Sample Laser Standard Operating Procedure

Building Name

795 nm Laser Diode Class 3B laser

Rev. 1.1 B.S. Coventry

Note: This is a sample and only a sample. This should be modified to suit lab abilities, equipment, and intended use case. Should be approved by institute laser safety officer.

# I. Purpose

This Standard Operating Procedure (SOP) outlines requirements to be considered by an authorized user of the laser speckle imaging (LSI) laser as well as describes the normal operation of the laser and any hazards that may be encountered during normal operation. Finally, the SOP explains how to minimize any hazards and how to respond in an emergency situation. This document is to be reviewed one year from the date of approval or as conditions warrant, whichever is the shorter time period.

**II. Personnel**

A. Authorized Personnel: The LSI laser may be operated only by authorized personnel who are fully cognizant of all safety issues involved in the operation of such a device. These personnel are to ensure that the laser is only operated in the manner laid out in this document. To become an authorized user, one must:

1. Complete the University of Wisconsin-Madison office of radiation safety laser e-Course and medical clearances.

2. Read and fully understand the SOP

3. Receive hands-on training on the LSI by an authorized user. View supplementary tutorial videos provided by Brandon S. Coventry, operator and certified user.

4. Sign the authorized user sheet to affirm that the above steps have been

completed.

B. Unauthorized personnel: No unauthorized personnel may enter WIMR (room number) during laser operation unless accompanied by an authorized user. All visitors must be briefed on proper safety protocol and must wear appropriate laser protective eyewear located on the premises.

# III. Hazards

A. Laser Hazards: The 795 nm LSI laser is a Class xx (as labeled by laser safety officer) laser. Severe eye damage (including blindness) and skin damage can result from direct beam and specular reflections

B. Electrical Hazards: electrical shock or electrocution could result from direct contact with high voltage.

Primary hazards come from the laser diode current pulser. Do not handle the pulser or disconnect laser diode while power is on. Any maintenance on the laser should be approved by the primary laser operator (B.S. Coventry, R.C.H. Chen) or the principle investigator (K.A. Ludwig).

C. Chemical: No chemical hazards associated with this experiment and device.

D. Pressure Hazards: Laser is of insufficient wavelength and power for significant pressure hazards.

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E. Other: While in standard operation, the laser could present an open beam eye-injury hazard from reflection off of surfaces if sufficient safety googles are not worn.

# IV. Hazard Controls

A. Lasers

* + 1. Only authorized personnel will operate lasers.
    2. Both doors in the surgery room will be closed during laser operation.
    3. During animal preparation and attachment of the fibre optic cable, laser will be off and detached from power. Laser safety glasses will be worn during preparation.
    4. Laser is only turned on during the experiment. If the animal needs to be adjusted during the experiment, the laser power will be removed and safety lock placed on.
    5. Unauthorized personnel will be only allowed entry to the laboratory during laser operation with the supervision of an authorized user and while the laser is off.
    6. Laser eye protection (LEP) for sufficient protection against 795 nm is available and is located at the desk next to the anechoic chamber. Laser eye protection is required to be worn for all beam alignments/beam manipulations or anytime there is an open beam that exceeds the maximum permissible value.
    7. Please note : Laser Eye Protection is wavelength specific and proper section is critical
    8. No jewelry or other reflective materials are to be worn while working with the Laser, especially on the hands and neck.
    9. Personal in the laser lab should avoid bending over or otherwise putting their eyes at the level of the beam path while the laser is in operation.
    10. Laser alignment must be performed only by following the steps outlined in the alignment procedure supplement or alignment section.
    11. If the beam path or fibre optic connections must be changed significantly by relocating the laser or optics, all users must be notified of the change.
    12. The same precautions that are taken for safe operation of the laser must also be followed when adjusting any of the optics in use with the apparatus.
    13. When a new principal researcher/experimenter takes over use of the laser system, the new user must conduct a survey for unwanted stray or diffuse beams. Appropriate tools such as visible and near-IR sensitive cards or viewer shall be used for locating the possibility of stray visible and near-IR light.
    14. Hardware current limits on laser pulser should not adjusted away from maximum experimental values.

B. Electrical

* + 1. Only qualified personnel may perform all internal maintenance to the laser and more than one user must be present when performing said maintenance.
    2. Every portion of the electrical system, including the printed circuit cards, should be assumed to be at dangerous voltage level.
    3. Safety interlock may only be removed when laser is to be engaged during the experiment when all users are out of the laser control area.

# V. Normal Operation

A. Don laser safety googles. Inspect all electrical and water connections for damage and connectivity. Ensure power to the laser is off and interlock protection engaged.

B. Complete animal preparation as per IACUC protocols and experimental conditions. Close both doors in the surgery room.

C. Turn on Tucker-Davis Technology (TDT) control programs and load experimental file.

D. Turn laser system on by providing power to the pulser and then switching the laser pulser power switch to the on position. At this point laser safety interlock must remain on.

E. Setup recording location in the TDT Project software and prep experiment. Click record when ready and then remove the laser safety interlock. The laser is now live and receiving voltage control signals from the TDT RX-7.

F. At the completion of the experiment, set the laser interlock back on and terminate the TDT program.

1. If this is the end of experiments for the animal, power down the laser by first turning off the laser pulser, and then turning off the power supply.
2. If another experiment is to occur, repeat steps E-F.

G. After all experiments are over, shut the laser system down in the following order: Set laser interlock switch to on. Turn off laser pulser power switch. Remove power from the laser pulser. Don laser safety goggles and remove the fibre optic cable from optrode implant. Remove animal from chamber and back to home cage.

# VI. Emergency Procedures

A. Laser accidents: Follow the steps outlined in the Procedure for Laser Accidents in Appendix B.

B. Power outage: If there is a power outage, turn off the laser to avoid a hazardous situation when power is restored.

# VII. Approved Users

I have read and understood the Standard Operating Procedures for *in vivo* INS experiments

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| Name (print) | Signature | PI Initial |
| Brandon S Coventry |  |  |
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**Appendix A** – Procedure for Laser Accidents

In the event of a laser accident, follow the procedure below:

1. Ensure that the laser is shut off.
2. Provide for the safety of the personnel (first aid, evacuation, etc.) as needed. Note — if an eye injury is suspected, have the injured person keep his/her head upright and still to reduce bleeding in the eye. A physician should evaluate laser injuries as soon as possible.
3. Obtain medical assistance for anyone who may be injured.
4. If there is a fire, pull the alarm, and contact the fire department by calling 9-911. Do not fight the fire unless it is very small and you have been trained in fire-fighting techniques.
5. Immediately contact and inform building managers of WIMR regarding the accident.
6. Immediately contact UW-Madison REM laser safety officer:
7. Inform PI Kip Ludwigand the current group safety officer (Brandon S Coventry) as soon as possible. If there is an injury, Kip Ludwig will need to submit a report of injury to the Worker’s Compensation Office.
8. After the incident, do not resume use of the laser system until the Non-Ionizing Radiation Safety Committee has reviewed the incident and approved the resumption of research.

# Appendix B – Calibration Procedures

TBD after laser audit.