

Laser Electron Gamma Source (LEGS) Decommissioning and Equipment Removal

April 18, 2007

Note:

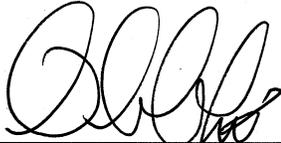
Signature of this cover sheet indicates agreement with the attached Unreviewed Safety (USI) analysis. It has been determined that decommissioning of the LEGS facility does not alter the safety basis of NSLS operations as stated in the NSLS Safety Assessment Document and does not require a modification of the NSLS Accelerator Safety Envelope.



Signature of the NSLS ESH/Q Manager

4/27/07

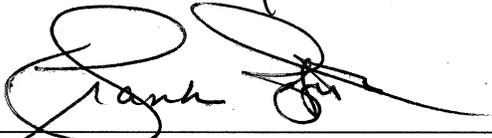
Date



Signature of the NSLS ESH Committee Chair

April 27, 2007

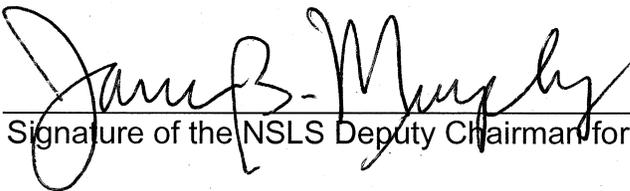
Date



Signature of the BNL Radiation Control Division
NSLS Facility Support Representative

4/27/07.

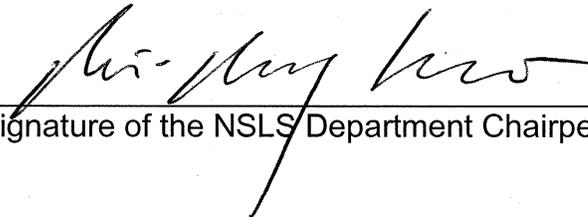
Date



Signature of the NSLS Deputy Chairman for Operations

4/27/07

Date



Signature of the NSLS Department Chairperson

5/4/07

Date



Signature of the NSLS Light Sources Directorate
Associate Laboratory Director

5-4-07

Date

NATIONAL SYNCHROTRON LIGHT SOURCE
UNREVIEWED SAFETY ISSUE (USI) ANALYSIS

LASER ELECTRON GAMMA SOURCE (LEGS)
DECOMMISSIONING AND EQUIPMENT REMOVAL

Introduction

This document is prepared as an addendum to the existing National Synchrotron Light Source (NSLS) Safety Assessment Document (SAD); dated August 14, 2006. It is intended to provide a reference for revision of the sections of that SAD pertaining to the LEGS project as required by the Brookhaven National Laboratory (BNL) Standard Based Management System (SBMS) Subject Area for Accelerator Safety.

Decommissioning of the LEGS project is analyzed here as an Unreviewed Safety Issue (USI) as defined in that Subject Area and in the DOE Order for Accelerator Safety; DOE O 420.2B. This document provides an overview of the impact that decommissioning of the LEGS project will have on the NSLS SAD and NSLS Accelerator Safety Envelope (ASE).

Executive Summary

NSLS beam line X5 is designated as the Laser Electron Gamma Source or LEGS and has been operated for approximately 20 years by the BNL Physics department. It is a unique beam line that involves use of a laser to back-scatter photons from the electron bunches circulating within the NSLS X-ray storage ring. The equipment configuration and risks associated with operation of the LEGS facility is evaluated in dedicated sections of the NSLS SAD.

The safety impact of decommissioning the LEGS project is outlined below. It is concluded that removal of the LEGS equipment and infrastructure can be accomplished without significant impact to the safety basis of the NSLS and that no change to the ASE will result. Removal of the SAD sections that pertain to the LEGS project is required at the next scheduled revision of that document.

LEGS Decommissioning Risk Analysis

A detailed description of the LEGS facility and associated hazards is included in the existing SAD text and will not be repeated here. Important to this discussion is that decommissioning of the LEGS facility will involve removal of equipment on the NSLS Experiment Floor, within the LEGS Target Room, and within the NSLS X-ray storage ring tunnel, and will require reconfiguration of the X-ray tunnel radiation shielding. Figure 1 below presents the LEGS beam line layout. Figure 2 below presents the LEGS Tagging Cave layout.

LEGS Beam Line

Removal of the LEGS or X5 beam line presents no unusual risk. Beam line configuration changes at the NSLS are common and are managed through established personnel protection system configuration control procedures and review by the NSLS Beam Line Review Committee. Decommissioning and removal of the beam line components will be managed through the NSLS Enhanced Work Planning process. Removal of the X5 beam line presents no change to the safety basis for the NSLS and does not impact the ASE.

LEGS Target Room

The LEGS target room contains the beam line end station and associated electronics, equipment, and materials. Decommissioning and removal of this equipment also presents no unusual risk. That effort will be managed by existing procedures for material handling, disposal, and recycling with the details managed through Enhanced Work Planning. Removal of the LEGS Target Room equipment and materials presents no change to the safety basis for the NSLS and does not impact the ASE.

LEGS Equipment within the X-ray tunnel

LEGS equipment within the X-ray tunnel includes the magnets that make up the electron spectrometer, an electron beam pipe for transport of electrons to the tagging cave detectors, and a Nickel beam stop. Decommissioning and removal of this equipment will involve careful attention to the critical lifts involved and to disposal or segregation of suspect materials that may exhibit slight radiological activation. Existing procedures will govern that process along with Enhanced Work Planning. Removal of this equipment presents no change to the safety basis for the NSLS and does not impact the ASE.

X-ray tunnel shielding configuration; the Tagging Cave

The Tagging Cave is an enclosure that protrudes into the X-ray tunnel. It has dimensions of 22" x 66" and is constructed of normal-density concrete, with an 18" thick wall through which the tagging line vacuum chamber passes, and 9" thick side and end walls. All the cave walls are lined on the inside with 0.275" borated flex panel and 1/2" thick lead sheet, including the sliding access door, whose basic structure is 3/4" plywood. The roof is made from 1/2" steel plate and is covered by 1/4" of lead and 4" of borated polyethylene. The tagging electrons pass through this booth, and re-enter the ring tunnel through a 3-1/2"x 19" slot in the end wall.¹

The purpose of the cave is to house the detectors that are used as part of the spectrometer for measuring the energy of electrons driven out of the standard orbit when photons from the LEGS laser system scatter off the circulating electron bunches stored in the X-ray ring. Measurement of these "tagging" electrons allows determination of the energy of the scattered photons directed to the LEGS target. The cave allows personnel access to the detectors without entry to the storage ring tunnel.

The concrete and polyethylene walls of the cave provide shielding for neutrons generated by electron loss from the storage ring. These walls are positioned to shield the opening in the storage ring tunnel concrete wall that provides cave access from the inner circumference area of the X-ray ring. That opening is closed with the sliding, plywood-lead door. The purpose of that door is to shield any X-rays generated through electron interaction with the detectors in the cave.

Removal of the cave walls within the X-ray tunnel will result in inadequate neutron shielding at the sliding door entrance. This can be resolved by closing that opening with 18 inches of normal density concrete and so returning that section of the tunnel wall to its original concrete thickness designed to shield neutrons generated within the tunnel. Once the tagging spectrometer is removed and the cave door opening is closed with concrete, the sliding plywood-lead door will no longer be needed as there will no longer be electrons directed to that location and no X-ray generation beyond that which occurs throughout the X-ray tunnel.

The tagging cave wall removal and entrance closure with concrete can be managed through existing material handling and management procedures and the NSLS Enhance Work Planning program. With removal of the spectrometer equipment and return of the X-ray tunnel to the original concrete thickness the cave entrance, there is no change to the NSLS facility safety basis or ASE.

¹ The tagging cave description is from the NSLS SAD.

Conclusion

Decommissioning of the LEGS facility presents no impact to the NSLS facility safety basis and requires no change to the ASE. This Unreviewed Safety Issue analysis indicates that the decommissioning can be managed with existing NSLS procedures and presents no substantive impact to the existing SAD. Once decommissioning is completed, reference to the LEGS facility in the SAD will be obsolete.

Recommendation

As LEGS decommissioning results in no impact to the NSLS facility safety basis or Accelerator Safety Envelope, review of this USI analysis may be completed by the NSLS Environment, Safety, and Health Committee.

This document should be appended to the existing NSLS SAD for reference until that SAD is next revised. The next scheduled revision should include removal of all reference to the LEGS facility.

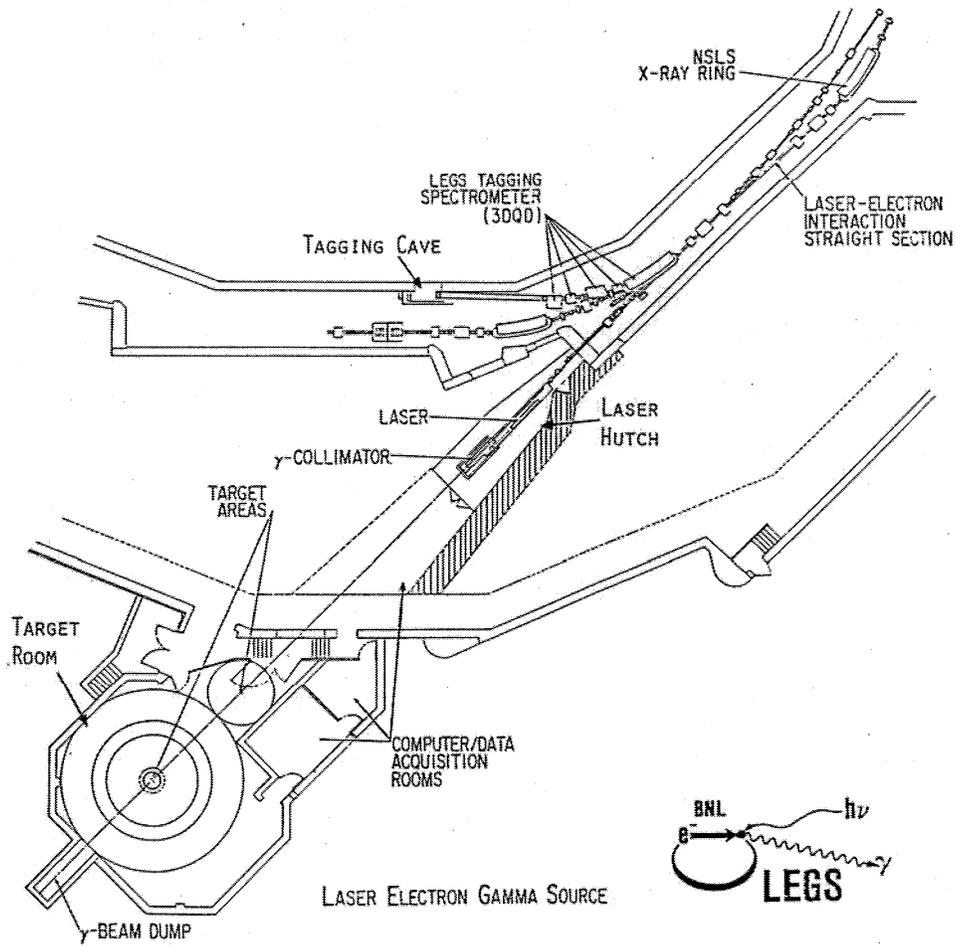


Figure 1

LEGS Beam Line Layout

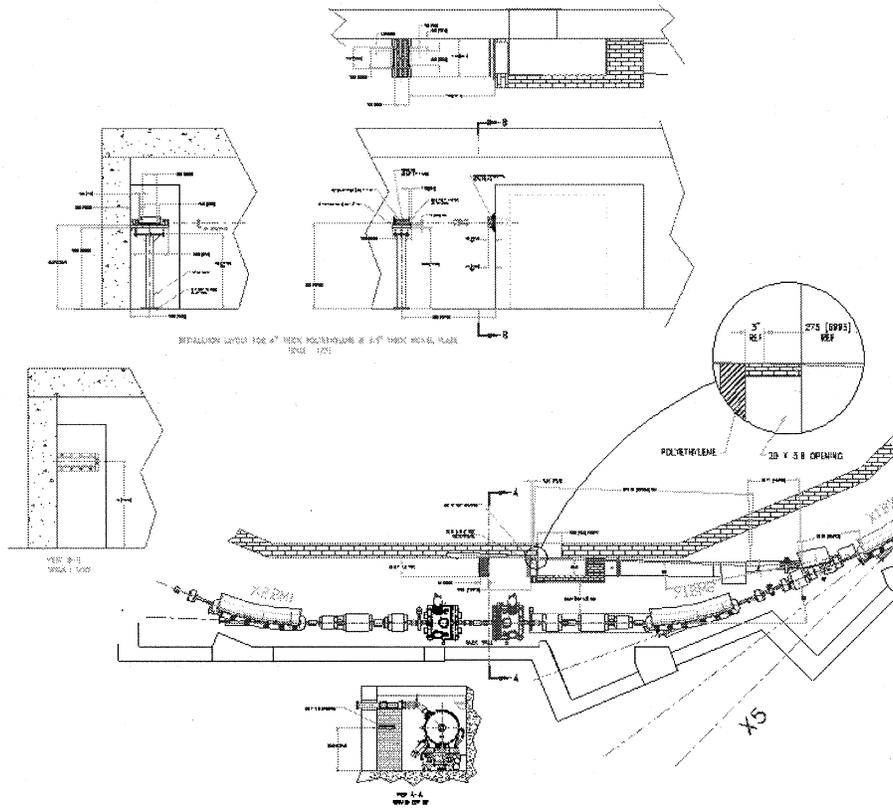


Figure 2
LEGS Tagging Cave

References

1. NSLS Safety Assessment Document; August 14, 2006
2. NSLS Accelerator Safety Envelope; February 02, 2006
3. BNL Standard Based Management Subject Area for Accelerator Safety; February 09, 2006
4. DOE Order; Safety of Accelerator Facilities; DOE O 420.2B
5. DOE Guide; Accelerator Facility Safety Implementation Guide for DOE O 420.2B, SAFETY OF ACCELERATOR FACILITIES; DOE G 420.2-1