STATEMENT OF WORK (SOW)	Doc. No. PS-391-000-95 R0	LUSI SUB-SYSTEM XPP

STATEMENT OF WORK:
LCLS-LUSI X-ray Pump Probe Detector Mover Anthropomorphic Six-Axis Robot Work Envelope and Base Location Design

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R0	11Oct2008	Initial release	

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1. Scope

This document defines the engineering and project management requirements for a design effort to determine the most acceptable installation configuration of an six axis anthropomorphic robot system to move the LUSI XPP wide-angle detector.

The design effort includes the determination of the most effective robot base location(s) and orientation.

The design effort also includes the determination of the final usable robot work envelope and analysis of its impact on the requirements of SLAC document SP-391-000-62 “LUSI XPP Detector-Mover Engineering Specification”.

Description, definition and specification of the detector mover requirements is referred to as “detector motion”.

This document assumes a thorough understanding of the contents of SLAC document number SP-391-000-62, “LUSI XPP Detector Mover Engineering Specification Document”.

2. Applicable Documents and Specifications

SP-391-000-62: “LUSI XPP Detector Mover Engineering Specification Document”

GP-391-750-14, “Hutch 3 - XPP Sub-system Stay Clear Definitive Lay-out”

3. Preferred Robot

The preferred robot for the proposed installation is the Staubli model RX160.

The Staubli model RX160L, or other robot, shall be considered, contingent on a full analysis of the applicability of the Staubli RX160.

4. Robot Working Point – Detector Orientation

For purposes of robot motion analysis, the robot working point and the front face of the array detector center pixel are coincident (ref: SP-391-000-62 section 11).

Unless otherwise defined (ref. Section 7):

The working point shall be centered on the robot mounting flange and located 165 millimeters in front of the wrist mounting flange along a line perpendicular to the wrist mounting flange surface.

The detector face normal is coaxial with a line perpendicular to the robot wrist mounting flange surface.

5. Design Requirement 1: LUSI Installation Robot Work Envelope

Design requirement 1 is to determine the maximum LUSI installation work envelope achievable for the subject robot.

For purposes of the LUSI installation and this statement of work the robot work envelope is defined as the maximum reach volume achievable, by the robot working point, with the robot moving in a manner consistent with the requirements of ESD SP-391-000-62.

For purposes of the LUSI installation and this statement of work the robot work envelope is NOT the work envelope advertised by the robot manufacturer.

The acceptable work envelope shall be such that the robot has the capability of positioning and orienting the detector within either of two detector motion volumes separated by 600 millimeters, consistent with the definitions of ESD SP-391-000-62 section 5.3 “Hutch 3 / XPP Hardware Layout”.

The two detector motion volumes shall be as defined by ESD SP-391-000-62 section 7 “Detector Motion Range Extents”.

The robot shall be capable of pointing the detector, and maintaining detector orientation, within either of the two detector motion volumes, per the requirements of ESD SP-391-000-62 section 6 “Detector-Motion coordinate System and Alignment”.

6. Design Requirement 2: Robot Base Location

Design requirement 2 is to determine the optimum robot base location to achieve the requirements of ESD SP-391-000-62.

A single robot base location is preferred (IE: robot base is stationary).

Unless otherwise approved by SLAC the robot base location shall be consistent with the XPP hutch 3 stay clear volumes (ref: GP-391-750-14).

6.1. Preferred Robot Base Location

The preferred robot base location is above the detector motion volumes.

7. Design Options - Negotiable Elements

Contingent on failure to discover an acceptable configuration using preferred robot model and basing location, design options shall be considered. An acceptable configuration is defined as one which achieves all the requirements as defined in ESD SP-391-000-62.

Design options may included, but shall not be limited to, the following options:

a) Elimination or reduction of back-scattering detection motion volume.
b) Reduction of maximum detection motion radius for all or part of either detector motion volume.
c) Mobile robot basing (IE: robot is based at two locations, one for each detection motion volume).
d) Multiple array detector mounting configurations to accommodate extreme detector motion radius or back scattering requirements.
e) Robot with larger work envelope.
f) Use of multiple robots based at locations to accommodate one detection motion volume each.
g) Base location other than from above.

SLAC reserves the right to define selection criteria, and grant final approval, of configurations deviating from “preferred”. SLAC also reserves the right of approval for exceptions to detector motion requirements as defined in ESD SP-391-000-62.

8. SLAC Supplied Documents – Data

SLAC shall supply, upon request, 3-d models of the detector volume (SP-391-000-62 section 7).

SLAC Shall Supply, upon request 3-d models of the stay clear volumes for adjacent components (SP-391-750-14).

3-d models shall be available in STEP, Parasolid or IGES formats.

SLAC shall supply any documents listed as “Applicable” in SP-391-000-62 and documents listed as “applicable” in those documents.

9. Status Reviews

9.1. Project Initiation

The LUSI XPP instrument scientist and lead engineer shall conduct a project initiation meeting with the project manager and his deputy prior to the commencement of any engineering analysis.

The meeting shall define the initial robot configuration / orientation, nominal robot base location and detector mount method to be investigated.

The meeting shall be followed, within 24 hours, with detailed meeting minutes, distributed by the XPP lead engineer, via e-mail or fax, to all attendees.

9.2. Progress Updates

The project manager, or designee, shall provide a written (E-mail, fax or hard copy) status report to the LUSI XPP instrument scientist and lead engineer on a weekly basis. Status reports shall address status of action items for the previous week and suggested paths of inquiry for the forthcoming week.

A teleconference or in person progress meeting shall be conducted within 24 hours of the receipt of the weekly status report. Teleconferences shall address open action items and establish weekly tasks.

10.Deliverables

In addition to information provided in the status – progress updates, the project manager shall provide the following to SLAC:

i) Precise location coordinates and orientation of the robot base.
ii) Graphic depiction of the LUSI installation robot work envelope. Graphics may take the form of 2 dimensional orthographic projections or 3 dimensional solid or surface parametric CAD models (STEP, PARASOLID, IGES). 3-d CAD preferred.
iii) Graphic depictions of the detection motion volumes if different from the specifications of ESD SP-391-000-62 section 7. Graphics may take the form of 2 dimensional orthographic projections or 3 dimensional solid or surface parametric CAD models (STEP, PARASOLID, IGES). 3-d CAD preferred.
iv) Precise relative position data between the LUSI installation work envelope and the detector motion volumes.
v) Analytic data sets of robot motion extreme positions. “Extreme positions” are defined as maximum and minimum angle values for all motion axis.

The project manager shall generate, and provide to SLAC, the above listed information for all configurations investigated and requested by the instrument scientist of lead engineer.