1. **Setup**
   A. Firmware (done)
   B. Software (in progress)
   C. Communicate with Chip - Calibration
   D. Event Receiver - Timing Signals

2. **Verification**
   A. Calibration
   B. Laser Pulse Energy Distribution
   C. Laser Pulse Time Bucket Distribution

3. **Measurements**
   A. Calibrate Laser Energy Delivered (bias supply return current)
   B. KPiX Channel Calibration with Laser
   C. Gain Switching
   D. ADC vs Laser Pulse Delay
   E. ADC vs Time Bucket

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**Parameters to Play With**

- Laser Energy
- Laser Pulse Rate
- Timing Settings (GUI controlled)
- Time Bucket (external sync)
- Gain Setting
- Capture Rate
- Double Pulses (requires setup)
- KPiX Channel (limited)
- Cabled vs Un-cabled
1. Setup

A. **Firmware** (done) – Set up Xilinx software and a little bit of hardware (programming cable and connector/adapter) to establish JTAG communication with the eprom on the KPiX FPGA board. Reprogrammed eprom with firmware from Ryan.

B. **Software** (in progress) – Have installed and “built” the latest version of the GUI. There is a comm error when booting the software.

C. **Communicate with KPiX** – When the GUI will boot correctly, need to verify that it communicates with the chip: read config, load config, run calibration with error-free data collection.

D. **Event Receiver** – When the GUI is verified, set up synchronous timing with the laser using external timing signal. Some time will be needed to tune the timing of the signals to verify that laser pulses can be delivered into arbitrarily-specified time bucket.
2. Verification

A. **Calibration** – Run calibration to compare to calibrations from before eprom reprogramming. Troubleshoot if necessary.

B. **Laser Pulse Energy Distribution** – Reconfirm distribution of ADC counts from laser pulses are suitably narrow: compare to earlier results. Troubleshoot if necessary.

C. **Laser Pulse Time Bucket Distribution** – Measure time distribution of laser pulses holding expected time bucket fixed. Optimize and discuss results.
3. Measurements

A. **Calibrate Laser Energy Delivered** – Determine best scheme for measuring laser energy delivered onto detector. Optics do not allow for direct measurement. Some work has been done to use measured bias supply return current to measure average power delivered per laser setting.

B. **KPiX Single Channel Calibration with Laser** – ADC measurement over range of laser power settings from off to maximum. Plot and determine linear fit (or quadratic fit). Can only do a single channel at a time, from list of channels with IR openings. Fixed gain.

C. **Gain Switching** – ADC measurement over range of laser power settings from off to maximum. Let gain switch automatically.

D. **ADC vs Laser Pulse Delay** – ADC measurement over time range relative to external timing signal to determine window of acceptance and edge behavior. Fixed laser energy and time bucket.

E. **ADC vs Time Bucket** – ADC measurement over whole range of available time buckets. Fixed laser energy.