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Design Specifications for the RF Gun Load Lock

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Brief Summary: This design document describes the requirements and concept for the 120 Hz gun load lock assembly. The approach is to have two load lock assemblies (or transporters) each containing the large diameter back plate of the gun. During a cathode change the gun back plate is replaced and held in place using a "porcupine" clamp. The cathode change procedure is given.

Keywords: Load lock, cathode, gun, UHV

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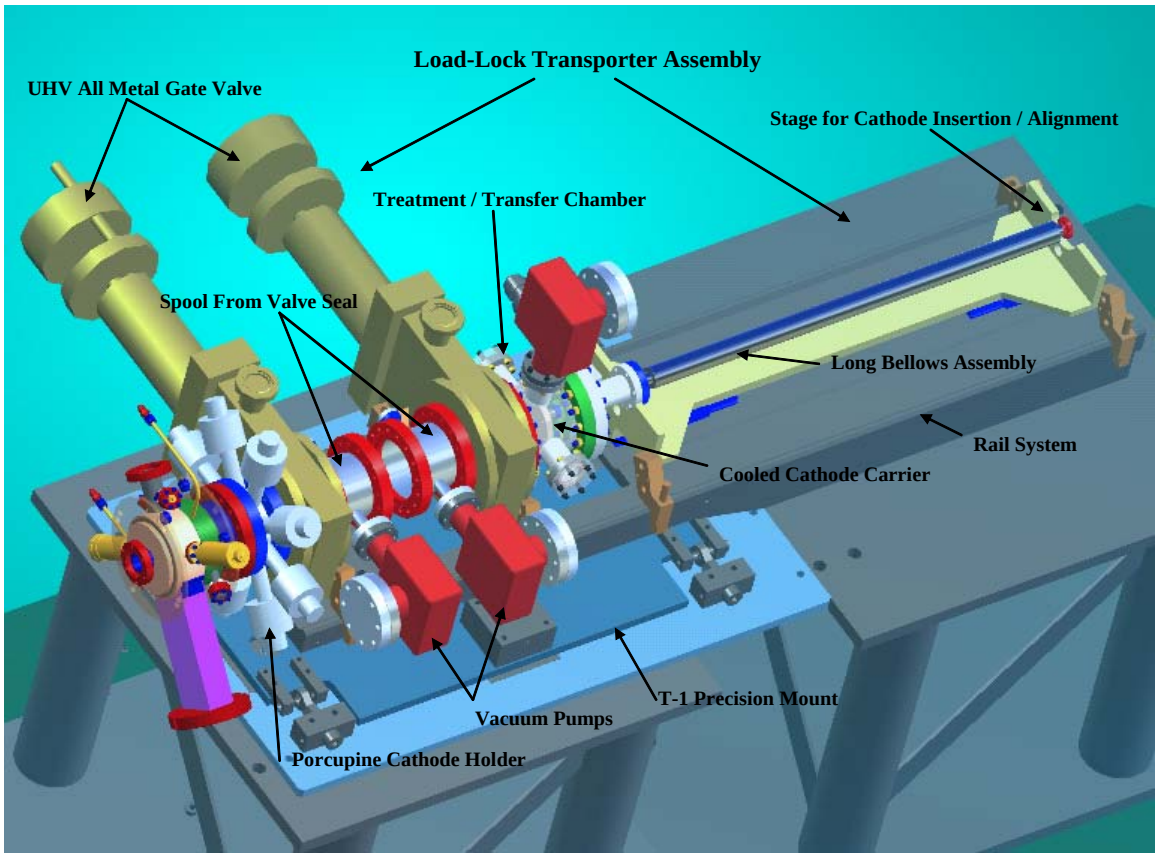
A load lock for the LCLS 120 Hz RF gun is required for the rapid interchange of cathodes onto the gun as well as to avoid exposing the cathode to contamination during installation. Implementing a load lock allows the gun to be operational in less then 1 hour after a cathode change since no bake out is required and minimal rf conditioning will be needed. A conceptual drawing of the load lock proposed by SLAC is shown in the figure.



The load lock approach adopted by SLAC requires two load-lock transporters: one mounted on the gun and another in the cathode processing lab where cathodes are prepared and stored for use on the gun. A single cathode is mounted in each transporter, eliminating the need for transferring cathodes under vacuum from a storage carrousel, or "6-pack". This design has the advantage of greatly reducing the mechanical complications of transferring cathodes and connecting them to cooling lines while under high vacuum. Cooling of the cathode is necessary, given the gun cooling requirements as detailed in the LCLS Technical Note "Design Considerations for the LCLS RF Gun". The cathode size is approximately the same as that of the standard BNL/SLAC/UCLA gun which has an RF seal at the outer diameter of the cathode cavity to avoid RF breakdown.

Cathode changes are performed by:

1. Releasing the cathode from the gun at the porcupine cathode holder.
2. Withdrawing the cathode into the treatment/transfer chamber.
3. Closing both UHV valves.
4. Turning off both pumps between the valves, venting and disconnecting this region.
5. Removing the entire cathode transporter assembly and replacing it with the second assembly containing the new cathode.

6. Re-attach transporter at flange between the two UHV valves, pump down spool and start vacuum pumps.
7. Open UHV valves.
8. Insert cathode and clamp with the porcupine cathode holder.
9. Verify good RF seal using RF measurements.
10. Turn on gun RF, process and operate injector.

In addition to the above specifications the load lock assembly requires:

1. To withstand repeated vacuum bakes to 250 degrees C.
2. Have a method for pulling and/or pushing the cathode plate a small distance (approximately +/-0.010 inches) to tune the cathode cell. It is desirable that this be done using a stepper motor for remote operation.
3. Cooling of the cathode plate.

There are plans for a cathode processing lab in the alcove at Sector 20 in which a new cathode can be installed and processed in the second transporter in preparation for mounting on the gun.