

A0 PHOTOINJECTOR CLASS IV LASER-ON CAVE ACCESS PROCEDURE

Prepared by: LASER OPERATOR, _____ ID: _____

Reviewed by: AD/ES&H, _____ ID: _____

Approved by: GROUP LEADER, _____ ID: _____

NOTE: THIS PROCEDURE APPLIES ONLY TO CLASS IV (& IIIB) LASERS. FOR LESSER CLASS LASERS, PLEASE FOLLOW THE "A0PI_Alignment_Laser-On_Access" OPERATING NOTE.

In order to align the laser inside the cave, a "qualified laser operator"¹ needs to be able to bypass the laser transport shutters. The laser operator will go through the steps below to make a laser-on access to the cave.

The laser-on access into the cave must be done by a minimum of two people, at least one of the entrants must be a qualified laser operator. The other entrant(s) may be another qualified laser operator or a "spectator". Should an accident occur which incapacitates one of the entrants, the second entrant can exit the cave and summon assistance.

If one of the entrants is a spectator, they must be provided with the appropriate protective eyewear and a qualified laser operator entrant must instruct the spectator on the laser hazards (e.g., hazardous diffuse reflections) and the steps to be taken in case of emergency (e.g., how to disable the laser beam by opening the cave door).

Training on this procedure, received from a qualified A0 laser operator, is required for all personnel (operators and spectators) who will perform a laser-on access. AD/A0PI is responsible for documenting the training.

Procedure Steps:

- 1) Obtain the "A0 South Access/Permit" (blue) Key (#9181) from the RF system operator or the MCR (Main Control Room) in order to ensure that the RF power cannot be enabled and that the cave door cannot be unlocked during the laser-on access. The qualified laser operator entrant must maintain this key in his/her possession until the access is completed.

NOTE: The entrants are NOT to reset any interlock boxes during the laser-on access.

- 2) Ensure a Class 4 Laser sign is posted on the outside of the cave access door.
- 3) Enter the cave and close the cave door securely to prevent others from entering the cave.
- 4) Visually search the cave to ensure that no one other than approved entrants is inside. Escort unapproved personnel out of the cave, ensuring that the cave door is again closed after they all are out.

¹ As per FNAL ES&H Manual chapter 5062.1

- 5) Don the appropriate laser protective eye wear and take other precautions necessitated by the activity to be performed before allowing the Class IV laser beam into the cave.
- 6) Insert an A0 Laser Lab Key (Key # PAD 657) into the "LASER SHUTTER BYPASS" box inside the cave. This will provide a permit for the Laser Transport shutters to open as long as the key is turned, there is vacuum in the Laser Transport, and the A0 South Cave door is closed.
- 7) Contact an operator in the A0 Laser Lab or A0 Control Room to reset and open the UV laser shutter (UVSHUT) (the electronic shutter does not open automatically when a permit is given).

NOTE: When the A0 Laser Lab key is removed from the bypass box, the shutter permit is revoked. If the cave door is opened, the shutter permit is revoked. The Laser Transport shutter state (open/closed) will be monitored by the safety system. If the transport shutter is open when it does NOT have a permit (i.e. it gets stuck open), the safety system will revoke the permit to the A0 Laser Lab power supplies in order to disable the Class 4 laser.

- 8) Once the activity requiring the laser-on access is completed, remove the A0 Laser Lab Key from the "LASER SHUTTER BYPASS" box, thus causing the Laser Transport shutters to close.
- 9) Confirm that the shutter has closed.
- 10) Exit the cave and return the "A0 South Access/Permit" Key to the RF operator or the MCR.

The Class 4, invisible laser beam utilized in the Photoinjector project is generated in apparatuses located in the A0 Laser Lab and transported through the Laser Transport pipe across the aisle ways to the A0 Photoinjector Cave.

During "normal" operation of the photoinjector, no one is permitted in the interlocked cave or transport pipe when the laser beam is being transported from the A0 Laser Lab to the cave. The transport has two shutters at its entrance in the A0 Laser Lab. There is a pneumatic safety system shutter enclosed in the entrance of the transport pipe. This is controlled solely by the A0 South Cave SSIU. There is an electronic shutter bolted to the laser optic table, just before the input window flange. This is permitted by the A0 South Cave SSIU and controlled by the operators. The evacuated stainless steel transport pipe is pressure interlocked to the A0 South Cave SSIU. The transport shutters can only be open if vacuum is present in the pipe, ensuring the integrity of the pipe. A permit for the transport shutters to open is provided only under three conditions:

- a) If the cave is secure and there is vacuum in the beam transport pipe;
- b) If the shutter is bypassed in the manner described in the Laser-On Access Procedure and there is vacuum in the beam transport pipe;
- c) If all of the class IV laser shutters are closed.

The bypass feature is controlled from the "Laser Shutter Bypass" control box located in the cave. The bypass box requires the use of the "A0 Laser Lab Key" to activate the bypass feature. This key is the same one that allows entrance to the A0 Laser Lab. The keys are numbered and issued to qualified laser operators at the discretion of the project leader and ES&H. A current list of key assignments is kept with ES&H and posted at the A0 Laser Lab door. One key is kept in the MCR, and one captured in the A0 Laser Lab Emergency Access Box located outside the south entrance to the A0 Laser Lab.

In order to align the laser inside the cave, laser operators need to be able to bypass the transport shutter during a laser-on access. During such an access, the primary safety issues being addressed are as follows:

- a) No one other than qualified laser operators and spectators, who have been briefed on laser hazards and emergency response by a qualified laser operator, are allowed to be in the cave during the laser-on access [Cave door will be closed and locked during the laser-on access period and the laser operator entrant will carry the "A0 South Access/Permit" Key with them during the access. That key is currently the only key that unlocks the cave door. If the cave door is opened, the laser bypass permit is revoked;
- b) The laser personnel on the access are protected from ionizing radiation hazards by having a means to ensure that RF is off during their access. This will be accomplished by carrying the "A0 South Access/Permit" Key with them during the access, ensuring that the RF does not receive a permit;
- c) If one of the laser personnel is injured in the Cave, the other entrant will summon assistance via the phone located in the cave and will open the cave door to permit others to enter;

- d) No one other than qualified laser operators can activate the laser bypass system. The key required to perform the Laser Transport shutter bypass is the A0 Laser Lab Key which is issued to qualified laser operators by the AD/ES&H.

The term "qualified laser operator" refers to individuals who have received the FNAL laser training and eye exam (per Chapter 5062.1 of the Fermilab ES&H Manual) and who are authorized by the project leader to perform operations associated with the Class 4 laser system.

Revision 2: July 17, 2003

Procedure updated to include the use of a job lock box for LOTO, update the terminology, update A0 Laser Lab key possession, and corrected grammar. -James Santucci

Revision 3: December 1, 2003

Procedure updated to safely allow class II alignment HeNe laser transmission through an open transport pipe, and into an open cave while all other laser beams greater than class II are blocked. Also updated terminology and readability.
-James Santucci

Revision 4: June 17, 2004

Procedure updated to accommodate safety system upgrades. Such as; the 3MW RF system modulator can now send RF to the North Cave or the South Cave while the other cave is in access, class IIIa alignment laser will be allowed into open cave and Transport under conditions of a operating note. Names of devices and keys have been updated.
-James Santucci