Dear Future Senior Design Team,

For this project, it’s very important to have knowledge of how to create printed circuit boards. There are several instructional videos online that will help show how to use software that designs PCBs. One free and easy to use software is ExpressPCB, which can be found online. Altium is also a viable software as that is what already exists on the Senior Design computers. When designing PCBs it’s best to get them checked by people who are experienced in this area. The Electronics Design Facility is on the fourth floor of the Physics Research Building, there are several workers there who are very knowledgeable of PCBs and are willing to check them and help give insightful design ideas to improve your PCBs. Make sure that when redesigning the APD PCB, all of the RF traces are matched to 50 Ohms as this will reduce the interference in the PCB and also try to keep any causes for noise such as the voltage inputs as far from the APD as possible.

The APD is far too small to solder by hand so be sure to ask the EDF to solder it because they will put a solder paste on the board and put it in an oven in order to be sure that the connections made are all good. When ordering parts make sure to order PCB components that are not too small to solder. Be sure to look at the sizes of everything that you are ordering and also make sure that they correspond to the correct pad sizes that you created on the PCB design software you are using. If the pad sizes are incorrect then the connections will not be any good since this can lead to shorting pins.

When dealing with the high voltage, make sure that all the connections are safe. Do this by placing electrical tape on any exposed wire. Do not touch any of the high voltage connections when they are on. Since the laser lab has metal tables be sure to not place the high voltage PCB directly on the table just in case it shorts. Make sure to mount the high voltage PCB in a safe place or place it within a housing.

If there are any abnormalities when testing with the Senior\_Design Labview GUI it may be due to one of the following things. When attempting to run the LabView Code, if it does not run properly meaning that the laser never turns on, first, check that the USB from the current controller is plugged into the computer. If that doesn’t work, then close the program and reopen it. If neither of the above work, then the computer is most likely operating in 64-bit mode which is the cause of the error. Restart the computer and when it is turning back on be sure to run 32-bit mode.

When running the code to use the probe, make sure that the current controller beeps as this is a vocal queue which tells that the current controller is connected. If the current controller has an error, it will display an error code starting with an E. When this occurs check that all of the RF cables and biased Ts have good connections. Make sure to tighten them as much as possible. Also check that everything is connected correctly as described in the setup section.

When operating the software system, if it does not update when new files are added to the lab folder or if scripts are unable to to communicate with the database, ensure the host machine is on and networked, and ensure the research drive is mounted. In the case that the system is unresponsive, attempt a system restart. In the case the system remains nonfunctional, attempt a complete reinstall of the host system. Note that you can either back up the database located in the “.tmsu” folder in the root directory of the lab folder, or propagate the database after installation. No data files will be lost as a result of the installation, as the database only stores information about the data files, not the files themselves.

In terms of where the probe currently stands as a project, it has a fully functional Vertical Cavity Surface Emitting Laser (VCSEL) PCB which has four MMX connectors which take in RF inputs from the current controller and a functional Avalanche Photodiode PCB which has two switches each with a different setting. There is also a working high voltage converter which plugs into a wall outlet and converts the voltage to a low voltage and high voltage input for the APD PCB. The next step would be most likely be to create multiple VCSEL and APD boards and test them all together at once to try and find an optimal optode layout or multi-optode layout. Some examples might be one source with multiple detectors or one detector with multiple sources or even multiple detectors and multiple sources. In order to use multiple detectors, a switching circuit would have to be made so that only one APD is on at a time and the Labview code would have to be changed so that it would be able to know which APD is on at a certain time.