THE NEED FOR LCLS-II

The Linac Coherent Light Source (LCLS) at SLAC is the world’s first hard x-ray free electron laser.

LCLS would like to take a leap forward in capability and increase the current 120 pulses a second system to 1 million pulses a second for even more exciting scientific experiments.

Here, the high power laser system for the development of LCLS-II, known as IGNIS, will be discussed with focus on the Herriott cell system which will be used to create an optical time delay in one of the laser beam arms.

Keywords: OPCPA laser system, multi-pass cell, interns, Herriott cell

WHAT I’VE BEEN UP TO

MOVING FROM OLD LASER LAB TO NEW SHINY LASER LAB

BUILDING LASER ENCLOSURE TO MEET SAFETY REGULATIONS

VISITING THE HUTCHES, SSRL, SLAC LINAC AND SEEING SOME SCIENCE IN ACTION

WORKING WITH THE COMMUNICATIONS GROUP AND PROMOTING SLAC INTERN LIFE

HERRIOTT CELL

IGNIS requires a pulse delay of 12.6μs, in order to achieve this a Herriott cell shall be used.

HOW DOES IT WORK?

A Herriott cell consists of two spherical mirrors of the same focal length. The input beam reflects off the spherical mirrors multiple times, and forms a pattern that remains on a rotational hyperbola.

The reflection points, in general, lie on an ellipse or circle.

FACTORs EFFECTING OPTICAL TIME DELAY

- Distance between mirrors
- Input beam angle
- Diameter of mirror

THE RE-ENTRANT CONDITION

The condition under which the beam will retrace its path and exit the Herriott cell:

\[ N \theta = 2M \pi \]

where \( N \) is the total number of passes the beam makes within the cell, \( M \) is an integer, and \( \theta \) is the angle between two successive reflections

SETUP

Figure 1: Top left and right: laser enclosure for IGNIS, bottom left: showing the inside of the laser enclosure so that optics are not damaged when the laser is on. Bottom right: inside of laser enclosure.

Figure 2: Picture of LINAC.

Figure 3: Experimental setup for testing the Herriott cell.

FINAL WORDS

IGNIS shall be a high power, high repetition OPCPA laser system that shall provide important insight for the construction of LCLS-II

ACKNOWLEDGEMENTS

I wish to thank Alan Fry and Mike Dunne for providing me with the unique opportunity of being the first international intern at SLAC, to Katalin Mecseki and Franz Tavella for being outstanding mentors, to Matthew Windeler for being a great lab buddy and to Hengen Gonzales, Omar Quilijas, Riccardo Veraldi and Ernesto Paiser for making my stay at SLAC memorable.

Use of the Linac Coherent Light Source (LCLS), SLAC National Accelerator Laboratory, is supported by the U.S. Department of Energy, Office of Science, Office of Basic Energy Sciences under Contract No. DE-AC03- 76SF00515.