ES&H DIVISION
RADIATION CONTROL DEPARTMENT

radiological safety analysis document

Hall D Winter-Summer 2026 Run

GLUEX2 (E12-12-002)
JLab Eta Factory (JEF) (E12-12-002A)
Liaison: Benedikt Zihlmann (GLUEX2/JEF)

January 30, 2026

RCD-RSAD-01.30.2026-HD

JDOCS designation:
ESH-RADCN-307143

Priority review level	1
Document classification	4
Next review due	n/a

Submit for approval ☐ yes ☑ no

Thomas
Jefferson
National
Accelerator
Facility

Jefferson Lab
Thomas Jefferson National Accelerator Facility

Hall D Winter-Summer 2026 Run

GLUEX2/JEF

RCD-RSAD-01.30.2026-HD

Approval	Signature on file	01.30.2026
	Adam Stavola, Acting Manager Radiation Control Department	Date
Reviewer	Signature on file	01.30.2026
	Mikhail Kostin, Radiation Physics Manager Radiation Control Department	Date
Preparer	Signature on file	01.30.2026
	Lorenzo Zana, Radiation Physicist Radiation Control Department	Date
Liaison	Signature on file	01.30.2026
	Benedikt Zihlmann, Staff Scientist Hall D	Date

Contents

This Hall D Radiological Safety Analysis Document (RSAD) identifies the general conditions and controls with regard to production, movement, or import of radioactive materials (RAM).

1 DESCRIPTION

The 2026 Hall D run is scheduled to take place from February 23 to July 26 with a total run time of 142 days. It will utilize up to 12 GeV electron beam and be split into two parts: Low Energy running, 56 days; GLUEXII/JEF, 86 days. For the Low Energy run (4 GeV), two targets will be used: a 30 cm liquid hydrogen (LH_2) target and a 30 cm liquid deuterium (LD_2) target. For the GLUEX-II/JEF experiments, only the 30 cm LH_2 target will be used. One diamond radiator will be utilized, as well as amorphous aluminum radiators. To provide a photon flux similar to that produced by the diamond radiators, the beam current for runs with amorphous radiators will be adjusted depending on the radiator's radiation length X_0.

The Low Energy experiment will operate with beam currents of up to 50 nA for the entire run period. The run plan includes 6 days of commissioning, followed by 6 days dedicated to luminosity calibration. During these initial phases, different primary collimator openings will be tested at full luminosity, with apertures of up to 9 mm, compared to the standard 5 mm opening used during typical 12 GeV operations. The remaining 44 days will be devoted to regular data taking using the primary collimator opening that provides the optimal compromise between statistical precision and data quality. At present, the experiment plans to operate with a 9 mm primary collimator opening.

The aluminum radiator used for this experiment will be thicker than the radiator normally operated in Hall-D (approximately a factor of two thicker). However, the beam currents planned for this experiment are approximately an order of magnitude lower than those typically used during standard Hall-D operations. This reduction in beam current is expected to offset the increased radiation production per electron associated with the thicker radiator in the Tagger area, which is physically separated from Hall-D.

Radiation levels will continue to be monitored by RadCon and are not expected to exceed those observed during normal operating conditions. These levels are considered acceptable by Hall-D management and remain well below the operational limits for the Tagger enclosure.

The GLUEX-II/JEF run period is scheduled to begin on May 2, 2026, and will consist of 80 days of standard running conditions, followed by 6 days of high-intensity test running.

Table 1. Low Energy experiment (56 days)

Radiator	Current (nA)	Total Time (days)	Comment
$1.0\text{x}10^{-3}$ X_0 aluminum	< 50	6	Commissioning
$1.0\text{x}10^{-3}$ X_0 aluminum	< 50	6	Luminosity calibration
$4.3\text{x}10^{-4}$ X_0 diamond	< 50	20	LH_2 target
$4.3\text{x}10^{-4}$ X_0 diamond	< 50	2	Empty target
$4.3\text{x}10^{-4}$ X_0 diamond	< 50	20	LD_2 target
$4.3\text{x}10^{-4}$ X_0 diamond	< 50	2	Empty target

Table 2. Standard running conditions (80 days)

Radiator	Current (nA)	Total Time (days)	Comment
$4.5x10^{-4}$ X_0 aluminum	< 300	7	LH_2 target
$4.3x10^{-4}$ X_0 diamond	< 200	73	LH_2 target

Table 3. High intensity test run conditions (6 days)

Radiator	Current (nA)	Total Time (days)	Comment
$4.5x10^{-4}$ X_0 Aluminum	< 600	1	LH_2 target
$4.3x10^{-4}$ X_0 Diamond	< 500	5	LH_2 target

2 SUMMARY and CONCLUSIONS

These experiments are not expected to produce significant levels of radiation at the site boundary that would cause exceeding the integrated maximum boundary dose limit of 10 mrem. However, dose will be monitored continuously by the Radiation Control Department (RCD or RadCon) to ensure the site boundary goal is not exceeded. Activation of target cells, collimators, and beam-line hardware must also be considered. As specified in Sections 4 and 7, the manipulation and/or handling of target cells and beam-line hardware (potentially radioactive material), the transfer of RAM, or modifications to the beam line after the target assembly, must be reviewed and approved by the RCD.

Adherence to this RSAD is vital.

3 CALCULATIONS of RADIATION DEPOSITED in the EXPERIMENTAL HALL and BOUNDARY

The radiation budget for given experiments is the amount of radiation expected at the site boundary as a result of a given set of experiments. This budget may be specified in terms of mrem at the site boundary or as a percentage of the Jefferson Lab design goal (10 mrem per year) for dose to the public. The design goal is 10% of the DOE annual dose limit to the public and cannot be exceeded without prior written consent from the RCD Manager (RCM) and the TJNAF Director.

Dedicated calculations for the dose rate at the site boundary for these experiments were not carried out; however, expected conditions were compared against previous experiments. The expectation of the small contribution of Hall D to the boundary dose accumulation will be verified during the run using the active monitors at the Jefferson Lab site boundary. If it appears that the radiation budget will be exceeded, the RCD will require a meeting with the experimenters and the Head of the Physics Division to determine if the run conditions are accurate, and to assess what actions may reduce the dose rates at the site boundary. If the dose approaches or exceeds 10 mrem during any calendar year, the run program will stop until a resolution can be reached.

4 RADIATION HAZARDS

The following controls shall be used to prevent the unnecessary exposure of personnel and to comply with federal, state, and local regulations, as well as with TJNAFs and the experimenter's home institution policies.

4.1 Beam in the Hall

When the Hall status is *Beam Permit*, there are potentially lethal conditions present. Therefore, prior to going to *Beam Permit*, several actions will occur. Announcements will be made over the intercom system notifying personnel of a change in status from *Restricted Access* (free access to the Hall is allowed with appropriate dosimetry and training) to *Sweep Mode*.

All magnetic locks on the exit doors will be activated. Persons trained to sweep the area will enter by *Controlled Access* (keyed access) and search in all areas of the Hall to check for personnel.

After the sweep, another announcement will be made indicating a change to *Power Permit*, followed by *Beam Permit*. The Run-Safe boxes will indicate "OPERATIONAL" and "UNSAFE".

IF YOU ARE IN THE HALL AT ANY TIME THAT THE RUN-SAFE BOXES INDICATE "UNSAFE", *IMMEDIATELY* PRESS THE "PUSH TO SAFE" BUTTON ON THE BOX.

Controlled area radiation monitors (CARMs) are located in strategic areas around the Hall and the Counting House to ensure that unsafe conditions do not occur in occupiable areas. RadCon will monitor the CARMs and prepare surveys, as necessary, to assess the impact of the experiment on radiation levels around the Hall.

4.2 Activation of Target and Beamline Components

All radioactive materials brought to Jefferson Lab shall be identified and reported to the Radiation Control Department (RCD). These materials include, but are not limited to, radioactive check sources (of any activity, exempt or non-exempt), previously used targets or radioactive beamline components, and previously used shielding or collimators. The RCD inventories and tracks all radioactive materials onsite and will coordinate all movement of used targets, collimators, and shielding.

RCD will further assess radiation exposure conditions and implement controls, as necessary, based on the identified radiological hazards. In particular, during the Low Energy running period, several configuration changes to the active collimator, located in the beam entrance cove of Hall-D, are planned. Dedicated simulations were performed to estimate the activation levels in the vicinity of the active collimator. These simulations indicate that, approximately 30 minutes after termination of the photon beam, dose equivalent rates of up to ~7 mrem/h at 30 cm from the front face of the collimator may be present.

Prior to any work in this area, a radiation survey will be performed to verify activation levels, and appropriate radiological controls will be implemented by RadCon as required.

There shall be no local movement of activated target configurations without direct supervision by the RCD.

No work (e.g., drilling, cutting, welding) is to be performed on beam-line components which could result in dispersal of radioactive material. Such activities must be conducted only with specific permission and control by the Radiation Control Department.

5 INCREMENTAL SHIELDING or OTHER RADIATION-REDUCTION MEASURES

none

6 OPERATIONS PROCEDURES

- All experimenters must comply with experiment-specific administrative controls. These controls begin with the measures outlined in the experiment's Conduct of Operations document, and include, but are not limited to, radiological work permits (RWPs), standard operating procedures (SOPs), or any verbal instructions from the Radiation Control Department. A general access RWP, governing access to the Halls and the accelerator enclosure, must be read and followed by all participants in the experiment. This RWP can be read and electronically signed online at: https://www.jlab.org/human_resources/training/webbasedtraining (under General Access RWP).
- Any individual with a need to handle RAM shall first successfully complete Radiation Worker Level 1 (RW-1) training.

- There shall be adequate communication between the experimenter(s) and the Accelerator Crew Chief and/or Program Deputy to ensure that all power restrictions on the radiator and the target are well known. Exceeding these power restrictions may lead to excessive and unnecessary contamination, activation, and personnel exposure.

- The radiator assembly and the downstream beam-line components may not be altered outside the scope of this RSAD without formal RCD review. Alteration of these components may increase radiation production in the Hall and subsequently increase dose at the site boundary.

- Radiological work permits are the standard work authorization documents used to control radiological work; RadCon will require RWPs based on established trigger levels.

- Standard RSAD controls apply; the RCD shall be contacted for any of the following activities.
  - entry to Radiation Areas or High Radiation Areas
  - movement of shielding or collimators
  - breaching the target chamber physical envelope
  - any work on beamline components downstream or in proximity of the target
  - maintenance of known or potentially contaminated systems
  - any destructive modifications to activated components (drilling, cutting, welding, etc.)

All posted guidance and instructions for contamination controls, shielding configuration, and access to radiological areas must be adhered to.

Note: Work planning for all radiological activities shall be coordinated through the Hall Work Coordinator using the ATLis work planning tool and, when a task hazard analysis is required, an ePAS.

7 DECOMMISSIONING and DECONTAMINATION of RADIOACTIVE COMPONENTS

Experimenters shall retain all targets and experimental materials and equipment brought to Jefferson Lab for temporary use during the experiment.

After sufficient decay of the radioactive target configurations, they shall be returned to the experimenter's home institution for final disposition.

All transportation shall be conducted in accordance with United States Department of Transportation Regulations (Title 49, Code of Federal Regulations). In the event that the experimenter's home institution cannot accept the radioactive material due to licensing requirements, the experimenter shall arrange for appropriate transfer of funds for disposal of the material. TJNAF cannot indefinitely store radioactive targets and experimental equipment.

8 RADIATION DAMAGE to HALL D ELECTRONICS

It is expected that the contribution of these experimental runs to the radiation damage to the Hall-D electronics will be negligible

The Radiation Control Department may be reached at any time through the Accelerator Crew Chief (757-269-7045) or directly by calling the RadCon cell phone (757-876-1743). On weekends, swing, and owl shifts, requests for RadCon support should be made through the Crew Chief. This will ensure prompt response with no duplication of effort.