

**LUSI PROJECT**  
**WORK BREAKDOWN STRUCTURE - PM-391-000-96**

4/13/2009

WBS	TITLE
<b>1</b>	<b>LUSI PROJECT MAJOR ITEM OF EQUIPMENT (MIE)</b>
<b>1.1</b>	<b>PROJECT MANAGEMENT</b>
1.1.01	ES&H
1.1.01.01	ES&H
1.1.02	Project Management
1.1.02.01	Management Office
1.1.02.02	Project Support
1.1.03	Technical Support
1.1.03.01	Technical Support
1.1.03.02	Reviews
1.1.03.03	Collaboration
<b>1.2</b>	<b>X-RAY PUMP PROBE (XPP)</b>
1.2.01	XPP System Integration & Design
1.2.02	XPP X-ray Optics & Support Table
1.2.02.01	XPP Support Table, Supports & Shielding
1.2.02.02	XPP Optics Support Table & Supports
1.2.02.03	<i>reserved</i>
1.2.03	XPP Laser System
1.2.03.01	XPP Ti:Sapphire Laser
1.2.03.01.01	<i>reserved</i>
1.2.03.01.02	Ti:Sapphire Amplifier(s) System/Pumps
1.2.03.01.03	Temporal Pulse Shaper
1.2.03.01.04	Optical Parametric Amplifier
1.2.03.01.05	<i>reserved</i>
1.2.03.02	XPP Optics, Optomechanics & Diagnostics
1.2.03.02.01	Optics & Optomechanics
1.2.03.02.02	Laser Diagnostics
1.2.03.02.03	Hutch Optical Table System
1.2.03.02.04	Optical Experiments
1.2.03.02.05	Laser Containment System
1.2.03.02.06	Laser Hall Optical Table System
1.2.04	XPP Detector System (BNL)
1.2.04.01	Detector Support and Integration
1.2.04.02	Detector Sensor
1.2.04.03	Detector Application Specific Integrated Circuits (ASIC)
1.2.04.04	Detector Controls, Electronics and DAQ
1.2.05	XPP Sample Environment & Diffractometer System
1.2.05.01	XPP Diffractometer System
1.2.06	XPP Facilities
1.2.06.01	XPP Hutch Specification
1.2.06.02	XPP Utilities & Hutch Equipment
1.2.07	XPP Vacuum System
1.2.07.01	XPP Vacuum Equipment

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WBS	TITLE
1.2.07.02	XPP Vacuum Hardware
1.2.07.02.01	XPP Spools & Bellows
1.2.07.02.02	XPP Vacuum Supports
1.2.08	XPP Installation
1.2.08.01	XPP Installation
<b>1.3</b>	<b>COHERENT X-RAY IMAGING (CXI)</b>
1.3.01	CXI System Integration & Design
1.3.02	CXI X-ray Optics
1.3.02.01	CXI KB System (0.1 micron)
1.3.02.02	CXI KB System (1 micron)
1.3.03	CXI Lasers
1.3.03.01	CXI Reference laser
1.3.03.02	<i>reserved</i>
1.3.04	CXI Coherent Imaging Injector
1.3.04.01	Coherent Imaging Particle Injector System
1.3.05	CXI Sample Environment
1.3.05.01	CXI Room Temperature Environment
1.3.05.01.01	CXI Sample Chambers & Ion TOF
1.3.05.01.02	CXI Precision Instrument Stands
1.3.05.01.03	CXI Detector Stage
1.3.05.02	<i>reserved</i>
1.3.06	CXI Hutch Facilities
1.3.06.01	CXI Hutch Specification
1.3.06.02	CXI Utilities & Hutch Equipment
1.3.07	CXI Vacuum System
1.3.07.01	CXI Vacuum Equipment
1.3.07.02	CXI Vacuum Hardware
1.3.07.02.01	CXI Bellows & Spools
1.3.07.02.02	CXI Vacuum Supports
1.3.08	CXI Installation
1.3.08.01	CXI Installation Phase
<b>1.4</b>	<b>X-RAY CORRELATION SPECTROSCOPY (XCS)</b>
1.4.01	XCS System Integration & Design
1.4.02	XCS X-ray Optics and Support Table
1.4.02.01	XCS XRT Supports, Tables and Shielding
1.4.02.02	XCS Hutch Supports, Tables and Shielding
1.4.02.03	XCS Stoppers
1.4.02.04	<i>reserved</i>
1.4.03	XCS Detector System (BNL)
1.4.03.01	Detector Support and Integration
1.4.03.02	Detector Sensor
1.4.03.03	Detector Application Specific Integrated Circuits (ASIC)
1.4.03.04	Detector Controls, Electronics and DAQ

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WBS	TITLE
1.4.04	XCS Sample Environment & Diffractometer System
1.4.04.01	XCS Diffractometer System
1.4.04.02	<i>reserved</i>
1.4.04.03	XCS Large Angle Mover & Chamber
1.4.05	XCS Hutch Facilities
1.4.05.01	XCS Hutch Specification
1.4.05.02	XCS Utilities & Hutch Equipment
1.4.06	XCS Vacuum System
1.4.06.01	XCS XRT Vacuum System
1.4.06.01.01	XCS XRT Vacuum Equipment
1.4.06.01.02	XCS XRT Spools & Bellows
1.4.06.01.03	XCS XRT Vacuum Supports
1.4.06.02	XCS Hutch Vacuum System
1.4.06.02.01	XCS Hutch Vacuum Equipment
1.4.06.02.02	XCS Hutch Spools & Bellows
1.4.06.02.03	XCS Hutch Vacuum Supports
1.4.07	XCS Installation
1.4.07.01	XCS XRT Installation
1.4.07.02	XCS Hutch 4 Installation
<b>1.5</b>	<b>DIAGNOSTICS &amp; COMMON OPTICS</b>
1.5.01	Diagnostics & Common Optics System Integration & Design
1.5.02	Diagnostics
1.5.02.01	Pop-in Profile/Wavefront Monitors
1.5.02.02	Pop-In Intensity Monitors
1.5.02.03	Intensity-Position Monitors
1.5.03	Common Optics
1.5.03.01	Large Offset Monochromator
1.5.03.02	X-ray Focusing Lenses
1.5.03.03	Slit System
1.5.03.04	Attenuators / Filters
1.5.03.05	Pulse Pickers
1.5.03.06	Harmonic Rejection Mirrors
1.5.03.07	Channel Cut Monochromator
<b>1.6</b>	<b>CONTROLS AND DATA ACQUISITION</b>
1.6.01	Controls and Data Acquisition System Integration & Design
1.6.02	LUSI Common Controls
1.6.02.01	Photon Beam Feedback
1.6.02.02	Electron Beam Feedback
1.6.02.03	Hutch Environmental Controls
1.6.02.04	FEH DAQ Data Storage
1.6.02.05	DAQ Data Processing
1.6.02.06	Racks & Cabling (Common)
1.6.03	X-ray Pump Probe (XPP) Hutch 3 (NEH)

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WBS	TITLE
1.6.03.01	XPP H3 Controls Requirements, Design and Setup
1.6.03.01.01	XPP H3 Controls Requirements, Design
1.6.03.01.02	XPP H3 Development Test Setup
1.6.03.02	XPP H3 Standard Hutch Controls
1.6.03.02.01	XPP H3 Cables & Racks
1.6.03.02.02	XPP H3 Workstation
1.6.03.02.03	XPP H3 Beam Line Processor
1.6.03.02.04	XPP H3 Channel Access Gateway
1.6.03.02.05	XPP H3 MPS
1.6.03.03	XPP H3 Specific Controls
1.6.03.03.01	XPP H3 Data Acquisition (DAQ)
1.6.03.03.02	XPP H3 DAQ Hutch Data Management
1.6.03.03.03	XPP H3 Experiment Configuration Control
1.6.03.03.04	XPP H3 Valve Controls
1.6.03.03.05	XPP H3 Vacuum Controls
1.6.03.03.06	XPP H3 Pop-In Profile Monitor Controls
1.6.03.03.07	XPP H3 Pop-In Intensity Monitor Controls
1.6.03.03.08	XPP H3 Intensity-Position Monitor Controls
1.6.03.03.09	XPP H3 X-Ray Focusing Lens Controls
1.6.03.03.10	XPP H3 Slit Controls
1.6.03.03.11	XPP H3 Attenuator Controls
1.6.03.03.12	XPP H3 Pulse Picker Controls
1.6.03.03.13	XPP H3 Harmonic Rejection Mirrors Controls
1.6.03.03.14	<i>reserved</i>
1.6.03.03.15	XPP H3 Vision Camera Controls
1.6.03.03.16	XPP H3 Diffractometer/Wide Angle Detector Controls
1.6.03.03.17	<i>reserved</i>
1.6.03.03.18	XPP H3 Laser System Controls
1.6.03.03.19	<i>reserved</i>
1.6.03.03.20	XPP H3 Laser Optics Controls
1.6.03.03.21	XPP H3 Laser Diagnostics
1.6.03.03.22	<i>reserved</i>
1.6.03.03.23	<i>reserved</i>
1.6.03.03.24	<i>reserved</i>
1.6.03.03.25	<i>reserved</i>
1.6.03.03.26	<i>reserved</i>
1.6.03.03.27	<i>reserved</i>
1.6.03.03.28	<i>reserved</i>
1.6.03.03.29	<i>reserved</i>
1.6.03.03.30	<i>reserved</i>
1.6.03.03.31	<i>reserved</i>
1.6.03.03.32	<i>reserved</i>
1.6.03.03.33	<i>reserved</i>

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WBS	TITLE
1.6.03.03.34	XPP H3 Controls System Integration Test
1.6.04	Coherent X-ray Imaging (CXI) Hutch 5 (FEH)
1.6.04.01	CXI H5 Requirements, Design and Setup
1.6.04.01.01	CXI H5 Controls Requirements and Design
1.6.04.01.02	CXI H5 Development Test Setup
1.6.04.02	CXI H5 Standard Hutch Controls
1.6.04.02.01	CXI H5 Cables & Racks
1.6.04.02.02	CXI H5 Workstation
1.6.04.02.03	CXI H5 Beam Line Processor
1.6.04.02.04	CXI H5 Channel Access Gateway
1.6.04.02.05	CXI H5 MPS
1.6.04.03	CXI H5 Specific Controls
1.6.04.03.01	CXI H5 Data Acquisition (DAQ)
1.6.04.03.02	CXI H5 DAQ Hutch Data Management
1.6.04.03.03	CXI H5 Experiment Configuration Control
1.6.04.03.04	CXI H5 Valve Controls
1.6.04.03.05	CXI H5 Vacuum Controls
1.6.04.03.06	CXI H5 Pop-In Profile Monitor Controls
1.6.04.03.07	CXI H5 Pop-In Intensity Monitor Controls
1.6.04.03.08	CXI H5 Intensity-Position Monitor Controls
1.6.04.03.09	<i>reserved</i>
1.6.04.03.10	CXI H5 Slit Controls
1.6.04.03.11	CXI H5 Attenuator Controls
1.6.04.03.12	CXI H5 Pulse Picker Controls
1.6.04.03.13	CXI H5 KB Mirror Controls
1.6.04.03.14	CXI H5 Sample Environment Controls
1.6.04.03.15	CXI H5 Particle Injector Controls
1.6.04.03.16	CXI H5 Ion TOF Controls
1.6.04.03.17	<i>reserved</i>
1.6.04.03.18	CXI H5 Vision Camera Controls
1.6.04.03.19	CXI H5 Detector Stage Controls
1.6.04.03.20	<i>reserved</i>
1.6.04.03.21	<i>reserved</i>
1.6.04.03.22	<i>reserved</i>
1.6.04.03.23	<i>reserved</i>
1.6.04.03.24	CXI H5 Reference Laser Controls
1.6.04.03.25	<i>reserved</i>
1.6.04.03.26	CXI H5 Controls System Integration Test
1.6.05	X-ray Correlation Spectroscopy (XCS) Hutch 4 (FEH)
1.6.05.01	XCS H4 Requirements, Design, Setup
1.6.05.01.01	XCS H4 Controls Requirements and Design
1.6.05.01.02	XCS H4 Development Test Setup
1.6.05.02	XCS H4 Standard Hutch Controls

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WBS	TITLE
1.6.05.02.01	XCS H4 Cables & Racks
1.6.05.02.02	XCS H4 Workstation
1.6.05.02.03	XCS H4 Beam Line Processor
1.6.05.02.04	XCS H4 Channel Access Gateway
1.6.05.02.05	XCS H4 MPS
1.6.05.03	XCS H4 Specific Controls
1.6.05.03.01	XCS H4 Data Acquisition (DAQ)
1.6.05.03.02	XCS H4 DAQ Hutch Data Management
1.6.05.03.03	XCS H4 Experiment Configuration Control
1.6.05.03.04	XCS H4 Valve Controls
1.6.05.03.05	XCS H4 Vacuum Controls
1.6.05.03.06	XCS H4 Pop-In Profile Monitor Controls
1.6.05.03.07	XCS H4 Pop-In Intensity Monitor Controls
1.6.05.03.08	XCS H4 Intensity-Position Monitor Controls
1.6.05.03.09	XCS H4 Slit Controls
1.6.05.03.10	XCS H4 Attenuator Controls
1.6.05.03.11	XCS H4 Harmonic Rejection Mirrors Controls
1.6.05.03.12	XCS H4 2D Detector Motion Camera Controls
1.6.05.03.13	XCS H4 Diffractometer Controls
1.6.05.03.14	XCS H4 Large Angle Detector Stage Controls
1.6.05.03.15	<i>reserved</i>
1.6.05.03.16	XCS H4 Controls System Integration Test
1.6.05.03.17	XCS H4 Vision Camera Controls
1.6.05.04	XCS Beam Transport to FEH
1.6.05.04.01	XCS BT to FEH Valve Controls
1.6.05.04.02	XCS BT to FEH Vacuum Controls
1.6.05.04.03	XCS BT to FEH Pop-In Profile Monitor Controls
1.6.05.04.04	XCS BT to FEH Pop-In Intensity Monitor Controls
1.6.05.04.05	XCS BT to FEH Intensity-Position Monitor Controls
1.6.05.04.06	XCS BT to FEH Monochromator Controls
1.6.05.04.07	XCS BT to FEH X-Ray Focusing Lens Controls
1.6.05.04.08	XCS BT to FEH Split and Delay Controls
1.6.05.04.09	XCS Beam Transport to FEH System Integration Test
1.6.06	Offline Data Management
1.6.06.01	Data Format and API
1.6.06.02	Data Catalog / Metadata Management
1.6.06.03	Processing Framework / Workflow / Pipeline
<b>2</b>	<b>LUSI PROJECT OTHER PROJECT COST (OPC)</b>
<b>2.1</b>	<b>PROJECT MANAGEMENT</b>
<b>2.2</b>	<b>X-RAY PUMP PROBE (XPP)</b>
2.2.01	XPP Physics Support & Engineering Integration
2.2.02	XPP Monochromator

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<b>WBS</b>	<b>TITLE</b>
2.2.03	XPP Laser System
2.2.04	XPP 2-D Detector System (BNL)
2.2.05	X-Ray Emission Spectrometer
2.2.06	XPP Sample Environment
2.2.07	XPP Lab Facilities
2.2.08	XPP Vacuum
2.2.09	XPP Installation
<b>2.3</b>	<b>COHERENT X-RAY IMAGING (CXI)</b>
<b>2.4</b>	<b>X-RAY CORRELATION SPECTROSCOPY (XCS)</b>
2.4.01	Physics Support & Engineering Integration
2.4.02	X-ray Optics
2.4.03	XCS- 2D X-Ray Detector (BNL)