INTERFACE CONTROL DOCUMENT (ICD)	Doc. No. SP 391-001-56- R0	LUSI SUB-SYSTEM CXI & DCO

LUSI CXI Instrument to DCO Interface Control Document

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R0	17APR 09	Initial release	

Table of Contents

1. Scope

This document defines the hardware interface between LCLS Ultra-fast Science Instruments (LUSI) WBS 1.3, Coherent X-ray Imaging instrument (CXI) and WBS 1.5, Diagnostics and Common Optics (DCO). This document also defines the responsibilities for interface between CXI or DCO and WBS 1.6, Controls and Data Acquisition (CDA).

2. DCO Hardware Overall Lengths

Individual DCO device assembly hardware will fit within an overall length less than or equal to the total length of the vacuum chamber for that component. This length includes the fine alignment supports.

It will be the responsibility of the Cognizant Engineer to insure the proper fit and adequate clearance of any device assembly with elements that exceed the envelope established by the overall vacuum chamber length.

3. Support Interface Datums

Two support interface datum surfaces will be established for CXI support structures that interface with any DCO component. The CXI support structures will be designed such that either interface datum surface will be available, at any "Z" position, with minimal hardware modifications. For obvious reason only one interface datum will be available at a given component fine alignment support location.

3.1. Upper Datum Surface

The upper interface datum surface is located 10" below the nominal beam height. This datum surface has a width of 20" and centered on the vertical beam centerline. The upper datum surface will be able to accommodate hardware wider than 20" at any elevation above the nominal datum surface (10" below beam center). See Figure 3-1

3.2. Lower Datum Surface (Be lenses)

The lower interface datum surface is located 16" below the nominal beam height. This datum surface has a width of 16", centered on the vertical beam centerline. The lower datum surface will be able to accommodate hardware no wider than 16" for an elevation extending 6" above the datum surface (16" to 10" below beam center). The lower datum surface will be able to accommodate hardware wider than 16" at any elevation above a point 10" below beam center, see Figure 3-1

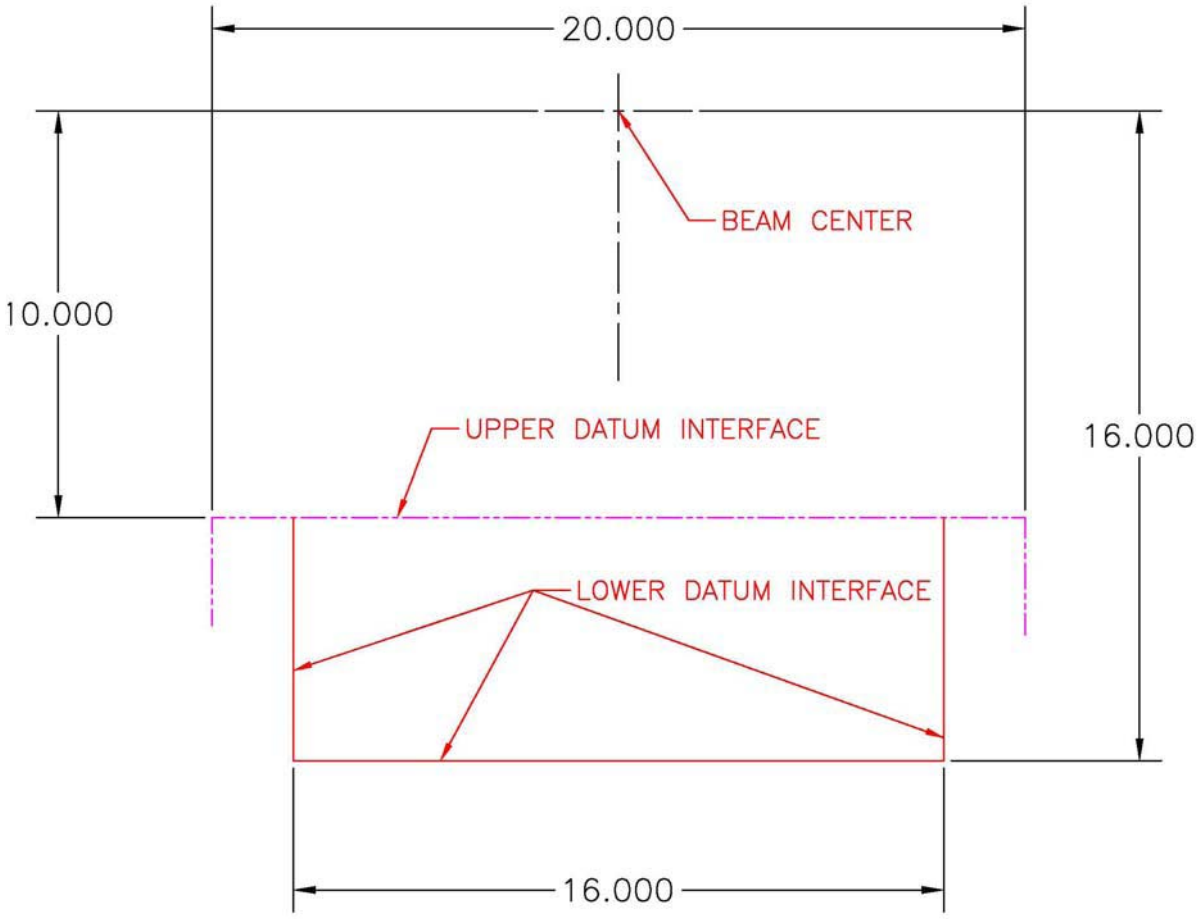

Figure 3-1: Upper and lower datum interface definitions

4. Component Fine-Alignment Support Hold Down Features

Both interface datum surfaces will be provided with a tapped hole pattern available for securing DCO component fine-alignment supports. Two rows of staggered holes will be provided; one row will be spaced at 10" and the other at 13" and centered transverse to the nominal X-ray beam centerline. The holes will be 5/16-18 UNC-2B thread with a minimum 2 diameter depth and a "stagger pitch" of 1.75". Judicious use of slots in the DCO component fine alignment stands will provide infinite adjustability in Z. Figure 4-1 describes the preceding requirements pictorially.

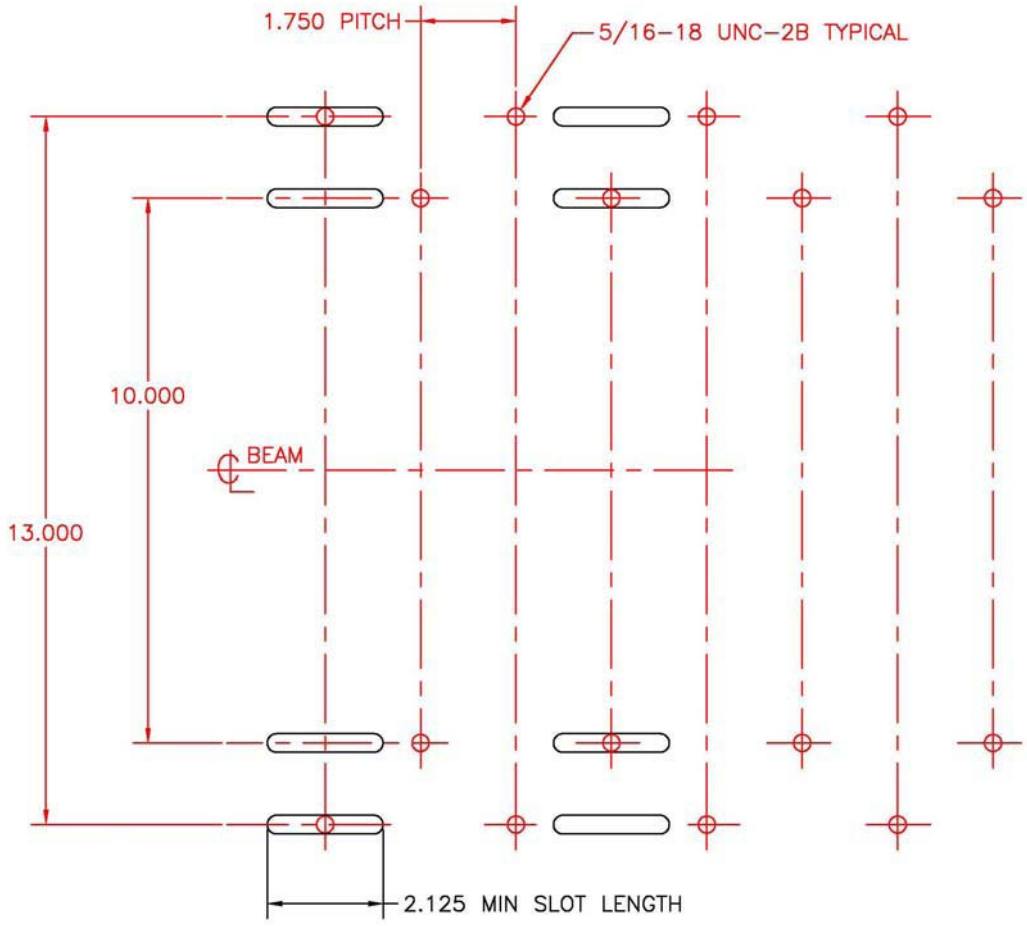

Figure 4-1: Support datum hole pattern

5. Controls - Hardware Interface

DCO will interface with the CDA group to develop requirements for the number, size, type, termination, and any other parameters required, to complete interconnect of all diagnostic and optics elements used for CXI in the XRT and/or hutch 5 of the FEH.

DCO or CDA will provide electrical cabling, fluid/pneumatic line and termination hardware. DCO or CDA will provide power supplies, port servers and related components for electrically actuated devices. DCO or CDA will provide solenoids, regulators, flow controls and related hardware for pneumatically actuated devices.

CXI will interface with the CDA group to complete cable management requirements for all diagnostic and common optics elements used for CXI in the XRT and/or hutch 5 of the FEH. CXI will provide specialized cable management hardware such as strain relief, flexible cable carriers or like hardware.

6. Mechanical

6.1. Mechanical Interfaces

All vacuum chambers fabricated by DCO will be linked to their vacuum environments as follows:

A 6" non-rotatable CF flange upstream

A 6" rotatable CF flange downstream

Any deviation from this configuration shall be subject to the approval of both the DCO and CXI lead engineers.

Mounting surfaces, for electrical connectors, shall be provided in an easily accessible and consistent location that allows for rapid installation and repair of any DCO component.

Where applicable, mechanical hard stops shall be implemented by DCO as part of the equipment protection system to prevent potential damage to moving hardware in the event of the failure of encoders, limit switches, etc.

6.2. Alignment/Fiducialization

Fiducialization capabilities (likely using tooling balls) shall be provided on each DCO assembly in the CXI instrument so that the nominal centerline of the vacuum chamber may be accurately identified and located during assembly both in the lab and in the beamline. Vacuum chamber position (x, y, z, pitch, roll, yaw) shall be recorded in the lab for future reference during the CXI instrument assembly. During installation, the chamber shall be aligned with the DCO alignment stage such that the as-measured centerline is collinear with the nominal X-ray beam centerline.

6.3. Vacuum Requirements

All DCO devices will be compatible with maintaining an Ultra-High Vacuum (UHV) with an average total pressure shall of 10^{-9} Torr or better. The vacuum enclosure must not

produce carbon-containing vacuum contaminants at partial pressures above 10^{-12} Torr after normal bake-out procedures in Ultra-High Vacuum, i.e. at total pressure less than 10^{-9} Torr. Any deviation from these requirements shall be subject to the approval of both the DCO and CXI lead engineers.

All lubricants, cutting fluids, etc., used in manufacturing shall be "sulfur-free". SLAC document No. SC-700-866-47 is a compendium of SLAC approved lubricants. The use of sanding discs, abrasive paper or grinding wheels is typically prohibited. In special circumstances good vacuum practices should be followed when grinding and polishing is required. This process shall be reviewed and approved by the engineer for its vacuum compatibility.

All parts and subassemblies shall be cleaned for UHV. Once parts are cleaned for vacuum, they shall be handled only with clean latex or nitrile gloves in/on a clean room/surface. This includes all subassemblies. For storage or transportation, they shall be placed in clean sealed vacuum grade plastic bag that has been back-filled with nitrogen.

6.4. Lifting Features

Clearly defined lifting features and instructions shall be provided to facilitate the assembly/installation of all devices, both in the lab and the beamline.

7. Electrical Safety

All electrical hardware and connections will be reviewed for compliance to national/local electrical code(s).

8. Acronyms

CDA: Controls and Data Acquisition

CXI: Coherent X-ray Imaging

DCO: Diagnostics and Common Optics

FEH: Far Experimental Hall

LUSI: LCLS Ultra-fast Science Instruments

SLAC: Stanford Linear Accelerator Center

UHV: Ultra-high vacuum

WBS: Work Breakdown Structure

XRT: X-ray Transport Tunnel