<b>5</b>
	<b>EPICS Enhancements</b>	<b>20</b>	<b>10</b>	<b>10</b>
	<b>Software Development Tools</b>	<b>6</b>	<b>3</b>	<b>3</b>
	<b>Embeded System Development Environment</b>	<b>1</b>	<b>1</b>	
	Support for External Software Developers	5	1	4
	Networked Accelerator Control	4	2	2
	New Ideas and Products	4	1	3
	Maintenance	50	28	22
	<b>Computer System</b>	<b>8</b>	<b>4</b>	<b>4</b>
	<b>Control System</b>	<b>10</b>	<b>7</b>	<b>3</b>
	<b>User Support and Training</b>	<b>8</b>	<b>3</b>	<b>5</b>
	<b>Trouble Shooting</b>	<b>24</b>	<b>14</b>	<b>10</b>
13613	<b>Low-Level Applications</b>	<b>139</b>	<b>103</b>	<b>36</b>
	Database	32	26	6
	<b>Requirements</b>	<b>2</b>	<b>1</b>	<b>1</b>
	<b>Design</b>	<b>2</b>	<b>2</b>	
	<b>Create</b>	<b>8</b>	<b>8</b>	

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	Commissioning	10	10	
	Maintenance	10	5	5
	<b>BPMs</b>	<b>18</b>	<b>9</b>	<b>9</b>
	Requirements	1	1	
	NMI Task	4	2	2
	IOC Database, etc.	3	1	2
	Firmware	5	3	2
	Applications	5	2	3
	<b>Toroids</b>	<b>1</b>	<b>1</b>	
	<b>BLM</b>	<b>2</b>	<b>2</b>	
	<b>Wire Scanners, Laser Wires</b>	<b>4</b>	<b>4</b>	
	<b>Profile &amp; Synchrotron Light Monitors</b>	<b>2</b>	<b>2</b>	
	<b>RF</b>	<b>32</b>	<b>23</b>	<b>9</b>
	Requirements	1	1	
	Low-Level Software	8	6	2
	RF Feedback	6	6	
	High_Level Software	10	5	5
	Veto System	2	2	
	Commissioning & Maintenance	5	3	2
	<b>Magnets</b>	<b>8</b>	<b>7</b>	<b>1</b>
	Requirements	1	1	
	Fieldbus Software	1	1	
	Firmware	2	1	1
	IOC Database	1	1	
	Displays for Operations	1	1	
	Applications: (virtual CAMAC, Remote Diag/Control	1	1	
	Remote Diagnostics of Embeded Software	1	1	
	<b>Magnet Movers</b>	<b>3</b>	<b>3</b>	
	Requirements	0.5	0.5	
	Design	2	2	
	Test and Commission	0.5	0.5	
	<b>Obstructions</b>	<b>2</b>	<b>2</b>	
	<b>Timing</b>	<b>12</b>	<b>9</b>	<b>3</b>

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	Requirements	1	1	
	MPG Software	3	2	1
	Bunch rate Limiting	2	1	1
	Beam Codes and Control	2	2	
	Linac Phasing	2	1	1
	Custom Hardware	2	2	
	Gun Control	2	2	
	Polarization Support	4	2	2
	Integration of New devices	10	4	6
	General Analog Monitor & Displays	4	4	
	Digital Systems	2	2	
	Fast Data Logging	1	1	
13614	<b>Tools and Utilities</b>	<b>25</b>	<b>24</b>	<b>1</b>
	Configuration Facility	2	2	
	Correlation Plot	1	1	
	Multiknobs	1	1	
	History Buffer	3	2	1
	Alarms	2	2	
	Summary Status Processes and Displays	2	2	
	Errors & Messages Logging and Viewing	1	1	
	Problem Reporting (CATER)	1	1	
	Accelerator GUI (Zplot)	2	2	
	Data Browsing and Visualization	2	2	
	Button Macros and Scripting	1	1	
	Instrumentation (GPIB) Development and Support (other buses)	1	1	
	CAMCOM equivalent	1	1	
	Maintenance	5	5	
13615	<b>High-Level Applications</b>	<b>23</b>	<b>21</b>	<b>2</b>
136151	On-Line Models	3	3	
136152	Steering	4	2	2
136153	LEM	1	1	
136154	Emittance	2	2	
136155	Other Beam Properties Measurement	2	2	

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136156	Beam-Based Alignment	2	2	
136157	Lattice Diagnostics	1	1	
136158	Lattice Optimization and Matching	1	1	
136159	IP Optimization, Beam-Beam Scans, etc.	2	2	
13615A	Simulation facility	2	2	
13615B	Other Accelerator Physics Applications	3	3	
13616	<b>Feedback Systems</b>	<b>24</b>	<b>15</b>	<b>9</b>
	Fast Feedback	17	11	6
	Basic Linear System	7	5	2
	Global Linac Feedback	1	1	
	Cascade	1	1	
	Optimization	1	1	
	Specialized Loops	1	1	
	DR (APS Style) Feedback	2	2	
	Ongoing Support	4		4
	PID Loops	2	2	
	Slow Feedback	5	2	3
	Basic System	2	1	1
	Setup Loops	2	1	1
	Maintenance	1		1
13617	<b>Protection Systems</b>	<b>48</b>	<b>45</b>	<b>3</b>
	MPS	35	32	3
	System Design: Comm. Protocols, Hardware, Software	5	5	
	Local SPIF DAQ Design	1	1	
	Global MAID Trip System	1	1	
	Local MAID Trip System	1	1	
	Local MAID DAQ Design	1	1	
	User Interface Design	1	1	
	System Controller Design	2	2	
	System Event Manager Design	2	2	
	System Algorithm Tools	2	2	
	System Diagnostics	2	2	
	System Database Integration	2	2	

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		TOTAL	Needed by Commiss.	Needed Later
	AP Slow Software	1	1	
	AP fast Software	1	1	
	AP Utility Software	1	1	
	Subsystem Checkout	2	2	
	System Integration and Test	2	2	
	Device Drivers: PIC, LDIM, RTD	1	1	
	AP Database Work: 1Week/IOC * 200 IOCs	4	1	3
	AP Algorithm Development Support: 0.2PY * 10 Years	2	2	
	Network Database Setup	1	1	
	BCS Interface	1	1	
	PPS	10	10	
	Implement Jlab PC-based PPS in EPICS	7	7	
	Interface PPS VME Scanner Card to Control Syst., Displays	1	1	
	Setup & Maintain database	1	1	
	Support for Digital CCTV Connectivity and Display	1	1	
	Ground Fault Detection	1	1	
	Klixon	1	1	
13618	<b>Systems Integration</b>	<b>20</b>	<b>10</b>	<b>10</b>
	Setup Network Equipment	4	2	2
	Setup IOC's	6	3	3
	Load Database, Utilities, Diagnostics	4	2	2
	Trouble Shooting Drivers, etc.	6	3	3
13619	<b>Automation</b>	<b>4</b>	<b>1</b>	<b>3</b>
1361A	<b>Detector Interface</b>	<b>3</b>		<b>3</b>
	Pulse Related Data	1		1
	Slow Data	1		1
	Dual Control Issues (Detector and Accelerator Controls)	1		1
1361B	<b>Supervision</b>	<b>56</b>	<b>36</b>	<b>20</b>