Experimental Facilities RSI for the High-Energy Engineering X-ray Scattering (HEX) Beamline Satellite Building

(Requirements, Specifications and List of Interfaces)

Version 3

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RSI for the HEX Beamline Satellite Building

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REVISION HISTORY

VERSION	DESCRIPTION	DATE	AUTHOR	APPROVED BY
1	First Issue.	10OCT2017	A. Broadbent	See page ii
2	Clarifications of requirements at Beamline PDR stage.	30MAR2018	A. Broadbent	See page ii
3	Update of requirements at Completion of SB Design.	18OCT2018	A. Broadbent	See page ii

Acronyms

HEX	High-energy Engineering X-ray (beamline)
LOB	Laboratory Office Building
PSS	Personnel Safety System
RSI	Requirements, Specifications, Interfaces
SR	Storage Ring
WBS	Work Breakdown Structure
PD	Photon Division

Contents

RSI for the HEX Beamline Satellite Building

1 IDENTIFICATION

This document, NSLS-II Experimental Facilities Requirements, Specifications and Interfaces (RSI) for the High-energy Engineering X-ray Scattering (HEX) Beamline Satellite Building is a part of the documentation system, mapping to the Work Breakdown Structure (WBS) for this project.

It captures and summarizes all requirements and specifications for the WBS elements within 7.05.07, HEX Satellite Station, and describes all its technical interfaces with other WBS elements.

2 SCOPE

This document covers the requirements for the High-energy Engineering X-ray Scattering (HEX) Beamline Satellite Building.

The following requirements are covered in this document:

a. Building temperature and temperature stability
b. Beamline and satellite building location
c. Building vibration
d. Acoustic noise
e. Fire safety;
f. Utilities required for the experimental program (and responsibility):

Item	**To be included in satellite building contract**	**Work by others (NSLS-II staff or by separate contract).**
Standard lighting and local emergency lighting to comply with codes	Yes, except….	Inside hutch
Electrical power distribution	Yes, except….	Inside hutch
Electrical grounding system	Yes, except….	Instrument grounding
De-ionized (process) water distribution	No	Yes
Process chilled water distribution	No	Yes
Liquid nitrogen distribution	No	Yes
Facility compressed gases	No	Yes

Experimental gases distribution	No	Yes
Ambient temperature sensors	As needed for HVAC system	As needed for instrument monitoring
Oxygen depletion sensors	No	Yes
Communications, Ethernet, and fire alarm system	Yes	No
Cable trays	For utilities under building contract only.	Yes
Gas-exhaust system	No	Yes
Laboratory and other support facilities	No	Yes

3 EXPERIMENTAL FACILITIES REQUIREMENTS FOR THE HEX BEAMLINE SATELLITE BUILDING

3.1 GENERAL

The Synchrotron Facility is designed to operate continuously 24 hours per day, 7 days per week (≥ 5,000 User Beam Hours per year). The design life of the facility, including the Satellite Building described here, shall be a minimum of 30 years.

The HEX beamline is one of up to 60 beamlines that will be constructed at the NSLS II facility. The nature of this beamline is such that the experimental station must be located outside the main NSLS-II experimental building. This document describes the necessary satellite building to house this beamline's end station and ancillary equipment.

3.2 BEAMLINE AND SATELLITE BUILDING LOCATION

The HEX beamline shall be located on the 27-ID straight, one of the low-beta straights that can accommodate a beamline with an external station. The beamline shall extend in length over the bypass corridor walkway and the satellite building shall be located outside the edge of the Storage Ring (SR) building.

3.3 REQUIREMENTS FOR HEX (AS COMPARED TO HXN)

The satellite building should be very similar to the HXN satellite building, with the following changes:

I. Required Changes

- The hutch concrete wall thicknesses shall be;
  - 0.7m thick for upstream wall and side walls
  - 1.0m thick for downstream wall
    (For reference, HXN walls were ~0.2m thick).
- The roof thickness shall be 0.6m. This will make the roof of the hutch into an exclusion zone. Dose on the building roof is sufficiently low for safe and unrestricted worker access.
- The internal dimensions of the hutch should be unchanged (the thickness of the shielding means the hutch footprint will grow), providing that the walkways around the outside remain legal when racks are located against the outside wall.
- The number of wall labyrinths for Users, PPS, utilities shall be 11 (excluding HVAC labyrinths):
  - 9 on the inboard wall
    (for User access, PPS, spares, etc.)
  - 1 on the upstream wall
    (mechanical utilities (PCW and gases) and/or vacuum)
  - 1 on the outboard wall

  The wall labyrinths listed above will have heavy lead labyrinth doors fitted (by NSLS-II) to the inside of the hutch (to simplify the PPS installation; a simple release switch can be fitted avoiding expensive locks or administrative controls, which was required at HXN). These doors are outside the scope of the conventional construction contract. The conventional construction contract will include the steel sleeves that pass through the wall and finish ½" above flush with the wall surface (onto which the door assemblies will be welded).
- Floor trenches with a cross section sufficient to accommodate a 24" cable tray (actual dimensions 24¼" x 4¼") are required to allow cables and pipes to pass under the walls. Quantities needed: four trenches on the outboard sidewall and two on the upstream wall.

- The unistrut embedded in the wall shall be full height, not just the top few feet of the wall. Fitting these with concrete should be avoided if possible (as happened with HXN).
- Due to the weight of the entrance doors (~1" lead), it is necessary that these are sliding rather than swing doors; care will need to be taken to ensure that there is no interference with adjacent services (electrical outlets etc.). The lead sliding doors (by NSLS-II) are not part of this conventional construction contract.
- Crane – Not needed (a small engine hoist will be used as required for small lifting tasks; it will be specified that all components are fitted with wheels).

II. Permissible Changes (for minimizing cost)

Temperature stability may be relaxed as follows:

- Hutch +/-0.5C over a two hour period, +/-1C over a 24 hour period
- Surrounding area +/-1C
- The hutch entrance vestibule is not required (remove to minimize costs).
- The air handling system is included in the building scope. Air from the main air handler can feed through a roof labyrinth (the labyrinth is part of the lead hutches contract) to two airsocks running the full length of the hutch; the false ceiling is not required. An air outlet labyrinth is required. The scope of the conventional construction contract will include the following;
  - Air inlet and outlet tube through the roof at the downstream / outboard corner comprising a straight through steel pipe of adequate diameter to meet the ventilation requirements (~16"). This tube shall be cast into the concrete and finish ½" above flush with the surface. The wall thickness shall be >0.5" (adequate for welding the air labyrinth to the outside).
  - Exhaust air outlet tube similar to the air inlet and outlet, but ~12" in diameter that can be used for extraction of gas from the hutch..
  - The ductwork connections (inside the hutch) from the tube passing through the roof, to the airsock (for the inlet air), and to the return air ductwork shall be in the scope of the satellite building contract.
  - The final ductwork connections (outside the hutch) to the air inlet/outlet labyrinths will be done by BNL staff in the event of the labyrinth components being installed after the satellite building contract is completed.
- The vibration requirement is significantly reduced;

- The use of Concredamp, or similar material is NOT required (this was a requirement for HXN).
- The floor thickness under the hutch could be reduced to 15" (same as the experimental floor), providing this will adequately support the hutch weight. However, some equipment and/or cable trays may need to recess into the floor. This may call for a floor thicker than 15", but it could still be thinner than HXN (1m). See detail drawing.
- The vibration isolation joints should be retained as used for the HXN design.

III. A vacuum pipe shall connect the beamline in the Experimental Hall to the beamline in the Satellite Building. This pipe will be no larger than 10" in diameter (this comprises 6" beam, 1" clearance each side to the tube, and 1" radial allowance for lead). The pipe will be fitted with 10" OD flanges; no allowance has been made for insulation. The pipe shall be connected to the Satellite Building in a manner that permits survey alignment and preserves the building thermal performance. A similar design to HXN/SIX may be employed for weatherproofing. The holes in the building will be made by BNL staff when the pipe is ready for installation.

IV. Further design changes are permissible, especially if costs can be minimized, although these should be approved by the HEX beamline team.

3.4 LABYRINTHS

The following labyrinth designs are required as a part of the conventional construction work (Figure 3-1). Note that in all cases the blue parts (and ductwork inside the enclosure) are supplied by NSLS-II, and the conventional construction work includes only the steel parts passing through the wall. These should be cast in-situ with the ends ½" above flush with the finished concrete surface to allow the external parts to be welded.

- Wall labyrinth
- HVAC inlet/outlet and exhaust labyrinths

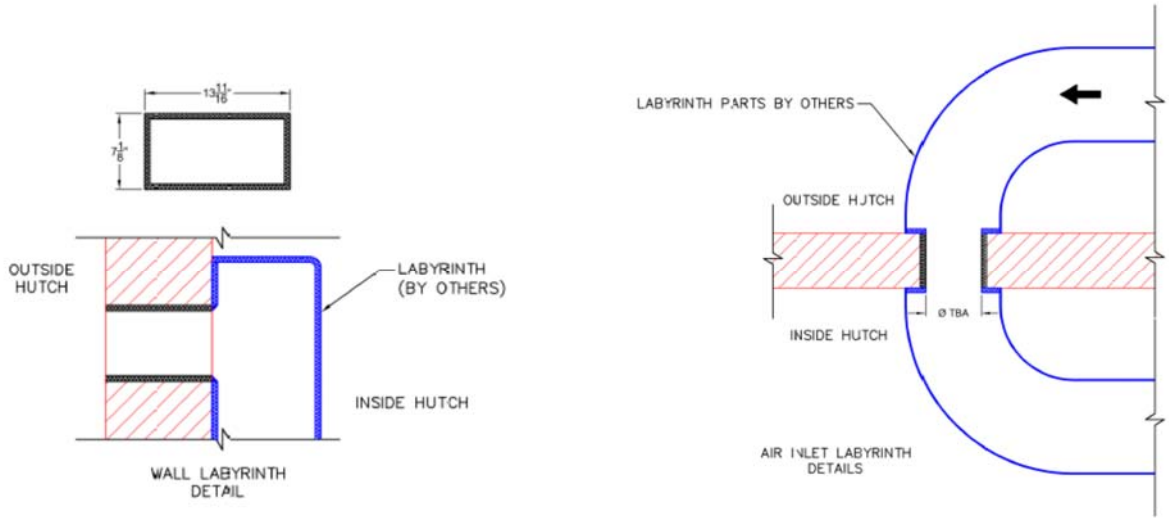

Figure 3-1: Conceptual Labyrinth Designs

3.5 OTHER REQUIREMENTS

- An exhaust system with fan (by NSLS-II): will be connected to the main exhaust system above the walkway inside the main ring building.
- LN2 System (by NSLS-II): To be installed under a separate contract by a specialist supplier.
- Gas System Provision (by NSLS-II): Details TBC.
- Trenches in the floor for installation of cables: See Figure 3-2 below. The lids shall be metal and the weight shall not exceed 45 lbs.

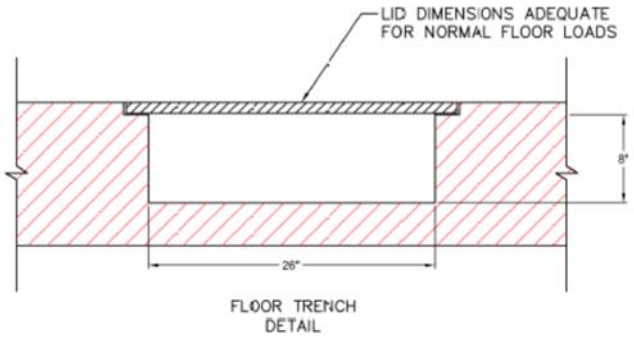

Figure 3-2: Floor Trench Detail (26" wide x 6" deep from underside of lid).

4 FURTHER CONSIDERATIONS

- Review and apply any lessons learned from the satellite buildings for the HXN & SIX beamlines.
- Insulation: The standard of contractor installed insulation was very poor at HXN, the sealing was also poor with significant air leakage. Specific emphasis will be required on this point, with inspection hold points written into the construction contract.
- Access to the building will be via the experimental floor through the roll-up door and via a personnel double width door (same as HXN). A separate single door shall also allow access to the LOB.
- Controls racks will be located behind the hutch (same as HXN).
- No windows to be included in the concrete hutch walls.
- External gutters are preferred.
- Anticipated heat loads;

Item	Heat load
6 people (area outside hutch)	70W (sensible) and 30W (latent) per person
Electrical equipment inside hutch	5 kW
Electrical equipment outside hutch	Use actual loads from HXN, exclude racks.