

FY 07 Laser Test Stand Report

In order to effectively test the silicon strips and Data Acquisition systems of the SVT, a Laser Test Stand (LTS) must be constructed. The LTS will allow a specific amount of charge to be deposited on individual channels in a controlled manner unlike that of source or beam testing. The LTS can be broken down into three specific areas of design: 1.) Laser / driver selection to meet the needed criteria of testing, 2.) Rail / support systems for movement and placement of the laser, 3.) Software / Hardware design for controlling laser functions and movement. This paper will discuss the progress that has been made in these areas in the Fiscal Year 07 and goals for the Fiscal Year 08.

Laser / Driver Research and Selection

In the selection of the laser, there are three important factors to consider: 1.) Wavelength, 2.) Power Output, and 3.) Switching speed / Pulse Width of the laser diode / driver. Each of these factors affect charge deposition and safety requirements. The table below (Fig 1) lists the calculated requirements for the laser / driver.

Laser / Driver Requirements

Wavelength	1064 nm	Needed to matches band gap energy of silicon
Power Output	< 1 mW	Needed to meet laser safety requirements
Pulse Rate	> 8 Mhz	Needed to match sampling rate of SVX-4
Pulse Width	25 ns < p < 132 ns	Need to fit within SVX-4 sampling window of 132 ns

Figure 1 – Table for Ideal Laser Diode and Driver Requirements

The choice made to meet these requirements is the BNC Model 6040 Mainframe with the 106C Optical Module. For further specifications of both the Model 6040 and 106C refer to references 1 and 2.

Due to the rare functionality of the requirements, the Mainframe and Optical Module's price is a factor. With this considered a "Plan B" was also researched and partially developed. In this secondary plan a integrated circuit laser driver was found that could power and meet the requirements (Ref 3). To accompany the driver a diode with a 1-2 ns second rise time was chosen (Ref 4). The only draw back of the secondary plan is that a laser diode with a wavelength of 1064 nm could not be found. A 670 nm diode was used in its place as it is a viable substitute although not ideal. Currently the "Plan B" prototype works and meets all criteria except for the wavelength. However, further testing is needed.

Rail / Support System

The LTS Rail and Support System allows the laser to be moved precisely over any point on the silicon detector in order to check proper operation of individual strips. The system will consist of three rails (x, y, z directions) each giving the laser movement in every axis. Currently only two, x and z, axis have been procured. The Zaber T-LLS Series high performance, precision motorized stage (Ref 5) is being used for perpendicular movement across the detector (x-axis). The Zaber KT-LA60A Actuator (Ref 6) with the a 60 mm TSB60 Series Stage (Ref 7) is used for laser focusing (z-axis). The prototype x-axis support (Fig 2) and the prototype laser support (Fig. 3) have both been designed and machined.

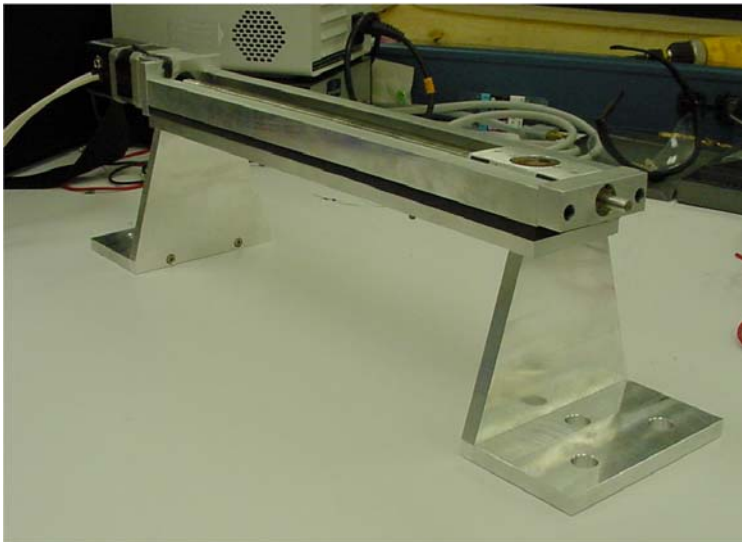


Figure 2 (Left) - X axis Support with X axis Rail Attached.

Figure 3 (Right) – Laser Support with Z axis and Laser Focusing Stages Attached.

Software / Hardware Control for Laser Functions and Movement

Control Software will allow for the Laser and its movements to be controlled remotely from a PC. Remote control is needed because the detector must be in a dark enclosure. The prototype software will be written in Labview for speed of testing.

Currently basic control programs have been written for the x and z axis rails but have not been implemented together in a working unit. No laser control software has

been written for laser control for the first or secondary plans due to the stage of laser development.

Expectations for FY 08

Advances must be made in all areas of the LTS. Due to lack of funding, previous year goals were not met. The BNC Model 6040 along with the Laser Module must be procured in order to begin software design for laser function controls. For the secondary plan, a laser control module must be engineered and designed in order to communicate remotely with the laser. This too must be completed before control software can be written.

Brackets and support structures must also be engineered and designed for the laser / rail movement system. Without these items control software cannot be written for either the primary or secondary plan.

Below is a tentative detailed list of goals for FY 08. The completion of this list is highly dependent on funding (Fig 4).

LTS FY 08 Task List		
Task	Priority	Notes
*Procurement of BNC Model 6040	*1	Needed to Start Laser Function Control Software
*Procurement of BNC Model 106C	*1	Needed to Start Laser Function Control Software
*Laser Control Module	*1	Temp. Alternative to Model 6040
Testing of "Plan B" prototype	*1	Detailed testing of Laser Driver and Diode
Design of X/ Z Support Bracket	*1	Supports and Secures X Rail to the Z Rail
Assembly	*2	Assembly of Brackets and Components
Software for Laser Movement	*2	Labview based
Software for Laser Functions	*2	Labview based
Software Testing	*3	Testing for Accurate Movement of Laser w/ Software
Update current prototype brackets	*3	Finalization of bracket design and engineering
*Notes	Priority 1's must come before Priority 2's, 3's	
	Laser Control Module (Green) is not Needed if Models 6040 and 106C Procured (Red).	

Figure 4 – Task List for Fiscal Year 08.

References

- 1.) BNC Model 6040
[http://www.berkeleynucleonics.com/resources/6040_\(brochure\).pdf](http://www.berkeleynucleonics.com/resources/6040_(brochure).pdf)
- 2.) BNC Model 106C
http://www.berkeleynucleonics.com/products/model_106c.html
- 3.) IC-Haus Fail-Safe Laser Diode Driver
http://www.ichaus.de/upload/pdf/Nz_b1es.pdf
- 4.) US-Lasers: 670nm-5mW-50C-Visible Laser Diode
<http://www.us-lasers.com/d670nm5.htm>
- 5.) Zaber T-LLS Series Motorized Dovetail Slides
http://www.zaber.com/products/product_group.php?group=T-LLS
- 6.) Zaber KT-LA60A Linear Actuator
http://www.zaber.com/products/product_detail.php?detail=KT-LA60A
- 7.) Zaber TSB60-I Linear Stage
http://www.zaber.com/products/product_detail.php?detail=TSB60-I