

ERL1a Operations - high level WBS					All activities related to installation, commissioning, and ERL R&D activities on the L0 injector test accelerator	
Project Code	Task Code	Duo Code	Category	Description	Approvals	Description of work
ERL_1				Electron Gun	K. Smolenski	
	ERL_1.1		c	Gun Design		R&D, Design and testing of concepts for improvements to the high voltage electron gun & cathode processing
	ERL_1.2		c	Gun EFI&C		Electron gun, cathode, power supply systems upgrades and modifications
	ERL_1.3		n	Gun Maintenance		Routine tuning, troubleshooting & repairs to gun, cathode processing, & power supply
ERL_2				Laser Systems	D. Ouzounov	
	ERL_2.1		c	Laser Systems Design		R&D and design studies of new and improved laser systems for the ERL injector
	ERL_2.2		c	Laser EFI&C		Laser system upgrades and modifications
	ERL_2.3		n	Laser Maintenance		Routine tuning, troubleshooting & repairs to laser related systems
ERL_3				RF Systems	S. Belomestnykh	
	ERL_3.1		c	RF Design		R&D, design and testing of concepts for improvements to the RF power and controls for the ERL injector. Design studies of SRF cavities and cryomodules for the ERL injector
	ERL_3.2		c	RF EFI&C		RF systems commissioning, modifications and improvements for injector operations
	ERL_3.3		n	RF Maintenance		Routine tuning, troubleshooting & repairs to RF systems
ERL_4				Beam Diag & Instr.	I. Bazarov	
	ERL_4.1		c	Instrumentation Design		Beam instrumentation R&D, design, & upgrade for phase space and beam dynamics measurements
	ERL_4.2		c	Instr. EFI&C		Commissioning and production of beam instrumentation systems and upgrades for phase space and beam dynamics measurements
	ERL_4.3		c	Instr. Commissioning		Characterization of beam instrumentation and validation of performance specifications
	ERL_4.4		n	Instr. Maintenance		Routine calibration, troubleshooting and repair of beam diagnostic and instrumentation systems.
ERL_5				ERL Experimental Program	I Bazarov	
	ERL_5.1		c	Beam Optics Design		Optics design studies for the ERL injector including linear, non-linear, and space charge effects. Writing codes for optics calculation and analysis.
	ERL_5.2		c	Beam Commissioning		Beam studies and model validation. Loading of beam optics into hardware, measurement and correction of optics, linear and non-linear measurements and corrections.
	ERL_5.3		n	Experimental program		Measurement, tuning, general accelerator design to achieve program objectives.
ERL_6				Electronics & power conversion	J. Barley	
	ERL_6.1		c	Control Hardware EFI&C		Control hardware (including control system computers and networking) and electronics modifications to support ERL injector modifications
	ERL_6.2		c	Mag & PS EFI&C		Magnet construction, installation, modifications and power supply installation, commissioning, and upgrades for injector operations
	ERL_6.3		c	Equipment Safety		Installation, upgrades and modifications to the equipment protection system for the ERL injector
	ERL_6.4		c	Electronics Commissioning		Characterization of magnet and electronics operations and validation of performance specifications
	ERL_6.5		n	Control hardware maintenance		Routine maintenance, troubleshooting, and repair of control system and equipment safety hardware.
	ERL_6.6		n	Magnet and power supply maintenance		Routine maintenance, troubleshooting, and repair of magnets and power supplies.
ERL_7				Vacuum	Y. Li	
	ERL_7.1		c	Vacuum EFI&C		Vacuum system design, fabrication, and testing of modifications, vacuum instrumentation and diagnostics, including beam dumps.
	ERL_7.2		c	Beam Dumps		Upgrades and modifications for the ERL injector beam dumps
	ERL_7.3		n	Vacuum maintenance		Routine monitoring, troubleshooting, and repairs to vacuum components, instrumentation, and beam dumps.
ERL_8				Genl Oprns & Safety	B. Dunham	
	ERL_8.1		n	Genl Oprns & Safety		All activities related to providing reliable beam operation for the ERL Phase 1A injector. Includes ERL specific safety programs, training, accelerator scheduling, operations, operators, work unit meetings, monitors, 24V interlocks, etc.
	ERL_8.1.1		n	Operations Support		General operations maintenance m&s
	ERL_8.1.2		n	Radiation Shielding		M&S for maintenance of shielding
	ERL_8.1.3		n	Radiation Monitors		M&S for maintenance of radiation monitors
	ERL_8.1.4		n	PPS Infrastructure		M&S for maintenance of wiring, panels, and other PPS hardware.
	ERL_8.2		c	EFI&C PPS & Safety		Design, engineering, fabrication, installation, and commissioning of the ERL Personnel Protection System (wiring, radiation monitors, light beams, signs) and radiation shielding.
	ERL_8.2.1		c	Radiation Shielding		Equipment for acquisition, fabrication, installation or commissioning of radiation shielding.
	ERL_8.2.2		c	Radiation Monitors		Equipment for acquisition, fabrication, installation or commissioning of radiation monitoring system.
	ERL_8.2.3		c	PPS Infrastructure		Equipment for acquisition, fabrication, installation or commissioning of PPS hardware, wiring, panels, etc.
ERL_9				Technical Support	R. Gallagher	
	ERL_9.1		n	Building & Shop		Maintenance, repairs, organization, coordination with CU facilities of general building and shop areas for the ERL specific needs.
	ERL_9.2		n	Utilities		Repairs, maintenance, coordination with CU facilities for water, electric, air, steam and other general utility systems for the ERL specific needs
	ERL_9.3		c	EFI&C Utilities and Infrastructure		Engineering, Fabrication, Installation and Commissioning of utilities and other equipment not specific to a single ERL system.
ERL_10				Control system Software	J. Dobbins	
	ERL_10.1		c	Codes, database, screens		Includes writing, fixing, improving computer codes, databases, entering data into databases, generating screens, initial work and upgrades to system. Control system software development, EPICS support and modifications
	ERL_10.2		n	Software Maintenance		Support for maintaining and operating the EPICS control system for the ERL injector.
ERL_11				Cryogenics	D. Widger	
	ERL_11.1		c	ERL Cryo upgrade		Includes all design, construction, installation and testing of cryogenics work for ERL for initial installation or for operational improvements.
	ERL_11.2		n	ERL cryo maintenance		Includes troubleshooting and repair of ERL cryo systems and maintaining supply of LN or other expendable cryogens.
ERL_12				Survey	S. Chapman	
	ERL_12.1		c	Alignment & Upgrade		Initial alignment and surveying for the injector. Improving alignment. Acquisition of new equipment.
	ERL_12.2		n	Alignment maintenance		Routine survey and realignment of ERL test injector.
ERL_13				Admin/Management	B. Dunham	
	ERL_13.1		n	Admin/Management Labor		ERL specific record keeping, management, administrative meetings, ERL related external activities (reviews, referee, talks, etc.) Explain in COMMENTS box.