# Theory

## Paper references

## Nominal values for wire radius and wire tension, applied tension, sensitivity, wave speed, operating frequency

## Limiting factors being dispersion, wire droop, minimum wire distance

## Aligning wire in Undulator

# Setup

## Wire holders, fiducial monuments, pulley and weight

## Water damper

## Laser photodiode

### Sign convention

### Wire closest to slit

#### Want best relative change in voltage when scanning laser across wire.

### Photodiode gain

### Setup close to undulator

## Translation stages

### Setup so all stages move same direction with given rotation.

## Current Source

### Function generators

### Electrons travel from black to red connector.

### Use ICT as trigger for scope (50ohm impedance)

### Short pulse operation

#### Signal proportional to beam velocity

#### Signal deflection is limited

#### Need to increase voltage

### Long pulse operation

#### Signal proportional to

## Scope

### Trigger with ICT

### Zoom in on first reflection. But be check that ring down is complete. (Especially for strong deflections in signal!)

### USE OFFSET so that waveform remains centered when changing scale factor.

### Identify working region by scanning laser across wire.

### Code to read waveform data

# Code (mostly for undulator)

## Code to retrieve waveform on trigger.

### Can verify shot manually or simply by checking if signal is clipping.

### Can reset channel offset to center next waveform

## Create\_Laser\_Calibration\_Curve

### Use short-pulse operation so waveform is flat.

### Run script, and turn move laser to fill in data on the scatterplot.

### Script only saves shot if not clipping and then repositions channel offset to track with the new signal.

### Larger waveform means better resolution.

### Be aware that operating the translation stage can give some noise to data. Move quickly after a shot is taken so the next moved waveform will clip and not be counted.

## Take\_Offset\_Measurements

### First you should have created a calibration curve. Put into given folder.

### Uses manual verification to save shots for a given wire offset to given folder.

## Get\_Signal\_Means\_and\_Amplitudes

### Brief overview. Look through code for details.

## Low\_Pass\_Filter

### Useful to remove high frequency noise. Especially important for Thorlabs laser (not sure where the 20us period/50kHz noise is coming from).